NETWORK DESIGN ORDER PREPARATION
TRAFFIC OPERATOR POSITION SYSTEM
(DMS-200 & 100/200)

CONTENTS PAGE

FIGURES

1. GENERAL

1.01 The Network Design Order serves two basic purposes:

(a) It is a requisition for changes in the amount 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.

Paragraph 1.03 through 10.02 define the make-up of the Traffic Operator Position System (TOPS) Network Design Order (NDO). The make-up of NDOs for Operator Centers (OCs) and Remote Operator Centers are defined in paragraphs 11.01 and 12.01, respectively.

1.02 This section is reissued to reflect SWBT's current Operator Services serving vehicle, the Traffic Operator Position System (TOPS). TOPS is an optional software feature package of the Northern Telecom, Inc. (NTI) Digital Multiplex System (DMS) 200 switch. A brief explanation of how TOPS works is in paragraph 1.08.

1.03 There are four basic types of NDOs. They are as follows:

(a) A Complete Network Design Order may be issued whenever a physical modification to the office or changes in a Face Sheet capacity occur. It is composed of all the pages that to 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 Facilities Administrator to use and maintain. A Complete Order should be written at least every twenty-four (24) months. It is to include all previous Supplement Orders and/or Partial Orders issued after the last Complete Order. If neither a BCS (Bulk Change Supplement) update nor an equipment addition is required, then the Complete Order must be issued as a Revised Order.

(b) 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 made by any Partial Order issued since the last Complete Order and pages of the 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.

(c) Supplement Orders are issued on outstanding Complete or Partial Orders to make corrections, changes and/or minor additions. They shall have the same order number as the Complete or Partial Order they are 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 Order shall be issued to change Real Time, Position, and/or Equipment Capacity or Exhaust Dates of an office due to a busy season change for a forecasted usage value, etc., on NDOs that have not been completed.

(d) 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 it completely. They are also used to reissue a completed order for record purposes.

1.04 The NDO is composed of two main components.

- o The Basic Data Section.
- o The Specification Section.

(a) The Basic Data Section of a NDO contains the historical data, future estimates, computations, Load and Trend (L&T) Charts, and Network Design engineering judgements 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 TOPS structural arrangements and dependencies as outlined in the Operator Services Fundamental Plan. These Assumptions include arrangements for Host and Remote OCs, Special Order Services Traffic (SOST), Directory Assistance (DA), Hotel Billing System, etc. Any other pertinent information of an explanatory nature that may be required for the use of the Network Design alone shall be included in the Basic Assumptions.

(b) 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 Section of a NDO should utilize the NTI DMS-100/200 NT8620 equipment questionnaire. The Equipment Questionnaire is to show the Present Installed, Changes, (additions, deletions) and Total Quantities of TOPS equipment determined by Network Design. The following Sections of the NT8620 questionnaire should be included in a TOPS NDO Specification Section:

Section 1	Office Overview
Section 2	Software Feature Packages
Section 3	Operator Position Equipment
Section 4	Input/Output Devices
Section 5	Lines (only if a DMS-100/200)
Section 6	Trunks and Service Circuits
Section 7	Central Control Complex, Networks
Section 13	Real Time Capacity

Since the TOPS is integrated into the DMS Switch, a complete NDO to provision the entire switch is required. See Section SW241-060-900, the DMS-100/200 NDOP practice.

1.05 The sizing and timing interval for TOPS additions should be determined in accordance with the recommendations set forth by the Task Force on Market Driven Policies. Those recommendations include general considerations for central office relief sizing and timing aimed at a balance between objective service levels and prudent risk management of capital. The final document is expected first half, 1988.

Each TOPS should have a Fundamental Plan, updated annually after each year's Busy Season, which covers the current year and the next five years. This plan should address system real time and position capacities, ultimate operator center sizing, and proposed relief plans, when applicable. The plan should be made following existing study procedures and should include all the required supporting data as outlined in current departmental practices as well as this Southwestern Bell practice for Network Design. The Fundamental Plan is normally initiated and maintained by Network Planning. However, any Fundamental Plan should have the participation of Network Design, Operator Services, and Switching Engineering.

1.06 The NDO should be arranged in the following standard sequence.

- o Face Sheet
- o NDO Index
- o Basic Data Section arranged as follows:

  L&T charts for total office originating plus terminating (O+T) calls, O+T CCS, and O+T CCS/NAL and/or O+T CCS/Trunk (See paragraph 2.04).

Position Utilization Chart followed by its supporting data (See paragraphs 4.01 through 4.04)

Processor Utilization Chart (see paragraph 3.03)

Individual Hardware L&T Charts, each followed by its supporting data (See paragraph 2.04).

Basic Assumptions, Policies, Authorizations and Fundamental Plans including necessary support data (See paragraphs 1.04 and 1.05).

OC sizing information (See paragraphs 5.01 through 5.04).

Additional trunking information, including the General Trunk Forecast (GTF), DS-1 Forecast, or equivalent. DS-1 is a 24-channel facility that carries voice and data traffic. (See paragraph 6.01).

- o Miscellaneous Information
- o Specification Section utilizing the standard NTI NT8620 Equipment Questionnaire. Section 3 of the NT8620 contains the TOPS equipment, but other sections are impacted by TOPS also. The affected sections are listed in paragraph 1.04(b).

1.07 The Face Sheet for a TOPS NDO has two parts the Narrative portion and the Summary of Equipment Capacities portion (See Figure 1).

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

What is to be done, i.e., major additions, changes or rearrangements.

Why it is to be done, i.e., references to approved studies, letters and authorities.

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.

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

- o Service Date. This is the date beyond which service impairments or encroachment on administrative spare terminations or capacities may be expected to occur if equipment relief is not available.

- 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., Bulk Change Supplements (BCS), Automated Coin Toll Service (ACTS) equipment, etc., and includes appropriate justification for the item unless the provision of this equipment is covered by policy determination.

- Processor Real Time Capacity. This portion of the Face Sheet is determined as outlined in paragraphs 3.01 through 3.06.

- Position Utilization. This portion of the Face Sheet is determined as outlined in paragraphs 4.01 through 4.04.

- DS-1 Termination Capacity. Since trunks or DS-1's are normally bought to match a trunk or DS-1 facilities forecast, they should not be considered limiting. (See paragraph 6.01). However, trunk/DS-1 terminations on the Digital Trunk Controllers (DTC), Digital Carrier Modules (DCM), or Trunk Modules (TM) can be limiting. This section of the face sheet should reflect which of these module groups is most limiting and the termination capacity, trunks/DS-1's required per the General Trunk Forecast or DS-1 forecast, and the exhaust date of the trunk/DS-1 terminations. The module group which terminates the majority of the trunks/DS-1's in the office should be listed here. It will be the DTCs in most offices.

  The DTC houses up to 10 DS-1 line cards, each terminating 2 span lines for a total of 20 DS-1's, i.e., a total of 480 trunks. The voice links for the TOPS host-remote OC connection ride DS-1's as do the digital trunks coming in and out of the TOPS tandem. The DS-1 capacity of the DTCs installed in the office is the number of DS-1 line cards installed times 2. The number of DS-1s required per the DS-1 forecast, at the end of the engineering period should be entered on the face sheet. Percent utilization is DS-1s required divided by DS-1 capacity times 100. The exhaust date should be stated as the first month of the busy season during the year that DS-1 line card relief is required. Basically, the same calculations should be done if Digital Carrier Modules are used, except a DCM houses up to 5 DS-1 line cards, each terminating one 24-channel DS-1 span line. DCM DS-1 capacity is the number of DS-1 DCM line cards installed. The percent spare DS-1s required should be based on economics and engineering judgement agreed upon by Network Design, the DS-1 facilities planner, Network Planning, Switching Engineering, and Trunk Forecasting/Trunk Servicing.

- Most Limiting Component (Non-Position). This refers to the most limiting of Real Time Capacity in call Attempts, or Equipment Capacity (service circuits, etc.). The term Most Limiting Component is defined as the component that has the earliest projected exhaust date.

- o Exhaust Date: Most Limiting Component (Non-Position). This is the earliest date the TOPS will exhaust (equipment provided for traffic) on any component other than positions. Exhaust Date Most Limiting Component (Non-Position) is applicable to Real Time Capacity in Call attempts.

- o Relief Date - Positions. This is the date for which position additions or deletions are called for in the approved Fundamental Plan.

(TOPS offices are DMS-200 or DMS-100/200 tandem switches. For this reason, face sheet data is not input to the Local Switch Demand and Facility (LSDF) data base).

1.08 Appendix 1 contains a reference listing which the Network Designer may use to acquire additional knowledge concerning TOPS Network Design and TOPS Operations.

Presently, all areas within Southwestern Bell Telephone are using (or plan to use) the Northern Telecom Digital Multiplex System 200 (DMS 200) switch and its associated Traffic Operator Position System (TOPS) to provide local and toll operator assisted services. The TOPS is integrated into the DMS 200 toll tandem switch. TOPS operator positions can be co-located with the switch itself or served remotely. The DMS switch serving the TOPS functions can be a pure DMS-200 tandem or a combined local/toll DMS-100/200 tandem. A combined DMS tandem contains subscriber lines as well as trunks. A pure DMS-200 tandem has incoming and outgoing trunks only.

It is also possible to centralize operators from a remote toll center to a host DMS 200 TOPS toll center. Operator Centralization (OC) is a software program which resides in the remote switch. The remote OC program momentarily routes the operator call to the host DMS 200 TOPS and enables the remote to perform a variety of toll functions. The remote toll center retains all existing trunking, translations, routing, and ticketing information. An operator voice link connects TOPS calls originating at a remote to the host. A three-port conference circuit at the remote switches the calling subscriber to the called subscriber and provides connection to the operator through the operator voice link (like a three-way call). When the operator functions are completed, the operator releases the call and the incoming TOPS trunk connects to the outgoing trunk to the called location. The conference circuit and voice link are then dropped and are available for another call. Digital data links provide signaling between the host and remote offices.

A "stand-alone" TOPS tandem is one which does not have remote toll centers (also DMS tandems with the OC software) homing on it. A "host" TOPS tandem is one which does serve remote toll centers with OC software. The remote TOPS tandems which home on the host are called "Remote OCs."

Following are definitions of terms used when engineering operator positions:

- ACTUAL (AVERAGE) WORK TIME - The time in seconds required to handle the average call and do other necessary work for the call.

- WORK VOLUME - The time in hundred call seconds (CCS) during which the total operator center positions are busy handling calls. Also referred to as "load", measured in half-hour intervals.

- INITIAL POSITION SEIZURES (IPS) - The number of times an operator position is seized to handle a call, including CAMA transferred calls. IPS excludes recalls.

- OCCUPANCY - In an operator service facility, the ratio of the portion of operator time spent while busy handling calls and other busy time to the total time assigned at a position, usually expressed as a percentage.

- SPEED OF ANSWER - A measurement of the speed with which the average call is answered during a given period.

- FORCE ADMINISTRATION DATA SYSTEM (FADS) - An arrangement of equipment providing traffic data from which additional derived data may be obtained to assist in arranging the most effective manning of operator services facilities and in calculating performance.

AUTOMATED COIN TOLL SERVICE (ACTS) - Customer dialed 1 + 7 Digit or 1 + 10 Digit call, originated from a coin phone, where a computerized voice instructs the customer on how much money to deposit to complete the call. An ACTS call normally does not involve an operator, but it can be transferred to an operator if the customer waits the length of the time-out after getting coin deposit instructions.

MECHANIZED CALLING CARD SERVICE (MCCS) - Customer dialed 0 + 7 Digit or 0 + 10 Digit call where, following the prompt tone to the customer, the customer dials his/her credit card and personal identification number. No operator is involved on a MCCS call unless the customer waits the required length of the time-out after receiving the prompt tone before continuing to dial in the credit card number.

CUSTOMIZED OPERATOR SERVICES (COS) - Formerly called Designated Operator Services (DOS). This planned SWBT offering is scheduled to begin in mid-1988. SWBT will provide operator-assisted services for Interexchange Carriers (IC) subscribing to COS. COS is a forerunner of the planned service offering, Exchange Access Operator Services (EAOS).

1.09 Time-share and other computer programs are available to assist in the analysis of TOPS loads and in the determination of equipment quantities. The following time-share computer programs are located on the Southwestern Bell Telephone Company STS Computer System: ND100P1, ND100P2, ND100P3. These programs, though originally used to determine operator position requirements in a previous Operator Services vehicle, are still valid for determining the 21st Highest Half Hour CCS load on positions. In the near future, the STS will be replaced, but the programs presently on STS will be transferred to the new system.

(a) Time-share computer programs for computing 21st Highest Half Hour (HHH) load (CCS) values. Because these programs were originally designed for a different system and have not been updated, they can be used for computing the 21st HHH only - not position requirements.

- Using measured half-hourly Work Volume (WV) CCS via ND100P1 (STS In-House Computer).

- Using Average Business Day (ABD) call volumes via ND100P2 and ND100P3 (STS In-House Computer). This program is for use when measured WV CCS data is unavailable, i.e., cordboards being replaced by TOPS.

  (Plans are underway to mechanize Network Design data needed from FADS. If and when the project is completed, the ND100 programs will no longer be needed.)

(b) Use NTI's REAL:: TIME processor occupancy calculation program for DMS 100 and 200 offices to determine processor/real time capacity. This program requires an IBM-compatible PC, LOTUS 1-2-3, version 2, and 640K memory to run. This program parallels section 13 of the NT8620 questionnaire. Analysis and continued monitoring of processor real time is critically important in a TOPS DMS tandem switch. TOPS features are usually the largest consumers of processor real time, especially when combined with other services like 800 service, etc.

2. BASIC DATA SECTION

2.01 The Basic Data Section of a Network Design Order contains the historical data, future estimates, computations, Position and Processor Utilization Charts, L&T Charts and Network Design engineering judgements that determine the basic equipment configuration. It also quotes the authorizations and policies that may be needed for approval. Other information that may be required for the use of Network Design alone shall be included in the Basic Data Section.

2.02 The Basic Data Section will contain a varied 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 TOPS 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). (2) January - December service months (December 23 December 22). The two data years allow for TOPS tandems with either winter or summer busy seasons to obtain a year's data that includes the entire busy season. These data years and dates coincide with existing policies for other offices.

(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, unless the component is being engineered using High Day Engineering procedures. In that case, the "Odd Ball" data should be properly coded in the data base.

(c) Average Busy Season (ABS) is defined as the three months within the study period, not necessarily consecutive, with the highest average business day load.

(d) Ten (10) High Hour is defined as the ten hours 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 in question.

(e) Office Busy Hour is defined as the time consistent hour throughout the busy season, having the highest originating plus terminating (O + T) CCS.

(f) Component ABS Busy Hour is defined as the time consistent hour having the highest average business day load throughout the busy season for a particular switch component, i.e., MF receivers, etc.

(g) CCS Position Engineering is defined as a procedure for engineering for the 21st High Half Hour (HHH). The target objective is that future Work Volume (WV) should not exceed the capacity of the positions provided in more than 20 individual High Half Hours of the design busy season at the end of the engineering period (EOP) (See paragraph 2.02(c).

2.03 In order to efficiently and effectively engineer a TOPS, Network Design must have access to the specific types of actual historical peg counts and load data that are required to engineer the TOPS hardware and software components. Network Design must coordinate the receipt of the necessary and appropriate historical data from the Operator Services Facilities Group that is responsible for the administration of the TOPS operator centers (including remote operator centers) and the Network Administration Group responsible for the DMS TOPS tandem switch. Since the release of BCS 20, interface to the Engineering and Administration Data Acquisition System (EADAS), a mechanized data collection sytem, has been possible. Beginning in 1988, mechanized data reports via USER COER (Central Office Equipment Reports) will provide formatted DMS switch data, including some TOPS reports. Most TOPS data, however, will have to come from the Force Administration Data System (FADS). If traffic data is not collected for every potential busy hour of the business day, Network Design must assure that the Operator Services Facilities group or Network Administration group is performing the following minimal functions when defining System or Component Study Hours:

(a) Determination of the component busy hour. At least one 10-day study per year should be run during the busy season. This study should be at least 12 to 16 hours in duration, for each day of the study.

(b) Determination of the 10 High Busy Hours. It is suggested that data be collected for all possible hours in which the component item can peak.

(c) Determination of the 21st HHH position load. A minimum of one and a maximum of five (5) of the busiest time consistent position WV hours may be used (See paragraph 4.02(a).

(d) A Office Busy Hour determination. (See paragraph 2.02(e)).

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 loads exceed previous projected or adjusted projected loads. Moreover, the work group responsible for data collection must perform the data validation function. One task involved in data validation, is the flagging of "Odd Ball" data. However, Network Design has the responsibility of performing reasonableness checks on all data that it receives. Reasonableness checks

must be performed by Network Design when the data is received. This will permit early correction of identifiable erroneous data. (See Figure 6 for suggested FADS, and other TOPS data and a description of the recommended items.

2.04 L&T Charts must be provided in the NDO for certain Hardware and total office traffic load sensitive items. Since the TOPS is integrated into the DMS tandem switch, it uses service circuits, etc. to process TOPS calls. Following are the criteria for L&T charts on these items.

(a) Total Office L&T Charts

A minimum of two (2) to five (5) years of historical data is required to be posted to the L&T Charts. To facilitate the posting of the historical data to the L&T Charts, the following must be performed.

(1) A Study Period must be defined for the DMS-100/200 TOPS tandem.

(2) 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. Figure 3 can be used to post and summarize historical and projected load (CCS) and attempt data.

(3) The appropriate Study Period O + T CCS and O + T attempts data (ABSBH, ABS Component Busy Hour, etc.) are posted on the L&T chart. Figure 4 illustrates a completed form.

(a) O + T CCS and attempt data is entered on the L&T Chart (Figure 3) as a graphical data point and as a tabular value.

(b) Trunk data is entered on the L&T Chart (Figure 3) as a tabular value. O + T calls and CCS/trunk should be derived by division of total O+T CCS (and calls) by trunks. Historical and projected values should be posted as graphical data points and as tabular values (Figure 3). Trunk quantities should be obtained from the General Trunk Forecast (GTF). However, Network Design must obtain a validated GTF per paragraph 2.07. When historical data is not available, data from a comparable (similar) DMS-100/200 TOPS office may be used to engineer the switch. When such data is used in the engineering of the TOPS tandem, 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 data (actual or similar DMS-100/200 office derived values) are trended from Cutover to five years in the future.

(b) Historical load per TRK (actual or similar DMS-100/200 office derived values) are trended from cutover to five years in the future.

(b) Hardware Component L&T Charts

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 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 the 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 electronic or digital Central Office conversions.

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

Whenever possible, projected loads must be calculated from projected trunk and load/TRK data. These loads must be adjusted for changing historical factors and/or new service offerings or managerial judgements (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 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 judgements.

Supporting data, in addition to the L&T Charts, should be provided.

Equipment Components for which L&T Charts are desirable.

(a) Hardware L&T Charts.

(1) MF Receivers (See DMS-100/200 NDOP practice, Section SW241-060-900, para. 7.12) (See Figure 4)
(2) Universal Tone Receivers (See DMS-100/200 NDOP practice, Section SW241-060-900, para. 7.12) (See Figure 4)
(3) Digitone Receivers for MCCS (See DMS-100/200 NDOP practice, Section SW241-060-900, para. 7.12) (See Figure 4)
(4) Conference Circuits (See DMS-100/200 NDOP practice, SW Section 241-060-900, para. 7.12) (See Figure 4)
(5) Processor Call Processing Occupancy (See paragraph 3.01 and Figure 5)
(6) Operator Position - Related data (See paragraph 4.02 and Figures 6-8)

(b) L&T charts should also be prepared and included in the NDO for the following TOPS position-related load and attempt data:

- o Position Utilization
- o Total Work Volume CCS
- o Average Work Time

Actuals from at least two history years should be posted to the graphs. Projected values for five future years should be trended also.

Since the first TOPS conversion in SWBT was in 1985, most TOPS DMS-100/200 switch data will be less than two years old. However, every attempt should be made to graph the above data, even if it must be from the old TSPS[C] switch data. For an existing TOPS, Average Busy Season Busy Hour (ABSBH) data should be obtained from the FADS data as shown in Figure 6. A blank L&T chart for position utilization data is illustrated in Figure 7. A completed L&T chart for portion utilization is illustrated in Figure 8. See Figure 9 for a blank L&T chart for average work time and work volume CCS. A completed one for AWT and WV CCS is in Figure 10. Data for figures 8 and 10 is obtained from FADS reports.

[C]TSPS is a trademark of AT&T.

2.05 Supporting data, including calculations and worksheets, justifying the projected IPS, Average Work Time (AWT), loads, terminations, memory quantities, etc., and adjustments to these projected items must be included in the NDO. Adjustments to trended data must be supported when the quantity of equipment items provided are greater with the adjustment than without. This supporting data should include previous years' measurements, developed historical growth factors, explanation of variations in past trends, forecasted growth factors used, explanation of why these factors are being used, etc. Appropriate projections should be adjusted for new features such as Customized Operator Services (COS, formerly Designated Operator Services, DOS), as well as, new policies and procedures. In addition to this data, adjustments, explanations, etc., should be summarized, perhaps in narrative paragraphs, in such a way as to clearly justify the forecasted loads, ratios, etc. Supporting data older than two (2) previous busy seasons is highly desirable even if it is historical TSPS data converted for use in TOPS projections.

2.06 A copy of the General Trunk Forecast (GTF) or DS-1 forecast must be included in the Basic Data Section of the NDO. The GTF or DS-1 forecast must be validated by the trunk or DS-1 forecaster, just as in any NDO. GTF/DS-1 guidelines for inclusion in the NDO are documented in the DMS-100/200 NDOP practice SW241-060-900, paragraph 8.03. See paragraph 6.01 of this practice (SW 241-060-920) for more information on TOPS trunk requirements and provisioning.

3. REAL TIME UTILIZATION

3.01 The validation, analysis and projection of call processing load data is a fundamental step in designing a TOPS. This step is necessary in determining the DMS switch processor real time capacity that will be necessary to meet demands for service at any given point in time. The following paragraphs discuss the procedures, graphs, supporting data and computer program runs used to develop the graphs that shall be included in every TOPS NDO and Planning Study involving DMS-100/200 Real Time.

3.02 Processor Capacity - Real time consumption of the main central processing unit and the peripheral processing units can be determined by use of Northern Telecom's PC-based diskette programs. The RTCALC (Real::Time) and PRTCALC programs have been distributed to all Network Design groups and should be used to determine main processor (RTCALC) and peripheral processor (PRTCALC) capacity. Designers should verify that they have the latest version of these programs because they are updated regularly by NTI. Instruction binders accompany the programs and should be used for guidance through the programs. Running them requires a personal computer (PC) using LOTUS ***1-2-3 software

and 640K memory. NTI System Planning Letter 84-03-001, issue #2, dated 11-5-85 explains the manual method for calculating processor capacity. NTI documents explaining peripheral processor capacity calculations are System Application Letter 85-10-001, issue #1, dated 10-21-85 and Switching Engineering Bulletins 86-05-001, issue #1 and 86-05-002 dated 5-5-86 and 5-6-86, respectively. Designers are strongly encouraged to use the computer programs to determine processor capacity. The processor can be a limiting switching item. Section 13 of the NT8620 addresses processor real time and parallels the computer program inputs. Section 13 of the NT8620 should be completed. Designers are also strongly encouraged to review the ACTIVITY (ACT100, ACT101, ACT102) data available by command input to a Maintenance and Administration Position (MAP) terminal. This report should be reviewed at least once per month for busy day, busy hour call processing and total processor occupancy. Designers should always be aware of current processor occupancy levels when preparing the NDO. Use of manual real time calculations is discouraged because updated call timings, adjustment factors, etc. are generally not kept current in documents like they are in the computer programs.

3.03 The recommended maximum call processing occupancy (CPOCC) for a DMS-100/200 (or DMS-200) TOPS tandem is 65%. This recommended maximum call processing occupancy is based on the amount of call processing time required for certain administrative processor functions. The ACTIVITY tool consumes some of the call processing occupancy when it is turned on. Minute-to-minute traffic peakedness is also a factor and a certain percentage must be built in to account for it. An engineerable amount of CPOCC for priority devices, like maintenance terminals, can also reduce the above recommended CPOCC maximums. GHQ letter 225.1001, dated September 18, 1986, signed by AVP-NCOE, documents the above mentioned considerations. NTI has also published System Engineering Bulletin 87-05-001, #2, dated January 15, 1988, entitled "CPU Loading Recommendation." This document contains a CPU loading worksheet which subtracts from 100% total CPU occupancy the percentages required for maintenance, EADAS, etc. When using the CPU loading worksheet from SEB 87-05-001, designers should be sure to include a 3% real time deduction for a TOPS Stand-Alone and an additional 3% for a host with remote OC; and 3% for a TOPS Remote OC.

A L&T chart to track past CPOCC percentages and project future CPOCC values as determined by the RTCALC program should be included in the NDO. See figure 5 for a blank and a completed CPOCC L&T chart.

The processor utilization L&T chart should include the High Day 0+T call attempts posted in addition to the corresponding CPOCC percents. A capacity line should be drawn at the previously determined CPOCC maximum and at the projected call attempt capacity of the processor. The chart should show CPOCC and call attempts for at least two historical years and cutover plus five years.

4. POSITION UTILIZATION

4.01 Position provisioning and utilization are the responsibilities of Network Design. The validation, analysis and projection of call processing load data is a fundamental step in this provisioning process. This step is necessary in determining the quantity of positions that will be required to meet the demands for service at any given point in time. This step is also very useful in determining how well the positions are being utilized throughout the engineering period. The following paragraphs (4.01 - 4.04) discuss the procedures, graphs, supporting data and finalized computer program runs used to develop the graphs that shall be included in every TOPS NDO and Planning Study involving TOPS Positions.

(a) TOPS position requirements are based on IPS (Initial Position Seizures) - for an initial TOPS - and the Average Work Time (AWT) developed from IPS and CCS data. The ND100P1 is a time-share program used to determine TOPS 21st High Half-Hour CCS. ND100P1 is presently available on the Southwestern Bell STS Computer System. Procedures for accessing the ND100P1 Program can be obtained from the Section Network Design TOPS Coordinator, or from the GHQ Network Design TOPS (DMS) Subject Matter Expert (SME). When a replacement for the STS materializes, new instructions for accessing these programs will be transmitted.

4.02 The following steps should be followed in determining position requirements:

(a) On a judgement basis and using past WV (Work Volume) and IPS data, select several half-hours of the day during which the busiest half-hours are likely to occur. After the selection is made, collect data for all these half-hours for all business days included in the Base Period (BP). The BP is the most recent 3 high months busy season (BS), the months not necessarily being consecutive. The BS for some metropolitan areas may exceed three months. As a guide, any month with Average Business Day (ABD) Calls within five (5) percent of the three months ABS average may be included in the BS. "Odd Ball" data not suitable for Design purposes should be excluded.

(b) Develop the half-hourly engineered load (L) in CCS for each of the forecasted time periods as documented in GHQ letter 225.06, dated August 19, 1980 using all the half-hourly data collected. The loads for the forecasted time periods are to be calculated using the ND100P1 or similar program. To use this program, all data should be verified in advance of program access and input. Following are the procedures for using the ND100P1 Program. Data items required are described by line number as follows:

LINE 100

1. Busy Hours (BH) IPS for the most recent 3 high month BS. This is also known as the BP. *

2. BS BH IPS for forecasted (projected) period, i.e., any period after the BP. *

3. BS BH AWT for the BP.

4. BS BH AWT for a forecasted Period; this is the same period used in 2 above.

CAUTION: Forecasted figures must be in the same terms as those used in the BP, (i.e., IPS and AWT developed from IPS).

*These figures can also be BS ABD volumes if BH data is not available.

Example:

AWTs From IPS Counts

$$AWT = \frac{\text{Work Vol. x 100}}{\text{IPS}}$$

IPS = TOPS call attempts + transferred CAMA calls +ACTS and MCCS transferred calls.

Example:

$$AWT = \frac{1500 \times 100}{4000}$$

AWT= 37.5

LINE 2000, 2001, etc.

A minimum of 120 and a maximum of 600 data items representing the high half-hour WV for the BP should be entered. Since the ND100P1 Program only handles one (1) forecast period at a time, it is necessary to run the program for each additional forecasted period to obtain the engineered load. To determine the BP engineered load, the projected IPS must be set

equal to the BP IPS and the projected AWT must be set equal to the BP AWT. Following the printing of the output for the BP, Line 100 must be reentered (ON-LINE) for each desired forecast period containing the BP data plus the additional forecast period data. Data for the BP and the desired forecast period must be provided on Line 100 in order for the program to calculate properly. Line 2000, etc., will be reused for each additional run; i.e., for each additional Line 100 used. Should the local Network Design Group already have a program developed to select and project 21st HHH, steps 4.02 a and b will not be necessary. As stated earlier, a mechanized method for selecting the 21st HHH from actual TOPS FADS data is being investigated by GHQ Network Design and Operator Services.

(c) Determine the number of positions required to service load L for each of the forecasted time periods from the TOPS Half-Hourly CCS Work Volume Capacity Tables developed by Bellcore and transmitted to the states in 1987. The SWBT recommended answer time to use is 2.1 seconds. The recommended maximum occupancy is 92%. Based on these two parameters and the calculated AWT, Work Volume half-hour CCS loads can be read into the table and required positions determined.

(d) Calculate the standard deviation for load L for each of the forecasted time periods as follows:

$$cv = \frac{Lh}{27.47} + \frac{L^2}{2c}$$

cv= The standard deviation for the load L in CCS.

L = The statistical 21st HHH load in CCS (Engineered Half Hourly CCS output of the ND100P1 Program).

h = The holding time, i.e., estimated AWT per call.

c = Positions required to serve load L from the Work Volume Capacity Tables.

(e) Determine the number of standard deviations (z value) to be used for each of the forecasted time periods to provide the confidence level that the load will be in the expected range. Selected z values recommended for use are as follows:

Engineering Period	Confidence Level	No. of Standard Deviations (z)
2 years or less	92%	1.4
3 years or more	96%	1.8

(f) Calculate the adjusted engineered load for each of the forecasted time periods as follows:

$$L_{adj} = L + z_{cv}$$

Where L_{adj} = adjusted engineered load (i.e., upper level); L, z, $_{cv}$ are defined above.

(g) Determine the number of positions for each of the forecasted time periods by consulting the appropriate Half-Hourly CCS Work Volume Capacity Tables. No Spares should be added to this number since forecast uncertainties have been accounted for with the standard deviation adjustments.

(h) Variations should be made in projected AWT and IPS to determine the most probable position requirements for the forecasted time periods. This can be accomplished using the ND100P1 Program by varying items (2) and (4) (See paragraph 4.02(b)) in data line 100 only and then making additional program runs to obtain new load (L) values for the forecasted time periods. Calculations required in paragraph 4.02(c)-(g) must then be recalculated. The variation of the projections permits the user to develop ranges of load and positions requirements and then to determine from these the most probable requirements to use for planning and engineering purposes. The input and output run from ND100P1 containing the most probable load requirements, and the subsequent calculations to determine position calculations to determine position requirements (paragraph 4.02(c)-(g)) for these load values must be included in the NDO.

4.03 The calculations documented in 4.02(c)-(g) can be incorporated into a PC-based computer program in the different Network Design sections. Such a program will reduce the possibility of human error and save time.

4.04 Once the position requirements have been determined by Network Design, these requirements should be entered on a Position Utilization Chart. The Position Utilization Chart (See Figure 8 for an example) should also be posted monthly with the average number of positions, as determined from the appropriate TOPS Half-Hourly Work Volume Capacity Tables, required to serve the busy half-hour WV CCS loads of each business day using a minimum of two-half hours of data daily. "Odd Ball" data which should not be used for design purposes should be excluded from the averages for ABS data. "Odd Ball" data should be properly coded and excluded from engineering calculations. In addition, for ABS data, following each BS, the 21st HHH CCS method of engineering should be

used to determine the actual position requirements for the most recent BS. These actual 21st HHH requirements should also be posted to the Chart for the actual BS months. All Charts should be maintained with at least two (2) years of historical 21st HHH load (WV CCS) and/or ABD busy Half Hour (BHH) positionrequirements, including BS 21st HHH position requirements. In addition, all charts should have five (5) years projected BS 21st HHH position requirements. Projected ABS data should be shown for the actual proposed BS months.

(a) In addition to plotting past and proposed positions requirements, the Position Utilization Chart should show currently installed positions, including training positions, and all planned changes in the installed position quantities in the appropriate month. The chart should also show the "Available" positions. The quantity of Administrative and Maintenance Positions should be agreed upon by Network Design, Operator Services, and Network Planning based on prudent risk management. The projected Administrative Position Margin should not exceed 10% of those positions required for traffic. Administrative Position determinations should be included in the NDO. The number of positions required for maintenance spare should also be included in the NDO.

(b) Available Positions = Installed Positions minus Administrative Positions minus Maintenance Positions minus Monitor/Training Positions. Efforts should be made to minimize the placement of additional positions to accommodate maintenance outages. Operator Services and Network Maintenance should locally determine repair priorities, etc. The provisioning of maintenance spare positions should not influence or trigger deployment of a new operator center.

(c) Proposed TOPS Position Utilization should also be included in the NDO. TOPS Position Utilization is calculated by dividing those positions required for traffic usage by those positions "Available" for traffic usage. Maximum TOPS Position Utilization should be achieved for the "available" positions before relief is provided. Position engineering intervals for TOPS should be determined by joint agreement among the work groups mentioned in 4.04(a) above.

(d) An example of a Position Utilization Chart is shown on Figure 7. Figure 7 is a blank form which is capable of being reproduced locally and used to prepare the L&T Charts for individual sites. The L&T Chart included in the NDO should show projected usage from the Job Completion Date to five years in the future.

4.05 Supporting data justifying the forecasted IPS and projected AWT must be included in the NDO (see Figures 9 and 10). This supporting data should include historical WV and AWT, developed historical growth factors for IPS, explanations of variations in past trends, forecasted WV and AWT, forecasted growth factors used, explanations of why these factors are being used, explanation of why the projected AWTs are being used, etc. After two (2) years of usable IPS data has been accumulated, it must be used to make future position projections (See paragraph 4.02(b). Projections of IPS and AWT data should be adjusted for new features that affect position requirements. In addition, this data, adjustments, explanations, etc., should be summarized in such a way as to clearly justify the forecasted position requirements. Supporting data older than two (2) previous BSs is highly desirable even if it is old TSPS data converted to use for TOPS projections. Breakdowns of past and proposed call data between toll, CAMA and Local Assistance calls is desirable to support increasing composite growth factors while allowing for reductions in some classes such as Local Assistance calls.

4.06 Training position requirements are provided by training organizations or force planners for both cutover and ongoing training. Training position requirements provided in the NDO must be supported. The Network Designer should obtain this supporting information from the Operator Services training organization or force planners. Examples of supporting data are: historical training requirements, historical force turnovers, future new feature training requirements, etc. Supervisory and/or monitor type positions should also be included.

5. PROCEDURES FOR DETERMINING THE NUMBER AND SIZE OF OPERATOR CENTERS

5.01 Network Design should provide to the Operator Services Force Manager the total number of engineered positions required to serve the actual load for the most recent busy season and a projection of positions required for each of the next five consecutive busy seasons. These requirements should be determined using current authorized System and Company Network Design practices (see paragraphs 4.01-4.05). In addition, Network Design should determine the minimum number of Operator Centers (OCs), based on engineering criteria required to handle the proposed position requirements.

5.02 The Operator Services Force Management planners should prepare five (5) sets of analyses similar to that shown in Figure 11; one for the first busy season after most recent busy season and one for each of the next four consecutive busy seasons. These analyses can be made by completing paragraphs 5.02(a) & (b).

(a) Determine the system's total Busy Season operator requirements.

(b) Determine the minimum number of OCs required from a span of supervision standpoint.

For the span of supervision criterion, an approximation can be made by dividing the operator requirements in (a) above by 108 (range 90-120): the result of an average of 6 Group Managers-Operator Services (GMOS) per office multiplied by 15 to 20 operators per GMOS (See Figure 11, Step B(2)).

5.03 Once the best schedule fit plans for the various numbers of OCs have been identified for each of the five years, interdepartmental meetings should be held to review, evaluate and decide which will be the recommended plan. The results of these meetings, the economic analyses performed and the logic used to determine the best plan are all to be described in a narrative section. This narrative section, as well as the analyses shown in Figure 11, should be included in all Network Design Orders and subsequent Estimates addressing large team positions (adds, deletes or changes.)

(a) This narrative section should be in as much detail as is available. Items of consideration that have actual costs associated with them should be identified. Items of consideration that are intangible factors should be addressed and their impact on the decision explained clearly.

(b) The recommended plan for each of the five years should take into account the next year plan to provide for a smooth transition from year to year. Sometimes an economic interim plan may not be compatible with the proposed plans for the future years. Care should be taken to prevent significant changes to the office sizes yearly as this can have a detrimental effect on the office personnel as well as being uneconomical. The Recommended Five Year Plan form, Figure 13, is to be used and included in the NDO to show the recommended plan for the system. This form also permits an easy review of the recommended plan by the interdepartmental committee so they can insure that the proposed transitions year by year are satisfactory.

(c) To give additional supporting information for the recommended plan, the OC Schedule of Operations form (Figure 14) should also be completed and included in the NDO for the BP and future study periods. The schedule reflected on the forms should be for each BS of the base year and the study years.

(d) In addition, a formal planning study is required for those years where the resultant plan to be followed indicates an additional operator office is required but equipment constraints do not exist. The analyses discussed in the previous Sections as well as the narrative discussed in this Section should be included in the study materials as well as the Network Designer's justification of the total engineered positions required for each of the five years as defined in current Company Network Design practices. At least two plans are to be compared: the resultant plan and a plan that can provide the positions required for traffic without the addition of a new OC. All other feasible plans should also be evaluated. Select and support the best overall plan, taking into account both the administrative benefits of the large team concepts and economic considerations.

(e) Figure 12 is a mini example describing many of the additional planning considerations to be reviewed and analyzed at the interdepartmental meetings.

(f) The departments which should comprise the interdepartmental committee determining the plan to be followed in the Study, Network Design Order and Estimate are:

Network Design
Network Engineering
Network Planning
Network Maintenance
Operator Services - Force Management
Operator Services - Facilities Administration

Network Planning is ultimately responsible for ensuring that a plan is developed and for routing the plan through the involved departments to obtain the signature of the respective district, division, and department level people. The writer of the narrative section of the analyses should be Operator Services-Force Management.

6. DETERMINATION OF TRUNK REQUIREMENTS

6.01 The General Trunk Forecast, DS-1 forecast, and supporting data for trunk provisioning must be included in the NDO. Trunk quantities in the General Trunk Forecast must be validated with the trunk forecaster before inclusion in the NDO. The procedures to be used for determining trunk requirements are as follows:

(a) Some spare trunks and terminations may be provided for administrative spare for each TOPS Stand-Alone, Host & Remote. The present spare applies to a specific trunk type. The percent spare is not to be applied on a trunk group by trunk group basis. The percent spare should be determined based on the needs of the office. Since the introduction of equal access, many offices have experienced trunk shortages due to the lack of timely and accurate forecasts from the Interexchange Carriers. The history and future data on the office should be studied regarding the frequency of "surprise" trunk requests. If data supports more than about 5% spare, then it should be documented in the NDO. If less than 5% spare trunks are required, then less should be provided. A tandem switch is often limited on trunk terminations. Every effort should be made to justify spare trunk quantities with historical and actual data. If this is done, a decision based on a reasonable balance between service and cost will be more likely. The Network Designer should take great care to provide adequate terminations in the tandem switch for all TOPS and other tandem trunk groups.

(b) The General Trunk Forecast (GTF) will contain the required quantities of 0+/0- trunk groups into the TOPS Host, Remote OC, or Stand-Alone tandem. These are the trunk groups from the surrounding end offices. These trunk groups are terminated on either a Trunk Module (TM), if analog, or a Digital Trunk Controller (DTC), if digital. See Section 6 of the NT8620 Questionnaire for module provisioning guidelines.

(c) The quantity of voice and data circuits between the TOPS Host and Remote OC are determined by Network Design initially. They have recently been added as part of the GTF and, hopefully, will be tracked forecasted and serviced by the Trunk Engineering work group. Section 3 of the NT8620 has the engineering guidelines for these circuits. The data circuits must be digital end-to-end facilities on T-Span. The data links are terminated on Digital Carrier Modules (DCM) at the Host and Remote offices. One DCM and one T-Span interface must be provided at the Host and Remote. Unused channels 2 through 23 of the T-Span can be used for the voice links. The T-Span interface for the data circuits must be card 0. Voice links can be analog.

Official Communications Services (OCS) has responsibility for interlata Host-Remote Voice links and must be notified of new Voice links being provisioned or additions via the GTF. Unless these links are properly forecast in the GTF, facilities may not be available as needed.

(d) See paragraph 12.01 for more information on Remote OC engineering.

Also, the NDO must recommend diversification of the T-Span lines for each OC.

(e) Determination of Hotel/Motel Auto Quote and Voice Quote paths to the Automated Charge Quotation Service (ACQS) in Dallas, Texas is done by GHQ Operator Services. These paths are provided via the SWBT packet switching network, administered by GHQ Official Communications Services (OCS). GHQ Operator Services provides forecast information to OCS for future path provisioning.

(f) Busy Line Verification (BLV) trunk requirements are contained in the General Trunk Forecast.

(g) Centralized Automatic Message Accounting (CAMA) Transfer incoming trunk group requirements are also contained in the GTF.

(h) Other trunk group requirements, i.e., night service transfer groups, etc. should also be contained in the GTF.

7. DETERMINATION OF HARDWARE SERVICE CIRCUIT REQUIREMENTS

7.01 Since TOPS and its associated hardware are integrated into the DMS-100/200 tandem, service circuits for TOPS are determined in Section 3 of NT8620 Questionnaire. Service circuits required for TOPS are:

(a) Conference Circuits. The voice channel of the operator position is connected through the DMS-200 switching network to a designated port of a 3-port conference circuit. The other two ports are connected to the calling and called parties. Provide one 3-port conference circuit per TOPS position required to handle traffic originating at the Host, plus 5% spare. At the Remote, provide one 3-port conference circuit per voice link, plus an additional 5% maintenance "hot standby".

(b) Digital Modems. There is a "nailed-up" or permanent connection between each operator position, through the DMS-200 switching network, to a digital modem. Data channels of the operator and supervisory positions and printers are connected to these digital modems. The digital modems are provided one per TOPS position and one per TOPS printer/teletype device, i.e., FADS, etc. at the Host. At the Remote, provide one digital modem per hotel auto quote terminal or teletype and one per Network Operator Trouble Information System (NOTIS) teletype at the Remote. If NOTIS is provisioned at the Remote, one analog or digital trunk associated with the modem is to be provided.

(c) Digitone Receivers for MCCS. Digitone Receivers (DTRs) are used to receive the customer's credit card digits dialed. Provisioning for these DTRs is detailed in Section 3K of the NT8620 questionnaire and in the DMS-100/200 NDOP practice, SW241-060-900, paragraph 6.02(c).

(d) Coin Detection Circuits for ACTS. These circuits are used to recognize coin deposit signals from a coin phone. Provisioning instructions are detailed in Section 3L of the NT8620 Questionnaire.

(e) Digital Recorded Announcements (DRA) for MCCS and ACTS. Provisioning instructions for these announcements are contained in Sections 3K and 3L of the NT8620 Questionnaire. These announcement machines require one Maintenance Trunk Module (MTM) for the MCCS DRA and one for the ACTS DRA.

(f) Other miscellaneous trunks and service circuits required for TOPS in the DMS-100/200 are detailed in the NT8620 questionnaire, Section 6, in NTI system Planning Letter 84-01-001, issue #1, dated January 26, 1984, entitled "DMS-200 Operator Services Planning Letter", and in NTI Product Planning Letter 83-10-003, issue #2, dated November 4, 1983, entitled "DMS-200 TOPS Operator Centralization (OC)."

8. DETERMINATION OF FRAME AND MISCELLANEOUS EQUIPMENT

8.01 Calculations for provisioning of frames and other miscellaneous equipment required for TOPS are contained in the NT8620 questionnaire. All applicable sections provide for inputs and calculated results of individual equipment components. At the end of each section, individual components are added based on their frame associations. Frame requirements are based on these calculations. The Switching Equipment Engineer will also detail additional frames needed for test equipment, alarms, power, etc.

9. DETERMINATION OF MEMORY REQUIREMENTS AND THE QUANTITIES OF SOFTWARE COMPONENTS

9.01 Northern Telecom, Inc. has an automated dial-up system called MEMCALC, which is the basis for DMS-100/200 program store and data store words/card provisioning. SWBT policy letter 225.1001, dated March 20, 1987, signed by AVP-NCOE, transmitted to all Network Design groups the MEMCALC Manual. It explains Network Design's inputs and the resulting output of the program.

Designers should have a working knowledge of the MEMCALC system, including the algorithms used for memory card provisioning. User ID and password information for MEMCALC access are available in each Network Design group, i.e., same as that of the Provisioning and Quotation System (PAQS-100). Designers should study the MEMCALC output and work closely with NTI software engineers to verify adequate memory provisioning.

9.02 Selection of the appropriate software packages for TOPS are a key element in memory provisioning. Section 2 of the NT8620 questionnaire lists the available software packages and their associated Product Engineering Codes (PEC). To be sure of the latest issue of the NT8620, the designer should contact the local NTI sales representative. Selection of software packages should be done jointly by Network Planning, Switching Engineering, Network Design, Operator Services, and Network Administration/Maintenance.

9.03 There are other parameters which must be defined in every DMS switch. In addition to those in the MEMCALC program, there are many others which require close coordination between Network Design, Switching Engineering, Operator Services, and Network Administration/Maintenance. These parameters should be carefully reviewed in a joint session of these work groups. It has been proven that such a session, usually held during the NDO/Customer Information (CI) meeting normally attended by a NTI engineer, improves the likelihood of accurate parameter settings. It may be necessary to hold such sessions some time between the CI meeting and the Bulk Change Supplement (BCS) load in the switch. A document containing recommended parameter settings in DMS 100/200 switches in currently being drafted by GHQ Network Design, Switching Engineering, and Network Design, Switching Engineering, and Network Administration/Maintenance. Its release is expected in the third or fourth quarter, 1988. Even after the issuance of this GHQ document, it will always be necessary for the above mentioned work groups to jointly discuss and agree upon parameter settings for every switch.

9.04 NTI has issued a System Engineering Bulletin 88-01-002, dated January 22, 1988 entitled "DMS-100F Memory Administration Provisioning Policies." It references MEMCALC and provides guidelines for provisioning administrative spare. Designers should receive a copy of a Network Administration memory tracking report or graph on a monthly basis. Via use of the Maintenance Administration Positions (MAP) terminal command CCMNT, Network Administration/Maintenance queries the switch for a status of words used and spare. Guidelines issued by GHQ Network Administration instruct the field to pull the reports and track memory consumption monthly. Contact your Network Administration coordinate for this report.

10. OPERATOR CENTER (OC) NETWORK DESIGN ORDER

10.01 The Operator Center (OC) is the location where the operators are physically located. This location, often several locations served by one Host DMS TOPS tandem, can be several miles from the Host TOPS tandem. In most cases, a separate NDO for the OC is not necessary because provisioning is detailed in Section 3 of the NT8620 questionnaire. If there is a need for additional equipment items to be documented and ordered, see paragraph 10.02.

10.02 An OC NDO may be required for installation of a new OC, modifications to an existing OC and for the removal of an OC. These orders may need to be separate from the TOPS DMS tandem Host, Remote, or Stand-Alone NDO, even though OC information on positions, etc. is included in the TOPS Host, Remote, or Stand-Alone NDO. The reason for this distinction between the OC, where the operators are physically located, and the TOPS Host, Remote, or Stand-Alone tandem is that, often, there is equipment and furniture at the OC locations that is ordered separately from the other TOPS and switching equipment. The same Basis Data section guidelines listed in paragraphs 2.01 - 2.05 can be used as they apply to OC provisiong. Paragraphs 4.01 - 4.05 and 5.01 detail the determination of position requirements. Justification for other equipment or furniture items not ordered in the NT8620 questionnaire should be documented in the OC NDO, if it is determined that a separate OC NDO is necessary.

11. REMOTE OC TANDEM NETWORK DESIGN ORDER

11.01 Since a Remote OC tandem is a DMS 100/200 or DMS-200 switch, the same type of NDO is required to provision it as with a TOPS Stand-Alone or TOPS Host tandem. The same NDO requirements listed in this practice apply to the Remote OC tandem also, with the exception of Operator Position provisioning which applies to the Host only.

12. TOPS NETWORK DESIGN FORMS

12.01 Blank forms and face sheets referred to in this section are required for use by Network Design in the construction of the TOPS NDOs. The forms will not be stocked because of the limited number of TOPS NDOs written in Southwestern Bell. However, the forms have been provided in this practice on reinforced paper which renders the forms suitable for local duplication (copying). Therefore, the forms are to be duplicated locally as required.

FIGURE 1
(Paragraph 1.07)

Southwestern Bell

NETWORK DEPARTMENT

_____ STATE

NETWORK DESIGN ORDER NO. _____

DATE _____

TITLE: _____

CLLI: _____
CITY STATE BLDG ENTITY

REQUIRED FOR SERVICE DATE _____

ESTIMATE REQUEST NO. _____

TRUNK FORECAST DATED _____ VALIDATED _____ CMAPS ID NO. _____

NATURE OF AND NECESSITY FOR WORK:

SUMMARY OF EQUIPMENT CAPACITIES

PRESENT BCS _____	E.O.P. BCS _____	PRESENT	PROPOSED
PROCESSOR REAL TIME CAPACITY	CALL ATTEMPT CAPACITY		
	CALL ATTEMPTS		
	PERCENT CAPACITY		
	EXHAUST DATE		
POSITION UTILIZATION	21st. HHH CCS (Adjusted CD		
	POSITIONS REQUIRED (CD)		
	POSITIONS INSTALLED		
	POSITIONS AVAILABLE		
	PERCENT UTILIZATION		
DS-1 CAPACITY	DS-1 TERMINATIONS INSTALLED		
	DS-1 TERMINATIONS REQUIRED		
	PERCENT UTILIZATION		
	EXHAUST DATE		
MOST LIMITING COMPONENT (NON-POSITION)			
EXHAUST DATE - MOST LIMITING			
RELIEF DATE - POSITIONS			

PREPARED BY: _____

CHECKED BY: _____ RECOMMENDED: _____

CHECKED BY: _____ APPROVED: _____

FIGURE 2
(Paragraph 1.07)

Southwestern Bell

NETWORK DEPARTMENT
_____ STATE

NETWORK DESIGN ORDER
NO._____
DATE _____

TITLE: _____

CLLI: _____
CITY STATE BLDG ENTITY

REQUIRED FOR SERVICE DATE _____

TRUNK FORECAST DATED _____ VALIDATED _____ CMAPS ID NO. _____

NATURE OF AND NECESSITY FOR WORK:

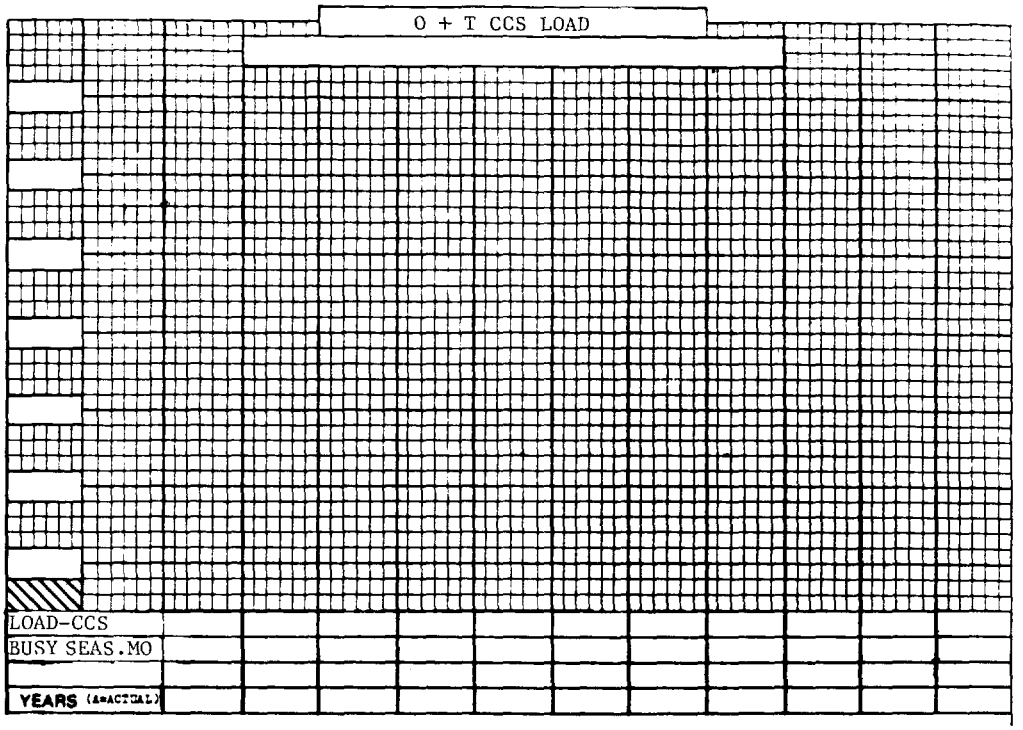
PREPARED BY: _____

CHECKED BY: _____ RECOMMENDED: _____

CHECKED BY: _____ APPROVED: _____

FIGURE 3 (Page 1 of 2)
(Paragraph 2.04)

LOADS AND TRENDS CHART



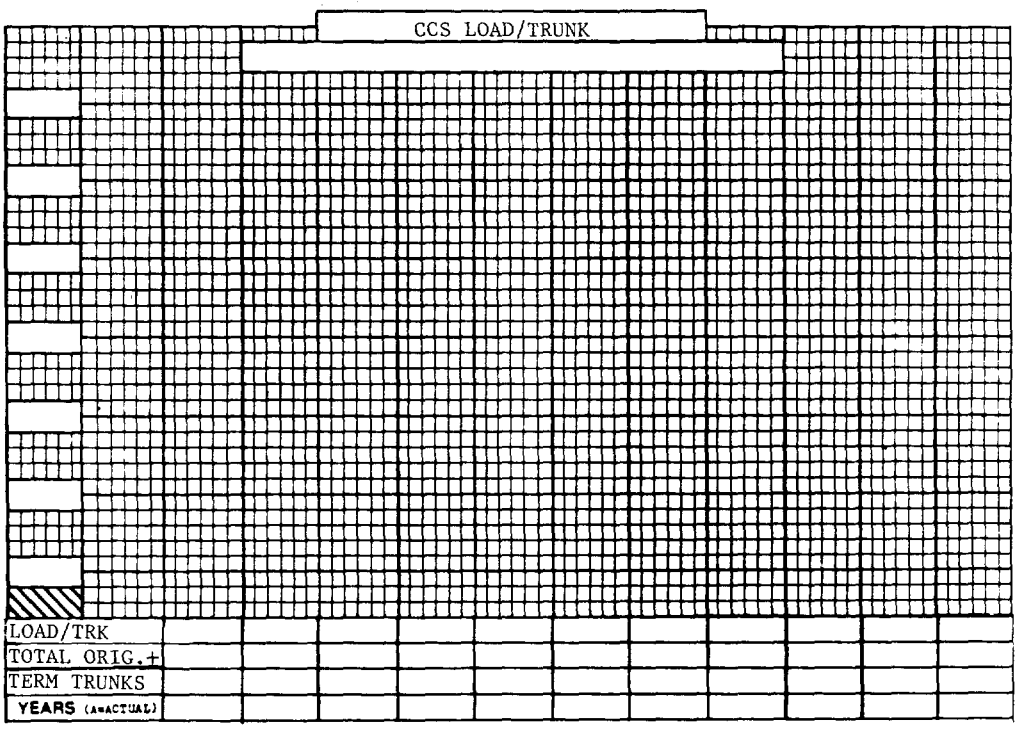
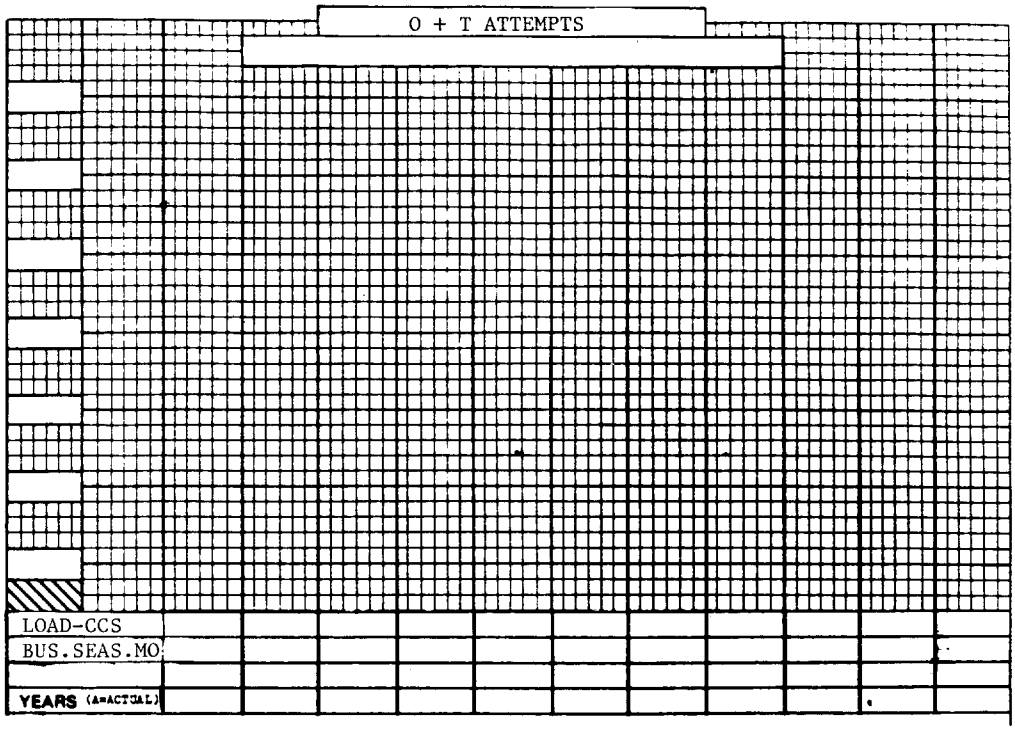


FIGURE 3 (Page 2 of 2)
(Paragraph 2.04)

LOADS AND TRENDS CHART



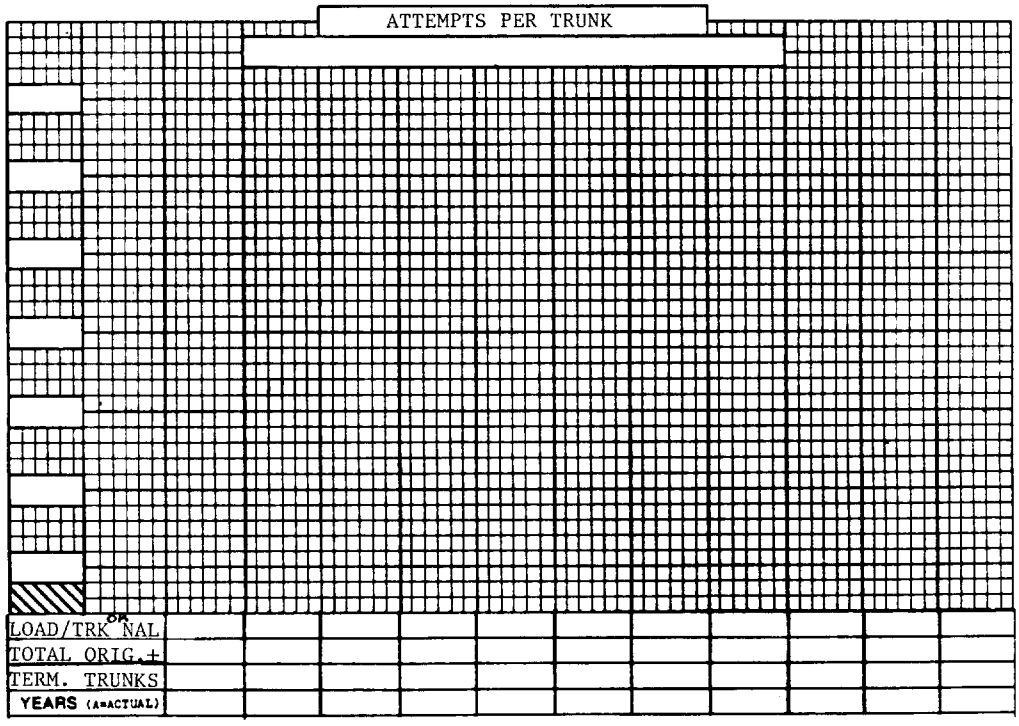
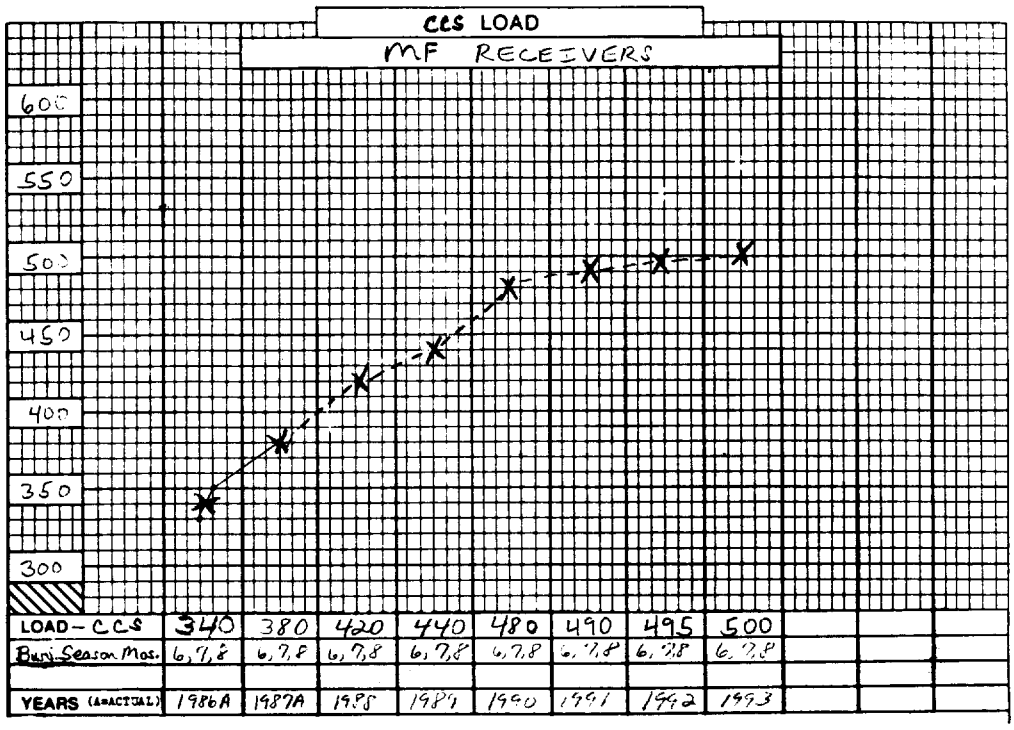
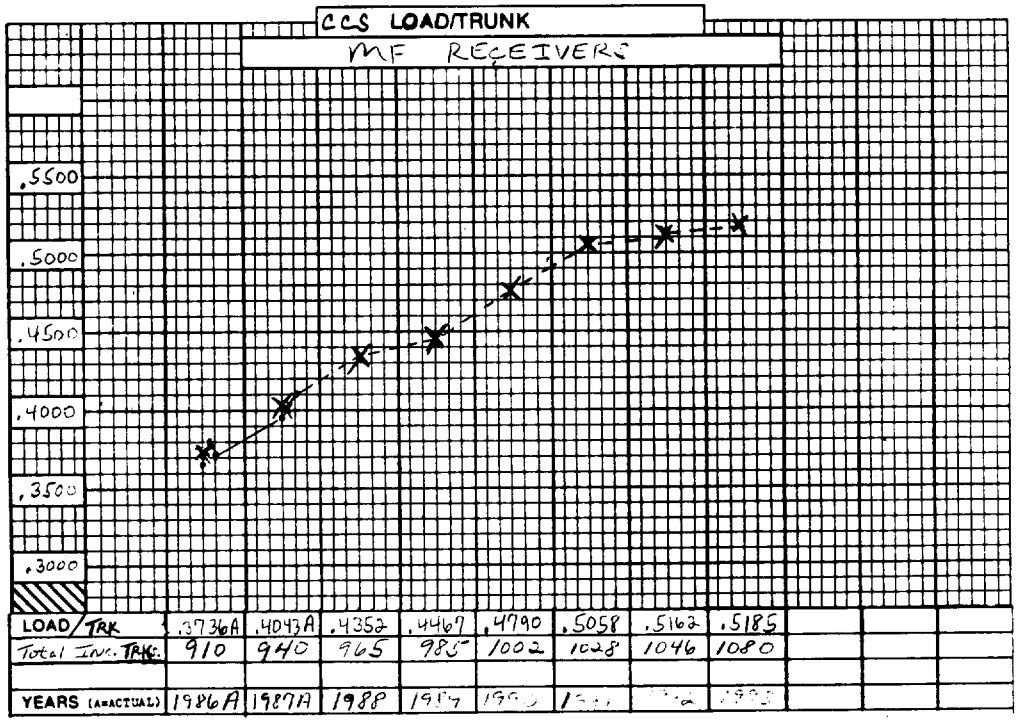


FIGURE 4
(Paragraph 2.04)



LOAD – CCS	340	380	420	440	480	490	495	500			
Busy Season Mos.	6,7,8	6,7,8	6,7,8	6,7,8	6,7,8	6,7,8	6,7,8	6,7,8			
YEARS (A=ACTUAL)	1986A	1987A	1988	1989	1990	1991	1992	1993			



LOAD/TRK	.3736A	.4043A	.4357	.4467	.4790	.5058	.5162	.5185			
Total Inc. TRKS.	910	940	965	985	1002	1028	1046	1080			
YEARS (A=ACTUAL)	1986A	1987A	1988	1989	1990	1991	1992	1993			

Note: UTRs, etc. can also be grouped in a similar manner.

FIGURE 5 (Page 1 of 2)
(Paragraph 3.03)

REAL TIME UTILIZATION CHART

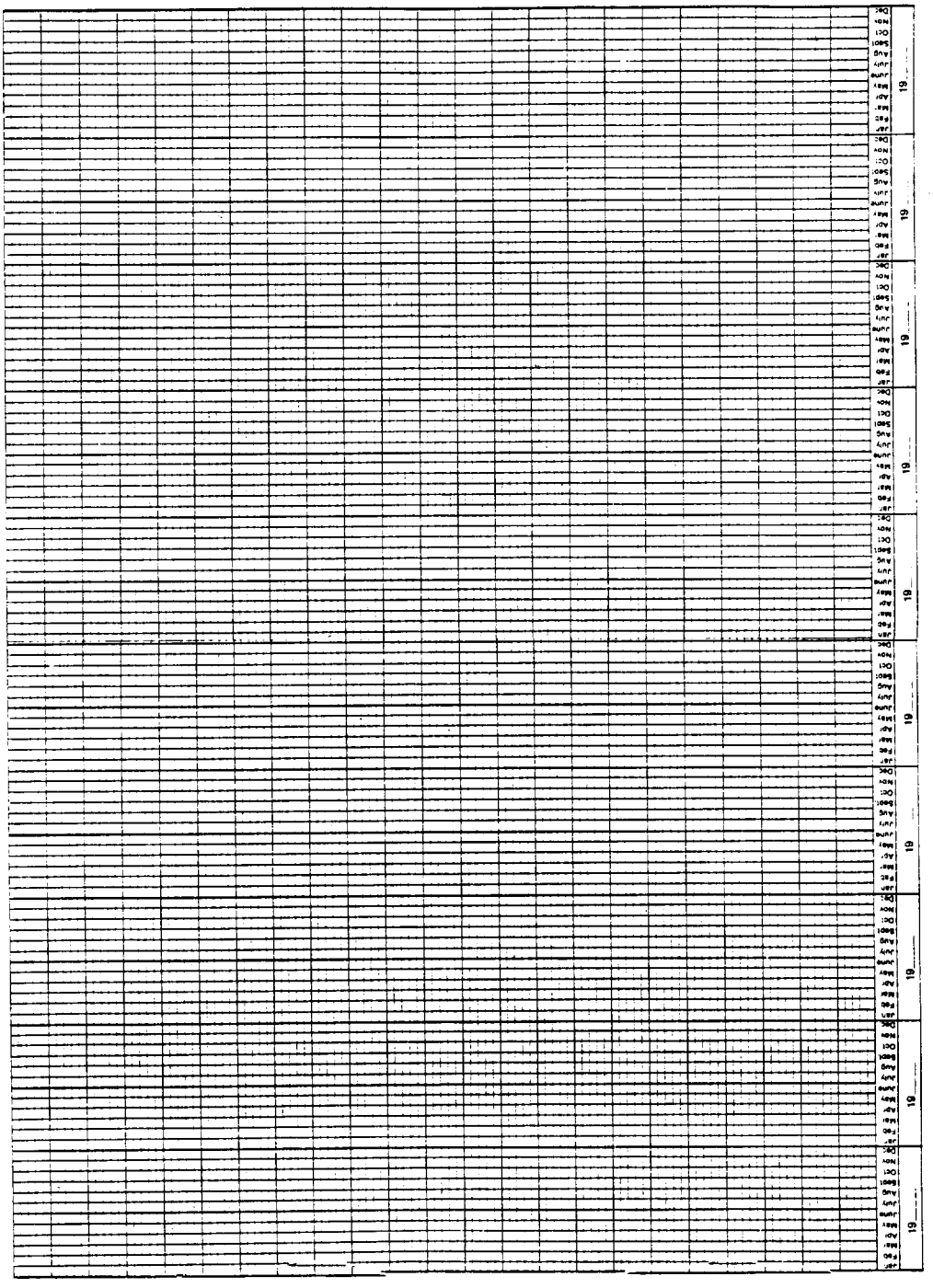


FIGURE 5 (Page 2 of 2)
(Paragraph 3.03)

REAL TIME UTILIZATION CHART

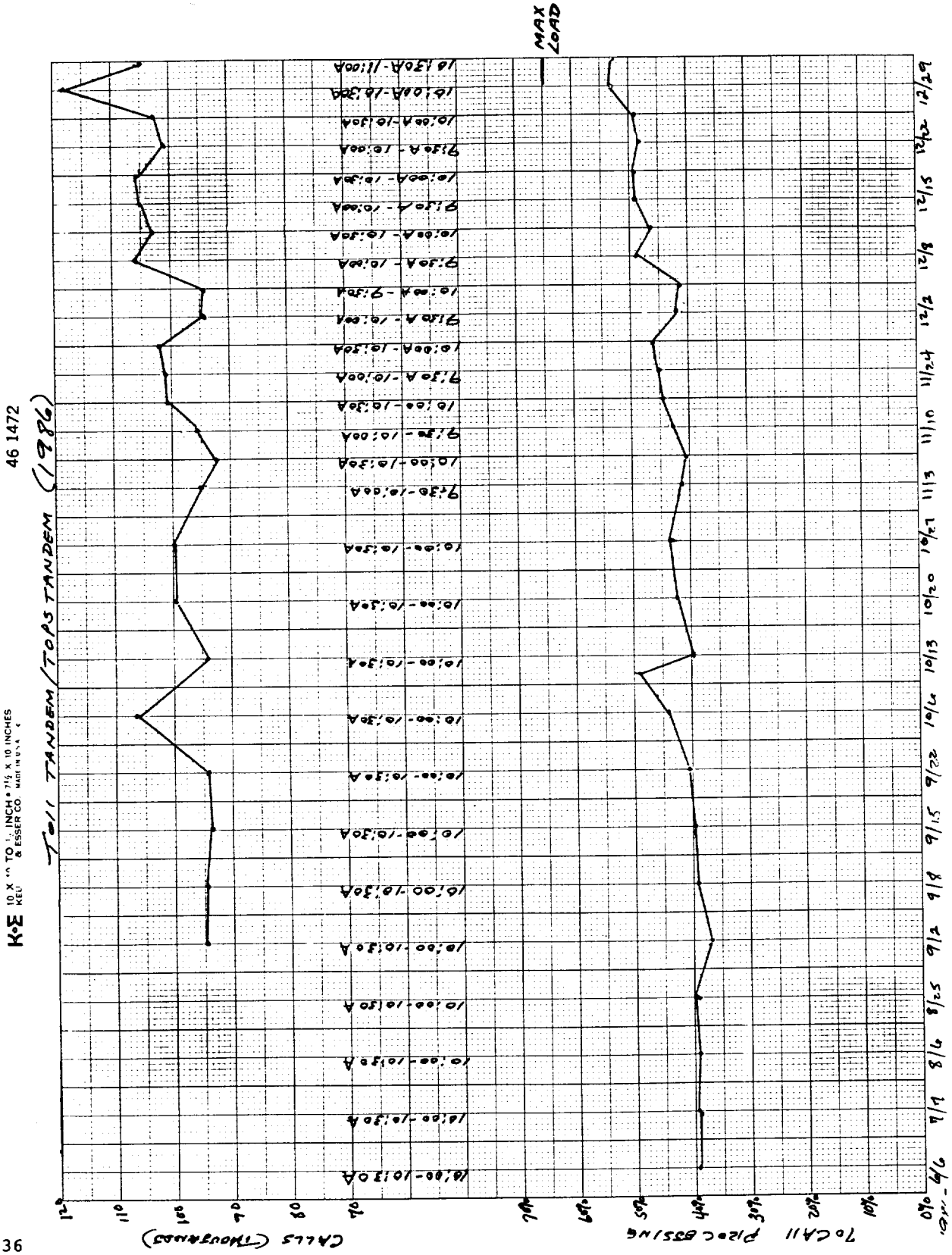


FIGURE 6 (Page 1 of 3)
(Paragraph 4.04)

SAMPLE - FADS DATA OUTPUT

Mon 14-Dec-1987 TOPS Session Team Report
REQUESTED: Tue 15-Dec-1987 09:19
SWT = 25.0

	SYSTEM IPS	AVG ANS	BAND	CLS WTG	AWT	ACT W/V	INIT W/V	% A/I	STD W/V	POS OCC	% OCC	SCANS
06:15A	246	49.4	5	121	25.3	62	28	222.3	62	63.9	97.4	90
06:30A	390	48.8	5	190	23.6	92	36	255.7	98	93.6	98.3	90
06:45A	590	40.9	5	241	19.3	113	53	214.8	148	115.2	98.8	90
07:00A	677	42.9	5	290	20.1	136	74	183.9	169	143.1	95.1	90
07:15A	1031	44.0	5	453	20.5	211	111	190.4	258	215.1	98.3	90
07:30A	1110	45.7	5	507	21.1	234	135	173.5	278	236.7	98.9	90
07:45A	1400	41.4	5	579	19.4	271	161	168.7	350	277.2	98.0	90
08:00A	1828	24.6	5	449	18.1	330	200	165.4	457	339.3	97.5	90
08:15A	2214	21.8	5	482	19.5	431	294	146.8	554	436.5	98.9	90
08:30A	2211	5.9	5	130	19.2	424	311	136.5	553	448.2	94.7	90
08:45A	2441	16.1	5	393	19.1	466	345	135.1	610	475.2	98.1	90
09:00A	2367	1.6	3	37	19.3	456	366	124.8	592	491.4	93.0	90
09:15A	2636	7.5	5	197	19.4	511	431	118.7	659	522.9	97.8	90
09:30A	2560	16.5	5	422	20.0	512	422	121.3	640	522.9	97.9	90
09:45A	2594	1.3	2	33	19.8	513	441	116.5	649	548.1	93.7	90
10:00A	2485	2.5	3	62	20.6	511	414	123.6	621	528.3	96.9	90
10:15A	2560	3.3	4	84	21.0	537	463	116.1	640	569.7	94.4	90
10:30A	2435	1.6	3	38	21.8	530	441	120.4	609	553.5	95.9	90
10:45A	2355	8.4	5	197	21.7	511	423	120.8	589	530.1	96.4	90
11:00A	2288	4.2	5	96	21.6	494	424	116.6	572	520.2	95.0	90
11:15A	2261	7.2	5	162	22.8	515	417	123.6	565	524.7	98.2	90
11:30A	2314	4.7	5	108	23.0	532	436	122.1	579	552.6	96.3	90
11:45A	2248	9.4	5	211	23.5	528	418	126.4	562	531.0	99.5	90
12:00N	2209	5.9	5	130	22.9	505	401	126.1	552	515.7	98.1	90
Session1	45450	12.4		5624	20.8	9436	7245	130.2	11366	9755.1	96.7	2160
Day	45450	12.4		5624	20.8	9436	7245	130.2	11366	9755.1	96.7	2160

	********** SCHED	FINAL	ACT	OPERATORS REQ	STD	********** A-F	A-R	S-R	F-R
06:15A	5.0	7.0	7.1	10	10	0.1	-2.9	-5.0	-3.0
06:30A	7.0	10.0	10.4	13	14	0.4	-2.6	-6.0	-3.0
06:45A	8.0	13.0	12.8	15	20	-0.2	-2.2	-7.0	-2.0
07:00A	10.0	16.0	15.9	18	22	-0.1	-2.1	-8.0	-2.0

FIGURE 6 (Page 2 of 3)

FADS OUTPUT REPORT COLUMN DESCRIPTIONS

SYSTEM IPS - A count of customer originated calls which reach operator positions. This count excludes position re-seizures and operator originated calls.

AVG ANS - The speed, in seconds, with which the average call is answered during a given time.

BAND - A number from 1 to 5 that indicates the average speed of answer customers are being served.

CLS WTG - The number of customers waiting in queue for position attachment.

AWT - The length of time, in seconds, used to handle the average call.

ACT W/V - All occupied operator positions which are busy handling a call or are otherwise unavailable to handle a new call for any reason.

INIT W/V - Estimated occupied operator positions busy handling a call or unavailable to handle a new call for any reason.

% A/I - The percent actual work volume to initial or estimated work volume.

STD W/V - The initial position seizures multiplied by the standard work time.

POS OCC - The number of operators occupying positions over a defined period of time.

% OCC - The percentage of time that occupied positions were busy during a measured period of time.

SCANS - Represents the number of scans made in a half-hour by the Traffic Usage Recorder (TUR) associated with the operator positions.

FIGURE 6 (Page 3 of 3)
(Paragraph 3.02)

TOPS AND TOTAL SWITCH REAL TIME OMs

(A complete and detailed explanation of each Operational Measurement group and field name listed here can be found in NTI practice, NTP 297-1001-114 and the corresponding Supplement. These OMs should be used as a basis for the REAL::TIME program referenced in paragraph 3.02.

DATA COLLECTION--ALL OFFICES

GROUP	FIELD NAME
TS	ALL
TRK	NATTMPT,INCATOT,NOVFLABT,INFAIL, OUTFAIL,TANDEM(GROUP TOTALS ONLY)
UTR	ALL
OFZ	ALL
OFZ2	PSGM,PDLM
EXT	EXTSEIZ,EXTOVFL
CP	CCBOVFL,CPTRAP,CPSUIC,ORIGDENY, WAITDENY,CPLOOVFL,CPLPOVFL,OUTBOVFL, MULTOVFL,WAKEOVFL
TRMT1	BLDN,BUSY,HNPI,NBLH,NBLN,NCRT,NOSC, PDIL,PSIG,RODR,SSTO,SYFL,UNDT,VACT
TRMT2	GNCT
TRMT3	STOB,STOC
TONES	ALL
ANN	ANNATT,ANNOVFL
RADR	ALL
RCVR	ALL
STN	STNATTS,STNMTCHF,STNOVFL
DTSR	ALL
SITE	ALL
RCF	RCFOFFRD,RCFDFLD
CWPOTS	ALL
SCPOTS	ALL
TWCPOTS	ALL
PMOVLD	ALL
CWTPOTS	ALL
CP2	ALL
ATTAMA	ALL
ATTLAMA	ALL
AMA	ALL
MACHACT	ALL
CF3P	ALL

ADDITIONAL DATA COLLECTION-TOPS OFFICES

GROUP	FIELD NAME
CDACTS	ALL
CDMCCS	ALL
DSMCCS	MCCSQRY,MCCSNAXR,MCCSABND, MCCSMERR,MCCSDBOV,OSTOPER
TOPSIPS	ALL
TOPSMISC	ALL
TOPSMTCE	ALL
TOPSQ	ALL
TOPSTRAF	ALL
TOPSUSE	ALL
TOPSSVC	ALL
TOPSOCPS	ALL
TOPSEA	ALL
TOPSQS	ALL
TOPSPSZ	ALL
TOPSRON	ALL
TOPSOC	ALL

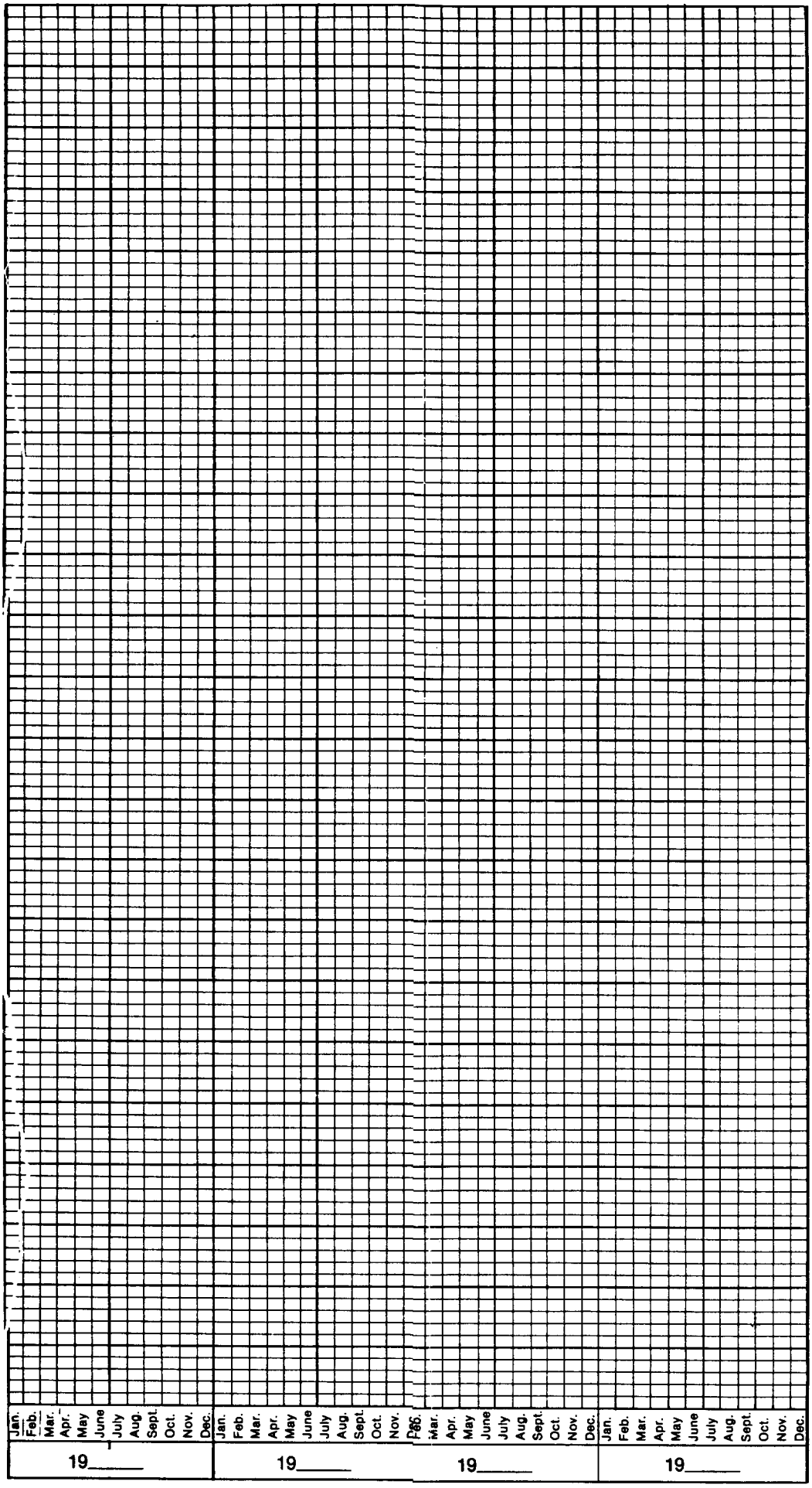


Figure 7 (paragraph 4.04)

FIGURE 8

(Paragraph 4.04)

POSITION UTILIZATION CHART

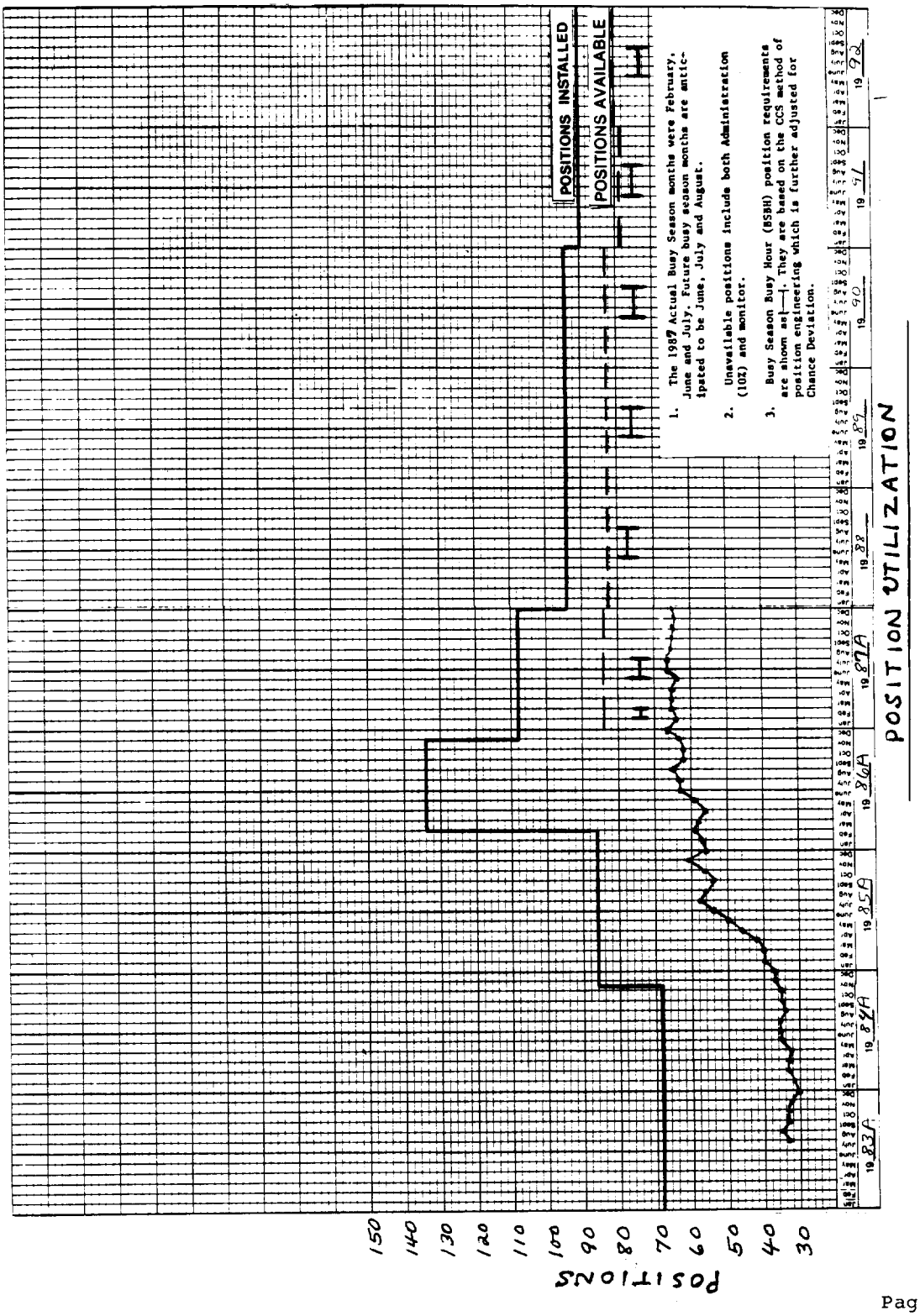
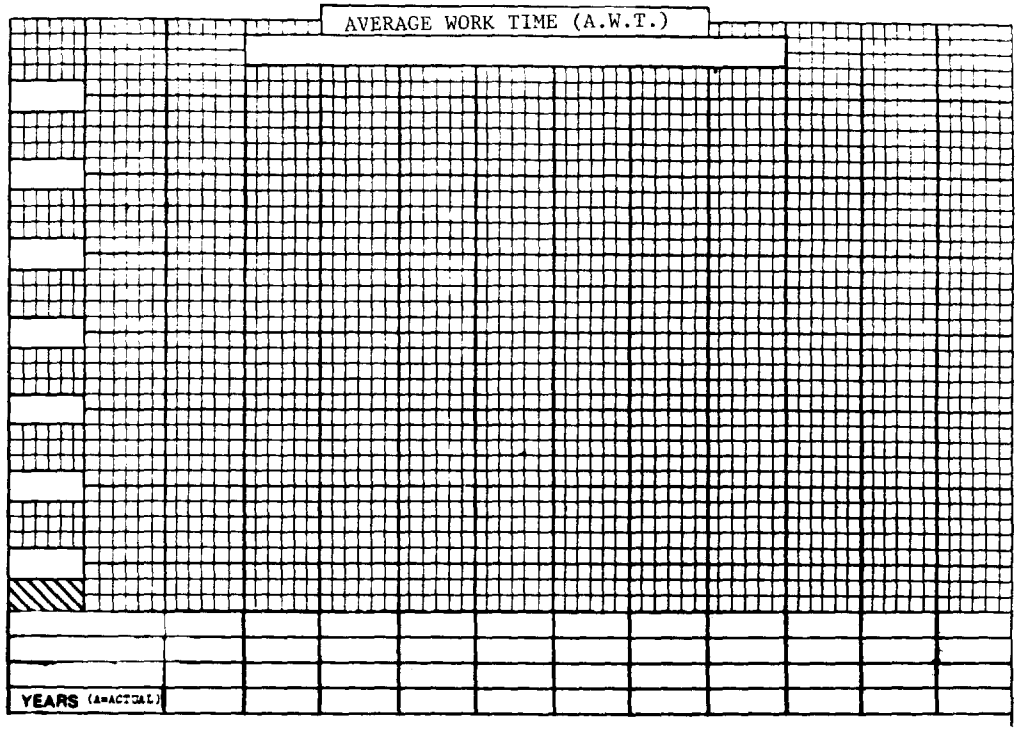


FIGURE 9
(Paragraph 4.05)

BLANK - AWT AND WV CCS CHART

LOADS AND TRENDS CHART



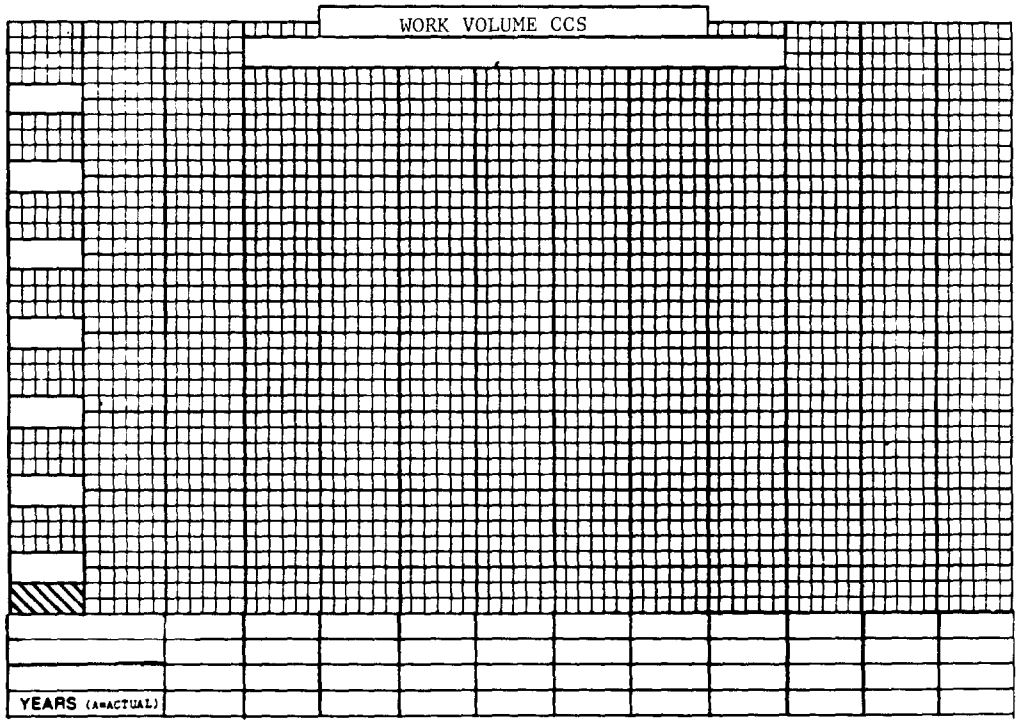
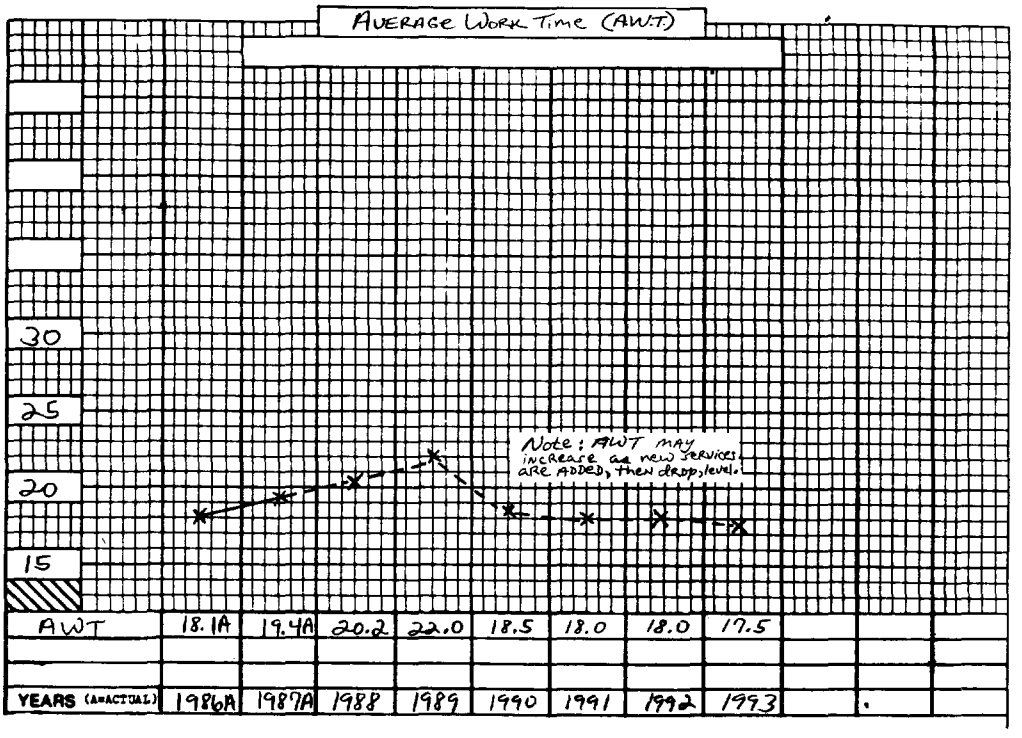


FIGURE 10
(Paragraph 4.05)

AWT AND WV CCS CHART



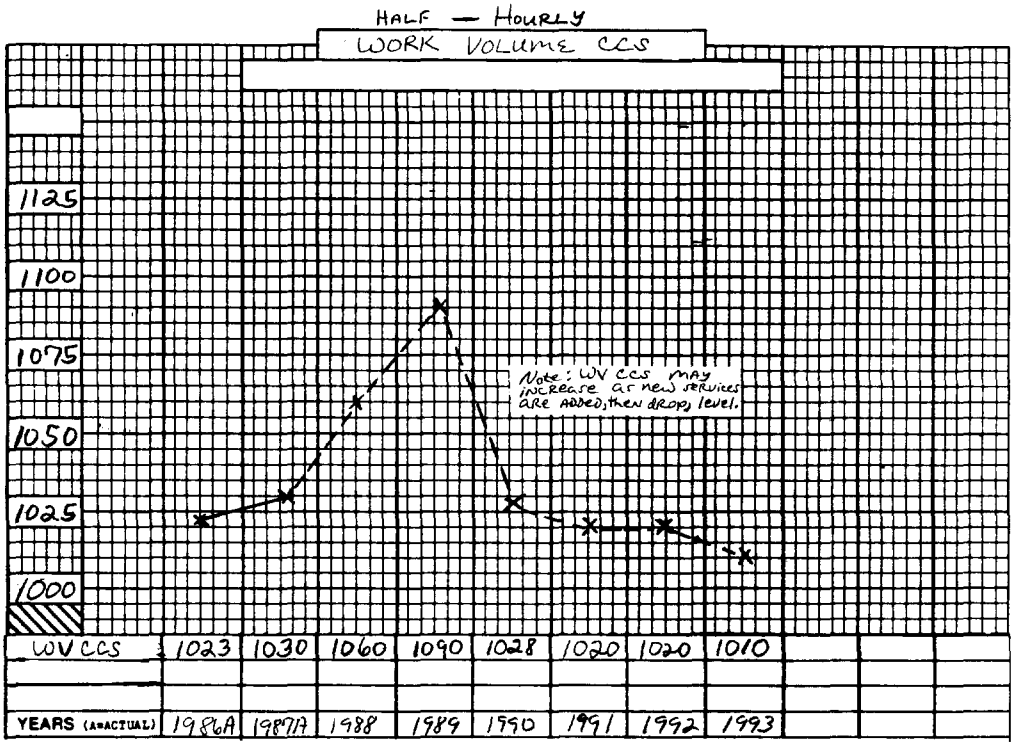


FIGURE 11
(Paragraph 5.0)

A. Engineered Office Requirements (from Network Design) (Note 1)

Estimated Total Positions Installed	150
Total System Position Requirements	124
Maximum Positions Per Office	62
Minimum Number of OCs	2.41 or 3

B. (1) Total Operator Requirements

		TSPS COMPLEX Avg. Bus. Day-Busy Season
Calls		119100 (Note 2)
SWT (Standard Work Time)		50 (Note 2)
STD. Wk. Vol. (CCS)		59550 (Note 2)
STD. CCS/Bd. Hr.		32.4
STD. Bd. Hrs.		1838
OPRNG. EFF. RATIO (SWT AWT)		1.20
Planned Bd. Hrs.		1532
Relief Hrs. (9.5%)		146
Misc. Hrs. (7.0%)		107
Total Hrs.		1785
Avg. Ov'll Tour Lgth.	7.0	
Required Operators		255
Percent Sat. Operators (67)	170	
Percent Sun. Operators (50)	128	
Day off relief Operators		60
Training (Based upon Hiring STRATEGY)		7
Absence (5%)		16
Administrative Force Margin (5%)		16
Vacations (Avg. 2 1/2 wks./opr.)		17
EWP EWN (5 Days/opr.)		6
Total Operators required		377

(2) Office Requirements (via span of supervision)

Operators	377
Approximate Operators per Office	108 (Range 90-120)
Number of Offices	3.5 or 4

FIGURE 11 (Cont.)
(Paragraph 5.0)

This is for example purposes only. MCAUTO's mechanized program can be used for this calculation, exclude service assistant, clerical and management requirements.

(3) Selected Days/Hours of Operation Based on Projected System Distribution.

	Plan 1		Plan 2	
	Days	Hours	Days	Hours
Office A	7	24	7	24
Office B	7	16	7	16
Office C	6	14	6	16
Office D	5	12	-	-

(4) Maximum Office Sizing (Operators) (Note 3)

	Plan 1				Plan 2			
	Days/ Hrs. of Oprn.	Grp. Mgrs.	Oprs/ Grp. Mgr.	Total Oprs.	Days/ Hrs. of Oprn.	Grp. Mgrs.	Oprs/ Grp. Mgr.	Total Oprs.
Office A	7/24	7	15	107	7/24	9	16	142
Office B	7/16	6	17	100	7/16	8	17	132
Office C	6/14	5	17	90	6/16	8	14	114
Office D	5/12	5	16	80				
Total		23		377	Total	25		388

FIGURE 11 (Cont)
(Paragraph 5.0)

(5) Maximum Office Sizing (Positions).

	Plan 1					Plan 2			
Office	A	B	C	D	Total	A	B	C	Total
Days	7	7	6	5		7	7	6	
Hours	24	16	14	12		24	16	16	
Grp. Mgrs.	7	6	5	5	23	9	8	8	25
Operators	107	100	90	80	377	142	132	114	388
Less:									
Sat. Oprs.	(58)	(54)	(58)	(-)	(170)	(62)	(58)	(55)	(175)
Sun. Opr.	(67)	(61)	(-)	(-)	(128)	(68)	(47)	(-)	(132)
Day off Relief Oprs.	25	23	12		60	26	24	11	61
ABD Oprs. Avail. (Note 4)	82	77	78	80	317	116	108	103	327
ABD Oprs. req'd for Traffic (Note 5)	66	62	65	68	261	95	89	85	269
Individual Office B.Q.H. Posns. (Note 6)	31	34	38	43	146	46	49	53	148
FMS System B.Q.H. Posns. (Note 7)					134				137
Administrative Positions (Note 8)					12				11
Positions Installed (Note 9)	32	36	38	44	158	46	50	54	156
(6) Administrative Position Margin (Note 10)					9.7%				8.9%
Utilization (Note 11)					92.5%				91.2%

FIGURE 11 (Cont)
(Paragraph 5.0)

Note 1: Network Design will estimate installed positions based upon objective engineering criteria utilization and percent administration.

Note 2: Data used by Operator Services Force Managers to calculate total operators required should agree closely with data projected and used by the Network Designer to determine total engineered positions required to handle traffic. Substantial differences must be resolved.

Note 3: For example purposes, Plan 2 reflects a 3% decrease in productivity due to improper span of supervision. This decreased productivity results in an increase of required oprs.

Note 4: The Saturday/Sunday operator requirements were proportioned for those offices that were open based on the proportion of operators available. The day off relief force was derived by adding the Saturday and Sunday requirements and dividing by 5.

Note 5: The ABD operators required for traffic are derived by reducing the ABD operators availabe to allow for vacation, absence, etc. It can be calculated by dividing the total ABD operators required on Item 1 of this example by the total operators available and multiplying by each office (e.g., office A: 122 x 262 ÷ 318 = 101).

FIGURE 11 (Cont)
(Paragraph 5.0)

Note 6: Individual Office Busy Quarter hour Positions (B.Q.H. POSNS.) as determined by allocation of FMS Schedules. Maximum Individual Office B.Q.H.'s may occur on different days of the week or in different weeks if weekends are rotated.

Note 7: The System Busy Quarter Hour Positions (B.Q.H. POSNS.) as determined from FMS Schedules.

Note 8: The difference between the FMS System Busy Quarter Hour Position Requirement and the Individual OC Busy Quarter Position Requirement.

Note 9: Configuration of installed positions.

Note 10: Example calculation of TOPS Percent Administrative Margin:

Sum of Ind. OC B.Q.H. POSNS.	146
Minus FMS System B.Q.H. POSNS.	134
	12

$$\frac{\text{Difference}}{\text{N.D. POSNS. Req. for TFC (CD)}} \times 100 = \%\ \text{Adm. POSN. Margin}$$

$$\frac{12}{124} \times 100 = 9.7\%$$

Note 11: Example calculation of TOPS percent utilization:

Total Installed Positions	158
Minus Adm. Pos.	12
Minus Monitors	4
Minus MTNCE	8
Equals Available POSNS.	134

$$\frac{\text{N.D. POSNS. REQ. for TFC (CD)}}{\text{Available POSNS.}} \times 100 = \text{Percent Utilization}$$

$$\frac{124}{134} \times 100 = 92.5\%$$

Note 12: This is a TOPS example.

FIGURE 12
(Paragraph 5.0)

Additional Planning Considerations Relative to Position Sizing for TOPS.

To deploy large team system total positions in groups representing position subsystems (OC'S) in an optimum configuration involves a series of trade offs. The interdepartmental meetings should identify all quantifiable costs, all intangible factors and then make a decision. All the items discussed, the results of the discussions, costs, intangible factor impacts, etc., should become part of the narrative section as described in paragraph 5.03 (a)-(f).

Following are a series of factors, grouped by categories, that should be considered in determining the final plan:

Example:

Let us assume we have a TOPS that requires approximately 170 installed positions at the end of an engineering period and we could configure them in one of several arrangements as shown:

	Loc. A	Loc. B	Loc. C	Loc. D
Plan 1	62	62	46	-
Plan 2	46	46	46	32
Plan 3	56	46	36	32

A. Other Administrative Considerations

1. What size labor market can be supported in each of these offices? Is the available labor market a limiting constraint which in turn limits the number of positions? Where should OC'S be placed (use demographic studies)?

2. Assuming there is an existing TOPS operation at location D, under Plan 1, consider the following -

   - What happens to the Company's image as a stable job supplier in this community if this location is abandoned? What happens to the Company's reputation among its employees?

   - What employee relocation expenses will be incurred? Identify these costs. Will there be a need to pay termination allowance to some existing employees? Identify this expense.

   - Can the employees in location D be relocated to the Company jobs, i.e., Directory Assistance, Intercept, Customer Assistance, Business Office, etc.

FIGURE 12 (cont)
(Paragraph 5.0)

3. How does the establishment of a new operating location or abandonment of existing locations blend with Equal Employment Opportunity (EEO) goals and targets?

4. What are the planned schedules for each of the operating locations, i.e., day only, 24 hour, 5 day offices, 7 day offices, etc.? The answer to this question is crucial to the position sizing question. The 46 position office could have a larger force if it were a 24 hour, seven day office than the 62 position office, with a five day, day only schedule. This consideration is discussed in detail in Section B.

5. What is a reasonable total force that one manager can be expected to administer successfully. Since there is a people limit, the position sizing should be developed considering the factors previously outlined (Item 4 above and Section B).

6. Span of supervision effectiveness: Manager-Operator Services (MOS) can handle 6-8 GMOS each (108 operators). Size of operating force then determines the number of positions needed, looking at office hours and force schedules.

7. Operator Courtesy results.

8. TELSAM results.

9. Operator Accuracy results.

10. Quality of work life - job quality items.

11. Training and development quality.

12. Operator job satisfaction improvement.

13. Guaranteed planning, development and administrative time for GMOS.

14. Impact on Position Utilization requirements.

B. Operations Expense Considerations

In our example, Plans 2 and 3 incur operation expenses greater than Plan 1. The expenses need t be quantified wherever possible. A partial list includes the following:

FIGURE 12 (Cont)
(Paragraph 5.0)

- building service maintenance for office D.

- equipment maintenance for office D. Although it could be argued maintenance costs in offices A, B, and C, are higher in Plan 1 due to more positions, these should not normally offset the additional site maintenance costs in Plans 2 and 3.

- employee and building security expenditures at office D.

- wage rate differentials between sites, if applicable.

- Operator Services Administration expense, i.e., additional clerical force required for the additional site, if applicable: additional Service Assistants and Managers, if applicable: additional expenditures for schedules, force programs, etc., for site D.

- Operator savings resulting from improved efficiency.

- Impact on operator turnover.

- Impact on training time.

- Effect on absence results.

C. Capital Expenditures/Engineering Considerations

1. In the instance where site D is a remote or semi-remote office, Plans 2 and 3 carry additional outside plant facility expenditures. There also needs to be an evaluation of providing diversified routes if they do not exist presently to any site including D. Central office equipment circuit capital expenditures for office D (at D and the Host) need to be included.

2. Plans 2 and 3 contain Land & Building capital expenditures not included in Plan 1. Land & Building expenditures in Plan 1 are probably greater in offices A, B, and C than Plans 2 and 3, but this does not offset the cost of office D. In the case where office D goes into existing telephone company building space, any building refurbishment charges should be incorporated in Plans 2 or 3.

FIGURE 12 (cont)
(Paragraph 5.0)

3. Any penalties incurred due to equipment sizing breaks should be included in the appropriate plan.

After the relevant cost differences (capital and expense) have been quantified, the interdepartmental committee is in a position to identify the plan with the least present worth of expenditures. It may be appropriate to select a plan that does not have the lowest present worth of expenditures for any of the numerous reasons cited earlier, but the committee can also identify the "cost" of selecting any such plan. The committee should also note all intangible or non-quantifiable factors contributing to the recommended plan. This will allow the company to quantify the "cost" of alternative decisions relative to operator office sizing.

FIGURE 13
(Paragraph 5.03(b))

Southwestern Bell _____ System

RECOMMENDED FIVE YEAR PLAN

POSITION ARRANGEMENT BY YEARS	INSTALLED POSITIONS						TOT. SYS. INST. POS.	POS. REQD. FOR 21st HHH ENGR.	% ADM. POS.
	OFC. A	OFC. B	OFC. C	OFC. D	OFC. E				
MOST RECENT BUSY SEASON 19___									
1st YR. 19___									
2nd YR. 19___									
3rd YR. 19___									
4th YR. 19___									
5th YR. 19___									

FIGURE 14 (Page 1 of 2)
(Paragraph 5.03(c))

OC SCHEDULE OF OPERATION

DATE: 2-1-88
STATE: ANYSTATE
OC UNIT: ANYBASE

SCHEDULE OF OPERATIONS—EXPECTED IMPLEMENTATION DATE: 5-31-88

		OC -0-	OC -1-	OC -2-	OC -3-	OC -4-	OC -5-	OC -6-	OC -7-
INSTALLED POSITIONS	PRESENT	50	54	54					
	CHANGE TO DATE	44 5-31-88	48 5-31-88	48 5-31-88					
NUMBER OF DAYS OC IS OPEN PER WEEK		7	6-7	7-6					
CALENDAR DAYS OC IS OPEN PER WEEK		SUN THRU SAT	SUN THRU SAT	SUN THRU SAT					
NUMBER OF HOURS OC IS OPEN PER DAY		24	15	17½					
CLOCK HOURS OC IS OPEN PER DAY		—	0800 THRU 2300	0630 THRU 2400					
LOCATION (Complete Address)		1 BDWY ANYCITY ANYSTATE	2 MAIN SOMECITY ANYSTATE	3 OAK OTHERCITY ANYSTATE					
WEEKEND ROTATIONS (Clearly Defined)		OC-1 and OC-2 ROTATE SUNDAYS OFF.							

FIGURE 14 (Page 2 of 2)
(Paragraph 5.03(c))

OC SCHEDULE OF OPERATION

DATE: _____
STATE: _____
OC UNIT: _____

SCHEDULE OF OPERATIONS—EXPECTED IMPLEMENTATION DATE: _____

	OC -0-	OC -1-	OC -2-	OC -3-	OC -4-	OC -5-	OC -6-	OC -7-
INSTALLED POSITIONS — PRESENT								
INSTALLED POSITIONS — CHANGE TO DATE								
NUMBER OF DAYS OC IS OPEN PER WEEK								
CALENDAR DAYS OC IS OPEN PER WEEK								
NUMBER OF HOURS OC IS OPEN PER DAY								
CLOCK HOURS OC IS OPEN PER DAY								
LOCATION (Complete Address)								
WEEKEND ROTATIONS (Clearly Defined)								