NETWORK DESIGN ORDER PREPARATION
DIGITAL MULTIPLEX SYSTEM - 10
(DMS-10)

CONTENTS

EXHIBITS

APPENDIX

1.0 GENERAL

PURPOSE AND SCOPE

1.01 This Section covers the preparation of a Network Design Order (NDO) for local Digital Multiplex System-10 (DMS-10). The DMS-10 is a product of Northern Telecom, Inc. (NTI). It specifies a uniform format that shall be used for all local DMS-10 NDOs.

1.02 This practice is being reissued to include the increased capacities that are associated with the 400 series Generic. In addition, changes in company practices and procedures are reflected in this reissue.

1.03 NDO Preparation (NDOP) requires a knowledge of how telephone switching equipment functions and full understanding of basic trunking principles. This practice does not attempt to cover these two items, but assumes that the Network Designers preparing the order have equipped themselves with this knowledge.

1.04 The fundamentals of Network Design as applied to local DMS-10 central office equipment (COE) are covered in the DMS-10 Equipment Questionnaire (NT8611). The following practices should also be referred to for additional information:

- o Northern Telecom Practice 297-3001-450, DMS-10 Traffic Provisioning
- o DMS-10 Technical Specification (Generic Specific)
- o Southwestern Bell Correspondence File Subject 225.10 or 225.1010 and Bellcore Letters
- o Appendix 1 of this practice - DMS-10 Network Design-Related documentation summary

1.05 General considerations and Company policies that apply to NDOP are contained herein.

The considerations involved in preparing a NDO may cover all departments as well as the various vendor switches in use or planned. It is important that NDOP be done carefully. This involves:

(a) A full sense of proprietorship.

(b) A full understanding of Company policy as related to quality of service and an objective balance between service and cost.

(c) A full knowledge of Network Design operations.

(d) A full knowledge of equipment operation.

(e) A full degree of cooperation and understanding between departments.

1.06 The art of NDOP is not an exercise in mathematics. There will be occasions when the mathematical computations will give a solution to a problem, and judgment may not be required. However, the mathematical computations involved in preparing a NDO are simply one of the tools that the Network Designer may use in applying judgment, and there is no substitute for intelligent judgment. The major decisions made by the Network Designer are in the Basic Data Section, and a NDO can be no better than the Designer's judgment that is applied in the Basic Data Section. Central Office Equipment cannot rectify a poor judgment decision made in the Basic Data Section.

2.0 ASSUMPTIONS

2.01 This section assumes that the need for a COE job has been determined by standard Company policy and practices and that is has been properly and accurately scheduled. It is also assumed that a job is included in the current construction budget and that equipment is allocated for it.

3.0 JOB SIZING AND TIMING

3.01 Every effort shall be made to limit the number of equipment jobs in a given DMS 10 to a minimum, with no more than one job within two busy seasons. Trunk relief jobs, integrated digital loop carrier jobs, intraLATA or interLATA switching relief jobs and Operator Services jobs should be coordinated so that they may be scheduled at the same time as the DMS 10 relief job. If the various jobs are scheduled together, close attention must be given to the effect on each job; integrated digital loop carrier, intraLATA, interLATA, etc., before schedule changes are made.

3.02 An engineering period (interval) is the interval of time between the planned "in service" date of an equipment addition and the date when the addition is estimated to exhaust. These engineering periods or engineering intervals are established so that each equipment installation will produce the best economic balance between the present worth of carrying charges on spare equipment and the cost of engineering, manufacturing and installing the equipment involved.

3.03 Two years is the normal engineering interval for a DMS-10. This interval should be used as a starting point in the design of local DMS-10 dial equipment.

3.04 The policy on engineering intervals is being reviewed by the Task Force on Market Driven Capital Policies. It's recommendations are expected to be released during the first quarter, 1988.

3.05 The final engineering interval should be based on engineering judgment considering the costs of the various types of equipment, reuse, installation costs, particularly for multiple "reentry" cost as well as carrying charges for spare equipment.

3.06 The principle of switching component "Harmony" should be considered in sizing a job. The office equipment quantities should be carefully analyzed to determine if a small amount of equipment can be added or deleted to shorten or lengthen a job to a more economical interval. Special care should be used to ensure that the job interval, which is based on a switching component exhaust (caused by a common control component), is more economical than if additions or deletions were made to the component which has caused the exhaust. As an example, if Digitone[R] Receivers are controlling and by adding only one Digitone Receiver, the exhaust date will be lengthened by 4 months, it would normally be more economical to lengthen the interval by adding the Digitone Receivers (this assumes that there are no other equipment additions necessary to lengthen the interval and that in four months a major item exhausts, or that the other additions are minor enough to still make the longer interval economical). Conversely, if the Digitone Receivers provisioned break over into an additional Peripheral Equipment Bay by only one receiver, consideration should be given to reducing the provision and shortening the engineering interval.

3.07 When the economical engineering interval has been determined, care should be taken to provide the necessary trunk equipment and all other equipment needed for that point in time. COE relief projects shall be scheduled to complete one month prior to the exhaust date of the existing equipment unless this occurs during the busy season when maximum switching capacity is required. In this event, jobs should be scheduled to complete one month in advance of the busy season. A note should be placed in the narrative of the face sheet stating a Capacity Exhaust Date (CED) as the first month of the busy season so that the job will be scheduled one month prior to the first month of the busy season. For example, "CED = 1-89" will insure job completion 12-88. Such a note will explain the difference between the calculated exhaust date for the most limiting item and the date the equipment is actually required for service prior to the busy season of exhaust.

3.08 Equipment and facilities are not to be reserved on the basis of the five year forecasts provided by the Interexchange Carriers (ICs). The submission of these forecasts by the IC, following SWBT procedures, improves the likelihood of availability, but does not guarantee it. The forecasts provided by the IC are used as input, compared with SWBT data and combined to form a reasonable forecast which serves as the basis for building an inventory of equipment and facilities consistent with capital constraints and prudent risk.

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3.09 If requested by the Interexchange Network Access Capacity Coordinator (INACC), the Network Switching Engineering Center (NSEC) will determine switching availability based on inputs from Circuit Administration Center (CAC) and the Demand Forecast Center (DFC). The NSEC will determine whether barriers such as building exhaust might prevent expansion within a two/three year period and evaluate capacity provisioning plans and equipment availability dates in conjunction with the Equipment Engineering Center (EEC). In addition, NSEC should contact Network Administration Center (NAC) to insure that provisioning plans are compatible with office administration.

3.10 The results of the NSEC's analysis will be forwarded to the INACC. Information will include a switching service plan stating how and when capacity will be provided (existing or proposed job) or whether special construction is required to satisfy requested service.

3.11 The specific reference to be used by the Network Designer for IC forecasts is the General Trunk Forecast (GTF). The GTF should reflect IC trunk requirements and is the designer's authority for trunk equipment provisioning, unless there is an alternate authority approved by upper level management.

4.0 THE NETWORK DESIGN ORDER

4.01 The NDO serves two basic purposes:

(a) It is a requisition for changes in the amount of and/or arrangements of telephone equipment.

(b) It is the Network Department's basic record of the equipment and its arrangements relative to the traffic capacity of the equipment and arrangements.

4.02 The NDO is composed of two main components:

(a) The Basic Data Section.

(b) The Specification Section.

4.03 The Basic Data Section of a NDO contains the historical data, future estimates and forecasts, computations, Traffic Growth Chart, Loads and Trends (L&T) Charts and Network Design engineering judgments that determine the basic equipment configurations. In addition, the Basic Data Section quotes the authorities and policies that may be needed for authorization. It also includes the Basic Assumptions which are those elements that define the present and future DMS-10 structural arrangements and dependencies. Any other pertinent information of an explanatory nature that may be required for the use of Network Design alone shall be included in the Basic Data Section.

4.04 The Specification Section of a NDO covers the detailed equipment quantities and arrangements for those components which are the responsibility of Network Design. The Specification part of a NDO must utilize the standard Northern Telecom DMS-10 Equipment Questionnaire, NT8611. The Equipment Questionnaire is to show Proposed traffic loads and feature demand for the end of the engineering period. Unfortunately, the DMS-10 NT8611 does not contain algorithms or provisioning calculations for equipment quantity determination. The SWBT Network Designer fills in end-of-period expected loads and demand and submits the questionnaire, via the Equipment Engineer, to NTI. NTI Engineering determines equipment quantities and configurations based on SWBT's NT8611 inputs. However, it is still the Network Designer's responsibility to obtain NTI's calculations and provisioning rules from documentation and/or NTI's engineers. The Network Designer must validate NTI's calculations and accept responsibility for adequate but economical DMS-10 central office provisioning.

4.05 The reproduced copies of the NDO can be made up of pages that have been copied on both the front and back sides. This will eliminate the inefficient use of paper that results from reproducing on only one side of a page.

4.06 There shall be four basic types of NDOs. They are as follows:

- o A Complete Network Design Order must be issued whenever a physical modification to the office and changes in a Face Sheet capacity occur. It is composed of all the pages that make up both the Basic Data Section and the Specification Section. Whenever feasible, the Network Designer should issue a Complete Order in preference to other types. A Complete Order insures a current look at all phases of the traffic data and equipment quantities of the office. They are easier for the Switching Engineer to work from and insure that essential details of the office will not be overlooked. They are also much simpler for the Network Administrator to use and maintain.

- o Partial Orders are issued for relatively minor changes or additions to an office when there is no NDO outstanding (unless the outstanding NDO is too close to completion to be supplemented). They are never used when the job will change the Face Sheet capacity or exhaust dates of the office. A Partial NDO is composed of only the particular pages of a previous Complete Order that are added or changed. It is important to note that all pages relating to the change caused by the Partial Order must be included. The reissued pages of a Partial Order should be numbered the same as the previous Complete Order. Added pages would be numbered with a letter suffix; e.g., page 7A.

  The pages that are reissued are to be shown on the Face Sheet of the order. The next Complete Order would incorporate all of the changes that were made by Partial Orders issued since the last complete Order and pages of the Complete Order will be renumbered to eliminate letter suffixes. A Partial Order should not be issued following another Partial Order if a Complete

Order has not been issued within the last 18 months. As a general guideline, if more than 25% of the pages of the Complete Order will be reissued in the Partial Order, a Complete Order should be issued rather than a Partial Order.

- o A Supplement Order is issued to an outstanding Complete or Partial Order to make corrections, changes and/or minor additions. It shall have the same order number as the Complete or Partial Order it is supplementing. The pages that are reissued shall be listed on the Face Sheet. A Supplement Order is also used to cancel an order. A supplement shall be used to change Talking Channel Capacity, Switching Equipment Capacity, Termination Capacity or Exhaust Dates of an office due to increased (decreased) NAL forecast changes, busy season change for a forecasted usage value etc., on jobs that have not been completed.

- o A Revised Order is a complete reissue of a Complete or Partial Order when the changes to an open order are so extensive that it is necessary to reissue a complete order for record purposes.

4.07 All Complete and Partial NDO's shall be numbered serially with a "year-alpha-numeric" code. The "year shall be the calendar year in which the order is signed out by the approving Network Design authority. The "alpha" shall designate the Section, Area, or other design group designation. The "numerical" shall begin with 1 for each "year." In addition, a suffix "alpha" code shall be used to designate an order other than Complete Order.

The alpha suffix shall be used as follows:

P - designates a Partial Order

S-1, S-2, etc. - designates a Supplement and number of Supplement

R - designates a Revised Order

4.08 The heading of a NDO should always contain the Title, the Common Language Location Identification Code, the Service Date, Estimate Request Number and the Construction Management Analysis and Provisioning System (CMAPS) identification number.

- o The Title of a Network Design Order should always contain the following items if it is for local switching equipment:

  Name of Town and Area
  Name of the Central Office
  Type of Switching Equipment
  A short Descriptive Title

Examples are:

ANYTOWN, MO - Capital, 222 DMS-10
add 500 Lines, 100 Numbers.

SOMEWHERE, KS - Chestnut, 247
DMS-10 add 1000 Lines, 1000 Numbers.

- The Common Language Location Identification (CLLI) Code, is an 11-character mnemonic code that uniquely identifies a specific location switching equipment as follows:

  City - 4 characters
  State - 2 characters
  Building - 2 characters
  Entity - 3 characters

  Examples: B L T N M O D I 3 4 1
  CITY ST BLDG ENTITY

  BELLTOWN, MO - Diamond-341

  Refer to Section 795-000-000 index listing for the specific Section for Individual States CLLI Codes if one has been established for the switching entity. If one has not been established contact the CLLI Coordinator in the Engineering Department.

- Ready For Service Date - The data on which the NAL capacity of an entity is increased or the entity is displaced.

- Required For Service Date - The date that the job must be in service to fulfill the need for that particular job.

- CMAPS ID Number is the assigned number for the specific COE job.

- Provisioning Forecast [Wire Center Area Forecast (WCAF)] DATED is the date of the Provisioning Forecast used to prepare the NDO. In addition, the date that the forecast was validated should be entered on this line if the forecast was issued more than sixty days before the NDO. If digital lines are involved, list the Network Distribution forecast date and validation date on the NDO face sheet.

- Trunk Forecast Date is the date of the General Trunk Forecast used to prepare the NDO. In addition, the date that the forecast was validated should be entered on this line if the forecast was issued more than sixty days before the NDO. If digital trunks are involved, it should be noted on the NDO face sheet the date of the T-span and/or Digital Central office termination forecast, including validation date.

5.0 NETWORK DESIGN ORDER PREPARATION POLICIES

5.01 The purpose of this Section is to cover the specific policies and practices that apply to NDOP in Southwestern Bell Telephone Company for DMS-10. If there are conflicts between information in this SWBT Section and information issued at some earlier date, the information contained in this SWBT Section shall be controlling.

5.02 No effort has been made to reproduce here the many Instructions, Practices, Network Design Letters, etc., that relate to Network Design Engineering. This SWBT Section includes, however, the policies covering NDOP that were previously set forth in policy letters and memoranda. This SWBT Section replaces and supersedes any such policy letters memoranda insofar as Network Design Engineering policies are concerned if and only if they conflict with this practice.

5.03 Efficient and effective network design has as its objective the provision of the right kind of equipment at the right place at the right time and in the right quantity to give an objective level (grade) of service to all Network customers with a minimum of capital dollar investment. In estimating equipment requirements the Network Designer must predict busy hour usage (and/or attempts) at some future point in time, perhaps three or four years away, when the facilities will have been installed and when the growth for which they are provided has been attained.

LOAD SERVICE RELATIONSHIP

5.04 It is the goal of Southwestern Bell Telephone Company to provide switching equipment and facilities in such quantity, type and location that there is a reasonable balance between the quality of service rendered and the cost to the Company to give that service. Design methods and the tables which serve as engineering bases have been developed on that relationship.

5.05 Aside from good mechanical and electrical performance in setting up calls and freedom from human error, customers are interested in two principal phases of their telephone service:

(a) The frequency with which connections to the desired telephone are established on the first attempt.

(b) The length of time required to complete the connection.

These areas of customer concern may be restated as several network design considerations:

(a) The elapsed time during which each call occupies switching facilities.

(b) The number of talking channels available in any group to handle the total calls offered.

(c) The efficiency of the groups of channels.

(d) The grade of service which can be provided to a given call load of certain established characteristics.

These considerations must translate to estimates of future traffic levels that can be handled by the switching office at the desired grade of service. The following service criteria have been authorized in Southwestern Bell Central Offices (COs) at the peak of the engineering interval:

Average Busy Season (ABS) -
Time Consistent Busy Hour

Dial Tone Speed over 3 Seconds - 1.5%
Originating Matching Loss - 1.0%
Incoming Matching Loss - 2.0%

10-High Day

Dial Tone Speed over 3 Seconds - 8.0%

High Day

Dial Tone Speed over 3 Seconds - 20.0%

DEFINITION OF BUSY SEASON

5.06 The busy season for local offices is defined as the three months, not necessarily consecutive, with the highest average time consistent busy hour CCS load per NAL.

EFFECTIVE USE OF SERVICE RESULT INFORMATION

5.07 Recognition of the fact that network design criteria are based upon averages means that the Network Designer must, as soon as possible after the conversion of a CO, begin to track its service results. These results may indicate a significant deviation in its load/service characteristics from those averages, for which compensation may be indicated in growth additions. For example, an office which is nearing its stated capacity but which consistently performs with 0% matching loss is obviously not as close to its actual switching capacity as one of a similar size and configuration which is experiencing some matching loss. On the other hand, a machine that is continually experiencing noticeable matching loss may need attention even though it has not yet reached

the NAL quantity stated as its switching capacity. It is important for the designer to be aware of both the service results condition and its potential effect on customer satisfaction and capital dollar investment. The service results graph (Exhibit 9) can be used by the Network Designer to track service results information. However, the service results graph is not a required input to the NDO. Exhibit 10 shows a graphical representation of the ABS Matching loss of an existing office.

5.08 The LSD&F (Local Switch Demand and Facility) Chart Part A contains this same information in tabular form. If the Part A is included in the NDO and the Network Design Engineer has verified that the services results data is accurately posted on it, the Service Results Graph may be discontinued if they are being used.

LINE AND DIRECTORY NUMBER PROVISIONING

5.09 Line Equipment - Line terminations will be engineered on the basis of 5% administrative margin for administration and test purposes.

5.10 In offices requiring lines in excess of the normally provided administrative margin, empirical data should be compiled by Network Administration through regularly scheduled studies as outlined in the appropriate network Administration Practices. In addition, the Line Utilization Monthly Work Sheet - Service Year form should be furnished to Network Design annually or as required for inclusion in the appropriate NDO.

5.11 The derived % line fill (actual) calculated by Network Administration is not the engineered % line fill (objective). However, Network Design can determine the engineered % line fill using the derived % fill, if provided, and through discussions with Network Administration. The engineered % fill should provide the best economical mix between equipment utilization and administrative margin requirements.

5.12 Line equipment should be provided to service the Provisioning Forecast (formally the Wire Center Area Forecast [WCAF]) at the end of the engineering period plus the administration margin outlined above. A "Line Termination Capacity" shall be computed in each office and shown on the Network Design Order Face Sheet (see Exhibit 2, page 4).

5.13 In the DMS-10 400 series switch, there is the Line Concentrating Module (LCM), same as that used in the DMS-100 switch for analog line terminations. But the LCM can terminate 640 analog lines. No LCM terminations are dedicated for test purposes. The number of lines installed is the total number of line drawer slots for which line cards have been purchased for the job the NDO addresses. "Unusable" or "Unavailable" lines are those wired slots which cannot be used

for customer line terminations because they are used for +48 Volt power converter cards. If line drawers and slots are wired in excess of what is required for the end of period, but no line cards have been purchased or held in a central location (like the plug-in center), these slots should not be counted as 'installed' or 'unavailable.' If, however, excess line drawers and slots have been wired and equipped with line cards or line cards are being stored in some location until they are needed, these slots should be counted as installed. The plug-in center concept is still under investigation and has not been approved for DMS line cards. Since line cards represent a significant portion of total switch cost, every effort should be made to harmonize equipment provisioning around the LCM breakage. (See Exhibit 2, page 4 for LCM Line termination capacity calculations.)

If peripheral equipment shelves (PE) are used, line termination capacity is calculated based on the number of line circuits installed. The line circuit packs terminate 4 line circuits per circuit pack with a maximum 14 circuit packs per shelf. The NT8611 Questionnaire emphasizes ordering line circuits rather than line circuit packs. NTI normally wires the PE shelf so that lines, analog trunks, or service circuits can be plugged into vacant slots after job completion. Since the entire shelf is not dedicated for line terminations only, wired equipped lines should equal the total number of line circuits installed for the face sheet entry. The normal 5% spare line terminations should be applied to obtain the PE line termination capacity. (See Exhibit 2, page 4.)

5.14 Directory Number - A directory Number Termination Capacity shall be established for each office and shown on the Network Design Order Face Sheet. This capacity should not be controlling.

5.15 Directory Numbers should be provided to service the demand (from the Provisioning Forecast) at the end of the engineering period plus supported administrative margin (i.e., administrative margin must be supported in the NDO).

5.16 Authorized Aging (Intercepting) Intervals - Directory Number Administrative Margin for intercepting, test, and administration should be based on the authorized aging (intercepting) intervals contained in the latest issue of Section 780-200-014.

5.17 Directory Number Administrative Margin - A Directory Number objective of 5% for administrative margin should be used for engineering purposes.

5.18 In offices requiring administrative margin other than 5%, actual data regarding disconnect and number change requirements, together with test terminal and

administrative margin requirements should be collected by the Administrator and a Terminal Utilization Monthly Work Sheet - Service Year form should be furnished to Network Design annually, or as required for inclusion in the NDO.

5.19 The derived % number fill (actual) calculated by Network Administration is not the engineered % number fill (objective). However, Network Design can determine the engineered % number fill using the derived % fill, if provided, and through discussions with Network Administration. The engineered % fill should provide the best economical mix between equipment utilization and administrative margin requirements.

6.0 NETWORK DESIGN ORDER ARRANGEMENT

6.01 The NDO should be arranged in the following standard sequence:

(a) Face Sheet

(b) NDO Page Index

(c) Basic Data Section arranged as follows:

- Traffic Growth Chart followed by its supporting data (see Paragraph 7.17).
- Local Switch Demand and Facility Chart output from the Demand and Facility Data Base System.
- Basic Assumptions, Policies and Authorizations including necessary support data, as required. (See Paragraph 4.3.)
- Summary of the validated Provisioning Forecast used in the engineering of the CO, including Network Distribution digital line forecasts or forecast summaries. Forecasts/summaries should illustrate cutover through end of period requirements.
- Summary of the validated analog and digital trunk forecasts used in the engineering of the CO. Trunk and facilities summaries should illustrate cutover through EOP requirements.
- Individual Hardware and Software component L&T Charts, each followed by their supporting data, as required. (See Paragraph 7.19.)
- DMS-10 Traffic Summary Worksheets, NT8611. (The Traffic Worksheets once included in the NT8611 have been discontinued by NTI.)

(d) Miscellaneous Information

(e) Specification Section utilizing the standard approved Northern Telecom DMS-10 Equipment Questionnaire, NT8611. The NT8611 includes ordering data for the Satellite Switching Office (SSO) of the DMS-10.

The reproduced copies of the NDO can be made up of pages that have been copied on both the front and back sides.

6.02 The Face Sheet (SW-7626) for a DMS-10 NDO has two parts which are the Narrative portion and the Summary of Equipment Capacities portion (see Exhibit 1). In addition, see Paragraph 4.8 for a description of the NDO heading information.

(a) The "Narrative" part of the Face Sheet should state:

- o What is to be done, i.e., major additions, changes or rearrangements.
- o Why it is to be done, i.e., references to approval studies, letters, Planned Facility Order (PFO) and authorities.
- o When it is to be done, i.e., current schedules and coordinating jobs.

(b) The "Summary of Equipment Capacities" illustrates the limiting equipment items in the office. (See Exhibit 2 for capacity calculations.)

(c) The following definitions apply to Face Sheet terms:

- o Nature of and Necessity for Work. This is the portion of the Face Sheet containing the narrative section. The narrative should identify any special equipment being ordered, i.e., Integrated Digital Loop Carrier, Remote Equipment Modules, Satellite Switching Offices, Local Automatic Message Accounting (LAMA), etc., and include appropriate justification for the time unless the provision of this equipment is covered by policy.
- o Generic. This is the portion of the Face Sheet that lists the appropriate generic program provided for the present and proposed DMS-10 Central Office configuration.
- o LU/LLN/LTN Concentration Ratio. This is the portion of the Face Sheet that lists for the present and proposed peripheral equipment their Line Concentration Ratio. For a DMS-10 with PE shelves for line equipment, this ratio is approximately 3.47 = 104 lines/30 speech channels. If LCMs are installed, the concentration ratio will be about 5.07 = 608 lines/120 speech channels (4 maximum DS30A loops per LCM). These

ratios represent maximum configurations. The ratio will have to be computed for each job, based on the number of lines and loops installed.

- Switching Equipment. This is the portion of the Face Sheet that lists for the present and proposed equipment the following items: the capacity of the equipment provided.

  Equipment items referred to under this heading are MF/DTMF receivers, Call Store (CS) Memory Packs and Data Store (DS) Memory Packs. In addition, Processor Real Time is also included under this heading. Multifrequency receiver capacity is measured in CCS (only receivers provided for service are used to determine capacity). CS and DS capacities are measured in memory words. Processor Real Time capacity is measured in seconds. The most limiting of MF/DTMF receivers, CS memory packs, DS memory packs or Processor Real Time is shown in the space reserved for Switching Equipment.

  It is highly recommended that the Provisioning and Quotation System (PAQS-10), NTI's dial-up system, be used in conjunction with the NT8611 preparation. PAQS-10 has sections which estimate the amount of equipment and memory required for the DMS-10 initial or growth job. It is especially useful for determining expected end-of-period utilization percents. (Each SWBT area has PAQS-10 user ID's and passwords. Logon instructions should be in each area, also, or can be obtained from the area NTI account representative. PAQS-10 is a menu-driven program which walks the user through its use.)

  Talking Channels can be a limiting item for Switching Equipment. If Talking Channels NAL capacity is less than or equal to Switching Common Control NAL capacity then Talking Channels is shown as the Limiting Switching Equipment Item.

- Talking Channels. This is the portion of the Face Sheet that lists for the present and proposed equipment the following items: the CCS capacity of the MLI and/or DS30A Loops provided for PE shelves and/or LCMs and the NAL capacity of the MLI and/or DS30A Loops provided for PE shelves/LCMs. CCS capacity per MLI loop for PE shelves = 730. MLI = Multiplex Loop Interface. CCS capacity per DS30A loop for LCMs = 830.

- Lines. This is the portion of the Face Sheet that lists for the present and proposed equipment the following items: the quantity of analog and digital lines installed, the capacity of the installed lines, the NAL capacity of the installed lines and the exhaust date of the installed line equipment. (See Exhibit 2 and Paragraph 5.13 for line termination capacity calculations and worksheet.)

- Numbers. This is the portion of the Face Sheet that lists for the present and proposed equipment the following items: the quantity of directory numbers the office is sized to handle and the NAL capacity of the directory numbers provided.

- Most Limiting Switching Item. This is the portion of the Face Sheet that lists for the present and proposed equipment the most limiting item of Dial Tone Equipment (Digitone receivers), Talking Channels, or Switching Equipment. The Most Limiting Switching Item is the above item that has the earliest NAL exhaust date. If several items have the same exhaust date and NAL capacity, then the most expensive item will be shown as the Most Limiting Switching Item. The code (from the LSD&F Manual) of the Most Limiting Switching Item must be entered in the space that is provided. The LSD&F is Local Switch Demand and Facility database.

- Blank Lines. The 8th and 9th positions/lines on the Face Sheet are provided for your use. They can be used to hold data that you believe is relevant or they can be left blank.

- Most Limiting. This is the portion of the Face Sheet that lists for the present and proposed equipment the most limiting item of Lines, Directory Numbers, Talking Channels, or Switching Equipment. The Most Limiting Component is the above item that has the earliest NAL exhaust date. If several items have the same exhaust date and NAL capacity, then the most expensive item will be shown as the Most Limiting Component. In addition, Directory Numbers, Digitone Receivers, or MF Receivers must not be the Most Limiting Component unless additional quantities of these items will result in the addition of PE shelves/bays, LCMs/LCE bays, CS memory packs or DS memory packs.

- CCS/NAL At Most Limiting Exhaust. This is the portion of the Face Sheet that lists for the present and proposed equipment the ABS O+T CCS/NAL value at the most limiting exhaust date. By design, the DMS-10 can handle up to 5.0 ABSBH O+T CCS/NAL.

7.0 BASIC DATA SECTION

7.01 The Basic Data Section of a NDO contains the historical data, forecasts and future estimates, computations, Traffic Growth Charts, L&T Charts and Network Design engineering judgments that determine the basic equipment configuration. It also quotes the authorizations and policies that may be needed for approvals. Other information that may be required for the use of Network Design alone shall be included in the Basic Data Section.

7.02 The Basic Data Section will contain an array of engineering data. The different data types are the result of the varied engineering requirements of the different components. The measurement terms that are presently in use or proposed for future use in the Design of DMS-10 equipment are as follows:

(a) A Study Period is defined as one of the following two data collection periods: (1) July-June service months (June 23 - June 22), and (2) January-December service months (December 23 - December 22). The two data years allow for DMS-10 Central Offices with winter or summer busy seasons. These data years and dates coincide with existing policies for other offices and with the official servicing observing dates.

(b) "Odd Ball" data is defined as data that is not suitable for Network Design purposes and must, therefore, be excluded from the historical data base. The exclusion of data from the historical data base must be coordinated with Network Administration.

(c) Average Busy Season (ABS) is defined as the three months within the study period, not necessarily consecutive, with the highest average time consistent busy hour load per NAL.

(d) Ten (10) High Hour is defined as the ten hours (time consistent) within the study period for which the particular equipment item experienced the highest loads. The highest of the Ten High Hours is referred to as the High Hour for the component is question.

(e) ABS-Busy Hour (BH) is defined as the time consistent hour having the highest average hour load over all business days throughout the busy season.

(f) Component ABS Busy Hour is defined as the time consistent hour having the highest average load throughout the component's busy season. Component and office ABS and BH need not be the same.

(g) Extreme Value Engineering provides a level of service which is met during the busiest hour of each day for all but three days of the busy season.

(h) Definitions can be found in Section 780-400-230, Section 226-060-400 and Section 226-060-420.

7.03 In order to efficiently and effectively engineer the hardware and software components of a DMS-10, Network Design must have access to the specific types of actual historical peg counts and load data that are identified in NT8611. Network Design must coordinate the receipt of the necessary and appropriate historical data from the Network Administration Group that is responsible for the Administration of DMS-10.

7.04 If traffic data is not collected and analyzed for every potential busy hour of the business day, Network Design must assure that the Network Administration Group is performing the busy hour determination as outlined in BSP 780-200-031 when defining System or Component Study Hours.

7.05 The required engineering data must be forwarded to Network Design at least monthly throughout the study period. In addition, the data should be received, if available, more frequently during the busy season. Receiving the data frequently during the busy season will allow Network Design to react if actual load exceeds previous projected or adjusted projected loads. The work groups that are responsible for the data collection and the data validation function are defined in "Guidelines - Network Data Responsibilities" transmitted February 3, 1982 by AVP-Network Central Office Operations and the AVP-Network Central Office Engineering and Circuit Provisioning. One task involved in data validation is the flagging of "Odd Ball" data. However, Network Design as a user of the data should perform data validation reviews on all data that it receives. The validation checks must be performed by Network Design when the data is received. This will permit early correction of identifiable erroneous data. For an explanation of DMS-10 data, see NTP 297-3XXX-456, the Operational Measurements (OMs) practice. (The "XXX" depends on the generic of the DMS-10. See Appendix 1 for an explanation of NTI's practice numbering scheme).

7.06 Traffic Growth Chart. Probably the most important single decision made by the Network Designer in preparing a Network Design Order is the estimate of ABS-BH O+T CCS per NAL. This estimate is the foundation on which the office is built and determines the basic Switching Capacity of the office. The O+T CCS/NAL estimate is made only after careful analysis of available historical data, the consideration of future trends and plans, the application of future trends and plans, and the application of intelligent judgment.

7.07 The "Originating plus Terminating" CCS per Network Access Line chart shows the actual performance for each usage study for the last three to five years. Only the counts made in the three busy months and their average should be posted to the chart. In addition to posting the actual CCS per Network Access Line data obtained from studies, the future ABS-BH CCS per Network Access Line shall be trended on the chart.

INSTRUCTIONS FOR PREPARING THE TRAFFIC GROWTH CHART.

7.08 Originating + Terminating CCS per Network Access Line, the upper portion of the chart, shows the historical and trended data for O+T CCS/NAL. Historical data as indicated by the solid portion of the "point graph" and the estimate of future usage is indicated by the dotted portion of the curve. The vertical "tick marks" on the dotted portion of the chart represents the exhaust date of the present and proposed equipment.

7.09 The basis for dial office engineering should be the average time consistent busy hour usage (CCS per NAL) for all business days in the Busy Season (3 busy months) for the Wire Center involved. For offices collecting data on a manual basis, normally five business days of data is all that is provided per month. The X on the Traffic Growth Chart represents the average of the 3 busy months.

NOTE: Business days may be days other than Monday through Friday.

7.10 The trended ABSBH O+T CCS/NAL must be posted to the End of Engineering Period (EOP) in addition to the three to five years of validated historical data used to develop the trend.

(a) Initial Job

1. Historical ABSBH CCS/NAL values are developed from the existing office's measured data. The historical ABSBH CCS/NAL values are used to develop a trend of future ABSBH O+T CCS/NAL demand.

2. Historical and trended ABSBH O+T CCS/NAL data are posted to the traffic growth chart.

3. When historical data is not available and a comparable (similar) DMS-10 office's data is used in the NDO, that data must be included as supporting data within the NDO and identified as such in the NDO and on the Traffic Growth Chart.

(b) Growth Job

1. Measured DMS-10 ABSBH O+T CCS/NAL values are used to develop a trend of future ABSBH O+T CCS/NAL demand. Both measured and trended data must be posted to the Traffic Growth Chart.

2. On growth jobs where three to five years of actual validated DMS-10 O+T CCS/NAL data are not available, either previously calculated equivalent DMS-10 data or previously used comparable (similar) DMS-10 office's data must be used to supplement the available DMS-10 actual data.

7.11 Lines and Directory Numbers. The lower portion of Exhibit 4 shows the historical trend in Lines and Directory Numbers growth as well as office capacities. The office capacities to be shown are Line Terminations; integrated digital loop carrier lines and analog lines shown separately. In addition, capacities expressed in Lines and Directory Numbers are to be shown. Actual Lines and Directory Numbers growth are indicated by the solid portion of the "point graph." The most recent Provisioning Forecast of Lines and Directory Numbers growth is indicated by the dotted line extension of the

actual data from year-end point to year-end point. Previous and proposed capacities should be entered on the chart as illustrated (in Exhibit 5). Tracking of number growth within the NXX codes in the office can be done using the lower portion of Exhibit 4.

7.12 It should be noted that there are six vertical spaces for each block on the graph. Each vertical space should represent a two month period and a year is represented by one block. This makes it possible to show the required for service date of the job that is being written and the required for service data of the next job in the appropriate month on the chart. This also makes it possible to show actual study months and usage data for these months. In evaluating the Usage per Network Access Line, it is essential to know whether a study was obtained in the Busy Season or not as this is a requirement to the proper evaluation of the data and its projection to the future.

7.13 Local Switch Demand and Facility Chart Data Base System - The Local Switch Demand and Facility Chart Data Base System (LSD&F DBS) is a computer storage vehicle for COE data as well as a time sharing system utilizing a BCR program. The LSD&F data base in used to produce LSD&F charts and numerous reports in order to evaluate various aspects of COE planning and capacity management.

7.14 All DMS-10 capacity changes will be reflected on the LSD&F charts. It is imperative that changes in COE schedules and capacity be kept up-to-date and as accurate as possible in the LSD&F DBS. In most areas, local policy requires inclusion of the LSD&F Part B and/or Part A graph. Local policy should be followed for these items.

7.15 Some of the information provided on the LSD&F chart duplicates the information provided on other documents in Network Design Orders (NDO) for COE. There is some benefit to be gained by eliminating those documents from the NDO where their function is jointly served by a single document provided on a mechanized basis. Therefore, the following documents may be eliminated from Network Design Orders with certain exceptions as described for the document.

7.16 LDS&F DBS INPUT CHART - This document was initially required to provide information to the group responsible for updating the LSD&F DBS. Experience in the States has shown that this function is better served by having the Design Engineer submit a marked-up copy of the LDS&F Chart Part B to convey this information. Where this procedure is followed, the LSD&F DBS Input Chart may be discontinued in the NDO.

7.17 Traffic Growth Chart (Exhibit 4 and 5) - This graph is currently required in the NDO to display historical CCS/NAL growth data and projections for growth throughout the engineering interval being designed. Part A of the LSD&F Chart

also provides this information in graph format. When this LSD&F graph contains at least four busy seasons of historical data, the LSD&F Part A may be substituted for the Traffic Growth Chart. Otherwise the Traffic Growth Chart will continue to be required in order to show the additional historical data not shown on the Part A. This will occur on dial-dial conversions where the new entity Part A will not show the old entity historical data. Since the Part A CCS/NAL graph is smaller in area than the Traffic Growth Chart, it must be examined by the Network Design Engineer to be sure that the chart is legible. NDOs routing for approval or used in Estimate Requests routing for approval should contain full size Part A charts, if the Part A is required per local policy.

7.18 Service Results Graph - This graph was used in the NDO to display Dial Tone Speed and Matching Loss historical results for an entity. The LSD&F Chart Part A contains this same information in tabular form. If the Part A is included in the NDO and the Network Design Engineer has verified that the service results data is accurately posted on it, the Service Results Graph may be discontinued.

7.19 Load and Trend (L&T) Charts should be provided in the NDO for all hardware traffic load sensitive items.

- o A minimum of three (3) to five (5) years of historical data is required to be posted to the L&T Charts, the following must be performed.

  (a) A Study Period must be defined for the DMS-10.

  (b) The appropriate data is collected during the Study Period. The data is then posted and summarized (either in tabular form or graphically) for each month of the study period. Exhibit 6 can be used to post and summarize historical and projected Load and Load/NAL data.

  (c) The appropriate Study load data (ABS-BH, ABS Component Busy Hour, etc.) are posted on the L&T chart, Exhibit 6, along with their ABS NAL and CCS/NAL. Exhibit 7 illustrates a completed form.

    (1) Load Data is entered on the L&T Chart (Exhibit 6) as a graphical data point and as a tabular value.

    (2) NAL data is entered on the L&T chart as a tabular value.

    (3) Component load/NAL data is obtained by dividing the appropriate study period NAL. Component load/NAL derived data is posted as a tabular value and as a graphical data point on the L&T Chart.

- When historical load and/or Load/NAL data is not available, data from a comparable (similar) DMS-10 CO may be used to engineer the DMS-10. When such data is used in the engineering of the DMS-10, that data must be included within the NDO as supporting data as if it were from the actual site, but identified as comparable data in the NDO and on the L&T Charts.

- Projected loads posted to the L&T Charts are determined as follows:

  (a) Historical loads/NAL (actual or similar DMS-10 CO) derived values are trended from cutover to five years in the future.

  (b) Historical NAL and projected NAL (projected NAL from the Wire Center Area forecast) are entered to cover the historical and projected data years.

  (c) Projected loads for each projection period are derived by multiplying the trended load/NAL by the projected NAL.

- A capacity line must be drawn on the L&T Chart for each hardware item. The capacity line is determined using the capacity of the hardware components provided for traffic; i.e., service circuits provided for service protection are not included when determining capacity.

- Historical data must be projected (trended) from the Job Completion Date to five years in the future. Embodied in the trending and eventual use of the trended data is the assumption that factors that affected the historical demands will similarly affect future demands. However, if the historical factors are changing, adjustments (decreases or increases) must be made to the projected load.

  Example: The usage demand on Multi-frequency receivers is trendable, and SXS Central Office replacements occur during the job life. Adjustments must then be made to the trended MF Receiver usage to account for the additional usage that will result from the SXS to ESS Central Office conversions.

  Also, adjustments for additional loads or reductions of loads that are the result of new (Generic) service offerings must be made in the projected loads.

- Whenever possible, projected loads must be calculated from projected NAL and load/NAL data. These loads must be adjusted for changing historical factors and/or new service offerings or managerial judgments (see previous paragraphs). Sometimes it is not possible to derive projected loads from trended historical data. Such situations arise from the installation of new

types of service circuits, new site without similar site data, and/or lost/destroyed data. These situations require the use of formulas to determine future quantities. Supporting data must then be provided to justify all components (call counts, holding times, acceptance rates, etc.), used in the formulas. The values used in the formula must be supported in the NDO for the future period. The supporting data consists of the formula variables historical data, trends and adjustments, growth rates, calculations, etc., and appropriate managerial judgments.

- o Supporting data in addition to the L&T Charts, must be provided in accordance with Paragraph 7.20.

- o Equipment Components that require L&T Charts.

  (a) Hardware L&T Charts

    (1) MF Receivers

    (2) Digitone Receivers

    (3) Conference Circuits

    (4) Universal Tone Receivers (400 Generic, but not yet available. When UTRs become available, they will replace MF Receivers and Digitone Receivers)

7.20 Supporting data including calculations and worksheets, justifying the projected loads, NAL terminations, lines, memory quantities, etc., and adjustments to these projected items must be included in the NDO. This supporting data should include previous years measurements, developed historical growth factors, explanations of variation in past trends, forecasted growth factors used, etc. Appropriate projections should be adjusted for new features, as well as, new policies and procedures. In addition, this data, adjustments, explanations, etc., should be summarized, perhaps in narrative paragraphs, in such a way as to clearly justify the forecasted loads, ratio, etc. Supporting data older than three (3) previous busy seasons is highly desirable even if it is the data of the replaced CO converted to DMS-10 equivalent type data.

8.0 DETERMINATION OF EQUIPMENT QUANTITIES

8.01 Supporting data requirements for the provisioning of DMS-10 equipment quantities are defined in earlier paragraphs of this SWBT Section. In addition, the

capacity line drawn on the service circuit Charts is the capacity of the circuits provided for traffic (i.e., service circuits provided for service protection are not used to determine capacity). The policy is to provide one additional service circuit pack of each type for service protection.

8.02 The determination of DMS-10 Equipment Quantities is not defined in NT8611. Network Design uses the NT8611 to provide data to NTI so that equipment quantities can be determined. NTI's PAQS-10 dial-up system, through not approved as a substitute for the NT8611, is a good estimator of equipment and memory required for the DMS-10. It provides estimated utilization of office components and memory and can be used to alert the designer if upper capacity limits are being approached. Both the NT8611 and PAQS-10 compliment each other in the DMS-10 ordering process. Memory utilization, for example, can approach or exceed end-of-period expectations if office characteristics are beyond those of NTI's "model office" design. The model office characteristics (traffic mix) are listed in NTI Planning Letter 85-03-001, dated 3-25-85 and in the DMS-10 Technical Specification - 400 Series Generic and earlier. It is highly recommended that PAQS-10 be used in conjunction with the NT8611 to maximize equipment and memory determination analysis. Network Design must enter, on the equipment questionnaire and PAQS-10 inputs, the appropriate values and the NDO supporting data. In addition, Network Design must resolve through Switching Engineering any discrepancies that exist between the equipment that is provided by NTI and the equipment that was determined by Network Design using the NT8611 and the PAQS-10 system.

8.03 The equipment quantities that are determined from Network Design NT8611 inputs are as follows:

- Line Circuits and Packs
- Analog Trunk Packs
- Digitone Receivers
- Multi-frequency Receivers
- Peripheral Equipment Bays
- Peripheral Equipment Shelves
- Digital Shelves for Digital Carrier Modules (DCMs)
- Digital Carrier Modules
- Networks
- Multiplexed Loops
- Network Packs
- Network Groups
- Network Shelves
- Junctor Packs (300 Series and earlier generics)
- Control Equipment Bays
- Data Store Memory
- Call Store Memory

- Read-Write Memory #
- Serial Data Interface
- Recorded Announcement Machines
- Recorded Announcement Bays
- Recorded Announcement Control Circuits
- Digital Recorded Announcement Packs (DRA) (400 Generics)
- Conference Circuits
- DS30A Loops between LCM and Network (400 Generics)
- Line Concentrating Modules (400 Generic)
- Line Concentrating Equipment Bays (400 Generics)
- Universal Tone Receivers (400 Generic, but not yet available)
- Subscriber Carrier Interface Unit (400 Generics)
- Tone and Digit Senders #
- Ringing Circuits #
- Service Observing Unit
- Remote Equipment Module
- Satellite Switching Offices (SSO)
- Office Carrier Module
- Remote Carrier Module
- Trunking Requirements*

* Trunk summaries, calculations and supporting data for trunk provisioning must be included in the NDO. Trunk quantities contained in the General Trunk Forecast must be validated with the trunk forecaster before inclusion in the NDO if the trunk forecast is older than sixty days. In addition, up to 10% additional trunk circuits (in excess of the Trunk Forecast) may be provided for administrative margin. This 10% administrative margin is not to be applied on a trunk group by trunk group basis, but by trunk circuit type.

\# Fixed Quantities

The NT8611 Questionnaire has a Traffic Data section which requires Network Design inputs. NTI uses these inputs to determine all traffic sensitive equipment quantities. The NT8611 does not include the calculations for traffic sensitive components, but such calculations are contained in NTP 297-3401-450, DMS-10 400 Series Generics Traffic Provisioning. The quantity determination calculations and associated capacity tables for the following equipment are provided in the above mentioned NTP.

Digitone Receivers and Packs
MF Receivers and Packs
Line Concentrating Modules
Line Concentrating Equipment Bays
Digital Carrier Modules

Subscriber Carrier Modules
Analog Peripheral Shelves and Bays
Multiplex Loops
DS-30A Loops
Multiplex Loop Interface Packs
Network Packs, Shelves, Modules
Conference Packs

Universal Tone Receivers, which replace the MF and Digitone Receivers (if desired), are provided one pack per network shelf. One UTR pack equals 32 channels of receivers. Tone and digit sender packs are provided at least two network module, or one per network shelf.

(Note: UTR's are not yet available in DMS-10, as of 8-87).

NTI Engineering and NTI's PAQS-10 program will calculate these quantities based on the Traffic Provisioning NTP rules. However, it is still - and always will be - the Network Designer's responsibility to understand these traffic provisioning rules and verify NTI's quantity determination of traffic sensitive components of the DMS-10 switch. See NTP 297-3401-450 for provisioning rules for DMS-10.

8.04 The following list of interesting DMS-10 facts are provided for your use and information. This list is by no means all inclusive.

- o Equal Access Availability - Equal access capability for DMS-10 has been available since late 1984 with the 209 Generic. Succeeding generics in the 300 and 400 series are also equal access capable.

- o Guidelines for Providing Equal Access - In DMS-10 offices installed prior to the availability of the equal access feature, equal access capability should be scheduled upon receipt of a bonafide request. DMS-10 offices installed after the general availability date for Generic 400 should initially be provided with the Generic 400 series and equal access capability. Generally, all new DMS-10 switches should be installed with the latest generic. Generic updates on an in-service switch should be based on economic justification.

- o Hardware DP customer digit receivers are not required because the reception of the DP signals is performed by the Central Processing Unit (CPU), or the LCM processor if LCMs are installed.

- o Hardware DP receivers are not required because the reception of the interoffice DP signals is performed by the CPU.

- Tone and Digit Sender packs are provided one per Network shelf.

- A minimum of two 3-way conference packs must be provided. Each conference pack is equipped with 30 channels. Each pack can handle 10 simultaneous 3-way conference connections. In addition, 3-way conference connection potential (maximum 10 per pack) requirements are determined using Poisson Capacity Table P.01 and Average Busy Season Time Consistent Busy Hour 3-way Conference Load.

- One Recorded Announcement Control Circuit can handle a maximum of nine unilingual or six bilingual announcements, analog or digital. Each announcement machine (analog or digital) can terminate twelve analog announcement trunks per announcement. Such trunks will be mounted on a PE shelf.

- A digital recorded announcement pack (DRA) is available for use with the DMS-10, generic 401.20 or later. A DRA pack (NTX2T85) provides one announcement channel per pack. A maximum of 4 paths per pack can be simultaneously accessed by customers. No trunks are required with the DRA pack. The DRA pack is a separate option from the analog audichron or digital announcement machine.

- Hardware Coin Control Circuits are not required because the coin control functions are performed by the CPU.

- DMS-10 switch memory consists of Call Store for transient call data, Data Store for office parameter data, and Program Store for the operating and call processing software. Each Central Processor Unit (CPU) has one memory controller and up to four 256K-word memory packs in the DMS-10 400 series generic. The basic system has three memory packs, but an additional one can be added if custom-calling penetration warrants. Memory is divided into "pages." The basic system has 12 pages, but an additional 4 pages can be added for additional custom-calling features. Each memory page contains 64K words. There are four memory pages per 256K memory pack.

- Use of the PAQS-10 system will estimate the amount of memory required based on inputs provided by Network Design. NTI's engineers use a similar program to determine memory requirements. It is important for the designer to analyze all sections printed from PAQS-10, but the memory section's percent utilization will alert the designer to memory capacity problems. Offices with a traffic mix that exceeds NTI's model office for DMS-10 could encounter memory problems. This is true for all DMS-10 generics. The NT8611 does not address memory requirements specifically because NTI Engineering determines the memory required for each DMS-10 job. Again, the Network Designer must make sure that adequate memory is provided by NTI for the end of period and for the life of the switch. Close coordination with the NTI engineer and a thorough review of NTI's memory and other equipment

calculations are a must with every job. Such a review should always be included in the pre-job (CI or Customer Information) meeting with the NTI engineer. Network Design should consult the Network Administration/Translations group prior to or during the CI meeting to assure that machine parameters, etc. are adequately provided.

- For the 400 series DMS-10, either one or two network modules can be accommodated, depending on the system size requirements, i.e., the number of digital multiplex loops required. Each network module has two shelves.

- There can be up to 40 digital network loops per shelf, 36 for peripheral equipment interfacing to the network and 4 for service circuits. So, a maximum of 160 loops is possible. Each loop provides 32 bidirectional channels (30 for voice and 2 for signaling). In each network shelf, 128 channels are set aside for the service functions. Each shelf has a Tone and Digit Sender, a Universal Tone Receiver, and a Conference Pack. These service service circuits have access to all network shelves because the diloops (one diloop = 2 network loops) are spread over all shelves in the network modules. (Universal Tone Receivers for DMS-10 are not yet available.)

- Each Digital Carrier Module must be assigned one of the Multiplex Loops (MUXL) provided for traffic. This MUXL is then no longer available to handle Peripheral Shelves and thereby reduces the line termination capacity of the DMS-10, unless additional MUXLs and PE shelves are provided.

- One Digital Carrier Module (DCM) is required to handle each (T-1) Digital Span Line. Six DCM's can be mounted on a DCM shelf. DCM's are provided as required for service. A vacant PE shelf must be reserved directly below a DCM shelf to allow for heat dissipation.

- Four slots of a PE shelf are reserved for analog E&M trunk packs or line packs. Ten slots are reserved for line packs, test packs, service circuit packs, etc., and two slots are reserved for PE shelf converters. The slots reserved for analog E&M trunks can be used to terminate other packs (for example, line packs.

- PE shelves are determined based on line, analog trunk and service circuit termination requirements.

- The "number of local wired lines for PE Provisioning (exclude REM) "and the number of installed equipped lines for PE Provisioning (exclude REM) should be equal."

- PE Bays are determined based on the number of PE shelves, DCM shelves, and SCM (Subscriber Carrier Module) shelves that are required for service. However, do not buy a PE bay for a few lines.

- Unused PE shelf locations in PE bays should not be provided/wired if the number is greater than two. Generally, two unused PE shelves can be equipped and the job harmonized economically. Also, greater than two unused PE shelves may be wired but not equipped (in which case the number of local wired lines for PE provisioning would not equal the number of installed (equipped) lines for PE provisioning) to produce an economized job. However, usually when greater than two unused PE shelves are wired and equipped, the equipped lines and the harmonized equipment remain unused for a length of time that proves to be uneconomical.

- The Emergency Stand Alone (ESA) feature allows the DMS-10 REM to process limited calls within the REM when T-1 span line failure inhibits call processing from the host DMS-10.

  The ESA mode of operation is maintained until the integrity of at least one of the span lines is reestablished, resulting in an automatic switchback to host control. All calls originated during the ESA mode of operation will be disconnected during switchback.

- The determination of Remote Equipment Modules (REM) is done in the NT8611 Questionnaire of the host DMS-10 switch.

- Each MUXL that is used in the REM arrangement will serve two PE shelves at the REM. One REM is dedicated to two or four loops.

- NAL quantities that are used to provide custom calling feature capability must be derived from the Wire Center Forecast for the engineering interval that is to be used.

- Satellite Switching Offices (SSO) are different from the Remote Equipment Module (REM) in that each SSO is a stand-alone 300 or 400 series DMS-10 with all the same features and call processing functionality as any other isolated DMS-10. However, each SSO has at least two DS-1 data links to the Host Switching Office (HSO). REMs and SCMs can be supported by a SSO also. The advantage to the HSO-SSO cluster arrangement is that billing for the SSOs can be done at the HSO via the data links, as can EADAS data collection. Maintenance functions for SSOs can also be centralized at the HSO. SSOs require separate NT8611s for each SSO. The HSO can serve up to eight SSOs in such a cluster arrangement. Should the DS-1 data links between HSO and SSO fail, the SSO can do its own call processing for all call types. Billing is also done at the SSO and AMA data is stored at the SSO until the HSO-SSO links are restored. Since there are at least two DS-1 links between the HSO and each SSO, other functions can be performed via the HSO for an SSO; such as carrying overflow Extended Area Service (EAS) or toll traffic, alternate routing, etc. See Appendix 1 for references on HSO-SSO clustering.

8.05 Loop Range Extension (LRI) Packs - Range extension provisioning for the DMS-10 was addressed in the October 7, 1981 joint letter from the AVP-Network Central Office Engineering and Circuit Provisioning and the AVP-Network Distribution Services. That letter covered the following points:

- The DMS-10 office should be considered to have a 1500 ohm resistance on range. Beyond this point range extension with gain should be applied as required.

- Although the Northern Telecom range extension appears to be slightly cheaper in this application, there are several drawbacks which are listed below.

  1. Northern Telecom offers only one extended range circuit pack designed for 2-party use but may also be used for single party service.

  2. A major application for extended range circuit is currently 4-party service for which a 5A REG or equivalent must be used.

  3. There is a significant price penalty when plug-ins are ordered separately (without a switching equipment addition). This requires a reasonable accurate forecast of usage and makes PICS stocking undesirable.

  4. Administrative needs are simplified with the use of one type of range extension.

  5. Most DMS-10 applications are in offices already equipped with 5A range extension equipment.

- Due to consideration of these factors, we recommend that external range extension be considered the Company standard in this application.

8.06 Digital Loop Carrier - The process required for provisioning Digital Central Office (DCO) line equipment capacity when integrated Digital Loop Carrier (DLC) is involved is more complex than the traditional analog central office process. It is more complex than the current process because there are two line equipment networks to equip, one for lines served via integrated DLC and one for analog line terminations (non-integrated DLC and analog subscriber lines). The demand in terms of lines served by each network depends on the amount of integrated DLC deployed. This means that an increased, ongoing, interactive provisioning and tracking effort between the Distribution Services Planning Center (DSPC) and the Network Switching Engineering Center (NSEC) will be required to support the NSEC DCO line equipment provisioning process.

8.07 Information Letter (IL 83-10-091) contained recommendations to efficiently and effectively integrate DLC/DCO technology. The letter identified six major areas to consider when a DLC is working out of a DCO. First, the NSEC has two networks of line equipment to manage with the size of each dependent on planning

decisions. Second, integrated DLC is generally economic (in terms of first cost) relative to non-integrated DLC regardless of switch utilization impact. However, this statement applies to typical DCO based on full allocated costs, and does not reflect certain costs such as breakage costs associated with investments in large equipment capacities for relatively small demand and existing Central Office Terminal (COT) reuse cost factors. In addition, the first cost comparisons do not include any additional administrative costs, such as those costs associated with the methods outlined here and/or further described in IL 83-10-091.

8.08 The third area addressed in IL 83-19-091, DCO line utilization, job sizing and job timing are directly impacted by DSPC planning activities. Joint up front coordination by Network Planning, DSPC and the NSEC will result in efficient use of Company resources and reduce the cost of implementing integrated DLC. One method that can be used to institute this joint provisioning process is for the DSPC and the NSEC to notify each other and Network Current Planning when either one is starting to design a future job/installation. This can help eliminate some of the costs associated with:

(1) Accelerated integrated DLC growth that results in trapped analog line termination capacity. Through joint coordination by the DSPC and the NSEC the DSPC may be able to bring in nonintegrated DLC, thereby utilizing the trapped analog line termination capacity and reducing the associated cost.

(2) Timing of the DLC jobs such that analog capacity is provided for short duration time-periods and that the increased analog capacity provided with a DCO job addition would not be utilized throughout the engineering period. Joint provisioning would time the DLC jobs so that any additional analog DCO capacity provided would be minimized and utilized throughout the engineering period.

(3) A DCO equipment addition that is the result of integrated DLC line termination exhaust only. Through up front provisioning by the DSPC and the NSEC, the DSPC may be able to increase the percent fill at relief at the DLC without affecting customer service. This increase in the percent fill at the DLC could postpone the need for a DCO addition and thereby eliminate some of the costs associated with an interim job.

8.09 The fourth area addressed in IL 83-10-09 is that NSEC engineers will be working with two forecasts neither of which may be as accurate as the previous single wire center forecast. Fifth, there is a clear need for DSPC and NSEC engineers to establish an improved, ongoing working relationship. And sixth, there is a need to educate people regarding the economic deployment of integrated DLC/DCO technology.

Three major recommendations that were not listed in the above paragraph are:

(1) The DSPC should provide five-year forecasts of integrated DLC systems, DLC systems' mode of operation, and associated lines served on each system to the NSEC.

(2) The NSEC should track both analog and integrated digital lines on the Central Office (CO) D&F Facility Chart in addition to the total number of lines per IL 83-10-091.

(3) The use of different authorized compatible vendors' integrated DLC equipment utilization. For example, if the ultimate forecasted line growth is 80-100 lines, it may prove economical, as well as efficient to install a 100 line size pair gain system instead of one sized for 200 lines or greater.

If the forecasted line growth on an integrated DLC does not materialize and the overall DCO line growth is as forecasted, the result will most likely be shortage of analog line terminations. To reduce the risk of an equipment shortage the recommendations listed in above paragraphs should be implemented. However, if a shortage does result the NSEC must balance service quality against cost as it determines how to resolve the shortage.

8.10 Because the split of analog and digital lines is a function of Distribution Services' planning decisions and customer growth patterns, there is some flexibility to manage this analog and digital line split. This flexibility is an important aspect of provisioning and utilizing the DCO line equipment. The increased forecasting uncertainties will result in increased potential for central office line equipment exhaust problems earlier than planned. Rather than add lines or advance a costly general addition to a DCO, it may be economical and desirable to "influence" the split in analog and integrated carrier lines by taking advantage of the dual connectivity or by providing some increased line equipment margin or by providing adequate standby equipment at a centralized inventory location. Several questions may be posed to resolve the split in the lines forecasted. Two such questions are:

(1) Is it more economical to delay the installation of additional integrated DLC until all available analog capacity is utilized?

(2) Is it better to go ahead and make a digital switch addition to accommodate new integrated DLC?

There are many issues that must be considered by both the NSEC and DSPC, not the least of which are the demands of our customers. Therefore, it is imperative that these groups work together at each decision point to make the most economical and practical choice.

8.11 Some specific alternatives to resolving equipment shortages are:

(1) Manage the analog and integrated DLC line split. A situation that may require management of the analog/digital split is that of noncoincident

exhaust of the analog and digital capacity components which could result in premature exhaust of the DCO (all DCO equipment capacities considered). A carrier serving area (CSA) may have dual connectivity back to the digital switch, that is, there is the option of connecting a circuit via copper pair (analog) or a digital loop (carrier). If the analog and digital capacities exhaust at different times, then an economic decision should be jointly reached by NSEC, DSPC and Network Planning.

(2) Advance a Central Office Equipment (COE) job or portions of a COE job.

(3) Provide spare COE analog and/or integrated DLC COE frames.

(a) Frames may be fully equipped.

(b) Frames may be equipped when needed to provide service.

(4) Provide spare pair gain facilities.

(a) Placing an integrated DLC unit in the CO with terminations on the MDF is one method of eliminating a shortage of analog CO line terminations.

(b) Placing a Central Office Terminal (COT) unit in the CO is one method of utilizing excess CO analog line terminations.

NOTE: Alternative 4b could also apply to routes served by fiber because the T1 lines can be pulled off at the multiplexer and directed to COT's or digital CO terminations.

(5) Advance a Distribution Services job or portions of a job.

(a) Shortage of digital equipment.

(1) Advance outside digital carrier facilities.

(2) Advance integrated DLC equipment.

(b) Shortage of CO analog lines.

(1) Advance integrated DLC jobs in other sectors of the Wire Center.

Network Planning, Network Design and Distribution Services must economically choose between the above items as well as any other feasible alternatives. In addition, service requirements may also be a factor in selecting alternatives.

8.12 Though equipment shortages can and do at times result in a decrease in the quality of service we offer to our customers, we must also be concerned about the affects of underutilized equipment. If it is not possible to coordinate DCO

and integrated DLC jobs and this inability results in underutilized equipment, then consideration should be given to removing frames which cannot be used during the life of the office. Bellcore IL 87/07-006, dated 7-2-87 echoes most of the same points made in the 1983 IL referenced above. The 1987 IL provides specific calculations and guidelines for balancing SLC-96 remote terminals, specifically.

9.0 CAPACITY DETERMINATION

9.01 The determination of Digitone receiver CCS capacity, MF receiver CCS capacity, Network CCS capacity, Network Termination capacity, Processor Real Time capacity, Call Store Memory capacity and Data Store Memory capacity are not really discussed in the NT8611. NTI determines most of the traffic-sensitive equipment quantities, using Network Design inputs from the Traffic Data section of the NT8611. However, the Network Designer should verify all NTI-determined quantities using NTP 297-3401-450 and PAQS-10 capacities should be determined using Exhibit 2.

9.02 The initial NAL capacity of the custom calling features in the DMS-10 is determined by the amount of memory that is provided for the forecasted quantity of the specific custom calling services. (See Exhibit 8.) In addition, in all DMS-10 generics, if the custom calling services require hardware service circuits, that circuit may impose a NAL capacity that is different from the one set by memory. In this case, the most restrictive NAL capacity is limiting.

NTI calculates the amount of memory the job requires. That requirement is compared to the maximum possible. If insufficient memory is available, then DMS-10 is not recommended for the replacement or as a growth option. The Network Designer can determine this memory utilization via the PAQS-10 system reports. If memory utilization approaches capacity before the desired "life of the switch" end of interval, alternative switch or relief plans will be required.

9.03 Because the Most Limiting Component's NAL value sets an upper limit for central office capacity, the NAL capacity of any customer calling service (speed calling 8, speed calling 30, 3-way calling, call waiting, call forwarding, remote call forwarding or DTMF cannot be greater than the Most Limiting Component NAL capacity.

9.04 The recommended methods for determining custom calling feature capacities in the DMS-10 400 series generic are as follows:

Method 1

Using the PAQS-10 system, assume 100% acceptance of all custom calling features, i.e., each main telephone at most limiting exhaust has every custom calling feature. Input the end of period total expected NALs for each of the

custom calling features main telephone requirements. If data store utilization is less than the planned maximum engineered, then each main telephone can have every custom calling feature. Main telephones with 3-way calling and/or the DTMF feature are exceptions, since they require service circuit hardware to serve these features. However, if sufficient pack vacancies exist to provide the appropriate service circuit, then the exception can be removed by writing a NDO to add the appropriate circuit pack. The addition of equipment must be supported in the NDO, however, justified by end of period demand per the Wire Center Area forecast. Any custom calling assumptions should be made considering that adequate spare memory should be left for growth, changes in services planned for the office, etc.

Method 2

Assume that the percent acceptance for each custom calling service is equal and is less than 100%, i.e., 2132 MTs with 3-way calling, 2132 MTs with speed calling, etc.) Input those to PAQS-10. Also assume that the value is less than the end of period NAL (MTs) capacity of the office. Analyze the resulting PAQS-10 memory utilization in the same manner as Method 1.

Method 3

Assume different acceptance percentages for each custom calling service and input those into PAQS-10. Analyze the resulting PAQS-10 memory utilization in the same manner as Method 1.

It should be noted that PAQS-10 is only a planning tool. It is not a mechanized ordering system and cannot be used as a substitute for the NT8611. However, PAQS-10 is the best source for approximating custom calling feature capacities. Since Network Design must provide such capacities, the PAQS-10 estimation of memory utilization will have to suffice until a better method becomes available. Other capacities should be determined using Exhibit 2.

10.0 REMOTE EQUIPMENT MODULE NETWORK DESIGN ORDER

10.01 A Remote Equipment Module (REM) NDO must be issued for installation of a new REM, modifications to an existing REM and for the removal of a REM. These orders must be separate from the DMS-10 order if the host is a series 300 or earlier generic. However, the information required to construct the REM NDO must be contained in the latest DMS-10 NDO, including calculations, historical data, questionnaire, etc., and need only be duplicated as required for inclusion in the REM NDO. The REM should be issued with an appropriate Face Sheet, Exhibit 3.

(a) The REM NDO Basic Data Section requirements are defined in Paragraph 7 of this Section.

(b) Summary of Equipment Capacities
- Lines is determined using equipped lines at the REM.

(c) Summary of Equipment Capacities
- Directory Numbers is defined as the quantity of REM Directory Numbers allocated in DMS-10 memory.

(d) Summary of Equipment Capacities
- Blank can be used as you so desire.

10.02 The Satellite Switching Office (SSO) is a separate, independent DMS-10 switch. A separate NT8611 and face sheet, etc., is also required for each SSO. See Paragraph 8.3 for more details. Appendix 1 also has references listed for more SSO information.

10.03 The Remote Line Concentrating Module (RLCM) is another remote option off of a host DMS-10, 400 series generic. In the host, a Subscriber Remote Interface (SRI) provides the interface between the host and RLCM. From the DMS network to the SRI, there can be 2 to 16 DS-30 links. Between the SRI and the RLCM, there can be 2 to 6 DS-1 links. Provisioning the RLCM itself follows the same basic rules as the Line Concentrating Module (LCM).

11.0 SPECIFICATION SECTION

11.01 The Specification Section of a NDO covers the detailed equipment quantities and arrangements for those components which are the responsibility of Network Design. The Specification part of a NDO must utilize the standard NT8611 Equipment Questionnaire. The Equipment Questionnaire shows the end of engineering period DMS-10 usage projections, call projections, etc., determined by Network Design.

12.0 DMS-10 NETWORK DESIGN FORMS

12.01 Blank forms and Face Sheets (Exhibits 1, 2, 3, 4, 6, 8, 9 and 12) referred to in this Section are required for use by Network Design in the construction of the DMS-10 NDO. Some forms will not be stocked. However, the forms have been provided in this practice full size which renders the forms suitable for local duplication. Therefore, the forms can be duplicated locally as required.

13.0 ILLUSTRATIONS OF SUPPORTING DATA

13.01 Examples of some methods used to provide supporting data in the NDO are included in Exhibit 11 for your information. When utilizing the examples and blank forms in Exhibit 11, the Network designer must validate, using the appropriate practices, that the examples and forms are still current and up-to-date. In addition, the reproduced copies of the NDO can be made up of pages that have been copied on both the front and back sides. This will eliminate the

inefficient use of paper that results from reproducing on only one side of a page.

14.0 AUTOMATIC MESSAGE ACCOUNTING (AMA)

14.01 The DMS-10 can accommodate AMA recording of charge calls. Either magnetic tape (440,000 AMA record capacity), disk, or a SWBT-approved AMA recording device can be used with the DMS-10. Several vendors have AMA teleprocessing-compatible devices also. Each vendor's device-specific engineering and provisioning documentation must be consulted for equipment quantity determination. See Appendix 1 for references on AMA. At least 3 days of AMA data storage (retention) should be available, regardless of the AMA data collection method used.

15.0 INTEGRATED BUSINESS SERVICES (IBS)/ENHANCED BUSINESS SERVICES (EBS)/MULTILINE VARIETY PACKAGE (MVP)

15.01 MVP and IBS are two software packages available with the DMS-10. MVP and IBS allow custom calling features for multiline business customers. All IBS stations must be single party Digitone lines. EBS will support a single customer group of 3,000 lines or any combination of lines of up to 64 different customer groups with total lines not exceeding 3,000 lines. All lines terminating in the customer group must be served by the same DMS-10 office and or its associated remotes. MVP, another software package, will allow the subscriber to integrate up to six lines into a single customer group. A maximum of 255 customer groups can be configured in the MVP package, allowing for a total of 1,530 MVP lines. In total, a DMS-10 can serve 319 customer groups and 4,530 IBS/EBS lines. (IBS I has been re-named Multiline Variety Package (MVP). IBS/MVP lines are provided based on the rules stated in the NT8611, Peripheral Equipment section. Enhanced Business Services (EBS), IBS, and IBS II are synonymous terms. MVP and IBS I are synonymous terms).

16.0 OTHER SUPPORT SYSTEMS (OSS)

16.01 DMS-10 is compatible with the following Other Support Systems:

COSMOS	SSC E2A
CAROT	EADAS*
ROTL	RMAS
TIRKS	AMATPS
PICS	MLT 1/2
No. 2 SCCS	ALIT

*EADAS (Engineering and Administrative Data Acquisition System) is SWBT's traffic data collection medium. Operational Measurements (OM) generated by

the DMS-10 can be sent to the EADAS collector, formatted, and processed into engineering reports. (Central Office Equipment Report (COER) format for DMS-10 is still under development by BELLCORE).

Other Support Systems - Acronyms

COSMOS	Computer System for Mainframe Operations
CAROT	Centralized Automatic Reporting on Trunks
ROTL	Remote Office Test Line
TIRKS	Trunk Integrated Record Keeping System
PICS	Plug-in Inventory Control System
No. 2 SCCS	Switching Control Center System
SSC E2A	SSC Telemetry Channel
EADAS	Engineering and Administrative Data Acquisition System
RMAS	Remote Memory Administrative System
AMATPS	AMA Teleprocessing System
MLT 1/2	Mechanized Loop Testing
ALIT	Automatic Line Insulation Testing

EXHIBIT 1

(Paragraph 6.02)

Form SW 7626
(Rev. 12-83)

Southwestern Bell

Retention Period-See J.P. 47

NETWORK DEPARTMENT
NETWORK ENGINEERING

NETWORK DESIGN ORDER NO. _____

_____ SECTION

APPROVAL DATE _____

Entity Name/Equipment Type _____

CLLI |___|___|___|___|___|___|___|___|___|___|___|
City State Bldg. Entity

Estimate Request No. _____

WCAF Dated _____ Validated _____ CMAPS ID NO. _____

Trunk Forecast Dated _____ Validated _____ Required For Service Date _____

Nature and Necessity For Work:

SUMMARY OF EQUIPMENT CAPACITIES

		PRESENT	PROPOSED
GENERIC			
LU/LLN/LTN CONCENTRATION RATIO			
SWITCHING EQUIPMENT	CCS CAPACITY - SW		
	NAL CAPACITY - SW		
TALKING CHANNELS	CCS CAPACITY - TC		
	NAL CAPACITY - TC		
LINES	INSTALLED		
	TERMINATION CAPACITY (LINES)		
	TERMINATION CAPACITY (NAL)		
	EXHAUST DATE		
TERMINALS OR NUMBERS	INSTALLED		
	TERMINATION CAPACITY (NAL)		
MOST LIMITING SWITCHING ITEM			
MOST LIMITING	ITEM		
	OFFICE MS CAPACITY		
	DATE OF OFFICE EXHAUST		
____ CCS/MS AT OFFICE EXHAUST			

	Signature and Title	Telephone Number
PREPARED:	_____	( ) _____
CHECKED:	_____	( ) _____
RECOMMENDED:	_____	( ) _____
APPROVED:	_____	( ) _____

Exhibit 2, Page 1 of 4
(Paragraph 6.02)

Form SW 7626
(Rev. 12-83)

Southwestern Bell

Retention Period-See J.P. 47

NETWORK DEPARTMENT
NETWORK ENGINEERING
_____SECTION

NETWORK DESIGN ORDER NO. _____
APPROVAL DATE _____

Entity Name/Equipment Type _____

CLLI |_____|_____|_____|_____|
City State Bldg. Entity

Estimate Request No. _____

WCAF Dated_____ Validated _____ CMAPS ID NO. _____

Trunk Forecast Dated _____ Validated _____ Required For Service Date _____

Nature and Necessity For Work:

To be used by the Section Network Design Groups to satisfy section requirements

Note G

The EOP user NAL to lines ratio to convert lines to NAL

SUMMARY OF EQUIPMENT CAPACITIES

		PRESENT	PROPOSED
GENERIC			
LU/~~LLN/LTN~~ CONCENTRATION RATIO			NOTE A
SWITCHING EQUIPMENT	CCS CAPACITY - SW		NOTE F
	NAL CAPACITY - SW		NOTE F
TALKING CHANNELS	CCS CAPACITY - TC		NOTE E
	NAL CAPACITY - TC		NOTE E
LINES	INSTALLED		Exh. 2, pg. 4
	TERMINATION CAPACITY (LINES)		NOTE A
	TERMINATION CAPACITY (NAL)		
	EXHAUST DATE		NOTE B
~~TERMINALS OR~~ NUMBERS	INSTALLED		NOTE C
	TERMINATION CAPACITY (NAL)- EMT)		Note C&D
MOST LIMITING SWITCHING ITEM			Para. 6.02c
X			
X			
MOST LIMITING	ITEM		Para. 6.02c
	OFFICE MS CAPACITY		
	DATE OF OFFICE EXHAUST		
Ø + T CCS/MS AT OFFICE EXHAUST			

Signature and Title Telephone Number

PREPARED: _____ ( ) _____
CHECKED: _____ ( ) _____
RECOMMENDED: _____ ( ) _____
APPROVED: _____ ( ) _____

Exhibit 2, Page 2 of 4
(Paragraphs 5.13 thru 5.19)
DMS10 NETWORK DESIGN ORDER FACE SHEET

NOTE A

Line Concentration Ratio

If LCMS used, 608 lines divided by 120 multiplex loop channels = 5.07
If PE shelves used, 104 lines divided by 30 multiplex loop channels = 3.47

Line Termination Capacity

Exhibit 2, Page 4, Line Termination Capacity Worksheet, should be used to determine line termination capacity.

NOTE B

The Exhaust Date is the date that the NAL capacity of the specific component will be reached. The exhaust date is determined by entering the Wire Center Area Forecast with the NAL value and relating that value to the date the value is to be achieved.

NOTE C

Numbers = (Total Directory Nos.) x $\frac{\text{(Percent number fill}}{100}$), where percent number fill is equal to 100% - % Administrative Margin (numbers). The administrative margin is defined in coordination with Network Administration. In addition, the administrative margin (directory numbers) must be supported in the NDO.

NOTE D

The NAL capacity is obtained from the most current validated Wire Center Area Forecast for the identical time period at which the Network Access Lines quantity on the forecast is equal to the number used as the Directory Number capacity.

NOTE E

1) PE Shelves, 300 series and earlier (CCS capacity - TC)

CCS Capacity = 300 x (Installed Equipped PE Shelves)

2) PE Shelves, 400 series (CCS capacity - TC)

CCS Capacity = 365 x (Installed Equipped PE Shelves)

3) LCM (CCS capacity - TC)

CCS Capacity = (No. of loops per LCM) x 830 x (No. of LCMs installed)

The NAL capacity of talking channels = total TC CCS capacity divided by ABSBH EOP O+T CCS/NAL.

Exhibit 2, Page 3 of 4
(Paragraphs 5.13 and 5.19)

DMS-10 FACE SHEET, LOCATION OF FACE SHEET VALUES

NOTE F Component	Quantities Installed	Capacity	NAL Capacity
MF Receiver	Provided for Service	CCS capy. ckts. req'd. for svc. - Table P.01, ABSBH.	CCS capy. ÷ MF Rcvr. EOP ABSBH CCS/NAL.
Digitone Receiver	Provided for Service	CCS capy. ckts. req'd. for svc. - Table P.01 ABSBH, P.05 HD	CCS capy. ÷ DT Rcvr. EOP CCS/NAL (higher of ABS vs. HD)
Call Stores (CS)	Three pages	CS Words = no. of CS 64K pages x 64 x 1024	*
Data Stores (DS)	Three or more pages	DS Words = no. of DS 64K pages x 64 x 1024	*
Processor	One (duplicated)	29,000 attempts-ABSBH (which is 70% CPU call processing use)	29,000 divided by 0+T calls/NAL ABSBH EOP

NOTE G CODE = The code for the most limiting component. The codes are defined in Local Switch Demand and Facilities (LSD&F) Manual, Section 5, Table 5.02-2.

* Call Store and data store capacities cannot accurately be expressed in NALs. However, percent utilization of memory can be used as a guide in determining when relief is required. As a general rule, 95% utilization of either call store or data store is considered the maximum allowed in SWBT. PAQS-10, the NTI Provisioning and Quotation System, will approximate percent utilization and should be used as a guide. In an existing DMS-10, the machine can be queried to determine actual utilization.

Office Name: _____

N.D.O. Number: _____

Page Number: _____

Issue Date: _____

DMS-10

LINE TERMINATION CAPACITY WORKSHEET

A) Analog Lines - LCM and PE.

1) LCM Installed Lines (No. of LCM's x 640 OR per SW 241-060-910, Para. 5.13) _____

2) PE Installed Lines (No. of line circuits on PE shelves) _____

3) Unavailable Lines (LCM only)

a) 2 x No. of +48V power converter cards _____

b) No. of 911 trunks _____

Total Unavailable Lines (3a +3b) _____

4) Available Installed Lines (Line 1 plus Line 2 minus Line 3) _____

5) Administrative Spare (Line 4 x 5%) _____

6) Analog Line Termination Capacity (Line 4 minus Line 5) _____

7) NAL Capacity of Analog Lines (Line 6 x NAL/LN Ratio) _____

8) Exhaust Date - Analog NALs _____

B) Digital Lines - SCMs

1) Installed Lines (No. of SLC's x 96 or)
No. of DMS-1's x 252 _____

2) Available Lines (Line 1 x _____% Network Distrib. Fill) _____

3) Unavailable Lines (Line 1 minus Line 2) _____

4) Administrative Spare (Line 2 x 5%) _____

5) Digital Line Termination Capacity (Line 2 minus Line 4) _____

6) NAL Capacity of Digital Lines (Line 5 x NAL/LN Ratio) _____

7) Exhaust Date - Digital NALs _____

Total Analog and Digital NALs at ML Exhaust (Sum A6 and B6 above) _____

EXHIBIT 3

(Paragraph 10.1)

REM

Form SW 7626 (Rev. 12-83)

Southwestern Bell

Retention Period-See J.P. 47

NETWORK DEPARTMENT
NETWORK ENGINEERING
_____ SECTION

NETWORK DESIGN ORDER NO. _____

APPROVAL DATE _____

Entity Name/Equipment Type _____

CLLI | City | State | Bldg. | Entity |

Estimate Request No. _____

WCAF Dated _____ Validated _____ CMAPS ID NO. _____

Trunk Forecast Dated _____ Validated _____ Required For Service Date _____

Nature and Necessity For Work:

Does Not Apply to the REM

SUMMARY OF EQUIPMENT CAPACITIES

		PRESENT	PROPOSED
~~GENERIC~~			
~~LU/LLN/LTN CONCENTRATION RATIO~~			
~~SWITCHING EQUIPMENT~~	~~CCS CAPACITY - SW~~		
	~~NAL CAPACITY - SW~~		
~~TALKING CHANNELS~~	~~CCS CAPACITY - TC~~		
	~~NAL CAPACITY - TC~~		
LINES	INSTALLED		
	TERMINATION CAPACITY (LINES)		
	TERMINATION CAPACITY (NAL)		
	EXHAUST DATE		
TERMINALS OR NUMBERS	INSTALLED		
	TERMINATION CAPACITY (NAL)		
~~MOST LIMITING SWITCHING ITEM~~			
~~MOST LIMITING~~	~~ITEM~~		
	~~OFFICE MS CAPACITY~~		
	~~DATE OF OFFICE EXHAUST~~		
~~CCS/MS AT OFFICE EXHAUST~~			

Signature and Title — Telephone Number

PREPARED: _____ ( )

CHECKED: _____ ( )

RECOMMENDED: _____ ( )

APPROVED: _____ ( )

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EXHIBIT 4

(Paragraph 7.17)

TRAFFIC GROWTH CHART

Southwestern Bell

Form 3

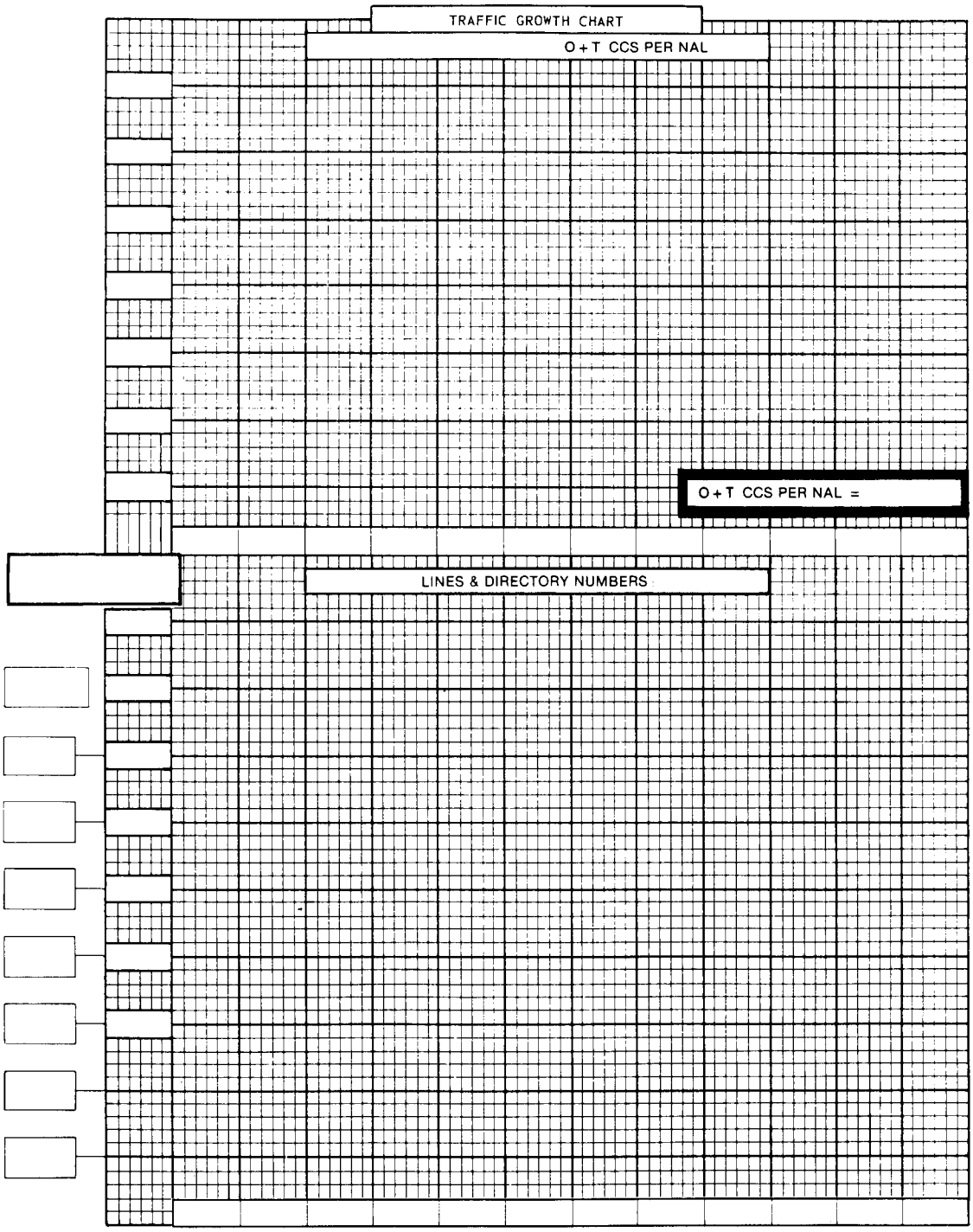


EXHIBIT 5

(Paragraph 7.17)

TRAFFIC GROWTH CHART

Southwestern Bell

Form 3

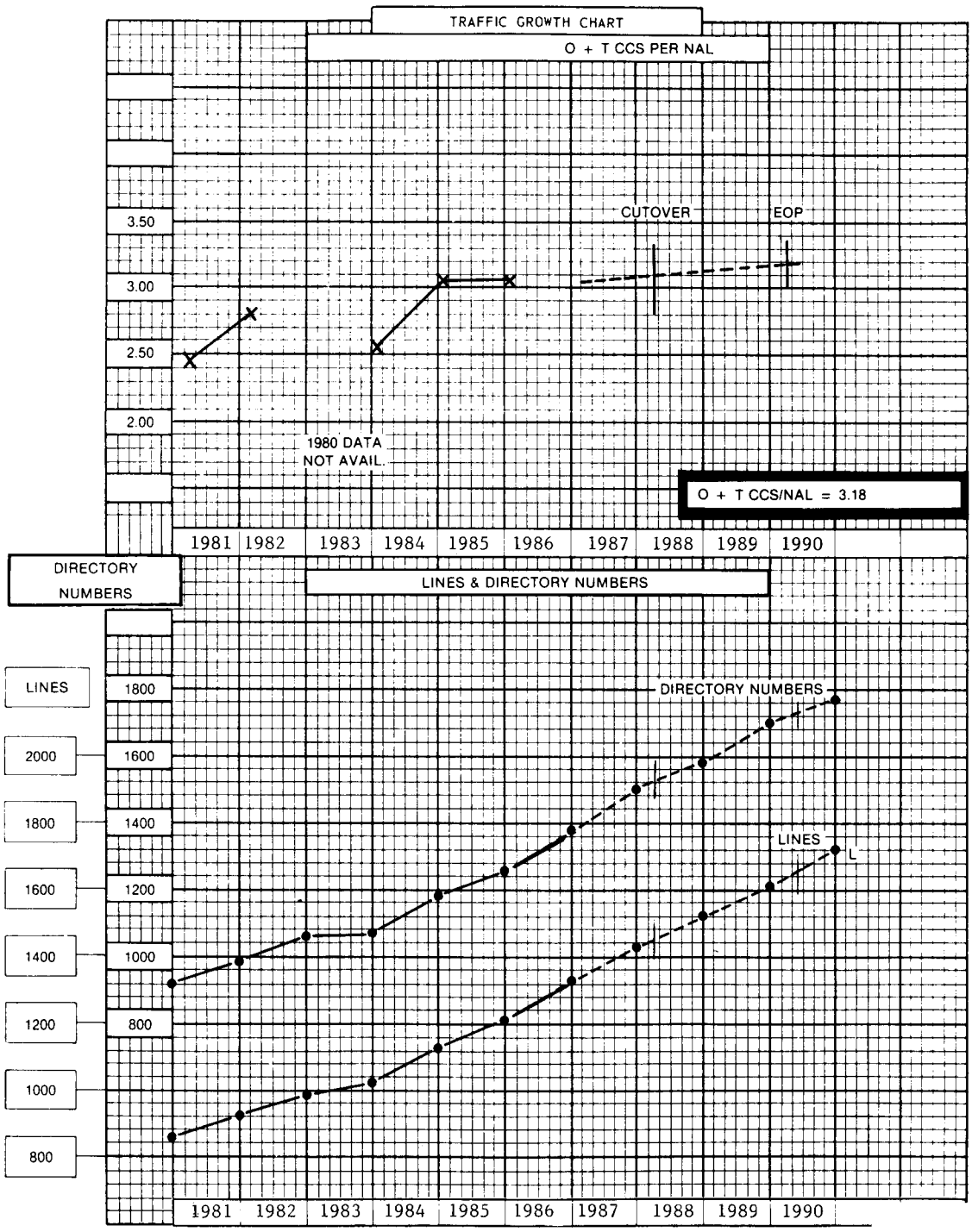


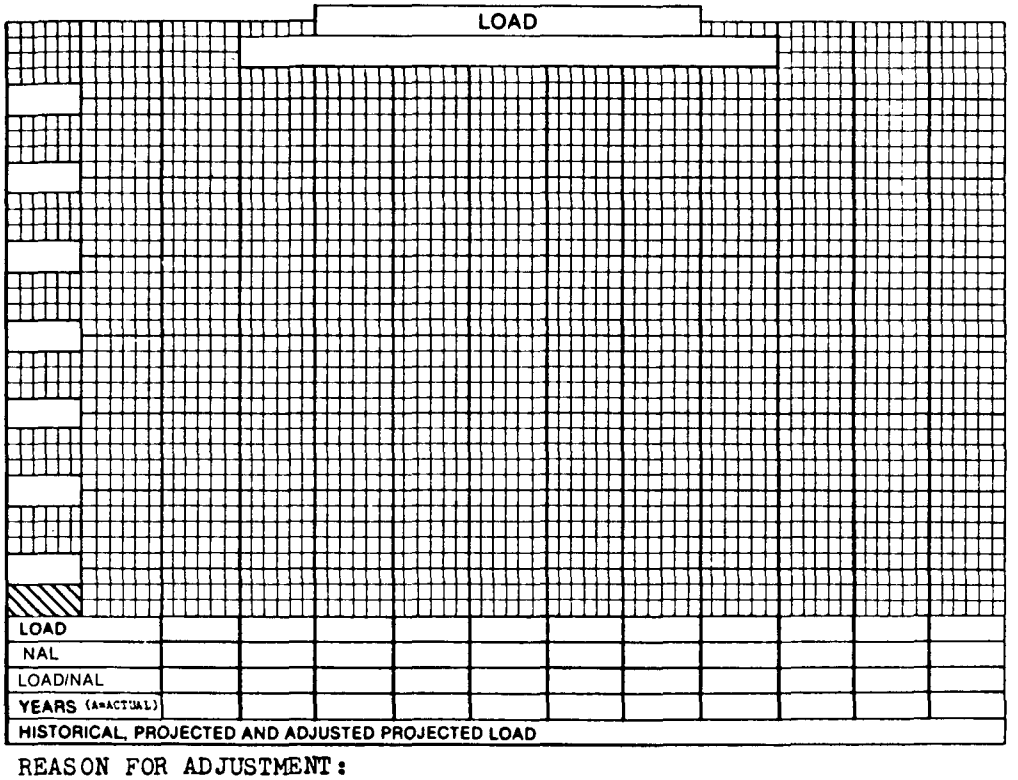
EXHIBIT 6

(Paragraph 7.19)

LOADS AND TRENDS CHART

Southwestern Bell

Form 4



REASON FOR ADJUSTMENT:

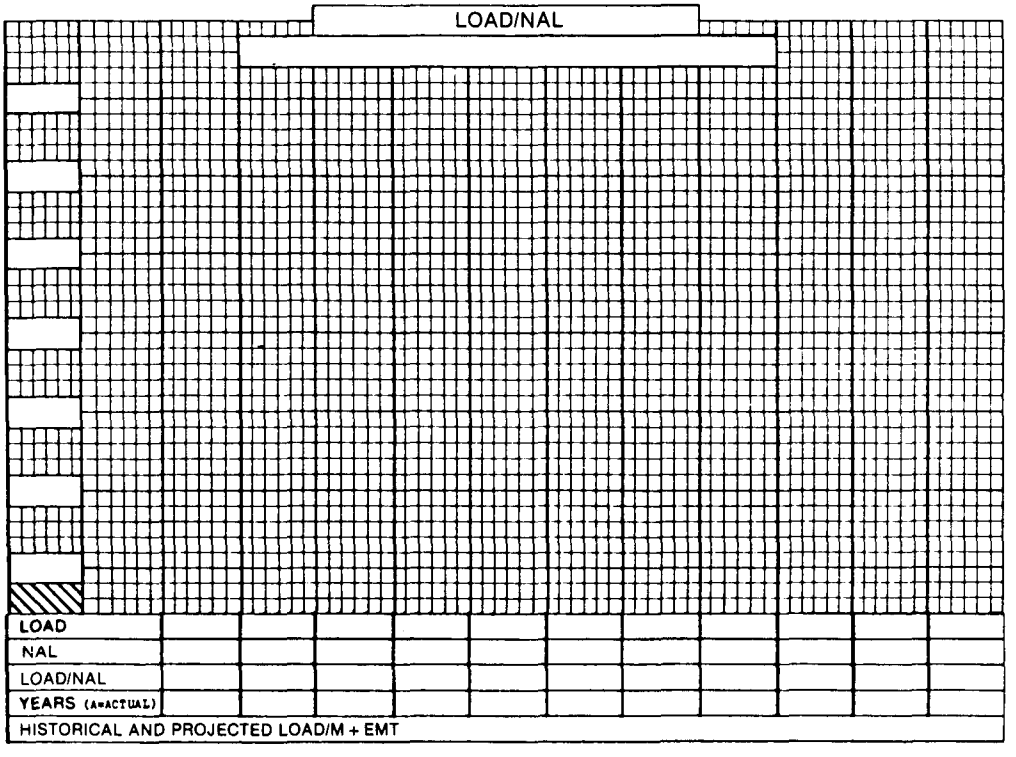


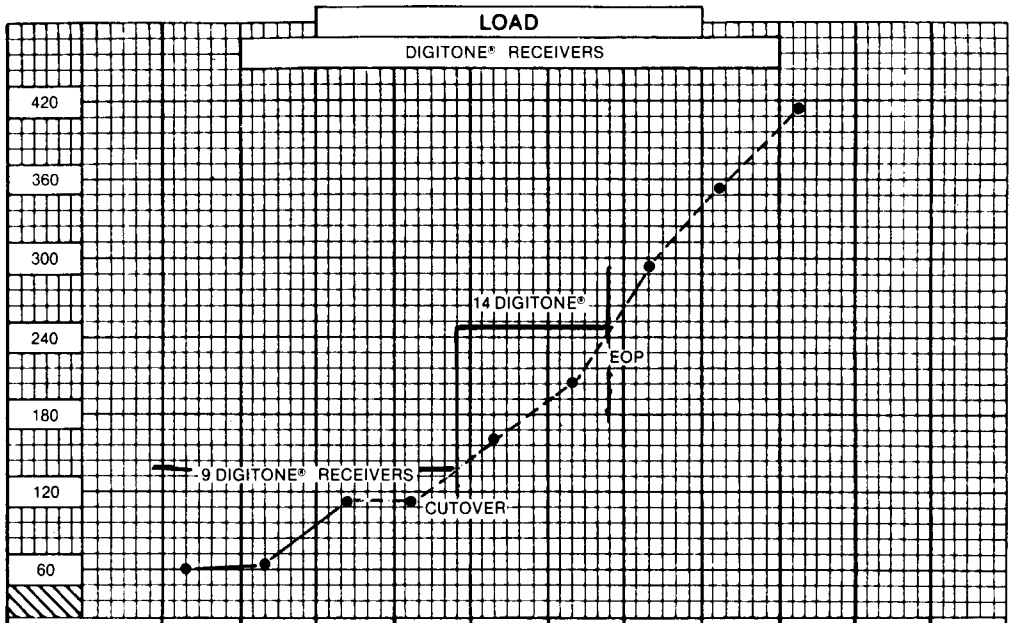
EXHIBIT 7

(Paragraph 7.19)

LOADS AND TRENDS CHART

Southwestern Bell

Form 4

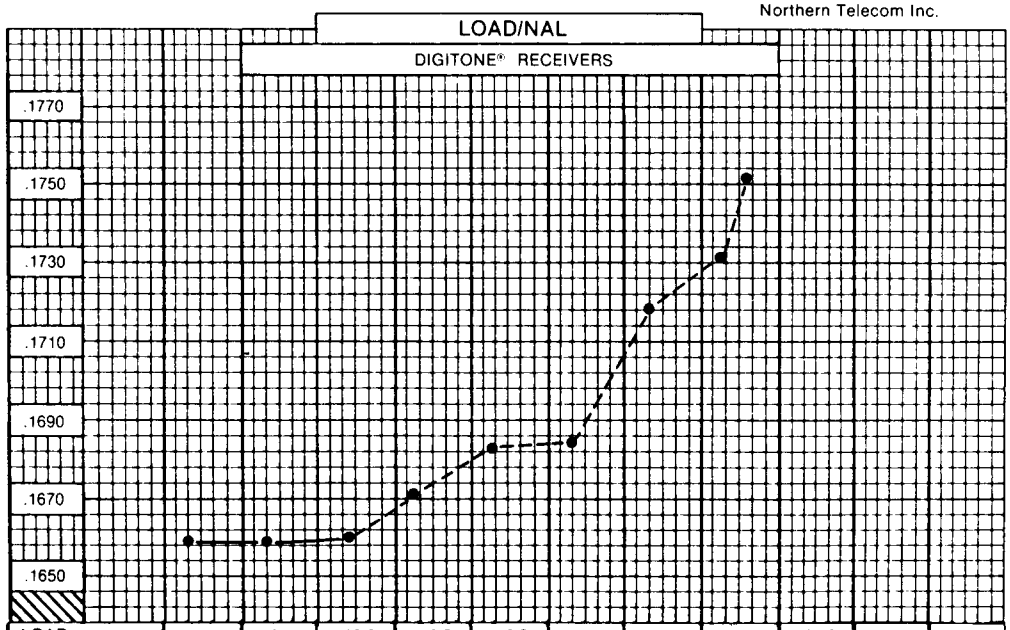


LOAD	60	61	109.2	116.5	158.9	204.9	298.9	336.7	404.9		
NAL	362	368	658	697	945	1216	1740	1944	2286		
LOAD/NAL	.1658	.1658	.1660	.1671	.1682	.1685	.1718	.1732	.1771		
YEARS (A=ACTUAL)	1985A	1986A	1987	1988	1989	1990	1991	1992	1993		

HISTORICAL, PROJECTED AND ADJUSTED PROJECTED LOAD

REASON FOR ADJUSTMENT: A = ACTUAL MEASURED DATA

® Registered Trademark of Northern Telecom Inc.



LOAD	60	61	109.2	116.5	158.9	204.9	298.9	336.7	404.9		
NAL	362	368	658	697	945	1216	1740	1944	2286		
LOAD/NAL	.1658	.1658	.1660	.1671	.1682	.1685	.1718	.1732	.1771		
YEARS (A=ACTUAL)	1985A	1986A	1987	1988	1989	1990	1991	1992	1993		

HISTORICAL AND PROJECTED LOAD/M + EMT

EXHIBIT 8
(Paragraph 9.2)
CAPACITY IN M.T. OF
CUSTOM CALLING
FEATURES

FEATURES	* PERCENT ACCEPTANCE OF EOP M.T.	MAIN TELEPHONE CAPACITY
SPEED CALLING 8		
SPEED CALLING 30		
3-WAY CALLING		
CALL WAITING		
CALL FORWARDING		
REMOTE CALL FORWARDING		
TOUCH-TONE		

* Require only if the percent acceptance of EOP M.T. is different from that obtained from the WCAF at EOP.

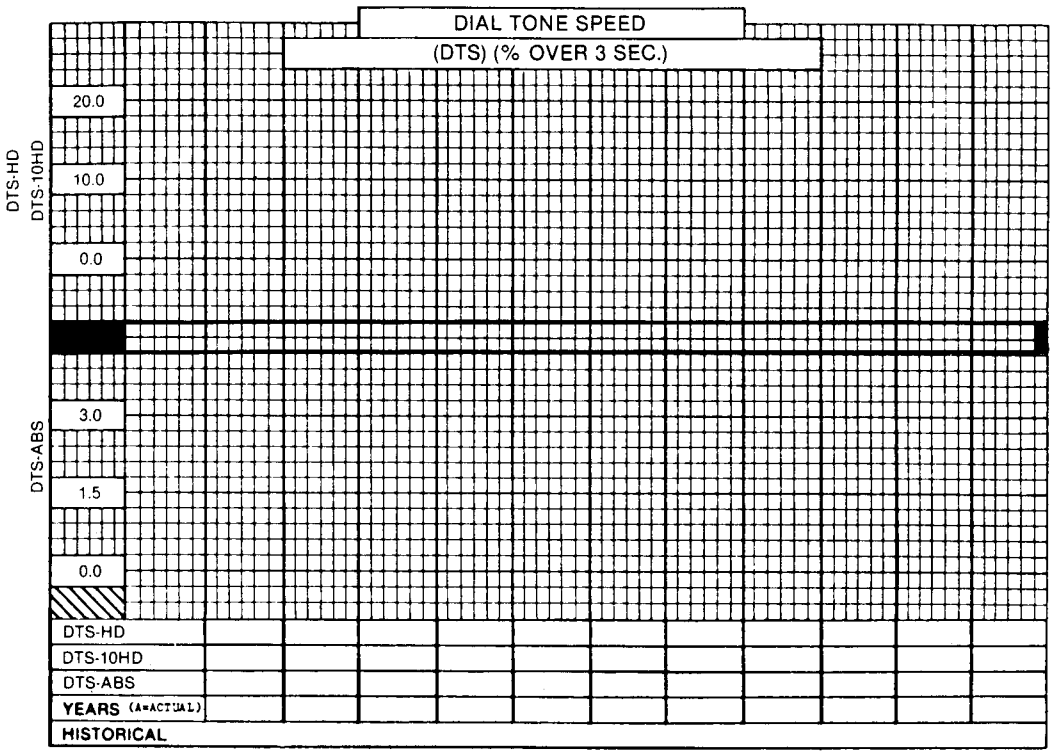
EXHIBIT 9

(Paragraph 5.7)

SERVICE RESULTS

Southwestern Bell

FORM 6



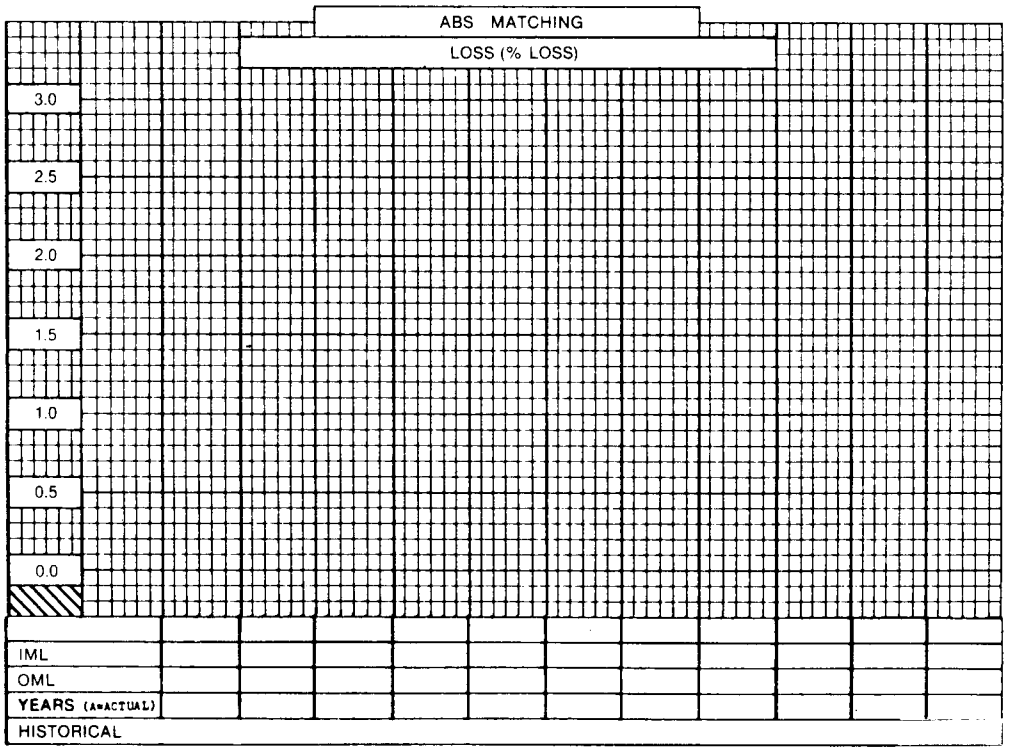


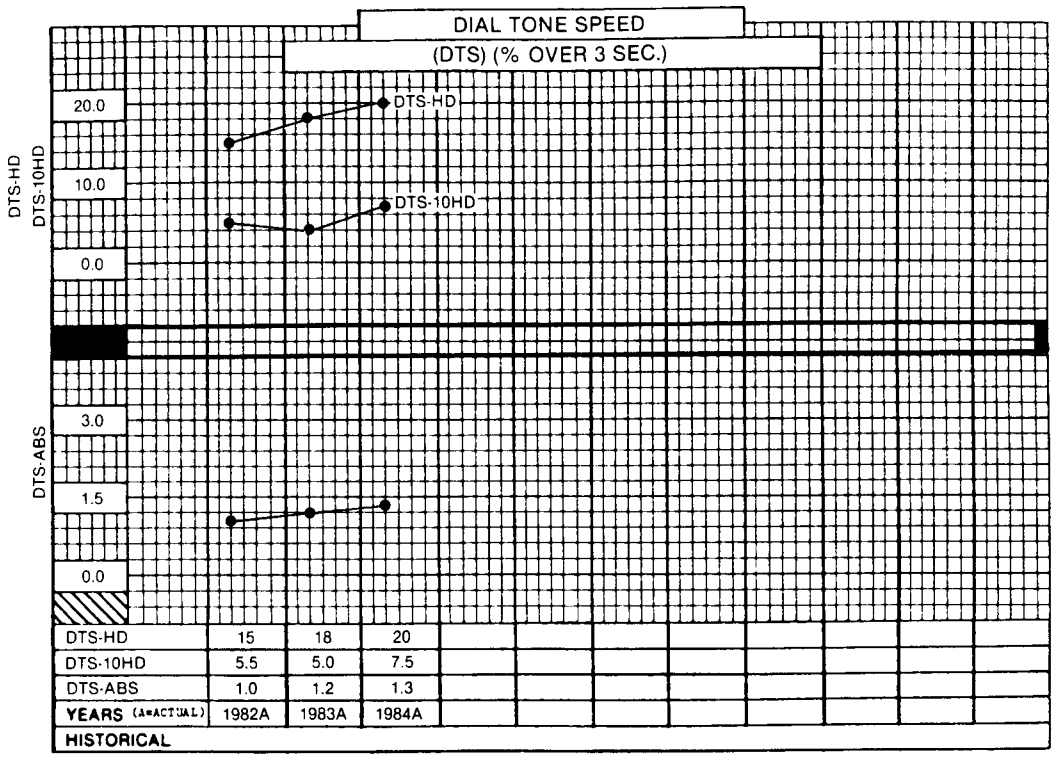
EXHIBIT 10

(Paragraph 5.7)

SERVICE RESULTS

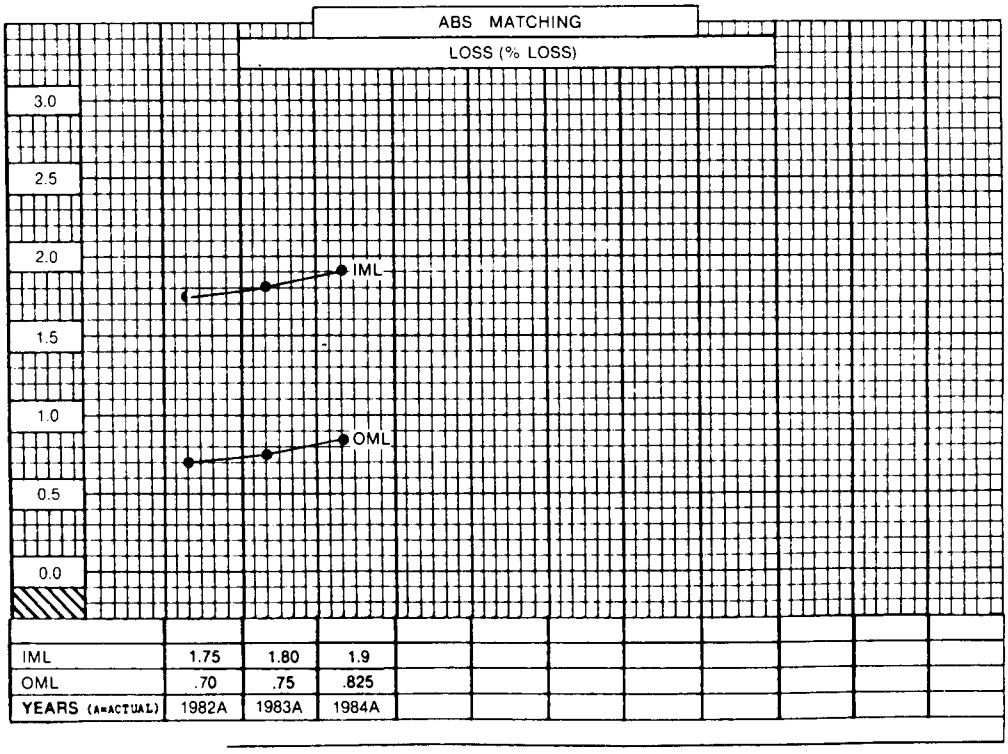
Southwestern Bell

FORM 6



DTS-HD	15	18	20								
DTS-10HD	5.5	5.0	7.5								
DTS-ABS	1.0	1.2	1.3								
YEARS (A=ACTUAL)	1982A	1983A	1984A								
HISTORICAL											

REASON FOR ADJUSTMENT: A = ACTUAL MEASURED DATA



IML	1.75	1.80	1.9								
OML	.70	.75	.825								
YEARS (A=ACTUAL)	1982A	1983A	1984A								

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(Paragraph 14.1)
EXAMPLE OF SUPPORTING DATA

GENERAL NOTES

1. This specification is for the ----- control Group "0" ----- Digital office.

2. The switching machine is a DMS-10 digital multiplex system.

3. The NNX code in this control group is 288.

4. There will be 1900 Directory Numbers in this control group to accommodate CO number reservations.

5. There are 1744 lines installed in the DMS-10.

6. The following desks and switchboards are associated with this office.

PURPOSE	BOARD
Vacant Code Oper.	Recorded Annc.
Verification Request	3CL/TSPS Desk
Toll Switch	4E Machine
Repair	CRS
Directory Assistance	No. 5ACD
Intercept	MIS
Service Observing	#12 Board
Local Test Desk	#16 Board
CAMA	4E Machine
TSPS	TSPS Console

7. This office is engineered for the following Busy Hour Calls:

Originating	1927
Intraoffice	680
Outgoing	1247
Incoming	899

8. This office is engineered for the following service features:
   Local Exchange Service - 4 wire
   Flat and Coin
   Operation with #5XB, SXS, DCO, 4ESS and TSPS
   Seven and Ten Digit Dialing
   X11 Service Codes
   0+, 0- and 1+ Calling
   Intercepting Trunk Arrangements to MIS and recorded announcements

EXHIBIT 11

EXAMPLE OF SUPPORTING DATA

GENERAL (Cont'd)

8. (Cont'd)

Station Signalling
Dial Pulse Rotary Dial
MF Touch Tone
Special Service Features
Add-On Conference
Speed Calling
Call Forwarding
Call Waiting
Alternate Routing
Line Load Control
Service Observing

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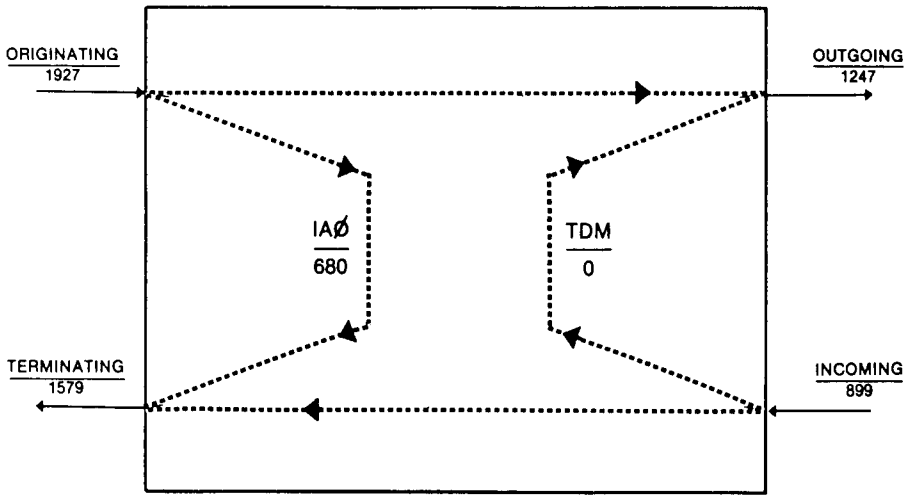
Southwestern Bell

SUMMARY OF CALLS



DMS-10

PROPOSED DISTRIBUTION OF BUSY HOUR TRAFFIC

9-89

EXHIBIT 11
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EXAMPLE OF SUPPORTING DATA

SUMMARY OF BASIC DATA

ABS-BH End of Period Call Data

TOTAL Incoming Calls	899
-Incoming Terminating	899
-Tandem Thru Switched	0
TOTAL Originating Calls	1927
-Originating Outgoing	1247
-Originating Intraoffice	680
TOTAL Originating and Terminating	3506
TOTAL Originating + Incoming	2826
Incoming DP Calls	248
-Average Digits per DP Call	4
Incoming MF Calls	651
Outgoing MF Calls	820
Outgoing DP Calls	427
Coin Local Calls	17
TOTAL Message Rate Calls Charged But Not Timed	0
TOTAL Message Rate Calls Charged and Timed	0
TOTAL Toll Calls Charged and Timed	195
TOTAL Inwats Calls AMA Recorded	0
TOTAL CCSA Calls AMA Recorded	0
International DDD Calls	1
Untimed Hotel-Motel Calls	0
Timed Hotel-Motel Calls	0
Reverting Call	2
CAMA ANI Calls	0
Call Waiting Calls	12
Add-On Conference Calls	3
Centrex Attendant Handled Calls	0
Recording Completing Calls (TOPS)	72

EXHIBIT 11
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EXAMPLE OF SUPPORTING DATA

FORECAST OF LINE, NALS, AND SERVICE

9-89

BASED ON WIRE CENTER AREA FORECAST DATED 7-1-87
(VALIDATED 9-10-87)

CLASS	LINES	NALS
FR1	1235	1235
FR2	21*	30
FR4	17*	44
FR1	112	112
Coin	14	14
FX(Res)**	143	143
(Bus)**	106	106
	1648	1684

*At Cut Over
**Most FX NALS Located in - - - - -.

Touch Tone	368
Call Waiting	82
Call Forwarding	60
3 Way Calling	24
Speed Calling (8)	18
Speed Calling (30)	5
Cons. Nos.	48

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EXAMPLE OF SUPPORTING DATA

BUSY HOUR USAGE

9-89

ORIGINATING

Class	Lines	M+EMT	BHCR	CALLS	H.T.	CCS Line	CCS MT	CCS Total
NC	1634	1670	1.14	1901	153	1.78	1.74	2902
Coin	14	14	1.86	26	165	3.07	3.07	43
TOTAL	1648	1684	1.144	1927	153	1.79	1.75	2945
Coin BH	14	14	2.43	34	173	4.21	4.21	59

TERMINATING

NC	1634	1670	.94	1542	149	1.44	1.41	2349
Coin	14	14	.49	7	157	.79	.79	11
TOTAL	1648	1684	.94	1549	150	1.43	1.40	2360

ORIGINATING PLUS TERMINATING

NC	1634	1670	2.08	3473		3.21	3.14	5251
Coin	14	14	2.36	33		3.86	3.86	54
TOTAL	1648	1684	2.08	3506	1.51	3.22	3.15	5305

Intraoffice Calls		680
Originating + Inc. Calls	1.68	2826

Southwestern Bell

ORIGINATING TRUNK GROUP SUMMARY AS OF _____, _____

OUTGOING TO	TYPE OFC.	NO. DGTS. REGD.	NO. DGTS. SENT	MF -- DP	TRUNK ORDER CODE	PRES. BOP	PROP 1987	PROP 1988	PROP 1989	NOTES
TSPS NCN	TSP	7/10	7/10	MF		0	8	8	8	
TSPS COIN	TSP	7/10	7/10	MF		0	6	6	6	
DDD CAMA	4ESS	7/10/14	7/10/14	MF		0	24	24	24	
REPAIR RS	1ESS	' 4	—	—		0	2	2	2	
"OPER." INTC	MIS	7/10	4	MF		0	4	4	4	
LTD TEST	TK	4	4	MF		0	2	2	2	
MASS CALL	ESS	7	7	MF		0	2	2	2	
DA	#5ACD	1	0	—		0	3	3	3	
ELGIN	ESS	7	6	MF		0	26	26	26	
FILLMORE	SXS	7	5	DP		0	21	21	21	
GENERAL	5XB	7	5	MF		0	6	6	6	
HICKORY	ESS	7	5	MF		0	7	7	7	
NATIONAL	5XB	7	6	DP		0	11	11	12	
RIVERSIDE	ESS	7	6	MF		0	11	11	11	
TEMPLE	ESS	7	6	MF		0	15	15	15	
WOODCREST	ESS	7	5	MF		0	7	7	7	
OWASSO	SXS	7	5	DP		0	11	11	12	
SANDSPRING	SXS	7	5	DP		0	6	6	6	

NOTES:

OFFICE

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Southwestern Bell

TERMINATING TRUNK GROUP SUMMARY AS OF _____, _____

INCOMING FROM	TYPE OFC.	NO. DGTS. RCVD.	MF — — DP	TRUNK ORDER CODE	PRES. BOP	PROP 1987	PROP 1988	PROP 1989	NOTES
OKC TC	4 ESS	4	MF		0	20	21	23	
VERIF		4	MF		0	1	1	1	
TEST DESK		4	MF		0	1	1	1	
REPAIR SERV.	ESS	4	MF		0	1	1	1	
ELGIN	ESS	4	MF		0	18	19	20	
FILLMORE	SXS	4	DP		0	17	18	18	
GENERAL	5XB	4	MF		0	8	8	8	
HICKORY	ESS	4	MF		0	9	9	9	
NATIONAL "0"	5XB	4	MF		0	8	8	8	
NATIONAL "1"	5XB	4	MF		0	8	8	8	
RIVERSIDE	ESS	4	MF		0	14	15	15	
TEMPLE	ESS	4	MF		0	15	16	16	
WOODCREST	ESS	4	MF		0	5	5	6	
OWASSO	SXS	4	DP		0	10	11	12	
SANDSPRING	SXS	4	DP		0	9	9	9	

NOTES.

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