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U.S. Department  
of Transportation  
**Urban Mass  
Transportation  
Administration**

# Development of a Graphics Based Automated Emergency Response System (AERS) for Rail Transit Systems

Transportation Systems Center  
Cambridge, MA 02142

May 1989  
Final Report



**UMTA Technical Assistance Program**

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Technical Report Documentation Page

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## PREFACE

The concept of using microcomputers for the provision of emergency transit information was first implemented at the San Francisco Bay Area Rapid Transit District (BART) in 1979. Since 1982, under the sponsorship of the Urban Mass Transportation Administration (UMTA), the Transportation Systems Center (TSC), in cooperation with the BART developers, has demonstrated the original Automated Emergency Response System (AERS) to transit officials at workshops and on-site at several transit systems.

In 1984, an effort was begun to significantly modify and update AERS. This report presents an overview of the second generation AERS (AERS2). Developed to assist transit systems in responding effectively to emergency situations, AERS2 is a microcomputer-based information retrieval system that provides train controllers, dispatchers, and supervisors with quick and accurate information. In contrast to the original AERS, AERS2 provides information through a color schematic map of a one-mile length of track on the upper half of the computer display screen and textual information on the lower half of the screen. The software needed to support AERS2 was developed by Richard Daesen of UNISYS, Bruce Tessier of RJO (but formerly of UNISYS), and Dr. Phani Raj of Technology and Management Systems. Because AERS2 was developed for the BART system, software modifications for ventilation protocols and the input of system data are required for use in other transit systems.

Among those people who have made contributions to this effort, special thanks must go to Franz K. Gimmler and Ronald Kangas of UMTA for their support of this project. Also deserving special thanks are Richard Blake of BART for his willingness to share his original program and his time and guidance in developing the AERS2 software; Joseph Petrie of TSC for his support in deploying the original AERS software, formulation of the AERS2 requirements, and guidance during the development; and Joseph Amado of WMATA and William Thorpe and David Andrus of PATCO for their help in the evaluation of the original AERS at their respective transit systems and for their assistance in identifying the needs that AERS2 should address. In addition, Ralph Weule and William Fleisher of BART, Donald Dzinski of APTA, and Del Lavery of TSC deserve recognition for their support and encouragement throughout the development of AERS.

## METRIC / ENGLISH CONVERSION FACTORS

### ENGLISH TO METRIC

#### LENGTH (APPROXIMATE)

- 1 inch (in) = 2.5 centimeters (cm)
- 1 foot (ft) = 30 centimeters (cm)
- 1 yard (yd) = 0.9 meter (m)
- 1 mile (mi) = 1.6 kilometers (km)

#### AREA (APPROXIMATE)

- 1 square inch (sq in, in<sup>2</sup>) = 6.5 square centimeters (cm<sup>2</sup>)
- 1 square foot (sq ft, ft<sup>2</sup>) = 0.09 square meter (m<sup>2</sup>)
- 1 square yard (sq yd, yd<sup>2</sup>) = 0.8 square meter (m<sup>2</sup>)
- 1 square mile (sq mi, mi<sup>2</sup>) = 2.6 square kilometers (km<sup>2</sup>)
- 1 acre = 0.4 hectares (he) = 4,000 square meters (m<sup>2</sup>)

#### MASS - WEIGHT (APPROXIMATE)

- 1 ounce (oz) = 28 grams (gr)
- 1 pound (lb) = .45 kilogram (kg)
- 1 short ton = 2,000 pounds (lb) = 0.9 tonne (t)

#### VOLUME (APPROXIMATE)

- 1 teaspoon (tsp) = 5 milliliters (ml)
- 1 tablespoon (tbsp) = 15 milliliters (ml)
- 1 fluid ounce (fl oz) = 30 milliliters (ml)
- 1 cup (c) = 0.24 liter (l)
- 1 pint (pt) = 0.47 liter (l)
- 1 quart (qt) = 0.96 liter (l)
- 1 gallon (gal) = 3.8 liters (l)
- 1 cubic foot (cu ft, ft<sup>3</sup>) = 0.03 cubic meter (m<sup>3</sup>)
- 1 cubic yard (cu yd, yd<sup>3</sup>) = 0.76 cubic meter (m<sup>3</sup>)

#### TEMPERATURE (EXACT)

$$[(x - 32)(5/9)]^{\circ}\text{F} = y^{\circ}\text{C}$$

### METRIC TO ENGLISH

#### LENGTH (APPROXIMATE)

- 1 millimeter (mm) = 0.04 inch (in)
- 1 centimeter (cm) = 0.4 inch (in)
- 1 meter (m) = 3.3 feet (ft)
- 1 meter (m) = 1.1 yards (yd)
- 1 kilometer (km) = 0.6 mile (mi)

#### AREA (APPROXIMATE)

- 1 square centimeter (cm<sup>2</sup>) = 0.16 square inch (sq in, in<sup>2</sup>)
- 1 square meter (m<sup>2</sup>) = 1.2 square yards (sq yd, yd<sup>2</sup>)
- 1 square kilometer (km<sup>2</sup>) = 0.4 square mile (sq mi, mi<sup>2</sup>)
- 1 hectare (he) = 10,000 square meters (m<sup>2</sup>) = 2.5 acres

#### MASS - WEIGHT (APPROXIMATE)

- 1 gram (gr) = 0.036 ounce (oz)
- 1 kilogram (kg) = 2.2 pounds (lb)
- 1 tonne (t) = 1,000 kilograms (kg) = 1.1 short tons

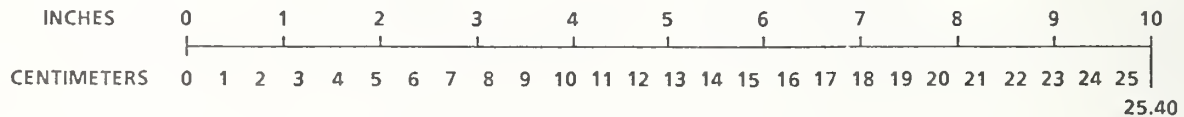
#### VOLUME (APPROXIMATE)

- 1 milliliter (ml) = 0.03 fluid ounce (fl oz)
- 1 liter (l) = 2.1 pints (pt)
- 1 liter (l) = 1.06 quarts (qt)
- 1 liter (l) = 0.26 gallon (gal)
- 1 cubic meter (m<sup>3</sup>) = 36 cubic feet (cu ft, ft<sup>3</sup>)
- 1 cubic meter (m<sup>3</sup>) = 1.3 cubic yards (cu yd, yd<sup>3</sup>)

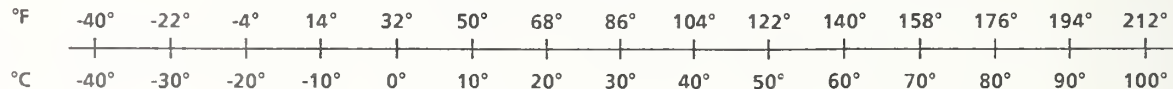
#### TEMPERATURE (EXACT)

$$[(9/5)y + 32]^{\circ}\text{C} = x^{\circ}\text{F}$$

### QUICK INCH-CENTIMETER LENGTH CONVERSION



### QUICK FAHRENHEIT-CELCIUS TEMPERATURE CONVERSION



For more exact and/or other conversion factors, see NBS Miscellaneous Publication 286, Units of Weights and Measures. Price \$2.50. SD Catalog No. C13 10 286.

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## I. INTRODUCTION

This report presents an overview of the second generation Automated Emergency Response System (AERS2). Developed to assist transit systems in responding effectively to emergency situations, AERS2 is a microcomputer-based information retrieval system that provides train controllers, dispatchers, and supervisors with quick and accurate information. In contrast to the original AERS<sup>1</sup> (hereafter referred to as AERS1), AERS2 provides information through a color schematic map of a one-mile length of track on the upper half of the computer display screen and textual information on the lower half of the screen.

The basic features of AERS2 are

1. AERS2 software is designed to meet train controller needs, and its development has been guided by transit system personnel during the entire development process.
2. AERS2 provides system information rapidly in map form.
3. The software was developed for any PC-XT compatible-or-higher MS-DOS based microcomputer with at least 640K of random access memory (RAM), a 10-megabyte hard drive, a color graphics board, an internal clock, and a medium-resolution color monitor.
4. The software is based on the dBase III database management system. However, it is not necessary to have dBase III to run AERS2, since the actual code is executable object code compiled from a dBase III source program.
5. Cost and space requirements for the hardware are low, allowing multiple units in a control room, thus providing a highly reliable, accessible AERS2 emergency-information retrieval capability.

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<sup>1</sup>Described by J.F. Petrie and W.T. Hathaway in Development of an Automated Emergency Response System (AERS) for Rail Transit Systems, U.S. Development of Transportation, Transportation Systems Center, Interim Report, October 1984.

6. The fundamental concept of AERS2 is based on AERS1, which has been satisfactorily in operation at the San Francisco Bay Area Rapid Transit District (BART), the Washington Metropolitan Area Transit Authority (WMATA), and the Port Authority Transit Corporation (PATCO) for the past four years.

AERS2 provides transit systems with four major benefits:

Benefit 1 - AERS2 provides prompt, complete, and clear emergency information in one location. The basic function of AERS2 is to provide, quickly and in one location, a color schematic map of an appropriate track section of the transit system, showing all relevant emergency related features. These features include the type of area (subway, grade, elevated, etc.), critical access points, third rail sections, stations, station phones, emergency phones, cross passage doors, track crossovers, intersecting streets, fire department phones, and fire emergency procedures. By providing these features, AERS2 saves controllers and emergency response organizations the need to search through various maps, charts, lists, and handbooks which may be scattered over several locations. This information eliminates the need to rely on memory for information which, by definition of an emergency, is needed only once in a great while. With AERS2, controllers can immediately and dependably obtain the critical data and procedures necessary in an emergency situation.

Benefit 2 - AERS2 facilitates planning, training, and coordination with outside emergency response organizations. Rail transit systems do not react to emergencies by themselves. Other emergency response organizations, particularly fire departments, medical personnel, and police, also have a role. In addition, each of these organizations has its own emergency procedures to carry out. A rail transit system must coordinate its response actions with those of the other emergency organizations. This coordination must be done quickly, surely, and with no mistakes or misunderstandings. In using AERS2, a rail transit system can plan emergency response procedures with emergency response organizations, train transit personnel, facilitate training of emergency response organization personnel, and coordinate their mutual responses when an emergency actually takes place.

Benefit 3 - AERS2 ensures that all important information is available for consideration, regardless of controller experience. By providing detailed information on the specific location where the emergency occurs, as well as specific procedures to follow, AERS2 provides controllers with immediate information and decision-making aids to assist in responding to the emergency situations. In addition, by having this information at hand, controllers will be under less stress in an emergency situation.

Aside from the obvious benefits for the controllers themselves, the information provided will also lead to better controller handling of personnel and equipment, more consistent actions among controllers, and fewer mistakes.

Benefit 4 - AERS2 is flexible, inexpensive, and independent of the main computer system. AERS2 can run on a large variety of readily available microcomputers (any IBM PC-XT compatible microcomputer using MS-DOS with at least 640K of RAM, a 10-megabyte hard drive, a color graphics board, an internal clock, and a medium-resolution color monitor). These can be purchased at very reasonable prices. Furthermore, as a stand-alone system independent of the main computer system, it not only remains functioning in case of main computer failure, but provides a key backup of important emergency information in such a case. Also as a stand alone, it serves to make the emergency-information system more secure.

The unique features of AERS2 and the benefits it provides to transit systems make it an ideal decision-making tool to assist in responding to emergency situations.

The following sections describe further the development and operation of AERS2. Section 2 provides a background and history of AERS2. Section 3 provides a detailed description of AERS2 data files. Section 4 presents the operation and the various functions of AERS2. Finally, Section 5 discusses the current status of AERS2 and provides conclusions and recommendations for further action.



## 2. HISTORY OF AERS2

The goal of any safety program should be to provide the highest practical level of safety. Accomplishing this goal requires not only the prevention of all accidents possible, but also the ability to effectively respond to accidents which do occur. Recognizing the need for effective response to accidents, the Urban Mass Transportation Administration (UMTA) asked the Transportation Systems Center (TSC) to work with the rail transit industry in the preparation of Emergency Preparedness Guidelines<sup>2</sup>. These guidelines address the need for planning, training, and preparing facilities, tools, and equipment to respond to rail transit emergencies. AERS2, described in this report, represents a significant tool that the train control personnel may use in responding to emergency situations.

When a rail transit system emergency occurs, time is of the essence. Train controllers and transit emergency personnel need to know what to do immediately. They need to know the location of many critical facilities such as access points, third rail power circuits, and emergency phones. Effectively responding to an emergency requires the controller to follow one of many procedures. Critical time can be lost if a controller has to look through handbooks, drawings, and catalogs for response information.

The concept of using microcomputers to provide emergency transit information was first implemented at BART in 1979. In that year, a serious fire took place in the BART Transbay Tube. What became apparent during this incident was the critical importance of having the proper emergency information and procedures immediately at the fingertips of train controllers. As a result, a microcomputer-based information retrieval system (AERS1) was designed and implemented. This system was written in the BASIC programming language and operated on an Apple II computer. AERS1 displayed, on the screen, emergency procedures and data, expressed as text, about the selected location.

In 1982, under UMTA's sponsorship, TSC, in cooperation with the BART developers, demonstrated AERS1 to transit officials at workshops and on-site at several transit

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<sup>2</sup>Developed by W.T. Hathaway, S.H. Markos, and R.J. Pawlak in Recommended Emergency Preparedness Guidelines for Rail Transit Systems, U.S. Department of Transportation, Transportation Systems Center, Final Report, 1985.

systems. Of the transit systems which expressed interest in AERS1, two of them, WMATA and PATCO, were selected as demonstration sites. The original BART software was modified to create versions of AERS1 for each site. Controllers at both transit systems expressed strong satisfaction and interest and, in fact, modified and expanded the originally supplied software on their own initiative.

In 1984, an effort was begun to significantly modify and update AERS1. Since AERS1 was originally developed, microcomputer hardware and software technology has improved considerably. Hard disks, with nearly an order of magnitude additional storage capacity, have largely replaced floppy disks as the primary storage media. The capacity of the internal RAM of microcomputers has more than quadrupled. High-resolution color monitors have become readily available at reasonable prices. Database management systems which had only been available before on mainframes and minicomputers now run on microcomputers as well, allowing the ready organization, retrieval, and modification of critical data.

Because of this improvement in technology and software, UMTA and TSC, with guidance from transit users of BART, WMATA, and PATCO, decided to redevelop AERS1 as a database-oriented graphics display system (AERS2). The use of a database management system allows a rail transit system to modify AERS2 as its needs change. It also allows a rail transit system not currently using AERS2 to implement it at its site. Implementation at a new transit system requires the identification of the complete facility and location data and the entry of that data into the AERS2 database, a detailed process which is assisted by the Maintenance Section described in section 4.4.2. It also requires the development and programming of ventilation and evacuation algorithms. The use of color character graphics provides a means to display the critical emergency information on a schematic map of the appropriate section of track, allowing the train controllers to comprehend the information more quickly and accurately. The construction of AERS2 to run on an IBM-compatible microcomputer with a color graphics monitor allows rail transit systems to acquire and use AERS2 with inexpensive computer equipment, often with minimal or no change to existing equipment.



### 3. DESIGN OF AERS2 COMPONENTS, DATA FILES, AND DATA FLOW

AERS2 consists of three major elements: hardware, software, and data. The hardware is readily available commercially. The software is available through TSC and is based on dBaseIII. The data files currently in place are those of BART and can be revised for other transit systems.

AERS2 hardware consists of a PC-XT compatible-or-higher MS-DOS microcomputer with at least 640K of RAM, a hard disk with a capacity of at least 10 megabytes, and an internal clock. The results are displayed on a medium-resolution color graphics monitor controlled by a color graphics adaptor (CGA), an enhanced graphics adaptor (EGA), or a VGA board or equivalent. A printer is helpful for documentation but is not necessary for operation of the program.

AERS2 software is based on the dBaseIII database management system. Data files are constructed in dBaseIII format and denoted as .DBF files. However, the dBaseIII source files (.PRG), though originally written in dBaseIII, are compiled from dBaseIII into machine language (object code) using the Clipper compiler. Therefore, AERS2 does not use dBaseIII interpreter during execution. This process greatly increases the execution speed of the software, though recompilation would be necessary should the data structure be significantly changed.

AERS2 data consist of three types of files: Facilities Data, Algorithms, and Screen Layout (containing symbol data). Facilities Data files describe the various transit system facilities, containing a facility description and either a track location or interval description depending on the type of facility. Algorithm files contain algorithms which analyze the fire emergency problem and provide the correct ventilation and evacuation procedures. Symbol data (contained in Screen Layout files) are the symbols used in the AERS2 graphics displays, together with what they represent.

There are two types of locations for Facilities Data files: point location and interval location.

Point-location data represent facilities which are placed at specific locations on the track line. Data files for such facilities list the facility identifier and the facility track location. Point-location facilities data include

- Stations
- Access points
- Doors
- Fans/Vents
- Emergency phones
- Crossovers
- Streets

Interval-location data represent facilities which exist throughout the system. Unlike the case with point-location facilities, every track location has an interval-location facility. Data files for such facilities list the facility identifier and the starting and ending points of the interval for which that identifier applies. Note that except for the end points of the track, each ending point of an interval is also the starting point for the next interval. Interval-location facilities data include

- Third rail section
- Type of area
- Control zones

Ventilation and evacuation procedures form the key to the Fire Emergency Response Section of AERS2. This source code is in the form of algorithms (found in Algorithm files) which accept fire and train location as input and return fan/vent settings and evacuation information for display on the upper half of the screen.

Symbol data (contained in Screen Layout files) determine the ASCII character symbols, color, and row positions on the screen for display of the AERS2 data. By having symbol data as an explicit file, AERS2 allows the screen design to be easily and flexibly changed. Symbol data include the type of symbol for each facility and the row location which the symbol occupies on the screen display.

These three types of files interact to fill the two display screens (FIRE EMERGENCY SCREEN and OTHER EMERGENCY SCREEN) on the monitor. Each screen is composed of two segments. The way the three types of data files interact and the screens to which they supply information are shown in figure 3-1. As shown in this figure, the

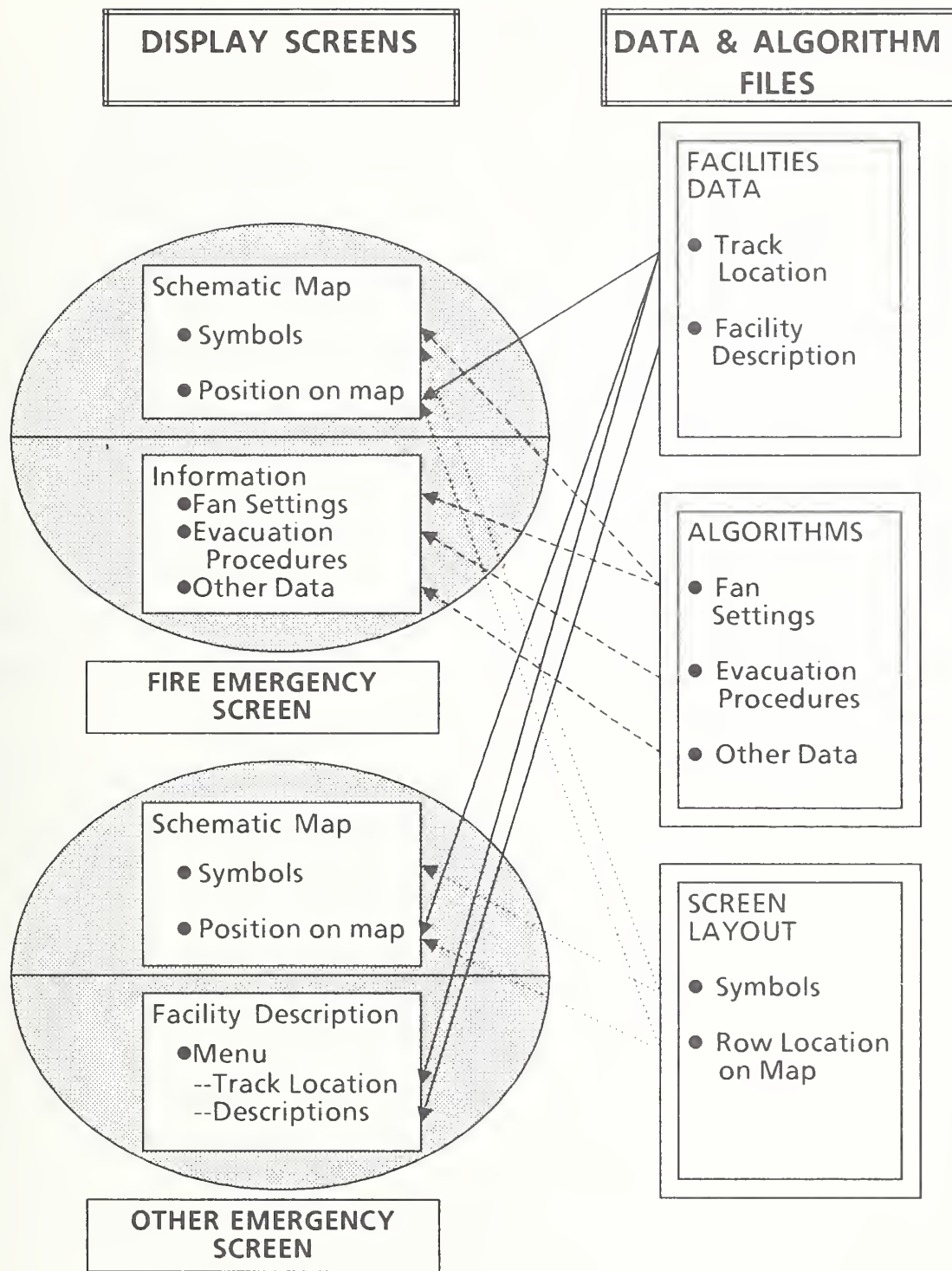


FIGURE 3-1. DATA FLOW TO AERS2 DISPLAYS

data files interact to result in the two screens.

The FIRE EMERGENCY SCREEN, shown in the upper left part of figure 3-1, contains the schematic map on the upper half of the screen and the information for a fire in the location shown on the map on the lower half of the screen. To display the schematic map, the program integrates information from the Facilities Data file about facilities at the fire location with information from the Screen Layout file about which symbols are used to represent the facilities at the fire location and in which row locations they appear. To display the information for a fire in this location, the computer uses the algorithms to identify the correct procedures. The fan setting determined by the algorithm is also reflected on the schematic map by highlighting the fans which the algorithms stipulate.

The OTHER EMERGENCY SCREEN, shown in the lower left part of figure 3-1, contains the schematic map on the upper half of the screen and facilities descriptions on the lower half of the screen. Displaying the schematic map involves the same procedures as above. To display the facilities descriptions, the computer accesses the Facilities Data file.

#### 4. DESCRIPTION OF AERS2 OPERATION

AERS2 comes recorded on four floppy disks. To install it on the hard disk of your microcomputer, make a directory, and copy each of the four disks into that directory. The commands are:

```
md \ aers2      {This command makes a directory called aers2}
cd \ aers2     {This command moves you into the directory called aers2}
(insert first disk into floppy drive 'a')
copy a:*. *    {This command copies all the files from the floppy in drive a
               into the directory called aers2}
(insert second disk into floppy drive 'a')
copy a:*. *
(insert third disk into floppy drive 'a')
copy a:*. *
(insert fourth disk into floppy drive 'a')
copy a:*. *
```

The floppy disks are not needed thereafter, though they should be kept as a backup.

After loading program files and data, the "config.sys" file on your computer must be changed. This is done by changing the directory and editing the "config.sys" file.

```
Cd \           < returns the user to the root directory >
Edlin config. sys < uses the DOS line editor to change the file >
L             < lists the file >
(#)          < enter the line number for "Files = " >
Files = 20   < type in "Files = 20" then enter >
(#)          < enter the line number for "Buffers = " >
Buffers = 20 < type "Buffers = 20" then enter >
e           < exits and saves the changes >
```

Turn off your computer or press "CTRL-ALT-DEL" to have the changes entered into the computer memory.

If no "config.sys" file exists, create one using Edlin, as described above.

To activate AERS2, enter the AERS2 Directory on the hard disk (typing "cd \ aers2" if not already in that directory), and then type "aers". After some processing, you will see a system map (shown in figure 4-1). At this point, type any key, and the AERS MAIN MENU (shown in figure 4-2) will appear.

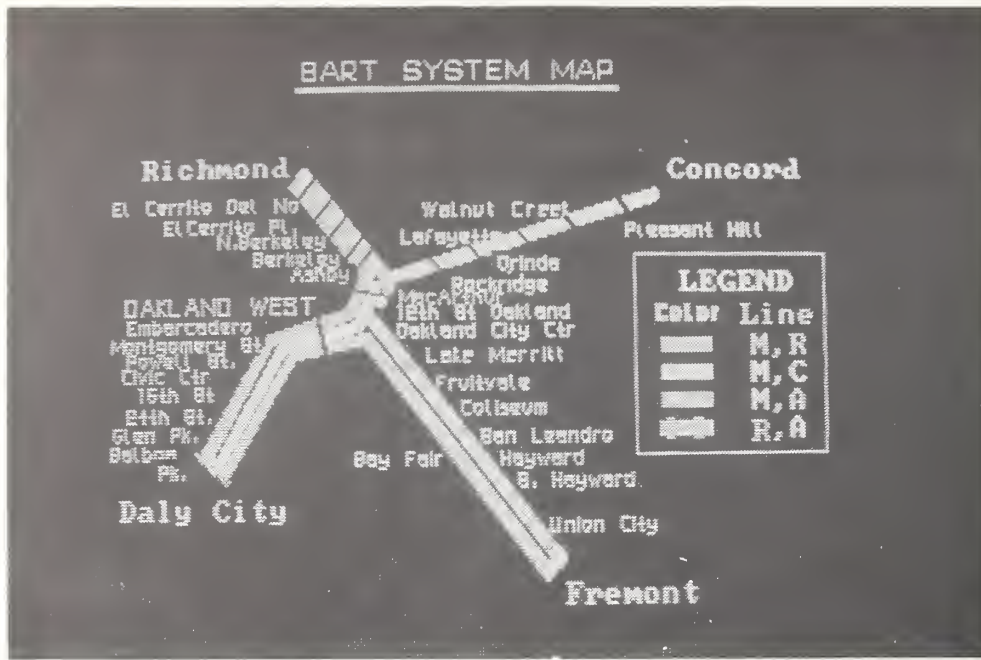


FIGURE 4-1. BART SYSTEM MAP

01/05/89

10:48:14

\* A E R S      M A I N      M E N U \*

TYPE OF RESPONSE
1. TRAIN FIRE EMERGENCY RESPONSES
2. OTHER EMERGENCY RESPONSES
3. EMERGENCY CHECKLIST MENU
4. MAINTENANCE MENU
5. RETURN TO DOS

SCHEDULE	
RICHMOND	CONCORD
11:00	11:03
11:10	11:13
11:20	11:23
DALY CITY	FREMONT
11:00	11:03
11:10	11:13
11:20	11:23

FIGURE 4-2. AERS MAIN MENU

## 4.1 AERS MAIN MENU

The AERS MAIN MENU shows the basic options offered by AERS2. This is the normal mode of AERS2. In the absence of an emergency or other reason to use AERS2, the AERS MAIN MENU will be shown on the screen. This menu shows that AERS2 is not currently in use, but at the push of a key can be running and available in an emergency.

As shown in figure 4-2, the AERS MAIN MENU consists of three portions: the date and time, a schedule display (SCHEDULE), and an options display (TYPE OF RESPONSE). The date and time derive directly from the microcomputer clock. The SCHEDULE displays the next three scheduled departure times of trains from each of the terminal stations on the transit system. This display, based on a user-supplied schedule and driven by the microcomputer clock, provides information to the train controllers during the large portion of time that AERS2 is not needed for emergency use. The options display (TYPE OF RESPONSE) shows the five options available on AERS2:

1. TRAIN FIRE EMERGENCY RESPONSES

Displays a one-mile schematic map of the transit system centered around a user-supplied location (on the upper half of the screen) and emergency ventilation and evacuation procedures and information (on the lower half of the screen).

2. OTHER EMERGENCY RESPONSES

Displays a one-mile schematic map of the transit system centered around a user-supplied location (on the upper half of the screen) and a menu allowing the display of more detailed information (on the lower half of the screen).

3. EMERGENCY CHECKLIST MENU

Displays appropriate checklists for various types of emergencies. The checklists describe the remedial actions to take for the given type of emergency. The actions are given in general terms not keyed to the specific location and are not accompanied by a schematic map or detailed information.

#### 4. MAINTENANCE MENU

Displays and updates information in the database itself. It is also used to change the colors or symbols used on the schematic map. For security protection of the database, good practice is to copy the Database Maintenance Section (from floppy disk to the hard disk) only when actually updating the database, and then to delete the copy (from the hard disk) after completing the update.

#### 5. RETURN TO DOS

Returns the computer to its operating system. This command is invoked if you wish to otherwise use the computer on which AERS2 is based. When ready to run AERS2 again, follow the instructions for activating AERS2 in the previous section.

Sections 4.2, 4.3, and 4.4 describe, in detail, the TRAIN FIRE EMERGENCY RESPONSES, OTHER EMERGENCY RESPONSES, and MAINTENANCE MENU, respectively.

#### 4.2 TRAIN FIRE EMERGENCY RESPONSES

To use the TRAIN FIRE EMERGENCY RESPONSES portion of AERS2, select option 1 from the AERS MAIN MENU. The screen will then show the display in figure 4-3, prompting you for the first of three critical input values. These are the track location of train (TRACK LOCATION), the number of cars in the train (TRAIN LENGTH), and the location of the fire relative to the train (FIRE LOCATION).

The TRACK LOCATION is the first required input. This can be given in three formats: MILEPOST-AND-TRACK, ZONE-AND-TRACK, or ZONE-INTERVAL-AND-TRACK. The MILEPOST-AND-TRACK format, the most commonly used, takes the form "xLt", where "x" is the milepost value, "L" the transit line, and "t" the track (for example, "7.0M1" refers to track "1" at milepost "7.0" on the "M" Line at BART). The ZONE-AND-TRACK format takes the form "Z-t", where "Z" is the zone designation and "t" is the track. (For example, "M16-2" refers to track "2" at zone "M16", Embarcadero Station; note that the dash ["-"] is always used in this format.) The ZONE-INTERVAL-AND-TRACK format takes the form "Z1-Z2-t", where "Z1" is a zone designation, "Z2" an adjacent zone designation, and "t" the track. (For example,



- 1 - TRACK LOCATION ?
- 2 - TRAIN LENGTH ?
- 3 - FIRE LOCATION ?

ACCEPTABLE FORMATS:

```

<MILEPOST><LINE><TRACK><'R'>
<ZONE>--<TRACK><'R'>
<ZONE>--<LINE><TRACK><'R'>
<ZONE>--<ZONE>--<TRACK><'R'>
--> ZONES MUST BE ADJACENT

```

FIGURE 4-3. TRAIN FIRE EMERGENCY RESPONSES

"M16-M20-2" refers to track "2" in the interval between zones "M16", Embarcadero Station, and "M20", Montgomery St. Station.) In any of the three formats, the letter "R" after the track number means the train is running in the reverse direction on that track.

Once the TRACK LOCATION is given, as shown in figure 4-4, AERS2 displays the schematic map on the upper half of the screen. The map is a key element of the data display and shows the segment of the line under consideration for  $\frac{1}{2}$  mile in either direction from the location of the fire. (If the location is closer than  $\frac{1}{2}$  mile to the beginning of the line, the first mile of the line is shown.) The  $\frac{1}{2}$  mile in either direction is used in both the TRAIN FIRE EMERGENCY RESPONSES display and the OTHER EMERGENCY RESPONSES display.

In the schematic map, two tracks are usually shown, one in each direction. However, certain sections have three or four tracks (due to a pocket track, an end of the line track, or dual trackage prior to a diverge point), in which case the extra tracks are displayed as well. The tracks are displayed in the same orientation as they

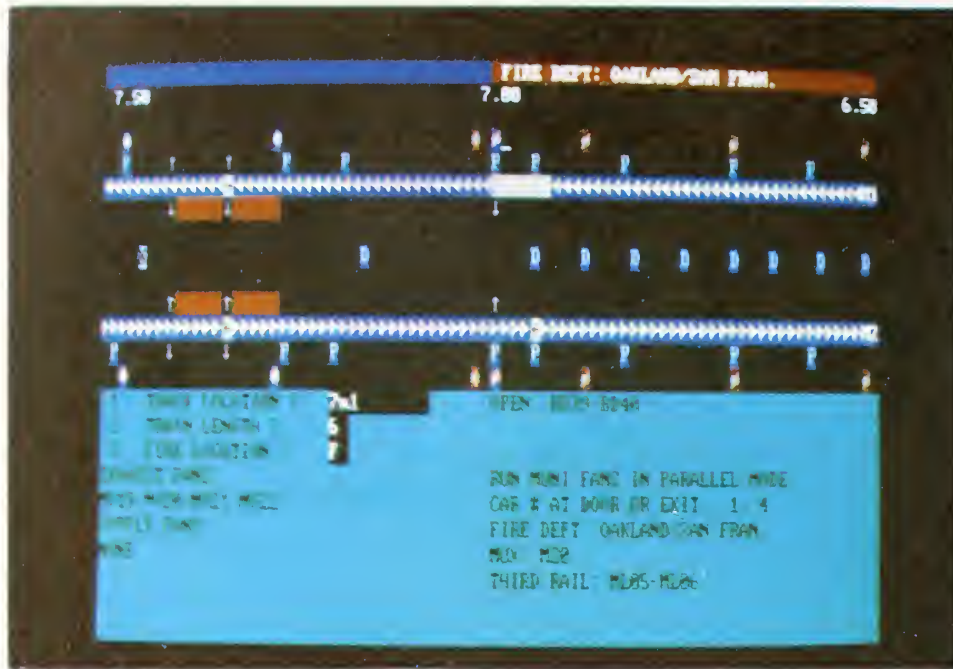


FIGURE 4-4. TRACK LOCATION, TRAIN LENGTH, AND FIRE LOCATION

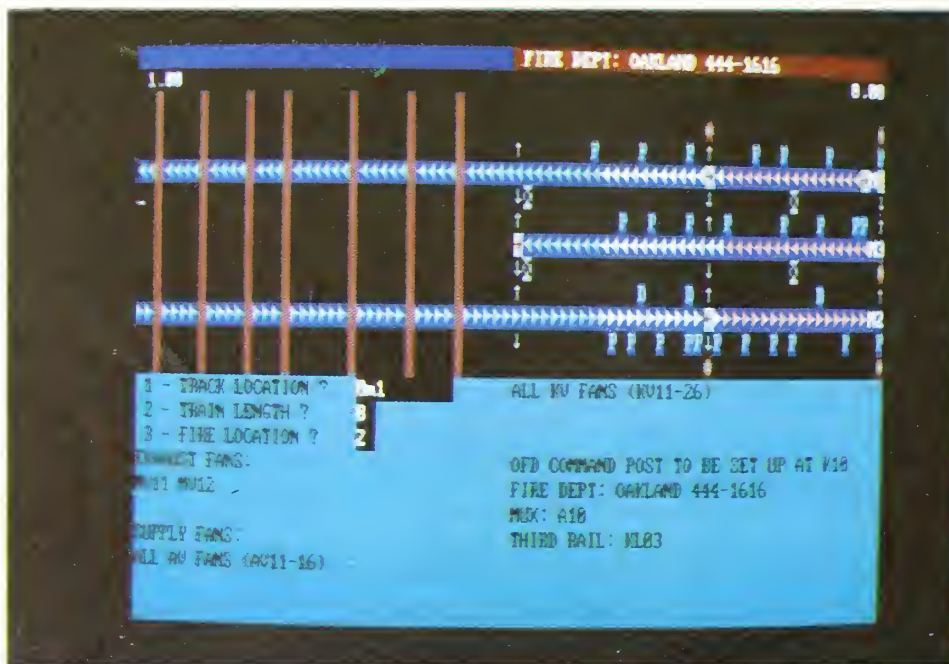


FIGURE 4-5. EXAMPLE OF OTHER TRAIN FIRE LOCATION

are shown in the train control room. On the BART system, the milepost numbers on the "M" (Main/Daly City) and "R" (Richmond) lines increase from right to left (as shown in Figure 4-4); however, the milepost numbers on the "A" (Alameda/Fremont) and "C" (Concord) lines move in the opposite direction, from left to right. The line designation and track number are shown to the left of the track lines (for example, "M1" means the "M" line, track "1"). For each transit system, AERS2 can be configured so that the tracks are displayed in the same orientation as in their respective control rooms.

The tracks are color coded to show the type of area (subway, at surface, elevated, etc.) of the track. The colors in the BART application are as follows:

Subway	White
Surface	Green
Elevated	Blue
Tunnel (unventilated)	Black
Transbay Tube	Yellow
Transbay Tube approach	Magenta
Berkeley Hills Tunnel	Red

Boundaries between successive third rail segments are shown by arrows (← or →) in the track line. Cross passage doors between two tracks are shown by the letter "D" at the proper location.

The map shows further information alongside the track lines. Access points to a set of tracks are displayed as arrows (↑ or ↓) on the row on the screen just inside the track line (i.e., the row below the upper track line or the row above the lower track line). Station platforms are displayed as bars ("—") on either the inside or the outside row. (Note that, because any station is by definition an access point to the system, the station symbol has an access arrow in its center.)

Displays for emergency phones, ventilation fans, and dampers are shown on the rows outside the track lines. Phones are shown by the letter "P", fans by the symbol "\*", and dampers by the symbol "Ø".

Milepost designations are shown on the top line of the map, at the extreme left-hand side, the center, and the extreme right-hand side, in the same orientation (increasing or decreasing from right to left) as the tracks themselves. Since each

map shows a one-mile segment, the left and right mileposts are separated by one mile from each other and by  $\frac{1}{2}$  mile from the center milepost. The name of the relevant fire department also appears on the top line.

With the track location having been provided, the second item requested by AERS2 is the length of the train (TRAIN LENGTH), as shown in Figure 4-4. In the BART configuration, this can be between two and ten cars.

The final item requested is the location of the fire within the train (FIRE LOCATION). The location can be either a number, or the letters "F", "M", "R", or "U". A number represents the position of the car which has the fire ("1" is the front car, "2" is the second car, etc.). The letter "F" stands for the front of the train (the first car), "M" stands for the middle or halfway point (the middle car), "R" stands for the rear of the train (the last car), and "U" stands for location unknown (in which case the middle of the train is assumed). (Note that this is slightly different from actual BART practice, where "F", "M", and "R" imply anywhere in their respective thirds of the train, rather than in a specific car.)

After the input data have been entered, AERS invokes the ventilation procedures for the specific information at hand and displays on the lower half of the screen the key emergency information. These include fan and damper settings, train position information with respect to tunnel doors and exits, fire departments, third rail (power rail) sections, train control location information, and other messages. As shown in figure 4-4, the ventilation procedures are to set fans "MV19", "MV20", "MV21", and "MV22" to exhaust air from the tunnel, to set no fans to supply air to the tunnel, to open dampers "BD39" and "BD40", and to run the fans for the MUNI tunnel, which lies above the BART tunnel in a mode parallel to that of the BART fans. In addition, these four fans and the two dampers are highlighted on the map. On a color display, fans set in exhaust mode are highlighted in yellow, while those set in supply mode are highlighted in white. The train symbol is also displayed, with the fire car flashing.

The position indication is that cars "1" and "4" are positioned directly at a door or exit. (Note that on the map car "1" is at the tunnel portal, while car "4" is alongside a cross-passage door.) The remaining information shows that one should call the Oakland/San Francisco fire departments, that the train control block ("MUX" or "MULTipleXer") is "M20", and that the train rests on two third rail sections, "ML05" and "ML06".

An example of another location is shown in figure 4-5. This figure illustrates the Oakland "Y" section of BART track at milepost "0" along with the proper ventilation procedures and the street crossings (shown as lines crossing the tracks) in that one-mile section of track.

To return to the AERS MAIN MENU, press any key. To run another TRAIN FIRE EMERGENCY RESPONSES scenario, return to the AERS MAIN MENU, and type "1" to re-enter the TRAIN FIRE EMERGENCY RESPONSES section.

### **4.3 OTHER EMERGENCY RESPONSES**

The TRAIN FIRE EMERGENCY RESPONSES section described above, used in case of fires, asks for TRACK LOCATION (which includes the milepost), TRAIN LENGTH, and FIRE LOCATION and then displays not only the proper schematic map but also ventilation and door evacuation information. If, however, the emergency does not involve a fire, only the milepost location is needed as input, and ventilation and door evacuation information is not required as output. Accordingly, the OTHER EMERGENCY RESPONSES section asks only for the milepost location and displays only the schematic map as output. The lower half of the screen, which in the TRAIN FIRE EMERGENCY RESPONSES section displays the ventilation and evacuation information, is instead available to display further identifying information about the facilities shown on the schematic map.

To use the OTHER EMERGENCY RESPONSES section, enter "2" from the AERS MAIN MENU. This will display the AERS ALTERNATE EMERGENCY PANEL (figure 4-6), providing the options to select the TRACK SECTION DISPLAY (the schematic map), to display the EMERGENCY CHECKLIST MENU, or to return to the MAIN MENU. Entering "1" (TRACK SECTION DISPLAY) will start the display procedure with a query for the TRACK LOCATION (figure 4-7). The location is given in a similar format as for the TRAIN FIRE EMERGENCY RESPONSES section, except that the track number is omitted (for example, "7.5M", "M16", or "M16-M20").

As described in section 4.2 and as shown in figure 4-8, the map will display a one-mile segment of the track on the upper half of the screen and the DISPLAY SELECTION MENU on the lower half of the screen.

\* AERS ALTERNATE EMERGENCY PANEL \*

ALT EMERGENCY OPTION

1. TRACK SECTION DISPLAY
2. EMERGENCY CHECKLIST MENU
3. RETURN TO MAIN MENU

SCHEDULE	
RICHMOND	CONCORD
17:15	17:18
17:20	17:23
17:25	17:28
DALY CITY	FREMONT
17:15	17:18
17:20	17:23
17:25	17:28

FIGURE 4-6. AERS ALTERNATE EMERGENCY PANEL

TRACK LOCATION ?  
ACCEPTABLE FORMATS:  
<MILEPOST> <LINE>  
<ZONE>  
<ZONE>-<ZONE>

FIGURE 4-7. TRACK SECTION DISPLAY: QUERY LOCATION

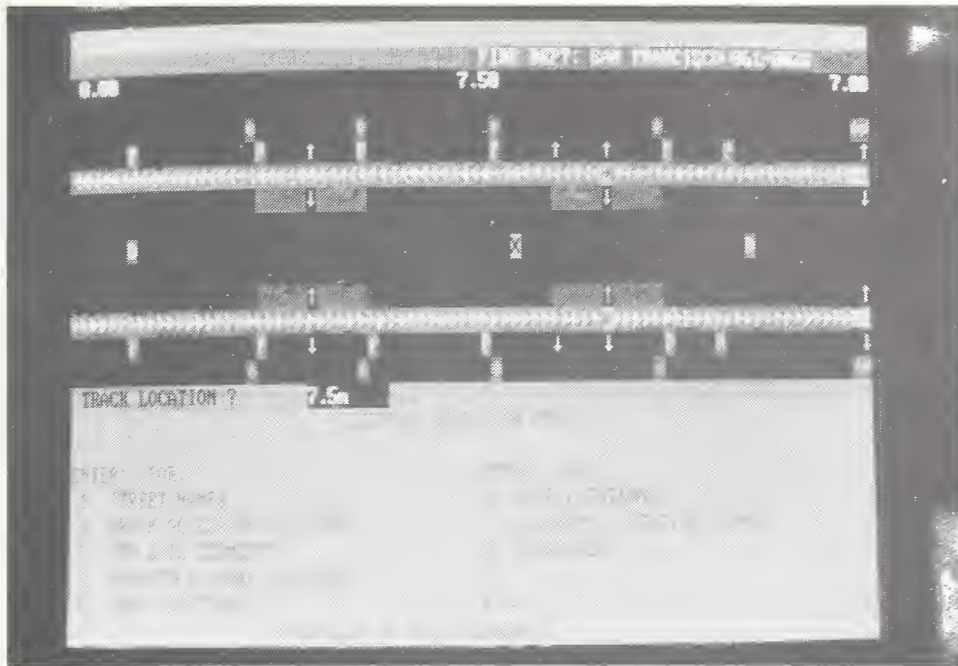


FIGURE 4-8. TRACK DISPLAY: SELECTION MENU

This menu gives the choice to display identifying information for the following items:

1. STREET NAMES
2. TRACK ACCESS DESCRIPTIONS
3. THIRD RAIL SEGMENTS
4. EMERGENCY PHONE LOCATIONS
5. VENT LOCATIONS
6. DOOR LOCATIONS
7. STATIONS / STATION PHONES
8. CROSSOVERS

To display specific information, enter the appropriate number (e.g., for emergency phones, enter "4"). The DISPLAY SELECTION MENU will be replaced by a listing of identifying information for the indicated facility or, if no such facilities exist within the displayed map segment on the upper half of the screen, by the message NO [name of facility] IN THIS AREA. The listing displayed consists of the milepost

location, track number if appropriate, name, and other information as required for each facility (for example, see figures 4-9 through 4-12). For the BART "M" line, figures 4-9 through 4-12 show track schematics and equipment at various mileposts. Figure 4-9 shows the street names between mileposts ".05" and "1.05". The streets are represented by the vertical bars, and their mileposts and names are given. The track number is not given because it does not pertain to street location. Figure 4-10 shows the emergency phone locations between mileposts "9" and "10", listing milepost, line, and number ("M510" is the number of the first phone). Figure 4-11 shows the vent locations between mileposts "12" and "13", listing the same information as above. Figure 4-12 shows the message NO STREET CROSSINGS IN THIS AREA, which is clear from the absence of bars on the schematic map.

As mentioned previously, the schematic map is invoked by entering "1" at the AERS ALTERNATE EMERGENCY PANEL. In a similar manner, entering "2" (at this menu) will display the EMERGENCY CHECKLIST MENU.

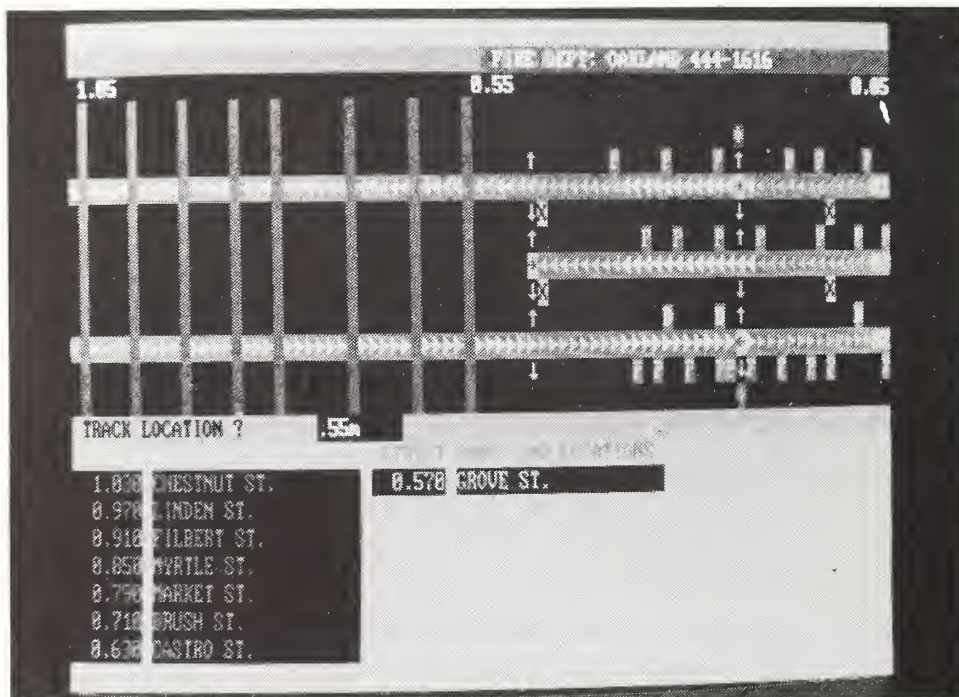


FIGURE 4-9. TRACK DISPLAY: STREET NAMES



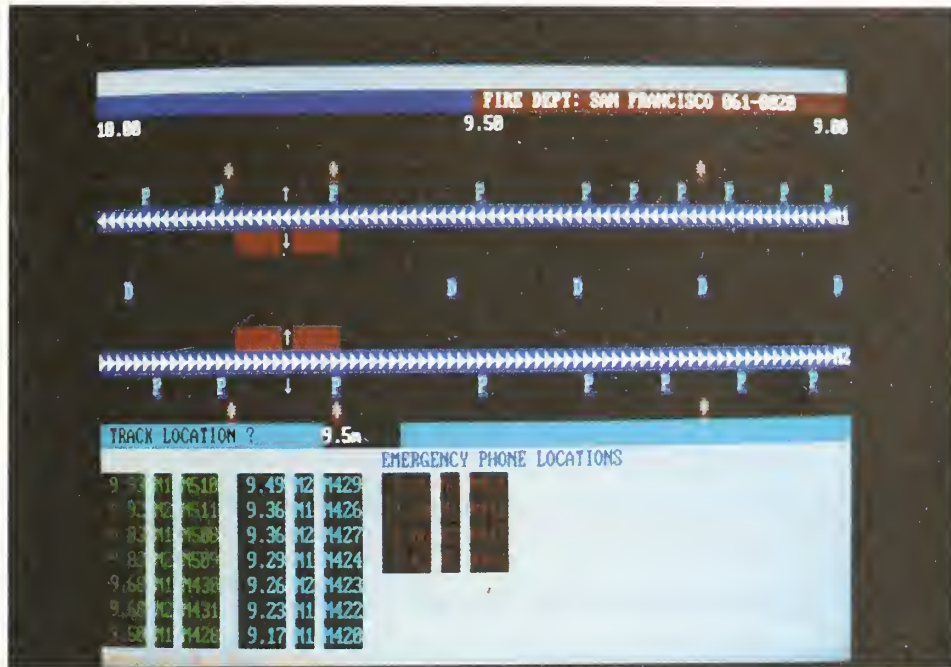


FIGURE 4-10. TRACK DISPLAY: EMERGENCY PHONE LOCATIONS



FIGURE 4-11. TRACK DISPLAY: VENT LOCATIONS

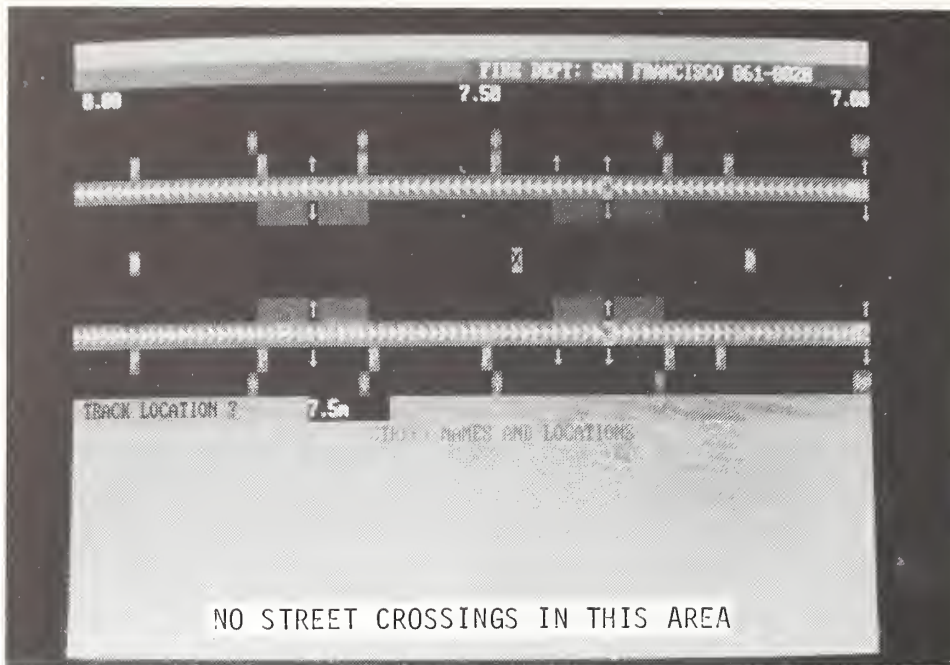


FIGURE 4-12. TRACK DISPLAY: NO STREET CROSSINGS

#### 4.4 MAINTENANCE MENU

Any information system needs to be maintained and updated as situations and needs change. AERS2 has software to carry out this function without the need to invoke dBaseIII commands. The software allows you to list all locations of a selected facility type within a given milepost range (a useful tool for identifying the milepost locations of records for maintenance purposes), as well as to add, edit, or delete records.

A word of caution for this part of AERS2: unlike the other sections, the Maintenance Section allows changes to the underlying data. To guard against inadvertent loss of data or introduction of incorrect data, use of this section should be well controlled. In lieu of a password-protection feature, the programs for the Maintenance Section should be kept on a separate floppy disk and put into the computer itself only when they are actually being used. Only those people responsible for the completeness and integrity of vital emergency information should have access to this section.

#### 4.4.1 Display Section

This Display Section is used to list locations of a specific facility within an entire transit line or a segment of more than one mile. (While this section can also be used for segments of one mile or less, the OTHER EMERGENCY RESPONSES section, invoked by entering "2" at the AERS MAIN MENU, better carries out this function.)

To list data in a given database file, enter "4" on the AERS MAIN MENU. This will display the MENU FOR MAINTENANCE (figure 4-13). Enter "2" for the data listing function. A list of facilities to choose from will be displayed. Enter the corresponding number, and then, as queried, the line designation and the milepost interval (figure 4-14). To display data for the whole line, enter "0" for the starting milepost and a very high number such as "99" for the ending milepost. AERS2 will then show a list of all facilities of the type chosen, which lie within the selected milepost range on the designated line (figure 4-15). A message DISPLAY NEXT SCREEN OR RETURN TO MENU (N/R) will appear at the bottom of the screen. If there are more facilities than space on the screen, entering "N" will display the next screen of facilities, while entering "R" will return to the MENU FOR MAINTENANCE. If the first screen is not full, either "N" or "R" will return to the MENU FOR MAINTENANCE.

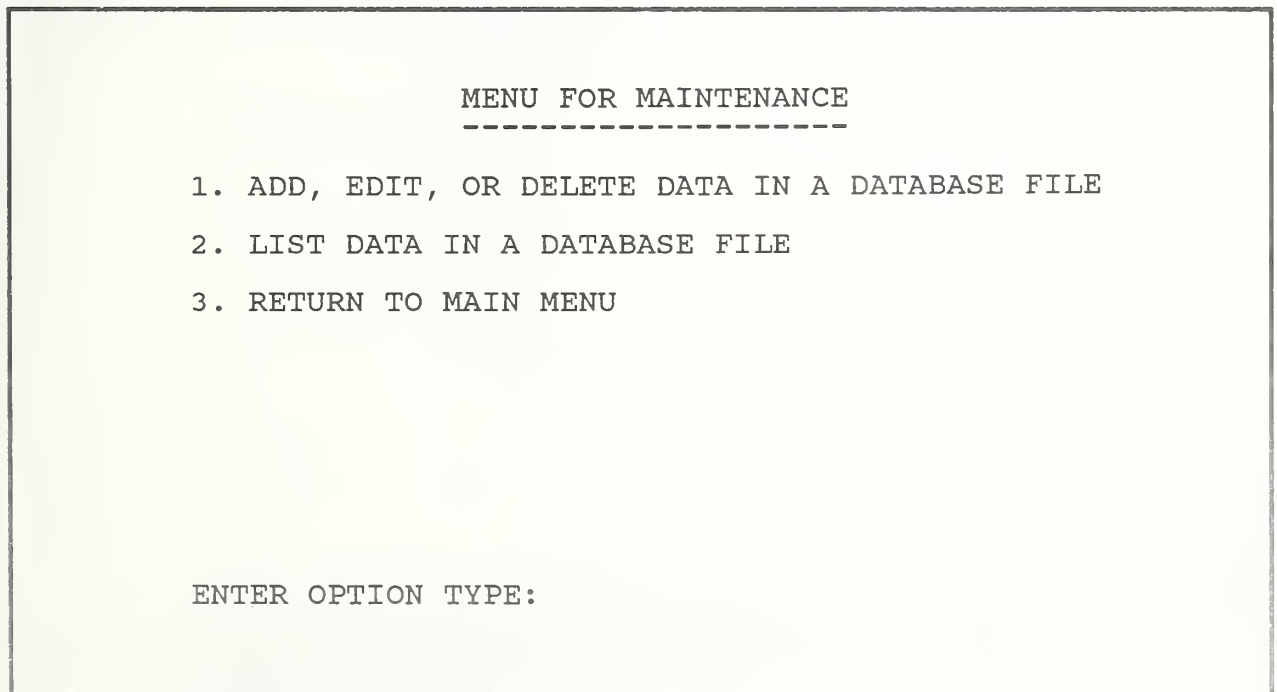


FIGURE 4-13. MENU FOR MAINTENANCE

1. FANS/VENTS
2. PORTALS
3. ACCESSES/STATIONS
4. STREETS
5. EMERGENCY PHONES
6. TRAIN CONTROL INTERFACES
7. THIRD RAIL SEGMENTS
8. FIRE DEPARTMENTS
9. TYPE OF AREA
10. RETURN TO PREVIOUS MENU

ENTER STARTING & ENDING MILEMARK:             6.000  
   8.000

ENTER LINE DESIGNATION: M

ENTER OPTION TYPE: 1

FIGURE 4-14. LIST OF FACILITIES: FILE MAINTENANCE

LINE: M	FANS/VENTS	DISPLAY
6.147 M1 BD29	7.626 M2 MV24	
6.147 M2 BD30	7.765 M1 MV25	
6.334 M1 BD31	7.765 M2 MV26	
6.334 M2 BD32		
6.522 M1 BD33		
6.522 M2 BD34		
6.698 M1 BD35		
6.698 M2 BD36		
6.886 M1 BD37		
6.886 M2 BD38		
7.000 M1 BD39		
7.000 M2 BD40		
7.013 M1 BV03		
7.013 M2 BV04		
7.270 M1 MV19		
7.270 M2 MV20		
7.475 M1 MV21		
7.475 M2 MV22		
7.626 M1 MV23		

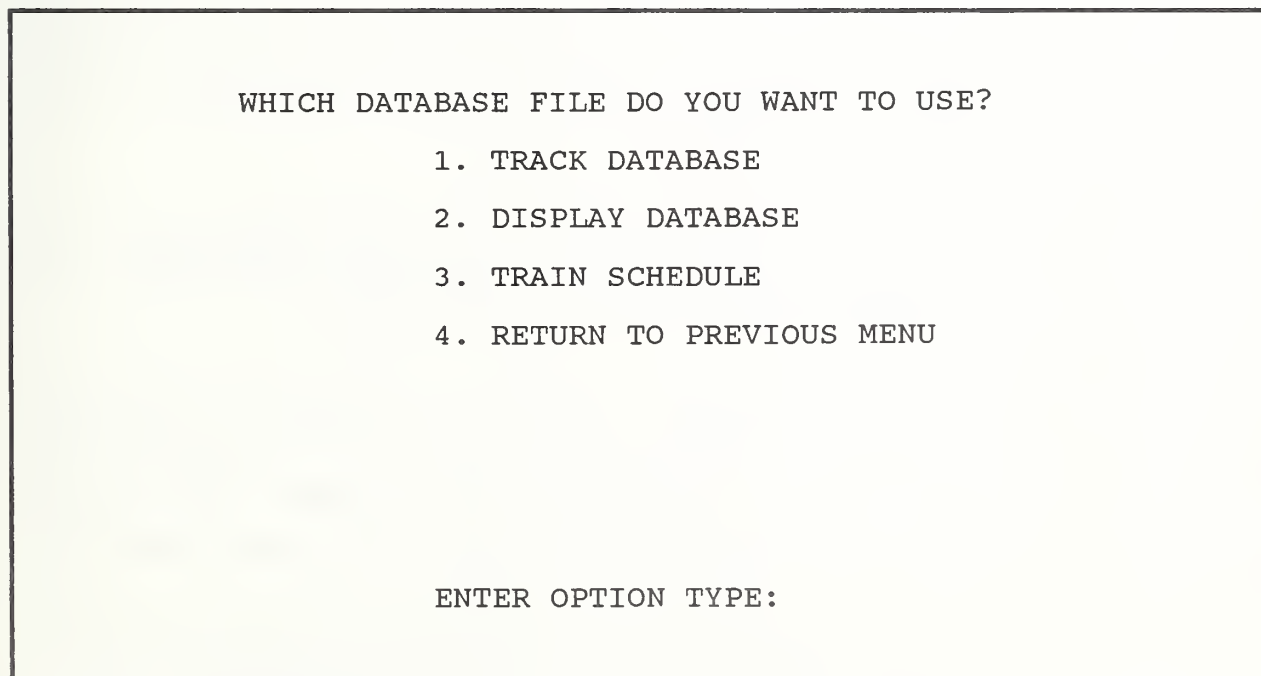
DISPLAY NEXT SCREEN OR RETURN TO MENU (N/R):

FIGURE 4-15. LIST OF FANS/VENTS: FILE MAINTENANCE

#### 4.4.2 Maintenance Section

The Maintenance Section adds, edits, and deletes records from the underlying AERS database. As mentioned above, this section should be used with caution and only by appropriate personnel. To invoke this section, enter "1" on the MENU FOR MAINTENANCE. This will display the SELECTION MENU FOR DATABASE MAINTENANCE (figure 4-16), allowing changes in either the track, display, or schedule databases. The TRACK DATABASE contains the various facilities, as well as their descriptions and locations, while the DISPLAY DATABASE contains the screen locations, characters, and colors used to display each facility on the screen. The TRAIN SCHEDULE database contains the train schedule used for the interactive SCHEDULE display on the AERS MAIN MENU and the AERS ALTERNATE EMERGENCY PANEL.

**4.4.2.1 Editing the Track Database** - Entering "1" on the SELECTION MENU selects the TRACK DATABASE for editing. After asking for the transit line in which the TRACK DATABASE is to be updated, the system produces the MENU FOR TRACK DATA (figure 4-17), which asks for the action desired. Possible actions are to add a new record or to edit or to delete an existing record.



```
WHICH DATABASE FILE DO YOU WANT TO USE?

1. TRACK DATABASE
2. DISPLAY DATABASE
3. TRAIN SCHEDULE
4. RETURN TO PREVIOUS MENU

ENTER OPTION TYPE:
```

FIGURE 4-16. SELECTION MENU FOR DATABASE MAINTENANCE

To add a new record, the system, after obtaining user confirmation, asks for the milepost location (figure 4-18) where the new record is to appear (the transit line was already entered from the SELECTION MENU); it then displays a blank form (figures 4-19a and 4-19b) consisting of two screens. (If a record already exists for the milepost, the message THE MESSAGE EXISTS ALREADY! will be displayed; in that event, use the EDIT A RECORD option to update the record as desired.) Insert the new information line by line, using "Enter" by itself to skip past unneeded lines. (Note -- be sure to enter the same milepost as was entered above, and the same transit line designation as was entered from the SELECTION MENU.) When the screen is completed or when "Escape" is pressed, the message CONFIRM ENTRIES? (Y/N) will appear. Enter "Y" to insert the information as shown into the database, or "N" to cancel it and display a blank screen once again.

To edit an existing record, the system asks (as shown in figure 4-20) for the milepost location of that record. (A major purpose of the Display Section, described in section 4.4.1, is to find the appropriate milepost for a given facility.) The system will then display a form similar to that shown for adding new records, except that the form (figures 4-21a and 4-21b) is already filled in with the existing information. If no record exists for the selected milepost, a message to that effect will appear instead of the form. To edit, move down line by line, making changes as appropriate, or press "Enter" by itself to make no change for a given line. When the screen is completed or when "Escape" is pressed, the message CONFIRM ENTRIES? (Y/N) will appear. Enter "Y" to insert the screen as shown into the database, or "N" to show the original screen again.

To delete a record, the system will ask for the milepost location (figure 4-22), and will then display the record (if it exists). It then asks for confirmation (figure 4-23) and, if "Y" is entered, deletes the record (this may take a minute).

**4.4.2.2 Editing the Display Characteristics** - Entering "2" on the SELECTION MENU selects the DISPLAY DATABASE for edit and produces the MENU FOR DISPLAY DATA (figure 4-24), which lists the various symbols and asks for a selection. After queries, the record for the desired symbol will be displayed. (If a new record is added, the screen will be blank.)

MENU FOR TRACK DATA

1. ADD A RECORD
2. EDIT A RECORD
3. DELETE A RECORD
4. RETURN TO PREVIOUS MENU

ENTER OPTION TYPE:

FIGURE 4-17. MENU FOR TRACK DATA MAINTENANCE

ENTER THE MILEMARK OF THE RECORD TO BE ADDED: 9.300

FIGURE 4-18. EDITING TRACK DATABASE: RECORD TO ADD

```

MILEMARK:                                0.000
LINE:
STATION NAME:
STATION CODE:
STATION TYPE:
STATION PHONE:
ZONE CODE:
ZONE TYPE:
AREA TYPE:
STREET NAME:
TRAIN CONTROL INTERFACE:
FIRE DEPARTMENT NAME:
FIRE DEPARTMENT PHONE:
NUMBER OF TRACKS:                        0
ACCESS:
TRACK ONE ACCESS:
TRACK ONE FAN CODE:
TRACK ONE FAN COMMENT:
TRACK ONE FAN TYPE:
VENTILATION TYPE:
TRACK ONE VENT HILITE:
TRACK ONE 3RD RAIL:
TRACK ONE DOOR CODE:

```

FIGURE 4-19a. TRACK DATABASE RECORD TO BE EDITED

```

TRACK ONE DOOR COMMENT:
TRACK ONE DOOR TYPE:
PORTAL TYPE:
TRACK ONE EMERG. PHONE:
TRACK TWO ACCESS:
TRACK TWO FAN CODE:
TRACK TWO FAN COMMENT:
TRACK TWO FAN TYPE:
TRACK TWO VENT HILITE:
TRACK TWO 3RD RAIL:
TRACK TWO DOOR CODE:
TRACK TWO DOOR COMMENT:
TRACK TWO DOOR TYPE:
TRACK TWO EMERG. PHONE:
TRACK THREE ACCESS:
TRACK THREE FAN CODE:
TRACK THREE FAN COMMENT:
TRACK THREE FAN TYPE:
TRACK THREE VENT HILITE:
TRACK THREE 3RD RAIL:
TRACK THREE DOOR CODE:
TRACK THREE DOOR COMMENT:
TRACK THREE DOOR TYPE:
TRACK THREE EMERG. PHONE:
TRACK FOUR ACCESS:
TRACK FOUR FAN CODE:
TRACK FOUR FAN COMMENT:
TRACK FOUR FAN TYPE:
TRACK FOUR VENT HILITE:
TRACK FOUR 3RD RAIL:
TRACK FOUR DOOR CODE:
TRACK FOUR DOOR COMMENT:
TRACK FOUR DOOR TYPE:
TRACK FOUR EMERG. PHONE:
CONFIRM ENTRIES?(Y/N)

```

FIGURE 4-19b. TRACK DATABASE RECORD TO BE EDITED (SECOND SCREEN)



```
WHAT IS THE MILEMARK OF THE RECORD YOU WANT TO EDIT? 9.500
```

FIGURE 4-20. MILEPOST LOCATION OF RECORD TO BE EDITED

An example of a display record is shown in figure 4-25, which describes the ventilation symbols for track "1" on the "M" line. According to this record, a fan is depicted by the symbol "\*" (ASCII character "15"), and a damper is depicted by the symbol "O" (ASCII character "237"). Any occurrence of an "M line, track-1" fan or damper will be displayed on row "4" of the schematic map. (The column is computed based on the milepost of the appropriate facility and the milepost of the map center.) Each symbol is shown in white, with a red background.

By using the "Enter" and "Escape" keys, you can edit the display of the symbols. For example, if you change the ASCII character for the fan to "43" and the foreground color to "G", an "M"-line, track-1" fan will be represented by a green "+" on a red background. (Note that the representation of "M-line, track-2" fans, as well as fans for the other lines, will remain unchanged.)

```

LINE: M
STATION NAME:
STATION CODE:
STATION TYPE:
STATION PHONE:
ZONE CODE:
ZONE TYPE:
AREA TYPE: S
STREET NAME:
TRAIN CONTROL INTERFACE: M60
FIRE DEPARTMENT NAME: SAN FRANCISCO
FIRE DEPARTMENT PHONE: 861-8020
NUMBER OF TRACKS: 2
ACCESS:
TRACK ONE ACCESS:
TRACK ONE FAN CODE:
TRACK ONE FAN COMMENT:
TRACK ONE FAN TYPE:
VENTILATION TYPE:
TRACK ONE VENT HILITE:
TRACK ONE 3RD RAIL: ML09
TRACK ONE DOOR CODE:

```

FIGURE 4-21a. RECORD EDITING FORM

```

TRACK ONE DOOR COMMENT:
TRACK ONE DOOR TYPE:
PORTAL TYPE:
TRACK ONE EMERG. PHONE: M428
TRACK TWO ACCESS:
TRACK TWO FAN CODE:
TRACK TWO FAN COMMENT:
TRACK TWO FAN TYPE:
TRACK TWO VENT HILITE:
TRACK TWO 3RD RAIL: MR08
TRACK TWO DOOR CODE:
TRACK TWO DOOR COMMENT:
TRACK TWO DOOR TYPE:
TRACK TWO EMERG. PHONE:
TRACK THREE ACCESS:
TRACK THREE FAN CODE:
TRACK THREE FAN COMMENT:
TRACK THREE FAN TYPE:
TRACK THREE VENT HILITE:
TRACK THREE 3RD RAIL:
TRACK THREE DOOR CODE:
TRACK THREE DOOR COMMENT:
TRACK THREE DOOR TYPE:
TRACK THREE EMERG. PHONE:
CONFIRM ENTRIES? (Y/N)

```

FIGURE 4-21b. RECORD EDITING FORM (SECOND SCREEN)

WHAT IS THE MILEMARK OF THE RECORD YOU WANT TO DELETE? 9.300

FIGURE 4-22. RECORD TO DELETE

YOU REALLY WANT TO DELETE THE RECORD? (Y/N)

FIGURE 4-23. CONFIRMATION OF RECORD DELETION

```

                                MENU FOR DISPLAY DATA
                                -----
1. AREA TYPE                    9. TRACK 1 VENT.              17. TRACK 4 EMER. PHN
2. LINE                         10. TRACK 2 VENT.            18. TRACK 4 VENT.
3. STREETS                      11. TRACK 3 VENT.            19. TRACK 1 EMER. HILITE
4. STATION TYPE                 12. 3RD RAIL                 20. TRACK 2 EMER. HILITE
5. TRACK ACCESS                 13. CROSSOVERS              21. TRACK 3 EMER. HILITE
6. TRACK 1 EMER. PHN           14. TRACK 1 DOORS            22. TRACK 4 EMER. HILITE
7. TRACK 2 EMER. PHN           15. TRACK 2 DOORS            23. RETURN TO PREV. MENU
8. TRACK 3 EMER. PHN           16. TRAIN

```

ENTER OPTION TYPE:

FIGURE 4-24. MENU FOR DISPLAY DATA

```

AERS                TRACK VENTILATION DISPLAY  LINE: M1                EDIT

Ventilation Character (Fan)   : 15
Ventilation Character (Damper): 237
Row                           : 4
Foreground Color              : W
Background Color              : R

```

FIGURE 4-25. EDITING TRACK VENTILATION DISPLAY

**4.4.2.3 Editing the Train Schedule** - Entering "3" on the SELECTION MENU allows editing of the TRAIN SCHEDULE used for the real time display in the AERS MAIN MENU and the AERS ALTERNATE EMERGENCY PANEL. The system will ask for the transit line for which the schedule change is to be made, and will then ask for the schedule time to be edited (figure 4-26). After the user enters and confirms the proper information, the message SORTING FILES PLEASE WAIT will be displayed while the new schedule table is being built.

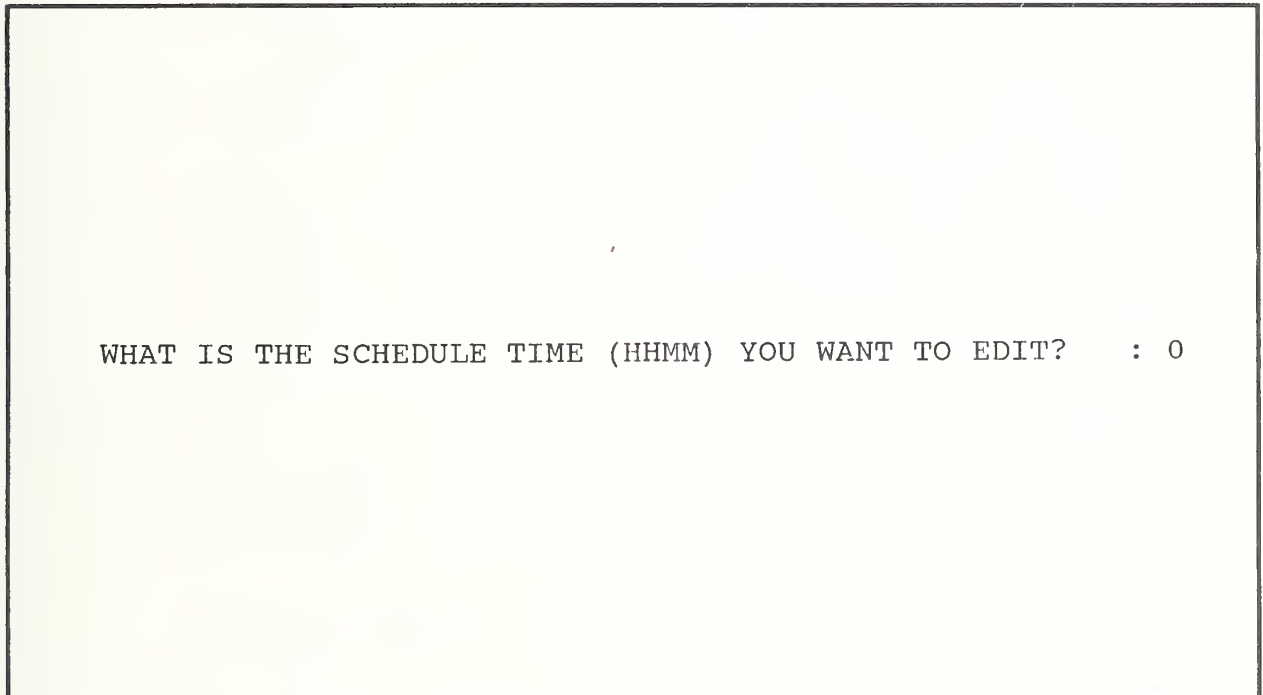


FIGURE 4-26. EDITING SCHEDULE TIME



## 5. SUMMARY AND RECOMMENDATIONS

### 5.1 SUMMARY

The concept of AERS2 presented in this report is a unique decision-making tool. AERS2 provides, in seconds and with just a few keystrokes, critical ventilation and evacuation procedures and locations for important emergency facilities. It does so through a screen display of a color graphics schematic map showing a one-mile segment of the transit system around the emergency location. This map is supported by two databases, one specifying the location and characteristics of all the emergency facilities, another specifying the manner in which these facilities are displayed on the map. In addition, there is a program containing all the algorithms and emergency procedures. These databases, as well as a database describing train schedules for real time display during non-emergency situations, can be easily edited through AERS2 without dBaseIII commands.

In summary, AERS2

- Facilitates planning, training, and coordination with outside emergency response organizations
- Provides in one location prompt full, clear emergency information
- Ensures that all important information is available for consideration, regardless of controller experience
- Is flexible, inexpensive, and independent of the main computer system.

### 5.2 RECOMMENDATIONS

AERS2 is another step in the ongoing process of assisting transit systems to respond effectively to emergencies. To promote awareness of the AERS2 concept and to assist transit systems in adapting AERS2 to their system, UMTA should undertake following efforts:

1. Disseminate the concept of AERS2 to rail transit systems through demonstrations and workshops. Use these efforts as well to identify

additional AERS2 applications, such as bus transit, automated people movers (APM), and regional emergency planning.

2. Conduct within the transit industry a peer review of AERS2. This will assist in dissemination and further identification of transit system emergency response needs.
3. Develop a methodology by which AERS2 can be used to automatically notify emergency response organizations and to initiate emergency responses (through ventilation actions, etc.).

There are a number of near-term development actions which can be carried out to further enhance AERS2:

1. Inclusion of an emergency checklist to allow the controller to electronically check off procedures as they are completed during an emergency.
2. Inclusion of the ability to "walk down the track", i.e., to bring to the screen at the touch of a key the next track segment, either upstream or downstream from the current segment.
3. Enhancement of the AERS2 display through the use of video disks.
4. Modification of the Database Display and Maintenance Sections to bring their user friendliness to the same level as the rest of AERS2. In addition, the inclusion of a password-protection feature to protect against unauthorized access to the Maintenance Section.







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