POINT-TO-POINT DATA—OVERVIEW OF SYSTEMS

TRUNK DATA

NETWORK OPERATIONS METHODS

1. BACKGROUND

1.01 This section defines point-to-point data and discusses their application in trunk forecasting and servicing. The types and sources of point-to-point data and the quality of these data are also discussed. Sections 780-401-310, -320, and -330 discuss available point-to-point data systems and describe their outputs and use in trunk engineering.

1.02 This is the initial issue of this section and is provided as part of a comprehensive restructure of the 780-401-ZZZ series. Whenever this section is reissued, the reason(s) for reissue will be given in this paragraph.

1.03 References in this section to methods, planning, data requirements, service levels, and equipment quantities are based on American Telephone and Telegraph Company recommendations.

1.04 For the standard meaning of terms and definitions used in this section, see Section 780-400-305, "Glossary of Trunk Facilities Terms and Definitions."

DEFINITION OF TERMS

1.05 Point-to-point data are measures of the volume of traffic from one defined geographic area to another. Point-to-point data are normally expressed in terms of traffic items, where a traffic item is the one-way traffic for a particular class (or classes) of service from an originating NXX, trunking entity, or toll center to a terminating NXX, trunking entity, or toll center. Point-to-point data systems consist of the hardware and software necessary for recording, accumulating, and summarizing these data.

REQUIREMENTS FOR POINT-TO-POINT DATA

1.06 Point-to-point data are required whenever it is necessary to derive loads for individual traffic items that share a trunk group with other traffic items. Where such sharing exists, traffic item loads cannot be determined from trunk group measurements. Generally, this condition of multiple traffic items on the same trunk group includes all traffic items that are switched at a tandem, and also may include some traffic items that route over end-office to end-office trunk groups. Whenever the desired traffic item is all of the traffic offered to a trunk group, the trunk group measurement data effectively are point-to-point data. This is

frequently the case for certain types of trunk groups, particularly end-office to end-office trunk groups.

1.07 In trunk forecasting, point-to-point data are necessary for each traffic item that may be routed in any of the forecast periods differently from the base or measurement period. These routing changes are commonly the result of the rehoming or recentering of end offices or tandems which require the establishment of new trunk groups and the resizing of existing trunk groups. Point-to-point data are also needed for traffic items that require a different projection treatment. For all such items, the point-to-point loads must be determined when forecasting the trunk groups involved.

1.08 In trunk servicing, point-to-point data are useful when it is necessary to reroute traffic when the assumptions underlying the forecast have not been realized, or to alleviate network overloads caused by unpredicted shorter term fluctuations.

TYPES OF POINT-TO-POINT DATA SYSTEMS

1.09 Several point-to-point data systems have evolved from the differing needs of engineering metropolitan networks and the North American network. The particular universe of point-to-point data, required for a given network in any forecast period, is theoretically all of the traffic items that may require individual treatment in the forecasting process. The impracticality of advance identification of such a universe in detail, the forces that prevent complete realization of an engineering plan, and the economics of point-to-point data collection systems have all influenced the design of these systems. As a result, the design of a particular system dictates the universe of point-to-point data encompassed in a particular study. Hence, present point-to-point data systems may provide data for all toll traffic, or all traffic switched at crossbar tandems, or all traffic in a metropolitan network, or a limited predetermined set of traffic items.

1.10 Point-to-point data systems measure the one-way traffic volumes from an NXX, trunking entity, toll center or NPA to an NXX, trunking entity, toll center or NPA. Thus, a system may collect and/or summarize point-to-point data for individual traffic items, or selected groupings of traffic items. Data may be collected for various hours and study periods but are normally scheduled

coincident with related trunk group measurements in busy season or base study periods. The coordinated scheduling of point-to-point and trunk group data supports the proper tracking of data from these two sources.

1.11 Data collected by different systems may not be expressed in identical terms due to the design of the particular system. The basic difference in point-to-point data systems is that some count events only, such as attempts or messages, while others count events and record the associated occupancy time, such as length of conversation.

QUALITY CONSIDERATIONS

1.12 In most multitandem metropolitan networks and the North American network, the number of traffic items for which point-to-point data are required, and the volumes of traffic they represent, are so large that existing point-to-point data systems have been designed to sample the universe to be measured. The requirement for point-to-point data is commonly focused on such complex networks. Since any sampling process introduces a degree of error, it is important that this source of error be recognized, and that the amount of error due to sampling be known and kept at acceptable levels.

1.13 The trunk forecasting process requires traffic items expressed in terms of offered loads. Since no point-to-point data system provides data directly in terms of offered loads, it is always necessary to convert source data into estimates of offered loads. This conversion process also contributes an element of error that must be recognized and kept at acceptable levels.

1.14 Other major factors which affect the quality of point-to-point data include how well the measurement period represents the busy-season busy hour(s) and how well the resulting data are coordinated with both trunk group data and routing records. Part 3 of this section contains a more detailed discussion of point-to-point data accuracy, and the sections pertaining to each point-to-point data system include discussion of the particular data quality associated with that system.

OTHER APPLICATIONS OF POINT-TO-POINT DATA

1.15 Point-to-point data, in addition to their use in trunking work, are used in other applications such as long-range network planning, separation

studies, rate studies, and marketing studies. Coordination of scheduling, collecting, and summarizing of point-to-point data for these other applications, as well as for trunking needs, is the responsibility of the trunking engineer. The discussion of point-to-point data, their accuracy, and recommended conversion routines included in this and the following sections are directed to the needs of trunk forecasting and servicing and have not been designed to serve other needs.

2. POINT-TO-POINT DATA TYPES AND SOURCES

2.01 The requirement for detail for each traffic item is implicit in the nature of point-to-point data and their uses. Accordingly, point-to-point data systems must either collect the required details or use an available data base that includes such information.

2.02 The Centralized Message Data System (CMDS) is an existing system that provides a standard operation for exchange of information for all intercompany billed toll traffic (CMDS-I) and additionally provides a data base of a 5 percent sample of all toll traffic (CMDS-II). Since toll billing procedures that support CMDS-II require basic calling, called and billable conversation time detail, the CMDS-II data base also provides a convenient source of toll point-to-point data. This data base is currently used for identified study periods as a source of estimated point-to-point loads for all toll traffic.

2.03 Inputs to the CMDS process are from the Automatic Message Accounting system (AMA) and other sources (such as operator handled or serviced traffic). The AMA provides data from customer dialed traffic, while the other sources provide non-AMA record toll messages. The combined data from all sources provide a total toll traffic base. The AMA process may also be used to provide billing information for nontoll traffic, such as multimessage unit (MMU) traffic. When such details are available, they may become another source of point-to-point data, even though they are not processed through CMDS.

2.04 Sections 780-403-345 and -350 describe the CMDS-II data base and data summaries that have been designed for trunk engineering applications. The trunk engineering applications for this data are described in Section 780-401-320.

2.05 Data summaries from CMDS-II, however, provide data only for toll traffic. Since CMDS-II employs a billing data base, it excludes traffic which is not billed, such as uncompleted attempts, 555 traffic, some official traffic, etc. For the completed messages included in the data base, it also excludes the nonconversation trunk occupancy time which is not billable, such as the time associated with the establishment of connections by switching systems and/or operators and ringing time. This nonbillable, or unrecorded, network occupancy represents loads that are carried on the message network, and must be considered in engineering future requirements.

2.06 Other point-to-point data systems that are available to meet some of the needs for data not provided by CMDS-II are the Point-to-Point Attempt Analyzer (PPAA) Crossbar Tandem system and Preroute Peg Count Registers for crossbar, panel and ESS offices. These systems provide counts of attempts during scheduled time intervals and study periods and identify the destination of each attempt recorded.

2.07 These particular systems (discussed in more detail in Sections 780-401-310 and -330) count attempts only and provide no indication of the holding time associated with each attempt. The conversion of these data to point-to-point loads generally employs an algorithm which does not accord individual holding times to each attempt or traffic item. Algorithms that accord individual holding times to individual items may be used to recognize distance or cost of a call; but, normally, a common holding time for all items is implicit in such systems.

2.08 A fundamental consideration in point-to-point data systems is whether the data are collected at end offices or tandems. End-office collection systems permit measurement of traffic generated in that end office. In end-office collection systems, the universe of data available is very large, and the traffic items actually needed may be only a small part of the universe. Accordingly, end-office systems may be arranged to record data on individual traffic items, or they may take a representative sample of a greater universe. End-office systems have the advantage of measuring traffic as close to the source as possible. They have the disadvantages of having to measure a potentially large universe and, in some systems, not identifying the actual routing of the traffic.

2.09 Tandem collection systems measure only the traffic switched at a tandem and only the first leg of the traffic routing. Since traffic items routed via tandems are most subject to route transfers, the point-to-point data furnished by these systems normally provide most of the data required for the determination of new trunk groups and rearrangements or resizing of existing groups affected by transfers. Tandem systems generally have the advantages of focusing on those items required for a forecast, providing actual study-period routes for traffic items, and assisting in the identification of misrouted traffic. They have the disadvantage of excluding traffic routed over end-office to end-office trunk groups, but adequate data for such traffic items are usually provided from trunk-group measurements. Generally, a tandem collection system does not identify the class of service, such as coin, business, or WATS. Figure 1 provides a comparison of the presently available standard point-to-point data systems and their features.

2.10 In addition to the standard systems mentioned in preceding paragraphs, Operating Companies have developed various special systems to meet particular point-to-point data needs. These systems generally reflect both the requirements in a given company, and the type of switching and/or billing equipment that exists in the company. Such systems fulfill recognized needs and may even be interfaced with mechanized systems. These systems are appropriate for their areas of application, provided that data are representative of the traffic levels and characteristics required for forecasting and servicing, and that they have an acceptable level of accuracy.

3. QUALITY OF POINT-TO-POINT DATA

3.01 Point-to-point data are one of the basic inputs to the trunk forecasting process and, accordingly, impact the accuracy of the output from that process. Point-to-point data vary in the accuracy with which data represent the traffic profiles of a base measurement period, being dependent on the type and volume of data collected and the size of the traffic items measured. Impact on forecast accuracy varies with the degree to which the forecast is based upon point-to-point data and with the level of volatility of the network between base and forecast periods. Since the effect of point-to-point data accuracy on forecast accuracy is not known, it is the objective to obtain point-to-point data that are coincident with associated trunk group data and that produce traffic item loads that are reasonably consistent over a period of time.

3.02 The quality of point-to-point data is determined by:

(a) How well the study-period traffic represents the levels, distribution profiles, and characteristics desired for projection to future levels

(b) How precisely the data measure the actual traffic during the study period

(c) How well these data are converted into loads.

3.03 Considerations in the selection of the days and hours that comprise a given study period for point-to-point data collection are identical with the considerations for determining a trunk base or measurement period. Considerations for the scheduling of trunk group data studies are covered in the 780-401-2ZZ series. To provide data of acceptable quality, point-to-point data studies should be coordinated with trunk group data studies, as the two types of data are normally used jointly in the determination of the base-offered loads required for a trunk forecast. The major considerations are that measurements be taken during the annual busy-season periods, and for a sufficient number of hours each day during the period to reflect the established traffic profiles during the significant hours.

3.04 Another major factor affecting the quality of point-to-point data is the accuracy with which the data indicate the actual study period traffic. The large size of the universe of point-to-point data items for any network or area normally dictates that some sampling technique be used in the data collection system. When sampling is employed, sampling error is introduced that affects point-to-point data accuracy.

3.05 The error that results from a random sampling process is dependent on how representative a given sample is of the universe from which it has been selected. This error is statistically dependent on the size of the sample, becoming smaller as the sample size is increased.

POINT-TO-POINT DATA SYSTEM	COLLECTION LOCATION	DATA SOURCE	UNIVERSE MEASURED	SAMPLE SIZE	DATA DETAIL	ROUTE IDENTIFICATION
CMDS-II (See Section 780-401-320)	End office or centralized location for recording billing data)	Billing Data	Toll Messages	5% of messages processed each day in each Revenue Accounting Office (RAO)	Messages and conversation CCS per traffic item.	None provided in system
PPAA (See Section 780-401-310)	Crossbar tandem	Marker Attempts	All attempts received at the crossbar tandem	Approximately 4% during busy hours	For each trunk group with an incoming appearance, the number of attempts (and percentage of total attempts) for each traffic item.	Incoming trunks to the crossbar tandem
Preroute Peg Count: No. 1XB & 5XB Panel No. 1, 2, & 3 ESS (See Section 780-401-330)	End office (or tandem if switching system is performing a tandem function)	Marker, Decoder, or Control group attempts	All attempts to (a) preassigned destination codes, or (b) group of codes	100% of traffic items for assigned codes	Number of attempts per traffic item	None provided in system

Fig. 1—Comparison of Point-to-Point Data Systems

3.06 An additional problem occurs when the sampling of a large universe is used to estimate subdivisions of that universe. As the number of subdivisions increases, and their size decreases, the accuracy of the estimate of each subdivision decreases. This occurs because the actual rate of sampling of any subdivision is not known since it varies from the established rate of sampling of the universe. The Trunk Engineering application of the CMDS-II data base is an example of this sampling problem, as discussed in Section 780-401-320.

3.07 All existing point-to-point data systems require conversion of output into terms of traffic-item offered loads. These loads may be developed for each traffic item from source point-to-point data, or developed by distributing a trunk group load with a set of point-to-point data. With either method, the conversion process becomes an additional source of error.

3.08 In the traffic item conversion method, point-to-point data are converted directly by the application of factors that convert attempts or messages to loads, or expand conversation time to include additional elements of load which must be carried on the network. It is generally adequate to apply overall conversion factors that include representative loading instead of individual traffic item loadings. It is crucial that base loads created from source data, using this conversion method, provide overall load levels that have no persistent bias. Persistent system bias will normally contribute to an understatement, or overstatement, of network requirements.

3.09 In the trunk group load distribution method, a load determined from trunk group data is distributed among all traffic items offered to, or carried on, the trunk group based on their ratios of point-to-point data in terms of attempts, messages, or conversation time. The concepts and procedures for forming ratios from point-to-point data are described in the sections pertaining to each point-to-point data system. This conversion process assures inclusion of all network usage, as determined from trunk group measurements.

3.10 The traffic item conversion method has the advantage of permitting any traffic item load to be developed individually, and is simple in its application. However, individual item conversion often provides no effective tracking between the resulting, derived item loads and the trunk group loads with which they will be merged in the forecasting process. The trunk group load distribution method provides point-to-point loads which track with the trunk group loads used in the forecasting process, but it has the disadvantages of requiring that point-to-point data be available for all traffic items offered to a trunk group, and the often substantial work involved when there are numerous such traffic items offered to the trunk group.

3.11 The procedures for application of these conversion methods, and the errors associated with the particular point-to-point data systems, are discussed in Sections 780-401-310, -320, and -330. These sections provide more detail on trunk engineering applications of each of the point-to-point data systems identified in this section.