GENERAL LOAD BALANCING PROCEDURES

SWITCHING, BILLING, AND CENTRAL OFFICE SYSTEMS MANAGEMENT

NETWORK OPERATIONS METHODS

1. GENERAL

PURPOSE

1.01   This section describes load balancing techniques as they relate to all types of central offices with primary emphasis on the load units serving customer lines. See Part 5 for a list of Bell System Practices pertaining to specific types of equipment.

1.02 This section is being issued to enable each of the existing sections on load balancing procedures to be shortened by removing all balancing information of a general or theoretical nature and placing it in this section. This will avoid the duplication of general information in the individual load balance sections. When this section is reissued, this paragraph will contain the reason for reissue.

1.03 The title of each figure in this section includes a number(s) in parentheses which identifies the paragraph(s) in which the figure is referenced.

1.04 This section is a full revision and consolidation of numerous documents on load balance. This includes: Load Balance Index Plan, Section 780-350-050, 780-020-031, 226-020-110, 216-020-110, 218-020-110, 231-070-740, 232-070-110, and TL 562 issued in 1966. This section also replaces all parts of the Central Office Management Guide, Division E, Section 4, which describes line balance by class of service and line loading including the development and interpretation of the score system and quality control limits (QCLs).

1.05 A load balance index plan has been developed for all traffic units which are capable of supplying usage data for load units serving customer lines. Data must be available on at least a monthly basis.

1.06 While the same load balance data may be used for indexing and administrative purposes, the data qualifications for indexing purposes are more stringent to ensure a standard basis of reporting among all offices. Therefore, the data requirements and procedures for indexing contained in Section 780-350-050, Load Balance Index Plan, will be followed.

NETWORK ADMINISTRATION RESPONSIBILITIES

1.07 The network administrator is responsible for ensuring that a traffic unit is providing the best possible service to customers for the offered traffic load. Good balance is recommended to achieve maximum benefits of the load-service relationship. The line assignment procedures established by the network administrator for a traffic unit are reflected in its load balance.

1.08 To achieve the objectives of good balance, the network administrator must arrange for the timely completion of the following work items:

(a) Loading plans

(b) Busy hour and side hour determination

(c) Scheduling of load balancing studies

(d) Data collection and validation

(e) Load balance analysis and corrective action

(f) Preparation of load balance forms

(g) Preparation of customer line usage assignment forms.

2. PRINCIPLES OF LOAD BALANCE

GENERAL

2.01 Balance in a traffic unit exists when the load generated by customer usage is distributed proportionately over all load units in the switching trains and networks. Since perfect balance is virtually impossible because of the chance variation of customer-offered loads, the network administrator is responsible for keeping load balance within practical limits.

2.02 Balancing a traffic unit improves service to the customer by reducing the possibility of switching failures, (eg, no dial tone, matching loss). Balancing reduces the regeneration of customer attempts and improves proper equipment utilization. Once an office is in a good state of balance, this condition should be maintained because it improves service and rebalancing a traffic unit is difficult, expensive, and time-consuming.

DEFINITION OF TERMS

2.03 The terminology and definitions used in this section are discussed in Section 780-350-050, Load Balance Index Plan.

2.04 A *traffic unit* is the same as a *dial entity.* The terminology is used to conform with the common language location identification

practice, see Section 795-100-100. Examples of traffic units are as follows:

(a) **Step-By-Step:** A group of lines using line finder or line switch groups, selector bays, and connector bays and served by the same intermediate distributing frame or its equivalent.

(b) **No. 1 Crossbar:** A group of lines using a common terminating marker group.

(c) **No. 5 Crossbar:** A group of lines using a common marker group.

(d) **Electronic Switching Systems:** A group of lines associated with one central control system using the same logic and processor.

2.05 A load unit is defined as that component of line originating equipment arranged for usage measurements and for which individual scores are to be computed. These are designated as horizontal groups for crossbar offices, line finder groups for step-by-step and concentrators for electronic offices.

2.06 A **loading division** is a group of load units of the same type of equipment with the same capacity designed to be loaded similarly by both usage and classes of service. Telephone number changes are not required to affect load balance within the loading division.

2.07 Where equipment features prevent similar loading and assigning due to equipment design, the operating telephone companies may create loading divisions. Creation of more than one loading division requires careful administration to ensure proper loading among divisions. Care should be taken so the establishment of additional loading divisions does not create undetectable imbalances in other equipment components. Loading divisions, of the same class of service, possessing approximately the same capacities, may be conveniently combined in order to assign customer lines. Combinations of this type are called **assignment divisions.**

2.08 A **study** is the period of time scheduled to measure and score the usage to determine load balance by quality control techniques.

2.09 The **class busy hour (CBH)** is the time consistent hour during which a loading division has the highest average hundred call seconds (CCS) usage measured for a 5-day period during the same week. The hour may start and end on the clock hour or half-hour.

2.10 A **side hour** is an amount of time equal to one hour that is time consistent and adjacent to the CBH. It may be on one side or both sides of the CBH in order to provide the highest possible CCS for the side hour, but must not be divided into time periods of less than one half of an hour. For example, if the CBH is 9:00 to 10:00 a.m., the side hour could be 8:00 to 9:00 a.m., or 10:00 to 11:00 a.m., or 8:30 to 9:00 a.m., and 10:00 to 10:30 a.m.

2.11 **Session busy hours (SBHs)** are comprised of the CBH and the side hour if the side hour has average weekly usage equal to at least 90 percent of the CBH during the busy season and at least 80 percent of the CBH during the nonbusy season.

LOAD BALANCING PLANS

2.12 Good load balance is recommended to achieve the design call-carrying capacity of a traffic unit. A good loading plan is one that improves balance at each opportunity and assures optimum balance during periods of peak loads. It recognizes that as designed engineered capacities are reached or exceeded, intensified administrative attention to balance is needed to assure that optimum service is provided. The use of good timely loading plans will ensure balance between all loading divisions and traffic units in a wire center.

2.13 A loading plan is developed by the network administrator using official documentation, historical data, expected office usage characteristics, and coordination with the network design engineer. These sources must be molded together to create a unique, comprehensive, and effective plan.

2.14 Official documentation includes the following:

(a) **Commercial Forecast:** This provides the expected growth by class of service.

(b) **Equipment Order:** Equipment order provides the information regarding installed equipment, engineered capacities (including trended data) by component, trunk and service circuits.

(c) *Demand and Facilities Chart:* This chart provides a pictorial representation of items (a) and (b). Indicates dates for job exhaust.

2.15 Historical data should be analyzed for developing trend information and to assist in making realistic decisions about CCS/MS by class of service, expected in-and-out movement, calling rates, service levels, etc.

2.16 Each traffic unit has its own unique characteristics which should be identified for loading purposes. Calling rates, holding times, in-and-out movement, class-of-service mix are affected by community items such as seasonal business, conventions, college activities, planned retirement communities, etc.

2.17 Coordination with the network design engineer is very important. The engineer has designed the entity based upon some basic traffic assumptions and historical data. The traffic unit has to be administered and loaded with this information in mind. It is recommended that prior to each job and every busy season the basic data design values, originating and terminating busy hour calls and traffic trends should be mutually discussed and agreed upon. If the calling characteristics or class-of-service mix should change during the year, the network administrator should inform the network design engineer. Any major change in traffic unit characteristics should be reflected in the loading plan.

2.18 The loading plan should be developed for the year, broken down by month, for each major class of service. The plan should state the expected monthly main station gain or loss and be compared to the actual monthly growth.

2.19 Once the plan is developed, loading priorities must be developed to assist in the day-to-day assignment job. Assignment considerations should include identifying those classes of service with heavy loads, such as Centrex and PBX lines. Special care should be taken to distribute high call volume customers such as outward wide area telephone service (WATS), inward WATS, and data ports.

2.20 If long range forecasts predict a drastic shift in class-of-service mix, loading plans should consider methods for efficiently managing such a change.

2.21 Once the loading priorities have been established, consideration should be given to the line assignments advanced to the plant assignment office.

2.22 *Perfect balance* might be thought of as a condition where customer usage is so distributed that each load unit within a loading division carries exactly its proportionate share of the total load. As customer-offered loads always vary, by chance, from day to day and week to week, such *perfect balance* is not a practical or even meaningful goal. Furthermore, due to these chance variations, load studies can never be taken as exact measurements of the state of balance. If, however, the measured variations among the load units do not exceed a reasonable estimate of the largest possible chance variation, a good *practical balance* exists. The intent of this section is to assist the administrator in achieving this good practical balance.

2.23 Balance requires constant analysis of the changes in load unit loads and of the effects on service. A single load unit which appears to have a load substantially above average in one week may be below average the next week without having had any assignment changes or corrective action applied to it. The trend is important as well as the relative position of a load unit for any given study period.

2.24 The degree of balance within a traffic unit affects three important phases of the administrative job. The first, of course, is service. Balancing improves service by reducing the possibility of switching blockages, thus minimizing customer dissatisfaction which should, in turn, reduce calls to repair service. A second important item is effective utilization of equipment (maximum utilization of capacity). Whenever a balanced condition exists among load units of a loading division, the best possible maintenance condition will result because of even wear on equipment components. Finally, a well-balanced traffic unit provides reliable data that show sound load-service relationships. This aids in engineering correct equipment quantities and future service levels.

2.25 Good balance also is important in underloaded traffic units as a safeguard against the results of unforeseeable heavy loads and in preparation for busy season or other anticipated loads. It is difficult, time-consuming, and expensive to rebalance

a traffic unit once it has been permitted to get out of balance. A traffic unit that is out of balance and is being brought back into balance by the issuance of line transfers over a relatively short time span is likely to fall short of the degree of balance expected. *Advantage should always be taken of directed line assignments to improve the balance within a unit.*

BALANCE BY CLASS OF SERVICE

2.26 In addition to the distribution of CCS usage, it is important to maintain a good distribution by classes of service among load units in a mixed class-of-service loading division to give them similar traffic characteristics. Balancing techniques which use load measurements alone may inadvertently lead to a poor class-of-service mix causing the load units to vary in an irregular manner from day-to-day and from hour-to-hour. Typical of these circumstances are: Friday evening business loads caused by shopping centers, local sports activities, early school dismissals, weather problems, social conditions, sudden stock market activities, etc. Service results are most unsatisfactory when there are periods of heavy load that occur daily or frequently at times other than the traffic unit busy hour(s) used for load balancing or network engineering purposes.

2.27 While a good class-of-service mix does not prevent load fluctuations, it does tend to spread them across all load units, thereby helping to maintain uniform service for all customers. A balance which includes good distribution by usage and by class of service will aid in deriving maximum utilization of central office equipment while producing the best possible service to the customer. It should also reduce tendencies toward separate load and service busy hours and minimize the number of load units having busy hours differing from the loading division busy hour. When separate load and service busy hours exist that do not appear to be satisfactorily minimized by a class-of-service redistribution, the appropriate Company staff group should be informed before extensive special procedures are undertaken.

SERVICE INDICATORS OF BALANCE

2.28 The degree of effort and attention to be given a particular traffic unit in regard to balance will depend to a large degree on the service level (dial tone speed-incoming matching loss) of that traffic unit. The service levels are depedent upon the percentage of engineered capacity and are compared to the actual results. Deviation from the expected service levels may be an indication of an imbalance condition. Some items to be monitored during load balance sessions are:

- Dial tone delay: dial pulse and TOUCH-TONE®

- Incoming matching loss (IML)

- Originating matching loss (OML)

- Incoming first failure to match (IFFM)

- Blocked dial tone delay (BDT).

Out of the busy season and in other periods of light traffic, low loads with poorer than expected service as indicated by load service relations may be an indication of imbalance.

2.29 *Customer Reports:* Customer reports are useful in varying degrees. For determining imbalance indicators, the network administrator may find the repair center reports of no dial tone the most useful. The customer trouble report analysis plan (CTRAP) provides detailed and summary reports for analyzing trouble or for identifying load units that should be investigated for imbalance. Some CTRAPs are adaptable for developing patterns for imbalance indications. One such report is the no-dial-tone with no-trouble-found (NDT-NTF). This report lists by line equipment number the NDT-NTF reports which can then be grouped by load units.

DETERMINATION OF BUSY HOUR AND ADJACENT SIDE HOUR

2.30 *Busy hour* studies should be taken periodically for the purpose of determining busy hours for engineering and administrative purposes. The busy hour by loading division must be the time-consistent hour of highest total usage. This hour is determined by a periodic study as discussed in Section 780-200-031, Busy Hour Determination—End Office. The side hour should be determined as discussed in Section 780-350-050, Load Balance Index Plan. These hours (10 hours per study) are called the SBH and are used in load balance studies.

2.31 The combination of CCS usage from *nonadjacent busy hours, such as a*

combination of 8 a.m. to 9 a.m., with 6 p.m. to 7 p.m., is not allowed. Studies show that in almost every case the characteristics are different for nonadjacent busy hours.

2.32 Because of the need for statistical reliability, *10-hour study periods are required* for load balance index reporting. Two 5-hour studies from adjacent weeks may be combined and used in one 10-hour study. These data may be used in index reporting purposes and for balance guides if required.

2.33 Load balance usage data should be collected as frequently as required to ensure good balance with a minimum of 10 hours scheduled per month. As a traffic unit approaches engineered capacity, more frequent studies may be needed to ensure the most effective load balance possible.

QUALITY CONTROL LIMITS

2.34 The following provides background information and gives the network administrator an insight in the use of quality control limits. The load balance index plan requires the use of QCLs based on:

(a) A minimum of 10 hours of study per month (QCL tables are based on 10 hours of data)

(b) Actual load as related to engineered capacity

(c) Average holding time (AHT) of the call generating usage on the line equipment.

2.35 The method used to select quality control limits and the development of standard deviations is outlined in the specific load balance Bell System Practice for each system. The quality control technique is a statistical procedure used to create a uniform approach to load balance procedures. This technique reliably indicates whether fluctuations in load data are the result of chance or are the

results of differences in customer calling characteristics, and therefore indicates whether or not corrective action should be taken. A successful load balance plan requires that QCLs be used which satisfactorily and accurately indicate a realistic indication of the traffic unit's balance.

2.36 *Chance and imbalance* are two primary causes for variation of individual load unit usage from the average of a number of load units in the same division. Chance variations result from the random calling patterns of customers using their telephones. The size of chance variations depends on certain measurable office characteristics:

(a) Average holding time of calls (AHT).

(b) The actual load in the division (percentage of capacity).

As a general rule, the larger the sample measured, the smaller the chance variation relative to the size of the sample. Each of the previously mentioned characteristics affects the size of samples observed in load studies.

2.37 Load unit variations due to chance follow the normal distribution pattern which is a bell-shaped distribution about the mean (average). This normal distribution is described by establishing an average value and the measure of dispersion of load unit loads around that value. The measure of dispersion, adjusted for the number of hours of data, is commonly called the standard deviation (SD). Trends are not a factor since each load unit is related to the average of all load units. An area representing ± one standard deviation (± one sigma [σ]) from the average in a normal distribution may be expected to include 68.3 percent of all the measurements. Plus/minus two standard deviations or ± two σ will include 95.4 percent of all measurements and ± three σ will include 99.7 percent of all measurements. This is illustrated in the distribution curve which follows:

per load unit and multiplying the result by 100. The calculation is made as follows:

Example:

Actual Average Usage (AL) = 84 CCS
Engineered Load (Capacity) (TL) = 116 CCS

$$\text{Percentage of Capacity} = \frac{\text{AL}}{\text{TL}} \times 100$$

$$= \frac{84}{116} \times 100 = 72.4\%$$

72.4 rounded to the nearest whole number (integer) would be 72%.
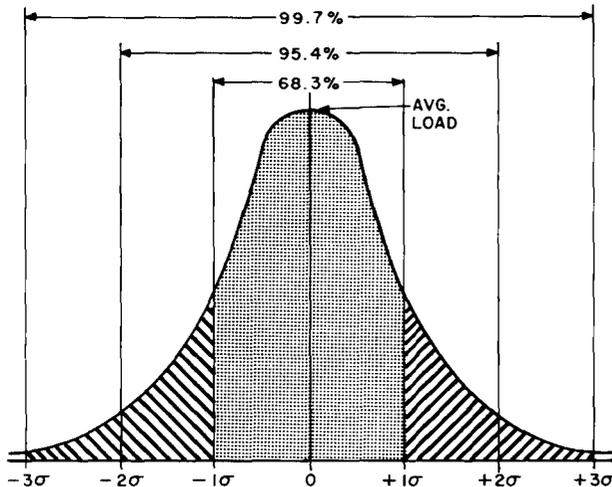
2.38 The problem of isolating and evaluating chance variations may be resolved by using the standard deviation. The size of a deviation from the mean may be used to judge whether that deviation may be due to chance or is most probably due to imbalance. As a basis for this judgment, standard QCLs representing three standard deviations have been developed. (This approach is arbitrary and is used by many industries to indicate items not meeting manufacturing tolerances.) To see what this means, consider 1000 groups for which the measured loads are averaged together. Mathematical analysis indicates that only three (the 0.3 percent outside the 99.7 percent) of these measurements can be expected to differ by chance from the mean by more than three standard deviations, ie, the QCL. In effect, it is assumed that *all* deviations from the mean greater than the QCLs are due to imbalance. Choosing larger QCLs would increase this assurance; however, there will be a greater chance that some deviations that truly reflect imbalance would be ignored. These three standard deviation (3 sigma) limits are utilized to compute the QCL tables.

2.39 There are two steps required in determining the appropriate QCL. The first step is to calculate the *percentage of capacity* for the study period. This is done by taking the actual average load and comparing it to the engineered load. This computation is made by dividing the total actual average usage [in CCS (AL)] per load unit by the engineered load capacity [in CCS (TL)]

This percentage can then be used to determine the *proper table for the selection of the QCL for the loading division* for the type of equipment involved. These tables cover the percentage of loading range from 30 percent to over 96 percent. The QCL value derived from this computation makes allowance for the fact that load unit loads in a lightly loaded traffic unit can fluctuate more than those in a comparable heavily loaded unit.

2.40 The table representing 66 to 75 percent would be selected. These tables are contained in each Bell System Practice on Load Balance Procedures (see Part 5).

2.41 The second step in the use of the QCL tables also provides for selection of the QCL based on AHT of the calls creating usage on the line equipment. Documentation of the AHT is required for each busy season. Detailed procedures to be followed for these calculations are provided in the section pertaining to the particular type of equipment involved.

2.42 After determining the QCL as described in the preceding paragraphs, it is possible to establish CCS values for the ±3 sigma points. It is also necessary to indicate load units which are approaching these limits. This is established by designating an intermediate point at ±1.5 sigma.

Example:

Assume average usage per load unit in a loading division is 200 CCS and the QCL is 44 percent.

200 CCS x .44 = 88 CCS

+3.0 SD = 200 CCS + 88 CCS = 288 CCS

-3.0 SD = 200 CCS - 88 CCS = 112 CCS

+1.5 SD = 200 CCS + 44 CCS = 244 CCS

-1.5 SD = 200 CCS - 44 CCS = 156 CCS

This is illustrated in the distribution curve which follows:

CCS VALUES...

−3σ	−1.5σ	0σ	+1.5σ	+3σ
112	156	200	244	288
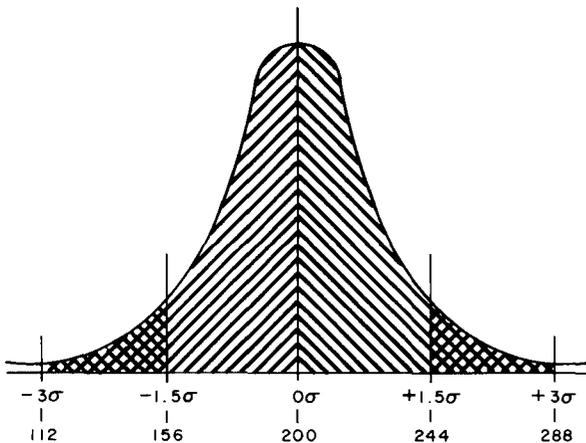
2.43 The use of CCS value at the specified 3.0 and 1.5 sigma limits works well for one week's data. Unfortunately, when a history is maintained to increase statistical reliability, the mathematics becomes too burdensome to utilize on a manual basis. This burden is lightened by the use of an alternate method called the score system.

DEVELOPMENT OF SCORES

2.44 The score system was developed to simplify the mathematics required in load balance procedures. Numerical values are assigned to represent the extent to which each load unit has deviated from the average during a measurement period. In application, all load units exceeding the QCL on a weekly record are assumed to be out of balance. The remaining load units may deviate to a lesser degree above and below the average.

2.45 The procedure for deriving scores is to take the QCL percentage as determined from the preceding paragraphs and apply it as follows.

(a) Each load unit with *exactly average* CCS is assigned a score of 0 (zero).

(b) Each load unit deviating above or below average, up to and including 1.5 standard deviations (one-half the QCL), is assigned a score of +1 or -1.

(c) Each load unit deviating above or below 1.5 standard deviations from the average and up to and including 3.0 standard deviations is assigned a score of +2 or -2.

(d) Each load unit deviating greater than ±3.0 standard deviations from the average is assigned a score of +4 or -4. Note that four is used rather than three in order to accentuate this undesirable deviation (see distribution curve below).

SCORE METHOD...
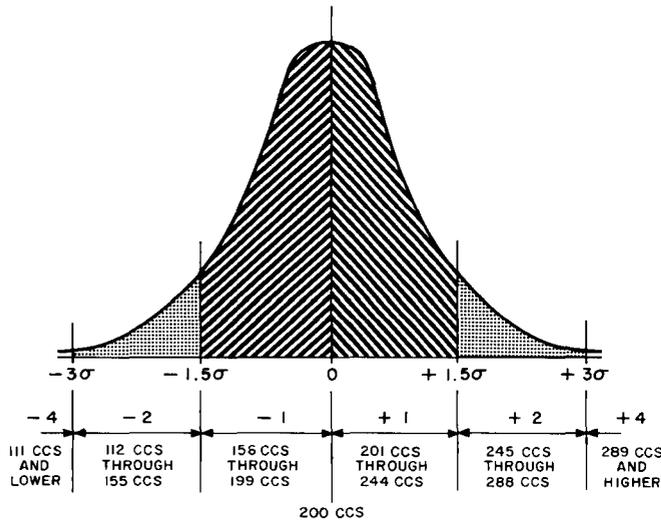
	−3σ	−1.5σ	0	+1.5σ	+3σ	
−4	−2		−1	+1	+2	+4
111 CCS AND LOWER	112 CCS THROUGH 155 CCS	156 CCS THROUGH 199 CCS		201 CCS THROUGH 244 CCS	245 CCS THROUGH 288 CCS	289 CCS AND HIGHER

200 CCS

Example:

Assume average usage per load unit in a loading division is 200 CCS and the QCL is 44 percent. A total of 3.0 standard deviations is 44 percent and 1.5 standard deviations are 22 percent. Scores are computed as follows:

LOAD UNIT CCS	SCORE
289 and higher	+4
245 through 288	+2
201 through 244	+1
200	0
156 through 199	−1
112 through 155	−2
111 and lower	−4

3. DATA COLLECTION

DATA ACQUISITION

3.01 Load balance usage data are normally collected on a weekly measurement schedule. These data are collected by a TUR or similar device such as those obtained from private vendors. Electronic offices supply their own data automatically as programmed. These devices can provide the data on a daily basis or on a total-week basis. Total-week readings reduce the clerical effort required. The devices measure total usage by load units on individual data collection devices (DCDs).

DATA COLLECTION FREQUENCY

3.02 Data must be collected and reported once a month for index purposes. They may be collected more frequently for administrative purposes for the following reasons:

(a) The office is out of balance and the network administrator wants to analyze the results of specific corrective action procedures.

(b) The office is nearing the end of the job interval and/or is load limited; therefore, fine-tuned assignments are required to ensure objective service levels.

(c) The office is a new installation (at or greater than 30 percent of capacity) or a growth addition has just been completed and a new load balance data base is required. The faster the new data are collected, the sooner the balance may be analyzed.

(d) The office has just completed an area cut and the network administrator wants to evaluate the effects of the applied loading plan.

MISSING OR INCOMPLETE DATA (WHEN WORKING IN MANUAL MODE)

3.03 There are circumstances under which the data for the study week may be incomplete as a result of equipment malfunctioning, lost or damaged data collection devices, etc. The criterion for data reporting in compliance with Section 780-350-050, Load Balance Index Plan, is that a *minimum of 7.1 hours* is required but that the *full 10 hours* are preferable. For administrative purposes, if 6 hours of data are available, it can be approached in several ways as follows.

(a) If they are available, 4 hours of data with the same traffic characteristics may be used from the previously collected week within the study month.

(b) The entire 10 hours from the previous study may be used if available.

(c) As a last resort, as few as 2 hours with the same traffic characteristics from the previously collected week may be used.

If valid data cannot be obtained within the study month for index purposes, the data are considered *not available* (NA). In mechanized data collection systems, substitution is not always possible.

DATA VALIDATION

3.04 The network administrator is responsible for the validation of load balance measurements. There are only a few ways to validate load balance data. These involve visual inspection and mathematical methods to determine if the measurements are reasonable and accurate.

(a) Data problems flagged by the mechanized data collection system should be investigated and cleared (zero usage for example). See paragraph 4.04 for flagging capabilities.

(b) Individual load unit registrations should be checked for reasonableness. Any unusual peaking of registrations over those obtained in previous weeks, along with an absence of unusual deviations from average working lines in a load unit may indicate equipment malfunctioning.

(c) Sudden changes in data ranges may indicate data collection device trouble. When these irregularities are present, every effort should be taken to correct them as soon as possible.

(d) Compare actual load unit usage with the engineered capacity of that load unit. Measurements which are at or exceed capacity can be evaluated on the basis of whether they reflect valid data and/or a load balance problem. The percentage of capacity is relative to the expected load. A loading division at 50 percent of capacity should not expect to find load unit loads nearing capacity whereas an office running greater than 75 percent would expect such load unit loads. Service indicators associated with load balance should be expected more frequently as the percentage of capacity is approaching engineered capacity. Care must be taken in this analysis to consider the characteristic range of randomness for the traffic unit being reviewed.

4. BALANCE TECHNIQUES

MECHANIZED PROCEDURES

4.01 A system has been developed for providing procedures for the proper balance and assignment of lines in addition to computing a load balance index. It is called the load balance system (LBS) and is a business information system (BIS) development with full user documentation. Complete documentation is available in BISP Section 756-370-321.

4.02 The user is responsible for providing specific information to the program in order for the necessary calculations and reports to be made. This specific information defines the parameters and includes:

(a) Number of main stations

(b) Average holding time (if data not available for system to compute)

(c) Theoretical capacity by load unit

(d) Average office CCS/main station or lowest CCS/main station

(e) Service observing end-of-month data.

4.03 Once parameters and usage information have been inputted to the mechanized program, four basic reports are available in an off-line mode.

(a) *Traffic Unit Index-Addendum* (TL 720): This report is prepared by loading divisions and traffic units each time a load balance index study is taken and includes load units installed (measured and not measured), capacity data, and balance and hot spot penalty points. The content of this report follows that of Form E-6402 (see Section 780-350-050). Indexes are provided for the company by areas, for divisions by districts, and for districts by traffic units (TL 722-728). See Fig. 1 for an example of a Traffic Unit Index-Addendum.

(b) *Index Study-Data Summary* (TL 732): Provides a working report that allows manual inspection of all load unit data being used for index calculation and is generated each time a valid loading division index study is processed. A full data summary or exception report is optional. Information includes: average hour

CCS (for the current study week), balance and hot spot penalty points for the three latest valid index study weeks, and a series of validation codes which point to a suspected problem. See Fig. 2 for an example of an Index Study-Data Summary (exception type report).

(c) *Balance Guide Reports* (TL 744, TL 745, TL 746, TL 747): These are line assignment guides to be used for line assigning purposes. These particular outputs are discussed in paragraphs 4.18 through 4.26. A similar removal guide is developed to identify potential line transfers from overloaded load units. For line assignment purposes, these reports should be requested at least monthly and supplemented with other reports as required. See Fig. 3 for an example of a Line Assignment Guide (TL 744).

(d) *Selected Reports:* Provides an output of nonindexed equipment as follows:

BISP LISTING	OFC TYPE	LOAD UNIT
TL 760	SXS	Connectors
TL 762	1XB	Incoming Link Frame-Horizontal Groups
TL 763	1XB	Office Link Frame-Horizontal Groups
TL 764	5XB	Trunk Link Frame-Horizontal Groups
TL 766	1ESS	Trunk Link Network-Grid
TL 768	XBT	Office Link Frame-Horizontal Group
TL 769	XBT	Trunk Link Frame-Horizontal Group

The load balance system has a series of report outputs that provide information on equipment such as connectors, trunk link frames, etc. Each equipment type supported has a specific report format and BISP listing number. The system automatically selects the proper report format when it receives the required study measurements from TDAS. LBS uses the EMC to determine the traffic unit type and equipment item.

All selected reports are equipment oriented, not CCS correction oriented as are the balance guides (LAG, LET). For example, the horizontal groups within a trunk link frame are shown in numerical order from 0 to 9, regardless of their indicated CCS correction. Each load unit carries the following information:

% of loading Avg — The load unit load percentage of the entire loading division's average.

Proj. CCS — The projected CCS value of the load unit based on the current CCS and history CCS for the unit.

Raw CCS Correction — The "plus" or "minus" CCS correction required to bring the load unit close to the average load of all units in the division.

History Weeks — The number of study weeks in history for each load unit.

4.04 *Flagging capabilities* are available for *data validation purposes* (the TL 701 Report). The system automatically flags load unit data that register:

(a) Zero usage (electromechanical switching systems only)

(b) Usage exceeding the number of circuits being measured times 36 times the number of hours of input

(c) As a hot spot following the criteria of the values provided in Section 780-350-050, Load Balance Index Plan (Fig. 2).

CORRECTIVE ACTION

4.05 Corrective action should be taken when there are adverse service indications or when the load measurements point to areas where there are high probabilities of blockage and hence a possible source of customer dissatisfaction.

4.06 In order to be more meaningful, the proper corrective action must have an established sequence of operation as follows:

(a) Review all load balance data. This review should indicate load units that are working at exceptionally heavy or light loads.

(b) Review data on the load units highlighted in (a) above. This review may prove to be the most valuable step. Errors at this stage cause unnecessary or incorrect action. Any equipments made busy should be investigated when verifying data.

(c) Assuming the data are valid, review the required CCS corrective action.

(d) If time and service conditions permit, achieve balance by directed line assignments.

(e) If LETs are required, several indicators should be analyzed to determine the proper lines to move (eg, customer reports, or other reports applicable to each system).

4.07 The most economical method of achieving and maintaining a good load balance in load units is through line assignment procedures (directed line assignments). The network administrator assigns new connects to lightly loaded load units and allows disconnects to accumulate in heavily loaded units.

4.08 Disconnects of lines in heavily loaded units serve to equalize the carried CCS in load units. On the other hand, disconnects in lightly loaded load units serve to heighten the imbalance.

4.09 Line equipment transfers accomplish the same objective as directed line assignments with quicker results. LETs must be kept to a minimum unless serious imbalance exists (+4s and hot spots) and the condition cannot be quickly corrected with directed line assignments.

4.10 LETs are expensive to implement and therefore, should be the *last-choice method of corrective action.*

4.11 The mechanized procedure developed for the load balance index plan has all the following features.

(a) It is based on empirical CCS measurements rather than scores. Differences in loads, even among load units with the same scores, can be detected.

(b) It is sensitive to usage trends so the user can avoid future overloads.

(c) It supplies more weight to recent measurements since they are more representative of the actual load situation.

(d) Finally, it adjusts the usage in load units to the average for the loading division to avoid wasteful overcorrection.

4.12 In a manual data processing environment, it is uneconomical to expend clerical time to achieve each of the four features discussed in paragraph 4.11.

4.13 Basically, the mechanized procedure for producing the LAG and LET reports takes historical load unit information and utilizes a weighted linear regression to estimate *expected* loads on these units as shown in the graph which follows. As can be seen, weekly loads do not fall on the best fit or weighted linear regression line. Each point on the line corresponds to a week and represents the expected values. The weeks are

numbered from week one (oldest) to week seven (newest).

> *Note:* The graph shows a period of seven weeks. However, this number would differ according to the amount of historical data that has been recorded (or is in memory). The system maintains a history file of up to 12 calendar weeks within a 90-day period. This graph is shown for illustration purposes and is not generated in this report format by LBS. The graph only illustrates the LBS software algorithms.
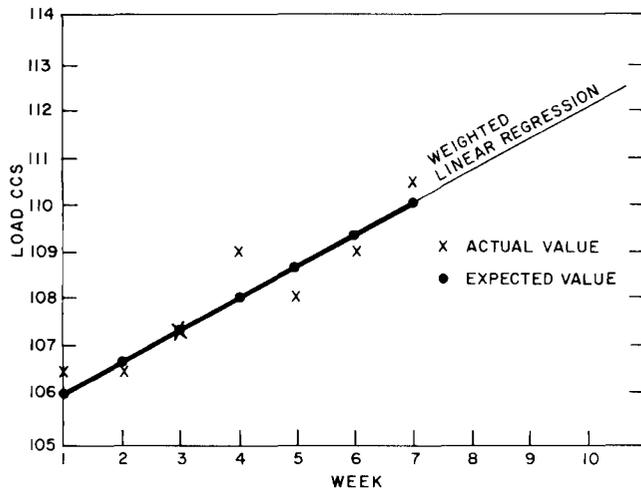
4.14 A similar approach is taken for the average load unit load in the loading division. Individual load units are then compared to their traffic unit regression line to determine the CCS amount to be added or removed (see graphs A through F in paragraph 4.15).

4.15 The CCS corrections are applied to the load units shown in the corrective action graphs below. These graphs are illustrative of LBS software algorithms only. It is not suggested they be produced by the local administrator.

(a)   (b)   (c)   (d)   (e)   (f)
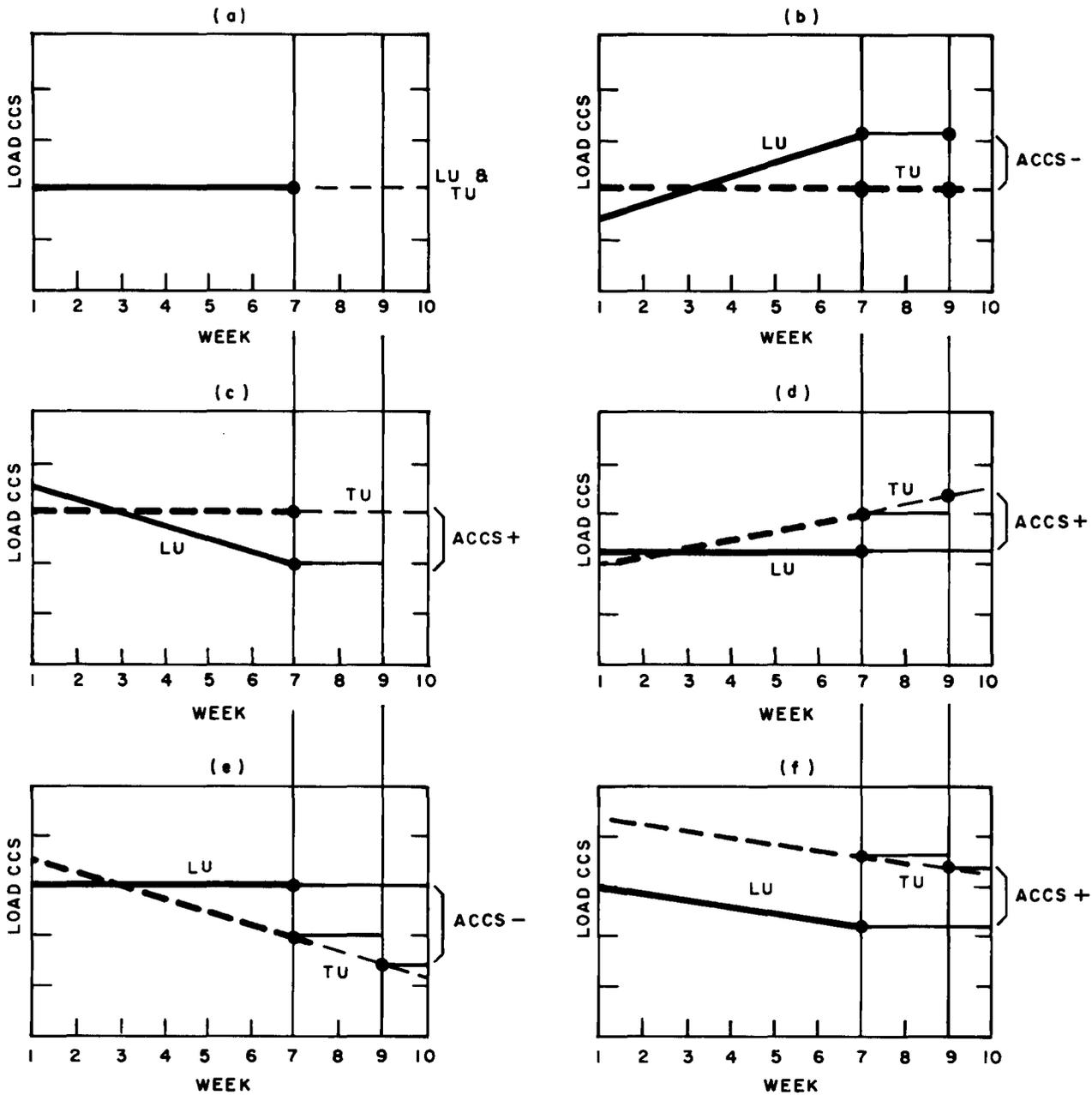
Graph A: None. The load unit and traffic unit average track exactly.

Graph B: Subtract CCS because the load unit is increasing and the traffic unit load is stable. The CCS difference for the latest week indicates a need for removal of load. Assuming that action will be taken in week nine, this difference during week seven

should be removed. This amount is taken at week seven levels because the load unit line is not as stable as the traffic unit line and should not be extrapolated.

Graph C: Add CCS. The load unit is decreasing and the traffic unit load is stable. The CCS difference for the latest week indicates a need for additional load. Assuming

that action will be taken during week nine, this difference during week seven should be added.

Graph D: Add CCS. The traffic unit load is increasing and the load unit load is stable. The CCS difference for the latest week indicates a need for additional load. If action is taken during week nine and the difference during week seven is added, there will be a slight undercorrection. Therefore, an additional amount must be loaded into this unit.

Graph E: Subtract CCS. The traffic unit load is decreasing and the load unit load is stable. The CCS difference for the latest week indicates a need for less load. If action is taken during week nine and the difference for week seven is subtracted, there will be a slight undercorrection. Therefore, an additional amount must be removed from this unit.

Graph F: Add CCS. Both the load unit and traffic unit loads are decreasing at approximately the same rate. The CCS difference for the latest week indicates a need for additional load. If action is taken during week nine and the difference during week seven is added, there will be a slight overcorrection. Therefore, a smaller amount must be loaded into this unit.

4.16 Corrective CCS values developed from the information in paragraph 4.15 cannot be considered exact because of the variable factors involved. Any overestimation in the CCS correction could result in more LETs than necessary to attain balance. It might be necessary to compensate for these additional moves at a later date. Consequently, the computer scales down all values derived in this manner.

4.17 Any method for scaling the CCS correction to be applied to load units is fairly arbitrary. The procedure adopted is to scale the values by a factor based upon the variance of estimated CCS to be added or subtracted. This procedure produces better load balance than the method used in the current plan (TL 562).

LINE ASSIGNMENT GUIDE

4.18 LBS can generate one of two types of LAGs:

- The TL 744 decremented LAG

- The TL 745 condensed LAG.

The decremented TL 744 is generated in a fashion that provides a ***desired order*** of assignments into load units. This is achieved in the computer program by:

(a) Selecting a load unit which needs the largest CCS addition for the next assignment

(b) Subtracting the CCS/MS (average or light) value from the total CCS correction needed for the load unit just selected

(c) Go back to (a).

This cycle is repeated as many times as required until the total number of load unit selections equals the LAG print volume (1-9999) value on the Common Update (CU) LBS master file. The administrator must specify a reasonable value on the CU inputs for the LAG print volume. Sufficient volume should be obtained to satisfy the expected inward assignment demand for the measurement interval between the generation of TL 744 reports. For example, two weeks between TL 744 reports, with an expected service order volume of 300 orders per week, would require a print volume of at least 600 per output. Each assignment order on the report carries the load unit identification selected in (a) above. Other information columns on a TL 744 do not, however, always carry data. The CCS TO ADD and PROJ CCS fields are used only for the first appearance of a load unit on the list. Each subsequent appearance of a load unit after the first appearance will have blank space under the above fields. The % CAP field entries appear in ascending order. Percentage of capacity will always appear for the first assignment order on the TL 744; however, it will only be printed subsequently when the last printed value changes. For example, the first load unit on a TL 744 shows the expected percentage of capacity (after assignment) to be 1. The percentage of capacity for the next load unit appearance (choice number 2 on the list) would not be printed unless it was greater than 1. This method allows the assigner to keep track

of the percentage of capacity as it increases without printing repeating values on the TL 744.

4.19 The spare line equipments selected may be recorded in the appropriate columns of the guide as they are being entered on the assignment lists. NA should be noted next to any load unit when spare line equipment is not available. Remaining columns are provided for administrative purposes such as listing the class of service, noting the assignment list number, entering remarks and/or noting the main frame location of the load unit.

4.20 Knowledge of the disconnect activity within a loading division is as important as knowledge of inward movement. The disconnect activity usually counteracts the efforts to bring load units closer to the average or it may satisfy a need for spare equipment in a load unit requiring additional CCS. The TL 744 may be used to account for disconnect activity. This involves keeping track of the line equipment disconnect and incorporating the information into the guide. For example:

(a) With the understanding that every disconnect negates an assignment, a flagging system may be devised to identify those load units with consistently low usage trend (the TL 732 flags these) in the line records. As disconnects occur within these flagged load units, they should be noted on the guide and entered on an assignment list, or

(b) Shortages of spare line equipment begin to appear when the loading division is working at a high-percentage fill. When NA is noted on the TL 744, an indication should also be made in the line equipment records in order to take advantage of any disconnect activity. The presence of an NA means that there is still a requirement for additional CCS in that load unit.

4.21 The LAG Cover Sheet is generated by LBS each time a regular TL 744 is generated with more than 80 appearances. Traffic Data Acquisition System (TDAS) studies with Traffic Measurement Request (TMR) numbers 1, 2, 5, or 6 will cause LBS to generate balance guide output including this cover sheet. This report should be used to locate individual load unit appearances in the TL 744 as required for manual line assignment activities (both inward and disconnect). It shows as many as 12 appearances of each load unit in the body of the main TL 744.

4.22 *Condensed Line Assignment Guide (TL 745)* (Fig. 4)—The condensed LAG (TL 745) is generated when studies are input with request numbers 1, 2, 5, or 6 on the TDAS-TMR and the CU master file record for the assignment division or loading division print control field contains the literal *COND*. Condensed LAGs will *not* have cover sheets.

4.23 The condensed LAG will list every load unit in a loading division or assignment division *once*. The guide is generated in a desired order of assignments with the load unit requiring the most corrective action listed *first* and the load unit requiring the least amount of corrective action listed last. Each assignment order on the guide will contain information in the PROJ CCS, ADD CCS and NBR LINES columns. The % CAP value will appear for the first assignment order and will be printed subsequently only when the last printed value changes.

4.24 The ADD CCS column will contain a minus (−) sign next to the value when the calculated CCS for a load unit is *above* the average for the loading division.

4.25 LBS divides the calculated amount of usage required to bring the load unit near the loading division average by the CCS/MS value input by the user in the data base to develop an *estimated* number of lines to be assigned. The minus (−) sign will appear next to the value when the estimated number of lines calculated should be *removed* from the load units. A single asterisk (*) will appear when the projected CCS value is greater than 1.5 standard deviations from the expected average load unit usage of the loading division. A double asterisk (**) will appear when the projected CCS value is greater than 3.0 standard deviations from the expected average. These signs (minus and asterisk) will normally appear near the bottom of a nonzone condensed LAG. These signs may or may not appear in each zone on a condensed LAG with zones. If they do appear they should normally be near the bottom of the assignment list for the zone.

4.26 The condensed LAG should be requested to more efficiently perform manual line assignments in the following instances:

(a) The traffic unit or loading division has a modular frame or conventional main frame with zoning.

(b) The traffic unit or loading division has a high percentage of line fill (load units with no spare line equipment begin appearing on the decremented LAG TL 744).

(c) The degree of loading division balance is so poor that a relatively small number of load units constitute all the appearances on the decremented LAG (TL 744).

LINE EQUIPMENT TRANSFER

4.27 *Line Equipment Transfer Guide (TL 746)*—This is the last choice method to achieve balance. See Fig. 5 for an example. The decremented TL 746 LET output is triggered when studies are input for balance guide and LET print volumes are specified on the appropriate master file record ('Assignment Division' or 'Loading Division'). TDAS-TMR numbers 1, 2, 5, or 6 will direct LBS to print LETs if the master file print option has a value in effect of 1 to 9999. Zero in the master file print option will suppress this report.

4.28 LET guides aid the user in selecting above average load units for line transfers to lightly loaded units. Line transfer choices on the TL 746 normally represent load units operating with above average loads ("+" scores); however, it may at times give choices for transfer with below-average loads. If the requested print volume is large enough, it is possible to cause the process of load unit selection to take load units with minus ("–") scores as the guide is decremented.

4.29 The LET is generated in a similar fashion as the LAG; by *desired order* of assignments *from* load units. This is achieved in the computer program by:

(a) Selecting a load unit which needs the largest CCS subtraction in order to bring it close to average load.

(b) Subtracting the CCS/MS (average or light) value from the total CCS correction needed of the unit just selected in (a).

(c) Go back to (a).

This cycle is repeated as many times as required until the number of load units selected equals the "LET Print Volume" value on the CU master file.

4.30 Similar to the decremented TL 744 LAG, information under certain columns on the LET may or may not be present. The order of assignment of line transfers and a corresponding load unit are shown for each line on the LET. "CCS To Remove" values are shown only for the *first* appearance of a load unit on the list. "Proj CCS" values are also shown only for the first appearance of a load unit on the LET. "% Capacity" is shown always for the very first line of the LET but is only printed subsequently as the originally printed values decrease.

4.31 Actual line equipment selected for transfer may be recorded in the appropriate columns of the LET at the same time as they are placed on the locally used "LET cut sheets". Space is provided to record the cut sheet number, or enter remarks, or note the main frame location of the load unit.

4.32 Like the LAG, disconnect activity within a loading division may affect the effort to bring load units closer to average. Disconnects to load units also selected for transfer may cause an overcorrection to take place in CCS reduction. Conversely, assignments into these load units may completely counteract the corrective action of a transfer.

4.33 It is suggested that load units actually selected for transfer be flagged in the line records to prevent the above situations from occurring. Inward assignments should not be made into these groups and disconnects worked should be noted on the TL 746 LET to prevent additional removal of load from load units.

4.34 If the *ZONE* option is used for the TL 744 LAG, then any LETs produced for the same loading division will also be produced in zones. All load units in the loading division are combined to produce their projected CCS values and CCS correction values; however, they are separated into zones for the production of the assignment guides when this special feature is used in TDAS DCD assignments.

4.35 *Condensed Line Equipment Transfer Guide (TL 747)* (Fig. 6)—The condensed LET (TL 747) is produced when studies are input for a balance guide and the LET print control volume specified on the master file record contains the literal *COND.* This guide will list every load

unit in a loading division or assignment division *once*. The condensed LET (TL 747) is generated in a similar fashion as the condensed LAG (TL 745). The load units are listed in a desired order of assignments with the load unit requiring the *most* corrective action (remove CCS) listed first and the load unit requiring the *least* amount of corrective action listed last. Each assignment order on the guide will contain information in the PROJ CCS, RMV CCS, and NBR LINES columns. The %CAP value will appear for the first assignment order and will be printed subsequently only when the last printed value changes.

4.36 The RMV CCS column will contain a minus (–) sign next to the value when the calculated CCS for a load unit is *below* the average for the loading division.

4.37 As with the condensed LAG (TL 745), LBS divides the calculated amount of usage by the input CCS/MS value to develop an estimated number of lines to be removed. The single and double asterisks (* and **) will appear when the projected CCS values are 1.5 and 3.0 standard deviations from the expected average load. These signs will normally appear at the top of a nonzone and zoned condensed LET.

4.38 The condensed LET should be requested when the network administrator wishes to identify those load units which are possible candidates for line equipment transfers.

4.39 *Computer System for Main Frame Operations (COSMOS):* The COSMOS line assignment system provides a number of parameters that are the responsibility of the network administrator. These parameters can be monitored and changed by the network administrator in order to control entity balance. To control traffic unit balance, the network administrator specifies the entity status (stable or growth), the upper and lower limits of main station fill, and the traffic unit priority. The network administrator also controls the party line fill ratio by designating which of three party service assignment procedures COSMOS is to follow. The network administrator determines whether crossloading should be allowed or disallowed in each entity and sets the crossload permit parameter accordingly. AT&T General Letter 76-10-205 provides a description of the training materials available to administer these parameters, and ordering information for these administrative documents.

4.40 The established procedures for determining what constitutes good class-of-service balance for electromechanical systems has not changed with COSMOS. For ESS, COSMOS will achieve class-of-service balance by assigning a class-of-service designation to each concentrator terminal and restricting assignments to those terminals having the required class-of-service designation. AT&T General Letter 76-10-205 provides detailed ordering information for the administrative tasks related to the administration of class-of-service allocations in No. 1 ESS, No. 1 and No. 5 crossbar and step-by-step offices.

4.41 *Business Information System Customer Service/Facilities Assignment and Control System (BISCUS/FACS):* BISCUS/FACS is another mechanized aid to load balance management. It is supported by full user documentation in standard BISP format. Specific software processing of TUR data for load balance assignment algorithms for each central office equipment type are covered in design specifications and are available to the user. For example, design specification DSC 05 is the document that gives the rules for central office facilities assignments for No. 5 crossbar offices.

5. REFERENCES

Bell System Practices

Section 780-350-050, Load Balance Index Plan

Section 780-101-270, Mechanized Aids to Management (COSMOS)

Section 231-070-740, Load Balancing Procedures, No. 1 ESS

Section 232-070-110, Load Balancing Procedures, No. 2 ESS

Section 216-020-110, Load Balancing Procedures, No. 1 Crossbar

Section 218-020-110, Load Balancing Procedures, No. 5 Crossbar

Section 226-020-110, Load Balancing Procedures, Step-By-Step

Section 780-200-031, Busy Hour Determination

Business Information Systems Practices (BISP)

756-370-321, Load Balance System Users Guide

756-370-324, Load Balance System Output

COMPANY_____
AREA_____

TNDS
LOAD BALANCE
TRAFFIC UNIT INDEX - LISTING

PROCESS DATE_____
BISP LISTING__TL 720__
RESP CODE_____

SERVICE OBSERVING MO/YR:

JOHN DOE
OFC TYPE:

ID	LOADING DIVISION DESCRIPTION	LATEST VALID STUDY	INDEX RAW LBI	INDEX LOAD BAL INDEX	PERFORMANCE BALANCE PENALTY PTS	PERFORMANCE BALANCE PENALTY FRAC	PERFORMANCE HOT SPOT PENALTY PTS	PERFORMANCE HOT SPOT PENALTY FRAC	LOAD UNITS QUAN INST	LOAD UNITS QUAN VALID	LOAD UNITS % VALID	LOAD & CAPACITY LINE CCS LOAD	LOAD & CAPACITY ACT CCS LOAD	LOAD & CAPACITY % CAP	WTD % CAP	SERVICE RESULTS DTS	SERVICE RESULTS IML
C1	FRLF TT	08 15	96	96	6	.22	0	.00	27	27	100.0	11772	8664	74	74		
D1	FRLF DP	08 15	96	96	14	.23	0	.00	60	60	100.0	22800	14736	65	65		
E1	2MRLF DP	08 15	NI	NI					1	1	100.0	270	43	16			
K1	2MRLF DP	08 15	NI	NI					12	12	100.0	1464	412	28			
N1	COIN DP	08 15	100	100	0	.00	0	.00	2	2	100.0	872	330	38	41		
P1	COIN TT	08 15	100	100	0	.00	0	.00	1	1	100.0	436	144	33	35		
TOTALS-			98	98	20	.22	0	.00	90	90	100.0	35880	23874	67	67		

Fig. 1—Traffic Unit Index-Addendum—TL 720 (Example) (4.03)

COMPANY_____
  AREA_____
  DIV_____
DIST_____

TNDS
LOAD BALANCE
INDEX STUDY--DATA SUMMARY

PROCESS DATE_____
BISP LISTING TL 732
RESP CODE_____

OFC TYPE:

LOADING DIVISION | STUDY WK DATE | END HOUR

HG	TRUE HR	AVG HR CCS	% ENG CAP	STUDY 3	MONTH 2	SCORE 1	PENALTY POINTS-BAL	HS	REMARKS
FRM 00									
3	10.0	159	110	-1	+2	+4	3	1	3
5		119	83	+4	+1	+1	1		
FRM 01									
2		163	113	+2	-1	+4	3		3
FRM 02									
0		119	83	+4	+1	+1	1		
FRM 03									
3		159	110	+1	-1	+4	3		3
8		79	55	+4	-1	-2	1	2	
FRM 04									
7		111	77	+4	-1	-1	1	2	
9		159	110	+2	-1	+4	3		3
FRM 05									
7		139	97	+4	+2	+2	1		
FRM 06									
5		103	72	+2	+4	-1	2		
FRM 07									
1		127	88	+4	+2	+1	1		
FRM 09									
1		199	138	+4	+4	+4	6	3	6
FRM 10									
0		99	69	-1	+4	-1	2		
7		71	49	+1	-1	-4		2	4
FRM 11									
4		147	102	+2	+2	+2			3
5		131	91	+1	+4	+2	2		

HG	TRUE HR	AVG HR CCS	% ENG CAP	STUDY 3	MONTH 2	SCORE 1	PENALTY POINTS-BAL	HS	REMARKS
FRM 12									
8	10.0	147	102	-1	-1	+2			3
FRM 13									
4		151	105	+1	+2	+4	3		3
FRM 14									
2		135	94	+4	+1	+2	1		
FRM 16									
2		151	105	-1	-1	+4	3	1	3
FRM 17									
0		147	102	+1	+1	+2			3
2		147	102	+1	+1	+2			3
FRM 18									
8		67	47	+1	-1	-4		2	4
FRM 19									
7		71	49	-1	-1	-4			4
FRM 22									
7		147	102	-1	+4	+2	2		3
FRM 24									
0		167	116	-4	+1	+4	3	1	3

REMARK CODES

1 ASCENDING TREND	4 CHECK LOW CCS	7 HOT SPOT	* = HOT SPOT
2 DESCENDING TREND	5 SECOND +4	8 FIRST SEQUENT HOT SPOT	
3 CHECK HIGH CCS	6 THIRD +4	9 SECOND SEQUENT HOT SPOT	

Fig. 2—Index Study-Data Summary—TL 732 (Example) (Sheet 1 of 2) (4.03) (4.04)

```
COMPANY_____              TNDS              PROCESS DATE_____
   AREA_____          LOAD BALANCE          BISP LISTING  TL 732
    DIV_____      INDEX STUDY--DATA SUMMARY  RESP CODE_____
   DIST_____
```

```
                 OFC TYPE:
                          STUDY WK   END
       LOADING DIVISION     DATE    HOUR
       ----------------   --------  ----
```

LOADING DIVISION INDEX CALCULATION

WEIGHTED LOAD DIV % OF CAP	BALANCE PENALTY PTS FRAC	HOT SPOT PENALTY PTS FRAC	% VALID HG	RAW LBI	HOT SPOT CORR	LBI
75	64 .16	0 .00	100.0	99	0	99

VALUES USED FOR CURRENT WEEK SCORE CALCULATION

AVG HOUR CCS/ HG	LD % CAP	AHT	T/S	TOTAL HG	VALID HG
112	78	166	3.97	400	400

LINE LINK FRAME STATISTICS

LLF	AVG HR CCS	BALANCE PENALTY	HOT SPOT PENALTY	LLF % CAP	LLF % OF GRP AVG
0	121	4	0	84	108
1	109	3	0	75	97
2	120	1	0	83	107
3	112	4	0	77	100
4	116	4	0	80	104
5	108	1	0	74	96
6	114	2	0	79	102
7	110	1	0	76	98
8	104	0	0	72	93
9	112	6	0	77	100
10	107	2	0	74	96
11	122	2	0	64	109
12	115	0	0	79	103
13	112	3	0	77	100
14	110	1	0	76	98
15	110	0	0	76	98
16	111	3	0	77	99
17	123	0	0	85	110
18	106	0	0	73	95
19	103	0	0	71	92

Fig. 2—Index Study-Data Summary—TL 732 (Example) (Sheet 2 of 2) (4.03) (4.04)

```
COMPANY_____
   AREA_____
    DIV_____
   DIST_____                                        PROCESS DATE_____
                               TNDS                    BISP LISTING TL 744
                          LOAD BALANCE                 RESP CODE_____
                             L A G
                          COVER SHEET

              STUDY WEEK DATE:                    CCS/MAIN STATION:

              LOAD    DIVISION:

  OFC TYPE:


  LOAD UNIT  ------------------FIRST 12 APPEARANCES------------------

  ---------- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ----
     072     125, 129, 133, 137, 141, 145, 149, 153, 157, 161, 165, 169
     073     199
     080      34,  36,  38,  40,  42,  44,  46,  48,  50,  52,  54,  56
     183      84,  87,  90,  93,  96,  99, 102, 105, 108, 111, 114, 117
     184       1,   2,   3,   4,   5,   6,   7,   8,   9,  10,  11,  12
```

Fig. 3—Line Assignment Guide—TL 744 (Example) (Sheet 1 of 2) (4.03)

```
COMPANY_____                    TNDS           PROCESS DATE_____
   AREA_____              LOAD BALANCE         BISP LISTING  TL 744
    DIV_____                 L A G             RESP CODE_____
   DIST_____
```

```
           STUDY WEEK DATE:                 CCS/MAIN STATION:

           LOAD    DIVISION:
OFC TYPE:
```

ASGM ORDER	CCS TO ADD	PROJ CCS	% CAP	MDF LOC	LOAD UNIT LFG	ASSIGNMENTS LT	C/S	DISCONNECTS LT	C/S
1	320	3	01		184				
2					184				
3			02		184				
4					184				
5			03		184				
6			04		184				
7					184				
8			05		184				
9					184				
10			06		184				
11			07		184				
12					184				
13			08		184				
14					184				
15			09		184				
16			10		184				
17					184				
18			11		184				
19					184				
20			12		184				
21			13		184				
22					184				
23			14		184				
24					184				
25			15		184				
26			16		184				
27					184				
28			17		184				
29					184				
30			18		184				
31					184				
32			19		184				
33			20		184				
34	236	3			080				
35					184				
36					080				
37			21		184				
38					080				
39					184				
40					080				

Fig. 3—Line Assignment Guide—TL 744 (Example) (Sheet 2 of 2) (4.03)

COMPANY_____   TNDS   PROCESS DATE_____
AREA_____   LOAD BALANCE   BISP LISTING __TL 745__
DIV_____   CONDENSED   RESP CODE_____
DIST_____   L A G

STUDY WEEK DATE: CCS/MAIN STATIONS: L 2.0

OFC TYPE: LOAD   DIVISION: M 4.0
       H 6.0

ZONE ID	MDF LOC	LOAD LLF	UNIT HG	PROJ CCS	% CAP	ADD CCS	NBR LINES	ASGM MADE	REMARKS
02		10	0	80	68	35	18	----	
02		10	9	80		35	18	----	
02		9	2	84	72	32	16	----	
02		10	6	88	75	28	14	----	
02		10	7	92	79	24	12	----	
02		10	3	92		24	12	----	
02		9	3	96	82	20	10	----	
02		9	1	100	86	17	9	----	
02		10	8	104	89	13	7	----	
02		10	4	108	93	9	5	----	
02		10	5	108		9	5	----	
02		10	1	120	103	- 2	- 1	----	
02		10	2	120		- 2	- 1	----	
02		9	9	120		- 2	- 1	----	
02		9	0	136	117	- 17	- 9	----	
02		9	7	140	120	- 20	- 10	----	
02		9	5	156	134	- 35	- 18	----	
02		9	6	156		- 35	- 18	----	
02		9	4	156		- 35	- 18	----	
02		9	8	160	137	- 38	- 19	----	
04		11	0	20	17	84	42	----	
04		11	5	21	18	84	42	----	
04		12	1	26	22	79	40	----	
04		12	8	49	42	57	29	----	
04		12	9	61	52	46	23	----	
04		11	4	100	86	17	9	----	
04		11	2	104	89	13	7	----	
04		12	0	108	93	9	5	----	
04		11	1	120	103	- 2	- 1	----	
04		12	2	124	106	- 6	- 3	----	
04		12	3	128	110	- 9	- 5	----	
04		12	4	132	113	- 13	- 7	----	
04		11	3	136	117	- 17	- 9	----	
04		11	6	140	120	- 20	- 10	----	
04		11	7	144	124	- 24	- 12	----	
04		12	5	148	127	- 28	- 14	----	
04		11	8	152	131	- 32	- 16	----	
04		11	9	156	134	- 35	- 18	----	
04		12	7	160	137	- 38	- 19	----	
04		12	6	160		- 38	- 19	----	

ZONE TRAFFIC UNIT EXAMPLE

Fig. 4—Condensed Line Assignment Guide—TL 745 (Example) (Sheet 1 of 2) (4.22)

```
COMPANY_____              TNDS              PROCESS DATE_____
   AREA_____          LOAD BALANCE          BISP LISTING  TL 745
    DIV_____           CONDENSED            RESP CODE_____
   DIST_____             L A G
```

```
MPLS MN 24 72C     STUDY WEEK DATE:            CCS/MAIN STATIONS:  L 2.0
OFC TYPE:             LOAD    DIVISION:                            M 4.0
                                                                  H 6.0
```

ZONE ID	MDF LOC	LOAD LLF	UNIT HG	PROJ CCS	% CAP	ADD CCS	NBR LINES	ASGM MADE	REMARKS
		12	7 .	80	68	35	18	----	
		14	3	80		35	18	----	
		15	2	84	72	32	16	----	
		14	7	84		32	16	----	
		13	7	88	75	28	14	----	
		13	3	92	79	24	12	----	
		11	7	92		24	12	----	
		12	3	96	82	20	10	----	
		11	3	96		20	10	----	
		10	4	100	86	17	9	----	
		17	3	104	89	13	7	----	
		13	6	104		13	7	----	
		01	1	108	93	9	5	----	
		10	1	108		9	5	----	
		16	3	112		6	3	----	
		10	6	112		6	3	----	
		17	4	116	100	2	1	----	
		15	8	116		2	1	----	
		12	6	120	103	- 2 -	1	----	
		16	7	120		- 2 -	1	----	
		13	2	124	106	- 6 -	3	----	
		13	8	128	110	- 9 -	5	----	
		17	6	132	113	- 13 -	7	----	
		12	4	132		- 13 -	7	----	
		14	1	136	117	- 17 -	9	----	
		11	4	140	120	- 20 -	10	----	
		13	0	144	124	- 24 -	12	----	
		15	9	144		- 24 -	12	----	
		15	0	148	127	- 28 -	14	----	
		10	9	148		- 28 -	14	----	
		17	7	148		- 28 -	14	----	
		12	2	152	131	- 32 -	16	----	
		16	6	152		- 32 -	16	----	
		17	2	152		- 32 -	16	----	
		$00	0	156	134	- 35 -	18	----	
		$07	5	156		- 35 -	18	----	
		$04	6	160	137	- 38 -	19	----	

NON-ZONE TRAFFIC UNIT EXAMPLE

Fig. 4—Condensed Line Assignment Guide—TL 745 (Example) (Sheet 2 of 2) (4.22)

COMPANY_____
  AREA_____
   DIV_____
DIST_____

TNDS
LOAD BALANCE
L E T

PROCESS DATE_____
BISP LISTING TL 746
RESP CODE_____

MPLS MN 01 34E   STUDY WEEK DATE: CCS/MAIN STATION:

                           LOAD   DIVISION: CG01-PARENT

OFC TYPE: ZONE

ASGM ORDER	CCS TO RMV	PROJ CCS	% CAP	MDF LOC	LOAD LLN	UNIT CONC	SELECTED SW	LVL	C/S	DISCONNECTS SW	LVL	C/S	
1	35	128	77		03	505							
2			74		03	505							
3			72		03	505							
4			69		03	505							
5	18	105	63		03	504							
6					03	505							
7			60		03	504							
8					03	505							
9			58		03	504							
10					03	505							
11			55		03	504							
12					03	505							
13			53		03	504							
14					03	505							
15			50		03	504							
16					03	505							
17	- 7	13	44		01	416							
18	- 7	13			05	512							
19					03	504							
20					03	505							

Fig. 5—Line Equipment Transfer Guide—TL 746 (Example) (4.27)

COMPANY_____
AREA_____
DIV_____
DIST_____

TNDS
LCAD BALANCE
CONDENSED
L E T

PROCESS DATE_____
BISP LISTING TL 747
RESP CODE_____

MPLS MN 24 72C   STUDY WEEK DATE:

OFC TYPE: 5XB   LOAD   DIVISION: C1

CCS/MAIN STATIONS: L 2.0
                    M 4.0
                    H 6.0

ZONE ID	MDF LOC	LOAD LLF	UNIT HG	PROJ CCS	% CAP	RMV CCS	NBR LINES	ASGM MADE	REMARKS
02		$ 9	8	160	137	38	19**	----	
02		$ 9	4	156	134	38	19**	----	
02		$ 9	6	156		35	18**	----	
02		$ 9	5	156		35	18**	----	
02		$ 9	7	140	120	20	10*	----	
02		$ 9	0	136	117	17	9	----	
02		$ 9	9	120	103	2	1	----	
02		10	2	120		2	1	----	
02		10	1	120		2	1	----	
02		10	5	108	93	- 9	- 5	----	
02		10	4	108		- 9	- 5	----	
02		10	8	104	89	- 13	- 7	----	
02		&$ 9	1	100	86	- 17	- 9	----	
02		&$ 9	3	96	82	- 20	- 10	----	
02		10	3	92	79	- 24	- 12	----	
02		10	7	92		- 24	- 12	----	
02		10	6	88	75	- 28	- 14	----	
02		&$ 9	3	84	72	- 32	- 16	----	
02		10	9	80	68	- 35	- 18	----	
02		10	0	80		- 35	- 18	----	
04		12	6	160	137	38	19**	----	
04		12	7	160		38	19**	----	
04		11	9	156	134	35	18**	----	
04		11	8	152	131	32	16*	----	
04		12	5	148	127	28	14*	----	
04		11	7	144	124	24	12*	----	
04		11	6	140	120	20	10*	----	
04		11	3	136	117	17	9	----	
04		12	4	132	113	13	7	----	
04		12	3	128	110	9	5	----	
04		12	2	124	106	6	3	----	
04		11	1	120	103	2	1	----	
04		12	0	108	93	- 9	- 5	----	
04		11	2	104	89	- 13	- 7	----	
04		11	4	100	86	- 17	- 9	----	
04		12	9	61	52	- 46	- 23	----	
04		12	8	49	42	- 57	- 29	----	
04		12	1	26	22	- 79	- 40	----	
04		11	5	21	18	- 84	- 42	----	
04		11	0	20	17	- 84	- 42	----	

ZONE TRAFFIC UNIT EXAMPLE

Fig. 6—Condensed Line Equipment Transfer Guide—TL 747 (Example) (4.35)