SBC-002-316-041
DSX-1 Frame Forecast M&P

Abstract

Presented in this document are the methods and procedures to implement a DSX-1 Cross-Connect Frame in SBC-13STATE Central Offices.

Audience: The primary audience for this document is **SBC-13STATE** personnel in the following disciplines: Transport Equipment Engineer (TEE), Facility Equipment Engineer (FEE), Digital Transport Engineer (DTE), Maintenance Engineer, Space Planner, Frame Planner, Long Range Technical Planners, Fundamental Network Planning and **SBC-13STATE** Authorized Vendors.
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1. Reasons for Reissue

Issue 2, Section-All: Updated to reflect **SBC-13STATE** applicability.

Issue 2, Section 4: IOR deployments are required to provide a primary functionality for each DS1.

Issue 3, Section 6: Updated to reflect changes in spacing between DSX-1 bays.

Issue 5, Section 6: Deletes references to aisle spacing for Cross-Connect bays.

Issue 2, Section 7, Paragraph B&C: Added chart and illustration drawings for typical cabling deployments.

Issue 4, Section 6: 11' 6" DSX-1 Bay limited to 9' Panel vertical height growth.

Issue 4, Section 7, PAN update reference, Panel use updates and Use of Cross-Aisle Troughs/Extenders.

Issue 5, Section 8: Deletes references to certain Frame Forecasting Documents and Databases.

Issue 2, Section 10: Reference Section updated in its entirety.

Issue 2, Section 11: Copyright Section updated in its entirety.

Issue 1, Section-All: This document originally was a section within SBC-002-316-003, Frame Forecast M&P. This document is now covering DSX-1 Frame installations only.

2. Introduction

The primary audience for this document is **SBC-13STATE** personnel in the following disciplines: Maintenance Engineer, Transport Equipment Engineer (TEE), Facility Equipment Engineer (FEE), Digital Transport Engineer (DTE), Space Planner, Frame Planner, Long Range Technical Planners, Fundamental Network Planning and NSS organizations. This document is to be used internally and have a limited distribution subject to the header/footer information. This M&P may be found on the internal Web Site: http://home.sbc.com/commonsystems/ or http://apex.sbc.com. This document has been updated to reflect Network Planning & Engineering (Common Systems Standards) for the following **SBC-13STATE** Local Exchange Carriers:

SBC-Southern New England Telephone (Connecticut)
SBC-Pacific Bell (California)
SBC-Nevada Bell (Nevada)
SBC-Southwestern Bell Telephone (Missouri, Texas, Arkansas, Oklahoma, Kansas)
SBC-Ameritech (Illinois, Wisconsin, Indiana, Ohio, Michigan)

The DSX-1 Cross-Connect Frame is considered as an indigenous part of the Central Office that will support the interconnection needs for customers, carriers, other telecommunications providers, switches, transport equipment and cable facilities in the serving Wire Center area. When forecasting the ultimate floor space requirements for the frame footprint, considerations are made based upon the initial 20-year projection of use by the above listed elements. The frame is deployed in a logical layout algorithm to maximize the overall life of the frame and to permit the greatest utilization of frame equipment and block assignments with the least amount of jumper congestion and blockage. It should be understood that, whenever possible, direct cabling between a Network Element to the DCS (Digital Cross-Connect System) without the use of DSX panels is strongly encouraged per the **SBC-13 STATE's** Fundamental Network Planning Memorandum dated May 29, 2001.

Subsequent growth requirements of the DSX-1 Cross-Connect Frame will be based upon Wire Center forecasting, technology additions and growth, and the need for increases in facility placement in direct support of the community growth that the Wire Center supports. Incremental growths of the DSX-1 Frames will be addressed in this document. It must be specified that the building structure is planned to support this initial 20-year life-of-frame deployment with associated cable entrance facilities provided throughout the length of the frame in a direct route through the Wire Center. Shorter timelines could result in increased costs due to the need to redistribute equipment and facilities on the frame on smaller frame hardware increments.

It is understood that State Utility Commissions may require a reduced interval in the forecast planning from the standard projection timelines. When this occurs, the floorspace layout should reflect the maximum permissible sizing available. The Space Planner, working with the Detail Engineering Service Provider (DESP), where applicable, shall take into account the best solution based upon space availability, most efficient design and least cost application for the frame placement and design.

The DSX-1 Cross-Connect Frame supports the technology and application based upon their metallic standard requirements. It is imperative that the DSX-1 Cross-Connect Frame must be forecasted with the appropriate space and strategic location allocated within the Wire Center. Every effort must be made to avoid blocking the logical growth layout of a DSX-1 Frame or the inappropriate placement of the frame within the WC, causing the potential need for expensive additional regeneration equipment.

3. DSX-1 Cross-Connect Frame Overview and Definition

A DSX-1 Cross-Connect Frame architecture serves as the primary interface between a DS1-generating Network Element (NE) and a Digital Cross-Connect System (DCS). The DSX-1 Cross-Connect Frame provides a centralized point for the organization and administration of the DS1 Copper Facility and provides for rearrangeable connections between any two terminations or appearances. A DSX-1 Cross-Connect Frame serves as a manual method of cross connecting DS1 and DS1C services, in addition to Digital Cross-Connect Systems.

DSX-1 systems are suitable for use in both large and small offices, digital loop carriers, controlled environmental vaults (CEVs), and customer premises. The systems are modular in design and serve as centralized termination, test access, cross-connect points and distribution frames for network elements.

The recommended services and applications that should terminate on a DSX1 are as follows:

1. "Nail-Up" services such are T1 spans dedicated to a Switch.
2. Collocation and other low penalty requesters of excess capacity.
3. Asynchronous equipment, stand alone applications, Manufacture Discontinued Add Drop Multiplexer (ADM) equipment.
4. Electrical interconnection of step-down rings.

By contrast, the DCS is an electronic and/or optical cross-connect method system for the same services. The recommended services and applications, which should terminate on a DCS are as follows:

- Potential Rearrangement Customers
- Transport Traffic
- DS1-DS0-OC Multiplexing Functionality
- Regeneration of the Signal
- Network Reconfiguration Services

The Wideband DCS and Broadband DCS can be utilized as a software configurable replacement for the manual DSX. Refer to the Infrastructure Deployment Guidelines (IDG), Transport Section, for DCS guidelines for the various network elements being cabled to the DSX and DCS. Direct cabling between a Network Element to the DCS without the use of DSX panels is strongly encouraged.

4. Intraoffice Repeaters (IOR) for the DSX-1

IOR deployment within **SBC-13STATE** should be minimized at all times and should only be considered as a last option alternative. The overall distance between one Network Element through the DSX field (DSX-DSX) and on to another Network Element represents the key distance limitations before IORs should be considered. The placement of multiple DSX lineups or cross-connect lengths within the DSX field longer than what is specified in this document do not necessitate an IOR deployment. Consideration must be given to Optical Deployment through Intraoffice Rings through various Network Element nodes in lieu of IORs**.**

Each DSX system is designed for a specific bit rate and signal level:

DS1---1.544 Megabits per second (Mb/s) equipment is interconnected at a DSX-1 panel.

DS1C---3.152 Mb/s equipment is interconnected at a DSX-1C panel.

DS2---6.312 Mb/s equipment is interconnected at a DSX-2 panel (Embedded Only)

The following fundamental functions are performed at a DSX-1 frame:

a) Termination - provides a manual interface point for digital equipment at a particular signal bit rate.

b) Cross-connecting – electrically connects the various digital equipment to form Digital Systems.

c) Testing – permits a technician to access the circuit so that the DS can be monitored or measured.

d) Patching – permits the rapid restoration of services allowing the technician to temporarily substitute for defective facilities or central office equipment.

e) Rolling – allows for the orderly transfer of a digital signal without interruption. This requires the use of a Bridging Office Repeater Test Set.

Some of the operational and maintenance functions performed at the DSX-1 bay are:

- . Testing and Fault Isolation
- . Interoffice Service Restoration
- . Office Layout
- . Digital Switch Cut-over
- . Office Record Keeping

5. DSX-1 C.O. Topology

This Frame Forecast M&P shall be in concert with the W-DCS IDG, Transport Tab 4. The DSX layout provides for the manual interconnection of two DS1 circuits at a cross-connect field. The Primary DSX lineup will cable directly to Network Elements without having the need to route through another DSX panel located at the NE. DSX-1 layouts are planned to support the building infrastructure in a logical arrangement. When the DS1 equipment placement is located on another floor or a non-contiguous equipment area, a multi-coaxial cable, using a MUX/DEMUX equipment arrangement, will result in a tie cable arrangement to the remote area and will result in termination onto a **satellite DSX-1** in its own bay. From this satellite location, twisted pair/overall jacketed cables may be pulled through common use switchboard cable racking to the Network Element. It must be emphasized that individual twisted pairs should not traverse firewall partitions and floors due to the resulting inefficient and inordinate arrangements and costs. The placement of DSX panels at or near Network Elements for the sole purpose of supporting that NE is not supported or recommended; DSX-1 placements should be placed to support the building, floor and neighborhood of the NE in question.

DSX-1 panels used as an indigenous part of the Network Element product located within the NE equipment may be provided as a part of the NE and solely cost supported by that product, not baseline funding. This type of application will always use rear-rear standard **SBC-13STATE** approved panels regardless of the DSX-1 topology in the Central Office.

6. DSX-1 Cross-Connect Frame

6A. General

Planning of the DSX-1 lineup will dictate careful consideration of the Central Office layout. It is important to place the DSX-1 lineups (if multiple) in a parallel arrangement in a contiguous arrangement with appropriate troughs for adequate jumper placements. The length of the lineup may be up to 85 feet with the correct provisions for trough and routing layouts and may have up to 4 parallel lineups.

A DSX-1 system consists of any number of individual DSX terminations to which network elements are connected and cross-connected. Each DSX termination consists of three jacks, four equipment (network element) terminals and five cross-connect terminals. A digital circuit requires two DSX terminations. The network element is connected to the equipment IN and OUT terminals. The circuit is completed by connecting the IN and OUT, with twisted wire jumpers at the cross-connect terminals.

6B. Interbay Patch Panels or Bridging Panels:

Interbay patch panels or Bridging Panels are required to allow patching across aisles and along the length of a DSX-1 lineup.

The use of Cross Aisle Bridging or the placement of one Interbay patch panel for every five bays, will be used to increase the sizing of interbay ports at these locations to compensate for higher density arrangements. Multiple lineups use a combination of in-line and cross-aisle line connections to separate panels. The growth pattern for a five-bay module varies depending on a single, double, or triple lineup complex.

The DSX-1 is ideally provisioned based upon a 5-year forecast with skeleton bays (without panels). The skeleton bay has all the required horizontal, vertical troughs and cable racking provisioned in advance of the panel request.

For any existing four bay interbay panel configuration, continue to use those same bays for additional Interbay panels from new lineups and extensions of existing bays using the five bay format. When the next new interbay is identified, place it five bays away from the last four bay interbay panel on the end cap. Continue on the existing lineups using the five interbay format. Connect these to the existing four bay interbay panels interspersed throughout the frame. Each Central Office must be evaluated as to the appropriate placement on imbedded lineups.

6C. Cross-Aisle Tie Pair Panels and Bridging Panels:

Cross-aisle tie pair panels are used in DSX-1 lineups to provide the ability to cross-connect two DS-1 or DS-1C circuits terminated on different DSX-1 lineups. The cross-aisle tie circuits consists of five wires terminated at each end on the rear of a cross-aisle tie pair panel. Some older DSX-1 equipment may use six wire cross-connection, with the sixth wire used to connect the ground leads from the fuse and alarm panels. This insures a consistent ground reference for tracing lamps. These tie pair panels shall be strategically placed in the same interbay panel bays in both DSX1 lineups to avoid tie pair cable congestion and long cross-connect jumpers.

Bridging Panels provide the ability to place one set of jumpers from one panel to another without the use of Cross-Aisle Panels. The Bridges span the aisle to provide an interlocking arrangement for streamlined jumper placement.

6D. QUASI-RANDOM Signal Source:

An ADC QRSS/BR unit shall be mounted at mid bay (1 per 5 bays in the same interbay location).

6E. DSX-1 Cross-Connect Rules:

In order to maintain complete flexibility, planning of the office size is of primary importance and determines the ultimate size and layout of the DSX-1.

1. Minimize the amount of multiple jumpers.
2. Use both the bottom and top horizontal troughs for jumpers that must traverse over two panels in distance.
3. Each Central Office must maintain the consistent standard at which point the jumpers are reversed to connect two T1s for back-to-back carrier interconnections.
4. Larger troughs must be purchased and installed when the jumper depth reaches within 2-inches of the top of the trough panel at any point in the lineup.
5. Work all disconnects and remove all jumpers and interbay, QRSS, cross-aisle panels and erase the circuit identification on the faceplate of the panels.
6. Provide slack on the horizontal trough of each panel not to exceed 4 inches nor be less than 2 inches.

Provide 5 inches of space between each 56 port/panel-bay and 7 1/2 inches between each 84 port/panel-bay for each DSX-1 bay, to alleviate cable congestion in the vertical relay rack duct. The maximum number of DSX-1 bays in the first lineup should not exceed 40 bays; additional bays in a DSX-1 lineup may result in possible cable congestion in the overhead racks. The placement of larger troughs will be required if this is not performed. In addition, it is recommended to either install a skeleton bay to pre-equip the required horizontal troughs and appropriately sized vertical rings or to place a complete set of troughs and vertical rings when each new bay is installed in a lineup.

DSX-1 panels shall be allowed to "grow to the top" in new or existing installations which contain 7' and 9' bays. However, in the tall (11’ 6”) configuration, growth with DSX-1 panels will be limited to the 9'-height level. For all three bay configurations, 7', 9' and 11' 6", two troughs will be allowed. Any tie cable panels and other miscellaneous panels should be mounted at the top of the DSX-1 bays.

Aisle spacing will conform with existing standards.

All DSX patch panels shall be physically and electrically compatible in the same DSX-1 lineup.

Horizontal cable troughs shall be added in every DSX-1 bay for the placement of cross-connects. An upper and lower express trough shall be installed in each 7-foot , 9-foot and 11' 6" high bay. Troughs of 8 inches in depth should be considered for all higher DSX-1 cross-connect wire densities.

The maximum hardwired cabling lengths between two active DS-1 Network Elements shall be as follows(Note: If applicable, these following maximum hardwired cabling distances must

include the standard cross-connect length between two DSX-1 panels of up to a maximum of 85 feet):

a) 22 gauge 1310 feet STANDARD FOR USE (NON-CONNECTORIZED)
b) 24 gauge 1100 feet NOT RECOMMENDED EXCEPT ON COSMIC FRAMES
c) 26 gauge 900 feet STANDARD, **CAUTION: THE PROPER STRIPPING TOOLS MUST BE PROVIDED IN ADVANCE OF WORK ACTIVITY FOR THIS GAUGE.**

All cross-connecting wire from one DSX-1 panel to another DSX-1 shall be limited to 85 feet.

The T1/1.544 Mb/s cross connect jumpers on the DSX-1 can use either two separate twisted pairs or one 4 lead twisted pair grouping. (Note: On standard MDF and Universal Modular (COSMIC ®) frames, the cross connect jumper is simply a twisted pair run together with the receive and transmit pairs. Transmit and receive signals must be in separate cables from the transport equipment to the DSX-1.

7. Planning Guidelines

7A. Overview

The standard DSX-1 Cross-Connect System in **SBC-13STATE** is the rear cross-connect panel topology. All new lineups in a Central Office will use this type architecture.

The standard jack used on all panels going forward is the Bantam jack. The use of 310/309 jacks will be not be continued even in existing lineups and bays.

Cabling from the Network Element or to another regenerative point will not exceed 655 feet from the DSX-1. Cabling will be grounded at the NE end. DSX-1 Cross-Connects should not exceed 85 feet in length.

The use of 56/84 port rear-rear modular DSX-1 Panels are to be used in accordance with Product Approval Notice (PAN) 20021028, SBC-*Product Approval Notice for DSX Products* dated April 2002. The use of front cross-connect units may be used to finish out existing lineups only. 84 port rear-rear DSX-1 panels are standard on a going forward basis. **The 56-port panel may be used in a Central Office only at locations that are currently using the 56-port panel universally in order to complete a partially filled bay AND the DSX-1 lineup will not exhaust within the DSX-1 Forecast Period mandated by the respective state PUC. All new DSX-1 bays will be filled only with 84 circuit panels. The only exception to this policy is that Remote Terminal(RT) applications may still use 56 circuit DSX-1 panels on an ongoing basis.**

Horizontal Wireways (Troughs) and vertical rings between the troughs shall be provided on all DSX-1 bays to maximize the space utilization and preclude trough congestion.

When any trough comes within 2-inches of the top of any bay, the entire trough lineup should be upgraded to the 8-inch size.

Adjustable cross-aisle troughs and cable trough extenders are to be used between line ups whenever possible to reduce costs associated with the use of more expensive panels.

Initial DSX-1 deployments will be in 5-bay increments with a forecasted space identified for the lineup to grow to 40 potential bays.

Grow existing DSX-1 lineups in 5-bay increments.

Begin a second lineup when the initial lineup grows beyond 20 bays.

Begin a third and a subsequent fourth lineup when the previous lineup reaches a length of 30 bays.

Provision 84-port panels in all Central Offices unless the site has the capability to avoid the exhaustion of the DSX-1 lineup based upon a 5 year forecast period.

Determine the number of bays from the Forecast and submit the information using the forms and processes covered in the Wire Center Planning Method & Procedures to the Space Planner.

7B. DS-1 Distances Table

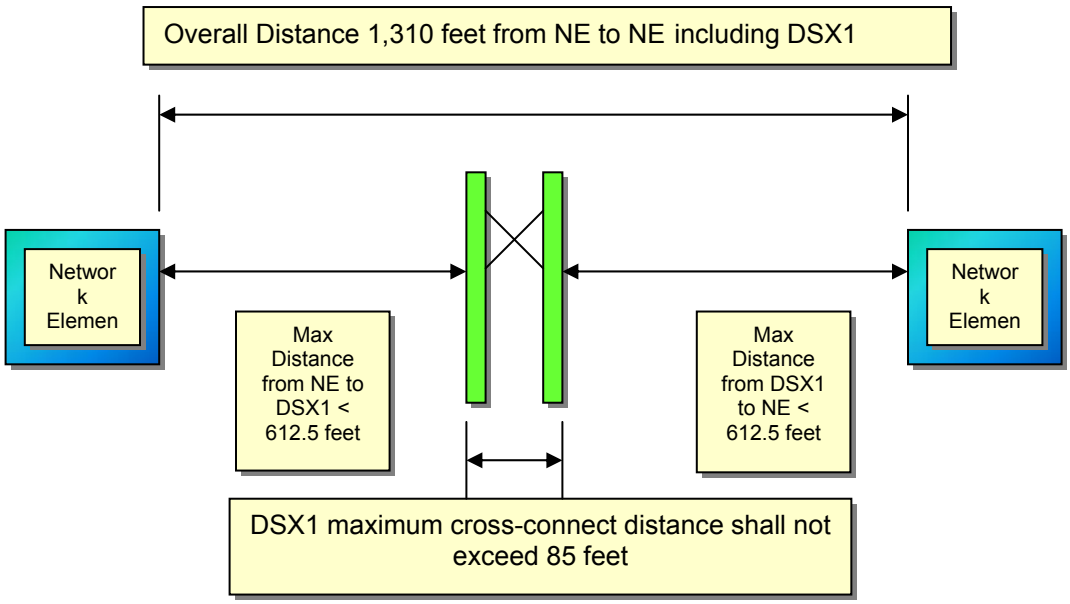
Type of Connection /Cable Used	Distance Limit (Network Element {NE}) -DSX1/DSX3)	Distance Limit Cross-Connect at DSX1/DSX3	Maximum Overall Distance Limit (NE-NE)*
DS1 22 gauge wire	612.5 feet	85 feet	1,310 feet
DS1 24 gauge wire	507.5 feet	85 feet	1,100 feet
DS1 26 gauge wire	407.5 feet	85 feet	900 feet

* Notice that if a DS1 signal has portions of both types of cabling, the finer gauge value will need to be used.

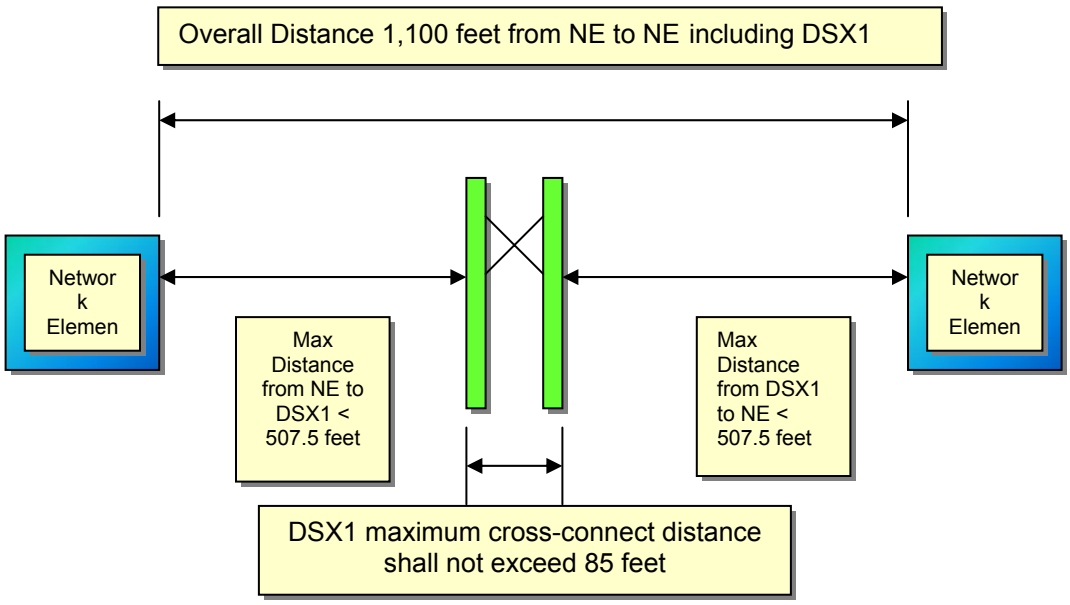
7C. DS-1 Distances Illustrations

The overall distance from one Network Element to another Network Element (such as a DCS) is shown in the drawings below:

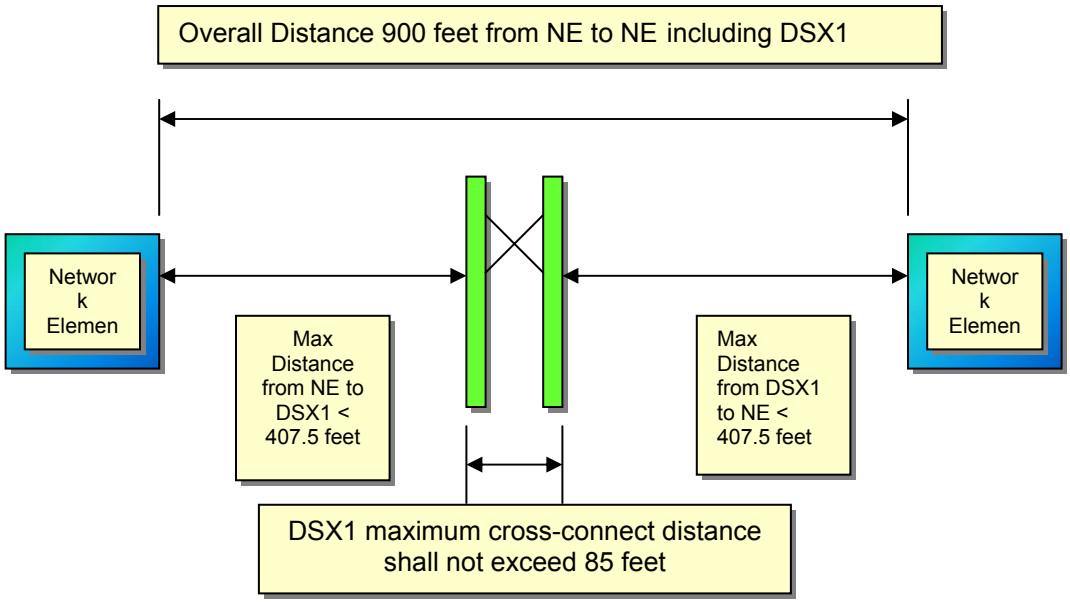
7C.1. 22-Gauge Cabling Arrangement



7C.2. 24-Gauge Cabling Arrangement



7C.3. 26-Gauge Cabling Arrangement



8. Frame Placement Strategy

The Transport Equipment Engineer (TEE) will request a forecast of demand for DSX-1 frames. In addition to the Forecasting Organization documentation, input can be received based upon strategic Business Initiatives, Customer demands and sales, Marketing Organizations, Collocation demands and from Internal work forces such as:

Local Field Operations/Network Operations
Outside Plant Engineers
Maintenance Engineers
Installation/Maintenance Organizations
Trunking and Inter Office Equipment Engineers
Transport Equipment Engineers (TEE)
Architecture Planning Engineers

The NP&E **SBC-13STATE** Forecasting Organization will determine the growth requirements, service needs and expected growth expectations through the following detailed forecast analysis:

Wire Center Forecast Form (refer also to Wire Center Planning M&P)

The minimum and required forecast intervals to be used are covered in the Wire Center Planning Methods & Procedures, SBC-002-316-101, as follows:

1. Mandatory Forecasting is to be performed every 6 months/12 months and is to project out a forecast for a minimum of three(3) years of usage.

2. It is recommended to perform a 5-year frame forecast.

3. A 10-year forecast needs to be performed for building exhaust situations.

Based upon the data received, the appropriate engineer/planner will evaluate the amount of service load and equipment necessary to meet service needs. These groups will translate the demand of equipment into the amount of bays or frame lineup lengths necessary to meet those objectives and forecasts.

Two typical examples:

A.) The Wire Center forecasts the placement of ten Lightspan 2000 Network Element(NE) systems within the next five years. The TEE determines that the Primary DSX-1 Cross-Connect Frame has sufficient bays for the NE and OSP terminations, but the NE Relay Racks will be placed on another floor. Evaluate the route of egress from the NE to the primary DSX-1 Frame. Keep in mind that the maximum ABAM (22 AWG) and 1249C (26 AWG) overall shielded hardwired cable distance runs from NE to DSX-1 are 612.5 feet and 407.5 feet, respectively.

B.) The Transport Equipment Engineer (TEE) has received a forecast for a new lineup of DSX-1 Rear-Rear Cross-Connect bays which are to be placed in parallel with several existing/working lineups of DSX-1 bays. The initial installation will involve placing all the DSX-1 Frame Hardware Bays, Overhead Wiring Troughs, Bridges and Cross-Aisle Panels(only if needed). The actual DSX-1 Rear-Rear Cross-Connect Panels will be installed into the DSX-1 equipment bays on an ongoing, as needed, basis in order to grow the lineup over time. To minimize costs associated with Cross-Aisle Panels, Bridges will be used wherever possible.

When incremental growth forecasts are the only option due to regulatory limitations, great care should be exercised to keep the frame from prematurely exhausting. The Forecast intervals need to be compressed to compensate for frames with less capacity than normal that could become exhausted due to small surges in growth. Ample diligence is required in the planning, use and mechanization of DSX-1 Cross-Connect Frames in order to preclude premature exhaustion. Some typical items of concern are listed below:

1.) Less than optimal placement of DSX-1 panels that will cause long cross-connect jumpers or convoluted cable routing. This may prematurely trigger the need for a new frame at a substantially increased cost over the ability to expand the existing frame structure.

2.) Cross-Connect Jumper blockage can develop between old and new adjoining frame areas unless great attention to detail is exercised in cable management by performing cable rearrangements and disconnect orders on a regular basis within one week of the date of the Service Order.

3.) Once the type of frame and amount of vertical/bays are determined, the Frame Planner/Transport Equipment Engineer will fill out and submit the Wire Center Equipment/Power Forecast to the Space Planner.

It is absolutely critical that the Transport Equipment Engineer (TEE) maintain documented records pertaining to both initial and growth DSX-1 decisions. The documentation needs to include the reasons for the placement/growth, the date/time group and the backup documentation from the forecast organization (or Fundamental Planners). This information will support the reasons as evidence in Regulatory Inquiries. Insure that the documentation will stand on its own merits and is written in a non-technical format.

9. References

For further information or electronic copies of this document and related information, visit the internal **SBC-13STATE** Web site: **http://home.sbc.com/commonsystems/** or **http://apex.sbc.com**

Infrastructure Deployment Guidelines (IDG), Transport, Tab 13, *DSX-1/3*, Issued Jul 2001
Building Blocks B Series *DSX-1(All Regions)*
SBC-E-01175-E SBC- *Equipment Drawings (DSX1) RX*
SBC-E-01175-W SBC- *Interconnect Drawings (DSX1) RX*
SBC-E-01089-W SBC - *DS1 BOR Drawings*
SBC-E-01101-E SBC – *Equipment Drawings DS1-IOR*
SBC-E-01101-W SBC – *Interconnect Drawings DS1-IOR*
PAN 20021028 SBC-*Product Approval Notice for DSX Products* April 2002
PAN 19985043 SBC-*Product Approval Notice for Fiber Protection Systems (Raceways and Fiber Duct Work)* August 1998
PAN 19985002 SBC-*Product Approval Notice for Fiber Splitters and Associated Housings* September 1998
BSP 800-003-150MP SBC-*Cable and Wire Installation for Cable Racks and (Fiber) Raceways* September 1998
SBC-002-316-002 *SBC – Collocation Provisioning Guidelines*, 2001
SBC-002-316-041 *SBC – DSX-1 Frame Forecast M&P*, 2001

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