

## 3.0 Input/Output Interface

The IDAS *Input/Output Interface* (I/O) converts data produced by regional travel demand models into a format for subsequent input to the IDAS analysis modules. The I/O interface reads in data from various network and trip matrix data files that are output from the travel demand model.

This section begins with an overview of the IDAS Setup process which is required prior to using the I/O interface. It then describes how the data contained in travel demand model files are read into the IDAS database using the I/O interface. This section also describes how the input/output interface connects with other IDAS modules and describes the output files generated by the interface for reporting of results and post-processing in IDAS. Figure 3.1 provides a flow chart of the IDAS input/output interface in relation to the other IDAS modules.

### ■ 3.1 Initial IDAS Setup

Before the user begins analysis, it is important that various system-level parameters are defined within IDAS. These system-level options include specification of the number of zones and area type relationships, network facility types, district definitions, data maintenance of the Direct Benefits and ITS Equipment spreadsheets, and ITS equipment sharing. Each of these system options appear as a worksheet with a tab the user can select.

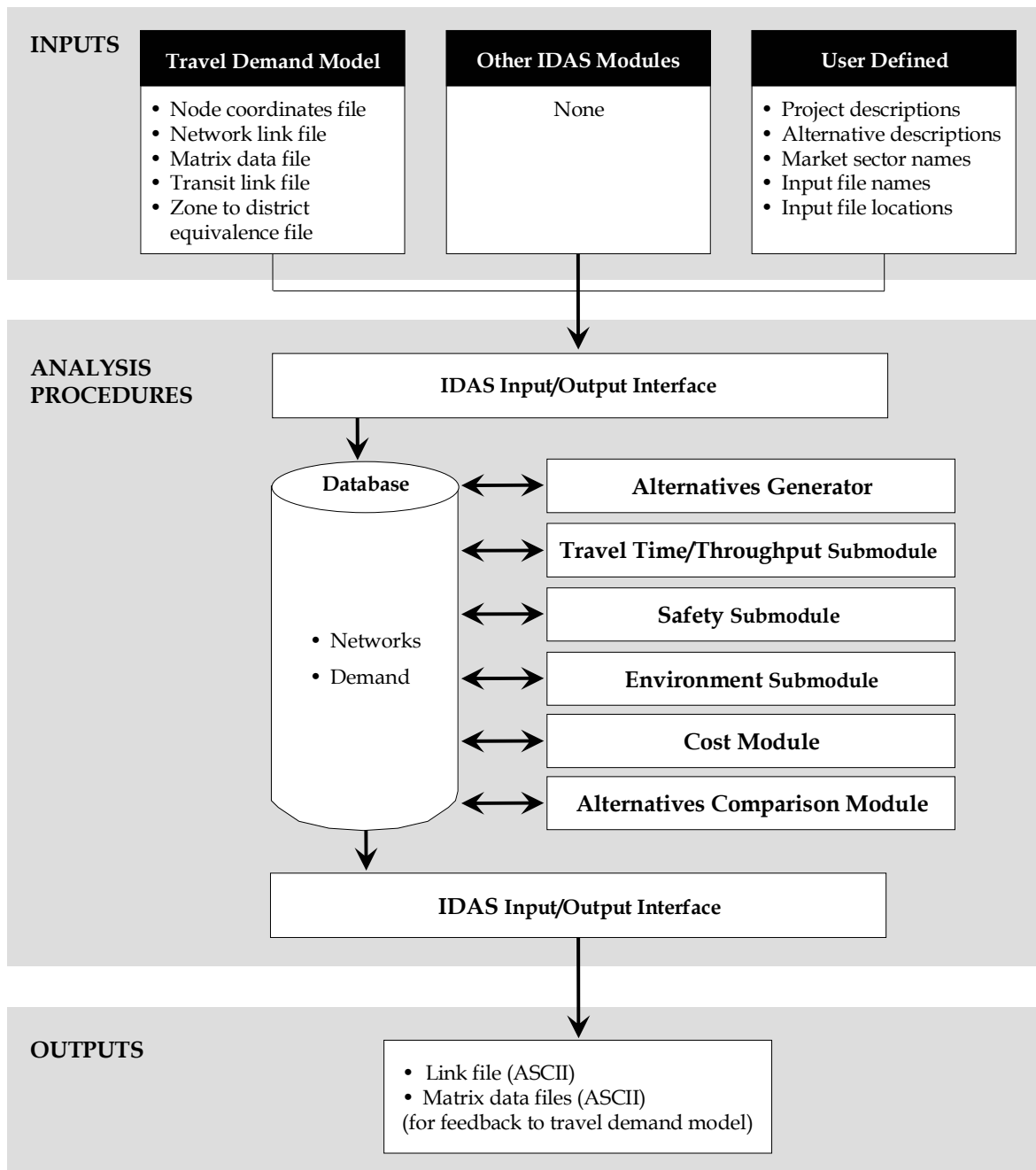
#### 3.1.1 TDM (Travel Demand Model) Data

IDAS requires that the user inputs the maximum number of traffic analysis zones (TAZ) in the model network, as well as equate the input area type codes to urban or suburban/rural types for the IDAS trip assignment process. The zone number defined must include both internal and external zones.

#### 3.1.2 Facility Types

Facility type labels and V/C (volume delay) curves for each facility type from the user’s link file are set in this worksheet. The user can define any descriptive label for up to 99 input facility types. These label headings appear in the performance statistics summaries generated by the Alternatives Comparison Module. The volume delay curves are described in more detail in Section 5.0 of this manual.

**Figure 3.1 IDAS Input/Output Interface**



### 3.1.3 Districts

The user can input a district scheme that consists of grouping of links. It is important to note that zone districts and link districts are used differently in IDAS. The Setup District values correspond to link districts that are used to identify the performance summary impacts of the ITS deployments at a district level. The zone to district equivalence file imported at the Project-level setup is used to simplify district-level deployments of zone-based improvements (such as transit). It is recommended that users identify link districts within the travel demand model prior to import into IDAS. However, if this is not available, the user has the ability to create or edit districts within IDAS. For detailed instructions on using this feature, see Section 2.4.8 of this User’s Manual.

### 3.1.4 Data Maintenance

Comprehensive databases of ITS costs/equipment and benefits related to various ITS improvements are included with the IDAS software, EQUIP2\_3.XLS, and DIRECTBENEFITS2\_3.XLS. These files may be viewed and edited using Excel, and then re-imported into IDAS to update equipment or cost requirements or benefits data, or to customize the database to the user’s preference. Although frequent changes to these files are not anticipated (nor recommended), the ability to edit ITS equipment and cost defaults and benefits data adds significant flexibility for the user. For more information on the ITS cost/equipment spreadsheet, please see Section 6.0 of this document. Detailed information regarding the ITS benefits spreadsheet can be found in Section 4.0.

IDAS also includes a spreadsheet, which can be imported, that lists several of the ITS option default values included in the Alternatives Generator, which can be modified by the user (IDAS\DOCUMENTS\ITSENTRYDEFAULTS2\_3.XLS). The user can modify the default impact value(s) and/or the range of values in this spreadsheet and re-import, so these user-defined default values would appear in any new ITS option generated by the user.

### 3.1.5 ITS Equipment Sharing

Equipment sharing defaults and cost-level values for ITS deployments are defined in this worksheet. The user can specify the level of cost sharing of equipment between different ITS improvements and can set the equipment cost levels to either low, mid or high cost levels when calculating costs.

## ■ 3.2 Data Inputs

This section describes the data required by the IDAS input/output interface. There are three primary sources for data inputs:

- User specified inputs;
- Data provided by the travel demand models; and
- Data provided from other IDAS modules.

### 3.2.1 Inputs Specified by the User

User-specified data inputs must be entered by the IDAS model user before the input/output interface can be applied. The user-specified inputs to the input/output interface consist mostly of input file names and locations. Typically, input data files are attached to a specific project, alternative, or market sector that the user will need to describe prior to processing of the data. The inputs specified by the user consist of the following:

- The names of user-defined projects and alternatives;
- The year of analysis;
- The names and descriptions of market sectors; and
- The names (and subdirectory locations) of input files to be read by the I/O interface for each defined project, alternative, and market sector.

Within each IDAS alternative, the user defines and describes each market sector, and inputs the corresponding network and trip table (matrix) information that is associated with the market sector. The user employs interface screens to input the alternative descriptions, market sectors, and input file names.

### 3.2.2 Inputs from the Travel Demand Models

There is a variety of inputs prepared by the regional demand models that are required by IDAS. These data consist of node coordinates data, link data, turn prohibitor data (optional), matrix data (such as travel times and trips), and zonal to district equivalence files (optional).

The travel demand model data reside in relatively free-format ASCII text data files. Each data field is separated by a delimiter, with either commas or blank spaces between each column of data. The input/output interface provides the capability to read virtually any data file in this delimited format. The user is prompted to make edits to adjust the input/output interface to properly align data columns and provide descriptions of the

data contained in the columns. This automated reading of data files in various formats minimizes the need for the user to edit ASCII text files prior to input into IDAS.

The following individual data files from the travel demand model are required for input into the IDAS interface:

- Node coordinates file;
- Network link characteristics file(s); and
- Matrix data file(s).

In addition, certain ITS components and certain types of analysis require additional data, such as:

- Zone to district equivalence file;
- Turn prohibitor file; and/or
- Transit data file(s).

In addition to these required data, there are a number of model parameters, such as the volume delay function, that have a significant impact on the analysis results. Most of these other model parameters are discussed in Section 5.0.

A description of the elements that comprise each file is provided in the following sections.

### ***Highway Networks***

IDAS requires detail-coded networks of freeway mainlines and ramps, with mainline freeway links coded in their separate directions. Such detail coding is required to test freeway management systems such as ramp metering.

Highway network data describe network nodes and links. These input data elements are fairly well defined, and are not anticipated to change much from the following specifications. Ten user link attributes have also been specified to provide flexibility in identifying network links with special characteristics. The two required file types associated with the highway networks are the node coordinates file and the network links file. The data components of these files are presented below, with the required numeric formats (integer, real, or either).

#### **Node Coordinates File**

1. Node number, integer
2. X coordinate, either
3. Y coordinate, either

**Network Links File (40,000 links maximum)**

1. A Node Number (beginning node of link), integer.
2. B Node Number (end node of link), integer.
3. Distance, in units of miles, real.
4. Travel Mode (1 = auto links, 2 = transit mode), integer. (Note: This variable helps to identify transit only links in a network. Most links will be coded as 1, meaning that personal vehicles can use the link. Transit only links should be coded as 2. If no transit links exist, all links should be coded as 1.)
5. Area Type (urban, CBD, suburban, rural, etc.) designator, integer. (Note: Any number of area types may be input into IDAS; however, they will be collapsed into two designations within the software (urban and suburban/rural) as defined by the user in File, Setup, TDM Data screen. This variable is used by IDAS to identify the proper volume delay curve to use in assigning traffic to the link. Due to limitations in the number of volume delay curves available in IDAS, the use of this variable as an indicator of “area type” is often abandoned. Instead, the variable is used as a flag indicator to enable the use of the maximum number of curves in the analysis.)
6. Number of Lanes (number of one-way travel lanes), integer or real.
7. Facility Type (freeway, arterial, HOV, transit, etc.) designator, integer. (Note: Before importing the links, the user should visit the File, Setup menu and define the links that will be imported (i.e., map the facility type number to the facility type definition).)
8. Volume, optional (for the specific time period), integer or real. (Note: This variable represents the loaded volume for the link assigned by the travel demand model. This is optional as IDAS performs its own assignment procedure. If volumes are unavailable, the value should be set to zero.)
9. Lane Capacity (one-way), in units of vehicles per lane for the specified time period (for example, a three-hour peak period lane capacity should be three times the hourly capacity), integer. (Note: This is not the typical vehicles per lane per hour unless a peak hour time period is being analyzed.)
10. Speed (input free-flow speed) or link travel time with speed in units of miles per hour and time in values of minutes, integer or real. (Note: Only centroid connectors can have a speed of zero. All other facility types must have a speed greater than zero.)
11. DistrictID, integer, optional. (Note: This field can be used to group certain links into categories or districts that define a particular corridor, agency jurisdiction, or any area or group of links defined by the user. This should correspond to the zone to district equivalence values. If links are not to be categorized into districts, the input variable for each link should be set to 1.)

12. Time Speed Indicator flag, alpha characters T or S. (Note: This variable tells the software whether the value in the **Speed** column represents a speed “S” (in mph) or a travel time “T” (in minutes).)

### *Turn Prohibitor File (Optional)*

1. From node, integer;
2. Through (intersection) node, integer;
3. To node, integer; and
4. Prohibitor code (a value of zero is required).

### *Zone to District Equivalence File*

1. Zone number, integer; and
2. District number, integer.

### *Matrix Data File*

Matrix data are two-dimensional array data structures that describe information for origin and destination zone pairs. This information could consist of trips, travel times, travel costs, or any other zonal pair data. The following matrices are required as inputs to IDAS, depending on the analysis to be performed:

- Person and/or vehicle trips, by market sector;
- In-vehicle travel times by market sector in minutes (optional for vehicle market sectors); and
- Out-of-vehicle travel times by market sector in minutes (optional for vehicle market sectors<sup>1</sup>).

The matrix data consist of the following elements:

1. Origin zone, integer;
2. Destination zone, integer; and
3. Matrix data values, (i.e., trips, time, costs, etc.) for each O-D pair, either.

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<sup>1</sup>Standard IDAS deployments will not use out-of-vehicle travel times for auto market sectors. However, if a user deploys generic improvements and enters an out-of-vehicle impact value for auto market sectors, the user must provide this table.

### *Transit Data File*

Transit data elements describe the transit characteristics of the study area. Particular ITS components that enhance transit service, such as automated transit scheduling systems, may require additional transit information to perform the analysis.

## ■ 3.3 Module Procedures and Components

The IDAS input/output interface has the primary function of translating the travel model input data into the IDAS internal databases to be used in the program analysis procedures. Interface screens are used to prompt the user to input the names, locations, and descriptions of various input files. The user interface is structured to facilitate the systematic input of all required files.

After entering the name and location of a data file into IDAS, the user is able to view (and in certain situations edit) the data and column designations of each data file. This information is provided in a graphical window showing a tabular database with column designations for each data variable.

Upon user approval, the data interface processes each ASCII data file by reading in each data element and storing this information as data arrays, or internal databases, within IDAS. As the data records are input and converted by the data interface, the following routines are initiated during the translation process:

- Error-checking routines to screen for illogical data values or file structure.
- Graphical representation of the data analysis progress (i.e., on-screen bar chart showing task percent complete).
- Messages indicating successful input of the individual data files.
- Messages indicating errors in processing of the data files. The results from error checking are reported with on-line messages and can be reported into a summary report file.

Once a file has been read successfully into the IDAS database, the data are available for use by other IDAS modules and submodules.

## ■ 3.4 Outputs

Data output from the IDAS interface serve primarily as inputs into the IDAS alternatives generator and the various benefits modules. The function of the interface is to reformat the original data into a format that can be used internally by IDAS. In addition, the inter-

face routines might be used to specify outputs of network and trip information, prepared by the IDAS analysis benefits modules, into ASCII format files that can be input back into the regional travel demand models, if the user so chooses.

### 3.4.1 Outputs Used by other IDAS Modules

The following sections describe how output produced from the IDAS input/output interface is used in other IDAS analysis modules.

#### *Alternatives Generator*

The data files that are outputs from the IDAS input/output interface are important inputs to support the alternatives generator (AG). The node, links, and coordinate data are used to graphically represent the control network in the AG. The outputs from the input/output interface represent the control alternative from which different ITS options are created. The user creates ITS options in the alternatives generator by adding ITS components to this control alternative.

#### *Benefits Module*

The benefits module uses the data input through the I/O interface in each of its submodules.

- **Travel Time/Throughput Submodule** - This module uses the control alternative and the ITS option data files from the AG to determine the impacts that ITS deployments will have on network travel times, traffic volumes, and related variables. The information passes through the alternatives generator prior to use as input in the travel time/throughput submodule. The data outputs generated by this module provide the updated travel time and network information that may be processed by the IDAS input/output interface to prepare output data files to be read back into the travel demand model (if the user so desires).
- **Safety Submodule** - The IDAS safety submodule determines the impacts that the improvements have on the network system safety. The link characteristics from the control alternative network are the primary type of direct information provided by the input/output interface, which is required by the safety submodule. These link characteristics are compared with updated link speeds and volumes calculated by the travel time/throughput submodule.
- **Environment Submodule** - The IDAS environment submodule determines the impacts that ITS deployments have on mobile emissions and fuel consumption. As with the safety submodule, the characteristics data for each network link of the control alternative are the primary information required by this submodule. Updated link speeds and volumes used to determine the emissions impacts of the deployments are prepared by the travel time/throughput submodule, and are used in the environment submodule.

### ***Cost Module***

The IDAS cost module calculates the cost of each ITS deployment and other descriptive cost information required to support the benefit/cost analysis. The cost module requires a minimum amount of data from the input/output interface, primarily the ITS equipment sharing selection during Setup. More information on the Cost Module can be found in Section 6 of this User’s Manual.

### ***Alternatives Comparison Module***

The alternatives comparison module (ACM) calculates user benefits resulting from the ITS deployments. The ACM uses the unmodified network travel time and link files specified in the input/output interface together with revised estimates from the benefits module to calculate the user benefits of each ITS option relative to the control alternative.

## **3.4.2 Output Reports**

The output reports produced by the IDAS input/output interface provide the user with information that the input files have been successfully processed by the data interface. This report includes the following information:

- Project and alternative description;
- Description of individual market sectors within the alternative;
- Listing of names and locations of input data files processed by the I/O interface;
- Information describing the successful processing of input data files, and the number of records input; and
- Information describing unsuccessful processing of input data, with a description of the file name and data record producing the error.

## **3.4.3 Output Data Used by the Travel Demand Model**

The data outputs prepared by the data interface are consistent with the data inputs originally fed into the interface. Output data files consist of the following:

- Loaded network link files; and
- Matrix data files (i.e., trip tables).

Information produced by the application of the travel time/throughput analysis module is processed by the IDAS input/output interface to produce the final output files. The format of the output data files is consistent with the input formats, and is produced as an ASCII text file.