TEXAS TRANPLAN APPLICATION GUIDE

by

George B. Dresser
Research Scientist

and

Tom A. Williams
Assistant Research Scientist

Research Report 947-6
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16. Abstract

TRANPLAN is a package of separate, distinct programs which perform travel demand analysis. TRANPLAN can be used to perform the traditional four-step transportation forecasting process: trip generation, trip distribution, mode choice, and traffic assignment.

This guide is intended for use by the Texas Department of Transportation offices, Metropolitan Planning Organizations, municipalities, counties, and consultants contracted by public agencies in the state of Texas. The guide should be used in conjunction with the TRANPLAN reference manual and the Highway Network Information Systems (HNIS) reference manual.

The information in this manual can be used to train new TRANPLAN users, refresh users who have been minimally exposed to TRANPLAN, and serve as a "template" to aid experienced users. This guide, however, is not intended to provide a comprehensive description of all the capabilities of the TRANPLAN software.

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METRIC (SI*) CONVERSION FACTORS

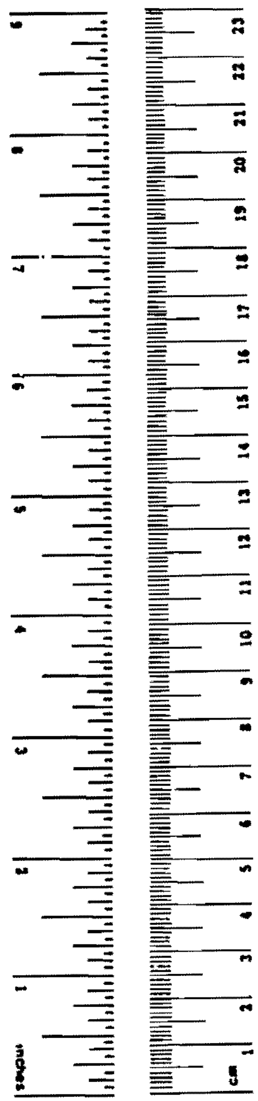
APPROXIMATE CONVERSIONS TO SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
	LENGTH			
in	inches	2.54	centimetres	cm
ft	feet	0.3048	metres	m
yd	yards	0.914	metres	m
mi	miles	1.61	kilometres	km
	AREA			
in^2	square inches	645.2	centimetres squared	cm^2
ft^2	square feet	0.0929	metres squared	m^2
yd^2	square yards	0.836	metres squared	m^2
mi^2	square miles	2.59	kilometres squared	km^2
ac	acres	0.395	hectares	ha
	MASS (weight)			
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams	Mg
	VOLUME			
fl oz	fluid ounces	29.57	millilitres	mL
gal	gallons	3.785	litres	L
ft^3	cubic feet	0.0328	metres cubed	m^3
yd^3	cubic yards	0.0765	metres cubed	m^3

NOTE: Volumes greater than 1000 L shall be shown in m^3.

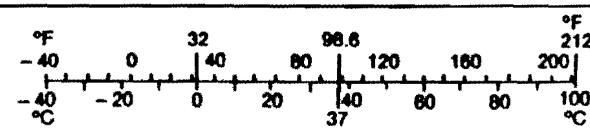
	TEMPERATURE (exact)			
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

* SI is the symbol for the International Syst:m of Measurements



APPROXIMATE CONVERSIONS TO SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
	LENGTH			
mm	millimetres	0.039	inches	in
m	metres	3.28	feet	ft
m	metres	1.09	yards	yd
km	kilometres	0.621	miles	mi
	AREA			
mm^2	millimetres squared	0.0016	square inches	in^2
m^2	metres squared	10.764	square feet	ft^2
km^2	kilometres squared	0.39	square miles	mi^2
ha	hectores (10 000 m^2)	2.53	acres	ac
	MASS (weight)			
g	grams	0.0353	ounces	oz
kg	kilograms	2.205	pounds	lb
Mg	megagrams (1 000 kg)	1.103	short tons	T
	VOLUME			
mL	millilitres	0.034	fluid ounces	fl oz
L	litres	0.264	gallons	gal
m^3	metres cubed	35.315	cubic feet	ft^3
m^3	metres cubed	1.308	cubic yards	yd^3
	TEMPERATURE (exact)			
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



These factors conform to the requirement of FHWA Order 5190.1A.

ABSTRACT

TRANPLAN is a package of separate, distinct programs to perform travel demand analysis. TRANPLAN can be used to perform the traditional four-step transportation forecasting process: trip generation, trip distribution, mode choice, and traffic assignment.

This guide is intended for use by the Texas Department Transportation offices, Metropolitan Planning Organizations, municipalities, counties, and consultants contracted by public agencies in the state of Texas. The guide should be used in conjunction with TRANPLAN reference manual and the Highway Network Information Systems (HNIS) reference manual.

The information in this manual can be used to train new TRANPLAN users, refresh users who have been minimally exposed to TRANPLAN, and serve as a "template" to aid experienced users. This guide, however, is not intended to provide a comprehensive description of all the capabilities of the TRANPLAN software.

DISCLAIMER

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CHAPTER ONE
INTRODUCTION

This chapter describes the use of TRANPLAN in the state of Texas. The following questions are answered:

- What is the purpose of this guide?
- Do you need TRANPLAN capability?
- How do you get TRANPLAN?
- How do you get TRANPLAN technical support?

Purpose of This Guide

This guide is intended for use by Texas Department of Transportation offices, Metropolitan Planning Organizations, municipalities, counties, and consultants contracted by public agencies in the state of Texas. The guide should be used in conjunction with the TRANPLAN reference manual and the Highway Network Information System (HNIS) reference manual.

The information contained in this manual should be used to train new TRANPLAN users, refresh users who have been minimally exposed to TRANPLAN, and serve as a "template" to aid experienced users. This guide is not intended, however, to provide a comprehensive description of all the capabilities of the TRANPLAN software.

Do You Need TRANPLAN Capability?

TRANPLAN is a package of separate, distinct programs to perform travel demand analysis. TRANPLAN can be used to perform the traditional four-step transportation forecasting process: trip generation, trip distribution, mode choice, and traffic assignment. It can also be used to forecast transit ridership. Currently, only trip distribution and traffic assignment are performed using TRANPLAN in most areas of Texas (all four steps are performed in North Central Texas). Transit modeling is not performed.

TRANPLAN can aid in the following areas:

- Development of long range plans by allowing local areas (TxDOT districts, MPO's, and municipalities) to test alternatives in land use scenarios and transportation systems;
- Testing of local system transportation alternatives and traffic impacts from changes in land use;
- Response to questions from local policy bodies concerning traffic.

Unless you are involved in the above areas, you probably do not need TRANPLAN capability. Learning and keeping current with TRANPLAN requires a substantial commitment of time; therefore, it is advised that unless you perform one of these functions often, or would do so if you had TRANPLAN, you could probably invest your time more wisely.

How to Get TRANPLAN in Texas

Getting TRANPLAN in Texas is easy: the Texas Department of Transportation (TxDOT) currently has a statewide license agreement with the developers of the TRANPLAN software, the Urban Analysis Group (UAG). This license allows TxDOT to distribute TRANPLAN to all public agencies, with the following exceptions:

- All public agencies which are members of the North Central Texas Council of Governments (NCTCOG);
- All public agencies which are in the metropolitan area of Austin, Texas;
- All public agencies which are in the metropolitan area of Houston, Texas.

TxDOT offices anywhere can obtain TRANPLAN. Public agencies in the NCTCOG region can obtain TRANPLAN at a minimal cost through NCTCOG. Agencies in the Austin area have previous agreements with the Urban Analysis Group for the use of TRANPLAN. The Houston area is limited under the state license to the TxDOT district office.

A request must be made to the Transportation Planning Division (D-10) of TxDOT to obtain TRANPLAN. Currently, TxDOT requires that an urbanized area (population of 50,000+) have a validated travel model before approval for TRANPLAN distribution is granted. The mainframe Texas Package model is used for all model validations and is performed by TxDOT.

How to Get Technical Help

TxDOT has authorized the Texas Transportation Institute (TTI) to administer TRANPLAN. TTI can provide several forms of technical assistance:

- Installing TRANPLAN and providing a training session to get you "up and running" at your office;

- Visiting your site for special circumstances requiring on-site training;

- Providing a seminar on the basic usage of TRANPLAN and HNIS each May in College Station;

- Assisting users at any time when they call TTI directly at (409) 845-5200.

The TRANPLAN developers, UAG, would prefer that you call TTI first, and then TTI will contact UAG if further assistance is necessary.

TTI and TxDOT also support a Texas TRANPLAN Users Group. To receive a current list of TRANPLAN Users in Texas, contact TTI. Meetings of the Texas TRANPLAN Users Group are held at least once a year at the Texas Transportation Planning Conference.

CHAPTER TWO
INSTALLING TRANPLAN

This chapter explains the installation procedures for TRANPLAN and provides the following:

- Computer hardware requirements
- TRANPLAN Installation
- System configuration
- Sample DOS batch files

INSTALLING TRANPLAN ON YOUR COMPUTER

Recommended Computer Hardware

The following is a list of **recommended** hardware required to run TRANPLAN. Actually, TRANPLAN will run on a lesser system than that listed below. However, you will probably want to run other applications on the system; and the following is a common, standard set-up.

Computer Hardware
i486 DX 33 MHz CPU, OR
    i486 SX or 386 CPU with math co-processor
13"/14" Super VGA color monitor and card
100 MByte minimum hard disk
4 MByte minimum RAM
Bus mouse
1 5.25" 1.2 MByte high density disk drive
1 3.5" 1.4 MByte high density disk drive
Extended keyboard
1 parallel port
2 serial ports
44 MByte minimum removable cartridge disk drive
2 44 MByte removable cartridges
2400 baud modem

Printer
Any printer capable of 132 column print (compressed mode or wide carriage)

Plotter
Hewlett Packard plotter or any plotter capable of HPGL emulation

Software
MS-DOS 5.0
Any text editor capable of reading large files (MS-DOS 5.0 EDIT is suitable in most areas)

How to Get TRANPLAN on Your Computer

Installing TRANPLAN is usually performed by TTI. If you are installing an upgrade of TRANPLAN, an install program can be run from your A: (or B:) drive by typing:

C:> A:INSTALL

when the TRANPLAN installation disk is in drive A. Also, be sure to read the READ.ME files on your upgrade diskettes. These provide descriptions of the upgrade features. For more information, refer to the TRANPLAN "User Manual Supplement and Installation Instructions" guide.

System Configuration for TRANPLAN

In order for TRANPLAN to run, the C:\TP or C:\TRANPLAN subdirectory must be on the "path" of the computer. To see if it is, type "PATH" at the C:> prompt. The path tells the computer where to find the TRANPLAN programs and is defined when you turn on the computer in the AUTOEXEC.BAT file. Below is a sample AUTOEXEC.BAT file for use on a TRANPLAN computer:

```
@ECHO OFF
PROMPT $p$g
PATH = C:\DOS;C:\;C:\UTIL;C:\TP;C:\TP\MISC
```

Note that the system defined above does not have any "Terminate and Stay Resident" (TSR) programs being loaded by the AUTOEXEC.BAT file when the computer is turned on. These programs are loaded into the computer memory and are not cleared when they are done. These programs can, and usually do, cause conflicts with TRANPLAN. It is best to have a very simple AUTOEXEC.BAT file to run TRANPLAN, such as the one listed above.

For TRANPLAN to run correctly, be sure to keep TSRs out of the CONFIG.SYS File. Be sure to have the following included in you CONFIG.SYS file:

```
DOS = HIGH
FILES = 30
BUFFERS = 10
```

You will probably be required by other programs on your system to add device drivers, or "DEVICE=..." statements, to your CONFIG.SYS file. Try to run TRANPLAN with the device drivers loaded. If it does not work, delete them from the CONFIG.SYS file, or edit your CONFIG.SYS file and place a "REM " in front of the "DEVICE=..." statement (you must then re-start your computer).

Handy DOS Batch Files

Other files you may need to add to your computer are batch files, or files with the extension ".BAT". These files can help when running TRANPLAN by performing repetitive, tedious tasks automatically.

One batch file that is necessary will help run HNIS (see Chapter Seven). This file allows you to run HNIS from any subdirectory, such as your model run subdirectory. The batch file should be named "HNIS.BAT" and placed in the "C:\UTIL" or "C:\TP" subdirectory. It assumes you have installed HNIS in a "C:\NIS" subdirectory. The sample HNIS.BAT listed below will help HNIS find the configuration files it needs.

```
COPY C:\NIS\NIS.CFG
C:\NIS\HNIS
```

Another batch file will help send plot codes to your plotter (individual plotters may vary). Below is a batch file, "TPLOT.BAT" which will send the appropriate codes for a Hewlett Packard plotter and copy a TRANPLAN plot file to the communications port (COMx) that is connected to the plotter. To use the batch file, type "C:>TPLOT *filename*", where *filename* is the name of a plot file created by TRANPLAN.

```
@ECHO OFF
MODE COM1:96,N,8,1,P
COPY %1 COM1
ECHO ON
```

All batch files can be saved in a "C:\UTIL" subdirectory or the "C:\TP" subdirectory, which is in the path defined in the AUTOEXEC.BAT file.

CHAPTER THREE
USING TRANPLAN

This chapter describes the elementary steps to use TRANPLAN. The following areas are summarized:

- Function files
- Using TRANPLAN
- Entering "TRNPLN"
- Entering "TRANPLAN"

Things to Remember

Running TRANPLAN involves understanding three basic things:

- What exactly you are running
- What the input files are
- What the output files are

Function Files

TRANPLAN operates in "batch" mode, meaning that a "batch" or "group" of instructions is loaded simultaneously. The "batch" of instructions is held in what are commonly called "setup" files or "function" files, usually with the filename extensions of ".IN" or ".FIL" so that they can be easily identified. To run TRANPLAN you need to create a setup file containing the instructions telling TRANPLAN exactly what model you wish to run. The following general control structure applies to all TRANPLAN functions.

```
$Function Name
$FILES
      INPUT FILE = FileID, USER ID = $Filename$
      OUTPUT FILE = FileID, USER ID = $Filename$
$HEADERS
      (up to three lines of header records)
$OPTIONS
      (list of options)
$PARAMETERS
      (list of parameters)
$DATA
      (data records)
$END TP FUNCTION
```

How to Run TRANPLAN

TRANPLAN programs (those ending with "EXE") are normally placed in a subdirectory set aside for TRANPLAN called "D:\TP" or "D:\TRANPLAN", where "D" is a hard disk drive (usually C: or D:). The studies that you do with TRANPLAN are placed in separate, unique subdirectories, with a name you choose to identify the study, such as

"C:\BASE15" for a baseline 2015 model run or "D:\ALTB20" for alternative B of a 2020 model run. Input setups (see Chapter Three) can be stored in a lower subdirectory, for instance, "C:\BASE15\IN" or "C:\BASE15\FIL". Setups usually have the extension of ".IN" or ".FIL", but this is not a requirement. See Figure 1.

To run TRANPLAN:

1) Establish a working subdirectory for executing TRANPLAN.

2) Ensure that the executable TRANPLAN file "TRNPLNXT.EXE" and all required executable modules are in the DOS path.

3) Copy all input TRANPLAN data files to the working directory.

4) Create a TRANPLAN input control file called "TRNPLN.IN".

5) Type in "TRNPLN" to execute TRANPLAN.

Entering "TRNPLN"

TRANPLAN is operated through a control file named TRNPLN.IN that can be created by using any text editing software. You can create a series of setup files for different operations, store them under different names, and copy the appropriate file into TRNPLN.IN prior to execution. You can append several functions together by following the $END TP FUNCTION line with another $Function Name line.

The control file is executed by entering TRNPLN from the keyboard. The package checks to see if all specified programs and input data files are stored on disk; then, it executes the programs in sequence. The output file specified in the setup file is written to disk under the name specified by the user, and reports are stored under the filename "TRNPLN.OUT".

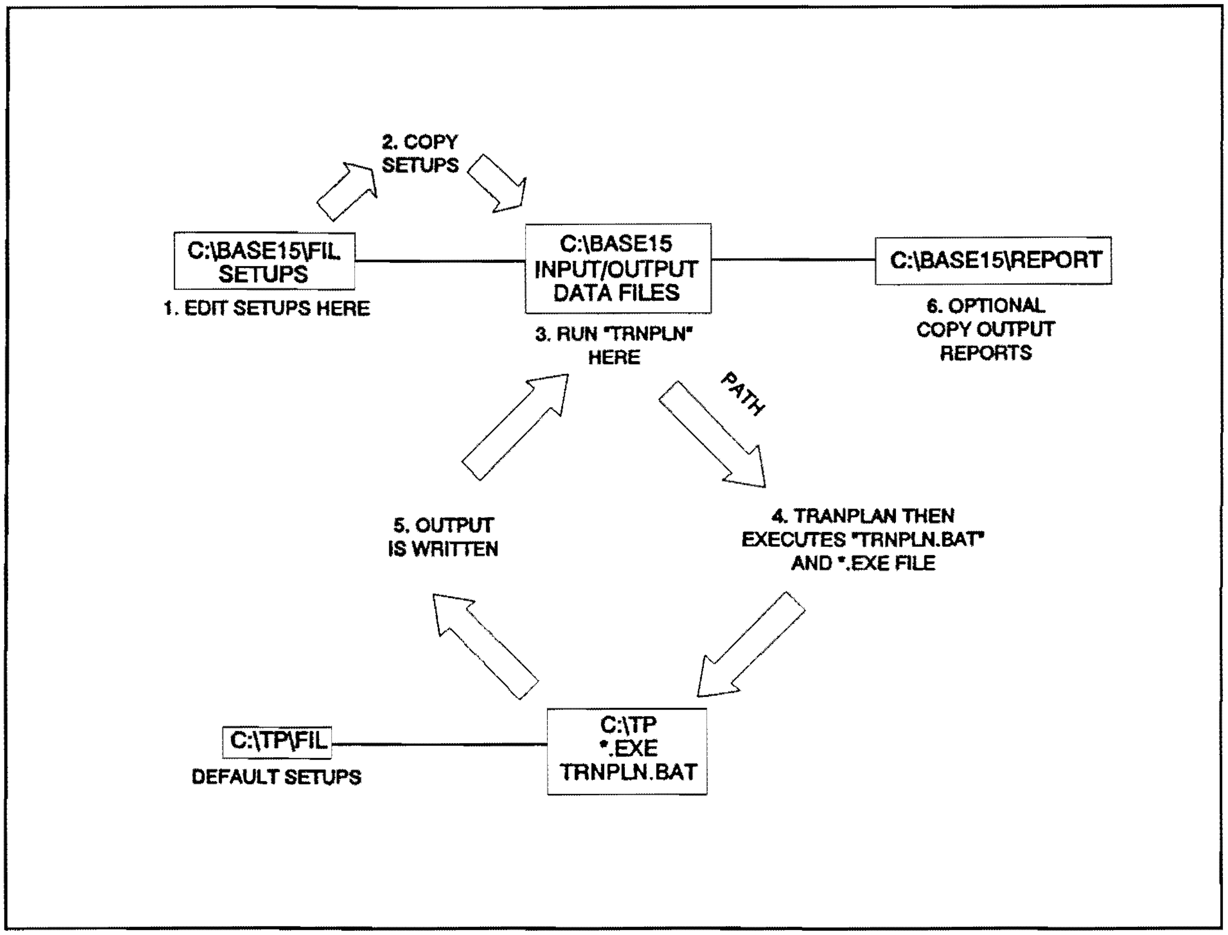


Figure 1 TRANPLAN Execution Process

Entering "TRANPLAN"

An alternative method of executing TRANPLAN is as follows:

C:>TRANPLAN *setup.in report.out*

where *setup.in* is the filename of the setup function file, and *report.out* is the output report filename.

In summary, TRANPLAN uses input setups which control the function executed, the input data set, and the output data set. Naming this setup file "TRNPLN.IN" and then typing "TRNPLN" or specifying it by typing "TRANPLAN" will execute the model run and create output reports in a file named "TRANPLAN.OUT" or the file specified in the "TRANPLAN" command.

CHAPTER FOUR
TRANPLAN FUNCTIONS

This chapter describes the most commonly used TRANPLAN "functions" or models. Each function performs a specific task, including:

- Network building and editing
- Matrix editing and reporting
- Traffic assignment
- Plotting

Networks

$BUILD HIGHWAY NETWORK
Converts an ASCII format, 80-column network (NETDATA) to TRANPLAN binary compressed format. Can also be used to perform network editing, such as adding or deleting links or nodes, or changing attribute values on links.

$MACRO HIGHWAY NETWORK UPDATE
Performs macro, or multiple, updates to a network in TRANPLAN format. Deletes, adds, subtracts, multiplies, divides, or replaces link attributes. For example, system-wide capacity changes based on area type and number of lanes.

$HIGHWAY SELECTED SUMMATION
Builds a matrix of minimum time, distance, or travel cost by "skimming" attributes along minimum paths from zone to zone in a network. Can build minimum paths based on one network attribute and then report to the output matrix the cumulative total of another attribute; for example, link lengths along a minimum travel time path. TRANPLAN format network is input to this function.

Trip Distribution

$GRAVITY MODEL
Performs the classic formulation of the traffic forecasting gravity model. Input files include an ASCII production-attraction file with friction factors (by trip purpose) appended to the bottom of the file. Also, input is a minimum impedance matrix in TRANPLAN format. Outputs a single, total-purpose trip matrix and/or a multiple, separate-purpose trip matrix file.

$FRATAR MODEL
An iterative FRATAR expansion model based on origin-destination growth factors. Used to "grow" a trip table.

Matrix Utilities

$MATRIX UPDATE
Addition, subtraction, multiplication (by a constant) and replacement operations on matrix files (trip tables and minimum impedance matrices). Optional conditional operation (EQ, LT, GT) and selected zones available.

$MATRIX MANIPULATE
Merges multiple table trip matrices (e.g., sums all trip purposes on one matrix) and performs addition, subtraction,

multiplication, and division on multiple combinations of tables and matrices.

$MATRIX COMPRESS
Aggregates Traffic Analysis Zones (or other zones) into districts, or larger zones. Function input usually a trip table; the output compression either printed or output to a second matrix (of fewer zones). The cell values of the output zones (or districts) are accumulations of the aggregated zones.

$MATRIX EXPAND
Opposite of $MATRIX COMPRESS. De-aggregates large districts into smaller zones. Values of the smaller zones in the resultant trip matrix, or factor matrix, are equal to the values of the districts in which they fell (or were specified in the function file).

$MATRIX TRANSPOSE
Transposes a TRANPLAN format trip matrix, usually a trip table. Each matrix cell A(i,j) becomes A(j,i). Also, will convert a production-attraction format trip table to origin-destination format.

Traffic Assignment

$LOAD HIGHWAY NETWORK
Loads a trip table onto the minimum paths through a network. Inputs a TRANPLAN format network and trip matrix and outputs either a "loaded history file" or a network with assigned traffic volumes. Capabilities include All-or-Nothing assignments, Capacity-Restrained assignments, and Turning Movements.

$LOAD HIGHWAY SELECTED LINKS
Same as $LOAD HIGHWAY NETWORK but also generates a selected link "history" file. The output includes loadings on specific links identified in the function file. The output is then read into $BUILD SELECTED LINK TRIP TABLE to analyze the origin and destination of trips using the selected links.

$BUILD SELECTED LINK TRIP TABLE
Combines a trip table and a selected link history file to produce a trip matrix of trips using the specified selected links. Generally followed by a $COMPRESS MATRIX function to analyze the resultant trip origin and destination patterns.

Plotting

$PLOT HIGHWAY NETWORK
Creates a plot file ready for sending to a plotter. Generally used to plot highway networks for coding base maps and debugging. Links can be selectively plotted and colored using Link Group codes or Assignment Group codes. Node numbers can also be plotted.

$PLOT HIGHWAY LOAD
Plots a loaded highway network with the same options as $PLOT HIGHWAY NETWORK. Also plots assigned volumes and band widths based on the assigned volume. Can optionally plot network colored by range of volume-to-capacity ratio.

$PLOT HIGHWAY PATHS
Plots the minimum impedance paths from selected origin zones. Good method of checking network coding. Output resembles a "tree" branching out from the origin node. TRANPLAN uses a "vine" builder to build minimum paths.

Reporting

$REPORT HIGHWAY NETWORK
Reports link descriptions, prohibited turns, node coordinates and unused nodes. Options using "OR" and/or "AND" specifications permit the reporting of selected portions of the network.

$REPORT HIGHWAY NETWORK SUMMARY
Reports summaries of highway network characteristics stratified by link class (i.e., link group and assignment group code values). The reports may be one-, two-, or three-dimensional tables. Summaries may be reported by cost, distance, time, user impedance, vehicle cost, vehicle distance, vehicle hours, vehicle user impedance, capacity time, capacity distance and volume capacity. Screenline summary reporting is also available.

$REPORT HIGHWAY LOAD
Reports link loadings in A-B, B-A, and total format. Turning movements are presented in an easy-to-read matrix format with one-way and two-way link totals. Options using "OR" and/or "AND" specifications permit the reporting of selected portions of the network. Zero volume links can be

suppressed from the report. Reporting of selected loading by iteration and trip purpose is permitted.

$REPORT HIGHWAY INCREMENTAL SUMMARY
Optionally generates three types of reports which describe the time, speed, and volume changes on a highway network during iterative loading. The first report is detailed by selected links of time, speed, and volume by iteration. The second report is a frequency distribution stratified by ratios of projected volume/capacity ratio and by time/speed ratio differences. The third report is a ground count comparison which is useful in validating the travel model.

$REPORT HIGHWAY PATHS
Reports the minimum paths, for the user-specified travel impedance, in either a detailed (non-destructive) format or in a compressed (destructive) format. All paths are built with a vine builder which guarantees the minimum path with turn prohibitors and turn penalties.

$REPORT MATRIX
Reports trip tables and selected summation (skim) file matrices, via either the body of the matrix or a trip end summary (for trip tables). Selected trip purpose and origin zone control the level of output.

$REPORT MATRIX COMPARISON
Compares two trip tables, usually survey origin-destination with model output. Reports zone-to-zone differences and rations, frequency distributions, statistical summaries by volume groups and trip end differences, and ratios.

$REPORT TRIP LENGTH FREQUENCY
Reports standard trip length frequency statistics based upon an input trip table and selected summation separation matrices. Reports include:

1. trips by impedance: unit, average statistics and
2. histograms by impedance unit and by accumulated units.

CHAPTER FIVE
RUNNING TRANPLAN WITH THE TEXAS PACKAGE

This chapter explains how to run the TRANPLAN model in conjunction with the Texas Package. Two methods are outlined:

- The Short Method using a trip table from the Texas Package
- The Long Method using productions and attractions from the Texas Package

TRANPLAN and the Texas Package

TRANPLAN is operated in conjunction with the Texas Travel Demand Package forecasting software which is maintained by TxDOT. Essentially, validation and calibration of the models in Texas (with the exception of the NCTCOG urbanized area) are performed using the mainframe TxDOT model system. Once an urbanized area is validated to existing conditions, the networks and demographics are downloaded from the mainframe to microcomputers for use in TRANPLAN by local offices.

TxDOT has authorized local areas to use TRANPLAN to perform alternatives analysis and then provide D-10 with final numbers for approval (documenting all assumptions). There are two methods of using data obtained from the Texas Package with TRANPLAN:

- Download a trip table and a network, referred to as the "Short Method"
- Download a vehicle trip generation file and network, referred to as the "Long Method"

Running the Short Method

Using the Short Method, a network (link and node coordinate data) is downloaded from the Texas Package. The network is then converted to TRANPLAN ASCII format with TTI conversion programs which are executed through the DOWN menu system (which stands for DOWNload). Next, a valid trip table is downloaded from the Texas Package and converted to TRANPLAN binary format using the DOWN menu system (when in binary, this file cannot be viewed with your text editor). Refer to Figure 2.

Once the network is converted to TRANPLAN ASCII format, the TRANPLAN function $BUILD HIGHWAY NETWORK is run. The output from the $BUILD HIGHWAY NETWORK function is a binary TRANPLAN network which can be viewed and edited using HNIS. With HNIS, you can make network additions, deletions, or modifications with interactive color graphics.

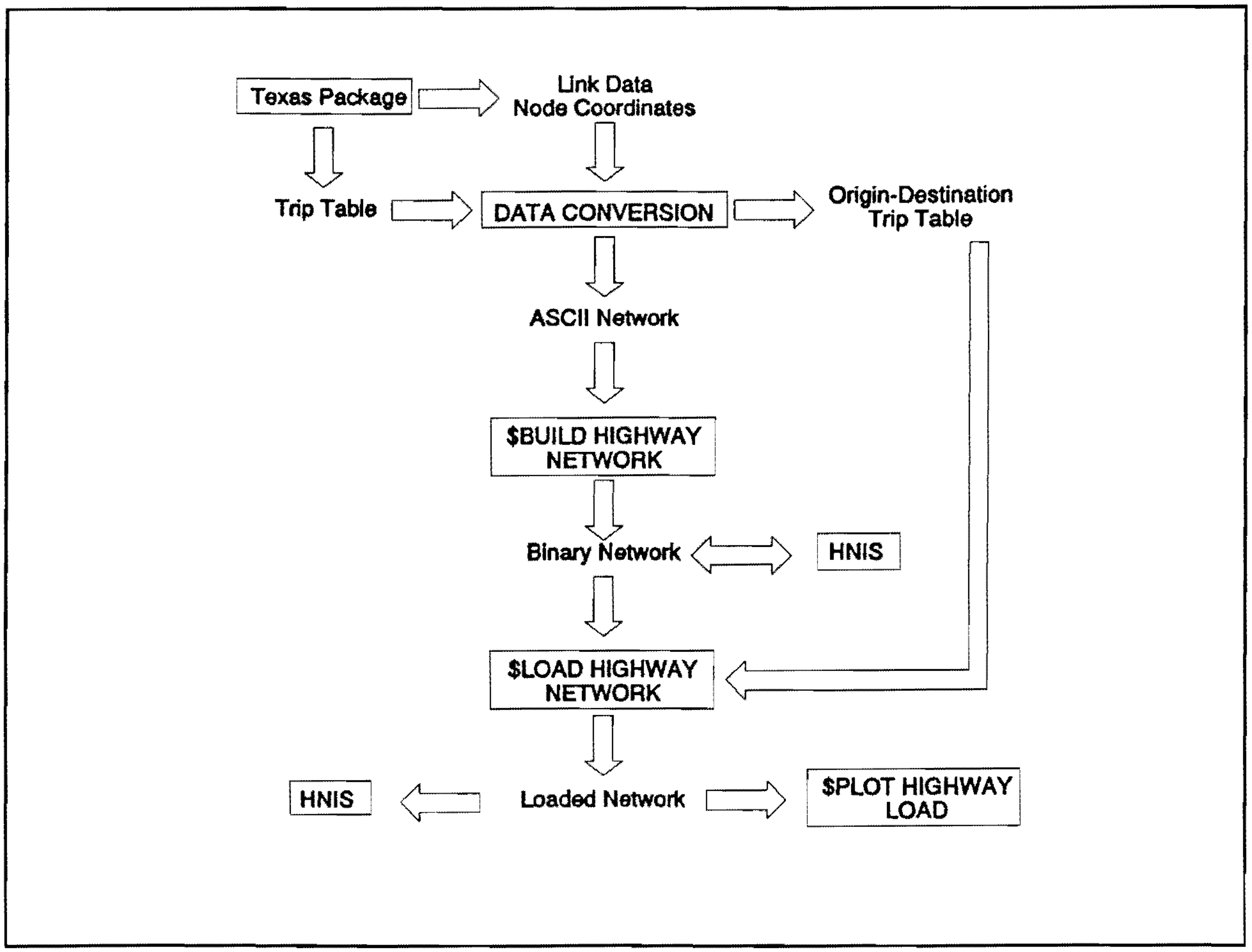


Figure 2 The Texas TRANPLAN Short Method

The final step in the Short Method is to load the origin-destination trip table onto the network using the $LOAD HIGHWAY NETWORK function. The standard type of loading, or traffic assignment, used for TRANPLAN in Texas is the incremental capacity restraint method. This method has two main features:

- Trips are loaded onto the network in five pre-specified increments or "Load Percentages." This means that if there are 100 trips between two zones and the load percentages are 15, 15, 20, 20, 30, then 15 trips will be loaded during the first increment onto the shortest travel time path, and the network travel times will be updated.

- The network travel times are updated after each increment of trips is loaded onto the network using the shortest travel time path between two given zones. The travel times are increased by a certain percentage according to a travel time decay function which relates the volume-to-capacity ratio (how much the network is congested) and a percentage increase in travel time (see Figure 3).

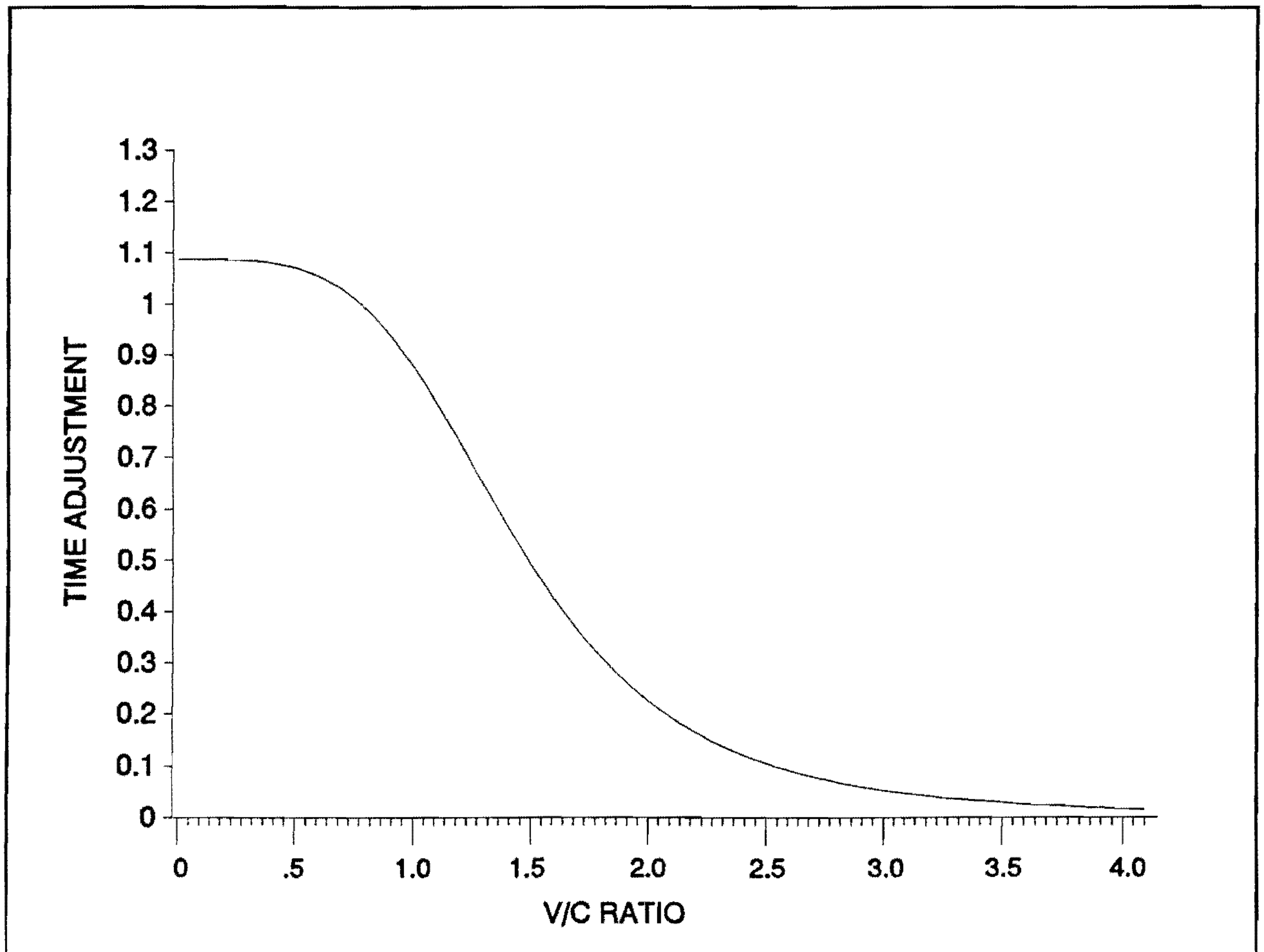


Figure 3 TRANPLAN Travel Time Decay Function

After the trips are loaded onto the network, the link traffic volumes can be viewed with HNIS or by creating a TRANPLAN plot file using the $PLOT HIGHWAY LOAD function. The $PLOT HIGHWAY LOAD function creates a computer plot file which can be sent to your plotter (usually with a DOS "COPY" command or with the sample "TPLOT.BAT" batch file).

In summary, the short method uses the following TRANPLAN steps:

1) Convert the Texas Package trip table, network, and x/y coordinates to TRANPLAN format.

2) Run $BUILD HIGHWAY NETWORK to check the network and convert it to binary.

3) Optionally, edit the network with HNIS.

4) Run $LOAD HIGHWAY NETWORK and check the results.

Running the Long Method

The TRANPLAN Long Method uses the same data conversion program (DOWN) as the Short Method to convert the network links and nodes to TRANPLAN ASCII format. Productions, attractions, and friction factors are also converted to TRANPLAN ASCII format and placed in the same file. The production-attraction file is created from the Texas Package trip generation model by TxDOT from zonal population and employment data collected by serial zone. Typically, the external trip ends on this file are not converted to TRANPLAN.

The following steps are used in the Texas TRANPLAN Long Method.

1) The ASCII network is checked and converted to binary by running $BUILD HIGHWAY NETWORK. This function is executed several times if problems are found on the network. The network can then be optionally edited with HNIS.

2) $HIGHWAY SELECTED SUMMATION "skims" the minimum travel time paths from each zone to all other zones and creates a matrix of cumulative travel times.

3) Radius data are converted from the Texas Package and used to update the intrazonal travel times (see next section of this guide for more detail).

4) The $GRAVITY MODEL takes productions and attractions from each zone and the minimum travel time matrix and distributes them using the gravity model formula. The result is a production/attraction format trip table.

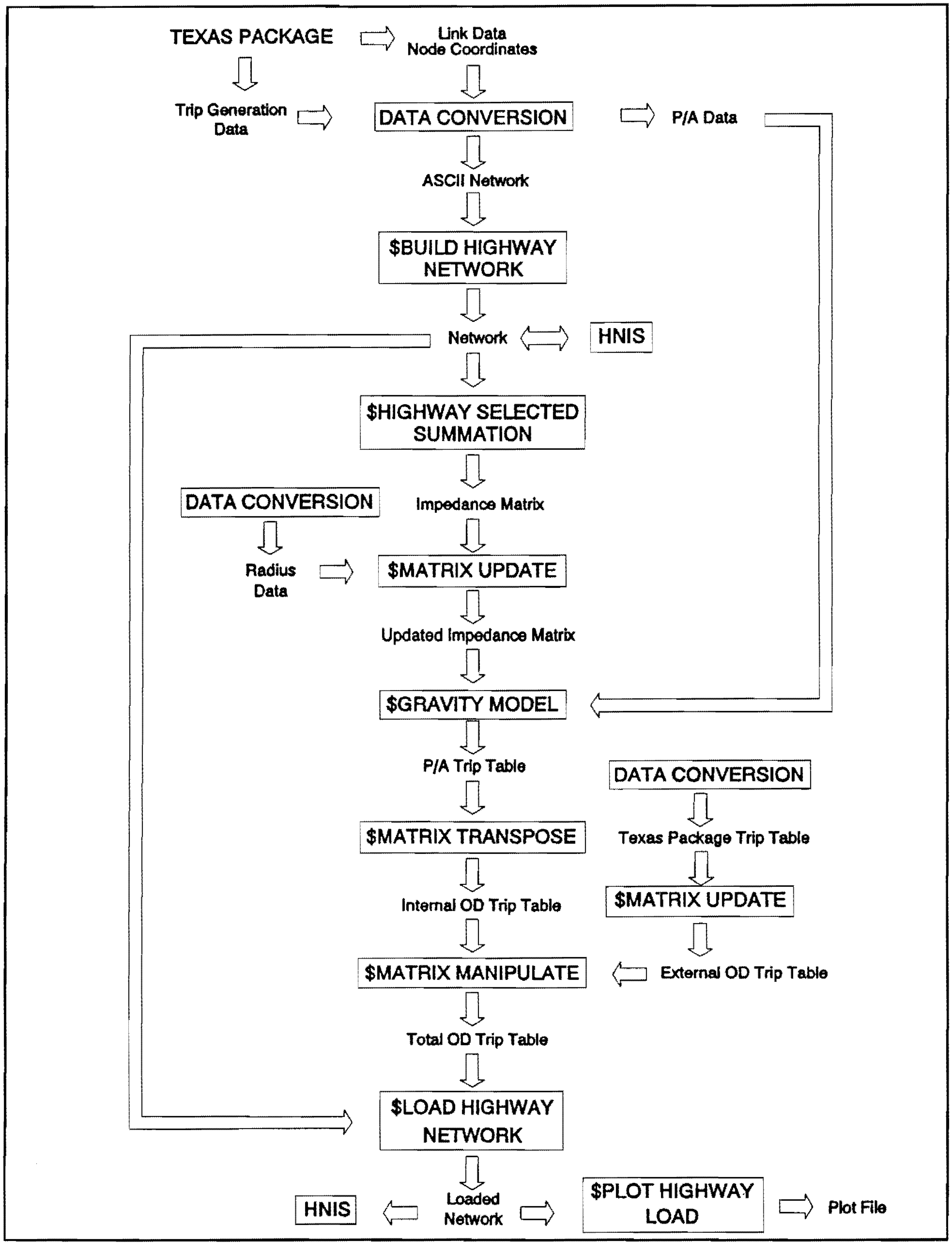


Figure 4 The Texas TRANPLAN "Long Method"

5) The $MATRIX TRANSPOSE function converts the trip table into an origin/destination format where each zonal interchange has the same number of trip ends as the opposite zonal interchange (e.g., the trip ends from zone 2 to zone 1 must equal the trip ends from zone 1 to zone 2). The trip ends are equal only when the trip table represents a full day.

6) Trips originating outside the study area (external trips) must be "borrowed" from the Texas Package trip table. A $MATRIX UPDATE function places a zero in all internal-to-internal trip interchanges of the Texas Package trip table, leaving only the external trips. The external trip table is then added to the internal-to-internal trip table to create a total trip table.

7) The final step in the Long Method is to load the trip matrix onto the shortest paths of the network using the $LOAD HIGHWAY NETWORK function. The Long Method uses the same incremental assignment technique used in the Short Method. Note that the loaded network in the Long Method is different than the loaded network used in the Short Method because the trip tables differ.

Intrazonal Travel Times

Sometimes it is necessary to estimate the **intrazonal** travel times more precisely than the TRANPLAN HIGHWAY SELECTED SUMMATION model is capable of doing. The Texas Package trip distribution model utilizes a zonal radius which is converted to data cards to represent centroid connector travel times used in the $MATRIX UPDATE function. For more information see Appendix C of TTI Research Report #1110-4F, "Subarea Analysis Using TRANPLAN/NEDS."

CHAPTER SIX
CONVERTING DATA FROM THE TEXAS PACKAGE

This chapter explains in detail how to convert networks and trips from the Texas Package mainframe model to TRANPLAN.

The Texas Package

TRANPLAN is run in Texas in coordination with the Texas Package of travel demand forecasting programs. The Texas Package is operated by Division 10 of TxDOT on a mainframe computer. Data can be easily converted from the Texas Package to TRANPLAN for use in your urbanized area. The North Central Texas Council of Governments maintains a similar TRANPLAN mainframe model process using the Dallas-Fort Worth Regional Travel Model.

Texas Package Conversion Menu

Data are downloaded to microcomputer and then sent to your office on diskette. Although the data are in ASCII format, the networks, node and zone centroid coordinates, trip tables, friction factors, and production-attraction data are not in the required format for TRANPLAN.

A menu-driven set of conversion programs has been developed by TTI to facilitate the transfer of data between TRANPLAN and the Texas Package. This menu is a DOS batch file called "DOWN.BAT." Typing "DOWN" at the DOS prompt will produce the following menu selections:

```
                CONVERSION PROGRAM MENU
                  FOR SUBAREA ANALYSIS

DOWNLOADING (FROM TEXAS PACKAGE TO TRANPLAN)
        1. LINK DATA CONVERSION
        2. COORDINATE DATA CONVERSION
        3. TRIP TABLE CONVERSION
        4. P/A DATA CONVERSION
        5. FRICTION-FACTOR CONVERSION
        6. ZONAL RADII CONVERSION

UPLOADING (FROM TRANPLAN TO TEXAS PACKAGE)
        7. LINK DATA CONVERSION
        8. P/A DATA CONVERSION

        E. EXIT TO DOS
```

Selecting one of the first six from the menu will execute a FORTRAN program to convert data from the Texas Package to TRANPLAN. The FORTRAN programs will then prompt you for input file names and output file names.

Converting Link Data

Selecting "LINK DATA CONVERSION" from the DOWN menu system will run a program to convert a downloaded network to TRANPLAN ASCII format. Selecting "COORDINATE DATA CONVERSION" will convert node numbers and coordinates to TRANPLAN ASCII format. These two files must then be concatenated; the node data usually come first. This combined node and link data file will then be input into the $BUILD HIGHWAY NETWORK function.

Data for the Short Method

When running the Short Method, you can select "TRIP TABLE CONVERSION." This program will convert a Texas Package ASCII format trip table to TRANPLAN binary format. The resulting file can be loaded onto a network using the $LOAD HIGHWAY NETWORK function.

Data for the Long Method

When running the Long Method, "P/A DATA CONVERSION" should be selected. This will convert a Texas Package production-attraction file to TRANPLAN ASCII format. "FRICTION FACTOR" conversion will produce a file of friction factors by trip purpose. These two files must be combined onto one file, the friction factors usually coming last. A DOS command can be used to concatenate files as follows:

C:>COPY *file1* + *file2* *file3*

where, *file1* and *file2* are the two files to be combined and *file3* is the resulting output for use with TRANPLAN.

Intrazonal Impedances

In some areas "ZONAL RADII CONVERSION" is performed. The output is a list of zone interchanges with intrazonal impedances for use in the $MATRIX UPDATE function to replace the TRANPLAN default intrazonal impedance values.

Most urbanized areas will need to convert data only on specific occasions. A validated model network and trip table should be converted along with the production-attraction file. In some cases, production-attraction data will need to be converted when land use changes are made through TxDOT.

CHAPTER SEVEN
HIGHWAY NETWORK INFORMATION SYSTEM

This chapter reviews some of the most used aspects of the TRANPLAN graphics network editing program, HNIS. The topics covered are:

- Choosing a method to edit networks
- Using HNIS to edit networks
- Using HNIS to display information
- Other helpful tips

Graphics Editing System

TRANPLAN is accompanied by the Highway Network Information System (HNIS). HNIS is a full-featured, interactive graphics, network editing program. TRANPLAN networks and loaded networks can be edited or displayed in many different forms. For a full description of HNIS menus and commands, please refer to the HNIS manual.

HNIS can be divided into two main functional areas:

- Editing network information
- Displaying network attributes

Choosing an Editing System

TRANPLAN networks can be edited using one of the following methods:

- Edit the TRANPLAN format ASCII file with a text editor and then run $BUILD HIGHWAY NETWORK
- Create edit cards for $BUILD HIGHWAY NETWORK or $MACRO HIGHWAY NETWORK UPDATE
- Use HNIS with interactive graphics

Although HNIS is perhaps the most appealing of the three methods, it is not always the most efficient solution. Editing the network ASCII file can be very time consuming and tedious, but it is sometimes more efficient than HNIS. However, network ASCII files should probably be edited only when one or two changes need to be made.

When large-scale editing is needed, such as creating a baseline alternative for a long range plan or a thoroughfare plan where several hundred network changes are required, creating a $BUILD HIGHWAY NETWORK update file is probably the best solution. To save time and effort, you should plot a base map, draw the network changes, and code the attributes on forms keeping a permanent copy of all the changes. For information on how to add, modify, and delete update records for input to the $BUILD HIGHWAY NETWORK function, refer to the TRANPLAN User Manual.

Editing Networks

HNIS is suitable for small- or large-scale network modifications, although some computer systems and networks run rather slowly. Adding a route alignment alternative or changing capacities on a thoroughfare are good examples of HNIS editing capability. The advantage to using HNIS for editing is the interactive capability; you can see the changes as you make them.

HNIS Configuration

HNIS provides several configuration files which set the default parameters for drawing and editing networks. These configuration files must be present in the working directory when you execute HNIS. Another method is to create a DOS batch file.

A common error message when using HNIS is "NIS.CFG not found." To correct this error, use the HNIS.BAT file found in Chapter Two of this guide, making sure the file is in the DOS path.

Some HNIS Tips

A time-saving feature of HNIS is the "STOP DRAW" function. When drawing a large network, press and hold the right mouse button. This will cause HNIS to cease drawing, saving time if you already have what you want drawn on the screen.

Another important editing feature is the "SETUP TEMP" function. This allows you to create a "template", a set of default attributes on a link. The "COPY TEMP" function is used to copy the default attributes to other links by just pointing the cursor at them, saving time.

When performing large-scale changes, a combination of the above methods may be suitable. Coding nodes using HNIS and links using $BUILD HIGHWAY NETWORK versus calculating node coordinates by hand may save time. Experimentation and experience will lead to the best coding application for you.

Displaying Information with HNIS

HNIS is best suited to displaying information from a loaded network. Traffic volumes, traffic counts, and speeds can be displayed after a $LOAD HIGHWAY NETWORK has been run. One way to display information on links graphically is by using the "POST SETUP" selection, then the "POST LINK" or "AUTO POST" selection, and then "REDRAW" the network. To display a list of all the attributes of a particular link, select "EDIT ATR"; and then close the menu without editing anything.

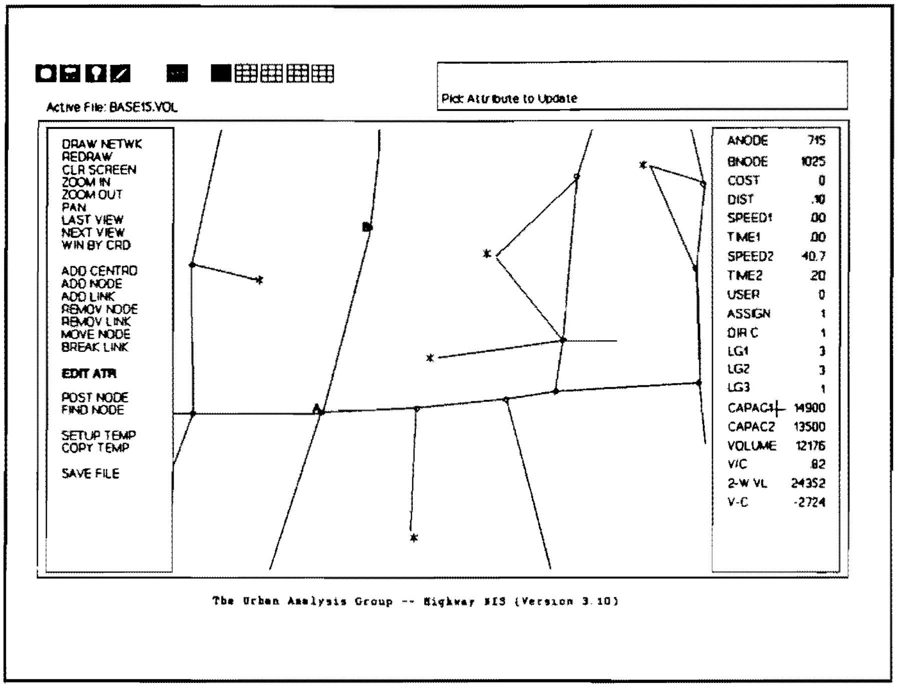


Figure 5 HNIS network editing screen

The assignment method recommended for use in Texas is the Incremental Capacity Restraint. TRANPLAN saves all five iterations on the output network file. When reading a loaded network, HNIS will prompt you for the "iteration for loaded volumes" and "iteration for loaded speeds". These are always set to the highest number of iterations that have been executed in the $LOAD HIGHWAY NETWORK run, usually five. When set to the highest iteration, HNIS will use the final iteration speeds and volumes to display and calculate minimum paths.

Capacity 1 or Capacity 2?

HNIS also prompts you for a default capacity. Capacity 1 is always used to store the theoretical daily capacity of the link. Capacity 2 is sometimes used to store an observed traffic count. This can be useful. Specifying Capacity 2 as the default will cause HNIS to calculate V/C and other volume-to-capacity comparisons (band widths, colors) using the ground count. Thus a V/C ratio would really be a volume-to-ground count comparison.

Coloring Links with HNIS

Loading a network in all one color, usually white, is not descriptive. Therefore, a network can be colored by functional class if desired. Specify LINK COLOR in HNIS and choose the field where functional class is stored (usually LG1, which is short for "link group 1"). Then pick the colors desired for each functional class, and re-draw the network. To choose the colors, click the mouse once on top of the color bars (see Figure 6). Then click on top of the coded link value which will represent the color chosen. The coded link values are arranged starting at 0 and going through 9 on the first row, then starting with 10 and going through 19 on the second row, and so on.

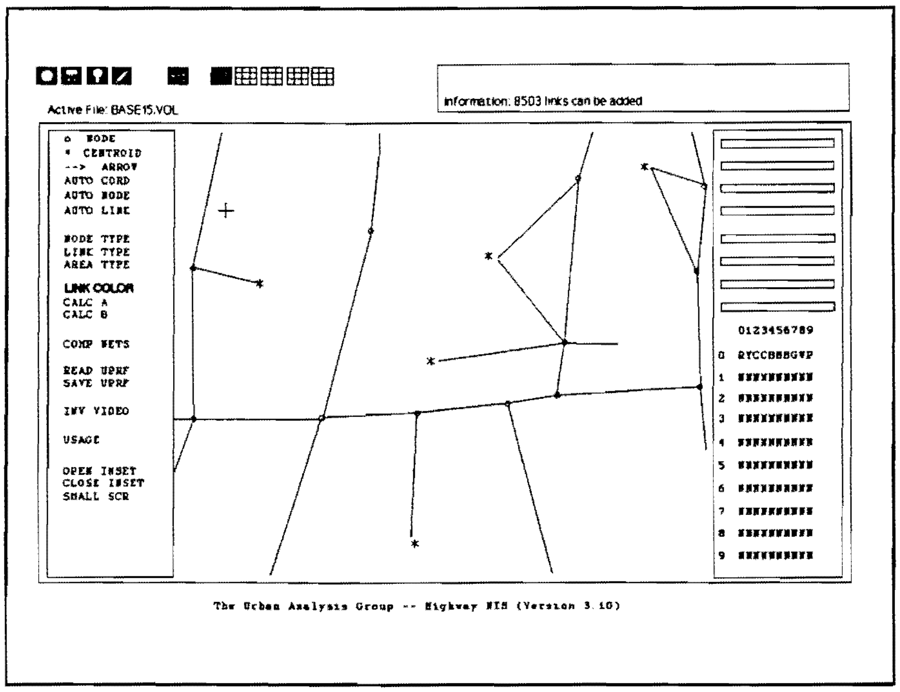


Figure 6 The HNIS "LINK COLOR" option

The settings do not have to be specified each time you load HNIS. Save the desired color settings by picking "SAVE UPRF" (for "save user profile") and give HNIS a filename. The next time you load HNIS, select "READ UPRF" and "LINK COLOR" (by LG1), and the default color settings will be restored.

LOS Display with HNIS

To display the network in color according to level of service (LOS), select "CLR BAND" (for "color band"). Simply select V/C and choose the colors for the ranges of V/C that define each level of service.

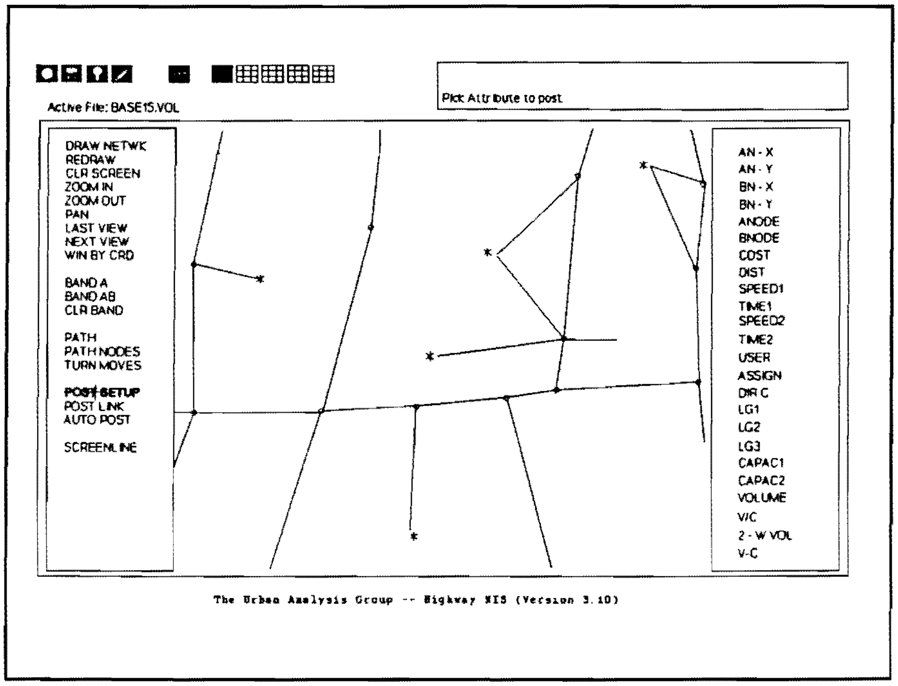


Figure 7 Posting information on links with HNIS

Comparing Alternatives on One Screen

Sometimes it is necessary to show the differences between two traffic assignment runs. HNIS provides a quick method to view the changes between alternatives graphically. The method to compare two traffic assignments is as follows:

1) Read the base network into HNIS first or the loaded network upon which the alternative was coded.

2) Select "COMP NETS" (for "compare networks") and specify the Capacity 2 field as the place for the volumes from the second network.

3) Draw a band width comparison of the two traffic assignments using the "BAND AB" function and selecting volume, Capacity 2, or other comparison variables.

HNIS Turning Movements

Detailed turning movement diagrams can be drawn quickly on the computer screen using HNIS. Turning movement nodes must be specified in the $LOAD HIGHWAY NETWORK function. The loaded network will then have turning movements saved for each node specified. In HNIS, select "TURN MOVES" and specify a node for which the turning movements were saved during the traffic assignment. A detailed display and band width of all turning movements at that node will be displayed.

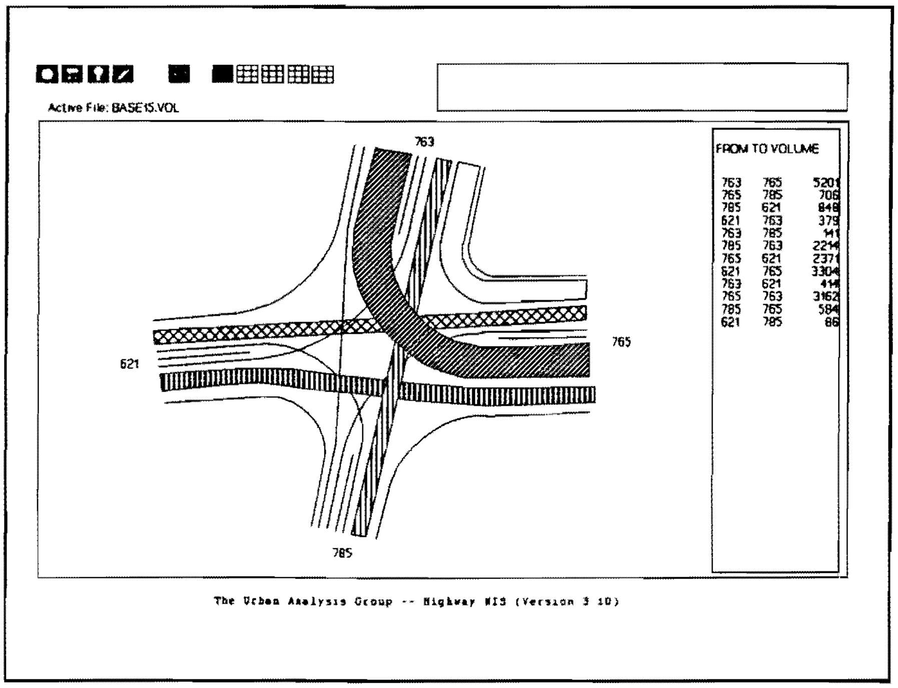


Figure 8 The HNIS turning movement diagram

CHAPTER EIGHT CREATING PLOTS WITH TRANPLAN

One of the most effective tools of the TRANPLAN modeling system is its ability to create highly informative plots. This chapter explains:

- How to create network plots
- How to create traffic assignment plots
- Tips to help send plots to your plotter

TRANPLAN Plotting Method

Plotting the network and traffic assignments of a TRANPLAN model run is one of the most important tasks you can perform. Effective displays of the information for public meetings and technical meetings can help create a successful project. Fortunately, creating plots with TRANPLAN is relatively simple if you have all of the equipment and connections set up properly.

TRANPLAN plots are created with a function file. The output from the function is a plotter file which can be copied directly to your plotter. Plotters have different graphics languages, so you must specify the plotter in the TRANPLAN setup. Many plotters will emulate, or interpret, the Hewlett-Packard Graphics Language (HPGL). HPGL is a common plotter format and TRANPLAN is well suited for its use.

Copying a plotter file to your plotter can involve setting the attributes of the communications port on your computer (COMx, where x=1, 2, or 3). A sample TPLOT.BAT file is described in Chapter Two which should simplify the task.

The following are some common examples of $PLOT HIGHWAY NETWORK and $PLOT HIGHWAY LOAD function files.

Base Network Plot

In this example, all links, nodes, zones, centroid connectors, and zone/node numbers will be plotted for the entire network. If only a portion of the network is desired, add a MINIMUM and a MAXIMUM X and Y in the $PARAMETERS section. The SELECTION ATTRIBUTE in this case is ASSIGNMENT GROUP, the field in which functional classification is stored. Each COLOR statement refers to a pen position in the order in which they occur (a black pen would be loaded into pen position 1 on the plotter, etc.).

```
$PLOT HIGHWAY NETWORK
$FILES
 INPUT FILE = HWYNET, USER ID = $HWYNET.DAT$
 OUTPUT FILE = TPLOT, USER ID = $PLOTNET.DAT$
$HEADERS
                PLOT HIGHWAY NETWORK
```

```
$OPTION
  DASHED CENTROID LINKS
$PARAMETERS
  PLOTTER = HP7475
  PAPER = NORMALA
  PLOT SIZE = 8
  SELECTION ATTRIBUTE = ASSIGNMENT GROUP
  CHARACTER HEIGHT = 0.07
$DATA
  COLOR = BLACK, ATTRIBUTE = 0
  COLOR = RED, ATTRIBUTE = 5-8
  COLOR = BLUE, ATTRIBUTE = 3-4
  COLOR = ORANGE, ATTRIBUTE = 2
  COLOR = PURPLE, ATTRIBUTE = 1
  COLOR = GREEN, ATTRIBUTE = 9
$END TP FUNCTION
```

Traffic Assignment Volume Plot

In the example below, the $PLOT HIGHWAY LOAD function is used to plot a network with volumes posted on each link. The links will be drawn using the pen placed in position one on the plotter.

```
$PLOT HIGHWAY LOAD
$FILES
  INPUT FILE = LODHIST, USER ID = $INCASSN.DAT$
  OUTPUT FILE = TPLOT, USER ID = $PLOTVOL.DAT$
$HEADERS
                    PLOT HIGHWAY LOAD
        VOLUMES  FROM INCREMENTAL ASSIGNMENT
$OPTION
  NO CENTROID LINKS
  ONLY CENTROID NODES
$PARAMETERS
  PLOTTER = HP7475
  PAPER = NORMALA
  PLOT SIZE = 8
  MINIMUM X = 36600
  MAXIMUM X = 41000
  MINIMUM Y = 10500
  MAXIMUM Y = 14800
  CHARACTER HEIGHT = 0.06
  LINK ANNOTATION = VOLUME CAPACITY RATIO
$DATA
$END TP FUNCTION
```

Traffic Assignment LOS Plot

In this example, the network will be colored according to the level of service. A range for the V/C ratio is defined for each LOS and is used for the SELECTION ATTRIBUTE.

```
$PLOT HIGHWAY LOAD
$FILES
  INPUT FILE = LODHIST, USER ID = $INCASSN.DAT$
  OUTPUT FILE = TPLOT, USER ID = $PLOTVC.DAT$
$HEADERS
                    PLOT HIGHWAY LOAD
```

```
        VOLUME/CAPACITY RATIO FROM INCREMENTAL ASSIGNMENT
$OPTION
 NO CENTROID LINKS
 ONLY CENTROID NODES
$PARAMETERS
 PLOTTER = HP7475
 PAPER = NORMALA
 PLOT SIZE = 8
 MINIMUM X = 36600
 MAXIMUM X = 41000
 MINIMUM Y = 10500
 MAXIMUM Y = 14800
 CHARACTER HEIGHT = 0.06
 LINK ANNOTATION = VOLUME CAPACITY RATIO
 SELECTION ATTRIBUTE = VOLUME CAPACITY RATIO
$DATA
 COLOR = BLACK, ATTRIBUTE = 0-10
 COLOR = GREEN, ATTRIBUTE = 11-30
 COLOR = BLUE, ATTRIBUTE = 31-50
 COLOR = ORANGE, ATTRIBUTE = 51-70
 COLOR = PURPLE, ATTRIBUTE = 71-90
 COLOR = RED, ATTRIBUTE = 91-99999
$END TP FUNCTION
```

Volume Band Width Plot

The BAND WIDTH FACTOR in the setup below will cause TRANPLAN to plot a band width of the attribute in the LINK ANNOTATION statement. The factor 0.00002 is multiplied by the total volume which will result in a band width of 50,000 vehicles per inch. The BAND INCREMENT specifies the spacing between fill lines; 0.06 will cause a partial filling of the bands.

```
$PLOT HIGHWAY LOAD
$FILES
 INPUT FILE = LODHIST, USER ID = $INCASSN.DAT$
 OUTPUT FILE = TPLOT, USER ID = $PLOTBAND.DAT$
$HEADERS
                 PLOT HIGHWAY LOAD
      BAND WIDTHS OF VOLUMES FROM INCREMENTAL ASSIGNMENT
$OPTION
 SUPPRESS NODE NUMBERS
 NO CENTROID LINKS
$PARAMETERS
 PLOTTER = HP7595
 PAPER = EXPANDB
 PLOT SIZE = 11
 MINIMUM X = 12000
 MAXIMUM X = 17000
 MINIMUM Y = 19000
 MAXIMUM Y = 22800
 LINK ANNOTATION = TOTAL VOLUME
 BAND WIDTH FACTOR = 0.00002
 BAND INCREMENT = 0.06
$DATA
$END TP FUNCTION
```

Plotting Paths

The $PLOT HIGHWAY PATHS function will plot a "tree" of the shortest paths from the root zone to all other zones. The root zone is specified in the SELECTED ZONES statement. This function is a good way to check the connectivity of your network.

```
$PLOT HIGHWAY PATHS
$FILES
 INPUT FILE = HWYNET, USER ID = $HWYNET.DAT$
 OUTPUT FILE = TPLOT, USER ID = $PATH.PLT$
$HEADERS
                    PLOT HIGHWAY PATHS
                 SELECTED ORIGIN ZONE = 1
$OPTION
 SUPPRESS NODE NUMBERS
$PARAMETERS
 PLOTTER = HP7475
 PAPER = NORMALA
 IMPEDANCE = TIME2
 SELECTED ZONES = 1
 PLOT SIZE = 8
 SELECTION ATTRIBUTE = ASSIGNMENT GROUP
$DATA
 COLOR = BLACK, ATTRIBUTE = 0-9
$END TP FUNCTION
```

CHAPTER NINE
REPORTING
TRANPLAN INFORMATION

This chapter describes some of the more important TRANPLAN reporting functions. TRANPLAN reports can be generated to print:

- Network and minimum path information
- Traffic assignment summaries
- Trip table and travel time matrices

Printing Network Data

The TRANPLAN function REPORT HIGHWAY NETWORK will produce four important reports:

1) A list of unused nodes (helpful in avoiding coding duplicate nodes when adding new network links)

2) A detailed, formatted printout of all network links or selected groupings based on area (WINDOW), ASSIGNMENT GROUP, or LINK GROUP

3) A list of nodes and coordinates

4) A list of turn prohibitor nodes

In the following, sample setup file network links are printed for $ASSIGNMENT GROUPS 1, 6, and 7.

```
$REPORT HIGHWAY NETWORK
$FILES
  INPUT FILE = HWYNET, USER ID = $HWYNET.DAT$
$HEADERS
                    REPORT HIGHWAY NETWORK
$OPTION
   PRINT UNUSED NODES
   PRINT COORDINATES
$PARAMETERS
  IMPEDANCE = TIME2
  ASSIGNMENT GROUP = 1,6-7
$END TP FUNCTION
```

REPORT HIGHWAY NETWORK

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	8600	6000	2	8600	2900	3	5000	5000	4	1900	6500	5	1700	2500
6	4300	2800	7	4300	1100	8	7000	1100	9	1400	500	10	9000	500
11	1500	4000	100	2500	6000	102	2500	5000	104	2500	4000	106	2500	1700
108	2500	500	110	3100	6000	112	4600	4000	114	4000	6000	116	5300	4000
118	5000	6000	120	6000	6000	122	6000	5000	124	6000	4000	126	6000	1700

REPORT HIGHWAY NETWORK

TURN PROHIBITOR REPORT

FROM	THROUGH	TO
130	120	122
235	140	138
231	126	230

REPORT HIGHWAY NETWORK

NETWORK DESCRIPTION REPORT

ANODE	BNODE	1 WAY	DIST	TIME2	SPEED2	L1	L2	L3	DIR	A/G	PNODE	ANODE	BNODE	1 WAY	DIST	TIME2	SPEED2	L1	L2	L3	DIR	A/G	PNODE
1	130		.50	2.00	15.00	10	0	0	1	4		2	134		.50	2.00	15.00	10	0	0	1	4	
													144		1.00	4.00	15.00	10	0	0	2	4	
3	102		2.50	10.00	15.00	10	0	0	3	4		4	100		1.20	4.80	15.00	10	0	0	3	4	
													118		1.00	4.00	15.00	10	0	0	2	4	
													122		1.00	4.00	15.00	10	0	0	1	4	
5	106		1.30	5.20	15.00	10	0	0	1	4		6	230		1.70	6.80	15.00	10	0	0	1	4	
													231		1.10	4.40	15.00	10	0	0	3	4	

REPORT HIGHWAY NETWORK

LIST OF UNUSED NODE NUMBERS FROM 1 TO 236

NODE	NODE	NODE	NODE	NODE	NODE	NODE	NODE	NODE	NODE
12	13	14	15	16	17	18	19	20	21
22	23	24	25	26	27	28	29	30	31
32	33	34	35	36	37	38	39	40	41
42	43	44	45	46	47	48	49	50	51

Printing Minimum Path Traces

Minimum path trees, can be reported from a network before or after traffic assignment. This report can be useful in determining the paths chosen when loading each iteration (or increment of the trip table) of the traffic assignment in $LOAD HIGHWAY NETWORK. Specify the parameter "SELECTED ITERATIONS =" to report a path from an incremental traffic assignment.

Two reports are produced by the REPORT HIGHWAY PATHS function. A "non-destructive" trace will produce a string of nodes backwards from the destination zone to the home node or zone (specified in the SELECTED ZONES statement). Also, the travel time is reported from the home node to each node in the node string. A "destructive" trace will trace all nodes backward to the home node without duplicating a path already traced.

The following setup will produce both destructive and non-destructive trace reports for Zones 1 through 4, and Zone 8.

```
$REPORT HIGHWAY PATHS
$FILES
  INPUT FILE = HWYNET, USER ID = $HWYNET.DAT$
$HEADERS
                 REPORT HIGHWAY PATHS (TREES)
$OPTIONS
  PRINT NONDESTRUCTIVE TRACES
  PRINT DESTRUCTIVE TRACES
$PARAMETERS
  IMPEDANCE = TIME 2
  SELECTED ZONES = 1-4,8
$END TP FUNCTION
```

REPORT HIGHWAY PATHS (TREES)

NON-DESTRUCTIVE VINE TRACE - VINE NO. 1

TO	THRU	TIME 2	THRU	TIME 2	THRU	TIME 2	THRU	TIME 2	THRU	TIME 2	THRU	TIME 2	THRU	TIME 2	
1	HOME NODE														
2		13.00	144	9.00	132	8.00	130	2.00	1						
3		12.00	118	8.00	120	6.00	130	2.00	1						
4		17.80	100	13.00	110	11.80	114	10.00	118	8.00	120	6.00	130	2.00	1

REPORT HIGHWAY PATHS (TREES)

DESTRUCTIVE VINE TRACE - VINE NO. 1

TO	THRU	TIME 2	THRU	TIME 2	THRU	TIME 2	THRU	TIME 2	THRU	TIME 2	THRU	TIME 2	THRU	TIME 2
1	HOME NODE													
2		13.00	144	9.00	132	8.00	130	2.00	-1-					
3		12.00	118	8.00	120	6.00	130	2.00	-1-					
4		17.80	100	13.00	110	11.80	114	10.00	118	8.00	-3-			

Printing Traffic Assignment Data

Several TRANPLAN functions will produce reports of selected iterations from a traffic assignment. The functions include:

- $REPORT HIGHWAY NETWORK
- $REPORT HIGHWAY LOAD

- $REPORT HIGHWAY NETWORK SUMMARY
- $REPORT HIGHWAY INCREMENTAL SUMMARY

All of the functions produce reports which are best suited to a particular piece of information which may be desired.

Printing Traffic Volumes

$REPORT HIGHWAY LOAD will produce a report of volumes in A-B, B-A, and both directions. Also, a matrix report for each turning movement node is reported. Below is a sample function file:

```
$REPORT HIGHWAY LOAD
$FILES
  INPUT FILE = LODHIST, USER ID = $INCASSN.DAT$
$HEADERS
                    REPORT HIGHWAY LOAD
$OPTIONS
  MINIMUM REPORT
  PRINT TURNS
$END TP FUNCTION
```

REPORT HIGHWAY LOAD
LINK VOLUME REPORT OF ALL-OR-NOTHING
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
1	130	27572	27574	55146	2	134	25750	24217	49967	3	102	2354	0	2354
						144	9395	10927	20322		118	5663	13657	19320
											122	24684	19045	43729
4	100	23074	23074	46148	5	106	33582	33581	67163	6	230	6450	4918	11368
											231	25828	27361	53189
7	231	27429	31296	58725	8	235	36628	48068	84696	9	108	14905	13427	28332
	232	0	0	0		236	31225	19787	51012		154	17131	18606	35737
	234	12063	8195	20258										
10	142	18874	18874	37748	11	104	21822	21821	43643	100	4	23074	23074	46148
	146	15043	15044	30087							102	9024	7625	16649
											110	15449	16848	32297
											150	0	0	0

REPORT HIGHWAY LOAD
LINK VOLUME REPORT OF ALL-OR-NOTHING
ASSIGNED TURN VOLUMES -- 100 PERCENT LOADING -- PURPOSE 1

AT	FROM	------TO------ 104	116	206	SUM IN	TWOWAY
-112-						
	104	---	5181	3053	8234	9998
	116	1764	---	0	1764	8071
	204	0	1126	0	1126	---
	SUM OUT	1764	6307	3053		

Printing Link Groups and VMT

The $REPORT HIGHWAY NETWORK SUMMARY function will produce several reports on groups of links. This function is useful in analyzing the gross effects of major system alternatives, such as changes in vehicle miles traveled and volume of travel crossing screenlines. A report by screenline of traffic counts and estimated volumes can be produced by specifying the option "CAPACITY 2" and placing ground counts in the Capacity 2 field of the network.

The following example illustrates the $REPORT HIGHWAY NETWORK SUMMARY function:

```
$REPORT HIGHWAY NETWORK SUMMARY
$FILES
  INPUT FILE = LODHIST, USER ID = $INCASSN.DAT$
$HEADERS
               REPORT HIGHWAY NETWORK SUMMARY
$OPTIONS
$PARAMETERS
  SCREENLINE = 1, LINK = 120-130,130-120,124-132,132-124,126-235,
                  235-126,128-236,236-128,218-220,206-208
  SCREENLINE = 2, LINK = 104-102,102-104,202-204,222-224,122-124,
                  124-122,130-132,132-130
$DATA
ID, V/C RATIO RESULTS BY FUNCTIONAL CLASSIFICATION
  TABLE = 1, UNITS = VEHICLE-DISTANCE,
     LINK CODE = ASSIGNMENT GROUP, RANGES = 1,2,3,4,
  TABLE = 2 UNITS = VOLUME/CAPACITY
     LINK CODE = ASSIGNMENT GROUP, RANGES = 1,2,3,4
$END TP FUNCTION
```

```
                    REPORT HIGHWAY NETWORK SUMMARY
                      FOR LOADING OF ALL-OF-NOTHING
TABLE NO. 1 -- V/C RATIO RESULTS BY FUNCTIONAL CLASSIFICATION
TABLE UNITS -- VEHICLE - MILES
         ---------------
         ASSIGNMENT GROUP   VV       TOTAL

                            1        52662.6
                            2        155632.0
                            3        719787.0
                            4        452769.7

         TOTAL                       1380851.0


         TABLE NO. 3 --
         TABLE UNITS -- VOLUME/CAPACITY2
         ---------------
         ASSIGNMENT GROUP   VV

                            1        .14
                            2        .45
                            3        .86
                            4        .00

TOTAL                                .90
```

SCREEN LINE VOLUME REPORT
SCREEN LINE NO. 1

A-NODE	B-NODE	VOLUME	CAPACITY	V/C
120	130	18912	20000	0.95
130	120	14231	20000	0.71
124	132	4371	20000	0.22
132	124	4386	20000	0.22
126	235	-29782	30000	-0.99
235	126	-19107	30000	-0.64
128	236	13806	20000	0.69
236	128	10615	20000	0.53
218	220	4053	40000	0.1
206	208	6875	40000	0.17
SCREEN LINE TOTAL		28360	260000	0.11

Printing Assignment Iterations

$REPORT HIGHWAY INCREMENTAL SUMMARY will produce a detailed report of each iteration of an incremental traffic assignment. Also a report of traffic counts to estimated volumes can be printed if traffic counts are retained in the Capacity 2 field of the network. This report is classified by "Count Volume Group." This is a range of traffic counts by which the average percent deviation from the estimated volume is reported. Refer to NCHRP Report 255 for more detailed information on comparing ground counts to estimated volumes.

```
$REPORT HIGHWAY INCREMENTAL SUMMARY
$FILES
  INPUT FILE = LODHIST, USER ID = $INCASSN.DAT$
$HEADERS
          REPORT HIGHWAY INCREMENTAL SUMMARY
$OPTIONS
  PRINT LINK SUMMARY
  PRINT GROUND COUNT COMPARISON
$END TP FUNCTION
```

REPORT HIGHWAY INCREMENTAL SUMMARY
INCREMENTAL SUMMARY
LOADED LINK SUMMARY REPORT

ANODE	BNODE	CAPACITY	VOLUME OR CAPACITY2	DIST	TIME	SPEED	PERCENT LOADED	ASSIGNED VOLUME	ACCUM VOLUME	VOLUME / CAPACITY	PROJECTED VOLUME	PRO.VOL/ CAPACITY	ITERATION
122	120	20000	8950	1	2	30	15	2112	2112	0.11	14080	0.7	1
					1.96	30.61	30	913	3025	0.15	10083	0.5	2
					1.86	32.26	50	2814	5839	0.29	11678	0.58	3
					1.9	31.58	70	1216	7055	0.35	10078	0.5	4
					1.86	32.26	100	4221	11276	0.56	11276	0.56	5
	WEIGHTED AVERAGE				1.9	31.6							
124	122	20000	8873	1	2	30	15	3771	3771	0.19	25140	1.26	1
					2.63	22.81	30	3243	7014	0.35	23380	1.17	2
					2.44	24.59	50	4321	11335	0.57	22670	1.13	3
					2.37	25.32	70	4322	15657	0.78	22367	1.12	4
					2.34	25.64	100	6483	22140	1.11	22140	1.11	5
	WEIGHTED AVERAGE				2.35	25.53							

REPORT HIGHWAY INCREMENTAL SUMMARY
INCREMENTAL SUMMARY
GROUND COUNT COMPARISON REPORT

RESULTS OF ITERATION 5-- .... 30.00 PCT. ASSIGNED
TOTAL ACCUMULATED PERCENT OF TRIPS ASSIGNED .. 100 PCT.
TOTAL VOLUMES OF COUNTS 1283313
TOTAL PROJECTED ASSIGNED VOLUME 1045054
COUNT MINUS PROJECTED VOLUME 238259
PERCENT ERROR IN PROJECTED ASSIGNMENT 18.6

TOTAL VOLUME ASSIGNED TO COUNT LINKS THIS LOADING 311520
TOTAL ACCUMULATED ASSIGNMENT TO COUNT LINKS 1045054
TOTAL NUMBER OF LINKS WITHOUT COUNTS 44
TOTAL ACCUMULATED ASSIGNMENT TO LINKS W/O COUNTS 789672
PERCENT OF TOTAL COUNT ASSIGNED THIS LOADING 24.3
PERCENT ACCUMULATED VOLUME OF TOTAL COUNT 81.4

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	1	873	0	873	0	0	0.1	0	873	100	0	0
1001-2000	3	1751	2931	-1179	2573	146.9	0.4	60.1	2831	161.7	1061	60.6
2001-3000	6	2213	2990	-777	4870	220.1	1	227.7	4932	222.9	907	41
3001-5000	9	3767	2493	1274	2216	58.8	2.6	155.4	2556	67.9	673	17.9
5001-7000	8	5870	9521	-3651	6185	105.4	3.7	385.6	7182	122.4	2792	47.6
7001-10000	15	8959	13565	-4605	10363	115.7	10.5	1211.3	11340	126.6	4103	45.8
10001-15000	12	12980	11004	1976	9173	70.7	12.1	857.7	9384	72.3	3103	23.9
15001-20000	25	17821	14938	2883	7864	44.1	34.7	1532	8376	47	4431	24.9
20001-25000	5	22413	2297	20116	2355	10.5	8.7	91.8	20253	90.4	596	2.7
25001-30000	12	27944	16606	11338	13540	48.5	26.1	1266.1	17660	63.2	5165	18.5
TOTAL	96	13368	10886	2482	10500	78.5	100	7854.7	10789	80.7	3245	24.3

Printing Matrix Data

There are two basic types of matrices that are used with TRANPLAN:

- Trip matrices
- Travel impedance matrices

A trip matrix is one or many tables representing trips from all origins to all destinations (zones) contained in a unique file. For instance, a trip matrix can contain a table for all trip purposes combined and tables for each of the trip purposes separately.

Another type of matrix is the travel impedance matrix. This contains the minimum path travel impedances (time or distance) from all origin zones to all destination zones. Travel impedance matrices can have several tables also. In a TRANPLAN impedance matrix, the tables on an impedance matrix are reserved according to the following :

TABLE	IMPEDANCE
1	Cost
2	Distance
3	Time 1
4	Time 2

Functions to Print Matrix Data

There are two basic functions which will print matrix information:

- $REPORT MATRIX
- $MATRIX COMPRESS

Printing a Large Matrix File

$REPORT MATRIX is useful for reporting selected origin zones and trips or travel times to all other zones on a large matrix. It is not efficient to print an entire matrix using $REPORT MATRIX. A 200 by 200 matrix will produce 40,000 cell entries and many pages of output. However, $REPORT MATRIX can selectively print just a few rows from the matrix.

The following example show the typical function file for printing an impedance matrix. The "SELECTED IMPEDANCES =" statement refers to the table number on the matrix.

```
$REPORT MATRIX
$FILES
 INPUT FILE = RTABIN, USER ID = $HWYSKIM.DAT$
$HEADERS
                REPORT SEPARATION MATRICES
$OPTIONS
 PRINT TABLE
$PARAMETERS
 SELECTED IMPEDANCES = TIME 2
 SELECTED ZONES = 2, 4, 8
$END TP FUNCTION
```

```
                              REPORT SEPARATION MATRICES

ORIGIN ZONE   2 SKIM VALUE   TIME 2

TO ZONE     -1-     -2-     -3-     -4-     -5-     -6-     -7-     -8-     -9-     -0-   TO ZONE

      1   13.20    0.00   16.00   19.40   20.22   16.33   14.33    9.71   21.88   12.11        10
     11   20.36
```

The example below is a useful tool used to print trips and trip ends. The trip ends are actually the column and row totals from the selected zones in the matrix.

```
$REPORT MATRIX
$FILES
 INPUT FILE = RTABIN, USER ID = $GMTVOL.DAT$
$HEADERS
                REPORT FOR TRIP ENDS AND TABLE
$OPTIONS
 PRINT TRIP ENDS
 PRINT TABLE
$PARAMETERS
 SELECTED IMPEDANCES = TIME 2
 SELECTED PURPOSES = 1
 SELECTED ZONES = 1-2
$END TP FUNCTION
```

REPORT FOR TRIP ENDS AND TABLE
TOTAL SUM OF PURPOSES 1-3

ORIGIN ZONE 1 PURPOSE 1 154500 TOTAL ORIG/PROD

TO ZONE	-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-0-	TO ZONE
1	110550	10531	10694	8567	415	736	642	5958	154	3869	10
11	2384										

ORIGIN ZONE 2 PURPOSE 1 135000 TOTAL ORIG/PROD

TO ZONE	-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-0-	TO ZONE
1	2581	90890	1600	2366	1393	1457	2204	21196	458	9236	10
11	1619										

REPORT FOR TRIP ENDS AND TABLE
TOTAL SUM OF PURPOSES 1-3

TRIP END SUMMARY — PURPOSE 1

ZONE/DIST	ORIG/PROD	DEST/ATTR	TOTAL	INTRATRIPS	ZONE/DIST	ORIG/PROD	DEST/ATTR	TOTAL	INTRATRIPS
1	154500	121743	276243	110550					
2	135000	117069	252069	90890					
TOTALS	289500	238812	528212	201440					

Producing a Summary Trip Table

$MATRIX COMPRESS will print and/or produce an output trip table that contains an aggregate of zones into districts. The $DATA section of the function file contains specifications for the aggregation of zones to districts. The zone-to-district equivalencies will need to be sketched out on a plot. $MATRIX COMPRESS is useful for printing (or creating a file) the entire trip matrix to check trip totals and travel patterns. Since the $DATA section aggregates zonal values, this function is not recommended for use with travel impedance matrices. Aggregated zone-to-zone impedances are not useful.

```
$MATRIX COMPRESS
$FILES
 INPUT FILE = COMPIN, USER ID = $ODTABLE.DAT$
$HEADERS
            REPORT COMPRESSED TABLE
$OPTIONS
 PRINT COMPRESSED MATRIX
$PARAMETERS
 NUMBER OF DISTRICTS = 4
$DATA
 DISTRICT = 1, ZONES = 1-100
 DISTRICT = 2, ZONES = 101-200
 DISTRICT = 3, ZONES = 201-300
 DISTRICT = 4, ZONES = 301-325
$END TP FUNCTION
```

REPORT COMPRESSED TRIP TABLE
COMPRESSED DISTRIBUTION FOR ALL 1 PURPOSE(S)

DISTRICT	1	2	3	4	TOTAL
1	92292	51459	30791	13518	188060
2	51483	67210	35212	15418	169323
3	30813	35210	23975	3073	93071
4	13913	15896	3153	6794	39756
TOTAL	188501	169775	93131	38803	490210

CHAPTER TEN
TRANPLAN UTILITIES

TRANPLAN is operated most often using the function files. However, sometimes it is necessary to manipulate TRANPLAN input and output to suit a specific need. TRANPLAN utilities can help.

Location of Utility Files

The TRANPLAN package provides several utilities to perform operations on TRANPLAN files outside of the function file framework. Many of the utilities can be used to convert TRANPLAN information to a format that can be used in other programs such as spreadsheets, database management systems, and geographic information systems.

These utilities are located under the "C:\TP\MISC" subdirectory. This subdirectory must be specified in the AUTOEXEC.BAT file in order to have the ability to execute them from any working subdirectory. All of the utilities are executed by entering the name of the utility at the DOS prompt.

Converting Networks

Network conversion utilities provided with TRANPLAN include NETCARD, LODPAK, and LODUNP. NETCARD converts a TRANPLAN binary format network or a TRANPLAN loaded network into ASCII format. LODUNP converts a loaded TRANPLAN network into ASCII format.

NETCARD will prompt for an input filename and an output filename. It will also ask if you wish to report speeds or travel times. The output is a formatted ASCII file capable of being used as the input data in the $BUILD HIGHWAY NETWORK function. Therefore, NETCARD can be used to convert a TRANPLAN binary network to ASCII and to edit the ASCII file directly with a text editor.

NETCARD Formats

NETCARD stores all nodes and links on the same ASCII file. The links normally follow the nodes. There are two types of node formats:

- Large Coordinate format places one node, X-coordinate, and Y-coordinate on each line.
- Default format places several nodes and their coordinates on each line. However, the coordinate values cannot be more than 9,999.

The tables in the Appendix define the NETCARD node and link formats.

Defining Speed and Time in NETCARD

Note that the Speed/Time Flag will be an "S" for speeds and a "T" for times. If the B-A direction Speed/Time Flag is neither an "S" or a "T" but is a "2", then the B-A direction variable fields are left blank. In this case, the B-A direction variables are identical to the A-B direction variables. If the Speed/Time Flag is a "1", then the link has only an A-B direction.

Loaded Networks and NETCARD

When converting a network prior to being loaded, columns 39-44 and columns 68-73 will contain information coded as Capacity 2. Ground counts are normally placed in this field. Conversion of a loaded network after traffic assignment will cause NETCARD to ask whether you want the Capacity 2 field as initially coded or as loaded volumes to be placed in columns 39-44 and 68-73.

NETCARD also asks if you want a specific iteration travel time to be placed in the Time 2 field. During an incremental capacity restraint assignment, the travel times are updated according to the V/C ratio on the link at each iteration.

Converting TRANPLAN Matrix Files

The TRANPLAN utilities CARDTP will convert a matrix from "card" or ASCII format to TRANPLAN binary format. TPCARD will convert from TRANPLAN binary to ASCII format. There are a few variations of the original programs, notably TPCARD1. TPCARD1 will output an ASCII format file with the origin zone, destination zone, and number of trips on each line.

Peeking at TRANPLAN Files

A utility program used to "peek" at a description of a TRANPLAN file is called HEADER. This utility will list any information on a TRANPLAN binary format file which was coded under the "$HEADERS" section of the function by which it was created. Also, HEADER will give miscellaneous information about the contents of the file, depending on the file type.

TRANPLAN Turning Movements Utility

An executable program, TURNS.EXE, will produce a file containing a formatted list of turning movement data from a TRANPLAN loaded network. The program will prompt you on the desired sort field and produce a list of turning movements with the "from" node, "through" node, "to" node, and turn volumes on each line.

CHAPTER ELEVEN
ALTERNATIVES ANALYSIS USING TRANPLAN

This chapter provides descriptive examples of alternatives analysis using the TRANPLAN model. Specific cases are outlined for:

- Transportation system alternatives
- Land use alternatives

Travel Model Paradigm

The typical procedure for developing and maintaining a travel model is the same regardless of software or hardware used. The following steps are used in travel demand forecasting:

1) Model calibration

2) Model validation

3) Baseline forecasting or first alternative

4) Alternatives analysis

First, the model is developed from travel survey information; and the main parameters, such as gravity model friction factors, are calibrated.

Second, a test run of the model is performed to simulate existing conditions (or a recent year). The ADT estimates produced by the model are compared to traffic counts, and the model is adjusted to correlate with the observed data.

Third, a baseline forecast is done using a horizon year (20-year) network representing projects that are funded or committed. The baseline forecast is then used to compare separate alternative changes to the network or activity level.

Two Types of Alternatives

Changes from the baseline forecast can be made in one of two ways:

1) A change in the network

2) A change in the activity level (or travel demand level)

A change in the network represents an addition (or subtraction) of supply to the system, either in additional facilities or by adding capacity to existing links. A change in the demand can be a result of a change in land use, such as the addition of a shopping center or residential area. Also, an increase or decrease in activity level can result from a change in travel demand (for highways) introduced by reduced travel or transit mode choice.

The steps followed when testing an alternative are:

1) Determine the scenario

2) Code the network or land use change

3) Run the appropriate TRANPLAN functions

4) Analyze and document the alternative assumptions and results

Testing a Capacity Change

One basic question asked concerning a travel demand model is, "What will happen if the performance of the transportation system is improved?" An increase in the number of lanes could result in decreased congestion but may unexpectedly attract additional traffic.

The first step is to determine the scenario. What is the question that you are trying to answer regarding the capacity change? Is the change going to take place in the near future or is it a long-term (20-year) idea? Which network should be used? Which demographics (trips) should be used?

Once the scenario is assumed, the network should be coded to reflect the capacity change. The network speeds and capacities should be clearly defined and consistently applied within your study area. Link speeds and capacities are based on tables by functional class, area type, and number of lanes. Since areas may differ, you should obtain the look-up table specific to your area directly from TxDOT D-10.

In the following example, a mid-range forecast year was chosen to test the capacity change by the addition of lanes on an arterial. A previous model run has created the trip table. Thus, the steps needed to test the network change are:

1) Code and check the network change

2) Run only the traffic assignment with the new network

3) Plot and compare the results of the capacity change to the base network

In this case, the network was coded using HNIS. A template was used (SET TEMP) with all of the correct speeds and capacities. The template was then copied (COPY TEMP) to each of the links to be changed. A visual inspection of the capacity changes was performed by posting the capacities on each link in HNIS. Then the following function was run using the existing trip table:

```
$LOAD HIGHWAY NETWORK
$FILES
 INPUT FILE = HWYNET, USER ID = $C:\NEWNET.95$
 INPUT FILE = HWYTRIP, USER ID = $BASE95.OD$
 OUTPUT FILE = LODHIST, USER ID = $NEW95.VOL$
$HEADER
                LOAD HIGHWAY NETWORK
                1995 325-ZONE NETWORK
      CAPACITY CHANGE ON 25TH STREET FROM A ST. TO M ST.
$OPTIONS
 BASE NETWORK
 ADJUST 100
$PARAMETERS
 IMPEDANCE = TIME2
 LOAD PERCENTAGES = 15,15,20,20,30
$DATA
 ASSIGNMENT GROUP = 0-9, XYDATA = (0.0,1.087) (0.5,1.076) (1.0,0.935)
                    (1.5,0.595) (2.0,0.301) (2.4,0.167)
                    (4.0,0.167)
$END TP FUNCTION
```

A plot was made of the two assignments: the base network and the new network with the capacity change. After inspection of the plot, HNIS was used to compare the two traffic assignments using the "COMP NETS" feature. Finally, all assumptions were documented.

Testing a Land Use Change

Testing the impacts of a land use change is more involved than network modification. Many new elements are added to the system when new development occurs. The basic four steps are followed (determine the scenario, code the change, run the model, analyze the results) but with many new questions:

- How much traffic will the development create?
- At what points will there be access to the development?

- From what direction will most of the traffic be coming from? What effect will street improvements have on this?

Many of these questions will need to be answered with assumptions prior to running the model. The model can then be used to:

- Tell which direction the demand will be coming from, and
- Tell what impact the additional traffic will have on the existing (or proposed) street system.

Generating Trips

Coding the number of vehicle trips can be performed by submitting the projected number of employees or households and other variables such as income to D-10 for generation of vehicle trips. This procedure is recommended if large scale land use changes are being tested.

However, small scale traffic impact analysis can be performed by obtaining the trip rates for your area from D-10 and manually calculating vehicle trips to and from the site. Since trip rates vary by urban area, it is important to obtain the specific look-up table for your area.

Vehicle trip attractions and productions are produced by multiplying the employees or households by the appropriate trip rate in the table obtained from TxDOT D-10 in Austin. These are coded, using a text editor, directly in the appropriate column of the ASCII production-attraction file.

Balancing Productions and Attractions

After the productions and attractions are calculated, the balance between total productions and attractions in the urban area needs to be checked. The ratio of total productions to total attractions needs to be in the range of 0.90 to 1.10. Additional productions or attractions may need to be added to the data set, or a simple re-allocation from other zones should take place to ensure an adequate balance.

Special generators are activities which create an amount of trips that is not in line with the standard trip generation rates. Examples of special generators include airports, theme parks, hospitals, universities, and regional shopping malls. Trip productions and attractions for these facilities can be estimated from ground counts.

After the production-attraction file is updated, the following TRANPLAN function files can be executed.

```
$BUILD HIGHWAY NETWORK
$FILE
  INPUT FILE = NETDATA, USER ID = $J87LNKXY.ANT$
  OUTPUT FILE = HWYNET, USER ID = $J87HWY.NET$
$HEADERS
                BUILD HIGHWAY NETWORK
                   681 ZONES
$OPTIONS
  LARGE COORDINATES
  NETDATA
$PARAMETERS
  NUMBER OF ZONES = 681
  MAXIMUM NODE = 9999
  ERROR LIMIT = 50
$END TP FUNCTION
$HIGHWAY SELECTED SUMMATION
$FILE
   INPUT FILE = HWYNET, USER ID = $J87HWY.NET$
   OUTPUT FILE = HWYSKIM, USER ID = $J87SKIM.SEL$
$HEADERS
              SKIM THE MINIMUM IMPEDANCE PATHS
$PARAMETERS
   IMPEDANCE = TIME 2
$DATA
   TABLE = TIME 2
$END TP FUNCTION
$MATRIX UPDATE
$FILE
  INPUT FILE = UPDIN, USER ID = $J87SKIM.SEL$
  INPUT FILE = MUPDATA, USER ID = $J87.RAD$
  OUTPUT FILE = UPDOUT, USER ID = $J87INTRA.SKM$
$HEADERS
  ADD RADII VALUES TO REFLECT INTRAZONAL IMPEDANCES
$OPTIONS
  MUPDATA
$END TP FUNCTION
$GRAVITY MODEL
$FILES
   INPUT FILE = GMSKIM, USER ID = $J87INTRA.SKM$
   INPUT FILE = GRVDATA, USER ID = $J87.PNA$
   OUTPUT FILE = GMTVOL, USER ID = $J87GMT.PAT$
$HEADERS
                 GRAVITY MODEL
             TO PRODUCE A P-A TRIP TABLE
$OPTIONS
   TOTAL PURPOSE FILE
   GRVDATA
   PRINT TRIP LENGTH STATISTICS
$PARAMETERS
   MAXIMUM PURPOSE = 4
   SELECTED PURPOSES = 1-4
   MAXIMUM TIME = 50
   IMPEDANCE = TIME 2
   ITERATIONS ON ATTRACTIONS = 5
   ATTRACTION CLOSURE = 5
```

```
$END TP FUNCTION
$MATRIX TRANSPOSE
$FILES
  INPUT FILE = TRNSPIN, USER ID = $J87GMT.PAT$
  OUTPUT FILE = ODVOL, USER ID = $J87.INT$
$HEADERS
                O-D THE P-A TRIP TABLE
$OPTIONS
  NO TRANSPOSED FILE
$PARAMETERS
  PA FACTORS = .5
  AP FACTORS = .5
$END TP FUNCTION
$MATRIX UPDATE
$FILE
  INPUT FILE = UPDIN, USER ID = $ODTRIP87.TEX$
  OUTPUT FILE = UPDOUT, USER ID = $J87.EXT$
$HEADERS
    STEP 1 - ZERO OUT THE INT-INT ON TEXAS PACKAGE TRIP TABLE
$DATA
  T1, 1-661, 1-661, R0
$END TP FUNCTION
$MATRIX MANIPULATE
$FILE
  INPUT FILE = TMAN1, USER ID = $J87.INT$
  INPUT FILE = TMAN2, USER ID = $J87.EXT$
  OUTPUT FILE = TMAN3, USER ID = $J87.OD$
$HEADERS
    STEP 2 - ADD THE INT-INT TO THE EXT TRIP TABLE
$DATA
  TMAN3, T1 = TMAN1,T1 + TMAN2,T1
$END TP FUNCTION
$LOAD HIGHWAY NETWORK
$FILES
 INPUT FILE = HWYNET, USER ID = $J87HWY.NET$
 INPUT FILE = HWYTRIP, USER ID = $J87.OD$
 OUTPUT FILE = LODHIST, USER ID = $J87INC1.VOL$
$HEADER
                LOAD HIGHWAY NETWORK
             INCREMENTAL LOADING ASSIGNMENT
$OPTIONS
 BASE NETWORK
 ADJUST 100
$PARAMETERS
 IMPEDANCE = TIME2
 LOAD PERCENTAGES = 15,15,20,20,30
$DATA
 ASSIGNMENT GROUP = 0-9, XYDATA = (0.0,1.087) (0.5,1.076) (1.0,0.935)
                    (1.5,0.595) (2.0,0.301) (2.4,0.167)
                    (4.0,0.167)
$END TP FUNCTION
```

The first step of the model, $HIGHWAY SELECTED SUMMATION, creates a minimum impedance, zone-to-zone, travel time matrix based on the minimum paths "skimmed" from the Time 2 field on the network. The $GRAVITY MODEL reads the minimum travel time matrix and the production-attraction file (with friction factors included) and creates a production-attraction format trip table.

The $GRAVITY MODEL does not allocate daily trips in a round-trip fashion. Instead, it "sends" productions to the best attraction points according to the gravity model equation. Therefore, it does not satisfy the round trip. The resulting production-attraction format trip table must be converted to an origin-destination format. The $MATRIX TRANSPOSE function of TRANPLAN version 7.1 will perform this task.

The final step is to load the trip table on the network with the $LOAD HIGHWAY NETWORK function. Note that this is the same function used in the Short Method. Finally, all data should be carefully summarized and documented for future reference.

APPENDIX
FILE FORMATS

TRANPLAN Node Data: Large Coordinates

NODE DATA			
Variable	**Units**	**Range**	**Columns**
Card Type		N	1
Node	Number	1-9,999	2-6
X-Coordinate	Feet	1-9,999,999	7-17
Y-Coordinate	Feet	1-9,999,999	18-28
User Identification	Any	Any	29-80

TRANPLAN Node Data: Default Coordinates

NODE DATA			
Variable	**Units**	**Range**	**Columns**
Card Type		N	1
Node	Number	1-16,000	2-6
X-Coordinate	Feet	1-9,999	9-13
Y-Coordinate	Feet	1-9,999	14-18
Alternate Node, X, and Y			20-72
User Identification	Any	Any	74-80

TRANPLAN Link Data

LINK DATA			
Variable	**Units**	**Range**	**Columns**
A-Node	Number	1-9,999	1-5
B-Node	Number	1-9,999	6-10
Assignment Group	Number	0-9	11
Distance	Miles*100	1-4,095	12-15
Speed/Time Flag	Letter	S or T	16
A-B Direction Data			
Time 1 or Speed 1	MPH or MIN * 100	0-4,095	17-20
Time 2 or Speed 2	MPH or MIN * 100	0-4,095	21-24
Direction Code	Number	1-16	25-26
Link Group 1	Number	0-99	27-28
Link Group 2	Number	0-99	29-30
Link Group 3	Number	0-99	31-32
Capacity 1	Vehicles/Day	0-999,999	33-38
Capacity 2 or Volume	Vehicles/Day	0-999,999	39-44
B-A Direction Data			
Speed/Time Flag	Letter or Number	S , T , 2, or 1	45
Time 1 or Speed 1	MPH or MIN * 100	0-4,095	46-49
Time 2 or Speed 2	MPH or MIN * 100	0-4,095	50-53
Direction Code	Number	1-16	54-55
Link Group 1	Number	0-99	56-57
Link Group 2	Number	0-99	58-59
Link Group 3	Number	0-99	60-61
Capacity 1	Vehicles/Day	0-999,999	62-67
Capacity 2 or Volume	Vehicles/Day	0-999,999	68-73

TRANPLAN
Production-Attraction Data

Variable	Units	Columns
Identifier	GP or GA	1-2
Zone Centroid	Number	4-7
NHB Productions	Trip Ends/Day	11-17
NHB Attractions	Trip Ends/Day	11-17
HBW Productions	Trip Ends/Day	18-24
HBW Attractions	Trip Ends/Day	18-24
HBNW Productions	Trip Ends/Day	25-31
HBNW Attractions	Trip Ends/Day	25-31
LOEX Productions[1]	Trip Ends/Day	32-38
EXLO Attractions[2]	Trip Ends/Day	32-38
TRTX Productions[3]	Trip Ends/Day	39-45
TRTX Attractions[3]	Trip Ends/Day	39-45

[1]LOEX = Local-external
[2]EXLO = External-local
[3]TRTX = Truck-taxi

TRANPLAN Friction Factors

Variable	Units	Columns
Impedance	Minutes	4-7
NHB F-Factor	Number	11-17
HBW F-Factor	Number	18-24
HBNW F-Factor	Number	25-31
TRTX F-Factor	Number	32-38

Texas Package Links

Variable	Units	Columns
A-Node	Number	7-11
B-Node	Number	13-17
Direction Sign or Code	Number or Code	19-20
One-Way Flag	Number	22
Length	Miles*100	24-26
Speed	MPH	28-29
Traffic Count	Vehicles/Day	31-36
Capacity	Vehicles/Day	38-43
Functional Classification	Code	45
Administrative Jurisdiction	Code	47
Location of A-Node (Literal)	Description	71-80

Texas Package Nodes

Variable	Units	Columns
Description	"CENTROID" or "NODE"	1-8
Zone or Node	Number	16-20
X-Coordinate	Number (F13.4)	24-37
Y-Coordinate	Number (F13.4)	41-54

Texas Package
Production-Attraction Data

Variable	Units	Columns
Literal Description	"GENERATION" or "FORECAST"	1-10
Zone Centroid	Number	11-15
NHB Productions	Trip Ends/Day	16-20
NHB Attractions	Trip Ends/Day	21-25
HBW Productions	Trip Ends/Day	26-30
HBW Attractions	Trip Ends/Day	31-35
HBNW Productions	Trip Ends/Day	36-40
HBNW Attractions	Trip Ends/Day	41-45
LOEX Productions[1]	Trip Ends/Day	46-50
EXLO Attractions[2]	Trip Ends/Day	51-55
TRTX Productions[3]	Trip Ends/Day	56-60
TRTX Attractions[3]	Trip Ends/Day	61-65

[1]LOEX = Local-external
[2]EXLO = External-local
[3]TRTX = Truck-taxi

Texas Package
Friction Factors

Variable	Units	Columns
Separation	Minutes	6-10
NHB Relative Value	Number	91-102
HBW Relative Value	Number	91-102
HBNW Relative Value	Number	91-102
TRTX Relative Value	Number	91-102

Texas Package Radii Values*

Variable	Units	Columns
Literal	"R-VALUE" or "RADIUS"	1-7
Zone	Number	9-12
Radius of Zone	Minutes	15-20

TRANPLAN Intrazonal Values**

Variable	Units	Columns
Literal	"TIME2"	6-10
Zone	Number	12-19
Intrazonal Impedance	Minutes*100	23-25

*These data are used to replicate intrazonal impedances according to the following formula:

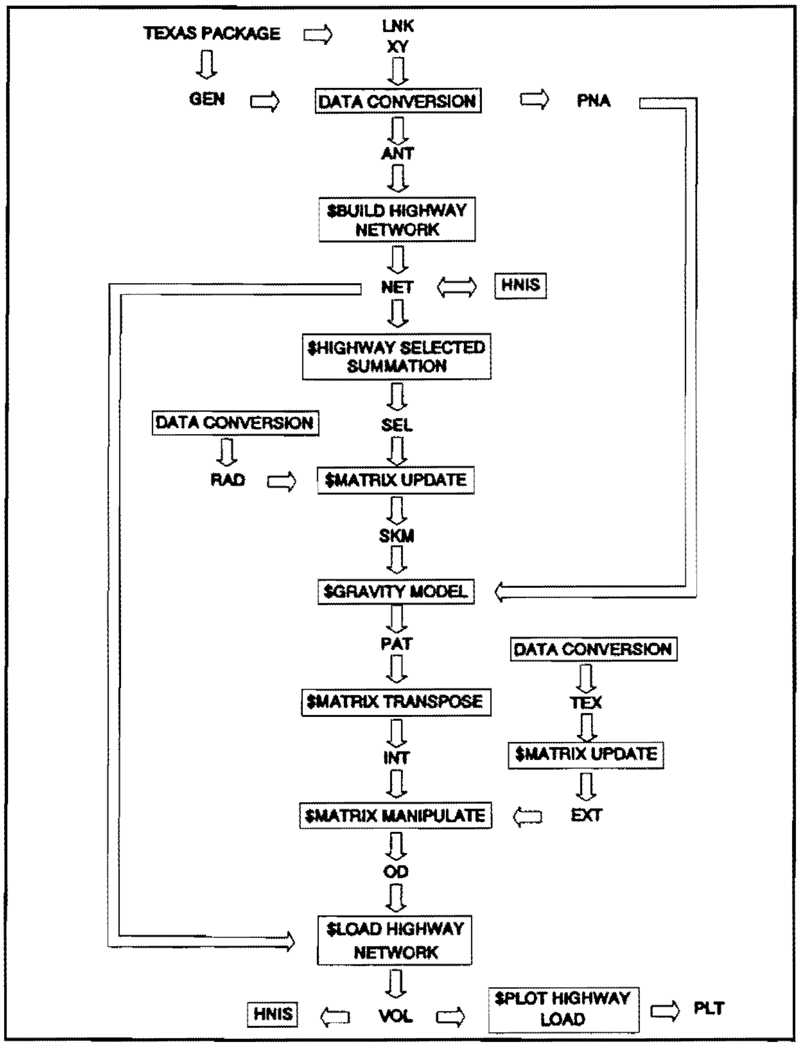
$$Iaa = \frac{2}{3}(2R_a)$$

Where:

I_{aa} = the calculated intrazonal impedance in zone a
R_a = the R-VALUE in zone a

**These data will be written out in a format for inclusion in the $DATA section of the $MATRIX UPDATE function.

Suggested File Name Extensions: Long Method



LNK ASCII Texas Package links after downloading from mainframe. Typically, this file is not used except during initial installation of a new validation.

XY ASCII Texas Package node numbers and coordinates, zone centroids, and other nodes typically used only during installation.

GEN ASCII Texas Package TRIPCALx results. Trip generation data for all trip purposes.

PNA ASCII TRANPLAN GRVDATA. Productions and attractions for all trip purposes and friction factors for all trip purposes (at end of file).

ANT ASCII TRANPLAN NETDATA network file.

NET Binary TRANPLAN HWYNET network file.

SEL HWYSKIM minimum impedance path matrix, before updating intra-zonal travel times with zonal radii, if used.

RAD TRANPLAN format update records used to change the intrazonal travel times to reflect the measured radius of the zone.

SKM HWYSKIM minimum impedance path matrix, after updating intrazonal travel times.

PAT Production/attraction format trip table, normally representing the total of all trip purposes (TRANPLAN GMTVOL).

INT Internal-to-internal urban area origin/destination format trip table. Typically, external and external-through trips are not calculated using the TRANPLAN $GRAVITY MODEL. All external station rows and columns of this matrix are zero.

TEX Texas Package origin/destination format trip table, after conversion to TRANPLAN binary format. Used in the long method to obtain external and external-through trips.

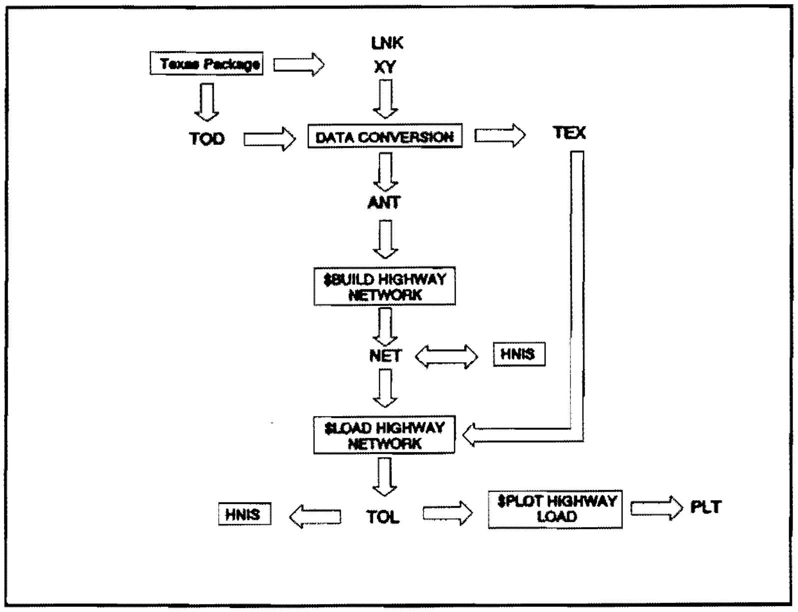
EXT Texas Package origin/destination format external and external-through trip table. All internal-internal trips on this matrix are zero.

OD Total origin/destination format trip table, including Texas Package external trips added to internal trips calculated from $GRAVITY MODEL.

VOL Loaded TRANPLAN network file (LODHIST), containing estimated or forecasted traffic volumes from all iterations of the incremental traffic assignment.

PLT TRANPLAN Hewlett-Packard Graphics Language (or other) ASCII plot instructions file, ready for sending to a compatible plotter.

Suggested File Name Extensions: Short Method



LNK ASCII Texas Package links after downloading from mainframe. Typically, this file is not used except during initial installation of a new validation.

XY ASCII Texas Package node numbers and coordinates, zone centroids, and other nodes typically used only during installation.

ANT ASCII TRANPLAN NETDATA network file.

TOD Texas Package trip table in ASCII format (12I6), as downloaded from mainframe computer.

TEX Texas Package trip table in TRANPLAN binary format, after conversion from ASCII. Ready for use in highway assignment.

NET Binary TRANPLAN HWYNET network file.

TOL TRANPLAN LODHIST loaded highway network, with all iterations from traffic assignment. This differs from the VOL file in that the trip table used for the traffic assignment was the TEX file directly from the Texas Package.

PLT TRANPLAN Hewlett-Packard Graphics Language (or other) ASCII plot instructions file, ready for sending to a compatible plotter.