

# Conduit or Cable Tray?

Tips for selecting the right means of cable conveyance for your application



**Photo 1.** Steel conduit provides unsurpassed protection from conductor damage, however, sales volume dropped by 15% between 1994 and 2004.

By Dan Carazo, Carazo Communications

In any electrical installation, the structure type used to support, fasten, direct, and protect the installed wire and cable runs is critical. That's why choosing the appropriate pathway is so important. This article provides some useful guidelines and considerations when determining whether to use conduit or cable tray systems — with an emphasis on comparing steel conduit with steel cable tray (Table on page 54). But before diving into the pros and cons of these two options, let's take a look at how business affects the application of both.

**Market trends.** In 2004, U.S. companies shipped more than \$2.2 billion of electrical conduit and fittings, which include all the many types of raceways, wireways, and cable trays. The combined value of U.S. shipments of all metallic and non-metallic conduits totaled more than \$1.7 billion.

For most wiring installations, conduit remains the first choice. One reason for this reality is the fact that conduit's broad range of design types includes rigid metal conduit (RMC), electrical metallic tubing (EMT), intermediate metal conduit (IMC), rigid PVC, flexible PVC, flexible MC (metal clad in aluminum or steel), liquid-tight, and

zinc-coated corrosion-resistant steel (**Photo 1** on page 52).

According to a report published by The Freedonia Group, a Cleveland-based business research company, "Demand for conduit declined precipitously between 1999 and 2004 to 1.7 billion feet...Conduit demand is expected to grow 1.6% per annum to 1.8 billion feet in 2009... Steel conduit will continue to lose ground based on its higher material cost and installed costs."

By comparison, the U.S. market for cable tray is far smaller with slightly more than \$200 million in annual sales. Nevertheless, cable tray sales have continued to grow steadily in recent years with one cable tray manufacturer citing an increase of 25% in 2005 and another recently reporting a 14% annual growth rate between 1997 and 2004.

One factor that is increasing interest in cable tray is the increased commercial use of metal-clad (MC) cable. According to one executive at a leading wire and cable manufacturer, "MC is becoming the product of choice for commercial electrical wiring systems. The driver behind this shift is the ease of installing MC, saving up to 50% when compared to a pipe and wire installation."

Since installed MC is frequently supported by a cable tray system, this trend bodes well for continued increases in cable tray use (**Photo 2**).

In addition to market dynamics, the popularity of one approach over the other is driven by other factors, including performance differences, regional influences, and cost considerations.

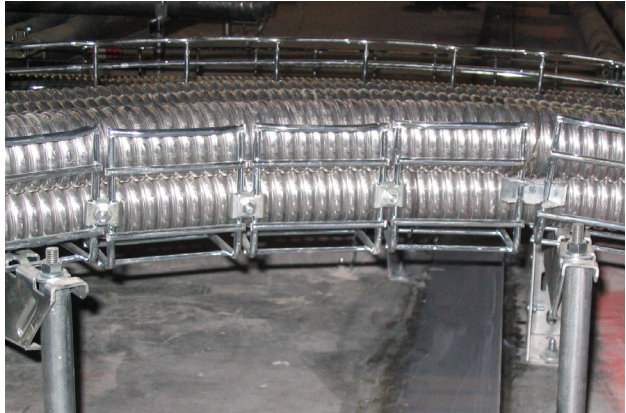
**Conductor protection.** The most obvious reason for the pervasive use and popularity of conduit is the fact that it is an enclosed raceway offering outstanding protection to the shielded wiring or cable. Because of its outstanding tensile strength, steel conduit provides excellent protection to the electrical conductor, providing a tough barrier in demanding environments. This is an important differentiating factor that's at the very heart of conduit's long-term popularity.

There are many applications that require substantial physical protection for wire and cable. For such projects, steel conduit is an ideal choice. Conduit with special coatings can also provide additional protection against corrosion.

**Regional differences.** As one marketing manager for an industry manufacturer put it, "Conduit inherited an installed base of gas pipes that used to be used for transmitting gas to gas lamps. When the conversion was made to electricity, the wiring was just run through the old gas pipes."

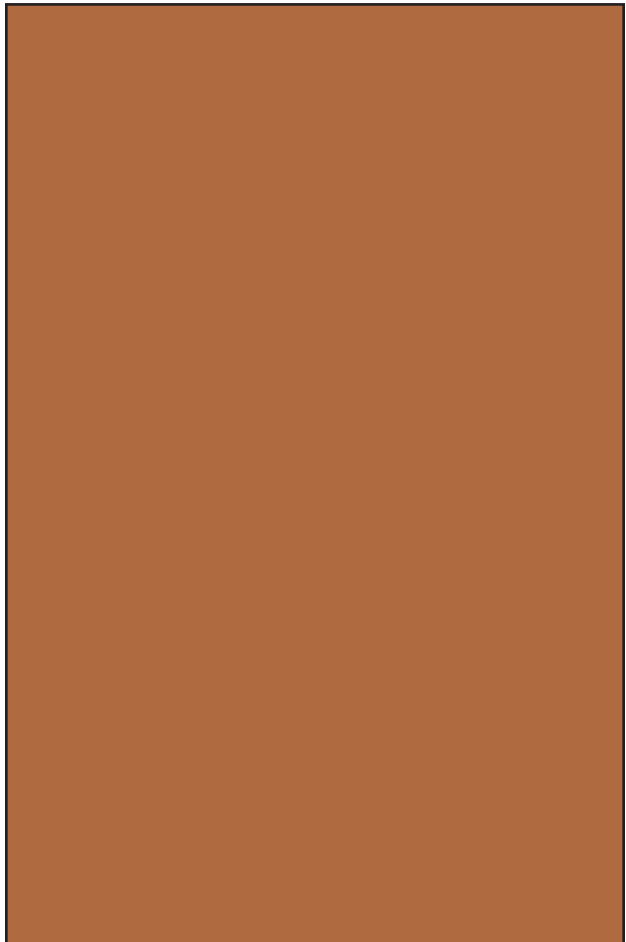
Seen in this light, the strong historical preference for conduit is understandable, but it's interesting to note that the same preference does not impact all regions outside the United States. In fact, cable tray holds an edge over conduit in both power and datacom applications outside the U.S. and Canada. In Europe, Asia, and South America, cable tray is the pathway of choice for most electrical work, both for power and datacom. Why then do conduit sales here in the U.S. eclipse those of cable tray by more than 850%?

In 1997, a survey of electrical industry professionals entitled "Cable or Conduit — Who Uses It and Why?" published by the



**Photo 2.** The use of cable tray continues to grow primarily due to its significantly reduced labor and materials installation costs.

IEEE attempted to determine future trends in cabling versus conduit wiring methods. The survey set out to measure preferences in four user groups: oil refineries, chemical plants, pulp & paper mills, and industry consultants. The authors attempted to clarify "why the U.S. market has not rapidly embraced cable tray... and



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Conduit/Cable Tray Comparison		
System	Advantages	Disadvantages
Steel conduit	High tensile strength provides the highest level of physical protection of conductors; non-combustible	Rising steel prices have significantly increased material costs
	Has fewest restrictions in NEC and local electrical codes	More labor intensive (increases costs for many types of installations)
	Specified in more standard industrial and commercial building specs	Requires additional cable-pulling labor costs
	Excellent EMI/EMF shielding (reduces effects by 95%)	Limited wire/cable capacity (too limited for many high-density needs in data centers, commercial and industrial applications)
	Classified as an equipment grounding conductor	Difficult to access, identify, repair, reposition, remove, or add cables
	May be encased in concrete, or buried	Conduits can allow smoke or toxic gases to travel throughout a building
Steel cable tray	Open system reduces cable installation time, generating labor cost savings	Must use cable tray-rated cables, which are more expensive due to their increased insulation
	Reduced costs for installation materials	Does not entirely enclose conductors; provides less physical protection from damage to conductors
	Greater wire capacity due to very wide widths (can hold far more conductors)	Restricted from some uses by NEC and local electrical codes
	Provides more conductor ventilation, which reduces cable heat	Installed wiring is aesthetically visible
	Cables are easily visible/easily accessed, making inspection and maintenance far easier and faster	
	Easy to build and construct for complex routings	
	Highly flexible, adaptable to re-routing cables	

Both systems are primarily used in commercial and industrial applications. This reference list outlines some pros and cons for each product type.

the difference in attitude between the U.S. and Canadian markets.”

The key findings included:

- Both U.S. and Canadian professionals agreed that cable tray systems have a lower initial material cost and are less expensive to install than conduit.

- A majority of professionals felt conduit offers better protection than cable tray.

- The pulp & paper and industry consultants groups had a strong preference for cable tray.

- Chemical plant and oil refinery responders each had a slight preference for conduit.

- U.S. responders preferred future use of conduit in hazardous areas.

- Fewer than 50% of the U.S. responders knew the NEC allowed MC cables to be installed in Division 1 locations (at the time of the report this was a recent Code change).

**Installation cost comparison.** Product advantages intended to reduce contractor installed labor costs drive much new product development. Recent innovative solutions intended to speed cable and wire installations include color-coded conduit that eliminate the need to spray paint, powder coat, or tape in the field to signify specific wiring types, and conduit with pre-lubricated interior surfaces for faster wire pulling.

Cable tray companies have also delivered cost-saving innovations by introducing new tray styles such as wire mesh trays, and designs that reduce or eliminate cutting to size in the field. There are now cable trays that snap together for assembly without nuts, bolts or tools, while others connect quickly using nothing more than pliers to bend pre-installed locking tabs or adjust-to-fit couplings.

Numerous cost comparison studies

have been published comparing labor and material costs for a specified installation when installing rigid steel conduit, EMT, and cable tray — a major Big Box retailer completed one such cost study. A 30% reduction for combined material and installation costs resulted by installing MC cable with a cable tray system versus installing EMT conduit and pulling conductors through them.

Another comparison performed by ??? confirms a 75% cost reduction using galvanized steel cable tray. Equivalent conductor fill areas were used for the comparison while cable-pulling costs were excluded. Using \$60/hour per NECA labor unit, the calculated total installed cost was approximately \$38,000 using rigid steel conduit compared to only \$9,000 when using galvanized steel ladder cable tray.

In 2004, NECA published a labor rate

## Enclosed Raceway System or Open Support System?

Electrical pathways include many different modes of supporting and routing installed wires and cables for power and low-voltage, but not all are considered raceway. Article 100 of the NEC defines 14 specific types of products as “raceway.” The NEC defines a “raceway” as “an enclosed channel of metal or nonmetallic materials designed expressly for holding wires, cable, or bus bars, with additional functions as permitted in this Code.”

That definition covers most of the commonly used wire/cable support structures, including conduit, tubing, pipe, wireways, busways, and both in-floor and surface-mounted raceways. However, cable tray is one exception that is *not* considered a “raceway” as defined by the NEC because cable tray is an “open” structural system that does not enclose the cable.

By comparison, the NEC defines a cable tray system as “a unit or assembly of units or sections and associated fittings forming a rigid structural system used to securely fasten or support cables and raceways.” The NEC also requires the use of specialized cable tray-rated cables in all cable tray installations, which typically increases the project cost for wire.

index that verified a 30% labor savings with wire mesh cable tray when compared with steel ladder tray.

**Making your selection.** In the case of cable tray, the ease of installation, coupled with lower materials costs, as well as a major reduction in cable-pulling costs, consistently results in double-digit savings when compared with similar steel conduit installations. While this cost advantage enhances the economic reasons for considering cable tray, this is but one of the three critical issues — safety, cost, and simplicity — one must examine when making electrical industry decisions. These factors still drive the need to install conduit in certain areas. **EC&M**

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