NEW EQUIPMENT BUILDING SYSTEM (NEBS) IN EXISTING BUILDINGS

CONTENTS PAGE

1. GENERAL

1.01 This section discusses and provides guidelines for using equipment that conforms to Section 800-610-164, New Equipment Building System (NEBS)—General Equipment Requirements, in existing buildings.

1.02 This section supersedes Section 4.2 of Specification X-74300, "NEBS Building Engineering Standards (BES)." Whenever this section is reissued, the reason for reissue will be listed in this paragraph.

1.03 The NEBS standards and associated planning information effectively integrate all aspects of building design and the physical requirements of modern electronic equipment and power systems. Their application to all new buildings that will be used as local central offices, toll terminal centers, or transmission stations is now underway throughout the Bell System. Concurrent with the development of these new standards for buildings, a complete complement of switching, transmission, power, and cable distributing equipment has been developed in accordance with Section 800-610-164, NEBS, General Equipment Requirements. Many of these new equipment systems are expected to be used extensively in existing buildings that were constructed to older standards. The "highbay space" was engineered originally for 11-1/2 foot high electromechanical types of switching equipment and electron tube types of transmission equipment. Since most of the newer solid-state electronic equipment, such as the No. 1, 2, 3, and 4 Electronic Switching Systems, some distributing frames, and the digital carrier system, come only in 7-foot high NEBS frameworks, plans for their efficient accommodation in existing space are needed.

1.04 Information included in this section addresses the general aspects of applying NEBS 7-foot equipment and cabling systems to existing non-NEBS space. Information pertinent to each particular system, eg, Broadband Analog Carrier, No. 1, 2, 3, and 4 ESS, and Digital Carrier, will be presented as required in appropriate building space planning sections.

1.05 Application of the NEBS equipment and planning information to existing space is not only possible but indeed yields many benefits. Moreover, in many cases NEBS equipment and floor plans may be the only solution where cabling space or cooling capacity is inadequate to handle electronic highbay equipment. These and other

factors are discussed briefly in the following paragraphs.

2. COORDINATED RACKING, COOLING, LIGHTING, AND BUILDING ELEMENTS

2.01 The cable pathways plan as described in Section 800-801-182, General Equipment Requirements, Cable Distribution Systems and Systems Assembly in Electronic Offices Having 7-foot Frameworks, can be adapted to existing space to coordinate effectively the elements of the equipment-building system. The plan standardizes the maximum sizes and locations of cable racks and integrates the frame and aisle lighting and cable distribution systems. It also incorporates the building elements (columns and cable holes), cooling air diffusers, fire detectors, and installer access requirements in an overall allocation of space that eliminates conflicts throughout the life of the building. Specific results achieved with the cable pathways plan are summarized in Section 760-100-030, NEBS In New Buildings. These results include energy conservation through a more efficient lighting arrangement, ample capacity for via and system cable from a three-level racking grid, and regulated cooling capability from coordinated positioning at the 10-foot level of overhead air diffusers or the modular cooling system.

3. EXISTING BUILDINGS WITH LIMITED CLEAR HEIGHTS

3.01 A large amount of space will become available for reuse due to replacement of electromechanical switching systems. This space usually has a clear ceiling height of 13 feet under all obstructions. Additional older space engineered for 4A Toll Crossbar and toll terminated equipment, including broadband carrier, has clear ceilings of 13 feet, 6 inches. Typically, one or two feet above these levels are occupied by the air distribution ducts that served these relatively low heat dissipating older equipment systems. This mechanical systems space provided for air ducts must be increased to cool the considerably hotter new electronic equipment. Typical specific heat release data for the newer equipments are given in the Section 760-555-15X series and in Section 760-230-100, Equipment Cooling. For long-range planning, a minimum vertical space of 2 feet, 6 inches is recommended for duct space to allow for cooling all future NEBS 7-foot equipment systems. Such 7-foot systems now range in heat dissipation from 10 to 60 watts per square foot of occupied area with some areas at loads of 80 watts per square foot. Also, 3 feet of vertical space is required for the cabling over NEBS equipment, compared to the 1 foot, 6 inches and 2 feet specified previously for the older 11-1/2 foot equipment. Considering these vertical space requirements, the NEBS system can be installed in existing space with existing racking in place or after removing all older ceiling-supported racking and ductwork. Figure 1 gives general representations of NEBS systems applied to existing buildings. One view depicts a situation where a Modular Cooling System (MCS) has been retrofitted into a cleared area and the other illustrates the use of a conventional cooling system with diffusers attached to flexible ducts that penetrate existing cable racks that are still required.

4. COMPACT FLOOR PLANS

4.01 The NEBS standard floor plans for 7-foot high 12-inch and 18-inch frames (Figures 2 and 3, respectively) establish minimum aisle-spacings after proper consideration of certain pertinent factors. Such factors are those associated with operations and maintenance, installation of frames and cabling, cooling and lighting, floor loading, and cable densities. Many of these factors are directly affected by frame height. For example, the 7-foot frames allow the elimination of ladder track hardware. The 7-foot frames with cabling in standard floor plan arrangements impose reasonable loads on the 150-psf designed floor. Also, air diffusing into the standard aisles from the 10-foot level permits lower energy air conditioning systems compared to those needed for equivalent highbay installations. Studies for MCS have shown that as much as a 10 percent penalty in air flow requirements occurs for each foot of elevation of the plenum ceiling above the 10-foot level.

4.02 These types of considerations have influenced the design of NEBS compatible subsystems and floor plans and result in a cost and performance-optimized equipment-building system. The more important performance characteristics of the 7-foot NEBS equipment system have been summarized in Table A. Listed also are characteristics that are needed for the same electronic equipment if it were assembled on 11-1/2 foot frames or bays. No attempt has been made to define specifically the costs associated with the two equipment-building systems. When a choice is possible either because the equipment is available on both NEBS and

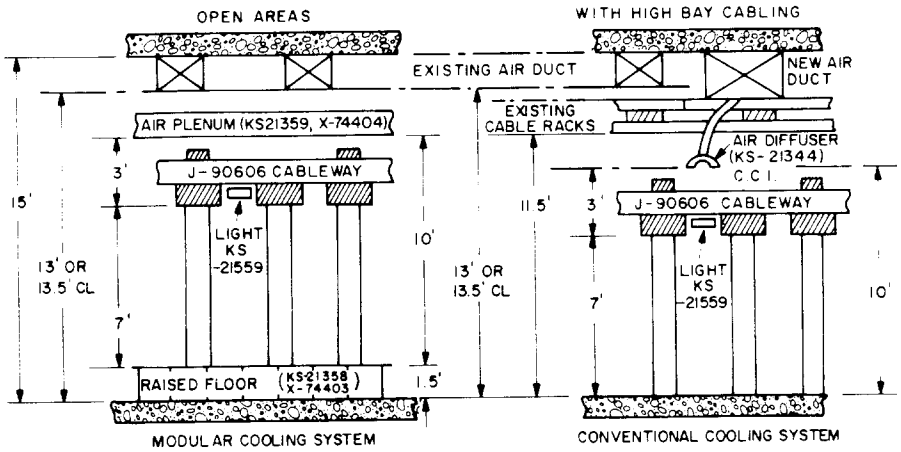
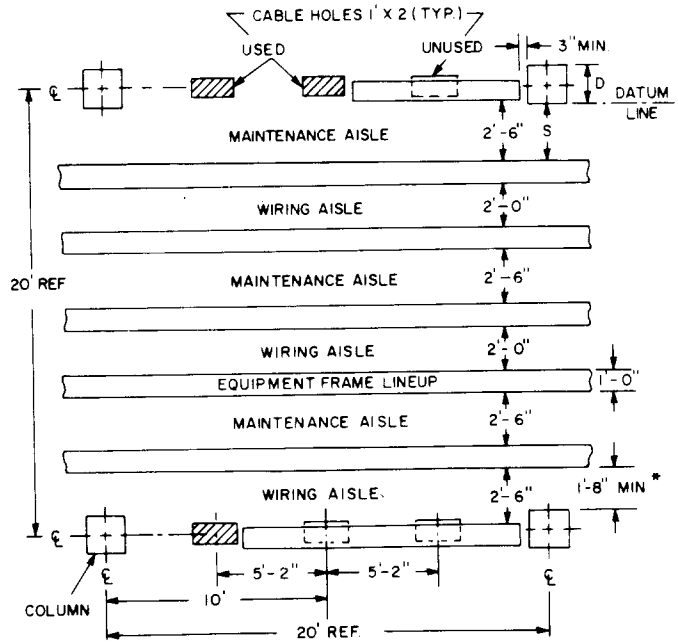


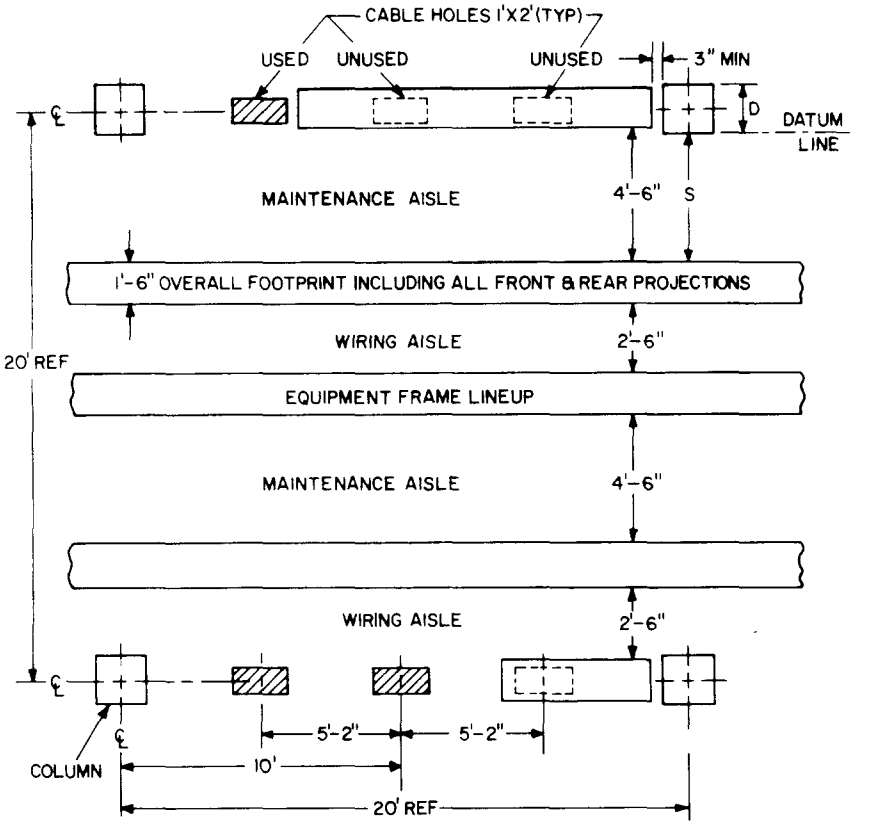
Fig. 1—NEBS Systems Applied to Existing Buildings Showing a Modular Cooling System and a Conventional Cooling System



COLUMN DEPTH "D"	SPACE AT COLUMN SPACE "S"
1'-10" OR LESS	2'-6"
2'-0"	2'-4"
2'-2"	2'-2"
2'-4" OR GREATER *	2'-0"

*FOR COLUMN DEPTS GREATER THAN 2'-4", IT MAY BE NECESSARY TO OMIT SOME FRAMES IN THE EQUIPMENT LINEUP OPPOSITE COLUMNS (WIRING AISLE SIDE)

Fig. 2—Typical Standard Floor Plan for Principal Depth 12-Inch Frame



COLUMN DEPTH "D"	SPACE AT COLUMN FACE "S"
1'-10" OR LESS	4'-6"
2'	4'-4"
2'-2"	4'-2"
2'-4"	4

Fig. 3—Typical Standard Floor Plan for 18-Inch Deep Frames

highbay frameworks or because of the limited floor area under study for a new equipment system, it is recommended that Table A be used as a guide to evaluate local conditions. In general, for the optional cases that may occur for certain classes of transmission equipment, the somewhat greater floor area usage that could result will be offset by several factors. These include higher cost for equipment installation, lighting and cooling, and a need for higher vertical space for cabling and air ducts when compared to the NEBS standard 7-foot offerings.

5. WHERE NEBS CAN BE USED

5.01 There are a number of aspects of the building and equipment layout that must be considered in determining where a NEBS-compatible equipment system can be used in existing non-NEBS space. First, the primary requirements of providing a 10-foot clear ceiling and a 150-psf floor load capability must be satisfied.

5.02 Next, the size of the new area and its location relative to existing highbay equipment

TABLE A

PERFORMANCE CHARACTERISTICS FOR 7-FOOT NEBS AND 11-1/2 FOOT ELECTRONIC EQUIPMENT SYSTEMS

FACTOR	NEBS (7')	SOLID-STATE HIGHBAY (11-1/2')*
Aisle Spacing		
Maintenance	2-1/2 and 4-1/2 ft.	3-1/2 and 6 ft.
Wiring	2 and 2-1/2 ft.	2 and 2-1/2 ft.
Cabling Space	3 ft.	4 ft.
Support System	Frames and Racks Floor Mounted	Floor, Auxiliary Framing to Ceiling and Adjacent Frames
Lighting Energy	1-1/2 watts/sq. ft. at 7 ft., 3 in.	3 watts/sq. ft. at 11 ft., 9 in.
Air Distribution		
Duct Space	2 ft. 6 in.	3 ft.
Max. Capacity	80 watts/ft.^{2} (MCS)	60 watts/ft.^{2} (CCS)

* Refers to generalized equipment. Only a limited number of types of transmission equipment are still available in other than 7-foot NEBS frameworks.

must be considered. Any restrictions caused by existing cable racks or cooling air ducts must be evaluated and finally, variations in the NEBS floor plans and cable pathway plans must be identified to accommodate the size and location of columns and cable holes. The issues that affect where and how NEBS can be used are discussed further in the following paragraphs.

6. SIZE AND LOCATION OF THE EQUIPMENT SYSTEM

6.01 It is commonly recommended that NEBS be planned for equipment systems that will occupy one building bay or more. When installed, the 7-foot frames should be separated from highbay equipment at main aisles or column lines. This facilitates planning the interfacing between the NEBS compatible J90606 cableway system and the existing high level racking. To fill out existing lineups within a building bay of highbay equipment or for equipping isolated areas, it is possible to use either 7-foot equipment with frame extenders or highbay equipment, if available. However, for more than one building bay, using extenders to interface NEBS 7-foot frames with high-level cable racks for equipment additions has several disadvantages in comparison to installing a 7-foot standard system. Specifically, it effectively wastes the 7 to 11-1/2 foot space for any purpose other than mounting a few miscellaneous panels because of the usual limited capacity of the existing high-level racking systems.

6.02 It is also important to consider the long-range plans for existing highbay equipment adjacent to the area where 7-foot equipment might be located. Such considerations are depicted in Fig. 4. Area A represents a case where NEBS equipment is desirable because of the size of the addition and since the future growth area is adjacent to the space where the addition is planned. Figure 4 (Area B) shows a case where NEBS is not recommended as the space is completely isolated from the future growth area by highbay equipment frames. Only if the removal of the highbay frames

is anticipated in the near future should this space be used for the full NEBS system. In isolated building bays, highbay equipment, if available, and NEBS equipment with frame extenders used in conjunction with the high-level racking are recommended.

7. ADAPTING NEBS STANDARDS TO EXISTING SPACE

7.01 When planning a 7-foot equipment addition into existing space, some of the standards, guidelines, and planning information must be altered slightly, due to building parameters and existing cable hole and equipment locations. The former primarily affects standard floor plans and the cable pathways standard. Location of existing equipment affects the interfacing between high level and NEBS racking systems. Also affected by the latter is the new equipment layout. These subjects will be appropriately covered in the sections on individual equipment systems.

8. FLOOR PLAN VARIATIONS

8.01 The NEBS standard floor plans (Figures 2 and 3) were developed for 20- by 20-foot building bays. Variations are possible for specific cases when other column spacing (eg, 18 feet, 6 inches, 21 feet, etc) exists. Aisle dimensions remain within standard limits for these applications. In order to simplify the planning process, a tabulation of recommended aisle spacings for both 12-inch and 18-inch frames has been prepared for 6-inch increments of column spacings in the directions perpendicular to equipment line-ups. These recommendations are presented in Fig. 5 through 7 for columns spaced between 16-1/2 and 25 feet for 12-inch deep frames. Aisle spacings for 18-inch deep frames placed in building bays with columns spaced from 13-1/2 to 25-1/2 feet are shown in Figures 8 through 10.

8.02 Table B summarizes the guidelines used in developing these spacings and provides guidance in determining aisle sizes for spacings not shown in the figures. Also shown in Figures 5 through 10 are maximum column sizes for which the recommended plans will retain adequate clearances between columns and equipment lineups. If difficulties arise due to larger column sizes, the planner should either omit frames from the lineup opposite the column as needed or adjust aisle spacings; decrease dimension B as necessary, consistent with the guidelines given in Table B; or decrease S_1 or S_2 if consistent with local operations requirements.

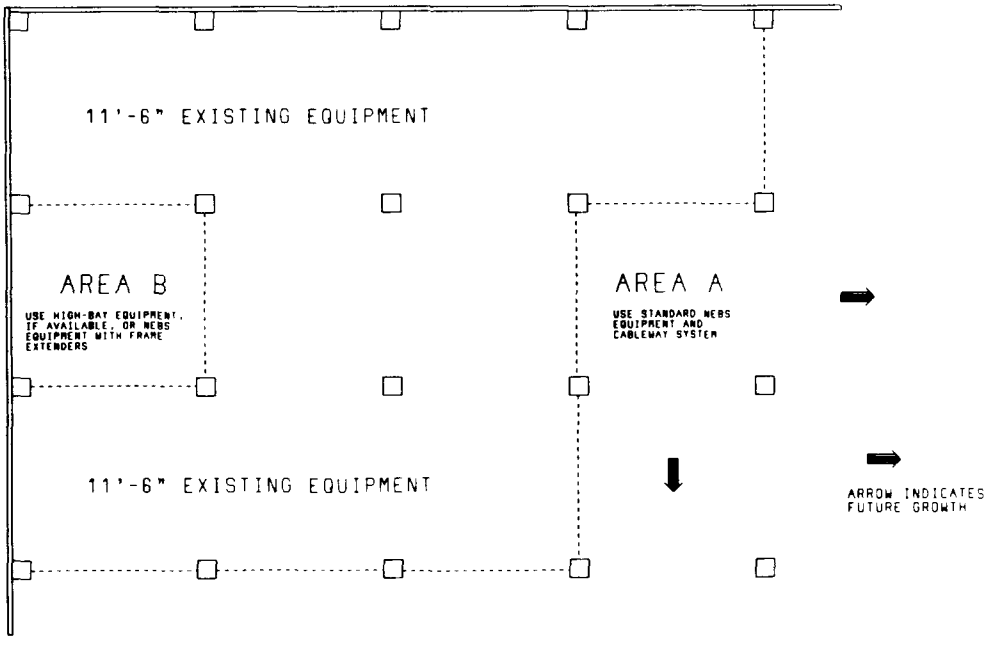
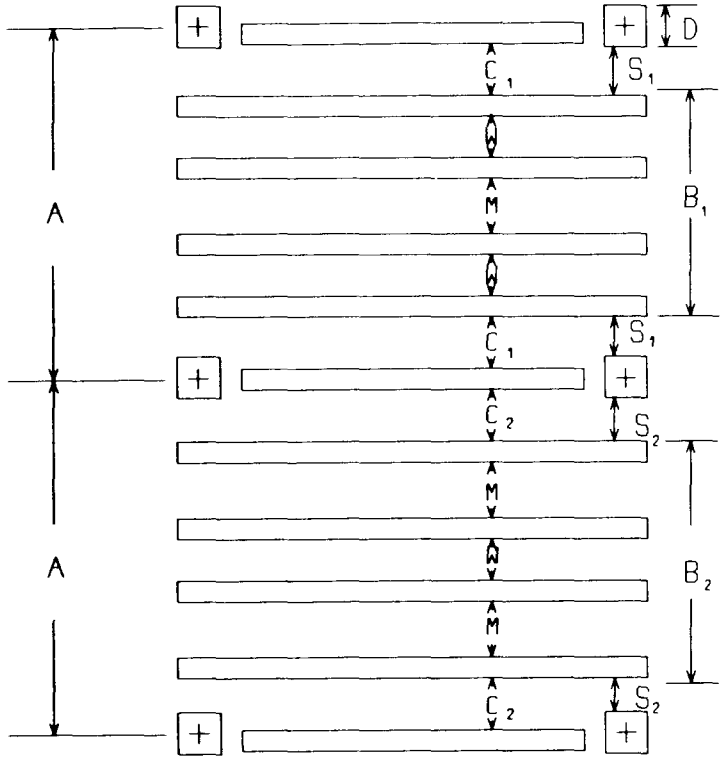


Fig. 4—NEBS Equipment in Non-NEBS Space Presently Occupied By Highbay Equipment



A	M	W	C_1	C_2	B_1	B_2	D_{***}
16-6	2-6	2-0	2-6	2-3	10-6	11-0	2-2
17-0	2-6	2-0	3-0	2-3	10-6	11-0	2-8
17-6	2-6	2-0	3-0	2-9	10-6	11-0	3-2
18-0	2-6	2-0	3-6	2-9	10-6	11-0	3-8

MINIMUM FOR S, IS 1-8
MINIMUM FOR S, IS 1-8

Fig. 5—Recommended Floor Plans for Principal Depth 12-Inch Frames for Column Spacings Between 16 Foot, 6 Inch and 18 Foot, 0 Inch

9. CABLE PATHWAYS VARIATIONS

9.01 The cable pathways plans for the standard NEBS configurations for 12- and 18-inch deep frames are shown in Fig. 11 and 12. They are affected by changes in column spacing in both directions, perpendicular to and parallel to equipment frame lineups. The former affects the number of cable pathways per building bay at both the 7- to 8-foot and the 9- to 10-foot levels, while the latter affects only the number of cross-aisle cable pathways at the 8- to 9-foot level.

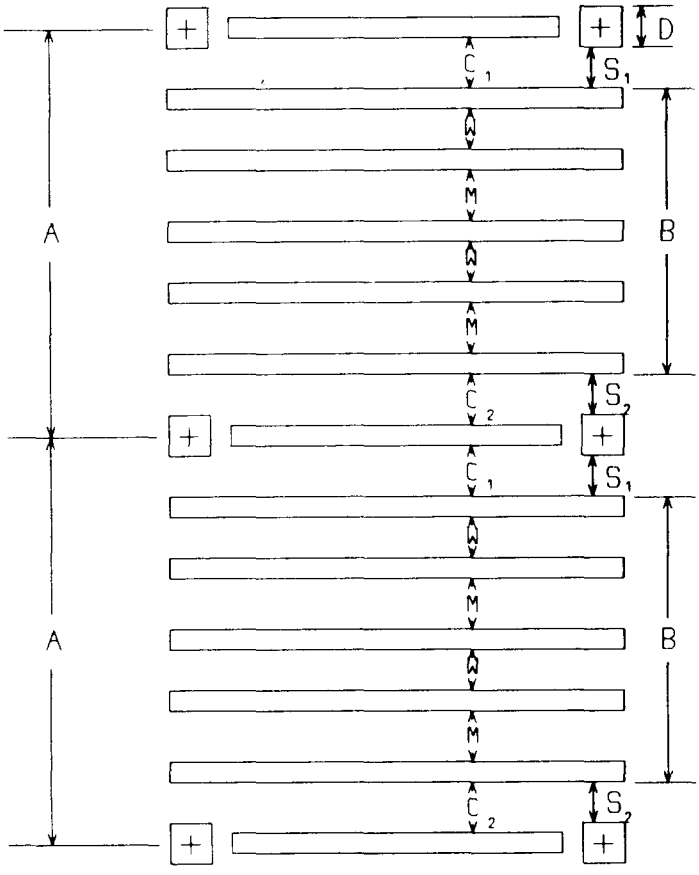
9.02 The recommended number of 7- to 8-foot and 9- to 10-foot level pathways are given in Table C as a function of the number of lineups of 12- or 18-inch frames per building bay. As indicated in Table C, the number of 9- to 10-foot via pathways is limited due to floor load limit of 150 pounds per square foot. However, with all the permissible maximum floor loading at 25 psf for cabling, via pathways may be located over each lineup.

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

9.04 The center-to-center spacing and size of cross-aisle pathways depend upon column size and cable hole locations in addition to column spacings. Specific examples of cross-aisle pathways for application to buildings that do not meet all the NEBS requirements are shown in Figures 13, 14, and 15.

9.05 Guidelines for establishing a modified cable pathways plan are listed below.

(a) The center-to-center distance between cross-aisle pathways should be not less than 4 feet and not more than 6 feet, preferably



A	M	W	C_1	C_2	B	D_{min}
18-6	2-6	1-8	2-6	1-8	13-4	1-10
19-0	2-6	1-10	2-6	1-10	13-8	2-0
19-6	2-6	2-0	2-6	2-0	14-0	2-2
20-0	2-6	2-0	2-6	2-6	14-0	2-8
20-6	2-6	2-0	3-0	2-6	14-0	3-2
21-0	2-6	2-0	3-0	3-0	14-0	3-8
21-6	2-6	2-0	3-6	3-0	14-0	4-2

MINIMUM FOR S_1 IS 1-8

MINIMUM FOR S_2 IS 1-8

Fig. 6—Recommended Floor Plans for Principal Depth 12-Inch Frames for Column Spacings Between 18 Foot, 6 Inch and 21 Foot, 6 Inch

between 4 feet, 6 inches and 5 feet, 6 inches. The minimum value assures adequate access for cabling and unobstructed flow of cooling air, while the maximum assures adequate lighting.

(b) Cross-aisle pathways may be decreased in size or even temporarily jogged in column lines to minimize interference with cable holes or to avoid columns or other obstructions.

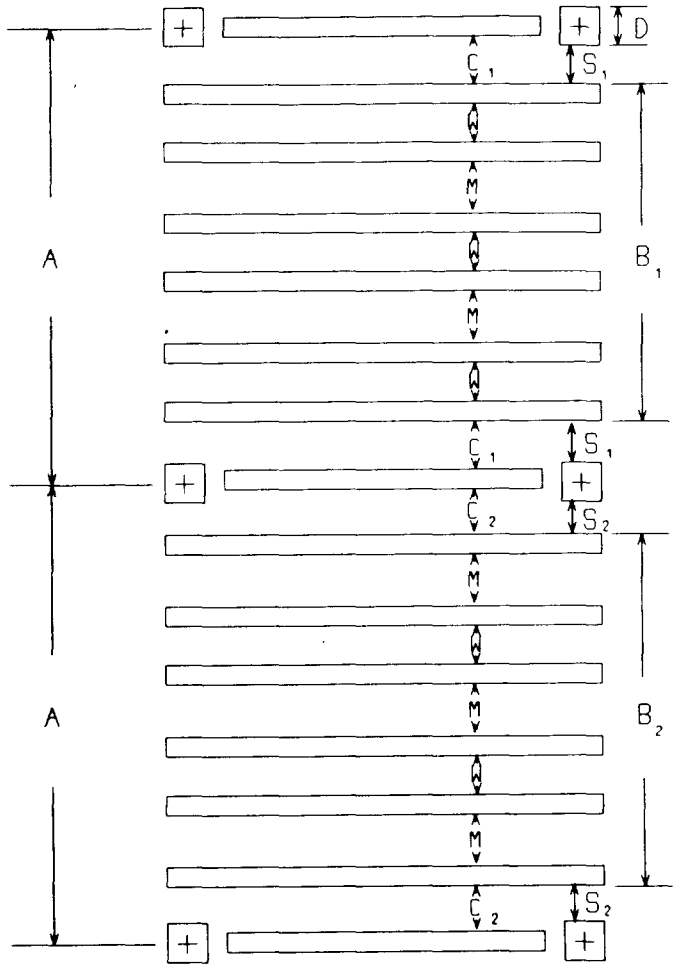
(c) When continuous cable slots or cable hole capacity greater than NEBS requirements exist, it is recommended that the cross-aisle pathways be arranged within the limitations of (a) such that cable hole capacity equivalent to NEBS requirements or greater is left unobstructed [(2) 1 foot by 2 foot holes/building bay].

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

(e) In some cases, a pathway can only be used for cabling between lineups within the same building bay since it may be completely obstructed by a column line. An example of this condition is shown in Fig. 13.

10. INTERFACING OF NEBS CABLEWAY WITH HIGH LEVEL RACKING

10.01 When the NEBS equipment system is used in areas adjacent to high-level racking or highbay equipment frames, it is necessary to



A	M	W	C_1	C_2	B_1	B_2	D_{***}
22-0	2-6	1-10	2-6	1-8	16-6	17-2	1-6
22-6	2-6	2-0	2-6	1-9	17-0	17-6	1-8
23-0	2-6	2-0	2-6	2-3	17-0	17-6	2-2
23-6	2-6	2-0	2-6	2-6	17-0	17-6	2-8
24-0	2-6	2-0	3-0	2-6	17-0	17-6	3-2
24-6	2-6	2-0	3-0	3-0	17-0	17-6	3-8
25-0	2-6	2-0	3-6	3-0	17-0	17-6	4-2

MINIMUM FOR S_1 IS 1-8

MINIMUM FOR S_2 IS 1-8

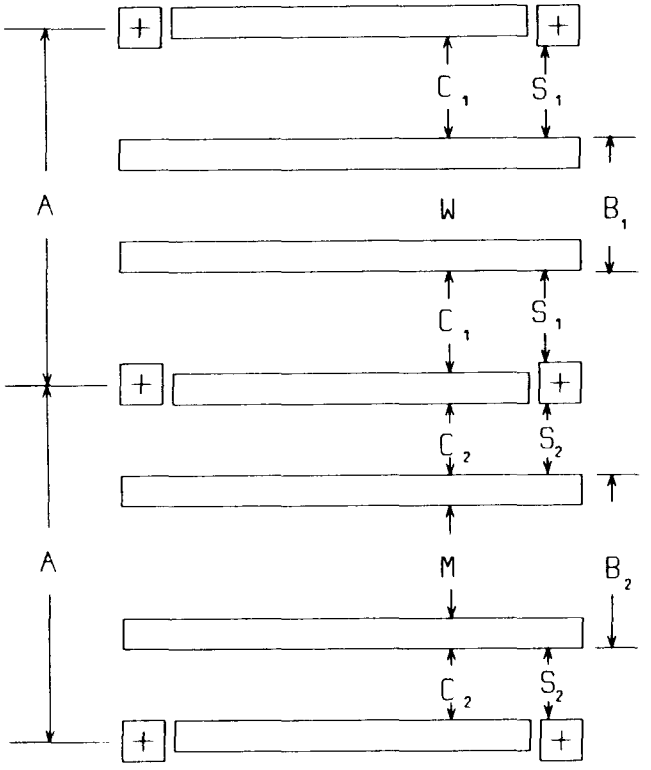
Fig. 7—Recommended Floor Plans for Principal Depth 12-Inch Frames for Column Spacings Between 22 Foot, 0 Inch and 25 Foot, 0 Inch

interface the cableway and the existing high-level racking systems. The interfacing can be accomplished with standard hardware described in Section 801-801-182 and referenced in specification J90606 when it occurs at the ladder-type or bar-type rack levels of the cable pathways plan. Thus, it is generally recommended that interfacing be planned for the 8- to 9-foot cross-aisle or the 9- to 10-foot via levels. For broadband cableway, interfacing can also be similarly accomplished at the 7- to 8-foot level over perpendicularly aligned distributing frames since bar-type racks are also used with this equipment. Figures 16 and 17 illustrate two methods for interfacing between a ceiling-supported multilevel racking system and the 8- to 9-foot level cross-aisle racks of the broadband cableway system.

10.02 It is further recommended that when the position of the level of the interface is optionally variable, it should be planned for the lowest level consistent with any other constraints that exist. This procedure results in minimizing the cable transfers between the various levels of the cableway system and the number of pathways utilized by the cable run. It is also recommended that the interface be planned for the column line or main aisle between the 7-foot and highbay equipment so that they will not affect the cabling of equipment located directly below.

11. LIGHTING

11.01 The frame and aisle lighting for a 7-foot high frame layout is an integral part of the system. Lighting fixture locations are determined by the cable pathways. Descriptive, application, and ordering information is given in specification J85515. If a portion of the area has an existing



A	M	W	C_1	C_2	B_1	B_2	D_{min}
13-6	4-0	2-6	3-6	2-3	5-6	7-0	2-0
14-0	4-0	2-6	3-9	2-6	5-6	7-0	2-6
14-6	4-6	2-6	4-0	2-6	5-6	7-6	3-0
15-0	4-6	2-6	4-0	3-0	5-6	7-6	3-6
15-6	4-6	2-6	4-6	3-0	5-6	7-6	4-0
16-0	5-0	3-0	4-6	3-0	6-0	8-0	4-0
16-6	5-0	3-0	5-0	3-0	6-0	8-0	4-6
17-0	5-6	3-0	5-0	3-3	6-6	8-6	4-6
17-6	5-6	3-6	5-0	3-6	6-6	8-6	5-0

MINIMUM FOR S_1 IS 3-0

MINIMUM FOR S_2 IS 2-0

Fig. 8—Recommended Floor Plans for Principal Depth 18-Inch Frames for Column Spacings Between 13 Foot, 6 Inch and 17 Foot, 6 Inch

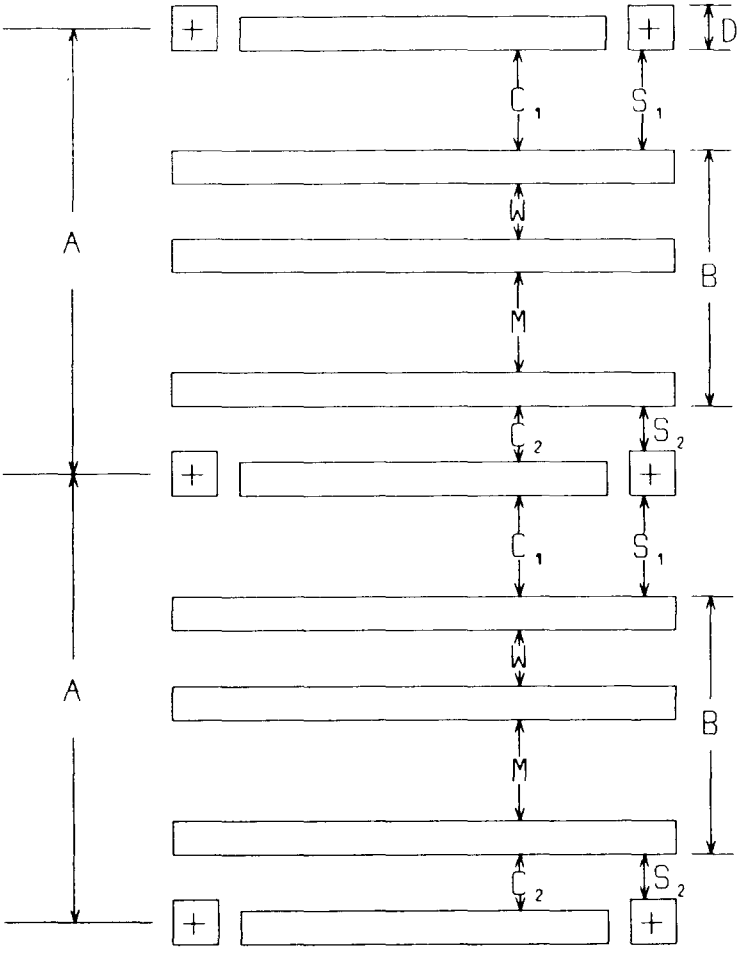
high-level lighting system, it should be salvaged, reused elsewhere, or retired in place, as it will probably not provide adequate lighting for the 7-foot equipment. This situation occurs because of the excess elevation and light blockage due to cableway mounted beneath the system.

12. COOLING

12.01 When reusing existing space, equipment cooling can be implemented by either modifying an existing conventional cooling system (CCS) or installing one of the versions of the Modular Cooling System (MCS). Discussion of CCS design is described in Sections 760-550-208, 760-550-212, 760-230-100, and 760-230-101. A complete description and associated planning guidelines for the MCS are found in ***Modular Cooling System, Planning and Engineering Guidelines,*** dated February, 1976. Use of a CCS or an MCS with a 7-foot equipment system requires attention to the options discussed below.

12.02 When a CCS either exists or is chosen as the means for cooling a NEBS equipment addition in existing space, it is important that the planner prepares a cable pathways plan before designing or modifying the cooling system ductwork. This plan provides standardized locations with respect to cable racks and lights and for cooling air supply diffusers at the 10-foot level. This insures unobstructed openings throughout the life of the installation for the free flow of air down to the equipment.

12.03 As shown in Fig. 1, the air diffusers (eg, KS-21344) can be connected to existing ductwork by flexible ducts (elephant trunks), allowing flexibility in diffuser locations. The diffusers are supported on a ceiling-hung auxiliary framing grid. A space of approximately 18 inches is usually available between the tops of the NEBS equipment and cabling systems (10 feet) and the bottoms of any existing racking. This space can be used for additional ductwork to handle extra



A	M	W	C_1	C_2	B	D_{***}
18-0	4-0	2-6	3-6	2-0	11-0	2-0
18-6	4-0	2-6	4-0	2-0	11-0	2-6
19-0	4-0	2-6	4-0	2-6	11-0	3-0
19-6	4-6	2-6	4-0	2-6	11-6	3-0
20-0	4-6	2-6	4-6	2-6	11-6	3-6
20-6	4-6	2-6	4-6	3-0	11-6	4-0
21-0	4-6	3-0	4-6	3-0	12-0	4-0
21-6	5-0	3-0	4-6	3-0	12-6	4-0
22-0	5-0	3-0	5-0	3-0	12-6	4-6
22-6	5-0	3-0	5-0	3-6	12-6	5-0
23-0	5-0	3-6	5-0	3-6	13-0	5-0

MINIMUM FOR S, IS 3-0

MINIMUM FOR S, IS 2-0

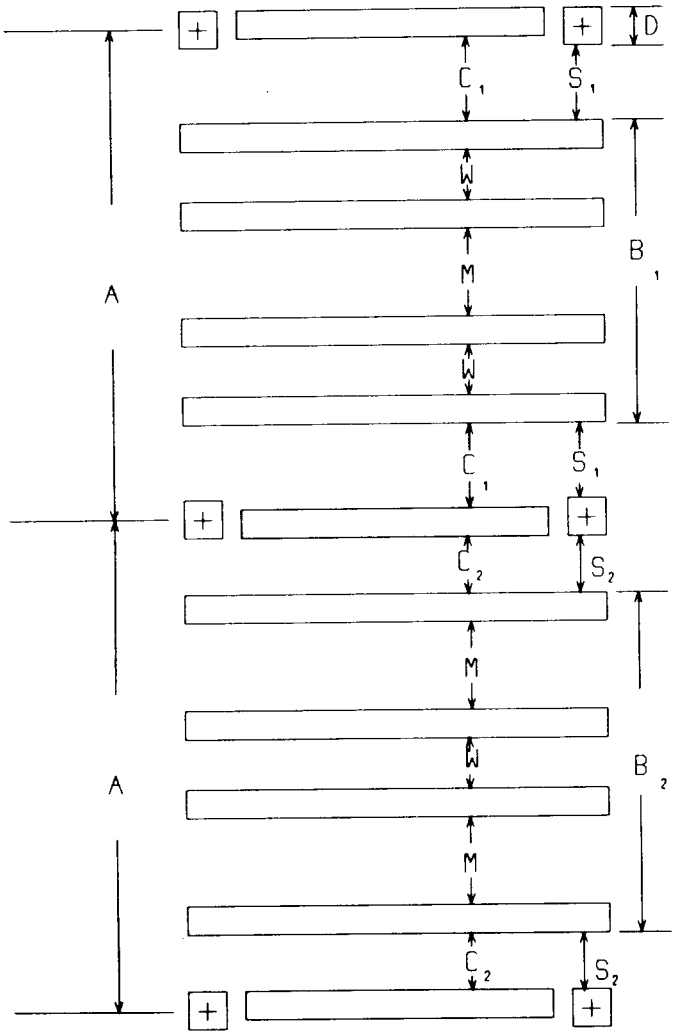
Fig. 9—Recommended Floor Plan for Principal Depth 18-Inch Frame for Column Spacings Between 18 Foot, 0 Inch and 23 Foot, 0 Inch

heat load or for mounting the diffusers and supporting hardware.

12.04 The MCS is designed specifically for No. 4 ESS and other high heat transmission systems and is fully compatible with all NEBS standards. Cost comparisons between MCS and a high-capacity CCS show an advantage for the MCS for heat dissipations in excess of 20 watts/square foot. Besides No. 4 ESS switching center applications, this system is well suited for cooling analog broadband carrier and digital T-carrier equipment that typically dissipate 25 watts/square foot or more over sizeable areas.

12.05 For existing buildings, the MCS without a raised floor may be just as effective as the full system where there is not enough vertical space. This type of arrangement, shown as Type B in Section 760-230-101, Equipment Room Air Distribution, is especially well suited to handling local "hot spots" by placing one or more process coolers in the high-heat areas and using local ducting to direct the air to the desired equipment.

12.06 The full MCS should be considered wherever possible, since a raised floor ensures flexibility, installation ease, and easy adaptability in the event of changes in equipment requirements. In any case where an MCS option or a combination of MCS elements and an existing CCS seem viable, a complete cost study should be conducted to account for variations in costs resulting from such factors as local labor conditions or special building considerations. It is also important to reiterate that a cable pathways plan be prepared for the



A	M	W	C_1	C_2	B_1	B_2	D_{***}
23-0	4-0	2-6	3-6	2-3	15-0	16-6	2-0
23-6	4-0	2-6	3-9	2-6	15-0	16-6	2-6
24-0	4-0	2-6	4-0	2-9	15-0	16-6	3-0
24-6	4-6	2-6	4-0	2-6	15-6	17-6	3-0
25-0	4-6	2-6	4-0	3-0	15-6	17-6	3-6
25-6	4-6	2-6	4-6	3-0	15-6	17-6	4-0

MINIMUM FOR S_1 IS 3-0

MINIMUM FOR S_2 IS 2-0

Fig. 10—Recommended Floor Plan for Principal Depth 18-Inch Frame for Column Spacings Between 23 Foot, 6 Inch and 25 Foot, 6 Inch

entire floor as an early step in the development of the floor plan. This is especially important for MCS options or combinations of MCS and CCS where dropped diffusers are used. Failure to establish the cable pathways plan could result in inefficient air conditioning or misalignment of diffusers with open areas in the cable rack arrangement. The subsequent correction of either condition after construction is extremely expensive.

13. REFERENCES

Section 760-230-100—Equipment Cooling—General

Section 760-230-101—Equipment Room Air Distribution

Section 760-550-208—Engineering Guide for Ventilation and Air Conditioning—Design Parameters

Section 760-550-212—Engineering Guide for Ventilation and Air Conditioning—Refrigeration Systems

Section 760-555-15X Series—Specific Heat Data for Equipment

Section 800-610-164, Issue 2—New Equipment Building System (NEBS) General Equipment Requirements

Section 801-801-182—General Equipment Requirements, Cable Distribution Systems and Systems

TABLE B

GUIDELINES FOR FLOOR PLAN VARIATIONS

A. Minimum Aisle Dimensions
(See Fig. 5 to 10 for standard arrangements)

AISLE		12-INCH FRAMES	18-INCH FRAMES
Maintenance	M	2′ - 6″	4′ - 0″
Wiring	W	1′ - 8″	2′ - 6″
Column (Maint.)	C_1	2′ - 6″	3′ - 6″
Column (Wiring)	C_2	1′ - 8″	2′ - 0″
Special	S_1	1′ - 8″	3′ - 0″
Special	S_2	1′ - 8″	2′ - 0″

B. Guidelines for establishing aisle dimensions for column spacings not shown in figures are listed below.

1. Establish preliminary dimensions by using next lower value of column spacing (A) in appropriate figure.
2. If any of these preliminary dimensions are less than the nominal NEBS spacings (ie, for A = 20), use any excess to increase them up to the nominal values.
3. Further excess should be used to vary aisles by interpolation of the tabular values in Figures 5 through 10.
4. Calculate D_{max} as follows:

   a. For Fig. 5, 7, 8, 10:

   $$D_{max} = \text{minimum of} \quad \begin{matrix} A - B_1 - 2S_1 \text{ min} \\ A - B_2 - 2S_2 \text{ min} \end{matrix}$$

   b. For Fig. 6 and 9

   $$D_{max} = A - B - (S_1 + S_2) \text{ min}$$

   If $D > D_{max}$, refer to above text for options.

Assembly in Electronic Offices Using 7-foot Frameworks

EL 4728—KS-21344 Air Diffuser for Cooling Central Office High Heat Equipment

J90606—Cableway Systems for Electronic Offices Using 7-foot Frameworks

Modular Cooling System, Planning and Engineering Guidelines, Bell Laboratories, Department 2434, February 1976.

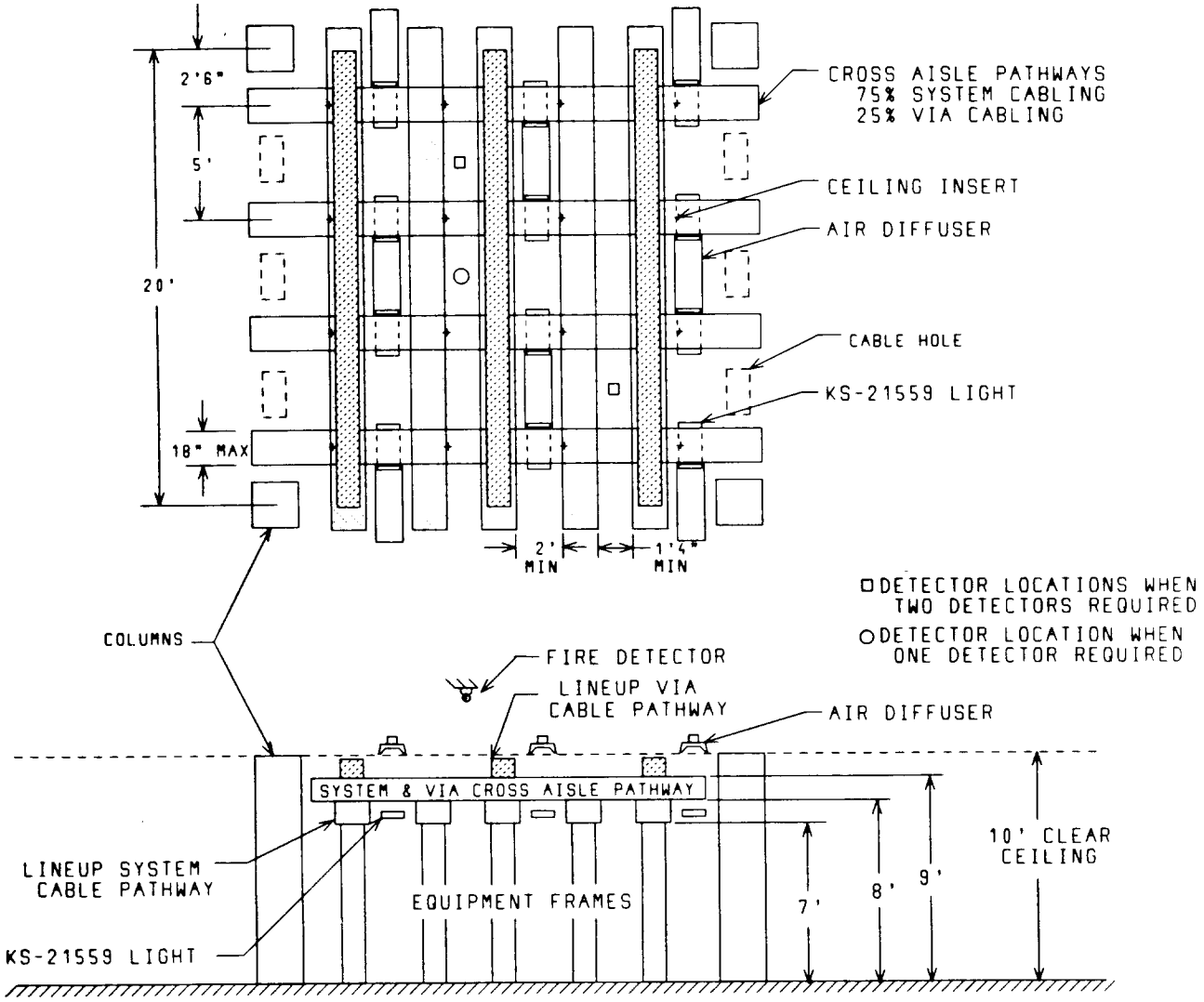


Fig. 11—Cable Pathways Plan for 12-Inch Deep Frame Areas

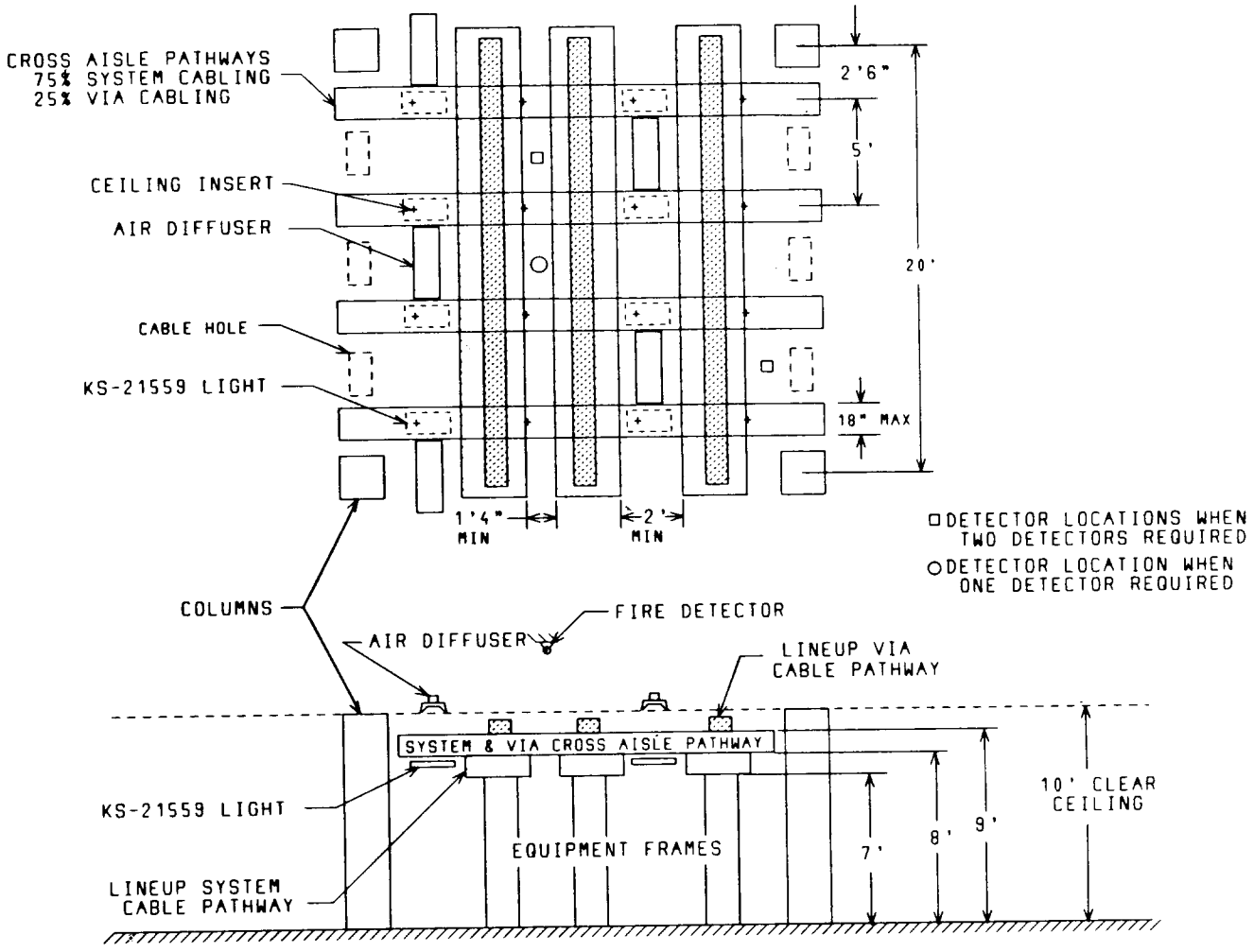


Fig. 12—Cable Pathways Plan for 18-Inch Deep Frame Areas

TABLE C

NUMBER OF LINE-UP CABLE PATHWAYS PER BUILDING BAY

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

*Excludes lineups in column lines.

TABLE D

NUMBER OF CROSS-AISLE CABLE PATHWAYS PER BUILDING BAY

COLUMN SPACING FT	CROSS-AISLE CABLE PATHWAYS PER BUILDING BAY
12 to 17	3
17 to 22	4
22 to 27	5

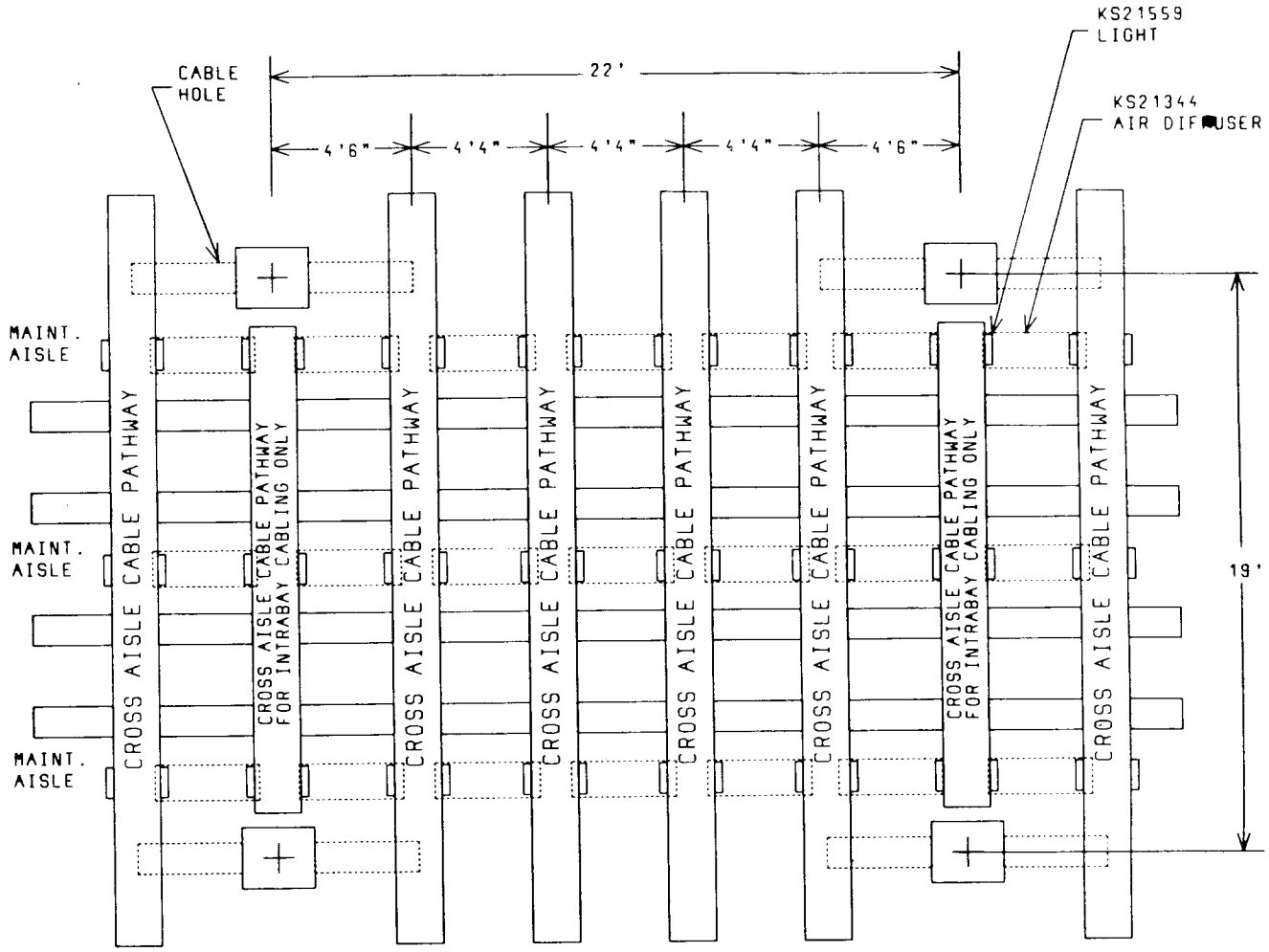


Fig. 13—Modified Cable Pathways

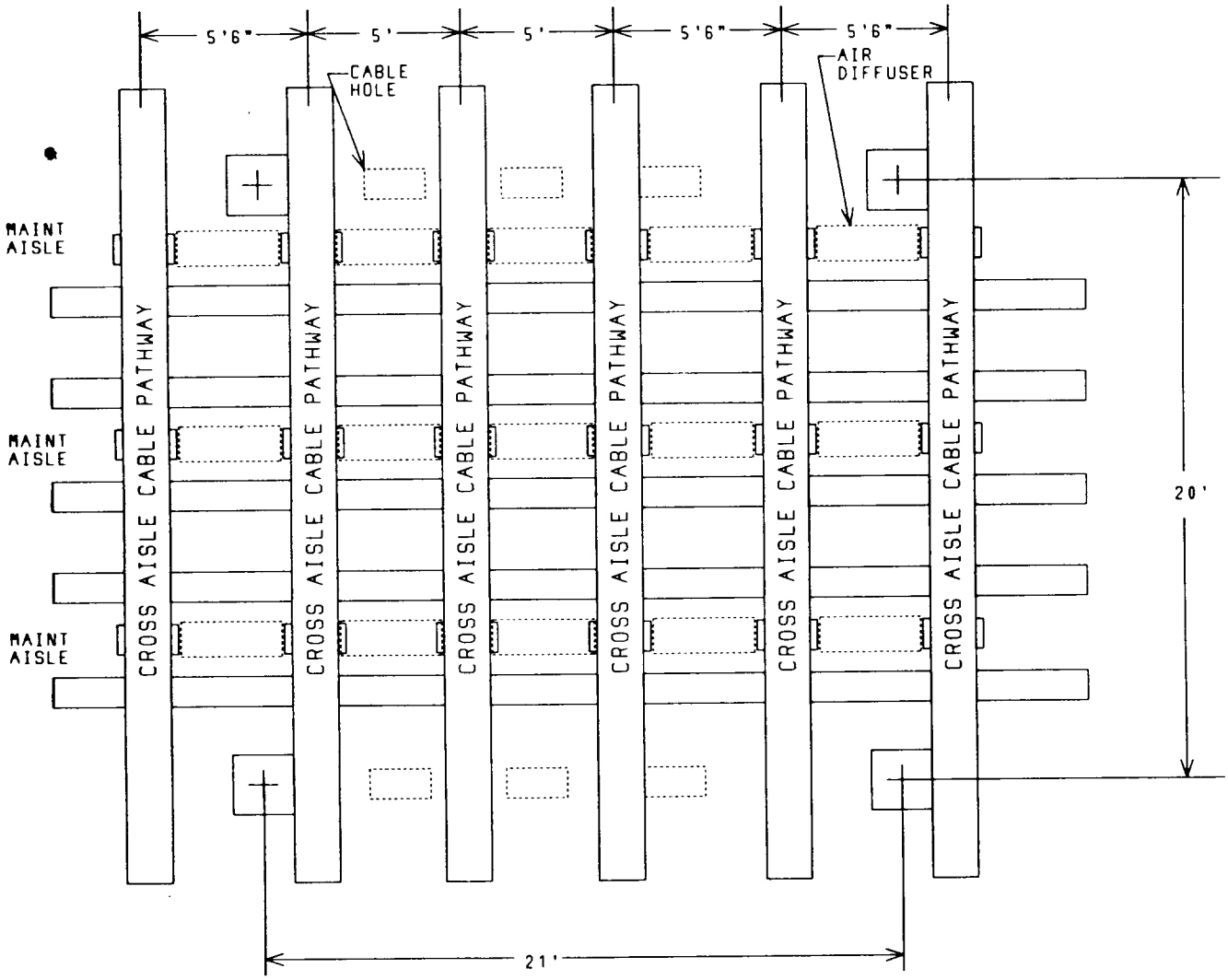


Fig. 14—Modified Cable Pathways

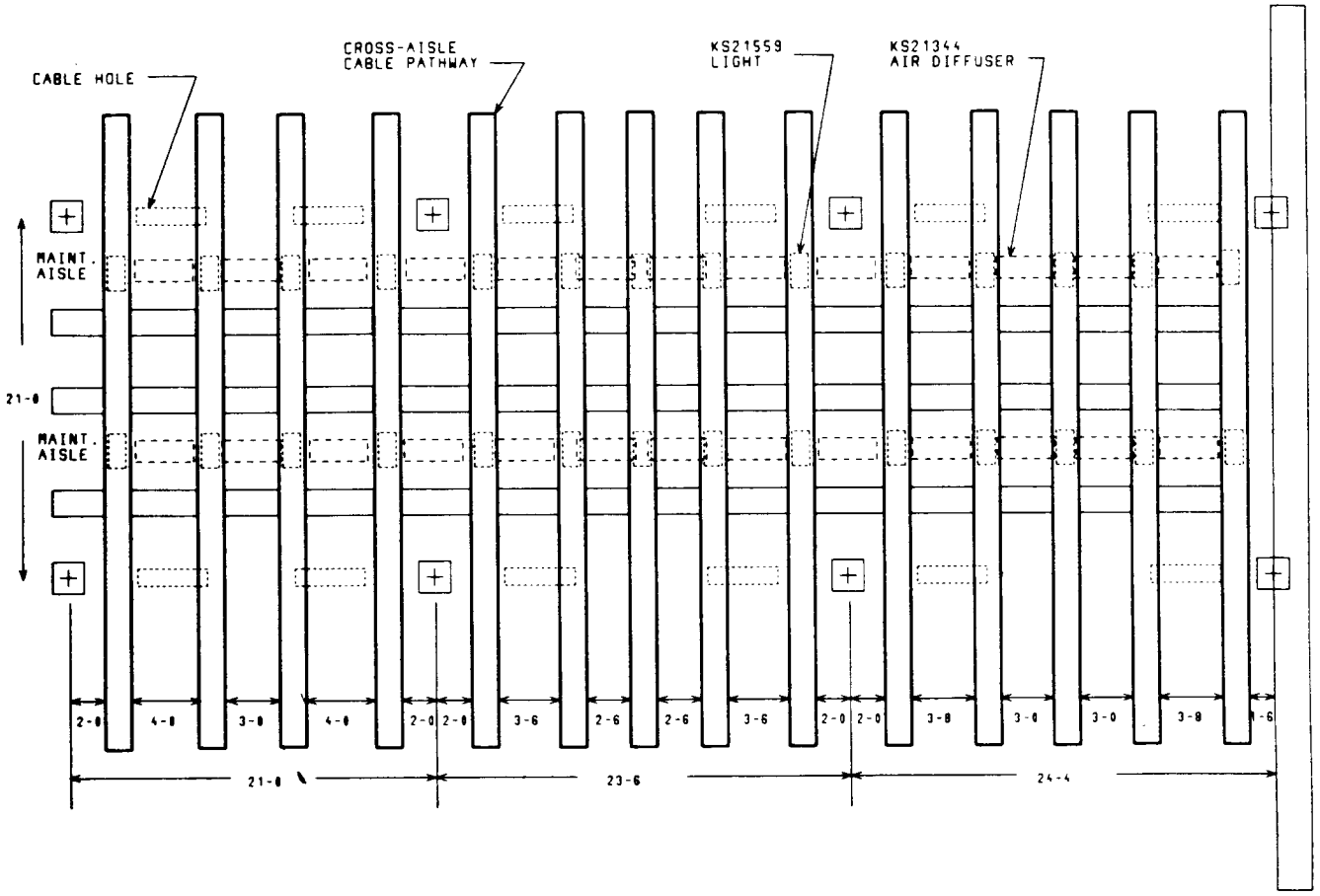


Fig. 15—Modified Cable Pathways

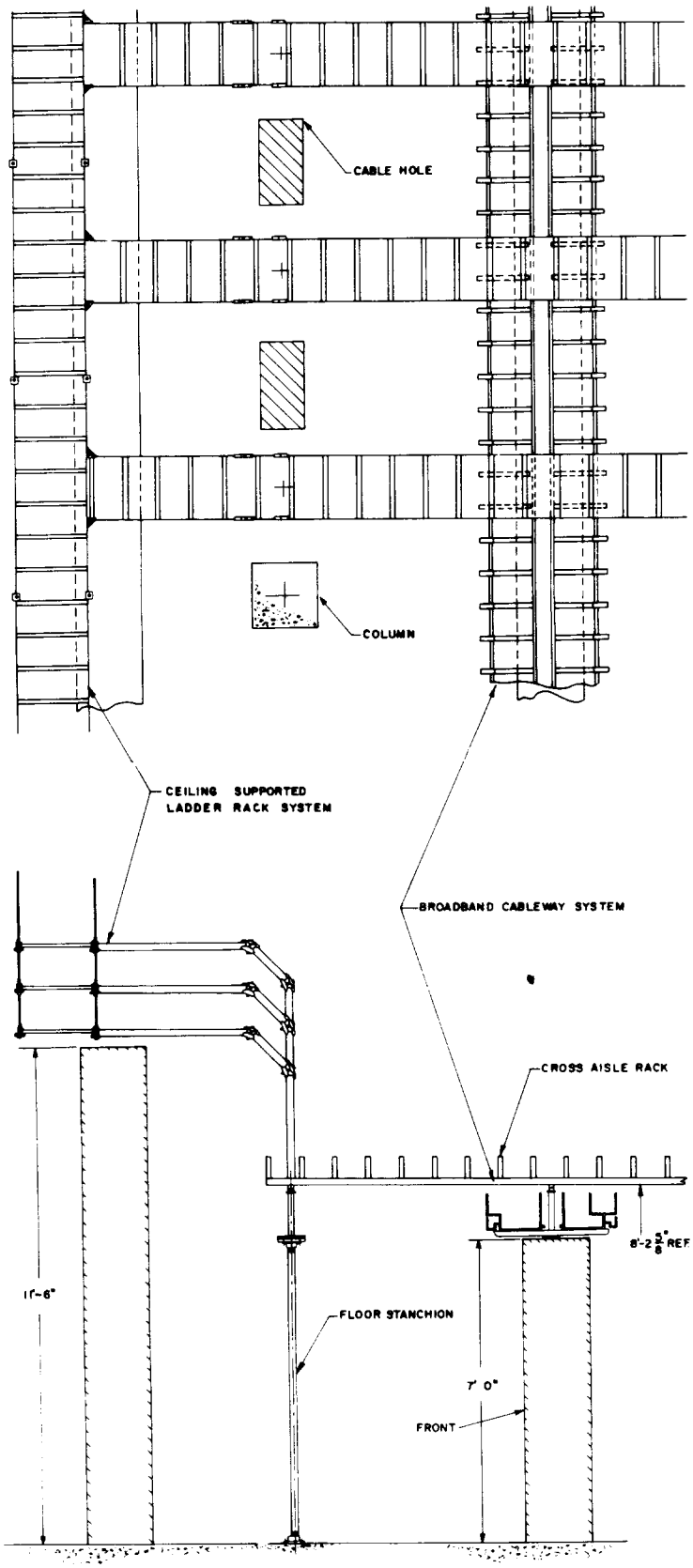


Fig. 16—Interface of NEBS Broadband Cableway System with Non-NEBS Ladder Rack System

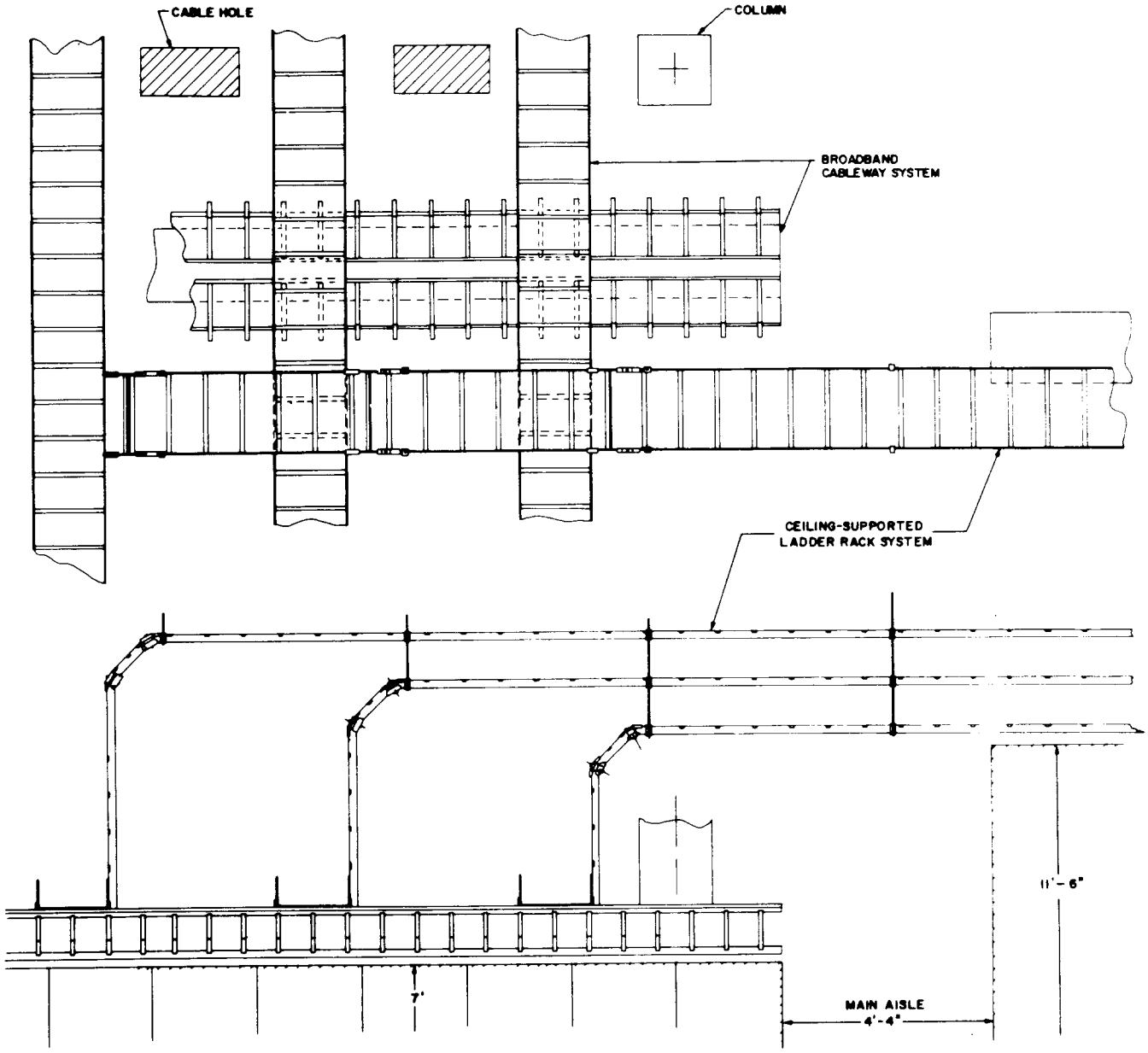


Fig. 17—Interface of NEBS Broadband Cableway System with Non-NEBS Ladder Rack System