CENTRAL OFFICE ENGINEERING
GENERAL ENGINEERING INFORMATION
CABLE DISTRIBUTION SYSTEMS AND SYSTEMS ASSEMBLY IN ELECTRONIC OFFICES USING 7-FOOT FRAMEWORKS
COMMON SYSTEMS

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1. GENERAL

A. SCOPE

1.01 This section, together with the supplementary information listed herein, covers the equipment design requirements to be used in the engineering and installation of cable distribution systems and common hardware, including end guards, stanchions, and frame-and-aisle lighting for central office equipment that meets the requirements of Section 800-610-164. Such equipment, called NEBS equipment, is generally mounted on 7-foot high frameworks of the ESS, unequal flange, or UNIFRAME type. The requirements in this section apply to this equipment installed in new buildings, building additions, existing space, and refurbished space. The requirements on new central office building space and additions constructed to house NEBS equipment are found in Division 760 Practices (superceding corresponding sections of the Building Engineering Standards, Specifications X-74300). NEBS standard space is characterized by 10 foot clear ceiling height, 12 feet 6 inches clearance between the top of the floor slab and the bottom of the lowest structural member, 150 pound per square foot (psf) live load capacity, and 20 foot square-building bays. These ceiling height and floor load criteria also represent minimum requirements for any existing space for standard arrangements of NEBS equipment.

1.02 Whenever this section is reissued, the reason for reissue will be specified in this paragraph.

B. INTRODUCTION

1.03 The cable distribution systems and associated common hardware for NEBS equipment take into account the requirements for cabling, cooling, assembling, lighting, and maintaining the equipment. They have been preengineered and are available in modular arrangements to simplify engineering and installation. Although designed primarily for use in NEBS buildings, these arrangements can be modified to suit job conditions when 7-foot high equipment is installed in non-NEBS and existing space. Adherence to the requirements stated herein will insure that current equipment will be interconnected and assem-

TABLE A

CABLE DISTRIBUTION SYSTEMS AND COMMON EQUIPMENT DOCUMENTATION FOR NEBS CENTRAL OFFICE EQUIPMENT

ITEMS	NO. 1 ESS	NO. 2 ESS	NO. 3 ESS	NO. 4 ESS	POWER	BROADBAND CXR	DIGITAL CXR	COSMIC MDF	LPCDF	VF & TERMINAL	TSPS	AIS
CABLE PATHWAYS PLAN	BSP 801-801-182											
SYSTEM CABLE RACKS	J1A054	J1A054	J1A054	J90606	SEE TABLE B 801-801-182	J90606	J90606	ED-6C015-30	ED-97788-( )	J90606	J1A054	J1A054
TYPICAL CABLE RACK LAYOUTS	FPD 820-001-150	FPD 820-600-150	FPD 820-650-150	BSP 760-100-065	BSP 760-240-100	BSP 760-100-080	BSP 760-100-085	ED-6C015-30	ED-97788-( )		FPD 821-100-150	FPDS SECT 21.5
VIA CABLE RACKS	BSP 801-801-182											
J90606/J1A054 INTERFACES	BSP 801-801-182											
FRAME & AISLE LIGHTING	J85515							ED-6C015-30	ED-97788-( )	J85515		
EQUIPMENT COOLING	BSP 760-230-100											
FIRE DETECTORS	BSP 760-621-150											
COMMON EQUIPMENT	SEE TABLE J BSP 801-801-182											

bled at minimum cost, and with flexibility to accommodate future equipment.

TABLE B

CABLING ARRANGEMENTS FOR POWER PLANTS

PLANT	TYPICAL CABLING PLAN
111A	ED-82265-10
326A&B	ED-82271-18 ED-82509-10 -11
415A	ED-82782-10 -11
132A,133A,150B,151B	ED-82838-( )
152,153,154,155 type	ED-82840-( )

1.04 A comprehensive set of documentation, including BSPs, specifications and ED drawings, describes the cable distribution systems and associated common hardware for NEBS equipment. As indicated in Table A, this section governs intersystem connections and overall hardware integration. Specific requirements and hardware details for individual functional elements are found in the referenced documents in Table A and Table B.

2. CABLE PATHWAYS PLAN

A. DESCRIPTION

2.01 The overall coordination of the superstructure and common hardware required for 7-foot high equipment is achieved with the "Cable Pathways Plan." The Plan standardizes the maximum size and possible locations of cable racks, and integrates the frame and aisle lighting system with the cable distribution system. The Cable Pathways Plan also incorporates the building elements, cooling air diffusers, fire detectors, and access requirements in an overall allocation of space that minimizes possible conflicts throughout the life of the building.

2.02 Fig. 1 illustrates the Cable Pathways Plan for 12-inch deep equipment frames installed in central office space meeting NEBS standards. The standard NEBS floor plan for such equipment employs five lineups per building bay. Fig. 2 illustrates the Cable Pathways for 18-inch deep frames arranged in the standard NEBS floor plan with three lineups per building bay.

2.03 In the Cable Pathways Plan, the cabling falls into two broad categories: System and Via cabling. System cabling interconnects all the equipment frames of a single major system, such as No. 4 ESS. Via cabling encompasses all other interconnections, including that which originates outside a system and passes over or terminates in it. All vertical cable runs are classified as Via cabling. Power cabling from a battery plant to a switching area is an example of Via cabling. With 7-foot high equipment, the 7- to 10-foot space above the frameworks is reserved primarily for cable distribution. All cable racks within this space are divided into two major categories:

(a) ***System cable racks*** carrying only System cables; and

(b) ***Via cable racks*** carryng only Via cables.

B. BENEFITS

2.04 The use of the Cable Pathways Plan will achieve the following benefits:

Cabling

(a) Efficient use of the 3 feet of vertical space allocated to cabling and lighting over 7-foot high NEBS equipment is assured.

(b) Potential cabling capacity in excess of present NEBS cabling limits (25 pounds per square foot) provides flexibility for accommodating future equipment which may have higher interconnection densities and lower equipment densities.

(c) Via cable runs can be planned in the directions parallel and perpendicular to the equipment lineups without creating cable congesting crossovers.

(d) Cross-aisle cable runs are coordinated with building elements and cable holes to eliminate interference with columns and to avoid blocking vertical cable runs.

(e) Unobstructed openings between cross-aisle troughs give installers adequate access to the cable racks.

Lighting

(a) The J85515 (802-015-160) lighting system requires fewer fixtures and consumes less energy. Lighting heat release is reduced by 1.5 watts per square foot. An overall expense saving is achieved, compared to older lighting systems.

(b) Lighting fixtures are readily accessible for lamp replacement and cleaning.

Cooling

(a) The locations of cooling air supply slots of the Modular Cooling System (MCS) or air supply diffusers of Conventional Cooling Systems (CCS) at the 10-foot level are standardized with respect to cable racks and lights.

(b) Throughout the life of the installation, unobstructed openings are available for the free flow of air down to the equipment.

Fire Detectors

(a) Fire detector locations are coordinated with the standardized locations of the cabling, cooling, and lighting systems over the wiring aisle above unobstructed openings between cross-aisle racks.

(b) Detectors will be placed out of the flow of cooling air.

(c) Detector indicator lights are fully visible and the heads are fully accessible for maintenance and testing.

2.05 The full benefits of the Cable Pathways Plan will be achieved if it is incorporated into the early stages of planning a central office. Building space planners, in consultation with cabling engineers, should establish a Cable Pathways Plan for all NEBS equipment areas of the wire center. They should be modified where necessary, to adapt to non-NEBS cable hole and column spacing. This early planning should include, when necessary, interfaces between cable distribution systems that conform to the Cable Pathways Plan and those that do not. In existing offices, transitions between existing cable racks and NEBS Cable Distribution Systems should also be planned.

2.06 The Pathways should be indicated on the study plans and the central office record drawings. When used for the ongoing planning of the office, the Cable Pathways plan will yield the following benefits in the central office engineering.

Cabling and Equipment Engineering

(a) All elements in the superstructure are readily accessible for installation, maintenance, and changes, including cable removing or mining.

(b) There is excess cabling capacity over equipment lineups to accommodate future equipment designs and to facilitate recabling.

(c) Via cable runs including vertical runs can be planned for the entire wire center, including future growth areas, with assurance of readily interfacing with any superstructure added in the future.

Building Engineering

(a) The equipment cooling air distribution system can be designed in advance of detailed engineering of cable racks and lights with the assurance that air supply diffusers will not be blocked by these elements in the superstructure.

(b) Fire detector heads can be located in coordination with the other elements in the overhead space before details on the superstructure design are available.

C. IMPLEMENTATION

2.07 The cable racks, frame and aisle lighting, and air diffusers are located in the Cable Pathways Plan according to the following rules:

(a) System cable racks running parallel to equipment lineups are 7 to 8 feet above the floor and directly over the lineups. A minimum spacing of 2 feet in the maintenance aisle and 1 foot 4 inches in the wiring aisles is maintained between lineup system racks.

(b) System cable racks running perpendicular (cross-aisle) to equipment lineups are in the cross-aisle cable pathways 8 to 9 feet above the floor on 5-foot centers across the equipment area, as shown in Fig. 1 and 2. Here they avoid cable holes and columns, provide installer access to cable racks, and maintain unobstructed "windows" for cooling air. The maximum width of these cable racks is 18 inches. In general, 75 percent of the total cross-aisle pathways capacity per building bay is allocated for cross-aisle System cable racks.

(c) Via cable racks running parallel to equipment lineups are in the cable pathways 9 to 10 feet above the floor and directly over the lineups. These racks should be 1 foot wide or less and located over not more than three equipment lineups per 20-foot building bay.

(d) Via cable racks running perpendicular (cross-aisle) to equipment lineups shall be in the cross-aisle cable pathways 8 to 9 feet above the floor on 5-foot centers across the equipment area. These Via cable racks share the cross-aisle pathways with the System cable racks. At least 25 percent of the total cross-aisle pathway capacity on a floor shall be allocated for Via cable racks.

(e) KS-21559 fixtures shall be located over maintenance aisles between 7 feet 3 inches and 8 feet above the floor and on the same 5-foot centers as the cross-aisle cable pathways. This places them directly below the cross-aisle pathways and thus below any cable racks. The fixtures can be supported directly from the cross-aisle cable racks or troughs or from support members installed between the lineup cable racks.

(f) With a conventional cooling system the air diffusers are at the 10-foot level, directly over the "windows" between cross-aisle cable pathways. Here they supply an unobstructed flow of cooling air into the equipment aisles. The air diffuser support can be provided by the building engineer or by Western Electric. In the latter case, a superstructure is suspended from the ceiling inserts pattern shown in Fig. 1 and 2 to support air diffusers and Via cable racks, if necessary.

(g) With a Modular Cooling System, as described in Section 802-011-150, the air closures in the suspended ceiling are located directly over the "windows" between the cross-aisle cable pathway. Other air closures are provided as required to achieve the required air flow.

D. NON-NEBS OR EXISTING SPACE

2.08 For non-NEBS or existing space, the Cable Pathways Plan should be modified to suit non-NEBS column and cable hole spacing frequently found in existing buildings. These variations will affect both the number and spacing of cross aisle and lineup pathways according to the following rules:

(a) The recommended numbers of 7- to 8-foot and 9- to 10-foot level pathways are given in Table C as a function of the number of line-ups of 12- or 18-inch deep frames per building bay. As indicated in Table C the number of 9- to 10-foot Via pathways is limited because of a floor load limit of 150 pounds per square foot. In a given situation, if the permissible maximum floor loading exceeds this value by at least 25 pounds per square foot, Via pathways may be located over each line-up.

TABLE C

MAXIMUM NUMBER OF LINE-UP CABLE PATHWAYS PER BUILDING BAY

LINE-UPS PER BLDG BAY	12-INCH DEEP FRAMES		18-INCH DEEP FRAMES	
	7 TO 8-FT	9 TO 10-FT	7 TO 8-FT	9 TO 10-FT
2	—	—	2	2
3	—	—	3	3
4	4	3	4	3
5	5	3	—	—
6	6	3	—	—

(b) The number of cross-aisle pathways per building bay will be varied depending on column spacing as shown in Table D.

TABLE D

NUMBER OF CROSS-AISLE CABLE PATHWAYS PER BUILDING BAY

COLUMN SPACING, FEET	CROSS-AISLE CABLE PATHWAYS PER BUILDING BAY
12 to 17	3
greater than 17 to 22	4
greater than 22 to 27	5

(c) The center-to-center distance between cross-aisle pathways should be not less than 4 feet and not more than 6 feet. The minimum value assures adequate access for cabling and unobstructed flow of cooling air, while the maximum value assures adequate lighting.

(d) As they cross column lines, cross-aisle pathways may be decreased in size or offset to minimize interference with cable holes or to avoid columns or other obstructions.

(e) Where there are continuous cable slots or where cable hole capacity exceeds NEBS requirements, it is recommended that the cross-aisle pathways be arranged within the limitations of (b) such that cable hole capacity equivalent to NEBS requirements (approximately 6 square feet in a 20-foot building bay) is left unobstructed.

(f) When a plan with other than four cross-aisle pathways per building bay is established, the allocation between System and Via cabling should remain at 25 percent Via, 75 percent System, preferably by reserving one out of every four pathways (on the average) for Via cabling.

(g) In some cases a pathway can only be used for cabling between line-ups within the same building bay since it may be completely obstructed by a column line. An example of this condition is shown in Fig. 3.

2.09 Fig. 3 through 5 illustrate examples of Cable Pathway Plans modified to meet non-NEBS building parameters.

3. VIA CABLING

A. DESCRIPTION

3.01 The Via cable racks transport all cabling that originates outside an equipment system and passes over or terminates in it. In general, ladder- or bar-type cable racks per ED-97870-( ) should be employed for Via cabling arranged according to the Cable Pathways Plan as described above.

3.02 In general, the cabling between the cable entrance facility, distributing frames, switching facilities, transmission facilities and power should be run on Via cable racks. All cabling within these facilities are System cabling. In addition, all vertical cable runs are placed in Via cable racks. When a single facility must be placed on more than one floor, the interfloor system cabling between the two parts of the system are also treated as Via cabling. Fig. 6 illustrates schematically the Via cable runs in a typical central office.

B. CABLE PILEUPS

3.03 The Via cable rack should be sized to limit the cable pileup to 6 inches or less at all times to provide adequate installation space. In general, all power cables and entrance cables should be secured on the cable racks to maintain order with these bulky cables. Power cables are also secured to meet the pairing and segregation requirements of Section 802-005-180. Switchboard cables can be run unsecured unless securing is required to meet pileup limitations. Under no circumstances shall the pileup exceed 6 inches with either secured or unsecured cabling methods. The cross-sectional area occupied by a cable run can be calculated by one of the following formulas.

For unsecured cabling:

$$\textit{Cable pileup area} = 1.40\ (\Sigma d^2)$$

For secured cabling:

$$\textit{Cable pileup area} = \Sigma d^2$$

Where:

$d^2 = \sum$ *of the squares of the diameters of all the cables in the pileup*

C. SUPPORT OF HORIZONTAL RUNS

3.04 The Via cable racks in the lineup and cross-aisle direction are installed at the elevations shown in Fig. 7.

3.05 The Via cable racks can be supported from the frames below or from the ceiling. Over equipped areas, the preferred arrangement is to support the Via cable racks from the 7-foot high equipment frames per ED-97798-50 over broadband carrier areas per ED-97868-50 over digital carrier areas, or per ED-97787-30 elsewhere. Over unequipped areas, the Via cable runs can be floor supported by stanchions per ED-97870-( ). However, if the stanchions are unacceptable for maintenance, operational, or access reasons, racks can be ceiling supported per ED-97870-( ). These racks shall be ceiling supported over equipped areas where frame supports cannot be used; for example, where Via cable racks must traverse areas that are only partially equipped with frames, or where cable buildup in the System cable racks prevent the installation of the supports for the Via racks in the System racks.

3.06 The Via cable racks shall be installed and supported in conformance with the requirements of Section 800-614-157, unless modified by drawings and specifications applicable to 7-foot high equipments and NEBS central offices.

3.07 Lateral bracing of frame supported Via cable racks is not required. The standard arrangements will provide adequate stability to the superstructure system. In partially equipped areas, where Via cable groups are ceiling supported over the unequipped areas and frame supported over equipped areas, no lateral bracing is required if at least 25 percent of the frames are installed initially. If Via cable racks are completely ceiling supported, bracing requirements per Section 800-614-157 must be met.

D. SUPPORT OF VERTICAL CABLE RUNS

3.08 The requirements for the support of vertical power cable runs per Section 800-614-152 must be met. If the vertical power cable run exceeds three floors, a horizontal section at least 20 feet long shall be introduced at intervals not exceeding three floors. Transitions between vertical and horizontal Via cable runs are made per ED-97870-( ).

3.09 The requirements of 3.06 through 3.08 for the support of Via cable racks are applicable only for central offices in regions with minor seismic risk. The requirements for the support and bracing of Via cable racks in central offices located in areas with moderate or major risk of earthquakes are found in Section 800-610-155. See Section 760-200-023 for guidance on estimating the seismic risk in a particular area.

E. INSTALLING AND PROTECTING CABLE RUNS

3.10 The general requirements for installing and protecting cable runs per Section 800-614-152 shall be met for all System and Via cable runs.

3.11 If switchboard cabling is installed unsecured on the Via cable racks, bar-type racks per ED-97870-( ) shall be used. If the cables are secured on the ladder-type cable racks they shall be clipped or sewed per the requirements of Sections 800-614-152 or 800-614-158.

F. CABLE SEGREGATION REQUIREMENTS

3.12 The applicable cable segregation requirements for interconnecting equipment systems in a central office must be followed in all cases. In general, switchboard cabling and power cabling should be run on separate cable racks to minimize noise induction between cables and to prevent physical damage of the switchboard cables by the heavy power cables. Entrance cables for tip cabling and carrier systems should also be placed on separate racks.

3.13 Segregation and pairing requirements for the various types of power cable are contained in Section 802-005-180. Paired cables should extend as nearly as practicable to their terminations, and should never be separated by a steel member such as a ladder-rack strap.

G. WAVEGUIDE RUNS

3.14 Indoor waveguide runs should be engineered to be as short as possible using the most direct path with the least number of bends. A master plan showing present and future space for waveguide runs should be formulated for each station. Conduit, cable rack, air-conditioning ducts, etc, should be routed around this dedicated space. Additional information for waveguide runs is contained in Section 804-309-151.

3.15 Table E lists the documentation applicable to the installation of hardware and cabling for the Via cabling over 7-foot high frames.

4. SYSTEMS CABLING

A. GENERAL

4.01 The System cabling transports all the cabling associated with a particular equipment system. Racks listed in Table A meet the cabling requirements for all equipment mounted on 7-foot high frames. In agreement with the NEBS standards, System cable racks are supported by the frames in equipped areas. Over equipped or partially equipped areas, they are supported by floor mounted stanchions. The specifications listed (Table A) should be consulted for detailed descriptions of these cable distribution systems.

B. J90606 CABLEWAY SYSTEM

4.02 The J90606 (801-006-158) Cableway System is used over the No. 4 ESS Network and Terminals, Voice Frequency Terminals, and T, L, N, and High Speed Digital Carrier equipment. The Cableway System meets all the requirements of the NEBS Equipment Design Requirements per Section 800-610-164. The Cable Pathways Plan can be fully implemented with the Cableway System.

C. J1A054 CABLE DISTRIBUTION SYSTEM

4.03 The J1A054 (801-801-155) cable distribution system used over No. 1, 2, and 3 ESS, TSPS, and AIS conforms to the Cable Pathways Plan in the size and location of both the lineup System and Via cabling, and in the use of the KS-21559 fixtures. One cross-aisle Pathway for Via cabling per 20-foot building bay, between the 8 and 9 foot levels, is shown on appropriate Floor Plan Data Sheets. The pathway is centered over two brackets mounted 1 foot 1 inch apart. Systems cross-aisle troughs can be mounted on 1 foot 1 inch centers. These features are available with the older 12-inch-wide lineup racks used over No. 2 and 3 ESS, TSPS, and AIS, and with the new 18-inch wide racks used over No. 1 ESS offices with remreed networks and miniature trunk frames.

4.04 The planning of areas to employ the J1A054 cable distribution system must incorporate the requirements for interfaces with cooling air diffusers, fire detectors, building columns, and vertical cable runs. Planning must also allow adequate installation access. The layout of equipment and cable racks must also be coordinated between areas employing the J90606 cableway and the J1A054 cable distribution system to minimize jogs in cable runs between the two systems and hence avoid excessive cable pileups and length. Guidance for this coordination is included below and on Floor Plan Data Sheets.

5. CABLE RACK INTERFACES

5.01 Cabling between different equipment areas, such as local switching, power, transmission, and distributing frames, is transported by Via cable racks installed in conformance with the requirements of the Cable Pathways Plan. However, when simplifications in hardware and layout are possible, direct connections between different System cable racks have been designed. These should be employed only when the two equipment systems are immediately adjacent to each other, or separated by no more

TABLE E

VIA CABLING DOCUMENTATION

ITEM	DOCUMENT
Clipping of Cables	BSP 800-614-158
Earthquake Bracing	BSP 800-610-155
Interfaces Between Horizontal and Vertical Via Cable Racks	ED-97870-( )
Protection and Running of Cables	BSP 800-614-152
Sewing Cables	BSP 800-614-152
Supporting Via Racks from the Ceiling	ED-97870-( )
Supporting Via Racks from Equipment Frames	ED-97787-30 ESS Cableways ED-97798-50 Broadband Cableway ED-97868-( ) Digital Cableway
Supporting Via Racks from Stanchions	ED-97870-( )
Vertical Cable Rack Support	BSP 800-614-157
Waveguide Run	BSP 804-309-151

than the width of a cross aisle or a column line. If the separation is greater, Via cable racks should be used to transport the cables between the equipment systems.

5.02 Table F tabulates the documentation covering the hardware available to interface the different System cable racks with each other. Table F also tabulates this information for System-to-Via cable rack interfaces and horizontal-to-vertical Via cable rack interfaces. The documents specified at the intersection of the columns and rows describe the interface between the two systems. For example, the interfaces between the No. 4 ESS Cableway and the COSMIC Frame Racks are found in ED-6C015-30. These interfaces should be applied to satisfy the requirements of 5.01.

5.03 The system specifications covering equipment grounding must be consulted to determine where electrical ground isolation is required between equipment systems. At these interfaces, connections that provide isolation at points of mechanical contact must be used.

5.04 Planning is significantly simplified for locating interfaces between systems that employ the Cable Pathway Plan. All the lineup and cross-aisle Via and System cable racks are located in the same pattern throughout the office eliminating any jogs or offsets in the cable runs. This characteristic gives the planner freedom in locating interfaces where required.

5.05 Interfaces between the J90606 cable distribution system, which fully meets the Cable Pathways Plan requirements, and the J1A054, which meets the Cable Pathways Plans requirements in the location of lineup Via and System racks but not for the cross-aisle racks, must be planned with more care. To avoid excess cable length and congestion of the lineup cable racks, jogs and offsets in continuous cross-aisle cable runs should be minimized. Fig. 8 shows how wide cross-aisle racks at the 8-foot level are used to provide interfaces where the center line-to-center line offset is less than 1 foot. For offsets between 1 and 5 feet, the extra cable length should be run in the lineup system rack at the 7-foot level, unless cable congestion is critical, in which case a lineup Via rack at the 9-foot level should be used. For offsets greater than 5 feet, a lineup Via rack should be installed as shown in Fig. 9.

5.06 Continuous equipment structures, such as equipment lineups with associated cable racks, battery stands, distributing frames, and protector frames shall not be installed over building structural joints including expansion joints. Via cable runs traversing these joints are capable of withstanding movements in the joints, and no special treatment is required.

TABLE F*

CABLE DISTRIBUTION SYSTEM INTERFACES

ITEMS	NO 4 ESS CABLEWAY	BROADBAND CABLEWAY	DIGITAL CABLEWAY	12 IN. WIDE J1A054 RACK	18 IN. WIDE J1A054 RACK	HORIZ VIA RACKS	VERTICAL VIA RACKS	LPCDF RACKS	COSMIC RACKS	POWERED PLANT RACKING
NO. 4 ESS CABLEWAY		USE VIA RACKING	USE VIA RACKING	ED-97741 -71 ED-97738 -30	ED-97741 -71 ED-97738 -30	ED-97870 -( )	ED-97870 -( )	ED-97788 -( )	ED-6C015 -30	USE VIA RACKING
BROADBAND CABLEWAY	USE VIA RACKING		USE VIA RACKING	USE VIA RACKING	USE VIA RACKING	ED-97898 -50	ED-97898 -50	USE VIA RACKING	NOT REQD	USE VIA RACKING
DIGITAL CABLEWAY	USE VIA RACKING	USE VIA RACKING		USE VIA RACKING	USE VIA RACKING	ED-97870 -( )	ED-97870 -( )	USE VIA RACKING	NOT REQD	USE VIA RACKING
12 IN. WIDE J1A054 RACK	ED-97741 -71 ED-97738 -30	USE VIA RACKING	USE VIA RACKING		ED-1A184 -70 ED-1A197 -71	ED-97870 -( )	ED-97870 -( )	ED-97788 -( )	ED-6C015 -30	USE VIA RACKING
18 IN. WIDE J1A054 RACK	ED-97741 -71 ED-97738 -30	USE VIA RACKING	USE VIA RACKING	ED-1A184 -70 ED-1A197 -71		ED-97870 -( )	ED-97870 -( )	ED-97788 -( )	ED-6C015 -30	USE VIA RACKING
HORIZ. VIA RACKS	ED-97870 -( )	ED-97798 -50	ED-97870 -( )	ED-97870 -( )	ED-97870 -( )		ED-97870 -( )	ED-97870 -( )	ED-97870 -( )	ED-97870 -( )
VERTICAL VIA RACKS	ED-97870 -( )	ED-97798 -50	ED-97870 -( )	ED-97870 -( )	ED-97870 -( )	ED-97870 -( )		ED-97870 -( )	ED-97870 -( )	ED-97870 -( )
LPCDF RACKS	ED-9788 -( )	USE VIA RACKING	USE VIA RACKING	ED-97788 -( )	ED-97788 -( )	ED-97870 -( )	ED-97870 -( )		NOT REQD	NOT REQD
COSMIC RACKS	ED-6C015 -30	NOT REQD	USE VIA RACKING	ED-6C015 -30	ED-6C015 -30	ED-97870 -( )	ED-97870 -( )	NOT REQD		NOT REQD
POWER PLANT RACKING	USE VIA RACKING	USE VIA RACKING	USE VIA RACKING	USE VIA RACKING	USE VIA RACKING	ED-97870 -( )	ED-97870 -( )	NOT REQD	NOT REQD	

* USE OF TABLE—The documents specified at the intersection of the columns and rows describe the interface between the two systems. For example, the interface between the No. 4 ESS Cableway and the COSMIC Frame racks are found in ED-6C015-30.

5.07 When equipment having different depth guard rails are located in the same lineup, the front surface of the guard rails for all frames must be aligned according to Section 800-610-164.

6. GENERAL CABLING REQUIREMENTS

A. CABLING

6.01 The System cable racks shall contain only System cabling. To permit orderly growth and management of offices, no Via cabling should be run in the System cable racks.

6.02 The capacities of the system cable racks, as found in the documentation indicated in Table A, shall not be exceeded throughout the life of the office. Similarly, the 6-inch cable pileup limitations for Via cable racks shall not be exceeded throughout the life of the office. By conforming to these requirements, structural overloads will be avoided and cable removal facilitated.

6.03 Care should be taken to insure a neat arrangement of cables both entering and leaving the racks to utilize the cabling capacity as efficiently as possible; large diameter loops should be avoided. Minimum bend radii for cables, as specified by applicable Bell System Practices and specifications, shall be maintained.

6.04 Bulk cable shall be cut to length to minimize slack in the cable racks. An exception is where fixed length cables are a requirement. For these cases, any slack shall be stored as described in the typical cabling plans indicated in Table A. These do-

cuments also govern the storage of slack associated with connectorized cables.

6.05 "Waterfalling" of cables, as illustrated in Fig. 10, may be necessary at the transitions between lineup and cross-aisle Via cable racks. To minimize blockage of the cross-aisle rack, the cables should be brought to one side of the turn as shown in Fig. 10. This will allow free passage of cables through the intersection.

6.06 All applicable cable segregation requirements shall be met in the Via and System cable racks. Table G lists the specifications containing these requirements.

TABLE G

CABLE SEGREGATION REQUIREMENTS

SYSTEMS	SPECIFICATIONS
NO. 1 ESS NO. 2 ESS NO. 3 ESS 1A Processor TSPS AIS	J1A054
NO. 4 ESS (including Terminals) Digital Carrier Broadband Carrier	J90606

6.07 All cables in the Via and System cable racks shall be protected against possible damage. Cabling run on the Via cable racks shall be protected per Section 800-614-157. Cabling run on System cable racks shall be protected per application specifications.

B. CABLE MINING (REMOVAL)

6.08 Cables with only nonworking conductors shall not be permitted to accumulate in the Via or System cable racks. The cable distribution systems covered in this section have been designed to simplify cable mining. Most cabling is unsecured, eliminating much of the time and effort needed to remove cable clips or twine when cables are mined. System cabling is kept separate from Via cabling, thereby minimizing the number of cables disturbed during the mining operation. By limiting cable pileups and removing cables on an on-going basis, mining operations can be performed on manageable cable pileups. Finally, the Cable Pathways Plan provides unobstructed openings to all cable rack levels for easy access by installers during this operation.

C. CABLE SPLICES

6.09 When cable splices or connectors are placed in Via or System cable racks, the allowable cable rack capacities must be decreased by the area occupied by the splice or connector. All sharp edges on splices or connectors must be protected with approved methods per Section 800-614-152 to prevent damage to cables. The splice or connector should be located within the cable racks such that it is always readily accessible to the installer.

D. GROUNDING

6.10 ***General Grounding Rules***—Detailed general grounding practices concerning Office Ground Electrodes, Equipment Ground Systems, AC Service Grounds, Incidental Grounds, Discharge Grounds, etc, are covered in Section 802-001-180. In general, grounding bonds between metallic structures and enclosures (frameworks, cable racks, cabinets, etc) shall consist of electrical conductors specified for grounding purposes.

6.11 ***Specific Grounding Rules***

(a) More specific requirements and design information concerning conductors, interconnections, bonding and special systems requirements in Central Offices are covered in Sections 802-001-190 through 195, 197, and 198. Additional information concerning Protection Practices and covering lightning, power circuit contacts, and protection devices are contained in Division 876 BSPs.

(b) Grounding rules and procedures specific and unique to new designs and systems will be spelled out within the appropriate system's BSPs.

(c) All grounding rules and procedures shall conform to appropriate BSP requirements and meet or exceed National Electrical Code requirements as well as local Code requirements.

(d) Specific methods and hardware requirements for grounding specific systems are contained in the documentation tabulated in Table H.

6.12 In general all System cable racks and support hardware are part of the same ground plane as the system they serve. At interfaces between System cable racks on different grounding systems, insulation or separation shall be employed in order to maintain ground isolation.

6.13 Via cable racks are always considered to be part of the "integrated" building ground system and as such do not require isolation between them and building elements. However, when they traverse over systems on other than integrated ground systems (such as No. 4 ESS which employs an "isolated" ground plane) then, they must be adequately isolated from such systems.

E. UNDERFLOOR CABLING

6.14 The following general requirements apply to the engineering of switchboard and power cable runs under raised floors.

(a) ***General***—All cabling under the raised floor should be neat and orderly to simplify future changes and additions.

(b) ***Power Cables***—All power cables shall be run in accordance with applicable electrical code requirements. In most cases, this means the use of conduit or armored power cables.

(c) ***Switchboard Cables***

(1) All switchboard cables must be protected from damage by heavy armored power cables.

(2) All switchboard cable must be protected to avoid damage from sharp corners and edges when run in the underfloor spaces.

(3) All switchboard cables must be protected from water as dampness may cause cable malfunction.

6.15 See Section 760-150-155 for more details and requirements for running cables under raised floors.

F. FIRE PROTECTION

6.16 In the layout of cable racks and in the routing of cables, critical lead length and cable segregation requirements for the equipment systems involved must be satisfied. Congestion of the cable racks must be avoided and cable length should be minimized. In addition, to control fire and smoke propagation in the event of a fire, interfloor cable holes must be properly closed and fire stopped, and consideration should be given to minimizing the number of cable holes opened during the installation intervals, consistent with any established plan which may exist for cabling the office.

6.17 The following guidelines apply to the layout of cable distribution systems and to the routing of cables in both old and new offices:

(a) The equipment system requirements governing critical lead length and cable segregation must be met.

(b) Congestion of cable racks must be avoided.

(c) Cable distribution systems must be installed in agreement with any established plan for the offices. In particular, for offices meeting the New Equipment-Building System (NEBS) Standards per Section 800-610-164, the Cable Pathways Plan shall be followed as described in Section 2.

(d) In all additions to existing central offices, the adjustable ceiling closure plate (ED-92116-73) shall be installed in all cable holes opened during the installation, if not already so equipped.

(e) The cable pileup on all vertical cable runs shall be limited so that it is not closer than 3 inches to the side of the cable hole, thus providing the clearance necessary to properly pack the hole with KS-5048 bags of mineral wool. (See Section 801-006-151.)

(f) In additions to existing central offices, cables shall be routed so as to minimize the number of cable holes to be opened, consistent with the requirements of (a) through (e) above. Rerouting of cable, at the expense of extra cable length up to the limits tabulated in Table I, is cost-effective.

(g) The planning and layout of a cable distribution system (including vertical cable runs) in new offices should take into consideration the growth of the office. The planners should seek to minimize the hole required to be opened during any single installation job, consistent with the requirements of (a) through (e) above.

TABLE H

CENTRAL OFFICE PROTECTIVE GROUNDING REQUIREMENTS

SPECIFIC REQUIREMENTS		GENERAL REQUIREMENTS
NO. 1 ESS NO. 2 ESS NO. 3 ESS 1A Processor TSPS AIS	ED-1A200-10	BSP 802-001-195
NO. 4 ESS (including Terminals)	ED-4A081-10	
Digital		
Broadband		
Power		

7. COMMON HARDWARE

7.01 Table J tabulates the documentation covering the engineering requirements of common hardware associated with 7-foot high equipment frames.

TABLE I

CABLE LENGTH/CABLE HOLE ACTIVITY TRADEOFFS

TYPE OF CABLE RUN	ADDITIONAL CABLE FEET FOR INSTALLATION*
Switchboard	75
Power	30

* It is economical to increase the total amount of cable in a run by this amount to avoid opening a cable hole. For example, for a switchboard cable run of 5 cables, it is economical to increase the length of the runs up to 75 feet (15 cable feet/5 cables) to avoid opening a cable hole.

7.02 The frame and aisle lighting, equipment cooling systems, and fire detector systems shall be located in agreement with the Cable Pathways Plan as discussed in 2.01.

7.03 The frame and aisle lighting is supported over the System Cable Racks as shown on Table K. With several systems, the lighting fixtures can be supported from either a support member or a cross-aisle cable rack or trough placed in the Pathway for the sole purpose of supporting the lighting fixture, when no cross-aisle cabling is required in that Pathway. If this choice exists, it is recommended that an 18 inch wide cable trough or rack be used as the lighting fixture support, unless it results in a severe cost penalty. The use of the rack will simplify future

TABLE J

COMMON HARDWARE

ITEM	DOCUMENT
Air Diffusers	ED-97803-30
End Guards 12 In. Deep Frames	ED-1A198-71
1A Processor	ED-5A179-70
Broadband	ED-1A198-71 ED-50766-50 ED-52481-50 ED-97288-50
Fire Detectors	BSP 760-621-150
Frame & Aisle Lighting	J85515
Frameworks ESS Unequal Flange Cable Duct Uniframe	 J1A055 J97038 J97039
Modular Cooling System	BSP 802-011-150
Support Stanchions	ED-1A209-70
Transmission Noise Measuring Displays	ED-95037

TABLE K

METHODS OF SUPPORT FOR LIGHTING FIXTURES IN CROSS-AISLE CABLE PATHWAYS

CABLE DISTRIBUTION SYSTEM	CROSS AISLE CABLE PATHWAY EQUIPPED WITH		
	SYSTEM TROUGH OR RACK	VIA RACK	NO TROUGH OR RACK
J1A054 No. 1,2,3 ESS Cable Distribution System	Trough	Support Member	Trough or Support Member
J90606 No. 4 ESS Cableway	Trough	Support Member	Trough or Support Member
J90606 Broadband Cableway	Support Member	Support Member	Support Member
J90606 Digital Cableway	Rack	Rack	Rack or Support Member

rearrangements and changes in the cable distribution system as they are required.

7.04 The KS-20805 L10 digital display unit is remotely located when used with the KS-20805 transmission measuring system in NEBS offices. The digital display unit is 7 feet 2-1/2 inches above the floor and can be easily removed if more height is required when installing frames. It is incorporated into the Cable Pathway Plan as shown in Fig. 11. The 1-inch high digital characters can be easily read from a distance of 30 feet. The preferred location of this unit between KS-21559 lighting fixtures is to position the back or connector side of the display unit close to the lighting fixtures to assure full visibility. Mounting information is on ED-95037-30.

7.05 End guards for ESS No. 1, 2, 3, and 4; high speed digital and radio are on ED-1A198-71. End guards for broadband (L5, L5E, and LMX-3 frames) are on ED-1A198-71, ED-50766-50, ED-52481-50, and ED-97288-50.

7.06 Sections 801-601-150 through 801-601-159 and 801-601-181 list alarm specifications with Section 801-601-153 listing the requirements for central offices.

7.07 ED-1A226-10 lists the hardware used for miscellaneous alarm units used with the ED-1A198-71 end guards in ESS No. 1, 2, 3, and 4; high speed digital and 3A-RDS Radio Systems.

7.08 Appliance outlets for use with ESS No. 1, 2, 3, and 4 are on ED-1A157-71. Appliance outlets for broadband, high speed digital and radio are found on ED-97795-70 except for unequal flange frames found on ED-97289-30.

8. REFERENCED DOCUMENTS

8.01 The following documents are referenced throughout this section (801-801-182).

(a) 760-100-065—Space Planning for No. 4 ESS

(b) 760-100-080—Space Planning Analog Carrier Terminal Offices

(c) 760-100-085—Space Planning Digital Carrier Terminal Offices

(d) 760-150-155—Building Planning for Operations Support Systems

(e) 760-200-023—Earthquake Design Loads

(f) 760-230-100—Equipment Cooling—General

(g) 760-240-100—Design Criteria for DC Power Plants

(h) 760-621-150—Design Criteria for Fire Detection System in Telephone Buildings

(i) 800-610-155—Earthquake and Disaster Bracing for Central Office and PBX Equipment—General Equipment Requirements

(j) 800-610-164—New Equipment-Building System (NEBS)—General Equipment Requirements

(k) 800-614-152—Switchboard, Power, and Local Power Cables Installation—General Equipment Requirements

(l) 800-614-157—Cable Racks Installation—General Equipment Requirements

(m) 800-614-158—Cable Clips Installation—General Equipment Requirements

(n) 801-006-151—(J90801)—Cable Hole Sheathing

(o) 801-601-153—Central Office Audible and Visual Maintenance Alarm Equipment—Equipment Design Requirements—Common Systems

(p) 801-601-181—Central Office Alarm System—NJ01046—Strapping and Interconnection Instructions

(q) 802-001-180—Protective Grounding Systems—General Grounding Requirements for Communication Systems in Central Offices, Radio Stations and Other Structures

(r) 802-001-181—Performance Requirements—For AMA No. 1 Accounting Center—Power Plant

(s) 802-001-182—Performance Requirements—TH Radio Tube Cooling System

(t) 802-001-190—Protective Grounding Systems—Equipment Ground Systems Material—General Equipment Requirements—Power Systems

(u) 802-001-191—Protective Grounding Systems—Office Ground Electrodes—Power Systems

(v) 802-001-192—Protective Grounding Systems—Equipment Ground System, Central Offices (CO GRD)

(w) 802-001-193—Protective Grounding Systems—Equipment Ground System, Central Offices—General Interface Requirements for DC Power and Communication Systems

(x) 802-001-194—Protective Grounding Systems—Equipment Ground System, Central Offices—General Interface Requirements for Manual Toll Relay Rack Ground System

(y) 802-001-195—Protective Grounding Systems—Equipment Ground System, Central Offices—General Interface Requirements for Electronic Switching Systems—Power Systems

(z) 802-001-197—Protective Grounding Systems—General Equipment Ground Requirements for Microwave Radio Main and Auxiliary Stations

(aa) 802-001-198—Protective Grounding Systems—General Equipment Ground Requirements for AC Service Distribution Systems in Building Housing Communication Systems—Power Systems

(ab) 802-005-180—Assembly and Installation of Power Plant Bus Bar and Wiring—General Equipment Requirements—Power Systems

(ac) 802-011-150—Modular Cooling Systems—Equipment Design Requirements—Power Systems

(ad) 802-015-160—Central Office Lighting Fluorescent Type—Equipment Design Standards—Power Systems

(ae) 804-309-151—Microwave Radio—Indoor—Waveguide Considerations—Equipment Design Requirements—Toll Systems

(af) FPD 820-001-150—Table of Frames and Floor Plan Conventions—No. 1 ESS

(ag) FPD 820-600-150—Table of Frames and Floor Plan Conventions—No. 2 and 2B ESS

(ah) FPD 820-650-150—Table of Frames and Floor Plan Conventions—No. 3 ESS

(ai) FPD 821-100-150—Table of Frames and Floor Plan Conventions—TSPS No. 1

(aj) FPDS SECTION 21.5—Table of Frames and Floor Plan Conventions—Automatic Intercept System

(ak) X-74300—Building Engineering Standards

(al) ED-1A157-71—Frame Base Appliance Outlets and Distribution

(am) ED-1A184-70—Common Systems—Electronic Switching Type—Lineup Cable Rack—Assembly and Stocklist

(an) ED-1A197-71—Common Systems—Cross-Aisle Cable Troughs—Assembly and Stocklist

(ao) ED-1A198-71—Electron Switching System Common—End Guard Assembly and Stocklist

(ap) ED-1A200-10—ESS No. 1—Arranged with 2 Wire, 4 Wire and Data Features—Method of Running and Connecting +24 Volt and −48 Volt Power Feeders and Grounding Methods

(aq) ED-1A209-70—Lineup Cable Rack Support Stanchions

(ar) ED-1A226-10—Electronic Switching Systems No. 1 or 2 Arranged with 2 Wire, 4 Wire and Data Features—Specification for Miscellaneous Alarm Units

(as) ED-4A081-10—ESS No. 4—Central Office Grounding System—Common Systems

(at) ED-5A179-70—Electronic Common System—Electronic Switching Type—18 In. End Guard—Assembly and Stocklist

(au) ED-6C015-30—Common Systems—Typical Cable Rack and Lighting Arrangement for COSMIC Frames

(av) ED-50766-50—Toll Systems—L4, L5 & MGT Carrier End Guard Assemblies for Unequal Flange Cable Duct Type Framework per ED-97170-50, ED-97171-50, and ED-97162-52

(aw) ED-52481-50—Toll Systems—End Guards and Duct Closing Details for LMX-3 Terminal Bays for use with Unequal Flange Framework per ED-97162-52

(ax) ED-82265-10—Power Systems—Typical Floor, Cabling and Cable Rack PLan Arrangements for 111A Power PLants for Electronic Switching Systems

(ay) ED-82271-18—Power Systems—Typical Floor Plans and Bus Bar Arrangements for 326A or 326B Power Plants

(az) ED-82509-10—Power Systems—Typical Bus Bar Arrangement for +24 Volt and −48 Volt 0-6000 Ampere Copper Bus Bar—Two Way Left or Right Growth—326B Power Plant

(ba) ED-82509-11—Power Systems—Typical Cabling and Arrangements for 0-6000 Amperes +24 Volt and −48 Volt 326B Power Plant

(bb) ED-82782-10—Power Systems—Cable Rack Arrangement for Multiple Units of 415A Power Plants

(bc) ED-82782-11—Power Systems—Cable Rack Arrangement for 415A Power Plant

(bd) ED-82838-( )—Power Systems—Cabling Arrangements for 132A, 133A, 150B, and 151B Power Plants

(be) ED-82840-( )—Power Systems—Cabling Arrangements for 152, 153, 154, and 155 Type Power Plants

(bf) ED-92116-73—Cable Hole Sheathing and Adjustable Ceiling Cover

(bg) ED-95037-30—Common Systems—Test Boards Transmission Measuring Noise Equipment and Aisle Display Support

(bh) ED-97288-50—Common Systems—End Guard Assembly for Cable Duct Type Frames per ED-97170-50, ED-97171-50, ED-97162-52, ED-97163-52 and ED-97501-51

(bi) ED-97289-30—Appliance Outlets

(bj) ED-97738-30—Common Systems—Electronic Switching Type—18-inch Lineup Cable Rack for No. 4 ESS, Toll and TRMSN 7-foot Framework—Assembly and Stocklist

(bk) ED-97741-71—Cross-Aisle Troughs for ED-97738-30 Cable Racks—Assembly and Stocklist

(bl) ED-97787-30—Floor Supported Via Cabling Systems

(bm) ED-97788-( )—Common Systems—Typical Cable Rack and Lighting Arrangement for Low Profile Conventional Distributing Frame

(bn) ED-97795-70—Frame Base Covers and A.C. Outlets

(bo) ED-97798-50—Common Systems—Lineup, Cross-Aisle and Via Racks for Broadband Carrier Transmission 7-foot Frameworks—Assembly and Stocklist

(bp) ED-97803-30—Common Systems—Application and Installation for KS-21344 Air Diffuser

(bq) ED-97868-50—Common Systems—Specification for Lineup, Cross-Aisle and Via Rack and Method of Installation of Digital Cableway

(br) ED-97870-( )—Via Cable Rack Installation over 7 foot Frames

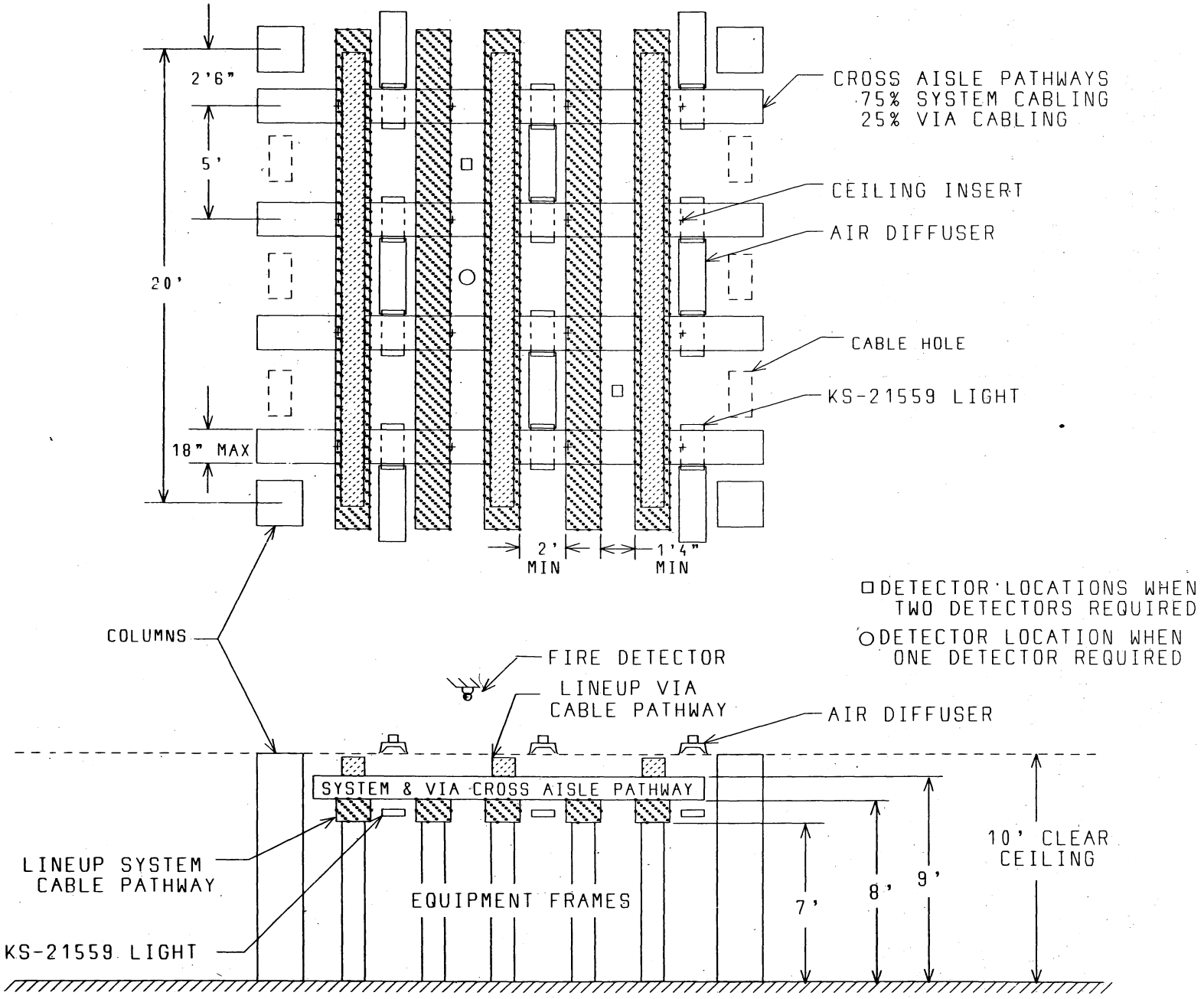

Fig. 1—Cable Pathways Plan for 12-Inch Deep Frame Areas

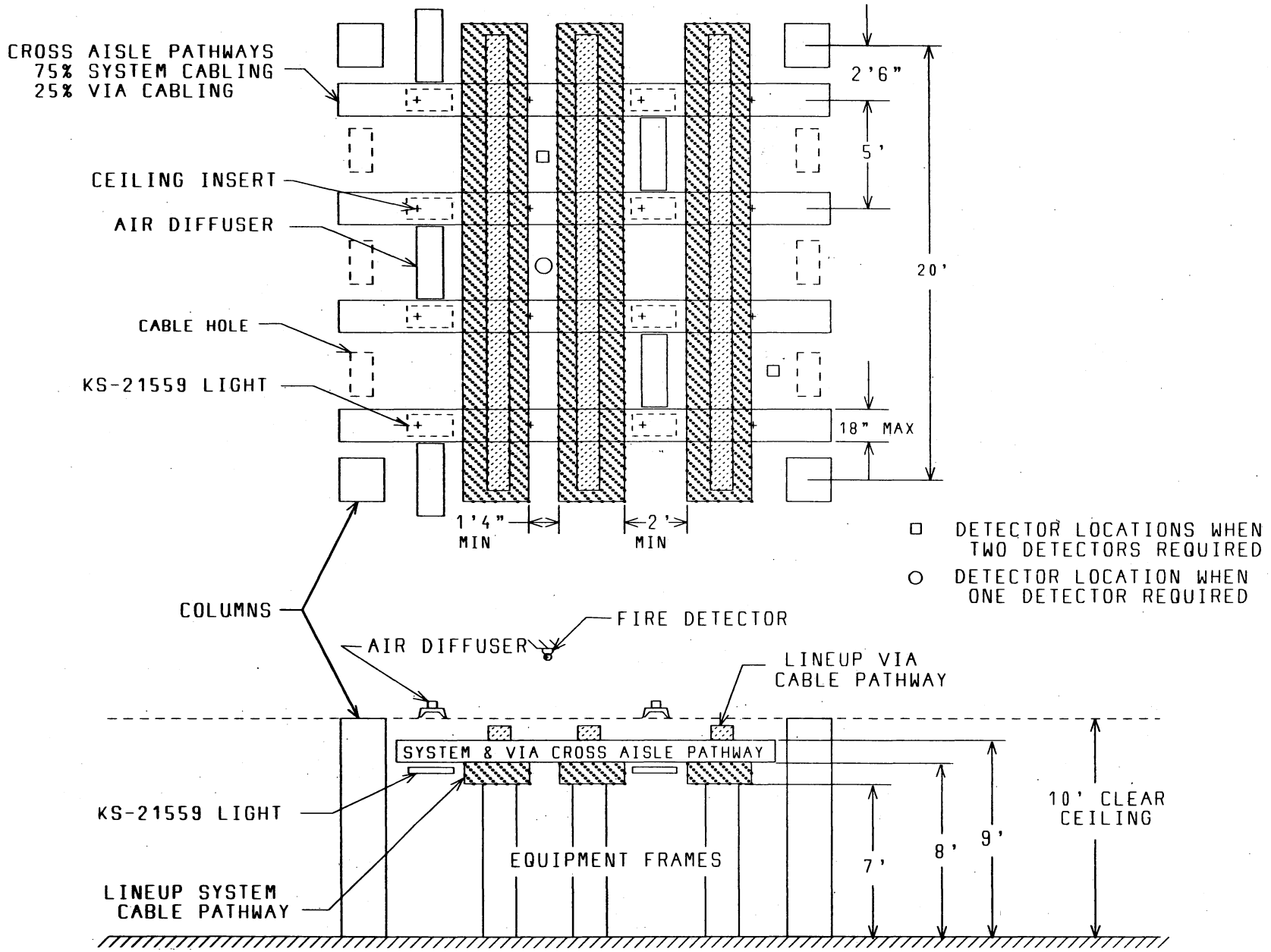

Fig. 2—Cable Pathways Plan for 18-Inch Deep Frame Areas

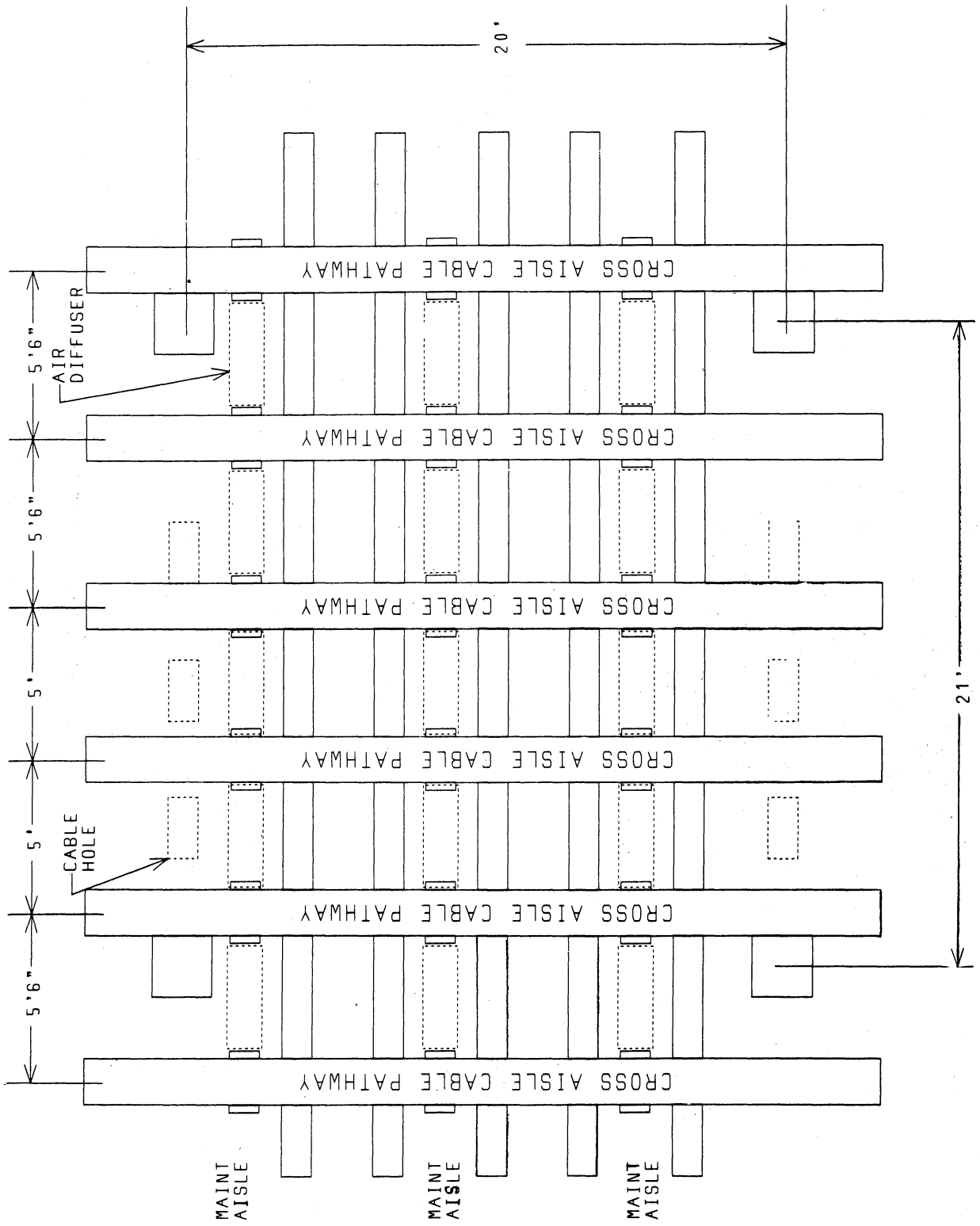

Fig. 3—Modified Cable Pathways Plan

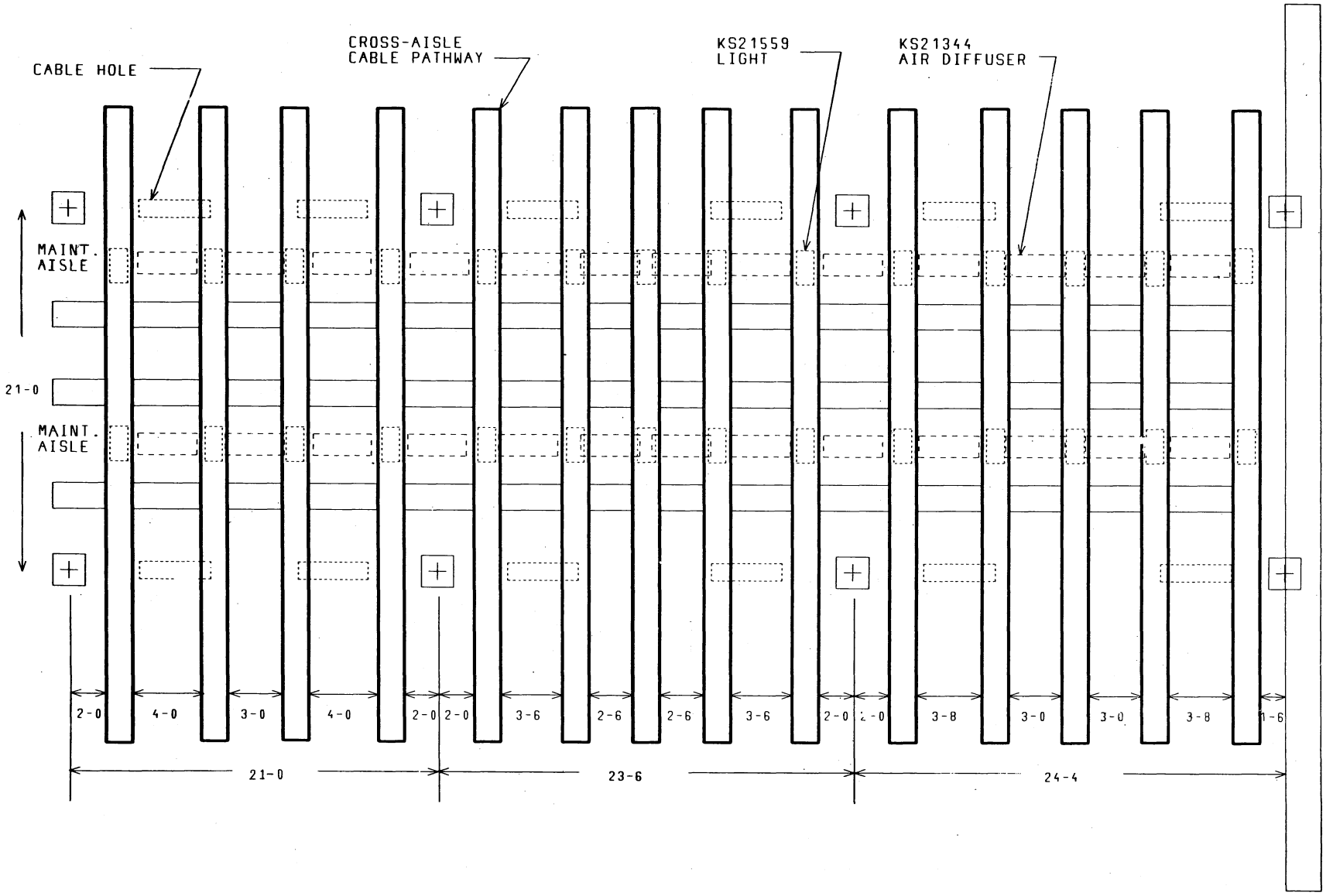

Fig. 4—Modified Cable Pathways Plan

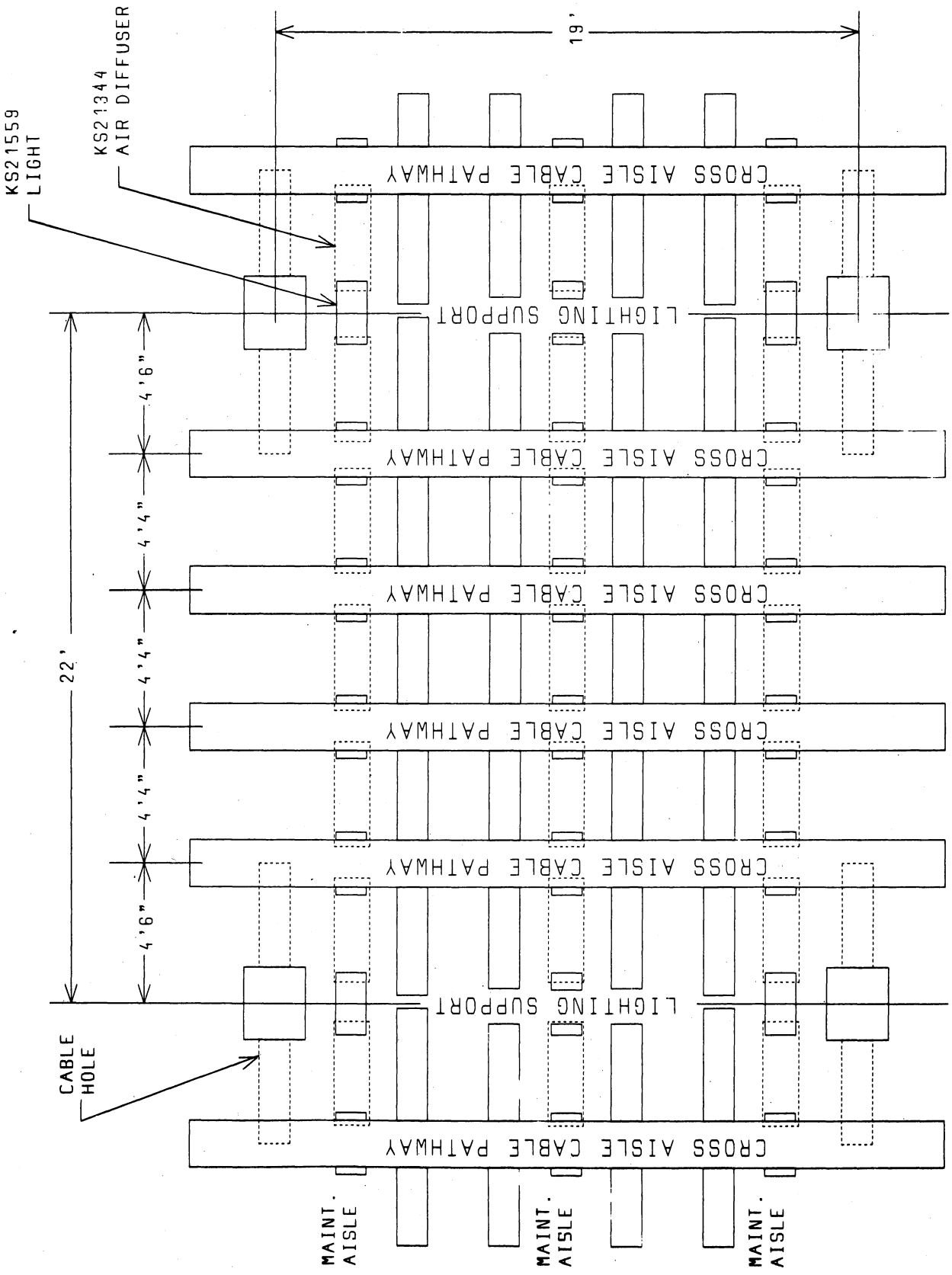

Fig. 5—Modified Cable Pathways Plan

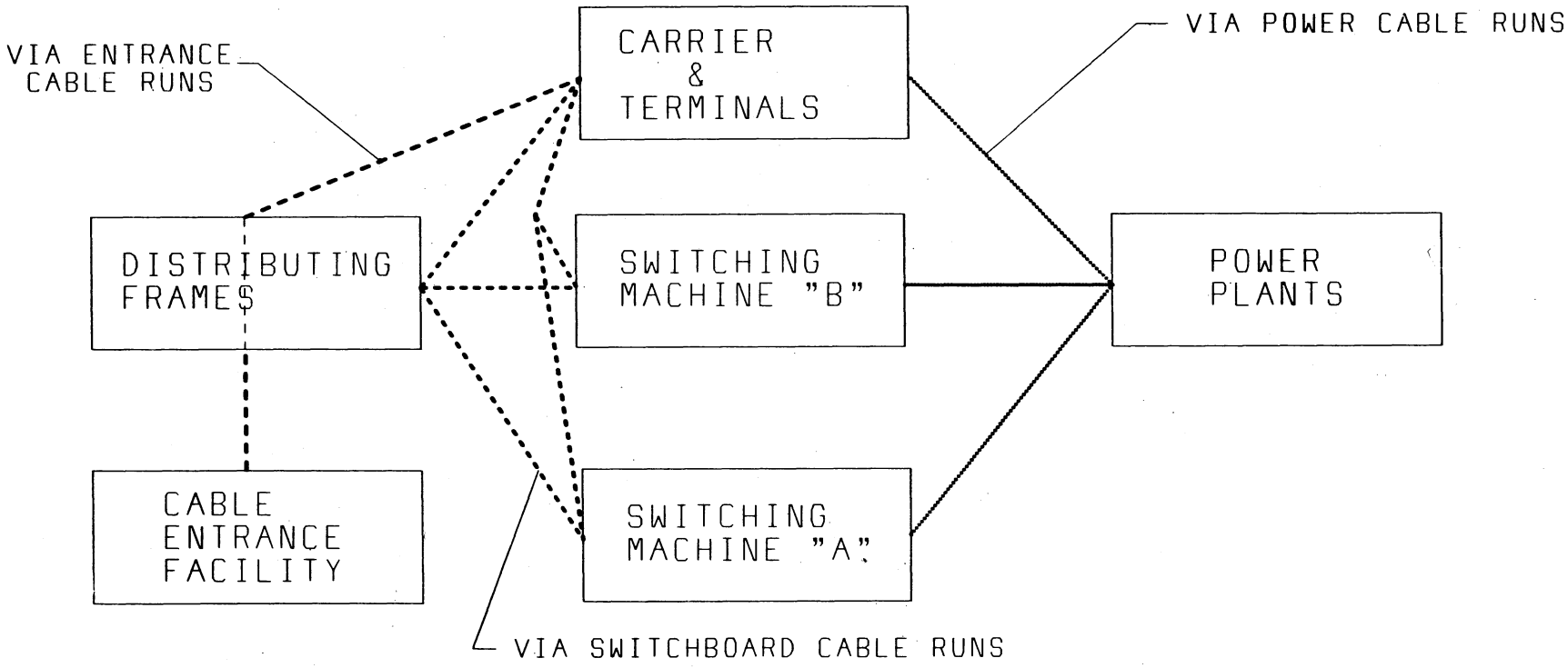

Fig. 6—Schematic Illustration of Via Cable Runs in a Typical Central Office

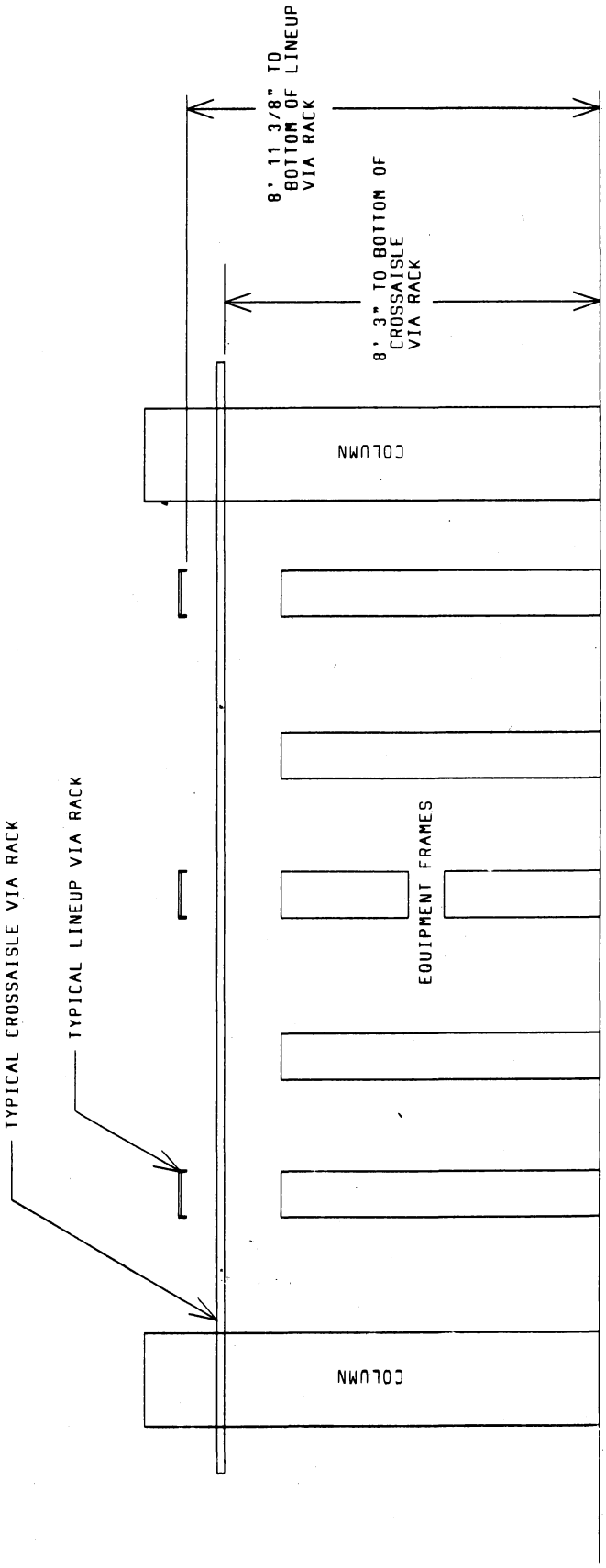

Fig. 7—Typical Elevations of Via Cable Racks

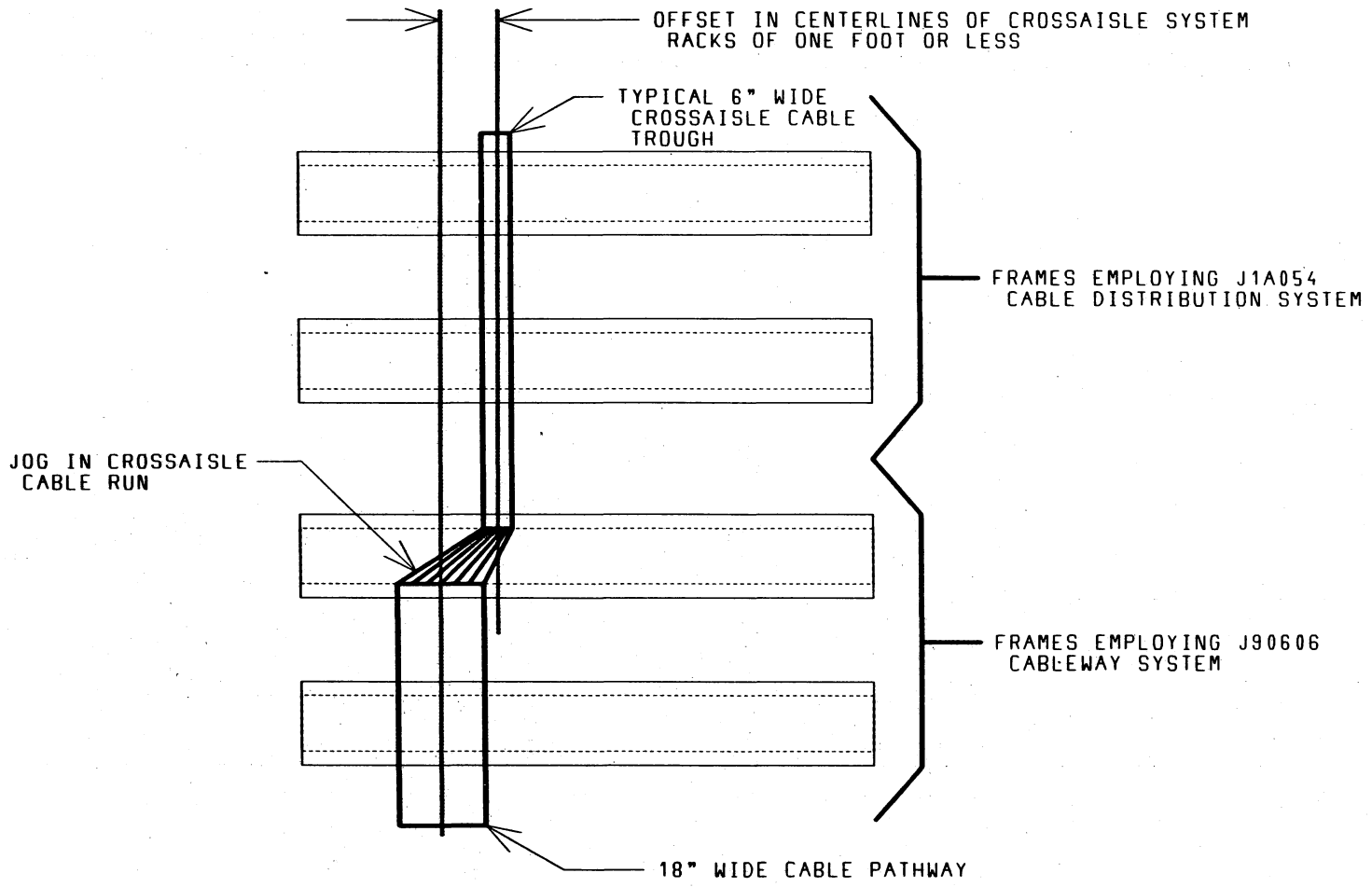

Fig. 8—Interface Between J90606 Cableway and J1A054 Cable Distribution System with Offset of 1 Foot or Less in Cable Pathways

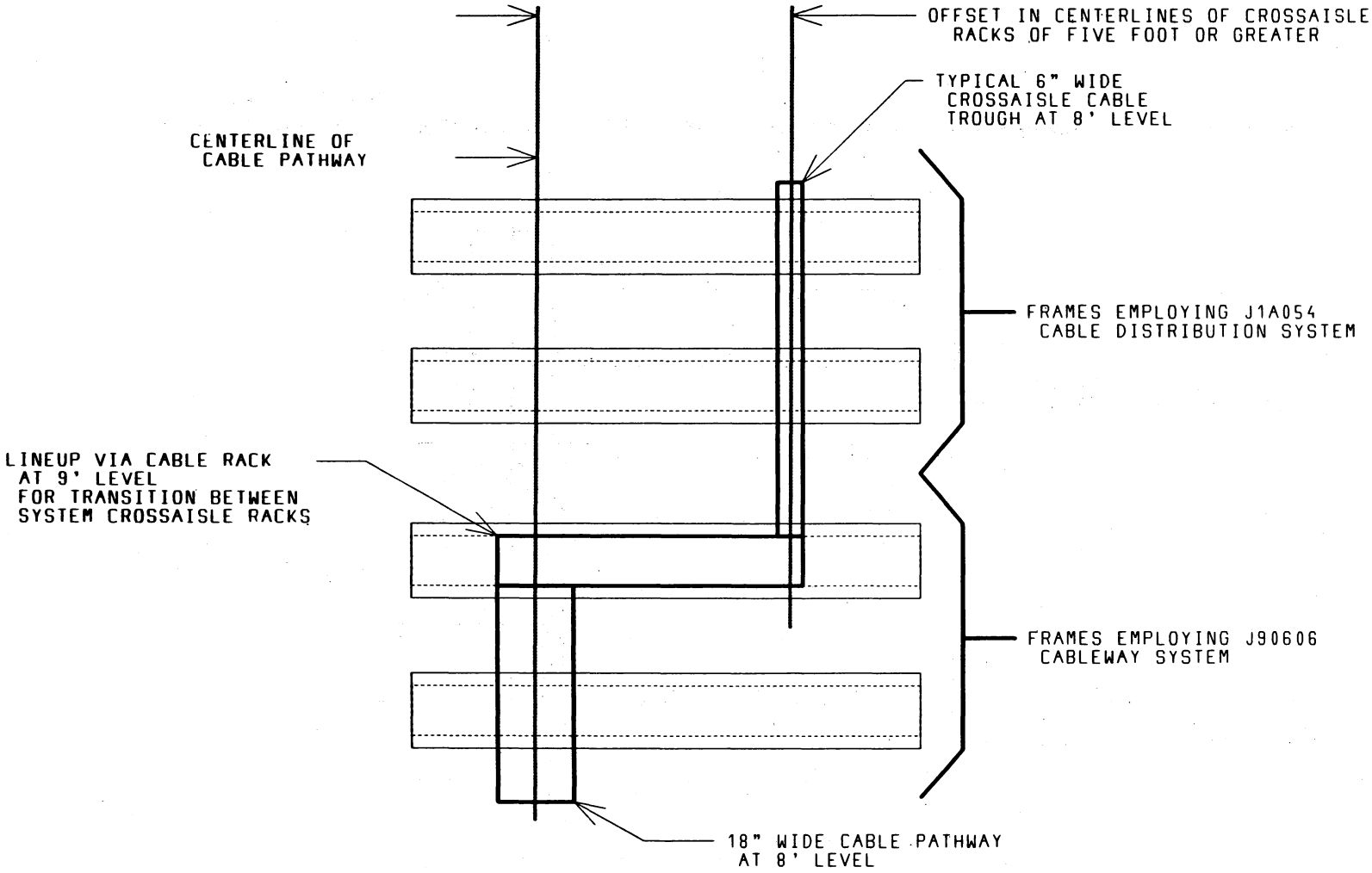

Fig. 9—Interface Between J90606 Cableway and J1A054 Cable Distribution System with Offset of 5 Feet or Greater in Cable Pathways

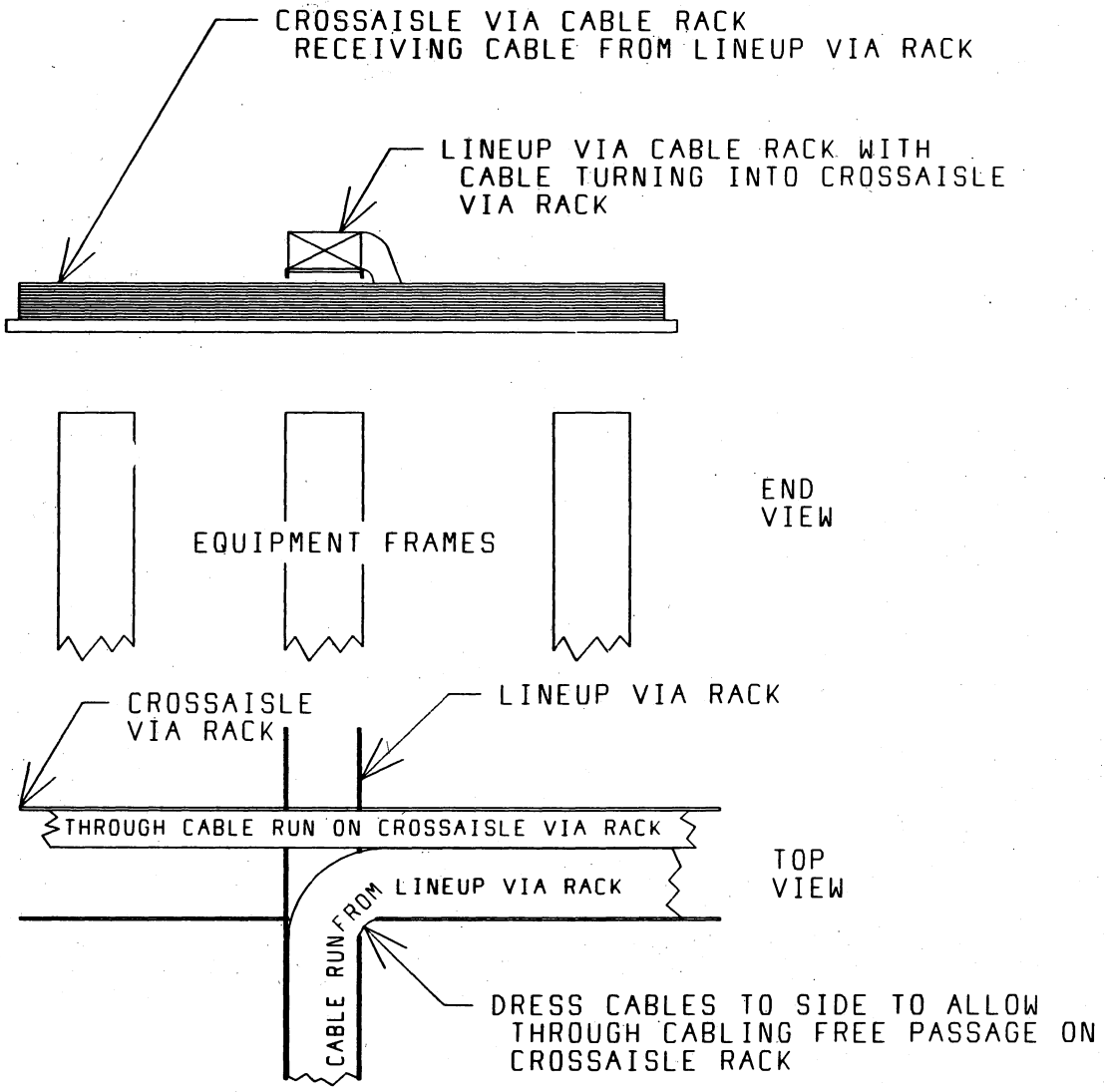

Fig. 10—Dressing Cables at Intersections of Cross Aisle and Lineup Via Cable Racks

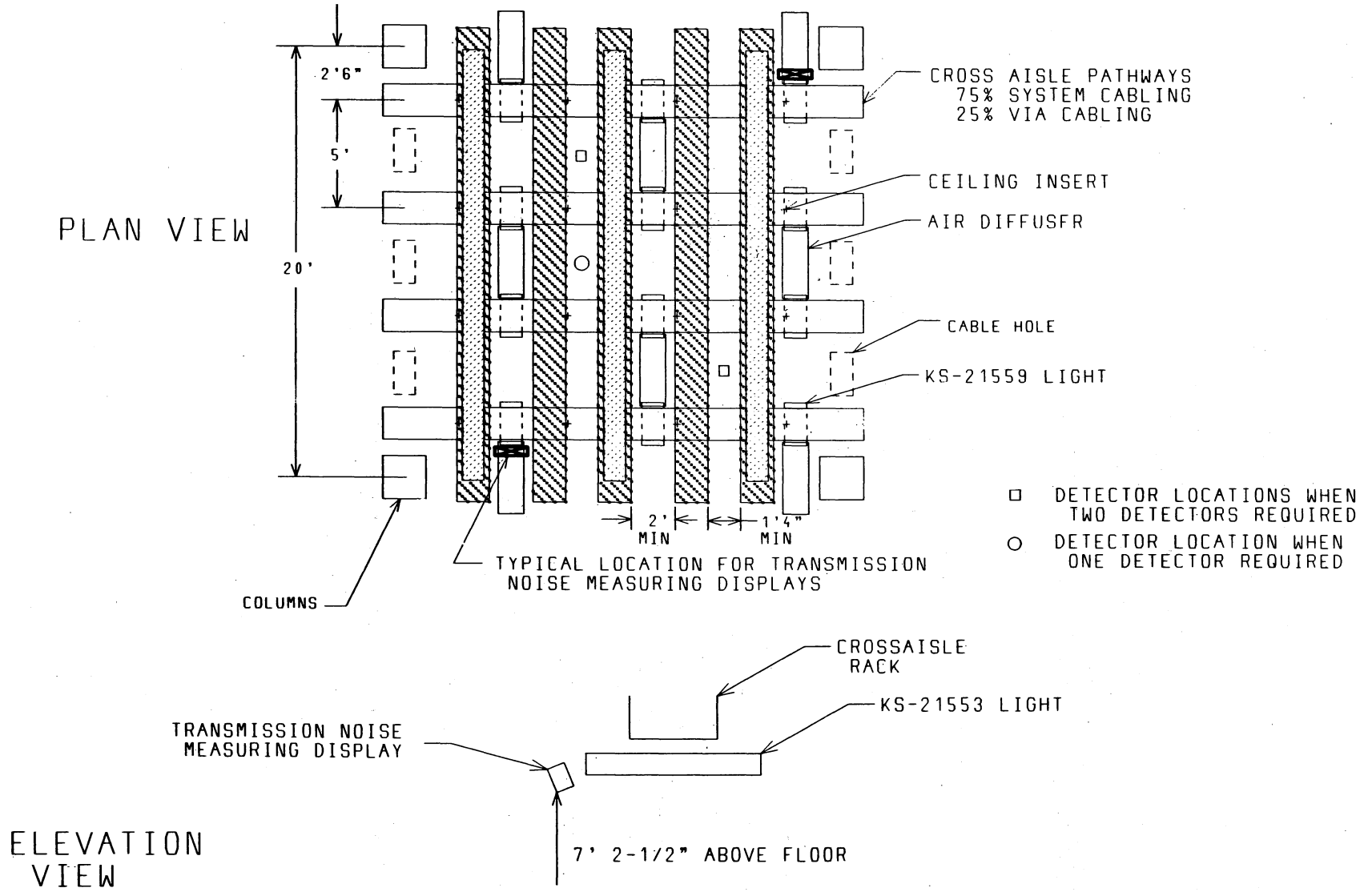

Fig. 11—Integration of Displays into Cable Pathways Plan