subject: Customer Telephone Facilities - 770 PBX
Traffic Business Services Facilities
Engineering Information

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FOR YOUR INFORMATION

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to: General Traffic and Switching Managers (Copies to Chief Engineers)

MR. M

from: Traffic Operations Director - Business Services

synopsis: Supplements GL 71-06-009 (June 1, 1971) to provide more details on traffic capacities of the new 770 PBX.

* * *

We now have better data on the incoming blocking potential, and on the call carrying capacities of the registers and marker of the 770 PBX.

These items are outlined in the attachment, and should suffice for your planning for the immediate future. The TBS Facilities Engineering Practices are temporarily being held up until the traffic characteristics of the system can be more reliably determined.

If there are any questions, Mr. J. L. Baker may be called in Denver on Area Code 303 427-3818.

ENGINEERING - PETE PORTER. 303 427-5225

Traffic Operations Director

Attachment

It can be seen that 6 to 7 registers will equal or surpass the marker limit of 1600 calls in the busy hour. However, caution should be used before accepting this as a sufficient number of registers. The following points must be evaluated.

1. The attendant has direct access and final preference to 3 registers without using a marker on incoming calls.

2. Toll restriction of the toll access codes "0" and "1" cause the register to remain attached until these digits are dialed by the PBX station user. This creates a longer register holding time. The volume of such calls depends on the proportion of lines that are permitted to dial "9", but are thereafter restricted from dialing toll calls.

3. Reorder (120 IPM) is furnished by the register. Excessive trunk overflow will use up registers.

   Note: A shortage of busy tone trunks will cause the register to furnish reorder to the calling party.

4. Toll restriction may be trunked to the attendant or given reorder on an optional basis. Reorder comes from the register.

5. The attendant cannot complete a call forward from an attendant trunk. She must originate the call on the trunk key and then call the station back. A significant amount of attendant controlled calling would generate additional register and marker usage.

If there is a need to determine the quantity of registers by the CCS method, it can be done by using the following holding times multiplied by the peg counts of the various types of calls, including those from tie trunks, CCSA trunks, conference lines and attendant position lines.

Operation	Holding Time in Seconds	
	Dial Pulse	TOUCH-TONE
Dial Tone to start dialing (use for second dial tone on Dial "9" also)	2.7	2.7
Dialing end to register release	2.1	2.1
Dialing time per digit (use on toll restriction also)	1.5	.8
Digit timing (Waiting next digit) (used on mised digit system)	3.0	3.0
Dial "0" attendant	4.2	2.9

NETWORK BLOCKING

It has been determined that incoming matching loss can exceed acceptable levels where there is a high CCS per line, and the number of switches is determined merely by the number of ports required as described in GL 71-06-009. The solution in such cases is to add more trunk switches. The methods for determining the number of network switches are outlined below. It is recommended that incoming matching loss of P.01 be provided.

LINE SWITCHES

Same as in GL 71-06-009; i.e., add up the number of line ports required, divide by 40, and round up to the nearest whole.

MIDDLE SWITCHES

Same as in GL 71-06-009; i.e., one middle switch for each trunk switch required.

TRUNK SWITCHES

The first step is the same as in GL 71-06-009; i.e., add up the number of trunk ports required, divide by 20, and round up to the nearest whole.

The second step is to calculate the average CCS per line by adding all calculated originating and terminating station usage plus conference, attendant position, tie trunks and CCSA trunk line port usage. The total line switch usage divided by the total line ports in use equals the average CCS per line.

The third step is to refer to Table B, attached. Find in the right hand vertical column the number of line switches required as described above. In the bottom horizontal line, find the number of trunk switches required as determined in Step 1. Follow the columns to the point where they intersect, which will indicate the CCS per line that can be carried. If the calculated average CCS per line (Step 2) is equal to or less than that obtained in Table B, the network call carrying capacity is sufficient to provide a proper level of service to the customer.

A fourth step is required only when the calculated CCS per line is greater than that shown at the intersection of the columns in Table B. In this case, follow the horizontal (lines) column to the right to obtain a CCS per line that is equal to or greater than the calculated CCS per line. When this value is obtained, follow the vertical column downward to determine the number of trunk switches required. The trunks should be distributed equally over all the trunk switches. If no value can be found that is equal to or greater than the calculated CCS per line, then a decision must be made whether the 770 PBX is the proper system to provide for the customer, not only for the job size under consideration, but also for future growth possibilities.

MARKER and REGISTERS

Preliminary evaluation of the marker and registers at the service level of 1.5% over 3 seconds dial tone delay indicates a careful analysis should be made of marker and register call processing capabilities.

Peg counts should be obtained or carefully estimated for Incoming Central Office calls, Outgoing Central Office calls and Intercom calls. Each of these types of calls will normally be in the range of 31 to 37 per cent of the total of the three types of calls. This would include false dial tone starts generated by fumbled receivers, ROH, partial dial, etc. The marker has been evaluated with each of these types of calls at 33% of the total calls including 20% of the originating attempts being false starts. With this criterion, the marker should process 1600 calls in the busy hour.

These calls generate marker attempts as follows:

Incoming Central Office Call - 1 marker attempt (connection)
Outgoing Central Office Call - 2 marker attempts (dial tone and connection)
Intercom Call - 2 marker attempts (dial tone and connection)

The marker connection on an intercom call has a holding time of approximately double that of other marker operations. Therefore, if a PBX has intercom calls significantly greater than 33% of the total calls, the marker busy hour call processing capacity would be reduced. A lower per cent of intercom calls would be the reverse situation.

Registers in the 770 PBX have been evaluated on the same basis as the marker. The following data may be used to determine register quantities but must be altered to fit the characteristics of the specific PBX system.

Table A

Number Registers	Busy Hour Offered Calls (1/3 incoming, 1/3 outgoing, 1/3 intercom)	CCS Capacity
2	100	8
3	450	22
4	800	41
5	1200	63
6	1600	86
7	2050	111
8	2500	137
9	3050	164
10	3550	192

Table B

770A PBX
Estimated Line Capacity (CCS)

Trunks

Lines	20	40	60	80	100	120	140	160	Line Switches
40	10.04 9.14								1
80	7.52 6.84	9.07 8.21							2
120	4.97 4.57	7.52 6.84	8.57 7.78						3
160	3.60 3.31	6.08 5.54	7.52 6.84	8.32 7.56					4
200		4.93 4.57	6.55 5.94	7.52 6.84	8.17 7.38				5
240		4.18 3.82	5.65 5.18	6.77 6.16	7.52 6.84	8.06 7.31			6
280		3.60 3.31	4.97 4.54	6.08 5.54	6.91 6.30	7.52 6.84	7.99 7.24		7
320			4.43 4.07	5.47 4.82	6.34 5.76	7.02 6.37	7.52 6.84	7.92 7.20	8
360			3.96 3.64	5.15 4.54	5.83 5.33	6.55 5.94	7.09 6.44	7.52 6.84	9
400			3.60 3.31	4.54 4.18	5.36 4.90	6.08 5.54	6.66 6.05	7.16 6.48	10
	1	2	3	4	5	6	7	8	

Trunk Switches

Upper figure is CCS/Line at 2% Incoming Match Loss
Lower figure is CCS/Line at 1% Incoming Match Loss