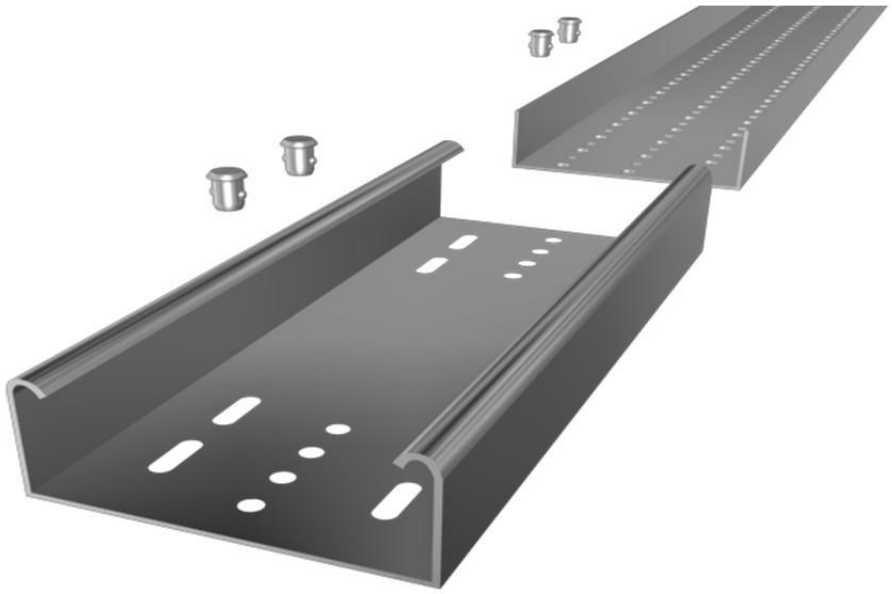
Snap Track



Comparison

Conduit & Other Channel Trays

TechLine® MFG.

Rev 3, 2017

Executive Summary

When comparing ventilated cable trays to conduit, cost advantages often approaching or exceeding 50% can be quantified. When using Snap Track, an additional 15-20% cost savings can be achieved. While several studies have been conducted comparing ladder tray to conduit, very few studies have been done showing the benefits of limited width channel tray. The following paper discusses both quantified and "soft" costs when comparing ventilated channel trays vs. conduit. Quantified costs include a side by side comparison of materials and labor for conduit vs. Snap Track. Soft costs include costs related to design, material, labor and maintenance.

Introduction

As tray rated cables have become more prevalent in industry, the use of cable tray as an alternative to conduit, has increased. Consequently, smaller width channel type trays are also increasingly being used to transition power and control cables from ladder tray to points of use.

Numerous articles have been written documenting the cost advantages of cable trays (ladder tray) over conduit. However, little information exists that specifically addresses the cost benefits of limited width channel tray. The intent of this paper is to provide industry both a general and quantified understanding of the advantages of a channel tray system, while documenting the additional and unique cost benefits of the Snap Track system.

It is not the intent of TechLine Mfg. or this paper to imply wiring systems should be selected solely on the basis of cost or that cable tray is the best alternative in all applications. Rather simply to answer the question…. *"Can the cost benefits of channel tray and Snap Track be defined and quantified".*

Advantages of Snap Track & Other Channel Type Cable Tray

Many of the advantages associated to ladder cable tray systems apply equally to ventilated channel cable tray systems.[1] Potential cost savings from both systems can be contributed to four (4) primary areas:

1. Design Costs
2. Material Costs
3. Labor Costs
4. Maintenance Costs

Design Cost Savings

1. Cable tray systems allow cable to enter and exit a cable tray anywhere along the cable tray route. This unique feature provides for the easy accommodation of additional cables. This feature is of particular benefit when revisions take place during the design and construction phase. When conduit is utilized revisions typically require an additional conduit run and result in additional expense.

Entry and exit of the Snap Track system is further enhanced through several unique fittings including: waterfall fittings, drop tees, takeoff fittings, and downspout fittings

2. Cable tray systems are not required to be mechanically continuous, which reduces the need for many complex installation details for structural interferences and cable entries into equipment. However, cable tray systems must remain electrically continuous, which has historically been accomplished through the use of a pair of bonding jumpers.

When installed mechanically discontinuous, the continuous hole pattern in all Snap Track tray allows for a single bonding jumper. Note there is no need to drill into the tray.

Alternatively, the Snap Track system uniquely offers formed adjustable fittings to fully protect and easily route cables around structural interferences.

3. It is commonly accepted that cable trays requires fewer supports than conduit. This position is derived from an understanding of "cable tray" as a whole, including ladder and trough trays. In reality more supports are often required for ventilated channel trays, which are commonly manufactured in only 10'-12' sections. Further, NEMA VE-2 recommends horizontal runs be supported on the quarter span. Consequently, horizontal support spans are for most channel trays, only equal to 8-10' and therefore are only equal to or even less than allowed for RMC conduit.

[2]

To overcome this constraint Snap Track trays are extruded in 20' sections. The Snap Track system can be installed, depending on the total load requirement, with support spans up to 18'. The resulting longer spans can reduce the number of required supports by up to 50%. Consequently, significant support savings can be obtained when compared to other trays and RMC conduits 1" and below.

NEMA VE-2

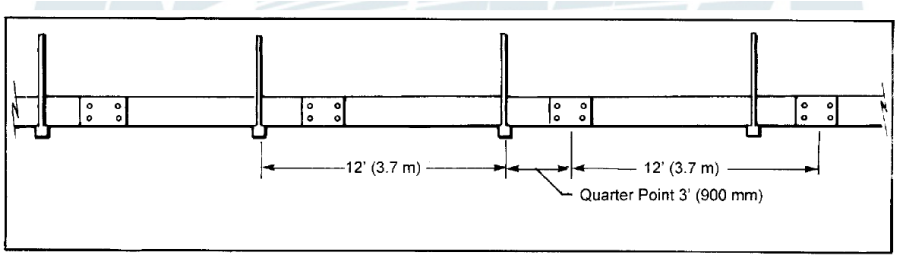


Figure 3-34 Cable Tray Support Locations

To begin, place a straight section across two supports so that the ends of the section are not directly on the support (see Figure 3-35). If the support span is equal to the length of the straight sections, bolt two pieces together for this step (see Figure 3-36). **The support span should not be greater than the straight section length, or as recommended by the manufacturer, to ensure that no more than one splice is located between supports.** Certain cable tray systems (see Figure 3-17) and certain splice designs allow for random splice location. See the manufacturer for details.

Snap Track Span (feet)															
TRAY		6'		8'		10'		12'		14'		16'		18'	
W	H	LOAD	DEFT	LOAD	DEFT	LOAD	DEFT	LOAD	DEFT	LOAD	DEFT	LOAD	DEFT	LOAD	DEFT
2"	2"	70.93 lbs/ft	.72 In.	25.15 lbs/ft	.96 In.	11.7 lbs/ft	1.2 In.	6.1 lbs/ft	1.44 In.	3.5 lbs/ft	1.68 In.	2.5 lbs/ft	1.92 In.	1.3 lbs/ft	2.16 In.
4"	2"	67.12 lbs/ft	0.63 In.	31.4 lbs/ft	0.96 In.	13.7 lbs/ft	1.2 In.	7.3 lbs/ft	1.44 In.	4.2 lbs/ft	1.68 In.	3.4 lbs/ft	1.92 In.	2.5 lbs/ft	2.16 In.
6"	2"	73.19 lbs/ft	0.63 In.	34.21 lbs/ft	0.80 In.	17.7 lbs/ft	1.2 In.	9.7 lbs/ft	1.44 In.	9.7 lbs/ft	1.68 In.	3.8 lbs/ft	1.92 In.	2.1 lbs/ft	2.16 In.

4. Space is always a major consideration when designing and installing a wiring system. Large conduit banks often require significantly more space than a cable tray wiring system.[3] An article in the January 2000 issue of Electrical Contractor Magazine entitled “Cable Management Promotes Cable Longevity, Easy Upgrades” states that cable trays take up 25% less space than conduit.

Unlike conduit, cable tray installation zones generally do not need to be increased as changes are made. This flexibility minimizes conflicts, typically between piping and electrical, during both the design and construction phases. Reducing or eliminating conflicts between disciplines will ultimately save time and money.

Material Procurement Cost Savings

1. Cable tray systems require fewer components than a conduit system. Therefore, savings can potentially be obtained from fewer components being specified, bid, purchased, received and stored. The potential for fewer components becomes clear when the NEC fill capacity for one 6 inch ventilated tray (3.8 sq. in.) is compared to rigid metal conduit, which would require (3)-2” conduit runs and associated pull boxes, junction boxes and accessories to match the capacity.

The fill capacities allowed for cable trays often result in fewer runs and less total footage than typical conduit designs.

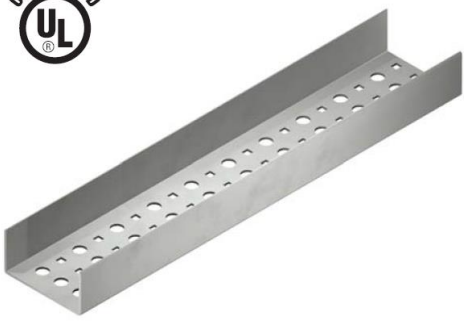
Fill capacity comparison of RMC conduit and Snap Track ventilated channel tray

Trade Size	RMC Over 2 Wires 40%	RMC Total Area 100%	ST Tray Size for More than One Multiconductor Less than 2000V	ST Tray Allowable Fill	ST Tray Total Area 100%
	in.^{2}	in.^{2}	Width (No.)	in.^{2}	in.^{2}
1/2	0.125	0.314	2	0.80	4.000
3/4	0.220	0.549	2	0.80	4.000
1	0.355	0.887	2	0.80	4.000
1 ¼	0.610	1.526	2	0.80	4.000
1 ½	0.829	2.071	2	0.80	4.000
2	1.363	3.408	4	2.500	8.000
2 ½	1.946	4.886	4	2.500	8.000
3	3.000	7.499	6	3.800	12.000

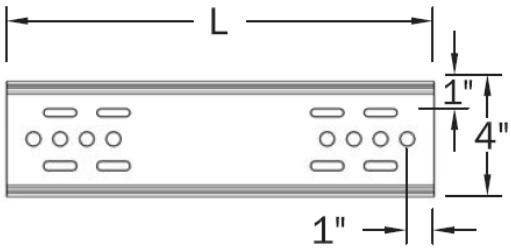
[4] NEC Table 392.22 (a) (5-6); Chapter 9, Table 4, Article -344

2. The raw material cost savings of a cable tray system has been documented in numerous articles including this paper. The side by side material cost comparison of tray wiring systems and conduit wiring systems indicate material savings of 20% can potentially be achieved.

The continuous hole pattern of the Snap Track tray and the corresponding patented connections allow the tray to be cut and assembled without exact measurements and minimal material waste. This feature often results in lower footage requirements than traditional channel trays.



To assist in determining cable lengths and installation Snap Track tray is marked every (1 meter) **UL Classified.**



Labor Cost Savings

1. As with material costs it has been well documented that cable tray systems require fewer man hours to install than conduit. However, labor rates and man hour rates may vary by region and contractor. Familiarity with the installation of tray systems may also cause variations. Therefore, exact percentages for labor savings should not be extrapolated. Nevertheless, TechLine Mfg. continually obtains actual man hour rates from EPC firms and

contractors, specifically contractors who have installed conduit, bolted channel tray, and Snap Track. Their input is periodically averaged and currently reflects the following man hour rates:

Average Man Hour Per Foot					
Rigid Conduit – RMS		**Channel Tray – Al Bolted**		**Snap Track**	
Size	MH / FT	Size	MH / FT	Size	MH / Ft
¾"	0.27	**3"**	0.23	**2"**	0.18
1"	0.40	**3"**	0.23	**2"**	0.18
1 ½"	0.42	**4"**	0.31	**4"**	0.25
2"	0.48	**4"**	0.31	**4"**	0.25
3"	0.56	**6"**	0.44	**6"**	0.35

Rate [5] The average rate for a Master Electrician (US Gulf Coast Region) is believed to be $31 per hour. Based on this average an "All in Labor Rate" of $60.00 per hour is used in this comparison**.**

Regardless of the labor rate, the data provided indicates that cable tray is installed in less time. A labor savings potential ranging from 15%-36% can be obtained when channel tray is utilized in lieu of conduit. While savings ranging between 33% - 48% can be realized through the patented Snap Track system. The data also indicates that maximum savings are realized when channel tray is used in lieu of conduit in sizes 1"-2".

Labor is one of the largest potential savings when cable tray is utilized as an alternative to conduit. Understanding the reasons why cable tray can be installed in less time will assist in maximizing the savings potential. Commonly stated reasons include:

- Fewer and less complicated components
- Time (cost) of cutting, threading, and sealing conduit
- Time (cost) of bending conduit
- Time (cost) of pulling cable
- Skill level required
- Revisions / re-work
- Disposal of cutting oil
- Installation practices (code requirements)

The Snap Track system has shown to further reduce labor costs by ~20%. These reductions are achieved through:

- Patented Push Pin Technology – No Bolts, Nuts or Tools Required
- Fewer Supports
- * Reduced field fabrication

*** The Snap Track system provides formed 3" through 36" radius fittings as well numerous unique items all designed to reduce field fabrication**

Maintenance Cost Savings

Although difficult to quantify, cost savings can be obtained throughout the life cycle of the cable tray system. During normal operations and maintenance, savings obtained through a cable tray system can be attributed to both improved reliability and flexibility.

1. Reliability

[6]An article in the October 1991 EC&M magazine, "Cable Pulling for Conduit Wiring Systems", stated that 91 percent of the insulated conductors that fail, do so due to the fact they were damaged during installation. Obviously the stresses placed on cable are greatly reduced when installed in an open tray system as compared to "pulled" through conduit. Consequently, conductor insulation failures are almost non-existent when cable tray systems are utilized.

[7]Another major concern in conduit systems is moisture related equipment failures. Condensation of ambient air and the resulting moisture accumulation is a concern with any enclosed wiring system. Accumulated moisture is literally piped through a conduit system and may eventually find its way to the equipment's metallic components. Over time the moisture can accelerate corrosion of these components and cause failure. Conduit systems can be specifically designed and installed to reduce moisture. However, this increases the cost of the system and is rarely done.

Concerns regarding moisture accumulation and the resulting maintenance costs can be eliminated with an open self-draining ventilated cable tray system.

2. Flexibility

During the life cycle of an industrial facility, upgrades and modifications do occur. As equipment is added or changed there is also a need to modify the wiring system. When additional cables need to be added, an open cable tray system can provide substantial advantages over conduit. In many cases, the additional cable can be easily added to and routed in the existing cable tray layout, while a separate conduit is often routed to new equipment.

However, when changes in direction, plane or elevation are required existing tray systems do require modification. With traditional bolted tray systems, these modifications often result in mechanically disconnected sections or the labor intensive removal and replacement of fittings.

With the Snap Track system, future modifications are easily accomplished by simply "unsnapping" existing fittings and "snapping" in new ones. The removed fittings can then be stored for future use!

Quantified Savings

As indicated, many of the potential cost savings of Snap Track and other channel type cable trays can be considered a "soft cost" and as such, are not easily quantified. What can be easily quantified is the raw material costs and the associated labor for an installation.

To compare raw material costs, a typical installation detail depicting a conduit wiring system, in a Class 1 Division 2 area, was converted to Snap Track.

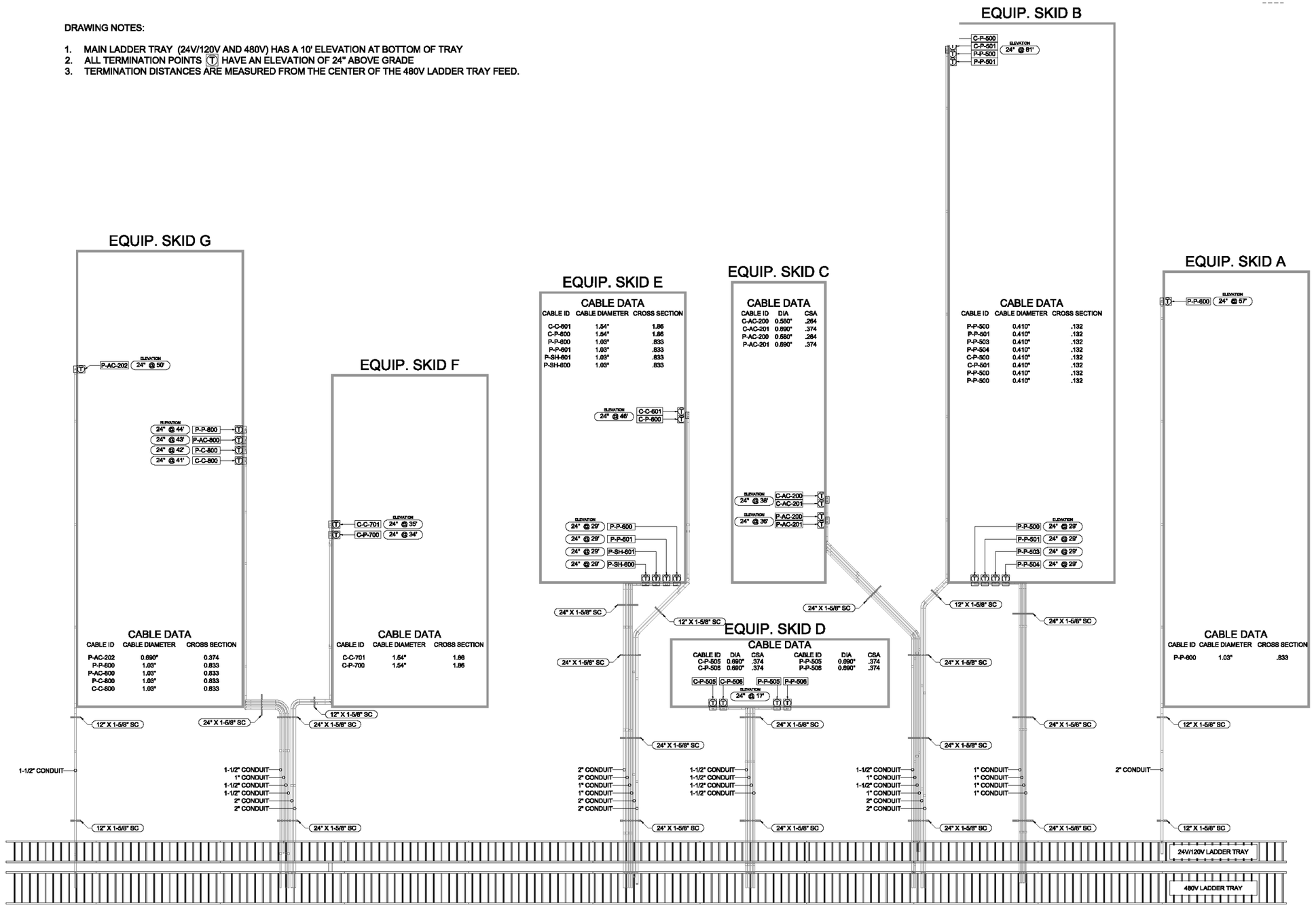
Material costs for the conduit were obtained from a major electrical distributor. Snap Track costs were obtained from the published MSRP price list.

For a comparison of labor costs the man hour rates previously presented and the "all in hourly rate" of $60.00 has been used.

Typical Skid Layout with Conduit

DRAWING NOTES:

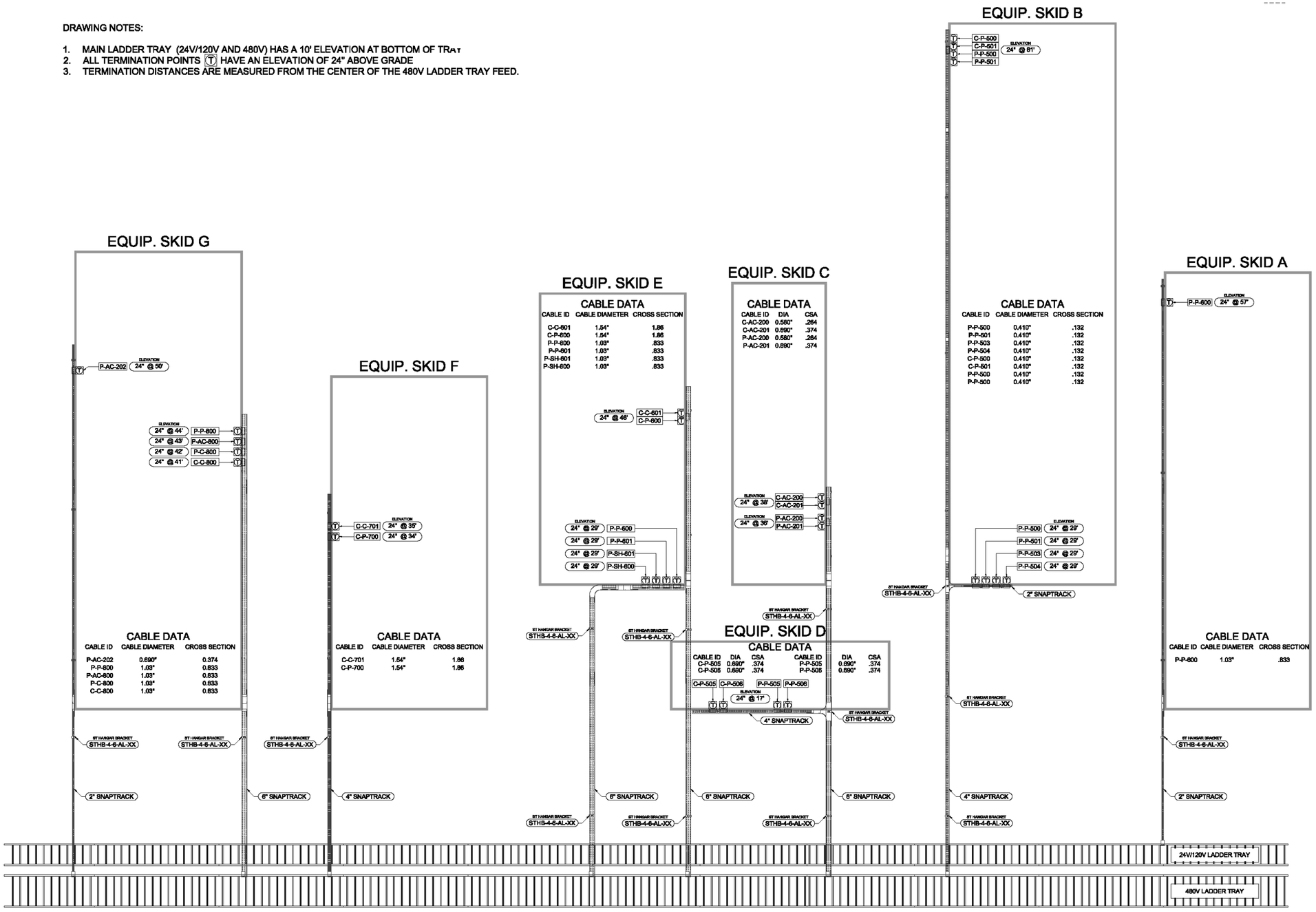
1. MAIN LADDER TRAY (24V/120V AND 480V) HAS A 10' ELEVATION AT BOTTOM OF TRAY
2. ALL TERMINATION POINTS (T) HAVE AN ELEVATION OF 24" ABOVE GRADE
3. TERMINATION DISTANCES ARE MEASURED FROM THE CENTER OF THE 480V LADDER TRAY FEED.

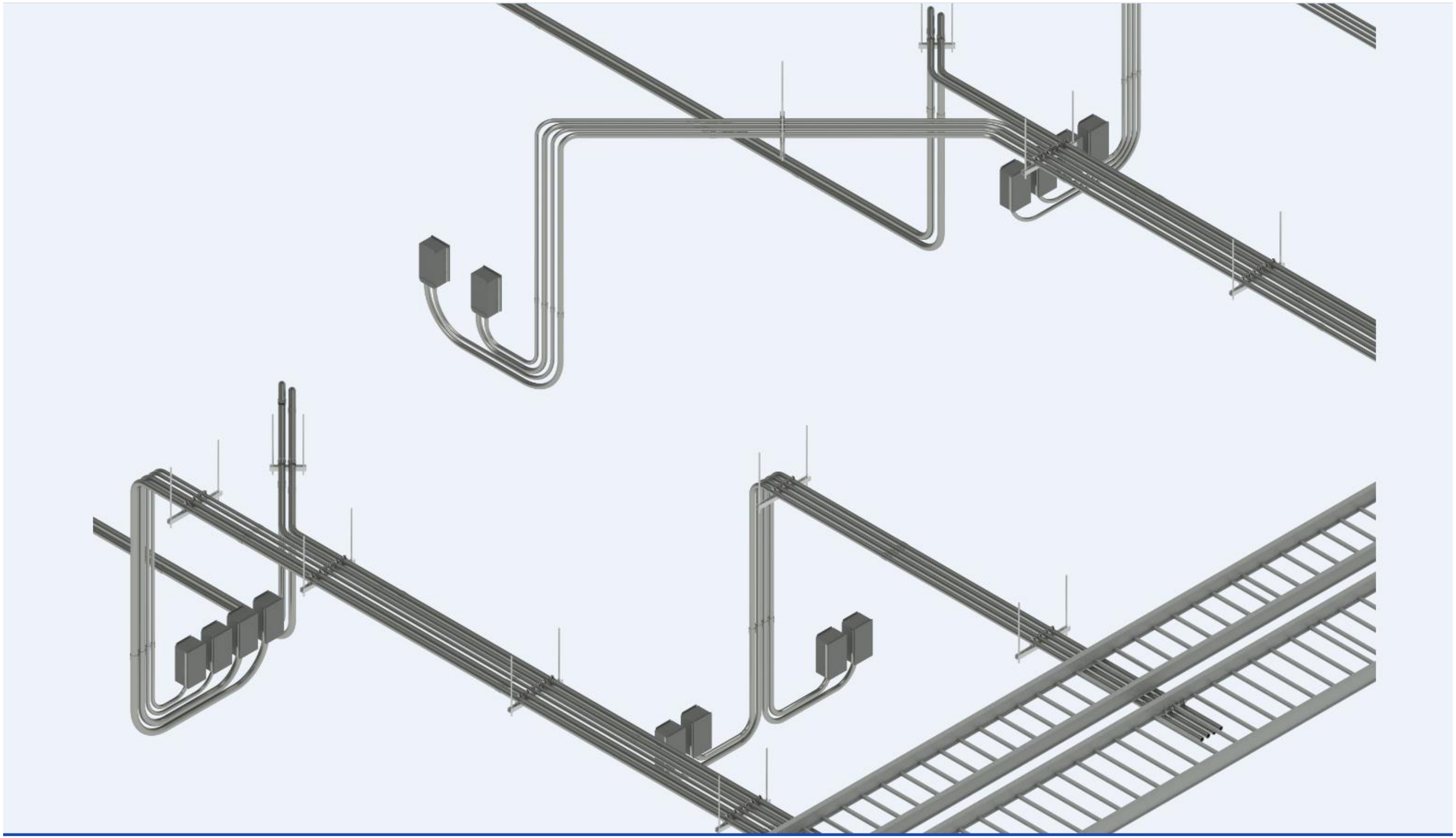


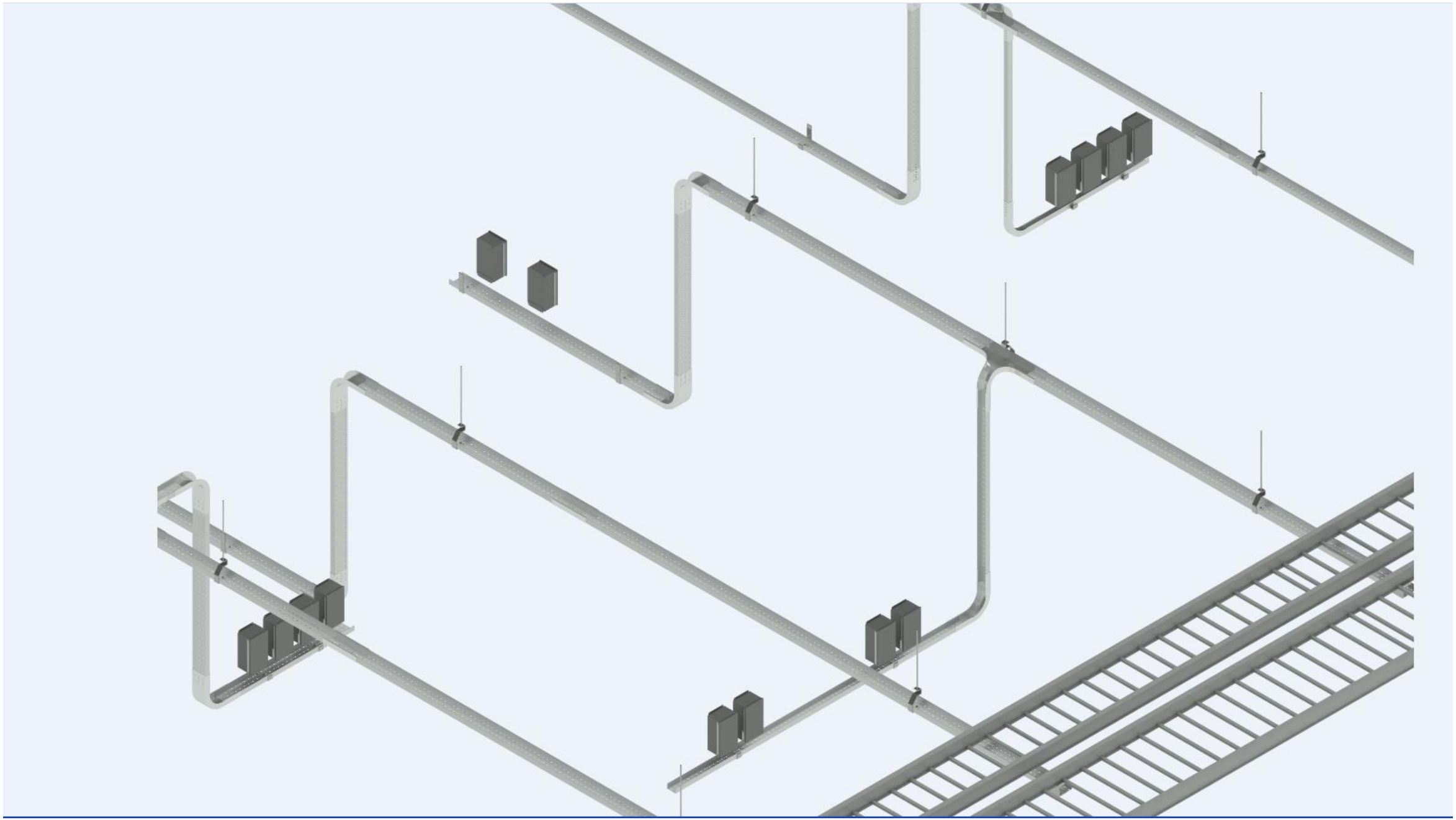
Typical Skid Layout with Snap Track Tray

DRAWING NOTES:

1. MAIN LADDER TRAY (24V/120V AND 480V) HAS A 10' ELEVATION AT BOTTOM OF TRAY
2. ALL TERMINATION POINTS (T) HAVE AN ELEVATION OF 24" ABOVE GRADE
3. TERMINATION DISTANCES ARE MEASURED FROM THE CENTER OF THE 480V LADDER TRAY FEED.







Snap Track BOM

QTY	UOM	PART NUMBER	PRICE	EXTENDED PRICE
160	FT	STC-2-2-AL	$ 5.06	$809.60
140	FT	STC-4-2-AL	$ 6.66	$932.40
180	FT	STC-6-2-AL	$ 7.81	$1,405.80
2	EA	STVO-2-2-AL-6R	$ 80.82	$161.64
3	EA	STVI-2-2-AL-6R	$ 80.82	$242.46
1	EA	STCS-2-2-AL	$ 21.01	$21.01
3	EA	STBE-2-2-AL	$ 14.50	$43.50
2	EA	STVO-4-2-AL-6R	$ 100.53	$201.06
3	EA	STVI-4-2-AL-6R	$ 100.53	$301.59
1	EA	STDT-4-2-AL-6R	$ 174.15	$174.15
2	EA	STCS-4-2-AL	$ 23.53	$47.06
3	EA	STBE-4-2-AL	$ 17.98	$53.94
4	EA	STVO-6-2-AL-6R	$ 114.51	$458.04
4	EA	STVI-6-2-AL-6R	$ 114.51	$458.04
1	EA	STDT-6-4-AL-6R	$ 174.15	$174.15
1	EA	STHE-6-2-AL-6R	$ 114.51	$114.51
4	EA	STCS-6-2-AL	$ 25.21	$100.84
4	EA	STBE-6-2-AL	$ 18.87	$75.48
13	EA	STULTTBKT-AL	$ 23.77	$309.01
14	EA	STHB-4-6-AL-XX	$ 26.21	$366.94
19	EA	STWB-4-6-AL	$ 22.01	$418.19
			BOM TOT	**$6,869.41**

Conduit BOM

QTY	UOM	PART NUMBER	PRICE	EXTENDED PRICE
400	FT	1" RGS Conduit	$ 2.26	$904.00
450	FT	1-1/2" RGS Conduit	$ 3.76	$1,692.00
550	FT	2" RGS Conduit	$ 4.50	$2,475.00
9	EA	1" Beam Clamp	$ 4.83	$43.47
10	EA	1 - 1/2" Beam Clamp	$ 6.26	$62.60
9	EA	2" Beam Clamp	$ 8.40	$75.60
60	EA	1" Strut Clamps	$ 0.91	$54.60
70	EA	1 -1/2" Strut Clamps	$ 1.26	$88.20
120	EA	2" Strut Clamps	$ 1.28	$153.60
125	FT	1 -5/8" Strut	$ 2.50	$312.50
28	EA	Crouse Hinds ECD15 1/2" Breather	$ 46.07	$1,289.96
9	EA	1" to 1/2" Reducer	$ 3.74	$33.66
10	EA	1 -1/2" to 1/2" Reducer	$ 10.87	$108.70
9	EA	2" to 1/2" Reducer	$ 18.75	$168.75
40	EA	1" RGC Coupling	$ 2.35	$94.00
45	EA	1 -1/2" RGC Coupling	$ 5.49	$247.05
55	EA	2" RGC Coupling	$ 8.99	$494.45
			BOM TOT	**$8,298.14**

Note: To minimize material and material costs all conduit bends were designed as field bends.

Conduit Estimate

Description	QTY	UOM	Unit Cost	Total Linear RGC Cost	* Ftg. & Assc.	**Supports	Total Raw Material	Material W/ 5% Waste Factor	M/HR Rate	Total WHS	Labor Rate	Total Labor	ESTIMATED TIC
1" RGC -Conduit	400	LF	2.26	$904.00	$488.83	$185.57	$1,578.40	$1,657.32	0.40	160.00	$60.00	$9,600.00	$11,257.32
1 1/2" RGC-Conduit	450	LF	3.76	$1,692.00	$768.52	$251.83	$2,712.35	$2,847.97	0.42	189.00	$60.00	$11,340.00	$14,187.97
2" RGC -Conduit	550	LF	4.50	$2,475.00	$1,178.19	$354.20	$4,007.39	$4,207.76	0.48	264.00	$60.00	$15,840.00	$20,047.76
Totals	1400			$5,071.00	$2,435.54	$791.60	$8,298.14	**$8,713.05**		**613.00**		**$36,780.00**	**$45,493.05**

*Conduit BOM

**ConduitDrawing

Snap Track Estimate

Description	Qty	UOM	Unit Cost	Total Linear Tray Cost	*Ftgs & Assc.	** Supports	Total Raw Material	W/ 3% Waste Factor	M/HR Rate	Total WHS	Labor Rate	Total Labor	Estimated TIC
2" Channel Tray	160	LF	5.06	$809.60	$468.61	$290.81	$1,569.02	$1,616.09	0.18	29	$60.00	$1,728.00	$3,344.09
4" Channel Tray	140	LF	6.66	$932.40	$777.80	$344.50	$2,054.70	$2,116.34	0.25	35	$60.00	$2,100.00	$4,216.34
6" Channel Tray	180	LF	7.81	$1,405.80	$1,381.06	$458.83	$3,245.69	$3,343.06	0.35	63	$60.00	$3,780.00	$7,123.06
Totals	480			$3,147.80	$2,627.47	$1,094.14	$6,869.41	**$7,075.49**		**127**		**$7,608.00**	**$14,683.49**

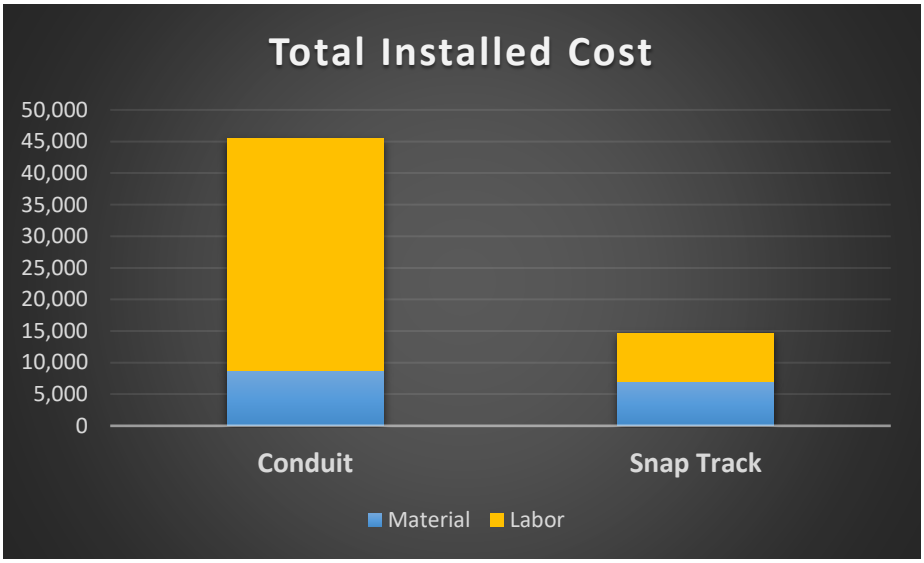
*Snap Track BOM

**18' Span See Drawing

Conclusion

Many of the advantages typically associated to ladder trays apply equally to ventilated channel trays. As with other types of cable trays “soft” cost savings are often achieved during design, procurement, and maintenance. When ventilated channel trays are compared directly to conduit, quantified savings from material and labor are similar to studies comparing larger conduit and ladder tray. This study, as well as other numerous studies comparing ladder tray to conduit, indicate potential total installed cost savings approaching or exceeding fifty percent (50%).

When Snap Track is compared to traditional ventilated channel trays an additional 15-20% savings can be obtained. These additional savings are primarily derived by reducing the number of supports, reducing field fabrication, and the labor required for assembly.



References:

[1] *Cable Tray Institute: Technical Bulletins*

Cable Tray Wiring Systems Have Many Cost Advantages

[2] *NEMA VE-2, Metal Cable Tray Installation Guidelines*

[3] *Electrical Contractor Magazine: January 2000 Issue*

[4] *NFPA 70, 2017*

[5] *www.salarycomparison.com*

[6] *EC&M Magazine: October 1991 Issue*

[7] *Cable Tray Institute: Technical Bulletins*

Moisture Problems in Electrical Systems