CENTREX SERVICE

NO. 5 CROSSBAR CENTREX WITH 608A CORD SWITCHBOARDS WITH NORMAL CORD PAIR OPERATION FOR THE ATTENDANT FACILITIES

GENERAL

A form of No. 5 crossbar Centrex has been developed by the New Jersey people to serve one large P.B.X. It offers the advantages of being able to be added to an existing wire spring No. 5 crossbar office without modifying the line link frames and completing markers for the new method of class-of-service and treatment identification and the transfer feature can be added to standard No. 5 crossbar "B" type non-tandem incoming trunks. The following is a description of the No. 5 crossbar Centrex office that serves the Bell Telephone Laboratories at Murray Hill, New Jersey:

Equipment and Features

1. Wire-spring No. 5 crossbar office with maximum of sixty classes-of-service (no treatments).
2. 608A cord switchboard with MF keysets.
3. Separate designations for the P.B.X. and regular subscribers.
4. High usage incoming trunks to each designation overflowing to combined groups serving both designations.
5. Modification of standard No. 5 crossbar incoming trunks for transfer. (No memory.)
6. Foreign exchange trunks.
7. Tie lines.
8. Tandem switching of tie line calls.
9. Dial dictation trunks.
10. 4-digit intra-P.B.X. dialing.
11. One digit and 3-digit tie line codes.
12. Numbering and Dialing Procedures
    "0" — Attendant
    "1" — First digit for "1XX" tie line codes
    "2, 3, 4, 6" — Thousands digits for extensions
    "5, 7, 8" — One-digit tie line codes
    "9" — Access to regular trunking network

Method of Operation

1. **Transfer Calls**

   A transfer request from a Centrex extension is activated by a switchhook flash. The switchhook flash causes the line link appearance of the incoming trunk to set up a demand for dial tone. The transfer request is then routed to a special group of transfer trunks on a manual class-of-service basis. The transfer trunks appear at the 608A cord switchboard on a double-jack basis. The attendant answers the transfer request with a back cord, and after receiving the transfer request, plugs the front cord of the pair into the associated jack. The new extension number will be key pulsed, and upon start of ring, the front cord is released. When the cord signal indicates that the second extension has answered, the back cord is taken down.

   A circuit difficulty is encountered if the second extension is busy and the incoming trunk returns a busy tone to the calling party. In order to remove the busy back condition from the incoming trunk, the attendant must release the front cord, re-insert, and transfer the call to a listed number which she can answer. This has not created an operating problem.

2. **Listed Number Calls**

   Listed number calls are routed in the normal manner to a hunting group with line equipments that terminate on jacks in the multiple of the 608A cord switchboard. Attendant

completion to local extensions is with normal cord pair operation via a 5-digit local completing group which originates in the multiple of the 608A switchboard and terminates on incoming trunk link frame appearances. Listed number calls for completion to tie lines are completed by the attendant via the tandem completing group to the local No. 5 crossbar office. The dial originating lines can not be used to complete listed number calls to tie lines because of different signalling conditions between the listed number trunks and the dial originating lines.

3. **Attendant "0" Calls**

Assistance calls and calls from restricted extensions are completed by the attendant on a normal cord pair basis. The attendant answers these calls with a back cord and completes with a front cord via the dial originating lines for calls to the DDD network and to tie lines.

4. **Tie Line Calls**

Local extensions dial both 1-digit and 3-digit tie line access codes. As additional thousands digits are required for extensions, all tie line codes will be of the "1XX" type. All the digits required for selection of the tie line group, switching, and reaching the terminating line are dialed into an originating register. Outgoing senders are used to outpulse over the tie lines. Extensive use is made of code conversion to permit a wide variety of switching capabilities. Some examples are:

a. Extension dials 162. The 162 is converted to 580. The 580 is outpulsed to the first SXS P.B.X. where a fifth level trunk is selected. The 80 is continued to the second SXS P.B.X. where an eighth level trunk is selected to the third SXS P.B.X. where the call is routed to the attendant trunk group.

b. Extension dials 143 + XXX + 4 digits. The 143 is code converted to a "9" and 9 + XXX + 4 digits is outpulsed. A ninth level trunk is selected at the distant SXS P.B.X. and the original extension user reaches a local central office where he can complete calls to its 7-digit area.

The Murray Hill No. 5 crossbar office has also been arranged as a tandem switching point for tie lines. Two-digit tie line codes are pulsed into an incoming register. These two digits plus any additional required digits are used either to complete locally or to switch through the No. 5 crossbar office to select outgoing tie lines. Some examples are:

a. Incoming register receives XX-XXXX. Call is completed to local extension.

b. Incoming register receives XX (two digits only). Call is completed to local 608A attendant or an outgoing tie line is selected and the code is converted to a "0" to reach distant attendant.

c. Incoming register receives XX + XXX + XXXX. Call is completed to a tie line group and the XX is code-converted to a "9". 9 + XXX + XXXX is outpulsed to select a ninth level trunk at a distant SXS P.B.X. to have access to the distant central office 7-digit area.

d. Incoming register receives XX + XXX + XXXX. Call is completed to an FX line on trunk link frame. This FX line is terminated on a local line link frame where after code conversion of the XX to a "9", the 9 + XXX + XXXX is outpulsed to an originating register to permit access to the 7-digit dialing area of the local No. 5 crossbar office on an AMA basis.

Miscellaneous Centrex Trunks and Circuits

1. **Transfer Trunks**

The transfer trunks are used for transfer requests only. They have trunk link frame appearances (type G108 auxiliaries) and terminate on locally developed relay equipments at the 608A switchboard. Double-jack appearances are required.

Traffic engineering considerations for transfer calls will include:

a. A dial tone marker attempt, an originating register use (.9″ HT), and completing marker use (HT .33″) to route call to the attendant.

b. Completion of transfer requests to a second extension involves additional CCS on line link and trunk link frames (45″) while call is being routed from the first extension to the attendant and back to the second extension. A completing marker use (HT .34″) for an incoming call and a 5-digit MFKP incoming register holding time of 6.2″ are required. Transfer trunks require 5-digit pulsing by the attendant because the original incoming trunk may have been common to both designations.

c. The number of transfer trunks required will be the result of the holding time times the estimated number of transfer calls with the resulting CCS read into a P = .001 table. Until actual operational data is available, it is suggested that the estimates of calls affected by transfer be sufficient to provide reasonable assurance of no postcutover transfer trunk shortage.

If a transfer trunk group overflow is incurred, the reorder tone returned to the calling party can be released only by the hang up of the calling party.

2. **Listed Number Trunks**

These trunks originate as line equipments on line link frames and terminate on SD-66719 type relay equipments at the 608A switchboard. These calls are included in the count of incoming calls in the basic data. However, the method of attendant completion of these calls involves additional switching path and common control usage not in the original count of calls. Traffic engineering considerations for listed number calls will include the following:

a. Listed number calls completed to local extensions will be completed via the local completing group and will add additional CCS to the line link frames and trunk link frames to the extent of the duration of the calls for these are not completed on a release loop basis. A 5-digit MFKP incoming register holding time of 6.2″, and a completing marker holding time of .34″ for an incoming call are required.

b. Listed number calls to be completed to tie lines are completed by the attendant via the tandem completing trunk group incoming to the local No. 5 office. The MFKP incoming register holding time is dependent upon the number of digits. A tandem switch completing marker HT of .40″ is required in addition to the outgoing sender usage. Additional CCS is added to link and trunk link frames for the second switch through these frames. Listed number lines are retained in the connection for the duration of the call. The number of listed number lines can be estimated by multiplying the number of calls times the holding time and reading the resulting CCS into a P = .01 table. It is suggested that adequate spare be provided.

3. **Attendant Trunks**

Attendant trunks are provided on the trunk link frames to route assistance calls from local extensions and attendant calls from tie lines to the 608A attendant. The No. 5 crossbar trunk (type 2D76) is coupled with SD-66716 type relay equipments at the 608A switchboard. Traffic engineering considerations will include the following:

a. It is assumed that all attendant calls from local extensions are included in the basic data of total originating calls. However, attendant completion is on a fixed loop basis via the dial originating lines and involves a second switch through the line link and trunk link frames, an MF originating register use (HT dependent upon the number of digits), a completing marker use for an outgoing call (.33″) and an outgoing sender use.

b. An estimate is required of the number of incoming tie line calls directed to

the 608A attendant. Completion of these calls may be to local extensions via the local completing trunk group which requires an MFKP incoming register use for five digits (6.2″), a completing marker use (.34″) for an incoming call and additional CCS for the second switch through the trunk link and line link frames. Completion to tie lines and the local office DDD network will involve the same traffic engineering considerations as in (a) above. The number of attendant trunks is estimated by multiplying the number of calls times the holding time and reading the resulting CCS into a P = .01 table and providing adequate reserve.

4. **Two-way Tie Lines**

Incoming tandem trunks are tied to outgoing "C" type trunks (1C36) with tandem—completing features by means of an auxiliary trunk (G88) to provide two-way service. Incoming and outgoing trunk link appearances are required. Tandem trunk numbers and line link frame appearances are provided for the incoming trunks. Incoming tie line trunks are not arranged for transfer. Traffic engineering considerations will include the switched CCS, incoming register uses, completing marker uses for switched calls, and outgoing sender uses.

In order for an incoming tie line call to be able to have access to the local No. 5 crossbar DDD network on an AMA basis, it is necessary to switch through the No. 5 office to an FX line (1C36) on the trunk link frame which terminates on a local line link frame. After switching through the office, a DP outgoing sender spills its digits to an originating register. Traffic engineering considerations for this type of call will include the considerations for switched traffic plus a dial tone marker attempt, DP originating register use, completing marker use for an outgoing call, and an outgoing sender use. CCS for a second switch through the office is added to the line link and trunk link frames.

5. **Incoming and Intra-Office Trunks**

a. **Incoming Trunks**

High usage incoming trunks individual to each designation overflowing to trunk groups common to the two designations have been provided. Incoming trunk groups individual to the P.B.X. designation and trunk groups serving both the regular subscribers and P.B.X. extensions have been modified locally to provide for transfer as the result of a switchhook flash. This transfer feature has no memory and can route transfer calls to only one attendant facility. As the result of a switchhook flash, the line link frame appearance of the incoming trunk sets up a demand for dial tone and the transfer request is routed on a manual class-of-service basis to the transfer trunk group. Activation of the transfer feature is controlled by the ringing combination assigned to the terminating line. The Centrex extensions have been assigned ringing combinations 05 for non-hunting lines and 08 for hunting groups. Regular subscribers have the normal ringing combination regularly assigned for their class-of-service which will not activate the transfer feature.

b. **Intra-office Trunks**

Since the regular subscribers have a different ANC code from the Centrex extensions, it was possible to provide a flat-rate intra-office trunk group to carry the following intra-marker group calls:

a. Calls from flat-rate regular subscribers to regular subscribers

b. Calls from extensions to extentions

c. Calls from extensions to regular subscribers

An AMA coin overtime group was provided on a 'back-to-back" basis (C17 and B60M) for calls from regular subscribers to the P.B.X. designation. The

incoming portion of the "back-to-back" intra-office trunk has been modified for transfer. This intra-office trunk arrangement requires in addition to outgoing and incoming completing marker uses, the use of an MF outgoing sender and MF incoming register.

6. **Dial Originating Lines**

Dial originating lines have been provided in the OGT multiple of the 608A switchboard (SD-66719) to be used to complete attendant "O" calls to the local office DDD network and to tie lines. These lines require assignment to MF vertical groups on the line link frames. MF originating register holding times to be used with calls from 608A switchboard attendants are included in the holding time tables in Section 2-a.

7. **Tandem Completing Trunks**

Tandem completing trunks have been provided in the OGT multiple of the 608A switchboard which terminate on B74M type trunks on the No. 5 crossbar trunk link frames. This trunk group is used to complete listed number calls to tie lines.

8. **Local Completing Trunks**

Local completing trunks have been provided in the OGT multiple of the 608A cord switchboard which terminate on B60M type trunks on the No. 5 crossbar trunk link frames. This trunk group is used to complete listed number calls to local extensions. These trunks have not been arranged for transfer because the attendant has cord supervision.

Markers

Dial Tone and completing markers need minor modifications to operate with this type of Centrex.

Incoming Register Link Frames

The incoming trunks arranged for transfer can be terminated in two incoming register link frame groups (DP or RP and MF) or can be terminated in a single incoming register link group equipped with both RP or DP and MF incoming registers. MF incoming trunks require a single appearance in the MF incoming register link group. The incoming register links need to be modified for separate or combined operation.

Originating Registers

The originating registers in this office were modified by local development. However, the new standard PBX combined originating registers have all the options necessary for operation with this system.

Dial Dictation Circuits

Dial dictation trunks were provided and operate on a dial selection basis off the trunk link frames (G108). Control of dictation machine is by dial operation after cut-through on a "1XX" code basis. Attendants and extensions with Touch-Tone calling can not operate the dictation machine.

Tie Line Group Busy Indication

Since attendants have access to tie lines on a dial selection basis only, a special group of lamps have been provided at the 608A cord switchboard to indicate to the attendant a tie line group busy condition. One lamp has been provided for each tie line group.

Night Closing Arrangements

P.B.X. make busy and transfer circuits have been provided which transfer certain of the listed number lines to a call director at a night location and make busy the remaining listed number lines.

Intercept Arrangements

Non-working numbers in number groups provided for the P.B.X. designation are routed to a 7A announcement system with a special announcement for the P.B.X. Blank thousands are routed to regular telephone company intercept. Calls for changed extension numbers can be routed to the attendant on a charge basis.

Holding Times and Capacity Tables

MF originating register holding times for calls originated by 608A cord switchboard attendants are included in Section 2-a. Standard holding times as published in the T.E.P. may be used for engineering all other items of equipment.

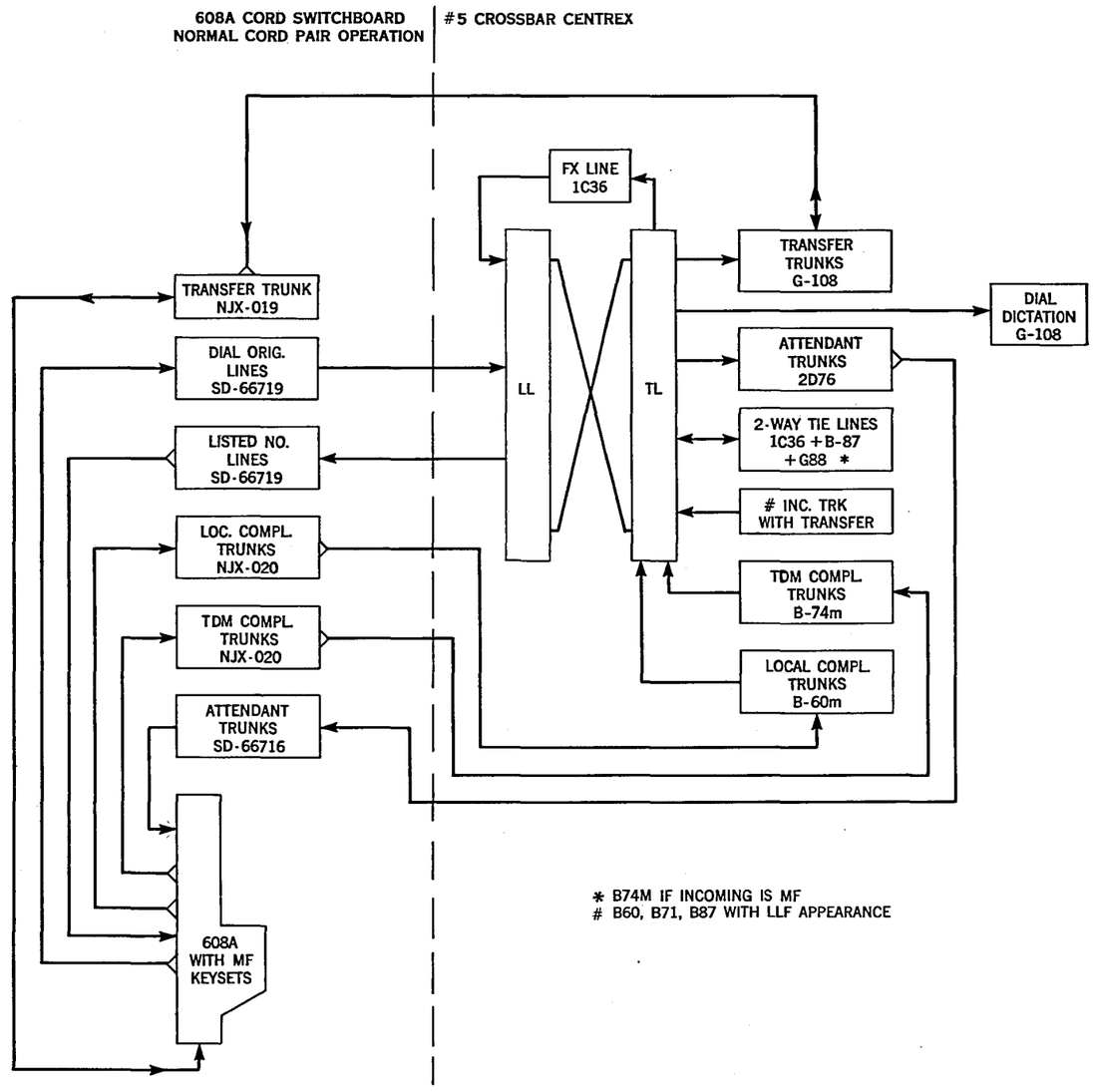

FIG. 1
#5 CROSSBAR CENTREX WITH 608A CORD SWITCHBOARDS
WITH NORMAL CORD PAIR OPERATION FOR THE ATTENDANT FACILITIES