BEFORE THE

FLORIDA PUBLIC SERVICE COMMISSION

DIRECT TESTIMONY OF

RICK BISSELL

ON BEHALF OF

AT&T COMMUNICATIONS OF THE SOUTHERN STATES, INC.

AND

MCI TELECOMMUNICATIONS COMPANY

AND

MCI METRO ACCESS TRANSMISSION SERVICES, INC.

DOCKET NOs: 960833-TP/960846-TP/971140-TP

November 13, 1997

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Q. PLEASE STATE YOUR NAME, ADDRESS, AND OCCUPATION.

A. My name is Rick Bissell and my business address is 13-99 Edgevalley Road, London, Ontario, Canada N5Y 5N1. I am a telecommunications consultant.

Q. PLEASE SUMMARIZE YOUR BACKGROUND IN THE FIELD OF TELECOMMUNICATIONS.

A. I have been employed in the telecommunications field for over 30 years. My career began in 1966 with Nortel (Northern Telecom) as a specifications writer for Central Office (CO) Common Systems Infrastructure (i.e. overhead ironwork, cable racking, equipment supporting details, lighting, grounding, cross-connects and cabling). About the year 1974, I moved to Bell Canada to take a position as a Central Office Building and Main Distribution Frame (MDF) Planner, responsible for the creation of "best practice" space planning scenarios for the integration of new equipment in existing COs; cable routes and equipment connectivity; sizing of new buildings and/or access remotes housings; and developing long term plans for the redevelopment of CO space coincident with Switch and/or Transmission modernization.

I also have worked on international assignments in Jamaica (1972), Antigua (1973), Riyadh, Saudi Arabia (1982-85) and Manila, Philippines (1995). My last position prior to leaving Bell Canada was in the Regulatory Planning Group, where I was responsible for developing Infrastructure and Space Planning proposals for physical collocation (i.e., placing competitive equipment in Bell Canada COs).

Since leaving Bell Canada in March, 1996, I have worked as an independent consultant in the area of telecommunications equipment space planning and installation of common systems infrastructure (overhead ironwork, cable routing, cabling, cross-connects, etc.). I have worked for Bell Sygma as Collocation Project Support Manager, where I developed the process flows and documentation to be used for implementing physical collocation in a uniform manner across the Stentor Operating Companies in Canada. Most recently, I have analyzed collocation cost studies and process proposals filed by various incumbent local exchange companies.

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY TODAY?

A. I have been retained by MCI Communications Corporation (MCI) and AT&T Communications of the Southern States, Inc. (AT&T) to lead a team of subject matter experts to develop technical models of: (1) the physical collocation of competitive local exchange carrier (CLEC) equipment in incumbent local exchange carrier (ILEC) Central Offices (COs); and (2) the "virtual" collocation of CLEC-provided, ILEC-owned equipment in ILEC COs, in order to identify all ILEC investments needed to provide collocation. (Collocation also can occur at other places in the ILEC's network, such as at the "telco closet" in a large office or apartment building. This testimony does not address this form of collocation.) For physical collocation, the team constructed a forward looking model central office layout and a forward looking model collocation area layout based upon the use of best practice CO space-planning strategies, efficient suppliers, and competitive processes, and from these identified all relevant investments. A similar process was used to identify investments for virtual collocation. These investments were provided to the consulting firm of Klick, Kent & Allen to develop collocation cost estimates in the Cost Model. A white paper describing in detail the model CO and collocation layouts and all the necessary ILEC investments for physical and virtual collocation is attached to this testimony as Exhibit RB - 1.

The purpose of this testimony is to provide the conceptual basis for the model CO and collocation layouts and to describe the major components of those layouts. Part One addresses physical collocation and Part Two addresses virtual collocation.

PART ONE: PHYSICAL COLLOCATION

Q. WHAT IS REQUIRED FOR PHYSICAL COLLOCATION?

A. Physical collocation is nothing more than an arrangement that allows a CLEC to locate its own telecommunications relay rack equipment in a segregated portion of the CO. The CLEC then pays the ILEC for the use of that space within the CO and is provided with the ability to enter the CO to install, repair, and maintain its collocated equipment. Figure 1 displays the limited number of elements required to establish CLEC collocation areas in an ILEC building. As shown, the only requirements are for fiber connectivity between the first manhole outside the CO and the CLEC's terminal equipment; -48V DC power connectivity between the CLEC equipment and a battery distribution fuse bay (BDFB); and optical and copper connectivity (Voice Grade, DS-1, DS-3) between the collocation area and an appropriate ILEC cross-connect. Each of these is discussed in greater detail below. The physical demarcation point between the ILEC and CLEC for all copper connections is at a point of termination (POT) bay, normally placed in close proximity to CLEC equipment.

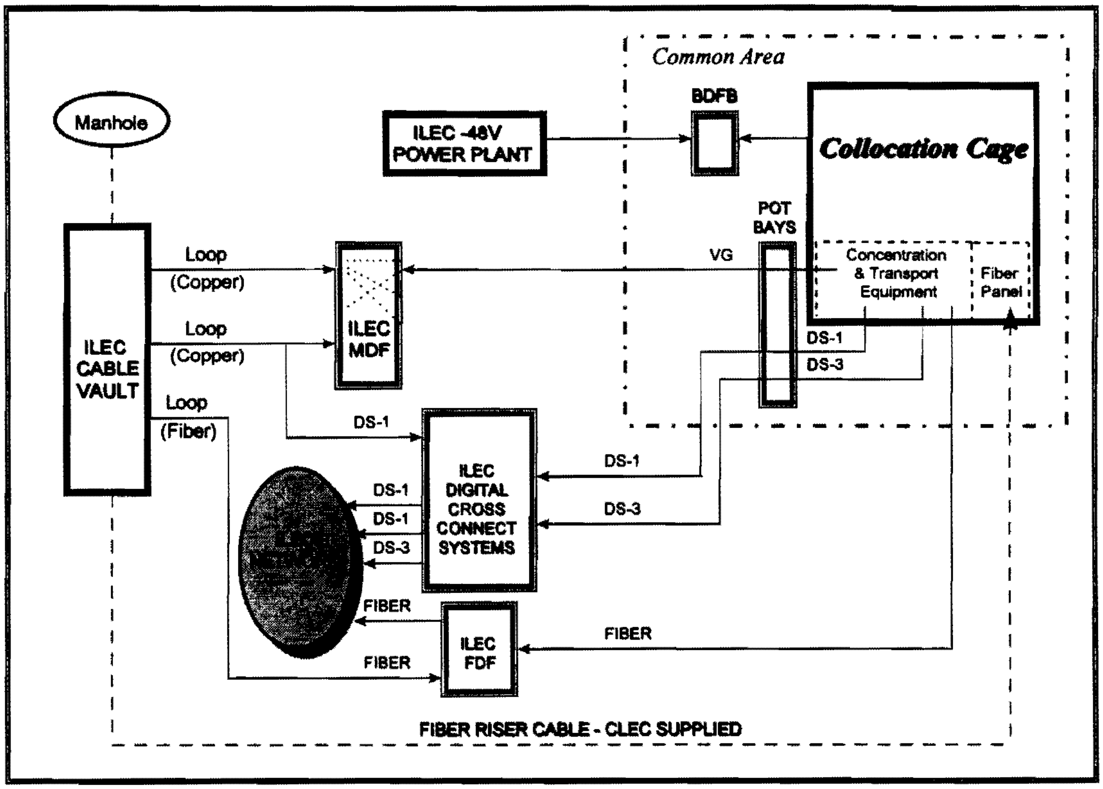


Figure 1

Q. IS PHYSICAL COLLOCATION A HIGH TECHNOLOGY ACTIVITY?

A. No. Physical collocation is a low technology, nuts and bolts activity within a high technology industry. It primarily consists of setting up metal cages to hold CLEC telecommunications equipment, and providing the following connectivity: fiber from the CLEC coming from the manhole into the cable vault and to the collocation cage; copper and optical connections to the ILEC cross-connects to pick up unbundled loops or connect to the ILEC network; and connectivity to the -48V DC power source. This requires building the cage, installing cables on racks, and properly grounding the equipment.

Q. WHAT FACTORS DID YOU CONSIDER IN DETERMINING THE BEST PRACTICES FOR IMPLEMENTING COLLOCATION?

A. Best practices assumes the use of cost efficient technology and only as much building space, labor, and materials as needed to properly place all equipment, including the appropriate amount of space for auxiliary equipment. It also assumes that the ILEC's decisions relating to collocation of a CLEC at the ILEC's CO will be made on the same bases as the ILEC's decisions for placing its own equipment.

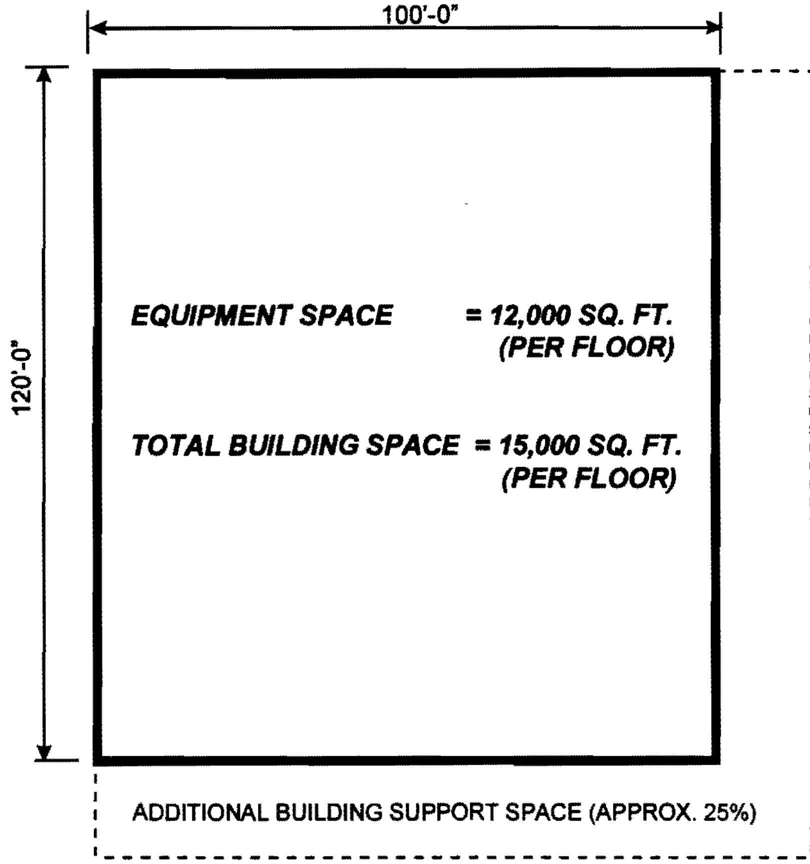
Q. WHY IS IT IMPORTANT TO IDENTIFY THE INVESTMENTS ASSOCIATED WITH COLLOCATION BASED ON THE USE OF BEST PRACTICE SPACE-PLANNING STRATEGIES?

A. CLEC collocation at an ILEC's CO is essential for the CLEC to provide local service efficiently with unbundled ILEC loops or other elements. Without collocation, there would be no way for the CLEC to concentrate the traffic coming from the unbundled loops in order to transport that traffic efficiently to the CLEC's switch. Thus, collocation is essential for new entrants who plan facilities-based entry. At the same time, collocation at the ILEC's CO is largely under the control of the ILEC. In a competitive environment, an ILEC will not have the incentive to minimize the costs to CLECs of being collocated. For example, the ILEC will not have the incentive to make space in its CO available to a CLEC on the same basis as it uses for making space available for additional equipment of its own. Basing the model CO and model collocation space -- and thus investments -- on best practice space planning will ensure the inclusion only of costs associated with an efficiently located collocation space.

Q. PLEASE DESCRIBE THE FORWARD-LOOKING CO MODEL LAYOUT.

A. The CO model layout assumes a new urban CO designed for up to 150,000 lines, together with associated transport, power, multi-media, and miscellaneous equipment space. Such an office would need approximately 36,000 square feet (sq. ft.) of equipment space -- or three equipment floors of about 12,000 sq. ft. (100 ft. x 120 ft.) each -- plus a below-ground cable vault. (See Figures 2 and 3.) The CO model layout also assumes an additional 3,000 sq. ft. on each floor and the entire basement (except for the cable vault area) to provide a generous allowance for building support services such as main corridors, elevators, washrooms, lunch rooms, conference facilities, administrative areas, electrical rooms, and mechanical rooms. This results in an overall footprint of 15,000 sq. ft.

The best practice CO planning strategy -- shown in Figure 3 -- provides adequate space for the long-term requirements associated with a forward-looking, urban CO and is representative of central office layouts that would have been constructed in recent years to accommodate growth in a downtown urban environment. New COs designed for areas outside of urban centers would likely consist of only one or two floors above the cable vault, requiring shorter cable connectivity lengths. Hence, the forward-looking physical central office model layout incorporates conservative assumptions in terms of recent CO telecommunications building deployment and is likely to be significantly larger than the average CO across the ILEC territory.



SUMMARY		
EQUIPMENT SPACE PER FLOOR	=	12,000 SQ. FT.
TOTAL FOOTPRINT PER FLOOR	=	15,000 SQ. FT.
NUMBER OF FLOORS	=	3
TOTAL EQUIPMENT SPACE	=	36,000 SQ. FT.
TOTAL ABOVE GROUND FLOOR SPACE	=	45,000 SQ. FT.
CABLE VAULT AND BUILDING SERVICES	=	BELOW GROUND

FORWARD LOOKING URBAN CENTRAL OFFICE

Figure 2

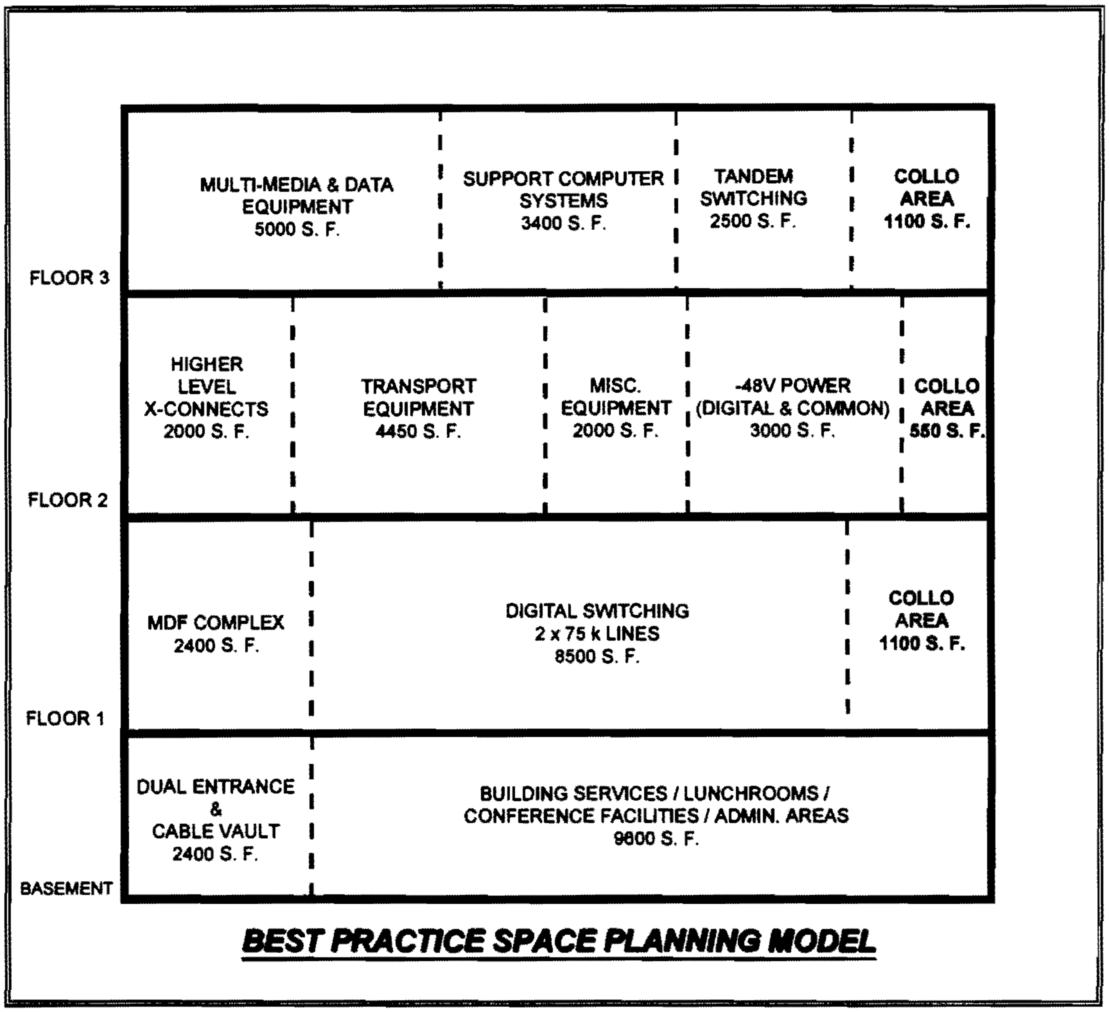


Figure 3

Q. HOW COULD THIS THREE-STORY BUILDING BE USED TO MODEL THE INVESTMENTS NEEDED TO PLACE COLLOCATION AREAS IN EXISTING CENTRAL OFFICES IN URBAN AREAS THAT MAY BE AS MUCH AS EIGHT STORIES?

A. The model CO layout contains enough space to house all the equipment needed in the largest urban COs -- and, indeed, is the general layout used over the past five years in planning new COs. If the equipment in a particular CO currently is spread out across eight stories, that is because the old analog equipment required lots of space and as that equipment has been replaced by digital equipment, pockets of space have become available throughout the eight stories that can be used for collocation space. If such space is not available, that is due to one of two things: the ILEC has not removed old equipment that it is no longer using or the ILEC is now housing administrative personnel in otherwise available equipment space. If the ILEC needed space for its own equipment, it would not locate its equipment far from the cross-connects, but rather would remove any unused equipment or administrative personnel in convenient spaces in the CO and place its telecommunications equipment there. Thus, use of the model CO layout simply is consistent with the way the ILEC would make space available for itself.

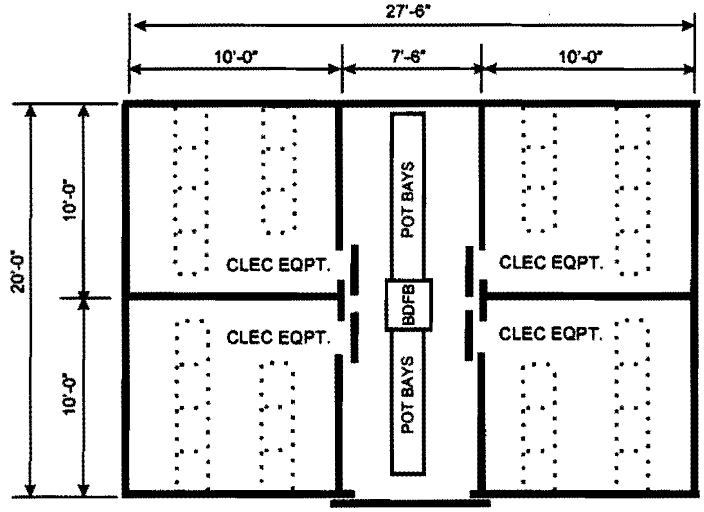
Q. IF THE MODEL CO IS BASED ON A LARGE URBAN SITUATION, CAN IT ALSO BE USED FOR SMALLER URBAN, SUBURBAN AND RURAL COLLOCATION SITUATIONS?

A. Yes. Smaller urban, suburban and rural situations will require less telecommunications equipment, so the CO likely would be only one or two floors plus basement, with approximately the same 15,000 square foot footprint. The connectivity lengths required will be shorter, reducing costs; land costs should be lower; and there may be no costs associated with elevators. Thus, even if there are some structural scale economies in the large urban CO, overall collocation costs are likely to be lower in smaller urban, suburban and rural locations than in the large urban locations modeled. Thus, the model CO layout provides a conservatively high estimate of collocation investment costs for other areas.

Q. PLEASE DESCRIBE THE MODEL COLLOCATION AREA LAYOUT.

A. The Model Layout assumes a best practice planning strategy that permits more than one collocation area to be assigned in a CO based on available space in close proximity to ILEC cross-connects. This is in contrast to an arbitrary assumption (sometimes made by the ILECs) that the first collocation area in a CO must be sized to accommodate all potential future CLECs, even when that decision results in placement of the collocation area in a remote location far from the cross-connects.

As shown in Figure 4, the collocation area model layout is 550 square feet to take advantage of smaller areas that would be in relatively close proximity to ILEC cross-connects (these pockets of space include those made available by prior replacements of older technologies with more space efficient digital equipment, vacant area, space occupied by administrative staff, or locations occupied by redundant equipment that an efficient ILEC would have removed long ago). This assumption reflects an expectation by the model layout developers that, in terms of placement, the ILEC would employ the same best planning process that it would use when planning efficient equipment space allocations for its own equipment.



SUMMARY		
OVERALL SPACE REQUIREMENT	=	550 SQ. FT.
NUMBER OF 100 SQ. FT. ALLOCATIONS	=	4
CLEC CAGE SPACE	=	100 SQ. FT.
SHARED COMMON SPACE	=	150 SQ. FT.
CLEC CONTRIBUTION FOR EACH 100 SQ. FT.	=	137.5 SQ. FT.
POT BAYS + TERMINATION PANELS	=	BY CLEC
DC POWER PANELS IN CAGE (IF REQUIRED)	=	BY CLEC
BDFB (INCLUDED IN POWER CONSUMPTION)	=	BY ILEC

FORWARD-LOOKING BEST PLANNING COLLOCATION MODEL

Figure 4

The 550 square feet included in the model collocation layout provides sufficient space to accommodate interface equipment such as point of termination (POT) bays and remote power distribution BDFB equipment, while avoiding the economic disadvantages of exceptionally large collocation areas. For those COs where more than 550 square feet of collocation space is required, a second collocation area would be selected when necessary. Proceeding in this manner is consistent with the FCC amended Order Part 51.323 (f)(1) (and Paragraph 585), which supports the concept of CLECs obtaining reasonable amounts of space in an ILEC's premises on a first-come, first-served basis.

Within the 550 square foot collocation area, the collocation area model layout assumes the construction of four 100 square foot equipment areas and a common area of 150 square feet (to accommodate ILEC and CLEC point of termination interface equipment bays and a BDFB). The Model anticipates that the cost of the entire common area would be shared by all CLECs (with no contribution from the ILEC) and that CLECs would request collocation space in increments of 100 square feet, without any guarantee of expanding into an adjacent space. If a CLEC requires additional space for expansion, it would have to take the next closest available space in much the same way as an ILEC would. For this type of situation, cage-to-cage cabling for cages occupied by the same CLEC should be permitted.

Q. PLEASE EXPLAIN HOW THE CONNECTIVITY LENGTHS USED TO DETERMINE INVESTMENT NEEDS WERE DERIVED FROM THE MODEL CO AND COLLOCATION LAYOUTS.

A. To ensure efficient connectivity arrangements, similar to those incurred by the ILEC in deploying its equipment, the Model Layout establishes collocation areas using pockets of existing vacant or administrative space in the CO. To be conservative, the Model calculates the average connectivity lengths based on a minimum and maximum scenario. For the maximum cable length, the model uses a worst case scenario with the collocation area located on the top floor (Floor 3) of the CO layout, the cross-connects located on Floor 1, and the collocation area at the extreme opposite corner of the building from where the cross connects are located. Based on this premise, there would be a two-floor distance between the collocation area and the ILEC cross-connects. For the minimum cable length, the model uses a best case scenario and assumes that the collocation area is located on the same floor and in close proximity to the ILEC cross-connects. However, since physical collocation requires the construction of cages, it is unlikely that a new collocation area could be built directly adjacent to ILEC cross-connects. Therefore, the best case scenario includes a 40 foot minimum length between the collocation area and the ILEC cross-connects. Both scenarios include a 15 foot cable drop (i.e., 7'6" on each end). Hence, the forward looking best practice CO model layout generates **minimum and maximum** copper connectivity lengths of 55 and 275 feet. (These extremes were determined as follows: equipment area width = 100 feet; equipment area length = 120 feet; distance between floors = 20 feet; cable drop to equipment at both ends = 15 feet. So the maximum two-floor distance would be 100' + 120' + 20' + 20' + 15' = 275', and the minimum same-floor distance would be 20' + 20' + 15' = 55'.) The investment generated therefore is based on an average connectivity length of 165 feet for Voice Grade, DS-1, or DS-3 cabling between the CLEC collocation area and the appropriate

ILEC cross-connect. Cabling investments for optical connectivity are based on 190 feet, since no POT bay is used, and the Model uses 25 feet of cabling in the cage and common area.

Q. HAVING CONSTRUCTED THE MODEL CO AND COLLOCATION SPACE LAYOUTS, WHAT INVESTMENT COMPONENTS DID YOU ESTIMATE?

A. We estimated investments associated with the following:

- overhead common systems infrastructure (cable racks, cable, etc.);
- power delivery, including backup capability; power consumption; equipment grounding;
- entrance fiber (bringing the CLEC's fiber from the manhole to the collocation space); The CLEC should be allowed to perform this function, itself, in which case the ILEC's portion of this investment would be limited to costs associated with providing the rack the cable resides on.
- copper connectivity between the collocation space and the cross-connects at the voice grade level, and at the DS-1 and DS-3 levels (each estimated separately using DSX and DCS technology);
- optical connectivity between the collocation space and the fiber cross-connect using 12 fiber breakout cable;

- construction elements associated with building the cage and maintaining the environment in the cage (partitioning, floor covering, electrical distribution panel, HVAC, lighting);
- land and building.
- manpower resources to plan both the entire 550 square foot collocation area and each collocation request within that area; and
- security.

Q. HOW DID YOU ESTIMATE THESE INVESTMENT COMPONENTS?

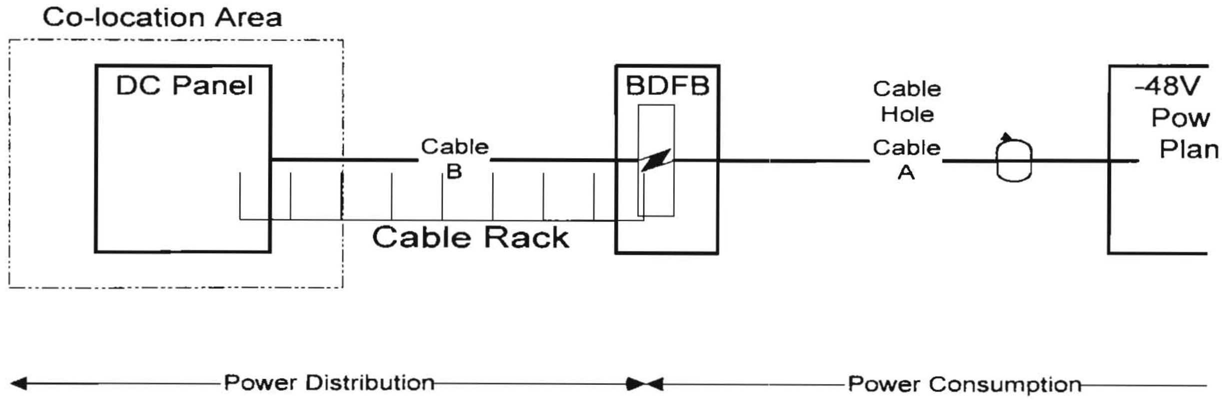
A. The general methodology used was as follows:

- Identify, end to end, all the specific elements needed to provide the components. (See, for example, the following chart depicting the end-to-end requirements for power delivery. Similar charts are provided in the White Paper for each investment component.)

- Obtain quotes (in hours or dollars, as appropriate) for the engineering, furnishing, and installation of these elements.

- Based on the judgment of the subject matter experts, select the quotes to use as input values and calculate the investment costs.

COLLOCATION MODEL - -48V DC POWER DELIVERY



Power Delivery Elements (-48V DC Option)				
Element	***Description***	***Prov. by CLEC/ILEC***	***Quantity***	***Remarks***
-48V DC Power Panel	Located in Cage	CLEC	--	CLEC installs -48V DC panels in cage and terminates ILEC provided feed
Cable 'B'	4 x #6 Cable between Cage & Collo BDFB	ILEC	35'-0"	One time charge for 40 Amps (20 Amp A & B feeds + return) as requested by CLEC -Includes 20'-0" drop in cage
Cable 'B'	4 x #2 Cable between Cage & Collo BDFB	ILEC	35'-0"	One time charge for 100 Amps (50 Amps A & B feeds + return) as requested by CLEC - Includes 20'-0" drop in cage
Cable 'B'	4 x 2/0 Cable between Cage & Collo BDFB	ILEC	35'-0"	One time charge for 200 Amps (100 Amps A & B feeds + return) as requested by CLEC - Includes

Cable Rack	15" CLEC specific	ILEC	5'-0"	20'-0" drop in cage Included in cage investment
BDFB	Located close to Collocation Cages	ILEC	--	Included in -48V DC Power Consumption Charge
Cable Rack Occupancy	Shared support for Cable 'A' below	ILEC	--	Included in -48V DC Power Consumption Charge
Cable 'A'	Cable betw –48V Power Plant & DFB	ILEC	--	Included in -48V DC Power Consumption Charge
-48V DC Power Plant	Shared use between CLEC's & ILEC	ILEC	--	Included in -48V DC Power Consumption Charge
Auto-start Diesel Fuel Tanks, etc.	Required for Battery Back-up	ILEC	--	Included in -48V DC Power Consumption Charge
AC Energy	Required for AC Energy used	ILEC	--	Included in -48V DC Power Consumption Charge

Q. DID YOU USE MAJOR SUPPLIERS, SUCH AS LUCENT AND NORTEL, FOR YOUR QUOTES ON PRICES AND HOURS?

A. No. The common systems infrastructure components and the magnitude of the construction project associated with physical collocation are relatively minor and can be handled by many smaller contractors at competitive rates. Indeed, even if larger suppliers, such as Lucent and Nortel, were price competitive, they are unlikely to be able to meet the short time intervals required for these very small jobs. For that reason, ILECs typically have various smaller contractors who specialize in ironwork, cabling, etc., authorized to complete short interval installations. The same is true with regard to the construction elements associated with preparing the cage. The use of a telecommunications giant or a major construction company for collocation components is akin to using a Big Eight accounting firm to handle a simple income tax return or using a major law firm in small claims court.

Q. DID YOU ASSUME THAT THE ILEC PROVIDES ALL THE EQUIPMENT?

A. No, it is assumed that the CLEC provides its own equipment wherever possible. This provides another protection against inflated costs to CLECs by providing them the opportunity to purchase their own equipment whenever they believe they can do so more cheaply.

Q. YOU INDICATE THAT YOU INCLUDED AN INVESTMENT ASSOCIATED WITH BUILDING SPACE AND, SEPARATELY, THE INVESTMENTS ASSOCIATED WITH HVAC, FLOOR COVERING, SECURITY AND OTHER ITEMS THAT OFTEN ARE PROVIDED AS PART OF THE CHARGE FOR SPACE IN A BUILDING. WHY DID YOU DO THIS?

A. We did this to ensure that all investment costs were included, although we believe as a result we provide a conservatively high estimate of investment requirements. The source that we use for the per square foot cost of building space, R.S. Means, is a data sourcebook widely used in the industry. The data provided are compiled from submissions from ILECs who actually have constructed central offices, but there is no explanation of what costs are included in those submissions. It is likely that these estimates include costs associated with sufficient air conditioning, floor covering, etc. to fully support the collocation space, and thus by including these items separately our investments may conservatively overstate investment requirements.

Q. DO THE INVESTMENTS GENERATED BY YOUR MODEL CO AND COLLOCATION LAYOUTS INCLUDE THE COSTS ASSOCIATED WITH BUILDING MODIFICATIONS THAT FREQUENTLY ARE INCLUDED IN ILEC COLLOCATION COST STUDIES?

A. The model layouts generate all investments necessary for the provision of collocation, but not for building modifications an ILEC would have to undertake just to bring space in the CO up to the level needed to house equipment. For example, our model incorporates the appropriate share of costs associated with meeting all regulatory requirements by including in the building cost per square foot used in the investment calculation the costs associated with full regulatory compliance. But it does not add to those costs any special costs associated with bringing a particular building or portion of a building to compliance. Building modifications to remove unused equipment also are not included as they represent additional costs to make a specific building space up to standard. Also, building modifications allegedly required to provide a "secure environment," such as the addition of costly new external entrances, are not included because they are not part of a cost efficient, forward looking solution to security problems.

Q. WHAT SECURITY REQUIREMENTS DID YOU INCLUDE FOR YOUR MODEL CO AND COLLOCATION LAYOUTS?

A. COs today are constructed with electronic security card systems to monitor access and egress. Each doorway will have an electronic card reader that will only admit the holders of pre-screened cards. These costs are included in the basic per square foot cost of a CO building just as the cost of locks on outside doors are included in the rent for office or apartment space. Thus, our model assumes the cost of the security card system is included in the per square foot cost in R.S. Means. The costs of purchasing individual cards and associated system maintenance, on the other hand, are assumed to be costs that each CLEC should bear.

PART TWO: VIRTUAL COLLOCATION

Q. WHAT IS VIRTUAL COLLOCATION?

A. Virtual collocation is an arrangement that allows a CLEC to place its own equipment in an area of a CO currently used by the ILEC to house its equipment (and not segregated from ILEC equipment). Typically, the CLEC purchases the equipment to be dedicated for its use on the ILEC's premises and sells the equipment to the ILEC for a nominal $1.00 sum while maintaining a repurchase option. The equipment is then installed in vacant space beside the ILEC's equipment. Typically, the ILEC handles day-to-day maintenance activities and is reimbursed by the CLEC. The CLEC is permitted to enter the CO upon request, but requires a security escort.

Q. WHY IS VIRTUAL COLLOCATION IMPORTANT?

A. Like physical collocation, virtual collocation provides a means by which new entrants can concentrate traffic from unbundled loops (or other elements) in order to transport that traffic to the CLEC's switch. A CLEC may wish to use virtual collocation if it lacks sufficient market share to justify a physical collocation arrangement, or because physical collocation cage construction costs render that method of collocation too costly. In addition, Section 251c(6) of the Telecommunications Act of 1996 requires that virtual collocation be provided when physical collocation is not practical for technical reasons or because of space limitations.

Q. DID YOU IDENTIFY INVESTMENT COMPONENTS AND INSTALLERS FOR VIRTUAL COLLOCATION USING THE SAME BEST PRACTICES DESCRIBED ABOVE?

A. Yes, the same approach was used. The investment differences simply reflect the different nature of virtual as opposed to physical collocation. Most significantly, since virtual collocation provides for CLEC equipment to be located within existing ILEC equipment areas and maintained by ILEC personnel, there are no cage construction components. Further, since most of the equipment associated with virtual collocation is provided by the CLEC, the scope and magnitude of initial investments for which the ILEC is responsible is greatly reduced.

Q. DOES THE VIRTUAL COLLOCATION MODEL INCLUDE INVESTMENTS FOR INITIAL CABLING?

A. No. Cabling is an integral part of most telecommunications installations, necessary to ensure continuity prior to (collocator) acceptance. Indeed, collocators typically require completion of systems readiness and operational tests prior to acceptance of a virtual collocation installation. Thus, suppliers normally include the cabling as part of the overall cost of installing telecommunications equipment components. The ILEC will not incur initial cabling costs since the CLEC is responsible to the installer for the invoice associated with the equipment installation. (This includes cabling for connectivity, as well as power and grounding.)

Q. HOW WERE CONNECTIVITY LENGTHS USED TO DETERMINE INVESTMENT NEEDS FOR THE VIRTUAL COLLOCATION MODEL?

A. Although there is no ILEC investment for initial cabling, investment is included for occupancy of cable racks on which the cables ride (as well as occupancy of ILEC inter-floor cable holes and terminations on ILEC cross-connects). To estimate the investment associated with cable rack occupancy, the Virtual Collocation Model uses the same connectivity lengths used to estimate investments for physical collocation. Since the CLEC-provided, ILEC-owned equipment is placed in the same equipment areas that the ILEC uses for its own equipment, it is likely that connectivity investments for virtual collocation will be **less** than those required for physical collocation. Thus, using the same connectivity lengths for virtual collocation as those used for physical collocation provides a conservative estimate.

Q. DID YOU INCLUDE INVESTMENTS ASSOCIATED WITH BUILDING SPACE FOR VIRTUAL COLLOCATION?

A. Yes. The overall method of estimating the building space investment for virtual collocation is the same as that used for physical collocation. In contrast to physical collocation, however, virtual collocation merely requires payment to the

ILEC for floor space; there are no additional building-related costs (such as for cage construction).

Q. HOW DID YOU APPROACH ESTIMATING THE BUILDING SPACE INVESTMENT FOR VIRTUAL COLLOCATION?

A. We used a best practice space planning approach to ensure that ILEC equipment space, and hence CO floor space, is used efficiently. ILEC equipment space is comprised of rows (called "lineups") of relay racks that, when installed, resemble empty metal bookcases without shelves. Relay racks are fabricated to permit the installation of equipment shelves on an "as required" basis. Thus, many existing racks in ILEC COs have unused space which can be used to mount CLEC equipment shelves. The telecommunications equipment in use today comes in various sizes (heights) and thus requires varying amounts of vertical "shelf space" on a relay rack. While this conceivably permits relay racks to be administered by the "rack inch," for administrative simplicity, the Virtual Collocation Model develops the investments for building space based on units of ¼ relay rack. Using units of ¼ relay rack ensures that ILEC equipment space is used efficiently and allows CLECs to pay only for the space used. In many instances relay racks with empty space will be available. In some cases, however, a new relay rack may need to be installed for a CLEC to place its equipment. The Virtual Collocation Model is designed to accommodate either situation by including the additional investment for a rely rack, if a new installation is required.

Q. HOW DID YOU CALCULATE THE AMOUNT OF BUILDING SPACE INVESTMENT ASSOCIATED WITH ¼ RELAY RACK?

A. The telecommunications relay racks used to house equipment in a CO are typically 2' wide, 1' deep, and 7' high. The racks are placed in "lineups" (rows) located 2' 6" to 3' apart to provide for aisle space in front and back for maintenance purposes. Including the relay rack footprint (2' by 1') plus 50% of the front and rear aisles (1' 6" + 1' 6" = 3') would require 8 square feet (2' x 4'). The Virtual Collocation Model assumes that each relay rack uses 9 square feet of floor space, which is sufficiently generous to incorporate end guards (which are only used when a relay rack is at the end of a lineup) and 15" deep frames. Thus, the Virtual Collocation Model develops the investment for floor space based on units of ¼ relay racks, the equivalent of 2.25 square feet of space.

Q. HOW IS MAINTENANCE HANDLED IN THE VIRTUAL COLLOCATION MODEL?

A. The CLEC is responsible for directing all maintenance activities associated with the virtual equipment. This includes system surveillance, direction of repair activity, and requests to the ILEC for maintenance assistance. The ILEC is responsible for hardware functions such as circuit pack replacement and changing fuses. Work will be performed by the ILEC upon the request of the CLEC, and will be reimbursed using the labor rate for the appropriate qualified technician.

Q. ARE SECURITY REQUIREMENTS NECESSARY FOR VIRTUAL COLLOCATION?

A. Yes. While CLEC personnel will not normally visit virtually collocated equipment for day-to-day operations, there may be instances when it is necessary for CLEC engineering or maintenance personnel to visit the ILEC CO. Since virtual equipment is located in ILEC equipment areas and not segregated from ILEC equipment, it is reasonable to expect that an ILEC security escort be in attendance during the entire time during a CLEC visit.

It is also reasonable to establish maximum response times for the elapsed interval between when a CLEC requests an appropriately qualified ILEC technician at a particular CO, and when a technician arrives and makes contact with the CLEC. The response times and charging increments for both maintenance and security escort requests vary depending on the type of CO. That is, whether a CO is staffed (technicians scheduled to work at the CO), attended (the hours during which technicians are required to be at the CO), and whether the request is during normal business hours (usually Monday to Friday, 8 am to 5 pm) or not. The charts below indicate appropriate response times and charging increments. Note that the ILEC must identify for CLECs which COs staffed, attended and the actual attended hours of any staffed CO.

MAINTENANCE AND ESCORT RESPONSE TIMES	
CENTRAL OFFICE TYPE	RESPONSE TIME
Staffed and Attended	1 hour
Staffed and Unattended	4 hours
Not staffed and NBD	2 hours
Not staffed and non-NBD	4 hours

Definitions:

Staffed-technicians are scheduled to work in the location.

Attended-hours during which technicians are required to be at the CO.

NBD (Normal Business Day)-usually Monday to Friday, 0800h to 1700h.

MAINTENANCE AND ESCORT CHARGING INCREMENTS		
CENTRAL OFFICE TYPE	INITIAL CHARGE	SUBSEQUENT CHARGE
Staffed and Attended	¼ hour	¼ hour
Staffed and Unattended	4 hours	¼ hour
Not staffed and NBD	¼ hour	¼ hour
Not staffed and non-NBD	4 hours	¼ hour

Q. DOES THIS CONCLUDE YOUR TESTIMONY?

A. Yes, at this time.

COLLOCATION WHITE PAPER

Part I - Physical Collocation

Part II - Virtual Collocation

Exhibit ______________
Dockets Nos. 960833,960846, and 971140
Rick Bissell - Composite Exhibit RB-1

Part I - Table of Contents

1 INTRODUCTION

1.1 PURPOSE OF STUDY

The purpose of this White Paper is to present a technical model of the physical collocation of competitive local exchange carrier (CLEC) equipment in incumbent local exchange carrier (ILEC) Central Office (CO) buildings.1 This White Paper presents a bottoms-up approach to implementing physical collocation by creating a forward-looking collocation model layout based upon the use of best practice CO planning strategies, least cost suppliers, and competitive processes. This will provide a clear and concise explanation of the physical requirements for efficient collocation of CLEC equipment at an ILEC CO. In addition, the White Paper provides the technical basis for determining the costs to meet these requirements and identifies the investments necessary for an efficient ILEC to provide physical collocation to CLECs.

1.2 OVERVIEW OF PHYSICAL COLLOCATION

The physical collocation of a CLEC's equipment is necessary for the efficient interconnection of networks, especially when the CLEC is using the ILEC's unbundled loops. Without collocation, there would be no way to concentrate local customer traffic and to efficiently transport the traffic to the CLEC's offices.

Physical collocation is nothing more than an arrangement that allows a CLEC to locate its own telecommunications relay rack equipment in a segregated portion of the CO. The CLEC then pays the ILEC for the use of that space within the CO and is provided with the ability to enter the CO to install, repair, and maintain its collocated equipment. Figure 1A

1 Physical collocation also can occur at other places in an ILEC network, such as in the "telco closet" in a large office or residential building. In addition, virtual collocation is possible. This white paper does not address these.

displays the limited number of elements required to establish CLEC collocation areas in an ILEC building. As shown, the only requirements are for fiber connectivity between the first manhole outside the CO and the CLEC's terminal equipment in the collocation area: -48V DC power connectivity between the CLEC equipment and a battery distribution fuse bay (BDFB); and copper connectivity (Voice Grade, DS-1, DS-3) between the collocation area and an appropriate ILEC cross-connect. Each of these are discussed in greater detail below. The physical demarcation point between the ILEC and CLEC is at a point of termination (POT) bay, normally placed in close proximity to CLEC equipment.2

2 While the long-term direction with regard to ILEC/CLEC interconnection may be to eliminate POT bays by moving this "physical demarcation" over to the ILEC cross-connect, in the near term it is advantageous to ensure an easily identifiable line of demarcation in close proximity to the CLEC equipment for ease of trouble shooting. Furthermore, the inclusion of a POT bay in the collocation area provides CLEC maintenance staff with uninhibited access for testing and repair without the requirement for a security escort, which might be required if the demarcation were moved to the ILEC cross-connect.

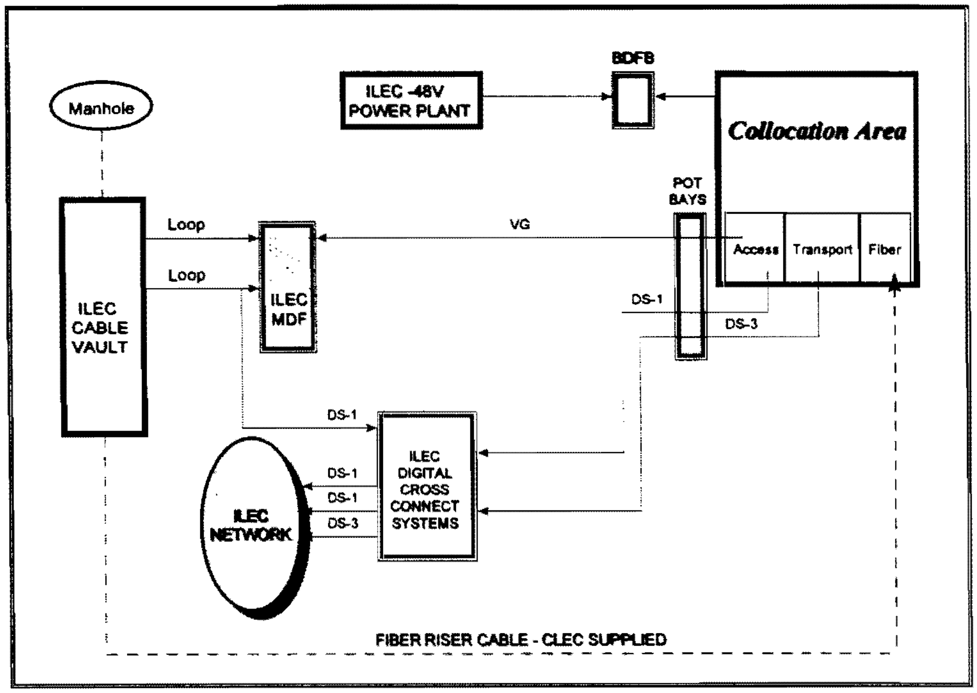


Figure 1A

Collocation is a low technology aspect of a high technology industry. It simply requires the placement and connection of CLEC equipment in an ILEC CO. The equipment located in telecommunications COs typically is placed in metal relay racks, sometimes called bays. As shown in Figure 1B, these relay racks are roughly 2'-0" wide, 12" deep, and 7'-0" high. Typically, telecommunications relay racks are fabricated with pre-drilled ironwork uprights to permit the installation of equipment shelves on an "as required" basis. Unlike previous vintages of telecommunications equipment, relay racks currently installed in COs are generally 7'-0" high, avoiding any need for complex overhead ironwork arrangements for support. Instead, they are supported directly on the floor slab using anchors appropriately sized for the specific seismic zone in which the equipment is installed. Relay racks are placed adjacent to each other in rows (called "lineups") to simplify cabling arrangements and day-to-day maintenance operations.

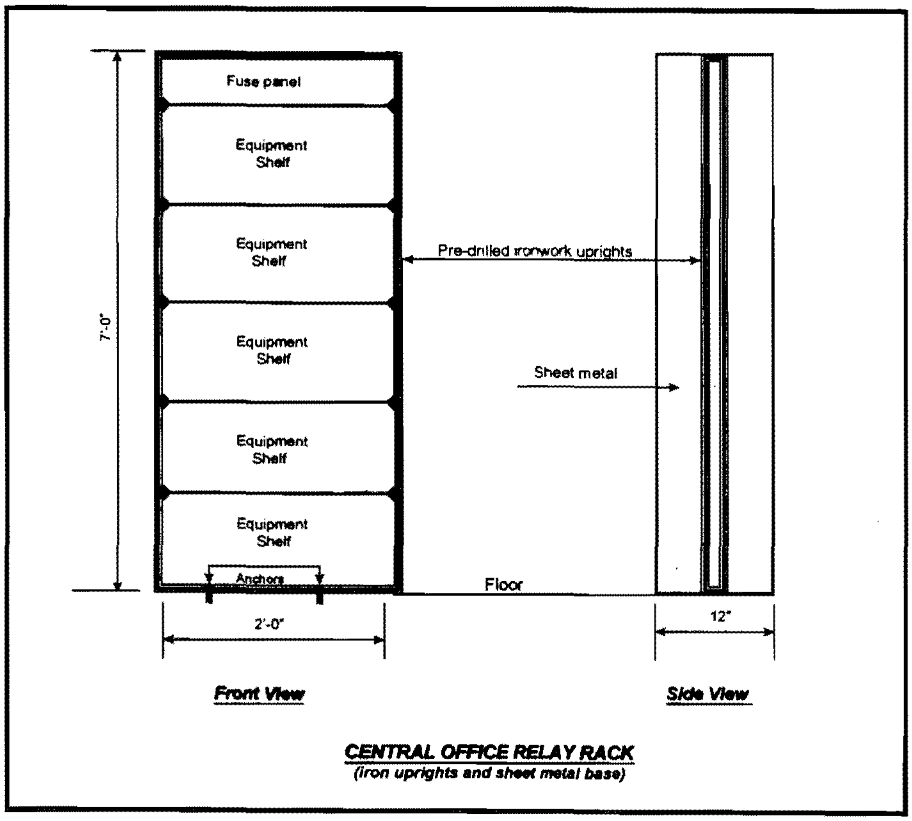

Fuse panel
Equipment Shelf
Equipment Shelf
Equipment Shelf
Equipment Shelf
Equipment Shelf
Anchors
7'-0"
2'-0"
Pre-drilled ironwork uprights
Sheet metal
Floor
12"
Front View
Side View
CENTRAL OFFICE RELAY RACK
(iron uprights and sheet metal base)

Figure 1B

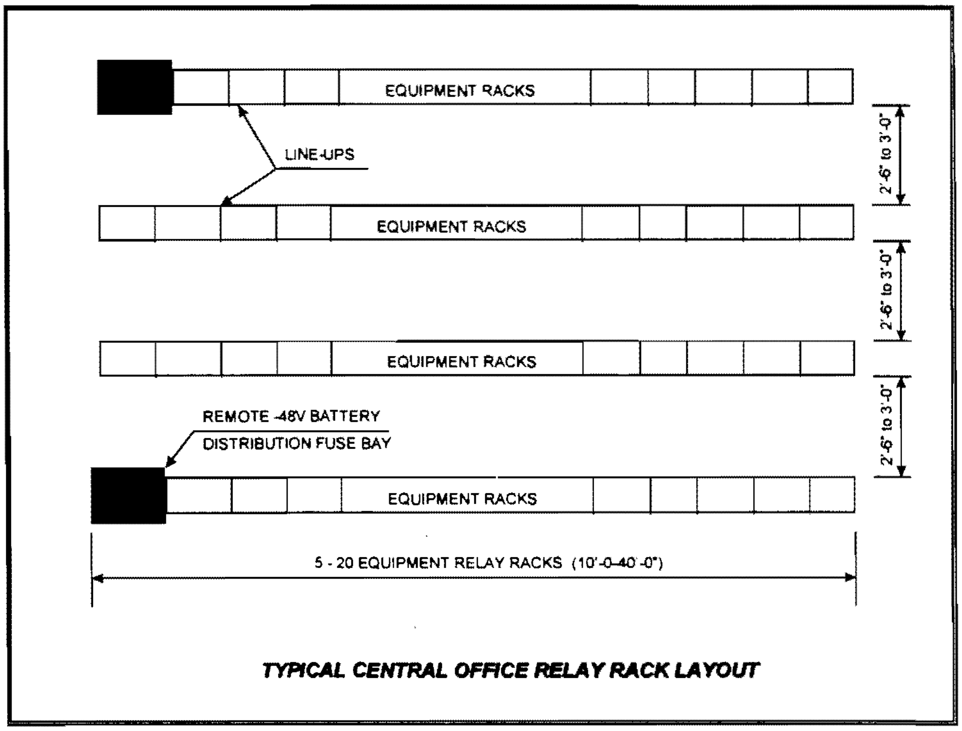


Figure 1C

As shown in Figure 1C, telecommunications equipment line-ups typically can be as short as ten or as long as forty feet, depending on physical constraints such as the availability of space and the length of power feeders. Telecommunications equipment floor layouts typically include both front and rear aisles for maintenance purposes. In addition, floor layouts incorporate battery power distribution fuse bays -- located every third or fourth line-up -- to provide -48 Volt power delivery in the most cost-efficient manner. It is not uncommon to find 1,000 or more equipment relay racks already located in a large urban ILEC CO. The installation of a few additional relay racks of equipment to provide competitive collocation should not be a difficult task, particularly since ILECs commonly install additional relay racks to provide service to their own customers on an ongoing basis.

2 COLLOCATION COSTS CAN EASILY BE OVERSTATED BY AN ILEC

An ILEC has the ability to artificially raise CLEC costs for physical collocation in numerous ways, including:

⇒ *Arbitrary sizing and placement of the collocation area within the CO.* ILECs have the incentive to place the collocation space far away from the ILEC cross-connects. Locating collocation space distant from the cross-connects increases CLEC costs because copper connectivity charges (Voice Grade, DS-1, DS-3) are length-sensitive. Similarly, the fiber riser charge is typically length-sensitive, and power delivery charges increase with complexity and distance relative to the shared BDFB and -48V DC power plant.

One common way that ILECs seek to accomplish this is to insist that the collocation spaces for all CLECs be located together in the CO, thus creating a requirement for a very large space that may not be available close to the cross-connects. The efficient approach is to size collocation spaces to fit into readily-available, conveniently located space on a first come first served basis, in much the same manner as the ILEC would do for itself when it requires additional equipment space. Indeed, with the deployment of digital equipment -- both in the local access network and to replace existing, less space-efficient analog switches in the CO -- there are many convenient spaces currently available for collocation space in ILEC COs.

Imposing all the costs of government-mandated building code upgrades on the CLEC: ILECs often are required to upgrade buildings to meet requirements such as the Americans with Disabilities Act or to incorporate the latest building code revisions (e.g., asbestos removal, electrical systems upgrades, sprinkler installations). These costs are not attributable to collocators but rather are part of the generic costs of CO space which should be borne by all users of the CO.

⇒ *Using non-competitive "contract prices" with "preferred suppliers" for the* *procurement and resale of interface equipment to CLECs*: ILECs have the incentive to employ these practices to artificially raise CLEC costs. This can be avoided by basing rates on least cost suppliers, competitive quotes, and best practice provisioning principles -- and most effectively by allowing the CLEC to purchase its own equipment wherever possible.

⇒ *Requiring CLECs to absorb excessive and inefficient manpower costs for in-house ILEC manpower and the use of non-competitive "preferred" consultants.*

⇒ *Inclusion of Time and Material (T&M) or Individual Case Basis (ICB) charges*: Charges based on existing inefficient processes and over-engineering practices, especially since these charges are "undefined," can become extremely costly to the CLEC since costs are only quantified on a case by case basis upon implementation of a collocation request. When a CLEC has the business need for a specific collocation space, it is in a vulnerable negotiating position. ILECs can use this leverage to artificially increase CLECs' costs by forcing CLECs to delay their business plans while challenging specific charges. Furthermore, any charge that simply reimburses ILECs for their time and materials on an individual cost basis provides the ILECs with no incentive to pursue efficiencies and improved competitive processes.

The collocation model that is described in this White Paper is based on best practice CO planning strategies and input prices that reflect those charged by competitive suppliers. As a result, both ILEC customers and CLEC customers benefit from the most efficient use of the CO. In addition, the collocation model that has been developed is extremely flexible, providing costs for elements that a CLEC may seek out of a collocation area, i.e., there are no hidden sub-charges. This enables the collocation cost model outputs to be used to construct a flexible tariff that can meet the requirements of an individual collocator at a specific ILEC CO, with an easily defined single end-to-end charge for each element.

3 CENTRAL OFFICE PLANNING

3.1 PREVIOUS PLANNING PRACTICES

Many COs were originally designed and built to accommodate very different technological requirements for equipment space, connectivity, air cooling requirements, etc. Modern switching and transmission equipment presents different requirements. As a result, most ILEC COs, and in particular large urban and suburban COs,3 currently have the following characteristics.

- ⇒ *Large multi-floor buildings with floors dedicated and reserved for specific equipment*
- ⇒ *Various sized "pockets" of space scattered throughout the CO, created by the replacement of analog equipment with more space efficient digital technologies*
- ⇒ *These "pockets " currently may be vacant, used by administrative staff, or still have unused analog equipment retired-in-place*
- ⇒ *Lengthy and indirect cable routes caused by congestion in the overhead cable racks as a result of removing previous equipment without removing cables*
- ⇒ *Multiple voice grade cross-connects using a Main Distribution Frame and various Intermediate Distribution Frames with complex inter-DF tie cable systems resulting in excessive cable lengths and additional points of failure*

Most of the above characteristics are the result of ILEC planning strategies that are no longer efficient. For example, when faced with new technologies or modernization requirements in its already large urban COs, ILECs traditionally have responded by either adding floors to the building or extending the building horizontally (rather than with forward-looking planning strategies that minimize the overall, long-term requirement for building space). As a result, COs throughout the country tend to be larger than necessary. The worst case scenarios, in terms of efficient utilization of equipment space, are usually the large urban, multiple-floor COs, which normally have significant amounts of space previously utilized for equipment now utilized by administrative or support personnel.

The situation is further exacerbated by the fact that many existing COs have congested overhead cable racking and/or blocked inter-floor cable holes, caused by removing equipment without also removing the unused cables that once connected this equipment from overhead racks. These conditions often make direct routing of cable difficult if not impossible -- particularly when cables are routed between floors and/or over existing equipment areas. At times, new cables must be routed around congestion or additional cable racking must be installed to alleviate areas of congestion. The result is much longer than necessary cabling lengths. Costs can easily be manipulated according to the placement of a collocation area by the ILEC.

Figure 3A provides an illustrative example of the overhead cable congestion that currently exists in most large urban central office buildings and the resultant excessive fiber, power, and copper cross-connect connectivity lengths created as a result of this embedded ILEC practice.

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3 As discussed below in Section 4.1, although the collocation model reflected in this white paper was developed assuming that the collocation space would be located in a large, urban ILEC CO, the collocation model is also applicable in non-urban COs.

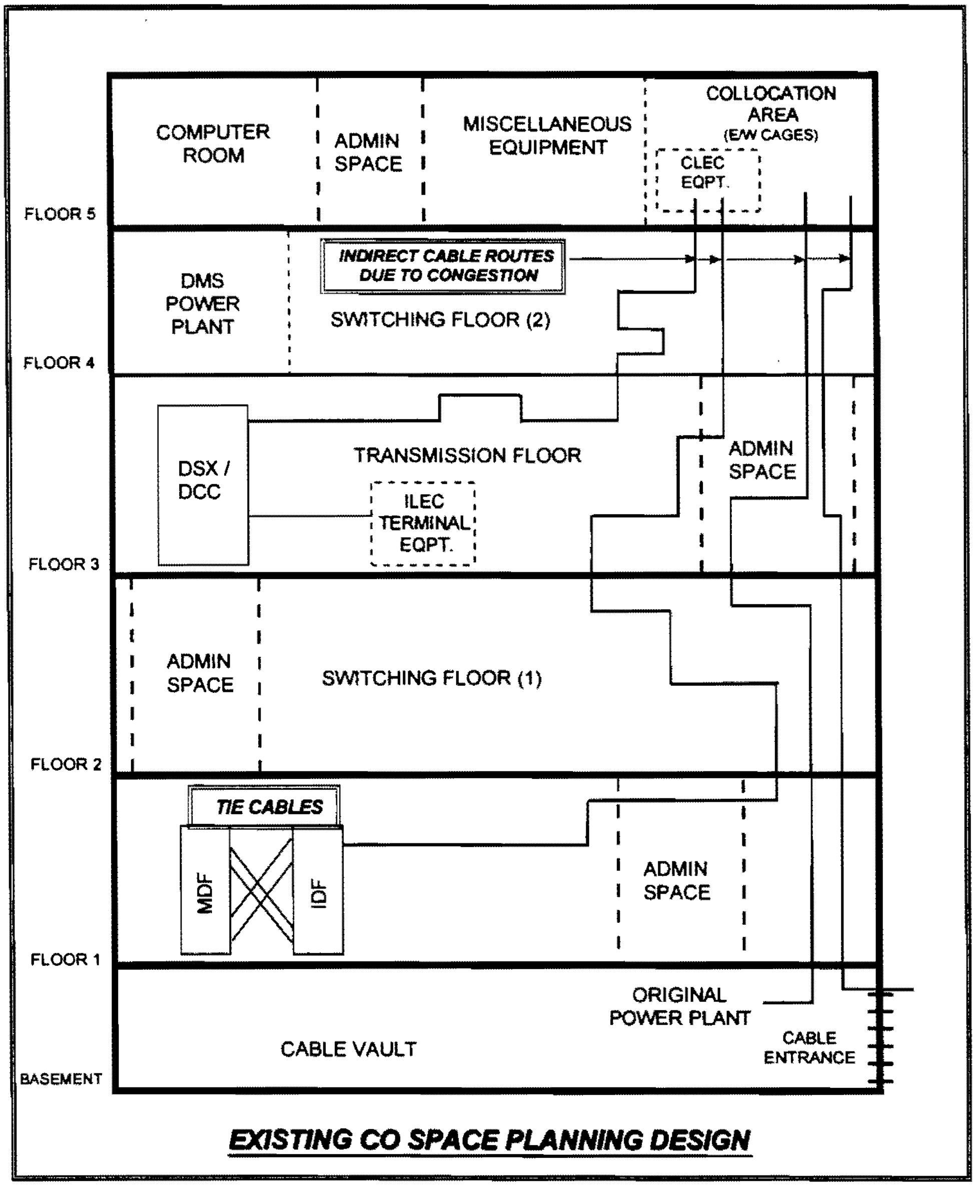


Figure 3A

The deployment of digital switching and transmission technologies that are far more space-efficient than their analog predecessors, and the advent of distributed remote switching modules in the local access network, have resulted in a requirement for less equipment space in the CO and have reduced cross-connect complexity for voice grade connections. Thus, COs built in the past five years have been and going forward can be designed according to a more *"forward looking"* space planning scenario that results in smaller buildings, fewer floors, less overall square footage, and shorter and more direct cable routing. Figure 3B provides an illustrative example.

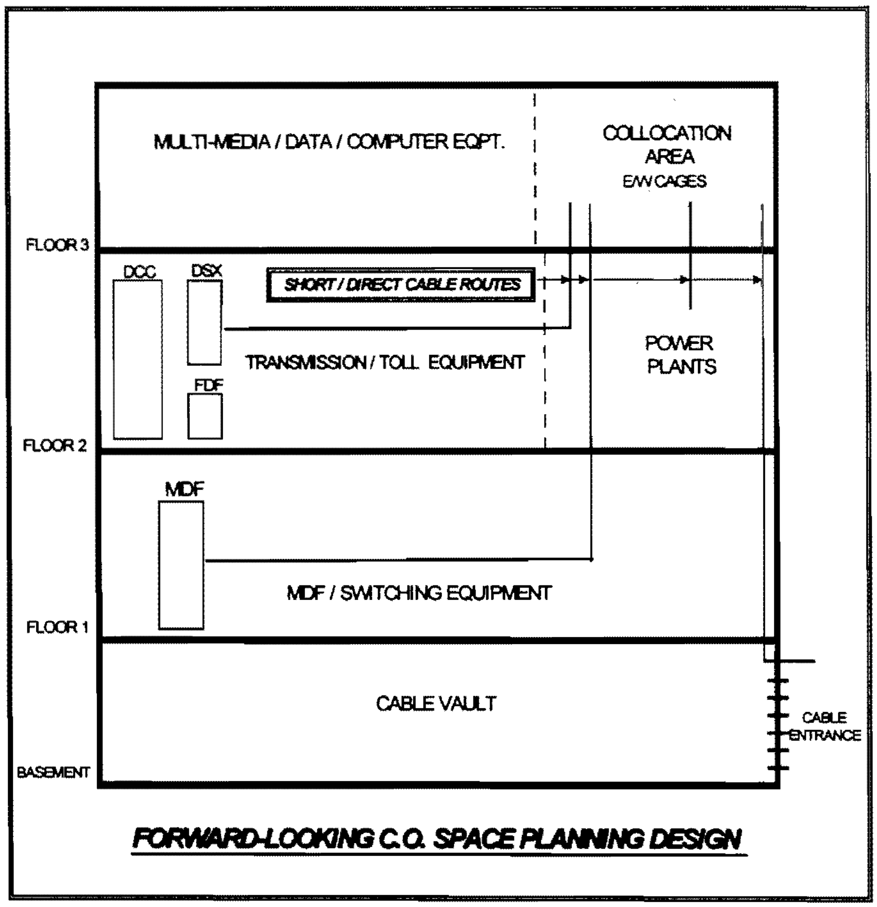


Figure 3B

As depicted in Figure 3B, an urban CO built today or in recent years requires only three equipment floors and, unlike many existing urban ILEC COs, has the following connectivity characteristics:

⇒ *Shorter and more direct cable routes*

⇒ *Less cable congestion*

⇒ *A single Main Distribution Frame for voice grade connections*

Thus, even in an urban environment, an efficient, forward-looking collocation area could not be more than two floors from the cross-connects.

3.2 BEST PRACTICE PLANNING STRATEGIES

The methodology used in this Model is to use an efficient, forward-looking CO model layout (such as the one displayed in Figure 3B) and current best practice CO planning strategies to calculate average connectivity lengths for the fiber riser between the cable vault and the collocation area, the power distribution cabling between collocation equipment and the BDFB, and the copper connections between the collocation area and appropriate ILEC cross-connect. These connectivity lengths are used in subsequent stages of the Collocation Model to establish investment levels required for efficient collocation.

The use of forward-looking average connectivity lengths developed from the CO model layout is appropriate because many existing urban CO conditions are simply not reflective of an efficient approach to CO space planning. If collocation charges were based on these existing CO conditions, unnecessary and discriminatory cost penalties would be imposed on CLECs -- costs that the ILEC would not incur to provide for its own going forward customers because it can place its own equipment in a manner that minimizes the deleterious effect of existing CO congestion. Furthermore, a forward-looking approach to determining average connectivity length ensures that both parties have the incentive to work toward the realization of a best practice and least cost space planning scenario on a case-by-case basis.

Examples of how a forward-looking CO model layout and average connectivity lengths can be employed to promote best planning practices within existing CO environments include:

a) *Using more than one vacant pocket of space to create multiple collocation areas on a first come first served basis*

b) *Relocating existing administrative staff currently located in prime equipment space to make that space available for collocation*

c) *Removing retired-in-place equipment currently located in prime equipment space to make that space available for collocation*

In short, calculating average connectivity lengths based on a forward-looking CO model layout ensures that an ILEC will apply the same type of best practice space planning strategies for collocating CLECs as the ILEC will use for placement of its own equipment within the CO. It minimizes the potential that large, costly collocation areas would be created in remote areas of the CO, and forces both parties to work together, improving the likelihood that both ILEC and CLEC are treated equally.

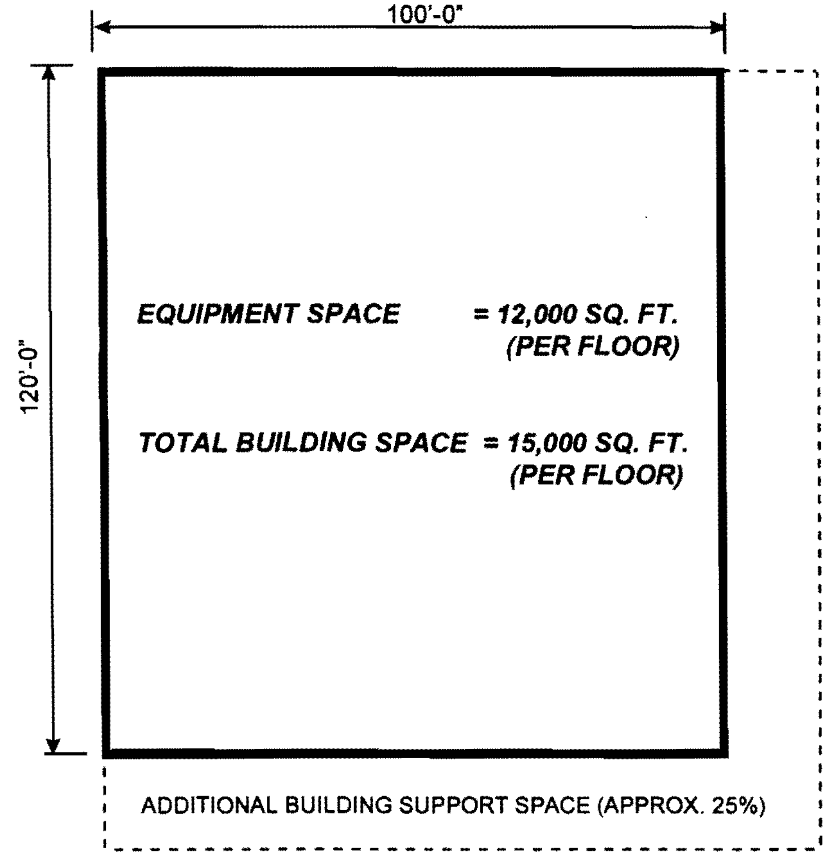
4 OVERVIEW OF ASSUMPTIONS USED IN THE COLLOCATION MODEL

4.1 FORWARD-LOOKING CENTRAL OFFICE MODEL LAYOUT

As noted above, the Collocation Model relies upon a forward-looking central office model layout to establish efficient collocation requirements. This CO model layout assumes a new urban CO designed for up to 150,000 lines, together with associated transport, power, multi-media, and miscellaneous equipment space. Such an office would need approximately 36,000 square feet (sq. ft.) of equipment space -- or three equipment floors of about 12,000 sq. ft. (100 ft. x 120 ft.) each -- plus a below-ground cable vault. (See Figures 4A and 4B.) The CO model layout also assumes an additional 3,000 sq. ft. on each floor and the entire basement (except for the cable vault area) to provide a generous allowance for building support services such as main corridors, elevators, washrooms, lunch rooms, conference facilities, administrative areas, electrical rooms, and mechanical rooms. This results in an overall footprint of 15,000 sq. ft.

The best practice CO planning strategy -- shown in Figure 4B -- provides adequate space for the long-term requirements associated with a forward-looking, urban CO and is representative of central office layouts that would have been constructed in recent years to accommodate growth in a downtown urban environment. New COs designed for areas outside of urban centers would likely consist of only one or two floors above the cable vault, requiring shorter cable connectivity lengths. Hence, the forward-looking physical central office model layout incorporates conservative assumptions in terms of recent CO telecommunications building deployment and is likely to be significantly larger than the average CO across the ILEC territory.

The forward-looking CO model layout being relied upon can also be used for COs located outside the downtown core or for situations where the ILEC's primary CO is not expected to grow to three floors due to demographics. The impact would be minimal, because even a single switch CO in a one floor building is likely to utilize a footprint of approximately 15,000 square feet with all equipment placed on the same floor. Thus the use of this model for COs located in a suburban environment and for ILECs that may not have multi-floor COs in the downtown core, would mean that the average connectivity lengths for fiber, copper and power would be over-stated by about 20-40 feet (i.e. the distance between floors). The only other area that would be affected is the land and building calculation. However, because the land and building calculation is based on assignable space, the impact on floor space rental is likely minimal (and, once again, overstated). The land cost used in the cost model is a default value and can be adjusted to suit local conditions.



SUMMARY		
EQUIPMENT SPACE PER FLOOR	=	12,000 SQ. FT.
TOTAL FOOTPRINT PER FLOOR	=	15,000 SQ. FT.
NUMBER OF FLOORS	=	3
TOTAL EQUIPMENT SPACE	=	36,000 SQ. FT.
TOTAL ABOVE GROUND FLOOR SPACE	=	45,000 SQ. FT.
CABLE VAULT AND BUILDING SERVICES	=	BELOW GROUND

FORWARD LOOKING URBAN CENTRAL OFFICE

Figure 4A

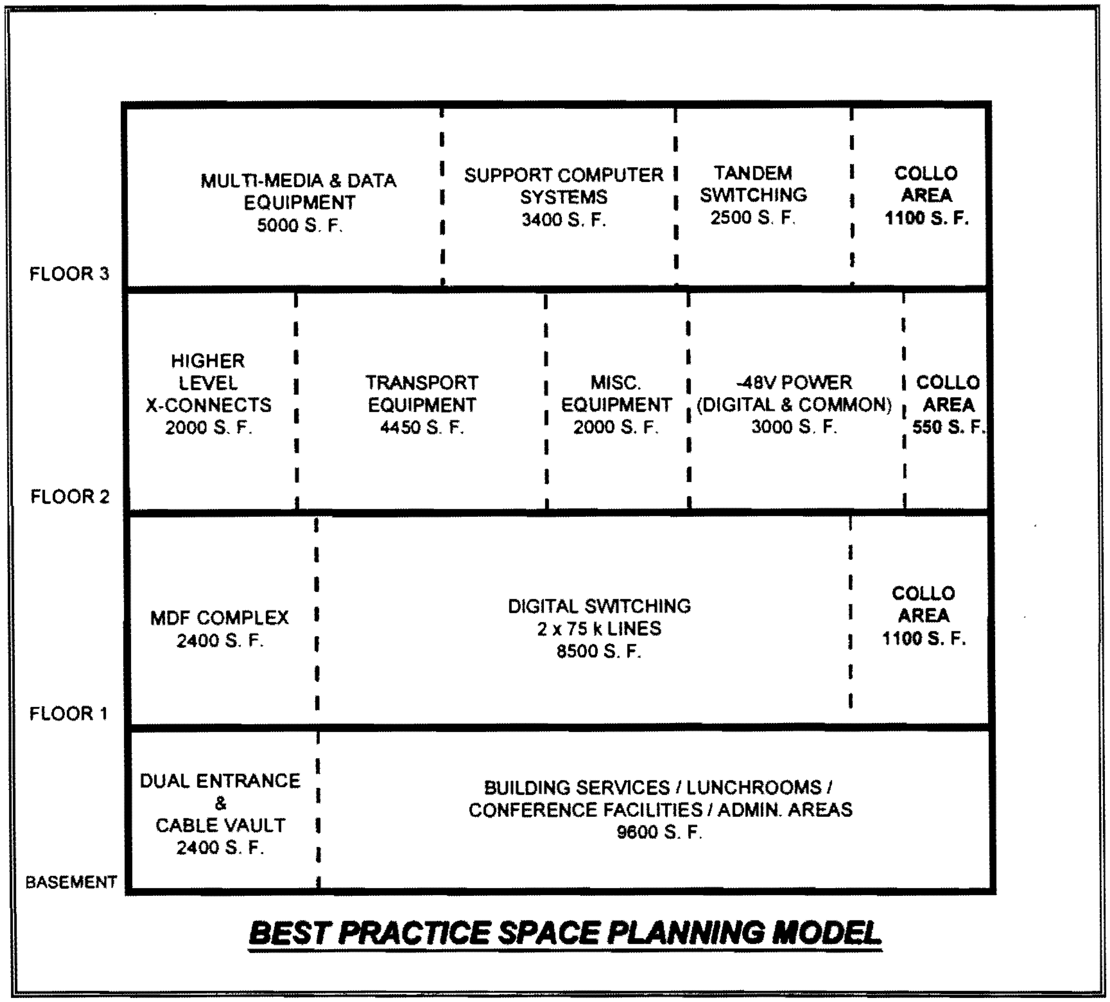


Figure 4B

To ensure efficient connectivity arrangements, similar to those incurred by the ILEC in deploying its equipment, the Model establishes collocation areas using pockets of existing vacant or administrative space in the CO. To be conservative, the Model calculates the average connectivity lengths based on a minimum and maximum scenario. For the maximum cable length, the model uses a worst case scenario with the collocation area located on the top floor (Floor 3) of the CO layout, the cross-connects located on Floor 1, and the collocation area at the extreme opposite corner of the building from where the cross connects are located. Based on this premise, there would be a two-floor distance between the collocation area and the ILEC cross-connects. For the minimum cable length, the model uses a best case scenario and assumes that the collocation area is located on the same floor and in close proximity to the ILEC cross-connects. However, since physical collocation requires the construction of cages, it is unlikely that a new collocation area could be built directly adjacent to ILEC cross-connects. Therefore, the best case scenario includes a 40 foot minimum length between the collocation area and the ILEC cross-connects. Both scenarios include a 15 foot cable drop (i.e., 7'6" on each end). Hence, the forward looking best practice CO model layout used in the Model generates ***minimum and maximum*** copper connectivity lengths of 55 and 275 feet.4 The Model therefore uses an average connectivity length of 165feet for Voice Grade, DS-1, or DS-3 cabling between the CLEC collocation area and the appropriate ILEC cross-connect.

The average connectivity length of 165 feet is an appropriate assumption because COs built today and in the future would not have the inherent cost penalties associated with cable congestion, blocked cable holes, multiple MDFs, inter-DF tie cable systems and other limitations (which can easily be manipulated to increase the cost of entry for CLECs). As shown in Figure 4C, when ILECs install the same type of multiplexing and fiber terminal equipment for themselves as for the CLECs, the average cable distance tends to be in the 100 to 125 foot range, because equipment would be placed on the same floor and as close as possible to ILEC cross-connects. Thus, the Model conservatively sets connectivity lengths for CLECs that are significantly longer than the equivalent costs for the ILEC.

4 These extremes were determined as follows: equipment area width = 100 feet; equipment area length = 120 feet; distance between floors = 20 feet; cable drop to equipment at both ends = 15 feet. So the maximum two-floor distance would be 100' + 120' + 20' + 20' + 15' = 275', and the minimum same-floor distance would be 20' + 20' + 15' = 55'.

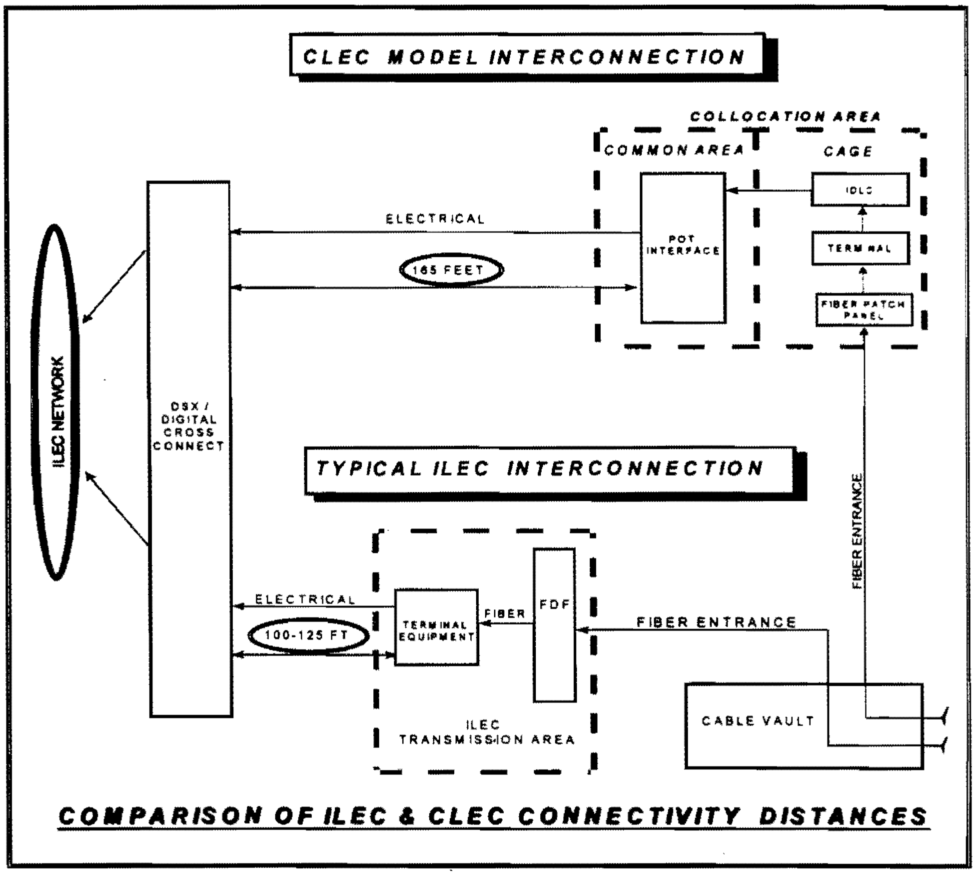


Figure 4C

Using the same forward-looking, three-floor CO model layout and the best practice planning assumptions discussed above, average lengths for all collocation-related cabling and connectivity components have been developed. A summary of all average connectivity lengths used is set forth in Chart 1 below.5

5 Calculations for all average cable lengths are included in backup documentation for the Collocation Model Layout.

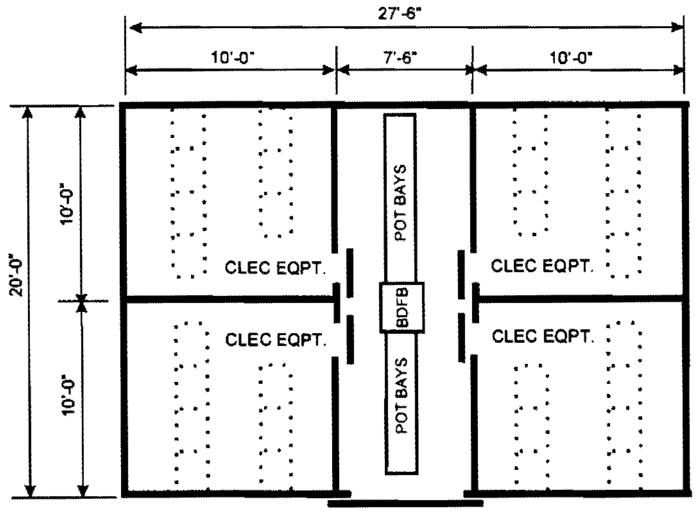
CHART 1 COLLOCATION MODEL CONNECTIVITY COMPONENTS AND AVERAGE DISTANCES			
TYPE OF CONNECTION	**CABLE LENGTH**	**CABLE RACK LENGTH**	**CABLE HOLES AND SLEEVES**
FIBER ENTRANCE CABLE (BY CLEC)	125'-0"	N/A	--
FIBER RISER CABLE (BY CLEC)	175'-0"	160'-0"	3
COPPER (DS-0/DS-1/DS-3)	165'-0"	150'-0"	2
-48V DC POWER PLANT TO BDFB	165'-0"	150'-0"	2
BDFB TO DC PANELS IN CAGE	35'-0"	5'-0"	--
FLOOR GROUND BAR TO COMMON AREA GROUND BAR	100'-0"	IN CONDUIT	--
COMMON AREA GROUND BAR TO EQUIPMENT GROUND BAR	30'-0"	CABLE BRACKETS ON COPPER RACK	--

4.2 CENTRAL OFFICE COLLOCATION AREA MODEL

The Collocation Model assumes a best practice planning strategy that permits more than one collocation area to be assigned in a CO based on available space in close proximity to ILEC cross-connects. This is in contrast to an arbitrary assumption (sometimes made by the ILECs) that the first collocation area in a CO must be sized to accommodate all potential future CLECs, even when that decision results in placement of the collocation area in a remote location far from the cross-connects.

As shown in Figure 4D, the Model assumes a collocation area model layout of 550 square feet to take advantage of smaller areas that would be in relatively close proximity to ILEC cross-connects (these pockets of space include those made available by prior replacements of older technologies with more space efficient digital equipment, vacant area, space occupied by administrative staff, or locations occupied by redundant equipment that an efficient ILEC would have removed long ago). This assumption reflects an expectation by the

Model developers that, in terms of placement, the ILEC would employ the same best planning process that it would use when planning efficient equipment space allocations for its own equipment.



SUMMARY		
OVERALL SPACE REQUIREMENT	=	550 SQ. FT.
NUMBER OF 100 SQ. FT. ALLOCATIONS	=	4
CLEC CAGE SPACE	=	100 SQ. FT.
SHARED COMMON SPACE	=	150 SQ. FT.
CLEC CONTRIBUTION FOR EACH 100 SQ. FT	=	137.5 SQ. FT
POT BAYS + TERMINATION PANELS	=	BY CLEC
DC POWER PANELS IN CAGE (IF REQUIRED)	=	BY CLEC
BDFB (INCLUDED IN POWER CONSUMPTION)	=	BY ILEC

FORWARD-LOOKING BEST PLANNING COLLOCATION MODEL

Figure 4D

The 550 square feet included in the collocation model layout provides sufficient space to accommodate interface equipment such as point of termination (POT) bays and remote power distribution BDFB equipment, while avoiding the economic disadvantages of exceptionally large collocation areas. For those COs where more than 550 square feet of collocation space is required, a second collocation area would be selected when necessary.

Proceeding in this manner is consistent with the FCC amended Order Part 51.323 (f)(1) (and Paragraph 585), which supports the concept of CLECs, obtaining reasonable amounts of space in an ILEC's premises on a first-come, first-served basis.

Within the 550 square foot collocation area, the collocation area model layout assumes the construction of four 100 square foot equipment areas and a common area of 150 square feet (to accommodate ILEC and CLEC point of termination interface equipment bays and a BDFB). The Model anticipates that the cost of the entire common area would be shared by all CLECs (with no contribution from the ILEC) and that CLECs would request collocation space in increments of 100 square feet, without any guarantee of expanding into an adjacent space. If a CLEC requires additional space for expansion, it would have to take the next closest available space in much the same way as an ILEC would. For this type of situation, cage-to-cage cabling for cages occupied by the same CLEC should be permitted.

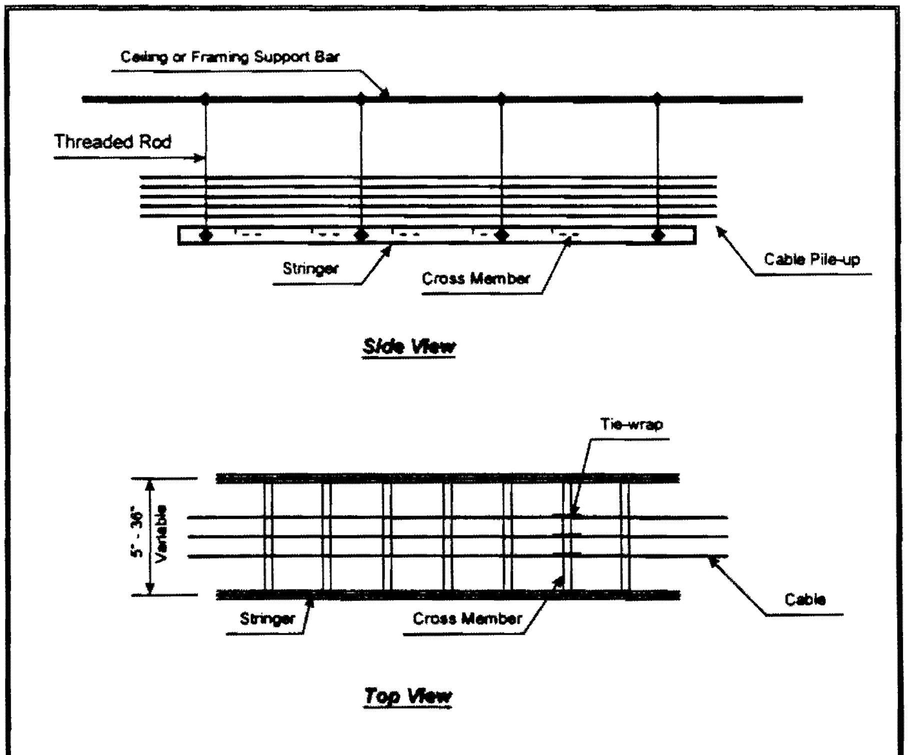
4.3 COMMON INTERFACE EQUIPMENT

With the exception of the shared BDFB, which is included in the Power Consumption elements discussed in Section 5, the Model assumes that all interface equipment located in the common area will be purchased and installed by the CLEC. This includes POT bays, and all required voice grade, DS-1, and DS-3 interconnection shelves to be placed on the POT bays.6 Proceeding in this manner permits CLECs to achieve the benefits of a competitive best practice and least cost approach to the provisioning of interface equipment, instead of forcing them to absorb the cost of potentially less-competitive contract prices currently in place between the ILEC and its suppliers.

6 All CLEC-provided POT bays and interconnection panels should conform to appropriate standards and be acceptable for use in telecommunications COs. Because this would be passive cross-connect equipment

4.4 OVERHEAD COMMON SYSYTEMS INFRASTRUCTURE

Cables are typically routed within the CO environment on overhead cable racks supported from the ceiling. (See Figure 4E.)



Central Office Channel Type Ladder Cable Rack

Figure 4E

CO cable racking is readily available in widths between five and thirty inches. Usually, different types of cabling (e.g., fiber, power, copper) are routed on separate cable racks. The bulk of the cabling in a CO is copper, which is typically placed on wider cable racks (15", 20", 25", 30"). Specialty cables, such as fiber and power, are usually placed on narrower 12" or 15" cable racks. Although the ILEC has the responsibility to supply copper, fiber, and power

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located completely within the secure collocation area, it would pose no potential threat to the ILECs' network security or integrity.

accessibility to the new collocation area in the most cost efficient manner,7 Figure 4F provides the preferred configuration for routing fiber, copper and power cables to each collocation area.

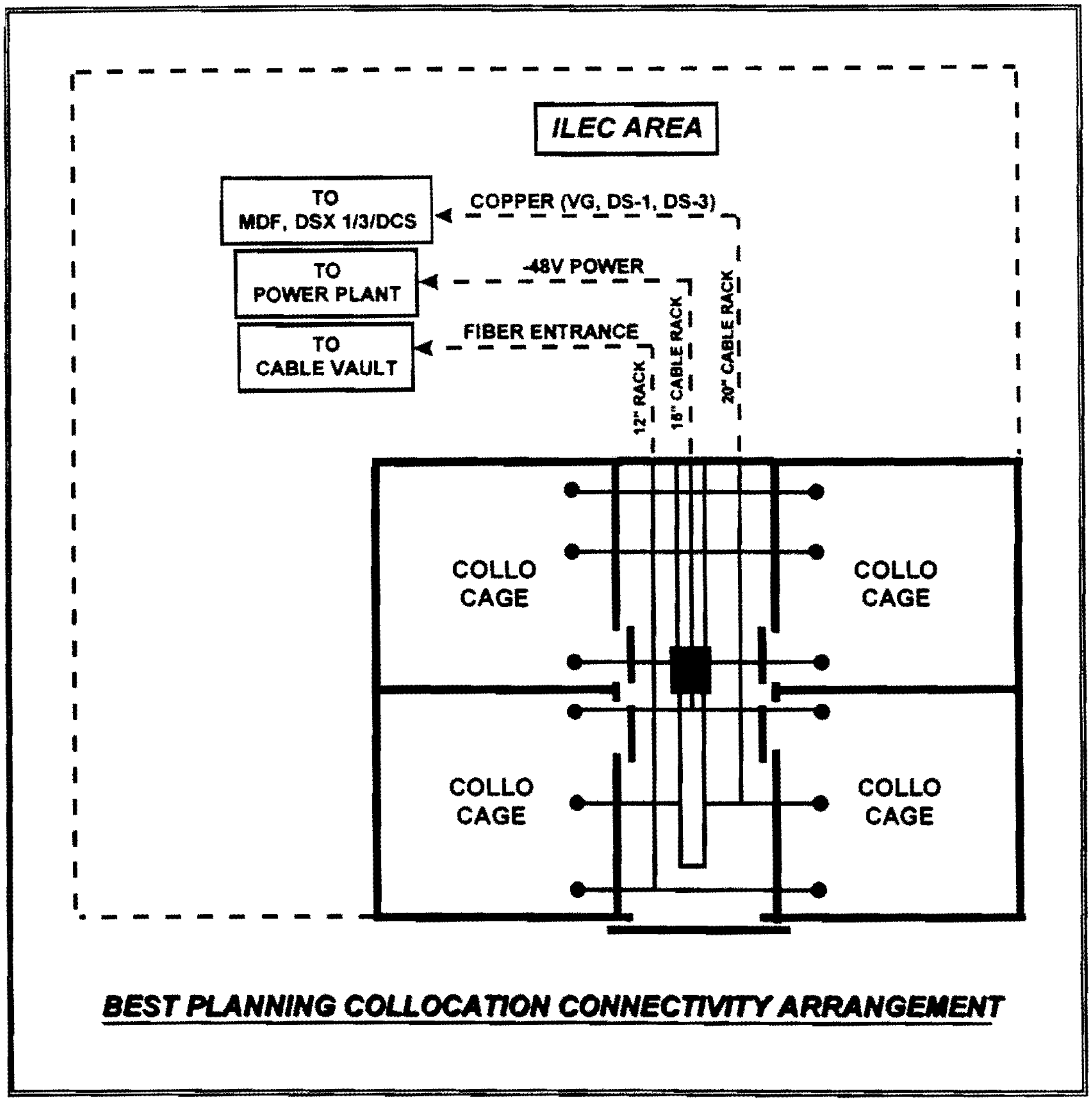

Figure 4F

As shown, an efficient connectivity arrangement provides for pre-placed cable routes installed by the ILEC at the time that the initial collocation area is constructed. The following

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7 The model assumes that if necessary the ILEC must place the racks between the collocation area and the cross-connects. Portions of the Cable Racks may already be in place. In either case, the CLEC's pay space

connectivity routes will be required by the CLECs and should be incorporated into the planning process for a new initial collocation area.

⇒ *a copper cable route for Voice Grade, DS-1, DS3 cables to ILEC cross-connects*
⇒ *a fiber cable route for Fiber Riser between the cable vault and the collocation cage*
⇒ *a power cable route for cabling between the -48V Power Plant and Collocation BDFB*

As previously noted, it is the responsibility of the ILEC to provide overhead cable racking to transport cables between various areas of the CO. With the exception of small amounts of cable located within the common area, the vast majority of cabling associated with collocation connectivity will be routed on shared cable racks within the ILEC CO. To account for this, a cable rack occupancy cost (based on the amount of space utilized on a particular shared cable rack) has been incorporated into the Model (for similar reasons, an occupancy cost for the use of ILEC inter-floor cable holes also is incorporated into the Model).

Because cables are many different sizes, the Model develops individual cable rack occupancy costs for the various types of telecommunications cable used in ILEC COs, which are reflected in Chart 2. The top portion of the chart, entitled Cable Rack Capacities, outlines the commonly-used cable rack sizes, together with the estimated number of cables that can be placed on each at various cable pile-up levels (e.g. build-up on the rack). The lower portion of Chart 2 sorts the various types of cabling commonly used for telecommunications equipment according to size, and develops a cable equivalency factor. As shown, DS-1 and DS-3 cables are the benchmark, with an equivalency of one cable. A 100-pair voice grade cable is equivalent to two benchmark cables; a fiber riser cable is equivalent to three benchmark cables; and a large 750 MCM power cable is equivalent to four benchmark cables.[8]

---

rental to the ILEC for their occupancy.
8 Equivalencies based on an approximation of cable size.

CHART 2													
COLLOCATION MODEL - CABLE RACK CAPACITIES													
CABLE RACK WIDTH		CABLE PILE-UP											
ACTUAL SIZE	CABLE SPACE	1"	2"	3"	4"	5"	6"	7"	8"	9"	10"	11"	12"
10"	8.5"	26	51	77	102	128	154	179	204	230			
12"	10.5"	32	63	94	126	158	189	221	252	283	315		
15"	13.5"	41	81	122	162	203	243	284	324	365	405	446	486
20"	18.5"	56	111	167	222	278	333	389	444	500	555	611	666
25"	23.5"	71	141	212	282	353	423	494	564	635	705	776	846
30"	28.5"	86	171	257	342	428	513	599	684	770	855		
CABLE TYPE	EQUIVALENCY FACTOR	OCCUPANCY FACTOR FOR CABLE RACK & CABLE HOLE USAGE											
Fiber Riser	3	Fiber Riser cables assume 7" Pile-up on 12" Racks * Capacity = 74 Cables (221/3)											
750 MCM	4	Power Distribution Cables assume 5" Pile-up on 15" Racks * Capacity = 51 Cables (203/4)											
100 Pair VG/DS-0	2	Copper DS-0 Voice Grade Cables assume 10" Pile-up on 20" Racks Capacity = 278 Cables (555/2)											
28 Pair DS-1	1	Copper DS-1 Cables assume 10" Pile-up on 20" Racks Capacity = 555 Cables **											
Coax DS-3	1	Coax DS-3 assume 10" Pile-up on 20" Racks Capacity = 555 Cables **											

** Reduced capacity due to rigidity & bending radius* *** DS-1 & DS-3 requires 2 cables per circuit*

The Occupancy Factors are a function of both pile-up on the rack and the widths of the racks. Although it is possible to find large 25" and 30" cable racks being utilized in some areas of certain COs, the occupancy factors used in the Collocation Model have been conservatively calculated assuming that copper connectivity uses 20" cable racks, power cables use 15" cable racks, and fiber riser cables use 12" cable racks. Although in some COs, existing cable build-up in overhead cable racks may be in excess of 1.5 feet in some areas of the CO (e.g., above cross-connects), the central office model layout develops cable rack occupancy factors using a conservative assumption of only 10" pile-up for copper cabling (voice grade, DS-1, DS-3), 7" pile-up for fiber riser cable, and 5" pile-up for the more rigid power cabling. Cable rack fills have therefore been accounted for by using conservative cable rack sizes with best practice cable pile-up assumptions (i.e., 25" and 30" cable racks and 1.5 foot cable build-up situations have not been considered).

Based on the previously-determined average connectivity lengths of 165 feet for copper connectivity and 175 feet for fiber riser cables, the length component to be used for the cable rack occupancy component on shared cable racks has been determined to be 150 feet and 160 feet, respectively, for copper and fiber connectivity. The fifteen foot difference between the average cable lengths of 165 and 175 feet and cable rack occupancy of 150 and 160 feet is accounted for by the cable drops to equipment at each end (7' 6"), where no cable rack is being used.

5 DC POWER AND GROUNDING ELEMENTS

5.1 OVERVIEW

The standard and most cost effective method of delivering -48V DC between the power plant and telecommunications equipment in a CO environment is to use a remote power distribution bay, such as a BDFB. This is particularly true in a multi-floor installation or in circumstances in which long cable runs are required to reach the power plant. The cost implications of excessive power cable runs back to the power plant could be used as a deterrent to CLEC collocation, because in many cases the cost of power cable increases much faster than the associated increase in distance. The major reason for this disproportionate increase in power cable cost in comparison to distance is that power cable must be sized to provide the correct voltage at the equipment. Therefore, as the length of power cable increases, the voltage loss also increases, creating the need for larger distribution cables, often costing several times more per foot.

For this reason, the accepted best practice power planning is to install a BDFB in close proximity to the equipment it will serve, thus permitting the use of smaller, less-costly cables for power distribution. This also ensures that the -48V power plant will not become exhausted due to the requirement for many small fuses. Figure 5A provides a schematic depicting the relationship between the - 48V power plant, the BDFB, and the end equipment.

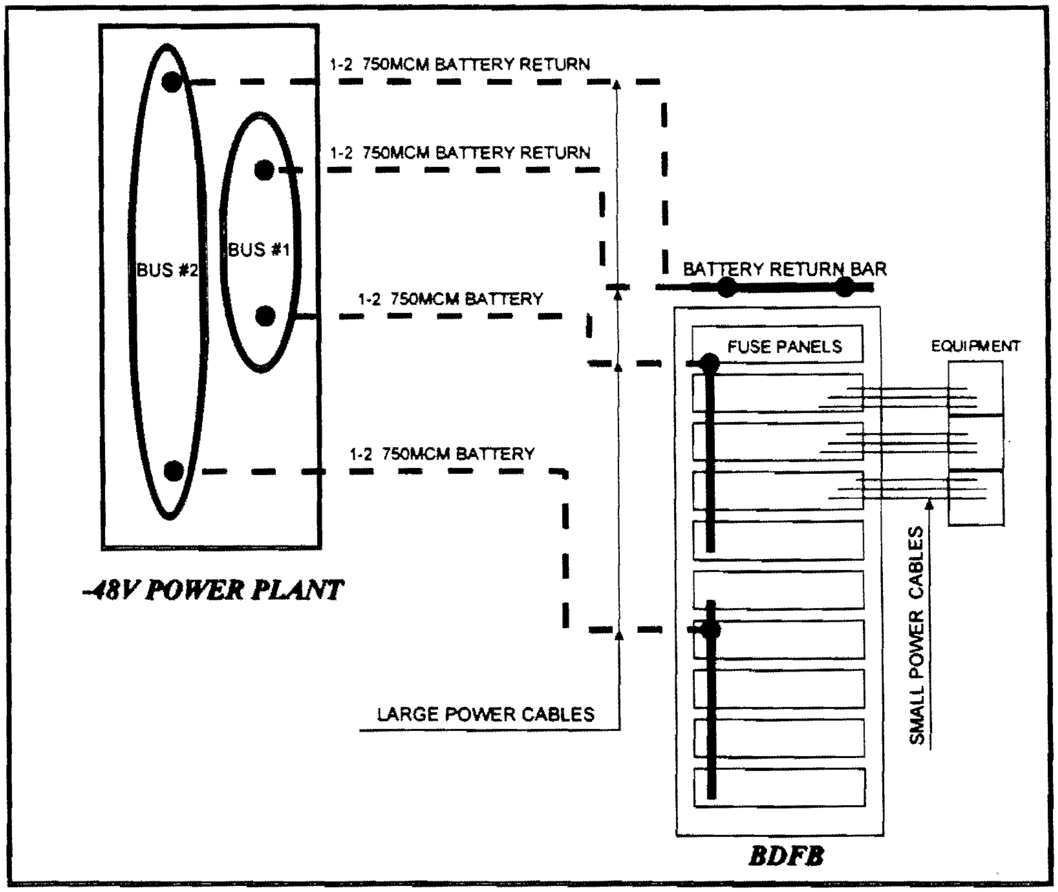


Figure 5A

In summary, the use of a remote BDFB located in close proximity to the equipment it will serve has become the norm for providing -48V DC power to telecommunications equipment, because it postpones the exhaust of the -48V power plant and is more cost-effective than running many large (and costly) power distribution cables all the way back to the power plant for equipment fusing. An overview of the accepted best practice method for the delivery of -48V DC power in a telecommunications environment is shown in Figure 5B.

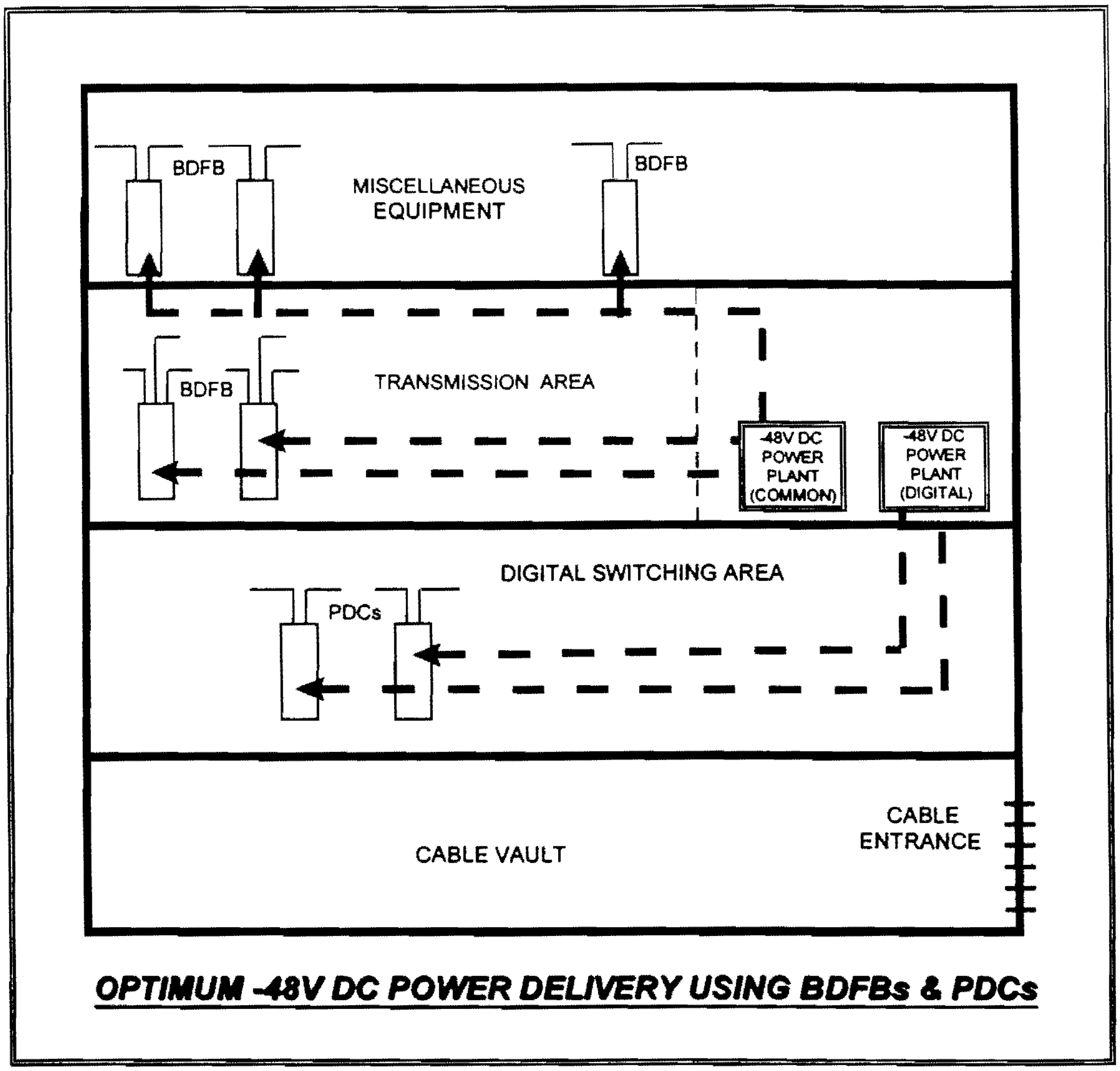


Figure 5B

Figure 5B illustrates the best practice method for delivering power. This configuration minimizes power distribution costs and provides optimum operations flexibility by placing fusing in close proximity to equipment. ILECs regularly utilize a BDFB or some other type of distribution bay (in the Nortel DMS switch, the BDFB is referred to as a power distribution center) placed close to the equipment it will serve. Normally, these BDFBs are strategically located according to the expected fuse requirements of the equipment. In a transmission environment, a BDFB is located in the first bay position of each third or fourth equipment line-up, depending on line-up length and expected demand for fuses. This standard approach permits short power feeders to equipment and ensures a least-cost approach to power distribution.

Figure 5B also reflects the use of an intermediate fuse bay, such as a BDFB, to distribute power. This has proven to be more cost-effective than running numerous cables to the power plant and has become the norm for distributing power to all types of telecommunications equipment, particularly in large urban COs with multiple floors.

The use of an intermediate distribution bay is the least-cost and best-practice method for delivering -48V DC power to telecommunications equipment. In a collocation environment however, the delivery of -48V power is typically divided into two separate charges:

1) *a monthly power consumption charge for shared use elements such as the power plant, diesel generator and distribution as far as the BDFB*

2) *a non-recurring power distribution charge to provide power feeders between the equipment and the closest BDFB*

Unless the line of demarcation between power consumption and power distribution is clearly defined, the opportunity for double recovery could be built into a model. To avoid this potential problem requires two basic steps. First, any NRCs related to common systems infrastructure (cable racking/power cables) for the delivery of -48V power should be based solely on the distance between the collocation equipment and a Collocation BDFB, and **NOT** between the Collocation Area and the -48V DC power plant. This is necessary because the investments required to deliver power between the -48V power plant and the BDFB are included in modeling the power consumption charge.

Second, an average length is used in the calculation of the investment for DC power distribution between the CLEC equipment and a collocation BDFB. This ensures that the ILEC uses the same best practice planning strategies as it would for its own installations by placing the BDFB in close proximity to collocation equipment.

Figure 5BB below superimposes a collocation scenario on the previously presented Figure 5B depicting an optimum telecommunications power delivery arrangement to demonstrate the requirement for a clear line of demarcation between power consumption and power distribution for collocation.

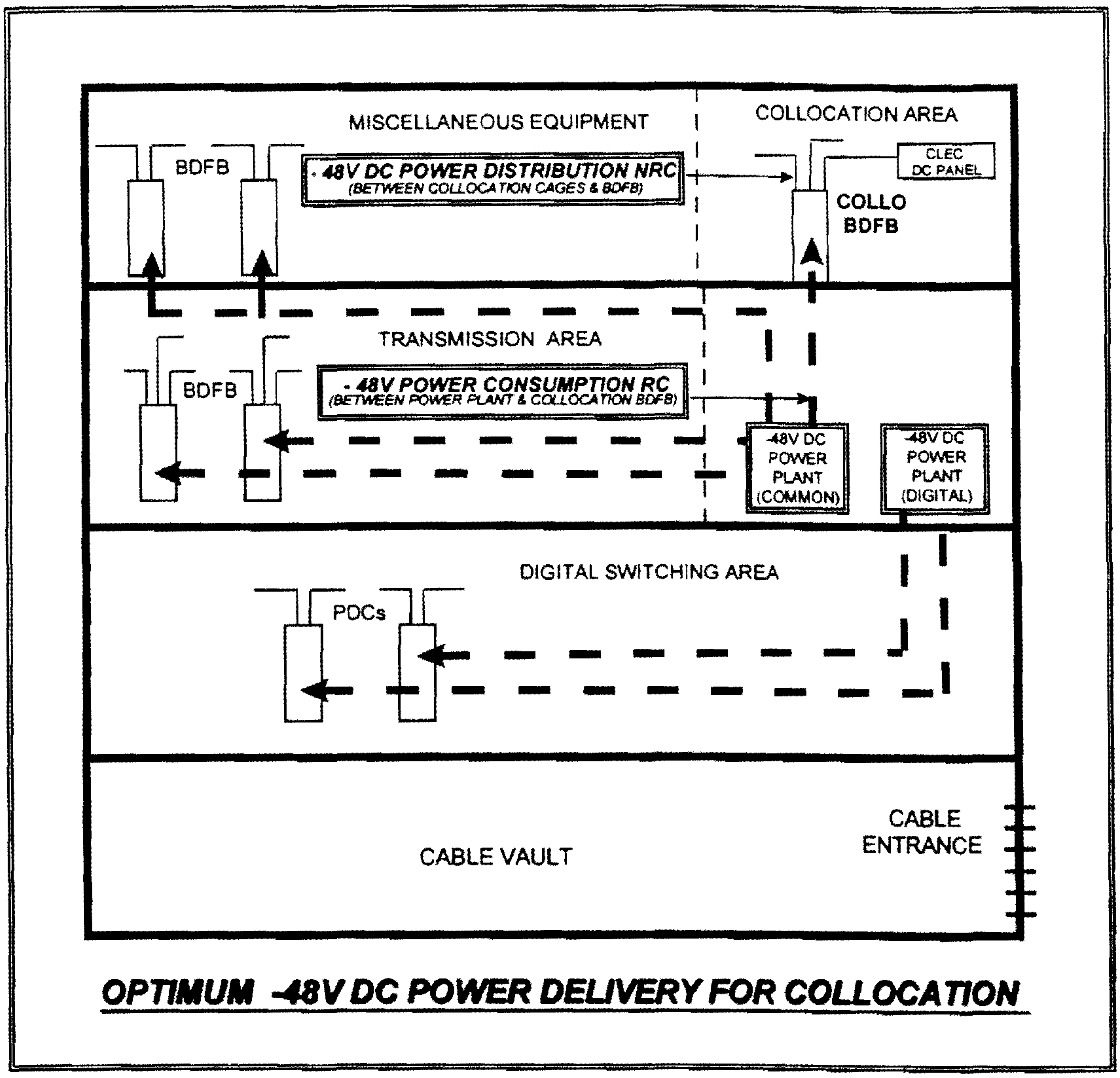


Figure 5BB

Proceeding in this manner ensures that -48V DC power will be delivered to CLECs in the most cost-effective manner by using best practice power planning principles (i.e., using BDFBs) and incorporating adequate checks and balances to ensure that no double-recovery could arise by calculating length sensitive power distribution NRCs in a way that would include portions of the investments already included in the power consumption recurring charge -- *a situation that would be very difficult to detect on a case by case basis.*

Because BDFBs are normally located within a few line-ups of the equipment to be fused, the best-practice planning scenario for the collocation BDFB is to place it as close as possible to the collocation area cages -- preferably in the collocation common area provided in the collocation area model layout, depicted in Figure 5C. Because this BDFB is simply a remote fuse bay connected to the shared -48V power plant, it also can be used by any ILEC equipment located near the collocation area.

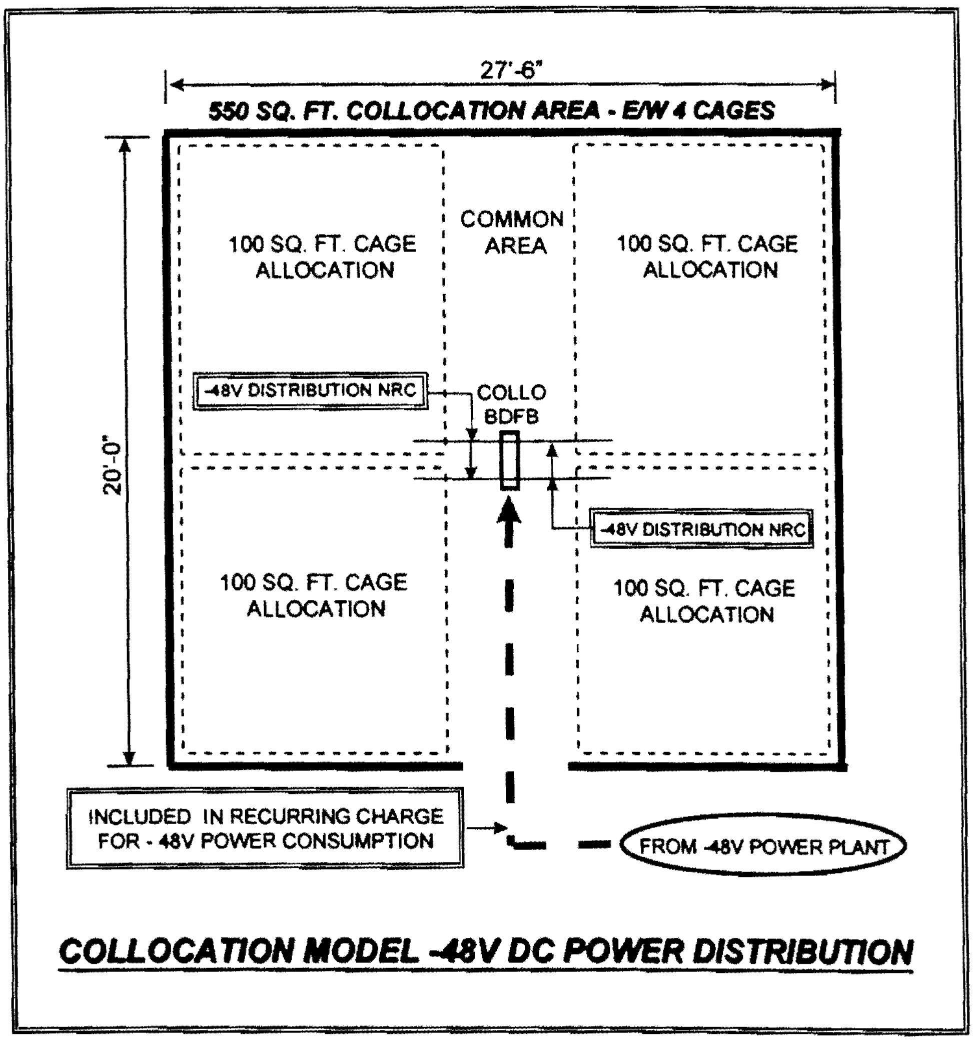


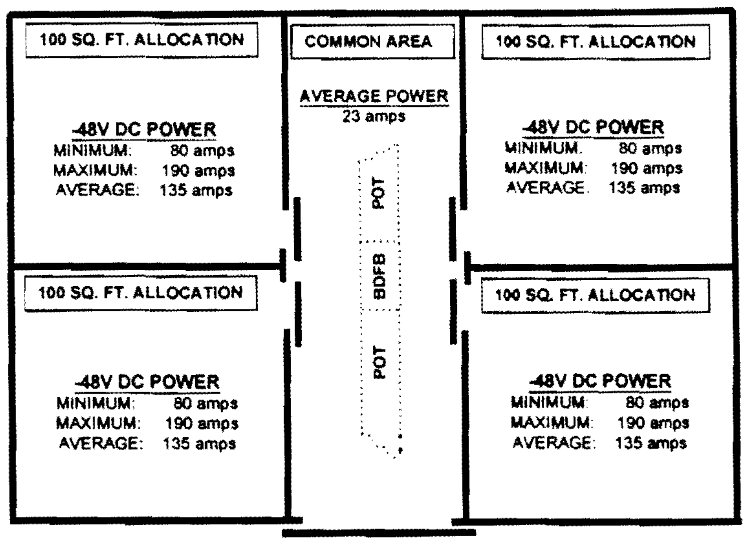
Figure 5C

Based on the assumption that the collocation BDFB is strategically located in the collocation common area as per the same best practice planning scenario used by the ILEC for the delivery of -48V DC power to its own equipment, it is unlikely that -48V DC power distribution cables for fusing collocation equipment would be longer than about 35 feet. Therefore, the Collocation Model assumes an average length of 35 feet for -48V DC power distribution between the collocation BDFB and the CLEC provided DC power panels placed inside each cage. The 35 feet assumes 15 feet in the common area and a 20 foot drop provided in the cage to allow the CLEC to connect to its DC power panels.

5.2 DC POWER REQUIREMENTS FOR COLLOCATION MODEL

As shown in Figure 5D, each 100 square-foot allocation provided by the collocation area model layout is likely to require 80 to 190 amps DC, depending on the type and amount of equipment installed by the collocator. Therefore, including the nominal 23 amps of power required in the collocation common area for POTS bays, the estimated ***average*** long term -- 48V DC power requirements to serve the proposed overall 550 square-foot collocation area is 563 amps. The use of averages for assessing the long term power requirement in the Model is reasonable, because the Model provides a cost element for power consumption charges that are imposed on a per amp unit. Thus, if one CLEC is a high user of DC power, the Model will determine power consumption costs based on the level of that CLEC's usage.9

9 If all CLECs simultaneously fill up their collocation spaces with equipment that requires the maximum 190 amps, rather than the average 135 amps, the only additional expenses that the ILEC will face (in addition to the power cost that is reimbursed in per amp charges) are those associated with additional air conditioning requirements. That additional cost is addressed in Section 8.3.



SUMMARY OF LONG TERM DC POWER REQUIREMENT	
ITEM	-48V DC POWER
AVERAGE REQUIREMENT / 100 SQ. FT. ALLOCATION	135 amps
EXPECTED REQUIREMENT IN COMMON AREA	23 amps
LONG TERM REQUIREMENT IN COLLOCATION AREA	563 amps

COLLOCATION MODEL - LONG TERM - 48V DC POWER

Figure 5D

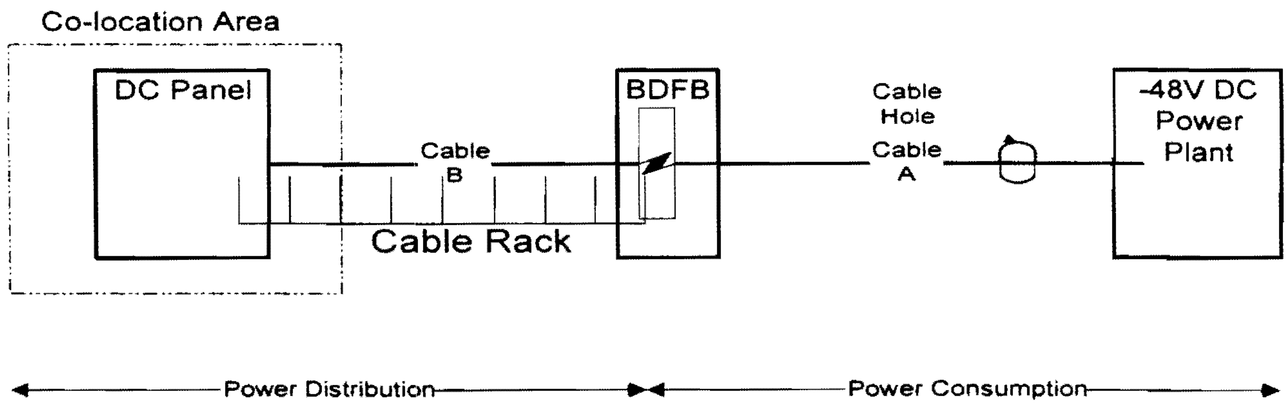
5.3 POWER DISTRIBUTION COMPONENTS

The Model includes the delivery of -48V DC power between the shared -48V DC power plant and the collocation BDFB in the cost that is developed for the power consumption element. The charge for power distribution between the BDFB and the CLEC-provided DC panels is limited to the previously mentioned 35 feet of power cable. The selection of ILEC-provided power cables will be dependent on the amount of bulk DC power requested by the CLEC.

Similarly, CLEC-provided DC power panels located in the CLEC cage for fusing are a function of individual CLEC fusing requirements and the amount of DC power the CLEC is willing to purchase.

In addition, the Model assumes that the CLEC reimburses the ILEC for the installation of a five foot length of 12" cable rack to connect between the CLEC cage and the power rack installed over the shared BDFB. Because this rack is only required on the initial installation, it is included as part of the collocation cage investments in the Model. A schematic setting forth the components that are included in the central office model layout as part of the non-recurring cost for -48V DC Power Distribution is displayed below.

COLLOCATION MODEL - -48V DC POWER DELIVERY



Power Delivery Elements (-48V DC Option)				
Element	**Description**	**Prov. by CLEC/ILEC**	**Quantity**	**Remarks**
-48V DC Power Panel	Located in Cage	CLEC	--	CLEC installs -48V DC panels in cage and terminates ILEC provided feed
Cable 'B'	4 x #6 Cable between Cage & Collo BDFB	ILEC	35'-0"	One time charge for 40 Amps (20 Amp A & B feeds + return) as requested by CLEC -Includes 20'-0" drop in cage
Cable 'B'	4 x #2 Cable between Cage & Collo BDFB	ILEC	35'-0"	One time charge for 100 Amps (50 Amps A & B feeds + return) as requested by CLEC - Includes 20'-0" drop in cage
Cable 'B'	4 x 2/0 Cable between Cage & Collo BDFB	ILEC	35'-0"	One time charge for 200 Amps (100 Amps A & B feeds + return) as requested by CLEC - Includes 20'-0" drop in cage
Cable Rack	15" CLEC specific	ILEC	5'-0"	Included in cage investment
BDFB	Located close to Collocation Cages	ILEC	--	Included in -48V DC Power Consumption Charge
Cable Rack Occupancy	Shared support for Cable 'A' below	ILEC	--	Included in -48V DC Power Consumption Charge
Cable 'A'	Cable between – 48V Power Plant & BDFB	ILEC	--	Included in -48V DC Power Consumption Charge
-48V DC Power Plant	Shared use between CLEC's & ILEC	ILEC	--	Included in -48V DC Power Consumption Charge
Auto-start Diesel Fuel Tanks, & AC	Required for Battery Back-up	ILEC	--	Included in -48V DC Power Consumption Charge

Switchboard				
AC Energy	Required for AC Energy used	ILEC	--	Included in -48V DC Power Consumption Charge

5.4 POWER CONSUMPTION COMPONENTS

The -48V DC power consumption components that are modeled to develop the power consumption recurring charge include all ILEC investments necessary to engineer, furnish, and install (EF&I) a shared -48V power plant, including the mandatory battery and diesel generator back-up. The Model also includes amounts for fuel tanks, AC entrance, and switchboard equipment. Based on the previously discussed best power practice planning strategy, a BDFB and associated cabling components also are included to ensure the most cost-efficient method of delivering -48V DC power to the collocation area.

To maximize its flexibility, the Model develops investments associated with two different power plant installations, one based on a 2500 amp DC power plant and the other based on a 4000 amp plant. These two sizes were selected to provide a reasonable range of ILEC investments in medium and large sized COs, respectively.

The following components are included in the Model to develop a proposed charge for CLEC -48V power consumption.10

10 Details regarding -48V power plant investments and the resultant charge are included in the Collocation Cost Model.

> - ***High capacity shared 1200 Amp BDFB (A&B feeds) with all shelves and fuses***
> - ***Power cable between the BDFB and ILEC -48V DC Power Plant***
> - ***Batteries to provide up to four hours reserve***
> - ***Battery Control Board (Power Distribution Center)***
> - ***Rectifiers (N+1) to carry load plus one for maintenance***
> - ***Engineering and Installation costs***
> - ***Cable rack and cable hole costs occupancy charges***
> - ***Standby diesel generator to ensure continuous supply of AC power***
> - ***Fuel tanks, AC entrance, Switchboard equipment***
> - ***AC Electric Energy component***

With a shared -48V DC power plant, it is impossible to separately meter (and separately charge for) CLEC AC electric energy usage. Therefore, an AC electric energy component is included in the model to account for the shared -48V DC power plant. As shown on Chart 3, the AC energy component is developed by restating the cost per AC kilowatt hour usage charge as a an AC energy rate per DC amp used.11 The rate determined as a result of the above energy calculation is added to the costs per amp for DC power to create the all-inclusive monthly power consumption charge.

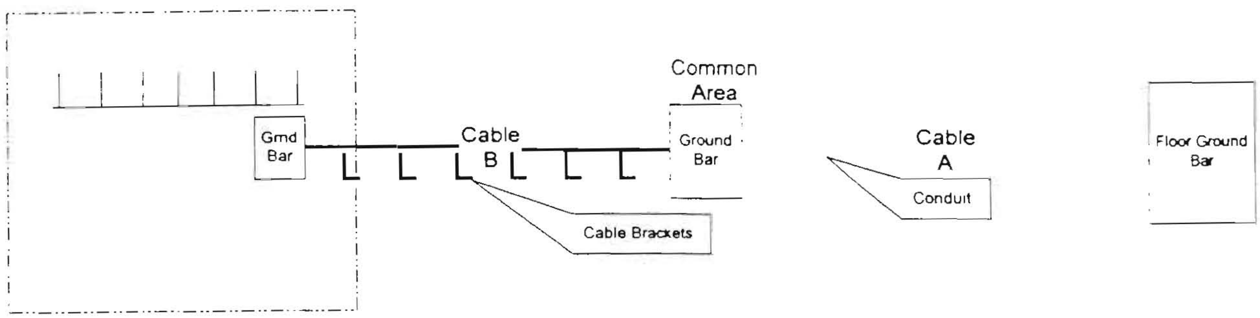
11 The example uses a rate of $0.05 per Kilowatt hour for electric power. The Model allows the actual rate per Kilowatt hour used in the cost calculations to be state-specific.

Chart 3	
Calculation of AC Electric Energy Component	
Quantity of DC Amps	1
Quantity of Watts per DC Amp	48
Hours Usage per Day	24
Days Usage per Month	30
Total Monthly DC Watts	34560
AC Equivalent Watts at 85% Rectifier Efficiency	40659
Total AC Kilowatt Hours	40.66
Cost per Kilowatt Hour	$ 0.05
AC Energy Rate per DC Amp	***$ 2.03***

5.5 EQUIPMENT GROUNDING COMPONENTS

As shown in the following schematic, the collocation area model layout assumes that each CLEC will furnish and install a cable rack mounted equipment ground bar within its cage. The CLEC also will install a suitable ground cable to connect to the ILEC provided ground bar that should be placed in the collocation common area for use by all CLECs. The following schematic outlines the grounding components assumed in the collocation area model layout (the shaded areas in the chart indicate elements provided by the ILEC for which the Collocation Model develops costs).

COLLOCATION MODEL - EQUIPMENT GROUNDING



Grounding Elements				
Element	**Description**	**Provided by CLEC/ILEC**	**Quantity**	**Remarks**
Equipment Ground Bar	Attached to CLEC Cable Rack in Cage	CLEC	--	CLEC will provide ground bar and connect to ILEC Ground Bar in Common Area
Cable 'B'	No. 4/0 cable between CLEC Ground Bar and Common Area Bar	CLEC	30'-0"	CLEC installs ground cable to connect to ILEC Common Area Ground Bar using cable brackets attached to ILEC cable racking
New Common Area Ground Bar	Extension of ILEC Building Principal Floor Ground	ILEC	--	ILEC to extend suitable ground to Common Area and place ground bar for all CLECs
Cable 'A'	No. 4/0 cable in conduit between existing CO Floor Ground Bar and new Common Area Bar	ILEC	100'-0"	ILEC extends suitable ground to Common Area for all CLECs

6 ACCESS (ENTRANCE FIBER) COMPONENTS

6.1 OVERVIEW

The collocation of competitive equipment in ILEC central office buildings includes fiber connectivity between the first manhole and the CLEC collocation area, using CLEC-provided, fire-retardant cable for routing cables through the CO. Ideally, the pulling and splicing of fiber cable between the manhole and the cable vault, and the subsequent routing of fiber riser cable between the cable vault and collocation area, would be performed by the CLEC. In the event that this is not permitted, however, the CO model layout incorporates assumptions (which are outlined below) to calculate the costs that an efficient ILEC would incur to perform these functions in a competitive environment.

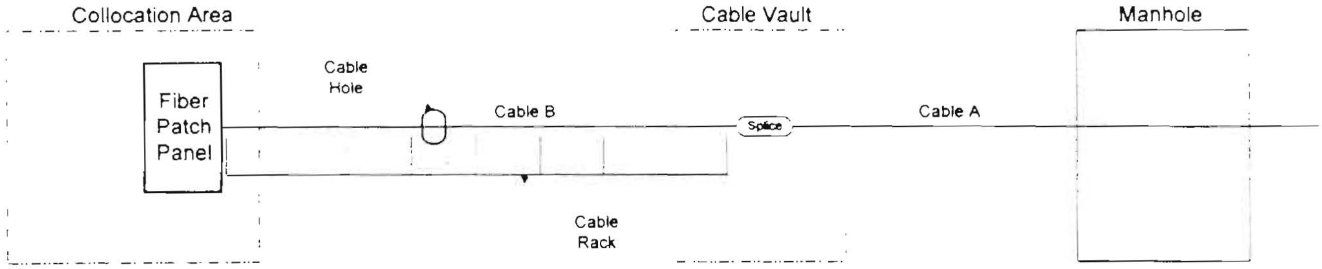
6.2 FIBER ENTRANCE COMPONENTS

The major elements required to route fiber cable between the first manhole and the Collocation cage using fire retardant cable include:

- ⇒ Pulling and splicing of cable in the cable vault
- ⇒ A splice case to change from external to internal fiber cable
- ⇒ Fire retardant riser cable between the vault splice and collocation area
- ⇒ Cable rack and cable hole (with occupancy charges based on usage)

The following schematic outlines the elements that have been used in the CO model layout to determine the cost of access connectivity (assuming that it would not be possible for the CLEC to perform the required pulling and splicing in the ILEC CO).

COLLOCATION MODEL - ENTRANCE FIBER (Fire Retardant Cable)



Access Elements (Cable Pulling & Splicing) - With Fire Retardant Provided					
Element	**Description**	**Provided by CLEC/ILEC**	**Quantity**	**Hours**	**Remarks**
Fiber Patch Panel	Located in cage	CLEC	--	--	Termination to Cage Fiber Patch Panel by CLEC
Cable 'B'	Between cage & vault splice	CLEC	175'-0"	--	Fire retardant Fiber cable provided by CLEC
Installation of Cable 'B'	Placed on shared cable rack (ILEC + CLECs)	ILEC	175'-0"	14	One time charge - Includes opening / closing of 3 cable holes
Cable Rack Occupancy	12" Rack shared by ILEC + CLECs	ILEC	135'-0"		Cost per cable
Cable Rack	12" Rack shared by all CLECs	ILEC	20'-0"	--	Included in cage cost modeling
Cable Rack	12" CLEC specific Rack	ILEC	5'-0"	--	Included in cage cost modeling
Cable Hole Occupancy	Cable holes shared by CLEC's & ILEC	ILEC	3	--	For use of ILEC cable holes
Splice Case	External to fire retardant cable	CLEC	1	--	Approved vault splice case provided by CLEC
Cable 'A'	Between vault splice & manhole	CLEC	--	--	Fiber cable provided by CLEC
Structure Charge	Between manhole & cable vault splice	Tariff Item	125'-0"	--	Per existing structures tariff
Cable Pulling	Manhole to cable vault splice	ILEC	125'-0"	4.0	Includes set-up & take-down
Splicing Activity	External cable to fire retardant cable	ILEC	--	3.0	Set-up & take-down in vault
Splice Fibers	In Cable Vault	ILEC	--	2.0	For up to 24 Fibers

Note: Access Design Charges included in ILEC Manpower Summary - Section 9

7 COPPER CONNECTIVITY COMPONENTS

7.1 OVERVIEW OF CONNECTIVITY MODELS

This aspect of the collocation area model layout addresses the need to provide connectivity between the collocation area and the ILEC cross-connects. The model assumes that connectivity between the CLEC and ILEC can be provided at three different transmission bandwidths.

1. ***Voice Grade (VG)*** is the transmission level of connection used to access the ILEC outside plant loops at a voice grade level. The CLEC will interconnect with voice grade circuits at the ILEC Main Distribution Frame (MDF).

2. ***Digital Stream 1 (DS-1)*** is the transmission level of connection containing 24 voice grade circuits ("circuit" is abbreviated as "ckt" in this document and the Collocation Model) at 1.544 Mb/s. This type of connection will be used primarily to provide connectivity between the collocation area and the ILEC access network to interconnect to unbundled DS-1 loops.

3. ***Digital Stream 3 (DS-3)*** is the transmission level of connection containing 28 DS-1 Systems or 672 equivalent voice grade circuits. DS-3 connections will be used primarily to provide connectivity from the CLEC switch site to the collocation area over leased facilities.

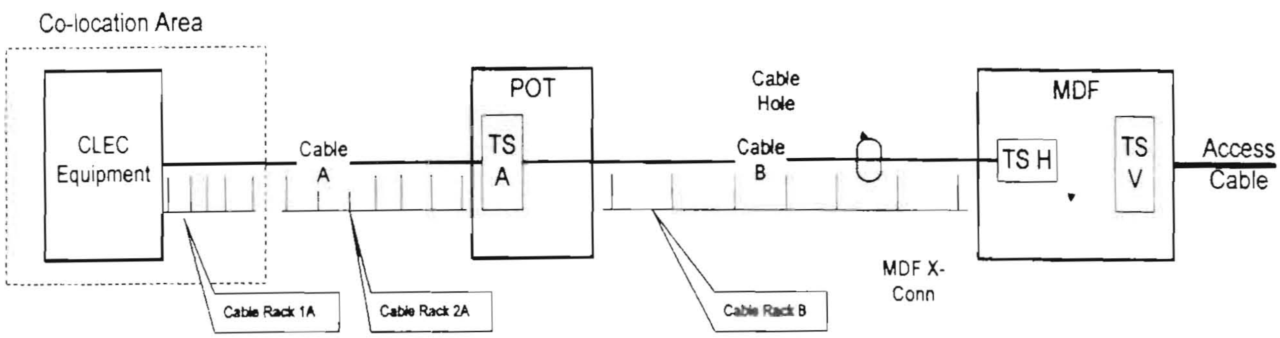
In most ILEC COs, the majority of DS-1 and DS-3 circuits to which CLECs will want to interconnect are currently located on DSX panels. However, in some ILEC COs those higher bandwidth circuits may have already been relocated to an electronic digital cross-connect system (DCS). The Collocation Model addresses both situations by including all components necessary for end to end connectivity in each case.

Depicted in schematic form on the following pages are the best practice and least-cost connectivity arrangements that have been adopted in the Collocation Model for all interconnection between the collocation area and various ILEC central office cross-connects. These include the following:

- ⇒ *Distance from the collocation area to the ILEC equipment is 165 feet*
- ⇒ *Cable Rack 1A is dedicated to an individual CLEC and included in the cage cost modeling*
- ⇒ *Cable Rack 2A is shared by all CLECs and also included in the cage cost modeling*
- ⇒ *Cable Rack B and all cable holes are shared between the ILEC and CLECs and reimbursed by a cable rack occupancy charge*

7.2 VOICE GRADE MODEL REQUIREMENTS

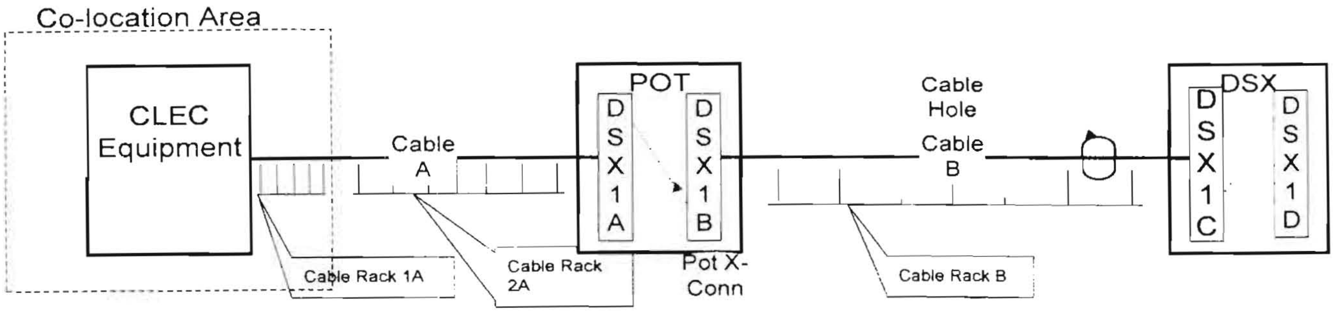
Copper Connectivity at Voice Grade Level



CONNECTIVITY ELEMENTS FOR VOICE GRADE SERVICE				
ELEMENT	**DESCRIPTION**	**PROVIDED BY**	**SIZE/CAPACITY**	**LENGTH**
CLEC Equipment	Voice Grade Equipment	CLEC		
Cable A	Cable from Line Cards to POT Bay	CLEC		<25 feet
Cable Rack 1A	20" Ladder Rack - CLEC specific - in cage cost model	ILEC		5 feet
Cable Rack 2A	20" Ladder Rack - Shared by CLECs - in cage cost model	ILEC		20 feet
POT Bay	Frame to hold Terminal Block for Demarcation Point.	CLEC	7'-0" high x 23" wide x 12 " deep	
TS A	66 Type Terminal Block	CLEC		
Cable B	Cable from Pot Bay Terminal Blocks to HMDF	ILEC	100 Pair	165 feet
Cable Hole Occupancy	2 Cable Holes shared by ILEC + CLECs	ILEC		
Cable Rack B Occupancy	20" Ladder Rack - Shared by ILEC + CLECs	ILEC		150 feet
MDF-H	Horizontal Terminal Block for X-Conn to Access side of DF	ILEC	100 pair	
MDF	MDF Terminal Strip Space	ILEC	1 block space	
MDF X-Connect	Jumper from horizontal to vertical ~ Included in Unbundled Loop	ILEC		
MDF-V	Vertical side terminal strip ~ Included in Unbundled Loop	ILEC		

7.3 DS-1 MODEL REQUIREMENTS USING A MANUAL DSX

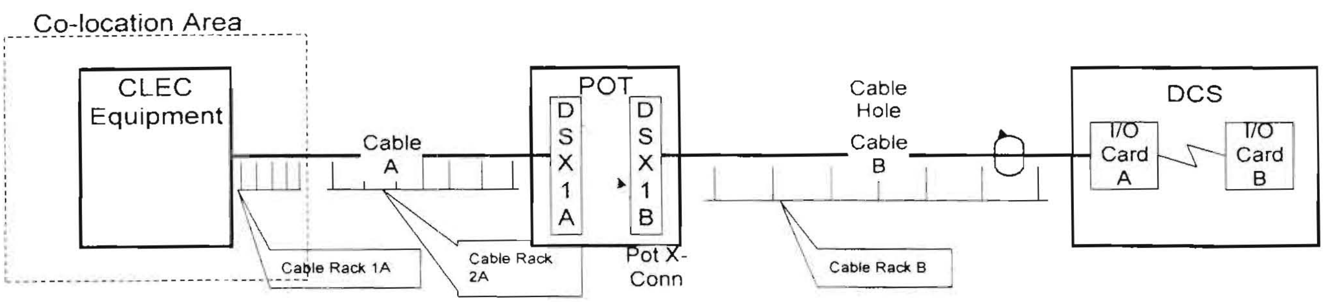
Copper Connectivity at DS-1 Level (DSX)



CONNECTIVITY ELEMENTS FOR DS-1 SERVICE (DSX OPTION)				
ELEMENT	**DESCRIPTION**	**PROVIDED BY**	**SIZE/CAPACITY**	**LENGTH**
CLEC Equipment	DS-1Multiplexer	CLEC	28 DS1	
Cable A	2x 30 Pair ABAM	CLEC	28 DS1	<25 feet
Cable Rack 1A	20" Ladder Rack - CLEC specific ~ included in cage cost model	ILEC		5 feet
Cable Rack 2A	20" Ladder Rack -Shared by CLECs ~ included in cage cost model	ILEC	555 ABAM	20 feet
POT	Demarcation Point	CLEC	7'-0" high x 23" wide x 12 " deep	
DSX-1A	Passive X-Connect Panel	CLEC	56 DS1	
POT X-conn	22 Gauge jumper wire	CLEC	4 feet	
DSX-1B	Passive X-Connect Panel	CLEC	56 DS1	
Cable B	2x 30 Pair ABAM	ILEC	28 DS1	165 feet
Cable Rack B Occupancy	20" Ladder Rack - Shared by ILEC + CLECs	ILEC	555 ABAM	150 feet
Cable Hole Occupancy	2 Cable Holes - Shared by ILEC + CLECs	ILEC	555 ABAM per hole	
DSX-1C	Passive X-Connect Panel	ILEC	56 DS1	
DSX	Digital X-Connect Frame shared by ILEC + CLECs	ILEC	560 DS1	

7.4 DS-1 MODEL REQUIREMENTS USING AN ELECTRONIC DCS

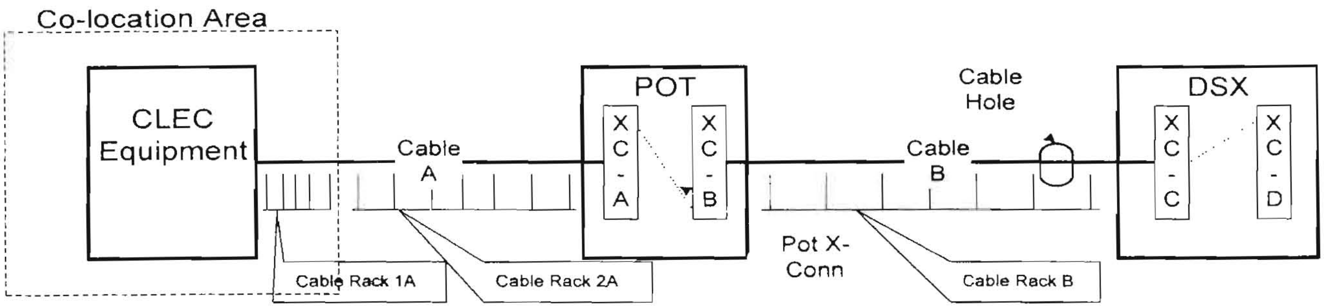
Copper Connectivity at DS-1 Level (DCS)



CONNECTIVITY ELEMENTS FOR DS-1 SERVICE (DCS OPTION)				
ELEMENT	**DESCRIPTION**	**PROVIDED BY**	**SIZE/CAPACITY**	**LENGTH**
CLEC Equipment	DS-1Multiplexer	CLEC	28 DS1	
Cable A	2x 30 Pair ABAM	CLEC	28 DS1	<25 feet
Cable Rack 1A	20" Ladder Rack - CLEC specific ~ included in cage cost model	ILEC		5 feet
Cable Rack 2A	20" Ladder Rack -Shared by CLECs ~ included in cage cost model	ILEC	555 ABAM	20 feet
POT	Demarcation Point	CLEC	7'-0" high x 23" wide x 12 " deep	
DSX-1A	Passive X-Connect Panel	CLEC	56 DS1	
POT X-conn	22 Gauge jumper wire	CLEC	4 feet	
DSX-1B	Passive X-Connect Panel	CLEC	56 DS1	
Cable B	2x 30 Pair ABAM	ILEC	28 DS1	165 feet
Cable Rack B Occupancy	20" Ladder Rack - Shared by ILEC + CLECs	ILEC	555 ABAM	150 feet
Cable Hole Occupancy	2 Cable Holes - Shared by ILEC + CLECs	ILEC	555 ABAM per hole	
DCS	Digital X-Connect System shared by ILEC + CLECs	ILEC	7168 DS1	

7.5 DS-3 MODEL REQUIREMENTS USING A MANUAL DSX

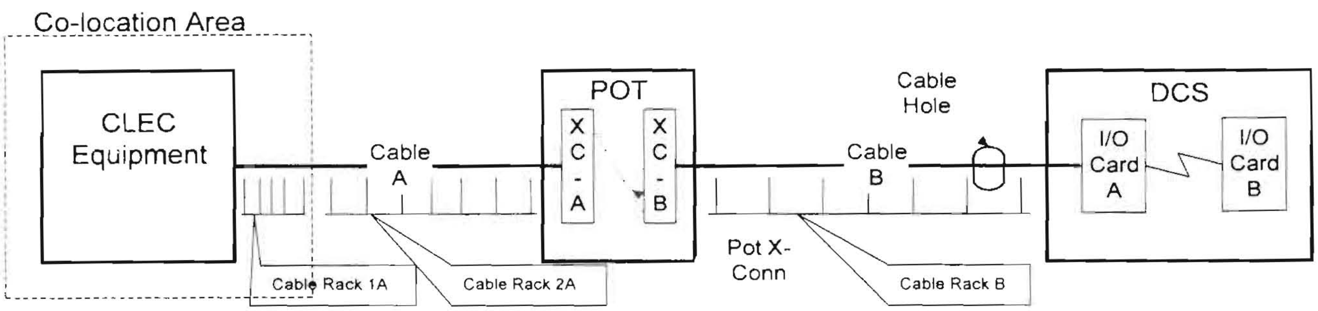
Copper Connectivity at DS-3 Level (DSX)



CONNECTIVITY ELEMENTS FOR DS-3 SERVICE (DSX OPTION)				
ELEMENT	**DESCRIPTION**	**PROVIDED BY**	**SIZE**	**LENGTH**
CLEC Equipment	DS-3 Terminal/Multiplexer	CLEC		
Cable A	734 Shielded	CLEC		<25 feet
Cable Rack 1A	20" Ladder Rack - CLEC specific ~ included in cage cost model	ILEC		5 feet
Cable Rack 2A	20" Ladder Rack - Shared by all CLECs	ILEC	555-734 type	20 feet
POT	Demarcation Point	CLEC	7'-0" high x 23" wide x 12 " deep	
XC-A	Passive X-Connect Panel	CLEC	16 DS3	
POT X-Conn	Shielded X-Connect Wire	CLEC	2 per DS3	3 feet
XC-B	Passive X-Connect Panel	CLEC	16 DS3	
Cable B	734 Shielded (2 cables)	ILEC	2 per DS3	165 feet
Cable Rack B Occupancy	20" Ladder cable rack - Shared ILEC + CLECs		555 734 Type	150 feet
Cable Hole Occupancy	2 Cable holes between floors ~ Shared ILEC + CLECs	ILEC	555 734 Type	
XC-C	Passive X-Connect Panel	ILEC	16 DS3	
DSX	Digital X-Connect Frame shared by ILEC + CLECs	ILEC	112 DS3	

7.6 DS-3 MODEL REQUIREMENTS USING AN ELECTRONIC DCS

Copper Connectivity at DS-3 Level (DCS)



CONNECTIVITY ELEMENTS FOR DS-3 SERVICE (DCS OPTION)				
ELEMENT	**DESCRIPTION**	**PROVIDED BY**	**SIZE**	**LENGTH**
CLEC Equipment	DS-3 Terminal/Multiplexer	CLEC		
Cable A	734 Shielded	CLEC		<25 feet
Cable Rack 1A	20" Ladder Rack - CLEC specific ~ included in cage cost model	ILEC		5 feet
Cable Rack 2A	20" Ladder Rack - Shared by all CLECs	ILEC	555-734 type	20 feet
POT	Demarcation Point	CLEC	7'-0" high x 23" wide x 12 " deep	
XC-A	Passive X-Connect Panel	CLEC	16 DS3	
POT X-Conn	Shielded X-Connect Wire	CLEC	2 per DS3	3 feet
XC-B	Passive X-Connect Panel	CLEC	16 DS3	
Cable B	734 Shielded (2 cables)	ILEC	2 per DS3	165 feet
Cable Rack B Occupancy	20" Ladder cable rack – Shared ILEC + CLECs		555 734 Type	150 feet
Cable Hole Occupancy	2 Cable holes between floors ~ Shared ILEC + CLECs	ILEC	555 734 Type	
Digital X-Connect System	DS-3 Digital Cross-Connect shared by ILEC + CLECs	ILEC	512 DS3	

8 LAND AND BUILDING ELEMENTS

8.1 OVERVIEW

The largest charges that ILECs have proposed for CLEC collocation have been associated with the costs of building modifications -- costs that allegedly are directly related to collocation placement in the CO. Since decisions regarding placement of the collocation area are typically made by the ILEC with no input from CLECs, if the CLEC must pay for all alleged building modification costs, the ILEC -- unless constrained -- has the ability to select a location in the CO that is either difficult to access or requires extensive new construction. ILECs can impose site preparation charges that include costs for demolishing existing walls, removing doors, electrical and mechanical components, etc., even before new construction begins. It is not uncommon for the ILEC to require CLECs to pay for new corridors, hallways, doors, and sometimes even a costly new external entrance to the building, allegedly to provide a"secure environment." (The issue of security as it relates to this Model is addressed in Section 8.2.)

Building renovation charges imposed on CLECs can be prohibitive if the ILEC is allowed to recover from the CLEC all expenses associated with mandated changes in local building codes. These include items such as asbestos removal, building modifications to meet the Americans with Disabilities Act requirements, new sprinklers, fire alarm systems etc. It is unreasonable to expect CLECs to assume the responsibility for upgrading COs that do not meet current standards. The costs attributable to meeting environmental and other regulations should be borne by the primary user of the CO. The appropriate share of these exceptional building costs will then be recovered in the per square foot land and building charge to the CLECs.

ILECs can inflate building rearrangement charges by claiming that major building services (e.g., emergency diesel power, air conditioning, electrical service) are currently at full capacity and that a CLEC collocation request that precipitates additional capacity needs should bear the full costs associated with that additional capacity in upfront nonrecurring charges. Upgrades to major building systems are not the responsibility of the CLEC; rather CLECs should pay their share of the major building systems costs through the rates for collocation elements that include these building systems. Therefore, any additional charge for building rearrangements or upgrades would result in double recovery.

The ILEC, as the primary user of the CO, must be responsible for the long term maintenance and upgrading of its CO buildings. The responsibility for expenditures associated with building codes revisions or upgrades to major building systems cannot be transferred to a particular CLEC simply because the timing of a particular major building component upgrade coincides with a CLEC collocation request. The CLEC's share of these costs are included in the monthly per square foot charge for rent and the cost of investments associated with the various collocation elements.

8.2 PLACEMENT AND SECURITY ISSUES

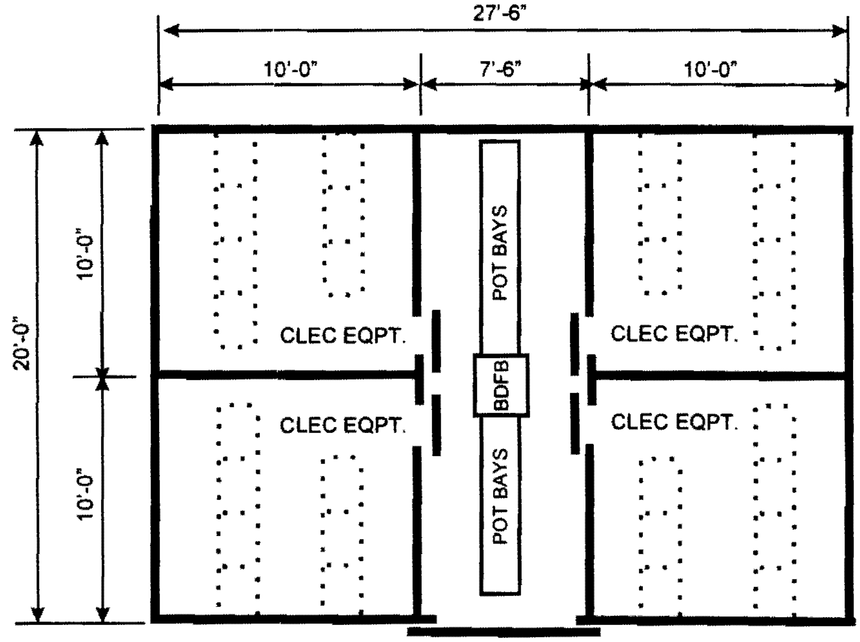
As noted in Section 3, the primary consideration in the establishment of a collocation area is that it be constructed relatively close to the ILEC cross-connects to minimize ongoing recurring charges for connectivity. From a physical perspective, however, the collocation space should be situated in an area of the CO that provides unrestricted access to the CLEC with the least disruption possible to the ILEC. This could be accomplished by locating the collocation area on an exterior wall or on a corridor. Since existing ILEC equipment rooms within the CO are typically secure and cannot be entered without a door code or card reader, placement along a corridor allows for uninhibited access by CLECs while at the same time providing security for the ILEC.

The CO model layout incorporates building investments that are directly attributable to the creation and rental of a collocation space by the ILEC. While the ILEC is entitled to ensure its equipment areas are secure, the CLEC should not have to bear the burden of excessive costs of providing extensive building renovations for the alleged purpose of insuring ILEC security. COs today are constructed with electronic security card systems to monitor access and egress. Each doorway has an electronic card reader that will admit only the holders of pre-screened cards. These costs are included in the basic per square foot cost of a CO building, just as the cost of locks on outside doors are included in the rent for office or apartment space. Thus, the model assumes the cost of the security system is included in the per square foot charge for rent. The costs of purchasing individual cards and associated system maintenance, on the other hand, are assumed to be costs each CLEC should bear.

8.3 COLLOCATION CONSTRUCTION COMPONENTS

The components and magnitude of the construction project associated with physical collocation are relatively minor and can be implemented by most smaller contractors at competitive rates. There is no requirement for ILECs to use only large construction companies for collocation related building rearrangements. That sort of requirement is akin to requiring the use of a Big Eight accounting firm to handle a simple income tax return or using a major law firm in small claims court.

The CO model layout assumes that the ILEC arranges and obtains all quotations based on a competitive bidding process. Subsequent to the receipt of the competitive tenders, the bids are analyzed as to content to ensure that all of the work has been included. The succeeding contractor is then permitted to complete the work in the most efficient and expeditious manner. Figure 8A shows the space-efficient collocation area incorporated in the Model. That collocation area is used throughout this section to outline various construction components, quantities, and associated costs.



FORWARD-LOOKING BEST PLANNING COLLOCATION MODEL

Figure 8A

Chart 4 includes a list of the common elements required for the construction of a typical collocation area in an ILEC CO. The rationale for including each construction element in the development of this collocation Model follows.

CHART 4			
COLLOCATION MODEL – SUMMARY OF CONSTRUCTION ELEMENTS			
ITEM	**QUANTITY**	**UNIT**	**REMARKS**
PARTITIONING (INCL. POSTS, FABRIC, RAILS, GATES & INSTALLATION)	155	Lin. Ft.	9 GA. galv. metal fabric 8'-0" high and c/w 2 3/8" posts and 1 11/16" top post
FLOOR TILE	550	Sq. Ft.	1/8" x 12 x 12 vinyl composite tile
ELECTRONIC CARDS	5	Each	Card reader system in CO
PADLOCKS FOR CAGES	4	Each	Provided by CLEC
PLYWOOD	1	Sheet	4' x 8' x ¾" sheet
HVAC	7.7	Tons	Maintain temperature 68-80F
LIGHTING	22	Each	Standard 1'x4' fluorescent fixtures
SWITCHING (MOTION DETECTION TYPE)	5	Each	1 per cage and 1 for Common Area
ELECTRICAL PANEL	1	Each	225 amp, 42 circuit , 120/240volts
ELECTRICAL RECEPTACLES	12	Each	20 amp duplex electrical outlets
GROUNDING	1	Each	Pre drilled copper ground bar
4/0 GROUNDING CABLE	140	Lin. Ft.	Unsheathed braided copper cable
MESH GROUNDING	10	Lin. Ft.	Safety and EMI compliant grounding

PARTITIONING

To segregate the CLEC space from the ILEC portion of the central office requires some type of partitioning. The types of partitions typically found in COs include drywall partitioning and masonry, as well as chain link fencing used to secure storage areas.

Cages to house collocators can be constructed of either drywall or chain link fencing. There are inherent advantages and disadvantages to both types of partitioning. Drywall partitioning is constructed of vertical metal studs covered with a layer of paper enclosed gypsum plaster. The butt joints of the boards are then covered with a plaster paste that is sanded smooth after it dries. This type of partitioning offers good security and privacy for the occupants. However, this method of construction creates a great deal of dust that is detrimental to the telecommunications equipment. It also prohibits air flow, which increases the cost of air conditioning.

The collocation area model layout assumes the use of chain link fencing, constructed of metal posts anchored to the floor with a galvanized, coated, 9 gauge metal fabric that is stretched to prevent sagging and that affords adequate security from intrusion. The cage is accessed by way of a sliding gate of similar construction to the partition walls. Many of the collocation installations to date have used this method of partitioning.

The collocation area model layout assumes the use of an 8 foot high chain link metal partitioning because of the ease of construction, economy, and relatively clean installation. Other advantages of an 8 foot high chain link partition include easier provision of air conditioning since the requirement for mechanical work is reduced. Cable racking can be installed more easily and fencing provides increased visibility, resulting in better security, from the ILEC perspective.

FLOOR TILE

Floor covering should be sufficient to support equipment and be easy to maintain. Also it must be free of static electricity that adversely affects the operation of the telecommunications equipment. Therefore, the collocation area model layout requires concrete floors covered with vinyl composite tiles.

A concrete floor slab with a live load of 150 to 300 pounds per square foot live load capacity is adequate to support commonly used telecommunications equipment. Further, the use of concrete permits the installation of expansion shields, allowing the best method of securing the equipment frames to the floor.

Occasionally equipment has been installed on concrete floors that have been painted, but there are drawbacks. First, there is an increased maintenance cycle of repainting. Second, the paint flaking that often occurs can be drawn into the equipment and cause malfunctioning.

Thus, a concrete floor slab covered with vinyl composition tile is considered to be the norm for telecommunications buildings.

ELECTRONIC CARDS, PADLOCKS

The Model assumes an electronic card reader system is used throughout the CO as the least cost method of providing security. There is no greater danger of sabotage from a collocator's employees and contractors than from the ILEC's employees and contractors. Thus, providing (and charging) CLECs for cards permits security to be maintained in the collocation area.

It is assumed that each Collocation Cage is provided with a padlock. However, the Model assumes that the CLEC will purchase and install its own padlock. A key or the combination would be provided to the ILEC for emergency situations.

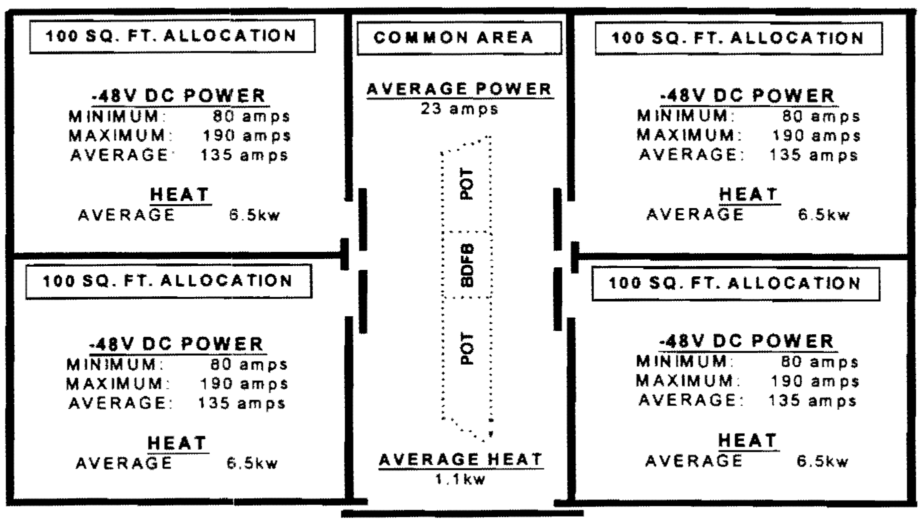
PLYWOOD

Plywood backboards will be used to mount the electrical distribution panel and any other components that cannot readily be attached to the metal cage.

HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)

Telecommunications equipment will operate at relatively high and low temperatures. However, sudden fluctuations in temperature can contribute to card failures. Therefore the model assumes a requirement for air conditioning in order to maintain room temperature between 65 and 80 degrees Fahrenheit.

Air conditioning (heating is not required) for the equipment should be based solely on the amount of heat that must be dissipated as a result of projected equipment installations rather than on the capital costs to replace an entire HVAC system. The electrical power used by telecommunications equipment is the indicator of the amount of heat that must be dissipated. As shown on sketch 8B, the Model assumes an average long term DC power requirement of about 135 amps for each 100 square foot allocation and an overall expected requirement of 7.7 tons air conditioning for the entire collocation area. The relationship between DC power, heat dissipation, and cooling requirements is shown in Figure 8B.12



SUMMARY OF LONG TERM POWER AND HEAT DISSIPATION		
ITEM	-48V DC POWER	HEAT
AVERAGE REQUIREMENT / 100 SQ. FT. ALLOCATION	135 amps	6.5 kw
EXPECTED REQUIREMENT IN COMMON AREA	23 amps	1.1 kw
LONG TERM REQUIREMENT IN COLLOCATION AREA	563 amps	27.1 kw
LONG TERM HEAT DISSIPATION	-	92,411 BTU
EXPECTED LONG TERM COOLING REQUIREMENT	-	7.7 TONS

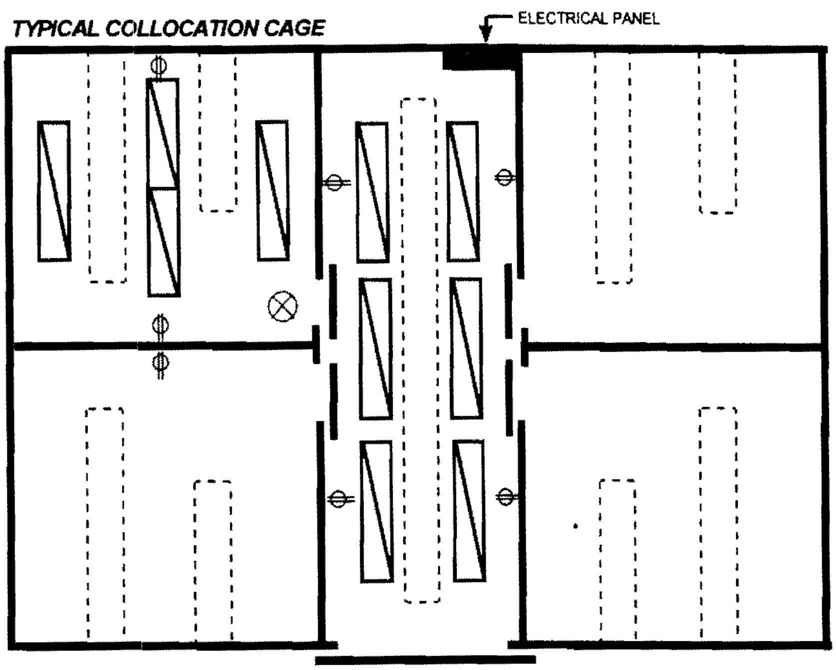
COLLOCATION MODEL
LONG TERM - 48V DC POWER AND HEAT DISSIPATION

Figure 8B

12 If the CLECs intend to utilize their collocation spaces more intensively than the average situation, and thus require 190 amps at the same time rather than 135 amps, then in addition to greater amperage needs, there will be additional air conditioning needs. The Collocation Model Layout Documentation shows what the additional costs would be for air conditioning if all four 100 square foot collocation spaces in a collocation area were to require 190 amps of power. The CLECs would be charged for the additional air conditioning expenses.

ELECTRICAL

As shown in Figure 8C, the collocation area model layout assumes fluorescent lighting in both the cages and the common area. Each 100 square foot allocation requires four 4'-0" units hung by chains from the slab above. To ensure adequate illumination, each fixture should be equipped with two 40 watt lamps. In addition, the model assumes six identical light fixtures used to illuminate the common area (for the POT bays and BDFB).



ELEMENT	SYMBOL	QUANTITY PER CAGE	QUANTITY IN COMMON AREA
4'-0" FLOUR. LIGHTS		4	6
20 amp AC OUTLETS		2	4
MOTION SWITCHES	⊗	1	1

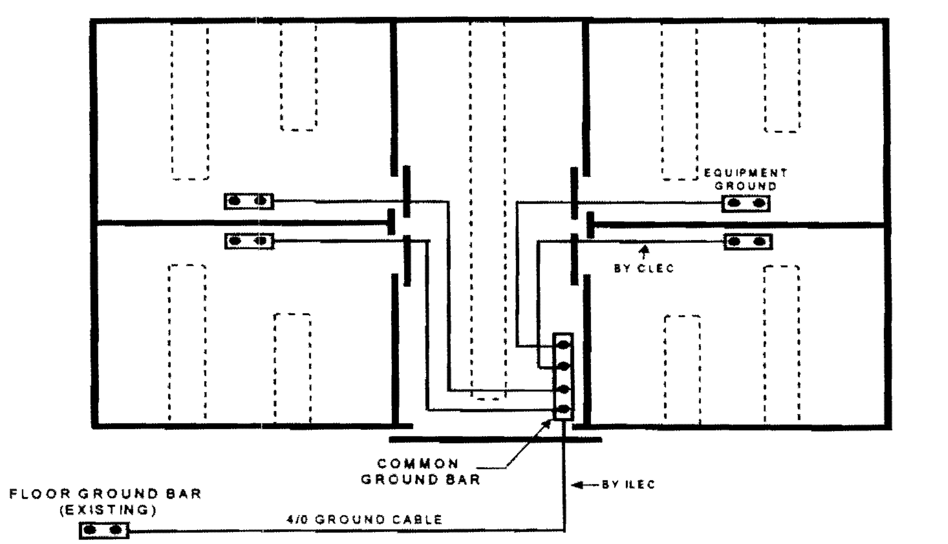
COLLOCATION MODEL - ELECTRICAL COMPONENTS

Figure 8C

The collocation area model layout also incorporates motion detector light switching that is activated when a technician enters the collocation area. Similarly, entering the cages within the collocation area activates the individual cage lighting. The lights will shut off when the technician leaves the area, thus conserving power and reducing costs. Furthermore, standard duplex electrical receptacles are included in the cages and the common area within the collocation area for operating test equipment and general convenience purposes. Finally, the collocation area model layout includes an AC electric distribution service panel to feed lighting, switching and outlets.

GROUNDING

As shown in Figure 8D, to ensure optimum grounding, the collocation area model layout incorporates the installation of a new common ground bar located in the common area by the ILEC. This ground bar, together with approximately 100 feet of 4/0 ground cable placed in conduit, will be connected to the existing floor ground bar by the ILEC. Each CLEC can then provide its own equipment ground and ground cable to connect to the common area ground as explained in Section 4.



COLLOCATION MODEL- GROUNDING LAYOUT

Figure 8D

8.4 COST OF FLOOR SPACE

The collocation area model layout recognizes that the ILEC should receive compensation for floor space used by the CLEC and therefore incorporates a cost per square foot land and buildings component. Although actual rates per square foot for land and buildings can be state-specific, the overall basis for calculating monthly rental charges for floor space remains constant. As shown in Chart 5, calculations are based on the forward-looking CO model layout, and assume an 80% factor for assignable space and a land to building ratio of 2:1 based on the building footprint.

CHART 5	
LAND & BUILDING COST CALCULATION TABLE	
EQUIPMENT SPACE CALCULATION	
Equipment Space Requirement	12,000
Ancillary Requirement	25%
Total Footprint per Floor	15,000
Number of Floors (incl. basement)	4
Gross Building Space	60,000
Assignable Space Factor	80%
Assignable Space	***48,000***
LAND CALCULATION	
Building Footprint	15000
Building to Land Ratio	2
Land Area Requirement	***30,000***
BUILDING CALCULATION	
Gross Building Space	***60,000***

8.5 REAL ESTATE RESOURCES

The following ILEC resources are required to implement the CO model layout:

1. ***Project Manager:*** reviews requirements of collocator and coordinates the activities of engineering consultants to produce working drawings. Ascertains that funding is in place to proceed with project. Reports to CLEC on progress and reviews the project with the ILEC subsequent to the completion of the collocation area.

2. ***Architect:*** produces architectural quality drawings depicting the exact location, dimensions, physical obstructions, and other pertinent information regarding the proposed collocation space. Requests tenders and reviews submissions for accuracy and completeness prior to the issuance of a contract by the Project Manager. In some instances, the Architect may also be the Project Manager.

3. ***Construction Manager:*** coordinates and reviews contractors' activities in the collocation space. Resolves on site interference with existing services. Monitors the progress and prepares construction activity reports.

The specific time allocations for each resource and associated project intervals are outlined in Section 9.

9 PROCESS ISSUES

9.1 ILEC MANPOWER REQUIREMENTS

The planning and implementation of a collocation area in an ILEC CO requires manpower effort on the part of the ILEC. To ensure fair and reasonable compensation for ILEC manpower, the CO model layout incorporates a planning component outlining the expected ILEC manpower requirements to implement a CLEC collocation request using best practice processes in a competitive environment. As shown in Chart 6, the ILEC resource requirements have been separated into manpower required to establish the initial collocation area and manpower requirements to implement each CLEC request. The first CLEC request includes both requirements.

CHART 6			
FUNCTION	***HOURS TO PLAN INITIAL COLLOCATION AREA***	***HOURS PER EACH CLEC REQUEST***	***NOTES***
OUTSIDE PLANT ACCESS DESIGN	0	6	
BUILDING PLANNING	10	4	
MDF PLANNING	0	4	
REAL ESTATE PROJECT MANAGER	6	2	
REAL ESTATE CONSTRUCTION MANAGER	8	4	
ARCHITECT	22	2	1
POWER ENGINEER	6	4	2
EQUIPMENT ENGINEER	6	4	3
EQUIPMENT INSTALLATION PROJECT MGR.	6	8	4
OPERATIONS GROUP	2	4	
APPLICATION FEE	0	10	5
TOTAL ILEC MANPOWER	***66***	***52***	***6***

NOTES

1. ASSUMES IN HOUSE ARCHITECT WITH NO EXTERNAL CHARGES FOR ARCHITECTS.
2. DISTRIBUTION ONLY (BDFB TO DC PANEL): -48V DC POWER ASSESSMENTS ARE DEMAND FUNCTIONS COVERED UNDER POWER CONSUMPTION CHARGE.
3. ONLY 5'0" CLEC-SPECIFIC RACK TO CAGE; OTHER CABLE AND CABLE RACKING IS DEMAND ACTIVITY COVERED UNDER RECURRING CHARGE.
4. SHOULD NOT INCLUDE COORDINATION OF DEMAND PROJECTS.
5. APPLICATION FEE TO COVER ACTIVITIES OF VARIOUS ILEC ADMINISTRATIVE AND BILLING GROUPS.
6. ASSUMES FIRST CLEC REQUEST COINCIDES WITH PLANNING OF INITIAL COLLOCATION AREA..

The proposed manpower requirements shown in the preceding chart have been developed assuming the following minimum requirements:

⇒ *Fully trained and competent staff*

⇒ *Best practice processes for building modifications*

⇒ *Best practice processes for CO Equipment and Power rearrangements*

⇒ *Up-to-date and accurate records (e.g., power consumption, equipment drawings, wiring lists , etc.)*

⇒ *Efficient suppliers/construction interfaces with least cost competitive intervals*

The CO model layout also assumes that the ILEC will only be reimbursed for time spent implementing functions associated with collocation elements covered by a non-recurring charge. Time expended assessing equipment for which the ILEC is reimbursed via a recurring charge (e.g., -48V power plant, shared cable racking, etc.) is an ongoing ILEC planning requirement, no different than the assessments the ILEC must undertake prior to implementing other demand projects and should therefore not be charged to CLECs. ILEC manpower spent due to existing inefficiencies such as the revisions to inaccurate drawing records, etc., should not be included in ILEC project management time to implement a CLEC collocation request.

The manpower requirements shown in Chart 6 provide an accurate assessment of the planning time required to efficiently implement a CLEC collocation request in a best practice competitive environment. These times are included in the Collocation Model as a specific component for the planning of a CLEC collocation request rather than permitting the ILEC to arbitrarily establish undefined charges using an ICB for Time and Materials, which can easily be manipulated on a case by case basis

9.2 IMPLEMENTATION INTERVALS

An assessment of the functions and intervals required to implement the first CLEC collocation request in a particular ILEC CO, assuming optimum efficiency, best practice processes and a competitive environment, indicates that the maximum interval from the time a CLEC applies to collocate in an ILEC CO until the collocation area is ready for equipment to be delivered by the CLEC should be 68 working/business days.

The interval for subsequent collocation requests in the same CO is less since some of the planning activities and building modifications would already be completed in response to the initial request. A reasonable interval for subsequent requests is calculated at

56 working/business days.

Rather than permitting the ILEC to establish arbitrary intervals on a case by case basis, the CO model layout adopts the following standard intervals for planning and implementing a CLEC collocation request in an ILEC CO:

- ⇒ *Initial Collocation request in a particular ILEC C.O. = 14 Calendar Weeks*
- ⇒ *Subsequent Collocation requests in the same C.O. = 11 Calendar Weeks*

PHYSICAL COLLOCATION MODEL LAYOUT DOCUMENTATION

PHYSICAL COLLOCATION MODEL LAYOUT DOCUMENTATION

Overview

The Physical Collocation Cost Model (Cost Model) was developed by MCI and AT&T to estimate the costs that an efficient incumbent local exchange carrier (ILEC) would incur to provide physical collocation to one or more competitive local exchange carriers (CLECs) at a central office (CO). The Cost Model is based upon a Physical Collocation Model Layout (Model Layout) that assumes best practice central office planning strategies, least cost suppliers, and competitive bidding. The Model Layout produces investments associated with an efficient collocation area placed in a segregated location of an ILEC's CO.

The Model Layout recognizes that it is inefficient for an ILEC to require that the collocation areas of all competitive local exchange carriers (CLECs) be located in a contiguous space. Such a large space is not likely to be available in close proximity to the ILEC cross-connect, so imposing such a requirement would unnecessarily raise CLEC costs for power, copper cabling, and cable racking and would impose other costs and inefficiencies.

The investments developed in this Model Layout are used as inputs into the Cost Model, which produces nonrecurring and recurring cost estimates.

This document provides the backup material supporting the engineering assumptions relied upon in the Model Layout, based upon the expertise of the subject matter experts (SMEs) retained by MCI and AT&T to advise them on physical collocation. Documentation relating to the actual cost calculations performed in the Cost Model is included in a separate document, entitled Physical Collocation Cost Model Description and Users' Guide.

The Physical Collocation Model Layout Engineering Assumptions

The Model Layout and Cost Model are based on a 550 square foot collocation area consisting of four 100 square foot collocation spaces plus a common area of 150 square feet to accommodate interface equipment. Spaces of this size are generally available in the ILEC COs. Interface equipment (such as point of termination bays) located in the common area paid for by the CLECs can be purchased and installed by the CLECs, and therefore the associated costs are not included in the Cost Model. (An exception is the collocation battery distribution fuse bay, BDFB, which extends fusing from the DC power plant to the collocation space. This is an ILEC responsibility and its costs are included in the power consumption elements of the Model.)

The Model Layout and Cost Model also assume that it is not the responsibility of the collocating CLECs to pay the costs of retrofitting COs to meet asbestos removal or Americans with Disabilities Act or other requirements. The costs associated with constructing buildings that are in compliance with codes and regulatory requirements are included in the recurring per square foot building charges that CLECs pay for their collocation spaces.

Sources for Input Prices

To ensure accurate inputs for the development of the Cost Model, it was necessary to determine the investments that would be incurred by the ILEC. The subject matter experts who developed the Model Layout constructed a list of all necessary equipment and requested quotes from various companies. Suppliers authorized to work within the CO will vary greatly in size, ranging from giant equipment manufacturers, such as Nortel and Lucent, that provide digital switches, to mid-sized firms, such as Alcatel, that provide digital cross-connect systems, to hundreds of smaller companies that supply common systems infrastructure components such as ironwork, relay racks, cable racks, and cable. Typically, the large switch suppliers include a complete line of common systems components to complement their main product line. It is the experience of the SMEs, however, that these large suppliers cannot meet the short lead times needed by ILECs for installation of simple equipment, such as cable racks, in their COs. Nor are their rates for these common systems installations competitive with those of smaller suppliers. As a result, ILECs commonly authorize and use smaller companies to install common systems infrastructure in the CO. These small companies have the flexibility to complete simple infrastructure projects for the ILECs on short notice. Since the majority of collocation components fall within the scope of common systems infrastructure, the SMEs used the quotes from small suppliers to develop their estimates of these collocation investment costs. Where components typically are available only from larger suppliers with a specialized product line, for example, digital cross-connects, the investment costs were based on quotations from a large supplier.

The SMEs sought quotes on prices and/or hours for engineering, furnishing, and installing (EF&I) a wide array of collocation equipment from two companies -- Express Intercommunications (Intercomm), a Texas company, and Primal Communications Ltd., which works in Bell Canada switching centers, as well as for other Canadian telephone companies. Express Intercommunications provided quotes only for the installation component. Primal provided more encompassing quotes, providing both furnish and install quotes for most elements, but very limited engineering information. In an effort to provide more complete information, Primal employed a subcontractor, Bob Alers (a former Nortel specification writer and estimator) to provide engineering estimates and a "sanity check," based on the perspective of a former employee of a large supplier.

When the SMEs reviewed the quotes for installation hours they received from these three sources, they noted two patterns. First, for most items, the Primal quote was the median of the three quotes; in no case did the Primal quotes differ greatly from both other quotes. Second, for several items, the quote from Intercomm or the quote from Alers differed greatly from the other two quotes and, in the judgment of the SMEs, did not appear to be as credible as the Primal quote. The SMEs therefore decided that for installation of all items, they would use the hours quoted by Primal in the Cost Model. (All quotes received are included in the Backup Sheets in Section Two.) Also, since Mr. Alers provided the bulk of the information on engineering, for the one item for which Primal also provided an engineering quote (cable rack/ladder), the SMEs used the Alers quote, which was the higher quote and thus a conservative choice.

The SMEs asked Alcatel for written price quotes for DS-1 and DS-3 electronic cross-connect equipment. In order to protect proprietary competitive information, Alcatel was asked to provide list prices. In developing the Cost Model, the SMEs assumed a conservative 20% discount from the list price.

The price quotes for -48V power components were provided by Primal, which uses Nortel, Reliance, and Peco 11 products. Primal provided all-inclusive EF&I prices for power plants of two different sizes, to permit the use of a blend of two different sizes in the Cost Model.

The price quote to furnish cable racks was obtained from Central Steel Fabricators, a company that provides cable rack to several large local exchange companies.

For cage construction related inputs, written price quotations were obtained from Simpson's Fence Ltd., and verbal estimates were provided by London General Contractors, Ltd., Westminster Electrical Ltd., and Smylie and Crow Associates, Inc., consulting engineers. A verbal estimate was also provided by Warman Security. In addition, the SMEs collected price information provided in the R. S. Means Building Construction Cost Data and Electrical Cost Data publications for 1997, data sources that are widely used in the industry. In most cases, the price quotes and verbal estimates differed from the R.S. Means prices by less than 5 percent; and in no cases by more than about 20 percent, with the R.S. Means prices typically the higher prices. The SMEs therefore chose to use the R.S. Means rates wherever such data existed.

All price quotes presented are in U.S. dollars. Where a quote received was in Canadian dollars, the SMEs converted the price to U.S. dollars by dividing by 1.4.

Labor Rates

The Cost Model uses a default labor rate value of $55.00 for all labor rates other than the -48 volt power consumption cost, which is based on a contractor price quote that incorporates 64 hours of contractor labor for engineering at $65 per hour. When the Cost Model is used as the basis for estimating state-specific costs, these default values are modified as follows:

For Frame Technicians and Splicers: A state-specific labor rate per hour is calculated based on hourly labor rates found in union contracts. These are fully assigned rates, which include salary and benefits for first-line supervision through third level (middle) management. Since the union contracts identify higher and lower pay zones within a state, where it was not possible to identify the average rate for a labor category, the highest pay zone is used for all rates, thereby assuming that the entire work force is at the maximum rate within their bands. Two publicly available ILEC cost studies -- one filed by NYNEX in New York State and one filed by Bell South in Georgia -- suggest that benefits generally represent an additional 33%-35% in costs over the contract labor rates. The Cost Study uses a 40% benefits loading to provide a conservatively high cost estimate. The first through third level management salaries and benefits are calculated and loaded on to the labor rates based on a ratio of 15:1 for contract to supervisory personnel, and 5:1 for the next two layers of management. These ratios are based on the judgment of SMEs. The salary and benefits for one clerical position also are incorporated. The loaded hourly rates are adjusted upward by 23% to take into account paid nonproductive time, including time off for vacations, holidays, personal days, training, coffee breaks, etc. Miscellaneous expenses are added to cover such items as travel expense, training, and office supplies. Finally, another increment is added to cover premium pay for overtime worked.

For First Level Management: A similar loading methodology is used as for frame technicians and splicers, but with the following differences: (1) there are 10 direct reports to a second level and 5 second-levels report to a third level; (2) there is a second support clerk for the second level in addition to the one for the third level; (3) many of the traditional planning loadings do not apply here since the collocation planning job is only of short duration. Since there are no union contracts on which to base the unloaded hourly rate for first level management, that input value was set by subject matter experts. With the loadings, the default national rate is $55.03.

Contractor Labor: Contractors charge hourly rates for their labor that implicitly incorporate all loadings. Primal provided a quote of $50 to $55 per hour, which is consistent with the experience of the subject matter experts. Since only contractors that have been certified by the ILEC may operate in their COs, there are fewer competitive options for contractor labor, and thus the differential between high-wage rate states and low-wage rate states is not likely to be as pronounced as for other labor. Thus, the $55 hourly rate represents a good, conservative, upper bound estimate (except for the engineering contract labor rate of $65 per hour that is incorporated in the -48 volt power consumption cost).

Model Layout Documentation

The Model Layout documentation is divided into three sections. Section One is comprised of input sheets, which contain the data used as inputs to the Cost Model (filed under separate cover). Section Two presents sources and supporting calculations for the figures that appear on the input sheets in Section One. Section Three presents quotes obtained from various suppliers that were used in Section Two.

Section One: Input Sheets

The input sheets contain the data used as inputs to the Cost Model. Most sheets also include a diagram to help illustrate the necessary components used in the relevant aspect of physical collocation (such as power distribution or connectivity). The input sheets also include a brief description of each component, which entity or entities provide and use the component, and the quantity (or size) and cost of the component.

Section Two: Connectivity Matrix and Backup Sheets

Section Two presents sources and supporting calculations for the figures that appear on the input sheets contained in Section One.

The first sheet in Section Two is a matrix supporting the investments for connectivity elements. The matrix (in columns J to M) provides the source data for the investments that appear on the input sheets in Section One. Each element is listed on a row, and a breakdown by component (if applicable or available) appears in corresponding columns (i.e., where applicable, the investment for each element is separated into investment for engineering, furnishing, and installing the element, with data in the form of hours, labor rate, and unit cost. Column N contains the reference to the backup sheet number for the respective elements). The backup sheets (BU #1 through BU #19) immediately follow the matrix.

The backup sheets outline the assumptions and costing source detail for the input sheets. Each backup sheet is labeled in the top right corner with "BU #xx". The backup sheets contain references to data sources. Where possible, the reference is to a supplier quote contained in Section Three. Where multiple quotes were obtained for an item, all quotes are presented and the quote used in the Cost Study is identified.

Section Three: Supplier Quotes

Section Three contains copies of the quotes supplied by various telecommunications contractors and other companies. These are the sources of the information referred to in the backup sheets in Section Two.

Source Addresses

Alcatel
1225 North Alma Road
Building 407-200
Richardson, Texas 75082
written quotations

Express Intercommunications
308 Banyan Road
Grapevine, Texas 76051
Attn: Percy Davis
written quotations

Simpson's Fence Ltd.
4010 Brech Avenue
London, Ontario, Canada
written quotation

Warman Security
1720 Sacramento Street
San Francisco, California 94111
verbal estimate

London General Contractors Ltd.
163 Chalfont Crescent
London, Ontario, Canada N6H 4Y3
Attn: Arden Sutherland
verbal estimates

Westminster Electrical Ltd.
4365 Colonel Talbot Road
London, Ontario, Canada
Attn: Steve Johnson
verbal estimates

Smylie and Crow Associates Inc.
Consulting Engineers
93 Dufferin Avenue
London, Ontario, Canada
Attn: Jim Smylie and Charlie Crow
verbal estimates

Primal Communications Ltd.
17 Forbes Road
Scarborough, Ontario, Canada
M1P 1K8
Attn: Michael McLafferty
written quotations

Central Steel Fabricators, Inc.
1843 S. 54th Avenue
Cicero, IL 60680
Attn: Michael Murzanski
(708) 652-2037
written quotation

ADC Telecommunications
2600 Skymark Avenue
Unit 12, Suite 202
Mississagua, Ontario, Canada
Attn: Alpha Dobson
written quotations

SECTION ONE

INPUT SHEETS

ENTRANCE FIBER

CONNECTIVITY: VOICE GRADE SERVICE

CONNECTIVITY: DS-1 SERVICE (DCS)

CONNECTIVITY: DS-1 SERVICE (DSX)

CONNECTIVITY: DS-3 SERVICE (DCS)

CONNECTIVITY: DS-3 SERVICE (DSX)

CONNECTIVITY: OPTICAL

POWER DELIVERY

POWER CONSUMPTION

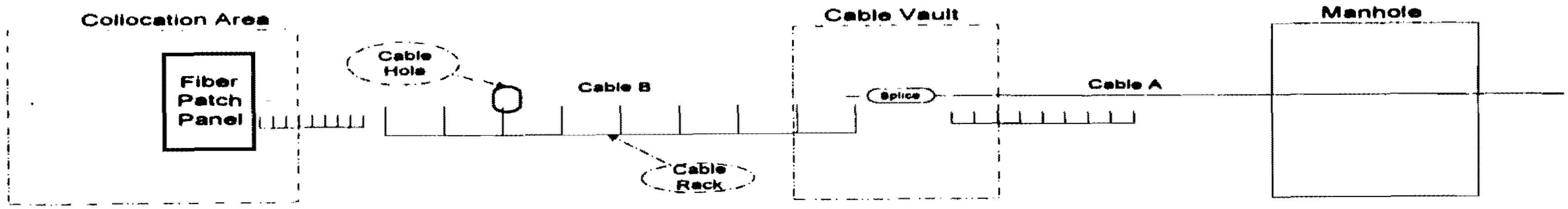
EQUIPMENT GROUNDING

REALTY (CAGE PREPARATION)

ILEC MANPOWER REQUIREMENTS

LAND AND BUILDING

COLLOCATION MODEL - ENTRANCE FIBER (Fire Retardant Cable)

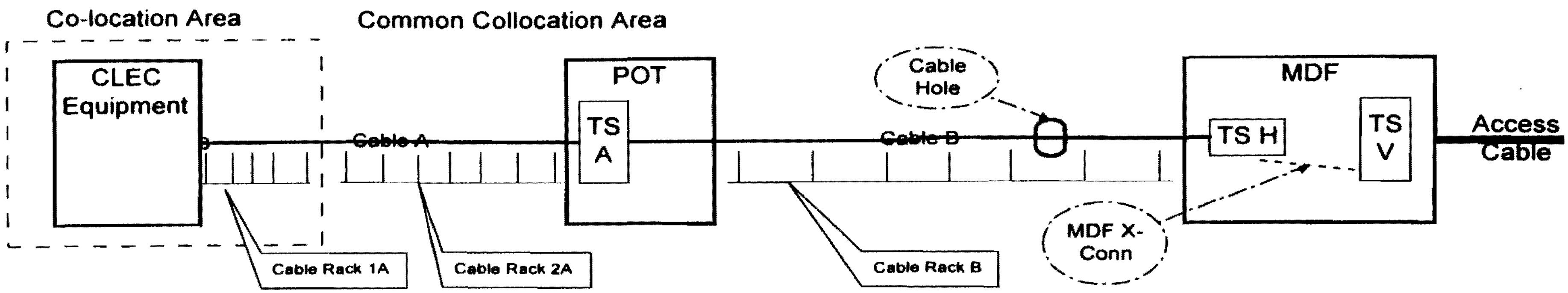


Element	Description	Provided by CLEC/ILEC	Used By	Re-useable	Quantity	Hours	Unit Cost	Total Cost	Remarks
Fiber Patch Panel	Located in cage	CLEC	1 CLEC	N/A	--	--	--	--	Termination to Cage Fiber Patch Panel by CLEC
Cable 'B'	Between cage & vault splice	CLEC	1 CLEC	N/A	175'-0"	--	---	--	Fire retardant Fiber cable provided by CLEC
Installation of Cable 'B'	Placed on shared cable rack	ILEC	1 CLEC	N	175'-0"	14	$55.00	$770.00	One time Charge - Includes opening/closing of 3 cable holes
Cable Rack Occupancy	12" Ladder Rack	ILEC	ILEC + 4 CLECs	Y	135'-0"		0.54/ft.	$75.60	Cost per cable for cable rack occupancy
Cable Rack	12" Ladder Rack	ILEC	4 CLECs	Y	20'-0"	--	$39.88/ft.	$797.60	Only required on first fiber cable installation - Included in cage cost
Cable Rack	12" Ladder Rack	ILEC	1 CLEC	Y	5'-0"	--	$39.88/ft.	$199.40	Only required on first fiber cable installation - Included in cage cost
Cable Hole Occupancy	Cable holes between floors	ILEC	ILEC+ 4 CLECs	Y	3	--	$9.46 ca.	$33.39 **	Used by ILEC and CLECs for routing fiber. Assumes 85% fill.
Splice Case	External to fire retardant cable	CLEC	1 CLEC	Y	1	--	--	--	Approved vault splice case provided by CLEC
Cable 'A'	Between vault splice & manhole	CLEC	1 CLEC	N/A	--	--	--	--	Fiber cable provided by CLEC
Cable Support Charge	Between vault splice & vault wall	ILEC	1 CLEC	Y	50'-0"	--	$0.54/ft	$27.00	Use same cost as cable rack occupancy
Structure Charge	Between vault wall & manhole	Tariff Item		N	75'-0"	--	--	--	Per existing structures agreement or use $0.05 / foot /month
Cable Pulling	Manhole to cable vault splice	ILEC	1 CLEC	N	125'-0"	4.0	$55.00	$220.00	Includes set-up & take-down
Splicing Activity	External cable to fire retardant cable	ILEC	1 CLEC	N	--	3.0	$55.00	$165.00	Set-up & take-down in vault
Splice Fibers	In Cable Vault	ILEC	1 CLEC	N	--	2.0	$55.00	$110.00	For up to 24 Fibers

Note: Access Design Charges included in ILEC Manpower Summary Chart

** Indicates 85% Fill

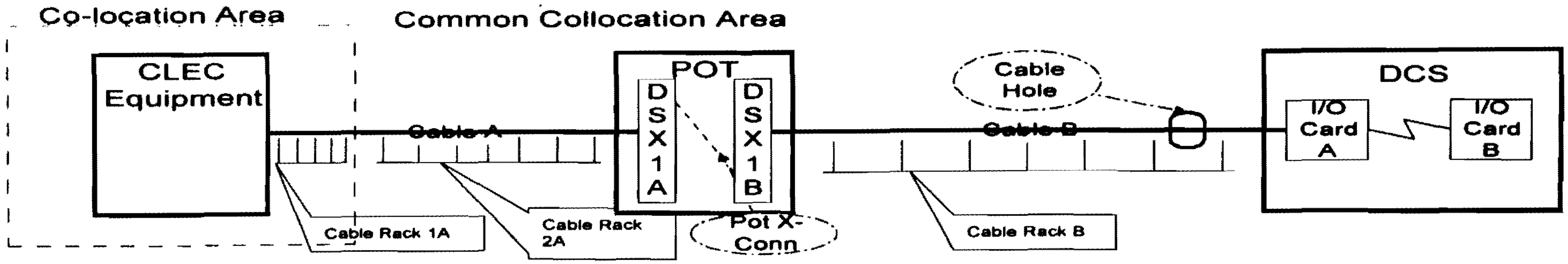
Collocation Model for Voice Grade Service



Element	Description	Provided By	Used By	Reusable Y/N	Size/ Capacity	Length	Unit Cost	Total Cost	Cost per 100 VG Cct.
CLEC Equipment	Voice Grade Equipment	CLEC	1 CLEC	NA					-
Cable A	Cable from Line Cards to POT Bay	CLEC	1 CLEC	NA		<25 feet			-
Cable Rack 1A	20" Ladder Rack	ILEC	1 CLEC	Y		5 feet	$40.52	$202.60	
Cable Rack 2A	20" Ladder Rack	ILEC	4 CLECs	Y		20 feet	$40.52	$810.40	
POT Bay	7' x 23" Frame to hold Terminal Blocks	CLEC	1 CLEC	NA					
TS A	66 Type Terminal Block	CLEC	1 CLEC	NA					
Cable B	Cable from Pot Bay terminal block to HMDF	ILEC	1 CLEC	N	100 Pair	165 feet	$4.01	$661.65	$661.65
Cable Hole	2 Cable Holes**	ILEC	ILEC + 4 CLECs	Y			$700.00 /hole	$1647.06 **	$5.92
Cable Rack B (Occupancy)	20" Ladder Rack	ILEC	ILEC + 4 CLECs	Y		150 feet	$40.52	$6078.00	$21.86
MDF-H	Horizontal Terminal Block to X-connect to Access side of frame	ILEC	1 CLEC	N	100 Pair		$95.00	$95.00	$95.00
MDF	MDF Terminal Block Space**	ILEC	ILEC + 4 CLECs	Y	1 block space		$178.95	$210.52 **	$210.52

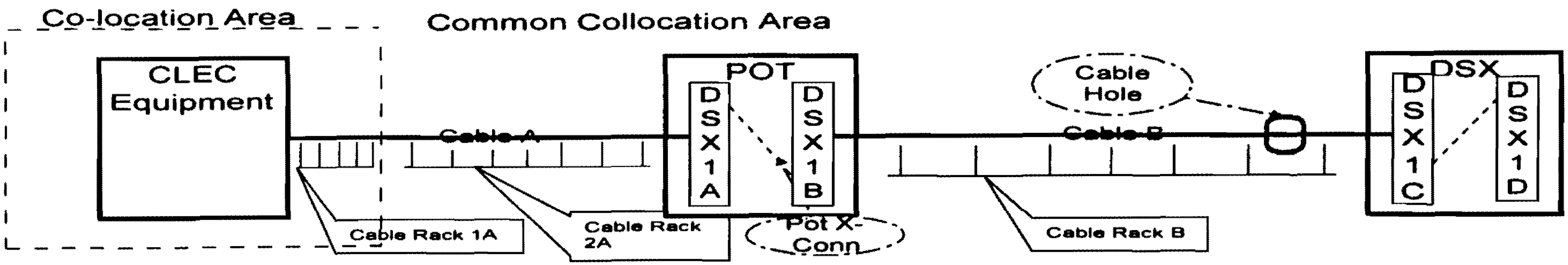
** Indicates 85% Fill

Collocation Model for DS-1 Service-DCS



Element	Description	Provided By	Used by	Reusable Y/N	Size/ Capacity	Length	Unit Cost	Cost	Cost per 28 DS-1 Cct
CLEC Equipment	DS1 Multiplexer	CLEC	1 CLEC	Y					
Cable A	2x 30 Pair ABAM	CLEC	1 CLEC	N	28 DS1	<25 feet			
Cable Rack 1A	20" Ladder Rack	ILEC	1 CLEC	Y		5 feet	$40.52	$202.60	
Cable Rack 2A	20" Ladder Rack	ILEC	4 CLECs	Y	555 ABAM	20 feet	$40.52	$810.40	
POT	7' Frame	CLEC	1 CLEC	Y					
DSX1 A	Manual X-conn Panel	CLEC	1 CLEC	Y	56 DS1				
POT X-conn	22 Gauge twisted pair jumper wire	CLEC	1 CLEC	N	4 feet				
DSX1 B	Manual X-conn Panel	CLEC	1 CLEC	Y	56 DS1				
Cable B	2x 30 Pair ABAM	ILEC	1 CLEC	N	28 DS1	165 feet	$3.48	$1148.40	$1148.40
Cable Rack B (Occupancy)	20" Ladder Rack	ILEC	ILEC +4 CLECs	Y	555 ABAM	150 feet	$40.52	$6078.00	$21.86
Cable Hole	2 Cable Holes**	ILEC	ILEC + 4 CLECs	Y	555 ABAM per hole		$700.00/ hole	$1647.06 **	$5.92
DCS	Digital X-conn**	ILEC	ILEC + 4 CLECs	Y	7168 DS1		$329.23 per DS1	$2,776,377.00 **	$10,845.22

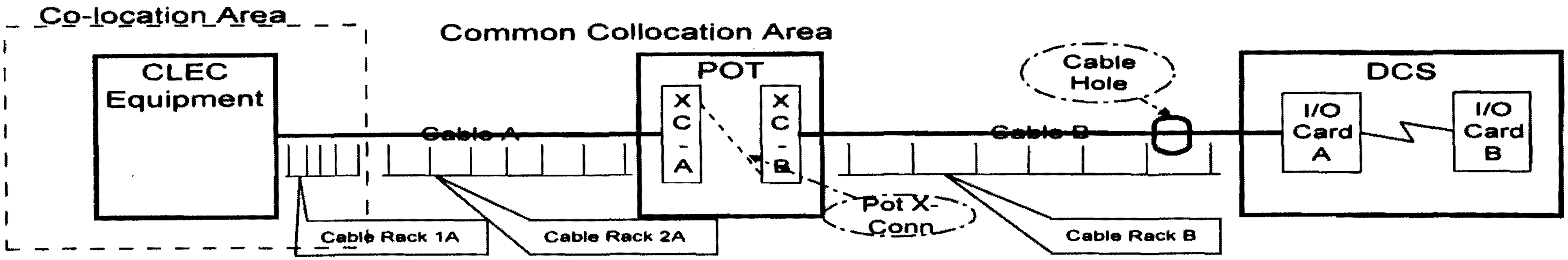
Collocation Model for DS-1 Service-DSX



Element	Description	Provided By	Used By	Reusable Y/N	Size/ Capacity	Length	Unit Cost	Cost	Cost per 28 DS-1 Cct
CLEC Equipment	DS1 Multiplexer	CLEC	1 CLEC	Y	28 DS1				
Cable A	2x 30 Pair ABAM	CLEC	1 CLEC	N	28 DS1	<25 feet			
Cable Rack 1A	20" Ladder Rack	ILEC	1 CLEC	Y		5 feet	$40.52	$202.60	
Cable Rack 2A	20" Ladder Rack	ILEC	4 CLECs	Y	555ABAM	20 feet	$40.52	$810.40	
POT	7' Frame	CLEC	1 CLEC	Y					
DSX1 A	Manual X-conn Panel	CLEC	1 CLEC	Y	56 DS1				
POT X-conn	22 Gauge twisted pair jumper wire	CLEC	1 CLEC	N	4 ft				
DSX1 B	Manual X-conn Panel	CLEC	1 CLEC	Y	56 DS1				
Cable B	2x 30 Pair ABAM	ILEC	1 CLEC	N	28 DS1	165 ft	$3.48 / ft	$1148.40	$1148.40
Cable Rack B (Occupancy)	20" Ladder Rack	ILEC	ILEC + 4 CLECs	Y	555ABAM	150 ft	$40.52	$6078.00	$21.86
Cable Hole	2 Cable Holes**	ILEC	ILEC + 4 CLECs	Y			$700.00 /hole	$1647.06 **	$5.92
DSX1 C	Manual X-conn Panel**	ILEC	ILEC + 4 CLECs	Y	56 DS1		$824.25	$969.71 **	$484.86
DSX	Digital X-conn Frame-Manual**	ILEC	ILEC + 4 CLECs	Y	560 DS1		$390.00	$458.82 **	$22.94

** Indicates 85% Fill

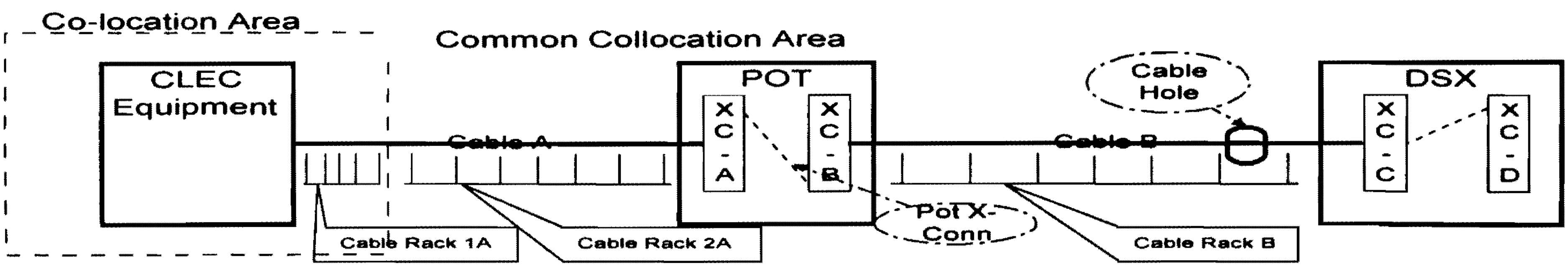
Collocation Model for DS-3 Service-DCS



Element	Description	Provided By	Used by	Reusable Y/N	Size	Length	Unit Cost	Cost	Cost per DS3 Cct
CLEC Equip	DS3 Terminal/Multiplexer	CLEC	1 CLEC	NA					
Cable A	734 Shielded	CLEC	1 CLEC	NA		<25 feet			
Cable Rack 1A	20" Ladder Rack	ILEC	1 CLEC	Y		5 feet	$40.52	$202.60	
Cable Rack 2A	20" Ladder Rack	ILEC	4 CLECs	Y	555-734 type	20 feet	$40.52	$810.40	
POT	7' Frame	CLEC	1 CLEC	NA					
XC-A	Manual X-conn Panel	CLEC	1 CLEC	NA	16 DS3's				
POT X-conn	Shielded X-conn Wire	CLEC	1 CLEC	NA	2 per DS3	3 feet			
XC-B	Manual X-conn Panel	CLEC	1 CLEC	NA	16 DS3's				
Cable B	734 Shielded (2 cables)	ILEC	1 CLEC	N	2 per DS3	165 feet	$0.89 / ft	$293.70	$293.70
Cable Rack B (Occupancy)	20" Ladder Rack	ILEC	ILEC + 4 CLECs	Y	555 734 Type	150 feet	$40.52	$6078.00	$21.86
Cable Hole	2 Cable holes between floors**	ILEC	ILEC + 4 CLECs	Y	555 734 Type		$700.00/ hole	$1647.06 **	$5.92
DCS	DS3 Digital Cross Connect**	ILEC	ILEC + 4 CLECs	Y	512 DS3		$2293.31 per DS3	$1,381,382.00 **	$2698.01

** Indicates 85% Fill

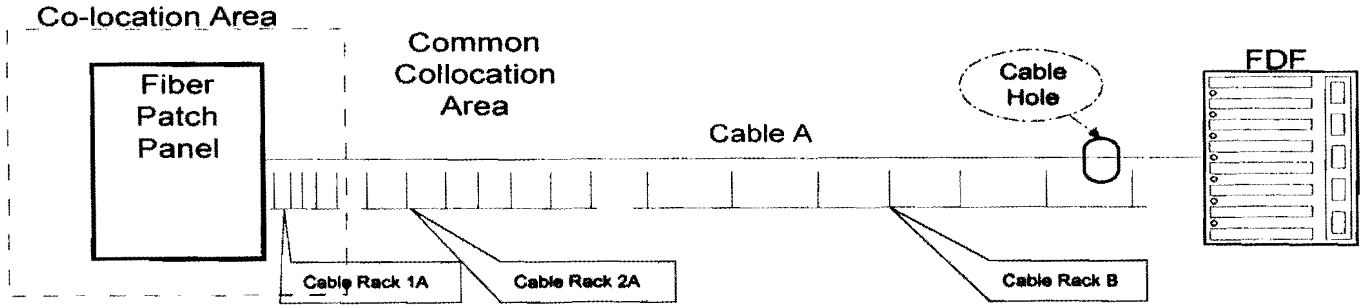
Collocation Model for DS-3 Service-DSX



Element	Description	Provided By	Used By	Reusable Y/N	Size	Length	Unit Cost	Cost	Cost per DS3 Cct
CLEC Equipment	DS3 Terminal/Multiplexer	CLEC	1 CLEC	NA					
Cable A	734 Shielded	CLEC	1 CLEC	NA		<25 feet			
Cable Rack 1A	20" Ladder Rack	ILEC	1 CLEC	Y		5 feet	$40.52	$202.60	
Cable Rack 2A	20" Ladder Rack	ILEC	4 CLECs	Y	555-734 type	20 feet	$40.52	$810.40	
POT	7' Frame	CLEC	1 CLEC	NA					
XC-A	Manual X-conn Panel	CLEC	1 CLEC	NA	16 DS3's				
POT X-conn	Shielded X-conn Wire	CLEC	1 CLEC	NA	2 per DS3	3 feet			
XC-B	Manual X-conn Panel	CLEC	1 CLEC	NA	16 DS3's				
Cable B	734 Shielded (2 cables)	ILEC	1 CLEC	N	2 per DS3	165 feet	$0.89 / ft	$293.70	$293.70
Cable Rack B (Occupancy)	20" Ladder Rack	ILEC	ILEC + 4 CLECs	Y	555 734 Type	150 feet	$40.52	$6078.00	$21.86
Cable Hole	2 Cable holes between floors**	ILEC	ILEC + 4 CLECs	Y	555 734 Type		$700.00/ hole	$1647.06 **	$5.92
XC-C	Manual X-conn Panel**	ILEC	ILEC + 4 CLECs	Y	16 DS3's		$5951.75	$7002.06 **	$437.63
DSX Frame	7' Frame**	ILEC	ILEC + 4 CLEC	Y	112 DS3's		$390.00	$458.82 **	$4.10

** Indicates 85% Fill

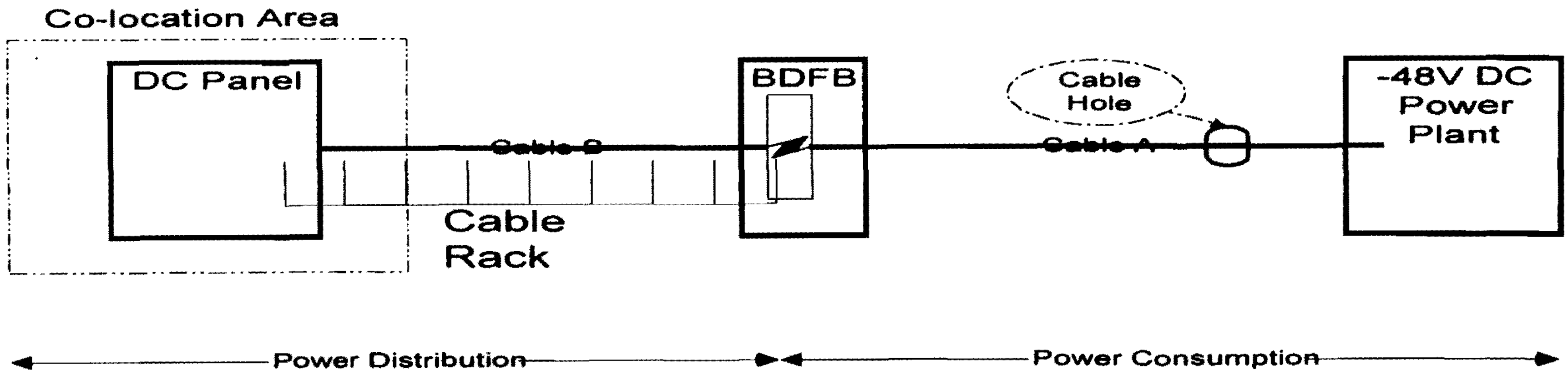
Co-location Model for Optical Service



Element	Description	Provided By	Used By	Reusable Y/N	Size	Length	Unit Cost	Cost	Cost per Optical Cable (12 Fiber)
CLEC Equipment	Fiber Patch Panel	CLEC	1 CLEC	NA					
Cable A	12 Fiber Breakout	ILEC	1 CLEC	N		190 ft.	$11.16	$2120.40	$2120.40
Cable Rack 1A	12" Ladder Rack	ILEC	1 CLEC	Y		5 ft	Note 1	Note 1	
Cable Rack 2A	12" Ladder Rack	ILEC	4 CLECs	Y		20 ft	Note 1	Note 1	
Cable Rack B (Occupancy)	12" Ladder Rack	ILEC	ILEC + 4 CLECs	Y	221 Breakout	150 ft	$39.88	$5982.00	$27.07
Cable Hole	2 Cable holes between floors	ILEC	ILEC + 4 CLECs	Y	221 Breakout		$700 / hole	$1647.06 **	$7.45
FDF	Fiber Distribution Frame	ILEC	ILEC + 4 CLECs	Y	768 Fibers		$232.19 per 12 Fibers	$273.16 **	$273.16

Note 1-same Rack as Entrance Fiber - **Indicates 85% Fill

COLLOCATION MODEL - -48V DC POWER DELIVERY



Element	*Description*	*Provided by CLEC/ILEC*	*Used By*	*Re-useable*	*Quantity*	*Unit Cost*	*Total Cost*	*Remarks*
-48V DC Power Panel	Located in Cage	CLEC	1 CLEC	N/A	--	--	--	CLEC installs -48V DC panels in cage; terminates ILEC feed
Cable 'B'	4 X #6 Cable between Cage & Collo BDFB	ILEC	1 CLEC	N	35'-0"	$3.94	$137.90	2 X 20 AMP A & B Cables plus 2 Battery returns
Cable 'B'	4 X #2 Cable between Cage & Collo BDFB	ILEC	1 CLEC	N	35'-0"	$5.14	$179.90	2 X 50 AMP A & B Cables plus 2 Battery returns
Cable 'B'	4 X 2/0 Cable between Cage & Collo BDFB	ILEC	1 CLEC	N	35'-0"	$6.70	$234.50	2 X 100 AMP A & B Cables plus 2 Battery returns
Cable Rack	15" CLEC specific	ILEC	1CLEC	Y	5'-0"	$40.12	$200.60	Only required with first -48V DC Power request; Between CLEC & ILEC BDFB rack
BDFB	Located close to Collocation Cages	ILEC	ILEC + 4 CLECs	N/A	--	--	--	Included in -48V DC Power Consumption Charge
Cable Rack Occupancy	Shared support for Cable 'A' below	ILEC		N/A	--	--	--	Included in -48V DC Power Consumption Charge
Cable 'A'	Cable between -48V Power Plant & BDFB	ILEC		N/A	--	--	--	Included in -48V DC Power Consumption Charge
-48V DC Power Plant	Shared use between CLEC's & ILEC	ILEC		N/A	--	--	--	Included in -48V DC Power Consumption Charge
AC Electrical & Auto-start Diesel	Required for Battery Back-up	ILEC		N/A	--	--	--	Included in -48V DC Power Consumption Charge

Collocation Model ~ Calculation of -48V DC Power Consumption Capital Investments

Element	Shared 2500 Amp Power Plant				Shared 4000 Amp Power Plant			
	Engineer	Furnish	Install	Total	Engineer	Furnish	Install	Total
1200 Amp BDFB-A & B Feed, c/w all shelves and fuses	Included	$ 14,400.00	$ 5,600.00	$ 20,000.00		$ 14,400.00	$ 5,600.00	$ 20,000.00
750MCM cable between -48V DC Power Plant & BDFB (4 Bat, 4 Return)	Included	$ 9,360.00	Included	$ 9,360.00		$ 9,360.00	Incl. Above	$ 9,360.00
Batteries-sufficient to provide 4 Hour Reserve	Included	$ 145,600.00	$ 18,666.00	$ 164,266.00		$ 280,000.00	$ 34,666.00	$ 314,666.00
Power Distribution Centre (Battery Control Board)	Included	$ 7,000.00	$ 5,000.00	$ 12,000.00		$ 10,500.00	$ 8,000.00	$ 18,500.00
Rectifiers - (N+1) to carry load plus 1 for Maintenance	Included	$ 58,800.00	$ 11,200.00	$ 70,000.00		$ 115,500.00	$ 16,800.00	$ 132,300.00
Power Plant & BDFB Engineering Charge	$ 4,160.00			$ 4,160.00	$ 5,200.00			$ 5,200.00
15" cable rack occupancy 8 x 750MCM x 150 feet (Power Plant to BDFB)	Included	Included	Included	$ 948.00	Included	Included	Included	$ 948.00
Occupancy for 2 x Floor Cable Holes	Included	Included	Included	$ 54.92	Included	Included	Included	$ 54.92
Standby Generator (including Fuel Tanks, AC Entrance & Switchboard Eqpt)	Included	Included	Included	$ 84,000.00	Included	Included	Included	$ 134,400.00
Total Element Investment	***$ 4,160.00***	***$ 235,160.00***	***$ 40,466.00***	***$ 364,788.92***	***$ 5,200.00***	***$ 429,760.00***	***$ 65,066.00***	***$ 635,428.92***
Investment Per Amp				***$ 145.92***				***$ 158.86***

Meld of -48V DC Power Consumption Investments	***$ 152.39***	***< Meld of 2500A & 4000A Power Plant Investments***
Assumed Utilization of Power Plant	***80%***	
Actual Investment per -48V DC Amp	***$ 190.48***	
Equals -48V DC Component per Amp		
AC Energy Component (See Chart 1 Below)	***$ 2.03***	
Equals Total Monthly DC & AC Component		

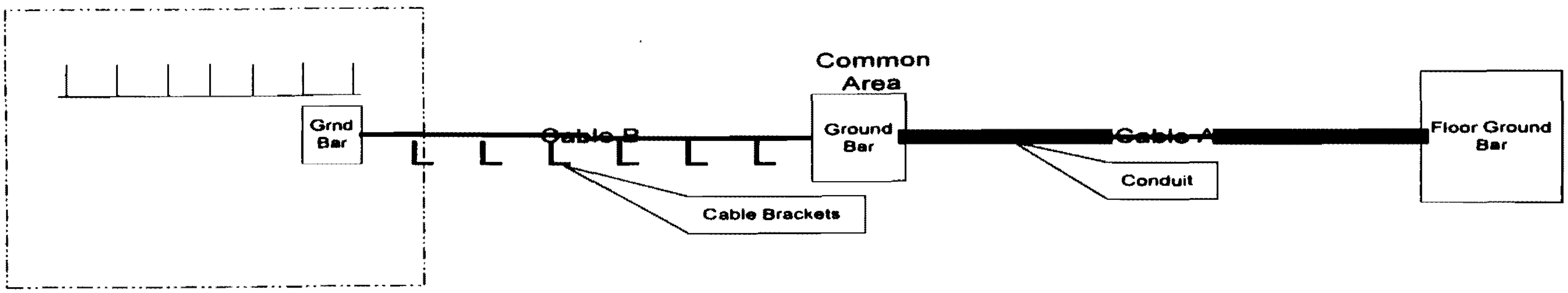
Notes:

1) *All 'material' investments are calculated as Reuseable.*
2) *Assumes maximum requirement of 4 hours reserve with auto-start diesel*

Chart 1	
Calculation of AC Component	
Quantity of DC Amps	1
Quantity of Watts per DC Amp	48
Hours Usage per Day	24
Days Usage per Month	30
Total Monthly DC Watts	34560
AC Equivalent Watts at 85% Rectifier Efficiency	40659
Total AC Kilowatt Hours	40.66
Cost per Kilowatt Hour	$ 0.05
AC Energy Rate per DC Amp	***$ 2.03***

Date Updated-10/3/97

COLLOCATION MODEL - EQUIPMENT GROUNDING



Element	***Description***	***Provided by CLEC/ILEC***	***Used By***	***Re-useable***	***Quantity***	***Unit Cost***	***Total Cost***	***Cost/ CLEC***	***Remarks***
Equipment Ground Bar	Attached to CLEC Cable Rack in Cage	CLEC	1 CLEC	N/A	--	--	--	--	CLEC will provide ground bar and connect to ILEC Ground Bar in Common Area
Cable 'B'	No. 4/0 cable between CLEC Ground Bar and Common Area Bar	CLEC	1 CLEC	N/A	30'-0"	--	--	--	CLEC installs ground cable to connect to ILEC Common Area Ground Bar using cable brackets attached to ILEC cable racking
New Common Area Ground Bar	Extension of ILEC Building Principal Floor Ground	ILEC	4 CLECs	Y	--	$107.00	$107.00	$26.75	ILEC to extend suitable ground to Common Area and place ground bar for all CLEC's (Includes Furnish & Install)
Cable 'A'	No. 4/0 cable in conduit between existing C.O. Floor Ground Bar and new Common Area Bar	ILEC	4 CLECs	Y	100'-0"	$8.65	$865.00	$216.25	ILEC extends suitable ground to Common Area for all CLEC's (Includes Furnish & Install)

COLLOCATION MODEL - SUMMARY OF REALTY COST ELEMENTS					
ITEM	***QUANTITY***	***UNIT***	***UNIT PRICE***	***TOTAL COST***	***COST PER 100 S. F.***
PARTITIONING (INCL. POSTS, FABRIC, RAILS, GATES & INSTALLATION)	155	Lin. Ft.	$ 20.90	$ 3,239.50	$ 809.88
FLOOR TILE	550	Sq. Ft.	$ 1.71	$ 940.50	$ 235.13
PADLOCKS FOR CAGES	4	Each	$ 50.00	$ 200.00	$ 50.00
PLYWOOD	1	Sheet	$ 250.00	$ 250.00	$ 62.50
HVAC	7.7	Tons	$ 1,785.00	$ 13,744.50	$ 3,436.13
LIGHTING	22	Each	$ 117.00	$ 2,574.00	$ 643.50
SWITCHING (MOTION DETECTION TYPE)	5	Each	$ 214.00	$ 1,070.00	$ 267.50
ELECTRICAL PANEL	1	Each	$ 2,150.00	$ 2,150.00	$ 537.50
ELECTRICAL RECEPTACLES	12	Each	$ 48.32	$ 579.84	$ 144.96
MESH GROUNDING	10	Lin. Ft.	$ 10.80	$ 108.00	$ 27.00
TOTAL COST TO CREATE COLLOCATION AREA				***$ 25,406.34***	
PROPOSED COST TO CLEC PER 100 SQ. FT. ALLOCATION					***$ 6,351.59***

ILEC MANPOWER REQUIREMENTS			
FUNCTION	***HOURS TO PLAN*** ***INITIAL COLLOCATION AREA***	***HOURS PER EACH*** ***CLEC REQUEST***	
OUTSIDE PLANT ACCESS DESIGN	0	6	
BUILDING PLANNING	10	4	
MDF PLANNING	0	4	
REAL ESTATE PROJECT MGMT	6	2	
REAL ESTATE CONSTRUCTION MGR	8	4	
ARCHITECURAL	22	2	
POWER ENGINEER	6	4	
EQUIPMENT ENGINEER	6	4	
EQUIPMENT INSTALLATION PROJECT MGR	6	8	
OPERATIONS GROUP	2	4	
APPLICATION FEE	0	10	
SECURITY ESCORTS	AS REQ'D	AS REQ'D	
TOTAL ILEC MANPOWER	*66*	*52*	

LAND & BUILDING COST CALCULATION TABLE		
SPACE CALCULATION		
Equipment Space Requirement		12,000
Ancillary Requirement		25%
Total Footprint per Floor		15,000
Number of Floors (incl. basement)		4
Gross Building Space		60,000
Assignable Space Factor		80%
Assignable Space		***48,000***
LAND CALCULATION		
Building Footprint		15,000
Building to Land Ratio		2
Land Area Requirement		30,000
Cost of Land / Sq.Ft.	$	20.00
Total Land Cost	$	600,000.00
Land Cost per Assignable Space	***$***	***12.50***
BUILDING CALCULATION		
Gross Building Space		60,000
Cost per Sq. Ft. (RS Means)	$	121.50
Total Cost of Building	$	7,290,000.00
Building Cost per Assignable Space	***$***	***151.88***
Total Land & Building Cost per Assignable Square Foot	***$***	***164.38***

SECTION TWO

BACKUP INDEX

Matrix of Collocation Cost Inputs

Collocation - Connectivity Element Backup Costs

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
	Element	Labor Rate Assoc'd.	Engr.		Furnish		Install		Total	Cost/Foot	Capacity	Cost per Cable	Cost per Circuit	Back Up Sheet #	Remarks
	Physical Collocation		Hours	Cost	Unit Cost	Total Cost	Hours	Cost							
1	175 ' Riser Cable Rack - 12" Ladder	$55.00	24	$ 1,320.00		$ 3,018.50	48	$ 2,640.00	$ 6,978.50	$ 39.88	74	$ 0.54		3,4	Furnish Incl. Cable Rack + Support Materials
2	175' Power Rack - 15" Delivery Ladder	$55.00	24	$ 1,320.00		$ 3,060.50	48	$ 2,640.00	$ 7,020.50	$ 40.12	51	$ 0.79		3,4	Furnish Incl. Cable Rack + Support Materials
3	175'-0" DS-0 Cable Rack - 20" Ladder	$55.00	24	$ 1,320.00		$ 3,130.50	48	$ 2,640.00	$ 7,090.50	$ 40.52	278	$ 0.15	$ 0.0015	3,4	Furnish Incl. Cable Rack + Support Materials
4	175'-0" DS-3 Cable Rack - 20" Ladder	$55.00	24	$ 1,320.00		$ 3,130.50	48	$ 2,640.00	$ 7,090.50	$ 40.52	555	$ 0.07	$ 0.1460	3,4	Furnish Incl. Cable Rack + Support Materials; Used 1 Coax
5	175' DS1 Cable Rack - 20" Ladder	$55.00	24	$ 1,320.00		$ 3,130.50	48	$ 2,640.00	$ 7,090.50	$ 40.52	555	$ 0.07	$ 0.0052	3,4	Furnish Incl. Cable Rack + Support Materials; Used 28 Pair
6	10x175' x 26 Ga. 100 Pair VG Cable	$55.00	20	$ 1,100.00	$ 2.00	$ 3,500.00	44	$ 2,420.00	$ 7,020.00	$ 4.01	100		$ 0.04	3,7	Assumes one pair per circuit; Includes 2 cable holes
7	10x175' x 30 Pair DS-1 Cable	$55.00	10	$ 550.00	$ 2.10	$ 3,675.00	34	$ 1,870.00	$ 6,095.00	$ 3.48	28		$ 0.25	3,7	Assumes two pair per circuit, Includes 2 cable holes
8	10x175' x 1 DS-3 Co-ax Cable	$55.00	2	$ 110.00	$ 0.23	$ 402.50	19	$ 1,045.00	$ 1,557.50	$ 0.89	1		$ 1.78	3,7	Assumes two pair per circuit; Includes 2 cable holes
9	Cable Support (on Entrance Fiber Sheet)											$ 0.54			Support for cable in vault area
10	1x175' Entrance Cable (24 Fiber)	$55.00	n/a	n/a	n/a	$ -	14	$ 770.00		$ -	1			6	Assumes per Cable price; Includes 3 cable holes
11	4x35'-0" 2/0 Power Cable (200 Amp)	$55.00	1	$ 55.00	$ 3.56	$ 124.60	1	$ 55.00	$ 234.60	$ 6.70				3,12	A & B Feed plus 2 Battery Returns
12	4x35'-0" #2 Power Cable (100 Amp)	$55.00	1	$ 55.00	$ 2.00	$ 70.00	1	$ 55.00	$ 180.00	$ 5.14				3,12	A & B Feed plus 2 Battery Returns
13	4x35'-0" #6 Power Cable (40 Amp)	$55.00	1	$ 55.00	$ 0.80	$ 28.00	1	$ 55.00	$ 138.00	$ 3.94				3,12	A & B Feed plus 2 Battery Returns
14	8' MDF Vertical	$55.00	Incl.	n/a	$ 3,400.00	$ 3,400.00	Incl.	Incl.	$ 3,400.00		1900	$178.95	$ 1.79	5	Assumes 10 spaces on Horizontal & 9 on Vertical
15	20xTermination Blocks - 66QC-100	$55.00	2	$ 110.00	$ 84.00	$ 1,680.00	2	$ 110.00	$ 1,900.00		2000	$95.00	$ 0.95	5	Only Horizontal block / Vertical in Unbundled loop
16	10xADC DSX-1 Panel (56 DS-1's)	$55.00	2	$ 110.00	$ 805.00	$ 8,050.00	1.5	$ 82.50	$ 8,242.50		560		$ 14.72	9	One Panel provides 56 in/out/test
17	10xADC DSX-3 Panel & Modules (16 Pos)	$55.00	2	$ 110.00	$ 5,932.50	$ 59,325.00	1.5	$ 82.50	$ 59,517.50		160		$ 371.98	9	One Module provides 16 in/out/test
18	1x1633 SX Digital X-Connect (512 DS-3)	$55.00	Incl.	n/a	$ 1,174,172.00	$ 1,174,172.00	Incl.	Incl.	$ 1,174,172.00		512		$ 2,293.30	1	Assumed 20% discount from list price
19	1x1631SMC Digital X-Conn (7168 DS-1)	$55.00	Incl.	n/a	$ 2,359,954.00	$ 2,359,954.00	Incl.	Incl.	$ 2,359,954.00		7168		$ 329.23	1	Assumed 20% discount from list price
20	Cable Hole for DS 1/3	$55.00	Incl.	Incl	$ 700.00	$ 700.00	Incl.	Incl.	$ 700.00		555	1.26	$2.52	2	Assumes 10 P2 DS 1/3 Cables required per circuit
21	23" Misc. Relay Rack	$55.00	2	$ 110.00	$ 170.00	$ 170.00	2	$ 110.00	$ 390.00		126		$ 3.10	8	Assumes 7 Panels x 18 Modules per Relay Rack
22	Cable Hole for Riser (Retardant)	$55.00	Incl.	Incl	$ 700.00	$ 700.00	Incl.	Incl.	$ 700.00		74	$9.46			1 24 Fiber Cable
23	1x35'-0" 4/0 Ground Cable	$55.00	1	$ 55.00	$ 1.47	$ 51.45	1	$ 55.00	$ 161.45	$ 4.61				10	For Bonding Equipment Bar to Common Area Bar
24	Cable Hole for DS-0	$55.00	Incl.	n/a	$ 700.00	$ 700.00	Incl.	Incl.	$ 700.00		278	$ 2.52	$ 0.03	2	Each DS-0 cable = 100 circuits
25	Cable Hole for DS-1/3	$55.00	Incl.	n/a	$ 700.00	$ 700.00	Incl.	Incl.	$ 700.00		555	$ 1.26	$ 2.52	2	2 DS-1/3 Cables required per circuit
26	Splice Case in Vault	$55.00	Incl.	n/a	$ 150.00	$ 150.00	Incl.	Incl.	$ 150.00		2			13	Assumes 2x12 fiber; Required on Initial
27	Common Area Ground Bar	$55.00	Incl	n/a	$ 107.00	$ 107.00	Incl.	Incl.	$ 107.00		1			10	Required on Initial - In Price of Cage
28	100'-0" Cable (Floor Ground>Common)	$55.00	Incl.	n/a	$ 8.65	$ 865.00	Incl.	Incl.	$ 865.00	$ 8.65	1			10	Required on Initial - In Price of Cage
29	Cable Pulling 125'-0" - Manhole>Vault	$55.00	n/a	n/a	n/a	$ -	4	$ 220.00						3,13	Includes Set-up & Take Down
30	Cable Pulling - 175'-0" Vault>Collo	$55.00	n/a	n/a	n/a	$ -	14	$ 770.00						3,13	Non Fire Retardant only
31	Splice 24 Fibers in Vault	$55.00	n/a	n/a	n/a	$ -	5	$ 275.00						13	Includes Set-up & Take Down (Contract Labor)
	Additions for Optical Connectivity & Virtual Collo														
32	175 '-0" Fiber Breakout Rack - 12" Ladder	$55.00	24	$ 1,320.00		$ 3,018.50	48	$ 2,640.00	$ 6,978.50	$ 39.88	221	$ 0.18		3	Incl. Cable Rack + Support Materials; Equivalent to 1 cable
33	175' Power Rack - 15" Distribution Ladder	$55.00	24	$ 1,320.00		$ 3,060.50	48	$ 2,640.00	$ 7,020.50	$ 40.12	284	$ 0.14		3	Incl. Cable Rack + Support Materials; Equivalent to 1 cable
34	Cable Hole for Fiber Breakout	$55.00	Incl.	n/a	$ 700.00	$ 700.00	Incl.	Incl	$ 700.00		221	$ 3.17		2	Fiber breakout cable = 6-12 fibers; Equivalent to 1 cable
35	1 x 175'-0" Breakout Cable (12 Fibers)	$55.00	2	$ 110.00		$ 962.95	16	$ 880.00	$ 1,952.95	$ 11.16				3,7	1x12 fiber breakout cable (incl. splicing at FDF&cable holes
36	Fiber Distribution Frame (768 Fibers)	$55.00	4	$ 220.00	$ 13,760.00	$ 13,760.00	16	$ 880.00	$ 14,860.00		768	$ 232.19		20	Assumes 20% discount ~ Cost per 12 fiber cable
37	Fiber Patchcords for entrance cable	$55.00	n/a	n/a	$ 63.50	$ 63.50	n/a	n/a	$ 63.50					VBU2	12 patchcords required for 24 fiber breakout cable
38															
39															
40															
41															
42															
43															
44															
45															

DIGITAL CROSS CONNECTS

DS3 DCS *(Matrix Line 18)*

Type used: Alcatel 1633 SX equipped for 512 DS3s.

List price : $ 1,467,716 equipped with all input/output cards.

Of this amount, $158,154 or 10.78% is for installation and testing, including engineering.

Source: written quote from Alcatel: Bob Harris, National Account Manager.

Subject matter experts assume a 20% negotiated discount ($1,174,172) and assume that E&I remain the same proportion of the total price:

Assume a 20% negotiated discount = $ 1,174,172
E & I- $126,575
Furnish $1,047,597

Cost per DS-3: $1,174,172 ÷ 512 = **$2293.30**

DS1 DCS *(Matrix Line 19)*

Type used: Alcatel 1631 SMC equipped for 7168 DS1s.

List price: $ 2,949,934 equipped with all input/output cards.

Of this amount, $128,782 or 4.37% is for installation and testing, including engineering.

Source: written quote from Alcatel: Bob Harris, National Account Manager.

Subject matter experts assume a 20% negotiated discount ($2,359,954) and assume that E&I remain the same proportion of the total price:
E & I $103,033
FURNISH $2,256,921

Cost per DS-1: $2,359,954 ÷ 7168 = **$329.23**

CABLE HOLES
(Matrix Lines 23 & 24)

Cable hole is assumed to be sized to fit the cable rack.

Costs include engineering, cutting and coring.

Source: subject matter expert Ken Bradshaw, based on verbal discussion with Smylie and Crow Associates. Estimate: **$700**

CABLE & CABLE RACKS LENGTHS

ENTRANCE: (Fiber Cable lengths from manhole to vault splice)

- Manhole to Cable Vault Entrance 125' consisting of:
  - Manhole to Vault Wall 75'
  - Vault Wall to Vault Splice 50'

Source: subject matter expert Donna Carney, AT&T.

RISER: (Cable from vault to Collocation Area)
Cable and cable rack lengths are determined by computing an average of two scenarios:

	3 Floors (max)	1 Floor (min)
Length on 1 floor	120'	20'
Width on 1 floor	100'	-
Vertical-between floors	60' (3 floors)	20' (1 floor)
Cable Rack to Equip.	15' (drops)	15' (drops)
TOTAL	295'	55'

Average Cable Length: (295 + 55) ÷ 2 = 175' (includes average 7'6" cable drop at each end)
Rack = 160' (no drops)

Source: subject matter expert Richard Bissell, based on forward looking central office model layout.

CONNECTIVITY: (Cable from Collocation Area to ILEC equipment) Cable and cable rack lengths are determined by computing an average of two scenarios.

	2 Floor (max)	Same Floor (min)
Length on 1 floor	120'	20'
Width on 1 floor	100'	20'
Vertical between floors	40' (2 floors)	--
Cable Rack to Equip.	15' (drops)	15' (drops)
TOTAL	275'	55'

Average Cable Length (275 + 55) ÷ 2 = 165' (includes average 7'6" cable drop at each end)
Rack = 150' (no drops)

Source: subject matter expert Richard Bissell, based on forward looking central office model layout.

COMMON AREA CABLE RACK/LADDER

ILEC places a 5' 0" between the collocation BDFB and the CLEC cage on initial cage construction.

Source: subject matter expert Richard Bissell, based on forward looking central office model layout.

OPTICAL CONNECTIVITY: (The cable from the collocation area to the ILEC Fiber Distribution Frame.) The cable length is computed using:

Average cable rack length from ILEC equipment to Collo area	150'
Cable rack length in Collocation common area	20'
Cable rack from Collocation common area to cage	5'
Cable Rack to Equipment	15'(drops)
	190'

Source: subject matter expert Richard Bissell, based on forward looking central office model layout.

POWER

Cable and cable racking for the power room to the collocation BDFB are included in the power consumption calculations. Lengths were determined by computing an average of two scenarios.

	2 Floor (max)	Same Floor (min)
Length on 1 floor	120'	20'
Width on 1 floor	100'	20'
Vertical between floors	40' (2 floors)	--
Cable Rack to Equip	15' (drops)	15' (drops)
TOTAL	275'	55'

Average Cable Length: (275 + 55) ÷ 2 = 165' (includes 7'6" cable drop at each end)
Rack = 150' (no drops)

Source: subject matter expert Richard Bissell, based on forward looking central office model layout.

CABLE FROM BDFB TO CLEC POWER PANEL

15' Common area to BDFB
20' Slack provided for CLEC in cage to connect to the CLEC power panel
35' Overall Length

CHART 1			
COLLOCATION MODEL CONNECTIVITY COMPONENTS AND AVERAGE DISTANCES			
TYPE OF CONNECTION	***CABLE LENGTH***	***CABLE RACK LENGTH***	***CABLE HOLES AND SLEEVES***
FIBER ENTRANCE CABLE (BY CLEC)	125'-0"	N/A	--
FIBER RISER CABLE (BY CLEC)	175'-0"	160'-0"	3
COPPER (DS-0/DS-1/DS-3)	165'-0"	150'-0"	2
OPTICAL	190'-0"	150'-0"	2
-48V DC POWER PLANT TO BDFB	165'-0"	150'-0"	2
BDFB TO DC PANELS IN CAGE	35'-0"	5'-0"	--
FLOOR GROUND BAR TO COMMON AREA GROUND BAR*	100'-0"	IN CONDUIT	--
COMMON AREA GROUND BAR TO EQUIPMENT GROUND BAR (installed by CLEC)	30'-0"	CABLE BRACKETS ON COPPER RACK	--

* See grounding, BU # 10.

98

CABLE RACK/LADDER

FURNISH

Assume placement is of medium to difficult complexity, so supporting "details" are required: for example, hangers, support rods, nuts, attachments to cable holes, etc.

Cable rack cost:	12" rack	$ 58.16 per 10' length
	15" rack	$ 60.55 per 10' length
	20" rack	$ 64.60 per 10' length

Source: Central Steel Fabricators, Inc.

Cable support assumptions:	$ 2,000 per 175' length
	$ 114.29 per 10' length

Source: subject matter expert Richard Bissell based on assumed requirement of approximately $2000 of supporting details for 175' run of cable racking.

Cable height pileup in the cable rack/ladder is based on the following chart:

CABLE TYPE	CABLE PILEUP USED	MAX PILEUP	% FILL
VOICE GRADE	10"	12"	83%
DS0	10"	12"	83%
DS1	10"	12"	83%
FIBER	7"	10"	70% *
POWER	5"	12"	42%*
BREAKOUT	7"	10"	70% *

* Reduced fill due to cable rigidity (bending radius).

ENGINEERING

Quotes received:	Primal =	16 hr
	Primal (Alers)=	24 hr (quote used)

INSTALLATION

Quotes received:	Primal =	48 hr (quote used)
	Primal (Alers)=	72 hr
	Intercomm =	16 hr

MAIN DISTRIBUTING FRAME (MDF)
(Matrix Line 14)

8' 0" FRAME

Planning price = $3400 per vertical. One vertical provides 10 levels on the horizontal side of the frame to accommodate terminal blocks, and provides sufficient space for 9 blocks on the vertical side to terminate local exchange cables.

Therefore, cost per terminal strip space is $3400 ÷ 19 = $179

Source: subject matter expert Richard Bissell, based on the assumption that the planning price includes MDF ironwork plus all required overhead and supporting material, cable racking, lighting, etc.

66 QC BLOCKS
(Included in voice grade costs.)
(Matrix Line 15)

FURNISH			
Source:	Primal	$ 84.00	
ENGINEERING			
Source:	Primal (Alers)	2 hr	
INSTALLATION			
Quotes received:	Primal	2 hr	(quote used)
	Primal (Alers)	12 hr	
	Intercomm	1 hr	

CABLE -- FIBER ENTRANCE

(Matrix Line 10)

(Cable used from Vault to Collocation area)

FURNISH	- Supplied by CLEC		
ENGINEERING	- Included in ILEC Manpower Cost		6 hr

Source: see BU # 19.

INSTALLATION	- Quotes received:	Intercomm	8 hr
		Primal	8 hr (quote used)

Open and close three cable holes. Source: Primal (Alers) 6 hr

Total hours: **14 hr**

CABLE

(Matrix Lines 6 to 8)

VF / DS-0 - 100 PAIRS -- 175' x 10 RUNS

FURNISH	-Source:	Primal	$ 2.00/foot
ENGINEERING	-Source:	Primal (Alers)	20 hr
INSTALLATION	-Quotes received:		
		Primal	40 hr (quote used)
		Primal (Alers)	74 hr
		Intercomm	35 hr

Open and close two cable holes. Source: Primal (Alers) 4 hr

Total hours: **44 hr**

DS-1 - 30 PAIRS -- 175' x 10 RUNS

FURNISH	-Source:	Primal	$2.10/foot
ENGINEERING	-Source:	Primal (Alers)	10 hr
INSTALLATION	-Quotes received:		
		Primal	30 hr (quote used)
		Primal (Alers)	58 hr
		Intercomm	25 hr

Open and close two cable holes. Source: Primal (Alers) 4 hr

Total hours: **34 hr**

DS-3 - 1 PAIR -- 175' - 0" x 10 RUNS

FURNISH	-Source:	Primal	$0.23/foot
ENGINEERING	-Source:	Primal (Alers)	2 hr
INSTALLATION	-Quotes received:		
		Primal	15 hr (quote used)
		Primal (Alers)	9 hr
		Intercomm	18 hr
Open and close two cable holes. Source: Primal (Alers)			4 hr
		Total hours:	**19 hr**

BREAKOUT CABLE (12 FIBER) -- 175' X 1 RUN

FURNISH	Source	Primal	$5.50/foot
ENGINEERING	Source	Primal	2 hr
INSTALLATION	Source	Primal	12 hr
Open and close two cable holes. Source: Primal (Alers)			4 hr
		Total Hours	16

23" RELAY RACKS

FURNISH

Source:	Primal	$ 170.00

ENGINEERING

Source:	Primal (Alers)	2.0 hr

INSTALLATION

Quotes received:	Primal	2.0 hr (quote used)
	Primal (Alers)	4.0 hr
	Intercomm	2.5 hr

DSX-1 PANEL
(Matrix Line 16)

FURNISH (1ADC Panel)

Source:	Primal	$ 805.00

ENGINEERING

Source:	Primal (Alers)	2.0 hr

INSTALLATION

Quotes received:	Primal (Alers)	2.5 hr
	Primal	1.5 hr (quote used)

DSX-3 Panel
(Matrix Line 17)

FURNISH (1ADC Panel)

Source:	Primal	$ 5,932.50

ENGINEERING

Source:	Primal (Alers)	2.0 hr

INSTALLATION

Quotes received:	Primal (Alers)	2.5 hr
	Primal	1.5 hr (quote used)

GROUNDING

(Matrix Line 28)

Source: subject matter expert Ken Bradshaw, based on the following assumptions:

CLEC installs ground bar on cable rack in collocation cage.

CLEC installs cable between ground in collocation cage to ILEC ground in collocation common area using cable brackets on ILEC cable rack.

ILEC installs a cable from the floor ground bar to a ground bar located in the common collocation area. Assume the distance for a one floor run is 100' if the existing bar is centrally located.

Cost elements:

1 ¼" PVC conduit	$4.60/linear foot	or	$460 per 100 feet
4/0 bare copper wire	$3.30/linear foot	or	$330 per 100 feet
4/0 crimp one hole copper lugs, quantity (2)			$75
		Total	$865 per 100 feet

Cost of 4/0 cable, including PVC conduit: **$ 8.65/foot**

Sources: RS Means Electrical Cost Data (1997), page 103 (PVC conduit)
RS Means Construction Cost Data (1997), page 421

COMMON AREA GROUND BAR

(Matrix Line 27)

Located in the collocation cage and connected to the common area ground bar.

FURNISH

Source: verbal quote from Westminster Electrical, Ltd. **$ 107.00** installed.

-48 VOLT POWER CONSUMPTION

A 1200 amp BDFB is supplied by the ILEC in the common area for distribution to all four cages and is included in the power consumption cost

Power consumption investments were developed based on an average of a medium (2,500 amp) and a large (4,000 amp) power plant and include:

- 1200 amp BDFB, including cabling for two floors (150')
- Rectifiers 14 x 200 amp for 2,500 amp
  11x 400 amp for 4,000 amp
- Power distribution center (PDC) as required for power room
- Standby generator, fuel tanks and electrical room equipment
- Batteries: 4 strings Absolyte 100A/81 for 2,500 amp
  4 strings Absolyte 100A/99 for 4,000 amp

Rectifiers sized for (n + 1) to ensure one spare for maintenance

Source: Primal (written quote attached)

STANDBY GENERATOR AND AC ENTRANCE

400,000 Watt auto start standby diesel generator	$165,000.00
Fuel tanks, AC switchboard, etc.	$115,000.00
Total	$280,000.00

$280,000.00 / 400,00 watts = $0.70 per watt. Using a conversion factor of 48 watts/DC amp: ($0.70/watt x 48 watts/amp) = $33.60 per -48V DC amp

2500 amp plant would require 2500 amps x $33.60/amp = **$ 84,000**
4000 amp plant would require 4000 amps x $33.60/amp = **$134,400**

Source: Primal

AC ELECTRIC ENERGY

Source: subject matter experts Allen Hobbs and Richard Bissell.

The chart below is used to calculate the cost of AC electricity necessary to convert to 48V DC. The calculation starts with 1 amp and the steps shown are taken to arrive at the kilowatt-hours required using an 85% efficient rectifier. Note that the rate per kilowatt-hour shown, $0.05, is a default value. The kilowatt-hour charge is applied to determine the AC rate per DC amp. The result is used to develop the power consumption charge.

Calculation of AC Electric Energy Component	
Quantity of DC Amps	1
Quantity of Watts per DC Amp	48
Hours Usage per Day	24
Days Usage per Month	30
Total Monthly DC Watts	34560
AC Equivalent Watts at 85% Rectifier Efficiency	40659
Total AC Kilowatt Hours	40.66
Cost per Kilowatt Hour	$ 0.05
AC Energy Rate per DC Amp	***$ 2.03***

-48 V POWER DELIVERY

(Matrix Line 11 to 13)

Assumes an "A" and a "B" feed and two battery returns for power source diversity (four cables total).

CLEC provides DC panels within collocation cage.

Delivery from power plant to BDFB is included in the power consumption charge.

ILEC provides cabling between collocation BDFB and CLEC DC panel. Length assumes 15'-0" in the common area and 20'-0" slack in the cage – total 35'-0".

FURNISH

Source: Primal ($/foot):

Cable Size	Price	Per 4 Cables
2/0	$ 0.89	$3.56
#2	$ 0.50	$2.00
#6	$ 0.20	$0.80

ENGINEERING

Source: Primal 1hr

INSTALLATION

Source: Primal 1 hr

ACCESS (FIBER ENTRANCE) ELEMENTS
CABLE PULLING AND SPLICING

(Matrix Lines 9, 29 - 31)

Source: subject matter experts Donna Carney, AT&T, and John Donovan

Cable pulling from manhole to cable vault (125') requires 4 hours, which includes cable pulling and travel time.

Cable splicing requires 5 hours: 3 hours set up and take down (includes 1 hour of travel), and 2 hours for splicing fiber (5 min per fiber x 24 fiber).

Fiber placement in cable rack (175') requires 14 hours (fire retardant cable used).

Splice case (external to inside cable) provided by CLEC.

No charge to enter building – cable vault is the same as manhole.

No splicing in the manhole due to possible moisture.

Fiber cable (external and inside) provided by CLEC.

Cost of design work: 6 hours maximum (working drawings, etc.). These hours are included in the ILEC manpower input for the initial installation. See BU #19.

For cable support charge in cable vault, used the same as cable rack occupancy charge ($ 0.54/foot).

PARTITIONING

Partitioning required for the enclosure and separation of 550 square feet of central office space for the purpose of collocation.

155 lineal feet of partitioning required to enclose four collocation spaces and a common area. Source: subject matter expert Ken Bradshaw.

To supply and install the specified material:

R.S. Means Building Construction Cost Data (1997) $ 20.90 (quote used)
Written quote from Simpson's Fence, Ltd. (averaged lineal foot price) $ 16.18

> R.S. Means (page 80): material priced ($13.30) is 9 gauge galvanized steel with barbed wire set in concrete, 6 feet high. Subject matter experts assume the cost to install on a concrete slab would be similar, and multiplied by 1.33 to adjust for 8 foot height requirement: $13.30 x 1.33 = $17.70 per lineal foot. 155 lineal feet x $17.70 = $ 2,742 plus $500 added for gate construction = $3,242. Per-foot price: $3,242 / 155 = $20.92, rounded to $20.90.
>
> Simpson's quote: $3510 Canadian/1.4 = $2507.14 US. Per foot price: $2507.14/155 = $16.18.

Total: 155 feet x $ 20.90/ft = $3,239.50

Partitioning cost for a 100 square foot collocation area includes one-fourth of the common area, so: $ 3,335.50 / 4 = **$ 809.88**

FLOOR TILE

550 square feet of floor tile 12" x 12" x 1/8" composite floor tile.

R.S. Means (1997), page 269 $ 1.71 / sq. ft. (quote used)
Verbal estimate by London General Contractors, Ltd. $ 1.77 / sq. ft

Total: 550 sq. ft. x $1.71/sq.ft. = $ 940.50

Floor tile cost for a 100 square foot collocation area includes one-fourth of the common area, so: $ 940.50 / 4 = **$ 235.13**

SECURITY ACCESS CARDS

Cards for an electronic security card access system.

Source: verbal estimate by Warman Security: $5–15/card. **$15 per card** (quote used)

PADLOCKS FOR CAGES

Brass coded padlock for the collocation cage door(s).

Source: verbal estimate by London General Contractors, Ltd.: **$ 50.00**

PLYWOOD BACKBOARD

Supply and install a plywood backboard in the collocation common area to support electrical distribution panel.

Source: verbal estimate by London General Contractors, Ltd.: $ 250.00

Plywood cost for a 100 square foot collocation area includes one-fourth of the common area, so: $ 250.00 / 4 = **$ 62.50**

HEATING VENTILATING AND AIR CONDITIONING

Source: Charlie Crow of Smylie and Crow Associates.

Heat generated by telecommunications equipment must be dissipated for its continued safe operation. Calculations for the value carried to the model are based on the electrical power consumed by the telecommunications equipment, as follows:

Assuming an average collocator equipment electrical demand 135 amps (x4) = 540 amps and the common area demand to be 23 amps for a total of 563 amps.

563 amps x 48 volts = 27,024 watts

The engineering factor to get heat from watts is 3.413, thus:
27,024 watts x 3.413 = 92,223 Btu

Cooling calculation 12,000 Btu = 1 ton of air conditioning, thus:
92,223 ÷ 12,000 = 7.7 tons

Consultant provided a "rule of thumb" value to calculate the investment for the design and construction of an air conditioning system of approximately $1,785.00 per ton of air conditioning, thus:

7.7 tons x $ 1,785.00 / ton = **$ 13,744.50** for HVAC for the entire collocation area.
Average cost for the Collocation Model for HVAC is $ 13,744.50 for HVAC.

HVAC cost for a 100 square foot collocation area includes heat dissipation in the common area, so: $ 13,744.50 / 4 = **$ 3,436.13**

Note: the maximum cost for HVAC, assuming the maximum amperage of 190 amps per 100 square feet collocation area was attained for all collocators simultaneously, would result in a cost of $ 19,080.00 for HVAC for the entire collocation area.

ELECTRICAL COMPONENTS

LIGHTING

Supply and install 4 fluorescent fixtures per collocation area (4 x 4 = 16) plus 6 for the common area: total 22 fixtures.

R.S. Means (1997), page 432	\$ 117.00 per fixture (quote used)
Verbal estimate by Westminster Electrical, Ltd.	\$ 113.00 per fixture

Total cost: 22 fixtures x \$117/fixture = \$ 2,574.00

Lighting cost for a 100 square foot collocation area includes one-fourth of the common area, so: \$ 2,574.00 / 4 = **\$ 643.50**

SWITCHING

Supply and install 5 motion detector switches to control lighting. One per cage and one for the common area.

Verbal estimate by Westminster Electrical, Ltd. \$ 214.00 (quote used)

Motion detector switching cost for a 100 square foot collocation area includes one-fourth of the common area, so: \$ 214.00 / 4 = **\$ 53.50**

ELECTRICAL PANEL

Supply and install one electrical distribution panel required: 42 circuit 225 amp 240/120 volt.

R.S. Means (1997), page 424	\$ 2150 / panel (quote used)
Verbal estimate by Westminster Electrical, Ltd.	\$ 2125 / panel

Electrical panel cost for a 100 square foot collocation area includes one-fourth of the common area panel, so: \$ 2,150 / 4 = **\$ 537.50**

ELECTRICAL RECEPTACLES

20 amp duplex electrical receptacles

2 outlets per collocation area	4 x 2 =	8
4 outlets for the common area		4
Total:		12 receptacles

Quotes received:

R.S. Means (1997), pages 414, 423

12 receptacles at	$ 19.90	= $ 238.80
Assuming 100' conduit and wire at	$ 3.41/ft	= $ 341.00
	Total	$ 579.80

Cost per outlet is $ 579.80 ÷ 12 = $ 48.32 (quote used)

Verbal estimate by Westminster Electrical, Ltd . (per outlet): $ 50.00

MESH GROUNDING

10 feet of ground cable installed complete with connector lug

Quotes received:

R.S. Means (1997), page 421

cable	$ 33.00	
2 connectors	75.00	
Total	$ 108.00	(quote used)

Verbal estimate by Westminster Electrical, Ltd. (per outlet): $ 105.00

LAND AND BUILDINGS

Source: subject matter experts Richard Bissell and Ken Bradshaw, based on forward looking central office (CO) model layout.

FLOOR SPACE

Assume a forward looking CO floor space of 12,000 square feet. For the building footprint, assume ancillary space for corridors, stairs, service shafts, etc. at 25% over the equipment space: 12,000 x 1.25 = 15,000 sq. ft.
Total gross space for four floors: 15,000 x 4 = 60,000 sq. ft.
Assume assignable space factor of 80%: .8 x 60,000 = **48,000 sq. ft.**

LAND COST CALCULATION

Source: subject matter expert Ken Bradshaw, based on experience.

Building to land ratio: 2 times footprint
Thus: 2 x 15,000 = 30,000 sq. ft.

Assume the cost of land is $20.00 per square foot. Note that the cost of land per square foot used is a default value. Thus: $20.00 x 30,000 sq. ft. = $ 600,000
Land cost per assignable square foot is $600,000 / 48,000 = **$ 12.50**

BUILDING COST CALCULATION

Source: subject matter expert Ken Bradshaw, based on experience.

The average cost of building a telephone exchange office is presented in R.S. Means (1997), page 450, for a 4,500 sq. ft., office is $135.00 per sq. ft.

Due to economies of scale, the cost of building a 60,000 sq. ft. office (a size factor of greater than 3.5) is calculated by applying a multiplier of 0.90 (R. S. Means, page 548): $ 135.00 per sq. ft. x 0.90 = $ 121.50 per sq. ft.

Thus, the cost of the proposed building in the Collocation Model is:
60,000 x $ 121.50 = $ 7,290,000.00

Further, the building cost per assignable square foot is:
7,290,000 ÷ 48,000 = **$ 151.88**

Total land plus building cost per assignable square foot: is
$ 12.50 + $ 151.88 = **$ 164.38**

ILEC MANPOWER

The following table lists the ILEC Groups involved in the Collocation Process and the tasks performed in fulfilling an Initial request for Collocation

Function	Tasks	Work Time (hours)
Outside Plant Access Design	Prepares Estimate for Work required	2
	Engineers Details and Tender	2
	Reviews Tenders, Award, and Updates Records	2
Building & MDF Planning	Selects Building Space	4
	Compiles Estimates and develops Plan	10
	Finalizes Plan	2
	Finalizes Project	2
Real Estate Project Manager	Prepares Estimate for Work required	4
	Engineers Details and Tender	2
	Reviews Tenders and Award	2
Real Estate Construction Manager	Coordinates Construction Activity	12
Architect	Prepares Estimate for Work required	4
	Engineers Details and Tender	20
Power Engineer	Prepares Estimate for work required	3
	Engineers Details and Tender	5
	Reviews Tenders and Award	2
Equipment Engineer	Prepares Estimate for work required	3
	Engineers Details and Tender	5
	Reviews Tenders and Award	2
Equipment Installation Project Manager	Coordinates Equipment Estimates	14
Operations Group	Attends Meetings and Interfaces with Contractors as required	6
ILEC Contact Group	Reviews Request and Forward to Planning	1
	Advises CLEC of Cost of Collocation	1
	Receives Acceptance and advises Planning	1
	Notifies CLEC of Completion	1
Other ILEC Groups	Performs related Tasks (e.g., billing)	6

Source: subject matter experts Richard Bissell, Allen Hobbs and Ken Bradshaw, based on experience.

FIBER DISTRIBUTION FRAME

FURNISH

Type used: ADC Standard Fiber Distribution Frame equipped with 8 x 96 termination SC connector modules for a total capacity of 768 fibers.

1 Universal Fiber Frame-7 ft		$ 1,150
8 Connector Modules-96 Termination		$15,400
1 Inter bay Management Panel		$ 650
	Total list price	$17,200

SOURCE: ADC Telecommunications, Inc.

Assume a 20% negotiated discount = $ 13,760.00

ENGINEERING

Source: Primal 4 hr

INSTALLATION

Source: Primal 16 hr

SECTION THREE
SUPPLIER QUOTES

ALCATEL

PRIMAL COMMUNICATIONS

EXPRESS INTERCOMMUNICATIONS

SIMPSON'S FENCE

CENTRAL STEEL FABRICATORS

R. S. MEANS BUILDING CONSTRUCTION COST DATA (1997)

R. S. MEANS ELECTRICAL COST DATA (1997)

ADC TELECOMMUNICATIONS

ALCATEL

Source document for Digital Cross Connects.

120

Subject: Request for Quotation
Date: Thu, 3 Jul 97 16:23:17 -0400
From: Harris_Bob/nsih1_RICHARDSON/alcatel/US/Telemail/alcanet@audopen.aud.alcatel.co
To: hobbs.london@sympatico.ca
CC: bob_harris@rockdal.aud.alcatel.com, cgoldfarb@mci.com,
robert.b.may@mci.com

Al,

My sincere aplogies for being late with this information. We had problems getting into electronic format as it was done from an internal pricing configurator. This is a different process due to the fact that no discounts were built into the prices. We had our secretary type this up by hand.

I paged you around 1:00 today to try to get your fax #. Please let me know if you have any question.

Regards,

Bob

PS: This quote DOES include I/O modules. If you do not need them, subract the cost of the I/O racks in this quote. Thanks.

> Bob,this is further to our telephone conversation concerning the request
> for price quotes on 2 pieces of Alcatel equipment.
>
> Would you please provide an installed price(EF&I) for the following:
>
> 1 Alcatel 1633 e/w 512 ports (copper only no fiber)
>
> 2 I/O card for 1633--price per card
>
> 3 Alcatel 1631SMC equiped as a DS1 cross conect (256 equivalent DS3's)
> (I believe that this is a mid sized DCS)
>
> 4 DS1 I/O card for 1631.
>
>
> If you or any of your staff are unclear about my request please do not
> hesitate to call me at 519-474-7588 or page me at 1-800-946-4646, ID
> 142-0858.
>
> If possible to meet the timeframe for the next filing I would like the
> information by Wed afternoon July 3.
>
> Thanks you for your assistance.
>
> Al Hobbs
>

Attachment 2	**Name:** 54-7041.doc **Type:** application/x-openmail-1879 **Encoding:** base64

122

97/07/03

1631 SX SMC
Equipped for 7,168 DS1

Product Name	QTY	Price	Extended
1631 SX-APS	1	$79,439.00	$79,439.00
1631 SX-TSI-RK	1	$61,744.00	$61,744.00
IO-RK	1	$250,504.00	$250,504.00
IO-RK	1	$250,504.00	$250,504.00
IO-RK	1	$250,504.00	$250,504.00
IO-RK	1	$250,504.00	$250,504.00
1631 SX-TSI-RK	1	$58,744.00	$58,744.00
1631 SX-TSI-RK	1	$61,744.00	$61,744.00
1631 SX-TSI-RK	1	$58,744.00	$58,744.00
IO-RK	1	$250,504.00	$250,504.00
IO-RK	1	$250,504.00	$250,504.00
IO-RK	1	$250,504.00	$250,504.00
IO-RK	1	$250,504.00	$250,504.00
1631 SX-SPARES	1	$43,896.00	$43,896.00
1631 SX-DATA-CABL	1	$156,000.00	$156,000.00
1631 SX-CONTROL	1	$14,350.00	$14,350.00
1631 SX-ASSEMBLY	1	$21,670.00	$21,670.00
1631 SX-OEM	1	$2,875.00	$2,875.00
1631 SX-ASSEMBLY	1	$36.00	$36.00
1631 SX-ASSEMBLY	1	$1,578.00	$1,578.00
1631 SX-APS	1	$23,000.00	$23,000.00
1631 SX-TSI-RK	1	$11,679.00	$11,679.00
IO-RK	1	$17,708.00	$17,708.00
IO-RK	1	$17,708.00	$17,708.00
IO-RK	1	$17,708.00	$17,708.00
IO-RK	1	$17,708.00	$17,708.00
1631 SX-TSI-RK	1	$11,679.00	$11,679.00
1631 SX-TSI-RK	1	$11,679.00	$11,679.00
1631 SX-TSI-RK	1	$11,679.00	$11,679.00
IO-RK	1	$17,708.00	$17,708.00
IO-RK	1	$17,708.00	$17,708.00
IO-RK	1	$17,708.00	$17,708.00
IO-RK	1	$17,708.00	$17,708.00
1631SX SMC	1	$44,920.00	$44,920.00
1631 SX - I&T - Installation & Testing (Includes Engineering)	1	$128,782.00 (0.33% of Tot)	$128,782.00
	Grand Total >>	**$2,949,934.00**	**$2,949,934.00** [illegible]
DS1 Module & Switch Card	1	**$1,575.00**	**$1,575.00**

97/07/03

1633 SX
Equipped for 512 DS3's

Product Name	QTY	Price	Extended
1633SX-APS	1	$81,223.00	$81,223.00
1633SX-STS-IO	1	$203,590.00	$203,590.00
1633SX-C/S	1	$63,708.00	$63,708.00

1633SX-STS-IO	1	$203,590.00	$203,590.00
1633SX-IO	1	$203,590.00	$203,590.00
1633SX-C/S	1	$53,048.00	$53,048.00
1633SX-STS-IO	1	$203,590.00	$203,590.00
1633SX-SPARES	1	$49,311.00	$49,311.00
1633SX-DATA-CABL	1	$28,700.00	$28,700.00
1633SX-CONTROL-CABL	1	$1,100.00	$1,100.00
1633SX-ASSEMBLY	1	$11,925.00	$11,925.00
1633SX-OEM	1	$3,085.00	$3,085.00
1633SX-ASSEMBLY	1	$857.00	$857.00
1633SX-APS	1	$13,440.00	$13,440.00
1633SX-DS3-IO-RK	1	$28,290.00	$28,290.00
1633SX-Matrix-RK	1	$22,490.00	$22,490.00
1633SX-DS3-IO-RK	1	$28,290.00	$28,290.00
1633SX-DS3-IO-RK	1	$28,290.00	$28,290.00
1633SX-Matrix-RK	1	$22,260.00	$22,260.00
1633SX-DS3-IO-RK	1	$28,290.00	$28,290.00
1633SX-S.W. & Doc.	1	$30,895.00	$30,895.00
1633 SX-I&T	1	$158,154.00	$158,154.00
	Grand Total >>	**$1,467,716.00**	**$1,467,716.00**
DS3 Module	1	**$1,040.00**	**$1,040.00**

PRIMAL COMMUNICATIONS

Source documents for Power, Engineering (Alers), Installation, Breakout Cable, Power Load Supplies and Engineering and Installation of Fiber Distribution Bay

PRIMAL COMMUNICATIONS LTD
17 FORBES ROAD
SCARBOROUGH, ONTARIO
M1P 1K8

Fax Cover Sheet

DATE:	July 3, 1997	TIME:	3:38 PM
TO:	RICHARD BISSELL	PHONE:	(519) 858-3749
		FAX:	(519) 858-3757
FROM:	Mike McLafferty Primal Comm. Ltd.	PHONE: FAX:	(416) 923-4384 (416) 923-4677

RE: Pricing profile

Number of pages including cover sheet: 4

Message

RICK:

QUOTE AS DISCUSSED. THREE SHEETS ACCOMPANY THIS FAX, SHEET 1 OUTLINES EF & I POWER COSTING, I USED NT, RELTEC AND PECO 11 AS A BASIS FOR THESE PRICES.

SHEET 2 IS PRICING FOR EF & I, FOR CABLE RACKING AND OVERHEAD IRONWORK. I USED NT, COMPOWER AND PRESTIGE AS A BASIS FOR THESE PRICES.

SHEET 3 FOCUSES ON INSTALLATION COSTS ASSOCIATED WITH VARIOUS TYPES OF EQUIPMENT.

THANKS AGAIN

MICHAEL McLAFFERTY

Typical Collocation Model -48V Power Plant Unit Costs (Power Consumption RC)

	2500 Amp				***4000 Amp***			
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BDFB-A & B Feed, e/w all shelves and fuses		$ 10,500.00	$ 5,600.00	$ 16,100.00		$ 10,500.00	$ 5,600.00	$ 16,100.00
Cable-Power Plant to BDFB-150 ft-,2 Bat, 2 Return		$ 4,680.00	INC/ABOVE	$ 4,680.00		$ 4,680.00	INC/ABOVE	$ 4,680.00
Batteries-sufficient to provide 3 Hour Reserve		$ 109,200.00	$ 14,000.00	$ 123,200.00		$ 210,000.00	$ 26,000.00	$ 236,000.00
Power Distribution Centre-typical for Pwr Room Distribution		$ 7,000.00	$ 5,000.00	$ 12,000.00		$ 10,500.00	$ 8,000.00	$ 18,500.00
Rectifiers-sufficient to carry load plus 1 reserve for Maintenance purposes		$ 58,800.00	$ 11,200.00	$ 70,000.00		$ 115,500.00	$ 16,800.00	$ 132,300.00
Standby Generator-autostart and transfer		$ 84,000.00	inc.	$ 84,000.00		$ 134,400.00	inc	$ 134,400.00
Total Engineering at $65.00/hr	64 hrs.			$ -	80 hrs			$ -
	[illegible]			$ -	[illegible]			$ -
				$ -				$ -
				$ -				$ -
Total Element Costs	$ 4,160.00	$ 274,180.00	$ 35,800.00	$ -	$ 5,200.00	$ 485,580.00	$ 56,400.00	$ 541,980.00
Cost Per Amp	$ 1.66	$ 109.67	$ 14.32	$ -	$ 1.30	$ 121.40	$ 14.10	$ 135.50

Notes:

1) Please provide details of cabling between -48V Power Plant & BDFB:

Type: ____________ Size: ____________ Diameter: ____________

2) Please indicate labor rate used for Engineering: ____________

3) Please indicate labor rate used for Installation: ____________

4) Assume 'average' long run requirement of 563 Watts redundant draw on BDFB with a 'maximum' of 725Watts redundant draw.

PRIMAL COSTING QUOTE

JUNE 10/97

	ITEM	ENGR. HOURS	INSTALL HRS.
1.	10 RUNS X 175' --26 GA. 100 PR. CABLE	20	74
2	10 RUNS X 175' – DS-1 30 PAIR CABLE	10	58
3.	10 RUNS X 175' –DS-3 1 PAIR CABLE	2	9
4	10 RUNS X 175' -8 FIBER BREAKOUT CA.	10	13
5.	1 RUN X 175' -12 FIBER ENTRANCE CA.	1	
6	1 RUN X 150' – 750 MCM PWR CABLE	1	12
7.	1 RUN X 35' – 4/0 PWR CABLE	1	2
8.	1 X 19" -- RELAY RACK	2	4
9.	1 X 23" -- RELAY RACK	2	4
10.	1 X 10 VERTICAL 8 FT. MDF	2	15
11.	1 X 10 VERTICAL 11'- 6" MDF	2	20
12.	CABLE RACK AND LIGHTS FOR MDF's	2ea.	
13.	10 ADC DSX-1 PANELS (56 in & 56 out)	2	2 hrs & 30 min.
14.	10 ADC DSX-3 PANELS	2	2 hrs & 30 min.
15.	20, 66 QC-100 BLOCKS	2	12
16.	20, BIX BLOCKS	2	12
17.	TERMINATE/TEST BOTH ENDS OF ITEM #1		66
18.	TERMINATE/TEST BOTH ENDS OF ITEM #2		26
19.	TERMINATE/TEST BOTH ENDS OF ITEM #3		6hrs 10min
20.	175' OF 30" CA RACK MEDIUM COMPLEXITY	24	72
21.	175' OF 22" CA RACK " "	24	72
22.	175' OF 15" CA RACK " "	24	72
23.	OPEN & CLOSE CA HOLE—EXISTING		2
24.	OPEN & CLOSE CA HOLE-– NEW		6

BOB ALERS

Typical Collocation Model - Connectivity Elements										
Element	Engr.		Furnish	Install		Total	Cost/Foot	Capacity	Cost /Circuit	Remarks
	Hours	Cost	Cost	Hours	Cost				Cable/etc.	
175 ' Cable racking - 12" Ladder	16		5385	48		$ 5,385.00				
175' Cable racking - 15" Ladder	16		5395	48		$ 5,395.00				
175' Cable Racking - 20" Ladder	16		5440	48		$ 5,440.00				
10 x 175' -100 Pr VF Ca (26G)			3500	40		$ 3,500.00				
10 x 175' x 30 Pair DS-1 Cable			3675	30		$ 3,675.00				
10 x 175' x 1 Pair DS-3 Cable			40.25	15		$ 40.25				
10 x 175' Breakout Cable-8 Fibers				40		$ -				
1 x 175' Entrance Cable-12 Fibers				8						
1 x 150' 750-MCM Pwr. Cable	1		818.9	8		$ 816.90				
1 X 35' 4/0 Pwr. Cable (175 Amp)	1		61.45	1		$ 79.10				
1 X 35' 2/0 Pwr. Cable (110 Amp)	1		31.12	1			.77			
1 X 35' # 2 Pwr. Cable (50 Amp)	1		17.4	0.5			.77			
1 x 35' # 6 Pwr. Cable (20 Amp)	1		6.86	0.5			.19			
1 x 8'-0" 10 Vertical MDF	20			80		$ -				
1 x 11'-6" 10 Vertical MDF	20			80		$ -				
20 x 66QC-100 term blocks			84	2		$ 84.00				
10 x ADC DSX-1 Panels			8050	1.5		$ 8,050.00				
10 x ADC DSX-3 Panels			3250			$ 3,250.00				
10 x 18 ADC DSX-3 Modules			56075			$ 56,075.00				
1 x 19" Misc. Relay Rack			168	2		$ 168.00				
1 x 23" Misc. Relay Rack			170	2		$ 170.00				
1 X Cable Rack Mtd. Ground Bar			140	1		$140.00				

Notes:

1) See Alcrs summary for additional Engineering estimates

PRIMAL COMMUNICATIONS LIMITED
17 FORBES ROAD, SCARBOROUGH, ONTARIO, M1P 1K3
TEL: (416) 923-4384, FAX: (416) 923-4677

July 25, 1997

Rick Bissell
306-80 Ridout St. South
London, Ontario
N6C 5H7

Rick,
In response to your revised quotation request,

1. To provide 4 hours instead of 3 hours of Battery reserve, using Absolyte Batteries.

2500 Amp. Plant	Furnish -	$ 145,600.00 *	vs.	$ 109,200.00
	Install -	18,666.00	vs.	14,000.00
	Eng. -	included in power plant (same)		
	Total -	<u>$ 164,266.00</u>	vs.	<u>$ 123,200.00</u>

* Using 4 strings of 100A/81 Batteries.

4000 Amp. Plant	Furnish -	$ 280,000.00 *	vs.	$ 210,000.00
	Install -	34,666.00	vs.	26,000.00
	Eng. -	included in power plant (same)		
	Total -	<u>$ 314,666.00</u>	vs.	<u>$ 236,000.00</u>

*Using 4 strings of 100A/99 Batteries.

2. To provide a 1200 Amp. BDFB instead of a 600 Amp.

1200 Amp BDFB	Furnish -	$ 14,400.00	vs.	$ 10,500.00
	Install -	5,600.00	(same)	
	Eng. -	incl. in power plant (same)		
	Total -	<u>$ 20,000.00</u>	vs.	<u>$ 16,100.00</u>

3. Cabling for 1200 Amp. BDFB	F & I -	$ 9,360.00	vs.	$ 4,680.00
	Eng. -	incl. in power plant (same)		

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4. To engineer the various Plants.

2500 Amp. Plant - 64 hours = $ 4,160.00

4000 Amp. Plant - 80 hours = $ 5,200.00

5. I confirm our price for 30 pair DS-1, FT4 rated cable of $ 2.10/ft.

Sincerely,

Michael McLafferty

PRIMAL COMMUNICATIONS LIMITED
17 FORBES ROAD, SCARBOROUGH, ONTARIO, M1P 1K8
TEL: (416) 923-4384, FAX: (416) 923-4677

July 25, 1997

Rick Bissell
306-80 Ridout St. South
London, Ontario
N6C 5H7

Rick,

I take this opportunity to clarify some questions you had on our pricing profile.

1. The time required to mount DSX-1 and DSX-3 panels is the same.
2. In our costing quote of June 10 (Bob Alers portion) items 17,18 and 19 are included in items 1,2 and 3 respectively.

Any other questions or clarifications please do not hesitate to call.

Sincerely,

Michael McLafferty

PRIMAL COMMUNICATIONS LIMITED
17 FORBES ROAD, SCARBOROUGH, ONTARIO, M1P 1K8
TEL: (416) 923-4384, FAX: (416) 923-4677

July 28, 1997

Rick Bissell
306-80 Ridout St. South
London, Ontario
N6C 5H7

Rick,

The following will clarify our labor rates.

1. Rate for Installer. - $50.00-$55.00/hr.
2. Rate for Engineering (Co equip.) - $50.00-$55.00/hr.
3. Rate for Engineering (Power Plants) - $60.00-$65.00/hr.

The above rates vary depending on the job complexity and its location. The rate for Engineering of Power plants is higher than the regular Engineering rate due to the unique skills required to facilitate this function.

Sincerely,

Michael McLafferty

PRIMAL COMMUNICATIONS LIMITED
17 FORBES ROAD, SCARBOROUGH, ONTARIO, M1P 1K8
TEL: (416) 923-4384, FAX: (416) 923-4677

Aug. 9, 1997

Rick Bissell
306-80 Ridout St. South
London, Ontario
N6C 5H7

Rick,

In response to your queries of Aug. 8/97:

1. The price for 10 x 175' of DS-3, 1 pair cable would be $402.50.
2. Installation effort required to run a 175' entrance Fiber Cable of 12 Fibers would be the same as for a 24 Fiber Cable (No splicing).

Sincerely,

Michael McLafferty

PRIMAL COMMUNICATIONS LIMITED
17 FORBES ROAD, SCARBOROUGH, ONTARIO, M1P 1K8
TEL: (416) 923-4384, FAX: (416) 923-4677

October 18, 1997

Rick Bissell
306-80 Ridout St. South
London, Ontario
N6C 5H7

<u>Re: Costing</u>

Rick;

As requested the following prices are to E,F & I various power load supplies. We are allowing for 4 lengths of 40 feet of each supply.

•	0-5 Amp	Engineer------ One hour	5-20 Amp	Engineer ------ One hour
	(#10 Gauge)	Furnish ------- $ 24.00	(#6 Gauge)	Furnish -------- $ 32.00
		Install ------- One hour		Install --------- One hour
•	20-30 Amp	Engineer ----- One hour	30-40 Amp	Engineer ----- One hour
	(#4 Gauge)	Furnish ------- $ 64.00	(#2 Gauge)	Furnish ------- $ 80.00
		Install -------- One hour		Install -------1 & ½ hrs.
•	40-50 Amp	Engineer ----- One hour	50-60 Amp	Engineer ----- One hour
	(#2 Gauge)	Furnish ------ $ 80.00	(#1 Gauge)	Furnish ------$120.00
		Install ------ 1 & ½ hrs.		Install ------ 1 & ½ hrs.

The cost to Engineer and Install a Fiber distribution bay would be to Engineer – 4 hours and to Install – 16 hours.
If you need anything else please do not hesitate to call.

Yours truly,

Michael McLafferty

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PRIMAL COMMUNICATIONS LIMITED

17 FORBES ROAD, SCARBOROUGH, ONTARIO, M1P 1K8
TEL: (416) 923-4384, FAX: (416) 923-4677

October 24, 1997

Rick Bissell
306-80 Ridout St. South
London, Ontario
N6C 5H7

<u>Re: Costing</u>

Rick;
As requested the following prices are to E,F & I, 175 ft. of Fiber breakout cable (12 fibers).

- Engineer------ Two hours
  Furnish ------- $ 962.95
  Install ------- 12 hours

If you need anything else please do not hesitate to call.

Yours truly,

Michael McLafferty

EXPRESS INTERCOMMUNICATIONS

Source document for installation hours.

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EXPRESS INTERCOMMUNICATIONS
++++++++++++++++++
VOICE + DATA + SOUND

CUSTOMER: M.C.I. DATE: 06/06/97
ATT: CHARLIE FINCHER

ITEM	HOURS	PRICE MATERIAL	HOUR TOTAL	QUANTITY	TOTAL HOURS
1: INSTALL 26GA 100PR CABLE	2.00	.00	2.00	10EA	20.00
2: INSTALL 30PR DS-1 CABLE	1.50	.00	1.50	10EA	15.00
3: INSTALL 14PR DS-3 CABLE	1.50	.00	1.50	10EA	15.00
4: INSTALL 1PR DS-3 CABLE	1.00	.00	1.00	10EA	10.00
5: INSTALL 8 STRAND FIBER CABLE AND TERMINATED TO S/T CONNECTORS.	6.00	.00	6.00	10EA	60.00
6: INSTALL 12 STRAND FIBER CABLE AND TERMINATED TO S/T CONNECTORS	8.00	.00	8.00	1EA	8.00
7: INSTALL 750 MCM POWER CABLE	3.00	.00	3.00	1EA	3.00
8: INSTALL 19" RELAY RACK	2.50	.00	2.50	2EA	5.00
9: INSTALL 23" RELAY RACK	2.50	.00	2.50	2EA	5.00
10: INSTALL GROUND BAR AND GROUND CABLE	1.50	.00	1.50	1EA	1.50
11: INST 8' MDF & EQUIPMENT	24.00	.00	24.00	1EA	24.00
12: INST 11'6" MDF & EQUIPMENT	24.00	.00	24.00	1EA	24.00
13: INSTALL ADC DSX-1 PANEL	.00	.00	.00	1EA	.00
14: INSTALL ADC DSX-3 PANEL	.00	.00	.00	1EA	.00
15: INSTALL FIBER PANEL	.50	.00	.50	1EA	.50
16: INSTALL 66OC-100 BLOCKS	.05	.00	.05	20EA	1.00
17: INSTALL KRONE BLOCKS	.05	.00	.05	20EA	1.00
18: TERMINATE 100PR 26GA CABLE	.75	.00	.75	10EA	7.50
19: TERMINATE DS-1 30PR CABLE	.50	.00	.50	10EA	5.00
20: TERMINATE DS-3 1PR CABLE	.15	.00	.15	10EA	1.50
21: INSTALL CABLE RACKING 12"	16.00	.00	16.00	1EA	16.00
22: INSTALL CABLE RACKING 15"	16.00	.00	16.00	1EA	16.00
23: INSTALL CABLE RACKING 20"	16.00	.00	16.00	1EA	16.00

HOURS TOTAL: 255.00

MAT'L: .00
LABOR: 255.00

EXPRESS INTERCOMMUNICATIONS

PERCY A. DAVIS

* NOTE: THEY DID INSTALL CABLE SEPARATE FROM TERMINATE & TEST ∴ COST = #1 + (2 × #18)
#2 + (2 × #19)
#3 + (2 × #20)

** NOTE: GROUND BAR + CABLE = 1.5 HRS
ASSUME 1.0 HR GROUND BAR IF SEPARATE
0.5 HR CABLE

SIMPSON'S FENCE

Source document for cage costs.

SIMPSON'S FENCE LTD.
"The Fence People Since 1950"
4010 Breck Avenue
LONDON, ONTARIO N6L 1B4
(519) 652-3269 Fax (519) 652-9088
GST # 10486 8179 RT

QUOTATION:

Customer:
BCI INCORPORATED
309 PALL MALL ST.
LONDON, ON N6B 2G8
ATT: KEN BRADSHAW
Re:

Quotation Date :06/04/97
Quotation Number: #1437
Reference Number:
WORK Order # :
Phone: 439-3924 FAX 439-4825

MATERIAL SPECIFICATIONS:

TERMINAL POST: 16 - 2 3/8" X 8.5' .100 WALL HDG PIPE
TOP RAIL : 1 11/16" .100 WALL HDG PIPE
COVERAGE : 2" x 9 ga x 96" G.A.W. 1.2 oz
TENSION WIRE : 9 ga BRACE WIRE HDG (PREM. 2 oz) PER. FT.
GATE # 1-4 : 3'w x 8'h SINGLE SLIDE GATE
GATE # 2 : 7'6"x 8'h SINGLE SLIDE GATE

PROJECT DESCRIPTION:

Fence Length : 128 FT.
Gate Length : 20.0 FT.
Total Length : 148 FT.
Post Spacing : 10.0 FT.
Coverage Height: 8.0 FT.

Tension Wire : 1 Stran

FENCE INSTALLED INSIDE BUILDING-EASY ACCESS. ALL POSTS FLANGED TO FLOOR
GATES ARE TO BE INSTALLED USING OVERHEAD BARN DOOR TRACK.

EXPECTED DELIVERY:

from Date of Confirmation.

QUOTATION AMOUNT -	$3,28
G.S.T.	$22
P.S.T.	Incl
QUOTATION TOTAL -	$3,51

F.O.B. -

TERMS:

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Representative - JOHN SIMPSON

Accepted by: ____________________

CENTRAL STEEL FABRICATORS

Source document for cable rack prices.

CENTRAL STEEL FABRICATORS, INC.

1843 S. 54th Avenue • Cicero, IL 60650 •

July 30,1997

MCI Corporation
Rick Bissell Consulting (519)858-3757
306-80 Ridout Road
London, Ontario Canada N6C5H7

Dear Mr. Bissell;

The following confirms our verbal quotation for telco style cable tray with 2" side members and roll formed channel cross members. Finish to be Telephone Gray enamel. Prices quoted are our list price, when skid lot quantities are ordered (40 pcs) there is a 5% discount. Blanket commitments in excess of 500 pcs would warrant contract pricing to be determined based on total program.

Prices are quoted in US Dollars, FOB Chicago, IL with terms of net 30 days.

Channel Side Bar		Tube Side Bar		Solid Side Bar	
CSF #	Price	CSF #	Price	CSF #	Price
22012	58.15	20012	57.40	21012	80.40
22015	60.55	20015	59.80	21015	82.30
22020	64.60	20020	63.70	21020	89.50

The last two digits of our part number on the cable rack represent the outside width. The Channel Side Bar is the type most frequently used by the BOCs which we serve. CSF also stocks a complete line of installation hardware as well as equipment bays and framing material.

We appreciate the opportunity to quote on your requirements and look forward to serving your needs.

Sincerely,
CENTRAL STEEL FABRICATORS, Inc.
Michael Murzanski
Michael Murzanski

ADC TELECOMMUNICATIONS

Source document for Fiber Distribution Frame price.

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Subject: Re: Request for Quote for FDF
Date: Tue, 14 Oct 97 10:12:16 -0600
From: alpha_dobson@adc.com
To: <hobbs.london@sympatico.ca>

Al here is the revised list with $US pricing:

QTY	P/N	Description	Price
1	E-501-L88	UNIVERSAL FIBER FRAME, 7'	$1150.00 ea,
8	E-501-L14	96 termination connector module, SC	$1925.00 ea.
1	E-501-1139	Interbay management panel, 7'	$ 650.00 ea.
1	E-501-140	Cable Clamp	$ 35.00 ea.

If you need anything else, please let me know.

Regards,

____________________ Reply Separator ____________________

Subject: Request for Quote for FDF
Author: Al Hobbs <hobbs.london@sympatico.ca> at Internet-Mail
Date: 10/10/97 2:07 PM

Alpha, this is to request a quotation for the standard list price in US$ for the following equipment. I would appreciate a separate breakdown of Engineer, Furnishand
Install for each .

FIBER DISTRIBUTION FRAME-ADC

Qty	Item	Catalog Number
1	Universal Standard Frame 7'x 26" x 12"	EL501-L88
8	96 Termination Connector Module SC Adapters	EL501-L14
2	End Guards 12" x 7'	UEGP-7PW

Separate Shipment

1	Cable Clamp	E501-L40

As stated in our telephone conversation I am a Consultant currently retained by MCI Metro & AT&T and will use this information in constructing input to a Collocation Cost Model . This data will be included in the testimony which will
e
filed with various State Regulatory Authorities.

Please call if you have any question or wish to clarify this request. I would apprecatie a reply by Oct 16 if possible.

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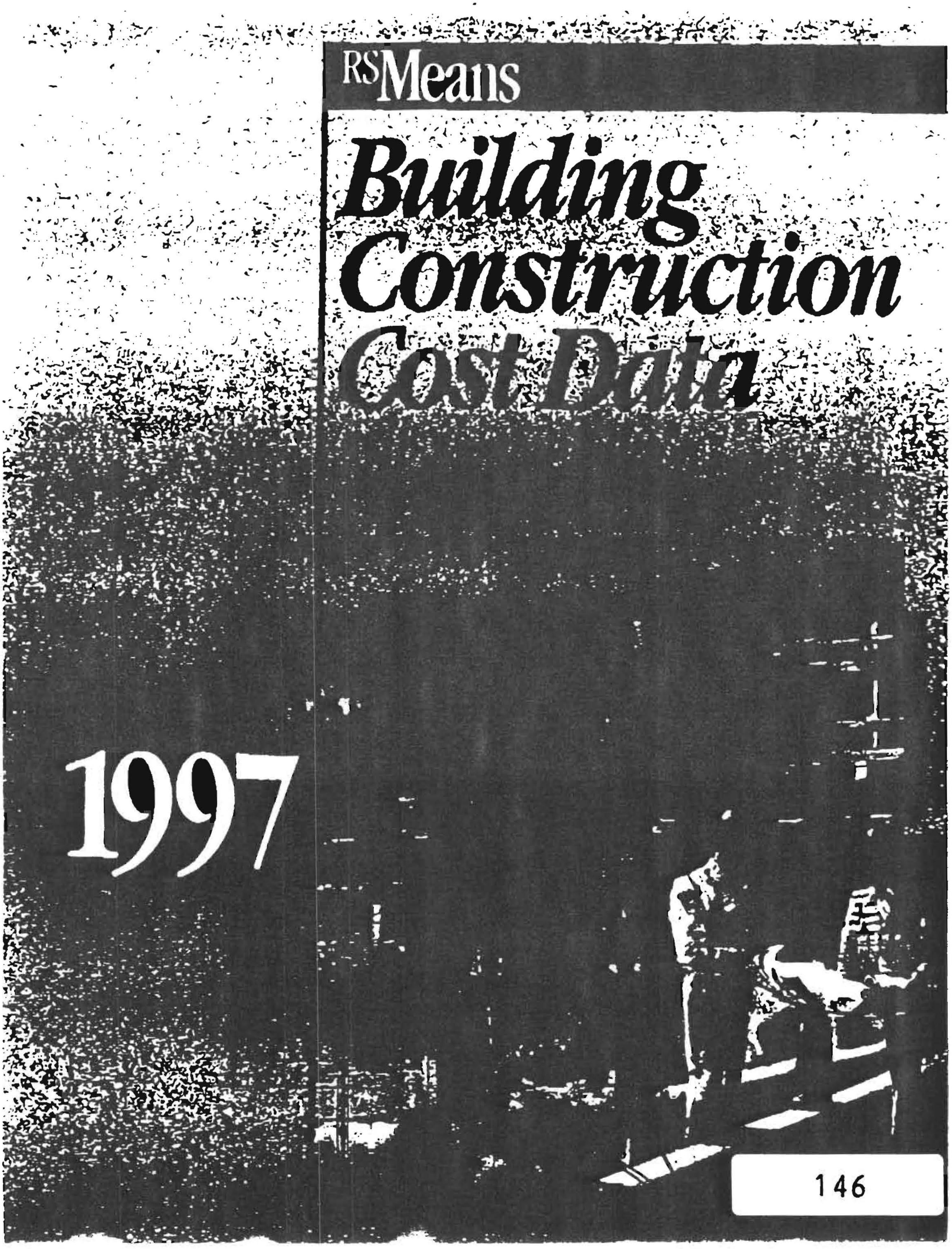
R. S. MEANS Building Construction Cost Data (1997)
R. S. MEANS Electrical Cost Data (1997)

Source documents for grounding, cage construction components, electrical components, and land and building calculations.


RSMeans
Building
Construction
Cost Data
1997
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028 | Site Improvements

028 100 | Irrigation Systems

		028 100 Irrigation Systems	CREW	DAILY OUTPUT	LABOR-HOURS	UNIT	1997 BARE COSTS MAT.	LABOR	EQUIP.	TOTAL	TOTAL INCL O&P
104	1305	Electric remote control valve, plastic, 3/4"	1 Skwk	18	.444	Ea.	12.35	11.80		24.15	3.
	1310	1"		13.50	.593		25.50	15.75		41.25	5.
	1320	1-1/2"		13.50	.593		41	15.75		56.75	7.
	1335	Quick coupling valves, brass, locking cover									
	1340	Inlet coupling valve, 3/4"	1 Skwk	18.75	.427	Ea.	46	11.35		57.35	6.
	1350	1"		18.75	.427		49.50	11.35		60.85	7.
	1360	Controller valve boxes, 6" round boxes		18.75	.427		3.07	11.35		14.42	2.
	1370	10" round boxes		14.25	.561		7.45	14.95		22.40	3.
	1380	12" square box		9.75	.821		13.15	22		35.15	4.
	1388	Electromech. control, 14 day 3-60 min, auto start to 23/day									
	1390	4 station	1 Skwk	.75	10.667	Ea.	108	284		392	57.
	1400	7 station		.46	17.204		120	460		580	85.
	1410	12 station		.30	26.846		190	715		905	1,32.
	1420	Dual programs, 18 station		.21	38.095		1,200	1,025		2,225	2,90.
	1430	23 station		.13	61.538		1,400	1,625		3,025	4,15.
	1435	Backflow preventer, bronze, 0-175 PSI, w/valves, test cocks									
	1440	3/4"	1 Skwk	2	4	Ea.	95	106		201	274
	1450	1"		2	4		102	106		208	281
	1460	1-1/2"		2	4		197	106		303	385
	1470	2"		2	4		223	106		329	415
	1475	Pressure vacuum breaker, brass, 15-150 PSI									
	1480	3/4"	1 Skwk	2	4	Ea.	47.50	106		153.50	22.
	1490	1"		2	4		88	106		194	266
	1500	1-1/2"		2	4		136	106		242	320
	1510	2"		2	4		152	106		258	335

028 200 | Fountains

		028 200 Fountains	CREW	DAILY OUTPUT	LABOR-HOURS	UNIT	MAT.	LABOR	EQUIP.	TOTAL	TOTAL INCL O&P
204	0010	FOUNTAINS Incl. fiberglass pools, pumps, piping and lights									
	0200	4' diameter pool, 18" diameter spray ring	Q-1	2	8	Ea.	750	221		971	1,150
	0300	6' diameter pool, 24" diameter spray ring		1.50	10.667		1,325	295		1,620	1,900
	0400	7.5' diameter pool, 48" diameter spray ring		1	16		1,925	440		2,365	2,775
	0500	Rain curtains, 3' rain bar, 2' x 4' x 1' pool		2	8		666	221		876	1,050
	0600	7' rain bar, 2' x 8' x 1' pool		1	16		1,400	440		1,840	2,200

028 300 | Fences & Gates

		028 300 Fences & Gates	CREW	DAILY OUTPUT	LABOR-HOURS	UNIT	MAT.	LABOR	EQUIP.	TOTAL	TOTAL INCL O&P
308	0010	FENCE, CHAIN LINK INDUSTRIAL									
	0020	6' H, 3 strands barb wire, 2" post @ 10' O.C., set in concrete									
	0200	9 ga. wire, galv. steel	B-80	250	.128	L.F.	6.15	2.85	1.85	10.85	13
	0300	Aluminized steel		250	.128		7.75	2.85	1.85	12.45	15
	0500	6 ga. wire, galv. steel		250	.128		9.75	2.85	1.85	14.45	17
	0600	Aluminized steel		250	.128		11.30	2.85	1.85	16	18
	0800	6 ga. wire, 6' high but omit barbed wire, galv. steel		260	.123		9.25	2.74	1.78	13.77	16
	0900	Aluminized steel		260	.123		12	2.74	1.78	16.52	19
	1100	Add for corner posts, 3" diam., galv. steel		40	.800	Ea.	50.50	17.85	11.60	79.95	96.
	1200	Aluminized steel		40	.800		61.50	17.85	11.60	90.95	109
	1300	Add for braces, galv. steel		80	.400		13.60	8.90	5.80	28.30	35
	1350	Aluminized steel		80	.400		16.80	8.90	5.80	31.50	38
	1400	Gate for 6' high fence, 1-5/8" frame, 3' wide, galv. steel		10	3.200		71.50	71.50	46.50	189.50	241
	1500	Aluminized steel		10	3.200		98.50	71.50	46.50	216.50	270
	2000	5'-0" high fence, 9 ga., no barbed wire, 2" line post,									
	2010	10' O.C., 1-5/8" top rail									
	2100	Galvanized steel	B-80	315	.102	L.F.	5.50	2.26	1.47	9.23	11.
	2200	Aluminized steel		315	.102	"	6.70	2.26	1.47	10.43	12.
	2400	Gate, 4' wide, 5' high, 2" frame, galv. steel		10	3.200	Ea.	93.50	71.50	46.50	211.50	265
	2500	Aluminized steel		10	3.200	"	101	71.50	46.50	219	273

...ring & Carpet

...esilient Tile Flooring

		CREW	DAILY OUTPUT	LABOR-HOURS	UNIT	1997 BARE COSTS MAT.	LABOR	EQUIP.	TOTAL	TOTAL INCL O&P	
	...ck	1 Tilf	315	.025	S.F.	2.78	.65		3.43	4.03	801
	...ck		315	.025		4.18	.65		4.83	5.55	
	...k		315	.025		4.65	.65		5.30	6.05	
	...sh, 1/8" thick		315	.025		3.58	.65		4.23	4.91	
	...ck		315	.025		4.72	.65		5.37	6.15	
2600	5/16" thick		315	.025		6.45	.65		7.10	8.05	
2650	1/2" thick		315	.025		9	.65		9.65	10.85	
3700	Polyethylene, in rolls, no base incl., landscape surfaces		275	.029		2.15	.75		2.90	3.48	
3800	Nylon action surface, 1/8" thick		275	.029		2.30	.75		3.05	3.64	
3900	1/4" thick		275	.029		3.32	.75		4.07	4.76	
4000	3/8" thick		275	.029		4.17	.75		4.92	5.70	
4100	Golf tee surface with foam back		235	.034		4.12	.87		4.99	5.80	
4200	Practice putting, knitted nylon surface		235	.034		3.50	.87		4.37	5.15	
4400	Polyurethane, thermoset, prefabricated in place, indoor										
4500	3/8" thick for basketball, gyms, etc	1 Tilf	100	.080	S.F.	3.30	2.05		5.35	6.65	
4600	1/2" thick for professional sports		95	.084		3.85	2.16		6.01	7.45	
4700	Outdoor, 1/4" thick, smooth, for tennis		100	.080		2.95	2.05		5	6.30	
4800	Rough, for track, 3/8" thick		95	.084		3.42	2.16		5.58	6.95	
5000	Poured in place, indoor, with finish, 1/4" thick		80	.100		2.43	2.56		4.99	6.45	
5050	3/8" thick		65	.123		2.95	3.16		6.11	7.95	
5100	1/2" thick		50	.160		3.92	4.10		8.02	10.40	
5500	Polyvinyl chloride, sheet goods for gyms, 1/4" thick		80	.100		3.36	2.56		5.92	7.30	
5600	3/8" thick		60	.133		3.79	3.42		7.21	9.20	
5900	Rubber, sheet goods, 36" wide, 1/8" thick		120	.067		2.95	1.71		4.66	5.80	
5950	3/16" thick		100	.080		4.20	2.05		6.25	7.65	
6000	1/4" thick		90	.089		4.85	2.28		7.13	8.75	
6050	Tile, marbleized colors, 12" x 12", 1/8" thick		400	.020		2.97	.51		3.48	4.03	
6100	3/16" thick		400	.020		4.25	.51		4.76	5.45	
6300	Special tile, plain colors, 1/8" thick		400	.020		3.75	.51		4.26	4.89	
6350	3/16" thick		400	.020		5.05	.51		5.56	6.30	
6410	Raised, radial or square, minimum		400	.020		4.90	.51		5.41	6.15	
6430	Maximum		400	.020		5.85	.51		6.36	7.20	
6450	For golf course, skating rink, etc., 1/4" thick		275	.029		5.75	.75		6.50	7.45	
6700	Synthetic turf, 3/8" thick		90	.089		3.10	2.28		5.38	6.80	
6750	Interlocking 2' x 2' squares, 1/2" thick, not										
6810	cemented, for playgrounds, minimum	1 Tilf	210	.038	S.F.	2.56	.98		3.54	4.27	
6850	Maximum		190	.042		6.55	1.08		7.63	8.85	
7000	Vinyl composition tile, 12" x 12", 1/16" thick		500	.016		.67	.41		1.08	1.35	
7050	Embossed		500	.016		.84	.41		1.25	1.53	
7100	Marbleized		500	.016		.84	.41		1.25	1.53	
7150	Solid		500	.016		.95	.41		1.36	1.66	
7200	3/32" thick, embossed		500	.016		.89	.41		1.30	1.59	
7250	Marbleized		500	.016		.96	.41		1.37	1.67	
7300	Solid		500	.016		1.40	.41		1.81	2.15	
7350	1/8" thick, marbleized CN		500	.016		1	.41		1.41	1.71	
7400	Solid		500	.016		1.63	.41		2.04	2.40	
7500	Vinyl tile, 12" x 12", .050" thick, minimum		500	.016		1.51	.41		1.92	2.27	
7550	Maximum		500	.016		2.95	.41		3.36	3.86	
7600	1/8" thick, minimum		500	.016		1.90	.41		2.31	2.70	
7650	Solid colors		500	.016		2.37	.41		2.78	3.22	
7700	Marbleized or Travertine pattern		500	.016		3.05	.41		3.46	3.96	
7750	Florentine pattern		500	.016		3.50	.41		3.91	4.46	
7800	Maximum		500	.016		7.20	.41		7.61	8.50	
8000	Vinyl sheet goods, backed, .065" thick, minimum		250	.032		1.23	.82		2.05	2.57	
8050	Maximum		200	.040		2.25	1.03		3.28	4	
8100	.080" thick, minimum		230	.035		1.45	.89		2.34	2.92	

087 | Hardware

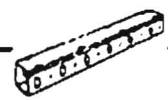
087 100 | Finish Hardware

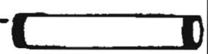
			CREW	DAILY OUTPUT	LABOR-HOURS	UNIT	1997 BARE COSTS MAT.	LABOR	EQUIP.	TOTAL	TOTAL INCL O&P
125	0050	Maximum	1 Carp	8	1	Ea.	218	26		244	[illegible]
	0100	Keyed, office/entrance/apartment, minimum		8	1		153	26		179	[illegible]
	0110	Maximum		7	1.143		262	29.50		291.50	[illegible]
	0120	Single cylinder, typical, minimum		8	1		131	26		157	[illegible]
	0130	Maximum		7	1.143		242	29.50		271.50	[illegible]
	0200	Hotel, minimum		7	1.143		162	29.50		191.50	[illegible]
	0210	Maximum		6	1.333		264	34.50		298.50	[illegible]
	0300	Communication, double cylinder, minimum		8	1		162	26		188	[illegible]
	0310	Maximum		7	1.143		210	29.50		239.50	[illegible]
	1000	Wrought knobs and sectional trim, non-keyed, passage, minimum		10	.800		85.50	20.50		106	[illegible]
	1010	Maximum		9	.889		168	23		191	[illegible]
	1040	Privacy, minimum		10	.800		100	20.50		120.50	[illegible]
	1050	Maximum		9	.889		180	23		203	[illegible]
	1100	Keyed, entrance, office/apartment, minimum		9	.889		148	23		171	[illegible]
	1110	Maximum		8	1		214	26		240	[illegible]
	1120	Single cylinder, typical, minimum		9	.889		142	23		165	[illegible]
	1130	Maximum		8	1		207	26		233	[illegible]
	2000	Cast knobs and full escutcheon trim									
	2010	Non-keyed, passage, minimum	1 Carp	9	.889	Ea.	181	23		204	[illegible]
	2020	Maximum		8	1		295	26		321	[illegible]
	2040	Privacy, minimum		9	.889		218	23		241	[illegible]
	2050	Maximum		8	1		315	26		341	[illegible]
	2120	Keyed, single cylinder, typical, minimum		8	1		218	26		244	[illegible]
	2130	Maximum		7	1.143		345	29.50		374.50	[illegible]
	2200	Hotel, minimum		7	1.143		262	29.50		291.50	[illegible]
	2210	Maximum		6	1.333		435	34.50		469.50	[illegible]
	3000	Cast knob and sectional trim, non-keyed, passage, minimum		10	.800		137	20.50		157.50	
	3010	Maximum		10	.800		273	20.50		293.50	
	3040	Privacy, minimum		10	.800		156	20.50		176.50	
	3050	Maximum		10	.800		273	20.50		293.50	
	3100	Keyed, office/entrance/apartment, minimum		9	.889		182	23		205	
	3110	Maximum		9	.889		287	23		310	
	3120	Single cylinder, typical, minimum		9	.889		182	23		205	
	3130	Maximum		9	.889		345	23		368	
	3190	For re-core cylinder, add					24			24	
	3900	Keyless, pushbutton type									
	4000	Residential/light commercial, deadbolt, standard	1 Carp	9	.889	Ea.	80	23		103	
	4010	Heavy duty		9	.889		95	23		118	
	4020	Industrial, heavy duty, with deadbolt		9	.889		194	23		217	
	4030	Key override		9	.889		215	23		238	
	4040	Lever activated handle ♿		9	.889		243	23		266	
	4050	Key override		9	.889		269	23		292	
	4060	Double sided pushbutton type		8	1		430	26		456	
	4070	Key override		8	1		465	26		491	
	4150	Card type, 1 time zone, minimum					270			270	
	4200	Maximum					910			910	[illegible]
	4250	3 time zones, minimum					685			685	
	4300	Maximum					1,575			1,575	[illegible]
	4350	System with printer, and control console, 3 zones				Total	7,675			7,675	[illegible]
	4400	6 zones				"	10,100			10,100	[illegible]
	4450	For each door, minimum, add				Ea.	1,125			1,125	[illegible]
	4500	Maximum, add				"	1,675			1,675	[illegible]
126	0010	HASP Steel, 3" assembly	1 Carp	15	.533	Ea.	2.13	13.80		15.93	
	0020	4-1/2"		15	.533		2.73	13.80		16.53	
	0040	6"		14	.571		4.08	14.80		18.88	

160 | Raceways

16 ELECTRICAL

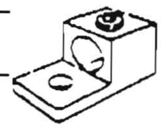
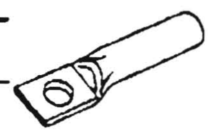
		160 100 | Cable Trays	CREW	DAILY OUTPUT	LABOR-HOURS	UNIT	1997 BARE COSTS MAT.	LABOR	EQUIP.	TOTAL	TOTAL INCL O&P
105	0010	CABLE TRAY LADDER TYPE w/ ftngs & supports, 4" dp., to 15' elev									
	0160	Galvanized steel tray									
	0170	4" rung spacing, 6" wide	1 Elec	49	.163	L.F.	7.70	4.91		12.61	15.80
	0200	12" wide		43	.186		9.25	5.60		14.85	18.60
	0400	18" wide		41	.195		10.75	5.85		16.60	20.50
	0600	24" wide		39	.205		12.35	6.15		18.50	23
	3200	Aluminum tray, 4" deep, 6" rung spacing, 6" wide		67	.119		10.55	3.59		14.14	17
	3220	12" wide		62	.129		11.80	3.88		15.68	18.80
	3230	18" wide		57	.140		13.15	4.22		17.37	21
	3240	24" wide	↓	53	.151	↓	14.60	4.54		19.14	23
	9980	Allow. for tray ftngs., 5% min.-20% max.									
150	0010	WIREWAY to 15' high									
	0100	Screw cover, with fittings and supports, 2-1/2" x 2-1/2"	1 Elec	45	.178	L.F.	7.35	5.35		12.70	16.10
	0200	4" x 4"		40	.200		8.10	6		14.10	17.90
	0400	6" x 6"		30	.267		13.75	8		21.75	27
	0600	8" x 8"	↓	20	.400	↓	19.60	12		31.60	39.50
	9980	Allow. for wireway ftngs., 5% min.-20% max.									
		160 200 | Conduits									
206	0010	CONDUIT To 15' high, includes 2 terminations, 2 elbows and (R160-205)									
	0020	11 beam clamps per 100 L.F.									
	0300	Aluminum, 1/2" diameter	1 Elec	100	.080	L.F.	1.07	2.40		3.47	4.79
	0500	3/4" diameter		90	.089		1.44	2.67		4.11	5.60
	0700	1" diameter		80	.100		1.95	3		4.95	6.65
	1000	1-1/4" diameter		70	.114		2.50	3.43		5.93	7.90
	1030	1-1/2" diameter		65	.123		3.10	3.70		6.80	8.95
	1050	2" diameter		60	.133		4.20	4.01		8.21	10.60
	1070	2-1/2" diameter		50	.160		6.75	4.81		11.56	14.65
	1100	3" diameter		45	.178		9	5.35		14.35	17.90
	1130	3-1/2" diameter		40	.200		11.10	6		17.10	21
	1140	4" diameter		35	.229		13.40	6.85		20.25	25
	1750	Rigid galvanized steel, 1/2" diameter		90	.089		1.30	2.67		3.97	5.45
	1770	3/4" diameter		80	.100		1.58	3		4.58	6.25
	1800	1" diameter		65	.123		2.20	3.70		5.90	7.95
	1830	1-1/4" diameter		60	.133		2.75	4.01		6.76	9.05
	1850	1-1/2" diameter		55	.145		3.30	4.37		7.67	10.20
	1870	2" diameter		45	.178		4.35	5.35		9.70	12.80
	1900	2-1/2" diameter		35	.229		7.50	6.85		14.35	18.55
	1930	3" diameter		25	.320		9.65	9.60		19.25	25
	1950	3-1/2" diameter		22	.364		12.15	10.95		23.10	30
	1970	4" diameter		20	.400		14.40	12		26.40	34
	2500	Steel, intermediate conduit (IMC), 1/2" diameter		100	.080		1.05	2.40		3.45	4.76
	2530	3/4" diameter		90	.089		1.25	2.67		3.92	5.40
	2550	1" diameter		70	.114		1.70	3.43		5.13	7
	2570	1-1/4" diameter		65	.123		2.20	3.70		5.90	7.95
	2600	1-1/2" diameter		60	.133		2.75	4.01		6.76	9.05
	2630	2" diameter		50	.160		3.35	4.81		8.16	10.90
	2650	2-1/2" diameter		40	.200		5.95	6		11.95	15.50
	2670	3" diameter		30	.267		7.85	8		15.85	20.50
	2700	3-1/2" diameter		27	.296		10.60	8.90		19.50	25
	2730	4" diameter		25	.320		12.55	9.60		22.15	28.50
	5000	Electric metallic tubing (EMT), 1/2" diameter		170	.047		.41	1.41		1.82	2.57
	5020	3/4" diameter CN		130	.062		.57	1.85		2.42	3.40
	5040	1" diameter		115	.070		.84	2.09		2.93	4.08
	5060	1-1/4" diameter	↓	100	.080	↓	1.24	2.40		3.64	4.97





161 | Conductors & Grounding

161 500 | Terminations

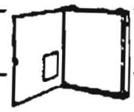
		161 500 Terminations	CREW	DAILY OUTPUT	LABOR-HOURS	UNIT	1997 BARE COSTS MAT.	LABOR	EQUIP.	TOTAL	TOTAL INCL O&P
520	0010	CABLE TERMINATIONS									
	0015	Wire connectors, screw type, #22 to #14	1 Elec	260	031	Ea.	05	92		97	1.45
	0020	#18 to #12		240	033		06	1		1.06	1.57
	0025	#18 to #10		240	033		08	1		1.08	1.59
	0030	Screw-on connectors, insulated, #18 to #12		240	033		07	1		1.07	1.58
	0035	#16 to #10		230	035		09	1.05		1.14	1.67
	0040	#14 to #8		210	038		19	1.14		1.33	1.93
	0045	#12 to #6		180	.044		.31	1.34		1.65	2.34
	0050	Terminal lugs, solderless, #16 to #10		50	.160		40	4.81		5.21	7.65
	0100	#8 to #4		30	.267		1.13	8		9.13	13.30
	0150	#2 to #1 		22	.364		2.65	10.95		13.60	19.30
	0200	1/0 to 2/0		16	500		5.05	15		20.05	28
	0250	3/0		12	667		5.05	20		25.05	35.50
	0300	4/0		11	727		5.05	22		27.05	38.50
	0350	250 MCM(kcmil)		9	889		5.15	26.50		31.65	45.50
	0400	350 MCM		7	1.143		11.95	34.50		46.45	64.50
	0450	500 MCM	↓	6	1.333	↓	11.95	40		51.95	73
	1600	Crimp 1 hole lugs, copper or aluminum, 600 volt									
	1620	#14	1 Elec	60	.133	Ea.	20	4.01		4.21	6.20
	1630	#12		50	.160		.27	4.81		5.08	7.50
	1640	#10		45	.178		27	5.35		5.62	8.30
	1700	#8		36	.222		.85	6.70		7.55	10.95
	1800	#6		30	.267		.94	8		8.94	13.10
	2000	#4		27	.296		1.23	8.90		10.13	14.70
	2200	#2 		24	.333		2.40	10		12.40	17.70
	2400	#1		20	400		2.45	12		14.45	21
	2600	2/0		15	533		3.15	16.05		19.20	27.50
	2800	3/0		12	.667		3.75	20		23.75	34
	3000	4/0		11	727		4.25	22		26.25	37.5C
	3200	250 MCM(kcmil)		9	889		4.95	26.50		31.45	45.5C
	3400	300 MCM		8	1		6.05	30		36.05	51.5C
	3500	350 MCM		7	1.143		6.15	34.50		40.65	58.5C
	3600	400 MCM		6.50	1.231		6.90	37		43.90	63
	3800	500 MCM	↓	6	1.333	↓	8.20	40		48.20	69

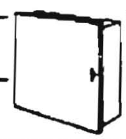
161 800 | Grounding

		161 800 Grounding	CREW	DAILY OUTPUT	LABOR-HOURS	UNIT	MAT.	LABOR	EQUIP.	TOTAL	TOTAL INCL O&P
810	0010	GROUNDING									
	0030	Rod, copper clad, 8' long, 1/2" diameter 	1 Elec	5.50	1.455	Ea.	13.65	43.50		57.15	80.5
	0050	3/4" diameter		5.30	1.509		25	45.50		70.50	95.5
	0080	10' long, 1/2" diameter		4.80	1.667		18.90	50		68.90	96
	0100	3/4" diameter		4.40	1.818		30.50	54.50		85	116
	0130	15' long, 3/4" diameter		4	2	↓	73.50	60		133.50	171
	0400	Bare copper, #6 wire		10	800	C.L.F.	24.50	24		48.50	63
	0600	#2		5	1.600		60	48		108	138
	0800	3/0		3.30	2.424		142	73		215	265
	1000	4/0		2.85	2.807		183	84.50		267.50	330
	1200	250 MCM(kcmil)	↓	2.40	3.333	↓	203	100		303	375
	1800	Water pipe ground clamps, heavy duty									
	2000	Bronze, 1/2" to 1" diameter	1 Elec	8	1	Ea.	8.50	30		38.50	54
	2100	1-1/4" to 2" diameter		8	1		12	30		42	58
	2200	2-1/2" to 3" diameter		6	1.333		32	40		72	95
	2800	Brazed connections, #6 wire		12	667		9.60	20		29.60	40
	3000	#2 wire		10	800		12.85	24		36.85	50
	3100	3/0 wire		8	1		19.35	30		49.35	66
	3200	4/0 wire		7	1.143		22	34.50		56.50	75
	3400	250 MCM wire	↓	5	1.600	↓	26	48		74	101

162 100 | Boxes

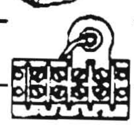
		162 100 Boxes	Crew	Daily Output	Labor-Hours	Unit	1997 Bare Costs Mat.	Labor	Equip.	Total	Total Incl O&P
130	3150	10" L x 6" W x 6" D	1 Elec	2.50	3.200	Ea.	202	96		298	365
	3200	12" L x 12" W x 6" D		2	4		340	120		460	565
	3250	16" L x 16" W x 6" D		1.30	6.154		670	185		855	1,025
	3300	20" L x 20" W x 6" D		.80	10		1,250	300		1,550	1,825
	3350	24" L x 18" W x 8" D		.70	11.429		1,375	345		1,720	2,025
	3400	24" L x 24" W x 10" D		.50	16		2,025	480		2,505	2,950
	3450	30" L x 24" W x 12" D		.40	20		2,750	600		3,350	3,925
	3500	36" L x 36" W x 12" D	↓	.20	40	↓	4,350	1,200		5,550	6,575
	6000	J.I.C. wiring boxes, NEMA 12, dust tight & drip tight									
	6050	6" L x 8" W x 4" D	1 Elec	10	.800	Ea.	29.50	24		53.50	68.50
	6100	8" L x 10" W x 4" D		8	1		37.50	30		67.50	86.50
	6150	12" L x 14" W x 6" D		5.30	1.509		59	45.50		104.50	133
	6200	14" L x 16" W x 6" D		4.70	1.702		71.50	51		122.50	156
	6250	16" L x 20" W x 6" D		4.40	1.818		153	54.50		207.50	250
	6300	24" L x 30" W x 6" D		3.20	2.500		225	75		300	360
	6350	24" L x 30" W x 8" D		2.90	2.759		240	83		323	390
	6400	24" L x 36" W x 8" D		2.70	2.963		265	89		354	425
	6450	24" L x 42" W x 8" D		2.30	3.478		290	105		395	475
	6500	24" L x 48" W x 8" D	↓	2	4	↓	315	120		435	530
	7000	Cabinets, current transformer									
	7050	Single door, 24" H x 24" W x 10" D	1 Elec	1.60	5	Ea.	91	150		241	325
	7100	30" H x 24" W x 10" D		1.30	6.154		108	185		293	395
	7150	36" H x 24" W x 10" D		1.10	7.273		122	219		341	465
	7200	30" H x 30" W x 10" D		1	8		131	240		371	505
	7250	36" H x 30" W x 10" D		.90	8.889		160	267		427	575
	7300	36" H x 36" W x 10" D		.80	10		166	300		466	635
	7500	Double door, 48" H x 36" W x 10" D		.60	13.333		350	400		750	985
	7560	24" H x 24" W x 12" D	↓	1	8	↓	182	240		422	560





162 300 | Wiring Devices

		162 300 Wiring Devices	Crew	Daily Output	Labor-Hours	Unit	Mat.	Labor	Equip.	Total	Total Incl O&P
310	0010	LOW VOLTAGE SWITCHING									
	3600	Relays, 120 V or 277 V standard	1 Elec	12	.667	Ea.	26	20		46	58.
	3800	Flush switch, standard		40	.200		9.05	6		15.05	18
	4000	Interchangeable		40	.200		11.80	6		17.80	22
	4100	Surface switch, standard		40	.200		6.60	6		12.60	16
	4200	Transformer 115 V to 25 V		12	.667		93	20		113	132
	4400	Master control, 12 circuit, manual		4	2		94	60		154	193
	4500	25 circuit, motorized		4	2		102	60		162	202
	4600	Rectifier, silicon		12	.667		30.50	20		50.50	63
	4800	Switchplates, 1 gang, 1, 2 or 3 switch, plastic		80	.100		3	3		6	7
	5000	Stainless steel		80	.100		8.10	3		11.10	13
	5400	2 gang, 3 switch, stainless steel		53	.151		15.65	4.54		20.19	24
	5500	4 switch, plastic		53	.151		6.70	4.54		11.24	14
	5800	3 gang, 9 switch, stainless steel	↓	32	.250	↓	50	7.50		57.50	66
320	0010	WIRING DEVICES									
	0200	Toggle switch, quiet type, single pole, 15 amp CN	1 Elec	40	.200	Ea.	4.10	6		10.10	1
	0600	3 way, 15 amp		23	.348		6.30	10.45		16.75	2
	0900	4 way, 15 amp		15	.533		20	16.05		36.05	4
	1650	Dimmer switch, 120 volt, incandescent, 600 watt, 1 pole		16	.500		10.60	15		25.60	3
	2460	Receptacle, duplex, 120 volt, grounded, 15 amp		40	.200		2.25	6		8.25	1
	2470	20 amp		27	.296		5.95	8.90		14.85	1
	2490	Dryer, 30 amp		15	.533		11.60	16.05		27.65	3
	2500	Range, 50 amp		11	.727		14.25	22		36.25	4
	2600	Wall plates, stainless steel, 1 gang		80	.100		1.70	3		4.70	[illegible]
	2800	2 gang		53	.151		4.15	4.54		8.69	[illegible]
	3200	Lampholder, keyless	↓	26	.308	↓	3.05	9.25		12.30	[illegible]



162 | Boxes & Wiring Devices

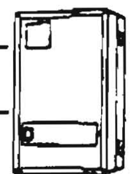
162 300 | Wiring Devices

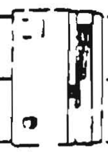
			CREW	DAILY OUTPUT	LABOR-HOURS	UNIT	1997 BARE COSTS MAT.	LABOR	EQUIP.	TOTAL
320	3400	Pullchain with receptacle	1 Elec	22	.364	Ea.	8.25	10.95		19.20

163 | Motors, Starters, Boards & Switches

163 100 | Starters & Controls

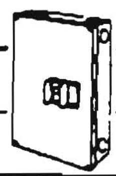
			CREW	DAILY OUTPUT	LABOR-HOURS	UNIT	1997 BARE COSTS MAT.	LABOR	EQUIP.	TOTAL
130	0010	MOTOR STARTERS & CONTROLS R160-580								
	0050	Magnetic, FVNR, with enclosure and heaters, 480 volt								
	0100	5 HP, size 0	1 Elec	2.30	3.478	Ea.	182	105		287
	0200	10 HP, size 1		1.60	5		218	150		368
	0300	25 HP, size 2		1.10	7.273		410	219		629
	0400	50 HP, size 3		.90	8.889		670	267		937
	0500	100 HP, size 4		.60	13.333		1,475	400		1,875
	0600	200 HP, size 5		.45	17.778		3,475	535		4,010
	0700	Combination, with motor circuit protectors, 5 HP, size 0		1.80	4.444		585	134		719
	0800	10 HP, size 1		1.30	6.154		605	185		790
	0900	25 HP, size 2		1	8		850	240		1,090
	1000	50 HP, size 3		.66	12.121		1,225	365		1,590
	1200	100 HP, size 4		.40	20		2,675	600		3,275
	1400	Combination, with fused switch, 5 HP, size 0		1.80	4.444		445	134		579
	1600	10 HP, size 1		1.30	6.154		470	185		655
	1800	25 HP, size 2		1	8		725	240		965
	2000	50 HP, size 3		.66	12.121		1,200	365		1,565
	2200	100 HP, size 4		.40	20		2,275	600		2,875

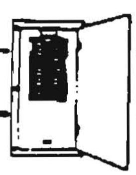




163 200 | Boards

			CREW	DAILY OUTPUT	LABOR-HOURS	UNIT	MAT.	LABOR	EQUIP.	TOTAL
205	0010	CIRCUIT BREAKERS (in enclosure)								
	0100	Enclosed (NEMA 1), 600 volt, 3 pole, 30 amp	1 Elec	3.20	2.500	Ea.	300	75		375
	0200	60 amp		2.80	2.857		300	86		386
	0400	100 amp		2.30	3.478		335	105		440
	0600	225 amp		1.50	5.333		880	160		1,040
	0700	400 amp		.80	10		1,500	300		1,800
	0800	600 amp		.60	13.333		2,175	400		2,575
	1000	800 amp		.47	17.021		2,825	510		3,335
245	0010	PANELBOARDS (Commercial use)								
	0050	NQOD, w/20 amp 1 pole bolt-on circuit breakers								
	0100	3 wire, 120/240 volts, 100 amp main lugs								
	0150	10 circuits	1 Elec	1	8	Ea.	390	240		630
	0200	14 circuits		.88	9.091		455	273		728
	0250	18 circuits		.75	10.667		500	320		820
	0300	20 circuits		.65	12.308		560	370		930
	0350	225 amp main lugs, 24 circuits		.60	13.333		635	400		1,035
	0400	30 circuits		.45	17.778		740	535		1,275
	0450	36 circuits		.40	20		845	600		1,445
	0500	38 circuits		.36	22.222		910	670		1,580
	0550	42 circuits		.33	24.242		950	730		1,680
	0600	4 wire, 120/208 volts, 100 amp main lugs, 12 circuits		1	8		440	240		680
	0650	16 circuits		.75	10.667		505	320		825
	0700	20 circuits		.65	12.308		590	370		960
	0750	24 circuits CN		.60	13.333		630	400		1,030





16 ELECTRICAL

74

166 | Lighting

		166 100 | Lighting	CREW	DAILY OUTPUT	LABOR-HOURS	UNIT	1997 BARE COSTS MAT.	LABOR	EQUIP.	TOTAL	TOTAL INCL O&P
115	5600	2 arms	1 Elec	8	1	Ea.	180	30		210	243
	5800	3 arms		5.30	1.509		240	45.50		285.50	330
	6000	4 arms		5.30	1.509		360	45.50		405.50	465
130	0010	INTERIOR LIGHTING FIXTURES including lamps, mounting									
	0030	hardware and connections									
	0100	Flourescent, C.W. lamps, troffer, recess mounted in grid, RS									
	0200	Acrylic lens, 1'W x 4'L, two 40 watt	1 Elec	5.70	1.404	Ea.	45	42		87	113
	0210	1'W x 4'L, three 40 watt		5.40	1.481		57	44.50		101.50	130
	0300	2'W x 2'L, two U40 watt		5.70	1.404		53	42		95	122
	0400	2'W x 4'L, two 40 watt		5.30	1.509		52	45.50		97.50	125
	0500	2'W x 4'L, three 40 watt		5	1.600		61	48		109	139
	0600	2'W x 4'L, four 40 watt CN		4.70	1.702		65	51		116	149
	0700	4'W x 4'L, four 40 watt		3.20	2.500		240	75		315	375
	0800	4'W x 4'L, six 40 watt		3.10	2.581		250	77.50		327.50	390
	0900	4'W x 4'L, eight 40 watt		2.90	2.759		260	83		343	410
	1000	Surface mounted, RS									
	1030	Acrylic lens with hinged & latched door frame									
	1100	1'W x 4'L, two 40 watt	1 Elec	7	1.143	Ea.	68	34.50		102.50	127
	1110	1'W x 4'L, three 40 watt		6.70	1.194		78	36		114	140
	1200	2'W x 2'L, two U40 watt		7	1.143		90.50	34.50		125	151
	1300	2'W x 4'L, two 40 watt		6.20	1.290		73	39		112	139
	1400	2'W x 4'L, three 40 watt		5.70	1.404		87	42		129	159
	1500	2'W x 4'L, four 40 watt		5.30	1.509		87	45.50		132.50	164
	1600	4'W x 4'L, four 40 watt		3.60	2.222		290	67		357	420
	1700	4'W x 4'L, six 40 watt		3.30	2.424		320	73		393	460
	1800	4'W x 4'L, eight 40 watt		3.10	2.581		330	77.50		407.50	480
	1900	2'W x 8'L, four 40 watt		3.20	2.500		150	75		225	278
	2000	2'W x 8'L, eight 40 watt		3.10	2.581		170	77.50		247.50	305
	2100	Strip fixture									
	2130	Surface mounted									
	2200	4' long, one 40 watt RS	1 Elec	8.50	.941	Ea.	28	28.50		56.50	73.5
	2300	4' long, two 40 watt RS		8	1		30	30		60	78
	2400	4' long, one 40 watt, SL		8	1		42	30		72	91
	2500	4' long, two 40 watt, SL		7	1.143		57	34.50		91.50	114
	2600	8' long, one 75 watt, SL		6.70	1.194		42	36		78	100
	2700	8' long, two 75 watt, SL		6.20	1.290		48	39		87	111
	2800	4' long, two 60 watt, HO		6.70	1.194		78	36		114	140
	2900	8' long, two 110 watt, HO		5.30	1.509		84	45.50		129.50	161
	3000	Pendent mounted, industrial, white porcelain enamel									
	3100	4' long, two 40 watt, RS	1 Elec	5.70	1.404	Ea.	48	42		90	117
	3200	4' long, two 60 watt, HO		5	1.600		78	48		126	158
	3300	8' long, two 75 watt, SL		4.40	1.818		90	54.50		144.50	181
	3400	8' long, two 110 watt, HO		4	2		118	60		178	220
	3470	Troffer, air handling, 2'W x 4'L with four 40 watt, RS		4	2		110	60		170	211
	3480	2'W x 2'L with two U40 watt RS		5.50	1.455		90	43.50		133.50	166
	3490	Air connector insulated, 5" diameter		20	.400		52	12		64	75
	3500	6" diameter		20	.400		53	12		65	76.5
	3580	Mercury vapor, integral ballast, ceiling, recess mounted,									
	3590	prismatic glass lens, floating door									
	3600	2'W x 2'L, 250 watt DX lamp	1 Elec	3.20	2.500	Ea.	265	75		340	405
	3700	2'W x 2'L, 400 watt DX lamp		2.90	2.759		275	83		358	430
	3800	Surface mtd., prismatic lens, 2'W x 2'L, 250 watt DX lamp		2.70	2.963		245	89		334	405
	3900	2'W x 2'L, 400 watt DX lamp		2.40	3.333		265	100		365	440
	4000	High bay, aluminum reflector									
	4030	Single unit, 400 watt DX lamp	1 Elec	2.30	3.478	Ea.	255	105		360	440

16 ELECTRICAL

171 | S.F., C.F. and % of Total Costs

171 000 | S.F. & C.F. Costs

				Unit	Unit Costs 1/4	Unit Costs Median	Unit Costs 3/4	% of Total 1/4	% of Total Median
740	2900	Electrical	R171 -100	S.F.	5.50	7.05	9	8.40%	10%
	3100	Total: Mechanical & Electrical			19.10	21.15	29.85	25.30%	28%
	9000	Per pupil, total cost		Ea.	5,900	9,800	31,900		
		Total: Mechanical & Electrical		•	1,975	2,500	10,100		
760	0010	SCHOOLS Junior High & Middle	R171 -100	S.F.	60.10	75	87.10		
	0020	Total project costs		C.F.	3.96	5.25	5.90		
	0500	Masonry		S.F.	6.80	9.05	11.15	8.80%	11.10%
	1800	Equipment			2.02	3.25	5	2.60%	4.30%
	2720	Plumbing			4.01	4.53	5.90	5.60%	6.90%
	2770	Heating, ventilating, air conditioning			4.61	8.90	12.40	8.70%	12.70%
	2900	Electrical			5.80	7.30	8.80	7.80%	9.40%
	3100	Total: Mechanical & Electrical			16.80	21.10	28	23.30%	25.70%
	9000	Per pupil, total cost		Ea.	7,600	8,700	10,800		
780	0010	SCHOOLS Senior High	R171 -100	S.F.	65.95	75.65	104		
	0020	Total project costs		C.F.	4.20	5.55	7.60		
	1800	Equipment		S.F.	1.73	4.07	6	2.30%	3.70%
	2720	Plumbing			3.36	6.15	10.10	5%	6.90%
	2770	Heating, ventilating, air conditioning			7.65	8.60	16.40	8.90%	11.60%
	2900	Electrical			6.45	8.40	14	8.30%	10%
	3100	Total: Mechanical & Electrical			17.45	23	42.90	19.80%	23.40%
	9000	Per pupil, total cost		Ea.	6,200	10,500	15,800		
800	0010	SCHOOLS Vocational	R171 -100	S.F.	53	75.30	95.45		
	0020	Total project costs		C.F.	3.30	4.74	6.55		
	0500	Masonry		S.F.	3.10	7.70	11.85	4%	10.90%
	1800	Equipment		•	1.66	2.30	5.70	2.80%	3.40%
	2720	Plumbing		S.F.	3.46	5.20	7.45	5.30%	7%
	2770	Heating, ventilating, air conditioning			4.90	8.85	14.80	8.80%	11.90%
	2900	Electrical			5.55	7.65	10.70	8.40%	11.40%
	3100	Total: Mechanical & Electrical			14.35	19.20	25.95	21.70%	27.30%
	9000	Per pupil, total cost		Ea.	7,550	19,800	29,600		
830	0010	SPORTS ARENAS	R171 -100	S.F.	46.70	62.10	91.10		
	0020	Total project costs		C.F.	2.52	4.61	5.85		
	2720	Plumbing		S.F.	2.40	4.09	7.50	4.50%	6.30%
	2770	Heating, ventilating, air conditioning			4.93	6.86	8.95	5.80%	10.20%
	2900	Electrical			3.99	6.40	7.90	7.60%	9.90%
	3100	Total: Mechanical & Electrical			12.05	21.40	27.52	13.40%	22.50%
850	0010	SUPERMARKETS	R171 -100	S.F.	42.85	50.30	60.15		
	0020	Total project costs		C.F.	2.44	2.89	4.38		
	2720	Plumbing		S.F.	2.40	3.02	3.54	5.40%	6%
	2770	Heating, ventilating, air conditioning			3.53	4.33	5.15	8.60%	8.60%
	2900	Electrical			5	6.20	7.50	10.40%	12.40%
	3100	Total: Mechanical & Electrical			13.70	15	19.60	18%	24.10%
860	0010	SWIMMING POOLS	R171 -100	S.F.	77.20	92.55	162		
	0020	Total project costs		C.F.	5.70	6.60	7.75		
	2720	Plumbing		S.F.	6.40	7.45	10.45	4.80%	9.60%
	2900	Electrical			5.25	7.30	10.55	7.50%	7.80%
	3100	Total: Mechanical & Electrical			11.40	24	44.45	17.70%	24.90%
[illegible]	0010	TELEPHONE EXCHANGES	R171 -100	S.F.	94.10	135	173		
	0020	Total project costs		C.F.	5.70	8.75	12.65		
	2720	Plumbing		S.F.	3.80	6	8.80	3.90%	5.30%
	2770	Heating, ventilating, air conditioning			7.90	18.20	22.60	11.40%	[illegible]
	2900	Electrical			[illegible]	14.30	[illegible]	[illegible]	[illegible]
	3100	Total: Mechanical & Electrical			20.20	27.75	52.65	27.30%	[illegible]
910	0010	THEATERS	R171 -100	S.F.	58.05	75.30	110		
	0020	Total project costs		C.F.	2.68	3.96	5.85		
	2720	Plumbing		S.F.	1.81	2.10	6.30	2.90%	4.70%
	2770	Heating, ventilating, air conditioning			5.65	6.85	8.45	8%	12.20%

17 SQUARE FOOT

R171-100 Square Foot Project Size Modifier

One factor that affects the S.F. cost of a particular building is the size. In general, for buildings built to the same specifications in the same locality, the larger building will have the lower S.F. cost. This is due mainly to the decreasing contribution of the exterior walls plus the economy of scale usually achievable in larger buildings. The Area Conversion Scale shown below will give a factor to convert costs for the typical size building to an adjusted cost for the particular project.

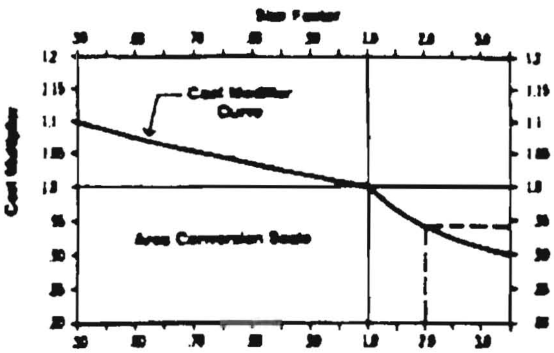
The Square Foot Base Size lists the median costs, most typical projec our accumulated data and the range in size of the projects.

The Size Factor for your project is determined by dividing your proje in S.F. by the typical project size for the particular Building Type. Wi this factor, enter the Area Conversion Scale at the appropriate Size Fa and determine the appropriate cost multiplier for your building size.

Example: Determine the cost per S.F. for a 100,000 S.F Mid-rise apartment building.

$$\frac{\text{Proposed building area} = 100{,}000 \text{ S.F.}}{\text{Typical size from below} = 50{,}000 \text{ S.F.}} = 2.00$$

Enter Area Conversion scale at 2.0, intersect curve, read horizontally the appropriate cost multiplier of .94. Size adjusted cost becomes .94 x $64.35 = $60.50 based on national average costs.



Note: For Size Factors less than .50, the Cost Multiplier is 1.1
For Size Factors greater than 3.5, the Cost Multiplier is .90

Square Foot Base Size

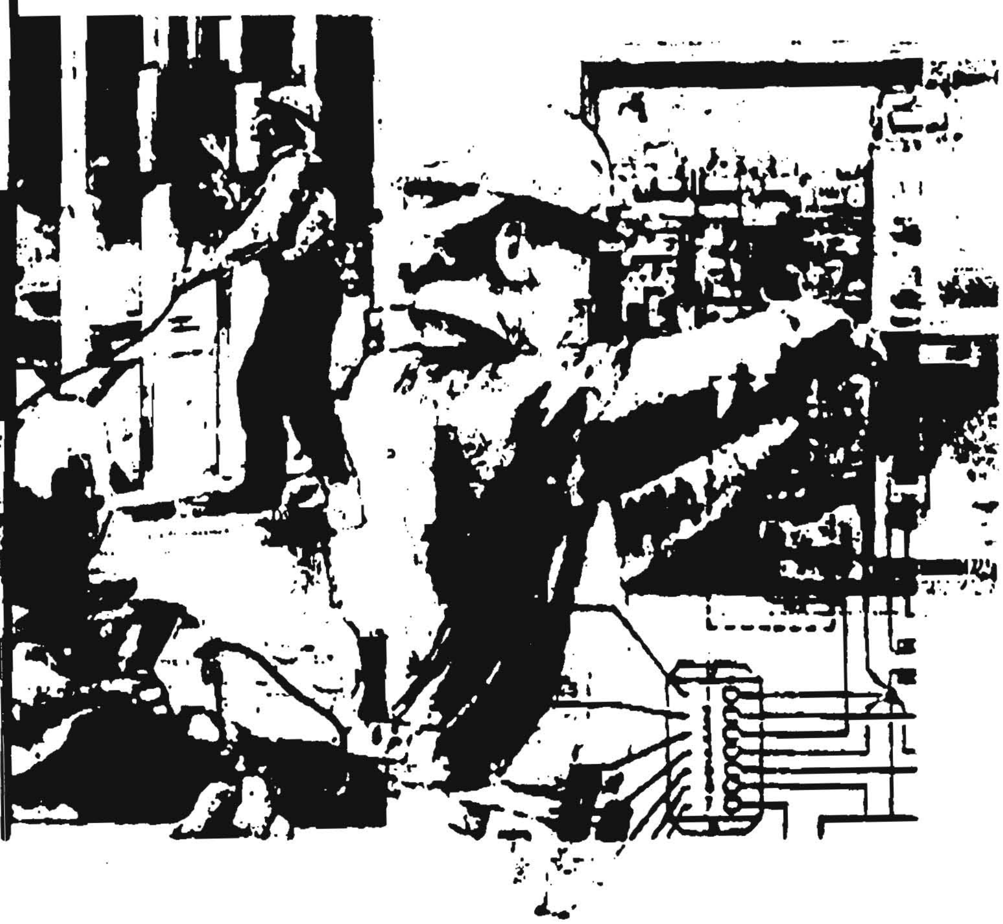
Building Type	Median Cost per S.F.	Typical Size Gross S.F.	Typical Range Gross S.F.	Building Type	Median Cost per S.F.	Typical Size Gross S.F.	Typical R Gross S
Apartments, Low Rise	$ 51.00	21,000	9,700.00 - 37,200	Jails	$155.00	13,700	7,500 -
Apartments, Mid Rise	64.35	50,000	32,000 - 100,000	Libraries	90.90	12,000	7,000 -
Apartments, High Rise	73.60	310,000	100,000 - 650,000	Medical Clinics	86.95	7,200	4,200 -
Auditoriums	85.60	25,000	7,600 - 39,000	Medical Offices	81.70	6,000	4,000 -
Auto Sales	52.20	20,000	10,800 - 28,600	Motels	62.60	27,000	15,800 -
Banks	113.00	4,200	2,500 - 7,500	Nursing Homes	84.00	23,000	15,000 -
Churches	76.35	9,000	5,300 - 13,200	Offices, Low Rise	68.30	8,600	4,700 -
Clubs, Country	76.00	6,500	4,500 - 15,000	Offices, Mid Rise	72.35	52,000	31,300 -
Clubs, Social	73.95	10,000	6,000 - 13,500	Offices, High Rise	91.60	260,000	151,000 -
Clubs, YMCA	77.75	28,300	12,800 - 39,400	Police Stations	114.00	10,500	4,000 -
Colleges (Class)	99.60	50,000	23,500 - 98,500	Post Offices	84.40	12,400	6,800 -
Colleges (Science Lab)	145.00	45,600	16,600 - 80,000	Power Plants	645.00	7,500	1,000 -
College (Student Union)	111.00	33,400	16,000 - 85,000	Religious Education	70.70	9,000	6,000 -
Community Center	79.45	9,400	5,300 - 16,700	Research	119.00	19,000	6,300 -
Court Houses	108.00	32,400	17,800 - 106,000	Restaurants	102.00	4,400	2,800 -
Dept. Stores	47.15	90,000	44,000 - 122,000	Retail Stores	50.10	7,200	4,000 -
Dormitories, Low Rise	81.45	24,500	13,400 - 40,000	Schools, Elementary	73.00	41,000	24,500 -
Dormitories, Mid Rise	106.00	55,600	36,100 - 90,000	Schools, Jr. High	75.00	92,000	52,000 -
Factories	45.70	26,400	12,900 - 50,000	Schools, Sr. High	75.65	101,000	50,500 -
Fire Stations	82.00	5,800	4,000 - 8,700	Schools, Vocational	75.30	37,000	20,500 -
Fraternity Houses	78.55	12,500	8,200 - 14,800	Sports Arenas	62.10	15,000	5,000 -
Funeral Homes	87.75	7,800	4,500 - 11,000	Supermarkets	50.30	20,000	12,000 -
Garages, Commercial	55.75	9,300	5,000 - 13,600	Swimming Pools	92.55	13,000	7,800 -
Garages, Municipal	71.30	8,300	4,500 - 12,600	Telephone Exchange	135.00	4,500	1,200 -
Garages, Parking	29.25	163,000	76,400 - 225,300	Theaters	75.30	10,500	8,800 -
Gymnasiums	73.75	19,200	11,600 - 41,000	Town Halls	81.95	10,800	4,800 -
Hospitals	141.00	55,000	27,200 - 125,000	Warehouses	33.75	25,000	8,000 -
House (Elderly)	69.25	37,000	21,000 - 66,000	Warehouse & Office	39.00	25,000	8,000 -
Housing (Public)	63.90	36,000	14,400 - 74,400				
Ice Rinks	72.20	29,000	27,200 - 33,600				

RSMeans

Electrical Cost Data

20th Annual Edition

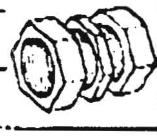
1997

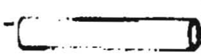


160 | Raceways

160 200 | Conduits

	160 200 | Conduits	CREW	DAILY OUTPUT	LABOR-HOURS	UNIT	1997 BARE COSTS MAT.	LABOR	EQUIP.	TOTAL	TOTAL INCL O&P
205 8550	2" diameter	1 Elec	320	.025	Ea.	4.04	.75		4.79	5.55
8560	2-1/2" diameter		266	.030		7.80	.90		8.70	9.90
8570	3" diameter		160	.050		11.15	1.50		12.65	14.50
8580	3-1/2" diameter		133	.060		15.05	1.81		16.86	19.25
8590	4" diameter		100	.080		33	2.40		35.40	39.50
8600	Offset connectors, 1/2" diameter		40	.200		2.08	6		8.08	11.25
8610	3/4" diameter		32	.250		2.98	7.50		10.48	14.55
8620	1" diameter		24	.333		4.93	10		14.93	20.50
8650	90° pulling elbows, female, 1/2" diameter, with gasket		24	.333		3.60	10		13.60	19
8660	3/4" diameter		20	.400		5.50	12		17.50	24
8700	Couplings, compression, 1/2" diameter, steel					1.66			1.66	1.83
8710	3/4" diameter					2.34			2.34	2.57
8720	1" diameter					3.60			3.60	3.96
8730	1-1/4" diameter					6.95			6.95	7.65
8740	1-1/2" diameter					10.30			10.30	11.30
8750	2" diameter					13.95			13.95	15.30
8760	2-1/2" diameter					57.50			57.50	63
8770	3" diameter					72			72	79
8780	3-1/2" diameter					112			112	124
8790	4" diameter					115			115	126
8800	Box connectors, compression, 1/2" diam., steel	1 Elec	120	.067		1.47	2		3.47	4.63
8810	3/4" diameter		110	.073		1.96	2.19		4.15	5.45
8820	1" diameter		90	.089		3.25	2.67		5.92	7.60
8830	1-1/4" diameter		70	.114		6.30	3.43		9.73	12.10
8840	1-1/2" diameter		60	.133		9.25	4.01		13.26	16.20
8850	2" diameter		50	.160		13.75	4.81		18.56	22.50
8860	2-1/2" diameter		36	.222		47	6.70		53.70	61.50
8870	3" diameter		27	.296		63	8.90		71.90	83
8880	3-1/2" diameter		21	.381		95.50	11.45		106.95	122
8890	4" diameter		16	.500		98	15		113	131
8900	Box connectors, insulated compression, 1/2" diam., steel		120	.067		1.66	2		3.66	4.84
8910	3/4" diameter		110	.073		2.34	2.19		4.53	5.85
8920	1" diameter		90	.089		3.60	2.67		6.27	7.95
8930	1-1/4" diameter		70	.114		7.20	3.43		10.63	13.05
8940	1-1/2" diameter		60	.133		12.20	4.01		16.21	19.45
8950	2" diameter		50	.160		17.80	4.81		22.61	27
8960	2-1/2" diameter		36	.222		59	6.70		65.70	75
8970	3" diameter		27	.296		76	8.90		84.90	97
8980	3-1/2" diameter		21	.381		105	11.45		116.45	133
8990	4" diameter		16	.500		113	15		128	147
9100	PVC, #40, 1/2" diameter		190	.042	L.F.	.54	1.27		1.81	2.49
9110	3/4" diameter		145	.055		.66	1.65		2.31	3.20
9120	1" diameter		125	.064		.90	1.97		2.87	3.88
9130	1-1/4" diameter		110	.073		1.20	2.19		3.39	4.60
9140	1-1/2" diameter		100	.080		1.40	2.40		3.80	5.15
9150	2" diameter		90	.089		1.85	2.67		4.52	6.05
9160	2-1/2" diameter		65	.123		3	3.70		6.70	8.85
9170	3" diameter		55	.145		3.50	4.37		7.87	10.40
9180	3-1/2" diameter		50	.160		4.45	4.81		9.26	12.10
9190	4" diameter		45	.178		5.05	5.35		10.40	13.55
9200	5" diameter		35	.229		7.25	6.85		14.10	18.30
9210	6" diameter		30	.267		9.85	8		17.85	23
9220	Elbows, 1/2" diameter		50	.160	Ea.	1.05	4.81		5.86	8.35
9230	3/4" diameter		42	.190		1.16	5.70		6.86	9.90
9240	1" diameter		35	.229		1.80	6.85		8.65	12.30
9250	1-1/4" diameter		28	.286		2.55	6.60		11.15	15.70


ELECTRICAL 16

Part II - Table of Contents

1 INTRODUCTION

1.1 PURPOSE

The purpose of part II of this White Paper is to present a technical model for the virtual collocation of CLEC equipment in ILEC CO buildings (the Virtual Collocation Model). As with the technical model for physical collocation, the Virtual Collocation Model is presented using a bottoms-up approach to implementing virtual collocation based on forward-looking collocation model layouts, the use of best practice CO planning strategies, least cost suppliers, and competitive processes. This will provide a clear and concise explanation of the requirements for efficient virtual collocation of CLEC equipment at an ILEC CO. In addition, part II provides the technical basis for determining the costs to meet these requirements and identifies the investments necessary for an efficient ILEC to provide virtual collocation to CLECs.

As with physical collocation, virtual collocation provides a means by which new entrants can concentrate traffic from unbundled loops (or other elements) in order to transport that traffic to the CLEC's switch. A CLEC may wish to use virtual collocation if it lacks sufficient market share to justify a physical collocation arrangement, or because physical collocation cage construction costs render that method of collocation too costly. In addition, Section 251c(6) of the Telecommunications Act of 1996 requires that virtual collocation be provided when physical collocation is not practical for technical reasons or because of space limitations.

1.2 OVERVIEW OF VIRTUAL COLLOCATION

Virtual collocation is nothing more than an arrangement that allows a CLEC to place its own telecommunications equipment in an area of the CO currently used by the ILEC for its own equipment. Typically, the CLEC purchases the necessary equipment, sells it to the ILEC for a nominal sum ($1.00) and then the equipment is installed in vacant space along with ILEC equipment. The ILEC performs day-to-day maintenance activities upon the request of the CLEC and is reimbursed by the CLEC. The CLEC is provided with the ability to enter the CO on request but requires a security escort. The elements required to establish CLEC collocation in an ILEC CO are depicted in Figure 1A (above). With virtual collocation, however, there is no separate cage; the CLEC's equipment is not segregated from the ILEC's equipment, and is instead placed in the same lineups that house the ILEC's equipment. In addition, the demarcation point between the ILEC and CLEC for virtual collocation is at the closest appropriate ILEC cross-connect, and there is no need to use POT bays for this purpose.

2 LAND AND BUILDINGS

2.1 COST OF FLOOR SPACE

Since virtual collocation provides for CLEC equipment to be located within existing ILEC equipment areas, there are no building related costs associated with a virtual collocation arrangement other than payment to the ILEC for floor space. The necessary building investment in a virtual collocation environment is directly related to the space used in the CO.

For the efficient use of equipment space, and hence floor space, in ILEC COs, the Virtual Collocation Model develops the investments for building space based on units of ¼ relay rack. Relay racks, which resemble empty metal bookcase without shelves, are fabricated to permit the installation of equipment shelves on an"as required" basis. Thus, many existing racks in ILEC COs have unused space which can be used to mount CLEC equipment shelves. The telecommunications equipment that CLECs may install come in various sizes (heights) and thus require varying amounts of vertical "shelf space" on a relay rack. While this conceivably permits relay racks to be administered by the "rack inch," for administrative simplicity the Virtual Collocation Model develops the investments for building space based on units of ¼ relay rack. Using units of ¼ relay rack ensures that ILEC equipment space is used efficiently and allows CLECs to pay only for the space used. In many instances relay racks with empty space will be available. In some cases, however, a new relay rack may need to be installed for a CLEC to place its equipment. The Virtual Collocation Model is designed to accommodate either situation by including the additional investment for a relay rack if a new installation is required.

Relay racks are roughly 2'-0" wide, 12" deep, and 7'-0" high and placed in lineups to simplify cabling and day-to-day maintenance operations. Equipment lineups are typically located with 2'-6" to 3'-0" front and rear aisles for maintenance purposes. For the purpose of this White Paper, it will be assumed that each relay rack utilizes nine (9) square feet of floor space. 1 (Using increments of ¼ relay racks is the equivalent of 2.25 square feet of space.)

The overall method of calculating monthly rental charges remains the same as for physical collocation. As shown in Chart 5 (above), calculations are based on the three floor forward-looking CO layout model developed in Part I of this White Paper and assume generous factors of 80% assignable space and a 2:1 land to building ratio based on the building footprint.

3 CONNECTIVITY

3.1 OVERVIEW OF CONNECTIVITY LENGTH ASSUMPTIONS

As explained in Section 4 of Part I, best practice planning strategies dictate that ILEC equipment is placed as close as possible to the appropriate cross-connect to minimize cable lengths. Figure 4C (above) provides an illustrative example of the average cable lengths for ILEC equipment. As shown, the average connectivity lengths between existing ILEC equipment areas and ILEC cross-connects are between 100-125 feet.

Since virtual CLEC equipment is placed in the same equipment areas that the ILEC uses for its own equipment (and is not segregated from the ILEC equipment), it is likely that connectivity investments for virtual collocation will be in the 100-125 foot range (i.e., less than that required for physical collocation). Thus, using the same connectivity lengths for virtual collocation as those used for physical collocation provides a conservative estimate.

There are two connectivity lengths required for virtual collocation that are developed using the same worse case/best case method described above in Section 4 of the physical collocation model. First, connecting the BDFB to CLEC Virtual Equipment assuming relay rack lineups of 40 feet, with a BDFB located in the first relay rack of every other line-up, results in a connectivity length of 40 feet. Second, connecting a CLEC's virtual equipment, assuming that the equipment will be within 12 lineups, results in a connectivity length of 65 feet. 2

Cabling is an integral part of most telecommunications installations, necessary to ensure continuity prior to acceptance. Installers normally include the cabling (and terminating) as part of the overall cost of installing telecommunications equipment components. Because the CLEC is responsible to the installer for the invoice associated with equipment installation, the ILEC will not incur initial cabling costs for connectivity, power or grounding.

The purpose in developing connectivity lengths for virtual collocation is two-fold:

⇒ First, to ensure that the ILEC obtains remuneration for the use of its cable racks.

⇒ Second, to propose maximum reasonable connectivity lengths, assuming a forward-looking CO using best practice planning principles.

The model assumes that the CLEC should be charged for cable and cable rack occupancy based on best practice planning principles. If an ILEC requires an installer to place

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1 Includes the relay rack footprint plus 50% of front and rear aisles. The 9 square feet is sufficiently generous to incorporate end guards and 15" deep frames.

virtual equipment in a location that does not reflect best practice planning principles, the ILEC could successfully impose higher than necessary costs on the CLEC – costs the ILEC would likely not pay to have its own equipment installed. This should not be permitted. A summary of the average connectivity lengths to be used for virtual installations is set forth in Chart 7.

2 Calculations for all cable lengths are included in the backup documentation.

CHART 7			
VIRTUAL COLLOCATION MODEL CONNECTIVITY COMPONENTS AND AVERAGE DISTANCES			
TYPE OF CONNECTION	***CABLE LENGTH***	***CABLE RACK LENGTH***	***CABLE HOLES AND SLEEVES***
FIBER ENTRANCE CABLE (BY CLEC)	125'-0"	N/A	--
FIBER RISER CABLE (BY CLEC)	175'-0"	160'-0"	3
COPPER (DS-0/DS-1/DS-3)	165'-0"	150'-0"	2
OPTICAL (FIBER BREAKOUT CABLES)	165'-0"	150'-0"	2
-48V DC POWER PLANT TO BDFB	165'-0"	150'-0"	2
BDFB TO FUSE PANEL ON VIRTUAL EQUIPMENT	40'-0"	25'-0"	--
CONNECTIONS BETWEEN CLEC VIRTUAL EQUIPMENT	65'-0"	50'-0"	--
TIMING LEADS FOR CLEC VIRTUAL EQUIPMENT	135'-0"	120'-0"	--

3.2 OVERHEAD COMMON SYSTEMS INFRASTRUCTURE COMPONENTS

As explained in paragraph 4.4 of Part 1, cables are routed within the CO environment on overhead cable racks hung from the ceiling. The following cable routes will be required for CLEC virtual collocation, but because virtual equipment installations will be in existing ILEC equipment areas these cable routes are likely to already be in place for ILEC equipment.3

⇒ *copper and optical cable routes between virtual equipment and ILEC cross-connects*

⇒ *fiber cable route for riser cable between the cable vault and Fiber Distribution Frame*

⇒ *a power cable route to the closest BDFB*

⇒ *copper and fiber cable routes between virtual CLEC equipment*

Generous occupancy factors which incorporate cable rack fills using best practice

3 The model assumes that, if necessary, the ILEC must place cable racks between the virtual collocation equipment and cross-connects. Portions of the cable racks are likely to be already in place since the equipment is placed adjacent to ILEC equipment. In either case, the CLECs pay space rental to the ILEC for cable rack occupancy.

cable pileup assumptions are used to develop investments for the use of ILEC cable racks and inter-floor cable holes.4 Because cables are many different sizes, the Model develops individual cable rack occupancy costs for the various types of telecommunications cable used in ILEC COs, which are reflected in Chart 8. The top portion of the chart, entitled Cable Rack Capacities, outlines the commonly-used cable rack sizes. together with the estimated number of cables that can be placed on each at various cable pile-up levels (e.g. build-up on the rack). The lower portion of Chart 8 sorts the various types of cabling commonly used for telecommunications equipment according to size, and develops a cable equivalency factor. As shown, copper DS-1 cables and 12 Fiber Optical Breakout cables are the benchmark, with an equivalency of one cable. All cables smaller than the benchmark, such as DS-3 cables and smaller power distribution cables have also been assigned a one cable equivalency. A 100-pair voice grade cable is equivalent to two benchmark cables; a fiber riser cable is equivalent to three benchmark cables; and a large 750 MCM power cable is equivalent to four benchmark cables.

4 Supporting data for cable rack occupancy calculations and an explanation of cable rack capacity table can be found in Paragraph 4.4 of Part I.

CHART 8													
COLLOCATION MODEL - CABLE RACK CAPACITIES													
CABLE RACK WIDTH		***CABLE PILE-UP***											
ACTUAL SIZE	***CABLE SPACE***	***1"***	***2"***	***3"***	***4"***	***5"***	***6"***	***7"***	***8"***	***9"***	***10"***	***11"***	***12"***
10"	8.5"	26	51	77	102	128	154	179	204	230			
12"	10.5"	32	63	94	126	158	189	221	252	283	315		
15"	13.5"	41	81	122	162	203	243	284	324	365	405	446	486
20"	18.5"	56	111	167	222	278	333	389	444	500	555	611	666
25"	23.5"	71	141	212	282	353	423	494	564	635	705	776	846
30"	28.5"	86	171	257	342	428	513	599	684	770	855		

CABLE TYPE	***EQUIVALENCY FACTOR***	***OCCUPANCY FACTOR FOR CABLE RACK & CABLE HOLE USAGE***
Fiber Riser	3	Fiber Riser cables assume 7" Pile-up on 12" Racks * Capacity = 74 Cables (221/3)
Breakout Cable (12 Fibers)	1	Fiber Breakout cables assume 7" Pile-up on 12" Racks* Capacity = 221 Cables
750 MCM	4	Power Delivery Cables assume 5" Pile-up on 15" Racks * Capacity = 51 Cables (203/4)
100 Pair VG/DS-0	2	Copper DS-0 Voice Grade Cables assume 10" Pile-up on 20" Racks Capacity = 278 Cables (555/2)
28 Pair DS-1	1	Copper DS-1 Cables assume 10" Pile-up on 20" Racks Capacity = 555 Cables **
Coax DS-3	1	Coax DS-3 assume 10" Pile-up on 20" Racks Capacity = 555 Cables **
Power Distribution Cable	1	Power Distribution for fusing CLEC Virtual Equipment to the BDFB assume 7" Pile-up on 15" Racks Capacity = 284 Cables

** Reduced capacity due to rigidity & bending radius* ***DS-1 & DS-3 requires 2 cables per circuit*

4 COPPER AND OPTICAL CONNECTIVITY COMPONENTS

4.1 OVERVIEW OF CONNECTIVITY MODELS

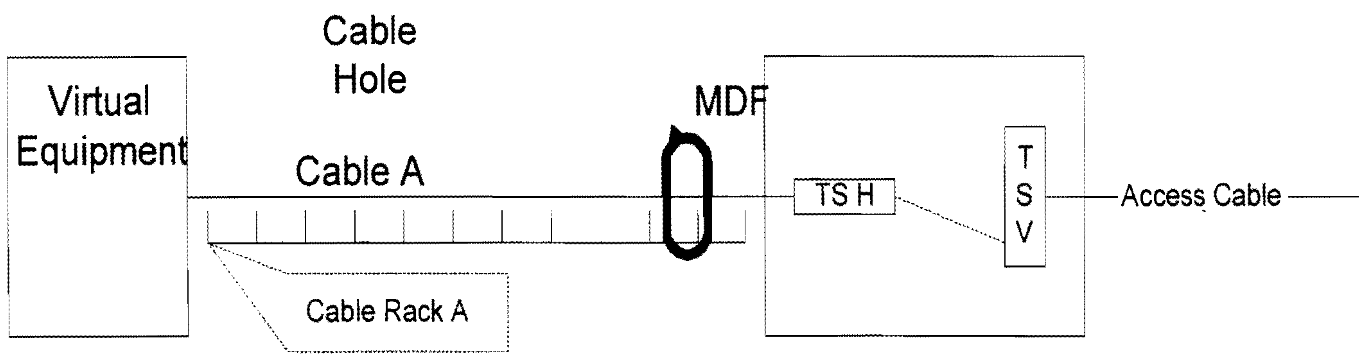
Virtual collocation requires connectivity between the CLEC's equipment and the ILEC cross-connects, as well as between various CLEC virtual components. The model assumes that connectivity between the CLEC and ILEC can be provided at different transmission bandwidths: voice grade, DS-1, DS-3 and OC-x (optical connections used to connect to "dark fiber" in the access network).

In most ILEC COs, the majority of DS-1 and DS-3 circuits to which CLECs will want to interconnect are currently located on DSX panels. However, in some ILEC COs those higher bandwidth circuits may have already been relocated to an electronic digital cross-connect system (DCS) or may appear at a Fiber Distribution Frame. The Collocation Model includes all components necessary for end to end connectivity in all cases.

Depicted in schematic form on the following pages are the best practice and least-cost connectivity arrangements that have been adopted in the Virtual Collocation Model for all interconnection between CLEC virtual equipment and to the various ILEC central office cross-connects.

4.2 VIRTUAL VOICE GRADE MODEL REQUIREMENTS

Copper Connectivity at Voice Grade Level

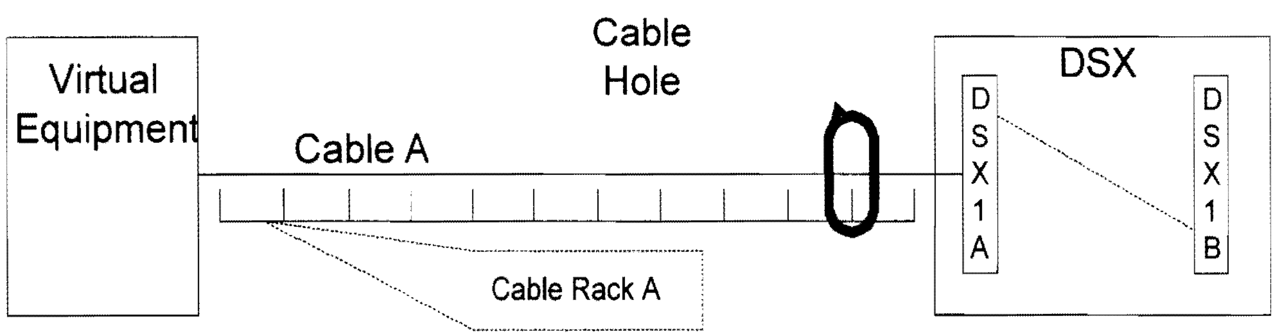


CONNECTIVITY ELEMENTS FOR VOICE GRADE SERVICE				
ELEMENT	**DESCRIPTION**	**PROVIDED BY**	**SIZE/CAPACITY**	**LENGTH**
Virtual CLEC Equipment	Voice Grade Equipment	CLEC		
Cable A *	Cable from Line Cards to Horizontal side of MDF	CLEC	100 pair cable	165 feet
Cable Hole Occupancy	2 Cable Holes shared by ILEC + CLECs	ILEC		
Cable Rack A Occupancy	20" Ladder Rack - Shared by ILEC + CLECs	ILEC	555 cables	150 feet
MDF-H*	Horizontal Terminal Block for X-Conn to Access side of DF	CLEC	100 pair	
MDF	MDF Terminal Strip Space	ILEC	1 block space	
MDF X-Connect	Jumper from horizontal to vertical ~ Included in Unbundled Loop	ILEC		
MDF-V	Vertical side terminal strip ~ Included in Unbundled Loop	ILEC		

* Supplied as part of the virtual equipment installation and paid for by CLEC

4.3 VIRTUAL DS-1 MODEL REQUIREMENTS USING A MANUAL DSX

Copper Connectivity at DS-1 Level (DSX)

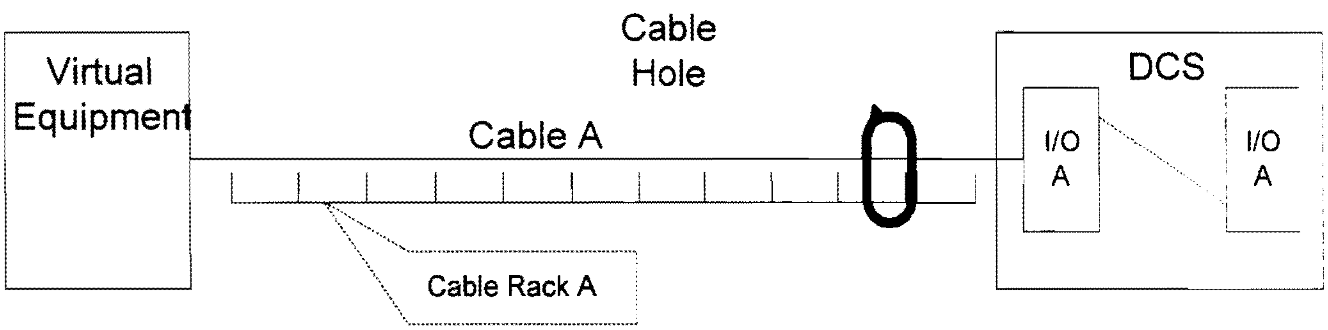


CONNECTIVITY ELEMENTS FOR DS-1 SERVICE (DSX OPTION)				
ELEMENT	***DESCRIPTION***	***PROVIDED BY***	***SIZE/CAPACITY***	***LENGTH***
Virtual CLEC Equipment	DS-1Multiplexer	CLEC	28 DS1	
Cable A *	2x 30 Pair ABAM	CLEC	28 DS1	165 feet
Cable Rack A Occupancy	20" Ladder Rack - Shared by ILEC + CLECs	ILEC	555 cables	150 feet
Cable Hole Occupancy	2 Cable Holes - Shared by ILEC + CLECs	ILEC	555 cables	
DSX-1C	Passive X-Connect Panel	ILEC	56 DS1	
DSX	Digital X-Connect Frame shared by ILEC + CLECs	ILEC	560 DS1	

* Supplied as part of the virtual equipment installation and paid for by CLEC

4.4 VIRTUAL DS-1 MODEL REQUIREMENTS USING AN ELECTRONIC DCS

Copper Connectivity at DS-1 Level (DCS)

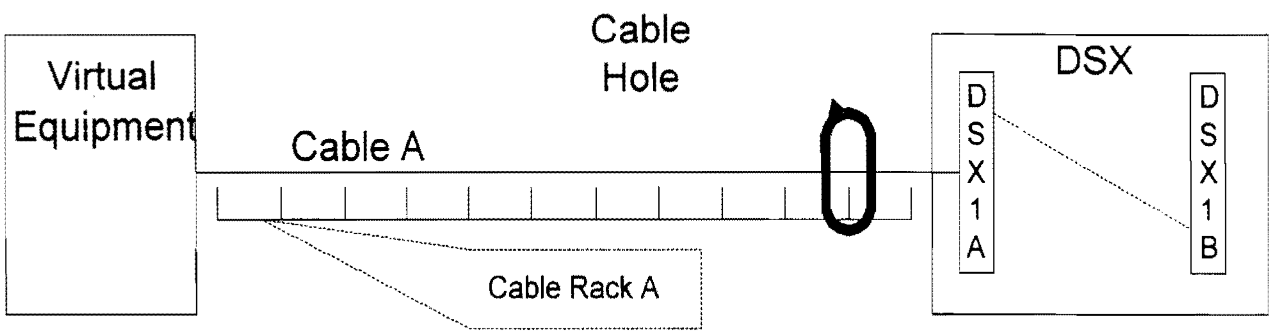


CONNECTIVITY ELEMENTS FOR DS-1 SERVICE (DCS OPTION)				
ELEMENT	**DESCRIPTION**	**PROVIDED BY**	**SIZE/CAPACITY**	**LENGTH**
CLEC Virtual Equipment	DS-1Multiplexer	CLEC	28 DS1	
Cable A *	2x 30 Pair ABAM	CLEC	28 DS1	165 feet
Cable Rack A Occupancy	20" Ladder Rack - Shared by ILEC + CLECs	ILEC	555 cables	150 feet
Cable Hole Occupancy	2 Cable Holes - Shared by ILEC + CLECs	ILEC	555 cables	
DCS	Digital X-Connect System shared by ILEC + CLECs	ILEC	7168 DS1	

* Supplied as part of the virtual equipment installation and paid for by CLEC

4.5 VIRTUAL DS-3 MODEL REQUIREMENTS USING A MANUAL DSX

Copper Connectivity at DS-3 Level (DSX)

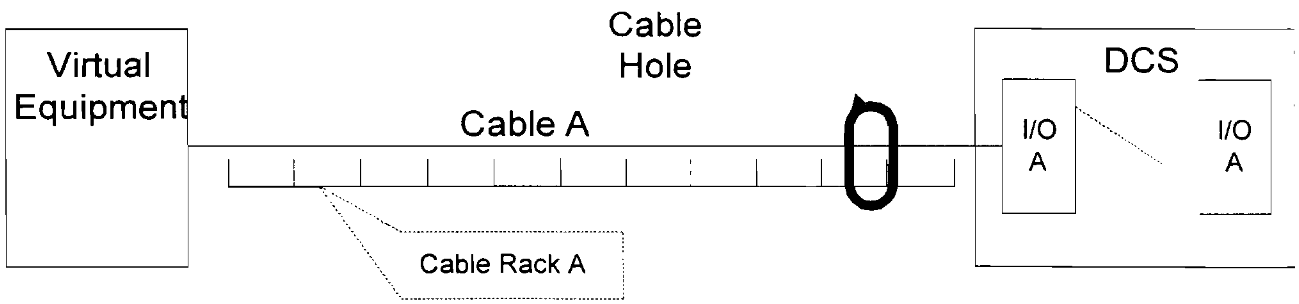


CONNECTIVITY ELEMENTS FOR DS-3 SERVICE (DSX OPTION)				
ELEMENT	***DESCRIPTION***	***PROVIDED BY***	***SIZE***	***LENGTH***
CLEC Virtual Equipment	DS-3 Terminal/Multiplexer	CLEC		
Cable A *	734 Shielded (2 cables)	CLEC	2 per DS3	165 feet
Cable Rack A Occupancy	20" Ladder cable rack - Shared ILEC + CLECs		555 cables	150 feet
Cable Hole Occupancy	2 Cable holes between floors ~ Shared ILEC + CLECs	ILEC	555 cables	
XC-C	Passive X-Connect Panel	ILEC	16 DS3	
DSX	Digital X-Connect Frame shared by ILEC + CLECs	ILEC	112 DS3	

* Supplied as part of the virtual equipment installation and paid for by CLEC

4.6 VIRTUAL DS-3 MODEL REQUIREMENTS USING AN ELECTRONIC DCS

Copper Connectivity at DS-3 Level (DCS)

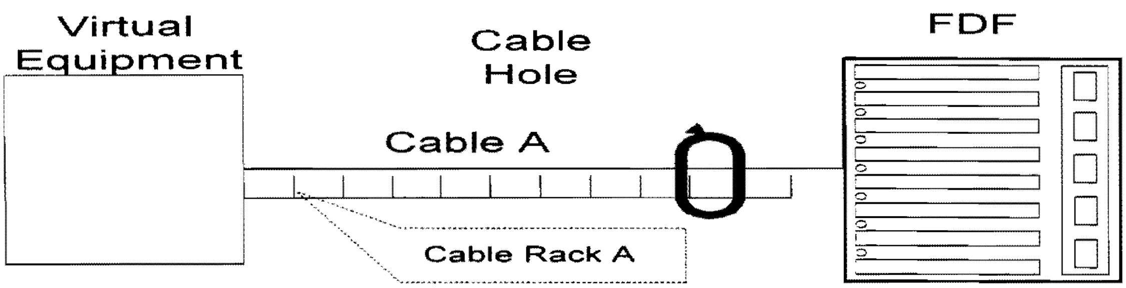


CONNECTIVITY ELEMENTS FOR DS-3 SERVICE (DCS OPTION)				
ELEMENT	***DESCRIPTION***	***PROVIDED BY***	***SIZE***	***LENGTH***
CLEC Virtual Equipment	DS-3 Terminal/Multiplexer	CLEC		
Cable A *	734 Shielded (2 cables)	CLEC	2 per DS3	165 feet
Cable Rack A Occupancy	20" Ladder cable rack – Shared ILEC + CLECs		555 cables	150 feet
Cable Hole Occupancy	2 Cable holes between floors ~ Shared ILEC + CLECs	ILEC	555 cables	
Digital X-Connect System	DS-3 Digital Cross-Connect shared by ILEC + CLECs	ILEC	512 DS3	

* Supplied as part of the virtual equipment installation and paid for by CLEC

4.7 VIRTUAL OPTICAL MODEL REQUIREMENTS USING FIBER FRAME

Fiber Connectivity at DS-3 Level

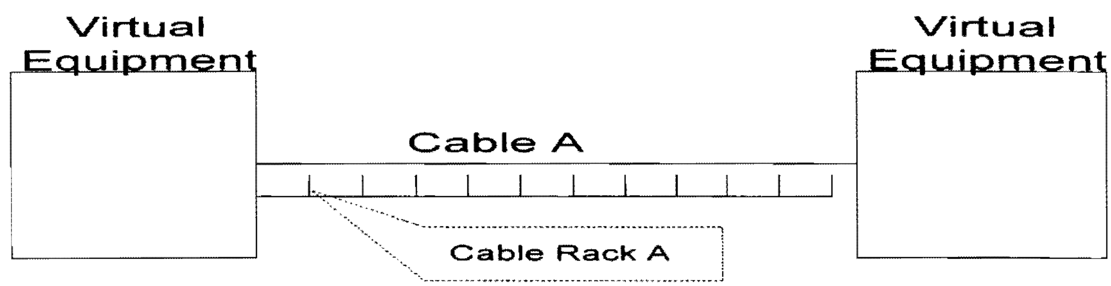


CONNECTIVITY ELEMENTS FOR OPTICAL SERVICE				
ELEMENT	**DESCRIPTION**	**PROVIDED BY**	**SIZE**	**LENGTH**
CLEC Virtual Equipment	Optical Terminal	CLEC		
Cable A *	Fiber breakout cable	CLEC	12 Fibers	165 feet
Cable Rack A Occupancy	12" Ladder cable rack – Shared ILEC + CLECs		221 cables	150 feet
Cable Hole Occupancy	2 Cable holes between floors ~ Shared ILEC + CLECs	ILEC	221 cables	
FDF	Fiber Distribution Frame	ILEC	768 Fibers	

* Supplied as part of the virtual equipment installation and paid for by CLEC

4.8 INTRA-CLEC VIRTUAL COPPER AND OPTICAL MODEL REQUIREMENTS

Virtual to Virtual Copper and Optical Connectivity



CONNECTIVITY ELEMENTS FOR INTRA-CLEC SERVICE				
ELEMENT	***DESCRIPTION***	***PROVIDED BY***	***SIZE***	***LENGTH***
CLEC Virtual Equipment	Optical and/or multiplexing equipment	CLEC		
Cable A *	Connects two equipment virtually located CLEC equipment shelves	CLEC	DS1 DS3 Fiber	65 feet
Cable Rack A Occupancy (for Fiber connection)	12" Ladder cable rack – Shared ILEC + CLECs		221 cables	50 feet
Cable Rack A Occupancy (for DS1 and DS3 connections)	20" Ladder cable rack – Shared ILEC + CLECs		555 cables	50 feet

* Supplied as part of the virtual equipment installation and paid for by CLEC

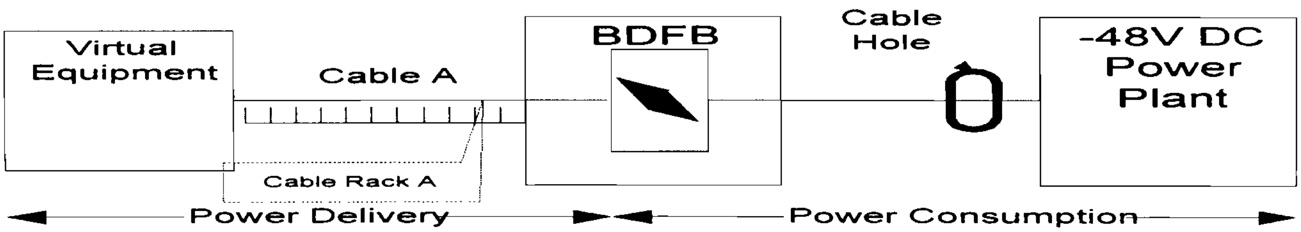
5 DC POWER AND GROUNDING ELEMENTS

5.1 OVERVIEW

As explained in detail in Section 5 of Part I, the standard and most cost effective method of delivering -48V DC between the power plant and telecommunications equipment in a CO is to use a remote power distribution bay, such as a BDFB. Using a BDFB located close to the equipment it will serve will postpones the exhaust of the -48V power plant and is more cost-effective than running many large (and costly) power distribution cables to the power plant for equipment fusing. An overview of the accepted best practice method for the delivery of -48V DC power in a telecommunications environment is shown in Figure 5B (above).

The delivery of -48V power in a virtual collocation is divided into two separate charges in a similar manner as physical collocation: (1) a monthly power consumption charge for shared use elements such as the power plant, diesel generator and distribution as far as the BDFB (that is, between the power plant and the BDFB); and (2) a monthly recurring charge for distribution associated with occupancy of the cable rack between the BDFB and the CLEC's virtual equipment. A schematic depicting the components included in the Virtual Collocation Model for -48V DC power appears below.

- 48V Power Delivery for Virtual Equipment Installation



Power Delivery Elements				
Element	**Description**	**Prov. By CLEC/ILEC**	**Quantity**	**Remarks**
CLEC Virtual Equipment	Located in ILEC lineup	CLEC	--	CLEC requests direct fusing to virtual equipment from BDFB
Cable 'A' (2 feeds of 0-5amps) *	4 x #10 cable between virtual equipment & BDFB	CLEC	40'-0"	Two A & B cables to feed 0-5amps + battery returns.
Cable 'A' (2 feeds of 6-20amps) *	4 x #6 cable between virtual equipment & BDFB	CLEC	40'-0"	Two A & B cables to feed 6-20amps + battery returns.
Cable 'A' (2 feeds of 21-30amps) *	4 x #4 cable between virtual equipment & BDFB	CLEC	40'-0"	Two A & B cables to feed 21-30amps + battery returns.
Cable 'A' (2 feeds of 31-50amps) *	4 x #2 cable between virtual equipment & BDFB	CLEC	40'-0"	Two A & B cables to feed 31-50amps + battery returns.
Cable 'A' (2 feeds of 51-60amps) *	4 x #1 cable between virtual equipment & BDFB	CLEC	40'-0"	Two A & B cables to feed 51-60amps + battery returns.
Cable Rack 'A'	15" existing cable rack	ILEC	25'-0"	Power delivery rack for ILEC & virtual equipment
BDFB	Located in close proximity to virtual equipment	ILEC	--	Included in -48V DC Power Consumption Charge
Cable Rack Occupancy	Shared support for Cable 'B' below	ILEC	--	Included in -48V DC Power Consumption Charge
Cable 'B'	Cable between – 48V Power Plant & BDFB	ILEC	--	Included in -48V DC Power Consumption Charge
-48V DC Power Plant	Shared use between CLEC's & ILEC	ILEC	--	Included in -48V DC Power Consumption Charge
Auto-start Diesel Fuel Tanks, & AC Switchboard	Required for Battery Back-up	ILEC	--	Included in -48V DC Power Consumption Charge
AC Energy	Required for AC Energy used	ILEC	--	Included in -48V DC Power Consumption Charge

* Supplied as part of the virtual equipment installation and paid for by CLEC

5.2 POWER DISTRIBUTION COMPONENTS

Assuming that a BDFB is located close to ILEC equipment, it is unlikely that -48V DC power distribution cables for fusing collocation equipment would be longer than about 40 feet. The Virtual Collocation Model assumes a cable length of 40 feet for -48V DC power distribution cabling between the collocation BDFB and the CLEC provided virtual equipment.5 As noted in Section 4 above, the cabling will be included in the cost of the equipment installation paid for immediately by the CLEC. The investment associated with the 40 feet of cabling calculation simply ensures remuneration to the ILEC for its cable racks and to ensure that the cost of power cable reflects best practice planning principles. As with connectivity, if the ILEC requires an installer to place virtual equipment in a location that does not reflect best practice planning principles, the ILEC could successfully impose higher than necessary costs on the CLEC -- costs the ILEC would likely not face if it were installing equipment for itself. This should not be permitted.

5.3 POWER CONSUMPTION COMPONENTS

Investments for -48V DC power consumption for the Virtual Collocation Model are based on the same approach used for physical collocation: all ILEC investments necessary to engineer, furnish, and install (EF&I) a shared -48V power plant (using a 2500 amp and a 4000 amp plant), including the mandatory battery and diesel generator back-up are identified. A BDFB and associated cabling components are also included to ensure the most cost-efficient method of delivering -48V DC power to the collocation area. However, the BDFB investment for virtual collocation is sized at 600 amps to more closely reflect BDFB sizes typically used in ILEC equipment areas.

As with physical collocation, a charge is developed for CLEC AC electric energy usage by restating the usage charge per AC kilowatt hour as an AC energy rate per DC amp used. (See Chart 3 above.)6 The rate from that calculation is added to the costs per amp for DC power to create the all-inclusive monthly power consumption charge.

5.4 EQUIPMENT GROUNDING

Unlike the physical collocation model outlined in Part I, the grounding of CLEC virtual equipment installations must adhere to the same method of grounding as adjacent ILEC equipment to ensure optimum performance of both carriers' equipment. The installer will ensure a grounding arrangement consistent with adjacent ILEC equipment when installing the CLEC virtual equipment. Since the CLEC is responsible for payment of that installation invoice, grounding investments are not modeled for virtual collocation.

6 ACCESS (ENTRANCE FIBER) COMPONENTS

6.1 OVERVIEW

Unlike physical collocation where the CLEC performs day-to-day maintenance operations a virtual scenario requires that the ILEC assume responsibility for ongoing maintenance of the entrance fiber. The best practice arrangement is therefore to terminate all CLEC entrance fibers at a centralized ILEC cross-connect, typically called a Fiber Distribution Frame (FDF). As with the physical collocation model layout outlined in Part I, the ideal arrangement is for the CLEC to perform the pulling and splicing of fiber cable between the manhole and the cable

---

5 The 40 feet includes 25 feet in cable racks and 7'-6" drops at each end. Assumptions are included in backup documentation.

6 The example uses a rate of $0.05 per Kilowatt hour for electric power. The Model allows the actual rate per Kilowatt hour used in the cost calculations to be state-specific.

vault, and the subsequent routing of fiber riser cable between the cable vault and the FDF. In the event that this is not permitted, however, the Virtual Collocation Model incorporates assumptions (outlined below) to calculate the costs that an efficient ILEC would incur to perform these functions in a competitive environment.

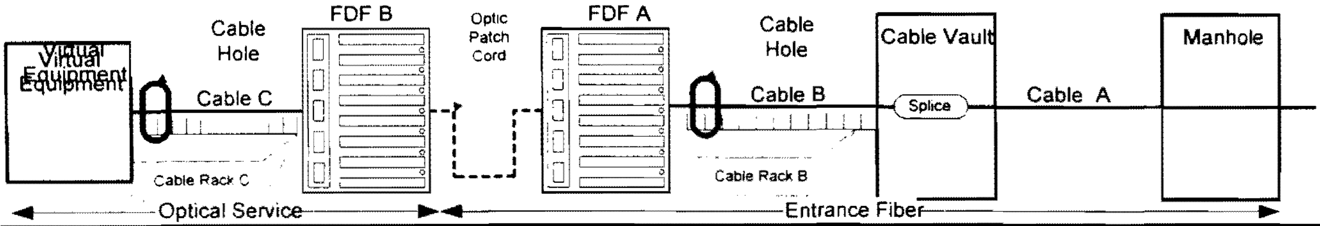
6.2 FIBER ENTRANCE COMPONENTS

The major elements required to route fiber cable between the first manhole and the Fiber Distribution Frame using fire retardant cable include:

- ⇒ Pulling and splicing of cable in the cable vault
- ⇒ A splice case to change from external to internal fiber cable
- ⇒ Fire retardant riser cable between the vault splice and FDF
- ⇒ Cable rack and cable hole (with occupancy charges based on usage)

The following schematic outlines the elements that have been used in the CO model layout to determine the cost of access connectivity (assuming that it would not be possible for the CLEC to perform the required pulling and splicing in the ILEC CO).

Access Elements – Cable Pulling and Splicing



Access Elements (Cable Pulling & Splicing) - With Fire Retardant Provided					
Element	***Description***	***Provided by CLEC/ILEC***	***Quantity***	***Hours***	***Remarks***
Optic Patch Cord	Between Fiber Distribution Frames	ILEC	6		1 required per fiber pair
Fiber Distribution Frame 'A'	ILEC Fiber Cross-connect	ILEC	12 Fibers	--	Frame capacity is 768 fibers
Cable 'B'	Between FDF & vault splice	CLEC	175'-0"	--	Fire retardant Fiber cable provided by CLEC
Installation of Cable 'B'	Placed on shared 12" cable rack (ILEC+CLECs)	ILEC	175'-0"	14	One time charge - Includes opening and closing of 3 cable holes
Cable Rack Occupancy	12" cable rack shared by ILEC + CLECs	ILEC	160'-0"	--	Cost per cable for use of on ILEC cable racks
Cable Hole Occupancy	Cable holes shared by CLEC's & ILEC	ILEC	3	--	For use of ILEC cable holes
Splice Case	External to fire retardant cable	CLEC	1	--	Approved vault splice case provided by CLEC
Cable 'A'	Between vault splice & manhole	CLEC	--	--	Fiber cable provided by CLEC
Cable Support Charge	Between vault splice and vault wall	ILEC	50'-0"	--	Cost Model to use same as cable rack occupancy for Riser cable
Structure Charge	Between manhole & cable vault splice	Tariff Item	75'-0"	--	Per existing structures tariff
Cable Pulling	Manhole to cable vault splice	ILEC	125'-0"	4.0	Includes set-up & take-down
Splicing Activity	External cable to fire retardant cable	ILEC	--	3.0	Set-up & take-down in vault
Splice Fibers	In Cable Vault	ILEC	--	2.0	For up to 24 Fibers

Note: Access Design Charges included in ILEC Manpower Summary in section 7.

7 PROCESS ISSUES

7.1 ILEC MANPOWER REQUIREMENTS AND IMPLEMENTATION INTERVALS

The planning and implementation of virtual collocation in an ILEC CO requires manpower effort on the part of the ILEC. To ensure fair and reasonable compensation for ILEC manpower, the Virtual Collocation Model incorporates a planning component outlining the necessary ILEC manpower requirements to implement a CLEC collocation request using best practice processes in a competitive environment. Chart 9 provides the ILEC resource requirements required for each virtual collocation request.

CHART 9	
ILEC MANPOWER REQUIREMENTS	
FUNCTION	***HOURS TO PLAN & IMPLEMENT EACH VIRTUAL COLLOCATION REQUEST***
OUTSIDE PLANT ACCESS DESIGN	6
BUILDING PLANNING	10
MDF PLANNING	4
POWER ENGINEER	8
EQUIPMENT ENGINEER	12
EQUIPMENT INSTALLATION PROJECT MGR	10
OPERATIONS GROUP	6
APPLICATION FEE (ADMINISTRATION)	10
SECURITY ESCORTS	AS REQ'D
TOTAL ILEC MANPOWER	***66***

NOTES:

1. ILEC ACTIVITIES SHOULD NOT INCLUDE COORDINATION OF DEMAND PROJECTS COVERED UNDER RECURRING CHARGE IN COST MODEL (EG. –48V POWER PLANT EXPANSIONS)
2. APPLICATION FEE TO COVER MARKETING CONTACT GROUP AND VARIOUS ADMINISTRATIVE AND BILLING GROUP ACTIVITIES.

The proposed manpower requirements assume the same minimum requirements as those listed for the physical model layout contained in Part I. For example, ILEC staff is assumed to be fully trained and competent, and the ILEC will only be reimbursed for time spent implementing functions associated with virtual collocation elements covered by a non-recurring charge.

The manpower requirements shown in Chart 9 provide an accurate assessment of the planning time required to efficiently implement a CLEC virtual collocation request in a best practice competitive environment. The intervals are included as a specific component to plan and implement a CLEC virtual collocation request so that the ILEC cannot arbitrarily establish undefined charges using an "individual case basis" for time and materials, which can easily be manipulated on a case by case basis.

An assessment of internal ILEC functions and intervals required to implement a CLEC virtual collocation request, assuming optimum efficiency, best practice processes and a competitive environment, indicates that the maximum interval from the time a CLEC applies for virtual collocation in an ILEC CO until the project is ready for installation work to commence is 22 working/business days.

8 OPERATIONAL ISSUES

8.1 MAINTENANCE ACTIVITY

The CLEC will be responsible for directing all maintenance activities associated with the virtual collocation equipment. This includes system surveillance, direction of repair activity, requests to the ILEC for maintenance activity/assistance. The ILEC is responsible for hardware functions such as circuit pack replacement and changing fuses. Work will be performed by the ILEC upon the request of the CLEC, and will be reimbursed using the labor rate for the appropriate qualified technician.

8.2 SECURITY ESCORTS

CLEC personnel will not normally be required to visit the virtually collocated equipment for day-to-day operations. However there may be instances when it is necessary for CLEC engineering and/or maintenance personnel to visit the ILEC CO. Because virtual installations will be in existing ILEC equipment areas it is reasonable to expect that an ILEC escort be in attendance for the entire time.

8.3 RESPONSE TIMES AND CHARGING INCREMENTS

Response time is defined as the total elapsed interval between the time of a CLEC request for an appropriately qualified technician at a particular CO until the technician arrives and makes contact with the CLEC. The response times listed in Chart 10 apply to both maintenance and security escort requests. Chart 11 depicts the method proposed to assess CLECs for time charged by ILEC Technicians.

CHART 10	
MAINTENANCE AND ESCORT RESPONSE TIMES	
CENTRAL OFFICE TYPE	**RESPONSE TIME**
Staffed and Attended	1 hour
Staffed and Unattended	4 hours
Not staffed and NBD	2 hours
Not staffed and non-NBD	4 hours
Definitions: **Staffed**-technicians are scheduled to work in the location. **Attended-**hours during which technicians are required to be at the CO. **NBD (Normal Business Day)-**usually Monday to Friday, 0800h to 1700h.	

CHART 11		
MAINTENANCE AND ESCORT CHARGING INCREMENTS		
CENTRAL OFFICE TYPE	INITIAL CHARGE	SUBSEQUENT CHARGE
Staffed and Attended	¼ hour	¼ hour
Staffed and Unattended	4 hours	¼ hour
Not staffed and NBD	¼ hour	¼ hour
Not staffed and non-NBD	4 hours	¼ hour

NOTE: It is essential that the ILEC provide the CLEC with a detailed explanation as to the actual attended hours of any manned CO as part of the collocation agreement.

8.4 CIRCUIT PACKS

A flat rate of 1 hour will be reimbursed to the ILEC for time spent packing and shipping defective circuit packs or time spent receiving and unpacking repaired circuit packs.

8.5 TRAINING OF ILEC TECHNICIANS

If CLEC's virtual equipment is not already deployed in a CO, it is reasonable to expect the CLEC to train ILEC technicians. The CLEC will reimburse the ILEC for costs associated with the initial training of a maximum of two technicians when the virtually installed equipment does not already exist in the CO. Rather than a complete product maintenance course, however, the training provided need only be an introductory course consisting of a product overview; hardware configurations; and hardware change procedures. The ILEC technicians being trained are assumed to be familiar with general precautions and procedures for maintenance of CO equipment. Any subsequent training of ILEC staff due to staff turnover, transfers, etc. is the responsibility of the ILEC.

VIRTUAL COLLOCATION MODEL DOCUMENTATION

MODEL DOCUMENTATION OVERVIEW

SECTION ONE: INPUT SHEETS

SECTION TWO: BACKUP INDEX

SECTION THREE: SUPPLIER QUOTE

<u>Overview</u>

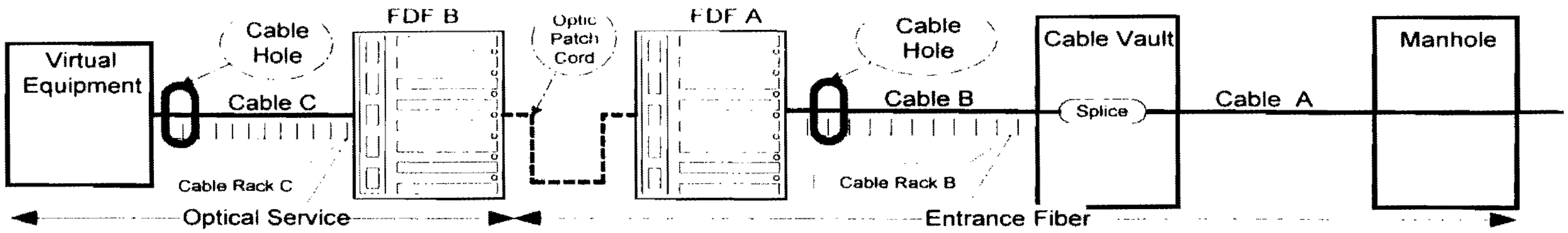
The Virtual Collocation Cost model was developed by MCI and AT&T to estimate the costs that an efficient ILEC would incur to provide virtual collocation to one or more CLECs at a central office. The Virtual Collocation Model is based upon the Physical Collocation Model. The same sources of input prices were used where applicable. Where the investment differs from that of the Physical Collocation Model, the differences are explained in the following pages.

SECTION ONE

INPUT SHEETS

ENTRANCE FIBER
CONNECTIVITY: VOICE GRADE SERVICE
CONNECTIVITY: DS-1 SERVICE (DCS)
CONNECTIVITY: DS-1 SERVICE (DSX)
CONNECTIVITY: DS-3 SERVICE (DCS)
CONNECTIVITY: DS-3 SERVICE (DSX)
CONNECTIVITY: OPTICAL
VIRTUAL TO VIRTUAL
POWER DELIVERY
MANPOWER REQUIREMENTS

Virtual Collocation Model - Entrance Fiber

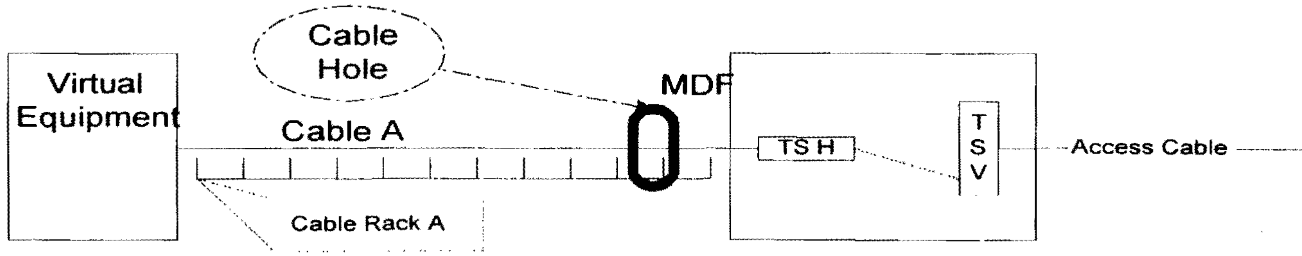


Element	Description	Provided by CLEC/ILEC	Used By	Re-useable	Quantity	Hours	Unit Cost	Total Cost	Remarks
Virtual Equipment	Located in ILEC Lineup	CLEC	1 CLEC	NA					Included in Optical Service
Cable Hole Occupancy	Cable Hole between Floors	ILEC	1 CLEC	NA					Included in Optical Service
Cable C	12 Fiber Breakout	CLEC	1 CLEC	NA					Included in Optical Service
Cable Rack Occupancy	12" Ladder Rack	ILEC	1 CLEC	NA					Included in Optical Service
Fiber Distribution Frame B	Located in ILEC Area	ILEC	1 CLEC	NA					Included in Optical Service
Optic Patch Cord	Between ILEC FDFs	ILEC	1 CLEC	Y	6		$63.50	$381.00	1 required per fiber pair
Fiber Distribution Frame A	Located in ILEC Area	ILEC	ILEC + CLECs	Y	12 Fibers		$232.19	$273.16 **	Frame Capacity is 768 Fibers. Assumes an 85% Fill
Cable 'B'	Between FDF & vault splice	CLEC	1 CLEC	N/A	175'-0"	--	---	--	Fire retardant Fiber cable provided by CLEC
Installation of Cable 'B'	Placed on shared cable rack	ILEC	1 CLEC	N	175'-0"	14	$55.00	$770.00	One time Charge - Includes opening/closing of 3 cable holes
Cable Rack Occupancy	12" Ladder Rack	ILEC	ILEC + CLECs	Y	160'-0"		$0.54/ft.	$86.40	Cost per Riser cable for cable rack occupancy
Cable Hole Occupancy	Cable holes between floors	ILEC	ILEC+ CLECs	Y	3	--	$9.46 ca.	$33.39 **	Used by ILEC and CLECs for routing fiber. Assumes 85% fill.
Splice Case	External to fire retardant cable	CLEC	1 CLEC	Y	1	--	--	--	Approved vault splice case provided by CLEC
Cable 'A'	Between vault splice & manhole	CLEC	1 CLEC	N/A	--	--	--	--	Fiber cable provided by CLEC
Cable Support Charge	Between vault splice & vault wall	ILEC	1 CLEC	Y	50'-0"	--	$0.54/ft	$27.00	Use same cost as cable rack occupancy for Riser Cable
Structure Charge	Between vault wall & manhole	Tariff Item		N	75'-0"	--	--	--	Per existing structures agreement or use $0.05 / foot /month
Cable Pulling	Manhole to cable vault splice	ILEC	1 CLEC	N	125'-0"	4.0	$55.00	$220.00	Includes set-up & take-down (Contract Labor)
Splicing Activity	External cable to fire retardant cable	ILEC	1 CLEC	N	--	3.0	$55.00	$165.00	Set-up & take-down in vault (Contract Labor)
Splice Fibers	In Cable Vault	ILEC	1 CLEC	N	--	2.0	$55.00	$110.00	For up to 24 Fibers (Contract Labor)

Note: Access Design Charges included in ILEC Manpower Summary Chart

** Indicates 85% Fill

Virtual Collocation Model for Voice Grade Service

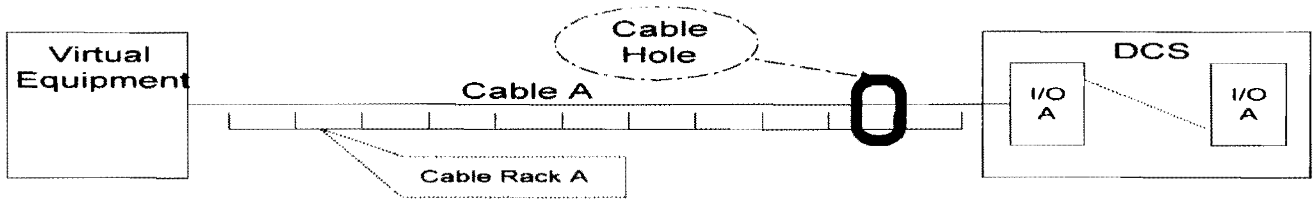


Element	Description	Provided By	Used By	Reusable Y/N	Size/ Capacity	Length	Unit Cost	Total Cost	Cost per 100 VG Cct.
Virtual Equipment*	Voice Grade Equipment	CLEC	1 CLEC	NA					
Cable A*	Cable from Line Cards to HMDF	CLEC	1 CLEC	NA	100 Pair	165 ft			
Cable Hole	2 Cable Holes**	ILEC	ILEC + CLECs	Y			$700.00 /hole	$1647.06 **	$5.92
Cable Rack A (Occupancy)	20" Ladder Rack	ILEC	ILEC + CLECs	Y		150 feet	$40.52	$6078.00	$21.86
MDF-H*	Horizontal Terminal Block to X-connect to Access side of frame	CLEC	1 CLEC	NA	100 Pair				
MDF	MDF Terminal Block Space**	ILEC	ILEC + CLECs	Y	1 block space		$178.95	$210.52 **	$210.52

*Cable and Terminal Strip are supplied and terminated as part of Virtual Equipment Installation and paid for by CLEC

** Indicates 85% Fill

Virtual Collocation Model for DS-1 Service-DCS

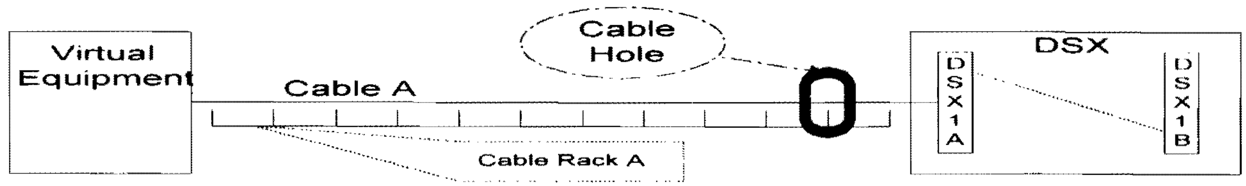


Element	Description	Provided By	Used by	Reusable Y/N	Size/ Capacity	Length	Unit Cost	Cost	Cost per 28 DS-1 Cct
Virtual Equipment*	DS1 Multiplexer	CLEC	1 CLEC	NA					
Cable A*	2x 30 Pair ABAM	CLEC	1 CLEC	NA	28 DS1	165 feet			
Cable Rack A (Occupancy)	20" Ladder Rack	ILEC	ILEC +4 CLECs	Y	555 ABAM	150 feet	$40.52	$6078.00	$21.86
Cable Hole	2 Cable Holes**	ILEC	ILEC + 4 CLECs	Y	555 ABAM per hole		$700.00/ hole	$1647.06 **	$5.92
DCS	Digital X-conn**	ILEC	ILEC + CLECs	Y	7168 DS1		$329.23 per DS1	$2,776,377.00 **	$10,845.22

*Cable is supplied and terminated as part of Virtual Equipment Installation and paid for by CLEC

** Indicates 85% Fill

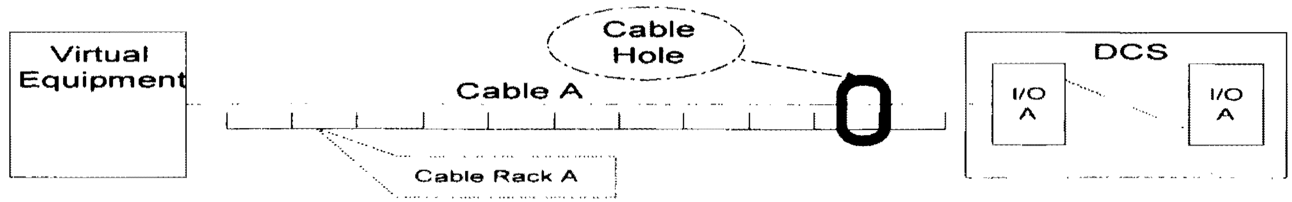
Virtual Collocation Model for DS-1 Service-DSX



Element	Description	Provided By	Used By	Reusable Y/N	Size/ Capacity	Length	Unit Cost	Cost	Cost per 28 DS-1 Cct
Virtual Equipment*	DS1 Multiplexer	CLEC	1 CLEC	NA	28 DS1				
Cable A*	2x 30 Pair ABAM	CLEC	1 CLEC	NA	28 DS1	165 ft			
Cable Rack A (Occupancy)	20" Ladder Rack	ILEC	ILEC + CLECs	Y	555ABAM	150 ft	$40.52	$6078.00	$21.86
Cable Hole	2 Cable Holes**	ILEC	ILEC + CLECs	Y			$700.00 /hole	$1647.06 **	$5.92
DSX1 C	Manual X-conn Panel**	ILEC	ILEC + CLECs	Y	56 DS1		$824.25	$969.71 **	$484.86
DSX	Digital X-conn Frame-Manual**	ILEC	ILEC + CLECs	Y	560 DS1		$390.00	$458.82 **	$22.94

*Cable is supplied and terminated as part of Virtual Equipment Installation and paid for by CLEC ** Indicates 85% Fill

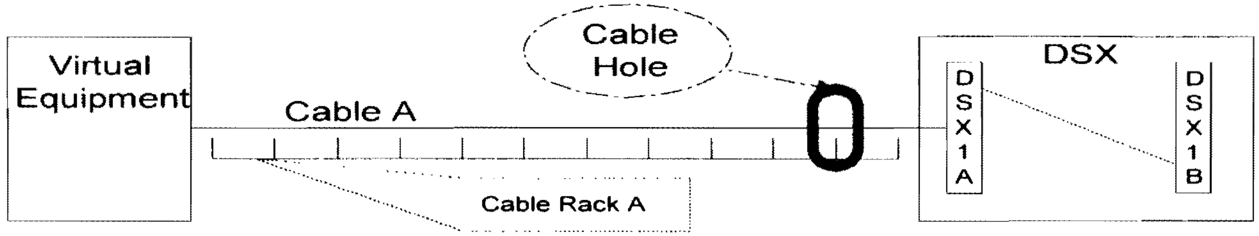
Virtual Collocation Model for DS-3 Service-DCS



Element	Description	Provided By	Used by	Reusable Y/N	Size	Length	Unit Cost	Cost	Cost per DS3 Cct
Virtual Equipment*	DS3 Terminal/Multiplexer	CLEC	1 CLEC	NA					
Cable A*	734 Shielded (2 cables)	CLEC	1 CLEC	NA	2 per DS3	165 feet			
Cable Rack A (Occupancy)	20" Ladder Rack	ILEC	ILEC + CLECs	Y	555 734 Type	150 feet	$40.52	$6078.00	$21.86
Cable Hole	2 Cable holes between floors**	ILEC	ILEC + CLECs	Y	555 734 Type		$700.00/ hole	$1647.06 **	$5.92
DCS	DS3 Digital Cross Connect**	ILEC	ILEC + CLECs	Y	512 DS3		$2293.30 1per DS3	$1,381,382.00 **	$2698.01

*Cable is supplied and terminated as part of Virtual Equipment Installation and paid for by CLEC ** Indicates 85% Fill

Virtual Collocation Model for DS-3 Service-DSX

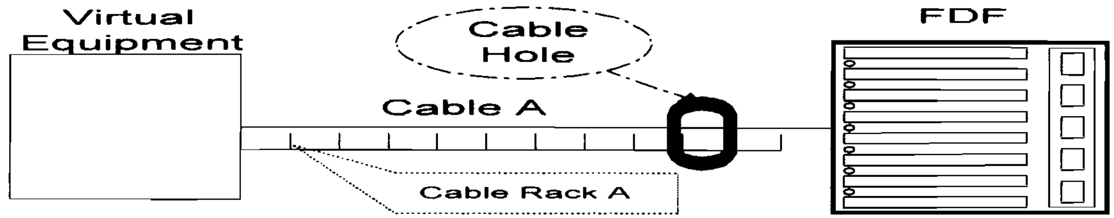


Element	Description	Provided By	Used By	Reusable Y/N	Size	Length	Unit Cost	Cost	Cost per DS3 Cct.
Virtual Equipment*	DS3 Terminal/Multiplexer	CLEC	1 CLEC	NA					
Cable A*	734 Shielded (2 cables)	CLEC	1 CLEC	NA	2 per DS3	165 feet			
Cable Rack A (Occupancy)	20" Ladder Rack	ILEC	ILEC + CLECs	Y	555 734 Type	150 feet	$40.52	$6078.00	$21.86
Cable Hole	2 Cable holes between floors**	ILEC	ILEC + CLECs	Y	555 734 Type		$700.00/ hole	$1647.06 **	$5.92
XC-C	Manual X-conn Panel**	ILEC	ILEC + CLECs	Y	16 DS3's		$5951.75	$7002.06 **	$437.63
DSX Frame	7' Frame**	ILEC	ILEC + 4 CLEC	Y	112 DS3's		$390.00	$458.82 **	$4.10

*Cable is supplied and terminated as part of Virtual Equipment Installation and paid for by CLEC

** Indicates 85% Fill

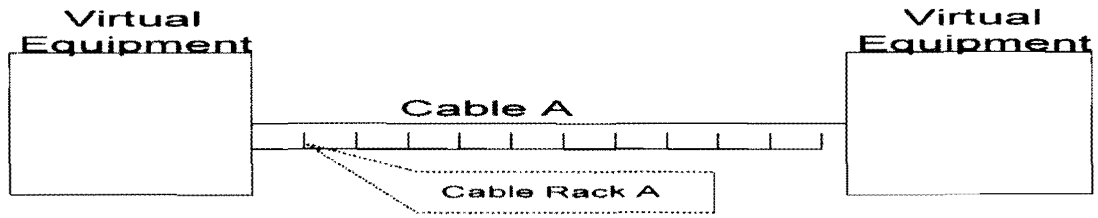
Virtual Collocation Model for Optical Service



Element	Description	Provided By	Used By	Reusable Y/N	Size	Length	Unit Cost	Cost	Cost per Optical Cable (12 Fiber)
Virtual Equipment*	Located in ILEC Lineup	CLEC	1 CLEC	NA					
Cable A*	12 Fiber Breakout	CLEC	1 CLEC	NA		165 ft.			
Cable Rack A (Occupancy)	12" Ladder Rack	ILEC	ILEC + CLECs	Y	221 Breakout	150 ft	$39.88	$5982.00	$27.07
Cable Hole	2 Cable holes between floors	ILEC	ILEC + CLECs	Y	221 Breakout		$700 / hole	$1647.06 **	$7.45
FDF	Fiber Distribution Frame	ILEC	ILEC + CLECs	Y	768 Fibers		$232.19 per 12 fibers	273.16 **	$273.16

*Cable is supplied and terminated as part of Virtual Equipment Installation and paid for by CLEC ** Indicates 85% Fill

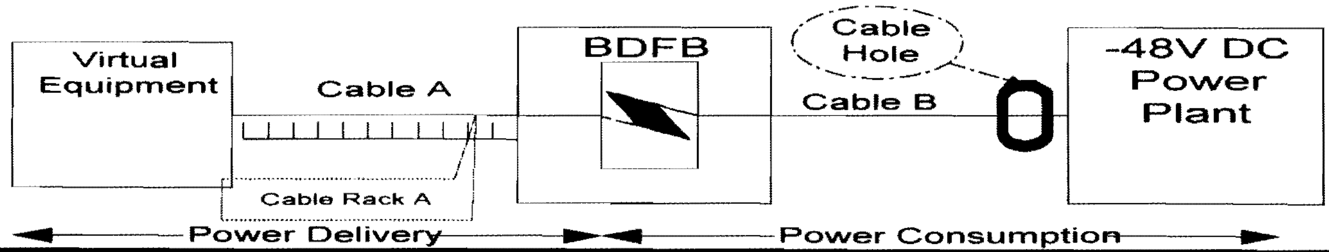
Virtual Collocation Virtual to Virtual



Element	Description	Provided By	Used By	Reusable Y/N	Size	Length	Unit Cost	Cost	Cost per Cable
Virtual Equipment*	Located in ILEC Lineup	CLEC	1 CLEC	NA					
Cable A*	Connects 2 bays on Virtually located equipment	CLEC	1 CLEC	NA	DS1, DS3 or Fiber	65 ft.			
Cable Rack A (Occupancy) for Optical 12 fiber cable	12" Ladder Rack	ILEC	ILEC + CLECs	Y	221 Breakout	50 ft	$39.88	$1994.00	$9.02
Cable Rack A (Occupancy) for DS1 or DS3 Circuit	20" Ladder Rack	ILEC	ILEC + CLECs	Y	734 Type or ABAM	50 ft	$40.52	$2026.00	$7.29

*Cable is supplied and terminated as part of Virtual Equipment Installation and paid for by CLEC

VIRTUAL COLLOCATION MODEL - -48V DC Power Delivery



Element	*Description*	*Provided by CLEC/ILEC*	*Used By*	*Re-useable*	*Quantity*	*Unit Cost*	*Total Cost*	*Remarks*
Virtual Equipment*	Located in ILEC Line Up	CLEC	1 CLEC	NA				
Cable A 2 x 0 to 5 Amp Feeds*	4 X #10 Cables between Virtual and ILEC BDFB	CLEC	1 CLEC	NA				Included in Virtual Equipment Installation
Cable A 2 x 6 to 20 Amp Feeds*	4 X #6 Cables between Virtual and ILEC BDFB	CLEC	1 CLEC	NA				Included in Virtual Equipment Installation
Cable A 2 x 21 to 30 Amp Feeds*	4 X #4 Cables between Virtual and ILEC BDFB	CLEC	1 CLEC	NA				Included in Virtual Equipment Installation
Cable A 2 x 31 to 50 Amp Feeds*	4 X #2 Cables between Virtual and ILEC BDFB	CLEC	1 CLEC	NA				Included in Virtual Equipment Installation
Cable A 2 x 51 to 60 Amp Feeds*	4 X #1 Cable between Virtual and ILEC BDFB	CLEC	1 CLEC	NA				Included in Virtual Equipment Installation
Cable Rack A	15" Existing Cable Rack	ILEC	ILEC + CLECs	Y	25'0"	$0.14	$3.50	Power Delivery Rack for all Bays in Lineup
BDFB	Located within 1 aisle of Virtual Equipment	ILEC	ILEC + CLECs	N/A	--	--	--	Included in -48V DC Power Consumption Charge
Cable Rack Occupancy	Shared support for Cable 'B' below	ILEC		N/A	--	--	--	Included in -48V DC Power Consumption Charge
Cable B	Cable between -48V Power Plant & BDFB	ILEC		N/A	--	--	--	Included in -48V DC Power Consumption Charge
-48V DC Power Plant	Shared use between CLEC's & ILEC	ILEC		N/A	--	--	--	Included in -48V DC Power Consumption Charge
AC Electrical & Auto-start Diesel	Required for Battery Back-up	ILEC		N/A	--	--	--	Included in -48V DC Power Consumption Charge

*Cable is supplied and terminated as part of Virtual Equipment Installation and paid for by CLEC

ILEC MANPOWER

Function	Work Time (hours)
Outside Plant Access Design	6
Building & MDF Planning	14
Power Engineer	8
Equipment Engineer	12
Equipment Installation Project Manager	10
Operations Group	6
ILEC Contact Group	4
Other ILEC Groups	6
	66

SECTION TWO

BACKUP INDEX

CABLE & CABLE RACK LENGTHS

POWER (Cable from the Battery Distribution Fuse Bay to the Virtual equipment)

		MIN	MAX
Length from BDFB to Adjacent Bay		5'	
Length from BDFB to end of aisle			40'
Length across aisle			5'
Cable Rack to equipment(drops)		15'	15'
	TOTAL	20'	60'

Average Cable Length (60 + 20)/2 = 40' (includes average 7'6" cable drop at each end)
Rack = 25' (no drops)

VOICE GRADE, DS1 AND DS3

Cable lengths used are 165' from BU#3, computed based on an average of a maximum and minimum scenario. Cable racks are 150' (15' less than the cable, which allows for two 7'6" drops from the cable rack to the equipment)

VIRTUAL TO VIRTUAL

		MIN	MAX
Length from Bay to Adjacent Bay		5'	
Length from Bay to end of aisle			40'
Length across 12 aisles			55'
Cable Rack to equipment(drops)		15'	15'
	TOTAL	20'	110'

Average Cable Length (110 + 20)/2 = 65' (includes average 7'6" cable drop at each end)
Rack = 50' (no drops)

OPTIC PATCH CORD

	10 BAY (max)	1 BAY (min)
From top connector to cable tray	7'	7'
Horizontal in cable tray	26'	2'
From cable tray to connector	7'	1'
Total	40	10

Average Cable Length: (40' + 10') / 2 =25' or 7.6 meters

Since fiber patch cords are available in standard lengths of 3, 6, 7, 10, 12, and 15 meters, a 10 meter length cord was selected.

10 Meter Fiber Patch Cord equipped with SC connectors = $63.50 each

Source: ADC Telecommunications

VBU #3

ILEC MANPOWER

The following table lists the ILEC Groups involved in the Virtual Collocation Process and the tasks performed in fulfilling a request for Collocation

Function	Tasks	Work Time (hours)
Outside Plant Access Design	Prepares Estimate for Work required	2
	Engineers Details and Tender	2
	Reviews Tenders and Awards	2
Building & MDF Planning	Selects Building Space	2
	Compiles Estimates and develops Plan	8
	Finalizes Plan and advise	2
	Finalizes Project	2
Power Engineer	Prepares Estimate for work required	3
	Engineers Details & Prepares Estimate	5
Equipment Engineer	Prepares Estimate for work required	4
	Engineers Details & Prepares Estimate	8
Equipment Installation Project Manager	Coordinates Equipment Estimates	10
Operations Group	Attends Meetings and Interfaces with Contractors as required	6
ILEC Contact Group	Reviews Request and Forward to Planning	1
	Advises CLEC of Collocation details	1
	Receives Acceptance of details and advises Planning	1
	Notifies CLEC of Completion	1
Other ILEC Groups	Performs related Tasks (e.g., billing)	6
	TOTAL	66

Source: subject matter experts Richard Bissell and Allen Hobbs, based on experience.