TRANSPORTATION PLANNING SUPPORT INFORMATION SYSTEM -
USING CMS EXEC2 TO EXECUTE SAS MACROS
IN A PANEL DRIVEN ENVIRONMENT

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Abstract
A system (DRAMS), under development by the Issue Analysis and Information Services Branch is described. The functions of the system are: data storage and maintenance; provide transportation related data to planners and analysts; produce publication quality tables and graphs; and provide SAS users with an easy to use method of extracting data for more specialized analyses.

This menu driven system utilizes panels formatted under Display Management System and controlled by EXEC2 programs. Users select data and data processing routines by moving the terminal's cursor to the option desired and pressing a function key. Decisions made in this way cause EXEC2 to write CMS GETSAS and SAS macro language statements to a temporary SAS source file. When the decision process is complete, EXEC2 initiates execution of the SAS source file.

Introduction
Responsibilities of the Issue Analysis and Information Services Branch include maintaining a data base of transportation related facts and figures, responding to inquiries and data requests from government agencies and private parties, and publication of a variety of reports useful to transportation planners, analysts, and managers. The system (DRAMS) described in this report grew from a need to enhance data management, analysis, and reporting capabilities which, until early 1984, consisted of a cumbersome mix of manual and automated procedures.

Design Considerations
To serve the widest possible range of users, including professionals with varied experience in the use of computers, a menu driven system would be developed which allows users to select data and data processing routines by positioning the terminal's cursor on the desired option and pressing a function key. Menus would present instructions, and more detailed help information would be displayed when a function key is pressed.

Automate the data base management activities of data entry, editing, and updating. Access to these functions would be restricted to authorized staff.

Automate production of publication quality tables and graphs.

Provide SAS users the facility to extract data and execute SAS procedures interactively.

The computer system most widely available to users is the IBM Virtual Machine/System Product installed at the Steven B. Teale Data Center, a state owned and operated facility.

The Data Base
A SAS data library is stored on disk. For each type of data, there are two SAS data sets—one contains data observations, while the second is a file of edit/update transactions applied to the first. The menu for selecting data is shown in Figure 1. The types of data currently included are:

- motor vehicle accident data for California highways;
- commercial air passenger enplanements and deplanements at California airports;
- automobile ownership and operating costs;
- intercity bus passengers;
- rail passengers;
- fuel prices;
- fuel sales;
- licensed drivers;
- motorists exceeding specified speeds;
- vehicle registrations;
- ridesharing applications;
- transit ridership; and
- vehicle miles of travel on state and non-state roads.

Data Processing Routines
The menu for selecting data processing routines is shown in Figure 2. Available data processing routines include the following:

- subset observations by values of ID variables;
- display subset observations, standardized reports, forecasts, and graphs;
- print publication quality reports and graphs;
- enter, edit, and update data (restricted to authorized personnel); and
- user program mode (for SAS users).
Display Management System (DMS) Panels

DMS provides a screen level formatting tool for defining menu panels which are presented to the user at the terminal. DMS allows three types of panel fields—text, select, and data. Text fields are used for instructions, help information, and function key definitions. Select fields are used for choosing optional data types and data processing routines. Data fields are used for data entry, edit, and update.

DMS also provides highlighting features for IBM 327x terminals (and compatible terminals and microcomputers). In general, text fields are displayed at normal intensity, while select and data fields are displayed at high intensity. The first panel displayed, Figure 1, shows the user the types of data available, instructions for selecting a type of data, and function key definitions.

The DMS display subcommand environment under EXEC2 allows for display of panels at the terminal, determination of which function key was pressed to interrupt the display, which select field the cursor was on at interruption, and unloading of values entered in data fields into EXEC2 variables.

EXEC2 Programs

EXEC2 programs serve as driver modules. The following functions are performed by EXEC2:

- invoke the DMS display subcommand environment;
- display DMS panels;
- determine which function key caused interruption of panel display;
- determine, at interruption, on which select field the cursor was;
- perform decision sequence checks to ensure appropriate output;
- transfer data values entered in data fields to EXEC2 variables (from which they are transferred to SAS macro variables);
- write CMS GETSAS commands and SAS macro language statements to a temporary disk file using the CMS EXECIO command;
- provide feedback to the user on each decision, including sequence and error reporting; and
- initiate execution of the SAS source file generated by EXEC2.

The system is driven by a primary EXEC2 program and 14 secondary EXEC2 programs. The primary program displays panels which allow the user to select the type of data and data processing required and, then, executes the appropriate secondary program. One secondary program controls the display of help information, while the others are specific to the type of data selected.

![Figure 1](image-url)
SAS Source Files

Some SAS source files used by the system are permanent while others are temporary. Permanent files are sets of one or more SAS macro definitions tailored to access specific SAS data sets and perform specific data processing routines. SAS macros also check for empty data sets and display messages at the terminal which inform a user about how to display more data and how to continue after SAS processing has completed.

Temporary files are generated by the EXEC2 programs, as described above, and contain CMS GETSAS, %LET, and %macroname statements. CMS GETSAS statements concatenate the appropriate permanent files of SAS macro definitions, %LET statements supply values for macro variables, and %macroname statements invoke the macros.

SAS Output

In general, SAS procedure and data step output are directed to the terminal. EXEC2 spools terminal output to a system printer if a user responds "yes" to a hard copy request prompt. If the user responds "no" the print is cancelled. Exceptions to this are for printing publication quality tables and graphs. For tables, output is directed to the user's minidisk and printed using a standard utility program. To produce graphs, the user tailors the graph using DRAMS at a full screen terminal. The output is saved in a SAS data set and can then be displayed at a graphics terminal by running PROC GREPLAY. The displayed graph is then output to a graphics copier (Figure 3).

Execution of DMS and SAS

Both SAS and the DMS display subcommand environment are executed in the user area of the virtual machine. Thus SAS and DMS cannot execute simultaneously. It is necessary, therefore, to exit the display environment before invoking SAS and to reinitialize the display subcommand environment when SAS processing is complete.

Conclusion

By using CMS commands and EXEC2 programs to control execution of SAS routines, a system for data reporting, analysis, and management has been developed, which is easy for non-programmers to use. The ability to interactively build files of SAS macro statements is a powerful tool. For the future, it is intended to expand the capabilities of the system by allowing access to additional types of data and SAS processing routines.

SAS is the registered trademark of SAS Institute Inc., Cary, NC, USA.

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**DATA PROCESSING OPTIONS**

HIGHLIGHTED BELOW ARE DATA ANALYSIS OPTIONS AVAILABLE. TO SELECT ONE OF THE AVAILABLE OPTIONS, POSITION THE CURSOR ON THE HIGHLIGHTED OPTION OF INTEREST AND DEPRESS THE ENTER KEY. PFKEY DEFINITIONS ARE SHOWN AT THE BOTTOM OF THIS PANEL.

- SELECT CERTAIN DATA RECORDS
- DISPLAY SELECTED DATA RECORDS
- DISPLAY STANDARD TABLES
- PRINT REPORT QUALITY TABLES
- DISPLAY FORECAST DATA
- INTERACTIVE GRAPHICS
- EDIT OR UPDATE DATA FILES
- USER PROGRAMMING MODE (FOR SAS PROGRAMMERS)

PF1=HELP    PF3=TERMINATE    ENTER=EXECUTE OPTION

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**Figure 2**
CALIFORNIA STATE HIGHWAY TRAVEL

MONTH OF THE YEAR

LEGEND: YEAR

SOURCE: CALTRANS, DIVISION OF TRAFFIC ENGINEERING

Figure 3