CHAPTER 13 Technology Transfer through Transport Planning Software Package

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13.1 Introduction to System II

The software package chosen by the JICA Study Team for installation at NTRC was System II, published in the USA by JHK & Associates. This package was chosen as it more than a transportation assignment software package. System II is described by its author as a regional information system. The database manager, graphics interface, forecasting models and subroutine libraries are included in the basic package.

System II has an extensive list of users both in the US and other countries. A partial list of users includes: the U.S. Army Corps of Engineers in Baltimore, Maryland, the Association of Monterey Bay Area Governments (AMBAG) in Monterey, California, the Brevard County Planning Department in Titusville, Florida, the California Department of Transportation (CALTRANS) in Fresno, the CALTRANS Office of Planning in Sacramento, California, the Chicago Area Transportation Study (CATS) in Chicago, Illinois. Other institutional users are: the City of Albuquerque, New Mexico, the L.A. County Metropolitan Transportation Authority in Los Angeles, California, the Metropolitan Washington Airports Authority (MWAA) in Washington, D.C., the New York State Department of Transportation (NYSDOT) New York, New York, the Santa Barbara County Air Pollution Control District in Santa Barbara, California, the Southern California Association of Governments in Los Angeles, California, US DOT at the Volpe National Transportation Systems Center in Cambridge, Massachusetts.

Educational users include: Arizona State University, California Polytechnic State University San Luis Obispo, California, California State University at Hayward in Hayward, California, George Mason University in Fairfax, Virginia, Georgia Institute of Technology in Atlanta, Georgia, Massachusetts Institute of Technology in Cambridge, Massachusetts, Purdue University West in Lafayette, Indiana, and the University of Central Florida Orlando, Florida.

International educational users include: Concordia University Montreal, Quebec, Canada, Queen's University in Kingston, Ontario, Canada, Ruhr University in Bochum, Germany, Southern Alberta Institute of Technology in Calgary, Alberta, Canada, the University of the Philippines in Manila, Philippines, and the University of Thrace in Xanthi, Greece.

Recently, in addition to the National Transport Research Centre, System II is in useat the Karachi Mass Transit Administration in Karachi, Pakistan.

13.2 Overview of System II

System II is described in terms of overall transport planning capabilities below. Some more specific information will follow

13.2.1 Overall Capabilities

(1) Trip Generation

Up to 100 Linear and non-linear regression equations and cross-classification models are available for each trip purpose. Trip generation includes household variable disaggregation by income level, household size, and auto ownership, as well as area type based submodels. Twenty independent variables and six production/attraction balancing techniques may be used in a System II model.

(2) Trip Distribution

Gravity Model with two dimensional FRATAR balancing can be used in a trip distribution model. Up to 100 sets of friction curves and correction factors with origin and destination submodels are available by area type and zone size. Intrazonal friction models include nearest neighbor, zone size disaggregation, and user defined terminal and intrazonal impedances.

(3) Mode Split

Nested Logit models can be classified by four auto occupancy classes and three transit access modes. Up to 100 sets of logit equations and correction factors stratified by origin and destination area type and zone size can be used. Impedance is based on travel time, distance, cost, waiting time, access time, number of transfers, level of service, and principal transit mode.

(4) Trip Assignment

All-or-Nothing, Iterative, Incremental, Equilibrium, and Stochastic techniques can be varied by iteration. System II includes dynamic turning movement penalties as well as multi-path and transit assignment. Select link is available for all techniques.

(5) Network

System II can model a maximum of 10,000 zones, 32,000 nodes, 32,000 2-way links. Highway and transit networks can be edited through a fully interactive graphic editing and database record management program. The interactive editor utilities is based on a "layering" concept which can present up to ten files simultaneously. Multiple networks able to be edited simultaneously. Up to 32,000 records per layer may be shown (The database size is theoretically unlimited). The editor allows interactive path building, address matching and bandwidth posting.

(6) Reports

Highway and transit network listings, paths, and loads are all subjects of standard reports. Highway turning movements, transit transfers, corridor volumes, and performance comparisons can be output as well as matrix squeezing, selected row listings, trip end summaries, and table comparison.

(7) Plotting

Highway and transit network characteristics and loadings can be plotted on CALCOMP, HPGL and ZETA plotters. System II supports filled bandwidths, eight posted attributes, sixteen selection layers, and eight color graphic plots and automatically creates multiple frames on roll feed plotters.

(8) Utilities

Conditionally add, subtract, factor, and edit matrices. Compress, expand and transpose matrices. Build intrazonal travel times. Calculates air quality emissions, accidents, and other performance measures. Includes a Traffic Impact Module with intersection and arterial level of service procedures, ITE trip generation equations by 128 land use categories, a project database manager, and land use based traffic distribution and assignment capabilities.

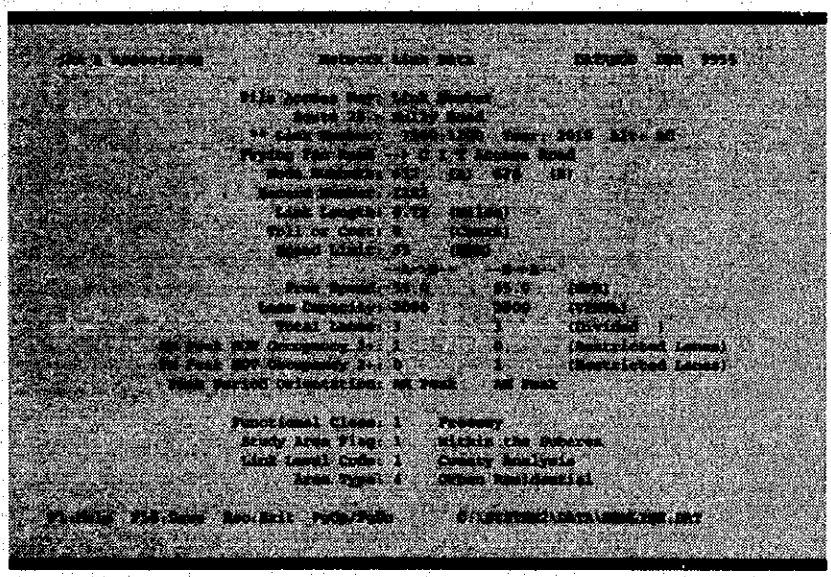
13.2.2 Database Management Interfaces

DATAMOD is the relational database management program that provides interactive access to all of the database files used in System II. These data sets include the following types of files:

- Highway Links - Roadway Characteristics
- Network Nodes - Location Information
- Zone Files - Socioeconomic and Demographic Data
- Transit Lines - Transit Service and Routes
- Traffic Counts - Roadways and Intersections
- Code Names - Street and Area Names

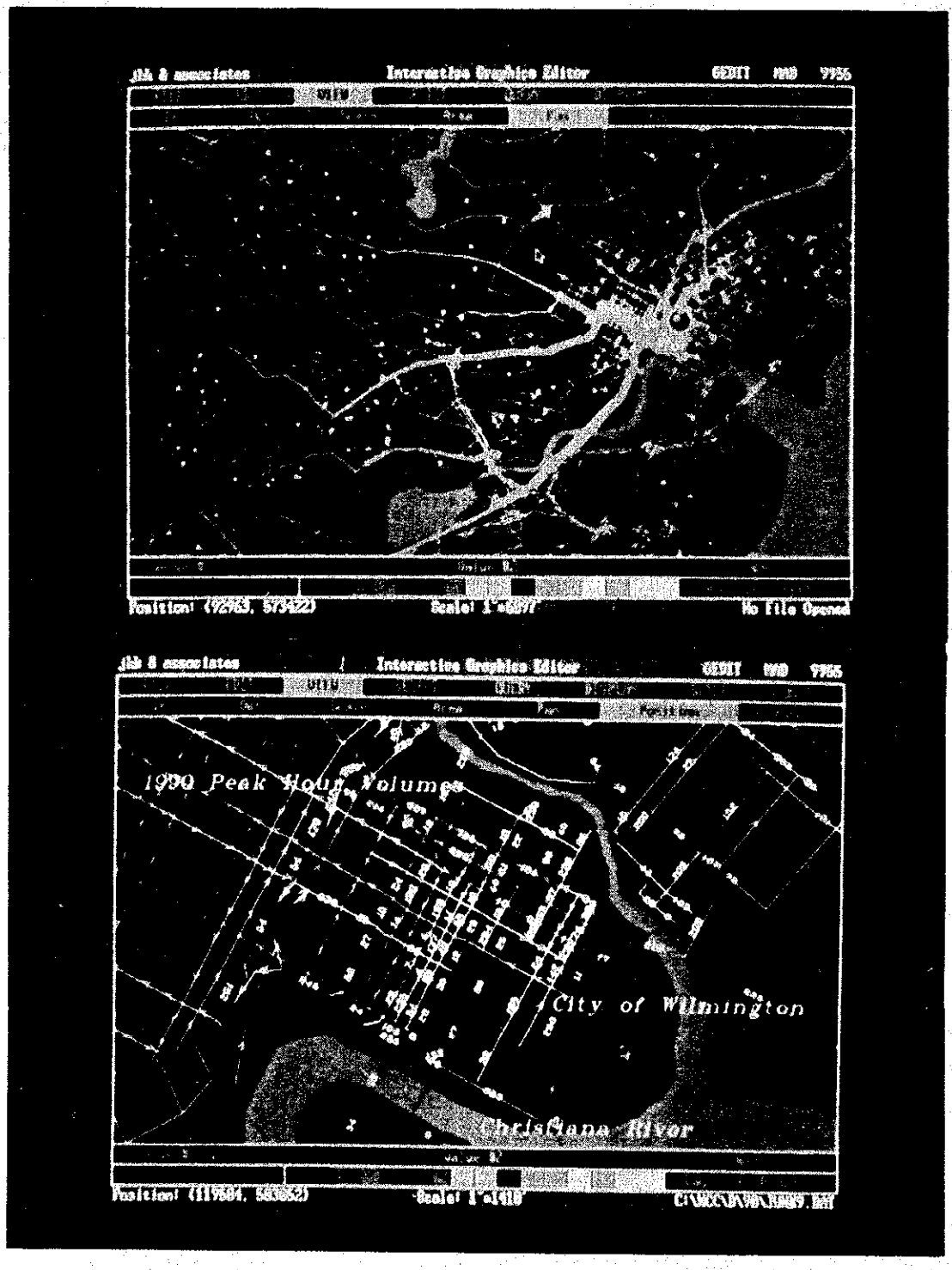
DATAMOD can create, review, or edit each of these database types. Each record in the database is presented on fully functional screen templates. Records can be retrieved randomly or in the order of any of several sort keys provided in the database. Individual records can be inserted, updated, and deleted. Duplicate records are generally prohibited. Each data field is verified against the logical range of the parameter. In the relational mode, field verification will also check for consistency among the databases.

Figure 13.2.2.1 DATAMOD Screen



GEDIT presents information from the System II databases as a color coded map of the transport network. It enables the user to interact with several databases simultaneously and visualize the spatial relationships between demographic and transportation facilities. GEDIT uses a layering concept that assigns each database to a different layer. Up to ten layers are available for a particular application. The user has full control over the ordering, hierarchy, and meaning of each layer. At any given time, only one layer is "active." All editing, selection, and query functions operate on the active layer.

Figure 13.2.2.2 GEDIT Screen



13.2.3 Running the Programs

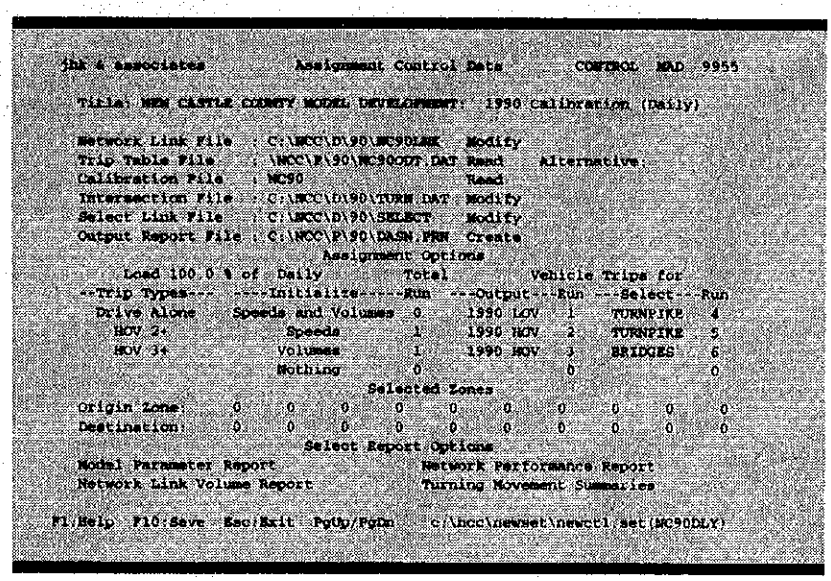
Before running a System II program, the user must set up the System II working environment. This is done by issuing a series of DOS commands which set the DOS environment to System II parameters.

In order to run most System II transport modelling programs, the user must supply:

- The name of the program
- Data files needed for the program to be run
- CONTROL information to tell the program what data files read or write and how to use them.
- CALIB information to tell the program specific modelling parameters which are needed by the program.

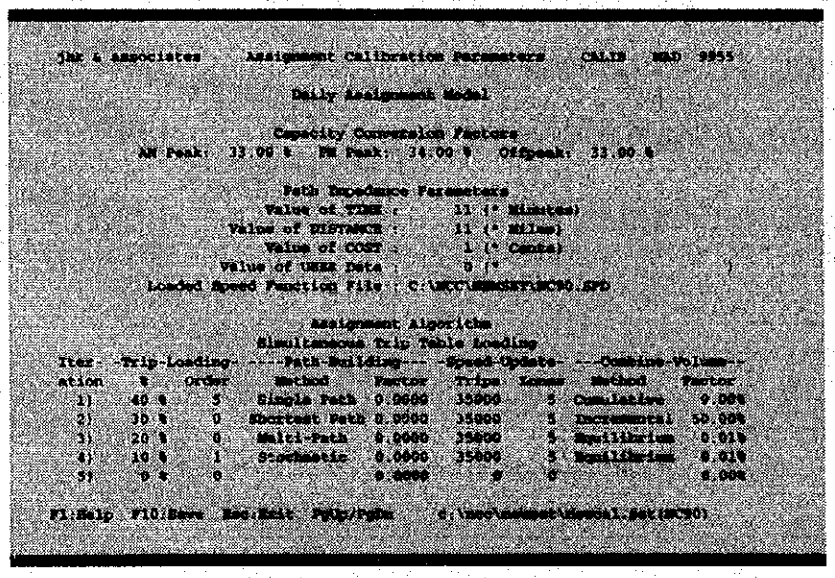
CONTROL is the user interface program for setting up and executing element of the transportation modelling process. Names of input and output files, processing commands, and report options for each program are stored in a Control database. The CONTROL program permits the user to create and edit individual program control records from the CONTROL.SET database. An example of one of the CONTROL databases can be seen in this project by typing the command: CONTROL ASSIGN PAKISTAN. This command invokes the CONTROL program to look at one of the records in the CONTROL.SET (Named PCONTROL.SET in this study) for the ASSIGN program. The name of the specific record in the CONTROL.SET is simply PAKISTAN.

Figure 13.2.3.1 CONTROL Screen



CALIB is the user interface program for defining transportation modelling parameters. Trip rates, friction curves, modelling techniques, and other modelling parameters for each program are stored in a Calibration database. The CALIB program permits the user to create and edit individual model parameter records from the CALIB.SET (Named PCALIB.SET) database. An example of one of the CALIB databases can be seen in this project by typing the command: CALIB ASSIGN PAKISTAN. Similarly to CONTROL, this command invokes the CALIB program to look at one of the records in the CALIB.SET for the ASSIGN program. The name of the record in the CALIB.SET is once again, simply PAKISTAN.

Figure 13.2.3.2 CALIB Screen



The only transportation planning program used in this study was ASSIGN. However, other important utility programs were used as well. Some of these were:

- DISPCTL and DISPCAL - Programs used to view the names and manipulate records in the CONTROL and CALIB.SET files.
- Complex Database Management was often done with the user programmable DATAEDIT program.
- Matrix Manipulation was accomplished with the MATRIX program.
- The Assignment Utilities VOLDUMP and LOADVOL were used in converting between System II databases and ASCII files.
- Calibration Statistics were created for the 1993 run using the System II program EVAL.

Instructions for the use of all of these programs are available in the System II manual.

13.3 Staff Training

Formal lectures on the both general transport modelling, System II, and the National Transport Plan specifically were given in the conference room at NTRC on 26 February and 8 September.

Topics discussed in Seminar I were:

I. Introduction

II. Overview of Transport Modelling
- A. The modelling process
  1. Trip tables
  2. Transport networks
- B. Trip generation
- C. Trip distribution
- D. Modal selection
- E. Trip assignment

III. Special Capabilities of System II
- A. DATAMOD
- B. GEDIT
- C. Special databases
  1. CONTROL
  2. CALIB
  3. SETUP
  4. HELP
  5. GEDIT

IV. Special Considerations for the JICA Study
- A. Special terminology
- B. Origin-destination tables

Seminar II addressed the following:

I. Creation of Origin-Destination Matrices
- A. Zone structure (NTRC 33-Zone to JICA 51-Zone)
  1. Splitting zones
  2. Intra-zonal trips
  3. External stations

II. Creation of the Network
- A. Creation of the road center line file
- B. Number of lanes

C. Road free speeds
D. Road capacities

III. Assignment
A. Incremental all-or-nothing assignment
B. BPR formula and QV formula
C. Determination of link impedance
D. Calibration of 1993 model

IV. Future Year Forecasts

In addition to the formal seminars, daily on-the-job training was conducted as part of the study. In Phase I of the study, the counterpart to the JICA team member was assigned from NTRC staff. Considerable time was devoted in Phase I to training the counter parts and to involve him with the planning process and the considerable amount of hands on work which must be done in any modelling assignment.

Unfortunately, after Phase I was completed, the counter part resigned in early September from NTRC and was not available during Phase II. During this phase, another stuff was assigned as the NTRC counterpart. During this phase of the project, although the new stuff was diligent in his efforts to learn the use of System II beside his own work, there was insufficient time for adequate training due to the limited schedule of JICA study team.

In the future, it would be better if a JICA staff member would be sent to the recipient agency for a minimum of two months with the sole assignment of staff training. This should ideally be done after completion of the regular project work so that results of the study could be used in training and showing examples. The present method of demonstrating and training while attempting to do the day to day work is useful, but entirely insufficient for the development of adequate staff skills for transport modelling. At JHK, the common wisdom is that it takes a new modeller about one year of working with System II on a day-to-day basis to become competent in its use. The acquisition of transport modelling skills is not an insignificant task.

13.4 Data and Program Files

The program files for System II are stored in C:\SYSTEM2\ on the computer left at NTRC. Project files are stored as described below.

```
C:\---PAK----------+-DAT----------+-06          Data files: 2006 Assignment
                   |               +-94          Data files: 1994 Base Year
                   |               +-98          Data files: 1998 Assignment
                   |               +-DEMONET     Demonstration Network
                   +-P                           Print files
                   +-PBAT                        Batch file for Startup
                   +-SET                         System II SET files
                   +-WQFILES                     Spreadsheet files
```

The C:\PAK\DAT\?? files are all data files necessary for a System II run. It includes link and node files, matrices, and so forth. DEMONET is a highly simplified network which is used for plotting purposes only. It cannot be used for modelling purposes due to its violation of System II rules for link length and because it does not have accurate link lengthsdue to its simplified nature. All modelling is done on the regular data files in the numbered subdirectories and assigned volumes are transferred to DEMONET for display purposes. This transfer is done automatically by using the batch files in the various numbered directories (not in .BAT). The relevant files are listed below.

The C:\PAK\P subdirectory holds all print files which are created by System II during model runs. C:\PAK\PBAT contains PAKSET.BAT which sets up the modelling environment. C:\PAK\SET\ contains all System II program set files (GEDIT.SET files are contained in numbered directories). C:\PAK\WQFILES contains various spreadsheet files which were used to complement the modelling process. These files may be Lotus 1-2-3 format or Quattro Pro format.

Important files and a short descriptions are listed below.

c:\pak\dat\06\06asgn.viu System II graphics file (View with GENVIEW)
c:\pak\dat\06\commit.set GEDIT.SET file for 2006 "Commited network"
c:\pak\dat\06\pcu06od1.dat 2006 PCU-base OD matrix
c:\pak\dat\06\pk06lnkc.dat 2006 "Commited" link file
c:\pak\dat\06\pk06lnkr.dat 2006 "Recommended" link file
c:\pak\dat\06\pk06node.dat 2006 node file
c:\pak\dat\06\pr06od.dat 2006 Rail OD table
c:\pak\dat\06\pr93lnk2.dat 2006 Rail link file
c:\pak\dat\06\pr93node.dat 2006 Rail node file
c:\pak\dat\06\recomm.set GEDIT.SET file for "Recommended network"
c:\pak\dat\06\run06c.bat Batch file for 2006 "Commited network"
c:\pak\dat\06\run06r.bat Batch file for 2006 "Recommended network"
c:\pak\dat\94\dlink93.asc Output from 1993 run06r.bat run / Input to Lotus file
c:\pak\dat\94\jstd93od.dat 1993 PCU-based OD matrix
c:\pak\dat\94\nation.dat Graphics file with outline of Pakistan
c:\pak\dat\94\pakdelay.dat BPR formulae for assignment
c:\pak\dat\94\pcu93cnt.asc 1993 count file in PCUs
c:\pak\dat\94\pk93lnk0.dat 1993 link file
c:\pak\dat\94\pk93node.dat 1993 node file
c:\pak\dat\94\pr93lnk1.dat 1993 Rail link file
c:\pak\dat\94\pr93node.dat 1993 Rail node file
c:\pak\dat\94\pr93od.dat 1993 Rail OD matrix file
c:\pak\dat\94\railway.set GEDIT.SET file for rail network
c:\pak\dat\94\text.dat Graphics file for city names

Similarly named files exist in other numbered subdirectories

c:\pak\dat\demonet\demo06.set 2006 Demonstration GEDIT.SET file
c:\pak\dat\demonet\demo98.set 1998 Demonstration GEDIT.SET file
c:\pak\dat\demonet\linkno06.asc 2006 Link numbers for data transfer
c:\pak\dat\demonet\linkno98.asc 1998 Link numbers for data transfer
c:\pak\dat\demonet\linknums.asc 1993 Link numbers for data transfer
c:\pak\dat\demonet\pk06lnkc.dat 2006 "Committed" link file
c:\pak\dat\demonet\pk06lnkr.dat 2006 "Recommended" link file
c:\pak\dat\demonet\pk98lnkc.dat 1998 "Committed" link file
c:\pak\dat\demonet\pk98lnkr.dat 1998 "Recommended" link file
c:\pak\dat\demonet\pk06node.dat 2006 Node file
c:\pak\dat\demonet\pk98node.dat 1998 Node file
c:\pak\set\pcalib.set CALIB.SET (Stores Calib files for all runs)
c:\pak\set\pcontrol.set CONTROL.SET (Stores job control files for all runs)
c:\pak\set\phelp.set HELP.SET (Stores help information)
c:\pak\set\psetup.set SETUP.SET (Stores project specific label information)