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**Ministry of Home Affairs**
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# Fire Hazard and Risk Analysis in the Country for Revamping the Fire Services in the Country

## Final Report – State Wise Risk Assessment, Infrastructure and Institutional Assessment of Pilot States (Delhi, Jammu & Kashmir, Rajasthan, Puducherry, Maharashtra, and Andaman & Nicobar Islands)

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# Table of Contents

Table of Contents ..... 2
List of Figures ..... 4
List of Tables ..... 5
Acknowledgements ..... 8
Executive Summary ..... 9
1 Introduction ..... 17
1.1 Background ..... 17
1.2 Role of Fire Services ..... 17
1.3 Objective of the Study ..... 19
1.4 Scope of the Study ..... 19
2 Technical Details on Methodology and Data Development ..... 20
2.1 Understanding of the Scope of Work ..... 20
2.2 Study Area ..... 21
2.3 Phased Approach ..... 21
3 GIS based Fire Hazard and Risk Analysis ..... 25
3.1 GIS Data Compilations ..... 25
3.2 GIS - Overlay Analysis ..... 29
3.3 Fire Hazard and Risk Analysis ..... 31
3.4 Hazard Ranking ..... 32
3.5 Exposure Vulnerability Ranking ..... 39
4 Field Surveys of Fire Stations for Data Collection ..... 51
4.1 Field-Survey of individual Fire Station and collection of Headquarter Data ..... 51
4.2 Stakeholder Analysis ..... 52
5 Development of Fire Decision Support System (FDSS) ..... 53
5.1 Salient Features ..... 53
5.2 High Level Design ..... 53
5.2.1 Data Warehouse ..... 55
5.3 Platform Components ..... 55
5.4 System Administration Interface ..... 58
5.5 Application Interface ..... 58
5.5.1 Technology ..... 59
5.6 Advantages of Open Source Platform ..... 61
5.7 Identification of Gaps in Infrastructure, Up-gradation and Modernization Requirement ..... 62

5.7.1 Infrastructure gaps ..... 62
5.7.2 Equipment Gaps ..... 62
5.7.3 Capacity gaps ..... 62
5.8 Preparation of detail cost estimates with Capital and O&M Investment Plan ..... 63
5.9 Institutional Assessment and Capacity Building Plan ..... 63
6 International and National Norms ..... 65
6.1 Literature Survey ..... 65
6.2 Response Time ..... 65
6.2.1 Germany ..... 65
6.2.2 Japan ..... 66
6.2.3 USA ..... 67
6.2.4 UK ..... 68
6.2.5 India ..... 68
Annex-1: Fire Headquarter Data Collection Form ..... 71
Annex-2: Fire Station Survey Form ..... 85
7 NCT of Delhi ..... 102
7.1 LULC map of Delhi ..... 105
7.2 Infrastructure Gap Analysis ..... 107
7.2.1 Fire Station Gap Analysis ..... 107
7.2.2 Fire Manpower Gap ..... 134
7.2.3 Investment and Financial Analysis ..... 139
7.2.4 Detailed road map for Investment plan ..... 152
7.2.5 Prioritization of Fire Stations/Fire Posts ..... 155
7.2.6 Avenues of Fund generation ..... 156
7.3 Capacity Building and Training Facilities ..... 157
7.3.1 Fire Training Facilities in Delhi ..... 157
7.3.2 Training Need Assessment ..... 159
7.4 Limitations of the Study ..... 163
7.5 Recommendations for Delhi Fire Services ..... 164

# List of Figures

Figure 1-1: Distribution of fire services by various States/UTs by administrative organization ..... 17
Figure 2-1 : State/UT wise distribution of fire service stations in India ..... 21
Figure 3-1 : Land use classification at 25m pixel for parts of Western Maharashtra (districts – Mumbai, Mumbai sub-urban, Thane, Pune and Raigarh)..... 28
Figure 3-2 : An enlarged view of classified urban agglomeration in Pune city areas..... 29
Figure 3-3 : Detailed classified urban agglomerate areas in parts of Delhi with overlay of GPS location of Fire Stations..... 30
Figure 3-4 : Overlay analysis for Fire Risk Assessment ..... 31
Figure 3-5 : Seismic zones of India ..... 32
Figure 3-6 : Wind zone map of India (BMTPC, 2006) ..... 34
Figure 3-7 : Climatic Zones of India..... 36
Figure 3-8 : Comparisons of district level ranking for residential built-up area percentages and absolute areas (in sq km) for all 35 districts of Maharashtra State ..... 45
Figure 3-9 : Comparison of district level ranking for residential built-up areas and industrial areas (in sq km) for all 35 districts of Maharashtra State ..... 46
Figure 5-1 : Three-tier architecture..... 54
Figure 5-2 : High level design of FDSS ..... 55
Figure 5-3 : User Interface for Base Analysis of FDSS..... 57
Figure 5-4 : System administration interface ..... 58
Figure 5-5 : FDSS - Systems Architecture..... 60
Figure 7-1: Fire stations locations operated by DFS with road and rail networks..... 102
Figure 7-2: Fire stations locations operated by DFS with their current jurisdictional areas 103
Figure 7-3: LULC map for Delhi ..... 106
Figure 7-4: Analysis for the requirement of Fire Stations in Delhi as per existing SFAC norms ..... 108
Figure 7-5: Analysis for the requirement of Fire Stations in Delhi as per revised SFAC norms ..... 109
Figure 7-6: Map showing Fire Stations gap analysis in northern part of Delhi ..... 111
Figure 7-7: Map showing Fire Stations gap analysis in North, North-West, and Central Delhi ..... 112
Figure 7-8: Map showing Fire Stations gap analysis in Central and South Delhi ..... 113
Figure 7-9: Map showing Fire Stations gap analysis in West and South-West Delhi ..... 114

# List of Tables

Table 2-1: Phase wise distribution of various States/UTs in the Country ..... 23

Table 3-1: Cluster class morphology in land use maps ..... 26

Table 3-2: Risk ranking schema for earthquake, wind and climatic zones ..... 33

Table 3-3: District level ranking for individual (earthquake, wind and climatic) hazard and integrated hazards ..... 37

Table 3-4: District level geographical area, population, population density, residential built-up area, residential built-up area in %, and industrial area ..... 40

Table 3-5: Grouping schema for ranking of exposure and vulnerability layers ..... 43

Table 3-6: Weightage assigned in risk scoring schema for integration of hazard and exposure vulnerability into fire risk categories ..... 47

Table 3-7: District risk rankings for all Pilot States/UTs ..... 47

Table 5-1: Advantages of Open Source Platform ..... 61

Table 6-1: Number of operational and additional Fire Stations and Fire Posts required in Delhi ..... 69

Table 6-2: Revised number of operational and additional Fire Stations and Fire Posts required in Delhi ..... 70

Table 7-1: Details of Delhi Fire Services operational Fire Stations ..... 104

Table 7-2: District name, geographical area and number of Fire Stations in each district .. 106

Table 7-3: Number of operational and additional Fire Stations and Fire Posts required in Delhi ..... 107

Table 7-4: Revised number of operational and additional Fire Stations and Fire Posts required in Delhi State ..... 109

Table 7-5: Proposed Fire Stations at different stages of construction in Delhi State ..... 110

Table 7-6: Details of operational and additional Fire Stations required for DFS ..... 115

Table 7-7: List of operational fire fighting and rescue vehicles available with DFS (As on Aug-Sep, 2011) ..... 121

Table 7-8: Gap in fire fighting and rescue vehicles in operational Fire Stations (As on Aug-Sep, 2011) ..... 121

Table 7-9: Total Gap in fire fighting and rescue vehicles in operational and new urban Fire Stations ..... 122

Table 7-10: Additional fire fighting and rescue vehicles required at new rural Fire Stations123

Table 7-11: List of major specialized firefighting equipment available with DFS (As on Aug-Sep, 2011) ..... 127

Table 7-12: Gap in major specialized firefighting equipment in operational Fire Stations (As on Aug-Sep, 2011) ..... 128

Table 7-13: Total gap in specialized equipment for operational and new urban Fire Stations ..... 130

Table 7-14: Additional specialized equipment required for new rural Fire Stations ..... 132

Table 7-15: Manpower requirement for station officer and lower staff Delhi Fire Service as per SFAC norm (Considering double shift duty pattern) ..... 134

Table 7-16: Manpower requirement for station officer and lower staff as per ARD, Delhi (double shift) ..... 134

Table 7-17: List of fire manpower available with DFS (As on Aug-Sep, 2011) ..... 136

Table 7-18: Manpower gap in operational Fire Stations for ideal jurisdiction area (As on Aug-Sep, 2011) ..... 136

Table 7-19: Total staff gap for operational and new urban Fire Stations ..... 137

Table 7-20: Additional staff required for new rural Fire Stations ..... 138

Table 7-21: Fire station building required for gap in operational and new urban Fire Stations (no. of bays) ..... 139

Table 7-22: Fire station building required for new rural Fire Stations (no. of bays) ..... 139

Table 7-23: Cost (in Lakhs Rupees) of Fire Station building (no. of bays) required for gap in operational and new urban Fire Stations ..... 140

Table 7-24: Cost (in Lakhs Rupees) of Fire Station building (no. of bays) required for new rural Fire Stations ..... 140

Table 7-25: Cost estimates (in Lakhs Rupees) for gap in fire fighting and rescue vehicles in operational and new urban Fire Stations ..... 141

Table 7-26: Cost estimates (in Lakhs Rupees) for gap in fire fighting and rescue vehicles in new rural Fire Stations ..... 142

Table 7-27: Cost estimate (in Lakhs Rupees) for gap in fire fighting specialized equipment for operational and new urban Fire Stations ..... 143

Table 7-28: Cost estimate (in Lakhs Rupees) for gap in specialized fire equipment for new rural Fire Stations ..... 144

Table 7-29: Annual cost estimates (in Lakhs Rupees) for manpower for DFS after filling up the gap in operational and new urban Fire Stations ..... 147

Table 7-30: Annual cost estimates (in Lakhs Rupees) for manpower for DFS for new rural Fire Stations ..... 147

Table 7-31: Cost estimates (in Lakhs Rupees) for staff-uniform (district level) ..... 148

Table 7-32: Annual recurring cost estimates (in Lakhs Rupees) for PDL, maintenance and training expense after filling the gap in operational and new urban Fire Stations ... 150

Table 7-33: State level summary of Capital Expenditure required for filling the gap (in Crores Rupees) ..... 151

Table 7-34: State level summary of Recurring Expenditure required for filling the gap (in Crores Rupees) ..... 151

Table 7-35: State level 10 year investment plan for Delhi Fire Services for filling gap in operational and new urban Fire Stations (in Crores Rupees) ..... 153

Table 7-36: State level 10 year investment plan for Delhi Fire Services for filling gap in operational, new urban and new rural Fire Stations (in Crores Rupees) ..... 153

Table 7-37: Prioritization for establishing new urban Fire Stations in Delhi State ..... 155

Table 7-38: Prioritization for establishing new rural Fire Stations/Posts in Delhi State ..... 156

Table 7-39: Training courses run by FSMA, Rohini ..... 157

Table 7-40: List of awareness programs carried out by DFS in the last 3-years ..... 158
Table 7-41: Estimated Training Requirements for Fire Personnel in Delhi Fire Service..... 160

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# Executive Summary

Fire service is one of the most important emergency response services in the country, which comes under the 12th schedule of the constitution dealing with Municipal functions. At present, fire prevention and fire fighting services are organized by the concerned States and Union Territories (UTs), and Urban Local Bodies (ULBs). Directorate of National Disaster Response Force and Civil Defence (NDRF&CD, Fire Cell), Ministry of Home Affairs (MHA) render technical advice to the States, UTs, and central ministries on fire protection, prevention, and legislation. Fire services in Maharashtra, Haryana, Gujarat, Chhattisgarh, Madhya Pradesh (excluding Indore), and Punjab are under the respective Municipal Corporations. In the remaining States, it is under the respective Home Department.

The growth of fire-services in the country has been on an ad-hoc basis, without much scientific analysis of existing risks in different parts of the country. Varying risk scenarios need different types of equipment. The risk varies with geographical location such as hilly-area, coastal-area, desert–area, and with residential (high-rise, medium, and low rise-buildings), industrial, commercial area or a combination of these. Moreover, lack of knowledge management for future planning and institutional capacity and funds are also seen as one of the major challenges in addressing improvements in fire and emergency services in the country. As per a recent analysis by the Standing Fire and Advisory Council (SFAC), the overall deficiency in the country in terms of number of Fire Stations is 97.54%, in terms of fire fighting and rescue vehicles is 80.04% and in terms of fire personnel is 96.28%, respectively, which is quite alarming (NDMA Guideline, 2012, CR SFAC, 2011). In consideration of this and the increasing fire risks from various hazards, the Directorate of NDRF&CD, Fire Cell, MHA planned a study called "**Fire Hazard and Risk Analysis in the Country for Revamping the Fire Services in the Country**", to identify existing gaps in terms of availability and requirement of Fire Stations, capacity-building, trained man-power and fire-fighting, rescue, and other specialized equipment

The **broad objectives** of the study are:

- To carry out GIS thematic map based Fire Hazard and Risk analysis though overlaying hazards and quantified risk, and classify the districts as base units into appropriate risk categories such as very high, high, medium, or low.
- To prepare a detailed Investment and Financing Plan for next 10 years for up-gradation, expansion and modernization of Fire Services, based on existing situation analysis and risk based actual requirements.
- To develop an open-source GIS based software called as a Fire Decision Support System (FDSS) containing administrative boundaries, quantified risk GIS layers and with capability of estimation of financial implications for desired capacity development.
- To prepare an Institutional Assessment and Capacity Building Plan, based on field-data collection, enquiry, spatial analysis and understanding of the availability and gaps in the fire service infrastructure.

## Role of Fire Services

The primary role of fire services has been to attend to fire incidents. Besides firefighting, fire department also attends to other emergencies such as building collapse, road traffic accidents, human and animal rescue etc., and other special service calls. Some fire services also attend medical emergencies for transportation of casualties through ambulances maintained by them. Similarly, some States, like Delhi, have separate flood department with

rescue boats and trained divers. The Fire Services maintain skeletal facilities to act as *'first responders'* and wait until assistance from the flood department arrives. It is therefore, considered appropriate that the specialized facilities for such jobs is maintained and operated by the concerned department.

As indicated in the National Disaster Management Authority (NDMA) guidelines, Fire Service is one of the Emergency Support Functions (ESF). Based on DM Act 2005, various States have also formulated State Disaster Management Authorities (SDMA's) and District Disaster Management Authorities (DDMA's) both of which consider Fire Service as an ESF. It is, therefore, evident that the role of Fire Services has become multi-dimensional that includes not only attending fire incident calls but also various other emergencies. Accordingly, fire services in the jurisdiction of the respective Fire Station are required to be prepared with suitable types of equipment to deal with various emergencies.

The role of fire services also includes effective fire prevention, creating awareness on fire safety, and enforcing the inbuilt fire protection arrangements for various types of occupancies in line with National Building Code (NBC) part – IV. However, majority of the States/Municipal Fire Services are unable to enforce the fire safety provisions due to a lack of appropriate directives from the authorities controlling the function of fire services. Some of the Fire Services do not adhere to NBC and have created their own fire-safety building bye-laws, e.g., Mumbai Fire Brigade. It may be noted that in-built fire safety arrangements and escape facilities are much more important than having a fire service within the premises without the above facilities. It is, therefore, necessary to enforce the fire-safety provisions through appropriate directives to all the States/UTs by the Ministry of Home Affairs (MHA) directly or through DG, NDRF & CD office.

In addition to the regular fire services, various other organizations/ industries, such as Ports, Airports, Defence, Power, Oil and Gas, Steel, Heavy Engineering, Fertilizers, Chemicals etc. have their own fire service set-ups (including their own captive resources), in order to provide fire protection to their facilities and some of them at times provide support to local fire services on request. All of them have their rules and regulations concerning fire safety. For example, Oil India Safety Directorate (OISD) norms for Oil and Gas Industries, International Civil Aviation Organization (ICAO) norms for Airports, Tariff Advisory Committee (TAC) regulations- now discontinued, for industries etc. and Electricity Rules for power sector.

Safety of highly hazardous processing and storage industries requires 100 percent round the clock built-in and functional fire protection arrangements with trained fire fighters as well as onsite and off-site disaster management plans. Fire services are not expected to create the infrastructure to independently tackle such emergencies within the industry, as it may be not be possible to do so. However, they are expected to support any on-site and off-site fire fighting to protect surrounding populations and handle such incidents during transportation through the civil areas. Moreover, local fire services should have mutual-aid schemes with all the industries in their jurisdiction and must be aware of the various arrangements available with them in order to provide efficient support, in case of an emergency.

## Phased Approach

In order to conduct this study for India, a vast country covering all the States and Union Territories (UTs), it was decided to conduct this study in a phased manner. In this initial phase, the pilot study comprises of 6 States and UTs (Jammu & Kashmir, Rajasthan, Maharashtra, Delhi, Andaman & Nicobar Island, and Puducherry).

## Field Surveys for Fire Infrastructure Data

To collect and collate the information on Fire Infrastructure of these Pilot States/ UTs, RMSI team developed two detailed forms “Headquarter Data Collection Form” and individual “Fire Station Field-Survey Form”. RMSI team field-surveyed all the Fire Stations in Pilot States/UTs for collecting detailed fire Infrastructure information. The detailed information collected includes address of Fire Station, name of Fire Station in-charge, emergency contact numbers, communication between Fire Station control room, public and headquarter control room; Fire Station building including staff accommodation and barracks; fire fighting vehicles and specialized equipment; fire personnel, their duty pattern and pay-scales; water availability and water sources for fire vehicles, fire-risk in the jurisdiction of Fire Station and its geographical coordinates (latitude, longitude -by using a Global Positioning System, GPS) etc. All this information for each Fire Station has been digitally converted and is available through Fire Decision Support System (FDSS), which can generate a Fire Station report at the click of a button.

## GIS based Fire Hazard and Risk Analysis

In general, fire risk is defined as the combination of hazard potential, exposure, and vulnerability:

Risk = F (**H**azard potential x **E**xposure x **V**ulnerability)

The occurrence of fire incidents that constitute a threat for the population and exposed infrastructure of a certain region is associated with economic and human losses, always as a function of the exposure conditions and the vulnerability of the exposed assets in that particular region. Different natural hazards such as seismic (earthquake), climatic, and wind are considered in risk analysis. Additionally hill zone are also considered in risk analysis due to increased fire risk from wooden houses and heating provisions in cold areas.

For estimating exposure and its vulnerability, detailed urban agglomerate classification maps generated from high-resolution satellite images have been used. With the help of remote sensing techniques applied on high-resolution satellite imageries, various types of urban agglomeration areas have been demarcated. These include urban, semi-urban, building blocks, and industrial and rural villages’ built-up areas of different densities (high medium, low). For exposure vulnerability, 4 different layers such as population density, residential built-up areas, high-rise building block density, and industrial areas have been developed individually at district level. For assessing fire risk, both absolute built-up areas in sq km as well as built-up areas percent (ratio of built-up areas to the total area) are considered as important parameters. It is obvious that industrial areas in districts have much lower percentages than residential built-up areas. However, presence of industrial areas in a district has a significant influence in assessing fire risk. Hence, industrial areas in absolute terms (sq km) have been considered in risk ranking.

In order to assess the impact of each exposure vulnerability type, a vulnerability score/ ranking has been assigned to each layer at their base unit. The vulnerability score represents the level of vulnerability (very high to negligible) of a specific type of exposure in response to the occurrences of small and medium fire incidents. The natural break in value distribution has been considered for defining the ranking class.

After developing ranking of individual units of hazard and exposure vulnerability, GIS layers have been overlaid on top of each other and a spatial analysis has been performed for integration in GIS environment. For combining hazard and risk, Weighted Factor Analysis (WFA) in GIS environment has been performed. Weighted ranking scores have been used in the integration analysis and quantified risk distribution for each district. Values of weighted factor depend upon the importance of a particular hazard/ vulnerability class in risk analysis.

For integration of hazards, equal weights have been assigned to wind, seismic and climatic hazards, while double weights have been given to hill zoning. This is because, in hilly terrain, wooden houses and heating provisions in buildings increase the chances of fire-incidences, and thus have been given higher weightage.

After obtaining integrated individual weighted score for hazard and exposure vulnerability, fire risk categories have been obtained in quantitative terms by further integration of hazard and exposure vulnerability. It is obvious that in the occurrence of the number of fire incidents in a given district, exposure vulnerability has more importance than the prevailing hazard. Hence, in quantified integration, double weights have been assigned to exposure vulnerability. The quantified numeric values of district risk scores are again grouped into four descriptive categories of district level risk ranking (very high, high, medium, and low).

As per project scope of work, countrywide district level fire hazard and risk analysis has been carried out. However, it is obvious that the fire risk is not uniformly distributed throughout the districts in both urban and rural areas. Considering the above fact, RMSI has performed GIS based risk analysis, based on distribution of population agglomeration by defining built-up areas into different risk categories, such as high-density urban, low-density urban, sub-urban, and village. Moreover, distinct demarcated industrial areas have also been considered in the analysis.

## Review of International and National Norms

To estimate the gaps from the existing position in terms of number of Fire Station and their appropriate location, the RMSI team followed scientific and innovative GIS based response time network analysis approach involving various norms and regulations. Various international and national norms on response time have been reviewed. Response time is defined as "*en route time (in minutes) taken by the fire fighting vehicle from the Fire Station to the fire emergency scene.*" Different counties follow different norms on response time such as:

**Germany**: response time in urban areas varies from 8 to 15 minutes

**Japan**: response time varies from 5 to 10 minutes, depending upon the location of the building

**USA**: response time varies from (3-4) to 8 minutes

**United Kingdom**: response time varies from 5 to 8 minutes

**India**: SFAC norms recommended response time for first fire tender is 3, 5, and 7 minutes respectively depending on risk category A, B, and C in urban area and 20 minutes in rural area. The norms also defined one Fire Station in an area of 10 sq km in urban area; and 50 sq km in rural area.

To investigate the practicability of SFAC norms, RMSI team carried out a number of simulations using GIS based network analysis. With these simulations, RMSI demonstrated that two SFAC norms (response time and area-based) are not in synchronization with each other, and recommended revised response time based norms for positioning a Fire Station, as response area will vary from place to place depending upon the road network.

- ***Depending upon the risk category, the recommended response time for first fire tender is 5 to 7 minutes in urban areas and 20 minutes in rural areas***

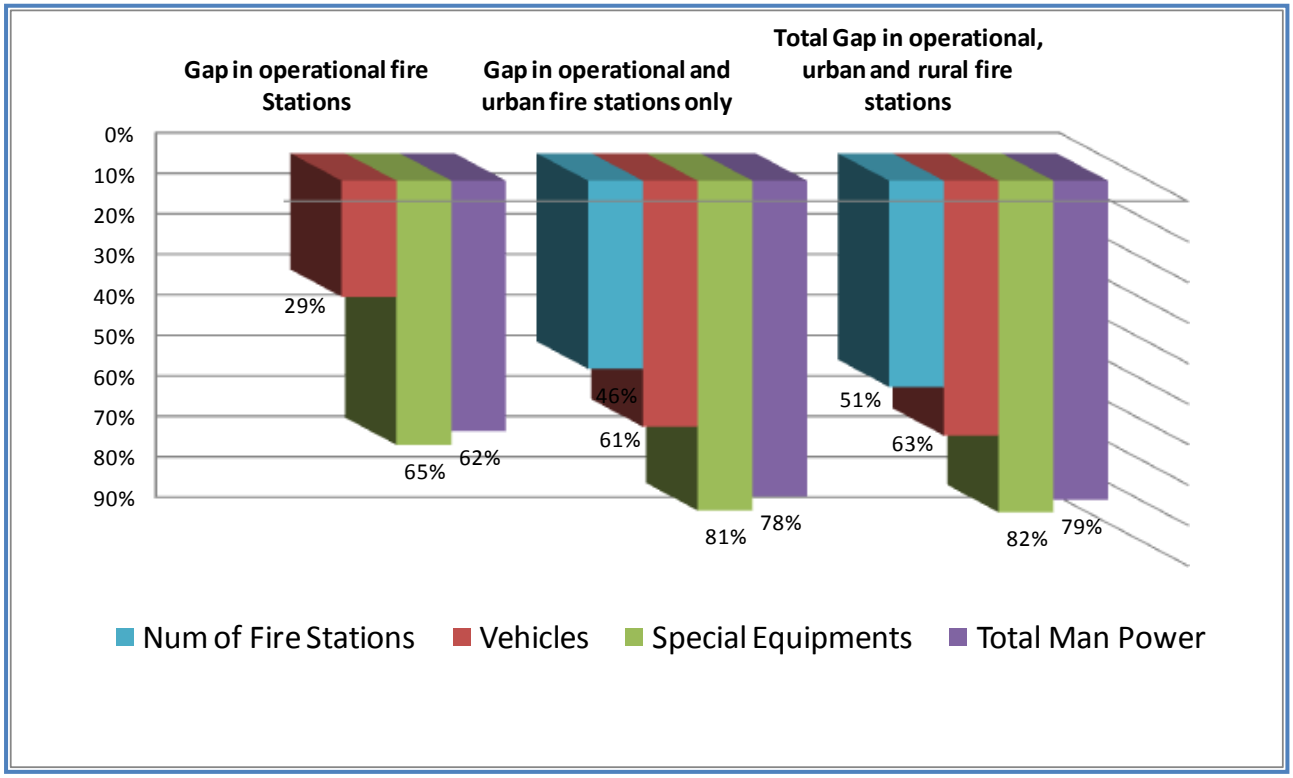
## Summary of Findings for Delhi State

Presently, Delhi Fire Services (DFS) has 51 operational Fire Stations in urban area, 1 Fire Station in rural area and 1 Training Centre-cum-Support Centre at Fire Safety Management Academy (FSMA), Rohini.

Based on detailed demarcated built-up areas and GIS based network analysis (response time analysis), ideal jurisdiction boundaries have been demarcated for all operational Fire Stations excluding areas served by other agencies, such as ports, airports, military cantonments, thermal power plants etc. The remaining areas, not covered under ideal jurisdiction of operational Fire Stations, are also divided for ideal jurisdictions of new proposed Fire Stations. The requirements for fire fighting and rescue vehicles and specialized equipment are based on ideal served population, population density, and built-up areas within ideal jurisdiction boundary.

### Fire Station Gap Analysis

As per detailed GIS based analysis, the State would require additional 46 Fire Stations in urban areas and 9 Fire Stations in rural areas. Out of the 46 urban Fire Stations proposed, DFS has already proposed 18 new Fire Stations, which are at different stages of construction. Thus, this study proposes a further addition of 28 urban Fire Stations and 9 rural Fire Stations, which is an overall deficiency of 51% (including 18 Fire Stations proposed by DFS) in terms of number of Fire Stations in Delhi (for details, please refer to section 7.2.1).




### Vehicles and Specialized Equipment Gap Analysis

For estimating the gap in fire fighting and rescue vehicles and specialized equipment in operational as well proposed Fire Stations both in urban and rural areas, the RMSI team modified the SFAC norms with expert opinions. These modifications also helped in optimization of resources and are detailed in section 7.2.1.1. Thus, this study finds an overall

gap of about 63% in fire fighting and rescues vehicles and about 82% in specialized equipment for both operational and new Fire Stations in urban and rural areas.

**Fire Personnel Gap Analysis**

For estimating the gap in fire personnel in operational as well new proposed Fire Stations both in urban and rural areas, the RMSI team used Administrative Reform Department (ARD, Delhi) norms based on duty pattern (double-shift) prevalent in Delhi as ARD has already optimized the fire manpower requirement in comparison to what has been suggested in SFAC norms. Thus, this study finds an overall gap of about 79% in fire personnel.

### Fire Prevention Wing

In addition to fire fighting staff, there is an urgent need for fire prevention wing for inspection, awareness generation, and training for schools, hospitals, high-rise buildings, govt. offices, public buildings etc., need further strengthening, so that recurrence of the fire incidences similar to that at the Advance Medical Research Institute (AMRI), Kolkata, in terms of their magnitude and frequency can be reduced. Accordingly, to support Director, Delhi Fire Services, additional officers at the levels of Chief Fire Officers (CFO), Dy Chief Fire Officers (Dy-CFO), Division Officers (DO), and Assistant Divisional Officer (ADO) have been recommended (for details, please refer to section 7.2.2).

### Fire Station, District and State Level Report Generation

The detailed report of Operational Fire Station, district and State levels for fire infrastructure and gap analysis is also available through Fire Decision Support System (FDSS), which can generate report for each Operational Fire Station, district, and State level reports at the click of a button.

### Roadmap for Investment and Financial Plan for next 10 years

The other tasks include the development of Investment and financial plan, Institutional Assessment & Capacity Building Plan along with a dynamic web-based Fire Decision Support System (FDSS). As detailed in section 7.2.3, the detailed investment and financial plan at district level includes estimation of capital cost for infrastructure cost, fire fighting and rescue vehicles, and specialized fire and communication equipment. The recurring expenditure cost includes fire personnel cost depending upon pay-scales at various levels; staff uniform cost, and Personal Protective Equipment (PPE); annual vehicle and specialized equipment maintenance cost, Petrol, Diesel, and Lubricant (PDL); building maintenance; office and training expenses etc. The detailed roadmap and investment plan (section 7.2.4) for the next 10-years includes both capital and recurring expenditures. Thus, RMSI analysis estimates a total Investment of **about Rs. 4,927 Crores** spread over a period of 10 years for Delhi State including inflationary factors and after filling the gaps for both operational and proposed urban and rural Fire Stations.

### Prioritization of New Fire Stations

The prioritization of new Fire Stations in Delhi for both rural and urban areas has been detailed in section 7.2.5. Accordingly, separate priority ranking for both urban and rural areas are given in Tables 7-37 and 7-38, respectively.

### Avenues for Fund Generation

DFS can generate new avenues for funds from the following:

- Introduction of Fire Tax (1% of existing property tax)
- Training programs at different levels and durations to private sector employees on chargeable basis

## Capacity Building and Training Facilities

The Capacity building and training facilities and training need assessment for various levels have been given in section 7.3. Additionally, RMSI team is making a separate report of Capacity Building and Training Infrastructure for all States/UTs in the country

## Limitations of Study

Limitations of study have been given in section 7.4.

## Recommendations

The report concludes with the recommendations for the Delhi State Fire Services and is detailed in section 7.5. In short, Delhi Fire Services can be revamped in the next 10 years to desired level, if sufficient funds and trained resources are made available.

## Report Structure

This report for pilot States/UTs is divided in two parts:

**Part A:** This part comprises of chapters 1-6, which are common for all the pilot States/UTs- Delhi, Jammu & Kashmir, Rajasthan, Puducherry, Maharashtra, and Andaman & Nicobar Islands.

- Chapter 1 provides brief details of project background, role of fire services, objective and scope of study
- Chapter 2 outlines the methodology adopted and data development
- Chapter 3 provides details on GIS based fire hazard and risk analysis
- Chapter 4 provides a brief overview of field-survey of individual Fire Station and headquarter data collection and approach for stakeholder analysis
- Chapter 5 briefly explains the Development of Fire Decision Support System (FDSS)
- Chapter 6 examines international and national norms

**Part B:** This part comprises of Chapters 7-12, which are prepared for pilot State/UT specific.

- Chapter 7 provides detailed analysis for the Delhi State
- Chapter 8 provides detailed analysis for the Rajasthan State
- Chapter 9 provides detailed analysis for the Maharashtra State
- Chapter 10 provides detailed analysis for the Jammu & Kashmir State
- Chapter 11 provides detailed analysis for the Puducherry UT
- Chapter 12 provides detailed analysis for the A&N Islands UT

For Part-B, this report consists of Chapter 7, which is for the Delhi State.

# PART -A

# 1 Introduction

## 1.1 Background

Fire service is one of the most important emergency response services. In India, Fire services come under the 12th Schedule of the constitution dealing with Municipal functions. At present, fire prevention and fire fighting services are organized by the concerned States and Union Territories (UTs), and Urban Local Bodies (ULBs). Ministry of Home Affairs (MHA) renders technical advice to the States, UTs, and central ministries on fire protection, prevention, and legislation. Fire services in Maharashtra, Haryana, Gujarat, Chhattisgarh, Madhya Pradesh excluding Indore, and Punjab are under the respective Municipal Corporations. In remaining States, it is under the Home Department (Figure 1-1).

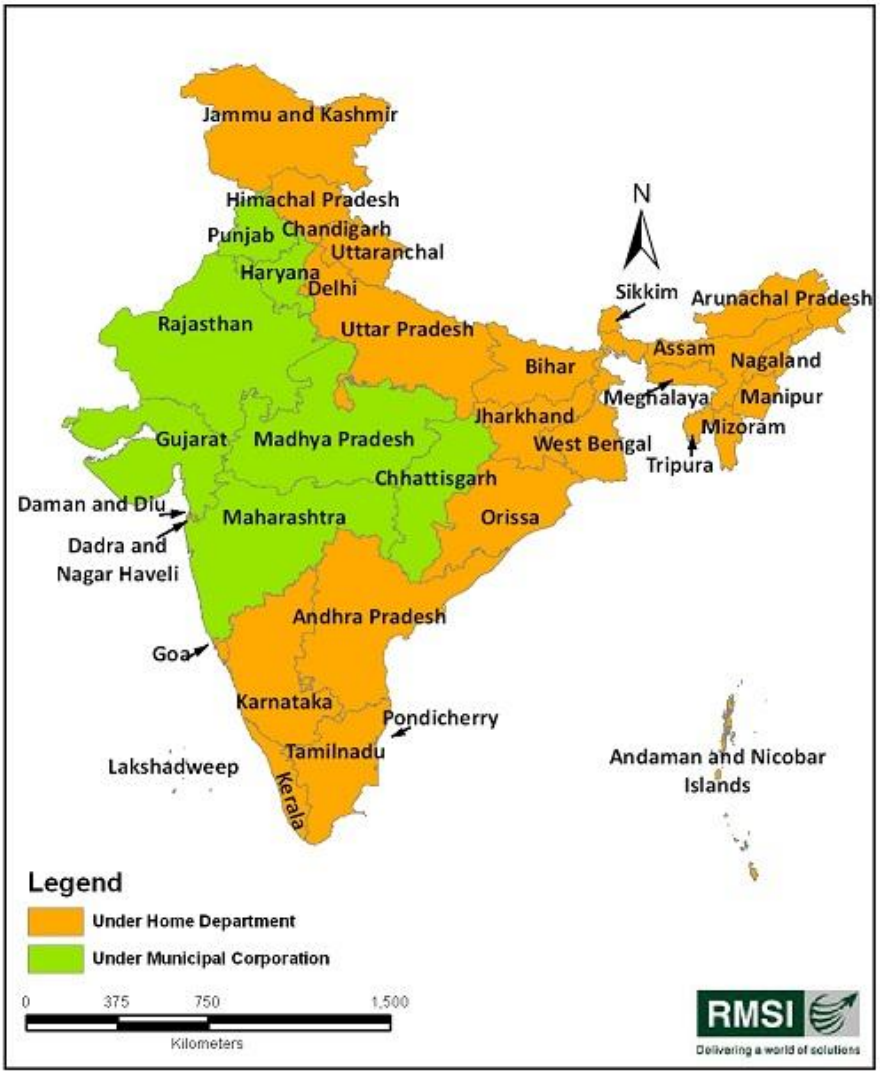



**Figure 1-1: Distribution of fire services by various States/UTs by administrative organization**

## 1.2 Role of Fire Services

As far as the role of fire services is concerned, the primary job of fire services has been to attend to fire incidents. However, they also attend to other emergencies like rescue from building collapse, road traffic accidents, human and animal rescue etc., and other special

service calls. Some fire services also attend medical emergencies for transportation of casualties through ambulances maintained by them. Similarly, some States have separate flood department with rescue boats and trained divers, like Delhi. The Fire Services maintain skeleton facility to act as 'first responder' and wait until assistance from flood department is reached. It is therefore, considered appropriate that the specialized facilities for such job is maintained and operated by the concerned department.

As indicated in the National Disaster Management Authority (NDMA) guidelines, Fire Services is one of the Emergency Support Functions (ESF). Based on DM Act 2005, various States have also formulated State Disaster Management Authorities (SDMA's) and District Disaster Management Authorities (DDMA's) both of which consider Fire Service as an ESF. It is therefore evident that the role of Fire Service is multi-dimensional that includes attending various emergencies. Accordingly, fire services are required to be prepared with suitable types of equipment to deal with various emergencies arising in the jurisdiction of the respective Fire Station.

The role of fire services also includes effective fire prevention, creating awareness on fire safety, and enforcing the inbuilt fire protection arrangements for various types of occupancies in line with National Building Code (NBC) part – IV. However, some of the States/Municipal Fire Services are unable to enforce the fire safety provisions due to a lack of appropriate directives from the authorities controlling the function of fire services. Some of the Fire Services do not adhere to NBC and have created their own fire-safety building bye-laws, e.g., Mumbai Fire Brigade. It may be noted that in-built fire safety arrangements and escape facilities are much more important than having a fire service within the premises without the above facilities. It is, therefore, necessary to enforce the fire-safety provisions through appropriate directives to all the States/UTs by the Ministry of Home Affairs (MHA) directly or through DG, NDRF & CD office.

In addition to the regular fire services, various other organizations/ industries, such as Ports, Airports, Defence, Power, Oil and Gas, Steel, Heavy Engineering, Fertilizers, Chemicals etc. have their own fire service set-ups (including their own captive resources), in order to provide fire protection to their facilities and some of them at times provide support to local fire services on request. All of them have their rules and regulations concerning fire safety. For example, Oil India Safety Directorate (OISD) norms for Oil and Gas Industries, International Civil Aviation Organization (ICAO) norms for Airports, Tariff Advisory Committee (TAC) regulations- now discontinued, for industries etc. and Electricity Rules for power sector.

Safety of highly hazardous processing and storage industries requires 100 percent round the clock built-in and functional fire protection arrangements with trained fire fighter as well as onsite and off-site disaster management plans. Fire services are not expected to create the infrastructure to independently tackle such emergencies within the industry, as it may be not be possible to do so. However, they are expected to support any on-site and off-site fire fighting to protect surrounding populations and handle such incidents during transportation through the civil areas. Moreover, local fire services should have mutual-aid schemes with all the industries in their jurisdiction and must be aware of the various arrangements available with them in order to provide efficient support, in case of an emergency.

The growth of fire-services in the country has been on an ad-hoc basis, without much scientific analysis of existing risks in different parts of the country. Varying risk scenarios need different types of equipment depending upon the risk and geographical location such as hilly-area, coastal-area, desert–area, and residential (high-rise, medium, and low rise-buildings), industrial, commercial area or a combination of these. Moreover, lack of knowledge management for future planning and institutional capacity and funds are also seen as major challenges in addressing improvements in fire and emergency services in the country. As per a recent analysis by the Standing Fire and Advisory Council (SFAC), the

overall deficiency in the country in number of Fire Stations is 97.54%, in fire fighting & rescue vehicles 80.04% and in fire personnel is 96.28%, respectively, which is quite alarming (NDMA Guideline, 2012, CR SFAC, 2011).

In consideration of this and the increasing risks from various hazards, such as Fire Following an Earthquake (FFEQ), and the rapid pace of urbanization and industrialization in the country, the Directorate of National Disaster Response Force and Civil Defence (NDRF&CD, Fire Cell), MHA felt the need for a comprehensive study to identify existing gaps in terms of availability and requirement of Fire Stations, capacity-building, in terms of trained man-power and fire-fighting, rescue, and other specialized equipment This comprehensive study **aims at preparing a perspective plan for the next 10 years for revamping the fire services in the country**.

## 1.3 Objective of the Study

The broader objective of this study is to prepare a Capital Investment and Institutional Strengthening plan for accelerated development of fire services in the country.

## 1.4 Scope of the Study

The study area for this assignment is the entire country under the Directorate of NDRF & Civil Defence (Fire). The scope of the assignment will include, inter alia, the following activities:

1. **Fire Hazard & Risk Analysis:** Carry out a GIS (Open Source) based fire hazard and risk analysis and identify the gaps in fire services in terms of fire fighting vehicles, specialized equipment, and trained fire personnel.
2. **Investment and Financing Plan:** Assess the status, availability and distribution of the fire service infrastructure under the Directorate of NDRF & Civil Defence (Fire Cell) by conducting field investigations and interviews. It is expected to conduct an investigation to assess the gaps and needs for future planning and up-gradation/ modernization of the fire service infrastructure in the country in a quantified approach. As part of the Investment and Financing Plan, it is also expected to estimate the Capital and O&M Investment plan for the next 10 years and the investment priorities.
3. **Institutional Assessment and Capacity Building Plan:** Based on field-data collection, enquiry, spatial analysis and understanding on the availability and gaps in the fire service infrastructure, and prepare an Institutional Assessment and Capacity-building plan for the department. Institutional Assessment and Capacity Building Plan will include but will not be limited to understanding the policies, regulations, strategies and programs of the department; existing legal and institutional mechanisms, issues and constraints of effective management; and training needs and capacity of the department's resources. Based on a comprehensive understanding of the mentioned variables, it is expected to prepare a consolidated national report and key recommendations for the Directorate of NDRF & CD (Fire Cell). It is also expected to explore the possibility of funding sources and provide recommendations for improvements to ensure appropriate financing mechanisms for capital expenditure, and for operation and maintenance.

# 2 Technical Details on Methodology and Data Development

## 2.1 Understanding of the Scope of Work

The primary objective of this comprehensive study on “Fire Hazard and Risk Analysis in the Country” is to prepare a capital investment and institutional strengthening plan for accelerated Development of Fire Services in the country. To achieve this objective of the study, the Directorate of NDRF & CD has defined the broad scope of the work as:

1. Risk and Hazard Analysis
    - Identifications of gaps in the existing fire services
2. Investment and Financial Plan
3. Institutional Assessment and Capacity Building Plan
    - Including survey of NFSC Nagpur and regional fire training Centers

As part of the Risk and Hazard Analysis, it is expected to carry out a GIS based hazard, risk analysis at base unit (district) level, and identify the gaps in the existing fire services. Risk assessment of forest fire is not included under the present scope of work. The infrastructures of forest department, privately owned fire safety infrastructure, infrastructures in restricted areas like military cantonments and airbases, and ammunition depots; nuclear facilities such as nuclear power plants, nuclear research reactors, heavy water plants; and mines, ports, airports, and oil exploration and oil refineries are excluded from the study. While assessing the infrastructure for the Investment and Financing Plan, RMSI has focused specifically on the State/UTs Fire Services. ***However, it may please be noted that RMSI team is also making efforts to get details of areas served by other agencies as well, so that requirement of establishing Fire Stations in these areas does not become part of the Gap analyses.***

As part of the ‘Investment and Financing Plan’, it is expected to assess the status, availability and distribution of the fire service infrastructure under the jurisdiction of Director General (NDRF & Civil Defence) through conducting field investigations and interviews. It is also expected to conduct an investigation to assess the gaps and needs for future planning, up gradation/ modernization of the fire service infrastructure in the country through a quantified approach. As part of the Investment and Financing Plan, it is also expected to estimate the Capital and O&M Investment plan for the next 10 years and the investment priorities. Based on the field data collection, enquiry, spatial analysis and understanding on the availability and gaps in the fire service infrastructure, it is expected to prepare an institutional assessment and capacity-building plan for the department. Institutional Assessment and Capacity Building Plan will include but not limited be to understanding the polices, regulations, strategies and programs of the department; existing legal and institutional mechanisms, issues and constrains of effective management; training needs and capacity of the department’s resources. Based on a comprehensive understanding of the mentioned variables, it is expected to prepare a consolidated National Report and key recommendations for the Director General (NDRF & Civil Defence) for all the Fire Stations under jurisdiction of the Directorate of NDRF & CD. Moreover, the possibility of funding sources will also be explored, and recommendations will be made for improvements to ensure good financing mechanisms for capital expenditure and operation and maintenance.

## 2.2 Study Area

The study area for this assignment is the entire fire service area of the country under the Directorate of NDRF & Civil Defence (Fire Cell). RMSI has carried out physical survey of all the Fire Stations under the Directorate of NDRF & CD (Fire Cell) (Figure 2-1) across the country.

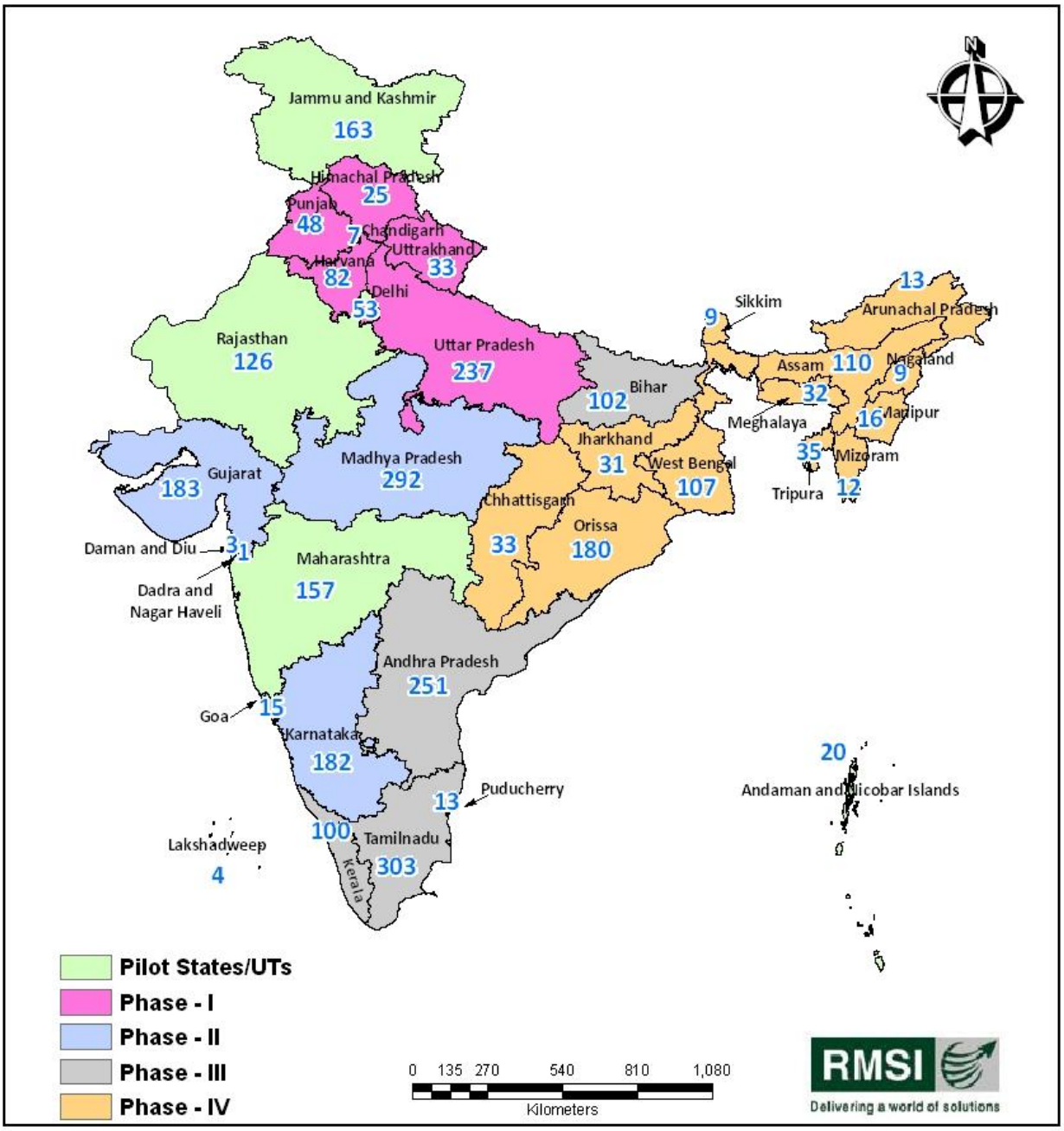



**Figure 2-1 : State/UT wise distribution of fire service stations in India**

## 2.3 Phased Approach

As India is a vast country and in order to conduct this study for all the States and Union Territories (UTs), it was decided to conduct this study in a phased manner (Table 2-1). In the initial phase, pilot study comprises of six States and UTs - **Jammu & Kashmir, Rajasthan,**

**Puducherry, Maharashtra, Andaman & Nicobar Island, and Delhi**. The Fire-Infrastructure of these Pilot States/ UTs has been Field–Surveyed by RMSI team and fire hazard and risk analyses have been carried out. The other tasks include development of Investment and financing plan, Institutional assessment & capacity building plan along with a prototype Fire Decision Support System (FDSS). The outcomes of pilot study were submitted to the Expert Group of the project for their review and approval and detailed discussions were held with senior Fire Officials, MHA and respective State/UT representatives. The approved report will be used as a template for conducting the study for all other States/ UTs in a phased manner (Table 2-1).

It may be noted that there could be region specific modifications and variations in the requirements of different kinds and types of firefighting equipment depending upon the risk category of the district (base unit) of Fire Station, its geographical location such as coastal-area, hilly-area and desert–area. Phase wise list of States/UTs also includes corresponding number of districts (Census, 2011), number of Talukas/ Mandals/ Tehsils (Census, 2001), and number of Fire Stations (Table 2-1).

**Although this report discusses the country as a whole, in general, however, it has been prepared for the pilot States/UTs in particular.**

**Table 2-1: Phase wise distribution of various States/UTs in the Country**

| States/UTs | No of Districts (Census 2011) | No of Talukas/ Tehsils/ Mandals (Census 2001) | No of Fire Stations |
|---|---|---|---|
| **Pilot Phase** | | | |
| NCT of Delhi | 9 | 27 | 53 |
| Maharashtra | 35 | 355 | 157 |
| Puducherry | 4 | 15 | 13 |
| Andaman & Nicobar Islands | 3 | 7 | 20 |
| Rajasthan | 33 | 241 | 126 |
| Jammu & Kashmir | 22 | 59 | 163 |
| **Phase I** | | | |
| Chandigarh | 1 | 1 | 7 |
| Haryana | 21 | 67 | 82 |
| Punjab | 20 | 72 | 48 |
| Himachal Pradesh | 12 | 109 | 25 |
| Uttarakhand | 13 | 49 | 33 |
| Uttar Pradesh | 71 | 300 | 237 |
| **Phase II** | | | |
| Madhya Pradesh | 50 | 259 | 292 |
| Gujarat | 26 | 227 | 183 |
| Daman & Diu | 2 | 2 | 3 |
| Dadra & Nagar Haveli | 1 | 1 | 1 |
| Karnataka | 30 | 175 | 182 |
| Goa | 2 | 11 | 15 |
| **Phase III** | | | |
| Kerala | 14 | 63 | 100 |
| Lakshadweep | 1 | 4 | 4 |
| Tamil Nadu | 32 | 202 | 303 |
| Andhra Pradesh | 23 | 1110 | 251 |
| Bihar | 38 | 533 | 102 |
| **Phase IV** | | | |
| West Bengal | 19 | 343 | 107 |
| Assam | 27 | 145 | 110 |
| Manipur | 9 | 38 | 16 |
| Meghalaya | 7 | 32 | 32 |
| Mizoram | 8 | 25 | 12 |
| Sikkim | 4 | 9 | 9 |
| Tripura | 4 | 38 | 35 |
| Nagaland | 11 | 93 | 9 |
| Arunachal Pradesh | 16 | 149 | 13 |

| States/UTs | No of Districts (Census 2011) | No of Talukas/ Tehsils/ Mandals (Census 2001) | No of Fire Stations |
|---|---|---|---|
| Orissa | 30 | 398 | 180 |
| Chhattisgarh | 18 | 97 | 33 |
| Jharkhand | 24 | 210 | 31 |
| **Total** | **640** | **5,466** | **2,987** |

# 3 GIS based Fire Hazard and Risk Analysis

Based on RMSI's vast experience of executing large projects at State and country levels, RMSI team has adopted the following approach (detailed below) to carry out this assignment. This approach has also been presented and discussed in a series of meetings with the officials of the Directorate of NDRF & CD, MHA, Government of India.

The risk of fire in urban areas has increased over the years and the rising cost of fire losses would seem to indicate that they are increasing at a greater rate than the measures devised to control them. Cities are growing in size and complexity day by day; therefore, they need to be managed more efficiently.

Geographic Information System (GIS) is an important and efficient tool that can be used by local administrations to minimize natural disasters (Recep Nisanci, 2010). Although there are many formal definitions of GIS, for practical purposes GIS can be defined as a computer-based system to aid in the collection, maintenance, storage, analysis, output and distribution of spatial data information (Bolstad, 2005). Thus, GIS technologies have been used in fire analysis related to the optimum location of Fire Stations. For example, Habibi et al. (2008), has made spatial analysis of urban Fire Stations in Tehran, using an analytical hierarchy process and GIS. Yang et al. (2004) also carried out studies concerning the selection of Fire Station locations using GIS.

Unlike a flat paper map, a GIS-generated map can represent many layers of different information. This representation provides a unique way of thinking about geographic space. By linking map databases, GIS enables users to visualize, manipulate, analyze and display spatial data. GIS technology based approach is cost-effective and provides accurate solutions in an expanding range of applications. RMSI team is adopting following approach for fire risk analysis of Indian States..

## 3.1 GIS Data Compilations

GIS Map based fire hazard and risk analysis is one of the main tasks of this assignment. In order to undertake hazard and risk analysis, various GIS layers and other associated thematic maps have been created for each of the pilot States/UTs that form the basis for risk ranking of base units (districts). The following is a list of selected GIS layers as base administrative layers and other dependant layers that have been used in GIS based fire risk analyses.

1. State administrative boundary layers
2. District administrative boundary layers
3. Rail network
4. Major (highways) and main road networks
5. Minor roads/ street road networks
6. Locations of cities, and major towns with their names
7. State level Land use land cover maps
8. Demarcation of residential, commercial and industrial built-up areas
9. Census population data 2011
10. Geographical locations (latitude, longitude) of operational Fire Stations

11. Other collateral data such as information from city development plans (if available), and demarcation of fire-station jurisdictional areas.

These data layers and their attribute data have been expanded according to needs analyses. The needs analyses include query information for the data needed for generating risk maps and effective fire fighting planning.

After taking into account all requirements and data types, RMSI team has generated various GIS data layers for further GIS spatial analyses. District boundaries were considered as the base unit for analysis in assessing fire services infrastructure gaps, risk quantifications, and risk classifications.

GIS maps for administrative boundary layers such as State, and district are based on published Census 2011 data. **Currently, Census 2011 has published only district level demographic data.** In comparison to previous census (Census 2001), several new districts have been created. These new districts have been considered in the analysis.

Classified land use and land cover data is the backbone in fire hazard and risk analysis. Latest vintage satellite images have been used to capture the various features such as road networks, forest areas and habitat/settlement areas (Figure 3-1). The various land use land cover classes were extracted from latest vintage satellite images at 25m resolution for the selected States and UTs, and at higher resolution for major cities. The extraction is based on a semi-automated classification approach to distinguish the classes based on their reflectance values in the source satellite imagery. Data quality and data validation checks have been carried out for each stage of data generation.

For LULC classification, remote sensing satellite images were geo-referenced and classified to generate different LULC layers such as vegetation, built-up area, water bodies, and streets, based on their spectral reflectance i.e. DN (Digital Number) values. In this process, through a semi-automated process, these DN values of satellite images are classified into respective LULC classes to generate the clutter data. These clutter data layers are further subdivided into their respective sub-classes and merged together to give preliminary clutter data. The output clutter goes through standard validation processes and quality checks to produce high quality final clutters. Table 3-1 shows a list of classified LULC data at 25-meter resolution. Figure 3-1 displays delineated LULC classes for different parts of western Maharashtra (districts– Mumbai, Mumbai sub-urban, Thane, Pune and Raigarh). Figure 3-2 shows an enlarged view of classified urban agglomerate of Pune city areas.

**Table 3-1: Cluster class morphology in land use maps**

| ID | Class Name | Description |
|---|---|---|
| 0 | **Unclassified** | Edge of the database |
| 1 | **Urban High Density** | Areas within urban perimeters, Inner city, very little/negligible vegetation. Closely packed buildings indicative of high density with only major streets and roads being visible. Absence of large open spaces. |
| 2 | **Urban Medium Density** | Medium density of buildings, vegetations are less but higher than the dense urban, major pedestrian zones being partially visible and streets and roads visible. Comparatively more open spaces exist within this region |
| 3 | **Urban Low Density** | Low density of buildings, vegetations / open area are higher than the medium urban, major pedestrian zones being partially visible and streets and roads visible. Comparatively more open spaces than medium density exist within this region |
| 4 | **Suburban High Density** | Suburban areas surrounding big cities (Outer parts of the city) with loosely packed built up and little vegetation. |

| ID | Class Name | Description |
|---|---|---|
| 5 | **Suburban Low Density** | Sparse Suburban areas in outskirt of big cities (Outer parts of the city) with loosely packed built up and little vegetation. |
| 6 | **Building Blocks** | Systematic groups of buildings, parallel or not, that may be separated by large open spaces. |
| 7 | **Villages** | Unsystematic small pockets /clusters of buildings, within large agriculture / open spaces |
| 8 | **Industrial** | **Industrial:** Factories, Warehouse, Garages, Shipyards, Mostly situated outside the main cities. |
| 9 | **Commercial Areas** | **Commercial:** Central Mall, Office Complexes with large building footprints, Central Business districts, Commercial buildings within the city (like petrol pumps, gas filling stations etc.) etc. will be classified as commercial areas |
| 10 | **Forest** | All kinds of dense forest in rural areas, over hills/ mountains, Natural Parks with high tree density. |
| 11 | **Low Dense Vegetation** | Low density of trees, low vegetation, bushes, scrubs with low tree density. |
| 12 | **Agriculture/Fellow** | All kinds of agriculture/fellow cultivated areas, croplands, farmlands etc. |
| 13 | **Water** | Inland permanent water bodies. This class will consist of lakes & dams. |
| 14 | **Open** | No buildings, no vegetation e.g. desert, beach, and open lands mostly barren. |
| 15 | **Quasi Open** | Areas with some obstruction like scattered trees or bushes with some mixed built-up, open, agricultural fallow lands etc |
| 16 | **Airport** | Airstrip and terminal buildings |
| 17 | **River/Canal** | Linear water features like streams and rivers. |
| 18 | **Seasonal Water Body** | Seasonal water body |
| 19 | **Sea** | Sea |

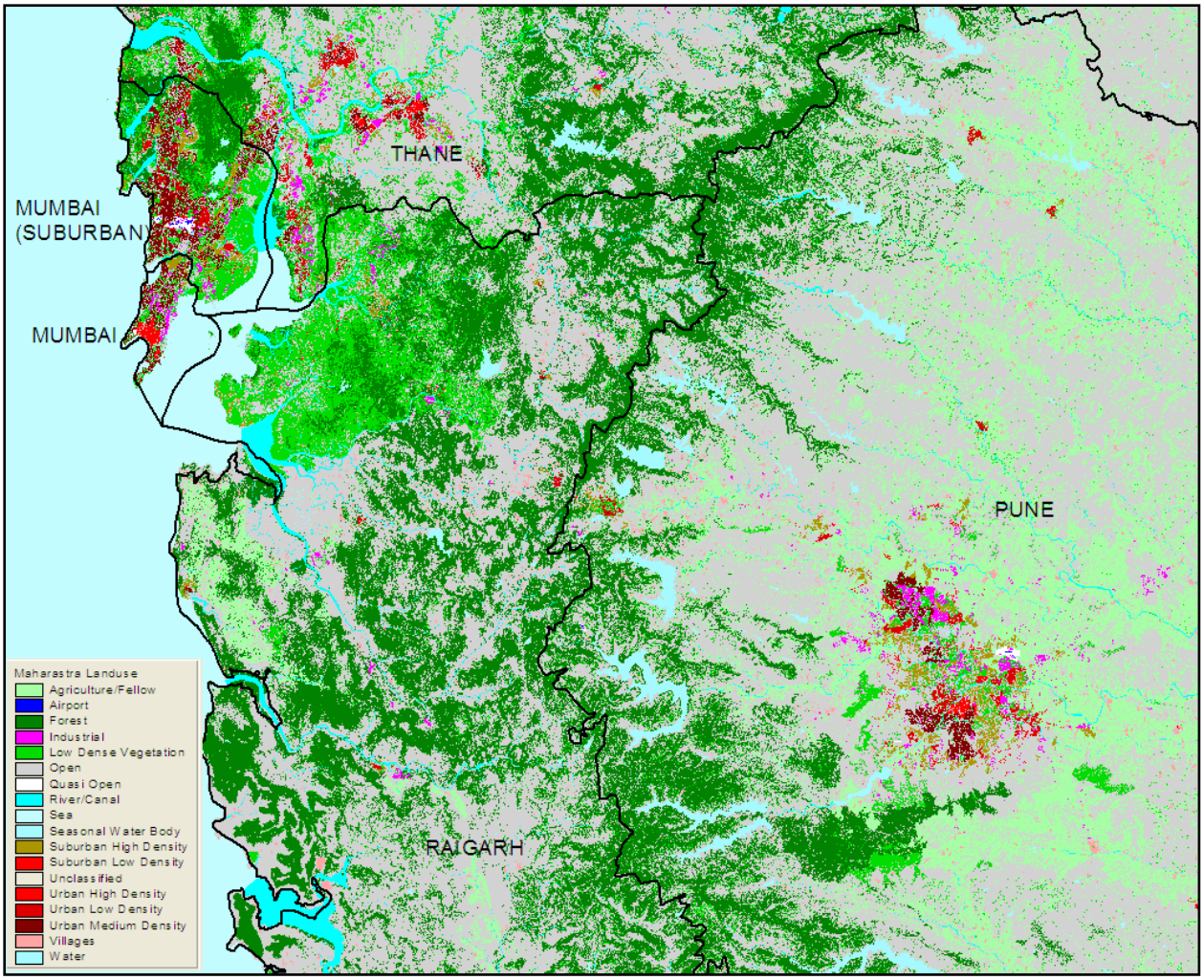



**Figure 3-1 : Land use classification at 25m pixel for parts of Western Maharashtra (districts – Mumbai, Mumbai sub-urban, Thane, Pune and Raigarh)**

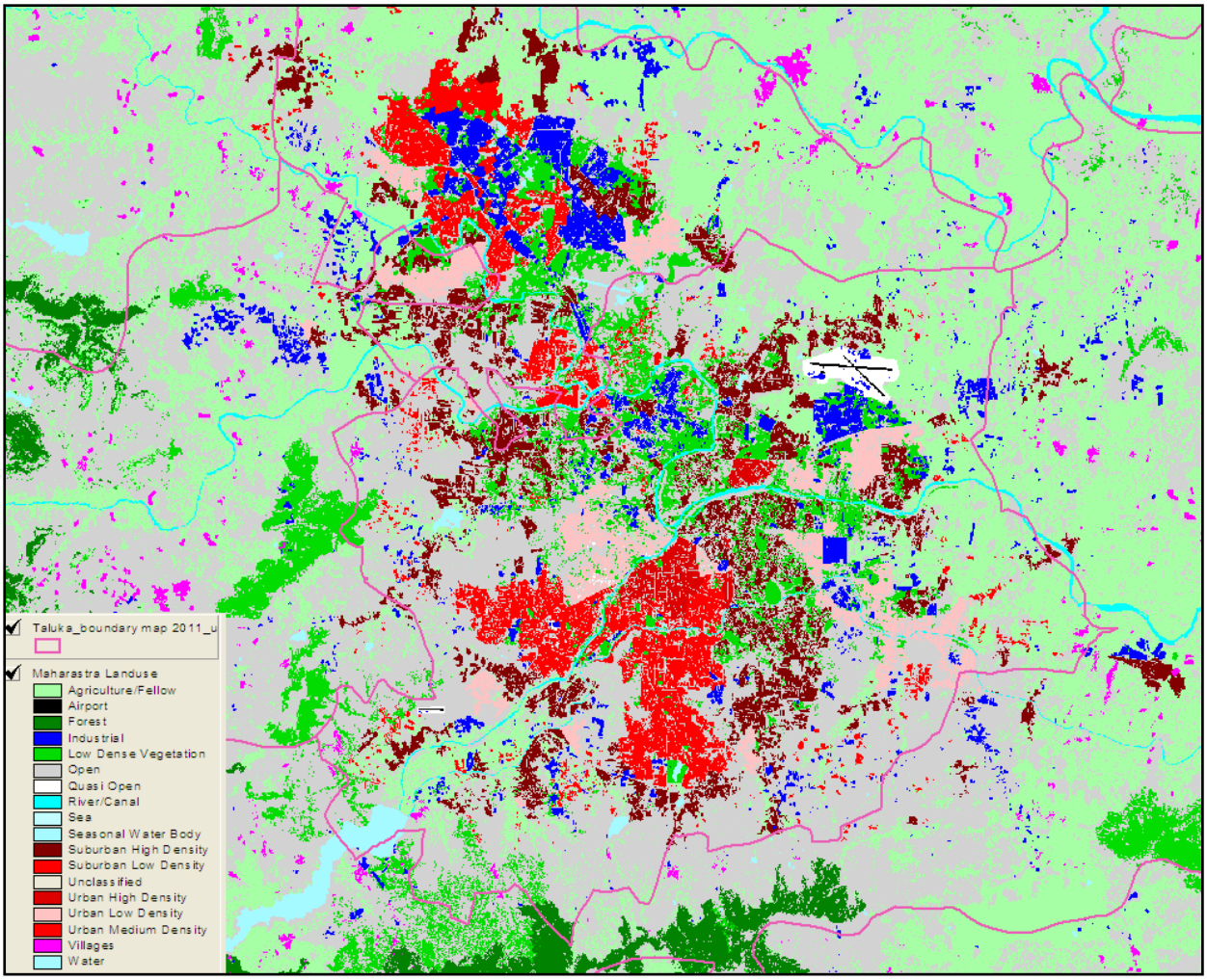



**Figure 3-2 : An enlarged view of classified urban agglomeration in Pune city areas**

For major city areas, classifications that are even more detailed have been created with a high-resolution data layer as shown in Figure 3-3. For major cities / towns, besides the other classified units, such as highways and main roads, minor roads/streets and localities, have been captured. After the field survey of individual Fire Stations, GPS locations of all Fire Stations have been displayed for gap analysis.

## 3.2 GIS - Overlay Analysis

The basic way to create or identify spatial relationships among various GIS layers is through the process of spatial overlay. Overlay is a GIS operation in which layers with a common, registered map base are joined on the basis of their occupation of space. (Keith C. Clarke, 1997). Spatial overlay is accomplished by joining and viewing together separate data sets that share all or part of the same area. The result of this combination is a new data set that identifies the spatial relationships.

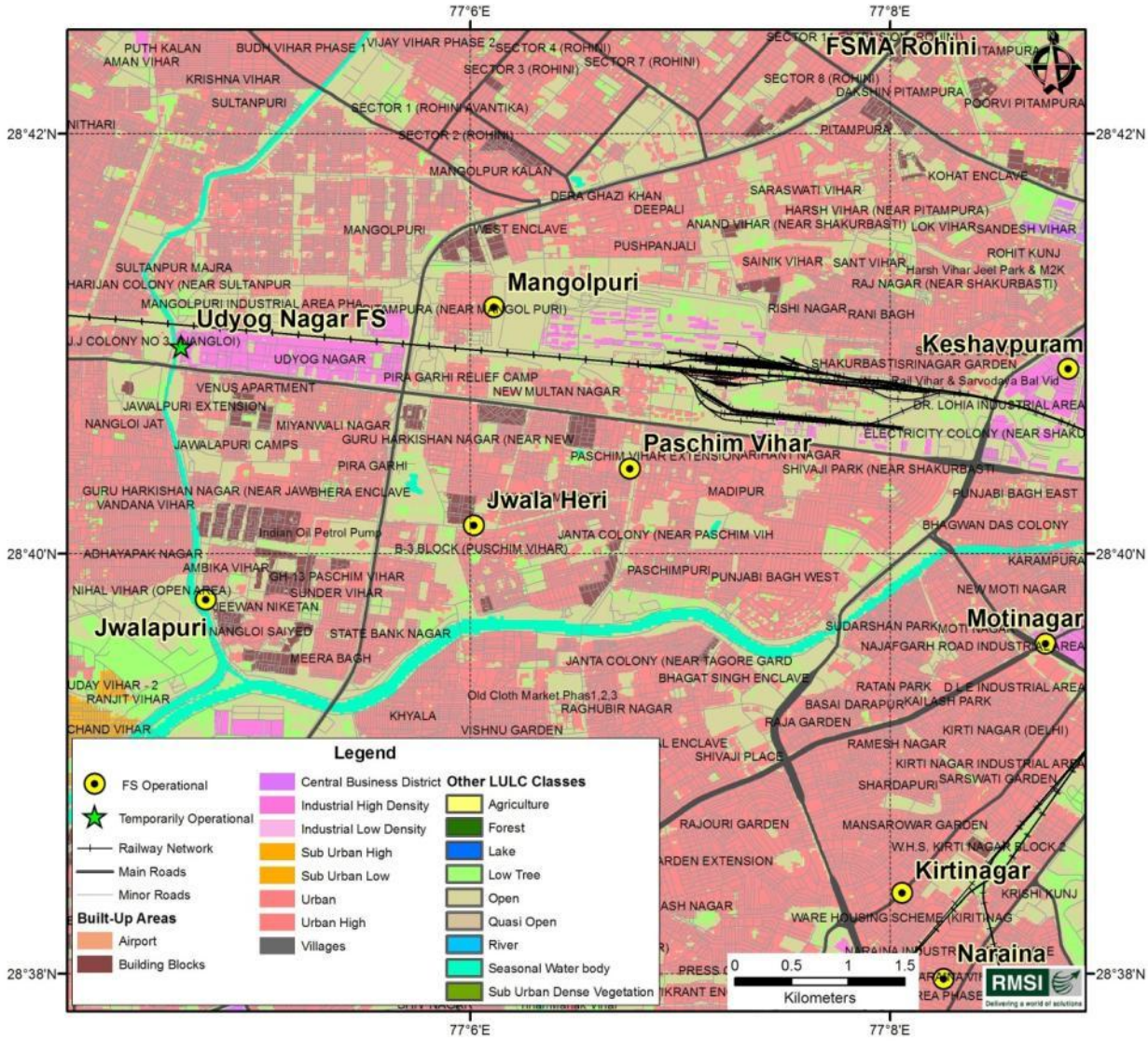



**Figure 3-3 : Detailed classified urban agglomerate areas in parts of Delhi with overlay of GPS location of Fire Stations**

Overlay analysis is a common, widely used method of analyzing and evaluating geospatial data. Overlay analysis utilizes map layers in GIS to discover relationships across the layers. Overlay analysis is used to investigate geographic patterns and to determine locations that meet specific criteria. Spatial overlay is illustrated and highlighted in Figure 3-4. Various data layers, such as Land Use Land Cover (LULC), composite hazard, demographic exposure, road network, administrative boundary and Fire Station locations have been used through overlay analysis by combining diverse data sets for hazard analysis and Fire Station gap analysis.

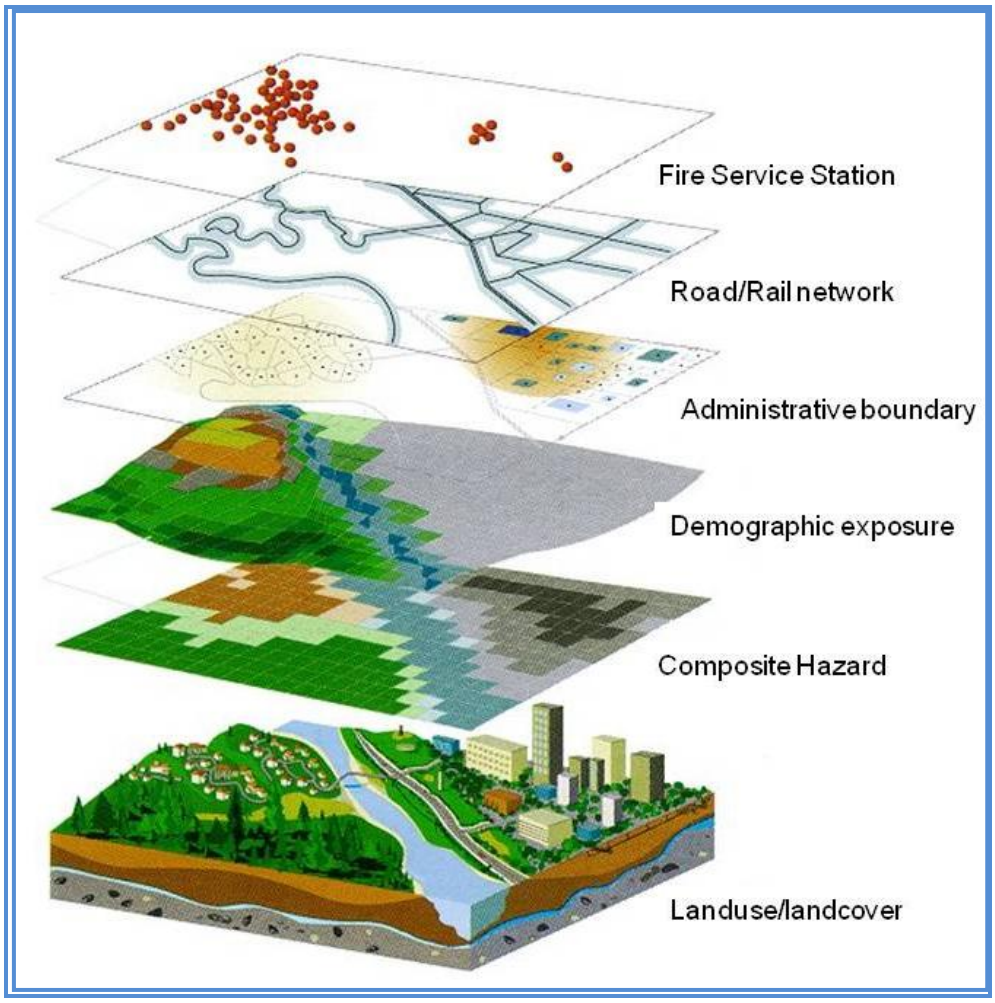



**Figure 3-4 : Overlay analysis for Fire Risk Assessment**

## 3.3 Fire Hazard and Risk Analysis

The first-turnout of fire vehicles normally originates from the Fire Station under whose jurisdiction the fire-call has been received. Sometimes, calls go to a centralized control room, from where they are directed to the concerned Fire Station. To provide an effective response, Fire Station infrastructure in the form of fire fighting and rescue vehicles, specialized equipment and manpower should also take into consideration of fire risks in addition to road conditions and population distribution. Thus, hazard and risk analysis of the base unit (district) should be on a scientific basis.

In general, fire risk is defined as the combination of hazard potential, exposure, and vulnerability:

Risk = F (**H**azard potential x **E**xposure x **V**ulnerability)

The occurrence of fire incidents that constitute a threat for the population and the exposed infrastructure of a certain region is associated with economic and human losses, always as a function of the exposure conditions and the vulnerability of the exposed assets in that particular region. In the present scope, fire risk can be defined as associated with the number of small and medium fire incidents and their locations.

## 3.4 Hazard Ranking

**Earthquake (Seismic zones)**

Besides loss of life, property damage, building collapses, and loss of basic amenities such as bridge and road damage, earthquakes can also induce small to large fires. Hence, earthquake zoning is an important parameter for fire risk analysis.

Based on occurrence of earthquakes of different intensities, the Seismic Zoning Map of India (IS 1893, 2001; BMTPC, 2006; NBC 2005) divides the country into 4 seismic zones as shown in Figure 3-5. Seismic Zone V is the highest risk zone where earthquakes having intensity of IX+ on Modified Mercalli Intensity (MMI) scale can take place. Earthquakes of intensities between VIII to IX can be experienced in seismic Zone IV, whereas earthquakes can occur between VI and VIII intensity in seismic Zone III.

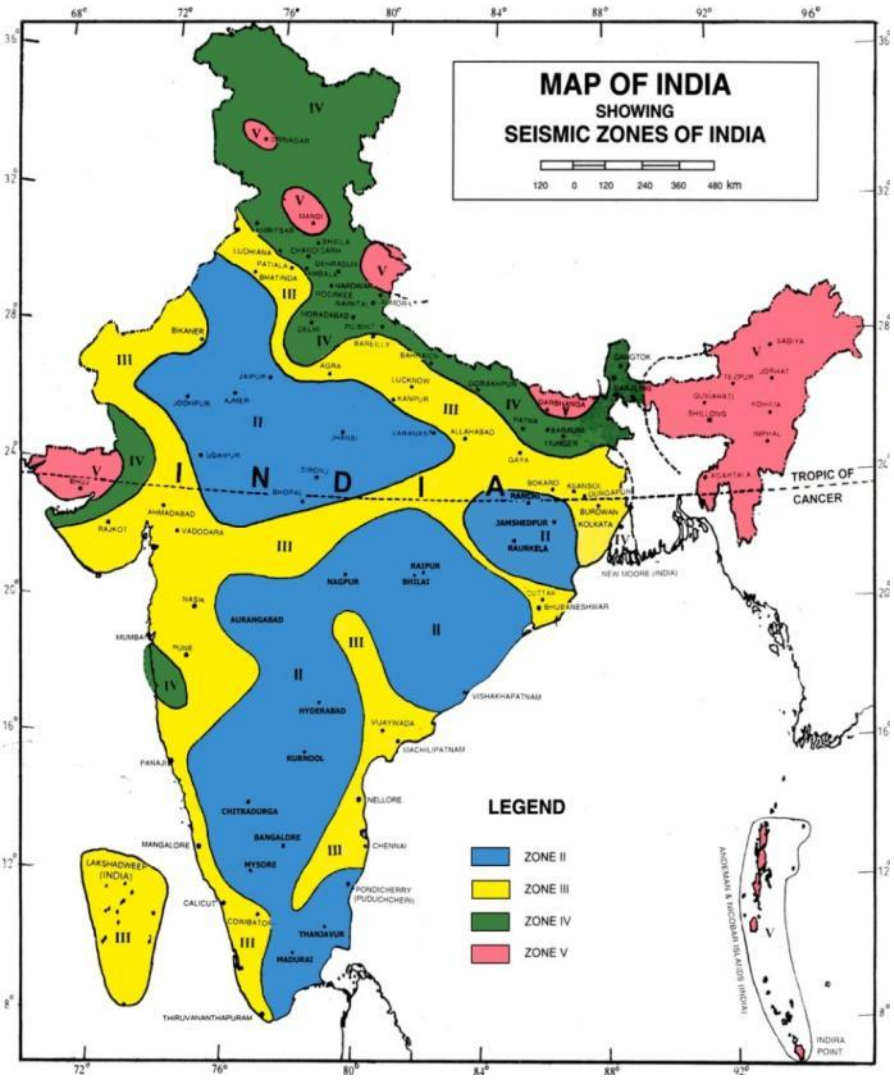



**Figure 3-5 : Seismic zones of India**

With GIS overlay analysis, district areas falling within each seismic zone have been computed. In order to compare seismic risk among various districts, district level ranking of seismic zones has been assigned, based on the scheme shown in Table 3-2. District level seismic ranking for pilot States/UTs is shown in Table 3-3.

### Wind Zones

Prevailing wind speed is one of the important parameters in assessing fire risk in the area. Wind speed has a noticeable influence on fire spread. The wind zone map illustrates the areas vulnerable to high wind speeds (Figure 3-6). There are six basic wind speeds considered for zoning, namely:

- 55m/s (198 km/hr) Very High Damage Risk Zone-A
- 50m/s (180 km/hr) Very High Damage Risk Zone-B
- 47m/s (169.2 km/hr) High Damage Risk Zone
- 44m/s (158.4 km/hr) Moderate Damage Risk Zone-A
- 39m/s (140.4 km/hr) Moderate Damage Risk Zone-B
- 33m/s (118.8 km/hr) Low Damage Risk Zone

The coastal areas are subjected to severe windstorms and cyclonic storms. A full-grown cyclone is 150 to 1,000 km across and 10 to 15 km high. Macro-level wind speed zones of India have been formulated and published in IS 875 (Part-3) – 1987. It is known that in certain events, the wind gusts could appreciably exceed the given basic wind speeds. For assessing vulnerability and fire risk to buildings, above macro-level zonings have been considered. Based on wind speed, risk ranking has been assigned to each wind zone following the schema described in Table 3-2. District wise estimated wind risk from GIS overlay analysis is shown in Table 3-3.

**Table 3-2: Risk ranking schema for earthquake, wind and climatic zones**

| Wind Zone | Ranking |
|---|---|
| Very High Damage Risk Zone - A (Vb=55m/s) | 4 |
| Very High Damage Risk Zone - B (Vb=50m/s) | 3.5 |
| High Damage Risk Zone (Vb=47m/s) | 3 |
| Moderate damage Risk Zone - A (Vb=44m/s) | 2 |
| Moderate damage Risk Zone - B (Vb=39m/s) | 1.5 |
| Low Damage Risk Zone (Vb=33m/s) | 1 |
| | |
| **Importance Factors/ Weightage** | **20%** |

| Seismic Zone | Ranking |
|---|---|
| ZONE V | 4 |
| ZONE IV | 3 |
| ZONE III | 2 |
| ZONE II | 1 |
| **20%** | |

| Climatic Zones | Ranking |
|---|---|
| Hot and Dry | 3 |
| Composite, Temperate | 2 |
| Warm and Humid | 1 |
| Cold Climate | 1 |
| **20%** | |

| Hill Zoning | Ranking |
|---|---|
| Cold climate | 5 |
| Other climates | 1 |
| **Importance Factors/ Weightage** | **40%** |

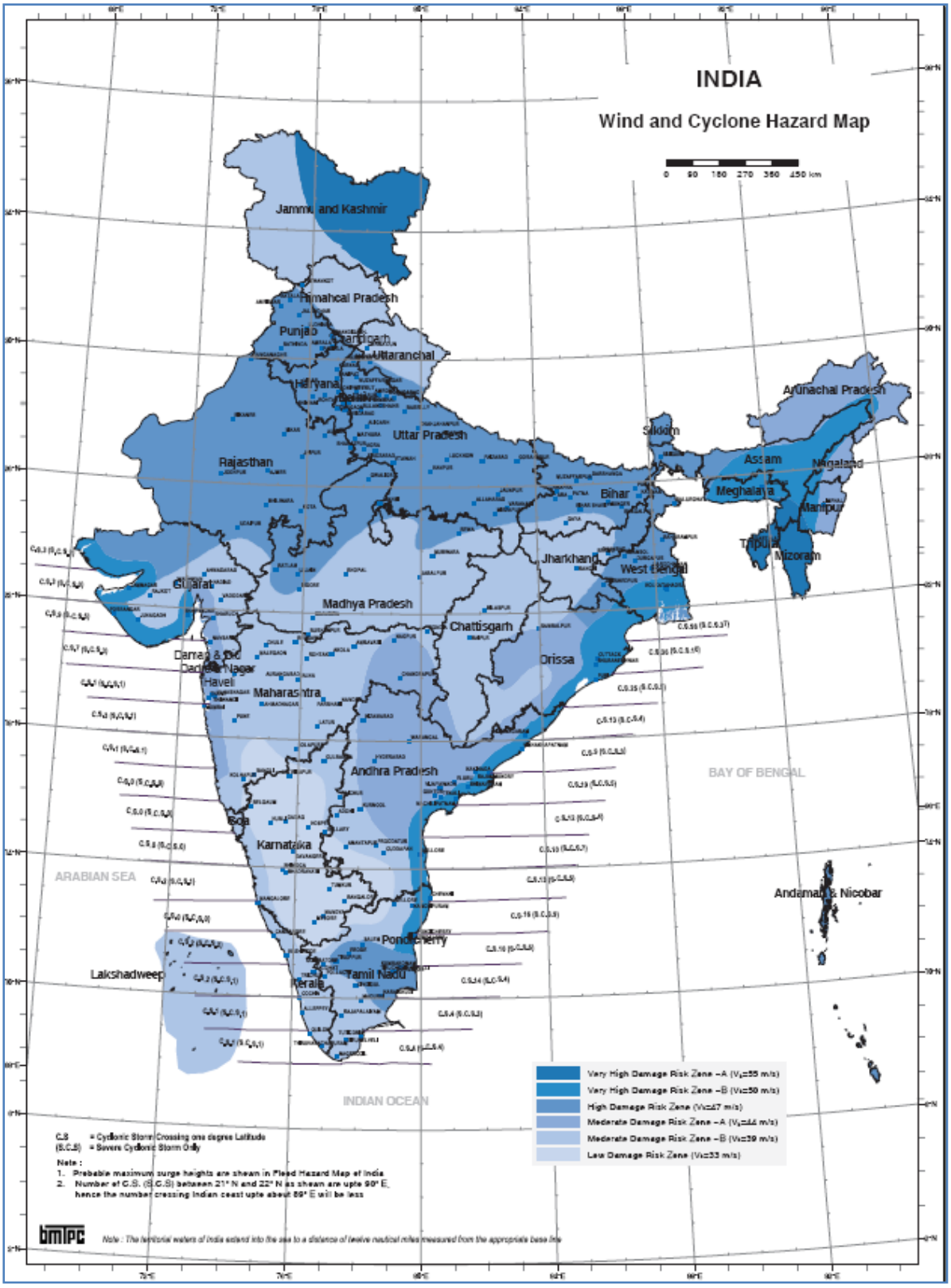



**Figure 3-6 : Wind zone map of India (BMTPC, 2006)**

### Climatic Zones

Regions having similar characteristic features of climate are grouped under one climatic zone. According to a recent code of the Bureau of Indian Standards, the country has been divided into the following five major climatic zones:

- Hot & Dry (mean monthly temperature >30 and relative humidity <55%);
- Warm & Humid (mean monthly temperature >25-30 and relative humidity >55-75%);
- Temperate (mean monthly temperature 25-30 and relative humidity <75%);
- Cold (mean monthly temperature <25 and relative humidity – can be any values);
- Composite (This applies when six months or more do not fall within any of the other categories meaning sharing characteristics of two or more of the above categories in a year).

Map of climatic zones is shown in Figure 3-7. The hot and dry zone lies in the western and the central parts of India; Jaisalmer, Jodhpur and Sholapur are some of the towns that experience this type of climate. In this zone, solar radiation and movement of hot winds are higher. The warm and humid zone covers the coastal parts of the country, such as Mumbai, Chennai and Kolkata. Pune and Bangalore are examples of non-coastal cities that fall the under moderate climatic zone. Generally, the Himalayan region experiences cold type of climate. The composite zone covers the northern Indo-Gangetic plains, such as New Delhi, Kanpur, and Allahabad.

With GIS overlay analysis, district overlap areas falling within each climatic zone have been computed. In order to compare impact of being a district in a climatic zone, district level ranking has been assigned based on the scheme shown in Table 3-2. District level climatic zone ranking for pilot States/ UT is shown in Table 3-3.

### Hilly Areas and Building Class Zones

Extreme cold climate, rugged topography and use of flammable material in building construction (such as wood) and the use of heating provisions in houses during cold weather is an important factor for causing fire incidents in that region. To capture such elements in fire risk hazard, Hilly Areas and Building Class Zones have been created. This class is directly linked to the cold climate zone. All hilly districts, (such as all districts of Jammu & Kashmir in the Pilot study) fall under this category. In such districts, a ranking of five has been assigned. Importance of this zone in terms of occurrence of number of fire incidents is quite high. Hence, while integrating, a double weightage of 40% has been assigned to this layer.

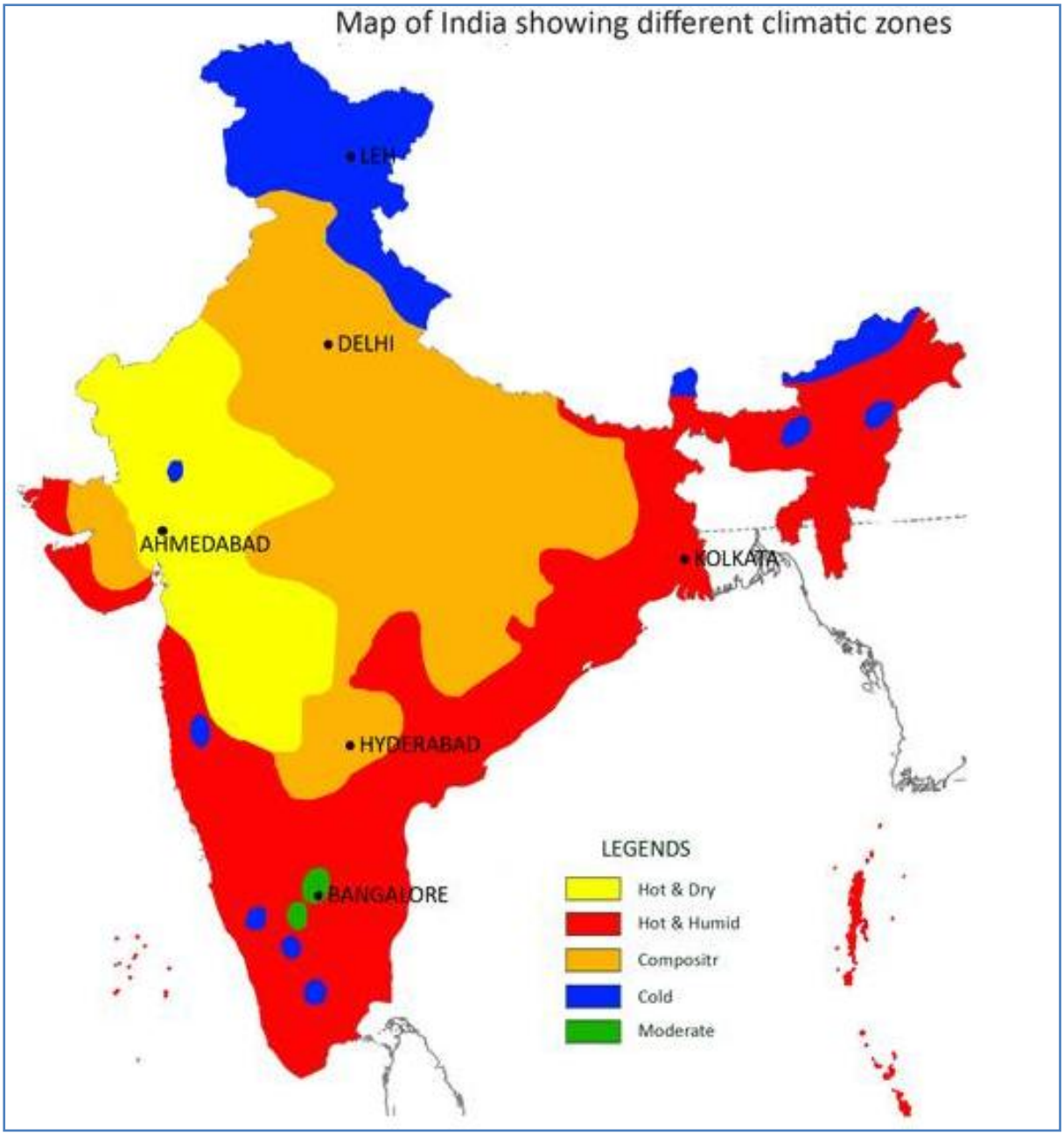



**Figure 3-7 : Climatic Zones of India**

**Table 3-3: District level ranking for individual (earthquake, wind and climatic) hazard and integrated hazards**

| Importance Factor | | | 20% | 20% | 20% | 40% | Integrated Hazard Zoning |
|---|---|---|---|---|---|---|---|
| State/ UT | District | Geographical Area (Sq km) | Wind Zoning | Seismic Zoning | Climate zoning | Hill zoning | |
| **Jammu & Kashmir** | | | | | | | |
| | Kupwara | 2,857 | 3.0 | 3.0 | 1.0 | 5.0 | 3.4 |
| | Badgam | 1,163 | 3.0 | 3.4 | 1.0 | 5.0 | 3.5 |
| | Leh (Ladakh) | 80,271 | 1.1 | 3.0 | 1.0 | 5.0 | 3.0 |
| | Kargil | 14,847 | 2.2 | 3.0 | 1.0 | 5.0 | 3.2 |
| | Punch | 1,725 | 3.0 | 3.0 | 1.0 | 5.0 | 3.4 |
| | Rajouri | 2,415 | 3.0 | 3.0 | 1.0 | 5.0 | 3.4 |
| | Kathua | 2,731 | 3.0 | 3.0 | 2.0 | 4.0 | 3.2 |
| | Baramula | 2,045 | 3.0 | 3.0 | 1.0 | 5.0 | 3.4 |
| | Bandipore | 2,889 | 3.0 | 3.0 | 1.0 | 5.0 | 3.4 |
| | Srinagar | 463 | 3.0 | 4.0 | 1.0 | 5.0 | 3.6 |
| | Ganderbal | 1,449 | 3.0 | 3.4 | 1.0 | 5.0 | 3.5 |
| | Pulwama | 839 | 3.0 | 4.0 | 1.0 | 5.0 | 3.6 |
| | Shupiyan | 459 | 3.0 | 3.3 | 1.0 | 5.0 | 3.6 |
| | Anantnag | 2,743 | 3.0 | 3.8 | 1.0 | 5.0 | 3.6 |
| | Kulgam | 1,203 | 3.0 | 3.2 | 1.0 | 5.0 | 3.4 |
| | Doda | 2,360 | 3.0 | 3.0 | 0.2 | 5.0 | 3.2 |
| | Ramban | 1,021 | 3.0 | 3.0 | 1.0 | 5.0 | 3.4 |
| | Kishtwar | 7,916 | 3.0 | 3.3 | 1.0 | 5.0 | 3.5 |
| | Udhampur | 2,361 | 3.0 | 3.0 | 1.5 | 4.0 | 3.1 |
| | Reasi | 2,094 | 3.0 | 3.0 | 1.0 | 5.0 | 3.5 |
| | Jammu | 2,112 | 3.0 | 3.0 | 1.2 | 4.5 | 3.2 |
| | Samba | 854 | 2.9 | 3.0 | 2.0 | 4.0 | 3.2 |
| **Delhi** | | | | | | | |
| | North West | 449 | 4.5 | 2.4 | 2.0 | 1.0 | 2.2 |
| | North | 63 | 4.5 | 3.0 | 2.0 | 1.0 | 2.3 |
| | North East | 72 | 4.5 | 3.0 | 2.0 | 1.0 | 2.3 |
| | East | 66 | 4.5 | 3.0 | 2.0 | 1.0 | 2.3 |
| | New Delhi | 35 | 4.5 | 3.0 | 2.0 | 1.0 | 2.3 |
| | Central | 16 | 4.5 | 3.0 | 2.0 | 1.0 | 2.3 |
| | West | 116 | 4.5 | 2.7 | 2.0 | 1.0 | 2.2 |
| | South West | 411 | 4.5 | 2.7 | 2.0 | 1.0 | 2.2 |
| | South | 256 | 4.5 | 3.0 | 2.0 | 1.0 | 2.3 |
| **Rajasthan** | | | | | | | |
| | Ganganagar | 10,629 | 4.5 | 1.2 | 2.2 | 1.0 | 2.0 |
| | Hanumangarh | 9,992 | 4.5 | 1.0 | 2.0 | 1.0 | 1.9 |
| | Bikaner | 27,043 | 4.5 | 1.9 | 3.0 | 1.0 | 2.3 |
| | Churu | 17,098 | 4.5 | 1.1 | 2.4 | 1.0 | 2.0 |
| | Jhunjhunun | 5,904 | 4.5 | 1.0 | 2.0 | 1.0 | 1.9 |
| | Alwar | 8,317 | 4.5 | 1.9 | 2.0 | 1.0 | 2.1 |
| | Bharatpur | 5,082 | 4.5 | 2.4 | 2.0 | 1.0 | 2.2 |
| | Dhaulpur | 3,032 | 4.5 | 1.3 | 2.0 | 1.0 | 2.0 |
| | Karauli | 4,874 | 4.5 | 1.0 | 2.0 | 1.0 | 1.9 |
| | Sawai Madhopur | 5,024 | 4.5 | 1.0 | 2.0 | 1.0 | 1.9 |
| | Dausa | 3,555 | 4.5 | 1.2 | 2.0 | 1.0 | 1.9 |

| Importance Factor | | | 20% | 20% | 20% | 40% | Integrated Hazard Zoning |
|---|---|---|---|---|---|---|---|
| State/ UT | District | Geographical Area (Sq km) | Wind Zoning | Seismic Zoning | Climate zoning | Hill zoning | |
| | Jaipur | 11,309 | 4.5 | 1.0 | 2.0 | 1.0 | 1.9 |
| | Sikar | 7,692 | 4.5 | 1.0 | 2.0 | 1.0 | 1.9 |
| | Nagaur | 17,710 | 4.5 | 1.0 | 2.6 | 1.0 | 2.0 |
| | Jodhpur | 22,903 | 4.5 | 1.2 | 3.0 | 1.0 | 2.1 |
| | Jaisalmer | 38,501 | 4.5 | 2.0 | 3.0 | 1.0 | 2.3 |
| | Barmer | 28,469 | 4.5 | 2.1 | 3.0 | 1.0 | 2.3 |
| | Jalor | 10,752 | 4.5 | 2.3 | 3.0 | 1.0 | 2.4 |
| | Sirohi | 5,169 | 4.5 | 2.1 | 1.7 | 1.0 | 2.0 |
| | Pali | 12,377 | 4.5 | 1.1 | 3.0 | 1.0 | 2.1 |
| | Ajmer | 8,537 | 4.5 | 1.0 | 2.6 | 1.0 | 2.0 |
| | Tonk | 7,256 | 4.5 | 1.0 | 2.3 | 1.0 | 2.0 |
| | Bundi | 5,825 | 4.5 | 1.0 | 2.9 | 1.0 | 2.1 |
| | Bhilwara | 10,477 | 4.5 | 1.0 | 3.0 | 1.0 | 2.1 |
| | Rajsamand | 4,683 | 4.5 | 1.0 | 3.0 | 1.0 | 2.1 |
| | Dungarpur | 3,794 | 3.0 | 1.8 | 3.0 | 1.0 | 1.9 |
| | Banswara | 4,315 | 3.0 | 1.2 | 3.0 | 1.0 | 1.8 |
| | Chittaurgarh | 7,882 | 4.5 | 1.0 | 3.0 | 1.0 | 2.1 |
| | Kota | 5,286 | 4.5 | 1.0 | 2.9 | 1.0 | 2.1 |
| | Baran | 6,834 | 4.5 | 1.0 | 2.9 | 1.0 | 2.1 |
| | Jhalawar | 6,270 | 4.5 | 1.0 | 3.0 | 1.0 | 2.1 |
| | Udaipur | 12,047 | 4.1 | 1.5 | 3.0 | 1.0 | 2.1 |
| | Pratapgarh | 4,259 | 4.2 | 1.0 | 3.0 | 1.0 | 2.0 |
| **Maharashtra** | | | | | | | |
| | Nandurbar | 5,915 | 3.0 | 2.0 | 3.0 | 1.0 | 2.0 |
| | Dhule | 7,197 | 3.0 | 2.0 | 3.0 | 1.0 | 2.0 |
| | Jalgaon | 11,805 | 3.0 | 1.5 | 3.0 | 1.0 | 1.9 |
| | Buldana | 9,775 | 3.0 | 1.1 | 3.0 | 1.0 | 1.8 |
| | Akola | 5,421 | 3.0 | 1.1 | 3.0 | 1.0 | 1.8 |
| | Washim | 5,212 | 3.0 | 1.0 | 3.0 | 1.0 | 1.8 |
| | Amravati | 12,244 | 3.0 | 1.6 | 2.7 | 1.0 | 1.9 |
| | Wardha | 6,326 | 3.6 | 1.0 | 2.0 | 1.0 | 1.7 |
| | Nagpur | 9,951 | 3.6 | 1.0 | 1.8 | 1.0 | 1.7 |
| | Bhandara | 4,090 | 3.7 | 1.0 | 1.3 | 1.0 | 1.6 |
| | Gondiya | 5,265 | 3.2 | 1.0 | 1.6 | 1.0 | 1.6 |
| | Gadchiroli | 14,486 | 3.9 | 1.4 | 1.1 | 1.0 | 1.7 |
| | Chandrapur | 11,334 | 4.0 | 1.5 | 1.0 | 1.0 | 1.7 |
| | Yavatmal | 13,566 | 3.4 | 1.0 | 2.2 | 1.0 | 1.7 |
| | Nanded | 10,623 | 3.1 | 1.0 | 2.5 | 1.0 | 1.7 |
| | Hingoli | 4,654 | 3.0 | 1.0 | 3.0 | 1.0 | 1.8 |
| | Parbhani | 6,406 | 3.0 | 1.0 | 3.0 | 1.0 | 1.8 |
| | Jalna | 7,706 | 3.0 | 1.0 | 3.0 | 1.0 | 1.8 |
| | Aurangabad | 10,234 | 3.0 | 1.3 | 3.0 | 1.0 | 1.8 |
| | Nashik | 15,599 | 3.0 | 2.0 | 2.8 | 1.0 | 2.0 |
| | Thane | 9,548 | 3.7 | 2.0 | 1.0 | 1.0 | 1.7 |
| | Mumbai (Suburban) | 454 | 4.0 | 2.0 | 1.0 | 1.0 | 1.8 |
| | Mumbai | 150 | 4.0 | 2.0 | 1.0 | 1.0 | 1.8 |
| | Raigarh | 7,060 | 3.9 | 2.8 | 1.0 | 1.0 | 1.9 |

| Importance Factor | | | 20% | 20% | 20% | 40% | Integrated Hazard Zoning |
|---|---|---|---|---|---|---|---|
| State/ UT | District | Geographical Area (Sq km) | Wind Zoning | Seismic Zoning | Climate zoning | Hill zoning | |
| | Pune | 15,700 | 3.0 | 2.1 | 1.9 | 1.0 | 1.8 |
| | Ahmadnagar | 17,102 | 3.0 | 2.0 | 3.0 | 1.0 | 2.0 |
| | Bid | 10,597 | 3.0 | 1.6 | 3.0 | 1.0 | 1.9 |
| | Latur | 7,254 | 3.0 | 1.3 | 2.8 | 1.0 | 1.8 |
| | Osmanabad | 7,588 | 3.0 | 1.8 | 3.0 | 1.0 | 2.0 |
| | Solapur | 14,919 | 2.9 | 1.9 | 2.8 | 1.0 | 1.9 |
| | Satara | 10,605 | 2.8 | 2.5 | 0.7 | 3.0 | 2.4 |
| | Ratnagiri | 8,325 | 3.8 | 2.5 | 1.0 | 1.0 | 1.9 |
| | Sindhudurg | 5,107 | 3.0 | 2.0 | 1.0 | 1.0 | 1.6 |
| | Kolhapur | 7,683 | 2.8 | 2.0 | 1.0 | 1.0 | 1.6 |
| | Sangli | 8,527 | 2.5 | 2.0 | 1.0 | 1.0 | 1.5 |
| **Andaman & Nicobar Islands** | | | | | | | |
| | Nicobars | 1,579 | 4.0 | 4.0 | 1.0 | 1.0 | 2.2 |
| | North & Middle Andaman | 3,401 | 4.0 | 4.0 | 1.0 | 1.0 | 2.2 |
| | South Andaman | 2,425 | 4.0 | 4.0 | 1.0 | 1.0 | 2.2 |
| **Puducherry** | | | | | | | |
| | Yanam | 20.9 | 5.0 | 3.0 | 1.0 | 1.0 | 2.0 |
| | Puducherry | 312.8 | 5.0 | 2.0 | 1.0 | 1.0 | 1.8 |
| | Mahe | 8.6 | 3.0 | 2.0 | 1.0 | 1.0 | 2.2 |

## 3.5 Exposure Vulnerability Ranking

For estimating exposure and its vulnerability, detailed urban agglomerate classification maps generated from high-resolution satellite images have been used. With the help of remote sensing techniques applied on high-resolution satellite imageries, 10 types of urban agglomeration areas have been delineated (Figures 3-1 and 3-2). For major city areas, even more detailed urban agglomerate classification has been created with high-resolution data layers as shown in Figure 3-3. These include urban, semi-urban, building blocks, industrial and rural villages' built-up areas. District level census 2011 population has been distributed to each population agglomeration cluster. For exposure vulnerability, 4 different layers viz. population density, residential built-up areas, high-rise building block density, and industrial areas have been developed individually at district level. Table 3-4 shows district level geographical area, population, population density, residential built-up area, industrial area, and residential built-up area in percentage.

**Table 3-4: District level geographical area, population, population density, residential built-up area, residential built-up area in %, and industrial area**

| District | | Geographical Area (sq km) | Population 2011 | Population Density | Residential Built--Up area (sq km) | Industrial Area (sq km) | Residential Built-Up area (in percentage) |
|---|---|---|---|---|---|---|---|
| **Jammu & Kashmir** | | | | | | | |
| | Kupwara | 2,857 | 875,564 | 306.42 | 41.29 | 0.099 | 1.4% |
| | Badgam | 1,163 | 735,753 | 632.74 | 59.91 | 0.374 | 5.2% |
| | Leh (Ladakh) | 80,271 | 147,104 | 1.83 | 34.96 | 0.011 | 0.0% |
| | Kargil | 14,847 | 143,388 | 9.66 | 6.52 | 0 | 0.0% |
| | Punch | 1,725 | 476,820 | 276.42 | 5.84 | 0 | 0.3% |
| | Rajouri | 2,415 | 619,266 | 256.4 | 8.42 | 0.167 | 0.3% |
| | Kathua | 2,731 | 615,711 | 225.49 | 32.82 | 1.033 | 1.2% |
| | Baramula | 2,045 | 1,015,503 | 496.55 | 73.73 | 0.247 | 3.6% |
| | Bandipore | 2,889 | 385,099 | 133.28 | 19.95 | 0.026 | 0.7% |
| | Srinagar | 463 | 1,269,751 | 2,743.04 | 67.39 | 1.056 | 14.6% |
| | Ganderbal | 1,449 | 297,003 | 205.01 | 26.12 | 0.054 | 1.8% |
| | Pulwama | 839 | 570,060 | 679.69 | 37.73 | 0.783 | 4.5% |
| | Shupiyan | 459 | 265,960 | 579.56 | 13.9 | 0 | 3.0% |
| | Anantnag | 2,743 | 1,070,144 | 390.19 | 21.36 | 0.011 | 0.8% |
| | Kulgam | 1,203 | 422,786 | 351.47 | 13.39 | 0 | 1.1% |
| | Doda | 2,360 | 409,576 | 173.57 | 8.14 | 0 | 0.3% |
| | Ramban | 1,021 | 283,313 | 277.49 | 4.33 | 0.058 | 0.4% |
| | Kishtwar | 7,916 | 231,037 | 29.19 | 8.65 | 0 | 0.1% |
| | Udhampur | 2,361 | 555,357 | 235.19 | 25.17 | 0.211 | 1.1% |
| | Reasi | 2,094 | 314,714 | 150.27 | 5.98 | 0.017 | 0.3% |
| | Jammu | 2,112 | 1,526,406 | 722.87 | 127.78 | 1.767 | 6.1% |
| | Samba | 854 | 318,611 | 373.04 | 23 | 4.203 | 2.7% |
| **Delhi** | | | | | | | |
| | North West | 449 | 3,651,261 | 8,133.80 | 84.34 | 14.051 | 18.8% |
| | North | 63 | 883,418 | 14,044.80 | 27.8 | 1.065 | 44.2% |
| | North East | 72 | 2,240,749 | 31,208.20 | 29.75 | 1.387 | 41.4% |
| | East | 66 | 1,707,725 | 25,913.88 | 28.8 | 1.167 | 43.7% |
| | New Delhi | 35 | 133,713 | 3,798.66 | 12.48 | 0.941 | 35.4% |
| | Central | 16 | 578,671 | 35,720.43 | 9.13 | 0.732 | 56.3% |
| | West | 116 | 2,531,583 | 21,918.47 | 54.96 | 2.999 | 47.6% |

| District | | Geographical Area (sq km) | Population 2011 | Population Density | Residential Built--Up area (sq km) | Industrial Area (sq km) | Residential Built-Up area (in percentage) |
|---|---|---|---|---|---|---|---|
| | South West | 411 | 2,292,363 | 5,574.81 | 75.15 | 5.497 | 18.3% |
| | South | 256 | 2,733,752 | 10,682.89 | 67.47 | 5.073 | 26.4% |
| **Rajasthan** | | | | | | | |
| | Ganganagar | 10,629 | 1,969,520 | 185.3 | 225.55 | 5.248 | 2.1% |
| | Hanumangarh | 9,992 | 1,779,650 | 178.11 | 210.24 | 2.394 | 2.1% |
| | Bikaner | 27,043 | 2,367,745 | 87.56 | 256.36 | 6.163 | 0.9% |
| | Churu | 17,098 | 2,041,172 | 119.38 | 222.78 | 0.9 | 1.3% |
| | Jhunjhunun | 5,904 | 2,139,658 | 362.38 | 113.58 | 1.49 | 1.9% |
| | Alwar | 8,317 | 3,671,999 | 441.53 | 141.81 | 16.816 | 1.7% |
| | Bharatpur | 5,082 | 2,549,121 | 501.56 | 77.61 | 1.504 | 1.5% |
| | Dhaulpur | 3,032 | 1,207,293 | 398.13 | 34.28 | 0.851 | 1.1% |
| | Karauli | 4,874 | 1,458,459 | 299.24 | 41.35 | 0.941 | 0.8% |
| | Sawai Madhopur | 5,024 | 1,338,114 | 266.32 | 63.89 | 0.257 | 1.3% |
| | Dausa | 3,555 | 1,637,226 | 460.61 | 38.67 | 1.565 | 1.1% |
| | Jaipur | 11,309 | 6,663,971 | 589.28 | 321.85 | 24.65 | 2.8% |
| | Sikar | 7,692 | 2,677,737 | 348.12 | 133.44 | 1.452 | 1.7% |
| | Nagaur | 17,710 | 3,309,234 | 186.85 | 200.54 | 2.054 | 1.1% |
| | Jodhpur | 22,903 | 3,685,681 | 160.93 | 253.18 | 33.099 | 1.1% |
| | Jaisalmer | 38,501 | 672,008 | 17.45 | 128.08 | 2.259 | 0.3% |
| | Barmer | 28,469 | 2,604,453 | 91.48 | 133.66 | 2.973 | 0.5% |
| | Jalor | 10,752 | 1,830,151 | 170.22 | 93.81 | 1.212 | 0.9% |
| | Sirohi | 5,169 | 1,037,185 | 200.65 | 51.49 | 3.97 | 1.0% |
| | Pali | 12,377 | 2,038,533 | 164.7 | 134.53 | 5.28 | 1.1% |
| | Ajmer | 8,537 | 2,584,913 | 302.79 | 134.51 | 6.86 | 1.6% |
| | Tonk | 7,256 | 1,421,711 | 195.94 | 75.15 | 0.778 | 1.0% |
| | Bundi | 5,825 | 1,113,725 | 191.2 | 49.99 | 0.939 | 0.9% |
| | Bhilwara | 10,477 | 2,410,459 | 230.07 | 101.97 | 7.489 | 1.0% |
| | Rajsamand | 4,683 | 1,158,283 | 247.34 | 35.86 | 11.386 | 0.8% |
| | Dungarpur | 3,794 | 1,388,906 | 366.05 | 25.83 | 0.791 | 0.7% |
| | Banswara | 4,315 | 1,798,194 | 416.72 | 15.56 | 1.347 | 0.4% |
| | Chittaurgarh | 7,882 | 1,544,392 | 195.94 | 68.27 | 7.234 | 0.9% |
| | Kota | 5,286 | 1,950,491 | 369.02 | 128.25 | 13.15 | 2.4% |

| District | | Geographical Area (sq km) | Population 2011 | Population Density | Residential Built--Up area (sq km) | Industrial Area (sq km) | Residential Built-Up area (in percentage) |
|---|---|---|---|---|---|---|---|
| | Baran | 6,834 | 1,223,921 | 179.09 | 109.92 | 3.318 | 1.6% |
| | Jhalawar | 6,270 | 1,411,327 | 225.11 | 151.94 | 7.328 | 2.4% |
| | Udaipur | 12,047 | 3,067,549 | 254.64 | 115.26 | 14.086 | 1.0% |
| | Pratapgarh | 4,259 | 868,231 | 203.86 | 20.59 | 0.245 | 0.5% |
| **Maharashtra** | | | | | | | |
| | Nandurbar | 5,915 | 1,646,177 | 278.31 | 73.93 | 2.269 | 1.2% |
| | Dhule | 7,197 | 2,048,781 | 284.69 | 78.64 | 4.806 | 1.1% |
| | Jalgaon | 11,805 | 4,224,442 | 357.86 | 163.81 | 5.534 | 1.4% |
| | Buldana | 9,775 | 2,588,039 | 264.75 | 96.47 | 2.766 | 1.0% |
| | Akola | 5,421 | 1,818,617 | 335.48 | 76.58 | 4.784 | 1.4% |
| | Washim | 5,212 | 1,196,714 | 229.62 | 44.92 | 0.881 | 0.9% |
| | Amravati | 12,244 | 2,887,826 | 235.86 | 150.26 | 5.335 | 1.2% |
| | Wardha | 6,326 | 1,296,157 | 204.9 | 64.9 | 2.857 | 1.0% |
| | Nagpur | 9,951 | 4,653,171 | 467.63 | 152.02 | 20.136 | 1.5% |
| | Bhandara | 4,090 | 1,198,810 | 293.11 | 49.41 | 0.728 | 1.2% |
| | Gondiya | 5,265 | 1,322,331 | 251.18 | 77.26 | 2.616 | 1.5% |
| | Gadchiroli | 14,486 | 1,071,795 | 73.99 | 128.39 | 1.108 | 0.9% |
| | Chandrapur | 11,334 | 2,194,262 | 193.59 | 112 | 5.901 | 1.0% |
| | Yavatmal | 13,566 | 2,775,457 | 204.6 | 129.66 | 5.239 | 1.0% |
| | Nanded | 10,623 | 3,356,566 | 315.98 | 100.94 | 2.479 | 1.0% |
| | Hingoli | 4,654 | 1,178,973 | 253.35 | 36.22 | 0.791 | 0.8% |
| | Parbhani | 6,406 | 1,835,982 | 286.63 | 48.35 | 1.636 | 0.8% |
| | Jalna | 7,706 | 1,958,483 | 254.16 | 66.94 | 3.231 | 0.9% |
| | Aurangabad | 10,234 | 3,695,928 | 361.14 | 141.75 | 15.032 | 1.4% |
| | Nashik | 15,599 | 6,109,052 | 391.62 | 239.08 | 25.156 | 1.5% |
| | Thane | 9,548 | 11,054,131 | 1,157.79 | 229.74 | 29.643 | 2.4% |
| | Mumbai (Suburban) | 454 | 9,332,481 | 20,560.65 | 104.57 | 7.761 | 23.0% |
| | Mumbai | 150 | 3,145,966 | 21,015.14 | 29.54 | 5.304 | 19.7% |
| | Raigarh | 7,060 | 2,635,394 | 373.29 | 71.39 | 14.23 | 1.0% |
| | Pune | 15,700 | 9,426,959 | 600.43 | 370.39 | 53.713 | 2.4% |
| | Ahmadnagar | 17,102 | 4,543,083 | 265.64 | 307.21 | 11.609 | 1.8% |
| | Bid | 10,597 | 2,585,962 | 244.02 | 88.82 | 1.882 | 0.8% |

| District | | Geographical Area (sq km) | Population 2011 | Population Density | Residential Built--Up area (sq km) | Industrial Area (sq km) | Residential Built-Up area (in percentage) |
|---|---|---|---|---|---|---|---|
| | Latur | 7,254 | 2,455,543 | 338.49 | 116.01 | 6.81 | 1.6% |
| | Osmanabad | 7,588 | 1,660,311 | 218.82 | 89.13 | 1.871 | 1.2% |
| | Solapur | 14,919 | 4,315,527 | 289.27 | 231.79 | 9.434 | 1.6% |
| | Satara | 10,605 | 3,003,922 | 283.25 | 206.87 | 3.688 | 2.0% |
| | Ratnagiri | 8,325 | 1,612,672 | 193.71 | 94.82 | 1.915 | 1.1% |
| | Sindhudurg | 5,107 | 848,868 | 166.23 | 69.57 | 1.491 | 1.4% |
| | Kolhapur | 7,683 | 3,874,015 | 504.22 | 196.89 | 10.018 | 2.6% |
| | Sangli | 8,527 | 2,820,575 | 330.8 | 141.53 | 6.334 | 1.7% |
| **Andaman & Nicobar Islands** | | | | | | | |
| | Nicobars | 1,579 | 36,819 | 23.32 | 3.8 | 0 | 0.2% |
| | North & Middle Andaman | 3,401 | 105,539 | 31.03 | 20.17 | 0 | 0.6% |
| | South Andaman | 2,425 | 237,586 | 97.98 | 19.53 | 0.121 | 0.8% |
| **Puducherry UT** | | | | | | | |
| | Karaikal | 160.3 | 200,314 | 1,255.43 | 23.07 | 0.76 | 14.4% |
| | Yanam | 20.9 | 55,616 | 1,853.87 | 4.01 | 0.75 | 13.4% |
| | Puducherry | 312.8 | 946,600 | 3,038.94 | 31.67 | 1.76 | 10.2% |
| | Mahe | 8.6 | 41,934 | 4,659.33 | 1.02 | 0.35 | 11.4% |

In order to assess the impact of each exposure vulnerability type, a vulnerability score/ ranking has been assigned to each layer at its base unit. The vulnerability score represents the level of vulnerability (very high to negligible) of a specific type of exposure in response to the occurrences of small and medium fire incidents. Base unit for vulnerability ranking is the district boundary. The natural break in value distribution has been considered for defining the ranking class.

Based on Census 2011 population, district-level population densities have been computed. and grouped into five ranges based on the schema shown in Table 3-5. A ranking of 5 has been assigned to highly dense districts, having populations greater than 10,000 per sq km, and 1 to sparsely populated districts having less than 200 people per sq km area.

**Table 3-5: Grouping schema for ranking of exposure and vulnerability layers**

| Population density | Ranking |
|---|---|
| >10,000 | 5 |
| 1,000 to 10,000 | 4 |
| 500 to 1,000 | 3 |
| 200 to 500 | 2 |
| <200 | 1 |
| | |

| Built-up area % | Ranking |
|---|---|
| >35 % | 5 |
| 14% to 35 % | 4 |
| 2% to 14 % | 3 |
| 1% to 2 % | 2 |
| <1 % | 1 |
| | |

| Residential Built-up area sq km | Ranking |
|---|---|
| >190 | 5 |
| 100 to 190 | 4 |
| 50 to 100 | 3 |
| 20 to 50 | 2 |
| <20 | 1 |

| Industrial area sq km | Ranking |
|---|---|
| >10 | 5 |
| 5 to 10 | 4 |
| 2 to 5 | 3 |
| 1 to 2 | 2 |
| < 1 | 1 |

As described earlier, various types of residential built-up areas have been delineated using high-resolution images. For assessing fire risk, both absolute built-up areas in sq km as well as built-up areas percent (ratio of built-up areas to the total area) are important parameters. Figure 3-8 illustrates an example of district level ranking of residential built-up area percent and corresponding residential built up area in absolute terms (i.e. area in sq.km.). In Maharashtra, Pune district has the highest residential built-up area, while in terms of residential built-up area in percentage, Pune district comes at fifth rank (Figure 3-8).

District level values of residential built-up area in percent and in absolute terms (i.e. area in sq km.) has been grouped separately into five classes and assigned a ranking score of 1- 5 based on the schema shown in Table 3-5. Districts having > 35% residential built-up have been assigned 5$^{th}$ ranking, while districts having <1 % built-up area as whole have been assigned a rank of 1. In Pilot States and UT, about one-third (34%) districts fall in rank 1. Similarly, 5 ranking has been assigned to district wise residential built-up areas in sq km based on schema shown in Table 3-5. This schema has been prepared based on natural breaks of value distribution considering all 106 districts of the pilot study area. Because of its appropriateness, the schema has been used for ranking all the districts in the remaining 29 States/UTs also.

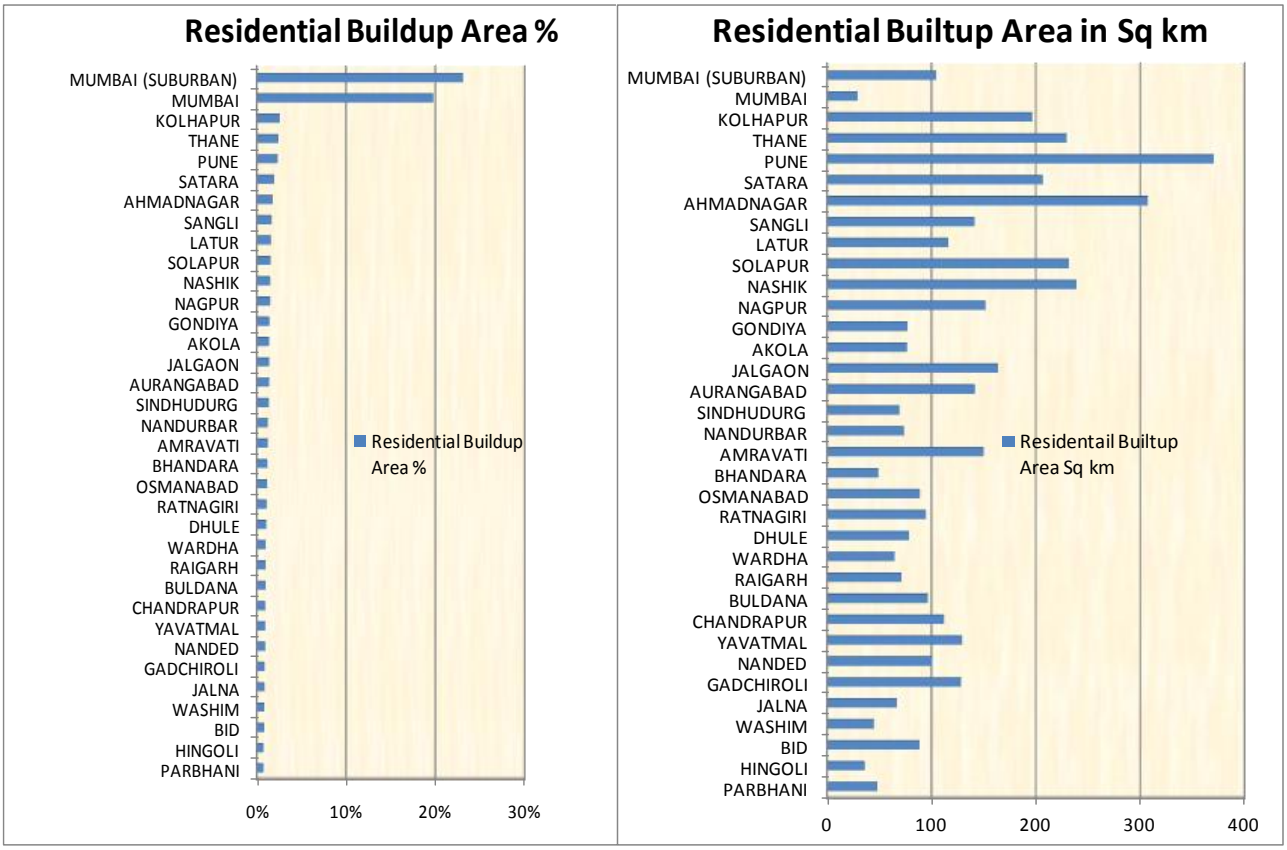



**Figure 3-8 : Comparisons of district level ranking for residential built-up area percentages and absolute areas (in sq km) for all 35 districts of Maharashtra State**

It is obvious that industrial areas in districts have much lower percentages than residential built-up areas. However, presence of industrial areas in a district has a significant influence in assessing fire risk. Hence, industrial areas in absolute terms (sq km) have been considered in risk ranking. In a similar fashion, district wise industrial areas have been grouped into five classes and vulnerability ranking has been assigned based on the schema described in Table 3-5. Districts having more than 10 sq km industrial plot area are ranked at 5, while districts having industrial area of less than 1 sq km are ranked at 1 (Table 3-5).

District level total residential built-up areas in sq km and industrial areas for all 35 districts of Maharashtra have been plotted for direct comparison in Figure 3-9. Industrial as well residential built-up area is the highest in Pune district. In contrast, Ahmadnagar, has second ranking in terms of residential built-up area, but in terms of industrial area, Thane district holds second ranking (Figure 3-9).

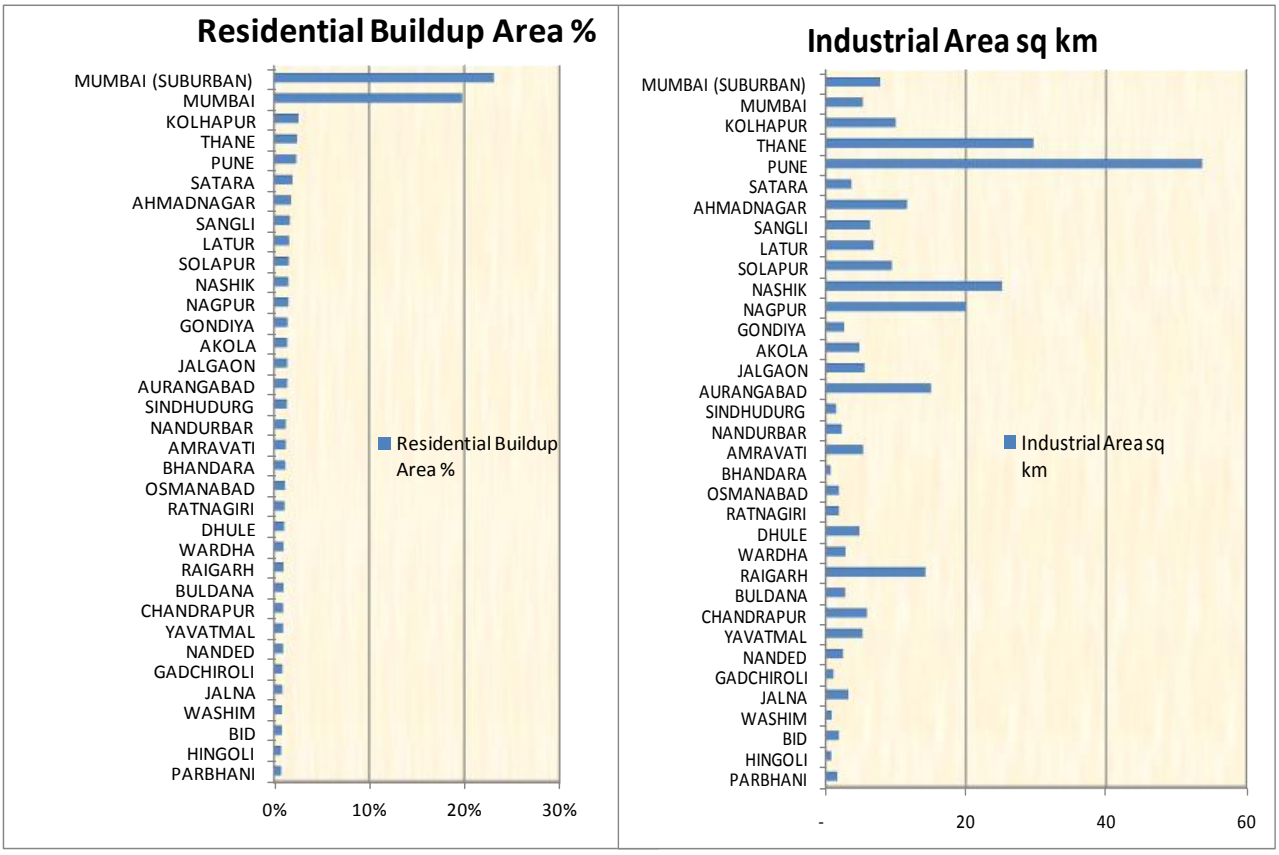



**Figure 3-9 : Comparison of district level ranking for residential built-up areas and industrial areas (in sq km) for all 35 districts of Maharashtra State**

### Integrated Risk Analysis

After developing ranking of individual units in terms of hazard and exposure vulnerability, GIS layers have been overlaid on top of each other and a spatial analysis has been performed for integration in GIS environment. For combining hazard and risk, Weighted Factor Analysis (WFA) in GIS environment has been performed. Weighted ranking scores have been used in the integration analysis and quantified risk distribution for all districts. Values of weighted factor depend upon the importance of a particular hazard/ vulnerability class in risk analysis. For example, temperate zone hazard value of a district has a much lower weight than the population density of a district.

For integration of hazards, equal weights have been assigned to wind, seismic, and climatic hazards, while double weights have been given to hill zoning (Table 3-5). This is because, in hilly terrain, wooden houses, and heating provisions in buildings increase the chances of fire-incidences, and thus have been given higher weightage.

Four layers of exposure/ vulnerability, such as population density, residential built-up area percentage, residential built-up area in sq km and Industrial area in sq km seem to have equal importance in the occurrence of the number of fire incidents in a district. Hence, equal weights have been assigned in integration of these layers (Table 3-6).

After obtaining integrated individual weighted score for hazard and exposure vulnerability, fire risk categories have been obtained in quantitative terms by further integration of hazard and exposure vulnerability. It is obvious that in the occurrence of the number of fire incidents in a given district, exposure vulnerability has more importance than the prevailing hazard.

Hence, in quantified integration, double weights have been assigned to exposure vulnerability (Table 3-6).

**Table 3-6: Weightage assigned in risk scoring schema for integration of hazard and exposure vulnerability into fire risk categories**

| Hazard | | Weightage | |
|---|---|---|---|
| H1 | Wind Zoning | W1 | 0.2 |
| H2 | Seismic Zoning | W2 | 0.2 |
| H3 | Climate zoning | W3 | 0.2 |
| H4 | Hill zoning | W4 | 0.4 |
| Integrated Hazard | | H1*W1+H2*W2+H3*W3+H4*W4 | |

| Exposure/ Vulnerability Class | | Weightage | |
|---|---|---|---|
| EV1 | Population Density | W1 | 0.25 |
| EV2 | Residential built-up area % | W2 | 0.25 |
| EV3 | Residential built-up area in sq km | W3 | 0.25 |
| EV4 | Industrial area in sq km | W4 | 0.25 |
| Integrated Exposure Vulnerability | | EV1*W1+EV2*W2+EV3*W3+EV4*W4 | |

**Fire Risk score = Integrated Hazard x 2 (Integrated Exposure Vulnerability)**

The quantified numeric values of district risk scores are again grouped into four descriptive categories of district level risk ranking (very high, high, medium, and low) as depicted in Table 3-7.

**Table 3-7: District risk rankings for all Pilot States/UTs**

| District | Population Density Ranking | Res Built-up Area sq km Ranking | Res Built-up Area Percentage Ranking | Industrial Area Ranking | Integrated Ranking | Overall District Risk Ranking |
|---|---|---|---|---|---|---|
| **Jammu & Kashmir** | | | | | | |
| Kupwara | 2 | 2 | 2 | 1 | 6.9 | Medium |
| Badgam | 3 | 3 | 3 | 1 | 8.5 | High |
| Leh (Ladakh) | 1 | 2 | 1 | 1 | 5.5 | Low |
| Kargil | 1 | 1 | 1 | 1 | 5.2 | Low |
| Punch | 2 | 1 | 1 | 1 | 5.9 | Low |
| Rajouri | 2 | 1 | 1 | 1 | 5.9 | Low |
| Kathua | 2 | 2 | 2 | 2 | 7.2 | Medium |
| Baramula | 3 | 3 | 3 | 1 | 8.4 | High |
| Bandipore | 1 | 2 | 1 | 1 | 5.9 | Low |
| Srinagar | 4 | 3 | 4 | 2 | 10.1 | Very high |
| Ganderbal | 2 | 2 | 2 | 1 | 7.0 | Medium |
| Pulwama | 3 | 2 | 3 | 1 | 8.1 | Medium |
| Shupiyan | 3 | 1 | 3 | 1 | 7.5 | Medium |
| Anantnag | 2 | 2 | 1 | 1 | 6.6 | Low |
| Kulgam | 2 | 1 | 2 | 1 | 6.4 | Low |

| District | Population Density Ranking | Res Built-up Area sq km Ranking | Res Built-up Area Percentage Ranking | Industrial Area Ranking | Integrated Ranking | Overall District Risk Ranking |
|---|---|---|---|---|---|---|
| Doda | 1 | 1 | 1 | 1 | 5.4 | Low |
| Ramban | 2 | 1 | 1 | 1 | 5.9 | Low |
| Kishtwar | 1 | 1 | 1 | 1 | 5.5 | Low |
| Udhampur | 2 | 2 | 2 | 1 | 6.6 | Medium |
| Reasi | 1 | 1 | 1 | 1 | 5.4 | Low |
| Jammu | 3 | 4 | 3 | 2 | 9.2 | Very high |
| Samba | 2 | 2 | 3 | 3 | 8.4 | High |
| **Delhi** | | | | | | |
| North West | 4 | 3 | 4 | 5 | 10.2 | Very high |
| North | 5 | 2 | 5 | 2 | 9.3 | Very high |
| North East | 5 | 2 | 5 | 2 | 9.3 | Very high |
| East | 5 | 2 | 5 | 2 | 9.3 | Very high |
| New Delhi | 4 | 1 | 5 | 1 | 7.8 | High |
| Central | 5 | 1 | 5 | 1 | 8.3 | High |
| West | 5 | 3 | 5 | 3 | 10.2 | Very high |
| South West | 4 | 3 | 4 | 4 | 9.7 | Very high |
| South | 5 | 3 | 4 | 4 | 10.3 | Very high |
| **Rajasthan** | | | | | | |
| Ganganagar | 1 | 5 | 3 | 4 | 8.5 | Very high |
| Hanumangarh | 1 | 5 | 3 | 3 | 7.9 | High |
| Bikaner | 1 | 5 | 1 | 4 | 7.8 | High |
| Churu | 1 | 5 | 2 | 1 | 6.5 | Medium |
| Jhunjhunun | 2 | 4 | 2 | 2 | 6.9 | Medium |
| Alwar | 2 | 4 | 2 | 5 | 8.6 | Very high |
| Bharatpur | 3 | 3 | 2 | 2 | 7.2 | Medium |
| Dhaulpur | 2 | 2 | 2 | 1 | 5.5 | Low |
| Karauli | 2 | 2 | 1 | 1 | 4.9 | Low |
| Sawai Madhopur | 2 | 3 | 2 | 1 | 5.9 | Medium |
| Dausa | 2 | 2 | 2 | 2 | 5.9 | Medium |
| Jaipur | 3 | 5 | 3 | 5 | 9.9 | Very high |
| Sikar | 2 | 4 | 2 | 2 | 6.9 | Medium |
| Nagaur | 1 | 5 | 2 | 3 | 7.5 | High |
| Jodhpur | 1 | 5 | 2 | 5 | 8.6 | Very high |
| Jaisalmer | 1 | 4 | 1 | 3 | 6.8 | Medium |
| Barmer | 1 | 4 | 1 | 3 | 6.8 | Medium |
| Jalor | 1 | 3 | 1 | 2 | 5.9 | Low |
| Sirohi | 2 | 3 | 2 | 3 | 7 | Medium |
| Pali | 1 | 4 | 2 | 4 | 7.6 | High |
| Ajmer | 2 | 4 | 2 | 4 | 8 | High |
| Tonk | 1 | 3 | 2 | 1 | 5.5 | Low |
| Bundi | 1 | 3 | 1 | 1 | 5.1 | Low |
| Bhilwara | 2 | 4 | 1 | 4 | 7.6 | High |
| Rajsamand | 2 | 2 | 1 | 5 | 7.1 | Medium |
| Dungarpur | 2 | 2 | 1 | 1 | 4.9 | Low |

| District | Population Density Ranking | Res Built-up Area sq km Ranking | Res Built-up Area Percentage Ranking | Industrial Area Ranking | Integrated Ranking | Overall District Risk Ranking |
|---|---|---|---|---|---|---|
| Banswara | 2 | 1 | 1 | 2 | 4.8 | Low |
| Chittaurgarh | 1 | 3 | 1 | 4 | 6.6 | Medium |
| Kota | 2 | 4 | 3 | 5 | 9.1 | Very high |
| Baran | 1 | 4 | 2 | 3 | 7.1 | Medium |
| Jhalawar | 2 | 4 | 3 | 4 | 8.6 | Very high |
| Udaipur | 2 | 4 | 1 | 5 | 8.1 | High |
| Pratapgarh | 2 | 2 | 1 | 1 | 5 | Low |
| **Maharashtra** | | | | | | |
| Nandurbar | 2 | 3 | 2 | 3 | 7 | Medium |
| Dhule | 2 | 3 | 2 | 3 | 7 | Medium |
| Jalgaon | 2 | 4 | 2 | 4 | 7.9 | High |
| Buldana | 2 | 3 | 1 | 3 | 6.3 | Medium |
| Akola | 2 | 3 | 2 | 3 | 6.8 | Medium |
| Washim | 2 | 2 | 1 | 1 | 4.8 | Low |
| Amravati | 2 | 4 | 2 | 4 | 7.9 | High |
| Wardha | 2 | 3 | 2 | 3 | 6.7 | Medium |
| Nagpur | 2 | 4 | 2 | 5 | 8.2 | High |
| Bhandara | 2 | 2 | 2 | 1 | 5.1 | Low |
| Gondiya | 2 | 3 | 2 | 3 | 6.6 | Medium |
| Gadchiroli | 1 | 4 | 1 | 2 | 5.7 | Low |
| Chandrapur | 1 | 4 | 1 | 4 | 6.7 | Medium |
| Yavatmal | 2 | 4 | 1 | 4 | 7.2 | Medium |
| Nanded | 2 | 4 | 1 | 3 | 6.7 | Medium |
| Hingoli | 2 | 2 | 1 | 1 | 4.8 | Low |
| Parbhani | 2 | 2 | 1 | 2 | 5.3 | Low |
| Jalna | 2 | 3 | 1 | 3 | 6.3 | Medium |
| Aurangabad | 2 | 4 | 2 | 5 | 8.3 | High |
| Nashik | 2 | 5 | 2 | 5 | 9 | Very high |
| Thane | 4 | 5 | 3 | 5 | 10.2 | Very high |
| Mumbai (Suburban) | 5 | 4 | 4 | 4 | 10.3 | Very high |
| Mumbai | 5 | 2 | 4 | 4 | 9.3 | Very high |
| Raigarh | 2 | 3 | 2 | 5 | 7.9 | High |
| Pune | 3 | 5 | 3 | 5 | 9.8 | Very high |
| Ahmadnagar | 2 | 5 | 2 | 5 | 9 | Very high |
| Bid | 2 | 3 | 1 | 2 | 5.9 | Medium |
| Latur | 2 | 4 | 2 | 4 | 7.8 | High |
| Osmanabad | 2 | 3 | 2 | 2 | 6.5 | Medium |
| Solapur | 2 | 5 | 2 | 4 | 8.4 | Very high |
| Satara | 2 | 5 | 2 | 3 | 8.4 | High |
| Ratnagiri | 1 | 3 | 2 | 2 | 5.9 | Low |
| Sindhudurg | 1 | 3 | 2 | 2 | 5.6 | Low |
| Kolhapur | 3 | 5 | 3 | 5 | 9.6 | Very high |
| Sangli | 2 | 4 | 2 | 4 | 7.5 | High |

| District | Population Density Ranking | Res Built-up Area sq km Ranking | Res Built-up Area Percentage Ranking | Industrial Area Ranking | Integrated Ranking | Overall District Risk Ranking |
|---|---|---|---|---|---|---|
| **Andaman & Nicobar Islands** | | | | | | |
| Nicobars | 1 | 1 | 1 | 1 | 4.2 | Low |
| North & Middle Andaman | 1 | 2 | 1 | 1 | 4.7 | Low |
| South Andaman | 1 | 2 | 1 | 1 | 4.7 | Low |
| **Puducherry UT** | | | | | | |
| Yanam | 4 | 1 | 4 | 1 | 7.2 | Medium |
| Puducherry | 4 | 2 | 4 | 2 | 8 | High |
| Mahe | 4 | 1 | 4 | 1 | 6.6 | Medium |
| Karaikal | 4 | 2 | 4 | 1 | 7.3 | Medium |

# 4 Field Surveys of Fire Stations for Data Collection

At present, there is a lack of a comprehensive centralized database on the distribution of fire service infrastructure, and the stock of existing fire fighting vehicles, manpower and specialized equipment, their types, and their quantities. Most of the information is either disaggregated or not updated. This information is required for undertaking the gap analysis, future planning, and improvement of institutional capacity, financial planning, and creating a roadmap for the next 10 years for revamping the fire services in the country. To have first-hand information on the distribution of the fire service stations across the country, trained human resources, infrastructure availability and their status, RMSI project team has carried out surveys of Fire Stations and collected data from Headquarters of all the States under the jurisdiction of DG, NDRF & CD (Fire) in the country. In addition to the survey of Fire Stations, the team has also collected the location (latitude, longitude) of Fire Stations using GPS. The geographical coordinate information is used for plotting all the Fire Station locations on the map to perform GIS based spatial analysis. This is required for the analysis of distribution of Fire Stations and gap analysis on fire-infrastructure, based on risk-category, response time, and population.

## 4.1 Field-Survey of individual Fire Station and collection of Headquarter Data

RMSI project team has designed a comprehensive “Fire Headquarter Data Collection Form” (*Annexure-1*) and individual “Fire Station Survey Form” (*Annexure-2*) to collect all the required information for each State/UT in the country.

The information includes but is not limited to:

i. Location (latitude, longitude) and location description of the Fire Station

ii. Name of fire-station in-charge and his contact details

iii. Fire Vehicles type, numbers, their model, year of manufacture/induction at the Fire Station, and general condition of fire vehicles

iv. Specialized firefighting equipment, their type, and quantity

v. Road access and connectivity to vulnerable areas

vi. Infrastructure facilities (accommodation) of fire-personnel and their distance from Fire Stations

vii. Duty patterns

viii. Staff details at different levels

ix. Water availability etc.

The Fire Headquarter Data Collection Form and individual Fire Station Survey Form have been designed in such a way as to extract most of the common information including communication, human resources, specialized equipment, fire-statistics etc. applicable for the entire State, in a quantitative way, which might help the analysis at a later stage. In addition to infrastructure information, RMSI also attempted to collect information/indicators related to vulnerability and risk through indirect questions like:

i. Year wise information on the number of events each unit had attended during the last 5 years and losses caused by fire events both in terms of assets and life.

ii. Few questions on the general perception of the fire officer and in charge of the unit on various types of risks in the Fire Station jurisdiction.

Analysis on the information of events over time and the loss can provide an understanding of the vulnerability and risk as well as the susceptibility trend over the year. The fire officer would be the key person who faces actual needs on the ground as well as in using the infrastructure for the service.

During the field survey in the pilot study, the RMSI team members have interacted with Fire Station In-charges to gather the required information. In addition to discussions with the Fire Station in charge, other key department officials have been contacted to know their perception about the fire risks and the difficulties that fire department is facing. The project team is ensuring that the Headquarter Data Collection Forms and Individual Fire Station Survey Forms are comprehensive and contain all information required for this assignment.

The field data collected by the survey team have undergone through quality checks and the project team has created a database with all collected information. The database has been designed in such a way that the data can be used for spatial and non-spatial analysis. All the Fire Stations have a unique code as identifier.

## 4.2 Stakeholder Analysis

Apart from the quantitative data collection on the distribution of fire service infrastructure, stock of the existing equipment and their quality, the RMSI team also interacted with some of the key fire officials and senior members in DGCD, MHA and NDRF. The focus of such discussions was more on institutional aspects (issues in the service delivery and suggestions), capacity, and future requirements. As these interactions are mostly with senior personnel of fire department, the focus has been to derive a broader picture in terms of requirements, investment, and institutional capacity building. This information has been compiled and summarized under various heads, for instance, requirement, investment, institutional capacity building, etc. RMSI key experts have been analyzing the diverse opinion of various fire officials and are providing their recommendations.

Any significant issue that was observed during this process, in terms of issues in the process of the delivery/bottlenecks in smooth operation were highlighted along with RMSI's suggested solution.

Finally, RMSI team held discussions with officials of the DG NDRF & CD and members of project review to present the summary of observations for discussions in several meetings

# 5 Development of Fire Decision Support System (FDSS)

This chapter discusses the modeling software solution named FDSS (Fire Decision Support System), developed by RMSI as part of the deliverables. FDSS is a dynamic web-based application aimed at supporting decision makers take optimal decisions on complex tasks, such as resource prepositioning, gap analysis, prioritization, and resource optimization along with the day-to-day tasks. The most important aspect of FDSS is that it enables the apex fire management authority to provide the entire country's fire agencies information on a single platform.

## 5.1 Salient Features

Following is a brief description of the FDSS platform. The platform is built on a framework that is state of the art and is the most suitable solution for users' needs.

The salient features of the FDSS platform include:

- Web based application built using .NET Framework 3.5 utilizing the GIS capabilities of an open source GIS Platform.
- Multi-tier system architecture that follows the Object Oriented Programming model with the following objectives:
    - Loose coupling between the various tiers – presentation, business and data
    - Ease of development and deployment
- Ability to navigate, query and render the spatial data
- Exposure view, query and update capabilities that will help the user to keep the information in the system up-to-date
- Ability to view and query the outputs in a tabular format
- A powerful reporting engine that enables a set of pre-formatted reports that provide various views of the outputs from the model
- A thematic map generator that uses the underlying GIS platform to depict the outputs from the model as pre-designed thematic maps..

## 5.2 High Level Design

FDSS has a multi-tier architecture to allow for modularity and scalability. The architecture follows the Object Oriented Programming model. The various tiers of the system are as shown in Figure 5-1.

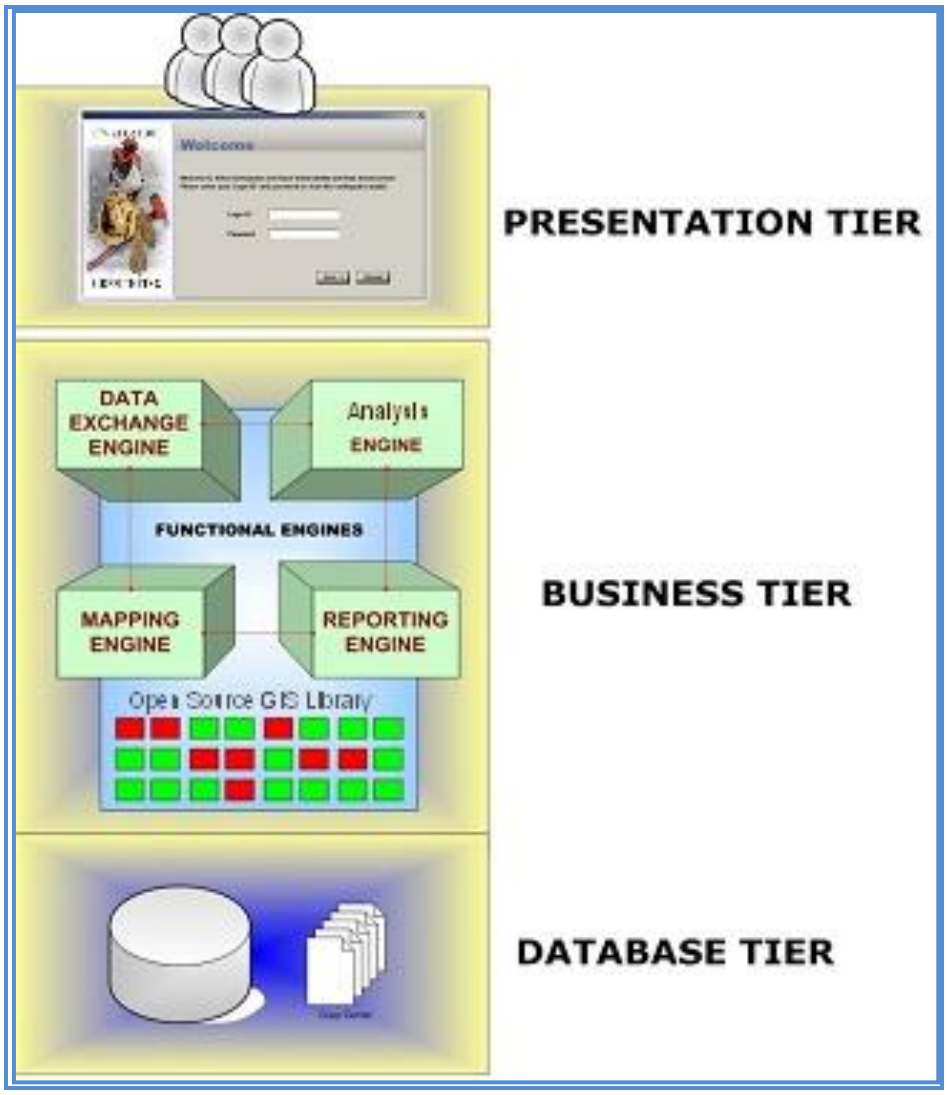



**Figure 5-1 : Three-tier architecture**

- **Presentation tier:** This interface is responsible for gathering inputs from the user and passing on the same to the business layer for processing. The presentation layer ensures that the communications passing through are in the appropriate form for the recipient business objects in the business tier. In FDSS, the user interface constitutes this tier.
- **Business tier:** consists of the system business rules and computing logic as a set of business objects. This tier also interfaces with the data tier. The Mapping engine, Data Access engine, Reporting engine, and Analysis engine constitute this tier.
- **Database tier:** consists of the environment that allows persistence of user information – both lookup and computed data. Physical implementation of this layer can be files on the system or databases. In FDSS, relational database constitutes this tier and houses both spatial and non-spatial data.

Figure 5-2 shows the high-level design for the FDSS platform. The whole architecture is modular. The major modules are user Data Warehouse, Platform Components, and User Interface. The model components are stand-alone and are not dependent on the platform

components. Both perform their respective tasks working with the same data on the backend and are guided by the same user interface on the front end. The following sections discuss the various modules in detail and showcase how all the requirements has been delivered by the FDSS platform.

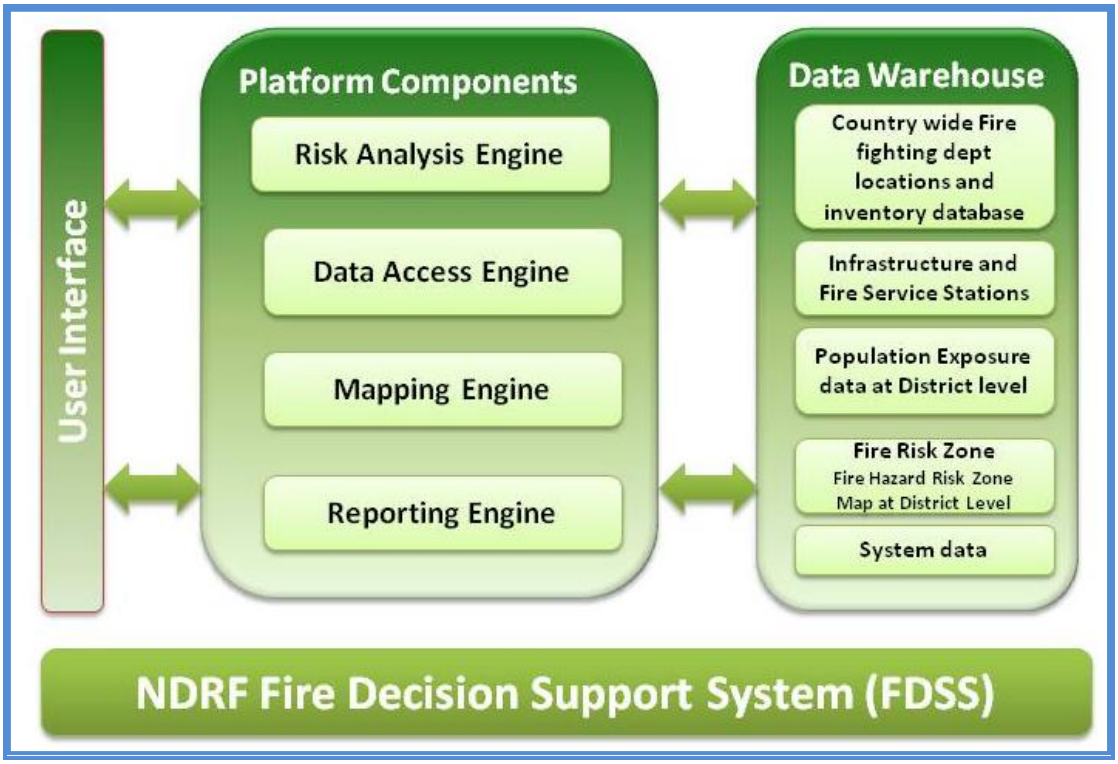



**Figure 5-2 : High level design of FDSS**

### 5.2.1 DATA WAREHOUSE

Data warehouse represents the Database tier. It stores all the input data to the model, system data, and the output results. The data can be categorized as spatial and non-spatial. All the spatial data resides either in the form of ESRI shape files and grids or Postgres based PostGIS database. Post GIS/ Postgres is an open source geo-spatial relational database system. All the non-spatial data is stored as tables in the Postgres database.

Spatial Data Layers: The spatial data layers stored in the data warehouse are:

- Fire station locations and inventory data at Fire Station level
- Land Use Land Cover classes by their use or occupancy
- Fire Risk Zone Map at district level
- Population density map at district level
- Road and Rail Network

## 5.3 Platform Components

Platform components represent the Application Tier. These components focus on the application logic for all data access, mapping and reporting. These are generic components

that operate directly on the data warehouse and present the data in different views to the user.

**Data Access Engine:** Data Access Engine provides access to all non-spatial data that are stored in the Data Warehouse. This includes data viewing and editing capabilities. This allows for bulk building inventory updates and extraction of results so the outcome of the analysis can be reused for other applications.

**Mapping Engine:** Mapping engine provides all mapping capabilities to the application. The major component in mapping engine is the Map Viewer that loads the spatial data and displays the map and provides all basic map navigation functions like Zoom, Pan, Identify tool and calculate distance. This engine also provides spatial querying capabilities like buffer query and point in polygon query. In addition to this, the mapping engine also provides capabilities for defining symbology for various map layers including themes based on a range of values and unique values. All the layers are loaded with a predefined symbology. The mapping engine provides the ability to view the hazard, damage and loss on maps using predefined themes based on a range of values.

**Reporting Engine:** Reporting engine generates all the reports. FDSS provides a set of preformatted predefined reports that can be printed or exported into Excel format. This provides the ability to format the data into tables, generate summations, and create graphs. The following reports are generated at district and State levels by the reporting engine:

- Infrastructure Report
- Gap Analysis Report
- Status report for individual Fire Stations, district and State levels for and other reports required for decision making

The FDSS provides functionality to run GAP Analysis at two levels:

- State
- District

This system provides the option for running gap analysis for firefighting and rescue vehicles, specialized equipment, firefighting manpower, building infrastructure. User can also opt to get output based on all the analysis parameters available.

**User Interface:** User Interface (Figure 5-3) comprises of the Presentation tier. This is the part of the FDSS platform that the user interacts with. User Interface for FDSS can be categorized into two types:

1) System Administration Interface
2) Application Interface

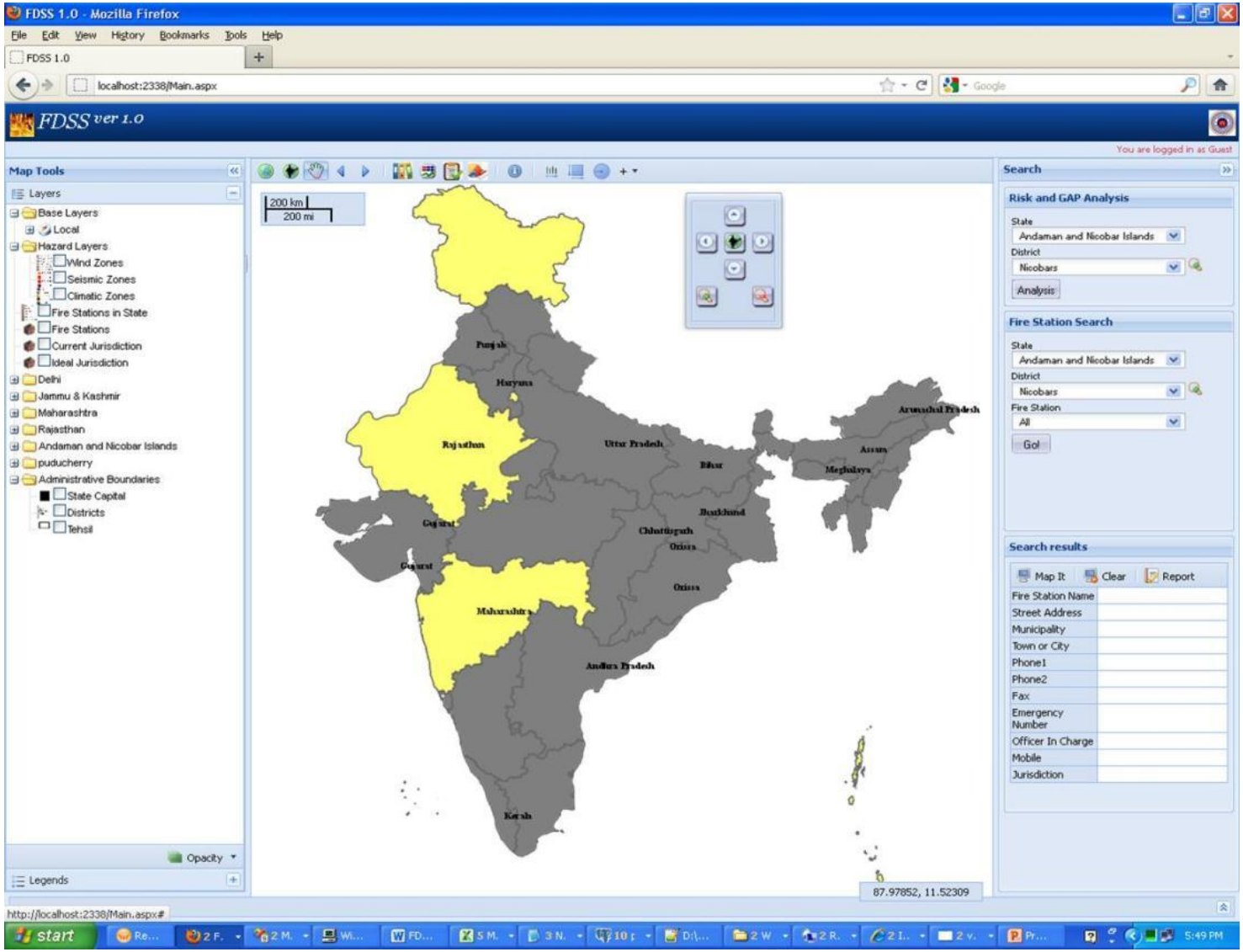



**Figure 5-3 : User Interface for Base Analysis of FDSS**

## 5.4 System Administration Interface

This is an individual stand alone component run at the server only. This desktop interface allows the administrator to manage users and update exposure, thereby providing security for other users and preventing unauthorized updation of the building exposure data. All the data updation and maintenance is done through the system administration interface. Figure 5-4 shows the system administration interface of the application.

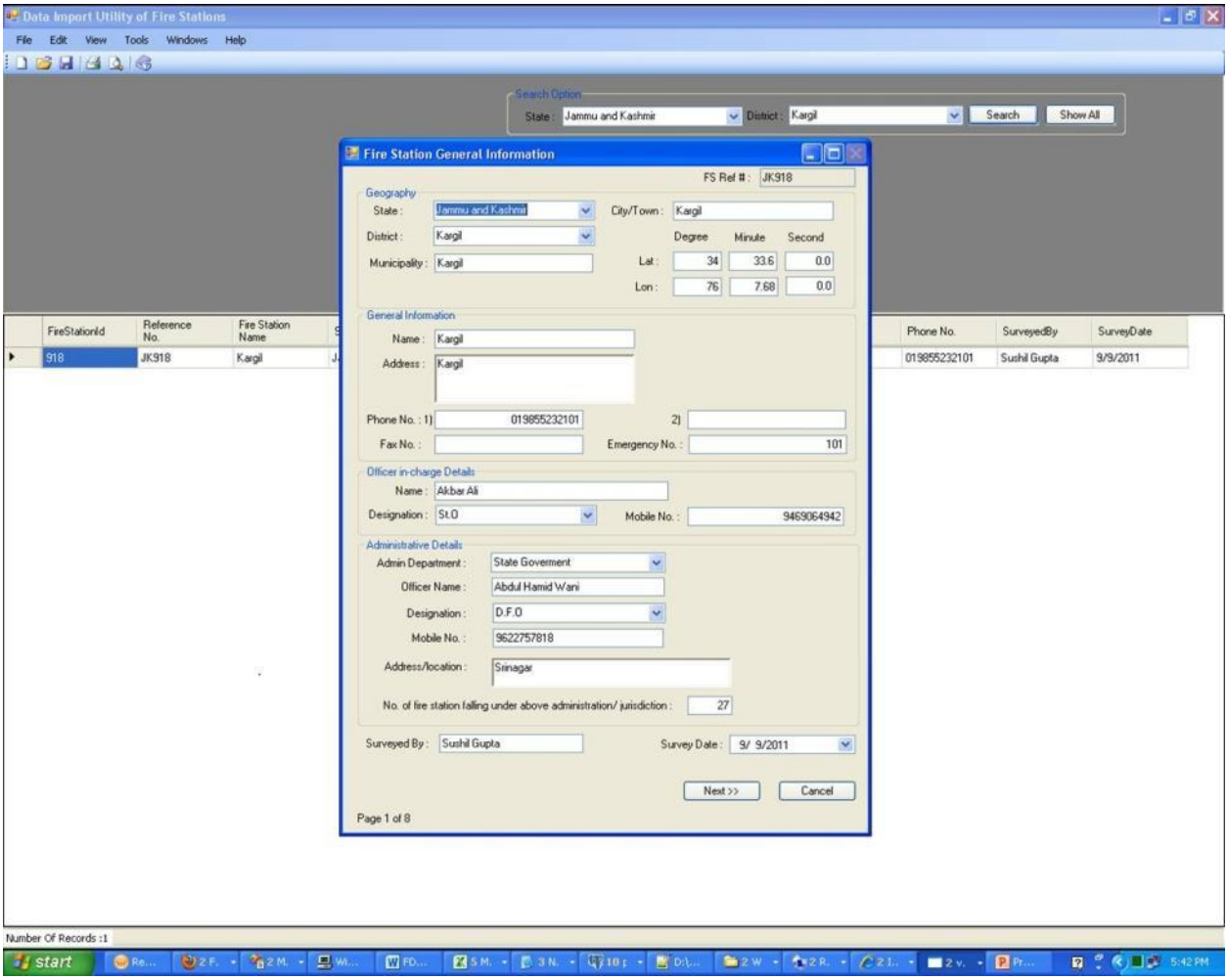



**Figure 5-4 : System administration interface**

## 5.5 Application Interface

**Data Management:** Exposure management provides the ability to view and query the underlying default demographic and Fire Station inventory datasets.

**Map Management:** The Map management interface provides support for viewing the information on a map by utilizing the Mapping Engine component from the Application Logic tier. It offers the following functionalities:

- Displays the following layers by default as the application is loaded:
    - Location of Fire Stations
    - Administrative boundary maps
    - Land use land cover map
    - Road / Rail network
    - Fire Risk Zone map

- Basic GIS tools like zoom, pan, zoom to selection, zoom to entire layer, location attribute information etc.
- Creates following maps based on analysis results:
    - Gap Analysis Map – showing gaps in existing resource, equipment and fire tenders (Figure 5-4)
- Adds custom layers to the layer manager and performs visual overlays
- Views attributes information, queries and analyzes the spatial data layers
- Enables users to view thematic maps based on defined attribute values.

**Analysis Management:** The analysis management interface provides the ability to execute the analysis. It allows the user the following options:

- View the fire risk analysis for any district.
- Gap analysis at State and district levels

**Results Management:** This entails generating displays of results in pre-defined formats based on user selection. Following are the various types of result views that are available in FDSS.

- Reports providing predefined content in predefined format. This utilizes the Reporting Engine Component to display various reports. Following is a list of various reports:
    - Fire Station Profile report
    - Gap Analysis report

### 5.5.1 TECHNOLOGY

The physical servers also represent the logical needs elaboration servers and the physical clients also represent the logical clients.

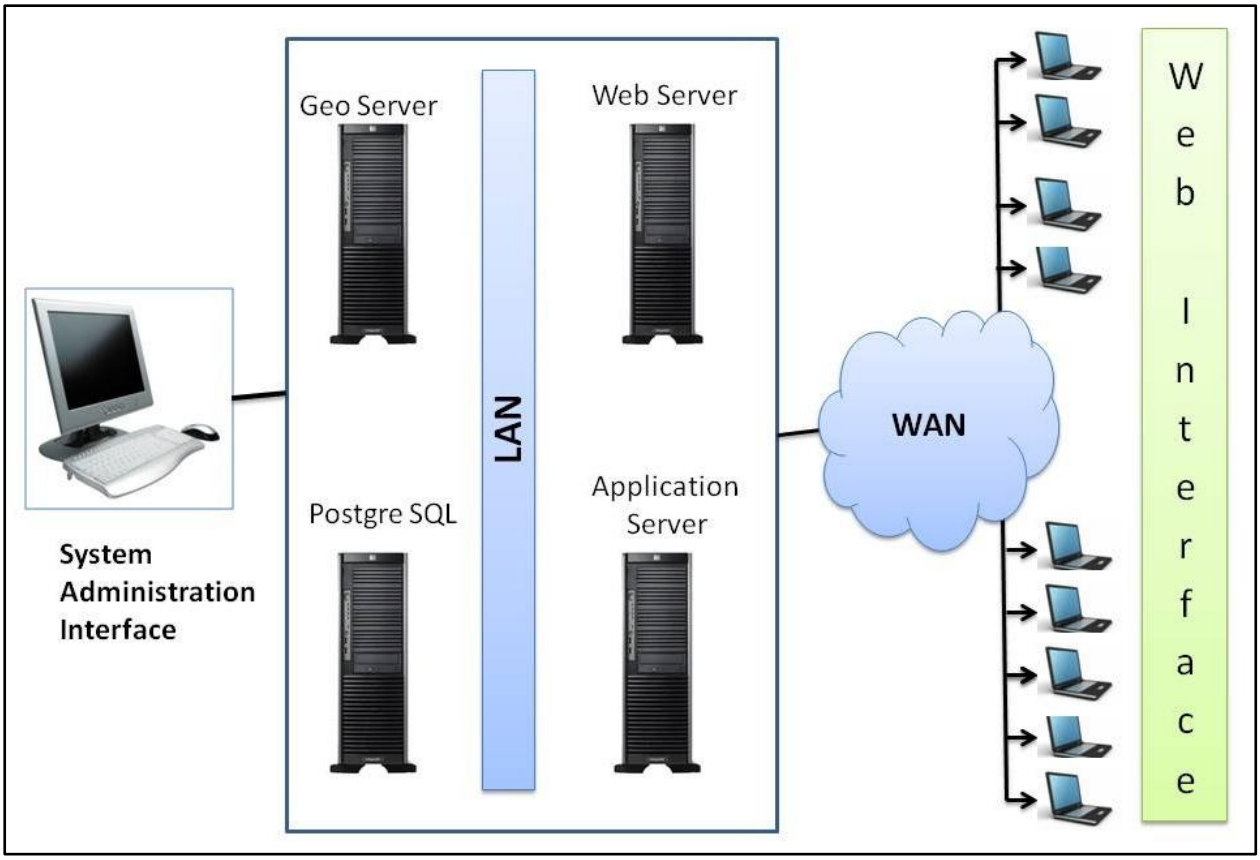



**Figure 5-5 : FDSS - Systems Architecture**

- The Frontend is web based, and registered users can view all kinds of maps and reports.
- Middleware: It is the Web server that hosts the web site and coordinates between the client and the backend servers for publishing maps and reports. Application Server serves as the main point of contact for the web server for all functionalities other than serving maps and GIS analyses. The application server is hosted in IIS 5.1 or higher and requires Dot net Framework 3.5.
- The backend consists of the following two components:

- Geo server and Geo web cache: This server handles map publishing and all the GIS functionalities. For all GIS analyses, it relies on the Post GIS database server. Geo server and Geo web cache are published in Apache Tomcat Server.
- Post GreSQL Database Server: This serves all the GIS and attributes data to both the application and map servers. In addition, it also takes care of all GIS analyses required for any functionality.

The technological framework for FDSS utilizes the following platforms:

**Hardware Configuration**

- Rack Server 2U having Intel Xeon (Quad Core) E5410 or higher processor support for dual multi core processor
- 16 GB DDR2-533 FB DIMM or higher ECC memory
- SVGA Video Controller with 16 MB RAM
- SAS Raid Controller having 128 MB buffer memory with battery backup and supporting RAID 0,1 and 5 Dual Gigabit Server Ethernet controller with teaming, load balancing and auto fail over feature
- 5X146GB SAS HS HDDD, IDE DVD ROM Drive with (N) hot swap Redunt Hot SEAP power supply

**Software Configuration**

- Operating System: Windows Server 2008
- Web Server: IIS 7.0
- Framework: .net Framework (3.5)

**Supported Browser**

- Internet Explorer 6.0 or higher
- Mozilla Firefox 3.0 or Higher

## 5.6 Advantages of Open Source Platform

The application software is built on open source GIS platform. The open source GIS platform has several advantages (Table 5-1) of production and development allowing users and developers not only to see the source code of software but also modify it and easily implement it in web applications.

**Table 5-1: Advantages of Open Source Platform**

| Advantages | Open Source Platform | Proprietary Software Platform |
|---|---|---|
| **Control and Audit**  | Gives power to control software code and hence modification can be carried out to suit the requirements | Forces users to adhere to standards and flexibility provided in the software only. Modifications are based solely on vendor discretion |
| **Low ownership Cost**  | No license fees are required thereby reducing annual license fees cost to zero, zero cost of scale as open source doesn't require additional licenses as the installation grows | License fees are required |
| **Quality and Excellence** | It's available publicly. A large no. of reviewers analyze the code making it more secure, increasing the quality and | Not available publicly. |

| Advantages | Open Source Platform | Proprietary Software Platform |
|---|---|---|
|  | excellence in design | |
| **Flexibility & customization**  | There is scope to customize the software toward end users' needs | Limited scope of customization |

## 5.7 Identification of Gaps in Infrastructure, Up-gradation and Modernization Requirement

Gap identification is being carried out using the information captured as part of the field surveys and stakeholder interviews, distribution of Fire Stations and risk analysis. The gaps in infrastructure can be in terms of number of Fire Stations in both served and un-served areas, availability of fire vehicles, fire-personnel and building infrastructure in the operational Fire Stations. Through the input of field survey work, risk categorization, and infrastructure requirement norms, gap analysis is performed at the district and State/UT level.

Gaps will primarily address the three areas:

### 5.7.1 Infrastructure gaps

This covers served/ un-served areas, unsuitable locations of Fire Stations, etc. This gap analysis is conducted by using suitably modified SFAC Norms, population density, existing Fire Station distribution and other infrastructural information obtained as part of the field surveys. In addition, the risk information has been used to reflect certain aspects of risk that affect the infrastructure. The outcomes of this analysis are information and maps that show the infrastructure deficiency at district and State levels.

### 5.7.2 Equipment Gaps

The objective of this analysis is to identify gaps in equipment existing at various Fire Stations against the population they serve, the hazards that the jurisdiction they serve is exposed to, trained map-power available, average response time to a fire call, etc. This will result in the identification of new types of equipment required, phasing out of old equipment and their replacement, and equipment effectiveness analysis.

### 5.7.3 Capacity gaps

This would cover the shortage of fire fighting personnel and additional training requirements for existing teams, etc. This analysis is conducted using infrastructure analysis information, equipment analysis information, population density, SFAC norms and risk information as the primary datasets, and average response time. The primary outcomes would include the gap in capacity in terms of number of additional fire fighting personnel required, and the additional requirement of trainings on equipment, tools, technologies and emergency management approaches.

Similarly, district/State/ country level reports on up gradation and modernization requirements of existing Fire Stations including MIS, GIS, and communication systems will

be generated by comparison of availability of existing resources and up gradation and modernization requirements through gap analysis.

The outcomes of the above analyses has been integrated to the Fire Decision Support System (FDSS), so similar analyses at a later stage may also be performed by changing the underlying datasets as things change on the ground.

## 5.8 Preparation of detail cost estimates with Capital and O&M Investment Plan

Once gaps in terms of number of Fire Stations, fire-personnel, infrastructure (building, vehicles and equipment), up gradation and modernization requirements of existing Fire Stations including MIS, GIS, and communication systems are finalized, the investment and financial analysis is performed in FDSS. This involves reviewing the outcomes of the gap analysis, prioritizing them by district and estimating the cost of investment.

The investment costs is estimated separately for infrastructure development and improvements, capacity building, and equipment procurement and modernization. This is where the extensive experience of RMSI team in fire department operations, equipment procurement, and training needs assessment and planning has been applied. For more detailed information regarding the specification of firefighting and rescue vehicles and equipment, please refer to the Vehicle and Equipment Specification report submitted by RMSI.

The outcomes of this process are a detailed investment plan that shows year-by-year investments prioritized by district, gaps and associated benefits. The financial plan addresses investment for next 10-years in a year-by-year phased manner approach. The financial tool has been integrated to the FDSS, which helps in generating various reports related to detailed cost estimates with Capital and O&M Investment Plan for next 10 years, and to prioritize investments. This is based on the current cost estimate and technological enhancement. However, the tool has flexibility to change/modify the cost of various infrastructural elements and re-regenerate reports for prioritization of the investment plan.

## 5.9 Institutional Assessment and Capacity Building Plan

The National Fire Service College (NFSC), Nagpur and other State Fire Training Centres across the country are key institutions involved in improving the level of fire personnel knowledge and their overall capabilities to face the challenges of fire-fighting. The RMSI team surveyed NFSC Nagpur and Pilot State/UTs Fire Training Centres across the country and studied their programs to delineate their role and relationship for improvement in training facilities for fire personnel in the country.

Human resource bottlenecks at various levels of training fire officials (such as refresher's training, breathing training in smoke, industrial training, specialized training to handle high rise fires, etc.) to different cadre of officials, issue of language in training; physical fitness; duty patterns (8 hours and 12 hours versus 24 hours); availability of accommodation in fire-stations; pay-scale structures, and promotion progression etc. are being studied in detail and recommendations are made for their implementation.

There are many ways of discovering funding avenues, such as introduction of Fire Tax, training programs to private sectors, tapping MP Local Area Development (MPLAD) funds etc. These issues are important since fire personnel need to be dedicated and motivated all times. For similar reasons, improvements in governance structure are imperative. Lack of

fire-personnel is another challenge. For this, revamping training facilities in the country is another important aspect in any capacity building plan.

Computerization of fire and emergency services and strict audit by a central authority can be one mechanism to ensure a good finance mechanism for capital expenditures and operation and maintenance. Training of fire personnel in the use of computers is another aspect, which is very important from the implementation perspective.

It may be noted that RMSI team is aware of past studies on the subject such as the recommendations by the SFAC and has kept these studies in mind while making recommendations for the Capacity Building Plan.

RMSI team has also prepared a detailed Roadmap for the Capacity Building Plan at country level for its implementation in next 10 years.

# 6 International and National Norms

## 6.1 Literature Survey

Under this task, standards and practices that are being followed in various developed countries for fire safety norms, such as in USA -NFPA (1211, 1710, 1720), Japan, UK, and Germany, are studied and compared.

As per literature survey and personnel communications with fire officials in different countries, international norms regarding response time *(defined as **en route time taken by the fire fighting vehicle from the Fire Station to fire emergency scene, and turnout time is not included in it**)* differs from country to country.

## 6.2 Response Time

The practices regarding response time of fire tenders/ambulances in different countries are as follows:

### 6.2.1 GERMANY

The response from Germany (27.10.2011) is as follows:

*"1. **Concerning the response time in Berlin**. On the basis of an agreement between CFO and the Ministry of Interior the options are:*

*Calls in Risk Areas class A (higher risks) - 15 fire-fighters must arrive in **max.15 minutes** at 90% of all calls and*

*Calls in Risk Areas class B (lower risks) - 15 fire-fighters must arrive in max.15 minutes at 50% of all calls.*

*The standard turn out time of a fire truck is **60 seconds for professionals**, as **for volunteers** the turn out time should not be higher **4 minutes**, otherwise the Control Centre will automatically send a professional fire truck.*

*Ambulance cars must be at the scene within **8 minutes** in 75% of all calls."*

*2. Temperature problem - heating devices in the garage (close the doors) and additional a electrical wire is going to the motor section of the vehicle for saving working temperature of the trucks."*

From the above, it may be inferred that in Germany, areas have been divided only into two Risk Categories (higher, lower) and **response time** in urban areas varies from **8 - 15 minutes**. As far as turnout time is concerned, it varies from 1 to 4 minutes.

### 6.2.2 JAPAN

Fire Service laws of Japan and its background:

1. The Japanese system of laws and regulations regarding fire service law (Hierarchy structure)
   A .Law: Fire Service Act
   B. Cabinet order: Order for Enforcement of the Fire Service Act
   ・Specify the type of building fire protection
   ・Technical standards for installation and maintenance of fire prevention equipment
C Ministerial ordinance: Rule for Enforcement of the Fire Service Act
   ・Details of technical standards for installation and maintenance of fire prevention equipment"
D. Municipal ordinances: Fire prevention ordinance"

2. Requirements for Fire prevention equipment
All Fire prevention equipment are necessary to have national certification in Japan (regulation not standard).

3. Background of Japanese fire service
・Fire service in Japan consists of **one unit per municipality**.
・Under the laws, fire prevention regulations are enacted by each of the municipalities.
・Fire prevention regulations are slightly different for each individual municipality.

- **Japanese Regulation, the response time has not been determined.**

According to the Fire Service Law Enforcement Order (**not regulation**), the fire panel shall be installed where there are always people in Japan.

In large buildings, the fire panel has been installed in Guard Room. Security people are always monitoring the fire panel.
At the same time the alarm is sounded, Fire tenders will rush to the site for extinguishing the fire.
Time to reach the site, which varies depending on the building, assumed at **5 to 10 minutes. (not determined by law).**

2. Since, there are several Islands in Japan, is there any different Regulations for Islands?
Almost the same.

As you know, Japan is made up of three islands and many small islands. There has prefectures, among which are divided into municipalities regardless of islands."

From the above, it may be inferred that in Japan, each municipality has at least one Fire Station and response time varies from 5 to 10 minutes, depending upon the location of building.

### 6.2.3 USA

“There are three National Fire Protection Association (NFPA) standards that contain time requirements that influence the delivery of fire and emergency medical services. These are:

1. **NFPA 1221**, Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems;
2. **NFPA 1710**, Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments; and
3. **NFPA 1720**, Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Volunteer Fire Departments.

NFPA 1710 contains time objectives that shall be established by career fire departments as follows:

- **Turnout time:** One minute (60 seconds) for turnout time
- **Fire response time:** Four minutes (240 seconds) or less for the arrival of the first arriving engine company at a fire suppression incident and/or eight minutes (480 seconds) or less for the deployment of a full first alarm assignment at a fire suppression incident
- **First responder or higher emergency medical response time:** Four minutes (240 seconds) or less for the arrival of a unit with first responder or higher-level capability at an emergency medical incident
- **Advanced life support response time:** Eight minutes (480 seconds) or less for the arrival of an advanced life support unit at an emergency medical incident, where the service is provided by the fire department

The standard States that the fire department shall establish a performance objective of not less than 90 percent for the achievement of each response time objective. NFPA 1710 does contain a time objective for dispatch time by requiring that "All communications facilities, equipment, staffing, and operating procedures shall comply with NFPA 1221." For the purposes of NFPA 1710, the following definitions apply:

- **Dispatch time:** The point of receipt of the emergency alarm at the public safety answering point to the point where sufficient information is known to the dispatcher and applicable units are notified of the emergency
- **Turnout time:** The time that begins when units acknowledge notification of the emergency to the beginning point of response time
- **Response time:** The time that begins when units are en route to the emergency incident and ends when units arrive at the scene

NFPA 1720 contains a time objective for dispatch time by requiring that "All communications facilities, equipment, staffing, and operating procedures shall comply with NFPA 1221, Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems." NFPA 1720 contains no time requirements for turnout and response times.

NFPA 1221 requires that 95 percent of alarms shall be answered within 15 seconds, 99 percent of alarms shall be answered in 40 seconds, and the dispatch of the emergency

response agency shall be completed within 60 seconds 95 percent of the time. The time lines for dispatching are taken from NFPA 1221:

- After the receipt of a call for assistance, the fire department will respond with the first unit to that location within three minutes.
- After receipt of a call for assistance, the fire department will respond with a unit to that location, within four minutes, to 90 percent of area served.

After receipt of a call for a medical emergency, the fire department will respond with an engine company to that location within four minutes and an ambulance within six minutes."

From the above, it may be inferred that in USA, response time varies from **(3 - 4 minutes) to 8 minutes.**

### 6.2.4 UK

The London Fire Brigade (LFB) is run by the London Fire and Emergency Planning Authority as part of a group of organizations operating under the 'umbrella' of the Greater London Authority. It is the third largest firefighting organization in the world, with **111 Fire Stations** (plus 1 River Thames-based station) from which it operates across the 1,587 sq km of Greater London, with its resident population of some 7.4 million. This increases by a further 500,000 each day during working hours.

In the year 2005/06 the London Fire Brigade answered some 268,000 emergency calls and attended nearly 156,000 incidents. On an average, the first fire engine arrived at an incident **within 8 minutes on 92 per cent of occasions**, meeting the Brigade's target, and **within 5 minutes on nearly 65 per cent of occasions**. When required, a second fire engine was on scene within ten minutes on 93 per cent of occasions, exceeding the target. (Hooper, Nov-Dec, 2006; http://www.cadcorp.com/pdf/PA-firebrigade_ukv4i5.pdf).

Another recent review of "Fire and Rescue Service response times" (Fire Research Series 1/2009) concludes that response times have increased due to traffic conditions, which was similar to the finding of the London Fire and Emergency Planning Authority thematic report, which concluded that it now ***takes 50 seconds longer for a 1st appliance to arrive on average and one minute longer for a second appliance.***

From the above, it may be inferred that in UK, response time varies from **5 to 8 minutes.**

### 6.2.5 INDIA

*"Standing Fire and Advisory Council (SFAC) reviewed the norms in various countries, and as given in the RFP, has laid down norms for the Fire and Emergency Services throughout the country based on:-*

- *Response time, fire risk, and population*
- *Depending on risk category A, B, and C the recommended response time for first fire tender is 3, 5, and 7 minutes, respectively*
- *One Fire Station per 10 sq. km in urban areas and one Fire Station per 50 sq. km in rural areas*
- *One Rescue Tender per 3 – 10 Lakhs population*
- In rural areas, the recommended response time is 20 minutes

From the above, it can be inferred that SFAC norms are based on the idealized conditions of the western world and would be too demanding, thus requiring some modifications.

To see the practicability of SFAC norms, RMSI did several simulations through *network analysis* taking different average vehicle speeds for Delhi State. These different speed simulations were presented on Nov. 02, 2011 to DFS officials and on Nov 03, 2011 to Fire Advisor and Deputy Fire Advisor at DG, NDRF, MHA. After discussions with both DFS and MHA officials, the average fire vehicle speeds on main roads has been taken as 40 km/hr and minor roads as 20 km/ hr. While, for congested areas, such as Sadar Bazar, Delhi, the average fire vehicle speed on main roads has been taken as 20 km/hr and for minor roads as 10 km/hr, respectively. RMSI choose Delhi, because it has a high density of Fire Stations in comparison to the rest of the States/UTs.

Taking SFAC norms as a guideline, RMSI analyzed the requirements of Fire Stations in Delhi, keeping a response time of 3 minutes for very high-risk category, 5 minutes for high category and taking response time in rural area as 20 minutes. *It may be noted that areas served by other agencies, such as the Airport and Military Cantonment have been excluded from the gap analysis, so that there is no duplicity of Fire Stations in those areas. Additionally, areas covered by forests, rivers, sparsely inhabited (small pockets of a few houses, say in a river channel) etc. have also not been considered in the gap analysis.* To make a distinction, the Fire Stations in rural areas are designated as **Fire Stations/Fire Posts**.

Thus, taking the vehicle speeds discussed earlier, and response time as per SFAC norms, Delhi requires additional **120** Fire Stations in urban areas and **10** rural Fire Stations/posts in rural areas (Table 6-1).

**Table 6-1: Number of operational and additional Fire Stations and Fire Posts required in Delhi**

| Urban | | Rural | |
|---|---|---|---|
| Operational Fire Stations | Additional Fire Stations | Operational Fire Station/ Fire Post | Additional Fire Stations/ Fire Posts |
| **51** | **120** | **1** | **10** |

*As per SFAC norms, one Fire Station is required per 10 sq. km in urban areas and per 50 sq. km in rural areas. This seems to be based on average area per station over a large area/State.*

From the above analysis, the average area per Fire Station in urban areas in Delhi comes to 4.7 sq km, while in rural area; it comes to 62.5 sq km. This analysis also shows that the average Fire Station coverage area in urban areas is too low when compared to the norms specified by SFAC, which is 10 sq km in urban area. Moreover, population covered in such a small area of less than 5 sq km is sometimes very low to justify opening of a new Fire Station, thus contradicting the area based norm of SFAC. Moreover, additional required number of Fire Stations will be too high and it may not be possible to set-up so many Fire Stations in Delhi, where land availability in urban areas is scarce.

Thus, keeping in view the above analyses, RMSI reanalyzed the requirements of Fire Stations in Delhi, by modifying the response time of 5 - 7 minutes for various risk categories and keeping the response time in rural area as 20 minutes. Accordingly, the proposed requirement of additional number of Fire Stations in urban and rural areas is shown in Table 6-2. In terms of average area and population served by the revised response time, the average area served comes to 8.38 sq km (close to 10 sq km) in urban areas serving an average population of 1, 61,289.

**Table 6-2: Revised number of operational and additional Fire Stations and Fire Posts required in Delhi**

| Urban | | Rural | | Total |
|---|---|---|---|---|
| Operational Fire Stations | Additional Fire Stations | Operational Fire Station/ Fire Post | Additional Fire Stations/ Fire Posts | |
| **51** | **46** | **1** | **9** | **107** |

As discussed in section 6.2.4, Greater London Authority operates 112 Fire Stations in an area of 1,587 sq km of Greater London, which is equivalent to on an average one Fire Station per 14.2 sq km. A comparison of the proposed 107 Fire Stations serving an area of 1483 sq km Delhi shows that in Delhi there will be one Fire Station on an average area of 13.9 sq km, which is almost equal to the average area per Fire Station in Greater London.

Thus, keeping in view the above analyses, RMSI recommend to modify the SFAC norms *(response time and area based)* to *response time based* norms for positioning a Fire Station, as response area will vary from place to place depending upon the road network:

***Depending upon the risk category, the recommended response time for first fire tender is 5 - 7 minutes in urban areas and 20 minutes in rural areas.***

# Annex-1: Fire Headquarter Data Collection Form

This questionnaire is prepared in consultation with Directorate General NDRF & CD for collecting basic information all fire infrastructure in the country as part of the project "Fire-Risk and Hazard analysis in the Country" with an objective to Prepare Capital Investment and Institutional Strengthening Plan for Accelerated Development of Fire Services in the Country. All information collection through this questionnaire will be kept confidential and will only be used for the preparation of the report and other deliverables of the project. Directorate General NDRF/ CD has entrusted RMSI Private Limited to carry out this assignment and State Officials are requested to provide required authentic information which is very important for preparation of this report and future development plans of the department.

## A. Fire Headquarters General Information

**HQ Ref #.....**

### Location Details

Fire Headquarters/Zone/District Office ---------- State----------

Street address …….

…….

Office Phone numbers: ……Fax…….. Web site (if any)……

Name & Designation of the Head of Department: ……..

Name & Designation of the nominated person by the dept. for providing data: ……..

Phone numbers ----------Email (s):----------

### Area under Jurisdiction

| Zonal Office (name and street address) | Num of districts covered | Census 2011 Population(to be filled by RMSI) | Num of Fire stations (Operational) | Num of Fire stations (under Construction) | Num of Fire stations proposed for future expansion |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |

**Surveyed by: Date:**

(Signature of the official provided the information)

## B. Area under Jurisdiction in each Zonal Office

Name of Zonal office ……..

| S.N. | Name of Fire stations | Name of district | Under direct Jurisdiction control of[1] | Population(to be filled by RMSI) | Num of Fire stations (Operational) | Num of Fire stations (under Construction) | Num of Fire stations proposed for future expansion | Any additional Information |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| | | | | | | | | |
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| | | | | | | | | |

Name of Zonal office ……..

| S.N. | Name of Fire stations | Name of district | Under direct Jurisdiction controlof[1] | Population(to be filled by RMSI) | Num of Fire stations (Operational) | Num of Fire stations (under Construction) | Num of Fire stations proposed for future expansion | Any additional Information |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

***Please add additional sheets if required***

[1] State Government Fire Department Police Department Municipal Corporation Others specify

## C. Human Resources and Staff Welfare

**Organization Structure and Human resources (Operational Staff)**

By State/ zonal Level

Zone Name ……..

| Level | Designation | Pay-scale | Duty Pattern | Number of sanctioned posts | Total Number of Filled posts | Total No of Vacant posts | Remark, if any |
|---|---|---|---|---|---|---|---|
| 10 | Director | | | | | | |
| 9 | Chief Fire Officers | | | | | | |
| 8 | Dy. ChiefFire Officer | | | | | | |
| 7 | Divisional Officer | | | | | | |
| 6 | Astt Divisional Officer | | | | | | |
| 5 | Station Officer | | | | | | |
| 4 | Astt Station Officer | | | | | | |
| 3 | Leading Fire men | | | | | | |
| 2 | Fire men/ Driver/ Fire Operator | | | | | | |
| 1 | Watch Room operator | | | | | | |
| Any other | Sweeper/ Gardener etc. | | | | | | |

***Please additional sheets for each Fire zonal region and Fire stations***

**Recruitment Rules for entry level in organization chart**

| Level | Essential qualifications per recruitment rule | Preferential | Training / Experience | Departmental Reservation policy if any |
|---|---|---|---|---|
| | | | | |
| 7 | | | | |
| 6 | | | | |
| 5 | | | | |
| 4 | | | | |
| 3 | | | | |
| 2 | | | | |
| 1 | | | | |
| Any other | | | | |

Please provide copy of State recruitment rules

**Trainings Details**

Training Centre Infrastructure for basic training and sub-officer course: If yes, provide details:

Name of Training Centre:

Number of Faculty/Trainers:

| Name of Training Course and Duration | Maximum capacity | Number of personnel Trained annually |
|---|---|---|
| 1. | | |
| 2. | | |
| 3. | | |
| 4. | | |

Training obtained by fire-staff annually (sub-officer course and above)

| S. No | Type of Training Obtained | Within State Training Centre | At NFSC, Nagpur | in other State Training Centre | Foreign country | Total Number of personnel Trained |
|---|---|---|---|---|---|---|
| 1. | | | | | | |
| 2 | | | | | | |
| 3 | | | | | | |
| 4 | | | | | | |

***Please provide yearly break-up for the last 5 years, if available***

**Staff Welfare:**

Please list the Staff welfare measures being followed in the State:

Details can be on ration money, sports facilities, TV for common room, cash rewards and recognition, incentives, through benevolent fund, Insurance, other schemes etc.

Measures to Improve Staff Efficiency

| S. no | Type of Drill | Frequency | Type of Drill (Please tick the appropriate √/ ×) | | | | | others |
|---|---|---|---|---|---|---|---|---|
| | | | Squad Drill | Pump/ Hose Drill - Dry | Pump/ Hose Drill - Wet | Ladder/ Rescue Drill | Rope Rescue Drill | |
| | Daily | | | | | | | |
| | Weekly | | | | | | | |
| | Bimonthly | | | | | | | |
| | Monthly | | | | | | | |
| | others | | | | | | | |

## D. Inventory of Equipment

**Division Wise Fire Vehicles**

Fire Station Name ----------

| Division/ Station Name | Number of Deployment of fire fighting units | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | water tender | Water Browser | Foam Tender | Dry Chemical Powder Tender | Emergency Tender/Rescue Tender/ Rescue Responder | Motor Pump | Motor Cycle | BA Van | Hose Tender | Aerial Ladder Platform | Hazmat Van | Others |
| | | | | | | | | | | | | |
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**Please provide separate list for working, non-working and under procurement**

**Additional Equipment**

Fire Station / District/ Division Name ----------

| Division/ Station Name | Gas Cutters | Bolt Cutters | Electric Drill | Circular Saw with Diamond Blade(Electric) | Chipping Hammer | Chain Saw- Diamond | Chain Saw- Bullet | Pneumatic Chisel | Spreader Cutters Hyd/electric/ Battery operated | Rescue Boats |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
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| | | | | | | | | | | |

**Any other not covered in above list**

…….

……..

……..

**Please provide separate list for each division/district**

## E. Communication between HQ and Zonal/district office

**Details of Control rooms**

Centralized Control Room for the entire State: Yes/ No , if yes please provide location and street address:

| S.No | Name of Control Room for the Division/district | Size in terms of number of Emergency Fire Telephone (EFT) lines | Command and Control | | Remark |
|---|---|---|---|---|---|
| | | | Manual | Computerized | |
| 1 | | | | | |
| 2 | | | | | |
| 3 | | | | | |
| 4 | | | | | |

**State Communication centre is connected with Zonal/District office through:** Internet/Intranet/Wireless/Telephone lines

**State Communication centre is connected with individual Fire Station through:** Internet/Intranet/Wireless/Telephone lines

**Frequency of Fire Report Transmission:**

From Individual Fire Station to District/Zonal Hq: Instantaneous, daily, weekly, bi-weekly/monthly

From Individual Fire Station to State Hq: Instantaneous, daily, weekly, bi-weekly/monthly

From Individual District/Zonal Hq to District/Zone Hq: Instantaneous, daily, weekly, bi-weekly/monthly

**Does State have a communication policy?**, *if yes, please provide a copy of the report:*

**Does State have any approved plans to improve communication?,** if yes, please provide a copy of the plan:

## F. Financial Details

Name of Zone

……

(If information provided zone wise)

Budget for year ……

| Plan | | | Non-Plan | | |
|---|---|---|---|---|---|
| Capital (Rs) | Revenue (Rs) | | Capital (Rs) | Revenue (Rs) | |
| | Equipment | | | Equipment | |
| | Maintenance | | | Maintenance | |
| | POL | | | POL | |

Please repeat if information is available for each zone/ State more than one year

## G. Fire and other Incidences Summary (last 5 years)

*Please provide information for each Fire Station, and District/division and Headquarter Level summary*

*Name of Station* …….

Number of Fire and other Incidence (P= Public and FS= Fire Service)

| Year | Total Calls (A+B+C+D) | Total Fire Incidence (A) | Occupancy wise break up of fire incidence | | | | Total Rescue incidence (B) | Break up of Rescue incidence | | | | Special service calls ( C) | False/ malicious calls (D) | Totalinjured | | Num of Deaths | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Residential | Industrial | Institutional/ commercial | Others | | Road Accidents | Building collapse | Animal | Others | | | P | FS | P | FS |
| 2010-11 | | | | | | | | | | | | | | | | | |
| 2009-10 | | | | | | | | | | | | | | | | | |
| 2008-09 | | | | | | | | | | | | | | | | | |
| 2007-06 | | | | | | | | | | | | | | | | | |
| 2006-07 | | | | | | | | | | | | | | | | | |

**Severity of fire incidences at each Fire Station, and District/division and Headquarter Level summary**

| Year | Total no of Small Fire Incidence | Total no of Medium Fire Incidence | Total no of Serious Fire Incidence | Brief description of Major Fire Incidence |
|---|---|---|---|---|
| 2010-11 | | | | |

| Year | Total no of Small Fire Incidence | Total no of Medium Fire Incidence | Total no of Serious Fire Incidence | Brief description of Major Fire Incidence |
|---|---|---|---|---|
| | | | | |
| 2009-10 | | | | |
| 2008-09 | | | | |
| 2007-06 | | | | |
| 2006-07 | | | | |

***(Attach additional sheets for each region/ and addition year)***

***Please provide definition of fire types***

***……***

***……***

Severity of events: Small fire – estimated loss of Rs. 10 lakhs, Medium – Rs. 10 to 50 lakhs, Serious - >Rs. 50 lakhs, any fire where there is human death to be consider as Serious fire. (As per the compendium, even there is causalities, it is considered as serious, but the causality severity not mentioned ***……..***

## H. Public Awareness Programs

Public Awareness Programs organized in last One Year

Name of Zonal/district Office …….

| Total no. of programs in the year including Fire Safety Week (a +b + c) | Total no. of persons attended (d + e + f) | No of Programs Organized | | | No of Persons attended | | | Brief description of the programs |
|---|---|---|---|---|---|---|---|---|
| | | Govt./ PSU (a) | Pvt. Locations (b) | Schools (c) | Govt./ PSU (d) | Pvt. Locations (e) | Schools (f) | |
| | | | | | | | | |

## I. Suggestions/views of the department for improvement of fire and emergency service in the State

| |
|---|
| 1. |
| 2. |
| 3. |
| 4. |
| 5. |
| 6. |
| 7. |
| 8. |
| ..... |

Contact person Details for Communication at RMSI (On behalf of DGCD, Fire Project Cell):

**Postal Address:**

Mr. Sushil Gupta
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A-8, RMSI, Sector-16, NOIDA
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email<Sushil.Gupta@rmsi.com>
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www.rmsi.com

# Annex-2: Fire Station Survey Form

This questionnaire is prepared in consultation with Directorate General NDRF & CD for collecting basic information all fire infrastructure in the country as part of the project "Fire-Risk and Hazard analysis in the Country" with an objective to Prepare Capital Investment and Institutional Strengthening Plan for Accelerated Development of Fire and Emergency Services in the Country. All information collection through this questionnaire will be kept confidential and will only be used for the preparation of the report and other deliverables of the project. Directorate General NDRF has entrusted RMSI Private Limited to carry out this assignment and State Officials and Official in-charge of Fire Station are requested to provide required authentic information which is very important for preparation of this report and future development plans of the department.

SW FS Ref #.....

## A. Fire Station General Information

| State | District | City/ Town | Block / Tehsil | Municipality | Latitude , Longitude (to be filled by RMSI)(DDM format) | | ID |
|---|---|---|---|---|---|---|---|
| | | | | | | | |

*Fire Station Name* .....

Address of the Fire Station (with landmark) .....

.....

Station Phone number(s) with STD code: 1) ..... 2)..... 3).....

Fax No: .....

Emergency No: .....

*Fire Station Type based on served area: Urban* ☐ *Rural* ☐

Name of officer in-charge ..... Designation .....Mobile number *(officer in-charge)* : .....

Fire Station is under the administration of (put tick mark in the box)

State Government ☐ Municipal Corporation ☐ Police Department ☐ Others specify.....

The Fire Station falls under the jurisdiction of (Division/Zone/Municipality) -.....

Name of Administrative District/Divisional/Zonal Fire Officer- .....Mobile.....

Address/location of District/Divisional/Zonal HQ- .....

Number of total Fire Stations fall under above jurisdiction/ administration- .....

**Surveyed by:** **Date:**

(Signature of Witness from Fire Department)
Name & Designation

## B. Fire Station Infrastructure Details

Does Fire Station has its own building: Yes in good condition , Yes, but condition is not good & need new building.

No permanent building

**If Fire Station is temporarily operational** from borrowed/ rented building of ……(Private, Municipality, Police, any other ……)

Please mentioned the status : Land acquired -…Yes/ No… and building under construction -……Yes/ No….

How many bay station should be in new Fire Station building

**If permanent building** - Fire Station belongs to State Fire Department / State Government / Municipal Corporation / Police fire Service/ any other

**Provide building details**

| Number of Floors | Number of Rooms | Approx Plot Area (SQM) | Approx Built-up Area (SQM) |
|---|---|---|---|
| | | | |

Whole Fire Station Building Structure Type : Pacca - Reinforced concrete (RCC) frame structure Pacca -Masonry with RCC Roof
Pacca Masonry walls with flexible Roof Kaccha masonry walls with Tin Roof Kaccha Tin shade Temp Porta- cabins
Kaccha wooden structure with tin Roof Others kaccha type specify ……

Mixed (kachha and pacca) (in case different parts of Fire Stations has different structure types)

If whole station building is not a permanent (Pacca) building structure and need new partial building, please specify the details of partial components that needs to be build

Vehicle bays (with num of bays) Fire Station office building Barracks Staff quarters

Age of building structure/ year of construction- …….. (write year in the blank space and tick in the box below)

Less than 5yrs 5-10 yrs 10-20yrs More than 20 yrs

Number of Bays/Garages for the Fire Vehicles - , How many fire vehicle parked within Bay/ Garage

Structure of Bay/ Garage- Pacca- RCC/Masonry Kaccha Tin Shade Open any other Kaccha …..……..

Availability of Staff Quarters - Yes No If Yes, mention numbers……

Availability of Barracks - Yes ☐ No ☐ , If Yes, mention numbers and total capacity……

Availability of T.V. in Barracks - Yes ☐ No ☐ Any other entertainment indoor/ outdoor……

Provision of Mess/ Canteen facilities in Fire Station- Yes ☐ No ☐

Availability of Watch room /Control Room- Yes ☐ No ☐ If yes, is it computerized - Yes ☐ No ☐

Is Watch room /Control room online/ internet connected with zonal/ headquarter Yes ☐ No ☐

Availability of drill/ parade ground - Yes ☐ No ☐ Availability of hose drying/ drill tower - Yes ☐ No ☐

Power Supply in the Fire Station Watch Room/ Control Room -

Electricity: Uninterrupted 24 Hrs ☐ Interrupted supply ☐ Availability of standby generator ☐ Inverter for control room ☐

Does the Fire Station maintain ambulance unit ? Yes ☐ No ☐

## C. Communication Systems

1. Between Public and Fire control room/ watch room
   i. Landline Telephone: Yes ☐ ☐ , If 'Yes', mention number of land line phone in operation…….
   ii. Emergency phone number- 101 or,…….Connection Type : Direct ☐ Indirect ☐ Not Available ☐
2. Hotline between Important agencies and Fire control room

   Oil industries/ storage ☐ Airport ☐ PCR ☐ Banks ☐ District Magistrate Office ☐

   Others specify…… ……
3. Automatic Fire Alarm between High Rise Buildings and Fire Station: Yes ☐ No ☐ If yes, num. of buildings …….
   If with any other agency, specify: ……

Availability of GPS on Fire Engines and other vehicles - Yes ☐ No ☐ If Yes, mention number of vehicles: ……..

4. Between Fire Station Control Room and Fire Vehicles
   Static Wireless Set in watch room Yes ☐ No ☐ Yes', mention number of operational phones …….
   Number of Mobile wireless sets: ☐ Number of Walky-Talky: ☐ Number of Satellite Phones: ☐
5. Type of Frequency used- HF ☐ VHF ☐ UHF ☐

## D. Water Supply Details for Fire Fighting Purpose

Whether 24 hours water available in fire vehicles? Yes ☐ No ☐

Water sources used by Fire Vehicles within Fire Station

Direct supply… ☐ … b) Overhead tank ☐ c) Pumping from underground tank … ☐

d) Pumping by Tube well ☐ .. e) any other ……

Any storage of water within Fire Station for fire vehicles- Yes ☐ No ☐

Water sources regularly used by Fire Vehicles outside Fire Station (also mention distance in km from Fire Station)

City over-head tank with coupling arrangements ☐ River ☐ Stream ☐ Well ☐ Pond ☐ Lake ☐

Other location / static fire hydrant available in the vicinity - Yes ☐ No ☐ , If 'Yes', provide number and distance (km) ……,……..……

Overall, is there any scarcity of water for fire vehicles- Yes ☐ No ☐

## E. Human Resources

***Permanent Staff Details- :***

| S. no. | Designation | Total Number of Permanent Working Staff | Duty pattern/ Shifts (hrs) | Vacant, but sanctioned posts | Numbers of temporary/ contract persons (if any) |
|---|---|---|---|---|---|
| 1. | Senior Fire Officers | | 24 hrs | | |
| 2. | Station Officer (St.O)/(FSO) | | | | |
| 3. | Sub Officer (S.O)/FSSO | | | | |
| 4. | Leading Fire Men (LFM) | | | | |

| S. no. | Designation | Total Number of Permanent Working Staff | Duty pattern/ Shifts (hrs) | Vacant, but sanctioned posts | Numbers of temporary/ contract persons (if any) |
|---|---|---|---|---|---|
| 5. | Driver | | | | |
| 6. | Fire Man (FM) | | | | |
| 7. | Sweeper | | | | |
| 8. | Cook | | | | |
| 9. | Any other | | | | |
| 10. | Any other | | | | |

Total Permanent Staff in the Fire Station [ ] Details of Temporary staff/ Contract persons (if any)……

***Level 10**: Director General/ Director; **Level 9**: CFO/ CO; **Level 8**: Deputy CFO/Joint Director; **Level 7**: AD/Deputy Controller/Deputy Director/DO; **Level 6**: ADO/ Inspector/EO/Fire Supervisor; **Level 5**: DFO/ADFO/AFO/Fire In-charge; **Level 4**: St.O/Sub Inspector/Station In-charge/ASt O./AEO; **Level 3**: S O/Assistant Sub Inspector/ASO/Sub-Fire Officer/; **Level 2** : LFM/ Mechanic Driver/Head Constable/Store Superintendant; **Level 1** : FM/ FM Driver/Radio Technician/ SGFM/ Driver/ Police Constable/ Wireless Technician/ Radio Technician/ Asst FM/ Sanitary Inspector, FO/FO Driver/Driver Operator/Driver/Ambulance Driver/ Clerk; **Level 0:** Cleaner, Fire Coolie, Supporting Staff, Attendant, Labourer, Peon, Security Guard, Tindal.*

### *Mode to maintain Physical Fitness*

| S. no | Type of Drill | Yes/No | S. no | Type of Drill | Yes/No |
|---|---|---|---|---|---|
| 1. | P.T./ Parade | Daily/…… | 4. | Vehicle maintenance | Weekly/Monthly/Quarterly/…… |
| 2. | Fire Drill | Daily/Weekly…… | 5. | Any other | …… |
| 3. | Games | Daily/ …… | | | |

## F. Fire Risk Covered in the Area under Jurisdiction

Jurisdiction of Fire Station (in approx sq km) ……*(collect current* jurisdiction *map from the Fire Station)*

| Fire Risk | If Yes, Brief description of its Name, Type, Risks involved | Dist. From FS (km) | No. of Units |
|---|---|---|---|
| Old city Area/ congested areas | | | |
| Jhuggi -Jhopdi (Thatched House Clusters) | | | |
| Industrial Area (also mention whether small/medium/large scale) | | | |
| Industrial Area (any other) | | | |
| High-Rise Buildings (>15m | | | |

| Fire Risk | If Yes, Brief description of its Name, Type, Risks involved | Dist. From FS (km) | No. of Units |
|---|---|---|---|
| height) | | | |
| Major Scrap yards (Iron/Wood etc) | | | |
| Oil Mills/Storage/Processing Units | | | |
| Refineries | | | |
| Underground Gas pipe lines | | | |
| LPG Bottling Plant | | | |
| Water –Treatment Plant (chlorine cylinders) | | | |
| Bulk Fuel Storage Area/ Petrol Pump | | | |
| Major Hazardous (MAH) units | | | |
| Explosive manufacturing/stores | | | |
| Port/ dockyard area | | | |
| Railway Station | | | |
| Airport Area | | | |
| Wild Forest-Area | | | |

| Fire Risk | If Yes, Brief description of its Name, Type, Risks involved | Dist. From FS (km) | No. of Units |
|---|---|---|---|
| Vicinity to Coast | | | |
| Army Ammunition Storage | | | |
| Cross-Border Shelling | | | |
| Any other | | | |
| Any other | | | |

Availability of water for Fire Fighting in High-Rise Building as per National Building Code (NBC) - All ☐ Few ☐ No ☐

Applicability of NBC/ local laws in District/ State for fire safety of High-Rise building - All ☐ Few ☐ No ☐

Applicability of NBC/ local laws for fire safety in industrial and other buildings- All ☐ Few ☐ No ☐

## G. Status of Fire Fighting Vehicles (attach separate sheet if number of vehicle are more than space provided below)

(Total number of Fire Fighting Vehicles at station ……..…)

| Sl No | Fire Vehicle Type | Fire Dept. Vehicle Number | Vehicle Registration Number | Make | Year of Fabrication (age) | Size/ water capacity (ltr) | Pumping capacity/ size (LPM) | Comm. System mounted on vehicle | If not in running condition (off road) |
|---|---|---|---|---|---|---|---|---|---|
| | Water Tender (WT) 1 | | | | | | | Wireless / GPS | Minor/ Major/Condemned |
| | Water Tender (WT) 2 | | | | | | | Wireless / | Minor/ |

| Sl No | Fire Vehicle Type | Fire Dept. Vehicle Number | Vehicle Registration Number | Make | Year of Fabrication (age) | Size/ water capacity (ltr) | Pumping capacity/ size (LPM) | Comm. System mounted on vehicle | If not in running condition (off road) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | GPS | Major/Condemned |
| | Water Tender (WT) 3 | | | | | | | Wireless / GPS | Minor/ Major/Condemned |
| | Water Bowser (WB) 1 | | | | | | | Wireless / GPS | Minor/ Major/Condemned |
| | Water Bowser (WB) 2 | | | | | | | Wireless / GPS | Minor/ Major/Condemned |
| | Foam Tender (FT) | | | | | | | Wireless / GPS | Minor/ Major/Condemned |
| | DCP Tender | | | | | kg | | Wireless / GPS | Minor/ Major/Condemned |
| | Multi-purpose Tender | | | | | | | Wireless / GPS | Minor/ Major/Condemned |
| | Hose Tender (HT) | | | | | | | Wireless / GPS | Minor/ Major/Condemned |
| | Rescue / emergency tender/ responder | | | | | | | Wireless / GPS | Minor/ Major/Condemned |
| | Advanced Rescue Tender (with inst. to handle hazardous materials) | | | | | | | Wireless / GPS | Minor/ Major/Condemned |
| | Aerial Ladder Platform (ALP) | | | | | | | Wireless / GPS | Minor/ Major/Condemned |
| | Turn Table Ladder (TTL) | | | | | | | Wireless / GPS | Minor/ Major/Condemned |
| | Hazmat Van | | | | | | | Wireless / GPS | Minor/ Major/Condemned |

| Sl No | Fire Vehicle Type | Fire Dept. Vehicle Number | Vehicle Registration Number | Make | Year of Fabrication (age) | Size/ water capacity (ltr) | Pumping capacity/ size (LPM) | Comm. System mounted on vehicle | If not in running condition (off road) |
|---|---|---|---|---|---|---|---|---|---|
| | B.A. Van | | | | | | | Wireless / GPS | Minor/ Major/Condemned |
| | Quick Response Tender (QRT) | | | | | | | Wireless / GPS | Minor/ Major/Condemned |
| | Motor Cycle Mist 1 | | | | | | | Wireless / GPS | Minor/ Major/Condemned |
| | Motor Cycle Mist 2 | | | | | | | Wireless / GPS | Minor/ Major/Condemned |
| | Rescue Boat | | | | | | | Wireless / GPS | Minor/ Major/Condemned |
| | Fire Boat | | | | | | | Wireless / GPS | Minor/ Major/Condemned |
| | High Pressure Light Van | | | | | | | Wireless / GPS | Minor/ Major/Condemned |
| | Any Other | | | | | | | Wireless / GPS | Minor/ Major/Condemned |

***Details of Vehicles- other than Fire Fighting/ Official Use***

| Sr No | Fire Vehicle Type | Vehicle Registration Number | Make | If allotted to individual | Comm. System mounted on vehicle | If not in running condition (off road) |
|---|---|---|---|---|---|---|
| | Ambulance | | | | Wireless / GPS | Minor/ Major/Condemned |
| | Motor cycle (office use) | | | | Wireless / GPS | Minor/ Major/Condemned |
| | Motor cycle (office use) | | | | Wireless / GPS | Minor/ Major/Condemned |
| | Jeep/ Gypsy (office use) | | | | Wireless / GPS | Minor/ Major/Condemned |
| | Jeep/ Gypsy (office use) | | | | Wireless / GPS | Minor/ Major/Condemned |

| Sr No | Fire Vehicle Type | Vehicle Registration Number | Make | If allotted to individual | Comm. System mounted on vehicle | If not in running condition (off road) |
|---|---|---|---|---|---|---|
| | Bus/ Mini Bus | | | | Wireless / GPS | Minor/ Major/Condemned |
| | Other Transport Vehicle | | | | Wireless / GPS | Minor/ Major/Condemned |
| | Any other | | | | Wireless / GPS | Minor/ Major/Condemned |

## *H. Specialized Equipment provided (mention total quantity for all equipment including vehicle and storage)*

| Equipment | Number/ Quantity | Equipment | Number/ Quantity |
|---|---|---|---|
| Self rescue units ropes/slugs (ft) | | Ladders (extension + hook) | |
| Foam compound (ltr.) | | Hand controlled nozzle/ branches | |
| Foam making branches (tool) | | Fog/ Mist Branch | |
| Breathing Apparatus (B.A.) Sets | | B.A. Compressor | |
| Personal Protection Suits (multi-layer suits etc) | | Combi Tool | |
| Personal Protection Equipment (PPE) (protection suit with BA sets etc) | | Jumping cushion / sheets | |
| Chemical Suit | | Dry Chemical Powder (DCP) Extinguisher | |
| Lock cutter | | First-Aid Box | |
| Hydraulic Rescue Tool (spreader, cutter, rams) | | Portable Pump | |
| Electric powered hammer/ floor breaker | | Submersible Pumps | |
| Electric chain saw for wood | | Pneumatic Lifting Bag (capacity -Ton) | |
| Electric powered concrete cutter saw | | Thermal Imaging Camera | |
| Electric chain saw for concrete | | Life Locator Equipment | |
| Petrol Powered Concrete Cutter Saw | | Chemical Leakage/Gas Detection Kit | |
| Petrol Chain Saw for Concrete | | Radio-active Leakage Detection Kit | |
| Petrol Chain Saw for Wood | | Curtain Spray Nozzle | |

| Equipment | Number/ Quantity | Equipment | Number/ Quantity |
|---|---|---|---|
| Hydraulic Chain Saw for Wood | | Escape Chutes (length m) | |
| Long Branch | | Search Light | |
| Short Branch | | Generator Set | |
| Diffuser | | Robots if any | |
| Lifebuoy | | Fire-Curtain | |
| Life Jacket | | Floating Pump | |
| Diving Suit (Wet / Dry) | | Smoke Exhauster/ PPV | |
| Fire Beater | | Any Other… | |
| Inflatable Lighting Tower | | Any Other… | |

## I. Other Dress Accessories

| | | |
|---|---|---|
| Normal Dangri | Individual issue / Group use | |
| Helmets (steel/leather/fiber) | Individual issue / Group use | |
| Gum Boots | Individual issue / Group use | |
| Fire retardant Dangri | Individual issue / Group use | |
| Any Other | | |

Any other incentives for staff such as ration money, insurance etc

Ration money – Yes ☐ No ☐ Amount (Rs) ……..

Insurance - Yes ☐ No ☐ Amount (Rs) ……..

## J. Suggestions/views of fire-official for improvement of fire and emergency service at the station

1)……

2)……

3)……

## K. Other Fire Station (nearby) not belonging to Fire Service Department

Airport / Defence Installations / Power Plant (all type) / Oil Refineries / Private Agency / Other Industries etc.

a) Name/Agency-…… cooperation with the above Fire Station …….

(in large fire only/ all small & big fires/ no cooperation)

Details of any mutual-aid scheme / ……

b) Name/Agency-…… cooperation with the above Fire Station …….

(in large fire only/ all small & big fires/ no cooperation)

Details of any mutual-aid scheme / ……

c) Name/Agency-…… cooperation with the above Fire Station …….

(in large fire only/ all small & big fires/ no cooperation)

Details of any mutual-aid scheme / ……

## L. Fire Calls and other Incidence Statistics (last 3-5 years) Name of Fire Station ……..

*Monthly number of fire calls and other special service calls (use additional sheet to pen down the Fire Statistics for last 5 years)*

| Month-Year | Total Calls (A+B+C+D) | Total Fire Incidence calls (A) | Occupancy wise break up of fire incidence (if any) | | | | Total Rescue incidence (B) | Break up of Rescue incidence (if any) | | | | Special service calls ( C) | False / malicious calls (D) | Total injured | | Total Death |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Residential | Industrial | Institutional/ commercial | Others | | Road Accidents | Building collapse | Animal | Others | | | Minor | Major | |
| 12-Jul | | | | | | | | | | | | | | | | |
| 12-Jun | | | | | | | | | | | | | | | | |
| 12-May | | | | | | | | | | | | | | | | |
| 12-Apr | | | | | | | | | | | | | | | | |
| 12-Mar | | | | | | | | | | | | | | | | |
| 12-Feb | | | | | | | | | | | | | | | | |
| 12-Jan | | | | | | | | | | | | | | | | |
| 11-Dec | | | | | | | | | | | | | | | | |
| 11-Nov | | | | | | | | | | | | | | | | |
| 11-Oct | | | | | | | | | | | | | | | | |
| 11-Sep | | | | | | | | | | | | | | | | |
| 11-Aug | | | | | | | | | | | | | | | | |
| 11-Jul | | | | | | | | | | | | | | | | |
| 11-Jun | | | | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11-May | | | | | | | | | | | | | | | | |
| 11-Apr | | | | | | | | | | | | | | | | |
| 11-Mar | | | | | | | | | | | | | | | | |
| 11-Feb | | | | | | | | | | | | | | | | |
| 11-Jan | | | | | | | | | | | | | | | | |
| 10-Dec | | | | | | | | | | | | | | | | |
| 10-Nov | | | | | | | | | | | | | | | | |
| 10-Oct | | | | | | | | | | | | | | | | |
| 10-Sep | | | | | | | | | | | | | | | | |
| 10-Aug | | | | | | | | | | | | | | | | |
| 10-Jul | | | | | | | | | | | | | | | | |
| 10-Jun | | | | | | | | | | | | | | | | |
| 10-May | | | | | | | | | | | | | | | | |
| 10-Apr | | | | | | | | | | | | | | | | |
| 10-Mar | | | | | | | | | | | | | | | | |
| 10-Feb | | | | | | | | | | | | | | | | |
| 10-Jan | | | | | | | | | | | | | | | | |
| 9-Dec | | | | | | | | | | | | | | | | |
| 9-Nov | | | | | | | | | | | | | | | | |
| 9-Oct | | | | | | | | | | | | | | | | |
| 9-Sep | | | | | | | | | | | | | | | | |
| 9-Aug | | | | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9-Jul | | | | | | | | | | | | | | | | |
| 9-Jun | | | | | | | | | | | | | | | | |
| 9-May | | | | | | | | | | | | | | | | |
| 9-Apr | | | | | | | | | | | | | | | | |
| 9-Mar | | | | | | | | | | | | | | | | |
| 9-Feb | | | | | | | | | | | | | | | | |
| 9-Jan | | | | | | | | | | | | | | | | |
| 8-Dec | | | | | | | | | | | | | | | | |
| 8-Nov | | | | | | | | | | | | | | | | |
| 8-Oct | | | | | | | | | | | | | | | | |
| 8-Sep | | | | | | | | | | | | | | | | |
| 8-Aug | | | | | | | | | | | | | | | | |

Please send Fire call statistics to :

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# PART B

# 7 NCT of Delhi

Delhi State, located between latitudes of 28°-24'-17" and 28°-53'-00" North and longitudes of 76°-50'-24" and 77°-20'-37" East, comprises of the National Capital Territory (NCT) of India. As per Census (2011), Delhi has nine districts with a population of about 16.75 million and a total area of 1,483 sq. km. It is surrounded by the States of Haryana in the south-west and Uttar Pradesh in the northeast. The river Yamuna, a major source of drinking water, is the territory's prominent geographical feature.

Delhi has a subtropical climate with temperatures varying from 4-5 degrees in winter to 40-45 degrees in summer. As per the "Vulnerability Atlas of India" (BMTPC, 2006), the territory of Delhi lies in the High Damage Seismic Risk zone and Very High Damage Wind Risk zone.


**Figure 7-1: Fire stations locations operated by DFS with road and rail networks**

Presently, Delhi Fire Services (DFS) is headed by a Director, DFS and currently operates 52 Fire Stations, one training centre-cum-support centre at Fire Safety Management Academy (FSMA), Rohini and one workshop at Motinagar covering the entire State. Figures 7-1 and 7-2 and Table 7-1 provide the Fire Station wise details, i.e., Fire Station name, current area

under jurisdiction, division name, zone name, subdivision name, divisional headquarter, and estimated population served by each Fire Station.


**Figure 7-2: Fire stations locations operated by DFS with their current jurisdictional areas**

**Table 7-1: Details of Delhi Fire Services operational Fire Stations**

| Sl No | FS Names | Division Name | Zone Name | Subdivision Name | Divisional Headquarter | Estimated Pop 2011 |
|---|---|---|---|---|---|---|
| 1 | Mayur Palace | East | New Delhi | Laxmi Nagar | Laxmi Nagar | 218,429 |
| 2 | Mayur Vihar | East | New Delhi | Laxmi Nagar | Laxmi Nagar | 443,258 |
| 3 | Tahirpur | East | New Delhi | Tahirpur | Laxmi Nagar | 361,653 |
| 4 | Shahdara | East | New Delhi | Shahdara | Laxmi Nagar | 301,789 |
| 5 | Shastri Park | East | New Delhi | Shahdara | Laxmi Nagar | 572,710 |
| 6 | Gokulpuri | East | New Delhi | Tahirpur | Laxmi Nagar | 999,557 |
| 7 | Geeta Colony | East | New Delhi | Shahdara | Laxmi Nagar | 569,540 |
| 8 | Secretariate | Central | New Delhi | Headquarters | DFS Headquarter | 3,091 |
| 9 | Daryaganj | Central | New Delhi | S.P Mukherjee Marg | DFS Headquarter | 15,461 |
| 10 | Paiwalan | Central | New Delhi | S.P Mukherjee Marg | DFS Headquarter | 174,225 |
| 11 | Rakabganj | Central | New Delhi | Connaught Place | DFS Headquarter | 26,896 |
| 12 | Chanakyapuri | South | South | Safdarjung | Bhikaji Cama Place | 240,871 |
| 13 | Jor Bagh | South | South | Safdarjung | Bhikaji Cama Place | 264,959 |
| 14 | Shankar Road | South-West | South | Shankar Road | Shankar Road | 119,540 |
| 15 | Prasad Nagar | South-West | South | Shankar Road | Shankar Road | 232,688 |
| 16 | Roop Nagar | North-West | West | Roop Nagar | Roop Nagar | 616,201 |
| 17 | Narela | North-West | West | Bawana | Roop Nagar | 255,845 |
| 18 | Jahangir Puri | North-West | West | Roop Nagar | Roop Nagar | 670,645 |
| 19 | Borgarh | North-West | West | Bawana | Roop Nagar | 164,633 |
| 20 | DSIDC Bawana | North-West | West | Bawana | Roop Nagar | 26,763 |
| 21 | Bawana | North-West | West | Bawana | Roop Nagar | 140,670 |
| 22 | Rohini - 15 | North-West | West | Rohini | Roop Nagar | 276,515 |
| 23 | Rohini - 5 and Udyognagar | North-West | West | Rohini | Roop Nagar | 1,280,280 |
| 24 | Wazirpur | West | West | Wazirpur | Moti Nagar | 187,031 |
| 25 | Keshavpuram | West | West | Wazirpur | Moti Nagar | 411,424 |
| 26 | Mangolpuri | North-West | West | Rohini | Roop Nagar | 61,718 |
| 27 | Rashtrapati Bhawan | South | New Delhi | Safdarjung | Bhikaji Cama Place | 1,123 |
| 28 | Sarita Vihar | South | South | Mathura Road | Bhikaji Cama Place | 518,809 |
| 29 | Okhla phase 1 | South | South | Mathura Road | Bhikaji Cama Place | 434,454 |
| 30 | Okhla phase 3 | South | South | Bhikaji Cama Place | Bhikaji Cama Place | 14,878 |
| 31 | Nehru Place | South | South | Bhikaji Cama Place | Bhikaji Cama Place | 974,090 |
| 32 | Mathura Road | South | South | Mathura Road | Bhikaji Cama Place | 348,170 |
| 33 | Bhikaji cama place | South | South | Bhikaji Cama Place | Bhikaji Cama Place | 511,301 |
| 34 | Najafgarh | South-West | South | Janakpuri | Shankar Road | 512,508 |
| 35 | Dwaraka sector 6 | South-West | South | Dwaraka | Shankar Road | 411,145 |

| Sl No | FS Names | Division Name | Zone Name | Subdivision Name | Divisional Headquarter | Estimated Pop 2011 |
|---|---|---|---|---|---|---|
| 36 | Janakpuri | South-West | South | Janakpuri | Shankar Road | 1,350,508 |
| 37 | Harinagar | South-West | South | Janakpuri | Shankar Road | 274,278 |
| 38 | Kirtinagar | West | West | Motinagar | Moti Nagar | 175,604 |
| 39 | Jwala Heri | West | West | Jwalapuri | Moti Nagar | 125,736 |
| 40 | Paschim Vihar | West | West | Motinagar | Moti Nagar | 159,808 |
| 41 | Motinagar | West | West | Motinagar | Moti Nagar | 358,411 |
| 42 | Jwalapuri | West | West | Jwalapuri | Moti Nagar | 733,062 |
| 43 | Tikri Kalan | West | West | Jwalapuri | Moti Nagar | 42,691 |
| 44 | Naraina | South-West | South | Shankar Road | Shankar Road | 141,221 |
| 45 | Laxminagar | East | New Delhi | Laxmi Nagar | Laxmi Nagar | 277,949 |
| 46 | Connaught circus and Barakhamba Road | Central | New Delhi | Headquarters | DFS Headquarter | 177,977 |
| 47 | Teliwara | Central | New Delhi | S.P Mukherjee Marg | DFS Headquarter | 45,089 |
| 48 | S.P Mukherjee marg | Central | New Delhi | S.P Mukherjee Marg | DFS Headquarter | 105,771 |
| 49 | CBD Shahdara | East | New Delhi | Shahdara | Laxmi Nagar | 194,616 |
| 50 | Rani Jhansi road | Central | New Delhi | Connaught Place | DFS Headquarter | 238,750 |

*Note:* ***In the above Table, recently operational Udyognagar Fire Station has been shown with Rohini-5 Fire Station (Sr No 23) and DFS Headquarter with Connaught Circus (Sr No 46). FSMA, Rohini is training – cum-support centre that supports during medium and serious fire incidences.***

In all, each Fire Station of DFS is serving about 3.2 Lakhs population.

## 7.1 LULC map of Delhi

Figure 7-3 shows the LULC map of Delhi. From the map, urban, rural, and industrial areas can be seen quite clearly apart from other classes.

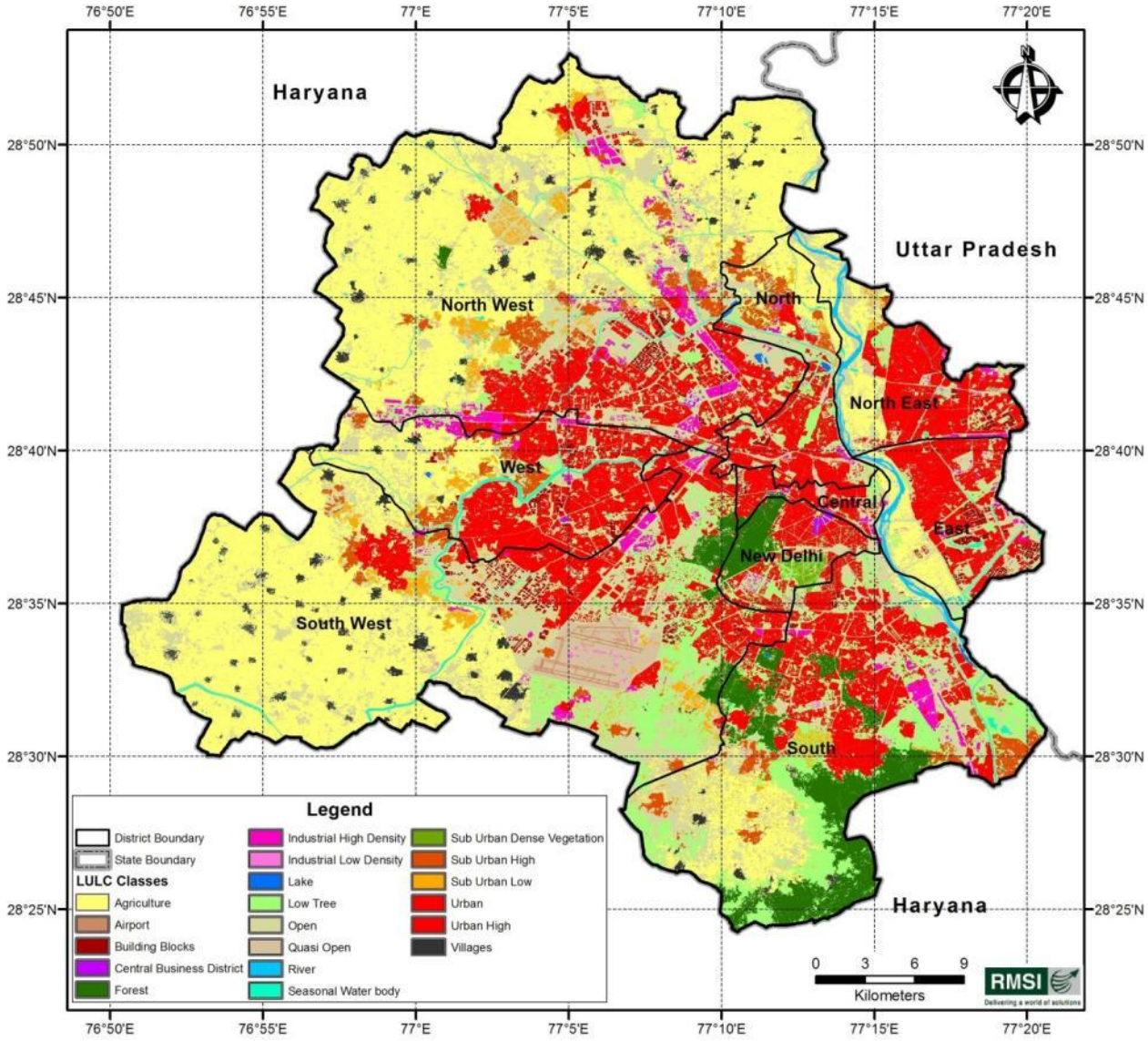


**Figure 7-3: LULC map for Delhi**

**Table 7-2: District name, geographical area and number of Fire Stations in each district**

| District | District Population (2011) | Population Density (2011) | Number of Operational Fire stations |
|---|---|---|---|
| Central | 578,671 | 35,720 | 5 |
| East | 1,707,725 | 25,914 | 6 |
| New Delhi | 133,713 | 3,799 | 6 |
| North | 883,418 | 14,045 | 3 |
| North East | 2,240,749 | 31,208 | 3 |
| North West * | 3,651,261 | 8,134 | 9 |
| South | 2,733,752 | 10,683 | 6 |
| South West | 2,292,363 | 5,575 | 5 |
| West | 2,531,583 | 22,014 | 10 |
| Total | 16,753,235 | 11,297 | 53 |

**: North –West district also have FSMA, Rohini - support centre –cum-training centre.*

## 7.2 Infrastructure Gap Analysis

### 7.2.1 Fire Station Gap Analysis

As discussed in section 6.2.5, taking SFAC norms as a guideline, RMSI analyzed for the requirements of Fire Stations in Delhi (Figure 7-5), keeping a response time of 3-5 minutes, and taking response time in rural area as 20 minutes. From Figure 7-5, it is clear that the locations of existing operational Fire Stations has been selected without much scientific analysis, as there are overlaps in the calculated jurisdiction areas, based on response time of the Fire Stations and there are large areas that are un-served, if the SFAC norms are to be followed in strict accordance in Delhi.

It may be noted that areas served by other agencies, such as Airport, Military Cantonment, Thermal Power Plants have been excluded from the gap analysis, so that there is no duplicity of Fire Stations in those areas. Additionally, areas covered by forest, river, very less inhabited (small pocket of a few houses, say in river channel) etc. have also not been considered in the gap analysis. To make a distinction, the Fire Stations in rural areas are designated as rural Fire Stations/Fire Posts.

Thus, taking the vehicle speeds discussed earlier, and response time as per SFAC norms, Delhi requires an additional **120** Fire Stations in urban areas and **10** rural Fire Stations/Posts in rural areas (Figure 7-5, Table 7-3).

**Table 7-3: Number of operational and additional Fire Stations and Fire Posts required in Delhi**

| Urban | | Rural | |
|---|---|---|---|
| Operational Fire Stations | Additional Fire Stations | Operational Fire Station/ Fire Post | Additional Fire Stations/ Fire Posts |
| **51** | **120** | **1** | **10** |

From the above analyses, it is clear that to meet the response time in urban areas as per SFAC recommendations, the additional required number of Fire Stations will be too high and it will be highly unpractical to set-up so many Fire Stations in Delhi, where land availability in urban areas is scarce. Therefore, to arrive at realistic and practical figures of number of Fire Stations requires a modification to the 3-minute response time.

*As per SFAC norms, one Fire Station is required per 10 sq. km in urban areas and per 50 sq. km in rural areas. This seems to be based on average area per station over a large area/State.*

From the above analysis, the average area per Fire Station in urban areas in Delhi comes to 4.7 sq km, while in rural area; it comes to 62.5 sq km. This analysis also shows that the average Fire Station coverage area in urban areas is too low when compared to the norms specified by SFAC, which is 10 sq km in urban area. Moreover, population covered in such a small area of less than 5 sq km is sometimes very low to justify opening of a new Fire Station, thus contradicting the area based norm of SFAC in urban area. Moreover, additional required number of Fire Stations will be too high and it will be highly unpractical to set-up so many Fire Stations in Delhi, where land availability in urban areas is scarce.

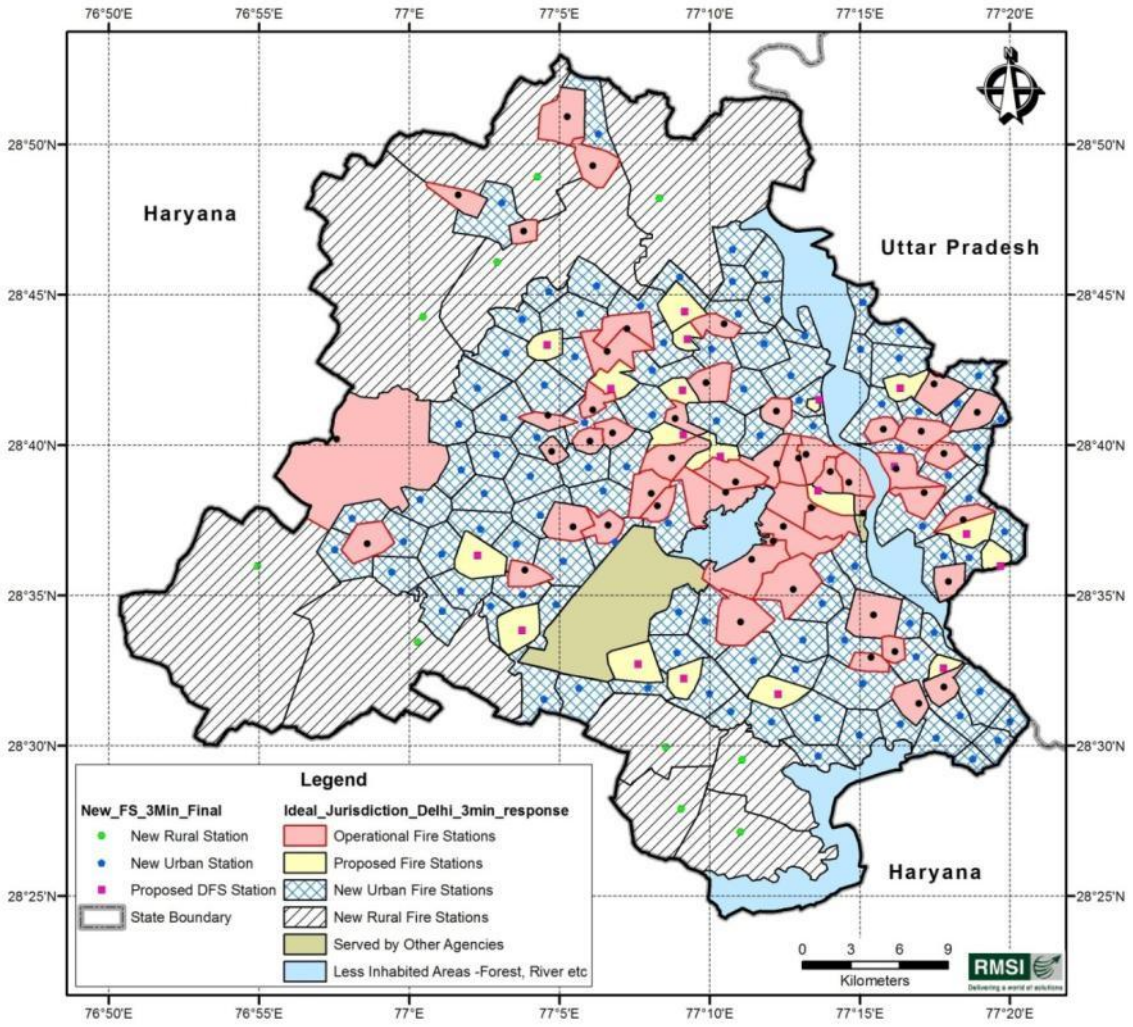


**Figure 7-4: Analysis for the requirement of Fire Stations in Delhi as per existing SFAC norms**

As discussed in section 6.2.5, RMSI proposed to modify the SFAC response time *norms in urban areas based on risk categories as follows:*

***Depending upon the risk category, the recommended response time for first fire tender is 5 - 7 minutes in urban areas.***

Accordingly, analyses have been carried out again with revised response times and are shown in Table 7-4 and Figure 7-5, respectively. More detailed maps of gap analysis are shown Figures 7-6 to 7-9.

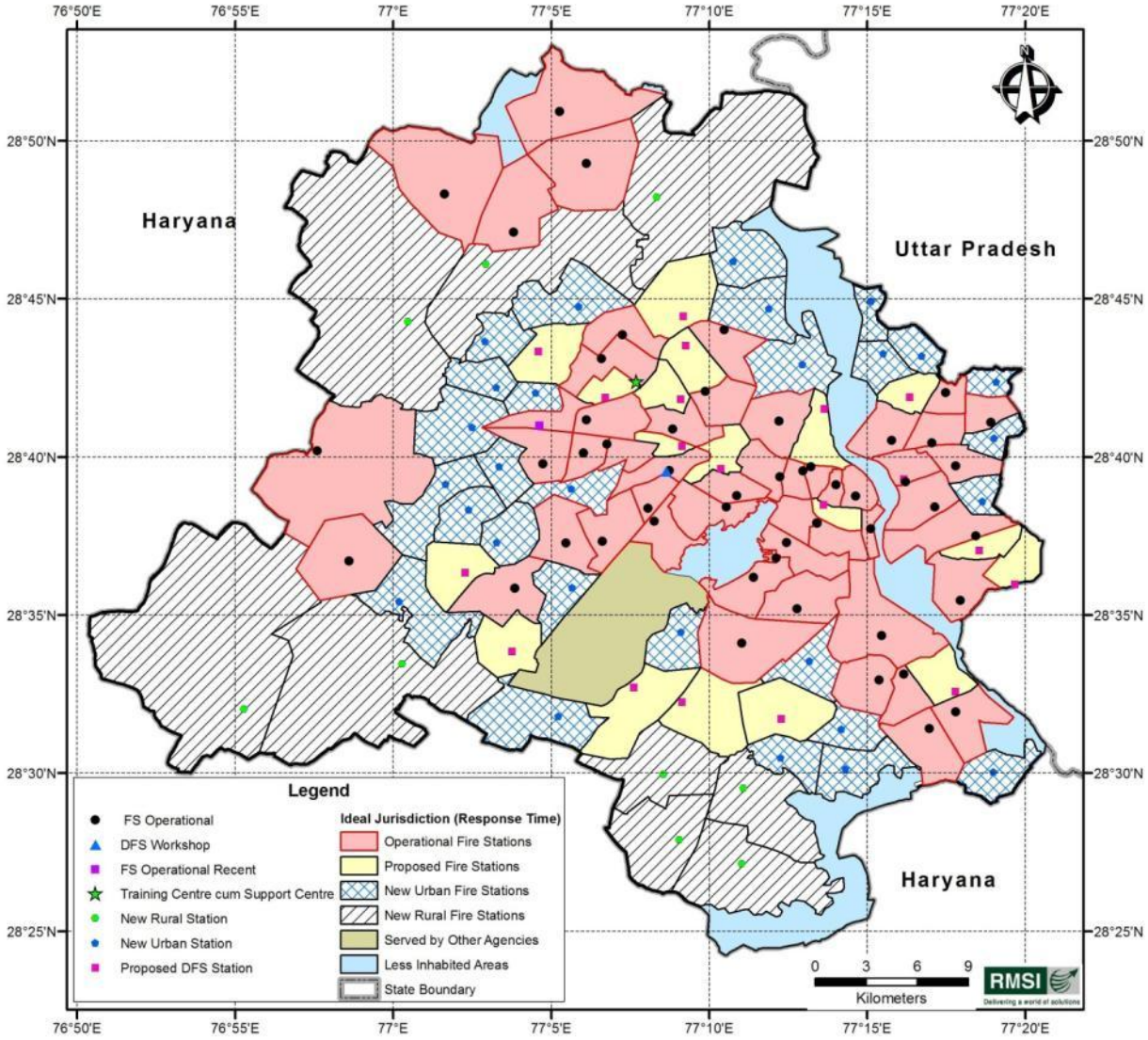


**Figure 7-5: Analysis for the requirement of Fire Stations in Delhi as per revised SFAC norms**

Accordingly, proposed requirement of additional number of Fire Stations in urban and rural areas is shown in Table 7-4.

**Table 7-4: Revised number of operational and additional Fire Stations and Fire Posts required in Delhi State**

| Urban | | Rural | | Total |
|---|---|---|---|---|
| Operational Fire Stations | Additional Fire Stations | Operational Fire Stations/ Fire Posts | Additional Fire Stations/ Fire Posts | |
| **51** | **46** | **1** | **9** | **107** |

Out of the 46 urban Fire Stations proposed, DFS has already proposed for 18 new Fire Stations, which are at different stages of construction (Table 7-5). Thus, this study proposes a further addition of **28 urban Fire Stations** and **9 rural Fire Stations/Posts**, which is an

overall deficiency of **51%** (including 18 Fire Stations proposed by DFS) in terms of number of Fire Stations in Delhi.

From Table 7-6, it can be seen that the average area served with the above modifications comes to 8.38 sq km in urban areas serving an average population of 1, 61,289 and 51.6 sq km in rural areas serving an average population of 97,913 respectively.

**Table 7-5: Proposed Fire Stations at different stages of construction in Delhi State**

| Fire Stations under Construction | | | |
|---|---|---|---|
| **Sr. No.** | **Name of the Site** | **Status** | **Remarks** |
| **1** | Gharoli Chand Cinema | 80% Complete | |
| **2** | Dallupura | 30% Complete | |
| **3** | City Center, MCD | Construction completed by MCD | Ready for possession |
| **Other proposed sites for Fire Stations** | | | |
| **1** | Chandrawal water works | Under process with PWD, Plans cleared, Revised estimate | |
| **2** | Anand Parbat | Under process with PWD, Revised estimate | |
| **3** | Rohini Sector-3 | Land alloted but possession is yet to be given by DDA | |
| **4** | Mahipalpur | Land identified, yet to be alloted | |
| **5** | Jasola Badarpur | Modified Drawings submitted to DDA | |
| **6** | Vasant Kunj | Possession of land is yet to be given by DDA due to encroachment | |
| **7** | Golden Park Rohtak Road | Possession of land is yet to be given by DDA due to encroachment | |
| **8** | Yamuna Vihar | Boundary wall erected, revised estimate is to be submitted by PWD | |
| **9** | Geetanjali Enclave | DMRC vacated the site, Drawings approved, under process with PWD | |
| **10** | Dwaraka Sector-3 | Drawings submitted to DDA, approval awaited | |
| **11** | Dwaraka Sector-20 | Drawings submitted to DDA, approval awaited | |
| **12** | Sanjay Gandhi Transport Nagar | Under process with PWD | |
| **13** | Shalimar Bagh | Land identified, yet to be alloted | |
| **14** | Pitampura | Land identified, yet to be alloted | |
| **15** | Facility Center Geeta Colony | Land alloted but possession is yet to be given by DDA | |
| **16** | Rohini Sector-23 | DDA to allocate and allot land | |

*Note: The proposed Geeta Colony Facility centre (Sr No 15) is about ½ km from the Operational Geeta Colony Fire Station, and has not been considered as a Fire Station in the analysis.*

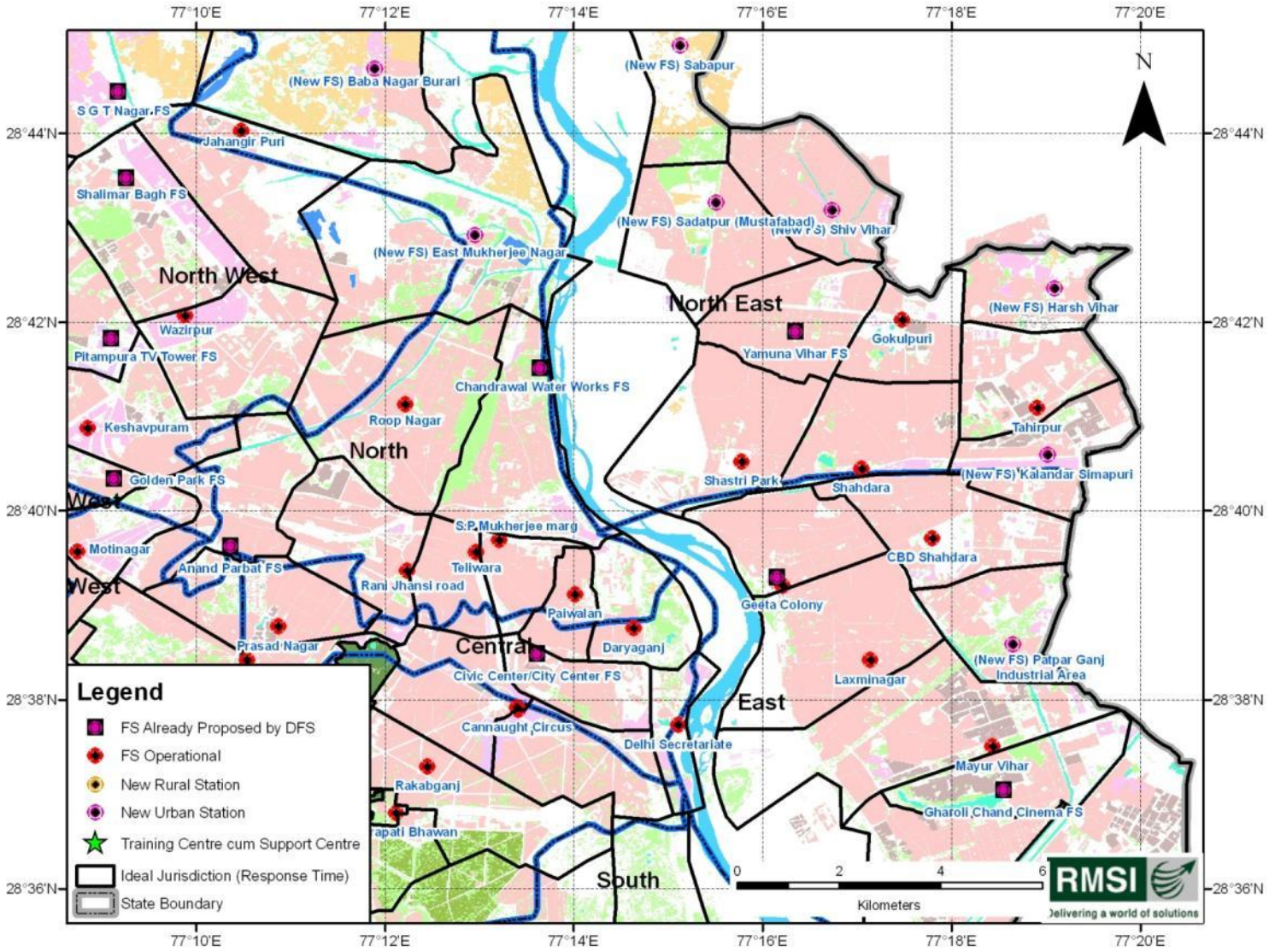


**Figure 7-6: Map showing Fire Stations gap analysis in northern part of Delhi**

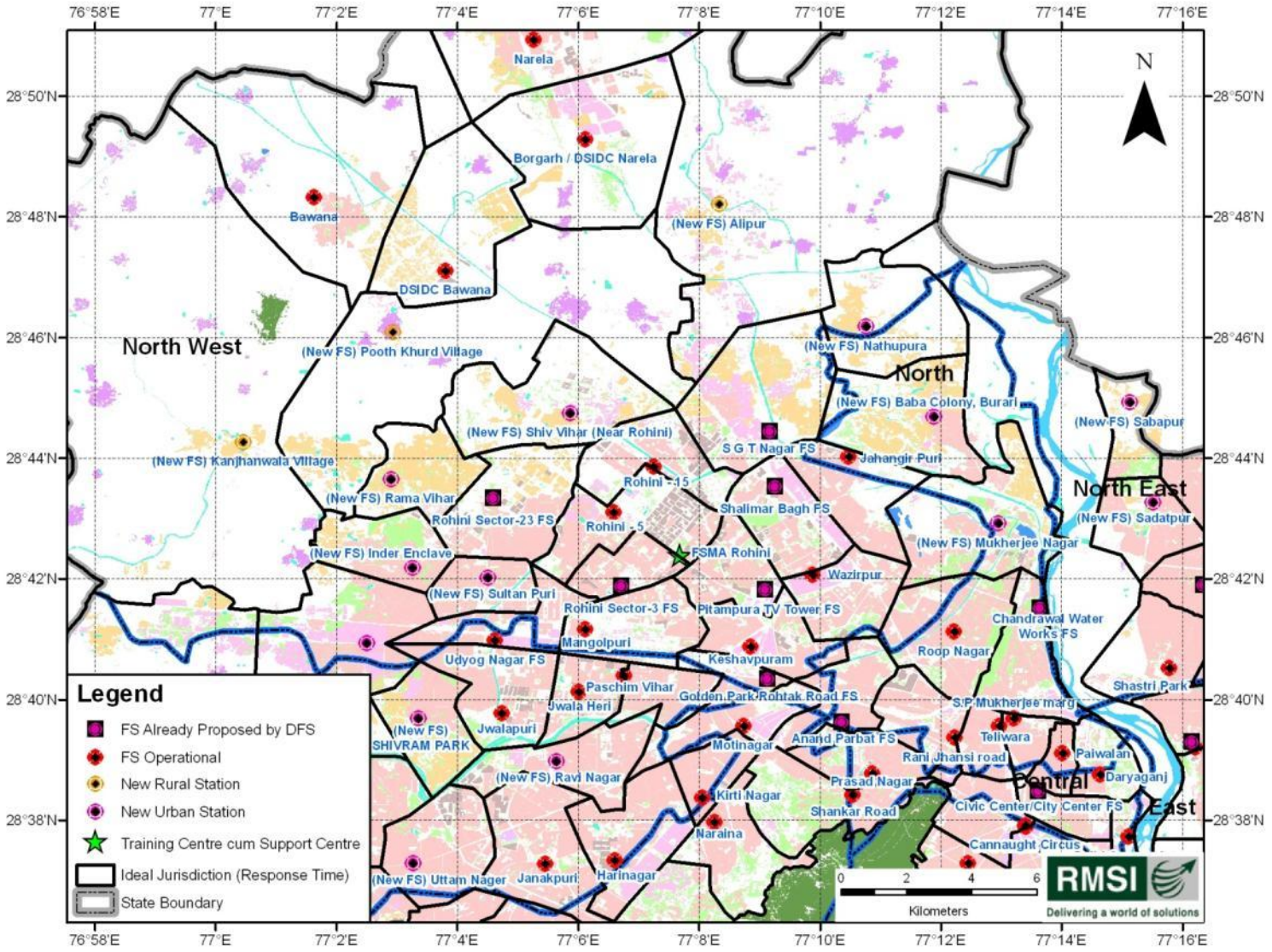


**Figure 7-7: Map showing Fire Stations gap analysis in North, North-West, and Central Delhi**

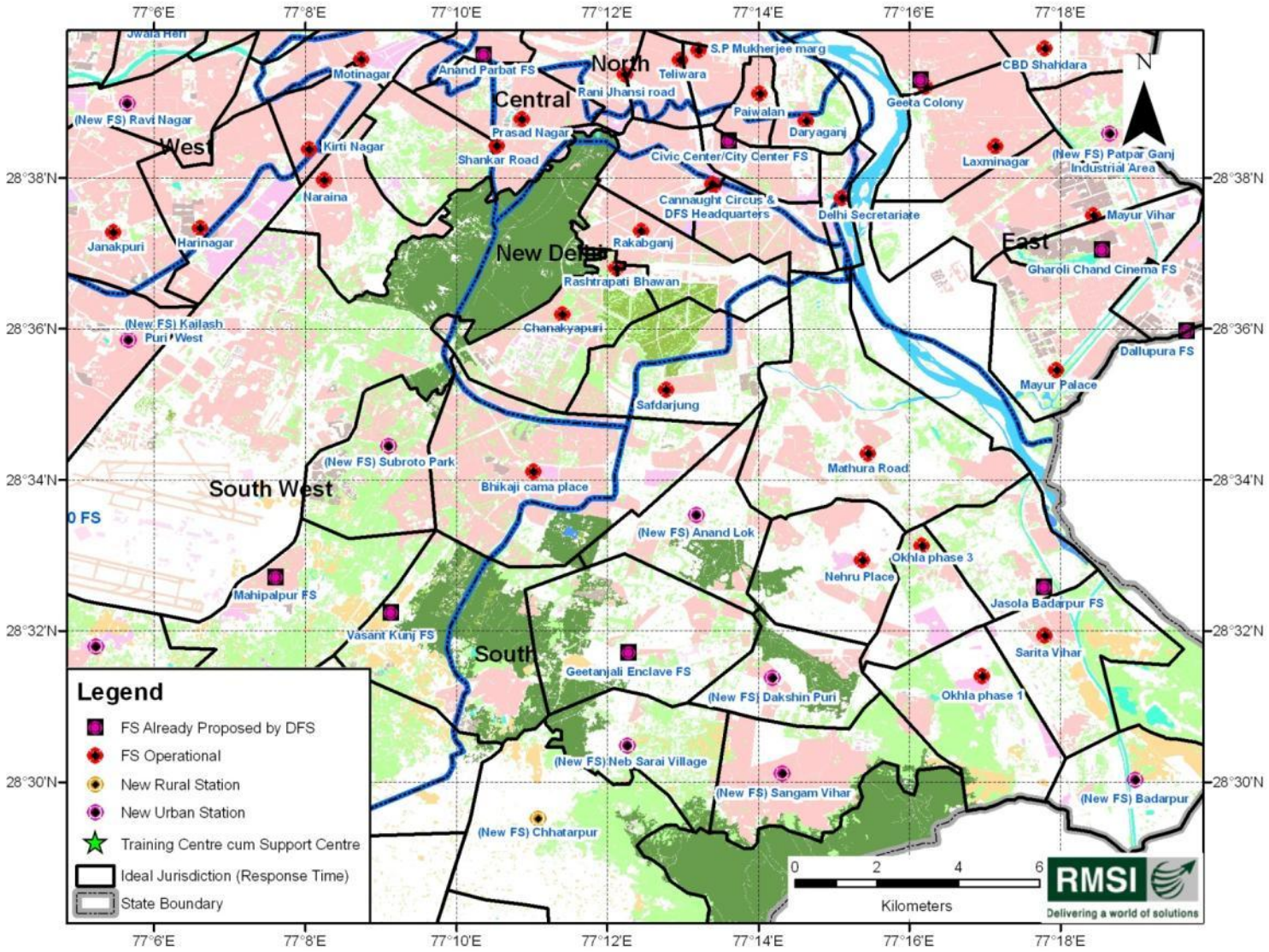


**Figure 7-8: Map showing Fire Stations gap analysis in Central and South Delhi**

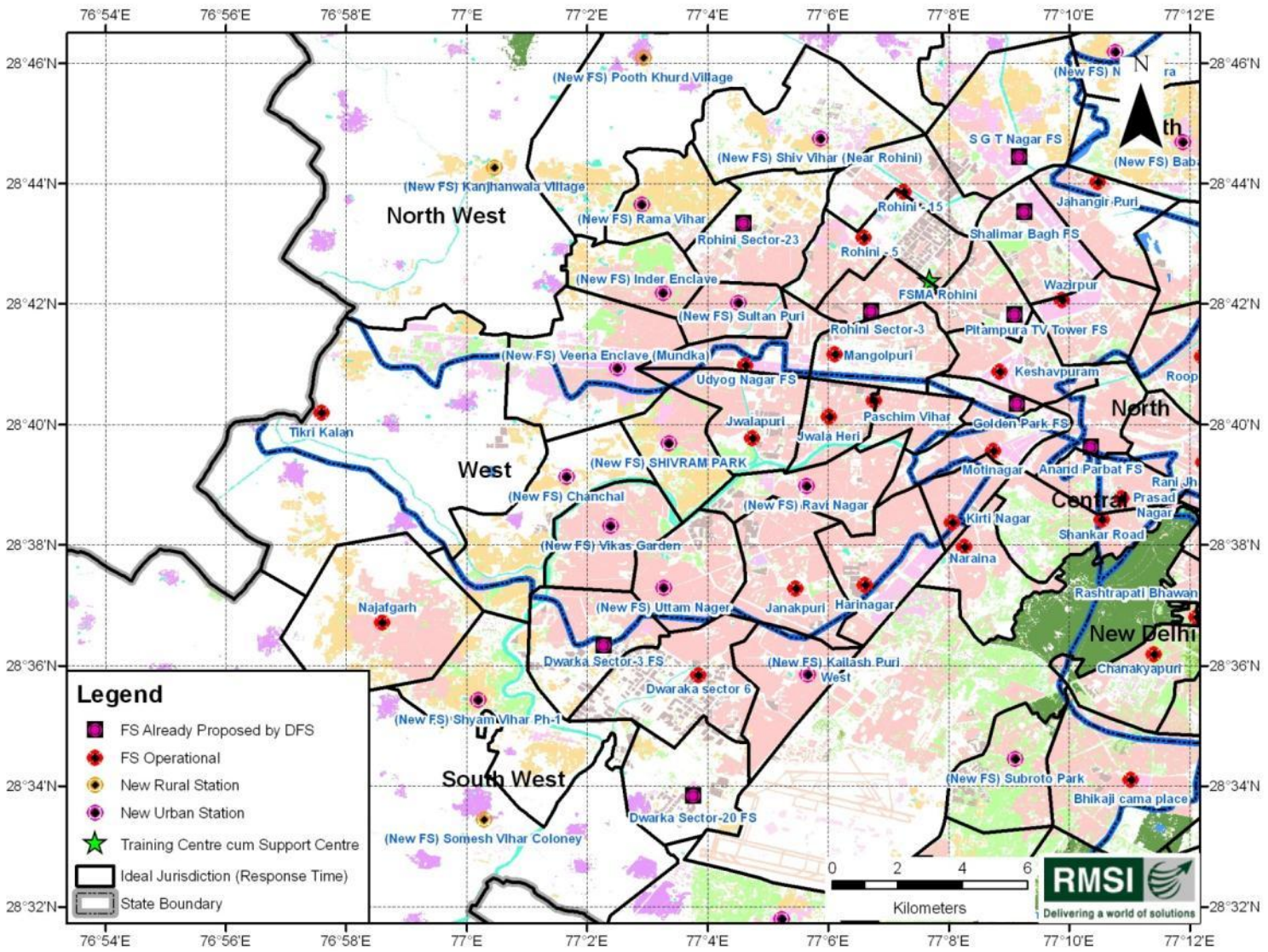


**Figure 7-9: Map showing Fire Stations gap analysis in West and South-West Delhi**

**Table 7-6: Details of operational and additional Fire Stations required for DFS**

| Sr. No. | District | Fire Station/ Post Name | Urban/ Rural | Area SQ KM | Estimated Population (2011) | Fire Station/Post Type |
|---|---|---|---|---|---|---|
| 1 | Central | Delhi Secretariat | U | 2.09 | 3,091 | FS Operational |
| 2 | Central | Civic Center/City Center FS | U | 2.95 | 39,774 | Proposed FS UC |
| 3 | Central | Prasad Nagar | U | 4.90 | 197,232 | FS Operational |
| | | | | | | |
| 4 | East | (New FS) Patpar Ganj Industrial | U | 4.30 | 25,704 | New FS res Urban |
| 5 | East | Gharoli Chand Cinema FS | U | 4.64 | 89,871 | FS Proposed UC |
| 6 | East | Dallupura FS | U | 5.92 | 120,349 | FS Proposed UC |
| 7 | East | CBD Shahdara | U | 5.90 | 197,312 | FS Operational |
| 8 | East | Mayur Palace | U | 9.14 | 200,418 | FS Operational |
| 9 | East | Geeta Colony | U | 4.47 | 252,889 | FS Operational |
| 10 | East | Mayur Vihar | U | 10.74 | 370,178 | FS Operational |
| 11 | East | Laxminagar | U | 7.76 | 425,857 | FS Operational |
| | | | | | | |
| 12 | New Delhi | Rashtrapati Bhawan | U | 0.42 | 1,032 | FS Operational |
| 13 | New Delhi | DFS Headquarter | U | 4.73 | 31,957 | FS Operational |
| 14 | New Delhi | Chanakyapuri | U | 8.18 | 36,049 | FS Operational |
| 15 | New Delhi | Rakabganj | U | 6.72 | 47,466 | FS Operational |
| 16 | New Delhi | Connaught Circus | U | 4.56 | 79,805 | FS Operational |
| | | | | | | |
| 17 | North | Daryaganj | U | 3.73 | 35,595 | FS Operational |
| 18 | North | S.P Mukherjee Marg | U | 2.04 | 59,200 | FS Operational |
| 19 | North | Chanderwal Water Works FS | U | 6.92 | 69,226 | FS Proposed |
| 20 | North | Paiwalan | U | 1.87 | 132,678 | FS Operational |
| 21 | North | Teliwara | U | 2.61 | 134,770 | FS Operational |
| 22 | North | Anand Parbat FS | U | 5.45 | 155,363 | FS Proposed |
| 23 | North | (New FS) Baba Nagar Burari | U | 11.58 | 156,648 | New FS res Urban |
| 24 | North | Rani Jhansi road | U | 5.28 | 161,657 | FS Operational |
| 25 | North | (New FS) East Mukherjee Nagar | U | 13.66 | 170,611 | New FS res Urban |
| 26 | North | Roop Nagar | U | 9.74 | 264,182 | FS Operational |
| | | | | | | |
| 27 | North East | (New FS) Kalandar Simapuri | U | 4.27 | 97,218 | New FS res Urban |
| 28 | North East | Tahirpur | U | 4.40 | 101,167 | FS Operational |
| 29 | North East | (New FS) Sabapur | U | 3.92 | 103,038 | New FS res Urban |
| 30 | North East | Gokulpuri | U | 3.45 | 154,260 | FS Operational |
| 31 | North East | (New FS) Harsh Vihar | U | 3.64 | 185,328 | New FS res Urban |
| 32 | North East | Yamuna Vihar FS | U | 5.07 | 257,889 | FS Proposed |
| 33 | North East | Shahdara | U | 4.96 | 301,186 | FS Operational |
| 34 | North East | Shastri Park | U | 7.50 | 325,371 | FS Operational |
| 35 | North East | (New FS) Sadatpur (Mustafabad) | U | 6.17 | 353,492 | New FS res Urban |
| 36 | North East | (New FS) Shiv Vihar | U | 5.30 | 368,542 | New FS res Urban |
| | | | | | | |

| Sr. No. | District | Fire Station/ Post Name | Urban/ Rural | Area SQ KM | Estimated Population (2011) | Fire Station/Post Type |
|---|---|---|---|---|---|---|
| 37 | North West | Golden Park Rohtak Road FS | U | 2.45 | 56,073 | FS Proposed |
| 38 | North West | (New FS) Pooth Khurd Village | R | 42.32 | 56,295 | New FS res Rural |
| 39 | North West | DSIDC Bawana | U | 15.34 | 63,737 | FS Operational |
| 40 | North West | Bawana | U | 28.86 | 67,854 | FS Operational |
| 41 | North West | Rohini Sector-3 FS | U | 3.90 | 69,353 | FS Proposed |
| 42 | North West | Borgarh / DSIDC Narela | U | 20.60 | 84,444 | FS Operational |
| 43 | North West | Pitampura TV Tower FS | U | 5.16 | 89,116 | FS Proposed |
| 44 | North West | Udyog Nagar FS | U | 5.23 | 95,278 | FS Operational |
| 45 | North West | Rohini - 15 | U | 7.15 | 95,656 | FS Operational |
| 46 | North West | Mangolpuri | U | 7.40 | 104,166 | FS Operational |
| 47 | North West | Wazirpur | U | 6.31 | 105,317 | FS Operational |
| 48 | North West | Shalimar Bagh FS | U | 7.28 | 106,312 | FS Proposed |
| 49 | North West | (New FS) Kanjhanwala Village | R | 94.31 | 107,062 | New FS res Rural |
| 50 | North West | (New FS) Shiv Vihar (Near | U | 14.01 | 111,604 | New FS res Urban |
| 51 | North West | (New FS) Alipur | R | 68.17 | 118,174 | New FS res Rural |
| 52 | North West | (New FS) Nathupura | U | 11.00 | 118,681 | New FS res Urban |
| 53 | North West | (New FS) Inder Enclave | U | 6.55 | 121,292 | New FS res Urban |
| 54 | North West | (New FS) Sultan Puri | U | 4.55 | 143,413 | New FS res Urban |
| 55 | North West | Keshavpuram | U | 6.13 | 166,498 | FS Operational |
| 56* | North West | Rohini - 5 | U | 8.56 | 181,842 | FS Operational |
| 57 | North West | Narela | U | 22.16 | 218,460 | FS Operational |
| 58 | North West | Jahangir Puri | U | 7.29 | 225,287 | FS Operational |
| 59 | North West | (New FS) Rama Vihar | U | 7.06 | 234,935 | New FS res Urban |
| 60 | North West | (New FS) Veena Enclave | U | 14.84 | 238,372 | New FS res Urban |
| 61 | North West | Rohini Sector-23 FS | U | 9.85 | 270,210 | FS Proposed |
| 62 | North West | Sanjay Gandhi Transport Nagar | U | 14.15 | 292,048 | FS Proposed |
| | | | | | | |
| 63 | South | (New FS) Neb Sarai Village | U | 7.75 | 57,022 | New FS res Urban |
| 64 | South | Safdarjung | U | 10.40 | 69,866 | FS Operational |
| 65 | South | Okhla phase 3 | U | 5.08 | 76,662 | FS Operational |
| 66 | South | Okhla phase 1 | U | 10.21 | 78,253 | FS Operational |
| 67 | South | (New FS) R.S.S.B Mehrauli | R | 28.71 | 99,543 | New FS res Rural |
| 68 | South | (New FS) Jaunapur Village | R | 19.84 | 110,780 | New FS res Rural |
| 69 | South | Nehru Place | U | 8.79 | 123,034 | FS Operational |
| 70 | South | Jasola Badarpur FS | U | 6.80 | 123,111 | FS Proposed |
| 71 | South | Vasant Kunj FS | U | 14.66 | 131,660 | FS Proposed |
| 72 | South | (New FS) Anand Lok | U | 8.41 | 148,291 | New FS res Urban |
| 73 | South | Sarita Vihar | U | 9.26 | 158,848 | FS Operational |
| 74 | South | (New FS) Chhatarpur | R | 21.62 | 166,160 | New FS res Rural |
| 75 | South | (New FS) Dakshnipuri | U | 6.75 | 180,572 | New FS res Urban |
| 76 | South | Geetanjali Enclave FS | U | 13.37 | 198,968 | FS Proposed |
| 77 | South | Mathura Road | U | 20.31 | 271,721 | FS Operational |
| 78 | South | (New FS) Sangam Vihar | U | 10.60 | 318,123 | New FS res Urban |
| 79 | South | (New FS) Badarpur | U | 8.29 | 326,113 | New FS res Urban |

| Sr. No. | District | Fire Station/ Post Name | Urban/ Rural | Area SQ KM | Estimated Population (2011) | Fire Station/Post Type |
|---|---|---|---|---|---|---|
| | | | | | | |
| 80 | South West | (New FS) Somesh VIhar Colony | R | 69.90 | 44,444 | New FS res Rural |
| 81 | South West | (New FS) Kapas Hera | U | 17.59 | 50,142 | New FS res |
| 82 | South West | (New FS) Ghumanhera Village | R | 102.91 | 50,628 | New FS res |
| 83 | South West | Mahipalpur FS | U | 15.76 | 72,049 | FS Proposed |
| 84 | South West | (New FS) Shyam Vihar Ph-1 | U | 16.22 | 72,611 | New FS res |
| 85 | South West | (New FS) Subroto Park | U | 8.33 | 72,680 | New FS res |
| 86 | South West | Dwarka Sector-20 FS | U | 9.88 | 77,526 | FS Proposed |
| 87 | South West | (New FS) Ghitorni Village | R | 20.45 | 84,202 | New FS res |
| 88 | South West | Shankar Road | U | 8.31 | 128,396 | FS Operational |
| 89 | South West | Naraina | U | 6.84 | 128,582 | FS Operational |
| 90 | South West | Motinagar | U | 5.40 | 130,326 | FS Operational |
| 91 | South West | Dwarka Sector-3 FS | U | 9.52 | 166,659 | FS Proposed |
| 92 | South West | Bhikaji cama place | U | 18.61 | 228,537 | FS Operational |
| 93 | South West | Dwaraka sector 6 | U | 11.72 | 249,793 | FS Operational |
| 94 | South West | Najafgarh | U | 17.95 | 261,018 | FS Operational |
| 95 | South West | (New FS) Kailash Puri West | U | 7.82 | 347,389 | New FS res |
| | | | | | | |
| 96 | West | Jwala Heri | U | 4.42 | 133,872 | FS Operational |
| 97 | West | Tikri Kalan | R | 47.74 | 141,842 | FS Operational |
| 98 | West | Paschim Vihar | U | 3.87 | 156,668 | FS Operational |
| 99 | West | Kirti Nagar | U | 3.53 | 172,669 | FS Operational |
| 100 | West | (New FS) Chnchal | U | 13.40 | 179,832 | New FS res |
| 101 | West | Jwalapuri | U | 8.37 | 205,425 | FS Operational |
| 102 | West | Janakpuri | U | 10.01 | 212,650 | FS Operational |
| 103 | West | (New FS) Vikas Garden | U | 8.42 | 218,976 | New FS res |
| 104 | West | (New FS) Shivram Park | U | 6.73 | 237,161 | New FS res |
| 105 | West | (New FS) Ravi Nagar | U | 7.58 | 261,534 | New FS res |
| 106 | West | Harinagar | U | 8.78 | 276,559 | FS Operational |
| 107 | West | (New FS) Uttam Nagar | U | 8.21 | 375,404 | New FS res |

**: FSMA, Rohini is training –cum-support centre that supports during medium and serious fire incidences. Hence, while doing gap analysis in terms of fire vehicles and fire equipment, and man-power this has been included in the North-West district.*

#### 7.2.1.1 Fire Fighting and Rescue Vehicles And Equipment Gap

For fire equipment gap analysis at the operational Fire Stations and the additional (new including proposed by DFS, Table 7.6) Fire Stations in urban areas and Fire Stations/Fire Posts in rural areas, the following criteria have been followed, which have been basically taken from SFAC norms and minor changes have been made with expert opinion, for optimization of resources.

1. **Pumping Unit:** For counting of existing pumping units at various DFS Fire Stations, equipment such as Fire Tender, Water Bowser, Water Mist Mini Fire Tender, Foam Tender, Crash Fire Tender, Fire Engine, Jumbo Tanker, and Multi-purpose Tender have been counted as one pumping unit. The SFAC criteria with some modifications have been proposed for estimating the requirement of pumping units. Accordingly, one pumping unit per 50,000 populations (subject to minimum one) up to three Lakhs population has been considered. For population of more than three Lakhs, one additional pumping unit per Lakhs of population has been considered. For example, if the population is 3, 50,000 or more but less than 4, 50,000, there should be 7 pumping units. At Fire Stations, where pumping unit requirements are coming to 2 or more units, half the units will be Water Tender and half the units will be Water Bowser, for example, for 2 pumping unit requirement, one will be Water Tender and one Water Bowser, however, for 3 pumping unit requirement, 2 will be Water Tender and 1 will be Water Bowser.

   **Note:** *we have considered pumping unit as a complete unit with water carrying capacity pumping unit, however, trailer fire pump with towing vehicle or a jeep fire engine, QRT with mist unit, or motor cycle with mist set have not been considered as a pumping unit. QRT with mist unit or motor cycle with mist set has been considered as a unit to cut response time in congested areas in urban areas.*

2. **Foam Tender:** For those Fire Stations, in whose jurisdiction small industrial area also lie, one Water Tender should be replaced with Foam Tender.
3. **DCP Tender:** Minimum one per district or one for 8-10 Fire Stations. Fire stations having a large industrial plot area (in their ideal jurisdiction of above) 1.0 - 3.0 sq km, should have additionally one DCP tender. For industrial areas more than 3.0 sq km to 6.0 sq km, there should be two DCP Tenders and so on.
4. **Advanced Rescue Tender:** One per district (minimum) up to 10 Lakhs population, and one additional unit for every 10 Lakhs urban population.
5. **Hydraulic Platform/ALP/TTL:** One per district depending upon the presence of high-rise buildings (height more than 15 m). Additional unit is to be provided for districts having a large number of such building blocks, i.e., Central Business Districts. It may be noted that Hydraulic Platform/ALP/TTL is not a replacement for in-built systems in high-rise buildings. Moreover, equipment is heavy and maneuvering on roads becomes difficult, where there are overhead electrical lines.
6. **HAZMAT Van:** Hazmat van is used rarely and is a very costly equipment requiring highly trained manpower. Hence, to optimize on resources and manpower, HAZMAT van is not recommended for future procurement in the State. However, for that purpose, an Advanced Rescue Responder is proposed (at Sr. No 4), which will have equipment to handle hazardous material release.
7. **Crash Fire Tender:** Crash fire Tender is not recommended for State Fire Services. Instead, for Fire Stations in the funnel area on either side of the airport, one WT should be replaced with Foam Tender depending upon the State policy.

8. **BA Van, Light Van and Control Van:** One each per district. However, to optimize on resources and manpower, we are proposing a BA Van- cum-Light Van – cum- Control Van.
9. **Hose Tender:** One per district (minimum) or one for 8-10 Fire Stations.
10. **Trailer Pump:** Though Trailer Pumps are prescribed in SFAC norms, it is not recommended for future use, as this needs an additional towing vehicle. In place of this, procurement of Portable Pump are recommended, which will be part of a Fire Tender (**(Specialized Equipment** Sl. No. 12).
11. **QRT:** One each at Fire Stations serving a population density (total population in the FS jurisdiction/area of jurisdiction, in sq km) above 30,000 persons/sq km in metro and big cities, above 15,000 persons/sq km in other cities, or in congested areas based on field-survey

    *Note: The criteria of population density has been relaxed for hilly State from 15,000 person/sq km (in plains) to 5,000 person/sq km in the Fire Station jurisdiction*
12. **Motorcycle with 2 water mist sets:** One each at Fire Stations serving higher population density or in congested areas with each QRT
13. **Ambulance:** It is seen that Ambulance services are also with some of the State fire services and in few other States this is looked after by the Ministry of Health department of the States. In case of Delhi, the ambulance service was initially with Delhi Police then transferred to DFS in the year 1985-86 and then transferred to CATS (Centralized Accident Trauma Service, Ministry of Health).

    It is observed during visit to the Fire Stations by the RMSI team that wherever the Ambulance are available with fire services, they neither have the Paramedic staff, nor adequate life support/normal equipment, and cannot be considered as an efficient system. It is therefore felt that either ambulance service should be run by Health Department through various hospitals / health centers or provide fully trained staff to fire services with properly equipped Ambulances. Accordingly, cost of the ambulance is not included in the gap analysis of the present study. However, the ambulance cost may be added, in case, it is decided in a particular State that Ambulance service should be part of fire services.
14. **Educational Van**: One per district and one additional unit for every 30 Lakhs district population

At rural Fire Station/ Fire Post level, if the estimated pumping units is two, then one water tender with a QRT on pickup truck having 500 - 600 liters of water mist capacity along with a motor cycle with two water mist backpacks will be provided. This will help in quick response, as a majority of inside roads within rural villages is narrow in width and congested. This will also help in optimization of resources.

*It may be noted that if a fire is responded to immediately, it may not flare-up into large fire; hence, QRT and Motorcycle are considered as a quick responder and not as full-fledged fire units. In case of large fires, nearby Fire Station(s) will provide support with Water Tenders and Water Bowsers.*

***For reserve requirements, RMSI estimated reserve requirement of 20% at the district level for new proposed Fire Stations. The replacement of condemned / major repair (off road) vehicles from operating Fire Stations can be accounted as reserve, and these will be distributed to individual Fire Stations by the concerned fire officials.*** This will help in optimizing the additional requirements of minimum of one reserve at each Fire Station.

Accordingly, fire fighting vehicles available with DFS and gaps in the existing and ideally proposed Fire Stations in all the districts have been estimated and are shown in Tables 7.7, 7.8, 7.9 and 7.10 respectively.

**Table 7-7: List of operational fire fighting and rescue vehicles available with DFS (As on Aug-Sep, 2011)**

| District | Fire Stations | Ideally Served Population Estimates | Water Tenders | Water Bowsers | Foam Tenders | Advanced Rescue Responders | Hydraulic Platform / Sky Lifts / TTL | DCP Tenders | Hose Tenders | BA Vans | Hazmat Vans | QRT | Motor Cycle Mists | Fire Boats | Ambulances | Education Vans | Total Vehicles |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Central | 5 | 196,309 | 6 | 5 | 1 | 0 | 2 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 17 |
| East | 6 | 1,747,840 | 11 | 6 | 1 | 2 | 0 | 1 | 0 | 1 | 1 | 1 | 2 | 0 | 0 | 0 | 26 |
| New Delhi | 6 | 658,649 | 9 | 4 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 18 |
| North | 3 | 458,152 | 5 | 2 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 12 |
| North East | 3 | 580,798 | 4 | 3 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 |
| North West | 9 | 1,042,597 | 13 | 7 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 26 |
| South | 6 | 778,384 | 10 | 6 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 0 | 0 | 0 | 28 |
| South West | 5 | 1,009,772 | 6 | 9 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 17 |
| West | 10 | 1,654,111 | 15 | 6 | 0 | 1 | 0 | 2 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 27 |
| **Total** | **53** | **8,126,612** | **79** | **48** | **6** | **7** | **6** | **4** | **5** | **4** | **3** | **7** | **10** | **0** | **0** | **0** | **179** |

*: includes FSMA Training cum-support centre

*Note: Total number of water Tender and water Bowser sanctioned are more than the number shown above, as a few fire fighting vehicles, which are under condemnation are not included here.*

**Table 7-8: Gap in fire fighting and rescue vehicles in operational Fire Stations (As on Aug-Sep, 2011)**

| District | Fire Stations | Ideally Served Population Estimates | Water Tenders | Water Bowsers | Foam Tenders | Advanced Rescue Responders | Hydraulic Platform / Sky Lifts / TTL | DCP Tenders | Hose Tenders | BA Vans | Hazmat Vans | QRT | Motor Cycle Mists | Fire Boats | Ambulances | Education Vans | Total Vehicles |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Central | 5 | 196,309 | -1 | -5 | 0 | 1 | -1 | 1 | 1 | 1 | 0 | -1 | -1 | 0 | 0 | 1 | -4 |
| East | 6 | 1,747,840 | 5 | 7 | 3 | 1 | 2 | 1 | 2 | 1 | 0 | 4 | 3 | 0 | 0 | 2 | 31 |

| District | Fire Stations | Ideally Served Population Estimates | Water Tenders | Water Bowsers | Foam Tenders | Advanced Rescue Responders | Hydraulic Platform / Sky Lifts / TTL | DCP Tenders | Hose Tenders | BA Vans | Hazmat Vans | QRT | Motor Cycle Mists | Fire Boats | Ambulances | Education Vans | Total Vehicles |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| New Delhi | 6 | 658,649 | -1 | 1 | 2 | 1 | 0 | 1 | 2 | 2 | 0 | 3 | 1 | 0 | 0 | 2 | 14 |
| North | 3 | 458,152 | 0 | 0 | 1 | 0 | 0 | 0 | -1 | 0 | 0 | 0 | -1 | 0 | 0 | 0 | -1 |
| North East | 3 | 580,798 | 1 | 1 | 2 | 0 | 0 | 0 | -1 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 7 |
| North West | 9 | 1,042,597 | 0 | -4 | 5 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 6 |
| South | 6 | 778,384 | -3 | -3 | 3 | 0 | 0 | 2 | 0 | 0 | 0 | -2 | -1 | 0 | 0 | 0 | -4 |
| South West | 5 | 1,009,772 | 3 | -1 | 4 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 8 |
| West | 10 | 1,654,111 | 1 | 4 | 7 | 2 | 0 | 1 | -1 | 1 | 0 | -1 | 0 | 0 | 0 | 1 | 15 |
| **Total** | **53** | **8,126,612** | **5** | **0** | **27** | **5** | **2** | **7** | **3** | **6** | **0** | **6** | **4** | **0** | **0** | **7** | **72** |

*: includes FSMA Training cum-support centre

**Table 7-9: Total Gap in fire fighting and rescue vehicles in operational and new urban Fire Stations**

| District | Fire Stations | Ideally Served Population Estimates | Water Tenders | Water Bowsers | Foam Tenders | Advanced Rescue Responders | Hydraulic Platform / Sky Lifts / TTL | DCP Tenders | Hose Tenders | BA Vans | Hazmat Vans | QRT | Motor Cycle Mists | Fire Boats | Ambulances | Education Vans | Total Vehicles |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Central | 6 | 236,083 | 0 | -5 | 0 | 1 | -1 | 1 | 1 | 1 | 0 | -1 | -1 | 0 | 0 | 1 | -3 |
| East | 9 | 1,983,764 | 8 | 8 | 5 | 1 | 2 | 1 | 2 | 1 | 0 | 4 | 3 | 0 | 0 | 2 | 37 |
| New Delhi | 6 | 658,649 | -1 | 1 | 2 | 1 | 0 | 1 | 2 | 2 | 0 | 3 | 1 | 0 | 0 | 2 | 14 |
| North | 7 | 1,010,000 | 6 | 3 | 4 | 0 | 0 | 0 | -1 | 0 | 0 | 0 | -1 | 0 | 0 | 0 | 11 |
| North East | 9 | 1,946,305 | 19 | 9 | 8 | 1 | 0 | 0 | -1 | 0 | 0 | 6 | 6 | 0 | 0 | 0 | 48 |

| District | Fire Stations | Ideally Served Population Estimates | Water Tenders | Water Bowsers | Foam Tenders | Advanced Rescue Responders | Hydraulic Platform / Sky Lifts / TTL | DCP Tenders | Hose Tenders | BA Vans | Hazmat Vans | QRT | Motor Cycle Mists | Fire Boats | Ambulances | Education Vans | Total Vehicles |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North West | 21 | 2,894,006 | 26 | 6 | 13 | 1 | 1 | 2 | 2 | 2 | 0 | 3 | 3 | 0 | 0 | 1 | 60 |
| South | 14 | 2,262,244 | 17 | 5 | 10 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 36 |
| South West | 12 | 1,868,828 | 15 | 3 | 6 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 29 |
| West | 15 | 2,927,018 | 18 | 13 | 11 | 2 | 0 | 1 | -1 | 1 | 0 | -1 | 0 | 0 | 0 | 1 | 45 |
| **Total** | **99** | **15,786,897** | **108** | **43** | **59** | **8** | **3** | **8** | **4** | **7** | **0** | **15** | **13** | **0** | **0** | **9** | **277** |

*: includes FSMA Training cum-support centre

**Table 7-10: Additional fire fighting and rescue vehicles required at new rural Fire Stations**

| District | Fire Stations | Ideally Served Population Estimates | Water Tenders | Water Bowsers | Foam Tenders | Advanced Rescue Responders | Hydraulic Platform / Sky Lifts / TTL | DCP Tenders | Hose Tenders | BA Vans | Hazmat Vans | QRT | Motor Cycle Mists | Fire Boats | Ambulances | Education Vans | Total Vehicle |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Central | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| East | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| New Delhi | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| North | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| North East | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| North West | 3 | 281,531 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 3 | 0 | 0 | 0 | 8 |
| South | 3 | 376,483 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 3 | 0 | 0 | 0 | 11 |

| District | Fire Stations | Ideally Served Population Estimates | Water Tenders | Water Bowsers | Foam Tenders | Advanced Rescue Responders | Hydraulic Platform / Sky Lifts / TTL | DCP Tenders | Hose Tenders | BA Vans | Hazmat Vans | QRT | Motor Cycle Mists | Fire Boats | Ambulances | Education Vans | Total Vehicle |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| South West | 3 | 179,274 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 0 | 0 | 0 | 8 |
| West | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total** | **9** | **837,288** | **12** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **6** | **9** | **0** | **0** | **0** | **27** |

*: includes FSMA Training cum-support centre

**Specialized Firefighting Equipment:**

Specialized firefighting equipment for Fire Stations in urban areas shall be provided as per the following criteria:

1. **Hydraulic Rescue Tool:** One for each Fire Station depending upon the seismic Zone IV and V, or Fire Station having urban population more than 1.5 Lakhs in its ideal jurisdiction including Hydraulic Cutter, Hydraulic Spreader, Hydraulic Pump, Power Wedge, and Hydraulic Rescue Ram depending upon the seismic Zone IV and V.
2. **Combi-Tool:** One Combi-Tool set shall be provided with each fire fighting vehicle.
3. **B.A. Set with BA Compressor:** Four B. A. Sets per fire fighting vehicle with minimum 1 compressor per Fire Station
4. **First Aid Box:** One for each fire fighting vehicle (minimum 2 at each Fire Station) with regular replacement of expired medicines
5. **Thermal Imaging Camera:** One for each Fire Station depending upon the seismic Zone IV and V, or Fire Station having urban population more than 1.5 Lakhs in its ideal jurisdiction
6. **Personal Protection Equipment (PPE):** One Set for each pumping unit or a minimum of 2 for each Fire Station
7. **Hydraulic Chain Saw/Cutter for Wood:** One for each Fire Station
8. **Electric/Petrol Chain Saw/Cutter for Wood:** One for each Fire Station
9. **Electric/Petrol Chain Saw/Cutter for Concrete:** One for each Fire Station
10. **Hand Held Gas Detector:** One piece per Vehicle
11. **Victim Location Device (Acoustic**): One for each Fire Station depending upon the seismic Zone IV and V, or Fire Station having urban population more than 1.5 Lakhs in its ideal jurisdiction
12. **Smoke Exhauster/PPV:** One per Fire Stations located in urban areas (minimum one per district)
13. **Portable Pump:** One for each fire fighting unit
14. **Pneumatic Lifting Bags:** One for each Fire Station depending upon the seismic Zone IV and V, or Fire Station having urban population more than 1.5 Lakhs in its ideal jurisdiction
15. **Inflatable Lighting Tower:** One per Fire Station
16. **High Capacity LED Torch Light:** One piece per vehicle

Note: Other smaller equipment such as ropes, Fireman Axe, Small Hammer, different Branches/Nozzles, Foam Compound has not been mentioned separately, as these are standard items for any Fire Station/post.

For rural Fire Stations/ Fire Posts, following specialized equipment has been recommended:

1. **B.A. Set with BA Compressor:** Two B. A. set per QRT and four B.A. Sets per fire fighting vehicle with one compressor per Fire Station/post
2. **Personal Protection Equipment (PPE):** One set per fire fighting vehicle
3. **Electric/Petrol Chain Saw/Cutter for Wood:** One per Fire Station/post
4. **Hydraulic Chain Saw/Cutter for Wood:** One per Fire Station/post

5. **Portable Pump:** One for each fire fighting unit
6. **Inflatable Lighting Tower:** One per Fire Station
7. **High Capacity LED Torch Light:** One piece per fire fighting vehicle
8. **First Aid Box:** One per fire fighting vehicle

***For reserve requirement, RMSI estimated reserve requirement of 20% at district level, and these will be distributed to individual Fire Stations by the concerned fire officials.*** This will help in optimizing the additional requirements of minimum one reserve at each Fire Station.

**Communication Equipment:**

For better coordination between Fire Station and fire fighting staff, communication plays an important role. Hence, there is a need that each fire vehicle and Fire Station is equipped with a communication device. Accordingly, following communication equipment for urban Fire Station are recommended:

1. **Static Wireless Set (VHF):** One set at each Fire Station
2. **Mobile Wireless Set (VHF):** One per vehicle including QRT
3. **Walky-Talky:** One per vehicle
4. **Megaphone:** One set per Fire Station/post

Additionally, at each rural Fire Post, each QRT should be equipped with one mobile wireless set and one walky-talky.

Accordingly, specialized fire equipment and communication equipment available with DFS and gap analysis for all the districts in Delhi has been carried out and is shown Tables 7.11,7.12, 7.13, and 7.14.

**Table 7-11: List of major specialized firefighting equipment available with DFS (As on Aug-Sep, 2011)**

| District | Fire Stations | Ideally Served Population Estimates | Hydraulic Rescue Tools | Combi Tools | B.A. Sets | BA Compressors | First-Aid Boxes | Thermal Imaging Cameras | Electric Chain Saws / Cutters / Hammers for Concrete | Electric Chain Saws / Cutters/ Hammers for Wood | Hydraulic / Manual Chain Saws / Cutters for Wood | Personal Protection Equipment | Hand Held Gas Detector Kits | Life Locator Equipment | Portable Pumps | Floating Pumps |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Central | 5 | 196,309 | 0 | 0 | 80 | 0 | 1 | 1 | 2 | 1 | 0 | 82 | 0 | 0 | 0 | 0 |
| East | 6 | 1,747,840 | 0 | 0 | 125 | 0 | 5 | 2 | 5 | 2 | 0 | 35 | 1 | 0 | 0 | 0 |
| New Delhi | 6 | 658,649 | 0 | 0 | 68 | 0 | 3 | 0 | 3 | 1 | 0 | 1 | 0 | 1 | 0 | 0 |
| North | 3 | 458,152 | 0 | 0 | 43 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| North East | 3 | 580,798 | 0 | 0 | 11 | 0 | 2 | 0 | 3 | 0 | 0 | 15 | 0 | 0 | 0 | 0 |
| North West | 9 | 1,042,597 | 0 | 5 | 125 | 0 | 4 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| South | 6 | 778,384 | 0 | 0 | 109 | 0 | 6 | 1 | 10 | 0 | 0 | 5 | 5 | 0 | 1 | 0 |
| South West | 5 | 1,009,772 | 0 | 2 | 88 | 0 | 2 | 0 | 0 | 0 | 2 | 4 | 0 | 0 | 0 | 0 |
| West | 10 | 1,654,111 | 0 | 3 | 79 | 0 | 5 | 0 | 4 | 0 | 0 | 3 | 0 | 0 | 0 | 0 |
| **Total** | **53** | **8,126,612** | **0** | **10** | **728** | **0** | **29** | **4** | **27** | **5** | **2** | **145** | **6** | **1** | **1** | **0** |

**Contd…..**

| District | Fire Stations | Ideally Served Population Estimates | Diving Suits (Dry Type) | Diving Suits (Wet Type) | Inflatable Lighting Towers | Smoke Exhausters / PPV | Pneumatic lifting bags | High Capacity LED Torches | Rescue Boats | Static Wireless Sets | Mobile Wireless Sets | Walky Talky | Mega Phones | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Central | 5 | 196,309 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 9 | 12 | 0 | 193 |
| East | 6 | 1,747,840 | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 5 | 15 | 13 | 0 | 214 |

| District | Fire Stations | Ideally Served Population Estimates | Diving Suits (Dry Type) | Diving Suits (Wet Type) | Inflatable Lighting Towers | Smoke Exhausters / PPV | Pneumatic lifting bags | High Capacity LED Torches | Rescue Boats | Static Wireless Sets | Mobile Wireless Sets | Walky Talky | Mega Phones | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| New Delhi | 6 | 658,649 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 2 | 8 | 5 | 0 | 96 |
| North | 3 | 458,152 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 2 | 3 | 3 | 0 | 56 |
| North East | 3 | 580,798 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 3 | 0 | 38 |
| North West | 9 | 1,042,597 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 9 | 11 | 10 | 0 | 166 |
| South | 6 | 778,384 | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 6 | 9 | 6 | 0 | 164 |
| South West | 5 | 1,009,772 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 7 | 6 | 0 | 116 |
| West | 10 | 1,654,111 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 9 | 15 | 9 | 0 | 129 |
| **Total** | **53** | **8,126,612** | **0** | **0** | **0** | **0** | **19** | **0** | **4** | **44** | **80** | **67** | **0** | **1,172** |

*: includes FSMA Training cum-support centre

**Table 7-12: Gap in major specialized firefighting equipment in operational Fire Stations (As on Aug-Sep, 2011)**

| District | Fire Stations | Ideally Served Population Estimates | Hydraulic Rescue Tools | Combi Tools | B.A. Sets | BA Compressors | First-Aid Boxes | Thermal Imaging Cameras | Electric Chain Saws / Cutters / Hammers for Concrete | Electric Chain Saws / Cutters/ Hammers for Wood | Hydraulic / Manual Chain Saws / Cutters for Wood | Personal Protection Equipment | Hand Held Gas Detector Kits | Life Locator Equipment | Portable Pumps | Floating Pumps |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Central | 5 | 196,309 | 6 | 7 | -51 | 6 | 17 | 5 | 4 | 5 | 6 | -70 | 11 | 6 | 6 | 0 |
| East | 6 | 1,747,840 | 9 | 39 | 43 | 9 | 45 | 7 | 4 | 7 | 9 | 7 | 50 | 9 | 32 | 0 |
| New Delhi | 6 | 658,649 | 10 | 22 | 20 | 9 | 30 | 9 | 6 | 8 | 9 | 22 | 30 | 8 | 14 | 0 |
| North | 3 | 458,152 | 3 | 11 | 3 | 4 | 12 | 4 | 4 | 4 | 4 | 13 | 12 | 4 | 7 | 0 |

| District | Fire Stations | Ideally Served Population Estimates | Hydraulic Rescue Tools | Combi Tools | B.A. Sets | BA Compressors | First-Aid Boxes | Thermal Imaging Cameras | Electric Chain Saws / Cutters / Hammers for Concrete | Electric Chain Saws / Cutters/ Hammers for Wood | Hydraulic / Manual Chain Saws / Cutters for Wood | Personal Protection Equipment | Hand Held Gas Detector Kits | Life Locator Equipment | Portable Pumps | Floating Pumps |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North East | 3 | 580,798 | 4 | 14 | 49 | 4 | 12 | 4 | 1 | 4 | 4 | 0 | 14 | 4 | 9 | 0 |
| North West | 9 | 1,042,597 | 7 | 26 | -13 | 11 | 34 | 7 | 12 | 11 | 12 | 29 | 36 | 7 | 16 | 0 |
| South | 6 | 778,384 | 9 | 18 | -39 | 9 | 23 | 8 | -1 | 9 | 9 | 14 | 21 | 9 | 9 | 0 |
| South West | 5 | 1,009,772 | 4 | 24 | 15 | 6 | 24 | 4 | 6 | 6 | 4 | 20 | 26 | 4 | 17 | 0 |
| West | 10 | 1,654,111 | 13 | 37 | 79 | 12 | 46 | 12 | 8 | 12 | 12 | 38 | 49 | 12 | 26 | 0 |
| **Total** | **53** | **8,126,612** | **65** | **198** | **106** | **70** | **243** | **60** | **44** | **66** | **69** | **73** | **249** | **63** | **136** | **0** |

**Contd……..**

| District | Fire Stations | Ideally Served Population Estimates | Diving Suits (Dry Type) | Diving Suits (Wet Type) | Inflatable Lighting Towers | Smoke Exhausters / PPV | Pneumatic lifting bags | High Capacity LED Torches | Rescue Boats | Static Wireless Sets | Mobile Wireless Sets | Walky Talky | Mega Phones | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Central | 5 | 196,309 | 0 | 0 | 5 | 5 | 6 | 14 | 0 | 0 | 3 | -2 | 6 | -5 |
| East | 6 | 1,747,840 | 0 | 0 | 6 | 6 | 3 | 56 | 0 | 1 | 34 | 20 | 9 | 405 |
| New Delhi | 6 | 658,649 | 0 | 0 | 6 | 6 | 5 | 34 | 0 | 4 | 19 | 12 | 9 | 292 |
| North | 3 | 458,152 | 0 | 0 | 3 | 3 | 4 | 13 | 0 | 1 | 7 | 7 | 4 | 127 |
| North East | 3 | 580,798 | 0 | 0 | 3 | 3 | 4 | 16 | 0 | 2 | 10 | 8 | 4 | 173 |
| North West | 9 | 1,042,597 | 0 | 0 | 9 | 9 | 9 | 34 | 0 | 0 | 18 | 15 | 12 | 301 |

| District | Fire Stations | Ideally Served Population Estimates | Diving Suits (Dry Type) | Diving Suits (Wet Type) | Inflatable Lighting Towers | Smoke Exhausters / PPV | Pneumatic lifting bags | High Capacity LED Torches | Rescue Boats | Static Wireless Sets | Mobile Wireless Sets | Walky Talky | Mega Phones | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| South | 6 | 778,384 | 0 | 0 | 6 | 6 | 3 | 29 | 0 | 0 | 14 | 10 | 9 | 175 |
| South West | 5 | 1,009,772 | 0 | 0 | 5 | 4 | 4 | 27 | 0 | 0 | 16 | 15 | 6 | 237 |
| West | 10 | 1,654,111 | 0 | 0 | 10 | 10 | 10 | 47 | 0 | 1 | 26 | 24 | 12 | 496 |
| **Total** | **53** | **8,126,612** | **0** | **0** | **53** | **52** | **48** | **270** | **0** | **9** | **147** | **109** | **71** | **2,201** |

*: includes FSMA Training cum-support centre

**Table 7-13: Total gap in specialized equipment for operational and new urban Fire Stations**

| District | Fire Stations | Ideally Served Population Estimates | Hydraulic Rescue Tools | Combi Tools | B.A. Sets | BA Compressors | First-Aid Boxes | Thermal Imaging Cameras | Electric Chain Saws / Cutters / Hammers for Concrete | Electric Chain Saws / Cutters/ Hammers for Wood | Hydraulic / Manual Chain Saws / Cutters for Wood | Personal Protection Equipment | Hand Held Gas Detector Kits | Life Locator Equipment | Portable Pumps | Floating Pumps |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Central | 6 | 236,083 | 7 | 8 | -46 | 7 | 20 | 6 | 5 | 6 | 7 | -67 | 13 | 7 | 8 | 0 |
| East | 9 | 1,983,764 | 12 | 47 | 73 | 12 | 54 | 10 | 7 | 10 | 12 | 14 | 57 | 12 | 38 | 0 |
| New Delhi | 6 | 658,649 | 10 | 22 | 20 | 9 | 30 | 9 | 6 | 8 | 9 | 22 | 30 | 8 | 14 | 0 |
| North | 7 | 1,010,000 | 7 | 24 | 59 | 8 | 24 | 8 | 8 | 8 | 8 | 27 | 23 | 8 | 17 | 0 |
| North East | 9 | 1,946,305 | 10 | 52 | 211 | 10 | 46 | 10 | 7 | 10 | 10 | 36 | 48 | 10 | 35 | 0 |
| North West | 21 | 2,894,006 | 16 | 75 | 207 | 26 | 85 | 17 | 26 | 25 | 26 | 87 | 83 | 17 | 52 | 0 |
| South | 14 | 2,262,244 | 17 | 60 | 137 | 17 | 55 | 16 | 7 | 17 | 17 | 58 | 57 | 17 | 37 | 0 |

| District | Fire Stations | Ideally Served Population Estimates | Hydraulic Rescue Tools | Combi Tools | B.A. Sets | BA Compressors | First-Aid Boxes | Thermal Imaging Cameras | Electric Chain Saws / Cutters / Hammers for Concrete | Electric Chain Saws / Cutters/ Hammers for Wood | Hydraulic / Manual Chain Saws / Cutters for Wood | Personal Protection Equipment | Hand Held Gas Detector Kits | Life Locator Equipment | Portable Pumps | Floating Pumps |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| South West | 12 | 1,868,828 | 11 | 42 | 98 | 14 | 46 | 11 | 14 | 14 | 12 | 45 | 45 | 12 | 33 | 0 |
| West | 15 | 2,927,018 | 18 | 72 | 219 | 17 | 74 | 17 | 13 | 17 | 17 | 71 | 77 | 17 | 52 | 0 |
| **Total** | **99** | **15,786,897** | **108** | **402** | **978** | **120** | **434** | **104** | **93** | **115** | **118** | **293** | **433** | **108** | **286** | **0** |

**Contd.....**

| District | Fire Stations | Ideally Served Population Estimates | Diving Suits (Dry Type) | Diving Suits (Wet Type) | Inflatable Lighting Towers | Smoke Exhausters / PPV | Pneumatic lifting bags | High Capacity LED Torches | Rescue Boats | Static Wireless Sets | Mobile Wireless Sets | Walky Talky | Mega Phones | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Central | 6 | 236,083 | 0 | 0 | 6 | 6 | 7 | 16 | 0 | 1 | 4 | 0 | 7 | 28 |
| East | 9 | 1,983,764 | 0 | 0 | 9 | 9 | 6 | 63 | 0 | 4 | 39 | 27 | 12 | 527 |
| New Delhi | 6 | 658,649 | 0 | 0 | 7 | 7 | 5 | 34 | 0 | 4 | 19 | 12 | 9 | 294 |
| North | 7 | 1,010,000 | 0 | 0 | 7 | 7 | 8 | 24 | 0 | 5 | 17 | 20 | 8 | 325 |
| North East | 9 | 1,946,305 | 0 | 0 | 9 | 9 | 10 | 54 | 0 | 8 | 42 | 40 | 10 | 677 |
| North West | 21 | 2,894,006 | 0 | 0 | 21 | 21 | 20 | 89 | 0 | 12 | 61 | 61 | 26 | 1053 |
| South | 14 | 2,262,244 | 0 | 0 | 14 | 14 | 11 | 65 | 0 | 8 | 45 | 46 | 17 | 732 |
| South West | 12 | 1,868,828 | 0 | 0 | 12 | 11 | 11 | 47 | 0 | 7 | 33 | 37 | 14 | 569 |
| West | 15 | 2,927,018 | 0 | 0 | 15 | 15 | 15 | 77 | 0 | 6 | 51 | 54 | 17 | 931 |
| **Total** | **99** | **15,786,897** | **0** | **0** | **100** | **99** | **93** | **469** | **0** | **55** | **311** | **297** | **120** | **5,136** |

*: includes FSMA Training cum-support centre

**Table 7-14: Additional specialized equipment required for new rural Fire Stations**

| State | Fire Stations | Ideally Served Population Estimates | Hydraulic Rescue Tools | Combi Tools | B.A. Sets | BA Compressors | First-Aid Boxes | Thermal Imaging Cameras | Electric Chain Saws / Cutters / Hammers for Concrete | Electric Chain Saws / Cutters/ Hammers for Wood | Hydraulic / Manual Chain Saws / Cutters for Wood | Personal Protection Equipment | Hand Held Gas Detector Kits | Life Locator Equipment | Portable Pumps | Floating Pumps |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Central | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| East | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| New Delhi | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| North | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| North East | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| North West | 3 | 281,531 | 0 | 0 | 4 | 3 | 3 | 0 | 0 | 2 | 2 | 2 | 0 | 0 | 3 | 0 |
| South | 3 | 376,483 | 0 | 0 | 6 | 3 | 6 | 0 | 0 | 3 | 3 | 3 | 0 | 0 | 5 | 0 |
| South West | 3 | 179,274 | 0 | 0 | 22 | 3 | 3 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 4 | 0 |
| West | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total** | **9** | **837,288** | **0** | **0** | **32** | **9** | **12** | **0** | **0** | **6** | **6** | **6** | **0** | **0** | **12** | **0** |

**Contd……..**

| District | Fire Stations | Ideally Served Population Estimates | Diving Suits (Dry Type) | Diving Suits (Wet Type) | Inflatable Lighting Towers | Smoke Exhausters / PPV | Pneumatic lifting bags | High Capacity LED Torches | Rescue Boats | Static Wireless Sets | Mobile Wireless Sets | Walky Talky | Mega Phones | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Central | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| District | Fire Stations | Ideally Served Population Estimates | Diving Suits (Dry Type) | Diving Suits (Wet Type) | Inflatable Lighting Towers | Smoke Exhausters / PPV | Pneumatic lifting bags | High Capacity LED Torches | Rescue Boats | Static Wireless Sets | Mobile Wireless Sets | Walky Talky | Mega Phones | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| East | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| New Delhi | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| North | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| North East | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| North West | 3 | 281,531 | 0 | 0 | 3 | 0 | 0 | 3 | 0 | 3 | 5 | 6 | 3 | 42 |
| South | 3 | 376,483 | 0 | 0 | 3 | 0 | 3 | 3 | 0 | 3 | 7 | 8 | 3 | 59 |
| South West | 3 | 179,274 | 0 | 0 | 3 | 0 | 0 | 3 | 0 | 3 | 4 | 7 | 3 | 58 |
| West | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total** | **9** | **837,288** | **0** | **0** | **9** | **0** | **3** | **9** | **0** | **9** | **16** | **21** | **9** | **159** |

### 7.2.2 FIRE MANPOWER GAP

SFAC guidelines have suggested manpower, including reserve for duty off, training, leave for Station Officer, Sub-Officer (75%) and Leading Firemen and lower staff (25%). This has been further estimated for two shifts for Leading Firemen and lower staff, as duty pattern for them is practically two-shift system (24-hour duty 24-hour off, Table 7-15).

**Table 7-15: Manpower requirement for station officer and lower staff Delhi Fire Service as per SFAC norm (Considering double shift duty pattern)**

| Sr No | Size of Station (Pumping Unit) | Station Officer | Sub-Officer* | Leading Firemen (L.F.) | Additional LFM | Total LFM | Drivers/ Operators | Fire men | Additional FM per FS (FAD, HID, DISP, WRO) | Total Fire men | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | One | 0 | 1.75 | 2.5 | 1.25 | 3.75 | 5 | 15 | 10 | 25 | 35.50 |
| 2 | Two | 1.75 | 1.75 | 5 | 1.25 | 6.25 | 7.5 | 30 | 10 | 40 | 57.25 |
| 3 | Three | 1.75 | 3.5 | 7.5 | 1.25 | 8.75 | 10 | 45 | 10 | 55 | 79.00 |
| 4 | Four | 3.5 | 3.5 | 10 | 1.25 | 11.25 | 15 | 60 | 10 | 70 | 103.25 |
| 5 | Five | 3.5 | 5.25 | 12.5 | 1.25 | 13.75 | 17.5 | 75 | 10 | 85 | 125.00 |
| 6 | Six | 3.5 | 7 | 15 | 1.25 | 16.25 | 22.5 | 90 | 10 | 100 | 149.25 |
| 7 | Seven | 5.25 | 7 | 17.5 | 1.25 | 18.75 | 25 | 105 | 10 | 115 | 171.00 |

**: Where extent of fire risk may justify Sub-Officers may be replaced with Station Officers*

The Administrative Reform Department (ARD, Delhi) has worked out fire manpower for DFS. Following fire manpower have been suggested including reserve duty off, training, leave for Station Officer and lower staff at 25% (Table 7-16).

**Table 7-16: Manpower requirement for station officer and lower staff as per ARD, Delhi (double shift)**

| Sr No | Fire Station (Pumping Unit) | Station Officer | Sub-Officer | LFM | Firemen-cum-Driver-cum Operator | Total Staff |
|---|---|---|---|---|---|---|
| 1 | One | 0 | 2.5 | 2.5 | 15.625 | 20.62 |
| 2 | Two | 1.25 | 2.5 | 2.5 | 31.250 | 37.50 |
| 3 | Three | 1.25 | 3.75 | 7.5 | 46.875 | 59.38 |
| 4 | Four | 2.5 | 4.6875 | 9.375 | 60.000 | 76.56 |
| 5 | Five | 2.5 | 5.625 | 11.25 | 73.125 | 92.50 |
| 6 | Six | 3.75 | 6.5625 | 13.125 | 87.188 | 110.62 |
| 7 | Seven | 3.75 | 7.5 | 15 | 101.250 | 127.50 |

From Tables 7-15 and 7-16, it is quite clear that The Administrative Reform Department (ARD, Delhi), has already optimized the fire manpower requirement in comparison of what has been suggested in SFAC norms. It may be noted that total number of staff is coming in decimal places, as calculations are on pumping units including reserve staff, which has been rounded of in the fire manpower gap analysis at district and State levels.

For rural Fire Stations/posts, there will be total fire fighting staff of 6 persons on QRT with 3 persons per shift (i.e., 1 Sub-Officer, 1 Leading Fireman, 1 Fireman-cum-Driver-cum-Operator). On Motorcycle, there will be a total staff of 4 persons with 2 persons per shift (1 sub-officer and 1 Fireman-cum-Driver-cum-Operator). The requirement of reserve (leave,

training, and contingent) shall be calculated at the rate of 25% of the district requirement and should be distributed accordingly.

In addition to fire fighting staff, there is an urgent need for fire prevention wing for inspection, awareness generation, and training for schools, hospitals, high – rise buildings, govt. offices, public buildings etc., so that recurrence of the fire incidences, such as Advance Medical Research Institute (AMRI), Kolkata, in terms of their magnitude and frequency can be reduced. Accordingly, to support Director, Delhi Fire Services, additional officers at the levels of Chief Fire Officers (CFO), Dy Chief Fire Officers (Dy-CFO), Division Officers (DO), and Assistant Divisional Officer (ADO) have been proposed. To meet the ideal requirement of officials, following numbers of total officials have been proposed (including existing officials), which may be recruited in a phased manner approach:

- Director: 1
- CFO: 4 (1:3 and one additional for Fire Prevention)
- Dy. CFO: 8 (1:1 and four additional for Fire Prevention)
- DO: 18 (one per 6-8 Fire Stations including for Fire Prevention)
- ADO: 54 (one per 3-4 Fire Stations including for Fire Prevention))

*It may be noted that for cleaning staff, we recommend hiring of Cleaners on contract basis. For computation in financial analysis, we have assumed a fixed salary of Rs 7,000/ pm, and without any reserve over that.*

Accordingly, existing fire manpower and gap analysis for all the districts in Delhi have been carried out and are shown Tables 7.17, 7.18, 7.19, and 7.20.

**Table 7-17: List of fire manpower available with DFS (As on Aug-Sep, 2011)**

| District | Num of FS | Level 10 | Level 9 | Level 8 | Level 7 | Level 6 | Level 5 | Level 4 | Level 3 | Level 2 | Level 1 | Level 0 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Central** | 5 | 1 | 1 | 1 | 0 | 1 | 2 | 10 | 12 | 39 | 156 | 7 | 230 |
| **East** | 6 | 0 | 0 | 0 | 0 | 2 | 1 | 4 | 8 | 35 | 105 | 2 | 157 |
| **New Delhi** | 6 | 0 | 0 | 0 | 0 | 1 | 2 | 2 | 11 | 36 | 110 | 5 | 167 |
| **North** | 3 | 0 | 0 | 0 | 0 | 1 | 0 | 3 | 8 | 23 | 77 | 3 | 115 |
| **North East** | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 3 | 15 | 38 | 2 | 61 |
| **North West** | 9 | 0 | 0 | 0 | 0 | 1 | 3 | 6 | 10 | 55 | 203 | 8 | 286 |
| **South** | 6 | 0 | 0 | 0 | 0 | 1 | 2 | 6 | 12 | 38 | 94 | 8 | 161 |
| **South West** | 5 | 0 | 0 | 0 | 0 | 1 | 1 | 4 | 11 | 26 | 119 | 4 | 166 |
| **West** | 10 | 0 | 0 | 0 | 0 | 1 | 1 | 9 | 14 | 48 | 207 | 8 | 288 |
| **Total** | **53** | **1** | **1** | **1** | **0** | **9** | **12** | **47** | **89** | **315** | **1109** | **47** | **1,631** |

***Level 10**: Director General/ Director; **Level 9**: CFO/ CO; **Level 8**: Deputy CFO/Joint Director; **Level 7**: AD/Deputy Controller/Deputy Director/DO; **Level 6**: ADO/ Inspector/EO/Fire Supervisor; **Level 5**: DFO/ADFO/AFO/Fire In-charge; **Level 4**: St.O/Sub Inspector/Station In-charge/ASt O./AEO; **Level 3**: S O/Assistant Sub Inspector/ASO/Sub-Fire Officer/; **Level 2** : LFM/ Mechanic Driver/Head Constable/Store Superintendant; **Level 1** : FM/ FM Driver/Radio Technician/ SGFM/ Driver/ Police Constable/ Wireless Technician/ Radio Technician/ Asst FM/ Sanitary Inspector, FO/FO Driver/Driver Operator/Driver/Ambulance Driver/ Clerk; **Level 0:** Cleaner, Fire Coolie, Supporting Staff, Attendant, Labourer, Peon, Security Guard, Tindal.*

**Table 7-18: Manpower gap in operational Fire Stations for ideal jurisdiction area (As on Aug-Sep, 2011)**

| District | Num of FS | Level 10 | Level 9 | Level 8 | Level 7 | Level 6 | Level 5 | Level 4 | Level 3 | Level 2 | Level 1 | Level 0 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Central** | 5 | 0 | 0 | 1 | 2 | 1 | -2 | -5 | 9 | -12 | 24 | -2 | 16 |
| **East** | 6 | 0 | 1 | 2 | 4 | 0 | -1 | 26 | 44 | 79 | 555 | 4 | 714 |
| **New Delhi** | 6 | 0 | 0 | 0 | 2 | 1 | -2 | 10 | 24 | 32 | 260 | 1 | 328 |
| **North** | 3 | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 6 | 3 | 63 | 0 | 75 |
| **North East** | 3 | 0 | 0 | 0 | 0 | 1 | 0 | 3 | 13 | 17 | 135 | 1 | 170 |

| District | Num of FS | Level 10 | Level 9 | Level 8 | Level 7 | Level 6 | Level 5 | Level 4 | Level 3 | Level 2 | Level 1 | Level 0 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **North West** | 9 | 0 | 0 | 0 | 2 | 2 | -3 | 10 | 28 | 10 | 210 | 1 | 260 |
| **South** | 6 | 0 | 1 | 2 | 2 | 1 | -2 | 5 | 18 | 15 | 252 | -2 | 292 |
| **South West** | 5 | 0 | 1 | 2 | 2 | 1 | -1 | 10 | 17 | 28 | 222 | 1 | 283 |
| **West** | 10 | 0 | 0 | 0 | 2 | 3 | -1 | 12 | 37 | 47 | 407 | 2 | 509 |
| **Total** | **53** | **0** | **3** | **7** | **18** | **10** | **-12** | **72** | **196** | **219** | **2,128** | **6** | **2,647** |

**Table 7-19: Total staff gap for operational and new urban Fire Stations**

| District | Num of FS | Level 10 | Level 9 | Level 8 | Level 7 | Level 6 | Level 5 | Level 4 | Level 3 | Level 2 | Level 1 | Level 0 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Central** | 6 | 0 | 0 | 1 | 2 | 1 | -2 | -5 | 13 | -9 | 40 | -1 | 40 |
| **East** | 9 | 0 | 1 | 2 | 4 | 1 | -1 | 28 | 53 | 88 | 633 | 7 | 816 |
| **New Delhi** | 6 | 0 | 0 | 0 | 2 | 1 | -2 | 10 | 24 | 32 | 260 | 1 | 328 |
| **North** | 7 | 0 | 0 | 0 | 2 | 1 | 0 | 4 | 24 | 30 | 220 | 4 | 285 |
| **North East** | 9 | 0 | 0 | 0 | 0 | 3 | 0 | 20 | 49 | 91 | 563 | 7 | 733 |
| **North West** | 21 | 0 | 0 | 0 | 2 | 6 | -3 | 32 | 86 | 102 | 822 | 13 | 1,060 |
| **South** | 14 | 0 | 1 | 2 | 2 | 4 | -2 | 22 | 58 | 89 | 695 | 6 | 877 |
| **South West** | 12 | 0 | 1 | 2 | 2 | 3 | -1 | 18 | 45 | 69 | 468 | 8 | 615 |
| **West** | 15 | 0 | 0 | 0 | 2 | 5 | -1 | 28 | 95 | 102 | 774 | 7 | 1012 |
| **Total** | **99** | **0** | **3** | **7** | **18** | **25** | **-12** | **157** | **447** | **594** | **4,475** | **52** | **5,766** |

***Level 10**: Director General/ Director; **Level 9**: CFO/ CO; **Level 8**: Deputy CFO/Joint Director; **Level 7**: AD/Deputy Controller/Deputy Director/DO; **Level 6**: ADO/ Inspector/EO/Fire Supervisor; **Level 5**: DFO/ADFO/AFO/Fire In-charge; **Level 4**: St.O/Sub Inspector/Station In-charge/ASt O./AEO; **Level 3**: S O/Assistant Sub Inspector/ASO/Sub-Fire Officer/; **Level 2** : LFM/ Mechanic Driver/Head Constable/Store Superintendant; **Level 1** : FM/ FM Driver/Radio Technician/ SGFM/ Driver/ Police Constable/ Wireless Technician/ Radio Technician/ Asst FM/ Sanitary Inspector, FO/FO Driver/Driver Operator/Driver/Ambulance Driver/ Clerk; **Level 0:** Cleaner, Fire Coolie, Supporting Staff, Attendant, Labourer, Peon, Security Guard, Tindal.*

**Table 7-20: Additional staff required for new rural Fire Stations**

| District | Num of FS | Level 10 | Level 9 | Level 8 | Level 7 | Level 6 | Level 5 | Level 4 | Level 3 | Level 2 | Level 1 | Level 0 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Central** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **East** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **New Delhi** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **North** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **North East** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **North West** | 3 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 10 | 19 | 57 | 3 | 90 |
| **South** | 3 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 11 | 21 | 75 | 3 | 112 |
| **South West** | 3 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 10 | 17 | 54 | 3 | 85 |
| **West** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total** | **9** | **0** | **0** | **0** | **0** | **3** | **0** | **1** | **31** | **57** | **186** | **9** | **287** |

***Level 10**: Director General/ Director; **Level 9**: CFO/ CO; **Level 8**: Deputy CFO/Joint Director; **Level 7**: AD/Deputy Controller/Deputy Director/DO; **Level 6**: ADO/ Inspector/EO/Fire Supervisor; **Level 5**: DFO/ADFO/AFO/Fire In-charge; **Level 4**: St.O/Sub Inspector/Station In-charge/ASt O./AEO; **Level 3**: S O/Assistant Sub Inspector/ASO/Sub-Fire Officer/; **Level 2** : LFM/ Mechanic Driver/Head Constable/Store Superintendant; **Level 1** : FM/ FM Driver/Radio Technician/ SGFM/ Driver/ Police Constable/ Wireless Technician/ Radio Technician/ Asst FM/ Sanitary Inspector, FO/FO Driver/Driver Operator/Driver/Ambulance Driver/ Clerk; **Level 0:** Cleaner, Fire Coolie, Supporting Staff, Attendant, Labourer, Peon, Security Guard, Tindal.*

### 7.2.3 INVESTMENT AND FINANCIAL ANALYSIS

#### 7.2.3.1 Capital Cost

**Building infrastructure costs**

Tables 7-21 and 7.22 provide details of the operational Fire Stations in terms of number of bays and additional number of new Fire Stations for which Fire Station buildings are required in Delhi State.

**Table 7-21: Fire station building required for gap in operational and new urban Fire Stations (no. of bays)**

| District | Number of Fire Stations | Bay1 | Bay2 | Bay3 | Bay4 | Bay5 | Bay6 | Bay7 | Bay More Than 7 |
|---|---|---|---|---|---|---|---|---|---|
| Central | 6 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| East | 9 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| New Delhi | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| North | 7 | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 0 |
| North East | 9 | 0 | 2 | 0 | 1 | 1 | 0 | 2 | 0 |
| North West* | 21 | 0 | 7 | 1 | 0 | 2 | 1 | 1 | 0 |
| South | 14 | 0 | 2 | 2 | 2 | 0 | 2 | 0 | 0 |
| South West | 12 | 0 | 5 | 0 | 1 | 0 | 1 | 0 | 0 |
| West | 15 | 0 | 0 | 0 | 2 | 2 | 0 | 1 | 0 |
| **Total** | **99** | **0** | **21** | **6** | **6** | **5** | **4** | **4** | **0** |

**: includes FSMA Training cum-support centre*

**Table 7-22: Fire station building required for new rural Fire Stations (no. of bays)**

| District | Number of Fire Stations | Bay1 | Bay2 | Bay3 | Bay4 | Bay5 |
|---|---|---|---|---|---|---|
| Central | 0 | 0 | 0 | 0 | 0 | 0 |
| East | 0 | 0 | 0 | 0 | 0 | 0 |
| New Delhi | 0 | 0 | 0 | 0 | 0 | 0 |
| North | 0 | 0 | 0 | 0 | 0 | 0 |
| North East | 0 | 0 | 0 | 0 | 0 | 0 |
| North West* | 3 | 0 | 3 | 0 | 0 | 0 |
| South | 3 | 0 | 3 | 0 | 0 | 0 |
| South West | 3 | 0 | 3 | 0 | 0 | 0 |
| West | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total** | **9** | **0** | **9** | **0** | **0** | **0** |

**: includes FSMA Training cum-support centre*

The ideal requirement of land in Delhi for a Fire Station is 2 ½ acres, and Delhi Development Authority (DDA) provide land to DFS at a nominal cost of Rs 10,000 per acre with 2.5% as an annual rent, which is very nominal. However, if land is not made available from DDA, and

same is acquired through Divisional Commissioner office, i.e., Gram-Sabha land, DFS has to pay about Rs 82.5 Lakhs per acre plus ground rent at the rate of 2.5% per annum. It may be noted that land cost will vary from time to time and place to place; hence, it has not been added in cost estimates. The civil construction cost estimation involves cost of Fire Station building including stores, offices, residential quarters, static water tanks, which will vary in size depending upon the number of bays (garage) in a Fire Station. Accordingly, total cost estimates for one, two, three, five, and seven bay Fire Stations (based on the P.W. D. norms) is about 150 Lakhs, 300 Lakhs, 450 Lakhs, 700 Lakhs, 950 Lakhs respectively (Table 7-23 and Table 7-24). Since, the proposed Fire Stations (18 in number) are in their preliminary stage of land acquisition/ construction; hence, we have included cost of construction for these Fire Stations in estimating the Capital costs.

**Table 7-23: Cost (in Lakhs Rupees) of Fire Station building (no. of bays) required for gap in operational and new urban Fire Stations**

| District | Number of Fire Stations | Bay1 | Bay2 | Bay3 | Bay4 | Bay5 | Bay6 | Bay7 | Total Cost for Construction |
|---|---|---|---|---|---|---|---|---|---|
| Central | 6 | 0.0 | 300.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 300.0 |
| East | 9 | 0.0 | 900.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 900.0 |
| New Delhi | 6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| North | 7 | 0.0 | 300.0 | 1,350.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1,650.0 |
| North East | 9 | 0.0 | 600.0 | 0.0 | 575.0 | 700.0 | 0.0 | 1,900.0 | 3,775.0 |
| North West* | 21 | 0.0 | 2,100.0 | 450.0 | 0.0 | 1,400.0 | 825.0 | 950.0 | 5,725.0 |
| South | 14 | 0.0 | 600.0 | 900.0 | 1,150.0 | 0.0 | 1,650.0 | 0.0 | 4,300.0 |
| South West | 12 | 0.0 | 1,500.0 | 0.0 | 575.0 | 0.0 | 825.0 | 0.0 | 2,900.0 |
| West | 15 | 0.0 | 0.0 | 0.0 | 1,150.0 | 1,400.0 | 0.0 | 950.0 | 3,500.0 |
| **Total** | **99** | **0.0** | **6,300.0** | **2,700.0** | **3,450.0** | **3,500.0** | **3,300.0** | **3,800.0** | **23,050.0** |

**:number includes FSMA Training cum-support centre*

**Table 7-24: Cost (in Lakhs Rupees) of Fire Station building (no. of bays) required for new rural Fire Stations**

| District | Number of Fire Stations | Bay1 | Bay2 | Bay3 | Bay4 | Bay5 | Total Cost for Construction |
|---|---|---|---|---|---|---|---|
| Central | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| East | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| New Delhi | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| North | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| North East | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| North West* | 3 | 0.0 | 900.0 | 0.0 | 0.0 | 0.0 | 900.0 |
| South | 3 | 0.0 | 900.0 | 0.0 | 0.0 | 0.0 | 900.0 |
| 0South West | 3 | 0.0 | 900.0 | 0.0 | 0.0 | 0.0 | 900.0 |
| West | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Total** | **9** | **0.0** | **2,700.0** | **0.0** | **0.0** | **0.0** | **2,700.0** |

Thus, total estimated capital cost for the Fire Stations building development for all the proposed and new rural Fire Stations will be **Rs. 257.5 Crores** (Tables 7-23 & 7-24 ).

### Fire Fighting and Rescue Vehicles and Equipment Costs

The costs of different fire vehicles and specialized equipment including communication sets (static and mobile VHF sets) have been taken as approximate rates quoted by fire equipment supplier. Accordingly, capital cost for fire vehicles and equipment for all the districts in Delhi have been estimated (Tables 7-25 to 7-28).

**Table 7-25: Cost estimates (in Lakhs Rupees) for gap in fire fighting and rescue vehicles in operational and new urban Fire Stations**

| District | Fire Stations | Water Tenders | Water Bowsers | Foam Tenders | Advanced Rescue Responders | Sky Lifts / TTL | DCP Tenders | Hose Tenders | BA Vans | Hazmat Vans | QRT | Motor Cycle Mists | Fire Boats | Ambulances | Education Vans | Total Vehicles cost |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Central | 6 | 0.0 | -150.0 | 0.0 | 500.0 | -500.0 | 35.0 | 30.0 | 30.0 | 0.0 | -9.0 | -6.8 | 0.0 | 0.0 | 20.0 | -50.8 |
| East | 9 | 280.0 | 240.0 | 200.0 | 500.0 | 1000.0 | 35.0 | 60.0 | 30.0 | 0.0 | 36.0 | 20.3 | 0.0 | 0.0 | 40.0 | 2441.3 |
| New Delhi | 6 | -35.0 | 30.0 | 80.0 | 500.0 | 0.0 | 35.0 | 60.0 | 60.0 | 0.0 | 27.0 | 6.8 | 0.0 | 0.0 | 40.0 | 803.8 |
| North | 7 | 210.0 | 90.0 | 160.0 | 0.0 | 0.0 | 0.0 | -30.0 | 0.0 | 0.0 | 0.0 | -6.8 | 0.0 | 0.0 | 0.0 | 423.3 |
| North East | 9 | 665.0 | 270.0 | 320.0 | 500.0 | 0.0 | 0.0 | -30.0 | 0.0 | 0.0 | 54.0 | 40.5 | 0.0 | 0.0 | 0.0 | 1819.5 |
| North West | 21 | 910.0 | 180.0 | 520.0 | 500.0 | 500.0 | 70.0 | 60.0 | 60.0 | 0.0 | 27.0 | 20.3 | 0.0 | 0.0 | 20.0 | 2867.3 |
| South | 14 | 595.0 | 150.0 | 400.0 | 0.0 | 0.0 | 70.0 | 0.0 | 0.0 | 0.0 | 0.0 | 6.8 | 0.0 | 0.0 | 20.0 | 1241.8 |
| South West | 12 | 525.0 | 90.0 | 240.0 | 500.0 | 500.0 | 0.0 | 0.0 | 0.0 | 0.0 | 9.0 | 6.8 | 0.0 | 0.0 | 20.0 | 1890.8 |
| West | 15 | 630.0 | 390.0 | 440.0 | 1000.0 | 0.0 | 35.0 | -30.0 | 30.0 | 0.0 | -9.0 | 0.0 | 0.0 | 0.0 | 20.0 | 2506.0 |
| **Total** | **99** | **3780.0** | **1290.0** | **2360.0** | **4000.0** | **1500.0** | **280.0** | **120.0** | **210.0** | **0.0** | **135.0** | **87.8** | **0.0** | **0.0** | **180.0** | **13942.8** |

**Table 7-26: Cost estimates (in Lakhs Rupees) for gap in fire fighting and rescue vehicles in new rural Fire Stations**

| District | Fire Stations | Water Tenders | Water Bowsers | Foam Tenders | Advanced Rescue Responders | Sky Lifts / TTL | DCP Tenders | Hose Tenders | BA Vans | Hazmat Vans | QRT | Motor Cycle Mists | Fire Boats | Ambulances | Education Vans | Total Vehicles cost |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Central | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| East | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| New Delhi | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| North | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| North East | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| North West | 3 | 105.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 18.0 | 20.3 | 0.0 | 0.0 | 0.0 | 143.3 |
| South | 3 | 175.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 27.0 | 20.3 | 0.0 | 0.0 | 0.0 | 222.3 |
| South West | 3 | 140.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 9.0 | 20.3 | 0.0 | 0.0 | 0.0 | 169.3 |
| West | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Total** | **9** | **420.0** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** | **54.0** | **60.8** | **0.0** | **0.0** | **0.0** | **534.8** |

**:number includes FSMA Training cum-support centre*

**Table 7-27: Cost estimate (in Lakhs Rupees) for gap in fire fighting specialized equipment for operational and new urban Fire Stations**

| District | Fire Stations | Hydraulic Rescue Tools | Combi Tools | B.A. Sets | BA Compressors | First-Aid Boxes | Thermal Imaging Cameras | Electric Chain Saws / Cutters / Hammers for Concrete | Electric Chain Saws / Cutters/ Hammers for Wood | Hydraulic / Manual Chain Saws / Cutters for Wood | Personal Protection Equipment | Hand Held Gas Detector Kits | Life Locator Equipment | Portable Pumps | Floating Pumps |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Central | 6 | 105.0 | 20.0 | -18.4 | 10.5 | 2.0 | 60.0 | 4.0 | 3.0 | 2.1 | -167.5 | 3.9 | 45.5 | 16.0 | 0.0 |
| East | 9 | 180.0 | 117.5 | 29.2 | 18.0 | 5.4 | 100.0 | 5.6 | 5.0 | 3.6 | 35.0 | 17.1 | 78.0 | 76.0 | 0.0 |
| New Delhi | 6 | 150.0 | 55.0 | 8.0 | 13.5 | 3.0 | 90.0 | 4.8 | 4.0 | 2.7 | 55.0 | 9.0 | 52.0 | 28.0 | 0.0 |
| North | 7 | 105.0 | 60.0 | 23.6 | 12.0 | 2.4 | 80.0 | 6.4 | 4.0 | 2.4 | 67.5 | 6.9 | 52.0 | 34.0 | 0.0 |
| North East | 9 | 150.0 | 130.0 | 84.4 | 15.0 | 4.6 | 100.0 | 5.6 | 5.0 | 3.0 | 90.0 | 14.4 | 65.0 | 70.0 | 0.0 |
| North West | 21 | 240.0 | 187.5 | 82.8 | 39.0 | 8.5 | 170.0 | 20.8 | 12.5 | 7.8 | 217.5 | 24.9 | 110.5 | 104.0 | 0.0 |
| South | 14 | 255.0 | 150.0 | 54.8 | 25.5 | 5.5 | 160.0 | 5.6 | 8.5 | 5.1 | 145.0 | 17.1 | 110.5 | 74.0 | 0.0 |
| South West | 12 | 165.0 | 105.0 | 39.2 | 21.0 | 4.6 | 110.0 | 11.2 | 7.0 | 3.6 | 112.5 | 13.5 | 78.0 | 66.0 | 0.0 |
| West | 15 | 270.0 | 180.0 | 87.6 | 25.5 | 7.4 | 170.0 | 10.4 | 8.5 | 5.1 | 177.5 | 23.1 | 110.5 | 104.0 | 0.0 |
| **Total** | **99** | **1620.0** | **1005.0** | **391.2** | **180.0** | **43.4** | **1040.0** | **74.4** | **57.5** | **35.4** | **732.5** | **129.9** | **702.0** | **572.0** | **0.0** |

**:number includes FSMA Training cum-support centre*

**Contd……..**

| District | Fire Stations | Diving Suits (Dry Type) | Diving Suits (Wet Type) | Inflatable Lighting Towers | Smoke Exhausters / PPV | Pneumatic lifting bags | High Capacity LED Torches | Rescue Boats | Static Wireless Sets | Mobile Wireless Sets | Walky Talky | Mega Phones | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Central | 6 | 0.0 | 0.0 | 12.6 | 6.0 | 35.0 | 6.4 | 0.0 | 0.3 | 0.7 | 0.0 | 2.1 | 149.2 |
| East | 9 | 0.0 | 0.0 | 18.9 | 9.0 | 30.0 | 25.2 | 0.0 | 1.1 | 6.6 | 3.2 | 3.6 | 768.1 |
| New Delhi | 6 | 0.0 | 0.0 | 14.7 | 7.0 | 25.0 | 13.6 | 0.0 | 1.1 | 3.2 | 1.4 | 2.7 | 543.8 |
| North | 7 | 0.0 | 0.0 | 14.7 | 7.0 | 40.0 | 9.6 | 0.0 | 1.4 | 2.9 | 2.4 | 2.4 | 536.5 |
| North East | 9 | 0.0 | 0.0 | 18.9 | 9.0 | 50.0 | 21.6 | 0.0 | 2.2 | 7.1 | 4.8 | 3.0 | 853.6 |
| North West | 21 | 0.0 | 0.0 | 44.1 | 21.0 | 100.0 | 35.6 | 0.0 | 3.2 | 10.4 | 7.3 | 7.8 | 1455.2 |
| South | 14 | 0.0 | 0.0 | 29.4 | 14.0 | 55.0 | 26.0 | 0.0 | 2.2 | 7.7 | 5.5 | 5.1 | 1161.4 |
| South West | 12 | 0.0 | 0.0 | 25.2 | 11.0 | 55.0 | 18.8 | 0.0 | 1.9 | 5.6 | 4.4 | 4.2 | 862.7 |
| West | 15 | 0.0 | 0.0 | 31.5 | 15.0 | 75.0 | 30.8 | 0.0 | 1.6 | 8.7 | 6.5 | 5.1 | 1353.8 |
| **Total** | **99** | **0.0** | **0.0** | **210.0** | **99.0** | **465.0** | **187.6** | **0.0** | **14.9** | **52.9** | **35.6** | **36.0** | **7684.3** |

**Table 7-28: Cost estimate (in Lakhs Rupees) for gap in specialized fire equipment for new rural Fire Stations**

| District | Fire Stations | Hydraulic Rescue Tools | Combi Tools | B.A. Sets | BA Compressors | First-Aid Boxes | Thermal Imaging Cameras | Electric Chain Saws / Cutters / Hammers for Concrete | Electric Chain Saws / Cutters/ Hammers for Wood | Hydraulic / Manual Chain Saws / Cutters for Wood | Personal Protection Equipment | Hand Held Gas Detector Kits | Life Locator Equipment | Portable Pumps | Floating Pumps |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Central | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| East | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| New Delhi | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| North | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

| District | Fire Stations | Hydraulic Rescue Tools | Combi Tools | B.A. Sets | BA Compressors | First-Aid Boxes | Thermal Imaging Cameras | Electric Chain Saws / Cutters / Hammers for Concrete | Electric Chain Saws / Cutters/ Hammers for Wood | Hydraulic / Manual Chain Saws / Cutters for Wood | Personal Protection Equipment | Hand Held Gas Detector Kits | Life Locator Equipment | Portable Pumps | Floating Pumps |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North East | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| North West | 3 | 0.0 | 0.0 | 1.6 | 4.50 | 0.3 | 0.0 | 0.0 | 1.0 | 0.6 | 5.0 | 0.0 | 0.0 | 6.0 | 0.0 |
| South | 3 | 0.0 | 0.0 | 2.4 | 4.50 | 0.6 | 0.0 | 0.0 | 1.5 | 0.9 | 7.5 | 0.0 | 0.0 | 10.0 | 0.0 |
| South West | 3 | 0.0 | 0.0 | 8.8 | 4.50 | 0.3 | 0.0 | 0.0 | 0.5 | 0.3 | 2.5 | 0.0 | 0.0 | 8.0 | 0.0 |
| West | 0 | 0.0 | 0.0 | 0.0 | 0.00 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Total** | **9** | **0.0** | **0.0** | **12.8** | **13.5** | **1.2** | **0.0** | **0.0** | **3.0** | **1.8** | **15.0** | **0.0** | **0.0** | **24.0** | 0.0 |

**Contd…**

| State | Fire Stations | Hydraulic Rescue Tools | Combi Tools | B.A. Sets | BA Compressors | First-Aid Boxes | Thermal Imaging Cameras | Electric Chain Saws / Cutters / Hammers for Concrete | Electric Chain Saws / Cutters/ Hammers for Wood | Hydraulic / Manual Chain Saws / Cutters for Wood | Personal Protection Equipment | Hand Held Gas Detector Kits | Life Locator Equipment | Portable Pumps | Floating Pumps |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Central | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| East | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| New Delhi | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| North | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| North East | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| State | Fire Stations | Hydraulic Rescue Tools | Combi Tools | B.A. Sets | BA Compressors | First-Aid Boxes | Thermal Imaging Cameras | Electric Chain Saws / Cutters / Hammers for Concrete | Electric Chain Saws / Cutters/ Hammers for Wood | Hydraulic / Manual Chain Saws / Cutters for Wood | Personal Protection Equipment | Hand Held Gas Detector Kits | Life Locator Equipment | Portable Pumps | Floating Pumps |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North West | 3 | 0.00 | 0.00 | 1.60 | 4.50 | 0.30 | 0.00 | 0.00 | 1.00 | 0.60 | 5.00 | 0.00 | 0.00 | 6.00 | 0.00 |
| South | 3 | 0.00 | 0.00 | 2.40 | 4.50 | 0.60 | 0.00 | 0.00 | 1.50 | 0.90 | 7.50 | 0.00 | 0.00 | 10.00 | 0.00 |
| South West | 3 | 0.00 | 0.00 | 8.80 | 4.50 | 0.30 | 0.00 | 0.00 | 0.50 | 0.30 | 2.50 | 0.00 | 0.00 | 8.00 | 0.00 |
| West | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Total** | **9** | **0.00** | **0.00** | **12.80** | **13.50** | **1.20** | **0.00** | **0.00** | **3.00** | **1.80** | **15.00** | **0.00** | **0.00** | **24.00** | **0.00** |

| District | Fire Stations | Diving Suits (Dry Type) | Diving Suits (Wet Type) | Inflatable Lighting Towers | Smoke Exhausters / PPV | Pneumatic lifting bags | High Capacity LED Torches | Rescue Boats | Static Wireless Sets | Mobile Wireless Sets | Walky Talky | Mega Phones | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Central | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| East | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| New Delhi | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| North | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| North East | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| North West | 3 | 0.0 | 0.0 | 6.3 | 0.0 | 0.0 | 1.2 | 0.0 | 0.8 | 0.9 | 0.7 | 0.9 | 29.8 |
| South | 3 | 0.0 | 0.0 | 6.3 | 0.0 | 15.0 | 1.2 | 0.0 | 0.8 | 1.2 | 1.0 | 0.9 | 53.8 |
| South West | 3 | 0.0 | 0.0 | 6.3 | 0.0 | 0.0 | 1.2 | 0.0 | 0.8 | 0.7 | 0.8 | 0.9 | 35.6 |
| West | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Total** | **9** | **0.0** | **0.0** | **18.9** | **0.0** | **15.0** | **3.6** | **0.0** | **2.4** | **2.7** | **2.5** | **2.7** | **119.2** |

#### 7.2.3.2 Recurring Cost

**Manpower Cost**

The fire manpower cost estimation per year have been carried out by taking into account pay-scale structure for different levels of employee from DFS, Headquarter. Accordingly, cost estimate for fire manpower gap at various levels is shown in Table 7-29 and Table 7-30.

**Table 7-29: Annual cost estimates (in Lakhs Rupees) for manpower for DFS after filling up the gap in operational and new urban Fire Stations**

| District | Fire Stations | Level 10 | Level 9 | Level 8 | Level 7 | Level 6 | Level 5 | Level 4 | Level 3 | Level 2 | Level 1 | Level 0 | Total Staff |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Central | 6 | 0.0 | 0.0 | 8.6 | 15.1 | 6.4 | -11.4 | -25.3 | 55.9 | -29.8 | 129.6 | -0.8 | 148.3 |
| East | 9 | 0.0 | 13.8 | 17.2 | 30.1 | 6.4 | -5.7 | 141.4 | 227.9 | 291.3 | 2050.9 | 5.9 | 2779.2 |
| New Delhi | 6 | 0.0 | 0.0 | 0.0 | 15.1 | 6.4 | -11.4 | 50.5 | 103.2 | 105.9 | 842.4 | 0.8 | 1112.9 |
| North | 7 | 0.0 | 0.0 | 0.0 | 15.1 | 6.4 | 0.0 | 20.2 | 103.2 | 99.3 | 712.8 | 3.4 | 960.3 |
| North East | 9 | 0.0 | 0.0 | 0.0 | 0.0 | 19.2 | 0.0 | 101.0 | 210.7 | 301.2 | 1824.1 | 5.9 | 2462.1 |
| North West | 21 | 0.0 | 0.0 | 0.0 | 15.1 | 38.4 | -17.2 | 161.6 | 369.8 | 337.6 | 2663.3 | 10.9 | 3579.5 |
| South | 14 | 0.0 | 13.8 | 17.2 | 15.1 | 25.6 | -11.4 | 111.1 | 249.4 | 294.6 | 2251.8 | 5.0 | 2972.1 |
| South West | 12 | 0.0 | 13.8 | 17.2 | 15.1 | 19.2 | -5.7 | 90.9 | 193.5 | 228.4 | 1516.3 | 6.7 | 2095.3 |
| West | 15 | 0.0 | 0.0 | 0.0 | 15.1 | 32.0 | -5.7 | 141.4 | 408.5 | 337.6 | 2507.8 | 5.9 | 3442.5 |
| **Total** | **99** | **0.0** | **41.3** | **60.3** | **135.5** | **160.0** | **-68.6** | **792.9** | **1922.1** | **1966.1** | **14499.0** | **43.7** | **19552.2** |

**Table 7-30: Annual cost estimates (in Lakhs Rupees) for manpower for DFS for new rural Fire Stations**

| District | Level 10 | Level 9 | Level 8 | Level 7 | Level 6 | Level 5 | Level4 | Level3 | Level2 | Level1 | Level 0 | Total Annual Staff Salary |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Central | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

| District | Level 10 | Level 9 | Level 8 | Level 7 | Level 6 | Level 5 | Level4 | Level3 | Level2 | Level1 | Level 0 | Total Annual Staff Salary |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| East | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| New Delhi | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| North | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| North East | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| North West | 0.0 | 0.0 | 0.0 | 0.0 | 6.4 | 0.0 | 0.0 | 43.0 | 62.9 | 184.7 | 2.5 | 299.5 |
| South | 0.0 | 0.0 | 0.0 | 0.0 | 6.4 | 0.0 | 5.1 | 47.3 | 69.5 | 243.0 | 2.5 | 373.8 |
| South West | 0.0 | 0.0 | 0.0 | 0.0 | 6.4 | 0.0 | 0.0 | 43.0 | 56.3 | 175.0 | 2.5 | 283.2 |
| West | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Total** | **0.0** | **0.0** | **0.0** | **0.0** | **19.2** | **0.0** | **5.1** | **133.3** | **188.7** | **602.6** | **7.6** | **956.4** |

***Level 10**: Director General/ Director; **Level 9**: CFO/ CO; **Level 8**: Deputy CFO/Joint Director; **Level 7**: AD/Deputy Controller/Deputy Director/DO; **Level 6**: ADO/ Inspector/EO/Fire Supervisor; **Level 5**: DFO/ADFO/AFO/Fire In-charge; **Level 4**: St.O/Sub Inspector/Station In-charge/ASt O./AEO; **Level 3**: S O/Assistant Sub Inspector/ASO/Sub-Fire Officer/; **Level 2** : LFM/ Mechanic Driver/Head Constable/Store Superintendant; **Level 1** : FM/ FM Driver/Radio Technician/ SGFM/ Driver/ Police Constable/ Wireless Technician/ Radio Technician/ Asst FM/ Sanitary Inspector, FO/FO Driver/Driver Operator/Driver/Ambulance Driver/ Clerk; **Level 0:** Cleaner, Fire Coolie, Supporting Staff, Attendant, Labourer, Peon, Security Guard, Tindal.*

The total estimated fire manpower cost for the gap in existing and proposed staff will be **Rs. 205.08 Crores** per year.

**Staff Uniform Cost**

The staff uniform cost have been estimated by taking a fixed cost of Rs.5,000/ per year (Table 7-31). The total estimated staff uniform cost for existing and proposed staff is about **Rs. 3.03 Crores** per year.

**Table 7-31: Cost estimates (in Lakhs Rupees) for staff-uniform (district level)**

| District | Level 9 | Level 8 | Level 7 | Level 6 | Level 4 | Level 3 | Level 2 | Level 1 | Level 0 | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| Central | 0 | 0 | 0.05 | 0.05 | 0.25 | 0.70 | 0.75 | 6.10 | 0.10 | 8.00 |
| East | 0.05 | 0.05 | 0.05 | 0.15 | 1.00 | 2.05 | 3.25 | 23.80 | 0.30 | 30.70 |
| New Delhi | 0 | 0 | 0.05 | 0.05 | -0.25 | 0.45 | -0.60 | 1.20 | -0.15 | 0.75 |
| North | 0 | 0 | 0.05 | 0.20 | 0.40 | 1.80 | 2.45 | 17.75 | 0.25 | 22.90 |

| District | Level 9 | Level 8 | Level 7 | Level 6 | Level 4 | Level 3 | Level 2 | Level 1 | Level 0 | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| North East | 0 | 0 | 0.05 | 0.20 | 1.40 | 3.05 | 5.70 | 36.00 | 0.40 | 46.80 |
| North West* | 0 | 0 | 0.05 | 0.50 | 1.70 | 5.15 | 6.35 | 47.40 | 0.90 | 62.05 |
| South | 0.05 | 0.05 | 0.05 | 0.40 | 1.15 | 3.45 | 5.50 | 38.50 | 0.40 | 49.55 |
| South West | 0.05 | 0.05 | 0.05 | 0.20 | 1.05 | 3.05 | 4.45 | 28.75 | 0.40 | 38.05 |
| West | 0 | - | 0.05 | 0.35 | 1.20 | 4.20 | 4.75 | 33.50 | 0.35 | 44.40 |
| Total | **0.15** | **0.15** | **0.45** | **2.10** | **7.90** | **23.90** | **32.60** | **233.00** | **2.95** | **303.20** |

**:number includes FSMA Training cum-support centre*

**Annual Fire Fighting & Rescue Vehicle and Specialized Equipment Maintenance & Repairs, PDL, Office and Training Expenses**

For Gap analysis, firefighting & rescue vehicle maintenance and repairs cost have been estimated based on the current expenditure of DFS on vehicle maintenance & repairs, and Petrol, Diesel & Lubricant (PDL) (Table 7-32).

Office expenditure (stationary, electricity, water, telephone, Internet etc.) and training expenses for gap have been estimated based on the current expenditure of DFS on Office expenditure and training per year (Table 7-32).

**Table 7-32: Annual recurring cost estimates (in Lakhs Rupees) for PDL, maintenance and training expense after filling the gap in operational and new urban Fire Stations**

| District | Num of Fire Stations | Annual Vehicle maintenance | Annual PDL Cost | Annual Equipment maintenance | Annual Building Maintenance | Office Expenses | Training Expenses |
|---|---|---|---|---|---|---|---|
| Central | 6 | 33.48 | 25.11 | 32.21 | 52.00 | 59.58 | 10.40 |
| East | 9 | 106.41 | 79.81 | 77.34 | 78.50 | 208.53 | 36.41 |
| New Delhi | 6 | 66.05 | 49.54 | 48.20 | 49.50 | 105.08 | 18.35 |
| North | 7 | 18.02 | 13.51 | 46.02 | 61.50 | 84.70 | 14.79 |
| North East | 9 | 49.91 | 37.43 | 71.94 | 102.50 | 167.87 | 29.31 |
| North West | 21 | 117.31 | 87.98 | 122.33 | 209.50 | 284.94 | 49.75 |
| South | 14 | 90.52 | 67.89 | 101.88 | 140.50 | 221.06 | 38.60 |
| South West | 12 | 57.78 | 43.34 | 73.36 | 109.50 | 166.95 | 29.15 |
| West | 15 | 92.40 | 69.30 | 113.61 | 174.00 | 276.98 | 48.36 |
| **Total** | **99** | **631.88** | **473.91** | **686.90** | **977.50** | **1,575.69** | **275.12** |

**:number includes FSMA Training cum-support centre*

**Table 7-33: State level summary of Capital Expenditure required for filling the gap (in Crores Rupees)**

| Capital Expenditure | | | | |
|---|---|---|---|---|
| Operational Type | Fire Station Building Infrastructure | Vehicles Cost | Equipment Cost | Total Capital Cost |
| Operational Fire Stations | 258.25 | 123.86 | 9.05 | 391.16 |
| Gap in Operational Fire Stations | 0.00 | 54.91 | 38.42 | 93.33 |
| New Urban Fire Stations | 230.50 | 84.52 | 38.39 | 353.41 |
| Total Gap in New Urban and Operational Fire Stations | 230.50 | 139.43 | 76.81 | 446.74 |
| New Rural Fire Stations | 27.00 | 5.35 | 1.19 | 33.54 |
| Total Gap in New Urban ,New Rural and Operational Fire Stations | 257.50 | 144.78 | 78.00 | 480.28 |

**Table 7-34: State level summary of Recurring Expenditure required for filling the gap (in Crores Rupees)**

| Recurring Expenditure | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Operational Type | Annual Staff Salary | Annual Vehicle Maintenance | Annual Maintenance Contract (Specialized Equipment) | Annual Petrol diesel and Lubricant Cost | Annual Building maintenance | Annual Office Expenses | Annual Training Expenses | Total Recurring Expenditure |
| Operational Fire Stations | 54.59 | 2.97 | 0.72 | 2.23 | 5.17 | 3.44 | 0.60 | 69.72 |
| Gap in Operational Fire Stations | 90.63 | 1.32 | 3.07 | 0.99 | 0.00 | 5.71 | 1.00 | 102.72 |
| New Urban Fire Stations | 104.89 | 2.03 | 3.07 | 1.52 | 4.61 | 6.61 | 1.15 | 123.88 |
| Total Gap in New Urban and Operational Fire Stations | 195.52 | 3.35 | 6.14 | 2.51 | 4.61 | 12.32 | 2.15 | 226.60 |
| New Rural Fire Stations | 9.56 | 0.13 | 0.10 | 0.10 | 0.54 | 0.60 | 0.11 | 11.13 |
| Total Gap in New Urban ,New Rural and Operational Fire Stations | 205.09 | 3.47 | 6.24 | 2.61 | 5.15 | 12.92 | 2.26 | 237.73 |

### 7.2.4 DETAILED ROAD MAP FOR INVESTMENT PLAN

All the above detailed capital and recurring expenses for Gaps in terms of construction of new Fire Station buildings, building maintenance, manpower, fire fighting vehicles and equipment and their maintenance, training of manpower, etc. have been taken into consideration, while finalizing the detailed investment road map plan for the next 10 years for DFS (Table 7-30).

A few assumptions have been made, while preparing the detailed roadmap for investment plan for the next 10 years:

- The first assumption is that the existing gaps in terms of manpower, fire fighting vehicles, and equipment will be filled up in first two years.
- The second assumption is that 40% gaps in Fire Station buildings will be filled up in first two year, and subsequently 10% gap in each year.
- The third assumption is that the average annual rate on expenses on fire vehicle maintenance, petrol, diesel & lubricants, and office expenses, training, uniform will remain the same as that in F.Y. 2010-11, however, on top of that an annual inflation factor of 8% (fire vehicle maintenance, petrol, diesel & lubricants), 5% (office expenses, training, uniform) has been added.
- The fourth assumption is that building construction cost will increase on an average by about 0.96% per year (construction cost index) and building maintenance cost by about 1% of total building construction cost as in 2010-11.
- The salary costs at each level have been estimated from the present pay scales for each level and an annual growth of 12% has been added for subsequent years.

**Table 7-35: State level 10 year investment plan for Delhi Fire Services for filling gap in operational and new urban Fire Stations (in Crores Rupees)**

| | Capital Expenditure | | Recurring Expenditure | | | | | |
|---|---|---|---|---|---|---|---|---|
| Year | Building Infrastructure | Vehicles and Equipment | Annual Vehicle Maintenance & PDL AMC | Annual Staff Salary | Annual Office Expenses | Annual Training Office Expenses | Annual Bldg. maintenance | Annual Total |
| First Year | 46.10 | 46.67 | 8.62 | 99.90 | 6.29 | 1.10 | 5.17 | 213.85 |
| Second Year | 51.17 | 49.00 | 12.21 | 162.65 | 10.25 | 1.68 | 5.22 | 292.17 |
| Third Year | 28.40 | 27.10 | 14.73 | 208.48 | 13.13 | 2.02 | 6.21 | 300.07 |
| Forth Year | 31.52 | 28.46 | 17.58 | 262.97 | 16.57 | 2.38 | 7.22 | 366.70 |
| Fifth Year | 34.99 | 14.94 | 19.89 | 311.03 | 19.59 | 2.64 | 7.77 | 410.86 |
| Sixth Year | 38.84 | 15.69 | 22.45 | 366.84 | 23.11 | 2.92 | 8.34 | 478.18 |
| Seventh Year | 43.11 | 16.47 | 25.30 | 431.56 | 27.19 | 3.22 | 8.91 | 555.76 |
| Eighth Year | 47.86 | 17.29 | 28.45 | 506.54 | 31.91 | 3.55 | 9.49 | 645.09 |
| Ninth Year | 0.00 | 18.16 | 31.96 | 593.29 | 37.38 | 3.89 | 10.09 | 694.76 |
| Tenth Year | 0.00 | 19.07 | 35.83 | 693.57 | 43.69 | 4.27 | 10.69 | 807.13 |
| Total | **322.00** | **252.84** | **217.01** | **3,636.83** | **229.12** | **27.67** | **79.10** | **4,764.56** |

**Table 7-36: State level 10 year investment plan for Delhi Fire Services for filling gap in operational, new urban and new rural Fire Stations (in Crores Rupees)**

| | Capital Expenditure | | Recurring Expenditure | | | | | |
|---|---|---|---|---|---|---|---|---|
| Year | Building Infrastructure | Vehicles and Equipment | Annual Vehicle Maintenance & PDL AMC | Annual Staff Salary | Annual Office Expenses | Annual Training Office Expenses | Annual Bldg. maintenance | Annual Total |
| First Year | 51.50 | 46.67 | 8.62 | 99.90 | 6.29 | 1.10 | 5.17 | 219.25 |
| Second Year | 57.17 | 49.00 | 12.21 | 162.65 | 10.25 | 1.68 | 5.22 | 298.17 |
| Third Year | 31.73 | 28.54 | 14.81 | 210.88 | 13.29 | 2.04 | 6.32 | 307.60 |
| Forth Year | 35.22 | 29.97 | 17.74 | 268.34 | 16.91 | 2.43 | 7.44 | 378.05 |
| Fifth Year | 39.09 | 15.73 | 20.10 | 318.55 | 20.07 | 2.71 | 8.05 | 424.31 |
| Sixth Year | 43.39 | 16.52 | 22.73 | 376.95 | 23.75 | 3.00 | 8.68 | 495.02 |
| Seventh Year | 48.16 | 17.35 | 25.65 | 444.78 | 28.02 | 3.32 | 9.31 | 576.59 |
| Eighth Year | 53.46 | 18.21 | 28.89 | 523.45 | 32.98 | 3.66 | 9.96 | 670.61 |
| Ninth Year | 0.00 | 19.13 | 32.49 | 614.60 | 38.72 | 4.03 | 10.61 | 719.58 |
| Tenth Year | 0.00 | 20.08 | 36.47 | 720.09 | 45.37 | 4.43 | 11.28 | 837.73 |
| Total | **359.72** | **261.20** | **219.71** | **3,740.20** | **235.63** | **28.41** | **82.04** | **4,926.90** |

From Table 7-35 and Table 7-36, it can be seen that it will involve a total investment of about **Rs. 4,764.5Crores and Rs. 4,926.9 Crores** spread over a period of 10 years for Delhi State including inflationary factors for filling gap in operational and new urban Fire Stations and for filling gap in operational, new urban and new rural Fire Stations, respectively. It may be noted that all the recurring expenses include current salaries and all other expenses from first year to all subsequent years for the next 10 years including various inflationary factors.

### 7.2.5 PRIORITIZATION OF FIRE STATIONS/FIRE POSTS

For prioritization of Fire Stations, the RMSI team has strictly followed risk categorization and population as a criteria. Accordingly, the priority for establishing new and DFS proposed urban Fire Stations and rural Fire Stations/posts has been given in Tables 7-37 and 7-38, respectively. The serial numbers in Tables 7-37 and 7-38 are as per Table 7.4.

It may be noted that actual implementation of priority depends upon a number of factors such as land availability, land possession, tackling any encroachment on available land, getting construction clearances from various authorities for implementation of construction work by PWD. Hence, DFS may change the priority of a Fire Station depending upon the local situation and requirements.

**Table 7-37: Prioritization for establishing new urban Fire Stations in Delhi State**

| Sr. No. | District | Fire Station. Name | Ideal Jurisdiction Area Sq (km) | Estimated Population (2011) | Rank |
|---|---|---|---|---|---|
| 36 | North East | (New FS) Shiv Vihar | 5.3 | 368,542 | 1 |
| 35 | North East | (New FS) Sadatpur (Mustafabad) | 6.17 | 353,492 | 2 |
| 31 | North East | (New FS) Harsh Vihar | 3.64 | 185,328 | 3 |
| 32 | North East | Yamuna Vihar FS | 5.07 | 257,889 | 4 |
| 107 | West | (New FS) Uttam Nager | 8.21 | 375,404 | 5 |
| 95 | South West | (New FS) Kailash Puri West | 7.82 | 347,389 | 6 |
| 79 | South | (New FS) Badarpur | 8.29 | 326,113 | 7 |
| 104 | West | (New FS) Shivram Park | 6.73 | 237,161 | 8 |
| 105 | West | (New FS) Ravi Nagar | 7.58 | 261,534 | 9 |
| 59 | North West | (New FS) Rama Vihar | 7.06 | 234,935 | 10 |
| 54 | North West | (New FS) Sultan Puri | 4.55 | 143,413 | 11 |
| 78 | South | (New FS) Sangam Vihar | 10.6 | 318,123 | 12 |
| 22 | North | Anand Parbat FS | 5.45 | 155,363 | 13 |
| 61 | North West | Rohini Sector-23 FS | 9.85 | 270,210 | 14 |
| 75 | South | (New FS) Dakshnipuri | 6.75 | 180,572 | 15 |
| 29 | North East | (New FS) Sabapur | 3.92 | 103,038 | 16 |
| 103 | West | (New FS) Vikas Garden | 8.42 | 218,976 | 17 |
| 37 | North West | Golden Park Rohtak Road FS | 2.45 | 56,073 | 18 |
| 27 | North East | (New FS) Kalandar Simapuri | 4.27 | 97,218 | 19 |
| 62 | North West | Sanjay Gandhi Transport Nagar FS | 14.15 | 292,048 | 20 |
| 6 | East | Dallupura FS | 5.92 | 120,349 | 21 |
| 5 | East | Gharoli Chand Cinema FS | 4.64 | 89,871 | 22 |
| 53 | North West | (New FS) Inder Enclave | 6.55 | 121,292 | 23 |
| 70 | South | Jasola Badarpur FS | 6.8 | 123,111 | 24 |
| 41 | North West | Rohini Sector-3 FS | 3.9 | 69,353 | 25 |
| 72 | South | (New FS) Anand Lok | 8.41 | 148,291 | 26 |
| 91 | South West | Dwarka Sector-3 FS | 9.52 | 166,659 | 27 |
| 43 | North West | Pitampura TV Tower FS | 5.16 | 89,116 | 28 |
| 60 | North West | (New FS) Veena Enclave (Mundka) | 14.84 | 238,372 | 29 |
| 76 | South | Geetanjali Enclave FS | 13.37 | 198,968 | 30 |

| Sr. No. | District | Fire Station. Name | Ideal Jurisdiction Area Sq (km) | Estimated Population (2011) | Rank |
|---|---|---|---|---|---|
| 48 | North West | Shalimar Bagh FS | 7.28 | 106,312 | 31 |
| 23 | North | (New FS) Baba Nagar Burari | 11.58 | 156,648 | 32 |
| 100 | West | (New FS) Chnchal | 13.4 | 179,832 | 33 |
| 25 | North | (New FS) East Mukherjee Nagar | 13.66 | 170,611 | 34 |
| 52 | North West | (New FS) Nathupura | 11 | 118,681 | 35 |
| 19 | North | Chanderwal Water Works FS | 6.92 | 69,226 | 36 |
| 71 | South | Vasant Kunj FS | 14.66 | 131,660 | 37 |
| 85 | South West | (New FS) Subroto Park | 8.33 | 72,680 | 38 |
| 50 | North West | (New FS) Shiv Vihar (Near Rohini) | 14.01 | 111,604 | 39 |
| 86 | South West | Dwarka Sector-20 FS | 9.88 | 77,526 | 40 |
| 63 | South | (New FS) Neb Sarai Village | 7.75 | 57,022 | 41 |
| 4 | East | (New FS) Patpar Ganj Industrial Area | 4.3 | 25,704 | 42 |
| 83 | South West | Mahipalpur FS | 15.76 | 72,049 | 43 |
| 84 | South West | (New FS) Shyam Vihar Ph-1 | 16.22 | 72,611 | 44 |
| 81 | South West | (New FS) Kapas Hera | 17.59 | 50,142 | 45 |
| 2 | Central | Civic Center/City Center FS | 2.95 | 39,774 | 46 |

**Table 7-38: Prioritization for establishing new rural Fire Stations/Posts in Delhi State**

| Sr. No. | District | Fire Post Name | Ideal Jurisdiction Area Sq (km) | Estimated Population (2011) | Rank |
|---|---|---|---|---|---|
| 74 | South | (New FS) Chhatarpur | 21.62 | 166,160 | 1 |
| 68 | South | (New FS) Jaunapur Village | 19.84 | 110,780 | 2 |
| 87 | South West | (New FS) Ghitorni Village | 20.45 | 84,202 | 3 |
| 67 | South | (New FS) R.S.S.B Mehrauli | 28.71 | 99,543 | 4 |
| 51 | North West | (New FS) Alipur | 68.17 | 118,174 | 5 |
| 38 | North West | (New FS) Pooth Khurd Village | 42.32 | 56,295 | 6 |
| 49 | North West | (New FS) Kanjhanwala Village | 94.31 | 107,062 | 7 |
| 80 | South West | (New FS) Somesh VIhar Colony | 69.9 | 44,444 | 8 |
| 82 | South West | (New FS) Ghumanhera Village | 102.91 | 50,628 | 9 |

### 7.2.6 AVENUES OF FUND GENERATION

DFS can generate new avenues for funds from the following:

- Introduction of Fire Tax (1% of existing property tax)
- Training programs at different levels and durations to private sector employees on chargeable basis

## 7.3 Capacity Building and Training Facilities

### 7.3.1 Fire Training Facilities in Delhi

The State has framed Recruitment Rules (RR) for each level, and these are being adhered to for filling vacant position through the Delhi Staff Selection Board (SSB) and the Union Public Service Commission (UPSC).

Presently, DFS has a training centre-cum-support centre at Fire Safety Management Academy (FSMA), Rohini. The centre has a total staff of 49 with one Divisional Officer (DO), 2 Station Officers (StO), 2 Sub-Officers (SO), 10 Leading Firemen (LFM), 7 Firemen (FM), 26 Fire Operators (FO) and 1 Cleaner. The training centre has 1 Mini Tender, 1 Water Bowser, 1 Rescue Tender (out of order), 1 Rescue Responder, 1 Motor Cycle with mist set, 1 TTL (out of order), 1 QRT (Innova), 1 Ambulance, and 1 Hazmat Van.

The centre also maintains a separate model room having cutout sections of various equipment and a facility of smoke chamber where the working of a sprinkler system can be demonstrated. It has a tunnel for Breathing Apparatus Training. The centre also provides live training to tackle fire generated due to gas leakage (LPG/CNG). The Centre has a magnificent Band Contingent, which also performs in training as well as takes part in fire fighting operations.

The centre is running a Sub-officer course (6 months duration) on behalf of NFSC, Nagpur for the last 5 years, apart from in-service special courses (Table 7-39). *In case of medium and serious fires, the training centre act as a fire fighting unit*.

**(photo source: http://www.delhi.gov.in/wps/wcm/connect/DOIT_FIRE/fire/home/)**

Apart from FSMA Rohini, DFS also sends fire officials to the National Fire Service College (NFSC), Nagpur. Thus, for DFS, these are the two key institutions involved in improving the knowledge base of fire personnel and their overall capabilities to face the challenges of fire-fighting. It may be noted that fire training infrastructure at FSMA, Rohini is not sufficient to meet the current and future training requirement of DFS. However, DFS has already taken a proactive initiative and is in the process of developing a State–of-art training centre near Gummanhera village, South-West District, Delhi.

**Table 7-39: Training courses run by FSMA, Rohini**

| Sr. No. | Courses / Practical Attachments (from April 01, 2010 to March 31, 2011) | Total Participants |
|---|---|---|
| 1 | D.I.F.E, Dwarka (w.e.f. 24 May 2010) | 114 |
| 2 | 26th Ext. Sub-Officers Course From NFSC, Nagpur (w.e.f. 05 July 2010) | 41 |
| 3 | Panipat Thermal Power Station, Panipat (w.e.f. 08 Nov 2010) | 12 |
| 4 | 27th Ext. Sub- Officers Corse from NFSC, Nagpur (w.e.f. 04 Jan. 2011) | 56 |
| | | |

| | | |
|---|---|---|
| | **Courses / Practical Attachments (from 01/04/2009 to 31/03/2010)** | |
| **1** | 63rd Batch of Fire Operators Course (01/04/2009 to 31/03/2010) | |
| | 01.04.09 to 30.09.09 | 56 |
| | 10.06.09 to 10.12.09 | |
| | 01.01.10 to 30.06.10 | |
| **2** | 24th Sub Officer's Course from NFSC, Nagpur (06.07.09 to 29.11.10) | 26 |
| **3** | Practical Attachment of 24th Sub officer's Course from NFS, Nagpur (30.11.10 to 19.02.10) | 26 |
| **4** | Practical Attachment from IIT students Gandhi Nagar, (Gujarat) | |
| | i) 14.12.0 to 18.12.09 | 45 |
| | ii) 19.12.09 to 24.12.09 | |
| **5** | Practical Attachment from DIFE, Dwarka (One Year Course) 01.06.09 to 30.06.09 | 79 |
| **6** | Practical Attachment from DIFE, Dwarka (Six Month Course) 01.06.09 to 30.06.09 | 45 |
| **7** | 3 Months Fire Fighting Training for ONGC (01.10.09 to 31.12.09) | 21 |
| | **Courses / Practical Attachments (from 01/04/2008 to 31/03/2009)** | |
| **1** | 22d Sub officers course | 29 |
| **2** | 23rd Sub officers course | 35 |
| **3** | CISF Practical Attachment | 43 |
| **4** | D.I.F.E, Dwarka | 55 |

DFS sends its officials for training in the areas of IT, procurement procedures, and administration at UT Civil Service Training Centre (UT CSTC). It is also working proactively in awareness generation programs and is conducting regular awareness programs for schools, hospitals, resident welfare societies, govt. offices etc. (Table 7-40). However, there is a need that each district is provided with an 'Education Van' equipped with short video films as produced by MHA, distribution of pamphlets on "DO"s and "DON'T"s generated by MHA and DFS, and live demonstrations of how to use "Portable Extinguishers" and handle small kitchen fires.

**Table 7-40: List of awareness programs carried out by DFS in the last 3-years**

| Sr. No. | Awareness Programs Lectures/ Demos in Govt. Departments/ Private Sector, In PVT./Govt. Schools Children and Staff | Total Participants |
|---|---|---|
| **From 01/04/2011 to 31/03/2011** | | |
| **1** | Atihant Play School, Rohini (April 2010) | 30 |
| **2** | NCC Cadets, Haryana Shakti S.S.S Kanjhawal, Delhi (May 2010) | 500 |
| **3** | NCC Cadets, GSKV, Bawana (May 2010) | 500 |
| **4** | NCC Cadets, Arya, H NA Shakti S.S.S. (May 2010), Kanjhawala, Delhi | 600 |
| **5** | NCC Cadets, Arya, H NA Shakti S.S.S. (May 2010), Kanjhawala, Delhi | 500 |
| **6** | NCC Cadets, Kerala Camp (June 2010) | 350 |
| **7** | NCC Cadets, Delhi Cantt (June 2010) | 500 |
| **8** | Titksha Public School, Rojini (August 2010) | 200 |
| **9** | St. John's Public School, Khera Khurd (August 2010) | 600 |
| **10** | Bon Ascent Kidzee School, C-Block, Rohini (Jan 2011) | 68 |
| **11** | Institute of Nuclear Medicine and Allied Sciences (September 2010) | 250 |
| **12** | D.G. Home Guards and Civil Defence (April 2010) | 71 |

| | | |
|---|---|---|
| **13** | Dr. Baba Saheb Ambedkar Hospital, Rohini (May 2010) | 80 |
| **14** | D.G. Home Guards and Civil Defence (October 2010) | 60 |
| **15** | D.G. Home Guards and Civil Defence (December 2010) | 34 |
| **16** | D.G. Home Guards and Civil Defence (February 2010) | 68 |
| **From 01/04/2009 to 31/03/2010** | | |
| **1** | Lecture and Demonstration at (Prince Public School, Rohini). During fire Service Week (14-20 April) -Approximate | 2,500 |
| **2** | For Government Department Undertakings | 300 |
| **3** | Government and Public Schools | 350 |
| **4** | Cinema Halls and Malls (Netaji Subhash Place Malls, Metro Station, Delhi Hatt, Pitampura) | 250 |
| **5** | Hospitals | 50 |
| **From 01/04/2008 to 31/03/2009** | | |
| **1** | N.C.C. | 3,000 |
| **2** | Private Schools | 12,000 |
| **3** | Government Schools | 6,500 |
| **4** | Home Guards and Civil Defence | 300 |
| **5** | DRDO | 77 |
| **6** | National Industrial Training Centre | 86 |
| **7** | Special Protection Group (SPG) | 160 |
| **8** | Sonia Vihar Water Treatment Plant | 130 |
| **9** | Central Jail, Tihar | 370 |
| **10** | RWAs of Jawahar Park, D-Block | 300 |
| **11** | *Meri Delhi Utsav*, Punjabhi Bagh | 8,000 |

Keeping in view these developments in training facilities, the RMSI team is of the view that future training requirements (say, from 2014 onwards) of DFS can be met fully through these training institutes.

### 7.3.2 TRAINING NEED ASSESSMENT

The roles of firefighter cannot be performed until and unless sufficient training is being imparted to the fire service personnel. The types of training and duration depend upon the type of entry to the fire service department or change of responsibility on promotion. The State has framed Recruitment Rules (RR) for each level, and these are being adhered to for filling the vacant positions. Broadly, there are two entry levels in Fire Services in India; 1) Fireman Level and 2) Middle Level (Sub Officer/ Asstt. Station Officer). Immediately after joining the Fire Services, it is mandatory that every fire personnel needs to undergo professional training.

In order to further strengthen the Delhi Fire Service, the gap in training has been estimated for each type of training. The Fire Station survey and gap analysis reveal that there is significant gap in training need for existing staff. The previous section (section 7.2.2.) details about huge gap in manpower in for operational Fire Stations and need of additional fire personnel for new urban and new rural Fire Stations. As the guidelines of SFAC, immediately after recruitment, fire personnel should undertake professional training. Moreover, there should be refresher training courses at an interval of 3 to 5 years for every fire personnel. The following sections details about the estimation of training need at every level (fireman, leading fireman, station officer, sub-officer etc.).

#### 7.3.2.1 Basic Training for Firemen

The basic training course should provide practical experience of fire fighting to meet the challenge in fire fighting operations. Fire personnel should also be trained for operation and maintenance of fire fighting vehicles and equipment.

Estimated number of fire personnel who require basic training for fireman in operational Fire Stations (after filling the gap of manpower), and additional new recruitment for new urban and new rural Fire Stations is shown in Table 7-41. Additional requirement of Refresher Training Course for Fireman after 3-5 years service as fireman is also shown the Table 7-41. Some of the special training for specialized equipment such as Breathing Apparatus, Global-positioning system etc should also be part of the refresher course. As a whole Delhi Fire Service would require to train 4,994 fire personnel in basic and refresher training in next 10 years. Therefore, State training centre should have adequate capacity and infrastructure for meeting such training requirement.

#### 7.3.2.2 Training Course for Leading Fireman

While promotion from fireman to leading fireman, fire personnel should undertake a training course for Leading Fireman. This training will provide both theoretical and practical training required for effective deployment of fire vehicles and fire equipment and personnel. In case, State Training Centre may not have adequate infrastructure and capacity, the Leading Fireman training should be provided at NFSC Nagpur, or any other suitable State Training Centre.

Estimated number of fire personnel who require training for leading fireman in operational Fire Stations (after filling the gap of manpower), and additional new recruitment for new urban and new rural Fire Stations is shown in Table 7-41.

**Table 7-41: Estimated Training Requirements for Fire Personnel in Delhi Fire Service**

| | | |
|---|---|---|
| **Basic Training for Fireman** | | |
| | Num of Fire Personnel in Operational Fire Stations | 2,461 |
| | Num of Fire Personnel in New Urban Fire Stations | 2,347 |
| | Num of Fire Personnel in New Rural Fire Stations | 186 |
| | **Total Num of Fire Personnel for Training** | **4,994** |
| | | |
| **Refresher Training for Fireman** | | |
| | Total Num of Fire Personnel | **3,439** |
| | | |
| **Leading Fireman Training Course** | | |
| | Num of Fire Personnel in Operational Fire Stations | 313 |
| | Num of Fire Personnel in New Urban Fire Stations | 375 |
| | Num of Fire Personnel in New Rural Fire Stations | 57 |
| | **Total Num of Fire Personnel for Training** | **745** |
| | | |
| **Other Specialized Training Course** | | |
| | **Total Num of Fire Personnel for Training** | **688** |
| | | |
| **Junior Officer Training Course** | | |
| | Num of Fire Personnel in Operational Fire Stations | 309 |
| | Num of Fire Personnel in New Urban Fire Stations | 336 |
| | Num of Fire Personnel in New Rural Fire Stations | 32 |

| | | |
|---|---|---|
| | **Total Num of Fire Personnel for Training** | **677** |
| | | |
| **Divisional Officer Training Course** | | |
| | Num of Fire Personnel in Operational Fire Stations | 33 |
| | Num of Fire Personnel in New Urban Fire Stations | 15 |
| | Num of Fire Personnel in New Rural Fire Stations | 3 |
| | **Total Num of Fire Personnel for Training** | **51** |
| | | |
| **Fire Prevention Course** | | |
| | **Total Num of Fire Personnel for Training** | **67** |

#### 7.3.2.3 Other Specialized Training Courses

Besides undertaken normal training course for Leading Fireman, every leading fireman should also undergo at least one special training for multi-tasking performance in due course of time. In many cases, fire services need to face new challenges and play an important role in other emergencies. Therefore, fire personnel must be well trained to perform in all possible situations. Thus, it is important that they undergo other specialized training as well.

Following are some of the other specialized trainings courses:

- Medical First Responder
- Breathing Apparatus
- Collapsed structure – Search & Rescue,
- Advanced Search & Rescue,
- Flood Rescue
- Chemical Disaster
- Flood / Cyclone Disaster Response
- Earthquake Disaster Response
- Emergency Response to Rail Accidents
- Hazardous Material Emergency

The syllabi of above courses are provided in SFAC guidelines. Number of leading fireman need to attend specialized course is shown in Table 7-41. In total, Delhi Fire Services would need to train at least 745 leading fireman for specialized course in next 10 years. Therefore, State training centre should have adequate capacity and infrastructure for meeting such training requirement.

#### 7.3.2.4 Junior Officer Training Course

While promotion from leading firemen to sub-officer/ station officer, fire personnel should undertake a Junior Officer training course. This course should provide an understanding of Fire Station administration, fire safety management and leadership as to be able to command a Fire Station and also command a fire crew in case of an emergency. Upon successful completion of the training, fire officers should be able to identify components of an effective fire service organization and planning requirement. The officials will be responsible for implementation of fire safety and prevention programs at their assigned Fire Station.

Estimated number of fire officers who need to participate in Junior Officer training course in operational Fire Stations (after filling the gap of manpower), and additional new recruitment for new urban and new rural Fire Stations in next 10 years is shown in Table 7-41.

Therefore, National and State Training Centers should have adequate capacity and infrastructure for meeting such training requirement for Delhi fire service.

#### 7.3.2.5 Divisional Fire Officer Training Course

On promotion to divisional officer, every fire officer should undertake a Divisional Fire Officer (DFO) training course. This course should provide with theory, principles and practices in terms of Fire Station management, facilities, fire inspection as well as effective guidelines to command fire crew and control at an incident site. This course should be designed to promote them for their roles as senior fire officers. Upon successful completion of training, officers should be able to identify components of an effective fire service organization, and implementation of fire prevention and fire safety programs at their assigned area of jurisdiction.

Estimated number of fire officers who require Divisional Officer training course in operational and new Fire Stations (after filling the gap of manpower) is shown in Table 7-41. About 51 fire officers in Delhi Fire Services would require this training in next 10 years.

#### 7.3.2.6 Awareness Generation Programs

Besides attending regular fire and other rescue calls, the State fire services should also work on awareness generation programs, and it should conduct regular awareness programs in schools, residential areas, NCC camps, oil and gas plants, Govt. offices etc.. Currently, numbers of awareness programs conducted so far by Delhi Fire Services are not up to the satisfactory level and there is urgent need to enhance such activities. For large scale public awareness generation, each district is being recommended with an Education Van equipped with short video films as produced by MHA, distribution of pamphlets on “DO”s and “DON’T”s to prevent fire event generated by MHA, live- demonstrations of how to use “portable extinguishers” and how to handle small kitchen fires.

## 7.4 Limitations of the Study

1. In fire hazard and risk analysis, fire-load of specific industry has not been taken into consideration. However, weightage has been given to the size of industrial area in the fire hazard and risk analysis of the base unit (district level). An attempt has been made even in the present assignment to go further down at lower levels. Providing special weightage of type of industry will require building level survey including estimation of fire-load for each industry, which is out of scope of present assignment.
2. Currently, Census 2011 has published only district level demographic data (the Tehsil/ Block level data is still unavailable), which has been used for further estimation and analysis purpose.
3. Floating population in cities has not been considered for distribution over the land use (built-up area); this may be attempted in future detailed studies.
4. Non-availability of a uniform level of fire statistics of all the fire events in the past 5 years.
5. Designation, rank structure and administrative control are very heterogeneous from State to State, which in the present State creates ambiguity while brining in at National level. For example, Director Position pay scale in one State may not be equal to that of Chief Fire Officer in another State. For the purpose of present assignment, we have divided the rank/designation structure into 11 levels (level 0 to level 10). For this, a system needs to be put in place through having a uniform administrative structure at national level to State level. This may require development and implementation of National Fire Act, which MHA is trying to develop in near future.
6. The fire fighting infrastructure of forest department, privately owned companies/ organizations, military cantonment and airbases, nuclear power plants, nuclear research reactors, heavy water plants, mines, ports, airports, oil exploration and oil refineries are out of scope of present study. However, RMSI has tried to get information about the fire-fighting infrastructure for these, and included available information, as there are limitations due to security concerns. This is more so, as result of this study may be made available in public domain with their spatial location. Studying fire infrastructure in above areas will require special MOU's with MHA and controlling agencies, and may be attempted in future studies to have a complete coverage of the country.

## 7.5 Recommendations for Delhi Fire Services

1. Delhi State was governed by Building bye-laws (1983) for the buildings existing at that time. Fire Prevention and Fire Safety Act (1986) came in force in 1986 as rules for implementing this were approved in 1987. This Act was applicable to only those buildings, which were 15 m or more in height *(high-rise)*. The Delhi Fire Service Act (2007) was issued as Delhi Act No. 2 of 2009, vide Notification No. F-7(21)/2010/H-III, dated 1-7-2010 and Delhi Fire Service Rules, 2010 vide Notification No. F-7(21)/2010/H-III/962, w.e.f. 2-7-2010. The Delhi Fire Service Act (2007) is applicable to all those buildings, which were 9 m and above in height. In addition, this act made NBC-Part IV mandatory. However, there is an urgent need for its strict implementation, especially to high-rise buildings, industrial units, institutions and public and private buildings.
2. Computerization of Delhi Fire Services (DFS) was envisioned in the early nineties and accordingly several initiatives have been taken. For example, DFS already has a dedicated website (http://www.delhi.gov.in/wps/wcm/connect/DOIT_FIRE/fire/home/*;* http://dfs.delhigovt.nic.in/dfs2/f_login.asp*).* DFS is also making fire reports available to public through online after 72 hours for an incident. However, all the Fire Stations have not been connected through INTRANET and training of fire personnel in use of computers is required, which is also important from modernization of fire services point of view.
3. Training of fire personnel in use of computers is another aspect, which is very important from the modernization of fire services point of view.
4. Online Vehicle tracking through GPS and development of a fully computerized response system is another area for improvement.
5. The State fire service should adopt a system of payment of incentives for driving specialized vehicles like ALP / TTL.
6. Based on prioritization of Fire Stations, State Fire Services needs to add new Fire Stations at a faster pace, to serve the entire State (both urban and rural areas) in a more systematic manner.DFS workshop takes care of day-to-day repairs on fire vehicles for the whole of Delhi. There are a large number of vacancies in the workshop, which need to be filled up as workload has increased, because the number of Fire Stations has increased in the recent years. Due to lack of staff, major repairs are being done through annual maintenance contract with Govt. authorized dealers and workshops. The records of repairs etc. are maintained by the workshop. However, there is a need to fill up the resultant vacancies in DFS workshop for enabling timely repairs.
7. Though DFS is creating public awareness programs for schools, colleges, shopping malls, cinema halls Govt. offices, Resident Welfare Associations, etc. DFS should have a dedicated Education Van in each district for the purpose. The van should be equipped with short video films as produced by MHA, distribution of pamphlets on “DO”s and “DON’T”s generated by MHA and DFS, and live demonstration of how to use “portable extinguishers” and handle small fires.
8. DFS needs to strengthen its Fire Prevention Wing (inspection, awareness, and training) so that in future, fire events similar to that at AMRI, Kolkata can be prevented. For this, DFS Fire Prevention Wing should carryout regular fire drills and fire-inspections,

awareness and training to public personnel in schools, hospitals, high-rise buildings, cinema halls, shopping malls, govt. and private offices, institutional buildings etc.

9. For congested areas, and by-lanes where movement of Water Tender and Water Bowser is difficult, QRTs and motorcycle with mist sets should be used for the fastest response, supplemented by the Water Tenders and Water Bowsers by laying the large hose pipelines. Additionally, State Fire Services should identify congested areas and request district administration to decongest such areas with the help of police. The congestion could be in terms of illegal extension of residential buildings, shops, unauthorized parking on roads. For unauthorized parking, State traffic department can also play an important role. Here role of Fire Prevention Wing officials is important, as such exercise are not one time exercise and should be carried out regularly.
10. The fire services in the State should have a routine audit by a central authority to ensure good finance mechanism for capital, and O&M expenditures.

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