

Introduction

M2probe is an ArcView™ application that automatically converts data structures in the EMME/2™ data bank to ArcView geographic layers (called “shapefiles”). M2probe therefore provides a way to bring EMME/2 data into a geographic information system (GIS) environment, where it can be analyzed using the spatial analysis capabilities of ArcView or mapped in combination with other sources of geographic information, such as aerial photographs.

M2probe was first developed for the Bernalillo County Public Works Department (Albuquerque, New Mexico). An early version was presented at the 1997 EMME/2 User’s Conference in San Francisco. It has since been significantly enhanced:

- M2probe now imports network node data
- M2probe now imports the transit vehicle table, the transit route table, and transit line itineraries for any scenario
- M2probe now provides a number of automated mechanisms for analyzing and displaying transit information.

ArcView is the most popular desktop GIS software product in the world. It was developed and is distributed by the Environmental Systems Research Institute. It runs with the “look-and-feel” of Windows-95/98/NT, and also runs on unix work stations. M2probe runs on Windows-95/98/NT and on several types of unix works stations (e.g., Sun-Sparc, HP, and RISC6000). It does not run on Mac systems.

The Implementation

M2probe has been implemented as an “extension” to ArcView. Extensions are special programs which alter and enhance ArcView’s own native capabilities. It consists of a large number of Avenue scripts (Avenue is the scripting language for ArcView) and several C++ programs, which provide access to the EMME/2 data bank.

The C++ programs provide direct access to the EMME/2 data bank. Therefore, users can easily convert network data from an EMME/2 data bank without leaving the ArcView environment. Users do not have to “batchout” files from the data bank.

Data Representation

ArcView naturally represents point, polyline, and polygon features (as well as image data). m2probe's data conversions work as follows:

Nodes	Converted to ArcView point shapefiles
Network Links	Converted to ArcView polyline shapefiles (because of EMM/2's representation, the polylines actually are a single segment)
Transit Vehicle Table	Converted to an ArcView "table"; the underlying file for ArcView tables are .dbf files.
Transit Route Table	Converted to an ArcView "table"; the underlying file for ArcView tables are .dbf files.
Transit Itineraries	Converted to ArcView polyline shapefiles. Each link in the transit line itinerary is tagged with the inode jnode pair for the underlying link, so transit information can be joined with the underlying network link.

An ArcView "shapefile" is actually a set of three files:

- The .shp file contains coordinate geometry for the feature, whether it be a point, a polyline, or a polygon.
- The .dbf file contains all of the attributes associated with the feature
- The .shx file is an index file to all of the features in the .shp file (i.e., a listing of the record numbers and their locations).

Analysis Tools

M2probe provides a number of analysis scripts that automates the analysis of networks. These include:

Roadway Networks	Computes VMT, VHT. With a capacity table available, will compute capacities and v/c ratios. With a level of service table available, will compute LOS. With a free-flow speed table, will compute VH of delay.
Transit Networks	Computes maximum load points, passenger miles of travel. With a capacity table available, will compute demand headways (required to provide sufficient capacity). Once headways are known (either those coded in the original network or those computed from the assignment, will compute fleet size requirements, revenue hours, vehicle hours, revenue miles, and load factors along the route.

And, finally, ArcView's own internal calculator provides the knowledgeable user virtual unlimited capability to add new fields and compute them, by formula, or by look-up table.

Summary Tools

Relying on ArcView's spatial analysis capabilities, m2probe can automatically summarize network data for districts or subareas.

Matrix Tools

If a user has developed a shapefile (a polygon theme) representing the traffic analysis zone (TAZ) system for an EMME/2 network, then m2probe can extract matrix data from the EMME/2 data bank and can attach it as a new field on the polygon theme. For example, an origin matrix representing home-base-work trip productions can be extracted from the EMME/2 data bank and attached as a field for the TAZ theme. Full matrix data can be extracted as well, provided it is summarized as a vector to be attached to the TAZ theme. M2probe allows users to define an area of interest, say a set of CBD zones, and will automatically summarize the total number of trips going to those zones from elsewhere in the region.

TAZ themes can then be mapped, using a variety of classification schemes (equal interval, quantile) and mapping styles (ramped colors, dot-density).

Data associated with TAZ themes can be converted to desire-line spider maps automatically.

Network Mapping Tools

M2probe will generate variable-width maps, such as those that might be used to represent total traffic volume, for either highway or transit networks. Network links can also be labeled with any attribute field in the theme.

Plans for the Future

We continue to work on extending the capabilities of m2probe. The next release will address:

Reading Extra-Attributes directly from the data bank

Internationalization of units

Ability to create district level desire line diagrams

Ability to perform post-assignment skim trees and network loadings

Availability

Our presentation last year generated some interest in the professional community. We therefore have been distributing copies of m2probe to interested parties. A User's Manual is available, and we provide limited technical support.

Other ArcView Projects

We have begun work on two new ArcView based applications. One provides complete network editing capability and the other provides a capability to run EMME/2 from ArcView.