TELEPHONE TRAFFIC - DIAL COMMON CONTROL SYSTEMS EQUIPMENT QUANTITIES

CONTENTS

1. GENERAL

1.1 This section is intended to provide REA borrowers, consulting engineers, and other interested parties with technical information for use in the design and engineering of REA borrowers' telephone systems. It relates specifically to the arrangement of equipment and calculation of quantities in "Common Control" local dial central offices.

1.2 The term "Common Control" as applied to local dial switching systems means the use of equipment which receives and stores part or all of the dial pulses from a subscriber's telephone, uses the pulses to establish a connection and is then released. The common control elements may be in use only until one digit is received or until all seven digits are dialed. By including a translator, digits may be prefixed, deleted, or translated into digits other than those dialed by the subscriber. The average holding time of the common control elements ranges from 4.5 to 17 seconds. It is independent of the length of conversation.

1.3 This section is limited to information concerning connections in the local switching equipment including those from toll and Extended Area Service (EAS) trunks and those to EAS and other trunk groups, such as Combined Line and Recording (CLR) and Information or Automatic Toll Ticketing (ATT). It includes the handling of incoming calls from toll and EAS trunk groups, but does not cover switching equipment used exclusively for the recording and completion of outgoing operator toll or Direct Distance Dialing (DDD) traffic. Neither does it include the requirements of electronic switching systems.

1.4 Common control equipment may be added to a direct response system such as step-by-step, or an integral feature of a crossbar system. Even though integrated common control systems differ in design, the same basic information is used to develop the amount of equipment required.

1.5 The objectives, with respect to dial tone delay and percentage of lost calls internally, are the same for common control systems as those in the specifications used for REA borrowers' dial systems.

1.6 Where an office handles its own toll traffic, the common control equipment may be designed and engineered to perform the register-sender and translator functions of an automatic toll ticketing (ATT) system. The toll requirements, in terms of machine attempts and holding time, are added to the local. Also, the capabilities of the register-senders and the translator have to be expanded to handle the toll traffic.

1.7 Special equipment can be added to a step-by-step office to provide for push button calling service alone, other common control features alone, or both.

1.8 Familiarity with REA TE & CM-350, "Basic Types of Switching Systems," will be helpful in understanding this section, particularly with respect to the advantages of common control operation.

2. ADDITION OF COMMON CONTROL TO STEP-BY-STEP SYSTEM

2.01 The basic purposes of adding common control equipment to a direct response (step-by-step) type of central office are to obtain the digit translation required by an extensive EAS network, to introduce push button calling, and to obtain other advantages of common control at minimum cost. The alternative is the replacement of the step-by-step equipment by a common control system with these features. The installation of common control equipment involves a substantial expenditure and this needs to be taken into account in considering the feasibility of extending EAS and introducing push button calling.

2.02 The method for adding common control in a step-by-step system is to insert a register-sender and associated equipment between the linefinder (or incoming interoffice trunk) and the first selector (or trunk selector) as illustrated in Figure 1. The pulses from the user's dial (or trunk) are stored in the register and are interpreted by the translator. The translator has a "memory" device which determines what digits, if any, are to be transmitted to the first and subsequent selectors. When this function is completed and the necessary digits have been transmitted, the linefinder and the first selector are connected by the link circuit, the common control equipment is released and is then available for handling other calls.

2.03 On local calls with conventional dials, the control elements may be released and the connection between the linefinder and first selector established as soon as enough digits are received to indicate that a local call is being dialed. This may be after one, two, or three digits. Subsequent digits go directly from the user's dial to the first and subsequent selectors. In practice, the control elements may be held until three digits are received, even though one or two indicate the call is local, in order to avoid the use of digit absorbing first selectors. A similar method may be used on EAS and on service or DDD calls which can be completed without transmitting special routing digits.

2.04 When provision is made for push button calling, each digit from a push button telephone is registered and converted, digit-by-digit, into dial pulses which are then transmitted tc the step-by-step selectors.

2.05 The holding time of the common control equipment depends on the nature of the call being handled. On a CLR call (dial zero), the first (and only) digit indicates that the connection should be cut through to the first selector at once and that the register-sender should be released. The digit "0" may have to be transmitted by the register-sender or it may already have been received by the first selector, directly from the user's dial, depending on the method of operation used. The holding time is four or five seconds. On a call to a multioffice EAS point, seven digits are recorded and eight may be transmitted, including one routing digit to reach the outgoing trunk from a level of the first selector. For this condition, the holding time is 17 seconds (Table 1). Two or more routing digits. can be prefixed where necessary, to reach all trunk groups. A critical factor in developing the register-sender requirements is the average holding time per attempt. There sometimes are alternatives which affect the register-sender holding time in laying out the routing plan. Provisions should be made for the register-sender to drop out as soon as the digits indicate no outpulsing is required on heavy traffic routes. Outpulsing should be limited, as far as practical, to light traffic routes.

2.06 The register-sender is called in every time a subscriber takes his receiver off the hook, regardless of whether he dials a complete number, only a digit or two, or does not dial at all (permanent signal). The ineffective attempts, that is, those which do not reach a called line may run in the order of 15 to 20 percent of the total attempts. A linefinder peg count would reflect all uses of the register-senders. However, a connector peg count may have to be increased something like 25 percent to obtain the number of register-sender attempts.

2.07 Enclosed, for illustration, is Table 1 showing the average register-sender holding times recommended by one supplier of common control equipment. Other suppliers suggest somewhat different values for their systems. It is the responsibility of the REA borrower's engineer to specify the number of register-sender calls during the busy hour for each classification involving a different holding time. From this the supplier can determine the number of register-senders required based on the capacity table in the specification.

2.08 The basis for estimating the various items of traffic is a peg count of total calls being handled on the equipment in service. As already stated, a linefinder peg count can be assumed to reflect register-sender attempts. Where not available, the connector peg count may be used by increasing it 25 percent unless some other figure is considered more accurate for the office. The peg count calls per line or per main station are determined and the total calls at the end of the engineering period are estimated on the basis of the projected number of lines or main stations. If a substantial amount of upgrading is in prospect, main stations are a more dependable base than lines in estimating future traffic volume.

2.09 The breakdown of total calls into the various categories involving different register-sender holding times may require some fairly broad approximations. Where peg count data are available, which give the number of calls to different destinations, such as local numbers, service codes, EAS groups, etc., they should, of course, be used. Where such information is not available, the total calls may be allocated to the different destinations on the basis of the capacity of the outgoing trunk groups in unit calls and the holding time per call. From these, the calls, or attempts, to each destination may be calculated by dividing the capacity in unit calls times 100 by the holding time in seconds. Following is an example:

EXAMPLE 1

Main Stations - Present	1000
Main Stations - Estimated End of Engineering Period	1200
Busy Hour Calls - Present Connector Peg Count	1100
Busy Hour Register-Sender Attempts - (1100 x 1.25)	1375
Busy Hour Register-Sender Attempts - Estimated End of Engineering Period $\frac{1200}{1000} \times 1375 =$	1650

	No. Equip.	Delay Table	Capacity Unit Calls	Hold Time	Number Calls	Number Calls End Engineering Period **
Second Selector 2000 Group	26	.01	471	120	393	671
Second Selector 3000 Group	14	.01	233	120	194	331
Toll and Asst. - Trunks 2-Way	10	.01	149	200	*38	65
DDD - Trunks 1-Way	6	.01	64	250	26	45
EAS						
City A Trunks 1-Way	16	.03	318	150	212	362
Office B Trunks 2-Way	8	.03	129	150	*43	73
Office C Trunks 2-Way	10	.03	178	150	*60	103
Total					966	1650

* - ½ total
** - Multiply number of calls by ratio of 1650 to 966.

2.10 From this information and the capacity table in the specification, the supplier is expected to develop the number of register-senders required, taking into account the sender access plan. Other common control equipment items are not dependent on traffic volume. However, the supplier will need to know the number of lines and the busy hour call rates expected at the end of the engineering period. If push button calling is to be furnished, the number of lines so equipped and the busy hour attempts per line must be supplied.

2.11 Where register-senders are provided for handling local traffic, they may or may not be needed for handling incoming calls from toll and EAS trunks. If they are needed, provision must be made for a connection of the trunks to register-senders as well as to incoming trunk selectors. Holding times could be estimated in a manner similar to that described for local originating traffic.

3. INTEGRATED COMMON CONTROL SYSTEM

3.1 In this type of system all digits from the subscriber's dial and from incoming trunks are registered and what is done with them depends on the type of call. On calls to local numbers, signals faster than dial pulses are transmitted to control elements which set up the connection. On local originating calls to an EAS point, the control elements set up a connection to the trunk group and from four to seven digits may be outpulsed to the distant office. The outpulsing may be dial pulses at 10 or 20 pulses per second or multifrequency pulses depending on the type of equipment at the terminating office.

3.2 The basic figure required for determining register-sender requirements is the number of calls to be handled. These must be broken down into the various types involving different register-sender holding times. The procedure for obtaining this information is similar to that already described for adding common control to a step-by-step office except that the breakdown usually can be limited to local, trunked, and service (toll, information, etc.) calls.

3.3 In the case of new offices, or whenever peg count figures are not available, the originating unit calls to be expected may be estimated as described in REA TE & CM-325, "Application Guide for the Preparation of Detail Dial Central Office Equipment Requirements." Dividing the unit calls times 100 by the holding time per attempt in seconds will give the total attempts to be handled by the register-senders. A figure of 120 seconds average holding time per local call may be assumed unless some other figure is considered more accurate. The incoming trunk unit call load, divided by the trunk holding time, may be used as a basis for estimating the register-sender requirements for incoming toll and EAS calls, but, of course, the holding times would be much longer than for local calls.

3.4 In addition to the above information on call attempts, the supplier will need line and station, interoffice trunk, and other data provided by the usual specification for central office equipment, REA Form 558c. It also will be necessary to specify the number of outward attempts and the type of pulsing for each trunk group over which pulses are to be transmitted.

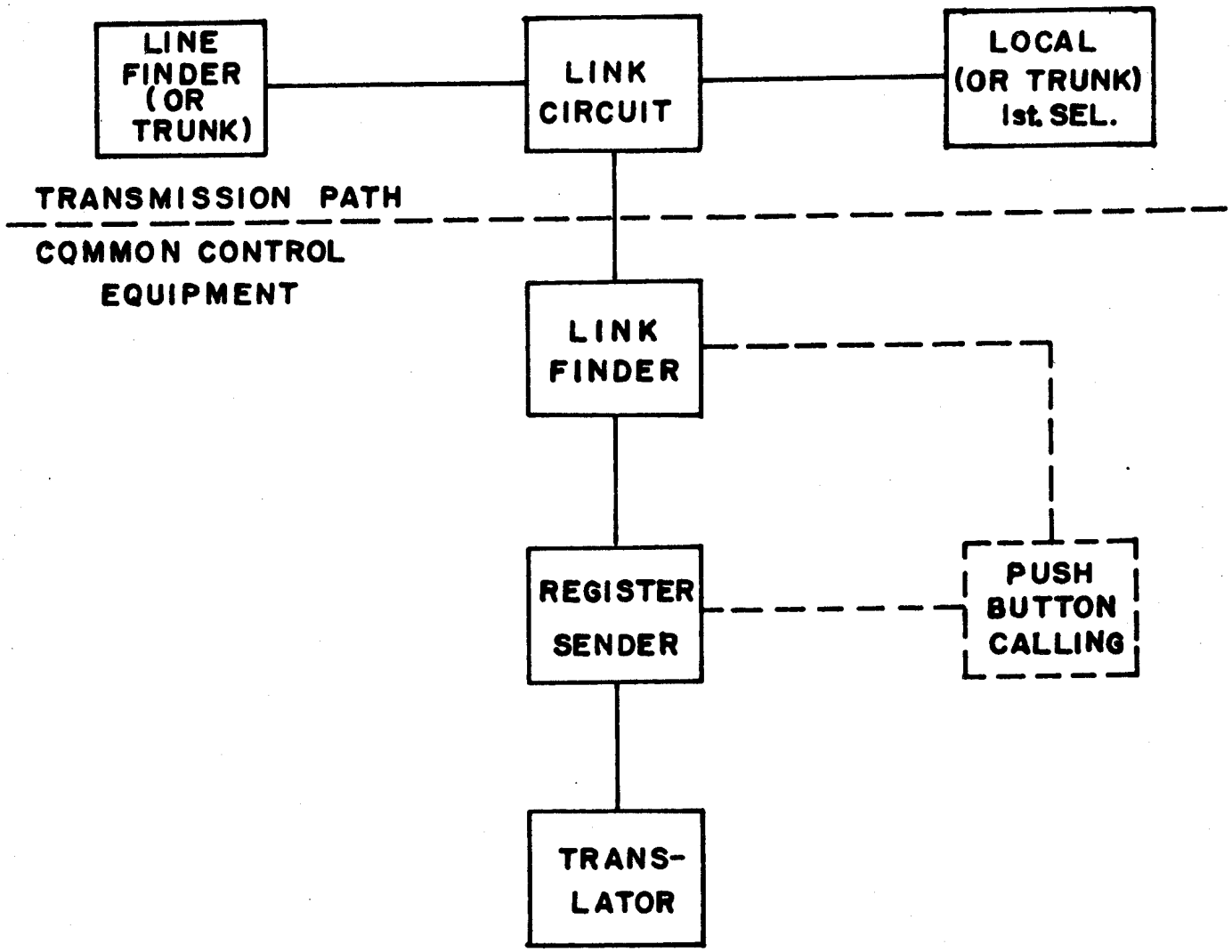
3.5 If provision is to be made for push button calling, the number of such lines and their calling rates must be specified.

TABLE 1

ILLUSTRATION OF REGISTER-SENDER HOLDING TIMES
(Automatic Electric Company)

	Average Register-Sender Holding Time	
	Dial Users	Push Button
Toll ticketing calls, three-digit service code calls, and seven-digit local calls:		
Release after one-digit	4.5 Seconds	Not Applicable
Release after two-digits	6.0 Seconds	Not Applicable
Release after three digits	7.5 Seconds	Not Applicable
Release after four digits (local calls)	9.0 Seconds	Not Applicable
After three dialed digits, translate and send:		
Two dialed digits	9.9 Seconds	6.6 Seconds
Four dialed digits	15 Seconds	9 Seconds
Five dialed Digits	15 Seconds	10 Seconds
Six dialed digits	15 Seconds	11 Seconds
Seven dialed digits	13 Seconds	12 Seconds
Eight dialed digits	17 Seconds	13 Seconds
Toll Calls		
Release after dialing "0"	4.5 Seconds	Not Applicable
Outpulse one routing digit	5.7 Seconds	4.2 Seconds
Outpulse two routing digits	6.9 Seconds	5.4 Seconds

Add four seconds if four seconds timeout is required to distinguish assistance from toll calls.



BLOCK DIAGRAM

SENDERIZED STEP-BY-STEP SYSTEM

Fig. 1