Directorate General NDRF & Civil Defence (Fire)
Ministry of Home Affairs
East Block 7, Level 7,
NEW DELHI, 110066,

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 Phase II States (Dadra and Nagar Haveli, Daman and Diu, Goa, Gujarat, Karnataka, Madhya Pradesh)

November 2012

Submitted by

RMSI
A-8, Sector 16
Noida 201301, INDIA
Tel: +91-120-251-1102, 2101
Fax: +91-120-251-1109, 0963
www.rmsi.com

Contact: **Sushil Gupta**
General Manager, Risk Modeling and Insurance
Email:Sushil.Gupta@rmsi.com

RMSI
Delivering a world of solutions

Table of Contents

List of Figures

List of Tables

Acknowledgements

The assistance of Dr. P. M. Nair, Director General (DG), NDRF & CD, Shri Mukul Goel, IG, NDRF & CD, Shri D. K. Shami, Dy. Fire Adviser, Shri Chandrashekhar, Director (Fire Project Cell), Shri Nakul Kumar Tarun, Dy. Director (Fire Project Cell), Shri Santosh Gupta, Assistant Director (Fire Project Cell), Shri Santosh J. Thomas, Assistant Director, (Fire Project Cell), NDRF & CD and other staff members of the Directorate of NDRF & CD is gratefully appreciated for giving this opportunity.

In addition, the support and valuable assistance of Shri R. Bannerjee, CEO; Shri V. Thiruppugazh, Additional CEO, and Shri Nisarg Dave, Sector Manager, Gujrat State Disaster Management Authority (GSDMA) is gratefully acknowledged. Also, the support of Shri M.F. Dastoor, CFO, Ahmedabad and all other CFO's of Municipal Corporations, their staff, and Heads of Municipal councils is greatfully acknowledged.

Our special thanks are due to Shri R. K. Srivastava, Joint-Secretary (DM), MHA, Shri Sanjay Agrawal, Director (DM), MHA and the project reviewing and monitoring committee consisting of Dr. P. M. Nair, DG, NDRF & CD, (Chairman), Dr G. A. Bhat (member), Lt. Col (retd.) P.K. Pathak, Consultant, NIDM (member), Shri D. K. Shami (member), and Shri Chandrashekhar (member – secretary), for sparing their valuable time in review of this report.

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 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 equipments.

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 Stations 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, 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 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 the initial phase, the pilot study comprises of 6 states and UTs (Jammu & Kashmir, Rajasthan, Maharashtra, Delhi, Andaman & Nicobar Island, and Puducherry), and in subsequent phases (Phase-I to Phase-IV) rest of States/UTs have been taken up as detailed in Section 2.3.

Field Surveys for Fire Infrastructure Data

To collect and collate the information on Fire Infrastructure of all the States/ UTs, RMSI team developed two detailed forms “Headquarter Data Collection Form” and individual “Fire Stations 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. etc. All this information for each and every 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 Stations 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.

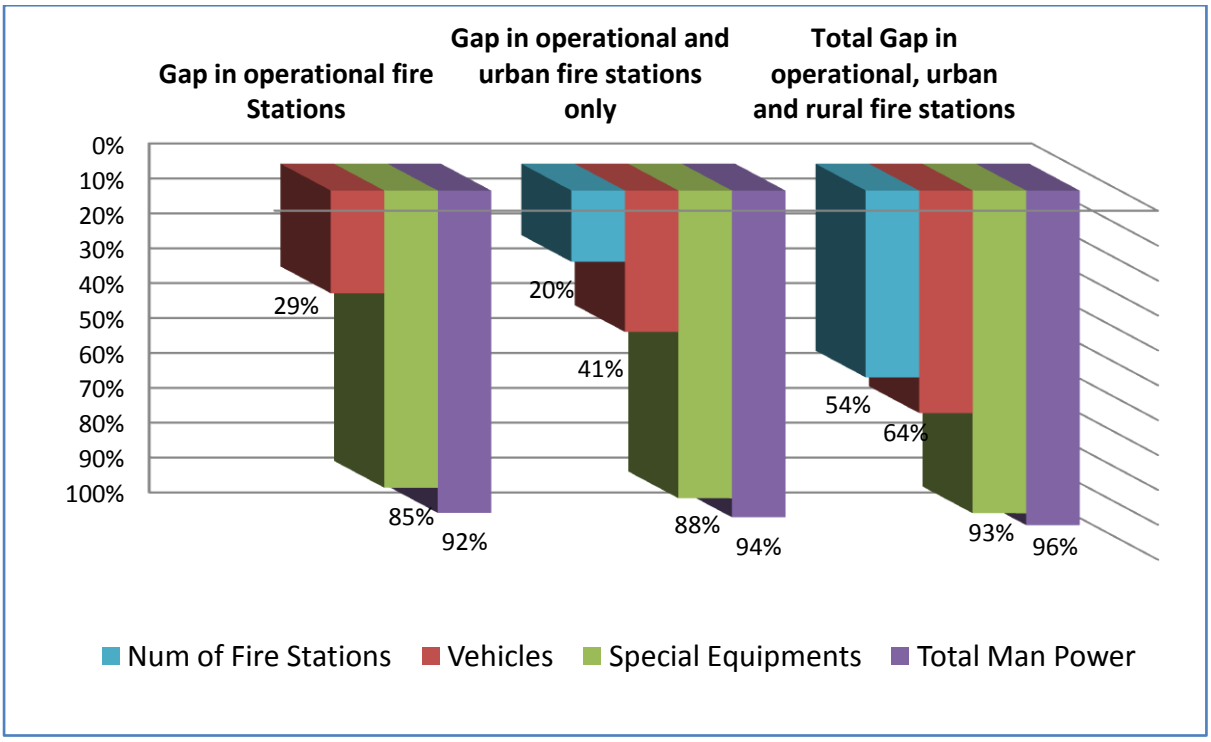
- ***Depending upon the risk category, the recommended response time for first fire tender is 5 to 7 minutes in urban areas and 20 minutes in rural areas***

Summary of Findings for Gujarat State

Presently, Gujarat Fire & Emergency Services (GF&ES) has 183 operational Fire Stations, one State Fire and Emergency Training Centre at Koturpur Water Works, Ahmedabad, and 5 Emergency Response Centres (ERCs) at Gandhinagar, Gandhidham, Rajkot, Surat, and Vadodara. 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 cantonment, thermal/nuclear power plants, refinaries 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 equipments 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 GF&ES would require additional 47 Fire Stations in urban areas and 164 Fire Stations in rural areas. Hence this study finds an overall gap of 54% in terms of number of Fire Stations in Gujarat State (for details, please refer to section 22.3.1).



Firefighting and Rescue Vehicles and Specialized Equipment Gap Analysis

Gujarat Fire and Emergencgy Services has state-of-art (and best in the country) firefighting & rescue vehicles and equipment 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 22.3.2. This study finds an overall gap of 64% in the firefighting and rescue vehicles and about 93% 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. The current duty pattern in Gujarat State is varying from 8 hours, 12 hours,and 24 hours, and RMSI team estimated for manpower requirement for double shift duty pattern (for details, please refer to section 22.3.3). Thus, in Gujarat State, this study finds an overall gap of 96% in fire personnel considering double shift duty pattern.

Fire Prevention Wing

In addition to fire fighting staff, there is an urgent need for a dedicated and well-coordinated *Gujarat State Fire Prevention Wing* for inspection, awareness generation, and training in schools, colleges, hospitals, shopping malls, cinema halls, high-rise buildings, industries, govt. offices, public buildings etc. need further strengthingso 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 Chief Executive Officer (CEO) and Additional Chief Executive Officer (ACEO), Gujarat State Disaster Management Authority (GSDMA), additional officers at the levels of Director (Technical), Joint Director (Technical), Deputy Director (Technical), Chief Fire Officer (CFO), Dy Chief Fire Officer (Dy-CFO), Divisional Fire Officer (DFO), and Assistant Divisional Fire Officer (ADFO) have been suggested (for details, please refer to section 22.3.3).

Fire Station, District, and State Level Report Generation

The detailed report of Operational Fire Stations, district and State levels for fire infrastructure and gap analysis is also available through the Fire Decision Support System (FDSS), which can generate reports for each Operational Fire Station, district, and State level 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 Fire Decision Support System (FDSS). As detailed in section 22.5, 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 22.5) for the next 10-years includes both capital and recurring expenditures. RMSI analysis estimates a total investment of **about Rs 22,085 Crores** (Table 22-36) spread over a period of 10 years for GFS 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 Gujarat State for both rural and urban areas has been detailed in section 22.6. Accordingly, separate priority ranking for both urban and rural areas are given in Table 22.38 and Table 22.39, respectively.

Avenues for Fund Generation

The Gujarat Fire Fire & Emergency Services 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

- Capitation fee for scrutiny of building plans.

Capacity Building and Training Facilities

The study finds that there are some gaps in Capacity Building and Training among the fire personnel within the Gujarat State. The detailed Capacity building and training need assessment for various levels have been discussed in section 22.8. Additionally, RMSI team is making a separate report of Capacity Building and Training Infrastructure for all States/UTs in the country.

Limitations of the study

Limitations of study are given in section 22.9.

Recommendations

The report concludes with the recommendations for the Gujarat State Fire and Emergency Services and are detailed in section 22.10. In short, GF&ES can be revamped in next 10 years to desired level provided sufficient funds and trained resources are made available.

Report Structure

This report for the Phase II States/UTs is divided in two parts:

Part A: This part comprises of chapters 1-6, which is common for all the 35 States/UTs Fire Services.

- 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 19-24, which are specific to the State/UT being discussed.

- Chapter 19 provides detailed analysis for the Dadra and Nagar Haveli UT
- Chapter 20 provides detailed analysis for the Daman and Diu UT
- Chapter 21 provides detailed analysis for the Goa State
- Chapter 22 provides detailed analysis for the Gujarat State
- Chapter 23 provides detailed analysis for the Karnataka State
- Chapter 24 provides detailed analysis for the Madhya Pradesh State

For Part-B, this report consists of Chapter 22, which is for Gujarat 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).

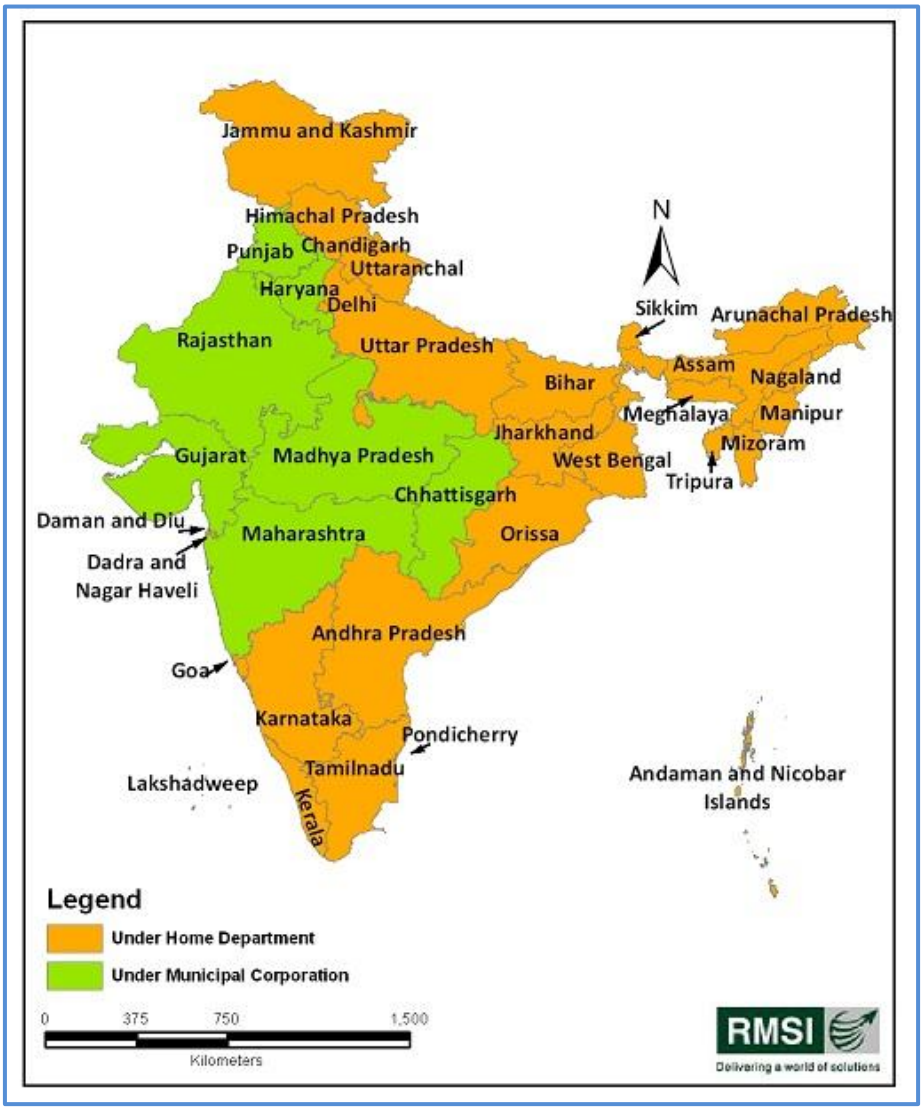


Figure 1-1: Distribution of fire services by various States/UTs by administrative organization

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 equipments 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 equipments. 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 Stated/UT Fire Service Department. ***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.

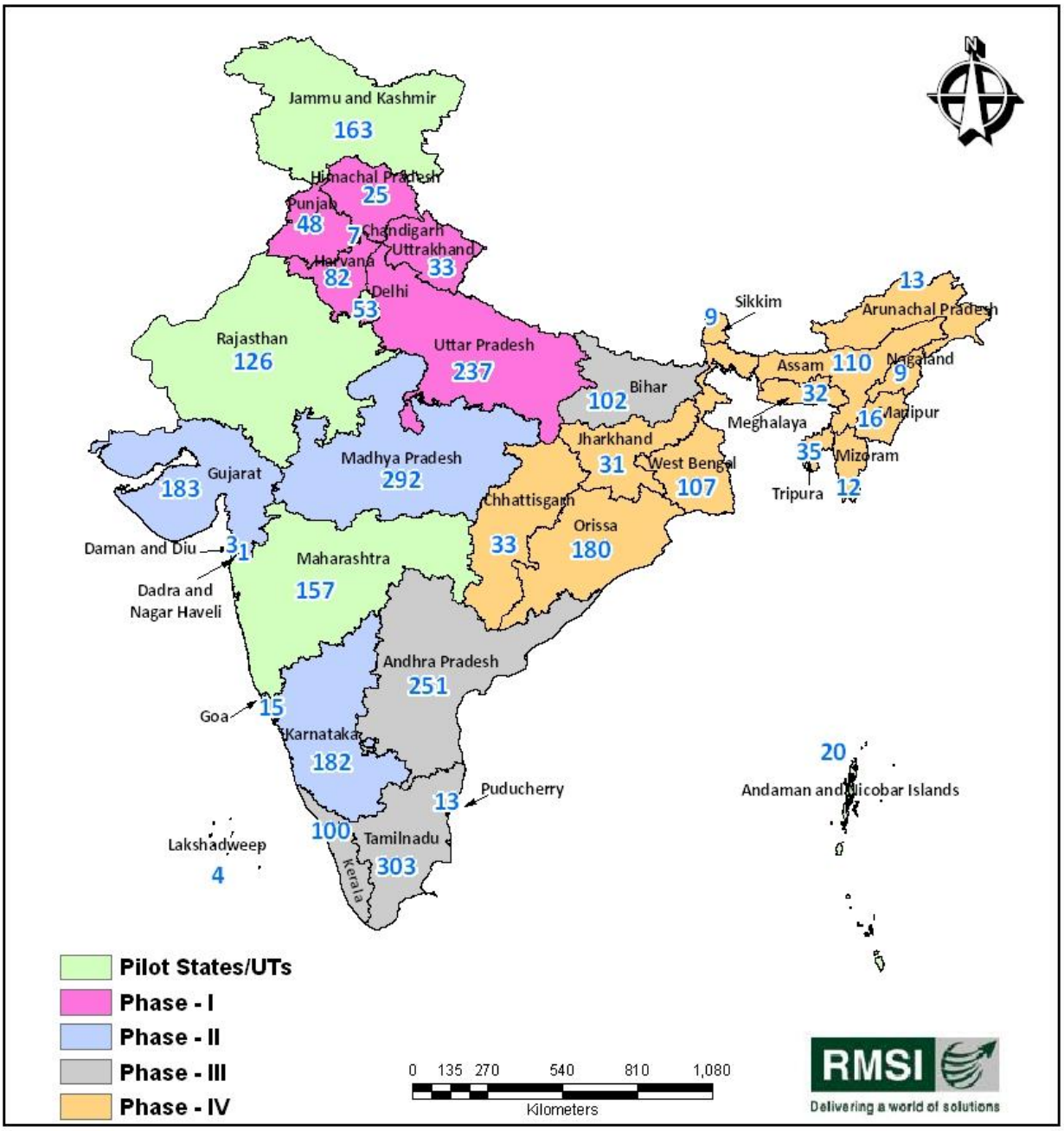


Figure 2-1 : State/UT wise distribution of fire service stations in India

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).

The initial phase pilot study comprises of six States and UTs - **Jammu & Kashmir, Rajasthan, Puducherry, Maharashtra, Andaman & Nicobar Island, and Delhi and rest of the States/UTs have been taken up in subsequent Phases (Phase-I to Phase-IV)**. The Fire- Infrastructure of all the 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 are being used as a template for conducting the study for the remaining States/ UTs in the phased manner indicated in 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 fire fighting equipments 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).

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

States	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

States	No of Districts (Census 2011)	No of Talukas/ Tehsils/ Mandals (Census 2001)	No of Fire Stations
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
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 Ffire 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 anddistrict 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 densities 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.
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.

ID	Class Name	Description
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

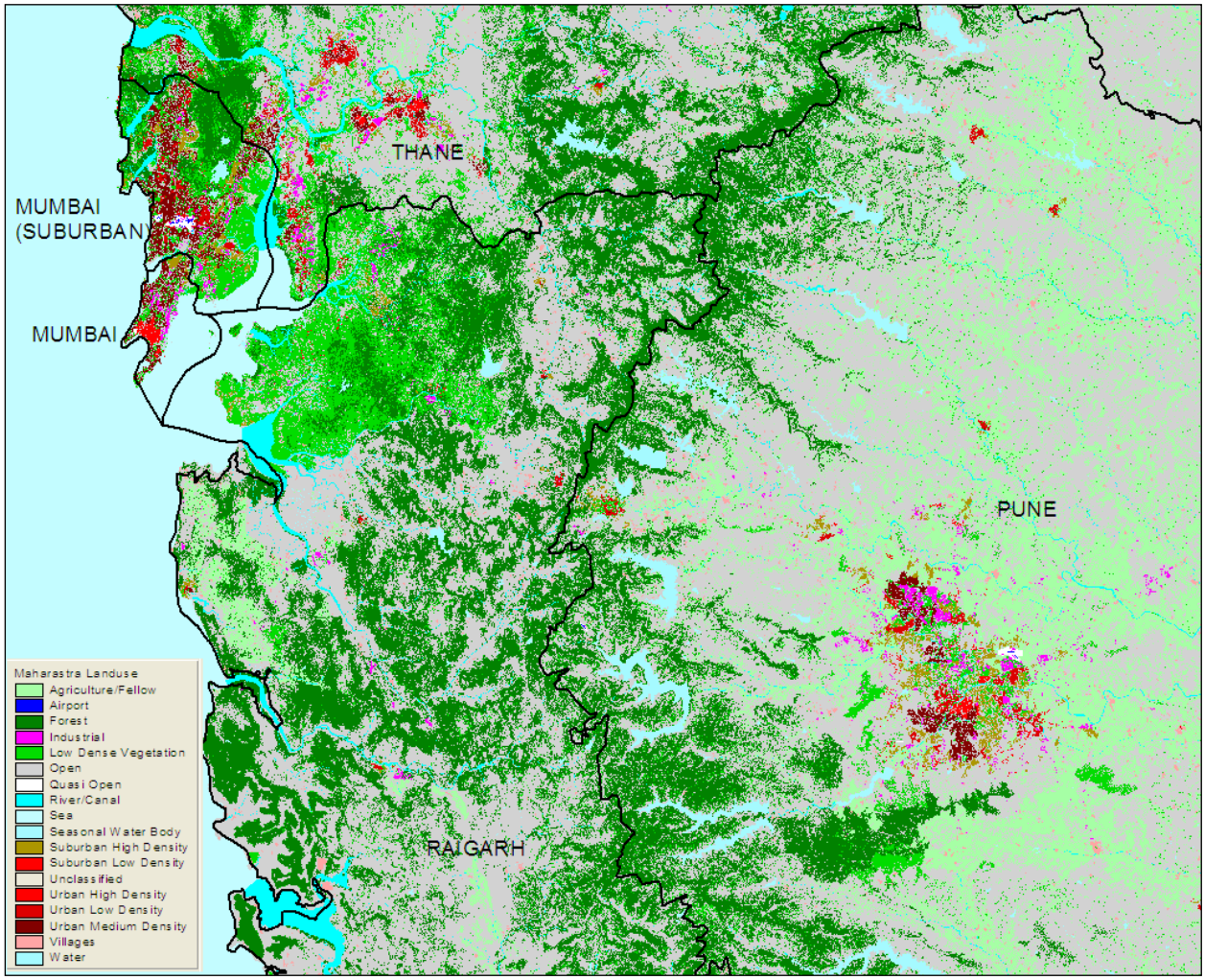


Figure 3-1 : An example of a Land use classification at 25m pixel. The example shows parts of Western Maharashtra (districts – Mumbai, Mumbai sub-urban, Thane, Pune, and Raigarh)

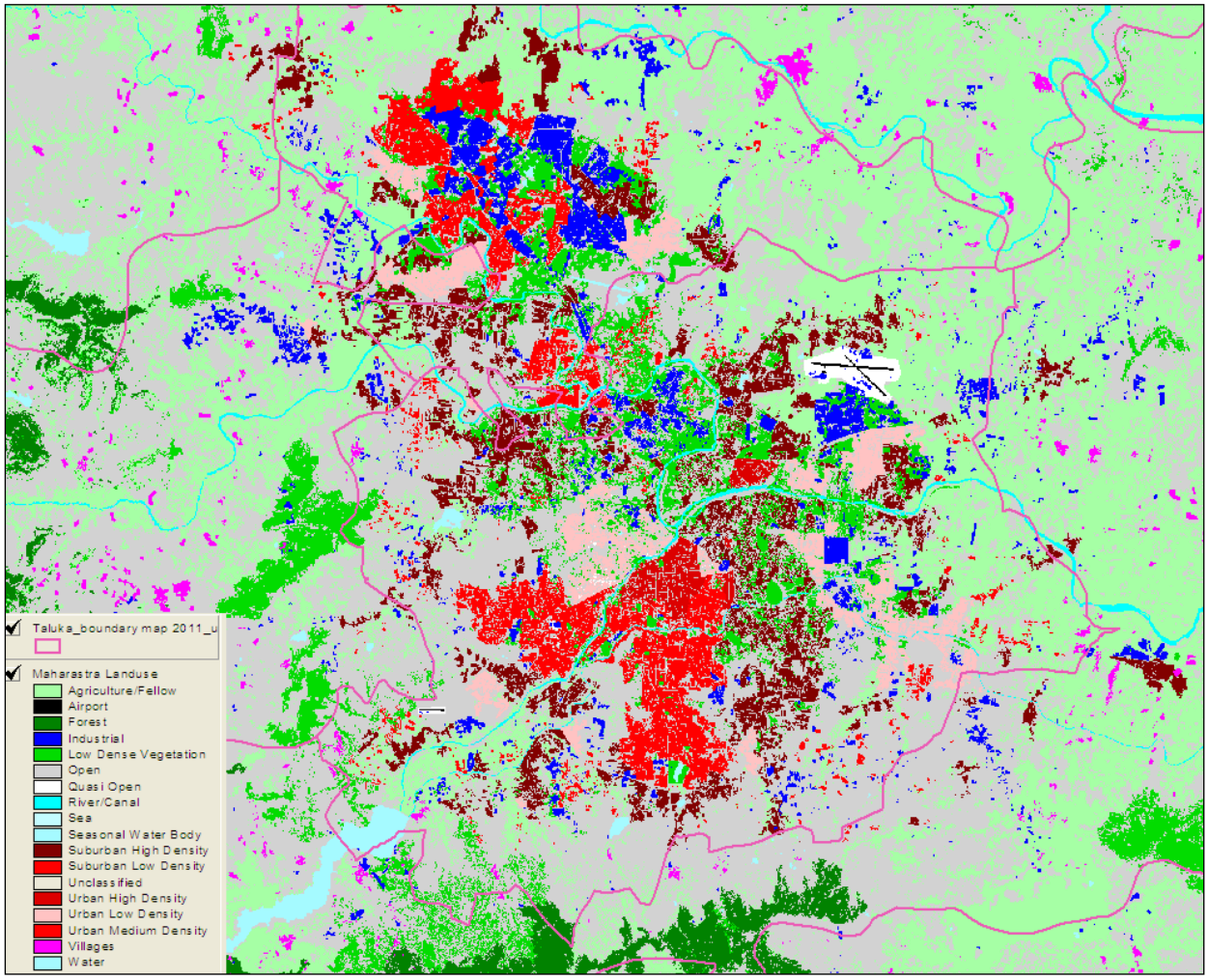


Figure 3-2 : Example of an enlarged view of classified. The example shows urban agglomeration classification in Pune city areas

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.

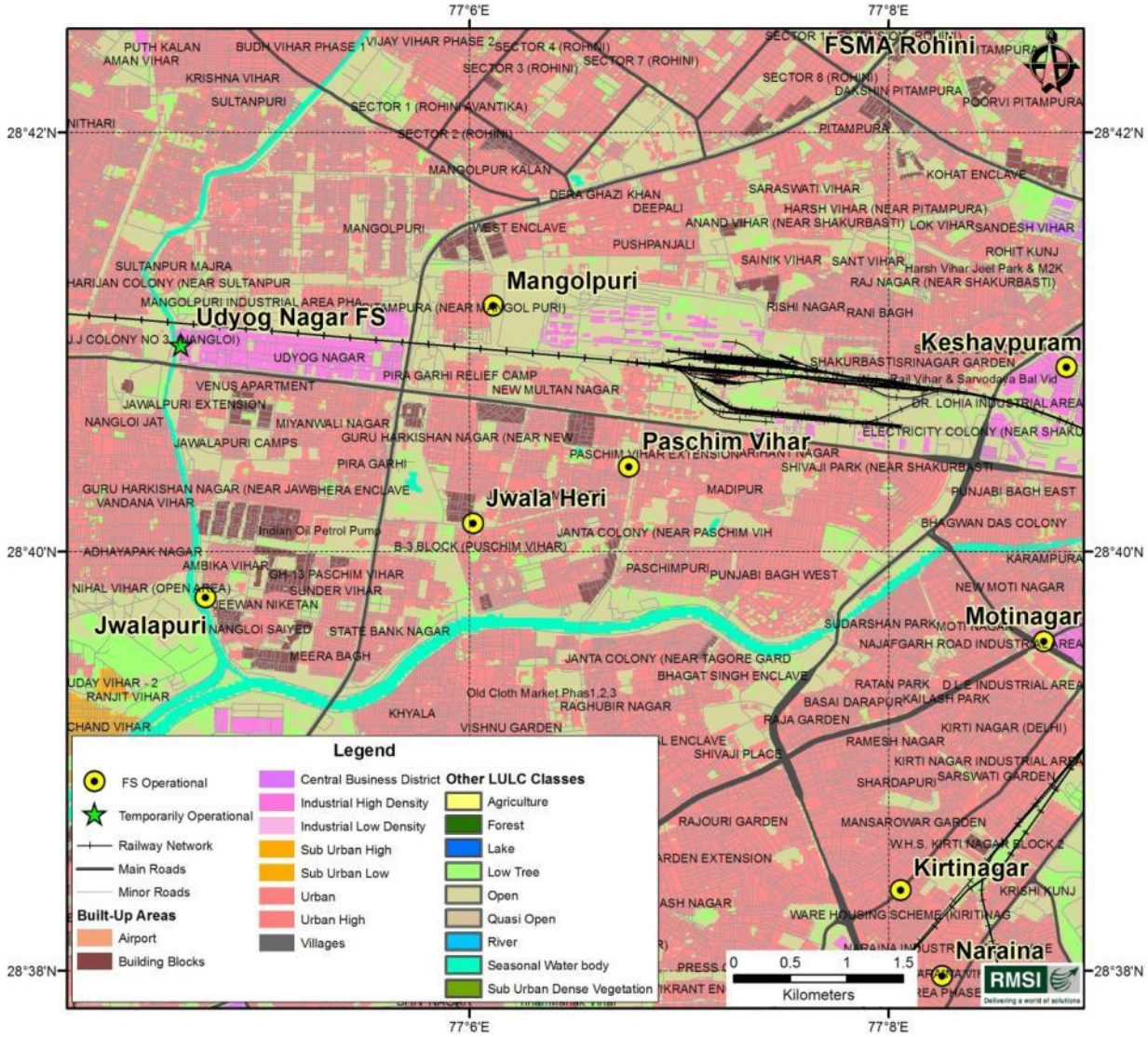


Figure 3-3 : An example of a detailed classified urban agglomerate area. The example shows parts of Delhi with overlay of GPS locations of Fire Stations

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.

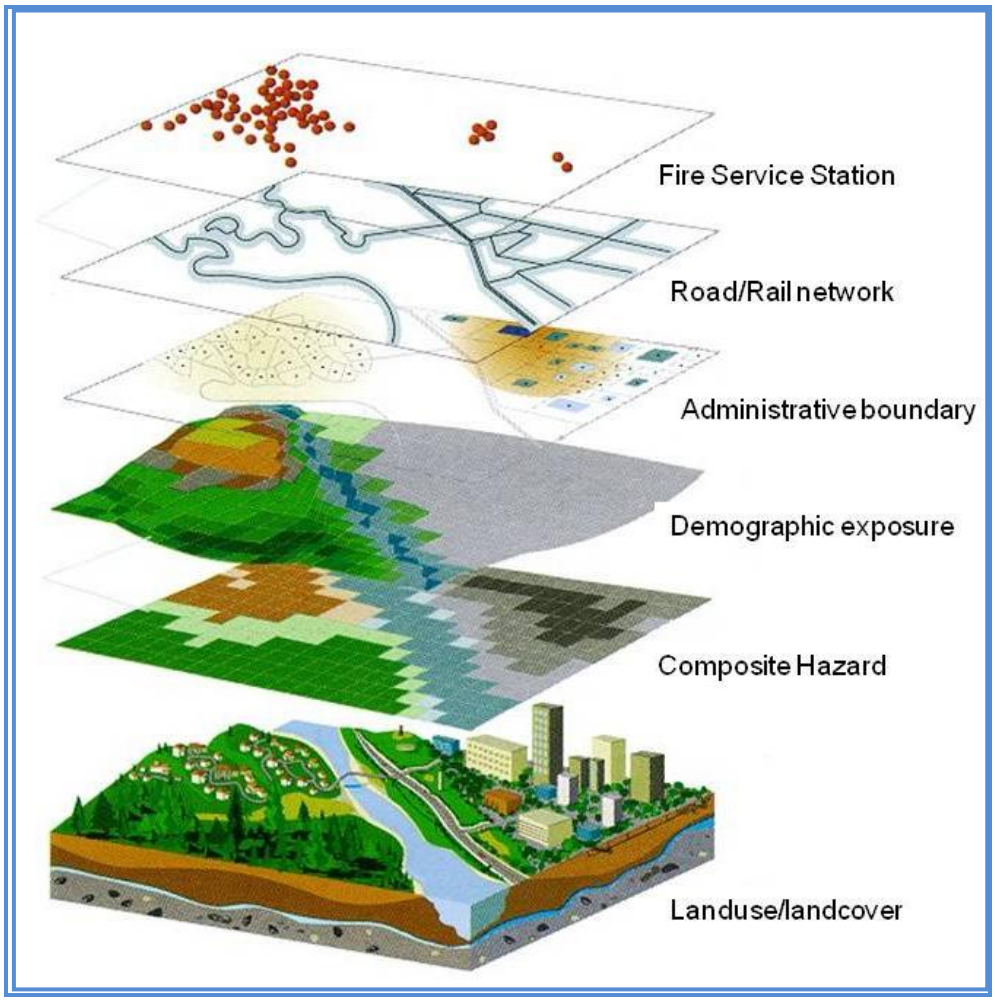


Figure 3-4 : Overlay analysis for Fire Risk Assessment

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.

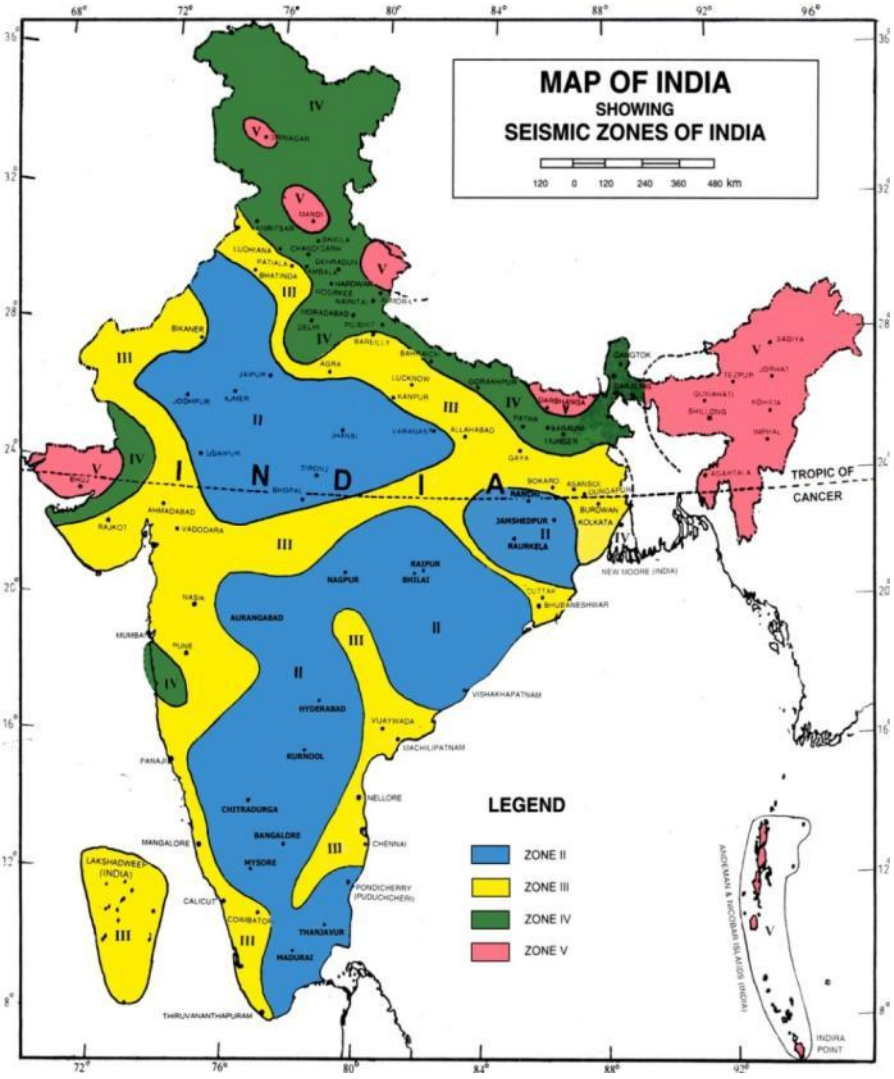


Figure 3-5 : Seismic Zones of India

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%**

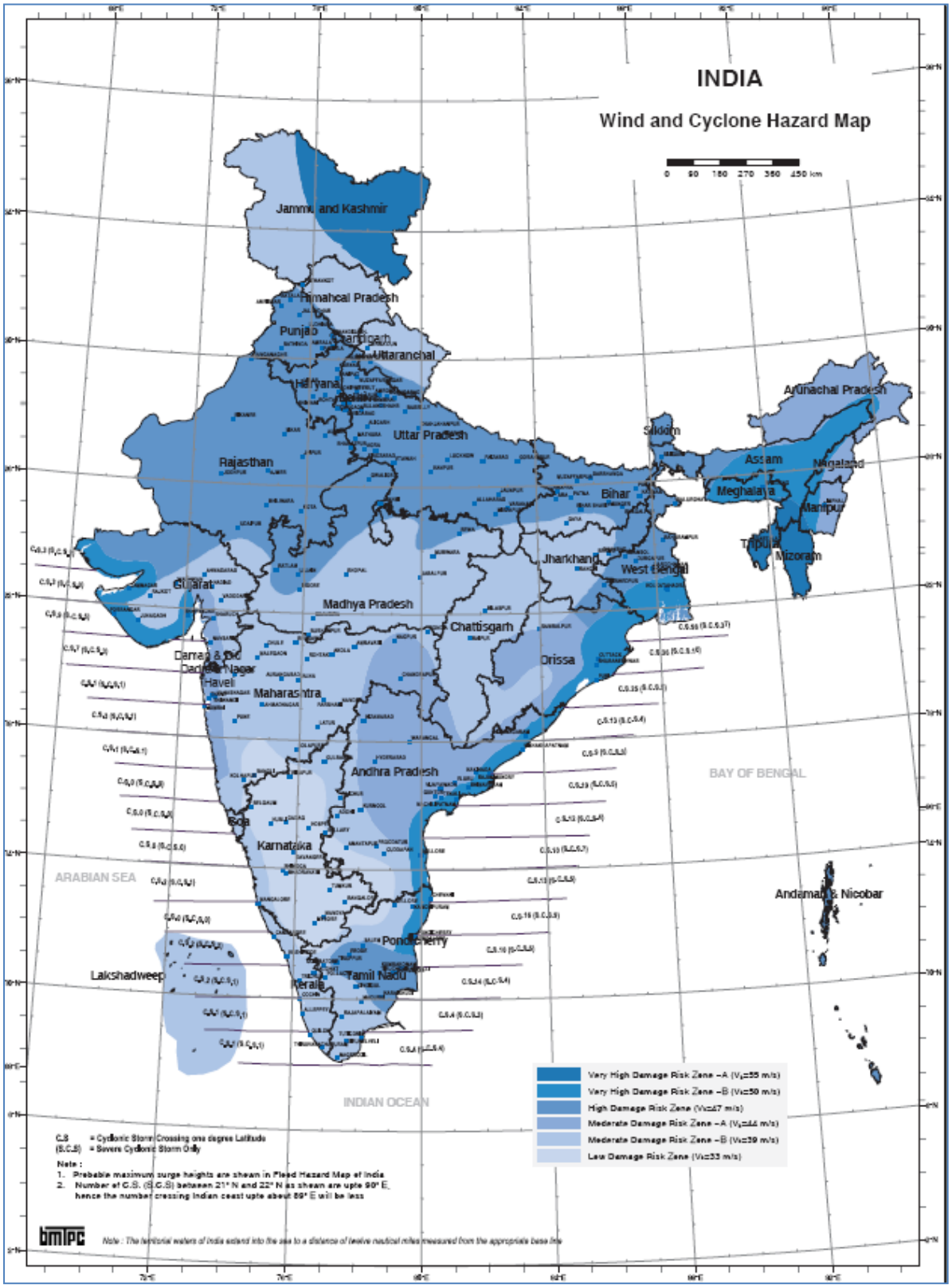


Figure 3-6 : Wind zone map of India (BMTPC, 2006)

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.

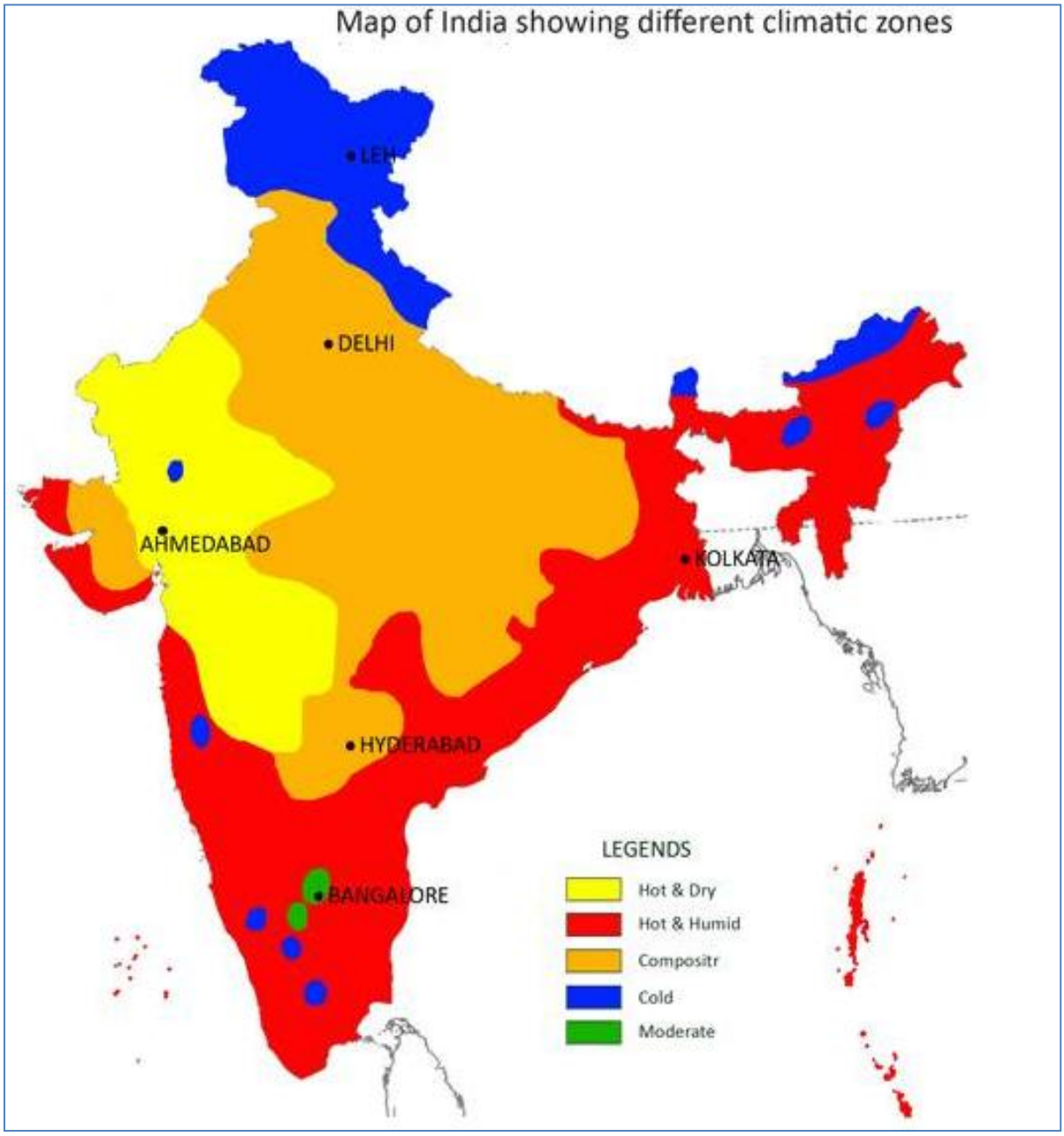


Figure 3-7 : Climatic Zones of India

Table 3-3: District level ranking for individual (earthquake, wind and climatic) hazard and integrated hazards for all Phase II States

Importance Factor			20%	20%	20%	40%	Integrated Hazard Zoning
State	**District**	**Geographical Area (Sq km)**	**Wind Zoning**	**Seismic Zoning**	**Climate Zoning**	**Hill Zoning**	
Madhya Pradesh							
	Alirajpur	3,334	1.5	2.0	3.0	2.0	2.1
	Anuppur	3,810	1.5	1.3	2.0	2.0	1.8
	Ashoknagar	4,743	2.4	1.0	2.2	2.0	1.9
	Balaghat	9,310	1.5	1.0	2.0	2.0	1.7
	Barwani	5,426	1.5	2.0	3.0	2.0	2.1
	Betul	10,074	1.5	2.0	2.1	2.0	1.9
	Bhind	4,478	3.0	1.0	2.0	2.0	2.0
	Bhopal	2,770	1.5	1.0	2.0	2.0	1.7
	Burhanpur	3,231	1.5	2.0	3.0	2.0	2.1
	Chhatarpur	8,717	2.1	1.0	2.0	2.0	1.8
	Chhindwara	11,855	1.5	1.6	2.0	2.0	1.8
	Damoh	7,337	1.5	1.2	2.0	2.0	1.7
	Datia	2,682	3.0	1.0	2.0	2.0	2.0
	Dewas	7,012	1.7	1.5	2.0	2.0	1.8
	Dhar	8,152	1.9	1.5	2.6	1.5	1.8
	Dindori	5,802	1.5	1.2	2.0	2.0	1.7
	East Nimar	7,477	1.5	2.0	2.7	1.5	1.8
	Guna	6,386	2.9	1.0	2.8	1.5	1.9
	Gwalior	4,572	3.0	1.0	2.0	2.0	2.0
	Harda	3,338	1.5	2.0	2.0	2.0	1.9
	Hoshangabad	6,698	1.5	2.0	2.0	2.0	1.9
	Indore	3,908	2.2	1.1	2.0	2.0	1.9
	Jabalpur	5,127	1.5	2.0	2.0	2.0	1.9
	Jhabua	3,442	1.7	1.4	3.0	2.0	2.0
	Katni	5,106	1.5	1.4	2.0	2.0	1.8
	Mandla	7,566	1.5	1.2	2.0	2.0	1.7
	Mandsaur	5,551	3.0	1.0	3.0	2.0	2.2
	Morena	4,994	3.0	1.0	2.0	2.0	2.0
	Narsimhapur	5,155	1.5	2.0	2.0	2.0	1.9
	Neemuch	4,306	3.0	1.0	3.0	2.0	2.2
	Panna	7,126	2.8	1.0	2.0	2.0	2.0
	Raisen	8,494	1.5	1.4	2.0	2.0	1.8
	Rajgarh	6,169	2.7	1.0	2.2	2.0	2.0
	Ratlam	4,859	2.7	1.0	2.9	1.5	1.9
	Rewa	6,363	2.7	1.0	2.0	2.0	1.9
	Sagar	10,301	1.5	1.1	2.0	2.0	1.7
	Satna	7,598	2.6	1.0	2.0	2.0	1.9

Importance Factor			20%	20%	20%	40%	Integrated Hazard Zoning
State	**District**	**Geographical Area (Sq km)**	**Wind Zoning**	**Seismic Zoning**	**Climate Zoning**	**Hill Zoning**	
	Sehore	6,573	1.5	1.4	2.0	2.0	1.8
	Seoni	8,807	1.5	1.2	2.0	2.0	1.7
	Shahdol	5,738	1.5	1.8	2.0	2.0	1.9
	Shajapur	6,195	2.6	1.0	2.2	2.0	2.0
	Sheopur	6,610	3.0	1.0	2.0	2.0	2.0
	Shivpuri	10,306	3.0	1.0	2.0	2.0	2.0
	Sidhi	4,830	1.5	1.5	2.0	2.0	1.8
	Singrauli	5,822	1.5	1.9	2.0	2.0	1.9
	Tikamgarh	5,052	2.1	1.0	2.0	2.0	1.8
	Ujjain	6,097	3.0	1.0	2.1	2.0	2.0
	Umaria	4,606	1.5	2.0	2.0	2.0	1.9
	Vidisha	7,312	1.5	1.0	2.0	2.0	1.7
	West Nimar	8,017	1.5	2.0	2.8	1.5	1.9
Gujarat							
	Ahmadabad	8,108	2.1	2.1	2.9	1.5	2.0
	Amreli	7,056	2.3	2.0	1.5	2.0	2.0
	Anand	3,205	1.9	2.0	3.0	2.0	2.2
	Banas Kantha	10,753	3.0	2.8	3.0	2.0	2.6
	Bharuch	6,477	1.9	2.0	3.0	2.0	2.2
	Bhavnagar	9,758	2.9	2.0	1.5	2.0	2.1
	Dohad	3,657	1.5	2.0	3.0	2.0	2.1
	Gandhinagar	1,652	1.5	2.0	3.0	2.0	2.1
	Jamnagar	10,868	3.3	2.7	1.2	1.5	2.0
	Junagadh	8,865	3.2	2.0	1.0	1.5	1.9
	Kachchh	41,580	3.2	4.0	1.7	2.0	2.6
	Kheda	3,955	1.6	2.0	3.0	2.0	2.1
	Mahesana	4,396	2.1	2.2	3.0	2.0	2.3
	Narmada	2,817	1.5	2.0	3.0	2.0	2.1
	Navsari	2,205	2.0	2.0	3.0	2.0	2.2
	Panch Mahals	5,727	1.5	2.0	3.0	2.0	2.1
	Patan	5,793	3.0	3.2	2.9	1.5	2.4
	Porbandar	2,328	3.5	2.0	1.0	1.0	1.7
	Rajkot	11,259	2.2	2.4	1.8	2.0	2.1
	Sabar Kantha	7,400	1.7	2.0	3.0	2.0	2.1
	Surat	4,336	1.9	2.0	3.0	2.0	2.2
	Surendranagar	10,431	1.9	2.4	2.3	2.0	2.1
	Tapi	3,140	1.5	2.0	3.0	2.0	2.1
	The Dangs	1,762	1.5	2.0	3.0	2.0	2.1
	Vadodara	7,549	1.5	2.0	3.0	2.0	2.1
	Valsad	2,950	2.0	2.0	2.1	2.0	2.0

Importance Factor			20%	20%	20%	40%	Integrated Hazard Zoning
State	**District**	**Geographical Area (Sq km)**	**Wind Zoning**	**Seismic Zoning**	**Climate Zoning**	**Hill Zoning**	
Daman & Diu							
	Daman	63	2.0	2.0	1.0	1.0	1.4
	Diu	28	3.4	3.0	1.0	1.0	1.9
Dadra & Nagar Haveli							
	Dadra & Nagar Haveli	490	2	2	1	1	1.4
Karnataka							
	Bagalkot	6,550	1.0	1.0	1.0	1.0	1.0
	Bangalore	2,199	1.0	1.0	1.4	1.5	1.3
	Bangalore Rural	2,301	1.0	1.0	1.9	2.0	1.6
	Belgaum	13,427	1.0	1.4	1.0	1.0	1.1
	Bellary	8,464	1.1	1.0	1.0	1.0	1.0
	Bidar	5,446	1.5	1.0	2.2	2.0	1.7
	Bijapur (K)	10,492	1.1	1.1	1.3	1.5	1.3
	Chamarajanagar	5,651	1.1	1.1	1.0	4.5	2.4
	Chikkaballapura	4,250	1.0	1.0	1.7	2.0	1.5
	Chikmagalur	7,200	1.0	1.1	1.0	1.0	1.0
	Chitradurga	8,437	1.0	1.0	1.0	1.0	1.0
	Dakshina Kannada	4,861	1.3	1.9	1.0	1.0	1.2
	Davanagere	5,922	1.0	1.0	1.0	1.0	1.0
	Dharwad	4,256	1.0	1.0	1.0	1.0	1.0
	Gadag	4,655	1.0	1.0	1.0	1.0	1.0
	Gulbarga	10,960	1.5	1.0	2.4	2.0	1.8
	Hassan	6,812	1.0	1.0	1.0	1.5	1.2
	Haveri	4,820	1.0	1.0	1.0	1.0	1.0
	Kodagu	4,108	1.1	1.6	1.0	4.5	2.5
	Kolar	3,988	1.0	1.0	1.0	1.0	1.0
	Koppal	5,569	1.0	1.0	1.0	1.0	1.0
	Mandya	4,964	1.0	1.0	1.4	1.5	1.3
	Mysore	6,308	1.0	1.1	1.0	1.5	1.2
	Raichur	8,446	1.2	1.0	1.7	2.0	1.6
	Ramanagara	3,516	1.0	1.0	1.5	1.5	1.3
	Shimoga	8,473	1.1	1.3	1.0	1.0	1.1
	Tumkur	10,604	1.0	1.0	1.1	1.5	1.2
	Udupi	3,580	1.5	2.0	1.0	1.0	1.3
	Uttara Kannada	10,270	1.3	1.7	1.0	1.0	1.2
	Yadgir	5,276	1.3	1.0	1.9	2.0	1.6
Goa							
	North Goa	1,737	1.5	2.0	1.0	1.0	1.3
	South Goa	1,960	1.5	2.0	1.0	1.0	1.3

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.

Table 3-4: District level geographical area, population, population density, residential built-up area, residential built-up area, and industrial area for all Phase II States

State	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)
Madhya Pradesh							
	Alirajpur	3,334	728,677	218.55	25.55	0.11	1%
	Anuppur	3,810	749,521	196.73	53.65	2.34	1%
	Ashoknagar	4,743	844,979	178.14	64.26	1.05	1%
	Balaghat	9,310	1,701,156	182.72	96.40	0.44	1%
	Barwani	5,426	1,385,659	255.37	40.44	2.80	1%
	Betul	10,074	1,575,247	156.37	77.68	0.62	1%
	Bhind	4,478	1,703,562	380.42	62.57	1.16	1%
	Bhopal	2,770	2,368,145	854.99	82.09	4.52	3%
	Burhanpur	3,231	756,993	234.29	27.59	0.33	1%
	Chhatarpur	8,717	1,762,857	202.23	67.40	1.48	1%
	Chhindwara	11,855	2,090,306	176.33	123.95	1.24	1%
	Damoh	7,337	1,263,703	172.24	83.03	2.20	1%
	Datia	2,682	786,375	293.17	36.33	0.38	1%
	Dewas	7,012	1,563,107	222.92	62.54	1.58	1%
	Dhar	8,152	2,184,672	267.98	125.80	12.08	2%
	Dindori	5,802	704,218	121.37	21.32	0.06	0%
	East Nimar	7,477	1,309,443	175.12	62.29	0.66	1%
	Guna	6,386	1,240,938	194.32	64.14	1.93	1%
	Gwalior	4,572	2,030,543	444.15	84.80	2.74	2%
	Harda	3,338	570,302	170.84	54.60	0.03	2%
	Hoshangabad	6,698	1,240,975	185.28	57.78	0.86	1%
	Indore	3,908	3,272,335	837.28	134.24	12.95	3%
	Jabalpur	5,127	2,460,714	479.99	105.38	7.18	2%
	Jhabua	3,442	1,024,091	297.56	20.24	0.37	1%
	Katni	5,106	1,291,684	252.97	48.15	1.84	1%

State	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)
	Mandla	7,566	1,053,522	139.25	61.03	1.37	1%
	Mandsaur	5,551	1,339,832	241.38	70.79	1.45	1%
	Morena	4,994	1,965,137	393.49	41.84	1.00	1%
	Narsimhapur	5,155	1,092,141	211.86	50.45	0.42	1%
	Neemuch	4,306	825,958	191.81	38.20	1.59	1%
	Panna	7,126	1,016,028	142.59	38.24	1.09	1%
	Raisen	8,494	1,331,699	156.78	51.62	2.88	1%
	Rajgarh	6,169	1,546,541	250.68	59.13	0.51	1%
	Ratlam	4,859	1,454,483	299.35	52.41	1.80	1%
	Rewa	6,363	2,363,744	371.50	43.03	1.13	1%
	Sagar	10,301	2,378,295	230.88	131.04	1.99	1%
	Satna	7,598	2,228,619	293.33	93.05	3.52	1%
	Sehore	6,573	1,311,008	199.47	45.46	0.80	1%
	Seoni	8,807	1,378,876	156.57	97.87	0.57	1%
	Shahdol	5,738	1,064,989	185.61	93.61	2.06	2%
	Shajapur	6,195	1,512,353	244.11	61.93	0.33	1%
	Sheopur	6,610	687,952	104.08	35.12	0.61	1%
	Shivpuri	10,306	1,725,818	167.46	85.39	0.94	1%
	Sidhi	4,830	1,126,515	233.24	22.09	0.45	0%
	Singrauli	5,822	1,178,132	202.35	25.14	0.95	0%
	Tikamgarh	5,052	1,444,920	286.02	61.80	0.13	1%
	Ujjain	6,097	1,986,597	325.84	110.09	2.97	2%
	Umaria	4,606	643,579	139.73	35.27	0.05	1%
	Vidisha	7,312	1,458,212	199.42	65.53	0.72	1%
	West Nimar	8,017	1,872,413	233.55	81.05	3.68	1%
Gujarat							
	Ahmadabad	8,108	7,208,200	889.05	214.89	41.78	3%
	Amreli	7,056	1,513,614	214.53	122.18	4.42	2%
	Anand	3,205	2,090,276	652.29	76.03	8.60	2%
	Banas Kantha	10,753	3,116,045	289.79	128.59	1.94	1%
	Bharuch	6,477	1,550,822	239.43	77.80	18.60	1%
	Bhavnagar	9,758	2,877,961	294.94	149.26	7.35	2%
	Dohad	3,657	2,126,558	581.50	33.71	0.87	1%
	Gandhinagar	1,652	1,387,478	839.77	46.01	3.08	3%
	Jamnagar	10,868	2,159,130	198.67	135.41	11.16	1%
	Junagadh	8,865	2,742,291	309.34	185.87	10.60	2%
	Kachchh	41,580	2,090,313	50.27	188.30	17.89	0%
	Kheda	3,955	2,298,934	581.23	91.91	2.45	2%
	Mahesana	4,396	2,027,727	461.23	112.54	8.23	3%
	Narmada	2,817	590,379	209.61	31.14	0.61	1%

State	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)
	Navsari	2,205	1,330,711	603.39	80.87	3.41	4%
	Panch Mahals	5,727	2,388,267	417.04	84.57	11.08	1%
	Patan	5,793	1,342,746	231.77	74.34	1.09	1%
	Porbandar	2,328	586,062	251.75	41.73	4.49	2%
	Rajkot	11,259	3,799,770	337.48	217.27	37.24	2%
	Sabar Kantha	7,400	2,427,346	328.02	123.60	2.09	2%
	Surat	4,336	6,079,231	1402.16	150.16	35.50	3%
	Surendranagar	10,431	1,755,873	168.32	112.57	7.42	1%
	Tapi	3,140	806,489	256.82	53.29	0.81	2%
	The Dangs	1,762	226,769	128.69	13.88	0.04	1%
	Vadodara	7,549	4,157,568	550.71	156.76	20.34	2%
	Valsad	2,950	1,703,068	577.38	82.02	21.89	3%
Daman & Diu							
	Daman	63	190,855	3024.35	7.78	2.28	12%
	Diu	28	52,056	1846.55	2.23	0.02	8%
Dadra & Nagar Haveli							
	Dadra & Nagar Haveli	490.28	342,853	699.31	7.92	7.82	2%
Karnataka							
	Bagalkot	6,550	1,890,826	288.68	90.39	2.92	1%
	Bangalore	2,199	9,588,910	4360.27	262.19	27.72	12%
	Bangalore Rural	2,301	987,257	429.00	46.52	9.83	2%
	Belgaum	13,427	4,778,439	355.89	228.68	9.92	2%
	Bellary	8,464	2,532,383	299.21	139.54	6.67	2%
	Bidar	5,446	1,700,018	312.15	71.12	2.66	1%
	Bijapur (K)	10,492	2,175,102	207.32	75.85	1.87	1%
	Chamarajanagar	5,651	1,020,962	180.66	69.79	0.11	1%
	Chikkaballapura	4,250	1,254,377	295.12	72.96	0.58	2%
	Chikmagalur	7,200	1,137,753	158.03	112.08	0.61	2%
	Chitradurga	8,437	1,660,378	196.80	116.65	1.28	1%
	Dakshina Kannada	4,861	2,083,625	428.65	123.82	6.64	3%
	Davanagere	5,922	1,946,905	328.78	137.65	3.10	2%
	Dharwad	4,256	1,846,993	433.96	90.93	6.01	2%
	Gadag	4,655	1,065,235	228.82	62.15	2.52	1%
	Gulbarga	10,960	2,564,892	234.01	105.08	4.86	1%
	Hassan	6,812	1,776,221	260.75	139.10	3.46	2%
	Haveri	4,820	1,598,506	331.61	122.48	1.12	3%
	Kodagu	4,108	554,762	135.05	57.31	0.90	1%
	Kolar	3,988	1,540,231	386.18	87.98	8.38	2%
	Koppal	5,569	1,391,292	249.84	71.66	4.13	1%

State	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)
	Mandya	4,964	1,808,680	364.33	162.45	5.15	3%
	Mysore	6,308	2,994,744	474.77	191.86	13.59	3%
	Raichur	8,446	1,924,773	227.88	108.32	4.08	1%
	Ramanagara	3,516	1,082,739	307.90	68.77	1.71	2%
	Shimoga	8,473	1,755,512	207.19	125.20	2.80	1%
	Tumkur	10,604	2,681,449	252.87	188.59	3.40	2%
	Udupi	3,580	1,177,908	329.02	31.85	0.98	1%
	Uttara Kannada	10,270	1,436,847	139.91	84.29	1.88	1%
	Yadgir	5,276	1,172,985	222.31	44.85	0.52	1%
Goa							
	North Goa	1,737	817,761	470.67	35.78	1.87	2%
	South Goa	1,960	639,962	326.53	24.37	1.72	1%

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. District-level population densities have been 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.). An example of this is shown in Figure 3-8 for Maharashtra. It can be seen that 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.) have 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 5th ranking, while districts having <1 % built-up area as whole have been assigned a rank of 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 is being used for ranking all the districts in the remaining 29 States/UTs also.

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).

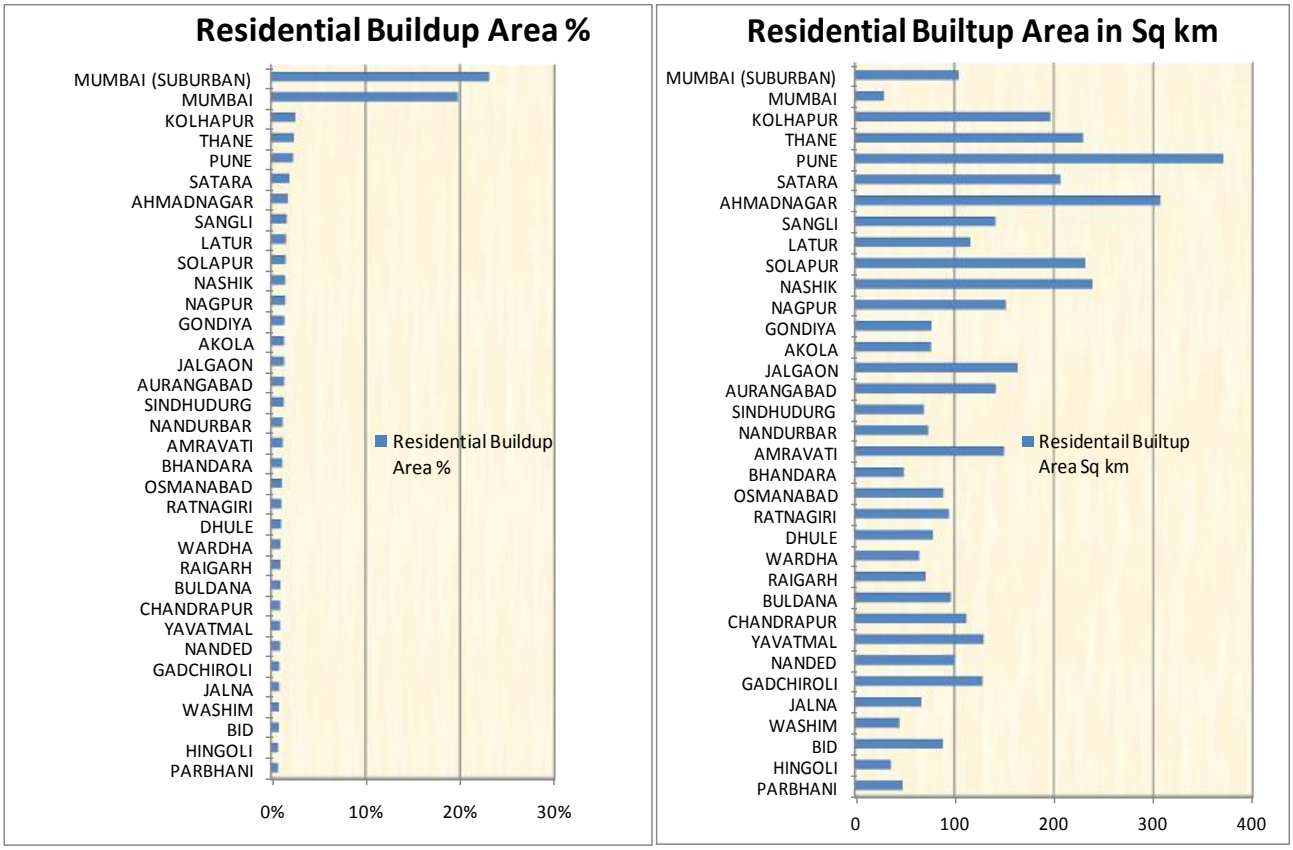


Figure 3-8 : Example of comparison of district level rankings for residential built-up area percentages and absolute areas (in sq km). The example shows a comparison for all 35 districts of Maharashtra State

An example of 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).

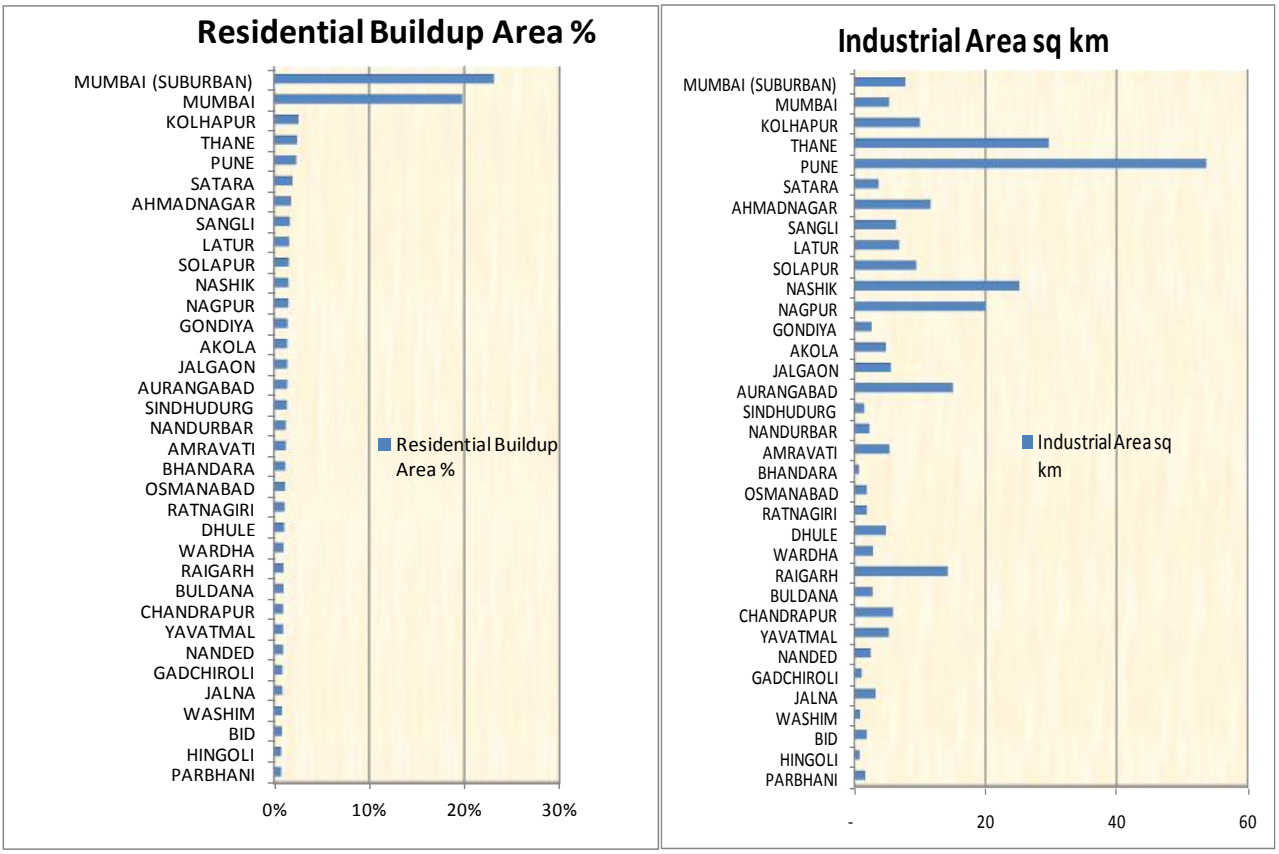


Figure 3-9 : Example of comparison of district level rankings for residential built-up areas and industrial areas (in sq km). The example shows a comparison for all 35 districts of Maharashtra State

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 Phase II States

State	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
Madhya Pradesh							
	Alirajpur	2	2	2	1	6	Medium
	Anuppur	1	3	2	3	6	Medium
	Ashoknagar	1	3	2	3	6	Medium
	Balaghat	1	3	2	1	5	Low
	Barwani	2	2	2	3	7	Medium
	Betul	1	3	2	1	5	Low
	Bhind	2	3	2	3	7	Medium
	Bhopal	3	3	3	4	8	High
	Burhanpur	2	2	2	1	6	Medium
	Chhatarpur	2	3	2	3	7	Medium
	Chhindwara	1	4	2	3	7	Medium
	Damoh	1	3	2	3	6	Medium
	Datia	2	2	2	1	6	Medium
	Dewas	2	3	2	3	7	Medium
	Dhar	2	4	3	5	9	Very High
	Dindori	1	2	1	1	4	Low
	EastNimar	1	3	2	1	5	Low
	Guna	1	3	2	3	6	Medium
	Gwalior	2	3	3	3	8	High
	Harda	1	3	3	1	6	Medium
	Hoshangabad	1	3	2	1	5	Low
	Indore	3	4	3	5	9	Very High
	Jabalpur	2	4	3	4	8	High
	Jhabua	2	2	2	1	6	Medium
	Katni	2	2	2	3	6	Medium
	Mandla	1	3	2	3	6	Medium
	Mandsaur	2	3	2	3	7	Medium
	Morena	2	2	2	1	6	Medium
	Narsimhapur	2	3	2	1	6	Medium
	Neemuch	1	2	2	3	6	Medium
	Panna	1	2	2	3	6	Medium

State	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
	Raisen	1	3	2	3	6	Medium
	Rajgarh	2	3	2	1	6	Medium
	Ratlam	2	3	2	3	7	Medium
	Rewa	2	2	2	3	6	Medium
	Sagar	2	4	2	3	7	Medium
	Satna	2	3	2	3	7	Medium
	Sehore	1	2	2	1	5	Low
	Seoni	1	3	2	1	5	Low
	Shahdol	1	3	3	3	7	Medium
	Shajapur	2	3	2	1	6	Medium
	Sheopur	1	2	2	1	5	Low
	Shivpuri	1	3	2	1	6	Medium
	Sidhi	2	2	1	1	5	Low
	Singrauli	2	2	1	1	5	Low
	Tikamgarh	2	3	2	1	6	Medium
	Ujjain	2	4	3	3	8	High
	Umaria	1	2	2	1	5	Low
	Vidisha	1	3	2	1	5	Low
	WestNimar	2	3	2	3	7	Medium
Gujarat							
	Ahmadabad	3	5	3	5	10	Very High
	Amreli	2	4	3	4	8	High
	Anand	3	3	3	4	9	Very High
	BanasKantha	2	4	2	3	8	High
	Bharuch	2	3	2	5	8	High
	Bhavnagar	2	4	3	4	9	Very High
	Dohad	3	2	2	1	6	Medium
	Gandhinagar	3	2	3	3	8	High
	Jamnagar	1	4	2	5	8	High
	Junagadh	2	4	3	5	9	Very High
	Kachchh	1	4	1	5	8	High
	Kheda	3	3	3	3	8	High
	Mahesana	2	4	3	4	9	Very High

State	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
	Narmada	2	2	2	1	6	Medium
	Navsari	3	3	3	3	8	High
	Panch Mahals	2	3	2	5	8	High
	Patan	2	3	2	3	7	Medium
	Porbandar	2	2	3	4	7	Medium
	Rajkot	2	5	3	5	10	Very High
	SabarKantha	2	4	3	3	8	High
	Surat	4	4	3	5	10	Very High
	Surendranagar	1	4	2	4	8	High
	Tapi	2	3	3	1	7	Medium
	The Dangs	1	1	2	1	5	Low
	Vadodara	3	4	3	5	10	Very High
	Valsad	3	3	3	5	9	Very High
Daman & Diu							
	Daman	4	1	4	3	7	Medium
	Diu	4	1	3	3	6	Medium
Dadra & Nagar Haveli							
	Dadra & Nagar Haveli	3	1	2	4	6	Medium
Karnataka							
	Bagalkot	2	3	2	3	6	Medium
	Bangalore	4	5	3	5	10	Very High
	Bangalore Rural	2	2	3	4	7	Medium
	Belgaum	2	5	3	4	8	High
	Bellary	2	4	3	4	8	High
	Bidar	2	3	2	3	7	Medium
	Bijapur (K)	2	3	2	3	6	Medium
	Chamarajanagar	1	3	2	1	6	Medium
	Chikkaballapura	2	3	3	1	6	Medium
	Chikmagalur	1	4	3	1	6	Medium
	Chitradurga	1	4	2	3	6	Medium
	Dakshina Kannada	2	4	3	4	8	High
	Davanagere	2	4	3	3	7	Medium
	Dharwad	2	3	3	4	7	Medium

State	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
	Gadag	2	3	2	3	6	Medium
	Gulbarga	2	4	2	4	8	High
	Hassan	2	4	3	3	7	Medium
	Haveri	2	4	3	3	7	Medium
	Kodagu	1	3	2	1	6	Medium
	Kolar	2	3	3	4	7	Medium
	Koppal	2	3	2	4	7	Medium
	Mandya	2	4	3	4	8	High
	Mysore	2	5	3	5	9	Very High
	Raichur	2	4	2	4	8	High
	Ramanagara	2	3	3	3	7	Medium
	Shimoga	2	4	2	3	7	Medium
	Tumkur	2	4	3	3	7	Medium
	Udupi	2	2	2	1	5	Low
	Uttara Kannada	1	3	2	3	6	Medium
	Yadgir	2	2	2	1	5	Low
Goa							
	North Goa	2	2	3	3	6	Medium
	South Goa	2	2	2	3	6	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 equipments, 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 equipments, 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 equipments 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.

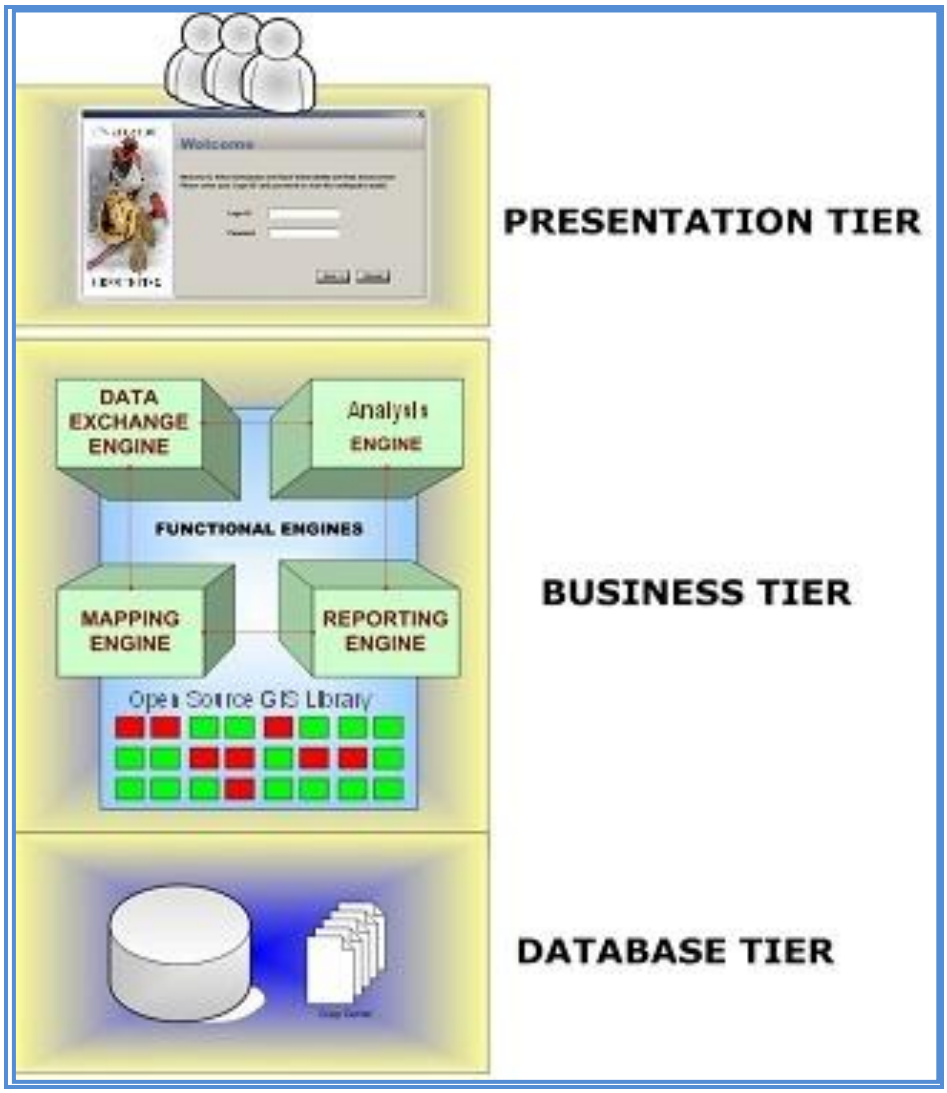


Figure 5-1 : Three-tier architecture

- **Presentation tier:** This user 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.

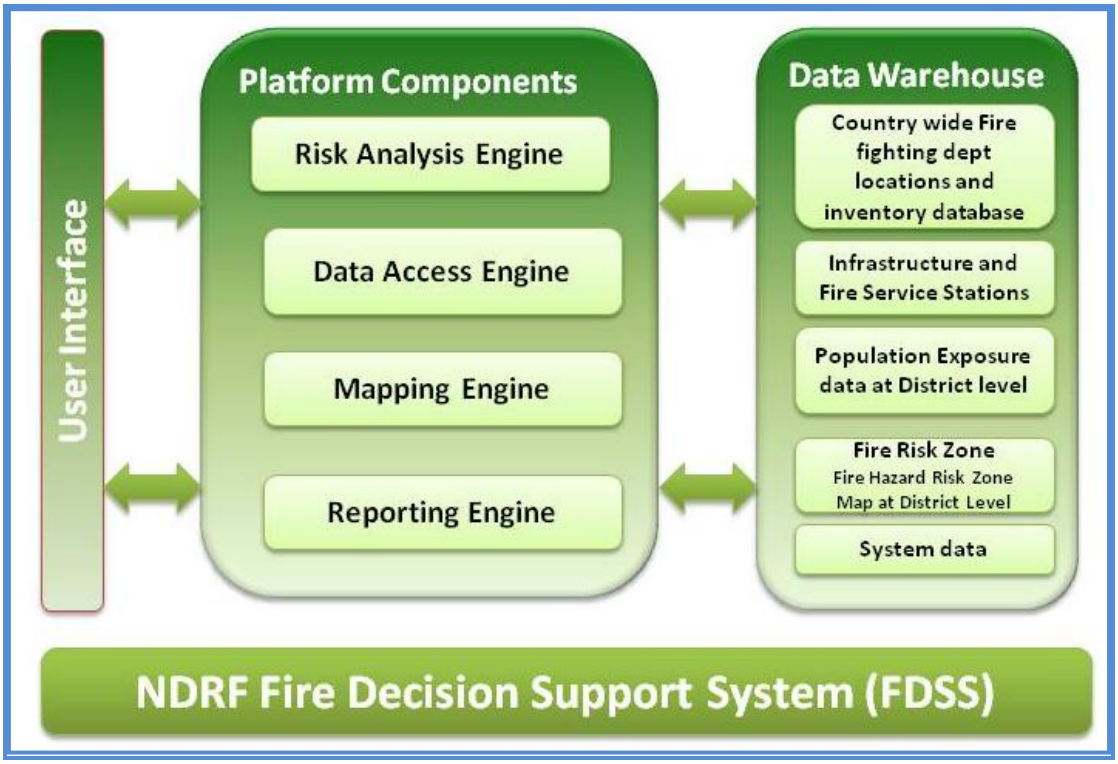


Figure 5-2 : High-level design of FDSS

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

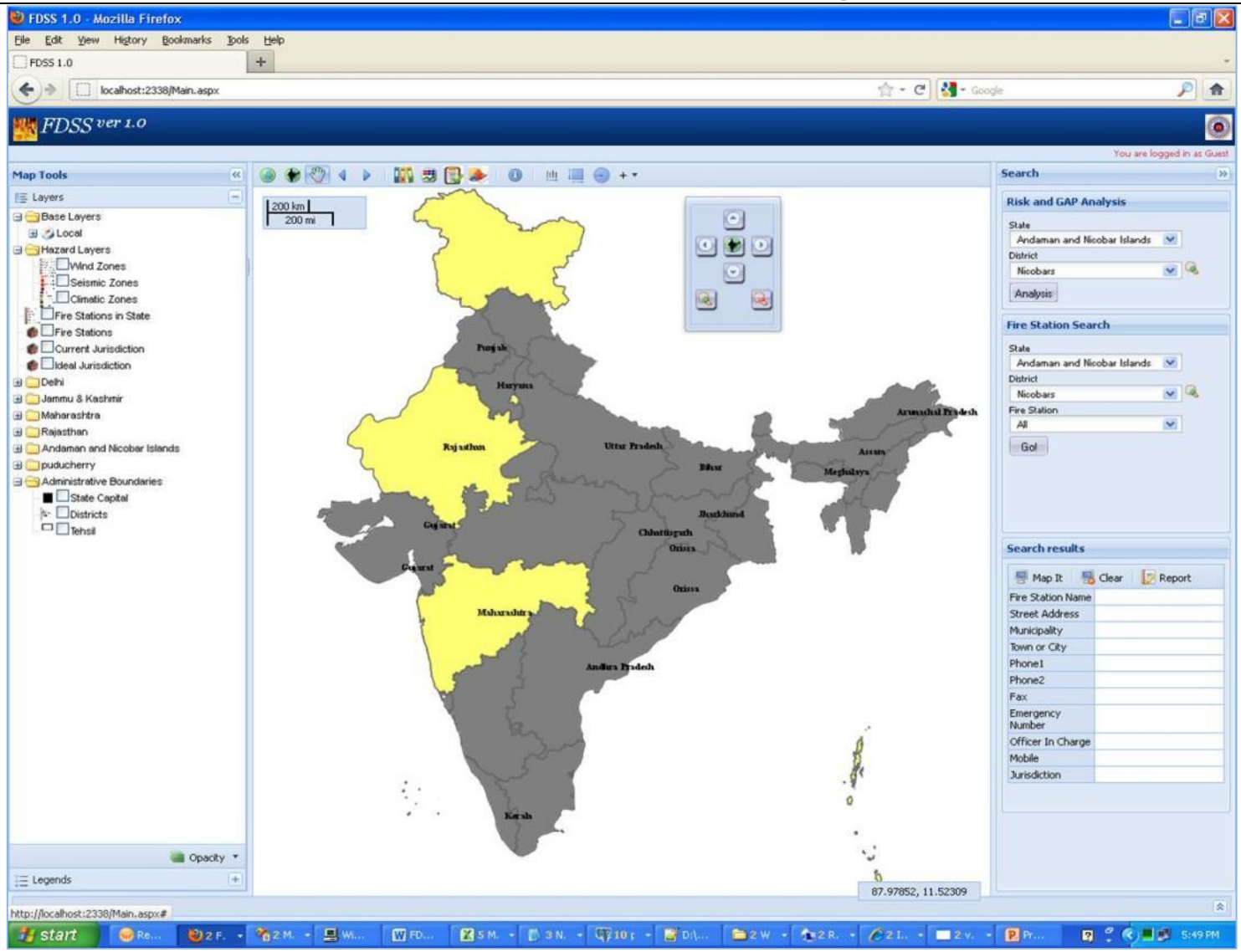


Figure 5-3 : User Interface for Base Analysis in FDSS. The example shows the States covered in the Pilot Phase of the study

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.

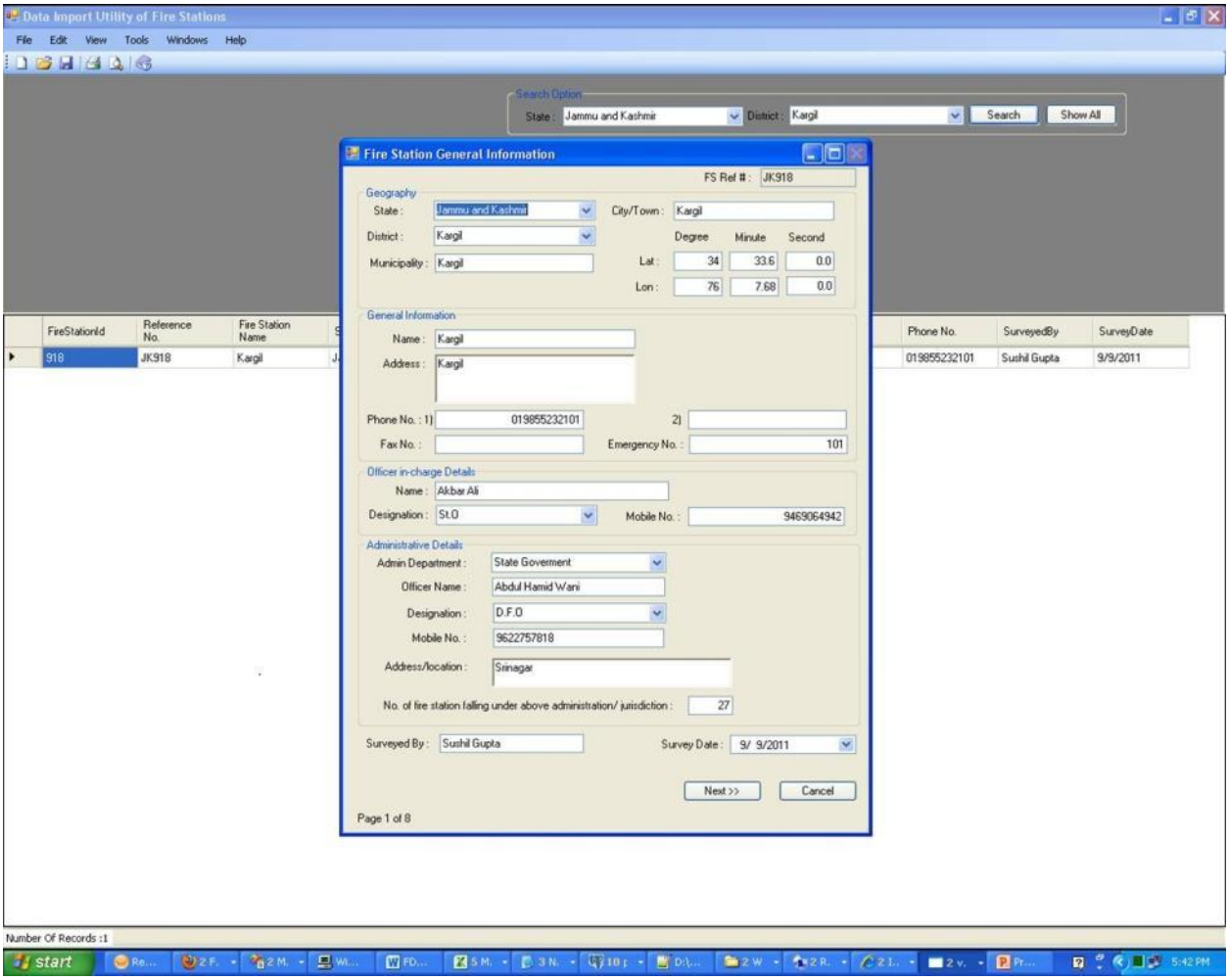


Figure 5-4 : System administration interface

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, equipments 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 or State
- 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 will be 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.

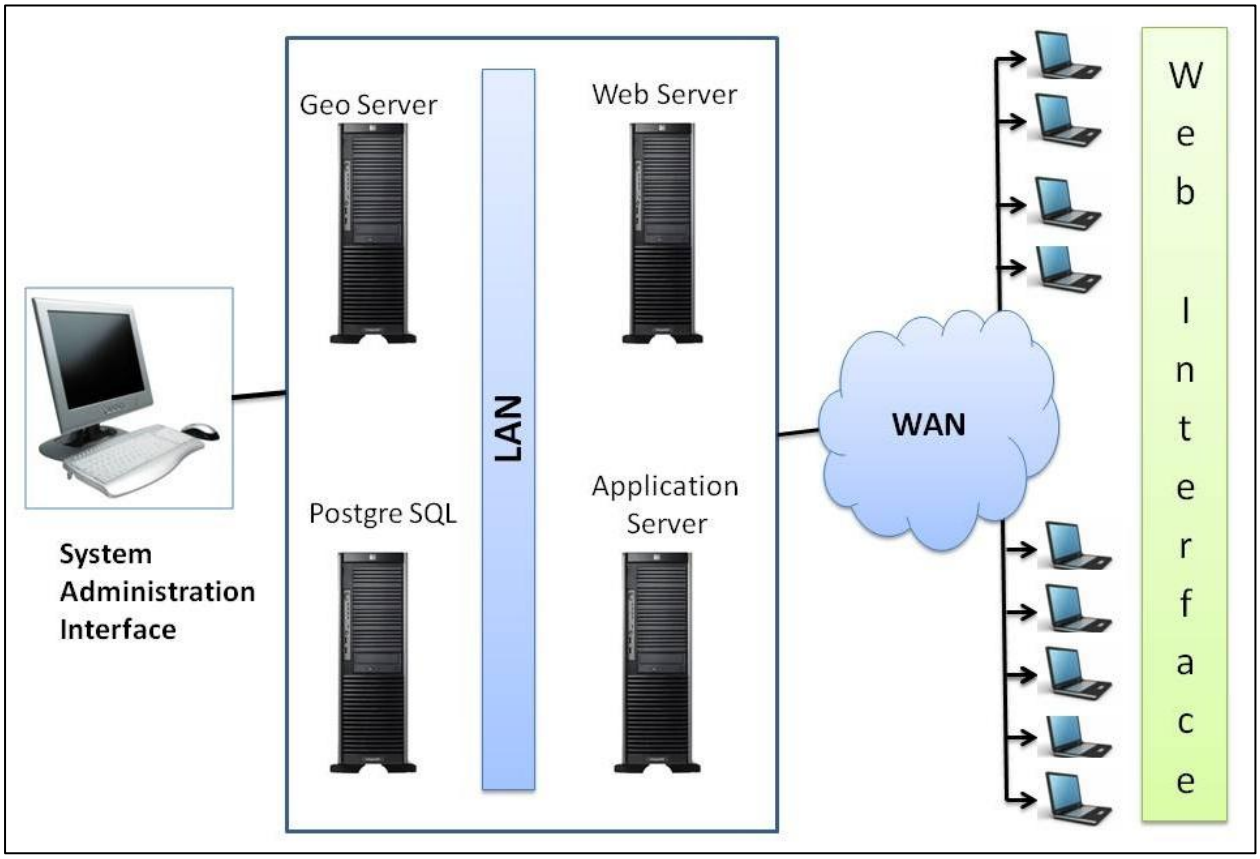


Figure 5-5 : FDSS - Systems Architecture

- 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 excellence in design	Not available publicly.

Advantages	Open Source Platform	Proprietary Software Platform
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 carried out in FDSS 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 in FDSS at the district and State 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 equipments 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 equipments 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 equipments, 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 equipments), 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 would be 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 have 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 Centers 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 Centers 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 studied in detail and recommendations were 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 being 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 equipments
All Fire prevention equipments 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.

HQ Ref #.....

A. Fire Headquarters General Information

Location Details

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

Address

……..

Office Phone numbers (with STD code):…… Fax ……Web site (if any)……

Name & Designation of the Head of Department: ……

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

……..

Mobile number …….. 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)

Area under Jurisdiction in each Zonal Office (provide jurisdiction map for each individual Fire Station)

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

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

Name of Zonal office …….

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

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

Please add additional sheets if required

C. Details of Proposed Fire Station

S.N.	Name of the Site for Proposed Fire Station	District	**Status of Work in Progress**, (e.g. approval awaited, plan cleared, land acquired/ allocated, % of construction completed)	Remarks

Please attach additional sheets if required

D. Human Resources and Staff Welfare (Please attach additional sheets for each zonal, divisional, and sub-div. Fire Stations)

Organization Structure and Human resources (Operational Staff including higher level officers)

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
11	Director General / Asst. Director General						
10	Director / Deputy Director						
9	Divisional Officer (D.O.)/ Fire Prevention Officer						
8	Station Officer (St. O)						
7	Sub Officer (S.O)						
6	Fire Engine Operator cum Driver (FEOD)/ Leading Fire Operator (LFO)						
5	Fire Operator (FO)						
4	Cleaner/ Sweeper						
3	Other Officers (Chief Mobilizing Officer/ Mobilizing Officer/ Asst. Mobilizing Officer)						

2	Other Officers (Mechanical Superintendent/ Foreman)						
1	Other Staffs (Mechanic/ Mechanic-Helper)						
Any Other							

Please attach additional sheets if required for each Fire zonal region/ division human resources *(broad categories of designations are mentioned below for reference)*

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, Cleaner, Tindal.*

Recruitment Rules for entry level in oragnization chart (Please provide copy of state recruitment rules in detail)

Level	Designations	Essential qualification as per recruitment rule	Preferential	Training / Experience	Departmental Reservation policy if any
8					
7					
6					
5					

4					
3	FEOD				
2	Leading Fire Operator				
1	Fire Operator				
Any Other					

Staff Welfare:

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

Ration money: Rs……..
Sports facilities: ……
TV for common room: ……..
Cash rewards and recognition: Rs……
Incentives, through benevolent fund: Rs…….. ……
Insurance: Rs…….....
Other schemes etc……

Measures to Improve Staff Efficiency

S. no	Type of Drill	Frequency *(Daily/Weekly, Bi-Monthly, Quarterly)*	Remarks
1.	**Squad Drill**	Daily	
2.	**Pump/ Hose Drill - Dry**	Weekly	
3.	**Pump/ Hose Drill - Wet**	Bimonthly	
4.	**Ladder/ Rescue Drill**	Monthly	
5.	**Rope Rescue Drill**	others	
6.			
7.			

E. Training Details

Name of State Training Centre and address:

……

Number of Faculty/Trainers with Designation:

……

……..

……

S. N.	Name of Training Courses	Duration (months)	Maximum capacity	Number of personnel Trained annually	Year
1					
2					
3					
4					

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

Year	Type of Training Obtained/ name of training course	Within State Training Centre	At NFSC, Nagpur	Other State Training Centre (mention City, State)	Foreign country	Total Number of personnel Trained
2011						
2010						
2009						

2008						
2007						
2006						

Please provide yearly break-up for the last 5 years

Training Centre Infrastructure for basic training and sub-officer course: Provide details of facilities at the training centre, short comings etc.

……
……
……
……
……
……

F. Inventory of Equipments

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

Please provide separate list for working, non-working and under procurement

Additional Equipments

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

Division/ Station Name	Gas Cutters	Bolt Cutters	B.A. Sets with B.A. Comp	Circular Saw with Diamond Blade(Electric)	Electric Hammer	Chain Saw-Concrete	Chain Saw-Wood	Pneumatic Lifting bags	Hydraulic Spreader and Cutters/ Cobmi-tool	Rescue Boats

Any other not covered in above list

…….

……..

……..

Please provide separate list for each division/district

G. 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:

H. 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

I. 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)	Total injured		Num of Deaths	
			Residential	Industrial	Institutional/ commercial	Others		Road Accidents	Building collapse	Animal	Others			P	FS	P	FS
2010-																	
2009-																	
2008-																	
2007-																	
2006-																	

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				
2009-10				
2008-09				

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
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 lakh, Medium – Rs. 10 to 50 lakh, Serious - >Rs. 50 lakh, 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

J. Public Awareness Programmes

Public Awareness Programmes 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 programmes
		Govt./ PSU (a)	Pvt. Locations (b)	Schools (c)	Govt./ PSU (d)	Pvt. Locations (e)	Schools (f)	

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

1.
2.
3.
4.
5.
6.
7.

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

Postal Address:

Mr Sushil Gupta
General Manager,
Risk Modeling and Insurance,
A-8, RMSI, Sector-16, NOIDA
PIN 201301 (U.P.) INDIA

Mobile- +91 9818798715
Phone (Office): +91 0120 2511102/ 2512101 ext 2612
(Office): +91 120 4040512 (direct)
Fax (Office): +91 0120 2511109/ 2510963
emailSushil.Gupta@rmsi.com

Sushilgupta74@yahoo.com 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 departm

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 ☐ ***ral*** ☐

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 Kachha masonry walls with Tin Roof accha Tin shade Temp orta- cabins
Kaccha wooden structure with tin Roof thers 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) e 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/ Garrage- Pacca- RCC/Masonry ha Tin Shade Op ar er 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 ☐ ☐

Availability of Watch room /Control Room- Yes ☐ ☐ 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 ☐ ☐ Availability of hose drying/ drill tower - Yes ☐ ☐

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 ☐ o ☐

C. Communication Systems

1. Between Public and Fire control room/ watch room
   - i. Landline Telephone: Yes ☐ o ☐ , If 'Yes', mention number of land line phone in operation…………
   - ii. Emergency phone number- 101 or,……….Connection Type : Direct ☐ I ct ☐ No ilable ☐
2. Hotline between Important agencies and Fire control room
   Oil industries/ storage ☐ Airport ☐ PCR ☐ Banks ☐ strict Magistrate Office ☐

   Others specify………………………………………………………………………

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

Availability of GPS on Fire Engines and other vehicles - Yes ☐ N ☐ , If mention number of vehicles: …………..

4. Between Fire Station Control Room and Fire Vehicles
   Static Wireless Set in watch room Yes ☐ ☐ es', mention number of operational phones …………

   Number of Mobile wireless sets: ☐ Number of Walky-Talky: ☐ Number of Satellite Phones: ☐

5. Type of Frequency used- HF ☐ F ☐ HF ☐

D. Water Supply Details for Fire Fighting Purpose

Whether 24 hours water available in fire vehicles? Yes ☐ N ☐

Water sources used by Fire Vehicles within Fire Station

Direct supply… ☐ . b) Overhead tank ☐ 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 'Y' ☐ 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)				
5.	Driver				
6.	Fire Man (FM)				
7.	Sweeper				
8.	Cook				
9.	Any other				

S. no.	Designation	Total Number of Permanent Working Staff	Duty pattern/ Shifts (hrs)	Vacant, but sanctioned posts	Numbers of temporary/ contract persons (if any)
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, Cleaner, Tindal.*

Mode to maintain Physical Fitness

S. no	Type of Drill	Yes/No	S. no	Type of Drill	Yes/No
8.	P.T./ Parade	Daily/……	4.	Vehicle maintenance	Weekly/Monthly/Quarterly/……
9.	Fire Drill	Daily/Weekly……	5.	Any other	……
10.	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)			

Fire Risk	If Yes, Brief description of its Name, Type, Risks involved	Dist. From FS (km)	No. of Units
Industrial Area (any other)			
High-Rise Buildings (>15m 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			
Vicinity to Coast			
Army Ammunition Storage			
Cross-Border Shelling			

Fire Risk	If Yes, Brief description of its Name, Type, Risks involved	Dist. From FS (km)	No. of Units
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 / GPS	Minor/ 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 /	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
	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
	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

Sl 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
	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	

Equipment	Number/ Quantity	Equipment	Number/ Quantity
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	
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 :

Mr. Sushil Gupta (General Manager), Risk Modeling & Insurance,
A-7, RMSI, Sector 16, Noida 201301, Fax: 0120 2511109
Mobile: 08826100332, phone: 0120 4040512(direct)
Sushil.Gupta@rmsi.com

PART B

7 Delhi State

This page has been left intentionally blank.

8 Rajasthan State

This page has been left intentionally blank.

9 Maharashtra State

This page has been left intentionally blank.

10 Jammu and Kashmir State

This page has been left intentionally blank.

11Puducherry UT

This page has been left intentionally blank.

12Andaman & Nicobar Islands UT

This page has been left intentionally blank.

13Chandigarh UT

This page has been left intentionally blank.

14Haryana State

This page has been left intentionally blank.

15Himachal Pradesh State

This page has been left intentionally blank.

16Punjab State

This page has been left intentionally blank.

17Uttarakhand State

This page has been left intentionally blank.

18Uttar Pradesh State

This page has been left intentionally blank.

19Dadra and Nagar Haveli UT

This page has been left intentionally blank.

20Daman and Diu UT

This page has been left intentionally blank.

21Goa State

This page has been left intentionally blank.

22 Gujarat State

22.1 Introduction

Gujarat, one of the most industrialized State of India, lies in western part of India. The State is located between 20º01′ to 24º07′ N latitudes and 68º04′ to 74º04′ E longitude and has an area of about 196,120 sq. km with a coastline of about 1,600 km, most of which lies on the Kathiawar peninsula. The State shares its border by Pakistan and Rajasthan in the north east, Madhya Pradesh in the east, and Maharashtra and the UTs of, Daman & Diu, and Dadra and Nagar Haveli in the south. The Arabian Sea borders the State from west and southwest. Its capital city is Gandhi Nagar.

In terms of topography, Gujarat shows a wide variation. Gujarat is located near the Thar Desert; therefore, most of the land is dry and arid in nature. Moreover, the topography of Gujarat is characterized by the small hilly tracts especially around the Rann of Kutch region. The topography of Gujarat is divided into 3 major regions, namely: 1) The Peninsular – the region, which is also known as Saurashtra, is essentially a hilly tract, 2) The Kutch – It is a barren and rocky area containing the great Rann and 3) the mainland that extends from the Rann of Kutch and the Aravalli hills to the river Damanganga.

Gujarat State has a strong base of industries, which contributed significantly to the development of the State as well as the country. . It has some of the largest businesses in India. Major agricultural produce of the State include cotton, groundnuts, dates, sugar cane, milk and milk products. Gujarat maintains a variety of industries, the principal ones being general and electrical engineering and the manufacture of textiles, vegetable oils, chemicals, soda ash, and cement. New industries include the production of fertilizers and petrochemicals. Gujarat produces about 91% of India's required amount of soda ash and gives the country about 66% of its national requirement of salt. Chemical Industries in Gujarat count for more than 35% of Indian Chemicals production.

The State is rich in calcite, gypsum, manganese, lignite, bauxite, limestone, agate, feldspar and quartz sand and successful mining of these minerals is done in their specified areas. Gujarat ranks first nationwide in gas-based thermal electricity generation with national market share of over 8% and second nationwide in nuclear electricity generation with national market share of over 1%.

The climate of Gujarat is moist in the southern districts and dry in the northern region. The Arabian Sea and the Gulf of Cambay reduce the temperature and render the climate more pleasant and healthy. The year can be divided into the winter season from November to February, the hot season from March to May, the south-west monsoon season from June to September and the intervening month of October. The average rainfall in Gujarat varies from 33to152 cm.

The State has a total population of 60,383,628 inhabiated in 26 districts as per census, 2011 (Table 22-1).

Presently, Gujarat Fire & Emergency Services (GF&ES) has 183 operational Fire Stations (Table 22-2 and Figure 22-2), 1 State Fire and Emergency Training Centre at Koturpur Water Works, Ahmedabad, and 5 Emergency Response Centres (ERCs) at Gandhinagar, Gandhidham, Rajkot, Surat, and Vadodara.

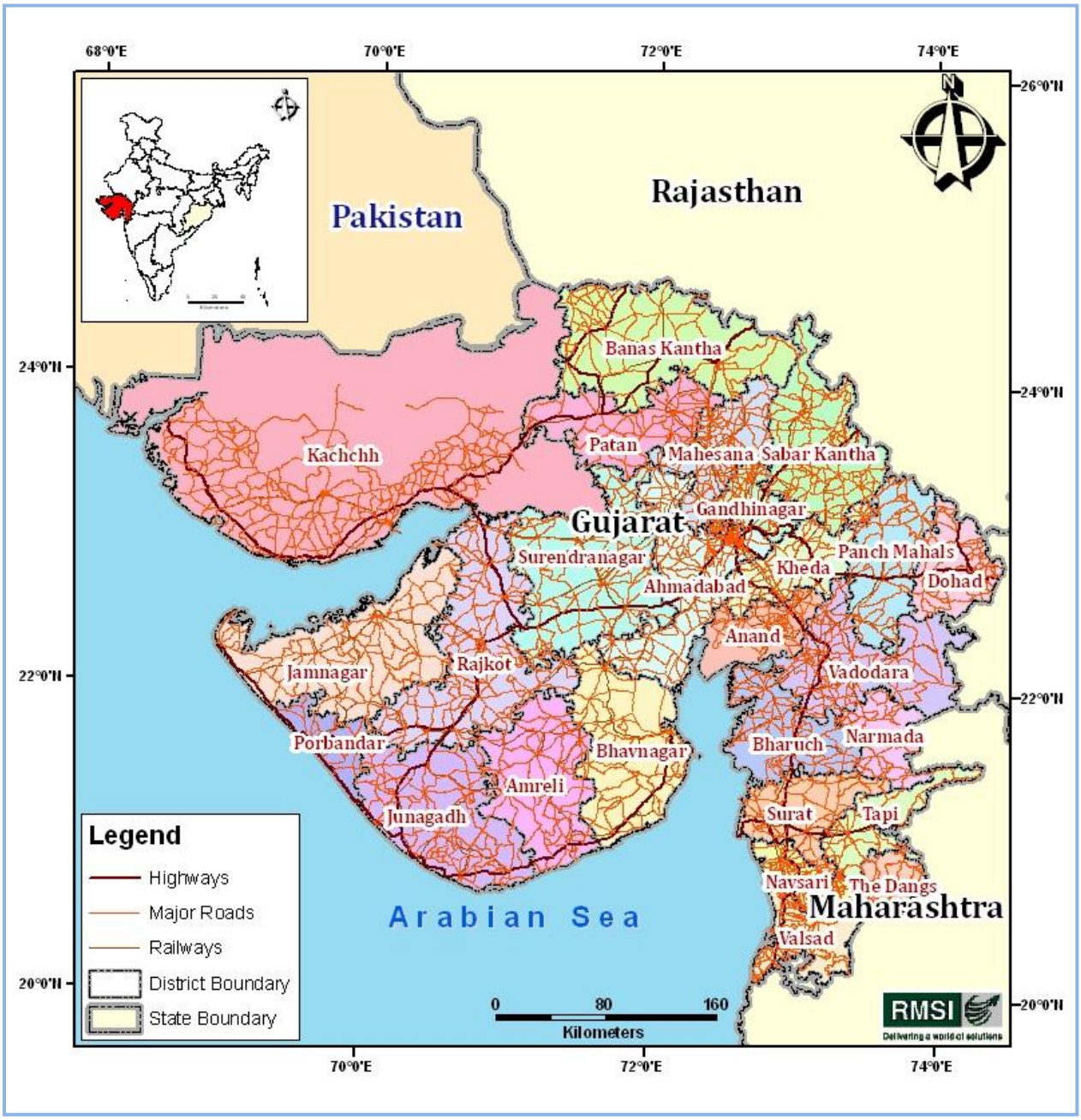


Figure 22-1: District map of Gujarat

Table 22-1: Gujarat Demography as per Census 2011

Gujarat State			
No. of Districts	26		Percentage of Urban Population
No. of Sub-Districts	225		
No. of Towns	348		42.58
No of Villages	18,225		
Population			
	Total	**Rural**	**Urban**
Persons	60,383,628	34,670,817	25,712,811
Males	31,482,282	17,802,975	13,679,307
Females	28,901,346	16,867,842	12,033,504
Sex Ratio (females per 1,000 males)	918	947	880

Table 22-2 provides the district wise details, i.e., number of operational Fire Stations, geographical, population as per Census 2011. From Table 22-2, it can be seen that on an average, each Fire Station in Gujarat State is serving more than three Lakhs population.

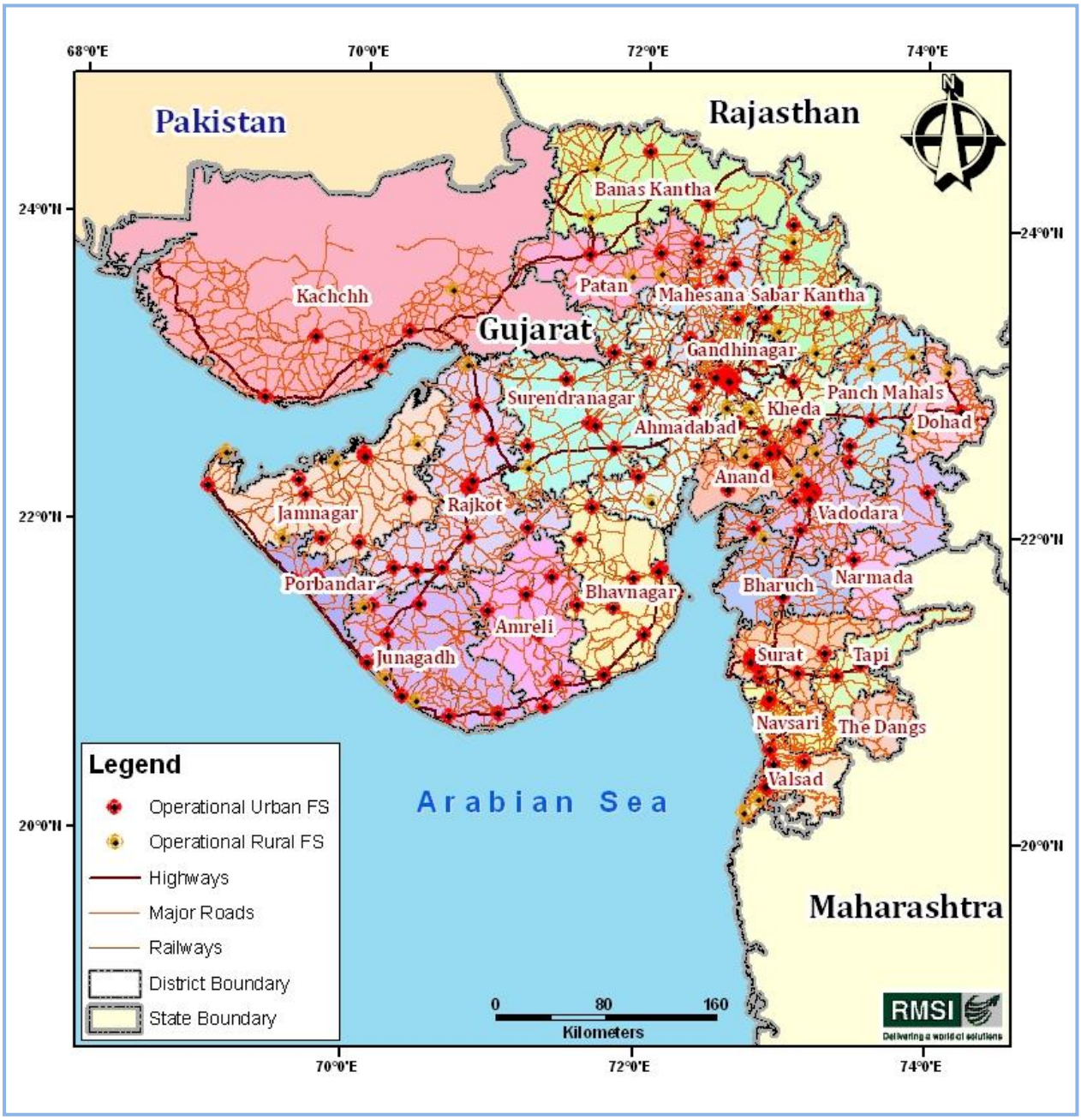


Figure 22-2: Location of operational Fire Stations in Gujarat

Table 22-2: Summary of district level operational Fire Stations in Gujarat

District name	Area (in sq km)	Total Population (Census 2011)	Number of Fire Station operational	Average Population per Fire Station
Ahmadabad	8,086	7,208,200	19	379,379
Amreli	7,397	1,513,614	7	216,231
Anand	2,940	2,090,276	8	261,285
Banas Kantha	10,757	3,116,045	5	623,209
Bharuch	6,527	1,550,822	5	310,164
Bhavnagar	9,980	2,877,961	9	319,773
Dohad	3,646	2,126,558	3	708,853
Gandhinagar	2,163	1,387,478	4	346,870
Jamnagar	14,125	2,159,130	13	166,087
Junagadh	8,846	2,742,291	10	274,229
Kachchh	45,652	2,090,313	6	348,386
Kheda	4,218	2,298,934	6	383,156
Mahesana	4,382	2,027,727	6	337,955
Narmada	2,755	590,379	1	590,379
Navsari	2,209	1,330,711	4	332,678
Panch Mahals	5,219	2,388,267	5	477,653
Patan	5,730	1,342,746	5	268,549
Porbandar	2,297	586,062	3	195,354
Rajkot	11,203	3,799,770	13	292,290
Sabar Kantha	7,390	2,427,346	8	303,418
Surat	4,327	6,079,231	15	405,282
Surendranagar	10,489	1,755,873	7	250,839
Tapi	3,435	806,489	2	403,245
The Dangs	1,764	226,769	0	0
Vadodara	7,549	4,157,568	12	346,464
Valsad	3,034	1,703,068	7	243,295
Total	**196,120**	**60,383,628**	**183**	**329,965**

22.2 Field Surveys of Fire Stations for Data Collection

To have first-hand information on the distribution of the fire service stations across the country, infrastructure availability and their status, fire fighting manpower etc., RMSI project team has carried out detailed surveys of Fire Stations and collected data though individual “Fire Station Survey Form” and Fire Headquarter Data Collection Form” as shown in Annexure 1 & 2. The collected information for each Fire Station is following categories:

1. Fire station general information
2. Fire station infrastructure details
3. Communication systems
4. Water supply details for firefighting purpose
5. Human resources

6. Fire risk covered in the area under jurisdiction
7. Status of fire fighting vehicles
8. Specialized equipments provided (Specify whether kept in vehicle or in stores)
9. Other accessories
10. Fire calls and other fire incidence statistics (last 3-5 years)

Besides the collection of field survey data, RMSI team has also collected the location coordinates (latitude, longitude) of Fire Stations using Geo Positioning System (GPS). The geographical coordinate information is used for plotting all the Fire Station locations in the map to perform GIS based spatial analyses. This is also used in the analysis of distribution of new proposed Fire Stations and gap analysis on fire-infrastructure, based on risk-category, response time, and population criteria.

22.3 Infrastructure Gap Analysis

22.3.1 Fire Station Location Gap Analysis

As discussed in section 6.2.5, response time of 5-7 minutes in urban area and 20 minutes in rural area has been considered. With network analysis, ideal jurisdiction areas have been delineated for all operating Fire Stations. In delineation of ideal jurisdiction areas, built-up areas such as various types of residential areas and industrial areas with estimated population has also been considered. After delineation of ideal jurisdiction area, un-served gaps in urban agglomeration have been identified. These un-served gaps are shown to be filled by new proposed urban Fire Stations. Table 22-3 shows district level summary of number of operational and new proposed Fire Stations with population covered within their ideal jurisdiction area.

Rural areas of Gujarat State are similarly covered with new rural Fire Stations. It may be noted that rural populations are very sparsely distributed in the State. Hence, locations of rural Fire Stations are demarcated to the nearest relatively bigger village having population of more than 5,000 -10,000 or major roads intersection. District level numbers of new rural Fire Stations are given in Table 22-3. Figures 22-2 to 22-10 depict representative detailed maps showing delineated ideal jurisdiction areas for operational and new proposed urban Fire Stations and location of new rural Fire Station in the State.

Detailed list of delineated operational, new urban and rural Fire Stations/fire post in Gujarat State are given in Table 22.38 and Table 22.39.

Table 22-3: District level number of operational and new Fire Stations in Gujarat

District	Num of Operational Fire Stations	Ideally Served Population under Operational Fire Stations	Num of New Urban Fire Stations	Ideally Served Population under new urban Fire Stations	Num of New Rural Fire Stations	Total Fire Stations
Ahmadabad	19	3,694,983	19	3,001,869	10	48
Amreli	7	455,430	0	0	7	14
Anand	8	1,144,722	1	29,277	4	13
Banas Kantha	5	886,285	0	0	12	17
Bharuch	5	763,416	0	0	5	10
Bhavnagar	9	1,032,799	1	188,307	6	16
Dohad	3	411,951	0	0	7	10
Gandhinagar	4	754,454	2	298,319	10	16
Jamnagar	13	1,385,795	2	112,219	4	19
Junagadh	10	1,615,437	1	43,180	8	19
Kachchh	6	796,293	1	51,664	6	13
Kheda	6	807,191	0	0	8	14
Mahesana	6	897,083	1	91,242	7	14
Narmada	1	94,053	0	0	3	4
Navsari	4	700,681	0	0	4	8
Panch Mahals	5	597,767	1	24,507	6	12
Patan	5	676,784	0	0	5	10
Porbandar	3	325,646	1	71,353	1	5
Rajkot	13	1,949,117	5	401,225	12	30
Sabar Kantha	8	1,230,392	0	0	7	15
Surat	15	2,448,396	7	1,802,865	10	32
Surendranagar	7	805,573	0	0	6	13
Tapi	2	143,348	0	0	3	5
The Dangs	0	0	0	0	2	2
Vadodara	12	1,612,768	5	830,241	8	25
Valsad	7	866,365	0	0	3	10
Total	**183**	**26,096,729**	**47**	**6,946,268**	**164**	**394**

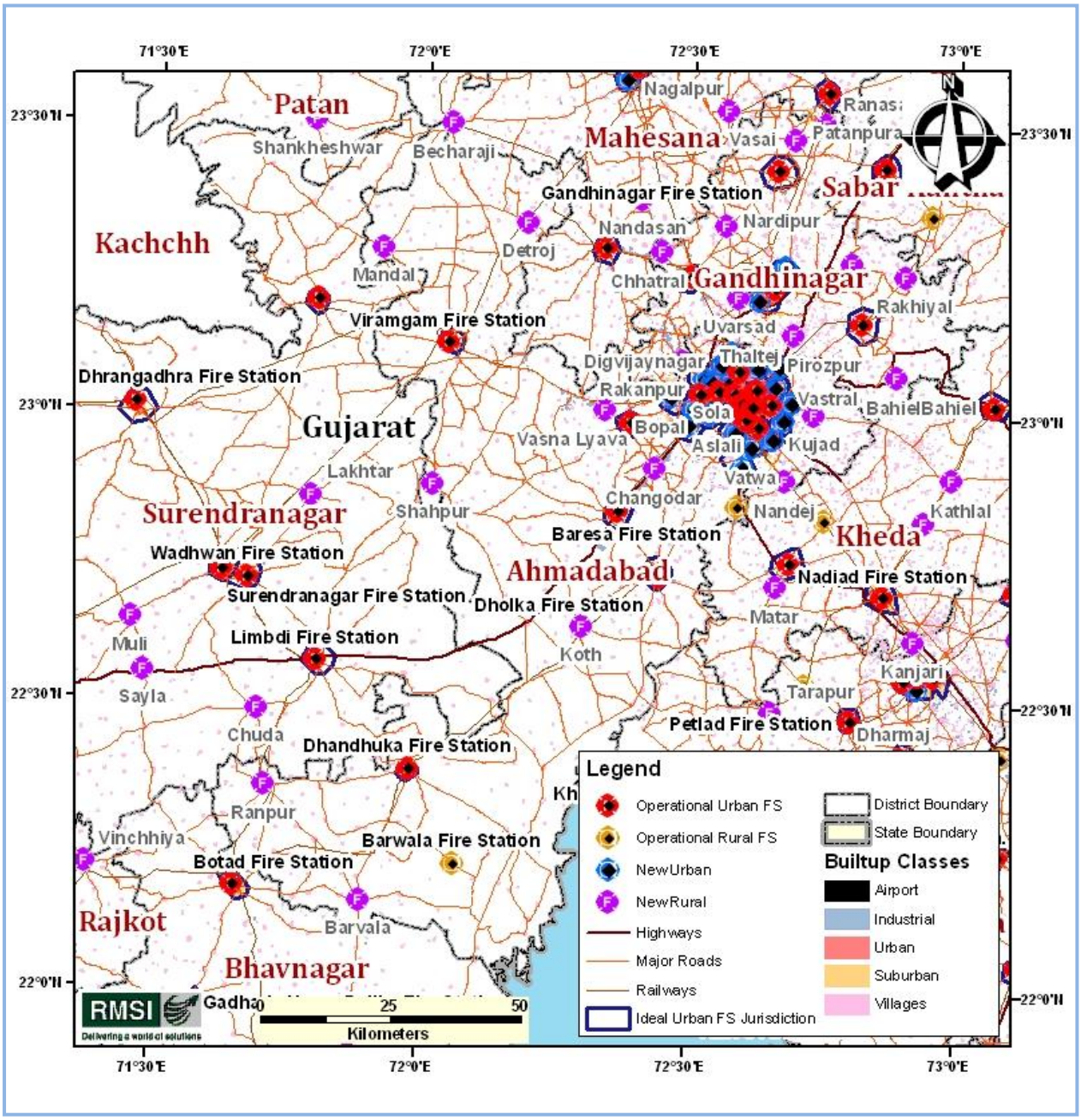


Figure 22-3: Fire Stations gap analysis for Ahmadabad and surrounding rural areas

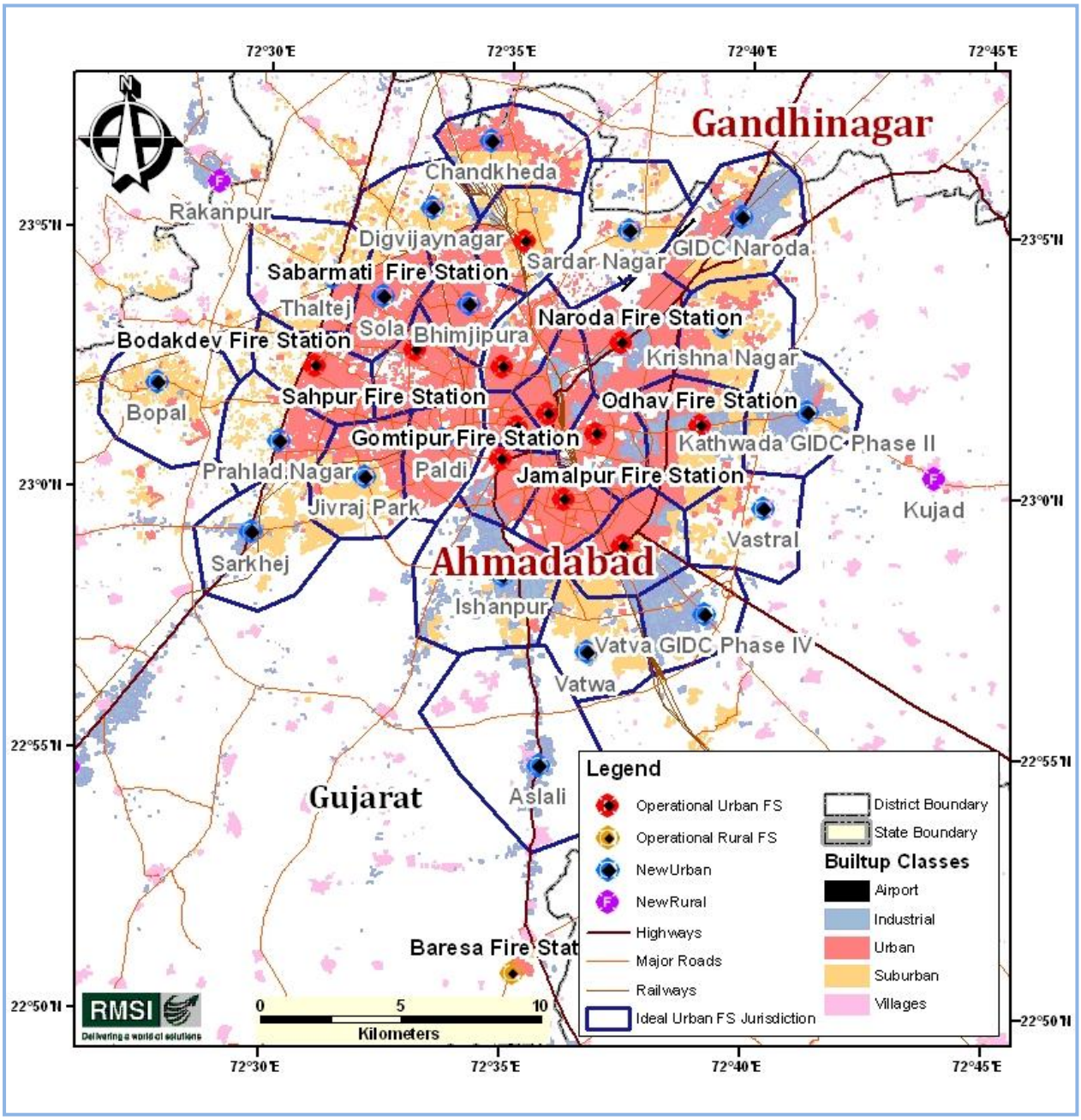


Figure 22-4: Fire Stations gap analysis for Ahamadabad urban areas

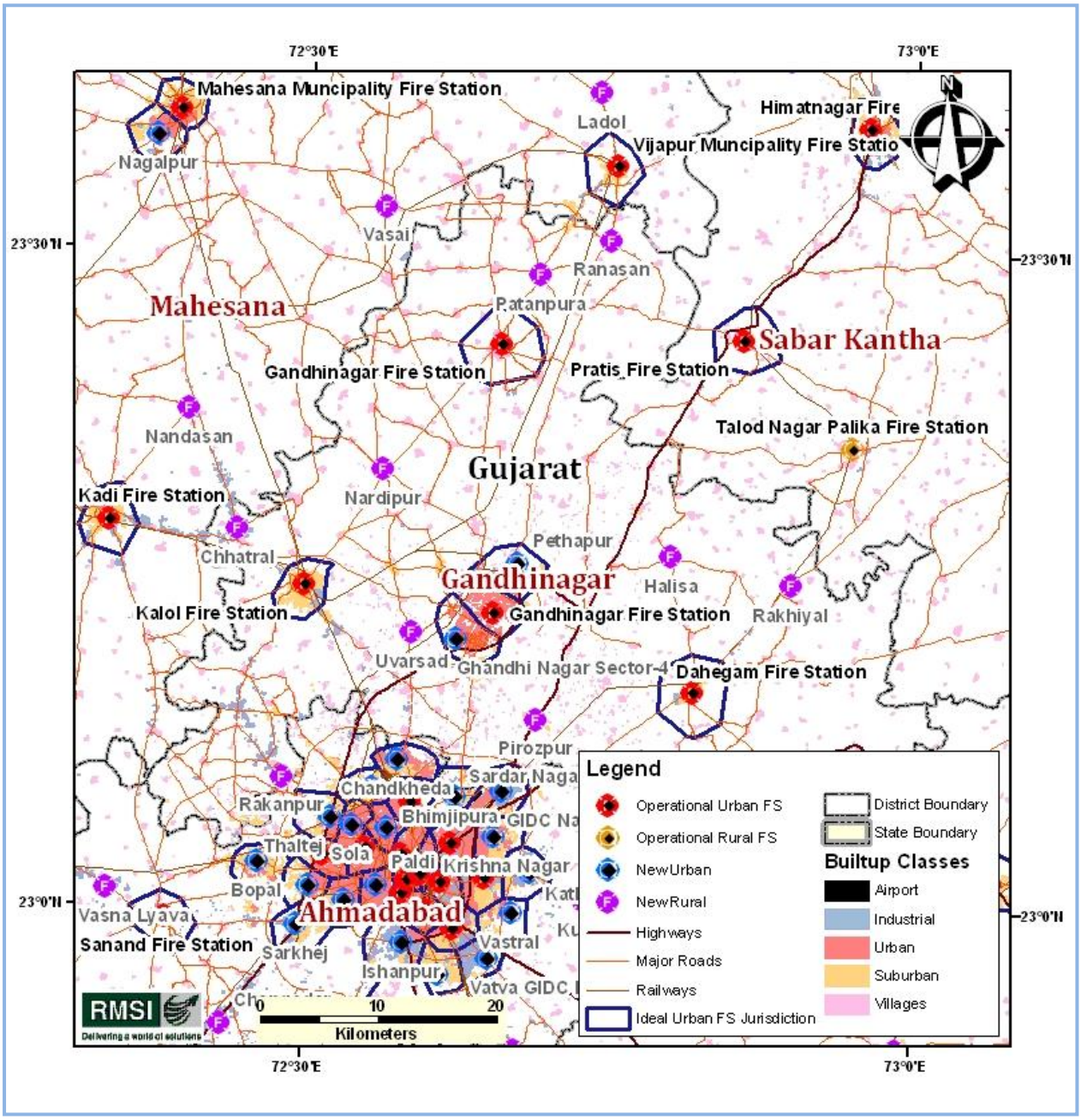


Figure 22-5: Fire Stations gap analysis for Gandhi Nagar and surrounding rural areas

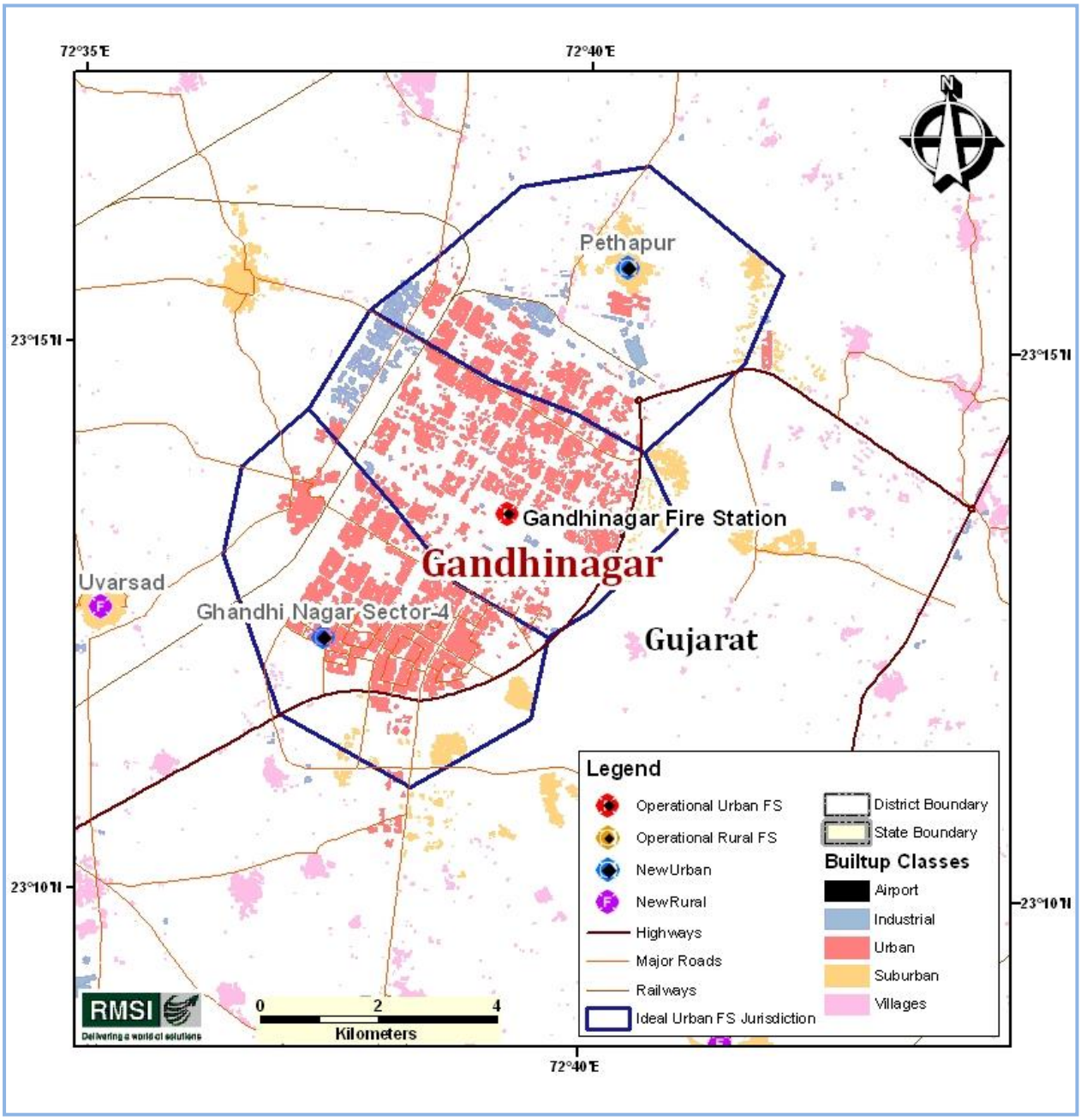


Figure 22-6: Fire Stations gap analysis for Gandhi Nagar urban areas

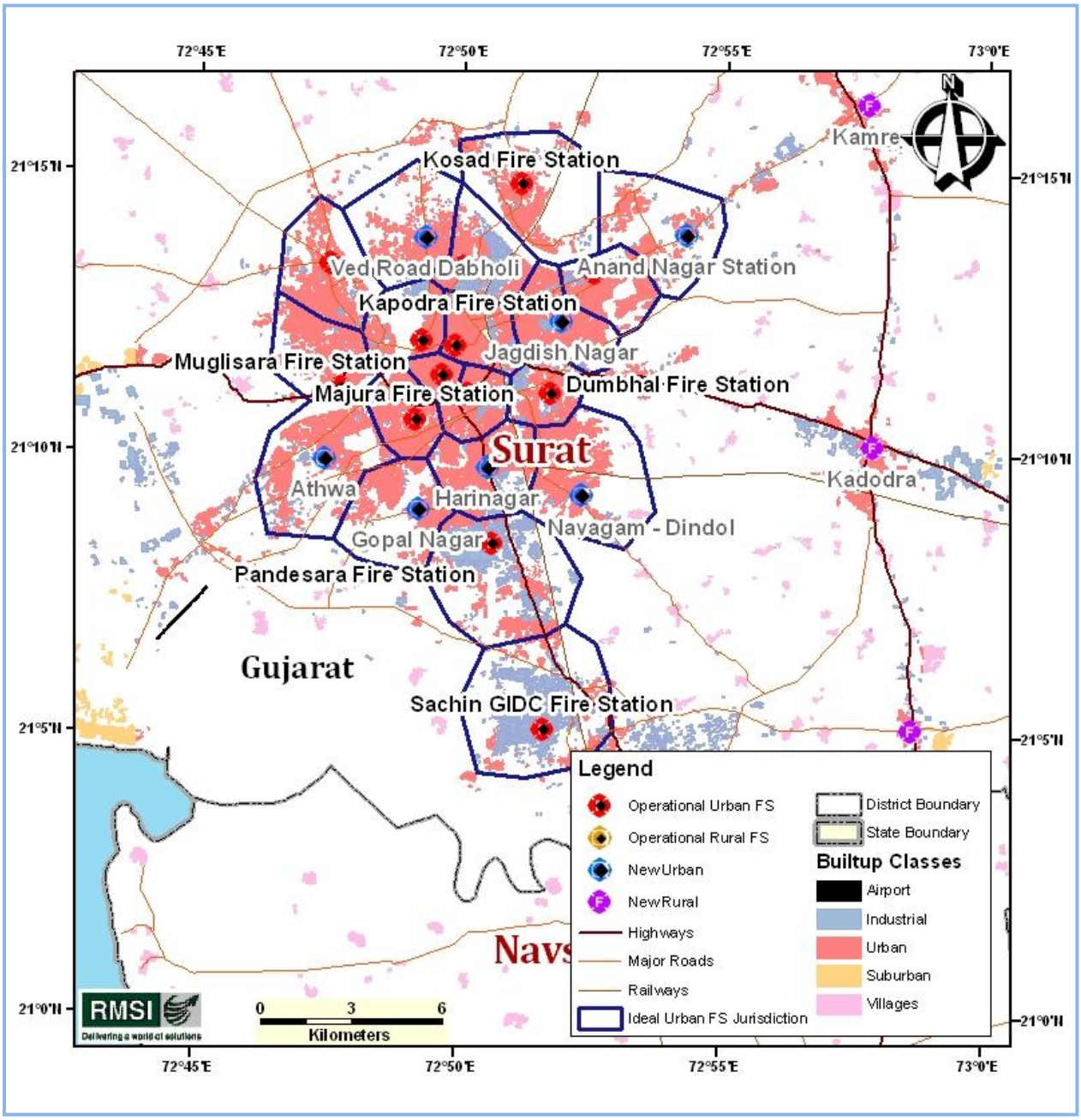


Figure 22-7: Fire Stations gap analysis for Surat urban areas

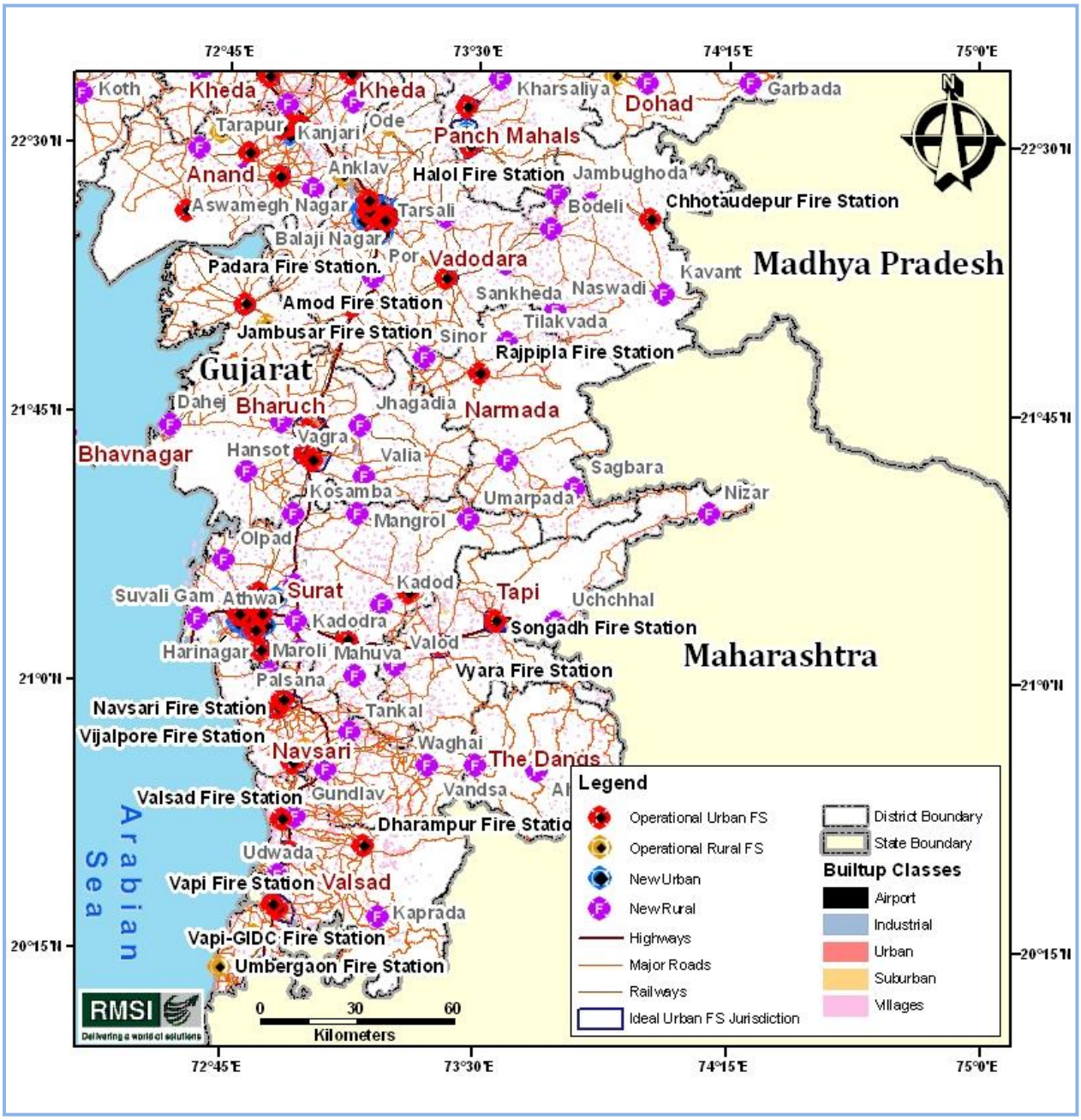


Figure 22-8: Fire Stations gap analysis for South Gujarat rural areas

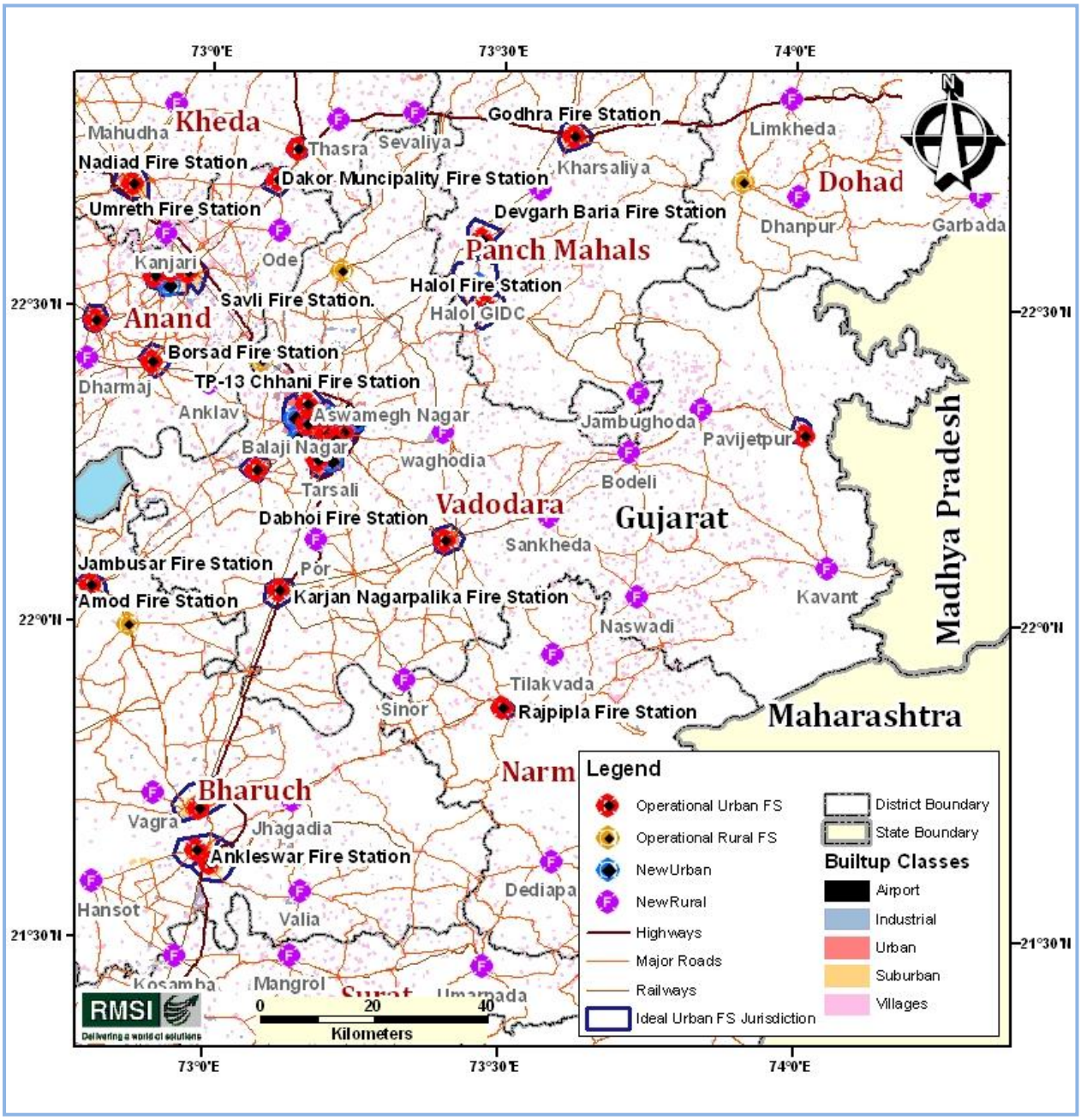


Figure 22-9: Fire Stations gap analysis for Vadodara and nearby rural areas

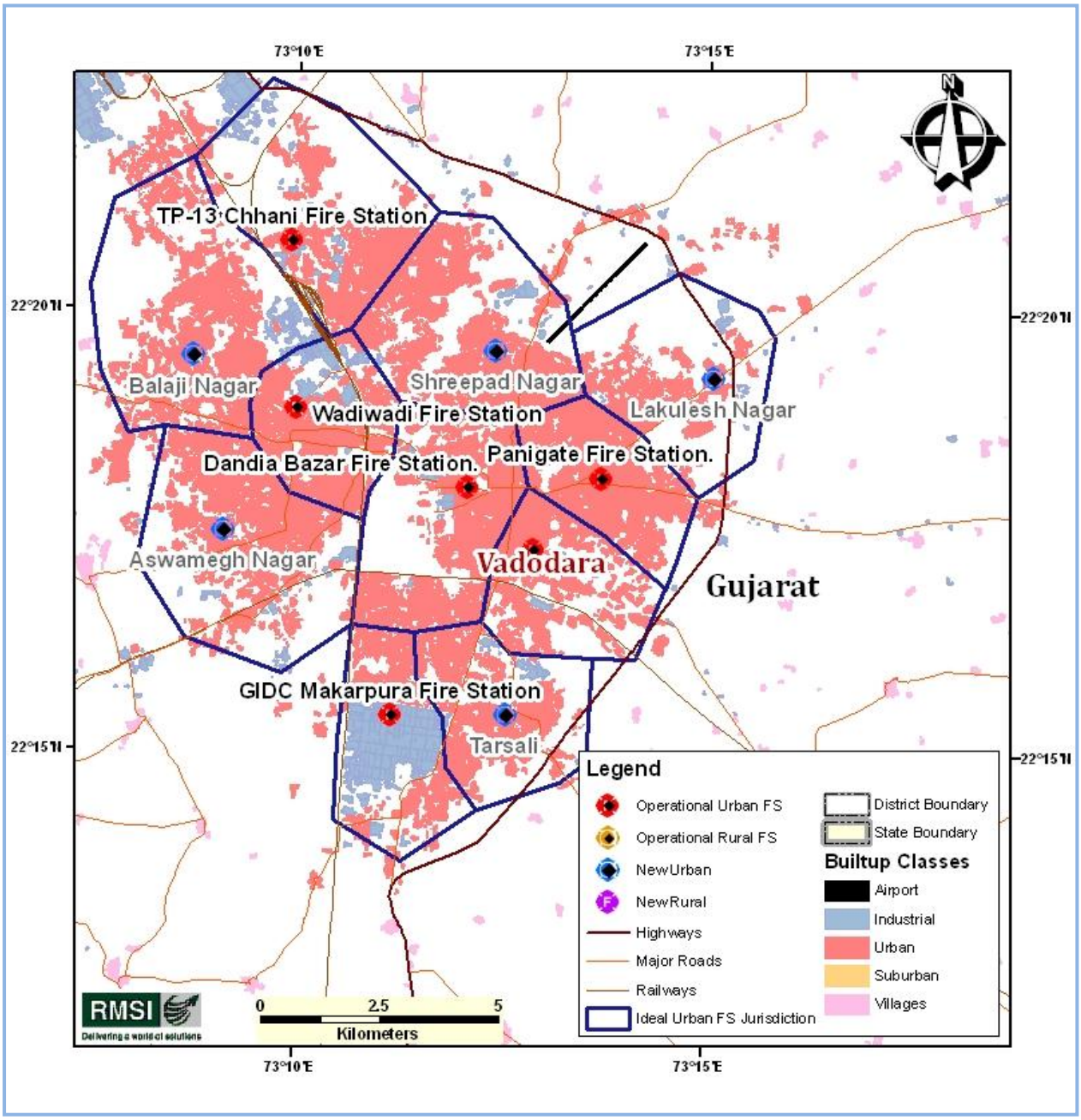


Figure 22-10: Fire Stations gap analysis for Vadodara urban areas

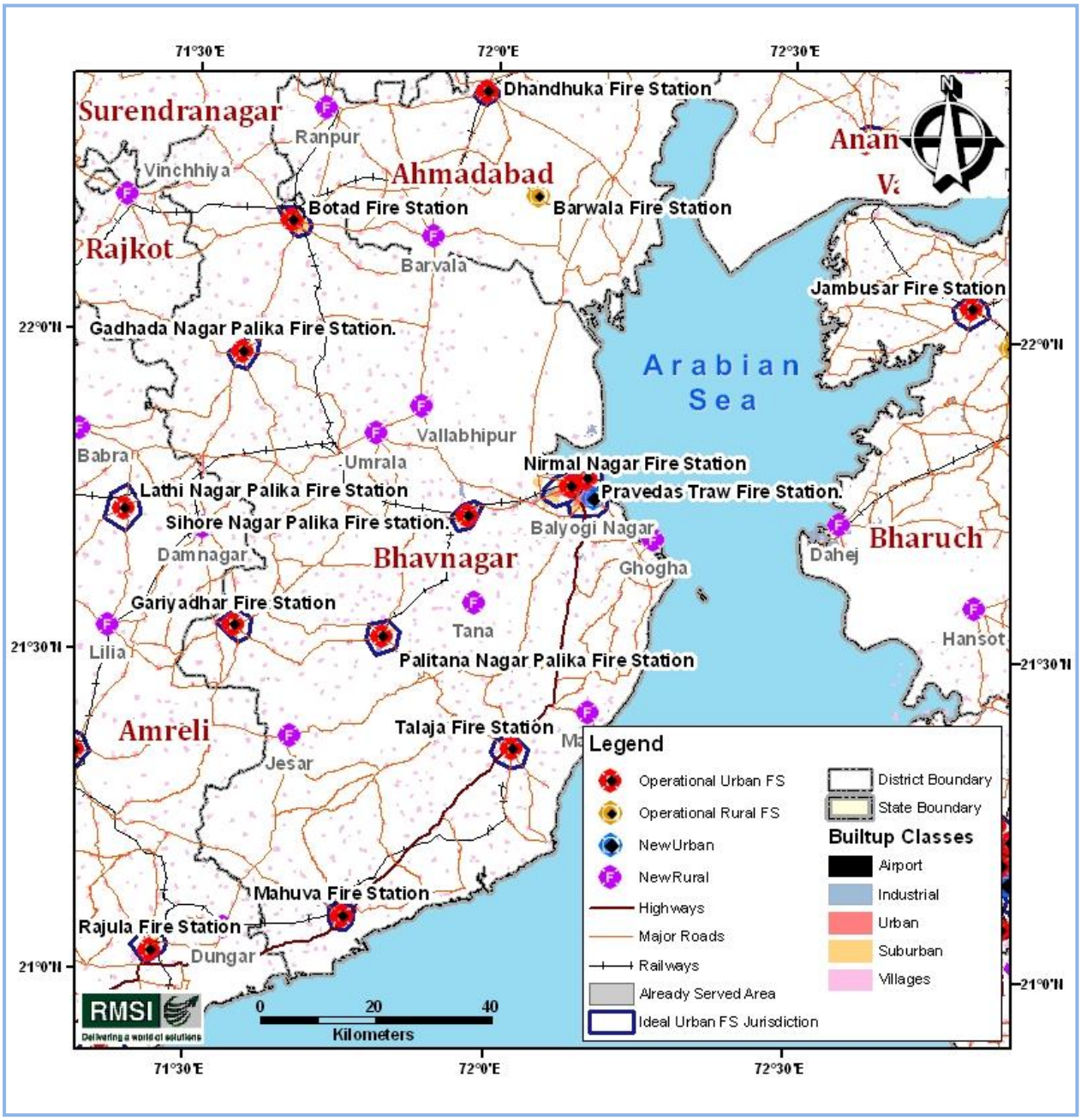


Figure 22-11: Fire Stations gap analysis for Bhavnagar rural areas

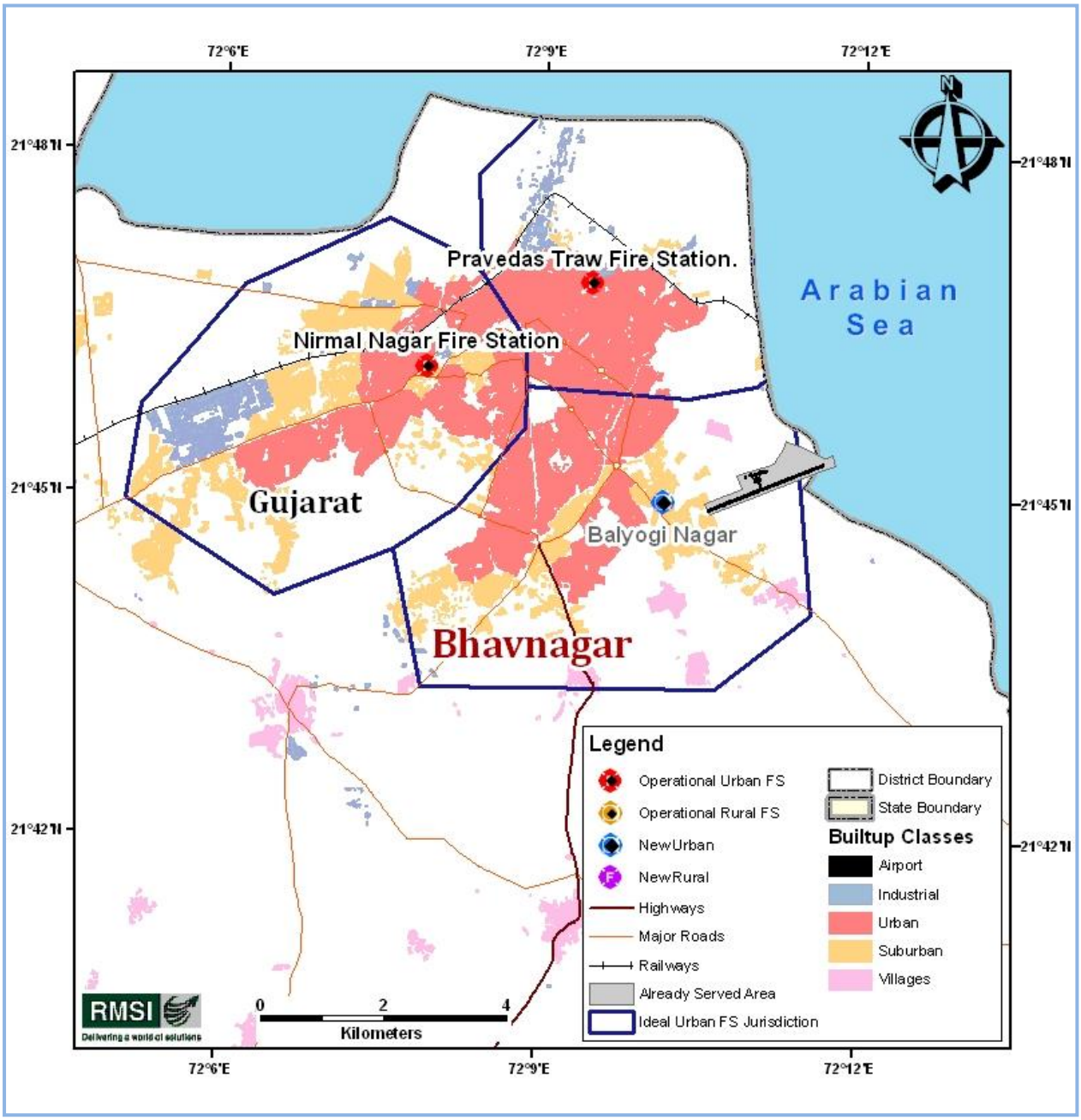


Figure 22-12: Fire Stations gap analysis for Bhavnagar urban areas

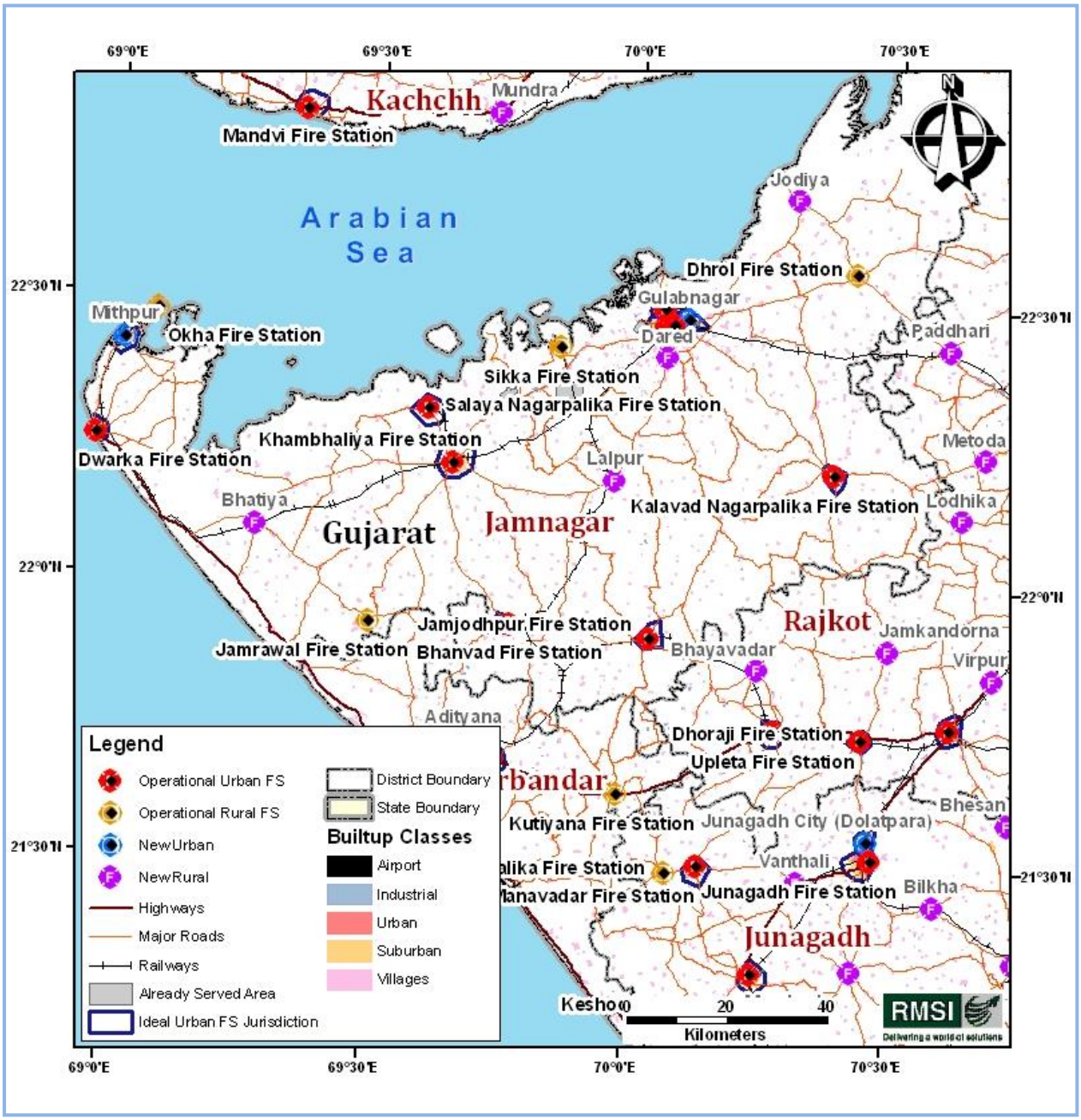


Figure 22-13: Fire Stations gap analysis for Jamnagar rural areas

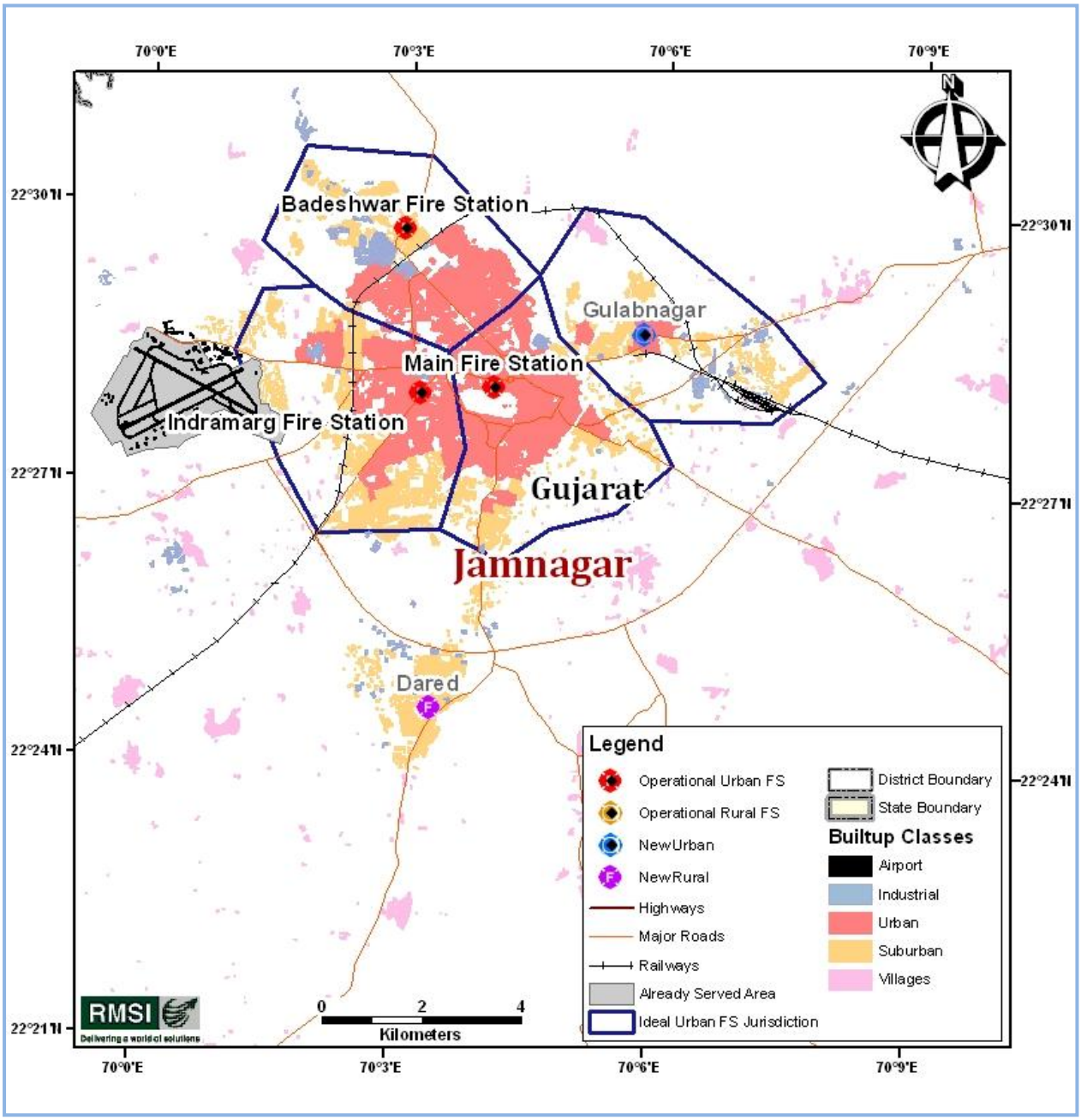


Figure 22-14: Fire Stations gap analysis for Jamnagar urban areas

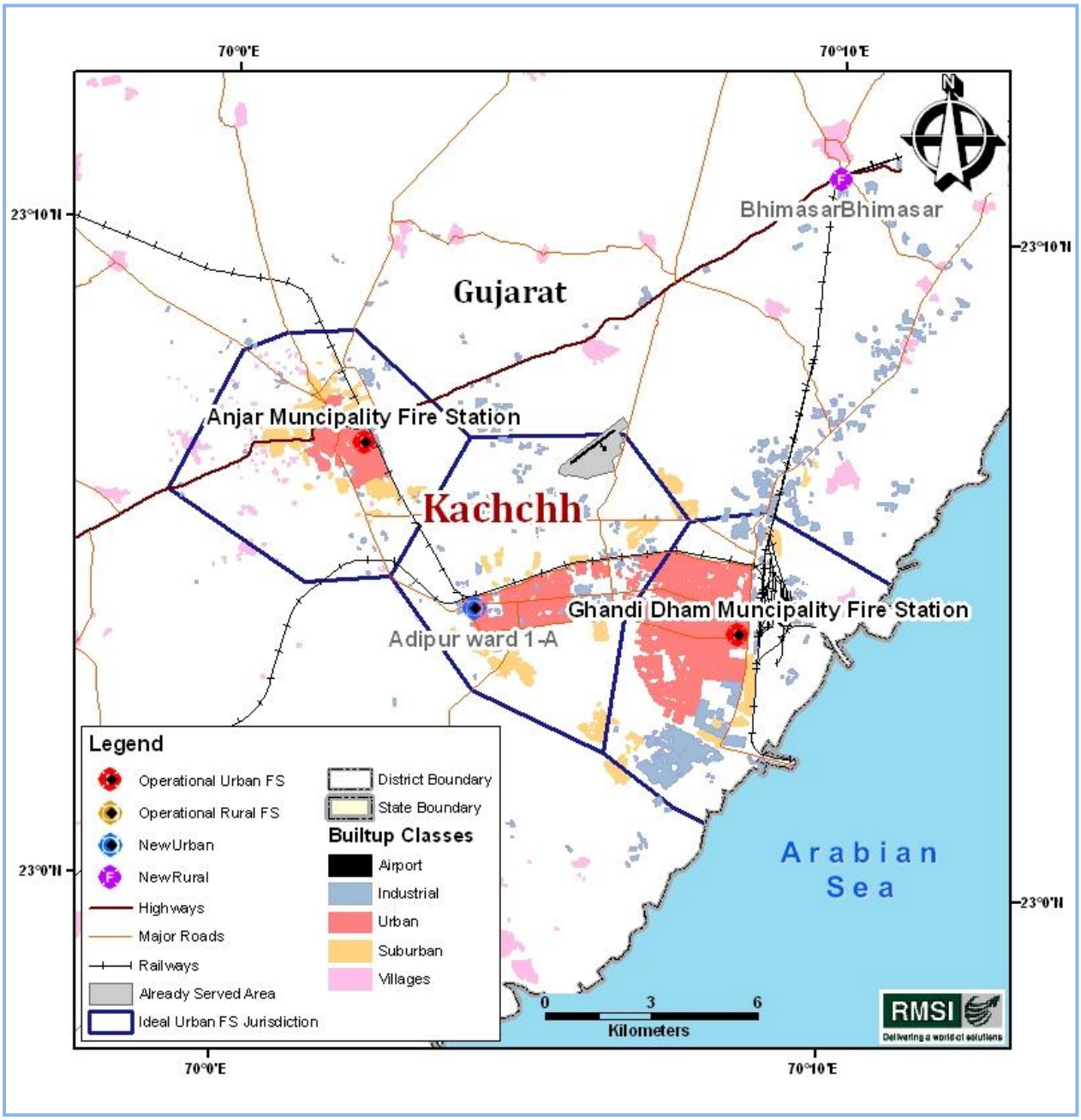


Figure 22-15: Fire Stations gap analysis for Kachchh urban areas

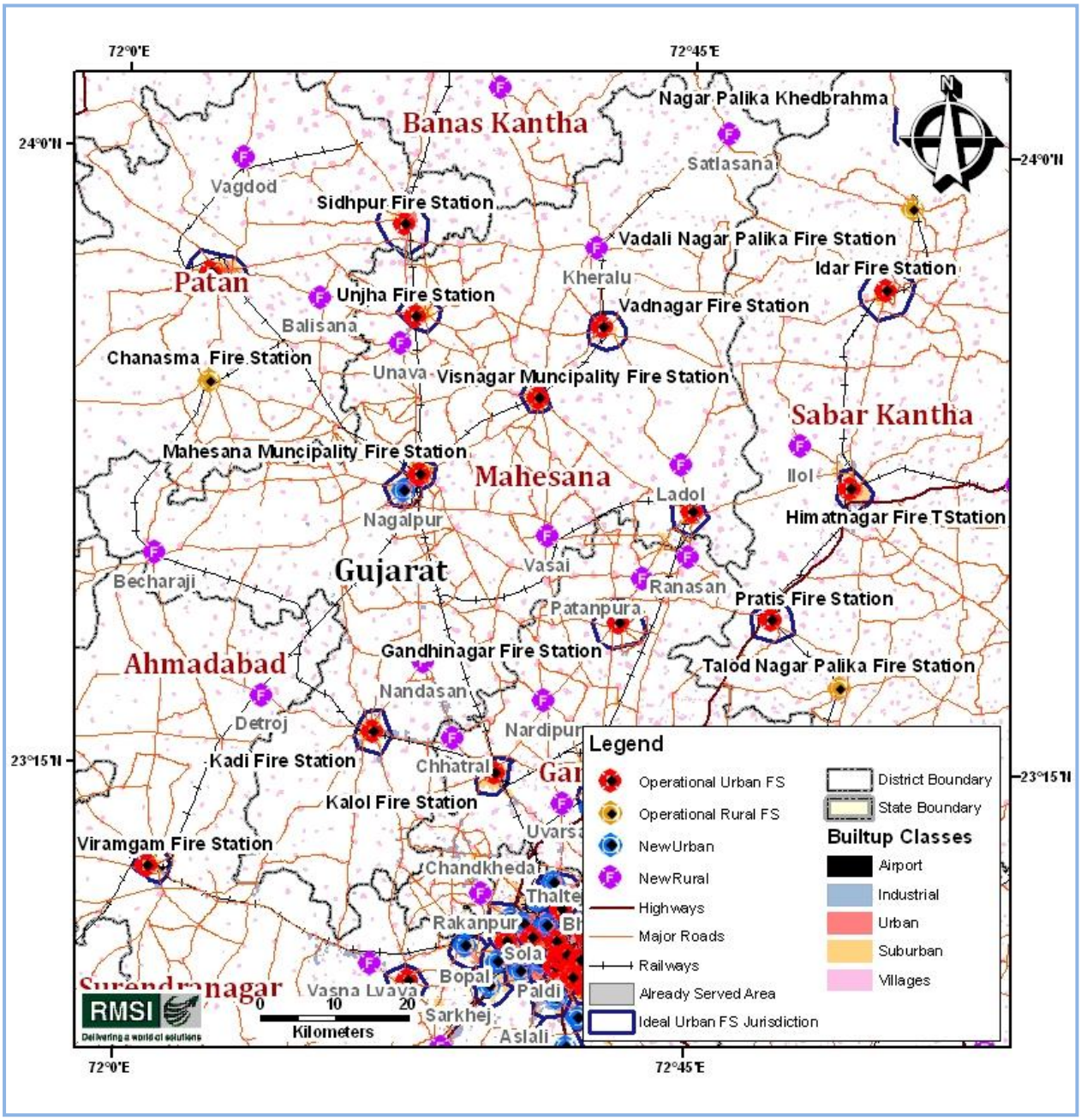


Figure 22-16: Fire Stations gap analysis for Mahesana rural areas

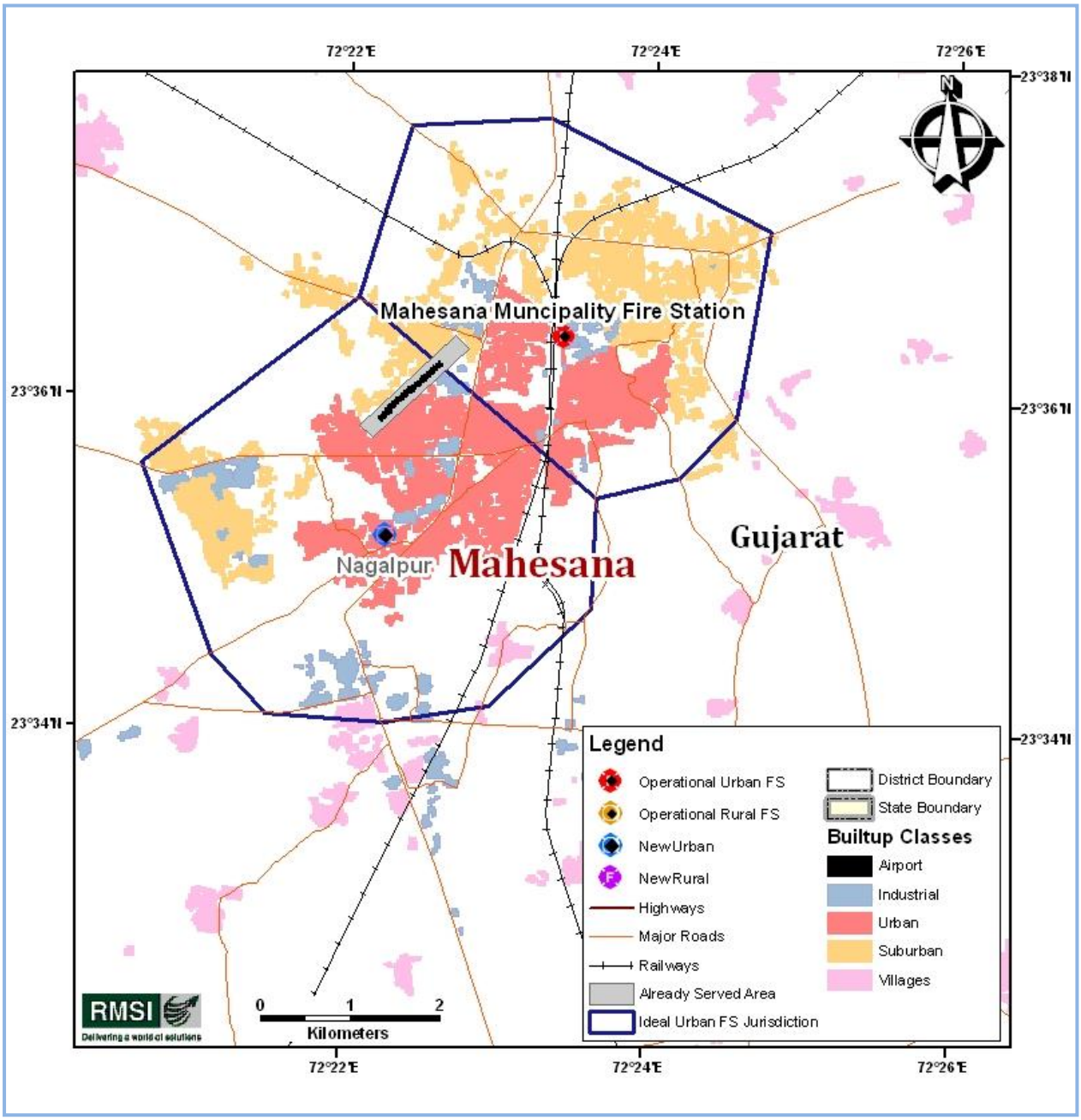


Figure 22-17: Fire Stations gap analysis for Mahesana urban areas

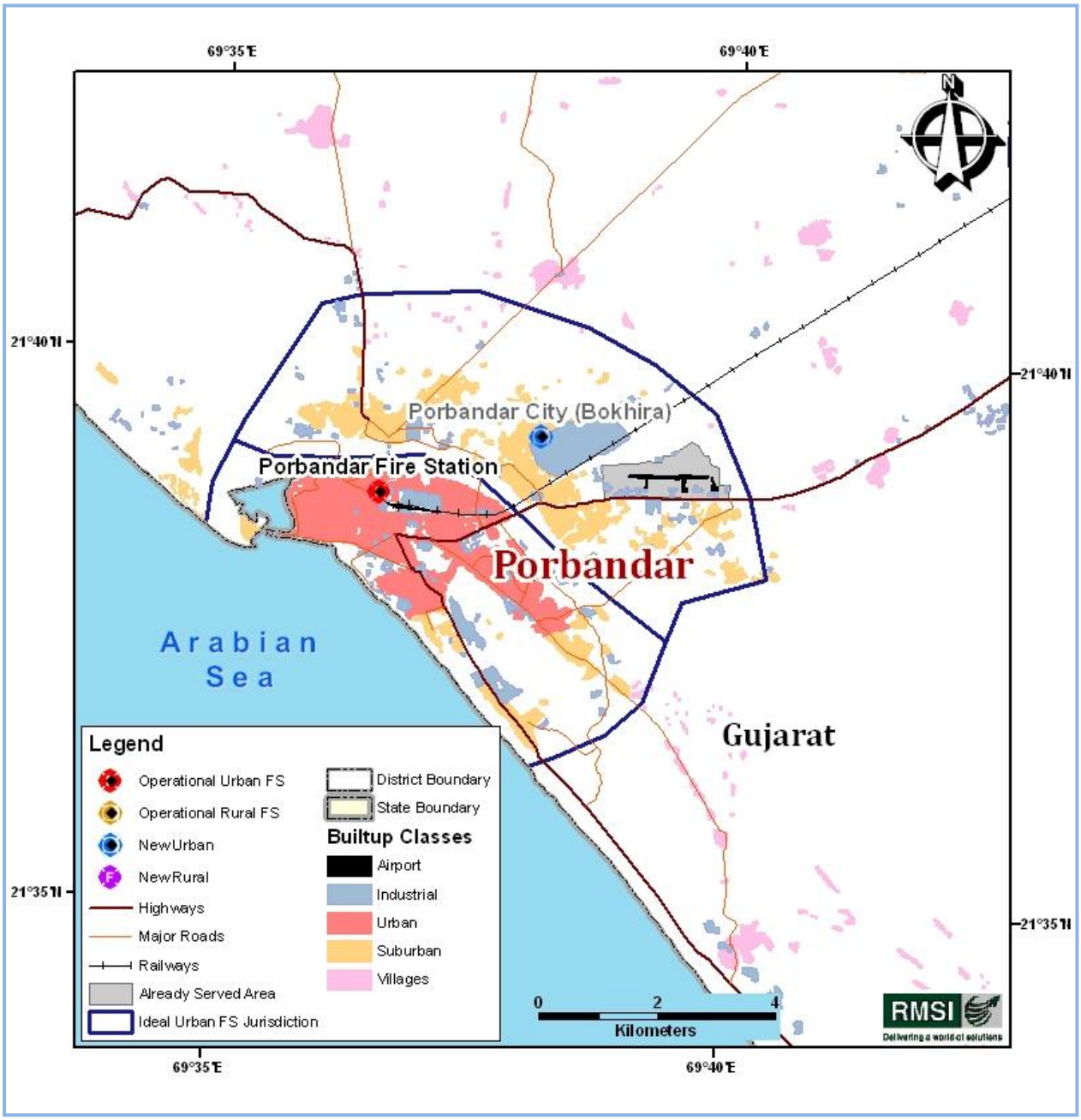


Figure 22-17: Fire Stations gap analysis for Porbandar urban areas

22.3.2 Fire fighting and rescue Vehicles And Equipment Gap

For firefighting and rescue vehicles and specialized equipment gap analysis at the operational Fire Stations and the additional Fire Stations in urban and 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 Fire Stations, equipments 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 3 lakhs population has been considered. For population of more than 3 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. *However, in hilly States, the criteria have been further relaxed.*

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 - 6.0 sq km, there should be 2 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 the State Fire and Emergency Service. 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 Pumps are recommended, which will be part of a Fire Tender **(Specialized Equipment at 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. **Fire Boat:** One each at selected Fire Stations, in whose jurisdiction some inhabitated areas exist near water bodies, such as lake, major river, sea, where fire fighting can be better performed, through watercourse.
14. **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 e.g., Rajasthan State has a modern fleet of Ambulances (108), well equipped with GPS, medical equipments and staff under National Rural Health Mission (Rajasthan), CATS (Centralized Accident Trauma Service, Ministry of Health) in case of Delhi State.

    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 equipments, 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.
15. **Educational Van**: One per district and one additional unit for every 30 Lakhs district population.

At rural Fire Station/ fire post, if the estimated pumping unit 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 majority of rural villages inside roads are small in width and congested. This will also help in optimization of resources. For rural Fire Stations/ Fire Posts where less than 10,000 persons are residing within its jurisdiction, QRT and motor cycle with two water mist backpacks has only been recommended.

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 being 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 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.

Specialized Equipment:

Specialized 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 or minimum one per district.
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 one compressor per Fire Station
4. **First Aid Box:** One for each fire fighting vehicle (minimum two 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 or minimum one per district
6. **Personal Protection Equipment (PPE):** One Set for each pumping unit or a minimum of two 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 or minimum one per district
12. **Portable Pump:** One for each fire fighting unit
13. **Floating Pump**: One for each Fire Boat
14. **Smoke Exhauster/PPV:** One per Fire Stations located in urban areas (minimum one per district)
15. **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 or minimum one per district
16. **Inflatable Lighting Tower:** One per Fire Station
17. **High Capacity LED Torch Light:** One piece per vehicle

Note: *Other smaller equipments 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 Station/fire post, following specialized equipment has been recommended:

1. **B.A. Set with BA Compressor:** Two B. A. set 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. . *The replacement of condemned / major repair (off road) vehicles as well as instruments 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 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 equipments 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
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 1 mobile wireless set and 1 walky-talky.

Detailed district level list of currently operational fire fighting vehicles available with Fire Service (As on Oct- 2012), vehicle gap in operational Fire Stations for ideal Jurisdiction area, additional vehicle required for new urban and rural Fire Stations and total vehicle gap for existing and new Urban Fire Stations are shown in Table 22-4 to 22-7. Similarly, gap analysis for specialized fire equipment is shown in Tables 22-8 to 22-15.

Table 22-4: List of operational fire fighting vehicles available with Gujarat Fire & Emergency Services (As on Oct, 2012)

District	Fire Stations	Ideally Served Population Estimates	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 Vehicle
Ahmadabad	19	3,694,983	39	44	5	15	3	3	0	0	0	4	0	0	25	0	138
Amreli	7	455,430	7	6	0	0	0	0	0	0	0	0	0	0	1	0	14
Anand	8	1,144,722	12	7	0	2	0	0	0	0	0	0	0	0	7	0	28
Banas Kantha	5	886,285	8	4	0	0	0	0	0	0	0	0	0	0	2	0	14
Bharuch	5	763,416	9	8	3	0	0	0	0	0	0	0	0	1	6	0	27
Bhavnagar	9	1,032,799	20	9	2	1	1	0	0	0	0	0	0	0	4	0	37
Dohad	3	411,951	5	3	0	0	0	0	0	0	0	0	0	0	4	0	12
Gandhinagar	4	754,454	6	6	0	0	1	0	0	0	0	0	0	0	4	0	17
Jamnagar	13	1,385,795	20	12	2	3	2	0	0	0	0	0	0	3	7	0	49
Junagadh	10	1,615,437	14	9	1	1	0	0	0	0	0	0	0	0	4	0	29
Kachchh	6	796,293	9	7	0	0	0	0	0	0	0	0	0	0	3	0	19
Kheda	6	807,191	12	7	0	0	0	0	0	0	0	1	0	2	8	0	30
Mahesana	6	897,083	12	9	0	0	0	0	0	0	0	0	0	0	6	0	27
Narmada	1	94,053	2	2	0	0	0	0	0	0	0	0	0	0	2	0	6
Navsari	4	700,681	6	6	0	0	0	0	0	0	0	0	0	0	3	0	15
Panch Mahals	5	597,767	8	6	0	0	0	0	0	0	0	0	0	1	3	0	18
Patan	5	676,784	10	4	0	0	0	0	0	0	0	0	0	0	1	0	15
Porbandar	3	325,646	6	3	0	0	0	0	0	0	0	0	0	0	3	0	12
Rajkot	13	1,949,117	22	21	1	4	1	0	0	0	0	0	0	5	12	0	66
Sabar Kantha	8	1,230,392	11	3	0	0	0	0	0	0	0	0	0	0	0	0	14
Surat	15	2,448,396	23	28	8	7	4	2	0	1	0	0	0	8	11	0	92
Surendranagar	7	805,573	8	8	0	0	0	0	0	0	0	0	0	0	6	0	22
Tapi	2	143,348	3	3	0	0	0	0	0	0	0	0	0	0	2	0	8
The Dangs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vadodara	12	1,612,768	23	26	5	4	1	0	0	0	0	0	0	0	14	0	73

District	Fire Stations	Ideally Served Population Estimates	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 Vehicle
Valsad	7	866,365	11	11	2	0	0	0	0	0	0	0	0	0	4	0	28
Total	**183**	**26,096,729**	**306**	**252**	**29**	**37**	**13**	**5**	**0**	**1**	**0**	**5**	**0**	**20**	**142**	**0**	**810**

Table 22-5: Vehicle gap in operational Fire Stations for their ideal jurisdiction area

District	Fire Stations	Ideally Served Population Estimates	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 Vehicle
Ahmadabad	19	3,694,983	5	-12	6	-8	1	3	4	1	0	9	13	0	0	2	24
Amreli	7	455,430	0	-3	2	1	0	1	2	1	0	3	3	0	0	1	11
Anand	8	1,144,722	2	0	6	0	1	0	2	1	0	3	3	0	0	1	19
Banas Kantha	5	886,285	3	5	1	1	0	1	2	1	0	3	3	0	0	1	21
Bharuch	5	763,416	0	-4	1	1	1	5	1	1	0	2	2	0	0	1	11
Bhavnagar	9	1,032,799	-5	-5	3	0	0	1	2	1	0	1	1	0	0	2	1
Dohad	3	411,951	0	0	1	1	0	1	1	1	0	3	3	0	0	1	12
Gandhinagar	4	754,454	3	-1	2	1	1	1	1	1	0	2	2	0	0	1	14
Jamnagar	13	1,385,795	1	-5	5	-1	-1	3	2	1	0	5	5	0	0	1	16
Junagadh	10	1,615,437	4	3	7	0	0	1	2	1	0	4	4	0	0	1	27
Kachchh	6	796,293	1	-3	4	1	0	3	2	1	0	2	2	0	0	1	14
Kheda	6	807,191	-1	-4	5	1	0	1	2	1	0	1	2	0	0	1	9
Mahesana	6	897,083	0	-2	4	1	0	1	2	1	0	2	2	0	0	1	12

District	Fire Stations	Ideally Served Population Estimates	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 Vehicle
Narmada	1	94,053	0	-1	0	1	0	1	1	1	0	1	1	0	0	1	6
Navsari	4	700,681	3	-1	3	1	0	1	1	1	0	2	2	0	0	1	14
Panch Mahals	5	597,767	0	-1	1	1	0	0	2	1	0	3	3	0	0	1	11
Patan	5	676,784	-1	1	1	1	0	1	1	1	0	3	3	0	0	1	12
Porbandar	3	325,646	-1	-3	2	1	0	1	1	1	0	2	2	0	0	1	7
Rajkot	13	1,949,117	4	-9	8	-2	1	3	2	1	0	6	6	0	0	3	23
Sabar Kantha	8	1,230,392	4	6	5	1	0	1	2	1	0	4	4	0	0	1	29
Surat	15	2,448,396	10	-12	3	-4	0	3	4	0	0	10	10	0	0	3	27
Surendranagar	7	805,573	2	-3	4	1	0	3	2	1	0	2	2	0	0	1	15
Tapi	2	143,348	0	-3	1	1	0	1	1	1	0	1	1	0	0	1	5
The Dangs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vadodara	12	1,612,768	-3	-16	4	-2	0	5	2	1	0	5	5	0	0	2	3
Valsad	7	866,365	1	-7	3	1	0	9	1	1	0	3	3	0	0	1	16
Total	183	26,096,729	**32**	**-80**	**82**	**0**	**4**	**51**	**45**	**24**	**0**	**82**	**87**	**0**	**0**	**32**	**359**

Table 22-6: Total gap in operational and new urban Fire Stations under their ideal jurisdiction areas

District	Fire Stations	Ideally Served Population Estimates	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 Vehicle
Ahmadabad	38	6,696,852	40	15	16	-7	1	11	6	1	0	14	18	0	0	3	118
Amreli	7	455,430	0	-3	2	1	0	1	2	1	0	3	3	0	0	1	11
Anand	9	1,173,999	3	0	6	0	1	1	2	1	0	3	3	0	0	1	21
Banas Kantha	5	886,285	3	5	1	1	0	1	2	1	0	3	3	0	0	1	21
Bharuch	5	763,416	0	-4	1	1	1	5	1	1	0	2	2	0	0	1	11
Bhavnagar	10	1,221,106	-2	-3	3	0	0	1	2	1	0	1	1	0	0	2	6
Dohad	3	411,951	0	0	1	1	0	1	1	1	0	3	3	0	0	1	12
Gandhinagar	6	1,052,773	7	1	3	1	1	1	2	1	0	3	3	0	0	1	24
Jamnagar	15	1,498,014	3	-5	6	-1	-1	4	2	1	0	5	5	0	0	1	20
Junagadh	11	1,658,617	5	3	7	0	0	2	2	1	0	4	4	0	0	1	29
Kachchh	7	847,957	2	-3	4	1	0	4	2	1	0	2	2	0	0	1	16
Kheda	6	807,191	-1	-4	5	1	0	1	2	1	0	1	2	0	0	1	9
Mahesana	7	988,325	1	-2	5	1	0	1	2	1	0	2	2	0	0	1	14
Narmada	1	94,053	0	-1	0	1	0	1	1	1	0	1	1	0	0	1	6
Navsari	4	700,681	3	-1	3	1	0	1	1	1	0	2	2	0	0	1	14
Panch Mahals	6	622,274	1	-1	1	1	0	1	2	1	0	3	3	0	0	1	13
Patan	5	676,784	-1	1	1	1	0	1	1	1	0	3	3	0	0	1	12
Porbandar	4	396,999	0	-3	3	1	0	2	1	1	0	2	2	0	0	1	10
Rajkot	18	2,350,342	10	-7	10	-2	1	3	3	1	0	7	7	0	0	3	36
Sabar Kantha	8	1,230,392	4	6	5	1	0	1	2	1	0	4	4	0	0	1	29
Surat	22	4,251,261	29	6	8	-4	0	3	4	0	0	16	16	0	0	3	81

District	Fire Stations	Ideally Served Population Estimates	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 Vehicle
Surendranagar	7	805,573	2	-3	4	1	0	3	2	1	0	2	2	0	0	1	15
Tapi	2	143,348	0	-3	1	1	0	1	1	1	0	1	1	0	0	1	5
The Dangs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vadodara	17	2,443,009	5	-9	9	-2	0	5	3	1	0	5	5	0	0	2	24
Valsad	7	866,365	1	-7	3	1	0	9	1	1	0	3	3	0	0	1	16
Total	**230**	**33,042,997**	**115**	**-22**	**108**	**1**	**4**	**65**	**50**	**24**	**0**	**95**	**100**	**0**	**0**	**33**	**573**

Table 22-7: Additional vehicle required for new rural Fire Stations under their ideal jurisdiction areas

District	Fire Stations	Ideally Served Population Estimates	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 Vehicle
Ahmadabad	10	1,122,311	10	2	5	0	0	5	0	0	0	10	10	0	0	0	42
Amreli	7	1,395,627	12	8	7	0	0	1	0	0	0	7	7	0	0	0	42
Anand	4	840,981	7	5	4	0	0	1	0	0	0	4	4	0	0	0	25
Banas Kantha	12	2,225,646	23	16	4	0	0	0	0	0	0	12	12	0	0	0	67
Bharuch	5	710,897	6	3	4	0	0	3	0	0	0	5	5	0	0	0	26
Bhavnagar	6	1,174,467	10	7	6	0	0	0	0	0	0	6	6	0	0	0	35
Dohad	7	1,729,515	18	13	2	0	0	0	0	0	0	7	7	0	0	0	47

District	Fire Stations	Ideally Served Population Estimates	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 Vehicle
Gandhinagar	10	1,288,420	11	4	7	0	0	4	0	0	0	10	10	0	0	0	46
Jamnagar	4	491,042	4	2	3	0	0	0	0	0	0	4	4	0	0	0	17
Junagadh	8	1,192,610	10	3	6	0	0	2	0	0	0	8	8	0	0	0	37
Kachchh	6	1,186,125	10	8	5	0	0	3	0	0	0	6	6	0	0	0	38
Kheda	8	1,478,330	15	9	3	0	0	1	0	0	0	8	8	0	0	0	44
Mahesana	7	976,664	9	2	5	0	0	1	0	0	0	7	7	0	0	0	31
Narmada	3	416,410	3	1	3	0	0	0	0	0	0	3	3	0	0	0	13
Navsari	4	793,727	6	5	4	0	0	1	0	0	0	4	4	0	0	0	24
Panch Mahals	6	748,699	8	3	1	0	0	0	0	0	0	6	6	0	0	0	24
Patan	5	700,872	6	3	4	0	0	0	0	0	0	5	5	0	0	0	23
Porbandar	1	150,333	1	1	1	0	0	0	0	0	0	1	1	0	0	0	5
Rajkot	12	1,629,118	13	5	10	0	0	11	0	0	0	12	12	0	0	0	63
Sabar Kantha	7	1,161,191	13	9	1	0	0	0	0	0	0	7	7	0	0	0	37
Surat	10	1,924,397	17	9	9	0	0	8	0	0	0	10	10	0	0	0	63
Surendranagar	6	760,403	6	2	3	0	0	0	0	0	0	6	6	0	0	0	23
Tapi	3	503,191	5	3	2	0	0	0	0	0	0	3	3	0	0	0	16
The Dangs	2	236,789	2	1	1	1	0	1	1	1	0	2	2	0	0	1	13
Vadodara	8	1,719,011	16	13	4	0	0	2	0	0	0	8	8	0	0	0	51
Valsad	3	783,852	7	5	3	0	0	2	0	0	0	3	3	0	0	0	23
Total	**164**	**27,340,628**	**248**	**142**	**107**	**1**	**0**	**46**	**1**	**1**	**0**	**164**	**164**	**0**	**0**	**1**	**875**

Table 22-8: List of specialized equipment available with Gujarat Fire & Emergency Services (As on Oct., 2012)

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
Ahmadabad	19	3,694,983	36	6	160	0	21	0	51	53	10	14	0	0	7	0
Amreli	7	455,430	4	0	0	0	11	0	0	0	0	0	0	0	0	0
Anand	8	1,144,722	6	0	3	0	6	0	0	1	0	2	0	0	5	0
Banas Kantha	5	886,285	0	0	0	0	4	0	0	0	0	0	0	0	1	0
Bharuch	5	763,416	4	0	15	1	11	1	0	2	0	29	0	0	1	0
Bhavnagar	9	1,032,799	2	1	11	1	8	0	3	2	0	3	0	0	3	0
Dohad	3	411,951	1	0	0	0	1	0	0	0	0	0	0	0	0	0
Gandhinagar	4	754,454	4	0	2	0	5	0	1	0	0	6	0	0	0	0
Jamnagar	13	1,385,795	11	4	8	1	13	2	3	3	0	2	1	1	5	1
Junagadh	10	1,615,437	5	0	4	0	6	0	1	2	0	4	0	0	1	0
Kachchh	6	796,293	0	0	0	0	4	0	0	0	0	1	0	0	2	0
Kheda	6	807,191	8	0	5	0	11	0	2	2	0	1	0	0	6	1
Mahesana	6	897,083	3	0	0	0	9	0	0	0	0	0	0	0	11	0
Narmada	1	94,053	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Navsari	4	700,681	1	0	2	0	6	0	0	0	0	0	0	0	0	0
Panch Mahals	5	597,767	2	0	1	0	7	0	1	0	0	1	0	0	0	0
Patan	5	676,784	1	0	0	0	2	0	0	0	0	0	0	0	6	0
Porbandar	3	325,646	1	0	0	0	1	0	0	1	0	0	0	0	0	0
Rajkot	13	1,949,117	19	4	65	0	28	1	32	16	0	22	0	0	7	1

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
Sabar Kantha	8	1,230,392	4	1	0	0	7	0	0	0	0	0	0	0	0	0
Surat	15	2,448,396	6	4	52	2	15	1	4	38	0	54	0	1	7	0
Surendranagar	7	805,573	2	0	0	0	9	0	0	0	0	0	0	0	1	0
Tapi	2	143,348	1	0	0	0	1	0	0	0	0	0	0	0	0	0
The Dangs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vadodara	12	1,612,768	4	15	100	2	38	0	17	34	0	19	1	0	7	3
Valsad	7	866,365	7	0	16	0	14	0	0	1	0	3	0	0	0	0
Total	**183**	**26,096,729**	**132**	**35**	**444**	**7**	**238**	**5**	**115**	**155**	**10**	**161**	**2**	**2**	**70**	**6**

Table 22-9: List of specialized equipment available with Gujarat Fire & Emergency Services (As on Oct, 2012) (continued..)

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
Ahmadabad	19	3,694,983	1	0	15	10	3	61	1	22	89	40	0	600
Amreli	7	455,430	0	0	0	0	0	8	0	0	0	0	0	23
Anand	8	1,144,722	0	0	0	0	0	1	2	1	2	4	0	33
Banas Kantha	5	886,285	0	0	0	0	0	2	0	1	2	0	0	10
Bharuch	5	763,416	0	0	1	1	2	2	1	2	12	8	0	93
Bhavnagar	9	1,032,799	0	1	0	0	3	9	1	3	8	0	0	59
Dohad	3	411,951	0	0	0	0	0	0	0	0	0	0	0	2
Gandhinagar	4	754,454	6	0	0	0	2	4	0	0	2	0	0	32
Jamnagar	13	1,385,795	0	3	4	1	4	23	0	4	11	0	0	105
Junagadh	10	1,615,437	0	0	1	0	0	17	1	0	0	0	0	42
Kachchh	6	796,293	0	0	0	0	0	0	0	0	0	0	0	7
Kheda	6	807,191	0	0	0	0	0	7	2	2	2	5	0	54
Mahesana	6	897,083	0	0	0	0	0	11	0	0	0	1	0	35
Narmada	1	94,053	0	0	0	0	0	0	0	0	0	0	0	0
Navsari	4	700,681	0	0	0	0	0	0	0	1	3	2	0	15
Panch Mahals	5	597,767	0	0	0	0	0	0	0	0	0	2	0	14
Patan	5	676,784	0	0	0	0	0	4	0	0	0	0	0	13
Porbandar	3	325,646	0	0	0	0	0	2	0	0	0	0	0	5
Rajkot	13	1,949,117	0	0	1	5	22	31	3	3	19	0	0	279
Sabar Kantha	8	1,230,392	0	0	0	0	0	4	1	0	6	3	0	26

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
Surat	15	2,448,396	4	2	0	4	19	10	29	12	72	24	0	360
Surendranagar	7	805,573	0	0	0	0	0	10	0	0	0	0	0	22
Tapi	2	143,348	0	0	0	0	0	0	0	1	4	1	0	8
The Dangs	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vadodara	12	1,612,768	1	3	3	2	1	103	3	7	33	10	0	406
Valsad	7	866,365	10	0	0	0	0	4	2	1	7	2	0	67
Total	**183**	**26,096,729**	**22**	**9**	**25**	**23**	**56**	**313**	**46**	**60**	**272**	**102**	**0**	**2310**

Table 22-10: Specialized equipment gap in operational Fire Stations for ideal jurisdiction area

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
Ahmadabad	19	3,694,983	-18	106	289	23	102	13	-31	-30	13	109	118	13	93	0
Amreli	7	455,430	3	12	62	8	9	0	7	8	8	20	13	0	15	0
Anand	8	1,144,722	4	31	134	10	31	4	8	9	10	35	31	4	25	0
Banas Kantha	5	886,285	6	17	108	6	25	6	4	6	6	29	18	6	23	0
Bharuch	5	763,416	1	13	71	5	13	0	5	4	6	-5	18	1	18	0
Bhavnagar	9	1,032,799	9	29	107	10	24	4	8	9	11	29	31	4	22	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
Dohad	3	411,951	1	6	50	4	13	1	1	4	4	14	7	1	12	0
Gandhinagar	4	754,454	1	22	80	5	17	1	4	5	5	16	23	1	18	0
Jamnagar	13	1,385,795	-1	22	172	15	38	5	8	13	16	49	25	6	34	2
Junagadh	10	1,615,437	3	32	188	12	44	7	7	10	12	46	32	7	41	0
Kachchh	6	796,293	6	16	91	7	21	6	6	7	7	24	19	6	18	0
Kheda	6	807,191	-2	19	91	7	14	2	4	5	7	24	20	2	15	0
Mahesana	6	897,083	3	30	115	7	22	4	7	7	7	31	31	4	14	0
Narmada	1	94,053	1	5	17	1	5	0	1	1	1	5	6	0	4	0
Navsari	4	700,681	3	14	84	5	18	2	4	5	5	24	16	2	19	0
Panch Mahals	5	597,767	2	12	73	6	13	1	3	6	6	19	12	1	17	1
Patan	5	676,784	5	11	79	6	20	6	4	6	6	22	12	6	12	0
Porbandar	3	325,646	0	6	38	4	11	0	2	3	4	12	7	0	9	0
Rajkot	13	1,949,117	-6	54	175	16	36	6	-18	0	16	42	61	7	46	2
Sabar Kantha	8	1,230,392	4	15	149	10	33	2	6	10	10	40	17	2	33	0
Surat	15	2,448,396	10	80	260	16	71	10	14	-20	18	32	90	10	59	1
Surendranagar	7	805,573	5	19	96	8	17	4	7	8	8	26	22	4	20	0
Tapi	2	143,348	0	6	22	2	6	0	2	2	2	7	7	0	5	0
The Dangs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vadodara	12	1,612,768	8	22	99	12	15	2	-5	-20	14	34	37	2	37	0
Valsad	7	866,365	-1	17	92	8	16	1	6	7	8	27	23	1	26	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
Total	**183**	**26,096,729**	**47**	**616**	**2742**	**213**	**634**	**87**	**64**	**65**	**210**	**711**	**696**	**90**	**635**	**6**

Table 22-11: Specialized equipment gap in operational Fire Stations for ideal jurisdiction area (continued..)

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
Ahmadabad	19	3,694,983	0	4	8	10	10	66	0	1	60	112	23	1094
Amreli	7	455,430	0	0	8	7	0	10	0	8	23	26	8	255
Anand	8	1,144,722	0	2	10	8	4	35	-1	9	42	41	10	496
Banas Kantha	5	886,285	0	0	6	4	6	28	0	5	33	35	6	383
Bharuch	5	763,416	0	0	5	4	-1	27	-1	4	23	27	6	244
Bhavnagar	9	1,032,799	0	1	11	11	1	22	0	8	29	40	11	431
Dohad	3	411,951	0	0	4	1	1	16	0	4	20	20	4	188
Gandhinagar	4	754,454	0	0	5	5	-1	19	0	5	28	31	5	295
Jamnagar	13	1,385,795	0	1	12	10	3	29	0	12	48	62	16	597
Junagadh	10	1,615,437	0	2	11	8	7	35	0	12	58	58	12	644

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
Kachchh	6	796,293	0	0	7	6	6	28	0	7	34	34	7	363
Kheda	6	807,191	0	0	7	6	2	19	-2	5	30	27	7	309
Mahesana	6	897,083	0	0	7	7	4	20	0	7	37	37	7	408
Narmada	1	94,053	0	0	1	1	0	6	0	1	11	11	1	79
Navsari	4	700,681	0	0	5	4	2	24	0	4	26	28	5	299
Panch Mahals	5	597,767	0	2	6	4	1	20	0	6	26	24	6	267
Patan	5	676,784	0	0	6	4	6	19	0	6	28	28	6	298
Porbandar	3	325,646	0	0	4	2	0	10	0	4	17	18	4	155
Rajkot	13	1,949,117	0	30	15	9	-15	36	9	13	63	82	16	695
Sabar Kantha	8	1,230,392	0	2	10	6	2	37	0	10	41	45	10	494
Surat	15	2,448,396	44	32	18	14	-8	80	-12	6	37	87	18	967
Surendranagar	7	805,573	0	0	8	7	4	19	0	8	35	36	8	369
Tapi	2	143,348	0	0	2	2	0	7	0	1	8	12	2	95
The Dangs	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vadodara	12	1,612,768	0	35	11	10	1	-44	16	7	35	58	14	400
Valsad	7	866,365	0	0	8	6	1	36	0	7	37	43	8	377
Total	**183**	**26,096,729**	**44**	**111**	**195**	**156**	**36**	**604**	**9**	**160**	**829**	**1022**	**220**	**10202**

Table 22-12: Total gap in specialized equipments 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	Prtoable Pumps	Floating Pumps
Ahmadabad	38	6,696,852	1	198	647	46	197	23	-8	-7	36	204	220	23	170	0
Amreli	7	455,430	3	12	62	8	9	0	7	8	8	20	13	0	15	0
Anand	9	1,173,999	4	32	139	11	33	4	9	10	11	37	33	4	26	0
Banas Kantha	5	886,285	6	17	108	6	25	6	4	6	6	29	18	6	23	0
Bharuch	5	763,416	1	13	71	5	13	0	5	4	6	-5	18	1	18	0
Bhavnagar	10	1,221,106	10	35	131	11	30	5	9	10	12	35	37	5	27	0
Dohad	3	411,951	1	6	50	4	13	1	1	4	4	14	7	1	12	0
Gandhinagar	6	1,052,773	2	30	114	7	25	2	6	7	7	24	31	2	26	0
Jamnagar	15	1,498,014	1	26	186	17	42	7	10	15	18	53	30	8	37	2
Junagadh	11	1,658,617	3	33	193	13	46	7	8	11	13	48	34	7	42	0
Kachchh	7	847,957	7	17	96	8	23	7	7	8	8	26	21	7	19	0
Kheda	6	807,191	-2	19	91	7	14	2	4	5	7	24	20	2	15	0
Mahesana	7	988,325	3	32	125	8	24	4	8	8	8	33	33	4	16	0
Narmada	1	94,053	1	5	17	1	5	0	1	1	1	5	6	0	4	0
Navsari	4	700,681	3	14	84	5	18	2	4	5	5	24	16	2	19	0
Panch Mahals	6	622,274	2	13	78	7	15	1	4	7	7	21	14	1	18	1
Patan	5	676,784	5	11	79	6	20	6	4	6	6	22	12	6	12	0
Porbandar	4	396,999	1	8	48	5	13	0	3	4	5	14	11	0	11	0
Rajkot	18	2,350,342	-4	67	225	22	52	7	-12	6	22	58	74	8	57	2

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	Prtoable Pumps	Floating Pumps
Sabar Kantha	8	1,230,392	4	15	149	10	33	2	6	10	10	40	17	2	33	0
Surat	22	4,251,261	18	138	476	24	129	17	22	-12	26	90	148	17	107	1
Surendranagar	7	805,573	5	19	96	8	17	4	7	8	8	26	22	4	20	0
Tapi	2	143,348	0	6	22	2	6	0	2	2	2	7	7	0	5	0
The Dangs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vadodara	17	2,443,009	13	46	195	18	39	6	1	-14	20	58	61	6	57	0
Valsad	7	866,365	-1	17	92	8	16	1	6	7	8	27	23	1	26	0
Total	**230**	**33,042,997**	**87**	**829**	**3574**	**267**	**857**	**114**	**118**	**119**	**264**	**934**	**926**	**117**	**815**	**6**

Table 22-13: Total gap in specialized equipments for operational and new urban Fire Stations (Continued….)

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
Ahmadabad	38	6,696,852	0	4	31	33	20	168	0	24	167	219	46	2462
Amreli	7	455,430	0	0	8	7	0	10	0	8	23	26	8	255
Anand	9	1,173,999	0	2	11	9	4	37	-1	10	44	43	11	523
Banas Kantha	5	886,285	0	0	6	4	6	28	0	5	33	35	6	383

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
Bharuch	5	763,416	0	0	5	4	-1	27	-1	4	23	27	6	244
Bhavnagar	10	1,221,106	0	1	12	12	2	28	0	9	35	46	12	514
Dohad	3	411,951	0	0	4	1	1	16	0	4	20	20	4	188
Gandhinagar	6	1,052,773	0	0	7	7	0	27	0	7	38	41	7	417
Jamnagar	15	1,498,014	0	1	14	12	5	34	0	14	53	68	18	671
Junagadh	11	1,658,617	0	2	12	9	7	37	0	13	60	60	13	671
Kachchh	7	847,957	0	0	8	7	7	30	0	8	36	36	8	394
Kheda	6	807,191	0	0	7	6	2	19	-2	5	30	27	7	309
Mahesana	7	988,325	0	0	8	8	4	22	0	8	39	39	8	442
Narmada	1	94,053	0	0	1	1	0	6	0	1	11	11	1	79
Navsari	4	700,681	0	0	5	4	2	24	0	4	26	28	5	299
Panch Mahals	6	622,274	0	2	7	5	1	22	0	7	28	26	7	294
Patan	5	676,784	0	0	6	4	6	19	0	6	28	28	6	298
Porbandar	4	396,999	0	0	5	3	0	14	0	5	21	22	5	198
Rajkot	18	2,350,342	0	30	21	15	-14	49	9	19	77	99	22	911
Sabar Kantha	8	1,230,392	0	2	10	6	2	37	0	10	41	45	10	494
Surat	22	4,251,261	44	32	26	22	-1	138	-12	14	95	145	26	1730
Surendranagar	7	805,573	0	0	8	7	4	19	0	8	35	36	8	369
Tapi	2	143,348	0	0	2	2	0	7	0	1	8	12	2	95
The Dangs	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vadodara	17	2,443,009	0	35	17	16	5	-20	16	13	60	83	20	751
Valsad	7	866,365	0	0	8	6	1	36	0	7	37	43	8	377
Total	**230**	**33,042,997**	**44**	**111**	**249**	**210**	**63**	**834**	**9**	**214**	**1068**	**1265**	**274**	**13368**

Table 22-14: Additional specialized equipment required for new rural 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
Ahmadabad	10	1,122,311	0	0	106	12	32	1	0	12	12	32	0	1	28	0
Amreli	7	1,395,627	0	0	146	8	41	0	0	8	8	41	0	0	34	0
Anand	4	840,981	0	0	86	5	24	0	0	5	5	24	0	0	20	0
Banas Kantha	12	2,225,646	0	0	235	14	66	11	0	14	14	66	0	11	55	0
Bharuch	5	710,897	0	0	74	6	22	0	0	6	6	22	0	0	18	0
Bhavnagar	6	1,174,467	0	0	125	7	35	0	0	7	7	35	0	0	29	0
Dohad	7	1,729,515	0	0	175	8	48	0	0	8	8	48	0	0	40	0
Gandhinagar	10	1,288,420	0	0	130	12	38	0	0	12	12	38	0	0	32	0
Jamnagar	4	491,042	0	0	53	5	16	5	0	5	5	16	0	5	13	0
Junagadh	8	1,192,610	0	0	110	10	32	0	0	10	10	32	0	0	27	0
Kachchh	6	1,186,125	0	0	125	7	35	7	0	7	7	35	0	7	29	0
Kheda	8	1,478,330	0	0	149	10	42	0	0	10	10	42	0	0	35	0
Mahesana	7	976,664	0	0	94	8	28	2	0	8	8	28	0	2	23	0
Narmada	3	416,410	0	0	41	4	12	0	0	4	4	12	0	0	10	0
Navsari	4	793,727	0	0	82	5	23	0	0	5	5	23	0	0	19	0
Panch Mahals	6	748,699	0	0	72	7	22	0	0	7	7	22	0	0	18	0
Patan	5	700,872	0	0	74	6	22	6	0	6	6	22	0	6	18	0
Porbandar	1	150,333	0	0	17	1	5	0	0	1	1	5	0	0	4	0
Rajkot	12	1,629,118	0	0	163	14	48	4	0	14	14	48	0	4	40	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
Sabar Kantha	7	1,161,191	0	0	127	8	36	0	0	8	8	36	0	0	30	0
Surat	10	1,924,397	0	0	192	12	54	0	0	12	12	54	0	0	45	0
Surendranagar	6	760,403	0	0	67	7	20	2	0	7	7	20	0	2	17	0
Tapi	3	503,191	0	0	55	4	16	0	0	4	4	16	0	0	13	0
The Dangs	2	236,789	0	0	24	2	7	0	0	2	2	7	0	0	6	0
Vadodara	8	1,719,011	0	0	178	10	49	0	0	10	10	49	0	0	41	0
Valsad	3	783,852	0	0	79	4	22	0	0	4	4	22	0	0	18	0
Total	**164**	**27,340,628**	**0**	**0**	**2779**	**196**	**795**	**38**	**0**	**196**	**196**	**795**	**0**	**38**	**662**	**0**

Table 22-15: Additional specialized equipment required for new rural Fire Stations (continued…)

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
Ahmadabad	10	1,122,311	0	0	12	0	1	38	0	12	38	38	12	387
Amreli	7	1,395,627	0	0	8	0	0	42	0	8	42	42	8	436
Anand	4	840,981	0	0	5	0	0	24	0	5	24	24	5	256
Banas Kantha	12	2,225,646	0	0	14	0	11	66	0	14	66	66	14	737
Bharuch	5	710,897	0	0	6	0	0	25	0	6	25	25	6	247
Bhavnagar	6	1,174,467	0	0	7	0	0	35	0	7	35	35	7	371
Dohad	7	1,729,515	0	0	8	0	0	48	0	8	48	48	8	503
Gandhinagar	10	1,288,420	0	0	12	0	0	43	0	12	43	43	12	439
Jamnagar	4	491,042	0	0	5	0	5	16	0	5	16	16	5	191
Junagadh	8	1,192,610	0	0	10	0	0	35	0	10	35	35	10	366
Kachchh	6	1,186,125	0	0	7	0	7	38	0	7	38	38	7	401
Kheda	8	1,478,330	0	0	10	0	0	43	0	10	43	43	10	457
Mahesana	7	976,664	0	0	8	0	2	29	0	8	29	29	8	314
Narmada	3	416,410	0	0	4	0	0	12	0	4	12	12	4	135
Navsari	4	793,727	0	0	5	0	0	24	0	5	24	24	5	249
Panch Mahals	6	748,699	0	0	7	0	0	22	0	7	22	22	7	242
Patan	5	700,872	0	0	6	0	6	22	0	6	22	22	6	256
Porbandar	1	150,333	0	0	1	0	0	5	0	1	5	5	1	52
Rajkot	12	1,629,118	0	0	14	0	4	61	0	14	61	61	14	578
Sabar Kantha	7	1,161,191	0	0	8	0	0	36	0	8	36	36	8	385
Surat	10	1,924,397	0	0	12	0	0	64	0	12	64	64	12	609

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
Surendranagar	6	760,403	0	0	7	0	2	20	0	7	20	20	7	232
Tapi	3	503,191	0	0	4	0	0	16	0	4	16	16	4	172
The Dangs	2	236,789	0	0	2	0	0	8	0	2	13	13	2	90
Vadodara	8	1,719,011	0	0	10	0	0	52	0	10	52	52	10	533
Valsad	3	783,852	0	0	4	0	0	24	0	4	24	24	4	237
Total	**164**	**27,340,628**	**0**	**0**	**196**	**0**	**38**	**848**	**0**	**196**	**853**	**853**	**196**	**8875**

22.3.3 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 (Table 22-16).

Table 22-16: Manpower requirement for Station Officer and lower staff for Gujarat as per SFAC norm (considering two shifts 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*

However, Delhi Administrative Reform Department (ARD), Govt. of India has studied the fire manpower requirement, and optimized it further for two-shift duty pattern. From Tables 22-16 and 22-17, 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 (Table 22-17).

Table 22-17: Manpower requirement for Station officer and lower staffs as per ARD, Delhi (2-shifts)

Sr No	Fire Station (Pumping Unit)	Station Officer	Sub-Officer	LFM	Firemen-cum-Driver-cum Operator	Total Staff
1	One	0.00	2.50	2.50	15.63	20.60
2	Two	1.25	2.50	2.50	31.25	37.50
3	Three	1.25	3.75	7.50	46.88	59.40
4	Four	2.50	4.69	9.38	60.00	76.60
5	Five	2.50	5.63	11.25	73.13	92.50
6	Six	3.75	6.56	13.13	87.19	110.60
7	Seven	3.75	7.50	15.00	101.25	127.50

Thus for optimization on resources, following manpower criteria have been suggested for manpower gap analysis. Accordingly, total firefighting manpower gap in both urban and rural

Fire Stations in Gujarat State has been estimated, which comes to 34,230 (Table 22.19 to 22.21) against the present strength of 1,457(Table 22.18)

The Gujarat State is having Municipal Fire & Emergency Services and in general, lacks in coordination. At Municipal level, fire & emergency services do not have promotional avenues, as fire officer is struck up at the level of Chief Fire Office. Hence, there is a need to have merit-based promotion, so that deserving employees remain motivated and do not leave the organization at midst of their career. Moreover, there is no uniformity on the applicability of building by-laws on fire safety and Municipal Corporation and Municipalities can deviate from the applicability of National Building Code (NBC) of fire safety.

Each Municipal Corporation/Municipality cannot be made self sufficient in isolation to deal with serious nature of Fire & Emergency. Because of these reasons, RMSI team recommends that Municipal fire and emergency services should come under the State Fire & Emergency Services. Accordingly, a hierarchy should be created to have proper co-ordination at all levels.

In addition to fire fighting staffs, there is an urgent need of senior level fire officers for making a well coordinated State level hierarchy for creation of a dedicated fire prevention wing for inspection, awareness generation and training, 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 Chief Executive Officer (CEO) and Additional Chief Executive Officer (ACEO), Gujarat State Disaster Management Authority (GSDMA), additional officers at the levels of Director (Technical), Joint Director (Technical), Deputy Director (Technical), Chief Fire Officer (CFO), Dy Chief Fire Officer (Dy-CFO), Divisional Fire Officer (DFO), and Assistant Divisional Fire Officer (ADFO) have been suggested. 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 (Technical) : 1
- Joint Director (Technical) : 1
- Deputy Director (Technical) : 1
- Chief Fire Officer (CFO) : 10
- Deputy Chief Fire Officer (Dy.CFO) : 20
- Divisional Fire Officer (DFO) : 49 (one per 8 Fire Stations)
- Assistant Divisional Fire Officer (ADFO) : 98 (one per 4 Fire Stations)

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 Gujarat State have been carried out and are shown Tables 22-19 to 22-21.

Table 22-18: List of firefighting manpower available for operational Fire Stations in Gujarat Fire & Emergency Services (As on Oct., 2012)

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
Ahmadabad	19	0	2	1	0	0	0	4	0	27	228	7	269
Amreli	7	0	1	0	0	0	0	0	0	0	7	1	9
Anand	8	0	0	0	0	0	0	1	0	0	20	2	23
Banas Kantha	5	0	0	0	0	0	0	0	0	3	3	0	6
Bharuch	5	0	0	0	0	0	1	5	0	2	20	2	30
Bhavnagar	9	0	1	0	0	0	1	3	2	1	37	2	47
Dohad	3	0	1	0	0	0	0	0	0	0	22	4	27
Gandhinagar	4	0	1	0	0	0	0	1	0	1	21	4	28
Jamnagar	13	0	1	0	0	0	0	2	0	1	60	14	78
Junagadh	10	0	0	0	0	0	0	1	0	0	13	4	18
Kachchh	6	0	0	0	0	0	0	0	0	0	8	8	16
Kheda	6	0	0	0	0	0	0	2	0	0	22	1	25
Mahesana	6	0	0	0	0	0	0	0	0	0	8	0	8
Narmada	1	0	0	0	0	0	0	1	0	0	3	0	4
Navsari	4	0	0	0	0	0	0	1	0	0	20	0	21
Panch Mahals	5	0	1	0	0	0	0	0	0	0	21	0	22
Patan	5	0	0	0	0	0	0	0	0	0	7	3	10
Porbandar	3	0	0	0	0	0	0	1	0	0	5	0	6
Rajkot	13	0	1	0	0	0	0	5	0	12	174	20	212
Sabar Kantha	8	0	1	0	0	1	0	0	0	0	7	1	10
Surat	15	0	0	0	0	1	0	2	15	24	307	13	362
Surendranagar	7	0	0	0	0	0	0	0	0	0	3	4	7
Tapi	2	0	0	0	0	0	0	0	0	0	3	0	3
The Dangs	0	0	0	0	0	0	0	0	0	0	0	0	0
Vadodara	12	0	0	0	0	0	0	5	1	19	146	22	193
Valsad	7	0	0	0	0	0	1	0	0	1	21	0	23

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
Total	**183**	**0**	**10**	**1**	**0**	**2**	**3**	**34**	**18**	**91**	**1,186**	**112**	**1,457**

Level 10*: Director General/Director/Joint Director/Deputy Director;* ***Level 9****: CFO/CO;* ***Level 8****: Deputy CFO;* ***Level 7****: Deputy Controller;* ***Level 6****: DO/DFO/Inspector/EO/Fire Supervisor;* ***Level 5****: ADO/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 22-19: Firefighting manpower gap in operational Fire Stations for ideal jurisdiction area

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
Ahmadabad	19	2	0	3	0	2	4	61	138	324	1,913	12	2,459
Amreli	7	0	0	2	0	1	2	7	29	62	335	6	444
Anand	8	0	0	0	0	2	4	18	42	92	558	6	722
Banas Kantha	5	0	0	0	0	2	4	16	33	85	521	5	666
Bharuch	5	0	0	0	0	2	3	11	32	78	511	3	640
Bhavnagar	9	0	0	2	0	2	3	13	39	80	513	7	659
Dohad	3	0	0	2	0	2	4	7	20	51	259	-1	344
Gandhinagar	4	1	0	2	0	2	4	13	28	72	454	0	576
Jamnagar	13	0	0	2	0	2	4	22	61	125	695	-1	910
Junagadh	10	0	0	0	0	2	4	24	54	120	726	6	936
Kachchh	6	0	0	0	0	2	4	14	32	72	446	-2	568
Kheda	6	0	0	0	0	2	4	13	30	60	359	5	473
Mahesana	6	0	0	0	0	2	4	16	35	80	484	6	627
Narmada	1	0	0	0	0	1	2	4	9	29	173	1	219
Navsari	4	0	0	0	0	2	4	12	27	65	381	4	495
Panch Mahals	5	0	0	2	0	2	4	11	26	61	332	5	443
Patan	5	0	0	0	0	2	4	11	26	64	364	2	473
Porbandar	3	0	0	0	0	2	4	5	17	43	238	3	312

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
Rajkot	13	0	0	2	0	2	4	27	75	158	857	-7	1,118
Sabar Kantha	8	0	0	2	0	1	4	19	44	98	594	7	769
Surat	15	0	0	0	0	1	4	43	86	217	1,082	2	1,435
Surendranagar	7	0	0	0	0	2	4	14	34	75	465	3	597
Tapi	2	0	0	0	0	1	2	5	12	31	189	2	242
The Dangs	0	0	0	0	0	0	0	0	0	0	0	0	0
Vadodara	12	0	0	0	0	2	4	24	63	129	774	-10	986
Valsad	7	0	0	0	0	2	3	19	42	87	492	7	652
Total	**183**	**3**	**0**	**19**	**0**	**45**	**91**	**429**	**1034**	**2358**	**13715**	**71**	**17,765**

***Level 10**: Director General/Director/Joint Director/Deputy Director; **Level 9**: CFO/CO; **Level 8**: Deputy CFO; **Level 7**: Deputy Controller; **Level 6**: DO/DFO/Inspector/EO/Fire Supervisor; **Level 5**: ADO/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, Cleaner, Tindal.*

Table 22-20: Total firefighting manpower gap for 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
Ahmadabad	38	2	0	3	0	2	4	107	238	541	3,302	31	4,230
Amreli	7	0	0	2	0	1	2	7	29	62	335	6	444
Anand	9	0	0	0	0	2	4	19	44	94	589	7	759
Banas Kantha	5	0	0	0	0	2	4	16	33	85	521	5	666
Bharuch	5	0	0	0	0	2	3	11	32	78	511	3	640
Bhavnagar	10	0	0	2	0	2	3	15	45	91	586	8	752
Dohad	3	0	0	2	0	2	4	7	20	51	259	-1	344
Gandhinagar	6	1	0	2	0	2	4	18	38	92	577	2	736
Jamnagar	15	0	0	2	0	2	4	23	67	135	757	1	991
Junagadh	11	0	0	0	0	2	4	25	56	122	757	7	973

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
Kachchh	7	0	0	0	0	2	4	15	34	74	477	-1	605
Kheda	6	0	0	0	0	2	4	13	30	60	359	5	473
Mahesana	7	0	0	0	0	2	4	17	37	82	515	7	664
Narmada	1	0	0	0	0	1	2	4	9	29	173	1	219
Navsari	4	0	0	0	0	2	4	12	27	65	381	4	495
Panch Mahals	6	0	0	2	0	2	4	12	28	63	363	6	480
Patan	5	0	0	0	0	2	4	11	26	64	364	2	473
Porbandar	4	0	0	0	0	2	4	6	21	50	285	4	372
Rajkot	18	0	0	2	0	2	4	31	93	188	1,029	-2	1,347
Sabar Kantha	8	0	0	2	0	1	4	19	44	98	594	7	769
Surat	22	0	0	0	0	1	4	65	138	333	1,724	9	2,274
Surendranagar	7	0	0	0	0	2	4	14	34	75	465	3	597
Tapi	2	0	0	0	0	1	2	5	12	31	189	2	242
The Dangs	0	0	0	0	0	0	0	0	0	0	0	0	0
Vadodara	17	0	0	0	0	2	4	35	87	175	1,086	-5	1,384
Valsad	7	0	0	0	0	2	3	19	42	87	492	7	652
Total	**230**	**3**	**0**	**19**	**0**	**45**	**91**	**526**	**1,264**	**2,825**	**16,690**	**118**	**21,581**

***Level 10**: Director General/Director/Joint Director/Deputy Director; **Level 9**: CFO/CO; **Level 8**: Deputy CFO; **Level 7**: Deputy Controller; **Level 6**: DO/DFO/Inspector/EO/Fire Supervisor; **Level 5**: ADO/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 22-21: Additional firefighting manpower required for new rural 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
Ahmadabad	10	0	0	0	0	0	0	9	42	89	389	10	539
Amreli	7	0	0	0	0	0	0	16	39	90	453	7	605
Anand	4	0	0	0	0	0	0	10	24	55	273	4	366
Banas Kantha	12	0	0	0	0	0	0	21	65	152	757	12	1,007
Bharuch	5	0	0	0	0	0	0	9	24	53	268	5	359
Bhavnagar	6	0	0	0	0	0	0	12	33	72	372	6	495
Dohad	7	0	0	0	0	0	0	19	45	112	634	7	817
Gandhinagar	10	0	0	0	0	0	0	12	44	99	451	10	616
Jamnagar	4	0	0	0	0	0	0	4	16	36	161	4	221
Junagadh	8	0	0	0	0	0	0	11	35	79	414	8	547
Kachchh	6	0	0	0	0	0	0	12	37	83	415	6	553
Kheda	8	0	0	0	0	0	0	12	42	98	464	8	624
Mahesana	7	0	0	0	0	0	0	9	30	64	296	7	406
Narmada	3	0	0	0	0	0	0	4	12	24	124	3	167
Navsari	4	0	0	0	0	0	0	9	23	53	261	4	350
Panch Mahals	6	0	0	0	0	0	0	4	25	53	212	6	300
Patan	5	0	0	0	0	0	0	6	22	46	223	5	302
Porbandar	1	0	0	0	0	0	0	1	5	11	52	1	70
Rajkot	12	0	0	0	0	0	0	21	60	136	653	12	882
Sabar Kantha	7	0	0	0	0	0	0	12	36	79	379	7	513
Surat	10	0	0	0	0	0	0	25	60	141	747	10	983
Surendranagar	6	0	0	0	0	0	0	4	23	49	202	6	284
Tapi	3	0	0	0	0	0	0	5	16	35	164	3	223
The Dangs	2	0	0	0	0	2	4	5	13	35	197	2	258
Vadodara	8	0	0	0	0	0	0	20	48	109	560	8	745

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
Valsad	3	0	0	0	0	0	0	9	22	58	325	3	417
Total	**164**	**0**	**0**	**0**	**0**	**2**	**4**	**281**	**841**	**1,911**	**9,446**	**164**	**12,649**

***Level 10**: Director General/Director/Joint Director/Deputy Director; **Level 9**: CFO/CO; **Level 8**: Deputy CFO; **Level 7**: Deputy Controller; **Level 6**: DO/DFO/Inspector/EO/Fire Supervisor; **Level 5**: ADO/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.*

22.3.4 Fire Station Building Infrastructure Gap

Depending upon the number of pumping units, no of bays in a Fire Station has been estimated. However, in order to consider future growth in population, a minimum two bay Fire Station has been proposed, even at a Fire Station having requirement of one pumping unit. Accordingly, gaps in operational Fire Stations, new urban and rural Fire Stations have been given in Table 22-22.

Table 22-22: Fire Station building required for gap in operational, new urban and new rural Fire Stations (no. of bays)

District	Fire Stations	Bay1	Bay2	Bay3	Bay4	Bay5	Bay6	Bay7	Bay More Than 7
Ahmadabad	48	8	8	6	-1	3	2	3	6
Amreli	14	3	1	3	3	1	1	0	1
Anand	13	1	1	0	4	1	1	0	1
Banas Kantha	17	3	1	3	2	2	0	1	3
Bharuch	10	-1	3	2	-1	0	1	0	2
Bhavnagar	16	3	2	0	1	5	1	0	0
Dohad	10	2	2	0	0	1	1	0	2
Gandhinagar	16	2	4	4	1	0	1	0	1
Jamnagar	19	6	1	2	2	1	0	1	0
Junagadh	19	2	7	0	2	2	0	0	2
Kachchh	13	1	1	2	0	2	1	1	1
Kheda	14	1	2	5	1	1	1	2	0
Mahesana	14	3	3	0	3	0	1	1	0
Narmada	4	0	2	1	0	-1	0	0	1
Navsari	8	-1	0	2	0	0	2	0	1
Panch Mahals	12	4	1	1	2	1	0	0	1
Patan	10	1	3	1	1	1	0	0	1
Porbandar	5	0	-1	3	0	1	0	0	1
Rajkot	30	4	3	5	5	2	0	0	2
Sabar Kantha	15	1	3	1	1	2	2	1	1
Surat	32	0	1	0	0	3	7	4	3
Surendranagar	13	4	2	2	0	2	-1	0	1
Tapi	5	2	0	0	1	1	-1	0	1
The Dangs	2	1	0	0	0	0	0	0	1
Vadodara	25	0	2	3	3	4	3	0	2
Valsad	10	-1	-3	2	0	2	3	1	1
Total	**394**	**49**	**49**	**48**	**30**	**37**	**26**	**15**	**36**

22.4 Investment and Financial Analysis

22.4.1 Capital Cost

Building Infrastructure Cost:

Table 22-23 provides details of the Fire Station building infrastructure cost analysis in Gujarat State. The ideal requirement of land for a Fire Station is 2 ½ acres, however, a 2 bay Fire Station may be constructed in a one acre land. 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.

Table 22-23: Cost (in Lakhs Rupees) of Fire Station building (no. of bays) required for gap in operational, new urban and new rural Fire Stations

District	Fire Stations	Bay1	Bay2	Bay3	Bay4	Bay5	Bay6	Bay7	Bay More Than 7	Total Bay
Ahmadabad	48	1,200.00	2,400.00	2,700.00	-575.00	2,100.00	1,650.00	2,850.00	5,700.00	18,025.00
Amreli	14	450.00	300.00	1,350.00	1,725.00	700.00	825.00	0.00	950.00	6,300.00
Anand	13	150.00	300.00	0.00	2,300.00	700.00	825.00	0.00	950.00	5,225.00
Banas Kantha	17	450.00	300.00	1,350.00	1,150.00	1,400.00	0.00	950.00	2,850.00	8,450.00
Bharuch	10	-150.00	900.00	900.00	-575.00	0.00	825.00	0.00	1,900.00	3,800.00
Bhavnagar	16	450.00	600.00	0.00	575.00	3,500.00	825.00	0.00	0.00	5,950.00
Dohad	10	300.00	600.00	0.00	0.00	700.00	825.00	0.00	1,900.00	4,325.00
Gandhinagar	16	300.00	1,200.00	1,800.00	575.00	0.00	825.00	0.00	950.00	5,650.00
Jamnagar	19	900.00	300.00	900.00	1,150.00	700.00	0.00	950.00	0.00	4,900.00
Junagadh	19	300.00	2,100.00	0.00	1,150.00	1,400.00	0.00	0.00	1,900.00	6,850.00
Kachchh	13	150.00	300.00	900.00	0.00	1,400.00	825.00	950.00	950.00	5,475.00
Kheda	14	150.00	600.00	2,250.00	575.00	700.00	825.00	1,900.00	0.00	7,000.00
Mahesana	14	450.00	900.00	0.00	1,725.00	0.00	825.00	950.00	0.00	4,850.00
Narmada	4	0.00	600.00	450.00	0.00	-700.00	0.00	0.00	950.00	1,300.00

District	Fire Stations	Bay1	Bay2	Bay3	Bay4	Bay5	Bay6	Bay7	Bay More Than 7	Total Bay
Navsari	8	-150.00	0.00	900.00	0.00	0.00	1,650.00	0.00	950.00	3,350.00
Panch Mahals	12	600.00	300.00	450.00	1,150.00	700.00	0.00	0.00	950.00	4,150.00
Patan	10	150.00	900.00	450.00	575.00	700.00	0.00	0.00	950.00	3,725.00
Porbandar	5	0.00	-300.00	1,350.00	0.00	700.00	0.00	0.00	950.00	2,700.00
Rajkot	30	600.00	900.00	2,250.00	2,875.00	1,400.00	0.00	0.00	1,900.00	9,925.00
Sabar Kantha	15	150.00	900.00	450.00	575.00	1,400.00	1,650.00	950.00	950.00	7,025.00
Surat	32	0.00	300.00	0.00	0.00	2,100.00	5,775.00	3,800.00	2,850.00	14,825.00
Surendranagar	13	600.00	600.00	900.00	0.00	1,400.00	-825.00	0.00	950.00	3,625.00
Tapi	5	300.00	0.00	0.00	575.00	700.00	-825.00	0.00	950.00	1,700.00
The Dangs	2	150.00	0.00	0.00	0.00	0.00	0.00	0.00	950.00	1,100.00
Vadodara	25	0.00	600.00	1,350.00	1,725.00	2,800.00	2,475.00	0.00	1,900.00	10,850.00
Valsad	10	-150.00	-900.00	900.00	0.00	1,400.00	2,475.00	950.00	950.00	5,625.00
Total	**394**	**7,350.00**	**14,700.00**	**21,600.00**	**17,250.00**	**25,900.00**	**21,450.00**	**14,250.00**	**34,200.00**	**156,700.00**

Thus, total estimated capital cost for the Fire Stations building development for gap in operational and all the proposed and new urban and rural Fire Stations is **Rs. 1567 Crores** (Table 22-23).

Firefighting and Rescue Vehicles and Specialized Equipment Cost:

The costs of different fire fighting vehicles and specialized equipments including communication sets (static and mobile VHF sets) have been taken as approximate rates quoted by fire equipment suppliers. Accordingly, capital cost for fire fighting vehicles and equipments for all the districts in Gujarat State has been estimated (Tables 22-24 to 22-29).

Table 22-24: Cost estimates (in Lakhs Rupees) for gap in fire fighting vehicles for 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	QRT	Motor Cycle Mists	Education Vans	Total Vehicle cost
Ahmadabad	38	1,400.00	450.00	640.00	-3,500.00	500.00	385.00	180.00	30.00	126.00	121.50	60.00	392.50
Amreli	7	0.00	-90.00	80.00	500.00	0.00	35.00	60.00	30.00	27.00	20.25	20.00	682.25
Anand	9	105.00	0.00	240.00	0.00	500.00	35.00	60.00	30.00	27.00	20.25	20.00	1,037.25
Banas Kantha	5	105.00	150.00	40.00	500.00	0.00	35.00	60.00	30.00	27.00	20.25	20.00	987.25
Bharuch	5	0.00	-120.00	40.00	500.00	500.00	175.00	30.00	30.00	18.00	13.50	20.00	1,206.50
Bhavnagar	10	-70.00	-90.00	120.00	0.00	0.00	35.00	60.00	30.00	9.00	6.75	40.00	140.75
Dohad	3	0.00	0.00	40.00	500.00	0.00	35.00	30.00	30.00	27.00	20.25	20.00	702.25
Gandhinagar	6	245.00	30.00	120.00	500.00	500.00	35.00	60.00	30.00	27.00	20.25	20.00	1,587.25
Jamnagar	15	105.00	-150.00	240.00	-500.00	-500.00	140.00	60.00	30.00	45.00	33.75	20.00	-476.25
Junagadh	11	175.00	90.00	280.00	0.00	0.00	70.00	60.00	30.00	36.00	27.00	20.00	788.00
Kachchh	7	70.00	-90.00	160.00	500.00	0.00	140.00	60.00	30.00	18.00	13.50	20.00	921.50
Kheda	6	-35.00	-120.00	200.00	500.00	0.00	35.00	60.00	30.00	9.00	13.50	20.00	712.50
Mahesana	7	35.00	-60.00	200.00	500.00	0.00	35.00	60.00	30.00	18.00	13.50	20.00	851.50
Narmada	1	0.00	-30.00	0.00	500.00	0.00	35.00	30.00	30.00	9.00	6.75	20.00	600.75
Navsari	4	105.00	-30.00	120.00	500.00	0.00	35.00	30.00	30.00	18.00	13.50	20.00	841.50
Panch Mahals	6	35.00	-30.00	40.00	500.00	0.00	35.00	60.00	30.00	27.00	20.25	20.00	737.25
Patan	5	-35.00	30.00	40.00	500.00	0.00	35.00	30.00	30.00	27.00	20.25	20.00	697.25
Porbandar	4	0.00	-90.00	120.00	500.00	0.00	70.00	30.00	30.00	18.00	13.50	20.00	711.50
Rajkot	18	350.00	-210.00	400.00	-1,000.00	500.00	105.00	90.00	30.00	63.00	47.25	60.00	435.25

District	Fire Stations	Water Tenders	Water Bowsers	Foam Tenders	Advanced Rescue Responders	Sky Lifts / TTL	DCP Tenders	Hose Tenders	BA Vans	QRT	Motor Cycle Mists	Education Vans	Total Vehicle cost
Sabar Kantha	8	140.00	180.00	200.00	500.00	0.00	35.00	60.00	30.00	36.00	27.00	20.00	1,228.00
Surat	22	1,015.00	180.00	320.00	-2,000.00	0.00	105.00	120.00	0.00	144.00	108.00	60.00	52.00
Surendranagar	7	70.00	-90.00	160.00	500.00	0.00	105.00	60.00	30.00	18.00	13.50	20.00	886.50
Tapi	2	0.00	-90.00	40.00	500.00	0.00	35.00	30.00	30.00	9.00	6.75	20.00	580.75
The Dangs	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
Vadodara	17	175.00	-270.00	360.00	-1,000.00	0.00	175.00	90.00	30.00	45.00	33.75	40.00	-321.25
Valsad	7	35.00	-210.00	120.00	500.00	0.00	315.00	30.00	30.00	27.00	20.25	20.00	887.25
Total	**230**	**4,025.00**	**-660.00**	**4,320.00**	**500.00**	**2,000.00**	**2,275.00**	**1,500.00**	**720.00**	**855.00**	**675.00**	**660.00**	**16,870.00**

Table 22-25: Cost estimates (in Lakhs Rupees) for gap in fire vehicles for 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	QRT	Motor Cycle Mists	Ambulances	Education Vans	Total Vehicle cost
Ahmadabad	10	350.00	60.00	200.00	0.00	0.00	175.00	0.00	0.00	90.00	67.50	0.00	0.00	942.50
Amreli	7	420.00	240.00	280.00	0.00	0.00	35.00	0.00	0.00	63.00	47.25	0.00	0.00	1,085.25
Anand	4	245.00	150.00	160.00	0.00	0.00	35.00	0.00	0.00	36.00	27.00	0.00	0.00	653.00
Banas Kantha	12	805.00	480.00	160.00	0.00	0.00	0.00	0.00	0.00	108.00	81.00	0.00	0.00	1,634.00

District	Fire Stations	Water Tenders	Water Bowsers	Foam Tenders	Advanced Rescue Responders	Sky Lifts / TTL	DCP Tenders	Hose Tenders	BA Vans	QRT	Motor Cycle Mists	Ambulances	Education Vans	Total Vehicle cost
Bharuch	5	210.00	90.00	160.00	0.00	0.00	105.00	0.00	0.00	45.00	33.75	0.00	0.00	643.75
Bhavnagar	6	350.00	210.00	240.00	0.00	0.00	0.00	0.00	0.00	54.00	40.50	0.00	0.00	894.50
Dohad	7	630.00	390.00	80.00	0.00	0.00	0.00	0.00	0.00	63.00	47.30	0.00	0.00	1,210.30
Gandhinagar	10	385.00	120.00	280.00	0.00	0.00	140.00	0.00	0.00	90.00	67.50	0.00	0.00	1,082.50
Jamnagar	4	140.00	60.00	120.00	0.00	0.00	0.00	0.00	0.00	36.00	27.00	0.00	0.00	383.00
Junagadh	8	350.00	90.00	240.00	0.00	0.00	70.00	0.00	0.00	72.00	54.00	0.00	0.00	876.00
Kachchh	6	350.00	240.00	200.00	0.00	0.00	105.00	0.00	0.00	54.00	40.50	0.00	0.00	989.50
Kheda	8	525.00	270.00	120.00	0.00	0.00	35.00	0.00	0.00	72.00	54.00	0.00	0.00	1,076.00
Mahesana	7	315.00	60.00	200.00	0.00	0.00	35.00	0.00	0.00	63.00	47.30	0.00	0.00	720.30
Narmada	3	105.00	30.00	120.00	0.00	0.00	0.00	0.00	0.00	27.00	20.30	0.00	0.00	302.30
Navsari	4	210.00	150.00	160.00	0.00	0.00	35.00	0.00	0.00	36.00	27.00	0.00	0.00	618.00
Panch Mahals	6	280.00	90.00	40.00	0.00	0.00	0.00	0.00	0.00	54.00	40.50	0.00	0.00	504.50
Patan	5	210.00	90.00	160.00	0.00	0.00	0.00	0.00	0.00	45.00	33.80	0.00	0.00	538.80
Porbandar	1	35.00	30.00	40.00	0.00	0.00	0.00	0.00	0.00	9.00	6.80	0.00	0.00	120.80
Rajkot	12	455.00	150.00	400.00	0.00	0.00	385.00	0.00	0.00	108.00	81.00	0.00	0.00	1,579.00
Sabar Kantha	7	455.00	270.00	40.00	0.00	0.00	0.00	0.00	0.00	63.00	47.30	0.00	0.00	875.30
Surat	10	595.00	270.00	360.00	0.00	0.00	280.00	0.00	0.00	90.00	67.50	0.00	0.00	1,662.50
Surendranagar	6	210.00	60.00	120.00	0.00	0.00	0.00	0.00	0.00	54.00	40.50	0.00	0.00	484.50

District	Fire Stations	Water Tenders	Water Bowsers	Foam Tenders	Advanced Rescue Responders	Sky Lifts / TTL	DCP Tenders	Hose Tenders	BA Vans	QRT	Motor Cycle Mists	Ambulances	Education Vans	Total Vehicle cost
Tapi	3	175.00	90.00	80.00	0.00	0.00	0.00	0.00	0.00	27.00	20.30	0.00	0.00	392.30
The Dangs	2	70.00	30.00	40.00	500.00	0.00	35.00	30.00	30.00	18.00	13.50	0.00	20.00	786.50
Vadodara	8	560.00	390.00	160.00	0.00	0.00	70.00	0.00	0.00	72.00	54.00	0.00	0.00	1,306.00
Valsad	3	245.00	150.00	120.00	0.00	0.00	70.00	0.00	0.00	27.00	20.30	0.00	0.00	632.30
Total	**164**	**8,680.00**	**4,260.00**	**4,280.00**	**500.00**	**0.00**	**1,610.00**	**30.00**	**30.00**	**1,476.00**	**1,107.00**	**0.00**	**20.00**	**21,993.00**

Table 22-26: 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
Ahmadabad	38	15.00	495.00	258.80	69.00	19.70	230.00	-6.40	-3.50	10.80	510.00	66.00	149.50	340.00	0.00
Amreli	7	45.00	30.00	24.80	12.00	0.90	0.00	5.60	4.00	2.40	50.00	3.90	0.00	30.00	0.00
Anand	9	60.00	80.00	55.60	16.50	3.30	40.00	7.20	5.00	3.30	92.50	9.90	26.00	52.00	0.00
Banas Kantha	5	90.00	42.50	43.20	9.00	2.50	60.00	3.20	3.00	1.80	72.50	5.40	39.00	46.00	0.00
Bharuch	5	15.00	32.50	28.40	7.50	1.30	0.00	4.00	2.00	1.80	-12.50	5.40	6.50	36.00	0.00
Bhavnagar	10	150.00	87.50	52.40	16.50	3.00	50.00	7.20	5.00	3.60	87.50	11.10	32.50	54.00	0.00

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
Dohad	3	15.00	15.00	20.00	6.00	1.30	10.00	0.80	2.00	1.20	35.00	2.10	6.50	24.00	0.00
Gandhinagar	6	30.00	75.00	45.60	10.50	2.50	20.00	4.80	3.50	2.10	60.00	9.30	13.00	52.00	0.00
Jamnagar	15	15.00	65.00	74.40	25.50	4.20	70.00	8.00	7.50	5.40	132.50	9.00	52.00	74.00	2.00
Junagadh	11	45.00	82.50	77.20	19.50	4.60	70.00	6.40	5.50	3.90	120.00	10.20	45.50	84.00	0.00
Kachchh	7	105.00	42.50	38.40	12.00	2.30	70.00	5.60	4.00	2.40	65.00	6.30	45.50	38.00	0.00
Kheda	6	-30.00	47.50	36.40	10.50	1.40	20.00	3.20	2.50	2.10	60.00	6.00	13.00	30.00	0.00
Mahesana	7	45.00	80.00	50.00	12.00	2.40	40.00	6.40	4.00	2.40	82.50	9.90	26.00	32.00	0.00
Narmada	1	15.00	12.50	6.80	1.50	0.50	0.00	0.80	0.50	0.30	12.50	1.80	0.00	8.00	0.00
Navsari	4	45.00	35.00	33.60	7.50	1.80	20.00	3.20	2.50	1.50	60.00	4.80	13.00	38.00	0.00
Panch Mahals	6	30.00	32.50	31.20	10.50	1.50	10.00	3.20	3.50	2.10	52.50	4.20	6.50	36.00	1.00
Patan	5	75.00	27.50	31.60	9.00	2.00	60.00	3.20	3.00	1.80	55.00	3.60	39.00	24.00	0.00
Porbandar	4	15.00	20.00	19.20	7.50	1.30	0.00	2.40	2.00	1.50	35.00	3.30	0.00	22.00	0.00
Rajkot	18	-60.00	167.50	90.00	33.00	5.20	70.00	-9.60	3.00	6.60	145.00	22.20	52.00	114.00	2.00
Sabar Kantha	8	60.00	37.50	59.60	15.00	3.30	20.00	4.80	5.00	3.00	100.00	5.10	13.00	66.00	0.00
Surat	22	270.00	345.00	190.40	36.00	12.90	170.00	17.60	-6.00	7.80	225.00	44.40	110.50	214.00	1.00
Surendranagar	7	75.00	47.50	38.40	12.00	1.70	40.00	5.60	4.00	2.40	65.00	6.60	26.00	40.00	0.00
Tapi	2	0.00	15.00	8.80	3.00	0.60	0.00	1.60	1.00	0.60	17.50	2.10	0.00	10.00	0.00
The Dangs	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
Vadodara	17	195.00	115.00	78.00	27.00	3.90	60.00	0.80	-7.00	6.00	145.00	18.30	39.00	114.00	0.00
Valsad	7	-15.00	42.50	36.80	12.00	1.60	10.00	4.80	3.50	2.40	67.50	6.90	6.50	52.00	0.00
Total	**230**	**1,305.00**	**2,072.50**	**1,429.60**	**400.50**	**85.70**	**1,140.00**	**94.40**	**59.50**	**79.20**	**2,335.00**	**277.80**	**760.50**	**1,630.00**	**6.00**

Table 22-27: Cost estimate (in Lakhs Rupees) for gap in fire fighting specialized equipment for operational and new urban Fire Stations (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
Ahmadabad	38	0.00	8.00	65.10	33.00	100.00	67.20	0.00	6.48	28.39	26.28	13.80	2502.15
Amreli	7	0.00	0.00	16.80	7.00	0.00	4.00	0.00	2.16	3.91	3.12	2.40	247.99
Anand	9	0.00	4.00	23.10	9.00	20.00	14.80	-5.00	2.70	7.48	5.16	3.30	535.84
Banas Kantha	5	0.00	0.00	12.60	4.00	30.00	11.20	0.00	1.35	5.61	4.20	1.80	488.86
Bharuch	5	0.00	0.00	10.50	4.00	-5.00	10.80	-5.00	1.08	3.91	3.24	1.80	153.23
Bhavnagar	10	0.00	2.00	25.20	12.00	10.00	11.20	0.00	2.43	5.95	5.52	3.60	638.2
Dohad	3	0.00	0.00	8.40	1.00	5.00	6.40	0.00	1.08	3.40	2.40	1.20	167.78
Gandhinagar	6	0.00	0.00	14.70	7.00	0.00	10.80	0.00	1.89	6.46	4.92	2.10	376.17
Jamnagar	15	0.00	2.00	29.40	12.00	25.00	13.60	0.00	3.78	9.01	8.16	5.40	652.85
Junagadh	11	0.00	4.00	25.20	9.00	35.00	14.80	0.00	3.51	10.20	7.20	3.90	687.11
Kachchh	7	0.00	0.00	16.80	7.00	35.00	12.00	0.00	2.16	6.12	4.32	2.40	522.8
Kheda	6	0.00	0.00	14.70	6.00	10.00	7.60	-10.00	1.35	5.10	3.24	2.10	242.69
Mahesana	7	0.00	0.00	16.80	8.00	20.00	8.80	0.00	2.16	6.63	4.68	2.40	462.07
Narmada	1	0.00	0.00	2.10	1.00	0.00	2.40	0.00	0.27	1.87	1.32	0.30	69.46
Navsari	4	0.00	0.00	10.50	4.00	10.00	9.60	0.00	1.08	4.42	3.36	1.50	310.36
Panch Mahals	6	0.00	4.00	14.70	5.00	5.00	8.80	0.00	1.89	4.76	3.12	2.10	274.07
Patan	5	0.00	0.00	12.60	4.00	30.00	7.60	0.00	1.62	4.76	3.36	1.80	400.44
Porbandar	4	0.00	0.00	10.50	3.00	0.00	5.60	0.00	1.35	3.57	2.64	1.50	157.36
Rajkot	18	0.00	60.00	44.10	15.00	-70.00	19.60	45.00	5.13	13.09	11.88	6.60	791.3
Sabar Kantha	8	0.00	4.00	21.00	6.00	10.00	14.80	0.00	2.70	6.97	5.40	3.00	466.17

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
Surat	22	176.00	64.00	54.60	22.00	-5.00	55.20	-60.00	3.78	16.15	17.40	7.80	1990.53
Surendranagar	7	0.00	0.00	16.80	7.00	20.00	7.60	0.00	2.16	5.95	4.32	2.40	430.43
Tapi	2	0.00	0.00	4.20	2.00	0.00	2.80	0.00	0.27	1.36	1.44	0.60	72.87
The Dangs	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
Vadodara	17	0.00	70.00	35.70	16.00	25.00	-8.00	80.00	3.51	10.20	9.96	6.00	1043.37
Valsad	7	0.00	0.00	16.80	6.00	5.00	14.40	0.00	1.89	6.29	5.16	2.40	289.44
Total	**230**	**176.00**	**222.00**	**522.90**	**210.00**	**315.00**	**333.60**	**45.00**	**57.78**	**181.56**	**151.80**	**82.20**	**13973.54**

Table 22-28: 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
Ahmadabad	10	0.00	0.00	42.40	18.00	3.20	10.00	0.00	6.00	3.60	80.00	0.00	6.50	56.00	0.00
Amreli	7	0.00	0.00	58.40	12.00	4.10	0.00	0.00	4.00	2.40	102.50	0.00	0.00	68.00	0.00
Anand	4	0.00	0.00	34.40	7.50	2.40	0.00	0.00	2.50	1.50	60.00	0.00	0.00	40.00	0.00
Banas Kantha	12	0.00	0.00	94.00	21.00	6.60	110.00	0.00	7.00	4.20	165.00	0.00	71.50	110.00	0.00

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
Bharuch	5	0.00	0.00	29.60	9.00	2.20	0.00	0.00	3.00	1.80	55.00	0.00	0.00	36.00	0.00
Bhavnagar	6	0.00	0.00	50.00	10.50	3.50	0.00	0.00	3.50	2.10	87.50	0.00	0.00	58.00	0.00
Dohad	7	0.00	0.00	70.00	12.00	4.80	0.00	0.00	4.00	2.40	120.00	0.00	0.00	80.00	0.00
Gandhinagar	10	0.00	0.00	52.00	18.00	3.80	0.00	0.00	6.00	3.60	95.00	0.00	0.00	64.00	0.00
Jamnagar	4	0.00	0.00	21.20	7.50	1.60	50.00	0.00	2.50	1.50	40.00	0.00	32.50	26.00	0.00
Junagadh	8	0.00	0.00	44.00	15.00	3.20	0.00	0.00	5.00	3.00	80.00	0.00	0.00	54.00	0.00
Kachchh	6	0.00	0.00	50.00	10.50	3.50	70.00	0.00	3.50	2.10	87.50	0.00	45.50	58.00	0.00
Kheda	8	0.00	0.00	59.60	15.00	4.20	0.00	0.00	5.00	3.00	105.00	0.00	0.00	70.00	0.00
Mahesana	7	0.00	0.00	37.60	12.00	2.80	20.00	0.00	4.00	2.40	70.00	0.00	13.00	46.00	0.00
Narmada	3	0.00	0.00	16.40	6.00	1.20	0.00	0.00	2.00	1.20	30.00	0.00	0.00	20.00	0.00
Navsari	4	0.00	0.00	32.80	7.50	2.30	0.00	0.00	2.50	1.50	57.50	0.00	0.00	38.00	0.00
Panch Mahals	6	0.00	0.00	28.80	10.50	2.20	0.00	0.00	3.50	2.10	55.00	0.00	0.00	36.00	0.00
Patan	5	0.00	0.00	29.60	9.00	2.20	60.00	0.00	3.00	1.80	55.00	0.00	39.00	36.00	0.00
Porbandar	1	0.00	0.00	6.80	1.50	0.50	0.00	0.00	0.50	0.30	12.50	0.00	0.00	8.00	0.00
Rajkot	12	0.00	0.00	65.20	21.00	4.80	40.00	0.00	7.00	4.20	120.00	0.00	26.00	80.00	0.00
Sabar Kantha	7	0.00	0.00	50.80	12.00	3.60	0.00	0.00	4.00	2.40	90.00	0.00	0.00	60.00	0.00
Surat	10	0.00	0.00	76.80	18.00	5.40	0.00	0.00	6.00	3.60	135.00	0.00	0.00	90.00	0.00
Surendranagar	6	0.00	0.00	26.80	10.50	2.00	20.00	0.00	3.50	2.10	50.00	0.00	13.00	34.00	0.00

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
Tapi	3	0.00	0.00	22.00	6.00	1.60	0.00	0.00	2.00	1.20	40.00	0.00	0.00	26.00	0.00
The Dangs	2	0.00	0.00	9.60	3.00	0.70	0.00	0.00	1.00	0.60	17.50	0.00	0.00	12.00	0.00
Vadodara	8	0.00	0.00	71.20	15.00	4.90	0.00	0.00	5.00	3.00	122.50	0.00	0.00	82.00	0.00
Valsad	3	0.00	0.00	31.60	6.00	2.20	0.00	0.00	2.00	1.20	55.00	0.00	0.00	36.00	0.00
Total	**164**	**0.00**	**0.00**	**1,111.60**	**294.00**	**79.50**	**380.00**	**0.00**	**98.00**	**58.80**	**1,987.50**	**0.00**	**247.00**	**1,324.00**	**0.00**

Table 22-29: Cost estimate (in Lakhs Rupees) for gap in specialized fire equipment for new rural Fire Stations (continued…)

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
Ahmadabad	10	0.00	0.00	25.20	0.00	5.00	15.20	0.00	3.24	6.46	4.56	3.60	288.96
Amreli	7	0.00	0.00	16.80	0.00	0.00	16.80	0.00	2.16	7.14	5.04	2.40	301.74
Anand	4	0.00	0.00	10.50	0.00	0.00	9.60	0.00	1.35	4.08	2.88	1.50	178.21
Banas Kantha	12	0.00	0.00	29.40	0.00	55.00	26.40	0.00	3.78	11.22	7.92	4.20	727.22
Bharuch	5	0.00	0.00	12.60	0.00	0.00	10.00	0.00	1.62	4.25	3.00	1.80	169.87

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
Bhavnagar	6	0.00	0.00	14.70	0.00	0.00	14.00	0.00	1.89	5.95	4.20	2.10	257.94
Dohad	7	0.00	0.00	16.80	0.00	0.00	19.20	0.00	2.16	8.16	5.76	2.40	347.68
Gandhinagar	10	0.00	0.00	25.20	0.00	0.00	17.20	0.00	3.24	7.31	5.16	3.60	304.11
Jamnagar	4	0.00	0.00	10.50	0.00	25.00	6.40	0.00	1.35	2.72	1.92	1.50	232.19
Junagadh	8	0.00	0.00	21.00	0.00	0.00	14.00	0.00	2.70	5.95	4.20	3.00	255.05
Kachchh	6	0.00	0.00	14.70	0.00	35.00	15.20	0.00	1.89	6.46	4.56	2.10	410.51
Kheda	8	0.00	0.00	21.00	0.00	0.00	17.20	0.00	2.70	7.31	5.16	3.00	318.17
Mahesana	7	0.00	0.00	16.80	0.00	10.00	11.60	0.00	2.16	4.93	3.48	2.40	259.17
Narmada	3	0.00	0.00	8.40	0.00	0.00	4.80	0.00	1.08	2.04	1.44	1.20	95.76
Navsari	4	0.00	0.00	10.50	0.00	0.00	9.60	0.00	1.35	4.08	2.88	1.50	172.01
Panch Mahals	6	0.00	0.00	14.70	0.00	0.00	8.80	0.00	1.89	3.74	2.64	2.10	171.97
Patan	5	0.00	0.00	12.60	0.00	30.00	8.80	0.00	1.62	3.74	2.64	1.80	296.8
Porbandar	1	0.00	0.00	2.10	0.00	0.00	2.00	0.00	0.27	0.85	0.60	0.30	36.22
Rajkot	12	0.00	0.00	29.40	0.00	20.00	24.40	0.00	3.78	10.37	7.32	4.20	467.67
Sabar Kantha	7	0.00	0.00	16.80	0.00	0.00	14.40	0.00	2.16	6.12	4.32	2.40	269
Surat	10	0.00	0.00	25.20	0.00	0.00	25.60	0.00	3.24	10.88	7.68	3.60	411
Surendranagar	6	0.00	0.00	14.70	0.00	10.00	8.00	0.00	1.89	3.40	2.40	2.10	204.39
Tapi	3	0.00	0.00	8.40	0.00	0.00	6.40	0.00	1.08	2.72	1.92	1.20	120.52
The Dangs	2	0.00	0.00	4.20	0.00	0.00	3.20	0.00	0.54	2.21	1.56	0.60	56.71
Vadodara	8	0.00	0.00	21.00	0.00	0.00	20.80	0.00	2.70	8.84	6.24	3.00	366.18
Valsad	3	0.00	0.00	8.40	0.00	0.00	9.60	0.00	1.08	4.08	2.88	1.20	161.24
Total	**164**	**0.00**	**0.00**	**411.60**	**0.00**	**190.00**	**339.20**	**0.00**	**52.92**	**145.01**	**102.36**	**58.80**	**6880.29**

22.4.2 Recurring Cost

Manpower Cost

The manpower cost estimation per year has been carried out by considering pay-scale structure for different level of employees. Accordingly, cost estimates for manpower requirement at various levels by district is shown in Table 22-30 and Table 22-31. The total estimated annual manpower cost for existing and proposed staff will be **Rs. 726.33 Crores** (Table 22-30) after filling gap in operational and new urban Fire Stations and **Rs. 421.39 Crores only** (Table 22-31) for new rural Fire Stations.

Table 22-30: Annual cost estimates (in Lakhs Rupees) for manpower for Gujarat 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
Ahmadabad	38	29.52	0.00	25.83	0.00	12.80	22.88	540.35	1,023.40	1,790.71	10,698.48	26.04	14,170.01
Amreli	7	0.00	0.00	17.22	0.00	6.40	11.44	35.35	124.70	205.22	1,085.40	5.04	1,490.77
Anand	9	0.00	0.00	0.00	0.00	12.80	22.88	95.95	189.20	311.14	1,908.36	5.88	2,546.21
Banas Kantha	5	0.00	0.00	0.00	0.00	12.80	22.88	80.80	141.90	281.35	1,688.04	4.20	2,231.97
Bharuch	5	0.00	0.00	0.00	0.00	12.80	17.16	55.55	137.60	258.18	1,655.64	2.52	2,139.45
Bhavnagar	10	0.00	0.00	17.22	0.00	12.80	17.16	75.75	193.50	301.21	1,898.64	6.72	2,523.00
Dohad	3	0.00	0.00	17.22	0.00	12.80	22.88	35.35	86.00	168.81	839.16	-0.84	1,181.38
Gandhinagar	6	14.76	0.00	17.22	0.00	12.80	22.88	90.90	163.40	304.52	1,869.48	1.68	2,497.64
Jamnagar	15	0.00	0.00	17.22	0.00	12.80	22.88	116.15	288.10	446.85	2,452.68	0.84	3,357.52
Junagadh	11	0.00	0.00	0.00	0.00	12.80	22.88	126.25	240.80	403.82	2,452.68	5.88	3,265.11
Kachchh	7	0.00	0.00	0.00	0.00	12.80	22.88	75.75	146.20	244.94	1,545.48	-0.84	2,047.21
Kheda	6	0.00	0.00	0.00	0.00	12.80	22.88	65.65	129.00	198.60	1,163.16	4.20	1,596.29
Mahesana	7	0.00	0.00	0.00	0.00	12.80	22.88	85.85	159.10	271.42	1,668.60	5.88	2,226.53
Narmada	1	0.00	0.00	0.00	0.00	6.40	11.44	20.20	38.70	95.99	560.52	0.84	734.09
Navsari	4	0.00	0.00	0.00	0.00	12.80	22.88	60.60	116.10	215.15	1,234.44	3.36	1,665.33
Panch Mahals	6	0.00	0.00	17.22	0.00	12.80	22.88	60.60	120.40	208.53	1,176.12	5.04	1,623.59
Patan	5	0.00	0.00	0.00	0.00	12.80	22.88	55.55	111.80	211.84	1,179.36	1.68	1,595.91

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
Porbandar	4	0.00	0.00	0.00	0.00	12.80	22.88	30.30	90.30	165.50	923.40	3.36	1,248.54
Rajkot	18	0.00	0.00	17.22	0.00	12.80	22.88	156.55	399.90	622.28	3,333.96	-1.68	4,563.91
Sabar Kantha	8	0.00	0.00	17.22	0.00	6.40	22.88	95.95	189.20	324.38	1,924.56	5.88	2,586.47
Surat	22	0.00	0.00	0.00	0.00	6.40	22.88	328.25	593.40	1,102.23	5,585.76	7.56	7,646.48
Surendranagar	7	0.00	0.00	0.00	0.00	12.80	22.88	70.70	146.20	248.25	1,506.60	2.52	2,009.95
Tapi	2	0.00	0.00	0.00	0.00	6.40	11.44	25.25	51.60	102.61	612.36	1.68	811.34
The Dangs	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
Vadodara	17	0.00	0.00	0.00	0.00	12.80	22.88	176.75	374.10	579.25	3,518.64	-4.20	4,680.22
Valsad	7	0.00	0.00	0.00	0.00	12.80	17.16	95.95	180.60	287.97	1,594.08	5.88	2,194.44
Total	**230**	**44.28**	**0.00**	**163.59**	**0.00**	**288.00**	**520.52**	**2,656.30**	**5,435.20**	**9,350.75**	**54,075.60**	**99.12**	**72,633.36**

Table 22-31: Cost estimate (in Lakhs Rupees) manpower in Gujarat for new rural 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
Ahmadabad	10	0.00	0.00	0.00	0.00	0.00	0.00	45.45	180.60	294.59	1,260.36	8.40	1,789.40
Amreli	7	0.00	0.00	0.00	0.00	0.00	0.00	80.80	167.70	297.90	1,467.72	5.88	2,020.00
Anand	4	0.00	0.00	0.00	0.00	0.00	0.00	50.50	103.20	182.05	884.52	3.36	1,223.63
Banas Kantha	12	0.00	0.00	0.00	0.00	0.00	0.00	106.05	279.50	503.12	2,452.68	10.08	3,351.43
Bharuch	5	0.00	0.00	0.00	0.00	0.00	0.00	45.45	103.20	175.43	868.32	4.20	1,196.60
Bhavnagar	6	0.00	0.00	0.00	0.00	0.00	0.00	60.60	141.90	238.32	1,205.28	5.04	1,651.14
Dohad	7	0.00	0.00	0.00	0.00	0.00	0.00	95.95	193.50	370.72	2,054.16	5.88	2,720.21
Gandhinagar	10	0.00	0.00	0.00	0.00	0.00	0.00	60.60	189.20	327.69	1,461.24	8.40	2,047.13
Jamnagar	4	0.00	0.00	0.00	0.00	0.00	0.00	20.20	68.80	119.16	521.64	3.36	733.16
Junagadh	8	0.00	0.00	0.00	0.00	0.00	0.00	55.55	150.50	261.49	1,341.36	6.72	1,815.62
Kachchh	6	0.00	0.00	0.00	0.00	0.00	0.00	60.60	159.10	274.73	1,344.60	5.04	1,844.07
Kheda	8	0.00	0.00	0.00	0.00	0.00	0.00	60.60	180.60	324.38	1,503.36	6.72	2,075.66

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
Mahesana	7	0.00	0.00	0.00	0.00	0.00	0.00	45.45	129.00	211.84	959.04	5.88	1,351.21
Narmada	3	0.00	0.00	0.00	0.00	0.00	0.00	20.20	51.60	79.44	401.76	2.52	555.52
Navsari	4	0.00	0.00	0.00	0.00	0.00	0.00	45.45	98.90	175.43	845.64	3.36	1,168.78
Panch Mahals	6	0.00	0.00	0.00	0.00	0.00	0.00	20.20	107.50	175.43	686.88	5.04	995.05
Patan	5	0.00	0.00	0.00	0.00	0.00	0.00	30.30	94.60	152.26	722.52	4.20	1,003.88
Porbandar	1	0.00	0.00	0.00	0.00	0.00	0.00	5.05	21.50	36.41	168.48	0.84	232.28
Rajkot	12	0.00	0.00	0.00	0.00	0.00	0.00	106.05	258.00	450.16	2,115.72	10.08	2,940.01
Sabar Kantha	7	0.00	0.00	0.00	0.00	0.00	0.00	60.60	154.80	261.49	1,227.96	5.88	1,710.73
Surat	10	0.00	0.00	0.00	0.00	0.00	0.00	126.25	258.00	466.71	2,420.28	8.40	3,279.64
Surendranagar	6	0.00	0.00	0.00	0.00	0.00	0.00	20.20	98.90	162.19	654.48	5.04	940.81
Tapi	3	0.00	0.00	0.00	0.00	0.00	0.00	25.25	68.80	115.85	531.36	2.52	743.78
The Dangs	2	0.00	0.00	0.00	0.00	12.80	22.88	25.25	55.90	115.85	638.28	1.68	872.64
Vadodara	8	0.00	0.00	0.00	0.00	0.00	0.00	101.00	206.40	360.79	1,814.40	6.72	2,489.31
Valsad	3	0.00	0.00	0.00	0.00	0.00	0.00	45.45	94.60	191.98	1,053.00	2.52	1,387.55
Total	**164**	**0.00**	**0.00**	**0.00**	**0.00**	**12.80**	**22.88**	**1,419.05**	**3,616.30**	**6,325.41**	**30,605.04**	**137.76**	**42,139.24**

***Level 10**: Director General/Director/Joint Director/Deputy Director; **Level 9**: CFO/CO; **Level 8**: Deputy CFO; **Level 7**: Deputy Controller; **Level 6**: DO/DFO/Inspector/EO/Fire Supervisor; **Level 5**: ADO/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, Cleaner, Tindal.*

Annual Vehicle Maintenance & Repairs, and PDL Cost

For Gap analysis, vehicle maintenance, repairs and Petrol, Diesel & Lubricant (PDL) costs have been estimated based on average current expenditure to total vehicles cost (Table 22-32). The total estimated cost on vehicle maintenance & repairs, and PDL will be **Rs. 26.57 Crores** per year for filling the gap in operational and urban areas in Gujarat State. The annual specialized equipment, building maintenance, office expanses, and training expanses will be **Rs. 14.34 Crores, Rs. 28.24 Crores, Rs. 48.69 Crores** and **Rs. 8.5 Crores**, respectively.

Table 22-32: Annual recurring cost estimates (in Lakhs Rupees) for petrol, diesel, and lubricants 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
Ahmadabad	38	304.04	228.03	268.67	487.50	948.80	165.66
Amreli	7	26.81	20.11	24.98	55.00	96.27	16.81
Anand	9	65.69	49.27	52.37	96.00	164.92	28.80
Banas Kantha	5	33.77	25.33	39.41	72.50	141.85	24.77
Bharuch	5	46.96	35.22	26.38	72.00	141.34	24.68
Bhavnagar	10	53.54	40.15	57.77	93.50	169.54	29.60
Dohad	3	24.17	18.13	14.63	33.50	80.00	13.97
Gandhinagar	6	60.41	45.31	39.14	85.50	163.24	28.50
Jamnagar	15	78.69	59.02	74.25	134.50	226.22	39.50
Junagadh	11	51.07	38.30	63.36	132.50	208.89	36.47
Kachchh	7	35.44	26.58	42.38	87.00	131.03	22.88
Kheda	6	35.08	26.31	31.85	73.00	105.75	18.46
Mahesana	7	38.44	28.83	42.76	84.00	141.90	24.78
Narmada	1	18.02	13.51	5.56	19.00	47.18	8.24
Navsari	4	30.28	22.71	26.22	61.00	109.32	19.09
Panch Mahals	6	29.81	22.36	24.70	57.00	107.44	18.76
Patan	5	28.25	21.19	34.34	57.00	102.13	17.83
Porbandar	4	25.00	18.75	13.90	51.00	80.00	13.97
Rajkot	18	109.69	82.26	110.18	207.50	329.06	57.46
Sabar Kantha	8	40.87	30.65	42.99	92.50	165.70	28.93
Surat	22	188.33	141.25	207.19	352.50	555.19	96.94
Surendranagar	7	35.20	26.40	37.39	74.00	127.45	22.25
Tapi	2	19.10	14.32	7.12	22.00	51.73	9.03
The Dangs	0	0.00	0.00	0.00	0.00	0.00	0.00
Vadodara	17	98.49	73.87	109.70	221.00	331.64	57.91
Valsad	7	41.33	31.00	37.08	103.00	143.11	24.99
Total	**230**	**1,518.48**	**1,138.86**	**1,434.31**	**2,824.00**	**4,869.68**	**850.26**

Table 22-33: State level summary of Capital Expenditure required for filling the gap (in Crores Rupees)

Capital Expenditure				
Operational Type	Fire Station Building Infrastructure	Vehicle Cost	Equipment Cost	Total Capital Cost
Operational Fire Stations	616.25	464.00	39.55	1,119.80
Gap in Operational Fire Stations	534.00	98.20	103.92	736.12
New Urban Fire Stations	261.75	70.50	35.82	368.07
Total Gap in New Urban and Operational Fire Stations	795.75	168.70	139.74	1,104.19
New Rural Fire Stations	771.25	219.93	68.80	1,059.98
Total Gap in New Urban ,New Rural and Operational Fire Stations	1,567.00	388.63	208.54	2,164.17

Table 22-34: 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	46.63	11.14	3.16	8.35	12.33	2.94	0.51	85.06
Gap in Operational Fire Stations	599.30	2.36	8.31	1.77	10.68	37.76	6.59	666.77
New Urban Fire Stations	127.03	1.69	2.87	1.27	5.24	8.00	1.40	147.49
Total Gap in New Urban and Operational Fire Stations	726.33	4.05	11.18	3.04	15.92	45.76	7.99	814.26
New Rural Fire Stations	421.39	5.28	5.50	3.96	15.43	26.55	4.64	482.74
Total Gap in New Urban ,New Rural and Operational Fire Stations	1,147.73	9.33	16.68	7.00	31.34	72.31	12.62	1,297.00

22.5 Detailed Financial Investment Plan

All the above detailed capital and recurring expenses have been taken into consideration, while finalizing the detailed Investment Plan for next 10 years for Gujarat State (Table 22-35 and Table 22-36).

Table 22-35: State level 10 year investment plan for Gujarat Fire Services for filling gap in operational and new urban Fire Stations (in Crores Rupees)

	Capital Expenditure		Recurring Expenditure					
Year	Building Infrastructure	Vehicle and Equipment	Annual Vehicle Maintenance & PDL AMC	Annual Staff Salary	Annual Office Expenses	Annual Training Office Expenses	Annual Bldg. maintenance	Total
First Year	159.15	101.06	28.87	346.28	21.82	3.81	17.67	678.65
Second Year	176.66	106.11	37.90	723.45	45.58	7.46	23.24	1,120.39
Third Year	98.04	23.44	42.29	842.13	53.05	8.14	24.54	1,091.64
Fourth Year	108.83	24.61	47.14	978.88	61.67	8.87	25.86	1,255.86
Fifth Year	120.80	12.92	51.70	1,116.33	70.33	9.49	26.66	1,408.24
Sixth Year	134.09	13.57	56.70	1,272.68	80.18	10.14	27.48	1,594.83
Seventh Year	148.84	14.25	62.16	1,450.47	91.38	10.83	28.31	1,806.24
Eighth Year	165.21	14.96	68.13	1,652.61	104.11	11.57	29.15	2,045.75
Ninth Year	0.00	15.71	74.65	1,882.38	118.59	12.36	30.01	2,133.70
Tenth Year	0.00	16.49	81.79	2,143.49	135.04	13.19	30.89	2,420.89
Total	**1,111.62**	**343.13**	**551.32**	**12,408.71**	**781.75**	**95.86**	**263.80**	**15,556.19**

Table 22-36: State level 10 year investment plan for Gujarat Fire Services for filling gap in operational, new urban and new rural Fire Stations (in Crores Rupees)

	Capital Expenditure		Recurring Expenditure					
Year	Building Infrastructure	Vehicle and Equipment	Annual Vehicle Maintenance & PDL AMC	Annual Staff Salary	Annual Office Expenses	Annual Training Office Expenses	Annual Bldg. maintenance	Total
First Year	313.40	101.06	28.87	346.28	21.82	3.81	17.67	832.90
Second Year	347.87	106.11	37.90	723.45	45.58	7.46	23.24	1,291.60
Third Year	193.07	87.11	45.73	947.85	59.71	9.16	27.68	1,370.32
Forth Year	214.30	91.46	54.57	1,215.69	76.59	11.02	32.22	1,695.85
Fifth Year	237.89	48.02	61.73	1,447.87	91.22	12.30	34.69	1,933.71
Sixth Year	264.06	50.42	69.69	1,718.26	108.25	13.69	37.21	2,261.57
Seventh Year	293.09	52.94	78.53	2,032.70	128.06	15.18	39.77	2,640.27
Eighth Year	325.34	55.59	88.34	2,397.86	151.07	16.79	42.39	3,077.36
Ninth Year	0.00	58.37	99.21	2,821.39	177.75	18.52	45.05	3,220.29
Tenth Year	0.00	61.28	111.26	3,312.04	208.66	20.38	47.76	3,761.38
Total	**2,189.02**	**712.36**	**675.83**	**16,963.39**	**1,068.69**	**128.32**	**347.66**	**22,085.26**

22.6 Prioritization of new Fire Stations/Fire Posts

For prioritization of new Fire Stations/Fire Posts, the RMSI team has strictly followed risk categorization and estimated population density in the jurisdiction of new Fire Station/fire post as criteria. Accordingly, the priority for establishing new urban Fire Stations and rural Fire Stations/posts has been given in Table 22-38 and Table 22-39, respectively.

However, 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. Hence, Gujarat FES may change the priority of a new Fire Station depending upon the local situation and requirements.

22.7 Avenues of Fund Generation

Gujarat State can generate new avenues for funds from the followings:

- Introduction of Fire Tax (1% of existing property tax)
- Introduction of Fire Cess, which can be collected for auditing and inspecting various occupancies for adoption of Fire Safety Measures besides training public manpower for use of first aid firefighting equipment
- Training programs at different levels and duration to private sector employee on chargeable basis

- Capitation fees can be charged for scrutiny of building plans
- Clearance of building plans from fire safety point of view
- Sale of condemned fire appliances, equipment, uniform articles and general store items
- Fee on deployment of members of Fire Service along-with necessary equipment and appliances beyond the jurisdiction of the State Fire Services
- Standby charges on deployment of members of Fire Service along-with equipment and appliances in the area for stand by for a specific duration can be charged except the visits of Government authorities, or in public interest, if demanded by the district administration
- Training Charges from the external trainees sponsored by private industries for short and long duration courses.

22.8 Capacity Building and Training Facilities

The Municipal Corporations has framed Recruitment Rules (RR), which are being used for the recruitment. However, there is a need to have uniform RRs for each level at the State level.

Presently, Gujarat Fire & Emergency Services has one Fire and Emergency Training Centre, at Kotarpur Waterworks, Ahmedabad that is being used for the training of firefighters in the State.

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. 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 Gujarat Fire & Emergency Services, the gap in training has been estimated for various levels of fire personnel. The Fire Station survey and gap analysis reveal that there are some gaps in training need for existing staff. The previous section (section 22.3.3) details about gap in firefighting manpower in operational Fire Stations and need of additional fire personnel for new urban and new rural Fire Stations. As per the guidelines of SFAC, immediately after recruitment, fire personnel should undertake professional trainings. Moreover, there should be refresher-training courses at an interval of 3 to 5 years for every fire personnel. The following sections detail about the estimation of training need at different levels (fireman, leading fireman, station officer, sub-officer etc.).

22.8.1 Basic Training for Fireman

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 equipments.

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 22-37. Additional requirement of Refresher Training Course for fireman after every 3-5 years of service is also shown the Table 22-37. Some of the special training for handling specialized equipment such as Breathing Apparatus, Global-positioning System etc should also be part of the Refresher course. As a whole, GF&ES would require to train 26,492 fire personnel in basic and 14,254 fire personnel in refresher training in next 10 years. Therefore, State training centre should have adequate capacity and infrastructure for meeting such training requirement.

22.8.2 TRAINING COURSE FOR LEADING FIREMAN

While promotion from fireman to leading fireman category, fire personnel should undertake training course designed for leading fireman. This training will provide both theoretical and practical training required for effective deployment of fire vehicles and fire equipment as well.

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 22-37. In total, GF&ES would need to train at least 4,763 leading fireman in next 10 years.

22.8.3 OTHER SPECIALIZED TRAINING COURSES

Besides regular 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, the 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. Some of the other specialized trainings courses are mentioned below:

- 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 for above courses are already provided in SFAC guidelines. Number of leading fireman need to attend specialized course is also shown in Table 22-37. In total, Gujarat State would need to train at least 2,852 fire personnel for specialized courses in next 10 years.

Table 22-37: Estimated training requirements for fire personnel in Gujarat Fire Services

Basic Training for Fireman		
	Number of Fire Personnel in Operational Fire Stations	14,071
	Number of Fire Personnel in New Urban Fire Stations	2,975
	Number of Fire Personnel in New Rural Fire Stations	9,446
	Total Number of Fire Personnel for Training	**26,492**
Refresher Training for Fireman		
	Total Number of Fire Personnel	**14,254**
Leading Fireman Training Course		
	Number of Fire Personnel in Operational Fire Stations	2,385
	Number of Fire Personnel in New Urban Fire Stations	467
	Number of Fire Personnel in New Rural Fire Stations	1,911
	Total Number of Fire Personnel for Training	**4,763**
Other specialized Training Course		
	Total Number of Fire Personnel for Training	**2,852**
Junior Officer Training Course		
	Number of Fire Personnel in Operational Fire Stations	1,479
	Number of Fire Personnel in New Urban Fire Stations	327
	Number of Fire Personnel in New Rural Fire Stations	1,122
	Total Number of Fire Personnel for Training	**2,928**
Divisional Officer Training Course		
	Number of Fire Personnel in Operational Fire Stations	160
	Number of Fire Personnel in New Fire Stations	6
	Total Number of Fire Personnel for Training	**166**
Fire Prevention Course		
	Total Number of Fire Personnel for Training	**177**

22.8.4 JUNIOR OFFICER TRAINING COURSE

While promotion from leading fireman 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 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 is shown in Table 22.37. After filling gap in operational Fire Stations, new urban and rural Fire Stations, GF&ES would require to train 2,928 junior officers in next 10 years.

22.8.5 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 22-38. About 166 fire officers in GF&ES would require this training in next 10 years.

22.8.6 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, colleges, residential areas, cinema halls, shopping malls, hospitals, NCC camps, industries, Govt.& private offices etc. Currently, numbers of awareness programs conducted so far by GF&ES are not up to the satisfactory level and there is a 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 produced by MHA, live- demonstrations of how to use “portable extinguishers” and how to handle small kitchen fires.

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 produced by MHA, live- demonstrations of how to use “portable extinguishers” and how to handle small kitchen fires.

22.9 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 is trying to get information about the fire-fighting infrastructure for these, and will include whatever information will be available, 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.

22.10 Recommendations for Gujarat State Fire & Emergency Services

1. The State is preparing Gujarat Fire and Emergency Act, which is under development. There is no uniformity on the applicability of building by-laws on fire safety and Municipal Corporation and Municipalities can deviate from the applicability of National Building Code (NBC) on fire safety. Thus, there is a need of the State Fire & Emergency Act and its enactment for strict implementation of fire safety codes in building design and construction. National Building Code (NBC) should be strictly adhered to in high-rise buildings, schools, hospitals, shopping malls, cinema halls, industrial units, institutions and public and private buildings. Moreover, keeping in mind the state vulnerability to natural and manmade hazards such as earthquake, cyclone, and industrial accidents, even low-rise structures need strict implementation of building code.
2. The Gujarat State Fire & Emergency Services has state-of-art (the best in the country) Firefighting & Rescue vehicles and equipments, and 5 Emergency Response Centres (ERCs) at Gandhinagar, Gandhidham, Rajkot, Surat, and Vadodara. The status of firefighting manpower in well organized Municipal Corporation is quite good, however, there is a significant gap in Fire Station building and dedicated firefighting manpower in smaller municipalities (Talukas)..
3. Instead of having fireman, driver, and operator separately, the state should recruit fireman-cum-driver-cum-operator. This will help in optimizing the large manpower requirements. Since, these may not be readily available, the state should train the new recruit in a systematic manner, and encourage all existing staff, specially, fireman and leading fireman to obtain heavy vehicle driving license. The GSF&S may offer some incentive towards this, as this will help in optimization of resources.
4. Based on prioritization of Fire Stations, GFE&S needs to add new Fire Stations in next 10 years to fill-up the gaps.
5. To have a Computerization of GF&ES, training of fire personnel in use of computers is required, which is very important from the modernization of point of view.
6. Online Vehicle tracking through GPS and development of a fully computerized response system is another area for improvement.
7. Though GF&ES in the state is creating public awareness programs for schools, colleges, hospitals, shopping mall.cinema halls,Govt. offices, high-rise buildings, etc., however, it can be improved further. For that purpose sufficient manpower at senior officer levels have been recommended to have a dedicated "*Fire Prevention Wing*". The fire prevention wing should have trained officials for fire inspection, awareness and training, so that fire incidences similar to that of AMRI, Kolkata should not occur in the state. The state should have a dedicated "*Education Van*" in each district for the purpose. The van should be well equipped with short video films as produced by MHA, distribution of pamphlets on "DO"s and "DON'T"s generated by MHA, and live demonstration of how to use "portable extinguishers" and handle small fires.
8. Periodic fire drills and fire-inspection of schools, colleges, hospitals, shopping malls, cinema halls, multi-storied buildings, and major industrial centers should be taken care by the GF&ES .
9. The GF&ES should ensure that for operational duty, physically unfit firefighter should not be part of team, and he/she should be allowed to work in the areas, other than fire response.

10. 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, GF&ES 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 officials is important as such, exercises are not one time exercise and should be carried out regularly.
11. As emphasized in section 22.3.3 (manpower gap analysis), the The Gujarat State is having Municipal Fire & Emergency Services, which general, lacks in coordination. At Municipal level, fire & emergency services do not have desired levels promotional avenues, as fire officer is struck up at the level of Chief Fire Office. Hence, there is a need to have merit-based promotion, so that deserving employees remain motivated and do not leave the organization at midst of their career.
12. Each Municipal Corporation/Municipality cannot be made self sufficient in isolation to deal with serious nature of Fire & Emergency. Because of these reasons, RMSI team recommends that Municipal fire and emergency services should come under the State Fire & Emergency Services. Accordingly, a hierarchy should be created to have proper co-ordination at all levels.
13. The GF&ES should have audit by a central authority to ensure good finance mechanism for capital, and O&M expenditures.

Table 22-38: Details of operational and new proposed urban Fire Stations with their ideal jurisdiction area, estimated ideal served population under their jurisdiction, and priority ranking for new Fire Stations

District	FSRefNo	Fire Station Name	Operational Type	Population Density	Priority Ranking of New FS
Ahmadabad	GJ_New Urban_10	Paldi	New Urban	33,499	3
Ahmadabad	GJ_New Urban_35	Sola	New Urban	31,891	4
Ahmadabad	GJ_New Urban_8	Bhimjipura	New Urban	28,415	5
Ahmadabad	GJ_New Urban_11	Jivraj Park	New Urban	26,159	6
Ahmadabad	GJ_New Urban_6	Krishna Nagar	New Urban	19,261	10
Ahmadabad	GJ_New Urban_34	Chandkheda	New Urban	14,773	14
Ahmadabad	GJ_New Urban_36	GIDC Naroda	New Urban	12,418	17
Ahmadabad	GJ_New Urban_13	Prahlad Nagar	New Urban	11,703	18
Ahmadabad	GJ_New Urban_2	Vatwa	New Urban	10,903	21
Ahmadabad	GJ_New Urban_33	Thaltej	New Urban	10,656	22
Ahmadabad	GJ_New Urban_9	Digvijaynagar	New Urban	10,403	23
Ahmadabad	GJ_New Urban_14	Bopal	New Urban	6,878	26
Ahmadabad	GJ_New Urban_12	Sarkhej	New Urban	6,837	27
Ahmadabad	GJ_New Urban_1	Ishanpur	New Urban	6,740	28
Ahmadabad	GJ_New Urban_5	Vastral	New Urban	6,083	29
Ahmadabad	GJ_New Urban_4	Kathwada GIDC Phase II	New Urban	4,444	32
Ahmadabad	GJ_New Urban_7	Sardar Nagar	New Urban	4,187	33
Ahmadabad	GJ_New Urban_3	Vatva GIDC Phase IV	New Urban	2,123	39
Ahmadabad	GJ_New Urban_37	Aslali	New Urban	749	40
Ahmadabad	GJ3745	Sabarmati Fire Station	Operational Urban	13,530	
Ahmadabad	GJ3747	Memnagar Fire Station	Operational Urban	30,597	
Ahmadabad	GJ3752	Jasdoha Nagar Fire Station.	Operational Urban	28,101	
Ahmadabad	GJ3756	Mani Nagar Fire Station.	Operational Urban	38,877	
Ahmadabad	GJ3757	Jamalpur Fire Station	Operational Urban	29,942	
Ahmadabad	GJ3758	Sahpur Fire Station	Operational Urban	27,241	
Ahmadabad	GJ3759	Danpith Fire Station.	Operational Urban	46,726	

District	FSRefNo	Fire Station Name	Operational Type	Population Density	Priority Ranking of New FS
Ahmadabad	GJ3702	Naroda Fire Station	Operational Urban	31,593	
Ahmadabad	GJ3714	Odhav Fire Station	Operational Urban	28,181	
Ahmadabad	GJ3716	Panch Kuwa Fire Station	Operational Urban	36,499	
Ahmadabad	GJ3718	Gomtipur Fire Station	Operational Urban	34,408	
Ahmadabad	GJ3785	Bodakdev Fire Station	Operational Urban	21,016	
Ahmadabad	GJ3969	Bavla Fire Station	Operational Urban	1,894	
Ahmadabad	GJ3974	Viramgam Fire Station	Operational Urban	3,261	
Ahmadabad	GJ3983	Sanand Fire Station	Operational Urban	2,055	
Ahmadabad	GJ3993	Dholka Fire Station	Operational Urban	3,927	
Ahmadabad	GJ4001	Dhandhuka Fire Station	Operational Urban	5,582	
Amreli	GJ3838	Rajula Fire Station	Operational Urban	2,332	
Amreli	GJ3841	Jafrabad Fire Station	Operational Urban	588	
Amreli	GJ3844	Amreli Fire Station.	Operational Urban	3,534	
Amreli	GJ3858	Bagasara Fire Station	Operational Urban	1,538	
Amreli	GJ3988	Savarkundla Nagar Seva Fire Station	Operational Urban	3,761	
Amreli	GJ3998	Lathi Nagar Palika Fire Station	Operational Urban	848	
Anand	GJ_New Urban_46	Vithal Udyognagar	New Urban	2,623	37
Anand	GJ3796	Vallabh Vidyanagar Fire Station	Operational Urban	8,223	
Anand	GJ3799	Anand Fire Station	Operational Urban	6,610	
Anand	GJ3801	Karamsad Fire Station	Operational Urban	3,043	
Anand	GJ3802	Borsad Fire Station	Operational Urban	9,675	
Anand	GJ3803	Petlad Fire Station	Operational Urban	11,236	
Anand	GJ3804	Umreth Fire Station	Operational Urban	5,264	
Anand	GJ3805	Khambhat Fire Station	Operational Urban	23,158	
Banas Kantha	GJ3817	Palanpur Fire Station.	Operational Urban	4,818	
Banas Kantha	GJ3840	Dhanera Municipality Fire Station.	Operational Urban	5,781	

District	FSRefNo	Fire Station Name	Operational Type	Population Density	Priority Ranking of New FS
Banas Kantha	GJ3859	Deesa Fire Station	Operational Urban	4,706	
Bharuch	GJ3754	Jambusar Fire Station	Operational Urban	3,316	
Bharuch	GJ3772	Ankleswar Fire Station	Operational Urban	2,697	
Bharuch	GJ3782	GIDC Ankleswar Disaster Mngmt and Prevention Fire Station	Operational Urban	1,433	
Bharuch	GJ3783	Bharuch Nagar Sewa Sadan Fire and Emergency Services.	Operational Urban	4,422	
Bhavnagar	GJ_New Urban_32	Balyogi Nagar	New Urban	7,052	25
Bhavnagar	GJ3832	Gariyadhar Fire Station	Operational Urban	2,765	
Bhavnagar	GJ3834	Talaja Fire Station	Operational Urban	1,794	
Bhavnagar	GJ3835	Mahuva Fire Station	Operational Urban	10,376	
Bhavnagar	GJ3848	Palitana Nagar Palika Fire Station	Operational Urban	3,416	
Bhavnagar	GJ3855	Pravedas Traw Fire Station.	Operational Urban	9,831	
Bhavnagar	GJ3857	Gadhada Nagar Palika Fire Station.	Operational Urban	2,791	
Bhavnagar	GJ3863	Sihore Nagar Palika Fire Station.	Operational Urban	5,497	
Bhavnagar	GJ3866	Nirmal Nagar Fire Station	Operational Urban	9,162	
Bhavnagar	GJ3871	Botad Fire Station	Operational Urban	7,221	
Dohad	GJ3814	Dohad Fire and Emergency Service	Operational Urban	4,260	
Gandhinagar	GJ_New Urban_41	Ghandhi Nagar Sector-4	New Urban	10,328	41
Gandhinagar	GJ_New Urban_42	Pethapur	New Urban	4,875	42
Gandhinagar	GJ3822	Gandhinagar Fire Station and Emergency Services	Operational Urban	7,019	
Gandhinagar	GJ3847	Kalol Fire Station	Operational Urban	27,641	
Gandhinagar	GJ3873	Dahegam Fire Station	Operational Urban	3,024	
Gandhinagar	GJ3879	Gandhinagar Fire Station	Operational Urban	1,474	
Jamnagar	GJ_New Urban_43	Mithpur	New Urban	4,284	43
Jamnagar	GJ_New Urban_38	Gulabnagar	New Urban	2,531	44

District	FSRefNo	Fire Station Name	Operational Type	Population Density	Priority Ranking of New FS
Jamnagar	GJ3743	Khambhaliya Fire Station	Operational Urban	2,679	
Jamnagar	GJ3733	Dwarka Fire Station	Operational Urban	6,735	
Jamnagar	GJ3735	Indramarg Fire Station	Operational Urban	9,751	
Jamnagar	GJ3736	Badeshwar Fire Station	Operational Urban	10,083	
Jamnagar	GJ3737	Main Fire Station	Operational Urban	13,960	
Jamnagar	GJ3972	Jamjodhpur Fire Station	Operational Urban	908	
Jamnagar	GJ3977	Bhanvad Fire Station	Operational Urban	1,969	
Jamnagar	GJ3995	Kalavad Nagarpalika Fire Station	Operational Urban	1,496	
Jamnagar	GJ4000	Salaya Nagarpalika Fire Station	Operational Urban	1,155	
Junagadh	GJ_New Urban_45	Junagadh City (Dolatpara)	New Urban	2,427	38
Junagadh	GJ3749	Una Fire Station	Operational Urban	6,396	
Junagadh	GJ3658	Kodinar Fire Station	Operational Urban	5,959	
Junagadh	GJ3663	Veraval-Patan Fire Station	Operational Urban	9,456	
Junagadh	GJ3664	Mangrol Fire Station	Operational Urban	5,092	
Junagadh	GJ3665	Keshod Fire Station	Operational Urban	8,064	
Junagadh	GJ3667	Manavadar Fire Station	Operational Urban	3,921	
Junagadh	GJ3668	Junagadh Fire Station	Operational Urban	10,029	
Kachchh	GJ_New Urban_39	Adipur ward 1-A	New Urban	1,103	45
Kachchh	GJ3819	Bhachau Fire Station.	Operational Urban	6,663	
Kachchh	GJ3823	Anjar Muncipality Fire Station	Operational Urban	1,323	
Kachchh	GJ3826	Ghandi Dham Muncipality Fire Station	Operational Urban	3,209	
Kachchh	GJ3831	Bhuj Muncipality Fire Station	Operational Urban	2,407	
Kheda	GJ3719	Nadiad Fire Station	Operational Urban	7,042	
Kheda	GJ3721	Sardur Bagh Fire Station	Operational Urban	8,091	
Kheda	GJ3985	Dakor Muncipality Fire Station	Operational Urban	7,413	
Kheda	GJ3987	Kheda Nagarpalika Fire Station	Operational Urban	2,001	

District	FSRefNo	Fire Station Name	Operational Type	Population Density	Priority Ranking of New FS
Kheda	GJ3992	Balasinor Fire Station	Operational Urban	4,495	
Mahesana	GJ_New Urban_40	Nagalpur	New Urban	5,660	31
Mahesana	GJ3837	Unjha Fire Station	Operational Urban	12,713	
Mahesana	GJ3842	Mahesana Muncipality Fire Station	Operational Urban	6,779	
Mahesana	GJ3843	Visnagar Muncipality Fire Station	Operational Urban	15,919	
Mahesana	GJ3845	Vijapur Muncipality Fire Station	Operational Urban	5,240	
Mahesana	GJ3846	Kadi Fire Station	Operational Urban	10,912	
Mahesana	GJ3881	Vadnagar Fire Station	Operational Urban	2,388	
Narmada	GJ3773	Rajpipla Fire Station	Operational Urban	12,373	
Navsari	GJ3740	Bilimora Fire Station	Operational Urban	4,844	
Navsari	GJ3761	Vijalpore Fire Station	Operational Urban	1,396	
Navsari	GJ3781	Navsari Fire Station	Operational Urban	7,558	
Panch Mahals	GJ_New Urban_47	Halol GIDC	New Urban	537	46
Panch Mahals	GJ3827	Halol Fire Station	Operational Urban	4,393	
Panch Mahals	GJ3828	Godhra Fire Station	Operational Urban	7,175	
Panch Mahals	GJ3829	Kalol Fire and Emergency Services	Operational Urban	3,908	
Patan	GJ3830	Radhanpur Fire Station.	Operational Urban	2,426	
Patan	GJ3860	Patan Fire Station	Operational Urban	4,387	
Patan	GJ3862	Sidhpur Fire Station	Operational Urban	3,334	
Porbandar	GJ_New Urban_44	Porbandar City (Bokhira)	New Urban	2,702	47
Porbandar	GJ3671	Ranavav Fire Station	Operational Urban	2,452	
Porbandar	GJ3739	Porbandar Fire Station	Operational Urban	7,944	
Rajkot	GJ_New Urban_27	New Subhash Nagar	New Urban	17,605	12
Rajkot	GJ_New Urban_29	Bajrangwadi	New Urban	7,890	24
Rajkot	GJ_New Urban_30	Aji GIDC	New Urban	4,139	34
Rajkot	GJ_New Urban_31	Navagam	New Urban	3,979	35

District	FSRefNo	Fire Station Name	Operational Type	Population Density	Priority Ranking of New FS
Rajkot	GJ_New Urban_28	Vavdi	New Urban	3,751	36
Rajkot	GJ3673	Upleta Fire Station	Operational Urban	4,035	
Rajkot	GJ3674	Dhoraji Fire Station	Operational Urban	7,409	
Rajkot	GJ3679	Bedipara Fire Station	Operational Urban	21,283	
Rajkot	GJ3685	Mavadi Fire Station	Operational Urban	21,859	
Rajkot	GJ3691	Kalavad Road Fire Station	Operational Urban	18,617	
Rajkot	GJ3693	Kanak Road Fire Station	Operational Urban	20,727	
Rajkot	GJ3726	Emergency Response Centre	Operational Urban	4,031	
Rajkot	GJ3728	Gondal Nagar Seva Sadan Fire Station	Operational Urban	3,321	
Rajkot	GJ3730	Jasdan Fire Station	Operational Urban	2,583	
Rajkot	GJ3731	Jetpur Navagar Fire Station	Operational Urban	4,872	
Rajkot	GJ3976	Wankaner Nagarpalika Fire Station	Operational Urban	3,275	
Rajkot	GJ3991	Morbi Fire Station	Operational Urban	5,097	
Sabar Kantha	GJ3824	Pratis Fire Station	Operational Urban	986	
Sabar Kantha	GJ3825	Himatnagar Fire TStation	Operational Urban	11,126	
Sabar Kantha	GJ3852	Modasa Nagar Palika Fire Station	Operational Urban	3,260	
Sabar Kantha	GJ3856	Nagar Palika Khedbrahma Fire Station.	Operational Urban	1,763	
Sabar Kantha	GJ3982	Idar Fire Station	Operational Urban	2,451	
Surat	GJ_New Urban_15	Jagdish Nagar	New Urban	41,572	1
Surat	GJ_New Urban_17	Harinagar	New Urban	37,406	2
Surat	GJ_New Urban_18	Gopal Nagar	New Urban	24,520	7
Surat	GJ_New Urban_21	Navagam - Dindol	New Urban	21,101	8
Surat	GJ_New Urban_19	Athwa	New Urban	19,288	9
Surat	GJ_New Urban_16	Ved Road Dabholi	New Urban	18,964	11
Surat	GJ_New Urban_20	Anand Nagar Station	New Urban	11,552	19
Surat	GJ3876	Mandvi Fire Station	Operational Urban	1,532	

District	FSRefNo	Fire Station Name	Operational Type	Population Density	Priority Ranking of New FS
Surat	GJ3748	Ghanchi sheri Fire Station.	Operational Urban	34,981	
Surat	GJ3751	Muglisara Fire Station	Operational Urban	22,798	
Surat	GJ3755	Sachin GIDC Fire Station	Operational Urban	5,381	
Surat	GJ3760	Kapodra Fire Station	Operational Urban	31,942	
Surat	GJ3762	Bardoli Fire Station	Operational Urban	2,393	
Surat	GJ3763	Navsari Bazar Fire Station	Operational Urban	51,133	
Surat	GJ3770	Kosad Fire Station	Operational Urban	13,469	
Surat	GJ3771	Mora Bhagal Fire Station	Operational Urban	28,989	
Surat	GJ3774	Pandesara Fire Station	Operational Urban	10,390	
Surat	GJ3775	Katagram Fire Station	Operational Urban	29,025	
Surat	GJ3776	Mondarwaja Fire Station.	Operational Urban	37,920	
Surat	GJ3784	Majura Fire Station	Operational Urban	40,777	
Surat	GJ3786	Adajan Fire Station.	Operational Urban	28,835	
Surat	GJ3787	Dumbhal Fire Station	Operational Urban	28,529	
Surat	GJ3741	Mandvi Fire Station	Operational Urban	3,632	
Surendranagar	GJ3698	Dhrangadhra Fire Station	Operational Urban	3,608	
Surendranagar	GJ3699	Surendranagar Fire Station	Operational Urban	6,640	
Surendranagar	GJ3700	Wadhwan Fire Station	Operational Urban	2,908	
Surendranagar	GJ3701	Limbdi Fire Station	Operational Urban	3,018	
Surendranagar	GJ3981	Thangadh Muncipality Fire Station	Operational Urban	3,137	
Surendranagar	GJ3989	Patdi Municipality Fire Station	Operational Urban	1,912	
Tapi	GJ3750	Vyara Fire Station	Operational Urban	2,026	
Tapi	GJ3753	Songadh Fire Station	Operational Urban	1,821	
Vadodara	GJ_New Urban_23	Shreepad Nagar	New Urban	14,909	**13**
Vadodara	GJ_New Urban_26	Aswamegh Nagar	New Urban	12,740	**15**
Vadodara	GJ_New Urban_22	Tarsali	New Urban	12,547	**16**
Vadodara	GJ_New Urban_25	Balaji Nagar	New Urban	11,112	**20**

District	FSRefNo	Fire Station Name	Operational Type	Population Density	Priority Ranking of New FS
Vadodara	GJ_New Urban_24	Lakulesh Nagar	New Urban	5,923	30
Vadodara	GJ3798	Padara Fire Station.	Operational Urban	4,421	
Vadodara	GJ3808	Karjan Nagarpalika Fire Station	Operational Urban	3,261	
Vadodara	GJ3810	Dabhoi Fire Station	Operational Urban	5,086	
Vadodara	GJ3811	Chhotaudepur Fire Station	Operational Urban	9,066	
Vadodara	GJ3816	Dandia Bazar Fire Station.	Operational Urban	14,257	
Vadodara	GJ3854	Wadiwadi Fire Station	Operational Urban	16,264	
Vadodara	GJ3867	Panigate Fire Station.	Operational Urban	21,209	
Vadodara	GJ3868	TP-13 Chhani Fire Station	Operational Urban	8,366	
Vadodara	GJ3869	Gajarawadi Fire Station	Operational Urban	12,928	
Vadodara	GJ3872	GIDC Makarpura Fire Station	Operational Urban	8,873	
Valsad	GJ3742	Pardi Fire Station	Operational Urban	3,290	
Valsad	GJ3744	Dharampur Fire Station	Operational Urban	1,331	
Valsad	GJ3766	Vapi-GIDC Fire Station	Operational Urban	3,625	
Valsad	GJ3768	Valsad Fire Station	Operational Urban	9,178	
Valsad	GJ3780	Vapi Fire Station	Operational Urban	7,163	

Table 22-39: Details of operational and new proposed rural Fire Stations with their ideal jurisdiction area, estimated ideal served population under their jurisdiction, and priority ranking for new Fire Stations

District	FSRefNo	Fire Station Name	Operational Type	Population Density	Priority Ranking of New FS
Ahmadabad	GJ_New Rural_164	Nandej	New Rural	389	12
Ahmadabad	GJ_New Rural_161	Changodar	New Rural	258	27
Ahmadabad	GJ_New Rural_163	Kujad	New Rural	251	30
Ahmadabad	GJ_New Rural_160	Barvala	New Rural	195	36
Ahmadabad	GJ_New Rural_61	Detroj	New Rural	153	48
Ahmadabad	GJ_New Rural_112	Ranpur	New Rural	141	54

District	FSRefNo	Fire Station Name	Operational Type	Population Density	Priority Ranking of New FS
Ahmadabad	GJ_New Rural_162	Vasna Lyava	New Rural	140	56
Ahmadabad	GJ_New Rural_166	Koth	New Rural	99	66
Ahmadabad	GJ_New Rural_167	Shahpur	New Rural	73	67
Ahmadabad	GJ_New Rural_125	Mandal	New Rural	69	68
Ahmadabad	GJ3967	Baresa Fire Station	Operational Rural	409	
Ahmadabad	GJ3971	Barwala Fire Station	Operational Rural	57	
Amreli	GJ_New Rural_182	Damnagar	New Rural	220	108
Amreli	GJ_New Rural_187	Dungar	New Rural	200	111
Amreli	GJ_New Rural_82	Lilia	New Rural	190	112
Amreli	GJ_New Rural_50	Babra	New Rural	176	114
Amreli	GJ_New Rural_128	Kunkavav	New Rural	175	115
Amreli	GJ_New Rural_183	Dhari	New Rural	142	121
Amreli	GJ_New Rural_77	Khambha	New Rural	128	124
Amreli	GJ3839	Chalala Fire Station	Operational Rural	156	
Anand	GJ_New Rural_190	Ode	New Rural	407	10
Anand	GJ_New Rural_132	Anklav	New Rural	395	11
Anand	GJ_New Rural_188	Dharmaj	New Rural	383	13
Anand	GJ_New Rural_103	Tarapur	New Rural	189	37
Anand	GJ3807	Sojitra Fire Station	Operational Rural	508	
Banas Kantha	GJ_New Rural_97	Vadgam	New Rural	538	71
Banas Kantha	GJ_New Rural_60	Deoder	New Rural	348	89
Banas Kantha	GJ_New Rural_58	Dantiwada	New Rural	343	90
Banas Kantha	GJ_New Rural_140	Bhildi	New Rural	286	96
Banas Kantha	GJ_New Rural_138	JherdaJherda	New Rural	271	100
Banas Kantha	GJ_New Rural_137	PathavadaPathavada	New Rural	238	103

District	FSRefNo	Fire Station Name	Operational Type	Population Density	Priority Ranking of New FS
Banas Kantha	GJ_New Rural_139	Thara	New Rural	221	107
Banas Kantha	GJ_New Rural_136	AmbajiAmbaji	New Rural	167	117
Banas Kantha	GJ_New Rural_89	Vav	New Rural	128	125
Banas Kantha	GJ_New Rural_57	Danta	New Rural	127	126
Banas Kantha	GJ_New Rural_49	Amirgarh	New Rural	124	127
Banas Kantha	GJ_New Rural_141	Suigam	New Rural	27	142
Banas Kantha	GJ3818	Tharad Municipality Fire Station.	Operational Rural	137	
Banas Kantha	GJ3820	Bhabhar Municipality Fire Station.	Operational Rural	160	
Bharuch	GJ_New Rural_72	Jhagadia	New Rural	313	94
Bharuch	GJ_New Rural_94	Vagra	New Rural	272	99
Bharuch	GJ_New Rural_93	Valia	New Rural	250	102
Bharuch	GJ_New Rural_69	Hansot	New Rural	234	105
Bharuch	GJ_New Rural_201	Dahej	New Rural	141	122
Bharuch	GJ3877	Amod Fire Station	Operational Rural	226	
Bhavnagar	GJ_New Rural_66	Ghogha	New Rural	268	25
Bhavnagar	GJ_New Rural_98	Umrala	New Rural	255	29
Bhavnagar	GJ_New Rural_185	Tana	New Rural	233	32
Bhavnagar	GJ_New Rural_186	Manar	New Rural	218	33
Bhavnagar	GJ_New Rural_184	Jesar	New Rural	156	47
Bhavnagar	GJ_New Rural_92	Vallabhipur	New Rural	148	50
Dohad	GJ_New Rural_196	Limdi	New Rural	1,262	144
Dohad	GJ_New Rural_197	Katwara	New Rural	756	145
Dohad	GJ_New Rural_65	Garbada	New Rural	646	146
Dohad	GJ_New Rural_83	Limkheda	New Rural	577	147
Dohad	GJ_New Rural_198	Sanjeli	New Rural	253	151
Dohad	GJ_New Rural_64	Fatehpura	New Rural	248	152

District	FSRefNo	Fire Station Name	Operational Type	Population Density	Priority Ranking of New FS
Dohad	GJ_New Rural_62	Dhanpur	New Rural	153	158
Dohad	GJ3809	Devgarh Baria Fire Station	Operational Rural	10,177	
Dohad	GJ3813	Zalod Fire Station	Operational Rural	432	
Gandhinagar	GJ_New Rural_156	Patanpura	New Rural	769	69
Gandhinagar	GJ_New Rural_152	Uvarsad	New Rural	529	73
Gandhinagar	GJ_New Rural_159	Nardipur	New Rural	521	74
Gandhinagar	GJ_New Rural_165	Rakanpur	New Rural	517	75
Gandhinagar	GJ_New Rural_157	Ranasan	New Rural	509	77
Gandhinagar	GJ_New Rural_153	Halisa	New Rural	453	83
Gandhinagar	GJ_New Rural_155	Rakhiyal	New Rural	423	84
Gandhinagar	GJ_New Rural_203	Chhatral	New Rural	365	87
Gandhinagar	GJ_New Rural_158	BahielBahiel	New Rural	336	91
Gandhinagar	GJ_New Rural_154	Pirozpur	New Rural	327	92
Jamnagar	GJ_New Rural_176	Dared	New Rural	156	119
Jamnagar	GJ_New Rural_81	Lalpur	New Rural	90	134
Jamnagar	GJ_New Rural_177	Bhatiya	New Rural	88	135
Jamnagar	GJ_New Rural_73	Jodiya	New Rural	76	136
Jamnagar	GJ3968	Sikka Fire Station	Operational Rural	221	
Jamnagar	GJ3970	Dhrol Fire Station	Operational Rural	152	
Jamnagar	GJ3975	Jamrawal Fire Station	Operational Rural	115	
Jamnagar	GJ3994	Okha Fire Station	Operational Rural	125	
Junagadh	GJ_New Rural_105	Talala	New Rural	205	34
Junagadh	GJ_New Rural_180	Malia	New Rural	178	39
Junagadh	GJ_New Rural_53	Bhesan	New Rural	175	40

District	FSRefNo	Fire Station Name	Operational Type	Population Density	Priority Ranking of New FS
Junagadh	GJ_New Rural_90	Vanthali	New Rural	166	43
Junagadh	GJ_New Rural_179	Girgadhada	New Rural	163	44
Junagadh	GJ_New Rural_122	Mendarda	New Rural	158	45
Junagadh	GJ_New Rural_181	Bilkha	New Rural	156	46
Junagadh	GJ_New Rural_86	Visavadar	New Rural	131	57
Junagadh	GJ3973	Sutrapara Fire Station	Operational Rural	407	
Junagadh	GJ3979	Bantva Nagarpalika Fire Station	Operational Rural	164	
Junagadh	GJ3980	Chorwad Nagarpalika Fire Station	Operational Rural	328	
Kachchh	GJ_New Rural_119	Mundra	New Rural	181	113
Kachchh	GJ_New Rural_134	KeraKera	New Rural	96	132
Kachchh	GJ_New Rural_135	BhimasarBhimasar	New Rural	59	139
Kachchh	GJ_New Rural_48	Naliya	New Rural	56	140
Kachchh	GJ_New Rural_118	Nakhatrana	New Rural	34	141
Kachchh	GJ_New Rural_79	Lakhpat	New Rural	13	143
Kachchh	GJ3880	Rapar Nagar Palika Fire Station	Operational Rural	31	
Kheda	GJ_New Rural_189	Kanjari	New Rural	639	70
Kheda	GJ_New Rural_75	Kathlal	New Rural	530	72
Kheda	GJ_New Rural_192	Sevaliya	New Rural	485	79
Kheda	GJ_New Rural_191	Thasra	New Rural	471	80
Kheda	GJ_New Rural_126	Mahudha	New Rural	455	81
Kheda	GJ_New Rural_123	Matar	New Rural	422	85
Kheda	GJ_New Rural_193	Lashundra	New Rural	299	95
Kheda	GJ_New Rural_87	Virpur	New Rural	225	106
Kheda	GJ3986	Mahemdabad Nagar Palika Fire Station	Operational Rural	523	
Mahesana	GJ_New Rural_146	Vasai	New Rural	377	17

District	FSRefNo	Fire Station Name	Operational Type	Population Density	Priority Ranking of New FS
Mahesana	GJ_New Rural_145	Unava	New Rural	312	21
Mahesana	GJ_New Rural_148	Nandasan	New Rural	271	24
Mahesana	GJ_New Rural_147	Ladol	New Rural	256	28
Mahesana	GJ_New Rural_78	Kheralu	New Rural	196	35
Mahesana	GJ_New Rural_67	Satlasana	New Rural	145	51
Mahesana	GJ_New Rural_52	Becharaji	New Rural	125	60
Narmada	GJ_New Rural_101	Tilakvada	New Rural	190	153
Narmada	GJ_New Rural_111	Sagbara	New Rural	160	156
Narmada	GJ_New Rural_59	Dediapada	New Rural	130	160
Navsari	GJ_New Rural_204	Maroli	New Rural	514	76
Navsari	GJ_New Rural_205	Tankal	New Rural	489	78
Navsari	GJ_New Rural_55	Chikhli	New Rural	453	82
Navsari	GJ_New Rural_51	Vandsa	New Rural	215	109
Navsari	GJ3746	Gandevi Fire Station	Operational Rural	649	
Panch Mahals	GJ_New Rural_194	Kharol	New Rural	314	93
Panch Mahals	GJ_New Rural_195	Kharsaliya	New Rural	267	101
Panch Mahals	GJ_New Rural_107	Shehera	New Rural	206	110
Panch Mahals	GJ_New Rural_121	Morwa	New Rural	158	118
Panch Mahals	GJ_New Rural_130	Jambughoda	New Rural	133	123
Panch Mahals	GJ_New Rural_131	Kadana	New Rural	116	128
Panch Mahals	GJ3864	Santrampur Fire Station	Operational Rural	167	
Panch Mahals	GJ3865	Lunawada Nagar Palika Fire Station	Operational Rural	324	
Patan	GJ_New Rural_96	Vagdod	New Rural	317	148
Patan	GJ_New Rural_144	Balisana	New Rural	308	150
Patan	GJ_New Rural_110	Sami	New Rural	154	157
Patan	GJ_New Rural_142	Shankheshwar	New Rural	43	161

District	FSRefNo	Fire Station Name	Operational Type	Population Density	Priority Ranking of New FS
Patan	GJ_New Rural_143	Santalpur	New Rural	26	162
Patan	GJ3833	Harij Muncipality Fire Station	Operational Rural	272	
Patan	GJ3861	Chanasma Fire Station	Operational Rural	292	
Porbandar	GJ_New Rural_178	Adityana	New Rural	132	159
Porbandar	GJ3672	Kutiyana Fire Station	Operational Rural	105	
Rajkot	GJ_New Rural_170	Metoda	New Rural	292	22
Rajkot	GJ_New Rural_169	Shapar Veraval	New Rural	288	23
Rajkot	GJ_New Rural_173	Dhuva	New Rural	183	38
Rajkot	GJ_New Rural_104	Tankara	New Rural	153	49
Rajkot	GJ_New Rural_129	Kotda sangani	New Rural	144	52
Rajkot	GJ_New Rural_114	Paddhari	New Rural	143	53
Rajkot	GJ_New Rural_172	Virpur	New Rural	141	55
Rajkot	GJ_New Rural_175	Vinchhiya	New Rural	129	58
Rajkot	GJ_New Rural_70	Jamkandorna	New Rural	128	59
Rajkot	GJ_New Rural_174	Kuvadava	New Rural	120	62
Rajkot	GJ_New Rural_127	Lodhika	New Rural	117	64
Rajkot	GJ_New Rural_171	Bhayavadar	New Rural	101	65
Rajkot	GJ3978	Maliya Fire Station	Operational Rural	79	
Sabar Kantha	GJ_New Rural_151	Ilol	New Rural	396	86
Sabar Kantha	GJ_New Rural_149	Raigadh	New Rural	363	88
Sabar Kantha	GJ_New Rural_63	Dhansura	New Rural	279	97
Sabar Kantha	GJ_New Rural_54	Bhiloda	New Rural	276	98
Sabar Kantha	GJ_New Rural_85	Malpur	New Rural	236	104
Sabar Kantha	GJ_New Rural_150	Meghrej	New Rural	109	129
Sabar Kantha	GJ_New Rural_88	Vijaynagar	New Rural	76	137

District	FSRefNo	Fire Station Name	Operational Type	Population Density	Priority Ranking of New FS
Sabar Kantha	GJ3849	Vadali Nagar Palika Fire Station	Operational Rural	296	
Sabar Kantha	GJ3850	Talod Nagar Palika Fire Station	Operational Rural	383	
Sabar Kantha	GJ3984	Bayad Fire Station	Operational Rural	317	
Surat	GJ_New Rural_208	Suvali Gam	New Rural	1,070	1
Surat	GJ_New Rural_211	Kadodra	New Rural	682	3
Surat	GJ_New Rural_133	Kamrej	New Rural	502	6
Surat	GJ_New Rural_209	Kosamba	New Rural	467	7
Surat	GJ_New Rural_210	Kadod	New Rural	465	8
Surat	GJ_New Rural_113	Palsana	New Rural	452	9
Surat	GJ_New Rural_115	Olpad	New Rural	382	14
Surat	GJ_New Rural_124	Mangrol	New Rural	380	16
Surat	GJ_New Rural_84	Mahuva	New Rural	325	18
Surat	GJ_New Rural_99	Umarpada	New Rural	169	42
Surendranagar	GJ_New Rural_108	Sayla	New Rural	174	116
Surendranagar	GJ_New Rural_120	Muli	New Rural	152	120
Surendranagar	GJ_New Rural_56	Chuda	New Rural	98	130
Surendranagar	GJ_New Rural_168	Sara	New Rural	98	131
Surendranagar	GJ_New Rural_80	Lakhtar	New Rural	93	133
Surendranagar	GJ_New Rural_68	Halvad	New Rural	62	138
Surendranagar	GJ3677	Chotila Fire Station	Operational Rural	183	
Tapi	GJ_New Rural_91	Valod	New Rural	313	149
Tapi	GJ_New Rural_116	Nizar	New Rural	175	154
Tapi	GJ_New Rural_100	Uchchhal	New Rural	174	155
The Dangs	GJ_New Rural_102	Ahwa (The Dangs)	New Rural	143	163
The Dangs	GJ_New Rural_202	Waghai	New Rural	89	164

District	FSRefNo	Fire Station Name	Operational Type	Population Density	Priority Ranking of New FS
Vadodara	GJ_New Rural_199	Bodeli	New Rural	515	5
Vadodara	GJ_New Rural_109	Sankheda	New Rural	381	15
Vadodara	GJ_New Rural_117	Naswadi	New Rural	324	19
Vadodara	GJ_New Rural_95	waghodia	New Rural	323	20
Vadodara	GJ_New Rural_200	Por	New Rural	263	26
Vadodara	GJ_New Rural_106	Sinor	New Rural	237	31
Vadodara	GJ_New Rural_71	Pavijetpur	New Rural	169	41
Vadodara	GJ_New Rural_76	Kavant	New Rural	119	63
Vadodara	GJ3800	Savli Fire Station.	Operational Rural	334	
Vadodara	GJ3806	Nandesari GIDC Notified Area Fire Station	Operational Rural	623	
Valsad	GJ_New Rural_206	Gundlav	New Rural	836	2
Valsad	GJ_New Rural_207	Udwada	New Rural	614	4
Valsad	GJ_New Rural_74	Kaprada	New Rural	122	61
Valsad	GJ3765	Umbergaon Fire Station	Operational Rural	1,562	
Valsad	GJ3738	Sarigam GIDC Fire Station	Operational Rural	538	

RMSI
Delivering a world of solutions

CMMi
A SEI CMMi Level 5 Company

TÜV NORD
TÜV NORD CERT GmbH
Certificate No.
44 100 090933
ISO 9001

RMSI is a professional services company providing geospatial solutions and application software services to clients worldwide

BSI
REGISTERED
ISO 27001

DQ TOP 20
Ranked amongst the Top 5 Indian IT's Best Employers for seven years in a row, since 2003

RANKED #1
Employer in India for 3 years in a row
GREAT PLACE TO WORK INSTITUTE
Business World - Great Places to Work Study 2009
RMSI ranked #1 across all industries, for the third year in a row