TRUNK NETWORK DESIGN—FIRST ROUTE AND ALTERNATE ROUTE

SELECTION—NETWORK ROUTE SELECTION MODE

TRUNK ENGINEERING

NETWORK OPERATIONS METHODS

1. GENERAL

1.01 This section face sheet is issued to assign its 9-digit number to Traffic Facilities Practices

Division G, Section 3-e(4), September 1976.

This is part of the conversion of all Traffic Facilities Practices (TFPs) to the 9-digit Bell System Practices (BSPs) series as described in GL-77-05-262 and GL-77-11-200.

1.02 When this section is reissued, all references to TFP numbers will be changed to the appropriate 9-digit BSP numbers.

1.03 Recommendations for changes, additions, or deletions to this section should be forwarded on Form E-3973 as specified in Section 000-010-015.

1.04 TFP to BSP cross-reference information can be found in GL-77-11-200 and in Section 780-400-005.

TRUNK FACILITIES

TRUNK NETWORK DESIGN

FIRST ROUTE AND ALTERNATE ROUTE SELECTION

NETWORK ROUTE SELECTION MODE

000-906

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TRUNK NETWORK DESIGN

FIRST ROUTE AND ALTERNATE ROUTE SELECTION

NETWORK ROUTE SELECTION MODE

1. GENERAL

1.01 This section describes the procedures used to determine the route a call should follow when trunk groups and homing arrangements are known. The rules which underlie these procedures are discussed in Section 3-e(2). As indicated in that section, the same rules underlie the load accumulation process used to determine candidate trunk groups as discussed in Section 3-e(3). Therefore, the selection of routes per this section will be on the same basis as the planning of routes per Section 3-e(3).

1.02 Whenever this section is reissued, the reason for reissue will be listed 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 The title for each figure includes a number(s) in parentheses which identifies the paragraph(s) in which the figure is referenced.

1.05 The routing of most calls in a hierarchical network involves an originating ladder, a terminating ladder, and trunking interconnecting the two ladders. In metropolitan networks, a 2-level ladder is normally employed. Sketches 1 and 2 illustrate double tandem and single tandem arrangements of a 2-level network. A 5-level ladder, common to the North American network, is illustrated in Sketch 3.
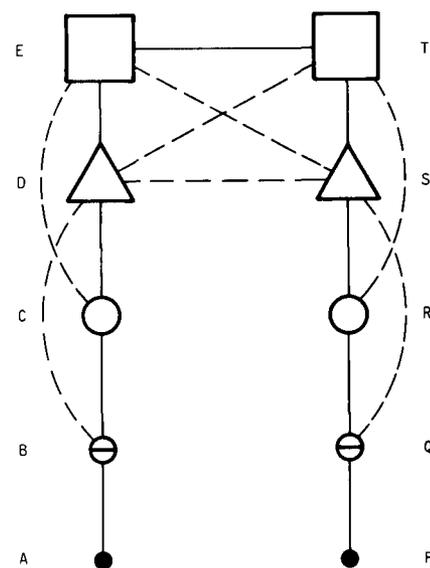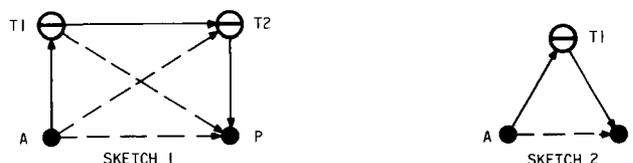
SKETCH 1

SKETCH 2

SKETCH 3

1.06 In metropolitan networks of two levels, the originating ladder is the final trunk group from end office to tandem, and the terminating ladder is the final trunk group from tandem to end office. Trunk groups A-P, A-T2, T1-P and T1-T2 in Sketch 1 are examples of interladder trunk groups.

1.07 In the North American network as illustrated in Sketch 3, for the routing of a call from A to P, the originating ladder is A-B-C-D-E, the
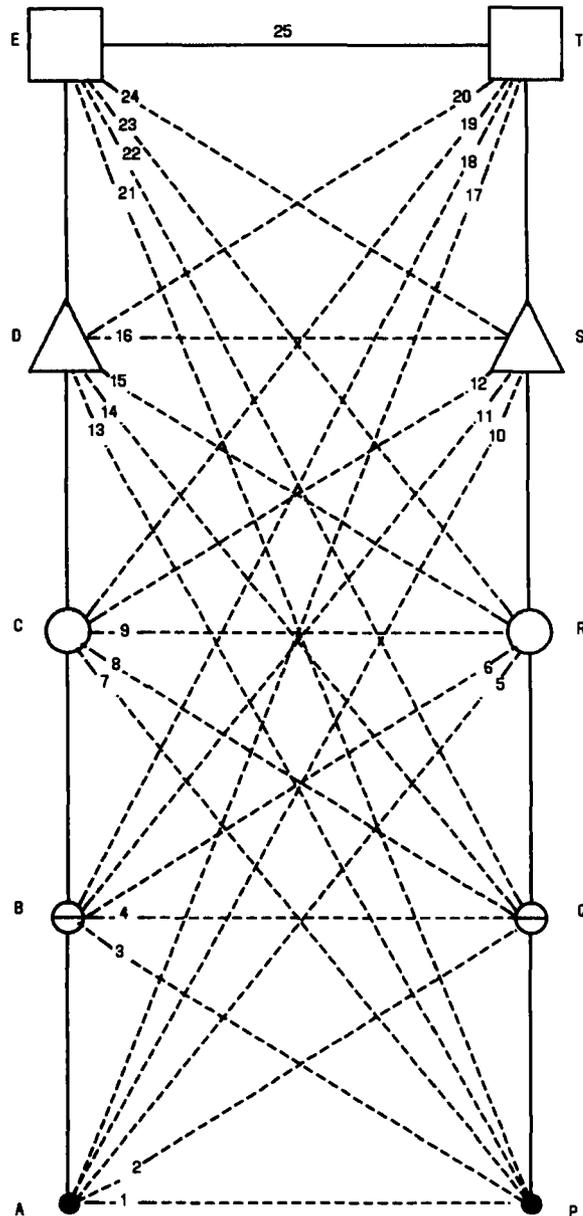
terminating ladder is T-S-R-Q-P, and trunk groups D-S, D-T, E-S, and E-T are examples of interladder trunk groups.

1.08 The identification of the proper interladder trunk group for the routing of a given call will identify the originating ladder "exit" point and the terminating ladder "entry" point. Once these exit and entry points are identified and the intraladder trunking arrangements are known, a first choice route from originating to terminating location can be determined as described beginning with 2.01.

2.   INTERLADDER ROUTE SELECTION

2.01   As described in Division G, Section 3-a, various levels of traffic concentration are used to achieve an appropriate balance between trunking and switching. The primary requirement, of course, is that every customer must be connectable to every other customer. In a hierarchy having a maximum of five levels, customer lines are terminated on the switching function 5 level. Switching functions 5, 4, 3, 2, and 1 are provided for concentrating traffic into efficient packages for trunking. Under this arrangement, there is a maximum of 25 interladder trunk groups from the originating ladder to the terminating ladder. The routing procedures here described provide a specific sequence of first route selection from among the 25 choices. Sketch 4 shows all of these trunk groups numbered sequentially, indicating the preference arrangement for routing a call from A to P. Note that this illustrates the trunk group choice only for the interladder trunk groups. Intraladder routing is described beginning with 3.01.

INTERLADDER TRUNK GROUPS –
COMPLETE INTERCONNECTION
SKETCH 4

2.02   For both interladder and intraladder routing, the switching *function* performed by a given switching system is a controlling factor. Switching functions are defined in the Glossary, Section 1-a(2), and there is also a discussion of multiple switching functions in Section 3-e(2). A discussion of route selection from switching systems performing multiple switching functions is found beginning with 4.03.

2.03   While Sketch 4 depicts the maximum interladder trunk group arrangement for a hierarchy having a maximum of five levels, it is also usable in specifying the trunk group selection sequence within a hierarchy of fewer than five levels, with final trunk groups between the highest equal class switching systems. For example in a 2-level Metropolitan network, trunk group B-Q in Sketch 4 may be a final trunk group and trunk

groups to switching systems C, D, E, R, S, and T are not involved. For a 3-level hierarchy, trunk group C-R may be a final trunk group and trunk groups to switching systems D, E, S, and T are not involved. For a 4-level hierarchy, trunk group D-S may be a final trunk group and trunk groups to switching systems E and T are not involved.

2.04 In a similar manner, the Sketch 4 trunking diagram also may be used to specify the trunk group selection sequence within a hierarchy of five or fewer levels, where the originating and terminating ladders are connected by final trunk groups to a common switching system. This can be illustrated by an intrasectional configuration as shown in Sketch 5.

INTERLADDER TRUNK GROUPS
SKETCH 5
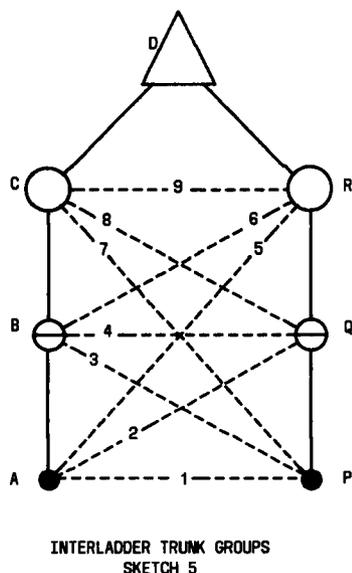
2.05 In the above example, routing involving a switch at D is determined by the intraladder procedures described beginning with 3.01 of this section.

2.06 To summarize, the trunking diagram in Sketch 4 can be used to determine which *interladder* trunk group should be selected as the first choice route for a call *from* A *to* P. This can be done by overlaying an actual trunking arrangement on the maximum arrangement per Sketch 4, and selecting the lowest numbered route

that is available. The general preference sequence for the interladder trunk group is:

   (1) A call involving no tandem switch

       Route A-P.

   (2) A call involving a function 4 switch

       Route A-Q, B-P, or B-Q in that order.

   (3) A call involving a function 3 switch

       Route A-R, B-R, C-P, C-Q, or C-R in that order.

   (4) A call involving a function 2 switch

       Route A-S, B-S, C-S, D-P, D-Q, D-R, or D-S in that order.

   (5) A call involving a function 1 switch

   Route A-T, B-T, C-T, D-T, E-P, E-Q, E-R, E-S, or E-T in that order.

2.07 This procedure provides only the *first choice* interladder route *from* A *to* P. It should not be assumed that calls from P to A will route in the same manner. To determine the P to A route requires reversing the diagram making P-Q-R-S-T the originating ladder and E-D-C-B-A the terminating ladder. Referring to Sketch 4 on this basis, the preferred route P to A is P-A, P-B, Q-A, Q-B, P-C, Q-C, R-A, R-B, R-C, P-D, Q-D, R-D, S-A, S-B, S-C, S-D, P-E, Q-E, R-E, S-E, T-A, T-B, T-C, T-D, T-E, in that sequence.

2.08 As discussed in Section 3-e(2), the *alternate route* for any high-usage trunk group is the route the point-to-point item between the trunk group terminals would follow if the high-usage trunk group did not exist. Referring to Sketch 4, this is the next higher-numbered trunk group terminated at one of the common switching systems. For example, trunk group 16 D-S alternate routes from D over trunk group 20 D-T, the next higher-numbered group with a switching system (D) common to both the direct and the alternate route.

3. INTRALADDER ROUTE SELECTION

3.01 Just as there is a preferred first choice route interconnecting originating and terminating

ladders as described above, there is also a preferred routing *within* each of these ladders. In a 5-level hierarchy there can be a maximum of 10 intraladder trunk groups, excluding PPHU and divided trunk groups, and eight possible *routes.* In a 4-level hierarchy, or in those cases where the exit or entry point described in 1.08 is at the fourth level, there can be six intraladder trunk groups and four possible routes. For a 3-level hierarchy or cases with exit or entry at the third level, there can be three intraladder trunk groups and two possible routes. For a 2-level hierarchy or cases with exit or entry at the second level, there is only the one final route. The routing procedures provide a specific sequence for selecting the preferred first choice route from among the available routes. Sketch 6 shows all the possible routes, numbered sequentially, indicating the preference arrangement.

5 LEVEL　　　4 LEVEL　　　3 LEVEL　　　2 LEVEL

INTRALADDER ROUTING
SKETCH 6
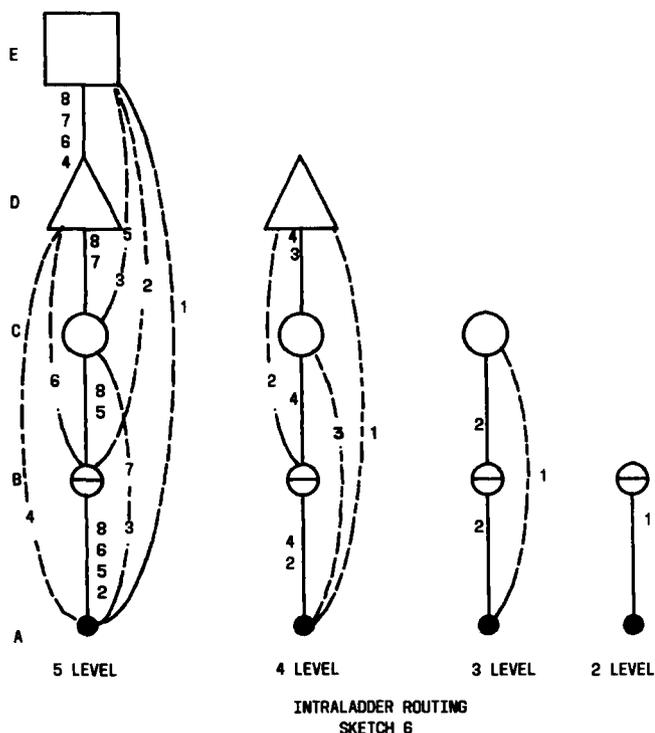
3.02 As discussed in 2.02, intraladder routing is dependent upon switching *function* rather than class. In the 5-level hierarchy depicted in Sketch 6 for example, class 3 switching system, C, could home directly on class 1 switching system, E. In such an arrangement, E would perform the 2 function as well as the 1 function for C. Trunk

group C-E in that case would be a final trunk group. Since the procedures here described relate to switching functions, they are applicable in this situation and in others involving multiple switching functions. There is further discussion of this point beginning with 4.03.

3.03 The identification of the proper interladder trunk group described in 2.06 also identifies the originating ladder "exit" point and the terminating ladder "entry" point. The preferred first choice route from the originating end office to the exit point, and from the entry point to the terminating end office, can be determined by overlaying an actual trunking configuration on the maximum configuration, per Sketch 6, and selecting the lowest numbered route that is available. The general preference sequence for the intraladder route is:

(1) End Office - Class 1 Switching System

A-E, A-B-E, A-C-E, A-D-E, A-B-C-E, A-B-D-E, A-C-D-E, or A-B-C-D-E in that order.

(2) End Office - Class 2 Switching System

A-D, A-B-D, A-C-D, or A-B-C-D in that order.

(3) End Office - Class 3 Switching System

A-C or A-B-C in that order.

3.04 The alternate routes for intraladder high-usage trunk groups are determined in the usual manner, ie., the next higher-numbered route terminated at both of the common switching systems. For example referring to Sketch 6, trunk group 1 A-E alternate routes via B over route 2 A-B-E.

4. NETWORK APPLICATION

4.01 By following the procedures discussed in subsections 2 and 3 above, the preferred first choice route for any end-office-to-end-office call can be ascertained if the trunk network and homing arrangements are known. It is basically a 3-step process:

(1) Referring to Sketch 4, identify the lowest numbered interladder trunk group in existence, thereby identifying originating ladder exit point and terminating ladder entry point.

(2) Referring to Sketch 6, identify the lowest numbered route from originating end office to the exit point.

(3) Referring to Sketch 6, identify the lowest numbered route from terminating ladder entry point to the terminating end office.

4.02 This process will identify the recommended first choice route from any end office to any other end office. Exceptions to this route can occur due to translation or trunking limitations.

4.03 As is usual throughout the routing discussion, this section deals with switching *functions* rather than *class* of switching system. In many cases, a given switching system performs several different switching functions.
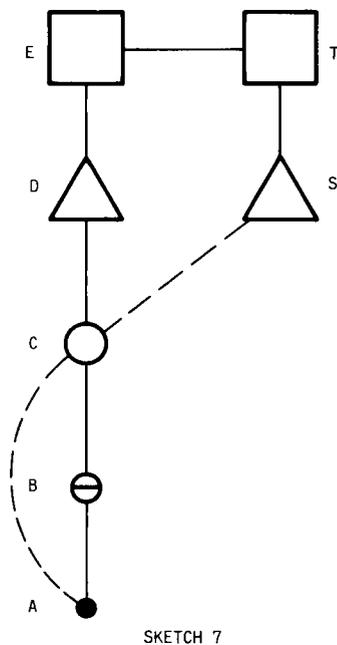
SKETCH 7

4.04 If class 4 switching system B in Sketch 7 is homed directly on E, then E performs switching functions 3, 2, and 1 for B. This is illustrated in Sketch 8. In the application of the route selection portion of the routing procedures (Sketches 4 and 6), interladder trunk groups should
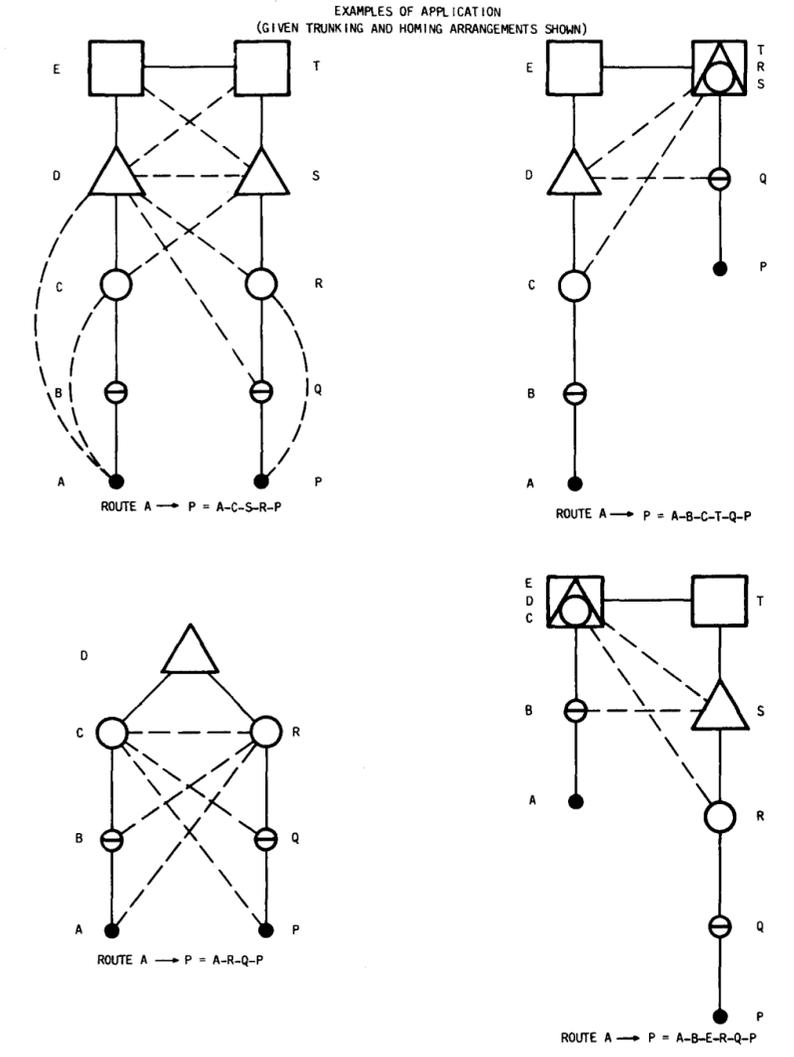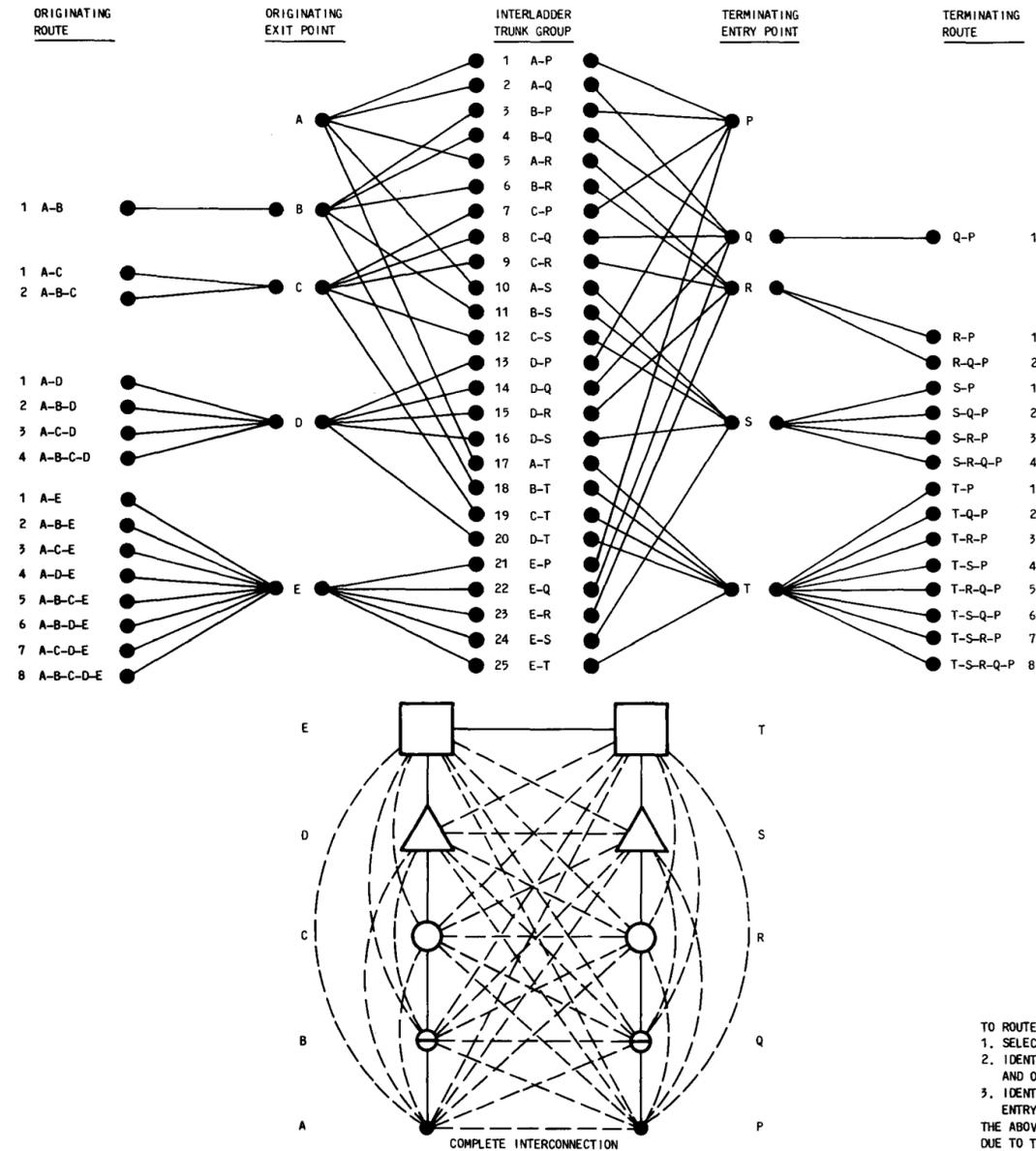
be assumed C-S, D-S, and E-S, and intraladder trunk groups should be assumed A-C, A-D, and A-E. In a similar manner, a trunk group terminated at any switching system serving multiple switching functions is available for each of those switching functions as discussed in Section 3-e(2).
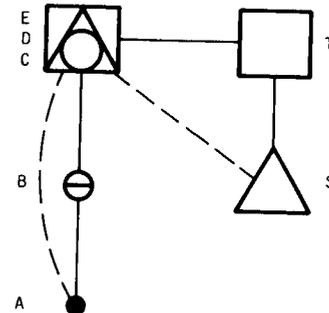
SKETCH 8

4.05 Fig. 1 of this section provides a schematic drawing which combines the information in Sketches 4 and 6. It shows the preferred first choice route for any end-office-to-end-office combination if the homing and trunking arrangements are known.

4.06 In many instances in longer haul networks there is little, if any, end-office trunking. The routing need in these cases is to identify class 4 to class 4 and higher level routes rather than class 5 to class 5. Fig. 2 provides the means to identify these routes. In a similar manner, as distances increase, there may be a need only to identify class 3 to class 3 and higher level routes. Fig. 3 provides this means. Charts can be developed for any combination of switching functions, but these three cover the most frequently needed ones in the North American network.
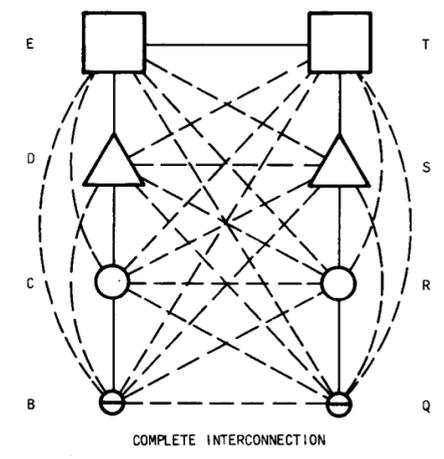
ORIGINATING
ROUTE

ORIGINATING
EXIT POINT

INTERLADDER
TRUNK GROUP

TERMINATING
ENTRY POINT

TERMINATING
ROUTE

1	A-P
2	A-Q
3	B-P
4	B-Q
5	A-R
6	B-R
7	C-P
8	C-Q
9	C-R
10	A-S
11	B-S
12	C-S
13	D-P
14	D-Q
15	D-R
16	D-S
17	A-T
18	B-T
19	C-T
20	D-T
21	E-P
22	E-Q
23	E-R
24	E-S
25	E-T

1 A-B

1 A-C
2 A-B-C

1 A-D
2 A-B-D
3 A-C-D
4 A-B-C-D

1 A-E
2 A-B-E
3 A-C-E
4 A-D-E
5 A-B-C-E
6 A-B-D-E
7 A-C-D-E
8 A-B-C-D-E

Q-P	1
R-P	1
R-Q-P	2
S-P	1
S-Q-P	2
S-R-P	3
S-R-Q-P	4
T-P	1
T-Q-P	2
T-R-P	3
T-S-P	4
T-R-Q-P	5
T-S-Q-P	6
T-S-R-P	7
T-S-R-Q-P	8

COMPLETE INTERCONNECTION

EXAMPLES OF APPLICATION
(GIVEN TRUNKING AND HOMING ARRANGEMENTS SHOWN)

ROUTE A ⟶ P = A-C-S-R-P

ROUTE A ⟶ P = A-B-C-T-Q-P

ROUTE A ⟶ P = A-R-Q-P
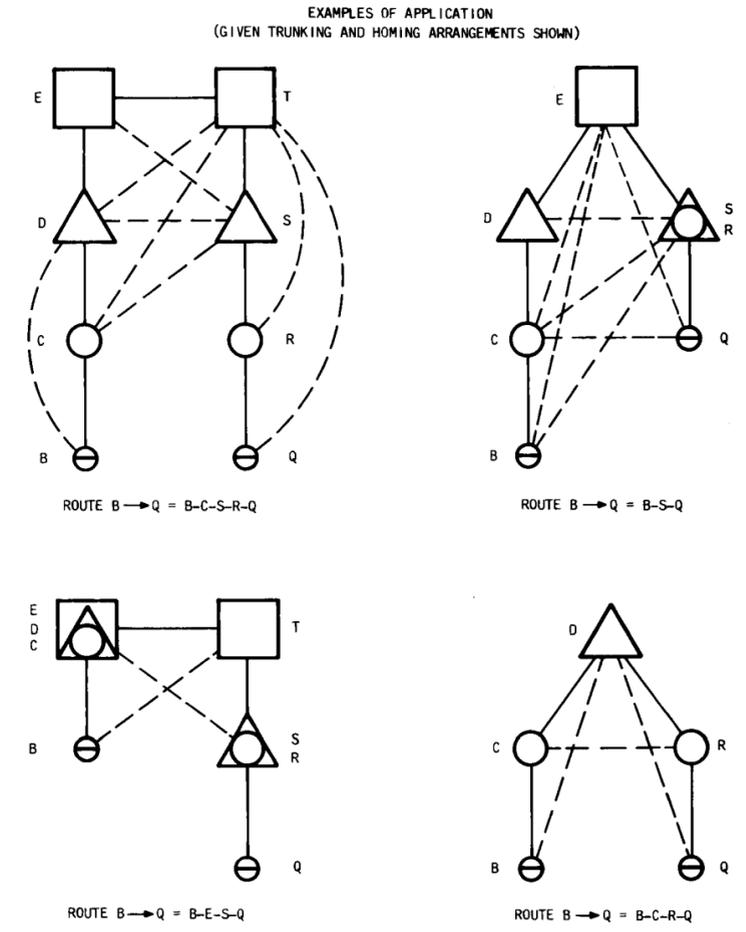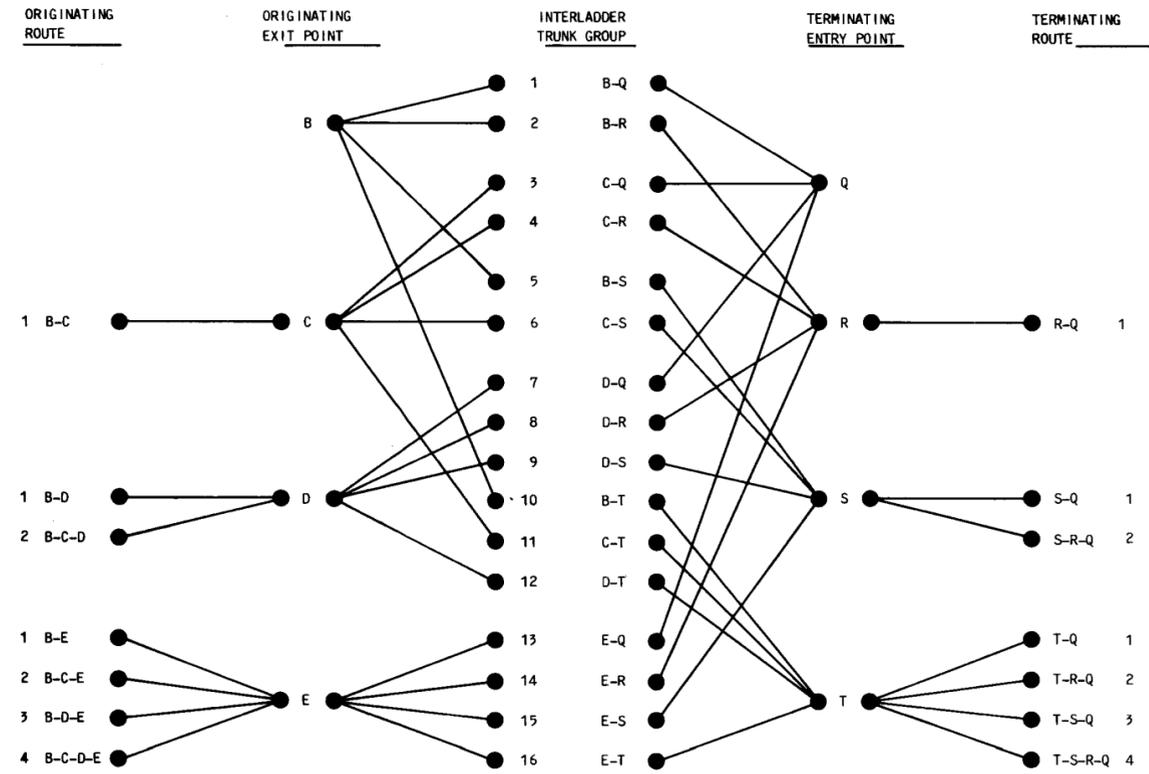
ROUTE A ⟶ P = A-B-E-R-Q-P

TO ROUTE A CALL FROM A TO P GIVEN THE HOMING ARRANGEMENTS AND THE HIGH USAGE TRUNK GROUPS WITHIN AND BETWEEN THE TWO HOMING LADDERS:
1. SELECT THE LOWEST NUMBERED INTERLADDER TRUNK GROUP IN EXISTENCE BETWEEN ORIGINATING AND TERMINATING LADDERS.
2. IDENTIFY THE ORIGINATING LADDER EXIT POINT AND SELECT LOWEST NUMBERED TRUNK GROUP IN EXISTENCE BETWEEN ORIGINATING POINT
   AND ORIGINATING LADDER EXIT POINT.
3. IDENTIFY THE TERMINATING LADDER ENTRY POINT AND SELECT LOWEST NUMBERED TRUNK GROUP IN EXISTENCE BETWEEN TERMINATING LADDER
   ENTRY POINT AND TERMINATING POINT.
THE ABOVE PROCEDURE WILL IDENTIFY THE PREFERRED FIRST CHOICE ROUTE FROM A TO P. EXCEPTIONS TO THIS ROUTE CAN OCCUR
DUE TO TRANSLATION OR TRUNKING LIMITATIONS.

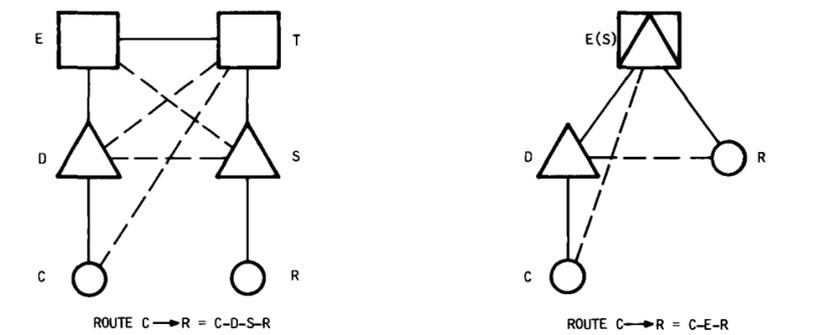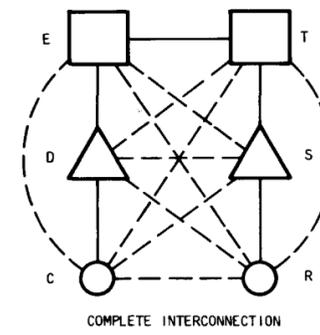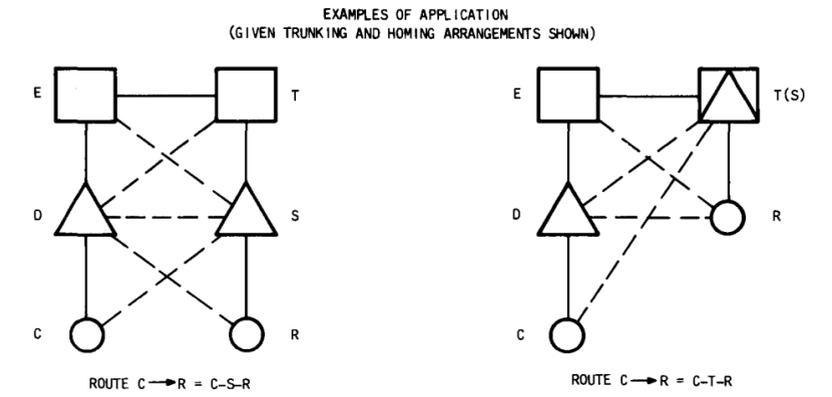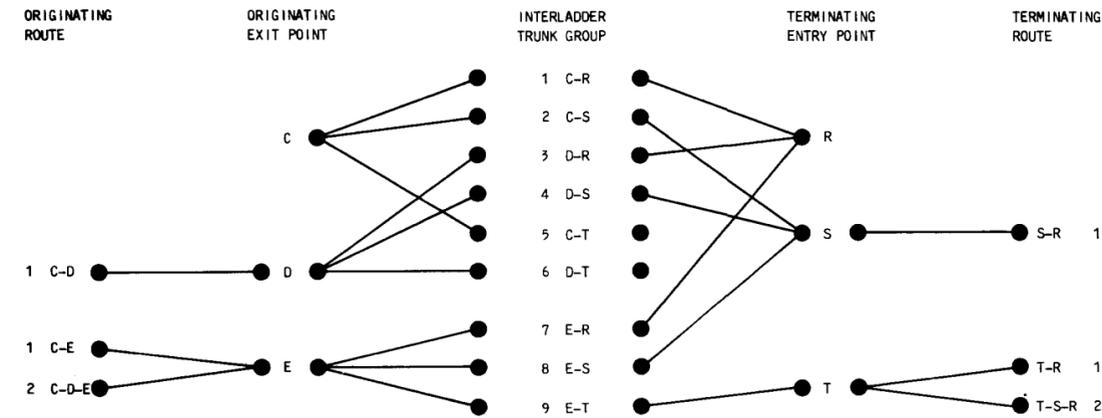**Fig. 1—Network Route Selection Mode—Class 5 to
Class 5 (4.05)**

Fig. 2—Network Route Selection Mode—Class 4 to Class 4 (4.06)

ORIGINATING
ROUTE

ORIGINATING
EXIT POINT

INTERLADDER
TRUNK GROUP

TERMINATING
ENTRY POINT

TERMINATING
ROUTE

EXAMPLES OF APPLICATION
(GIVEN TRUNKING AND HOMING ARRANGEMENTS SHOWN)

1 C-R
2 C-S
3 D-R
4 D-S
5 C-T
6 D-T

7 E-R
8 E-S
9 E-T

1 C-D

1 C-E
2 C-D-E

S-R   1

T-R   1
T-S-R 2

ROUTE C —▶ R = C-S-R

ROUTE C —▶ R = C-T-R

COMPLETE INTERCONNECTION

ROUTE C —▶ R = C-D-S-R

ROUTE C —▶ R = C-E-R

TO ROUTE A CALL FROM C TO R GIVEN THE HOMING ARRANGEMENTS AND THE HIGH USAGE TRUNK GROUPS
WITHIN AND BETWEEN THE TWO HOMING LADDERS:

1. SELECT THE LOWEST NUMBERED INTERLADDER TRUNK GROUP IN EXISTENCE BETWEEN ORIGINATING
   AND TERMINATING LADDERS.

2. IDENTIFY THE ORIGINATING LADDER EXIT POINT AND SELECT LOWEST NUMBERED TRUNK GROUP IN
   EXISTENCE BETWEEN ORIGINATING POINT AND ORIGINATING LADDER EXIT POINT.

3. IDENTIFY THE TERMINATING LADDER ENTRY POINT AND SELECT LOWEST NUMBERED TRUNK GROUP
   IN EXISTENCE BETWEEN TERMINATING LADDER ENTRY POINT AND TERMINATING POINT.

THE ABOVE PROCEDURE WILL IDENTIFY THE PREFERRED FIRST CHOICE ROUTE FROM C TO R.
EXCEPTIONS TO THIS ROUTE CAN OCCUR DUE TO TRANSLATION OR TRUNKING LIMITATIONS.

Fig. 3—Network Route Selection Mode—Class 3 to
Class 3 (4.06)