Q. We are installing fiber in conduit for a waste water treatment facility. Typically, we use underground concrete-in-cast duct bank of 2”, 3”, 4” or 6” conduit sizes. We currently require the contractor to install the fiber optic cable inside non-corrugated innerduct before placing it inside the conduit. There is now some thinking about eliminating the use of innerduct. What is your opinion about this?

A. Let your voice be louder and clearer—do not eliminate the innerduct! The R.O.I on the added costs will be realized in the short term for several reasons.

SEE PHOTO ONE

You’ve got questions about datacom
Bo Conrad, a BICSI-certified instructor, will answer them. To have your question answered in Power Outlet e-mail us at poweroutlet@rexelusa.com and put “Ask Bo” in the subject line.
Innerduct provides the following:

**Extra protection** from water migration, rodents, accumulated dirt and debris, as well as from other trades using the same duct (e.g. electrical, broadband, security, LECs, etc.). [SEE PHOTO TWO]

**Ease of pulling** when adding or removing fiber. [SEE PHOTO THREE] Conduits can become very congested—spaghetti-like. Remember, there are multiple trades using the backbone pathway. Even if you are pulling cable using Kellum Grips (“Chinese fingers”) or when using a swivel/pulling eye, cable naturally tends to spiral around other cables when being pulled and often gets caught.

Subsequently, you may exceed the industry-standard maximum 600 pounds per foot tensile strength rating of the OSP fiber cable.

**Innerduct will reduce the chance of exceeding the fill ratio (40%) of the duct—or at least keep it confined to fiber cables only. [SEE PHOTO FOUR]**

**Q. Why is innerduct corrugated? What differentiates it from non-corrugated or smooth-wall/solid rigid innerduct?**

**A. As an industry practice, corrugated innerduct is non-metallic and is used inside buildings and for short OSP (Outside Plant) cable runs. The “vacuum cleaner hose” corrugated design is lightweight and adds the needed flexibility for storage on spools, and bending while installing the innerduct.**
But the corrugated design’s most important feature is reducing the friction surface of the cable pull. **SEE PHOTO FIVE**

“Slit Duct” versions offer the same features, but have a slit along the entire length of the innerduct. This is primarily used in retrofit cable applications to stuff cable into—similar to what you may use for your auto or trailer electrical needs.

Most common used and stocked corrugated outside diameter width sizes are 1” and 1 ¼”. Other available sizes include ¾”, 1 ½” and 2”.

Orange usually designates PVC or a riser-rated compound and should comply with UL910 NEC 770 and UL2024A for Low Smoke and Flame Resistance. Usually-but-not-always, white (and orange) designates UL1666 PVDF plenum-rating. Innerduct may be purchased with or without the 900 pounds-per-foot rope/tape—as seen in **PHOTO SIX**.

Economically, it usually makes sense to purchase innerduct with the pull rope/tape—otherwise you will need an exceptionally long fish tape or will have to blow pull rope in separately. Be courteous to the next tech (who may be you!) and **pull additional replacement rope/tape along with your cable pulls both in the conduit as well as the innerduct.**

**Non-corrugated inner duct** is referenced by a variety of industry slang terms, including “smooth-wall,” “rigid,” and “solid-wall”. Similar to corrugated, it is also offered in a variety of colors. Typically constructed of High-Density Polyethylene (HDPE), it carries no NEC fire-rating. Riser-rated PVC and PVDF plenum-rated versions are available by special order.

As seen in **PHOTO SEVEN**, this type of innerduct is more robust and is typically used for longer-haul OSP (Outside Pant) applications. It has significantly thicker walls providing added protection against Mother Nature, Mother Rodents, and Mothers of Other-Trades.

As expected, smooth-wall solid innerduct weighs more and is less flexible, but provides for higher tension pull strength (withstanding a pick up truck pull!) for installations in longer-pull OSP conduit systems. It is less susceptible to abrasion, scouring, and root penetration.

Installing innerduct into duct systems requires having the spools mounted onto
custom-made trailers—see PHOTO EIGHT. It is not exclusive to datacom and telecom and is also used for electrical, security, etc. Smooth wall solid innerduct provides better drainage in sloped installations at the lower end than corrugated where water can be trapped between the ridges.

MORE ABOUT INNERDUCT

Micro-ducts—notice the smaller conduit in PHOTO SEVEN. They get even smaller and are appropriately called Micro-Ducts—some are shipped pre-filled with fiber cables already installed.

Drilling drain holes?—The best-known manufacturers of innerduct include Arnco, Carlon, Duraline, Endot, Pacific Pipe, and Tyco Amp Netconnect. Most of the manufacturers that I spoke with do not support drilling drain holes—a very controversial procedure. Additionally, some of these manufacturers are offering “dual-wall” solid conduit having smooth-wall outsides, but longitudinal or spiral corrugated insides to reduce cable pulling friction.

Available widths vary include ½”, ¾”, 1”, 1¼”, 1½”, 2” and 4”. Depending on the size and construction type, smooth-wall solid innerduct lengths can range from 1,000 feet to as long as 6,500 to 8,000 feet.

Which should you use? First, determine your handling capability. The longer lengths are bulky (with 84” spools); they require a forklift for handling the extra weight, and a specially equipped trailer for the installation.

If you are expected to exceed the 900 pounds/foot rating of the pull rope/tape, the option is to use “Mule” pull tape (rated at 1,250 pounds per foot).

If tracing a fiber installation is a priority, tunable/traceable conduit is a much preferred alternative to installing OFC (Optical Fiber Conductive) cable.

OFC cable is defined as having any type of conductive or metal as part of its construction:

1. Using a stainless steel center strength member (in lieu of common fiberglass-type rod);
2. direct burial-type having a “Armadillo” type outer jacket, made from flex aluminum or stainless steel; or,
3. a copper tonable strand embedded in the fiber cable’s jacket wall.

You may find OFC cable difficult to work with and less flexible. It easily kinks and needs to be bonded and grounded—which adds to both the labor and material cost factors.

Water migration—If both ends of the duct system are not properly plugged or sealed, you must accept the fact that water, moisture from humidity, dirt, and debris will eventually migrate into OSP duct systems and related innerduct. Over an extended period of time, even worms, rodents, spiders, and snakes will find their way into the confines. This is true for most all OSP applications—no matter if the conduit system is sloped on a hillside, encased in cement, or placed above or below freeze lines and water tables.

Manufacturers offer end-plugs, plug sets, and even bladder seats to seal ends of innerduct. Nicknames are derived upon the fixed conduit stacking arrangement (e.g. triplex is a triangle and quadplex stacked two onto two, etc).

For the many reasons stated, using innerduct provides better protection and makes for easier installations for your telecom cabling. Your choices are varied and you should review your options with your designer and your distributor.

Additional note: Don’t forget to carefully choose your cable jacketing! It, too, should be based upon the environmental factors of protection from outside weather (water) factors and/or fire-ratings for inside applications.

Conrad, a BICSI-certified trainer, has a bachelor’s degree in engineering and an MBA. His resume includes corporate executive positions from international marketing and manufacturing to corporate distributor sales and training. His company, Crossbow Communications (www.crossbowcom.com), is licensed by BICSI to conduct the Professional Cable Installer program.

MORE ‘ASK BO’—ONLINE

See Rexel’s online E-Zine for more questions—and answers—from Bo Conrad on datacom and telecom topics. Find the E-zine at http://www.rexelusa.com/ezines.htm. Navigate to the “Ask Bo” online archives (which have different questions and answers from what has appeared in the magazine) by clicking on the link you’ll find at the URL above.