OPERATING MANUAL

FOR

T H E T E X A S S M A L L N E T W O R K P A C K A G E

TRANSPORTATION PLANNING PROGRAMS

by

Gary D. Long
Engineering Research Associate

Charles E. Bell
Data Processing Programmer

Vergil G. Stover
Study Supervisor

Research Report 119-1

Development and Evaluation of Traffic Projection
and Assignment Techniques
Research Study Number 2-10-68-119

Sponsored by the
Texas Highway Department
in cooperation with the
U. S. Department of Transportation
Federal Highway Administration

TEXAS TRANSPORTATION INSTITUTE
Texas A&M University
College Station, Texas

October 1969

(Updated to status of February 1971)

ABSTRACT

The Texas Small Network Package is a collection of computer programs designed to assign traffic to small transportation networks. This manual describes the format specifications and procedures which have been established to operate the package.

SUMMARY

Traffic assignment is a technique which has been developed to aid future transportation planning in the evaluation of transportation system alternatives. Due to the vast quantity of data and the tedious computations involved, reliance upon computers and automated data processing is almost imperative.

The Texas Small Network Package is a collection of computer programs designed to assign traffic to small transportation networks. The package has been prepared for use with an IBM 360 computer system.

Several special feat ··· ··e in the Texas Small Network Package in addition to tl regarding the assignment of traffic to minimum time paths, ar of traffic to "spider" networks connecting zone centroids. A self-balancing assignment program is included which can improve the agreement of assigned ; with counted volumes. The self-balancing assignment program can also be used to induce a compliance of the assigned volumes with capacity limitations. Corridor intercepts may be coded to obtain corridor analysis summaries, travel routes may be coded to obtain volume profile comparisons and/or plots, and selected links may be indicated for a special analysis of all traversing movements. Under normal operation, each assignment is preserved and compared with previous assignments.

IMPLEMENTATION STATEMENT

The Texas Small Network Package has been operational on the IBM 360 computer installation of the Texas Highway Department since January, 1968. It has been used extensively by the Texas Highway Department since that time.

Numerous additions, revisions and improvements have been implemented since the original transmittal. The cooperative research program between the Texas Highway Department and the Texas Transportation Institute has produced many research results which have been converted to a useable form through the preparation or modification of computer programs, and the programs have then been inserted into the Texas Small Network Package. Since research and development is dynamic in nature, this documentation will become obsolete as continuing research efforts produce new results to be implemented in the package.

The opinions, findings, and conclusions expressed in this publication are those of the authors and are not necessarily those of the Federal Highway Administration.

TABLE OF CONTENTS

INTRODUCTION

The purpose of this manual is to describe the procedures and formats which have been established to operate the Texas Small Network Package.

The Texas Small Network Package has been developed to perform traffic assignments. It is designed to interface, and be fully compatible, with the Texas Trip Distribution Package which has been prepared to perform trip distributions. Further information regarding trip distribution capabilities may be obtained by consulting the operating manual for the Texas Trip Distribution Package.

The Texas Small Network Package can be used to accomplish the following:

- assemble a coded transportation network for traffic assignment
- prepare a printed description of an assignment network
- revise or update an assignment network
- prepare trip records for traffic assignment
- prepare a printed description of trip interchanges
- trace any or all possible minimum paths
- prepare a printed description of any or all minimum paths
- assign traffic to an assignment network
- prepare a printed description of assigned volumes including turning movements
- prepare mileage and vehicle-mile summaries by functional class and jurisdiction
- balance assigned volumes with counted volumes
- balance assigned volumes with capacities
- prepare corridor volume summaries
- prepare interchange reports for selected links

- summarize assigned volumes along travel routes
- plot volume profiles along travel routes
- compare assigned volumes with previous assignments
- compare assigned volumes with traffic counts
- compare assigned volumes with link capacities
- expand interchanges using the "Fratar" technique
- sum trip generations for each zone
- add trip matrices together
- prepare a "spider" network for assignment
- prepare a printed description of a "spider" network
- assign trips to a "spider" network

NETWORK LIMITATIONS

The Texas Small Network Package has the capability of handling traffic assignment networks containing up to 4000 nodes. A maximum of 1200 of these 4000 nodes may be centroids. The largest permitted node number is 4000 and largest centroid number is 1200. Centroids must be numbered in an unbroken sequence. A gap in the numbering sequence may exist after the last centroid number and between any node numbers.

Each centroid or node may be connected to a maximum of 6 inbound and 6 outbound directional links. The maximum number of directional links that can be accommodated is 16,000 - including the dummy directional links associated with the prohibited direction that occurs with one-way network links. The maximum impedance associated with any link is 16383, which will correspond to 163.83 minutes if computed from distance represented in hundredths of a mile and speed represented in tenths of a mile per hour.

For large networks that exceed the capacity of the Texas Small Network Package programs, a companion set of programs, the Texas Large Network Package, is available. These programs accept networks containing up to 16,000 nodes with 40,000 directional links. Further information may be obtained by consulting the operating manual for the Texas Large Network Package.

COMPUTER REQUIREMENTS

The Texas Small Network Package operates on an IBM 360 computer under the full operating system (OS). A minimum of one tape drive and one disk drive must be available in addition to what is required by OS. A 512K core storage capacity is necessary; normally only about 300K is ever used at one time (including buffers, data sets, etc). The package will operate under MVT.

P R O G R A M C O N T R O L

CONTROL PROGRAM

CONTROL CARDS

- Header Cards
- Program Call Cards
- Unit Designation Cards
- Stop Card

DATA SET SPECIFICATIONS

CROSS REFERENCE OF DATA SETS WITH ASSOCIATED PROGRAMS

CONTROL PROGRAM

The Texas Small Network Package operates as a single job step under OS/360, with the exception of the OUTPUT SELECTED LINKS program. The programs comprising the package are written using a combination of Fortran and assembly programming languages. In general, Fortran is used in the main programs and executes calls to assembly language subroutines. The Overlay option of the Linkage Editor is used to prepare a Load Module. This Load Module can be made a part of the system by the KEEP and CATLG options, or it can be used once and then deleted.

The control program is the first segment of the Load Module. It remains in core at all times. Its purpose is to read and interpret control cards from the input data set, SYSIN. Once the control program has control, a control card will be read and either a program will be called into core by means of the overlay control routine and control transferred to it, or another control card will be read, or control will be returned to OS/360. Each control card that is read is written on the output data set, SYSOUT.

The output data set, SYSOUT, is used for the printed output of all programs. The input data set, SYSIN, is used for input of Control Cards, Parameter Cards, and Link Data Cards. It can also be used for Trip Volume Records by exercising an appropriate Unit Designation Card before the PREPARE TRIP VOLUMES program.

Cumulative time and time between individual program executions are obtained from calculations with readings from the core clock. The time-of-day is obtained prior to the reading of any control cards by the control program,

and thereafter the time-of-day is obtained each time control is returned to the control program. The difference between two consecutive time-of-day times is printed on SYSOUT, with the readings reported in hundredths of a minute. CUMULATIVE TIME references the initial interrogation of the core clock by the control program and TIME SINCE LAST QUERY references the previous interrogation of the core clock by the control program. The message appears as follows:

CUMULATIVE TIME = ---.-- TIME SINCE LAST QUERY = ---.--

If the operating system used does not have the timer option, the times printed will be unpredictable and overflows may occur from the calculations of the elapsed time, but this will not interfere with program execution. It should be noted that under MVT elapsed time as calculated from successive time-of-day readings may not indicate the real machine time used. Under MVT, the computer may be processing other jobs in addition to the Texas Small Network Package programs between core clock readings.

CONTROL CARDS

All control cards described here are read from the input data set, SYSIN. The descriptions contain a brief statement of the function performed by each together with the format of each control card.

Header Cards

A page heading is written with most the printed output on data set SYSOUT. Identification information can be inserted in bytes 1-74 of the heading array by punching this information in columns 7-80 of a Header Card in the following format:

Columns	Contents
1- 4	$HEA
5- 6	ignored (can be DR)
7-80	Header Information

This card should logically precede any Program Call Cards but may be located any place that is acceptable for a Program Call Card. The identification information will be replaced with each valid encounter of a new Header Card.

The last twelve of the 92 bytes in the heading array contain the date in EBCDIC. The date is printed in the headings about 15 spaces to the right of the information from the Header Card. The date is determined initially and remains unchanged after the control program starts execution. If execution overlaps midnight, the date will continue to show the date at program initiation.

Program Call Cards

Each program in the Texas Small Network Package is called by name. A dollar sign ($) must be in column one, followed by the program name, including embedded blanks, beginning in column two. Following the name, the card must be blank through column 32. The specific column content for the Program Call Card for each program is given in its program description.

Unit Designation Cards

The Unit Designation Cards change the data set unit numbers used by various programs. This feature has been provided mainly for the MERGE program, but the Unit Designation Cards can also change the unit numbers of other data sets as well.

The Unit Designation Cards are in a variable format in which the first blank terminates the card scan. Column 1 must contain a dollar sign, the next columns should contain the symbolic name of the data set (5-7 characters). A comma should be punched in the column immediately following the last character in the symbolic name, and the desired unit number for the data set should follow this comma. The column following should be a blank on all Unit Designation Cards; the exception is the $MERGIN card which should have a total of from two to six numbers separated by commas, with the last number followed by a blank. The Unit Designation Cards can be located any place that is acceptable for a Program Call Card. However, the Unit Designation Cards must preceed the Program Call Card of the program using the affected data set.

The symbolic data sets are initialized to the values given in the following table. Formats for altering these values are given for each Unit Designation Card. Unit designations must be provided for units used with the MERGE program if it is being executed.

Data Set References

Symbolic Name	(Default) Unit Number	Description	Unit Designation Card Format
INLNK	5	Link Data Cards (BCD)	$INLNK, --
CTVIN	10	Trip Volume Records (BCD)	$CTVIN, --
CTVOUT	8	Trip Matrix	$CTVOUT, --
FRATAR	16	Forecasted Trip Matrix	$FRATAR, --
MERGOUT	*	Accumulated Trip Matrix	$MERGOUT, --
MERGIN	*,*,*,*,*,*	Trip Matrices	$MERGIN,--,--,--,--,--,--
NETWORK	1	Network Flexible Records	$NETWORK, --
NEWNET	9	New Network Flexible Records	$NEWNET, --
ROUTE	25	Route Profiles	$ROUTE, --
SEPARAT	20	Interzonal Separations	$SEPARAT, --

After a Unit Designation Card is processed, the variable unit numbers are listed in a message which is:

LINK DATA INPUT = --, BCD TRIPS = --, BIN TRIPS = --,

FORECAST TRIPS = --, MERGE INPUT = --,--,--,--,--,--,

MERGE OUTPUT = --, NETWORK = --, NEW NETWORK = --,

SEPARATION MATRIX = --, ROUTE PROFILE = --

*No default option exists for the MERGE program. Appropriate Unit Designation Cards must be provided by the user.

The dashed fields correspond to INLNK, CTVIN, CTVOUT, FRATAR, six MERGIN fields, MERGOUT, NETWORK, NEWNET, SEPARAT and ROUTE.

Stop Card

A Stop Card should be the last card in the SYSIN data set if the Texas Small Network Package job step is to terminate with a condition code of zero.

Column	Contents
1- 5	$STOP
6-32	blank
33-80	ignored

If the SYSIN data set does not have a Stop Card and the control program processes all of the control cards in the data set normally, the program will end with a condition code of 0 and the following message will be printed.

END OF FILE READ ON 5

If an invalid control card is read, the program will end with a STOP 9999 and the message:

INVALID CONTROL CARD READ, EXECUTION TERMINATED.

DATA SET SPECIFICATIONS

In order to operate the Texas Small Network Package, it will be necessary to provide appropriate specifications for each data set involved with each program being executed. To optimize storage allocation, the data set parameters should be tailored to suit the characteristics of each individual study area. As a general guide, the specifications in the following table are presented along with corresponding capacities based upon the package limitations. All parameters refer to Job Control Language (JCL) Data Definitions (DD). The appropriate IBM manual should be consulted for further description of the requirements.

SAMPLE DATA SET SPECIFICATIONS

Data Control Block (DCB) Parameters and Corresponding Capacities

Data Set Reference	Default Value	RECFM	LRECL	BLKSIZE	Maximum Number of Logical Records	Maximum Space in Cylinders*
INLNK	5					
CTVIN	10					
CTVOUT	8	VBS	416	792	14401	48
FRATAR	16	VBS	416	792	14401	48
17	17	VBS	416	792	14401	48
MERGIN		VBS	416	792	14401	48
MERGOUT		VBS	416	792	14401	48
NETWORK	1	VBS	184	1692	20022	26
NEWNET	9	VBS	184	1692	20022	26
12	12	VBS	184	1692	20022	26
13	13	VBS	184	1692	20022	26
3	3	VS	884	888	138	1
11	11	VS	884	888	138	1
4	4	FB	50	600	4001	1
SEPARAT	20	VBS	1004	1008	7000	51
ROUTE	25	VBS	100	604	8169	7
SELTRP	**	FB	18	1620	***	****

* Space in cylinders for an IBM 2314 Direct Access Storage Disk with the given RECFM, LRECL, BLKSIZE and maximum number of logical records.

** SELTRP is a DD name.

*** The maximum number of interchanges possible on a single link (perhaps a bridge) connecting two equal sized but separate portions of a network, joined by that single link, would be 720,000

****Based on an assumed network of 1200 centroids with 3600 trip interchanges per selected link, one cylinder would be required per selected link.

CROSS REFERENCE OF DATA SETS WITH ASSOCIATED PROGRAMS

Data Set Identification	Relocatable Data Sets										Fixed Data Sets							
	INLNK	CTVIN	CTVOUT	FRATAR	MERGOUT	MERGIN	NETWORK	ROUTE	NEWNET	SEPARAT	Scratch	Scratch	Scratch	Scratch	Network	Scratch	SELTRP	PLOTTAPE
(Default) Unit Number	5	10	8	16	**	**	1	25	9	20	3	4	17	11	12	13	***	***
PREPARE NETWORK	I						0				I/0	I/0		I/0				
ASSEMBLE NETWORK	I						0				I/0	I/0		I/0				
REVISE NETWORK	I						0				I/0	I/0		I/0	I	I/0		
OUTPUT NETWORK							I											
DELETE ASSIGNMENTS							0								I			
PREPARE TRIP VOLUMES		I	0															
OUTPUT TRIP VOLUMES			I															
BUILD TREES							I			0								
ASSIGN			I				I	I/0	0	0								
ASSIGN SELF-BALANCING			I				I/0	I/0	I/0	0								
ASSIGN SELECTED LINKS			I				I	I/0	0	0							0	
PLOT ROUTE PROFILES								I										0
FRATAR FORECAST****			I	I/0									I/0					
SUM TRIP ENDS			I															
MERGE					0	I												
PREPARE SPIDER NETWORK	I						0*					0						
OUTPUT SPIDER NETWORK							I*					I						
ASSIGN SPIDER NETWORK			I				I*					I						

I = Input Data Set

0 = Output Data Set

* For these programs this data set is fixed to unit 1.

** No default option exists for the MERGE program. Appropriate Unit Designation Cards must be provided by the user.

*** Assembly language program reference.

**** The FRATAR FORECAST program sets the CTVOUT unit to the same unit as FRATAR.

Note: Some of the output data sets may be suppressed by use of the DD DUMMY option in the JCL.

P R O G R A M D E S C R I P T I O N S

PREPARE NETWORK

ASSEMBLE NETWORK

REVISE NETWORK

OUTPUT NETWORK

DELETE ASSIGNMENTS

PREPARE TRIP VOLUMES

OUTPUT TRIP VOLUMES

BUILD TREES

ASSIGN

ASSIGN SELF-BALANCING

ASSIGN SELECTED LINKS

OUTPUT SELECTED LINKS

PLOT ROUTE PROFILES

FRATAR FORECAST

SUM TRIP ENDS

MERGE

PREPARE SPIDER NETWORK

OUTPUT SPIDER NETWORK

ASSIGN SPIDER NETWORK

PREPARE NETWORK

PREPARE NETWORK

Program Function

The PREPARE NETWORK program accepts Link Data Cards and organizes the Network. This program is analogous to the ASSEMBLE NETWORK program except for the format of the Link Data Cards.

Data Set References

Input:	$INLNK	(5)*	Link Data Cards
Scratch:		(4)	
		(3)	(Unnecessary with under 2727 Link Data Cards)
		(11)	(Unnecessary with under 5454 Link Data Cards)
Output:	$NETWORK	(1)*	Network

Program Call Card

Column	Contents
1-16	$PREPARE NETWORK
17-32	blank
33-80	ignored

---

* Default unit

Parameter and Data Cards

Subnetwork Specification Card

Column	Contents
1- 6	Number of subnetworks (must be 1)
7-12	Speed/Time field to be selected from Link Data Cards (1, 2, 3; blank = 3)
13-80	ignored

Subnetwork Parameter Card

Column	Contents
1- 6	Subnetwork number (must be 1)
7-12	First centroid number (must be 1)
13-18	Last centroid number (1200 maximum)
19-24	Last arterial node number (4000 maximum)
25-30	Last freeway node number (4000 maximum)
31-80	ignored

Link Data Cards

These cards normally comprise the bulk of the cards in the Link Data deck. Only the Link Data Cards that are coded for the subnetwork number indicated on the Subnetwork Parameter Card may follow it for processing. As many Link Data Cards as are necessary to describe the network may be supplied behind the Subnetwork Parameter Card. It should be noted that each centroid or node may be connected to a maximum of 6 inbound and 6 outbound directional links.

For convenience in card handling and also to attach all A-node literals, the Link Data Cards may be sorted on the A-node, but this is not a require-

ment for input to the PREPARE NETWORK program. However, only the A-node literals which are in ascending sequence of A-nodes in the Data Cards will be saved. This Link Data Card format is similar to the BELMN and TEXAS Control Link Data Card format.

Column	Contents
1	Administrative Jurisdiction (0-9, A-F; blank = 0)
2- 6	A-node Number (1-4000)
7-11	B-node Number (1-4000)
12	blank
13	Direction Sign from A-node (0 or + or &; 1 or -)
14	Sign change to B-node (1 or - = change, other = no change)
15	blank
16-18	Link Length in hundredths of miles
19	blank
20	Link Speed/Time (T or 1 denotes Time given, S or 2 denotes Speed given in appropriate Speed/Time field)
21	blank
22-24	Speed/Time field 1 — Speed in tenths of MPH; or Time in hundredths of minutes
25-27	Speed/Time field 2 — Speed in tenths of MPH; or Time in hundredths of minutes
28-30	Speed/Time field 3 — Speed in tenths of MPH; or Time in hundredths of minutes
31-34	blank
35	Two-way link indicator (blank or 0 indicates A-B link is one-way only; T or 1 indicates link is two-way and Time given for B-A direction in columns 37-45; S or 2 indicates link is two-way and Speed given for B-A direction in columns 37-45)

Column	Contents	
36	blank	
37-39	Speed/Time field 1	Speed in tenths of MPH; or Time in hundredths of minutes
40-42	Speed/Time field 2	
43-45	Speed/Time field 3	
46-54	blank	
55-74	Location of A-node (literal)	
75-78	ignored	
79	Duplicate Mileage Eliminator (1 to eliminate)	
80	Functional Classification (0-9, A-F; blank = 0)	

End Link Data Cards

Column	Contents
1	L
2-80	blank

End Subnetworks

This is the last card in the Link Data Deck.

Column	Contents
1	N
2-80	blank

Normal Operation

The Link Data Cards including parameter cards are read from the INLNK data set. They are examined for errors within the card, such as nodes out of range, and for errors in connecting the nodes. The Network is organized and written on the NETWORK data set.

Error Messages

SUBNETWORK ------ LINK DATA POSITIONED IN PLACE OF SUBNETWORK ------

NETWORK PROCESSING CANNOT CONTINUE - PROGRAM TERMINATING WITH A STOP 4

Columns 1-6 of the general subnetwork header card do not correspond to the expected serial sequence of subnetwork processing. Control is returned to the CONTROL PROGRAM which will then try to read another control card and, finding only data cards, will cause the job to terminate. Correct the error in the link data Subnetwork Parameter Card and rerun the program.

INVALID NODE NUMBER FOR SUBNETWORK ------

An invalid node number for the current specified subnetwork has been found in either the A-node or B-node field of a Link Data Card. The erroneous card is printed and ignored.

NO VALID CHARACTER FOUND FOR TIME OR SPEED INDICATOR ON PRIMARY LINK

This card is printed and ignored.

LINK DIRECTION INDICATOR SET TO 0

If the shaft flag indicator is not 0, 1, -, &, or +, the shaft flag is set to 0. If the arrow flag indicator is 1 or -, the arrow flag indicator is set opposite to the shaft flag indicator. If the arrow flag

indicator is not 1 or -, then it is set equal to the shaft flag indicator.

NO VALID CHARACTER ON THIS CARD FOR EITHER TWO-WAY OR ONE-WAY INDICATOR. ALL LINK INFORMATION GIVEN BY THIS CARD WILL BE IGNORED

Columns 35 of the specified Link Data Card contains a character other than a blank, O, T, 1, S, or 2. The A-B link, which has already been entered in the NETWORK is removed and the card is ignored.

DUPLICATE FROM ANODE ------ TO BNODE ------ LINK DATA CARD NUMBER ------ AND LINK DATA CARD NUMBER ------

A duplicate link has been found connecting the specified nodes. Both links are left in the NETWORK. The Link Data Card numbers refer to the order in which the link data were read. The first Link Data Card is numbered 1, the second is numbered 2, etc. The possibility exists for a similar message to be printed if the reverse link exists and is also duplicated.

INVALID PARTITION CARD READ--CARD IGNORED

This message indicates an error in either the Subnetwork Specification Card or Subnetwork Parameter Card. Correct the error and rerun.

LINK TIME EXCESSIVE--CHANGED TO LINK TIME OF 163.83

The link time was greater than 163.83 minutes which is the maximum allowable value. The link may be recoded and split into two links by adding an extra node in order to reduce the time to a value within the maximum limit.

MORE THAN 6 LINKS FOR NODE ------, ------ LINKS WERE FOUND

BNODE CARD BNODE CARD BNODE CARD BNODE CARD BNODE CARD

----- ----- ----- ----- ----- ----- ----- ----- ----- -----

There are more than 6 nodes connected to the node number which is printed. The actual number of links is printed and all nodes which are connected are listed under the "BNODE" part of the message followed by the Link Data Card number from which the link was on.

ISOLATED CENTROID ----- BNODE CARD BNODE CARD BNODE CARD

----- ----- ----- ----- ----- -----

This message is printed if a centroid is connected to the network with only one one-way link. The node which it is connected to is listed and the Link Data Card number.

ISOLATED NODE ----- BNODE CARD BNODE CARD BNODE CARD

----- ----- ----- ----- ----- -----

This message is printed if a node is connected to the network in only one direction (i.e., inbound or outbound). The nodes connecting the centroid are listed along with the positions of the associated Link Data Cards.

There are ------ LINKS IN THE NETWORK, WHICH IS GREATER THAN THE MAXIMUM OF 16000 LINKS.

This message is printed if there are more than 8000 Link Data Cards.

ASSEMBLE NETWORK

ASSEMBLE NETWORK

Program Function

The ASSEMBLE NETWORK program accepts Link Data Cards and organizes the NETWORK. This program is analogous to the PREPARE NETWORK program except for the format of the Link Data Cards.

Data Set References

Input:	$INLNK	(5)*	Link Data Cards
Scratch:		(4)	
		(3)	(Unnecessary with under 2727 Link Data Cards)
		(11)	(Unnecessary with under 5454 Link Data Cards)
Output:	$NETWORK	(1)*	Network

Program Call Card

Column	Contents
1-17	$ASSEMBLE NETWORK
18-32	blank
33-80	ignored

---

* Default unit

Parameter and Data Cards

Subnetwork Parameter Card

Column	Contents
1- 6	ignored
7-12	First centroid number (must be 1)
13-18	Last centroid number (1200 maximum)
19-24	Last arterial node number (4000 maximum)
25-30	Last freeway node number (4000 maximum)
31-80	ignored

Link Data Cards

For convenience in card handling and also to attach all node location literals, the Link Data Cards may be sorted on the A-node, but this is not a requirement. However, the literal description of the A-node location will be saved for only those A-nodes which are in ascending numerical sequence in the Link Data.

Column	Contents
1- 6	ignored
7-11	A-node Number (1-4000)
12	ignored
13-17	B-node Number (1-4000)
18	ignored
19	Direction Sign from A-node (0 or + or &; 1 or -)
20	Sign Change to B-node (1 or - = change; other = no change)

Column	Contents
21	ignored
22	One-Way Flag (1=one-way; other=two-way)
23	ignored
24-26	Length (0-999)
27	ignored
28-29	Speed (0-99)
30	ignored
31-36	Traffic Count (0-999999)
37	ignored
38-43	Capacity (0-999999)
44	ignored
45	Functional Classification (0-9, A-F; blank=0)
46	ignored
47	Administrative Jurisdiction (0-9, A-F; blank=0)
48	ignored
49-50	Route Code (0-31; blank=0)
51	ignored
52-53	Corridor Intercept (0-99; blank=0)
54	ignored
55	Duplicate Mileage Eliminator (1 to eliminate)
56	ignored
57-61	Impedance (if zero, time is substituted)
62-70	ignored
71-80	Location of A-node (literal)

End Link Data Cards

Column	Contents
1	L
2-80	blank

or

1- 6	ENDLNK
7-80	blank

Node Data Cards

These cards, if there are any, follow the End Link Data Card. These cards must be sorted on the node numbers. These cards contain the coordinates and the subarea code for nodes.

Column	Contents
1- 6	blank
7-11	Node Number
12-13	ignored
14-17	X coordinate
18-19	ignored
20-23	Y coordinate
24-25	ignored
26-27	Subarea code
28-80	ignored

End Subnetworks

This is the last card in the Link Data Deck.

Column	Contents
1	N
2-80	blank

or

Column	Contents
1- 6	ENDNET
7-80	blank

Normal Operation

The Link Data Cards including parameter cards are read from the INLNK data set. They are examined for errors within the card, such as nodes out of range, and for errors in connecting the nodes. The network is organized and written on the NETWORK data set.

Error Messages

INVALID NODE NUMBER FOR SUBNETWORK ------

An invalid node number for the current specified subnetwork has been found in either the A-node or B-node field of a Link Data Card. The erroneous card is printed and ignored.

NO VALID CHARACTER FOUND FOR TIME OR SPEED INDICATOR ON PRIMARY LINK

This card is printed and ignored.

LINK DIRECTION INDICATOR SET TO 0

If the shaft flag indicator is not 0, 1, -, &, or +, the shaft flag is set to 0. If the arrow flag indicator is 1, the arrow flag indicator is set opposite to the shaft flag indicator. If the arrow flag indicator is not 1 or -, then it is set equal to the shaft flag indicator.

NO VALID CHARACTER ON THIS CARD FOR EITHER TWO-WAY OR ONE-WAY INDICATOR.
ALL LINK INFORMATION GIVEN BY THIS CARD WILL BE IGNORED

Column 35 of the specified Link Data Card contains a character other than a blank, 0, T, 1, S, or 2. The A-B link, which has already been entered in the NETWORK, is removed and the card is ignored.

DUPLICATE LINK FROM ANODE ------ TO BNODE ------ LINK DATA CARD NUMBER ------
AND LINK DATA CARD NUMBER ------

A duplicate link has been found connecting the specified nodes. Both links are left in the network. The Link Data Card numbers refer to the order in which the Link Data were read. The first Link Data Card is numbered 1, the second is numbered 2, etc. The possibility exists for a similar message to be printed if the reverse link exists and is also duplicated.

INVALID PARTITION CARD READ--CARD IGNORED

This message indicates an error in either the Subnetwork Specification Card or Subnetwork Parameter Card. Correct the error and rerun.

LINK TIME EXCESSIVE--CHANGED TO LINK TIME OF 163.83

The link time was greater than 163.83 minutes which is the maximum allowable value. The link may be recoded and split into two links by adding an extra node in order to reduce the time to a value within the maximum limit.

MORE THAN 6 LINKS FOR NODE ------,------ LINKS WERE FOUND

BNODE	CARD	BNODE	CARD	BNODE	CARD	BNODE	CARD	BNODE	CARD
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

There are more than 6 nodes connected to the node number which is printed. The actual number of links is printed and all nodes which are connected are listed under the "BNODE" part of the message followed by the Link Data Card number from which the link was on.

ISOLATED CENTROID ----- BNODE CARD BNODE CARD BNODE CARD

-----	-----	-----	-----	-----	-----

This message is printed if a centroid is connected to the network in only one direction (i.e., inbound or outbound). The nodes connecting the centroid are listed along with the positions of the associated Link Data Cards.

ISOLATED NODE ----- BNODE CARD BNODE CARD BNODE CARD

-----	-----	-----	-----	-----	-----

This message is printed if a node is connected to the network but there is either no way to reach it or no way to get from it to the network.

There are ------ LINKS IN THE NETWORK, WHICH IS GREATER THAN THE MAXIMUM OF 16000 LINKS.

This message is printed if there are more than 8000 Link Data Cards.

REVISE NETWORK

REVISE NETWORK

Program Function

The REVISE NETWORK program accepts Link Data Cards and an old NETWORK data set, and produces a revised NETWORK data set.

Data Set References

Input:	$INLNK	(5)*	Link Data Cards
		(12)	Network (old version)
Scratch:		(13)	
		(4)	
		(3)	(Unnecessary with under 2727 Link Data Cards)
		(11)	(Unnecessary with under 5454 Link Data Cards)
Output:	$NETWORK	(1)*	Network (revised version)

Program Call Card

Column	Contents
1-15	$REVISE NETWORK
16-32	blank
33-80	ignored

---

* Default unit

Parameter and Data Cards

Subnetwork Parameter Card

Column	Contents
1- 6	Subnetwork number (set to 1 by program)
7-12	First centroid number (must be 1)
13-18	Last centroid number (1200 maximum)
19-24	Last arterial node number (4000 maximum)
25-30	Last freeway node number (4000 maximum)
31-80	ignored

Link Data Cards

These cards are only necessary for links on which parameters are to be modified and for new links and for links to be deleted. Up to 8,000 Link Data Cards may be used.

For convenience in card handling and also to attach all node location literals, the Link Data Cards may be sorted on the A-node, but this is not a requirement. However, the literal description of the A-node location will be saved for only those A-nodes which are in ascending numerical sequence in the Link Data. The Link Data Card format is the same as for the ASSEMBLE NETWORK program.

Column	Contents
1- 6	"DELETE" all connections between the A-node and B-node "(blank)" if the connection is in the network, revise parameters; otherwise, insert the link.
7-11	A-node Number (1-4000)

Column	Contents
12	ignored
13-17	B-node Number (1-4000)
18	ignored
19	Direction Sign from A-node (0 or + or &; 1 or -)
20	Sign Change to B-node (1 or - = change; other = no change)
21	ignored
22	One-Way Flag (1 = one-way; other = two-way)
23	ignored
24-26	Length (0-999)
27	ignored
28-29	Speed (0-99)
30	ignored
31-36	Traffic Count (0-999999)
37	ignored
38-43	Capacity (0-999999)
44	ignored
45	Functional Classification (0-9, A-F; blank = 0)
46	ignored
47	Administrative Jurisdiction (0-9, A-F; blank = 0)
48	ignored
49-50	Route Code (0-31; blank = 0)
51	ignored
52-53	Corridor Intercept (0-99; blank = 0)
54	ignored

Column	Contents
55	Duplicate Mileage Eliminator (1 to eliminate)
56	ignored
57-61	Impedance (if zero, time is substituted)
62-70	ignored
71-80	Location of A-node (literal)

End Link Data Cards

Column	Contents
1	L
2-80	blank

or

1-60	ENDLNK
7-80	blank

Node Data Cards

These cards, if there are any, follow the End Link Data Card. These cards must be sorted on the node numbers. These cards contain the coordinates and the subarea code for nodes. If a field on this card is blank, no revision is performed.

Column	Contents
1- 6	blank
7-11	Node Number
12-13	ignored
14-17	X coordinate
18-19	ignored

Column	Contents
20-23	Y coordinate
24-25	ignored
26-27	Subarea code
28-80	ignored

End Subnetworks

This is the last card in the Link Data Deck.

Column	Contents
1	N
2-80	blank

or

1- 6	ENDNET
7-80	blank

Normal Operation

The REVISE NETWORK program is divided into two major phases which are processed in succession.

The first phase reads the Subnetwork Parameter Card and uses these parameters to check node number validity. This phase reads all Link Data Cards and checks for valid node numbers and other data. After 2727 Link Data Cards are read, they are sorted on the A-node, link type code, and record number. The remaining links are processed similarly. After the ENDLNK and ENDNET cards have been read, the last of the links are sorted.

The second phase writes the new network parameters, the heading and date, plus the headings and dates of any previous assignments which are

also copied. The sorted links are merged with the links on the old NETWORK data set to produce the new NETWORK data set. In this step, links with the DELETE code are deleted from the NETWORK, but if these links are reentered from the Link Data input, they are replaced. New links are given an impedance of 163.83 and a volume of zero for all previous assignments. Links which are modified retain their impedances and volumes from previous assignments, but all link parameters are replaced.

It might appear that some nonexistent turning movement combinations are created in instances where, for example, links are added and the number of directional links emanating from a given node is increased above a total of four, or in instances when links are removed and the number of directional links emanating from a given node is reduced to four or less. However, the assigned volumes for such turning movements will always be zero, and the implied movement should simply be ignored.

At the end of execution, the number of network links is counted and the network is written on the NETWORK data set. The number of links is not known until this point because Link Data Cards without the "DELETE" code may be new links or may only modify links in the old NETWORK data set.

Error Messages

INVALID NODE NUMBER FOR SUBNETWORK 1

An invalid node number for either the A-node or the B-node for a Link Data Card has been found; the card is ignored.

NO VALID LINK DIRECTION INDICATOR FOUND ON THIS CARD

LINK DIRECTION INDICATOR SET TO 0

This message is printed when the shaft flag is not 0, 1, +, &, or -. The A-node and B-node are listed.

LINK TIME EXCESSIVE--CHANGED TO LINK TIME OF 163.83

This message is written when the link time is greater than 163.83 minutes.

DUPLICATE LINK FROM ANODE ------ TO BNODE ------ FROM LINK DATA CARD NUMBER ------ AND LINK DATA CARD NUMBER ------

This message is self-explanatory, both links are written on the new NETWORK data set.

MORE THAN 6 LINKS FOR NODE ------, -- LINKS WERE FOUND

BNODE	CARD	BNODE	CARD

BNODE	CARD	BNODE	CARD

The limit of the number of links per node is 6. If more than 6 directional links per node are used in an assignment, the trees will be incorrect.

ISOLATED CENTROID ------

BNODE	CARD	BNODE	CARD	BNODE	CARD

This message means that the centroid cannot be reached from any node in the network or that there is no way to reach the network from the centroid. If there is only one node connected to this node and the link is one-way from the centroid then this link will effectively become a two-way link for the purpose of building trees.

If an assignment is made in the last case, incorrect turning movements through the node connected to the centroid may result.

ISOLATED NODE ------ BNODE CARD BNODE CARD BNODE CARD

----- ----- ----- ----- ----- -----

This message is written if the node cannot be reached from another node or if there is no connection from the node to a third node.

THERE ARE ------ LINKS IN THE NETWORK, WHICH IS GREATER THAN THE MAXIMUM OF 16000 LINKS

The number of links in this message includes duplicate links and dummy links going the opposite direction to one-way links. A two-way link must not be coded as two one-way links.

THE LAST NODE NUMBER ------ IS GREATER THAN THE MAXIMUM NUMBER OF NODES WHICH IS 4000

This message indicates the Last Freeway Node number on the Subnetwork Parameter Card is greater than 4000.

ANODE ------ NOT IN NETWORK

This indicates that the node number is either negative or greater than the Last Freeway node number.

END OF DATA SET ON UNIT --, ANODE = ------ NSX = ---------

This indicates that either a logic error has occurred in the program, or records have been lost from the data set.

LINK ----- TO ----- NOT DELETED

This indicates that DELETE was coded on a Link Data Card, which had the A-node and B-node listed in the message, but the link was not in the old NETWORK data set. The link cannot be deleted. The "DELETE" operation takes precedence over parameter modifications, but both can be applied to any given link. This means that the given link will not get an error message, and the result will be that all previous loadings on the link will be lost, and the parameters will be replaced with those from the new Link Data Card.

FATAL ERROR, OLD FLEXIBLE RECORD DATASET 12 IS MISSING

This means that either there is no DD card for FT12F001 or that the data set contains no data.

OUTPUT NETWORK

OUTPUT NETWORK

Program Function

The OUTPUT NETWORK program accepts the NETWORK data set, and prints the BCD Network Description.

Data Set References

Input:	$NETWORK	(1)*	Network
Output:		(6)	BCD Network Description

Program Call Card

Column	Contents
1-15	$OUTPUT NETWORK
16-32	blank
33-80	ignored

Parameter and Data Cards

None

Normal Operation

The initial records on the NETWORK data set are examined to determine the number of subnetworks. Each subnetwork and its associated partition table was read, converted to the BCD format, and written on SYSOUT. This process continues until completion, and control is then returned to the control program.

Error Messages

None

---

* Default unit

DELETE ASSIGNMENTS

DELETE ASSIGNMENTS

Program Function

This program can delete any number of assignments from the NETWORK data set and can also replace the impedances to be used on the next assignment with the impedances used on any previous assignment (even if the assignment is being deleted), or it can modify the impedances according to the impedance adjustment function.

Data Set References

Input:	(12)	Network (old version)
Output:	$NETWORK (1)*	Network (revised version)

Program Call Card

Column	Contents
1-19	$DELETE ASSIGNMENTS
20-32	blank
33-80	ignored

Parameter and Data Cards

The parameter cards may be in any order, except the End Card which must be last. The End Card is the only card which must be included. The Impedance Card and the Adjust Card cannot be used at the same time.

---

* Default unit

Impedance Card

Column	Contents
1-10	*IMPEDANCE
11-12	Assignment number
13-80	ignored

Adjust Card

Column	Contents
1- 7	*ADJUST
8-10	blank
11-12	Assignment number
13-80	ignored

Delete Card

Column	Contents
1- 7	*DELETE
8-10	blank
11-12	Assignment number
13-80	ignored

End Card

Column	Contents
1- 4	*END
5-12	blank
13-80	ignored

Normal Operation

The program reads the parameter record from the old NETWORK data set to determine the number of assignments. The parameter cards are then read and examined. Each card is written after being read, and any errors are detected, a message is written immediately after it. The End Card must be last; it is the only parameter card which is always required. The program will continue to examine parameter cards until an End Card is reached or until a card is read which does not contain an asterisk in Column 1. Each parameter card, except the End Card, contains an assignment number. The assignment number of the first assignment is one. The assignment number of the last assignment corresponds to the total number of assignments. The assignment number read from a parameter card must be in this range.

The Impedance Card will cause the new NETWORK data set to be written so that the impedance from the assignment number specified on this card will be used for the next assignment. This option can be used for any assignment, even if the assignment is being deleted. The Adjust Card will cause an action that is identical with the Impedance Card except that if a link has a nonzero count field, its new impedance will be computed according to the self-balancing adjustment function using link counts.

A Delete Card will cause the assignment number it references to be deleted from the new NETWORK data set.

After the End Card has been read, the program will execute a STOP 3 if any errors have been detected in the parameter cards. Otherwise, it will copy the header record, which was written when the old NETWORK data set was first assembled or last revised, to the new NETWORK data set. Then

the header records from previous assignments, which are not to be deleted, are copied to the new NETWORK data set. For assignments which are deleted, the corresponding header records are printed in the following message:

ASSIGNMENT -- ' (header record) ' DELETED

The -- is the assignment number on the old NETWORK data set. The node and link records are then copied and the actions specified in the parameter cards are performed.

Error Messages

ASSIGNMENT -- IS INVALID, EXECUTION WILL END WITH A STOP 3.

This message means that the assignment number read from Columns 11-12 from the card printed above this message is not in the range of the number of assignments on the old NETWORK data set. The program continues examining parameter cards for errors.

INVALID DELETE ASSIGNMENTS PARAMETER CARD, EXECUTION WILL END WITH A STOP 3.

This indicates that Columns 1-10 of the card printed above this message is not one of the four parameter cards. If the card contains an "*" in Column 1, the program will continue examining parameter cards for errors, otherwise it will execute a STOP 3 statement.

*IMPEDANCE AND *ADJUST PARAMETER CARDS ARE MUTUALLY EXCLUSIVE, EXECUTION WILL END WITH A STOP 3.

This message is self explanatory; the program continues examining parameter cards.

PREPARE TRIP VOLUMES

PREPARE TRIP VOLUMES

Program Function

The PREPARE TRIP VOLUMES program reads and converts BCD Trip Volume Records into a format suitable for assignment or further processing.

Data Set References

Input:	$CTVIN	(10)* BCD Trip Volume Records
Output:	$CTVOUT	(8)* Trip Matrix

Program Call Card

Column	Contents
1-21	$PREPARE TRIP VOLUMES
22-32	blank
33-80	ignored

Parameter and Data Cards

Parameter Card

Column	Contents
1- 5	One of three volume field specifications: *24HR - Select the trip volumes from bytes 13-18 of the input records; minimum logical record length is 18 bytes.

---

* Default unit

Column	Contents
	*AMPK - Select the trip volume from bytes 19-24 of the input records; minimum logical record length is 24 bytes.
	*PMPK - Select the trip volume from bytes 25-30 of the input records; minimum logical record length is 30 bytes
6	blank
7-12	Number of subnetworks
13-18	First Centroid Number, Subnetwork 1
19-24	Last Centroid Number, Subnetwork 1
25-30	First Centroid Number, Subnetwork 2
31-36	Last Centroid Number, Subnetwork 2
37-42	First Centroid Number, Subnetwork 3
43-48	Last Centroid Number, Subnetwork 3
49-54	First Centroid Number, Subnetwork 4
55-60	Last Centroid Number, Subnetwork 4
61-80	ignored

Note: Only the centroid information as specified by the number of subnetworks in columns 7-12 is required, irrelevant fields are ignored.

Trip Volume Records

Trip Volume Records contain the O-D trip information as expanded and summarized according to serial zone. The format of the Trip Volume Records should be:

Byte	Contents
1- 6	Zone of Origin
7-12	Zone of Destination
13-18	24-hour volume
19-24	AM peak volume
25-30	PM peak volume

Note: If $CTVIN card specifies Unit 5, the end of the Trip Volume Records data set is indicated by a V in byte 1 of a trailer record.

Normal Operation

The data set containing the Trip Volume Records must be sorted on bytes 1-12. Multiple entries for a particular origin and destination zone combination are not permitted. The Parameter Card is read and interpreted. The BCD Trip Volume Records are read and checked for errors, and the Trip Matrix is then written.

Error Messages

NONE VALID ORIGIN ------ OR DESTINATION ------

Either bytes 1-6 of the Trip Volume Record contain an origin zone number outside the range established by the Parameter Card or bytes 7 - 12 of the Trip Volume Record contain a destination zone number outside the range established by the Parameter Card. The record is ignored and processing continues.

NO DATA FIELD DESIGNATED 24HR USED

If Columns 1-5 of the Parameter Card contain an invalid volume field

specification, the 24-hour volume field is used. Valid fields are *24HR, *AMPK, *PMPK, with a blank in Column 6.

VOLUME DATA OUT OF SORT

This message is printed if either an origin zone number or a destination zone number is less than that of the previous record; that is, the data record is out of ascending order. The program continues and lists each record that is encountered that is out of sort. Control is returned to the control program. Sort the data set of Trip Volume Records on bytes 1-12 and rerun.

DUPLICATE SET OF VOLUME DATA ENCOUNTERED ------ ------ ------ NOT KEPT

The zone to zone movement given by this record has been previously processed. The record is ignored and processing continues. The three fields indicate the origin zone, destination zone, and trip volume, respectively.

OUTPUT TRIP VOLUMES

OUTPUT TRIP VOLUMES

Program Function

The OUTPUT TRIP VOLUMES program reads the Trip Matrix, as prepared by the PREPARE TRIP VOLUMES program or FRATAR FORECAST program, and writes a BCD description of the Trip Matrix on SYSOUT for subsequent printing.

Data Set References

Input:	$CTVOUT	(8)*	Trip Matrix
Output:		(6)	BCD Trip Matrix Description

Program Call Card

Column	Contents
1-20	$OUTPUT TRIP VOLUMES
21-32	blank
33-80	ignored

Parameter and Data Cards

None

Normal Operation

As the input data set is read, the BCD Trip Matrix Description is written on Unit 6. This process continues until all rows of the Trip Matrix have been processed, at which time control returns to the control program.

Error Messages

None

---

* Default unit

BUILD TREES

BUILD TREES

Program Function

The BUILD TREES program traces minimum paths from designated centroids to all other centroids in the network, based upon given link impedances. This program outputs the zonal separations for all specified centroids and also writes BCD Minimum Path Descriptions for all relevant paths. (If a Separation Matrix is to be used by the Texas Trip Distribution Package, the paths must be traced in numerical sequence of zones of origin, and no skips are permitted in the sequence.)

Data Set References

Input:	$NETWORK	(1)*	Network
Output:	$SEPARAT	(20)*	Separation Matrix
		(6)	BCD Minimum Path Description

Program Call Card

Column	Contents
1-12	$BUILD TREES
13-32	blank
33-80	ignored

---

* Default unit

Parameter and Data Cards

Turn Penalty Card

This card specifies the amount of time to be added as a penalty for each turn:

Column	Contents
1- 5	*TURN
6	blank
7-12	Turn penalty in hundredths (a decimal point is assumed between columns 10 and 11)
13-80	ignored

Tree Selection Card

This card specifies those centroids from which trees should be built. One Tree Selection Card is required; a minimum of one to a maximum of 1200 centroids is permissible. The Tree Selection Card may specify various groups of one or more trees in any order. This property is designed for formatting selected trees. For this function, the Separation Matrix output should normally be suppressed (by the DD DUMMY option). To obtain the Separation Matrix, all trees should be selected in an unbroken serial sequence. The trees themselves are not written for subsequent loading since this can be achieved in a single process using the ASSIGN program.

In the format of the Tree Selection Card, the six byte fields are each composed of two subfields, A and B, of five bytes and one byte, respectively:

Column	Contents
1- 5	*TREE
6- 7	blank

Column	Contents	
8-12	Subfield A	first selection field
13	Subfield B	
14-18	Subfield A	second selection field
19	Subfield B	
20-24	Subfield A	third selection field
25	Subfield B	
26-30	Subfield A	fourth selection field
31	Subfield B	
32-36	Subfield A	fifth selection field
37	Subfield B	
38-42	Subfield A	sixth selection field
43	Subfield B	
44-48	Subfield A	seventh selection field
49	Subfield B	
50-54	Subfield A	eighth selection field
55	Subfield B	
56-60	Subfield A	ninth selection field
61	Subfield B	
62-66	Subfield A	tenth selection field
67	Subfield B	
68-72	Subfield A	eleventh selection field
73	Subfield B	

Note: A comma (,) may be punched in column 73 if desired when subfield 68-72 is used. However, columns 73-80 are not read; the program places the comma when entries are punched in columns 68-72.

Subfield A may contain any valid centroid number in the network. Subfield B functions as a delimiter and may contain a blank, comma, or period. Any other character will give an error message. A period used as a delimiter causes all trees built within the control range to have BCD Minimum Path Descriptions printed for inspection. This does not affect the tree building process otherwise, except it causes a delay due to writing the output.

In processing selection fields from left to right, the occurrence of two consecutive A subfields separated by a blank B subfield will initiate a control setup for inclusive tree building beginning with the centroid specified by the first A subfield and ending with the centroid specified by the second A subfield. A comma in the second B subfield is optional for this situation, since the starting and ending centroids have been found for a search group. The occurrence of two successive B subfields containing either commas (may be implied as mentioned above) or periods, causes a single centroid to be specified, i.e., a control setup for inclusive tree building beginning and ending with the centroid specified in the intermediate A subfield.

For example, to build trees 1 through 90, with BCD Minimum Path Descriptions of trees 1 and 50, the following Tree Selection Card would be required:

Column	Contents
1- 5	*TREE
6- 7	blank
8-13	bbbb1.
14-19	bbbb2b
20-25	bbb49b
26-31	bbb50.
32-37	bbb51b
38-43	bbb90b

Normal Operation

The NETWORK data set is examined for its header record. Then the Turn Penalty Card and Tree Selection Card are read from data set SYSIN. The following messages are printed if these cards are correct:

THE TREE CARDS HAVE ESTABLISHED THE FOLLOWING PARAMETERS

TURN PENALTY = ---.--

FOR SUBNETWORK 1 SEARCH MINIMUM PATHS FROM ZONES ------ TO ------ INCLUSIVE AND {OUTPUT / SUPPRESS OUTPUT}

The network is read and paths are traced and written for printing if specified. The zonal separations are written for all trees specified. When all trees are traced the following message is printed:

TREE BUILD TIME = ----.--

LOAD TIME = 0.0 MINUTES

The tree build time is the total time that the tree builder subroutine was executed to build all trees, and is calculated from successive readings of the time-of-day from the core clock. This time does not include the time for input and output used by the program.

Error Messages

INCORRECT SUBN = ------

The program prints this message when the number of subnetworks is not 1, and then continues using only the first subnetwork.

INVALID TURN PENALTY OR TREE CARD READ

The program prints this line under the card which has an error in its identification field (columns 1-6). The correct contents for columns

1-6 for the two cards are *TURN and *TREE. The program stops with a STOP 0 after examining both cards for errors.

ILLEGAL FIELD SEPARATION CHARACTER IN TREE CARD

This message is printed if a field separation character is found which is not a comma, a period or a blank. The program stops with a STOP 0 after it examines the rest of the Tree Card.

---- ERROR(S) DETECTED IN ABOVE PARAMETER CARDS, EXECUTION TERMINATED

The program stops with a STOP 0.

**** TURN TYPE FOR NODE ------, ILLEGAL, = ----------, SET TO 28

This message should only be printed if an input error has occurred in reading the NETWORK data set. It indicates that no turning movements will be saved for the node in the message.

LSTCEN .GT. 1200, = ------

This message indicates that there are too many centroids. The program stops at this point with a STOP 0.

NODES .GT. 4000, = ------

This message is self-explanatory. The program stops with a STOP 0 at this point.

LSTVOL . GT. 16000, = ------

This message is printed if there are more than 16000 one-way links (or more than 8000 Link Data Cards) and the number of one-way links is printed, then the program stops with a STOP 0.

NUMBER OF TURNING VOLUMES .GT. 20000, = ------

This message indicates that more than 20000 turning volumes must be saved in the loading process. The number of turning volumes to be saved is printed. The program then stops with a STOP 0. At present, the only ways to prevent this message is to either make the network smaller or run it under ASSIGN SELECTED LINKS with the option for link volumes only on the loaded network output.

ASSIGN

ASSIGN

Program Function

The ASSIGN program traces minimum paths from designated centroids to all other centroids in the network, based upon given link impedances. This program simultaneously reads the Trip Matrix and assigns the trips to the network links according to the path selected. Link volumes are accumulated directionally as well as turning movements at intersections. The paths are alternately traced and then loaded.

Data Set References

Input:	$NETWORK	(1)*	Network
	$CTVOUT	(8)*	Trip Matrix
Output:	$NEWNET	(9)*	Network
	$SEPARAT	(20)*	Separation Matrix
		(6)	BCD Minimum Path and Assigned Description
	$ROUTE	(25)	Route Profile

Program Call Card

Column	Contents
1- 7	$ASSIGN
8-32	blank
33-80	ignored

* Default unit

Parameter and Data Cards

Turn Penalty Card

This card specifies the amount of time to be added as a penalty for each turn:

Column	Contents
1- 5	*TURN
6	blank
7-12	Turn penalty in hundredths of a minute (a decimal point is assumed between columns 10 and 11)
13-80	ignored

Tree Selection Card

This card specifies those centroids from which trees should be built. One Tree Selection Card is required; a minimum of one to a maximum of 1200 centroids is permissible. The Tree Selection Card may specify various groups of one or more trees in any order, but proper functioning of the load process requires that the trees be built in an unbroken ascending numerical sequence. In the format of the Tree Selection Card the six byte fields are each composed of two subfields, A and B, of five bytes and one byte respectively:

Column	Contents	
1- 5	*TREE	
6- 7	blank	
8-12	Subfield A	first selection field
13	Subfield B	

Column	Contents	
14-18	Subfield A	second selection field
19	Subfield B	
20-24	Subfield A	third selection field
25	Subfield B	
26-30	Subfield A	fourth selection field
31	Subfield B	
32-36	Subfield A	fifth selection field
37	Subfield B	
38-42	Subfield A	sixth selection field
43	Subfield B	
44-48	Subfield A	seventh selection field
49	Subfield B	
50-54	Subfield A	eighth selection field
55	Subfield B	
56-60	Subfield A	ninth selection field
61	Subfield B	
62-66	Subfield A	tenth selection field
67	Subfield B	
68-72	Subfield A	eleventh selection field
73	Subfield B	

Note: A comma (,) may be punched in column 73 if desired when subfield 68-72 is used. However, columns 73-80 are not read; the program places the comma when entries are punched in columns 68-72.

Subfield A may contain any valid centroid number in the network. Subfield B functions as a delimiter and may contain a blank, comma, or period. Any other character will give an error message. A period used as a delimiter causes all trees built within the control range to have BCD Minimum Path Descriptions printed for inspection. This does not affect the tree building process otherwise, except it causes a delay due to writing the output.

In processing selection fields from left to right, the occurrence of two consecutive A subfields separated by a blank B subfield will initiate a control setup for inclusive tree building beginning with the centroid specified by the first A subfield and ending with the centroid specified by the second A subfield. A comma in the second B subfield is optional for this situation, since the starting and ending centroids have been found for a search group. The occurrence of two successive B subfields containing either commas (may be implied as mentioned above) or periods, causes a single centroid to be specified (i.e., a control setup for inclusive tree building beginning and ending with the centroid specified in the intermediate A subfield).

For example, to build trees 1 through 90, with BCD Minimum Path Descriptions of trees 1 and 50, the following Tree Selection Card would be required:

Column	Contents
1- 5	*TREE
6- 7	blank
8-13	bbbb1.
14-19	bbbb2b
20-25	bbb49b
26-31	bbb50.
32-36	bbb51b
38-43	bbb90b

Normal Operation

The NETWORK data set is examined for its header record. Then the Turn Penalty Card and Tree Selection Card are read from data set SYSIN. The following messages are printed if these cards are correct:

THE TREE CARDS HAVE ESTABLISHED THE FOLLOWING PARAMETERS

TURN PENALTY = ---.--

FOR SUBNETWORK 1 SEARCH MINIMUM PATHS FROM ZONES ------ TO ------ INCLUSIVE AND {OUTPUT / SUPPRESS OUTPUT}

The appropriate portions of the message are repeated as often as necessary to describe the various control ranges for the tree search.

The program then examines the header record on the Trip Matrix. It builds all trees specified on the Tree Selection Card. After each tree is built, it is formatted if output has been requested and then it is used to load its corresponding trips. After all trees are traced and the network assigned, the following messages are printed:

TREE BUILD TIME = ---.-- MINUTES

LOAD TIME = ----.-- MINUTES

ELAPSED TIME = ---.-- MINUTES

These times are calculated from differences in time-of-day readings of the core clock, and on a system processing only one job at a time they indicate the time to build all trees, the time to load all trees (which includes time to read the Trip Matrix), and the time elapsed during the entire execution of the program to this point.

The BCD Assigned network Description is then written on the SYSOUT data set. This output consists of the link volumes and turning movements with associated node locations. Following is a list of analysis tables which are also printed:

CROSS CLASSIFICATION OF V/C FREQUENCIES FROM LAST TWO ASSIGNMENTS.

CROSS CLASSIFICATION OF LINK COUNTS BY V/C RATIO FROM LAST TWO ASSIGNMENTS.

JURISDICTION SUMMARY (This table is not printed when there are Functional class codes on the link data).

JURISDICTIONAL/FUNCTIONAL CROSS CLASSIFICATION OF ASSIGNED VOLUMES (This table is not written if more than 95 percent of the links have no functional class code).

JURISDICTIONAL/FUNCTIONAL CROSS CLASSIFICATION OF COUNTED VOLUMES (This table is not written if more than 95 percent of the links have no functional class code or if all locations in the table are zero).

JURISDICTIONAL/FUNCTIONAL CROSS CLASSIFICATION OF LINK CAPACITIES (This table is not written if more than 95 percent of the links have no functional class code or if all locations in the table are zero).

COMPARISON OF ASSIGNED VOLUMES WITH COUNTED VOLUMES

COMPARISON OF ASSIGNED VOLUMES WITH LINK CAPACITIES

COMPARISON OF ASSIGNED VOLUMES (from last assignment) WITH ASSIGNED VOLUMES FROM (assignment before last)

ROUTE PROFILES

CORRIDOR INTERCEPTS

Error Messages

INCORRECT SUBN = ------

The program prints this message when the number of subnetworks is not 1 and then it continues using only the first subnetwork.

INVALID TURN PENALTY OR TREE CARD READ

The program prints this line under the card which has an error in its identification field (columns 1-6). The correct contents for columns 1-6 for the two cards are *TURN and *TREE. The program stops with a STOP 0 after examining both cards for errors.

ILLEGAL FIELD SEPARATION CHARACTER IN TREE CARD

This message is printed if a field separation character is found which is not a comma, a period or a blank. The program stops with a STOP 0 after it examines the rest of the tree card.

---- ERROR(S) DETECTED IN ABOVE PARAMETER CARDS, EXECUTION TERMINATED

The program stops with a STOP 0.

**** TURN TYPE FOR NODE ------, ILLEGAL, = ----------, SET TO 28

This message should only be printed if an input error has occurred in reading the NETWORK data set. It indicates that no turning movements will be saved for the node in the message.

LSTCEN .GT. 1200, = ------

This message indicates that there are too many centroids. The program stops at this point with a STOP 0.

NODES .GT. 4000, = ------

This message is self-explanatory. The program stops with a STOP 0 at this point.

LSTVOL .GT. 16000, = ------

This message is printed if there are more than 16000 one-way links (or more than 8000 Link Data Cards) and the number of one-way links is printed, then the program stops with a STOP 0.

NUMBER OF TURNING VOLUMES .GT. 20000, = ------

This message indicates that more than 20000 turning volumes must be saved in the loading process. The number of turning volumes to be saved is printed. The program then stops with a STOP 0. At present, the only ways to prevent this message is to either make the network smaller or run it under ASSIGN SELECTED LINKS with the option for link volumes only on the loaded network output.

TRMV ERR ----------

This error message is printed in the loaded NETWORK output if one or more of the turning movements cannot be calculated. This message indicates that the network has not been correctly loaded. This message should occur only if there is a CPU error; these errors are very rare on the IBM 360 computers. The program continues.

ANODE = ------ BNODE = ------ V(1) = -------- V(2) = -------- RANGE ERROR.

This message indicates a negative volume was read from the NETWORK data set for one of the last two assignments. The A-node and B-node numbers of the related link are indicated. The volumes from the last two assignments are printed in hexadecimal. Negative trip volumes are caused by an error in the Variable Blocked Spanned record format. Changes have been made in the program to use record format type Variable Blocked, so this error message should not occur.

MORE THAN TWO LINKS FROM NODE -----

This message occurs during the processing of the route profiles and indicates that a node has three or more links with the same route code. Only two of the links will be retained. This will cause links to be lost in the Route Profile output for this route.

ROUTE -- HAS NO ENDS, A LINK WILL BE CHOSEN AS A STARTING POINT.

The links included in this route form a closed loop. The link with the lowest node number will be chosen as the starting point for the route profile output.

ASSIGN SELF-BALANCING

ASSIGN SELF-BALANCING

Program Function

The function of this program is to produce an assignment in which the assigned volumes are in relative balance with traffic counts or else conform to link capacities. This is an iterative technique which adjusts link impedances to obtain the desired balance. The program produces several cross classification tables and comparison tables to indicate how well the above function is being achieved.

Data Set References

Input:	$NETWORK	(1)*	Network
	$CTVOUT	(8)*	Trip Matrix
Output:	$NEWNET	(9)*	Network
	$SEPARAT	(20)*	Separation Matrix
	$ROUTE	(25)*	Route Profile

Program Call Card

Column	Contents
1-22	$ASSIGN SELF-BALANCING
23-32	blank
33-80	ignored

---

* Default unit

or

Column	Contents
1-22	$ASSIGN SELF-DIVERTING
23-32	blank
33-80	ignored

Parameter Card and Data Cards

Turn Penalty Card

This card specifies the amount of time to be added as a penalty for each turn and provides for selection of capacities, rather than traffic counts:

Column	Contents
1- 5	*TURN
6	blank
7-12	Turn penalty in hundredths of a minute (a decimal point is assumed between columns 10 and 11).
13-30	ignored
31-33	CAP to select capacities; otherwise, traffic counts will be selected
34	blank
35-80	ignored

Tree Selection Card

This card specifies those centroids from which trees should be built. One Tree Selection Card is required; a minimum of one to a maximum of 1200 centroids is permissible. The Tree Selection Card may specify various groups of one or more trees in any order, but proper functioning of the load

process requires that the trees be built in an unbroken ascending numerical sequence. In the format of the Tree Selection Card the six byte fields are each composed of two subfields, A and B, of five bytes and one byte, respectively:

Column	Contents	
1- 5	*TREE	
6- 7	blank	
8-12	Subfield A	first selection field
13	Subfield B	
14-18	Subfield A	second selection field
19	Subfield B	
20-24	Subfield A	third selection field
25	Subfield B	
26-30	Subfield A	fourth selection field
31	Subfield B	
32-36	Subfield A	fifth selection field
37	Subfield B	
38-42	Subfield A	sixth selection field
43	Subfield B	
44-48	Subfield A	seventh selection field
49	Subfield B	
50-54	Subfield A	eighth selection field
55	Subfield B	
56-60	Subfield A	ninth selection field
61	Subfield B	
62-66	Subfield A	tenth selection field
67	Subfield B	
68-72	Subfield A	eleventh selection field
73	Subfield B	

Note: A comma (,) may be punched in column 73 if desired when subfield 68-72 is used. However, columns 73-80 are not read; the program places the comma when entries are punched in columns 68-72.

Subfield A may contain any valid centroid number in the network. Subfield B functions as a delimiter and may contain a blank, comma, or period. Any other character will give an error message. A period used as a delimiter causes all trees built within the control range to have BCD Minimum Path Descriptions printed for inspection. This does not affect the tree building process otherwise, except it causes a delay due to writing the output.

In processing selection fields from left to right, the occurrence of two consecutive A subfields separated by a blank B subfield will initiate a control setup for inclusive tree building, beginning with the centroid specified by the first A subfield and ending with the centroid specified by the second A subfield. A comma in the second B subfield is optional for this situation, since the starting and ending centroids have been found for a search group. The occurrence of two successive B subfields containing either commas (may be implied as mentioned above) or periods, causes a single centroid to be specified, i.e., a control setup for inclusive tree building beginning and ending with the centroid specified in the intermediate A subfield.

For example, to build trees 1 through 90, with BCD Minimum Path Descriptions of trees 1 and 50, the following Tree Selection Card would be required:

Column	Contents
1- 5	*TREE
6- 7	blank
8-13	bbbb1.
14-19	bbbb2b

Column	Contents
20-25	bbb49b
26-31	bbb50.
32-36	bbb51b
38-43	bbb90b

Normal Operation

The Turn Penalty Card and Tree Selection Card are read and interpreted. The following messages are printed if these cards are correct:

THE TREE CARDS HAVE ESTABLISHED THE FOLLOWING PARAMETERS

TURN PENALTY = ---.--

FOR SUBNETWORK 1 SEARCH MINIMUM PATHS FROM ZONES ------ TO ------ INCLUSIVE AND {OUTPUT / SUPPRESS OUTPUT}

The appropriate portions of the message are repeated as often as necessary to describe the various control ranges for the tree search. The steps described below are repeated for each of three to five iterations.

The NETWORK data set is read. Minimum path trees are traced according to the Turn Penalty Card and Tree Selection Card, and the Trip Matrix is assigned to the minimum paths. On the first iteration, the entire assignment is printed. This will correspond to a minimum time path assignment if impedances have been calculated from speed and distance.

The variable C is set to either traffic counts or capacities, depending upon the option selected on the Turn Penalty Card. If C is zero, the link impedance is not changed. If C represents capacity and the link is underassigned, the link impedance is not changed. Otherwise, the link impedance is revised according to the following relationship:

$$I' = (0.75 + 0.25 \frac{V}{C}) * I$$

if $I'/I > 1.43$, I' is set to $1.43\ I$

if $I' > 163.83$, I' is set to 163.83

if $I' = 0.0$ & $I \neq 0.0$, I' is set to 0.01

where: I' = revised impedance

I = last impedance

V = volume assigned at the last iteration

C = count or capacity

The new network containing the revised impedances is written on the NEWNET data set. The route profile and separation matrix data sets are also written. Data will also be included in the NEWNET data set from the last assignment (and all previous assignments up to a maximum of 20) describing nondirectional link volumes and the corresponding link impedances. The following tables and summaries are also produced:

CROSS CLASSIFICATION OF V/C FREQUENCIES FROM LAST TWO ASSIGNMENTS.

CROSS CLASSIFICATION OF LINK COUNTS BY V/C RATIO FROM LAST TWO ASSIGNMENTS.

JURISDICTION SUMMARY (This table is not printed if there are functional class codes on the link data).

JURISDICTIONAL/FUNCTIONAL CROSS CLASSIFICATION OF ASSIGNED VOLUMES (This table is not written if more than 95 percent of the links have no functional class code).

JURISDICTIONAL/FUNCTIONAL CROSS CLASSIFICATION OF COUNTED VOLUMES
(This table is not written if more than 95 percent of the links have no functional class code or if all locations in the table are zero).

JURISDICTIONAL/FUNCTIONAL CROSS CLASSIFICATION OF LINK CAPACITIES
(This table is not written if more than 95 percent of the links have no functional class code or if all locations in the table are zero).

COMPARISON OF ASSIGNED VOLUMES WITH COUNTED VOLUMES

COMPARISON OF ASSIGNED VOLUMES WITH LINK CAPACITIES

COMPARISON OF ASSIGNED VOLUMES (from last assignment) WITH ASSIGNED VOLUMES FROM (assignment before last)

ITERATION WEIGHTING - MULTIPLE REGRESSION ANALYSIS

The iteration number is printed in the Heading record of each of the above tables. Then the unit numbers of the NETWORK and NEWNET data sets are switched. If the calculated T value for the last entry in the ITERATION WEIGHTING-MULTIPLE REGRESSION ANALYSIS table is less than 1.96, and three iterations have been completed, the repetitions are terminated. A maximum of five iterations is allowed.

After the iterative process terminates, the B values from the final ITERATION WEIGHTING-MULTIPLE REGRESSION ANALYSIS table are multiplied by 100 (B(0) is disregarded). Any negative values are set to zero, and the integer portion of the other B values is selected after scaling the sum to 100 percent. These values are then printed in a table entitled ITERATION WEIGHTS APPLIED.

A weighted assignment is calculated by applying the iteration weights

(percentages) to their respective assigned volumes and summing. A new NEWNET data set is prepared which includes the weighted assigned volumes. A set of printed tables similar to those already described for the individual iterations is written for the weighted assignment.

Using the same iteration weights applied with the assigned volumes, a set of weighted impedances is calculated in an analogous manner. The weighted impedances are used for one final assignment, and everything written for the calculated weighted assignment is also produced for the weighted impedance assignment. All assigned volumes and turning movements are printed for the weighted impedance assignment. Finally, the Route Profile and Corridor Intercept tables are printed, followed by a table of assigned volumes and impedances from all iterations (including the weighted assignments). The last assignment produces new data sets on the NETWORK or NEWNET, SEPARAT, and ROUTE units. A message is written at the end indicating the unit number on which the final NETWORK data set has been written:

THE FINAL LOADED NETWORK IS ON --

Error Messages

INCORRECT SUBN = ------

The program prints this message when the number of subnetworks is not 1; it then continues using only the first subnetwork.

INVALID TURN PENALTY OR TREE CARD READ

The program prints this line under the card which has an error in its identification field (columns 1-6). The correct contents for columns 1-6 for the two cards are *TURN and TREE. The program stops with a STOP 0 after examining both cards for errors.

ILLEGAL FIELD SEPARATION CHARACTER IN TREE CARD

This message is printed if a field separation character is found which is not a comma, a period or a blank. The program stops with a STOP 0 after it examines the rest of the Tree Card.

---- ERROR(S) DETECTED IN ABOVE PARAMETER CARDS, EXECUTION TERMINATED

The program stops with a STOP 0

**** TURN TYPE FOR NODE -----, ILLEGAL, = ----------, SET TO 28

This message should only be printed if an input error has occurred in reading the NETWORK data set. It indicates that no turning movements will be saved for the node in the message.

LSTCEN .GT. 1200, = ------

This message indicates that there are too many centroids. The program stops at this point with a STOP 0.

NODES .GT. 4000, = ------

This message is self-explanatory. The program stops with a STOP 0 at this point.

LSTVOL .GT. 16000, = ------

This message is printed if there are more than 16000 one-way links (or more than 8000 Link Data Cards) and the number of one-way links is printed, then the program stops with a STOP 0.

NUMBER OF TURNING VOLUMES .GT. 20000, = ------

This message indicates that more than 20000 turning volumes must be

saved in the loading process. The number of turning volumes to be saved is printed. The program then stops with a STOP 0. At present the only ways to prevent this message is to either make the network smaller or run it under ASSIGN SELECTED LINKS with the option for link volumes only on the loaded network output.

TRMV ERR ----------

This error message is printed in the loaded network output if one or more of the turning movements cannot be calculated. This message indicates that the network has not been correctly loaded. This message should occur only if there is a CPU error; these errors are very rare on the IBM 360 computers. The program continues.

ANODE = ------ BNODE = ------ V(1) = -------- V(2) = ----- RANGE ERROR.

This message indicates a negative volume was read from the NETWORK data set for one of the last two assignments. The A-node and B-node numbers of the related link are indicated. The volumes from the last two assignments are printed in hexadecimal. Negative trip volumes are caused by an error in the Variable Blocked Spanned record format. Changes have been made in the program to use record format type Variable Blocked, so this error message should not occur.

MORE THAN TWO LINKS FROM NODE -----

This message occurs during the processing of the Route Profiles and indicates that a node has three or more links with the same route code. Only two of the links will be retained. This will cause links to be lost in the Route Profile output for this route.

ROUTE -- HAS NO ENDS, A LINK WILL BE CHOSEN AS A STARTING POINT.

The links included in this route form a closed loop. The link with the lowest node number will be chosen as the starting point for the Route Profile output.

ASSIGN SELECTED LINKS

ASSIGN SELECTED LINKS

Program Function

The ASSIGN SELECTED LINKS program performs the same functions as the ASSIGN program and has the added feature of being capable of tracing the trip interchanges across selected Network links. The assigned network output can be suppressed if desired.

Data Set References

Input:	$NETWORK	(1)*	Network
	$CTVOUT	(8)*	Trip Matrix
Output:	$NEWNET	(9)*	Network
	$SEPARAT	(20)	Separation Matrix
	(SELTRP)**		Selected Interchanges
		(6)	BCD Minimum Path and Assigned Network Descriptions
	$ROUTE	(25)*	Route Profiles

Program Call Card

Column	Contents
1-22	$ASSIGN SELECTED LINKS
23-32	blank
33-80	ignored

---

* Default unit

** SELTRP is a DD name

Parameter and Data Cards

Turn Penalty Card

This card specifies the amount of time to be added as a penalty for each turn:

Column	Contents
1- 5	*TURN
6	blank
7-12	Turn penalty in hundredths of a minute (a decimal point is assumed between columns 10 and 11)
13-80	ignored

Tree Selection Card

This card specifies those centroids from which trees should be built. One Tree Selection Card is required; a minimum of one to a maximum of 1200 centroids is permissible. The Tree Selection Card may specify various groups of one or more trees in any order, but proper functioning of the load process requires that the trees be built in an unbroken ascending numerical sequence. In the format of the Tree Selection Card the six byte fields are each composed of two subfields, A and B, of five bytes and one byte respectively:

Column	Contents	
1- 5	*TREE	
6- 7	blank	
8-12	Subfield A	first selection field
13	Subfield B	

Column	Contents	
14-18	Subfield A	second selection field
19	Subfield B	
20-24	Subfield A	third selection field
25	Subfield B	
26-30	Subfield A	fourth selection field
31	Subfield B	
32-36	Subfield A	fifth selection field
37	Subfield B	
38-42	Subfield A	sixth selection field
43	Subfield B	
44-48	Subfield A	seventh selection field
49	Subfield B	
50-54	Subfield A	eighth selection field
55	Subfield B	
56-60	Subfield A	ninth selection field
61	Subfield B	
62-66	Subfield A	tenth selection field
67	Subfield B	
68-72	Subfield A	eleventh selection field
73	Subfield B	

Note: A comma (,) may be punched in column 73 if desired when subfield 68-72 is used. However, columns 73-80 are not read; the program places the comma when entries are punched in columns 68-72.

Subfield A may contain any valid centroid number in the network. Subfield B functions as a delimiter and may contain a blank, comma, or period. Any other character will give an error message. A period used as a delimiter causes all trees built within the control range to have BCD Minimum Path Descriptions printed for inspection. This does not

affect the tree building process otherwise, except it causes a delay due to writing the output.

In processing selection fields from left to right, the occurrence of two consecutive A subfields separated by a blank B subfield will initiate a control setup for inclusive tree building, beginning with the centroid specified by the first A subfield and ending with the centroid specified by the second A subfield. A comma in the second B subfield is optional for this situation, since the starting and ending centroids have been found for a search group. The occurrence of two successive B subfields containing either commas (may be implied as mentioned above) or periods, causes a single centroid to be specified, i.e., a control setup for inclusive tree building, beginning and ending with the centroid specified in the intermediate A subfield.

For example, to build trees 1 through 90, with BCD Minimum Path Descriptions of trees 1 and 50, the following Tree Selection Card would be required:

Column	Contents
1- 5	*TREE
6- 7	blank
8-13	bbbb1.
14-19	bbbb2b
20-25	bbb49b
26-31	bbb50.
32-37	bbbb51b
38-43	bbb90b

Output Specification Card

The Output Specification Card denotes the assigned network output option that is desired. Columns 7-80 are ignored.

Columns 1-6	Action
*ALL	Write link volumes, turn volumes, and the vehicle-hour and vehicle-mile summary
*LINKS	Write link volumes and the vehicle-hour and vehicle-mile summary only
*NONE	Write the vehicle-hour and vehicle-mile summary only

Selected Link Cards

A Selected Link Card must be provided for each desired link. This card also limits the number of interchanges to print. If any of the limits are omitted or zero it will be set for the maximum number permitted. None of the options should be set greater than the allowable maximum. After any one of the three limits has been reached, the output will be terminated.

Column	Contents
1- 4	*SEL
5- 6	blank
7-12	A-node
13-18	B-node
19-24	Percentage of total volume to be included (range 1 to 100)
25-30	Minimum two-way volume to be allowed (range 1 to 32767)

Column	Contents
31-36	Number of zone pairs to be included (range 1 to 32767)
37-80	ignored

End Selected Links

Column	Contents
1- 4	*END
5-80	blank

Normal Operation

The NETWORK data set is examined for its header record. Then the Turn Penalty Card and Tree Selection Card are read from data set SYSIN. The following messages are printed if these cards are correct:

THE TREE CARDS HAVE ESTABLISHED THE FOLLOWING PARAMETERS

TURN PENALTY = ---.--

FOR SUBNETWORK 1 SEARCH MINIMUM PATHS FROM ZONES ------ TO ------ INCLUSIVE AND {OUTPUT / SUPPRESS OUTPUT}

The appropriate portions of the message are repeated as often as necessary to describe the various control ranges for the tree search.

The program establishes a link index for each link and also sets a flag on each selected link for loading. The program then traces all trees specified by the Tree Selection Card. After each tree has been traced, a zonal separation record is written on the Separation Matrix data set, and the BCD Minimum Path Description is also written if specified. As the trips are assigned to the minimum paths, all trip interchanges assigned to a selected link are written with the link node numbers and link index on data set SELTRP.

Upon completion the following messages are printed:

TREE BUILD TIME = ----.-- MINUTES

LOAD TIME = ----.-- MINUTES

ELAPSED TIME = ----.-- MINUTES

These times are calculated from differences in time-of-day readings of the core clock, and on a system processing only one job at a time they indicate the time to trace all trees, the time to load all trees (which includes time to read the Trip Matrix and Output selected interchanges), and the elapsed time during the entire execution of the program to this point. The load time will be considerably longer than for the ASSIGN program because a less efficient method must be used with selected links, and the selected interchanges must be written.

The BCD Assigned Network Description is then written on the SYSOUT data set if the output option card specified *ALL or *LINKS. If the option was *LINKS no turning movements will be written. If the option was *NONE, no BCD Assigned Network Description will be written.

The SELTRP data set must be used as input to a set of three job steps to produce the selected link output. These job steps consist of two sorts and a FORTRAN program. See OUTPUT SELECTED LINKS.

Error Messages

INCORRECT SUBN = ------

The program prints this message when the number of subnetworks is not 1, and then it continues using only the first subnetwork.

INVALID TURN PENALTY OR TREE CARD READ

The program prints this line under the card which has an error in its identification field (columns 1-6) The correct contents for columns 1-6 for the two cards are *TURN and *TREE. The program stops with a STOP 0 after examining both cards for errors.

ILLEGAL FIELD SEPARATION CHARACTER IN TREE CARD

This message is printed if a field separation character is found which is not a comma, a period or a blank. The program stops with a STOP 0 after it examines the rest of the Tree Card.

---- ERROR(S) DETECTED IN ABOVE PARAMETER CARDS, EXECUTION TERMINATED

The program stops with a STOP 0.

**** TURN TYPE FOR NODE ------, ILLEGAL, = ----------, SET TO 28

This message should only be printed if an input error has occurred reading the NETWORK data set. It indicates that no turning movements will be saved for the node in the message.

LSTCEN .GT. 1200, = ------

This message indicates that there are too many centroids. The program stops at this point with a STOP 0.

NODES .GT. 4000, = ------

This message is self-explanatory. The program stops with a STOP 0 at this point.

LSTVOL .GT. 16000, = ------

This message is printed if there are more than 16000 one-way links (or more than 8000 Link Data Cards) and the number of one-way links is printed, then the program stops with a STOP 0.

NUMBER OF TURNING VOLUMES .GT. 20000, = ------

This message indicates that more than 20000 turning volumes must be saved in the loading process. The number of turning volumes to be saved is printed. The program then stops with a STOP 0. At present the only ways to prevent this message is to either make the network smaller or run ASSIGN SELECTED LINKS with the option for link volumes only on the loaded network output.

TRMV ERR ----------

This error message is printed in the loaded network output if one or more of the turning movements cannot be calculated. This message indicates that the network has not been correctly loaded. This message should occur only if there is a CPU error; these errors are very rare on the IBM 360 computers. The program continues.

LOAD SELECTED LINKS OUTPUT OPTION INVALID, OPTION READ = ---- RUN DELETED

The invalid output option is printed in the message and the program terminates with a STOP 6.

ANODE = ------ BNODE = ------ V(1) = -------- V(2) = ------ RANGE ERROR.

This message indicates a negative volume was read from the NETWORK data

set for one of the last two assignments. The A-node and B-node numbers of the related link are indicated. The volumes from the last two assignments are printed in hexadecimal. Negative trip volumes are caused by an error in the Variable Blocked Spanned record format. Changes have been made in the program to use record format type Variable Blocked, so this error message should not occur.

MORE THAN TWO LINKS FROM NODE -----

This message occurs during the processing of the Route Profiles and indicates that a node has three or more links with the same route code. Only two of the links will be retained. This will cause links to be lost in the Route Profile output for this route.

ROUTE -- HAS NO ENDS, A LINK WILL BE CHOSEN AS A STARTING POINT.

The links included in this route form a closed loop. The link with the lowest node number will be chosen as the starting point for the Route Profile output.

OUTPUT SELECTED LINKS

OUTPUT SELECTED LINKS

Program Function

This program sorts selected link interchange records and produces BCD Selected Link Interchanges for printing. The interchanges assigned to each selected link are printed in descending order of magnitude of nondirectional volumes until either a limit parameter has been satisfied or until all interchanges have been printed.

Data Set References

FIRST STEP (SORT)

Input

SORTIN - Data set referred to by DD name SELTRP in the Assign Selected Links Program.

Output

SORTOUT - (Input to second step.)

SECOND STEP (SORT)

Input

SORTIN - (Output from first step)

Output

SORTOUT - (Input to third step)

THIRD STEP (FORTRAN)

Input

1 - (Output from second step)

Output

6 - BCD Selected Link Interchanges

Note: SORTIN and SORTOUT are DD names. Additional SORTWORK data sets are also required - refer to the IBM 360 Sort/Merge Manual.

Program Call Card

There is no Call Card. This group of job steps must be either appended to the Texas Small Network Package job steps or executed separately as a different job. If the group of job steps is to be processed with the Texas Small Network Package, then the Texas Small Network Package must end execution either by reading a Stop Card or by reaching an end of data set on the SYSIN data set while trying to read a new CONTROL CARD.

Parameter and Data Cards

None

Normal Operation

This set of job steps sorts the selected trips on the selected link index, A-zone, and B-zone. During the final phase of this sort, the trip interchanges with the same link index are transformed to a single record containing both directional and nondirectional volumes. The second sort is on the link index and nondirectional volume. The FORTRAN program processes these records and produces the selected link output governed by the limit parameters. If the collection of interchanges through a selected link reaches a limit before printing all interchanges, the limit is printed along with the percentage of the nondirectional volumes accounted for to this point. The heading and date which were written on the SELTRP data set when it was produced are used as a title for the output.

Error Messages

ERROR, INTERCHANGE RECORD OUT OF SORT, INDEX & PREVIOUS INDEX = ------,

------ ANODE = ------ BNODE = ------ TWO-WAY VOL = ----------

B-A VOL = ----------

This message could be produced if one of the sorts did not execute correctly or if a record was lost due to an input-output error.

PLOT ROUTE PROFILES

PLOT ROUTE PROFILES

Program Function

The PLOT ROUTE PROFILES program accepts the route profile data set which was produced by the ASSIGN, ASSIGN SELF-BALANCING, or ASSIGN SELECTED LINKS program, and produces a data set for CALCOMP plotting of assigned volumes, traffic counts, and/or link capacities from specified routes. The program also prints all route profiles.

Data Set References

Input:	$ROUTE	(25)*	Route Profile
Output:		(PLOTTAPE) **	CALCOMP Plotter Commands
		(6)	BCD Route Profile Descriptions

Program Call Card

Column	Contents
1-20	$PLOT ROUTE PROFILES
21-32	blank
33-80	ignored

Parameter and Data Cards

Route Plot Card

Columns 1-4 of the Route Plot Card may be punched *ALL to produce plots of all Route Profiles. Individual routes may be specified in the following manner:

---

* Default unit
** PLOTTAPE is a DD name.

Column	Contents
1	If nonblank, plot route 1. If blank, do not plot route 1.
2-31	If column n is nonblank, plot route profile n. If column n is blank, do not plot route profile n.
32-80	ignored

Assignment Plot Card

Columns 1-4 of the Assignment Plot Card may be punched *ALL to permit all available assignments, traffic counts, and link capacities to be plotted. Specific combinations may be selected as follows:

Column	Contents
1	If nonblank, plot traffic counts. If blank, do not plot traffic counts.
2	If nonblank, plot link capacities. If blank, do not plot link capacities.
3	If nonblank, plot first assignment. If blank, do not plot first assignment.
4-22	If column n+2 is nonblank, plot assignment number n. If column n+2 is blank, do not plot assignment number n.
23-80	ignored

Normal Operation

The Route Plot Card is read, interpreted, and printed. Then the Assignment Plot Card is read, interpreted, and printed. In addition to the route numbers and assignment numbers which have been selected, the words COUNTS and/or CAPACITIES will also be printed to indicate their selection. The

program plots the heading records and processing dates for the assignments which are plotted. All route profiles are printed, including those which are plotted.

Error Messages

None

FRATAR FORECAST

FRATAR FORECAST

Program Function

The FRATAR FORECAST program accepts a deck of zonal growth factors and uses Fratar's method of successive approximations to generate a Forecasted Trip Matrix. Each approximation constitutes one iteration; the number of repetitions is governed by either an iteration limit or a deviation limit described herein. Nondirectional trip matrices, having the directional volumes combined and entered into both directions of movement, are assumed as both input and output.

Data Set References

Input:	$CTVOUT	(8)*	Trip Matrix
		(5)	Growth Factors
Scratch:		(17)	
Output:	$FRATAR	(16)*	Forecasted Trip Matrix

Note: If the OUTPUT TRIP VOLUMES program or the SUM TRIP ENDS program or the ASSIGN program or the ASSIGN SELECTED LINKS program is executed after the FRATAR FORECAST program, the Trip Matrix input unit for those programs will be set to the Forecasted Trip Matrix unit for the FRATAR FORECAST program as specified by the $FRATAR Unit Designation Card.

Program Call Card

Column	Contents
1-16	$FRATAR FORECAST
17-32	blank
33-80	ignored

* Default Unit

Parameter and Data Cards

Fratar Parameter Card

Column	Contents
1- 5	Iteration Limit (Maximum number allowed)
6-10	Growth Factor Selection 1 Use 24HR 2 Use AMPK 3 Use PMPK
11-15	Deviation Limit (Maximum deviation from a value of 1.0, allowable for any zone, for the ratio of desired to resulting trip generations - scaled in hundredths and normally set at 10 for 0.1)

Growth Factors

Individual Growth Factors must be supplied to the FRATAR FORECAST program for each zone. These are used as the initial values in the first iteration.

Column	Contents	
1- 6	Zone Number	
7-12	Existing trip generations	
13-18	Future trip generations	
19-24	24-Hour Growth Factor	in hundredths with decimal point omitted
25-30	AM Peak Growth Factor	
31-36	PM Peak Growth Factor	

End Card

Columns 1 through 36 should contain zeros. This card is used as protection against reading past the End-of-Data Set.

Normal Operation

The Fratar Parameter Card is read and checked for validity. An Iteration Limit of 10 is substituted for an invalid entry. The input Trip Matrix is copied to Unit 16 and the existing Trip End Summary is obtained. The zonal Growth Factors are then read and error checking proceeds. Following the last card in the Growth Factors deck should be the End Card which serves as added protection against reading past the End-of-Data Set. If 24HR Growth Factors are specified, each Growth Factor is computed using the existing Trip End Summary and the future trip ends obtained from the Growth Factor cards. The existing trip ends from the Trip End Summary are used, rather than the existing trips from the Growth Factor cards. If AMPK or PMPK Growth Factors are specified, the Growth Factors and existing trips are taken directly from the card. If no fatal errors occur, the program proceeds to the forecast phase.

The forecast phase is the actual expansion of the trip volumes. First, the weighting factor denominators are calculated using the existing Trip End Summary and the Growth Factor array. The weighting factors are then calculated and used to expand the existing Trip Matrix. The convergence ratios are printed and a new iteration then begins. The input Trip Matrix is passed three times on the first iteration and two times on each succeeding iteration.

The Forecasted Trip Matrix will always be written on Unit 16 or the unit specified by a $FRATAR Unit Designation Card. The original Trip Matrix will remain unchanged on Unit 8 or the unit specified by $CTVOUT Unit Designation Card. A rounding factor of .8 is used to compensate for the round-off error of integer arithmetic. The results were more accurate using a .8 rounding factor than a .5 rounding factor due to the summation properties of the program.

The Fratar formula for expansion of nondirectional trip matrices (having the directional volumes combined and entered into both directions of movement) is:

$$e_k = \sum_{m=1}^{n} t_{km}$$

$$g_k = \frac{E_k}{e_k}$$

$$w_k = \sum_{m=1}^{n} t_{km} * g_m$$

$$T_{ij} = t_{ij} * g_i * g_j * \left(\frac{w_i + w_j}{2}\right)$$

T_{ij} = forecasted trips interchanging between zone i and zone j

t_{ij} = existing trips interchanging between zone i and zone j

E_k = future trip ends for zone k

e_k = existing trip ends for zone k

g_k = growth factor for zone k

w_k = weighting factor for zone k

Error Messages

IMPROPER GROWTH FACTOR FIELD SPECIFIED FATAL ERROR

If columns 6-10 of the Fratar Parameters Card is not 1, 2, or 3, this error message is written and control is returned to the control program.

ERROR ON CARD

When a read error is encountered in the Growth Factors deck, the number of the card in the deck is written and control is returned to the control program.

ERROR = --- ------

A growth factor of 0 has been encountered. The first number is the subnet number and the second is the normalized centroid number in the subnet. After all growth factors have been examined, the job is deleted with a STOP 0. (All growth factors which are not in the Growth Factor deck are set to zero, so that a missing Growth Factor card will cause this message).

INVALID ZONE NUMBER ------

The origin zone written is out of the range of zone numbers for the sub-network. The data are ignored and processing continues.

EXISTING TRIPS REPORTED AS ------ COMPUTED AS ------ FOR ZONE ------

This message may occur only if the 24-hour field of the Growth Factors deck has been specified. Otherwise, no existing trips are expected to be reported in the Growth Factors deck columns 7-12. If, however, the 24-hour field is being used, a comparison is made between the existing trips

Determined by the Trip End Summary from the input Trip Matrix. Any discrepancy detected results in the above message being printed for information purposes only, and the trips obtained by the Trip End Summary are used for computation purposes.

GROWTH FACTOR REPORTED AS ------ COMPUTED AS ------ FOR ZONE --- COMPUTED GROWTH FACTOR USED ---

This message may occur only if the 24-hour field of the Growth Factors deck has been specified. Otherwise, columns 7-12 of the Growth Factors deck (existing trips) and columns 13-18 of the Growth Factors deck (future trips) are ignored. If, however, the 24-hour field is being used, the future trips are divided by the existing trips to obtain a computed growth factor. If a discrepancy exists between the computed growth factor and the one reported in columns 19-24, the above error message will result. The computed growth factor is accepted and the given growth factor is ignored.

GROWTH FACTOR MISSING FOR INTERNAL ZONE NUMBER ------, FATAL ERROR FOR FRATAR FORECAST --- ERROR SCAN CONTINUES, DELETION EMINENT

A growth factor has not been given for the specified internal zone. Each zone will be checked for this error, thus the message may appear more than once. An abort switch is set as a result of this error, and the program will be terminated after the Growth Factors deck is edited.

SUM TRIP ENDS

SUM TRIP ENDS

Program Function

The SUM TRIP ENDS program determines trip volume summary characteristics for each zone. These data include the number of trips entering, number of trips exiting, number of intrazonal trips, number of trip generations, number of zones with trips entering, and number of zones with trips exiting, for each zone. Also printed is a summary of total trips, total trip generations, and total intrazonal trip generations.

Data Set References

Input: $CTVOUT (8)* Trip Matrix

Output: (6) BCD Trip Generation Summary

Program Call Card

Column	Contents
1-14	$SUM TRIP ENDS
15-32	blank
33-80	ignored

Parameter and Data Cards

None.

---

*Default unit

Normal Operation

The Trip Matrix data set is read, summarized, and the BCD Trip Generations Summary is then written on SYSOUT and control is returned to the control program.

Error Messages

None.

MERGE

MERGE

Program Function

The MERGE program accepts from two to six Trip Matrix data sets and performs a matrix addition to produce an Accumulated Trip Matrix.

Data Set References

Input:	$MERGIN	(--)*	Trip Matrix	two to six Trip Matrices
		(--)*	Trip Matrix	
			⋮	
		(--)*	Trip Matrix	
Output:	$MERGOUT	(--)*	Accumulated Trip Matrix	

Program Call Card

Column	Contents
1- 6	$MERGE
7-32	blank
33-80	ignored

Parameter and Data Cards

Merge Parameter Card

Column	Contents
1- 5	*REEL
7-12	Number of data sets to merge
13-18	Maximum number of subnetworks in each data set (should be 1)

*No default option exists for the MERGE program. Appropriate Unit Designation Cards must be provided by the user.

Normal Operation

The Merge Parameter Card is read to determine the number of data sets to be accumulated. The header records are then read from each input Trip Matrix and the first node numbers compared. They must all be equal. A header record is then written for the Accumulated Trip Matrix containing the first node and the largest last node number. After the Accumulated Trip Matrix has been written, control is returned to the control program.

Error Messages

----- ------ ----- INVALID *REEL CARD, EXECUTION DELETED

Columns 1-5 do not contain *REEL. The message shows the contents of the first 18 columns of the error card.

NUMBER OF SUBNETS OR NUMBER OF REELS TOO LARGE

If the number of subnetworks exceeds 4 or the number of data sets exceeds 6, execution is terminated following this message.

FIRST NODE FROM MERGE FILE ONE = ------- NOT EQUAL TO FIRST NODE FROM MERGE FILE --- = -------

EXECUTION DELETED

If the first node numbers in all Trip Matrix header records are not equal, execution is terminated following this message.

PREPARE SPIDER NETWORK

PREPARE SPIDER NETWORK

Program Function

The PREPARE SPIDER NETWORK program accepts the BCD Spider Link Data Cards and organizes the Spider Network. The user must specify whether the Time or Speed parameter will be read from the Link Data Cards.

Data Set References

Input: $INLNK (5)* Spider Link Data Cards

Output: (1) Spider Network

(4) Spider Node Locations

Program Call Card

Column	Contents
1-23	$PREPARE SPIDER NETWORK
24-32	blank
33-80	ignored

Parameter and Data Cards

Spider Network Link Data Cards

These cards are the actual link definition cards. They furnish all the information required to form the Spider Network. Limitations on the

*Default unit

spider network are as follows:

Maximum number of nodes is 3500

Maximum number of connections to any node is 8

Maximum link impedance is 10.23

All information is for two-way links given A-B. B-A links contain identical information. The format is as follows:

Columns	Contents
1- 2	blank
3- 6	A-node number for all links on this card
7	ignored
8-12	B-node number for the first link
13	ignored
14-16	Distance in hundredths of miles for the first link
17	ignored
18	speed or time indicator for the first link (S for speed, T for time)
19	ignored
21-23	speed in tenths of a mile per hour or time in hundredths of a minute for the first link
24-25	ignored
26-30	B-node number for the second link (if this field is blank or zero only one link is assumed to be on this card)
31	ignored
32-34	Distance in hundredths of miles for the second link
35	ignored

Columns	Contents
36	speed or time indicator for the second link (S for speed, T for time)
37	ignored
38-40	Speed in tenths of a mile per hour or time in hundredths of a minute for the second link
41-42	ignored
43-47	B-node number for the third link (if this field is blank or zero it is assumed there is a maximum of two links on this card)
48	ignored
49-51	Distance in hundredths of a mile for the third link
52	ignored
53	Speed or time indicator for the third link (S for speed, T for time)
54	ignored
55-47	Speed in tenths of a mile per hour or time in hundredths of a minute for the third link
58-59	ignored
60-64	B-node number for the fourth link (if this field is blank or zero it is assumed there is a maximum of three links on this card)
65	ignored
66-68	Distance in hundredths of a mile for the fourth link
69	ignored
70	Speed or time indicator for the fourth link (S for speed, T for time)
71	ignored
72-74	Speed in tenths of a mile per hour or time in hundredths of a minute for the fourth link
75-80	ignored

End Link Data Cards

Column	Contents
1	L
2-80	ignored
or	
1- 6	ENDLNK
7-80	ignored

Node Locator Cards

If these cards are included they must be arranged in sorted order, and a blank card must be inserted for each node which is skipped. The first Node Locator Card will correspond to the first node, etc.

Columns	Contents
1-20	Node location
21-80	ignored

End Link Data

This is the last card in the Link Data Deck.

Column	Contents
1	L
2- 4	blank
5-80	ignored
or	
1- 6	ENDLNK
7-80	ignored

Normal Operation

The Spider Network Link Data Cards are read and checked for validity. If the Time parameter has been specified for the link, it is read and retained. If the Speed parameter has been specified for the link, the speed and distance are read; time is calculated and retained. In order to determine network speed, a series of one minute speed ranges is established. As each link is processed, a counter corresponding to the speed range into which the link speed falls is incremented. At the conclusion of link processing, the highest speed of the range in which the most links are found is taken to be the network speed. Control is returned to the control program.

Error Messages

MORE THAN 8 WAYS OUT FOR NODE ------ ------ -------.--

The specified node already has 8 nodes connected to it. The message includes the A-node, B-node, and link time.

ILLEGAL NODE DESIGNATION ON THIS CARD ------ ------ -------.--

Either the A-node or the B-node is not within range (1-3500). The message includes the A-node, B-node, and the link time.

LINK TIME CALCULATED OR GIVEN EXCEEDS 10.23 MINUTES, FOR LINK

------ ----- -------.--

TIME SET TO 10.23 MINUTES

Either the time given by the Spider Network Link Data Card or the time calculated from the speed and distance read from it exceeds 10.23 minutes. The time is set to 10.23 minutes. The message includes the A-node, the B-node, and the link time.

MISPUNCHED TIME AND/OR SPEED FIELD ------ ------

The Speed/Time indicator field contains something other than a T or an S. The message includes the A-node and the B-node. The erroneous card is ignored.

DUPLICATE LINK ------ ------ -------.-- DELETED, LINK ------ ------ -------.-- KEPT

A duplicate link has been encountered. The message indicates deletion of the link and time encountered last and retention of the link and time encountered first.

OUTPUT SPIDER NETWORK

OUTPUT SPIDER NETWORK

Program Function

The OUTPUT SPIDER NETWORK program accepts the Spider Network and writes the BCD Spider Network Description for printing. Associated Spider Node Locations are attached.

Data Set References

Input: (1) Spider Network

(4) Spider Node Locations

Output: (6) BCD Spider Network Description

Program Call Card

Column	Contents
1-22	$OUTPUT SPIDER NETWORK
23-32	blank
33-80	ignored

Parameter and Data Cards

None.

Normal Operation

Network Description is written in the following form:

A-Node B-Node Link Time Node Location

Control is returned to the control program.

Error Messages

None.

ASSIGN SPIDER NETWORK

ASSIGN SPIDER NETWORK

Program Function

The ASSIGN SPIDER NETWORK program traces and loads the spider trees and writes the BCD Assigned Spider Network Description for printing.

Data Set References

Input:		(1)	Spider Network
		(4)	Spider Node Locations
	$CTVOUT	(8)*	Trip Matrix
Output:		(6)	BCD Assigned Spider Network Description

Program Call Card

Column	Contents
1-23	$ASSIGN SPIDER NETWORK
24-32	blank
33-80	ignored

Parameter and Data Cards

None.

---

*Default unit

Normal Operation

The first trip record from the Trip Matrix is read, the corresponding minimum paths are traced, and the trips are loaded. For each succeeding trip record, the process is repeated until the entire Trip Matrix has been loaded. The Assigned Spider Network Description is then written for printing and control is returned to the control program.

Error Messages

None.