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16. Abstract

This report represents the detailed evaluation of the TRANPLAN package including sample control files and outputs incorporated in a research project entitled "Subarea Analysis Using Microcomputers." One of the study objectives is to develop and incorporate procedures into the Texas Travel Demand Package for downloading a portion of the output from the Texas Package to the selected microcomputer transportation planning package to perform subarea analysis. The TRANPLAN package was tested and recommended for interface with the Texas Package.

TRANPLAN is a comprehensive, fully-integrated, and user-oriented transportation modeling software with highway and transit programs. Unlike other software, TRANPLAN uses English-like syntax and uniform specifications in all programs. TRANPLAN is distributed on 12 (13 if plotting) diskettes, and requires about 3.5 MB of storage if all programs are transferred to a hard disk. The entire set of programs is separated into 42 modules referred to as "FUNCTIONS," each of which has specific capabilities. TRANPLAN documentation is available in hard copy. The package also includes substantial plotting capability. Recently, TRANPLAN has been interfaced with on-line, interactive graphics software for Network Editing and Display (NEDS). Detailed evaluation of TRANPLAN plotting capabilities and NEDS were included in this report.

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DETAILED EVALUATION OF THE TRANPLAN PACKAGE OF MICROCOMPUTER PROGRAMS

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Subarea Analysis Using Microcomputers

Research Report Number 1110-1

Research Study Number 2-10-87-1110

Sponsored by

Texas State Department of Highways and Public Transportation

In Cooperation with the
U.S. Department of Transportation
Federal Highway Administration

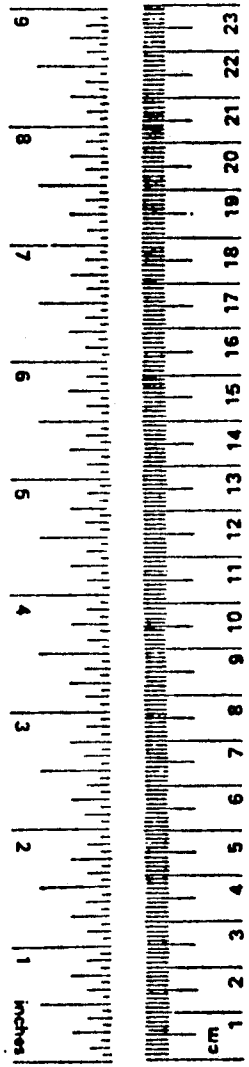
Texas Transportation Institute
The Texas A&M University System
College Station, Texas

October 1988

METRIC CONVERSION FACTORS

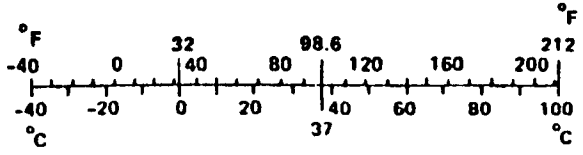
Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C



Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



*1 in = 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price $2.25, SD Catalog No. C13.10:286.

ABSTRACT

This report represents the detailed evaluation of the TRANPLAN package including sample control files and outputs incorporated in a research project entitled "Subarea Analysis Using Microcomputers." One of the study objectives is to develop and incorporate procedures into the Texas Travel Demand Package for downloading a portion of the output from the Texas Package to the selected microcomputer transportation planning package to perform subarea analysis. The TRANPLAN package was tested and recommended for interface with the Texas Package.

TRANPLAN is a comprehensive, fully-integrated, and user-oriented transportation modeling software with highway and transit programs. Unlike other software, TRANPLAN uses English-like syntax and uniform specifications in all programs. TRANPLAN is distributed on 12 (13 if plotting) diskettes, and requires about 3.5 MB of storage if all programs are transferred to a hard disk. The entire set of programs is separated into 42 modules referred to as "FUNCTIONS," each of which has specific capabilities. TRANPLAN documentation is available in hard copy. The package also includes substantial plotting capability. Recently, TRANPLAN has been interfaced with on-line, interactive graphics software for Network Editing and Display (NEDS). Detailed evaluation of TRANPLAN plotting capabilities and NEDS were included in this report.

DISCLAIMER

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1. GENERAL INFORMATION

TRANPLAN, the most popular proprietary transportation modeling software, is a comprehensive, fully-integrated, user-oriented system, fully compatible with highway and transit programs, thus simplifying the procedures of multi-modal systems planning. Unlike other transportation software, TRANPLAN uses English-like syntax and uniform specifications in all programs. The TRANPLAN package includes also substantial plotting capability.

Recently, TRANPLAN has been interfaced with on-line, interactive graphics software for Network Editing and Display (NEDS). NEDS is an on-line, menu-driven graphics package for the creation and maintenance of transportation planning networks as well as for the display of network attributes and assignments.

DEVELOPER/CONTACT

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ENVIRONMENT

The TRANPLAN package currently is available for the following hardware and operating system configuration. For all the following computers, the package syntax is identical:

- IBM PC, IBM PC/XT, IBM AT or compatible under PC-DOS (or MS-DOS) version with a minimum of 512 Kbytes of RAM and a desirable of 640 Kbytes of RAM
- PRIME (all models)
- MC 68000-based super-microcomputers
- CDC CYBER's (all models)
- DEC-VAX (750, 780, and Micro VAX models)

For the IBM PC family of microcomputers, DOS must be configured to accept several disk files simultaneously. Configurating DOS requires modification or creation of a file called "CONFIG.SYS" which must contain the minimum "FILES=10" command. Most TRANPLAN users include the "FILES=20" and "BUFFERS=20" specifications in a "CONFIG.SYS" file in the root directory.

NEDS is also written in structured FORTRAN77 and currently executes on PRIME and VAX minicomputers, UNIX-based MC 68000, MicroVAX computers, and the IBM PC family of microcomputers with 640 Kbytes of RAM. For all systems, a high resolution monitor option is available. For the IBM PC microcomputer, an EGA (Enhanced Graphics Adapter, 640x350 resolution) option is available. Although no processor board upgrade is required, a Microsoft-compatible mouse system is necessary for cursor movement on the EGA monitor.

PACKAGE FEATURES

TRANPLAN is distributed on 12 (13 if plotting) diskettes, and requires about 3.5 mb of storage if all programs are transferred to a hard disk. The package is structured as a dynamic tool for the planner. The entire set of programs is separated into 42 modules referred to as "FUNCTIONS," each of which has specific capabilities. The modular structure enables new and improved techniques to be incorporated without affecting existing modules of the library set. The package consists of the following modules (programs) from the PC versions of TRANPLAN:

- Distribution/Modal Choice Models

  1. GMODEL.EXE - Gravity Model and Calibrate Gravity Model
  2. FRATAR.EXE - Fratar Model
  3. MSPLIT.EXE - Modal Choice
  4. SPLTCAL.EXE - Calibrate Modal Choice

- Networks

  1. HWYNET.EXE - Build Highway Network
  2. MACNET.EXE - Macro Highway Network Update
  3. CUNET.EXE - Build Cost User Network
  4. HUDNET.EXE - Build Transit Network
  5. EXNET.EXE - Extract Subarea Network

- Paths

  1. SLCTSM.EXE - Highway Selected Summation
  2. HUDPATH.EXE - Build Transit Paths
  3. HUDPSUM.EXE - Transit Selected Summation
  4. IZTIME.EXE - Build Intrazonal Impedances

- Loading

  1. HWYLOD.EXE - Load Highway Network and Load Highway Selected Links
  2. TRLOAD.EXE - Load Transit Network
  3. TRSTOS.EXE - Load Transit Station to Station
  4. POST1.EXE - Build Selected Link Trip Tables
  5. POST2.EXE - Analyze Multiple Selected Links
  6. STOCH.EXE - Stochastic Highway Load
  7. SUBAREA.EXE - Extract Subarea Trip Table

- Matrix Utilities

  1. UTABLE.EXE - Matrix Update
  2. MTABLE.EXE - Matrix Manipulate
  3. COMPRESS.EXE- Matrix Compress
  4. TRNSPS.EXE - Matrix Transpose
  5. EXPAND.EXE - Matrix Expand
  6. TRFARE.EXE - Build Fare Matrix
  7. BUILD.EXE - Build Trip Table

- Reporting

    1. RPTNET.EXE - Report Highway Network
    2. RPTPAT.EXE - Report Highway Paths
    3. RTABLE.EXE - Report Matrix
    4. RPTLOD.EXE - Report Highway Load
    5. TRPRAS.EXE - Report Transit Load
    6. CORDOR.EXE - Report Corridor Volumes
    7. RVOLCOM.EXE - Report Matrix Comparison
    8. RWEAVE.EXE - Report Complex Weaves
    9. RVLSUM.EXE - Report Highway Network Summary
    10. RINCSM.EXE - Report Highway Incremental Summary
    11. RNTACC.EXE - Report Network Accessibility
    12. TLFREQ.EXE - Report Trip Length Frequency

- Plotting

    1. PLOTNET.EXE - Plot Highway Network and Plot Highway Load
    2. PLOTPATH.EXE- Plot Highway Paths

- Trip Generation

    1. TRIPGEN.EXE - Trip Generation

NEDS programs include the following features:

- Interactive Network Editing
- Bandwidth Displays
- Minimum Path Determination
- Highway/Transit Networks
- Alternate Host Computers
- High/Medium Resolution Monitors
- Hard Copy Options
- Color Displays
- Volume/Capacity Analysis
- Road Link Loading
- Transit Line Loadings
- Network Zoom and Pan
- User-Specified Restart
- Restore Last Views

PACKAGE INSTALLATION AND OPERATION

Although the TRANPLAN syntax is virtually identical regardless of the computer environment utilized, the computer operating systems do vary. The basic commands/instructions are presented to access and execute TRANPLAN on IBM PC/XT, IBM AT or compatible under PC-DOS (or MS-DOS) version. The method of installation and operation described below is direct and fairly simple:

1. Establish a working directory for executing TRANPLAN.
2. Ensure that the executable TRANPLAN file "TRNPLNXT.EXE" and all required executable modules are in the working directory (or on a DOS "PATH").
3. Copy any input TRANPLAN data files to the working directory.
4. Create a TRANPLAN input control file on "TRNPLN.IN."
5. Type in "TRNPLN" to execute TRANPLAN.

TRANPLAN is operated through a control file named TRNPLN.IN that can be set up using a system editor. The file contains commands that specify which program or programs are to be run, the files, parameters and options to be used by each program, and any special report headers. These functions have a set of controls which are uniform in concept and format. However, differences exist in the details of each function in the user manual; these are given in individual write-ups of each function. A user could create a series of these files for different operations, store them under different names, and copy the appropriate file into TRNPLN.IN prior to execution. The following general control structure applies to all TRANPLAN function.

```
$Function Name

$FILES
     INPUT FILE = Filename, USER ID = $Identification$
     OUTPUT FILE = Filename, USER ID = $Identification$

$HEADERS
     (up to three lines of header records)

$OPTIONS
     (list of options)

$PARAMETERS
     (list of parameters)

$DATA
     (data records)

$END TP FUNCTION
```

The control file is executed by entering TRNPLN on the keyboard. The package checks to see if all specified programs and input data files are stored on disk, then executes the programs in sequence. Output files specified in the control files are stored under names specified by the user, and reports are stored on disks under a file name TRNPLN.OUT. The print or type commands can then be used to access the stored reports. Exhibit 1-1 presents an example of the general control files.

NEDS is a user-oriented, menu-driven system which is easy to learn because the menus are essentially self-explanatory. A user manual is available which details each menu selection item. The user manual contains precise installation instructions.

For example, DISPLAY POSITIONING OPTIONS are the first set of options in the menu. These options allow the user to display different portions of the network within the NEDS viewport window. The entire network may be drawn with the "DRAW NETWK" option/selection. "ZOOM" permits the user to define a rectangular area to be enlarged in order to view a subarea of the network in detail. "PAN" allows the user to move the view of the network in any direction with respect to the current display. "PAN BY CRD" permits the user to specify a window with specific coordinate values. "LAST VIEW"

```
$GRAVITY MODEL

$FILES
     INPUT FILE = GMSKIM, USER ID = $HWYSKIM.DAT$
     OUTPUT FILE = GMVOL, USER ID = $GMVOL.DAT$
     OUTPUT FILE = GMTVOL, USER ID = $GMTVOL.DAT$

$HEADERS
                         GRAVITY MODEL
                    B/CS (TEST HIGHWAY NETWORK)
                   285-ZONE TEST HIGHWAY NETWORK

$OPTIONS
     MERGED PURPOSE FILE
     TOTAL PURPOSE FILE
     PRINT TRIP ENDS
     PRINT ATTRACTIONS
     PRINT TRIP LENGTH STATISTICS
     PRINT ACCESSIBILITY INDICES

$PARAMETERS
     MAXIMUM PURPOSE = 5
     SELECTED PURPOSES = 1-5
     MAXIMUM TIME = 36
     IMPEDANCE = TIME 2
     ITERATIONS ON ATTRACTIONS = 5
     ATTRACTION CLOSURE = 10.0

$DATA
GP    1 1     690      1      6      0    359
GP    2 1     461     18     45      0    252
GP    3 1     416      0      0      0    228
GP    4 1       0      0      0      0      0
 :
 :
GA    1 1     690    386    949    690    359
GA    2 1     461    270    642    461    252
GA    3 1     416    229    588    416    228
GA    4 1       0      0      0      0      0
 :
 :
GF    1 1   88335  29244 136330  88335  45467
GF    2 1   69948  25591 107010  69948  34838
GF    3 1   55543  22281  83610  55543  26541
GF    4 1   44398  19140  65181  44398  20216
 :
 :
 :

$END TP FUNCTION
```

Exhibit 1-1. A Sample of General TRANPLAN Control File.

displays the preceeding network views; the "NEXT VIEW" option/selection returns the "next" network view (in a circular buffer of seven views). These display positioning options provide the user quick and easy ways of locating the desired window into the network.

DOCUMENTATION

TRANPLAN documentation is available in hard copy. It can also be obtained on disk files (three diskettes for TRANPLAN/NEDS). Each program is described in a separate file which reviews its capabilities, identifies required and optional files, defines parameters and options, presents the format of any 80-character ASCII data records, and provides one or more examples of a control file. In addition, there are files describing the installation and overall operation of the package, including the execution of demonstration files. The manual is separated into the following parts:

- GENERAL DESCRIPTION - Describes the characteristics of TRANPLAN relevant to all functions, such as general syntax, data file structures, and the method for accessing TRANPLAN.

- DISTRIBUTION/MODAL CHOICE MODELS - Describes the forecasting models which simulate travel behavior, such as the Gravity model, Fratar model, Modal Choice models, as well as calibration techniques.

- NETWORKS - Describes the functions which are used to build and update highway and transit networks.

- PATHS - Describes the functions which are used to build minimum paths for highway and transit networks.

- LOADING - Describes the functions used for loading trips on highway and transit networks. Several loading methods are available in addition to special post-processor techniques for analyses of loaded networks.

- MATRIX UTILITIES - Describes the functions which are used to create and modify matrices (i.e., trip tables and travel impedance tables.)

- REPORTING - Describes the functions which are used SOLELY for generating reports. (Many other functions also produce reports, but are not included in this section because the reports are secondary operations.)

- PLOTTING - Describes the functions which produce on-line or off-line plots for pictorial representation of network characteristics.

- TRIP GENERATION - Describes the application trip generation capabilities of TRANPLAN.

DATA ENTRY AND STORAGE

There are two methods of job or run data entry in TRANPLAN; they are the use of $FILE and $DATA specifications in the job control file. Data files, such as a link data file (the file name = NETDATA), can be created separately; these files are in fixed format. They can then be accessed using the $FILE specification. Other files, such as a highway network file (the file name = HWYNET), are created by a TRANPLAN program; all of these file specifications are in free format. Input files in the $FILES control, including job control files, are ASCII records that can be created and modified using a text editor.

The $DATA control indicates that one or more data records immediately follow. Data requirements are given in detail in each applicable function write-up. The data are specified in one of two ways: fixed format and free format.

- Fixed Format - Data specifications which potentially require large amounts of data entry are coded in fixed format and must be inserted in a particular order. Coding sheets are included in the User's Manual for the data that must be entered in fixed format; these are network data, trip generation variables, productions and attractions, and Friction Factors. An example is the highway network data records (link data) shown under $DATA for the job control file shown in Exhibit 1-2.

```
$BUILD HIGHWAY NETWORK
$FILE
     OUTPUT FILE = HWYNET, USER ID = $HWYNET.DAT$
$HEADERS
                              BUILD HIGHWAY NETWORK
                                        B/CS
                     BUILDING 285-ZONE TEST HIGHWAY NETWORK
$PARAMETERS
   NUMBER OF ZONES = 285
   MAXIMUM NODE = 1119
   ERROR LIMIT = 50
$DATA
    1 11149   3S    1500              0     02
    1  8959   3S    1500              0     02
    1 11049  11S    1500              0     02
    2  8929   8S    1500              0     02
    2  8919   8S    1500              0     02
    3 11039   8S    1500              0     02
     :
     :
$END TP FUNCTION
```

Note: See page 1-10 in the Build Highway Network section of the User's Manual for the link data record format.

Exhibit 1-2. An Example of Data Specification in FIXED FORMAT.

- Free Format - Free form coding is typically used where data requirements are small. In this case, the data are specified similar to parameters, the only difference being that data items of the same type are often repeated, whereas parameters are not. The manner in which data must be entered for each program which uses a free format is specified in the User's Manual. An example would be Weave Set declarations shown under $DATA in Exhibit 1-3.

```
$REPORT COMPLEX WEAVES
$FILES
   INPUT FILE = HWYTRIP, USER ID = $GMTVOL.DAT$
   INPUT FILE = SELHIST, USER ID = $SELHIST.DAT$
   INPUT FILE = SELHST2, USER ID = $SELHST2.DAT$
   INPUT FILE = SELHST3, USER ID = $SELHST3.DAT$
   INPUT FILE = SELHST4, USER ID = $SELHST4.DAT$
   INPUT FILE = SELHST5, USER ID = $SELHST5.DAT$
$HEADERS
                          REPORT COMPLEX WEAVES
                            B/CS TEST NETWORK
                       EXIT AND ENTER RAMPS ON HWY-6
$DATA
   WEAVE SET,
   ID = HIGHWAY WEAVES
   ENTRY LINKS = 1059-1060,1055-1056,1052-1053,1047-1048,
                 1044-1045,1040-1041,1037-1038,1034-1033
   EXITS LINKS = 1056-1057,1060-1061,1049-1050,1053-1054,
                 1041-1042,1045-1046,1033-1035,1038-1039
$END TP FUNCTION
```

Exhibit 1-3. An Example of Data Specification in FREE FORMAT.

If more than one option, parameter, or datum is specified on the same record (line), they must be separated by commas. Commas need not be used if separate records are used for each statement. Blanks may be left between letters and numbers of any single statement (i.e., "TIME1" and "TIME 1" are equivalent). The blanks are ignored except in "user identification" specifications.

Many parameters and data are specified as lists of numeric values. In any such case, all desired values should be put in one list and in ascending order (recommended for readability) unless otherwise indicated. Ranges of values may be specified within a list in lieu of declaring each particular value. For example, the statement "SELECTED PURPOSES = 1-3, 5, 7-8" is equivalent to the statement "SELECTED PURPOSES = 1, 2, 3, 5, 7, 8" and would imply that Purposes 1, 2, 3, 5, 7, and 8 of a data file are to be utilized in the current function (see SELECTED ZONES parameter specification in Exhibit 3-1).

Data files that are created by TRANPLAN programs for use by other programs generally are unformatted files written and read using FORTRAN's unformatted option. A subroutine is available for reading and writing matrix files, and the user's manual illustrates its use.

2. BUILD HIGHWAY NETWORK

A TRANPLAN network is similar to a UTPS or PLANPAC network. Network link data, turn penalty data and/or turn prohibitor data, and node coordinates may be input (the name of input file = NETDATA). Exhibit 2-1 shows a sample control file set up for this function.

```
$BUILD HIGHWAY NETWORK
$FILE
     INPUT FILE = NETDATA, USER ID = $NETDATA.DAT$
     INPUT FILE = OLDNET, USER ID = $OLDNET.DAT$
     OUTPUT FILE = HWYNET, USER ID = $HWYNET.DAT$
$HEADERS
                              BUILD HIGHWAY NETWORK
                                      B/CS
                    BUILDING 285-ZONE TEST HIGHWAY NETWORK
$OPTIONS
   DELETE ALL NODE COORDINATES
   UPDATE NETWORK
   NETDATA
   PRINT DATA

$PARAMETERS
   NUMBER OF ZONES = 285
   MAXIMUM NODE = 1119
   ERROR LIMIT = 50

$END TP FUNCTION
```

Exhibit 2-1. A Sample Control File for Build Highway Network.

Extensive network data edit capabilities exist for the user. All edit messages are descriptive for convenient and quick interpretation. A full listing of the network data may be optionally reported; otherwise, only records with errors are listed (the name of output file = HWYNET). An existing highway network may be updated by any of three methods (the name of input file = OLDNET):

- o Deletion of existing network components;
- o Insertion of new components; and
- o Modification of existing links.

When a large set of links is to be modified or deleted according to some consistent pattern other than link by link, the MACRO HIGHWAY NETWORK UPDATE function should be used instead of the update option in BUILD HIGHWAY NETWORK function.

Link data, optional node coordinate, and turn prohibitor information are entered as ASCII records that can be either part of the job control file or a separate file. In either case, a system editor or a program developed by the user must be applied to prepare the data.

NODES

Nodes must be numbered in the sequence zones followed by other nodes. Zones (internal zones followed by external stations) must be numbered sequentially without gaps; however, gaps are allowed in numbering other nodes. The network builder permits up to 31 exits at a node. However, if turn prohibitors are used at a node, only eight exits are permitted. Also if turns are to be saved during loading, only four exits should be used at any node. Node coordinates are optional; values may range from -9999 to 99999. With the "Large Coordinate" option, eight-digit (2^{31}-1) coordinates may be utilized, thus permitting State Planner coordinate systems applicability. A sample of the output format for Node Coordinates is illustrated in Exhibit 2-2.

DCCD / UAG
TRANPLAN SYSTEM
VERSION 5.0

REPORT HIGHWAY NETWORK
B/CS NETWORK

PAGE NO. 1
DATE 27JUL87
TIME 15:28:54

NODE COORDINATES

NODE	X-COORD	Y-COORD	NODE	X-COORD	Y-COORD	NODE	X-COORD	Y-COORD	NODE	X-COORD	Y-COORD	NODE	X-COORD	Y-COORD
1	20529	32498	2	21161	33122	3	20894	32095	4	10464	6580	5	10922	6765
6	11357	7009	7	11426	7612	8	11809	7942	9	12151	7635	10	12273	8481
11	20069	32747	12	19889	33263	13	18957	34211	14	18718	33057	15	20192	32505
16	19709	32408	17	19679	31981	18	20024	31915	19	18792	30863	20	18713	31343
21	18472	31987	22	17593	29453	23	16942	28399	24	17739	30673	25	16797	31299
26	17026	32447	27	17047	33373	28	15604	33711	29	16306	34354	30	16723	35092
31	16956	36038	32	19881	35657	33	21309	35864	34	20162	34501	35	20586	33715
36	21185	34515	37	21066	33553	38	21422	33341	39	21536	33227	40	21802	33996
41	22030	33592	42	21783	31736	43	21841	30872	44	21145	30757	45	21085	31550
46	20328	31538	47	20366	30759	48	19517	30752	49	19672	29058	50	20537	29165
51	19768	27340	52	20782	27767	53	21305	29186	54	22435	29864	55	22945	30655
56	22954	28916	57	22470	27993	58	22631	26690	59	21890	26640	60	21258	27140
61	20625	26438	62	21240	25357	63	22839	25998	64	22435	24988	65	20287	23418
66	20405	23995	67	20036	24874	68	19764	26060	69	18701	23239	70	17691	22932
71	17248	22799	72	16649	23015	73	16645	23696	74	17440	24316	75	17194	25809
76	18165	25664	77	18780	25330	78	18881	26957	79	18437	27037	80	17496	27458
81	18544	27969	82	18904	28037	83	18999	29218	84	18805	29774	85	18061	29336
86	16023	27927	87	15718	26389	88	16081	23352	89	15252	23296	90	13354	23170
91	12344	23718	92	13135	26547	93	10219	29850	94	15916	29837	95	15720	31545
96	14117	31515	97	15457	32713	98	13454	33692	99	14465	35661	100	8696	33162
101	8627	37332	102	3936	39358	103	6265	42474	104	5884	45958	105	6806	43956
106	11158	45133	107	11401	41206	108	11675	38134	109	14457	37811	110	16174	44009
111	14260	48110	112	12716	50105	113	16374	51338	114	16792	50190	115	21321	46938
116	18529	41589	117	20838	44756	118	20899	40194	119	16870	38107	120	18959	38622
121	21082	38535	122	21470	41085	123	22228	41501	124	21789	38850	125	22931	39216

Exhibit 2-2. An Example Output of Node Coordinates.

LINKS

A link distance is specified in hundredths of a unit with a maximum value of 40.95. Either a speed (in hundredths of a unit, maximum value = 99.99 which may be modified with the Speed Scale Factor parameter) or a travel time (in hundredths of a unit, maximum value = 40.95) may be specified as impedance information. Up to two time or speed values may be supplied for each directional link. Capacity is entered in the first field for each link direction with a maximum value of 999,999. Observed (directional) ground count volumes may be coded in the second data field, or the field may be used to enter alternative capacities. B-to-A values need not be coded for symmetrical links. In addition, a table of opposite direction codes can be supplied in the network parameters (see Exhibit 2-3).

An assignment group code (A/G value = 0 to 9) may be specified for each link to indicate which user-specified speed-column curve is to be applied during a capacity-restrained assignment. Also, up to three sets of two-digit link group codes (L1, L2, and L3) can be assigned to each direction of the link. These codes can be used in macro-updating and in selecting links for network reports and summaries.

A direction code (DIR ranging from 1 to 16) may be specified for each link; the codes are used to designate macro-turn penalties and node-specific turn penalties optional for path building functions. A user identification field allows the user seven alpha-numeric characters to aid in identifying the particular link. Exhibit 2-3 shows a sample output of Network Description Report.

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REPORT HIGHWAY NETWORK
B/CS NETWORK

PAGE NO. 14
DATE 27JUL87
TIME 15:28:54

NETWORK DESCRIPTION REPORT

ANODE	BNODE	1WAY	DIST	TIME2	SPEED2	L1	L2	L3	DIR	A/G	PNODE	ANODE	BNODE	1WAY	DIST	TIME2	SPEED2	L1	L2	L3	DIR	A/G	PNODE
359	139		.65	2.60	15.00					9		360	361		.05	.10	30.00					8	
	212		.30	1.20	15.00					9			1073		.10	.12	50.00					3	
	358		.48	.58	49.66					3			1074	1	.16	.21	45.71					7	
	987		.38	.46	49.57					3													
361	360		.05	.10	30.00					8		362	346		.23	.46	30.00					8	
	869		.15	.30	30.00					8			868		.12	.24	30.00					8	
	870		.15	.30	30.00					8			869		.19	.38	30.00					8	
	1077		.06	.08	45.00					7													
363	130		.29	1.16	15.00					9		364	130		.25	1.00	15.00					9	
	868		.35	.70	30.00					8			344		.46	.69	40.00					5	
	873		.50	1.00	30.00					8			872		.51	.77	39.74					5	

Exhibit 2-3. An Example Output of Link Description Report.

3. BUILD HIGHWAY PATHS AND SEPARATION MATRICES

HIGHWAY SELECTED SUMMATION

This function allows the user to skim either all or selected minimum impedance paths to produce interzonal impedance matrices (the name of output file = HWYSKIM). The minimum paths may be generated based on Cost, Distance, either of two time fields (Time 1,2), or User specified network parameters (the name of input file = HWYNET). As the minimum paths are built based on one impedance, the values for the other impedances may also be accumulated. Up to seven (four on the IBM PC version) interzonal matrices may be built in one run. Exhibit 3-1 illustrates a sample control file of this function.

The HWYSKIM file is generated by this function; however, the function does not allow the user to report selected summation (skim) table. REPORT MATRIX function should be used to report separation matrices. TRANPLAN utilizes a VINE builder which guarantees a minimum path with turn penalties and turn prohibitors.

```
$HIGHWAY SELECTED SUMMATION
$FILE
     INPUT FILE = HWYNET, USER ID = $HWYNET.DAT$
     OUTPUT FILE = HWYSKIM, USER ID = $HWYSKIM.DAT$
$HEADERS
                         SKIM THE MINIMUM IMPEDANCE PATHS
                           B/CS (TEST HIGHWAY NETWORK)
                    TO PRODUCE INTERZONAL IMPEDANCE MATRICES
$PARAMETERS
     IMPEDANCE = TIME 2
     TURN PENALTIES = (1-2,10)(1-3,5)
     SELECTED ZONES = 1-20,120,160-185,250
$DATA
     TABLE = TIME 2
$END TP FUNCTION
```

Exhibit 3-1. A Sample Control File for Build Highway Paths.

BUILD INTRAZONAL IMPEDANCES

This function allows the user to generate intrazonal impedances (the name of output file = IZOUT) for any skim table (the name of input file = IZIN) based on the nearest zone(s). The program calculates the intrazonal impedance as one-half the average impedance to the adjacent zone(s) as specified by the user.

Two alternate forms of adjacency may be specified: the user may explicitly input the adjacent zones for each zone (by ZONE and ADJACENT ZONES data specifications) or the user may specify a number of adjacent zones (by NUMBER OF ADJACENT ZONES parameter) for the program to analyze. In the latter case, the program determines the adjacent zone(s) and calculates

half the average impedance to the adjacent zone(s). Intrazonal impedances are generated for all skim tables on the input file. The following Exhibit 3-2 illustrates a sample control file for this function, and Exhibit 3-3 shows an example of the output format.

```
$BUILD INTRAZONAL IMPEDANCES
$FILE
     INPUT FILE = IZIN, USER ID = $HWYSKIM.DAT$
     OUTPUT FILE = IZOUT, USER ID = $IZTIME.DAT$
$HEADERS
                          BUILD INTRAZONAL IMPEDANCES
                          B/CS (TEST HIGHWAY NETWORK)
                            USING FIVE NEAREST ZONES
$OPTION
     PRINT DETAIL
$PARAMETER
     AVERAGE ADJACENT ZONES = 5
$END TP FUNCTION
```

Exhibit 3-2. A Sample Control File for Build Intrazonal Impedances.

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BUILD INTRAZONAL IMPEDANCES
B/CS (TEST HIGHWAY NETWORK)
USING FIVE NEAREST ZONES

PAGE NO. 3
DATE 27JUL87
TIME 15:48:08

ZONE	TABLE NO.	INTRA IMPED	ADJ. ZONE	IMPED VALUE	ADJ. ZONE	IMPED VALUE	ADJ. ZONE	IMPED VALUE	ADJ. ZONE	IMPED VALUE	ADJ. ZONE	IMPED VALUE	ADJ. ZONE	IMPED VALUE	ADJ. ZONE	IMPED VALUE	ADJ. ZONE	IMPED VALUE	ADJ. ZONE	IMPED VALUE
26	4	131	226	224	21	256	20	266	14	280	24	280								
27	4	137	14	252	30	272	226	276	26	284	29	288								
28	4	158	29	281	97	300	30	307	31	339	99	356								
29	4	135	30	152	28	281	27	288	31	306	99	323								
30	4	109	31	144	29	152	34	252	99	267	27	272								
31	4	134	30	144	34	284	99	299	29	306	13	307								
32	4	112	34	164	33	200	36	214	35	266	40	274								
33	4	118	36	196	32	200	34	246	40	256	41	283								
34	4	78	35	116	36	136	32	164	37	180	12	187								
35	4	51	37	64	12	100	11	115	34	116	38	117								
:																				
:																				
:																				

Exhibit 3-3. An Example Output of Build Intrazonal Impedances.

4. TRIP GENERATION

TRIP GENERATION function accepts Traffic Analysis Zone data such as population, dwelling units, employment, socio-economic data, and applies user-supplied linear relationships to generate Productions and Attractions for input to the Gravity Model (see Exhibit 4-1). The P's and A's are generated in TRANPLAN format and may be merged into a TRANPLAN control stream or placed on the file (the name of output file = GRVDATA), and input directly to the Gravity Model. There is no explicit P/A balancing in this program, but the Gravity Model will scale attractions to match productions.

Up to 15 trip tables may be built from an ASCII survey file that conforms to the format specified in the user's manual. In addition to origin zone, destination zone, and number of trips, each record contains eight fields that nominally contain information on trip purpose, mode of travel, time of day, and codes defining the origin and destination zones. The function permits up to 25 independent variables and up to 26 coefficients or generation rates. Default formats exist for both data types; however, the user may optionally specify the formats for reading the data sets by using the USER FORMAT option. All generated data are checked, and all negative results are flagged and made equal to zero.

```
$TRIP GENERATION
$FILE
     OUTPUT FILE = GRVDATA
$HEADERS
                          TRIP GENERATION
          GENERATION OF 3-PURPOSE AND 5-ZONE TRIP P/A
$OPTIONS
     PRINT DATA
$PARAMETERS
     NUMBER OF ZONES = 5
     PURPOSE = 1, ID = HBWORK,
          PRODUCTION COEFFICIENTS = (1,3.2),
          ATTRACTION COEFFICIENTS = (2,0.017)
     PURPOSE = 2, ID = HBOTHER,
          PRODUCTION COEFFICIENTS = (1,5.6),
          ATTRACTION COEFFICIENTS = (2,0.005),(3,0.025)
     PURPOSE = 3, ID = NHOMEBASED,
          PRODUCTION COEFFICIENTS = (2,0.007),(3,0.010),
          ATTRACTION COEFFICIENTS = (2,0.007),(3,0.010)
     INDEPENDENT VARIABLE = 1, ID = DWELLUNIT
     INDEPENDENT VARIABLE = 2, ID = FLOORSPAC1
     INDEPENDENT VARIABLE = 3, ID = FLOORSPAC2
$DATA
   1    1000   6000   3000
   2      50  40000  20000
   3       0 100000  35000
   4     100  20000   7500
   5       0  40000   5000
$END TP FUNCTION
```

Exhibit 4-1. A Sample Control File for Trip Generation.

5. TRIP DISTRIBUTION

GRAVITY MODEL

GRAVITY MODEL function accepts the interzonal skim impedances (the name of input file = GMSKIM) and zonal trip end productions/attractions (the name of input file = GRVDATA) stratified by class of trip (purpose), travel impedance factors, zone-to-zone travel indices, and K-factors (optional), and generates a zone-to-zone trip table file (the name of output file = GMVOL and GMTVOL) from the Gravity Model distribution formula. The function also checks the acceptability of computed attractions, and if necessary, adjusts the calculated attractions to each zone to equal the input attractions. Exhibit 5-1 illustrates an example control file for the Gravity Model.

```
$GRAVITY MODEL
$FILES
    INPUT FILE = GMSKIM, USER ID = $HWYSKIM.DAT$
    INPUT FILE = GRVDATA, USER ID = $GMODEL1.DAT$
    OUTPUT FILE = GMVOL, USER ID = $GMVOL.DAT$
    OUTPUT FILE = GMTVOL, USER ID = $GMTVOL.DAT$
$HEADERS
                          GRAVITY MODEL
                    B/CS (TEST HIGHWAY NETWORK)
                   285-ZONE TEST HIGHWAY NETWORK
$OPTIONS
    MERGED PURPOSE FILE
    TOTAL PURPOSE FILE
    GRVDATA
    PRINT TRIP ENDS
    PRINT ATTRACTIONS
    PRINT TRIP LENGTH STATISTICS
    PRINT ACCESSIBILITY INDICES
$PARAMETERS
    MAXIMUM PURPOSE = 5
    SELECTED PURPOSES = 1-5
    MAXIMUM TIME = 36
    IMPEDANCE = TIME 2
    ITERATIONS ON ATTRACTIONS = 5
    ATTRACTION CLOSURE = 10.0
$END TP FUNCTION
```

Exhibit 5-1. A Sample Control File for Gravity Model.

The impedance used in the model may be from any table (e.g., cost, travel time, or weighted impedance) in the skim tree file supplied to the Gravity Model program. Friction Factors are supplied, by trip purpose, for all integer values of impedance over the range occurring in the skim tables. The classical gravitational formula is restructured for computer users as follows:

1. The separation is generalized to allow inclusion of any travel index. In TRANPLAN, time, distance, cost or a combination of them

may be used. Most users select time as the indicator of separation.

2. The effect of separation for each minute time increment is represented by a table of "Friction Factors"; this replaces the squared quantity in the denominator. The travel separation function is then more easily represented.
3. A modification in the basic gravitational formulation is made to combine all these effects with the constant of proportionality.

When the user desires to balance attractions, the number of iterations (by the number of ITERATIONS ON ATTRACTIONS parameter) and the convergence criteria (by the percentage of ATTRACTION CLOSURE parameter) are specified and the model iterates until either convergence or the number of iterations specified by the user is met. Attraction iterations are based on individual zonal level adjustments.

Adjustment K-factors may be supplied, by purpose, for ranges of origin and destination zones. They are applied on a zone-to-zone basis. P/A tables may be converted to O/D tables by setting up a run that applies three of the matrix utility programs (TRNSPS, UTABLE, MTABLE) in series.

This function optionally prints trip ends (see Exhibit 5-2), Fratar iterations, attractions (see Exhibit 5-3), trip length statistics (see Exhibits 5-4 to 5-6), and accessibility indices (see Exhibit 5-7). All reports can be printed after each iteration of a trip distribution or only at the end of a run.

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GRAVITY MODEL USING TEXAS PACK F-FACTORS
B/CS (TEST HIGHWAY NETWORK)
285-ZONE TEST HIGHWAY NETWORK

PAGE NO. 59
DATE 27JUL87
TIME 16:25:49

TRIP END SUMMARY --- PURPOSE 1 TOTAL ALL PURPOSES

ZONE/DIST	ORIG/PROD	DEST/ATTR	TOTAL	INTRATRIPS	ZONE/DIST	ORIG/PROD	DEST/ATTR	TOTAL	INTRATRIPS
81	711	547	1258	1	121	0	0	0	0
82	1332	2489	3821	16	122	677	1310	1987	36
83	1124	2792	3916	15	123	99	136	235	1
84	1841	3289	5130	34	124	424	631	1055	6
85	1577	1576	3153	13	125	1310	438	1748	15
86	5314	3899	9213	146	126	780	160	940	3
87	2802	1146	3948	23	127	1821	460	2281	13
88	881	2295	3176	18	128	1857	924	2781	31
89	3311	8530	11841	254	129	920	2360	3280	24
90	24	8	32	0	130	2253	2368	4621	77
91	536	1186	1722	8	131	465	773	1238	5
92	1034	151	1185	2	132	1967	3224	5191	78
93	675	257	932	12	133	538	1130	1668	10
94	2939	2341	5280	70	134	41	5	46	0
95	185	69	254	0	135	1	0	1	0

Exhibit 5-2. A Sample Output of Trip End Summary.

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TRANPLAN SYSTEM
VERSION 5.0

GRAVITY MODEL USING TEXAS PACK F-FACTORS
B/CS (TEST HIGHWAY NETWORK)
285-ZONE TEST HIGHWAY NETWORK

PAGE NO. 10
DATE 27JUL87
TIME 16:25:49

MODEL/INPUT TRIP ATTRACTIONS REPORT -- ITERATION 5 ON ATTRACTIONS

	PURPOSE 1				PURPOSE 2				PURPOSE 3				PURPOSE 4			
ZONE	MODEL	INPUT	RATIO	AT CL	MODEL	INPUT	RATIO	AT CL	MODEL	INPUT	RATIO	AT CL	MODEL	INPUT	RATIO	AT CL
41	297	297	1.00		224	224	1.00		416	416	1.00		146	145	1.01	**
42	750	750	1.00		320	320	1.00		1011	1011	1.00		367	367	1.00	
43	99	99	1.00		39	39	1.00		140	140	1.00		48	48	1.00	
44	142	142	1.00		51	51	1.00		198	198	1.00		69	69	1.00	
45	272	272	1.00		98	98	1.00		368	368	1.00		133	133	1.00	
46	488	488	1.00		245	245	1.00		679	679	1.00		239	239	1.00	
47	167	166	1.01	**	50	50	1.00		216	216	1.00		81	81	1.00	
48	1051	1051	1.00		516	516	1.00		1439	1439	1.00		514	514	1.00	
49	2159	2160	1.00		1084	1084	1.00		3007	3007	1.00		1056	1056	1.00	
50	450	450	1.00		173	173	1.00		623	623	1.00		220	220	1.00	
51	1253	1253	1.00		646	646	1.00		1772	1772	1.00		612	612	1.00	
52	876	876	1.00		520	520	1.00		1234	1234	1.00		428	428	1.00	
53	1083	1083	1.00		556	556	1.00		1519	1519	1.00		529	529	1.00	
54	252	252	1.00		77	77	1.00		325	325	1.00		123	123	1.00	
55	169	169	1.00		74	74	1.00		238	238	1.00		83	83	1.00	

Exhibit 5-3. A Sample Output of Trip Attractions.

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TRANPLAN SYSTEM
VERSION 5.0

GRAVITY MODEL USING TEXAS PACK F-FACTORS
B/CS (TEST HIGHWAY NETWORK)
285-ZONE TEST HIGHWAY NETWORK

PAGE NO. 27
DATE 27JUL87
TIME 16:25:49

TRIP LENGTH FREQUENCY DISTRIBUTION
GRAVITY MODEL -- ITERATION 5 ON ATTRACTIONS
SUMMARY

	TOTAL TRIPS	TRIP-HOURS	AVE. TRIP LENGTH (MIN)	VARIANCE (MIN)	STANDARD DEVIATION (MIN)
PURPOSE NO. 1	114240	10457	5.492	8.731	2.955
PURPOSE NO. 2	63211	7100	6.739	11.046	3.323
PURPOSE NO. 3	167289	16062	5.761	8.643	2.940
PURPOSE NO. 4	55837	9636	10.354	13.789	3.713
PURPOSE NO. 5	49989	4502	5.404	8.731	2.955

Exhibit 5-4. A Summary Output of Trip Length Frequency Distribution.

TRIP LENGTH FREQUENCY DISTRIBUTION
GRAVITY MODEL -- ITERATION 5 ON ATTRACTIONS
PURPOSE NO. 4

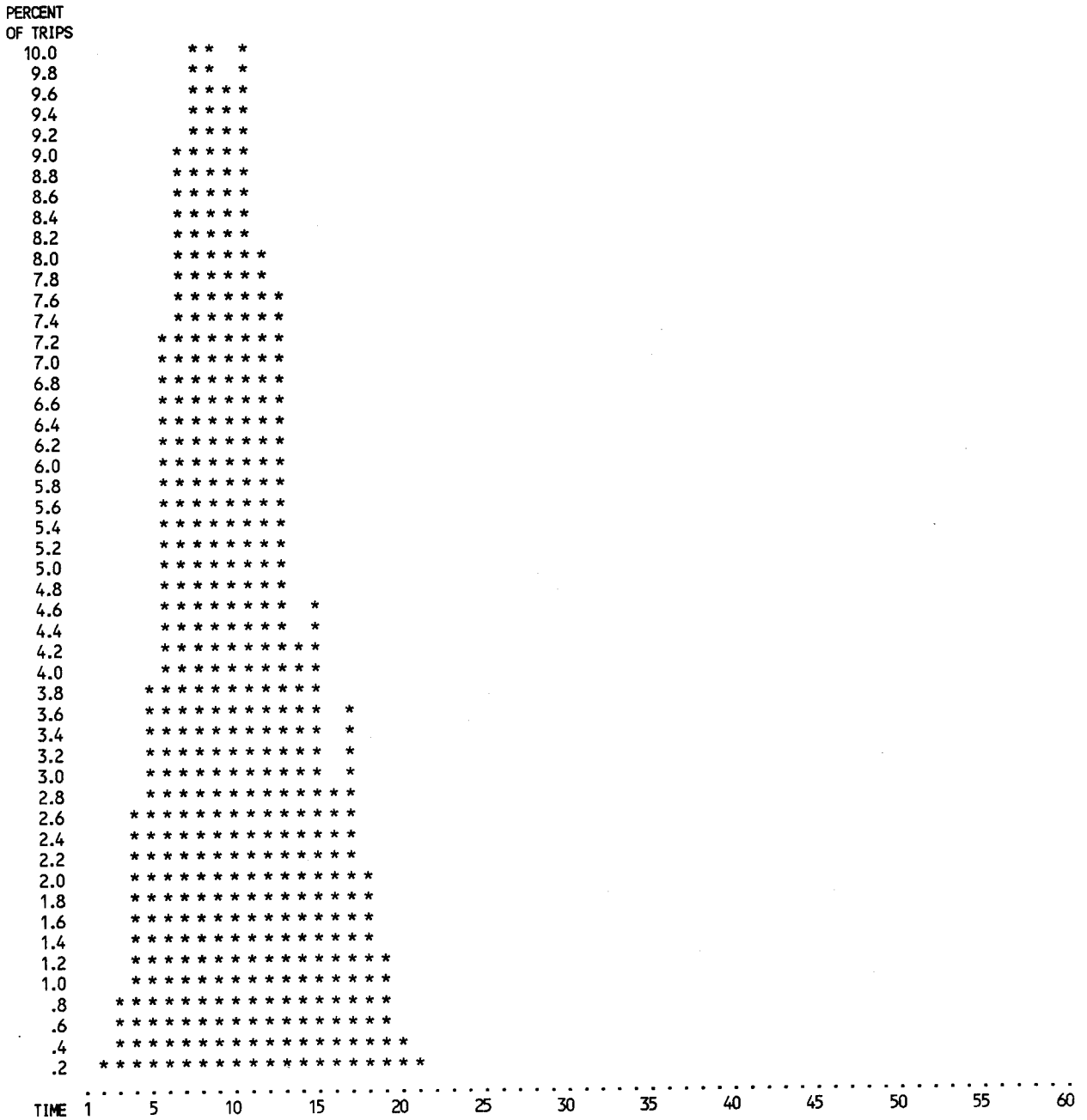

Exhibit 5-5. A Sample Graphic Output of TLF Distribution.

DCCO / UAG
TRANPLAN SYSTEM
VERSION 5.0

GRAVITY MODEL USING TEXAS PACK F-FACTORS
B/CS (TEST HIGHWAY NETWORK)
285-ZONE TEST HIGHWAY NETWORK

PAGE NO. 35
DATE 27JUL87
TIME 16:25:49

TRIP LENGTH FREQUENCY DISTRIBUTION
GRAVITY MODEL -- ITERATION 5 ON ATTRACTIONS
CUMULATIVE DISTRIBUTION -- PURPOSE NO. 4

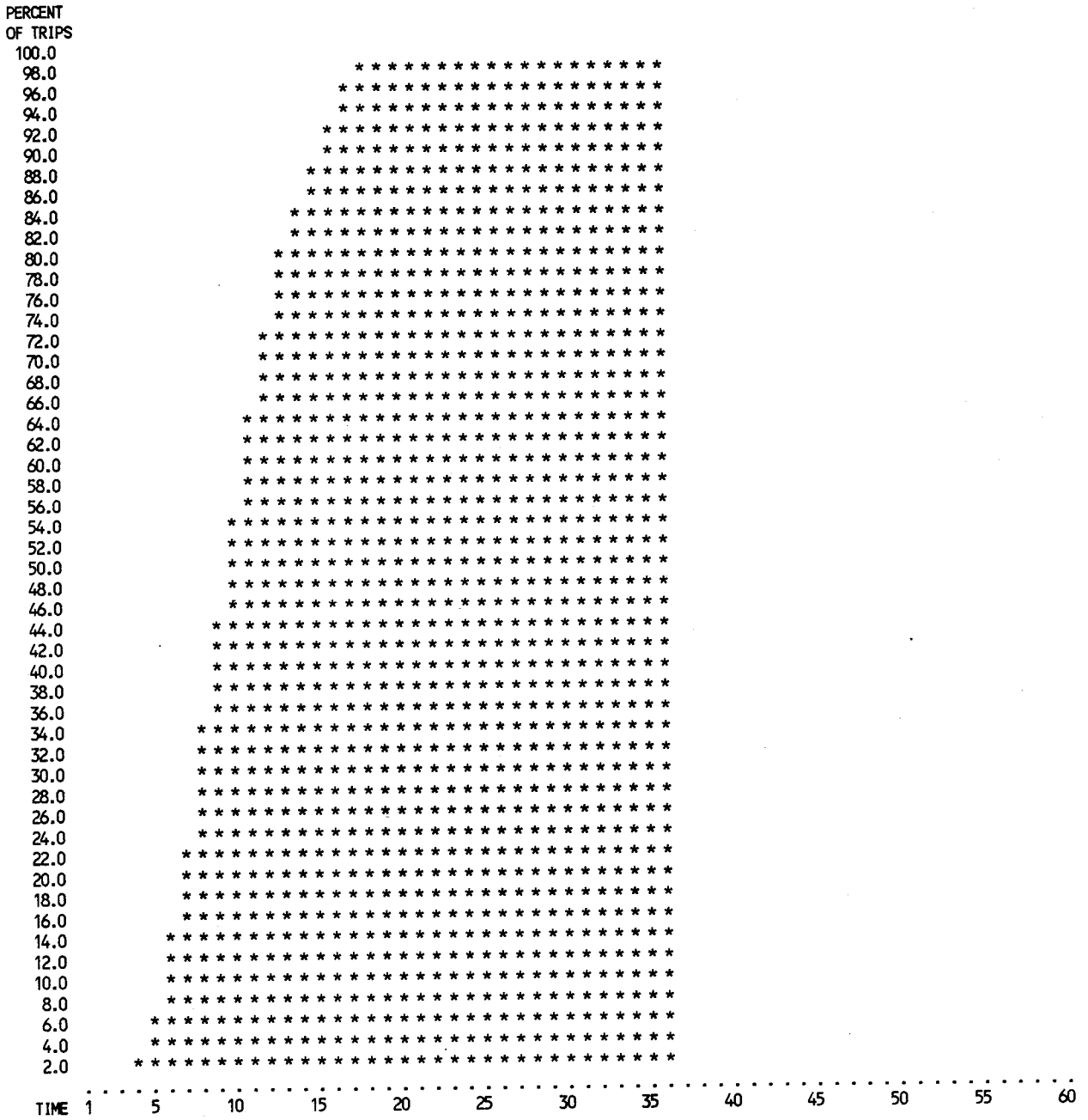

Exhibit 5-6. A Sample Graphic Output of TLF Cumulative Distribution.

DCCO / UAG
TRANPLAN SYSTEM
VERSION 5.0

GRAVITY MODEL USING TEXAS PACK F-FACTORS
B/CS (TEST HIGHWAY NETWORK)
285-ZONE TEST HIGHWAY NETWORK

PAGE NO. 3
DATE 27JUL87
TIME 16:25:49

F-FACTOR ITERATION NO. 0

ACCESSIBILITY INDICES REPORT -- ITERATION 5 ON ATTRACTIONS

ZONE	PURP 1	PURP 2	PURP 3	PURP 4	PURP 5
1	3700928	990533	8193051	811087	756120
2	3388273	935626	7460862	757717	687222
3	3750354	994136	8273340	823022	763698
4	662714	285876	1171900	279703	93500
5	666755	286688	1178543	280645	93990
6	625418	276335	1105530	269876	86425
7	762729	312327	1379767	306709	109277
8	694049	294570	1242835	289271	97785
9	781272	316938	1412979	310978	112382
10	929287	361081	1703606	351297	136564
11	3635089	983770	8046143	804030	742404
12	3372421	942368	7440560	757421	690447
13	2693473	826971	5881228	646085	543266
14	2824662	849859	6171022	680676	563395
15	3751378	1001453	8294701	823577	769238
16	3559358	969840	7862870	797210	724426
17	3672107	986174	8090715	821616	744780
18	3827852	1010154	8447256	840244	782785
19	3815263	1009017	8394174	861245	766394
20	3415103	956830	7517255	798072	684481
21	3009866	880292	6559215	729568	592613
22	2875495	857133	6190268	731945	555519
23	3136621	902876	6772299	785811	605442
24	3141525	908930	6838663	760156	623140
25	2325323	761599	4958361	627459	442838
26	2294465	754813	4914430	612330	437717
27	2208328	744059	4742101	583908	433468
28	1962763	711217	4185730	537329	388252
29	2162348	745380	4660409	557672	443366
30	2484683	804644	5418099	595552	517425
31	2291769	763900	4976496	565520	469929
32	2398458	763973	5198483	579550	476975
33	2365700	750261	5103365	576782	463965
34	2880688	856223	6323136	660807	584696
35	3228960	912084	7119579	727353	654654
36	3026025	877436	6643465	678502	619624
37	3290031	919970	7264563	733549	670046
38	3334169	923082	7347031	742572	674844
39	3452410	942853	7612249	765233	701697
40	3222832	911614	7101527	721038	655412
41	3496184	950051	7716952	763903	715175
42	3242153	904201	7071669	742614	645350
43	3303759	910527	7128538	766038	654583
44	3478161	942311	7576532	799712	690420
45	3459281	944040	7582199	789862	691768
46	3801175	1000705	8366648	840251	771659
47	3700375	979516	8105865	834742	746201
48	3749232	993439	8233543	852457	748674
49	3754595	989239	8202492	878927	733594
50	3722215	974521	8101294	856037	738330

Exhibit 5-7. A Sample Output of Accessibility Indices.

CALIBRATE GRAVITY MODEL

This function generates gravity model distribution rates (F-Factors) from origin-destination survey data (the name of output file = NEWHIST). F-Factors are used as input in distributing future trips in subsequent runs of the GRAVITY MODEL function. In essence, the model is calibrated by an interactive process during one computer run, thereby eliminating the need for multiple runs and laborious hand calculations between runs. Exhibit 5-8 shows a sample control file for the Calibrate Gravity Model.

```
$CALIBRATE GRAVITY MODEL
$FILES
    INPUT FILE = GMSKIM, USER ID = $HWYSKIM.DAT$
    INPUT FILE = GMHIST, USER ID = $GMHIST.DAT$
    OUTPUT FILE = NEWHIST, USER ID = $NEWHIST.DAT$
    OUTPUT FILE = GMVOL, USER ID = $GMVOL.DAT$
    OUTPUT FILE = GMTVOL, USER ID = $GMTVOL.DAT$
$HEADERS
                        CALIBRATE GRAVITY MODEL
                    B/CS (TEST HIGHWAY NETWORK)
                TO PRODUCE F-FACTORS AND TO CALIBRATE GM
$OPTIONS
    GRAVITY MODEL HISTORY FILE
    NEW HISTORY FILE
    PRINT ALL ITERATIONS
    PRINT TRIP LENGTH STATISTICS
    PRINT ACCESSIBILITY INDICES
    MERGED PURPOSE FILE
    TOTAL PURPOSE FILE
    PRINT TRIP ENDS
$PARAMETERS
    MAXIMUM PURPOSE = 4
    IMPEDANCE = TIME 2
    SMOOTH PERCENTAGE = 20.0
    FFACTOR ITERATIONS = 10
    FFACTOR CLOSURE = 0.01
    MAXIMUM TIME = 36
    ITERATIONS ON ATTRACTIONS = 9
$END TP FUNCTION
```

Exhibit 5-8. A Sample Control File for Calibrate Gravity Model.

A trip length frequency distribution of the survey data, associated productions and attractions, and F-Factors (initially set to 100) are input on a Gravity Model History File (the name of input file = GMHIST). The calibration is an iterative process with least-squares used to estimate a log-linear friction function in each iteration. The user controls the number of iterations and sets convergence criteria.

The user may specify either the maximum number of iterations to be executed during the calibration run or the F-Factor closure percentage

(floating point) for the program. At the end of each F-Factor iteration, the average trip length computed is compared with the origin-destination average trip length. If the ratio for all selected purposes is within +/- the specified percent, the program will execute only one additional iteration to finalize and write files (unless the current iteration is the maximum which is specified).

SMOOTH PERCENTAGE parameter allows the user to specify the percentage of time (impedance) intervals at the high end which are considered less reliable than those at the low end. For example, if the maximum time were 100 minutes and smooth percentage were 40.0, then that portion of the trip length frequency from 61 to 100 minutes would be smoothed.

FRATAR MODEL

FRATAR function will update a trip table according to an iterative Fratar expansion process. Generally, it is used to expand a base year trip table (the name of input file = FRATIN from the GMVOL file) based on zonal origin and destination growth factors (the name of input file = FRADATA). Exhibit 5-9 shows a sample control file for the Fratar Model.

```
$FRATAR MODEL
$FILES
     INPUT FILE = FRATIN, USER ID = $EXEX.DAT$
     INPUT FILE = FRADATA, USER ID = $GROWTH.DAT$
     OUTPUT FILE = FRATOUT, USER ID = $FRATAR.DAT$
$HEADERS
                FRATAR MODEL B/CS (TEST HIGHWAY NETWORK)
                    285-ZONE TEST HIGHWAY NETWORK
                 TO PRODUCE EXTERNAL-THRU TRIP TABLE
$OPTIONS
     FRADATA
     PRINT ALL ITERATIONS
     PRINT TRIP ENDS
$PARAMETERS
     SELECTED PURPOSES = 1
     NUMBER OF ITERATIONS = 4
$END TP FUNCTION
```

Exhibit 5-9. A Sample Control File for Fratar Model.

An expanded trip table file (the name of output file = FRATOUT) is generated. This file contains the same number of zones as the input file and the number of purposes specified by the user. If the PRINT TRIP END option is selected, the REPORT MATRIX function is automatically called to produce a trip end summary report of the file FRATOUT (see Exhibit 5-10). If the PRINT ALL ITERATIONS option is selected, growth factor summaries are reported for each iteration (see Exhibit 5-11). Exhibit 5-9 shows a sample control file for the Fratar Model.

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FRATAR MODEL B/CS (TEST HIGHWAY NETWORK)
285-ZONE TEST HIGHWAY NETWORK
TO PRODUCE EX-THRU TRIP TABLE

PAGE NO. 45
DATE 12NOV87
TIME 10:05:13

TRIP END SUMMARY --- PURPOSE 1

ZONE/DIST	ORIG/PROD	DEST/ATTR	TOTAL	INTRATRIPS	ZONE/DIST	ORIG/PROD	DEST/ATTR	TOTAL	INTRATRIPS
241	0	0	0	0	281	1782	1750	3532	0
242	0	0	0	0	282	120	121	241	0
243	0	0	0	0	283	0	0	0	0
244	0	0	0	0	284	146	147	293	0
245	0	0	0	0	285	0	0	0	0
246	0	0	0	0					
247	0	0	0	0					
248	0	0	0	0					
249	0	0	0	0					
250	0	0	0	0					
251	0	0	0	0					
252	0	0	0	0					
253	0	0	0	0					
254	0	0	0	0					
255	0	0	0	0					
256	0	0	0	0					
257	0	0	0	0					
258	0	0	0	0					
259	0	0	0	0					
260	0	0	0	0					
261	0	0	0	0					
262	0	0	0	0					
263	0	0	0	0					
264	0	0	0	0					
265	0	0	0	0					
266	0	0	0	0					
267	0	0	0	0					
268	0	0	0	0					
269	0	0	0	0					
270	876	885	1761	0					
271	16	16	32	0					
272	1707	1739	3446	0					
273	50	51	101	0					
274	37	36	73	0					
275	16	17	33	0					
276	776	769	1545	0					
277	0	0	0	0					
278	57	59	116	0					
279	613	606	1219	0					
280	0	0	0	0					
TOTALS	6196	6196	12392	0					

Exhibit 5-10. A Sample Output of Trip End Summary.

FRATAR GROWTH FACTOR SUMMARY -- DESTINATIONS -- AFTER ITERATION NO. 4

RANGE GROWTH FACTOR	PURPOSE 1 NO. ZONES	PURPOSE 1 PCT ZONES	PURPOSE 2 NO. ZONES	PURPOSE 2 PCT ZONES	PURPOSE 3 NO. ZONES	PURPOSE 3 PCT ZONES	PURPOSE 4 NO. ZONES	PURPOSE 4 PCT ZONES	PURPOSE 5 NO. ZONES	PURPOSE 5 PCT ZONES	PURPOSE 6 NO. ZONES	PURPOSE 6 PCT ZONES
0.000 - 0.899	0	.00										
0.900 - 0.909	0	.00										
0.910 - 0.919	0	.00										
0.920 - 0.929	0	.00										
0.930 - 0.939	0	.00										
0.940 - 0.949	0	.00										
0.950 - 0.959	0	.00										
0.960 - 0.969	0	.00										
0.970 - 0.979	0	.00										
0.980 - 0.989	3	25.00										
0.990 - 1.009	7	58.33										
1.010 - 1.019	2	16.67										
1.020 - 1.029	0	.00										
1.030 - 1.039	0	.00										
1.040 - 1.049	0	.00										
1.050 - 1.059	0	.00										
1.060 - 1.069	0	.00										
1.070 - 1.079	0	.00										
1.080 - 1.089	0	.00										
1.090 - 1.099	0	.00										
1.100 AND UP	0	.00										
TOTAL	12	100.00										

NOTE -- GROWTH FACTORS OF ZERO NOT INCLUDED

FRATAR TRIP END SUMMARY -- DESTINATIONS -- AFTER ITERATION NO. 4

	PURPOSE 1			PURPOSE 2			PURPOSE 3			PURPOSE 4		
ZONE	MODEL	DESIRED	GROWTH FACTOR	MODEL	DESIRED	GROWTH FACTOR	MODEL	DESIRED	GROWTH FACTOR	MODEL	DESIRED	GROWTH FACTOR
268	0	0	.00									
269	0	0	.00									
270	884	876	.99									
271	16	16	1.00									
272	1739	1707	.98									
273	50	50	1.00									
274	38	37	.99									
275	16	16	1.00									
276	771	776	1.01									
277	0	0	.00									
278	58	57	.99									
279	606	613	1.01									
280	0	0	.00									
281	1751	1782	1.02									
282	120	120	1.00									
283	0	0	.00									
284	148	146	.99									
285	0	0	.00									
TOTAL	6197	6196	1.00									

NOTE -- DESTINATION TOTALS ABOVE MIGHT DIFFER SLIGHTLY FROM THOSE ON FILE FRATOUT DUE TO ROUNDING

Exhibit 5-11. A Sample Output of Fratar Growth Factor Summary.

6. MODE SPLIT

MODE CHOICE function performs the "splitting" of trips (the name of input file = TOTVOL) between two competing modes of transportation according to previously determined curvilinear diversion relationships between the modes. The program also requires two files that contain the transit travel impedances (the name of input file = TRSKIM) and the highway travel impedances (the name of input file = HWYSKIM) to be utilized by this function. The program creates the following output files: the transit passenger trip table (TRVOL), the highway person trip table (HWYVOL), and the auto driver table (ADRVOL). The split is achieved through diversion curves which specify the percentage of transit travel as a function of the ratio or difference between one of the following factors which affect the modal choice methodology in this program:

- Trip purposes;
- Production area characteristics (P Code);
- Attraction area characteristics (A Code); and
- Any two measures of interzonal travel impedance (i.e., two of cost, distance, or time).

The program will accept up to 15 trip purposes, 8 P Codes and 8 A Codes (e.g., CBD or other employment center), and 8 second interzonal impedance ranges (e.g., cost difference for mode split curves based on travel time ratios); these allow considerable flexibility in associating the trip characteristics to diversion rationale.

TRANPLAN includes a program for calibrating diversion curves from transit and total person trip tables and from transit and auto impedance tables. CALIBRATE MODEL CHOICE function enables the user to systematically stratify modal split data sets to derive optimum estimating curves. Calibrated curves can be consolidated in subsequent runs of the calibration program.

7. TRAFFIC ASSIGNMENT

A job control file would be prepared to run an assignment program optionally followed by appropriate analysis or reporting programs. If no select link analyses were to be performed, the file would include FILE names, OPTIONS and PARAMETERS for the basic assignment (HWYLOD1) program, followed by similar information for either the network (RPTNET = Report Highway Network) or assignment (RPTLOD = Report Highway Load) reporting programs. Job control information for the general (RVLSUM = Report Highway Network Summary) or incremental assignment (RINCSM = Report Highway Incremental Summary) summary programs also could be included in the file.

LOAD HIGHWAY NETWORK

LOAD HIGHWAY NETWORK (HWYLOD) function has essentially three types of loading with some types having many user options:

All-Or-Nothing - All selected interzonal highway trips (by SELECTED PURPOSES, ORIGINS, DESTINATIONS, or ODS) are loaded on the minimum paths (based on time, distance, cost, or user impedances) of the input highway network (the names of input files = HWYNET and HWYTRIP). This is a free-flow assignment with no consideration given to the type of links or link capacities. Exhibit 7-1 shows a sample control file setup for all-or-nothing assignment using Load Highway Network function.

```
$LOAD HIGHWAY NETWORK
$FILES
  INPUT FILE = HWYNET, USER ID = $HWYNET.DAT$
  INPUT FILE = HWYTRIP, USER ID = $GMTVOL.DAT$
  OUTPUT FILE = LODHIST, USER ID = $HWYLOD1.DAT$
$HEADER
                        LOAD HIGHWAY NETWORK
                          B/CS TEST NETWORK
                  ALL-OR-NOTHING, FREE ASSIGNMENT
$PARAMETERS
  IMPEDANCE = TIME2
$END TP FUNCTION
```

Exhibit 7-1. A Sample Control File for All-or-Nothing.

Incremental Loading - For each iteration, a user-specified percentage of all interzonal highway trips is loaded on the minimum paths determined during path building. This function has the capability of adjusting link times on the initial (base) network or on the network used during the previous iteration. The function, via user option, may or may not expand the accumulated volume to represent conceptually a 100 percent loading (ADJUST 100 option) during determination of the assigned volume/capacity ratio. Also in Incremental Loading, the user may specify that "undivertable" trips (notably very short and very long trips) are loaded along with the first specified percentage of "divertable" trips on the initial or "free" network. Incremental Loading continues as described above on the remaining "divertable" highway

trips. Exhibit 7-2 shows a sample control file setup for incremental assignment using Load Highway Network function.

```
$LOAD HIGHWAY NETWORK
$FILES
     INPUT FILE = HWYNET, USER ID = $HWYNET.DAT$
     INPUT FILE = HWYTRIP, USER ID = $GMTVOL.DAT$
     OUTPUT FILE = LODHIST, USER ID = $HWYLOD2.DAT$
$HEADER
                    LOAD HIGHWAY NETWORK
                     B/CS TEST NETWORK
               INCREMENTAL LOADING ASSIGNMENT
$OPTIONS
     DAMPING
     BASE NETWORK
$PARAMETERS
     IMPEDANCE = TIME2
     LOAD PERCENTAGES = 40,30,20,10
$END TP FUNCTION
```

Exhibit 7-2. A Sample Control File for Incremental Loading.

Restraint Loading - As above, all selected interzonal highway trips are loaded on the minimum paths of the input highway network. A loading of 100 percent is performed on paths built from the adjusted network for each iteration. Up to 10 iterations may be performed. Exhibit 7-3 shows a sample control file setup for capacity restraint assignment using Load Highway Network function.

```
$LOAD HIGHWAY NETWORK
$FILES
     INPUT FILE = HWYNET, USER ID = $HWYNET.DAT$
     INPUT FILE = HWYTRIP, USER ID = $GMTVOL.DAT$
     OUTPUT FILE = LODHIST, USER ID = $HWYLOD3.DAT$
$HEADER
                    LOAD HIGHWAY NETWORK
                     B/CS TEST NETWORK
          CAPACITY RESTRAINT LOADING ASSIGNMENT
$PARAMETERS
     IMPEDANCE = TIME2
     BPR ITERATIONS = 5
     MINIMUM SPEED = (0,45)(1,40)(2,35)(3,35)(4,30)
                      (5,25)(6,20)(7,30)(8,20)(9,10)
     MAXIMUM SPEED = (0,75)(1,70)(2,65)(3,65)(4,60)
                      (5,55)(6,50)(7,60)(8,50)(9,30)
     DAMPING FACTOR = 0.40
 $END TP FUNCTION
```

Exhibit 7-3. A Sample Control File for Restraint Loading.

The following features exist in both Restraint Loading and Incremental Loading. The network parameter, time, is adjusted link by link according to user-specified volume/capacity time adjustment curve data or the following capacity restraint formula:

$$T_n = T_{n-1} \times [1.0 + 0.15(V/C)^4] \times 0.87$$

The adjusted time may be optionally dampened by a user-specified parameter (e.g., as only one-quarter of the time difference of T_n and T_{n-1}). This has the effect of lessening the oscillation of loadings from one iteration to the next. The counted volume may be taken as the capacity for assigned volume/capacity ratio determination (CAPACITY 2 option). For each Assignment Group, minimum and maximum speeds (MINIMUM and MAXIMUM SPEEDS options) may be specified within which the adjusted speed on a link must lie after adjustment.

For all types of loading, turn volumes may be saved during loading for up to 50 ranges of nodes. Turn volumes for node configurations with up to four entry links and five exit links may be saved at each selected node for subsequent reporting. Again, TRANPLAN utilizes a VINE builder as opposed to the traditional TREE builders.

LOAD HIGHWAY SELECTED LINKS

This function performs the selected link analysis element of the highway network loading process. It is interrelated with the LOAD HIGHWAY NETWORK function and the loading options are the same. The three parameters (LOAD, ONE WAY or TWO WAY, SELECTED LINKS), which are the only differences from the previous function, are used instead of the selected zones (by SELECTED PURPOSES, ORIGINS, DESTINATIONS, or ODS). A sample control file is presented in Exhibit 7-4.

```
$LOAD HIGHWAY SELECTED LINKS
$FILES
     INPUT FILE = HWYNET, USER ID = $HWYNET.DAT$
     INPUT FILE = HWYTRIP, USER ID = $GMTVOL.DAT$
     OUTPUT FILE = LODHIST, USER ID = $HWYLOD2.DAT$
     OUTPUT FILE = SELHIST, USER ID = $SELHIST.DAT$
     OUTPUT FILE = SELHST2, USER ID = $SELHST2.DAT$
$HEADER
                    LOAD HIGHWAY SELECTED LINKS
                         B/CS TEST NETWORK
          PREPARE FOR *REPORT COMPLEX WEAVES* FUNCTION
$OPTIONS
     DAMPING
$PARAMETERS
     BPR ITERATIONS = 2
     IMPEDANCE = TIME2
     ONE WAY SELECTED LINKS = 1037-1038,1041-1042,1044-1045,1049-1050,
          1052-1053,1056-1057,1059-1060,1065-1066,1064-1065,1060-1061
$END TP FUNCTION
```

Exhibit 7-4. A Sample Control File for Selected Links Loading.

A selected link history file (the name of output file = SELHIST) is produced which is input to the various post-processor functions (e.g., POST1 = Build Selected Link Trip Table and SUBAREA = Extract Subarea Trip Table) and report functions (e.g., POST2 = Analyze Multiple Selected Link Trip Tables and RWEAVE = Report Complex Weaves). A loaded highway network history file (the name of output file = LODHIST) is also produced by this function. Therefore, the user need not run the LOAD HIGHWAY NETWORK function for selected link analysis.

BUILD SELECTED LINK TRIP TABLE

This function is the first in a series of selected link post-processors which manipulates the selected link history file (the name of input file = SELHIST generated by the LOAD HIGHWAY SELECTED LINKS function) to produce reports or trip table files (the name of output file = SELVOL) for the analysis of loaded networks. The selected volume file is a merged trip table file of up to 15 tables. Each is comprised of those trips which traversed one user-specified selected link (one-way). A trip end summary of the selected volume file may be reported optionally by the PRINT TRIP ENDS option. A sample control file is shown in Exhibit 7-5.

```
$BUILD SELECTED LINK TRIP TABLE
$FILES
     INPUT FILE = HWYTRIP, USER ID = $GMTVOL.DAT$
     INPUT FILE = SELHIST, USER ID = $SELHIST.DAT$
     INPUT FILE = SELHST2, USER ID = $SELHST2.DAT$
     OUTPUT FILE = SELVOL, USER ID = $SELVOL1.DAT$
$HEADER
                    BUILD SELECTED LINK TRIP TABLE
                         B/CS TEST NETWORK
                       ANALYSIS OF RAMP TRIPS
$OPTIONS
     PRINT TRIP ENDS
$PARAMETERS
     SELECTED LINKS = 1037-1038,1041-1042,1044-1045,1049-1050,
                      1052-1053,1056-1057,1059-1060,1065-1066,
                      1064-1065,1060-1061,1055-1056,1053-1054,
                      1047-1048,1045-1046,1040-1041
$END TP FUNCTION
```

Exhibit 7-5. A Sample Control File for Selected Link Trip Table.

For example, if the user wishes to determine the origins and destinations of all trips using either direction of a particular bridge link, the LOAD HIGHWAY SELECTED LINKS function would produce a selected link history file from the network description and trip table file. This post-processor then would combine the original trip table file and the selected link history file to generate a two-table selected volume file. A trip end summary of this file would indicate the number of bridge crossings which originate or terminate at each zone for each travel direction. Also, the selected volume file could be compressed (by the MATRIX COMPRESS function)

to indicate generalized corridor flows for the bridge. Exhibit 7-6 shows an example output table for this function.

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BUILD SELECTED LINK TRIP TABLE
B/CS TEST NETWORK
ANALYSIS OF RAMP TRIPS

PAGE NO. 3
DATE 28JUL87
TIME 11:50:54

TRIP END SUMMARY --- PURPOSE 1 SELECTED LINK ID 1037 - 1038

ZONE/DIST	ORIG/PROD	DEST/ATTR	TOTAL	INTRATRIPS	ZONE/DIST	ORIG/PROD	DEST/ATTR	TOTAL	INTRATRIPS
161	1024	0	1024	0	201	0	0	0	0
162	0	0	0	0	202	0	170	170	0
163	0	0	0	0	203	0	114	114	0
164	0	31	31	0	204	0	0	0	0
165	114	0	114	0	205	0	0	0	0
166	0	40	40	0	206	0	0	0	0
167	2	0	2	0	207	0	5	5	0
168	0	0	0	0	208	0	0	0	0
169	4	0	4	0	209	0	165	165	0
170	3	0	3	0	210	0	60	60	0
171	0	2	2	0	211	0	194	194	0
172	0	0	0	0	212	0	6	6	0
173	91	0	91	0	213	0	27	27	0
174	0	37	37	0	214	0	0	0	0
175	22	0	22	0	215	0	70	70	0
176	108	0	108	0	216	0	15	15	0
177	0	0	0	0	217	0	14	14	0
178	0	45	45	0	218	0	0	0	0
179	0	0	0	0	219	0	0	0	0
180	3	0	3	0	220	0	0	0	0
181	0	117	117	0	221	0	5	5	0
182	0	52	52	0	222	0	7	7	0
183	0	0	0	0	223	0	0	0	0
184	0	7	7	0	224	0	0	0	0
185	0	0	0	0	225	0	1	1	0
186	1072	0	1072	0	226	0	24	24	0
187	0	0	0	0	227	0	0	0	0
188	970	0	970	0	228	0	0	0	0
189	168	0	168	0	229	0	0	0	0
190	431	0	431	0	230	0	94	94	0
191	43	0	43	0	231	0	0	0	0
192	40	0	40	0	232	0	0	0	0
193	21	0	21	0	233	0	0	0	0
194	45	0	45	0	234	0	6	6	0
195	46	0	46	0	235	0	7	7	0
196	173	0	173	0	236	0	0	0	0
197	289	0	289	0	237	423	0	423	0
198	165	0	165	0	238	251	0	251	0

Exhibit 7-6. A Sample Output for Selected Link Trip Table.

ANALYZE MULTIPLE SELECTED LINKS

This function is the second in a series of selected link post-processors which manipulate the selected link history file (the name of input file = SELHIST generated by the LOAD HIGHWAY SELECTED LINKS function) to produce reports or trip table files (the name of output file = SELVOL) for the analysis of loaded networks. An example control file is shown in Exhibit 7-7. This particular post-processor analyzes trips which use "origin" links, "through" links, and "destination" links (specification of "through" links is optional) as DATA input.

```
$ANALYZE MULTIPLE SELECTED LINKS
$FILES
  INPUT FILE = HWYTRIP, USER ID = $GMTVOL.DAT$
  INPUT FILE = SELHIST, USER ID = $SELHIST.DAT$
  INPUT FILE = SELHST2, USER ID = $SELHST2.DAT$
  INPUT FILE = SELHST3, USER ID = $SELHST3.DAT$
  OUTPUT FILE = SELVOL, USER ID = $SELVOL2.DAT$
$HEADER
                        ANLYZE MULTIPLE SELECTED LINKS
                              B/CS TEST NETWORK
                    ANALYSIS OF TAMU CAMPUS CORDON CROSSING
$OPTIONS
  SELECTED VOLUME FILE
$DATA
  TABLE1
  ID = TAMU CAMPUS CORDON CROSSING
  ORIGIN LINKS = 627-628,635-634,701-711,705-706,691-690,
                 702-700,696-912,693-913
  NO THROUGH LINKS
  DESTINATION LINKS = 634-635,711-701,706-705,690-691,
                      700-702,912-696,913-693
$END TP FUNCTION
```

Exhibit 7-7. A Sample Control File for Multiple Selected Links.

An example for the use of Analyze Multiple Selected Links is where the transportation planner is interested in knowing trips which use specific links (origin links) on one side of a river, use a bridge link (through link), and selected links (destination links) on the other side. The LOAD HIGHWAY SELECTED LINKS function would first be performed with all three types of links declared as selected link history files with the highway trip table to produce the desired report and/or selected volume file output. Another application of this function would be the reporting of trips crossing a cordon surrounding an activity center. Exhibit 7-8 shows an example output of multiple selected links analysis.

Up to 15 sets (tables) of analysis conditions may be specified during each execution of this function. The number of links in each set is restricted only by the amount of available memory. The function produces an origin link to destination link matrix report for each set and optionally produces a trip table (by the SELECTED VOLUME FILE option) with links

replacing zones for each set. This trip table would logically be generated only if there were many links specified per set and could be compressed with MATRIX COMPRESS to summarize groups of links within each set.

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ANALYZE MULTIPLE SELECTED LINKS
B/CS TEST NETWORK
ANALYSIS OF TAMU CAMPUS CORDON CROSSING

PAGE NO. 1
DATE 28JUL87
TIME 13:34:20

MULTIPLE SELECTED LINKS ANALYSIS REPORTS

TABLE NO. 1 ID = TAMU CAMPUS CORDON CROSSING

ORIGIN LINKS	DESTINATION LINKS 634 - 635	711 - 701	706 - 705	690 - 691	700 - 702	912 - 696	913 - 693	TOTAL
627 - 628	0	0	0	0	0	0	0	0
635 - 634	0	0	0	4120	0	0	1541	5661
701 - 711	0	0	0	0	0	0	0	0
705 - 706	0	0	0	0	0	0	0	0
691 - 690	17	1	23	0	0	0	5	46
702 - 700	0	924	3374	0	0	0	55	4353
696 - 912	0	0	0	0	0	0	0	0
693 - 913	0	0	523	549	5	0	0	1077
TOTAL	17	925	3920	4669	5	0	1601	11137

Exhibit 7-8. A Sample Output for Multiple Selected Links.

EXTRACT SUBAREA TRIP TABLE

This function, which is another of the selected link post-processors, manipulates the selected link history file (the name of input file = SELHIST generated by the LOAD HIGHWAY SELECTED LINKS function) to produce trip table(s) (the name of output file = SUBVOL) of trips within, into and out of the cordoned off area of the network. For example, the user may be interested in extracting a segment representing the downtown area of a regional highway network to perform a more detailed investigation of traffic patterns within that area (see Exhibit 7-9).

The function generates a trip table for a subarea of a network defined by links on the boundary and zones within the boundary. Each zone within the boundary becomes a renumbered zone (by NUMBER OF INTERNAL ZONES parameter), and each link crossed by the cordon line also becomes a new zone (external station by NUMBER OF STATIONS parameter). Trips crossing the link inbound (by ENTRY STATION data) become the new zone productions (or origins), and trips crossing outbound (by EXIT STATION data) become the new zone attractions (or destinations). The internal zones of the extracted subarea are renumbered sequentially (by INTERNAL ZONE CORRESPONDENCE data) from one on a one-to-one basis according to user instructions.

The output from this routine is a new trip table, SUBVOL, corresponding to the selected subarea and external stations. Only those purposes on the original file which are selected by the user are written onto SUBVOL. This trip table may be assigned to a subarea highway or transit network, or it may be further manipulated to refine the subarea zone system with the MATRIX EXPAND utility.

```
$EXTRACT SUBAREA TRIP TABLE
$FILES
  INPUT FILE = VOLUME, USER ID = $GMTVOL.DAT$
  INPUT FILE = SELHIST, USER ID = $SELHIST.DAT$
  INPUT FILE = SELHST2, USER ID = $SELHST2.DAT$
  INPUT FILE = SELHST3, USER ID = $SELHST3.DAT$
  OUTPUT FILE = SUBVOL, USER ID = $SUBVOL1.DAT$
$HEADER
                        EXTRACT SUBAREA TRIP TABLE
                            B/CS TEST NETWORK
                  ANALYSIS OF BRYAN CBD AREA AS SUBAREA
$PARAMETERS
  NUMBER OF INTERNAL ZONES = 6
  NUMBER OF STATIONS = 14
$DATA
  INTERNAL ZONE CORRESPONDENCE = 1-1,2-2,11-3,37-4,38-5,39-6
  ENTRY STATION = 7, LINK = 391-392
  ENTRY STATION = 8, LINK = 390-397
  ENTRY STATION = 9, LINK = 387-386
  ENTRY STATION = 10, LINK = 444-447
  ENTRY STATION = 11, LINK = 444-445
  ENTRY STATION = 12, LINK = 428-427
  ENTRY STATION = 13, LINK = 425-426
  ENTRY STATION = 14, LINK = 449-448
  ENTRY STATION = 15, LINK = 459-452
  ENTRY STATION = 16, LINK = 455-392
  ENTRY STATION = 17, LINK = 1106-1105
  ENTRY STATION = 18, LINK = 1103-1102
  ENTRY STATION = 19, LINK = 401-400
  ENTRY STATION = 20, LINK = 385-386
  EXIT STATION = 7, LINK = 392-391
  EXIT STATION = 8, LINK = 397-390
  EXIT STATION = 9, LINK = 386-387
  EXIT STATION = 10, LINK = 447-444
  EXIT STATION = 11, LINK = 445-444
  EXIT STATION = 12, LINK = 427-428
  EXIT STATION = 13, LINK = 426-425
  EXIT STATION = 14, LINK = 448-449
  EXIT STATION = 15, LINK = 452-459
  EXIT STATION = 16, LINK = 392-455
  EXIT STATION = 17, LINK = 1105-1106
  EXIT STATION = 18, LINK = 1102-1103
  EXIT STATION = 19, LINK = 400-401
  EXIT STATION = 20, LINK = 386-385
$END TP FUNCTION
```

Exhibit 7-9. A Sample Control File for Extract Subarea Trip Table.

STOCHASTIC HIGHWAY LOAD

This function accepts a highway trip table (the name of input file = HWYNET) and a highway network (the name of input file = HWYTRIP) and performs a probabilistic multipath traffic assignment (the name of output file = LODHIST). Trips are assigned to all "reasonable" paths between each origin and destination, each path receiving a fraction of interzonal trips which is proportional to:

EXP (-THETA x DELTA)

where, THETA = User-specified diversion parameter and
DELTA = Difference between the minimum path impedance and that of the alternate path.

The program may use five "standard" impedances (e.g., COST, DISTANCE, TIME1, TIME2, OR USER) or an adjusted time from a restrained loading on a loaded highway network history file. The user has the capability of selecting origins (by SELECTED ORIGINS parameter) from which, and destinations (by SELECTED DESTINATIONS parameter) to which, trips may be loaded on the network. An example control file is shown in Exhibit 7-10.

```
$STOCHASTIC HIGHWAY LOAD
$FILES
  INPUT FILE = HWYNET, USER ID = $HWYNET.DAT$
  INPUT FILE = HWYTRIP, USER ID = $GMTVOL.DAT$
  OUTPUT FILE = LODHIST, USER ID = $STOCH.DAT$
$HEADER
                          STOCHASTIC HIGHWAY LOAD
                             B/CS TEST NETWORK
      PROBABILISTIC MULTIPATH TRAFFIC ASSIGNMENT BY SELECTED ORIGINS
$OPTIONS
  WRITE LOADED HISTORY FILE
  PRINT LINK LOADS
$PARAMETERS
  IMPEDANCE = TIME2
  DIVERSION PARAMETER = 0.3
  LOAD PERCENT = 100
  SELECTED ORIGINS = 1-3,160-162,165,170-179,196-198,202,241-242
$END TP FUNCTION
```

Exhibit 7-10. A Sample Control File for Stochastic Highway Load.

The program contains a loaded network report (by PRINT LINK LOADS option) and optionally produces a loaded highway network history file (by WRITE LOADED HISTORY FILE option) which can be reported by the REPORT HIGHWAY LOAD function. However, selected link options are not available using this assignment procedure (see Exhibit 7-11).

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STOCHASTIC HIGHWAY LOAD
B/CS TEST NETWORK
PROBABILISTIC MULTIPATH TRAFFIC ASSIGNMENT BY SELECTED ORIGINS

DATE 28JUL87
TIME 14:43:52

LINK AND TURN VOLUMES

A	(B)	A-TO-B	B-TO-A	2-WAY	(B)	A-TO-B	B-TO-A	2-WAY	(B)	A-TO-B	B-TO-A	2-WAY	(B)	A-TO-B	B-TO-A	2-WAY
1070	(374)	5673	1823	7496	(871)	2347	1390	3737	(1069)	0	4807	4807				
1071	(133)	1076	507	1583	(989)	1926	1020	2946	(1068)	1351	2826	4177				
1072	(372)	70	20	90	(870)	180	341	521	(871)	271	160	431				
1073	(360)	3784	975	4759	(987)	1024	3150	4174	(989)	496	124	620	(1075)	715	213	928
	(1074)	0	1557	1557												
1074	(360)	0	6627	6627	(1069)	10997	2104	13101	(1073)	1557	0	1557	(1076)	656	4479	5135
1075	(1073)	213	715	928	(1076)	516	0	516	(1081)	302	316	618				
1076	(336)	397	4437	4834	(1074)	4479	656	5135	(1075)	0	516	516	(1077)	733	0	733
1077	(347)	851	3843	4694	(361)	4107	382	4489	(1076)	0	733	733				
1078	(1079)	33	47	80	(1081)	47	33	80								
1079	(1078)	47	33	80	(1082)	2	2	4	(1086)	32	46	78				
1080	(353)	303	1608	1911	(354)	1624	325	1949	(866)	62	56	118				
1081	(138)	284	284	568	(1075)	316	302	618	(1078)	33	47	80				
1082	(353)	5	13	18	(355)	11	3	14	(1079)	2	2	4				
1085	(338)	0	439	439	(339)	56	62	118	(1088)	445	0	445				
1086	(134)	5	41	46	(1079)	46	32	78	(1087)	32	10	42				
1087	(862)	475	7095	7570	(1086)	10	32	42	(1088)	7087	445	7532				
1088	(1085)	0	445	445	(1087)	445	7087	7532	(336)	7087	0	7087				
1089	(256)	0	0	0	(278)	0	2928	2928	(547)	2928	0	2928				
1090	(233)	1	21	22	(654)	12	2662	2674	(930)	2681	11	2692				
1101	(400)	13781	16252	30033	(1102)	16252	13781	30033								
1102	(1101)	13781	16252	30033	(1103)	2627	3022	5649	(1104)	17136	15388	32524	(1119)	3878	2760	6638
1103	(3)	300	93	393	(412)	2561	3163	5724	(1102)	3022	2627	5649				
1104	(1)	468	207	675	(3)	1190	493	1683	(1102)	15388	17136	32524	(1105)	17124	16334	33458
1105	(426)	15934	13133	29067	(1104)	16334	17124	33458	(1106)	5153	7710	12863	(1107)	5376	4830	10206
1106	(3)	174	52	226	(414)	5166	7845	13011	(1105)	7710	5153	12863				
1107	(895)	320	300	620	(1105)	4830	5376	10206	(1108)	5147	4621	9768				
1108	(1)	530	211	741	(1107)	4621	5147	9768	(1109)	4842	4635	9477				
1109	(427)	4570	5139	9709	(1108)	4635	4842	9477	(1110)	6175	5890	12065	(1113)	687	196	883
1110	(15)	21	7	28	(1109)	5890	6175	12065	(1111)	6157	5886	12043				
1111	(445)	164	213	377	(446)	5950	5762	11712	(1110)	5886	6157	12043	(1112)	137	5	142
1112	(15)	3	1	4	(1111)	5	137	142	(1115)	134	4	138				
1113	(15)	4	5	9	(1109)	196	687	883	(1114)	688	196	884				
1114	(1)	537	177	714	(1113)	196	688	884	(1117)	378	246	624				
1115	(1)	64	26	90	(1112)	4	134	138	(1116)	158	66	224				
1116	(452)	2557	2672	5229	(891)	215	95	310	(1115)	66	158	224	(1117)	2609	2522	5131
1117	(892)	301	164	465	(1114)	246	378	624	(1116)	2522	2609	5131	(1118)	2513	2431	4944
1118	(1)	274	39	313	(2)	116	49	165	(893)	630	296	926	(1117)	2431	2513	4944
	(1119)	2547	3101	5648												
1119	(894)	245	92	337	(895)	650	239	889	(1102)	2760	3878	6638	(1118)	3101	2547	5648

Exhibit 7-11. A Sample Output for Stochastic Highway Load by Print Link Load Option.

EQUILIBRIUM ASSIGNMENT

Equilibrium assignment has recently been added to the TRANPLAN package. The equilibrium assignment in TRANPLAN will also permit selected link analysis.

8. MATRIX UTILITIES

TRANPLAN contains seven matrix handling programs. UTABLE is designed to modify one or more tables in a single file, while MTABLE is used to merge or split tables from one or more files. TRNSPS simply transposes one or more tables. COMPRESS is used to create district-level tables, while EXPAND is used to split zones for detailed analysis. TRFARE can be used for transit cost inputs to modal choice analysis. BUILD accepts trip survey data in TRANPLAN format and allocates the trips to trip tables according to user-specified selection criteria. Any element, row, column, rectangular portion, or segment of the diagonal of a matrix can be modified by a constant using addition, subtraction, multiplication, or replacement. Matrix updating operations can be made conditional on the value in a matrix element.

MATRIX UPDATE

This function allows the user to update entries (the name of output file = UPDOUT) in a multipurpose trip table file or selected summation (skim) file (the name of input file = UPDIN). Addition, subtraction, multiplication, and replacement operations may be performed on any number of table entries. Update transactions may be specified with any one of four different formats. Three formats handle special cases - row (origin zone) updates, column (destination zone) updates, and diagonal (intrazonal) updates - in a simplified manner. With these formats, the user can easily add terminal times and change intrazonal table entries. The fourth format is a general instruction and may be used for any update transactions, including special cases. A sample control file is shown in Exhibit 8-1.

```
$MATRIX UPDATE
$FILES
  INPUT FILE = UPDIN, USER ID = $MTABLE.DAT$
  OUTPUT FILE = UPDOUT, USER ID = $ODTOTAL.DAT$
$HEADERS
                          STEP 3 -- MATRIX UPDATE
                      B/CS TEST NETWORK FOR CE672
                TO GENERATE O/D FROM P/A TRIP TABLE
$DATA
  T1, 1-285, 1-285, *0.5
$END TP FUNCTION
```

Exhibit 8-1. A Sample Control File for Matrix Update.

MATRIX MANIPULATE

This function allows the user to merge or demerge trip tables or selected summation tables (the name of input files = TMANx and the name of output files = TMANy) as well as to add, subtract, multiply, or divide any combination of trip tables or selected summation tables. Up to a total of nine input and output files may be used in a single run. The function does not have options and parameters specifications. A sample control file is shown in Exhibit 8-2.

```
$MATRIX MANIPULATE
$FILES
  INPUT FILE = TMAN1, USER ID = $GMTVOL.DAT$
  INPUT FILE = TMAN2, USER ID = $TRNSPS1.DAT$
  OUTPUT FILE = TMAN3, USER ID = $MTABLE.DAT$
$HEADERS
                        STEP 2 -- MATRIX MANIPULATE
                             B/CS TEST NETWORK
                    TO GENERATE O/D FROM P/A TRIP TABLES
$DATA
  TMAN3, T1 = TMAN1,T1 + TMAN2,T1
$END TP FUNCTION
```

Exhibit 8-2. A Sample Control File for Matrix Manipulate.

MATRIX COMPRESS

This function combines traffic analysis zones of a trip table file or selected summation file (the name of input file = COMPIN) into districts (the name of output file = COMPOT). The resultant district-to-district file may be reported (by PRINT COMPRESSED MATRIX option) by this function and/or saved on an output file (by WRITE COMPRESSED MATRIX option).

Zone/district equivalencies are specified by listing the zone numbers or ranges of numbers comprising each district. Every zone must be included in one district and only one (by ONE DISTRICT PER ZONE option), and the districts which are numbered consecutively may be given descriptive identifiers (e.g., ID = RESIDENTIAL AREA or ID = INDUSTRIAL AREA). A sample control file is shown in Exhibit 8-3.

```
$MATRIX COMPRESS
$FILES
   INPUT FILE = COMPIN, USER ID =$TESTVOL.DAT$
   OUTPUT FILE = COMPOT,USER ID =$COMPVOL.DAT$
$HEADERS
   MATRIX COMPRESS OUTPUT -- HEADER NO. 1
   MATRIX COMPRESS OUTPUT -- HEADER NO. 2
   MATRIX COMPRESS OUTPUT -- HEADER NO. 3
$OPTIONS
   WRITE COMPRESSED MATRIX, PRINT COMPRESSED MATRIX
$PARAMETERS
   NUMBER OF DISTRICT = 2
$DATA
   DISTRICT = 1, ZONES = 1-2
   DISTRICT = 2, ZONES = 3-5
$END TP FUNCTION
```

Exhibit 8-3. A Sample Control File for Matrix Compress.

MATRIX TRANSPOSE

This function is used in transposing any matrix (the name of input file = TRNSPIN); each matrix element A(i,j) is moved to location A(j,i) (the name of output file = TRNSPOT). If the matrix being transposed is multipurpose (multi-table), then any or all purpose tables may be transposed. A trip end summary of the transposed matrix may be reported within the function (by PRINT TRIP ENDS option).

The most common application of the function is in conversion of a trip table from production/attraction (P/A) format to attraction/production (A/P) format. In this case, the transposed matrix is added to the original matrix (by the MATRIX MANIPULATE function) and then "split" (by the MATRIX UPDATE function) to generate an appropriate origin/destination (O/D) format. A sample control file is shown in Exhibit 8-4.

```
$MATRIX TRANSPOSE
$FILES
   INPUT FILE = TRNSPIN, USER ID =$GMTVOL.DAT$
   OUTPUT FILE = TRNSPOT,USER ID =$TRNSPS1.DAT$
$HEADERS
                    STEP 1 -- MATRIX TRANSPOSE
                    B/CS TEST NETWORK 285-ZONE
                TO GENERATE O/D FROM P/A TRIP TABLE
$OPTIONS
   PRINT TRIP ENDS
$END TP FUNCTION
```

Exhibit 8-4. A Sample Control File for Matrix Transpose.

MATRIX EXPAND

This function disaggregates zones of a matrix (the name of input file = XPANDIN) into sub-zones (the name of output file = XPANDOT). It is most commonly utilized in "small area" analysis where a subarea of an existing zonal system is to be refined in detail by splitting the zones in that sub-area into finer elements while retaining the existing structure in the remainder of the zonal system. Expansion factors are expressed in terms of the percentage (by ORIGIN and DESTINATION PERCENTS data specifications) of trip interchanges of an old zone to be allocated to each specified new zone according to whether the trip has its origin/production or destination/attraction in that new zone. If the new zone percentage values need not conserve the total number of trips in the old zones, NO TOTAL CHECK option should be specified.

This function permits multipurpose trip tables as both input and output. Expansion factors may vary by purpose. Renumbering or reordering of zones (by REORDER ZONES data specification) may also be performed by this function, and new zones may be generated with all row (origin) and column (destination) elements set to zero. A sample control file is shown in Exhibit 8-5.

```
$MATRIX EXPAND
$FILES
   INPUT FILE = XPANDIN, USER ID = $TESTVOLUME$
   OUTPUT FILE = XPANDOT, USER ID = $TEST.XPANDOT$
$HEADERS
   TEST MATRIX EXPAND HEADER NO. 1
   TEST MATRIX EXPAND HEADER NO. 2
   TEST MATRIX EXPAND HEADER NO. 3
$OPTIONS
   PRINT TRIP ENDS
$PARAMETERS
   NEW MAXIMUM ZONE = 7
$DATA
   REORDER ZONES = 1-2, 2-1
   UNCHANGED ZONES = 3
   ZERO ZONES = 4
   NEWZONE = 5, OLDZONE = 5, OD PERCENTAGE = 50.0, 50.0, 50.0
   NEWZONE = 6, OLDZONE = 5, OP = 10.0,10.0,10.0, DP = 40.0,40.0,40.0
   NEWZONE = 7, OLDZONE = 5, OP = 40.0,40.0,40.0, DP = 10.0,10.0,10.0
$END TP FUNCTION
```

Exhibit 8-5. A Sample Control File for Matrix Expand.

BUILD FARE MATRIX

This function creates a zone-to-zone transit fare matrix according to user instructions (the names of input files = TRNET and TRPATH). The zonal fare matrix (the name of output file = TRFARE) is generated as a standard TRANPLAN selected summation (skim) file with fares being inserted in the first table. The matrix can be used for transit cost inputs to modal choice analysis. Fares may be "simple" district fares expanded to a zonal level, or transit paths may be input and boarding fares, transfer fares, or station-to-station fares applied.

BUILD TRIP TABLE

This function accepts trip survey data in TRANPLAN format (the name of input file = SRVDATA) and allocates the trips to trip tables according to user-specified selection criteria (the name of output file = VOLUME). Up to 16 criteria sets for each of 15 trip tables may be established; each set may contain up to 8 separate criteria. A given trip is included in a trip table if it satisfies all criteria in any criteria set(s) for that table. A trip may be allocated to any number of trip tables. All input records must be sorted on origin zone.

9. REPORTING

REPORT HIGHWAY NETWORK

This function allows the user to report all or part of a highway network file (the name of input file = HWYNET). Link descriptions, prohibited turns, node coordinates and unused node numbers may all be reported in a single run if desired. An example control file is given in Exhibit 9-1.

```
$REPORT HIGHWAY NETWORK
$FILE
   INPUT FILE = HWYNET, USER ID = $HWYNET.DAT$
$HEADERS
                              REPORT HIGHWAY NETWORK
                                   B/CS NETWORK
$OPTION
    PRINT COORDINATES
    PRINT UNUSED NODES
$PARAMETERS
   IMPEDANCE = TIME2
$END TP FUNCTION
```

Exhibit 9-1. A Sample Control File for Report Highway Network.

This link description report can be presented in either a detailed format (by DETAIL option) for which the full link description is given, or in an abbreviated format (by default) for which only the major link characteristics are given in order to minimize the amount of report output. If the abbreviated format is chosen, then for each link the following data are printed: ANODE, BNODE, One-Way Flag, one Impedance, one Speed, three Link Group codes, Direction code, Assignment Group code, and Prohibited node(s) if applicable. Two links are described per line of output. If the detailed format is chosen, then for each link the above link data are printed, as well as the other three Impedances, the second Speed, and either Capacity and Volume or two Capacities. Only one link is described per line of output.

Two selective link options are available for reporting only portions of a network: an "AND" option (by SELECTED AND NODES parameter) where both ANODE and BNODE must be selected for the link description to be included in the report, and an "OR" option (by SELECTED OR NODES parameter) where only the ANODE or BNODE need be selected. For example, if freeway nodes are coded within unique ranges of numbers, then the first option could be used to report all freeway links, while the second option could be used to report only freeway links and exits from and entries to the freeways. Alternatively, the options could be used to report only the downtown area of a network. Both options may be used in the same run. A current user has commissioned the feature to report by coordinate-driven windows.

The function will accept either a highway network file or a loaded highway network history file. If the file is a loaded highway history file,

the historical network description for any or all iterations may be reported in a single run.

Prohibited turns are always indicated within the network description report. Additionally, they are also listed in a turn prohibitor report for easy scanning. The ANODE ("from" node), BNODE ("through" node), and PNODE ("to" node) for each prohibited turn is listed in the order in which the user inserted them in building the network. The report does not require any option specification and is additional to the listing of prohibited turns within the link description report (see the previous Exhibit 2-3).

Node coordinates (by PRINT COORDINATES option) may be reported in an ordered list if they have been coded in the network. For each node, an X-coordinate and a Y-coordinate are given, with five nodes printed per line (see the previous Exhibit 2-2).

A report of all unused node numbers (up to the maximum node number) can also be requested (by PRINT UNUSED NODES option). This report is very convenient in determining available node numbers for subsequent additions to the network (see Exhibit 9-2).

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VERSION 5.0

REPORT HIGHWAY NETWORK
B/CS NETWORK

PAGE NO. 1
DATE 27JUL87
TIME 15:28:54

LIST OF UNUSED NODE NUMBERS FROM 1 TO 1119

NODE	NODE	NODE	NODE	NODE	NODE	NODE	NODE	NODE	NODE
259	260	261	262	263	264	265	266	267	268
269	286	287	288	289	290	291	292	293	294
295	296	297	298	299	300	320	324	329	331
332	356	357	377	450	453	476	497	498	499
500	504	548	616	625	653	659	761	762	763
764	765	766	767	768	769	770	771	772	773
774	775	776	777	778	779	780	781	782	783
784	785	786	787	788	789	790	791	792	793
794	795	796	797	798	799	800	801	802	803
804	805	806	807	808	809	810	811	812	813
814	815	816	817	818	819	820	821	822	823
824	825	826	827	828	829	830	831	832	833
834	835	836	837	838	839	840	841	842	843
844	845	846	847	848	849	867	883	932	964
968	1004	1012	1028	1029	1083	1084	1091	1092	1093
1094	1095	1096	1097	1098	1099	1100			

Exhibit 9-2. A Sample Output for Unused Nodes.

REPORT HIGHWAY PATHS

This function allows the user to selectively report paths of minimum impedance for a standard highway network or loaded highway network history file (the name of input file = HWYNET). Two types of reports can be produced: non-destructive tree traces (by PRINT NONDESTRUCTIVE TRACES

option) in which the path to each destination zone is traced back to each selected origin zone, and destructive tree traces (by PRINT DESTRUCTIVE TRACES option) for which the path to each destination zone is traced back only until a path which has been previously traced is encountered (see Exhibit 9-3 for a sample control file and Exhibits 9-4 and 9-5 for example outputs). As can be readily seen by a comparison of Exhibits 9-4 and 9-5, the Destructive Tree Traces option is easier to use and requires less printing time; therefore, the option is more commonly used than the Non-destructive Tree Traces option.

```
$REPORT HIGHWAY PATHS

$FILES
   INPUT FILE = HWYNET, USER ID = $HWYNET.DAT$

$HEADERS
                        REPORT HIGHWAY PATHS (TREES)
                  FOR SELECTED ZONES AND SELECTED NODES
                              OF B/CS NETWORK

$OPTIONS
   PRINT NONDESTRUCTIVE TRACES
   PRINT DESTRUCTIVE TRACES

$PARAMETERS
   IMPEDANCE = TIME 2
   SELECTED ZONES = 2,161,177,221
   SELECTED NODES = 301,305

$END TP FUNCTION
```

Exhibit 9-3. A Sample Control File for Report Highway Paths.

Paths, which are automatically built within this function, may be based upon any one of the five standard impedance measures (by IMPEDANCE parameter specification): Time 1, Time 2, Cost, User, Distance. Optionally up to 256 Turn Penalty values (by TURN PENALTIES parameter) may be used in the building of paths if Direction Codes (ranges 1-16) have been specified in the highway network. Another option allows minimum paths to be built through centroids (by THROUGH CENTROIDS option) where applicable.

The user may select any number of origin zones (by SELECTED ZONES parameter), as well as up to 20 origin nodes (by SELECTED NODES parameter) to report paths. Normally the paths for all selected origin zones or nodes are traced only up to the maximum zone number for the network; alternatively, paths may be traced up to the maximum node number if desired.

If a loaded highway network history file is being reported, path impedances may be taken from any iteration or iterations of the file. Each selected iteration will generate a separate report.

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REPORT HIGHWAY PATHS (TREES)
FOR SELECTED ZONES AND SELECTED NODES
OF B/CS NETWORK

PAGE NO. 1
DATE 28JUL87
TIME 15:09:20

NON-DESTRUCTIVE VINE TRACE - VINE NO. 2

TO	THRU TIME 2	THRU TIME 2	THRU TIME 2	THRU TIME 2	THRU TIME 2	THRU TIME 2	THRU TIME 2
1	1.00	1118 .64	893 .40	2			
2	HOME NODE						
3	1.24	1104 1.04	1102 .85	1101 .76	400 .68	399 .52	2
4	18.67	1026 17.15	1023 16.61	970 15.99	969 15.16	966 14.32	965 13.96
	721 13.12	720 11.69	726 11.10	727 10.87	728 10.57	714 10.12	715 9.53
	713 9.38	712 9.24	711 9.15	706 8.92	707 8.68	690 8.50	686 8.08
	685 7.81	684 7.54	668 7.19	914 7.06	667 6.90	666 6.73	664 6.53
	637 6.32	639 6.05	640 5.78	642 5.65	643 5.53	583 5.06	582 4.98
	580 4.62	579 4.26	577 4.05	522 3.85	521 3.64	520 3.49	513 3.20
	512 3.03	432 2.39	431 2.30	430 2.13	425 1.57	426 1.41	1105 1.21
	1104 1.04	1102 .85	1101 .76	400 .68	399 .52	2	
5	18.63	1026 17.15	1023 16.61	970 15.99	969 15.16	966 14.32	965 13.96
	721 13.12	720 11.69	726 11.10	727 10.87	728 10.57	714 10.12	715 9.53
	713 9.38	712 9.24	711 9.15	706 8.92	707 8.68	690 8.50	686 8.08
	685 7.81	684 7.54	668 7.19	914 7.06	667 6.90	666 6.73	664 6.53
	637 6.32	639 6.05	640 5.78	642 5.65	643 5.53	583 5.06	582 4.98
	580 4.62	579 4.26	577 4.05	522 3.85	521 3.64	520 3.49	513 3.20
	512 3.03	432 2.39	431 2.30	430 2.13	425 1.57	426 1.41	1105 1.21
	1104 1.04	1102 .85	1101 .76	400 .68	399 .52	2	
6	18.99	1026 17.15	1023 16.61	970 15.99	969 15.16	966 14.32	965 13.96
	721 13.12	720 11.69	726 11.10	727 10.87	728 10.57	714 10.12	715 9.53
	713 9.38	712 9.24	711 9.15	706 8.92	707 8.68	690 8.50	686 8.08
	685 7.81	684 7.54	668 7.19	914 7.06	667 6.90	666 6.73	664 6.53
	637 6.32	639 6.05	640 5.78	642 5.65	643 5.53	583 5.06	582 4.98
	580 4.62	579 4.26	577 4.05	522 3.85	521 3.64	520 3.49	513 3.20
	512 3.03	432 2.39	431 2.30	430 2.13	425 1.57	426 1.41	1105 1.21
	1104 1.04	1102 .85	1101 .76	400 .68	399 .52	2	
7	18.09	1023 16.61	970 15.99	969 15.16	966 14.32	965 13.96	721 13.12
	720 11.69	726 11.10	727 10.87	728 10.57	714 10.12	715 9.53	713 9.38
	712 9.24	711 9.15	706 8.92	707 8.68	690 8.50	686 8.08	685 7.81
	684 7.54	668 7.19	914 7.06	667 6.90	666 6.73	664 6.53	637 6.32
	639 6.05	640 5.78	642 5.65	643 5.53	583 5.06	582 4.98	580 4.62
	579 4.26	577 4.05	522 3.85	521 3.64	520 3.49	513 3.20	512 3.03
	432 2.39	431 2.30	430 2.13	425 1.57	426 1.41	1105 1.21	1104 1.04
	1102 .85	1101 .76	400 .68	399 .52	2		
8	18.41	1023 16.61	970 15.99	969 15.16	966 14.32	965 13.96	721 13.12
	720 11.69	726 11.10	727 10.87	728 10.57	714 10.12	715 9.53	713 9.38
	712 9.24	711 9.15	706 8.92	707 8.68	690 8.50	686 8.08	685 7.81

Exhibit 9-4. A Sample Output for Non-Destructive Vine Trace.

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TRANPLAN SYSTEM
VERSION 5.0

REPORT HIGHWAY PATHS (TREES)
FOR SELECTED ZONES AND SELECTED NODES
OF B/CS NETWORK

PAGE NO. 1
DATE 28JUL87
TIME 15:09:20

DESTRUCTIVE VINE TRACE - VINE NO. 2

TO	THRU	TIME 2	THRU	TIME 2	THRU	TIME 2	THRU	TIME 2	THRU	TIME 2	THRU	TIME 2	THRU	TIME 2
1		1.00	1118	.64	893	.40	-2-							
2	HOME NODE													
3		1.24	1104	1.04	1102	.85	1101	.76	400	.68	399	.52	-2-	
4		18.67	1026	17.15	1023	16.61	970	15.99	969	15.16	966	14.32	965	13.96
	721	13.12	720	11.69	726	11.10	727	10.87	728	10.57	714	10.12	715	9.53
	713	9.38	712	9.24	711	9.15	706	8.92	707	8.68	690	8.50	686	8.08
	685	7.81	684	7.54	668	7.19	914	7.06	667	6.90	666	6.73	664	6.53
	637	6.32	639	6.05	640	5.78	642	5.65	643	5.53	583	5.06	582	4.98
	580	4.62	579	4.26	577	4.05	522	3.85	521	3.64	520	3.49	513	3.20
	512	3.03	432	2.39	431	2.30	430	2.13	425	1.57	426	1.41	1105	1.21
	1104	1.04	-3-											
5		18.63	1026	17.15	-4-									
6		18.99	1026	17.15	-4-									
7		18.09	1023	16.61	-4-									
8		18.41	1023	16.61	-4-									
9		18.01	1023	16.61	-4-									
10		17.19	970	15.99	-4-									
11		1.39	451	1.19	452	.92	1116	.70	1117	.61	892	.32	-2-	
12		1.49	459	1.09	452	.92	-11-							
13		2.60	462	1.64	461	1.35	459	1.09	-12-					
14		2.83	449	1.55	448	1.34	451	1.19	-11-					
15		1.13	1113	1.09	1114	.90	1117	.61	-11-					
16		1.71	447	1.51	448	1.34	-14-							
17		1.72	427	1.44	1109	1.21	1113	1.09	-15-					
18		1.64	427	1.44	-17-									
19		2.49	429	2.25	430	2.13	-4-							
20		2.66	440	2.42	441	1.94	442	1.84	898	1.77	428	1.70	427	1.44
	-17-													

Exhibit 9-5. A Sample Output for Destructive Vine Trace.

REPORT MATRIX

This function allows the user to report a trip end summary, selectively to report a trip table, or to report a selected summation (skim) table (the name of input file = RTABIN) (see Exhibit 9-6).

```
$PRINTER
$REPORT MATRIX
$FILE
  INPUT FILE = RTABIN, USER ID = $GMTVOL.DAT$
$HEADERS
                        REPORT FOR TRIP ENDS AND TABLE
                            B/CS TEST HWY NETWORK
                          TOTAL SUM OF PURPOSES 1-4
$OPTIONS
  PRINT TRIP ENDS
  PRINT TABLE
$PARAMETERS
  SELECTED ZONES = 1-3,86-87,91-95,107,132,137,
                   160-162,165,170
$END TP FUNCTION
```

Exhibit 9-6. A Sample Control File for Report Matrix.

It is called by the user option from any other function which produces a trip end file by PRINT TRIP ENDS option and generates a trip end summary report (see Exhibit 9-7) or a trip table by PRINT TABLE option (see Exhibit 9-8). The function permits the selection of specific tables (purposes or skim impedances) and specific origin/production zones.

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VERSION 5.0

REPORT FOR TRIP ENDS AND TABLE
B/CS TEST HWY NETWORK
TOTAL SUM OF PURPOSES 1-5

PAGE NO. 4
DATE 28JUL87
TIME 16:28:23

TRIP END SUMMARY --- PURPOSE 1

ZONE/DIST	ORIG/PROD	DEST/ATTR	TOTAL	INTRATRIPS	ZONE/DIST	ORIG/PROD	DEST/ATTR	TOTAL	INTRATRIPS
81	711	547	1258	1	121	0	0	0	0
82	1332	2489	3821	16	122	677	1310	1987	36
83	1124	2792	3916	15	123	99	136	235	1
84	1841	3289	5130	34	124	424	631	1055	6
85	1577	1576	3153	13	125	1310	438	1748	15
86	5314	3899	9213	146	126	780	160	940	3
87	2802	1146	3948	23	127	1821	460	2281	13
88	881	2295	3176	18	128	1857	924	2781	31
89	3311	8530	11841	254	129	920	2360	3280	24
90	24	8	32	0	130	2253	2368	4621	77
:		:		:		:			:
:		:		:		:			:

Exhibit 9-7. A Sample Output for Trip End Summary.

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VERSION 5.0

REPORT FOR TRIP ENDS AND TABLE
B/CS TEST HWY NETWORK
TOTAL SUM OF PURPOSES 1-5

PAGE NO. 1
DATE 28JUL87
TIME 16:28:23

ORIGIN ZONE 1 PURPOSE 1 1056 TOTAL ORIG/PROD

TO ZONE	-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-0-	TO ZONE
1	16	12	10	0	0	0	0	0	0	0	10
11	4	4	18	10	0	2	1	28	9	0	20
21	6	10	3	8	0	5	3	0	5	21	30
31	6	5	8	11	8	4	5	4	8	12	40
41	7	19	3	1	6	11	2	19	30	5	50
51	14	10	19	2	3	2	3	4	11	21	60
61	3	11	4	12	2	1	5	15	4	5	70
71	1	2	1	3	6	6	9	8	4	5	80
81	1	8	10	11	6	10	3	3	12	0	90
91	1	1	1	8	0	0	1	17	1	0	100
101	2	1	2	0	0	0	0	3	8	1	110
111	0	0	0	2	0	1	0	0	0	2	120
121	0	6	0	3	1	1	2	4	11	11	130
131	3	13	5	0	0	0	1	2	7	0	140
141	2	5	0	2	7	5	18	12	6	0	150
151	2	4	0	7	6	0	2	3	0	6	160
161	23	0	3	3	3	2	1	0	2	0	170
171	1	3	2	9	5	8	30	11	1	0	180
181	6	7	3	1	0	1	1	7	0	5	190
191	2	0	0	2	2	1	5	3	2	1	200
201	0	9	3	0	0	0	1	0	16	4	210
211	12	0	2	0	2	0	0	0	0	1	220
221	1	4	0	0	1	5	0	0	0	10	230
231	0	0	0	0	1	0	2	0	0	0	240
241	3	1	0	0	1	0	0	0	0	0	250
251	0	0	1	0	0	0	0	2	0	0	260

ORIGIN ZONE 2 PURPOSE 1 776 TOTAL ORIG/PROD

TO ZONE	-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-0-	TO ZONE
1	13	9	9	0	0	0	0	0	0	0	10
11	3	4	11	6	0	1	2	17	6	0	20
21	3	8	2	4	0	4	1	0	3	18	30
31	6	5	6	8	5	3	5	3	6	11	40
41	5	12	1	1	3	8	2	12	19	5	50
51	9	8	12	1	2	1	4	3	6	12	60
61	3	6	3	10	1	1	4	12	3	3	70
71	1	0	1	2	4	6	6	6	3	4	80
81	0	5	8	9	3	7	2	2	7	0	90
91	2	0	0	7	0	0	1	12	0	1	100
101	1	1	0	0	0	0	2	3	5	0	110
111	0	0	0	2	0	0	0	0	0	2	120
121	0	4	0	5	1	0	2	4	8	9	130
131	2	12	4	0	0	0	1	1	8	0	140

Exhibit 9-8. A Sample Output for Trip Table.

For skim tables, it accumulates origin zone row totals as a measure of zonal accessibilities and inserts decimal points, as scaled by the user, into the reports (see Exhibit 9-9).

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VERSION 5.0

REPORT SEPARATION MATRICES
B/CS TEST HWY NETWORK
USING INTRAZONAL IMPEDANCES (DIAGONAL) = 1.0

PAGE NO. 1
DATE 28JUL87
TIME 15:44:08

ORIGIN ZONE 2 SKIM VALUE TIME 2

TO ZONE	-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-0-	TO ZONE
1	1.00	1.00	1.24	18.67	18.63	18.99	18.09	18.41	18.01	17.19	10
11	1.39	1.49	2.60	2.83	1.13	1.71	1.72	1.64	2.49	2.66	20
21	3.05	4.52	5.05	3.59	4.89	4.74	4.89	5.78	4.89	3.83	30
31	4.15	3.46	3.61	2.48	1.60	2.04	0.78	0.90	0.96	1.79	40
41	1.10	1.74	2.59	2.56	2.07	1.69	2.32	2.57	3.75	3.25	50
51	4.77	4.38	3.89	3.80	3.08	4.45	5.27	5.05	4.89	4.51	60
61	5.02	6.65	5.67	6.13	7.50	7.07	6.26	5.37	6.62	7.17	70
71	8.37	8.29	7.60	6.75	6.22	5.48	5.54	4.29	4.91	5.71	80
81	4.11	3.69	3.31	3.37	3.90	6.02	6.85	8.59	8.95	9.54	90
91	8.82	7.66	9.40	5.44	6.16	6.68	6.22	7.02	5.38	12.24	100
101	8.67	12.66	12.55	13.46	14.74	12.83	10.97	9.17	7.41	9.65	110
111	12.19	12.32	12.20	12.76	8.91	8.54	7.78	7.14	4.76	6.16	120
121	6.10	6.05	6.29	4.36	5.28	5.73	5.32	4.71	2.61	3.70	130
131	4.56	3.83	4.25	7.53	6.78	6.33	6.99	5.80	6.42	5.74	140
141	6.94	5.04	7.66	4.74	4.13	3.45	1.90	0.88	3.55	17.11	150
151	4.10	6.10	5.97	6.72	7.29	6.81	9.93	11.26	15.56	9.81	160
161	9.63	10.91	10.92	11.44	10.48	11.99	14.07	12.52	11.53	11.55	170
171	10.32	9.42	11.78	8.49	9.41	8.73	8.69	7.73	7.25	9.29	180
181	7.41	7.22	8.02	8.78	9.44	9.36	8.45	9.14	9.62	8.49	190
191	9.37	9.99	10.17	10.62	11.76	10.97	9.32	10.19	11.40	11.77	200
201	12.48	7.48	8.60	9.33	8.05	9.44	5.48	7.43	2.41	7.10	210
211	4.80	5.99	5.70	4.40	5.82	7.38	10.54	7.94	9.71	12.51	220
221	7.06	6.52	6.65	12.17	7.94	3.71	4.83	4.51	5.14	2.57	230
231	4.42	5.10	9.90	7.23	2.61	7.41	12.41	14.62	15.17	22.98	240
241	13.25	12.14	13.54	14.56	13.54	10.89	14.88	16.18	16.48	15.80	250
251	15.53	18.41	16.64	17.50	20.62	8.40	18.37	7.83	20.14	20.14	260
261	20.14	20.14	20.50	20.50	20.50	18.33	18.33	18.33	18.33	11.57	270
271	10.77	10.19	10.19	5.49	5.49	4.62	5.15	7.00	9.59	19.27	280
281	15.45	17.27	15.28	11.42	7.68						

ORIGIN ZONE 161 SKIM VALUE TIME 2

TO ZONE	-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-0-	TO ZONE
1	9.58	9.78	9.20	12.23	12.19	12.55	11.65	11.97	11.57	10.75	10
11	9.90	10.30	11.41	11.33	9.69	10.11	10.05	9.66	9.28	10.27	20
21	11.01	10.67	9.91	10.61	12.26	12.25	12.77	13.57	13.24	11.62	30
31	11.94	10.74	10.56	10.22	10.10	9.48	9.91	9.92	9.70	9.40	40
41	9.23	8.78	7.66	8.26	8.90	9.28	8.83	9.36	8.74	8.09	50
51	8.12	7.81	8.77	7.34	7.22	6.53	7.91	6.40	6.53	7.19	60
61	7.22	7.22	5.99	5.71	7.01	6.97	7.19	7.27	6.10	6.08	70
71	6.78	6.86	7.66	7.94	8.70	7.49	6.63	7.24	7.67	8.73	80
81	8.17	7.76	8.30	9.01	9.22	9.73	9.47	8.59	8.42	9.46	90
91	9.45	10.85	15.28	11.48	12.20	12.56	13.09	14.45	13.17	18.12	100
101	16.46	20.45	20.34	21.10	22.53	20.47	18.61	16.96	15.20	17.29	110

Exhibit 9-9. A Sample Output for Skim Table.

REPORT HIGHWAY LOAD

This function allows the user to report assigned volumes from any iteration(s) and any purpose(s) of a loaded highway network history file (the name of input file = LODHIST). An example of the control file is shown in Exhibit 9-10. Each iteration and each purpose results in a separate report. Any combination of link volumes (see Exhibit 9-11) and turn volumes (see Exhibit 9-12) can be reported in the same run.

```
$REPORT HIGHWAY LOAD
$FILE
   INPUT FILE = LODHIST, USER ID = $HWYLOD1.DAT$
$HEADERS
                              REPORT HIGHWAY LOAD
                               B/CS TEST NETWORK
                      LINK VOLUME REPORT OF ALL-OR-NOTHING
$OPTIONS
   MINIMUM REPORT
   PRINT TURNS
$END TP FUNCTION
```

Exhibit 9-10. A Sample Control File for Report Highway Load.

For a link volume report, ANODE, BNODE, assigned volume, reverse direction (if link is two-way), and total two-way volume are reported for each link, three nodes per printed line. Link volume reports may be generated for the complete file or for selected links from the file. For a selective report, two selective link options, both of which may be used in the same run, are available: an "AND" option (by SELECTED AND NODES parameter) where both ANODE and BNODE must be selected for the link description to be included in the report, and an "OR" option (by SELECTED OR NODES parameter) where only the ANODE or BNODE need be selected. For example, if freeway nodes are coded within unique ranges of numbers, then the first option could be used to report all freeway links or the second option could be used to report all freeway links and entries to and exits from the freeways. Alternatively, if nodes within a downtown area were coded within known ranges, then the downtown area links could be selectively reported. Again, a current user has commissioned the feature to report by coordinate-driven windows.

The printing of all links having assigned volumes equal to zero can be suppressed (by MINIMUM REPORT option). This option, like the selective link option, has the effect of minimizing the length of a report, particularly when only selected zones were loaded during assignment or when the network was loaded during a selected link analysis. Additionally, the printing of link volumes can be totally suppressed if only turning movement reports are desired (by SUPPRESS LINKS option).

If the loaded highway network history file is multipurpose, then a single report which adds volumes from any number of selected purposes may be generated for each selected iteration by means of a simple option (by ADD PURPOSES option).

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REPORT HIGHWAY LOAD
B/CS TEST NETWORK
LINK VOLUME REPORT OF ALL-OR-NOTHING

PAGE NO. 9
DATE 29JUL87
TIME 08:57:51

ASSIGNED VOLUMES -- 100 PERCENT LOADING -- PURPOSE 1

ANODE	BNODE	A-B	B-A	TWOWAY	ANODE	BNODE	A-B	B-A	TWOWAY	ANODE	BNODE	A-B	B-A	TWOWAY
345	125	357	1224	1581	346	127	13	24	37	347	127	339	1598	1937
	128	129	97	226		128	297	471	768		988	552	2651	3203
	343	1011	320	1331		349	16	49	65		1077	4217	859	5076
	349	382	238	620		362	507	289	796					
348	126	5	5	10	349	345	238	382	620	350	125	6	4	10
	127	26	59	85		346	49	16	65		126	8	18	26
	349	195	356	551		348	356	195	551		349	75	25	100
	988	335	141	476		350	25	75	100		352	21	63	84
351	125	60	67	127	352	350	63	21	84	353	126	12	24	36
	136	79	524	603		351	104	52	156		137	247	1415	1662
	352	52	104	156		353	295	168	463		352	168	295	463
	864	659	155	814		865	63	284	347		1080	1576	278	1854
											1082	14	5	19

Exhibit 9-11. A Sample Output of Link Volumes for Report Highway Load.

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VERSION 5.0

REPORT HIGHWAY LOAD
B/CS TEST NETWORK
LINK VOLUME REPORT OF ALL-OR-NOTHING

PAGE NO. 10
DATE 29JUL87
TIME 08:57:51

ASSIGNED TURN VOLUMES -- 100 PERCENT LOADING -- PURPOSE 1

AT	FROM	TO					
-369-		365	368	389	874	SUM IN	TWOWAY
	365	---	0	6064	771	6835	11796
	368	0	---	1126	3869	4995	11330
	389	3698	820	---	4708	9226	23425
	874	1263	5515	7009	---	13787	23135
	SUM OUT	4961	6335	14199	9348		
-371-		370	373	383	SUM IN	TWOWAY	
	370	---	7783	0	7783	22138	
	373	14355	---	0	14355	22138	
	383	0	0	---	0	0	
	SUM OUT	14355	7783	0			

AT	FROM	TO				
-370-		371	372	874	SUM IN	TWOWAY
	371	---	0	14355	14355	22138
	372	0	---	0	0	0
	874	7783	0	---	7783	22138
	SUM OUT	7783	0	14355		
-372-		132	370	1072	SUM IN	TWOWAY
	132	---	0	0	0	0
	370	0	---	0	0	0
	1072	0	0	---	0	0
	SUM OUT	0	0	0		

Exhibit 9-12. A Sample Output of Turn Volumes for Report Highway Load.

If turn volumes were saved during loading of the network, these may be reported within the body of the link volume report (by PRINT TURNS option). Alternatively, the user may select a subset (up to 50 ranges) of the nodes for which turn volumes were saved; or the user may suppress printing of all turn volumes. If the link volume report is requested in conjunction with the turn volume report, zero-value link volumes may not be suppressed and only the last iteration of the first purpose is reported (other iterations and purposes can be easily reported in a separate run in this case). To speed up manual plotting of assigned volumes during analysis, an option is available to round reported two-way link volumes to the nearest hundred in link and turn volume reports (by ROUND VOLUMES option). Exact values of directional volumes are still printed so that exact two-way volumes can be determined if necessary.

REPORT CORRIDOR VOLUMES

This function permits the user to report one-way trip interchanges between selected groups of zones on a multipurpose trip table file (the name of input file = CORDIN). Zones may be included in more than one group (by NUMBER OF GROUPS parameter) or excluded from all groups. When reporting trip interchanges between overlapping groups, the user has the option of including trips between zones common to both groups and also setting intra-zonal volumes to zero (by ZERO INTRAS option). The user, by selectively rearranging the zone groupings (by GROUP, ZONES data specifications), has an extremely versatile tool for measuring the trip interchange activity in a corridor. This capability is especially useful in analyzing potential transit corridors.

REPORT MATRIX COMPARISON

This function compares cell entries of two trip table files or two selected summation files (the names of input base file and compared file = MATCOM1 and MATCOM2) and reports the comparison in any of four ways. A sample control file is shown in Exhibit 9-13.

```
$REPORT MATRIX COMPARISON
$FILES
   INPUT FILE = MATCOM1, USER ID = $COMGMT.DAT$
   INPUT FILE = MATCOM2, USER ID = $COMTEX.DAT$
$HEADERS
                        REPORT MATRIX COMPARISON
          B/CS TEST NETWORK COMPARISON OF 285x285 TRIP MATRICES
                   BETWEEN TEXAS PACKAGE AND TRANPLAN
$OPTIONS
   PRINT ZONAL DIFFERENCES
   PRINT FREQUENCY DISTRIBUTION
   PRINT STATISTICAL SUMMARY
   PRINT TRIP END COMPARISON
$PARAMETERS
   SELECTED ZONES = 1,258,270,285
$END TP FUNCTION
```

Exhibit 9-13. A Sample Control File for Report Matrix Comparison.

- Differences (MATCOM1-MATCOM2) and ratios (MATCOM2/MATCOM1) between zone-to-zone volumes or impedances for selected origin (production) zones of the two files by PRINT ZONAL DIFFERENCES option (see Exhibit 9-14).

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VERSION 5.0

REPORT MATRIX COMPARISON
B/CS TEST NETWORK COMPARISOM OF 285x285 TRIP MATRICES
BETWEEN TEXAS PACKAGE AND TRANPLAN

PAGE NO. 1
DATE 17SEP87
TIME 13:17:33

VOLUME COMPARISON REPORT ---- VOLUME DIFFERENCES AND RATIOS.
MAXIMUM CENTROID NUMBER = 285 NUMBER OF PURPOSES = 1

ORIGIN ZONE 1 PURPOSE 1

	ZONE	1	2	3	4	5	6	7	8	9	0
TAPE 1	1	16	12	10	0	0	0	0	0	0	0
TAPE 2		16	12	10	0	0	0	0	0	0	0
DIFF.		0	0	0	0	0	0	0	0	0	0
RATIO		1.00	1.00	1.00	.00	.00	.00	.00	.00	.00	.00
TAPE 1	11	4	4	18	10	0	2	1	28	9	0
TAPE 2		3	5	17	10	1	2	1	26	9	1
DIFF.		1	-1	1	0	-1	0	0	2	0	-1
RATIO		.75	1.25	.94	1.00	.00	1.00	1.00	.93	1.00	.00
TAPE 1	21	6	10	3	8	0	5	3	0	5	21
TAPE 2		5	10	3	7	1	4	3	0	6	19
DIFF.		1	0	0	1	-1	1	0	0	-1	2
RATIO		.83	1.00	1.00	.88	.00	.80	1.00	.00	1.20	.90
TAPE 1	31	6	5	8	11	8	4	5	4	8	12
TAPE 2		7	7	7	10	8	4	5	5	8	10
DIFF.		-1	-2	1	1	0	0	0	-1	0	2
RATIO		1.17	1.40	.88	.91	1.00	1.00	1.00	1.25	1.00	.83
TAPE 1	41	7	19	3	1	6	11	2	19	30	5
TAPE 2		8	19	1	3	6	11	2	18	31	6
DIFF.		-1	0	2	-2	0	0	0	1	-1	-1
RATIO		1.14	1.00	.33	3.00	1.00	1.00	1.00	.95	1.03	1.20
TAPE 1	51	14	10	19	2	3	2	3	4	11	21
TAPE 2		13	10	18	4	1	2	4	3	11	20
DIFF.		1	0	1	-2	2	0	-1	1	0	1
RATIO		.93	1.00	.95	2.00	.33	1.00	1.33	.75	1.00	.95
TAPE 1	61	3	11	4	12	2	1	5	15	4	5
TAPE 2		3	10	3	16	2	1	5	15	4	4
DIFF.		0	1	1	-4	0	0	0	0	0	1
RATIO		1.00	.91	.75	1.33	1.00	1.00	1.00	1.00	1.00	.80
TAPE 1	71	1	2	1	3	6	6	9	8	4	5
TAPE 2		1	2	2	3	7	6	9	8	4	5
DIFF.		0	0	-1	0	-1	0	0	0	0	0
RATIO		1.00	1.00	2.00	1.00	1.17	1.00	1.00	1.00	1.00	1.00
TAPE 1	81	1	8	10	11	6	10	3	3	12	0
TAPE 2		1	8	10	11	6	10	3	3	12	0
DIFF.		0	0	0	0	0	0	0	0	0	0
RATIO		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	.00

Exhibit 9-14. A Sample Output of Zonal Differences and Ratios.

- Frequency distribution ((MATCOM1-MATCOM2)/(MATCOM1+MATCOM2)) of the differences in the zone-to-zone volumes or impedances (by PRINT FREQUENCY DISTRIBUTION option) stratified by volume/impedance groups (35 standard groups and up to 10 user-specified groups by ADDITIONAL VOLUME GROUPS parameter) (see Exhibit 9-15).

DCCO / UAG — REPORT MATRIX COMPARISON — PAGE NO. 13
TRANPLAN SYSTEM — B/CS TEST NETWORK COMPARISOM OF 285x285 TRIP MATRICES — DATE 17SEP87
VERSION 5.0 — BETWEEN TEXAS PACKAGE AND TRANPLAN — TIME 13:17:33

VOLUME COMPARISON REPORT ---- FREQUENCY DISTRIBUTION (V1-V2).
MAXIMUM CENTROID NUMBER = 285 — NUMBER OF PURPOSES = 1
INTERCHANGES WITH ZERO VOLUME — TAPE 1 = 40675 — TAPE 2 = 40466

PURPOSE 1

VOLUME GRP V1		NEGATIVE -50 TO -31	-30 TO -21	-20 TO -11	-10 TO -8	-7 TO -6	-5 TO -4	-3 TO -3	-2 TO -2	-1 TO -1	-0 TO +0	POSITIVE +1 TO +1	+2 TO +2	+3 TO +3	+4 TO +5	+6 TO +7	+8 TO +10	+11 TO +20	+21 TO +30	+31 TO +50	TOT
0-	1	0	0	0	0	0	14	127	995	4545	41362	2841	0	0	0	0	0	0	0	0	49884
2-	2	0	0	0	0	0	6	40	271	913	2453	1514	558	0	0	0	0	0	0	0	5755
3-	3	0	0	0	0	0	2	38	212	706	1753	951	363	74	0	0	0	0	0	0	4099
4-	4	0	0	0	0	0	6	28	154	549	1265	673	238	49	6	0	0	0	0	0	2968
5-	5	0	0	0	0	0	3	23	133	451	927	530	186	33	7	0	0	0	0	0	2293
6-	6	0	0	0	0	0	3	31	99	333	737	409	145	29	1	0	0	0	0	0	1787
7-	7	0	0	0	0	0	2	13	69	296	633	344	128	25	3	0	0	0	0	0	1513
8-	8	0	0	0	0	0	6	22	65	232	507	297	100	14	1	0	0	0	0	0	1244
9-	9	0	0	0	0	0	5	21	67	193	430	229	76	9	0	0	0	0	0	0	1030
10-	10	0	0	0	0	0	8	15	54	154	355	206	82	13	0	0	0	0	0	0	887
11-	15	0	0	0	0	3	42	68	177	503	1297	681	286	59	1	0	0	0	0	0	3117
16-	20	0	0	0	0	11	34	28	77	295	741	380	180	34	4	0	0	0	0	0	1784
21-	25	0	0	0	2	13	18	13	60	159	481	274	116	25	0	0	0	0	0	0	1161
26-	30	0	0	0	2	10	7	8	39	105	291	186	88	20	5	0	0	0	0	0	761
31-	35	0	0	0	10	9	3	5	28	68	218	106	72	19	3	0	0	0	0	0	541
36-	40	0	0	4	8	3	0	3	12	53	152	92	49	12	3	0	0	0	0	0	391
41-	45	0	0	3	8	1	0	8	14	56	119	70	33	9	4	0	0	0	0	0	325
46-	50	0	0	7	4	0	0	4	11	19	79	57	32	16	3	0	0	0	0	0	232
51-	60	0	0	11	0	0	0	4	20	41	132	61	39	15	5	0	0	0	0	0	328
61-	70	0	0	10	0	0	0	2	7	26	86	48	32	11	4	0	0	0	0	0	226
71-	80	0	0	2	0	0	2	3	11	22	66	45	23	14	3	0	0	0	0	0	191
81-	90	0	1	1	0	0	1	4	4	13	27	15	32	9	7	0	0	0	0	0	114
91-	100	0	2	2	0	0	0	2	6	6	38	19	15	12	5	2	0	0	0	0	109
101-	150	0	1	0	0	1	3	5	9	15	46	50	46	33	20	6	1	1	0	0	237
151-	200	0	1	0	0	0	3	2	0	5	20	13	13	14	21	4	0	1	0	0	97
201-	250	0	0	0	0	0	4	0	0	3	9	4	7	4	3	5	0	0	0	0	39
251-	300	0	0	0	0	0	1	0	1	2	4	2	3	2	13	3	0	0	0	0	31
301-	350	0	0	0	0	1	0	0	1	0	2	1	2	2	6	3	2	0	0	0	20
351-	400	0	0	0	0	1	1	0	0	1	2	1	0	2	1	2	3	1	0	1	16
401-	450	0	0	0	0	0	0	1	0	0	4	0	0	0	6	2	0	0	0	0	13
451-	500	0	0	0	0	0	1	1	0	0	2	0	0	0	1	0	1	0	0	0	6
501-	1000	0	0	1	0	1	0	2	0	0	3	0	4	0	2	1	2	6	0	0	22
1001-	2000	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1	1	0	0	4
TOTAL		0	5	41	34	54	175	521	2597	9764	54242	10099	2948	558	138	28	10	10	0	1	81225

Exhibit 9-15. A Sample Output of Frequency Distribution.

- Statistical summaries (i.e., total, percent, and average volume for each table; the sum of the squares, the mean, and the standard deviation of the differences; the standard deviation as a percent of the average volume; the root mean square error (RMSE); and the percent RMSE) for the standard and user-specified volume/impedance groups by PRINT STATISTICAL SUMMARY option (see Exhibit 9-16).

DCCO / UAG
TRANPLAN SYSTEM
VERSION 5.0

REPORT MATRIX COMPARISON
B/CS TEST NETWORK COMPARISOM OF 285x285 TRIP MATRICES
BETWEEN TEXAS PACKAGE AND TRANPLAN

PAGE NO. 14
DATE 17SEP87
TIME 13:17:33

VOLUME COMPARISON REPORT ---- STATISTICAL CALCULATIONS.
MAXIMUM CENTROID NUMBER = 285 NUMBER OF PURPOSES = 1

PURPOSE 1

VOLUME GRP V1		VOL. TAPE1	AVG. VOL.	VOL. TAPE2	AVG. VOL.	AVG. DIFF.	STD. DEV.	PRCNT S.D.	PRCNT TOTAL	WGHTD AVG.	ROOT MN SQ.	PRCNT RMS	SUM OF SQ DIFF
0-	1	9209	.2	13340	.3	-.08	.50	2.70	2.02	5.47	.5	273.67	12733
2-	2	11510	2.0	10479	1.8	.18	1.02	.51	2.53	1.29	1.0	51.89	6199
3-	3	12297	3.0	11650	2.8	.16	1.09	.36	2.70	.98	1.1	36.80	4997
4-	4	11872	4.0	11517	3.9	.12	1.11	.28	2.61	.72	1.1	27.82	3675
5-	5	11465	5.0	11234	4.9	.10	1.12	.22	2.52	.57	1.1	22.57	2921
6-	6	10722	6.0	10568	5.9	.09	1.14	.19	2.36	.45	1.1	19.00	2322
7-	7	10591	7.0	10386	6.9	.14	1.10	.16	2.33	.37	1.1	15.84	1859
8-	8	9952	8.0	9861	7.9	.07	1.14	.14	2.19	.31	1.1	14.29	1625
9-	9	9270	9.0	9272	9.0	.00	1.14	.13	2.04	.26	1.1	12.69	1344
10-	10	8870	10.0	8804	9.9	.07	1.22	.12	1.95	.24	1.2	12.20	1320
11-	15	39915	12.8	39739	12.7	.06	1.27	.10	8.77	.87	1.3	9.96	5074
16-	20	31712	17.8	31604	17.7	.06	1.38	.08	6.97	.54	1.4	7.80	3426
21-	25	26470	22.8	26388	22.7	.07	1.47	.06	5.82	.38	1.5	6.45	2514
26-	30	21247	27.9	21128	27.8	.16	1.56	.06	4.67	.26	1.6	5.62	1871
31-	35	17799	32.9	17778	32.9	.04	1.94	.06	3.91	.23	1.9	5.90	2035
36-	40	14822	37.9	14805	37.9	.04	2.18	.06	3.26	.19	2.2	5.75	1857
41-	45	13943	42.9	13983	43.0	-.12	2.23	.05	3.07	.16	2.2	5.21	1622
46-	50	11097	47.8	11099	47.8	-.01	3.04	.06	2.44	.15	3.0	6.35	2140
51-	60	18046	55.0	18072	55.1	-.08	2.68	.05	3.97	.19	2.7	4.87	2352
61-	70	14829	65.6	14872	65.8	-.19	3.64	.06	3.26	.18	3.6	5.55	2995
71-	80	14339	75.1	14291	74.8	.25	2.37	.03	3.15	.10	2.4	3.18	1086
81-	90	9760	85.6	9699	85.1	.54	3.15	.04	2.15	.08	3.2	3.73	1165
91-	100	10408	95.5	10388	95.3	.18	4.15	.04	2.29	.10	4.2	4.35	1880
101-	150	28702	121.1	28406	119.9	1.25	2.69	.02	6.31	.14	3.0	2.45	2080
151-	200	16638	171.5	16484	169.9	1.59	4.07	.02	3.66	.09	4.4	2.55	1852
201-	250	8798	225.6	8744	224.2	1.38	2.96	.01	1.93	.03	3.3	1.45	416
251-	300	8389	270.6	8306	267.9	2.68	2.66	.01	1.84	.02	3.8	1.39	441
301-	350	6488	324.4	6419	321.0	3.45	3.57	.01	1.43	.02	5.0	1.53	493
351-	400	5903	368.9	5917	369.8	-.88	18.10	.05	1.30	.06	18.1	4.91	5252
401-	450	5374	413.4	5340	410.8	2.62	2.73	.01	1.18	.01	3.8	.92	186
451-	500	2780	463.3	2772	462.0	1.33	4.82	.01	.61	.01	5.0	1.08	150
501-	1000	15621	710.0	15518	705.4	4.68	7.25	.01	3.43	.04	8.6	1.22	1639
1001-	2000	6046	1511.5	6025	1506.3	5.25	6.38	.00	1.33	.01	8.3	.55	273
TOTAL		454884	5.6	454888	5.6	.00	1.00	.18	100.00	17.92	1.0	17.92	81794

Exhibit 9-16. A Sample Output of Statistical Summaries.

- Differences and ratios between zonal trip ends such as productions, attractions, totals and intrazonal trip ends by PRINT TRIP END COMPARISON option (see Exhibit 9-17).

DCCO / UAG
TRANPLAN SYSTEM
VERSION 5.0

REPORT MATRIX COMPARISON
B/CS TEST NETWORK COMPARISOM OF 285x285 TRIP MATRICES
BETWEEN TEXAS PACKAGE AND TRANPLAN

PAGE NO. 16
DATE 17SEP87
TIME 13:17:33

TRIP END COMPARISON REPORT -- PURPOSE 1

	ZONE/DIST	ORIG/PROD	DEST/ATTR	TOTAL	INTRATRIPS	ZONE/DIST	ORIG/PROD	DEST/ATTR	TOTAL	INTRATRIPS
TAPE 1	21	984	817	1801	6	31	957	1304	2261	18
TAPE 2		984	826	1810	8		957	1298	2255	18
DIFF		0	-9	-9	-2		0	6	6	0
RATIO		1.00	1.01	1.00	1.33		1.00	1.00	1.00	1.00
TAPE 1	22	1399	2720	4119	37	32	944	1299	2243	16
TAPE 2		1399	2705	4104	37		944	1310	2254	16
DIFF		0	15	15	0		0	-11	-11	0
RATIO		1.00	.99	1.00	1.00		1.00	1.01	1.00	1.00
TAPE 1	23	334	795	1129	4	33	1893	1627	3520	45
TAPE 2		334	805	1139	3		1893	1642	3535	45
DIFF		0	-10	-10	1		0	-15	-15	0
RATIO		1.00	1.01	1.01	.75		1.00	1.01	1.00	1.00
TAPE 1	24	1711	1664	3375	21	34	1316	1655	2971	19
TAPE 2		1711	1658	3369	21		1316	1622	2938	20
DIFF		0	6	6	0		0	33	33	-1
RATIO		1.00	1.00	1.00	1.00		1.00	.98	.99	1.05
TAPE 1	25	472	115	587	0	35	850	1128	1978	5
TAPE 2		472	109	581	1		850	1156	2006	7
DIFF		0	6	6	-1		0	-28	-28	-2
RATIO		1.00	.95	.99	.00		1.00	1.02	1.01	1.40
TAPE 1	26	2902	978	3880	41	36	770	661	1431	5
TAPE 2		2902	981	3883	40		770	640	1410	3
DIFF		0	-3	-3	1		0	21	21	2
RATIO		1.00	1.00	1.00	.98		1.00	.97	.99	.60
TAPE 1	27	1064	599	1663	11	37	494	752	1246	2
TAPE 2		1064	601	1665	10		494	775	1269	3
DIFF		0	-2	-2	1		0	-23	-23	-1
RATIO		1.00	1.00	1.00	.91		1.00	1.03	1.02	1.50
TAPE 1	28	1	1	2	0	38	252	539	791	1
TAPE 2		1	1	2	0		252	518	770	1
DIFF		0	0	0	0		0	21	21	0
RATIO		1.00	1.00	1.00	.00		1.00	.96	.97	1.00
TAPE 1	29	498	1057	1555	13	39	755	1209	1964	5
TAPE 2		498	1063	1561	12		755	1224	1979	7
DIFF		0	-6	-6	1		0	-15	-15	-2
RATIO		1.00	1.01	1.00	.92		1.00	1.01	1.01	1.40
TAPE 1	30	2799	4724	7523	156	40	1133	2009	3142	16
TAPE 2		2799	4718	7517	156		1133	2025	3158	17
DIFF		0	6	6	0		0	-16	-16	-1
RATIO		1.00	1.00	1.00	1.00		1.00	1.01	1.01	1.06
:			:		:			:		:
:			:		:			:		:

Exhibit 9-17. A Sample Output of Trip End Comparisons.

The two files must contain the same number of zones but not necessarily the same number of tables (purposes). Selected purposes may be reported as long as each purpose number is the same for both files. Examples of application of this function are the comparison of trip tables generated by different modeling techniques or modeled versus surveyed.

REPORT COMPLEX WEAVES

Like other selected link post-processors, this function manipulates the selected link history file(s) (the names of input file = HWYTRIP, SELHIST) generated by the LOAD HIGHWAY SELECTED LINKS function and produces reports for the detailed analysis of specific sections of loaded networks. Exhibits 9-18 and 9-19 show examples of the control file and output, respectively.

```
$REPORT COMPLEX WEAVES
$FILES
   INPUT FILE = HWYTRIP, USER ID = $GMTVOL.DAT$
   INPUT FILE = SELHIST, USER ID = $SELHIST.DAT$
$HEADERS
                              REPORT COMPLEX WEAVES
                                B/CS TEST NETWORK
                           EXIT AND ENTER RAMPS ON HWY-6
$DATA
   WEAVE SET
   ID = HIGHWAY WEAVES
   ENTRY LINKS = 1037-1038,1044-1045,1052-1053,1059-1060
   EXIT LINKS = 1041-1042,1049-1050,1056-1057,1065-1066
$END TP FUNCTION
```

Exhibit 9-18. A Sample Control File for Report Complex Weaves.

```
DCCO / UAG                          REPORT COMPLEX WEAVES                PAGE NO.    1
TRANPLAN SYSTEM                       B/CS TEST NETWORK                  DATE   29JUL87
VERSION 5.0                    EXIT AND ENTER RAMPS ON HWY-6             TIME  11:08:19

                        COMPLEX WEAVE ANALYSIS REPORTS

WEAVE SET NO.  1     ID = HIGHWAY WEAVES

                                 EXIT LINKS
          ENTRY      1041   1049   1056   1065
          LINKS     -1042  -1050  -1057  -1066  TOTAL

     1037 - 1038        3    452    337    514   1306
     1044 - 1045        0     92     70     98    260
     1052 - 1053        0      0    107    863    970
     1059 - 1060        0      0      0   1925   1925

           TOTAL        3    544    514   3400   4461
```

Exhibit 9-19. A Sample Output for Report Complex Weaves.

A typical application of this particular function is to determine the movements of trips entering and exiting a section of freeway. The report output, which is a series of "from-to" matrices with volumes stratified by "Entry" and "Exit" links, is useful in freeway weaving analysis. Entry and exit links are typically freeway ramps but would also include the two freeway links leading into and out of the weaving section. The function can also be used to identify volumes utilizing an isolated pair or sets of selected links. Each entry and exit link must have been specified as a selected link during the loading process.

No options and parameters are specified for this function except the SELECTED PURPOSE parameter specification. Up to 20 weave link sets may be reported in a single run. Each set is defined by entry and exit links (by ENTRY and EXIT LINKS data specifications) restricted only by the number of selected links which can be specified while generating the selected link history file.

REPORT HIGHWAY INCREMENTAL SUMMARY

This function produces three types of reports which describe the time and speed changes on a highway network during each iteration of incremental loading (the name of input file = LODHIST) (see Exhibit 9-20).

```
$REPORT HIGHWAY INCREMENTAL SUMMARY
$FILES
   INPUT FILE = LODHIST, USER ID = $HWYLOD2.DAT$
$HEADERS
                    REPORT HIGHWAY INCREMENTAL SUMMARY
                              B/CS TEST NETWORK
                  FOR SELECTED LINKS WITH COUNT VOLUMES
$OPTIONS
   PRINT LINK SUMMARY
   PRINT CHANGE DISTRIBUTIONS
   PRINT GROUND COUNT COMPARISON
$PARAMETERS
   SELECTED AND NODES = 270-282,284,285,333,325,330,358,990,378,1089,
                        308,309,336,1076,338,340,339,1085,341,864,
                        343,345,347,988,358,359,361,870,364,872,
                        406,407,412,1103,419,421,424,425,435,436,
                        439,474,465,468,472,475,478,991,480,481,487,
                        573,533,534,536,539,537,538,543,1055,546,
                        572,579,580,586,633,600,601,618,619,619,904,
                        619,620,622,624,624,697,629,630,637,639,
                        715,908,717,906,717,718,720,721,720,726,
                        760,972,862,1087,871,1070,887,888,928,1043,
                        1071,1069,1074,1078,1081,1086,1087,1102,
                        1119,1102,1104,1105,1106,1115,1116
$END TP FUNCTION
```

Exhibit 9-20. A Sample Control File for Report Highway Incremental Summary.

- A detailed report, by link(s) selected, of the time, speed, and loaded volume changes for each successive iteration (by PRINT LINK SUMMARY option), is shown in the following Exhibit 9-21. All links are reported unless selected ranges of links are specified with SELECTED OR NODES and/or SELECTED AND NODES parameters.

DCCO / UAG
TRANPLAN SYSTEM
VERSION 5.0

REPORT HIGHWAY INCREMENTAL SUMMARY
B/CS TEST NETWORK
FOR COMPARING WITH COUNT VOLUMES

PAGE NO. 1
DATE 24JUL87
TIME 11:41:41

LOADED LINK SUMMARY REPORT

ANODE	BNODE	CAPACITY	VOLUME OR CAPACITY2	DIST	TIME	SPEED	PERCENT LOADED	ASSIGNED VOLUME	ACCUMULATED VOLUME	VOLUME / CAPACITY	PROJECTED VOLUME	PRO.VOL/ CAPACITY	ITERATION
270	333	5000	4020	.10	.12	50.00	40	2666	2666	.53	6665	1.33	1
					.13	46.15	70	2070	4736	.95	6765	1.35	2
					.14	42.86	90	1298	6034	1.21	6704	1.34	3
					.15	40.00	100	656	6690	1.34	6690	1.34	4
			WEIGHTED AVERAGE		.13	46.18							
271	325	5000	295	.10	.12	50.00	40	208	208	.04	520	.10	1
					.12	50.00	70	241	449	.09	641	.13	2
					.12	50.00	90	89	538	.11	597	.12	3
					.12	50.00	100	26	564	.11	564	.11	4
			WEIGHTED AVERAGE		.12	50.00							
272	330	8100	4650	.10	.12	50.00	40	2832	2832	.35	7080	.87	1
					.12	50.00	70	2167	4999	.62	7141	.88	2
					.12	50.00	90	1379	6378	.79	7086	.87	3
					.12	50.00	100	686	7064	.87	7064	.87	4
			WEIGHTED AVERAGE		.12	50.00							
273	330	8100	510	.10	.12	50.00	40	365	365	.05	912	.11	1
					.12	50.00	70	343	708	.09	1011	.12	2
					.12	50.00	90	164	872	.11	968	.12	3
					.12	50.00	100	64	936	.12	936	.12	4
			WEIGHTED AVERAGE		.12	50.00							
274	358	5000	1055	.10	.12	50.00	40	817	817	.16	2042	.41	1
					.12	50.00	70	675	1492	.30	2131	.43	2
					.12	50.00	90	375	1867	.37	2074	.41	3
					.12	50.00	100	181	2048	.41	2048	.41	4
			WEIGHTED AVERAGE		.12	50.00							
275	358	5000	442	.10	.12	50.00	40	332	332	.07	830	.17	1
					.12	50.00	70	316	648	.13	925	.19	2
					.12	50.00	90	150	798	.16	886	.18	3
					.12	50.00	100	61	859	.17	859	.17	4
			WEIGHTED AVERAGE		.12	50.00							
276	990	8100	4775	.10	.12	50.00	40	3306	3306	.41	8265	1.02	1
					.12	50.00	70	2527	5833	.72	8332	1.03	2
					.12	50.00	90	1618	7451	.92	8278	1.02	3
					.12	50.00	100	805	8256	1.02	8256	1.02	4
			WEIGHTED AVERAGE		.12	50.00							

Exhibit 9-21. A Sample Output for Report Highway Incremental Summary by Print Link Summary Option.

- Frequency distributions of links (one for each iteration), stratified by (a) ratios of projected volume/capacity and (b) time/speed differences between each iteration and the base network (by PRINT CHANGE DISTRIBUTIONS option) are shown in Exhibit 9-22.

DCCO / UAG
TRANPLAN SYSTEM
VERSION 5.0

REPORT HIGHWAY INCREMENTAL SUMMARY
B/CS TEST NETWORK
FOR COMPARING WITH COUNT VOLUMES

PAGE NO. 49
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DISTRIBUTION OF LINKS BY TRAFFIC VOLUME AND TIME/SPEED CHANGE, USING PROJECTED VOLUMES

RESULTS OF ITERATION 4 -- 10 PCT. ASSIGNED
TOTAL ACCUMULATED PERCENT OF TRIPS ASSIGNED = 100 PCT.

TOTAL NUMBER OF SECTIONS WITHOUT CAPACITIES = 0
TOTAL PROJECTED VOLUME OF LINKS W/O CAPACITY = 0

NEW TIME OR SPEED MINUS VALUE USED IN ITERATION NO. 3

	POSITIVE SPEED DIFFERENCE								NEGATIVE TIME DIFFERENCE								-TOTALS-		
PROJECTED VOL/CAPTY RATIO	20+	15-19	10-14	7- 9	5- 6	3- 4	1- 2	.1-.9	0	.1-.9	1- 2	3- 4	5- 6	7- 9	10-14	15-19	20+	NO. OF SECT.	AVER. CAPAC.	AVER. PROJ. VOLUME
0.00-0.09	0	0	0	1	19	26	9	0	15	70	0	0	0	0	0	0	0	70	6274	234
0.10-0.19	0	0	0	3	6	14	6	0	5	34	0	0	0	0	0	0	0	34	7459	1123
0.20-0.29	0	0	0	0	7	13	10	0	5	35	0	0	0	0	0	0	0	35	4736	1165
0.30-0.39	0	0	0	1	5	10	5	0	0	21	0	0	0	0	0	0	0	21	4817	1683
0.40-0.49	0	0	0	3	4	14	3	0	1	25	0	0	0	0	0	0	0	25	7600	3317
0.50-0.59	0	0	0	1	6	9	4	0	5	25	0	0	0	0	0	0	0	25	5834	3257
0.60-0.69	0	0	0	0	2	9	9	0	3	23	0	0	0	0	0	0	0	23	6926	4509
0.70-0.79	0	0	0	0	1	3	5	0	1	10	0	0	0	0	0	0	0	10	5840	4369
0.80-0.89	0	1	0	1	1	4	9	1	11	28	0	0	0	0	0	0	0	28	6470	5504
0.90-0.99	2	0	0	1	0	1	5	1	8	18	0	0	0	0	0	0	0	18	7003	6689
SUB-TOTAL	2	1	0	11	51	103	65	2	54	289	0	0	0	0	0	0	0	289	6299	2481
	POSITIVE TIME DIFFERENCE								NEGATIVE SPEED DIFFERENCE											
1.00-1.09	1	0	0	1	0	2	5	2	10	21	0	0	0	0	0	0	0	21	8343	8666
1.10-1.19	1	0	1	0	4	1	3	0	2	12	0	0	0	0	0	0	0	12	8050	9240
1.20-1.29	0	0	0	6	1	0	2	0	0	9	0	0	0	0	0	0	0	9	8444	10552
1.30-1.39	0	1	2	2	0	1	1	0	1	8	0	0	0	0	0	0	0	8	5856	7865
1.40-1.49	2	1	1	2	0	1	0	0	0	7	0	0	0	0	0	0	0	7	7114	10238
1.50-1.59	2	1	1	0	0	0	0	0	0	4	0	0	0	0	0	0	0	4	5225	8076
1.60-1.69	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	1	7400	12521
1.70-1.79	2	0	1	0	0	0	0	0	0	3	0	0	0	0	0	0	0	3	5433	9406
1.80-1.89	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.90-1.99	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.00-2.19	3	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	3	5433	11371
2.20-2.39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.40-2.59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.60-2.79	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.80-2.99	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.00-3.49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.50-3.99	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.00-4.49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.50-4.99	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>5.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	13	4	6	23	56	108	76	4	67	355	2	0	0	0	0	0	0	357	6515	3772

Exhibit 9-22. A Sample Output for Report Highway Incremental Summary by Print Change Distributions Option.

- A Ground Count Comparison Report produces various summary statistics which are useful in evaluating the ability of the highway network to reproduce counted traffic volumes (by PRINT GROUND COUNT COMPARISON option) (see Exhibit 9-23).

DCCD / UAG
TRANPLAN SYSTEM
VERSION 5.0

REPORT HIGHWAY INCREMENTAL SUMMARY
B/CS TEST NETWORK
FOR COMPARING WITH COUNT VOLUMES

PAGE NO. 53
DATE 24JUL87
TIME 11:41:41

GROUND COUNT COMPARISON REPORT

RESULTS OF ITERATION 4 -- 10 PCT. ASSIGNED		TOTAL VOLUME ASSIGNED TO COUNT LINKS THIS LOADING.	82708
TOTAL ACCUMULATED PERCENT OF TRIPS ASSIGNED.	100 PCT.	TOTAL ACCUMULATED ASSIGNMENT TO COUNT LINKS.....	912193
TOTAL VOLUMES OF COUNTS.....	949739	TOTAL NUMBER OF LINKS WITHOUT COUNTS.....	91
TOTAL PROJECTED ASSIGNED VOLUME.....	912193	TOTAL ACCUMULATED ASSIGNMENT TO LINKS W/O COUNTS..	434337
COUNT MINUS PROJECTED VOLUME.....	37546	PERCENT OF TOTAL COUNT ASSIGNED THIS LOADING.....	8.7
PERCENT ERROR IN PROJECTED ASSIGNMENT.....	4.0	PERCENT ACCUMULATED VOLUME OF TOTAL COUNT.....	96.0

COUNT VOL GROUP	NO. OF SECTIONS	AVERAGE COUNT	AVERAGE PROJ. VOL	AVERAGE DIFFERENCE	STANDARD DEVIATION	PCT.STD.DEV./ AVE COUNT	PERCENT OF TOTAL	WEIGHTED AVERAGE	ROOT MEAN SQUARE	PERCENT R.M.S.	AVG ACCUM VOLUME	PCT AVE COUNT
1- 1000	44	479	764	-283	819	171.0	2.2	379.4	866	180.8	88	18.4
1001- 2000	66	1448	1605	-156	1373	94.8	10.1	954.1	1382	95.4	171	11.8
2001- 3000	55	2444	1968	476	1400	57.3	14.2	810.7	1479	60.5	196	8.0
3001- 5000	34	4032	3935	97	2754	68.3	14.4	985.9	2756	68.4	435	10.8
5001- 7000	37	5871	5063	808	3268	55.7	22.9	1273.1	3366	57.3	460	7.8
7001- 10000	18	8462	9652	-1189	3216	38.0	16.0	609.5	3429	40.5	967	11.4
10001- 15000	6	13670	14087	-417	1872	13.7	8.6	118.3	1918	14.0	669	4.9
15001- 20000	4	17436	13466	3971	1344	7.7	7.3	56.6	4192	24.0	582	3.3
20001- 25000	2	20097	15562	4535	1407	7.0	4.2	29.6	4748	23.6	619	3.1
TOTAL	266	3570	3429	141	2211	61.9	100.0	6192.5	2216	62.1	311	8.7

Exhibit 9-23. A Sample Output for Report Highway Incremental Summary by Print Ground Count Comparison Option.

For the Incremental Loading of the LOAD HIGHWAY NETWORK function, the counted volume may be taken as the capacity (by CAPACITY 2 option) for assigned volume/capacity ratio determination. In this function, CAPACITY 2 option specifies that the link capacities used in the INCREMENTAL LOADING were extracted from the counted volume field of each link data record. If this option were not selected, capacities were extracted from the capacity field.

A Ground Count Comparison Report specifies that summaries are to be stratified according to selected volume groups in addition to 14 standard sets of groups (by ADDITIONAL VOLUME GROUPS parameter specification). The selected groups are defined by their lower and upper limits (e.g., 1-1500), and up to 35 additional groups may be specified.

REPORT HIGHWAY NETWORK SUMMARY

This function reports summaries of highway network characteristics stratified by link class (i.e., link group and assignment group code values) (the name of input file = LODHIST). Exhibit 9-24 shows a sample control file setup for report highway network summary. The summary report may be one-, two- or three-dimensional tables, depending on how many link classes are specified. Also, selected values of link classes may be reported to reduce the amount of printing (see Exhibit 9-25).

```
$REPORT HIGHWAY NETWORK SUMMARY
$FILES
    INPUT FILE = LODHIST, USER ID = $HWYLOD11.DAT$
$HEADERS
                        REPORT HIGHWAY NETWORK SUMMARY
                            B/CS TEST NETWORK
                        FOR LOADING OF ALL-OF-NOTHING
$PARAMETERS
    SCREENLINE = 1, LINK = 720-721,723-1021,747-945,753-947,752-756,
                           1031-1033,950-757,949-757
$DATA
ID, STATISTICAL RESULTS FROM ALL-OR-NOTHING
    TABLE = 1 UNITS = VEHICLE-DISTANCE
    TABLE = 2 UNITS = CAPACITY2-DISTANCE
    TABLE = 3 UNITS = VOLUME/CAPACITY
$END TP FUNCTION
```

Exhibit 9-24. A Sample Control File for Report Highway Network Summary.

```
DCCO / UAG                      REPORT HIGHWAY NETWORK SUMMARY          PAGE NO.     1
TRANPLAN SYSTEM                      B/CS TEST NETWORK                  DATE   29JUL87
VERSION 5.0                     FOR LOADING OF ALL-OF-NOTHING           TIME   16:26:42

      SCREEN LINE VOLUME REPORT

      SCREEN LINE NO.  1

      A-NODE   B-NODE    VOLUME

        720      721       460
        723     1021       478
        747      945      1695
        753      947         0
        752      756      3855
       1031     1033      3527
        950      757      3308
        949      757         0

SCREEN LINE TOTAL =        13323
```

Exhibit 9-25. A Sample Output for Report Highway Network Summary.

The network characteristics may be summarized (Cost, Distance, Time, User, Vehicle Cost, Vehicle-Distance, Vehicle-Hours, Vehicle User, Capacity Time, Capacity Distance, Volume/Capacity) (by ID and UNITS data). Up to 20 such tables (by the number of TABLES data) may be reported in a single run of this function. COST and DISTANCE UNITS parameters specify the name of the unit to be printed in all reports.

In addition, the function permits specification of up to 1000 one-way links to be summarized as screenlines from a loaded highway network (by SCREENLINE and LINKS data specifications). Incremental directional volumes crossing each link are reported for each selected iteration together with the screenline totals.

Although the input file is always specified as LODHIST, the function will accept either a loaded or unloaded highway network file. For a loaded highway network history file, loaded volumes reported are total volumes unless selected iterations and/or purposes are selected.

REPORT HIGHWAY NETWORK ACCESSIBILITY

This function reports the "accessibility" of selected origin zones of a highway or transit network (the name of input file = NETSKIM). Accessibility is defined here as the distribution of some defined activity measure versus the travel impedance to reach that activity from the selected zone(s). The activity measure may be population, employment, or the like; and it may be expressed in terms of trip end frequencies.

A useful application of this function is in the evaluation of alternative transportation corridors to link a suburban zone to employment centers in the rest of the metropolitan area. The zone would be specified as a selected origin zone; home-based work trip attractions for the metropolitan area could be used as an indicator of potential employment. The function would report the number of trip attractions within each minute time interval (based on the network skims for the alternative in question) and the cumulative distribution. Plotting of such distributions for all alternative networks would assist in comparing accessibility of the selected zone (by SELECTED ZONES parameter) to area-wide employment (or employment trip ends) for the various alternatives. Median values would also give some indication of relative accessibilities.

Each selected origin zone and each "purpose" produces a separate accessibility report (by SELECTED PURPOSES parameter). Activity measures may be included for any or all of the destination zones.

REPORT TRIP LENGTH FREQUENCY

This function reports the trip length frequency statistics for an input trip table (the name of input file = VOLUME) merged with an input selected summation (skim) file (the name of input file = SKIM). A trip length frequency report is generated for each purpose. Trip length histograms, both for each impedance increment and for the accumulated trips up to each impedance increment, are displayed, along with average statistics.

10. PLOTTING

The TRANPLAN package contains two plotting modules: the PLOTNET module is utilized for PLOT HIGHWAY NETWORK and PLOT HIGHWAY LOAD and the PLOTPATH is for PLOT HIGHWAY PATHS. The plotting programs support the three principal plotters in use today: CALCOMP, Hewlett-Packard, and Houston Instruments. The method of installation and operation depends on the plotter (see the README.* files in a plotting program disk and/or the plotter user manual distributed with the plotter). After generation of the output file (TPLOT), the file should be copied to the plotter.

For drum plotters, paper widths typically vary from 10 inches to 36 inches in the Y-direction. The length of 10 feet is recommended. For the plotters without drums, the size of paper is a function of the plotter hardware from 8.5 x 11 inches to usually about 3 x 4 feet.

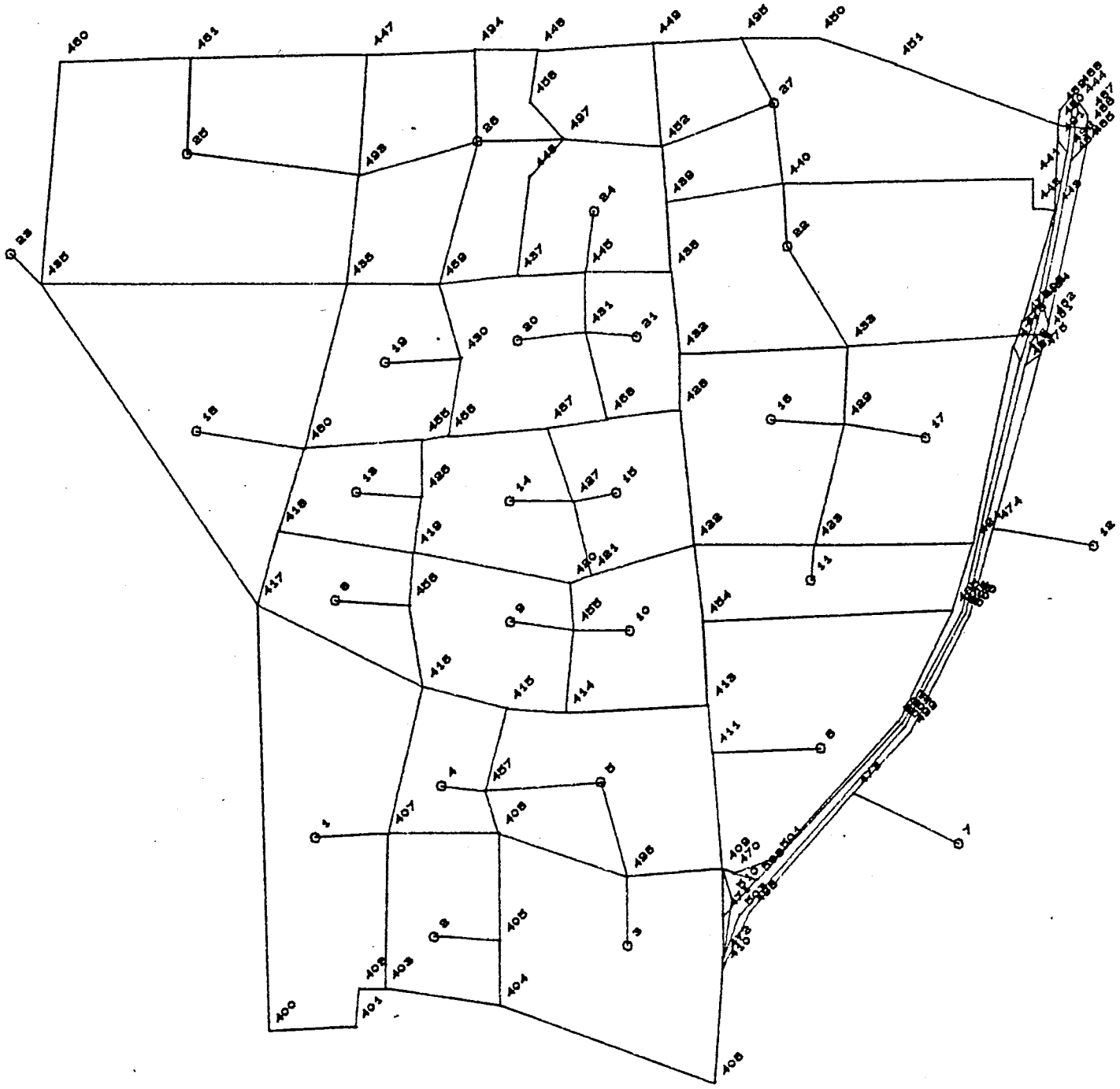
PLOT HIGHWAY NETWORK

This function generates a graphic description of a highway network (the name of output file = TPLOT) based on its node coordinate data (the name of input file = HWYNET). The simplest form includes a plot of the links, node numbers and centroids. Depending on the specified limits of the X- and Y-coordinates, all or part of the network can be plotted. Exhibit 10-1 illustrates an example control file for plotting highway network. Exhibit 10-2 shows the plot of highway network.

```
$PLOT HIGHWAY NETWORK
$FILES
  INPUT FILE = HWYNET, USER ID = $DRRNET1.DAT$
  OUTPUT FILE = TPLOT, USER ID = $NET1.DAT$
$HEADERS
                        PLOT HIGHWAY NETWORK
                  USING TEST NETWORK WITH DAN'S ZONES
                        SOUTH OF B/CS NETWORK
$OPTION
  SINGLE PEN
$PARAMETERS
  PLOTTER = HP7475
  PAPER = NORMALA
  PLOT SIZE = 8
  MAXIMUM X = 2424
  MINIMUM X = 1
  MINIMUM Y = 126
  MAXIMUM Y = 2470
  SCALE FACTOR = 346.15
  CHARACTER HEIGHT = 0.04
  ROTATION ANGLE = 270
$END TP FUNCTION
```

Exhibit 10-1. A Sample Control File for Plot Highway Network.

Links are represented by up to ten different colors according to the value of user-specified link attributes (by Selection Attribute parameter



PLOT HIGHWAY NETWORK
USING TEST NETWORK WITH DAN'S ZONES
SOUTH OF B/CS NETWORK

27NOV87 14:04:41

Exhibit 10-2. A Sample Output for Plot Highway Network.

and the Color and Attribute data specifications). Allowable values of the link attributes are Link Groups 1, 2, or 3; Assignment Group; Speeds 1 or 2; Capacity; Volume; Volume Capacity Ratio; Cost; Distance; Times 1 or 2; or user. The link attributes may be used to selectively plot links of a network. Also, values of some link characteristics (by Link Annotation parameter) may be posted alongside each link (by Annotation Factor parameter) or plotted as band widths (by Band Width Factor parameter). Street names up to 20 characters are permitted with user options controlling where the names are posted (by the Input File = ROADATA).

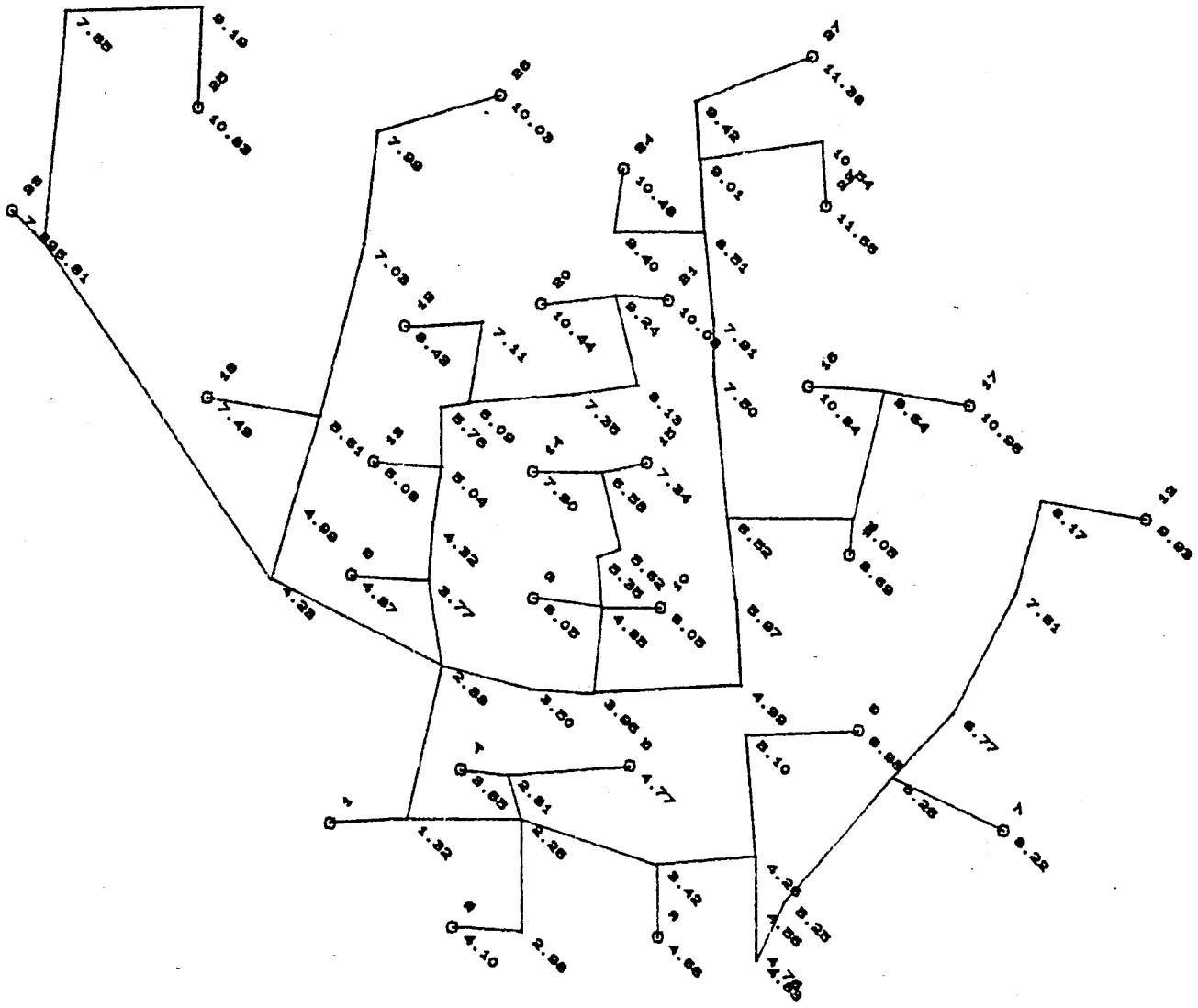
The Suppress Node Numbers option specifies that the node numbers are not to be plotted. The Only Centroid Nodes option specifies that only centroidal links will be plotted if nodes are not suppressed. The Plot Size parameter that specifies the width of the paper in inches in the Y-direction is required. The height of characters can be adjusted by the Character Height parameter. The Rotation Angle parameter specifies a rotation angle in floating point degrees.

PLOT HIGHWAY PATHS

This function selectively plots paths of minimum impedance (the name of output file = TPLOT) from a standard highway network or loaded highway network history file (the name of input file = HWYNET). The plot includes links and their associated node numbers. The cumulative value of the impedance may also be plotted (by Post Cumulative Impedances option). Exhibit 10-3 illustrates an example control file for plotting highway paths. Exhibit 10-4 shows the plot of a highway path.

```
$PLOT HIGHWAY PATHS
$FILES
  INPUT FILE = HWYNET, USER ID = $DRRNET1.DAT$
  OUTPUT FILE = TPLOT, USER ID = $PATH1.DAT$
$HEADERS
                                PLOT HIGHWAY PATHS
                      USING SOUTH OF B/CS NETWORK WITH 27 ZONES
                         SELECTED ZONE = 1 AND ANGLE = 270
$OPTION
  POST CUMULATIVE IMPEDANCES
  SUPPRESS NODE NUMBERS
  SINGLE PEN
$PARAMETERS
  PLOTTER = HP7475
  PAPER = NORMALA
  IMPEDANCE = TIME2
  SELECTED ZONES = 1
  PLOT SIZE = 8
  CHARACTER HEIGHT = 0.04
  MAXIMUM X = 2700
  ROTATION ANGLE = 270
$END TP FUNCTION
```

Exhibit 10-3. A Sample Control File for Plot Highway Path.



PLOT HIGHWAY PATHS
USING SOUTH OF B/CS NETWORK WITH 27 ZONES
SELECTED ZONE = 1 AND ANGLE = 270

FROM ZONE 1

87 17: 56: 15

Exhibit 10-4. A Sample Output for Plot Highway Path.

Paths which are automatically built within this function may be based upon any one of the five standard impedance measures (by Impedance parameter): Time 1, Time 2, Cost, User, or Distance. The user may select any number of origin zones (by Selected Zones parameter) as well as up to 20 origin nodes (by Selected Nodes parameter) from which to plot paths. Each selected zone or node should generate a separate plot. If a loaded highway network file is being plotted, path impedances may be taken from any iteration of the file (by Selected Iterations parameter).

The Suppress Node Numbers option specifies that the node numbers are not to be plotted. The Only Centroid Nodes option specifies that only centroidal links will be plotted if nodes are not suppressed. The Plot Size parameter that specifies the width of the paper in inches in the Y-direction is required. The height of characters can be adjusted by the Character Height parameter. The Rotation Angle parameter specifies a rotation angle in floating point degrees.

PLOT HIGHWAY LOAD

This function generates a graphic description of a loaded highway network based on its node coordinate data. The same multicolor, selection, and annotation capabilities exist for this function as for the PLOT HIGHWAY NETWORK function. Exhibit 10-5 illustrates an example control file for plotting highway load.

```
$PLOT HIGHWAY LOAD
$FILES
  INPUT FILE = LODHIST, USER ID = $DRRLOD2.DAT$
  OUTPUT FILE = TPLOT, USER ID = $LOAD1.DAT$
$HEADERS
                          PLOT HIGHWAY LOAD
                  USING TEST NETWORK WITH DAN'S ZONES
                        SOUTH OF B/CS NETWORK
$OPTION
  SINGLE PEN
  ONLY CENTROID NODES
  AVERAGE BPR ITERATIONS
  BOTH DIRECTIONS
$PARAMETERS
  PLOTTER = HP7475
  PLOT SIZE = 8
  SELECTION ATTRIBUTE = VOLUME CAPACITY RATIO
  CHARACTER HEIGHT = 0.04
  ROTATION ANGLE = 270
$DATA
  COLOR = BLACK, ATTRIBUTE = 0 - 79
  COLOR = BLUE, ATTRIBUTE = 80 - 99
  COLOR = GREEN, ATTRIBUTE = 100 - 199
  COLOR = RED, ATTRIBUTE = 200 - 9999
$END TP FUNCTION
```

Exhibit 10-5. A Sample Control File for Plot Highway Load.

11. NEDS

INTRODUCTION

TRANPLAN has been interfaced with interactive graphics software for Network Editing and Display (NEDS). NEDS was developed by the Center for Urban Analysis in association with Jim Fennessy and Ed Granzow of The Urban Analysis Group. NEDS contains two modules: HNEDS for highway networks and TNEDS for transit networks. NEDS was developed in a production environment. NEDS is an on-line, menu-driven graphics package for the creation and maintenance of transportation planning networks as well as for the display of network attributes and assignments.

NEDS is also written in structured FORTRAN77 and currently executes on PRIME and VAX minicomputers, UNIX-based MC 68000, MicroVAX computers, and the IBM PC family of microcomputers with 640 Kbytes RAM and with 560 Kbytes available. For all systems, a high resolution monitor option is available. For the IBM PC microcomputer, an EGA (Enhanced Graphics Adapter, 640x350 resolution) option is available. Although no processor board upgrade is required, a MicroSoft-compatible mouse system is necessary for cursor movement on the EGA monitor.

NEDS minimizes the time to prepare and change transportation networks and presents modelling results quickly via screen displays. NEDS has the following features:

- o Hard copy options
- o Color displays
- o Volume/Capacity analysis
- o Link loadings
- o Transit line loadings
- o Network zoom and pan
- o User-specified restart
- o Restore last/next views
- o Interactive network editing
- o Band width displays
- o Minimum path determination
- o Highway/Transit networks
- o Alternate host computers
- o High/medium resolution monitors
- o Icon and menu-driven
- o Link attribute posting

NEDS INSTALLATION AND OPERATION

NEDS is a user-oriented, menu-driven system which is easy to learn because the menus are essentially self-explanatory. To execute the NEDS program, the following steps of installation and operation should be performed:

1. COPY HNEDS.EXE to the current (working) directory or into a directory on the DOS "PATH."
2. The three configuration files (NEDS.CFG, NEDMENU.CFG, NEDATTR.CFG) must be in the current directory.
3. Ensure that the network file is in the current directory.
4. Type HNEDS to execute the program.
5. Enter the input filename.
6. Enter distance scale factor (any numeric value, e.g. 100).
7. Select either Capacity1 or Capacity2.
8. Enter selected loaded iteration.
9. Select command and options using a mouse after showing cross mark in the center of the monitor.

If EGAEPSON.COM is invoked prior to the execution of HNEDS, then at any point the current contents of the screen may be plotted on an EPSON (or compatible) printer by entering <shift> PrtSc. While NEDS is running, the principle source of program control is through the graphics cursor. The graphics cursor is moved around the screen to point at particular objects which are selected for specific purposes. The user terminal must be equipped with a mouse (or digitizer). The cursor is controlled by the mouse, and an option is selected by depressing any button on the mouse. This sequence of point and select is referred to as a pick. When a pick is requested by NEDS, the user positions the cursor and depresses a mouse button at the desired location.

During some commands, the program may require the entry of alphanumeric data, such as a file name or zone number. When this occurs, a prompt will appear in the dialogue area requesting the desired information. The response is entered and terminated by depressing the RETURN or ENTER key.

A command is activated by picking the location of the command as it appears in the command menu. When a command is picked, it will become "turned-on," meaning that its menu entry will become highlighted and that the command will get ready or will begin to execute. Commands will automatically be turned off if they are invoked incorrectly, or in some cases, when they are aborted. If a command is not behaving as expected, the user should ensure that it is on. A good rule to follow is that if a command's menu entry is highlighted, the command is either in the process of executing, or it is waiting for further action from the user.

The behavior of a command falls into one of several categories, depending on the purpose of the command. Commands which control the reading and writing of network files execute once via user-directed prompts. Commands which adjust the display window execute once and may be executed within most commands. Commands which enable different display characteristics are turned on and off (toggled) like light switches, and remain active while other commands execute. Many commands which perform editing or which adjust the color menu usually stay turned on, allowing repeated executions. In general, the user can switch freely between commands in this last category without turning the current commands off.

NEDS utilizes nine icons, four windows, and dialogue queries to control program execution and allocation of network files. Exhibit 11-1 shows NEDS screen layouts.

NEDS FILE READING AND WRITING

After invoking the system command(s) required to initiate NEDS, the program asks the user for the input highway network or loaded highway network file via the following prompt: "Enter name of input file >."

The user responds by entering the file name of the input file. NEDS checks to see if the file exists and, if not, prompts the user to respecify the file name. The user may also specify "NONE" or "none" to exit NEDS at this point. If NEDS has been used in the update mode, then NEDS requests that the user specify a final or interim output file name via the following prompt: "Enter name of output file >."

Again, the user responds by entering the desired file name for the output. If the file specified by the user already exists, then the user must respecify another file name. A response of "NONE" or "none" tells NEDS that the updates for this NEDS session will not be saved.

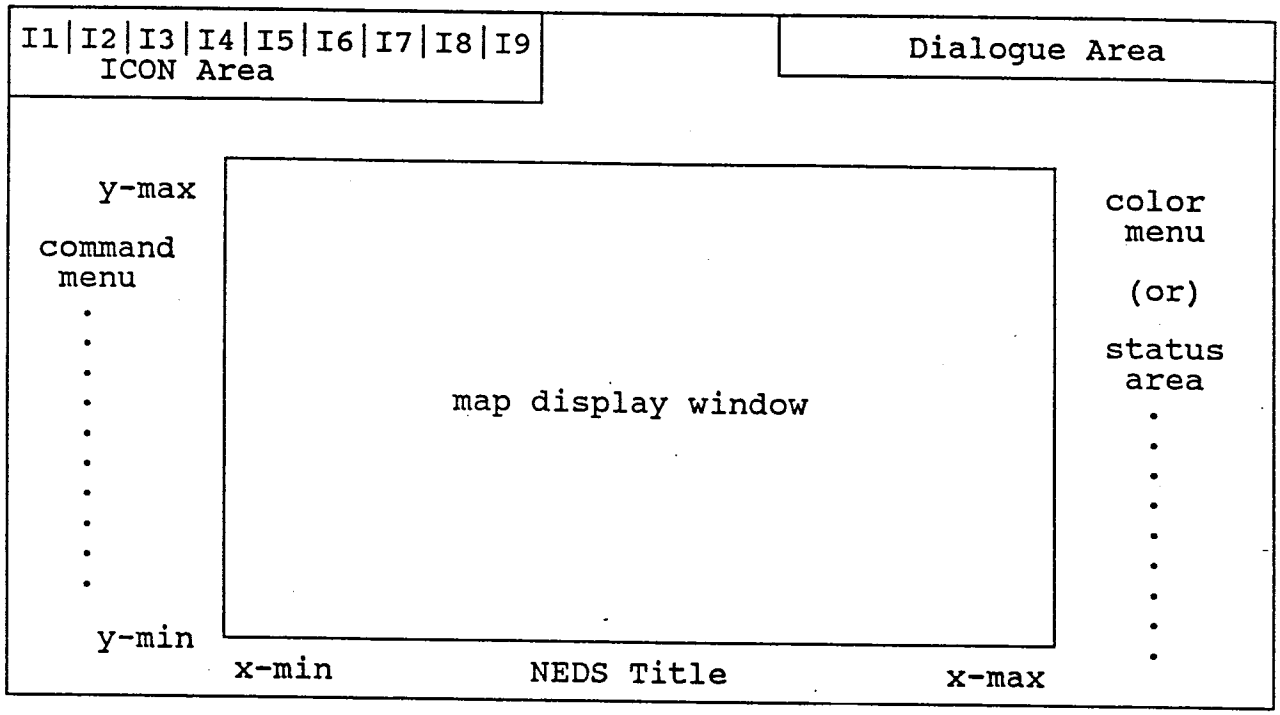


Exhibit 11-1. NEDS Screen Layout.

STOP DRAW

The user can interrupt the program when it is drawing a network at any time by pressing the right hand button on the mouse and holding it until the drawing operation stops. Once the drawing has stopped, the button can be released and a prompt will appear in the dialogue area.

Stop Draw? (Y/N)

Typing a "Y" and the RETURN key will stop the current operation and allow the user to select a different function. Typing an "N" or any other character followed by the RETURN key will cancel the interrupt and allow drawing to continue.

NEDS ICONS

NEDS utilizes nine icons to control program execution and options. Four user-specifiable windows are symbolized by four additional icons. These icons are constantly displayed for invocation at any time during the execution of NEDS:

I1. A "STOP" sign to exit NEDS.

I2. An "EASEL" to load the setup menu.
I3. An "EYEGLASS" to load the view menu.
I4. A "PENCIL/ERASER" to load the update menu.
I5. A posting "link with annotation" to set posting criteria.
I6. A network with boundary outline to specify subarea network extraction.
I7. A "1" to signify graphics page number 1.
I8. A "2" to signify graphics page number 2 -- only two pages are available and the mouse drivers do not currently display the cursor on graphics page 2. The page 2 capability is only available on the IBM PC with the EGA monitor.
I9. A "SCREEN" icon to redefine the view area and retain the current menu and status area.

USER WINDOWS

Up to four user windows can be defined for each NEDS session. These windows are created through use of the zoom, pan, and window by coordinates' options to define the desired display window. Following this, the user picks any of the four "window pane" icons displayed at the top of the screen and is prompted for a three-character ID to be used to identify the window. This ID is then displayed below the selected icon to identify the window. User window settings can be saved as part of user profiles.

SETUP MENU (I2)

This menu is utilized to control various display and update options in NEDS. The commands available on this menu are "toggled" ON (highlighted) and OFF.

- NODE -- (Default OFF) -- When this option is selected, the nodes in the network are displayed with a 'o'.

- CENTROID -- (Default OFF) -- When this option is selected, the centroids (or zones) in the network are displayed with a '*'.

- X,Y CORD -- (Default OFF) -- With this option invoked, node coordinates are displayed by each node in the display window. This option should be used in conjunction with the "POST LINK" or "AUTO POST" options of the View Menu as described below.

- NODE NUMBR -- (Default OFF) -- This option causes node numbers to be displayed by each node in the display window. This option is also used with the "POST LINK" and "AUTO POST" options.

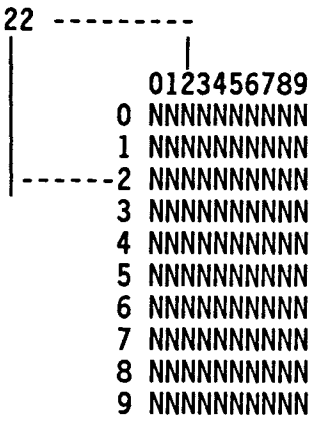
- AUTO CORD -- (Default ON) -- This option controls the assignment of new node coordinates during the updating mode of NEDS. If ON, then NEDS will automatically assign the coordinates of any new nodes; if OFF, then the user will be prompted to assign the coordinates.

- AUTO NODE -- (Default ON) -- This option controls the assignment of new nodes during the updating mode of NEDS. If ON, then NEDS will automatically select new node or centroid numbers; if OFF, then the user will be prompted to assign new node numbers.

- AUTO LINK -- (Default ON) -- This option controls the calculation of link distances. If ON, then NEDS will automatically calculate the distance; if OFF, then the user must input the distance via the update menu and change the distance attribute.

- LG1, LG2, LG3, and ASG -- (Default OFF) -- These four options (mutually exclusive) control the color displays by link type. Only one of these options may be selected at any one time.

- CHNG LGRNG -- (Default OFF) -- When this option is selected, the color options are displayed in the color menu area of the screen with a link (or assignment group) table displayed below the color selection:



  The user positions the cursor into any of the color selection boxes in the color menu area, presses the mouse button, and "pokes" as many of the link group values which are to be displayed in the selected color. The group table is depicted as units across and tens down; i.e., assignment group codes only reference the first row. For example, to select code 21 and a color of Blue the user would first pick the blue rectangle and then the third row and third column of the values table, as illustrated above.

- READ UPRF -- This option allows the user to read in a previously saved session profile. The session profile contains the user selected settings from the associated NEDS session. After selecting this option, the user is prompted for an eight or less character ID. If the requested profile is found, the screen is refreshed and any previously saved user window IDs are displayed at the top of the screen. More information about the form and content of NEDS User Profiles is presented at the back of this chapter.

- SAVE UPRF -- This option allows the user to save the current parameter settings of a NEDS session for later recall in a user profile. For further information about user profiles, see the above option READ UPRF.

VIEW MENU (I3)

This menu is utilized to specify various display options in NEDS. A highway network is viewed as a picture drawn in the map display window. The

specific size and location of the window is indicated by the X-min, X-max, Y-min and Y-max values that are displayed on the screen. The window may be adjusted to enlarge, reduce, or move around to different parts of the picture.

- DRAW NETWK -- If this option is selected, the entire network is drawn, including any updates performed during the current session.

- REDRAW -- If this option is selected, the current window is redrawn.

- CLR SCREEN -- This option is utilized to clear the entire screen and restore just the icon and window area boundaries. For direct connection to a computer, this option would very rarely be required; however, for dial-up access, this command could be used to redraw the entire screen which may have been corrupted by extraneously transmitted characters.

- ZOOM IN -- This option is utilized to enlarge a user-specified portion of the picture in the display window. Pick ZOOM IN once to turn it on. NEDS prompts the user to pick the upper left and lower right corners of a new view area in the display window. Those points form the opposite corners of a box which will be expanded as much as possible to fit and will be centered within the display area. Failure to pick two points in the display window will abort this command.

- ZOOM OUT -- This option is utilized to shrink a portion of the picture in the display window. Pick ZOOM OUT once to turn it on. NEDS prompts the user to pick the upper left and lower right corners of a new "box" in the display window. NEDS will fit the current window into the "box" and fill in the rest of the window with the environs about the current window. Failure to pick two points in the display window will abort this command.

- PAN -- This option is used for panning the display window relative to the current picture. Pick PAN to turn it on. NEDS prompts the user to pick two points in the display window. The first pick is any point in the window. The second pick is the desired location of that point in the redrawn window. Failure to pick two points within the display window will abort PAN.

- LAST VIEW -- This option is used for restoring previous pictures in the display window. The display will be redrawn using the "backward" window definition. LAST VIEW may be executed up to seven times to restore previous display windows. This is a circular command.

- NEXT VIEW -- This option is used for restoring previous pictures in the display window after the LAST VIEW commands are used. The display will be redrawn using the "forward" window definition. NEXT VIEW may be executed up to seven times to display next windows again. This is also a circular command.

- WIN BY CRD -- This option is used to select specific X and Y values for the minimum and maximum display window coordinates. Pick WIN BY

CRD to turn on this option. NEDS prompts the user for each coordinate value. When all four values have been entered, the display will be redrawn with the best possible fit. Failure to properly enter any value will abort this option.

- BAND CAP1 -- This option selects CAPACITY1 as the link attribute to be used for band width plotting. Typically, after picking this option, the user would select the NM OF BAND or CHNG BAND options to modify band width scaling.

- BAND CAP2 -- This option selects CAPACITY2 (or counted volume) as the link attribute to be utilized for band width plotting. Typically, the user would select the NM OF BAND or CHNG BAND options to modify band width scaling.

- BAND VOL -- This option selects the loaded volumes for band width plotting. Typically, the user would then select the NM OF BAND or CHNG BAND options to modify band width scaling.

- BAND V/C -- This option selects the volume/capacity ratio for each link for band width plotting. The volume field is the loaded volume on each link after assignment. Typically, the user would select the NM OF BAND or CHNG BAND options to modify band width scaling.

- COLOR V/C -- This options specifies that volume/capacity ranges will determine the colors for link and bandwidth displays.

- BAND V&C -- This option specifies that both volume and capacity will be displayed on each link as overlapping bandwidths. Where capacity exceeds volume, excess capacity is displayed as a green band; utilized capacity is displayed as a blue band. If volume exceeds capacity, the capacity deficiency appears as a red band. Typically, the user would select the NM OF BAND or CHNG BAND options to modify band width scaling.

- CHNG BAND -- When this option is selected, the user moves the cursor to the band widths displayed in the status area and changes the band width range value. The value to be changed is picked using the mouse, and NEDS prompts for a value to be entered in the dialogue area (followed by the RETURN key). Because the band widths are scaled linearly, the user should enter linear values for the requested values. Also, any link with a value not within the specified ranges will not be displayed. If the user enters a value in any single range and leaves all other values as "0," NEDS will automatically calculate proportional values for the "0" ranges. The values will be automatically changed when the user exits the CHNG BAND function by picking the FINISHED box in the lower right-hand corner of the screen.

- NM Of BAND -- When this option is specified, the user is prompted for the number of bands (for the particular band width option specified) desired. The user may specify from one to eight bands.

- PATH -- When this option is specified, NEDS prompts the user for a network impedance from which to build paths. The user is then

prompted to select a home zone or node as the origin for the path. This is followed by a prompt for a destination zone or node; if "0" is entered, then the path is displayed to all centroids from the origin node or centroid. When the path display is complete, the user can enter either "0" to the home node prompt to exit to the NEDS menu selection level or enter an origin and destination for another path. If another origin destination pair is selected, the new path will be superimposed on the current display in a new color.

- PATH NODE -- This option is the same as the PATH option except that the origin and destination of the path(s) have posted node/centroid numbers.

- POST LINK -- When this option is turned on, the user may select individual links for posting. All posting options set using the Post Menu will be displayed.

- AUTO POST -- This option is mutually exclusive with POST LINK and when picked, any network displayed will include posting of attributes set using the Post Menu.

The X Y COOR and NODE NUMBR options of the Setup Menu require that either POST LINK or AUTO POST be set to display these link attributes.

UPDATE MENU (I4)

This menu is utilized to pick the various update options in NEDS. A highway network is viewed as a picture drawn in the map display window. The specific size and location of the window is indicated by the X-min, X-max, Y-min, and Y-max values that are displayed on the screen. The window may be adjusted to enlarge, reduce, or move around to different parts of the picture.

Many of the options described in the Update Menu section utilize the auto repeat facility. This means that once the command is picked, it remains active until it is repicked. For instance, the ADD NODE command will continue to prompt the user for new node locations until it is explicitly switched off.

- DRAW NETWK -- If this option is selected, the entire network is drawn including any updates performed during the current session.

- REDRAW -- If this option is selected, the current window is redrawn.

- CLR SCREEN -- This option is utilized to clear the entire screen and restore just the icon and window area boundaries. For direct connection to a computer, this option would very rarely be required; however, for dial-up access, this command could be used to redraw the entire screen which may have been corrupted by extraneously transmitted characters.

- ZOOM IN -- This option is utilized to enlarge a user-specified portion of the picture in the display window. Pick ZOOM IN once to turn it on. NEDS prompts the user to pick the upper left and lower right corners of a new view area in the display window. Those

points form the opposite corners of a box which will be expanded as much as possible to fit and will be centered within the display area. Failure to pick two points in the display window will abort this command.

- ZOOM OUT -- This option is utilized to shrink a portion of the picture in the display window. Pick ZOOM OUT once to turn it on. NEDS prompts the user to pick the upper left and lower right corners of a new "box" in the display window. NEDS will fit the current window into the "box" and fill in the rest of the window with the environs about the current window. Failure to pick two points in the display window will abort this command.

- PAN -- This option is used for panning the display window relative to the current picture. Pick PAN to turn it on. NEDS prompts the user to pick two points in the display window. The first pick is any point in the window. The second pick is the desired location of that point in the redrawn window. Failure to pick two points within the display window will abort PAN.

- LAST VIEW -- This option is used for restoring previous pictures in the display window. The display will be redrawn using the "backward" window definition. LAST VIEW may be executed up to seven times to restore previous display windows. This is a circular command.

- NEXT VIEW -- This option is used for restoring previous pictures in the display window after the LAST VIEW commands are used. The display will be redrawn using the "forward" window definition. NEXT VIEW may be executed up to seven times to display next windows again. This is also a circular command.

- WIN BY CRD -- This option is used to select specific X and Y values for the minimum and maximum display window coordinates. Pick WIN BY CRD to turn on this option. NEDS prompts the user for each coordinate value. When all four values have been entered, the display will be redrawn with the best possible fit. Failure to properly enter any value will abort this option.

- ADD CENTRD -- After picking this option, the user moves the cursor to the location for a new centroid if AUTO CORD has been set via the setup menu. If AUTO CORD has not been set, then NEDS prompts the user for the X and Y coordinate values. If AUTO NODE has been set, then NEDS automatically assigns the next available centroidal node as the centroid number. If AUTO NODE has not been set, NEDS will prompt the user for the centroid number. This is an Auto Repeat command.

- ADD NODE -- After picking this option, the user moves the cursor to the location for a new node if AUTO CORD has been set via the setup menu. If AUTO CORD has not been set, then NEDS prompts the user for the X and Y coordinate values. If AUTO NODE has been set, then NEDS automatically assigns the next available node as the node number. If AUTO NODE has not been set, NEDS will prompt the user for the node number. This is an Auto Repeat command.

- ADD LINK -- This option is picked to add a link to the network. Position the cursor to the A-node of the link, and then depress the mouse button. NEDS then requests the user to position the cursor to the respective B-node of the new link. After depressing the mouse button again, the Status Area will display the A-node and B-node followed by attribute values for the A-B link. Initially these are all blank, and the dialogue area requests link attributes in descending order. After entering the values for A-B, NEDS asks if the link is two-way; if it is, NEDS prompts the user for B-A attributes. This is an Auto Repeat command. If the user has created a link template using the SETUP TEMP option, these template values will be displayed as defaults when adding a link.

- REMOV LINK -- After picking this option, the user positions the cursor at any location on the link to be deleted. After the mouse button is depressed, the link is highlighted in green and NEDS asks if this is the correct link. If the user types "Y" or "y," the link is deleted. Typing any other character will retain the link and prompt for another to be deleted. This is an Auto Repeat command.

- REMOV NODE -- After picking this option, the user positions the cursor near the node to be deleted and depresses the mouse button. All links to/from the selected node are highlighted (they will be deleted with the node). Typing "Y" or "y" in response to NEDS prompt will delete the node and any attached links. Any other response will retain the node. This is an Auto Repeat command.

- MOVE NODE -- After picking this option, the user positions the cursor at the node to be moved and depresses the mouse button. The cursor is positioned to the desired location for the node and the mouse button is depressed again. The effects of moving the node are displayed immediately with the ends of attached links moved as necessary. Distances for all affected links are modified accordingly. This is an Auto Repeat command.

- BREAK LINK -- This option is picked to insert a new node on an existing link. The cursor is positioned to the point on the link where the new node is to be added. NEDS automatically assigns the new node as the next available node number. One link A-B (as well as the B-A link, if two-way) becomes two links A-X and X-B, with the new links having the same attributes as the original link and distances automatically calculated by NEDS. This is an Auto Repeat command.

- LIST ATRIB -- After this option is picked, the user positions the cursor at any point on a link to list its attributes. The user is prompted for the A-node of the link, and all attributes of the link in the A-B direction are displayed in the Status Area.

- CHNG ATRIB -- After picking a link using the LIST ATTRIB option, the user may pick this option to change link attributes. The user picks the attribute value in the Status Area, and NEDS will prompt for a new value. This is an Auto Repeat command.

- POST NODE -- This option is picked to display the node number(s) for

any node(s) in the display window; and when the cursor is positioned to desired node(s) and the mouse button is depressed, the associated node number is displayed. This is an Auto Repeat command.

- FIND NODE -- This option is picked to find any node in the network. NEDS prompts the user for the desired node number. If the node is within the current display area, the node number is displayed; and the node location is highlighted. If it is not in the display area, the user is prompted to pick either the DRAW NETWK or REDRAW options. The complete network or current window will be redisplayed with the annotated node number at the center of the window.

- SETUP TEMP -- This option is used to set up a template of link attributes to be used with multiple links. After picking this option, a list of attribute titles is displayed in the Status Area. Some or all of the attributes may be "filled in" for copying to other links. Picking a particular attribute will prompt for a new value for that attribute. Picking it again will display "No Copy" in the attribute value field, and the attribute will no longer be active in the template. This is an Auto Repeat command.

- COPY TEMP -- After building the setup template, this option is picked; and the mouse is used to pick each link to copy the template. Only those attributes set using the SETUP TEMP option will be copied to the links selected. This is an Auto Repeat command.

- SAVE FILE -- At any time during a NEDS session, the user may elect to save a network file. If this option is selected, then the user is prompted for an output file name.

POST MENU (I5)

This menu is utilized to control various posting options in NEDS. The commands available on this menu are "toggled" ON (highlighted) and OFF.

- POST X -- (Default OFF) -- The X-coordinate of the A and B nodes for each selected link will be displayed.

- POST Y -- (Default OFF) -- The Y-coordinate of the A and B nodes for each selected link will be displayed.

- POST NODE -- (Default OFF) -- The node number of the A and B nodes for each selected link will be displayed.

- POST COST -- (Default OFF) -- The cost of each link (in hundredths of units) will be posted on all links selected.

- POST DIST -- (Default OFF) -- The distance of each link (in hundredths of units) will be posted on all links selected.

- POST SPED1 -- (Default OFF) -- The speed in the first speed field of each link (in tenths of units) will be posted on all links selected.

- POST SPED2 -- (Default OFF) -- The speed in the second speed field

of each link (in tenths of units) will be posted on all links selected.

- POST USER -- (Default OFF) -- The user (alternate cost) of each link (in hundredths of units) will be posted on all links selected.

- POST ASGRP -- (Default OFF) -- The assignment group code of each link will be posted on all links selected.

- POST DR CD -- (Default OFF) -- The direction code of each link will be posted on all links selected.

- POST LG1, LG2, or LG3 -- (Default OFF) -- The Link Groups 1, 2, or 3 code of each link will be posted on all links selected.

- POST CAP1 -- (Default OFF) -- The capacity (CAPACITY1) of each link (in units) will be posted on all links selected.

- POST CAP2 -- (Default OFF) -- The CAPACITY2 (counted volume) of each link (in units) will be posted on all links selected.

- POST VOL -- (Default OFF) -- The loaded volume of each link (in units) will be posted on all links selected.

- POST V/C -- (Default OFF) -- The volume capacity ratio of each link (in hundredths) will be posted on all links selected. For loaded networks, the volume will be the selected loaded iteration/purpose; and for base networks the volume used will be the counted volume (CAPACITY2) values.

Note: Any number of link attributes may be posted on the links. Care should be observed to ensure that the display window is not too cluttered for meaningful evaluation. If more than one link attribute is set ON, then the attributes are displayed as vertical lists. A key relating color to posted attribute is displayed in the Dialogue Area.

EXTRACT SUBAREA MENU (I6)

This menu is utilized to extract and display subarea networks. A highway network is viewed as a picture drawn in the map display window. The specific size and location of the window is indicated by the X-min, X-max, Y-min, and Y-max values that are displayed on the screen. The window may be adjusted to enlarge, reduce, or move around to different parts of the picture.

Some options described in the Extract Subarea Menu section utilize the auto repeat facility. This means that once the command is picked, it remains active until it is repicked. For instance, the PIK CORDON command will continue to prompt the user for additional cordon locations until it is explicitly switched off.

- DRAW NETWK -- If this option is selected, the entire network is drawn, including any updates performed during the current session.

- REDRAW -- If this option is selected, the current window is redrawn.

- CLR SCREEN -- This option is utilized to clear the entire screen and restore just the icon and window area boundaries. For direct connection to a computer, this option would very rarely be required; however, for dial-up access, this command could be used to redraw the entire screen which may have been corrupted by extraneously transmitted characters.

- ZOOM IN -- This option is utilized to enlarge a user-specified portion of the picture in the display window. Pick ZOOM IN once to turn it on. NEDS prompts the user to pick the upper left and lower right corners of a new view area in the display window. Those points form the opposite corners of a box which will be expanded as much as possible to fit and will be centered within the display area. Failure to pick two points in the display window will abort this command.

- ZOOM OUT -- This option is utilized to shrink a portion of the picture in the display window. Pick ZOOM OUT once to turn it on. NEDS prompts the user to pick the upper left and lower right corners of a new "box" in the display window. NEDS will fit the current window into the "box" and fill in the rest of the window with the environs about the current window. Failure to pick two points in the display window will abort this command.

- PAN -- This option is used for panning the display window relative to the current picture. Pick PAN to turn it on. NEDS prompts the user to pick two points in the display window. The first pick is any point in the window. The second pick is the desired location of that point in the redrawn window. Failure to pick two points within the display window will abort PAN.

- LAST VIEW -- This option is used for restoring previous pictures in the display window. The display will be redrawn using the "backward" window definition. LAST VIEW may be executed up to seven times to restore previous display windows. This is a circular command.

- NEXT VIEW -- This option is used for restoring previous pictures in the display window after the LAST VIEW commands are used. The display will be redrawn using the "forward" window definition. NEXT VIEW may be executed up to seven times to display next windows again. This is also a circular command.

- WIN BY CRD -- This option is used to select specific X and Y values for the minimum and maximum display window coordinates. Pick WIN BY CRD to turn on this option. NEDS prompts the user for each coordinate value. When all four values have been entered, the display will be redrawn with the best possible fit. Failure to properly enter any value will abort this option.

- PIK CORDON -- This option is picked to identify the cordon stations to be used in defining a subarea network. The user picks the links to be used as cordon links and NEDS adds nodes to those links. Operation is the same as the Update Menu's BRK LINK command.

- o CLR CORDON -- This option allows the user to delete the currently defined cordon developed using the PIK CORDON option. The nodes which were added by the PIK CORDON option are retained, but NEDS no longer uses them as cordon nodes.

- o EXTRAC AREA -- This option should be used after cordon definition has been completed. After picking this option, the user will be prompted to pick a point within the subarea using the mouse. NEDS will then check for complete closure of the subarea and highlight links within the subarea. The user is prompted to save the subarea. "Y" or "y" will delete all links not in the subarea. Any other response will return the user to the menu without altering the network. A second prompt queries the user if he wishes to renumber zones. "Y" or "y" will renumber all internal subarea zones and assign new zone numbers to cordon nodes. Any other response will leave zone and node numbering unaltered.

NEDS CONFIGURATION FILES

All versions of NEDS (1.10 or greater) require three configuration files to be in the working directory from which NEDS is being executed.

NEDS.CFG -- This file contains information concerning the display terminal and should NOT be modified by a user.

NEDMENU.CFG -- This file contains menu definition specifications, and ONLY the names may be changed by the user. Modification of this file permits the user to rename any of the menu option names should an alternate name(s) be more meaningful to the user. The names have a limit of 10 characters.

NEDATTR.CFG -- This file contains attribute definition specifications, and ONLY the names may be changed by the user. Modification of this file permits the user to rename any of the attribute names should an alternate names(s) be more meaningful to the user. The names have a limit of five characters.

NEDS USER PROFILES

NEDS allows the user to save session setup parameters for reuse through its Setup Menu options, READ UPRF and SAVE UPRF. Steps to use these options are described in the Setup Menu section. The following characteristics of a NEDS session are saved in a user profile:

- o Attribute colors from the CHNG LGRNG command.
- o User window definition and IDs (4).
- o Bandwidth ranges from the CHNG BAND command.
- o Volume/Capacity color ranges from the CHNG BAND command.

User profiles are saved with a user-specified ID of up to eight characters and a NEDS supplied suffix of ".UPF." To display user profile files in your current directory, use the command "DIR *.UPF" for either MS-DOS or DEC VAX systems.

Appendix A. DEFINITION OF TERMS

ACCESSIBILITY - ACCESSIBILITY INDEX
Potential of opportunities for interaction. The denominator of the gravity model formula.

ALL-OR-NOTHING ASSIGNMENT
The process of allocating the total number of trips between two zones to the path or route with the minimum travel time.

CAPACITY
The maximum number of vehicles that can pass over a given section of a lane or roadway in one direction (in TRANPLAN) or in both directions (in Texas Package) during a given time period under prevailing roadway and traffic conditions.

CAPACITY GROUP
A designator with a value of 0 to 9 which is assigned to a link (any link may have different capacity groups in the A - B and B - A direction) which is normally used to reflect the range of capacity on that link. Although this is the customary use of the capacity group designator, it can actually be coded by the user to reflect any kind of breakdown of links in the network at the option of the user.

CAPACITY RESTRAINT
The process by which the assigned volume on a link is compared with the practical capacity of that link and the speed of the link adjusted to reflect the relationship between speed, volume, and capacity. The procedure is iterative until a realistic balance is achieved.

CENTROID
An assumed point in a zone that represents the origin or destination of all trips to or from the zone. Generally, it is the center of trip ends rather than a geometrical center of zonal area.

CENTROID CONNECTOR
A link which connects a centroid to the coded street and highway network. In most coded networks, this connector represents the local streets by which a trip travels from an individual parcel of land to the higher classification of streets coded in the network. It has no physical facility representation but serves only to get trips from the centroid on the coded network.

CORDON LINE
An imaginary line enclosing a study area.

CUTLINE
An imaginary line placed at a strategic location to intercept all the links in an identified corridor. Traffic counts and trips assigned to the corridor are compared as a check of survey accuracy or model calibration.

DESTINATION
The zone in which a trip terminates.

INCREMENTAL ASSIGNMENT
A method of traffic assignment in which trips are loaded to the network in fractional amounts (specified by the user) on the minimum path. An adjustment to capacity is made after each loading. The volume on the links is incremented (hence the name) each loading until 100% of the trips are loaded.

INTERZONAL TRIP
A trip traveling between two different zones.

INTRAZONAL TRIP
A trip with both its origin and destination in the same zone.

JURISDICTION
This item, coded in the link card, can define the political subdivision of study area in which the link is found. Alternatively, it can identify a portion of the network such as the Interstate system.

LINK
A section of the highway network defined by a node at each end.

LINK GROUPS
A numeric code (0-99) which provides the user with the ability to group links with common characteristics for subsequent referencing, updating, and/or reporting.

LINK LOAD
The assigned volume on a link.

LOADING
The process of determining the link loads by selecting routes of travel and accumulating the trip volumes on each link that is traversed.

MINIMUM PATH
That route of travel between two points which has the least accumulation of time, distance, or other parameter to traverse. This path is found by the build trees program.

MODE OF TRAVEL
Means of travel such as auto driver, vehicle passenger, mass transit passenger, or walking.

NODE
A numbered point representing an intersection of zone centroid.

ORIGIN
The location of the beginning of a trip or the zone in which a trip begins.

PATH
A path is a continuous string of connected links within the network.

ROUTE
That combination of street and freeway sections connecting an origin and destination. In traffic assignment, a continuous group of links connecting two centroids that normally requires the minimum time to traverse.

SCREENLINE
An imaginary line, usually along physical barriers such as rivers or railroad tracks splitting the study area into two parts.

SEPARATION MATRIX
An interzonal total impedance matrix produced from the minimum paths between each pair of zones. The minimum impedance paths may be generated based on cost, distance, travel time, or user network parameters.

SKIMMED TREES
A series of binary records containing the travel time only between each pair of zones. The data is obtained from a portion of the binary tree records.

STATION
A location at the external cordon line where driver interviews are conducted.

TRAFFIC ASSIGNMENT
The process of determining route or routes of travel and allocating the zone-to-zone trips to these routes.

TRAVEL TIME
The time required to travel between two points, including the terminal time at both ends of the trip.

TREE
A record showing the shortest routes and time of travel from a given zone to all nodes in the highway network.

TRIP ATTRACTIONS
The number of home-based trip ends at the nonresidence end of the trip-maker; for example, all work trips to and from the work place are considered as attractions at the work place. A location which has no residences will, therefore, have no trip productions. All trips to and from the locations will be attractions. For all nonhome-based trips, attractions are synonymous with productions.

TRIP END
Either a trip origin or a trip destination.

TRIP LENGTH FREQUENCY DISTRIBUTION
The array which relates the trips or the percentage of trips made at various trip time or distance intervals.

TRIP PRODUCTIONS
The number of home-based trip ends at the residence end of the trip maker; for example, all work trips to and from the residence are considered as home-based work productions at the residence. If three home-to-work trips and two work-to-home trips are associated with a residence, it is considered to produce five home-based work trips. For all nonhome-based trips, productions are synonymous with origins.

TRIP TABLE (or MATRIX)
A table of zone-to-zone trips showing trips by direction between each pair of zones. The trips may be separated by mode, by purpose, by time period, by vehicle type, or by other classification. This is an output of trip distribution.

TURN PENALTY
The travel time added to the total travel time of a trip when a turn is made in the network.

TURN PROHIBITOR
A data card, similar to a link card, which instructs the tree building program to prohibit a particular movement through the network.

VINE
A record showing the routing such that all four links connected to a node may be traversed, if necessary, to produce the minimum path. Whereas the tree is calculated to each node, the vine is calculated to each of the legs from a node (which are numbered in some sequential manner). The vine allows turn prohibitions to be included in the network as well as time penalties for turns to reflect conditions on a highway network.

ZONE
A portion of the study area, delineated as such for particular land use and traffic analysis purposes.

Appendix B. MICROCOMPUTER HARDWARE REQUIREMENTS

The TRANPLAN package currently is available for the following hardware and operating system configuration. For all the following computers, the package syntax is identical: IBM PC, IBM PC/XT, IBM AT or compatible under PC-DOS (or MS-DOS); PRIME (all models); MC 68000-based super-microcomputers; CDC CYBER's (all models); and DEC-VAX (750, 780, and Micro VAX models).

For the IBM PC family of microcomputers, DOS must be configured to accept several disk files simultaneousely. Configuring DOS requires modification or creation of a file called "CONFIG.SYS" which must contain the minimum "FILES=10" command. Most TRANPLAN users include the "FILES=20" and "BUFFERS=20" specifications in a "CONFIG.SYS" file in the root directory. TRANPLAN is distributed on 12 (13 if plotting) diskettes, and requires about 3.5 MB of storage if all programs are transferred to a hard disk. A hard disk environment with 640 KB RAM and with 580 KB available is essential for the current design criteria.

The package supports the three principal plotters in use today: CALCOMP, Hewlett-Packard and Houston Instruments. Printer requirements are essentially not critical; TRANPLAN requires 132-column printers, and they can be controlled by either carriage tape or software controls. TRANPLAN is not an on-line, interactive system and, therefore, does not require any particular display terminal configuration.

NEDS is also written in structured FORTRAN77 and executes on PRIME and VAX minicomputers, UNIX-based MC 68000, and Micro VAX computers. Also, NEDS currently executes on the IBM PC family of microcomputers with 640 KBytes of RAM; therefore, virtually all hardware of TRANPLAN will be capable of processing NEDS. For all systems, a high resolution monitor option is available. For the IBM PC microcomputer, an EGA (Enhanced Graphics Adapter, 640x350 resolution) option is available. Although no processor board upgrade is required, a Microsoft-compatible mouse system is necessary for cursor movement on the EGA monitor.

The following hardware is essentially required for using TRANPLAN/NEDS:

TRANPLAN: * IBM/AT compatible with 20 MB hard disk (e.g., COMPAQ 286)
* 132-column printer (e.g., IBM Proprinter X24)
* Plotter (e.g., HP7475 for readable plot of 30-zone network)

NEDS : * Mid Resolution (640x350) Color Monitor with EGA
* Microsoft-compatible Mouse System

The following hardware is desirably required for using TRANPLAN/NEDS:

TRANPLAN: * IBM/AT compatible with 40 MB hard disk (e.g., COMPAQ 386)
* 132-column faster printer (e.g., Okidata ML393)
* Plotter (e.g., Houston Inst. DMP-56A w/MP Kit Accessory)

NEDS : * High Resolution (1024x780) Color Monitor (e.g., Seiko GR-1104 or GR-1105 with Seiko CH-5301 hard copy unit optional)
* Microsoft-compatible Mouse System