MODEL USER'S GUIDE:

NOACA REGIONAL TRAVEL DEMAND

FORECASTING MODEL

Northeast Ohio Areawide Coordinating Agency

1299 Superior Avenue
Cleveland, OH 44114-3204

August 2007

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NOACA

Planning For Greater Cleveland

The Northeast Ohio Areawide Coordinating Agency (NOACA) is a public Organization serving the counties of and municipalities & townships within Cuyahoga, Geauga, Lake, Lorain and Medina (covering an area with 2.1 million people). NOACA is the agency designated or recognized to perform the following functions:

- **Serve as the Metropolitan Planning Organization (MPO), with responsibility for comprehensive cooperative and continuous planning for highways, public transit, and bikeways, as defined in the Transportation Equity Act for the 21st Century.**
- **Perform continuous water quality, transportation-related air quality and other environmental planning functions.**
- **Administer the area clearinghouse function, which includes providing local government with the opportunity to review a wide variety of local or state applications for federal funds.**
- **Conduct transportation and environmental planning and related demographic, economic and land use research.**
- **Serve as an information center for transportation and environmental and related planning.**
- **At NOACA Governing Board direction, provide transportation and environmental planning assistance to the 172 units of local, general purpose government.**

The NOACA Governing Board is composed of 38 local public officials. The Board convenes monthly to provide a forum for members to present, discuss and develop solutions to local and areawide issues and make recommendations regarding implementation strategies. As the area clearinghouse for the region, the Board makes comments and recommendations on applications for state and federal grants, with the purpose of enhancing the region's social, physical, environmental and land use/transportation fabric. NOACA invites you to take part in its planning process. Feel free to participate, to ask questions and to learn more about areawide planning. For more information, call:

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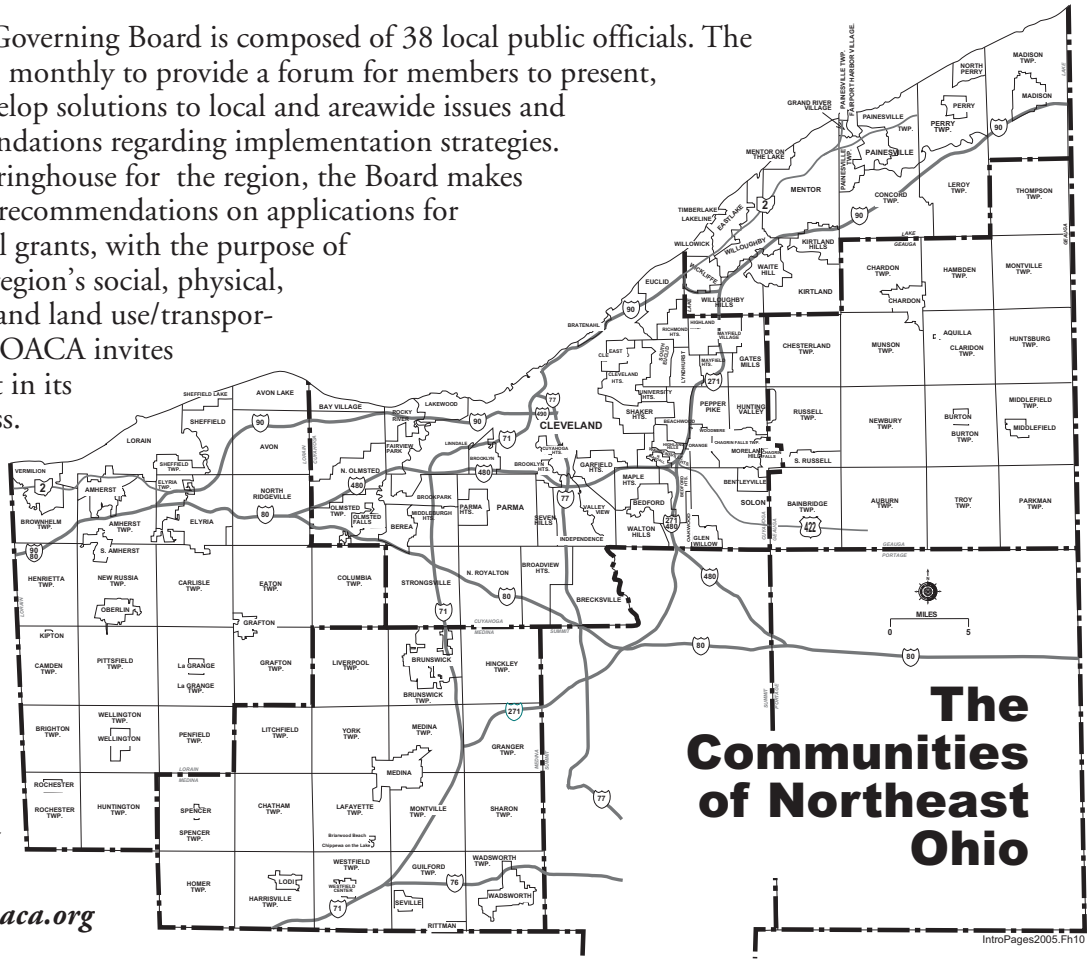

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Model Design Overview

The regional travel demand forecasting models for the Cleveland area were developed by Parsons Brinckerhoff, with assistance from the Northeast Ohio Areawide Coordinating Agency (NOACA), for the Greater Cleveland Regional Transit Authority (GCRTA). The models are implemented in the Cube Voyager travel demand modeling software package and a series of stand-alone programs written expressly for the Cleveland area. The entire model stream is run using several macros which require no user intervention once a model run is underway. A full model run requires approximately 1.7 gigabytes of hard-drive space. The use of 'feedback' loops, in which assignment outputs are re-used in the estimation of trip generation, distribution, and mode choice models, requires that the models be run iteratively. The model is set to perform at most 10 feedback iterations, but will do less if it converges in less iterations. A 10-iteration full model run takes approximately 15 hours on a Pentium 1.6 GHz processor.

In addition to the travel demand model, the Cube implementation includes an interface to run ODOT's capacity and speed calculators.

This document describes the scripts, input/output/parameter files, and stand-alone programs that implement the Cleveland regional travel demand models. First, the general structure of the models and model flow is briefly described. This is followed by a description of file management in the Cube environment and in particular for the Cleveland models. Procedures for installing the catalog, for running the base and other scenarios and for running the ODOT calculators are covered in the next two sections. The input and parameter files needed to run the model, as well as the output and report files produced during a model run are described next. Finally, the stand-alone programs written by PB to implement the auto ownership, trip generation and mode choice procedures are described. The appendix contains a detailed description of the input files. *This document is not intended as a substitute for the detailed GCRTA model development report.*

Model Flow

The Cleveland travel demand forecasting models constitute what is commonly defined as 'best practices' approaches to the traditional four-step modeling procedure. These models incorporate many of the most current modeling techniques in use in the United States by similarly sized metropolitan regions. Many of the features that enhance the Cleveland model system also add to their complexity, including;

- The use of 'feedback' loops to achieve consistency between initial travel times and costs used in lower levels of the model chain (trip generation, distribution, mode choice) and those output from higher levels of the model chain (highway assignment).

- The consideration of transit accessibility in the logit auto ownership model.

- The use of a relatively complex market segmentation scheme for work trip distribution (auto ownership and household income).

- The use of a composite measure of impedance, which considers transit accessibility, for 0 auto work trip distribution.

- A sub-classification scheme for work trip purposes (direct, strategic, complex) to capture trip chaining behavior and reflect this behavior in mode choice models.

- The use of peak and off-peak time periods for all trip purposes through mode choice, and the use of four time-period highway assignments (AM. Peak, Midday, P.M. Peak, and Night).

- Both peak and off-peak transit assignments for all trip purposes.

These features increase the computational requirements of running the models beyond more traditional travel models. Many of these features have necessitated the development of stand-alone software, written in the C or FORTRAN language, including:

- **AUTOGEN**, which implements socio-economic submodels, the logit auto ownership submodel, trip generation models (internal, internal-external, and truck), and calculates and writes skims used in trip distribution.
- **NLOGIT**, which implements nested–logit mode choice models.

Figure 1 shows the general flow of the Cleveland model chain.

Skim-Building

First, peak and off-peak speeds are calculated based on observed speeds coded on the A.M. and Midday input highway networks respectively, and a new set of A.M. and Midday highway networks are created. These networks are then used to create peak and off-peak highway time and distance skims, and intrazonal time is added. Transit skims are also created using the transit lines and transit operational characteristics. The total unweighted peak and off-peak walk-to-rail transit times (in-vehicle time, total wait time, and auxiliary transit time) are added together into one file, which is used in the calculation of transit accessibility for auto ownership and in the computation of composite impedance for trip distribution.

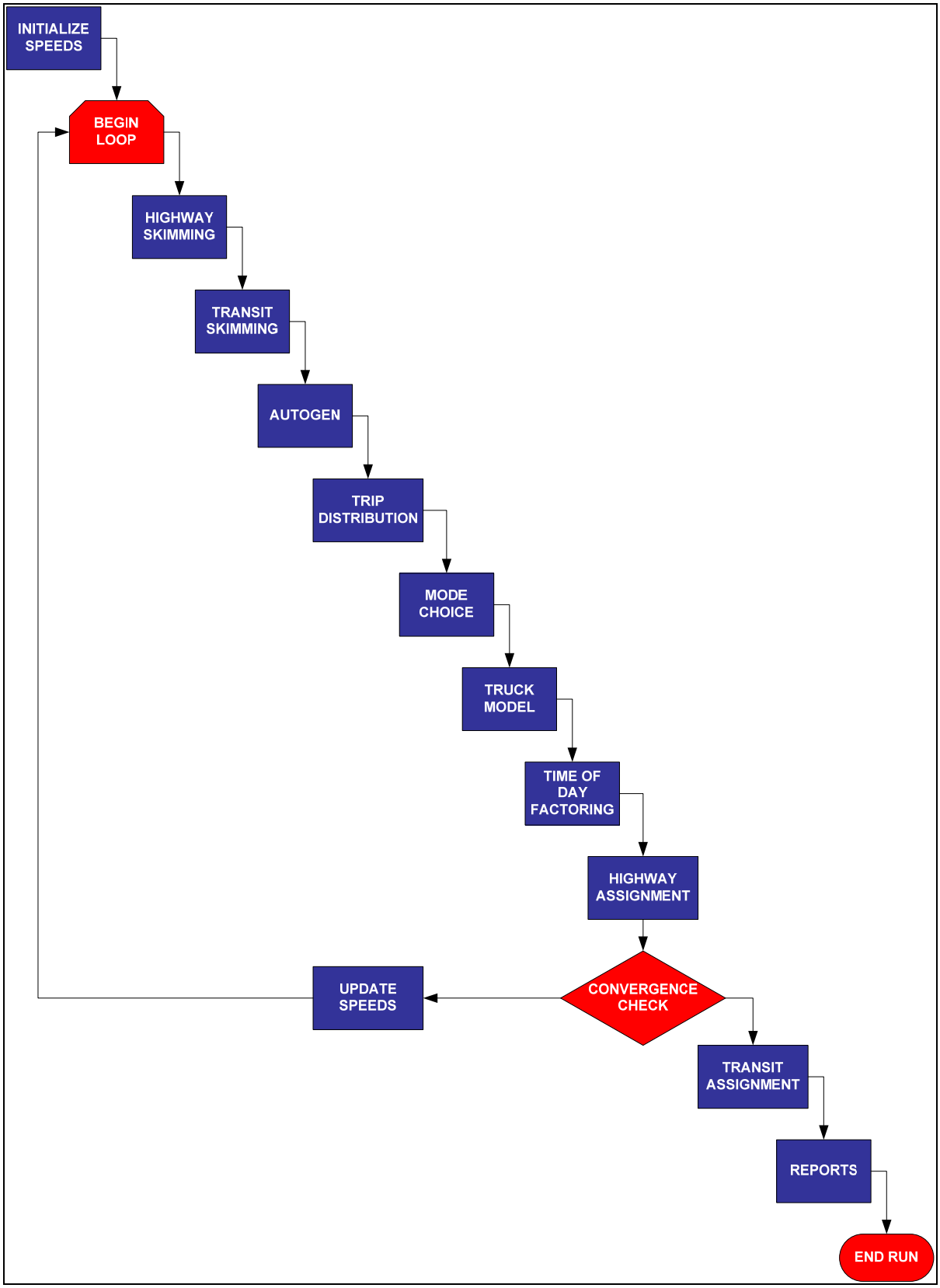
Trip Generation

Next, **AUTOGEN** is run, which reads the socio-economic input files, transit and highway skim files, internal-external percentage file, and external station percentage file. **AUTOGEN** estimates households by household income, household size, and number of workers per household. A logit auto ownership model determines number of autos per household, based on stratified households and accessibility measures. These stratifications are used to compute trip productions by purpose, time period (peak versus off-peak) and zone. To estimate trip attractions, cross-classification models are applied to employment by type. Internal trip productions and attractions are written to ASCII input files. Daily internal-external trip productions and attractions are computed and written to ASCII input files. The commercial vehicle model is implemented in **AUTOGEN**. Finally, **AUTOGEN** computes composite impedance for 0 auto work trips and writes a Cube Voyager formatted skim file to be used in trip distribution.

Trip Distribution

Gravity models are then implemented for all internal trip purposes and for both peak and off-peak periods. Commercial vehicles and internal-external trips are also distributed to create 24-hour trip tables. These gravity models are implemented in Voyager. All input files are created in **AUTOGEN**, including friction factors and impedance skims (terminal times are also added in this step). District level summaries and trip length frequency distributions are also created for comparison and validation purposes. Trip tables output from trip distribution are then collapsed for input to mode choice. Work trip tables are collapsed by household income. Home-based Shop, Home-Based Social/Recreational, and Home-Based Other trip purposes are collapsed into Home-Based Other. Auto ownership stratifications are maintained for home-based trips, as is the segmentation of Home-Based Work trips (direct, strategic and complex trips).

Figure 1: Model Flow Diagram



Mode Choice

The next step is the application of **NLOGIT**, the stand-alone mode choice program. **NLOGIT** reads the skims and trip tables produced by previous model steps, along with the zonal socio-economic data file, parking cost file, household auto ownership file, and zonal walk to transit accessibility file. **NLOGIT** applies nested logit mode choice models, and creates trip tables by mode, trip purpose, and time period (peak and off-peak). **NLOGIT** also creates a file containing the percent of total work trips by zone that chose the walk mode, which is read by the auto ownership program in the next iteration of feedback.

Highway Assignment

Time-of-day factors are then applied to **NLOGIT** outputs to allocate trips to four time periods: A.M. peak (5-10 A.M.), Midday (10 to 3 P.M.), P.M. peak (3-6 P.M.) and Night (6 P.M – 5 AM). Just before assignment, 24-hour speeds on each network are replaced with free-flow speeds, stratified by facility type and area type. Link capacities for each time period are calculated by factoring the 24 hour capacity. The trip tables are then assigned to their respective networks using an equilibrium assignment algorithm, with HCM 2000 volume-delay functions. The four time periods are added together to create a 24-hour loaded highway network.

Feedback Implementation

The feedback loop is implemented using Cube's LOOP procedures. LOOP tells Cube to iterate between the first program group (network skimming) and the last program group (highway assignment), until the model converges, or until the pre-specified maximum number of iterations is reached (currently set to 10). The model has converged when the % root mean square error (%RMSE) of the current and previous iterations' volumes is less than 5%, and the %RMSE of the current and previous iterations' AM trip table is also less than 5%. A highway network archive of all iterations' volumes (each time period and total daily volume) is kept for future reference. Copies of the AM trip table produced by all iterations are also kept. If the model has not converged, feedback volumes for the peak and off-peak networks are computed using the method of successive averages, respectively using the AM and Midday volumes. Peak and off-peak speeds for the next model iteration are computed from the feedback volumes using the HCM 2000 volume-delay functions.

Transit Assignment

Once the model converges, transit assignments are performed for both peak and off-peak time periods. The transit assignments are executed using trip tables in production => attraction format.

Model Installation

The following procedures will install the model and base year 2000 input data on a workstation.

1. Unzip NCUBE.ZIP in the folder where you want to install the model.
2. Use a text editor to edit the file USER.TPL in the \PROGRAMS folder. Do a find/replace on C:\PROJECTS\NOACA\CONVERSION\NCUBE\ and replace this with the path to your \PROGRAMS folder; thus if you install the model on your C: drive in a folder called NCUBE, you would replace C:\PROJECTS\NOACA\CONVERSION\NCUBE\ with C:\NCUBE\.
3. Copy the edited USER.TPL to your CUBE installation directory; the default installation folder is C:\PROGRAM FILES\CITILABS\CUBE. This file is required to run the ODOT CAP2000 calculators.
4. Copy the files TWMENU.RSC and USERPROGS.RSC in the \PROGRAMS folder to the \RESOURCE folder of the CUBE installation directory. These files are required to run the non-cube model applications, namely GAWK, AUTOGEN and NLOGIT.
5. Add the following line C:\Projects\NOACA\Conversion\NCube\Programs or the path folder in your computer's Environment Variables Path (It's part of system properties)
6. Copy file *cc3270.dll* from C:\Projects\NOACA\Conversion\NCube\Programs into C:\WINDOWS\system32 folder
7. Open the NCUBE.CAT file in CUBE. Open the model application by double-clicking on "ncube" in the Applications pane. When it prompts to change path names, answer yes.

File Management

The model uses the file management utilities provided by Cube, and this dictates the directory structure of the application, particularly the \Base subfolder. See Figure 2. The root directory for the model application and model run files is the folder where the catalog is installed. All files that may be scenario-specific, such as input, output and report files, are in the \Base sub-directory. The Cube/Voyager scripts are in the \Controls sub-directory. Applications other than Cube & Voyager used by the model, such as AUTOGEN, NLOGIT and GAWK are in the \Programs folder.

The \Base sub-directory contains all data required to run the base year scenario, as well as its outputs, structured in five sub-folders, as shown in Figure 2. All files in the \inputs sub-directory are specified using catalog keys, and are listed under Inputs in Cube's Data Pane. A selection of output files has been added to Cube's Data Pane output list. The user is free to add or delete files from this list. All standard report and print files produced by Voyager are in the \reports sub-directory. These files cannot be viewed in the Data Pane because the Data Pane reports are exclusively produced with Cube Reports. The \controls sub-directory contains the AUTOGEN and NLOGIT control files. The \parameters sub-directory contains various scenario-specific parameters used by the model, such as time of day factors, initial speed tables and capacity conversion factors.

Figure 2: Catalog File Structure

```
\Base
    \inputs
    \outputs
    \reports
    \controls
    \parameters
\Controls
\Programs
```

When a new scenario is created, Cube will create a folder under \Base to store the new scenarios files. The user needs to create the sub-directory structure under the new scenario folder, that is, create the \inputs, \outputs, \reports, \controls and \parameters folder using Windows Explorer or similar file browser software. See Figure 3 for a sample structure assuming the new scenario is called Alternative1.

Figure 3: Catalog File Structure for a Child Scenario

```
\Base
    \Alternative1
        \inputs
        \outputs
        \reports
        \controls
        \parameters
    \inputs
    \outputs
    \reports
    \controls
    \parameters
\Controls
\Programs
```

The user is responsible for populating the \inputs, \controls and \parameters folders. The \controls and \parameters files need not change for each scenario; in fact, it is likely that they will remain constant for most scenarios, and therefore the contents of the sub-folders under \Base can be copied to the new scenario sub-folders. The \outputs and \reports folder will be populated by the model, once the scenario is run. The user is responsible for populating the \inputs folder.

Running the Model

The model is run using Cube's Scenario Manager tools. Upon installation, the Base scenario should be all setup and ready to run. In order to run other scenarios, first the scenarios need to be created. Once this is done, then they are run in the same fashion as the Base scenario. These steps are described next.

Running the Base Scenario

As indicated above, the model installation sets up the Base scenario. This means that all input, control and parameter files reside in their respective folders, that the outputs and reports folders are created, and that the catalog keys point to the appropriate input files. Figure 4 shows the Scenario key edit dialog screen, for the case where the scenario folder is ***C:\Projects\NOACA\conversion\ncube\Base***.

To run the base scenario, Cube provides three options, listed under Application\Run Application:

1. Create a Task Run File Only, to run later from Task Monitor: this is useful when the user wants to make multiple runs.
2. Create a Script, to run from Voyager: this creates a script file of the entire model chain, which can then be called up and run from Voyager.
3. Run the Application now from Task Monitor: this begins execution of the selected scenario run immediately.

Alternatively, the run can be started from the Scenario menu:

1. Select Edit/Run Scenario
2. Review the values assigned to all scenario keys
3. Press the Run button to run the scenario

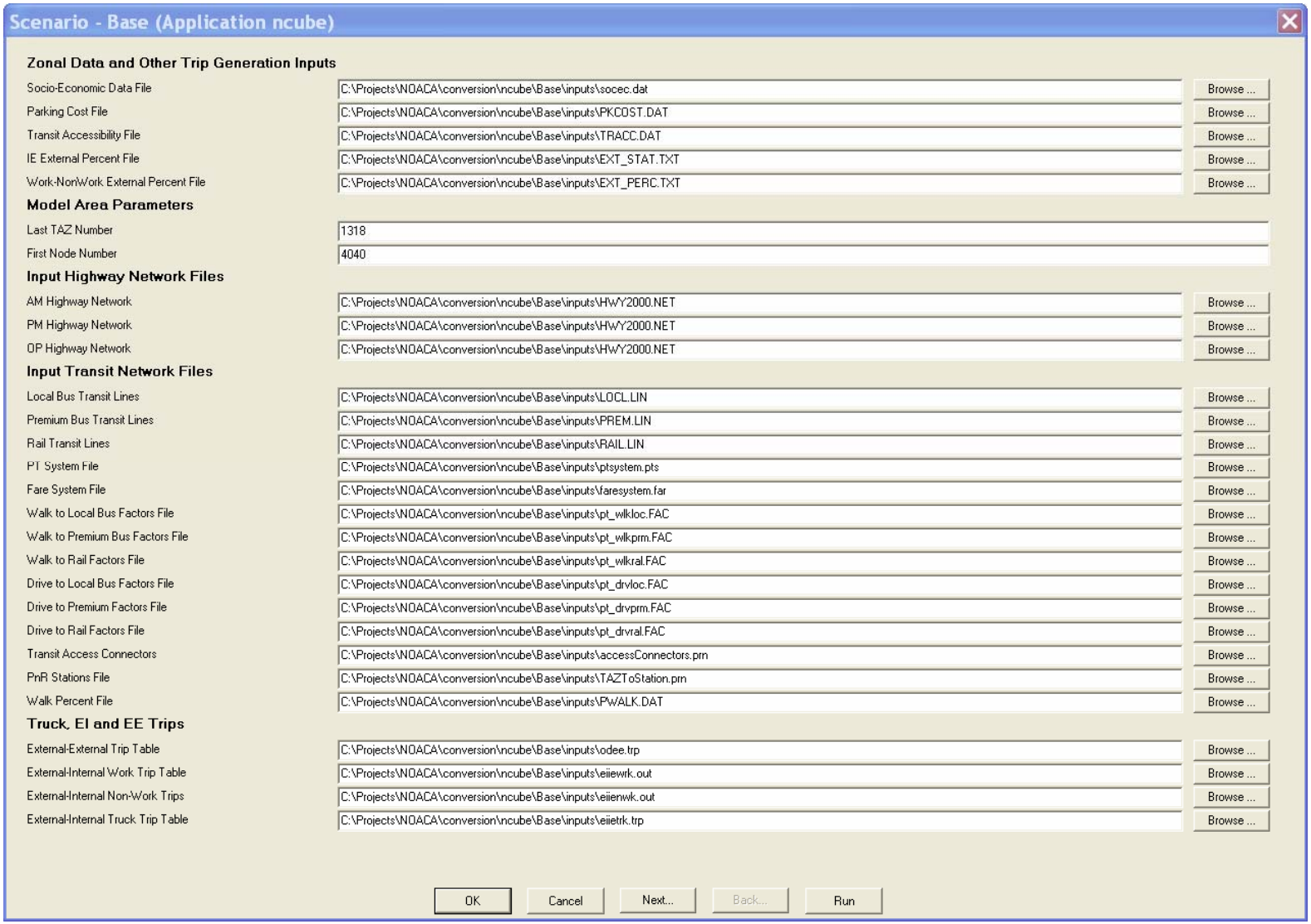
Creating and Running Other Scenarios

The following steps describe how to create and run a scenario other than the Base scenario:

1. Create the new scenario in Cube's Scenarios Pane.
2. Select the new scenario in Cube's Scenario Pane.
3. Create the folder structure to store model inputs and outputs, as described in the File Management section of this document.
4. Populate the \inputs folder with the inputs files particular to this scenario.
5. Populate the \controls and \parameters folder. In most cases, this simply involves copying the files from the respective Base scenario folders.
6. Edit the scenario keys to their appropriate values, and in particular, make sure they refer to the input files in this scenario's \input folder.
7. Run the scenario, using any of the options described above for the Base scenario.

Please note that it is not necessary to update all the input folders of a child scenario. Cube will use the input files specified for the scenario's keys, even if they reside in a different scenario folder.

Figure 4: Scenario Key Dialog Window



Running the ODOT Calculators

The ODOT speed and capacity calculators are run via process templates developed by Ohio DOT Technical Services. To access a process template:

1. Select Process Template from the Run menu
2. Choose the calculator you wish to run
3. Populate the dialog window box that opens up with the appropriate file paths and other information
4. Press OK to run the calculator.

File Description

This section describes the input, output and report files produced by all model steps, with the exception of AUTOGEN and NLOGIT, which are covered in their respective sections. The file description is organized by program subgroup as shown in the Cube catalog, in addition to the global parameter files, which may be used by any subgroup. A detailed description of the format and contents of the input files is available in the Appendix.

Global Parameter Files

NCUBE.VAR:

This is the Cube variables file. It is created by Cube every time a scenario is run. It is used to keep track of the feedback iteration number (for naming output files), and also to report the model convergence % rmse at each feedback iteration.

PARAMETERS.TXT:

This file contains the model parameters listed below.

Parameter	*Value*	*Description*
OCC3PAM	3.7	Average vehicle occupancy for SR3+ AM Peak
OCC3PMD	3.7	Average vehicle occupancy for SR3+ Midday
OCC3PPM	3.7	Average vehicle occupancy for SR3+ PM Peak
OCC3PNT	3.7	Average vehicle occupancy for SR3+ Night
CONFACNT	0.29	Hourly to Night period capacity conversion factor
CONFACAM	0.38	Hourly to AM Peak period capacity conversion factor
CONFACMD	0.20	Hourly to Midday period capacity conversion factor
CONFACPM	0.50	to PM Peak period capacity conversion factor
PCEFLAT	2.0	PCE for Heavy Trucks in Flat or Non-defined Terrain
PCEROLLING	3.0	PCE for Heavy Trucks in Rolling Terrain
PCEMTN	5.0	PCE for Heavy Trucks in Mountainous Terrain

Group 1: Speed Initialization

Input Files

AM, PM and OP Highway networks	These networks are inputs to the model system and must therefore be defined via their respective catalog keys. In the current implementation, a single network file contains all the information for the AM, PM and OP procedures.
Speed Tables: amspeeds.dat pmspeeds.dat opspeeds.dat	By default, the model will read initial peak and off-peak speeds from network variables. The script however provides the option of reading these speeds from a lookup table. A set of lookup year 2000 speed tables are included with the model installation, in the \parameters folder. To use these speeds, the relevant script sections must be enabled. Even if not used, these files must be present in the \parameters folder.

Output Files

Highway networks: amwspds.net pmwspeds.net opwspds.net	The output highway networks contain the SPEED field, which is used to calculate peak and off-peak skims, using the AM and OP output network respectively.

Report Files

speedam.prn speedpm.prn speedop.prn	Standard print files produced by Voyager's NETWORK function.

Group 2: LOOP control

Input Files

First iteration highway networks: amwspds.net opwspds.net	For the first iteration, the model uses the highway networks output by the speed initialization group.
Second and higher iteration highway networks: amupdspds.net opupdspeds.net	For the second and all subsequent iterations, the model uses the highway networks output by the feedback procedures.

Output Files

Current iteration highway networks: amhwy.net ophwy.net	The LOOP function copies the relevant input networks to commonly-named network files. These files will be used by processes inside the LOOP.

Group 3: Highway Skimming

Input Files

Highway networks: amhwy.net ophwy.net	These are the networks output by the LOOP control process.

Output Files

Highway skims: hwyskims.mat	Highway skim tables in Cube Voyager format: Table 1 – peak highway distance Table 2 – peak highway time Table 3 – off peak highway time Table 4 – walk distance

Report Files

pkhwyskm.prn ophwyskm.prn nonmotskm.prn	Standard print files produced by Voyager's HIGHWAY function. Each report corresponds to the processes that skim the peak, off-peak and non-motorized networks, respectively.
mrgskms.prn	Standard print file produced by Voyager's MATRIX function. Corresponds to the process that merges the period skim files into a single matrix.

Group 4: Transit Skimming

The transit network consists of 18 sub-networks, corresponding to 2 time periods, 3 transit modes (local, express, rail) and 3 access modes (walk, pnr and knr). The table below describes all input files, but only one set of output & report files (those corresponding to the peak local bus skims). Similar output and report files are produced for each sub-network.

Input Files

Generate.awk	GAWK script file used to produce GENERATE statements for the PUBLIC TRANSPORT function.
TAZ to Station File	The name of this file must be specified using its catalog key. This file links individual TAZs to specific park-and-ride lots.
Auto Access Connector File	The name of this file must be specified using its catalog key. This file links highway network nodes to transit nodes, for purposes of building auto access and bus transfer links.
Highway networks: amhwy.net ophwy.net	These are the networks output by the LOOP control process.
Transit line files: Local bus, express bus and rail transit	The names of these files must be specified using their catalog keys.
PT system file	The name of this file must be specified using its catalog key. This file contains global parameters for the Voyager's PUBLIC TRANSPORT function, such as mode numbers, names and description; operator numbers; and other.
Fares file	The name of this file must be specified using its catalog key. It contains fare information for use by Voyager's PUBLIC TRANSPORT function.
Factors files: walk local drive local walk premium drive premium walk rail drive rail	The names of these files must be specified using their catalog keys. They contain parameters for Voyager's PUBLIC TRANSPORT function, such as maximum allowable transfers, transfer penalties, value of time, fare system by mode, and others. The same factors are used to build and skim the peak and off-peak transit networks. PNR and KNR factors are the same (drive).

Output Files

GENERATE statements: wlkralgenerate.s pnrralgenerate.s knrralgenerate.s pnrlocgenerates. knrlocgenerate.s pnrprmgenerate.s knrprmgenerate.s	There files contain GENERATE statements for Voyager's PUBLIC TRANSPORT function. These statements indicate how to build the non-transit connectors (walk and drive access to rail, and drive access to park and ride).
Transit networks: pkwlkloc.net pkpnrloc.net pkknrloc.net	Transit network files in internal Voyager format. Similar files are produced for the premium and rail networks, both for peak and off-peak periods.
Non transit leg files: pkwlkloc.ntl pkpnrloc.ntl	Final non-transit legs used to build the transit networks, in Voyager format (these are text files). Similar files are produced for the premium and rail networks, both for peak and off-peak periods.

pkknrloc.ntl

Route files:
pkwlkloc.rte
pkpnrloc.rte
pkknrloc.rte

Final transit routes in internal Voyager format. These files are used for transit assignment. Similar files are produced for the premium and rail networks, both for peak and off-peak periods.

Skim files:
pkwlkloc.mat
pkpnrloc.mat
pkknrloc.mat

Transit skim tables in Cube Voyager format:

	Wlk	PNR	KNR
Initial wait time	Table 1	Table 1	Table 1
Transfer wait time	Table 2	Table 2	Table 2
Number of transfers	Table 3	Table 3	Table 3
Walk access & egress time	Table 4	Table 4	Table 4
Not used	Table 5	Table 5	Table 5
Drive access to formal lot		Table 6	Table 6
Drive access to informal lot		Table 7	Table 7
Local bus in-vehicle travel time	Table 6	Table 8	Table 8
Premium bus in-vehicle travel time	Table 7	Table 9	Table 9
Rail in-vehicle travel time	Table 8	Table 10	Table 10
Fares	Table 9	Table 11	Table 11
Total in-vehicle travel time	Table 10	Table 12	Table 12
Total time	Table 11	Table 13	Table 13

Highway network with connectors:
amwconn.net
opwconn.net

Highway networks with added bus-to-rail walk access connectors.

Report Files

pkwlkloc.prn
pkpnrloc.prn
pkknrloc.prn

Standard print files produced by Voyager's PUBLIC TRANSPORT function. Similar files are produced for the premium and rail networks, both for peak and off-peak periods.

pkwlkloc.rpt
pkpnrloc.rpt
pkknrloc.rpt

Standard report file produced by Voyager's PUBLIC TRANSPORT function. All reports from Route Enumeration and Route Evaluation are written to these files.

amautoconn.prn
opautoconn.prn

Standard print files produced by Voyager's NETWORK function. These are produced when adding bus-to-rail walk access connectors to the highway networks.

Group 6: Trip Distribution

Input Files

Highway skims:
distrib.mat

This is the highway skim file created by AUTOGEN.

Productions and attractions:
pktrips.dat
optrips.dat

Productions and attractions by purpose and market segment. This file is produced by AUTOGEN.

Friction factors:
ffactors.dat

Friction factors for all purposes and market segments. These files are produced by AUTOGEN.

EI work trips
EI non-work trips

External-Internal work and non-work auto trips. The names of these files must be specified using their catalog keys. Trips expected in hundredths of units.

Output Files

Trip tables:

Trip tables produced by the gravity models.

pkwka0.mat
pkwka1.mat
pknwk.mat
opwka0.mat
opwka1.mat
opnwk.mat

Work trips:

	LowInc	MedInc	HighInc
Direct	Table 1	Table 2	Table 3
Strategic	Table 4	Table 5	Table 6
Complex	Table 7	Table 8	Table 9

Non Work trips:

Table 1: School
Table 2: University
Table 3: Shop
Table 4: Social/Rec
Table 5: Other
Table 6: Non-home based work
Table 7: Non-home based other

Trip tables in mode choice format:
pkmcwork.mat
opmcwork.mat
mcnwrk.mat
eiewrk.mat
eienwk.mat

These are the gravity model tables, formatted as expected by the mode choice application, NLOGIT.

Report Files

pkwka0.prn
pkwka1.prn
pknwk.prn
opwka0.prn
opwka1.prn
opnwk.prn

Standard print files produced by Voyager's MATRIX function. These print files report the results of the gravity models.

sumtriptabs.prn

Standard print file produced by Voyager's MATRIX function. This print file reports on the results of preparing the trip tables for mode choice input.

Distsum.prn
Distsumtabs.prn

Standard print files produced by Voyager's MATRIX function. These print files report on the results of producing district-to-district flow tables.

hbwlow0dst.prn
hbwmed0dst.prn
hbwhi0dst.prn
hbwlow1dst.prn
hbwmed1dst.prn
hbwhi1dst.prn
hbwlow2dst.prn
hbwmed2dst.prn
hbwhi2dst.prn
hbcdst.prn
hbudst.prn
hbsdst.prn
hbrdst.prn
hbodst.prn
nhbwdst.prn
nhbodst.prn

These print files contain the district summaries.

tlfds.prn

Standard print file produced by Voyager's MATRIX function. This file contains the estimated trip length frequency distributions for all purposes.

Group 8: Truck Model

Input Files

Highway skims: distrib.mat	This is the highway skim file created by AUTOGEN.
Productions and attractions: trucks.dat optrips.dat	Productions and attractions. This file is produced by AUTOGEN.
Friction factors: ffactors.dat	Friction factors for all purposes and market segments. These files are produced by AUTOGEN.
External-Internal trip table	External-internal truck trip table. The name of this file must be specified using its catalog key. Trips expected in hundredths of units.

Output Files

Truck tables: trucks.mat	Trip tables produced by the truck gravity models. Table 1: Linked trips 2-axle trucks Table 2: Linked trips 3-axle trucks Table 3: Linked trips 4+ axle trks Table 4: Garage trips 2-axle trucks Table 5: Garage trips 3_axle trucks Table 6: Garage trips 4+ axle trucks Table 7: IE/EI truck trips

Report Files

trucks.prn	Standard print files produced by Voyager's MATRIX function. These print files report the results of the truck gravity models.

Group 9: Trip Factoring

Input Files

Person trip tables by mode: pkhbw.mat pkhbc.mat pkhbu.mat pkhbs.mat pkhbr.mat pkhbo.mat pknhw.mat pknho.mat eiiewrk.mat eiienwk.mat	Trip tables by mode produced by NLOGIT.
External-internal trips eiiewrk.mat eiienwk.mat	External – Internal trip tables. These tables are copied to the outputs folder during trip distribution.
External-external trips	External-external vehicle trip table. The name of this file must be specified using its catalog key.
Time of day factors: todfactors.dbf	Time of day factors for each trip purpose. These factors are used to convert the peak and off-peak trip tables to am, md, pm and nt trips. This file resides in the \parameters folder.

Output Files

Transit trips:
pktrntrps.mat
optrntrps.mat

Peak and off-peak transit trip tables, in PA format.

	Local	Premium	Rail
Walk	Table 1	Table 4	Table 7
PNR	Table 2	Table 5	Table 8
KNR	Table 3	Table 6	Table 9

Highway trips:
amvehtrp.mat
mdvehtrp.mat
pmvehtrp.mat
ntvehtrp.mat

Vehicle trip tables, in OD format:
Table 1: drive alone
Table 2: shared ride 2
Table 3: shared ride 3+
Table 4: trucks

Report Files

factoring.prn — Standard print file produced by Voyager's MATRIX function. This file reports the result of applying the time of day factors and adding up trips into four time periods (for highway) or peak/off-peak (for transit).

Group 10: Highway Assignment

Input Files

Highway trips:
amvehtrp.mat
mdvehtrp.mat
pmvehtrp.mat
ntvehtrp.mat

Vehicle trip tables, in OD format:
Table 1: drive alone
Table 2: shared ride 2
Table 3: shared ride 3+
Table 4: trucks

AM, PM and OP Highway networks — These networks are inputs to the model system and must therefore be defined via their respective catalog keys. In the current implementation, a single network file contains all the information for the AM, PM and OP procedures. The off-peak speed is assumed to be the free-flow speed.

BPR curve:
bprconexp.csv

Parameters of the HCM 2000 BPR curves. This file resides in the \parameters folder.

AM trip tables:
amvehtrps_#.mat

AM vehicle trips for the current and previous iterations. These are used to check for trip table convergence.

Output Files

Loaded highway networks:
amassing.net
mdassign.net
pmassign.net
ntassign.net

Highway networks with estimated volumes.

Turn volumes:
amturnvols.trn
mdturnvols.trn
pmturnvols.trn
ntturnvols.trn

Turn volumes, at all highway nodes.

Highway paths:
amhwypaths.pth
mdhwypaths.pth
pmhwypaths.pth
nthwypaths.pth

Highway paths. These files are optional. To save them, the PATH keys need to be set to *true (1)*. Use caution: these are very large files.

Volume archives:
vol24_#.net

This network file stores the link volumes estimated during iteration # and all previous iterations. It includes the daily volume. This file is used to compute link convergence.

Link volumes: vol24.dbf	This file stores the link volumes estimated during the current iteration. This file is used to compute highway validation statistics.
Catalog variables: ncube.var tppl#.var	This is the catalog variables file. It is used here to save the results of the model convergence checks. When ran from Application Manager, Cube creates a file called ncube.var. When ran from Voyager, it creates a file called tppl#.var.

Report Files

amassign.prn mdassign.prn pmassign.prn ntassign.prn	Standard print file produced by Voyager's HIGHWAY function. These files report the highway assignments results.
combinevols.prn	Standard print file produced by Voyager's NETWORK function. This file reports the result of creating the volume archive.
linkconvg.prn	Standard print file produced by Voyager's NETWORK function. This file reports the result of checking for link convergence.
matconvg.prn	Standard print file produced by Voyager's MATRIX function. This file reports the result of checking for AM trip table convergence.

Groups 11 to 14: Speed Feedback

Input Files

Loaded highway networks: amassign.net mdassign.net	Highway networks with estimated volumes.
Volume archives: vol24_#.net	This network file stores the link volumes estimated during iteration # and all previous iterations. It includes the daily volume. This file is used to compute link convergence and speed feedback
BPR curve: bprconexp.csv	Parameters of the HCM 2000 BPR curves. This file resides in the \parameters folder.

Output Files

Highway networks with updated speeds: amupdspds.net opupdspeds.net	Highway networks with peak and off-peak speeds calculated using the estimated volumes from all previous iterations.

Report Files

amspdupdate.prn mdspdupdate.prn	Standard print file produced by Voyager's NETWORK function. These files report the results of computing feedback peak and off-peak speeds.

Group 15: Transit Assignments

The model performs 18 transit assignments, one for each transit sub-network (2 time periods, 3 transit modes (local, express, rail) and 3 access modes (walk, pnr and knr). The table below describes the input output and report files corresponding to the peak local bus sub-networks only. Similar files are produced for each sub-network.

Input Files

Transit networks: pkwlkloc.net pkpnrloc.net pkknrloc.net	Transit network files in internal Voyager format. Similar files are produced for the premium and rail networks, both for peak and off-peak periods.
Route files: pkwlkloc.rte pkpnrloc.rte pkknrloc.rte	Final transit routes in internal Voyager format. These files are produced during transit skimming. Similar files are produced for the premium and rail networks, both for peak and off-peak periods.
Trip Tables: pktrntrps.mat	Transit trip tables. Similar file exists for the off-peak trips. These files are produced in the Factoring application subgroup.

Output Files

Loaded links file: pkwlkloclod.dbf pkprnloclod.dbf pkknrloclod.dbf	Link file with loaded transit and non-transit legs.

Report Files

pkwlkloclod.prn pkpnrloclod.prn pkknrloclod.prn	Standard print files produced by Voyager's PUBLIC TRANSPORT function. Similar files are produced for the premium and rail networks, both for peak and off-peak periods.
pkwlkloclod.rpt pkpnrloclod.rpt pkknrloclod.rpt	Standard report file produced by Voyager's PUBLIC TRANSPORT function. All reports from Route Evaluation are written to these files.

Group 16: Reporting

Input Files

Link volumes: vol24.dbf	This file stores the link volumes estimated during the current iteration.

Output Files

Link validation statistics: volgrp_val.dbf Fclass_val.dbf	These files report validation statistics for each link volume group and link functional class group. This file is optional; it is produced only when the VALIDATION key is set to *True*.
Screenline validation statistics: Scrnln_val.dbf	This file reports validation statistics for highway network screenlines. The screenlines must be coded on the input highway networks. This file is optional; it is produced only when the VALIDATION key is set to *True*.

Report Files

highwayvalidation.prn screenline_valid.prn	Standard print file produced by Voyager's MATRIX function. These files report the results of computing the validation statistics.

AUTOGEN

AUTOGEN is a combined Auto Ownership and Trip Generation Application Program developed for the Cleveland region. **AUTOGEN** may be run as a stand-alone program or as part of the four-step model chain. In order to run it as part of the model chain, **AUTOGEN** has been implemented as a Cube User Program. To run it as a stand alone program, the command line must include the control file name (AUTOGEN autogen.ctl). **AUTOGEN** provides inputs to the Voyager Gravity Model function as well as reports and summaries of computations and results. Complete descriptions of all of the **AUTOGEN** functions are given below; Figure 2 shows the program flow.

Socio-Economic Sub-Models

AUTOGEN will estimate the number of households by a number of socio-economic variables for every internal zone in the Cleveland region (currently 1003 zones). These models take the form of curve-fitted share models with the exception of the Auto Ownership model, which is a multinomial logit model. The sub-models are listed below:

- Household Income
  - INPUTS:
    - Total occupied households per zone
    - Average household income per zone
    - Average regional household Income
  - OUTPUT:
    - Households by household income group (1, 2, 3, 4) per zone

- Household Size
  - INPUTS:
    - Total occupied households per zone
    - Average household size per zone
  - OUTPUT:
    - Households by household size (1, 2, 3, 4+) per zone

- Workers per Household
  - INPUTS:
    - Total occupied households per zone
    - Average workers per household per zone
  - OUTPUT:
    - Households by workers per household (0, 1, 2, 3+) per zone

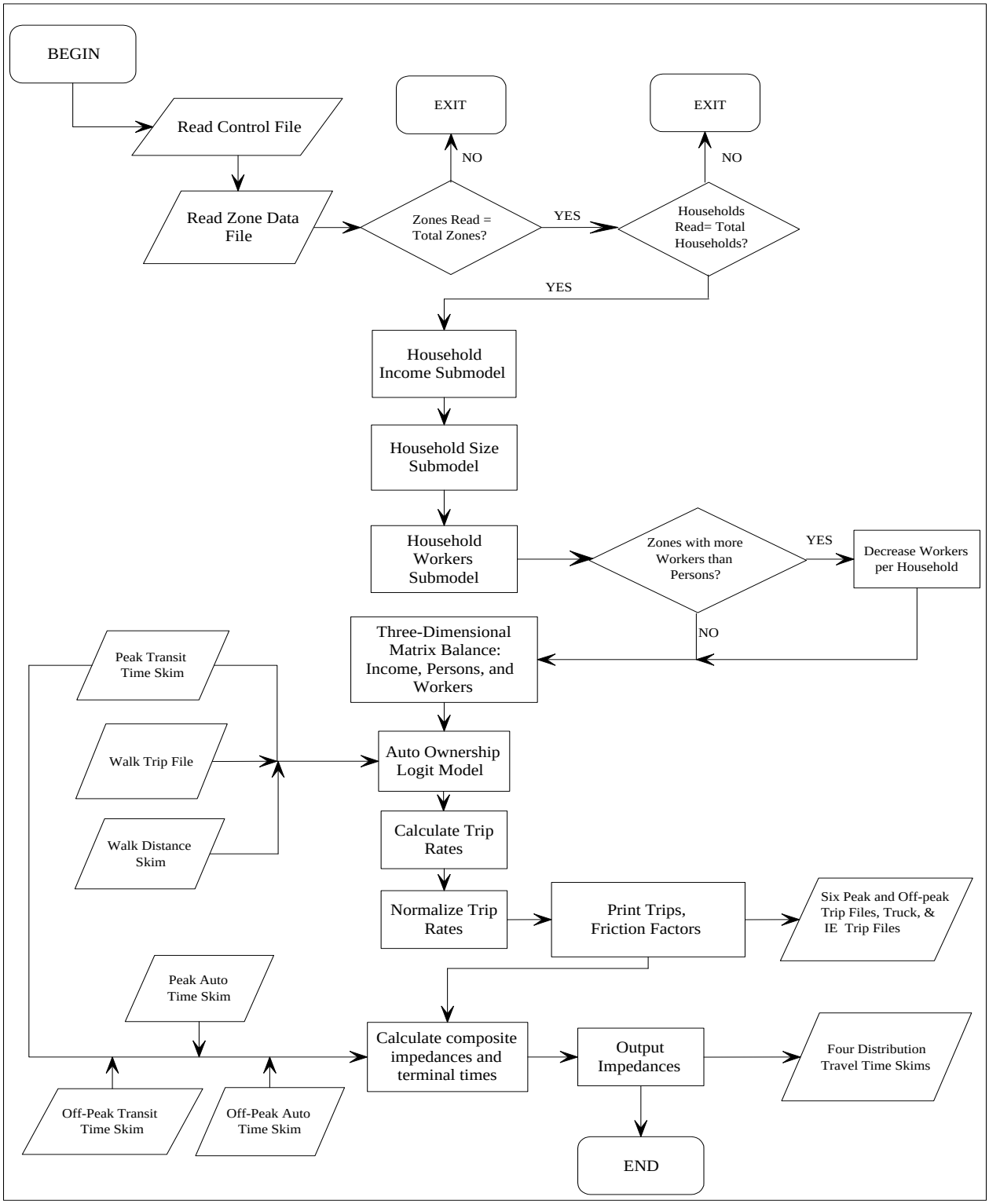
Auto Ownership Logit Model

AUTOGEN implements a multinomial logit Auto Ownership model to estimate the number of households by 0, 1, 2, and 3+ autos per household for every zone. The auto ownership model[1] requires the joint distribution of households by household income, household size, and workers per household as an input. A three-dimensional matrix-balancing algorithm is implemented in **AUTOGEN** to derive this joint distribution for every zone with occupied households in the Cleveland region. The seed matrix for the balancing algorithm is the regional distribution of households by household income, household size, and workers per household from the 1990 Public

[1] For a more thorough documentation of the Auto Ownership Logit Model, see the paper entitled "Estimation Results: Household Auto Ownership Model Development", by PBQ&D for NOACA, May 1997.

Use Micro-data Samples (PUMS). The vectors are supplied by the previously estimated household sub-models.

Figure 5: AUTOGEN Program



Additionally, the auto ownership model recognizes the impact of accessibility on auto ownership. **AUTOGEN** reads Cube Voyager matrices with zone-to-zone peak transit travel times and zone-to-zone walk distance to compute the amount of total regional retail employment within 40 minutes of transit time and 1 mile walking distance respectively. **AUTOGEN** also provides a direct feedback loop to mode choice by reading a text file with the number of walk-to-work trips by zone.

- Autos per Household (0, 1, 2, 3+)
    - INPUTS:
        - Joint distribution of households by household income, household size and workers per household
        - Percent walk-to-work file
        - Cube Voyager peak transit travel time skim matrix
        - Cube Voyager walk distance skim matrix
        - Total Retail employment per zone
        - Population density per zone
    - OUTPUT:
        - Joint distribution of households by household income, household size, workers per household, and auto ownership (0, 1, 2, 3+)

Trip Generation

AUTOGEN will compute the number of trips by trip purpose for input into the Voyager Gravity Model function. The stratifications for these cross-classification models vary by trip purpose. A brief explanation of each trip purpose is given below.

Work trip production rates were estimated for households stratified by household size, workers per household, and auto ownership. However, the trip distribution gravity models were stratified by auto ownership (0, 1, and 2+) and household income group (1, 2, 3, 4). The work trip production models use a two-dimensional matrix-balancing algorithm to compute the number of trips by Auto Ownership and Household Income for each zone in the Cleveland region. The algorithm uses a matrix of expanded work trips by auto ownership and household income as a seed. The row vectors are the number of trips by auto ownership estimated from application of the production models. The column vectors are the number of work trips by household income. Column vectors are estimated by applying a work trip production rate by income group (derived from the household survey) to the number of households by income group (estimated by the household income sub-model). Column vectors are scaled to row vectors prior to balancing. The output matrix contains the total number of work trips by auto ownership and household income group.

- Work Trip Production Models (Direct, Strategic, and Complex)
    - INPUTS:
        - Households by the joint distribution of households by household size, workers per household, and auto ownership
        - Households by household income group
    - OUTPUT:
        - Direct, Strategic, and Complex Home-Based-Work Trips by auto ownership and household income

- Home-Based-Shop, Social/Recreational, Other, University and Non-Home-Based-Other Trip Productions
    - INPUT:
        - Joint distribution of households by household size and auto ownership

    - OUTPUT:
        - Trip productions by non-work trip purpose per zone

- Non-Home-Based-Work Trip Productions
    - INPUT:
        - Joint distribution of households by workers per household and auto ownership
    - OUTPUT:
        - Non-Home-Based-Work trip productions per zone

- Home-Based School (captive and non-captive) Trip Productions
    - INPUT:
        - Joint distribution of households by household size, workers per household and auto ownership per zone
    - OUTPUT:
        - Home-Based School (Captive and Non-captive) trips by zone

- Work Trip Attraction Models (Direct, Strategic, Complex, and Non-home-based-Work)
    - INPUTS:
        - Employment by Basic, Service, and Retail per zone
        - Total occupied households per zone
    - OUTPUT:
        - Home-Based Work and Non-home-based-Work Trip attractions by auto ownership (0, 1, 2+) and household income group (1, 2, 3, 4) per zone

- Home-Based Shop, Social/Recreational, Other, School, University and Non-Home-Based-Other Trip Attraction Models
    - INPUTS:
        - Employment by Basic, Service, and Retail per zone
        - Total area (square miles) per zone
        - Total population per zone
        - Total elementary/secondary enrollment per zone
        - Total university enrollment per zone
    - OUTPUT:
        - Non-Work Trip Attractions by trip purpose and zone

- Truck trips
    - INPUTS:
        - Employment by Basic, Service, and Retail per Zone
    - OUTPUT:
        - Truck trip productions and attractions by trip purpose and zone

- Internal-External trips
    - INPUTS:
        - Total trip productions and attractions by purpose and zone, described above.
        - Zone – external district equivalencies, in *ZoneDataFile*
        - District percent file (*ExternalFile*)
        - External station percent file (*ExtStationFile*)
    - OUTPUTS:
        - Internal-external trips by purpose and zone.

Trip Printing

AUTOGEN outputs two (2) files for input to the Voyager Gravity Model function for internal trip purposes (peak and off-peak), plus one file for truck trips and one file for internal-external trips. The names of the output files can be changed by the user; however, the trip purposes in each file remain constant. **AUTOGEN** applies user-supplied purpose-specific peak hour factors when printing these files (except for truck trips and IE trips, which are 24-hour productions and attractions). Additionally, **AUTOGEN** writes out a friction factor file, containing factors for purposes (internal, commercial and external). The trip purposes in each file are listed in the [TRIPFILES] section, below.

Composite Impedances

Another feature of **AUTOGEN** is the computation of composite impedance values for each zone-to-zone interchange in the Cleveland region. When this function is active (by setting the *WriteSkim* flag, below), **AUTOGEN** reads peak and off-peak transit and highway travel time matrices and writes a matrix with peak and off-peak composite impedance values and peak and off-peak highway travel time plus terminal times.

The output Cube Voyager impedance and highway time matrix has the following tables:

- Table 1: Peak Composite Impedance
- Table 2: Off-Peak Composite Impedance
- Table 3: Peak Highway Time + Terminal Time
- Table 4: Off-Peak Highway Time + Terminal Time

Control File

The following section describes the elements of the control file required to run **AUTOGEN**. The control file is organized into separate related sections, identified by brackets ([ ]).

[INFILES]
This section lists all the files required to run **AUTOGEN**. A maximum of 200 characters is allowed to describe the path and location of each file. The files are briefly described below.

ZoneDataFile	This is an ASCII text file with input socio-economic information for each zone. Every zone must be listed (currently 1003 zones). Comments may be included in this file if preceded by an asterisk (*).
TransitSkim	Transit skim matrices file, in Cube Voyager internal format.
PeakTransitTable	Peak transit time table (access+egress+wait+in-vehicle) in *TransitSkim* file.
OffPeakTransitTable	Off-peak transit time table in *TransitSkim* file.
AutoSkim	Auto skim matrix, in Cube Voyager internal format
PeakAutoTable	Peak auto travel time table in *AutoSkim* file
OffPeakAutoTable	Off-peak auto travel time table in *AutoSkim* file.
WalkDistanceTable	Distance travel time table in *AutoSkim* file.
WalkPercentFile	Walk-to-work proportions TAZ file.
ExternalFile	Internal-External trip proportion district file.
ExtStationFile	External station IE trip proportions file.

[OUTFILES]
This section lists all the files that are output by **AUTOGEN** with the exception of the trip files. A maximum of 200 characters is allowed to describe the path and location of each file. All of the files,

with the exception of the *ReportFile*, will only be created if they are selected in the *[PARAMETERS]* section. The files are briefly described below.

ReportFile	AUTOGEN report file.
DistrictFile	Lists total productions and attractions by district and trip purpose.
VectorFile	Household market segment TAZ report file.
JointDistFile	Household joint distribution report file.
CoefficientFile	Balancing coefficients report file.
AutoOwnFile	Auto ownership calculations report file.
ZoneTripFile	Trip productions and attractions TAZ report file.
DistribSkim	TRANPLAN internal formatted matrix containing peak and off-peak composite impedances and highway travel times plus terminal times, used for trip distribution.

[TRIPFILES]

This section lists the files that contain internal productions and normalized attractions by zone and trip purpose for input into the TRANPLAN Gravity Model. Friction factors are appended to these files.

PkTrips	Peak trips by purpose.
OpTrips	Off peak trips by purpose.
FFactors	Friction factors for all purposes.
TruckFile	Truck trips by purpose.
IEFile	Internal-External trips.

[PARAMS]

Scenario	Name of current scenario being tested (max 199 chars) to print to output files.
Zones	The number of zones in the *ZoneDataFile*.
TotHouseholds	The total number of households in the *ZoneDataFile*.
WriteDistrict	Write district summaries to *DistrictFile*. (Y or N)
WriteVectors	Write total households by each market segment to *VectorFile*. (Y or N)
WriteJoint	Write joint distribution of households to *JointDistFile*. (Y or N)
WriteCoefficients	Write balancing coefficients to *CoefficientFile*. (Y or N)
WriteTrips	Write trips in Cube Voyager format to [TRIPFILES]. (Y or N)
WriteSkim	Write distribution skims in Cube Voyager format to *DistribSkim*. (YES or NO)
Normalize	Normalize submodels to user-inputs. Must be set to No for future year scenarios. (Y or N)
Externals	Use internal-external trip generation model. (Y or N)

[AUTOS]

This section will only be used if the *Normalize* flag (YES or NO) is set to YES.

This section contains information used to calibrate Auto Ownership Model Bias constants. If the user wants to see all calculations for the Auto Ownership Model, the Debug flag (YES or NO) should be set to YES. However, this option dramatically increases the run-time of **AUTOGEN**.

[INCOME]
This section will only be used if the *Normalize* flag (YES or NO) is set to YES.

AvgRegInc	Average regional income.
IncomeGroupnHHs	The total number of regional households in Income Group *n*. These numbers must add up to the total number of regional households specified in [PARAMS].

[SIZE]
This section will only be used if the *Normalize* flag (YES or NO) is set to YES.

SizeGroupnHHs	The total number of regional households with *n* persons per household. These numbers must add up to the total number of regional households specified in [PARAMS].

[WORKERS]
This section will only be used if the *Normalize* flag (YES or NO) is set to YES.

WorkerGroupnHHs	The total number of regional households with *n* workers per household. These numbers must add up to the total number of regional households specified in [PARAMS].

[EXTERNALS]
This section lists the percent of total trips that are external, by trip purpose. This has been replaced by an internal-external trip model and is only required if *Externals* is set to NO.

Direct	Percent external trips for Home-Based-Work-Direct trip purpose.
Strategic	Percent external trips for Home-Based-Work-Strategic trip purpose.
Complex	Percent external trips for Home-Based-Work-Complex trip purpose.
School	Percent external trips for Home-Based-School trip purpose.
University	Percent external trips for Home-Based-University trip purpose.
Shop	Percent external trips for Home-Based-Shop trip purpose.
Social	Percent external trips for Home-Based-Social/Recreational trip purpose.
Other	Percent external trips for Home-Based-Other trip purpose.
NHBW	Percent external trips for Non-Home-Based-Work trip purpose.
NHBO	Percent external trips for Non-Home-Based-Other trip purpose.

[PEAK]
This section lists the percent of total trips that occur in the peak period, by trip purpose. See trip purposes in *[EXTERNALS]*, above.

File Formats

AUTOGEN TAZ Planning Variables Input File Format (ZoneDataFile)

Column	*Data Element*
1-10:	Zone number (5-county)
21-30:	Occupied households
31-40:	Population in households
41-50:	Total workers in households
61-70:	Average household income
71-80:	Basic employment
81-90:	Service employment
91-100:	Retail employment
101- 110:	Square miles
111-120:	Secondary/Elementary enrollment
121-130:	University enrollment
131-140:	Internal district used for reporting (MAX 200)
141-150:	Internal-External HBW district
151-160:	Internal-External NHBW district
161-170:	County
171-180:	Area type

AUTOGEN Distribution Skim Output File Format (DistribSkim)

Table 1:	Peak Composite Impedance
Table 2:	Off-Peak Composite Impedance
Table 3:	Peak Highway Travel Time + Terminal Time
Table 4:	Off-Peak Highway Travel Time + Terminal Time

AUTOGEN Percent Walk to Work Input File Format (WalkPercentFile)

Column	*Data Element*
1-10:	Zone number
11-20:	Number of work trips by walk mode

AUTOGEN IE Trip Proportion Input File Format (ExternalFile)

Column	*Data Element*
1-5:	IE district
6-11:	HBW percent IE
12-17:	HBW percent IE attractions
18-23:	HBW percent IE productions
24-29:	NHBW percent IE
30-35:	NHBW percent IE attractions
36-41:	NHBW percent IE productions

AUTOGEN External Station Input File Format (ExtStationFile)

Column	*Data Element*
1-5:	External station zone number
6-11:	Percent HBW productions
12-17:	Percent HBW attractions
18-23:	Percent NHBW productions
24-29:	Percent NHBW attractions
30-35:	Percent truck trips

AUTOGEN Peak and Off Peak Trip File Format (PkTrips & OpTrips)

	Purpose 1:	Home-Based-Work-Direct, Income 1, Auto 0
	Purpose 2:	Home-Based-Work-Direct, Income 2 & 3, Auto 0
	Purpose 3:	Home-Based-Work-Direct, Income 4, Auto 0
*	Purpose 4:	Home-Based-Work-Strategic, Income 1, Auto 0
*	Purpose 5:	Home-Based-Work-Strategic, Income 2 & 3, Auto 0
*	Purpose 6:	Home-Based-Work-Strategic, Income 4, Auto 0
	Purpose 7:	Home-Based-Work-Complex, Income 1, Auto 0
	Purpose 8:	Home-Based-Work-Complex, Income 2 & 3, Auto 0
	Purpose 9:	Home-Based-Work-Complex, Income 4, Auto 0
	Purpose 10:	Home-Based-Work-Direct, Income 1 & 2, Auto 1
	Purpose 11:	Home-Based-Work-Direct, Income 3 & 4, Auto 1
	Purpose 12:	Home-Based-Work-Direct, Income 1 & 2, Auto 2+
	Purpose 13:	Home-Based-Work-Direct, Income 3 & 4, Auto 2+
	Purpose 14:	Home-Based-Work-Strategic, Income 1 & 2, Auto 1
	Purpose 15:	Home-Based-Work-Strategic, Income 3 & 4, Auto 1
	Purpose 16:	Home-Based-Work-Strategic, Income 1 & 2, Auto 2+
	Purpose 17:	Home-Based-Work-Strategic, Income 3 & 4, Auto 2+
	Purpose 18:	Home-Based-Work-Complex, Income 1 & 2, Auto 1
	Purpose 19:	Home-Based-Work-Complex, Income 3 & 4, Auto 1
	Purpose 20:	Home-Based-Work-Complex, Income 1 & 2, Auto 2+
	Purpose 21:	Home-Based-Work-Complex, Income 3 & 4, Auto 2+
	Purpose 22:	Home-Based-School
	Purpose 23:	Home-Based-University
	Purpose 24:	Home-Based-Shop
	Purpose 25:	Home-Based-Social/Recreational
	Purpose 26:	Home-Based-Other
	Purpose 27:	Non-Home-Based-Work
	Purpose 28:	Non-Home-Based-Other

* In the current model implementation, there are no Home-Based-Work-Strategic trips for households with 0 Autos. These purposes were left in the trip files as place-holders.

AUTOGEN Truck Trip File Format (TruckFile)

Purpose 1: Linked 2-axle
Purpose 2: Linked 3-axle
Purpose 3: Linked 4+ axle
Purpose 4: Garage-based 2-axle
Purpose 5: Garage-based 3-axle
Purpose 6: Garage-based 4+ axle
Purpose 7: I-E Truck, all axles

AUTOGEN Internal-External Trip File Format (IEFile)

Purpose 1: HBW internal productions, external attractions
Purpose 2: HBW external productions, internal attractions
Purpose 3: NHBW internal productions, external attractions
Purpose 4: NHBW external productions, internal attractions

NLOGIT

NLOGIT is the mode choice application program for the Cleveland travel demand forecasting model system. **NLOGIT** applies nested logit mode choice models for each of five trip purposes (Home-Based Work, Home-Based University, Home-Based Other, Non-Home-Based Work, and Non-Home-Based Other) and two time periods (Peak and Off-peak). The program is a compatible with the Cube Voyager modeling system and can operate either within the Cleveland travel forecasting job stream or as a stand-alone application. The program has the capability to read and write directly to and from Cube Voyager formatted binary files, reducing the overall run-time of the mode choice process and eliminating unnecessary disk-related operations.

In addition, this program features an auto-calibrate capability. That is, the program can be used with minimal user intervention to calibrate auto-ownership specific bias constants in order to replicate known mode shares. This feature provides GCRTA and NOACA the ability to easily update the Cleveland mode choice models as current information with respect to modal shares from Census data or transit on-board surveys becomes available.

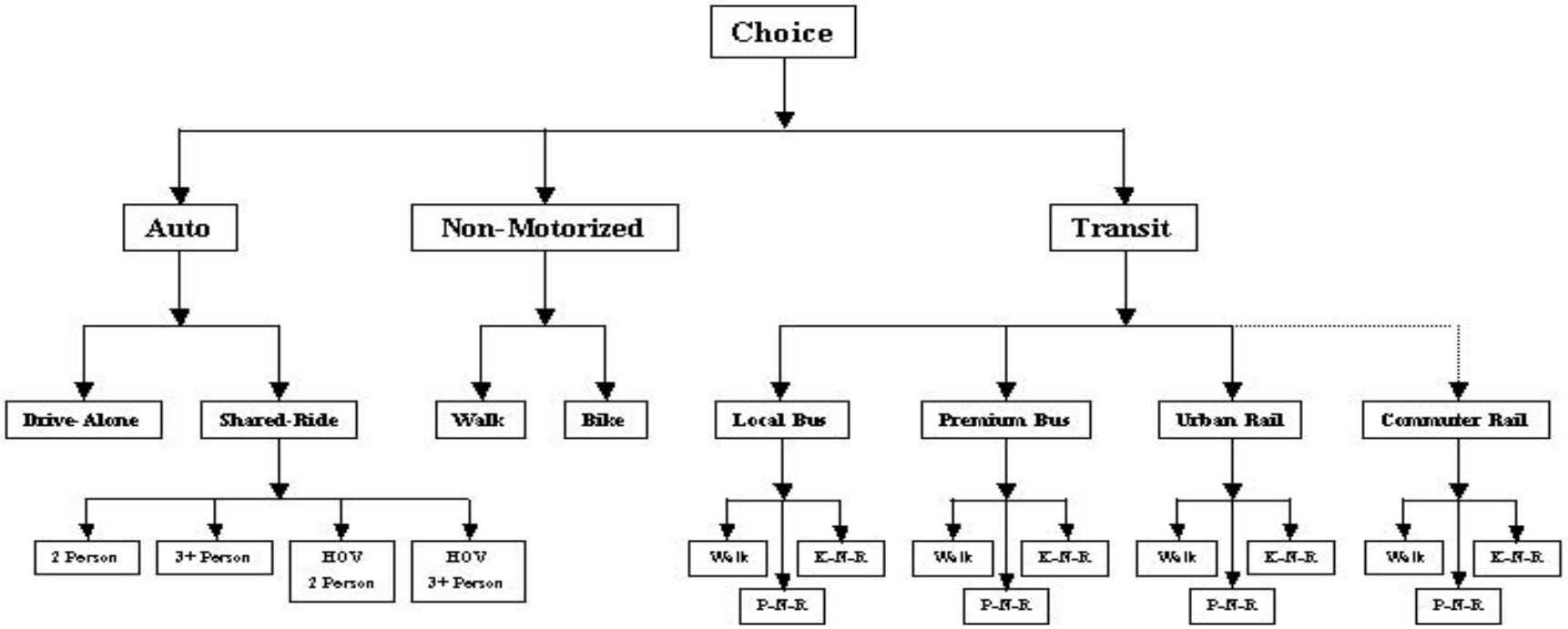
Available Modes

As currently structured, the mode choice program is capable of considering a wide range of highway and transit modes of travel. The existing structure of the mode choice model and the relative position of each choice in the model structure are shown in Figure 3. There are 14 choices which can be selected at the "lowest level" or choice level of the model:

1.	Drive Alone	(Auto)
2.	2 Person Auto	(Auto)
3.	3+ Person Auto	(Auto)
4.	Walk	(Not assigned)
5.	Bike	(Not assigned)
6.	Walk to Local Bus	(Transit)
7.	Walk to Express Bus	(Transit)
8.	Walk to Urban Rail	(Transit)
9.	Park-n-Ride to Local Bus	(Transit)
10.	Park-n-Ride to Express Bus	(Transit)
11.	Park-n-Ride to Urban Rail	(Transit)
12.	Kiss-n-Ride to Local Bus	(Transit)
13.	Kiss-n-Ride to Express Bus	(Transit)
14.	Kiss-n-Ride to Urban Rail	(Transit)

NLOGIT has been designed to facilitate the description and specification of required input files and parameters. All of the information required from the user is supplied to the program in the form of a control file described in detail below. The file must be renamed to NLOGIT.CTL and placed in the same directory as the program prior to execution. To run the program, simply type **NLOGIT** at the DOS command prompt, or call it in a DOS batch file. In the Cube catalog, **NLOGIT** has been implemented as a User Program.

Figure 6: Cleveland Mode Choice Model Structure (All Purposes and Time Periods)



NLOGIT Control File

&FILES

FPERIN=	Input person trip matrix (Voyager internal format)
FSKLCL=	Transit skim matrix-local bus
FSKEXP=	Transit skim matrix-express bus
FSKRAL=	Transit skim matrix-urban rail
FSKA0P=	Drive alone highway skim matrix (created by **AUTOGEN**)
FSKA2P=	2-Person highway skim matrix (optional)
FSKA3P=	3+ Person highway skim matrix (optional)
FZDATA=	Planning variables TAZ data file
FZWALK=	Walk access proportions TAZ data file
FPCOST=	Parking cost TAZ data file
FMDOUT=	Mode choice model output person trip table matrix.
FPWALK=	Percent walk to work TAZ data file (output).
FADRIV=	Drive to work attraction TAZ data file (output/input)
FRPORT=	Mode choice model report file (output)
FHOVPR=	Person-trip file for HOV option (output)
FAUTOP=	

&PARAMS

TZONES=	Total number of zones, including externals
NZONES=	Number of internal zones
NCATS=	Number of auto ownership categories (3)
PERTBL=	Purpose number for person trip matrix (1-5)
HHLDF=	Household trip factor by auto ownership (for non-work trips only)
SCHBUS=	Proportion of school bus trips by auto ownership (school trips only)
NITER=	Number of calibration iterations

&OPTIONS

DRYRUN=	Check for input datasets and parameters only (T/F)
DEBUG=	Program debug option (T/F)
HWY2P=	Presence of 2 Person skim matrix (T/F)
HWY3P=	Presence of 3+ Person skim matrix (T/F)
EXPBUS=	Presence of express bus skim matrix (T/F)
RAIL=	Presence of urban rail skim matrix (T/F)
CALIB=	Self calibration enable (T/F)
WALKP=	Walk proportion file (T/F)
WORK=	
DAILYPK=	
OFFPK=	
NHBW=	
HOV=	

&SELECTS

REPORTS=	Modal trip summary report request (1-2)
I=	Origin zone selection
J=	Destination zone selection

&PARMS

ADJFCT=	
CIVT=	In-vehicle time coefficient
CWAIT1=	Initial wait time coefficient for first 7 minutes
CWAIT2=	Initial wait time coefficient for greater than 7 minutes
CTWALK=	Transfer walk coefficient

CDRIVE=	Transit drive-access coefficient
CBIKE=	Bike distance coefficient
CWALK=	Walk distance coefficient
CWALK1=	Short walk coefficient
CWALK2=	Long walk coefficient
COCOST=	Out-of-pocket cost coefficient
CPCOST=	Parking cost coefficient
CXFERS=	Number of transfers coefficient
CLBXFR=	Local bus transfer coefficient
CCBD=	CBD attraction zone indicator constant
CCBDT=	CBD attraction zone transit zone indicator constant
CCBDW=	CBD attraction zone walk indicator constant
CCMPLX=	Complex work trip indicator constant
CSTRAT=	Strategic work trip indicator constant
CDENW=	Residential density coefficient for transit walk access
CSIZE2=	2-Person Household Size Coefficient
CSIZE3=	3+ Person Household Size Coefficient
CFORML=	Formal lot indicator constant
CHOVT=	HOV time savings coefficient
HOVMIN=	Minimum time savings threshold for CHOVT
HOVDIS=	Minimum distance traveled on HOV lanes
HOVDT=	Minimum travel time savings requirement for HOV
HOVTM=	Minimum travel time savings per mile required for HOV
OCC3P=	Average 3+ occupancy value
ACPM=	Auto operating cost per mile
INTDA=	Drive-alone proportion for intrazonal trips
INT2P=	2 person proportion for intrazonal trips
INT3P=	3+ person proportion for intrazonal trips
INTWK=	Walk/bicycle proportion for intrazonal trips
KBIKE(I)=	Bike bias constant – Auto Level I
KWLK(I)=	Walk bias constant – Auto Level I
KAT(I)=	Auto bias constant – Auto Level I
KSR(I)=	SR 2 Person bias constant – Auto Level I
K3P(I)=	SR 3 Person bias constant – Auto Level I
KLBP(I)=	Local bus PNR bias constant – Auto Level I
KLBK(I)=	Local bus KNR bias constant – Auto Level I
KLBW(I)=	Local Bus walk bias constant – Auto Level I
KEBP(I)=	Express bus PNR bias constant – Auto Level I
KEBK(I)=	Express bus KNR bias constant – Auto Level I
KEBW(I)=	Express Bus walk bias constant – Auto Level I
KURP(I)=	Urban rail PNR bias constant – Auto Level I
KURK(I)=	Urban rail KNR bias constant – Auto Level I
KURW(I)=	Urban rail walk bias constant – Auto Level I
KEXP(I)=	Express bus bias constant – Auto Level I
KRAL(I)=	Urban rail bias constant – Auto Level I
KBUS(I)=	Local bus bias constant – Auto Level I
KTRN(I)=	Transit bias constant – Auto Level I
CLSPRM=	Primary mode nesting coefficient
CLSSUB=	Access mode nesting coefficient

Note: Non-Home-Based Work and Non-Home-Based Other mode choice models are not stratified by auto ownership; bias constants apply to all trips.

NLOGIT File Formats

NLOGIT Trip Matrix Output Table Format

1= Walk to local bus transit trips
2= PNR to local bus transit trips
3= KNR to local bus transit trips
4= Walk to express bus transit trips
5= PNR to express bus transit trips
6= KNR to express bus transit trips
7= Walk to urban rail transit trips
8= PNR to urban rail transit trips
9= KNR to urban rail transit trips
10= Walk trips
11= Bicycle trips
12= Drive alone person trips
13= Shared Ride 2 person trips
14= Shared Ride 3+ person trips

NLOGIT Planning Variables File (FZDATA)

Column	*Data Element*
1-10:	Zone number (5-county)
11-20:	Total housing units (not used)
21-30:	Occupied households
31-40:	Population
41-50:	Total workers in households
51-60:	Total employment
61-70:	Average household income
71-80:	Basic employment
81-90:	Service employment
91-100:	Retail employment
101-110:	Square miles
111-120:	Secondary/Elementary enrollment
121-130:	University enrollment
131-140:	Internal district used for reporting
141-150:	Internal-External HBW district
151-160:	Internal-External NHBW district
161-170:	County (1 Lorain, 2 Cuyahoga, 3 Lake, 4 Geauga, 5 Medina)
171-180:	Area type (5 CBD, 4 High Commercial, 3 Urban, 2 Suburban, 1 Rural)

NLOGIT Walk Access Proportion Data File (FZWALK)

Column	*Data Element*
1-5:	Traffic analysis zone
6-10:	Percent of zone area within 0.25 miles of transit service
11-15:	Percent of zone area within 0.50 miles of transit service

NLOGIT Parking Cost TAZ Data File (FPCOST)

Column	*Data Element*
1-7:	Traffic analysis zone
8-14:	Daily parking cost (cents)
15-21:	2-hour parking cost (cents)

Appendix: Input Files

This section provides both format and contents detail of all the input files required by the model. The files are identified by their key name, and next to it the actual filename for the Base scenario is provided. Please note that input files may be given any filename.

{AM, PM and OP HIGHWAY NETWORKS} : *HWY2000.NET*
The highway networks are used for skimming and for assignment. These files must be in Cube format. The link variables required are described in the ODOT Capacity Calculator documentation.

{FARE SYSTEM FILE} : *FARESYSTEM.FAR*
This is the Public Transport fare system file. A single fare system file is used to define fares for all lines in the model, classified into ten different fare systems, as shown below.

```
FARESYSTEM NUMBER=1,
           NAME="LCT Local",
           STRUCTURE=FLAT,
           IBOARDFARE=125,
           FAREFROMFS=0,0,0,0,0,0,0,0,0,0
FARESYSTEM NUMBER=2,
           NAME="LCT Express",
           STRUCTURE=FLAT,
           IBOARDFARE=200,
           FAREFROMFS=0,0,0,0,0,0,0,0,0,0
FARESYSTEM NUMBER=3,
           NAME="BTA Routes",
           STRUCTURE=FLAT,
           IBOARDFARE=50,
           FAREFROMFS=0,0,0,0,0,0,0,0,0,0
FARESYSTEM NUMBER=4,
           NAME="Laketran Local Routes",
           STRUCTURE=FLAT,
           IBOARDFARE=75,
           FAREFROMFS=0,0,0,0,0,0,0,0,0,0
FARESYSTEM NUMBER=5,
           NAME="Laketran Express Routes",
           STRUCTURE=FLAT,
           IBOARDFARE=200,
           FAREFROMFS=0,0,0,125,0,0,0,0,0,0
FARESYSTEM NUMBER=6,
           NAME="GCRTA Circulators",
           STRUCTURE=FLAT,
           IBOARDFARE=50,
           FAREFROMFS=0,0,0,0,0,0,0,0,0,0
FARESYSTEM NUMBER=7,
           NAME="GCRTA Local Routes",
           STRUCTURE=FLAT,
           IBOARDFARE=108,
           FAREFROMFS=0,0,0,0,0,0,75,0,0,0
FARESYSTEM NUMBER=8,
           NAME="GCRTA Express & Freeway Flyers",
           STRUCTURE=FLAT,
           IBOARDFARE=108,
           FAREFROMFS=0,0,0,0,0,100,25,0,0,0
FARESYSTEM NUMBER=9,
           NAME="GCRTA XCnty Express & Freeway Flyers",
           STRUCTURE=FLAT,
           IBOARDFARE=208,
           FAREFROMFS=0,0,0,0,0,100,25,0,0,0
FARESYSTEM NUMBER=10,
           NAME="GCRTA Rail",
           STRUCTURE=FLAT,
           IBOARDFARE=106,
           FAREFROMFS=0,0,0,0,0,100,25,0,0,0
```

{LOCAL BUS FILE} *: LOCL.IN*
{PREMIUM TRANSIT FILE} *: PREM.IN*
{RAIL TRANSIT FILE} *: RAIL.IN*
These are the transit line files. Please refer to the Voyager documentation for a detailed description of a line statement specification.

{PT SYSTEM FILE} : *PTSYSTEM.PTS*
This is the Public Transport System file. This file contains data on modes, operators and wait curves.

```
;;<<PT>>;;
MODE NUMBER =  1 LONGNAME = "Walk Access-Egress"                NAME = "WlkAcc"
MODE NUMBER =  2 LONGNAME = "Sidewalk"                          NAME = "Sidewalk"
MODE NUMBER =  3 LONGNAME = "Bus to Rail Xfer Walk"             NAME = "BusXfer"
MODE NUMBER =  4 LONGNAME = "Walk to Rail Access"               NAME = "RalAccWlk"
MODE NUMBER =  7 LONGNAME = "Drive to formal PNR"               NAME = "DrvFrml"
MODE NUMBER =  8 LONGNAME = "Drive to informal PNR"             NAME = "DrvInfl"
MODE NUMBER =  9 LONGNAME = "Drive to KNR"                      NAME = "DrvKNR"
MODE NUMBER = 10 LONGNAME = "LCT Local & Express Routes"        NAME = "LCTLOC"
MODE NUMBER = 11 LONGNAME = "BTA Routes"                        NAME = "BTA"
MODE NUMBER = 12 LONGNAME = "LakeTran Local Routes"             NAME = "LKTLOC"
MODE NUMBER = 13 LONGNAME = "LakeTran Express Routes"           NAME = "LKTEXP"
MODE NUMBER = 14 LONGNAME = "GCRTA Circulators and Local Routes" NAME = "RTALOC"
MODE NUMBER = 15 LONGNAME = "GCRTA Express Routes"              NAME = "RTAEXP"
MODE NUMBER = 16 LONGNAME = "GCRTA Freeway Flyer Routes"        NAME = "RTAFLY"
MODE NUMBER = 17 LONGNAME = "GCRTA Heavy Rail Routes"           NAME = "RTAHVY"
MODE NUMBER = 18 LONGNAME = "GCRTA Light Rail Routes"           NAME = "RTALRT"

OPERATOR NUMBER = 1 LONGNAME = "GCRTA"                            NAME = "RTA"
OPERATOR NUMBER = 2 LONGNAME = "Lorain County Transit"            NAME = "LCT"
OPERATOR NUMBER = 3 LONGNAME = "Brunswick Transit Alternative"    NAME = "BTA"
OPERATOR NUMBER = 4 LONGNAME = "LAKETRAN"                         NAME = "LT"

WAITCRVDEF NUMBER = 1,CURVE=1-0.5,15-7.5,100-50.0
```

{WALK-LOCAL FACTORS} *: PT_WLKLOC.FAC*
{WALK-PREMIUM FACTORS} *: PT_WLKPRM.FAC*
{WALK-RAIL FACTORS} *: PT_WLKRAL.FAC*
{DRIVE-LOCAL FACTORS} *: PT_DRVLOC.FAC*
{DRIVE-PREMIUM FACTORS} *: PT_DRVPRM.FAC*
{DRIVE-RAIL FACTORS} *: PT_DRVRAL.FAC*

These are the Public Transport factor files. These factors are used for Route Enumeration and Route Evaluation. Below is a printout of the PT_DRVRAL.FAC file. Values equal to those shown here are used for the other transit sub-modes, except for the transfer penalties (XFERPEN) and the in-vehicle travel time factors (RUNFACTOR). The table lists the values used for XFERPEN and RUNFACTOR on all networks.

```
/* PT FACTORS FOR DRIVE TO RAIL TRANSIT */

/*For Route Enumeration*/
MAXFERS=3
SPREADFACT = 1.0
SPREADFUNC=1
SPREADCONST = 1.0
REWAITMIN = 1.0
REWAITMAX = 60.0
MAXCOMPD = 500000

XFERPEN=15.0, FROM=10-16, TO=10,11,12,14
XFERPEN=3.0, FROM=10,11,12,14, TO=17-18
XFERPEN=3.0, FROM=17-18, TO=10,11,12,14
XFERPEN=60.0, FROM=7, TO=10,11,12,14
XFERPEN=60.0, FROM=8, TO=10,11,12,14
```

```
XFERPEN=60.0, FROM=9, TO=10,11,12,14
XFERPEN=60.0, FROM=5, TO=5

RUNFACTOR[10] = 2.0
RUNFACTOR[11] = 2.0
RUNFACTOR[12] = 2.0
RUNFACTOR[14] = 2.0
RUNFACTOR[17] = 0.5
RUNFACTOR[18] = 0.5

/* Fare System */

/* Note:  FARESYSTEM=2,6, AND 9 ARE CODED EXPLICITLY IN ROUTE FILE */

VALUEOFTIME[10]=400
VALUEOFTIME[11]=400
VALUEOFTIME[12]=400
VALUEOFTIME[13]=400
VALUEOFTIME[14]=400
VALUEOFTIME[15]=400
VALUEOFTIME[16]=400
VALUEOFTIME[17]=400
VALUEOFTIME[18]=400

FARESYSTEM=1, MODE=10
FARESYSTEM=3, MODE=11
FARESYSTEM=4, MODE=12
FARESYSTEM=5, MODE=13
FARESYSTEM=7, MODE=14
FARESYSTEM=8, MODE=15-16
FARESYSTEM=10, MODE=17-18

/*For Route Evaluation*/
ALPHA = 1.0
LAMBDAW = 0.2
LAMBDAA = 0.2
CHOICECUT=0.01
WAITFACTOR=2.0,n=2000-99999
```

Transfer Penalties and In-Vehicle Time Factors

Factor	*WlkLoc*	*WlkPrm*	*WlkRal*	*DrvLoc*	*DrvPrm*	*DrvRal*
XFERPEN						
FROM=10,11,12,14, TO=10,11,12,14	15			15		
FROM=10-16, TO=10-16		15			15	
FROM=10,11,12,14, TO=10,11,12,14			15			15
FROM=10,11,12,14, TO=17,18			3			3
FROM=17,18, TO=10,11,12,14			3			3
FROM=5, TO=5			60			60
FROM=7,8,9, TO=10,11,12,14					60	60
RUNFACTOR[10]	1.0	3.0	2.0	1.0	3.0	2.0
RUNFACTOR[11]	1.0	3.0	2.0	1.0	3.0	2.0
RUNFACTOR[12]	1.0	3.0	2.0	1.0	3.0	2.0
RUNFACTOR[13]		1.0			1.0	
RUNFACTOR[14]	1.0	3.0	2.0	1.0	3.0	2.0
RUNFACTOR[15]		1.0			1.0	
RUNFACTOR[16]		1.0			1.0	
RUNFACTOR[17]			0.5			0.5
RUNFACTOR[18]			0.5			0.5

{AUTO ACCESS CONNECTOR FILE} : *accessConnectors.prn*

This file is used to build bus to rail transfer links and auto access connectors. The file format and its contents are detailed below.

Auto Access Connector File Format

Columns	*Contents*
1-5	Highway node
7-11	Transit node
13-17	Walk distance
19-23	Walk time
25	Access flag: it tells the model which kind of connector to build from the highway node to the transit stop/station node W – walk access B – bus transfer P – formal park and ride access I – informal park and ride access K – kiss and ride access
27-28	Transit mode number
30-43	Transit mode name
45-79	Transit station

Auto Access Connector File Contents:

```
 8366 15074   0.0   2.0 P 18 GreenLine      Green Rd.
 8368 15074   0.0   2.0 P 18 GreenLine      Green Rd.
 8366 15074   0.0   1.0 W 18 GreenLine      Green Rd.
 8368 15074   0.0   1.0 W 18 GreenLine      Green Rd.
 8363 15073   0.0   1.0 W 18 GreenLine      Belvoir
 8364 15073   0.0   1.0 W 18 GreenLine      Belvoir
 8325 15072   0.0   2.0 P 18 GreenLine      Warrensville
 8356 15072   0.0   2.0 P 18 GreenLine      Warrensville
 8325 15071   0.0   1.0 W 18 GreenLine      Courtland
 8356 15071   0.0   1.0 W 18 GreenLine      Courtland
 8326 15070   0.0   1.0 W 18 GreenLine      Eaton
 8328 15070   0.0   1.0 W 18 GreenLine      Eaton
 8326 15069   0.0   1.0 W 18 GreenLine      Attleboro
 8327 15068   0.0   1.0 W 18 GreenLine      Lee_2
 8331 15067   0.0   1.0 W 18 GreenLine      South Park
 8162 15066   0.0   1.0 W 18 GreenLine      Southington
 8161 15065   0.0   1.0 W 18 GreenLine      Coventry
15625 15085   0.0   1.0 B 18 BlueLine       Warrensville/Van Aken
 8347 15085   0.0   1.0 B 18 BlueLine       Warrensville/Van Aken
 8343 15084   0.0   2.0 P 18 BlueLine       Farnsleigh
 8343 15083   0.0   2.0 P 18 BlueLine       Lynnfield
 8334 15082   0.0   2.0 P 18 BlueLine       Kenmore
 8334 15081   0.0   2.0 P 18 BlueLine       Avalon
 8174 15080   0.0   1.0 W 18 BlueLine       Lee
 8174 15080   0.0   1.0 B 18 BlueLine       Lee
 8175 15079   0.0   2.0 P 18 BlueLine       Ashby
 8170 15078   0.0   2.0 P 18 BlueLine       Onaway
 8170 15077   0.0   2.0 P 18 BlueLine       Southington
 8169 15076   0.0   2.0 P 18 BlueLine       South Woodland
 8155 15075   0.0   2.0 P 18 BlueLine       Drexmore
 8343 15085   0.0   1.0 W 18 BlueLine       Warrensville/Van Aken
 8343 15084   0.0   1.0 W 18 BlueLine       Farnsleigh
 8343 15083   0.0   1.0 W 18 BlueLine       Lynnfield
```

```
 8334 15082   0.0   1.0 W 18 BlueLine       Kenmore
 8334 15081   0.0   1.0 W 18 BlueLine       Avalon
 8175 15079   0.0   1.0 W 18 BlueLine       Ashby
 8170 15069   0.0   1.0 W 18 BlueLine       Onaway
 8170 15077   0.0   1.0 W 18 BlueLine       Southington
 8169 15076   0.0   1.0 W 18 BlueLine       South Woodland
 8155 15075   0.0   1.0 W 18 BlueLine       Drexmore
 8147 15064   0.0   1.0 W 18 Blue&GreenLine Shaker Square
 8239 15064   0.0   1.0 B 18 Blue&GreenLine Shaker Square
 8147 15064   0.0   1.0 B 18 Blue&GreenLine Shaker Square
 8142 15063   0.0   1.0 W 18 Blue&GreenLine E.116th
 8142 15063   0.0   1.0 B 18 Blue&GreenLine E.116th
 8044 15062   0.0   2.0 P 18 Blue&GreenLine Woodhill
 8044 15062   0.0   1.0 W 18 Blue&GreenLine Woodhill
 8054 15062   0.0   1.0 B 18 Blue&GreenLine Woodhill
 8061 15062   0.0   1.0 W 18 Blue&GreenLine E. 79th
15151 15062   0.0   1.0 B 18 Blue&GreenLine E. 79th
 8070 15054   0.0   2.0 P 18 Blue&GreenLine E. 55th
 8070 15054   0.0   1.0 W 18 Blue&GreenLine E. 55th
15144 15054   0.0   1.0 B 18 Blue&GreenLine E. 55th
 7974 15609   0.0   1.0 W 18 Blue&GreenLine E. 34th / Campus
 7970 15609   0.0   1.0 B 18 Blue&GreenLine E. 34th / Campus
 4127 15152   0.0   1.0 W 18 Blue&GreenLine Tower City
 4095 15152   0.0   1.0 B 18 Blue&GreenLine Tower City
 4097 15152   0.0   1.0 B 18 Blue&GreenLine Tower City
 4123 15152   0.0   1.0 B 18 Blue&GreenLine Tower City
 4042 15521   0.0   1.0 W 18 Blue&GreenLine Settler's Landing
14243 15522   0.0   1.0 W 18 Blue&GreenLine Flats East Bank
 4046 15606   0.0   1.0 W 18 Blue&GreenLine West 3rd
 4051 15523   0.0   1.0 W 18 Blue&GreenLine North Coast
 4310 15524   0.0   1.0 W 18 Blue&GreenLine South Harbor
 9003 15060   0.0   2.0 P 17 RedLine        Windermere
 9003 15060   0.0   1.0 W 17 RedLine        Windermere
15150 15060   0.0   1.0 B 17 RedLine        Windermere
 9011 15059   0.0   0.0 P 17 RedLine        Superior
 9011 15059   0.0   1.0 W 17 RedLine        Superior
15149 15059   0.0   1.0 B 17 RedLine        Superior
 9011 15059   0.0   1.0 B 17 RedLine        Superior
 9134 15058   0.0   1.0 W 17 RedLine        120th / Euclid
 9134 15058   0.0   1.0 B 17 RedLine        120th / Euclid
 9131 15057   0.0   1.0 W 17 RedLine        University Circle
 9123 15057   0.0   1.0 B 17 RedLine        University Circle
15320 15057   0.0   1.0 B 17 RedLine        University Circle
 8041 15056   0.0   1.0 W 17 RedLine        E. 105th / Quincy
15146 15056   0.0   1.0 B 17 RedLine        E. 105th / Quincy
 8050 15600   0.0   1.0 W 17 RedLine        E. 89th
 8050 15600   0.0   1.0 B 17 RedLine        E. 89th
 8070 15054   0.0   2.0 P 17 RedLine        E. 55th
 8070 15054   0.0   1.0 W 17 RedLine        E. 55th
15144 15054   0.0   1.0 B 18 RedLine        E. 55th
 4127 15051   0.0   1.0 W 18 RedLine        Tower City
 4095 15051   0.0   1.0 B 18 RedLine        Tower City
 4097 15051   0.0   1.0 B 18 RedLine        Tower City
 4123 15051   0.0   1.0 B 18 RedLine        Tower City
 6643 15050   0.0   1.0 W 18 RedLine        W. 25th / Lorain
 6643 15050   0.0   1.0 B 18 RedLine        W. 25th / Lorain
 5386 15049   0.0   1.0 W 18 RedLine        W. 65th / Madison
 5386 15049   0.0   1.0 B 18 RedLine        W. 65th / Madison
 5403 15049   0.0   1.0 B 18 RedLine        W. 65th / Madison
 4417 15048   0.0   2.0 P 17 RedLine        W. Blvd./Cudell
 4417 15048   0.0   1.0 W 17 RedLine        W. Blvd./Cudell
 4542 15047   0.0   2.0 P 17 RedLine        W. 117th./Madison Routes
 4542 15047   0.0   1.0 W 17 RedLine        W. 117th./Madison Routes
15137 15047   0.0   1.0 B 17 RedLine        W. 117th./Madison Routes
 4542 15047   0.0   1.0 B 17 RedLine        W. 117th./Madison Routes
 4095 15047   0.0   1.0 B 17 RedLine        W. 117th./Madison Routes
 5461 15046   0.0   2.0 P 17 RedLine        Triskett
 5461 15046   0.0   1.0 W 17 RedLine        Triskett
 5461 15046   0.0   1.0 B 17 RedLine        Triskett
15136 15046   0.0   1.0 B 17 RedLine        Triskett
 5554 15045   0.0   2.0 P 17 RedLine        Westpark
 5554 15045   0.0   1.0 W 17 RedLine        Westpark
15135 15045   0.0   1.0 B 17 RedLine        Westpark
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 5748 15044   0.0   2.0 P 17 RedLine        W. 150th/Puritas
 5748 15044   0.0   1.0 W 17 RedLine        W. 150th/Puritas
 5672 15043   0.0   2.0 P 17 RedLine        Brookpark (East)
 5672 15043   0.0   1.0 W 17 RedLine        Brookpark (East)
 5709 15043   0.0   2.0 P 17 RedLine        Brookpark (West)
 5709 15043   0.0   1.0 W 17 RedLine        Brookpark (West)
 9767  9767   0.0   2.0 P 14 RTA            E. 129th St/ St. Clair Loop
 7211  7211   0.0   2.0 P 16 RTA            Brecksville City Hall
 6553  6553   0.0   2.0 P 14 RTA            Strongsville P&R
 6481  6481   0.0   2.0 P 14 RTA            Sprague/Fair Loop Berea
11254 11254   0.0   2.0 P 14 RTA            Great Northern Shopping Center
 8594  8594   0.0   2.0 P 14 RTA            Solon P&R
 8594  8594   0.0   2.0 P 16 RTA            Solon P&R
 4600  4600   0.0   2.0 P 14 RTA            Clague Road P&R at Bay Village
 4600  4600   0.0   2.0 P 16 RTA            Clague Road P&R at Bay Village
 6725  6725   0.0   2.0 P 14 RTA            Brookpark / Pearl White Castle
 6725  6725   0.0   2.0 P 16 RTA            Brookpark / Pearl White Castle
 8209  8209   0.0   2.0 P 14 RTA            E. 130th / Corlett Ave.
 8257  8257   0.0   2.0 P 14 RTA            E. 131st / MilesAve.
 7579  7579   0.0   2.0 P 14 RTA            Southgate Transit Center
10649 10649   0.0   2.0 P 14 RTA            Randall Park Mall
 4824  4824   0.0   2.0 P 14 LCT            Lorain Erie/Broadway
 5941  5941   0.0   2.0 P 14 LCT            Elyria/Oberlin Rd./Hadaway St. P&R
 6920  6920   0.0   2.0 P 11 BTA            Laurel Square Shopping Center
10033 10033   0.0   2.0 I 14 RTA            Shoregate Shopping Center
10033 10033   0.0   2.0 I 16 RTA            Shoregate Shopping Center
 9302  9302   0.0   2.0 I 14 RTA            Loehman's Plaza
 9302  9302   0.0   2.0 I 16 RTA            Loehman's Plaza
 9909  9909   0.0   2.0 I 14 RTA            Euclid Square Mall
 9909  9909   0.0   2.0 I 16 RTA            Euclid Square Mall
 9225  9225   0.0   2.0 I 14 RTA            Hilltop Plaza
 9225  9225   0.0   2.0 I 16 RTA            Hilltop Plaza
 9344  9344   0.0   2.0 I 14 RTA            Eastgate Shopping Center
 9344  9344   0.0   2.0 I 16 RTA            Eastgate Shopping Center
 9243  9243   0.0   2.0 I 14 RTA            Severance Center Mall
 9243  9243   0.0   2.0 I 16 RTA            Severance Center Mall
 8588  8588   0.0   2.0 I 14 RTA            Solon Square Shopping Center
 8588  8588   0.0   2.0 I 16 RTA            Solon Square Shopping Center
 8417  8417   0.0   2.0 I 14 RTA            Randall Park Mall
 8417  8417   0.0   2.0 I 16 RTA            Randall Park Mall
 7579  7579   0.0   2.0 I 14 RTA            Southgate Shopping Center
 7579  7579   0.0   2.0 I 16 RTA            Southgate Shopping Center
 8911  8911   0.0   2.0 I 14 RTA            Church Square Shopping Center
 8911  8911   0.0   2.0 I 16 RTA            Church Square Shopping Center
 7978  7978   0.0   2.0 I 14 RTA            Longwood Plaza
 7978  7978   0.0   2.0 I 16 RTA            Longwood Plaza
 7434  7434   0.0   2.0 I 14 RTA            Broadway Shops
 7434  7434   0.0   2.0 I 16 RTA            Broadway Shops
 7517  7517   0.0   2.0 I 14 RTA            Turney Town
 7517  7517   0.0   2.0 I 16 RTA            Turney Town
 7607  7607   0.0   2.0 I 14 RTA            Garfield Mall
 7607  7607   0.0   2.0 I 16 RTA            Garfield Mall
 7107  7107   0.0   2.0 I 14 RTA            Rockside Corners
 7107  7107   0.0   2.0 I 16 RTA            Rockside Corners
 6656  6656   0.0   2.0 I 14 RTA            Clark/ W. 30th
 6656  6656   0.0   2.0 I 16 RTA            Clark/ W. 30th
 6268  6268   0.0   2.0 I 14 RTA            Memphis/Fulton Shopping Center
 6268  6268   0.0   2.0 I 16 RTA            Memphis/Fulton Shopping Center
 6711  6711   0.0   2.0 I 14 RTA            Brookpark/Broadview Shopping Center
 6711  6711   0.0   2.0 I 16 RTA            Brookpark/Broadview Shopping Center
 6702  6702   0.0   2.0 I 14 RTA            Ridge Park Square
 6702  6702   0.0   2.0 I 16 RTA            Ridge Park Square
 5494  5494   0.0   2.0 I 14 RTA            Westown Square Shopping Center
 5494  5494   0.0   2.0 I 16 RTA            Westown Square Shopping Center
 6749  6749   0.0   2.0 I 14 RTA            Parmatown Mall
 6749  6749   0.0   2.0 I 16 RTA            Parmatown Mall
 6365  6365   0.0   2.0 I 14 RTA            Southland Shopping Center
 6365  6365   0.0   2.0 I 16 RTA            Southland Shopping Center
 4568  4568   0.0   2.0 I 14 RTA            Westgate Mall
 4568  4568   0.0   2.0 I 16 RTA            Westgate Mall
 4597  4597   0.0   2.0 I 14 RTA            Bay Noll Shopping Center
 4597  4597   0.0   2.0 I 16 RTA            Bay Noll Shopping Center
10424 10424   0.0   2.0 I 14 RTA            West Bay Plaza
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10424 10424   0.0   2.0 I 16 RTA           West Bay Plaza
 4693  4693   0.0   2.0 I 16 RTA           US-6/Miller Rd. at Avon Lake
 4423  4423   0.0   1.0 K 14 RTA           Detroit Ave/W. 74th
 5316  5316   0.0   1.0 K 14 RTA           Detroit Ave/W. 32nd
 5322  5322   0.0   1.0 K 14 RTA           Detroit Ave/W. 25th
 5335  5335   0.0   1.0 K 14 RTA           Bridge Ave/W.38th St.
 5338  5338   0.0   1.0 K 14 RTA           Lorain/Fulton
 5395  5395   0.0   1.0 K 14 RTA           W.65th St North of I-90
 5397  5397   0.0   1.0 K 14 RTA           Bridge Ave/W.58th St.
 5410  5410   0.0   1.0 K 14 RTA           Bridge Ave/W.47th St.
 6186  6186   0.0   1.0 K 14 RTA           Lorain/Abbey Ave.
 6944  6944   0.0   1.0 K 14 RTA           Abbey Ave./W.11th St.
 6948  6948   0.0   1.0 K 14 RTA           Literary Rd/Professor St.
 6950  6950   0.0   1.0 K 14 RTA           Jeferson Ave/Professor St.
 6935  6935   0.0   1.0 K 14 RTA           Jeferson Ave/Professor St.
 6971  6971   0.0   1.0 K 14 RTA           W 14th St. North of I-490
 7344  7344   0.0   1.0 K 14 RTA           Broadway/E.14th St
 7966  7966   0.0   1.0 K 14 RTA           Comm. College Ave/E.30th St.
 7958  7958   0.0   1.0 K 14 RTA           Comm. College Ave/E.22nd St.
 8733  8733   0.0   1.0 K 14 RTA           Superior/E.32nd St.
 8784  8784   0.0   1.0 K 14 RTA           Carnegie/E.30th St.
 8832  8832   0.0   1.0 K 14 RTA           Superior / E. 105th St.
 8845  8845   0.0   1.0 K 14 RTA           Superior / E. 79th St.
 8851  8851   0.0   1.0 K 14 RTA           Superior / E. 71th St.
 8738  8738   0.0   1.0 K 14 RTA           Payne Ave./ E. 49th St.
 8919  8919   0.0   1.0 K 14 RTA           Hugh Ave./ E. 55th St.
 9183  9183   0.0   1.0 K 14 RTA           Grantwood Ave./ E.105th St.
 9614  9614   0.0   1.0 K 14 RTA           St. Clair/Marquette St.
 9619  9619   0.0   1.0 K 14 RTA           St. Clair/E. 40th. St.
 9620  9620   0.0   1.0 K 14 RTA           St. Clair/E. 43rd. St.
 9624  9624   0.0   1.0 K 14 RTA           St. Clair/E. 38th. St.
 9626  9626   0.0   1.0 K 14 RTA           St. Clair/E. 38th. St.
 9628  9628   0.0   1.0 K 14 RTA           St. Clair/E. 32nd. St.
 9656  9656   0.0   1.0 K 14 RTA           St. Clair/E. 93rd. St.
 9660  9660   0.0   1.0 K 14 RTA           Yale/Earle Ave / E. 105th. St.
 9663  9663   0.0   1.0 K 14 RTA           Adams Ave / E. 105th. St.
 9672  9672   0.0   1.0 K 14 RTA           St. Clair / E. 79th St.
 9676  9676   0.0   1.0 K 14 RTA           St. Clair / E. 69th St.
 9683  9683   0.0   1.0 K 14 RTA           Superior/E.55st St.
 9685  9685   0.0   1.0 K 14 RTA           St. Clair/E.61st St.
 9686  9686   0.0   1.0 K 14 RTA           Superior/E.61st St.
 9688  9688   0.0   1.0 K 14 RTA           St. Clair/Addison Rd.
 9761  9761   0.0   1.0 K 14 RTA           Taft Ave./Eddy Rd.
 9777  9777   0.0   1.0 K 14 RTA           Lakeview Rd / Fairport Ave.
 9782  9782   0.0   1.0 K 14 RTA           Lakeview Rd/Parklawn Dr.
 4232  4232   0.0   1.0 K 14 RTA           Carnegie Ave/Commercial Rd.
 9795  9795   0.0   1.0 K 14 RTA           St. Clair/E.102nd St.
14356 14356   0.0   2.0 P 13 LakeTran      Madison at I-90/SR-528
10170 10170   0.0   2.0 P 13 LakeTran      Market Street
10705 10705   0.0   2.0 P 13 LakeTran      Lakeland Community College
10143 10143   0.0   2.0 P 13 LakeTran      SR-2/Lloyd Rd.
```

{TAZ TO STATION FILE}: *TAZToStation.prn*

This file is used to build drive access connectors to transit stations. The format of the file is described below. A printout is omitted due to the large file size.

TAZ to Station File Format

Columns	*Contents*
1-8	TAZ
9-16	Transit station node

{EE TRIPS} : *ODEE.TRP*
This file contains the external-external trip tables, in Cube/Voyager format. Trips are expected in integer units (i.e, vehicles). The file contains two trip tables:

Table 1 – Auto EE trips
Table 2 – Truck EE trips

{EI WORK TRIPS} : *EIIEWRK.OUT*

This file contains the external-internal work trip tables, in Cube/Voyager format. Trips are expected in hundredths of units (i.e., vehicles * 100). The file contains two trip tables:

Table 1 – Internal – External auto work trips
Table 2 – External – Internal auto work trips

{EI NON-WORK TRIPS}: *EIIENWK.OUT*

This file contains the external-internal non-work trip tables, in Cube/Voyager format. Trips are expected in hundredths of units (i.e., vehicles * 100). The file contains two trip tables:

Table 1 – Internal – External auto non-work trips
Table 2 – External – Internal auto non-work trips

{EI TRUCK TRIPS} : *EIIETRK.TRP*

This file contains the external-internal truck trip table, in Cube/Voyager format. Trips are expected in hundredths of units (i.e., vehicles * 100). The file contains one trip table, which includes both IE and IE truck trips.

{SOCIO-ECONOMIC DATA FILE} : *SOCEC.DAT*

This files contains the zonal input socio-economic data for AUTOGEN and NLOGIT. The file format is described in the table below. A printout is omitted due to the large file size.

Socio-Economic Data File Format

Columns	*Contents*
1-10	Zone number (5-county)
11-20	Total housing units (not used)
21-30	Occupied households
31-40	Population
41-50	Total workers in households
51-60	Total employment
61-70	Average household income
71-80	Basic employment
81-90	Service employment
91-100	Retail employment
101-110	Square miles

Columns	*Contents*
111-120	Secondary/Elementary enrollment
121-130	University enrollment
131-140	Internal district used for reporting
141-150	Internal-External HBW district
151-160	Internal-External NHBW district
161-170	County (1 Lorain, 2 Cuyahoga, 3 Lake, 4 Geauga, 5 Medina)
171-180	Area type (5 CBD, 4 High Commercial, 3 Urban, 2 Suburban, 1 Rural)

{WALK PERCENT FILE}: *PWALK.DAT*

This file indicates the percent of work trips from each TAZ that walk to work. The file format is detailed below. A printout is omitted due to the large file size.

Walk Percent File Format

Columns	*Contents*
1-10	Zone number
11-20	Percent of work trips that walk to work

{WORK-NONWORK EXTERNAL PERCENT FILE} : *EXT_PER.TXT*

This file indicates the proportion of internal-external work and non-work trips, as well as their production and attraction split.

Work & Non-Work External Percent File Format

Columns	*Contents*
1-5	IE district
6-11	HBW percent IE: Total percent to be taken from Work trips
12-17	HBW percent IE attractions: Of the total percent, this percent to be taken from the attraction end
18--23	HBW percent IE productions: Of the total percent, this percent to be taken from the production end
24-29	NHBW percent IE: Total percent to be taken from Non Work trips
30-35	NHBW percent IE attractions: Of the total percent, this percent to be taken from the attraction end
36-41	NHBW percent IE productions: Of the total percent, this percent to be taken from the production end

Work & Non-Work External Percent File Contents

```
1  4.01 70.30 29.70  0.83 50.00 50.00
2 11.50 71.00 29.00  2.51 50.00 50.00
3 36.77 68.10 31.90  6.60 50.00 50.00
```

{IE EXTERNAL PERCENT FILE} : *EXT_STAT.TXT*

This file contains percent IE trips by external station. The file format and contents are detailed below.

IE External Percent File Format

Columns	*Contents*
1-5	External station zone number
6-11	Percent HBW productions
12-17	Percent HBW attractions
18-23	Percent NHBW productions
24-29	Percent NHBW attractions
30-35	Percent truck trips

IE External Percent File Contents

```
* Ext_stat.txt updated 4/20/04
* This file contains percent IE trips by external station
* It is read by autogen if the external model function is used
* The percent externals by station must add up to 100
* Format:
*Zone WorkPP WorkA NWrkP NWrkA TRUCK
 1237  2.54  2.54  5.51  5.51  1.67
 1238  0.23  0.23  0.57  0.57  0.04
 1239  0.09  0.09  0.42  0.42  0.10
 1240  2.94  2.94  3.63  3.63  6.90
 1241  0.16  0.16  0.59  0.59  0.30
 1242  0.09  0.09  0.23  0.23  0.06
 1243  2.54  2.54  2.72  2.72  6.90
 1244  0.90  0.90  1.51  1.51  0.55
 1245  0.91  0.91  1.25  1.25  3.93
 1246  0.09  0.09  0.23  0.23  0.33
 1247  0.29  0.29  0.52  0.52  1.32
 1248  0.15  0.15  0.16  0.16  0.07
 1249  0.15  0.15  0.18  0.18  0.22
 1250  0.51  0.51  1.04  1.04  1.03
 1251  0.16  0.16  0.28  0.28  1.32
 1252  0.18  0.18  0.52  0.52  0.72
 1253  0.48  0.48  0.54  0.54  0.99
 1254  0.05  0.05  0.05  0.05  0.07
 1255  1.70  1.70  3.41  3.41  9.65
 1256  0.53  0.53  1.18  1.18  1.17
 1257  0.07  0.07  0.15  0.15  0.35
 1258  0.71  0.71  1.15  1.15  0.58
 1259  0.27  0.27  0.38  0.38  0.25
 1260  0.34  0.34  0.63  0.63  0.83
 1261  0.85  0.85  1.04  1.04  1.09
 1262  0.40  0.40  0.80  0.80  0.21
 1263  0.32  0.32  0.59  0.59  0.25
 1264  0.45  0.45  0.40  0.40  0.26
 1265  0.35  0.35  0.30  0.30  0.18
 1266  0.65  0.65  1.60  1.60  0.91
 1267  4.65  4.65  3.89  3.89  1.27
 1268  1.36  1.36  1.37  1.37  0.83
 1269  0.28  0.28  0.60  0.60  0.00
 1270  0.26  0.26  0.39  0.39  0.06
 1271  0.41  0.41  0.43  0.43  0.19
 1272  0.18  0.18  0.35  0.35  0.11
 1273  2.45  2.45  2.63  2.63  3.93
 1274  0.20  0.20  0.32  0.32  0.04
 1275  0.12  0.12  0.16  0.16  0.00
 1276  3.62  3.62  3.86  3.86  0.83
 1277  1.59  1.59  1.71  1.71  0.69
 1278  0.45  0.45  0.76  0.76  0.40
 1279  0.16  0.16  0.28  0.28  0.00
```

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1280  0.09  0.09  0.08  0.08  0.10
1281  5.14  5.14  2.07  2.07  5.49
1282  6.79  6.79  4.54  4.54  9.65
1283  2.53  2.53  1.99  1.99  7.27
1284  0.29  0.29  0.33  0.33  0.00
1285  0.42  0.42  0.30  0.30  0.11
1286  2.55  2.55  2.71  2.71  1.24
1287  1.41  1.41  0.73  0.73  0.50
1288  0.51  0.51  0.46  0.46  0.10
1289  0.12  0.12  0.17  0.17  0.00
1290  2.72  2.72  2.96  2.96  5.83
1291 20.38 20.38 12.51 12.51  4.14
1292  0.36  0.36  0.34  0.34  0.21
1293  1.47  1.47  1.25  1.25  0.41
1294  0.65  0.65  0.55  0.55  0.28
1295  2.60  2.60  2.16  2.16  1.57
1296  0.34  0.34  0.23  0.23  0.07
1297  2.05  2.05  2.21  2.21  0.97
1298  1.81  1.81  2.33  2.33  1.43
1299  0.25  0.25  0.28  0.28  0.04
1300  0.32  0.32  0.27  0.27  0.14
1301  0.91  0.91  0.46  0.46  1.10
1302  0.42  0.42  0.34  0.34  0.14
1303  0.36  0.36  0.43  0.43  0.66
1304  0.10  0.10  0.22  0.22  0.15
1305  1.36  1.36  1.02  1.02  1.46
1306  0.33  0.33  0.33  0.33  0.15
1307  0.54  0.54  0.22  0.22  0.23
1308  1.11  1.11  1.00  1.00  0.72
1309  0.63  0.63  0.75  0.75  0.68
1310  0.24  0.24  0.34  0.34  0.88
1311  0.63  0.63  0.60  0.60  0.55
1312  0.42  0.42  0.30  0.30  0.19
1313  0.11  0.11  0.12  0.12  0.07
1314  0.26  0.26  0.35  0.35  0.14
1315  2.60  2.60  3.40  3.40  2.20
1316  0.45  0.45  0.57  0.57  0.25
1317  1.87  1.87  2.64  2.64  0.28
1318  0.03  0.03  0.11  0.11  0.00
```

{PARKING COST FILE} : *PKCOST.DAT*

This file contains daily (for work trips) and two-hour (for non-work trips) parking costs (in cents) by TAZ.

Parking Cost File Format

Columns	*Contents*
1-7	Traffic analysis zone
8-14	Daily parking cost (cents
15-21	2-hour parking cost (cents)

Parking Cost File Contents

```
  1  288.3  288.3
  3  726.4  726.4
  4  985.4  965.5
  5  347.5  347.5
  6  347.5  347.5
  7  288.3  288.3
  8  796.3  694.6
 10  743.8  743.8
 11  719.1  927.1
 12  899.5  732.7
 13  899.5  732.7
```

```
  14  603.7  241.7
  15  462.9  462.9
  17  368.1  356.4
  18 1122.8 1122.8
  19  866.2  792.2
  21  945.4  795.0
  22  866.2  792.2
  23  567.7  474.5
  24  535.8  394.9
  25  527.4  302.5
  26  347.5  347.5
  27  717.9  391.0
  30  347.7  340.8
  33  135.6  135.6
  37  504.5  429.8
  38  461.2  400.2
  39  210.9  210.9
  40  228.0  228.0
  41  228.0  228.0
  42  479.1  479.1
  45  338.9  237.0
  46  135.6  135.6
  47  318.5  290.9
  49  180.8  180.8
  51  351.7  351.7
  52  985.4  965.5
  53  270.6  252.1
  54  210.9  210.9
  55  527.4  302.5
  58  137.0  100.0
  59  137.0  100.0
  61  162.0  162.0
  62  137.0  100.0
  63  137.0  100.0
  66  162.0  162.0
  67  162.0  162.0
  68  137.0  131.0
  70  137.0  131.0
  85  106.8  106.8
  86  200.0  117.0
  87  500.0  500.0
 172  135.6  135.6
 247  137.0  100.0
 248  162.0  162.0
```

{TRANSIT ACCESSIBILITY FILE} : *TRACC.DAT*

This file indicates the proportion of a TAZ that has short and long walk accessibility to transit. The file format is detailed below. A printout is omitted due to the large file size.

Transit Accessibility File Format

Columns	*Contents*
1-5	Traffic analysis zone
6-10	Percent of zone area within 0.25 miles of transit
11-15	Percent of zone area within 0.50 miles of transit service