FiRECAM Version 1.6.1 - Expert Tools and Options Manual

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National Research Council Canada
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NRCC-45569

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Version 1.6.1

EXPERT TOOLS AND OPTIONS MANUAL

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1 FiRECAM EXPERT OPTIONS AND DATA

WARNING

THESE OPTIONS ARE TO BE USED BY EXPERIENCED FiRECAM USERS AND THE FIRE RISK MANAGEMENT PROGRAM FOR VERIFICATION AND TESTING PURPOSES. IT IS INCLUDED FOR COMPLETENESS, BUT THE FIRE RISK MANAGEMENT PROGRAM CANNOT ASSUME RESPONSIBILITY OR BE HELD LIABLE FOR IMPROPER USE AND MODIFICATION OF THE FiRECAM EXPERT OPTIONS.

FiRECAM allows users to access additional input file data under its **Expert Mode**. Expert mode allows the user to modify seldom-modified statistical data in the following categories:

- Climate and Location
- Building Occupant Response and Action Statistics
- Fire Spread and Failure Statistics
- Numerical Control
- Fire Department Characteristics

Choosing **Program Options** under the FiRECAM **Options** Menu, as in Figure 1-1, allows a user to enter **Expert mode** by displaying the File Options tabbed dialog.

Figure 1-1. The Options Menu

Once the **Expert Options** item is chosen, the user then chooses the **Expert** Program Options tree node, as in Figure 1-2.

Figure 1-2. FiRECAM Program Options - Program Options

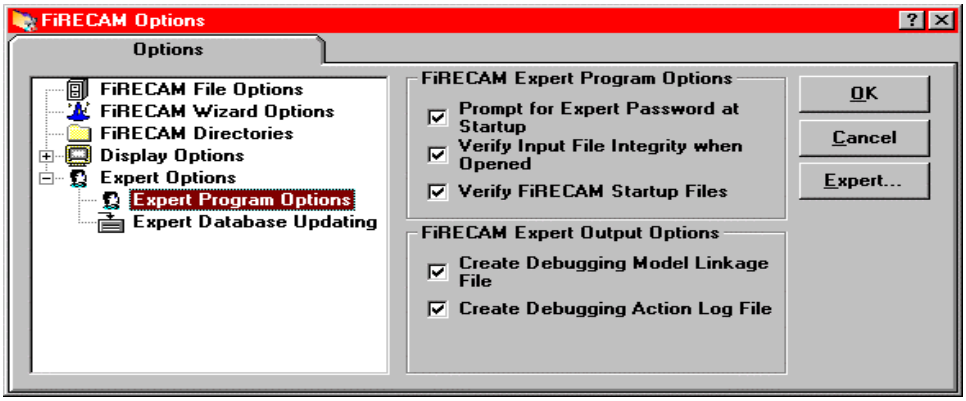


Table 1-1. Expert Mode Options.

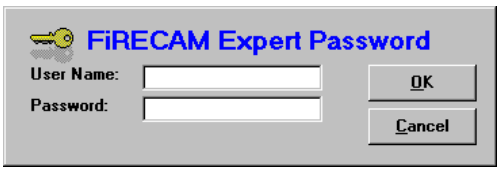
Expert Options	
FiRECAM Expert Program Options	
Prompt for Expert Password at Startup	This option controls whether FiRECAM will prompt, when started, for an ***expert password***, as shown below:  If the user enters a valid user name and password, the expert menus and toolbar will be enabled. For a full description of Expert Mode and the Expert Database, see the FiRECAM Expert Data Appendices. Expert Mode can also be entered by clicking the **Expert…** button on the upper right hand side of the **File Options** form (see Figure 1-2).
Verify Input File Integrity when Opened	When a FiRECAM input file is opened, its integrity will be checked; all sections of the input file are properly formatted. If there are any errors in the file, or the file is corrupt, FiRECAM will display an error message, and will not attempt to open the file.
Verify FiRECAM Startup Files	When FiRECAM first starts, runtime files, such as the fire growth and climate databases, will be checked. If any of these runtime files are missing or corrupt, FiRECAM will first try to repair these files. If the repair procedure is unsuccessful, FiRECAM will display an error message. **NOTE**: This option, when selected, will slow down startup time.

Table 1-1 Continued

Expert Options	
FiRECAM Expert Output Options	
Create Debugging Model Linkage File	When this option is checked, FiRECAM will, during a run: • Create a run dump file • Copy the contents of the FiRECAM initialization file (FIRECAM.INI) • Copy the contents of the FiRECAM input file that is being run • Copy the contents of each FiRECAM temporary file at the end of executing a scenario • Copy the time and date of the run. This file will retain the same base file name of the input file, but with the extension **DUM**. For example, if the input file is named **CASE1.FCI** The dump file will be named **CASE1.DUM** This file is used to help in debugging FiRECAM and will be used for technical support. A typical FiRECAM dump file is shown in Listing 1-1.
Create Debugging Action Log File	When this option is enabled, FiRECAM will create an error logging file (by default) called **ACTION.LOG**, which will list the actions performed as FiRECAM executes, user interactions and runtime error messages. This file is used primarily for technical support and error debugging and summarizes all the calculations performed by FiRECAM; the user's input actions, and any warning and error messages. A typical log file is listed in Listing 1-2. Some of the contents of this file are: • Computer Information • FiRECAM Startup • Copy of FiRECAM Input File • Dialog Box Invocations • Model Execution • Run Time Errors

Figure 1-3. FiRECAM Program Options - Expert Database Options

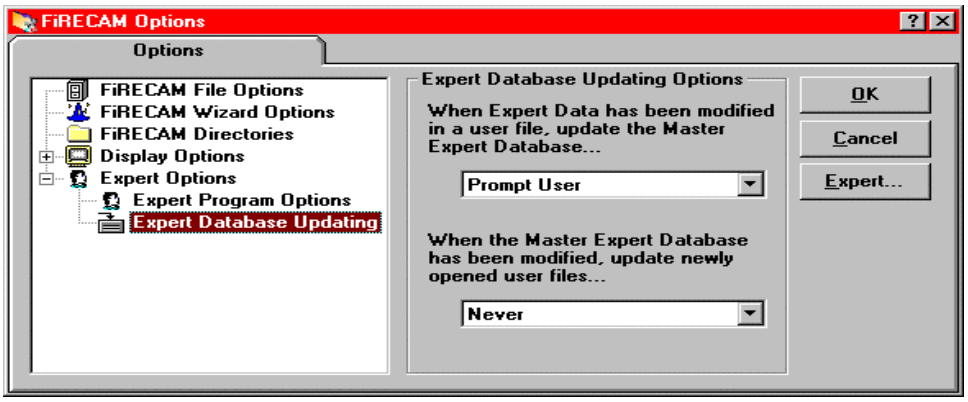


Table 1-2. Expert Database Updating Options

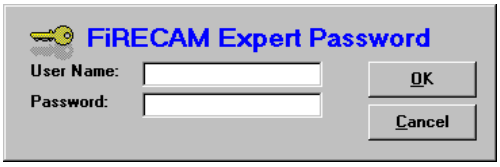
Expert Options	
Expert Database Updating	
Expert Database Updating Options	When Expert Data has been modified in a user file, update the Master Expert database… • Never The Master Expert Data will never be updated to reflect any changes done to the user file's expert sections. • Prompt User The user will be prompted to apply changes to the Master Expert Data after the user's expert data has changed. • Always The Master Expert Data will always be updated to reflect any changes done to the user file's expert sections. The user will **not** be prompted to apply the changes.

Table 1-2 Continued

Expert Options	
Expert Database Updating	
Expert Database Updating on Saving File	When the Master Expert Database has been modified, update newly opened user files… • Never The user file will never be updated to reflect any changes done to the Master Expert Database. • Prompt User The user will be prompted to apply changes if the Master Expert Database has changed. • Always The user file's Expert Data will always be updated to reflect any changes done to the Master Expert Database. The user will **not** be prompted to apply the changes.

When the user clicks the **Expert…** button, FiRECAM will prompt for a user name and a password. This user name/password feature is used to prevent casual and accidental modification of FiRECAM's Expert database. For a full description of FiRECAM Expert passwords, and the FiREPASS Expert Password Utility, refer to Appendix B, "**FiRECAM EXPERT PASSWORD UTILITY**"

Figure 1-4. FiRECAM Expert Password Prompting Input Box



When Expert Mode is entered, open FiRECAM input files will display an expanded tree view, as shown below in Figure 1-5. The new **Expert Data** tree root at the bottom of the tree node list allows the inspection of all the file's expert data entries. For a complete description of the Expert Data see Section 1.1,"FiRECAM Expert Options".

Figure 1-5. Typical FiRECAM Input File Data Tree Showing Expanded Expert Node

Listing 1-1. Typical FiRECAM Dump File Fragment

```
=========================================================================
=========================================================================

FiRECAM Version       : 0.09.00
Free Memory (KB)      : 84630
Free User Resources   : 90
Free GDI Resources    : 90
DOS Version           : 5.00
Windows Version       : 3.10
Windows Mode          : Enhanced
CPU Type              : 486
Math Coprocessor      : Present
Video Driver          : VGA
Video Resolution      : 1280 x 1024
Colors                : 256
Mouse                 : Microsoft, or IBM PS/2
Network               : LAN Support
Language              : English (American)
Keyboard              : Enhanced 101 or 102 key US and Non US keyboards

=========================================================================
=========================================================================

=========================================================================
File Name : FiRECAM.INI
=========================================================================

[PassWords]
t=A3D6FA917FE81105

[Units]
Units=2

[Debug]
DefaultModelSelection=32767
DefaultScenarioSelection=63

[Program Directories]
NewFileInitOption=0
ProgramTEMPLocation=0
ProgramREPORTLocation=0
NewFileInitFileName=FiRECAM.MAS
ProgramREPORTDir=REPORTS

[Logo]
DisplayToolBar=-1
DisplayLogoAtStart=2
DefaultEditWindowPosition=5
ToolBar1=-0000001+0000000+0000000+0000000+0001755+0000000+0000000
ToolBar3=+0000000+0000000+0000000+0000000+0000720+0000000+0000000

[New Files]
FinalFileOption=207

[Monitor]
ExecutionMonitor=519

[Recent Files]
RecentFile1=E:\PROJECTS\FIRECAM\PWC2_1.FCI
RecentFile2=E:\PROJECTS\FIRECAM\CBC_1.FCI
RecentFile3=E:\PROJECTS\FIRECAM\PWC2_1.FCI
RecentFile4=E:\PROJECTS\FIRECAM\CBC_1.FCI
```

Listing 1-2 displays a typical log file after a run in FiRECAM when the **Create Debugging Action Log File** item is checked.

Listing 1-2. Section of a Typical FiRECAM Log File Fragment

```
================================================================================
FIRECAM.LOG
LOG FILE CREATED ON Wednesday, April 16, 1997

FiRECAM Version       : 0.09.00
Free Memory (KB)      : 87831
Free User Resources   : 90
Free GDI Resources    : 90
DOS Version           : 5.00
Windows Version       : 3.10
Windows Mode          : Enhanced

CPU Type              : 486
Math Coprocessor      : Present
Video Driver          : VGA
Video Resolution      : 1280 x 1024
Colors                : 256

================================================================================
LOG ENTRY :    0            4/16/97       Reading FIRECAM.INI...
       .
       .
       .
LOG ENTRY :    0            4/16/97       DONE !!!
================================================================================
LOG FILE CLOSED ON Wednesday, April 16, 1997
================================================================================
```

1.1 FiRECAM Expert Menu

When Expert Mode is active, FiRECAM displays

- The FiRECAM Expert menu
- An Expert Data tree view item that provides access to the expert data categories.

The FiRECAM Expert Menu debugging options (see Figure 1-6) are discussed in detail in Chapter 4, “FiRECAM Expert Debugging Options”.

Figure 1-6. The FiRECAM Expert Menu

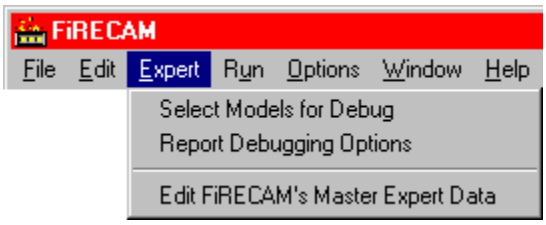
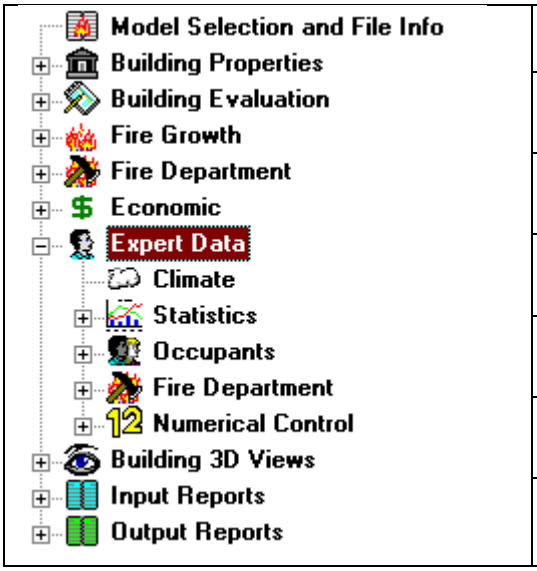


Figure 1-7 below shows a typical FiRECAM input file screen with the Expert Data tree root visible. By clicking on the ‘+’ sign to the left of the **Expert Data** tree item, the user will expand the tree to view all the available data categories, as ahown below.

Figure 1-7. Expert Data Tree Root – Expanded View with Node Legends



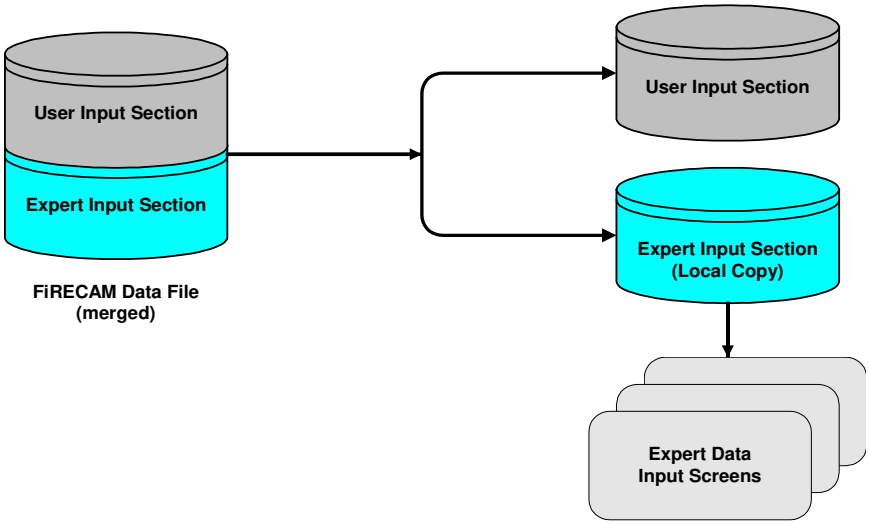
	Expert Data Root
	Climate and Location Data
	Fire Statistical Data
	Occupant Statistical Data
	Fire Department Statistical Data
	Numerical Data

1.2 Editing FiRECAM's Master Expert Database

In order to understand FiRECAM' expert data, it is important to note that the expert data for an input file is stored in two locations:

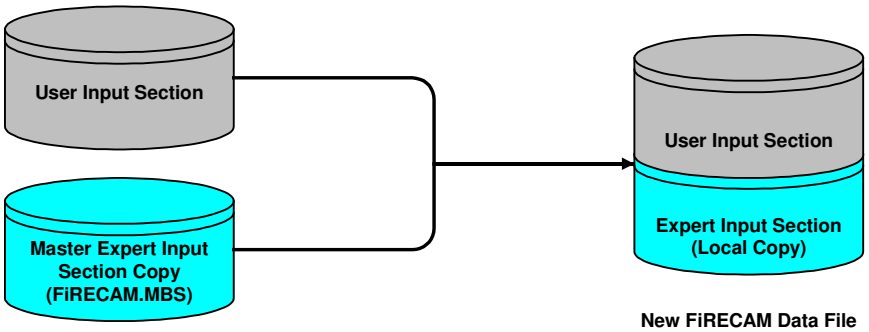
- A local copy in the Expert section of a FiRECAM input file

  When a FiRECAM input file is saved, a copy of the Expert data (derived from the file **FIRECAM.MBS**, the master copy of the expert data file section) is appended to the end of the file. When the file is opened at a later date, the file's local copy of the expert data is used, and it is this local copy that can be edited and modified by the user. The second location of the master data, described below, is not touched, except by selecting automatic options. These updating options are described below as well.



- A master copy of the data in FiRECAM's master Expert Database (**FIRECAM.MBS)**

  FiRECAM also keeps a copy of the Master Expert data in a file called **FIRECAM.MBS**. When a **new** file is created using one of the wizard or templates, a copy of this master expert data is appended to the end of the new file to create its local copy, or instance, of expert data.



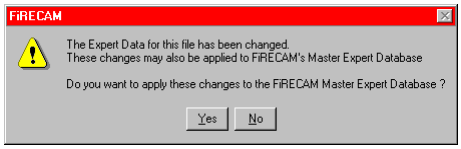
When a user saves a file after modifying any of the expert data, the master copy of the expert data can be updated to reflect the changes by a choice of three options (as set in the **Expert** file options menu):

- Never

  The Master Expert Data will never be updated to reflect any changes done to the user file's expert sections. This is useful when the master expert data file should never be modified, as in setting to a reference file for a particular location.

- Prompt User

  The user will be prompted to apply changes to the Master Expert Data after the user's expert data has changed, as shown below:



- Always

  The Master Expert Data will always be updated to reflect any changes done to the user file's expert sections.

FiRECAM also allows a user to directly modify FiRECAM's master expert database. By selecting **Edit FiRECAM's Master Expert Data** from the **Expert** menu, as shown below, a special dialog with an Expert tree will appear, as in Figure 1-8.

Figure 1-8. FiRECAM Expert Menu – Edit Master Expert Data

Figure 1-9. Master Expert Tree View Root

Figure 1-10 shows the master Expert data tree root expanded to the first level. The main first level categories are

- Climate Data
- Fire Department Data
- Numerical Control

Two additional first level categories:

- Apartment Occupancy, and
- Office Occupancy

are used to display and modify data that applies to these specific occupancy types.

Data specific to occupancy types are:

- Fire Statistics
- Occupant Statistics
- Expert Report

Figure 1-11 shows the Fire Department root expanded, and Figure 1-12 shows the Apartment and Office occupancy nodes expanded. The descriptions of the data falling under these categories are described later in this section, starting with Section 1.3, “FiRECAM Climate and Location Data”

Figure 1-10. Master Expert Tree View – First Level Expanded

Figure 1-11. Master Expert Tree View – Fire Department Node Expanded

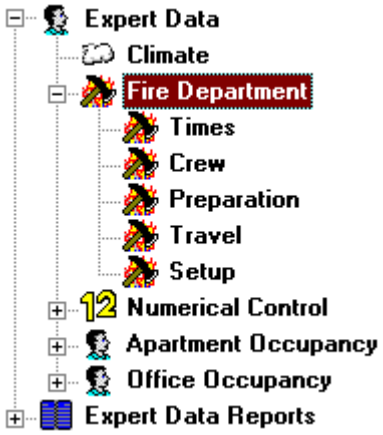
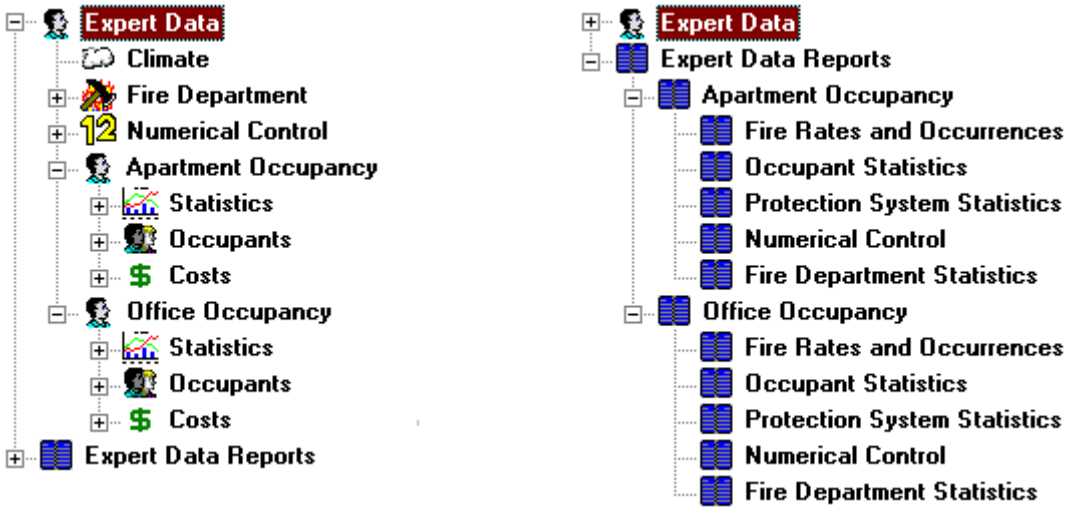


Figure 1-12. Master Expert Tree View – Occupancy Type and Report Nodes Expanded



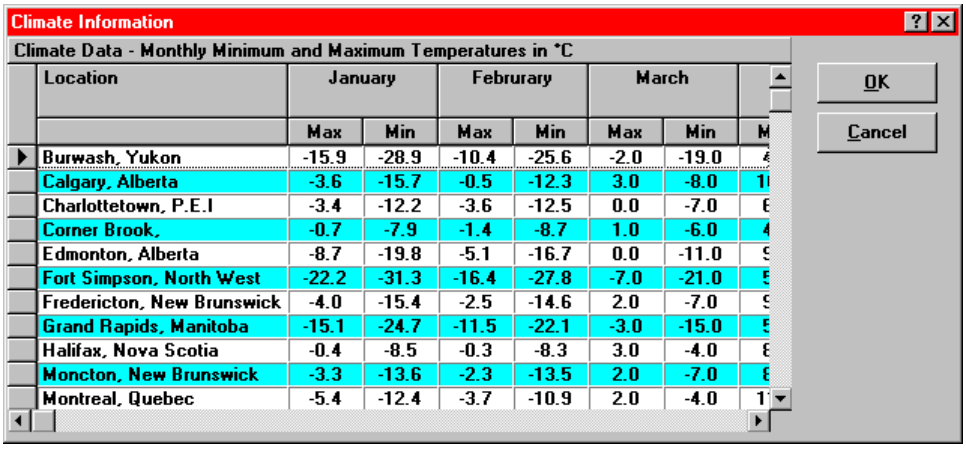
1.3 FiRECAM Climate and Location Data

When the user clicks the **Climate** item (see Figure 1-13 below), a dialog box showing the contents of the climate database will appear.

Figure 1-13. Expert View - Climate Database

The **Climate** database is displayed as an Access compatible grid of data containing the city or region name, and its associated temperatures for each month. A typical view of the climate database contents is shown below, in Figure 1-14 and explained in Table 1-3.

Figure 1-14. Climate and Location Input Dialog Box



Location	January		February		March		
	Max	Min	Max	Min	Max	Min	M
Burwash, Yukon	-15.9	-28.9	-10.4	-25.6	-2.0	-19.0	4
Calgary, Alberta	-3.6	-15.7	-0.5	-12.3	3.0	-8.0	1
Charlottetown, P.E.I	-3.4	-12.2	-3.6	-12.5	0.0	-7.0	8
Corner Brook,	-0.7	-7.9	-1.4	-8.7	1.0	-6.0	4
Edmonton, Alberta	-8.7	-19.8	-5.1	-16.7	0.0	-11.0	9
Fort Simpson, North West	-22.2	-31.3	-16.4	-27.8	-7.0	-21.0	5
Fredericton, New Brunswick	-4.0	-15.4	-2.5	-14.6	2.0	-7.0	9
Grand Rapids, Manitoba	-15.1	-24.7	-11.5	-22.1	-3.0	-15.0	5
Halifax, Nova Scotia	-0.4	-8.5	-0.3	-8.3	3.0	-4.0	8
Moncton, New Brunswick	-3.3	-13.6	-2.3	-13.5	2.0	-7.0	8
Montreal, Quebec	-5.4	-12.4	-3.7	-10.9	2.0	-4.0	1

Table 1-3. Climate and Location Database Contents

Climate and Location Database	
Climate Data	**Influences**
Location The location of the building, usually as a city and province (or country).	• Smoke Spread
Maximum Temperature Minimum Temperature The maximum and minimum expected temperatures for each month of the year, expressed in °C for the corresponding above location.	

1.4 FiRECAM Occupant Response Data

When the user clicks the **Occupants** item (see Figure 1-15 below), a dialog box showing the contents of the occupant response database will appear.

Figure 1-15. Expert View - Occupants

The **Occupants** item (see Figure 1-15) allows the user to inspect data relating to the occupants' responses during a fire. The main responses are:

- Occupant Perception
- Occupant Action
- Interpretation Times
- Travel Speeds

Table 1-4 summarizes the occupant response perception and action probabilities.

1.4.1 Occupant Perception and Action Probabilities

Expert data on Occupant Perception and Action Probabilities can be found in the Perception and Action tab, as shown in Figure 1-16 below.

Figure 1-16. Occupant Response Input Dialog Box - Perception and Action Tab

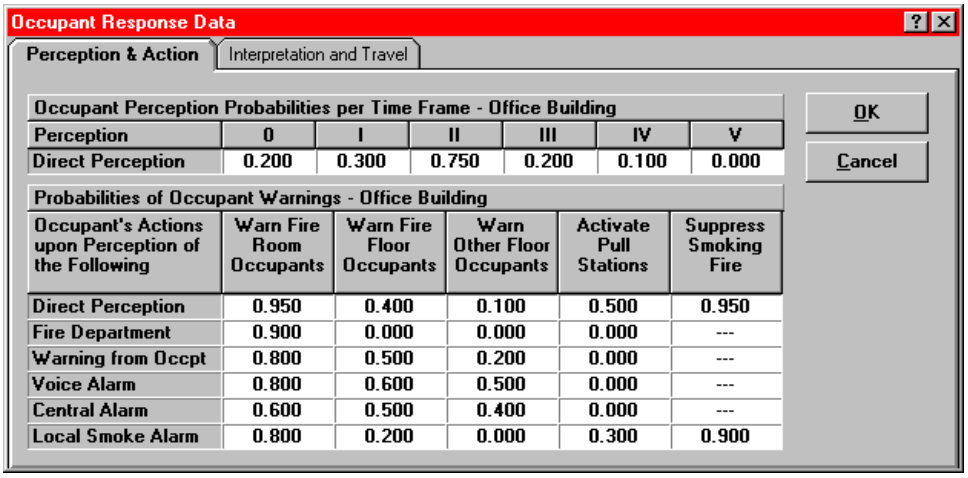


Table 1-4 summarizes the data items found on this tab.

Table 1-4. Occupant Response Perception and Action Probabilities

Occupant Response Data	
Occupant Perception Probabilities	**Influences**
Occupant Perception Probabilities per Time Frame The probability that a building occupant will directly perceive a fire incident due to fire cues (sight, smell, and sound) in a given time frame. Values are listed for the following Time Frames: • Time Frames 0 to 5	• Occupant Response • Occupant Evacuation • Fire Department Response

Table 1-4 Continued

Occupant Response Data	
Occupant Action Probabilities	**Influences**
Perception Types: • Direct Perception • Warning from Fire Department • Warning from Occupants • Warning from Voice Alarm System • Warning from Central Alarm System • Warning from Local Smoke Alarm The probability that a building occupant after any of the following perceptions, given that he has: • directly perceived a fire event, • received a fire event warning from the fire department after it has arrived at the site • received a fire event warning from other building occupants • received a fire event warning from a central alarm system with voice communication systems • received a fire event warning from a central alarm system • received a fire event warning from a local self-contained smoke detector will perform any of the following actions. • Warning Fire Compartment Occupants • Warning Fire Floor Occupants • Warning Other Floor Occupants • Activating a Pull Bar	• Occupant Response • Occupant Evacuation

1.4.2 Occupant Interpretation and Travel Speeds

Expert data on Interpretation Times and Travel Speeds can be found in the Interpretation and Travel tab, as shown in Figure 1-17 below.

Figure 1-17. Occupant Response Input Dialog Box - Interpretation and Travel Tab

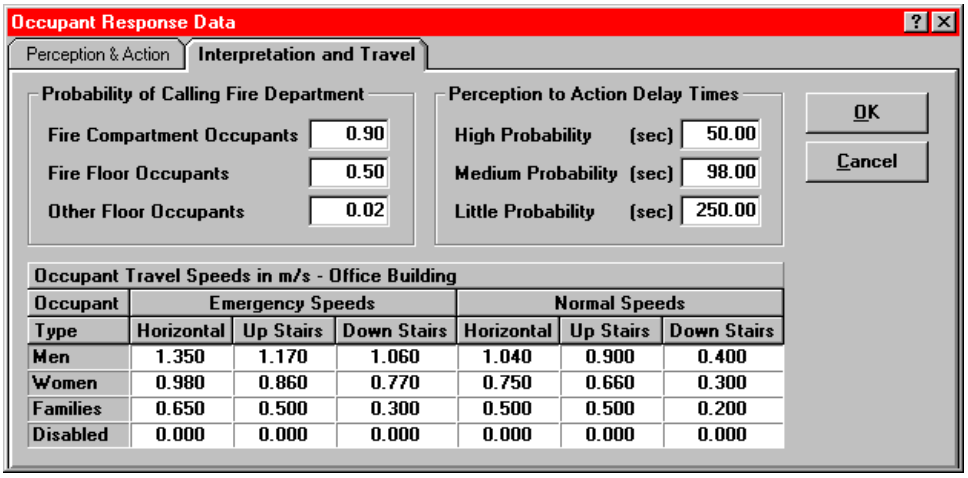


Table 1-5 summarizes the occupant response interpretation times and travel speeds.

Table 1-5. Occupant Response Interpretation and Travel Speed Data

Occupant Response Data	
Probability of Calling Fire Department	**Influences**
Location of occupants: • Fire Compartment Occupants • Fire Floor Occupants • Other Floor Occupants The probability that occupants • in the compartment of fire origin, • on the floor of fire origin, and • on the floors other than the floor of fire origin will call the fire department after perceiving a fire or receiving a fire warning from fire cue, local or central alarm.	• Occupant Response • Occupant Evacuation • Fire Department Action

Table 1-5 Continued

Occupant Response Data	
Perception to Action Delay Times	**Influences**
Delay times for: • High Probability • Medium Probability • Little Probability The time delay in seconds between the instant the occupant **perceives** an event relating to a fire, and the instant that the occupant **decides to act** on that event, given a **high, medium** or **low** probability of action by the occupant.	• Occupant Response • Occupant Evacuation
Occupant Travel Speeds	**Influences**
Emergency Speeds: • Horizontal Distances • Up Stairs • Down Stairs Normal Speeds: • Horizontal Distances • Up Stairs • Down Stairs The travel speeds assumed by the occupants when traveling during **emergency** and **normal** conditions for **horizontal**, **up stairs** and **down stairs**, in meters/second. Values for: • Men • Women • Children, Seniors, Families • People with Special Needs	• Occupant Evacuation

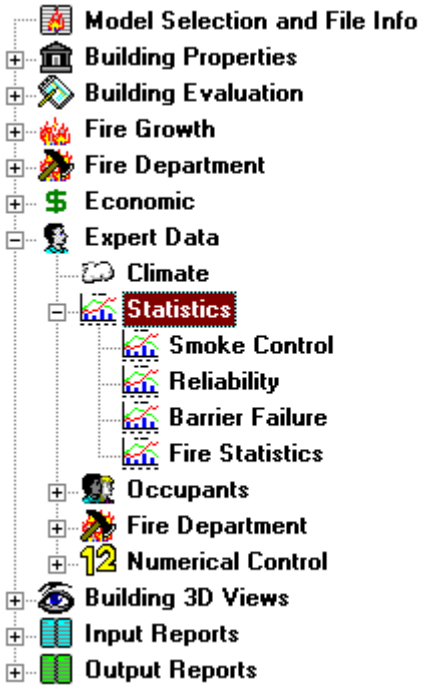
1.5 FiRECAM Fire and Alarm System Components Statistics

The Statistics node of the Expert Data Tree root includes data for three areas:

- Smoke Control
- Reliability
- Barrier Failure
- Fire Statistics

These are shown in Figure 1-18.

Figure 1-18. Expert View - Statistics



1.5.1 Smoke Control Statistics

Expert data on detectors, sensors, smoke control and sprinklers can be found in the Smoke Control tab, as shown in Figure 1-19 and explained in Table 1-6 below.

Figure 1-19. Fire and Alarm System Input Dialog Box - Smoke Control Tab

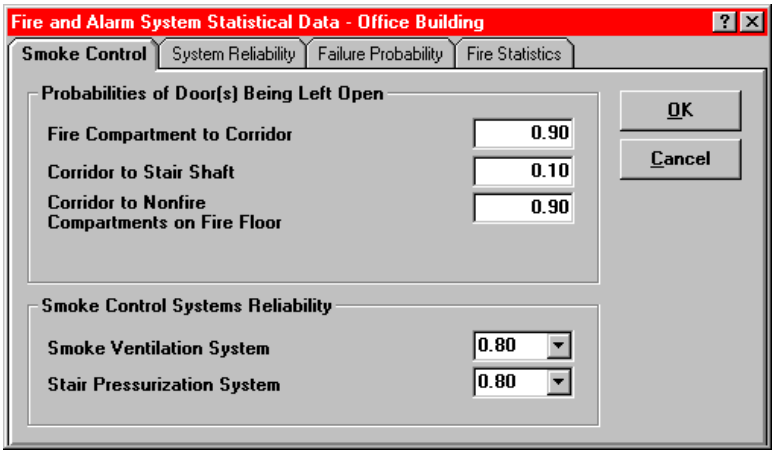


Table 1-6. Statistical Data - Smoke Control Data

Fire and Alarm System Statistical Data	
Probabilities of Door(s) Being Left Open	**Influences**
Door locations: • Fire Compartment to Corridor • Corridor to Stair Shaft • Corridor to Non-fire Compartments on Fire Floor The probability that the doors leading from: • a fire origin compartment to a corridor • a corridor to a stair shaft • a corridor to compartments on the fire origin floor, other than the fire origin compartment will be left open when a fire starts.	• Smoke Spread • Fire Spread Failure Probabilities • Expected Risk to Life

Table 1-6 Continued

Fire and Alarm System Statistical Data	
Smoke Control Systems	**Influences**
Smoke Ventilation System The probability that an installed smoke ventilation system is effective.	• Smoke Spread
Stair Pressurization System The probability that an installed stair pressurization system is effective.	

1.5.2 System Reliability

Figure 1-20. Fire and Alarm System Input Dialog Box – System Reliability Tab

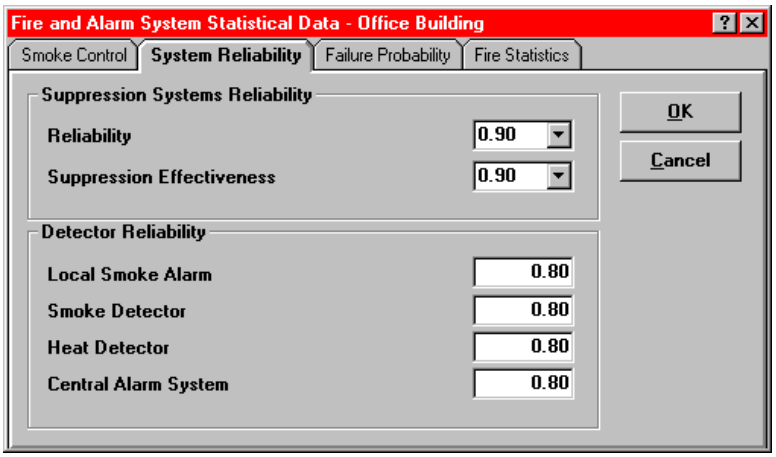


Table 1-7. Statistical Data – System Reliability Data

Fire and Alarm System Statistical Data	
Suppression Systems Reliability	**Influences**
Reliability The reliability of an automatic suppression (sprinkler) system, expressed as the probability that the sprinkler system will activate during a fire, given that a fire occurs.	• Design Fire Occurrence Probability
Suppression Effectiveness The probability that an automatic suppression (sprinkler) system, once activated, will actually suppress a fire.	• Design Fire Occurrence Probability • Occupant Response • Fire Department Action

Table 1-7 Continued

Fire and Alarm System Statistical Data	
Detector Reliability	**Influences**
Local Smoke Alarm The reliability of a local smoke detector alarm, expressed as the probability that the local smoke alarm will activate during a fire, given that a fire occurs.	• Occupant Response • Fire Department Response and Action
Smoke Detector The reliability of a central alarm smoke detector, expressed as the probability that the smoke detector will activate during a fire, given that a fire occurs.	
Heat Detector The reliability of a central alarm heat detector, expressed as the probability that the heat detector will activate during a fire, given that a fire occurs.	
Central Alarm System The reliability of a central alarm system control panel, expressed as the probability that the alarm system will function after receiving signals from detectors.	

1.5.3 Barrier Failure Probabilities

Figure 1-21. Fire and Alarm System Input Dialog Box – Barrier Failure Tab

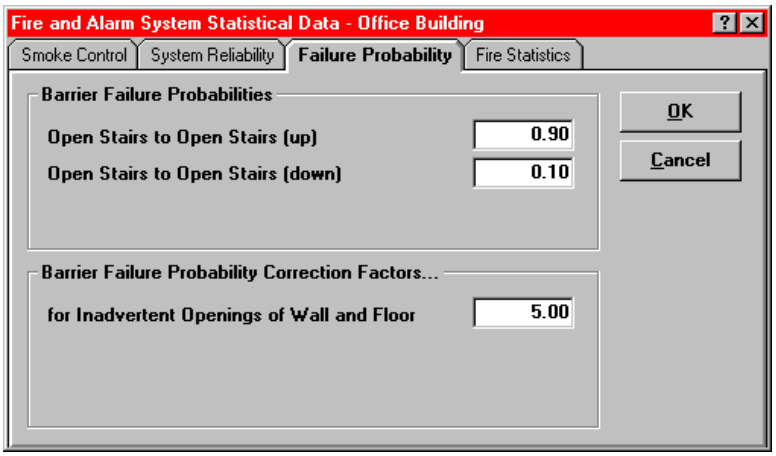


Table 1-8. Fire and Alarm System Statistical Data –Barrier Failure Probabilities

Fire and Alarm System Statistical Data	
Barrier Failure Probabilities	**Influences**
Barrier failures for the following stair directions: • Open Stairs to Open Stairs (up) • Open Stairs to Open Stairs (down) The probability that any barriers between floors in the stairwells will fail in the • upward direction • downward direction when exposed to a flashover fire.	• Fire Spread
Barrier Failure Probability Correction Factors	**Influences**
Factor for Inadvertent Openings of Wall and Floor Acceleration factor used for computing the probability that a wall or floor barrier will fail if there is a high probability that openings will be created during the failure of the barrier.	• Fire Spread

1.5.4 Fire Scenario Probabilities and Occurrence Rates of Fires

Figure 1-22. Fire and Alarm System Input Dialog Box - Fire Occurrence Tab

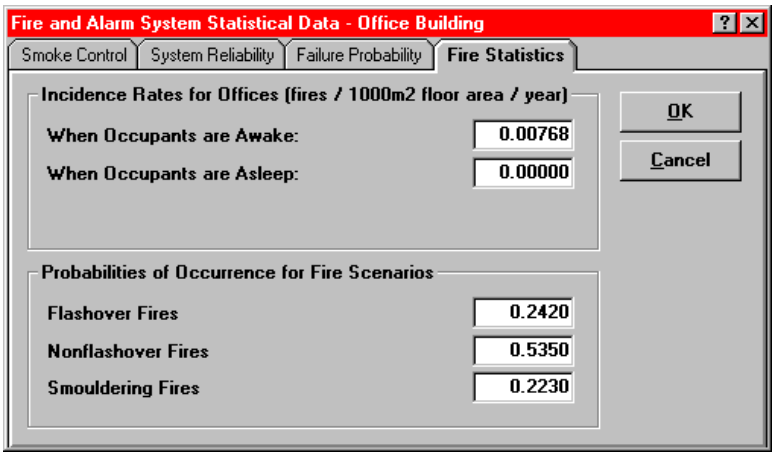


Table 1-9. Fire and Alarm System Data - Fire Occurrence Statistics

Fire and Alarm System Statistical Data	
Fire Incidence Rates	**Influences**
Depending on the building occupation Type: • Apartment Buildings (fires / compartment / year) • Office Buildings (fires / 1000 m^2 floor area / year) The rate of occurrence of fire for apartment or office buildings, given as the number of fires that could occur per • Compartment per year for apartment buildings, • 1000 m^2 floor area per year for office buildings, assuming the building occupants are • Awake • Asleep when the fire starts.	• Fire Scenario Occurrence Probability • Expected Risk to Life • Fire Losses • Fire Cost Expectation

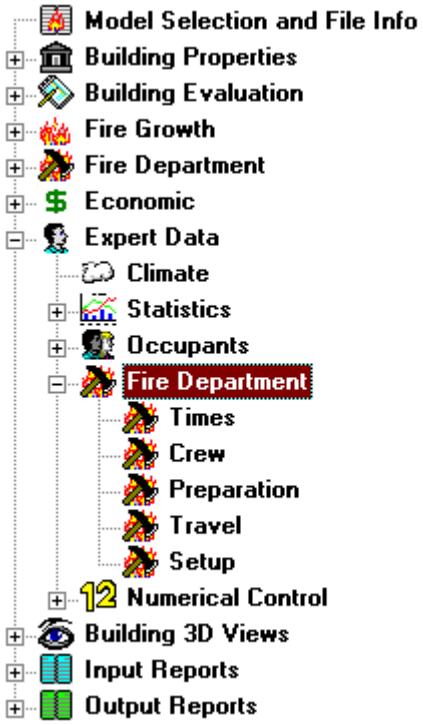
Table 1-9 Continued

Fire and Alarm System Statistical Data	
Probabilities of Occurrence for Fire Scenarios	**Influences**
Probabilities for the following fire types: • Flashover Fires • Nonflashover Fires • Smouldering Fires The probability that a fire, given that it occurs, will become either • a fully developed flashover fire, • a nonflashover (flaming) fire or • a smouldering fire for each text entry box.	• Fire Scenario Occurrence Probability • Expected Risk to Life • Fire Losses • Fire Cost Expectation

1.6 FiRECAM Fire Department Characteristics and Statistical Data

FiRECAM also includes expert data on Fire Department characteristics. This information can be found by selecting the **Fire Department** tree root, as shown below in Figure 1-23.

Figure 1-23. Expert View - Fire Department



The **Fire Department** tree root data covers information in the following specific areas:

- Times
- Crew
- Preparation
- Travel
- Setup

1.6.1 Ideal Fire Department Action Times

The “Times” tab shown in Figure 1-24 presents the best possible idealized times for dispatch, preparation, travel and setup.

Figure 1-24. Fire Department Input Dialog Box - Times Tab

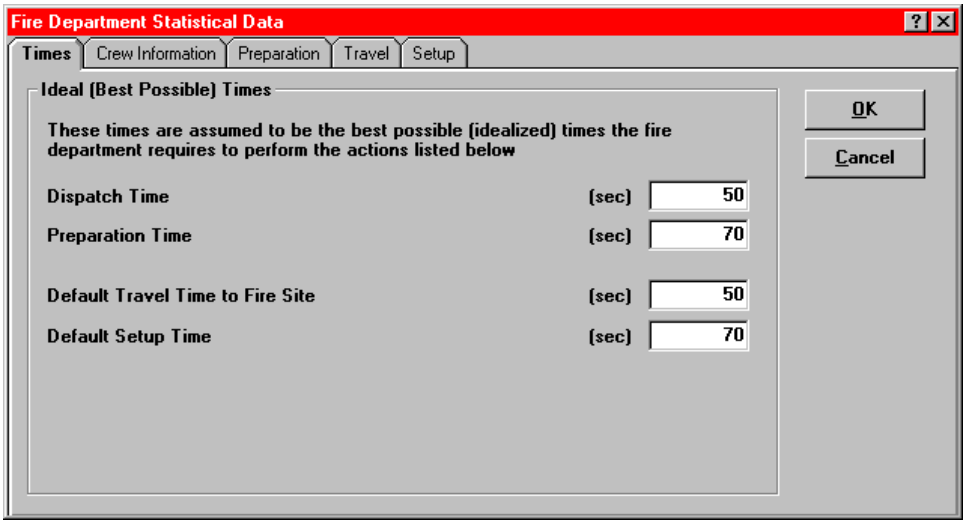


Table 1-10 summarizes the definitions of these statistical “Time” data.

Table 1-10. Fire Department – Time Data

Fire Department Statistical Data – Times Tab	
Ideal (Best Possible) Times	**Influences**
Ideal Dispatch Time The **dispatch** time the fire department takes**, assuming conditions are ideal**.	• Fire Department Response Times
Ideal Preparation Time The **preparation** time the fire department takes, **assuming conditions are ideal**.	

Table 1-10 Continued

Fire Department Statistical Data – Times Tab	
Ideal (Best Possible) Times	**Influences**
Default Travel Time to Fire Site The default time the fire department takes to arrive at a fire site, **assuming the fire department response is not calculated**; that is; the user chooses not to run a Fire Department Response and Evaluation.	• Fire Department Response Times
Default Setup Time The default time the fire department takes to setup its equipment, **assuming the fire department response is not calculated**; that is; the user chooses not to run a Fire Department Response and Evaluation.	

1.6.2 Fire Crew and Resource Statistics

Factors regarding fire crews and resources are shown in the “Crew Information” tab (see Figure 1-25).

Figure 1-25. Fire Department Input Dialog Box - Crew Information Tab

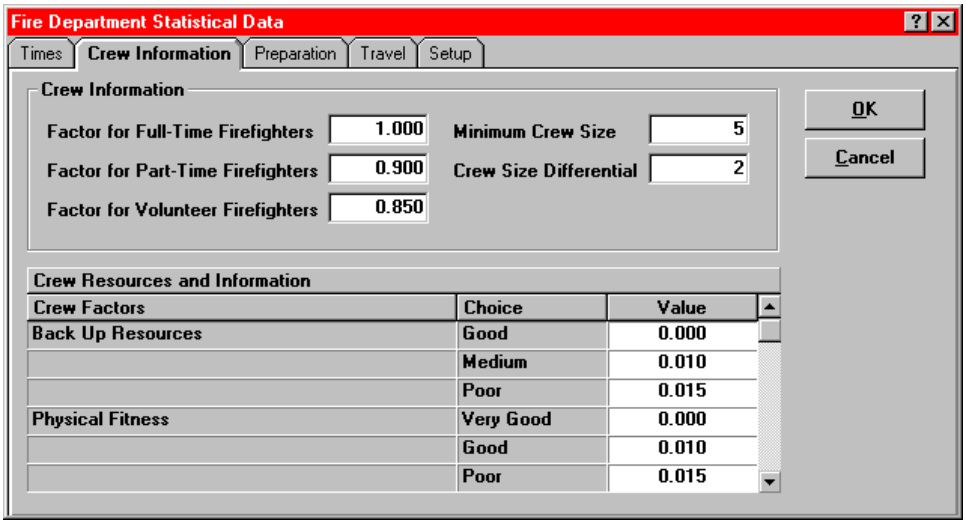


Table 1-11 summarizes the definitions of these statistical data regarding fire department crews and resources.

Table 1-11. Fire Department – Crew Data

Fire Department Statistical Data – Crew Information Tab	
Crew Information	**Influences**
Time factors for the following crew types: • Factor for Full-Time Firefighters • Factor for Part-Time Firefighters • Factor for Volunteer Firefighters The effectiveness factor for • full-time firefighters, • part-time firefighters or • volunteer firefighters expressed as a number between 0 and 1. This is usually set to one (1) for full-time firefighters. These factors are used as weighing factors, where values less than one (1) indicate less effectiveness.	• Fire Department Action and Effectiveness

Table 1-11 Continued

Fire Department Statistical Data – Crew Information Tab	
Crew Information	**Influences**
Minimum Crew Size The minimum crew size, in persons, that is required to be considered effective; that is, what is the smallest crew size for the firefighters to have any effect on the fire in terms of extinguishment and rescue effectiveness.	• Fire Department Action and Effectiveness
Crew Size Differential What is the difference, in persons, between the minimum crew size defined above, and the maximum allowable crew size for its overall effectiveness to have no more impact on the fire?	• Fire Department Action and Effectiveness
Crew Information Factors for Available Resources	**Influences**
Time factors for the following resources: • Back Up Resources • Physical Fitness of Firefighters • Condition of Firefighter's Equipment These factors are time dilation factors, which influence the crew **setup** time. A zero value means that there is no effect, a positive value will stretch the required time. Factor values for: • Good • Fair • Poor	• Fire Department Action and Effectiveness

1.6.3 Site Preparation Statistics

Statistics on site preparation are shown in the “Preparation” tab (see Figure 1-26).

Figure 1-26. Fire Department Input Dialog Box - Preparation Tab

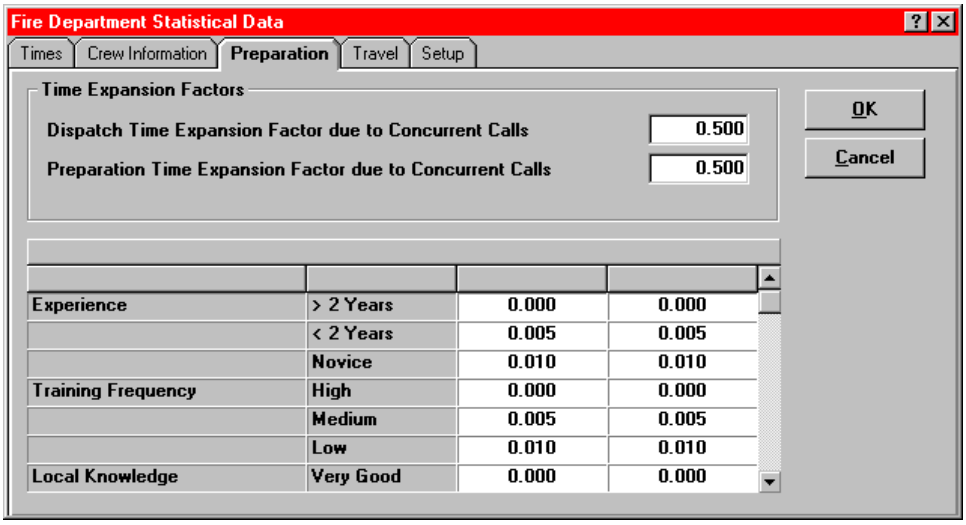


Table 1-12 summarizes the definitions of the site preparation statistical data.

Table 1-12. Fire Department – Preparation Data

Fire Department Statistical Data – Preparation Tab	
Time Expansion Factors	**Influences**
Dispatch Time Expansion Factor due to Concurrent Calls These factors are time dilation factors, which influence the **ideal crew dispatch time** when concurrent calls to the fire department must be considered. A zero value means that there is no effect, a positive value will stretch the required time.	• Fire Department Response Times
Preparation Time Building Expansion Factor due to Concurrent calls These factors are time dilation factors, which influence the **ideal crew preparation time** when concurrent calls to the fire department must be considered. A zero value means that there is no effect, a positive value will stretch the required time.	• Fire Department Response Times

Table 1-12 Continued

Fire Department Statistical Data – Preparation Tab	
Dispatch and Preparation Time Factors	**Influences**
Time factors for the following firefighter characteristics: • Experience • Training Frequency • Local Knowledge • Availability of Resources • Explosion Potential • Building Collapse Potential • Hazardous Material Release These factors are time dilation factors, which influence the **ideal crew preparation time**. A zero value means that there is no effect, a positive value will stretch the required time. Factor values for: • Good • Fair • Poor	• Fire Department Response Times
Communication System Factors Time expansion factor for the setup time due to the presence of • Central Alarm • PA System	

Table 1-12 Continued

Fire Department Statistical Data – Preparation Tab	
Dispatch and Preparation Time Factors	**Influences**
Incident Notification Factor values for: • Auto Alarm • 911 Centre • Public Phone	• Fire Department Response Times
Notification of Absent Firefighters Factor values for: • Page System • Special Phone • PA System	

1.6.4 Travel Statistics

FiRECAM also provides a set of travel statistics and travel time factors shown in the “Travel” tab (see Figure 1-27).

Figure 1-27. Fire Department Input Dialog Box - Travel Tab

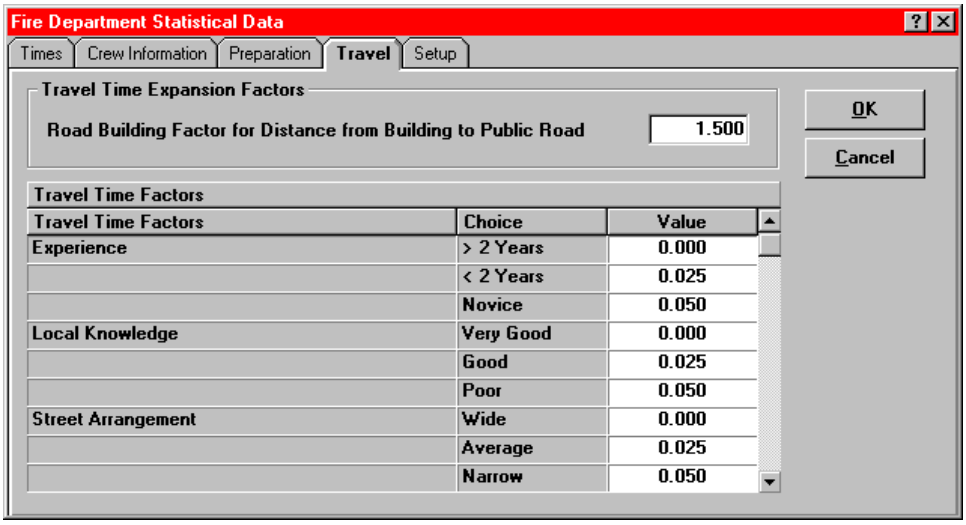


Table 1-13 provides a detailed description of travel statistics.

Table 1-13. Fire Department – Travel Data

Fire Department Statistical Data – Travel Tab	
Travel Times Expansion Factors	**Influences**
Road Building Factor for Distance from building to Public Road Time expansion factor for the travel time when the building is situated at some distance from the public read or is not easily accessible.	• Fire Department Response Times

Table 1-13 Continued

Fire Department Statistical Data – Travel Tab	
Travel Time Factors	**Influences**
Experience Factor values for: • >= 2 years experience • < 2 years experience • Novice	• Fire Department Response Times
Local Knowledge Factor values for: • Very Good • Good • Poor	
Street Layout and Arrangement Factor values for: • Wide Streets • Average Streets • Narrow Streets	
Curves and Intersections Factor values for: • Low Curve Frequency • Medium Curve Frequency • High Curve Frequency	
Traffic Volume Factor values for: • Low Traffic • Medium Traffic • High Traffic	

1.6.5 Setup Time Statistics

FiRECAM also provides a set of default setup times and statistics shown in the “Setup” tab (see Figure 1-28).

Figure 1-28. Fire Department Input Dialog Box - Setup Tab

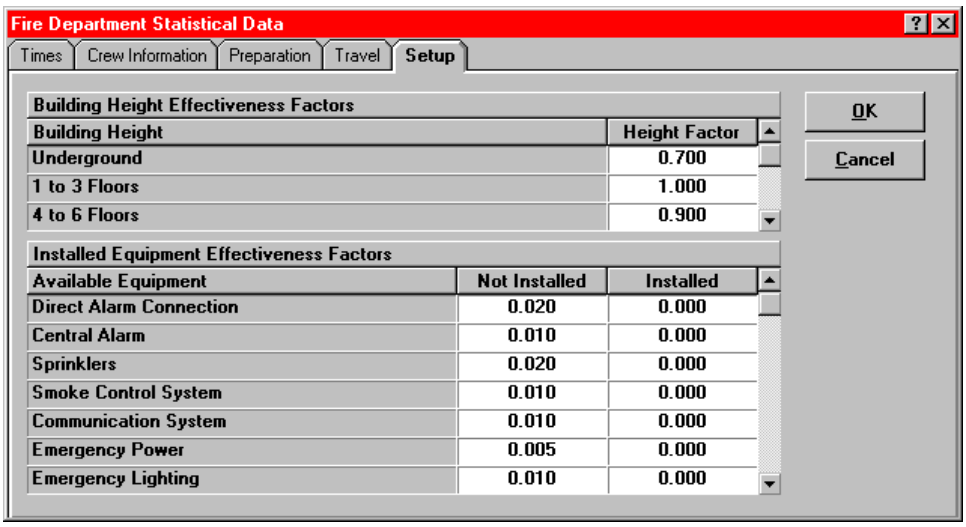


Table 1-14 provides a detailed description of fire department crew setup factors.

Table 1-14. Fire Department – Crew Setup Data

Fire Department Statistical Data – Setup Tab	
Building Height Effectiveness Factors	**Influences**
Building Height Factor: • Underground • 1 to 3 Floors • 4 to 6 Floors • 7 to 13 Floors • More than 13 Floors Factors that influence the setup time and rescue effectiveness due to the height of the building.	• Fire Department Response Times • Firefighting Rescue and Suppression Effectiveness

Table 1-14 Continued

Fire Department Statistical Data – Setup Tab	
Installed Equipment Effectiveness Factors	**Influences**
Time factors for the following equipment: • Direct Alarm Connection • Central Alarm • Sprinklers • Smoke Control Systems • Communication System • Emergency Power • Emergency Lighting • Fire Rated Elevators • Fire Hose Cabinets • Manual Fire Extinguishers Effectiveness reduction factors for the presence or absence of installed equipment. Factor values for: • Device(s) not Installed • Device(s) Installed	• Fire Department Response Times • Firefighting Rescue and Suppression Effectiveness

1.7 FiRECAM Numerical Control

In FiRECAM, the Expert Data provides a tree root option for **Numerical Control** that is used to control flame spread calculations (see Figure 1-29).

Figure 1-29. Expert View - Numerical Control

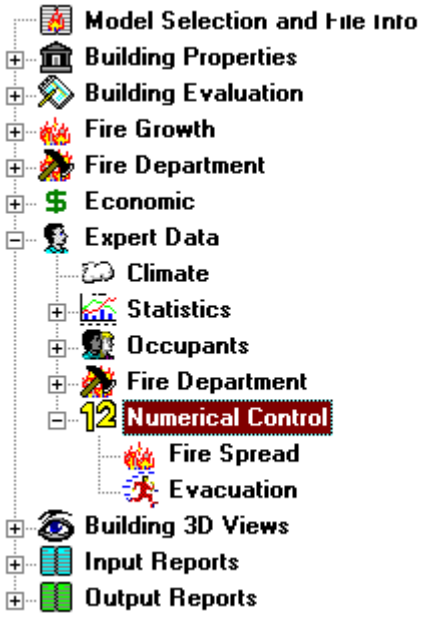


Figure 1-30 displays the options available for fire spread probability calculations, and Table 1-15 provides a description of the fire spread probability calculation parameters.

Figure 1-30. Fire Spread Parameters Input Dialog Box

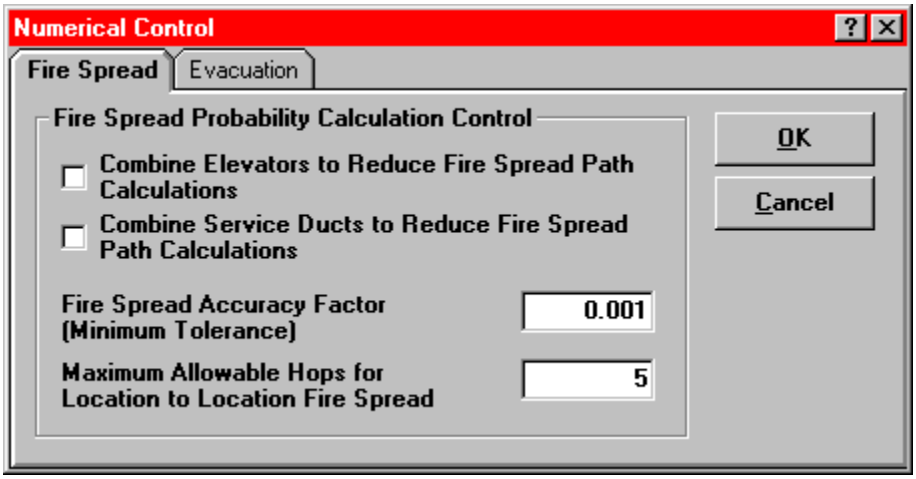


Table 1-15. Fire Spread Parameter Data

Numerical Control	
Fire Spread Probability Calculation Control	**Influences**
Combine Elevators to Reduce Fire Spread Path Calculations This option allows FiRECAM to combine elevator shafts into a single fire spread path, to allow more efficient fire path searching for tall buildings.	• Fire Spread
Combine Service Ducts to Reduce Fire Spread Path Calculations This option allows FiRECAM to combine service duct shafts into a single fire spread path, to allow more efficient fire path searching for tall buildings.	
Fire Spread Accuracy Factor (Minimum Tolerance) The minimum allowable probability value for fire spread through a set of barrier locations, before it is assumed the probability of fire spread value becomes insignificant.	
Maximum Allowable Hops for Location to Location Fire Spread The total number of hops (barriers) a fire can cross to spread from a given location to a destination location before the fire spread ceases.	

Figure 1-31. Fire Spread Parameters Input Dialog Box

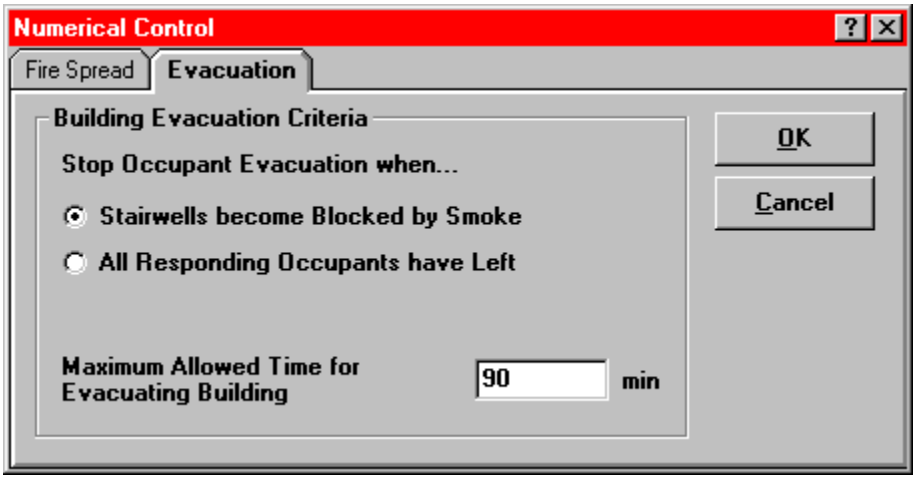


Table 1-16. Evacuation Parameter Data

Numerical Control	
Evacuation Calculation Control	**Influences**
Stop Occupant Evacuation when... • Stairwells become blocked by smoke • All responding occupants have left Evacuation stops when one of these conditions has been satisfied	• Evacuation
Maximum Allowable time for building evacuation The maximum time allowed for evacuation, **assuming none of the above conditions could be satisfied.** This time limit is typically used to prevent infinite run times.	

2 FiRECAM EXPERT PASSWORD UTILITY

WARNING

THIS UTILITY IS TO BE USED BY EXPERIENCED FiRECAM USERS AND THE FIRE RISK MANAGEMENT PROGRAM FOR VERIFICATION AND TESTING PURPOSES. IT IS INCLUDED FOR COMPLETENESS, BUT THE FIRE RISK MANAGEMENT PROGRAM CANNOT ASSUME RESPONSIBILITY OR BE HELD LIABLE FOR IMPROPER USE AND MODIFICATION OF THE FiRECAM EXPERT DATABASE CONTENTS. CAUTION IS ADVISED WHEN INSPECTING OR MODIFYING THE FiRECAM EXPERT DATABASE.

The **FiR**ECAM **E**xpert **Pass**word **(FIREPASS.EXE)** Utility is used to manage access to FiRECAM's expert database. Access is allowed to users who have a valid user name and password to enter FiRECAM's Expert Mode. FiRECAM will always prompt a user for his user name and password before allowing entry into expert mode.

By using **FIREPASS**, an expert user or administrator may

- Add users to the Expert User List,
- Remove an existing user,
- Modify an existing user's password.

These operations are described in further detail in the following sections.

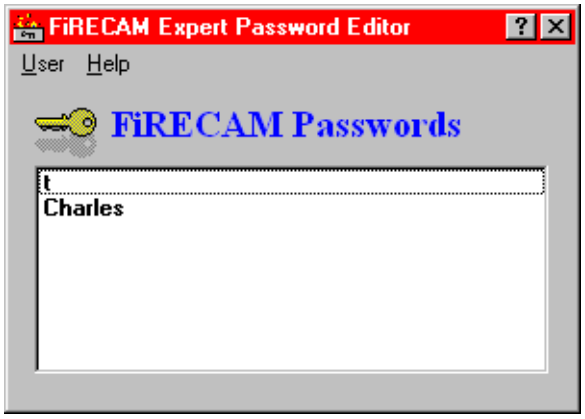
2.1 Starting FiREPASS

To Start the FiRECAM Expert Password Utility

- Go to the FiRECAM Program Group
- Double-click the **FiREPASS** icon to start the program, or choose **Start -> Program Files -> FiRECAM -> FiREPASS** from the Windows **Start** button.

- The **FiREPASS** Main Screen shown below will then appear, as in Figure 2-1:

Figure 2-1. FiREPASS Main Startup Screen

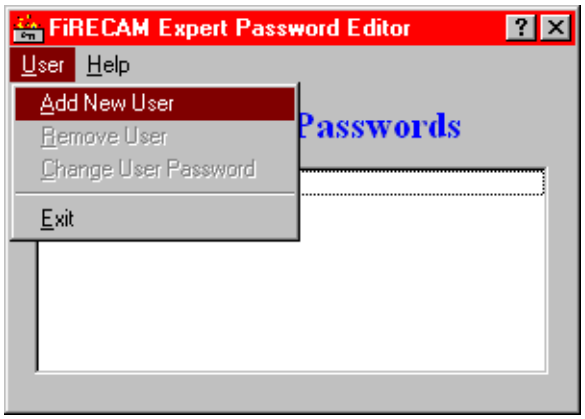


2.2 Adding a User to the Expert User List

To add a new user to the FiRECAM expert user's list:

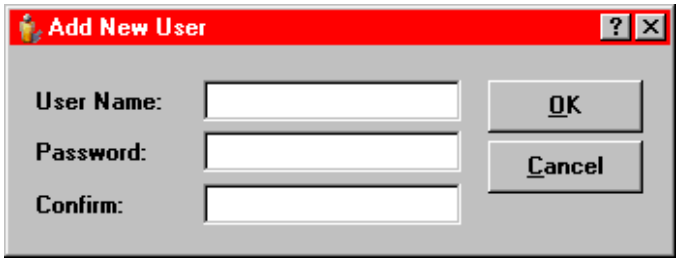
- Choose the **Add New User** from the **User** menu below

Figure 2-2. Adding a New User



- A password input dialog for the user's name and password will then appear, as shown in Figure 2-3:

Figure 2-3. Add New User Dialog



- Type a user name in the **User Name:** text box.
- Type the user's desired password in the **Password:** text box, and retype the password in the **Confirm:** text box.
- Click the **OK** button on the password input dialog box.

The user name and password will then be entered in the FiRECAM expert user and password list.

2.3 Modifying a User in the Expert User List

To modify an existing user password:

- Highlight the user to modify in the FiRECAM passwords list box by clicking on the desired user's name list. For example, Figure 2-4 below shows user '**t**' selected.

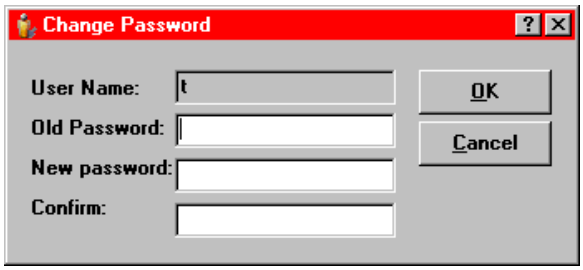
Figure 2-4. Selecting a User from the List

- Choose the **Change User Password** from the **User** menu

Figure 2-5. Changing an Existing User Password

- A password input dialog for the user's old and new passwords will then appear:

Figure 2-6. Password Change Dialog



- Type the user's old password in the **Old Password:** text box.
- Type the user's new password in the **New Password:** text box, and retype the new password in the **Confirm:** text box.
- Click the **OK** button on the password input dialog box.

The user's new password will then be entered in the password list.

2.4 Removing a User from the Expert User List

To remove a user from FiRECAM's Expert User List:

- Highlight the user to remove in the FiRECAM passwords list box by clicking on the desired entry. For example, Figure 2-7 below shows user **'t'** selected.

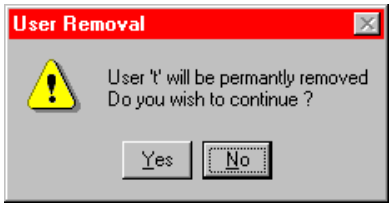
Figure 2-7. Selecting a User from the List

- Choose the **Remove User** from the **User** menu.

Figure 2-8. Removing an Existing User

- A confirmation dialog will then appear to verify the user choice.

Figure 2-9. Remove Confirmation Dialog



- Click the **Yes** button on the confirmation dialog box. The user will be deleted.

The user will then be removed from the Expert user list, and the User list will be updated.

2.5 Getting Help

FiREPASS has online help available. To access FiREPASS Help, choose **FiREPASS Help** from the **Help** menu, as shown below

There is also an **About FiREPASS…** splash screen available which provides some feedback on system information. Selecting this option from the **Help** menu will display this splash screen as shown in Figure 2-11 and Table 2-1 below:

Figure 2-10. Invoking FiREPASS Help and About FiREPASS

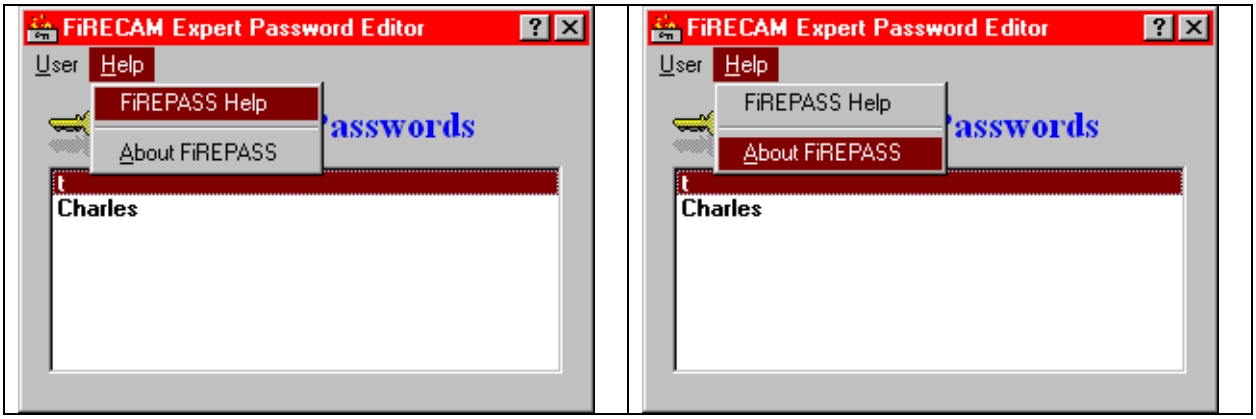


Figure 2-11. About FiREPASS Screen

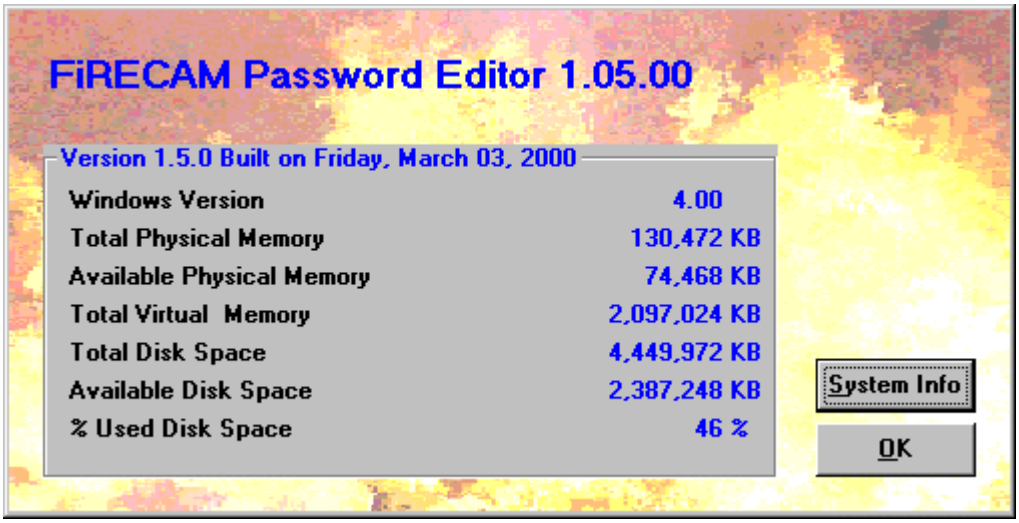


Table 2-1. Computer System Information

Computer Resources	
Windows Version	Windows Version
Total Physical Memory	Total installed RAM in the computer system in KB
Available Physical Memory	Available free RAM in the computer system in KB
Total Virtual Memory	Total virtual memory available (includes RAM and paging file) in KB
Total Disk Space	Total disk space in KB on drive C:
Available Disk Space	Available disk space in KB on drive C:
% Used Disk Space	% of used disk space on drive C:

3 FiRECAM STUCTURED STORAGE OUTPUT FILE BROWSER

WARNING

THIS UTILITY IS TO BE USED BY EXPERIENCED FiRECAM USERS AND THE FIRE RISK MANAGEMENT PROGRAM FOR VERIFICATION AND TESTING PURPOSES. IT IS INCLUDED FOR COMPLETENESS, BUT THE FIRE RISK MANAGEMENT PROGRAM CANNOT ASSUME RESPONSIBILITY OR BE HELD LIABLE FOR IMPROPER USE OF THIS UTILITY.

The **FiRE**CAM Structured Storage **Browse**r **(FIREBROWSE.EXE)** is used to browse through the contents of a FiRECAM output file. After a run, FiRECAM creates an output file, which contains the results in an internal folder and storage-structured format.

A FiRECAM output file contains the results of a run in an internal structure that mimics the organization of a disk's file system in a single file. This structure, called Structured Storage, is based on a new standardized technique for structuring blocks of data within the confines of a single file and is implemented as part of the Object Linking and Embedding (OLE) subsystem. In a Structured Storage file, blocks of data within a file are organized just as files are organized on a drive -- in a hierarchical structure. The storage elements analogous to directories are called **Storages** and those analogous to files are called **Streams**.

The next sections describe the use of the FiRECAM Structured Storage Browser.

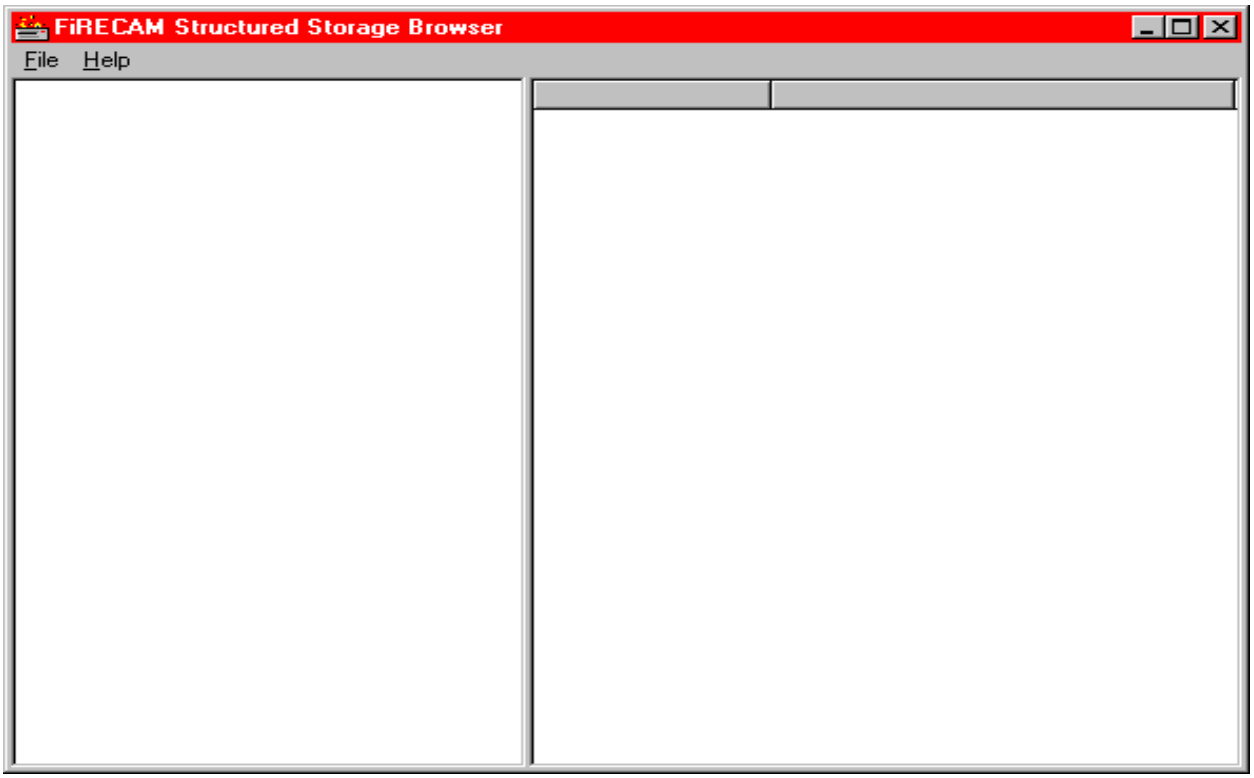
3.1 Starting FiREBrowse

To Start the FiRECAM Structured Storage File Browser

- Go to the FiRECAM Program Group
- Double-click the **FiREBrowse** icon to start the program, or choose **Start -> Program Files -> FiRECAM -> FiREBrowse** from the Windows **Start** button.

  - The **FiREBrowse** Main Screen shown below will then appear, as in Figure 3-1. The screen is organized in two main panes:
    - The left-hand side is a tree view that mimics the look of a Windows Explorer view showing the internal hierarchical layout of the file.
    - The right-hand pane shows information about a selected storage, as well as the contents of a selected stream.

Figure 3-1. FiREBrowse Main Startup Screen - No Opened File



3.2 Viewing a FiRECAM Structured Storage Output File

To view the contents of a FiRECAM output file, select the **Open File** from the **File** menu as shown below. An **Open File...** dialog will appear with the default file extension for a FiRECAM output file (**STG)**. This file contains the corresponding output data for a FiRECAM input file (with extension **FCI)**. The file's contents will then be loaded and displayed in a hierarchical tree view structure for quick browsing.

Figure 3-2. FiREBrowse File Open Menu and File Open Dialog

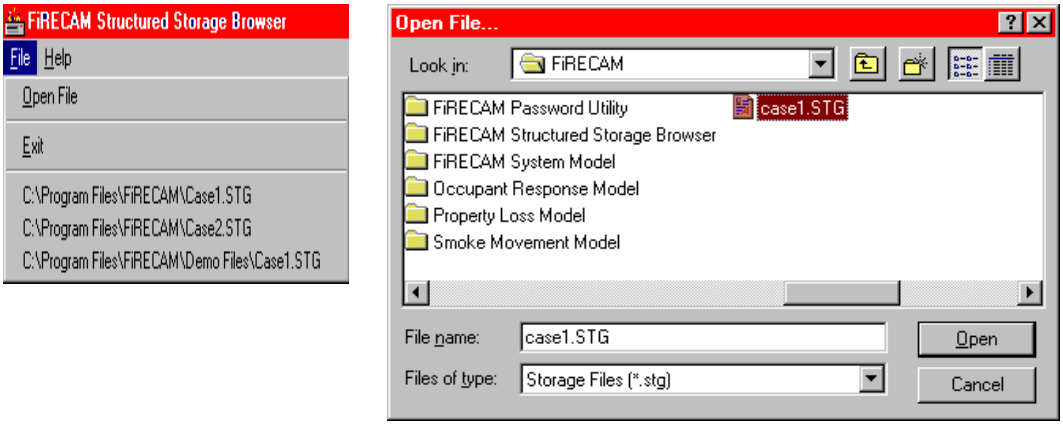


Figure 3-3. FiREBrowse Showing Structure and Contents of Opened File

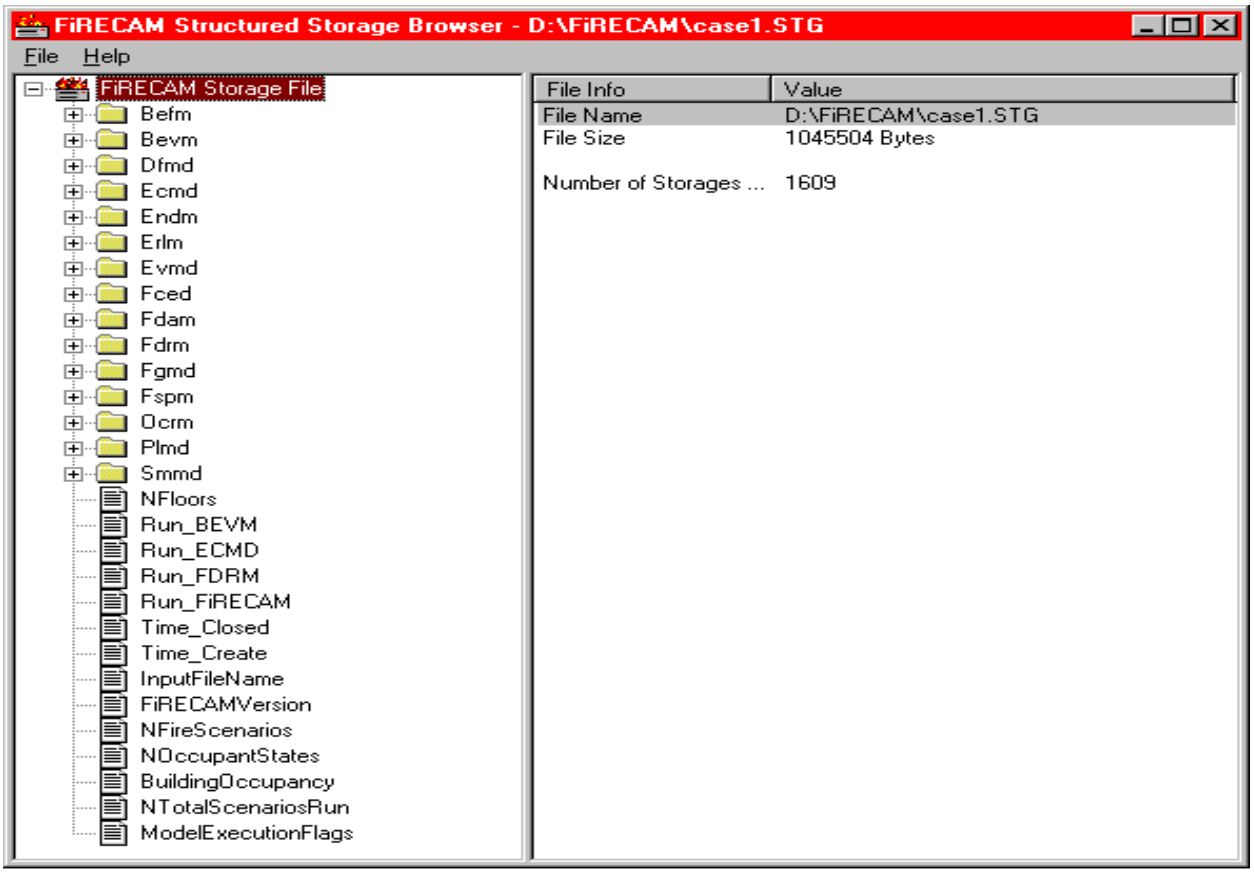


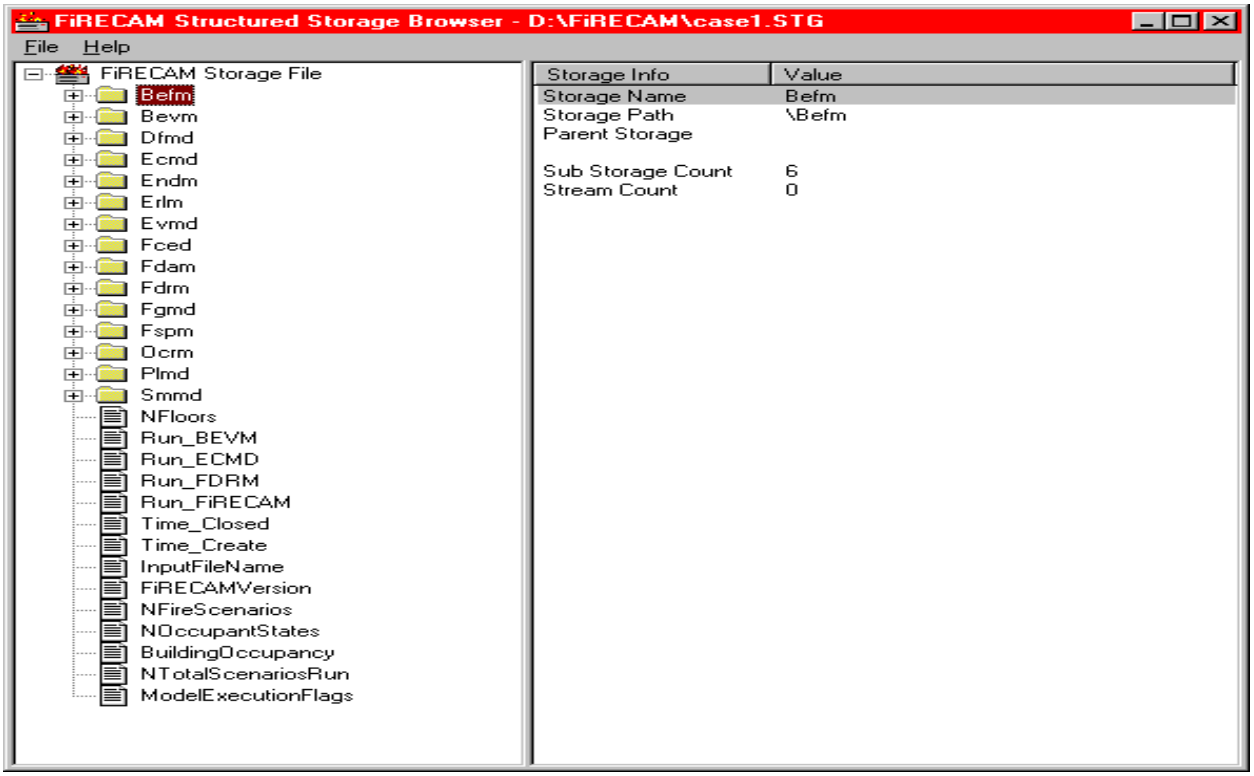
Table 3-1. Storage and Stream Icons

Icon	Type	Description
	Storage	A folder-like data structure that contains other storages or streams. The contents of a storage is a directory of its sub-storages and streams in a hierarchical structure
	Stream	A data stream that contains a block of data stored as a single non-seperable entity (stream). A stream is represented by a Visual Basic variant data type that saves information about the data's type (as in integer, single or string) as well as a copy of the data itself. Strings and arrays of data can also be saved as a single block.

3.2.1 Viewing a Storage

To view the contents of a storage, select one of the folder-like images from the tree view list in the left-hand pane of the main windows, as shown below:

Figure 3-4. Selecting and viewing the Contents of a Storage



When a storage is selected, the right-hand pane lists information about the selected storage and its contents. The information listed for a storage includes:

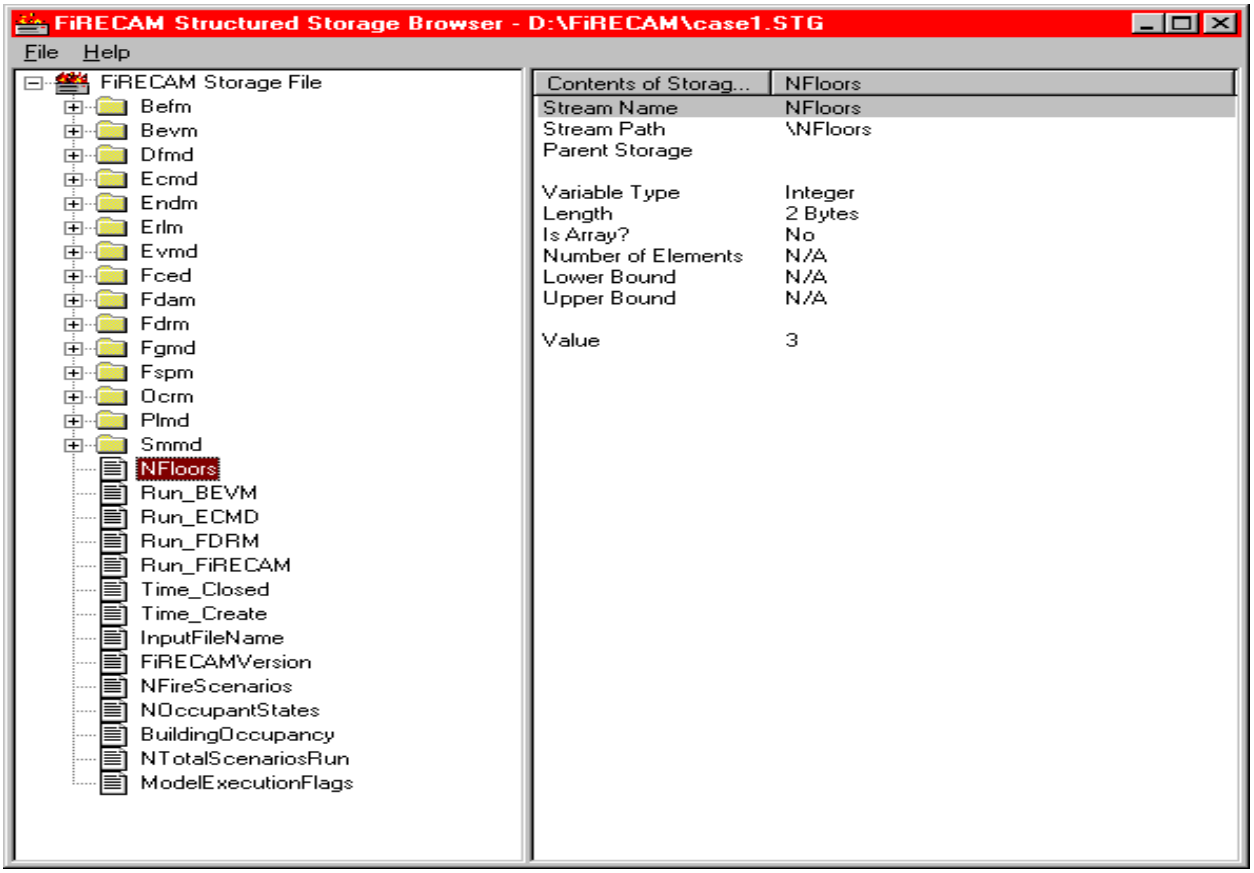
Table 3-2. Storage Contents and Values

Storage Info	Value
• Storage Name	The name of the storage element
• Storage Path	The full path of the storage from the topmost root storage (the highest upper level), including parent storages.
• Parent Storage	The name of this storage's parent storage
• Sub Storage Count	Count of child storages (sub-storages) this storage contains
• Stream Count	Count of the streams contained in this storage

3.2.2 Viewing a Stream

To view the contents of a stream, select one of the page-like images from the tree view list in the left-hand pane of the main windows, as shown below:

Figure 3-5. Selecting and viewing the Contents of a Stream



When a stream is selected, the right-hand pane lists information about the selected stream and its contents. The information listed for a stream includes:

Table 3-3. Stream Contents and Values

Storage Info	Value
• Stream Name	The name of the stream element
• Stream Path	The full path of the storage from the topmost root storage (the highest upper level), including parent storages.
• Parent Storage	The name of this stream's parent storage

Table 3-3 Continued

• Variable Type	The variable type contained in this stream, from one of the following types: • Empty • Null • Integer • Long Integer • Single Precision • Double Precision • Currency • Date • String • General Object • Error Object • Boolean • Variant • Data Access Object • Decimal • Byte
• Length	The length in bytes of the individual storage elements, whether as a single value or as part of an array (see below) • Empty 16 Bytes • Null 16 Bytes • Integer 2 Bytes • Long Integer 4 Bytes • Single Precision 4 Bytes • Double Precision 8 Bytes • Currency 8 Bytes • Date 8 Bytes • String Length of String in Bytes • General Object 16 Bytes • Error Object 16 Bytes • Boolean 2 Bytes • Variant 16 Bytes • Data Access Object 16 Bytes • Decimal 8 Bytes • Byte 1 Byte
• Is Array?	Indicates whether the stream contains an array of values rather than a scalar (single value)
• Number of Elements	For arrays, this is the total number of elements in the array. For scalars, this value is not applicable (N/A)
• Lower Bound	For arrays, this is the lower index bound value of the elements in the array. For scalars, this value is not applicable (N/A)
• Upper Bound	For arrays, this is the upper index bound value of the elements in the array. For scalars, this value is not applicable (N/A)
• Value(s)	This the value of the contents of the stream. For arrays, the values are listed as an ordered list of the values of each element, including the value of their indices.

3.3 Getting Help

FiREBrowse has online help available. To access FiREPASS Help, choose **FiREBrowse Help** from the **Help** menu, as shown below

Also available is an **About FiREBROWSE** splash screen which provides some feedback on system information.

Figure 3-6. Invoking FiREBrowse Help and About FiREBrowse

Selecting the About FIREBrowse will display this splash screen as shown below:

Figure 3-7. About FiREBrowse

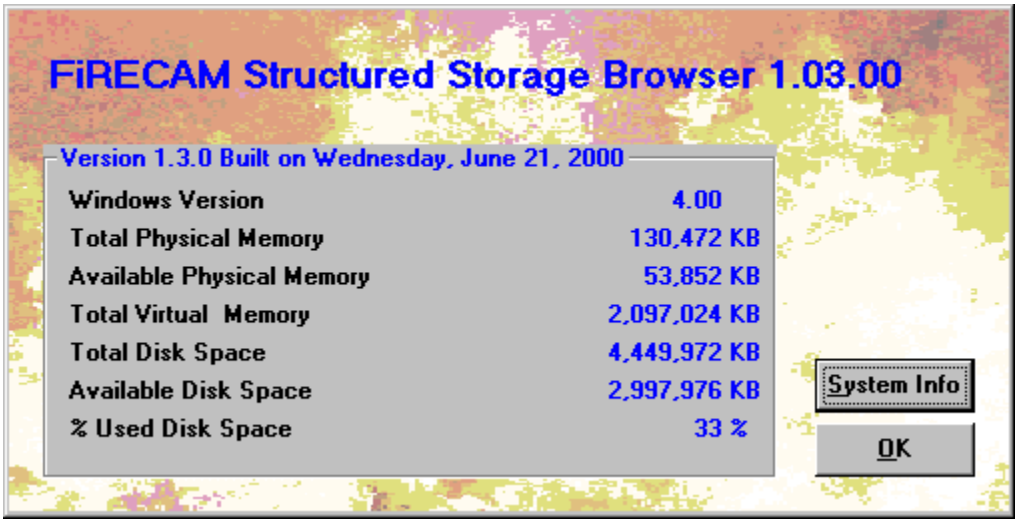


Table 3-4. Computer System Information

Computer Resources	
Windows Version	Windows Version
Total Physical Memory	Total installed RAM in the computer system in KB
Available Physical Memory	Available free RAM in the computer system in KB
Total Virtual Memory	Total virtual memory available (includes RAM and paging file) in KB
Total Disk Space	Total disk space in KB on drive C:
Available Disk Space	Available disk space in KB on drive C:
% Used Disk Space	% of used disk space on drive C:

4 FIRECAM EXPERT DEBUGGING OPTIONS

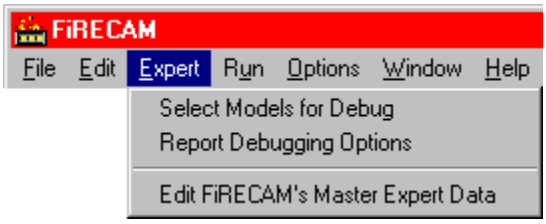
WARNING

THIS UTILITY IS TO BE USED BY EXPERIENCED FiRECAM USERS AND THE FIRE RISK MANAGEMENT PROGRAM FOR VERIFICATION AND TESTING PURPOSES. IT IS INCLUDED FOR COMPLETENESS, BUT THE FIRE RISK MANAGEMENT PROGRAM CANNOT ASSUME RESPONSIBILITY OR BE HELD LIABLE FOR IMPROPER USE AND MODIFICATION OF THE FiRECAM EXPERT DATABASE CONTENTS. CAUTION IS ADVISED WHEN INSPECTING OR MODIFYING THE FiRECAM EXPERT DATABASE.

4.1 Viewing Expert Data

In order to view FiRECAM's expert data, the user has to have entered a valid username and password at the FiRECAM Expert Password prompt. Once this process is successful, the Expert Menu's submenu "Edit FiRECAM's Master Expert Data" can be accessed (see Figure 4-1.)

Figure 4-1. Expert Mode Menu



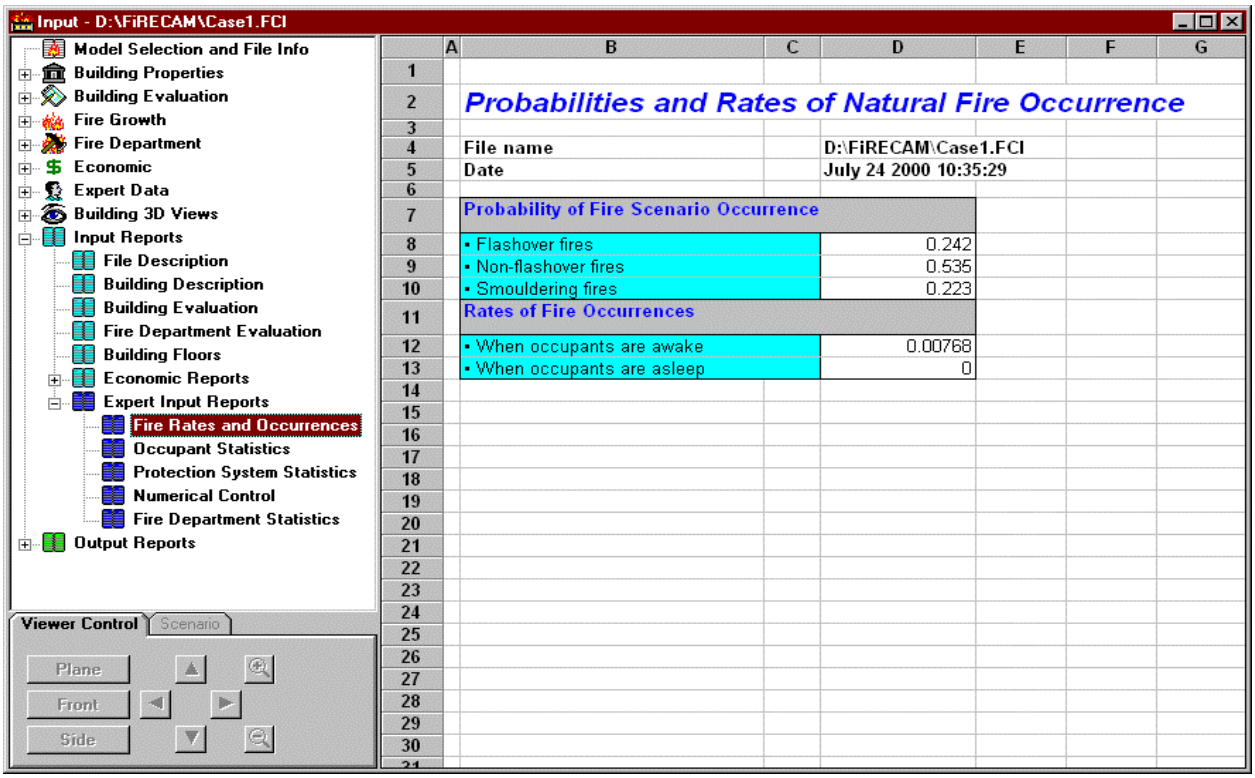
In addition, the user can also view the expert input data when an input report is viewed. An excel worksheet report is displayed as shown in Figure 4-2.

Statistical information and factors used by the Expert Data cover the following areas:

- Fire Rates and Occurrences
- Occupant Statistics
- Protection System Statistics
- Numerical Control
- Fire Department Statistics

Figure 4-2 displays the Expert Data tree root that will present the expert input data used in the form of an Excel® spreadsheet report.

Figure 4-2. Expert Data Spreadsheet



4.1.1 Probabilities and Rates of Natural Fire Occurrence

Table 4-1 presents the parameters available for fire scenario occurrences and rates of fire occurrences, while Table 4-2 displays a spreadsheet fragment of these parameters.

Table 4-1. Probabilities and Rates of Natural Fire Occurrence

Probability of Scenario Occurrence
• Probability of occurrence for flashover fires • Probability of occurrence for non-flashover fires • Probability of occurrence for smouldering fires
Rates of Fire Occurrences
• Rate of fire occurrence when occupants are awake • Rate of fire occurrence when occupants are asleep

Table 4-2. Typical Expert Data Spreadsheet Fragment with Probabilities and Rates of Natural Fire Occurrence

Probability of Fire Scenario Occurrence	
• Flashover fires	0.2420
• Non-flashover fires	0.5350
• Smouldering fires	0.2230
Rates of Fire Occurrences	
• When occupants are awake	0.00768
• When occupants are asleep	0.00000

4.1.2 Occupant Statistical Data

Table 4-3 presents the parameters available for occupant perception factors; occupant action factors and occupant travel speeds, while Table 4-4 displays a spreadsheet fragment of these parameters.

Table 4-3. Probabilities of Perception and Action and Occupant Speeds

Occupant Risk Factors
• Perception
Occupant Risk Factors
• Perceive • Warn Occupants • Local Alarm • Central Alarm • Voice Alarm • Fire Department
Occupant Travel Speeds
• Emergency Horizontal • Emergency Stair (Up) • Emergency Stair (Down) • Normal Horizontal • Normal Stair (Up) • Normal Stair (Down)

Table 4-4. Typical Expert Data Spreadsheet Fragment

Interpretation Time Delays		
• Reasonable response probability	sec	50
• Fair response probability	sec	98
• Little response probability	sec	250
Probability of Calling Fire Department by…		
• Occupants in fire origin compartment		0.9000
• Occupants on fire origin floor		0.5000
• Occupants on non fire origin floors		0.0200

4.1.3 Protection System and Smoke Control Statistical Data

Table 4-5 presents the probability parameters available for sensor operation, smoke and sprinkler control and barrier failure, while Table 4-6 displays a spreadsheet fragment of these probability parameters.

Table 4-5. Protection System Statistics

Sensor Operation Probability
• Local smoke alarm activation probability • Smoke detector activation probability • Heat detector activation probability • Reliability of central alarm system (control panels)
Smoke and Sprinkler Control
• Probability that smoke ventilation system is working • Probability that stair pressurization system is working • Reliability of automatic sprinkler system • Effectiveness of automatic sprinkler system
Probability of Barrier Failures
• Failure probability between open stairs to open stairs (up) • Failure probability between open stairs to open stairs (down)

Table 4-6. Typical Expert Data Spreadsheet Fragment with Protection System Statistics

Sensor Activation Probabilities	
Local smoke alarm	0.8000
Smoke detector	0.8000
Heat detector	0.8000
Reliability of central alarm system (control panels)	0.8000
Smoke and Sprinkler Control	
Probability that smoke ventilation system is working	0.8000
Probability that stair pressurization system is working	0.8000
Reliability of automatic sprinkler system	0.9000
Effectiveness of automatic sprinkler system	0.9000
Probability of Barrier Failures	
Open stairs to open stairs (up)	0.9000
Open stairs to open stairs (down)	0.1000

Table 4-7 presents the probability parameters available for door conditions, while Table 4-8 displays a spreadsheet fragment of these probability parameters.

Table 4-7. Door Statistics

Probability of Doors
• Probability of door from fire compartment to corridor on any level being open • Probability of door leading from corridor to stair shaft on any level being open • Probability of door leading from non-fire compartment to corridor on any level being open

Table 4-8. Typical Expert Data Spreadsheet Fragment with Door Statistics

Probability of Open Doors	
From fire compartment to corridor on any level	0.9000
From corridor to stair shaft on any level	0.1000
From non-fire compartment to corridor on any level	0.9000

4.1.4 Numerical Control Data

Table 4-9 presents the parameters available for barrier failure and the failure correction factors used by FiRECAM's Expert Data, while Table 4-10 displays a spreadsheet fragment of these parameters and factors.

Table 4-9. Numerical Model Parameters

Barrier Failure Parameters
• Standard deviation/mean fire rating for the construction element • Average thermal inertia value of building materials • Standard deviation of the inventory fire load density • Inventory mean load fire density
Failure Correction Factors
• Correction for walls and floors made of plasterboard • Correction for inadvertent openings of wall and floor • Fire Spread Control • Tolerance limit for probability of fire spread calculations

Table 4-10. Typical Expert Data Spreadsheet Fragment with Numerical Model Parameters

Fire Spread Control	
Combine stairs	No
Combine elevators	No
Combine service ducts	No
Tolerance limit for probability of fire spread calculations	0.001
Maximum path length (hops) for fire spread calculations	5
Evacuation Control	
Stop evacuation when…	Stairs blocked by smoke
Maximum allowed time for evacuation building sec	90

4.1.5 Fire Department Statistical Data

Table 4-11 presents the default setup and response time parameters used by FiRECAM's Expert Data, while Table 4-12 displays a spreadsheet fragment of these time parameters.

Table 4-11. Fire Department Statistics

Default Setup and Response
• Dispatch Time • Preparation Time • Response Time • Travel Time • Setup Time

Table 4-12. Typical Expert Data Spreadsheet Fragment with Fire Department Statistics

Ideal Setup and Response Times		
Dispatch Time	sec	50
Preparation Time	sec	70
Response Time	sec	120
Travel Time	sec	50
Setup Time	sec	70

Table 4-13 presents the dispatch and preparation time factors used by FiRECAM's Expert Data, while Table 4-14 displays a spreadsheet fragment of these time factors.

Table 4-13. Fire Department Dispatch and Preparation Data

Dispatch Time Factors
• Experience • Training • Local Knowledge • Availability • Potential for Explosions • Potential for Building Collapse • Potential for Hazardous Material
Preparation Time Factors
• Experience • Training • Local Knowledge • Availability • Potential for Explosions • Potential for Building Collapse • Potential for Hazardous Material

Table 4-14. Typical Expert Data Spreadsheet Fragment with Fire Department Dispatch and Preparation Data

Dispatch Time Expansion Factors		
Experience	> 2 Years	0.0000
	< 2 Years	0.0050
	Novice	0.0100
Training	High	0.0000
	Medium	0.0050
	Low	0.0100
Local Knowledge	Very Good	0.0000
	Good	0.0050
	Poor	0.0100
Availability	Good	0.0000
	Medium	0.0050
	Poor	0.0100
Potential for Explosions	Low	0.0000
	Medium	0.0050
	High	0.0100
Potential for Building Collapse	Low	0.0000
	Medium	0.0050
	High	0.0100
Potential for Hazardous Material	Low	0.0000
	Medium	0.0050
	High	0.0100
Preparation Time Expansion Factors		
Experience	> 2 Years	0.0000
	< 2 Years	0.0050
	Novice	0.0100
Training	High	0.0000
	Medium	0.0050
	Low	0.0100
Local Knowledge	Very Good	0.0000
	Good	0.0050
	Poor	0.0100
Availability	Good	0.0000
	Medium	0.0050
	Poor	0.0100
Potential for Explosions	Low	0.0000
	Medium	0.0050
	High	0.0100
Potential for Building Collapse	Low	0.0000
	Medium	0.0050
	High	0.0100
Potential for Hazardous Material	Low	0.0000
	Medium	0.0050
	High	0.0100

Table 4-15 presents the travel time factors used by FiRECAM's Expert Data, while Table 4-16 displays a spreadsheet fragment of these time factors.

Table 4-15. Travel and Route Condition Factors

Travel Time Factors
• Communication Systems • Incident Notification • Notification of Absent Firefighters • Experience • Local Knowledge • Street Arrangements • Curves and Intersections • Traffic Volume

Table 4-16. Typical Expert Data Spreadsheet Fragment with Travel and Route Condition Factors

Travel Time Expansion Factors		
Communication Systems	Central Alarm	0.0000
	PA System	0.1000
	(not used)	0.0000
Incident Notification	Auto Alarm	0.0000
	911 Centre	0.5000
	Public Phone	1.0000
Notification of Absent Firefighters	Page System	0.0000
	Special Phone	0.5000
	PA System	1.0000
Experience	> 2 Years	0.0000
	< 2 Years	0.0250
	Novice	0.0500
Local Knowledge	Very Good	0.0000
	Good	0.0250
	Poor	0.0500
Street Arrangements	Wide	0.0000
	Average	0.0250
	Narrow	0.0500
Curves and Intersections	Low	0.0000
	Medium	0.0500
	High	0.1000
Traffic Volume	Low	0.0000
	Medium	0.1000
	High	0.2000

Table 4-17 presents the equipment factors used by FiRECAM's Expert Data, while Table 4-18 displays a spreadsheet fragment of these equipment factors.

Table 4-17. Equipment Factors

Equipment Description
• Direct Alarm Connection • Central Alarm • Sprinklers • Smoke Control System • Communication System • Emergency Power • Emergency Lighting • Fire Elevators • Hose Cabinets • Manual Fire Extinguishers

Table 4-18. Typical Expert Data Spreadsheet Fragment with Equipment Factors

Equipment Installations	Installed	Not Installed
Direct Alarm Connection	0.0200	0.0000
Central Alarm	0.0100	0.0000
Sprinklers	0.0200	0.0000
Smoke Control System	0.0100	0.0000
Communication System	0.0100	0.0000
Emergency Power	0.0050	0.0000
Emergency Lighting	0.0100	0.0000
Fire Elevators	0.0050	0.0000
Hose Cabinets	0.0100	0.0000
Manual Fire Extinguishers	0.0100	0.0000

Table 4-19 presents crew and building height factors used by FiRECAM's Expert Data, while Table 4-20 displays a spreadsheet fragment of these factors.

Table 4-19. Crew and Building Factors

Crew Description
• Factor for Full-Time Firefighters • Factor for Part-Time Firefighters • Factor for Volunteer Firefighters • Minimum Crew Size • Crew Size Differential
Building Height
• Underground • 1 to 3 Floors • 4 to 6 Floors • 7 to 13 Floors • > 13 Floors

Table 4-20. Typical Expert Data Spreadsheet Fragment with Crew and Building Factors

Crew Description	
Factor for Full Time Firefighters	1.0000
Factor for Part Time Firefighters	0.9000
Factor for Volunteer Firefighters	0.8500
Minimum Crew Size	5
Crew Size Differential	2
Building Height	
Underground	0.7000
1 to 3 Floors	1.0000
4 to 6 Floors	0.9000
7 to 13 Floors	0.7000
> 13 Floors	0.4000

4.2 Fire Scenario and FiRECAM Model Selection

For expert users, FiRECAM allows selective execution of FiRECAM models, as well as the fire scenarios. To select FiRECAM fire scenarios and models, choose the **Select Models for Debug** from the **Expert** menu as shown in Figure 4-3.

Figure 4-3. FiRECAM Expert Menu - Scenario and Models

Fire scenarios can be selected by using the FiRECAM model selection fire scenarios tab, as shown in Figure 4-4.

Table 4-21 summarizes FiRECAM's model execution for different fire scenarios and occupant states.

Table 4-21 FiRECAM Model Scenario and Occupant State Execution Lists

Scenario	BEVM	FDRM	ECMD	BEFM	DFMD	FGMD	FDAM	OCRM	SMMD	EVMD	FDEM	FSPM	ENDM	ERLM	PLMD	FCED
Run Once Only[1]	●	●	●	●												●
FL/DO - Flashover fire, fire compartment door open					●	●	●	●	●	●	●	●	●	●	●	
FL/DC - Flashover fire, fire compartment door closed					●	●	●	●	●	●	●	●	●	●	●	
NF/DO - Non-flashover fire, fire compartment door open					●	●	●	●	●	●	●	●	●	●	●	
NF/DC - Non-flashover fire, fire compartment door closed					●	●	●	●	●	●	●	●	●	●	●	
SM/DO - Smouldering fire, fire compartment door open					●	●	●	●	●	●	●	●	●	●	●	
SM/DC - Smouldering fire, fire compartment door closed					●	●	●	●	●	●	●	●	●	●	●	
Occupants Awake[2]					●	●	●	●	●	●	●		●	●	●	
Occupants Asleep					●		●	●		●	●		●	●		
Each Fire Origin Floor[3]				●					●	●	●	●	●			

[1] Some models are scenario independent, therefore their output is computed once only.
[2] For office occupancy buildings, occupants are always assumed to be awake; occupants asleep scenario is not run.
[3] Fire floor calculations are done internally.

Figure 4-4. FiRECAM Debug Selection - Fire Scenarios

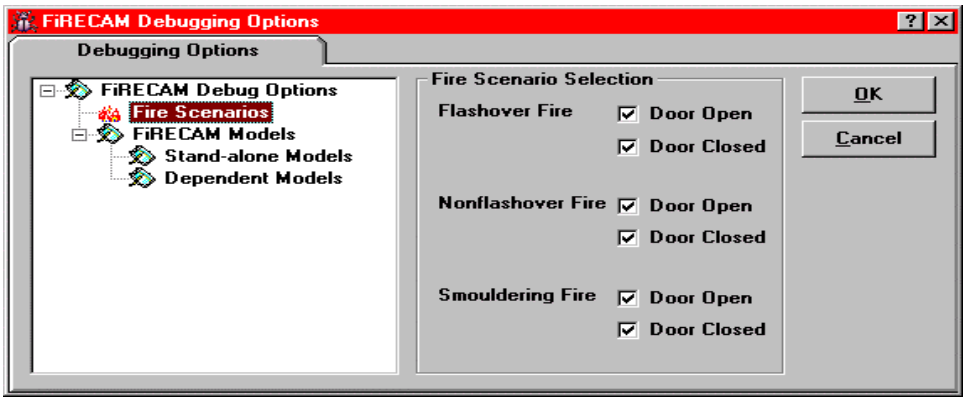


Figure 4-4 displays FiRECAM's model debugging options according to different fire scenarios.

Table 4-22. FiRECAM Model Debugging Options – Fire Scenarios

Model Debugging Options	
Fire Scenarios	**Fire Compartment Door State**
Flashover Fire	Door Open
	Door Closed
Nonflashover Fire	Door Open
	Door Closed
Smouldering Fire	Door Open
	Door Closed

FiRECAM models can also be selected by using the FiRECAM model selection tab, as shown in Figure 4-5.

Figure 4-5. FiRECAM Debug Selection - Stand-alone Models

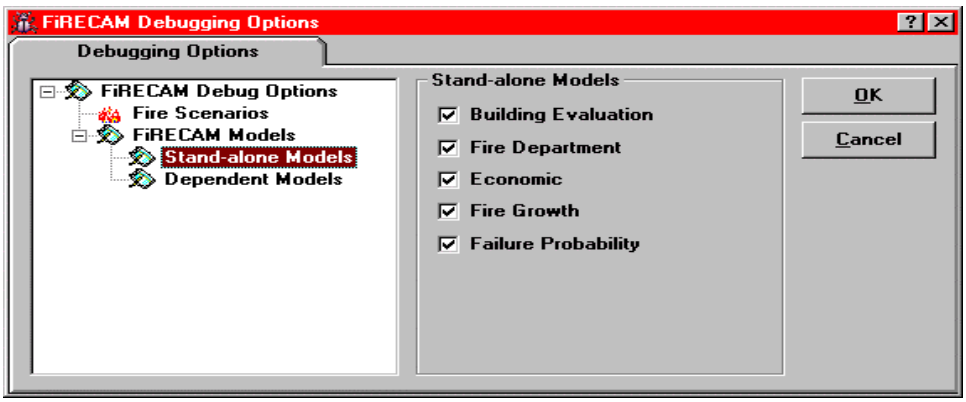


Figure 4-6. FiRECAM Debug Selection - Dependent Models

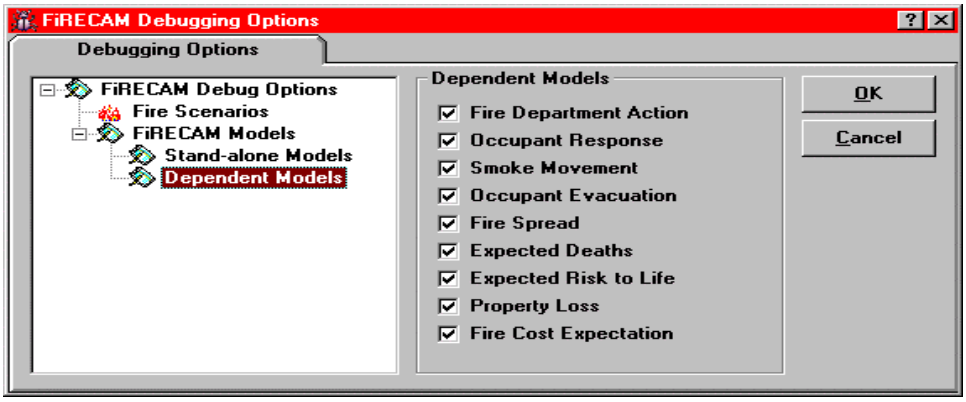


Table 4-23 displays FiRECAM's model debugging options according to FiRECAM models and submodels.

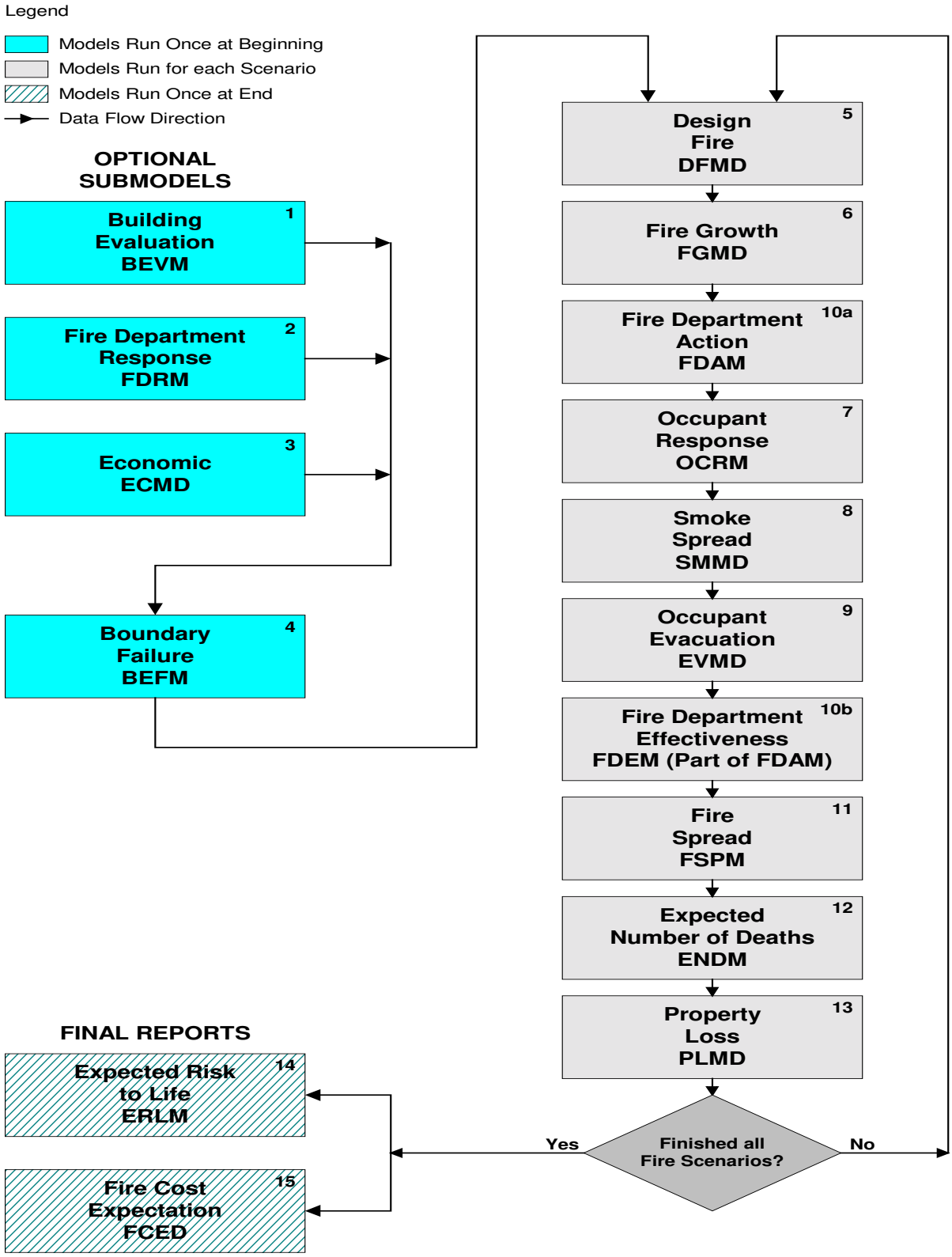
Table 4-23. FiRECAM Model Debugging Options – FiRECAM Models

Model Debugging Options		
Standalone Submodels	**Short Name**	**Description**
Building Evaluation	**BEVM**	Building Evaluation Model
Fire Department	**FDRM**	Fire Department Response Model
Fire Cost Expectation	**FCED**	Fire Cost Expectation Model
Economic	**ECMD**	Economic Model
Failure Probability	**BEFM**	Boundary Element Failure Model
Dependent Submodels	**Short Name**	**Description**
Occupant Response	**OCRM**	Occupant Response Model
Evacuation	**EVMD**	Evacuation Model
Fire Department Action	**FDAM**	Fire Department Action Model
Smoke Movement	**SMMD**	Smoke Movement Model
Flame Spread	**FSPM**	Fire Spread Model
Expected Deaths	**ENDM**	Expected Number Of Deaths Model
Expected Risk to Life	**ERLM**	Expected Risk To Life Model
Property Loss	**PLMD**	Property Loss Model
Fire Growth	**FGMD**	Fire Growth Model

Table 4-24. Model Execution Sequence Dependency Matrix

BEVM	v															
FDRM	v															
ECMD	v															
BEFM	v															
DFMD	v															
FGMD	v															
FDAM	v		●				●									
OCRM	v		●				●	●								
SMMD	v		●				●	●	●							
EVMD	v		●				●	●	●	●						
FSPM	v		●		●		●	●								
ENDM	v		●		●		●	●	●	●	●	●				
PLMD	v		●		●		●	●	●	●	●	●	●			
ERLM	v		●	●	●	●	●	●	●	●		●				
FCED	v		●	●	●	●	●	●	●	●		●		●		
Model Output		v BEVM	v FDRM	v ECMD	v BEFM	v DFMD	v FGMD	v FDAM	v OCRM	v SMMD	v EVMD	v FSPM	v ENDM	v PLMD	v ERLM	v FCED

Figure 4-7 FiRECAM Model Execution Sequence



5 REFERENCES

1. Yung, D., Hadjisophocleous, G. V., Proulx, G. and Kyle, B.R., 1996, Cost Effective Fire-Safety Upgrade Options for a Canadian Government Office Building, Proceedings of the International conference on performance Based Codes and Fire Safety Design Methods, Ottawa, Canada.

2. Gaskin, J. and Yung, D., 1993, Canadian and U.S.A. Fire Statistics for Use in the Risk-Cost Assessment Model, Internal Report No. 637, Institute for Research in Construction, National Research Council Canada, Ottawa, Canada.

3. Hadjisophocleous, G. V. and Yung, D., 1994, Parametric Study of the NRCC Fire Risk-Cost Assessment Model for Apartment and Office Buildings, Proceedings of the 4th International Symposium on Fire Safety Science, Ottawa, Canada, pp. 829-840.

4. Takeda, H. and Yung, D., 1992, Simplified Fire Growth Models for Risk-Cost Assessment in Apartment Buildings, Journal of Fire Protection Engineering, Vol. 4, No. 2, pp. 53-66.

5. Proulx, G. and Hadjisophocleous, G. V., 1994, Occupant Response Model: A Sub-Model for the NRCC Risk-Cost Assessment Model, Proceedings of the 4th International Symposium on Fire Safety Science, Ottawa, Canada, pp. 841-852.

6. Hadjisophocleous, G. V. and Yung, D., 1992, A Model for Calculating the Probabilities of Smoke Hazard from Fires in Multi-Storey Buildings, Journal of Fire Protection Engineering, Vol. 4, No. 2, pp.67-80.