Video Value

The Business Case for UTP in the CCTV Security and Surveillance Environment

BY JEFFREY HERMAN

Until recently, closed-circuit television (CCTV) security and surveillance equipment has been predominantly installed using coax cable. Although the technology to support twisted pair in the CCTV environment has been around for many years, today more and more CCTV dealers and installers are specifying twisted pair for the entire cabling system simply because it makes good business sense. The reasons for this shift are numerous:

- The quality of the UTP (unsheilded twisted pair) cable on the market is so good one can't often tell the difference between coax and UTP in terms of image quality.
- The quality of the CCTV cameras and receivers has improved.
- The price of CCTV equipment has dropped significantly over the years leading to a profusion of CCTV equipment in many applications.
- The increase in CCTV equipment has made cabling a more significant cost factor of any contract.
- The increase in the amount of CCTV coax cabling has put a strain on the building's cabling infrastructure.
- The cost of video transmission products that support UTP has dropped dramatically, making it cost-effective to switch to UTP even for short distances under 500 feet.

In this article, we'll look at some guidelines by which a CCTV installer can prepare his or her own business case for a complete twisted pair solution using CCTV baluns. The methodology will be presented to determine what the cost-savings would be in a fully UTP-based cabling system by establishing the basic cost assumptions, while providing a worksheet and case examples to guide CCTV system integrators/installers in building their own business case.

Business Case Approach

The approach to building a business case for UTP involves comparing the cost of connecting CCTV cameras with twisted pair versus the cost of connecting the same system using coax cable. Therefore, the first step is to estimate what the cost of cabling would be for a coax-based system. The second step is to estimate the cost of the same system using twisted pair and CCTV baluns.

COAX CABLING. In order to calculate the cost of a coax-based system, the following procedure is recommended:

1. Determine the number of camera connections that must be made between the cameras and a video multiplexer or switch. For each connection, determine the approximate cable length.
2. Calculate the price-per-foot currently being paid for coax cable. The price will also depend on whether plenum or

non-plenum cable is required. (Plenum cable is rated for use in plenum ceilings where conduits are not used and is more expensive.)

3. Calculate the material cost of the cable for each connection based on the length of the cable.
4. Calculate the total material cost of the cabling for all the camera connections.

TWISTED PAIR CABLING. The next step is to estimate what the same CCTV system would cost if twisted pair cable is used instead:

1. Identify if there are cameras clustered within a certain zone or area. For example, if four cameras are clustered in one zone, they can share a 4-pair homerun cable to the video multiplexer. A short drop cable using less expensive Category 3 cable can be used to connect the cameras to the homerun cable.
2. Determine for each zone what length of Category 5 cable is needed to connect the zone to the video multiplexer.
3. Determine for each camera in each zone what length of cable is needed to connect to the homerun cable. Due to the short length of drop cable needed to connect the camera to the homerun cable, less expensive Category 3 cable can be used instead of Category 5.
4. In cases where a camera is in an isolated area, determine what length of Category 5 twisted pair will be needed.
5. Calculate what price-per-foot you would pay for Category 3 or Category 5 twisted pair cable. The price will also depend on whether plenum or non-plenum cable is required. (Plenum is more expensive.)
6. Calculate the material cost of the cable for each connection based on the length of the cable.
7. Determine the number of CCTV baluns that will be needed to support the entire CCTV system. The baluns work in pairs, so two baluns are needed for each camera connection, one at each end of the cable.

Cost Assumptions

COAXIAL CABLE COSTS. This primary cost-savings results directly from the replacement of coax cable by twisted pair. The average cost of coax cable is $0.09 per foot for non-plenum and $0.27 per foot for plenum.

TWISTED PAIR CABLE COSTS. The cost of twisted pair is generally lower per foot than coaxial cable. Since Category 5 or superior cable is usually installed in most buildings today; the average cost per foot is highly competitive and ranges from $0.05 for non-plenum to $0.15 per foot for plenum. Prices vary widely, depending on manufacturer, distributor and volume purchase agreements.

HOMERUN CABLES. A major difference in working with twisted pair versus coax cable is the possibility of running multiple cameras under a single homerun cable. For example, let's say that four cameras are located in one zone. Each camera is between 500 and 550 feet from the video multiplexer. When using coax cable, four homerun coax cables would be needed to connect the cameras to the multiplexer. Similarly, when using twisted pair, only one Category 5 homerun cable is needed with four shorter cables to connect the homerun cable to the cameras. These cables could even be less expensive Category 3 cables.

COST OF TWISTED PAIR BALUNS. Added to the cost of the twisted pair cable is the cost of a pair of twisted pair baluns for each camera connection. This cost offsets the cost-savings resulting from the use of UTP versus coax cable. However, on longer runs, the cost-savings will be more noticeable. On very short cable runs, there may not be any savings. Therefore, the cable length and the cost of the baluns will determine the material cost-savings on that cable run. For this example, a price of $70 per balun pair will be used.

COST OF WORKMANSHIP. The cost of installing UTP versus coax is more difficult to quantify since each installer is faced with his or her own set of labor factors.

COST OF CABLE MANAGEMENT. CCTV cameras are generally not moved around too often; therefore, the cost of moves, adds and changes is not a major consideration. However, the advantage of using UTP means that additional cameras can be added more quickly if there is pre-installed twisted pair through the building complex. Most buildings today are cabled with twisted pair to facilitate moves, adds and changes of data and voice equipment.

INTANGIBLE BENEFITS OF UTP. There are other benefits of using UTP that can translate indirectly into additional cost-savings:

- Fewer boxes of cable need to be transported resulting in greater ease of handling.
- UTP is less bulky and easier to pull through walls and conduits and around corners. It also uses less conduit and duct space than coax.
- UTP occupies approximately half the space of coax for a given length of cable, thereby using less truck space.
- UTP cable usually weighs one third of coax for a given cable length, allowing greater ease of handling.
- UTP may be in boxes or on spools and can therefore be deployed

under a variety of different conditions.

- Ease of moves, adds and changes. Once the cable is installed, making changes in the CCTV layout is easier because the cabling is already in place.
- By allowing CCTV in addition to voice and data to be connected via UTP, the investment in a structured cabling system (SCS) is further cost-justified.

With the above costs identified, the CCTV installer has enough information to construct a business case for twisted pair in a CCTV security and surveillance cabling system. This information can be entered on a worksheet such as the one shown on page 33.

An Example – 16 Cameras Spanning 10 Zones

In order to illustrate the material cost-savings one can obtain by using twisted pair for CCTV, the following example is presented.

An installation requires 16 cameras to be placed in 10 different zones. Two of the zones (Zones 1 and 7) have four cameras clustered near each other. The other cameras are isolated from one another. (See Table 1.)

Most camera connections are traditionally made using coaxial cable. Occasionally fiber may be used, either because extended distance is required or because the cabling passes through an electrically "noisy" environment. Assuming none of the cameras require fiber optic cable, 16 homerun coaxial cables must be connected between the cameras and the central monitoring equipment as shown in Figure 1.

If the same installation is implemented using twisted pair cable, all homerun cables are replaced by Category 5 twisted pair. In the case where four cameras are in one zone, the cameras can share a 4-pair Category 5 homerun cable. Short Category 3 drop cables can be brought from each camera to the homerun cable. Since the drop cables are short and the signal loss minimal, less expensive Category 3 UTP can be used as illustrated on page 34.

Zone	Camera #	Distance (ft.)
1	1	550
1	2	525
1	3	530
1	4	510
2	5	1500
3	6	2000
4	7	500
5	8	300
6	9	200
7	10	1200
7	11	1230
7	12	1240
7	13	1250
8	14	200
9	15	400
10	16	200

Table 1 Example – 16 Cameras Spanning 10 Zones

Based on this scenario, the following cost assumptions have been made:

Cost of Coax Cable:
$0.27 per foot (plenum)

Cost of CAT 5 4-pair UTP:
$0.15 per foot (plenum)

Cost of CAT 3 UTP:
$0.05 per foot (non-plenum)

Cost per CCTV Balun:
$35.00 per balun (a pair is needed per camera connection)

Once the figures have been entered onto the spreadsheet, as shown on

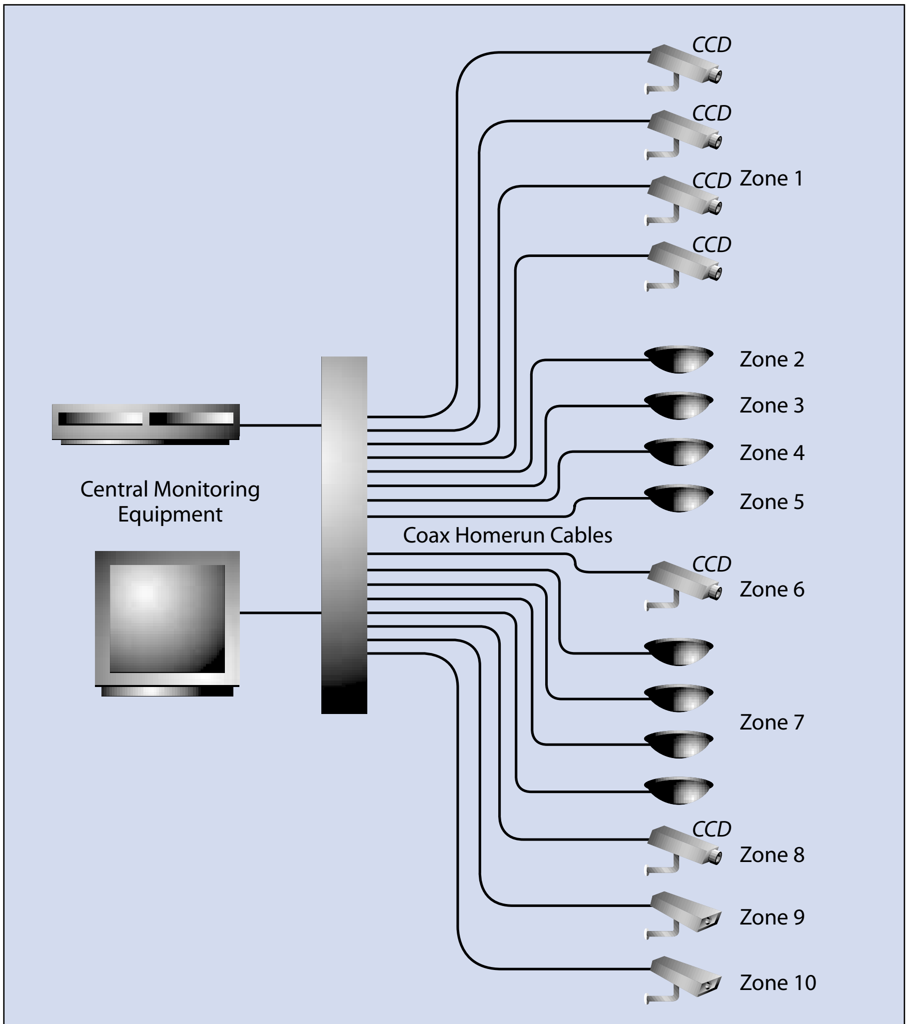

Figure 1 The Coax Installation

Worksheet – 16 Cameras Spanning 10 Zones

Coax Cable

Zone	Camera	Cable Type	Cable Grade	Length	Qty.	Price/Ft.	Extension
1	1	Homerun	Coax	550	1	$0.27	$149
1	2	Homerun	Coax	525	1	$0.27	$142
1	3	Homerun	Coax	530	1	$0.27	$143
1	4	Homerun	Coax	510	1	$0.27	$138
2	5	Homerun	Coax	1500	1	$0.27	$405
3	6	Homerun	Coax	2000	1	$0.27	$540
4	7	Homerun	Coax	500	1	$0.27	$135
5	8	Homerun	Coax	300	1	$0.27	$81
6	9	Homerun	Coax	200	1	$0.27	$54
7	10	Homerun	Coax	1200	1	$0.27	$324
7	11	Homerun	Coax	1230	1	$0.27	$332
7	12	Homerun	Coax	1240	1	$0.27	$335
7	13	Homerun	Coax	1250	1	$0.27	$338
8	14	Homerun	Coax	200	1	$0.27	$54
9	15	Homerun	Coax	400	1	$0.27	$108
10	16	Homerun	Coax	200	1	$0.27	$54
Cable Cost				12335	16		$3,332

Twisted Pair

Zone	Camera	Cable Type	Cable Grade	Length	Qty.	Price/Ft.	Extension	Baluns	Cost	Extension
1	1	Drop	CAT 3	50	1	$0.05	$3	2	$35.00	$70
1	2	Drop	CAT 3	25	1	$0.05	$1	2	$35.00	$70
1	3	Drop	CAT 3	30	1	$0.05	$2	2	$35.00	$70
1	4	Drop	CAT 3	10	1	$0.05	$1	2	$35.00	$70
1	1-4	Homerun	CAT 5	500	1	$0.15	$75			
2	5	Homerun	CAT 5	1500	1	$0.15	$225	2	$35.00	$70
3	6	Homerun	CAT 5	2000	1	$0.15	$300	2	$35.00	$70
4	7	Homerun	CAT 5	500	1	$0.15	$75	2	$35.00	$70
5	8	Homerun	CAT 5	300	1	$0.15	$45	2	$35.00	$70
6	9	Homerun	CAT 5	200	1	$0.15	$30	2	$35.00	$70
7	10	Drop	CAT 3	0	1	$0.05	$0	2	$35.00	$70
8	11	Drop	CAT 3	30	1	$0.05	$2	2	$35.00	$70
8	12	Drop	CAT 3	40	1	$0.05	$2	2	$35.00	$70
8	13	Drop	CAT 3	50	1	$0.05	$3	2	$35.00	$70
8	10-13	Homerun	CAT 5	1200	1	$0.15	$180			
8	14	Homerun	CAT 5	200	1	$0.15	$30	2	$35.00	$70
9	15	Homerun	CAT 5	400	1	$0.15	$60	2	$35.00	$70
10	16	Homerun	CAT 5	200	1	$0.15	$30	2	$35.00	$70
Cable Cost				7235	18		$1,064	32		$1,120
Mtl Cost										$2,184
Savings										$1,148
% Savings										34%

Table 2

page 33, the following cost-savings are apparent:

1. The total savings by using unshielded twisted pair (UTP) instead of coax is $1148.
2. The percentage savings is 34 percent versus coax.
3. The ability to connect multiple cameras under a single 4-pair Category 5 cable translates into a labor and material cost-savings, since there is 5000 feet less of cable to be installed.

Conclusion

Given the current cabling technologies and cost assumptions, it is apparent that a fully twisted pair cabling system for CCTV is cost-effective, for any length of camera connection within the range that twisted pair can support. There is no longer a need for short coaxial patch cables because the conversion to twisted pair occurs at the CCTV hardware. The example provided here can be applied to larger installations involving hundreds of cameras where the use of CCTV baluns translates into considerable cost-savings in material alone.

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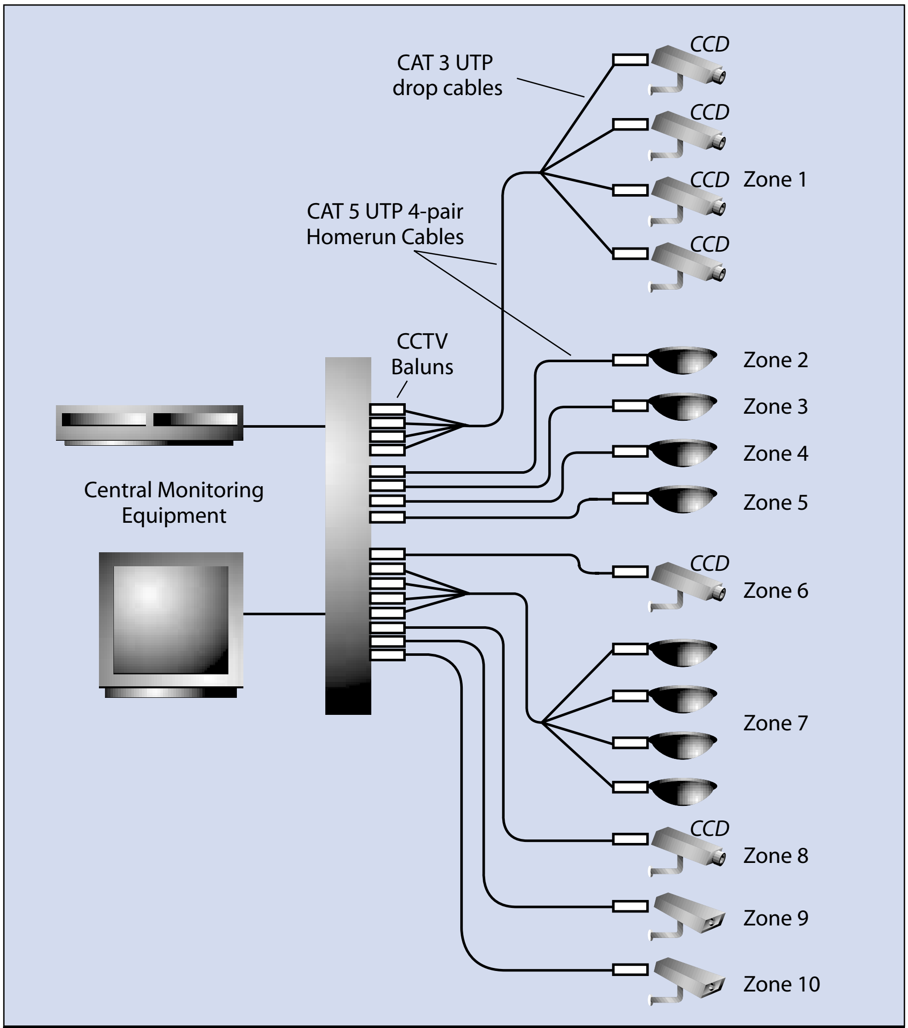

Figure 2 The Twisted Pair Installation

Terminology

We realize the confusion acronyms, abbreviations and other industry jargon can create. To address this dilemma, we provide this ongoing list of terminology as a monthly resource in *CBM*. Be sure to look for it in each issue.

Dual-Attached Station (DAS)
A station defined in the fiber distributed data interface (FDDI) standard that has two dual-fiber optic connections (MIC A and MIC B) that allow it to be connected to the dual FDDI ring.

Dual-Fiber Cable
A type of fiber cable that has two single-fiber cables enclosed in a jacket of extruded polyvinyl chloride (PVC), with a ripcord for pulling back the jacket to access the fibers.

Dual Homing
The optional connection of dual-attached stations (DASs) to concentrators to increase reliability of the DAS network attachment.

Dual-Media Access Control (DMAC)
A station with two media access control (MAC) entities, which allow for logical connectivity to each of the dual FDDI rings. A DMAC station can independently send and receive data from both rings and thus has an available bandwidth of 200 Mbps from the network.

Ducts
Various pathways or conduits ranging from PVC to metallic to clay/tile. Example: the main feeder channels in which communication cable is routed between buildings in a campus environment.

Dumb Terminal
A dumb terminal is a device that can send and receive data but cannot process data.