

# **User's Guide**

## **for the**

# **Multimodal Statewide Freight Transportation Model**

This guide describes the procedures to operate the statewide multimodal freight transportation model developed for the Iowa DOT by the ISU Center for Transportation Research and Education. The user may manipulate this model to provide decision-making information for a variety of freight transportation issues. Several classifications of probable freight planning issues, and the necessary model alterations, are described in detail in this Guide. With a thorough understanding of the model design, several more issues may be addressed with similar modifications. This ability will be quickly recognized as the user gains experience in the model processes and results.

The following conditions describe the hardware and software by which the model had been constructed:

#### Hardware Requirements:

- PC with DOS and Windows 95 or Windows NT 3.51 (or any more recent Windows version of each).

#### Software requirements:

- TRANPLAN v. 8.0 or higher
- MapInfo v. 4.0 or higher
- MapBasic v. 4.0 or higher
- Text file editor (Notepad, Textpad, Write, etc.)

# User's Guide

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### *Model Objective*

To ascertain the modal freight traffic volumes which result from changes in modal transportation costs. Freight transportation policy, infrastructure investment, or transport technology may cause such changes in transport cost.

### *Modeling Summary*

Development of the modeling process and input files involves several steps, as detailed in the Developer's Guide. However, the modeling procedures can be summarized as follows:

1. Identify commodity tonnage produced or attracted to each zone.
2. Identify probable policy effect, and make appropriate changes to model inputs (commodity production or attraction; or network representation).
3. Assign freight flows to the network with the objective of minimizing total logistics cost for each movement.
4. Calibrate and validate the resulting traffic assignment with other data sources.

### ***Description of Model Inputs***

The User's Guide assumes that all of the following files are existing in the proper formats. To construct one of these files or programs, please refer to the Developer's Guide. These files and programs are used in the modeling process (listed in order of use):

#### **REEBIE.EXE            PROGRAM**

FORTTRAN program that compiles commodity flow data from the REEBIE Transearch database (for a description of the Transearch database, refer to Developer's Guide). These data are formatted to the requirements of TRANPLAN (MODELS, page 1-1 to 1-11). This program requires REEB###.TXT, and TAZ###.TXT (described next) as input. This program produces the following commodity flow text files:

- SUMPA.TXT – productions and attractions for all flows
- SUMTPA.TXT – productions and attractions for only truck flows
- SUMRPA.TXT – productions and attractions for only rail flows
- AFLOWS.TXT – origins and destinations for all flows
- RFLOWS.TXT – origins and destinations for rail flows
- TFLOWS.TXT – origins and destinations for truck flows

#### **REEB###.TXT            TEXT FILE**

commodity flow data taken directly from the REEBIE Transearch database (### indicates the three digit SIC number for modeling a specific commodity, and would be replaced with that number: ex. REEB201.TXT). These data are manipulated with REEBIE.EXE.

#### **TAZ###.TXT            TEXT FILE**

traffic analysis zone (TAZ) data used to manipulate the commodity flow data to the model requirements (### indicates the three digit SIC number for modeling a specific commodity, and would be replaced with that number: ex. TAZ201.TXT). These data are input to REEBIE.EXE.

#### **FF###.TXT            TEXT FILE**

friction factor data used to distribute freight traffic in the modeling process. These data are input to the gravity model distribution process in TRANPLAN, and formatted appropriately (MODELS, page 1-1 to 1-11).

#### **IMTRNSFR.TAB        GIS TABLE**

a table of all intermodal transfer paths (from, through, and to nodes). Each intermodal path is considered a turn penalty in the modeling process. This file is input to TRANSF.EXE, used later to format the turn penalties to the TRANPLAN requirements.

TRANSFRS.TAB      GIS TABLE

a table of all inter-operator transfer paths (from, through, and to nodes) for exchanges between rail operators. Each path is considered a turn penalty in the modeling process. This file is input to TRANSF.EXE, used later to format the turn penalties to the TRANPLAN requirements.

STMOD.MB(X)      PROGRAM

the MapBasic program that executes most modeling steps within MapInfo, the GIS software. This program creates a user-friendly interface, asking the user for specific file information, and calling appropriate TRANPLAN and FORTRAN programs when needed.

NETWORK.TAB      GIS TABLE

the GIS (MapInfo) network link coverage constructed of railroad lines, highway routes, and rail/truck intermodal connections. All data contained within is exported to a text file needed in TRANPLAN (NETWORKS, page 1-1 to 1-13). For information on network construction and model development, please refer to the Developer's Guide.

LINKS.TAB          GIS TABLE

the GIS (MapInfo) node coverage for all link intersections in NETWORK.TAB. All data contained within is exported to a text file needed in TRANPLAN (NETWORKS, page 1-1 to 1-13).

TRANSF.EXE          PROGRAM

formats the turn penalty tables (IMTRANSFR.TAB and TRANSFRS.TAB) to TRANPLAN requirements (LOADING, page 1-1 to 1-10).

NETBLD.EXE          PROGRAM

FORTTRAN program that constructs a TRANPLAN control file (NETBLD.IN) for the TRANPLAN portion of the modeling process. The following files must be copied and added to the end of NETBLD.IN:

- ATTACH.TXT –            for production/attraction model process
- ATTACH2.TXT –        for origin/destination calibration plots

LOADED.EXE          PROGRAM

FORTTRAN program that converts TRANPLAN output to GIS format for display and analysis of modeling results.

ID\_NOD.MB(X)      PROGRAM

MapBasic program that creates a table of nodes and coordinates, and assigns node coordinates to network links.

## ***Modeling Procedure – Policy-Free***

### **Step 1:**

Select a working location on the hard drive (c: drive) in which all modeling files will be placed.

### **Step 2:**

Copy these files to that chosen location (### indicates commodity code {ex: 201 for meat}) :

- REEB###.TXT {ex: REEB201.TXT for meat freight flows}
- TAZ###.TXT
- FF###.TXT
- LOADED.EXE
- NETBLD.EXE
- REEBIE.EXE
- TRANSF.EXE

### **Step 3:**

Rename:

- REEB###.TXT TO REEBIE.TXT
- TAZ###.TXT TO TAZ.TXT

### **Step 4:**

Execute REEBIE.EXE from the DOS prompt (typical instructions for DOS execution procedures)

- a) Change DOS directory to same directory chosen in Step 1.
- b) Type 'reebie' and <enter>.
- c) Type 'exit' when program is successfully terminated.

### **Step 5:**

Select appropriate turn penalties (\$/ton) for intermodal, and/or rail inter-operator transfers.

a) Start MapInfo, and open the following tables:

- Intermodal transfers = IMTRNSFR.TAB
- RR operator transfers = TRANSFRS.TAB

b) Choose TABLE > UPDATE COLUMN from menu bar.

Table to Update: IMTRNSFR.TAB

Column to Update: penalty

Get Value From: IMTRNSFR.TAB

Value: {type appropriate INTEGER number for penalty value}

c) Repeat Step 5-b) for TRANSFRS.TAB

d) Choose FILE > SAVE TABLE from menu bar and save both tables.

**Step 6:**

In MapInfo, choose FILE > RUN MAPBASIC PROGRAM from menu bar.  
Select STMOD.MBX.

**Step 7:**

While the program is executing, the following questions will appear.

- a) Links table = NETWORK.TAB
- b) Nodes table = NODES.TAB
- c) **NO**, you do NOT want data saved on drive identified in window.
  - 1) Rather, select the directory chosen in Step 1.
  - 2) Choose "File Type" to be "\*.\*"
  - 3) Highlight ANY file (selected file will NOT be opened or corrupted).
  - 4) Click 'OK'
- d) YES, re-export links and nodes.
- e) Intermodal transfers = IMTRNSFR.TAB  
RR operator transfers = TRANSFRS.TAB
- f) At first DOS prompt, type 'netbld' (see Step 4 for DOS instructions).  
AFTER typing 'exit', do these steps OUTSIDE of MapInfo <ALT-TAB>:
  - 1) In a text editor program, open NETBLD.IN from directory chosen in Step 1.
  - 2) Open ATTACH.TXT in another session of a text editor program.
  - 3) Highlight all text in ATTACH.TXT file, choose EDIT > COPY in the menu bar, and paste all to the end of the NETBLD.IN file (EDIT > PASTE).
  - 4) Locate **\$INCLUDE FF###.TXT** within NETBLD.IN file.
  - 5) Change ### to SIC of commodity modeled.  
Now have (example): **\$INCLUDE FF201.TXT**
  - 6) Save NETBLD.IN (FILE > SAVE).
- g) At second DOS prompt, type 'transf' (see Step 4 for DOS instructions).

- h) When TRANPLAN is called from within MapInfo:
- 1) Click 'OPEN' and locate NETBLD.IN from directory chosen in Step 1.
  - 2) No designated 'OUT FILE' is necessary.
  - 3) Click 'RUN' and wait until finished (1 to 2 minutes).
  - 4) Click 'EXIT'.
- i) When TRANPLAN Utilities is called from within MapInfo:
- 1) Highlight "NETCARD" from the selection menu.
  - 2) Click "Open" and locate directory chosen in Step 1.  
"CURRENT DIRECTORY" line should match directory structure from Step 1.
  - 3) Click "RUN"
    - Input file = OUT.BIN
    - Output file = OUT.DAT
    - Choose 'N' for all questions that follow.
    - If 'Program terminated with exit code 0', then everything is O.K.
  - 5) Click 'EXIT'.
- j) User participation is complete. Allow MapBasic program to finish.
- k) Choose FILE > SAVE COPY AS
- 1) Select 'links'. This is the loaded network table, containing link volumes in the last column of the table, 'tot\_vol'.
  - 2) Save selected table to any convenient location, to be used for analysis.

## ***Modeling Procedure – Truck and Rail Calibration Plots***

### **Step 1:**

Make sure that Step 1 through Step 4 of previous section have been executed.

### **Step 2:**

Select appropriate turn penalties (\$/ton) for intermodal, and/or rail inter-operator transfers.

a) Start MapInfo, and open the following tables:

- Intermodal transfers = IMTRNSFR.TAB
- RR operator transfers = TRANSFRS.TAB

b) Choose TABLE > UPDATE COLUMN from menu bar.

Table to Update: IMTRNSFR.TAB

Column to Update: penalty

Get Value From: IMTRNSFR.TAB

Value: {IMTRNSFR.TAB, type '0' (zero)}

{TRANSFRS.TAB, type appropriate INTEGER number}

c) Choose FILE > SAVE TABLE from menu bar and save both tables.

d) Choose FILE > CLOSE ALL from menu bar.

### **Step 3:**

Create turn penalty data for TRUCK calibration plot, ensuring that NO flow occurs on rail:

a) In MapInfo, open the following transfer penalty tables:

- Rail centroids = CNTRRAIL.TAB
- RR operator = TRANSFRS.TAB

b) For CNTRRAIL.TAB, make 'penalty' = 0 (zero) [see Step 2-b for instructions]

c) Choose TABLE > APPEND ROWS TO TABLE from menu.

Append Table: CNTRRAIL.TAB

to Table: TRANSFRS.TAB

d) Choose FILE > SAVE COPY AS from menu bar, and select 'transfrs'.

File Name: NORAIL.TAB

THIS file will be the new RR operator transfer table.

e) Choose FILE > CLOSE ALL from menu bar.

Select 'Discard' when "Data has been modified ..." for 'Transfrs'.

#### Step 4:

Create turn penalty data for RAIL calibration plot, ensuring that NO flow occurs by truck:

- a) In MapInfo, open the following transfer penalty tables:
  - Highway centroids = CNTRTRUK.TAB
  - RR operator = TRANSFRS.TAB
- b) For CNTRTRUK.TAB, make 'penalty' = 0 (zero) [see Step 2-b for instructions]
- c) Choose TABLE > APPEND ROWS TO TABLE from menu.  
Append Table: CNTRTRUK.TAB  
to Table: TRANSFRS.TAB
- d) Choose FILE > SAVE COPY AS from menu bar, and select 'transfrs'.  
File Name: NOTRUK.TAB  
THIS file will be the new RR operator transfer table.
- e) Choose FILE > CLOSE ALL from menu bar.  
Select 'Discard' when "Data has been modified ..." for 'Transfrs'.

#### Step 5:

In MapInfo, choose FILE > RUN MAPBASIC PROGRAM from menu bar.  
Select STMOD.MBX.

#### Step 6:

While the program is executing, the following questions will appear.

- a) Links table = NETWORK.TAB
- b) Nodes table = NODES.TAB
- c) NO, you do NOT want data saved on drive identified in window.
  - 1) Rather, select the directory chosen in Step 1.
  - 2) Choose "File Type" to be "\*.\*)"
  - 3) Highlight ANY file (selected file will NOT be opened or corrupted).
  - 4) Click 'OK'
- d) YES, re-export links and nodes.
- e) Intermodal transfers = IMTRNSFR.TAB  
RR operator transfers = TRANSFRS.TAB

- f) At first DOS prompt, type 'netbld' (see Step 4 for DOS instructions).  
 AFTER typing 'exit', do these steps OUTSIDE of MapInfo <ALT-TAB>:
- 1) In a text editor program, open NETBLD.IN from directory chosen in Step 1.
  - 2) Open ATTACH2.TXT in another session of a text editor program.
  - 3) Highlight all text in ATTACH2.TXT file, choose EDIT > COPY in the menu bar, and paste all to the end of the NETBLD.IN file (EDIT > PASTE).
  - 4) Locate **INPUT FILE = SRVDATA, USER ID = \$aflows.txt** within NETBLD.IN file.
  - 5) Change **\$aflows.txt\$** to either:
    - \$tflows.txt\$** for truck validation plot, or
    - \$rflows.txt\$** for rail validation plot.
  - 6) Save NETBLD.IN (FILE > SAVE).
- g) At second DOS prompt, type 'transf' (see Step 4 of previous section for DOS instructions).
- h) When TRANPLAN is called from within MapInfo:
- 1) Click 'OPEN' and locate NETBLD.IN from directory chosen in Step 1.
  - 2) No designated 'OUT FILE' is necessary.
  - 3) Click 'RUN' and wait until finished (1 to 2 minutes).
  - 4) Click 'EXIT'.
- i) When TRANPLAN Utilities is called from within MapInfo:
- 1) Highlight "NETCARD" from the selection menu.
  - 2) Click "Open" and locate directory chosen in Step 1.  
 "CURRENT DIRECTORY" line should match directory structure from Step 1.
  - 3) Click "RUN"
    - Input file = OUT.BIN
    - Output file = OUT.DAT
    - Choose 'N' for all questions that follow.
    - If 'Program terminated with exit code 0', then everything is O.K.
  - 4) Click 'EXIT'.
- j) User participation is complete. Allow MapBasic program to finish.
- k) Choose FILE > SAVE COPY AS
- 1) Select 'links'. This is the loaded network for the calibration plot, containing link volumes in the last column of the table, 'tot\_vol'.
  - 2) Save selected table to any convenient location, to be used for analysis.

### Step 7:

Rewind to Step 5 for to create calibration plot for the other mode.