

User Manual: Models and report-generating programs of TRANUS

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Tranus Programs

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Overview of the Tranus programs

Installation and computer requirements

Tranus requires Windows 2000/NT/XP (it also runs on Windows 98, but full compatibility cannot be guaranteed). Installation is very simple from a CD or from Internet, and only takes a few minutes. The software comes in two separate executable files. Running each one installs certain components with a typical Windows installer. If a previous installation is detected, the installer suggests the same location. This is recommended. If it is the first installation, a default location is suggested (C:\TRANUS), although a different one may be chosen.

At the beginning the installation program asks the user if he/she agrees with the terms of the license as shown. Tranus is a free and open software that follows the specifications established by Creative Commons, a non-profit organization that looks after free software. The specific conditions that Tranus adheres to may be seen in <http://creativecommons.org/licenses/by-sa/2.0/>.

If the Tranus software is installed in Windows XP, the installation program will automatically set the environment so that the model and reporting programs may be run from any folder in the hard disk. This procedure will not work in previous versions of Windows, and you may have to set the environment manually. If you don't know how to do this, consult an expert. Versions previous to and including Windows 98 have a file C:\AUTOEXEC.BAT. Inside this file you will find a PATH statement. You can add ;C:\TRANUS\BIN to the PATH statement so that the Tranus programs become accessible from anywhere in your hard drive (assuming that you have chosen C:\TRANUS as the installation folder).

A basic RAM of 215 K is good enough for most applications, but everything will run faster and smoother if you have more memory.

Structure of programs

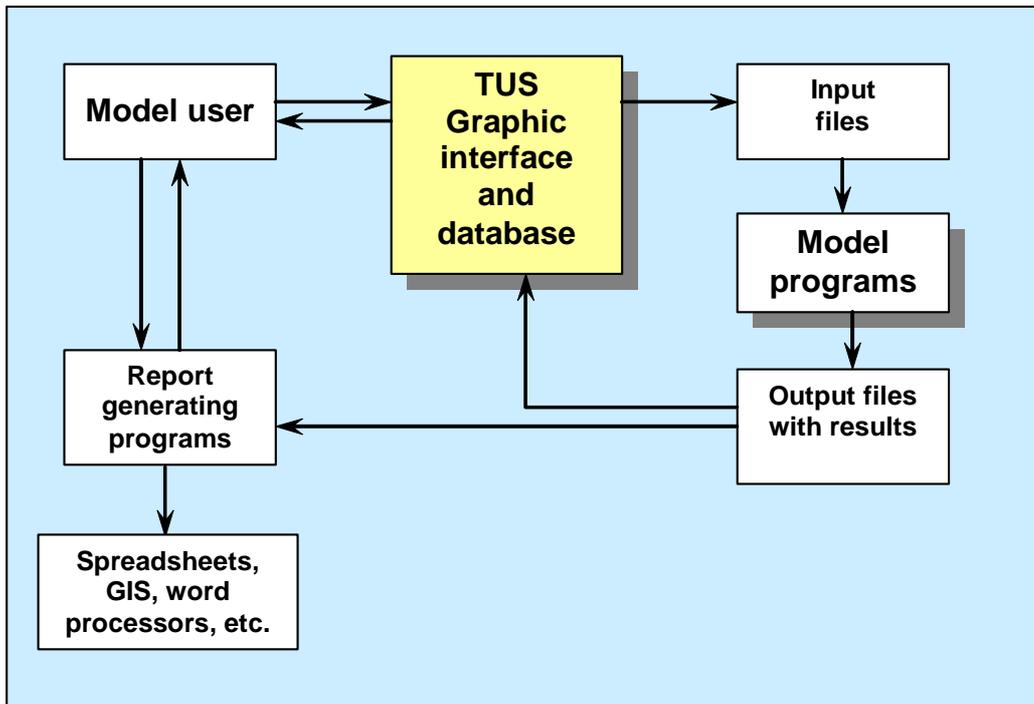
The Tranus software package contains three groups of programs:

- a) **Tranus User Shell (TUS)**. This is the graphical interface and database. Most of the activities involving the preparation of a database for a project, interactive edition of the transport network, importing or exporting road and transit networks, incorporating a digital map with geographic coordinates, graphic representation of transport results, generation of numerical reports, and running the model programs. TUS also holds an object-oriented and dynamic database of a complete Project. The latter means that the program keeps the data consistent, constantly validating the data and checking all scenarios within a project. TUS provides facilities to interact with other Windows programs, such as word processors, spreadsheets and GIS databases. The use of the TUS interface is described in detail in a separate document, and in its own extensive Help facility.
- b) **Model programs**. This is the set of programs that perform the calculations, such as path search, transport assignment, activities location, and so on. These programs may be run directly from the TUS interface or from the Windows Command window. TUS generates the necessary data for these programs. When each run is completed, results are stored in files that may be consulted from the interface or with the report generating programs. The use of these programs is described in detail later below in this document.
- c) **Reports generating programs**. Some numerical reports are generated directly from the TUS interface, but others are generated with these special programs. A large variety of reports may be generated with many options. Some of the programs may be run automatically with predetermined options and formats. The resulting reports may be read by standard spreadsheets for further processing, or fed into GIS programs.

The following figure illustrates the main components of the Tranus system. The model user creates and manipulates the application from the TUS interface. From there data files are generated for the model programs and are run directly or from the command window. The model programs read these datasets, perform the

necessary calculations and store the results in binary files. The model user may generate maps and numerical reports with the results directly from the interface, or by using the reports generating programs.

Main components of the Tranus system



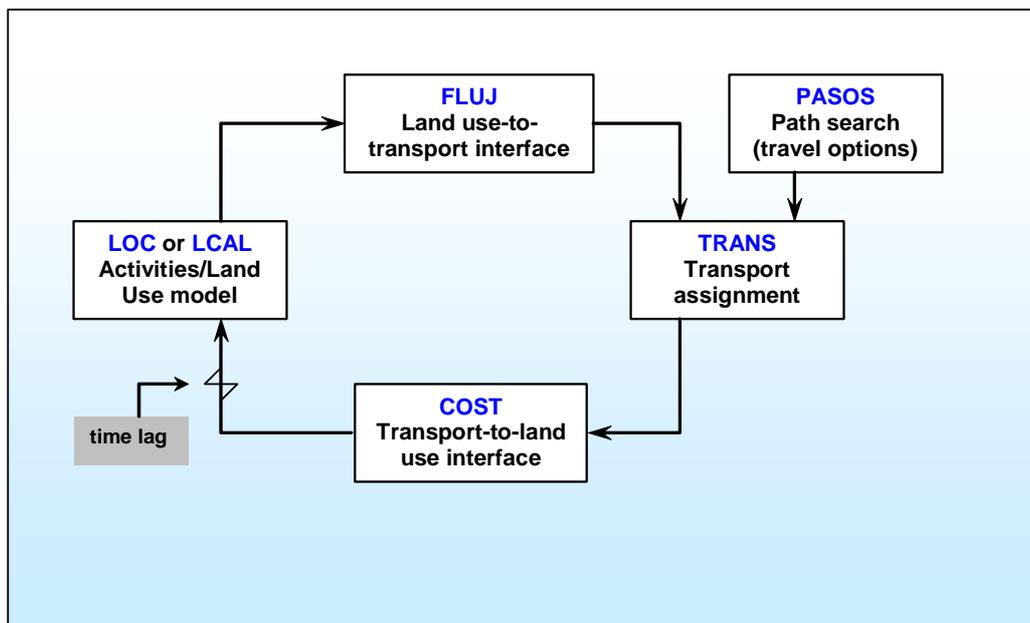
Model programs

Introduction

This part of the manual describes the model programs and the way to operate them from the commands window of the Windows operating system. The separate TUS manual describes the way to run the programs directly from the interface (recommended). The information provided in this part of the documentation is for advanced users only that may be interested in the details.

The main programs are related to each other. For each scenario, the model programs read data from the interface and from the results of a previous scenario. Then the programs perform the calculations and store the results in binary files. For each scenario the programs must be run in a specific sequence, as illustrated in the following figure:

Sequence of model programs



As may be seen, all programs, except PASOS, form a cycle. The land use model requires the output from a previous time period run of the transport model. In turn, the transport model requires the flows generated by the activities interaction in the land use model to assign trips to the transport network. In this way the cycle spirals through time.

In the base year, however, there is no previous time period. In this case the transport assignment model TRANS must be run initially without flows, calculating transport costs and disutilities assuming an empty network. These are fed into the activities and land use model, resulting in new flows that are fed into the transport model. The sequence may be run several times until land use and transport are equilibrated. As will be described later, in the

base year program LCAL is run instead of LOC. Note that in between the land use and transport model there are separate interface programs that make some necessary transformations.

The specific way in which such sequence of programs is run is described later below. The process may be run manually, running each program one-by-one. Longer batch processes are also possible and very convenient. It is also possible to run the programs directly from the TUS interface (recommended), although there are minor limitations. If the programs are run from the command window of Windows, the model user must generate the data for the corresponding scenarios from the interface by using menus Project→Generate All Files, or Project→Generate Single Scenario, or Project→Generate Single Files.

Once the data has been generated for a base year scenario, the model programs must be run in the following sequence:

- PASOS, reads the network and transport data and estimates travel options for each origin-destination pair and transport mode
- TRANS, initially calculates transport costs and disutilities assuming an empty network
- COST, transforms transport costs and disutilities from transport categories to land use categories
- LCAL, Simulates the location and interaction of activities and land use, as a function of, among others, transport costs and disutilities, and generates a first estimate of socioeconomic flows
- FLUJ, transforms the flows from socioeconomic categories into transport categories
- TRANS is run for a second time to assign the flows to the network, and to calculate travel costs and disutilities with a loaded network

The sequence COST-LCAL-FLUJ-TRANS may be repeated several times to reach land use-transport equilibrium. Note that it is not necessary to run PASOS repeatedly, because travel options are always calculated with an empty network.

The same sequence is followed for future scenarios, except that LOC is used instead of LCAL.

A sequence of commands to run these programs may be written into a *batch file*. The TUS interface helps in this by creating standard batch files that may be edited to suit specific requirements. From the TUS interface it is also possible to set up long batch files, store them and retrieve them later.

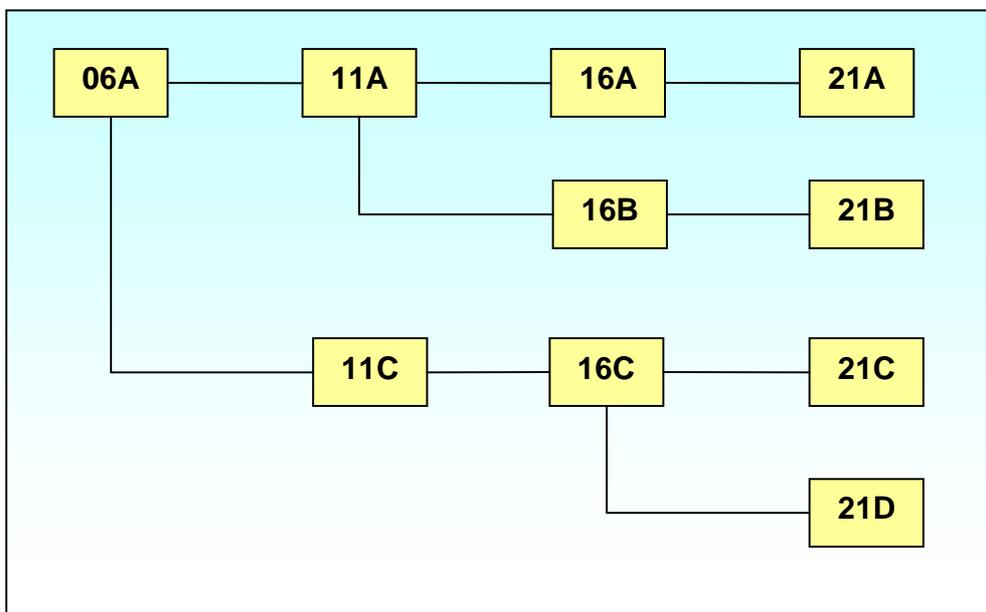
TUS may run the programs directly with the menu Project→Run (recommended). In this case the interface automatically generates the data files for the model programs before they are run. The data files are in text format, so that they may be modified by the model user. It is strongly advised that you do not do this, because they may get corrupted. Any modification, however simple, must be made in the menus of the TUS interface. The program only takes a couple of seconds to generate a new set of files with the correct formats.

Files and folders automatically generated by TUS

As was mentioned above, the database in the interface TUS holds a complete project with many scenarios. Scenarios are organized in the form of a scenario tree, visible in the left side of the TUS window. When you build an application you must give to it as code name (3 characters), and you store the data in a file that you can name at will. Assume you are developing a model of Metropolis and you give it a code name MET. You may store the database in a file called Metropolis Future Plan 2030.tuz . The .tuz extension is mandatory and given automatically. The .tuz file must be stored in some work folder, such as C:\Metroplan. We will call this the **Application's Root Folder (ARF)**. It is very important that you run all Model Programs, as well as all Reports Generating Programs from the ARF.

In developing the application, several scenarios may be defined to form the scenario tree. Consider the following figure as containing the scenario tree that you have defined in the Metropolis application. Each scenario must be given a three-letter code. There is always a single Base Scenario (06A) to represent, say, year 2006. From this base there is a number of scenarios that ‘hang’ forming branches. A first branch is represented by scenarios 11A, 16A and 21A, representing years 2011, 2016 and 2021 and a set of policies, perhaps a ‘do-nothing’ scenario. Branching from scenario 11A there is a 16B scenario, perhaps the same as 11A but adding a railway project, and this continues to 21B. Scenario 11C branches out straight from the Base and continues as 16C and 21C, representing perhaps a policy of bus lanes. Finally scenario 21D branches out from 16C to represent a variation at the end of the projection period, for instance, a limitation on urban expansion. This organization of the scenario tree also tells the model about the precedence between scenarios. For instance 11A is the ‘previous’ scenario to 16B, most relevant to the land use model.

Example of a scenario tree



The TUS interface understands this structure. When you use the commands to generate datafiles, TUS organizes data into separate folders, one for each scenario. Then the following may happen:

- Each time menu Project→Generate All Files is activated, TUS creates (or overwrites) folders hanging from the ARF with names identical to the scenario, that is, 06A, 11A, and so on. Most of the datafiles are written into the corresponding folders but there are a few exceptions of data that is not scenario-dependent and consequently get written directly into the ARF.
- If you activate menu Project→Generate Single Scenario, TUS asks which one you want and creates (or overwrites) that specific scenario.
- When you activate the Project→Run menu, TUS automatically generates (or overwrites) the folders and data required to run whatever scenarios you asked for.

Running the model programs from the Command window

The Windows operating system includes a special window for running command-driven programs. This window also provides full compatibility with the older DOS operating system, and in fact not long ago it was called the DOS window. Look for this window in Start→All Programs, usually in Accessories with a logo like this one:

```
C:\
```

Alternatively go Start→Run, and in the dialog that appears type CMD. A basic knowledge of the DOS commands is required at this stage. From this command window you may run any of the Tranus programs.

The first thing to do is to place the command prompt in the same folder where the .tuz file is stored, that is, the ARF folder as explained in the previous section. The sequence of actions to run a program is, then:

- a) Generate the scenario data or the complete scenario tree data with the Project→Generate All Files or Single Scenario.
- b) Place the command in the ARF
- c) Run the program with the appropriate command

For instance, if you want to run path search for scenario 16B in the previous example, the command line will look like:

```
C:\Metroplan\PASOS 16B
```

PASOS is being run from the ARF but it will automatically look for data within the 16B folder. If you forgot to generate this folder in step a) above, PASOS will respond with a very angry message.

Note that if you want to run LOC (the land use model) for scenario 16B with the command:

```
C:\Metroplan\LOC 16B
```

Program LOC will look for data in the 16B folder, but it will also look for the 'previous' scenario data in folder 11A (see the figure above). If it doesn't find any of these, it will also get angry.

As expected, when any of the model programs finish, they store the results in the corresponding scenario folders. In the examples above PASOS will store the results in the scenario folder 16B, and LOC will do the same.

Some model programs have options. For instance, the transport model TRANS may perform an initial run without flows, and program FLUJ may be run without land use results. These options will be described in full in the following sections. To find out which options are available, use the following command:

```
[Any program] /?
```

Program COST: transformations of transport costs and disutilities

General description

The purpose of program COST is to transform the matrices of costs and disutilities by transport categories generated by the transport assignment model TRANS, into matrices by socioeconomic category required by LOC or LCAL. The transport model generates a matrix of costs and disutilities for each transport category, such as trips to work, light freight, containers, and so on, while the land use model requires costs and disutilities for the socioeconomic sectors that generated these flows, such as industry, agriculture, population. Consequently program COST must group or split costs according to the proportions that have been defined by the model user. These proportions are also used by program FLUJ, but in opposite direction. This process is described in detail in the Mathematical Description Manual. The proportions and other characteristics in which each socioeconomic sector generates each transport categories are defined in the menu *LandUse* → *Intersectors* → *Categories*.

Program COST also estimates intrazonal costs and disutilities required by LOC and LCAL, because the transport assignment model TRANS does not generate them. To do this, program COST looks for the transport cost and disutility of the nearest zone, and then applies a pre-defined proportion. This proportion is defined in *Project* → *Option* → *Land Use* as a default value for all zones. Different values for specific zones may be specified by overriding the default in the menu *Project* → *Zones*.

Operation of program COST

To run program COST from the command widow, the following command is used:

COST

The Tranus logo appears on screen, as in all programs, followed by the message:

IDENTIFY YEAR AND POLICY (3 characters) -->

The user must reply with a valid scenario code (year/policy) *xxx*, such as *08B*. Alternatively a single command may be used:

COST <xxx>

In this case the user is not prompted with on-screen menus and runs directly. This form is very useful in a batch file with a long sequence of program runs. Further descriptions of the COST command are obtained by typing *COST /?* in the command line. During program execution, some messages are displayed on screen to report on progress.

Hopefully no error messages should appear, but if they do and are fatal, execution stops. The resulting matrices of costs and disutilities are stored in files with extension *.CIS and may be consulted with program MATS.

If the menu *Project* → *Run* is used, program COST is ran automatically after each run of the transport assignment model TRANS.

Program FLUJ: transformation of flows

General description

The purposes of program FLUJ are:

- a) To transform the matrices of economic flows from socioeconomic categories generated by LCAL or LOC, into matrices of flows by transport categories, as required by the transport assignment model TRANS.
- b) To introduce possible exogenous trips by transport categories and mode into the transport model.

These two functions may be combined in several ways. For an integrated land use-transport application, a) is obligatory and b) is optional. For a transport-only application all trips to be assigned must be specified in b).

The land use model generates flows or spatial interactions by socioeconomic sectors such as agriculture, industry, population, etc., in the corresponding units (\$, Tons, jobs, households, etc.). These flows give rise to transport demand by transport categories, such as light freight or trips to work by income groups in specific proportions. The relationships between land use sectors and transport categories are defined in *LandUse* → *Intersectors* → *Categories*. Exogenous trips are defined in menu Transport → *Exogenous Trips*. Details of these transformations are given in the *Mathematical Description Manual*.

Operation of program FLUJ

To run program FLUJ from the command widow, the following command is used:

```
FLUJ
```

In transport-only applications the only purpose of running FLUJ is to read matrices of exogenous trips. To avoid looking for matrices of flows generated by the land use model, the following command is used instead:

```
FLUJ I
```

The Tranus logo appears on screen, as in all programs, followed by the message:

```
IDENTIFY YEAR AND POLICY (3 characters) -->
```

The user must reply with a valid scenario code (year/policy) *xxx*, such as *08B*. Alternatively a single command may be used:

```
FLUJ <xxx> [i]
```

In this case the user is not prompted with on-screen menus and runs directly. This form is very useful in a batch file with a long sequence of program runs. Further descriptions of the FLUJ command are obtained by typing FLUJ /? in the command line. During program execution, some messages are displayed on screen to report on progress.

Should any fatal error messages appear, execution stops. The resulting matrices of costs and disutilities are stored in files with extension *.FIS and may be consulted with program MATS.

If the menu *Project*→*Run* is used, program FLUJ runs automatically after each run of the land use model LCAL or LOC.

Program LCAL: Base-year activities and land use model

General description

Program LCAL performs all calculations related to the location of activities and land use for the base year. It has a built-in procedure that helps in the calibration process. The program estimates a set of factors that affect location prices so that the results of the model get as close as possible to data. Consequently, these factors are only calculated for the base year, and are projected into future scenarios unchanged. For subsequent periods, program LOC should be used instead.

Program LCAL stores the results of the location of activities and land use in files with extension *.L1S, that may be inspected with program IMPLOC. Matrices of flows are stored in files with extensions *.L2S and may be inspected with program MATS. All data and parameters are introduced in the *Land Use* menu of the TUS interface. Program LCAL also looks for matrices of transport costs and disutilities generated by program COST and stored in *.L1S files.

Operation of program LCAL

To run program LCAL from the command window, the following command is used:

```
LCAL
```

The Tranus logo appears on screen, as in all programs, followed by the message:

```
IDENTIFY YEAR AND POLICY (3 characters) →  
New or additional run? (N/a) →
```

The user must reply with a valid scenario code (year/policy) *xxx*, such as *08B*. With option *N* LCAL runs from the first iteration to the last (this is the default condition). With option *a*, LCAL reads the results of a previous run and continues making additional iterations. Alternatively a single command may be used:

```
LCAL xxx [N/A]
```

If options *N* or *A* are not specified, the program assumes *N*. Further descriptions of the LCAL command are obtained by typing `LCAL /?` in the command line. Program LCAL may be ran directly from the TUS interface with the menu *Project*→*Run*. If it is a base year, program LCAL is automatically chosen. For subsequent years program LOC is selected.

During execution a number of messages appear on screen to report progress and the state of convergente. The following messages appear:

```
READING PARAMETERS AND DATA  
LOCATION OF PRODUCTION  
Iter i Sect: number and name of sector
```

At the end of each iteration the state of convergence is presented:

Convergency indicators

Sector	ConvPrec	Zone	ConvProd	Zone	ProdEx	ProdInd
4	0.04	14	0.03	35	30456.	87963.

The following is the meaning of each indicator:

Sect	Sector being reported.
ConvPrec	Convergence indicator of the prices of the sector. It is the percentage by which the prices changed the most.
Zone	Zone to which the indicator corresponds. It is the zone in which the price of the sector changed the most.
ConvProd	Convergence indicator of the production of the sector. It is the percentage by which the production changed the most.
Zona	Zone to which the indicator corresponds. It is the zone in which the price of the sector changed the most.
ProdEx	Total exogenous production for the sector.
ProdInd	Total induced production for the sector accumulated up to this iteration.

Because ProdEx is a given value, it should not vary from one iteration to another. ProdInd will change rapidly at the beginning, changing slowly towards the end as convergence is reached. The program iterates until all convergence indicators are below a certain predefined criteria or until the maximum number of iterations have been performed. In menú *Project*→*Options*→*Land Use* both the convergence criteria and the maximum number of iterations is specified. If the last iteration is reached without convergence, a warning message is displayed.

Program LOC: Activities and land use model

General description

Program LOC performs all the calculations related to the location of activities and land use for time periods other than the base year, in which case program LCAL should be used instead.

Program LOC stores the results of the location of activities and land use in files with extension *.L1S, that may be inspected with program IMPLOC. Matrices of flows are stored in files with extensions *.L2S and may be inspected with program MATS. All data and parameters are introduced in the *Land Use* menu of the TUS interface. Program LOC also looks for matrices of transport costs and disutilities generated by program COST and stored in *.L1S files for a previous time period.

Operation of program LOC

To run program LOC from the command widow, the following command is used:

```
LOC
```

The Tranus logo appears on screen, as in all programs, followed by the message:

```
IDENTIFY YEAR AND POLICY (3 characters) →  
New or Additional run? (N/A) →
```

The user must reply with a valid scenario code (year/policy) *xxx*, such as *08B*. With option *N* LOC runs from the first iteration to the last (this is the default condition). With option *a*, LOC reads the results of a previous run and continues making additional iterations. Alternatively a single command may be used:

```
LOC <XXX> <N/A>
```

If options *N* or *A* are not specified, the program assumes *N*. Further descriptions of the LOC command are obtained by typing `LOC /?` in the command line. Program LOC may be ran directly from the TUS interface with the menu *Project*→*Run*. If it is a base year, program LCAL is automatically chosen. For subsequent years program LOC is selected.

During execution a number of messages appear on screen to report progress and the state of convergente. The following messages appear:

```
READING PARAMETERS AND DATA  
LOCATION OF PRODUCTION  
Iter i Sect: number and name of sector
```

At the end of each iteration the state of convergence is presented:

```
Convergency indicators  
Sector ConvPrec Zone ConvProd Zone ProdEx ProdInd  
4 0.04 14 0.03 35 30456. 87963.
```

The following is the meaning of each indicator:

Sect	Sector being reported.
ConvPrec	Convergence indicator of the prices of the sector. It is the percentage by which the prices changed the most.
Zone	Zone to which the indicator corresponds. It is the zone in which the price of the sector changed the most.
ConvProd	Convergence indicator of the production of the sector. It is the percentage by which the production changed the most.
Zona	Zone to which the indicator corresponds. It is the zone in which the price of the sector changed the most.
ProdEx	Total exogenous production for the sector.
ProdInd	Total induced production for the sector accumulated up to this iteration.

Because ProdEx is a given value, it should not vary from one iteration to another. ProdInd will change rapidly at the beginning, changing slowly towards the end as convergence is reached. The program iterates until all convergence indicators are below a certain predefined criteria or until the maximum number of iterations have been performed. In menú *Project*→*Options*→*Land Use* both the convergence criteria and the maximum number of iterations is specified. If the last iteration is reached without convergence, a warning message is displayed.

Program PASOS: path search by mode

General description

The purpose of program PASOS is to find a set of paths or travel options from each origin to each destination by mode. Note that in Tranus a mode may be made up of several operators and possible transit routes. A path is defined as a series of physical links and operators or routes combined in different ways, with possible transfers between them. Path search is always calculated on the basis of an empty network.

All transport-related data is introduced in the TUS interface in the *Transport* menu. The maximum number of paths by mode and the corresponding overlapping factors are defined in *Transport*→*Modes*.

The results of the path search procedure may be viewed graphically with the TUS interface (see the TUS Manual). A number of indicators are presented along with each path. Further details of the way in which paths are calculated are presented in the Mathematical Description Manual.

Operation of program PASOS

To run program PASOS from the command widow, the following command is used:

```
PASOS
```

The Tranus logo appears on screen, as in all programs, followed by the message:

```
IDENTIFY YEAR AND POLICY (3 characters) →
```

The user must reply with a valid scenario code (year/policy) *xxx*, such as *08B*. Alternatively a single command may be used:

```
PASOS <XXX>
```

In this case the program runs immediately without prompting any menus, particularly useful when setting up a *batch* process. It is also possible and convenient to run program PASOS directly from the TUS interface using the menu *Project*→*Run*.

During program execution some messages appear on screen to report the progress of the calculations. These are:

```
READING PARAMETERS AND DATA
Number of links in network
      nnn  mmm
ADY   Mod k  (x%)  a=(y%)
PAS   Mod k  Orig i  (w%)  h=(z%)
```

The value of *nnn* indicates the total number of physical links in the network, and *mmm* is the number of link-routes combinations. ADY indicates that PASOS is building an adjacency matrix, that is, the dual network as described in the Mathematical Description; *x%* is the percentage progress; *y%* is the percentage of memory use with respect to the capacity of the program. PAS indicates that paths are being calculated from origin *i* by mode *k*. *w%* is the percentage progress; *z%* is the percentage memory being used with respect to the capacity of the program. Possible error or warning messages may appear on screen, and if fatal, causes the execution to be aborted.

Program TRANUS: transport assignment model

General description

Program TRANUS assigns travel demand to the network, both physical and operative. Main processes are trip generation, modal split (optional), assignment and capacity constraint for roads and transit. The calculations proceed iteratively, repeating the sequence over and over until convergence is achieved.

There are three options for running TRANUS:

- Initial run (I)
- New run (N)
- Additional run (A)

The initial run is used to obtain initial estimates of travel costs and disutilities when there are yet no flows to assign, usually for the base year. With this option the transport assignment model only calculates one iteration, and the resulting costs and disutilities correspond to an empty network. This further allows the land use model to run, thus generating initial flows and eventually a full transport load.

With the New run (N) option TRANUS reads flows from the land use model and/or exogenous trips and assigns them to the network in several iterations. This is the default option. The additional (A) starts off where a previous run finished, thus making additional iterations. In both cases the model stores the results of the assignment in terms of loads by link, matrices of trips by mode and category, matrices of costs and disutilities, indicators, and many others. The results may be reported by programs MATS, IMPTRA and MATEP described later below. The TUS interface also generates reports directly in HTML format for Excel, using the *Reports* menu.

Operating program TRANUS

To run program TRANUS from the command widow, the following command is used:

```
TRANUS
```

The Tranus logo appears on screen, as in all programs, followed by the message:

```
IDENTIFY YEAR AND POLICY (3 characters) -->
      Initial, New or Additional run (I/N/A) ?
```

The user must reply with a valid scenario code (year/policy) *xxx*, such as *08B* and a choice for the initial, new or additional run. Alternatively a single command may be used:

```
TRANUS <XXX> [I/N/A]
```

In this case the program runs immediately without prompting any menus. This is particularly useful when setting up a *batch* process without the need to be present. It is also possible and convenient to run program TRANUS directly from the TUS interface using the menu *Project*→*Run*.

As the calculations are being made, the program presents a number of on-screen messages to report progress. At the end of each iteration the state of convergence is reported:

Iter	Categ	ZonOrig	ObjConv	ConvFluj	Orig	Dest	ConvVel	Orig	Dest
1	1	1	0.001	0.070	130	138	0.040	210	211

The first three values indicate the iteration number, transport category and zone being processed. The rest indicate the degree of convergence achieved so far, evaluated in terms of the percentage change between one iteration and the next:

ObjConv: is the convergence target to be achieved, specified by the model user in *Project*→*Options*→*Transport*.

ConvFluj: is the achieved convergence with respect to flows. It is the percentage change in the number of passengers in the link that varied the most. Such link is identified by Orig and Dest.

ConvVel: is the achieved degree of convergence with respect to speeds. It is the percentage change in speed in the link that varied the most. Such link is identified by Orig and Dest.

Both convergence indicators must be smaller than the target to stop the program.

Reports generating programs

With a successful run of a sequence of models, a large number of binary files containing the results is generated. The reports generating programs are used to produce tables and other numeric presentations of these results in a variety of ways. Tables of results may be inserted in spreadsheets for further enhancement and comparative analysis of several scenarios. Tables may also be used to feed GIS programs to produce elaborate maps with results, or may be used as input to traffic models or environmental analysis programs. This section of the manual describes the operation of these programs, together with the options provided and formats available. The TUS interface also provides a limited number of reporting options, although in future versions of Tranus this more modern and convenient way of generating reports will be expanded considerably.

The reports generating programs described here follow a similar scheme. They are activated through commands in the command window of Windows, and present menus with many options. The resulting report gets stored in a file, usually a text file with tabs or commas as separators. In turn, these files may be opened with spreadsheets or other programs. Some reporting programs offer the possibility of specifying a query in a special text file. This is particularly useful for large and complex queries or queries that have to be repeated many times. Each reporting program also provides options to specify a query in a single command line. This is useful when setting up batch files, in which case a large sequence of models is run unattended, together with a set of reports that are produced automatically.

The main reporting programs are:

EVAL, presents a set of matrices with transport-related consumers' surplus in origin-destination form by user category, resulting from the comparison of two sets of scenarios.

IMPLOC, presents the results of the land use models LCAL and LOC in a variety of formats, usually tables by zone and sector.

IMPTRA, presents the results of the transport assignment model TRANS in a variety of ways. Selective lists of links may be presented with the number of assigned vehicles, travelers, level of service, speeds, and so on. Lists of transit routes with all the corresponding results may also be produced. Tables of system-wide indicators are very useful to assess the performance of the transport system. Other options are distributions of vehicle-km by speed class, detailed demand profiles by transit routes, and so on.

MATS, presents matrices with both land use and transport results in origin-destination form. Matrices of economic flows by land use category may be produced, as well as trip matrices by transport category and mode, transport costs and disutilities, trip lengths and times, and others.

MATESP, produces *special* reports from the transport model, requiring additional processing. Some take the form of origin-destination tables, such as trip matrices that use one or more links, or trips that use a specific transport operator, trips that make one or more transfers, and so on. A particularly interesting result is movements around one or more nodes in the network, an information that may be passed on to a traffic model.

These programs are described in the following sections.

Program EVAL: Economic evaluation tables

General description

Program EVAL calculates and presents matrices of consumers' surplus by transport category in origin-destination form. This is the result of comparing two scenarios for one or more time periods. One scenario is defined as a *base case*, and the other as the *alternative*. Usually the base case represents a condition *without projects*, and the alternative case a situation *with a specific project* that is to be evaluated.

The results of EVAL represent user benefits in cost/benefit analysis. The model user will probably expand the results in daily or annual terms, and will complement them with other benefits, such as operating cost savings, transit revenues, maintenance cost savings and others, to form annual tables of benefits. These annual series may be compared with investment profiles and non-modeled costs, from where the traditional economic indicators may be calculated, such as Net Present Value, Internal Rate of Return or Benefits/Costs ratios.

EVAL calculates consumers' surplus with the well-known rule-of-a-half, where:

$$\Delta S_{ij}^m = (\tilde{c}_{ij}^{mAlt} - \tilde{c}_{ij}^{mBase})(T_{ij}^{mAlt} + T_{ij}^{mBase}) / 2$$

where:

ΔS_{ij}^m consumers' surplus for travelers of category m traveling from zone i to j ;

\tilde{c}_{ij}^{m*} transport disutility for the base or alternative case;

T_{ij}^{m*} number of trips for the base or alternative case.

As may be seen in detail in the Mathematical Description manual, transport disutilities result from the log-sum of the logit or powit models. Note that because trip generation in Tranus is elastic, the number of trips in the base case may be different to those in the alternative case.

The resulting matrices of consumers' surplus may be of particular interest in ways other than economic evaluation. Careful inspection of individual cells tell which origin-destination pairs are getting most of the benefits from a specific transport project. Negative values show o-d pairs that are worse-off with the project. A detailed analysis of the reasons that may cause the loss of benefits may lead to an improved design of the project. Note that the results are in the monetary units of the model and for the time period being simulated. For instance, if the model has been specified in US \$ and represents a two-hour peak period, then the users' benefits will be in these units.

Operating program EVAL

A small text file with extension E1E must be prepared before running EVAL, as described later below. To run the program, the following command must be introduced:

```
EVAL
```

The program prompts two questions:

```
Bas -->
Alt -->
```

The user must reply with a single character to identify the base and alternative cases, such as B and A. After this the program prompts a message to specify the name of the file where the results are to be stored:

```
Specify an output file:
[PATH]name.ext (up to 32 characters)

Enter-----> YYYYB-A.EVL
```

The program suggests a file name with extension EVL, but a different name may be specified. If the file already exists, the program generates a warning::

```
File YYYYXX already exists. Overwrite it ? (Y/n)
```

Enter Y (or y) or simply *Enter* to overwrite the file, or N (or n) to specify a different name.

Next program EVAL looks for the E1E file and produces an error message if the file is not present. Then the program produces a few messages to inform about the progress of the calculations.

File E1E has the following content that must be prepared by the model user (an empty template is provided with the installation of Tranus):

Evaluation Parameters

Metro of Bogota Study

*-----

1.0 Scenario definitions

1.1 Time periods

Year	'Base Case'	'Alternative'
2007	'07C'	'07D'
2015	'12C'	'12D'

*-----

In the example above, Scenario D is to be compared against Scenario C for periods 2007 and 2015.

The following is an example of the resulting matrices of consumers' surplus. After a standard heading with the study area and date/time, a matrix with origin-destination values is presented. In the sample, only the first 12 zones are shown.

**EVAL - EVALUATION PROCEDURE**

Barcelona-Puerto La Cruz

Area BaseCase Alternative Date/time evaluation

BLC C D 25-11-2002 11:07

TRANSPORT USERS'S SURPLUS BY ZONE AND CATEGORY

(In transport time units)

Per: 2007

CAT 1 Com-Serv

ZON	1	2	3	4	5	6	7	8	9	10	11	12
1 Pertigal	0	0	0	0	0	0	-1	0	0	0	0	4
2 Pamatacu	0	0	0	-2	0	0	-7	0	0	5	11	14
3 Bobure	0	-5	0	0	1	0	-1	2	1	14	8	81
4 Guanta	-2	-14	0	0	-1	0	79	-1	4	9	17	142
5 Chorrero	0	-6	2	-2	0	6	1	1	0	7	6	16
6 Puerto d	0	0	0	0	0	0	0	0	0	0	0	0
7 El Chaur	0	0	0	7	0	1	0	0	0	2	-6	22
8 Guaragua	9	18	4	-21	-3	-51	0	0	14	9	-24	-50
9 Refineri	0	0	0	0	0	0	0	0	0	0	0	0
10 Las Deli	3	-13	12	26	4	7	0	45	-1	0	267	-7
11 Casco de	-2	15	2	33	2	3	-4	21	2	-10	0	0
12 Barrio E	7	3	6	10	9	3	0	-40	-1	17	3	0

Program IMPLOC: Land use reports

General description

The purpose of IMPLOC is to produce reports from the results of the land use models LOC and LCAL. There are two sets of land use results: activities location and land use, and matrices of flows. IMPLOC deals with the former, while the latter is dealt with program MATS described later in this manual. IMPLOC produces tables of results in a variety of formats, and stores them in delimited text files that may be viewed with a spreadsheet.

Operating program IMPLOC

The following command is used to operate IMPLOC:

```
IMPLOC
```

The program responds with the following question:

```
IDENTIFY YEAR AND POLICY (3 characters) -->
```

The user must reply with the usual year/policy code *xxx* corresponding to the scenario for which the reports will be produced. Alternatively a single command may be used:

```
IMPLOC xxx
```

This is followed by another question to specify where the results are to be stored:

```
Specify an output file:  
[PATH]name.ext (up to 32 characters)  
  
Enter----> YYYXXX.LOC
```

The program suggests a file name *YYYXXX.LOC*, where *YYY* is the study code and *XXX* the year/policy code, with extension *.LOC*. Press *Enter* to accept the suggestion or type a different name up to 32 characters long including path. If the file name already exists, the program emits a warning message:

```
File YYYXXX already exists. Overwrite it ? (Y/n)
```

Reply *Y* (or *y*) or simply *Enter* to overwrite the file, or *N* (or *n*) to specify a different name.

Next, the program displays a menu with the following options::

Display options:

- [1] All information by sector and zone
- [2] Total production by sector and zone
- [3] Total production by year/policy
- [4] Internal information by sector and zone
- [5] Consumption coefficients by sector
- [6] Total consumption by sector and zone

Option --->

The following sections describes each option in detail.

Option 1: All information by sector and zone

Produces a set of tables by zone, one for each sector, with the results of the simulation as illustrated below. A heading indicates the study and scenario name, and the date/time of the simulation. This is followed by tables by sector, in the order specified in the database. The example below shows one sector: Residential Land and the beginning of the corresponding values, each record corresponding to a zone.

```

-----
T R A N U S           (c)MODELISTICA
I M P L O C : LAND USE RESULTS
-----

Public transport study of Valencia      SCENARIO: Base Calibration
Area Policy      Date/time simulation
VAL      91A      9- 2-1994      18:31      ITER 18

SEC 7: RESIDENTIAL LAND

```

Zone	ProdTot	DemTot	ProdCost	Price	Supply	Adjust%
1	172.	172.	16500.0	17682.5	176.	50.1
2	275.	275.	18000.0	17250.7	343.	79.2
3	191.	191.	19000.0	18591.5	220.	-6.4
4	417.	417.	21000.0	20536.2	418.	20.8
5	139.	139.	16000.0	15681.8	200.	28.1
6	314.	314.	16000.0	15689.1	399.	13.7

The meaning of each field is as follows:

- ProdTot:** Total production by zone
- DemaTot:** Total demand by zone
- ProdCost:** Production cost by zone
- Price:** Price by zone
- Supply:** Maximum constraint to production by zone

Adjust: Adjusting factor to the price (estimated by LCAL)

These concepts are defined in the Mathematical Description manual.

Option 2: Total production by sector and zone

Compiles a single table with total production by sector and zone, as shown in the example below:

Zone	Industrial Emplmnt	Commercial Emplmnt	Population High inc	Population Med inc	Population Low inc	Education	Resident Land	Industrial Land	Mixed Land
1	5410	8659	0	36967	6514	20011	126	68	0
3	15340	28944	4159	106902	27724	70041	230	126	101
5	14520	28017	28229	28270	6273	30307	0	367	0
7	19911	56333	53584	4933	3079	27422	0	301	72
8	16767	30925	31883	8513	2125	15153	0	292	2
9	20485	51085	26572	0	3321	5921	81	140	0
10	33937	102034	36367	12715	8657	77133	0	166	149
12	8942	30045	0	9440	2356	29234	0	26	27

Option 3: Total production by year/policy

This option compiles a single table with the production of one or more sectors for several scenarios. The program makes some additional questions, beginning with:

List of year/policy (/ to end)
Max 6 →

Do not include the year/policy that was specified previously, since it will be included by default. For example, if this option was started with scenario 90A, and results are required for five-year periods up to 2010, then the following list will be required:

95A 00A 05A 10A /

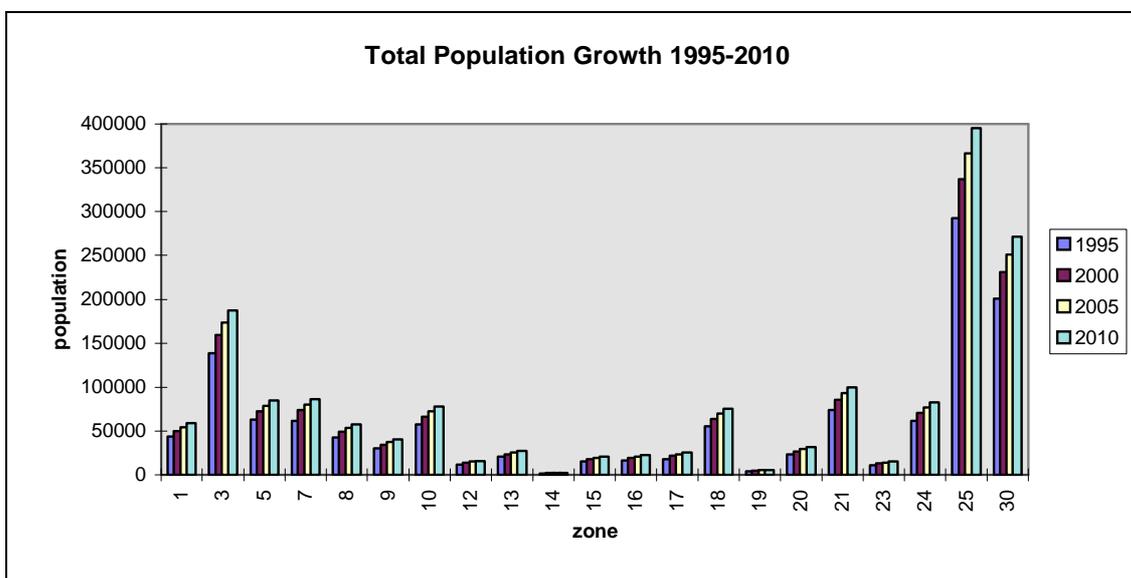
Next, define the list of sectors that will be included in the table:

List of sectors to add, ending with /

This option is useful to add, for example, total population by income, or total employment over all sectors. The following table shows the results of adding two income levels of population over a projection period. The table was read in Excel to produce the graph. The table could have been used to produce a thematic map in a GIS.

Sects: 5 Low-income households + 6 High-income households

Zona	1990-A	1995-A	2000-A	2005-A	2010-A
1	40888.	48464.	57574.	65649.	75354.
2	68252.	80999.	96367.	109917.	126242.
3	34028.	40647.	48692.	56138.	65014.
4	89155.	106378.	127832.	146993.	169735.
5	20148.	23840.	28004.	31945.	36445.
6	55263.	65640.	78047.	89055.	102046.
7	15570.	18474.	21905.	24750.	27945.
8	92561.	106747.	127752.	146291.	167242.
9	37086.	43510.	51781.	58831.	66797.
10	28882.	33162.	39996.	45953.	52663.
11		0.		15.	
12	194906.	230714.	273278.	310805.	354621.
13	86484.	102632.	121312.	137373.	155656.
14	61083.	71402.	82659.	90604.	97976.
15	8426.	10012.	11930.	13660.	15754.
16	99111.	117824.	140065.	159489.	182460.
17	37993.	44670.	52243.	58458.	65228.
18	10231.	12073.	14177.	15930.	17887.
19	75487.	86720.	98612.	106738.	115250.
20		0.		0.	
21	19831.	23223.	26967.	29675.	32350.
22	23186.	27040.	31114.	33755.	35984.
TOT	1098570.	1294187.	1530321.	1732023.	1962664.


Option 4: Internal information by sector and zone

This option compiles a set of tables similar to those with Option 1, but with additional columns, such as location costs and disutilities, consumption cost, calculated attractors. This is meant to be used for detailed inspection of the main internal calculations made by the model.

Option 5: Consumption coefficients by sector and zone

This option compiles a set of tables, one for each sector. Only sectors with elastic demand functions are included, typically land or floorspace.

An example is shown below. The first three rows of the table show the parameters of the elastic demand functions (minimum, maximum and elasticity). Then each one of the following rows correspond to a zone. The columns include all sectors that consume the sector being tabulated. In the example, the table shows the consumption of residential land. Each cell contains the unit consumption of residential land in each zone by each consuming sector. For example, each low-income resident in zone 2 consumes 7.312528 m² of residential land. Note that all values must lie somewhere in between the minimum and the maximum. In zone 1 all sectors are consuming exactly the minimum, probably corresponding to a very expensive central zone.

Sector 17: Residential Land

Zone	Low-income population	Med-income population	High-income population	Retail employment	Service employment
Min	1.06	1.47	0.86	1.28	1.09
Max	13.43	16.69	11.87	14.72	12.62
Elas	4.00E-05	3.00E-05	4.00E-05	3.00E-05	3.00E-05
1	1.06	1.47	0.86	1.28	1.09
2	7.312528	10.59387	6.425103	9.336821	8.001841
3	6.728427	9.946847	5.905221	8.765468	7.511684
4	7.190899	10.46043	6.316847	9.218987	7.900753
5	7.302598	10.583	6.416265	9.327222	7.993606
6	2.641654	4.7244	2.267761	4.153793	3.55539
7	3.519355	6.001618	3.048965	5.281639	4.522954
8	1.060002	1.470107	0.860002	1.280094	1.090081
9	6.314045	9.477699	5.536397	8.351188	7.156279
10	6.804883	10.03245	5.973271	8.841064	7.576538

Option 6: Total consumption by sector and zone

This option compiles a table with a very similar format to that of Option 5. Instead of unit consumption, total consumption is presented. The parameters of the demand function are not included in this table. The following is an example, similar to the previous table. In this case low-income population in zone 2 consume a total of 420.49 hectares of residential land.

Sector 17: Residential Land

Zone	Low-income population	Med-income population	High-income population	Retail employment	Service employment
1	322.37	374.59	111.34	255.95	1247.69
2	420.49	490.84	85.86	212.02	1102.62
3	1048.15	1943.79	323.67	1263.33	3649.78
4	888.84	2534.06	259.43	1508.41	2987.65
5	131.61	375.06	14.50	107.88	835.91
6	809.62	1431.35	222.29	648.43	1700.54
7	2148.83	2858.49	542.63	1838.00	5111.85
8	203.15	254.24	66.68	319.87	826.70
9	830.34	1304.90	120.15	539.63	2189.78
10	1308.71	2156.35	229.74	676.30	4131.97

Program IMPTRA: Transport model reports

General description

Program IMPTRA reads the results of a transport simulation and compiles tables in text form that, in turn, may be displayed in spreadsheets, GIS, presentation programs, and so on. A considerable variety of queries may be made, and the results may be presented in a number of ways and formats. In general, IMPTRA produces all reports related to transport, except for those in matrix form that are produced with program MATS, and some special reports produced by MATESP. The TUS interface also produces some transport-related tables from the menu *Reports*.

Operating program IMPTRA

There are two modes to operate IMPTRA:

Interactive: specifying the options on screen

Data file: specifying the options in a text file called IMPTRA.DAT

The interactive mode is useful for occasional quick and short queries, while the use of a file is designed for large and/or repeated queries, such as long lists of links, cordons, and the like.

The following command is used to run IMPTRA:

```
IMPTRA
```

The usual question is prompted:

```
IDENTIFY YEAR AND POLICY (3 characters) -->
```

The user must reply with a valid year/policy code *xxx*. Alternatively, a single command may be used:

```
IMPTRA xxx
```

Next, the program presents the main options:

```
Options to input data:  
  
[0] Manually on-screen  
[1] Read from file IMPTRA.DAT
```

```
Option -->
```

In both cases the user is asked to define the file where the report is to be stored:

```
Specify an output file:  
[PATH]name.ext (up to 32 characters)  
  
Enter----> YYYXXX.TRA
```

The program suggests a file name, which may be accepted by pressing Enter. A different name of up to 32 characters may be specified instead. If the file name already exists, the usual warning is presented:

```
File YYYXXX already exists. Overwrite it ? (Y/n)
```

Y (or y) or press *Enter* to overwrite the file, or choose a different name.

If the interactive option was chosen, IMPTRA presents the following menu:

```
Options to display assignment results:
```

- (1) All links
- (2) By link type
- (3) By Demand/Capacity range
- (4) Specified on-screen
- (5) Table of indicators
- (6) Cordons (only with IMPTRA.DAT)
- (7) Transit Routes profiles
- (9) Link-Route & Category profile
- (10) Route profile, comma-delimited

```
List of options ending with /
```

Several options may be specified separated with blank spaces and ending with /. Each option is described below.

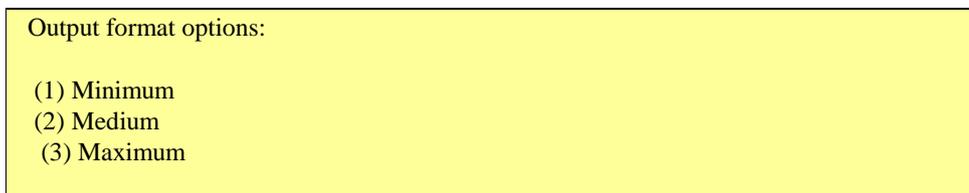
- | | |
|-------------------------------------|--|
| (1) All links | Assignment results for all links in the network. |
| (2) By link type | Assignment results for a selection of link types. |
| (3) By Demand/Capacity range | Assignment results for all links that fall within a demand/capacity range. |
| (4) Specified on screen | Assignment results for a selection of links specified on screen. Intended for short lists. Long lists may be specified in file IMPTRA.DAT. |
| (5) Table of indicators | A large number of tables with performance indicators of the transport system as a whole for the various agents: users, operators and administrators. Essential statistics for analysis and evaluation. |

- | | |
|---|--|
| (6) Cordons | This option is only available through file IMPTRA.DAT. For specified cordons, a comparison between collected data and simulated values is compiled. |
| (7) Transit routes profiles | Detailed link-by-link results for a selection of (or all) transit routes. All possible simulated values and indicators, plus global performance indicators for each route. Double-clicking on a link in the TUS interface provides similar indicators for an individual link. |
| (8) Vehicle-km by speed range | This option is only available through file IMPTRA.DAT. Produces a set of tables with vehicle-km by speed class by operator, essential for calculation of emissions. |
| (9) Link/route and category profile | Produces a database-type ASCII comma-delimited table with all possible information at the most disaggregated level possible: link-route-transport category. With this, list the model user can produce any table of results to suit the specific needs on an application. a link. Any database program such as Access will be able to read this large file and perform whatever queries are needed. For large applications, this file may be of an important size. |
| (10) Route profiles, comma delimited | Produces a database-type file with comma-delimited fields, with the all data and performance indicators on a route-by-route level. |

Each one of these options is described in more detail in the paragraphs below.

Options 1 to 4: assignment results in links

Options 1 to 4 presents the results of the assignment on a link basis matching one of the criteria offered. Whatever the option, IMPTRA presents a menu to select a format:



Option →

With each option, the following results are obtained:

- (1) Minimum**
- Link Id
 - Origin node
 - Destination node
 - Link type
 - Link capacity
 - Demand/capacity ratio in link
 - Equivalent vehicles (pcu's)
 - Total vehicles (sum of all vehicles)
 - Level of service in link (A to H)

- (2) **Medium** Same as the Minimum Option, plus for each operator/route:
 Id number of operator/route
 Capacity of the operator/route in link
 Demand in operator/route in demand units (passengers, Tons, etc.)
 Number of vehicles of operator/route in link
 Demand/capacity ratio of operator/route in link
 Number of equivalent vehicles of operator/route in link
- (3) **Máximo** Same as option medium, plus:
 Free-flow speed of operator in link
 Congestion speed of operator in link
 Initial waiting time for boarding passengers (free-flow condition)
 Final waiting time for boarding passengers (congested condition)

IMPTRA calculates the level of service in a link based on the relationship between the initial free-flow speed and the final congestion speed as specified in the *Highway Capacity Manual* of the Federal Highway Administration of the USA. To the original A to F levels specified in the HCM two additional G and H levels were added to represent the most severe congested conditions. The following tables shows the final/initial speed ratios for each level of service.

Level of service	Final/initial speed ratios
A	1.000 - 0.875
B	0.875 - 0.700
C	0.700 - 0.550
D	0.550 - 0.425
E	0.425 - 0.325
F	0.325 - 0.250
G	0.250 - 0.180
H	0.180 - 0.000

Note that the Level of Service ratios apply to all vehicles sharing a link, since all speeds are reduced proportionally. This is different to the ratio demand/capacity at a transit route level in many reports used to represent the relationship between the number of passengers on board and the capacity of the route.

Option 1: all links

With this option IMPTRA produces a list of all links in the network with the corresponding information depending on the selected format option. Care must be taken because the resulting list can be very large. Use options 2, 3 or 4 to filter the list and reduce its size.

Option 2: by link type

IMPTRA presents the following question:

List of link types (/to finish)
 →

Respond with one or more valid link type Id numbers, ending the list with a /. Should the list include a non-specified link type Id causes the question to be repeated.

Option 3: links by demand/capacity range

IMPTRA asks for the D/C range:

```
Specify demand/capacity range
Min →
Max →
```

Option 4: selected links specified on-screen

```
Specify links to display (Origin=0 to finish)
Orig →
Dest →
```

The user must specify the links to be included. An origin = 0 ends the list. If a long list of links is needed or the same list is to be repeated several times, it is more practical to specify the list in file IMPTRA>DAT.

Option 7: route profiles

The program displays the list of all transit routes. The user may choose one or more in the form of a list ending with /. If the reply is 0 / then all routes are included in the report.

Option 9: all information

This option does not present sub-options. Produces a text file in database format that may be opened with a spreadsheet or a database program. In this way the user may make custom reports not included in the previous options. For each link the number of demand units (passengers or Tons) is reported in full detail for each combination of link, operator or route and demand category.

Option 10: route statistics

Option 7 produces a very detailed report for each transit route at a link level, plus a summary for each route. Option 10 produces a summarized report with one record for each route. The format is comma-delimited text file for easy access with spreadsheets or database programs. The user can then filter the results or produce custom tables at will.

Description of the outputs

As mentioned, if any option 1 to 4 is selected, three format sub-options may be chosen, as will be described here. In all cases the results are produced in an ASCII text file with a first record with headings and subsequent records with values for the corresponding fields.

Minimum format

ID	Orig	Destin	Tip	Cap	D/C	VehicSt	VehTot	LOS
1355	101	102	2	46800	.92	42903.	27586.	C
1825	102	101	2	46800	.92	42903.	27586.	C
2367	101	201	3	54000	.37	19834.	14274.	A
3567	201	101	3	54000	.37	19834.	14274.	A
114	102	204	2	76194	.56	42903.	27586.	A

The content of each field is as follows:

ID	Id number of the link
Orig	Origin node of link
Dest	Destination node of link
Tip	Link type
Cap	Capacity of the link for the simulation period. If, for instance, the capacity of a link was specified for one hour and then a total-day simulation was performed with a time factor of 18, then the resulting total-day capacity is presented in the list. If the capacity was coded as <i>undefined</i> , then a capacity of -1 is presented.
D/C	Demand/capacity ratio
VehSt	Total number of vehicles in the link in equivalent or standard units (pcu)
VehTot	Sum of all vehicles in the link
LOS	Level of service in HCM terms.

Medium format

With this format each record represents a link/operator or link/route combination. Consequently, the same link may appear several times in the list. For example, a link could contain automobiles, pedestrians, trucks and several bus routes. In this case the list will include one record for automobiles, one for pedestrians, and so on, and one for each transit route on the link. The following is an example and the description of each field follows below.

ID	Orig	Dest	Tip	Capac	D/C	VehSt	VehTot	LOS	Op #	Oper	CapOp	DemOp	D/C Op
1451	1301	1304	6	43200	.17	7530.	5706.	A	1	AUTOM	7184.	4490.	1.0
1451	1301	1304	6	43200	.17	7530.	5706.	A	31	MICRO	18244.	12116.	1.0
2305	1603	1901	5	21600	1.24	26833.	16702.	F	1	AUTOM	18363.	11477.	1.0
2305	1603	1901	5	21600	1.24	26833.	16702.	F	6	CAMION	27514.	22193.	1.0
2305	1603	1901	5	21600	1.24	26833.	16702.	F	31	MICRO	43989.	29233.	1.0
2554	1901	1603	5	21600	1.24	26833.	16702.	F	1	AUTOM	18363.	11477.	1.0
2554	1901	1603	5	21600	1.24	26833.	16702.	F	6	CAMION	27514.	22193.	1.0
2554	1901	1603	5	21600	1.24	26833.	16702.	F	31	MICRO	43989.	29333.	1.0
1765	2001	2101	5	21600	.77	16699.	9093.	C	1	AUTOM	8979.	5612.	1.0
1765	2001	2101	5	21600	.77	16699.	9093.	C	6	CAMION	28614.	23184.	1.0
1765	2001	2101	5	21600	.77	16699.	9093.	C	31	MICRO	16452.	14097.	1.0

To the fields included in the minimum format, the following have been added:

Op #	Id number of the operator or route
Oper	Name of operator or route
CapOp	Capacity of the operator or route for the simulation period
DemOp	Demand for operator or route in demand units (passengers, Tons, etc.) in the simulation period
D/C Op	Demand/capacity ratio in the operator or route for the period of simulation

Maximum format

Produces a table with a very similar structure to the medium format, but with some additional fields for each link/operator or link/route combination.

Id	Or	Des	Tip	CapV	D/C	VehSt	VehTt	Srv	Oper#	Oper	Capac	DemOp	VehOp	D/COp	VehSt	VELin	VELfi	ESPin	ESPfi
2102	101	102	2	46800	.92	42903.	27586.	C	1	AUTOM	30400.	30400.	19000.	1.00	19000.	80.	44.	.00	.00
2102	101	102	2	46800	.92	42903.	27586.	C	6	CAMION	72844.	72844.	6070.	1.00	18211.	60.	33.	.00	.00
2102	101	102	2	46800	.92	42903.	27586.	C	21	BUS	26438.	26438.	661.	1.00	1983.	60.	33.	.12	.12
2205	101	102	2	46800	.92	42903.	27586.	C	31	MICRO	27819.	27819.	1855.	1.00	3709.	60.	33.	.10	.10
2205	102	101	2	46800	.92	42903.	27586.	C	1	AUTOM	30400.	30400.	19000.	1.00	19000.	80.	44.	.00	.00
2205	102	101	2	46800	.92	42903.	27586.	C	6	CAMION	72844.	72844.	6070.	1.00	18211.	60.	33.	.00	.00
2205	102	101	2	46800	.92	42903.	27586.	C	21	BUS	26438.	26438.	661.	1.00	1983.	60.	33.	.12	.12
2205	102	101	2	46800	.92	42903.	27586.	C	31	MICRO	27819.	27819.	1855.	1.00	3709.	60.	33.	.10	.10
3144	101	201	3	54000	.37	19834.	14274.	A	1	AUTOM	18106.	18106.	11316.	1.00	11316.	60.	58.	.00	.00
3144	101	201	3	54000	.37	19834.	14274.	A	6	CAMION	6413.	6413.	534.	1.00	1870.	45.	43.	.00	.00
3144	101	201	3	54000	.37	19834.	14274.	A	21	BUS	23539.	23539.	588.	1.00	2060.	30.	29.	.12	.12
3144	101	201	3	54000	.37	19834.	14274.	A	31	MICRO	27528.	27528.	1835.	1.00	4588.	35.	34.	.10	.10

The following fields have been added with respect to the medium format:

VehOp	Number of vehicles of the operator or route for the simulation period
VehSt	Number of vehicles of the operator or route in standard or equivalent units (pcu)
VELin	Initial free-flow speed for the operator or route
VELfin	Final congested speed for the operator or route
ESPin	Initial waiting time for passengers boarding the route at link (free-flow conditions)
Espfin	Final congested waiting time for passengers boarding the route at link

Option 5 – Performance indicators

With this option, many tables are produced with indicators of the transport system as a whole. Tables are organized with user indicators first, followed by operators' indicators and finally administrators' indicators. The format of the report is ASCII text tab-delimited.

Total trips by category and mode

This table presents door-to-door trips for all categories by mode. Care must be taken with the units, since some may correspond to passengers, some to Tons, and so on. Consequently the total at the end could be irrelevant..

TOTAL TRIPS BY CATEGORY AND MODE

CatId	CatName	Auto	Taxi	Transit	Light Freight	Heavy Freight	TOTAL
1	Retail/serv	21672	135	27267	0	0	49074
2	Education	12227	33	41602	0	0	53862
3	WorkLow	20999	30	57698	0	0	78728
4	WorkHigh	53238	51	12761	0	0	66049
5	ExternalPass	15544	714	19007	0	0	35265
10	Freight	0	0	0	1725	880	2605
	TOTAL	123679	964	158335	1725	880	285583

Repressed demand by category and mode

In the first iteration the transport model assigns trips to an empty network, i.e. without congestion. As congestion builds up in subsequent iterations, the number of trips gets reduced, as a function of the elasticity in the trip generation model. Consequently, the difference between the number of trips in the first iteration and the last represent the number of trips that were not made because of congestion, that is, the repressed demand.

REPRESEED DEMAND BY CATEGORY AND MODE

CatId	CatName	Trips	% of Total
1	Retail/serv	10880	0.18
2	Education	12465	0.19
3	WorkLow	11453	0.13
4	WorkHigh	12109	0.15
5	ExternalPass	0	0
10	Freight	0	0

In this example external passengers and freight have been defined exogenously, and consequently have no elasticity and no repressed demand.

Total statistics by transport category

For each transport category total statistics are presented as shown in the example below. Total Distance may be in passenger-km, Ton-miles, and so on and for peak-hour or total-day, depending on the model specifications defined by the user. Total Cost is the total amount of money paid by travelers of each category in monetary units. Total Travel Time is the total amount of time spent by travelers of each category actually traveling (excluding waiting time). Dividing Time/Distance gives average speed by category. Total Waiting Time is the total time

spent by travelers waiting for services, usually transit services. Total Disutility is the total composite cost of travel for each category in monetary units. Cost, plus Travel Time multiplied by the value of travel time, plus waiting time multiplied by the value of waiting time, yields Total Generalized Cost.

TOTAL STATISTICS BY TRANSPORT CATEGORY

CatId	CatName	Distance	Cost	TravTime	WaitTime	Disutil
1	Retail/serv	581112	10606136	26418	3818	19649906
2	Education	741279	5992594	37955	6535	18087762
3	WorkLow	1067080	18012224	53432	8395	22532666
4	WorkHigh	754980	14434583	24126	1900	20256146
5	ExternalPass	1878865	36083628	43023	5189	31812002
10	Freight	146706	54057708	4940	0	35014780

Average statistics by transport category

This table has the same format as the previous one, but in terms of averages. It is simply the result of dividing the totals of the previous table by the corresponding total number of trips in the first table. Note that in the case of travel and waiting time the results will be in decimal hours (multiply by 60 to obtain minutes).

AVERAGE STATISTICS BY TRANSPORT CATEGORY

CatId	CatName	Distance	Cost	TravTime	WaitTime	Disutil
1	Retail/serv	11.84	216.13	0.54	0.08	400.42
2	Education	13.76	111.26	0.7	0.12	335.82
3	WorkLow	13.55	228.79	0.68	0.11	286.21
4	WorkHigh	11.43	218.54	0.37	0.03	306.68
5	ExternalPass	53.28	1023.21	1.22	0.15	902.08
10	Freight	56.32	20751.52	1.9	0	13441.37

Statistics by transport operator

The following indicators are presented for each operator:

STATISTICS BY TRANSPORT OPERATOR

OperId	OperName	Trips	Units-Dist	Energy	Costs	Income	Revenue
1	Automobile	123679	2042047	16983068	48714200	36535680	-1.2E+07
2	Taxi	964	39848	356966	1,014,007	5,854,694	4,840,687
3	Pedestrians	308844	98741	0	0	0	0
31	Conv Bus	15512	126876	527141	1566640	1558068	-8572
32	Urban Bus	17953	151514	670242	1985704	2092307	106603
33	Minibus	185362	1379589	5221412	16560649	18700616	2139967
34	Suburb Bus	44225	531097	734793	3402007	7521209	4119202
35	Interurb Bus	18188	652578	284604	3184660	12731831	9547171
36	School Bus	4532	13082	0	108889	135964	27074
40	Light Truck	1725	96025	3925982	17964436	21557324	3592888
46	Heavy Truck	880	50679	7471430	27083636	32500400	5416764

The meaning of each column is as follows:

- OperId Id number of operator
- OperName Name of operator
- Trips Number of trips, that is, total boarding
- Units-Dist Units-distance traveled, such as passenger-km or Ton-miles
- Energy Energy used by operator, in the corresponding units such as liters of gasoline, gallons of diesel fuel, kilowatts, etc.
- Costs Total operating cost
- Income Total operating income
- Revenue Difference between costs and income

Note that the total number of trips or boarding can be larger than the number of trips by mode in the user tables. This is because a traveler may have made a door-to-door trip with several transfers, thus boarding units several times.

Statistics by transport administrators

For each transport administrator, this table presents the total length, possible income from tolls, maintenance costs and revenues (income – costs). Note that in length each way is counted, that is, a two-way roads get counted twice.

STATISTICS BY TRANSPORT ADMINISTRATOR

AdmId	AdmName	Length	Income	MaintCost	Revenue
1	Gobierno	1697	4858504	1700476	3158028
4	Pocaterr	87	3158028	1421112	1736915

Statistics by category and operator

A series of tables with identical format are presented with the relationships between demand categories and operators. The following is an example of the first table showing the number of boardings.

BOARDINGS BY CATEOGRY AND OPERATOR

CAT/OP	1 Auto	2 Taxi	3 Pedestr	31 Conv Bus	32 Urb Bus	33 Minibus	34 Suburb	35 InterUrb
Retail/serv	21672	135	55296	2900	3018	30747	6717	80
Education	12227	33	84981	4580	5200	53910	8562	128
WorkLow	20999	30	117430	6271	6499	66507	17302	123
WorkHigh	53238	51	26039	1261	1712	15251	3605	65
ExternalPass	15544	714	25098	500	1524	18948	8038	17793
TOTAL	123679	964	308844	15512	17953	185363	44225	18188

The sum of all boardings for each operator must be the same as in the previous *Statistics by Operator* table. Adding horizontally to obtain total boardings by category may result in a bigger figure compared to the total number of trips by category in the first table, because of possible transfers. The number of boardings may be divided by the number of trips to obtain the average number of transfers. With program MATESP very detailed tables of transfers may be obtained.

Similarly, the following tables by category and operator are produced:

- **Monetary cost by category and operator:** total amount of money that each operator pays to each operator. The vertical sum represents total income by operator, and should be the same as in table *Statistics by Operator* described before. The horizontal sum should be the same as the cost column in the *Total Statistics by Transport Category*.
- **Travel time by category and operator:** same as above but in time units. The horizontal sum must be the same as that reported in the *Statistics by Operator* table.
- **Waiting time by category and operator:** time spent by travelers of category waiting for units of operator, in hours.
- **Total time by category and operator:** sum of the two previous tables.
- **Distance by category and operator:** In units such as passenger-km, Tons-miles, etc. The horizontal sum must be the same as in the table *Total Statistics by Transport Category*.

Option 6 - Cordons (only with IMPTRA.DAT)

An example follows of the table that results with this option, as specified with file IMPTRA.DAT. A cordon is defined as a set of links. IMPTRA presents the results of assigned vehicles in standard and total units for each link in the set, followed by observed values as specified in IMPTRA.DAT.

Cordon Direction				
NthCBD North				
Orig	Dest	VehSt	VehTot	Count
2500	2988	56356	46014	43800
2988	2500	70811	60083	55800
3835	3745	36657	30215	27200
3651	3781	28669	24421	22000
3654	3173	55501	46235	47100
3776	3781	25756	23800	24100
TOTAL		273750	230768	220000
Cordon Direction				
EstCBD East				
Orig	Dest	VehSt	VehTot	Count
3215	3772	7302	6448	7800
3367	3799	3528	1947	1800
3204	3849	28677	23198	19800
3183	3696	74489	61297	62400
3301	3388	38006	29575	28400
3339	3301	35843	29731	30200
TOTAL		187845	152196	150400

Routes profiles (option 7)

For each route, the following table is presented:

Orig	Dest	Capac	Demand	Dem/Cap	Velo c	SpareCap	Board	Aligh t	FinalCap	WaitTime
101	152	9216.	832.	0.09	4.	9216.	832.	0.	8384.	0.:05:24
102	152	9216.	2799.	0.30	4.	9216.	2799.	0.	6417.	0.:07:33
104	151	9216.	64.	0.01	4.	9216.	64.	0.	9152.	0.:04:20
105	151	9216.	607.	0.07	4.	9216.	607.	0.	8609.	0.:05:06
151	104	9216.	23.	0.00	4.	9193.	0.	23.	9216.	0.:04:14
151	105	9216.	448.	0.05	4.	8768.	0.	448.	9216.	0.:04:14
151	152	9216.	5275.	0.57	30.	6787.	2845.	785.	4726.	0.:08:47
151	351	9216.	2665.	0.29	30.	6763.	212.	0.	6551.	0.:04:40
152	101	9216.	691.	0.08	4.	8525.	0.	691.	9216.	0.:04:14
152	102	9216.	2096.	0.23	4.	7120.	0.	2096.	9216.	0.:04:14
152	151	9216.	5567.	0.60	30.	4462.	813.	2743.	6392.	0.:06:25
152	751	9216.	5632.	0.61	30.	4492.	908.	0.	3584.	0.:06:36
301	351	9216.	1181.	0.13	4.	9216.	1181.	0.	8035.	0.:05:50
302	351	9216.	881.	0.10	4.	9216.	881.	0.	8335.	0.:05:28
351	151	9216.	2063.	0.22	30.	7153.	0.	204.	7357.	0.:04:14
351	301	9216.	1316.	0.14	4.	7900.	0.	1316.	9216.	0.:04:14
351	302	9216.	1349.	0.15	4.	7867.	0.	1349.	9216.	0.:04:14
701	751	9216.	1525.	0.17	4.	9216.	1525.	0.	7691.	0.:06:14
711	2051	9216.	182.	0.02	4.	9216.	182.	0.	9034.	0.:04:31
751	152	9216.	4798.	0.52	30.	4418.	0.	654.	5072.	0.:04:14
751	701	9216.	1044.	0.11	4.	8172.	0.	1044.	9216.	0.:04:14
751	2051	9216.	6197.	0.67	30.	3019.	0.	437.	3456.	0.:04:14
2002	2052	9216.	2683.	0.29	4.	9216.	2683.	0.	6533.	0.:07:26
2051	711	9216.	262.	0.03	4.	8954.	0.	262.	9216.	0.:04:14
2051	751	9216.	4883.	0.53	30.	4850.	517.	0.	4333.	0.:05:35
2051	2052	9216.	6487.	0.70	30.	3668.	939.	0.	2729.	0.:07:13
2052	2002	9216.	3174.	0.34	4.	6042.	0.	3174.	9216.	0.:04:14
2052	2051	9216.	5410.	0.59	30.	3806.	0.	1176.	4982.	0.:04:14
2052	5651	9216.	3463.	0.38	30.	5753.	0.	0.	5753.	0.:04:14
5401	5651	9216.	2876.	0.31	4.	9216.	2876.	0.	6340.	0.:07:37
5651	2052	9216.	2876.	0.31	30.	6340.	0.	0.	6340.	0.:04:14
5651	5401	9216.	3463.	0.38	4.	5753.	0.	3463.	9216.	0.:04:14

Each record represents a link, identified by the origin and destination node numbers. The definitions of the fields are the following:

Capac	Capacity of the route in link, calculated as the frequency multiplied by the capacity of each vehicle. For a given route, capacity should be the same in all links.
Demand	Number of on-board passengers in the link
Dem/Cap	Demand/Capacity ratio in link
Speed	Speed of route in link
SpareCap	Spare capacity of route in link before boarding
Board	Number of passengers boarding the route in link
Alight	Number of passengers that alight from route in link
FinalCap	Final capacity of route in link after boarding

WaitTime Waiting time for those boarding route in link

The table for each route is followed by a number of statistics for the whole route. These are:

TotalDist	16.7			
TotalTime	0.9			
Pass-Dist	69209.3			
Vehic-Dist	400.8			
Vehic-Hours	22.7			
PasDis/VehHrs	3046.2			
AvSpeed	17.6			
Frequency	24.0			
Fleet	27.			
CritVol	6487.	0.70	2051-	2052

- TotalDist** Total length of route. Includes the return trip if the route was coded with the same Id both ways.
- TotalTime** Time units take to complete the route. Includes the return trip if the route was coded with the same Id both ways.
- Pass-Dist** such as passenger-km transported by the route.
- Veh-Dist** such as bus-km. Multiplying this value by the capacity of each vehicles gives total supply in passenger units. If this, in turn, is divided by Pass-Dist produces average occupancy.
- Veh-Hours** such as bus-hours.
- PasDis/VehHrs** A very effective indicator of the efficiency of the route.
- AvSpeed** May or may not include the return trip
- Frequency** Equilibrium frequency. The intermediate value between minimum and maximum estimated by the model. In vehicles per hour.
- Fleet** Calculated as a function of Total Time and frequency, plus 20% to account for dead time in terminals.
- CritVol** Critical volume, indicating the number of passengers, the demand/capacity ratio and the origin and destination numbers of the link where the critical volume takes place.

Vehicle-distance by speed class (option 8)

Produces a table for each operator with the distribution of vehicle-distance (vehicle-km) by speed class or speed range, as defined in file IMPTRA.DAT. The following table is an example compiled from several tables per operator. These tables are particularly useful to calculate emissions.

Speed class		Vehicle type – Year 2005 Trend Scenario			
Minimum	Maximum	SOV (1)	HOV (2)	Total Autos	Buses
0	7.5	823768	116794	940562	6237
7.5	12.5	1729949	303598	2033547	12791
12.5	17.5	1928494	335444	2263938	10947
17.5	22.5	1500537	784561	2285098	28913
22.5	27.5	2964654	286392	3251046	27607
27.5	32.5	1809676	450316	2259992	6853
32.5	37.5	2724078	527395	3251473	8889
37.5	42.5	3252818	1096905	4349723	11564
42.5	47.5	2775869	1702735	4478604	5492
47.5	52.5	2643366	1498176	4141542	0
52.5	57.5	1948046	3535124	5483170	0
57.5	62.5	3394473	2228400	5622873	0
62.5	67.5	2909334	0	2909334	0
Total		30405062	12865840	43270902	119293

- (1) SOV: Single occupancy vehicles
 (2) HOV: High occupancy vehicles

Link-route and category profile (option 9)

This option produces a database-type table in tab-delimited ASCII format. Each record contains assignment results data at the most disaggregate level possible: link, operator/route and demand category. Consequently, the resulting file can be large. This file may be opened with a spreadsheet or preferably a database program. The user can then produce any number of custom tables from the results of the assignment.

The following is an example with just two links, but several operators and demand categories:

Id	Orig	Dest	Tip	RutId	Rut	OperId	Oper	CatId	Cat	Unit-Dist	Board	Alight	Income
1	1	10109	15	-13	Pedestrian	13	Pedestrian	11	WorkLow	11.7	29.3	29.3	0.0
1	1	10109	15	-13	Pedestrian	13	Pedestrian	12	Work_Med	2.8	6.9	6.9	0.0
1	1	10109	15	-13	Pedestrian	13	Pedestrian	13	Work_High	0.4	1.0	1.0	0.0
1	1	10109	15	-14	Pickup	14	Pickup	11	WorkLow	8.8	21.9	0.0	0.8
1	1	10109	15	-14	Pickup	14	Pickup	12	Work_Med	4.4	11.1	0.0	0.4
1	1	10109	15	-14	Pickup	14	Pickup	13	Work_High	1.9	4.6	0.0	0.2
1	1	10109	15	-15	Truck	15	Truck	22	Timber	0.0	0.0	0.0	0.0
1	1	10109	15	-15	Truck	15	Truck	23	Agriculture	3.5	8.8	0.0	5.3
1	1	10109	15	-15	Truck	15	Truck	24	Cattle	0.9	2.4	0.0	1.4
1	1	10109	15	-15	Truck	15	Truck	25	Miscell	3.8	9.6	0.0	5.7
5	2	10222	12	-13	Pedestrian	13	Pedestrian	11	WorkLow	29.6	73.9	73.9	0.0
5	2	10222	12	-13	Pedestrian	13	Pedestrian	12	Work_Med	6.8	16.9	16.9	0.0
5	2	10222	12	-13	Pedestrian	13	Pedestrian	13	Work_High	1.1	2.7	2.7	0.0
5	2	10222	12	-14	Pickup	14	Pickup	11	WorkLow	20.9	52.3	0.0	1.8
5	2	10222	12	-14	Pickup	14	Pickup	12	Work_Med	9.9	24.6	0.0	0.9
5	2	10222	12	-14	Pickup	14	Pickup	13	Work_High	4.6	11.4	0.0	0.4
5	2	10222	12	-15	Truck	15	Truck	22	Timber	0.0	0.0	0.0	0.0
5	2	10222	12	-15	Truck	15	Truck	23	Agriculture	7.3	18.2	0.0	10.9
5	2	10222	12	-15	Truck	15	Truck	24	Cattle	0.3	0.8	0.0	0.5
5	2	10222	12	-15	Truck	15	Truck	25	Miscell	2.7	6.7	0.0	4.0

Id	Link Id number
Orig	Origin node of link
Dest	Destination node of link
Type	Link type of link
RutId	Route Id number. Appears negative if it corresponds to an operator without transit routes.
Route	Name of operator/route
OperId	Operator's Id number
Oper	Operator's name
CatId	Id number of travel demand category
Category	Name of category
Unit-Dist	Unit-distance traveled by category on link by operator (passenger-Km or Tons-Km)
Board	Demand units of the category that board the operator and route in link.
Alight	Demand units of the category that alight from the operator and route in link.
Income	Income of operator/route in link paid by category, including boarding tariffs and tariffs by distance or time.

Statistics by route (Option 10)

This option produces a database-type comma-delimited text file. The first row contains field headings, followed by one record per transit route. The indicators in this table are the same as those at the end of each route profile produced with Option 7. The following is an example of the table obtained:

RutID	Name	Oper ID	Name	Freq	Freq Min	Freq Max	Total Dist	Total Time	Pass -Dist	Vehic -Dist	Vehic-Hours	PasDis/ VehHrs	Avg Speed	Fleet	Crit Vol	Crit Vol/Cap	Board	Target Occ	Avg Occ
3107	631/1	31	BusConv	7	5	7	18	1	7959	253	14	577.1	18.3	7	708	0.75	1290	50	47
3108	631/2	31	BusConv	4	4	7	18.3	1	2470	146	7	369.4	21.9	3.3	235	0.44	404	50	25.2
3109	634-635/1	31	BusConv	4.2	4	22	17.8	1	3834	149	8	471.4	18.3	4.1	429	0.76	948	50	38.4
3204	13A/2	32	BusUrb	4	4	6	18.3	1	3427	146	6	552.8	23.6	3.1	393	0.68	509	50	32.5
3222	29/2	32	BusUrb	4	4	6	14.2	1	1394	114	5	304.5	24.8	2.3	228	0.4	402	50	17
3227	40B/1	32	BusUrb	3	3	6	13.8	1	1623	83	4	434.3	22.1	2	188	0.43	314	50	27.2
3231	50A/1	32	BusUrb	9	7	9	13.1	1	11302	236	13	885.8	18.5	6.4	1134	0.88	1433	50	66.5
3305	104/1	33	Minibus	6.5	5	7	14.8	1	1606	193	10	162.4	19.5	5	348	0.73	372	50	22.5
3319	133-471/1	33	Minibus	27	25	27	6.5	0	7828	349	12	656.8	29.3	6	1455	0.73	1455	50	60.6
3401	Guigue	34	Suburban	56	50	56	66.2	3	200651	7410	283	708.4	26.2	141.6	6759	0.93	11594	50	41.7
3402	Sjoaquin	34	Suburban	34	32	34	52.7	3	118207	3581	177	668.2	20.2	88.4	3823	0.86	12507	50	50.8
3403	Val-Ccarab	34	Suburban	11	11	13	60.4	1	28101	1329	32	890.6	42.1	15.8	1213	0.85	3321	50	32.5
3501	Val-Pcab	35	InterUrban	4	4	34	69.6	1	432	557	12	36.8	47.5	6	12	0.03	13	50	1.3
3502	Val-Oeste	35	InterUrban	5	5	11	154.7	4	23019	1547	36	638.5	42.9	18	378	0.63	820	50	24.8
4101	TronA	41	BTroncal	65	62	65	24	1	185156	3115	118	1574.2	26.5	58.8	11911	0.96	30404	50	62.6
4102	TronB	41	BTroncal	26	26	43	14.7	1	26507	762	32	827.5	23.8	16	3434	0.7	7213	50	36.6
4301	Metro1	43	Metro	18	18	20	11.5	0	165366	415	12	13955.9	35	5.9	28943	0.73	52755	50	36.2
4302	Metro2	43	Metro	15	15	17	11.2	0	96979	335	10	10120	35	4.8	13213	0.4	23920	50	26.3
4401	Ferrocarril	44	FerrPas	4	4	5	144.4	2	188400	1155	16	11419.4	70	8.2	4821	0.86	7408	50	23.3

Program MATS: Matrices reports

General description

The TRANUS models estimate a number of origin-destination matrices that are stored in compact binary files. Program MATS is used to generate reports on these matrices. Matrices may be reported at the original zone by zone level, or may be aggregated using an auxiliary file called MATS.DAT. The resulting files are tab-delimited text files, easily read by spreadsheets and database programs.

The following table lists all matrices generated in the system, indicating the program that generates them.

Matrix	Program
Disutilities by travel demand category	TRANS
Disutilities by mode and travel demand category	TRANS
Disutilities by socioeconomic sector	COST
Trips by mode	TRANS
Trips by travel demand category	TRANS
Trips by mode and travel demand category	TRANS
Total trips (sum over all categories)	TRANS
Frequency distribution of trips by mode by cost	TRANS
Flows by socioeconomic sector	LOC
Flows by travel demand category	FLUJ
Transport costs by travel demand category	TRANS
Transport costs by socioeconomic sector	COST
Exogenous trips by travel demand category	FLUJ
Exogenous trips by mode and travel demand category	FLUJ

Operating program MATS

To run program MATS use the command:

MATS

The program will ask for the usual year/policy definition:

IDENTIFY YEAR AND POLICY (3 characters) -->

Next, the program offers two options:

Options to input data:

- [1] Manually on-screen
- [2] Read from file MATS.DAT

With Option 1 any of the above listed matrices may be produced.

Option 2 reads the specifications from a text file called MATS.DAT. In this case several matrices may be produced, and they may be aggregated as well.

A message to specify the output is presented next:

```
Specify an output file:  
[PATH]name.ext (up to 32 characters)  
  
Enter----> YYYXXX.MAT
```

Type Enter to accept the suggested filename or type a different name of up to 32 characters long. If the filename already exists the program prompts:

```
File YYYXXX already exists. Overwrite it ? (Y/n)
```

Type *Y* or *Enter* to overwrite.

If the input option chosen at the beginning was to ask MATS to read the specifications from file MATS.DAT, then the program makes no further questions. If, however, the on-screen option was selected, a menu is presented as follows:

Options to display matrices:

- [1] Disut. by transport category
- [2] Disut. by mode and transport category
- [3] Disut. by socio-economic sector
- [4] Trips by mode
- [5] Trips by transport category
- [6] Trips by mode and transport category
- [7] Total trips (sum of categories)
- [8] Frequency distribution of trips by mode
- [9] Flows by socio-economic sector
- [10] Flows by transport category
- [11] Costs by transport category
- [12] Costs by socio-economic sector
- [13] External trips by transport category
- [14] External trips by category and mode

Option →

With Option 7 (Total Trips) the program adds the number of trips over all categories. Care must be taken that person trips are not added with freight.

Option 8 produces a table for each mode with the frequency distribution of trips with respect to composite cost. For this, the program asks the user to define the interval:

Intervals in the scale of costs ? :

The user types in a value, such as 0.5, or 25, etc.

Example of a matrix report

All matrices are produced in a similar way, as in the following example:

DISUTILITIES BY TRANSPORT CATEGORY

Category **Iter** **Area** **Pol** **Date/hour of simulation**
1 COMERC **18** **VAL** **01A** **9- 2-2004** **16:38**

Zon#	Nombre	1	2	3	4	5	6	7	8	9	10	11	12
		Nagnor	NagSur	JoseEst	JoseOes	Centro	NorCen	SurCen	Tocuyo 1	Tocuyo 2	Tocuyo 3	Toc 4	StaRosa
1	NaguaNor	.0	3.1	4.7	4.2	5.1	4.7	5.3	9.1	9.5	11.4	7.7	4.8
2	NaguaSur	3.1	.0	3.5	3.7	4.8	4.1	5.4	8.9	9.3	9.7	8.2	5.1
3	SJoseEst	4.7	3.5	.0	3.6	3.5	4.0	4.1	8.4	8.8	9.4	8.1	4.7
4	SJoseOes	4.2	3.7	3.6	.0	3.5	4.1	4.7	6.5	7.1	8.5	6.8	4.2
5	CentroNo	5.1	4.8	3.5	3.4	.0	3.8	7.6	6.9	7.3	8.6	8.0	5.0
6	CentroSu	5.5	5.2	4.5	4.2	3.9	.0	3.2	7.1	7.5	8.2	5.4	2.9
7	CentroEs	5.3	5.5	4.2	4.8	7.7	2.7	.0	5.8	6.2	6.6	7.3	3.8
8	Tocuyito	9.1	8.9	8.5	6.5	7.0	6.9	5.8	.0	5.1	6.9	7.8	5.6
9	Tocuyito	9.5	9.3	8.9	7.1	7.5	7.3	6.2	5.1	.0	6.8	9.4	6.3
10	Tocuyito	10.7	9.0	9.4	8.6	8.6	7.7	6.6	6.9	6.8	.0	10.8	6.1
11	Tocuyito	7.8	8.2	8.2	6.9	8.1	5.0	7.3	7.8	9.4	10.8	.0	5.5
12	StaRosa	4.8	5.1	4.7	4.2	5.0	2.9	3.7	5.6	6.3	6.1	5.5	.0

Example of a frequency distribution report

COST	%	Viajes
1.00	.00	0.
2.00	6.56	20476.
3.00	27.16	84733.
4.00	19.56	61039.
5.00	18.11	56492.
6.00	8.49	26492.
7.00	6.15	19205.
8.00	5.40	16842.
9.00	1.20	3733.
10.00	2.64	8230.
11.00	1.03	3222.
12.00	1.54	4807.
13.00	.72	2252.
14.00	.12	376.
15.00	.86	2693.
16.00	.25	785.
17.00	.14	445.
18.00	.00	0.
19.00	.05	171.
20.00	.01	30.
TOTAL	100.0	312022
	0	.

Program MATESP: special reports

General description

The Tranus model programs generate and store most of the results of the simulations in binary files that may be consulted and reported with the reporting programs described in this manual. There are, however, several transport-related information items that do not get stored because it would be very inefficient to do so and because they are not required frequently in applications. Program MATESP generates this information on request, repeating the simulations performed in the last iteration of TRANS.

Some of the options provided may be used to produce very interesting thematic maps. The following options are provided by MATESP:

- 1) **Trips that use one or more operators.** Produces O-D matrices by category of trips that use one or more specific operators in their trips. Trips are added to the matrix even if the operators requested only form part of a trip through transfers. For example, with this option a matrix of trips that use a metro may be produced, or maybe the metro and an integrated bus-feeder mode.
- 2) **Trips that use one or more links.** Produces O-D matrices by category that use one or more links as part of their trips. A good example is to provide a list of links that make up a toll road, to see the area of influence, that is, the origins and destinations that use the toll road by travel demand category.
- 3) **Transfers.** Produces O-D matrices of trips that make a given number of transfers. This is particularly useful to identify O-D pairs ill-served by direct transit routes with a significant number of trips, suggesting a possible improvement. If zero transfers is asked for, the resulting matrix will show direct trips by origin-destination pair.
- 4) **Distance Matrices.** Produces O-D matrices with the minimum travel distance by category.
- 5) **Time Matrices.** Produces O-D matrices with the minimum travel time by category.
- 6) **Cost Matrices.** Produces O-D matrices with the minimum travel cost by category.
- 7) **Transfers between operators.** Produces a matrix of form *from operator-to operator*. The first row of this matrix, labeled *O Board* contains the number of trips that boarded each operator directly.
- 8) **Trips through nodes.** Reports in detail all turning movements around a node, usually an intersection or a transit station. Takes the form: from node, through node, to node, from operator/route, to operator/route. For example, if the node is an intersection, the report will show all turning movements, as well as passengers making transfers from one route to another. If the node is the mouth of a metro station, the report will show how many passengers enter the station by walking, by bicycle, by integrated feeder bus, by normal bus, and so on.

Running program MATESP

Use the following command:

```
MATESP
```

The program asks for the scenario or year/policy to report:

IDENTIFY YEAR AND POLICY (3 characters) -->

Enter a valid year/policy code *xxx*. Alternatively use a single command:

`MATESP xxx`

Next the program asks whether the file MATS.DAT will be used:

Options to input data:
[1] Manually on-screen
[2] Read from file MATS.DAT
Option →

Then the program asks where to direct the output:

Specify an output file:
[PATH]name.ext (up to 32 characters)
Enter----> `YYYXXX.ESP`

Press Enter to accept the suggested filename, or type an alternative filename. Finally a menu with options is presented, whether or not file MATS.DAT has been selected (this file is only used to aggregated the matrices in options 1 to 4):

Options to display matrices:
[1] Trips by operator
[2] Trips that use one or more links
[3] Matrix of transfers
[4] Matrix of Distance
[5] Matrix of Time
[6] Matrix of Costs
[7] Matrix of Transfers Between Operators
[8] Flows through nodes

Option --->

Depending on the option selected, the program asks for some additional questions, as follows:

Option 1, displays the list of all operators to select one or more

Option 2, displays the list of travel demand categories to choose from. If the option to specify manually the options was selected, then the program will ask for a list of links to be specified on-screen. If option IMPTRA.DAT was selected, then this file is used to obtain the list of links.

Option 3, displays the list of all modes to choose from and then asks for the number of transfers to report.

Options 4, 5 or 6, display the list of modes and travel demand categories to choose from.

Option 8, asks for a list of nodes to report.

Matrices produced by options 1 to 7 have a similar format with dimensions $n \times n$ where n is the number of zones. In the case of options 1 to 3 if file MATS.DAT was chosen, then matrices are aggregated accordingly. If option 8 is selected, a table of the form shown below is produced:

thruNode	fromNode	fromOper	toNode	toOper	Flow
1	5	1	3126	1	179
1	5	1	5569	1	4258
1	5	2	5569	2	45
1	5	40	5569	40	137
1	5	350	5569	350	142
1	3126	1	5	1	605
1	3126	1	5569	1	2415
1	3126	2	5569	2	87
1	3126	40	5569	40	57

In this example node 1 was asked for. Operator 1 is cars, 2 is pedestrians, 40 is taxis and 350 is a bus route. Flows are in passengers.