Fire Protection Information System

By

Mohd. Noor Aizuddin bin Ismail

Dissertation submitted in partial
fulfillment of the requirements for the
Bachelor of Engineering (Hons)
(Civil Engineering)

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CERTIFICATION OF APPROVAL

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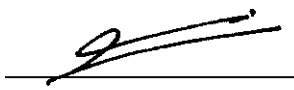
Approved by,



(AP. Dr. Abdul Nasir Matori)

UNIVERSITI TEKNOLOGI PETRONAS
TRONOH, PERAK
June 2007

CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgement, and the original work contained herein have not been undertaken or done by unspecified sources or persons.

MOHD. NOOR AIZUDDIN BIN ISMAIL

ACKNOWLEDGEMENT

Bismillah ar-Rahmani ar-Rahim

In the Name of Allah, the Most Compassionate, the Most Merciful

Alhamdulillah, thanks to Allah S.W.T, with His guidance and bless, I managed to complete my Final Year Project entitled **Fire Protection Information System.**

I would like to express my special gratitude to my supervisor AP. Dr. Abdul Nasir Matori for his guidance, idea nad giving me this opportunity to do this project. Enormous gratitude goes to the internal examiners for their comments and recommendation for this project during FYP 1.

Special acknowledgement goes to my parents for their supports and motivation. Last but not least thanks to all parties who involve directly or indirectly during the period of completion of this project.

ABSTRACT

The project title is Fire Protection Information System consist of Emergency Response Plan and maintenance of Fire Protection equipment and it is a case study of MMC Oil & Gas Office which were located at level 20, 21 & 22 of Menara Asia Life, Jalan Tun Razak, Kuala Lumpur . The objective of the project is to develop and implement a GIS database for Fire Protection System of MMC Office while perform analysis on Fire Protection System maintenance information capabilities of Emergency Response Plan (ERP). These Project objectives are also to assess the effectiveness of GIS for fire protection equipment, maintenance management. Maintenance is a very important task for a well-developed country in order to avoid from any catastrophe. Maintenance of a building especially Fire Protection System for a large scale building such as MMC Office could be costly and therefore it could be neglected due to the high cost to maintain. Thus, a proper maintenance management of a building will minimize cost to perform the maintenance within the given budget. Scope of the project is to evaluate the performance of Fire Protection maintenance and Emergency Response Plan (ERP) and, minimize the maintenance cost of high- and medium-rise building while taking into account the Fire Protection System management. This will focus on several critical aspects in the building which need a frequent checking/maintaining, by designing a user-friendly databases and easily accessible by users. In order to complete the project, a research, raw maintenance database gathering, compilation of building plan (autoCAD format) need to be done. Then, the database will be converted in a newly developed database system by using GIS applications. Learning GIS – based software for instance MapInfo 7.0 Professional is going to be crucial for this project. To design a user-friendly interface, Microsoft Visual Basic is going to be used by manipulating the GIS system database. At the end of the timeline, the end-product of this project is going to be a system database which will assist building managers and engineers in building managing Fire Protection System of a building more efficiently.

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1.1 Background of Study

Building maintenance is the process of keeping the building in good condition to ensure its facade, durability and functionality. For the completion of the project, knowledge on the application of GIS software (Map Info, Arc View and Visual Basic) and building maintenance management will apply. The subject under discussions will serve as the fundamentals in understanding the essential theoretical concepts and act as guidance in learning the best approach for the project. Geographic Information System (GIS) is a collection of computer hardware, software, and geographic data for capturing, managing, analyzing, and displaying all forms of geographically referenced information. By using geographic information system (GIS), information or database will be linking to location data (utilities system and infrastructures), for instance fire alarm system, location of each fire extinguisher, hose reel, fireman intercom and location of emergency escape route. GIS can layer the information to give a better understanding on how it all works together. We can choose what layers to combine based on what questions we need to answer.[2]

1.2 Problem Statement

Maintaining Fire Protection System and Emergency Response Plan (ERP) for a large scale building for instance MMC Office in Menara Asia Life, Jalan Tun Razak, Kuala Lumpur could be costly and therefore it could be neglected due to the high cost to maintain. Using GIS, maintenance process could be properly scheduled and priortized to optimize the maintenance process within the budget.

1.2.1 Problem Identification

The problem arose when there is a maintenance budget for a specified building. Regular building maintenance is essential because it helps conserve both energy and materials over the life of the building. To plan and prioritize maintenance activities effectively, building managers must be able to assess the risk of failure. There is thus a need for software to integrate this information and provide building managers with cost effective maintenance scenarios.

1.2.2 Significant of the Project

The end-product from this project is expected to assist engineers and technician to properly schedule and priortize maintenance works and Emergency Response Plan to be done efficiently within the limited budget and time. The project aim is to conduct studies on minimize of cost for building maintenance (utilities system and infrastructure) especially Fire Protection System for a large scale building such as MMC Office at Menara Asia Life. Jalan Tun Razak, Kuala Lumpur. Therefore, as this project is to be completed by the given time, it can be used as a guideline in implementation of new building to be constructed as well as to the current building. This project will thoroughly carry out the data analysis to fully minimize the cost of building management.

1.3 Objective and Scope of Study

1.3.1 The Relevancy of the Project

This paper presents purpose, functions, structures, hardware and software support of the Intelligent GIS for Fire Protection System, where the system to provide computer support in fire rescue protection process and to handle regulations monitoring of fire protection and prevention. It is an open GIS that works on cheap hardware and software platforms. The system provides real-time, computer monitoring and management of fire & rescue action. It also provides storing, processing, analyzing, searching and representing spatial data, relevant for fire protection system and maintenance service work.

The objectives of the project are:

1. To develop and implement a GIS database for Fire Protection System Maintenance and Emergency Response Plan (ERP) of MMC Office in Kuala Lumpur..

2. To perform some analysis on Fire Protection System information capabilities of MMC Office.

3. To assess the effectiveness of GIS for building maintenance management.

1.3.2 Feasibility of the Project within the Scope and Time Frame

Due to time constraint and certain technical aspect, the project is narrowed down to MMC Office in Jalan Tun Razak, Kuala Lumpur which was author Industrial Internship placement from December 05 to July 06, instead of UTP Academic complex.

The Fire Protection System consist of;

- Emergency Response Plan (ERP) including, Emergency Response Team (ERT) and Emergency Escape Route
- Fire Alarm System
- Fireman Intercom
- Hose reel System
- Portable Fire Extinguisher

CHAPTER 2
LITERATURE REVIEW AND THEORY

2.1 Geographical Information System (GIS)

GIS can be defined as a system for capturing, storing, checking, manipulating, analyzing and displaying data which are spatially referenced [5].

Geographic information systems (GISs) are spread used in all areas where there is a need for documenting, organizing and using different geographic information. They can be found in government institutions, public and private corporations, and can be used by different users for different purposes, for example, for map production, statistics, research, environment control, facility management, natural resource management, demographic and spatial planning, control, command and communication, navigation of airplanes, ships and cars, as well as for different analysis and simulation of the use of spatial objects. Due to complex system structure, the complete and exact definition of GIS principles doesn't still exist. One of it's main characteristics aspects is multidiscipline approach. Geographic information systems are of great interests for scientists in geography, cartography, surveying, computer science, computer graphic and many other fields. This is the reason why computer programs dealing with geographic information are given different names: "Geobase information systems", "Information systems of natural resources", "Geodata systems", "Land information systems", etc. Nowadays, the term GIS has become a general name for all systems above. At present, GIS is defined as computer-based information system which uses for capture, store, manipulate and display spatially referenced data in different poit of time for solving complex research, planning and management problems [11]. Different functional descriptions of geographic information systems can be found in various papers. However, five basic components can be seen:

- data input processing
- data storage, retrieval and database management
- data manipulation and analysis
- display and product reports
- user interface

The query language is used as the part of user interface. GIS includes database management system with powerful graphic algorithms, spatial operations and powerful graphic interface provide work with windows, icons, menus, and direct object manipulation [11].

Geographic information systems found special application in systems for monitoring and management of spatial objects and in command, control and communication information systems which have application in the army, policy, large transport and energetic systems.

2.2 GIS Application in Modern World

" When the UDS GIS Committee began its task of selecting a pipeline information system, we were well aware of the broad range of application available for our consideration. None of use were GIS experts. We had only broad directives regarding system functionality. Our budget was limited and were quite sure that million dollar solution will never receive an approval. In addition to many commercial GIS alternatives, we were being asked to consider a data management system being developed internally. The challenge before u was considerable."

Gerald Childers
Ultramar Diamond Shamrock Corporation (UDS)
P.O. Box 696000, San Antonio, Texas 78269-6000

2.3 GIS Approach in Building Maintenance Management

GIS Approach in Building Maintenance Management are obviously more comprehensive compared to the traditional approach. GIS approach using a system to store and manipulate the maintenance data while traditional approach requires manual access to the databases and spreadsheets [1]. No more bulky filing system containing all the building maintenance data.

Advantages of GIS Approach in Building Maintenance Management;

- Systematic and convenient storage of database
- Time saving for maintenance planning
- Better data accessibility

2.4 Building Maintenance

Building maintenance can be classified into two categories which is periodical and unexpected[6],

2.4.1 Periodical (Planned maintenance)

This consist the list of works which are expected need to be done on schedule or in a maintenance cycle. Most of periodical maintenance done can be considered as a preventive action. Preventive maintenance is done to prevent any damages to the building utilities and infrastructure.

2.4.2 Unexpected (Unplanned maintenance)

This consist the list of works which need to be carried out beyond the plan due to any unexpected failures or errors to the building utilities and infrastructures. Most of unexpected maintenance done can be considered as a corrective action. Corrective maintenance is done to bring back the utilities and infrastructures into its normal functionality from errors or failures.

2.5 Fire Protection System

The design of any fire-protection system is an exact science that takes into account a building's use, occupancy, footprint, and even its other installed systems.

Planning for fire protection involves an integrated approach in which system designers need to analyze building components as a total package. In most cases, the analysis needs to go beyond basic code compliance and the owner's minimum legal responsibilities for providing protection.

The design process should be a holistic one for both new construction and retrofits. Building ownership and management, architects, engineers, contractors, and consultants all need to be involved in the planning and design process, and fully understand the issues and concerns of all other parties.

2.5.1 Code Compliance

Code compliance is the first objective in any design. Codes are legal minimum requirements that need to meet the minimum with any design.

2.5.2 The Design

In the design process, these typical fire-protection system goals are on the table for consideration:

- Saving lives.
- Saving property.
- Preserving business continuity.

It all depends on how a building is used and occupied. A warehouse or storage facility, for example, will have different fire-protection requirements than a multi-tenant office building.

While no standard fire-protection design blueprint exists for any two buildings, the systems found in any building typically include these basic components:

- Detection.
- Alarms and notification.
- Suppression.

All components of modern fire-protection systems need to work together to effectively detect, contain, control, and/or extinguish a fire in its early stages - and to survive during the fire. To achieve the most beneficial symbiosis between these components, it's best to involve an experienced system designer, such as a fire-protection engineer, in the early stages of the planning and design process.

2.5.3 Maintaining Safety

Beyond the components that actually make up an integrated fire-protection system, there's another important factor that affects design: maintenance.

An improperly maintained system lacks reliability and, therefore, true protection. If a system is not maintained properly, its reliability degrades rapidly.

2.6 Emergency Response Plan

An emergency is defined in the Emergency Response Plan as a situation or the threat of an impending situation having, or having the potential to abnormally affect lives, property, the environment, or to threaten grave public disorder and which by its nature and magnitude requires controlled and co-coordinated response by a number of agencies, as distinct from routine operations[7].

"**Emergency Response Plan**" means a plan formulated pursuant to the MMC Oil & Gas Engineering Sdn. Bhd. By governing the provision of necessary services during an emergency and the procedures under and manner in which employees of the MMC Oil & Gas Engineering Sdn. Bhd. and other persons will respond to an emergency.[7]

This Evacuation Plan identifies the membership and responsibilities of the MMC and various departments and the authority and manner under which this body plans to respond to an emergency that requires an evacuation.

2.6.1 Evacuation

The objective of this evacuation plan is to provide a vehicle through which a timely and effective evacuation and relocation of people can be achieved.

Evacuation plan is a supporting document for the Emergency Response Plan that is used to identified and organize the various responses aimed at evacuating persons exposed to a threat from an evacuation sector to a reception sector, while ensuring them a minimum of essential services during an emergency[6].

There are 2 types of evacuations;

Precautionary Evacuation occurs when it is recommend evacuating within a certain parameter usually a building or a block until the initial situation is contained.

Mandatory Evacuation takes place when there is an absolute need to evacuate an area usually on a large scale, possibly for a long period of time (i.e for more than 24 hrs). For the purpose of this evacuation plan the definition that will set the plan or parts of this plan into motion will therefore be Mandatory Evacuation.

2.7 Emergency Management

During an emergency or crisis, layout play a critical role in response, search and rescue, mitigating further damage, and understanding the extent of the impacts. GIS is an appropriate platform for organizing the extensive amount of spatial data both generated and utilized during an emergency. A properly designed and implemented GIS will allow managers and responders to access critical location data in a timely manner so that lives and property can be protected and restored. Fire departments are the front line of defense for emergencies of all types. Large-scale emergencies

range from natural disasters (earthquakes, floods, hurricanes, ice storms, etc.) to industrial or technological emergencies (train car derailments, petroleum fires, hazardous material spills, etc.) to terrorist attacks. Large-scale emergencies often involve multiple casualties, critical infrastructure damage, and evacuations and can last for several days or months. Managing large-scale emergencies is complex and can involve search and rescue operations; displaced citizens; loss of utility services; and coordination among many departments, agencies, levels of government, and the private sector. One of the most complex challenges of emergency management is determining where damage is most extensive, where lives are most threatened, and where to assign limited emergency response personnel and equipment. During a major search operation for a lost or overdue hiker, GIS can accurately determine which sectors have been searched adequately and which sectors need to be revisited [9].

GIS provides a primary capability to organize, display, and analyze information for sound decision making. Integrating GIS data layers and imagery of the affected area(s) provides incident commanders with a comprehensive view of the emergency. GIS provides the primary capability to create a "common operating picture" for the incident. Emergencies are very dynamic and, as circumstances change, GIS can reflect these changes. GIS can incorporate temporal information on weather, and hazardous material locations.

2.8 General Fully Comprehensive Service Maintenance Cost

Example on fully comprehensive service maintenance cost for a general large scale building;

Financial: Lower costs and Improved Efficiency

Fixed Costs (5 years)	Maintenance Labor	Parts	Emergency Calls	Loss of Business	Total Cost
Labor only unfixed costs	RM 671,474.71	RM 400,000.00	RM 35,000.00	RM 31,200.00	RM1,137,674.71
Fully comprehensive fixed costs	Included	Included	Included	None	RM 853,442.70

Notes:

Loss of business based on 10 hours per week lost

Emergency Calls based on 35 calls per annum

Total financial saving per year approximately RM 284,000.00 per year

Savings **RM 1,421,160.05** over a 5 year period

CHAPTER 3

METHODOLOGY / PROJECT WORK

3.1 Procedure Identification

In order to ensure this project is accomplished successfully;

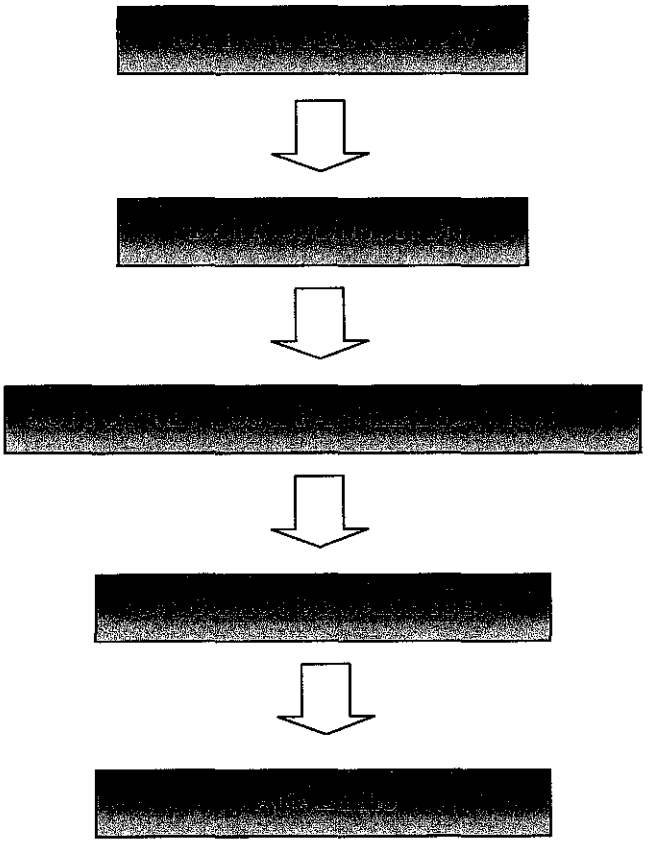


Figure 3.1: Methodology Flow

3.1.1 Literature Review and Data Collection;

During this phase, literature review and studies regarding the topic (fire protection information management), Geographic Information System (GIS) and current/most update building maintenance management practice need to be done.

Data collection and acquisition also needs to be done. Data regarding this project are specific building plan and latest revision of maintenance data can be obtained from document control or Administration department of a contractor for a specific building (MMC Office in KL).

3.1.2 Software Familiarisation;

Some software are new to author. Author attend tutorial conducted by Dr. Nasir Ab. Matori in order to improve author skills on the software.

The softwares are:

- MapInfo 7.0 Professional
- AutoCAD 2006
- Microsoft Visual Basic

3.1.3 Database Development and Analysis;

Once every date completely compiled, GIS database need to be developed by using MapInfo software. The end-product expected from this project is a software program which it enable user to manipulate the data for building maintenance management purposes. User-interface is very important to the program so Visual Basic codes is going to be generated. A good user interface will make the program easily understood and items that featured in the building plan should be easily identified.

3.2 Tool

3.2.1 Hardware

Minimum specifications of computer facilities need to be prepared by author in order to run the software, preparing reports and accessing data.

3.2.2 Software

- MapInfo 7.0 Professional
- AutoCAD 2006
- Microsoft Visual Basic

MapInfo Professional provides data visualization, including step-by-step thematic mapping and three linked views of data;

a) Maps
b) Graphs
c) Tables

Maps can be digitized to create vector images, and edited using several functions;

a) Reshape objects
b) Snap-to editing
c) Move Object
d) Overlay Nodes
e) Copy Objects
f) Create polylines from regions

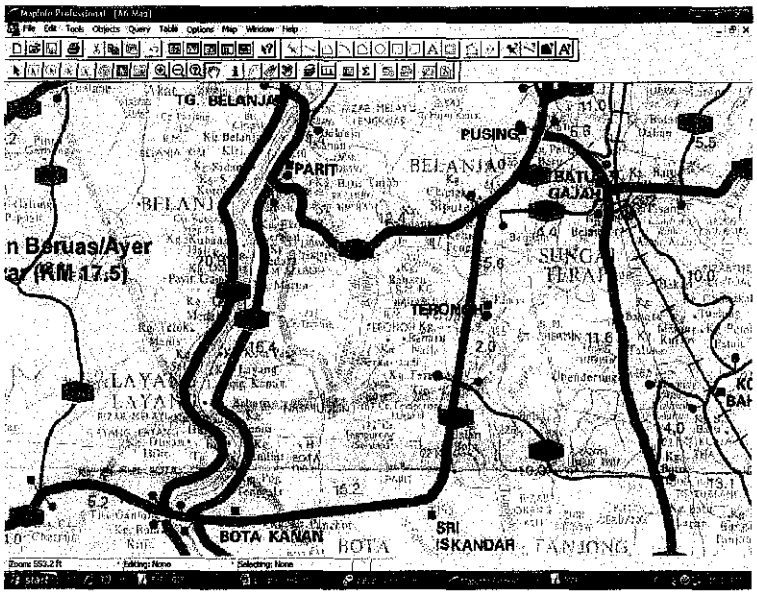


Figure 3.2 : MapInfo Professional

MapInfo Professional data can be visualized to create thematic maps using ranged shading, bar & pie charts, dot densities, graduated symbol and individual values. Range classifications of maps can be based on equal counts and ranges.

Thematic options can be combined to create maps that display multiple variables from many tables.

Thematic join can be based on count, sum, value, average, min/max, weighted average, rational sum, proportional average and proportional weighted average[8].

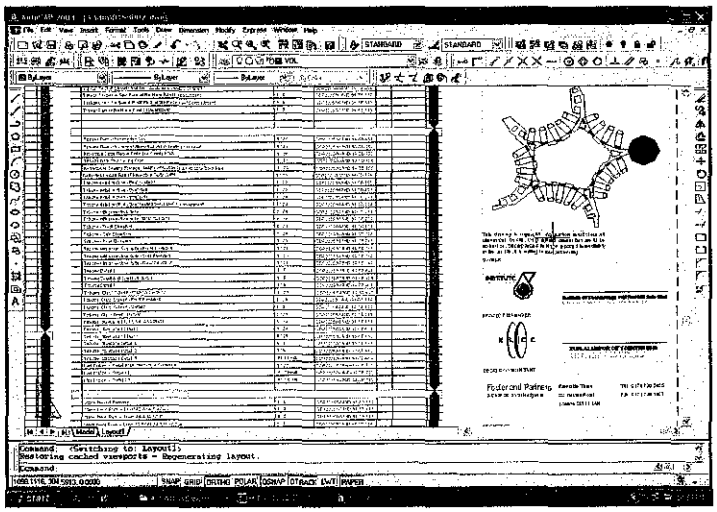


Figure 3.3 : AutoCAD 2006

AutoCAD is a Microsoft Windows-based suite of CAD software products for 2- and 3-dimensional design and drafting, developed and sold by Autodesk.

Modern AutoCAD includes a full set of basic solid modeling and 3D tools, but lacks the advanced capabilities of solid modelling applications. AutoCAD can co-exist with such products as a 2D drafting tool. Like other CAD programs, AutoCAD is fundamentally a vector graphics drawing program. It uses primitive entities — such as lines, polylines, circles, arcs, and text — as the foundation for more complex objects.

AutoCAD supports a number of application programming interfaces (APIs) for customization and automation. These include AutoLISP, Visual LISP, VBA, .NET and ObjectARX. ObjectARX is a C++ class library, which was also the base for products extending AutoCAD functionality to specific fields, to create products such as Autodesk Architectural Desktop, AutoCAD Electrical, or third-party AutoCAD based applications.

AutoCAD's native file format, AutoCAD DWG, and to a lesser extent, its interchange file format, DXF, have become de facto standards for interchange of 2D CAD data. In 2006, Autodesk estimated the number of active DWG files to be in excess of one billion. In the past, Autodesk has estimated the total number of DWG files in existence to be more than three billion.

AutoCAD currently runs exclusively on Microsoft desktop operating systems. Versions for Unix and Macintosh were released in the 1980s, but these were later dropped. AutoCAD can run on an emulator or compatibility layer like Virtual PC or Wine, keeping in mind the performance issues that can arise when working with 3-dimensional objects.

CHAPTER 4
RESULT AND DISCUSSION

4.1 System Flow

Figure 2 show the summary on how the system will flow. It shows the flow of the system when users start running it until the user quit from the system. From figure 2, it clearly shows on how system administrator can monitor the system performance and recommend any changes in order to minimize the maintenance cost.

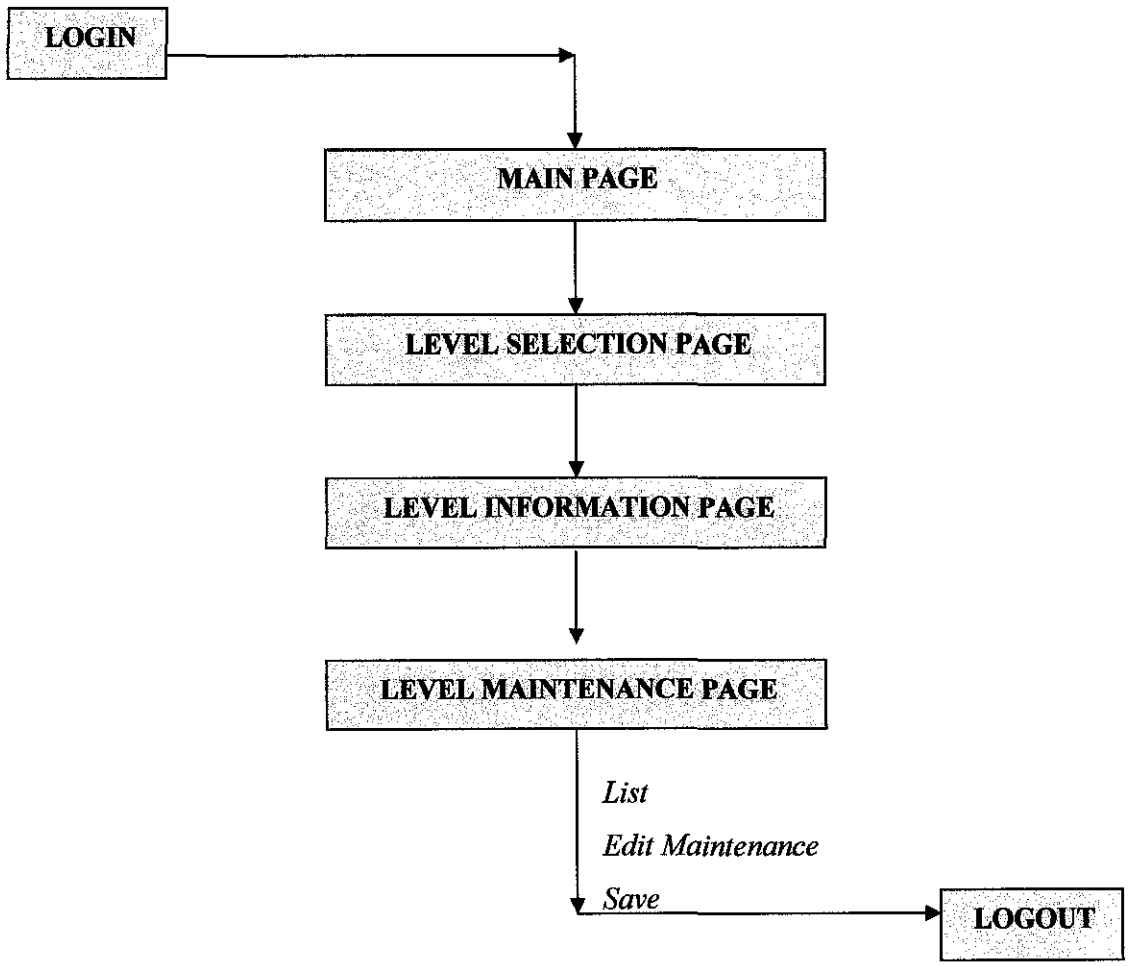


Figure 4.1 : System Flow

4.2 Fire Protection Services and Public Address System

Figure 4.2 : *Fire Protection Services and Public Address System*

MMC Office monthly maintenance servicing for Fire Protection Services and Public Address System, which consist of Addressable Fire Alarm System EST 3.2, Fireman Intercom System, Public Address System and Hose reel System. The purpose of this preventive maintenance for Fire Protection Services and Public Address System is to ensure the performance, reliability, safety and effective services as required by Department of Safety and Health (D.O.S.H) and Fire Department.

The objective of the monthly maintenance is to ensure the reliability and efficiency of Fire Protection Services and Public Address System. Hence maintenance personnel required to full fill the following requirement [6];

1. To make sure all Fire Protection Services and Public Address System in this package in good working condition, safe and effective for operation as required by D.O.S.H and Fire Department.

2. To submit monthly report including print out test paper to Maintenance Department, report and inform soonest possible if any cases of emergency and must be done soonest possible.

3. To provide necessary tools and test equipment for the maintenance services, testing and operation of the system.

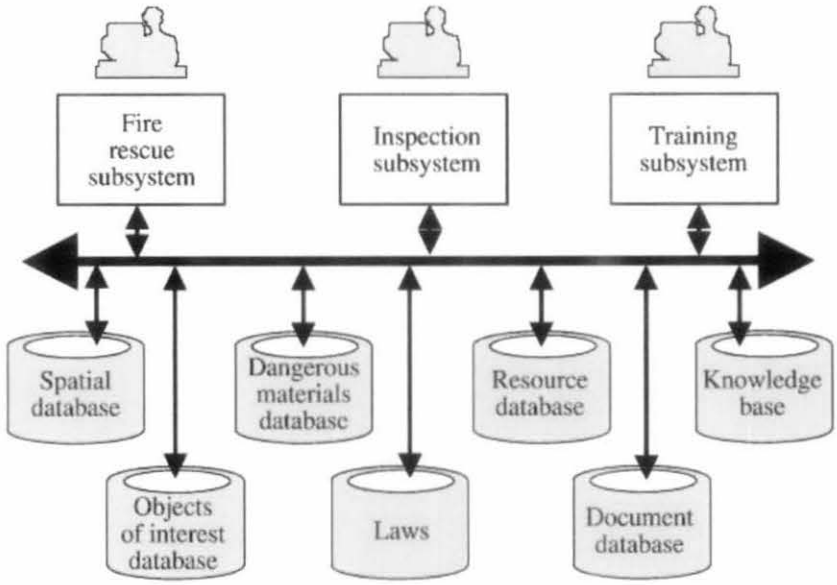


Figure 4.3 : *The system Architecture*

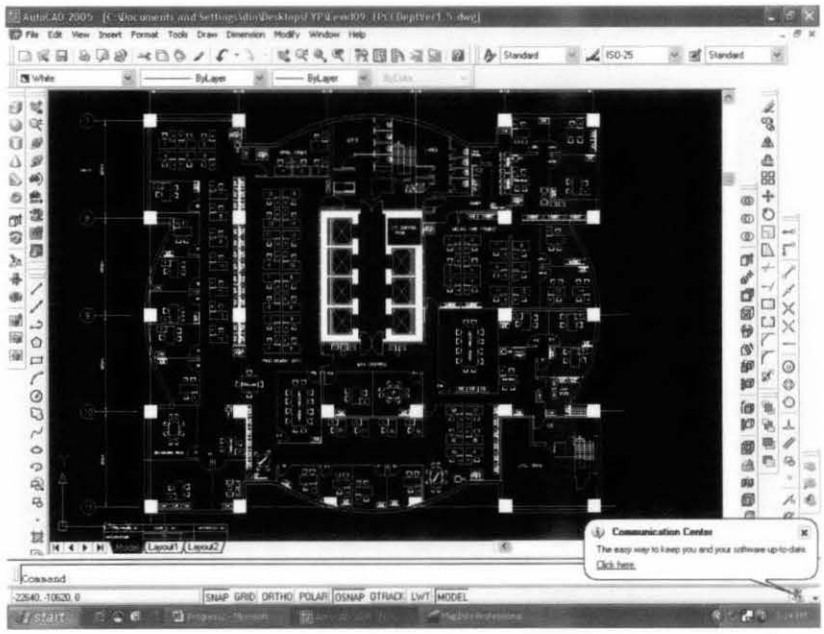


Figure 4.4 : *Level 21,MMC Office Layout*

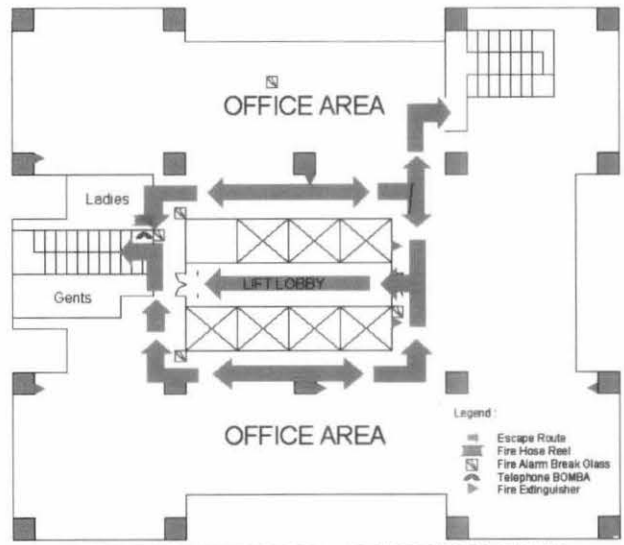
4.3 Emergency Response Plan

4.3.1 Emergency Escape Route

The procedures outlines in this Emergency Escape Route are based on a philosophy of evacuation and relocation within the limits of MMC Office. To assist fire, police, public works and other response agencies who will initiate evacuation. MMC Office has been divided into 5 major zones corresponding with the fire department zones. Where possible, zone boundaries have been selected that would be known to the staff of that zones [7].

It is recognized and accepted that circumstances will dictate, for instance, the boundaries of the area to be evacuated, the direction of movement, and the location of reception centers. The time of day or night will have a bearing on the number of people to be evacuated from a zone. This is result of a population shift from residential areas to work locations and from an influx of people from outside the office area

This plan will be activated as soon as it becomes apparent that due to an emergency of such magnitude as to warrant its implementation, evacuation and relocations of people within the office area.



TYPICAL FLOOR LAYOUT OF LEVEL 20, 21 & 22 MENARA ASIA LIFE

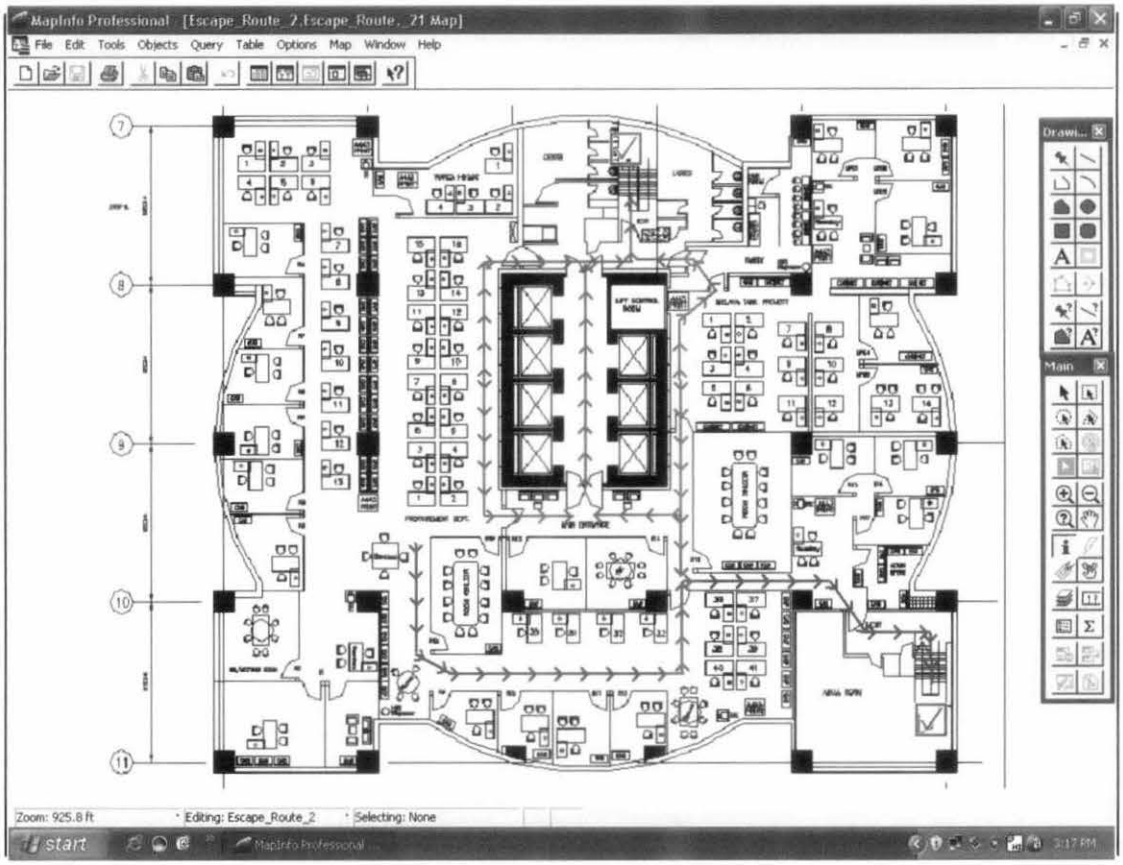


Figure 4.5 : *Level 21,MMC Office Escape Routes and Emergency Exit.*

As for MMC Oil & Gas Office, each floor (level 20,21,22) have 2 emergency exits. There 2 emergency routes in each floor,whether heading to Emergency Exit A (red arrow) or to Emergency Exit B (blue arrow).

4.3.2 Assembly Area

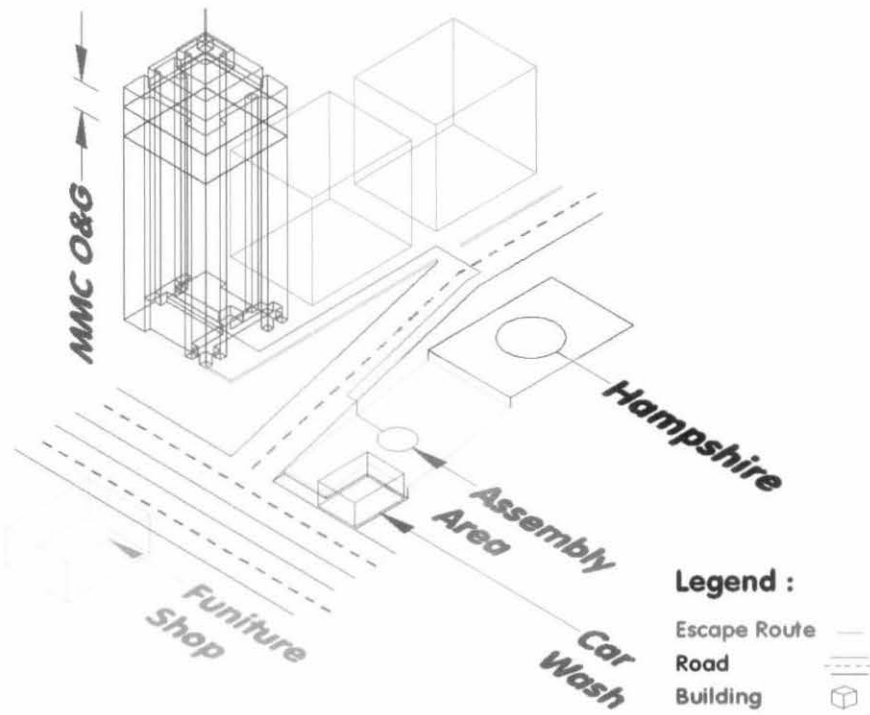


Figure 4.6 : *Assembly Area*

Assembly area is a place where local buildings, well known entertainment spots, parking lots, parks where residents/staff affected will be instructed to report and from which point they will transported to the reception center.[7]

A **Reception Center** is a site where evacuees are received, and from which Emergency Sosial Services (ESS) are administered are provided. The Red Cross usually provides these services. It may consist only one or more than one bulding.[7]

4.4 Database Development

Databases is a key resource in the Fire Protection system. The wide variety of data associated with resources, plans and incidents are stored in existing databases. The Fire Protection system uses the following databases:

- Spatial database includes maps of { region, building location, routes ,etc.)

- Object database includes building plans, information and photographs of building, scanned images, etc.

- Dangerous materials database includes main features of dangerous materials, means to neutralize, procedures to manipulation, etc.

- Forces and resources database includes personnel data, training, specialization of Building Manager and inspectors, equipments and means to extinguish a fire, rescue and safety tools, etc.

- Laws database includes standards, laws and regulations on fire security, protection and prevention, manipulations with explosive substances, flammable liquids and gasses, etc

- Document database stores inspector's and officer's reports, and different laws centered documents.

The following pages shows the result of database development base on the **Fire Protection** Equipment maintenance scope of works;

SCOPE OF WORKS ADDRESSABLE FIRE ALARM SYSTEM (EST 3.2)

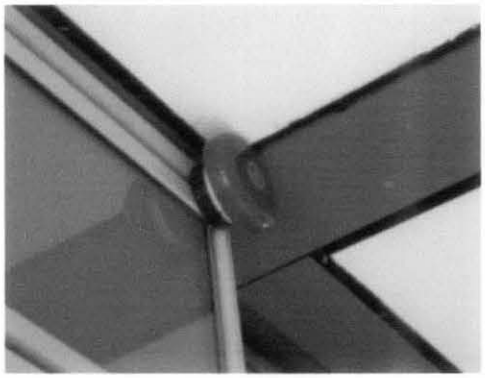


Figure 4.7 : *Fire Alarm*

Bil	**Description**	**Frequency**
1	To check the print out from the event printer at Main Fire Alarm Panel and attend the devices need to be services.	Monthly
2	To check the Green Power-on indicator is illuminated at fire alarm panels	Monthly
3	To check and replace (if necessary) the LED light on the mimic panel of fire alarm panels via test lamp button.	Monthly
4	To check and clean components of fire alarm panels	Monthly
5	To check the battery performance and ensure that the terminals are clean. To ensure that all the battery charged and associated components are in good working condition.	Monthly
6	To test and ensure that the fault monitor facility of the fire alarm panels is in order	Monthly
7	To check the correct setting of time and date are displayed properly at fire alarm panels	Monthly
8	To check connection of all terminals screws is tight and cables in the panel are secured	Monthly

9	To check the panel control buttons (Reset, Alarm silence and etc) are operating correctly	Monthly
10	To check the physical condition of all fire detectors, manual call point and alarm bells for mechanical damage. To replace glass for manual call point (if necessary).	Monthly
11	To simulate fire alarm call by random test the fire detectors and manual call point (take out auxiliary supply). Testing at least 10% of fire detectors and manual call point per level. Check for the complete system configuration/setting of the panel. Check the fire detector LED lights and the proper indication are given at the fire alarm panel	Monthly
12	To ensure that the alarm indication performs its functions. To actuate at random any block and see relevant Pre-programmed Voice Evacuation by PA System	Quarterly
13	To check the correct operation of fire alarm bell during alarm	Quarterly
14	To verify that the alarm will trip the AHU,Ventilation fan,Lift and release all Electro Magnetic Lock (EML) for Building Supervisory System (BSS)	Quarterly
15	To check the sensitivity of the fire detector using the List Sensitivity Menu.	Quarterly
16	To conduct alarm test and verify with local fire brigade for the CMS Direct Fire Brigade Link Signal receiving.	Annually
17	To verify by testing the input and output mapping operates as programmed	Annually
18	To visually check that the internal structural layout of the building, including inter-office portioning has not changed from system specification to such extent that it may affect the efficient operation of the fire alarm system	Annually

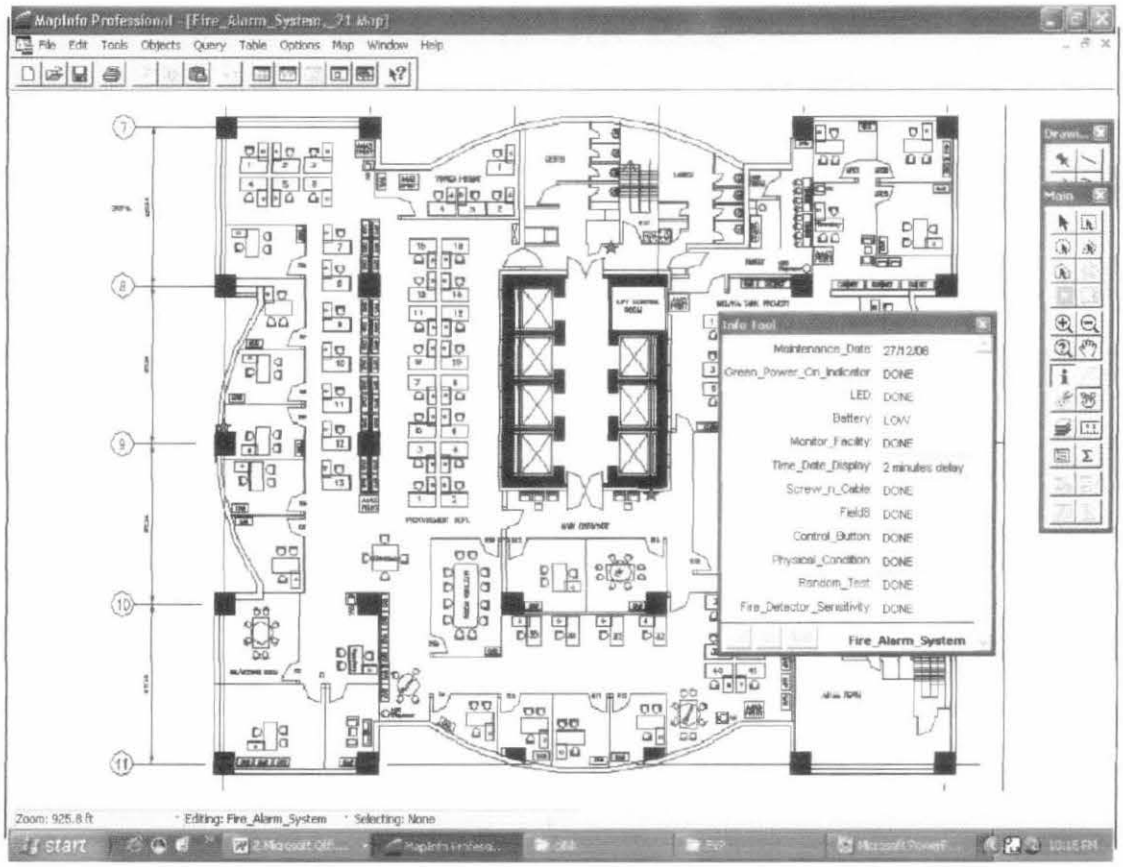


Figure 4.8 : *Location of Fire Alarm Location, Level 21,MMC Office.*

SCOPE OF WORKS OF FIREMAN INTERCOM

Bil	Description	Frequency
1	To check any fireman intercom that is damaged.	Monthly
2	To test communication with Main Fireman Intercom and ensure that the fireman intercom is in good working condition	Monthly
3	To check the battery performance and ensure that the terminals are clean and ensure that all battery chargers and associated components are in good condition.	Monthly

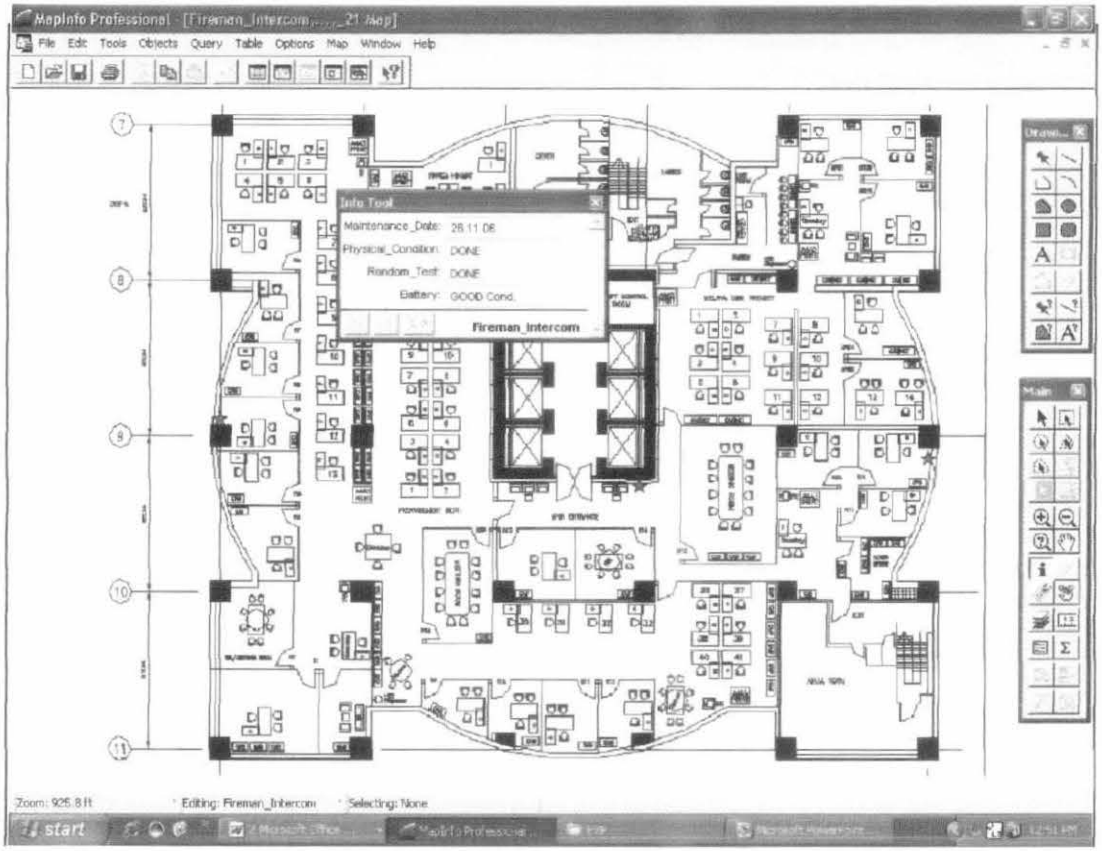


Figure 4.9 : *Location of Fireman Intercom Location, Level 21,MMC Office.*

SCOPE OF WORKS OF HOSEREEL SYSTEM

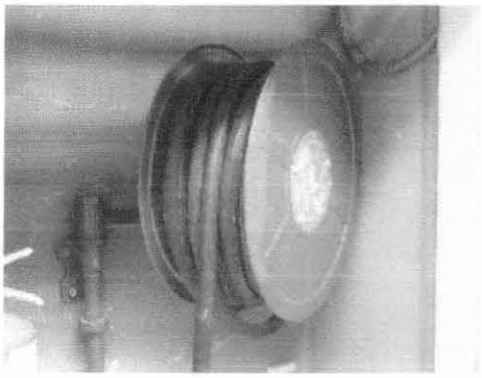


Figure 4.10 : *Hosereel System*

Bil	Description	Frequency
1	To check and clean component of Hose reel panel	Monthly
2	To check all connection of all terminal screws is tight and cables in the panel are secured	Monthly
3	To check the workable of Pre-programmed Voice Evacuation through Fire Alarm activation. Pre-announcement to inform end user before testing	Monthly
4	To test run electrical and diesel pump for automatic starting and switch over operation for a minimum running of 15 minutes and make sure proper indication given at fire alarm panels	Monthly
5	To check performance and condition of electrical and diesel pump. Top-up diesel oil if necessary	Monthly
6	To verify that the cut in and cut out pressure for electrical and diesel pump followed the design pressure. Adjust differential pressure switch if necessary.	Monthly
7	To check the reliability of differential pressure switch. Replace if necessary	Monthly
8	To check hose reel water tank, piping and ancillary valve for leak and rust.	Monthly
9	To check the condition of all hose reel drum, valves,	Monthly

	nozzles and piping.	
10	To random test at least 1 hose reel drum at top level every block and make sure that hose reel pump start (if pressure below cut-in pressure).	Monthly

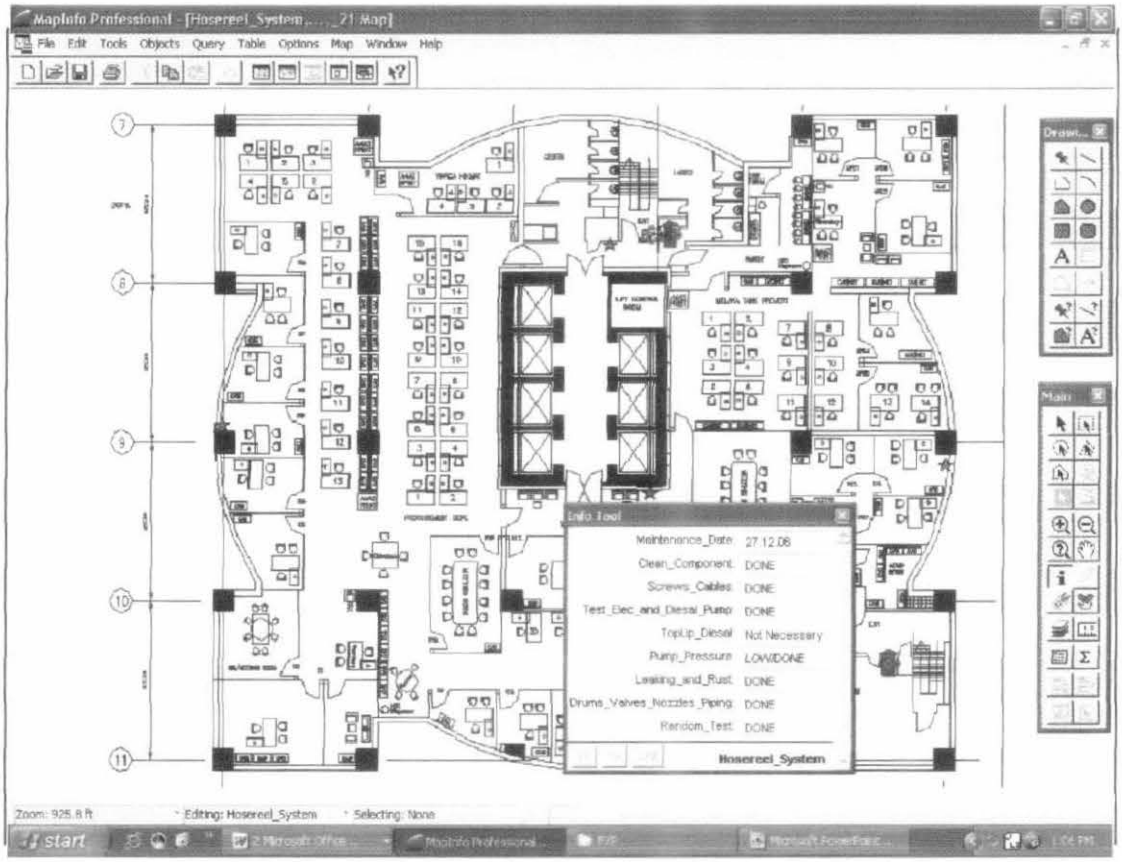


Figure 4.11 : *Location of Hosereel System, Level 21,MMC Office.*

SCOPE OF WORKS OF PORTABLE FIRE EXTINGUISHER

Figure 4.12 : *Portable Fire Extinguisher*

Bil	Description	Frequency
1	To check the extinguisher is in its proper place	Monthly
2	To check the extinguisher is clearly visible	Monthly
3	To check the access to the extinguisher is not obstructed	Monthly
4	To check the extinguisher operating instructions face forward	Monthly
5	To check seals or tamper are intact	Monthly
6	To ensure pressure gauge is in the normal range.	Monthly
7	To ensure no obvious physical damage (hose, nozzle, pin etc).	Monthly
8	To ensure contractor's annual maintenance tag is attached	Monthly
9	To renew Fire extinguisher Bomba Certificates (as requested by **ITPSB)**	Annually

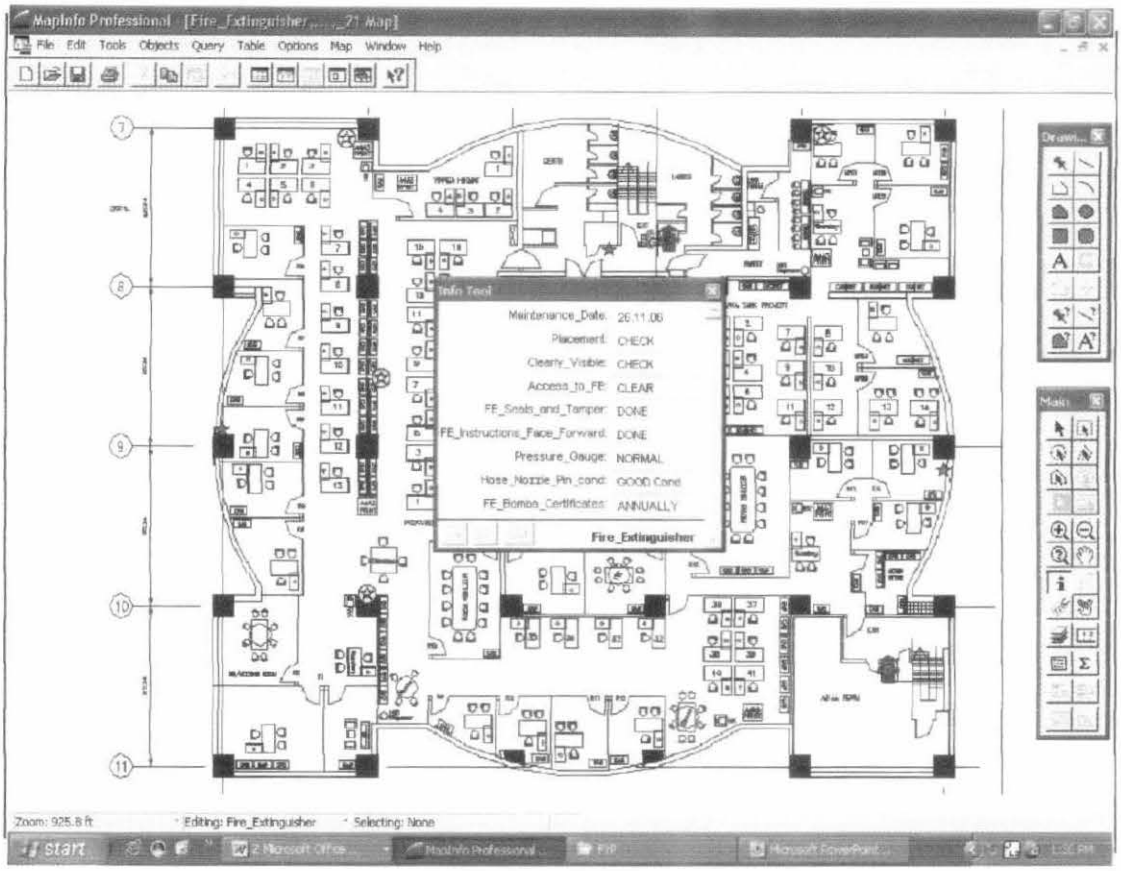


Figure 4.13 : *Location of Portable Fire Extinguisher, Level 21,MMC Office.*

4.5 Analysis

GIS can perform complex incident analysis to display trends, illustrate patterns, and identify areas of high call volume. A GIS display of historical incidents (represented by points or icons on the map where they occurred) includes attribute information for each incident. Attribute information (descriptive data about a map feature) contained in the underlying database can include;

- Incident type
- Incident cause
- Date of incident
- Time of incident report
- Units that responded

Incidents can be queried based on incident type, cause, time, units assigned, or other variables contained in the attribute data. GIS searches the data tables, gathers the data that GIS can perform complex incident analysis to display trends, illustrate patterns, and identify areas of high call volume.

During the last phase for this project, some analysis will be done to ensure the effectiveness of MMC Office Fire Protection System. This analysis is going to be future references for a new building or to MMC Office itself.

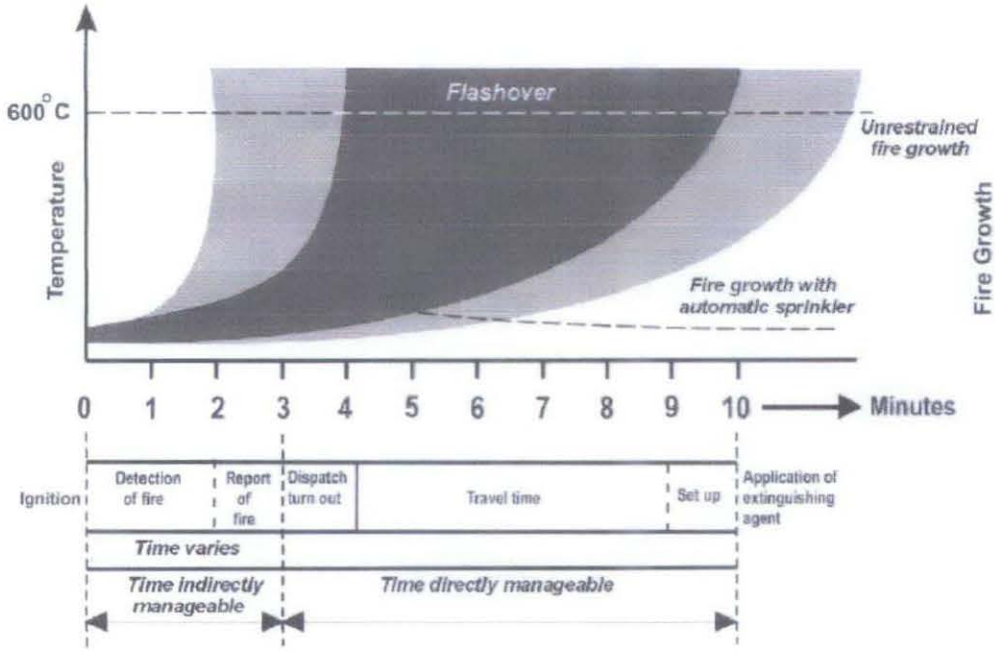
The analyses are:

- **Escape and Fire Growth analysis;**

Time is the critical element when an emergency is reported. Fire growth can expand at a rate of many times its volume per minute. Time is the critical factor for the rescue of occupants and the application of extinguishing agents to minimize loss. The time segment between fire ignition and the start of fire suppression has a direct relationship to fire loss. The delivery of emergency medical services is also time critical [9].

Survival rates for some types of medical emergencies are dependent on rapid intervention by trained emergency medical personnel. In most cases, the sooner trained fire or emergency medical rescue personnel arrive, the greater the chance for survival and conservation of property.

Regardless of the speed of growth or length of burn time, all fires go through the same stages of growth. One particular stage emerges as very significant because it marks a critical change in conditions. It is called *flashover*. Measuring the time to flashover is a function of time and temperature. Fire growth occurs exponentially; that is, fire doubles itself every second of free burn that is allowed. This can be plotted on what is known as the time and temperature curve [10].



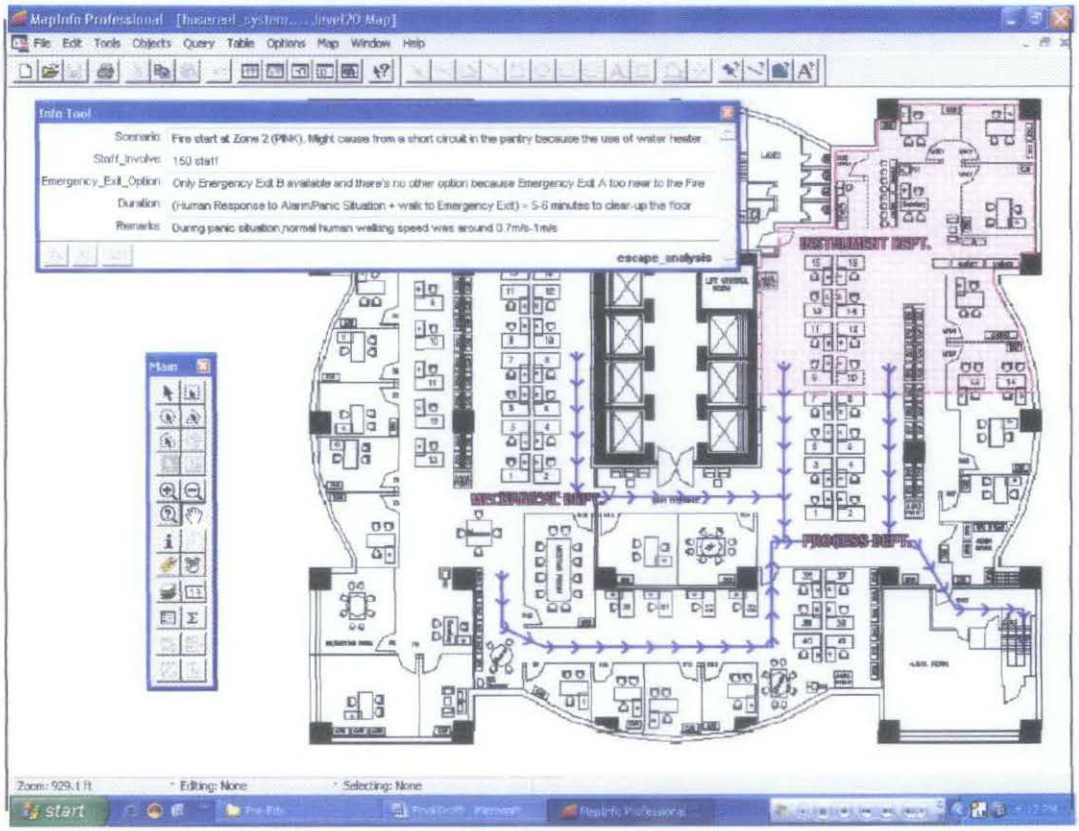


Figure 4.14 : *Escape and Fire Growth analysis, Level 21,MMC Office.*

There are a number of factors that determine when flashover may occur. These include the type of fuel, the arrangement of the fuels in the room, room size, and so on. Because these factors vary, the exact time to flashover cannot be predicted. Flashover can typically occur from less than 4 to beyond 10 minutes after free burning starts. A post flashover. Fire burns hotter and moves faster, compounding the search and rescue problems in the remainder of the structure at the same time that more firefighters are needed for fire attack.

- **Component Placement analysis;**

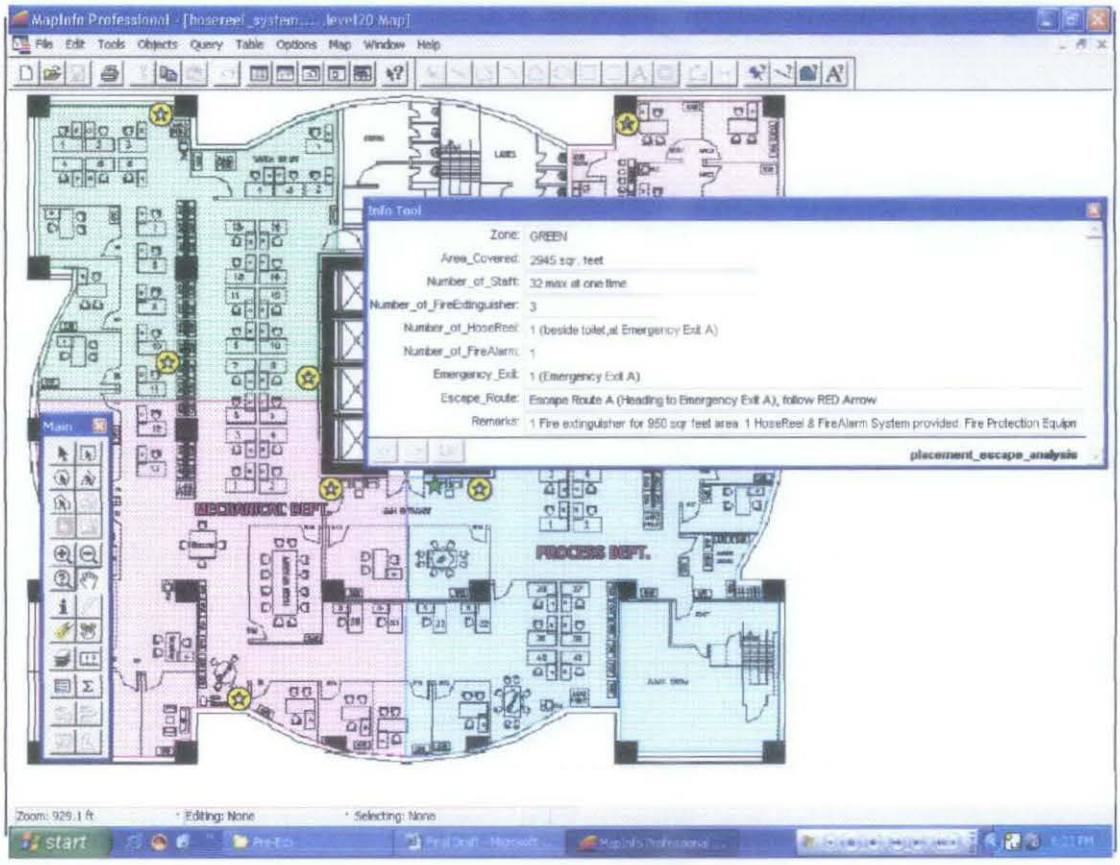


Figure 4.15 : *Component Placement analysis, Level 21,MMC Office.*

This analysis will analyse the suitability of MMC office Fire Protection System component placement base on every zone. As a result it will determine the effectiveness of every fire protection system component placement.

- **Facility Damage analysis;**

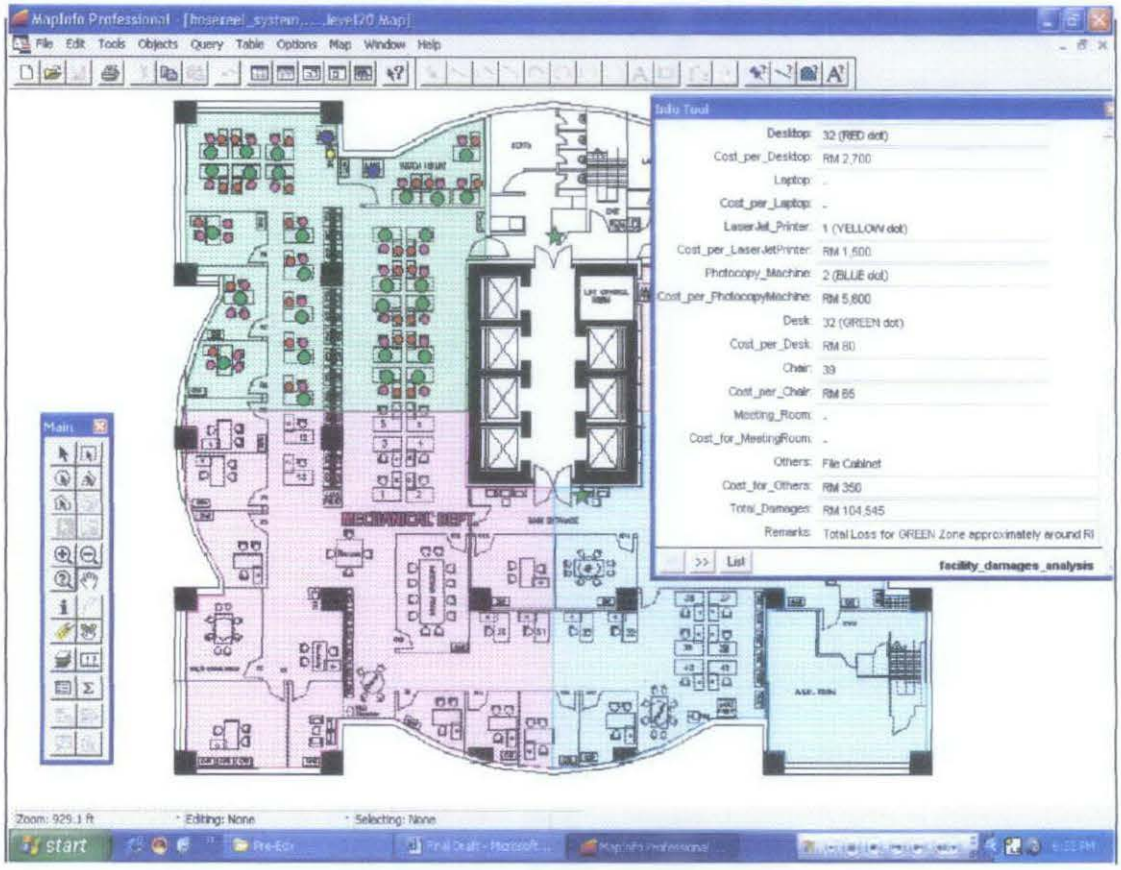


Figure 4.16 : *Facility Damage analysis, Level 21,MMC Office.*

This analysis will analyse the cost for each facilities provided in each zone. As a result it will determine the total loss if fire happened on that particular zone. Every facility was differentiate with a different colour of symbol.

CHAPTER 5
CONCLUSION

This project requires author to master some of IT (Information Technology) element in order to implement the system design. This cycle flow is giving opportunity to the author to learn deeply about GIS.

GIS is widely used method for many purposes for instance management, business planning, marketing territories, demographics characteristics and strategic allocations. The author will implement the possibility a new approach in building maintenance management instead of the traditional filling approach.

The most effective way to improve outcomes for both fire and medical emergency response is to reduce response time. By understanding the objectives of each step in the response sequence, a fire department can measure its current performance against these objectives. That information provides the necessary framework for assessing the cost of reducing response time during any of these steps. The rest of this section will describe how GIS can be used to apply a rational decision-making process for reducing overall emergency response time.

Essentially, each community must decide their desired response and travel times. There are a number of factors that influence the selection of a specific response/travel time. All applicable factors must be considered when making a decision on a specific response/ travel time for a community.

As a final conclusion, author hope that GIS approach for Fire Protection maintenance management will going to be a better, systematic and more comprehensive approach rather than the traditional filling approach. This is due to data accessibility, storage convenience, decreasing duration for maintenance

planning and accuracy in decision making process. The system mission is to assist the public in the protection of life and property by minimizing the impact of fire, medical emergencies, and potential disasters or events that affect communities and the environment. Defending communities from natural or manmade emergencies through planning, preparedness, incident response, public education, and code enforcement is best accomplished through accurate information sharing. GIS is one of the most effective tools to analyze, define, clarify, and visualize community issues/problems to deliver emergency services to all.

5.1 Scope Expansion

As wireless broadband networks expand, GIS support for tactical operations becomes more powerful. Mobile PCs, computer tablets, and handheld devices with GPS and wireless advances allow first responders to send and receive geographic information and incident updates. As fire and emergency medical services expand, the importance of GIS is becoming widely recognized. First responders must get to the emergency, size up the emergency, and deploy. The first responder's mission is to save lives and protect property and natural resources. GIS information support to the first responder mission can include;

- Incident location
- Quickest route
- Hydrant locations
- Preplans
- Photographs
- Floor plans
- Hazardous material locations
- Utility control panels

REFERENCES

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[4] George B. Korte, P.E 2001, The G.I.S Book, 5th Edition, How to Implement, Manage, and Assess the Value of Geographic Information Systems, Onward Press, New York

[5] Department of The Enviroment (DOE) (1987), *Handling Geographic Information, HMSO*, London.

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[7] Departmet of HSE (MMC) (2006), *Fire Protection,Escape Routes and Emergency Manual*, MMC Oil & Gas

[8] http://www.wikipedia.org

[9] The Commission on Fire Accreditation International, Creating and Evaluating Standards of Response Coverage for Fire Departments, 4th Edition.

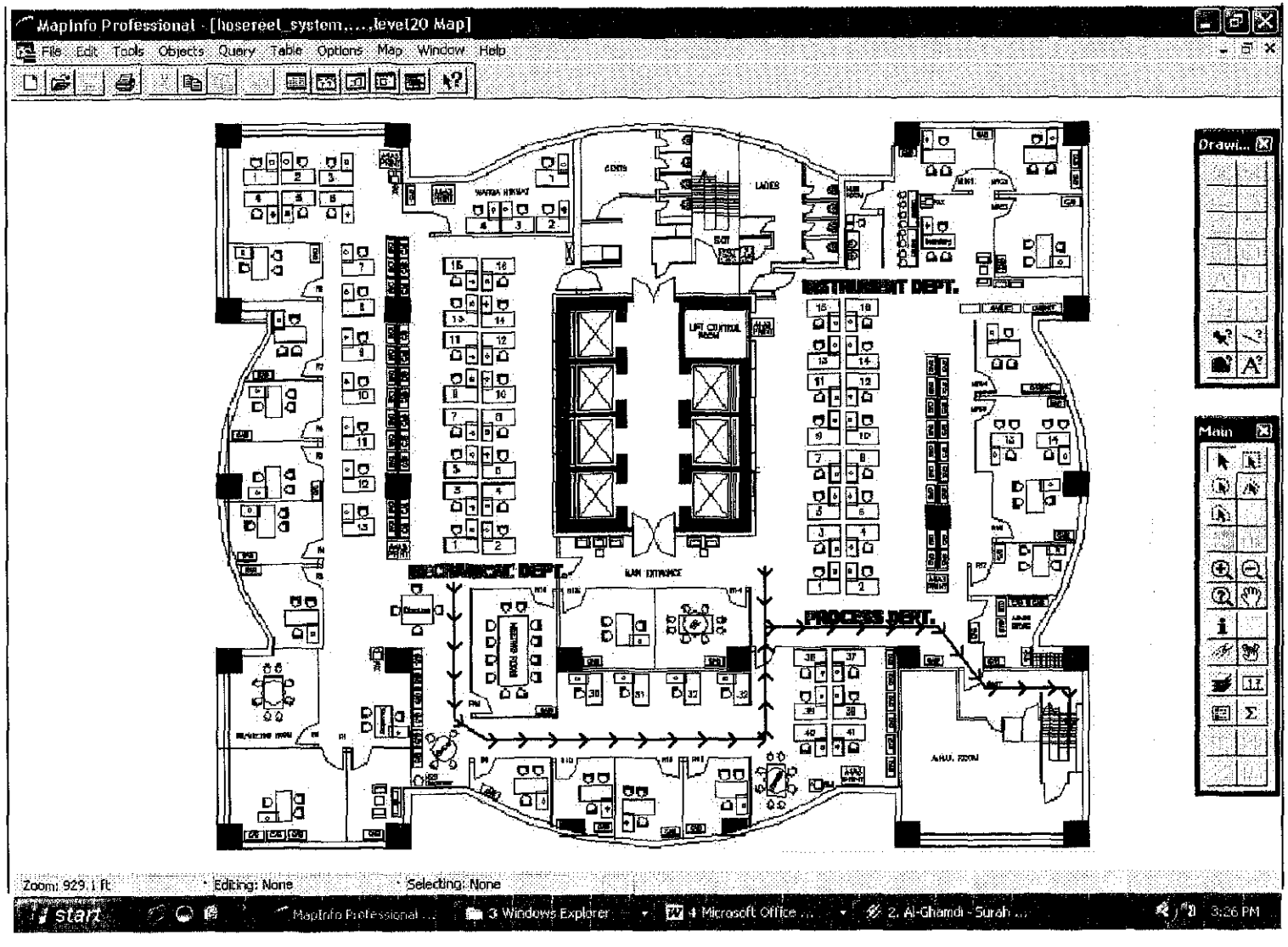
[10] National Commission on Fire Prevention and Control (1973), America Burning, The Report of the National Commission on Fire Prevention and Control. Washington, D.C.

[11] M. Fischer (1994), "From conventional to knowledge-based Geographic Information Systems", Computer, Environ. and Urban Systems, Vol. 18, No.4.

[12] (1995),"Information system for Fire Department - Project proposal", *Computer graphics & GIS Lab,* University of Nis.

APPENDICES

SCREENSHOTS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File Edit Tools Objects Query Table Options Map Window Help
INSTRUMENT DEPT.
MECHANICAL DEPT.
PROCESS DEPT.
Drawi...
Main
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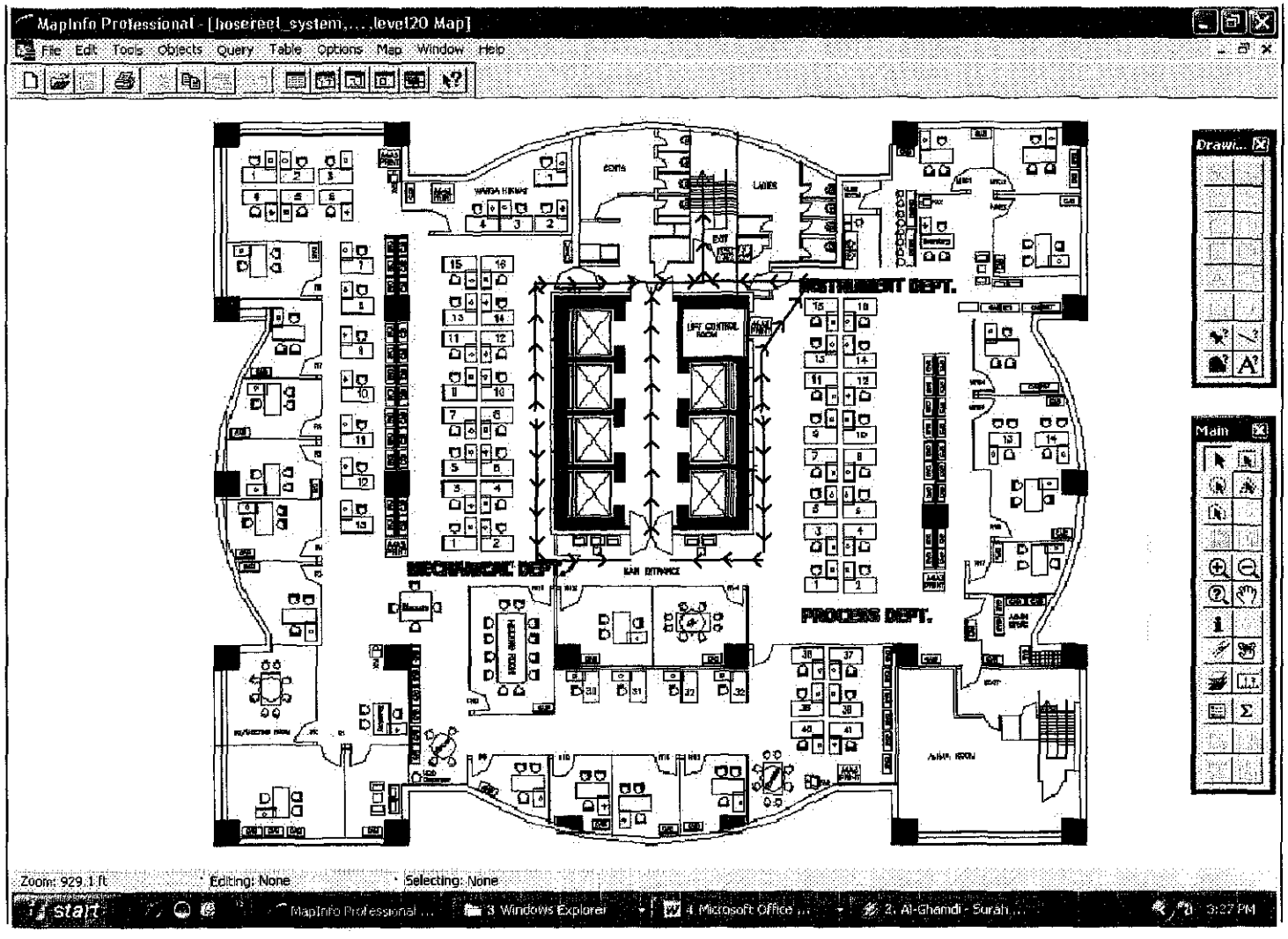
Selecting: None
start
MapInfo Professional ...
3 Windows Explorer
4 Microsoft Office ...
2. Al-Ghamdi - Surah ...
3:26 PM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MECHANICAL DEPT.
PROCESS DEPT.
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Main
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start
MapInfo Professional ...
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4 Microsoft Office ...
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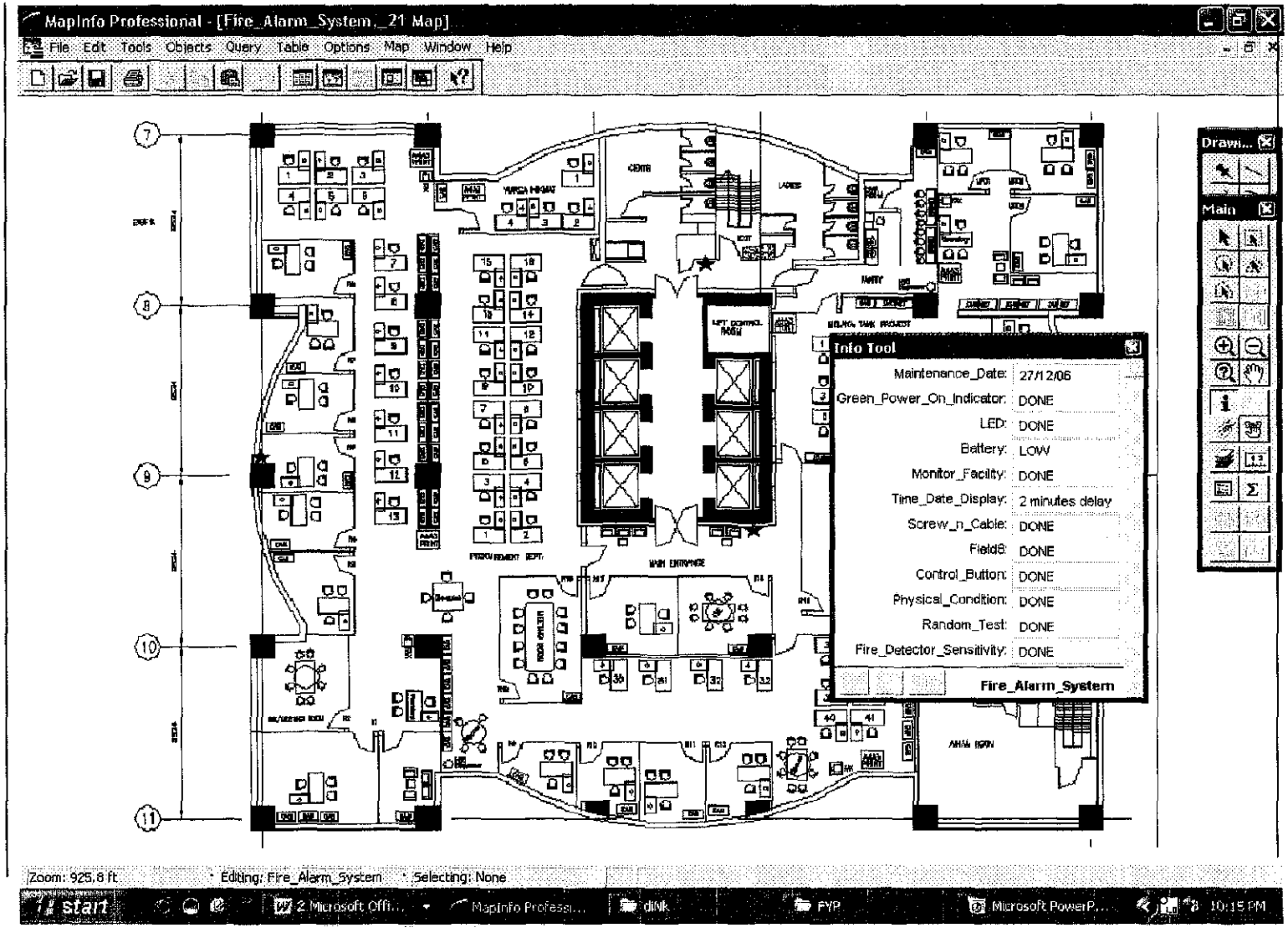
MapInfo Professional - [Fire_Alarm_System_21 Map]
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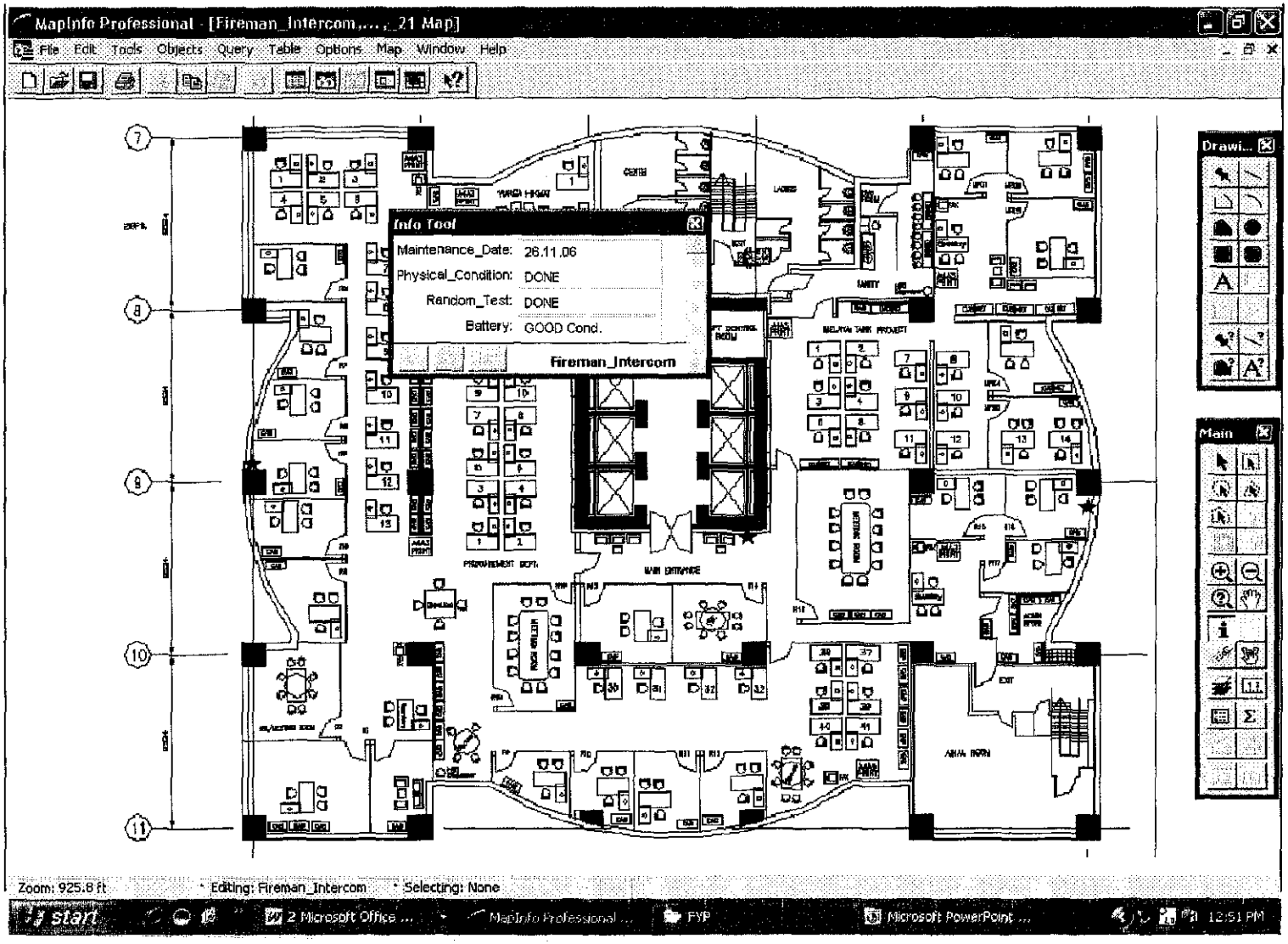
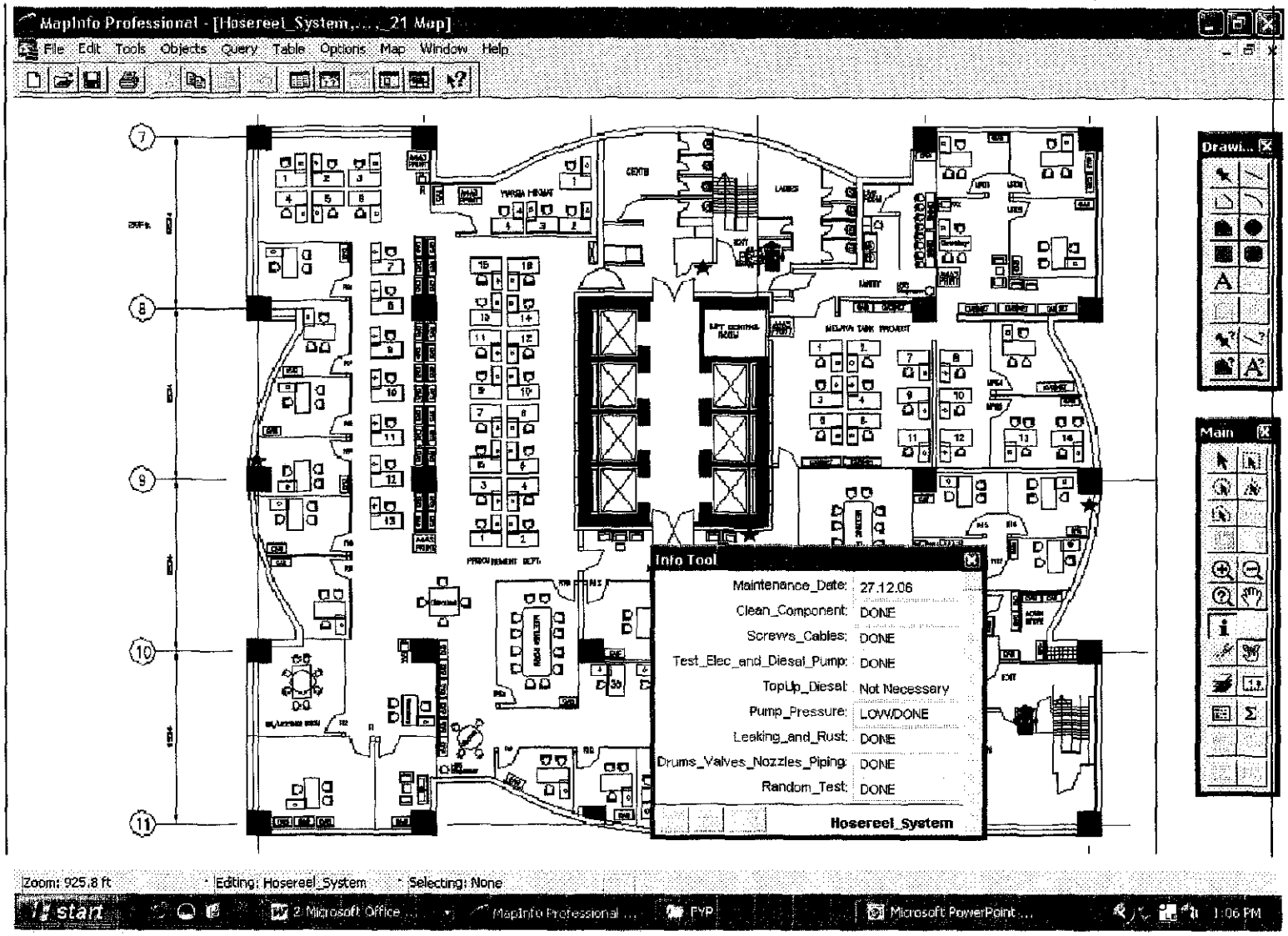
Info Tool
Maintenance_Date: 27/12/06
Green_Power_On_Indicator: DONE
LED: DONE
Battery: LOW
Monitor_Facility: DONE
Time_Date_Display: 2 minutes delay
Screw_n_Cable: DONE
Field8: DONE
Control_Button: DONE
Physical_Condition: DONE
Random_Test: DONE
Fire_Detector_Sensitivity: DONE
Fire_Alarm_System
Zoom: 925.8 ft
Editing: Fire_Alarm_System
Selecting: None
start
10:15 PM


MapInfo Professional - [Fireman_Intercom,...,_21 Map]
File Edit Tools Objects Query Table Options Map Window Help
Info Tool
Maintenance_Date: 26.11.06
Physical_Condition: DONE
Random_Test: DONE
Battery: GOOD Cond.
Fireman_Intercom
Drawi...
Main
Zoom: 925.8 ft
Editing: Fireman_Intercom
Selecting: None
start
2 Microsoft Office ...
MapInfo Professional ...
FYP
Microsoft PowerPoint ...
12:51 PM


MapInfo Professional - [Hosereel_System,...._21 Map]
File Edit Tools Objects Query Table Options Map Window Help
Drawi...
Main
Info Tool
Maintenance_Date: 27.12.06
Clean_Component: DONE
Screws_Cables: DONE
Test_Elec_and_Diesal_Pump: DONE
TopUp_Diesal: Not Necessary
Pump_Pressure: LOW/DONE
Leaking_and_Rust: DONE
Drums_Valves_Nozzles_Piping: DONE
Random_Test: DONE
Hosereel_System
Zoom: 925.8 ft
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Microsoft PowerPoint ...
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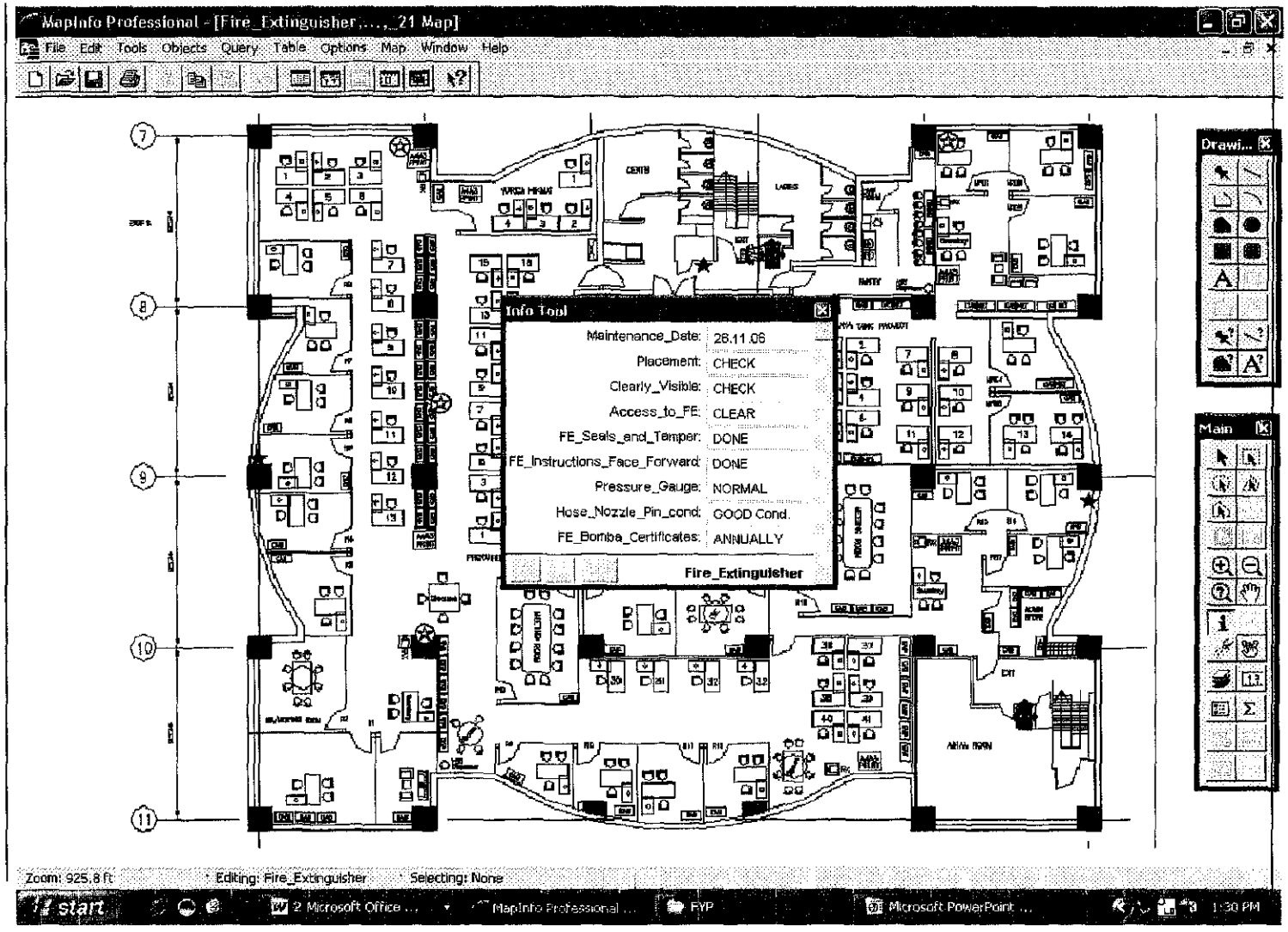
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Info Tool
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Clearly_Visible: CHECK
Access_to_FE: CLEAR
FE_Seals_and_Temper: DONE
FE_Instructions_Face_Forward: DONE
Pressure_Gauge: NORMAL
Hose_Nozzle_Pin_cond: GOOD Cond.
FE_Bomba_Certificates: ANNUALLY
Fire_Extinguisher
Drawi...
Main
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MapInfo Professional ...
FYP
Microsoft PowerPoint ...
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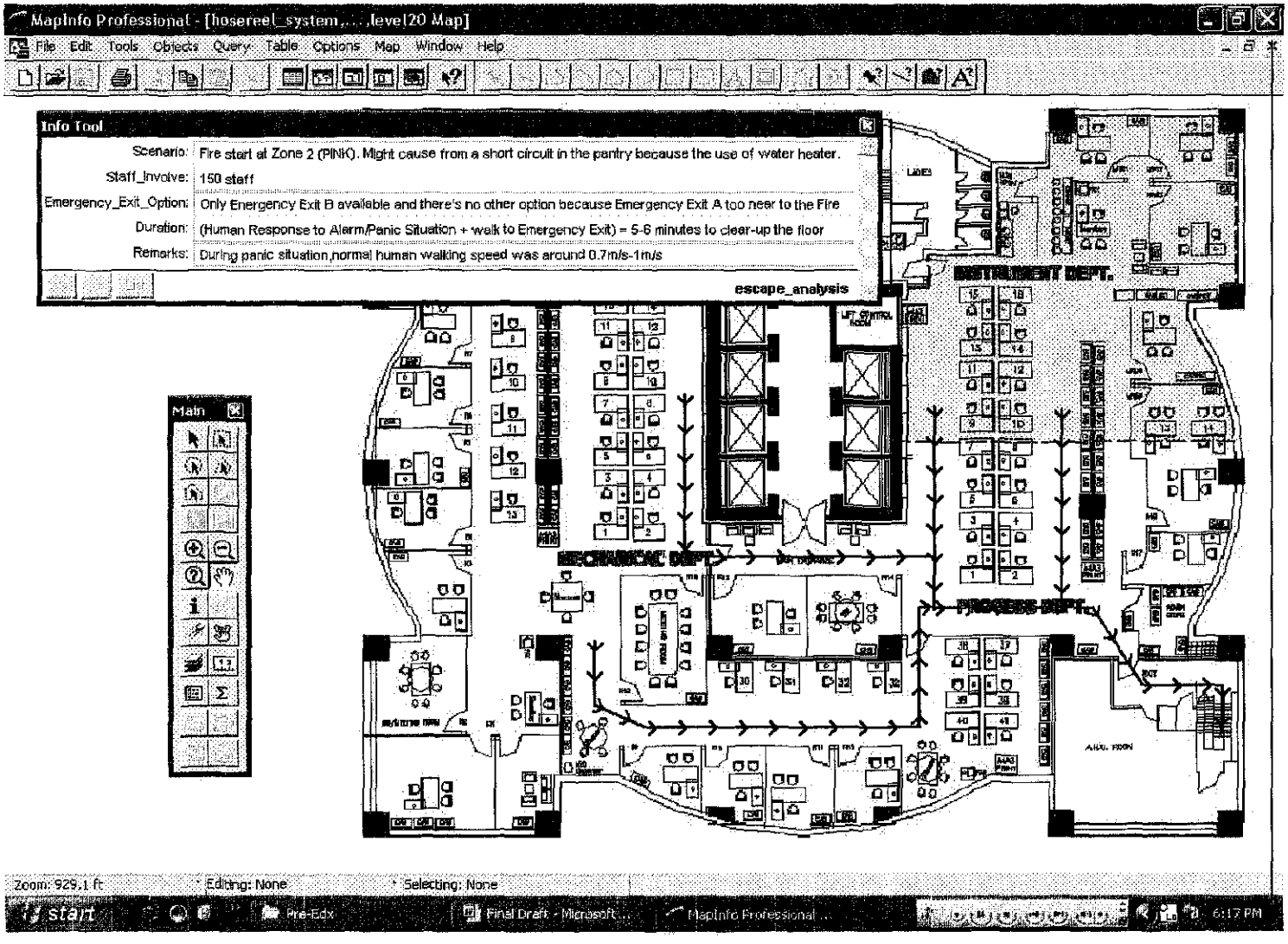
MapInfo Professional - [hosereel_system,....level20 Map]
File Edit Tools Objects Query Table Options Map Window Help
Info Tool
Scenario: Fire start at Zone 2 (PINK). Might cause from a short circuit in the pantry because the use of water heater.
Staff_Involve: 150 staff
Emergency_Exit_Option: Only Energency Exit B available and there's no other option because Emergency Exit A too near to the Fire
Duration: (Human Response to Alarm/Panic Situation + walk to Emergency Exit) = 5-6 minutes to clear-up the floor
Remarks: During panic situation,normal human walking speed was around 0.7m/s-1m/s
escape_analysis
Main
INSTRUMENT DEPT.
MECHANICAL DEPT.
PROCESS DEPT.
Zoom: 929.1 ft
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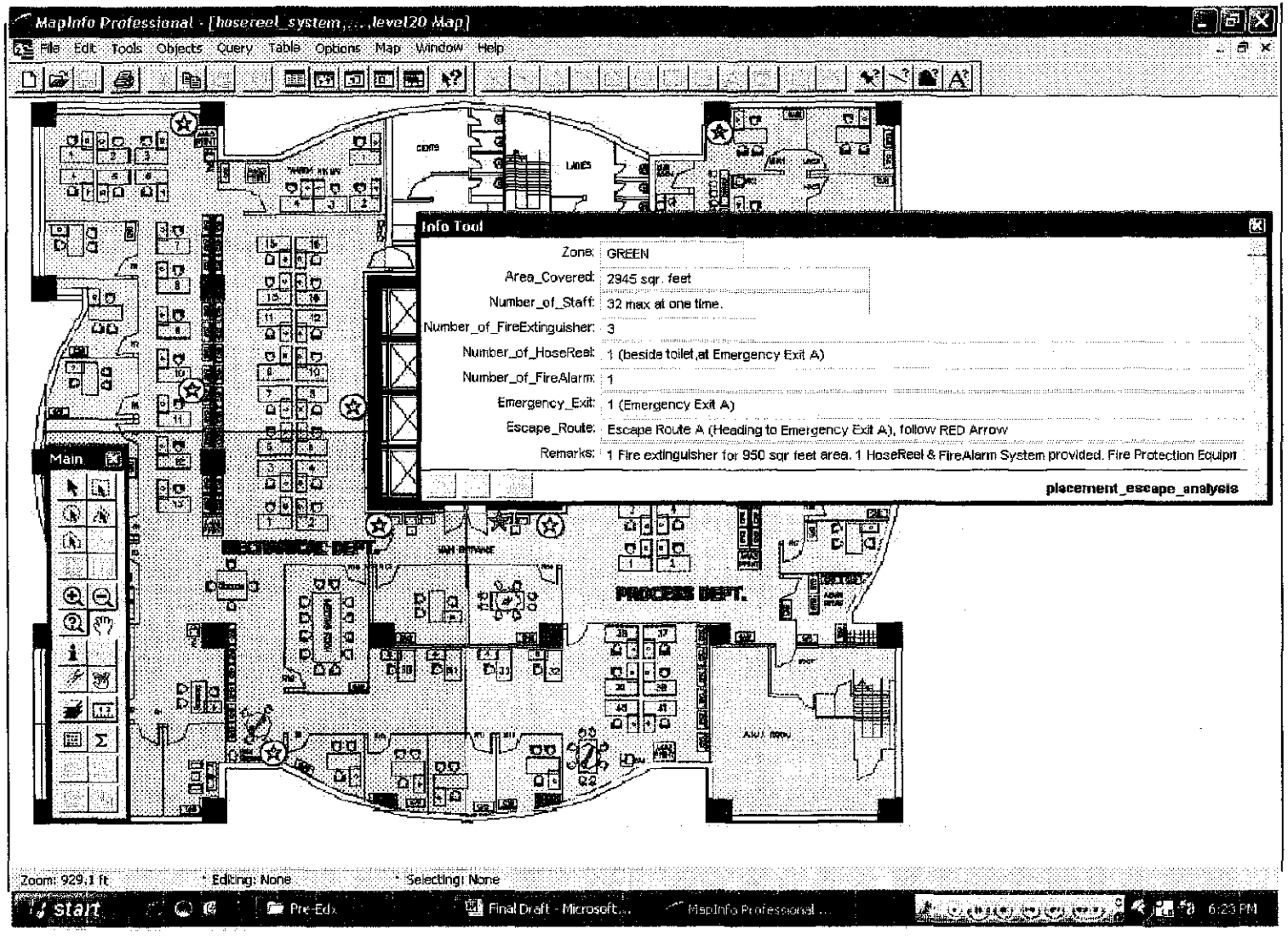
start
Pre-Edx
Final Draft - Microsoft...
MapInfo Professional ...
6:17 PM


MapInfo Professional - [hosereel_system,...,level20 Map]
File Edit Tools Objects Query Table Options Map Window Help
Info Tool
Zone: GREEN
Area_Covered: 2945 sqr. feet
Number_of_Staff: 32 max at one time.
Number_of_FireExtinguisher: 3
Number_of_HoseReel: 1 (beside toilet,at Emergency Exit A)
Number_of_FireAlarm: 1
Emergency_Exit: 1 (Emergency Exit A)
Escape_Route: Escape Route A (Heading to Emergency Exit A), follow RED Arrow
Remarks: 1 Fire extinguisher for 950 sqr feet area. 1 HoseReel & FireAlarm System provided. Fire Protection Equipn
placement_escape_analysis
Main
MECHANICAL DEPT.
PROCESS DEPT.
Zoom: 929.1 ft
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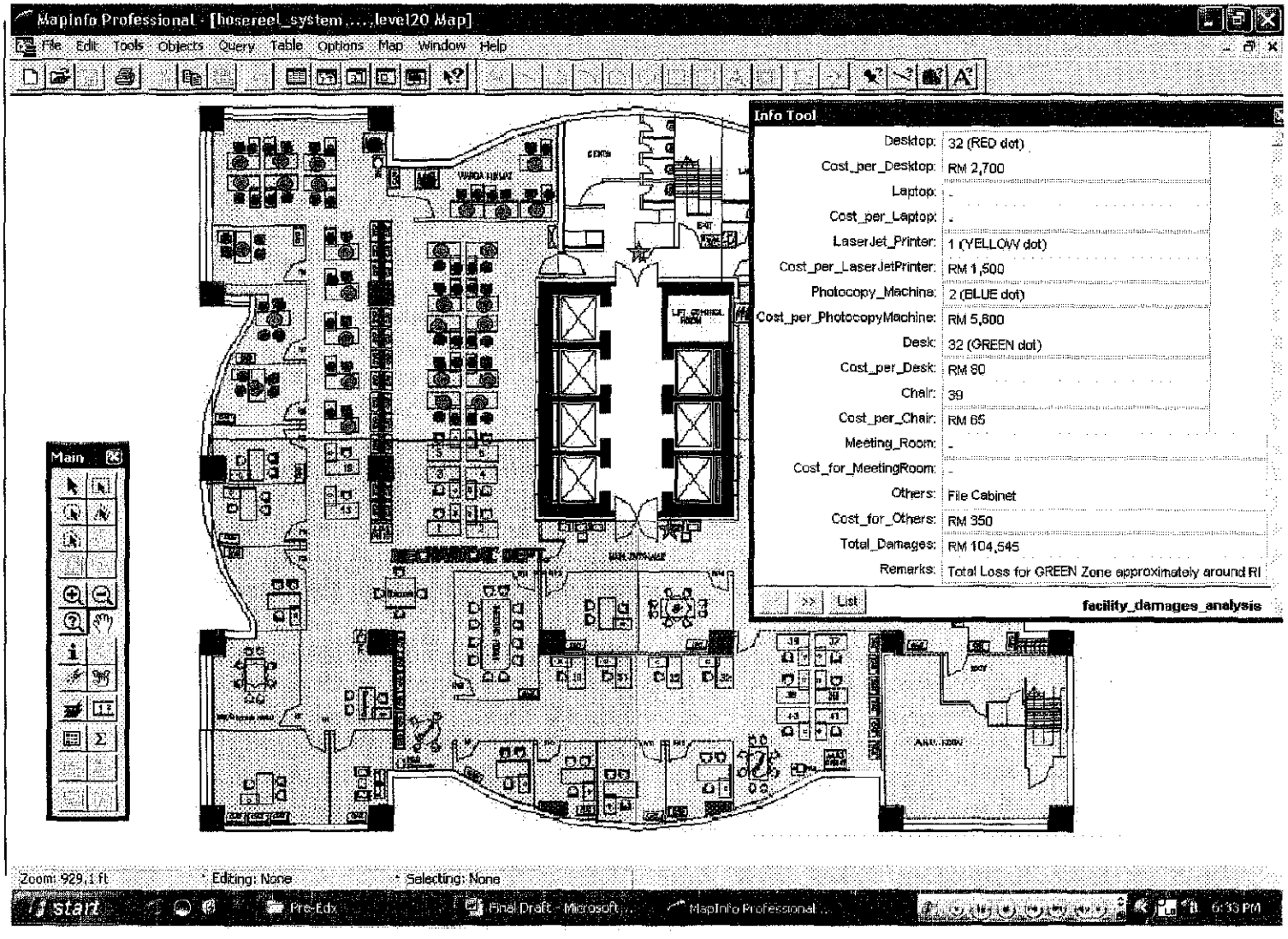
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Cost_per_Desktop: RM 2,700
Laptop: -
Cost_per_Laptop: -
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Cost_per_LaserJetPrinter: RM 1,500
Photocopy_Machine: 2 (BLUE dot)
Cost_per_PhotocopyMachine: RM 5,600
Desk: 32 (GREEN dot)
Cost_per_Desk: RM 80
Chair: 39
Cost_per_Chair: RM 65
Meeting_Room: -
Cost_for_MeetingRoom: -
Others: File Cabinet
Cost_for_Others: RM 350
Total_Damages: RM 104,545
Remarks: Total Loss for GREEN Zone approximately around RI
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