



**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 – National Report on Fire Hazard and Risk Analysis,  
Infrastructure and Institutional Assessment, and Key  
Recommendations**

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Submitted by

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*Phase-III States/UTs:* Director General, State Disaster Response & Fire Services, Shri P. Venkateshwar, Director, State Disaster Response & Fire Services, Andhra Pradesh; Shri Abhyanand, DG-cum-Commandant General and Shri Alok Raj, IG-cum-Add. Commandant General, Home Guard & Fire Services; and Shri Ramesh Chandra, State Fire Officer, Bihar; DGP-cum-Commandant General, Shri K. S. Sivanandan, Director (Technical), Kerala Fire and Rescue Services; Shri Bholanath, Director General Police/Director, Shri Thiru. V. Ganesan, APA & Dy. Director (Admin), Shri Thiru. S. Vijayasekar, Dy. Director (Northern Region), Tamil Nadu Fire and Rescue Services; Shri Ajay Kumar, SP-cum-Chief Fire Officer, Lakshadweep Fire Services;

*Phase-IV States/UTs:* Shri D. P. Tarenia, DG, Shri G. K. Bhattacharya, ADG, Shri D. P. Biswas, OSD (retired ADG), West Bengal Fire and Emergency Services; Shri D. K. Bora, ADG-cum-Director, State Fire Service Organization, Assam; Shri Binoy Kumar Behera, ADG-cum-Director, Shri Pranabindu Acharaya, IG, Shri Sukanta Sethi, Chief Fire Officer, Orissa Fire Services; Shri J.K. Sharma, IGP, Shri H.S. Dhaliwal, Director, Shri Kim Aya, SP Fire Service Force, Shri Apang Tawang (the then SP Fire Service Force), Arunachal Pradesh; Shri L. Singsit, IGP-cum-Director, Shri Neilasa Sopfii, S. P., Nagaland Fire and Emergency Services; Shri N. Noren Singh, Director, Manipur Fire Service; Shri C. Laldina, Sr. SP-cum-Director, Shri Zorammawia, previous DIG-cum-Director, Shri P.C. Lal Chunglura, Add. SP, Shri L. Varte, Station Officer, Mizoram Fire & Emergency Services; Shri Kuldeep Kumar, ADGP-cum-Director, Shri A.K. Das, Joint Director, Shri Tapan Roy, Maintenance Superintendent, Tripura Fire Service; Shri Suresh Prasad, State Fire Officer, Shri R. K. Thaur, Fire

Station Officer, Shri Sudhir Kumar Verma, Fire Station Officer, Jharkhand Fire Service; Dr. Rohit Yadav, Commissioner UA&D & CEO, State Urban Development Agency; Shri B. L. Agrawal, Secretary, Department of Revenue & Disaster Management; Shri R.C. Patel, IG, Home Guard; Shri Lokeshwar Sahu, OSD; Shri B. L. Chandrakar, Executive Engineer & nodal Fire Officer, Municipal Corporation of Raipur, Chattisgarh Fire Service; is gratefully acknowledged.

## Executive Summary

Fire service is one of the most important emergency response services in the country, which comes under the 12<sup>th</sup> 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) 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 the remaining States, it is under the respective Home Department.

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

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

- To carry out GIS thematic map based Fire Hazard and Risk analysis through 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/UTs have also formulated State Disaster Management Authorities (SDMA's) and District Disaster Management Authorities (DDMA's) both of which consider Fire Service as an ESF. It is, therefore, evident that the role of Fire Services has become multi-dimensional that includes not only attending fire incident calls but also various other emergencies. Accordingly, fire services in the jurisdiction of the respective Fire Station are required to be prepared with suitable types of equipment to deal with various emergencies.

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

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

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

### **Approach for Fire Hazard and Risk Analysis**

In order to conduct this study for India, a vast country covering all the States and Union Territories (UTs), the study has been conducted 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 Station Field-Survey Form”. RMSI team field-surveyed all the Fire Stations in all States/UTs for collecting detailed fire Infrastructure information. The detailed information collected includes address of Fire Station, name of Fire Station In-Charge, emergency contact numbers, communication between Fire Station control room, public and headquarter control room; Fire Station building including staff accommodation and barracks; fire fighting vehicles and specialized equipment; fire personnel, their duty pattern and pay-scales; water availability and water sources for fire vehicles, fire-risk in the jurisdiction of Fire Station and its geographical coordinates (latitude, longitude -by using a Global Positioning System, GPS) etc. All this information for each 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:

$$\text{Risk} = F (\text{Hazard potential} \times \text{Exposure} \times \text{Vulnerability})$$

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 the 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 countries 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***

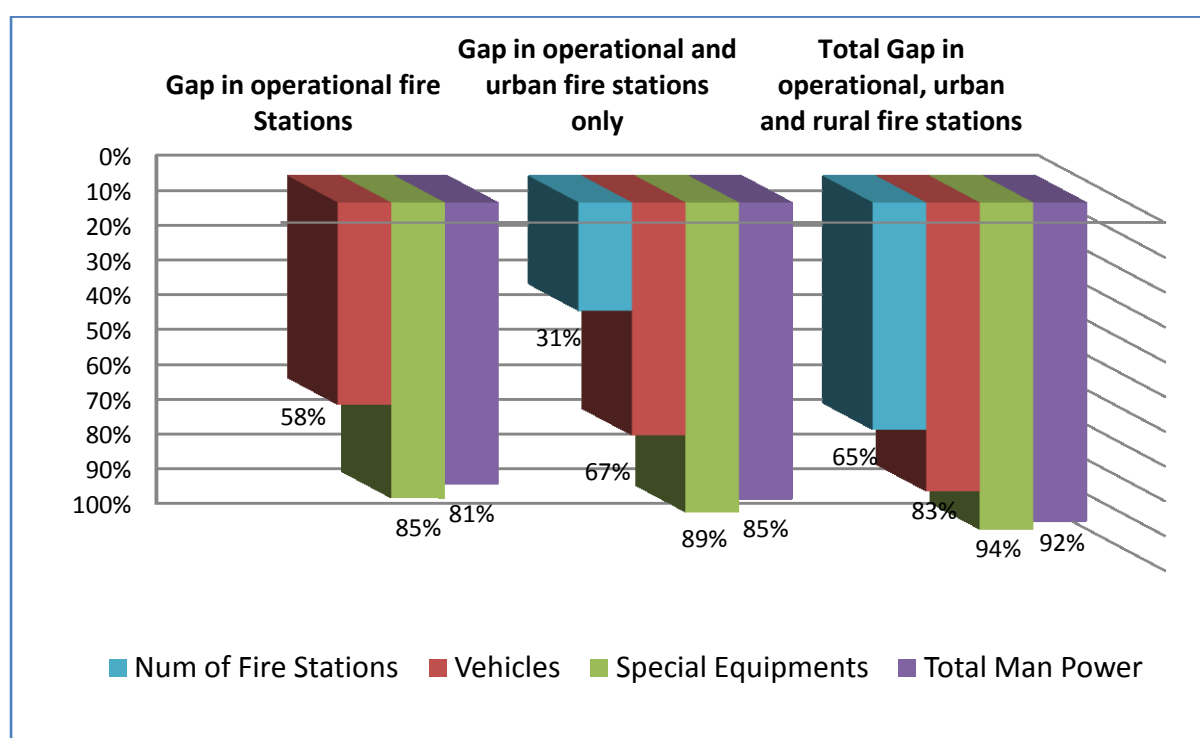
## Summary of Findings for Fire Hazard and Risk Analysis for India

As a whole, presently in India, there are 2,987<sup>\*</sup> operational Fire Stations spread over 35 States/UTs.

Based on detailed demarcated built-up areas and GIS based network analysis (response time analysis), ideal jurisdiction boundaries have been demarcated for all operational Fire Stations excluding areas served by other agencies, such as ports, airports, military cantonments, thermal/nuclear power plants, refineries 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, as a whole in India, there is a requirement of additional 1,347 Fire Stations in urban areas and 4,272 Fire Stations in rural areas. Hence this study finds an overall gap of 65% in terms of number of Fire Stations in the entire country (for details, please refer to section 42.3.1).



### Firefighting and Rescue Vehicles and Specialized Equipment Gap Analysis

For estimating the gap in firefighting 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 at district level of each States/UTs and are detailed in section 42.3.2. As whole for entire India, This study finds an overall gap of 83% in the firefighting and rescue vehicles and about 94% 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 of fire personnel varies from State to State. Some States have 8 hours (e.g., West Bengal, Tripura), 12 hours (e.g., Delhi), and 24 hours (e.g., Orissa, Jharkhand, Madhya Pradesh) duty patterns, and RMSI team estimated for manpower requirement for double shift duty pattern (12 hours) (for details, please refer to section 42.3.3). Thus, as a whole in entire India, this study finds an overall gap of 92% in fire personnel considering double shift duty pattern.

## Fire Prevention Wing

In addition to fire fighting staff in State Fire Services, there is an urgent need for a dedicated and well-coordinated *State/UT 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 strengthening so that recurrence of the fire incidences similar to that at the Advance Medical Research Institute (AMRI), Kolkata, in terms of their magnitude and frequency can be reduced. Some of States (e.g., Tamil Nadu, Goa, Delhi, and Andhra Pradesh) having a full-fledged dedicated *Fire Prevention Wing* and conducting awareness generation program on frequently. As a whole, most of the States fire services lack in awareness generation. Hence there is need to develop a dedicated *Fire Prevention Wing* to make people familiar with common fire safety measures and its implementation.

Accordingly, to support the Heads of Fire Services in different States/UTs, 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 42.3.3). It should be kept in mind that the number of officers suggested for above designations would vary from State to State or UT to UT depending upon various factors such as presence of urban agglomerations, industrial set ups including hazardous units, State's/ UT's current administration pattern etc.

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

The detailed report of Operational Fire Stations, District and State/UT level report 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 dynamic web-based Fire Decision Support System (FDSS). As detailed in section 42.5, the detailed investment and financial plan at State/ UT level includes estimation of capital cost for infrastructure, 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 42.5) for the next 10-years includes both capital and recurring expenditures. RMSI analysis estimates a total investment of **about Rs 382,112 Crores** (Table 42-35) spread over a



period of 10 years for revamping the fire services in the country 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 each State/UT for both rural and urban areas has been detailed in section 42.6. Accordingly, separate priority ranking for both urban and rural areas are given in State/UTs report

### **Avenues for Fund Generation**

The Fire & Emergency Services in the country can generate new avenues for funds from the following:

- Introduction of Fire Tax (1% of existing property tax)
- Introduction of Fire Cess, which can be collected for auditing and inspecting various residential, commercial, and industrial occupancies for adoption of Fire Safety Measures besides training public manpower for use of first aid firefighting equipment
- Training programs at different levels and durations to private sector employees on chargeable basis
- Sale of condemned fire appliances, equipments, uniform articles and general store items
- Capitation fee for scrutiny of building plans.

### **Capacity Building and Training Facilities**

The study finds that there are substantially gaps in Capacity Building and Training among the fire personnel in various States/ UTs of India. The detailed Capacity Building and Training need assessment for various levels have been discussed in section 42.8. 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 the study are given in section 42.9.

### **Key Recommendations**

The State-specific recommendations have been made in the detailed report of each State/UT and this report concludes with the key recommendations and is detailed in section 42.10. As discussed in previous sections on gap analysis, there are significant gaps in the Operational Fire Stations in terms of firefighting and rescue vehicles, specialized equipment, and firefighting manpower. Also, there are significant gaps in the required number of new Fire Stations both in urban and rural areas. In short, Fire and Emergency Services in the country can be revamped in the next 10 years to desired level provided sufficient funds and trained firefighting manpower are made available.

### **Report Structure**

This National Report for the entire country is divided in three parts:

**Part A:** This part comprises of chapters 1-6, which are common for all the 35 States/UTs Fire Service for which this study is conducted.

- Chapter 1 provides brief details of project background, role of fire services, objective and scope of study
- Chapter 2 outlines the methodology adopted and data development
- Chapter 3 provides details on GIS based fire hazard and risk analysis

- Chapter 4 provides a brief overview of field-survey of individual Fire Station and headquarter data collection and approach for stakeholder analysis
- Chapter 5 briefly explains the Development of Fire Decision Support System (FDSS)
- Chapter 6 examines international and national norms

**Part B:** This part comprises of Chapters 7-41, which are specific to the State/UT Fire Service being discussed.

- Chapter 7 provides summary of analysis for the Delhi State
- Chapter 8 provides summary of analysis for the Rajasthan State
- Chapter 9 provides summary of analysis for the Maharashtra State
- Chapter 10 provides summary of analysis for the Jammu & Kashmir State
- Chapter 11 provides summary of analysis for the Puducherry UT
- Chapter 12 provides summary of analysis for the A&N Islands UT
- Chapter 13 provides summary of analysis for the Chandigarh UT
- Chapter 14 provides summary of analysis for the Haryana State
- Chapter 15 provides summary of analysis for the Himachal Pradesh State
- Chapter 16 provides summary of analysis for the Punjab State
- Chapter 17 provides summary of analysis for the Uttarakhand State
- Chapter 18 provides summary of analysis for the Uttar Pradesh State
- Chapter 19 provides summary of analysis for the Dadra and Nagar Haveli UT
- Chapter 20 provides summary of analysis for the Daman and Diu UT
- Chapter 21 provides summary of analysis for the Goa State
- Chapter 22 provides summary of analysis for the Gujarat State
- Chapter 23 provides summary of analysis for the Karnataka State
- Chapter 24 provides summary of analysis for the Madhya Pradesh State
- Chapter 25 provides summary of analysis for the Andhra Pradesh State
- Chapter 26 provides summary of analysis for the Bihar State
- Chapter 27 provides summary of analysis for the Kerala State
- Chapter 28 provides summary of analysis for the Lakshadweep UT
- Chapter 29 provides summary of analysis for the Tamil Nadu State
- Chapter 30 provides summary of analysis for the Arunachal Pradesh State
- Chapter 31 provides summary of analysis for the Assam State
- Chapter 32 provides summary of analysis for the Chhattisgarh State
- Chapter 33 provides summary of analysis for the Jharkhand State
- Chapter 34 provides summary of analysis for the Manipur State
- Chapter 35 provides summary of analysis for the Meghalaya State
- Chapter 36 provides summary of analysis for the Mizoram State
- Chapter 37 provides summary of analysis for the Nagaland State
- Chapter 38 provides summary of analysis for the Orissa State
- Chapter 39 provides summary of analysis for the Sikkim State
- Chapter 40 provides summary of analysis for the Tripura State
- Chapter 41 provides summary of analysis for the West Bengal State

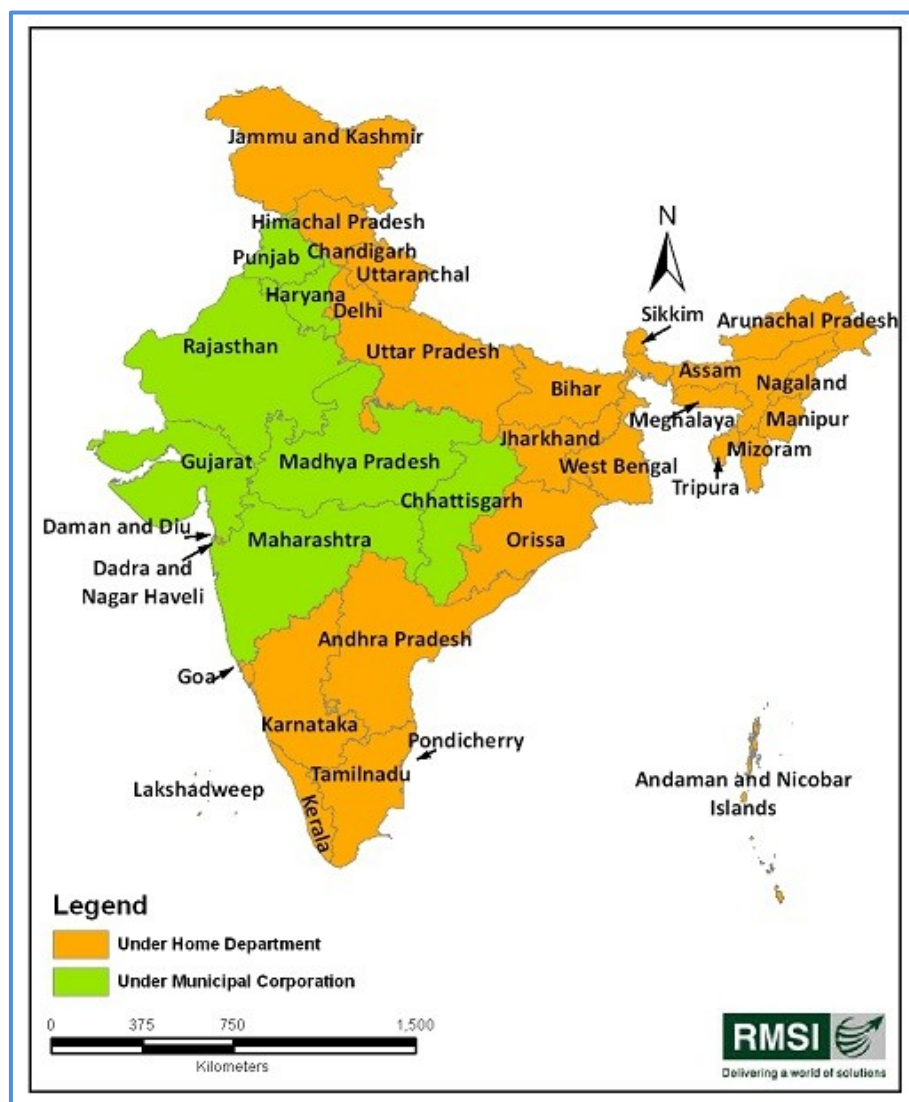
**Part C:** This part comprises of detailed analysis at country level.

# 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 12<sup>th</sup> 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/UTs, 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 upgradation/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:

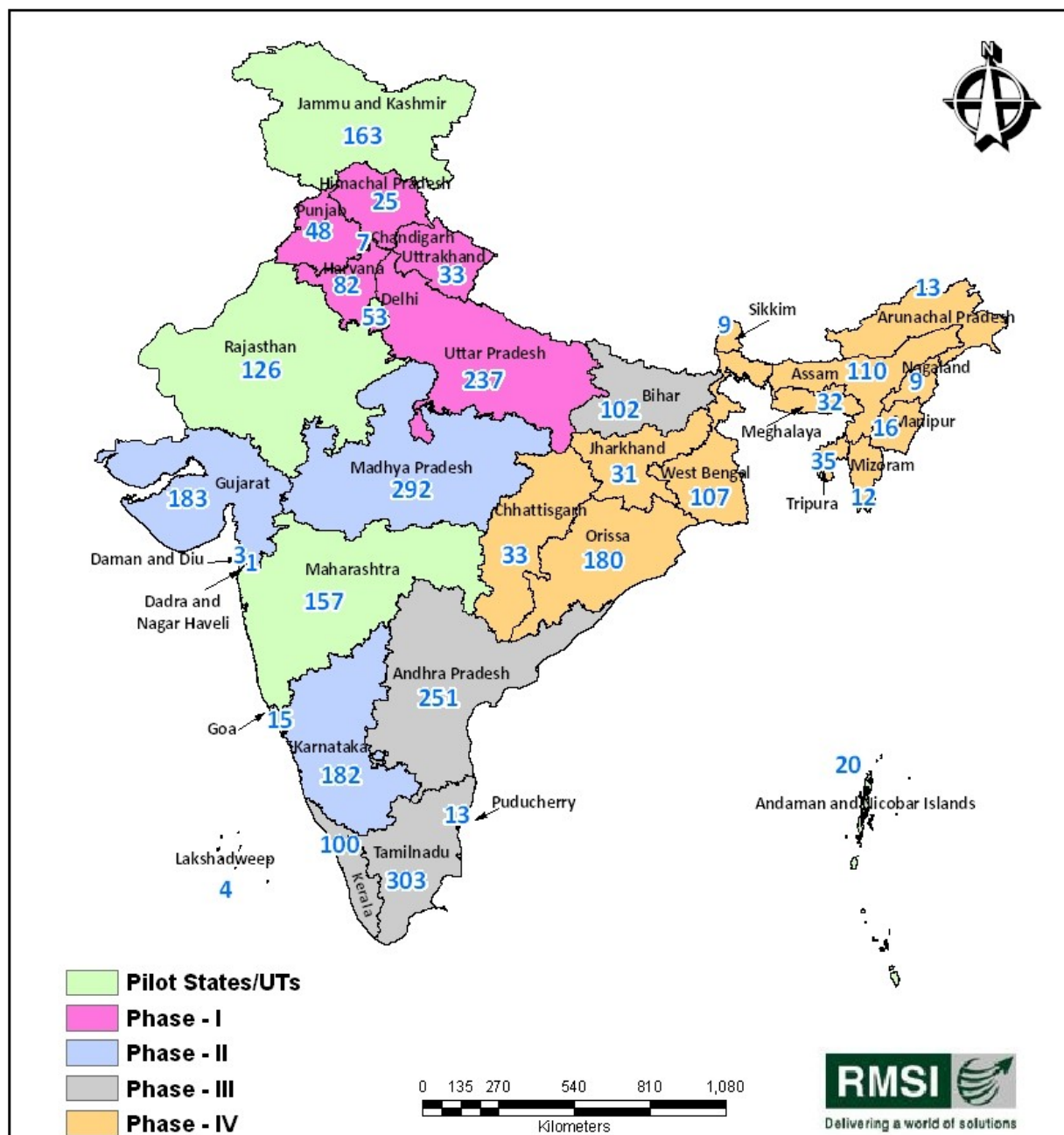
1. Risk and Hazard Analysis
  - Identifications of gaps in the existing fire services
2. Investment and Financial Plan
3. Institutional Assessment and Capacity Building Plan
  - Including survey of NFSC Nagpur and regional fire training Centers

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 for States/UTs Fire & Emergency Services. ***However, it may please be noted that RMSI team has also made 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 policies, regulations, strategies and programs of the department; existing legal and institutional mechanisms, issues and constraints 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 pilot States/UTs reports were 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/UTs	No of Districts (Census 2011)	No of Talukas/ Tehsils/ Mandals (Census 2001)	No of Fire Stations
<b>Pilot Phase</b>			
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*
<b>Phase I</b>			
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
<b>Phase II</b>			
Madhya Pradesh	50	259	292
Gujarat	26	227	183

States/UTs	No of Districts (Census 2011)	No of Talukas/ Tehsils/ Mandals (Census 2001)	No of Fire Stations
Daman & Diu	2	2	3
Dadra & Nagar Haveli	1	1	1
Karnataka	30	175	182
Goa	2	11	15
<b>Phase III</b>			
Kerala	14	63	100
Lakshadweep	1	4	4
Tamil Nadu	32	202	303
Andhra Pradesh	23	1110	251
Bihar	38	533	102
<b>Phase IV</b>			
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
<b>Total</b>	<b>640</b>	<b>5,466</b>	<b>2,987</b>

\*

In Jammu and Kashmir, It may be noted that in the past, seven operational Fire Stations were relocated adjacent to other operational Fire Stations as State was facing operational difficulties due to terrorism. For the purpose of ideal jurisdiction and gap analysis based on network analysis (travel distance by first fire vehicle and ideal population served), these Fire Stations are not accounted as separate Fire Stations. *Thus, total numbers of operating Fire Stations in the State of Jammu and Kashmir are considered 156 stations for analysis point of view against 163 operational as per State records.* Once situation permits, these stations can be relocated to their original/ any other suitable location. Hence, in the analysis section, in all the tables total count of Fire Stations is coming 2,980.

### 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 has adopted following approach for fire risk analysis of Indian States/UTs.

#### 3.1 GIS Data Compilations

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

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

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

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

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

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

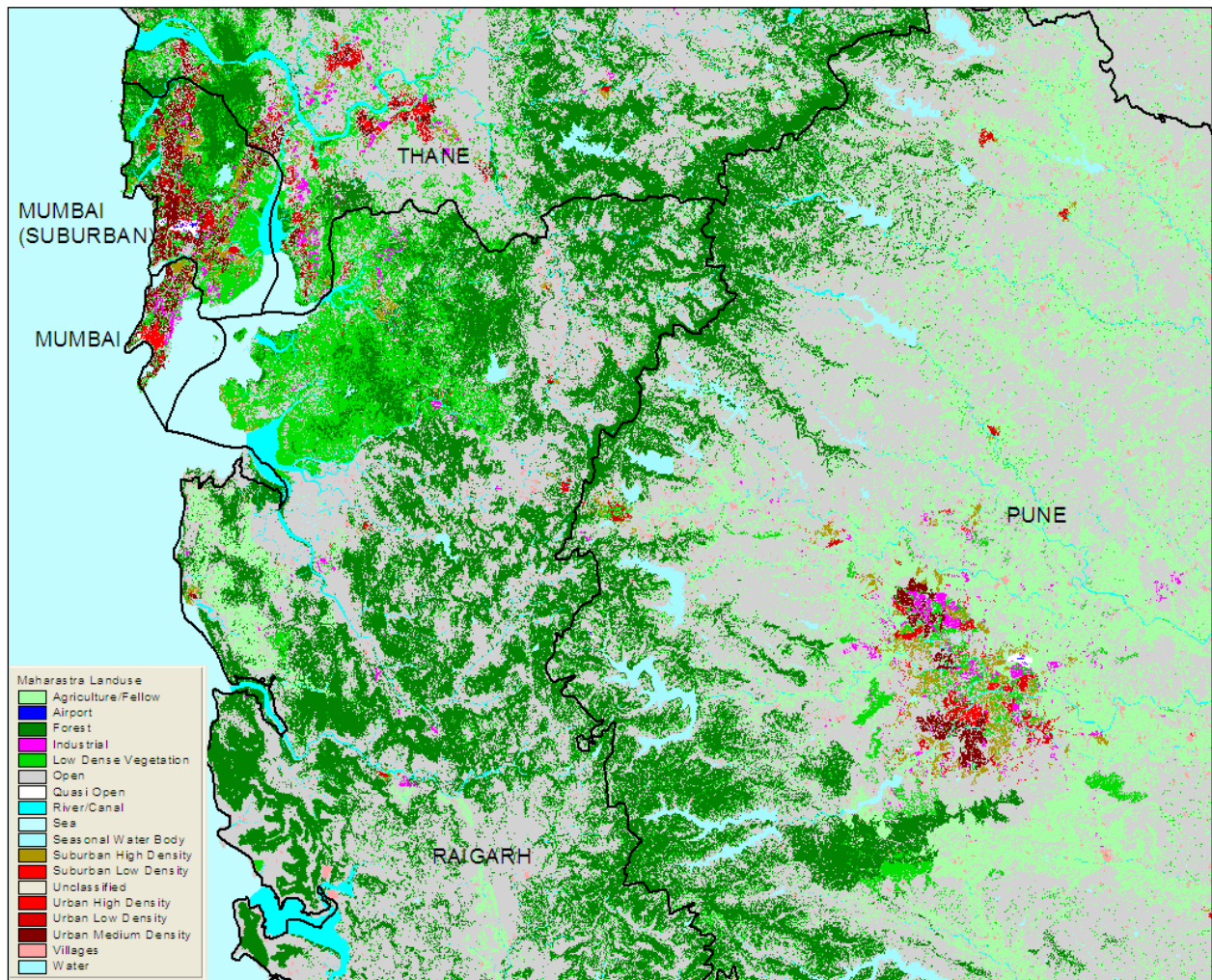
For LULC classification, remote sensing satellite images were geo-referenced and classified to generate different LULC layers such as vegetation, built-up area, water bodies, and streets, based on their spectral reflectance i.e. DN (Digital Number) values. In this process, through a semi-automated process,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

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

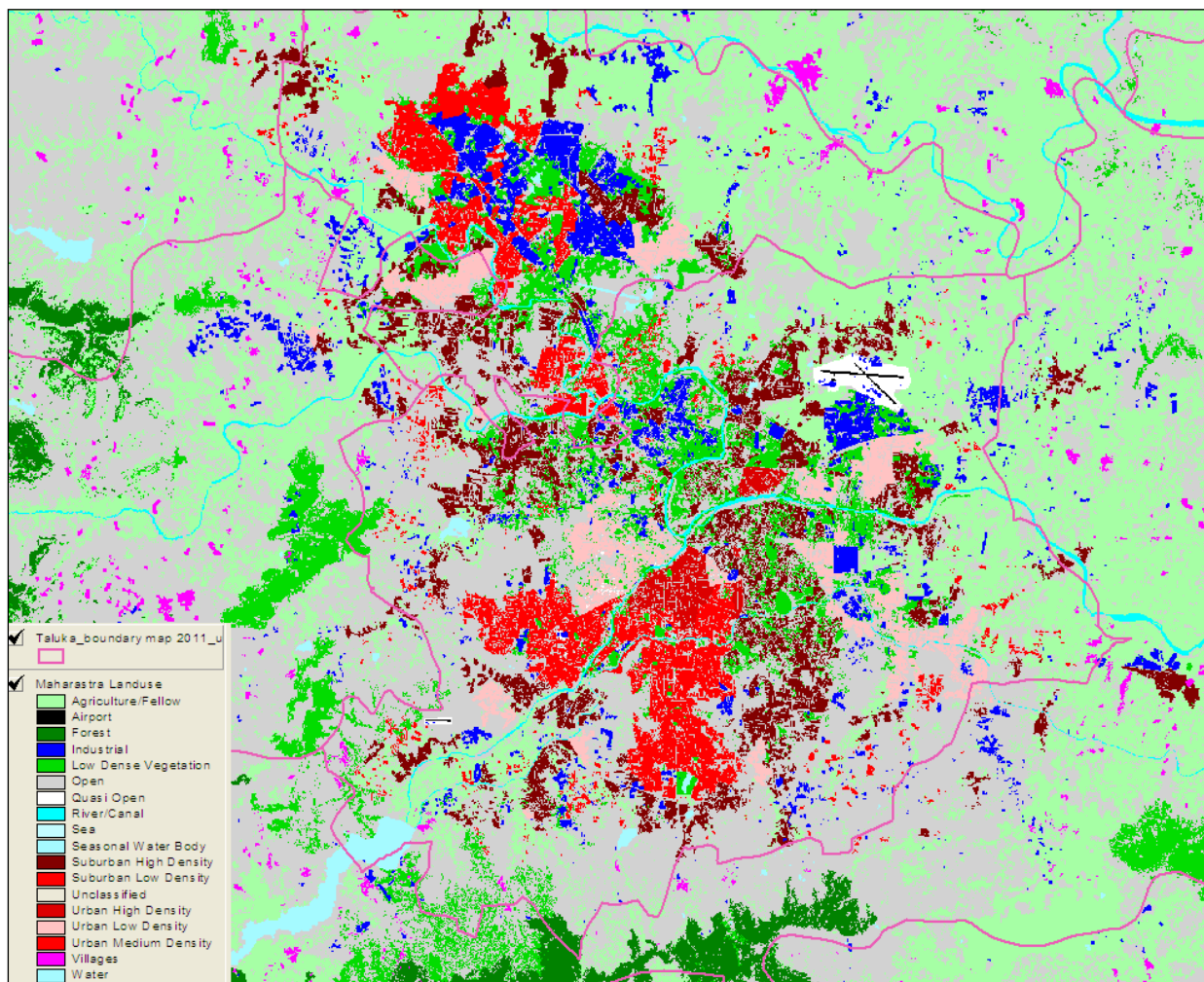
ID	Class Name	Description
0	<b>Unclassified</b>	Edge of the database
1	<b>Urban High Density</b>	Areas within urban perimeters, Inner city, very little/negligible vegetation. Closely packed buildings indicative of high density with only major streets and roads being visible. Absence of large open spaces.
2	<b>Urban Medium Density</b>	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	<b>Urban Low Density</b>	Low density of buildings, vegetations / open area are higher than the medium urban, major pedestrian zones being partially visible and streets and roads visible. Comparatively more open spaces than medium density exist within this region
4	<b>Suburban High Density</b>	Suburban areas surrounding big cities (Outer parts of the city) with loosely packed built up and little vegetation.
5	<b>Suburban Low Density</b>	Sparse Suburban areas in outskirts of big cities (Outer parts of the city) with loosely packed built up and little vegetation.
6	<b>Building Blocks</b>	Systematic groups of buildings, parallel or not, that may be separated by large open spaces.

ID	Class Name	Description
7	<b>Villages</b>	Unsystematic small pockets /clusters of buildings, within large agriculture / open spaces
8	<b>Industrial</b>	<b>Industrial:</b> Factories, Warehouse, Garages, Shipyards, Mostly situated outside the main cities.
9	<b>Commercial Areas</b>	<b>Commercial:</b> 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	<b>Forest</b>	All kinds of dense forest in rural areas, over hills/ mountains, Natural Parks with high tree density.
11	<b>Low Dense Vegetation</b>	Low density of trees, low vegetation, bushes, scrubs with low tree density.
12	<b>Agriculture/Fallow</b>	All kinds of agriculture/fallow cultivated areas, croplands, farmlands etc.
13	<b>Water</b>	Inland permanent water bodies. This class will consist of lakes & dams.
14	<b>Open</b>	No buildings, no vegetation e.g. desert, beach, and open lands mostly barren.
15	<b>Quasi Open</b>	Areas with some obstruction like scattered trees or bushes with some mixed built-up, open, agricultural fallow lands etc
16	<b>Airport</b>	Airstrip and terminal buildings
17	<b>River/Canal</b>	Linear water features like streams and rivers.
18	<b>Seasonal Water Body</b>	Seasonal water body
19	<b>Sea</b>	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)**



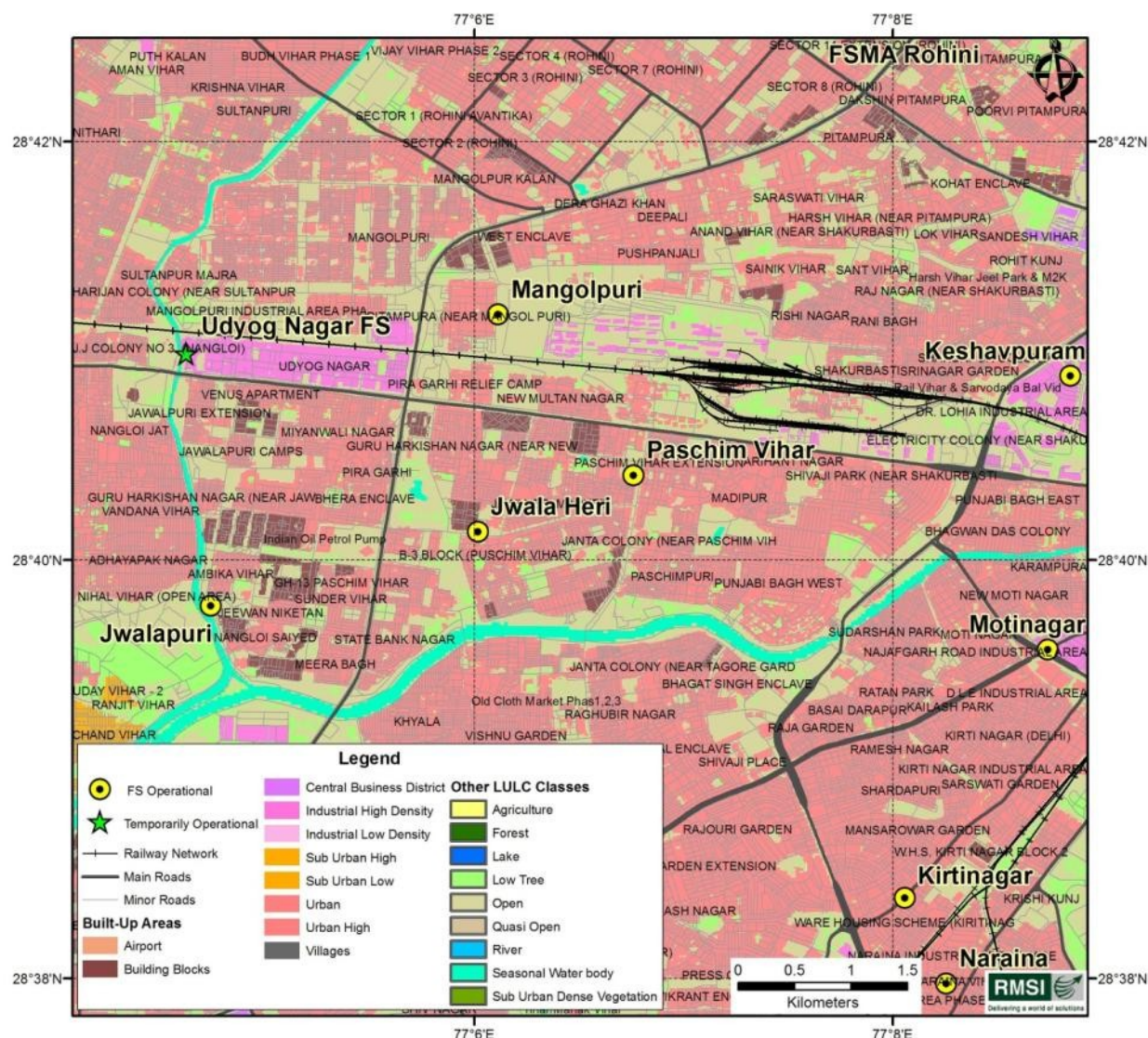
**Figure 3-2 : Example of an enlarged view of classified. The example shows urban agglomeration classification in Pune city areas**

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 based on 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.

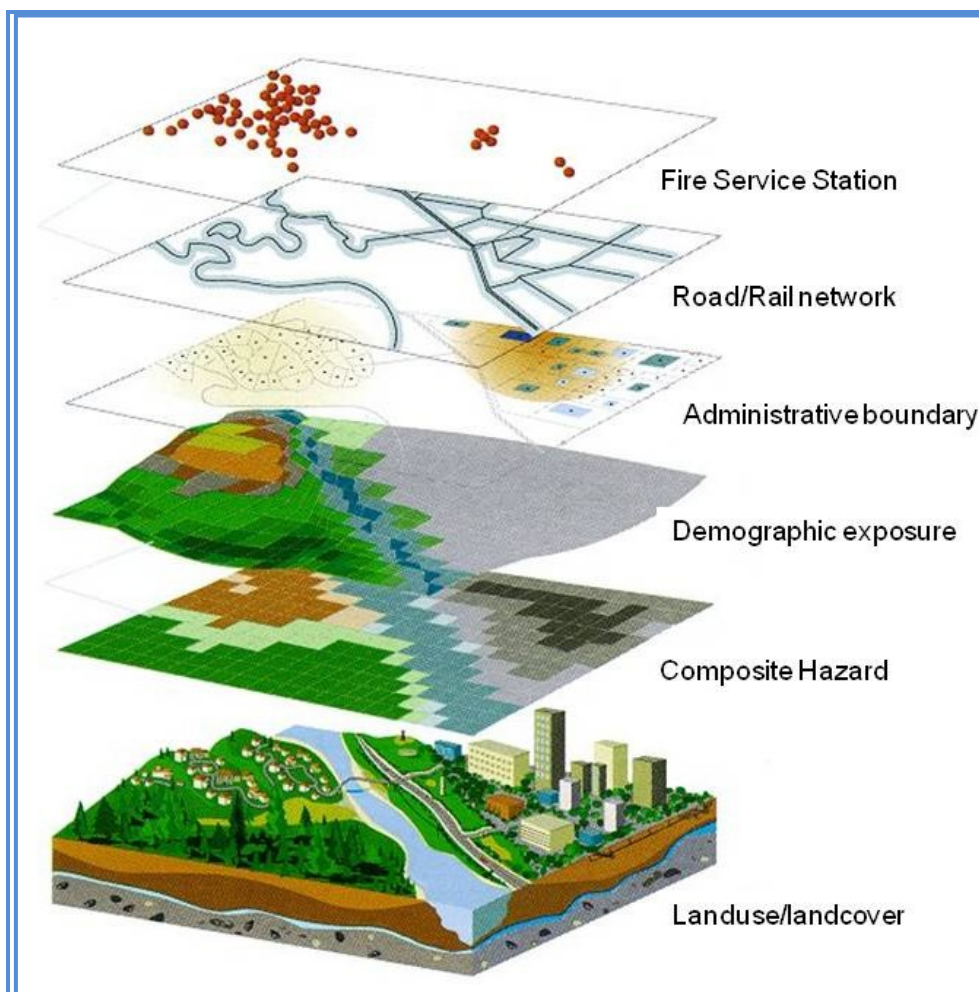




**Figure 3-3 : An example of a detailed classified urban agglomerate area. The example shows parts of Delhi with overlay of GPS locations of Fire Stations**

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:

$$\text{Risk} = F (\text{Hazard potential} \times \text{Exposure} \times \text{Vulnerability})$$

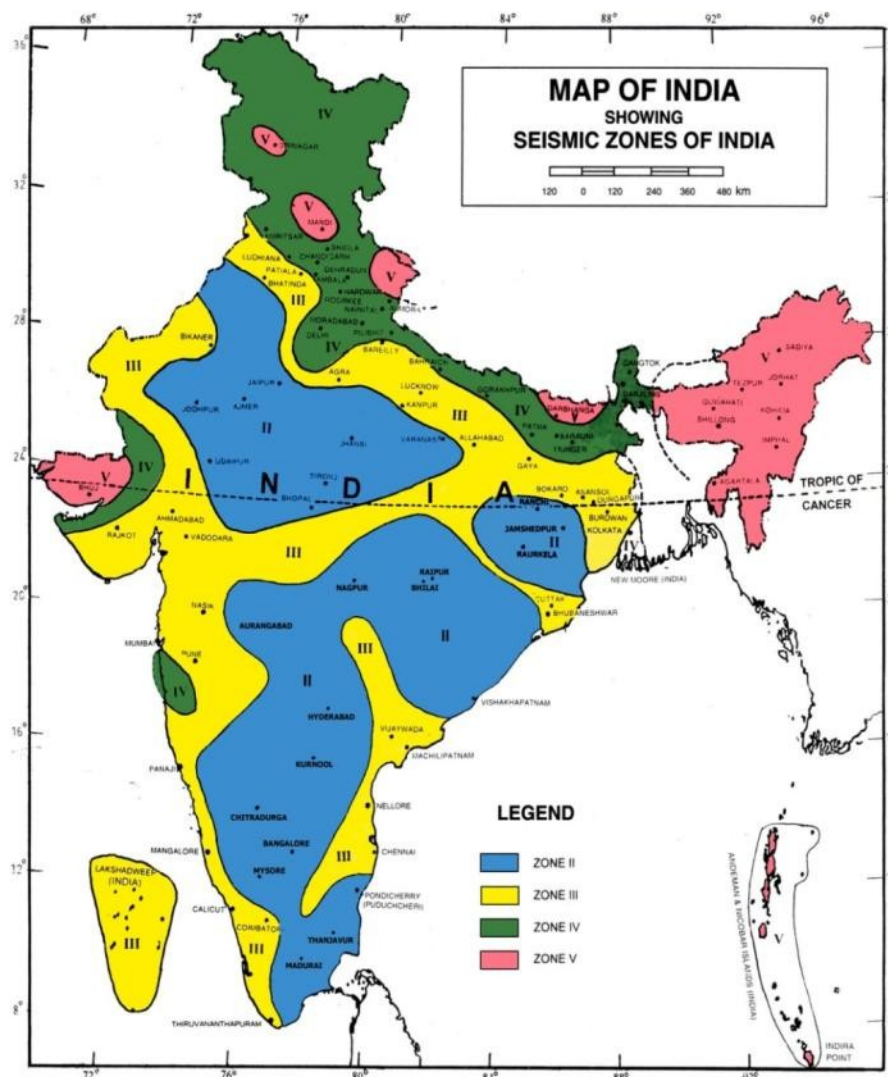
The occurrence of fire incidents that constitute a threat for the population and the exposed infrastructure of a certain region is associated with economic and human losses, always as a function of the exposure conditions and the vulnerability of the exposed assets in that particular region. In the present 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	Seismic Zone	Ranking	Climatic Zones	Ranking
Very High Damage Risk Zone - A (Vb=55m/s)	4	ZONE V	4	Hot and Dry	3
Very High Damage Risk Zone - B (Vb=50m/s)	3.5	ZONE IV	3	Composite, Temperate	2
High Damage Risk Zone (Vb=47m/s)	3	ZONE III	2	Warm and Humid	1
Moderate damage Risk Zone - A (Vb=44m/s)	2	ZONE II	1	Cold Climate	1
Moderate damage Risk Zone - B (Vb=39m/s)	1.5				
Low Damage Risk Zone (Vb=33m/s)	1				
<b>Importance Factors/ Weight age</b>	<b>20%</b>	<b>20%</b>		<b>20%</b>	
		<b>Hill Zoning</b>	<b>Ranking</b>		
		Cold climate	5		
		Other climates	1		
<b>Importance Factors/ Weightage</b>		<b>40%</b>			

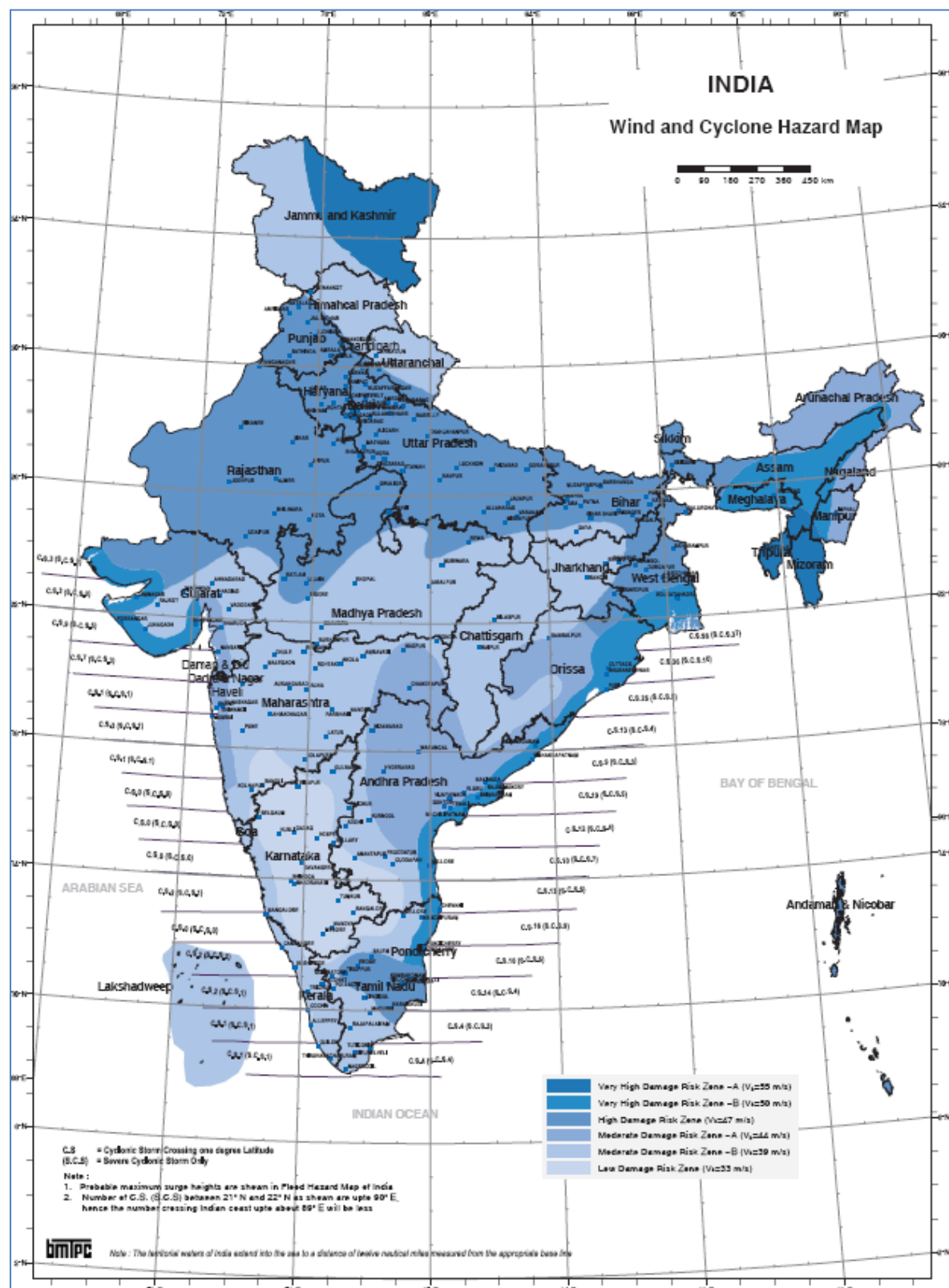


Figure 3-6 : Wind zone map of India (BMTPC, 2006)

## 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).

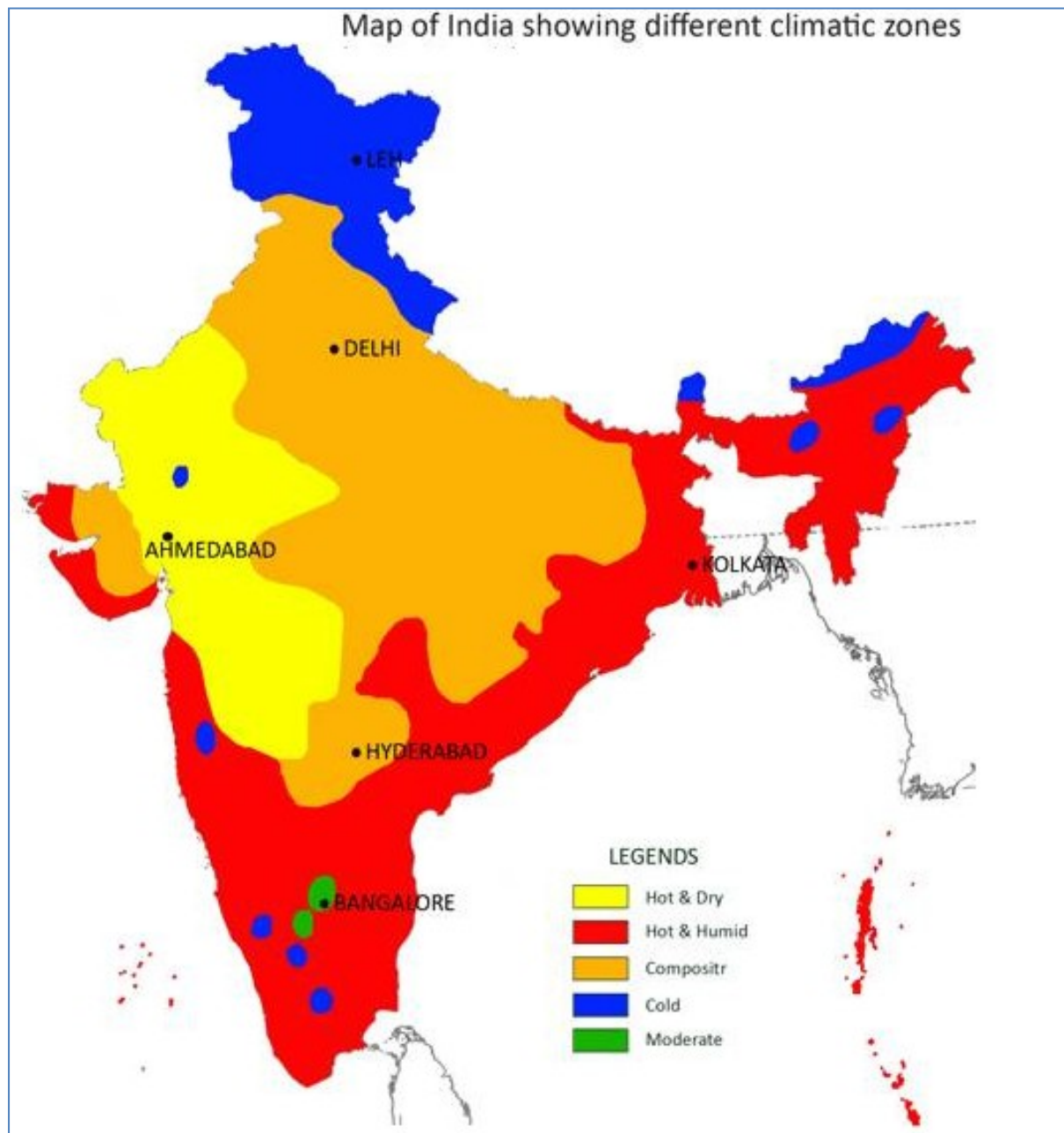
Map of climatic zones is shown in Figure 3-7. The hot and dry zone lies in the western and the central parts of India; Jaisalmer, Jodhpur and Sholapur are some of the towns that experience this type of climate. In this zone, solar radiation and movement of hot winds are higher. The warm and humid zone 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 States/UTs of India**

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



Importance Factor			20%	20%	20%	40%	Integrated Hazard Zoning
State/ UT	District	Geographical Area (Sq km)	Wind Zoning	Seismic Zoning	Climate Zoning	Hill Zoning	
	Alwar	8,317	4.5	1.9	2.0	1.0	2.1
	Bharatpur	5,082	4.5	2.4	2.0	1.0	2.2
	Dhaulpur	3,032	4.5	1.3	2.0	1.0	2.0
	Karauli	4,874	4.5	1.0	2.0	1.0	1.9
	Sawai Madhopur	5,024	4.5	1.0	2.0	1.0	1.9
	Dausa	3,555	4.5	1.2	2.0	1.0	1.9
	Jaipur	11,309	4.5	1.0	2.0	1.0	1.9
	Sikar	7,692	4.5	1.0	2.0	1.0	1.9
	Nagaur	17,710	4.5	1.0	2.6	1.0	2.0
	Jodhpur	22,903	4.5	1.2	3.0	1.0	2.1
	Jaisalmer	38,501	4.5	2.0	3.0	1.0	2.3
	Barmer	28,469	4.5	2.1	3.0	1.0	2.3
	Jalor	10,752	4.5	2.3	3.0	1.0	2.4
	Sirohi	5,169	4.5	2.1	1.7	1.0	2.0
	Pali	12,377	4.5	1.1	3.0	1.0	2.1
	Ajmer	8,537	4.5	1.0	2.6	1.0	2.0
	Tonk	7,256	4.5	1.0	2.3	1.0	2.0
	Bundi	5,825	4.5	1.0	2.9	1.0	2.1
	Bhilwara	10,477	4.5	1.0	3.0	1.0	2.1
	Rajsamand	4,683	4.5	1.0	3.0	1.0	2.1
	Dungarpur	3,794	3.0	1.8	3.0	1.0	1.9
	Banswara	4,315	3.0	1.2	3.0	1.0	1.8
	Chittaurgarh	7,882	4.5	1.0	3.0	1.0	2.1
	Kota	5,286	4.5	1.0	2.9	1.0	2.1
	Baran	6,834	4.5	1.0	2.9	1.0	2.1
	Jhalawar	6,270	4.5	1.0	3.0	1.0	2.1
	Udaipur	12,047	4.1	1.5	3.0	1.0	2.1
	Pratapgarh	4,259	4.2	1.0	3.0	1.0	2.0
Maharashtra							
	Nandurbar	5,915	3.0	2.0	3.0	1.0	2.0
	Dhule	7,197	3.0	2.0	3.0	1.0	2.0
	Jalgaon	11,805	3.0	1.5	3.0	1.0	1.9
	Buldana	9,775	3.0	1.1	3.0	1.0	1.8
	Akola	5,421	3.0	1.1	3.0	1.0	1.8
	Washim	5,212	3.0	1.0	3.0	1.0	1.8
	Amravati	12,244	3.0	1.6	2.7	1.0	1.9
	Wardha	6,326	3.6	1.0	2.0	1.0	1.7
	Nagpur	9,951	3.6	1.0	1.8	1.0	1.7
	Bhandara	4,090	3.7	1.0	1.3	1.0	1.6
	Gondiya	5,265	3.2	1.0	1.6	1.0	1.6
	Gadchiroli	14,486	3.9	1.4	1.1	1.0	1.7

Importance Factor			20%	20%	20%	40%	Integrated Hazard Zoning
State/ UT	District	Geographical Area (Sq km)	Wind Zoning	Seismic Zoning	Climate Zoning	Hill Zoning	
	Chandrapur	11,334	4.0	1.5	1.0	1.0	1.7
	Yavatmal	13,566	3.4	1.0	2.2	1.0	1.7
	Nanded	10,623	3.1	1.0	2.5	1.0	1.7
	Hingoli	4,654	3.0	1.0	3.0	1.0	1.8
	Parbhani	6,406	3.0	1.0	3.0	1.0	1.8
	Jalna	7,706	3.0	1.0	3.0	1.0	1.8
	Aurangabad	10,234	3.0	1.3	3.0	1.0	1.8
	Nashik	15,599	3.0	2.0	2.8	1.0	2.0
	Thane	9,548	3.7	2.0	1.0	1.0	1.7
	Mumbai (Suburban)	454	4.0	2.0	1.0	1.0	1.8
	Mumbai	150	4.0	2.0	1.0	1.0	1.8
	Raigarh	7,060	3.9	2.8	1.0	1.0	1.9
	Pune	15,700	3.0	2.1	1.9	1.0	1.8
	Ahmadnagar	17,102	3.0	2.0	3.0	1.0	2.0
	Bid	10,597	3.0	1.6	3.0	1.0	1.9
	Latur	7,254	3.0	1.3	2.8	1.0	1.8
	Osmanabad	7,588	3.0	1.8	3.0	1.0	2.0
	Solapur	14,919	2.9	1.9	2.8	1.0	1.9
	Satara	10,605	2.8	2.5	0.7	3.0	2.4
	Ratnagiri	8,325	3.8	2.5	1.0	1.0	1.9
	Sindhudurg	5,107	3.0	2.0	1.0	1.0	1.6
	Kolhapur	7,683	2.8	2.0	1.0	1.0	1.6
	Sangli	8,527	2.5	2.0	1.0	1.0	1.5
<b>Andaman &amp; Nicobar Islands</b>							
	Nicobars	1,579	4.0	4.0	1.0	1.0	2.2
	North & Middle Andaman	3,401	4.0	4.0	1.0	1.0	2.2
	South Andaman	2,425	4.0	4.0	1.0	1.0	2.2
<b>Puducherry</b>							
	Yanam	20.9	5.0	3.0	1.0	1.0	2.0
	Puducherry	312.8	5.0	2.0	1.0	1.0	1.8
	Mahe	8.6	3.0	2.0	1.0	1.0	2.2
<b>Himachal Pradesh</b>							
	Chamba	6,487	1.5	3.1	1.7	4.5	3.1
	Kangra	5,704	1.5	3.4	2.0	4.0	3.0
	Lahul & Spiti	13,841	1.5	3.0	1.2	5.0	3.1
	Kullu	5,513	1.5	4.0	1.2	5.0	3.3
	Mandi	3,963	1.5	4.0	1.7	4.5	3.2
	Hamirpur	1,123	2.7	1.6	2.0	4.0	2.8
	Una	1,541	2.4	3.0	2.0	4.0	3.1
	Bilaspur	1,167	1.7	3.3	2.0	4.0	3.0

Importance Factor			20%	20%	20%	40%	Integrated Hazard Zoning
State/ UT	District	Geographical Area (Sq km)	Wind Zoning	Seismic Zoning	Climate Zoning	Hill Zoning	
	Solan	1,937	2.0	3.1	2.0	4.0	3.0
	Sirmaur	2,837	1.9	3.0	2.0	4.0	3.0
	Shimla	5,171	1.5	3.6	1.4	5.0	3.3
	Kinnaur	6,495	1.5	3.2	1.0	5.0	3.1
<b>Punjab</b>							
	Gurdaspur	3,600	2.6	3.0	2.0	1.0	1.9
	Kapurthala	1,661	3.0	2.9	2.0	1.0	2.0
	Jalandhar	2,601	3.0	2.9	2.0	1.0	2.0
	Hoshiarpur	3,366	2.9	3.0	2.0	1.0	2.0
	Shahid Bhagat Singh Nagar	1,276	3.0	3.0	2.0	1.0	2.0
	Fatehgarh Sahib	1,145	3.0	3.0	2.0	1.0	2.0
	Ludhiana	3,703	3.0	2.5	2.0	1.0	1.9
	Moga	2,238	3.0	2.0	2.0	1.0	1.8
	Firozpur	5,255	3.0	1.7	2.0	1.0	1.7
	Muktsar	2,633	3.0	1.8	2.0	1.0	1.8
	Faridkot	1,465	3.0	2.0	2.0	1.0	1.8
	Bathinda	3,366	3.0	2.0	2.0	1.0	1.8
	Mansa	2,209	3.0	1.8	2.0	1.0	1.8
	Patiala	3,368	3.0	2.3	2.0	1.0	1.9
	Amritsar	2,648	3.0	2.9	2.0	1.0	2.0
	Tarn Taran	2,404	3.0	2.3	2.0	1.0	1.9
	Rupnagar	1,370	3.0	3.0	2.0	1.0	2.0
	Sahibzada Ajit Singh Nagar	1,067	3.0	3.0	2.0	1.0	2.0
	Sangrur	3,583	3.0	2.0	2.0	1.0	1.8
	Barnala	1,404	3.0	2.0	2.0	1.0	1.8
<b>Chandigarh</b>							
	Chandigarh	120	3.0	3.0	2.0	1.0	2.0
<b>Uttarakhand</b>							
	Uttarkashi	7,971	1.5	3.0	1.2	5.0	3.1
	Chamoli	7,901	1.5	3.6	1.0	5.0	3.2
	Rudra Prayag	1,942	1.5	3.0	1.1	5.0	3.1
	Tehri Garhwal	3,929	1.5	3.0	1.8	4.5	3.1
	Dehradun	3,097	1.5	3.0	2.0	4.0	2.9
	Garhwal	5,301	1.9	3.0	2.0	4.0	3.0
	Pithoragarh	7,263	1.5	4.0	1.0	5.0	3.3
	Bageshwar	2,283	1.5	4.0	1.0	5.0	3.3
	Almora	3,127	1.5	3.0	1.4	5.0	3.2
	Champawat	1,765	1.8	3.0	1.5	5.0	3.3
	Nainital	4,049	2.7	3.0	2.0	4.0	3.1

Importance Factor			20%	20%	20%	40%	Integrated Hazard Zoning
State/ UT	District	Geographical Area (Sq km)	Wind Zoning	Seismic Zoning	Climate Zoning	Hill Zoning	
	Udham Singh Nagar	2,559	3.0	3.0	2.0	4.0	3.2
	Haridwar	2,305	1.8	3.0	2.0	4.0	3.0
<b>Haryana</b>							
	Panchkula	915	3.0	3.0	2.0	1.0	2.0
	Ambala	1,458	3.0	2.8	2.0	1.0	2.0
	Yamuna Nagar	1,722	3.0	2.8	2.0	1.0	2.0
	Kurukshetra	1,666	3.0	2.0	2.0	1.0	1.8
	Kaithal	2,285	3.0	2.0	2.0	1.0	1.8
	Karnal	2,489	3.0	2.0	2.0	1.0	1.8
	Panipat	1,260	3.0	2.0	2.0	1.0	1.8
	Sonipat	2,179	3.0	2.0	2.0	1.0	1.8
	Jind	2,763	3.0	2.0	2.0	1.0	1.8
	Fatehabad	2,490	3.0	1.4	2.0	1.0	1.7
	Sirsa	4,254	3.0	1.0	2.0	1.0	1.6
	Hisar	4,092	1.7	1.2	2.0	1.0	1.4
	Bhiwani	4,631	2.1	1.0	2.0	1.0	1.4
	Rohtak	1,673	3.0	1.8	2.0	1.0	1.8
	Jhajjar	1,908	1.7	2.0	2.0	1.0	1.5
	Mahendragarh	1,939	3.0	1.1	2.0	1.0	1.6
	Rewari	1,528	3.0	2.0	2.0	1.0	1.8
	Gurgaon	1,241	3.0	2.7	2.0	1.0	1.9
	Mewat	1,475	3.0	3.0	2.0	1.0	2.0
	Faridabad	744	3.0	3.0	2.0	1.0	2.0
	Palwal	1,411	3.0	3.0	2.0	1.0	2.0
<b>Uttar Pradesh</b>							
	Saharanpur	3,742	2.9	2.7	2.0	1.0	1.9
	Muzaffarnagar	4,077	3.0	2.4	2.0	1.0	1.9
	Bijnor	4,389	3.0	3.0	2.0	1.0	2.0
	Moradabad	3,615	3.0	3.0	2.0	1.0	2.0
	Rampur	2,668	3.0	3.0	2.0	1.0	2.0
	Jyotiba Phule Nagar	2,283	3.0	3.0	2.0	1.0	2.0
	Meerut	2,620	3.0	3.0	2.0	1.0	2.0
	Baghpat	1,347	3.0	2.4	2.0	1.0	1.9
	Ghaziabad	2,014	3.0	3.0	2.0	1.0	2.0
	Gautam Buddha Nagar	1,425	3.0	3.0	2.0	1.0	2.0
	Bulandshahr	3,523	3.0	3.0	2.0	1.0	2.0
	Aligarh	3,746	3.0	3.0	2.0	1.0	2.0
	Mahamaya Nagar	1,771	3.0	2.8	2.0	1.0	2.0
	Mathura	3,359	3.0	3.0	2.0	1.0	2.0
	Agra	4,032	3.0	2.0	2.0	1.0	1.8
	Firozabad	2,411	3.0	2.0	2.0	1.0	1.8

Importance Factor			20%	20%	20%	40%	Integrated Hazard Zoning
State/ UT	District	Geographical Area (Sq km)	Wind Zoning	Seismic Zoning	Climate Zoning	Hill Zoning	
	Mainpuri	2,708	3.0	2.0	2.0	1.0	1.8
	Budaun	5,094	3.0	2.6	2.0	1.0	1.9
	Bareilly	3,834	3.0	3.0	2.0	1.0	2.0
	Pilibhit	3,621	3.0	2.9	2.0	1.0	2.0
	Shahjahanpur	4,675	3.0	2.1	2.0	1.0	1.8
	Kheri	7,756	3.0	2.5	2.0	1.0	1.9
	Sitapur	5,822	3.0	2.0	2.0	1.0	1.8
	Hardoi	6,041	3.0	2.0	2.0	1.0	1.8
	Unnao	4,628	3.0	2.0	2.0	1.0	1.8
	Lucknow	2,558	3.0	2.0	2.0	1.0	1.8
	Rae Bareli	4,655	3.0	1.9	2.0	1.0	1.8
	Farrukhabad	2,191	3.0	2.0	2.0	1.0	1.8
	Kannauj	2,086	3.0	2.0	2.0	1.0	1.8
	Etawah	2,332	3.0	1.3	2.0	1.0	1.7
	Auraiya	2,015	3.0	1.2	2.0	1.0	1.6
	Kanpur Dehat	3,207	3.0	1.1	2.0	1.0	1.6
	Kanpur Nagar	2,915	3.0	1.3	2.0	1.0	1.7
	Jalaun	4,590	3.0	1.0	2.0	1.0	1.6
	Jhansi	5,120	3.0	1.0	2.0	1.0	1.6
	Lalitpur	5,066	1.8	1.0	2.0	1.0	1.4
	Hamirpur	4,283	2.7	1.6	2.0	4.0	2.8
	Mahoba	2,933	3.0	1.0	2.0	1.0	1.6
	Banda	4,584	3.0	1.0	2.0	1.0	1.6
	Chitrakoot	3,136	3.0	1.0	2.0	1.0	1.6
	Fatehpur	4,207	3.0	1.0	2.0	1.0	1.6
	Pratapgarh	3,753	3.0	1.8	2.0	1.0	1.8
	Kaushambi	1,838	3.0	1.0	2.0	1.0	1.6
	Allahabad	5,507	3.0	1.0	2.0	1.0	1.6
	Barabanki	3,891	3.0	2.0	2.0	1.0	1.8
	Faizabad	2,701	3.0	2.0	2.0	1.0	1.8
	Ambedkar Nagar	2,368	3.0	2.0	2.0	1.0	1.8
	Sultanpur	4,468	3.0	2.0	2.0	1.0	1.8
	Bahraich	4,370	3.0	2.6	2.0	1.0	1.9
	Shrawasti	2,531	3.0	2.9	2.0	1.0	2.0
	Balrampur	3,365	3.0	3.0	2.0	1.0	2.0
	Gonda	4,081	3.0	2.1	2.0	1.0	1.8
	Siddharthnagar	2,871	3.0	3.0	2.0	1.0	2.0
	Basti	2,774	3.0	2.2	2.0	1.0	1.8
	Sant Kabir Nagar	1,771	3.0	2.4	2.0	1.0	1.9
	Maharajganj	2,947	3.0	3.0	2.0	1.0	2.0
	Gorakhpur	3,417	3.0	2.4	2.0	1.0	1.9

Importance Factor			20%	20%	20%	40%	Integrated Hazard Zoning
State/ UT	District	Geographical Area (Sq km)	Wind Zoning	Seismic Zoning	Climate Zoning	Hill Zoning	
	Kushinagar	2,939	3.0	3.0	2.0	1.0	2.0
	Deoria	2,604	3.0	2.3	2.0	1.0	1.9
	Azamgarh	4,449	3.0	2.0	2.0	1.0	1.8
	Mau	1,589	3.0	2.0	2.0	1.0	1.8
	Ballia	3,064	3.0	2.0	2.0	1.0	1.8
	Jaunpur	4,086	3.0	2.0	2.0	1.0	1.8
	Ghazipur	3,440	3.0	2.0	2.0	1.0	1.8
	Chandauli	2,574	2.8	2.0	2.0	1.0	1.8
	Varanasi	1,569	3.0	2.0	2.0	1.0	1.8
	Sant Ravidas Nagar	1,021	3.0	1.0	2.0	1.0	1.6
	Mirzapur	4,596	2.9	1.2	2.0	1.0	1.6
	Sonbhadra	6,897	1.6	1.9	2.0	1.0	1.5
	Etah	2,468	3.0	2.0	2.0	1.0	1.8
	Kanshiram Nagar	2,023	3.0	2.2	2.0	1.0	1.8
<b>Madhya Pradesh</b>							
	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



Importance Factor			20%	20%	20%	40%	Integrated Hazard Zoning
State/ UT	District	Geographical Area (Sq km)	Wind Zoning	Seismic Zoning	Climate Zoning	Hill Zoning	
	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
	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
<b>Gujarat</b>							
	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

Importance Factor			20%	20%	20%	40%	Integrated Hazard Zoning
State/ UT	District	Geographical Area (Sq km)	Wind Zoning	Seismic Zoning	Climate Zoning	Hill Zoning	
	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
<b>Daman &amp; Diu</b>							
	Daman	63	2.0	2.0	1.0	1.0	1.4
	Diu	28	3.4	3.0	1.0	1.0	1.9
<b>Dadra &amp; Nagar Haveli</b>							
	Dadra & Nagar Haveli	490	2.0	2.0	1.0	1.0	1.4
<b>Karnataka</b>							
	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

Importance Factor			20%	20%	20%	40%	Integrated Hazard Zoning
State/ UT	District	Geographical Area (Sq km)	Wind Zoning	Seismic Zoning	Climate Zoning	Hill Zoning	
	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
<b>Goa</b>							
	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
<b>Andhra Pradesh</b>							
	Adilabad	16,114	2.0	1.4	1.3	1.5	1.5
	Anantapur	19,182	1.1	1.0	1.1	1.0	1.0
	Chittoor	15,013	1.4	1.5	1.0	1.0	1.2
	East Godavari	10,840	2.9	1.8	1.0	1.0	1.5
	Guntur	11,400	2.3	1.4	1.0	1.0	1.3
	Hyderabad	192	2.0	1.0	2.0	2.0	1.8
	Karimnagar	11,845	2.0	1.2	1.9	2.0	1.8
	Khammam	15,968	2.0	1.9	1.0	1.0	1.4
	Krishna	8,754	2.6	2.0	1.0	1.0	1.5
	Kurnool	17,701	1.6	1.0	1.0	1.0	1.1
	Mahbubnagar	18,471	1.8	1.0	1.7	2.0	1.7
	Medak	9,726	1.9	1.0	2.0	2.0	1.8
	Nalgonda	14,233	2.0	1.0	1.4	1.5	1.5
	Nizamabad	7,971	1.9	1.0	2.0	2.0	1.8
	Prakasam	17,617	2.5	1.2	1.0	1.0	1.3
	Rangareddy	7,510	1.8	1.0	2.0	2.0	1.8
	Sri Potti Sriramulu Nellore	13,213	2.9	1.8	1.0	1.0	1.5
	Srikakulam	5,867	3.3	1.0	1.0	1.0	1.5
	Visakhapatnam	11,604	2.6	1.0	1.0	1.0	1.3
	Vizianagaram	6,169	2.6	1.0	1.0	1.0	1.3
	Warangal	12,911	2.0	1.3	1.6	2.0	1.8
	West Godavari	7,727	2.4	2.0	1.0	1.0	1.5
	Y.S.R.	15,356	1.4	1.1	1.0	1.0	1.1
<b>Bihar</b>							
	Araria	2,826	3.0	4.0	1.0	1.0	2.0
	Arwal	521	3.0	2.0	2.0	2.0	2.2
	Aurangabad	3,314	1.9	2.0	2.0	2.0	2.0
	Banka	3,055	2.8	2.8	1.4	1.5	2.0
	Begusarai	1,946	3.0	3.0	2.0	2.0	2.4
	Bhagalpur	2,578	3.0	3.0	1.0	1.0	1.8
	Bhojpur	2,431	3.0	2.0	2.0	2.0	2.2

Importance Factor			20%	20%	20%	40%	Integrated Hazard Zoning
State/ UT	District	Geographical Area (Sq km)	Wind Zoning	Seismic Zoning	Climate Zoning	Hill Zoning	
	Buxar	1,668	3.0	2.0	2.0	2.0	2.2
	Darbhanga	2,524	3.0	3.5	1.8	2.0	2.5
	Gaya	4,985	1.5	2.0	2.0	2.0	1.9
	Gopalganj	2,044	3.0	3.0	2.0	2.0	2.4
	Jamui	3,121	1.6	2.4	2.0	2.0	2.0
	Jehanabad	1,060	2.8	2.0	2.0	2.0	2.2
	Kaimur (Bhabua)	3,372	2.6	2.0	2.0	2.0	2.1
	Katihar	3,070	3.0	3.0	1.0	1.0	1.8
	Khagaria	1,504	3.0	3.0	1.4	1.5	2.1
	Kishanganj	2,012	3.0	3.4	1.0	1.0	1.9
	Lakhisarai	1,225	2.7	3.0	2.0	2.0	2.3
	Madhepura	1,816	3.0	3.6	1.0	1.0	1.9
	Madhubani	3,525	3.0	4.0	1.0	1.0	2.0
	Munger	1,421	3.0	3.0	2.0	2.0	2.4
	Muzaffarpur	3,191	3.0	3.0	1.9	2.0	2.4
	Nalanda	2,378	2.8	2.7	2.0	2.0	2.3
	Nawada	2,504	1.5	2.1	2.0	2.0	1.9
	Pashchim Champaran	5,245	3.0	3.0	1.7	2.0	2.3
	Patna	3,191	3.0	2.6	2.0	2.0	2.3
	Purba Champaran	3,982	3.0	3.0	1.4	1.5	2.1
	Purnia	3,245	3.0	3.3	1.0	1.0	1.9
	Rohtas	3,850	2.5	2.0	2.0	2.0	2.1
	Saharsa	1,677	3.0	3.3	1.4	1.5	2.1
	Samastipur	2,701	3.0	3.0	2.0	2.0	2.4
	Saran	2,686	3.0	2.8	2.0	2.0	2.4
	Sheikhpura	668	2.5	3.0	2.0	2.0	2.3
	Sheohar	444	3.0	3.0	1.0	1.0	1.8
	Sitamarhi	2,199	3.0	3.4	1.0	1.0	1.9
	Siwan	2,223	3.0	2.6	2.0	2.0	2.3
	Supaul	2,437	3.0	4.0	1.0	1.0	2.0
	Vaishali	2,030	3.0	3.0	2.0	2.0	2.4
<b>Kerala</b>							
	Alappuzha	1,423	1.5	2.0	1.0	1.0	1.3
	Ernakulam	3,067	1.5	2.0	1.0	1.0	1.3
	Idukki	4,377	1.5	2.0	1.0	1.0	1.3
	Kannur	2,979	1.5	2.0	1.0	1.0	1.3
	Kasaragod	1,998	1.5	2.0	1.0	1.0	1.3
	Kollam	2,495	1.5	2.0	1.0	1.0	1.3
	Kottayam	2,216	1.5	2.0	1.0	1.0	1.3
	Kozhikode	2,353	1.5	2.0	1.0	1.0	1.3
	Malappuram	3,579	1.4	2.0	1.0	1.0	1.3

Importance Factor			20%	20%	20%	40%	Integrated Hazard Zoning
State/ UT	District	Geographical Area (Sq km)	Wind Zoning	Seismic Zoning	Climate Zoning	Hill Zoning	
	Palakkad	4,503	1.5	2.0	1.0	1.0	1.3
	Pathanamthitta	2,662	1.5	2.0	1.0	1.0	1.3
	Thiruvananthapuram	2,180	1.5	2.0	1.0	1.0	1.3
	Thrissur	3,053	1.5	2.0	1.0	1.0	1.3
	Wayanad	2,149	1.2	2.0	1.0	1.0	1.2
<b>Lakshadweep</b>							
	Lakshadweep	36	1.5	2.0	1.0	1.0	1.3
<b>Tamil Nadu</b>							
	Ariyalur	1,940	3.0	1.0	1.0	1.0	1.4
	Chennai	167	3.5	2.0	1.0	1.0	1.7
	Coimbatore	3,857	1.5	2.0	1.0	1.0	1.3
	Cuddalore	3,718	3.3	1.0	1.0	1.0	1.5
	Dharmapuri	4,502	1.4	1.5	1.0	1.0	1.2
	Dindigul	6,063	1.8	1.1	1.0	3.0	2.0
	Erode	6,008	2.2	1.2	1.0	1.0	1.3
	Kancheepuram	4,477	3.3	1.4	1.0	1.0	1.5
	Kanniyakumari	1,688	1.5	2.0	1.0	1.0	1.3
	Karur	2,908	3.0	1.0	1.0	1.0	1.4
	Krishnagiri	5,138	1.1	1.2	1.0	1.0	1.0
	Madurai	3,717	1.6	1.0	1.0	1.0	1.1
	Nagapattinam	2,567	3.0	1.0	1.0	1.0	1.4
	Namakkal	3,425	3.0	1.1	1.0	1.0	1.4
	Perambalur	1,747	3.0	1.0	1.0	1.0	1.4
	Pudukkottai	4,670	3.0	1.0	1.0	1.0	1.4
	Ramanathapuram	4,254	1.8	1.0	1.0	1.0	1.2
	Salem	5,246	2.6	1.3	1.0	1.0	1.4
	Sivaganga	4,102	2.4	1.0	1.0	1.0	1.3
	Thanjavur	3,408	3.0	1.0	1.0	1.0	1.4
	The Nilgiris	2,576	1.2	2.0	1.0	1.0	1.2
	Theni	2,875	1.5	1.2	1.0	1.0	1.1
	Thiruvallur	3,401	3.0	2.0	1.0	1.0	1.6
	Thiruvarur	2,117	3.0	1.0	1.0	1.0	1.4
	Thoothukkudi	4,636	1.5	1.0	1.0	1.0	1.1
	Tiruchirappalli	4,499	3.0	1.0	1.0	1.0	1.4
	Tirunelveli	6,819	1.5	1.4	1.0	1.0	1.2
	Tiruppur	5,860	2.4	1.7	1.0	1.0	1.4
	Tiruvannamalai	6,192	1.6	1.6	1.0	1.0	1.3
	Vellore	6,077	1.2	2.0	1.0	1.0	1.2
	Viluppuram	7,290	2.4	1.0	1.0	1.0	1.3
	Virudhunagar	4,253	1.5	1.0	1.0	1.0	1.1
<b>Arunachal Pradesh</b>							

Importance Factor			20%	20%	20%	40%	Integrated Hazard Zoning
State/ UT	District	Geographical Area (Sq km)	Wind Zoning	Seismic Zoning	Climate Zoning	Hill Zoning	
	Anjaw	6,808	2.0	4.0	1.0	1.0	1.8
	Changlang	5,536	2.1	4.0	1.0	1.0	1.8
	Dibang Valley	10,633	2.0	4.0	1.0	4.5	3.2
	East Kameng	6,806	2.0	4.0	1.0	4.5	3.2
	East Siang	3,989	2.4	4.0	1.0	1.5	2.1
	Kurung Kumey	7,240	2.0	4.0	1.0	5.0	3.4
	Lohit	4,689	2.7	4.0	1.0	1.0	1.9
	Lower Dibang Valley	4,036	2.4	4.0	1.0	1.0	1.9
	Lower Subansiri	2,965	2.0	4.0	1.0	1.0	1.8
	Papum Pare	3,956	2.1	4.0	1.0	1.0	1.8
	Tawang	2,446	2.0	4.0	1.0	5.0	3.4
	Tirap	2,345	2.1	4.0	1.0	1.0	1.8
	Upper Siang	7,572	2.0	4.0	1.0	5.0	3.4
	Upper Subansiri	6,984	2.0	4.0	1.0	5.0	3.4
	West Kameng	5,444	2.0	4.0	1.0	1.5	2.0
	West Siang	8,661	2.0	4.0	1.0	5.0	3.4
<b>Assam</b>							
	Baksa	2,604	3.3	4.0	1.0	1.0	2.1
	Barpeta	2,416	3.5	4.0	1.0	1.0	2.1
	Bongaigaon	1,152	3.1	4.0	1.0	1.0	2.0
	Cachar	4,100	3.9	4.0	1.0	1.0	2.2
	Chirang	2,047	3.0	4.0	1.0	1.0	2.0
	Darrang	1,700	3.5	4.0	1.0	5.0	3.7
	Dhemaji	2,728	3.3	4.0	1.0	1.0	2.1
	Dhubri	2,362	3.0	4.0	1.0	1.0	2.0
	Dibrugarh	3,725	3.5	4.0	1.0	1.0	2.1
	Dima Hasao	5,297	3.5	4.0	1.0	1.0	2.1
	Goalpara	2,101	3.4	4.0	1.0	1.0	2.1
	Golaghat	3,844	3.5	4.0	1.0	1.0	2.1
	Hailakandi	1,438	4.0	4.0	1.0	1.0	2.2
	Jorhat	3,104	3.5	4.0	1.0	4.5	3.5
	Kamrup Metro	1,063	3.5	4.0	1.0	5.0	3.7
	Kamrup Rural	3,317	3.5	4.0	1.0	4.5	3.5
	Karbi Anglong	11,279	3.5	4.0	1.0	1.0	2.1
	Karimganj	1,960	4.0	4.0	1.0	1.0	2.2
	Kokrajhar	3,310	3.0	4.0	1.0	1.0	2.0
	Lakhimpur	3,277	3.2	4.0	1.0	1.0	2.0
	Morigaon	1,626	3.5	4.0	1.0	5.0	3.7
	Nagaon	4,362	3.5	4.0	1.0	1.0	2.1
	Nalbari	1,118	3.5	4.0	1.0	1.0	2.1
	Sivasagar	2,906	3.5	4.0	1.0	1.5	2.3



Importance Factor			20%	20%	20%	40%	Integrated Hazard Zoning
State/ UT	District	Geographical Area (Sq km)	Wind Zoning	Seismic Zoning	Climate Zoning	Hill Zoning	
	Sonitpur	5,655	3.2	4.0	1.0	1.0	2.0
	Tinsukia	4,222	3.4	4.0	1.0	1.0	2.1
	Udalguri	2,163	3.3	4.0	1.0	1.5	2.3
<b>Chhattisgarh</b>							
	Bastar	10,589	1.5	1.0	1.8	2.0	1.7
	Bijapur (Ch)	9,131	1.9	1.4	1.2	1.5	1.5
	Bilaspur (Ch)	8,418	1.5	1.0	2.0	2.0	1.7
	Dakshin Bastar Dantewada	8,587	1.6	1.1	1.1	1.5	1.4
	Dhamtari	4,136	1.5	1.0	2.0	2.0	1.7
	Durg	8,619	1.5	1.0	2.0	2.0	1.7
	Janjgir - Champa	3,922	1.5	1.0	2.0	2.0	1.7
	Jashpur	5,967	1.5	1.0	1.7	2.0	1.6
	Kawardha	4,237	1.5	1.0	2.0	2.0	1.7
	Korba	6,695	1.5	1.2	2.0	2.0	1.7
	Koriya	6,696	1.5	2.0	2.0	2.0	1.9
	Mahasamund	4,829	1.6	1.0	2.0	2.0	1.7
	Narayanpur	3,929	1.5	1.0	2.0	2.0	1.7
	Raigarh (Ch)	7,175	1.5	1.4	2.0	2.0	1.8
	Raipur	12,577	1.5	1.0	2.0	2.0	1.7
	Rajnandgaon	8,138	1.5	1.0	2.0	2.0	1.7
	Surguja	15,993	1.5	1.8	2.0	2.0	1.9
	Uttar Bastar Kanker	7,259	1.5	1.0	2.0	2.0	1.7
<b>Jharkhand</b>							
	Bokaro	2,976	1.5	1.4	2.0	2.0	1.8
	Chatra	3,815	1.5	2.0	2.0	2.0	1.9
	Deogarh	2,571	2.5	2.0	1.8	2.0	2.1
	Dhanbad	2,110	2.1	2.0	2.0	2.0	2.0
	Dumka	3,911	3.0	2.0	1.0	1.0	1.6
	Garhwa	4,162	1.5	1.9	2.0	2.0	1.9
	Giridih	5,124	1.5	2.0	2.0	2.0	1.9
	Godda	2,349	3.0	2.7	1.0	1.0	1.7
	Gumla	5,482	1.5	1.0	1.5	2.0	1.6
	Hazaribagh	3,588	1.5	1.8	2.0	2.0	1.9
	Jamtara	1,881	2.9	2.0	1.5	1.5	1.9
	Khunti	2,548	1.5	1.0	1.8	2.0	1.7
	Kodarma	2,613	1.5	2.0	2.0	2.0	1.9
	Latehar	4,386	1.5	1.3	2.0	2.0	1.8
	Lohardaga	1,537	1.5	1.0	2.0	2.0	1.7
	Pakur	1,888	3.0	2.0	1.0	1.0	1.6
	Palamu	4,484	1.5	2.0	2.0	2.0	1.9

Importance Factor			20%	20%	20%	40%	Integrated Hazard Zoning
State/ UT	District	Geographical Area (Sq km)	Wind Zoning	Seismic Zoning	Climate Zoning	Hill Zoning	
	Paschimi Singhbhum	7,439	2.3	1.0	1.1	1.5	1.5
	Purbi Singhbhum	3,685	3.1	1.0	1.0	1.5	1.6
	Ramgarh	1,446	1.5	1.1	2.0	2.0	1.7
	Ranchi	5,299	1.5	1.0	2.0	2.0	1.7
	Sahibganj	2,282	3.0	2.7	1.0	1.0	1.7
	Saraikela - Kharswan	2,743	2.4	1.0	1.6	2.0	1.8
	Simdega	3,857	1.5	1.0	1.0	1.0	1.1
<b>Manipur</b>							
	Bishnupur	525	2.2	4.0	1.0	1.0	1.8
	Chandel	3,494	2.0	4.0	1.0	1.0	1.8
	Churachandpur	4,990	3.4	4.0	1.0	1.0	2.1
	Imphal East	795	2.7	4.0	1.0	1.0	1.9
	Imphal West	533	2.0	4.0	1.0	1.0	1.8
	Senapati	3,814	2.2	4.0	1.0	1.0	1.8
	Tamenglong	4,575	3.5	4.0	1.0	1.0	2.1
	Thoubal	782	2.0	4.0	1.0	1.0	1.8
	Ukhrul	4,900	2.0	4.0	1.0	1.0	1.8
<b>Meghalaya</b>							
	East Garo Hills	3,097	3.5	4.0	1.0	1.0	2.1
	East Khasi Hills	3,045	3.5	4.0	1.0	1.0	2.1
	Jaintia Hills	4,104	3.6	4.0	1.0	1.0	2.1
	Ri Bhoi	2,544	3.5	4.0	1.0	5.0	3.7
	South Garo Hills	1,951	3.5	4.0	1.0	1.0	2.1
	West Garo Hills	3,624	3.4	4.0	1.0	1.0	2.1
	West Khasi Hills	5,582	3.5	4.0	1.0	1.5	2.3
<b>Mizoram</b>							
	Aizawl	3,205	4.0	4.0	1.0	5.0	3.8
	Champhai	3,564	4.0	4.0	1.0	4.5	3.6
	Kolasib	1,659	4.0	4.0	1.0	4.5	3.6
	Lawngtlai	1,926	4.0	4.0	1.0	5.0	3.8
	Lunglei	4,509	4.0	4.0	1.0	5.0	3.8
	Mamit	2,844	4.0	4.0	1.0	4.5	3.6
	Saiha	2,042	4.0	4.0	1.0	5.0	3.8
	Serchhip	1,344	4.0	4.0	1.0	4.5	3.6
<b>Nagaland</b>							
	Mon	2,386	2.3	4.0	1.0	4.5	3.3
	Dimapur	841	3.5	4.0	1.0	1.0	2.1
	Kiphire	1,205	2.0	4.0	1.0	1.0	1.8
	Kohima	1,678	2.3	4.0	1.0	1.0	1.9
	Longleng	564	2.3	4.0	1.0	5.0	3.5
	Mokokchung	1,761	2.8	4.0	1.0	5.0	3.6

Importance Factor			20%	20%	20%	40%	Integrated Hazard Zoning
State/ UT	District	Geographical Area (Sq km)	Wind Zoning	Seismic Zoning	Climate Zoning	Hill Zoning	
	Peren	1,891	3.5	4.0	1.0	1.0	2.1
	Phek	2,256	2.0	4.0	1.0	1.0	1.8
	Tuensang	2,487	2.0	4.0	1.0	1.5	2.0
	Wokha	1,778	3.1	4.0	1.0	4.5	3.4
	Zunheboto	1,385	2.0	4.0	1.0	1.5	2.0
<b>Orissa</b>							
	Anugul	6,548	2.0	1.2	1.0	1.0	1.2
	Balangir	6,648	2.0	1.0	1.5	2.0	1.7
	Baleshwar	3,947	3.5	1.2	1.0	1.0	1.5
	Bargarh	5,951	1.9	1.0	1.8	2.0	1.7
	Baudh	3,173	2.0	1.0	1.0	1.0	1.2
	Bhadrak	2,611	3.5	1.5	1.0	1.0	1.6
	Cuttack	3,976	3.1	1.6	1.0	1.0	1.5
	Debagarh	3,016	2.0	1.5	1.0	1.0	1.3
	Dhenkanal	4,589	3.1	1.7	1.0	1.0	1.6
	Gajapati	4,218	2.4	1.0	1.0	1.0	1.3
	Ganjam	8,593	2.8	1.0	1.0	1.0	1.4
	Jagatsinghapur	1,793	3.5	2.0	1.0	1.0	1.7
	Jajapur	2,993	3.5	2.0	1.0	1.0	1.7
	Jharsuguda	2,120	1.5	1.3	2.0	2.0	1.8
	Kalahandi	8,039	1.8	1.0	1.4	1.5	1.4
	Kandhamal	8,195	1.7	1.0	1.0	1.0	1.1
	Kendrapara	2,656	3.5	2.0	1.0	1.0	1.7
	Kendujhar	8,566	3.1	1.1	1.0	1.0	1.4
	Khordha	2,976	3.4	1.3	1.0	1.0	1.5
	Koraput	8,496	1.5	1.0	1.0	1.0	1.1
	Malkangiri	5,826	1.5	1.0	1.0	1.0	1.1
	Mayurbhanj	10,757	3.3	1.0	1.0	1.0	1.5
	Nabarangapur	5,532	1.5	1.0	1.7	2.0	1.6
	Nayagarh	3,999	2.2	1.0	1.0	1.0	1.2
	Nuapada	3,911	2.0	1.0	2.0	2.0	1.8
	Puri	3,606	3.5	1.5	1.0	1.0	1.6
	Rayagada	7,485	1.6	1.0	1.0	1.0	1.1
	Sambalpur	6,794	1.8	1.2	1.1	1.5	1.4
	Subarnapur	2,412	2.0	1.0	1.3	1.5	1.5
	Sundargarh	9,972	1.6	1.1	1.3	1.5	1.4
<b>Sikkim</b>							
	East Sikkim	998	3.0	3.0	1.0	5.0	3.4
	North Sikkim	4,450	3.0	3.0	1.0	5.0	3.4
	South Sikkim	767	3.0	3.0	1.0	4.5	3.2
	West Sikkim	1,254	3.0	3.0	1.0	3.0	2.6

Importance Factor			20%	20%	20%	40%	Integrated Hazard Zoning
State/ UT	District	Geographical Area (Sq km)	Wind Zoning	Seismic Zoning	Climate Zoning	Hill Zoning	
Tripura							
	West Tripura	2,870	4.0	4.0	1.0	2.0	2.6
	South Tripura	2,996	4.0	4.0	1.0	2.0	2.6
	North Tripura	1,989	4.0	4.0	1.0	2.0	2.6
	Dhalai	2,170	4.0	4.0	1.0	2.5	2.8
West Bengal							
	Bankura	7,154	3.0	1.6	1.0	1.0	1.5
	Barddhaman	7,311	3.0	2.0	1.0	1.5	1.8
	Birbhum	4,733	3.0	2.0	1.0	1.0	1.6
	Dakshin Dinajpur	2,342	3.0	3.0	1.0	1.0	1.8
	Darjiling	3,255	3.0	3.0	1.0	1.0	1.8
	Haora	1,460	3.5	2.0	1.0	1.0	1.7
	Hugli	3,279	3.3	2.0	1.0	1.0	1.7
	Jalpaiguri	6,452	3.0	3.1	1.0	1.0	1.8
	Koch Bihar	3,563	3.0	3.1	1.0	1.0	1.8
	Kolkata	99	3.5	2.0	1.0	1.0	1.7
	Maldah	3,746	3.0	2.8	1.0	1.0	1.8
	Murshidabad	5,708	3.0	2.0	1.0	1.0	1.6
	Nadia	4,087	3.0	2.0	1.0	1.0	1.6
	North Twenty Four Parganas	4,234	3.5	2.0	1.0	1.0	1.7
	Paschim Medinipur	9,737	3.4	1.6	1.0	1.0	1.6
	Purba Medinipur	4,137	3.5	2.0	1.0	1.0	1.7
	Puruliya	6,457	2.6	1.1	1.8	2.0	1.9
	South Twenty Four Parganas	8,192	3.5	2.0	1.0	1.0	1.7
	Uttar Dinajpur	3,236	3.0	3.0	1.0	1.0	1.8

### 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 States/UTs of India**

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)
<b>Jammu &amp; Kashmir</b>						
Kupwara	2,857	875,564	306.42	41.29	0.10	1.40%
Badgam	1,163	735,753	632.74	59.91	0.37	5.20%
Leh (Ladakh)	80,271	147,104	1.83	34.96	0.01	0.00%
Kargil	14,847	143,388	9.66	6.52	0.00	0.00%
Punch	1,725	476,820	276.42	5.84	0.00	0.30%
Rajouri	2,415	619,266	256.40	8.42	0.17	0.30%
Kathua	2,731	615,711	225.49	32.82	1.03	1.20%
Baramula	2,045	1,015,503	496.55	73.73	0.25	3.60%
Bandipore	2,889	385,099	133.28	19.95	0.03	0.70%
Srinagar	463	1,269,751	2743.04	67.39	1.06	14.60%
Ganderbal	1,449	297,003	205.01	26.12	0.05	1.80%
Pulwama	839	570,060	679.69	37.73	0.78	4.50%
Shupian	459	265,960	579.56	13.90	0.00	3.00%
Anantnag	2,743	1,070,144	390.19	21.36	0.01	0.80%
Kulgam	1,203	422,786	351.47	13.39	0.00	1.10%
Doda	2,360	409,576	173.57	8.14	0.00	0.30%
Ramban	1,021	283,313	277.49	4.33	0.06	0.40%
Kishtwar	7,916	231,037	29.19	8.65	0.00	0.10%
Udhampur	2,361	555,357	235.19	25.17	0.21	1.10%
Reasi	2,094	314,714	150.27	5.98	0.02	0.30%
Jammu	2,112	1,526,406	722.87	127.78	1.77	6.10%
Samba	854	318,611	373.04	23.00	4.20	2.70%
<b>Delhi</b>						
North West	449	3,651,261	8133.80	84.34	14.05	18.80%
North	63	883,418	14044.80	27.80	1.07	44.20%
North East	72	2,240,749	31208.20	29.75	1.39	41.40%
East	66	1,707,725	25913.88	28.80	1.17	43.70%
New Delhi	35	133,713	3798.66	12.48	0.94	35.40%
Central	16	578,671	35720.43	9.13	0.73	56.30%
West	116	2,531,583	21918.47	54.96	3.00	47.60%
South West	411	2,292,363	5574.81	75.15	5.50	18.30%
South	256	2,733,752	10682.89	67.47	5.07	26.40%
<b>Rajasthan</b>						
Ganganagar	10,629	1,969,520	185.30	225.55	5.25	2.10%
Hanumangarh	9,992	1,779,650	178.11	210.24	2.39	2.10%
Bikaner	27,043	2,367,745	87.56	256.36	6.16	0.90%



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)
Churu	17,098	2,041,172	119.38	222.78	0.90	1.30%
Jhunjhunun	5,904	2,139,658	362.38	113.58	1.49	1.90%
Alwar	8,317	3,671,999	441.53	141.81	16.82	1.70%
Bharatpur	5,082	2,549,121	501.56	77.61	1.50	1.50%
Dhaulpur	3,032	1,207,293	398.13	34.28	0.85	1.10%
Karauli	4,874	1,458,459	299.24	41.35	0.94	0.80%
Sawai Madhopur	5,024	1,338,114	266.32	63.89	0.26	1.30%
Dausa	3,555	1,637,226	460.61	38.67	1.57	1.10%
Jaipur	11,309	6,663,971	589.28	321.85	24.65	2.80%
Sikar	7,692	2,677,737	348.12	133.44	1.45	1.70%
Nagaur	17,710	3,309,234	186.85	200.54	2.05	1.10%
Jodhpur	22,903	3,685,681	160.93	253.18	33.10	1.10%
Jaisalmer	38,501	672,008	17.45	128.08	2.26	0.30%
Barmer	28,469	2,604,453	91.48	133.66	2.97	0.50%
Jalor	10,752	1,830,151	170.22	93.81	1.21	0.90%
Sirohi	5,169	1,037,185	200.65	51.49	3.97	1.00%
Pali	12,377	2,038,533	164.70	134.53	5.28	1.10%
Ajmer	8,537	2,584,913	302.79	134.51	6.86	1.60%
Tonk	7,256	1,421,711	195.94	75.15	0.78	1.00%
Bundi	5,825	1,113,725	191.20	49.99	0.94	0.90%
Bhilwara	10,477	2,410,459	230.07	101.97	7.49	1.00%
Rajsamand	4,683	1,158,283	247.34	35.86	11.39	0.80%
Dungarpur	3,794	1,388,906	366.05	25.83	0.79	0.70%
Banswara	4,315	1,798,194	416.72	15.56	1.35	0.40%
Chittaurgarh	7,882	1,544,392	195.94	68.27	7.23	0.90%
Kota	5,286	1,950,491	369.02	128.25	13.15	2.40%
Baran	6,834	1,223,921	179.09	109.92	3.32	1.60%
Jhalawar	6,270	1,411,327	225.11	151.94	7.33	2.40%
Udaipur	12,047	3,067,549	254.64	115.26	14.09	1.00%
Pratapgarh	4,259	868,231	203.86	20.59	0.25	0.50%
<b>Maharashtra</b>						
Nandurbar	5,915	1,646,177	278.31	73.93	2.27	1.20%
Dhule	7,197	2,048,781	284.69	78.64	4.81	1.10%
Jalgaon	11,805	4,224,442	357.86	163.81	5.53	1.40%
Buldana	9,775	2,588,039	264.75	96.47	2.77	1.00%
Akola	5,421	1,818,617	335.48	76.58	4.78	1.40%
Washim	5,212	1,196,714	229.62	44.92	0.88	0.90%
Amravati	12,244	2,887,826	235.86	150.26	5.34	1.20%
Wardha	6,326	1,296,157	204.90	64.90	2.86	1.00%
Nagpur	9,951	4,653,171	467.63	152.02	20.14	1.50%

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)
Bhandara	4,090	1,198,810	293.11	49.41	0.73	1.20%
Gondiya	5,265	1,322,331	251.18	77.26	2.62	1.50%
Gadchiroli	14,486	1,071,795	73.99	128.39	1.11	0.90%
Chandrapur	11,334	2,194,262	193.59	112.00	5.90	1.00%
Yavatmal	13,566	2,775,457	204.60	129.66	5.24	1.00%
Nanded	10,623	3,356,566	315.98	100.94	2.48	1.00%
Hingoli	4,654	1,178,973	253.35	36.22	0.79	0.80%
Parbhani	6,406	1,835,982	286.63	48.35	1.64	0.80%
Jalna	7,706	1,958,483	254.16	66.94	3.23	0.90%
Aurangabad	10,234	3,695,928	361.14	141.75	15.03	1.40%
Nashik	15,599	6,109,052	391.62	239.08	25.16	1.50%
Thane	9,548	11,054,131	1157.79	229.74	29.64	2.40%
Mumbai (Suburban)	454	9,332,481	20560.65	104.57	7.76	23.00%
Mumbai	150	3,145,966	21015.14	29.54	5.30	19.70%
Raigarh	7,060	2,635,394	373.29	71.39	14.23	1.00%
Pune	15,700	9,426,959	600.43	370.39	53.71	2.40%
Ahmadnagar	17,102	4,543,083	265.64	307.21	11.61	1.80%
Bid	10,597	2,585,962	244.02	88.82	1.88	0.80%
Latur	7,254	2,455,543	338.49	116.01	6.81	1.60%
Osmanabad	7,588	1,660,311	218.82	89.13	1.87	1.20%
Solapur	14,919	4,315,527	289.27	231.79	9.43	1.60%
Satara	10,605	3,003,922	283.25	206.87	3.69	2.00%
Ratnagiri	8,325	1,612,672	193.71	94.82	1.92	1.10%
Sindhudurg	5,107	848,868	166.23	69.57	1.49	1.40%
Kolhapur	7,683	3,874,015	504.22	196.89	10.02	2.60%
Sangli	8,527	2,820,575	330.80	141.53	6.33	1.70%
<b>Andaman &amp; Nicobar Islands</b>						
Nicobars	1,579	36,819	23.32	3.80	0.00	0.20%
North & Middle Andaman	3,401	105,539	31.03	20.17	0.00	0.60%
South Andaman	2,425	237,586	97.98	19.53	0.12	0.80%
<b>Puducherry UT</b>						
Karaikal	160.3	200,314	1255.43	23.07	0.76	14.40%
Yanam	20.9	55,616	1853.87	4.01	0.75	13.40%
Puducherry	312.8	946,600	3038.94	31.67	1.76	10.20%
Mahe	8.6	41,934	4659.33	1.02	0.35	11.40%
<b>Himachal Pradesh</b>						
Chamba	6,487	518,844	79.98	7.09	0.47	0.11%
Kangra	5,704	1,507,223	264.23	44.84	0.32	0.79%
Lahul & Spiti	13,841	31,528	2.28	0.33	-	0.00%

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)
Kullu	5,513	437,474	79.36	10.39	-	0.19%
Mandi	3,963	999,518	252.21	13.85	0.05	0.35%
Hamirpur	1,123	454,293	404.55	17.12	-	1.52%
Una	1,541	521,057	338.09	39.42	0.60	2.56%
Bilaspur	1,167	382,056	327.42	6.28	0.22	0.54%
Solan	1,937	576,670	297.64	20.18	5.17	1.04%
Sirmaur	2,837	530,164	186.90	10.06	0.92	0.35%
Shimla	5,171	813,384	157.31	13.72	0.17	0.27%
Kinnaur	6,495	84,298	12.98	2.25	-	0.03%
<b>Punjab</b>						
Gurdaspur	3,600	2,299,026	638.59	51.39	0.19	1.43%
Kapurthala	1,661	817,668	492.39	17.90	0.20	1.08%
Jalandhar	2,601	2,181,753	838.81	45.56	0.28	1.75%
Hoshiarpur	3,366	1,582,793	470.20	39.29	0.11	1.17%
Shahid Bhagat Singh Nagar	1,276	614,362	481.29	15.79	0.07	1.24%
Fatehgarh Sahib	1,145	599,814	523.95	13.91	0.10	1.22%
Ludhiana	3,703	3,487,882	941.96	72.75	1.26	1.96%
Moga	2,238	992,289	443.39	23.90	0.25	1.07%
Firozpur	5,255	2,026,831	385.69	48.47	0.30	0.92%
Muktsar	2,633	902,702	342.79	22.40	0.23	0.85%
Faridkot	1,465	618,008	421.89	15.82	0.12	1.08%
Bathinda	3,366	1,388,859	412.61	31.41	0.42	0.93%
Mansa	2,209	768,808	348.04	18.68	0.18	0.85%
Patiala	3,368	1,892,282	561.86	42.68	0.34	1.27%
Amritsar	2,648	2,490,891	940.79	51.76	0.52	1.96%
Tarn Taran	2,404	1,120,070	465.87	23.90	0.09	0.99%
Rupnagar	1,370	683,349	498.79	16.92	0.16	1.23%
Sahibzada Ajit Singh Nagar	1,067	986,147	924.04	20.51	0.37	1.92%
Sangrur	3,583	1,654,408	461.75	39.96	0.52	1.12%
Barnala	1,404	596,294	424.68	14.37	0.10	1.02%
<b>Chandigarh</b>						
Chandigarh	120	1,054,686	8811.64	18.91	0.13	15.80%
<b>Uttarakhand</b>						
Uttarkashi	7,971	329,686	41.36	16.14	0.04	0.20%
Chamoli	7,901	391,114	49.50	15.78	0.03	0.20%
Rudra Prayag	1,942	236,857	121.95	8.40	-	0.43%
Tehri Garhwal	3,929	616,409	156.90	24.35	0.19	0.62%
Dehradun	3,097	1,698,560	548.54	99.30	1.71	3.21%

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)
Garhwal	5,301	686,527	129.51	45.23	0.30	0.85%
Pithoragarh	7,263	485,993	66.91	17.25	-	0.24%
Bageshwar	2,283	259,840	113.79	14.68	-	0.64%
Almora	3,127	621,927	198.92	36.30	-	1.16%
Champawat	1,765	259,315	146.91	9.83	-	0.56%
Nainital	4,049	955,128	235.86	47.12	1.30	1.16%
Udham Singh Nagar	2,559	1,648,367	644.24	68.25	10.35	2.67%
Haridwar	2,305	1,927,029	836.06	67.04	8.78	2.91%
<b>Haryana</b>						
Panchkula	915	558,890	611.01	14.31	0.11	1.56%
Ambala	1,458	1,136,784	779.43	22.78	0.17	1.56%
Yamuna Nagar	1,722	1,214,162	704.94	24.69	0.29	1.43%
Kurukshetra	1,666	964,231	578.94	20.92	0.26	1.26%
Kaithal	2,285	1,072,861	469.59	25.16	0.28	1.10%
Karnal	2,489	1,506,323	605.22	26.99	0.51	1.08%
Panipat	1,260	1,202,811	954.34	21.71	0.81	1.72%
Sonipat	2,179	1,480,080	679.17	29.48	0.53	1.35%
Jind	2,763	1,332,042	482.10	29.57	0.22	1.07%
Fatehabad	2,490	941,522	378.12	23.66	0.20	0.95%
Sirsa	4,254	1,295,114	304.41	34.36	0.14	0.81%
Hisar	4,092	1,742,815	425.87	38.19	0.37	0.93%
Bhiwani	4,631	1,629,109	351.78	39.61	0.21	0.86%
Rohtak	1,673	1,058,683	632.97	21.17	0.18	1.27%
Jhajjar	1,908	956,907	501.60	20.07	0.38	1.05%
Mahendragarh	1,939	921,680	475.40	18.42	0.01	0.95%
Rewari	1,528	896,129	586.47	18.43	0.30	1.21%
Gurgaon	1,241	1,514,085	1220.36	34.70	0.76	2.80%
Mewat	1,475	1,089,406	738.81	19.54	0.06	1.33%
Faridabad	744	1,798,954	2416.42	34.17	0.69	4.59%
Palwal	1,411	1,040,493	737.54	21.43	0.13	1.52%
<b>Uttar Pradesh</b>						
Saharanpur	3,742	3,464,228	925.80	124.00	3.56	3.31%
Muzaffarnagar	4,077	4,138,605	1015.13	160.87	4.67	3.95%
Bijnor	4,389	3,683,896	839.26	0.08	-	0.00%
Moradabad	3,615	4,773,138	1320.41	166.79	3.90	4.61%
Rampur	2,668	2,335,398	875.18	88.77	1.81	3.33%
Jyotiba Phule Nagar	2,283	1,838,771	805.55	76.85	2.62	3.37%
Meerut	2,620	3,447,405	1315.85	150.65	5.32	5.75%
Baghpat	1,347	1,302,156	966.69	62.08	1.06	4.61%
Ghaziabad	2,014	4,661,452	2315.02	152.24	18.76	7.56%

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)
Gautam Buddha Nagar	1,425	1,674,714	1175.40	91.01	12.99	6.39%
Bulandshahr	3,523	3,498,507	993.10	138.03	4.31	3.92%
Aligarh	3,746	3,673,849	980.64	143.53	1.19	3.83%
Mahamaya Nagar	1,771	1,565,678	884.02	53.26	0.38	3.01%
Mathura	3,359	2,541,894	756.74	106.36	5.16	3.17%
Agra	4,032	4,380,793	1086.59	153.44	6.51	3.81%
Firozabad	2,411	2,496,761	1035.77	80.81	2.15	3.35%
Mainpuri	2,708	1,847,194	682.17	76.11	1.31	2.81%
Budaun	5,094	3,712,738	728.86	143.30	2.22	2.81%
Bareilly	3,834	4,465,344	1164.65	142.46	3.62	3.72%
Pilibhit	3,621	2,037,225	562.62	61.94	0.99	1.71%
Shahjahanpur	4,675	3,002,376	642.28	99.89	2.61	2.14%
Kheri	7,756	4,013,634	517.48	151.76	3.52	1.96%
Sitapur	5,822	4,474,446	768.55	175.29	0.93	3.01%
Hardoi	6,041	4,091,380	677.23	135.06	1.58	2.24%
Unnao	4,628	3,110,595	672.14	151.74	2.50	3.28%
Lucknow	2,558	4,588,455	1793.61	196.29	4.14	7.67%
Rae Bareilly	4,655	3,404,004	731.33	176.39	2.54	3.79%
Farrukhabad	2,191	1,887,577	861.67	54.16	2.05	2.47%
Kannauj	2,086	1,658,005	794.95	56.12	0.36	2.69%
Etawah	2,332	1,579,160	677.22	64.69	1.88	2.77%
Auraiya	2,015	1,372,287	681.17	60.93	2.61	3.02%
Kanpur Dehat	3,207	1,795,092	559.82	80.62	1.71	2.51%
Kanpur Nagar	2,915	4,572,951	1568.62	175.63	14.47	6.02%
Jalaun	4,590	1,670,718	364.01	79.06	1.05	1.72%
Jhansi	5,120	2,000,755	390.78	90.77	3.00	1.77%
Lalitpur	5,066	1,218,002	240.44	47.52	0.76	0.94%
Hamirpur	4,283	1,104,021	257.76	17.12	-	0.40%
Mahoba	2,933	876,055	298.70	45.23	0.08	1.54%
Banda	4,584	1,799,541	392.57	90.90	5.47	1.98%
Chitrakoot	3,136	990,626	315.87	48.12	0.26	1.53%
Fatehpur	4,207	2,632,684	625.73	121.43	0.65	2.89%
Pratapgarh	3,753	3,173,752	845.76	145.95	0.55	3.89%
Kaushambi	1,838	1,596,909	868.91	71.84	0.27	3.91%
Allahabad	5,507	5,959,798	1082.27	238.62	4.37	4.33%
Barabanki	3,891	3,257,983	837.32	119.86	1.10	3.08%
Faizabad	2,701	2,468,371	913.75	75.17	0.59	2.78%
Ambedkar Nagar	2,368	2,398,709	1012.83	90.75	0.42	3.83%
Sultanpur	4,468	3,790,922	848.48	177.28	2.41	3.97%

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)
Bahraich	4,370	3,478,257	795.98	106.27	0.65	2.43%
Shrawasti	2,531	1,114,615	440.40	73.97	0.00	2.92%
Balrampur	3,365	2,149,066	638.75	76.23	0.01	2.27%
Gonda	4,081	3,431,386	840.88	111.35	0.48	2.73%
Siddharthnagar	2,871	2,553,526	889.39	106.60	0.04	3.71%
Basti	2,774	2,461,056	887.18	67.22	0.50	2.42%
Sant Kabir Nagar	1,771	1,714,300	968.10	59.66	0.21	3.37%
Maharajganj	2,947	2,665,292	904.31	111.24	2.22	3.77%
Gorakhpur	3,417	4,436,275	1298.43	188.75	2.33	5.52%
Kushinagar	2,939	3,560,830	1211.56	94.39	0.12	3.21%
Deoria	2,604	3,098,637	1189.76	97.62	0.42	3.75%
Azamgarh	4,449	4,616,509	1037.73	196.28	0.70	4.41%
Mau	1,589	2,205,170	1387.93	74.09	0.39	4.66%
Ballia	3,064	3,223,642	1052.05	126.29	0.06	4.12%
Jaunpur	4,086	4,476,072	1095.47	193.42	1.36	4.73%
Ghazipur	3,440	3,622,727	1052.97	157.16	0.18	4.57%
Chandauli	2,574	1,952,713	758.75	73.33	0.74	2.85%
Varanasi	1,569	3,682,194	2347.36	139.57	2.85	8.90%
Sant Ravidas Nagar	1,021	1,554,203	1521.79	56.13	0.58	5.50%
Mirzapur	4,596	2,494,533	542.80	72.09	0.88	1.57%
Sonbhadra	6,897	1,862,612	270.07	68.32	5.58	0.99%
Etah	2,468	1,761,152	713.60	70.84	1.48	2.87%
Kanshiram Nagar	2,023	1,438,156	711.05	54.02	0.50	2.67%
<b>Madhya Pradesh</b>						
Alirajpur	3,334	728,677	218.55	25.55	0.11	1.00%
Anuppur	3,810	749,521	196.73	53.65	2.34	1.00%
Ashoknagar	4,743	844,979	178.14	64.26	1.05	1.00%
Balaghat	9,310	1,701,156	182.72	96.40	0.44	1.00%
Barwani	5,426	1,385,659	255.37	40.44	2.80	1.00%
Betul	10,074	1,575,247	156.37	77.68	0.62	1.00%
Bhind	4,478	1,703,562	380.42	62.57	1.16	1.00%
Bhopal	2,770	2,368,145	854.99	82.09	4.52	3.00%
Burhanpur	3,231	756,993	234.29	27.59	0.33	1.00%
Chhatarpur	8,717	1,762,857	202.23	67.40	1.48	1.00%
Chhindwara	11,855	2,090,306	176.33	123.95	1.24	1.00%
Damoh	7,337	1,263,703	172.24	83.03	2.20	1.00%
Datia	2,682	786,375	293.17	36.33	0.38	1.00%
Dewas	7,012	1,563,107	222.92	62.54	1.58	1.00%
Dhar	8,152	2,184,672	267.98	125.80	12.08	2.00%
Dindori	5,802	704,218	121.37	21.32	0.06	0.00%



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)
East Nimar	7,477	1,309,443	175.12	62.29	0.66	1.00%
Guna	6,386	1,240,938	194.32	64.14	1.93	1.00%
Gwalior	4,572	2,030,543	444.15	84.80	2.74	2.00%
Harda	3,338	570,302	170.84	54.60	0.03	2.00%
Hoshangabad	6,698	1,240,975	185.28	57.78	0.86	1.00%
Indore	3,908	3,272,335	837.28	134.24	12.95	3.00%
Jabalpur	5,127	2,460,714	479.99	105.38	7.18	2.00%
Jhabua	3,442	1,024,091	297.56	20.24	0.37	1.00%
Katni	5,106	1,291,684	252.97	48.15	1.84	1.00%
Mandla	7,566	1,053,522	139.25	61.03	1.37	1.00%
Mandsaur	5,551	1,339,832	241.38	70.79	1.45	1.00%
Morena	4,994	1,965,137	393.49	41.84	1.00	1.00%
Narsimhapur	5,155	1,092,141	211.86	50.45	0.42	1.00%
Neemuch	4,306	825,958	191.81	38.20	1.59	1.00%
Panna	7,126	1,016,028	142.59	38.24	1.09	1.00%
Raisen	8,494	1,331,699	156.78	51.62	2.88	1.00%
Rajgarh	6,169	1,546,541	250.68	59.13	0.51	1.00%
Ratlam	4,859	1,454,483	299.35	52.41	1.80	1.00%
Rewa	6,363	2,363,744	371.50	43.03	1.13	1.00%
Sagar	10,301	2,378,295	230.88	131.04	1.99	1.00%
Satna	7,598	2,228,619	293.33	93.05	3.52	1.00%
Sehore	6,573	1,311,008	199.47	45.46	0.80	1.00%
Seoni	8,807	1,378,876	156.57	97.87	0.57	1.00%
Shahdol	5,738	1,064,989	185.61	93.61	2.06	2.00%
Shajapur	6,195	1,512,353	244.11	61.93	0.33	1.00%
Sheopur	6,610	687,952	104.08	35.12	0.61	1.00%
Shivpuri	10,306	1,725,818	167.46	85.39	0.94	1.00%
Sidhi	4,830	1,126,515	233.24	22.09	0.45	0.00%
Singrauli	5,822	1,178,132	202.35	25.14	0.95	0.00%
Tikamgarh	5,052	1,444,920	286.02	61.80	0.13	1.00%
Ujjain	6,097	1,986,597	325.84	110.09	2.97	2.00%
Umaria	4,606	643,579	139.73	35.27	0.05	1.00%
Vidisha	7,312	1,458,212	199.42	65.53	0.72	1.00%
West Nimar	8,017	1,872,413	233.55	81.05	3.68	1.00%
<b>Gujarat</b>						
Ahmadabad	8,108	7,208,200	889.05	214.89	41.78	3.00%
Amreli	7,056	1,513,614	214.53	122.18	4.42	2.00%
Anand	3,205	2,090,276	652.29	76.03	8.60	2.00%
Banas Kantha	10,753	3,116,045	289.79	128.59	1.94	1.00%
Bharuch	6,477	1,550,822	239.43	77.80	18.60	1.00%

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Bhavnagar	9,758	2,877,961	294.94	149.26	7.35	2.00%
Dohad	3,657	2,126,558	581.50	33.71	0.87	1.00%
Gandhinagar	1,652	1,387,478	839.77	46.01	3.08	3.00%
Jamnagar	10,868	2,159,130	198.67	135.41	11.16	1.00%
Junagadh	8,865	2,742,291	309.34	185.87	10.60	2.00%
Kachchh	41,580	2,090,313	50.27	188.30	17.89	0.00%
Kheda	3,955	2,298,934	581.23	91.91	2.45	2.00%
Mahesana	4,396	2,027,727	461.23	112.54	8.23	3.00%
Narmada	2,817	590,379	209.61	31.14	0.61	1.00%
Navsari	2,205	1,330,711	603.39	80.87	3.41	4.00%
Panch Mahals	5,727	2,388,267	417.04	84.57	11.08	1.00%
Patan	5,793	1,342,746	231.77	74.34	1.09	1.00%
Porbandar	2,328	586,062	251.75	41.73	4.49	2.00%
Rajkot	11,259	3,799,770	337.48	217.27	37.24	2.00%
Sabar Kantha	7,400	2,427,346	328.02	123.60	2.09	2.00%
Surat	4,336	6,079,231	1402.16	150.16	35.50	3.00%
Surendranagar	10,431	1,755,873	168.32	112.57	7.42	1.00%
Tapi	3,140	806,489	256.82	53.29	0.81	2.00%
The Dangs	1,762	226,769	128.69	13.88	0.04	1.00%
Vadodara	7,549	4,157,568	550.71	156.76	20.34	2.00%
Valsad	2,950	1,703,068	577.38	82.02	21.89	3.00%
<b>Daman &amp; Diu</b>						
Daman	63	190,855	3024.35	7.78	2.28	12.00%
Diu	28	52,056	1846.55	2.23	0.02	8.00%
<b>Dadra &amp; Nagar Haveli</b>						
Dadra & Nagar Haveli	490.28	342,853	699.31	7.92	7.82	2.00%
<b>Karnataka</b>						
Bagalkot	6,550	1,890,826	288.68	90.39	2.92	1.00%
Bangalore	2,199	9,588,910	4360.27	262.19	27.72	12.00%
Bangalore Rural	2,301	987,257	429.00	46.52	9.83	2.00%
Belgaum	13,427	4,778,439	355.89	228.68	9.92	2.00%
Bellary	8,464	2,532,383	299.21	139.54	6.67	2.00%
Bidar	5,446	1,700,018	312.15	71.12	2.66	1.00%
Bijapur (K)	10,492	2,175,102	207.32	75.85	1.87	1.00%
Chamarajanagar	5,651	1,020,962	180.66	69.79	0.11	1.00%
Chikkaballapura	4,250	1,254,377	295.12	72.96	0.58	2.00%
Chikmagalur	7,200	1,137,753	158.03	112.08	0.61	2.00%
Chitradurga	8,437	1,660,378	196.80	116.65	1.28	1.00%
Dakshina Kannada	4,861	2,083,625	428.65	123.82	6.64	3.00%

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Davanagere	5,922	1,946,905	328.78	137.65	3.10	2.00%
Dharwad	4,256	1,846,993	433.96	90.93	6.01	2.00%
Gadag	4,655	1,065,235	228.82	62.15	2.52	1.00%
Gulbarga	10,960	2,564,892	234.01	105.08	4.86	1.00%
Hassan	6,812	1,776,221	260.75	139.10	3.46	2.00%
Haveri	4,820	1,598,506	331.61	122.48	1.12	3.00%
Kodagu	4,108	554,762	135.05	57.31	0.90	1.00%
Kolar	3,988	1,540,231	386.18	87.98	8.38	2.00%
Koppal	5,569	1,391,292	249.84	71.66	4.13	1.00%
Mandya	4,964	1,808,680	364.33	162.45	5.15	3.00%
Mysore	6,308	2,994,744	474.77	191.86	13.59	3.00%
Raichur	8,446	1,924,773	227.88	108.32	4.08	1.00%
Ramanagara	3,516	1,082,739	307.90	68.77	1.71	2.00%
Shimoga	8,473	1,755,512	207.19	125.20	2.80	1.00%
Tumkur	10,604	2,681,449	252.87	188.59	3.40	2.00%
Udupi	3,580	1,177,908	329.02	31.85	0.98	1.00%
Uttara Kannada	10,270	1,436,847	139.91	84.29	1.88	1.00%
Yadgir	5,276	1,172,985	222.31	44.85	0.52	1.00%
<b>Goa</b>						
North Goa	1,737	817,761	470.67	35.78	1.87	2.00%
South Goa	1,960	639,962	326.53	24.37	1.72	1.00%
<b>Andhra Pradesh</b>						
Adilabad	16,114	2,737,738	169.90	32.37	35.31	0.20%
Anantapur	19,182	4,083,315	212.87	39.53	43.04	0.21%
Chittoor	15,013	4,170,468	277.79	38.32	41.75	0.26%
East Godavari	10,840	5,151,549	475.24	36.69	39.94	0.34%
Guntur	11,400	4,889,230	428.87	39.62	43.24	0.35%
Hyderabad	192	4,010,238	20924.27	5.91	6.39	3.08%
Karimnagar	11,845	3,811,738	321.80	33.68	36.92	0.28%
Khammam	15,968	2,798,214	175.24	42.47	-	0.27%
Krishna	8,754	4,529,009	517.39	48.16	-	0.55%
Kurnool	17,701	4,046,601	228.61	26.74	-	0.15%
Mahbubnagar	18,471	4,042,191	218.84	22.33	-	0.12%
Medak	9,726	3,031,877	311.74	30.42	33.12	0.31%
Nalgonda	14,233	3,483,648	244.76	38.44	-	0.27%
Nizamabad	7,971	2,552,073	320.18	18.92	-	0.24%
Prakasam	17,617	3,392,764	192.59	27.95	-	0.16%
Rangareddy	7,510	5,296,396	705.24	112.25	122.53	1.49%
Sri Potti Sriramulu Nellore	13,213	2,966,082	224.49	23.06	25.74	0.17%

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)
Srikakulam	5,867	2,699,471	460.14	8.66	9.53	0.15%
Visakhapatnam	11,604	4,288,113	369.53	36.14	39.18	0.31%
Vizianagaram	6,169	2,342,868	379.80	7.80	8.39	0.13%
Warangal	12,911	3,522,644	272.85	290.54	7.00	2.25%
West Godavari	7,727	3,934,782	509.24	237.97	10.43	3.08%
Y.S.R.	15,356	2,884,524	187.85	40.15	43.84	0.26%
<b>Bihar</b>						
Araria	2,826	2,806,200	993.12	150.62	0.33	5.33%
Arwal	521	699,563	1343.16	16.61	0.01	3.19%
Aurangabad	3,314	2,511,243	757.82	99.78	0.71	3.01%
Banka	3,055	2,029,339	664.20	98.31	0.05	3.22%
Begusarai	1,946	2,954,367	1518.27	83.39	2.47	4.29%
Bhagalpur	2,578	3,032,226	1176.36	90.88	0.78	3.53%
Bhojpur	2,431	2,720,155	1118.83	89.13	0.50	3.67%
Buxar	1,668	1,707,643	1023.52	66.60	1.01	3.99%
Darbhanga	2,524	3,921,971	1554.09	98.57	0.80	3.91%
Gaya	4,985	4,379,383	878.45	182.63	0.97	3.66%
Gopalganj	2,044	2,558,037	1251.62	123.98	0.30	6.07%
Jamui	3,121	1,756,078	562.75	71.65	0.11	2.30%
Jehanabad	1,060	1,124,176	1060.89	49.26	0.40	4.65%
Kaimur (Bhabua)	3,372	1,626,900	482.45	47.13	1.84	1.40%
Katihar	3,070	3,068,149	999.55	112.79	0.31	3.67%
Khagaria	1,504	1,657,599	1102.23	55.26	0.01	3.67%
Kishanganj	2,012	1,690,948	840.42	92.64	0.18	4.60%
Lakhisarai	1,225	1,000,717	816.97	41.60	0.04	3.40%
Madhepura	1,816	1,994,618	1098.19	70.36	0.03	3.87%
Madhubani	3,525	4,476,044	1269.72	165.12	0.04	4.68%
Munger	1,421	1,359,054	956.59	54.86	0.48	3.86%
Muzaffarpur	3,191	4,778,610	1497.46	181.37	1.87	5.68%
Nalanda	2,378	2,872,523	1207.92	90.99	0.72	3.83%
Nawada	2,504	2,216,653	885.20	74.18	0.23	2.96%
Pashchim Champaran	5,245	3,922,780	747.95	167.90	0.82	3.20%
Patna	3,191	5,772,804	1809.32	172.29	5.53	5.40%
Purba Champaran	3,982	5,082,868	1276.34	266.98	1.20	6.70%
Purnia	3,245	3,273,127	1008.76	153.10	0.10	4.72%
Rohtas	3,850	2,962,593	769.45	118.87	2.16	3.09%
Saharsa	1,677	1,897,102	1130.94	54.84	0.09	3.27%
Samastipur	2,701	4,254,782	1575.26	169.97	0.12	6.29%
Saran	2,686	3,943,098	1467.96	123.02	0.71	4.58%

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)
Sheikhpura	668	634,927	950.84	17.44	0.13	2.61%
Sheohar	444	656,916	1480.71	41.70	0.15	9.40%
Sitamarhi	2,199	3,419,622	1555.04	119.43	0.32	5.43%
Siwan	2,223	3,318,176	1492.72	158.36	0.37	7.12%
Supaul	2,437	2,228,397	914.30	96.49	0.09	3.96%
Vaishali	2,030	3,495,249	1722.04	107.86	0.70	5.31%
<b>Kerala</b>						
Alappuzha	1,423	2,121,943	1491.08	230.06	1.32	16.17%
Ernakulam	3,067	3,279,860	1069.39	273.50	6.12	8.92%
Idukki	4,377	1,107,453	253.02	87.65	0.07	2.00%
Kannur	2,979	2,525,637	847.77	243.68	0.91	8.18%
Kasaragod	1,998	1,302,600	651.93	149.47	1.25	7.48%
Kollam	2,495	2,629,703	1053.91	275.24	1.46	11.03%
Kottayam	2,216	1,979,384	893.34	173.51	0.85	7.83%
Kozhikode	2,353	3,089,543	1312.77	157.94	1.74	6.71%
Malappuram	3,579	4,110,956	1148.75	350.83	1.00	9.80%
Palakkad	4,503	2,810,892	624.20	341.73	2.73	7.59%
Pathanamthitta	2,662	1,195,537	449.12	138.76	1.23	5.21%
Thiruvananthapuram	2,180	3,307,284	1516.92	145.57	5.66	6.68%
Thrissur	3,053	3,110,327	1018.83	325.72	1.89	10.67%
Wayanad	2,149	816,558	379.93	57.74	0.26	2.69%
<b>Lakshadweep</b>						
Lakshadweep	36	64,429	1,741	1.70	0.27	4.65%
<b>Tamil Nadu</b>						
Ariyalur	1,940	752,481	387.95	33.64	2.45	1.73%
Chennai	167	4,681,087	28025.00	93.72	4.42	56.11%
Coimbatore	3,857	3,472,578	900.43	182.35	24.37	4.73%
Cuddalore	3,718	2,600,880	699.48	127.64	7.53	3.43%
Dharmapuri	4,502	1,502,900	333.82	39.76	1.70	0.88%
Dindigul	6,063	2,161,367	356.49	196.03	8.42	3.23%
Erode	6,008	2,259,608	376.09	117.41	9.08	1.95%
Kancheepuram	4,477	3,990,897	891.48	212.63	21.76	4.75%
Kanniyakumari	1,688	1,863,174	1103.51	113.12	0.42	6.70%
Karur	2,908	1,076,588	370.21	71.98	4.25	2.48%
Krishnagiri	5,138	1,883,731	366.63	61.78	12.23	1.20%
Madurai	3,717	3,041,038	818.19	109.33	10.79	2.94%
Nagapattinam	2,567	1,614,069	628.81	112.68	0.95	4.39%
Namakkal	3,425	1,721,179	502.53	79.26	15.24	2.31%
Perambalur	1,747	564,511	323.12	24.31	0.28	1.39%

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Pudukkottai	4,670	1,618,725	346.64	232.27	3.49	4.97%
Ramanathapuram	4,254	1,337,560	314.46	103.34	0.83	2.43%
Salem	5,246	3,480,008	663.39	113.90	18.23	2.17%
Sivaganga	4,102	1,341,250	327.01	148.98	3.13	3.63%
Thanjavur	3,408	2,402,781	704.98	245.74	1.73	7.21%
The Nilgiris	2,576	735,071	285.39	34.30	0.67	1.33%
Theni	2,875	1,243,684	432.62	57.12	2.75	1.99%
Thiruvallur	3,401	3,725,697	1095.45	168.85	23.10	4.96%
Thiruvarur	2,117	1,268,094	599.07	125.81	0.47	5.94%
Thoothukkudi	4,636	1,738,376	375.01	155.27	5.17	3.35%
Tiruchirappalli	4,499	2,713,858	603.16	180.73	3.53	4.02%
Tirunelveli	6,819	3,072,880	450.61	227.48	3.45	3.34%
Tiruppur	5,860	2,471,222	421.74	174.60	21.28	2.98%
Tiruvannamalai	6,192	2,468,965	398.73	105.21	1.54	1.70%
Vellore	6,077	3,928,106	646.38	142.30	5.80	2.34%
Viluppuram	7,290	3,463,284	475.11	183.51	3.35	2.52%
Virudhunagar	4,253	1,943,309	456.89	123.38	9.68	2.90%
<b>Arunachal Pradesh</b>						
Anjaw	6,808	21,089	3.10	2.14	0.00	0.03%
Changlang	5,536	147,951	26.73	15.28	0.00	0.28%
Dibang Valley	10,633	7,948	0.75	4.22	0.00	0.04%
East Kameng	6,806	78,413	11.52	5.84	0.00	0.09%
East Siang	3,989	99,019	24.82	20.95	0.00	0.53%
Kurung Kumey	7,240	89,717	12.39	1.85	0.00	0.03%
Lohit	4,689	145,538	31.04	20.16	0.00	0.43%
Lower Dibang Valley	4,036	53,986	13.38	12.36	0.00	0.31%
Lower Subansiri	2,965	82,839	27.94	25.34	0.00	0.86%
Papum Pare	3,956	176,385	44.58	11.81	0.13	0.30%
Tawang	2,446	49,950	20.42	9.51	0.00	0.39%
Tirap	2,345	111,997	47.76	16.66	0.00	0.71%
Upper Siang	7,572	35,289	4.66	7.49	0.00	0.10%
Upper Subansiri	6,984	83,205	11.91	15.36	0.00	0.22%
West Kameng	5,444	87,013	15.98	8.50	0.00	0.16%
West Siang	8,661	112,272	12.96	17.90	0.00	0.21%
<b>Assam</b>						
Baksa	2,604	953,773	366.29	167.40	0.00	6.43%
Barpeta	2,416	1,693,190	700.78	117.46	0.01	4.86%
Bongaigaon	1,152	732,639	636.19	61.23	0.05	5.32%
Cachar	4,100	1,736,319	423.45	107.37	0.39	2.62%



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Chirang	2,047	481,818	235.38	57.82	0.80	2.82%
Darrang	1,700	908,090	534.17	145.14	0.00	8.54%
Dhemaji	2,728	688,077	252.23	87.89	0.03	3.22%
Dhubri	2,362	1,948,632	824.83	116.92	0.00	4.95%
Dibrugarh	3,725	1,327,748	356.46	215.82	0.22	5.79%
Dima Hasao	5,297	213,529	40.31	49.13	0.05	0.93%
Goalpara	2,101	1,008,959	480.22	111.00	0.00	5.28%
Golaghat	3,844	1,058,674	275.41	82.77	1.13	2.15%
Hailakandi	1,438	659,260	458.56	77.96	0.10	5.42%
Jorhat	3,104	1,091,295	351.55	154.74	1.12	4.99%
Kamrup Metro	1,063	1,260,419	1185.19	122.22	7.69	11.50%
Kamrup Rural	3,317	1,517,202	457.45	233.35	0.29	7.03%
Karbi Anglong	11,279	965,280	85.58	69.80	0.18	0.62%
Karimganj	1,960	1,217,002	621.02	91.14	0.00	4.65%
Kokrajhar	3,310	886,999	267.95	110.47	0.02	3.34%
Lakhimpur	3,277	1,040,644	317.59	248.02	0.23	7.57%
Morigaon	1,626	957,853	589.05	88.59	0.00	5.45%
Nagaon	4,362	2,826,006	647.84	160.65	0.28	3.68%
Nalbari	1,118	769,919	688.81	157.56	0.02	14.09%
Sivasagar	2,906	1,150,253	395.83	205.58	0.60	7.07%
Sonitpur	5,655	1,925,975	340.59	300.24	0.51	5.31%
Tinsukia	4,222	1,316,948	311.91	1.44	0.09	0.03%
Udalguri	2,163	832,769	385.05	224.17	0.00	10.36%
<b>Chhattisgarh</b>						
Bastar	10,589	1,411,644	133.31	120.66	0.35	1.14%
Bijapur (Ch)	9,131	255,180	27.95	37.30	0.07	0.41%
Bilaspur (Ch)	8,418	2,662,077	316.23	170.31	2.30	2.02%
Dakshin Bastar Dantewada	8,587	532,791	62.04	43.19	0.72	0.50%
Dhamtari	4,136	799,199	193.25	76.46	0.46	1.85%
Durg	8,619	3,343,079	387.88	245.41	10.02	2.85%
Janjgir - Champa	3,922	1,620,632	413.24	128.52	2.27	3.28%
Jashpur	5,967	852,043	142.79	44.64	0.00	0.75%
Kawardha	4,237	822,239	194.04	45.26	0.20	1.07%
Korba	6,695	1,206,563	180.23	78.22	3.79	1.17%
Koriya	6,696	659,039	98.42	23.72	0.16	0.35%
Mahasamund	4,829	1,032,275	213.75	96.08	1.21	1.99%
Narayanpur	3,929	140,206	35.69	10.64	0.01	0.27%
Raigarh (Ch)	7,175	1,493,627	208.16	100.76	3.43	1.40%
Raipur	12,577	4,062,160	322.98	272.52	15.97	2.17%

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Rajnandgaon	8,138	1,537,520	188.93	132.76	1.97	1.63%
Surguja	15,993	2,361,329	147.65	110.93	0.36	0.69%
Uttar Bastar Kanker	7,259	748,593	103.13	99.95	0.06	1.38%
<b>Jharkhand</b>						
Bokaro	2,976	2,061,918	692.89	174.37	8.51	5.86%
Chatra	3,815	1,042,304	273.23	60.62	0.33	1.59%
Deogarh	2,571	1,491,879	580.23	96.83	0.51	3.77%
Dhanbad	2,110	2,682,662	1271.17	178.53	5.25	8.46%
Dumka	3,911	1,321,096	337.77	128.33	0.45	3.28%
Garhwa	4,162	1,322,387	317.71	68.80	0.54	1.65%
Giridih	5,124	2,445,203	477.23	165.43	1.01	3.23%
Godda	2,349	1,311,382	558.20	45.97	0.35	1.96%
Gumla	5,482	1,025,656	187.10	84.15	0.61	1.54%
Hazaribagh	3,588	1,734,005	483.32	77.46	0.82	2.16%
Jamtara	1,881	790,207	420.03	42.83	0.24	2.28%
Khunti	2,548	530,299	208.15	31.77	0.74	1.25%
Kodarma	2,613	717,169	274.50	67.54	0.83	2.58%
Latehar	4,386	725,673	165.46	80.90	0.44	1.84%
Lohardaga	1,537	461,738	300.39	44.85	0.28	2.92%
Pakur	1,888	899,200	476.37	30.57	0.06	1.62%
Palamu	4,484	1,936,319	431.84	101.22	0.68	2.26%
Paschimi Singhbhum	7,439	1,501,619	201.85	129.04	1.98	1.73%
Purbi Singhbhum	3,685	2,291,032	621.70	122.52	8.05	3.32%
Ramgarh	1,446	949,159	656.36	58.73	3.07	4.06%
Ranchi	5,299	2,912,022	549.55	166.91	11.30	3.15%
Sahibganj	2,282	1,150,038	503.93	32.15	0.22	1.41%
Saraikela - Kharswan	2,743	1,063,458	387.65	115.52	4.61	4.21%
Simdega	3,857	599,813	155.50	27.60	0.02	0.72%
<b>Manipur</b>						
Bishnupur	525	240,363	457.47	27.48	0.07	5.23%
Chandel	3,494	144,028	41.23	5.93	0.16	0.17%
Churachandpur	4,990	271,274	54.36	21.07	0.19	0.42%
Imphal East	795	452,661	569.49	29.77	0.56	3.74%
Imphal West	533	514,683	964.76	38.78	0.84	7.28%
Senapati	3,814	354,972	93.07	12.85	0.04	0.34%
Tamenglong	4,575	140,143	30.63	11.94	0.00	0.26%
Thoubal	782	420,517	538.00	44.57	0.21	5.70%
Ukhrul	4,900	183,115	37.37	6.46	0.00	0.13%

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)
<b>Meghalaya</b>						
East Garo Hills	3,097	317,618	102.55	29.22	0.01	0.94%
East Khasi Hills	3,045	824,059	270.66	34.83	1.45	1.14%
Jaintia Hills	4,104	392,852	95.72	22.31	0.20	0.54%
Ri Bhoi	2,544	258,380	101.57	10.11	0.13	0.40%
South Garo Hills	1,951	142,574	73.08	7.46	0.01	0.38%
West Garo Hills	3,624	642,923	177.43	16.65	0.07	0.46%
West Khasi Hills	5,582	385,601	69.08	39.58	0.06	0.71%
<b>Mizoram</b>						
Aizawl	3,205	404,054	126.00	8.05	0.02	0.25%
Champhai	3,564	125,370	35.00	2.86	0.00	0.08%
Kolasib	1,659	83,054	50.00	1.81	0.00	0.11%
Lawngtlai	1,926	117,444	61.00	1.76	0.00	0.09%
Lunglei	4,509	154,094	34.00	3.49	0.00	0.08%
Mamit	2,844	85,757	30.00	2.06	0.00	0.07%
Saiha	2,042	56,366	28.00	1.40	0.00	0.07%
Serchhip	1,344	64,875	48.00	1.46	0.00	0.11%
<b>Nagaland</b>						
Mon	2,386	39,538	16.57	10.20	0.00	0.43%
Dimapur	841	49,595	59.01	23.61	0.61	2.81%
Kiphire	1,205	14,335	11.90	4.56	0.00	0.38%
Kohima	1,678	36,157	21.54	15.70	0.02	0.94%
Longleng	564	8,846	15.69	2.11	0.00	0.37%
Mokokchung	1,761	20,046	11.38	15.35	0.03	0.87%
Peren	1,891	15,221	8.05	5.24	0.00	0.28%
Phek	2,256	27,538	12.21	7.70	0.00	0.34%
Tuensang	2,487	34,931	14.05	9.39	0.02	0.38%
Wokha	1,778	19,673	11.07	9.63	0.00	0.54%
Zunheboto	1,385	20,101	14.52	10.37	0.00	0.75%
<b>Orissa</b>						
Anugul	6,548	1,271,703	194.22	102.64	4.54	1.57%
Balangir	6,648	1,648,574	247.97	67.70	1.14	1.02%
Baleshwar	3,947	2,317,419	587.17	285.94	5.41	7.24%
Bargarh	5,951	1,478,833	248.52	59.78	1.25	1.00%
Baudh	3,173	439,917	138.64	26.54	0.25	0.84%
Bhadrak	2,611	1,506,522	576.96	77.86	0.61	2.98%
Cuttack	3,976	2,618,708	658.68	169.16	6.83	4.25%
Debagarh	3,016	312,164	103.49	26.33	0.02	0.87%
Dhenkanal	4,589	1,192,948	259.96	87.20	2.55	1.90%
Gajapati	4,218	575,880	136.54	6.08	0.12	0.14%

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)
Ganjam	8,593	3,520,151	409.64	99.70	5.48	1.16%
Jagatsinghapur	1,793	1,136,604	634.05	120.38	1.35	6.71%
Jajapur	2,993	1,826,275	610.16	115.01	2.38	3.84%
Jharsuguda	2,120	579,499	273.31	28.25	2.31	1.33%
Kalahandi	8,039	1,573,054	195.67	55.77	1.55	0.69%
Kandhamal	8,195	731,952	89.32	39.74	0.24	0.48%
Kendrapara	2,656	1,439,891	542.17	72.39	0.05	2.73%
Kendujhar	8,566	1,802,777	210.46	135.59	0.82	1.58%
Khordha	2,976	2,246,341	754.84	126.99	6.76	4.27%
Koraput	8,496	1,376,934	162.07	70.20	3.54	0.83%
Malkangiri	5,826	612,727	105.17	29.24	0.15	0.50%
Mayurbhanj	10,757	2,513,895	233.70	246.42	1.23	2.29%
Nabarangapur	5,532	1,218,762	220.30	94.94	0.47	1.72%
Nayagarh	3,999	962,215	240.59	41.88	0.06	1.05%
Nuapada	3,911	606,490	155.09	19.43	0.87	0.50%
Puri	3,606	1,697,983	470.83	69.14	0.84	1.92%
Rayagada	7,485	961,959	128.52	24.63	0.95	0.33%
Sambalpur	6,794	1,044,410	153.73	63.36	2.24	0.93%
Subarnapur	2,412	652,107	270.35	26.04	0.12	1.08%
Sundargarh	9,972	2,080,664	208.64	135.53	11.25	1.36%
<b>Sikkim</b>						
East Sikkim	998	281,293	281.82	10.77	0.09	1.08%
North Sikkim	4,450	43,354	9.74	2.68	0.00	0.06%
South Sikkim	767	146,742	191.29	7.60	0.41	0.99%
West Sikkim	1,254	136,299	108.69	7.16	0.00	0.57%
<b>Tripura</b>						
West Tripura	2,870	1,724,619	601.00	25.74	0.06	0.90%
South Tripura	2,996	875,144	292.00	14.91	0.00	0.50%
North Tripura	1,989	693,281	349.00	10.33	0.00	0.52%
Dhalai	2,170	377,988	174.00	6.37	0.00	0.29%
<b>West Bengal</b>						
Bankura	7,154	6,882	0.96	233.19	4.68	3.26%
Bardhaman	7,311	7,024	0.96	530.06	34.60	7.25%
Birbhum	4,733	4,545	0.96	255.61	2.85	5.40%
Dakshin Dinajpur	2,342	2,219	0.95	104.09	1.30	4.44%
Darjiling	3,255	3,149	0.97	96.13	1.23	2.95%
Haora	1,460	1,467	1.01	227.33	18.86	15.57%
Hugli	3,279	3,149	0.96	313.56	10.51	9.56%
Jalpaiguri	6,452	6,227	0.97	261.79	1.59	4.06%
Koch Bihar	3,563	3,387	0.95	203.15	0.42	5.70%

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)
Kolkata	99	185	1.87	54.47	10.46	55.02%
Maldah	3,746	3,733	1.00	220.59	0.81	5.89%
Murshidabad	5,708	5,324	0.93	340.11	2.98	5.96%
Nadia	4,087	3,927	0.96	291.01	2.96	7.12%
North Twenty Four Parganas	4,234	4,094	0.97	504.34	10.47	11.91%
Paschim Medinipur	9,737	9,345	0.96	639.05	7.53	6.56%
Purba Medinipur	4,137	4,736	1.14	785.18	15.49	18.98%
Puruliya	6,457	6,259	0.97	223.99	0.98	3.47%
South Twenty Four Parganas	8,192	9,960	1.22	661.85	11.57	8.08%
Uttar Dinajpur	3,236	3,140	0.97	148.91	0.79	4.60%

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

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

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

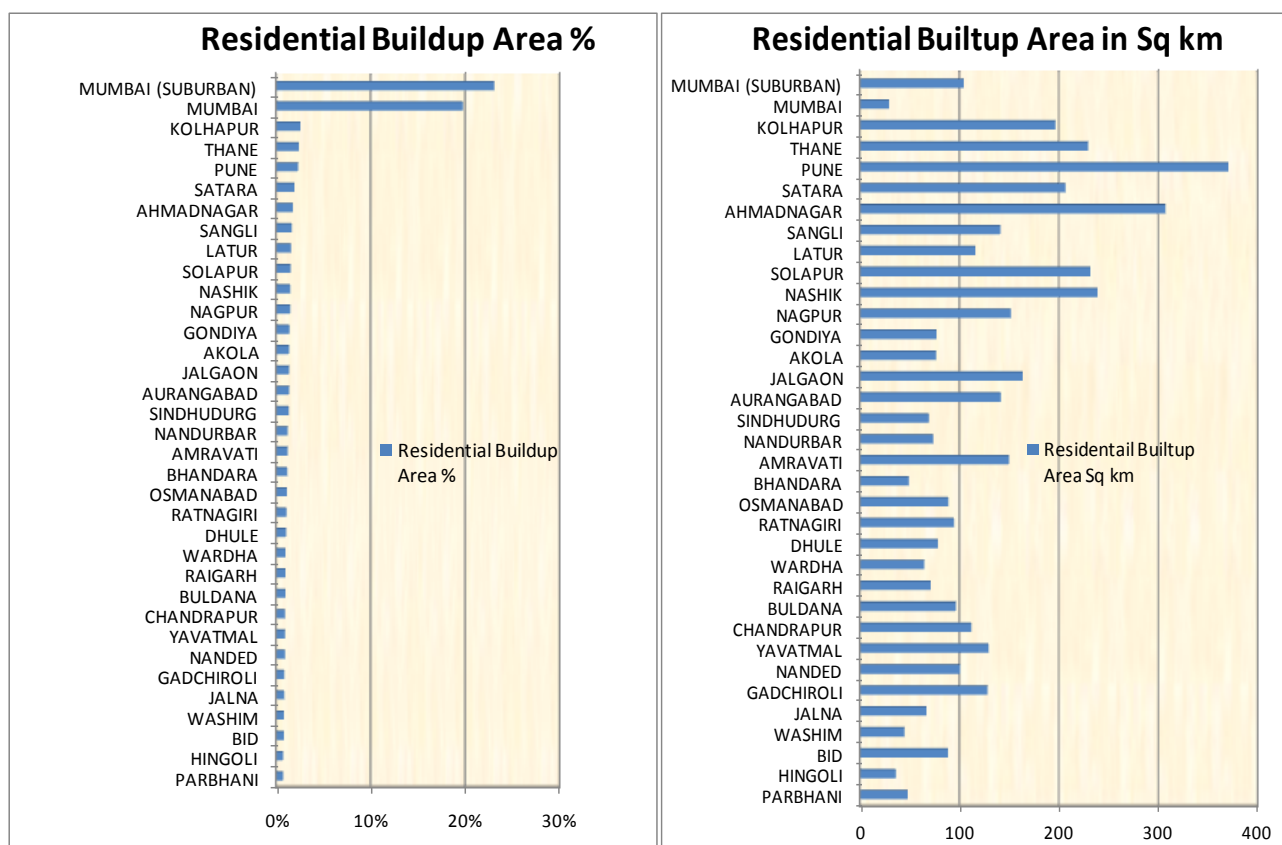
Population density	Ranking	Built-up area %	Ranking
>10,000	5	>35 %	5
1,000 to 10,000	4	14% to 35 %	4
500 to 1,000	3	2% to 14 %	3
200 to 500	2	1% to 2 %	2
<200	1	<1 %	1
Residential Built-up area sq km	Ranking	Industrial area sq km	Ranking
>190	5	>10	5
100 to 190	4	5 to 10	4
50 to 100	3	2 to 5	3
20 to 50	2	1 to 2	2
<20	1	< 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 5<sup>th</sup> 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).

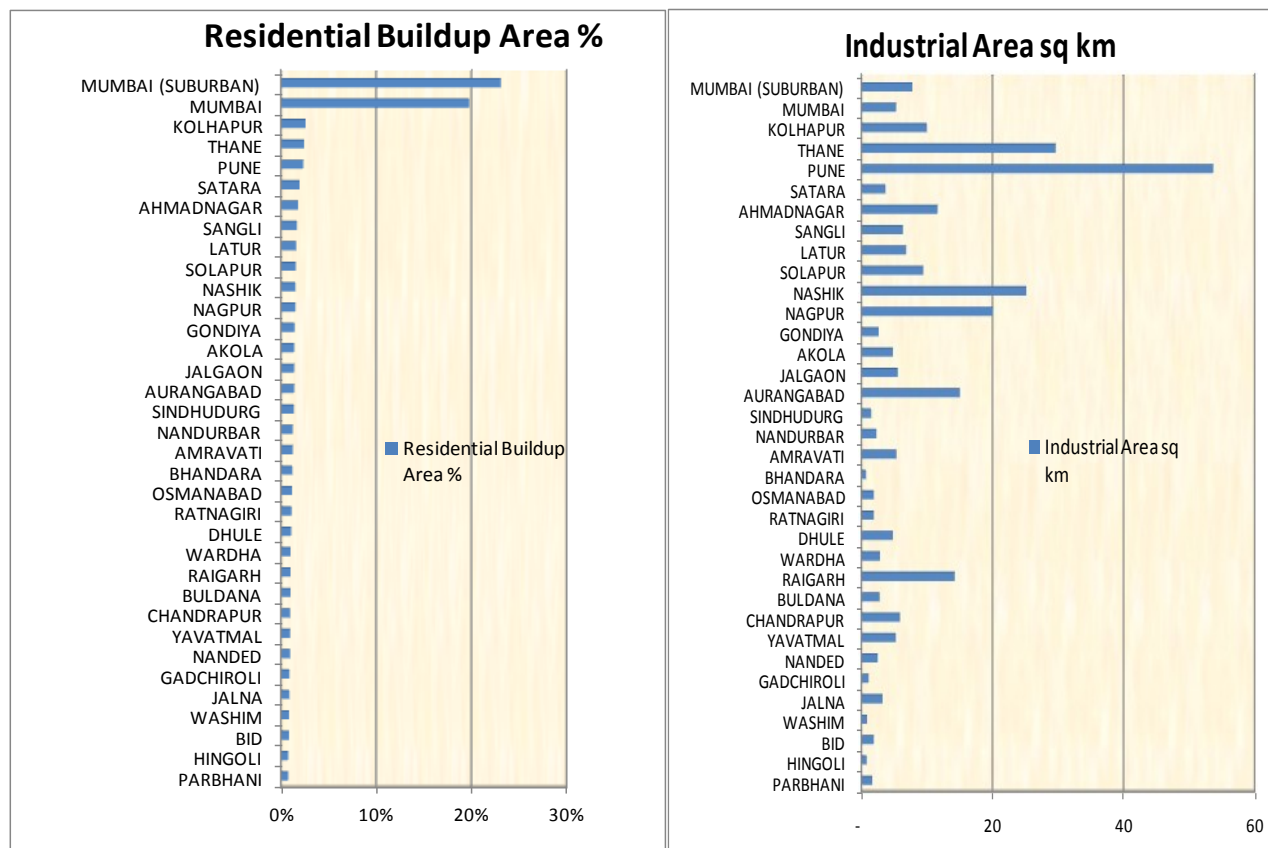


**Figure 3-8 : Example of comparison of district level rankings for residential built-up area percentages and absolute areas (in sq km). The example shows a comparison for all 35 districts of Maharashtra State**

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 States/UTs**

District		Population Density Ranking	Res Built-up Area sq km Ranking	Res Built-up Area Percentage Ranking	Industrial Area Ranking	Integrated Ranking	Overall District Risk Ranking
<b>Jammu &amp; Kashmir</b>							
	Kupwara	2	2	2	1	6.9	Medium
	Badgam	3	3	3	1	8.5	High
	Leh (Ladakh)	1	2	1	1	5.5	Low
	Kargil	1	1	1	1	5.2	Low
	Punch	2	1	1	1	5.9	Low
	Rajouri	2	1	1	1	5.9	Low
	Kathua	2	2	2	2	7.2	Medium
	Baramula	3	3	3	1	8.4	High
	Bandipore	1	2	1	1	5.9	Low
	Srinagar	4	3	4	2	10.1	Very high
	Ganderbal	2	2	2	1	7	Medium
	Pulwama	3	2	3	1	8.1	Medium
	Shupiyan	3	1	3	1	7.5	Medium
	Anantnag	2	2	1	1	6.6	Low
	Kulgam	2	1	2	1	6.4	Low
	Doda	1	1	1	1	5.4	Low
	Ramban	2	1	1	1	5.9	Low
	Kishtwar	1	1	1	1	5.5	Low
	Udhampur	2	2	2	1	6.6	Medium
	Reasi	1	1	1	1	5.4	Low
	Jammu	3	4	3	2	9.2	Very high
	Samba	2	2	3	3	8.4	High
<b>Delhi</b>							
	North West	4	3	4	5	10.2	Very high
	North	5	2	5	2	9.3	Very high
	North East	5	2	5	2	9.3	Very high
	East	5	2	5	2	9.3	Very high
	New Delhi	4	1	5	1	7.8	High
	Central	5	1	5	1	8.3	High
	West	5	3	5	3	10.2	Very high
	South West	4	3	4	4	9.7	Very high
	South	5	3	4	4	10.3	Very high
<b>Rajasthan</b>							
	Ganganagar	1	5	3	4	8.5	Very high
	Hanumangarh	1	5	3	3	7.9	High

District		Population Density Ranking	Res Built-up Area sq km Ranking	Res Built-up Area Percentage Ranking	Industrial Area Ranking	Integrated Ranking	Overall District Risk Ranking
	Bikaner	1	5	1	4	7.8	High
	Churu	1	5	2	1	6.5	Medium
	Jhunjhunun	2	4	2	2	6.9	Medium
	Alwar	2	4	2	5	8.6	Very high
	Bharatpur	3	3	2	2	7.2	Medium
	Dhaulpur	2	2	2	1	5.5	Low
	Karauli	2	2	1	1	4.9	Low
	Sawai Madhopur	2	3	2	1	5.9	Medium
	Dausa	2	2	2	2	5.9	Medium
	Jaipur	3	5	3	5	9.9	Very high
	Sikar	2	4	2	2	6.9	Medium
	Nagaur	1	5	2	3	7.5	High
	Jodhpur	1	5	2	5	8.6	Very high
	Jaisalmer	1	4	1	3	6.8	Medium
	Barmer	1	4	1	3	6.8	Medium
	Jalor	1	3	1	2	5.9	Low
	Sirohi	2	3	2	3	7	Medium
	Pali	1	4	2	4	7.6	High
	Ajmer	2	4	2	4	8	High
	Tonk	1	3	2	1	5.5	Low
	Bundi	1	3	1	1	5.1	Low
	Bhilwara	2	4	1	4	7.6	High
	Rajsamand	2	2	1	5	7.1	Medium
	Dungarpur	2	2	1	1	4.9	Low
	Banswara	2	1	1	2	4.8	Low
	Chittaurgarh	1	3	1	4	6.6	Medium
	Kota	2	4	3	5	9.1	Very high
	Baran	1	4	2	3	7.1	Medium
	Jhalawar	2	4	3	4	8.6	Very high
	Udaipur	2	4	1	5	8.1	High
	Pratapgarh	2	2	1	1	5	Low
<b>Maharashtra</b>							
	Nandurbar	2	3	2	3	7	Medium
	Dhule	2	3	2	3	7	Medium
	Jalgaon	2	4	2	4	7.9	High
	Buldana	2	3	1	3	6.3	Medium
	Akola	2	3	2	3	6.8	Medium

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
	Washim	2	2	1	1	4.8	Low
	Amravati	2	4	2	4	7.9	High
	Wardha	2	3	2	3	6.7	Medium
	Nagpur	2	4	2	5	8.2	High
	Bhandara	2	2	2	1	5.1	Low
	Gondiya	2	3	2	3	6.6	Medium
	Gadchiroli	1	4	1	2	5.7	Low
	Chandrapur	1	4	1	4	6.7	Medium
	Yavatmal	2	4	1	4	7.2	Medium
	Nanded	2	4	1	3	6.7	Medium
	Hingoli	2	2	1	1	4.8	Low
	Parbhani	2	2	1	2	5.3	Low
	Jalna	2	3	1	3	6.3	Medium
	Aurangabad	2	4	2	5	8.3	High
	Nashik	2	5	2	5	9	Very high
	Thane	4	5	3	5	10.2	Very high
	Mumbai (Suburban)	5	4	4	4	10.3	Very high
	Mumbai	5	2	4	4	9.3	Very high
	Raigarh	2	3	2	5	7.9	High
	Pune	3	5	3	5	9.8	Very high
	Ahmadnagar	2	5	2	5	9	Very high
	Bid	2	3	1	2	5.9	Medium
	Latur	2	4	2	4	7.8	High
	Osmanabad	2	3	2	2	6.5	Medium
	Solapur	2	5	2	4	8.4	Very high
	Satara	2	5	2	3	8.4	High
	Ratnagiri	1	3	2	2	5.9	Low
	Sindhudurg	1	3	2	2	5.6	Low
	Kolhapur	3	5	3	5	9.6	Very high
	Sangli	2	4	2	4	7.5	High
Andaman & Nicobar Islands							
	Nicobars	1	1	1	1	4.2	Low
	North & Middle Andaman	1	2	1	1	4.7	Low
	South Andaman	1	2	1	1	4.7	Low
Puducherry UT							
	Yanam	4	1	4	1	7.2	Medium

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
	Puducherry	4	2	4	2	8	High
	Mahe	4	1	4	1	6.6	Medium
	Karaikal	4	2	4	1	7.3	Medium
<b>Himachal Pradesh</b>							
	Chamba	1	1	1	1	7.1	Medium
	Kangra	2	1	2	1	7.47	Medium
	Lahul & Spiti	1	1	1	1	7.27	Medium
	Kullu	1	1	1	1	7.67	High
	Mandi	2	1	1	1	7.71	High
	Hamirpur	2	2	1	1	7.19	Medium
	Una	2	3	2	1	8.16	High
	Bilaspur	2	1	1	1	7.26	Medium
	Solan	2	2	2	4	8.51	Very high
	Sirmaur	1	1	1	1	6.95	Medium
	Shimla	1	1	1	1	7.63	High
	Kinnaur	1	1	1	1	7.26	Medium
<b>Punjab</b>							
	Gurdaspur	3	2	3	1	6.09	Medium
	Kapurthala	2	2	1	1	5.47	Low
	Jalandhar	3	2	2	1	5.96	Low
	Hoshiarpur	2	2	2	1	5.72	Low
	Shahid Bhagat Singh Nagar	2	2	1	1	5.5	Low
	Fatehgarh Sahib	3	2	1	1	5.73	Low
	Ludhiana	3	2	3	2	6.31	Medium
	Moga	2	2	2	1	5.35	Low
	Firozpur	2	1	2	1	4.99	Low
	Muktsar	2	1	2	1	5.03	Low
	Faridkot	2	2	1	1	5.1	Low
	Bathinda	2	1	2	1	5.08	Low
	Mansa	2	1	1	1	4.78	Low
	Patiala	3	2	2	1	5.71	Low
	Amritsar	3	2	3	1	6.2	Medium
	Tarn Taran	2	1	2	1	5.2	Low
	Rupnagar	2	2	1	1	5.5	Low
	Sahibzada Ajit Singh Nagar	3	2	2	1	6	Medium
	Sangrur	2	2	2	1	5.35	Low



District		Population Density Ranking	Res Built-up Area sq km Ranking	Res Built-up Area Percentage Ranking	Industrial Area Ranking	Integrated Ranking	Overall District Risk Ranking
	Barnala	2	2	1	1	5.1	Low
<b>Chandigarh</b>							
	Chandigarh	4	4	1	1	6.5	Medium
<b>Uttarakhand</b>							
	Uttarkashi	1	1	1	1	7.27	Medium
	Chamoli	1	1	1	1	7.42	Medium
	Rudra Prayag	1	1	1	1	7.24	Medium
	Tehri Garhwal	1	1	2	1	7.36	Medium
	Dehradun	3	3	3	2	8.56	Very high
	Garhwal	1	1	2	1	7.21	Medium
	Pithoragarh	1	1	1	1	7.59	High
	Bageshwar	1	1	1	1	7.58	High
	Almora	1	2	2	1	7.87	High
	Champawat	1	1	1	1	7.52	High
	Nainital	2	2	2	2	8.25	High
	Udham Singh Nagar	3	3	3	5	9.9	Very high
	Haridwar	3	3	3	4	9.19	Very high
<b>Haryana</b>							
	Panchkula	3	2	1	1	5.75	Low
	Ambala	3	2	2	1	5.92	Low
	Yamuna Nagar	3	2	2	1	5.93	Low
	Kurukshetra	3	2	2	1	5.6	Low
	Kaithal	2	2	2	1	5.35	Low
	Karnal	3	2	2	1	5.6	Low
	Panipat	3	2	2	1	5.6	Low
	Sonapat	3	2	2	1	5.6	Low
	Jind	2	2	2	1	5.35	Low
	Fatehabad	2	1	2	1	4.87	Low
	Sirsa	2	1	2	1	4.7	Low
	Hisar	2	1	2	1	4.23	Low
	Bhiwani	2	1	2	1	4.34	Low
	Rohtak	3	2	2	1	5.53	Low
	Jhajjar	3	2	2	1	5.07	Low
	Mahendragarh	2	1	1	1	4.48	Low
	Rewari	3	2	1	1	5.35	Low
	Gurgaon	4	3	2	1	6.38	Medium
	Mewat	3	2	1	1	5.75	Low

District		Population Density Ranking	Res Built-up Area sq km Ranking	Res Built-up Area Percentage Ranking	Industrial Area Ranking	Integrated Ranking	Overall District Risk Ranking
	Faridabad	4	3	2	1	6.5	Medium
	Palwal	3	2	2	1	6	Medium
<b>Uttar Pradesh</b>							
	Saharanpur	3	3	4	3	7.07	Medium
	Muzaffarnagar	4	3	4	3	7.28	Medium
	Bijnor	3	1	1	1	5.5	Low
	Moradabad	4	3	4	3	7.5	High
	Rampur	3	3	3	2	6.75	Medium
	Jyotiba Phule Nagar	3	3	3	3	7	Medium
	Meerut	4	3	4	4	7.75	High
	Baghpat	3	3	3	2	6.5	Medium
	Ghaziabad	4	3	4	5	8	High
	Gautam Buddha Nagar	4	3	3	5	7.75	High
	Bulandshahr	3	3	4	3	7.25	Medium
	Aligarh	3	3	4	2	7	Medium
	Mahamaya Nagar	3	3	3	1	6.42	Medium
	Mathura	3	3	4	4	7.49	Medium
	Agra	4	3	4	4	7.34	Medium
	Firozabad	4	3	3	3	6.85	Medium
	Mainpuri	3	3	3	2	6.35	Medium
	Budaun	3	3	4	3	7.11	Medium
	Bareilly	4	3	4	3	7.48	Medium
	Pilibhit	3	2	3	1	6.22	Medium
	Shahjahanpur	3	3	3	3	6.65	Medium
	Kheri	3	2	4	3	6.82	Medium
	Sitapur	3	3	4	1	6.35	Medium
	Hardoi	3	3	4	2	6.6	Medium
	Unnao	3	3	4	3	6.83	Medium
	Lucknow	4	3	5	3	7.35	Medium
	Rae Bareli	3	3	4	3	6.81	Medium
	Farrukhabad	3	3	3	3	6.6	Medium
	Kannauj	3	3	3	1	6.1	Medium
	Etawah	3	3	3	2	6.07	Medium
	Auraiya	3	3	3	3	6.28	Medium
	Kanpur Dehat	3	3	3	2	5.98	Low
	Kanpur Nagar	4	3	4	5	7.32	Medium

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
	Jalaun	2	2	3	2	5.45	Low
	Jhansi	2	2	3	3	5.7	Low
	Lalitpur	2	1	2	1	4.21	Low
	Hamirpur	2	1	1	1	6.94	Medium
	Mahoba	2	2	2	1	4.95	Low
	Banda	2	2	3	4	5.95	Low
	Chitrakoot	2	2	2	1	4.95	Low
	Fatehpur	3	3	4	1	5.95	Low
	Pratapgarh	3	3	4	1	6.27	Medium
	Kaushambi	3	3	3	1	5.7	Low
	Allahabad	4	3	5	3	6.96	Medium
	Barabanki	3	3	4	2	6.6	Medium
	Faizabad	3	3	3	1	6.1	Medium
	Ambedkar Nagar	4	3	3	1	6.35	Medium
	Sultanpur	3	3	4	3	6.85	Medium
	Bahraich	3	3	4	1	6.58	Medium
	Shrawasti	2	3	3	1	6.19	Medium
	Balrampur	3	3	3	1	6.48	Medium
	Gonda	3	3	4	1	6.39	Medium
	Siddharthnagar	3	3	4	1	6.75	Medium
	Basti	3	3	3	1	6.16	Medium
	Sant Kabir Nagar	3	3	3	1	6.27	Medium
	Maharajganj	3	3	4	3	7.25	Medium
	Gorakhpur	4	3	4	3	7.26	Medium
	Kushinagar	4	3	3	1	6.75	Medium
	Deoria	4	3	3	1	6.48	Medium
	Azamgarh	4	3	5	1	6.85	Medium
	Mau	4	3	3	1	6.35	Medium
	Ballia	4	3	4	1	6.6	Medium
	Jaunpur	4	3	5	2	7.09	Medium
	Ghazipur	4	3	4	1	6.6	Medium
	Chandauli	3	3	3	1	6.02	Medium
	Varanasi	4	3	4	3	7.08	Medium
	Sant Ravidas Nagar	4	3	3	1	5.96	Low
	Mirzapur	3	2	3	1	5.49	Low
	Sonbhadra	2	1	3	4	5.5	Low
	Etah	3	3	3	2	6.35	Medium

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
	Kanshiram Nagar	3	3	3	1	6.18	Medium
<b>Madhya Pradesh</b>							
	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
	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

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
	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
	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

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
	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
<b>Daman &amp; Diu</b>							
	Daman	4	1	4	3	7	Medium
	Diu	4	1	3	3	6	Medium
<b>Dadra &amp; Nagar Haveli</b>							
	Dadra & Nagar Haveli	3	1	2	4	6	Medium
<b>Karnataka</b>							
	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
	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



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
	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
<b>Goa</b>							
	North Goa	2	2	3	3	6	Medium
	South Goa	2	2	2	3	6	Medium
<b>Andhra Pradesh</b>							
	Adilabad	1	2	1	5	6	Medium
	Anantapur	2	2	1	5	6	Medium
	Chittoor	2	2	1	5	6	Medium
	East Godavari	2	2	1	5	7	Medium
	Guntur	2	2	1	5	6	Medium
	Hyderabad	5	1	3	4	8	High
	Karimnagar	2	2	1	5	7	Medium
	Khammam	1	2	1	1	3	Low
	Krishna	3	2	2	1	5	Low
	Kurnool	2	2	1	1	4	Low
	Mahbubnagar	2	2	1	1	4	Low
	Medak	2	2	1	5	7	Medium
	Nalgonda	2	2	1	1	4	Low
	Nizamabad	2	1	1	1	4	Low
	Prakasam	1	2	1	1	3	Low
	Rangareddy	3	4	2	5	9	Very high
	Sri Potti Sriramulu Nellore	2	2	1	5	7	Medium
	Srikakulam	2	1	1	4	5	Low
	Visakhapatnam	2	2	1	5	6	Medium
	Vizianagaram	2	1	1	4	5	Low
	Warangal	2	5	2	4	8	High
	West Godavari	3	5	3	5	9	Very high
	Y.S.R.	1	2	1	5	6	Medium
<b>Bihar</b>							
	Araria	3	4	3	1	8	High
	Arwal	4	1	3	1	7	Medium
	Aurangabad	3	4	3	1	7	Medium

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
	Banka	3	3	3	1	7	Medium
	Begusarai	4	3	3	3	9	Very high
	Bhagalpur	4	3	3	1	7	Medium
	Bhojpur	4	3	3	1	8	High
	Buxar	4	3	3	2	8	High
	Darbhanga	4	3	3	1	8	High
	Gaya	3	4	3	1	7	Medium
	Gopalganj	4	4	3	1	8	High
	Jamui	3	3	2	1	7	Medium
	Jehanabad	4	3	3	1	8	High
	Kaimur (Bhabua)	2	2	2	2	6	Medium
	Katihar	4	4	3	1	8	High
	Khagaria	4	3	3	1	8	High
	Kishanganj	3	3	3	1	7	Medium
	Lakhisarai	3	2	3	1	7	Medium
	Madhepura	4	3	3	1	7	Medium
	Madhubani	4	4	3	1	8	High
	Munger	3	3	3	1	7	Medium
	Muzaffarpur	4	4	3	2	9	Very high
	Nalanda	4	3	3	1	8	High
	Nawada	3	3	3	1	7	Medium
	Pashchim Champaran	3	4	3	1	8	High
	Patna	4	4	3	4	10	Very high
	Purba Champaran	4	5	3	2	9	Very high
	Purnia	4	4	3	1	8	High
	Rohtas	3	4	3	3	9	Very high
	Saharsa	4	3	3	1	8	High
	Samastipur	4	4	3	1	8	High
	Saran	4	4	3	1	8	High
	Sheikhpura	3	1	3	1	6	Medium
	Sheohar	4	2	3	1	7	Medium
	Sitamarhi	4	4	3	1	8	High
	Siwan	4	4	3	1	8	High
	Supaul	3	3	3	1	7	Medium
	Vaishali	4	4	3	1	8	High
Kerala							

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
	Alappuzha	4	5	4	2	9	Very high
	Ernakulam	4	5	3	4	9	Very high
	Idukki	2	3	2	1	5	Low
	Kannur	3	5	3	1	7	Medium
	Kasaragod	3	4	3	2	7	Medium
	Kollam	4	5	3	2	8	High
	Kottayam	3	4	3	1	7	Medium
	Kozhikode	4	4	3	2	8	High
	Malappuram	4	5	3	1	8	High
	Palakkad	3	5	3	3	8	High
	Pathanamthitta	2	4	3	2	7	Medium
	Thiruvananthapuram	4	4	3	4	9	Very high
	Thrissur	4	5	3	2	8	High
	Wayanad	2	3	3	1	6	Medium
<b>Lakshadweep</b>							
	Lakshadweep	4	1	3	1	6	Medium
<b>Tamil Nadu</b>							
	Ariyalur	2	2	2	3	6	Medium
	Chennai	5	3	5	4	10	Very high
	Coimbatore	3	4	3	5	9	Very high
	Cuddalore	3	4	3	4	8	High
	Dharmapuri	2	2	2	2	5	Low
	Dindigul	2	5	3	4	9	Very high
	Erode	2	4	2	4	7	Medium
	Kancheepuram	3	5	3	5	10	Very high
	Kanniyakumari	4	4	3	1	7	Medium
	Karur	2	3	2	4	7	Medium
	Krishnagiri	2	3	2	5	7	Medium
	Madurai	3	4	3	5	9	Very high
	Nagapattinam	3	4	3	1	7	Medium
	Namakkal	3	3	2	5	8	High
	Perambalur	2	2	2	1	5	Low
	Pudukkottai	2	5	3	3	8	High
	Ramanathapuram	2	4	2	1	6	Medium
	Salem	3	4	2	5	8	High
	Sivaganga	2	4	3	3	7	Medium
	Thanjavur	3	5	3	2	8	High

District		Population Density Ranking	Res Built-up Area sq km Ranking	Res Built-up Area Percentage Ranking	Industrial Area Ranking	Integrated Ranking	Overall District Risk Ranking
	The Nilgiris	2	2	2	1	5	Low
	Theni	2	3	2	3	6	Medium
	Thiruvallur	4	4	3	5	10	Very high
	Thiruvarur	3	4	3	1	7	Medium
	Thoothukkudi	2	4	3	4	8	High
	Tiruchirappalli	3	4	3	3	8	High
	Tirunelveli	2	5	3	3	8	High
	Tiruppur	2	4	3	5	8	High
	Tiruvannamalai	2	4	2	2	6	Medium
	Vellore	3	4	2	4	8	High
	Viluppuram	2	4	3	3	7	Medium
	Virudhunagar	2	4	3	4	8	High
<b>Arunachal Pradesh</b>							
	Anjaw	1	1	1	1	4	Low
	Changlang	1	1	1	1	4	Low
	Dibang Valley	1	1	1	1	5	Low
	East Kameng	1	1	1	1	5	Low
	East Siang	1	2	2	1	5	Low
	Kurung Kumey	1	1	1	1	5	Low
	Lohit	1	2	1	1	4	Low
	Lower Dibang Valley	1	1	1	1	4	Low
	Lower Subansiri	1	2	2	1	5	Low
	Papum Pare	1	1	1	1	4	Low
	Tawang	1	1	1	1	5	Low
	Tirap	1	1	2	1	4	Low
	Upper Siang	1	1	1	1	5	Low
	Upper Subansiri	1	1	1	1	5	Low
	West Kameng	1	1	1	1	4	Low
	West Siang	1	1	1	1	5	Low
<b>Assam</b>							
	Baksa	2	4	3	1	7	Medium
	Barpeta	3	4	3	1	8	High
	Bongaigaon	3	3	3	1	7	Medium
	Cachar	2	4	3	1	7	Medium
	Chirang	2	3	3	1	7	Medium
	Darrang	3	4	3	1	9	Very high
	Dhemaji	2	3	3	1	7	Medium

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
	Dhubri	3	4	3	1	8	High
	Dibrugarh	2	5	3	1	8	High
	Dima Hasao	1	2	2	1	5	Low
	Goalpara	2	4	3	1	7	Medium
	Golaghat	2	3	2	2	7	Medium
	Hailakandi	2	3	3	1	7	Medium
	Jorhat	2	4	3	2	9	Very high
	Kamrup Metro	4	4	3	4	11	Very high
	Kamrup Rural	2	5	3	1	9	Very high
	Karbi Anglong	1	3	2	1	6	Medium
	Karimganj	3	3	3	1	7	Medium
	Kokrajhar	2	4	3	1	7	Medium
	Lakhimpur	2	5	3	1	8	High
	Morigaon	3	3	3	1	9	Very high
	Nagaon	3	4	3	1	8	High
	Nalbari	3	4	4	1	8	High
	Sivasagar	2	5	3	1	8	High
	Sonitpur	2	5	3	1	8	High
	Tinsukia	2	1	1	1	5	Low
	Udalguri	2	5	3	1	8	High
<b>Chhattisgarh</b>							
	Bastar	1	4	2	1	6	Medium
	Bijapur (Ch)	1	2	1	1	4	Low
	Bilaspur (Ch)	2	4	3	3	8	High
	Dakshin Bastar Dantewada	1	2	2	1	4	Low
	Dhamtari	1	3	3	1	6	Medium
	Durg	2	5	3	5	9	VeryHigh
	Janjgir - Champa	2	4	3	3	8	High
	Jashpur	1	2	2	1	5	Low
	Kawardha	1	2	2	1	5	Low
	Korba	1	3	2	3	6	Medium
	Koriya	1	2	1	1	4	Low
	Mahasamund	2	3	3	3	7	Medium
	Narayanpur	1	1	1	1	4	Low
	Raigarh (Ch)	2	4	2	3	7	Medium
	Raipur	2	5	3	5	9	VeryHigh

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
	Rajnandgaon	1	4	3	3	7	Medium
	Surguja	1	4	2	1	6	Medium
	Uttar Bastar Kanker	1	4	2	1	6	Medium
<b>Jharkhand</b>							
	Bokaro	3	4	3	4	9	VeryHigh
	Chatra	2	3	3	1	6	Medium
	Deogarh	3	3	3	1	7	Medium
	Dhanbad	4	4	3	4	10	VeryHigh
	Dumka	2	4	3	1	7	Medium
	Garhwa	2	3	3	1	6	Medium
	Giridih	2	4	3	3	8	High
	Godda	3	2	3	1	6	Medium
	Gumla	1	3	3	1	6	Medium
	Hazaribagh	2	3	3	1	6	Medium
	Jamtara	2	2	3	1	6	Medium
	Khunti	2	2	2	1	5	Low
	Kodarma	2	3	3	1	6	Medium
	Latehar	1	3	3	1	6	Medium
	Lohardaga	2	2	3	1	6	Medium
	Pakur	2	2	3	1	6	Medium
	Palamu	2	4	3	1	7	Medium
	PaschimiSinghbhum	2	4	3	3	7	Medium
	PurbiSinghbhum	3	4	3	4	9	VeryHigh
	Ramgarh	3	3	3	3	8	High
	Ranchi	3	4	3	5	9	VeryHigh
	Sahibganj	3	2	2	1	6	Medium
	Saraikela-Kharswan	2	4	3	4	8	High
	Simdega	1	2	2	1	4	Low
<b>Manipur</b>							
	Bishnupur	2	2	3	1	6	Medium
	Chandel	1	1	1	1	4	Low
	Churachandpur	1	2	1	1	5	Low
	ImphalEast	3	2	3	1	6	Medium
	ImphalWest	3	2	3	1	6	Medium
	Senapati	1	1	1	1	4	Low
	Tamenglong	1	1	1	1	4	Low
	Thoubal	3	2	3	1	6	Medium



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
	Ukhrul	1	1	1	1	4	Low
<b>Meghalaya</b>							
	East Garo Hills	1	2	2	1	5	Low
	East Khasi Hills	2	2	2	3	7	Medium
	Jaintia Hills	1	2	2	1	5	Low
	Ri Bhoi	1	1	1	1	6	Medium
	South Garo Hills	1	1	1	1	4	Low
	West Garo Hills	1	1	1	1	4	Low
	West Khasi Hills	1	2	2	1	5	Low
<b>Mizoram</b>							
	Aizawl	1	1	1	1	6	Medium
	Champhai	1	1	1	1	6	Medium
	Kolasib	1	1	1	1	6	Medium
	Lawngtlai	1	1	1	1	6	Medium
	Lunglei	1	1	1	1	6	Medium
	Mamit	1	1	1	1	6	Medium
	Saiha	1	1	1	1	6	Medium
	Serchhip	1	1	1	1	6	Medium
<b>Nagaland</b>							
	Mon	1	1	1	1	5	Low
	Dimapur	1	2	3	1	6	Medium
	Kiphire	1	1	1	1	4	Low
	Kohima	1	1	2	1	4	Low
	Longleng	1	1	1	1	5	Low
	Mokokchung	1	1	2	1	6	Medium
	Peren	1	1	1	1	4	Low
	Phek	1	1	1	1	4	Low
	Tuensang	1	1	1	1	4	Low
	Wokha	1	1	2	1	6	Medium
	Zunheboto	1	1	2	1	5	Low
<b>Orissa</b>							
	Anugul	1	4	3	4	7	Medium
	Balangir	2	3	2	3	7	Medium
	Baleshwar	3	5	3	4	9	VeryHigh
	Bargarh	2	3	2	3	7	Medium
	Baudh	1	2	2	1	4	Low
	Bhadrak	3	3	3	1	7	Medium

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
	Cuttack	3	4	3	4	9	VeryHigh
	Debagarh	1	2	2	1	4	Low
	Dhenkanal	2	3	3	3	7	Medium
	Gajapati	1	1	1	1	3	Low
	Ganjam	2	4	2	4	7	Medium
	Jagatsinghapur	3	4	3	3	8	High
	Jajapur	3	4	3	3	8	High
	Jharsuguda	2	2	2	3	6	Medium
	Kalahandi	1	3	2	3	6	Medium
	Kandhamal	1	2	1	1	4	Low
	Kendrapara	3	3	3	1	7	Medium
	Kendujhar	2	4	3	1	6	Medium
	Khordha	3	4	3	4	9	VeryHigh
	Koraput	1	3	2	3	6	Medium
	Malkangiri	1	2	2	1	4	Low
	Mayurbhanj	2	5	3	3	8	High
	Nabarangapur	2	3	3	1	6	Medium
	Nayagarh	2	2	2	1	5	Low
	Nuapada	1	1	1	1	4	Low
	Puri	2	3	3	1	6	Medium
	Rayagada	1	2	1	1	4	Low
	Sambalpur	1	3	2	3	6	Medium
	Subarnapur	2	2	2	1	5	Low
	Sundargarh	2	4	2	5	8	High
<b>Sikkim</b>							
	East Sikkim	2	1	2	1	6	Medium
	North Sikkim	1	1	1	1	5	Low
	South Sikkim	1	1	2	1	6	Medium
	West Sikkim	1	1	2	1	5	Low
<b>Tripura</b>							
	West Tripura	3	2	1	1	6	Medium
	South Tripura	2	1	1	1	5	Low
	North Tripura	2	1	1	1	5	Low
	Dhalai	1	1	1	1	5	Low
<b>West Bengal</b>							
	Bankura	1	5	3	4	8	High
	Bardhaman	1	5	3	5	9	VeryHigh

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
	Birbhum	1	5	3	3	8	High
	Dakshin Dinajpur	1	4	3	3	7	Medium
	Darjiling	1	3	3	3	7	Medium
	Haora	1	5	4	5	9	VeryHigh
	Hugli	1	5	3	5	9	VeryHigh
	Jalpaiguri	1	5	3	3	8	High
	Koch Bihar	1	5	3	1	7	Medium
	Kolkata	1	3	5	5	9	VeryHigh
	Maldah	1	5	3	1	7	Medium
	Murshidabad	1	5	3	3	8	High
	Nadia	1	5	3	3	8	High
	North Twenty Four Parganas	1	5	3	5	9	VeryHigh
	Paschim Medinipur	1	5	3	4	8	High
	Purba Medinipur	1	5	4	5	9	VeryHigh
	Puruliya	1	5	3	1	7	Medium
	South Twenty Four Parganas	1	5	3	5	9	VeryHigh
	Uttar Dinajpur	1	4	3	1	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 is being 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 access the information of all the Fire Services in the entire country on a single platform.

### 5.1 Salient Features

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

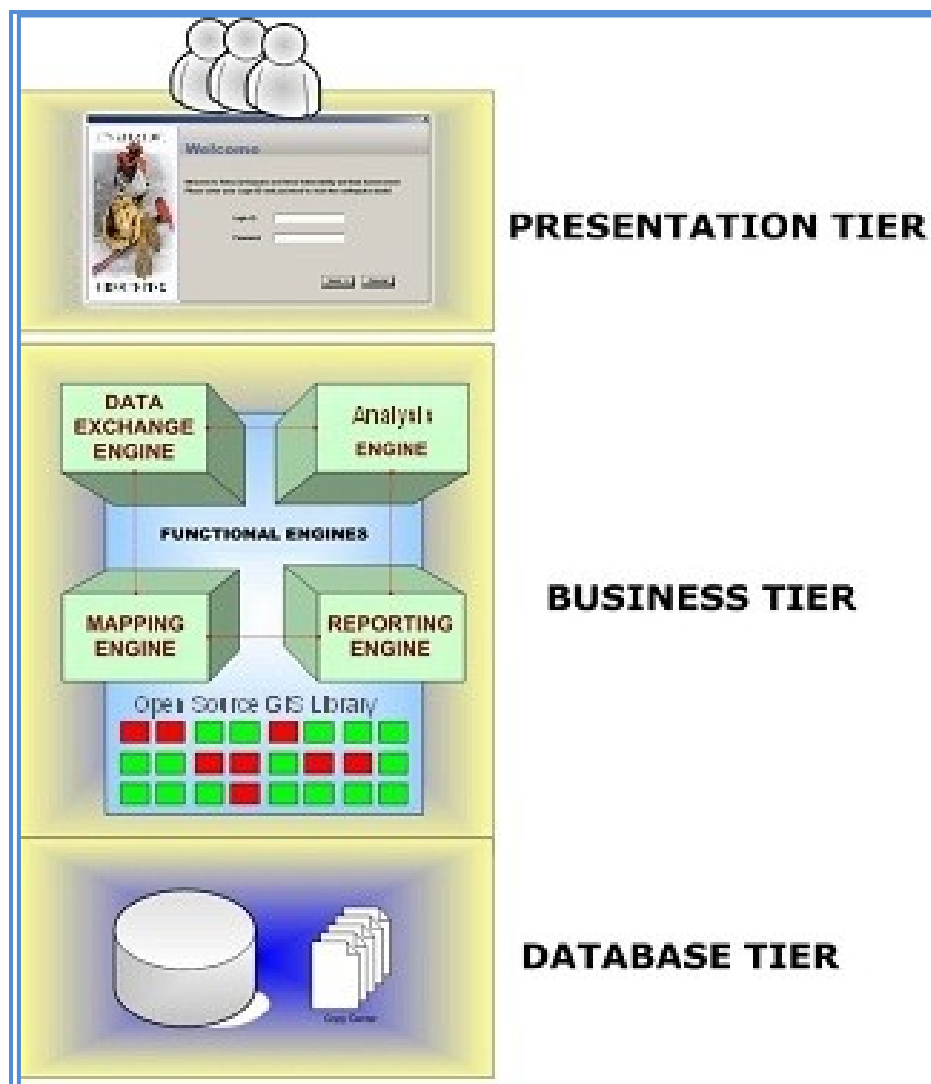
The salient features of the FDSS platform include:

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

### 5.2 High Level Design

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



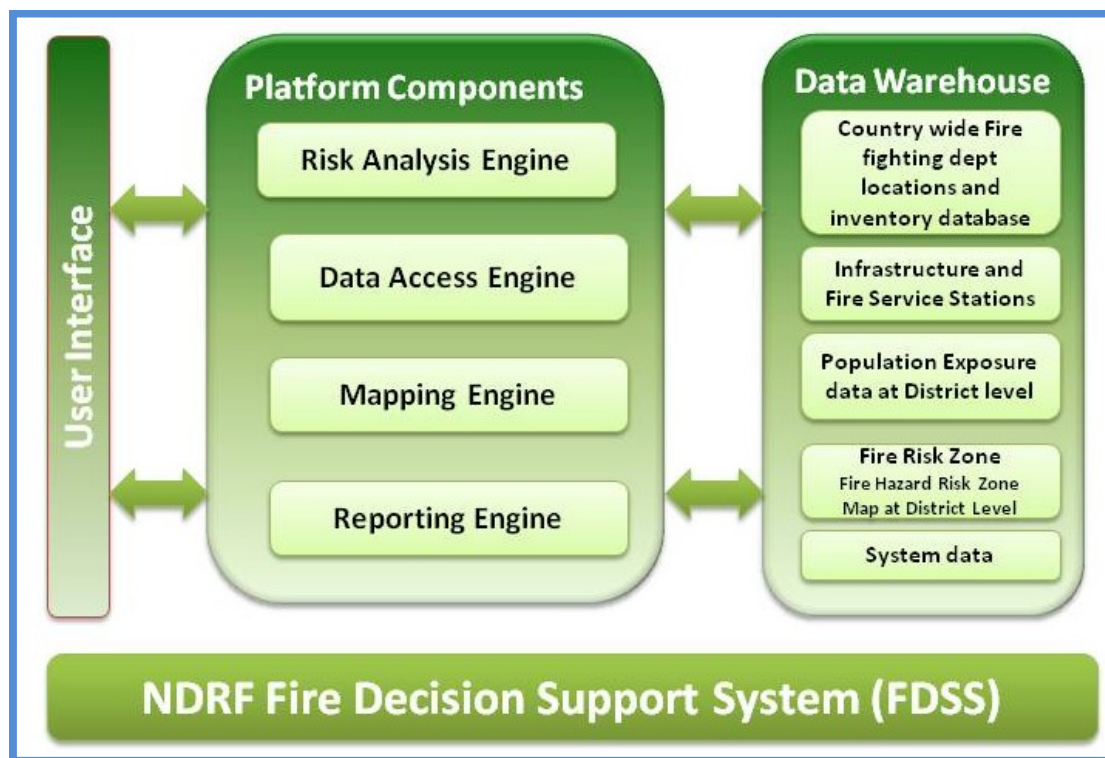


**Figure 5-1 : Three-tier architecture**

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

Figure 5-2 shows the high-level design for the FDSS platform. The whole architecture is modular. The major modules are user Data Warehouse, Platform Components, and User Interface. The model components are stand-alone and are not dependent on the platform components. Both perform their respective tasks working with the same data on the backend

and are guided by the same user interface on the front end. The following sections discuss the various modules in detail and showcase how all the requirements are delivered by the FDSS platform.



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

### 5.2.1 DATA WAREHOUSE

Data warehouse represents the Database tier which 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 reside 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

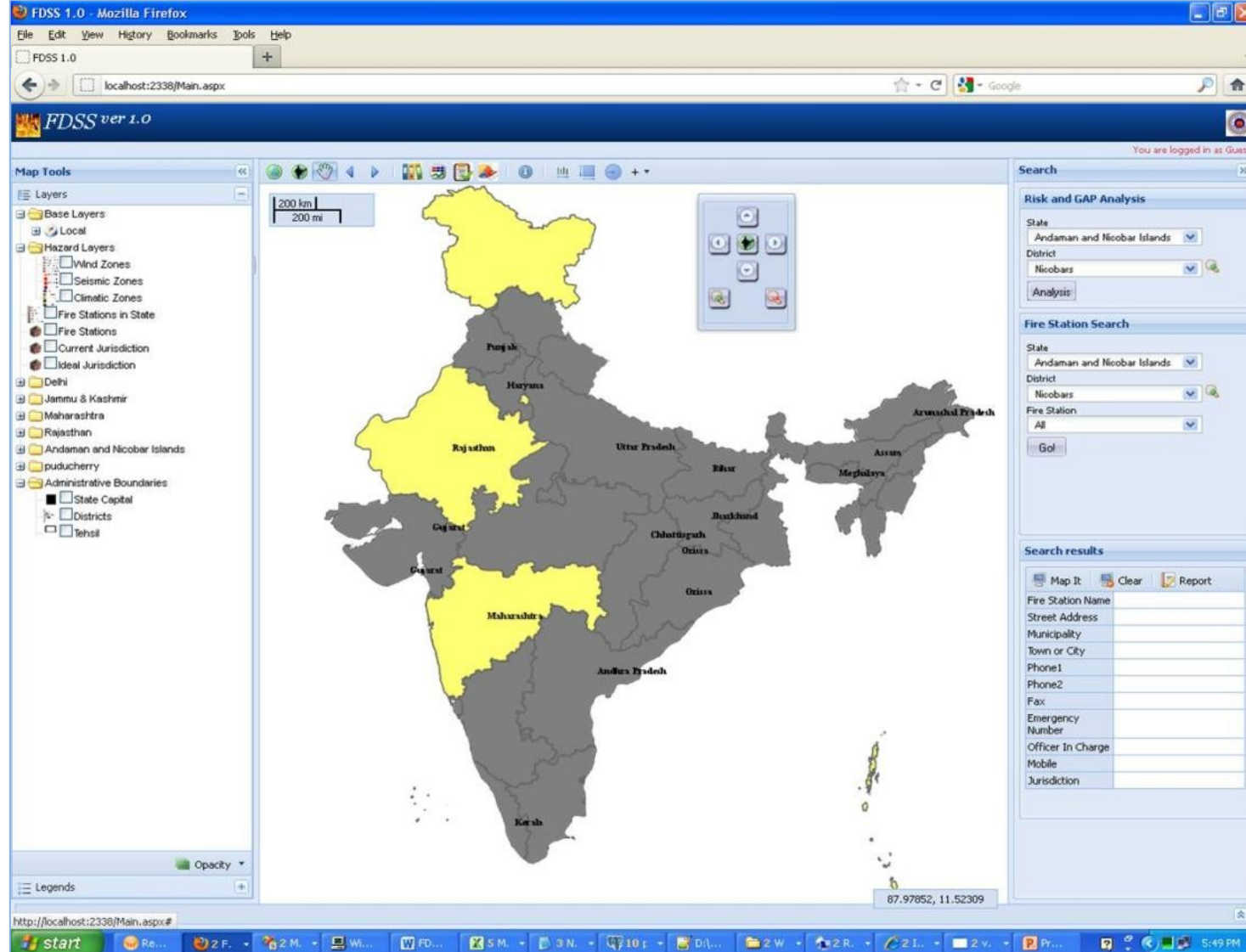
The FDSS provides functionality to run GAP Analysis at two levels:

- State
- District

This system provides the option for running gap analysis for firefighting and rescue vehicles, equipment, manpower and 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:

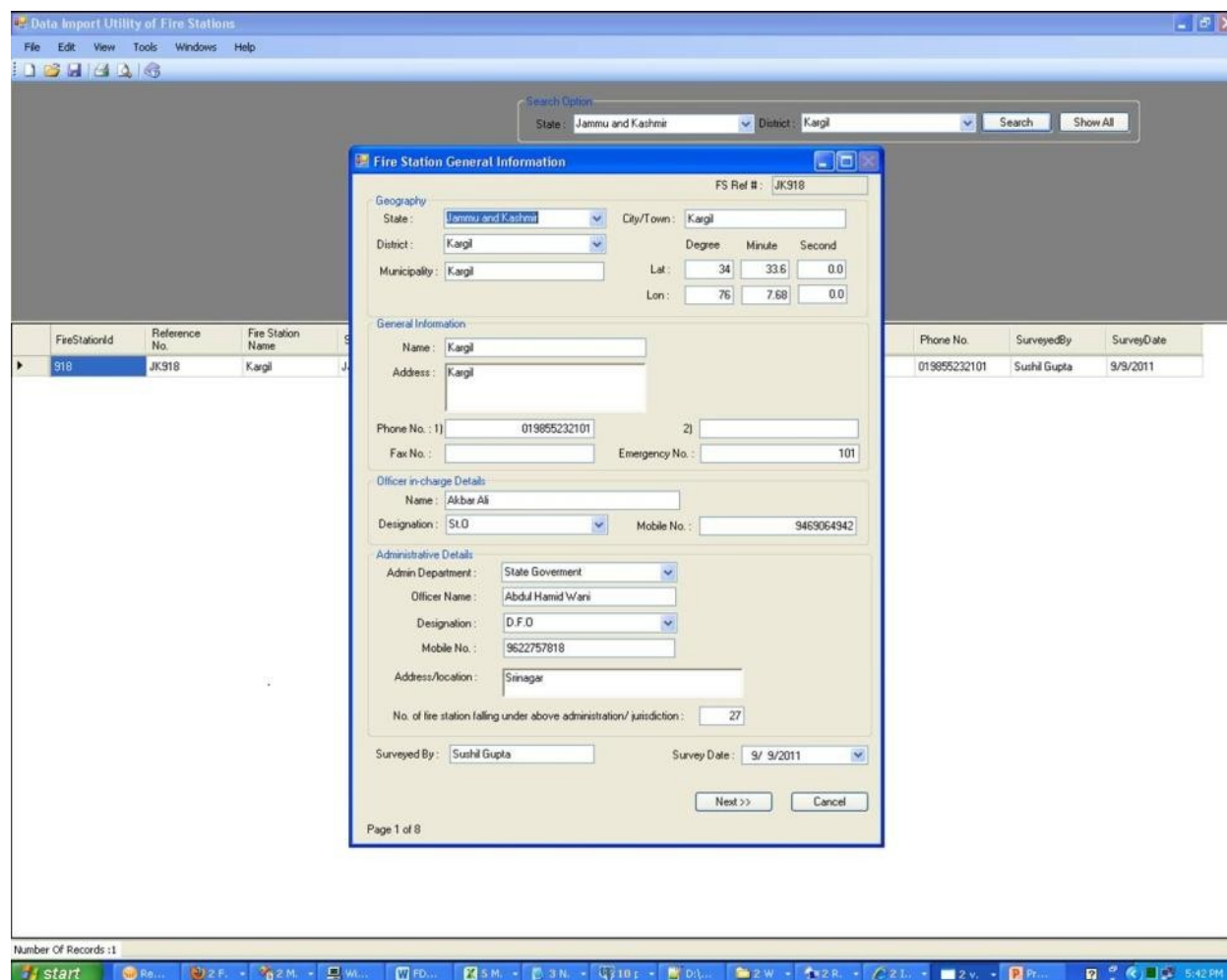
- 1) System Administration Interface
- 2) Application Interface



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

## 5.4 System Administration Interface

This is an individual stand alone component that 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.



**Data Import Utility of Fire Stations**

Search Option  
 State : Jammu and Kashmir District : Kargil Search Show All

**Fire Station General Information** FS Ref # : JK918

**Geography**  
 State : Jammu and Kashmir City/Town : Kargil  
 District : Kargil Degree Minute Second  
 Municipality : Kargil Lat : 34 33.6 0.0  
 Lon : 76 7.68 0.0

**General Information**  
 Name : Kargil  
 Address : Kargil  
 Phone No. : 1) 019855232101 2)   
 Fax No. : Emergency No. : 101

**Officer-in-charge Details**  
 Name : Akbar Ali  
 Designation : SLD Mobile No. : 9469064942

**Administrative Details**  
 Admin Department : State Government  
 Officer Name : Abdul Hamid Wani  
 Designation : D.F.O.  
 Mobile No. : 9622757818  
 Address/location : Srinagar  
 No. of fire station falling under above administration/ jurisdiction : 27

Surveyed By : Sushil Gupta Survey Date : 9/ 9/2011

Next >> Cancel

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FireStationId	Reference No.	Fire Station Name
918	JK918	Kargil

Number Of Records : 1

**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:
  - o Location of Fire Stations
  - o Administrative boundary maps
  - o Land use land cover map
  - o Road / Rail network
  - o 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:
  - o 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
- Gap analysis at State and district levels

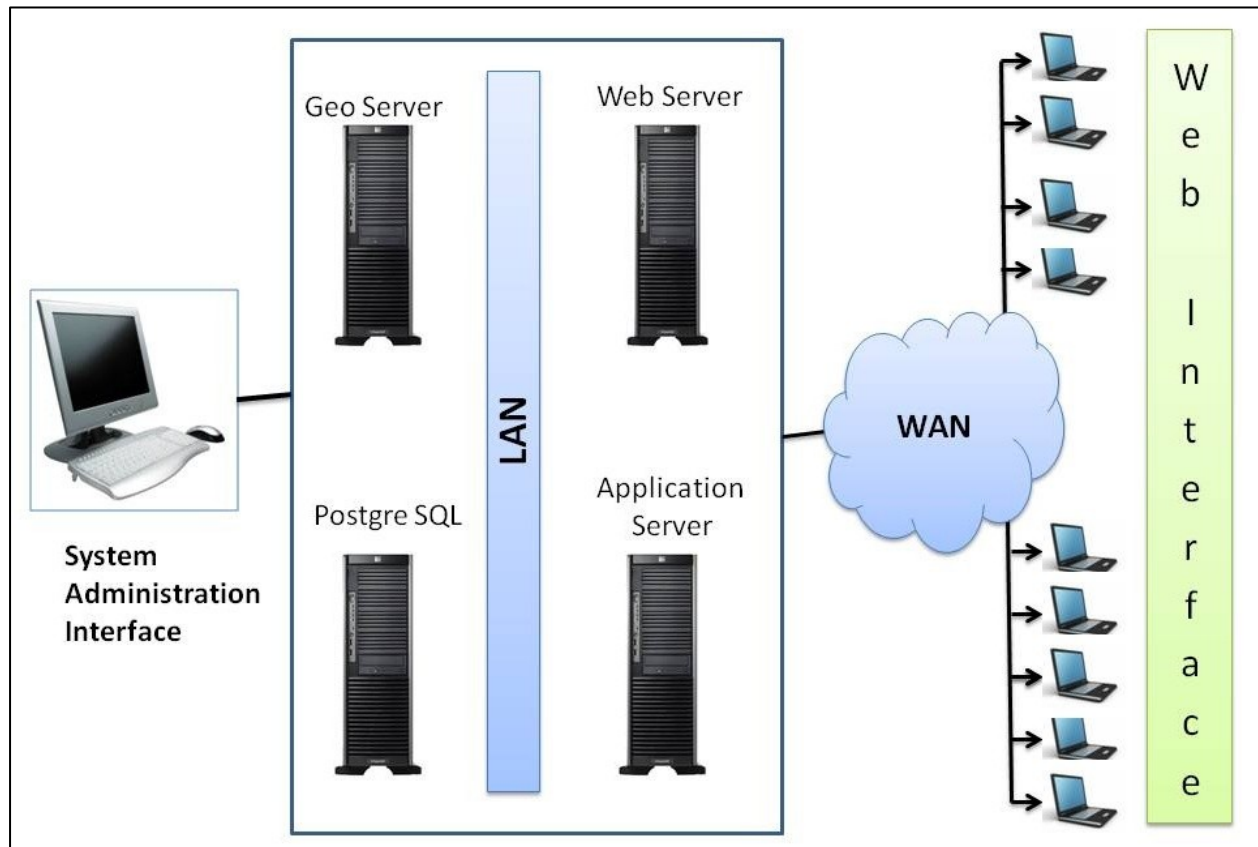
**Results Management:** This entails generating displays of results in pre-defined formats based on user selection. Following are the various types of result views that will be available in FDSS.

- 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 Front-end 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 HDD, IDE DVD ROM Drive with (N) hot swap Redund 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
<b>Control and Audit</b> 	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
<b>Low ownership Cost</b> 	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
<b>Quality and Excellence</b> 	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.
<b>Flexibility &amp; customization</b> 	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 has been carried out using the information collected 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 existing 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 following three areas:

### **5.7.1 INFRASTRUCTURE GAPS**

This covers served/ un-served areas, unsuitable locations of Fire Stations, etc. This gap analysis is being 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 man-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 are 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.

Few assumptions has been made while preparing the detailed roadmap for investment plan for the next 10 years. For example,

- Existing gaps in terms of manpower, fire fighting and rescue vehicles, and equipments will be filled up in first two years
- 40% gaps in Fire Station buildings will be filled up in first two year, and subsequently 10% gap in each year
- The average annual rate on expenses on fire vehicle maintenance, petrol, diesel & lubricants, and office expenses, training, uniform will remain the same as that in F.Y. 2011-12, however, on top of that an annual inflation factor of 8% (fire vehicle maintenance, petrol, diesel & lubricants), 5% (office expenses, training, uniform) has been added
- Building infrastructure cost will increase on an average by about 11% per year and building maintenance cost by about 1% of total building construction cost as in 2010-11
- The salary costs at each level have been estimated from the present pay scales for each level and an annual growth of 12% has been added for subsequent years

## 5.9 Institutional Assessment and Capacity Building Plan

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

Human resource bottlenecks at various levels of training fire officials (such as refresher's training, breathing training in smoke, industrial training, specialized training to handle high-rise fires, etc.) to different cadre of officials, issue of language in training; physical fitness; duty patterns (8 hours and 12 hours versus 24 hours); availability of accommodation in fire-stations; pay-scale structures, and promotion progression etc. are 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. For more detailed information, please refer to the National Level Training report as well as individual State/ UT report submitted by RMSI.

## 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](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 Stations	Fire	Additional Stations	Fire	Operational Station/ Fire Post	Fire	Additional Stations/ Fire Posts	Fire Posts
<b>51</b>		<b>120</b>		<b>1</b>		<b>10</b>	

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

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

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

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

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

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

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

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

## Annex-1: Fire Headquarter Data Collection Form

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

### A. Fire Headquarters General Information

HQ Ref #.....

#### Location Details

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

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 <sup>1</sup>	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 <sup>1</sup>	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

<sup>1</sup> State Government    Fire Department    Police Department    Municipal Corporation    Others specify



Name of Zonal office .....

S.N.	Name of Fire stations	Name of district	Under direct Jurisdiction control of <sup>1</sup>	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/Deputy Director/ Joint Director; **Level 9:** CFO/ CO; **Level 8:** Deputy CFO/Joint Director; **Level 7:** Assistant Director/Deputy Controller/Deputy Director/DO; **Level 6:** DO/DFO/Inspector/EO/Fire Supervisor; **Level 5:** ADFO/ADO/AFO/Fire In-charge; **Level 4:** St.O/Sub Inspector/Station In-charge/Asst 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 organization chart (Please provide copy of State recruitment rules in detail)**

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



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
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 casualties, 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:***

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General Manager,  
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## Annex-2: Fire Station Survey Form

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

SW FS Ref #.....

### A. Fire Station General Information

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

**Fire Station Name** .....

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

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

Fax No: .....

Emergency No: .....

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

Name of officer in-charge ..... Designation .....

Mobile number (*officer in-charge*) : .....

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

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

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

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

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

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

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

(Signature of Witness from Fire Department)  
Name & Designation

## B. Fire Station Infrastructure Details

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

☐ No permanent building

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

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

How many bay station should be in new Fire Station building

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

### Provide building details

Number of Floors	Number of Rooms	Approx Plot Area (SQM)	Approx Built-up Area (SQM)
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

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 ☐ Kaccha Tin shade ☐ Temp Porta- cabins ☐  
 Kaccha wooden structure with tin Roof ☐ Others kaccha type specify .....

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

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

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

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

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

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

Structure of Bay/ Garrage- Pacca- RCC/Masonry ☐ Kaccha Tin Shade ☐ Open ☐ any other kaccha .....

Availability of Staff Quarters - Yes ☐ No ☐ , If Yes, mention numbers.....

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

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

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

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

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

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

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

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

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

### C. Communication Systems

#### 1. Between Public and Fire control room/ watch room

i. Landline Telephone: Yes ☐ No ☐ , If 'Yes', mention number of land line phone in operation.....

ii. Emergency phone number- 101 or,.....Connection Type : Direct ☐ Indirect ☐ Not Available ☐

#### 2. Hotline between Important agencies and Fire control room

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

Others specify.....

#### 3. Automatic Fire Alarm between High Rise Buildings and Fire Station: Yes ☐ No ☐ If yes, num. of buildings .....

If with any other agency, specify: .....

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

#### 4. Between Fire Station Control Room and Fire Vehicles

Static Wireless Set in watch room Yes ☐ No ☐ If 'Yes', mention number of operational phones .....

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

#### 5. Type of Frequency used- HF ☐ VHF ☐ UHF ☐

## D. Water Supply Details for Fire Fighting Purpose

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

Water sources used by Fire Vehicles within Fire station

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

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

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

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

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

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

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

## E. Human Resources

### Permanent Staff Details- :

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

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

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

**Level 10:** Director General/ Director/Deputy Director/ Joint Director; **Level 9:** CFO/ CO; **Level 8:** Deputy CFO/Joint Director; **Level 7:** Assistant Director/Deputy Controller/Deputy Director/DO; **Level 6:** DO/DFO/Inspector/EO/Fire Supervisor; **Level 5:** ADFO/ADO/AFO/Fire In-charge; **Level 4:** St.O/Sub Inspector/Station In-charge/Asst O./AEO; **Level 3:** S O/Assistant Sub Inspector/ASO/Sub-Fire Officer/; **Level 2 :** LFM/ Mechanic Driver/Head Constable/Store Superintendent; **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)			
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			



Fire Risk	If Yes, Brief description of its Name, Type, Risks involved	Dist. From FS (km)	No. of Units
Explosive manufacturing/stores			
Port/ dockyard area			
Railway Station			
Airport Area			
Wild Forest-Area			
Vicinity to Coast			
Army Ammunition Storage			
Cross-Border Shelling			
Any other			
Any other			

Availability of water for Fire Fighting in High-Rise Building as per National Building Code (NBC) -

 All ☐ Few ☐ No ☐

Applicability of NBC/ local laws in District/ State for fire safety of High-Rise building -

 All ☐ Few ☐ No ☐

Applicability of NBC/ local laws for fire safety in industrial and other buildings-

 All ☐ Few ☐ No ☐

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

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

SI 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 / GPS	Minor/ Major/Condemned
	DCP Tender					kg		Wireless / GPS	Minor/ Major/Condemned
	Multi-purpose Tender							Wireless / GPS	Minor/ Major/Condemned
	Hose Tender (HT)							Wireless / GPS	Minor/ Major/Condemned
	Rescue / emergency tender/ responder							Wireless / GPS	Minor/ Major/Condemned
	Advanced Rescue Tender (with inst. to handle hazardous materials)							Wireless / GPS	Minor/ Major/Condemned
	Aerial Ladder Platform (ALP)							Wireless / GPS	Minor/ Major/Condemned
	Turn Table Ladder (TTL)							Wireless /	Minor/

SI 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
	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*

SI 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

SI No	Fire Vehicle Type	Vehicle Registration Number	Make	If allotted to individual	Comm. System mounted on vehicle	If not in running condition (off road)
	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	
Electric chain saw for concrete		Life Locator Equipment	

Equipment	Number/ Quantity	Equipment	Number/ Quantity
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) .....

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### 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																
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10-Jan																
9-Dec																
9-Nov																
9-Oct																
9-Sep																

## Fire-Risk and Hazard Analysis in the Country



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](mailto:Sushil.Gupta@rmsi.com)

# PART B

## 7 Delhi State

Presently, Delhi Fire Services (DFS) is headed by a Director, DFS and currently operates 52 Fire Stations, one training centre-cum-support centre at Fire Safety Management Academy (FSMA), Rohini and one workshop at Motinagar covering the entire State. The State has a total population of 16,753,235 in nine districts as per Census, 2011. On an average, each Fire Station of DFS is serving about 3.2 Lakhs population.



**Figure 7-1 : Fire Stations locations operated by DFS with their current jurisdictional areas**

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 airport, military cantonment, thermal/nuclear power plants, refineries 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 State would require additional 46 Fire Stations in urban areas and 9 Fire Stations in rural areas. Out of the 46 urban Fire Stations proposed, DFS has already proposed 18 new Fire Stations, which are at different stages of construction. Thus, this study proposes a further addition of 28 urban Fire Stations and 9 rural Fire Stations, which is an overall deficiency of 51% (including 18 Fire Stations proposed by DFS) in terms of number of Fire Stations in Delhi (for details, please refer to Chapter 7 of Delhi Report).

### Firefighting and Rescue Vehicles and Specialized Equipment Gap Analysis

For estimating the gap in firefighting 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 Chapter 7 of Delhi Report. Thus, this study finds an overall gap of about 63% in firefighting and rescues vehicles and about 82% in specialized equipment for both operational and new Fire Stations in urban and rural areas.

### Fire Personnel Gap Analysis

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

**Table 7-1: Gap Analysis for the Delhi Fire Services**

<b>Gap Analysis</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicles</b>	<b>Special Equipment</b>	<b>Firefighting Manpower</b>
Operational Fire Stations	53	179	1,172	1,631
Gap in Operational Fire Stations		72	2,201	2,647
New Urban Fire Stations	46	205	2,933	3,119
New Rural Fire Stations	9	27	159	287
<b>Gap Analysis in %</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicle</b>	<b>Special Equipments</b>	<b>Firefighting Man Power</b>
Gap in Operational Fire Stations		29%	65%	62%
Gap in Operational and new urban Fire Stations only	46%	61%	81%	78%
Total Gap in Operational, new (urban and rural) Fire Stations	51%	63%	82%	79%

### Fire Prevention Wing

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

and Assistant Divisional Officers (ADOs) have been recommended (for details, please refer to Chapter 7 of Delhi Report).

### Detailed Financial Investment plan

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 Chapter 7 of Delhi Report, 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 (for details refer Chapter 7 of Delhi Report) for the next 10-years include both capital and recurring expenditures. Thus, RMSI analysis estimates a total investment of about **Rs.4,927 Crores** spread over a period of 10 years for Delhi State including inflationary factors and after filling the gaps for both operational and proposed urban and rural Fire Stations.

**Table 7-2: State level Investment plan (in Crores Rupees) for Delhi Fire Services only considering gap in operational, new urban and new rural Fire Stations**

Year	Capital Expenditure		Recurring Expenditure					Annual Total
	Building Infrastructure	Vehicles and Equipments	Annual Vehicle Maintenance & PDL AMC	Annual Staff Salary	Annual Office Expenses	Annual Training Office Expenses	Annual Bldg. maintenance	
First Year	51.5	46.67	8.62	99.90	6.29	1.10	5.17	219.25
Second Year	57.17	49.00	12.21	162.65	10.25	1.68	5.22	298.17
Third Year	31.73	28.54	14.81	210.88	13.29	2.04	6.32	307.60
Forth Year	35.22	29.97	17.74	268.34	16.91	2.43	7.44	378.05
Fifth Year	39.09	15.73	20.10	318.55	20.07	2.71	8.05	424.31
Sixth Year	43.39	16.52	22.73	376.95	23.75	3.00	8.68	495.02
Seventh Year	48.16	17.35	25.65	444.78	28.02	3.32	9.31	576.59
Eighth Year	53.46	18.21	28.89	523.45	32.98	3.66	9.96	670.61
Ninth Year	0.00	19.13	32.49	614.60	38.72	4.03	10.61	719.58
Tenth Year	0.00	20.08	36.47	720.09	45.37	4.43	11.28	837.73
<b>Total</b>	<b>359.72</b>	<b>261.20</b>	<b>219.71</b>	<b>3,740.20</b>	<b>235.63</b>	<b>28.41</b>	<b>82.04</b>	<b>4,926.90</b>

### Prioritization of New Fire Stations

The prioritization of new Fire Stations in Delhi for both rural and urban areas has been detailed in Chapter 7 of Delhi Report.

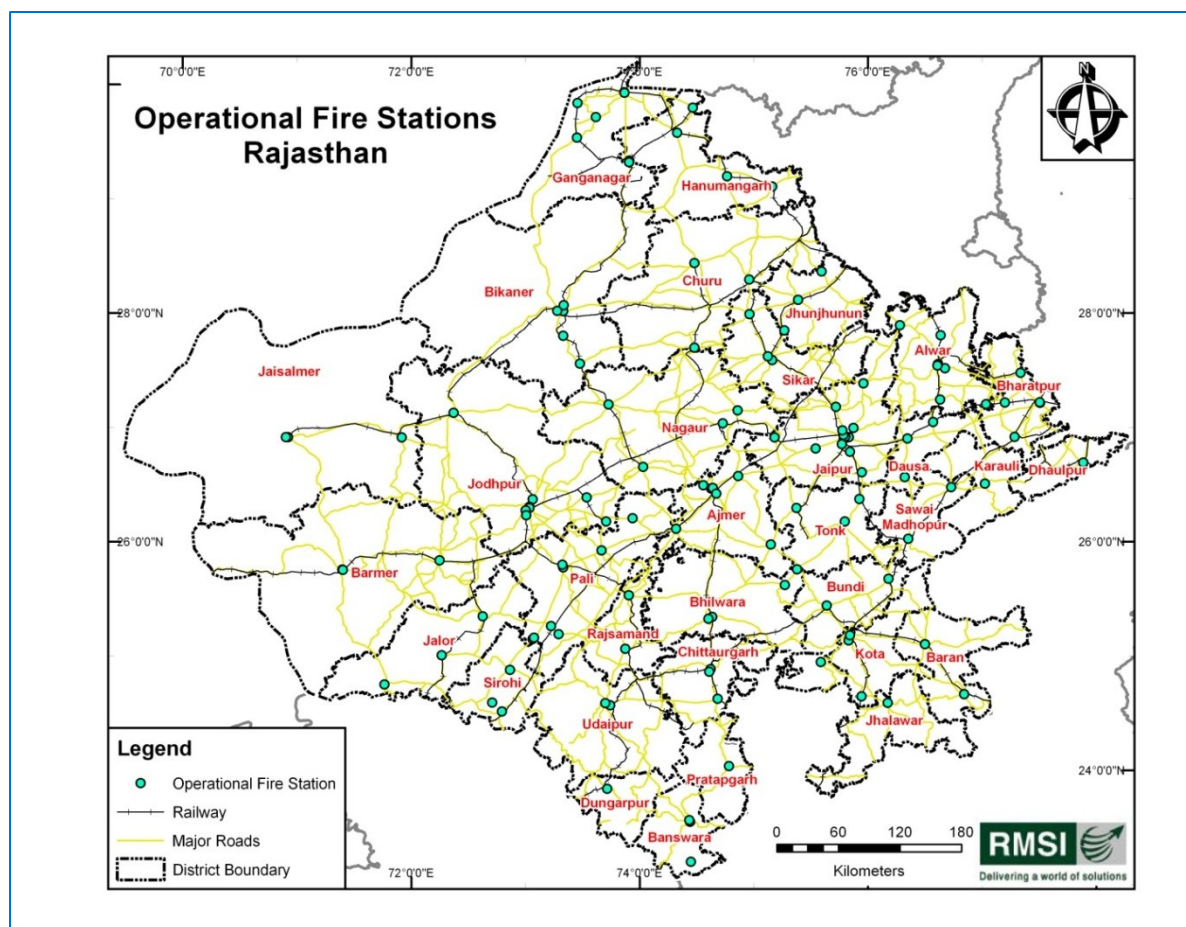
### Capacity Building and Training Facilities

The Capacity building and training facilities and training need assessment for various levels have been given in Chapter 7 of Delhi Report.

## 8 Rajasthan State

Presently, a Director, an Additional Director, Local Body Directorate, and two Chief Fire Officers head Rajasthan State Fire Services. There are also a few Fire Stations operated by Civil Defence & Home Guard headed by ADG, Civil Defence & Home Guard, Rajasthan.

As per Census (2011), Rajasthan has 6.86 Crores population distributed in 33 districts, having about three fourth populations (75.1%) as rural and one fourth (24.9%) as urban. Currently, there are 126 Fire Stations operational in Rajasthan, and on an average serving more than 5.4 lakhs population per Fire Station.



**Figure 8-1 : Location of operational Fire Stations in Rajasthan State with road and rail networks**

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 airport, military cantonment, power plants etc. The remaining areas, not covered under ideal jurisdiction of operational Fire Stations were 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 within ideal jurisdiction boundary and built-up industrial areas.



### Fire Station Gap Analysis

As per detailed GIS based analysis, the State would require additional 107 Fire Stations in urban areas and 641 Fire Stations in rural areas. Thus, this study proposes a further addition of 108 urban Fire Stations and 641 rural Fire Stations, which is an overall deficiency of 86% in terms of number of Fire Stations in Rajasthan (for details, please refer to Chapter 8 of Rajasthan State Report).

### Firefighting and Rescue Vehicles and Specialized Equipment Gap Analysis

For estimating the gap in fire fighting and rescue vehicles and specialized equipment in operational as well proposed Fire Stations both in urban and rural areas, the RMSI team modified the SFAC norms with expert opinions. These modifications also helped in optimization of resources and are detailed in Chapter 8 of Rajasthan State Report. Thus, this study finds an overall gap of about 86% in fire fighting and rescues vehicles and about 99% 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 double-shift duty pattern as ARD has already optimized the fire manpower requirement in comparison to what has been suggested in SFAC norms. The current duty pattern in Rajasthan is triple shift. RMSI team has estimated the fire manpower requirement for double shift (for details, please refer to section Chapter 8 of Rajasthan State Report). Thus, this study finds an overall gap of about 96% in fire personnel for double shift duty pattern.

**Table 8-1: Gap Analysis for the Rajasthan Fire Services**

<b>Gap Analysis</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicles</b>	<b>Special Equipment</b>	<b>Firefighting Manpower</b>
Operational Fire Stations	126	264	245	1,158
Gap in Operational Fire Stations		167	8,905	6,367
New Urban Fire Stations	107	293	3,892	4,720
New Rural Fire Stations	641	1120	12,649	18,849
<b>Gap Analysis in %</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicle</b>	<b>Special Equipments</b>	<b>Firefighting Man Power</b>
Gap in Operational Fire Stations		39%	97%	85%
Gap in Operational and new urban Fire Stations only	46%	64%	98%	91%
Total Gap in Operational, new (urban and rural) Fire Stations	86%	86%	99%	96%

### Fire Prevention Wing

In addition to fire fighting staff, there is an urgent need for fire prevention wing for inspection, awareness generation, and training for schools, hospitals, high-rise buildings, govt. offices, public buildings etc., so that recurrence of the fire incidences similar to that at the Advance Medical Research Institute (AMRI), Kolkata, in terms of their magnitude and frequency can

be reduced. Accordingly, to support Director, Rajasthan Fire Services, additional officers at the levels of Joint Directors (JD), Chief Fire Officers (CFO), Dy Chief Fire Officers (Dy-CFO), Division Officers (DO), and Assistant Divisional Officer (ADO) have been recommended (for details, please refer to Chapter 8 of Rajasthan State Report).

### Detailed Financial Investment plan

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 Chapter 8 of Rajasthan State Report, 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 (for details refer Chapter 8 of Rajasthan State Report) for the next 10-years include both capital and recurring expenditures. Thus, RMSI analysis estimates a total investment of **about Rs. 19,162.13 Crores** spread over a period of 10 years for Rajasthan State including inflationary factors and after filling the gaps for both operational and proposed urban and rural Fire Stations.

**Table 8-2: State level Investment plan (in Crores Rupees) for Rajasthan Fire Services only considering gap in operational, new urban and new rural Fire Stations**

Year	Capital Expenditure		Recurring Expenditure					Total
	Building Infrastructure	Vehicles and Equipments	Annual Vehicle Maintenance & PDL AMC	Annual Staff Salary	Annual Office Expenses	Annual Training Office Expenses	Annual Bldg. Maintenance	
First Year	498.10	147.88	11.80	150.04	9.45	1.65	8.25	827.18
Second Year	552.89	155.27	20.88	293.97	18.52	3.03	9.46	1,054.03
Third Year	306.85	113.31	28.77	525.71	33.12	5.08	19.27	1,032.11
Forth Year	340.60	118.97	37.78	808.83	50.96	7.33	29.26	1,393.74
Fifth Year	378.08	62.46	44.43	1,029.12	64.83	8.74	34.50	1,622.17
Sixth Year	419.67	65.59	51.89	1,290.62	81.31	10.28	39.85	1,959.21
Seventh Year	465.82	68.87	60.27	1,600.06	100.80	11.95	45.30	2,353.07
Eighth Year	517.08	72.31	69.66	1,965.19	123.81	13.76	50.85	2,812.65
Ninth Year	0.00	75.93	80.16	2,394.90	150.88	15.72	56.51	2,774.11
Tenth Year	0.00	79.72	91.90	2,899.46	182.67	17.84	62.28	3,333.87
<b>Total</b>	<b>3,479.10</b>	<b>960.31</b>	<b>497.55</b>	<b>12,957.88</b>	<b>816.35</b>	<b>95.39</b>	<b>355.54</b>	<b>19,162.13</b>

### Prioritization of New Fire Stations

The prioritization of new Fire Stations in Rajasthan for both rural and urban areas has been detailed in Chapter 8 of Rajasthan State Report.

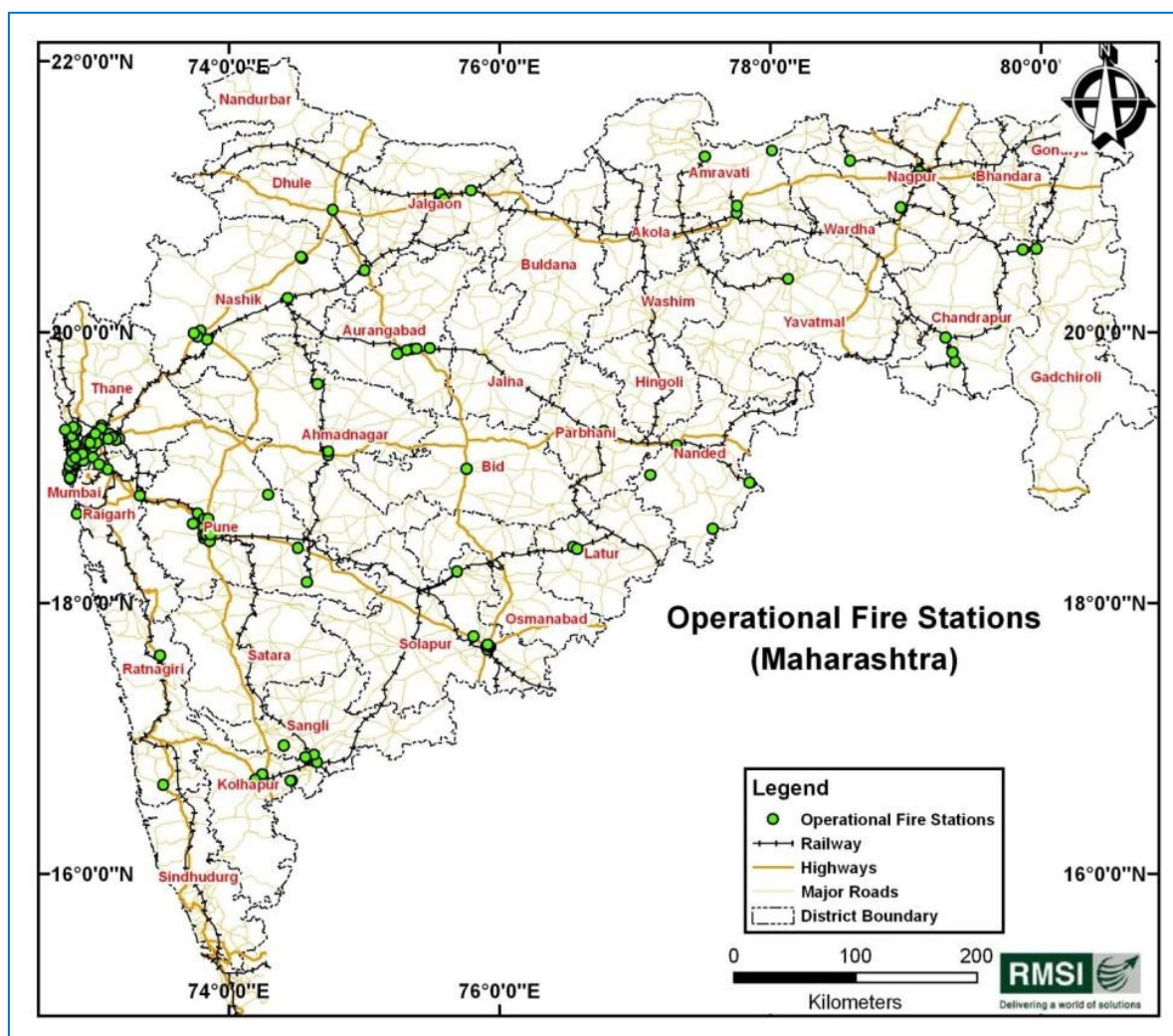
### Capacity Building and Training Facilities

The Capacity building and training facilities and training need assessment for various levels have been given in Chapter 8 of Rajasthan State Report.

## 9 Maharashtra State

Maharashtra State Fire Services presently has 157 operational Fire Stations in urban areas, two operational training centres at Nagpur and Mumbai and third one is being developed at Santacruz (E), Mumbai. Presently, State Fire Services is headed by a Director and the Fire Stations in various Municipal Corporations are headed by respective Chief Fire Officers (CFO), and Dy. Chief Fire Officers (DCFO).

As per Census (2011), Maharashtra State has 11.23 Crores population distributed among 35 districts. On an average, each Fire Station in Maharashtra State is serving about 7.3 Lakhs population.



**Figure 9-1 : Location of operational Fire Stations in Maharashtra State with road and rail networks**

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 airport, military cantonment, power plants etc. The remaining areas, not covered under ideal jurisdiction of operational Fire Stations were 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 within ideal jurisdiction boundary and built-up industrial areas.

### Fire Station Gap Analysis

As per detailed GIS based analysis, the State would require additional 251 Fire Stations in urban areas and 666 Fire Stations in rural areas. Thus, this study proposes a further addition of 251 urban Fire Stations and 666 rural Fire Stations, which is an overall deficiency of 85% in terms of number of Fire Stations in Maharashtra (for details, please refer to Chapter 9 of Maharashtra State Report).

### Firefighting and Rescue Vehicles and Specialized Equipment Gap Analysis

For estimating the gap in fire fighting and rescue vehicles and specialized equipment in operational as well proposed Fire Stations both in urban and rural areas, the RMSI team modified the SFAC norms with expert opinions. These modifications also helped in optimization of resources and are detailed in Chapter 9 of Maharashtra State Report. Thus, this study finds an overall gap of about 88% in fire fighting and rescues vehicles and about 92% 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 double-shift, duty pattern as ARD has already optimized the fire manpower requirement in comparison to what has been suggested in SFAC norms. The current duty pattern in Maharashtra is triple shift. RMSI team estimated the fire manpower requirement for double shift duty pattern (for details, please refer to Chapter 9 of Maharashtra State Report). Thus, this study finds an overall gap of about 90% in fire personnel for double shift duty pattern.

**Table 9-1: Gap Analysis for the Maharashtra Fire Services**

<b>Gap Analysis</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicles</b>	<b>Special Equipment</b>	<b>Firefighting Manpower</b>
Operational Fire Stations	157	434	3,356	5,240
Gap in Operational Fire Stations		504	8,357	6,998
New Urban Fire Stations	251	858	11,691	14,480
New Rural Fire Stations	666	1,713	19,596	26,601
<b>Gap Analysis in %</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicle</b>	<b>Special Equipments</b>	<b>Firefighting Man Power</b>
Gap in Operational Fire Stations		54%	71%	57%
Gap in Operational and new urban Fire Stations only	62%	76%	86%	80%
Total Gap in Operational, new (urban and rural) Fire Stations	85%	88%	92%	90%

### Fire Prevention Wing

In addition to fire fighting staff, there is an urgent need for fire prevention wing for inspection, awareness generation, and training for schools, hospitals, high-rise buildings, govt. offices,



public buildings etc., so that recurrence of the fire incidences similar to that at the Advance Medical Research Institute (AMRI), Kolkata, in terms of their magnitude and frequency can be reduced. Accordingly, to support Director, Maharashtra Fire Services, additional officers at the levels of Joint Directors (JD), Chief Fire Officers (CFO), Dy Chief Fire Officers (Dy-CFO), Division Officers (DO), and Assistant Divisional Officer (ADO) have been recommended (for details, please refer to Chapter 9 of Maharashtra State Report).

### Detailed Financial Investment plan

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 Chapter 9 of Maharashtra State Report, 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 for investment plan (section 9.3.5, Chapter 9 of Maharashtra State Report) for the next 10-years includes both capital and recurring expenditures. Thus, RMSI analysis estimates a total investment of **about Rs.31, 587.80 Crores** spread over a period of 10 years for Maharashtra State Fire Services including inflationary factors and after filling the gaps for both operational and proposed urban and rural Fire Stations.

**Table 9-2: State level Investment plan (in Crores Rupees) for Maharashtra State Fire Services only considering gap in operational and new urban Fire Stations**

Year	Capital Expenditure		Recurring Expenditure					Total
	Building Infrastructure	Vehicles and Equipments	Annual Vehicle Maintenance & PDL AMC	Annual Staff Salary	Annual Office Expenses	Annual Training Office Expenses	Annual Bldg. Maintenance	
First Year	703.75	165.47	27.55	293.71	18.50	3.23	11.74	1,223.96
Second Year	781.16	173.75	38.46	468.34	29.51	4.83	13.88	1,509.92
Third Year	433.55	224.76	53.90	868.26	54.70	8.39	27.56	1,671.12
Forth Year	481.22	235.99	71.55	1,357.43	85.52	12.30	41.51	2,285.53
Fifth Year	534.18	123.90	84.48	1,735.90	109.36	14.75	48.84	2,651.41
Sixth Year	592.94	130.10	99.03	2,185.65	137.70	17.41	56.30	3,219.13
Seventh Year	658.15	136.60	115.35	2,718.36	171.26	20.30	63.91	3,883.92
Eighth Year	730.56	143.43	133.66	3,347.43	210.89	23.44	71.67	4,661.08
Ninth Year	0.00	150.60	154.16	4,088.36	257.57	26.84	79.57	4,757.09
Tenth Year	0.00	158.13	177.08	4,958.90	312.41	30.52	87.63	5,724.65
<b>Total</b>	<b>4,915.52</b>	<b>1,642.72</b>	<b>955.22</b>	<b>22,022.33</b>	<b>1,387.40</b>	<b>162.01</b>	<b>502.60</b>	<b>31,587.80</b>

### Prioritization of New Fire Stations

The prioritization of new Fire Stations in Maharashtra State for both rural and urban areas has been detailed in Chapter 9 of Maharashtra State Report.

### Capacity Building and Training Facilities

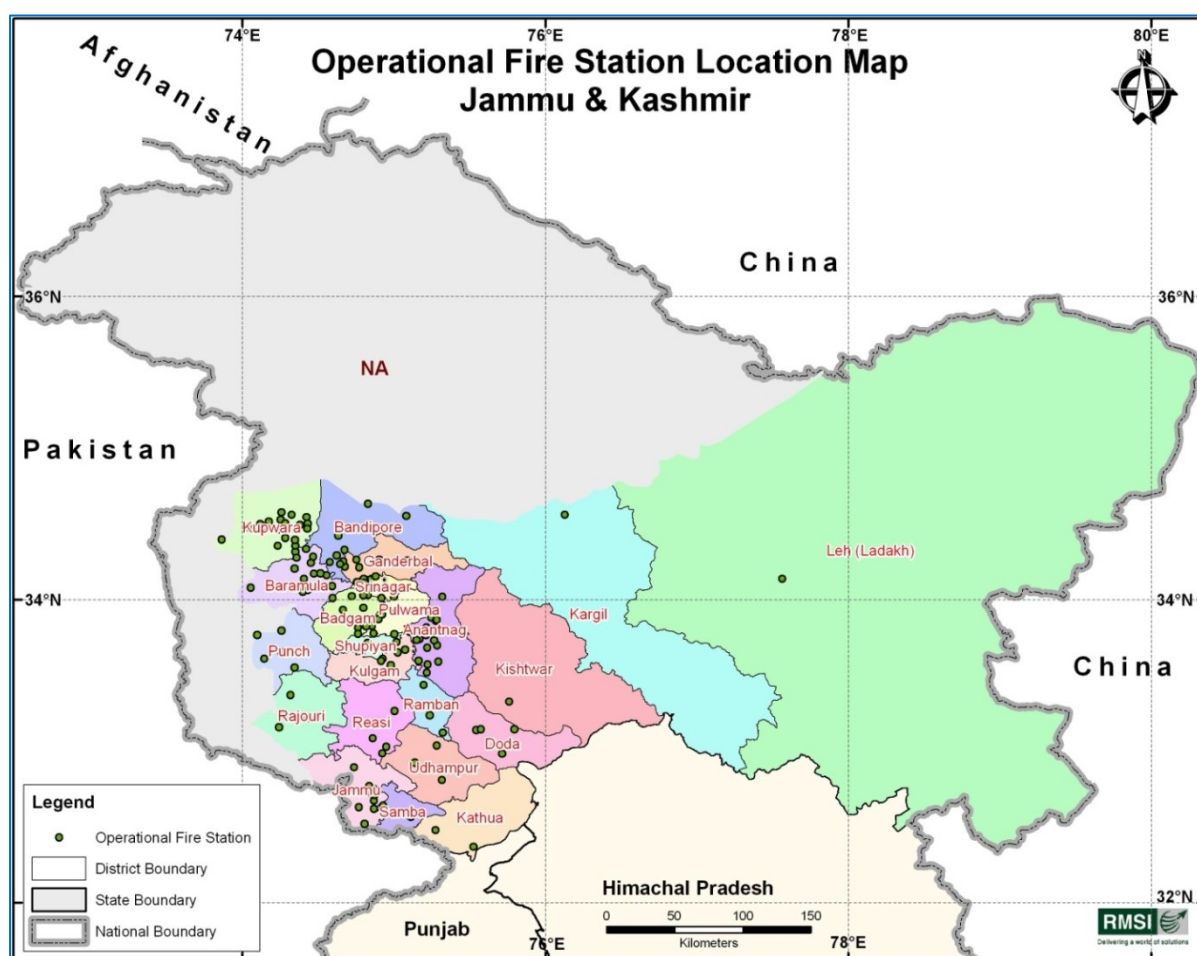
The Capacity building and training facilities and training need assessment for various levels have been given in Chapter 9 of Maharashtra State Report.

## 10 Jammu and Kashmir State

Jammu & Kashmir Fire and Emergency Services (J&K FES) presently have 163 operational Fire Stations. However, in the past, five operational Fire Stations were relocated adjacent to other operational Fire Stations (as State was facing operational difficulties due to terrorism) and two were under construction.

Presently, J & K Fire and Emergency Services is headed by a Director General. J&K FES, and currently operates 163 Fire Stations, and 2 workshops (1 each at Srinagar Headquarter and Jammu division) covering the entire State.

As per Census (2011), the State has 22 districts, with a population of about 12.548 million and a geographical area of about 222,236 sq km.



**Figure 10-1 : Location of operational Fire Stations in Jammu & Kashmir with road and rail networks**

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 airport, military cantonment, power plants etc. The remaining areas, not covered under ideal jurisdiction of operational Fire Stations were 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 within ideal jurisdiction boundary and built-up industrial areas.

### Fire Station Gap Analysis

As per detailed GIS based analysis, the State would require additional 27 Fire Stations in urban areas and 94 Fire Stations in rural areas. There is an overall deficiency of 44% in terms of number of Fire Stations in J&K State (for details, please refer to Chapter 10 of Jammu & Kashmir State Report).

### Firefighting and Rescue Vehicles and Specialized Equipment Gap Analysis

For estimating the gap in fire fighting and rescue vehicles and specialized equipment in operational as well proposed Fire Stations both in urban and rural areas, the RMSI team modified the SFAC norms with expert opinions. These modifications also helped in optimization of resources and are detailed in Chapter 10 of Jammu & Kashmir State Report. Thus, this study finds an overall gap of about 58% in fire fighting and rescues vehicles and about 91% in specialized equipment for both operational and new Fire Stations in urban and rural areas.

### Fire Personnel Gap Analysis

For estimating the gap in fire personnel in operational as well new proposed Fire Stations both in urban and rural areas, the RMSI team used Administrative Reform Department (ARD, Delhi) norms based on duty pattern (double-shift) prevalent in Delhi as ARD has already optimized the fire manpower requirement in comparison to what has been suggested in SFAC norms. Thus, this study finds an overall gap of about 76% in fire personnel considering double shift duty pattern.

**Table 10-1: Gap Analysis for the Jammu and Kashmir Fire & Emergency Services**

<b>Gap Analysis</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicles</b>	<b>Special Equipment</b>	<b>Firefighting Manpower</b>
Operational Fire Stations	156 <sup>*</sup>	246	764	2,241
Gap in Operational Fire Stations		160	4,734	4,459
New Urban Fire Stations	27	34	753	632
New Rural Fire Stations	94	146	1,844	2,140
<b>Gap Analysis in %</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicle</b>	<b>Special Equipments</b>	<b>Firefighting Man Power</b>
Gap in Operational Fire Stations		39%	86%	67%
Gap in Operational and new urban Fire Stations only	15%	44%	88%	69%
Total Gap in Operational, new (urban and rural) Fire Stations	44%	58%	91%	76%

\*

*It may be noted that in the past, seven operational Fire Stations were relocated adjacent to other operational Fire Stations as State was facing operational difficulties due to terrorism. For the purpose of ideal jurisdiction and gap analysis based on network analysis (travel distance by first fire vehicle and ideal population served), these Fire Stations are not accounted as separate Fire Stations. Thus, total numbers of operating Fire Stations in the State of Jammu and Kashmir are considered 156 stations for analysis point of view against*



*163 operational as per State records. Once situation permits, these stations can be relocated to their original/ any other suitable location.*

### Fire Prevention Wing

In addition to fire fighting staff, there is an urgent need for fire prevention wing for inspection, awareness generation, and training for schools, hospitals, high-rise buildings, government offices, public buildings etc., so that recurrence of the fire incidences similar to that at the Advance Medical Research Institute (AMRI), Kolkata, in terms of their magnitude and frequency can be reduced. Accordingly, to support Director General, J&K Fire and Emergency Services, additional officers at the levels of Director, Joint-Director, Dy. Director, Assistant Director, and Division Fire Officers have been recommended (for details, please refer to Chapter 10 of Jammu & Kashmir State Report).

### Detailed Financial Investment plan

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 chapter 10 of Jammu & Kashmir State Report, 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 (chapter 10 of Jammu & Kashmir State Report) for the next 10-years includes both capital and recurring expenditures. Thus, RMSI analysis estimates a total investment of **about Rs. 6,679.75 Crores** spread over a period of 10 years for J&K Fire and Emergency Services including inflationary factors and after filling the gaps for both operational and proposed urban and rural Fire Stations.

**Table 10-2: State level Investment plan (in Crores Rupees) for J&K Fire and Emergency Services only considering gap in operational, new urban and new rural Fire Stations**

Year	Capital Expenditure		Recurring Expenditure					Annual Total
	Building Infrastructure	Vehicles and Equipments	Annual Vehicle Maintenance & PDL AMC	Annual Staff Salary	Annual Office Expenses	Annual Training Office Expenses	Annual Bldg. maintenance	
First Year	123.50	80.33	10.51	149.83	9.44	1.65	6.16	381.42
Second Year	137.09	84.35	16.21	251.54	15.85	2.59	9.06	516.68
Third Year	76.08	15.80	18.46	304.40	19.18	2.94	10.52	447.38
Forth Year	84.45	16.59	20.97	366.33	23.08	3.32	12.01	526.74
Fifth Year	93.74	8.71	23.20	424.51	26.74	3.61	12.83	593.34
Sixth Year	104.06	9.14	25.65	491.38	30.96	3.91	13.67	678.77
Seventh Year	115.50	9.60	28.35	568.19	35.80	4.24	14.52	776.20

Year	Capital Expenditure		Recurring Expenditure					Annual Total
	Building Infrastructure	Vehicles and Equipments	Annual Vehicle Maintenance & PDL AMC	Annual Staff Salary	Annual Office Expenses	Annual Training Office Expenses	Annual Bldg. maintenance	
Eighth Year	128.21	10.08	31.32	656.35	41.35	4.60	15.38	887.29
Ninth Year	0.00	10.59	34.58	757.50	47.72	4.97	16.26	871.62
Tenth Year	0.00	11.12	38.16	873.47	55.03	5.37	17.16	1,000.31
<b>Total</b>	<b>862.62</b>	<b>256.31</b>	<b>247.43</b>	<b>4,843.49</b>	<b>305.14</b>	<b>37.21</b>	<b>127.56</b>	<b>6,679.75</b>

### Prioritization of New Fire Stations

The prioritization of new Fire Stations in Jammu & Kashmir State for both rural and urban areas has been detailed in chapter 10 of Jammu & Kashmir State Report.

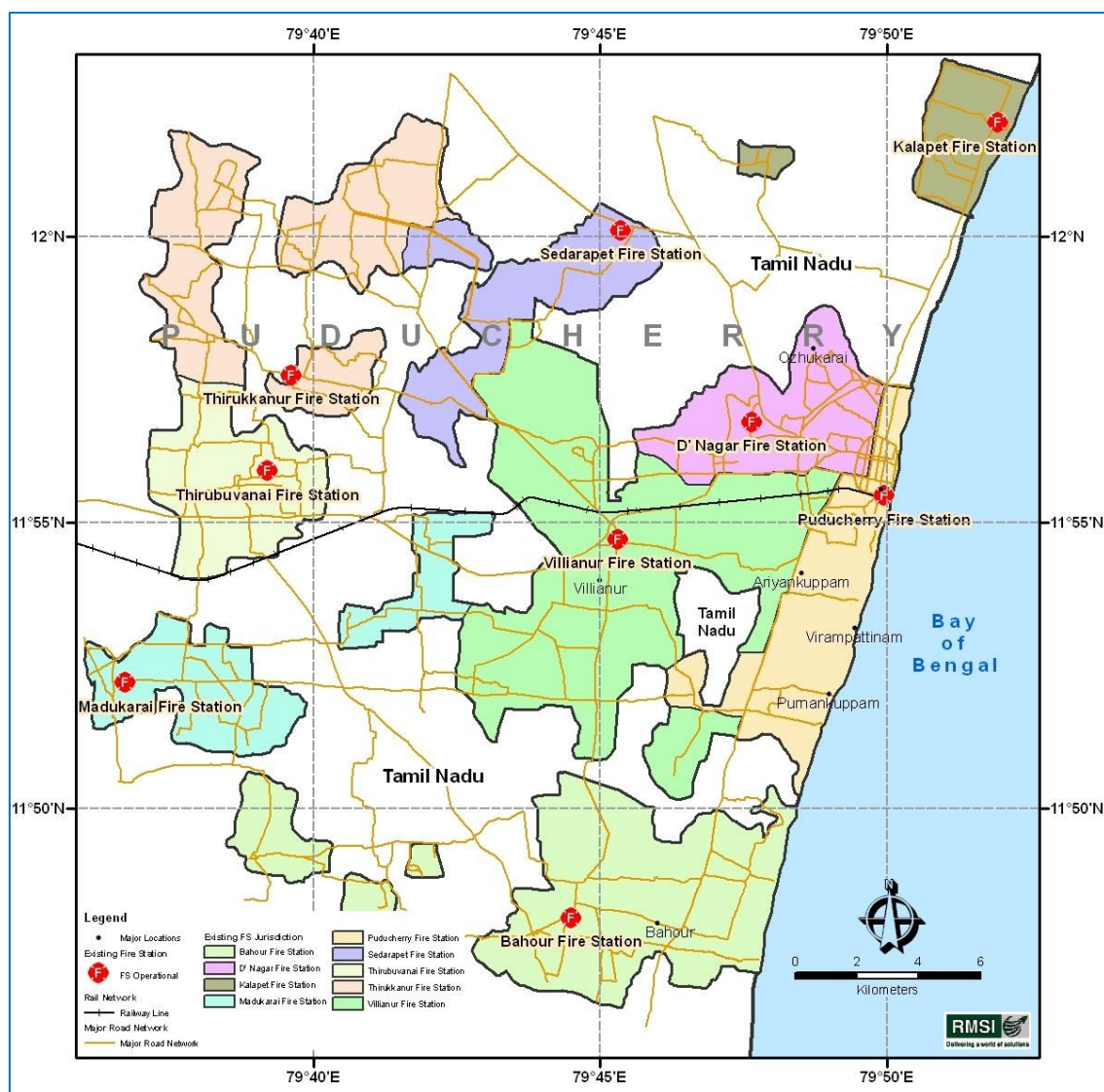
### Capacity Building and Training Facilities

The Capacity building and training facilities and training need assessment for various levels have been given in Chapter 10 of Jammu & Kashmir State Report.

## 11 Puducherry UT

Presently, Puducherry Fire Service Department is headed by a Divisional Fire Officer and currently operates 13 Fire Stations (9 in Puducherry district, 2 in Karaikal district and 1 each at Mahe and Yanam districts). Due to unavailability of permanent training centre in the Union Territory, all the recruits are trained at the D'Nagar Fire Station.

As per Census (2011), State has 4 districts, with a population of about 1,244,464. In all, each Fire Station of Puducherry Fire Service Department is serving about 0.95 Lakhs population



**Figure 11-1 : Location of operational Fire Stations in Puducherry district**

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 airport, military cantonment, power plants etc. The remaining areas, not covered under ideal jurisdiction of operational Fire Stations were 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 within ideal jurisdiction boundary and built-up industrial areas.

### Fire Station Gap Analysis

As per detailed GIS based analysis, the Puducherry Fire Services would require additional 4 Fire Stations, which is an overall deficiency of 24% (for details, please refer to Chapter 11 of Pudduchery report).

### Firefighting and Rescue Vehicles and Specialized Equipment Gap Analysis

For estimating the gap in fire fighting and rescue vehicles and specialized equipment in operational as well proposed Fire Stations both in urban and rural areas, the RMSI team modified the SFAC norms with expert opinions. These modifications also helped in optimization of resources and are detailed in chapter 11 of Puducherry report. Thus, this study finds an overall gap of about 55% in fire fighting and rescues vehicles and about 93% in specialized equipment for both operational and new Fire Stations in both 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 Puducherry as ARD has already optimized the fire manpower requirement in comparison to what has been suggested in SFAC norms. Thus, this study finds an overall gap of about 80% in fire personnel considering double shift duty pattern.

**Table 11-1: Gap Analysis for the Puducherry Fire Services**

<b>Gap Analysis</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicles</b>	<b>Special Equipment</b>	<b>Firefighting Manpower</b>
Operational Fire Stations	13	26	56	221
Gap in Operational Fire Stations		16	558	583
New Urban Fire Stations	4	16	201	293
New Rural Fire Stations	0	0	0	0
<b>Gap Analysis in %</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicle</b>	<b>Special Equipments</b>	<b>Firefighting Man Power</b>
Gap in Operational Fire Stations		38%	91%	73%
Gap in Operational and new urban Fire Stations only	24%	55%	93%	80%
Total Gap in Operational, new (urban and rural) Fire Stations	24%	55%	93%	80%

### Fire Prevention Wing

In addition to fire fighting staff, there is an urgent need for fire prevention wing for inspection, awareness generation, and training for schools, hospitals, high-rise buildings, govt. offices, public buildings etc., so that recurrence of the fire incidences similar to that at the Advance Medical Research Institute (AMRI), Kolkata, in terms of their magnitude and frequency can be reduced. Accordingly, to support Chief Fire Officers (CFO), additional officers at the

levels of Dy. Chief Fire Officers (Dy-CFO), Division Officers (DO), and Assistant Divisional Officer (ADO) have been recommended (for details, please refer to Chapter 11 of Pudduchery report).

### Detailed Financial Investment plan

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 Chapter 11 of Pudduchery report, 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 (Chapter 11 of Puducherry report) for the next 10-years includes both capital and recurring expenditures. Thus, RMSI analysis estimates a total investment of about **Rs. 749.3 Crores** spread over a period of 10 years for Puducherry Fire Services including inflationary factors and after filling the gaps for both operational and proposed urban and rural Fire Stations.

**Table 11-2: State level Investment plan (in Crores Rupees) for Puducherry Fire Service Department only considering gap in operational and new urban Fire Stations**

Year	Capital Expenditure		Recurring Expenditure					
	Building Infra structure	Vehicles and Equipments	Annual Vehicle Maintenance & PDL and AMC	Annual Staff Salary	Annual Office Expenses	Annual Training Office Expenses	Annual Bldg. maintenance	Annual Total
First Year	7.75	13.72	1.25	17.15	1.08	0.19	0.96	42.10
Second Year	8.60	14.41	2.06	30.52	1.92	0.31	1.16	58.99
Third Year	4.77	1.57	2.32	36.62	2.31	0.35	1.25	49.19
Forth Year	5.30	1.65	2.60	43.75	2.76	0.40	1.35	57.80
Fifth Year	5.88	0.86	2.86	50.53	3.18	0.43	1.40	65.15
Sixth Year	6.53	0.91	3.14	58.31	3.67	0.46	1.46	74.49
Seventh Year	7.25	0.95	3.46	67.23	4.24	0.50	1.52	85.14
Eighth Year	8.05	1.00	3.80	77.45	4.88	0.54	1.57	97.29
Ninth Year	0.00	1.05	4.17	89.15	5.62	0.59	1.63	102.21
Tenth Year	0.00	1.10	4.58	102.54	6.46	0.63	1.70	117.02
<b>Total</b>	<b>54.13</b>	<b>37.22</b>	<b>30.24</b>	<b>573.25</b>	<b>36.12</b>	<b>4.41</b>	<b>13.99</b>	<b>749.36</b>

### Prioritization of New Fire Stations

The prioritization of new Fire Stations in Puducherry for urban areas has been detailed in Chapter 11 of Pudduchery Report.

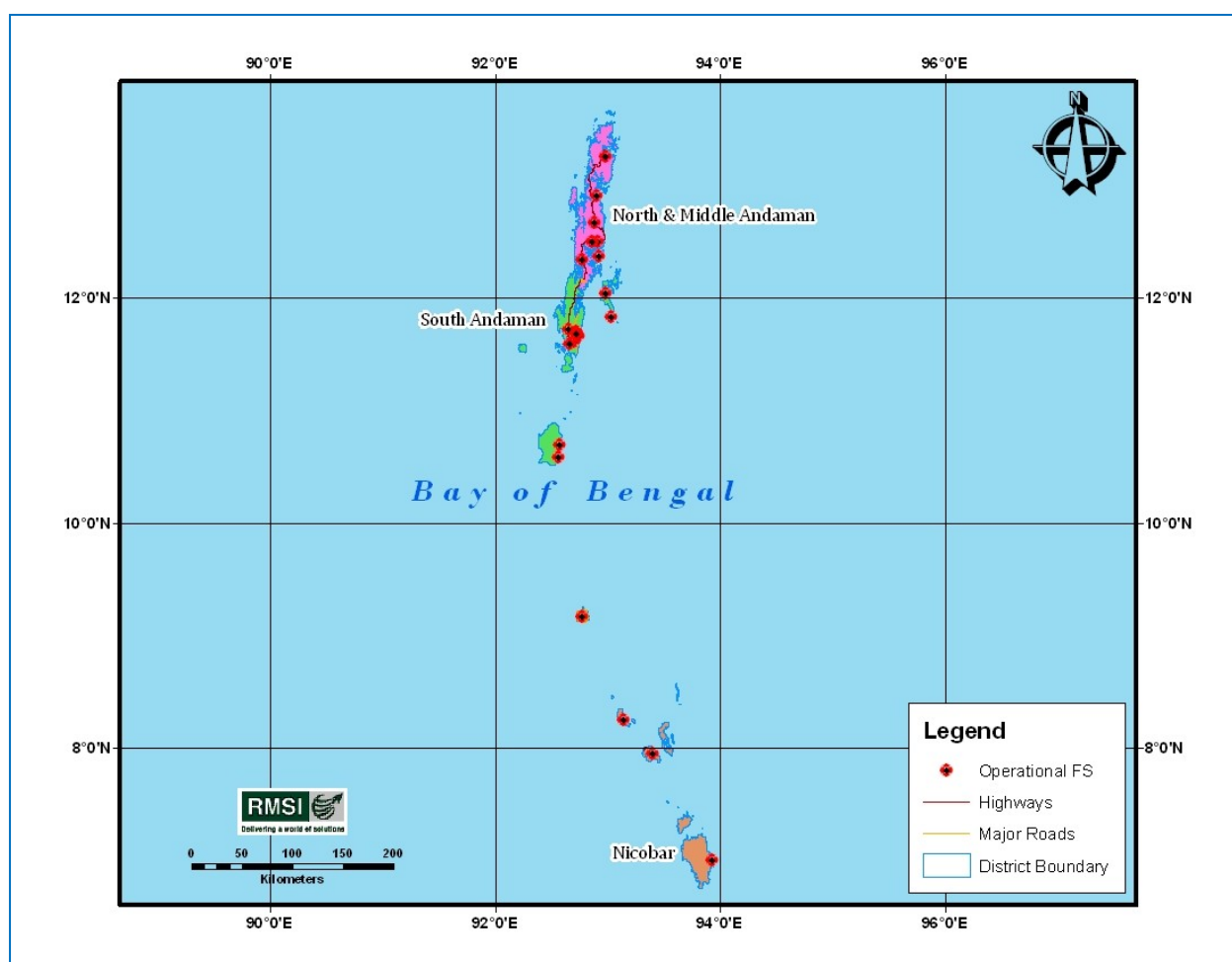
### Capacity Building and Training Facilities

The Capacity building and training facilities and training need assessment for various levels have been given in Chapter 11 of Puducherry Report.

## 12 Andaman & Nicobar Islands UT

The Fire Service in Andaman and Nicobar Islands is under Department of Police, functioning, as a separate unit technically headed by the Chief Fire Officer (CFO) under the control and supervision of Dy. Inspector General Police, Andaman & Nicobar Islands and the head of the department is Director General of Police, A&N Islands. As per Census (2011), UT has 3 districts, with a population of about 379,944. The Andaman & Nicobar Fire Service presently has 20 Fire Stations (4 in Nicobar district, 5 in North & Middle Andaman district and 11 in South Andaman district); Fire Service provides fire coverage to all-important habited Islands of this territory.

Andaman and Nicobar Police Fire Service Department also have a Fire Service Training Centre at its Headquarter (Aberdeen Fire Station, Port Blair) and imparts basic training to fire personnel.



**Figure 12-1 : Location of operational Fire Stations in Andaman and Nicobar Islands**

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 airport, military cantonment, power plants etc. The remaining areas, not covered under ideal jurisdiction of operational Fire Stations were 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 within ideal jurisdiction boundary and built-up industrial areas.

### Fire Station Gap Analysis

As per detailed GIS based analysis, the A&N Fire Services would require additional 6 Fire Stations, which is an overall deficiency of 23% (for details, please refer to Chapter 12 of Andaman & Nicobar Report).

### Firefighting and Rescue Vehicles and Specialized Equipment Gap Analysis

For estimating the gap in fire fighting and rescue vehicles and specialized equipment in operational as well proposed Fire Stations both in urban and rural areas, the RMSI team modified the SFAC norms with expert opinions. These modifications also helped in optimization of resources and are detailed in Chapter 12 of Andaman & Nicobar Report. Thus, this study finds an overall gap of about 73% in fire fighting and rescues vehicles and about 80% 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 A&N islands as ARD has already optimized the fire manpower requirement in comparison to what has been suggested in SFAC norms. Thus, this study finds an overall gap of about 68% in fire personnel considering double shift duty pattern.

**Table 12-1: Gap Analysis for the Andaman and Nicobar Fire Services**

<b>Gap Analysis</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicles</b>	<b>Special Equipment</b>	<b>Firefighting Manpower</b>
Operational Fire Stations	20	32	225	476
Gap in Operational Fire Stations		68	784	834
New Urban Fire Stations	0	0	0	0
New Rural Fire Stations	6	18	120	189
<b>Gap Analysis in %</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicle</b>	<b>Special Equipments</b>	<b>Firefighting Man Power</b>
Gap in Operational Fire Stations		68%	78%	64%
Gap in Operational and new urban Fire Stations only	0%	68%	78%	64%
Total Gap in Operational, new (urban and rural) Fire Stations	23%	73%	80%	68%

### Fire Prevention Wing

In addition to fire fighting staff, there is an urgent need for fire prevention wing for inspection, awareness generation, and training for schools, hospitals, high-rise buildings, govt. offices, public buildings etc., so that recurrence of the fire incidences similar to that at the Advance Medical Research Institute (AMRI), Kolkata, in terms of their magnitude and frequency can be reduced. Accordingly, to support Dy. Director, A&N Fire Services, additional officers at



the levels of Chief Fire Officers (CFO), Dy Chief Fire Officers (Dy-CFO), Division Officers (DO), and Assistant Divisional Officer (ADO) have been recommended (for details, please refer to Chapter 12 of Andaman & Nicobar Report).

### Detailed Financial Investment plan

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 Chapter 12 of Andaman & Nicobar Report, 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 (Chapter 12 of Andaman & Nicobar Report) for the next 10-years includes both capital and recurring expenditures. Thus, RMSI analysis estimates a total investment of **about Rs. 1,072.3 Crores** spread over a period of 10 years for A&N Fire Services including inflationary factors and after filling the gaps for both operational and proposed urban and rural Fire Stations.

**Table 12-2: State level Investment plan (in Crores Rupees) for Andaman & Nicobar Police Fire Service Gaps for filling gap in operational and new Fire Stations (in Crores Rupees)**

Year	Capital Expenditure		Recurring Expenditure					Annual Total
	Building Infra structure	Vehicles and Equipments	Annual Vehicle Maintenance & PDL and AMC	Annual Staff Salary	Annual Office Expenses	Annual Training Office Expenses	Annual Bldg. maintenance	
First Year	11.40	19.95	1.73	29.73	1.87	0.33	1.06	66.07
Second Year	12.65	20.94	3.07	49.55	3.12	0.51	1.46	91.31
Third Year	7.02	0.91	3.36	57.06	3.60	0.55	1.55	74.05
Forth Year	7.80	0.95	3.68	65.66	4.14	0.60	1.64	84.47
Fifth Year	8.65	0.50	4.01	74.53	4.70	0.63	1.70	94.71
Sixth Year	9.61	0.53	4.36	84.57	5.33	0.67	1.75	106.81
Seventh Year	10.66	0.55	4.74	95.95	6.05	0.72	1.81	120.47
Eighth Year	11.83	0.58	5.16	108.84	6.86	0.76	1.86	135.90
Ninth Year	0.00	0.61	5.61	123.45	7.78	0.81	1.92	140.18
Tenth Year	0.00	0.64	6.10	140.00	8.82	0.86	1.98	158.40
<b>Total</b>	<b>79.63</b>	<b>46.15</b>	<b>41.82</b>	<b>829.35</b>	<b>52.25</b>	<b>6.44</b>	<b>16.74</b>	<b>1,072.38</b>

### Prioritization of New Fire Stations

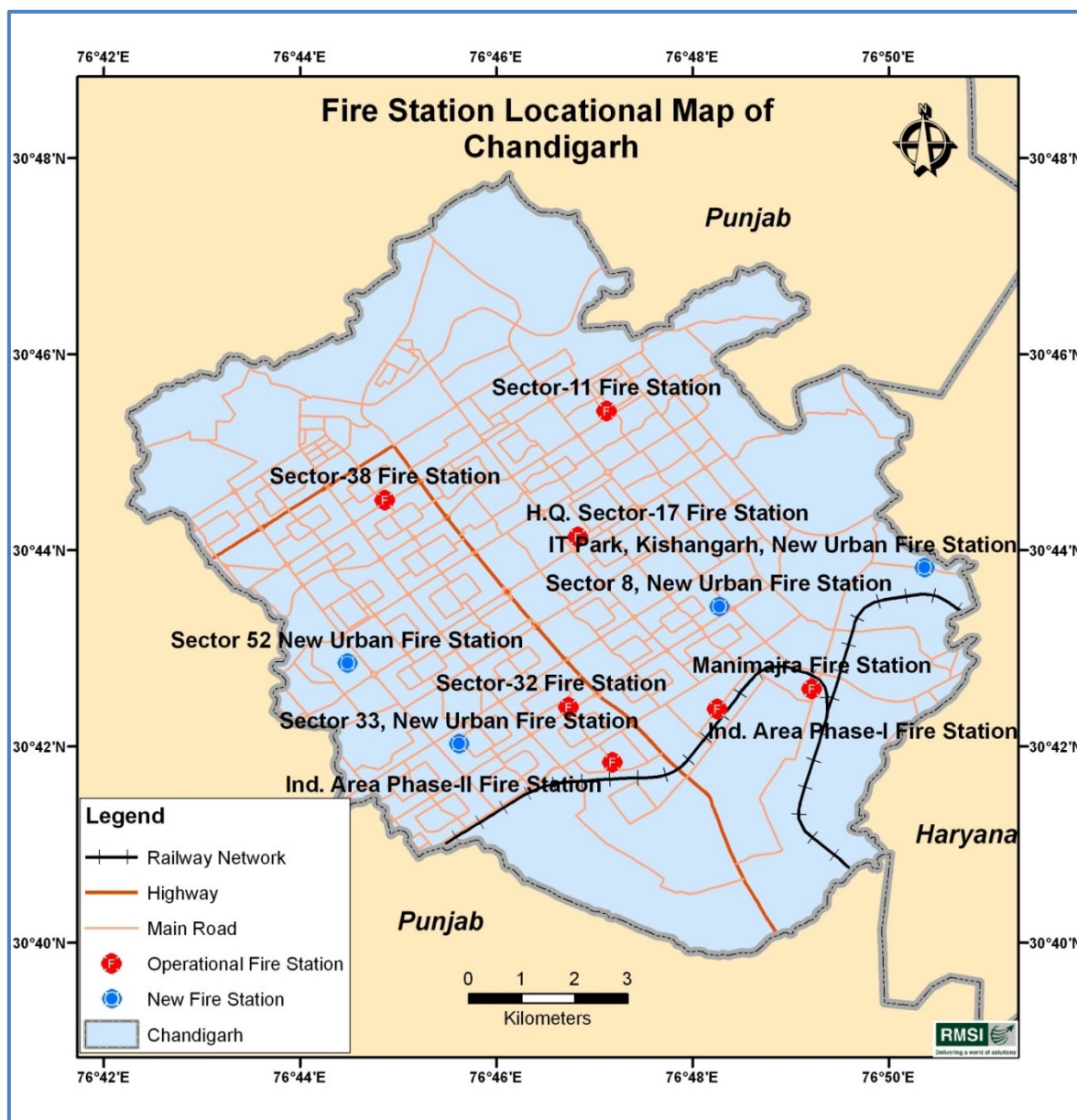
The prioritization of new Fire Stations in Andaman and Nicobar for urban areas has been detailed in Andaman & Nicobar Report.

### Capacity Building and Training Facilities

The Capacity building and training facilities and training need assessment for various levels have been given in Andaman & Nicobar Report.

## 13 Chandigarh UT

Chandigarh Fire and Emergency Services (CF&ES) has seven operational Fire Stations and it is headed by Joint-Commissioner–cum-Chief Fire Officer, CF&ES. Chandigarh UT has a only one district and a population of 1,054,686. On an average, each Fire Station of Chandigarh Fire & Emergency Services is serving more than one Lakh population.



**Figure 13-1 : Locations of operational Fire Stations in Chandigarh UT**

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 airport, military cantonment, power plants etc. The remaining areas, not covered under ideal jurisdiction of operational Fire Stations were 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 within ideal jurisdiction boundary and built-up industrial areas.

### Fire Station Gap Analysis

As per detailed GIS based analysis, Chandigarh U.T. would require additional 4 Fire Stations. Out of the 4 Fire Stations proposed, CF&ES has already proposed 1 new Fire Station at Sector 53, for which land acquisition work has already been completed. Thus, this study proposes a further addition of 3 Fire Stations, which is an overall deficiency of 36% (including 1 Fire Stations proposed by CF&ES) in terms of number of Fire Stations (for details, please refer Chapter 13 of Chandigarh UT report).

### Firefighting and Rescue Vehicles and Specialized Equipment Gap Analysis

For estimating the gap in fire fighting and rescue vehicles and specialized equipment in operational as well proposed Fire Stations, the RMSI team modified the SFAC norms with expert opinions. These modifications also helped in optimization of resources and are detailed in Chapter 13 of Chandigarh UT Report. Thus, this study finds an overall gap of about 41% in fire fighting and rescues vehicles and about 77% in specialized equipment for both operational and new Fire Stations

### Fire Personnel Gap Analysis

For estimating the gap in fire personnel in operational as well new proposed Fire Stations, the RMSI team used Administrative Reform Department (ARD, Delhi) norms based on duty pattern (double-shift) prevalent in Delhi as ARD has already optimized the fire manpower requirement in comparison to what has been suggested in SFAC norms. Thus, this study finds an overall gap of about 73% in fire personnel considering double shift duty pattern.

**Table 13-1: Gap Analysis for the Chandigarh Fire & Emergency Services**

<b>Gap Analysis</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicles</b>	<b>Special Equipment</b>	<b>Firefighting Manpower</b>
Operational Fire Stations	7	37	160	239
Gap in Operational Fire Stations		10	359	462
New Urban Fire Stations	4	16	181	198
New Rural Fire Stations	-	0	-	-
<b>Gap Analysis in %</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicle</b>	<b>Special Equipments</b>	<b>Firefighting Man Power</b>
Gap in Operational Fire Stations		21%	69%	66%
Gap in Operational and new urban Fire Stations only	36%	41%	77%	73%
Total Gap in Operational, new (urban and rural) Fire Stations	36%	41%	77%	73%

### Fire Prevention Wing

In addition to fire fighting staff, there is an urgent need for fire prevention wing for inspection, awareness generation, and training for schools, hospitals, high-rise buildings, govt. offices, public buildings etc., so that recurrence of the fire incidences similar to that at the Advance Medical Research Institute (AMRI), Kolkata, in terms of their magnitude and frequency can be reduced. Accordingly, to support Joint-Commissioner–cum-Chief Fire Officer, CF&ES, additional officers at the levels of CFO, Division Officers (DO), and Assistant Divisional

Officer (ADO) have been recommended (for details, please refer to Chapter 13 of Chandigarh UT Report).

### Detailed Financial Investment plan

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 Chapter 13 of Chandigarh UT Report, the detailed investment and financial plan at district level includes estimation of capital cost for infrastructure, 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 (Chapter 13 of Chandigarh UT Report) for the next 10-years includes both capital and recurring expenditures. RMSI analysis estimates a total investment of **about Rs. 582.4 Crores** spread over a period of 10 years for Haryana State including inflationary factors and after filling the gaps for both operational and proposed urban and rural Fire Stations.

**Table 13-2: State level Investment plan (in Crores Rupees) for Chandigarh Fire & Emergency Services Gaps for filling gap in operational and new Fire Stations (in Crores Rupees)**

Year	Capital Expenditure		Recurring Expenditure					Annual Total
	Building Infra structure	Vehicles and Equipments	Annual Vehicle Maintenance & PDL and AMC	Annual Staff Salary	Annual Office Expenses	Annual Training Office Expenses	Annual Bldg. maintenance	
First Year	2.40	3.65	1.76	15.74	0.99	0.17	0.63	25.34
Second Year	2.66	3.83	2.16	26.42	1.66	0.27	0.64	37.66
Third Year	1.48	1.34	2.42	31.24	1.97	0.30	0.69	39.43
Forth Year	1.64	1.40	2.71	36.83	2.32	0.33	0.75	45.98
Fifth Year	1.82	0.74	2.97	42.28	2.66	0.36	0.78	51.61
Sixth Year	2.02	0.77	3.26	48.51	3.06	0.39	0.81	58.82
Seventh Year	2.24	0.81	3.58	55.62	3.50	0.42	0.85	67.02
Eighth Year	2.49	0.85	3.93	63.74	4.02	0.45	0.88	76.36
Ninth Year	0.00	0.90	4.31	73.02	4.60	0.48	0.92	84.22
Tenth Year	0.00	0.94	4.73	83.59	5.27	0.51	0.95	95.99
<b>Total</b>	<b>16.76</b>	<b>15.24</b>	<b>31.82</b>	<b>476.97</b>	<b>30.05</b>	<b>3.68</b>	<b>7.90</b>	<b>582.43</b>

### Prioritization of New Fire Stations

The prioritization of new Fire Stations in Chandigarh UT for urban areas has been detailed in Chapter 13 of Chandigarh UT Report.

### Capacity Building and Training Facilities

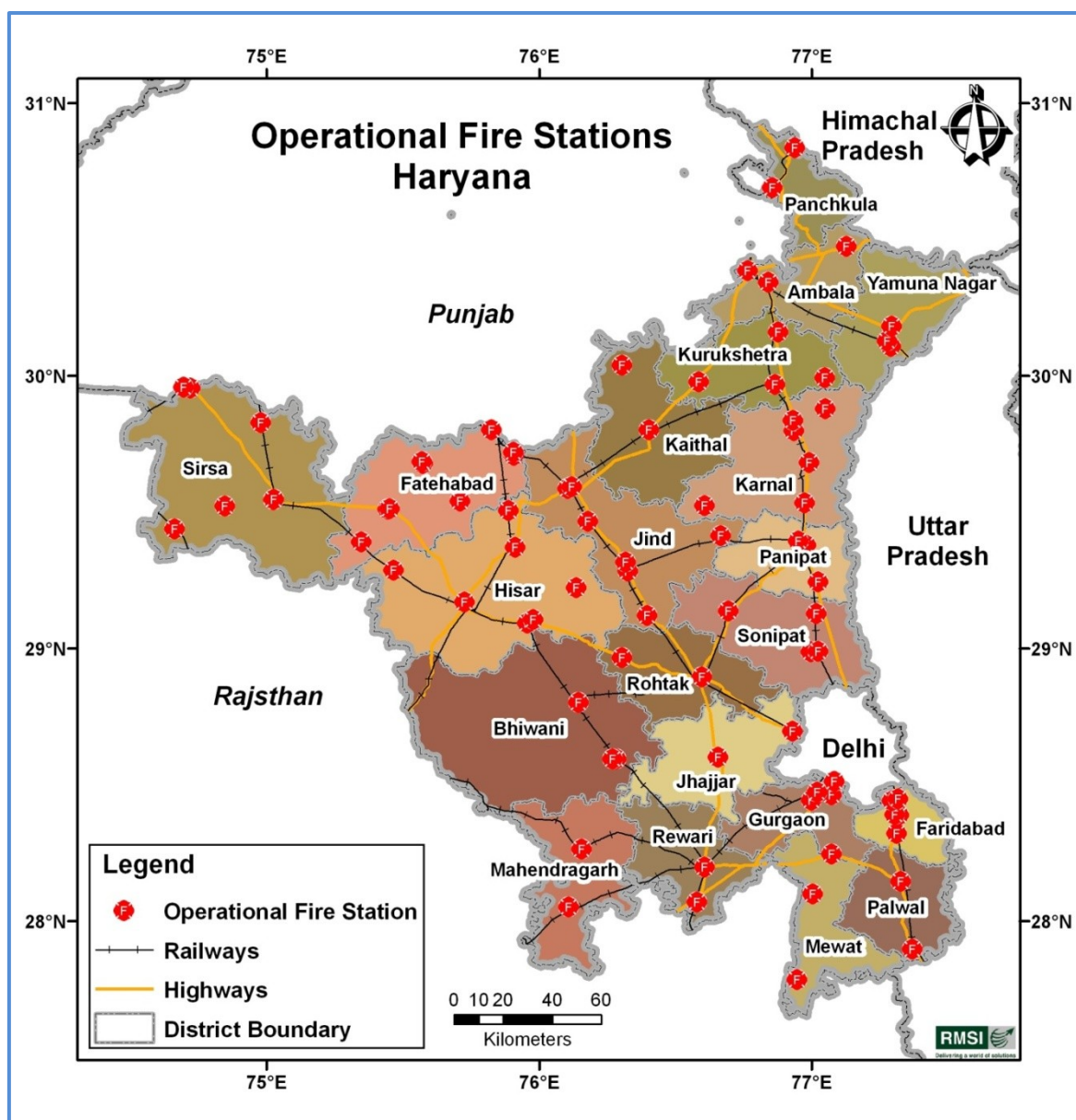
The Capacity building and training facilities and training need assessment for various levels have been given in chapter 13 of Chandigarh UT Report.



## 14 Haryana State

Presently, Haryana State has 82 operational Fire Stations out of which 64 Fire Stations are being operated by Haryana State Fire Service (HSFS) and 18 Fire Stations are being operated by Haryana State Agricultural Marketing Board (HSAMB). Currently, Haryana State Fire Services is headed by a Director General, Urban Local Body Bodies (ULBs), and a State Fire Officer.

Haryana has a population of 2, 53, 53,081 spread over 21 districts. On an average, each Fire Station in Haryana is serving more than 3.1 Lakhs population.



**Figure 14-1 : Location of operational Fire Stations in Haryana State with road and rail networks**

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 airport, military cantonment,

power plants etc. The remaining areas, not covered under ideal jurisdiction of operational Fire Stations were 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 within ideal jurisdiction boundary and built-up industrial areas.

### Fire Station Gap Analysis

As per detailed GIS based analysis, the State would require additional 34 Fire Stations in urban areas and 80 Fire Stations in rural areas. Thus, this study proposes a further addition of 34 urban Fire Stations and 80 rural Fire Stations, which is an overall deficiency of 58% in terms of number of Fire Stations in Haryana (for details, please refer to Chapter 14 of Haryana State Report).

### Firefighting and Rescue Vehicles and Specialized Equipment Gap Analysis

For estimating the gap in fire fighting and rescue vehicles and specialized equipment in operational as well proposed Fire Stations both in urban and rural areas, the RMSI team modified the SFAC norms with expert opinions. These modifications also helped in optimization of resources and are detailed in Chapter 14 of Haryana State Report. Thus, this study finds an overall gap of about 75% in fire fighting and rescues vehicles and about 97% in specialized equipment for both operational and new Fire Stations in urban and rural areas.

### Fire Personnel Gap Analysis

For estimating the gap in fire personnel in operational as well new proposed Fire Stations both in urban and rural areas, the RMSI team used Administrative Reform Department (ARD, Delhi) norms based on duty pattern (double-shift) prevalent in Delhi as ARD has already optimized the fire manpower requirement in comparison to what has been suggested in SFAC norms. Thus, this study finds an overall gap of about 96% in fire personnel considering two-shift duty pattern.

**Table 14-1: Gap Analysis for the Haryana State Fire Services**

<b>Gap Analysis</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicles</b>	<b>Special Equipment</b>	<b>Firefighting Manpower</b>
Operational Fire Stations	82	214	311	601
Gap in Operational Fire Stations		110	4,480	6,566
New Urban Fire Stations	34	75	1,246	1,510
New Rural Fire Stations	80	467	4,593	6,285
<b>Gap Analysis in %</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicle</b>	<b>Special Equipments</b>	<b>Firefighting Man Power</b>
Gap in Operational Fire Stations		34%	94%	92%
Gap in Operational and new urban Fire Stations only	29%	46%	95%	93%
Total Gap in Operational, new (urban and rural) Fire Stations	58%	75%	97%	96%

### Fire Prevention Wing

In addition to fire fighting staff, there is an urgent need for fire prevention wing for inspection, awareness generation, and training for schools, colleges, hospitals, cinema halls, shopping

malls, high-rise buildings, public and private offices, residential areas, industries etc., so that recurrence of the fire incidences similar to that at the Advance Medical Research Institute (AMRI), Kolkata, in terms of their magnitude and frequency can be reduced. Accordingly, to support Director, Delhi Fire Services, Director General, Fire additional officers at the levels of Director (Technical), Chief Fire Officers (CFO), Dy Chief Fire Officers (Dy-CFO), Division Officers (DO), and Assistant Divisional Officer (ADO) have been recommended (for details, please refer to Chapter 14 of Haryana State Report).

### Detailed Financial Investment plan

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 Chapter 14 of Haryana State Report, the detailed investment and financial plan at district level includes estimation of capital cost for infrastructure, 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 (Chapter 14 of Haryana State Report) for the next 10-years includes both capital and recurring expenditures. RMSI analysis estimates a total investment of **about Rs. 9,308.08 Crores** spread over a period of 10 years for Haryana State including inflationary factors and after filling the gaps for both operational and proposed urban and rural Fire Stations.

**Table 14-2: State level Investment plan (in Crores Rupees) for Haryana Fire Services Gaps for filling gap in operational, new urban and new rural Fire Stations (in Crores Rupees)**

Year	Capital Expenditure		Recurring Expenditure					
	Building Infra structure	Vehicles and Equipments	Annual Vehicle Maintenance & PDL and AMC	Annual Staff Salary	Annual Office Expenses	Annual Training Office Expenses	Annual Bldg. maintenance	Annual Total
First Year	142.45	81.43	9.95	131.92	8.31	1.45	5.77	381.28
Second Year	158.12	85.50	15.47	272.29	17.15	2.81	7.80	559.14
Third Year	87.76	45.58	19.23	370.10	23.32	3.58	9.99	559.55
Forth Year	97.41	47.86	23.51	487.45	30.71	4.42	12.22	703.57
Fifth Year	108.13	25.13	26.86	586.79	36.97	4.99	13.42	802.28
Sixth Year	120.02	26.38	30.60	702.96	44.29	5.60	14.64	944.49
Seventh Year	133.22	27.70	34.77	838.55	52.83	6.26	15.88	1,109.22
Eighth Year	147.88	29.09	39.41	996.56	62.78	6.98	17.15	1,299.85
Ninth Year	0.00	30.54	44.57	1,180.43	74.37	7.75	18.44	1,356.10
Tenth Year	0.00	32.07	50.31	1,394.07	87.83	8.58	19.76	1,592.61
<b>Total</b>	<b>994.98</b>	<b>431.27</b>	<b>294.69</b>	<b>6,961.11</b>	<b>438.54</b>	<b>52.41</b>	<b>135.08</b>	<b>9,308.08</b>

### Prioritization of New Fire Stations

The prioritization of new Fire Stations in Haryana for urban areas has been detailed in Chapter 14 of Haryana State Report.

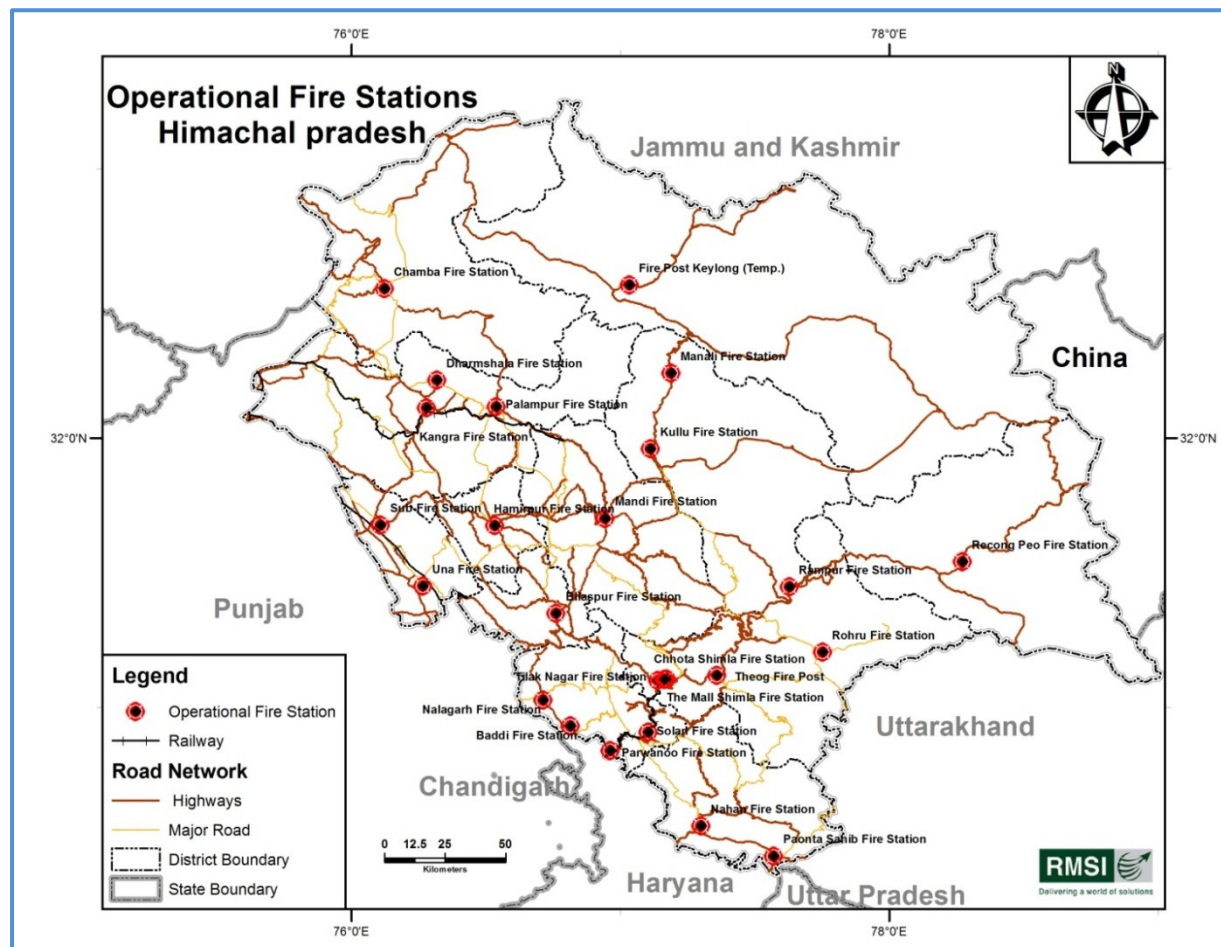
### Capacity Building and Training Facilities

The Capacity building and training facilities and training need assessment for various levels have been given in Chapter 14 of Haryana State Report.



## 15 Himachal Pradesh State

Presently Himachal Pradesh Fire Services has 25 operational Fire Stations/ Posts and one training centre at Baldeyan, 22 km from Shimla. Himachal Pradesh State Fire Service is headed by an Additional Director General-cum- Director Fire Services, Chief Fire Officers, Deputy Chief Fire Officers, and Divisional Officers. As per the Census (2011), Himachal Pradesh State has 6.86 million population distributed among 12 districts and on an average, each Fire Station in Himachal Pradesh is serving more than two Lakhs population.



**Figure 15-1 : Locations of operational Fire Stations in Himachal Pradesh**

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 airport, military cantonment, power plants etc. The remaining areas, not covered under ideal jurisdiction of operational Fire Stations were 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 within ideal jurisdiction boundary and built-up industrial areas.

### Fire Station Gap Analysis

As per detailed GIS based analysis, the State would require additional 11 Fire stations in urban areas and 83 Fire stations in rural areas. Thus, this study proposes a further additional of 11 urban Fire Stations and 83 rural Fire Stations, which is an overall deficiency of 79% in terms of number of Fire Stations in Himachal Pradesh (for details, please refer to Chapter 15 of Himachal Pradesh State Report).

### Firefighting and Rescue Vehicles and Specialized Equipment Gap Analysis

For estimating the gap in fire fighting and rescue vehicles and specialized equipment in operational as well proposed Fire Stations both in urban and rural areas, the RMSI team modified the SFAC norms with expert opinions. These modifications also helped in optimization of resources and are detailed in Chapter 15 of Himachal Pradesh State Report. Hence, this study finds an overall gap of about 82% in fire fighting and rescue vehicles and 95% in specialized equipments 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. Hence, this study finds an overall gap of about 94% in fire personnel considering two-shift duty pattern.

**Table 15-1: Gap Analysis for the Himachal Pradesh Fire Services**

<b>Gap Analysis</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicles</b>	<b>Special Equipment</b>	<b>Firefighting Manpower</b>
Operational Fire Stations	25	79	218	335
Gap in Operational Fire Stations		64	1,109	2,304
New Urban Fire Stations	11	27	406	378
New Rural Fire Stations	83	275	2,882	2,259
<b>Gap Analysis in %</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicle</b>	<b>Special Equipments</b>	<b>Firefighting Man Power</b>
Gap in Operational Fire Stations		45%	84%	87%
Gap in Operational and new urban Fire Stations only	31%	54%	87%	89%
Total Gap in Operational, new (urban and rural) Fire Stations	79%	82%	95%	94%

### Fire Prevention Wing

In addition to fire fighting staff, there is an urgent need for fire prevention wing for inspection, awareness generation, and training for schools, colleges, hospitals, shopping malls, cinema halls, high-rise buildings, industries, govt. offices, public buildings etc., so that recurrence of the fire incidences similar to that at the Advance Medical Research Institute (AMRI), Kolkata, in terms of their magnitude and frequency can be reduced. Accordingly, to support Add. Director (Police) –cum-Director Himachal Fire Services, additional officers at the levels of Director (Technical), Chief Fire Officers (CFO), Dy Chief Fire Officers (Dy-CFO), Divisional Officers (DO), and Assistant Divisional Officer (ADO) have been recommended (for details, please refer to Chapter 15 of Himachal Pradesh State Report).

### Detailed Financial Investment plan

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 Chapter 15 of Himachal Pradesh State Report, 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 (Chapter 15 of Himachal Pradesh State Report) for the next 10-years includes both capital and recurring expenditures. RMSI estimates total investment of **about Rs 3,429 46 Crores** spread over the period of 10years for Himachal Pradesh for filling the gaps for both operational and proposed rural and urban Fire Stations.

**Table 15-2: State level Investment plan (in Crores Rupees) for Himachal Pradesh Fire Services Gaps for filling gap in operational, new urban and new rural Fire Stations (in Crores Rupees)**

Year	Capital Expenditure		Recurring Expenditure					Annual Total
	Building Infra structure	Vehicles and Equipments	Annual Vehicle Maintenance & PDL and AMC	Annual Staff Salary	Annual Office Expenses	Annual Training Office Expenses	Annual Bldg. maintenance	
First Year	58.65	42.20	3.89	50.66	3.19	0.56	2.23	161.38
Second Year	65.10	44.31	6.45	100.69	6.34	1.04	3.41	227.35
Third Year	36.13	18.73	8.03	134.48	8.47	1.30	4.17	211.32
Forth Year	40.10	19.66	9.83	174.92	11.02	1.59	4.95	262.08
Fifth Year	44.52	10.32	11.24	209.52	13.20	1.78	5.37	295.96
Sixth Year	49.42	10.84	12.81	249.91	15.74	1.99	5.80	346.52
Seventh Year	54.85	11.38	14.57	296.97	18.71	2.22	6.24	404.94
Eighth Year	60.88	11.95	16.52	351.73	22.16	2.46	6.68	472.39
Ninth Year	0.00	12.55	18.69	415.36	26.17	2.73	7.14	482.63
Tenth Year	0.00	13.18	21.10	489.19	30.82	3.01	7.60	564.90
<b>Total</b>	<b>409.66</b>	<b>195.13</b>	<b>123.13</b>	<b>2,473.44</b>	<b>155.83</b>	<b>18.67</b>	<b>53.60</b>	<b>3,429.46</b>

### Prioritization of New Fire Stations

The prioritization of new Fire Stations in Himachal Pradesh State for urban areas has been detailed in Chapter 15 of Himachal Pradesh State Report.

### Capacity Building and Training Facilities

The Capacity building and training facilities and training need assessment for various levels have been given in Chapter 15 of Himachal Pradesh State Report.

## 16 Punjab State

Presently, Punjab State Fire Services is headed by a Director, Department of Local Govt., Punjab, one State Chief Fire Officer (officiating), and one Assistant Divisional Fire Officer (ADFO) in each district of Amritsar, Barnala, Fatehgarh Sahib, Gurudaspur, Jalandhar, and Patiala.

As per the 2011 census, the total population of the State is 2.77 Crores and currently, there are 48 Fire Stations operational in Punjab. On an average each Fire Station serving more than 5.7 lakhs population.



**Figure 16-1 : Location of operational Fire Stations in Punjab State with road and rail networks**

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 airport, military cantonment,



power plants etc. The remaining areas, not covered under ideal jurisdiction of operational Fire Stations were 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 within ideal jurisdiction boundary and built-up industrial areas.

### Fire Station Gap Analysis

As per detailed GIS based analysis, the State would require additional 34 Fire stations in urban areas and 93 Fire stations in rural areas. Thus, this study proposes a further additional of 34 urban Fire Stations and 93 rural Fire Stations, which is an overall deficiency of 73% in terms of number of Fire Stations in Punjab (for details, please refer to Chapter 16 of Punjab State Report).

### Firefighting and Rescue Vehicles and Specialized Equipment Gap Analysis

For estimating the gap in fire fighting and rescue vehicles and specialized equipment in operational as well proposed Fire Stations both in urban and rural areas, the RMSI team modified the SFAC norms with expert opinions. These modifications also helped in optimization of resources and are detailed in Chapter 16 of Punjab State Report. Thus, this study finds an overall gap of about 88% in fire fighting and rescue vehicle and about 97% 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 Punjab is double shift duty pattern (for details refer to Chapter 16 of Punjab State Report). Thus, this study finds an overall gap of about 96% in fire personnel for double duty shift pattern.

**Table 16-1: Gap Analysis for the Punjab State Fire Services**

<b>Gap Analysis</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicles</b>	<b>Special Equipment</b>	<b>Firefighting Manpower</b>
Operational Fire Stations	48	118	280	581
Gap in Operational Fire Stations		161	3,602	4,921
New Urban Fire Stations	34	89	1,461	1,756
New Rural Fire Stations	93	585	5,805	8,989
<b>Gap Analysis in %</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicle</b>	<b>Special Equipments</b>	<b>Firefighting Man Power</b>
Gap in Operational Fire Stations		58%	93%	89%
Gap in Operational and new urban Fire Stations only	41%	68%	95%	92%
Total Gap in Operational, new (urban and rural) Fire Stations	73%	88%	97%	96%

### Fire Prevention Wing

In addition to fire fighting staff, there is an urgent need for fire prevention wing for inspection, awareness generation, and training for schools, hospitals, high-rise buildings, govt. offices,

public buildings etc., so that recurrence of the fire incidences similar to that at the Advance Medical Research Institute (AMRI), Kolkata, in terms of their magnitude and frequency can be reduced. Accordingly, to support Director, Deptt. of Local Govt., Punjab, additional officers at the levels of Director (Technical), Chief Fire Officers (CFO), Dy Chief Fire Officers (Dy-CFO), Division Officers (DO), and Assistant Divisional Officer (ADO) have been recommended (for details, please refer to Chapter 16 of Punjab State Report).

### Detailed Financial Investment plan

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 Chapter 16 of Punjab State Report, 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 (Chapter 16 of Punjab State Report) for the next 10-years includes both capital and recurring expenditures. , RMSI analysis estimates a total investment of **about Rs. 9,632.5 Crores** spread over a period of 10 years for Delhi State including inflationary factors and after filling the gaps for both operational and proposed urban and rural Fire Stations.

**Table 16-2: State level Investment plan (in Crores Rupees) for Punjab Fire Services Gaps for filling gap in operational, new urban and new rural Fire Stations (in Crores Rupees)**

Year	Capital Expenditure		Recurring Expenditure					Annual Total
	Building Infra structure	Vehicles and Equipments	Annual Vehicle Maintenance & PDL and AMC	Annual Staff Salary	Annual Office Expenses	Annual Training Office Expenses	Annual Bldg. maintenance	
First Year	158.9	103.07	7.11	104.15	6.56	1.15	4.29	385.22
Second Year	176.38	108.22	13.20	210.46	13.26	2.17	5.55	529.24
Third Year	97.89	54.49	17.19	325.65	20.52	3.15	8.35	527.24
Forth Year	108.66	57.21	21.73	465.46	29.32	4.22	11.21	697.81
Fifth Year	120.61	30.04	25.18	577.72	36.40	4.91	12.73	807.58
Sixth Year	133.88	31.54	29.04	710.22	44.74	5.66	14.27	969.35
Seventh Year	148.60	33.12	33.35	866.20	54.57	6.47	15.84	1,158.16
Eighth Year	164.95	34.77	38.17	1,049.39	66.11	7.35	17.45	1,378.20
Ninth Year	0.00	36.51	43.55	1,264.08	79.64	8.30	19.08	1,451.16
Tenth Year	0.00	38.34	49.55	1,515.18	95.46	9.32	20.74	1,728.59
<b>Total</b>	<b>1,109.88</b>	<b>527.31</b>	<b>278.07</b>	<b>7,088.52</b>	<b>446.58</b>	<b>52.69</b>	<b>129.51</b>	<b>9,632.55</b>

### Prioritization of New Fire Stations

The prioritization of new Fire Stations in Punjab State for urban areas has been detailed in Chapter 16 of Punjab State Report.

### Capacity Building and Training Facilities

The Capacity building and training facilities and training need assessment for various levels have been given in Chapter 16 of Punjab State Report.

## 17 Uttarakhand State

Presently, Uttarakhand State Fire & Emergency Services is headed by Director General, Police & Fire Services. As per the 2011 Census, the total population of the State is 1, 01, 16,752 and currently, there are 33 Fire Stations operational in Uttarakhand. On an average each Fire Station serving more than three Lakhs population.



**Figure 17-1 : Location of operational Fire Stations in Uttarakhand State**

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 airport, military cantonment, power plants etc. The remaining areas, not covered under ideal jurisdiction of operational Fire Stations were 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 within ideal jurisdiction boundary and built-up industrial areas.

### Fire Station Gap Analysis

As per detailed GIS based analysis, the State would require additional 33 Fire stations in urban areas and 58 stations in rural areas. Hence this study recommends a further of addition of 33 urban Fire Stations and 58 rural Fire Stations, which is an overall gap of 73% in terms of number of Fire Stations in Uttarakhand State (for details, please refer to Chapter 17 of Uttarakhand State Report)



### Firefighting and Rescue Vehicles and Specialized Equipment Gap Analysis

For estimating the gap in fire fighting and rescue vehicles and specialized equipment in operational as well proposed Fire Stations both in urban and rural areas, the RMSI team modified the SFAC norms with expert opinions. These modifications also helped in optimization of resources and are detailed in Chapter 17 of Uttarakhand State Report. This study finds an overall gap of 77% in fire fighting and rescue vehicles and about 92% 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 Uttarakhand State is 24 hours, in general RMSI team estimated for manpower requirement for double shift duty pattern (for details, please refer Chapter 17 of Uttarakhand State Report). Thus, in Uttarakhand State, this study finds an overall gap of about 85% in fire personnel considering double shift duty pattern.

**Table 17-1: Gap Analysis for the Uttarakhand Fire & Emergency Services**

<b>Gap Analysis</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicles</b>	<b>Special Equipment</b>	<b>Firefighting Manpower</b>
Operational Fire Stations	33	112	447	1,017
Gap in Operational Fire Stations		80	1,240	1,936
New Urban Fire Stations	33	69	1,408	1,212
New Rural Fire Stations	58	233	2,345	2,453
<b>Gap Analysis in %</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicle</b>	<b>Special Equipments</b>	<b>Firefighting Man Power</b>
Gap in Operational Fire Stations		42%	74%	66%
Gap in Operational and new urban Fire Stations only	50%	57%	86%	76%
Total Gap in Operational, new (urban and rural) Fire Stations	73%	77%	92%	85%

### Fire Prevention Wing

In addition to fire fighting staff, there is an urgent need for fire prevention wing for inspection, awareness generation, and training for schools, colleges, hospitals, shopping malls, cinema halls, high-rise buildings, Industries, govt. offices, public buildings etc., so that recurrence of the fire incidences similar to that at the Advance Medical Research Institute (AMRI), Kolkata, in terms of their magnitude and frequency can be reduced. Accordingly, to support Director General, Police & Fire Services, additional officers at the levels of Director (Technical), Deputy Director (Technical), Chief Fire Officers (CFO), Dy Chief Fire Officers (Dy-CFO), Division Officers (DO), and Assistant Divisional Officer (ADO) have been recommended (for details, please refer to Chapter 17 of Uttarakhand State Report).

### Detailed Financial Investment plan

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 Chapter 17 of Uttarakhand State Report, 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 (Chapter 17 of Uttarakhand State Report) for the next 10-years includes both capital and recurring expenditures. RMSI analysis estimates a total investment of **about Rs. 4,247.1 Crores** spread over a period of 10 years for Uttarakhand State including inflationary factors and after filling the gaps for both operational and proposed urban and rural Fire Stations.

**Table 17-2: State level Investment plan (in Crores Rupees) for Uttarakhand Fire & Emergency Services Gaps for filling gap in operational, new urban and new rural Fire Stations (in Crores Rupees)**

Year	Capital Expenditure		Recurring Expenditure					Annual Total
	Building Infra structure	Vehicles and Equipments	Annual Vehicle Maintenance & PDL and AMC	Annual Staff Salary	Annual Office Expenses	Annual Training Office Expenses	Annual Bldg. maintenance	
First Year	75.25	49.39	4.65	67.16	4.23	0.74	2.77	204.19
Second Year	83.53	51.86	7.68	112.59	7.09	1.16	3.97	267.88
Third Year	46.36	25.03	9.76	156.46	9.86	1.51	5.07	254.05
Forth Year	51.46	26.28	12.14	209.24	13.18	1.90	6.19	320.38
Fifth Year	57.12	13.80	13.97	253.39	15.96	2.15	6.80	363.19
Sixth Year	63.40	14.49	16.01	305.13	19.22	2.43	7.41	428.09
Seventh Year	70.37	15.21	18.29	365.63	23.03	2.73	8.04	503.31
Eighth Year	78.12	15.97	20.84	436.25	27.48	3.05	8.68	590.40
Ninth Year	0.00	16.77	23.68	518.57	32.67	3.40	9.33	604.42
Tenth Year	0.00	17.61	26.83	614.35	38.70	3.78	9.99	711.27
<b>Total</b>	<b>525.60</b>	<b>246.40</b>	<b>153.85</b>	<b>3,038.77</b>	<b>191.44</b>	<b>22.86</b>	<b>68.25</b>	<b>4,247.18</b>

### Prioritization of New Fire Stations

The prioritization of new Fire Stations in Uttarakhand for urban and rural areas has been detailed in Chapter 17 of Uttarakhand State Report.

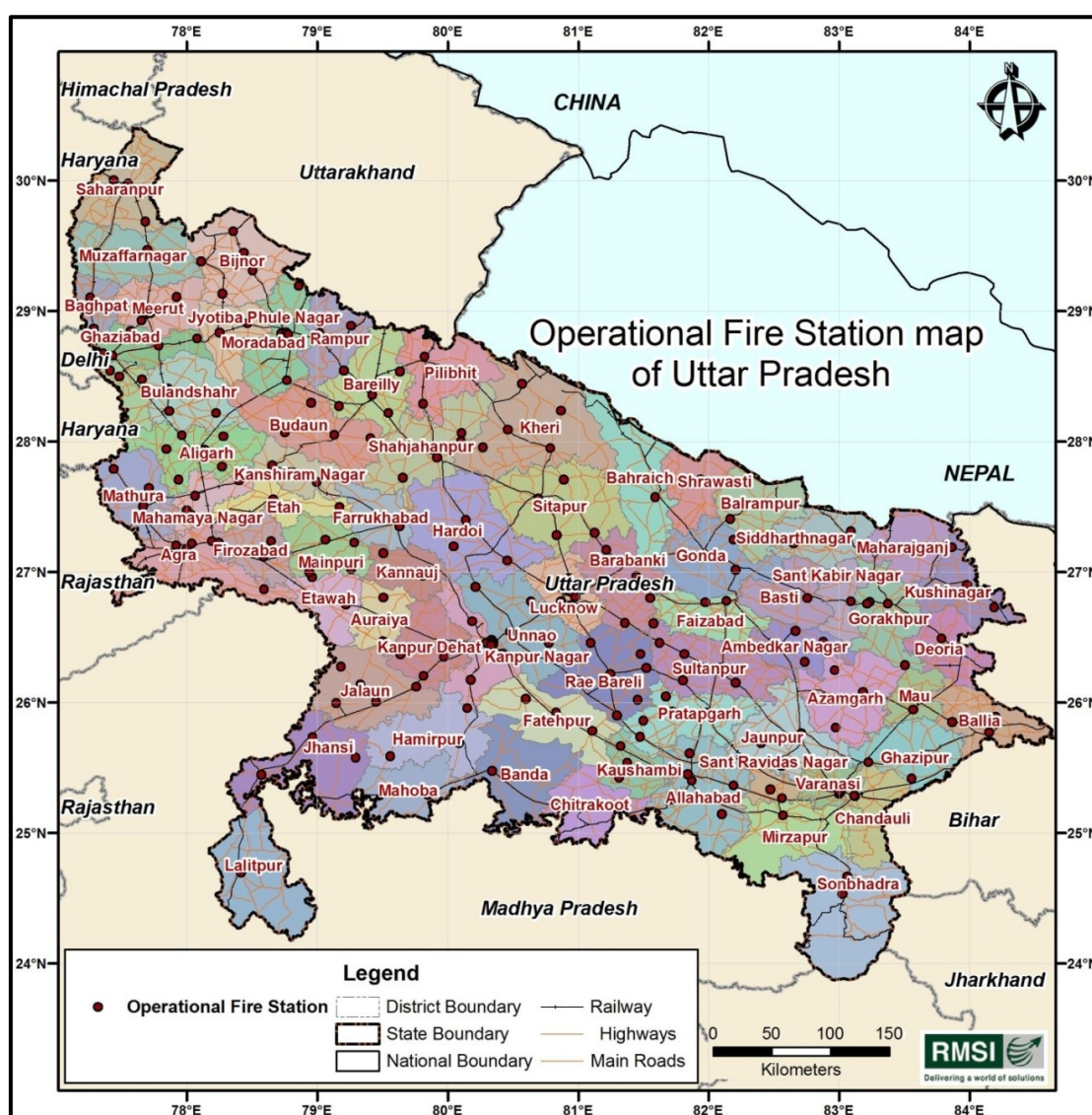
### Capacity Building and Training Facilities

The Capacity building, training facilities and training need assessment for various levels has been given in Chapter 17 of Uttarakhand State Report.

## 18 Uttar Pradesh State

The Uttar Pradesh State Fire Service was established long back on 26<sup>th</sup> July 1944. However, till the amendment of the Uttar Pradesh Fire Service Act in 1952, the Fire Stations catered to the Municipal Board areas only. Presently, it has 237 operational Fire Stations distributed in the 71 districts of the State and a headcount of 4,613 firefighting personnel.

The Uttar Pradesh Fire Service is working under the Uttar Pradesh Police department and has its own Fire Service Act. Presently, the State fire service is headed by Director General of Police and the fire service headquarter is located at Lucknow. The State Fire Service Training Center is located at Unnao and supervised by a Commandant Officer. The 237 operational Fire Stations serve an average population of more than 8.4 Lakhs per Fire Station.



**Figure 18-1 : Locations of operational Fire Stations in Uttar Pradesh State**

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 airport, military cantonment,

power plants etc. The remaining areas, not covered under ideal jurisdiction of operational Fire Stations were 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 within ideal jurisdiction boundary and built-up industrial areas.

### Fire Station Gap Analysis

As per detailed GIS based analysis, the State would require additional 117 Fire stations in urban areas and 352 stations in rural areas. Hence this study recommends a further of addition of 469 Fire Stations, which is an overall gap of 66% in terms of number of Fire Stations in Uttar Pradesh State (for details, please refer to Chapter 18 of Uttar Pradesh State Report).

### Firefighting and Rescue Vehicles and Specialized Equipment Gap Analysis

For estimating the gap in fire fighting and rescue vehicles and specialized equipment in operational as well proposed Fire Stations both in urban and rural areas, the RMSI team modified the SFAC norms with expert opinions. These modifications also helped in optimization of resources and are detailed in Chapter 18 of Uttar Pradesh State Report. This study finds an overall gap of 92% in fire fighting and rescue vehicles and about 96% in specialized equipment for both operational and new Fire Stations in urban and rural areas in Uttar Pradesh.

### 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 Uttar Pradesh State is 24 hours, in general, and RMSI team estimated for manpower requirement for double shift duty pattern (for details, please refer Chapter 18 of Uttar Pradesh State Report). Thus, in Uttar Pradesh State, this study find an overall gap of about 95% in fire personnel considering double shift duty pattern.

**Table 18-1: Gap Analysis for the Uttar Pradesh Fire Services**

<b>Gap Analysis</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicles</b>	<b>Special Equipment</b>	<b>Firefighting Manpower</b>
Operational Fire Stations	237	417	2,303	4,628
Gap in Operational Fire Stations		1,298	15,444	29,094
New Urban Fire Stations	117	323	5,614	6,457
New Rural Fire Stations	352	2,955	32,404	48,911
<b>Gap Analysis in %</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicle</b>	<b>Special Equipments</b>	<b>Firefighting Man Power</b>
Gap in Operational Fire Stations		76%	87%	86%
Gap in Operational and new urban Fire Stations only	33%	80%	90%	88%
Total Gap in Operational, new (urban and rural) Fire Stations	66%	92%	96%	95%

### Fire Prevention Wing

In addition to fire fighting staff, there is an urgent need for fire prevention wing for inspection, awareness generation, and training for schools, colleges, hospitals, shopping malls, cinema



halls, high-rise buildings, govt. offices, public buildings, and industries etc., to reduce the recurrence of the fire incidences similar to the Advance Medical Research Institute (AMRI), Kolkata, in terms of their magnitude and frequency can be reduced. Accordingly, to support Director General, Police & Fire Services, additional officers at the levels of Director (Technical), Joint Director (Technical), Deputy Director (Technical), Chief Fire Officers (CFO), Dy Chief Fire Officers (Dy-CFO), Division Officers (DO), and Assistant Divisional Officer (ADO) have been recommended (for details, please refer to Chapter 18 of Uttar Pradesh State Report).

### Detailed Financial Investment plan

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 Chapter 18 of Uttar Pradesh State Report, 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 (Chapter 18 of Uttar Pradesh State Report) for the next 10-years includes both capital and recurring expenditures. RMSI analysis estimates a total investment of **about Rs. 53,1851.8 Crores** spread over a period of 10 years for Uttar Pradesh State including inflationary factors and after filling the gaps for both operational and proposed urban and rural Fire Stations.

**Table 18-2: State level Investment plan (in Crores Rupees) for Uttar Pradesh Fire Services Gaps for filling gap in operational, new urban and new rural Fire Stations (in Crores Rupees)**

Year	Capital Expenditure		Recurring Expenditure					Annual Total
	Building Infra structure	Vehicles and Equipments	Annual Vehicle Maintenance & PDL and AMC	Annual Staff Salary	Annual Office Expenses	Annual Training Office Expenses	Annual Bldg. maintenance	
First Year	920.55	472.41	31.43	647.65	40.80	7.12	19.93	2,139.89
Second Year	1,021.81	496.02	58.61	1,278.23	80.53	13.18	33.79	2,982.17
Third Year	567.10	269.62	77.86	1,894.09	119.33	18.31	47.39	2,993.71
Forth Year	629.47	283.10	99.81	2,639.37	166.28	23.92	61.25	3,903.20
Fifth Year	698.74	148.63	116.29	3,246.15	204.51	27.58	68.63	4,510.53
Sixth Year	775.61	156.06	134.76	3,960.56	249.51	31.55	76.15	5,384.21
Seventh Year	860.90	163.86	155.45	4,799.68	302.38	35.85	83.81	6,401.93
Eighth Year	955.62	172.06	178.58	5,783.17	364.34	40.49	91.62	7,585.87
Ninth Year	0.00	180.66	204.42	6,933.58	436.81	45.51	99.57	7,900.56
Tenth Year	0.00	189.69	233.25	8,276.81	521.44	50.93	107.68	9,379.80
<b>Total</b>	<b>6,429.81</b>	<b>2,532.11</b>	<b>1,290.45</b>	<b>39,459.30</b>	<b>2,485.93</b>	<b>294.46</b>	<b>689.82</b>	<b>53,181.88</b>

### Prioritization of New Fire Stations

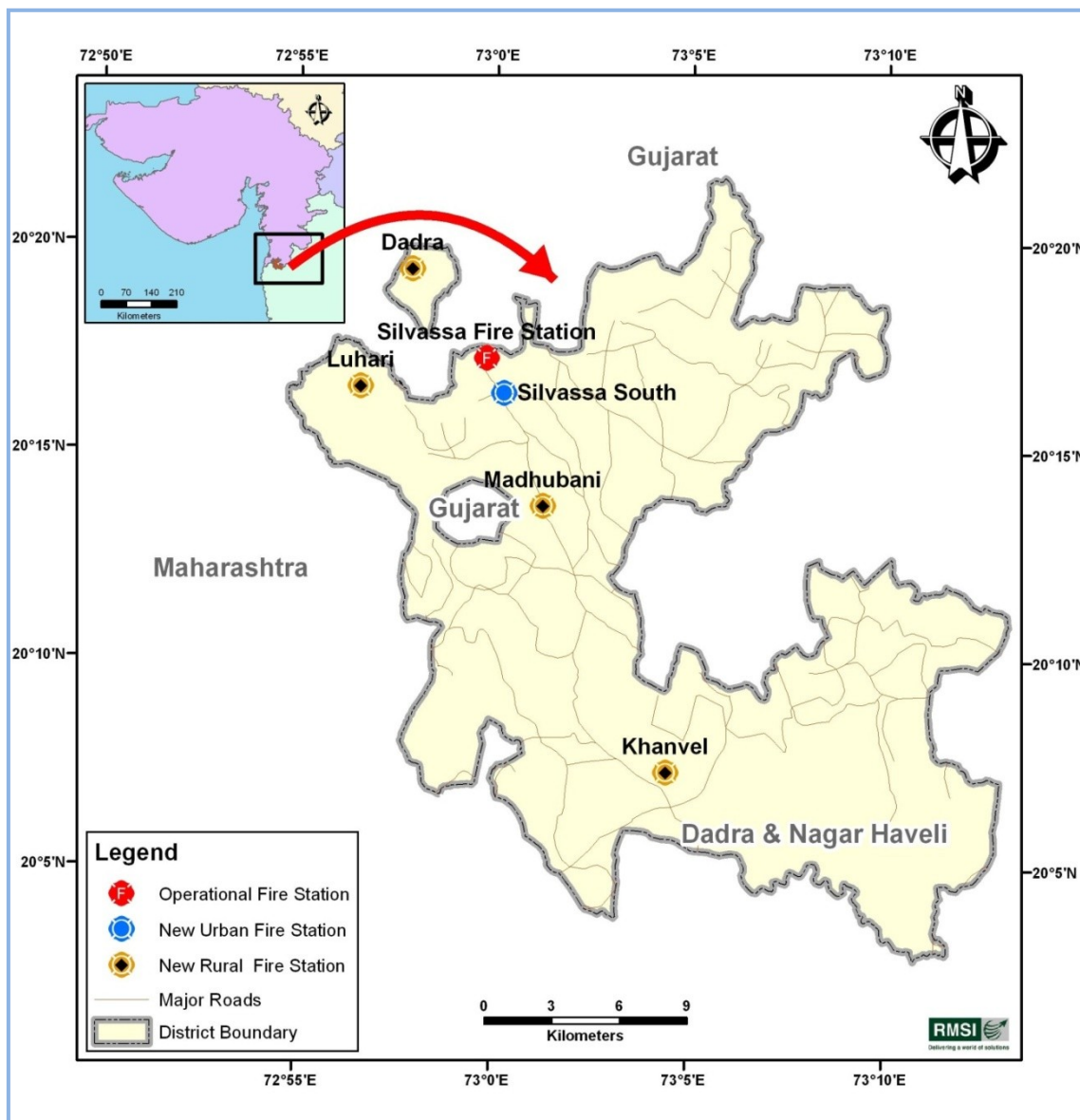
The prioritization of new Fire Stations in Uttar Pradesh for urban areas has been detailed in Chapter 18 of Uttar Pradesh State Report.

### Capacity Building and Training Facilities

The Capacity building and training facilities and training need assessment for various levels have been given in Chapter 18 of Uttar Pradesh State Report.

## 19 Dadra and Nagar Haveli UT

Presently, Dadra and Nagar Haveli Fire & Emergency Services is headed by IGP-cum-Director, UT. The UT has a population of 342,853, spread over one administrative district. On an average, operational one Fire Station in Dadra & Nagar Haveli UT is serving entire population of more than three Lakhs.



**Figure 19-1 : Locations of operational and proposed Fire Stations in Dadra and Nagar Haveli UT**

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 airport, military cantonment, power plants etc. The remaining areas, not covered under ideal jurisdiction of operational Fire Stations were 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 within ideal jurisdiction boundary and built-up industrial areas.

### Fire Station Gap Analysis

As per detailed GIS based analysis, the UT would require additional 1 Fire stations in urban areas and 4 Fire stations in rural areas. Hence this study finds an overall gap of 83% in terms of number of Fire Stations in Dadra & Nagar Haveli F&ES (for details, please refer to Chapter 19 of Dadra Nagar Haveli UT Report).

### Firefighting and Rescue Vehicles and Specialized Equipment Gap Analysis

For estimating the gap in fire fighting and rescue vehicles and specialized equipment in operational as well proposed Fire Stations both in urban and rural areas, the RMSI team modified the SFAC norms with expert opinions. These modifications also helped in optimization of resources and are detailed in Chapter 19 of Dadra Nagar Haveli UT Report. This study finds an overall gap of 76% in the firefighting and rescue vehicles and about 73% 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 Dadra & Nagar Haveli F&ES is double shift (24 hours duty, 24 hours off), and RMSI team also estimated for manpower requirement for double shift duty pattern (for details, please refer to Chapter 19 of Dadra Nagar Haveli UT Report). Thus, in Dadra & Nagar Haveli, this study finds an overall gap of 96% in fire personnel considering double shift duty pattern.

**Table 19-1: Gap Analysis for the Dadra and Nagar Haveli Fire & Emergency Services**

<b>Gap Analysis</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicles</b>	<b>Special Equipment</b>	<b>Firefighting Manpower</b>
Operational Fire Stations	1	9	89	19
Gap in Operational Fire Stations		4	16	241
New Urban Fire Stations	1	5	55	37
New Rural Fire Stations	4	19	165	238
<b>Gap Analysis in %</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicle</b>	<b>Special Equipments</b>	<b>Firefighting Man Power</b>
Gap in Operational Fire Stations		31%	15%	93%
Gap in Operational and new urban Fire Stations only	50%	50%	44%	94%
Total Gap in Operational, new (urban and rural) Fire Stations	83%	76%	73%	96%

### Fire Prevention Wing

In addition to fire fighting staff, there is an urgent need for fire prevention wing for inspection, awareness generation, and training for schools, colleges, hospitals, shopping malls, cinema halls, high-rise buildings, industries, govt. offices, public buildings etc., so that recurrence of the fire incidences similar to that at the Advance Medical Research Institute (AMRI), Kolkata, in terms of their magnitude and frequency can be reduced. Accordingly, to support IGP-cum-



Director, UTs of Dadra & Nagar Haveli, and Daman & Diu, F&ES, additional officers at the levels of Chief Fire Officers (CFO), Dy Chief Fire Officers (Dy-CFO), Division Fire Officers (DFO), and Assistant Divisional Fire Officers (ADFO) have been recommended (for details, please refer to Chapter 19 of Dadra Nagar Haveli UT Report).

### Detailed Financial Investment plan

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 Chapter 19 of Dadra Nagar Haveli UT Report, 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 (Chapter 19 of Dadra Nagar Haveli UT Report) for the next 10-years includes both capital and recurring expenditures. RMSI analysis estimates a total investment of **about Rs 333.3Crores** spread over a period of 10 years for Dadra & Nagar Haveli, F&ES including inflationary factors and after filling the gaps for both operational and proposed urban and rural Fire Stations.

**Table 19-2: State level Investment plan (in Crores Rupees) for Dadra & Nagar Haveli UT Fire and Emergency Services Gaps for filling gap in operational, new urban and new rural Fire Stations (in Crores Rupees)**

Year	Capital Expenditure		Recurring Expenditure					Annual Total
	Building Infra structure	Vehicles and Equipments	Annual Vehicle Maintenance & PDL and AMC	Annual Staff Salary	Annual Office Expenses	Annual Training Office Expenses	Annual Bldg. maintenance	
First Year	4.15	0.30	0.65	4.75	0.30	0.05	0.19	10.39
Second Year	4.61	0.32	0.71	9.91	0.62	0.10	0.19	16.47
Third Year	2.56	2.89	0.92	13.40	0.84	0.13	0.28	21.02
Forth Year	2.84	3.04	1.16	17.57	1.11	0.16	0.37	26.24
Fifth Year	3.15	1.60	1.34	21.12	1.33	0.18	0.41	29.13
Sixth Year	3.50	1.67	1.55	25.27	1.59	0.20	0.46	34.24
Seventh Year	3.88	1.76	1.78	30.10	1.90	0.22	0.51	40.15
Eighth Year	4.31	1.85	2.03	35.73	2.25	0.25	0.56	46.98
Ninth Year	0.00	1.94	2.31	42.29	2.66	0.28	0.61	50.09
Tenth Year	0.00	2.04	2.63	49.90	3.14	0.31	0.66	58.67
<b>Total</b>	<b>28.99</b>	<b>17.40</b>	<b>15.09</b>	<b>250.03</b>	<b>15.75</b>	<b>1.88</b>	<b>4.24</b>	<b>333.39</b>

### Prioritization of New Fire Stations

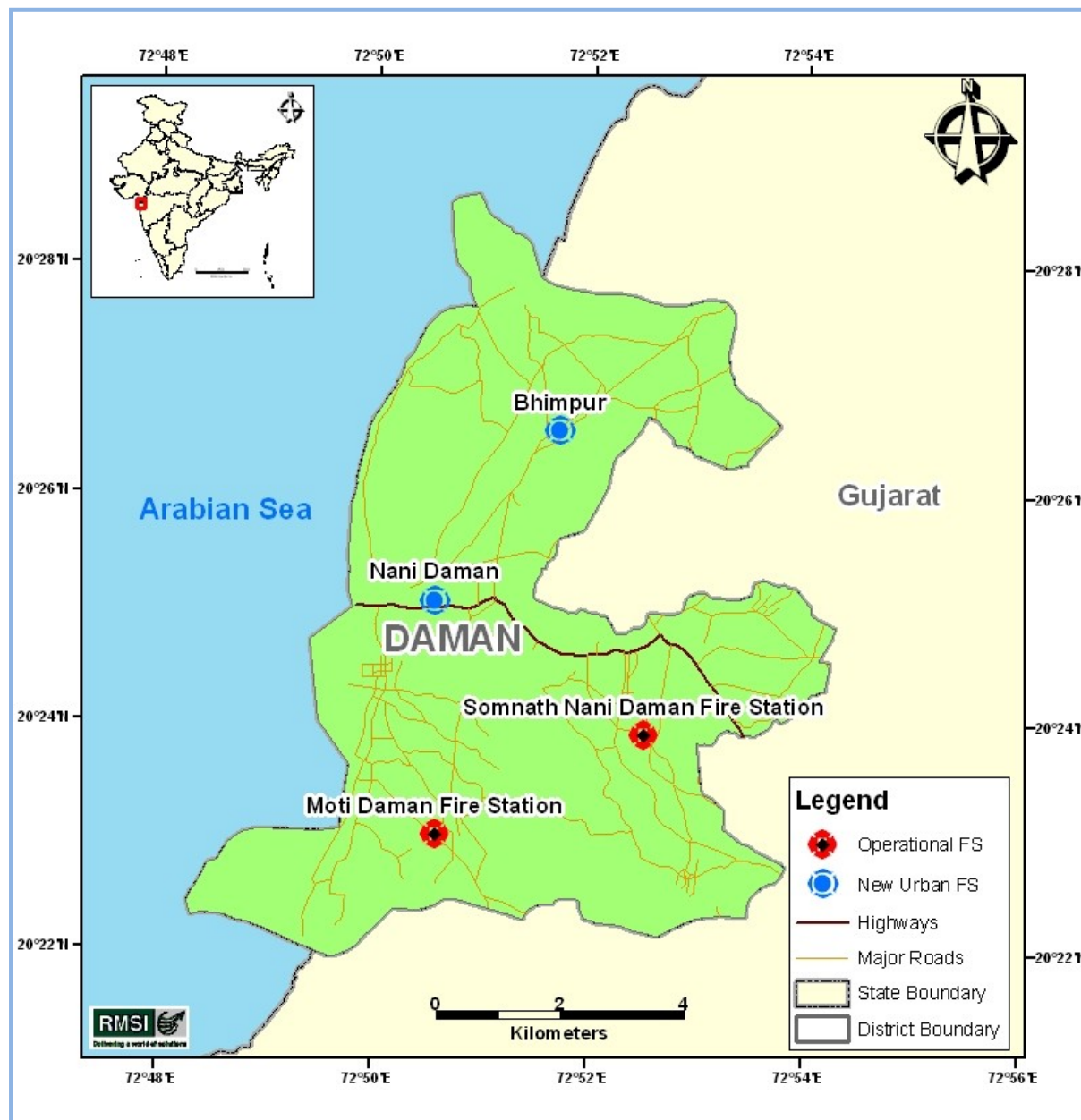
The prioritization of new Fire Stations in Dadra and Nagar Haveli for urban areas has been detailed in Chapter 19 of Dadra and Nagar Haveli UT Report.

### Capacity Building and Training Facilities

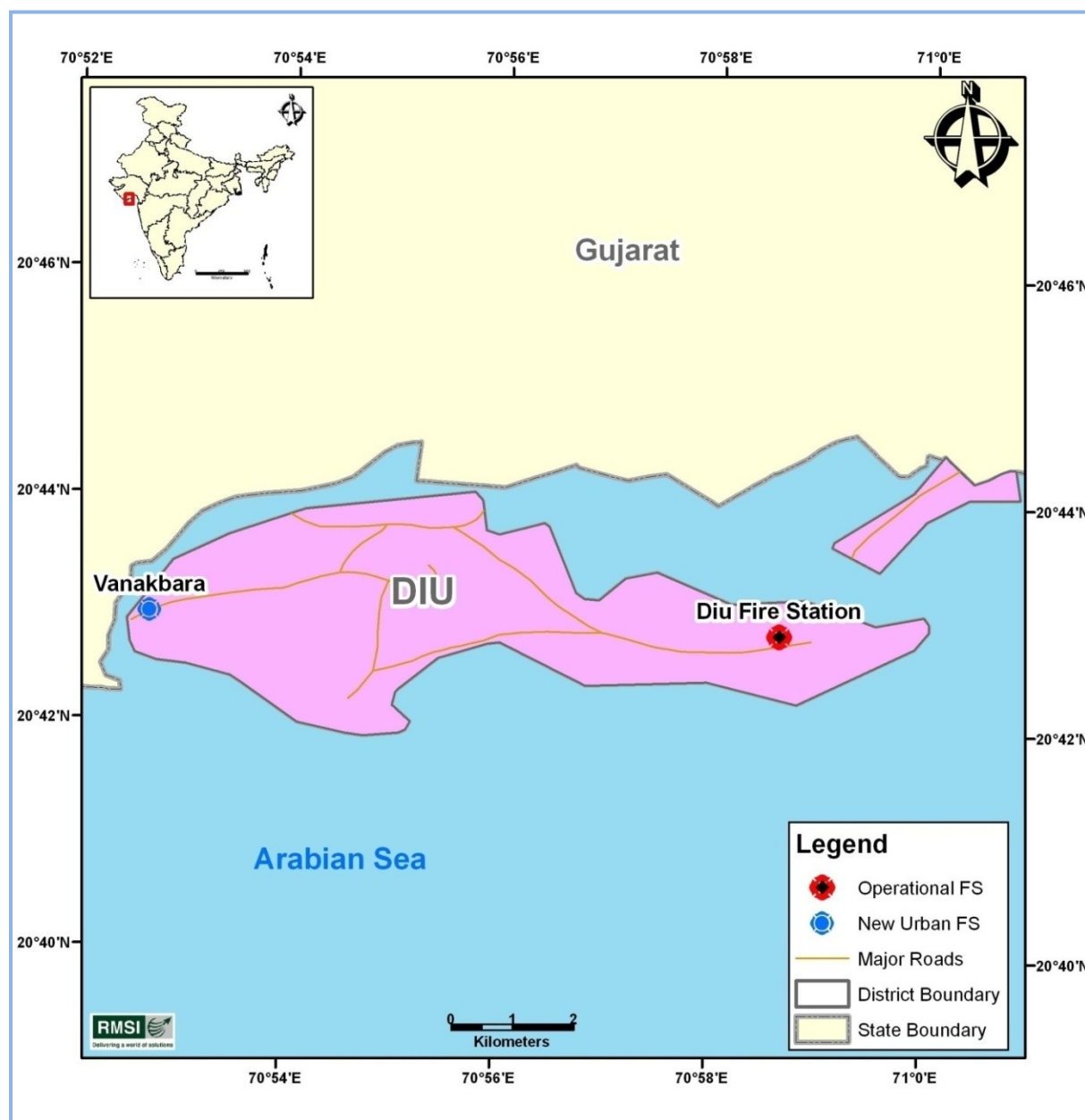
The Capacity building and training facilities and training need assessment for various levels have been given in Chapter 19 of Dadra and Nagar Haveli UT Report.

## 20 Daman and Diu UT

The Daman and Diu spread over a total area of 112 sq km has population of 242,911 and UT is administered by two districts. Currently, in the UT, there are only 03 operational Fire Station working under the department of Fire and Emergency Services. On an average, each Fire Station in UT is serving more than eighty thousand populations.



**Figure 20-1 : Locations of operational and proposed Fire Stations in Daman UT**



**Figure 20-2 : Locations of operational and proposed Fire Stations in Diu UT**

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 airport, military cantonment, power plants etc. The remaining areas, not covered under ideal jurisdiction of operational Fire Stations were 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 within ideal jurisdiction boundary and built-up industrial areas.

### Fire Station Gap Analysis

As per detailed GIS based analysis, the UT would require additional 3 Fire stations in urban areas. Hence this study finds an overall gap of 50% in terms of number of Fire Stations in Daman and Diu F&ES (for details, please refer to Chapter 20 of Daman & Diu UT Report).

### Firefighting and Rescue Vehicles and Specialized Equipment Gap Analysis

For estimating the gap in fire fighting and rescue vehicles and specialized equipment in operational as well proposed Fire Stations both in urban and rural areas, the RMSI team modified the SFAC norms with expert opinions. These modifications also helped in optimization of resources and are detailed in section 20.3.2. This study finds an overall gap of 67% in the firefighting and rescue vehicles and about 63% 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 Daman & Diu F&ES is double shift (24 hours duty, 24 hours off), and RMSI team also estimated for manpower requirement for double shift duty pattern (for details, please refer to Chapter 20 of Daman & Diu UT Report). Thus, in Daman and Diu, this study finds an overall gap of 91% in fire personnel considering double shift duty pattern.

**Table 20-1: Gap Analysis for the Daman and Diu Fire & Emergency Services**

<b>Gap Analysis</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicles</b>	<b>Special Equipment</b>	<b>Firefighting Manpower</b>
Operational Fire Stations	3	14	150	58
Gap in Operational Fire Stations		17	112	482
New Urban Fire Stations	3	11	138	139
New Rural Fire Stations	-	-	-	-
<b>Gap Analysis in %</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicle</b>	<b>Special Equipments</b>	<b>Firefighting Man Power</b>
Gap in Operational Fire Stations		55%	43%	89%
Gap in Operational and new urban Fire Stations only	50%	67%	63%	91%
Total Gap in Operational, new (urban and rural) Fire Stations	50%	67%	63%	91%

### Fire Prevention Wing

In addition to fire fighting staff, there is an urgent need for fire prevention wing for inspection, awareness generation, and training for schools, colleges, hospitals, shopping malls, cinema halls, high-rise buildings, industries, govt. offices, public buildings etc., so that recurrence of the fire incidences similar to that at the Advance Medical Research Institute (AMRI), Kolkata, in terms of their magnitude and frequency can be reduced. Accordingly, to support IGP-cum-Director, UTs of Dadra & Nagar Haveli, and Daman & Diu, F&ES, additional officers at the levels of Chief Fire Officers (CFO), Dy Chief Fire Officers (Dy-CFO), Division Fire Officers (DFO), and Assistant Divisional Fire Officer (ADFO) have been recommended (for details, please refer to Chapter 20 of Daman & Diu UT Report).

### Detailed Financial Investment plan

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 Chapter 20 of Daman & Diu UT Report, 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 (Chapter 20 of Daman & Diu UT Report) for the next 10-years includes both capital and recurring expenditures. RMSI analysis estimates a total investment of about Rs **453.5 Crores** spread over a period of 10 years for Daman and Diu F&ES including inflationary factors and after filling the gaps for both operational and proposed urban and rural Fire Stations.

**Table 20-2: State level Investment plan (in Crores Rupees) for Daman & Diu UT Fire and Emergency Services Gaps 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	3.70	4.97	0.97	10.05	0.63	0.11	0.35	20.78
Second Year	4.11	5.22	1.30	20.39	1.28	0.21	0.44	32.95
Third Year	2.28	1.05	1.47	23.98	1.51	0.23	0.49	31.01
Fourth Year	2.53	1.10	1.65	28.15	1.77	0.26	0.53	36.00
Fifth Year	2.81	0.58	1.82	32.25	2.03	0.27	0.55	40.32
Sixth Year	3.12	0.61	2.01	36.93	2.33	0.29	0.58	45.86
Seventh Year	3.46	0.64	2.22	42.27	2.66	0.32	0.60	52.16
Eighth Year	3.84	0.67	2.44	48.35	3.05	0.34	0.63	59.32
Ninth Year	0.00	0.70	2.69	55.29	3.48	0.36	0.65	63.18
Tenth Year	0.00	0.74	2.96	63.20	3.98	0.39	0.68	71.95
<b>Total</b>	<b>25.84</b>	<b>16.30</b>	<b>19.53</b>	<b>360.85</b>	<b>22.73</b>	<b>2.78</b>	<b>5.49</b>	<b>453.53</b>

### Prioritization of New Fire Stations

The prioritization of new Fire Stations in Daman and Diu for urban areas has been detailed in Chapter 20 Daman and Diu UT Report.

### Capacity Building and Training Facilities

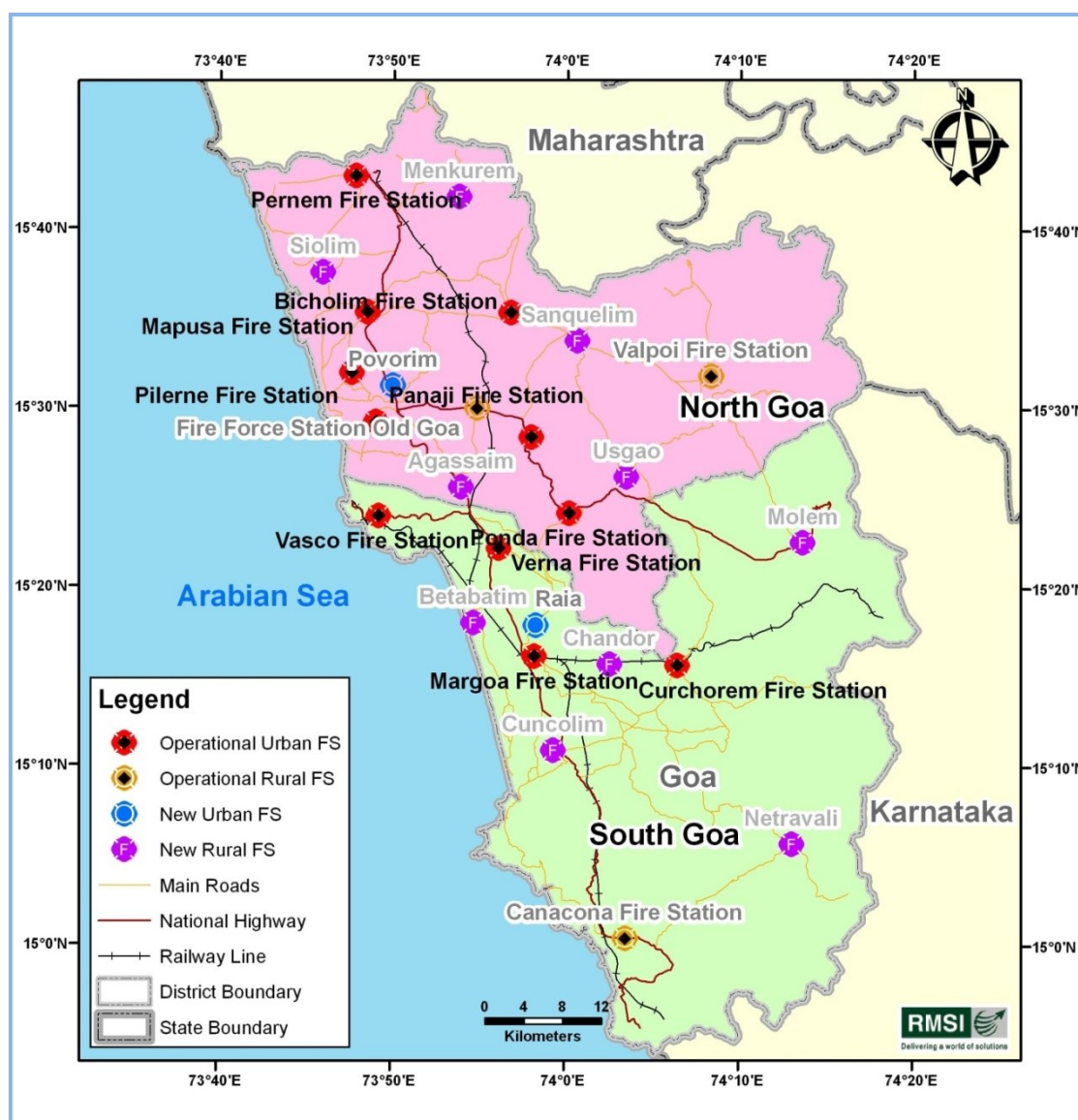
The Capacity building and training facilities and training need assessment for various levels have been given in Chapter 20 Daman & Diu UT Report.



## 21 Goa State

Goa Fire Services are administered under well organized Directorate of Fire and Emergency Services (F & ES) which was setup in 1984 to fulfill the need of increased fire risk in Goa . Currently, 15 Fire Stations (10 in North Goa & 5 in South Goa) are operational by Goa Fire & Emergency Services (GF & ES).

The State is having 1,457,723 persons among which approximately 62% population lives in urban areas and on an average; each Fire Station in Goa is serving ninety thousands of population.



**Figure 21-1 : Locations of operational and proposed Fire Stations in Goa**

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 airport, military cantonment, power plants etc. The remaining areas, not covered under ideal jurisdiction of operational

Fire Stations were 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 within ideal jurisdiction boundary and built-up industrial areas.

### Fire Station Gap Analysis

As per detailed GIS based analysis, the State would require additional 4 Fire stations in urban areas and 9 Fire stations in rural areas. Hence this study finds an overall gap of 46% in terms of number of Fire Stations in Goa State (for details, please refer to Chapter 21 of Goa State Report).

### Firefighting and Rescue Vehicles and Specialized Equipment Gap Analysis

For estimating the gap in fire fighting and rescue vehicles and specialized equipment in operational as well proposed Fire Stations both in urban and rural areas, the RMSI team modified the SFAC norms with expert opinions. These modifications also helped in optimization of resources and are detailed in Chapter 21 of Goa State Report. This study finds an overall gap of 57% in the firefighting and rescue vehicles and about 76% 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 Goa State is practically two- shifts, and RMSI team estimated for manpower requirement for two- shift duty pattern (for details, please refer to Chapter 21 of Goa State Report). Thus, in Goa State, this study finds an overall gap of 68% in fire personnel considering double shift duty pattern.

**Table 21-1: Gap Analysis for the Goa Fire & Emergency Services**

<b>Gap Analysis</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicles</b>	<b>Special Equipment</b>	<b>Firefighting Manpower</b>
Operational Fire Stations	15	41	251	443
Gap in Operational Fire Stations		16	333	473
New Urban Fire Stations	4	9	156	146
New Rural Fire Stations	9	30	299	333
<b>Gap Analysis in %</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicle</b>	<b>Special Equipments</b>	<b>Firefighting Man Power</b>
Gap in Operational Fire Stations		28%	57%	52%
Gap in Operational and new urban Fire Stations only	21%	38%	66%	58%
Total Gap in Operational, new (urban and rural) Fire Stations	46%	57%	76%	68%

### Fire Prevention Wing

The existing fire prevention wing in the State for inspection, awareness generation, and training for schools, colleges, hospitals, shopping malls, cinema halls, high-rise buildings, industries, govt. offices, public buildings etc., need further strengthening, so that recurrence



of the fire incidences similar to that at the Advance Medical Research Institute (AMRI), Kolkata, in terms of their magnitude and frequency can be reduced. Accordingly, to support Director, Goa Fire and Emergency Services, additional officers at the levels of Deputy Director, Chief Fire Officers (CFO), Deputy Chief Fire Officers (Dy-CFO), Divisional Officers (DO), and Assistant Divisional Officers (ADO) have been recommended (for details, please refer to Chapter 21 of Goa State Report).

### Detailed Financial Investment plan

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 Chapter 21 of Goa State Report, 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 (Chapter 21 of Goa State Report) for the next 10-years includes both capital and recurring expenditures. RMSI analysis estimates a total investment of about Rs **908.5 Crores** spread over a period of 10 years for GFES including inflationary factors and after filling the gaps for both operational and proposed urban and rural Fire Stations.

**Table 21-2: State level Investment plan (in Crores Rupees) for Goa Fire and Emergency Services Gaps for filling gap in operational, new urban and new rural Fire Stations (in Crores Rupees)**

Year	Capital Expenditure		Recurring Expenditure					Total
	Building Infrastructure	Vehicle and Equipment	Annual Vehicle Maintenance & PDL AMC	Annual Staff Salary	Annual Office Expenses	Annual Training Office Expenses	Annual Bldg. maintenance	
First Year	8.65	7.79	1.99	22.95	1.45	0.25	1.38	44.46
Second Year	9.60	8.17	2.57	34.66	2.18	0.36	1.55	59.09
Third Year	5.33	2.92	2.95	42.79	2.70	0.41	1.68	58.77
Forth Year	5.91	3.07	3.37	52.37	3.30	0.47	1.81	70.30
Fifth Year	6.57	1.61	3.74	61.14	3.85	0.52	1.89	79.32
Sixth Year	7.29	1.69	4.14	71.27	4.49	0.57	1.97	91.42
Seventh Year	8.09	1.77	4.59	82.94	5.23	0.62	2.05	105.29
Eighth Year	8.98	1.86	5.09	96.39	6.07	0.67	2.13	121.20
Ninth Year	0.00	1.96	5.63	111.88	7.05	0.73	2.21	129.46
Tenth Year	0.00	2.05	6.23	129.69	8.17	0.80	2.30	149.24
<b>Total</b>	<b>60.42</b>	<b>32.89</b>	<b>40.29</b>	<b>706.09</b>	<b>44.48</b>	<b>5.41</b>	<b>18.96</b>	<b>908.55</b>

### Prioritization of New Fire Stations

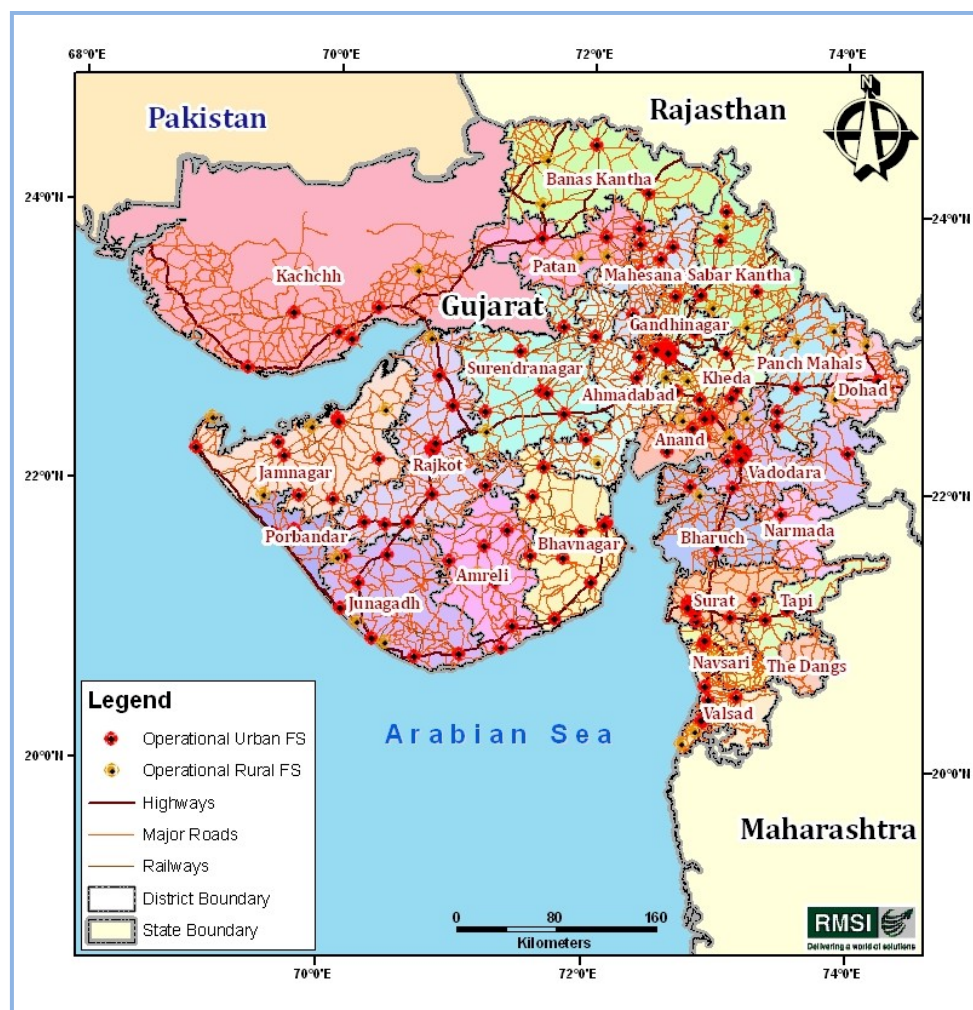
The prioritization of new Fire Stations in Goa State for urban areas has been detailed in Chapter 21 Goa State Report.

### Capacity Building and Training Facilities

The Capacity building and training facilities and training need assessment for various levels have been given in Chapter 21 Goa State Report.

## 22 Gujarat State

Presently, Gujarat Fire & Emergency Services (GF&ES) has 183 operational Fire Stations, 1 State Fire and Emergency Training Centre at Koturpur Water Works, Ahmedabad, and 5 Emergency Response Centers (ERCs) at Gandhinagar, Gandhidham, Rajkot, Surat, and Vadodara. The State has a total population of 60,383,628 inhabited in 26 districts as per Census, 2011. On an average, each Fire Station in Gujarat State is serving more than three Lakhs population.



**Figure 22-1 : Location of operational Fire Stations in Gujarat**

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 airport, military cantonment, thermal/nuclear power plants, refineries 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 Chapter 22 of Gujarat State Report).

### Firefighting and Rescue Vehicles and Specialized Equipment Gap Analysis

Gujarat Fire and Emergency 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 Chapter 22 of Gujarat State Report. This study finds an overall gap of 64% in the firefighting and rescue vehicles and about 91% 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 Chapter 22 of Gujarat State Report ). Thus, in Gujarat State, this study finds an overall gap of 96% in fire personnel considering double shift duty pattern.

**Table 22-1: Gap Analysis for the Gujarat Fire & Emergency Services**

<b>Gap Analysis</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicles</b>	<b>Special Equipment</b>	<b>Firefighting Manpower</b>
Operational Fire Stations	183	810	2,310	1,457
Gap in Operational Fire Stations		359	10,202	17,765
New Urban Fire Stations	47	214	3,166	3,816
New Rural Fire Stations	164	875	8,875	12,649
<b>Gap Analysis in %</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicle</b>	<b>Special Equipments</b>	<b>Firefighting Man Power</b>
Gap in Operational Fire Stations		31%	82%	92%
Gap in Operational and new urban Fire Stations only	20%	41%	85%	94%
Total Gap in Operational, new (urban and rural) Fire Stations	54%	64%	91%	96%

### 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., so that recurrence of the fire incidences similar to that at

the Advance Medical Research Institute (AMRI), Kolkata, in terms of their magnitude and frequency can be reduced. Accordingly, to support 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).

### Detailed Financial Investment plan

As detailed in Chapter 22 of Gujarat State Report, 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. RMSI analysis estimates a total investment of **about Rs 22,085.3 Crores** spread over a period of 10 years for GF&ES including inflationary factors and after filling the gaps for both operational and proposed urban and rural Fire Stations.

**Table 22-2: State level Investment plan (in Crores Rupees) for Gujarat Fire and Emergency Services Gaps for filling gap in operational, new urban and new rural Fire Stations (in Crores Rupees)**

Year	Capital Expenditure		Recurring Expenditure					Total
	Building Infrastructure	Vehicle and Equipment	Annual Vehicle Maintenance & PDL AMC	Annual Staff Salary	Annual Office Expenses	Annual Training Office Expenses	Annual Bldg. maintenance	
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
<b>Total</b>	<b>2,189.02</b>	<b>712.36</b>	<b>675.83</b>	<b>16,963.39</b>	<b>1,068.69</b>	<b>128.32</b>	<b>347.66</b>	<b>22,085.26</b>

### Prioritization of New Fire Stations

The prioritization of new Fire Stations in Gujarat State for both rural and urban areas has been detailed in Chapter 22 of Gujarat State report.

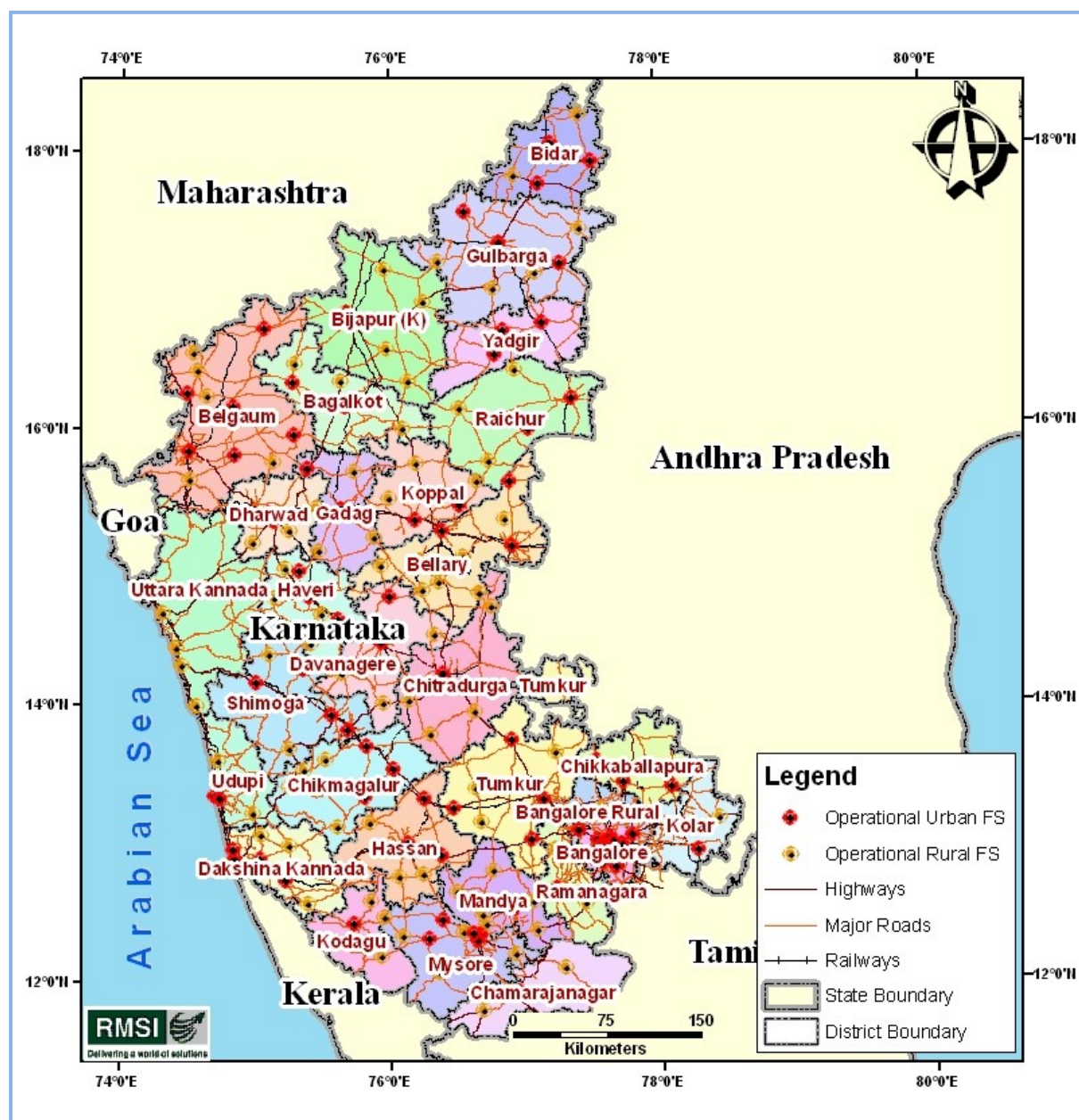
### Capacity Building and Training Facilities

The study finds that there is a substantial gap for 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 Chapter 22 of Gujarat State report.



## 23 Karnataka State

Currently, Karnataka Fire and Emergency Service (KFES) has 182 operational Fire Stations (178 Fire Stations and 4 Fire Protection Squads—cum—Fire Station) and one R.A. Mundkur Fire & Emergency Services Academy, at Bannerghatta Road, Bangalore, working as a Regional Fire & Emergency Services Training Centre. In general, Fire and Emergency Infrastructure of the Fire Stations in the State is very good.



**Figure 23-1 : Location of operational Fire Stations in Karnataka**

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 airport, military cantonment, thermal/nuclear power plants etc. The remaining areas, not covered under ideal jurisdiction

of operational Fire Stations, are also divided for ideal jurisdictions of new proposed Fire Stations. The requirements for fire fighting and rescue vehicles and specialized 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 KFES would require additional 63 Fire stations in urban areas and 132 Fire stations in rural areas. Hence this study finds an overall gap of 52% in terms of number of Fire Stations in Karnataka State (for details, please refer to Chapter 23 of Karnataka State Report).

### Firefighting and Rescue Vehicles and Specialized Equipment Gap Analysis

For estimating the gap in fire fighting and rescue vehicles and specialized equipment in operational as well proposed Fire Stations both in urban and rural areas, the RMSI team modified the SFAC norms with expert opinions. These modifications also helped in optimization of resources and are detailed in Chapter 23 of Karnataka State Report. This study finds an overall gap of 77% in the firefighting and rescue vehicles and about 86% 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 Karnataka State is 8 hours (2-shifts) except Fire Stations in Bangalore city, which have 3-shift duty pattern, and RMSI team estimated for manpower requirement for double shift duty pattern (for details, please refer to Chapter 23 of Karnataka State Report). Thus, in Karnataka State, this study finds an overall gap of 87% in fire personnel considering double shift duty pattern.

**Table 23-1: Gap Analysis for the Karnataka Fire & Emergency Services**

<b>Gap Analysis</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicles</b>	<b>Special Equipment</b>	<b>Firefighting Manpower</b>
Operational Fire Stations	182	465	3,157	4,324
Gap in Operational Fire Stations		591	8,122	14,249
New Urban Fire Stations	63	276	4,225	5,171
New Rural Fire Stations	132	720	7,426	10,321
<b>Gap Analysis in %</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicle</b>	<b>Special Equipments</b>	<b>Firefighting Man Power</b>
Gap in Operational Fire Stations		56%	72%	77%
Gap in Operational and new urban Fire Stations only	26%	65%	80%	82%
Total Gap in Operational, new (urban and rural) Fire Stations	52%	77%	86%	87%

### Detailed Financial Investment plan

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 Chapter 23 of Karnataka State Report, 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. RMSI analysis estimates a total investment of **about Rs 21,245.1 Crores** spread over a period of 10 years for KFES including inflationary factors and after filling the gaps for both operational and proposed urban and rural Fire Stations.

**Table 23-2: State level Investment plan (in Crores Rupees) for Karnataka Fire and Emergency Services Gaps for filling gap in operational, new urban and new rural Fire Stations (in Crores Rupees)**

Year	Capital Expenditure		Recurring Expenditure					Total
	Building Infrastructure	Vehicle and Equipment	Annual Vehicle Maintenance & PDL AMC	Annual Staff Salary	Annual Office Expenses	Annual Training Office Expenses	Annual Bldg. maintenance	
First Year	297.80	149.21	23.53	385.10	24.26	4.24	16.11	900.25
Second Year	330.56	156.67	33.55	697.82	43.96	7.20	21.30	1,291.06
Third Year	183.46	85.25	40.90	911.19	57.40	8.81	25.56	1,312.58
Forth Year	203.64	89.51	49.22	1,165.71	73.44	10.57	29.90	1,621.99
Fifth Year	226.05	47.00	55.89	1,386.90	87.37	11.78	32.26	1,847.25
Sixth Year	250.91	49.35	63.30	1,644.38	103.60	13.10	34.67	2,159.31
Seventh Year	278.50	51.81	71.54	1,943.69	122.45	14.52	37.12	2,519.64
Eighth Year	309.15	54.40	80.70	2,291.16	144.34	16.04	39.62	2,935.41
Ninth Year	0.00	57.13	90.86	2,694.03	169.72	17.68	42.16	3,071.59
Tenth Year	0.00	59.98	102.14	3,160.60	199.12	19.45	44.75	3,586.04
<b>Total</b>	<b>2,080.06</b>	<b>800.32</b>	<b>611.63</b>	<b>16,280.60</b>	<b>1,025.68</b>	<b>123.38</b>	<b>323.45</b>	<b>21,245.11</b>

### Prioritization of New Fire Stations

The prioritization of new Fire Stations in Karnataka for both rural and urban areas has been detailed in detailed in Chapter 23 of Karnataka State report.

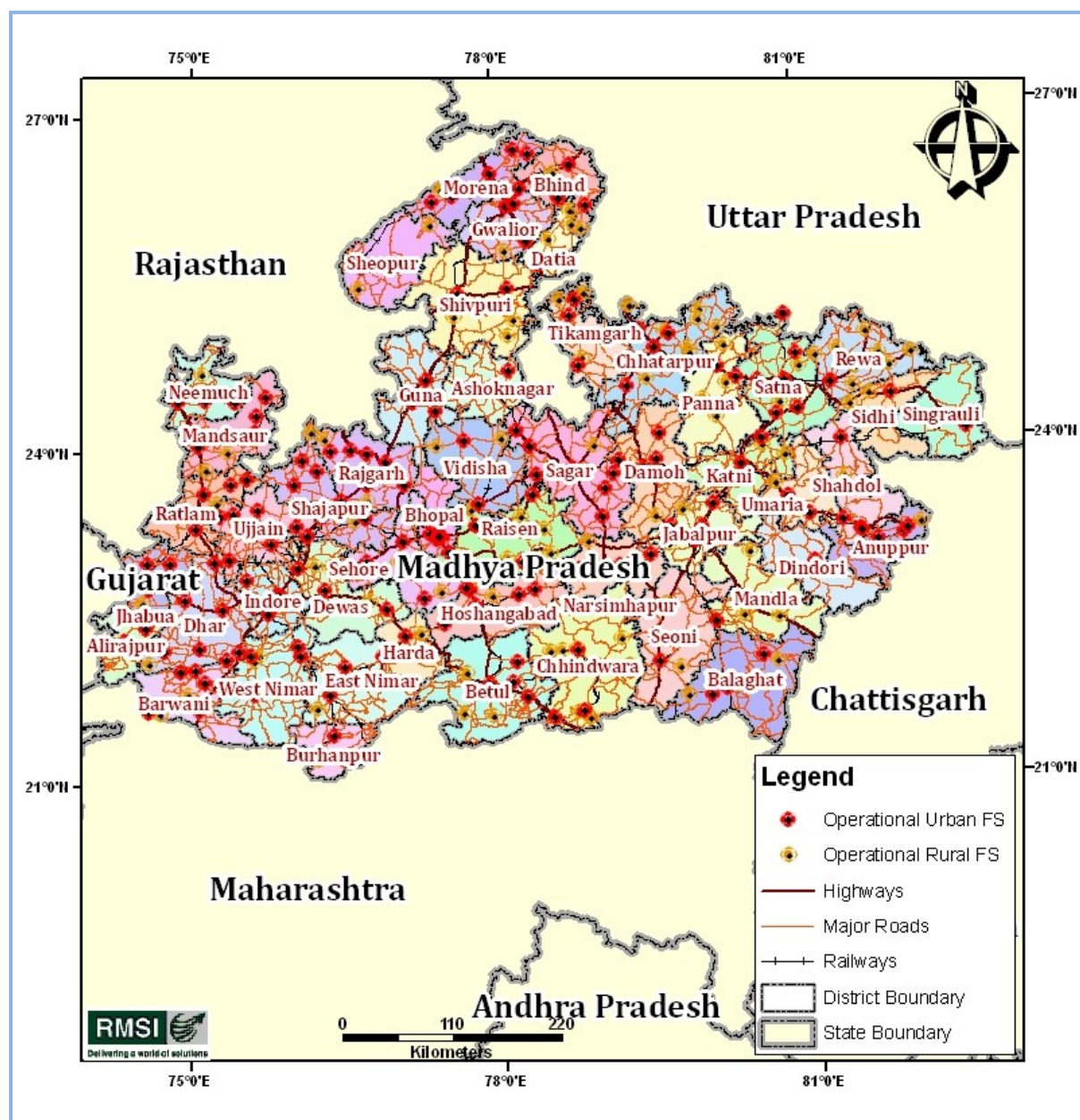
### Capacity Building and Training Facilities

The study finds that there are some gaps in capacity building and training among the fire personnel within the Karnataka State. The detailed Capacity building and training need assessment for various levels has been discussed in Chapter 23 of Karnataka State report.



## 24 Madhya Pradesh State

Presently, Madhya Pradesh Fire Service has only 292 operational Fire Stations spread over all the States and a few Fire Stations out of 292 are being operated by Police Fire Service. The State has a total population of 72,597,565 inhabited in 50 districts as per Census, 2011. On an average each Fire Station in the State is serving more than two Lakhs forty eight thousand population.



**Figure 24-1 : Location of operational Fire Stations in Madhya Pradesh**

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 airport, military cantonment, thermal power plants etc. The remaining areas, not covered under ideal jurisdiction of

operational Fire Stations, are also divided for ideal jurisdictions of new proposed Fire Stations. The requirements for fire fighting and rescue vehicles and specialized 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 Madhya Pradesh Fire Services would require additional 58 Fire Stations in urban areas and 163 Fire Stations in rural areas. Hence this study finds an overall gap of 43% in terms of number of Fire Stations in Madhya Pradesh State (for details, please refer to Chapter 24 of Madhya Pradesh State Report).

### Firefighting and Rescue Vehicles and Specialized Equipment Gap Analysis

For estimating the gap in fire fighting and rescue vehicles and specialized equipment in operational as well proposed Fire Stations both in urban and rural areas, the RMSI team modified the SFAC norms with expert opinions. These modifications also helped in optimization of resources and are detailed in Chapter 24 of Madhya Pradesh State Report. This study finds an overall gap of 81% in the firefighting and rescue vehicles and about 97% 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 for firefighters in the State is varying from 8 hours (3- shifts), to 12 hrs (2-shifts) to 24 hours, and RMSI team estimated for manpower requirement for double shift duty pattern (for details, please refer to Chapter 24 of Madhya Pradesh State Report). Thus, in Madhya Pradesh State, this study finds an overall gap of 98% in fire personnel considering double shift duty pattern.

**Table 24-1: Gap Analysis for the Madhya Pradesh Fire Services**

<b>Gap Analysis</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicles</b>	<b>Special Equipment</b>	<b>Firefighting Manpower</b>
Operational Fire Stations	292	480	936	964
Gap in Operational Fire Stations		913	14,417	23,848
New Urban Fire Stations	58	140	2,432	2,820
New Rural Fire Stations	163	941	9,933	13,659
<b>Gap Analysis in %</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicle</b>	<b>Special Equipments</b>	<b>Firefighting Man Power</b>
Gap in Operational Fire Stations		66%	94%	96%
Gap in Operational and new urban Fire Stations only	17%	69%	95%	97%
Total Gap in Operational, new (urban and rural) Fire Stations	43%	81%	97%	98%

### Detailed Financial Investment plan

As detailed in Chapter 24 of Madhya Pradesh State Report, 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 (Chapter 24 of Madhya Pradesh State Report) for the next 10-years includes both capital and recurring expenditures. RMSI analysis estimates a total investment of about **Rs 28,483.8 Crores** spread over a period of 10 years for Madhya Pradesh Fire Services including inflationary factors and after filling the gaps for both operational and proposed urban and rural Fire Stations.

**Table 24-2: State level Investment plan (in Crores Rupees) for Madhya Pradesh Fire Services Gaps for filling gap in operational, new urban and new rural Fire Stations (in Crores Rupees)**

Year	Capital Expenditure		Recurring Expenditure					Total
	Building Infrastructure	Vehicle and Equipment	Annual Vehicle Maintenance & PDL AMC	Annual Staff Salary	Annual Office Expenses	Annual Training Office Expenses	Annual Bldg. maintenance	
First Year	657.1	294.23	24.49	431.37	27.18	4.74	21.01	1,460.11
Second Year	729.38	308.94	42.32	930.32	58.61	9.59	38.99	2,118.16
Third Year	404.81	83.00	50.21	1,179.92	74.33	11.41	45.61	1,849.28
Forth Year	449.33	87.15	59.09	1,476.01	92.99	13.38	52.35	2,230.30
Fifth Year	498.77	45.76	66.45	1,739.65	109.60	14.78	56.05	2,531.06
Sixth Year	553.64	48.04	74.60	2,045.32	128.86	16.29	59.82	2,926.57
Seventh Year	614.52	50.45	83.63	2,399.29	151.16	17.92	63.66	3,380.62
Eighth Year	682.14	52.97	93.63	2,808.76	176.95	19.66	67.57	3,901.68
Ninth Year	0.00	55.62	104.70	3,281.96	206.76	21.54	71.55	3,742.13
Tenth Year	0.00	58.40	116.93	3,828.28	241.18	23.56	75.60	4,343.95
<b>Total</b>	<b>4,589.68</b>	<b>1,084.55</b>	<b>716.05</b>	<b>20,120.88</b>	<b>1,267.62</b>	<b>152.88</b>	<b>552.20</b>	<b>28,483.85</b>

### Prioritization of New Fire Stations

The prioritization of new Fire Stations in Madhya Pradesh for both rural and urban areas has been detailed in Chapter 24 of Madhya Pradesh State Report.

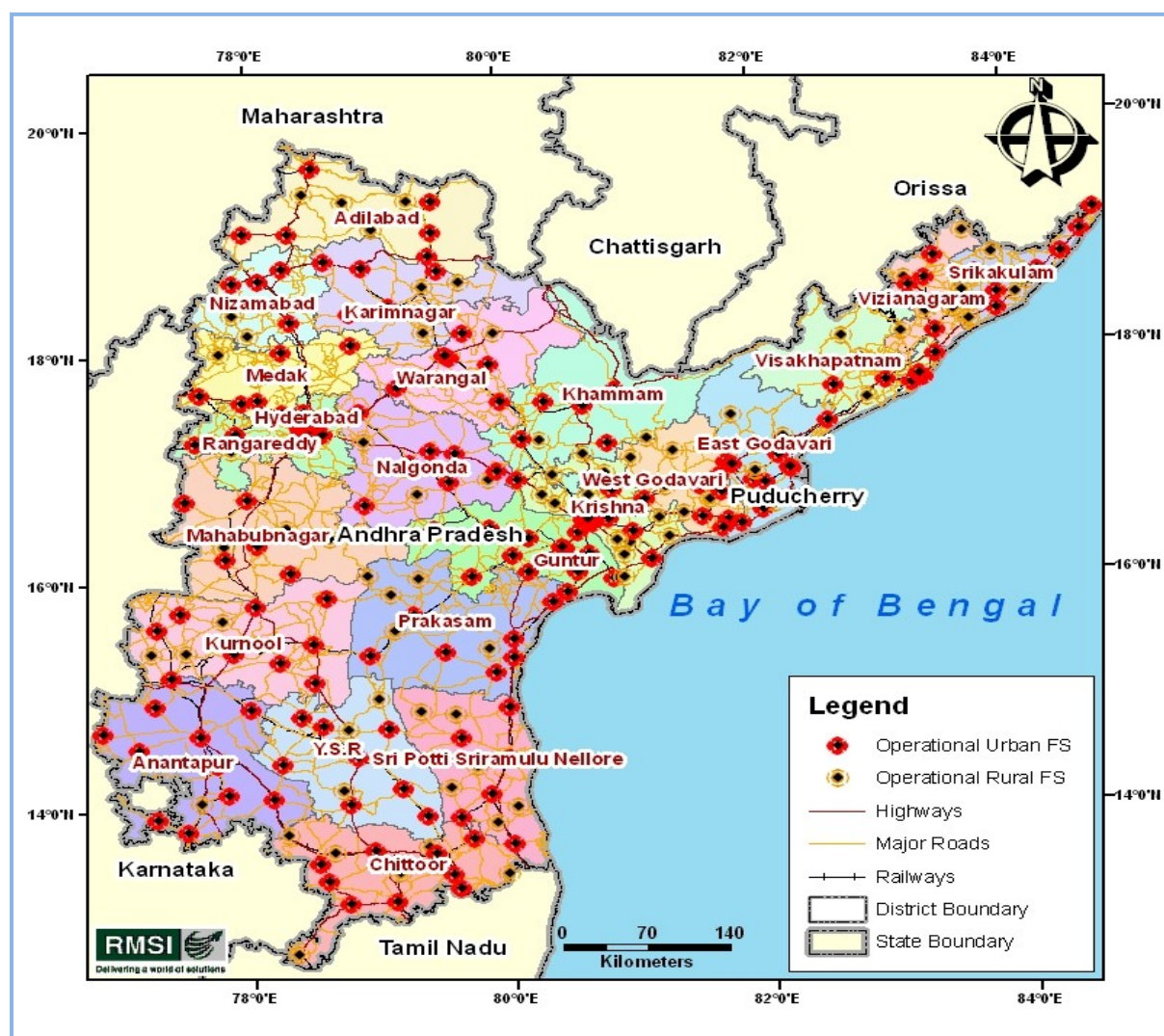
### Capacity Building and Training Facilities

The study finds that there is a substantial gap for capacity building and training among the fire personnel within the Madhya Pradesh State. The detailed Capacity building and training need assessment for various levels has been discussed in Chapter 24 of Madhya Pradesh State Report.



## 25 Andhra Pradesh State

Presently, the Andhra Pradesh Fire service is one of the largest fire brigade networks in India with 251 operational Fire Stations spread over the length and breadth of Andhra Pradesh. The main objective of the department is to provide fire safety to the public, conduct firefighting, and rescue operations and thereby reduce loss of life and property. The department was established in November 1956, currently known as AP State Disaster Response and Fire Services (AP DRFS). The department is running with a number of firefighting vehicles and specialized equipment as well as 3,676 total firefighting manpower. Currently the State has 251 operational Fire Stations serve an average population of more than 3.3 Lakhs per Fire Station.



**Figure 25-1 : Location of operational Fire Stations in Andhra Pradesh**

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 airport, military cantonment, thermal power plants etc. The remaining areas, not covered under ideal jurisdiction of operational Fire Stations, are also divided for ideal jurisdictions of new proposed Fire

Stations. The requirements for firefighting 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 State would require additional 130 Fire stations in urban areas and 228 stations in rural areas. Hence this study finds a overall gap of 59% in terms of number of Fire Stations in the State (for details, please refer to Chapter 25 of Andhra Pradesh State Report).

### Firefighting and Rescue Vehicles and Specialized Equipment Gap Analysis

For estimating the gap in firefighting 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 Chapter 25 of Andhra Pradesh State Report. This finds an overall gap of 90% in the firefighting and rescue vehicle and about 90% 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 as 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 Andhra Pradesh State is 24 hours, in general, and RMSI team estimated for manpower requirement for double shift duty pattern (for details, please refer to Chapter 25 of Andhra Pradesh State Report). Thus, in Andhra Pradesh State, this study finds an overall gap of about 91% in fire personnel considering double shift duty pattern.

**Table 25-1: Gap Analysis for the Andhra Pradesh Fire Services**

<b>Gap Analysis</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicles</b>	<b>Special Equipment</b>	<b>Firefighting Manpower</b>
Operational Fire Stations	251	278	3,194	3,676
Gap in Operational Fire Stations		892	11,190	16,669
New Urban Fire Stations	130	362	6,157	7,089
New Rural Fire Stations	228	1,225	12,535	14,948
<b>Gap Analysis in %</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicle</b>	<b>Special Equipments</b>	<b>Firefighting Man Power</b>
Gap in Operational Fire Stations		76%	78%	82%
Gap in Operational and new urban Fire Stations only	34%	82%	84%	87%
Total Gap in Operational, new (urban and rural) Fire Stations	59%	90%	90%	91%

### Detailed Financial Investment plan

As detailed in Chapter 25 of Andhra Pradesh State Report, the detailed investment and financial plan at district level includes estimation of capital cost for infrastructure cost, firefighting 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 (Chapter 25 of Andhra Pradesh State Report) for the next 10-years includes both capital and recurring expenditures. RMSI analysis estimates a total investment of **about Rs 26,423.4 Crores** spread over a period of 10 years for Andhra Pradesh State Disaster Response and Fire Services including inflationary factors and after filling the gaps for both operational and proposed urban and rural Fire Stations.

**Table 25-2: State level Investment plan (in Crores Rupees) for Andhra Pradesh Disaster Response and Fire Services Gaps 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	435.60	255.81	19.08	403.35	25.41	4.44	16.59	1,160.28
Second Year	483.52	268.60	34.55	765.19	48.21	7.89	23.40	1,631.36
Third Year	268.35	126.88	44.22	1,040.95	65.58	10.06	29.84	1,585.89
Forth Year	297.86	133.22	55.22	1,371.88	86.43	12.43	36.40	1,993.44
Fifth Year	330.64	69.94	63.67	1,651.87	104.07	14.04	39.93	2,274.15
Sixth Year	367.01	73.44	73.11	1,979.30	124.70	15.77	43.52	2,676.85
Seventh Year	407.37	77.11	83.66	2,361.53	148.78	17.64	47.18	3,143.26
Eighth Year	452.20	80.97	95.42	2,806.99	176.84	19.65	50.91	3,682.98
Ninth Year	0.00	85.02	108.54	3,325.36	209.50	21.83	54.71	3,804.96
Tenth Year	0.00	89.26	123.14	3,927.73	247.45	24.17	58.58	4,470.33
<b>Total</b>	<b>3,042.56</b>	<b>1,260.26</b>	<b>700.61</b>	<b>19,634.14</b>	<b>1,236.95</b>	<b>147.91</b>	<b>401.06</b>	<b>26,423.49</b>

### Prioritization of New Fire Stations

The prioritization of new Fire Stations in Andhra Pradesh for both rural and urban areas has been detailed in Chapter 25 of Andhra Pradesh State Report.

### Capacity Building and Training Facilities

Andhra Pradesh State Disaster Response and Fire Services has a well functioning training centre. The study finds that there are some gaps for capacity building and training among the fire personnel within the Andhra Pradesh State Disaster Response and Fire Services. The detailed Capacity building and training need assessments for various levels have been discussed in Chapter 25 of Andhra Pradesh State Report.



## 26 Bihar State

Presently, Bihar State Fire Services has 102 operational Fire Station, both in urban and rural areas and one upcoming Fire Training Centre. The State has a total population of 103,804,634 inhabited in 38 districts as per Census, 2011. On an average, each Fire Station in Bihar State is serving more than 10 Lakhs population.



**Figure 26-1 : Location of operational Fire Stations in Bihar**

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 airport, military cantonment,

thermal power plants etc. The remaining areas, not covered under ideal jurisdiction of operational Fire Stations, are also divided for ideal jurisdictions of new proposed Fire Stations. The requirements for fire fighting and rescue vehicles and specialized 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 State would require additional 82 Fire stations in urban areas and 466 stations in rural areas. Hence this study finds a overall gap of 84% in terms of number of Fire Stations in Bihar State (for details, please refer to Chapter 26 of Bihar State Report).

### Firefighting and Rescue Vehicles and Specialized Equipment Gap Analysis

For estimating the gap in fire fighting and rescue vehicles and specialized equipment in operational as well proposed Fire Stations both in urban and rural areas, the RMSI team modified the SFAC norms with expert opinions. These modifications also helped in optimization of resources and are detailed in Chapter 26 of Bihar State Report. This finds an overall gap of 92% in the firefighting and rescue vehicle and about 99% 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 as 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 Bihar State is 24 hours, in general, and RMSI team estimated for manpower requirement for double shift duty pattern (for details, please refer to Chapter 26 of Bihar State Report). Thus, in Bihar State, this study finds an overall gap of about 99% in fire personnel considering double shift duty pattern.

**Table 26-1: Gap Analysis for the Bihar State Fire Services**

<b>Gap Analysis</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicles</b>	<b>Special Equipment</b>	<b>Firefighting Manpower</b>
Operational Fire Stations	102	268	513	318
Gap in Operational Fire Stations		325	5,840	11,536
New Urban Fire Stations	82	181	3,256	3,369
New Rural Fire Stations	466	2,529	26,539	30,807
<b>Gap Analysis in %</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicle</b>	<b>Special Equipments</b>	<b>Firefighting Man Power</b>
Gap in Operational Fire Stations		55%	92%	97%
Gap in Operational and new urban Fire Stations only	45%	65%	95%	98%
Total Gap in Operational, new (urban and rural) Fire Stations	84%	92%	99%	99%

### Detailed Financial Investment plan

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 please refer to Chapter 26 of Bihar State Report, 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 (please refer to Chapter 26 of Bihar State Report) for the next 10-years includes both capital and recurring expenditures. RMSI analysis estimates a total investment of **about Rs 27,510.2 Crores** spread over a period of 10 years for Bihar State including inflationary factors and after filling the gaps for both operational and proposed urban and rural Fire Stations.

**Table 26-2: State level Investment plan (in Crores Rupees) for Bihar Fire Services Gaps 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	626.30	187.15	14.51	205.24	12.93	2.26	6.66	1,055.04
Second Year	695.19	196.51	25.56	447.70	28.21	4.62	12.62	1,410.40
Third Year	385.83	199.90	38.55	786.82	49.57	7.61	23.14	1,491.42
Forth Year	428.26	209.89	53.45	1,200.88	75.66	10.88	33.87	2,012.89
Fifth Year	475.39	110.20	64.10	1,523.98	96.01	12.95	39.51	2,322.14
Sixth Year	527.69	115.71	76.12	1,907.33	120.16	15.19	45.26	2,807.47
Seventh Year	585.72	121.49	89.66	2,360.74	148.73	17.63	51.12	3,375.09
Eighth Year	650.16	127.57	104.87	2,895.51	182.42	20.27	57.10	4,037.89
Ninth Year	0.00	133.95	121.94	3,524.63	222.05	23.14	63.19	4,088.89
Tenth Year	0.00	140.64	141.06	4,263.04	268.57	26.23	69.39	4,908.95
<b>Total</b>	<b>4,374.55</b>	<b>1,543.01</b>	<b>729.82</b>	<b>19,115.86</b>	<b>1,204.30</b>	<b>140.78</b>	<b>401.86</b>	<b>27,510.18</b>

### Prioritization of New Fire Stations

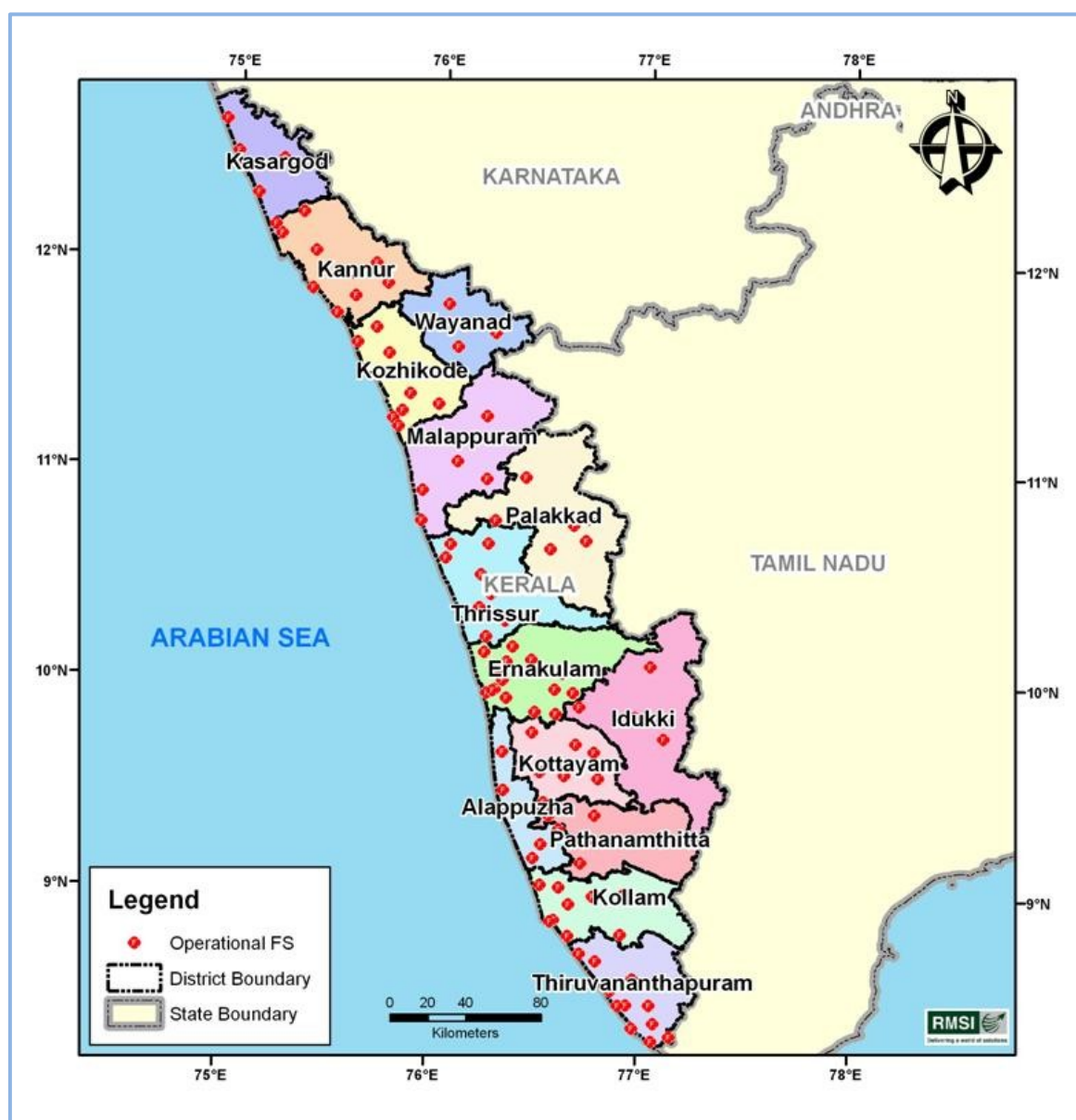
The prioritization of new Fire Stations in Bihar for both rural and urban areas has been detailed in Chapter 26 of Bihar State Report.

### Capacity Building and Training Facilities

The study finds that there is a substantial gap for capacity building and training among the fire personnel within the Bihar State. The detailed Capacity building and training need assessment for various levels have been discussed in Chapter 26 of Bihar State Report.

## 27 Kerala State

The Kerala Fire and Rescue Services (FRS) Department came into existence by the enactment of Kerala Fire Force Act 1962. The Department is currently running a total of 100 operational Fire Stations with strength of 2,427 fire personnel at all levels. The State is equipped with firefighting vehicles and specialized equipment serving current population. The State is also having the Fire Service Training School located at Kochi to train fire personnel as well as one upcoming state-of-the-art training school at Viyyoor, Thrissur to cater the gap of trained fire personnel in the State. On an average, the 100 operational Fire Stations serve a population of more than 3.3 Lakhs per Fire Station in Kerala.



**Figure 27-1 : Location of operational Fire Stations in Kerala**

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 airport, military cantonment, thermal power plants etc. The remaining areas, not covered under ideal jurisdiction of operational Fire Stations, are also divided for ideal jurisdictions of new proposed Fire Stations. The requirements for fire fighting and rescue vehicles and specialized 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 State would require additional 57 Fire Stations in urban areas and 71 Fire Stations in rural areas. Hence this study finds an overall gap of 56% in terms of number of Fire Stations in Kerala State (for details, please refer to Chapter 27 of Kerala State Report).

### Firefighting and Rescue Vehicles and Specialized Equipment Gap Analysis

For estimating the gap in firefighting 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 Chapter 27 of Kerala State Report. This finds an overall gap of 68% in the firefighting and rescue vehicle and about 94% 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 as 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 Kerala State is 24 hours, in general, and RMSI team estimated for manpower requirement for double shift duty pattern (for details, please refer to Chapter 27 of Kerala State Report). Thus, in Kerala State, this study finds an overall gap of about 86% in fire personnel considering double shift duty pattern.

**Table 27-1: Gap Analysis for the Kerala Fire & Rescue Services**

<b>Gap Analysis</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicles</b>	<b>Special Equipment</b>	<b>Firefighting Manpower</b>
Operational Fire Stations	100	363	871	2,427
Gap in Operational Fire Stations		183	5,006	6,120
New Urban Fire Stations	57	248	3,993	5,127
New Rural Fire Stations	71	351	3,638	4,046
<b>Gap Analysis in %</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicle</b>	<b>Special Equipments</b>	<b>Firefighting Man Power</b>
Gap in Operational Fire Stations		34%	85%	72%
Gap in Operational and new urban Fire Stations only	36%	54%	91%	82%
Total Gap in Operational, new (urban and rural) Fire Stations	56%	68%	94%	86%

### Detailed Financial Investment plan

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 Chapter 27 of Kerala State Report, 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 (Chapter 27 of Kerala State Report) for the next 10-years includes both capital and recurring expenditures. RMSI analysis estimates a total investment of **about Rs 10,760.3 Crores** spread over a period of 10 years for Kerala State including inflationary factors and after filling the gaps for both operational and proposed urban and rural Fire Stations.

**Table 27-2: State level Investment plan (in Crores Rupees) for Kerala Fire and Rescue Services Gaps 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	144.65	47.78	12.71	183.63	11.57	2.02	11.04	413.40
Second Year	160.56	50.17	16.66	321.40	20.25	3.31	12.41	584.78
Third Year	89.11	54.51	21.04	436.55	27.50	4.22	14.98	647.91
Forth Year	98.91	57.23	26.01	574.71	36.21	5.21	17.59	815.87
Fifth Year	109.80	30.05	29.87	691.71	43.58	5.88	19.01	929.88
Sixth Year	121.88	31.55	34.18	828.51	52.20	6.60	20.46	1,095.36
Seventh Year	135.28	33.13	38.98	988.18	62.26	7.38	21.93	1,287.12
Eighth Year	150.16	34.78	44.33	1,174.24	73.98	8.22	23.43	1,509.15
Ninth Year	0.00	36.52	50.30	1,390.73	87.62	9.13	24.96	1,599.25
Tenth Year	0.00	38.35	56.93	1,642.26	103.46	10.11	26.52	1,877.62
<b>Total</b>	<b>1,010.34</b>	<b>414.07</b>	<b>331.02</b>	<b>8,231.91</b>	<b>518.61</b>	<b>62.08</b>	<b>192.31</b>	<b>10,760.35</b>

### Prioritization of New Fire Stations

The prioritization of new Fire Stations in Kerala for both rural and urban areas has been detailed in section Chapter 27 of Kerala State Report.

### Capacity Building and Training Facilities

The study finds that there is a substantial gap for capacity building and training among the fire personnel within the Kerala State. The detailed capacity building and training need assessment at various levels have been discussed in Chapter 27 of Kerala State Report.



## 28 Lakshadweep UT

Presently, Lakshadweep UT has 4 operational Fire Stations located in Agati, Andrott, Karavatti, and Minocoy under LFS department. The UT is prone to high fire hazards due to several reasons. The houses in the island primarily have the thatched roof. Due to abundance of coconut and other shrub trees, there are likely chances of fire accident due to high tension wires of electricity going through trees. Apart from this, every island has a huge storage of diesel oil in tanks for smooth running of powerhouse which in turn provides electricity for lightening the houses, running electrical machines in offices and factory. Large storages of Diesel, Kerocene, and Petrol are also common in these islands for domestic and commercial purposes. Hence, fire risk due to high volume storage of such inflammables should be taken into consideration by the UT Fire Service. To mitigate various fire risks and uniformly serve entire population, Lakshadweep UT will require few additional Fire Stations.



**Figure 28-1 : Location of operational Fire Stations in Lakshadweep**

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. 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 UT of Lakshadweep would require additional 5 Fire Stations. Hence this study finds an overall gap of 56% in terms of number of Fire Stations in the UT (for details, please refer to Chapter 28 of Lakshadweep UT Report).

### Firefighting and Rescue Vehicles and Specialized Equipment Gap Analysis

For estimating the gap in fire fighting and rescue vehicles and specialized equipment in operational as well proposed Fire Stations both in urban and rural areas, the RMSI team modified the SFAC norms with expert opinions. These modifications also helped in optimization of resources and are detailed in Chapter 28 of Lakshadweep UT Report. This finds an overall gap of 77% in the firefighting and rescue vehicles and about 97% 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 as 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 Lakshadweep UT is double shift duty pattern (12 hours) in general, and the RMSI team has estimated ideal firefighting personnel requirement for double shift duty pattern (for details, please refer to Chapter 28 of Lakshadweep UT Report). Thus, in Lakshadweep UT, this study finds an overall gap of about 89% in fire personnel considering double shift duty pattern.

**Table 28-1: Gap Analysis for the Lakshadweep UT Fire Services**

<b>Gap Analysis</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicles</b>	<b>Special Equipment</b>	<b>Firefighting Manpower</b>
Operational Fire Stations	4	10	12	54
Gap in Operational Fire Stations		14	181	266
New Urban Fire Stations	0	0	0	0
New Rural Fire Stations	5	20	162	157
<b>Gap Analysis in %</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicle</b>	<b>Special Equipments</b>	<b>Firefighting Man Power</b>
Gap in Operational Fire Stations		58%	94%	83%
Gap in Operational and new urban Fire Stations only	0%	58%	94%	83%
Total Gap in Operational, new (urban and rural) Fire Stations	56%	77%	97%	89%

### Detailed Financial Investment plan

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 Chapter 28 of Lakshadweep UT Report, the detailed investment and financial plan at district level includes estimation of capital cost for infrastructure, 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 (Chapter 28 of Lakshadweep UT Report) for the next 10-years includes both capital and recurring expenditures. RMSI analysis estimates a total investment of about **Rs 312.0 Crores** spread over a period of 10 years for Lakshadweep UT Fire Services including inflationary factors and after filling the gaps for both operational and proposed urban and rural Fire Stations.

**Table 28-2: State level Investment plan (in Crores Rupees) for Lakshadweep UT Fire Services Gaps for filling gap in operational, new urban and new rural Fire Stations (in Crores Rupees)**

Year	Capital Expenditure		Recurring Expenditure					Total
	Building Infrastructure	Vehicle and Equipment	Annual Vehicle Maintenance & PDL AMC	Annual Staff Salary	Annual Office Expenses	Annual Training Office Expenses	Annual Bldg. maintenance	
First Year	3.40	4.25	0.38	6.31	0.40	0.07	0.22	15.02
Second Year	3.77	4.46	0.65	12.15	0.77	0.13	0.31	22.24
Third Year	2.09	1.06	0.76	14.90	0.94	0.14	0.35	20.25
Forth Year	2.32	1.12	0.89	18.15	1.14	0.16	0.38	24.16
Fifth Year	2.58	0.59	0.99	21.14	1.33	0.18	0.40	27.21
Sixth Year	2.86	0.62	1.11	24.58	1.55	0.20	0.42	31.34
Seventh Year	3.18	0.65	1.24	28.55	1.80	0.21	0.44	36.08
Eighth Year	3.53	0.68	1.39	33.12	2.09	0.23	0.46	41.50
Ninth Year	0.00	0.71	1.55	38.38	2.42	0.25	0.48	43.79
Tenth Year	0.00	0.75	1.72	44.42	2.80	0.27	0.50	50.46
<b>Total</b>	<b>23.75</b>	<b>14.88</b>	<b>10.68</b>	<b>241.71</b>	<b>15.23</b>	<b>1.85</b>	<b>3.96</b>	<b>312.05</b>

### Prioritization of New Fire Stations

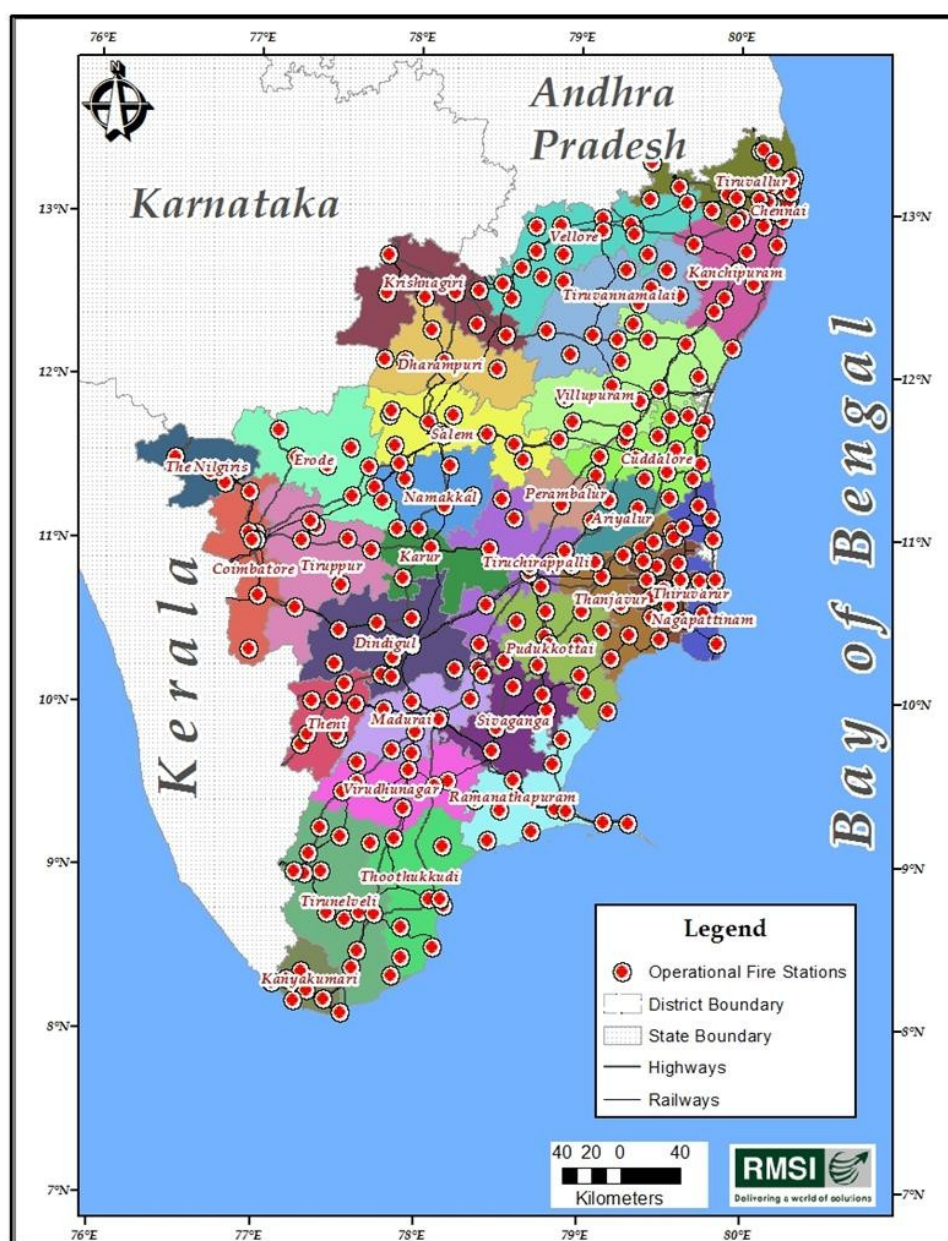
The prioritization of new Fire Stations in Lakshadweep UT has been detailed in Chapter 28 of Lakshadweep UT Report

### Capacity Building and Training Facilities

The study finds that there is a substantial gap for capacity building and training among the fire personnel within the Lakshadweep. The detailed Capacity building and training need assessment for various levels has been discussed in Chapter 28 of Lakshadweep UT Report.

## 29 Tamil Nadu State

Tamil Nadu is one of the most fire hazard prone State in the country and reported a large numbers of fire incidents. The largest fireworks factories located in Sivakasi is one of the most vulnerable city in term of fire risk. A recent fire accident of 5 September 2012 caused at least 37 casualties and many injured. Keeping in view the high fire risk, the State Fire & Rescue Services requires to strengthen its Fire Prevention Wing with dedicated senior officials, trained manpower, and firefighting vehicles and specialized equipment. Due to huge industrialization and urban development, the State has 303 operational Fire Stations spread over the State.



**Figure 29-1 : Location of operational Fire Stations in Tamil Nadu**

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 airport, military cantonment, nuclear/ thermal power plants etc. The remaining areas, not covered under ideal jurisdiction of operational Fire Stations, are also divided for ideal jurisdictions of new proposed Fire Stations. The requirements for fire fighting and rescue vehicles and specialized 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 State would require additional 46 Fire Stations in urban areas and 102 Fire Stations in rural areas. Hence this study finds a overall gap of 33% in terms of number of Fire Stations in Tamil Nadu State (for details, please refer to Chapter 29 of Tamil Nadu State Report).

### Firefighting and Rescue Vehicles and Specialized Equipment Gap Analysis

For estimating the gap in fire fighting and rescue vehicles and specialized equipment in operational as well proposed Fire Stations both in urban and rural areas, the RMSI team modified the SFAC norms with expert opinions. These modifications also helped in optimization of resources and are detailed in Chapter 29 of Tamil Nadu State Report. This finds an overall gap of 79% in the firefighting and rescue vehicle and about 92% 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 as 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 Tamil Nadu State is double shift duty pattern (12 hours), in general, and RMSI team also estimated firefighting personnel requirement for double shift duty pattern (for details, please refer to Chapter 29 of Tamil Nadu State Report). Thus, in Tamil Nadu State, this study finds an overall gap of about 85% in fire personnel considering double shift duty pattern.

**Table 29-1: Gap Analysis for the Tamil Nadu Fire & Rescue Services**

<b>Gap Analysis</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicles</b>	<b>Special Equipment</b>	<b>Firefighting Manpower</b>
Operational Fire Stations	303	484	2,049	5,408
Gap in Operational Fire Stations		1,137	16,295	20,899
New Urban Fire Stations	46	212	3,295	4,021
New Rural Fire Stations	102	521	5,329	6,349
<b>Gap Analysis in %</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicle</b>	<b>Special Equipments</b>	<b>Firefighting Man Power</b>
Gap in operational Fire Stations		70%	89%	79%
Gap in operational and new urban Fire Stations only	13%	74%	91%	82%
Total Gap in operational, new (urban and rural) Fire Stations	33%	79%	92%	85%



### Detailed Financial Investment plan

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 Chapter 29 of Tamil Nadu State Report, the detailed investment and financial plan at district level includes estimation of capital cost for infrastructure, 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 (Chapter 29 of Tamil Nadu State Report) for the next 10-years includes both capital and recurring expenditures. RMSI analysis estimates a total investment of **about Rs 24,527.9 Crores** spread over a period of 10 years for Tamil Nadu Fire & Rescue Services including inflationary factors and after filling the gaps for both operational and proposed urban and rural Fire Stations.

**Table 29-2: State level Investment plan (in Crores Rupees) for Tamil Nadu Fire and Rescue Services Gaps for filling gap in operational, new urban and new rural Fire Stations (in Crores Rupees)**

Year	Capital Expenditure		Recurring Expenditure					Total
	Building Infrastructure	Vehicle and Equipment	Annual Vehicle Maintenance & PDL AMC	Annual Staff Salary	Annual Office Expenses	Annual Training Office Expenses	Annual Bldg. maintenance	
First Year	338.90	274.77	27.23	527.36	33.22	5.80	22.31	1,229.60
Second Year	376.18	288.51	44.67	985.79	62.11	10.17	32.43	1,799.85
Third Year	208.78	57.70	51.40	1,190.81	75.02	11.51	35.67	1,630.89
Forth Year	231.74	60.59	58.92	1,430.83	90.14	12.97	38.97	1,924.15
Fifth Year	257.24	31.81	65.47	1,656.91	104.39	14.08	40.85	2,170.74
Sixth Year	285.54	33.40	72.69	1,916.66	120.75	15.27	42.76	2,487.06
Seventh Year	316.94	35.07	80.65	2,214.88	139.54	16.54	44.71	2,848.32
Eighth Year	351.81	36.82	89.42	2,557.07	161.10	17.90	46.69	3,260.81
Ninth Year	0.00	38.66	99.07	2,949.51	185.82	19.36	48.70	3,341.12
Tenth Year	0.00	40.60	109.70	3,399.30	214.16	20.92	50.75	3,835.42
<b>Total</b>	<b>2,367.13</b>	<b>897.92</b>	<b>699.21</b>	<b>18,829.11</b>	<b>1,186.24</b>	<b>144.52</b>	<b>403.84</b>	<b>24,527.96</b>

### Prioritization of New Fire Stations

The prioritization of new Fire Stations in Tamil Nadu for both rural and urban areas has been detailed in Chapter 29 of Tamil Nadu State Report.

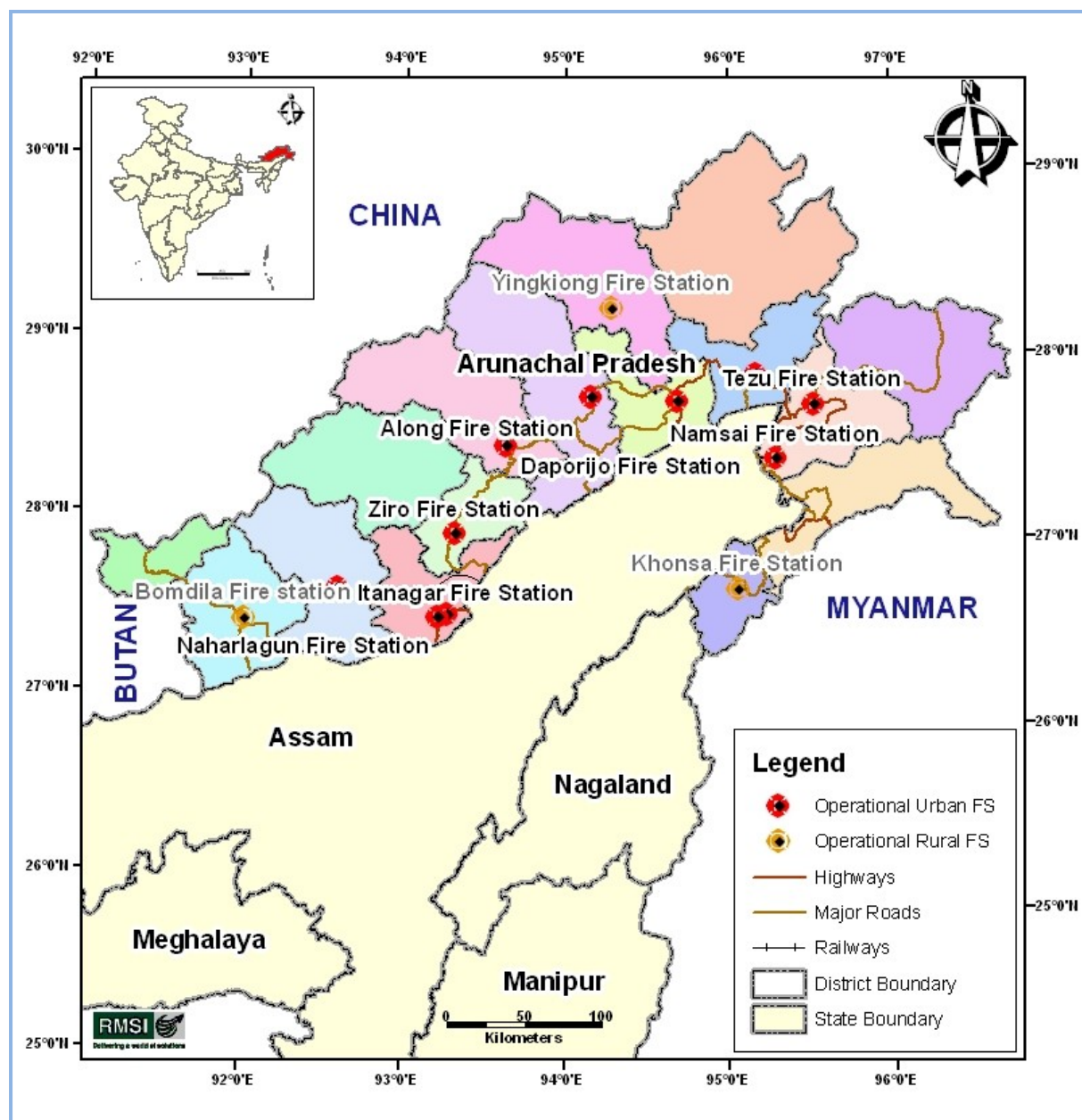
### Capacity Building and Training Facilities

The State has a fully functional State Training School in Chennai, however, there is scope for capacity building and training among the fire personnel within the Tamil Nadu State. The capacity building and training need assessment for various levels have been discussed in Chapter 29 of Tamil Nadu State Report.



## 30 Arunachal Pradesh State

Arunachal Pradesh is the largest northeastern State in terms of area, however, it is less population density than Assam. As per the Census (2011), the State has 13,82,611 populations distributed among 16 districts out of which 22% population lives in urban areas. Presently, Arunachal Pradesh Fire Service Force (APFSF) has 13 operational Fire Stations. On an average, each Fire Station in Arunachal Pradesh serving more than 1 Lakhs of population.



**Figure 30-1 : Location of operational Fire Stations in Arunachal Pradesh**

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 airport, military cantonment,

power plants etc. The remaining areas, not covered under ideal jurisdiction of operational Fire Stations, are also divided for ideal jurisdictions of new proposed Fire Stations. The requirements for fire fighting and rescue vehicles and specialized 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 State would require additional 1 Fire stations in urban areas and 30 Fire stations in rural areas. Hence this study finds an overall gap of 70% in terms of number of Fire Stations in Arunachal Pradesh (for details, please refer to Chapter 30 of Arunachal Pradesh State Report).

### Firefighting and Rescue Vehicles and Specialized Equipment Gap Analysis

For estimating the gap in fire fighting and rescue vehicles and specialized equipment in operational as well proposed Fire Stations both in urban and rural areas, the RMSI team modified the SFAC norms with expert opinions. These modifications also helped in optimization of resources and are detailed in Chapter 30 of Arunachal Pradesh State Report. This study finds an overall gap of 86% in the firefighting and rescue vehicles and about 97% 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 Arunachal Pradesh is 24 hours, and RMSI team estimated for manpower requirement for double shift duty pattern (for details, please refer to Chapter 30 of Arunachal Pradesh State Report). Thus, in Arunachal Pradesh, this study finds an overall gap of 93% in fire personnel considering double shift duty pattern.

**Table 30-1: Gap Analysis for the Arunachal Pradesh Fire Force**

<b>Gap Analysis</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicles</b>	<b>Special Equipment</b>	<b>Firefighting Manpower</b>
Operational Fire Stations	13	30	62	215
Gap in Operational Fire Stations		71	724	1,451
New Urban Fire Stations	1	2	38	37
New Rural Fire Stations	30	116	968	1,417
<b>Gap Analysis in %</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicle</b>	<b>Special Equipments</b>	<b>Firefighting Man Power</b>
Gap in Operational Fire Stations		70%	92%	87%
Gap in Operational and new urban Fire Stations only	7%	71%	92%	87%
Total Gap in Operational, new (urban and rural) Fire Stations	70%	86%	97%	93%

### Detailed Financial Investment plan

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 Chapter 30 of Arunachal Pradesh State Report, 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 (Chapter 30 of Arunachal Pradesh State Report) for the next 10-years includes both capital and recurring expenditures. RMSI analysis estimates a total investment of about **Rs. 2,105.8 Crores** spread over a period of 10 years for Arunachal Pradesh including inflationary factors and after filling the gaps for both operational and proposed urban and rural Fire Stations.

**Table 30-2: State level Investment plan (in Crores Rupees) for Arunachal Pradesh Fire Force Gaps for filling gap in operational, new urban and new rural Fire Stations (in Crores Rupees)**

Year	Capital Expenditure		Recurring Expenditure					Total
	Building Infrastructure	Vehicle and Equipment	Annual Vehicle Maintenance & PDL AMC	Annual Staff Salary	Annual Office Expenses	Annual Training Office Expenses	Annual Bldg. maintenance	
First Year	34.80	40.58	2.38	31.91	2.01	0.35	1.18	113.22
Second Year	38.63	42.61	4.59	63.28	3.99	0.65	2.11	155.86
Third Year	21.44	12.40	5.59	83.02	5.23	0.80	2.47	130.94
Forth Year	23.80	13.02	6.72	106.58	6.71	0.97	2.83	160.63
Fifth Year	26.41	6.83	7.62	126.98	8.00	1.08	3.04	179.97
Sixth Year	29.32	7.18	8.63	150.75	9.50	1.20	3.24	209.82
Seventh Year	32.55	7.54	9.75	178.39	11.24	1.33	3.45	244.25
Eighth Year	36.13	7.91	11.00	210.50	13.26	1.47	3.66	283.93
Ninth Year	0.00	8.31	12.38	247.74	15.61	1.63	3.88	289.54
Tenth Year	0.00	8.72	13.91	290.89	18.33	1.79	4.10	337.74
<b>Total</b>	<b>243.07</b>	<b>155.10</b>	<b>82.57</b>	<b>1,490.04</b>	<b>93.87</b>	<b>11.28</b>	<b>29.96</b>	<b>2,105.89</b>

### Prioritization of New Fire Stations

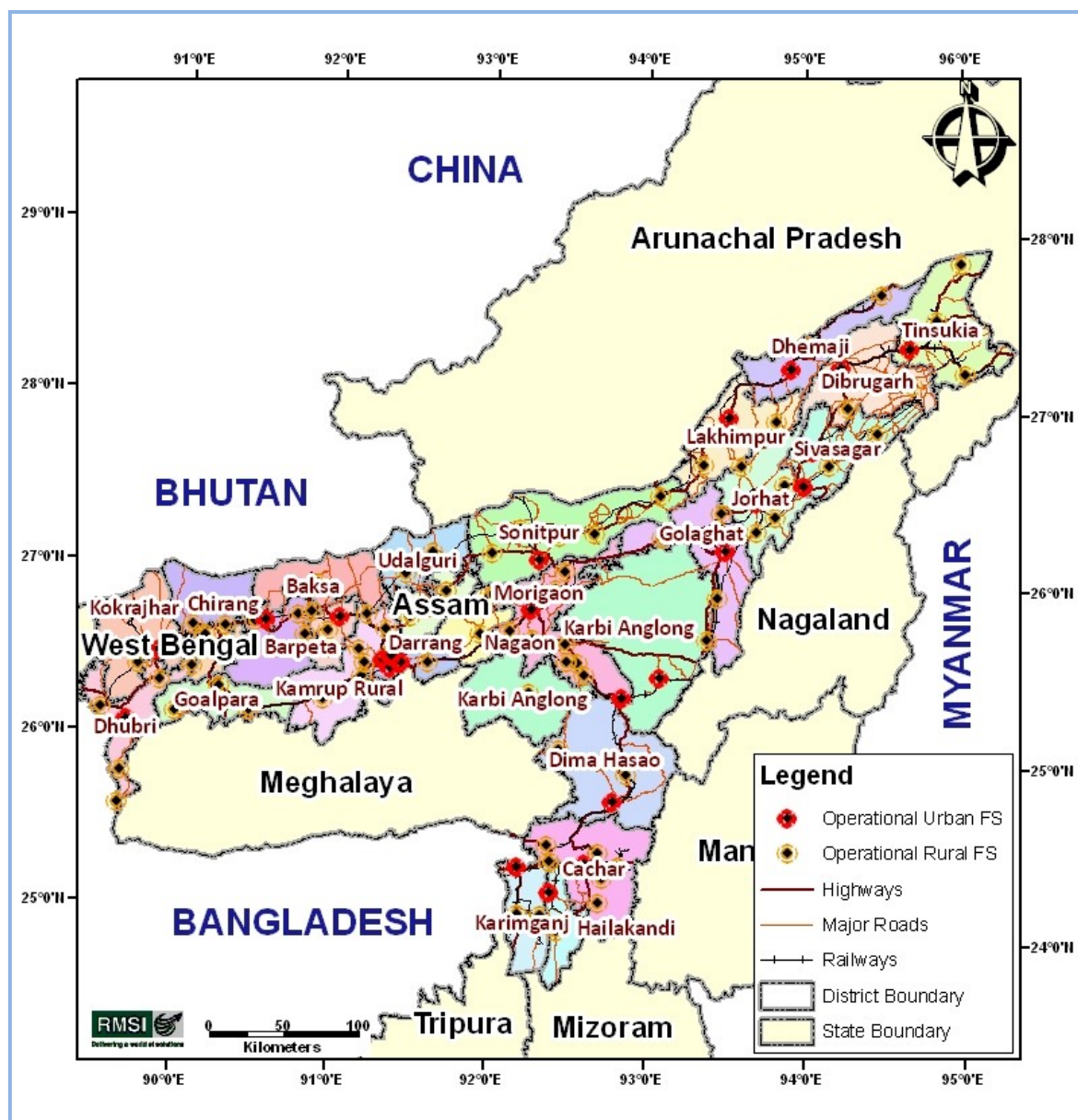
The prioritization of new Fire Stations in Arunachal Pradesh for both rural and urban areas has been detailed in Chapter 30 of Arunachal Pradesh State Report.

### Capacity Building and Training Facilities

The study finds that there is a substantial gap for capacity building and training among the fire personnel within the Arunachal Pradesh. The detailed Capacity building and training need assessment for various levels have been discussed in Chapter 30 of Arunachal Pradesh State Report.

## 31 Assam State

In Assam, “Assam Fire Service Organization (AFSO)” governs the Fire Services. The AFSO was created in the year 1956 by taking over and merging the Fire Stations belonging to the Municipal Boards of Shillong & Silchar by the State Govt. of Assam. Currently, AFSO has 110 operational Fire Station spread over the State. The State has a total population of 31,169,272 inhabited in 27 districts as per Census, 2011. On an average, each Fire Station in Assam State is serving more than two Lakhs population.



**Figure 31-1 : Location of operational Fire Stations in Assam**

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 airport, military cantonment, thermal power plants, oil-refineries, 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 AFSSO would require additional 25 Fire stations in urban areas and 67 Fire stations in rural areas. Hence this study finds an overall gap of 46% in terms of number of Fire Stations in Assam State (for details, please refer to Chapter 31 of Assam State Report).

### Firefighting and Rescue Vehicles and Specialized Equipment Gap Analysis

For estimating the gap in fire fighting and rescue vehicles and specialized equipment in operational as well proposed Fire Stations both in urban and rural areas, the RMSI team modified the SFAC norms with expert opinions. These modifications also helped in optimization of resources and are detailed in Chapter 31 of Assam State Report. This study finds an overall gap of 75% in the firefighting and rescue vehicles and about 95% 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 Assam State is 24 hours, and RMSI team estimated for manpower requirement for double shift duty pattern (for details, please refer to Chapter 31 of Assam State Report). Thus, in Assam State, this study finds an overall gap of 87% in fire personnel considering double shift duty pattern.

**Table 31-1: Gap Analysis for the Assam Fire Service Organization**

<b>Gap Analysis</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicles</b>	<b>Special Equipment</b>	<b>Firefighting Manpower</b>
Operational Fire Stations	110	279	624	2,297
Gap in Operational Fire Stations		439	6,409	10,069
New Urban Fire Stations	25	36	873	734
New Rural Fire Stations	67	362	3,786	5,166
<b>Gap Analysis in %</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicle</b>	<b>Special Equipments</b>	<b>Firefighting Man Power</b>
Gap in Operational Fire Stations		61%	91%	81%
Gap in Operational and new urban Fire Stations only	19%	63%	92%	82%
Total Gap in Operational, new (urban and rural) Fire Stations	46%	75%	95%	87%

### Detailed Financial Investment plan

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 Chapter 31 of Assam State Report, 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 (Chapter 31 of Assam State Report) for the next 10-years includes both capital and recurring expenditures. RMSI analysis estimates a total investment of **about Rs 12,174.9 Crores** spread over a period of 10 years for Assam State Fire Service Organization including inflationary factors and after filling the gaps for both operational and proposed urban and rural Fire Stations.

**Table 31-2: State level Investment plan (in Crores Rupees) for Assam Fire Service Organization Gaps 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	182.90	151.06	12.95	245.18	15.45	2.70	8.02	618.25
Second Year	203.02	158.61	21.89	464.15	29.24	4.79	13.53	895.22
Third Year	112.68	31.47	25.42	569.13	35.86	5.50	15.20	795.26
Forth Year	125.07	33.04	29.38	692.64	43.64	6.28	16.91	946.94
Fifth Year	138.83	17.35	32.77	806.67	50.82	6.85	17.86	1,071.14
Sixth Year	154.10	18.22	36.51	938.09	59.10	7.47	18.83	1,232.32
Seventh Year	171.05	19.13	40.64	1,089.44	68.64	8.14	19.82	1,416.85
Eighth Year	189.87	20.08	45.20	1,263.60	79.61	8.85	20.82	1,628.04
Ninth Year	0.00	21.09	50.23	1,463.88	92.23	9.61	21.85	1,658.89
Tenth Year	0.00	22.14	55.78	1,694.03	106.72	10.42	22.89	1,911.99
<b>Total</b>	<b>1,277.51</b>	<b>492.18</b>	<b>350.77</b>	<b>9,226.81</b>	<b>581.29</b>	<b>70.61</b>	<b>175.73</b>	<b>12,174.90</b>

### Prioritization of New Fire Stations

The prioritization of new Fire Stations in Assam State for both rural and urban areas has been detailed in Chapter 31 of Assam State Report.

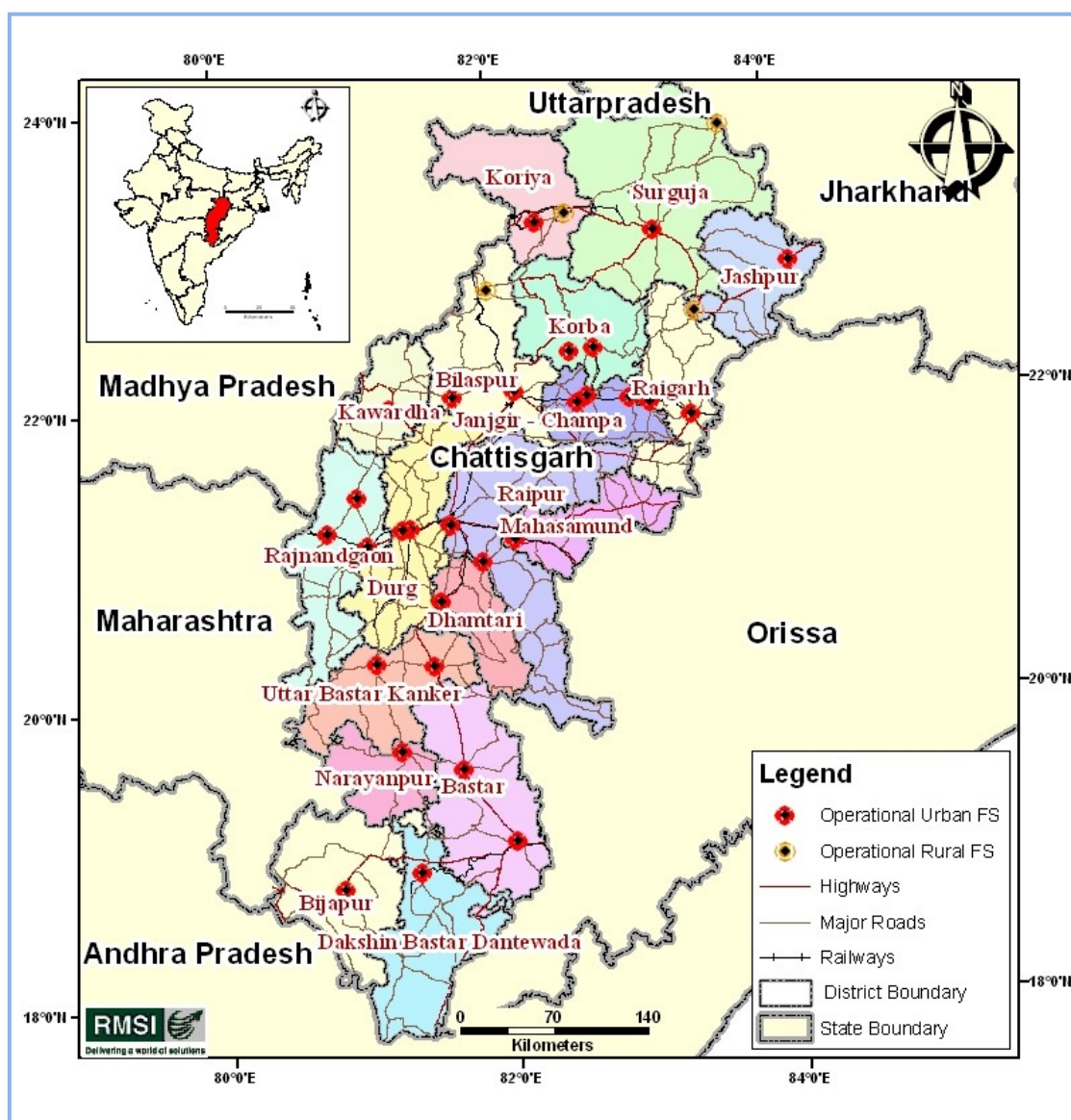
### Capacity Building and Training Facilities

The study finds that there are some gaps in capacity building and training among the fire personnel within the Assam State. The detailed Capacity building and training need assessment for various levels has been discussed in Chapter 31 of Assam State Report.



## 32 Chhattisgarh State

Currently, Chhattisgarh Fire Services (CFS) has 33 operational Fire Stations with each Fire Station serving an average of more than seven Lakhs population. Due to rapid industrial growth and increased urbanization, there is urgent need to strengthen the State Fire Service by new setting new Fire Stations, increasing trained firefighters and State-of-the-art firefighting vehicle and specialized equipments. The State has a total population of 25,540,196 inhabited in 18 districts as per Census, 2011. On an average, each Fire Station in Chhattisgarh State is serving more than seven Lakhs and seventy thousand populations.



**Figure 32-1 : Location of operational Fire Stations in Chhattisgarh**

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 airport, military cantonment, thermal power plants etc. The remaining areas, not covered under ideal jurisdiction of operational Fire Stations, are also divided for ideal jurisdictions of new proposed Fire

Stations. The requirements for fire fighting and rescue vehicles and specialized 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 Chhattisgarh Fire Service would require additional 14 Fire Stations in urban areas and 103 Fire Stations in rural areas. Hence this study finds an overall gap of 78% in terms of number of Fire Stations in Chhattisgarh State (for details, please refer to Chapter 32 of Chhattisgarh State Report).

### Firefighting and Rescue Vehicles and Specialized Equipment Gap Analysis

For estimating the gap in fire fighting and rescue vehicles and specialized equipment in operational as well proposed Fire Stations both in urban and rural areas, the RMSI team modified the SFAC norms with expert opinions. These modifications also helped in optimization of resources and are detailed in Chapter 32 of Chhattisgarh State Report. This study finds an overall gap of 93% in the firefighting and rescue vehicles and about 98% 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 for firefighters in Chhattisgarh State is generally 8 hours (3-shift), and RMSI team has estimated for manpower requirement for double shift duty pattern (for details, please refer to Chapter 32 of Chhattisgarh State Report). Thus, in Chhattisgarh State, this study finds an overall gap of 97% in fire personnel considering double shift duty pattern.

**Table 32-1: Gap Analysis for the Chhattisgarh Fire Services**

<b>Gap Analysis</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicles</b>	<b>Special Equipment</b>	<b>Firefighting Manpower</b>
Operational Fire Stations	33	59	153	125
Gap in Operational Fire Stations		158	1,828	882
New Urban Fire Stations	14	47	768	220
New Rural Fire Stations	103	603	6,397	2,790
<b>Gap Analysis in %</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicle</b>	<b>Special Equipments</b>	<b>Firefighting Man Power</b>
Gap in Operational Fire Stations		73%	92%	88%
Gap in Operational and new urban Fire Stations only	30%	78%	94%	90%
Total Gap in Operational, new (urban and rural) Fire Stations	78%	93%	98%	97%

### Detailed Financial Investment plan

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 Chapter 32 of Chhattisgarh State Report, 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 (Chapter 32 of Chhattisgarh State Report) for the next 10-years includes both capital and recurring expenditures. RMSI analysis estimates a total investment of about **Rs 3,782.2 Crores** spread over a period of 10 years for Chhattisgarh Fire Services including inflationary factors and after filling the gaps for both operational and proposed urban and rural Fire Stations

**Table 32-2: State level Investment plan (in Crores Rupees) for Chhattisgarh Fire Services Gaps for filling gap in operational, new urban and new rural Fire Stations (in Crores Rupees)**

Year	Capital Expenditure		Recurring Expenditure					Total
	Building Infrastructure	Vehicle and Equipment	Annual Vehicle Maintenance & PDL AMC	Annual Staff Salary	Annual Office Expenses	Annual Training Office Expenses	Annual Bldg. maintenance	
First Year	154.05	82.14	4.88	21.15	1.33	0.23	2.56	266.35
Second Year	171.00	86.25	9.37	42.68	2.69	0.44	4.19	316.61
Third Year	94.90	48.92	12.74	74.50	4.69	0.72	6.73	243.21
Forth Year	105.34	51.37	16.59	113.35	7.14	1.03	9.32	304.13
Fifth Year	116.93	26.97	19.45	143.70	9.05	1.22	10.68	328.00
Sixth Year	129.80	28.32	22.65	179.70	11.32	1.43	12.07	385.30
Seventh Year	144.07	29.73	26.25	222.28	14.00	1.66	13.49	451.49
Eighth Year	159.92	31.22	30.28	272.48	17.17	1.91	14.94	527.91
Ninth Year	0.00	32.78	34.78	331.54	20.89	2.18	16.41	438.57
Tenth Year	0.00	34.42	39.81	400.84	25.25	2.47	17.91	520.70
<b>Total</b>	<b>1,076.00</b>	<b>452.11</b>	<b>216.80</b>	<b>1,802.22</b>	<b>113.54</b>	<b>13.28</b>	<b>108.32</b>	<b>3,782.27</b>

### Prioritization of New Fire Stations

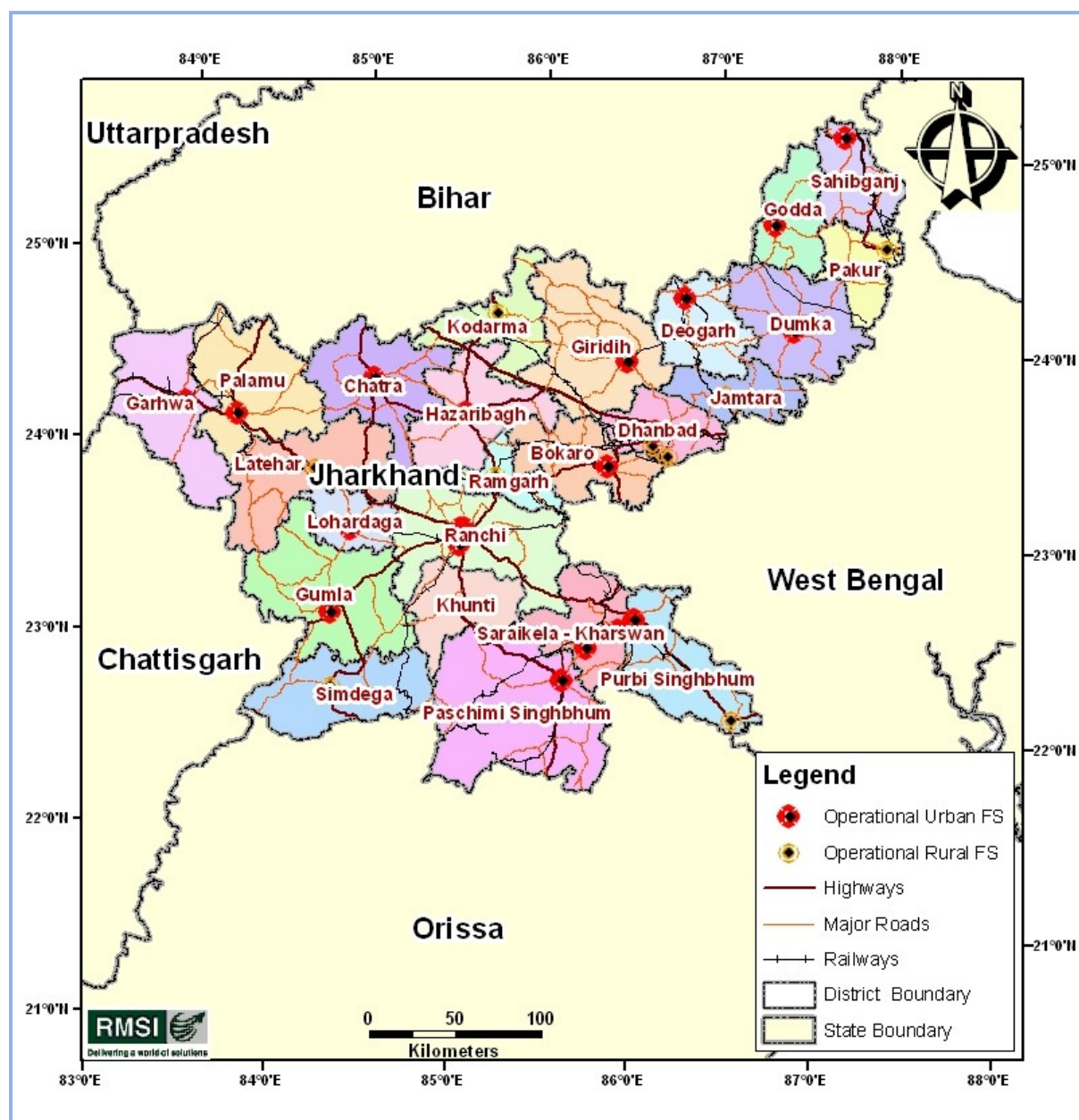
The prioritization of new Fire Stations in the Chhattisgarh State for both rural and urban areas has been detailed in Chapter 32 of Chhattisgarh State Report.

### Capacity Building and Training Facilities

The study finds that there is a substantial gap for capacity building and training among the fire personnel within the Chhattisgarh State. The detailed Capacity building and training need assessment for various levels has been discussed in Chapter 32 of Chhattisgarh State Report.

## 33 Jharkhand State

Jharkhand State Fire Service has 31 operational Fire Stations spread 24 districts. The State has a total population of 32,966,238 inhabited in 24 districts as per Census, 2011. On an average, each Fire Station in the State is serving more than ten Lakhs population.



**Figure 33-1 : Location of operational Fire Stations in Jharkhand**

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 airport, military cantonment, thermal power plants etc. The remaining areas, not covered under ideal jurisdiction of operational Fire Stations, are also divided for ideal jurisdictions of new proposed Fire



Stations. The requirements for fire fighting and rescue vehicles and specialized 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 Jharkhand Fire Services would require additional 12 Fire stations in urban areas and 137 Fire stations in rural areas. Hence this study finds an overall gap of 83% in terms of number of Fire stations in Jharkhand State (for details, please refer to Chapter 33 of Jharkhand State Report).

### Firefighting and Rescue Vehicles and Specialized Equipment Gap Analysis

For estimating the gap in fire fighting and rescue vehicles and specialized equipment in operational as well proposed Fire stations both in urban and rural areas, the RMSI team modified the SFAC norms with expert opinions. These modifications also helped in optimization of resources and are detailed in Chapter 33 of Jharkhand State Report. This study finds an overall gap of 91% in the firefighting and rescue vehicles and about 98% 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 for firefighters in the State is 24 hours, and RMSI team estimated for manpower requirement for double shift duty pattern (for details, please refer to Chapter 33 of Jharkhand State Report). Thus, in Jharkhand State, this study finds an overall gap of 92% in fire personnel considering double shift duty pattern.

**Table 33-1: Gap Analysis for the Jharkhand Fire Services**

<b>Gap Analysis</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicles</b>	<b>Special Equipment</b>	<b>Firefighting Manpower</b>
Operational Fire Stations	31	95	262	402
Gap in Operational Fire Stations		220	2,667	919
New Urban Fire Stations	12	53	773	235
New Rural Fire Stations	137	734	7,591	3,491
<b>Gap Analysis in %</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicle</b>	<b>Special Equipments</b>	<b>Firefighting Man Power</b>
Gap in Operational Fire Stations		70%	91%	70%
Gap in Operational and new urban Fire Stations only	28%	74%	93%	74%
Total Gap in Operational, new (urban and rural) Fire Stations	83%	91%	98%	92%

### Detailed Financial Investment plan

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 Chapter 33 of Jharkhand State Report, 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 (Chapter 33 of Jharkhand State Report) for the next 10-years includes both capital and recurring expenditures. RMSI analysis estimates a total investment of about **Rs 4,569.6 Crores** spread over a period of 10 years for Jharkhand Fire Services including inflationary factors and after filling the gaps for both operational and proposed urban and rural Fire Stations.

**Table 33-2: State level Investment plan (in Crores Rupees) for Jharkhand Fire Services Gaps 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	171.25	99.26	6.62	31.79	2.00	0.35	3.33	314.60
Second Year	190.09	104.22	12.20	56.24	3.54	0.58	5.33	372.21
Third Year	105.50	57.31	16.25	95.92	6.04	0.93	8.09	290.03
Forth Year	117.10	60.17	20.87	144.32	9.09	1.31	10.89	363.75
Fifth Year	129.99	31.59	24.33	182.29	11.48	1.55	12.38	393.61
Sixth Year	144.29	33.17	28.21	227.30	14.32	1.81	13.89	462.99
Seventh Year	160.15	34.83	32.56	280.48	17.67	2.09	15.44	543.22
Eighth Year	177.77	36.57	37.42	343.16	21.62	2.40	17.01	635.95
Ninth Year	0.00	38.40	42.85	416.84	26.26	2.74	18.61	545.70
Tenth Year	0.00	40.32	48.92	503.26	31.71	3.10	20.24	647.54
<b>Total</b>	<b>1,196.14</b>	<b>535.84</b>	<b>270.24</b>	<b>2,281.58</b>	<b>143.74</b>	<b>16.86</b>	<b>125.21</b>	<b>4,569.61</b>

### Prioritization of New Fire Stations

The prioritization of new Fire Stations in Jharkhand for both rural and urban areas has been detailed in Chapter 33 of Jharkhand State Report.

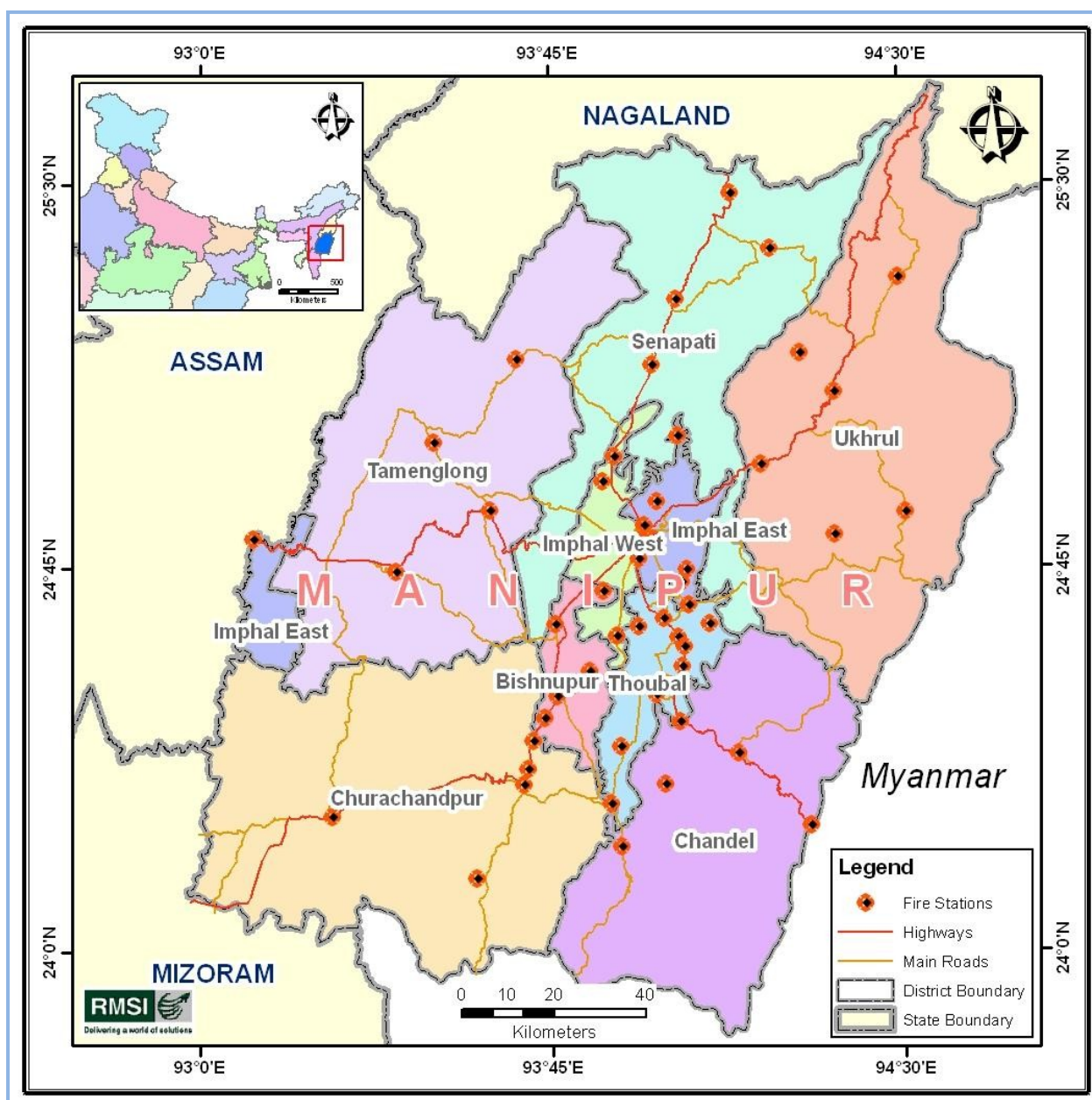
### Capacity Building and Training Facilities

The study finds that there is a substantial gap for capacity building and training among the fire personnel within the Jharkhand State. The detailed Capacity building and training need assessment for various levels have been discussed in Chapter 33 of Jharkhand State Report.



## 34 Manipur State

Manipur Fire Services (MFS) has 16 operational Fire Stations, a small workshop cum training school, and a wireless control room at Manipur Fire Service Headquarter, Imphal. The State has a total population of 2,721,756 inhabited in 9 districts as per Census, 2011. On an average, each Fire Station in Manipur State is serving more than one Lakhs population.



**Figure 34-1 : Location of operational Fire Stations in Manipur**

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 airport, military cantonment, thermal power plants etc. The remaining areas, not covered under ideal jurisdiction of

operational Fire Stations, are also divided for ideal jurisdictions of new proposed Fire Stations. The requirements for fire fighting and rescue vehicles and specialized 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 State would require additional 11 Fire Stations in urban areas and 27 Fire Stations in rural areas. Hence this study finds an overall gap of 70% in terms of number of Fire Stations in Manipur State (for details, please refer to Chapter 34 of Manipur State Report). Keeping in view the typical land use pattern around the Loktak Lake, large encroachments, lack of access to lakeside houses by the roads, two new lake Fire Stations has been proposed in the new rural FS category to combat fire and rescue people, in case of an emergency, in an efficient manner.

### Firefighting and Rescue Vehicles and Specialized Equipment Gap Analysis

For estimating the gap in fire fighting and rescue vehicles and specialized equipment in operational as well proposed Fire Stations both in urban and rural areas, the RMSI team modified the SFAC norms with expert opinions. These modifications also helped in optimization of resources and are detailed in Chapter 34 of Manipur State Report. This study finds an overall gap of 72% 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 Manipur State is 24 hours, and RMSI team estimated for manpower requirement for double shift duty pattern (for details, please refer to Chapter 34 of Manipur State Report). Thus, in Manipur State, this study finds an overall gap of 93% in fire personnel considering double shift duty pattern.

**Table 34-1: Gap Analysis for the Manipur Fire Services**

<b>Gap Analysis</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicles</b>	<b>Special Equipment</b>	<b>Firefighting Manpower</b>
Operational Fire Stations	16	57	151	191
Gap in Operational Fire Stations		52	758	1,453
New Urban Fire Stations	11	21	396	309
New Rural Fire Stations	26	76	716	595
<b>Gap Analysis in %</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicle</b>	<b>Special Equipments</b>	<b>Firefighting Man Power</b>
Gap in Operational Fire Stations		48%	83%	88%
Gap in Operational and new urban Fire Stations only	41%	56%	88%	90%
Total Gap in Operational, new (urban and rural) Fire Stations	70%	72%	93%	93%

### Detailed Financial Investment plan

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 Chapter 34 of Manipur State Report, 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 (Chapter 34 of Manipur State Report) for the next 10-years includes both capital and recurring expenditures. RMSI analysis estimates a total investment of about **Rs. 1,764.9 Crores** spread over a period of 10 years for Manipur State including inflationary factors and after filling the gaps for both operational and proposed urban and rural Fire Stations.

**Table 34-2: State level Investment plan (in Crores Rupees) for Manipur Fire Services Gaps for filling gap in operational, new urban and new rural Fire Stations (in Crores Rupees)**

Year	Capital Expenditure		Recurring Expenditure					Total
	Building Infrastructure	Vehicle and Equipment	Annual Vehicle Maintenance & PDL AMC	Annual Staff Salary	Annual Office Expenses	Annual Training Office Expenses	Annual Bldg. maintenance	
First Year	28.55	31.17	2.69	31.00	1.95	0.34	1.29	96.99
Second Year	31.69	32.72	4.50	62.26	3.92	0.64	2.10	137.83
Third Year	17.59	6.88	5.27	77.14	4.86	0.75	2.38	114.87
Forth Year	19.52	7.23	6.14	94.70	5.97	0.86	2.67	137.08
Fifth Year	21.67	3.79	6.88	110.71	6.97	0.94	2.83	153.79
Sixth Year	24.05	3.98	7.69	129.20	8.14	1.03	2.99	177.09
Seventh Year	26.70	4.18	8.58	150.53	9.48	1.12	3.16	203.77
Eighth Year	29.64	4.39	9.57	175.12	11.03	1.23	3.33	234.32
Ninth Year	0.00	4.61	10.67	203.45	12.82	1.34	3.50	236.39
Tenth Year	0.00	4.84	11.88	236.05	14.87	1.45	3.68	272.78
<b>Total</b>	<b>199.41</b>	<b>103.81</b>	<b>73.87</b>	<b>1,270.15</b>	<b>80.02</b>	<b>9.70</b>	<b>27.94</b>	<b>1,764.90</b>

### Prioritization of New Fire Stations

The prioritization of new Fire Stations in Manipur State for both rural and urban areas has been detailed in Chapter 34 of Manipur State Report.

### Capacity Building and Training Facilities

The study finds that there is a substantial gap for capacity building and training among the fire personnel within the Manipur State. The detailed Capacity building and training need assessment for various levels has been discussed in Chapter 34 of Manipur State Report.

## 35 Meghalaya State

Meghalaya Fire and Emergency Services (MFES) has 32 operational Fire Stations spread over 7 district. Presently, the fire services of the State governed by the Police services. The formation of new Directorate of Fire and Emergency services is in progress under Meghalaya Fire and Emergency Service Act 2012.



**Figure 35-1 : Location of operational Fire Stations in Meghalaya**

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 airport, military cantonment, thermal power plants etc. The remaining areas, not covered under ideal jurisdiction of operational Fire Stations, are also divided for ideal jurisdictions of new proposed Fire Stations. The requirements for fire fighting and rescue vehicles and specialized 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 State would require additional 2 Fire stations in urban areas and 15 Fire stations in rural areas. Hence this study finds an overall gap of 35% in terms of number of Fire Stations in Meghalaya States (for details, please refer to Chapter 35 of Meghalaya State Report).

### Firefighting and Rescue Vehicles and Specialized Equipment Gap Analysis

For estimating the gap in fire fighting and rescue vehicles and specialized equipment in operational as well proposed Fire Stations both in urban and rural areas, the RMSI team modified the SFAC norms with expert opinions. These modifications also helped in optimization of resources and are detailed in Chapter 35 of Meghalaya State Report. This study finds an overall gap of 62% in the firefighting and rescue vehicles and about 92% 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 Meghalaya State is 24 hours, and RMSI team estimated for manpower requirement for double shift duty pattern (for details, please refer to Chapter 35 of Meghalaya State Report). Thus, in Meghalaya State, this study finds an overall gap of 78% in fire personnel considering double shift duty pattern.

**Table 35-1: Gap Analysis for the Meghalaya Fire & Emergency Services**

<b>Gap Analysis</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicles</b>	<b>Special Equipment</b>	<b>Firefighting Manpower</b>
Operational Fire Stations	32	80	165	725
Gap in Operational Fire Stations		78	1,334	1,953
New Urban Fire Stations	2	4	69	75
New Rural Fire Stations	15	48	457	523
<b>Gap Analysis in %</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicle</b>	<b>Special Equipments</b>	<b>Firefighting Man Power</b>
Gap in Operational Fire Stations		49%	89%	73%
Gap in Operational and new urban Fire Stations only	6%	51%	89%	74%
Total Gap in Operational, new (urban and rural) Fire Stations	35%	62%	92%	78%

### Detailed Financial Investment plan

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 Chapter 35 of Meghalaya State Report, 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 (Chapter 35 of Meghalaya State Report) for the next 10-years includes both capital and recurring expenditures. RMSI analysis estimates a total investment of **about Rs 2,175.4 Crores** spread over a period of 10 years for Meghalaya State including inflationary factors and after filling the gaps for both operational and proposed urban and rural Fire Stations.

**Table 35-2: State level Investment plan (in Crores Rupees) for Meghalaya Fire and Emergency Services Gaps for filling gap in operational, new urban and new rural Fire Stations (in Crores Rupees)**

Year	Capital Expenditure		Recurring Expenditure					Total
	Building Infrastructure	Vehicle and Equipment	Annual Vehicle Maintenance & PDL AMC	Annual Staff Salary	Annual Office Expenses	Annual Training Office Expenses	Annual Bldg. maintenance	
First Year	18.45	22.50	3.30	56.92	3.59	0.63	2.02	107.40
Second Year	20.48	23.63	4.85	100.59	6.34	1.04	2.64	159.56
Third Year	11.37	3.23	5.42	117.61	7.41	1.14	2.80	148.98
Forth Year	12.62	3.39	6.05	137.28	8.65	1.24	2.97	172.19
Fifth Year	14.00	1.78	6.64	156.86	9.88	1.33	3.06	193.56
Sixth Year	15.55	1.87	7.29	179.16	11.29	1.43	3.16	219.74
Seventh Year	17.25	1.96	8.00	204.56	12.89	1.53	3.27	249.45
Eighth Year	19.15	2.06	8.77	233.47	14.71	1.63	3.37	283.17
Ninth Year	0.00	2.16	9.62	266.37	16.78	1.75	3.47	300.16
Tenth Year	0.00	2.27	10.55	303.82	19.14	1.87	3.58	341.22
<b>Total</b>	<b>128.87</b>	<b>64.83</b>	<b>70.50</b>	<b>1,756.63</b>	<b>110.66</b>	<b>13.58</b>	<b>30.35</b>	<b>2,175.43</b>

### Prioritization of New Fire Stations

The prioritization of new Fire Stations in Meghalaya State for both rural and urban areas has been detailed in Chapter 35 of Meghalaya State Report.

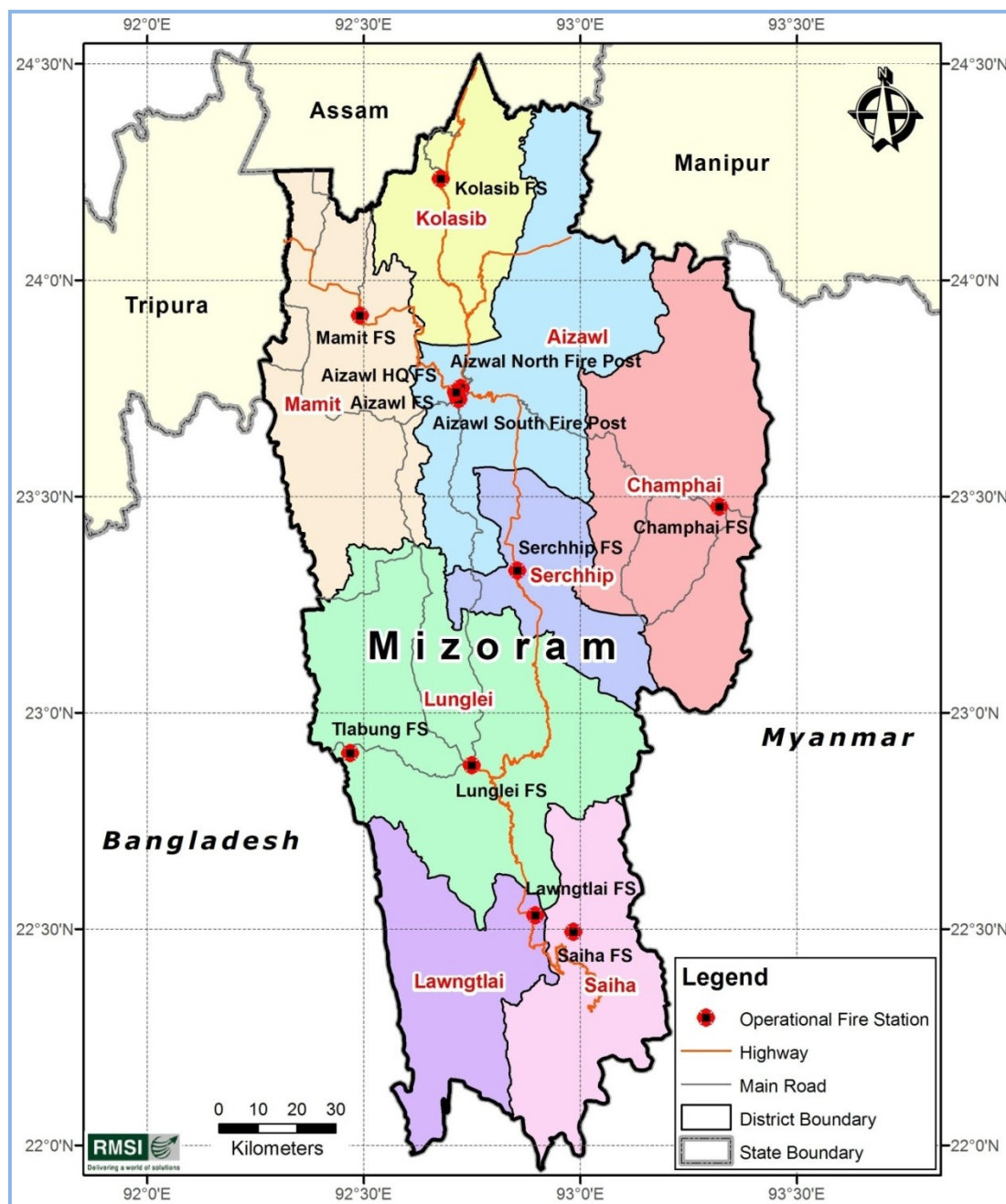
### Capacity Building and Training Facilities

The study finds that there is a substantial gap for capacity building and training among the fire personnel within the Meghalaya State. The detailed Capacity building and training need assessment for various levels has been discussed in Chapter 35 of Meghalaya State Report.



## 36 Mizoram State

Mizoram State Fire Services has 12 operational Fire Stations covering 8 districts. The State has a total population of 10, 91,014 inhabited in 8 districts as per Census, 2011. On an average, each Fire Station in Mizoram State is serving more than 90 thousand populations.



**Figure 36-1 : Location of operational Fire Stations in Mizoram**

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 airport, military cantonment, thermal power plants etc. The remaining areas, not covered under ideal jurisdiction of

operational Fire Stations, are also divided for ideal jurisdictions of new proposed Fire Stations. The requirements for fire fighting and rescue vehicles and specialized 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 State would require additional 8 Fire stations in urban areas and 31 Fire stations in rural areas. Hence this study finds a overall gap of 76% in terms of number of Fire Stations in Mizoram State (for details, please refer to Chapter 36 of Mizoram State Report).

### Firefighting and Rescue Vehicles and Specialized Equipment Gap Analysis

For estimating the gap in fire fighting and rescue vehicles and specialized equipment in operational as well proposed Fire Stations both in urban and rural areas, the RMSI team modified the SFAC norms with expert opinions. These modifications also helped in optimization of resources and are detailed in Chapter 36 of Mizoram State Report. This finds an overall gap of 84% in the firefighting and rescue vehicle and about 96% 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 Mizoram State is 24 hours, in general, and RMSI team estimated for manpower requirement for double shift duty pattern (for details, please refer to Chapter 36 of Mizoram State Report). Thus, in Mizoram State, this study finds an overall gap of about 93% in fire personnel considering double shift duty pattern.

**Table 36-1: Gap Analysis for the Mizoram Fire Services**

<b>Gap Analysis</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicles</b>	<b>Special Equipment</b>	<b>Firefighting Manpower</b>
Operational Fire Stations	12	30	71	159
Gap in Operational Fire Stations		47	605	1,106
New Urban Fire Stations	8	12	252	212
New Rural Fire Stations	31	95	1,051	699
<b>Gap Analysis in %</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicle</b>	<b>Special Equipments</b>	<b>Firefighting Man Power</b>
Gap in Operational Fire Stations		61%	89%	87%
Gap in Operational and new urban Fire Stations only	40%	66%	92%	89%
Total Gap in Operational, new (urban and rural) Fire Stations	76%	84%	96%	93%

### Detailed Financial Investment plan

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 Chapter 36 of Mizoram State Report, 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 (Chapter 36 of Mizoram State Report) for the next 10-years includes both capital and recurring expenditures. RMSI analysis estimates a total investment of about **Rs 1,508.4 Crores** spread over a period of 10 years for Mizoram State including inflationary factors and after filling the gaps for both operational and proposed urban and rural Fire Stations.

**Table 36-2: State level Investment plan (in Crores Rupees) for Mizoram Fire Services Gaps for filling gap in operational, new urban and new rural Fire Stations (in Crores Rupees)**

Year	Capital Expenditure		Recurring Expenditure					Total
	Building Infrastructure	Vehicle and Equipment	Annual Vehicle Maintenance & PDL AMC	Annual Staff Salary	Annual Office Expenses	Annual Training Office Expenses	Annual Bldg. maintenance	
First Year	25.15	31.41	1.88	23.99	1.51	0.26	1.01	85.22
Second Year	27.92	32.98	3.62	48.09	3.03	0.50	1.64	117.77
Third Year	15.49	8.45	4.41	61.33	3.86	0.59	1.92	96.06
Forth Year	17.20	8.87	5.30	77.06	4.85	0.70	2.21	116.18
Fifth Year	19.09	4.66	6.01	90.99	5.73	0.77	2.36	129.61
Sixth Year	21.19	4.89	6.80	107.15	6.75	0.85	2.52	150.16
Seventh Year	23.52	5.14	7.69	125.89	7.93	0.94	2.68	173.78
Eighth Year	26.11	5.39	8.67	147.57	9.30	1.03	2.85	200.92
Ninth Year	0.00	5.66	9.75	172.65	10.88	1.13	3.02	203.10
Tenth Year	0.00	5.95	10.96	201.63	12.70	1.24	3.19	235.66
<b>Total</b>	<b>175.67</b>	<b>113.39</b>	<b>65.08</b>	<b>1,056.34</b>	<b>66.55</b>	<b>8.03</b>	<b>23.40</b>	<b>1,508.46</b>

### Prioritization of New Fire Stations

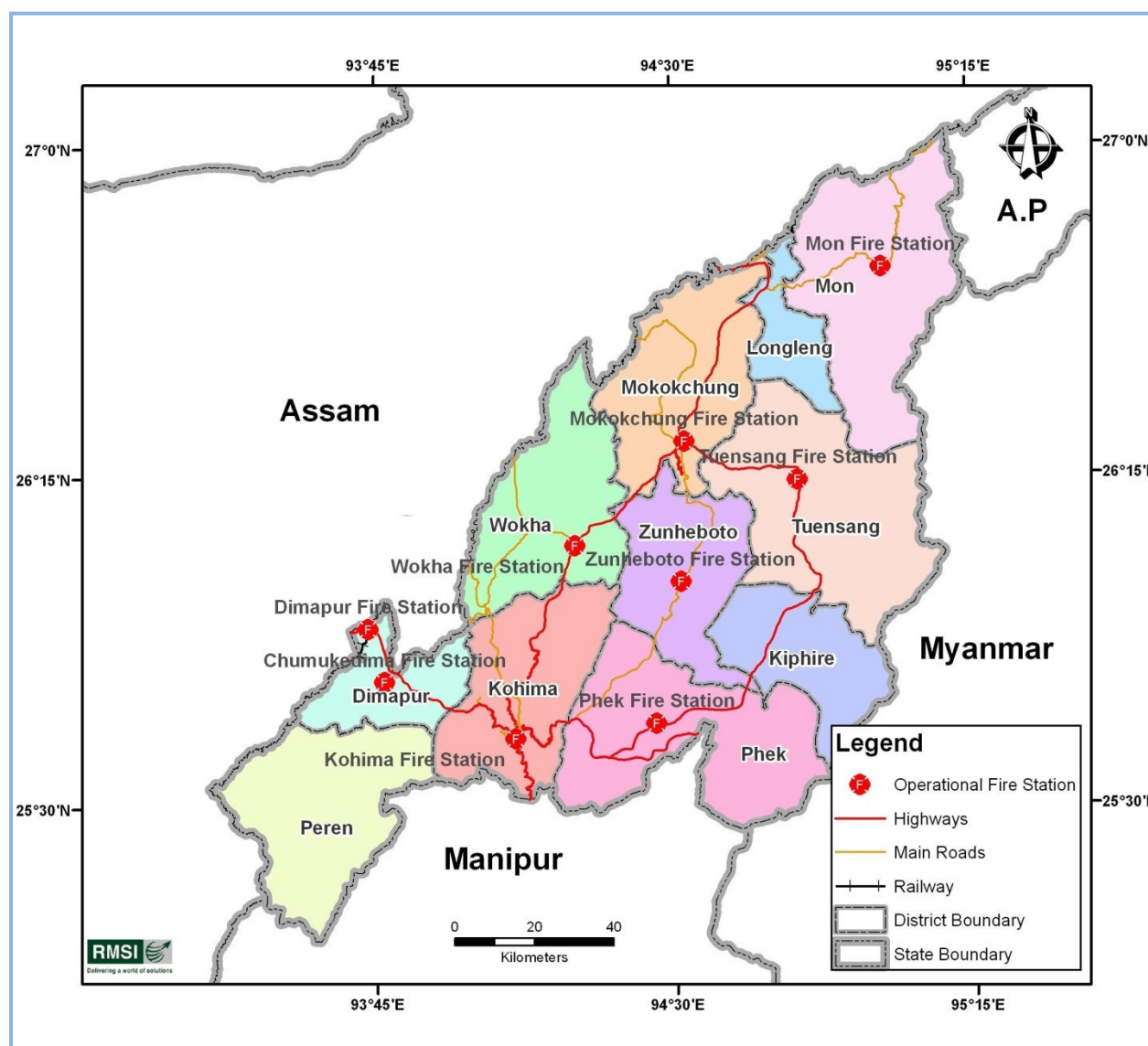
The prioritization of new Fire Stations in Mizoram State for both rural and urban areas has been detailed in Chapter 36 of Mizoram State Report.

### Capacity Building and Training Facilities

The study finds that there is a substantial gap for capacity building and training among the fire personnel within the Mizoram State. The detailed Capacity building and training need assessment for various levels has been discussed in Chapter 36 of Mizoram State Report.

## 37 Nagaland State

Nagaland is one the smallest States of India covering a total geographical area of 16,632 sq km with a total population 1,980,602 as per census 2011. Currently, Nagaland Fire and Emergency Services (NF & ES) have 9 operational Fire Stations with each Fire Station serving an average of more than 2 Lakhs population. The NF & ES is also planning to setup a modest training centre in Kohima for trainings of fireman, leading fireman and officers. Due to low number of existing Fire Stations, the Nagaland FES urgently requires additional Fire Stations to uniformly serve population throughout the State.



**Figure 37-1 : Location of operational Fire Stations in Nagaland State**

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 airport, military cantonment, thermal/nuclear power plants, refineries 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 NF&ES would require additional 10 Fire Stations in urban areas and 29 Fire Stations in rural areas. Hence this study finds an overall gap of 81% in terms of number of Fire Stations in Nagaland State (for details, please refer to Chapter 37 of Nagaland State Report)

### Firefighting and Rescue Vehicles and Specialized Equipment Gap Analysis

For estimating the gap in fire fighting and rescue vehicles and specialized equipment in operational as well proposed Fire Stations both in urban and rural areas, the RMSI team modified the SFAC norms with expert opinions. These modifications also helped in optimization of resources and are detailed in Chapter 37 of Nagaland State Report. This study finds an overall gap of 79% in the firefighting and rescue vehicles and about 99% 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 Nagaland State is 24 hours, and RMSI team estimated for manpower requirement for double shift duty pattern (for details, please refer to Chapter 37 of Nagaland State Report). Thus, in Nagaland State, this study finds an overall gap of 90% in fire personnel considering double shift duty pattern.

**Table 37-1: Gap Analysis for the Nagaland Fire & Emergency Services**

<b>Gap Analysis</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicles</b>	<b>Special Equipment</b>	<b>Firefighting Manpower</b>
Operational Fire Stations	9	47	31	327
Gap in Operational Fire Stations		45	802	1,430
New Urban Fire Stations	10	25	416	373
New Rural Fire Stations	29	110	959	1,040
<b>Gap Analysis in %</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicle</b>	<b>Special Equipments</b>	<b>Firefighting Man Power</b>
Gap in Operational Fire Stations		49%	96%	81%
Gap in Operational and new urban Fire Stations only	53%	60%	98%	85%
Total Gap in Operational, new (urban and rural) Fire Stations	81%	79%	99%	90%

### Fire Prevention Wing

In addition to fire fighting staff, there is an urgent need for fire prevention wing for inspection, awareness generation, and training for schools, colleges, hospitals, shopping malls, cinema halls, high-rise buildings, industries, govt. offices, public buildings etc., so that recurrence of the fire incidences similar to that at the Advance Medical Research Institute (AMRI), Kolkata, in terms of their magnitude and frequency can be reduced. Accordingly, to support IGP-cum-



Director, Nagaland Fire and Emergency Services, additional officers at the levels of Director (Technical), Chief Fire Officers (CFO), Dy Chief Fire Officers (Dy-CFO), Divisional Fire Officers (DFO), and Assistant Divisional Fire Officers (ADFO) have been recommended (for details, please refer to Chapter 37 of Nagaland State Report).

### Detailed Financial Investment plan

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 Chapter 37 of Nagaland State Report, 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 (Chapter 37 of Nagaland State Report) for the next 10-years includes both capital and recurring expenditures. RMSI analysis estimates a total investment of about Rs **2,063.1 Crores** spread over a period of 10 years for NF&ES including inflationary factors and after filling the gaps for both operational and proposed urban and rural Fire Stations.

**Table 37-2: State level Investment plan (in Crores Rupees) for Nagaland Fire & Emergency Services Gaps for filling gap in operational, new urban and new rural Fire Stations (in Crores Rupees)**

Year	Capital Expenditure		Recurring Expenditure					Total
	Building Infrastructure	Vehicle and Equipment	Annual Vehicle Maintenance & PDL AMC	Annual Staff Salary	Annual Office Expenses	Annual Training Office Expenses	Annual Bldg. maintenance	
First Year	27.05	33.27	2.22	34.84	2.19	0.38	1.32	101.28
Second Year	30.03	34.94	4.08	66.22	4.17	0.68	1.65	141.77
Third Year	16.66	12.83	5.11	85.88	5.41	0.83	2.09	128.81
Forth Year	18.50	13.47	6.27	109.30	6.89	0.99	2.54	157.96
Fifth Year	20.53	7.07	7.18	129.76	8.17	1.10	2.78	176.61
Sixth Year	22.79	7.42	8.20	153.56	9.67	1.22	3.03	205.90
Seventh Year	25.30	7.80	9.33	181.20	11.42	1.35	3.28	239.67
Eighth Year	28.08	8.19	10.59	213.26	13.44	1.49	3.54	278.59
Ninth Year	0.00	8.60	12.00	250.41	15.78	1.64	3.80	292.22
Tenth Year	0.00	9.02	13.56	293.40	18.48	1.81	4.06	340.34
<b>Total</b>	<b>188.94</b>	<b>142.60</b>	<b>78.55</b>	<b>1,517.82</b>	<b>95.62</b>	<b>11.51</b>	<b>28.10</b>	<b>2,063.14</b>

### Prioritization of New Fire Stations

The prioritization of new Fire Stations in the Nagaland State for both rural and urban areas has been detailed in Chapter 37 of Nagaland State Report.

### Capacity Building and Training Facilities

The Capacity building and training facilities and training need assessment for various levels have been given in Chapter 37 of Nagaland State Report.



## 38 Orissa State

Presently, Orissa Fire Services (OFS) has 180 operational Fire Stations and 1 Orissa Fire Services Training Institute, Bhubaneswar. Currently, Fire Services are headed by ADG-cum-Director, Orissa Fire Services. The State has a population of 41,947,358 distributed over 30 districts. On an average, the 180 operational Fire Stations serve a population of more than two Lakhs per Fire Station in Orissa



**Figure 38-1 : Location of operational Fire Stations in Orissa State**

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 airport, military cantonment, thermal/nuclear power plants, refineries 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 OFS would require additional 25 Fire stations in urban areas and 126 Fire stations in rural areas. Hence this study finds an overall gap of 46 % in terms of number of Fire Stations in Orissa State (for details, please refer to Chapter 38 of Orissa State Report).

### Firefighting and Rescue Vehicles and Specialized Equipment Gap Analysis

For estimating the gap in fire fighting and rescue vehicles and specialized equipment in operational as well proposed Fire Stations both in urban and rural areas, the RMSI team modified the SFAC norms with expert opinions. These modifications also helped in optimization of resources and are detailed in Chapter 38 of Orissa State Report. This study finds an overall gap of 82% in the firefighting and rescue vehicles and about 89% 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 for firemen in Orissa State is 24 hours, and RMSI team estimated for manpower requirement for double shift duty pattern (for details, please refer to Chapter 38 of Orissa State Report). Thus, in Orissa State, this study finds an overall gap of 89% in fire personnel considering double shift duty pattern.

**Table 38-1: Gap Analysis for the Orissa Fire Services**

<b>Gap Analysis</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicles</b>	<b>Special Equipment</b>	<b>Firefighting Manpower</b>
Operational Fire Stations	180	279	1,695	2,606
Gap in Operational Fire Stations		669	7,825	12,592
New Urban Fire Stations	25	53	876	1,029
New Rural Fire Stations	126	567	5,291	7,549
<b>Gap Analysis in %</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicle</b>	<b>Special Equipments</b>	<b>Firefighting Man Power</b>
Gap in Operational Fire Stations		71%	82%	83%
Gap in Operational and new urban Fire Stations only	12%	72%	84%	84%
Total Gap in Operational, new (urban and rural) Fire Stations	46%	82%	89%	89%

### Fire Prevention Wing

In addition to fire fighting staff, though the State has established a “*Fire Prevention Wing*”. However, there is a need for a dedicated *Fire Prevention Wing* for inspection, awareness generation, and training for schools, colleges, hospitals, shopping malls, cinema halls, high-rise buildings, industries, govt. offices, public buildings etc., so that recurrence of the fire incidences similar to that at the Advance Medical Research Institute (AMRI), Kolkata, in terms of their magnitude and frequency can be reduced. Accordingly, to support ADG-cum-Director, Orissa Fire Services, additional officers at the levels of Director (Technical), Deputy Director (Technical), Chief Fire Officer (CFO), Dy Chief Fire Officer (Dy-CFO),

Divisional Fire Officers (DFOs), and Assistant Divisional Fire Officers (ADFOs) have been recommended (for details, please refer to Chapter 38 of Orissa State Report).

### Detailed Financial Investment plan

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 Chapter 38 of Orissa State Report, 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 (Chapter 38 of Orissa State Report) for the next 10-years includes both capital and recurring expenditures. RMSI analysis estimates a total investment of **about Rs 15,234.3 Crores** spread over a period of 10 years for Orissa Fire Service including inflationary factors and after filling the gaps for both operational and proposed urban and rural Fire Stations.

**Table 38-2: State level Investment plan (in Crores Rupees) for Orissa Fire Services Gaps for filling gap in operational, new urban and new rural Fire Stations (in Crores Rupees)**

Year	Capital Expenditure		Recurring Expenditure					Total
	Building Infrastructure	Vehicle and Equipment	Annual Vehicle Maintenance & PDL AMC	Annual Staff Salary	Annual Office Expenses	Annual Training Office Expenses	Annual Bldg. maintenance	
First Year	178.30	189.91	17.13	299.32	18.86	3.29	15.24	722.05
Second Year	197.91	199.40	28.29	571.02	35.97	5.89	19.08	1,057.57
Third Year	109.84	41.70	32.78	711.13	44.80	6.87	21.42	968.55
Forth Year	121.92	43.78	37.81	876.65	55.23	7.95	23.80	1,167.14
Fifth Year	135.34	22.99	42.13	1,026.75	64.69	8.72	25.13	1,325.76
Sixth Year	150.23	24.14	46.91	1,200.25	75.62	9.56	26.49	1,533.19
Seventh Year	166.75	25.34	52.18	1,400.61	88.24	10.46	27.87	1,771.45
Eighth Year	185.09	26.61	57.99	1,631.76	102.80	11.42	29.28	2,044.96
Ninth Year	0.00	27.94	64.40	1,898.23	119.59	12.46	30.71	2,153.33
Tenth Year	0.00	29.34	71.46	2,205.16	138.92	13.57	32.17	2,490.61
<b>Total</b>	<b>1,245.38</b>	<b>631.15</b>	<b>451.09</b>	<b>11,820.89</b>	<b>744.71</b>	<b>90.20</b>	<b>251.20</b>	<b>15,234.61</b>

### Prioritization of New Fire Stations

The prioritization of new Fire Stations in the Orissa State for both rural and urban areas has been detailed in Chapter 38 of Orissa State Report.

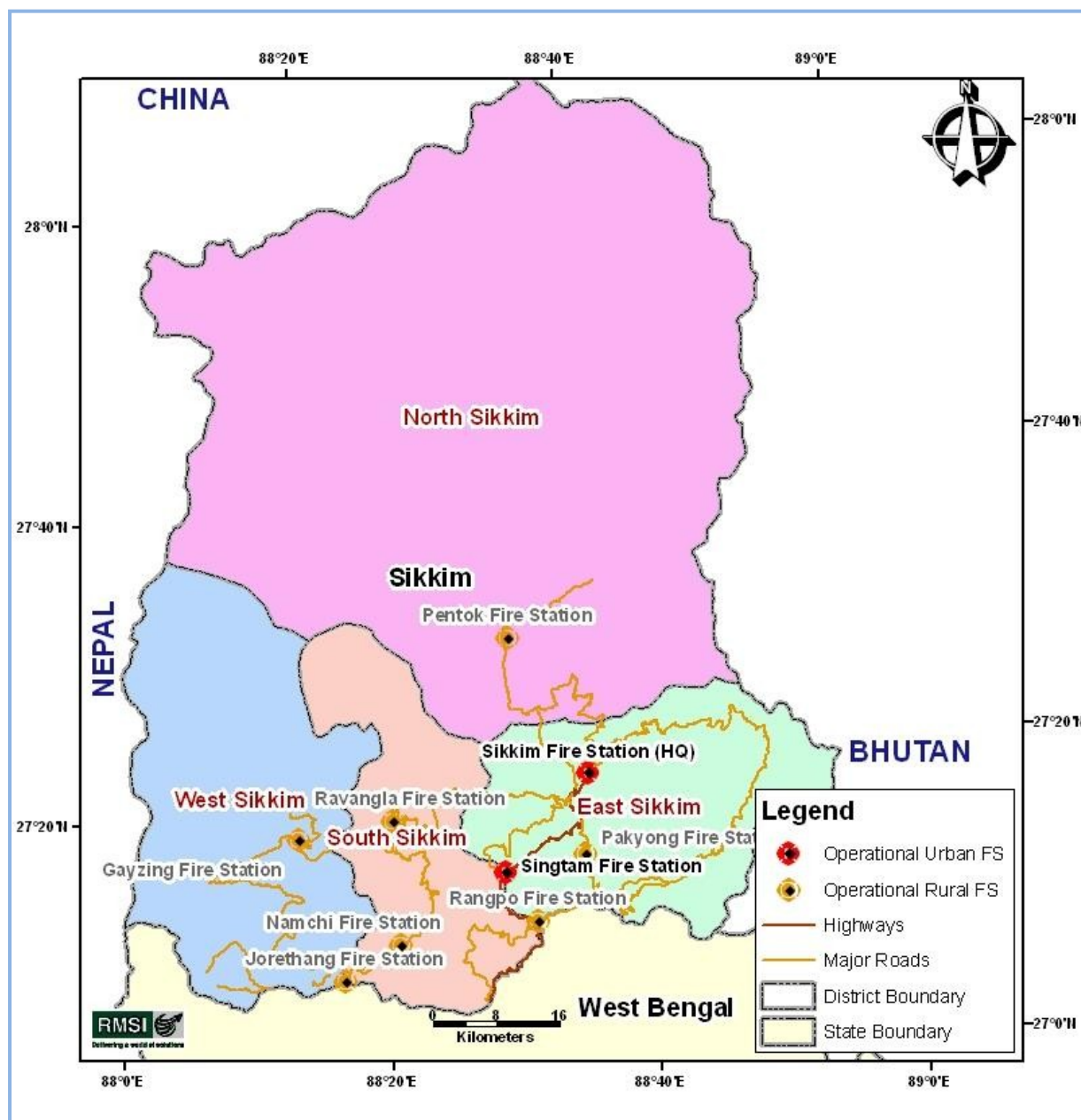
### Capacity Building and Training Facilities

The Capacity building and training facilities and training need assessment for various levels have been given in Chapter 38 of Orissa State Report.

## 39 Sikkim State

The Sikkim Fire and Emergency Services (SFES) is one of branch running under the Sikkim Police Department. Currently, Sikkim does not have any State Fire Act; however it is in under progress stage and likely to be implemented in future. The currently State owns nine operational Fire Stations spread over the 4 districts, serving a total population of 607,688.

On an average, each Fire Station in Sikkim State is serving more than 67 thousand populations.



**Figure 39-1 : Location of operational Fire Stations in Sikkim State**

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 airport, military cantonment, thermal/nuclear power plants, refineries 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 State would require additional 1 Fire station in urban areas and 15 Fire stations in rural areas. Hence this study finds an overall gap of 64% in terms of number of Fire Stations in Sikkim State (for details, please refer to Chapter 39 of Sikkim State Report).

### Firefighting and Rescue Vehicles and Specialized Equipment Gap Analysis

For estimating the gap in fire fighting and rescue vehicles and specialized equipment in operational as well proposed Fire Stations both in urban and rural areas, the RMSI team modified the SFAC norms with expert opinions. These modifications also helped in optimization of resources and are detailed in Chapter 39 of Sikkim State Report. This study finds an overall gap of 82% in the firefighting and rescue vehicles and about 91% 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 Sikkim State is 24 hours, and RMSI team estimated for manpower requirement for double shift duty pattern (for details, please refer to Chapter 39 of Sikkim State Report). Thus, in Sikkim State, this study finds an overall gap of 93% in fire personnel considering double shift duty pattern.

**Table 39-1: Gap Analysis for the Sikkim Fire & Emergency Services**

<b>Gap Analysis</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicles</b>	<b>Special Equipment</b>	<b>Firefighting Manpower</b>
Operational Fire Stations	9	18	81	95
Gap in Operational Fire Stations		32	328	708
New Urban Fire Stations	1	3	35	32
New Rural Fire Stations	15	45	426	473
<b>Gap Analysis in %</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicle</b>	<b>Special Equipments</b>	<b>Firefighting Man Power</b>
Gap in Operational Fire Stations		64%	80%	88%
Gap in Operational and new urban Fire Stations only	10%	66%	82%	89%
Total Gap in Operational, new (urban and rural) Fire Stations	64%	82%	91%	93%

### Fire Prevention Wing

In addition to fire fighting staff, there is an urgent need for fire prevention wing for inspection, awareness generation, and training for schools, colleges, hospitals, shopping malls, cinema

halls, high-rise buildings, industries, govt. offices, public buildings etc., so that recurrence of the fire incidences similar to that at the Advance Medical Research Institute (AMRI), Kolkata, in terms of their magnitude and frequency can be reduced. Accordingly, to support Director, Sikkim Fire & Emergency Services, additional officers at the levels of Director (Technical), Chief Fire Officers (CFO), Dy Chief Fire Officers (Dy-CFO), Divisional Fire Officers (DFO), and Assistant Divisional Fire Officer (ADFO) have been recommended (for details, please refer to Chapter 39 of Sikkim State Report).

### Detailed Financial Investment plan

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 Chapter 39 of Sikkim State Report, 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 (Chapter 39 of Sikkim State Report) for the next 10-years includes both capital and recurring expenditures. RMSI analysis estimates a total investment of about Rs **843.2 Crores** spread over a period of 10 years for Sikkim State including inflationary factors and after filling the gaps for both operational and proposed urban and rural Fire Stations.

**Table 39-2: State level Investment plan (in Crores Rupees) for Sikkim Fire and Emergency Services Gaps for filling gap in operational, new urban and new rural Fire Stations (in Crores Rupees)**

Year	Capital Expenditure		Recurring Expenditure					Total
	Building Infrastructure	Vehicle and Equipment	Annual Vehicle Maintenance & PDL AMC	Annual Staff Salary	Annual Office Expenses	Annual Training Office Expenses	Annual Bldg. maintenance	
First Year	8.70	14.23	1.18	15.57	0.98	0.17	0.76	41.60
Second Year	9.66	14.94	2.00	30.65	1.93	0.32	0.96	60.45
Third Year	5.36	2.61	2.31	38.50	2.43	0.37	1.07	52.65
Forth Year	5.95	2.74	2.65	47.81	3.01	0.43	1.18	63.78
Fifth Year	6.60	1.44	2.95	56.16	3.54	0.48	1.24	72.42
Sixth Year	7.33	1.51	3.28	65.84	4.15	0.52	1.31	83.94
Seventh Year	8.14	1.59	3.65	77.03	4.85	0.58	1.37	97.20
Eighth Year	9.03	1.67	4.05	89.95	5.67	0.63	1.44	112.43
Ninth Year	0.00	1.75	4.49	104.87	6.61	0.69	1.50	119.91
Tenth Year	0.00	1.84	4.98	122.08	7.69	0.75	1.57	138.90
<b>Total</b>	<b>60.77</b>	<b>44.32</b>	<b>31.54</b>	<b>648.46</b>	<b>40.85</b>	<b>4.94</b>	<b>12.41</b>	<b>843.28</b>

### Prioritization of New Fire Stations

The prioritization of new Fire Stations in Sikkim State for both rural and urban areas has been detailed in Chapter 39 of Sikkim State Report.

### Capacity Building and Training Facilities

The Capacity building and training facilities and training need assessment for various levels have been given in Chapter 39 of Sikkim State Report.



## 40 Tripura State

Presently, Tripura Fire Services (TFS) has 35 operational Fire Stations and a central workshop cum training school, a central store and a wireless wing at Fire Service Complex, Badharghat, Tripura (west). Currently, TFS is headed by ADGP-cum-Director, Tripura Fire Services.

Tripura State has about 37 Lakhs populations distributed among four districts. On an average, each Fire Station in Tripura State is serving more one Lakhs population.



**Figure 40-1 : Location of operational Fire Stations in Tripura State**

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 airport, military cantonment, thermal/nuclear power plants, refineries 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 State would require additional 3 Fire stations in urban areas and 15 Fire stations in rural areas. Hence this study finds an overall gap of 34% in terms of number of Fire Stations in Tripura States (for details, please refer to Chapter 40 of Tripura State Report).

### Firefighting and Rescue Vehicles and Specialized Equipment Gap Analysis

For estimating the gap in fire fighting and rescue vehicles and specialized equipment in operational as well proposed Fire Stations both in urban and rural areas, the RMSI team modified the SFAC norms with expert opinions. These modifications also helped in optimization of resources and are detailed in Chapter 40 of Tripura State Report. This study finds an overall gap of 61% in the firefighting and rescue vehicles and about 89% 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 Tripura State is 8 hours (3 shifts), and RMSI team estimated for manpower requirement for double shift duty pattern (for details, please refer to Chapter 40 of Tripura State Report). Thus, in Tripura State, this study finds an overall gap of 44% in fire personnel considering double shift duty pattern.

**Table 40-1: Gap Analysis for the Tripura Fire Services**

<b>Gap Analysis</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicles</b>	<b>Special Equipment</b>	<b>Firefighting Manpower</b>
Operational Fire Stations	35	76	234	1,303
Gap in Operational Fire Stations		69	1,349	579
New Urban Fire Stations	3	3	84	67
New Rural Fire Stations	15	48	464	373
<b>Gap Analysis in %</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicle</b>	<b>Special Equipments</b>	<b>Firefighting Man Power</b>
Gap in Operational Fire Stations		48%	85%	31%
Gap in Operational and new urban Fire Stations only	8%	49%	86%	33%
Total Gap in Operational, new (urban and rural) Fire Stations	34%	61%	89%	44%

### Fire Prevention Wing

In addition to fire fighting staff, there is an urgent need for fire prevention wing for inspection, awareness generation, and training for schools, colleges, hospitals, shopping malls, cinema

halls, high-rise buildings, industries, govt. offices, public buildings etc., so that recurrence of the fire incidences similar to that at the Advance Medical Research Institute (AMRI), Kolkata, in terms of their magnitude and frequency can be reduced. Accordingly, to support ADGP-cum-Director, Tripura Fire Services, additional officers at the levels of Director (Technical), Chief Fire Officers (CFO), Dy Chief Fire Officers (Dy-CFO), Division Fire Officers (DFO), and Assistant Divisional Fire Officer (ADFO) have been recommended (for details, please refer to Chapter 40 of Tripura State Report).

### Detailed Financial Investment plan

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 Chapter 40 of Tripura State Report, 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 (Chapter 40 of Tripura State Report) for the next 10-years includes both capital and recurring expenditures. RMSI analysis estimates a total investment of about Rs **1,669.3 Crores** spread over a period of 10 years for Tripura State including inflationary factors and after filling the gaps for both operational and proposed urban and rural Fire Stations.

**Table 40-2: State level Investment plan (in Crores Rupees) for Tripura Fire Services Gaps for filling gap in operational, new urban and new rural Fire Stations (in Crores Rupees)**

Year	Capital Expenditure		Recurring Expenditure					Total
	Building Infrastructure	Vehicle and Equipment	Annual Vehicle Maintenance & PDL AMC	Annual Staff Salary	Annual Office Expenses	Annual Training Office Expenses	Annual Bldg. maintenance	
First Year	20.45	29.38	2.96	52.75	3.32	0.58	2.31	111.76
Second Year	22.70	30.85	4.87	70.70	4.45	0.73	3.05	137.35
Third Year	12.60	3.27	5.45	82.81	5.22	0.80	3.20	113.35
Forth Year	13.98	3.44	6.09	96.81	6.10	0.88	3.37	130.67
Fifth Year	15.52	1.80	6.69	110.70	6.97	0.94	3.47	146.10
Sixth Year	17.23	1.89	7.35	126.53	7.97	1.01	3.57	165.55
Seventh Year	19.12	1.99	8.07	144.57	9.11	1.08	3.67	187.61
Eighth Year	21.23	2.09	8.85	165.11	10.40	1.16	3.77	212.62
Ninth Year	0.00	2.19	9.71	188.51	11.88	1.24	3.88	217.40
Tenth Year	0.00	2.30	10.65	215.14	13.55	1.32	3.99	246.96
<b>Total</b>	<b>142.84</b>	<b>79.22</b>	<b>70.71</b>	<b>1,253.62</b>	<b>78.98</b>	<b>9.74</b>	<b>34.26</b>	<b>1,669.37</b>

### Prioritization of New Fire Stations

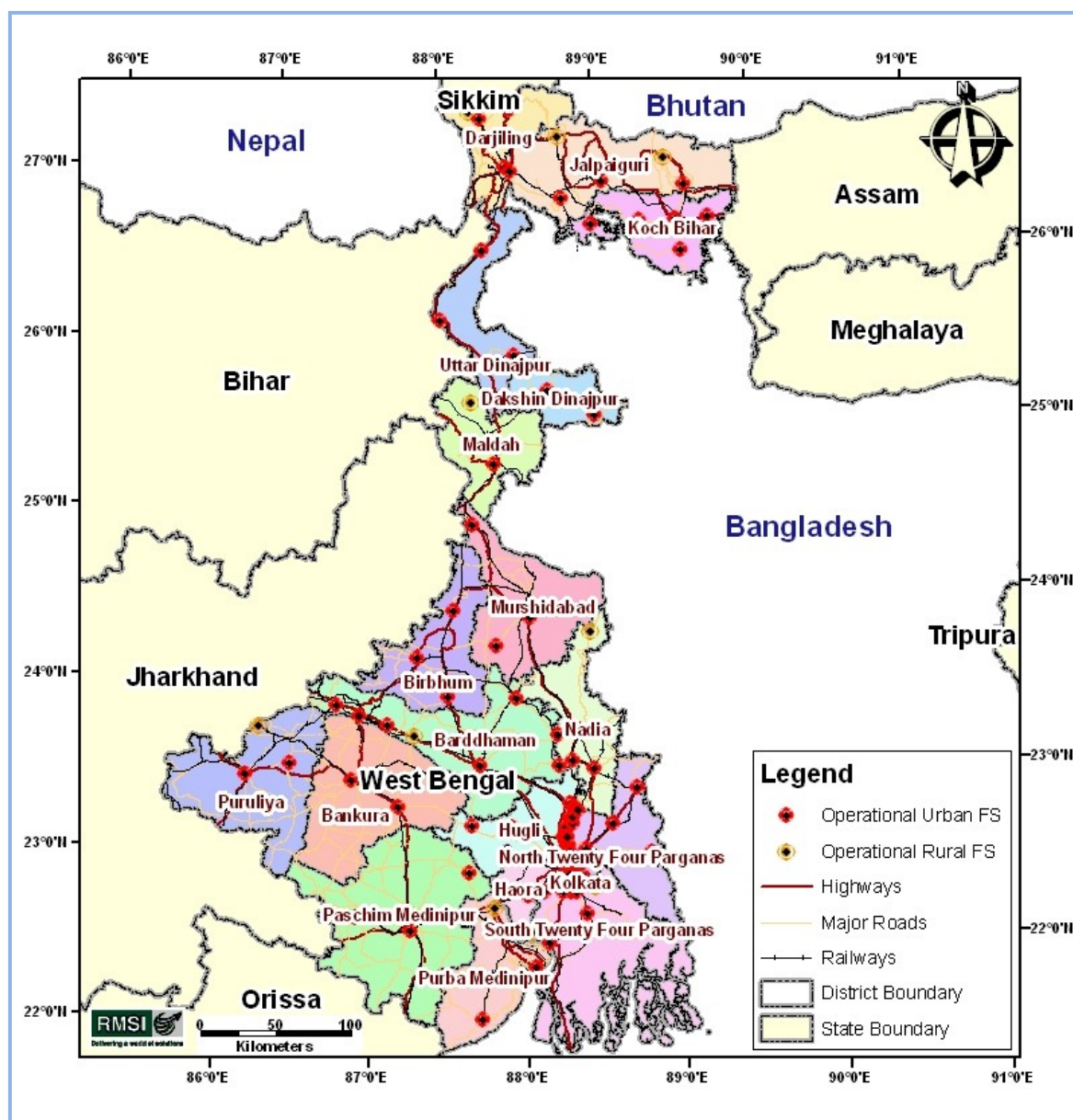
The prioritization of new Fire Stations in the Tripura State for both rural and urban areas has been detailed in Chapter 40 of Tripura State Report.

### Capacity Building and Training Facilities

The Capacity building and training facilities and training need assessment for various levels have been given in Chapter 40 of Tripura State Report.

## 41 West Bengal State

The State has a total area of 88,027 km<sup>2</sup>, which administratively divided into 19 districts. The total population of State is 91,347,736 and State is ranked 4<sup>th</sup> most populous State (Census, 2011). Currently, West Bengal Fire and Emergency Services has 107 operational Fire Stations and on an average, each Fire Station in West Bengal is serving more than eight Lakhs population.



**Figure 41-1 : Location of operational Fire Stations in West Bengal**

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 airport, military cantonment, thermal/nuclear power plants, refineries 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 WBFES would require additional 76 Fire stations in urban areas and 252 Fire stations in rural areas. Hence this study finds an overall gap of 75% in terms of number of Fire Stations in West Bengal State (for details, please refer to Chapter 41 of West Bengal State Report).

### Firefighting and Rescue Vehicles and Specialized Equipment Gap Analysis

For estimating the gap in fire fighting and rescue vehicles and specialized equipment in operational as well proposed Fire Stations both in urban and rural areas, the RMSI team modified the SFAC norms with expert opinions. These modifications also helped in optimization of resources and are detailed in Chapter 41 of West Bengal State Report. This study finds an overall gap of 89% in the firefighting and rescue vehicles and about 98% 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 West Bengal State is 8 hours (3-shifts), and RMSI team estimated for manpower requirement for double shift duty pattern (for details, please refer to Chapter 41 of West Bengal State Report). Thus, in West Bengal State, this study finds an overall gap of 89% in fire personnel considering double shift duty pattern.

**Table 41-1: Gap Analysis for the West Bengal Fire & Emergency Services**

<b>Gap Analysis</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicles</b>	<b>Special Equipment</b>	<b>Firefighting Manpower</b>
Operational Fire Stations	107	299	742	5,202
Gap in Operational Fire Stations		296	6,498	6,616
New Urban Fire Stations	76	353	5,558	6,872
New Rural Fire Stations	252	1716	18,748	28,933
<b>Gap Analysis in %</b>				
	<b>No. of Fire Stations</b>	<b>Firefighting &amp; Rescue Vehicle</b>	<b>Special Equipments</b>	<b>Firefighting Man Power</b>
Gap in Operational Fire Stations		50%	90%	56%
Gap in Operational and new urban Fire Stations only	42%	68%	94%	72%
Total Gap in Operational, new (urban and rural) Fire Stations	75%	89%	98%	89%

### Fire Prevention Wing

In addition to fire fighting staff, there is an urgent need for fire prevention wing for inspection, awareness generation, and training for schools, colleges, hospitals, shopping malls, cinema halls, high-rise buildings, industries, govt. offices, public buildings etc., so that recurrence of the fire incidences similar to that at the Advance Medical Research Institute (AMRI), Kolkata,

in terms of their magnitude and frequency can be reduced. Accordingly, to support Director General, West Bengal Fire & Emergency Services, additional officers at the levels of Director (Technical), Joint Director (Technical), Deputy Director (Technical), Chief Fire Officers (CFO), Dy Chief Fire Officers (Dy-CFO), Divisional Fire Officers (DFO), and Assistant Divisional Fire Officer (ADFO) have been recommended (for details, please refer to Chapter 41 of West Bengal State Report).

### Detailed Financial Investment plan

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 Chapter 41 of West Bengal State Report, 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 (Chapter 41 of West Bengal State Report) for the next 10-years includes both capital and recurring expenditures. RMSI analysis estimates a total investment of about Rs **26,616.4 Crores** spread over a period of 10 years for West Bengal State including inflationary factors and after filling the gaps for both operational and proposed urban and rural Fire Stations.

**Table 41-2: State level Investment plan (in Crores Rupees) for West Bengal Fire and Emergency Services Gaps for filling gap in operational, new urban and new rural Fire Stations (in Crores Rupees)**

Year	Capital Expenditure		Recurring Expenditure					Total
	Building Infrastructure	Vehicle and Equipment	Annual Vehicle Maintenance & PDL AMC	Annual Staff Salary	Annual Office Expenses	Annual Training Office Expenses	Annual Bldg. maintenance	
First Year	469.45	116.06	12.42	286.88	18.07	3.16	10.33	916.36
Second Year	521.09	121.87	19.96	447.38	28.19	4.61	13.48	1,156.58
Third Year	289.20	165.54	30.52	800.58	50.44	7.74	21.96	1,365.98
Forth Year	321.01	173.81	42.64	1,232.10	77.62	11.17	30.61	1,888.95
Fifth Year	356.34	91.25	51.27	1,567.80	98.77	13.32	35.17	2,213.92
Sixth Year	395.54	95.82	61.02	1,966.33	123.88	15.66	39.82	2,698.06
Seventh Year	439.03	100.61	72.00	2,437.92	153.59	18.21	44.56	3,265.91
Eighth Year	487.34	105.64	84.34	2,994.39	188.65	20.97	49.39	3,930.71
Ninth Year	0.00	110.92	98.20	3,649.31	229.91	23.95	54.32	4,166.60
Tenth Year	0.00	116.46	113.73	4,418.29	278.35	27.19	59.33	5,013.36
<b>Total</b>	<b>3,278.99</b>	<b>1,197.98</b>	<b>586.09</b>	<b>19,800.97</b>	<b>1,247.46</b>	<b>145.98</b>	<b>358.96</b>	<b>26,616.44</b>

### Prioritization of New Fire Stations

The prioritization of new Fire Stations in the West Bengal State for both rural and urban areas has been detailed in Chapter 41 of West Bengal State report.

### Capacity Building and Training Facilities

The Capacity building and training facilities and training need assessment for various levels have been given in Chapter 41 of West Bengal State report.



# PART C

## 42 Fire Services in India

### 42.1 Introduction

In India, fire service is one of the most important emergency response services. In India, Fire Services come under the 12<sup>th</sup> 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). 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).

The growth of fire-services in India has been on an ad-hoc basis, without much scientific analysis of existing fire risks in different parts of the country. Varying risk scenarios need different types of equipment to combat fire. 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 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.

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.

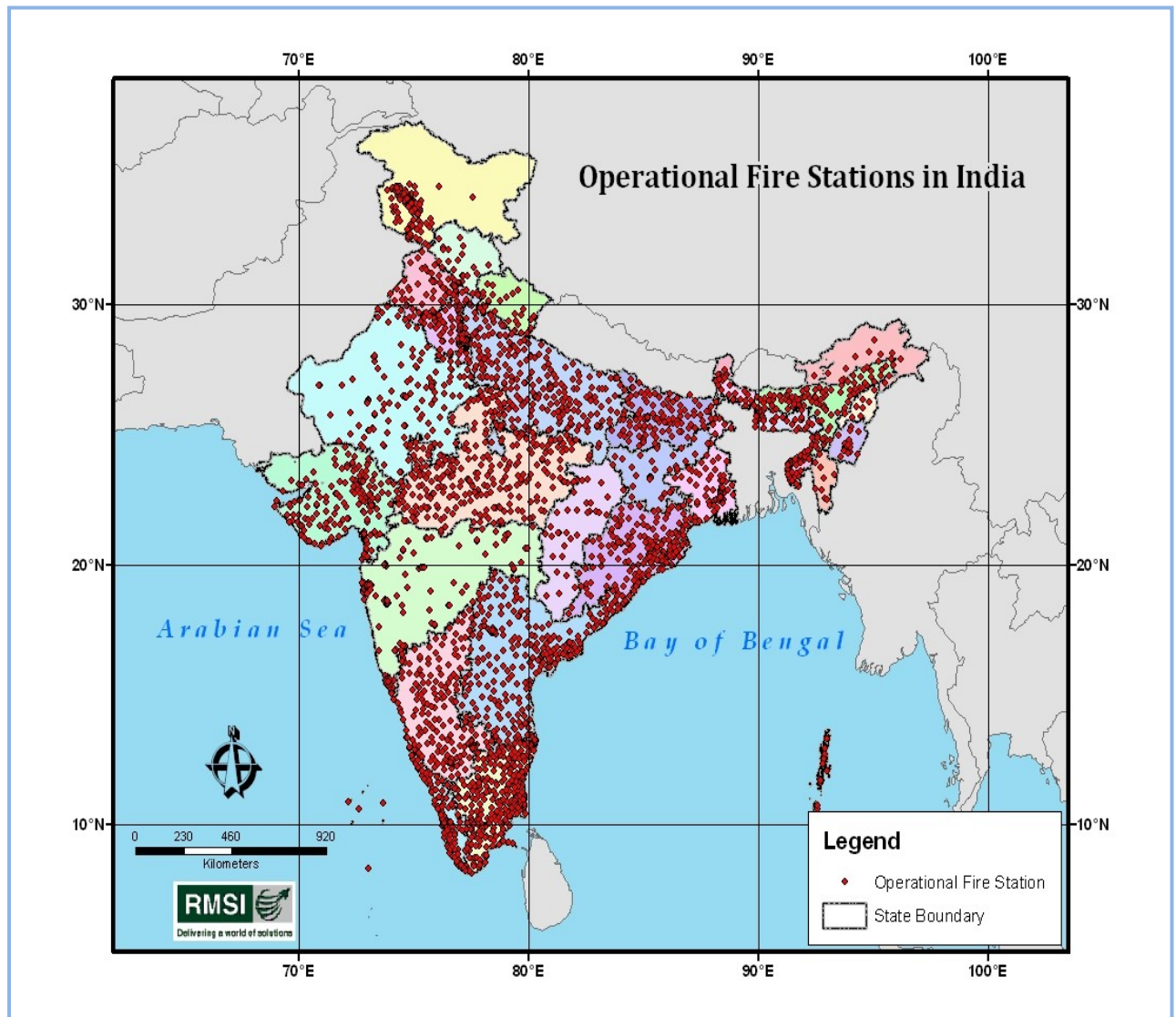
In addition to the regular fire services, various other organizations/ industries, such as Ports, Airports, Defence, Power, Oil and Gas, Steel, Heavy Engineering, Fertilizers, Chemicals etc. have their own fire service set-ups (including their own captive resources), in order to provide fire protection 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.

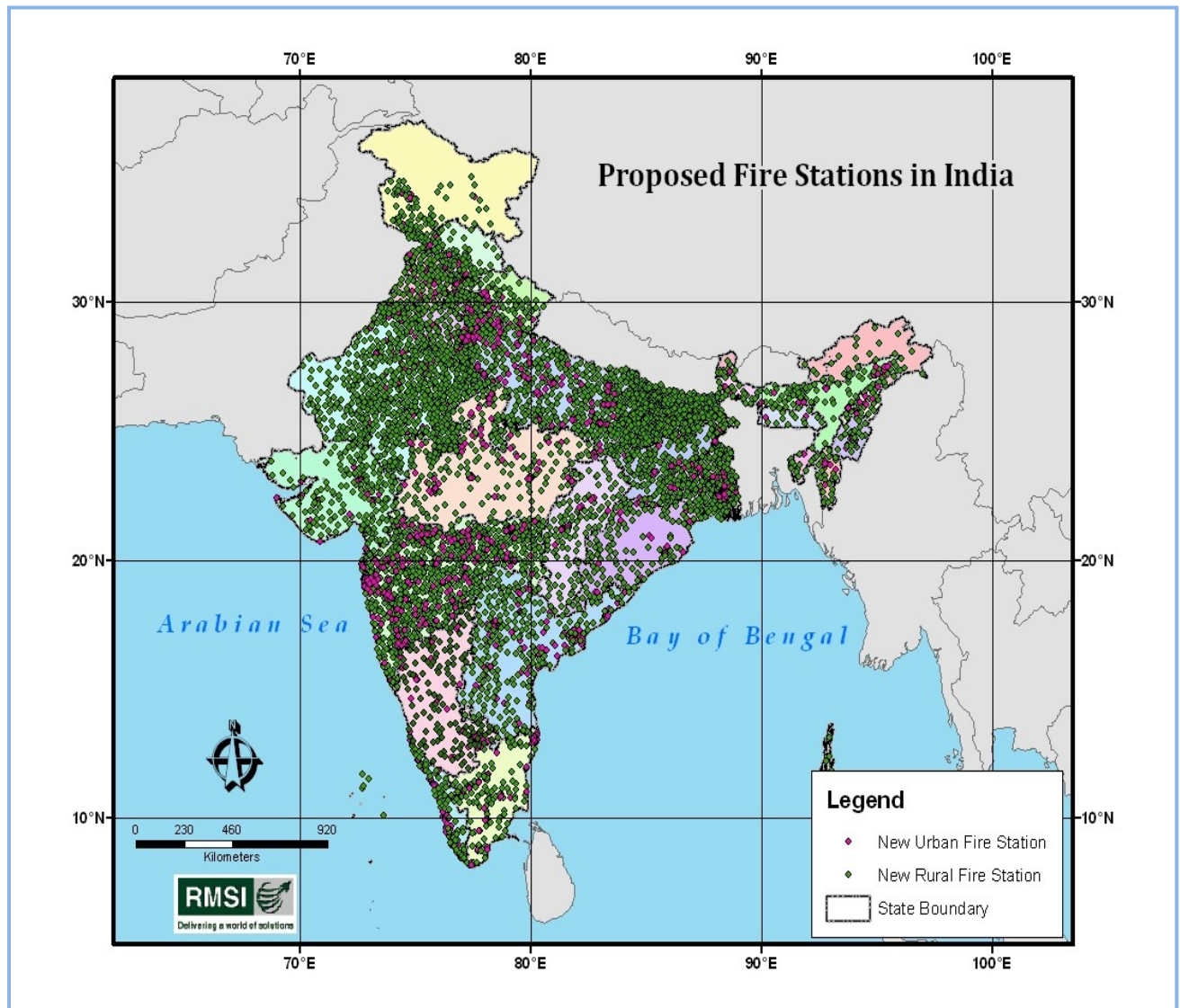
In consideration of this and the increasing fire risks from various hazards, the Directorate of NDRF&CD, Fire Cell, MHA planned a study called “**Fire Hazard and Risk Analysis in the Country for Revamping the Fire Services in the Country**”, to identify existing gaps in terms of availability and requirement of Fire Stations, capacity-building, trained man-power and fire-fighting, rescue, and other specialized equipments.

**Table 42-1: Demography of India as per Census 2011**

INDIA			
<i>As per Census 2011</i>			
No. of States / UTs	35		Percentage of urban Population
No. of Districts	640		
No. of Sub-Districts	5,924		31.16%
No of Towns	7,935		
No of Villages	640,867		
Population			
	Total	Rural	Urban
Persons	1,210,193,422	833,087,662	377,105,760
Male	623,724,248	427,917,052	195,807,196
Female	586,469,174	405,170,610	181,298,564
Sex Ratio (females per 1,000 males)	940	947	926



**Figure 42-1: Locations of operational Fire Stations in India**



**Figure 42-2: Locations of proposed urban and rural Fire Stations in India**

## 42.2 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 through 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.

## 42.3 Infrastructure Gap Analysis

### 42.3.1 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 42-2 shows State level summary of number of operational and new proposed Fire Stations with population covered within their ideal jurisdiction area.

Rural areas of entire India 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. State/UT level numbers of new urban and new rural Fire Stations are given in Table 42-2. Figures 42-1 to 42-2 depict representative detailed maps showing delineated ideal jurisdiction areas for operational and new proposed urban Fire Stations and locations of new rural Fire Stations in entire India.



**Table 42-2: State/UT level number of operational and new Fire Stations in entire India**

State/UT	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
A & N Islands	20	329,067	0	0	6	26
Andhra Pradesh	251	33,243,439	130	12,647,317	228	609
Arunachal Pradesh	13	416,547	1	25,702	30	44
Assam	110	18,371,991	25	1,280,503	67	202
Bihar	102	12,140,981	82	5,940,732	466	650
Chandigarh	7	753,890	4	300,796	0	11
Chhattisgarh	33	3,636,523	14	1,794,566	103	150
Dadra and Nagar Haveli	1	26,355	1	60,629	4	6
Daman & Diu	3	129,888	3	113,023	0	6
Delhi	53	8,126,612	46	7,660,285	9	108
Goa	15	656,232	4	206,986	9	28
Gujarat	183	26,096,729	47	6,946,268	164	394
Haryana	82	6,663,340	34	2,710,224	80	196
Himachal Pradesh	25	1,526,646	11	588,083	83	119
J & K	156	7,997,349	27	1,076,979	94	277
Jharkhand	31	6,500,677	12	1,940,455	137	180
Karnataka	182	27,910,627	63	9,511,179	132	377
Kerala	100	12,908,553	57	9,468,918	71	228
Lakshadweep	4	40,405	0	0	5	9
Madhya Pradesh	292	35,688,704	58	4,828,502	163	513
Maharashtra	157	22,376,238	251	32,387,748	666	1074
Manipur	16	864,211	11	601,731	26	53
Meghalaya	32	2,093,340	2	111,189	15	49
Mizoram	12	390,185	8	147,855	31	51
Nagaland	9	343,345	10	482,792	29	48
Orissa	180	23,258,380	25	1,655,359	126	331
Puducherry	13	679,564	4	564,704	0	17
Punjab	48	5,819,269	34	2,958,676	93	175
Rajasthan	126	11,121,029	107	11,375,345	641	874
Sikkim	9	233,300	1	31,659	15	25
Tamil Nadu	303	47,086,170	46	8,311,898	102	451
Tripura	35	2,647,470	3	75,825	15	53
Uttar Pradesh	237	55,671,967	117	11,962,253	352	706
Uttarakhand	33	2,112,512	33	2,344,639	58	124
West Bengal	107	15,123,371	76	12,762,558	252	435
<b>Total</b>	<b>2,980</b>	<b>392,984,906</b>	<b>1347</b>	<b>152,875,378</b>	<b>4,272</b>	<b>8,599</b>

\* In Jammu and Kashmir, It may be noted that in the past, seven operational Fire Stations were relocated adjacent to other operational Fire Stations as State was facing operational difficulties due to terrorism. For the purpose of ideal jurisdiction and gap analysis based on network analysis (travel

distance by first fire vehicle and ideal population served), these Fire Stations are not accounted as separate Fire Stations. *Thus, total numbers of operating Fire Stations in the State of Jammu and Kashmir are considered 156 stations for analysis point of view against 163 operational as per State records.* Once situation permits, these stations can be relocated to their original/ any other suitable location. Hence, in the analysis section, in all the tables total count of Fire Stations is coming 2,980.

#### 42.3.2 FIRE FIGHTING AND RESCUE VEHICLES AND SPECIALIZED 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/UT. 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/UT 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 and State/UT specific study).  
*Note: The criteria of population density has been relaxed for hilly State/UT 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 inhabited 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/UTs this is looked after by the Ministry of Health of the States/UTs 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/UT 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 State/UT level list of currently operational fire fighting vehicles available with Fire Service (As on Nov- 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 42-3 to 42-6. Similarly, gap analysis for specialized fire equipment is shown in Tables 42-7 to 42-14.

**Table 42-3: List of operational fire fighting vehicles available with Fire Services of All States/UTs (As on Nov, 2012)**

State/ UT	Fire Stations	Ideally Served Population Estimates	Water Tenders	Water Bowzers	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
Andaman and Nicobar Islands	20	329,067	27	3	1	0	0	0	1	0	0	0	0	0	0	0	32
Andhra Pradesh	251	33,243,439	258	2	1	3	2	3	0	0	1	1	4	0	2	1	278
Arunachal Pradesh	13	416,547	26	2	1	0	0	0	0	0	0	1	0	0	0	0	30
Assam	110	18,371,991	268	0	4	1	1	0	0	0	2	3	0	0	0	0	279
Bihar	102	12,140,981	230	10	9	4	2	1	0	0	0	11	0	0	1	0	268
Chandigarh	7	753,890	10	4	0	3	2	3	0	0	0	5	7	0	3	0	37
Chhattisgarh	33	3,636,523	47	4	6	0	0	1	0	0	0	1	0	0	0	0	59
Dadra and Nagar Haveli	1	26,355	3	2	1	2	0	0	0	0	0	0	0	0	1	0	9
Daman and Diu	3	129,888	4	1	2	2	0	0	0	0	0	1	1	0	3	0	14
Delhi	53	8,126,612	79	48	6	7	6	4	5	4	3	7	10	0	0	0	179
Goa	15	656,232	22	1	2	3	1	0	0	0	0	2	0	0	10	0	41
Gujarat	183	26,096,729	306	252	29	37	13	5	0	1	0	5	0	20	142	0	810
Haryana	82	6,663,340	129	37	27	10	2	0	0	0	0	9	0	0	0	0	214
Himachal Pradesh	25	1,526,646	37	21	5	3	0	2	0	0	0	8	3	0	0	0	79
Jammu and Kashmir	156	7,997,349	216	11	2	6	4	0	0	0	0	1	0	2	4	0	246
Jharkhand	31	6,500,677	74	11	6	2	0	0	0	0	0	0	0	0	2	0	95
Karnataka	182	27,910,627	386	16	3	28	7	0	4	0	0	1	9	1	10	0	465
Kerala	100	12,908,553	270	0	0	20	0	0	0	0	0	1	12	2	58	0	363
Lakshadweep	4	40,405	10	0	0	0	0	0	0	0	0	0	0	0	0	0	10
Madhya Pradesh	292	35,688,704	415	12	15	9	3	5	1	0	0	0	0	0	20	0	480
Maharashtra	157	22,376,238	287	37	14	22	24	1	3	4	2	0	0	1	38	1	434
Manipur	16	864,211	33	3	5	1	1	0	0	0	0	13	0	0	1	0	57
Meghalaya	32	2,093,340	60	8	8	3	1	0	0	0	0	0	0	0	0	0	80
Mizoram	12	390,185	22	0	0	0	0	0	0	0	0	6	2	0	0	0	30
Nagaland	9	343,345	37	2	1	0	0	0	0	0	0	7	0	0	0	0	47



State/ UT	Fire Stations	Ideally Served Population Estimates	Water Tenders	Water Bowzers	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
Orissa	180	23,258,380	243	7	2	7	3	0	0	0	0	7	4	0	6	0	279
Puducherry	13	679,564	21	2	1	1	0	0	0	0	0	0	0	0	1	0	26
Punjab	48	5,819,269	103	5	3	1	0	0	0	0	0	1	0	0	5	0	118
Rajasthan	126	11,121,029	222	25	11	0	2	0	0	0	0	0	2	0	2	0	264
Sikkim	9	233,300	15	1	0	1	0	0	0	0	0	1	0	0	0	0	18
Tamil Nadu	303	47,086,170	389	17	10	17	7	0	0	0	0	0	0	0	42	2	484
Tripura	35	2,647,470	42	0	4	1	1	1	0	0	0	27	0	0	0	0	76
Uttar Pradesh	237	55,671,967	350	26	19	1	5	0	0	0	0	0	0	0	16	0	417
Uttarakhand	33	2,112,512	61	0	18	2	0	5	0	0	0	1	9	0	16	0	112
West Bengal	107	15,123,371	243	36	3	3	5	1	1	0	0	7	0	0	0	0	299
<b>Total</b>	<b>2,980</b>	<b>392,984,906</b>	<b>4,945</b>	<b>606</b>	<b>219</b>	<b>200</b>	<b>92</b>	<b>32</b>	<b>15</b>	<b>9</b>	<b>8</b>	<b>127</b>	<b>63</b>	<b>26</b>	<b>383</b>	<b>4</b>	<b>6,729</b>

Table 42-4: Vehicle gap in operational Fire Stations of all States/UTs for their ideal jurisdiction area

State/UT	Fire Stations	Ideally Served Population Estimates	Water Tenders	Water Bowzers	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
Andaman and Nicobar Islands	20	329,067	5	6	3	3	0	0	3	3	0	20	20	2	0	3	68
Andhra Pradesh	251	33,243,439	234	213	63	25	9	37	44	23	0	107	104	0	0	33	892
Arunachal Pradesh	13	416,547	-7	-1	2	11	1	11	11	11	0	10	11	0	0	11	71
Assam	110	18,371,991	12	50	33	27	7	30	29	27	0	96	99	0	0	29	439
Bihar	102	12,140,981	-22	41	29	35	12	45	54	37	0	24	33	0	0	37	325
Chandigarh	7	753,890	0	1	3	0	0	0	2	1	0	2	0	0	0	1	10

State/UT	Fire Stations	Ideally Served Population Estimates	Water Tenders	Water Bowzers	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
Chhattisgarh	33	3,636,523	5	12	6	18	5	17	18	18	0	20	21	0	0	18	158
Dadra and Nagar Haveli	1	26,355	-2	0	0	-1	1	1	1	1	0	1	1	0	0	1	4
Daman and Diu	3	129,888	-1	1	2	0	1	2	2	2	0	2	2	2	0	2	17
Delhi	53	8,126,612	5	0	27	5	2	7	3	6	0	6	4	0	0	7	72
Goa	15	656,232	-4	0	1	1	1	2	3	2	0	3	5	0	0	2	16
Gujarat	183	26,096,729	32	-80	82	0	4	51	45	24	0	82	87	0	0	32	359
Haryana	82	6,663,340	-13	-5	2	12	6	25	25	22	0	7	8	0	0	21	110
Himachal Pradesh	25	1,526,646	-6	-1	5	9	2	9	13	12	0	4	5	0	0	12	64
Jammu and Kashmir	156	7,997,349	-30	0	8	16	0	7	27	22	0	41	42	5	0	22	160
Jharkhand	31	6,500,677	8	24	15	21	4	23	23	23	0	28	28	0	0	23	220
Karnataka	182	27,910,627	39	63	87	13	8	37	38	31	0	125	117	0	1	32	591
Kerala	100	12,908,553	-42	53	19	-2	7	14	18	14	0	49	38	0	0	15	183
Lakshadweep	4	40,405	-5	0	1	1	0	1	1	1	0	4	4	5	0	1	14
Madhya Pradesh	292	35,688,704	92	133	103	43	10	52	62	50	0	159	159	0	0	50	913
Maharashtra	157	22,376,238	21	121	53	23	8	38	52	21	0	66	66	0	0	35	504
Manipur	16	864,211	-4	-1	-3	8	1	9	9	9	0	1	14	0	0	9	52
Meghalaya	32	2,093,340	-19	-1	3	4	1	7	7	7	0	31	31	0	0	7	78
Mizoram	12	390,185	-3	0	4	8	1	8	7	8	0	1	5	0	0	8	47
Nagaland	9	343,345	-9	0	7	8	2	6	6	8	0	1	8	0	0	8	45
Orissa	180	23,258,380	68	89	53	27	11	31	41	30	0	142	145	0	0	32	669
Puducherry	13	679,564	-6	2	1	3	1	3	4	4	0	0	0	0	0	4	16
Punjab	48	5,819,269	-17	23	36	19	6	22	20	19	0	7	7	0	0	19	161
Rajasthan	126	11,121,029	-63	30	25	36	2	34	35	33	0	1	0	0	0	34	167
Sikkim	9	233,300	-6	0	3	3	1	4	4	4	0	7	8	0	0	4	32
Tamil Nadu	303	47,086,170	122	264	192	21	6	58	52	30	0	181	181	0	0	30	1137

State/UT	Fire Stations	Ideally Served Population Estimates	Water Tenders	Water Bowzers	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
Tripura	35	2,647,470	2	12	3	5	1	3	6	4	0	1	28	0	0	4	69
Uttar Pradesh	237	55,671,967	246	320	117	72	19	73	73	71	0	112	112	0	0	83	1298
Uttarakhand	33	2,112,512	-7	2	-1	11	2	10	13	13	0	16	8	0	0	13	80
West Bengal	107	15,123,371	-30	46	72	20	0	24	39	19	0	35	42	0	0	29	296
<b>Total</b>	<b>2,980</b>	<b>392,984,906</b>	<b>595</b>	<b>1,417</b>	<b>1,056</b>	<b>505</b>	<b>142</b>	<b>701</b>	<b>790</b>	<b>610</b>	<b>0</b>	<b>1,392</b>	<b>1,443</b>	<b>14</b>	<b>1</b>	<b>671</b>	<b>9,337</b>

Table 42-5: Total gap in operational and new urban Fire Stations under their ideal jurisdiction areas

State/UT	Fire Stations	Ideally Served Population Estimates	Water Tenders	Water Bowzers	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
Andaman and Nicobar Islands	20	329,067	5	6	3	3	0	0	3	3	0	20	20	2	0	3	68
Andhra Pradesh	381	45,890,756	457	280	95	27	10	44	60	23	0	112	109	0	0	37	1254
Arunachal Pradesh	14	442,249	-6	-1	3	11	1	11	11	11	0	10	11	0	0	11	73
Assam	135	19,652,494	37	53	39	27	7	31	30	27	0	96	99	0	0	29	475
Bihar	184	18,081,713	70	69	57	36	12	47	68	38	0	31	40	0	0	38	506
Chandigarh	11	1,054,686	5	4	3	0	0	0	2	1	0	6	4	0	0	1	26
Chhattisgarh	47	5,431,089	28	24	14	19	5	18	20	18	0	20	21	0	0	18	205
Dadra and Nagar Haveli	2	86,984	0	0	0	0	1	1	1	1	0	2	2	0	0	1	9
Daman and Diu	6	242,911	2	1	4	0	1	3	2	2	0	4	4	3	0	2	28
Delhi	99	15,786,897	108	43	59	8	3	8	4	7	0	15	13	0	0	9	277
Goa	19	863,218	0	1	3	1	1	2	3	2	0	4	6	0	0	2	25

# Fire-Risk and Hazard Analysis in the Country



State/UT	Fire Stations	Ideally Served Population Estimates	Water Tenders	Water Bowzers	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
Gujarat	230	33,042,997	115	-22	108	1	4	65	50	24	0	95	100	0	0	33	573
Haryana	116	9,373,564	27	9	16	13	6	26	26	22	0	9	10	0	0	21	185
Himachal Pradesh	36	2,114,729	4	0	9	9	2	11	15	12	0	8	9	0	0	12	91
Jammu and Kashmir	183	9,074,328	0	0	8	16	0	7	27	22	0	43	44	5	0	22	194
Jharkhand	43	8,441,132	29	38	24	21	4	27	25	23	0	29	29	0	0	24	273
Karnataka	245	37,421,806	151	131	135	14	11	52	43	31	0	137	129	0	1	32	867
Kerala	157	22,377,471	69	129	53	0	8	15	25	14	0	56	45	0	0	17	431
Lakshadweep	4	40,405	-5	0	1	1	0	1	1	1	0	4	4	5	0	1	14
Madhya Pradesh	350	40,517,206	163	158	131	43	10	64	65	50	0	159	159	0	0	51	1053
Maharashtra	408	54,763,986	397	344	124	38	18	62	65	33	0	117	117	0	0	47	1362
Manipur	27	1,465,942	7	0	0	8	1	9	9	9	0	4	17	0	0	9	73
Meghalaya	34	2,204,529	-16	-1	3	4	1	8	7	7	0	31	31	0	0	7	82
Mizoram	20	538,040	5	0	4	9	1	8	8	8	0	2	6	0	0	8	59
Nagaland	19	826,137	1	1	13	8	2	7	7	8	0	4	11	0	0	8	70
Orissa	205	24,913,739	97	96	58	27	11	34	45	30	0	143	146	0	0	35	722
Puducherry	17	1,244,268	2	7	2	3	1	3	4	4	0	1	1	0	0	4	32
Punjab	82	8,777,945	21	38	58	20	6	30	23	20	0	7	7	0	0	20	250
Rajasthan	233	22,496,374	106	121	55	36	2	37	35	33	0	1	0	0	0	34	460
Sikkim	10	264,959	-5	0	3	3	1	4	4	4	0	8	9	0	0	4	35
Tamil Nadu	349	55,398,068	209	330	232	21	6	60	53	30	0	189	189	0	0	30	1349
Tripura	38	2,723,295	5	12	3	5	1	3	6	4	0	1	28	0	0	4	72
Uttar Pradesh	354	67,634,220	406	406	158	76	20	76	76	71	0	116	116	0	0	100	1621
Uttarakhand	66	4,457,151	38	6	11	11	2	10	13	13	0	20	12	0	0	13	149
West Bengal	183	27,885,929	126	140	145	20	0	25	45	19	0	46	53	0	0	30	649
<b>Total</b>	<b>4,327</b>	<b>545,860,284</b>	<b>2,658</b>	<b>2,423</b>	<b>1,634</b>	<b>539</b>	<b>159</b>	<b>809</b>	<b>881</b>	<b>625</b>	<b>0</b>	<b>1,550</b>	<b>1,601</b>	<b>15</b>	<b>1</b>	<b>717</b>	<b>13,612</b>

**Table 42-6: Additional vehicle required for new rural Fire Stations under their ideal jurisdiction areas**

State/UT	Fire Stations	Ideally Served Population Estimates	Water Tenders	Water Bowlers	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
Andaman and Nicobar Islands	6	50,877	6	0	0	0	0	0	0	0	0	6	6	0	0	0	18
Andhra Pradesh	228	38,774,777	403	236	89	0	0	37	4	0	0	228	228	0	0	0	1225
Arunachal Pradesh	30	940,362	30	0	1	5	0	5	5	5	0	30	30	0	0	5	116
Assam	67	11,516,774	125	87	16	0	0	0	0	0	0	67	67	0	0	0	362
Bihar	466	85,722,916	839	587	167	0	0	0	4	0	0	466	466	0	0	0	2529
Chandigarh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chhattisgarh	103	20,109,486	200	145	52	0	0	0	0	0	0	103	103	0	0	0	603
Dadra and Nagar Haveli	4	255,869	4	0	2	0	0	5	0	0	0	4	4	0	0	0	19
Daman and Diu	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Delhi	9	837,288	12	0	0	0	0	0	0	0	0	6	9	0	0	0	27
Goa	9	594,505	9	0	3	0	0	0	0	0	0	9	9	0	0	0	30
Gujarat	164	27,340,628	248	142	107	1	0	46	1	1	0	164	164	0	0	1	875
Haryana	80	15,979,517	180	64	63	0	0	0	0	0	0	80	80	0	0	0	467
Himachal Pradesh	83	4,741,780	87	15	7	0	0	0	0	0	0	83	83	0	0	0	275
Jammu and Kashmir	94	3,344,064	78	0	0	0	0	0	0	0	0	34	34	0	0	0	146
Jharkhand	137	24,525,108	235	145	67	1	0	8	2	1	0	137	137	0	0	1	734
Karnataka	132	23,708,912	212	122	104	0	0	17	0	0	0	132	132	0	0	1	720
Kerala	71	11,010,206	109	65	35	0	0	0	0	0	0	71	71	0	0	0	351
Lakshadweep	5	24,024	5	0	0	0	0	0	0	0	0	5	5	5	0	0	20
Madhya Pradesh	163	32,080,764	302	209	101	0	0	3	0	0	0	163	163	0	0	0	941
Maharashtra	666	57,601,624	876	0	0	0	0	0	0	0	0	472	365	0	0	0	1713
Manipur	26	1,255,807	24	1	1	0	0	0	0	0	0	24	24	2	0	0	76
Meghalaya	15	759,478	17	0	1	0	0	0	0	0	0	15	15	0	0	0	48
Mizoram	31	552,974	31	0	1	0	0	0	1	0	0	31	31	0	0	0	95

State/UT	Fire Stations	Ideally Served Population Estimates	Water Tenders	Water Browsers	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
Nagaland	29	1,154,465	30	0	5	3	0	4	4	3	0	29	29	0	0	3	110
Orissa	126	17,033,620	175	70	63	0	0	0	7	0	0	126	126	0	0	0	567
Puducherry	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Punjab	93	18,926,291	196	96	86	0	0	21	0	0	0	93	93	0	0	0	585
Rajasthan	641	39,479,627	696	18	0	0	0	0	0	0	0	220	186	0	0	0	1120
Sikkim	15	342,729	15	0	0	0	0	0	0	0	0	15	15	0	0	0	45
Tamil Nadu	102	16,740,890	166	70	67	0	0	14	0	0	0	102	102	0	0	0	521
Tripura	15	947,737	16	1	1	0	0	0	0	0	0	15	15	0	0	0	48
Uttar Pradesh	352	131,947,257	1139	962	150	0	0	0	0	0	0	352	352	0	0	0	2955
Uttarakhand	58	5,659,601	97	7	13	0	0	0	0	0	0	58	58	0	0	0	233
West Bengal	252	63,461,807	614	399	197	0	0	0	1	0	0	252	252	0	0	1	1716
<b>Total</b>	<b>4,272</b>	<b>657,421,764</b>	<b>7,176</b>	<b>3,441</b>	<b>1,399</b>	<b>10</b>	<b>0</b>	<b>160</b>	<b>29</b>	<b>10</b>	<b>0</b>	<b>3,592</b>	<b>3,454</b>	<b>7</b>	<b>0</b>	<b>12</b>	<b>19,290</b>



**Table 42-7: List of specialized equipment available with Fire Services of all States/UTs (As on Nov. 2012)**

State/UT	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
Andaman and Nicobar Islands	20	329,067	0	0	28	0	20	0	39	19	0	0	0	0	21	0
Andhra Pradesh	251	33,243,439	0	0	179	3	57	0	3	4	6	65	1	0	280	1
Arunachal Pradesh	13	416,547	0	5	13	0	3	0	0	2	0	19	0	0	8	0
Assam	110	18,371,991	22	16	127	2	51	0	5	1	17	113	0	0	140	0
Bihar	102	12,140,981	3	20	81	1	37	3	23	17	0	20	1	0	30	0
Chandigarh	7	753,890	0	0	27	3	5	2	1	1	1	50	3	0	1	0
Chhattisgarh	33	3,636,523	4	7	11	0	15	0	8	2	0	31	0	0	49	0
Dadra and Nagar Haveli	1	26,355	4	2	8	1	12	1	6	6	1	8	0	0	4	3
Daman and Diu	3	129,888	2	3	13	3	5	0	18	17	1	12	1	1	11	1
Delhi	53	8,126,612	0	10	728	0	29	4	27	5	2	145	6	1	1	0
Goa	15	656,232	11	2	42	3	12	0	7	45	0	38	2	1	8	0
Gujarat	183	26,096,729	132	35	444	7	238	5	115	155	10	161	2	2	70	6
Haryana	82	6,663,340	1	3	81	0	59	0	15	11	7	18	0	0	18	0
Himachal Pradesh	25	1,526,646	6	8	49	4	41	0	7	8	3	18	0	0	24	0
Jammu and Kashmir	156	7,997,349	0	3	158	0	63	2	14	35	14	20	1	1	182	3
Jharkhand	31	6,500,677	0	11	53	0	54	1	0	0	0	53	0	0	3	0
Karnataka	182	27,910,627	53	24	647	47	310	8	103	77	23	105	63	1	363	3
Kerala	100	12,908,553	49	62	237	5	1	0	2	141	2	94	0	23	93	37

State/UT	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
Lakshadweep	4	40,405	0	0	0	0	3	0	1	2	0	0	0	0	4	0
Madhya Pradesh	292	35,688,704	7	19	84	4	219	0	155	38	0	33	14	0	98	1
Maharashtra	157	22,376,238	0	0	496	0	181	7	61	159	16	1740	11	1	14	0
Manipur	16	864,211	0	10	20	4	0	0	6	3	0	8	0	0	35	1
Meghalaya	32	2,093,340	0	1	9	9	2	0	5	2	1	8	0	0	34	9
Mizoram	12	390,185	0	10	5	1	0	0	0	0	0	12	0	0	6	0
Nagaland	9	343,345	0	19	0	0	0	0	0	0	0	1	0	0	9	0
Orissa	180	23,258,380	20	27	147	15	162	1	11	225	5	67	1	0	74	11
Puducherry	13	679,564	0	0	10	0	5	0	0	8	0	6	0	0	1	0
Punjab	48	5,819,269	0	5	32	0	42	0	27	6	1	11	51	0	15	0
Rajasthan	126	11,121,029	0	0	86	0	90	0	8	5	0	8	4	0	2	0
Sikkim	9	233,300	0	3	7	3	5	1	0	8	0	2	0	0	17	0
Tamil Nadu	303	47,086,170	16	4	716	6	351	3	47	98	3	262	6	5	124	14
Tripura	35	2,647,470	1	4	7	0	20	0	4	1	0	9	0	0	79	2
Uttar Pradesh	237	55,671,967	0	13	504	11	153	0	23	20	2	174	0	0	355	61
Uttarakhand	33	2,112,512	11	3	84	5	99	1	13	7	0	22	0	0	29	6
West Bengal	107	15,123,371	10	2	84	8	114	0	9	7	15	21	0	0	143	10
<b>Total</b>	<b>2,980</b>	<b>392,984,906</b>	<b>352</b>	<b>331</b>	<b>5,217</b>	<b>145</b>	<b>2,458</b>	<b>39</b>	<b>763</b>	<b>1,135</b>	<b>130</b>	<b>3,354</b>	<b>167</b>	<b>36</b>	<b>2,345</b>	<b>169</b>

**Table 42-8: List of specialized equipment available with Fire Services of all States of India (As on Nov. 2012)**  
(continued..)

State/UT	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
Andaman and Nicobar Islands	20	329,067	0	0	0	0	17	0	0	20	30	31	0	225
Andhra Pradesh	251	33,243,439	1	0	9	1	1	336	0	490	499	1258	0	3194
Arunachal Pradesh	13	416,547	0	0	1	1	0	6	2	0	0	2	0	62
Assam	110	18,371,991	2	3	45	44	2	16	0	6	3	9	0	624
Bihar	102	12,140,981	0	0	36	4	1	198	0	8	14	16	0	513
Chandigarh	7	753,890	0	0	7	0	7	12	0	8	26	6	0	160
Chhattisgarh	33	3,636,523	0	0	5	1	1	19	0	0	0	0	0	153
Dadra and Nagar Haveli	1	26,355	0	2	4	0	4	8	0	1	8	6	0	89
Daman and Diu	3	129,888	0	2	8	1	11	17	4	2	11	6	0	150
Delhi	53	8,126,612	0	0	0	0	19	0	4	44	80	67	0	1172
Goa	15	656,232	0	4	14	2	4	11	2	16	13	14	0	251
Gujarat	183	26,096,729	22	9	25	23	56	313	46	60	272	102	0	2310
Haryana	82	6,663,340	2	0	25	15	1	34	2	3	10	6	0	311
Himachal Pradesh	25	1,526,646	0	1	9	0	0	40	0	0	0	0	0	218
Jammu and Kashmir	156	7,997,349	0	4	0	0	10	5	2	74	101	72	0	764
Jharkhand	31	6,500,677	0	0	0	3	0	84	0	0	0	0	0	262
Karnataka	182	27,910,627	20	8	80	3	38	327	11	159	477	207	0	3157
Kerala	100	12,908,553	3	6	54	6	16	33	2	1	4	0	0	871
Lakshadweep	4	40,405	0	0	0	0	0	2	0	0	0	0	0	12

State/UT	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
Madhya Pradesh	292	35,688,704	2	4	0	0	0	156	0	39	42	21	0	936
Maharashtra	157	22,376,238	0	0	0	0	113	0	2	91	246	218	0	3356
Manipur	16	864,211	0	0	0	1	2	14	1	1	30	15	0	151
Meghalaya	32	2,093,340	3	7	5	1	2	42	1	8	1	15	0	165
Mizoram	12	390,185	0	0	0	0	0	11	0	3	0	23	0	71
Nagaland	9	343,345	0	0	0	0	0	0	0	2	0	0	0	31
Orissa	180	23,258,380	3	6	395	0	7	322	165	8	2	21	0	1695
Puducherry	13	679,564	0	0	0	0	1	0	0	9	10	6	0	56
Punjab	48	5,819,269	0	0	1	0	0	55	0	13	8	13	0	280
Rajasthan	126	11,121,029	0	0	0	0	1	0	0	8	7	26	0	245
Sikkim	9	233,300	0	0	2	1	2	2	0	12	1	15	0	81
Tamil Nadu	303	47,086,170	0	1	37	49	33	14	45	41	52	122	0	2049
Tripura	35	2,647,470	0	0	0	0	0	35	0	32	40	0	0	234
Uttar Pradesh	237	55,671,967	0	0	60	4	1	143	0	182	429	168	0	2303
Uttarakhand	33	2,112,512	2	0	20	1	10	54	0	33	43	4	0	447
West Bengal	107	15,123,371	0	0	2	2	10	8	0	80	88	129	0	742
<b>Total</b>	<b>2,980</b>	<b>392,984,906</b>	<b>60</b>	<b>57</b>	<b>844</b>	<b>163</b>	<b>370</b>	<b>2,317</b>	<b>289</b>	<b>1,454</b>	<b>2547</b>	<b>2,598</b>	<b>0</b>	<b>27,340</b>

**Table 42-9: Specialized equipment gap in operational Fire Station for ideal jurisdiction area**

State/UT	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
Andaman and Nicobar Islands	20	329,067	25	44	207	25	49	25	9	6	25	69	60	25	23	2
Andhra Pradesh	251	33,243,439	62	575	3781	298	1048	62	198	297	295	1040	613	62	598	0
Arunachal Pradesh	13	416,547	13	37	123	13	39	13	13	11	13	23	57	13	26	0
Assam	110	18,371,991	18	144	1870	132	511	40	35	133	117	448	160	40	326	0
Bihar	102	12,140,981	78	279	1418	119	378	78	74	103	120	395	350	81	300	0
Chandigarh	7	753,890	9	42	103	6	36	7	8	8	8	-32	38	9	24	0
Chhattisgarh	33	3,636,523	16	99	425	36	113	20	24	34	36	92	106	20	52	0
Dadra and Nagar Haveli	1	26,355	0	4	14	0	-6	0	-4	-4	0	-2	6	1	3	-2
Daman and Diu	3	129,888	3	10	35	0	8	2	-15	-14	2	1	15	1	1	6
Delhi	53	8,126,612	65	198	106	70	243	60	44	66	69	73	249	63	136	0
Goa	15	656,232	7	22	76	15	27	2	8	-27	18	1	24	1	19	0
Gujarat	183	26,096,729	47	616	2742	213	634	87	64	65	210	711	696	90	635	6
Haryana	82	6,663,340	41	314	1122	124	309	43	90	110	114	350	239	42	175	0
Himachal Pradesh	25	1,526,646	21	66	185	24	37	27	20	20	25	60	88	27	40	0
Jammu and Kashmir	156	7,997,349	81	131	1301	170	407	79	145	137	158	286	242	80	62	4
Jharkhand	31	6,500,677	23	170	677	34	148	22	28	34	34	149	181	23	163	0
Karnataka	182	27,910,627	5	341	2505	172	567	34	8	142	196	772	341	41	357	0

State/UT	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
Kerala	100	12,908,553	4	200	1324	116	435	24	77	-20	119	342	276	1	257	0
Lakshadweep	4	40,405	2	5	38	5	9	2	1	3	5	12	5	2	6	5
Madhya Pradesh	292	35,688,704	50	526	3998	348	964	57	67	314	352	1081	531	57	831	0
Maharashtra	157	22,376,238	68	918	2933	221	685	64	160	62	205	-1152	830	68	585	0
Manipur	16	864,211	12	34	172	13	56	12	6	14	17	48	44	12	12	0
Meghalaya	32	2,093,340	11	42	349	30	106	11	6	37	38	100	51	11	56	0
Mizoram	12	390,185	12	25	123	12	35	12	12	13	13	23	48	12	24	0
Nagaland	9	343,345	9	35	198	9	54	9	9	9	9	53	60	9	36	0
Orissa	180	23,258,380	24	173	2428	202	589	29	62	-8	212	684	235	30	0	154
Puducherry	13	679,564	2	18	190	15	45	2	15	7	15	28	44	2	20	0
Punjab	48	5,819,269	44	195	1027	79	241	44	34	75	80	258	144	44	138	0
Rajasthan	126	11,121,029	20	499	2528	294	732	20	163	295	300	613	512	20	212	0
Sikkim	9	233,300	5	9	74	8	20	4	5	3	11	23	19	5	4	0
Tamil Nadu	303	47,086,170	77	664	4488	357	1086	29	142	265	360	1175	708	27	1051	0
Tripura	35	2,647,470	20	48	363	42	94	21	17	41	42	105	57	21	19	0
Uttar Pradesh	237	55,671,967	127	656	4939	275	1311	127	152	266	284	1290	669	127	835	0
Uttarakhand	33	2,112,512	24	96	308	32	12	34	22	30	37	89	117	35	61	0
West Bengal	107	15,123,371	30	409	1793	122	392	40	107	123	115	474	411	40	349	0
<b>Total</b>	<b>2,980</b>	<b>392,984,906</b>	<b>1,055</b>	<b>7644</b>	<b>4,3963</b>	<b>3,631</b>	<b>11,414</b>	<b>1,142</b>	<b>1,806</b>	<b>2,650</b>	<b>3,654</b>	<b>9,682</b>	<b>8,226</b>	<b>1,142</b>	<b>7,436</b>	<b>175</b>



**Table 42-10: Specialized equipment gap in operational Fire Station for ideal jurisdiction area (continued..)**

State/UT	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
Andaman and Nicobar Islands	20	329,067	0	4	20	20	8	60	0	5	30	18	25	784
Andhra Pradesh	251	33,243,439	0	0	292	200	61	768	0	-189	774	54	301	11190
Arunachal Pradesh	13	416,547	0	0	12	12	13	51	0	13	109	107	13	724
Assam	110	18,371,991	0	0	89	-4	38	579	0	128	738	733	134	6409
Bihar	102	12,140,981	0	0	84	93	80	256	0	112	655	667	120	5840
Chandigarh	7	753,890	0	0	0	9	2	24	0	-1	15	35	9	359
Chhattisgarh	33	3,636,523	0	0	31	31	19	125	0	36	236	241	36	1828
Dadra and Nagar Haveli	1	26,355	0	-2	-3	1	-2	-1	0	0	5	7	1	16
Daman and Diu	3	129,888	0	18	-2	2	-5	0	1	1	16	23	3	112
Delhi	53	8,126,612	0	0	53	52	48	270	0	9	147	109	71	2201
Goa	15	656,232	0	0	4	13	0	24	0	2	37	42	18	333
Gujarat	183	26,096,729	44	111	195	156	36	604	9	160	829	1022	220	10202
Haryana	82	6,663,340	0	0	97	87	41	281	-2	118	305	358	122	4480
Himachal Pradesh	25	1,526,646	0	0	19	27	27	37	0	28	151	152	28	1109
Jammu and Kashmir	156	7,997,349	14	0	156	68	71	343	0	97	261	271	170	4734
Jharkhand	31	6,500,677	0	0	34	25	23	143	0	34	344	344	34	2667
Karnataka	182	27,910,627	0	0	139	108	4	583	-1	60	623	906	219	8122
Kerala	100	12,908,553	0	0	67	73	8	402	0	120	519	541	121	5006
Lakshadweep	4	40,405	0	10	5	2	2	11	5	5	18	18	5	181
Madhya Pradesh	292	35,688,704	0	0	352	222	57	1027	0	313	1413	1505	352	14417

State/UT	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
Maharashtra	157	22,376,238	0	0	157	157	-1	922	0	130	674	451	220	8357
Manipur	16	864,211	0	0	17	11	10	54	0	16	83	98	17	758
Meghalaya	32	2,093,340	0	0	34	10	9	74	1	31	151	137	39	1334
Mizoram	12	390,185	0	0	13	12	12	37	0	10	83	61	13	605
Nagaland	9	343,345	0	0	9	9	9	60	0	7	100	100	9	802
Orissa	180	23,258,380	0	328	-178	73	23	448	0	209	948	943	217	7825
Puducherry	13	679,564	0	0	13	7	1	50	0	6	40	23	15	558
Punjab	48	5,819,269	0	0	75	60	44	239	0	64	359	278	80	3602
Rajasthan	126	11,121,029	0	0	126	126	19	621	0	292	656	557	300	8905
Sikkim	9	233,300	0	0	9	4	3	29	0	-1	48	35	11	328
Tamil Nadu	303	47,086,170	0	0	326	140	49	1465	0	322	1625	1576	363	16295
Tripura	35	2,647,470	0	0	42	21	21	79	0	10	100	144	42	1349
Uttar Pradesh	237	55,671,967	0	0	226	171	126	1287	0	104	1001	1296	175	15444
Uttarakhand	33	2,112,512	0	0	17	34	25	54	0	4	65	107	37	1240
West Bengal	107	15,123,371	0	0	128	114	36	514	0	50	577	544	130	6498
<b>Total</b>	<b>2,980</b>	<b>392,984,906</b>	<b>58</b>	<b>469</b>	<b>2,658</b>	<b>2,146</b>	<b>917</b>	<b>11,520</b>	<b>13</b>	<b>2,305</b>	<b>13,735</b>	<b>13,503</b>	<b>3,670</b>	<b>154,614</b>

**Table 42-11: Total gap in specialized equipments for operational and new urban Fire Stations**

State/UT	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
Andaman and Nicobar Islands	20	329,067	25	44	207	25	49	25	9	6	25	69	60	25	23	2
Andhra Pradesh	381	45,890,756	83	967	5340	453	1479	83	353	452	450	1471	1013	83	925	0
Arunachal Pradesh	14	442,249	14	39	133	14	41	14	14	12	14	25	59	14	28	0
Assam	135	19,652,494	48	184	2034	162	566	70	65	163	147	488	200	70	360	0
Bihar	184	18,081,713	144	466	2145	214	600	144	169	198	215	617	540	147	349	0
Chandigarh	11	1,054,686	13	54	143	10	48	11	12	12	12	-23	50	13	36	0
Chhattisgarh	47	5,431,089	16	151	631	53	170	20	41	51	53	144	158	20	95	0
Dadra and Nagar Haveli	2	86,984	5	8	26	1	-2	1	-3	-3	1	2	6	2	5	-1
Daman and Diu	6	242,911	8	18	64	3	17	2	-12	-11	5	10	23	1	8	8
Delhi	99	15,786,897	108	402	978	120	434	104	93	115	118	293	433	108	286	0
Goa	19	863,218	12	31	112	20	37	2	13	-22	23	11	33	1	27	0
Gujarat	230	33,042,997	87	829	3574	267	857	114	118	119	264	934	926	117	815	6
Haryana	116	9,373,564	62	384	1398	158	397	64	124	144	148	438	309	63	245	0
Himachal Pradesh	36	2,114,729	32	88	253	35	65	38	31	31	36	88	113	38	59	0
Jammu and Kashmir	183	9,074,328	108	161	1417	197	461	106	172	164	185	340	271	107	94	4
Jharkhand	43	8,441,132	23	224	890	48	205	22	42	48	48	203	235	23	208	0
Karnataka	245	37,421,806	67	628	3629	244	862	66	80	214	268	1067	647	73	597	0
Kerala	157	22,377,471	54	473	2402	186	722	54	147	50	189	629	551	31	485	0

State/UT	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
Lakshadweep	4	40,405	2	5	38	5	9	2	1	3	5	12	5	2	6	5
Madhya Pradesh	350	40,517,206	62	675	4593	414	1136	69	133	380	418	1230	680	69	955	0
Maharashtra	408	54,763,986	166	1742	6112	490	1524	162	429	331	474	-535	1604	167	1306	0
Manipur	27	1,465,942	24	54	252	25	83	24	18	26	29	68	64	24	30	0
Meghalaya	34	2,204,529	13	45	364	32	110	13	8	39	40	104	55	13	59	0
Mizoram	20	538,040	21	35	164	21	51	21	21	22	22	39	58	21	33	0
Nagaland	19	826,137	20	58	288	20	81	20	20	20	20	80	84	20	50	0
Orissa	205	24,913,739	51	220	2630	229	655	32	89	19	239	750	288	33	0	154
Puducherry	17	1,244,268	4	29	248	19	60	4	19	11	19	40	58	4	35	0
Punjab	82	8,777,945	65	270	1393	117	343	65	68	113	118	360	220	65	213	0
Rajasthan	233	22,496,374	43	734	3468	401	1010	43	270	402	407	925	747	43	472	0
Sikkim	10	264,959	6	11	81	9	22	5	6	4	12	25	21	6	6	0
Tamil Nadu	349	55,398,068	97	905	5433	409	1331	29	194	317	412	1420	952	27	1252	0
Tripura	38	2,723,295	23	51	378	45	100	24	20	44	45	111	60	24	22	0
Uttar Pradesh	354	67,634,220	197	1003	6329	410	1706	197	287	401	419	1685	1016	197	1126	0
Uttarakhand	66	4,457,151	62	175	609	70	102	72	60	68	75	179	196	73	126	0
West Bengal	183	27,885,929	38	810	3370	212	796	48	197	213	205	875	812	48	743	0
<b>Total</b>	<b>4,327</b>	<b>545,860,284</b>	<b>1,803</b>	<b>11,973</b>	<b>61,126</b>	<b>5,138</b>	<b>16,127</b>	<b>1,770</b>	<b>3,308</b>	<b>4,156</b>	<b>5,160</b>	<b>14,174</b>	<b>12,547</b>	<b>1,772</b>	<b>11,079</b>	<b>178</b>

**Table 42-12: Total gap in specialized equipments for operational and new urban Fire Station (Continued....)**

State/UT	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
Andaman and Nicobar Islands	20	329,067	0	4	20	20	8	60	0	5	30	18	25	784
Andhra Pradesh	381	45,890,756	0	0	447	355	82	1168	0	-34	1203	518	456	17347
Arunachal Pradesh	14	442,249	0	0	13	13	14	53	0	14	111	109	14	762
Assam	135	19,652,494	0	0	119	26	68	620	0	158	781	789	164	7282
Bihar	184	18,081,713	0	0	179	188	146	446	0	207	863	904	215	9096
Chandigarh	11	1,054,686	0	0	4	13	6	36	0	3	27	47	13	540
Chhattisgarh	47	5,431,089	0	0	48	48	19	178	0	53	292	302	53	2596
Dadra and Nagar Haveli	2	86,984	0	-2	-2	2	-1	3	0	1	9	11	2	71
Daman and Diu	6	242,911	0	24	3	5	-3	8	3	4	24	32	6	250
Delhi	99	15,786,897	0	0	99	98	93	469	0	55	311	297	120	5134
Goa	19	863,218	0	0	9	18	1	33	0	7	46	52	23	489
Gujarat	230	33,042,997	44	111	249	210	63	834	9	214	1068	1265	274	13368
Haryana	116	9,373,564	0	0	131	121	62	351	-2	152	375	446	156	5726
Himachal Pradesh	36	2,114,729	0	0	30	38	38	59	0	39	179	186	39	1515
Jammu and Kashmir	183	9,074,328	14	0	183	95	98	374	0	124	290	325	197	5487
Jharkhand	43	8,441,132	0	0	48	39	23	201	0	48	406	408	48	3440
Karnataka	245	37,421,806	0	0	211	180	36	889	-1	132	940	1227	291	12347
Kerala	157	22,377,471	0	0	137	143	38	677	0	190	808	842	191	8999
Lakshadweep	4	40,405	0	10	5	2	2	11	5	5	18	18	5	181
Madhya Pradesh	350	40,517,206	0	0	418	288	69	1189	0	379	1580	1694	418	16849

State/UT	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
Maharashtra	408	54,763,986	0	0	408	407	98	1747	0	398	1499	1030	489	20048
Manipur	27	1,465,942	0	0	29	23	22	74	0	28	103	125	29	1154
Meghalaya	34	2,204,529	0	0	36	12	11	78	1	33	155	141	41	1403
Mizoram	20	538,040	0	0	22	21	21	47	0	19	96	80	22	857
Nagaland	19	826,137	0	0	20	20	20	84	0	18	126	129	20	1218
Orissa	205	24,913,739	0	328	-151	100	26	501	0	236	1008	1020	244	8701
Puducherry	17	1,244,268	0	0	17	11	3	64	0	10	54	31	19	759
Punjab	82	8,777,945	0	0	114	94	65	330	0	102	450	380	118	5063
Rajasthan	233	22,496,374	0	0	233	233	42	856	0	399	891	771	407	12797
Sikkim	10	264,959	0	0	10	5	4	31	0	0	50	37	12	363
Tamil Nadu	349	55,398,068	0	0	378	192	49	1709	0	374	1870	1825	415	19590
Tripura	38	2,723,295	0	0	45	24	24	82	0	13	103	150	45	1433
Uttar Pradesh	354	67,634,220	0	0	361	306	196	1634	0	239	1348	1691	310	21058
Uttarakhand	66	4,457,151	0	0	55	72	63	133	0	42	144	197	75	2648
West Bengal	183	27,885,929	0	0	218	204	44	917	0	140	988	958	220	12056
<b>Total</b>	<b>4327</b>	<b>545,860,284</b>	<b>58</b>	<b>475</b>	<b>4,146</b>	<b>3,626</b>	<b>1,550</b>	<b>15,946</b>	<b>15</b>	<b>3,807</b>	<b>18,246</b>	<b>18,055</b>	<b>5,176</b>	<b>221,411</b>



**Table 42-13: Additional specialized equipment required for new rural Fire Stations**

State/UT	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
Andaman and Nicobar Islands	6	50,877	0	0	24	6	12	0	6	6	6	6	0	0	6	0
Andhra Pradesh	228	38,774,777	0	0	4042	276	1148	0	0	276	276	1148	0	0	956	0
Arunachal Pradesh	30	940,362	5	10	219	34	71	5	5	34	34	71	20	5	61	0
Assam	67	11,516,774	0	0	1258	78	353	0	0	78	78	353	0	0	295	0
Bihar	466	85,722,916	0	0	8763	559	2471	0	0	559	559	2471	0	0	2059	0
Chandigarh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chhattisgarh	103	20,109,486	0	0	2153	124	600	0	0	124	124	600	0	0	500	0
Dadra and Nagar Haveli	4	255,869	1	0	38	5	12	0	3	5	5	12	0	0	10	1
Daman and Diu	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Delhi	9	837,288	0	0	32	9	12	0	0	6	6	6	0	0	12	0
Goa	9	594,505	4	0	80	11	25	0	0	11	11	25	0	0	21	0
Gujarat	164	27,340,628	0	0	2779	196	795	38	0	196	196	795	0	38	662	0
Haryana	80	15,979,517	0	387	1388	80	387	0	0	80	80	387	0	0	387	0
Himachal Pradesh	83	4,741,780	0	0	722	97	231	0	0	97	97	231	231	0	192	0
Jammu and Kashmir	94	3,344,064	0	0	408	94	179	0	75	94	94	112	0	0	112	0
Jharkhand	137	24,525,108	1	7	2476	162	700	1	1	162	162	700	7	1	584	0
Karnataka	132	23,708,912	0	0	2423	158	684	0	0	158	158	684	0	0	570	0

State/UT	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
Kerala	71	11,010,206	0	0	1173	85	335	0	0	85	85	335	0	0	280	0
Lakshadweep	5	24,024	0	0	36	6	12	0	0	6	6	12	0	0	10	5
Madhya Pradesh	163	32,080,764	0	0	3329	195	930	0	0	195	195	930	0	0	775	0
Maharashtra	666	57,601,624	0	0	6336	666	666	0	0	1646	1646	1646	0	0	1348	0
Manipur	26	1,255,807	0	2	182	31	64	0	0	31	31	60	0	0	28	2
Meghalaya	15	759,478	0	0	122	17	40	0	0	17	17	40	0	0	33	0
Mizoram	31	552,974	0	72	229	38	77	0	0	38	38	77	72	0	63	0
Nagaland	29	1,154,465	3	6	236	33	77	3	3	33	33	77	10	3	62	0
Orissa	126	17,033,620	0	0	1780	150	519	0	0	150	150	519	0	0	0	0
Puducherry	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Punjab	93	18,926,291	0	0	2066	93	563	0	0	93	93	497	0	0	470	0
Rajasthan	641	39,479,627	0	0	2872	641	1313	0	0	641	641	933	0	0	934	0
Sikkim	15	342,729	0	0	108	18	36	0	0	18	18	36	0	0	30	0
Tamil Nadu	102	16,740,890	0	0	1698	123	488	0	0	123	123	488	0	0	405	0
Tripura	15	947,737	0	0	122	17	40	0	0	17	17	40	0	0	40	0
Uttar Pradesh	352	131,947,257	0	0	11650	421	3125	0	0	421	421	3125	0	0	2603	0
Uttarakhand	58	5,659,601	0	0	701	69	211	0	0	69	69	211	0	0	175	0
West Bengal	252	63,461,807	0	0	6414	301	1754	0	0	301	301	1754	0	0	1754	0
<b>Total</b>	<b>4,272</b>	<b>657,421,764</b>	<b>14</b>	<b>484</b>	<b>65,859</b>	<b>4,793</b>	<b>17,930</b>	<b>47</b>	<b>93</b>	<b>5,770</b>	<b>5,770</b>	<b>18,381</b>	<b>340</b>	<b>47</b>	<b>15,437</b>	<b>8</b>

**Table 42-14: Additional specialized equipment required for new rural Fire Station (continued...)**

State	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
Andaman and Nicobar Islands	6	50,877	0	0	6	0	6	6	0	6	6	12	6	120
Andhra Pradesh	228	38,774,777	0	0	276	0	0	1191	0	276	1197	1197	276	12535
Arunachal Pradesh	30	940,362	0	0	34	5	5	80	0	34	101	101	34	968
Assam	67	11,516,774	0	0	78	0	0	353	0	78	353	353	78	3786
Bihar	466	85,722,916	0	0	559	0	0	2471	0	559	2475	2475	559	26539
Chandigarh	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chhattisgarh	103	20,109,486	0	0	124	0	0	600	0	124	600	600	124	6397
Dadra and Nagar Haveli	4	255,869	0	0	5	0	2	18	0	5	19	19	5	165
Daman and Diu	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Delhi	9	837,288	0	0	9	0	3	9	0	9	16	21	9	159
Goa	9	594,505	0	2	11	0	0	25	1	11	25	25	11	299
Gujarat	164	27,340,628	0	0	196	0	38	848	0	196	853	853	196	8875
Haryana	80	15,979,517	0	0	81	0	0	391	0	81	391	392	81	4593
Himachal Pradesh	83	4,741,780	0	0	97	0	0	231	0	97	231	231	97	2882
Jammu and Kashmir	94	3,344,064	0	0	94	0	0	94	0	94	112	188	94	1844
Jharkhand	137	24,525,108	0	0	162	1	1	709	0	162	715	715	162	7591
Karnataka	132	23,708,912	0	0	158	0	0	705	0	158	706	706	158	7426
Kerala	71	11,010,206	0	0	85	0	0	335	0	85	335	335	85	3638
Lakshadweep	5	24,024	0	10	6	0	0	12	5	6	12	12	6	162
Madhya Pradesh	163	32,080,764	0	0	195	0	0	933	0	195	933	933	195	9933

State	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
Maharashtra	666	57,601,624	0	0	666	0	0	666	0	666	1646	1332	666	19596
Manipur	26	1,255,807	2	2	31	0	0	60	2	31	62	64	31	716
Meghalaya	15	759,478	0	0	17	0	0	40	0	17	40	40	17	457
Mizoram	31	552,974	0	0	38	0	0	77	0	38	78	78	38	1051
Nagaland	29	1,154,465	0	0	33	3	3	81	0	33	97	97	33	959
Orissa	126	17,033,620	0	0	150	0	0	519	0	150	527	527	150	5291
Puducherry	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Punjab	93	18,926,291	0	0	95	0	0	497	0	95	571	579	93	5805
Rajasthan	641	39,479,627	0	0	641	0	0	641	0	641	828	1282	641	12649
Sikkim	15	342,729	0	0	18	0	0	36	0	18	36	36	18	426
Tamil Nadu	102	16,740,890	0	0	123	0	0	504	0	123	504	504	123	5329
Tripura	15	947,737	0	0	17	0	0	40	0	17	40	40	17	464
Uttar Pradesh	352	131,947,257	0	0	421	0	0	3125	0	421	3125	3125	421	32404
Uttarakhand	58	5,659,601	0	0	69	0	0	211	0	69	211	211	69	2345
West Bengal	252	63,461,807	0	0	301	0	0	1754	0	301	1756	1756	301	18748
<b>Total</b>	<b>4,272</b>	<b>657,421,764</b>	<b>2</b>	<b>14</b>	<b>4,796</b>	<b>9</b>	<b>58</b>	<b>17,262</b>	<b>8</b>	<b>4,796</b>	<b>18,601</b>	<b>1,8839</b>	<b>4,794</b>	<b>204,152</b>

### 42.3.3 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 42-15).

**Table 42-15: Manpower requirement for Station officer and lower staff as per SFAC norm (2- shifts)**

Sr No	Size of Station (Pumping Unit)	Station Officer	Sub-Officer*	Leading Firemen (L.F.M)	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 42-15 and 42-16, it is quite clear that The Administrative Reform Department (ARD, Delhi), has already optimized the fire manpower requirement in comparison of what has been suggested in SFAC norms. It may be noted that total number of staff is coming in decimal places, as calculations are on pumping units including reserve staff, which has been rounded off in the fire manpower gap analysis at district and State levels (Table 42-16).

**Table 42-16: 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 entire India has been estimated, which comes to 559,681 (Table 42.18 to 42.20) against the present strength of 51,163 (Table 42.17)

During the analysis, it has been observed that 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 the applicability of National Building Code (NBC) of fire safety.

In addition to fire fighting staffs, there is an urgent need of senior level fire officers for making a well coordinated State/UT 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 State/ UTs Fire Service Organization, 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) etc 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:

*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 States/UTs of entire India have been carried out and are shown in respective tables.



**Table 42-17: List of firefighting manpower available for operational Fire Stations in Fire Services of all States/UTs of India (As on Nov. 2012)**

State/UT	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
Andaman and Nicobar Islands	20	0	1	0	0	0	3	16	12	63	346	35	476
Andhra Pradesh	251	2	0	0	0	24	27	1	244	573	2794	11	3676
Arunachal Pradesh	13	0	0	0	0	0	0	10	15	29	161	0	215
Assam	110	1	0	0	0	4	14	77	162	357	1581	101	2297
Bihar	102	0	1	0	0	1	1	8	4	125	178	0	318
Chandigarh	7	0	0	0	0	0	0	4	4	30	201	0	239
Chhattisgarh	33	0	1	0	0	1	0	3	0	13	105	2	125
Dadra and Nagar Haveli	1	0	0	0	0	0	0	1	1	3	14	0	19
Daman and Diu	3	0	0	0	0	0	1	0	5	10	39	3	58
Delhi	53	1	1	1	0	9	12	47	89	315	1109	47	1631
Goa	15	1	0	0	0	1	2	15	17	76	327	4	443
Gujarat	183	0	10	1	0	2	3	34	18	91	1186	112	1457
Haryana	82	1	1	0	0	0	2	34	47	76	432	8	601
Himachal Pradesh	25	1	1	0	1	1	0	3	20	57	249	2	335
Jammu and Kashmir	156	2	2	0	6	14	11	26	93	749	1299	39	2241
Jharkhand	31	0	1	0	0	0	0	7	5	65	324	0	402
Karnataka	182	3	4	4	8	32	8	165	156	785	3131	28	4324
Kerala	100	3	0	0	0	5	8	89	109	484	1639	90	2427
Lakshadweep	4	0	0	0	0	0	0	0	4	9	40	1	54
Madhya Pradesh	292	1	2	2	0	10	5	20	19	52	827	26	964
Maharashtra	157	1	11	5	0	7	23	96	129	420	4288	260	5240
Manipur	16	1	0	0	0	0	0	1	7	23	159	0	191
Meghalaya	32	0	0	0	0	2	1	26	34	99	544	19	725
Mizoram	12	0	0	0	0	0	0	4	4	19	122	10	159
Nagaland	9	0	1	1	0	0	0	6	16	33	249	21	327
Orissa	180	0	1	1	0	6	17	131	100	617	1722	11	2606

State/UT	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
Puducherry	13	0	0	1	0	0	1	2	10	34	158	15	221
Punjab	48	0	1	0	0	0	7	23	91	67	386	6	581
Rajasthan	126	0	2	0	4	14	25	6	4	36	1003	64	1158
Sikkim	9	0	1	4	0	0	0	7	23	18	42	0	95
Tamil Nadu	303	1	6	0	0	32	49	96	238	946	3683	357	5408
Tripura	35	0	0	0	0	2	0	19	51	140	1054	37	1303
Uttar Pradesh	237	3	28	0	0	0	0	104	19	525	3880	69	4628
Uttarakhand	33	1	3	0	0	0	0	30	18	43	907	15	1017
West Bengal	107	3	2	5	0	8	39	192	216	1562	3044	131	5202
<b>Total</b>	<b>2980</b>	<b>26</b>	<b>81</b>	<b>25</b>	<b>19</b>	<b>175</b>	<b>259</b>	<b>1,303</b>	<b>1,984</b>	<b>8,544</b>	<b>3,7223</b>	<b>1524</b>	<b>51,163</b>

**Level 10:** Director General/ Director/Deputy Director/ Joint Director; **Level 9:** CFO/ CO; **Level 8:** Deputy CFO/Joint Director; **Level 7:** Assistant Director/Deputy Controller/Deputy Director/DO; **Level 6:** DO/DFO/Inspector/EO/Fire Supervisor; **Level 5:** ADFO/ADO/AFO/Fire In-charge; **Level 4:** St.O/Sub Inspector/Station In-charge/Asst O./AEO; **Level 3:** S O/Assistant Sub Inspector/ASO/Sub-Fire Officer; **Level 2:** LFM/ Mechanic Driver/Head Constable/Store Superintendent; **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 42-18: Firefighting manpower gap in operational Fire Stations for ideal jurisdiction area**

State/UT	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
Andaman and Nicobar Islands	20	1	0	2	0	4	3	14	82	130	613	-15	834
Andhra Pradesh	251	3	6	12	0	42	96	508	911	1721	13130	240	16669
Arunachal Pradesh	13	2	1	2	0	6	6	38	82	195	1106	13	1451
Assam	110	2	2	4	0	21	33	208	529	1341	7920	9	10069
Bihar	102	3	3	8	0	66	94	283	585	1208	9184	102	11536

State/UT	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
Chandigarh	7	0	1	0	0	2	4	11	37	74	326	7	462
Chhattisgarh	33	2	0	2	0	18	35	96	223	273	202	31	882
Dadra and Nagar Haveli	1	0	1	1	0	1	1	5	9	27	195	1	241
Daman and Diu	3	0	1	1	0	1	1	13	19	59	387	0	482
Delhi	53	0	3	7	18	10	-12	72	196	219	2128	6	2647
Goa	15	1	1	1	0	2	5	1	40	36	375	11	473
Gujarat	183	3	0	19	0	45	91	429	1034	2358	13715	71	17765
Haryana	82	0	20	21	0	21	40	115	372	755	5148	74	6566
Himachal Pradesh	25	0	3	8	-1	14	24	68	119	241	1805	23	2304
Jammu and Kashmir	156	1	2	0	6	8	26	101	423	91	3684	117	4459
Jharkhand	31	2	0	2	0	23	35	145	288	312	81	31	919
Karnataka	182	2	2	8	-8	10	66	266	892	1688	11169	154	14249
Kerala	100	1	5	10	0	23	21	115	359	465	5111	10	6120
Lakshadweep	4	0	1	1	0	1	2	5	16	39	198	3	266
Madhya Pradesh	292	4	4	10	0	49	86	522	1460	3212	18235	266	23848
Maharashtra	157	6	13	19	0	66	99	232	673	1047	4946	-103	6998
Manipur	16	0	1	1	0	7	13	45	81	153	1136	16	1453
Meghalaya	32	1	1	4	0	4	10	26	127	283	1484	13	1953
Mizoram	12	1	1	2	0	6	10	31	66	122	865	2	1106
Nagaland	9	1	0	0	0	6	9	37	60	170	1159	-12	1430
Orissa	180	3	3	8	0	31	51	209	842	1522	9754	169	12592
Puducherry	13	0	1	0	2	4	4	18	46	54	456	-2	583

State/UT	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
Punjab	48	1	18	19	0	21	35	118	189	565	3913	42	4921
Rajasthan	126	8	31	33	0	85	98	181	489	763	4617	62	6367
Sikkim	9	1	0	-1	0	3	5	12	28	93	558	9	708
Tamil Nadu	303	3	2	16	0	12	39	562	1213	2017	17089	-54	20899
Tripura	35	1	1	2	0	4	11	21	74	71	396	-2	579
Uttar Pradesh	237	4	43	71	0	88	177	733	1610	3329	22871	168	29094
Uttarakhand	33	1	1	8	0	15	29	47	147	280	1390	18	1936
West Bengal	107	5	5	11	0	40	49	100	406	-107	6131	-24	6616
<b>Total</b>	<b>2,980</b>	<b>63</b>	<b>177</b>	<b>312</b>	<b>17</b>	<b>759</b>	<b>1,296</b>	<b>5,387</b>	<b>13,727</b>	<b>24,806</b>	<b>171,477</b>	<b>1,456</b>	<b>219,477</b>

**Level 10:** Director General/ Director/Deputy Director/ Joint Director; **Level 9:** CFO/ CO; **Level 8:** Deputy CFO/Joint Director; **Level 7:** Assistant Director/Deputy Controller/Deputy Director/DO; **Level 6:** DO/DFO/Inspector/EO/Fire Supervisor; **Level 5:** ADFO/ADO/AFO/Fire In-charge; **Level 4:** St.O/Sub Inspector/Station In-charge/Asst O./AEO; **Level 3:** S O/Assistant Sub Inspector/ASO/Sub-Fire Officer; **Level 2 :** LFM/ Mechanic Driver/Head Constable/Store Superintendent; **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 42-19: Total firefighting manpower gap for operational and new urban Fire Stations**

State/UT	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
Andaman and Nicobar Islands	20	1	0	2	0	4	3	14	82	130	613	-15	834
Andhra Pradesh	381	3	6	12	0	49	118	674	1380	2510	18636	370	23758
Arunachal Pradesh	14	2	1	2	0	6	6	39	84	197	1137	14	1488
Assam	135	2	2	4	0	21	36	218	593	1412	8481	34	10803

State/UT	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
Bihar	184	3	3	8	0	67	137	348	829	1563	11763	184	14905
Chandigarh	11	0	1	0	0	2	4	14	52	105	471	11	660
Chhattisgarh	47	2	0	2	0	18	38	119	283	333	262	45	1102
Dadra and Nagar Haveli	2	0	1	1	0	1	1	6	11	29	226	2	278
Daman and Diu	6	0	1	1	0	1	1	15	29	79	491	3	621
Delhi	99	0	3	7	18	25	-12	157	447	594	4475	52	5766
Goa	19	1	1	1	0	2	5	5	50	49	490	15	619
Gujarat	230	3	0	19	0	45	91	526	1264	2825	16690	118	21581
Haryana	116	0	20	21	0	21	40	144	495	932	6295	108	8076
Himachal Pradesh	36	0	3	8	-1	14	24	74	149	278	2099	34	2682
Jammu and Kashmir	183	1	2	0	6	8	26	103	490	164	4147	144	5091
Jharkhand	43	2	0	2	0	23	44	172	348	375	145	43	1154
Karnataka	245	2	2	8	-8	15	84	401	1195	2314	15190	217	19420
Kerala	157	1	5	10	0	23	45	238	639	1049	9170	67	11247
Lakshadweep	4	0	1	1	0	1	2	5	16	39	198	3	266
Madhya Pradesh	350	4	4	10	0	54	104	581	1655	3522	20410	324	26668
Maharashtra	408	6	24	30	0	129	228	587	1646	2708	15972	148	21478
Manipur	27	0	1	1	0	7	13	49	109	184	1371	27	1762
Meghalaya	34	1	1	4	0	4	11	28	131	287	1546	15	2028
Mizoram	20	1	1	2	0	6	12	32	86	146	1022	10	1318
Nagaland	19	1	0	0	0	6	9	45	87	204	1453	-2	1803
Orissa	205	3	3	8	0	35	61	226	923	1639	10529	194	13621

State/UT	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
Puducherry	17	0	1	0	2	4	4	25	63	88	687	2	876
Punjab	82	1	19	20	0	22	37	158	306	760	5278	76	6677
Rajasthan	233	8	31	33	0	94	172	279	822	1256	8223	169	11087
Sikkim	10	1	0	-1	0	3	6	12	31	99	579	10	740
Tamil Nadu	349	3	2	16	0	24	63	663	1444	2481	20232	-8	24920
Tripura	38	1	1	2	0	5	13	21	81	78	443	1	646
Uttar Pradesh	354	4	43	71	0	88	177	878	2035	4052	27918	285	35551
Uttarakhand	66	1	1	8	0	15	29	70	243	404	2326	51	3148
West Bengal	183	5	5	11	0	45	76	283	797	697	11517	52	13488
<b>Total</b>	<b>4327</b>	<b>63</b>	<b>189</b>	<b>324</b>	<b>17</b>	<b>887</b>	<b>1708</b>	<b>7209</b>	<b>18895</b>	<b>33582</b>	<b>230485</b>	<b>2803</b>	<b>296162</b>

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**Table 42-20: Additional firefighting manpower required for new rural Fire Stations**

State/UT	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
Andaman and Nicobar Islands	6	0	0	0	0	0	1	0	20	38	124	6	189
Andhra Pradesh	228	0	0	0	0	0	0	407	936	1695	11682	228	14948
Arunachal Pradesh	30	0	0	0	0	0	5	21	124	245	992	30	1417



State/UT	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
Assam	67	0	0	0	0	0	0	128	347	769	3855	67	5166
Bihar	466	0	0	0	0	0	0	852	1927	3512	24050	466	30807
Chandigarh	0	0	0	0	0	0	0	0	0	0	0	0	0
Chhattisgarh	103	0	0	0	0	0	0	205	587	896	999	103	2790
Dadra and Nagar Haveli	4	0	0	0	0	0	1	6	15	27	185	4	238
Daman and Diu	0	0	0	0	0	0	0	0	0	0	0	0	0
Delhi	9	0	0	0	0	3	0	1	31	57	186	9	287
Goa	9	0	0	0	0	0	0	3	31	58	232	9	333
Gujarat	164	0	0	0	0	2	4	281	841	1911	9446	164	12649
Haryana	80	0	0	0	0	0	0	171	398	728	4908	80	6285
Himachal Pradesh	83	0	0	0	0	0	0	20	220	247	1689	83	2259
Jammu and Kashmir	94	0	0	0	0	0	0	9	217	322	1498	94	2140
Jharkhand	137	0	0	0	0	0	1	237	719	1130	1267	137	3491
Karnataka	132	0	0	0	0	0	2	242	682	1540	7723	132	10321
Kerala	71	0	0	0	0	0	0	90	279	474	3132	71	4046
Lakshadweep	5	0	0	0	0	0	0	0	17	32	103	5	157
Madhya Pradesh	163	0	0	0	0	0	19	330	890	2032	10225	163	13659
Maharashtra	666	0	0	0	0	0	26	486	2301	3412	19710	666	26601
Manipur	26	0	0	0	0	0	0	1	64	67	437	26	595
Meghalaya	15	0	0	0	0	0	0	3	52	97	356	15	523
Mizoram	31	0	0	0	0	0	0	2	76	76	514	31	699
Nagaland	29	0	0	0	0	0	3	18	85	114	791	29	1040

State/UT	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
Orissa	126	0	0	0	0	0	3	142	562	1196	5520	126	7549
Puducherry	0	0	0	0	0	0	0	0	0	0	0	0	0
Punjab	93	0	0	0	0	0	0	236	553	1305	6802	93	8989
Rajasthan	641	0	0	0	0	3	31	416	1855	2285	13618	641	18849
Sikkim	15	0	0	0	0	0	0	0	52	97	309	15	473
Tamil Nadu	102	0	0	0	0	0	0	159	402	711	4975	102	6349
Tripura	15	0	0	0	0	0	0	3	37	37	281	15	373
Uttar Pradesh	352	0	0	0	0	0	0	1280	2449	5725	39105	352	48911
Uttarakhand	58	0	0	0	0	0	0	47	179	263	1906	58	2453
West Bengal	252	0	0	0	0	0	0	701	1626	4080	22274	252	28933
<b>Total</b>	<b>4,272</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>8</b>	<b>96</b>	<b>6,497</b>	<b>18,574</b>	<b>35,178</b>	<b>198,894</b>	<b>4,272</b>	<b>263,519</b>

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#### 42.3.4 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 42-21.

**Table 42-21: Fire station building required for gap in operational, new urban and new rural Fire Stations (no. of bays)**

State/UT	Fire Stations	Bay1	Bay2	Bay3	Bay4	Bay5	Bay6	Bay7	Bay More Than 7
A & N Islands	26	0	9	2	2	0	0	1	0
Andhra Pradesh	609	33	44	123	91	57	47	6	8
Arunachal Pradesh	44	23	0	0	0	0	10	5	1
Assam	202	35	23	19	23	14	21	7	25
Bihar	650	96	130	133	115	78	43	19	27
Chandigarh	11	1	2	1	0	0	0	0	0
Chhattisgarh	150	38	8	12	16	25	17	7	17
Dadra and Nagar Haveli	6	0	2	2	1	0	0	-1	1
Daman & Diu	6	-1	2	1	0	0	0	0	1
Delhi	108	0	30	6	6	5	4	4	0
Goa	28	6	7	0	-1	0	0	0	2
Gujarat	394	49	49	48	30	37	26	15	36
Haryana	196	35	21	26	11	7	10	29	1
Himachal Pradesh	119	74	11	3	1	2	6	7	0
J & K	277	33	177	1	2	3	0	0	0
Jharkhand	180	50	15	17	11	11	10	6	40
Karnataka	377	6	27	39	35	36	35	13	38
Kerala	228	53	12	21	8	13	3	15	22
Lakshadweep	9	5	0	0	0	0	0	0	1
Madhya Pradesh	513	112	73	69	51	38	49	125	46
Maharashtra	1,074	-1	696	158	59	18	8	9	11
Manipur	53	33	0	2	0	0	1	6	2
Meghalaya	49	22	5	2	-3	-2	0	1	6
Mizoram	51	34	4	0	0	1	1	5	0
Nagaland	48	24	8	-2	-1	1	2	3	4
Orissa	331	73	-27	19	29	13	25	12	21
Puducherry	17	0	4	1	1	1	0	0	1
Punjab	175	10	27	25	24	21	10	23	0
Rajasthan	874	0	699	46	13	6	5	3	0
Sikkim	25	15	-1	-1	-1	0	3	0	1
Tamil Nadu	451	-12	11	40	39	49	37	16	50

State/UT	Fire Stations	Bay1	Bay2	Bay3	Bay4	Bay5	Bay6	Bay7	Bay More Than 7
Tripura	53	24	3	-2	5	4	0	1	0
Uttar Pradesh	706	69	5	45	31	41	88	325	0
Uttarakhand	124	53	22	5	5	7	2	13	-1
West Bengal	435	9	26	37	58	50	61	10	85
<b>Total</b>	<b>8,599</b>	<b>1,001</b>	<b>2,124</b>	<b>898</b>	<b>661</b>	<b>536</b>	<b>524</b>	<b>685</b>	<b>446</b>

## 42.4 Investment and Financial Analysis

### 42.4.1 CAPITAL COST

#### Building Infrastructure Cost:

Table 42-22 provides details of the Fire Station building infrastructure cost analysis in entire India. 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 42-22: Cost (Lakhs) of Fire Station building (no. of bays) required for gap in operational, new urban and new rural Fire Stations**

State/UT	Fire Stations	Bay1	Bay2	Bay3	Bay4	Bay5	Bay6	Bay7	Bay More Than 7	Total Bay cost
A & N Islands	26	0.0	2,700.0	900.0	1,150.0	0.0	0.0	950.0	0.0	5,700.0
Andhra Pradesh	609	4,950.0	13,200.0	55,350.0	52,325.0	39,900.0	38,775.0	5,700.0	7,600.0	217,800.0
Arunachal Pradesh	44	3,450.0	0.0	0.0	0.0	0.0	8,250.0	4,750.0	950.0	17,400.0
Assam	202	5,250.0	6,900.0	8,550.0	13,225.0	9,800.0	17,325.0	6,650.0	23,750.0	91,450.0
Bihar	650	14,400.0	39,000.0	59,850.0	66,125.0	54,600.0	35,475.0	18,050.0	25,650.0	313,150.0
Chandigarh	11	150.0	600.0	450.0	0.0	0.0	0.0	0.0	0.0	1,200.0
Chhattisgarh	150	5,700.0	2,400.0	5,400.0	9,200.0	17,500.0	14,025.0	6,650.0	16,150.0	77,025.0
Dadra and Nagar Haveli	6	0.0	600.0	900.0	575.0	0.0	0.0	-950.0	950.0	2,075.0
Daman & Diu	6	-150.0	600.0	450.0	0.0	0.0	0.0	0.0	950.0	1,850.0
Delhi	108	0.0	9,000.0	2,700.0	3,450.0	3,500.0	3,300.0	3,800.0	0.0	25,750.0
Goa	28	900.0	2,100.0	0.0	-575.0	0.0	0.0	0.0	1,900.0	4,325.0
Gujarat	394	7,350.0	14,700.0	21,600.0	17,250.0	25,900.0	21,450.0	14,250.0	34,200.0	156,700.0
Haryana	196	5,250.0	6,300.0	11,700.0	6,325.0	4,900.0	8,250.0	27,550.0	950.0	71,225.0
Himachal Pradesh	119	11,100.0	3,300.0	1,350.0	575.0	1,400.0	4,950.0	6,650.0	0.0	29,325.0

State/UT	Fire Stations	Bay1	Bay2	Bay3	Bay4	Bay5	Bay6	Bay7	Bay More Than 7	Total Bay cost
J & K	277	4,950.0	53,100.0	450.0	1,150.0	2,100.0	0.0	0.0	0.0	61,750.0
Jharkhand	180	7,500.0	4,500.0	7,650.0	6,325.0	7,700.0	8,250.0	5,700.0	38,000.0	85,625.0
Karnataka	377	900.0	8,100.0	17,550.0	20,125.0	25,200.0	28,875.0	12,350.0	36,100.0	149,200.0
Kerala	228	7,950.0	3,600.0	9,450.0	4,600.0	9,100.0	2,475.0	14,250.0	20,900.0	72,325.0
Lakshadweep	9	750.0	0.0	0.0	0.0	0.0	0.0	0.0	950.0	1,700.0
Madhya Pradesh	513	16,800.0	21,900.0	31,050.0	29,325.0	26,600.0	40,425.0	118,750.0	43,700.0	328,550.0
Maharashtra	1074	-150.0	208,800.0	71,100.0	33,925.0	12,600.0	6,600.0	8,550.0	10,450.0	351,875.0
Manipur	53	4,950.0	0.0	900.0	0.0	0.0	825.0	5,700.0	1,900.0	14,275.0
Meghalaya	49	3,300.0	1,500.0	900.0	-1,725.0	-1,400.0	0.0	950.0	5,700.0	9,225.0
Mizoram	51	5,100.0	1,200.0	0.0	0.0	700.0	825.0	4,750.0	0.0	12,575.0
Nagaland	48	3,600.0	2,400.0	-900.0	-575.0	700.0	1,650.0	2,850.0	3,800.0	13,525.0
Orissa	331	10,950.0	-8,100.0	8,550.0	16,675.0	9,100.0	20,625.0	11,400.0	19,950.0	89,150.0
Puducherry	17	0.0	1,200.0	450.0	575.0	700.0	0.0	0.0	950.0	3,875.0
Punjab	175	1,500.0	8,100.0	11,250.0	13,800.0	14,700.0	8,250.0	21,850.0	0.0	79,450.0
Rajasthan	874	0.0	209,700.0	20,700.0	7,475.0	4,200.0	4,125.0	2,850.0	0.0	249,050.0
Sikkim	25	2,250.0	-300.0	-450.0	-575.0	0.0	2,475.0	0.0	950.0	4,350.0
Tamil Nadu	451	-1,800.0	3,300.0	18,000.0	22,425.0	34,300.0	30,525.0	15,200.0	47,500.0	169,450.0
Tripura	53	3,600.0	900.0	-900.0	2,875.0	2,800.0	0.0	950.0	0.0	10,225.0
Uttar Pradesh	706	10,350.0	1,500.0	20,250.0	17,825.0	28,700.0	72,600.0	308,750.0	0.0	459,975.0
Uttarakhand	124	7,950.0	6,600.0	2,250.0	2,875.0	4,900.0	1,650.0	12,350.0	-950.0	37,625.0
West Bengal	435	1,350.0	7,800.0	16,650.0	33,350.0	35,000.0	50,325.0	9,500.0	80,750.0	234,725.0
<b>Total</b>	<b>8,599</b>	<b>150,150.0</b>	<b>637,200.0</b>	<b>404,100.0</b>	<b>380,075.0</b>	<b>375,200.0</b>	<b>432,300.0</b>	<b>650,750.0</b>	<b>423,700.0</b>	<b>3,453,475.0</b>

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. 34,534.75 Crores** (Table 42-22).



**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 all States/UTs of India have been estimated (Tables 42-23 to 42-28).

**Table 42-23: Cost estimates (in Lakhs Rupees) for gap in fire fighting vehicles for operational and new urban Fire Stations**

State/UT	Fire Stations	Ideally Served Population Estimates	Water Tenders	Water Bowzers	Foam Tenders	Advanced Rescue Responders	Sky Lifts / TTL	DCP Tenders	Hose Tenders	BA Vans	QRT	Motor Cycle Mists	Fire Boats	Ambulances	Education Vans	Total Vehicle Cost
Andaman and Nicobar Islands	20	329,067	175.0	180.0	120.0	1500.0	0.0	0.0	90.0	90.0	180.0	135.0	30.0	0.0	60.0	2560.0
Andhra Pradesh	381	45,890,756	15995.0	8400.0	3800.0	13500.0	5000.0	1540.0	1800.0	690.0	1008.0	735.8	0.0	0.0	740.0	53208.8
Arunachal Pradesh	14	442,249	-210.0	-30.0	120.0	5500.0	500.0	385.0	330.0	330.0	90.0	74.3	0.0	0.0	220.0	7309.3
Assam	135	19,652,494	1295.0	1590.0	1560.0	13500.0	3500.0	1085.0	900.0	810.0	864.0	668.3	0.0	0.0	580.0	26352.3
Bihar	184	18,081,713	2450.0	2070.0	2280.0	18000.0	6000.0	1645.0	2040.0	1140.0	279.0	270.0	0.0	0.0	760.0	36934.0
Chandigarh	11	1,054,686	175.0	120.0	120.0	0.0	0.0	0.0	60.0	30.0	54.0	27.0	0.0	0.0	20.0	606.0
Chhattisgarh	47	5,431,089	980.0	720.0	560.0	9500.0	2500.0	630.0	600.0	540.0	180.0	141.8	0.0	0.0	360.0	16711.8
Dadra and Nagar Haveli	2	86,984	0.0	0.0	0.0	0.0	500.0	35.0	30.0	30.0	18.0	13.5	0.0	0.0	20.0	646.5
Daman and Diu	6	242,911	70.0	30.0	160.0	0.0	500.0	105.0	60.0	60.0	36.0	27.0	45.0	0.0	40.0	1133.0
Delhi	99	15,786,897	3780.0	1290.0	2360.0	4000.0	1500.0	280.0	120.0	210.0	135.0	87.8	0.0	0.0	180.0	13942.8
Goa	19	863,218	0.0	30.0	120.0	500.0	500.0	70.0	90.0	60.0	36.0	40.5	0.0	0.0	40.0	1486.5
Gujarat	230	33,042,997	4025.0	-660.0	4320.0	500.0	2000.0	2275.0	1500.0	720.0	855.0	675.0	0.0	0.0	660.0	16870.0
Haryana	116	9,373,564	945.0	270.0	640.0	6500.0	3000.0	910.0	780.0	660.0	81.0	67.5	0.0	0.0	420.0	14273.5
Himachal Pradesh	36	2,114,729	140.0	0.0	360.0	4500.0	1000.0	385.0	450.0	360.0	72.0	60.8	0.0	0.0	240.0	7567.8
Jammu and Kashmir	183	9,074,328	0.0	0.0	320.0	8000.0	0.0	245.0	810.0	660.0	387.0	297.0	75.0	0.0	440.0	11234.0

# Fire-Risk and Hazard Analysis in the Country



State/UT	Fire Stations	Ideally Served Population Estimates	Water Tenders	Water Bowzers	Foam Tenders	Advanced Rescue Responders	Sky Lifts / TTL	DCP Tenders	Hose Tenders	BA Vans	QRT	Motor Cycle Mists	Fire Boats	Ambulances	Education Vans	Total Vehicle Cost
Jharkhand	43	8,441,132	1015.0	1140.0	960.0	10500.0	2000.0	945.0	750.0	690.0	261.0	195.8	0.0	0.0	480.0	18936.8
Karnataka	245	37,421,806	5285.0	3930.0	5400.0	7000.0	5500.0	1820.0	1290.0	930.0	1233.0	870.8	0.0	10.0	640.0	33908.8
Kerala	157	22,377,471	2415.0	3870.0	2120.0	0.0	4000.0	525.0	750.0	420.0	504.0	303.8	0.0	0.0	340.0	15247.8
Lakshadweep	4	40,405	-175.0	0.0	40.0	500.0	0.0	35.0	30.0	30.0	36.0	27.0	75.0	0.0	20.0	618.0
Madhya Pradesh	350	40,517,206	5705.0	4740.0	5240.0	21500.0	5000.0	2240.0	1950.0	1500.0	1431.0	1073.3	0.0	0.0	1020.0	51399.3
Maharashtra	408	54,763,986	13895.0	10320.0	4960.0	19000.0	9000.0	2170.0	1950.0	990.0	1053.0	789.8	0.0	0.0	940.0	65067.8
Manipur	27	1,465,942	245.0	0.0	0.0	4000.0	500.0	315.0	270.0	270.0	36.0	114.8	0.0	0.0	180.0	5930.8
Meghalaya	34	2,204,529	-560.0	-30.0	120.0	2000.0	500.0	280.0	210.0	210.0	279.0	209.3	0.0	0.0	140.0	3358.3
Mizoram	20	538,040	175.0	0.0	160.0	4500.0	500.0	280.0	240.0	240.0	18.0	40.5	0.0	0.0	160.0	6313.5
Nagaland	19	826,137	35.0	30.0	520.0	4000.0	1000.0	245.0	210.0	240.0	36.0	74.3	0.0	0.0	160.0	6550.3
Orissa	205	24,913,739	3395.0	2880.0	2320.0	13500.0	5500.0	1190.0	1350.0	900.0	1287.0	985.5	0.0	0.0	700.0	34007.5
Puducherry	17	1,244,268	70.0	210.0	80.0	1500.0	500.0	105.0	120.0	120.0	9.0	6.8	0.0	0.0	80.0	2800.8
Punjab	82	8,777,945	735.0	1140.0	2320.0	10000.0	3000.0	1050.0	690.0	600.0	63.0	47.3	0.0	0.0	400.0	20045.3
Rajasthan	233	22,496,374	3710.0	3630.0	2200.0	18000.0	1000.0	1295.0	1050.0	990.0	9.0	0.0	0.0	0.0	680.0	32564.0
Sikkim	10	264,959	-175.0	0.0	120.0	1500.0	500.0	140.0	120.0	120.0	72.0	60.8	0.0	0.0	80.0	2537.8
Tamil Nadu	349	55,398,068	7315.0	9900.0	9280.0	10500.0	3000.0	2100.0	1590.0	900.0	1701.0	1275.8	0.0	0.0	600.0	48161.8
Tripura	38	2,723,295	175.0	360.0	120.0	2500.0	500.0	105.0	180.0	120.0	9.0	189.0	0.0	0.0	80.0	4338.0
Uttar Pradesh	354	67,634,220	14210.0	12180.0	6320.0	38000.0	10000.0	2660.0	2280.0	2130.0	1044.0	783.0	0.0	0.0	2000.0	91607.0
Uttarakhand	66	4,457,151	1330.0	180.0	440.0	5500.0	1000.0	350.0	390.0	390.0	180.0	81.0	0.0	0.0	260.0	10101.0

State/UT	Fire Stations	Ideally Served Population Estimates	Water Tenders	Water Browsers	Foam Tenders	Advanced Rescue Responders	Sky Lifts / TTL	DCP Tenders	Hose Tenders	BA Vans	QRT	Motor Cycle Mists	Fire Boats	Ambulances	Education Vans	Total Vehicle Cost
West Bengal	183	27,885,929	4410.0	4200.0	5800.0	10000.0	0.0	875.0	1350.0	570.0	414.0	357.8	0.0	0.0	600.0	28576.8
<b>Total</b>	<b>4327</b>	<b>545,860,284</b>	<b>93030.0</b>	<b>72690.0</b>	<b>65360.0</b>	<b>269500.0</b>	<b>79500.0</b>	<b>28315.0</b>	<b>26430.0</b>	<b>18750.0</b>	<b>13950.0</b>	<b>10806.8</b>	<b>225.0</b>	<b>10.0</b>	<b>14340.0</b>	<b>692906.8</b>

**Table 42-24: Cost estimates (in Lakhs Rupees) for gap in fire vehicles for new rural Fire Stations**

State/UT	Fire Stations	Ideally Served Population Estimates	Water Tenders	Water Browsers	Foam Tenders	Advanced Rescue Responders	Sky Lifts / TTL	DCP Tenders	Hose Tenders	BA Vans	QRT	Motor Cycle Mists	Fire Boats	Education Vans	Total Vehicle cost
Andaman and Nicobar Islands	6	50,877	210.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	54.00	40.50	0.00	0.00	304.50
Andhra Pradesh	228	38,774,777	14,105.00	7,080.00	3,560.00	0.00	0.00	1,295.00	120.00	0.00	2,052.00	1,539.00	0.00	0.00	29,751.00
Arunachal Pradesh	30	940,362	1,050.00	0.00	40.00	2,500.00	0.00	175.00	150.00	150.00	270.00	202.50	0.00	100.00	4,637.50
Assam	67	11,516,774	4,375.00	2,610.00	640.00	0.00	0.00	0.00	0.00	0.00	603.00	452.25	0.00	0.00	8,680.25
Bihar	466	85,722,916	29,365.00	17,610.00	6,680.00	0.00	0.00	0.00	120.00	0.00	4,194.00	3,145.50	0.00	0.00	61,114.50
Chandigarh	0	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
Chhattisgarh	103	20,109,486	7,000.00	4,350.00	2,080.00	0.00	0.00	0.00	0.00	0.00	927.00	695.25	0.00	0.00	15,052.25
Dadra and Nagar Haveli	4	255,869	140.00	0.00	80.00	0.00	0.00	175.00	0.00	0.00	36.00	27.00	0.00	0.00	458.00
Daman and Diu	0	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
Delhi	9	837,288	420.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	54.00	60.75	0.00	0.00	534.75
Goa	9	594,505	315.00	0.00	120.00	0.00	0.00	0.00	0.00	0.00	81.00	60.75	0.00	0.00	576.75

# Fire-Risk and Hazard Analysis in the Country



State/UT	Fire Stations	Ideally Served Population Estimates	Water Tenders	Water Bowzers	Foam Tenders	Advanced Rescue Responders	Sky Lifts / TTL	DCP Tenders	Hose Tenders	BA Vans	QRT	Motor Cycle Mists	Fire Boats	Education Vans	Total Vehicle cost
Gujarat	164	27,340,628	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
Haryana	80	15,979,517	6,300.00	1,920.00	2,520.00	0.00	0.00	0.00	0.00	0.00	720.00	540.00	0.00	0.00	12,000.00
Himachal Pradesh	83	4,741,780	3,045.00	450.00	280.00	0.00	0.00	0.00	0.00	0.00	747.00	560.25	0.00	0.00	5,082.25
Jammu and Kashmir	94	3,344,064	2,730.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	306.00	229.50	0.00	0.00	3,265.50
Jharkhand	137	24,525,108	8,225.00	4,350.00	2,680.00	500.00	0.00	280.00	60.00	30.00	1,233.00	924.75	0.00	20.00	18,302.75
Karnataka	132	23,708,912	7,420.00	3,660.00	4,160.00	0.00	0.00	595.00	0.00	0.00	1,188.00	891.00	0.00	20.00	17,934.00
Kerala	71	11,010,206	3,815.00	1,950.00	1,400.00	0.00	0.00	0.00	0.00	0.00	639.00	479.25	0.00	0.00	8,283.25
Lakshadweep	5	24,024	175.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	45.00	33.75	75.00	0.00	328.75
Madhya Pradesh	163	32,080,764	10,570.00	6,270.00	4,040.00	0.00	0.00	105.00	0.00	0.00	1,467.00	1,100.25	0.00	0.00	23,552.25
Maharashtra	666	57,601,624	30,660.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4,248.00	2,463.75	0.00	0.00	37,371.75
Manipur	26	1,255,807	840.00	30.00	40.00	0.00	0.00	0.00	0.00	0.00	216.00	162.00	30.00	0.00	1,318.00
Meghalaya	15	759,478	595.00	0.00	40.00	0.00	0.00	0.00	0.00	0.00	135.00	101.25	0.00	0.00	871.25
Mizoram	31	552,974	1,085.00	0.00	40.00	0.00	0.00	0.00	30.00	0.00	279.00	209.25	0.00	0.00	1,643.25
Nagaland	29	1,154,465	1,050.00	0.00	200.00	1,500.00	0.00	140.00	120.00	90.00	261.00	195.75	0.00	60.00	3,616.75
Orissa	126	17,033,620	6,125.00	2,100.00	2,520.00	0.00	0.00	0.00	210.00	0.00	1,134.00	850.50	0.00	0.00	12,939.50
Puducherry	0	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
Punjab	93	18,926,291	6,860.00	2,880.00	3,440.00	0.00	0.00	735.00	0.00	0.00	837.00	627.75	0.00	0.00	15,379.75
Rajasthan	641	39,479,627	24,360.00	540.00	0.00	0.00	0.00	0.00	0.00	0.00	1,980.00	1,255.50	0.00	0.00	28,135.50
Sikkim	15	342,729	525.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	135.00	101.25	0.00	0.00	761.25
Tamil Nadu	102	16,740,890	5,810.00	2,100.00	2,680.00	0.00	0.00	490.00	0.00	0.00	918.00	688.50	0.00	0.00	12,686.50

State/UT	Fire Stations	Ideally Served Population Estimates	Water Tenders	Water Bowsers	Foam Tenders	Advanced Rescue Responders	Sky Lifts / TTL	DCP Tenders	Hose Tenders	BA Vans	QRT	Motor Cycle Mists	Fire Boats	Education Vans	Total Vehicle cost
Tripura	15	947,737	560.00	30.00	40.00	0.00	0.00	0.00	0.00	0.00	135.00	101.25	0.00	0.00	866.25
Uttar Pradesh	352	131,947,257	39,865.00	28,860.00	6,000.00	0.00	0.00	0.00	0.00	0.00	3,168.00	2,376.00	0.00	0.00	80,269.00
Uttarakhand	58	5,659,601	3,395.00	210.00	520.00	0.00	0.00	0.00	0.00	0.00	522.00	391.50	0.00	0.00	5,038.50
West Bengal	252	63,461,807	21,490.00	11,970.00	7,880.00	0.00	0.00	0.00	30.00	0.00	2,268.00	1,701.00	0.00	20.00	45,359.00
<b>Total</b>	<b>4272</b>	<b>657,421,764</b>	<b>251,160.00</b>	<b>103,230.00</b>	<b>55,960.00</b>	<b>5,000.00</b>	<b>0.00</b>	<b>5,600.00</b>	<b>870.00</b>	<b>300.00</b>	<b>32,328.00</b>	<b>23,314.50</b>	<b>105.00</b>	<b>240.00</b>	<b>478,107.50</b>



**Table 42-25: Cost estimate (in Lakhs Rupees) for gap in fire fighting specialized equipment for operational and new urban Fire Stations**

State/UT	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
Andaman and Nicobar Islands	20	375.00	110.00	82.80	37.50	4.90	250.00	7.20	3.00	7.50	172.50	18.00	162.50	46.00	2.00
Andhra Pradesh	381	1,245.00	2,417.50	2,136.00	679.50	147.90	830.00	282.40	226.00	135.00	3,677.50	303.90	539.50	1,850.00	0.00
Arunachal Pradesh	14	210.00	97.50	53.20	21.00	4.10	140.00	11.20	6.00	4.20	62.50	17.70	91.00	56.00	0.00
Assam	135	720.00	460.00	813.60	243.00	56.60	700.00	52.00	81.50	44.10	1,220.00	60.00	455.00	720.00	0.00
Bihar	184	2,160.00	1,165.00	858.00	321.00	60.00	1,440.00	135.20	99.00	64.50	1,542.50	162.00	955.50	698.00	0.00
Chandigarh	11	195.00	135.00	57.20	15.00	4.80	110.00	9.60	6.00	3.60	-57.50	15.00	84.50	72.00	0.00
Chhattisgarh	47	240.00	377.50	252.40	79.50	17.00	200.00	32.80	25.50	15.90	360.00	47.40	130.00	190.00	0.00
Dadra and Nagar Haveli	2	75.00	20.00	10.40	1.50	-0.20	10.00	-2.40	-1.50	0.30	5.00	1.80	13.00	10.00	-1.00
Daman and Diu	6	120.00	45.00	25.60	4.50	1.70	20.00	-9.60	-5.50	1.50	25.00	6.90	6.50	16.00	8.00
Delhi	99	1,620.00	1,005.00	391.20	180.00	43.40	1,040.00	74.40	57.50	35.40	732.50	129.90	702.00	572.00	0.00
Goa	19	180.00	77.50	44.80	30.00	3.70	20.00	10.40	-11.00	6.90	27.50	9.90	6.50	54.00	0.00
Gujarat	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
Haryana	116	930.00	960.00	559.20	237.00	39.70	640.00	99.20	72.00	44.40	1,095.00	92.70	409.50	490.00	0.00
Himachal Pradesh	36	480.00	220.00	101.20	52.50	6.50	380.00	24.80	15.50	10.80	220.00	33.90	247.00	118.00	0.00
Jammu and Kashmir	183	1,620.00	402.50	566.80	295.50	46.10	1,060.00	137.60	82.00	55.50	850.00	81.30	695.50	188.00	4.00
Jharkhand	43	345.00	560.00	356.00	72.00	20.50	220.00	33.60	24.00	14.40	507.50	70.50	149.50	416.00	0.00

State/UT	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
Karnataka	245	1,005.00	1,570.00	1,451.60	366.00	86.20	660.00	64.00	107.00	80.40	2,667.50	194.10	474.50	1,194.00	0.00
Kerala	157	810.00	1,182.50	960.80	279.00	72.20	540.00	117.60	25.00	56.70	1,572.50	165.30	201.50	970.00	0.00
Lakshadweep	4	30.00	12.50	15.20	7.50	0.90	20.00	0.80	1.50	1.50	30.00	1.50	13.00	12.00	5.00
Madhya Pradesh	350	930.00	1,687.50	1,837.20	621.00	113.60	690.00	106.40	190.00	125.40	3,075.00	204.00	448.50	1,910.00	0.00
Maharashtra	408	2,490.00	4,355.00	2,444.80	735.00	152.40	1,620.00	343.20	165.50	142.20	-1,337.50	481.20	1,085.50	2,612.00	0.00
Manipur	27	360.00	135.00	100.80	37.50	8.30	240.00	14.40	13.00	8.70	170.00	19.20	156.00	60.00	0.00
Meghalaya	34	195.00	112.50	145.60	48.00	11.00	130.00	6.40	19.50	12.00	260.00	16.50	84.50	118.00	0.00
Mizoram	20	315.00	87.50	65.60	31.50	5.10	210.00	16.80	11.00	6.60	97.50	17.40	136.50	66.00	0.00
Nagaland	19	300.00	145.00	115.20	30.00	8.10	200.00	16.00	10.00	6.00	200.00	25.20	130.00	100.00	0.00
Orissa	205	765.00	550.00	1,052.00	343.50	65.50	320.00	71.20	9.50	71.70	1,875.00	86.40	214.50	0.00	154.00
Puducherry	17	60.00	72.50	99.20	28.50	6.00	40.00	15.20	5.50	5.70	100.00	17.40	26.00	70.00	0.00
Punjab	82	975.00	675.00	557.20	175.50	34.30	650.00	54.40	56.50	35.40	900.00	66.00	422.50	426.00	0.00
Rajasthan	233	645.00	1,835.00	1,387.20	601.50	101.00	430.00	216.00	201.00	122.10	2,312.50	224.10	279.50	944.00	0.00
Sikkim	10	90.00	27.50	32.40	13.50	2.20	50.00	4.80	2.00	3.60	62.50	6.30	39.00	12.00	0.00
Tamil Nadu	349	1,455.00	2,262.50	2,173.20	613.50	133.10	290.00	155.20	158.50	123.60	3,550.00	285.60	175.50	2,504.00	0.00
Tripura	38	345.00	127.50	151.20	67.50	10.00	240.00	16.00	22.00	13.50	277.50	18.00	156.00	44.00	0.00
Uttar Pradesh	354	2,955.00	2,507.50	2,531.60	615.00	170.60	1,970.00	229.60	200.50	125.70	4,212.50	304.80	1,280.50	2,252.00	0.00
Uttarakhand	66	930.00	437.50	243.60	105.00	10.20	720.00	48.00	34.00	22.50	447.50	58.80	474.50	252.00	0.00
West Bengal	183	570.00	2,025.00	1,348.00	318.00	79.60	480.00	157.60	106.50	61.50	2,187.50	243.60	312.00	1,486.00	0.00
<b>Total</b>	<b>4327</b>	<b>27,045.00</b>	<b>29,932.50</b>	<b>24,450.40</b>	<b>7,707.00</b>	<b>1,612.70</b>	<b>17,700.00</b>	<b>2,646.40</b>	<b>2,078.00</b>	<b>1,548.00</b>	<b>35,435.00</b>	<b>3,764.10</b>	<b>11,518.00</b>	<b>22,158.00</b>	<b>178.00</b>

**Table 42-26: Cost estimate (in Lakhs Rupees) for gap in fire fighting specialized equipment for operational and new urban Fire Stations (contd...)**

State/UT	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
Andaman and Nicobar Islands	20	0.00	8.00	42.00	20.00	40.00	24.00	0.00	1.35	5.10	2.16	7.50	1429.01
Andhra Pradesh	381	0.00	0.00	938.70	355.00	410.00	467.20	0.00	-9.18	204.51	62.16	136.80	17035.39
Arunachal Pradesh	14	0.00	0.00	27.30	13.00	70.00	21.20	0.00	3.78	18.87	13.08	4.20	945.83
Assam	135	0.00	0.00	249.90	26.00	340.00	248.00	0.00	42.66	132.77	94.68	49.20	6809.01
Bihar	184	0.00	0.00	375.90	188.00	730.00	178.40	0.00	55.89	146.71	108.48	64.50	11508.58
Chandigarh	11	0.00	0.00	8.40	13.00	30.00	14.40	0.00	0.81	4.59	5.64	3.90	730.94
Chhattisgarh	47	0.00	0.00	100.80	48.00	95.00	71.20	0.00	14.31	49.64	36.24	15.90	2399.09
Dadra and Nagar Haveli	2	0.00	-4.00	-4.20	2.00	-5.00	1.20	0.00	0.27	1.53	1.32	0.60	135.62
Daman and Diu	6	0.00	48.00	6.30	5.00	-15.00	3.20	15.00	1.08	4.08	3.84	1.80	338.9
Delhi	99	0.00	0.00	207.90	98.00	465.00	187.60	0.00	14.85	52.87	35.64	36.00	7681.16
Goa	19	0.00	0.00	18.90	18.00	5.00	13.20	0.00	1.89	7.82	6.24	6.90	538.15
Gujarat	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
Haryana	116	0.00	0.00	275.10	121.00	310.00	140.40	-10.00	41.04	63.75	53.52	46.80	6710.31
Himachal Pradesh	36	0.00	0.00	63.00	38.00	190.00	23.60	0.00	10.53	30.43	22.32	11.70	2299.78
Jammu and Kashmir	183	56.00	0.00	384.30	95.00	490.00	149.60	0.00	33.48	49.30	39.00	59.10	7440.58
Jharkhand	43	0.00	0.00	100.80	39.00	115.00	80.40	0.00	12.96	69.02	48.96	14.40	3269.54
Karnataka	245	0.00	0.00	443.10	180.00	180.00	355.60	-5.00	35.64	159.80	147.24	87.30	11503.98
Kerala	157	0.00	0.00	287.70	143.00	190.00	270.80	0.00	51.30	137.36	101.04	57.30	8191.6
Lakshadweep	4	0.00	20.00	10.50	2.00	10.00	4.40	25.00	1.35	3.06	2.16	1.50	231.37
Madhya Pradesh	350	0.00	0.00	877.80	288.00	345.00	475.60	0.00	102.33	268.60	203.28	125.40	14624.61
Maharashtra	408	0.00	0.00	856.80	407.00	490.00	698.80	0.00	107.46	254.83	123.60	146.70	18374.49

State/UT	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
Manipur	27	0.00	0.00	60.90	23.00	110.00	29.60	0.00	7.56	17.51	15.00	8.70	1595.17
Meghalaya	34	0.00	0.00	75.60	12.00	55.00	31.20	5.00	8.91	26.35	16.92	12.30	1402.28
Mizoram	20	0.00	0.00	46.20	21.00	105.00	18.80	0.00	5.13	16.32	9.60	6.60	1295.15
Nagaland	19	0.00	0.00	42.00	20.00	100.00	33.60	0.00	4.86	21.42	15.48	6.00	1528.86
Orissa	205	0.00	656.00	-317.10	100.00	130.00	200.40	0.00	63.72	171.36	122.40	73.20	6778.28
Puducherry	17	0.00	0.00	35.70	11.00	15.00	25.60	0.00	2.70	9.18	3.72	5.70	654.6
Punjab	82	0.00	0.00	239.40	94.00	325.00	132.00	0.00	27.54	76.50	45.60	35.40	6003.24
Rajasthan	233	0.00	0.00	489.30	233.00	210.00	342.40	0.00	107.73	151.47	92.52	122.10	11047.42
Sikkim	10	0.00	0.00	21.00	5.00	20.00	12.40	0.00	0.00	8.50	4.44	3.60	420.74
Tamil Nadu	349	0.00	0.00	793.80	192.00	245.00	683.60	0.00	100.98	317.90	219.00	124.50	16556.48
Tripura	38	0.00	0.00	94.50	24.00	120.00	32.80	0.00	3.51	17.51	18.00	13.50	1812.02
Uttar Pradesh	354	0.00	0.00	758.10	306.00	980.00	653.60	0.00	64.53	229.16	202.92	93.00	22642.61
Uttarakhand	66	0.00	0.00	115.50	72.00	315.00	53.20	0.00	11.34	24.48	23.64	22.50	4421.26
West Bengal	183	0.00	0.00	457.80	204.00	220.00	366.80	0.00	37.80	167.96	114.96	66.00	11010.62
<b>Total</b>	<b>4327</b>	<b>232.00</b>	<b>950.00</b>	<b>8,706.60</b>	<b>3,626.00</b>	<b>7,750.00</b>	<b>6,378.40</b>	<b>75.00</b>	<b>1,027.89</b>	<b>3,101.82</b>	<b>2,166.60</b>	<b>1,552.80</b>	<b>223340.2</b>

**Table 42-27: Cost estimate (in Lakhs Rupees) for gap in specialized fire equipment for new rural Fire Stations**

State/UT	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
Andaman and Nicobar Islands	6	0.00	0.00	9.60	9.00	1.20	0.00	4.80	3.00	1.80	15.00	0.00	0.00	12.00	0.00
Andhra Pradesh	228	0.00	0.00	1,616.80	414.00	114.80	0.00	0.00	138.00	82.80	2,870.00	0.00	0.00	1,912.00	0.00
Arunachal Pradesh	30	75.00	25.00	87.60	51.00	7.10	50.00	4.00	17.00	10.20	177.50	6.00	32.50	122.00	0.00
Assam	67	0.00	0.00	503.20	117.00	35.30	0.00	0.00	39.00	23.40	882.50	0.00	0.00	590.00	0.00
Bihar	466	0.00	0.00	3,505.20	838.50	247.10	0.00	0.00	279.50	167.70	6,177.50	0.00	0.00	4,118.00	0.00
Chandigarh	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
Chhattisgarh	103	0.00	0.00	861.20	186.00	60.00	0.00	0.00	62.00	37.20	1,500.00	0.00	0.00	1,000.00	0.00
Dadra and Nagar Haveli	4	15.00	0.00	15.20	7.50	1.20	0.00	2.40	2.50	1.50	30.00	0.00	0.00	20.00	1.00
Daman and Diu	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
Delhi	9	0.00	0.00	12.80	13.50	1.20	0.00	0.00	3.00	1.80	15.00	0.00	0.00	24.00	0.00
Goa	9	60.00	0.00	32.00	16.50	2.50	0.00	0.00	5.50	3.30	62.50	0.00	0.00	42.00	0.00
Gujarat	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
Haryana	80	0.00	967.50	555.20	120.00	38.70	0.00	0.00	40.00	24.00	967.50	0.00	0.00	774.00	0.00
Himachal Pradesh	83	0.00	0.00	288.80	145.50	23.10	0.00	0.00	48.50	29.10	577.50	69.30	0.00	384.00	0.00
Jammu and Kashmir	94	0.00	0.00	163.20	141.00	17.90	0.00	60.00	47.00	28.20	280.00	0.00	0.00	224.00	0.00
Jharkhand	137	15.00	17.50	990.40	243.00	70.00	10.00	0.80	81.00	48.60	1,750.00	2.10	6.50	1,168.00	0.00
Karnataka	132	0.00	0.00	969.20	237.00	68.40	0.00	0.00	79.00	47.40	1,710.00	0.00	0.00	1,140.00	0.00
Kerala	71	0.00	0.00	469.20	127.50	33.50	0.00	0.00	42.50	25.50	837.50	0.00	0.00	560.00	0.00
Lakshadweep	5	0.00	0.00	14.40	9.00	1.20	0.00	0.00	3.00	1.80	30.00	0.00	0.00	20.00	5.00

State/UT	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
Madhya Pradesh	163	0.00	0.00	1,331.60	292.50	93.00	0.00	0.00	97.50	58.50	2,325.00	0.00	0.00	1,550.00	0.00
Maharashtra	666	0.00	0.00	2,534.40	999.00	66.60	0.00	0.00	823.00	493.80	4,115.00	0.00	0.00	2,696.00	0.00
Manipur	26	0.00	5.00	72.80	46.50	6.40	0.00	0.00	15.50	9.30	150.00	0.00	0.00	56.00	2.00
Meghalaya	15	0.00	0.00	48.80	25.50	4.00	0.00	0.00	8.50	5.10	100.00	0.00	0.00	66.00	0.00
Mizoram	31	0.00	180.00	91.60	57.00	7.70	0.00	0.00	19.00	11.40	192.50	21.60	0.00	126.00	0.00
Nagaland	29	45.00	15.00	94.40	49.50	7.70	30.00	2.40	16.50	9.90	192.50	3.00	19.50	124.00	0.00
Orissa	126	0.00	0.00	712.00	225.00	51.90	0.00	0.00	75.00	45.00	1,297.50	0.00	0.00	0.00	0.00
Puducherry	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
Punjab	93	0.00	0.00	826.40	139.50	56.30	0.00	0.00	46.50	27.90	1,242.50	0.00	0.00	940.00	0.00
Rajasthan	641	0.00	0.00	1,148.80	961.50	131.30	0.00	0.00	320.50	192.30	2,332.50	0.00	0.00	1,868.00	0.00
Sikkim	15	0.00	0.00	43.20	27.00	3.60	0.00	0.00	9.00	5.40	90.00	0.00	0.00	60.00	0.00
Tamil Nadu	102	0.00	0.00	679.20	184.50	48.80	0.00	0.00	61.50	36.90	1,220.00	0.00	0.00	810.00	0.00
Tripura	15	0.00	0.00	48.80	25.50	4.00	0.00	0.00	8.50	5.10	100.00	0.00	0.00	80.00	0.00
Uttar Pradesh	352	0.00	0.00	4,660.00	631.50	312.50	0.00	0.00	210.50	126.30	7,812.50	0.00	0.00	5,206.00	0.00
Uttarakhand	58	0.00	0.00	280.40	103.50	21.10	0.00	0.00	34.50	20.70	527.50	0.00	0.00	350.00	0.00
West Bengal	252	0.00	0.00	2,565.60	451.50	175.40	0.00	0.00	150.50	90.30	4,385.00	0.00	0.00	3,508.00	0.00
<b>Total</b>	<b>4272</b>	<b>210.00</b>	<b>1,210.00</b>	<b>26,343.60</b>	<b>7,189.50</b>	<b>1,793.00</b>	<b>470.00</b>	<b>74.40</b>	<b>2,885.00</b>	<b>1,731.00</b>	<b>45,952.50</b>	<b>102.00</b>	<b>305.50</b>	<b>30,874.00</b>	<b>8.00</b>



**Table 42-28: Cost estimate (in Lakhs Rupees) for gap in specialized fire equipment for new rural Fire Stations**  
(continued...)

State/UT	Fire Stations	Diving Suits (Dry)	Diving Suits (Wet)	Inflatable Lighting Towers	Smoke Exhaustors / PPV	Pneumatic lifting bags	High Capacity LED Torches	Rescue Boats	Static Wireless Sets	Mobile Wireless Sets	Walky Talky	Mega Phones	Total
Andaman and Nicobar Islands	6	0.00	0.00	12.60	0.00	30.00	2.40	0.00	1.62	1.02	1.44	1.80	107.28
Andhra Pradesh	228	0.00	0.00	579.60	0.00	0.00	476.40	0.00	74.52	203.49	143.64	82.80	8708.85
Arunachal Pradesh	30	0.00	0.00	71.40	5.00	25.00	32.00	0.00	9.18	17.17	12.12	10.20	846.97
Assam	67	0.00	0.00	163.80	0.00	0.00	141.20	0.00	21.06	60.01	42.36	23.40	2642.23
Bihar	466	0.00	0.00	1,173.90	0.00	0.00	988.40	0.00	150.93	420.75	297.00	167.70	18532.18
Chandigarh	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Chhattisgarh	103	0.00	0.00	260.40	0.00	0.00	240.00	0.00	33.48	102.00	72.00	37.20	4451.48
Dadra and Nagar Haveli	4	0.00	0.00	10.50	0.00	10.00	7.20	0.00	1.35	3.23	2.28	1.50	132.36
Daman and Diu	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Delhi	9	0.00	0.00	18.90	0.00	15.00	3.60	0.00	2.43	2.72	2.52	2.70	119.17
Goa	9	0.00	4.00	23.10	0.00	0.00	10.00	5.00	2.97	4.25	3.00	3.30	279.92
Gujarat	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
Haryana	80	0.00	0.00	170.10	0.00	0.00	156.40	0.00	21.87	66.47	47.04	24.30	3973.08
Himachal Pradesh	83	0.00	0.00	203.70	0.00	0.00	92.40	0.00	26.19	39.27	27.72	29.10	1984.18
Jammu and Kashmir	94	0.00	0.00	197.40	0.00	0.00	37.60	0.00	25.38	19.04	22.56	28.20	1291.48
Jharkhand	137	0.00	0.00	340.20	1.00	5.00	283.60	0.00	43.74	121.55	85.80	48.60	5332.39
Karnataka	132	0.00	0.00	331.80	0.00	0.00	282.00	0.00	42.66	120.02	84.72	47.40	5159.6
Kerala	71	0.00	0.00	178.50	0.00	0.00	134.00	0.00	22.95	56.95	40.20	25.50	2553.8
Lakshadweep	5	0.00	20.00	12.60	0.00	0.00	4.80	25.00	1.62	2.04	1.44	1.80	153.7
Madhya Pradesh	163	0.00	0.00	409.50	0.00	0.00	373.20	0.00	52.65	158.61	111.96	58.50	6912.52
Maharashtra	666	0.00	0.00	1,398.60	0.00	0.00	266.40	0.00	179.82	279.82	159.84	199.80	14212.08

State/UT	Fire Stations	Diving Suits (Dry)	Diving Suits (Wet)	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
Manipur	26	8.00	4.00	65.10	0.00	0.00	24.00	10.00	8.37	10.54	7.68	9.30	510.49
Meghalaya	15	0.00	0.00	35.70	0.00	0.00	16.00	0.00	4.59	6.80	4.80	5.10	330.89
Mizoram	31	0.00	0.00	79.80	0.00	0.00	30.80	0.00	10.26	13.26	9.36	11.40	861.68
Nagaland	29	0.00	0.00	69.30	3.00	15.00	32.40	0.00	8.91	16.49	11.64	9.90	776.04
Orissa	126	0.00	0.00	315.00	0.00	0.00	207.60	0.00	40.50	89.59	63.24	45.00	3167.33
Puducherry	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Punjab	93	0.00	0.00	199.50	0.00	0.00	198.80	0.00	25.65	97.07	69.48	27.90	3897.5
Rajasthan	641	0.00	0.00	1,346.10	0.00	0.00	256.40	0.00	173.07	140.76	153.84	192.30	9217.37
Sikkim	15	0.00	0.00	37.80	0.00	0.00	14.40	0.00	4.86	6.12	4.32	5.40	311.1
Tamil Nadu	102	0.00	0.00	258.30	0.00	0.00	201.60	0.00	33.21	85.68	60.48	36.90	3717.07
Tripura	15	0.00	0.00	35.70	0.00	0.00	16.00	0.00	4.59	6.80	4.80	5.10	344.89
Uttar Pradesh	352	0.00	0.00	884.10	0.00	0.00	1,250.00	0.00	113.67	531.25	375.00	126.30	22239.62
Uttarakhand	58	0.00	0.00	144.90	0.00	0.00	84.40	0.00	18.63	35.87	25.32	20.70	1667.52
West Bengal	252	0.00	0.00	632.10	0.00	0.00	701.60	0.00	81.27	298.52	210.72	90.30	13340.81
<b>Total</b>	<b>4272</b>	<b>8.00</b>	<b>28.00</b>	<b>10,071.60</b>	<b>9.00</b>	<b>290.00</b>	<b>6,904.80</b>	<b>40.00</b>	<b>1,294.92</b>	<b>3,162.17</b>	<b>2,260.68</b>	<b>1,438.20</b>	<b>144,655.9</b>

#### 42.4.2 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 in each State is shown in Table 42-29 and Table 42-30. The total estimated annual manpower cost for existing and proposed staff will be **Rs. 9,998.29 Crores** (Table 42-29) after filling gap in operational and new urban Fire Stations and **Rs. 8,777.22 Crores only** (Table 42-30) for new rural Fire Stations.

**Table 42-29: Annual cost estimates (in Lakhs Rupees) for manpower for entire India after filling up the gap in operational and new urban Fire Stations**

State/UT	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
Andaman and Nicobar Islands	20	14.76	0.00	17.22	0.00	25.60	17.16	70.70	352.60	430.30	1,986.12	-12.60	2,901.86
Andhra Pradesh	381	44.28	82.50	103.32	0.00	313.60	674.96	3,403.70	5,934.00	8,308.10	60,380.64	310.80	79,555.90
Arunachal Pradesh	14	29.52	13.75	17.22	0.00	38.40	34.32	196.95	361.20	652.07	3,683.88	11.76	5,039.07
Assam	135	29.52	27.50	34.44	0.00	134.40	205.92	1,100.90	2,549.90	4,673.72	27,478.44	28.56	36,263.30
Bihar	184	44.28	41.25	68.88	0.00	428.80	783.64	1,757.40	3,564.70	5,173.53	38,112.12	154.56	50,129.16
Chandigarh	11	0.00	13.75	0.00	0.00	12.80	22.88	70.70	223.60	347.55	1,526.04	9.24	2,226.56
Chhattisgarh	47	29.52	0.00	17.22	0.00	115.20	217.36	600.95	1,216.90	1,102.23	848.88	37.80	4,186.06
Dadra and Nagar Haveli	2	0.00	13.75	8.61	0.00	6.40	5.72	30.30	47.30	95.99	732.24	1.68	941.99
Daman and Diu	6	0.00	13.75	8.61	0.00	6.40	5.72	75.75	124.70	261.49	1,590.84	2.52	2,089.78
Delhi	99	0.00	41.25	60.27	135.54	160.00	-68.64	792.85	1,922.10	1,966.14	14,499.00	43.68	19,552.19
Goa	19	14.76	13.75	8.61	0.00	12.80	28.60	25.25	215.00	162.19	1,587.60	12.60	2,081.16
Gujarat	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
Haryana	116	0.00	275.00	180.81	0.00	134.40	228.80	727.20	2,128.50	3,084.92	20,395.80	90.72	27,246.15
Himachal Pradesh	36	0.00	41.25	68.88	-7.53	89.60	137.28	373.70	640.70	920.18	6,800.76	28.56	9,093.38
Jammu and Kashmir	183	14.76	27.50	0.00	45.18	51.20	148.72	520.15	2,107.00	542.84	13,436.28	120.96	17,014.59
Jharkhand	43	29.52	0.00	17.22	0.00	147.20	251.68	868.60	1,496.40	1,241.25	469.80	36.12	4,557.79
Karnataka	245	29.52	27.50	68.88	-60.24	96.00	480.48	2,025.05	5,138.50	7,659.34	49,215.60	182.28	64,862.91
Kerala	157	14.76	68.75	86.10	0.00	147.20	257.40	1,201.90	2,747.70	3,472.19	29,710.80	56.28	37,763.08
Lakshadweep	4	0.00	13.75	8.61	0.00	6.40	11.44	25.25	68.80	129.09	641.52	2.52	907.38
Madhya Pradesh	350	59.04	55.00	86.10	0.00	345.60	594.88	2,934.05	7,116.50	11,657.82	66,128.40	272.16	89,249.55
Maharashtra	408	88.56	330.00	258.30	0.00	825.60	1,304.16	2,964.35	7,077.80	8,963.48	51,749.28	124.32	73,685.85

# Fire-Risk and Hazard Analysis in the Country



State/UT	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
Manipur	27	0.00	13.75	8.61	0.00	44.80	74.36	247.45	468.70	609.04	4,442.04	22.68	5,931.43
Meghalaya	34	14.76	13.75	34.44	0.00	25.60	62.92	141.40	563.30	949.97	5,009.04	12.60	6,827.78
Mizoram	20	14.76	13.75	17.22	0.00	38.40	68.64	161.60	369.80	483.26	3,311.28	8.40	4,487.11
Nagaland	19	14.76	0.00	0.00	0.00	38.40	51.48	227.25	374.10	675.24	4,707.72	-1.68	6,087.27
Orissa	205	44.28	41.25	68.88	0.00	224.00	348.92	1,141.30	3,968.90	5,425.09	34,113.96	162.96	45,539.54
Puducherry	17	0.00	13.75	0.00	15.06	25.60	22.88	126.25	270.90	291.28	2,225.88	1.68	2,993.28
Punjab	82	14.76	261.25	172.20	0.00	140.80	211.64	797.90	1,315.80	2,515.60	17,100.72	63.84	22,594.51
Rajasthan	233	118.08	426.25	284.13	0.00	601.60	983.84	1,408.95	3,534.60	4,157.36	26,642.52	141.96	38,299.29
Sikkim	10	14.76	0.00	-8.61	0.00	19.20	34.32	60.60	133.30	327.69	1,875.96	8.40	2,465.62
Tamil Nadu	349	44.28	27.50	137.76	0.00	153.60	360.36	3,348.15	6,209.20	8,212.11	65,551.68	-6.72	84,037.92
Tripura	38	14.76	13.75	17.22	0.00	32.00	74.36	106.05	348.30	258.18	1,435.32	0.84	2,300.78
Uttar Pradesh	354	59.04	591.25	611.31	0.00	563.20	1,012.44	4,433.90	8,750.50	13,412.12	90,454.32	239.40	120,127.48
Uttarakhand	66	14.76	13.75	68.88	0.00	96.00	165.88	353.50	1,044.90	1,337.24	7,536.24	42.84	10,673.99
West Bengal	183	73.80	68.75	94.71	0.00	288.00	434.72	1,429.15	3,427.10	2,307.07	37,315.08	43.68	45,482.06
<b>Total</b>	<b>4327</b>	<b>929.88</b>	<b>2,598.75</b>	<b>2,789.64</b>	<b>128.01</b>	<b>5,676.80</b>	<b>9,769.76</b>	<b>36,405.45</b>	<b>81,248.50</b>	<b>111,156.42</b>	<b>746,771.40</b>	<b>2,354.52</b>	<b>999,829.13</b>

**Level 10:** Director General/ Director/Deputy Director/ Joint Director; **Level 9:** CFO/ CO; **Level 8:** Deputy CFO/Joint Director; **Level 7:** Assistant Director/Deputy Controller/Deputy Director/DO; **Level 6:** DO/DFO/Inspector/EO/Fire Supervisor; **Level 5:** ADFO/ADO/AFO/Fire In-charge; **Level 4:** St.O/Sub Inspector/Station In-charge/ASst O./AEO; **Level 3:** S O/Assistant Sub Inspector/ASO/Sub-Fire Officer; **Level 2 :** LFM/ Mechanic Driver/Head Constable/Store Superintendent; **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 42-30: Cost estimate (In Lakhs Rupees) manpower in entire India for new rural Fire Stations**

State/UT	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
Andaman and Nicobar Islands	6	0.00	0.00	0.00	0.00	0.00	5.72	0.00	86.00	125.78	401.76	5.04	624.30
Andhra Pradesh	228	0.00	0.00	0.00	0.00	0.00	0.00	2,055.35	4,024.80	5,610.45	37,849.68	191.52	49,731.80
Arunachal Pradesh	30	0.00	0.00	0.00	0.00	0.00	28.60	106.05	533.20	810.95	3,214.08	25.20	4,718.08
Assam	67	0.00	0.00	0.00	0.00	0.00	0.00	646.40	1,492.10	2,545.39	12,490.20	56.28	17,230.37
Bihar	466	0.00	0.00	0.00	0.00	0.00	0.00	4,302.60	8,286.10	11,624.72	77,922.00	391.44	102,526.86
Chandigarh	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
Chhattisgarh	103	0.00	0.00	0.00	0.00	0.00	0.00	1,035.25	2,524.10	2,965.76	3,236.76	86.52	9,848.39
Dadra and Nagar Haveli	4	0.00	0.00	0.00	0.00	0.00	5.72	30.30	64.50	89.37	599.40	3.36	792.65
Daman and Diu	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
Delhi	9	0.00	0.00	0.00	0.00	19.20	0.00	5.05	133.30	188.67	602.64	7.56	956.42
Goa	9	0.00	0.00	0.00	0.00	0.00	0.00	15.15	133.30	191.98	751.68	7.56	1,099.67
Gujarat	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
Haryana	80	0.00	0.00	0.00	0.00	0.00	0.00	863.55	1,711.40	2,409.68	15,901.92	67.20	20,953.75
Himachal Pradesh	83	0.00	0.00	0.00	0.00	0.00	0.00	101.00	946.00	817.57	5,472.36	69.72	7,406.65
Jammu and Kashmir	94	0.00	0.00	0.00	0.00	0.00	0.00	45.45	933.10	1,065.82	4,853.52	78.96	6,976.85
Jharkhand	137	0.00	0.00	0.00	0.00	0.00	5.72	1,196.85	3,091.70	3,740.30	4,105.08	115.08	12,254.73
Karnataka	132	0.00	0.00	0.00	0.00	0.00	11.44	1,222.10	2,932.60	5,097.40	25,022.52	110.88	34,396.94
Kerala	71	0.00	0.00	0.00	0.00	0.00	0.00	454.50	1,199.70	1,568.94	10,147.68	59.64	13,430.46
Lakshadweep	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	73.10	105.92	333.72	4.20	516.94
Madhya Pradesh	163	0.00	0.00	0.00	0.00	0.00	108.68	1,666.50	3,827.00	6,725.92	33,129.00	136.92	45,594.02
Maharashtra	666	0.00	0.00	0.00	0.00	0.00	148.72	2,454.30	9,894.30	11,293.72	63,860.40	559.44	88,210.88
Manipur	26	0.00	0.00	0.00	0.00	0.00	0.00	5.05	275.20	221.77	1,415.88	21.84	1,939.74
Meghalaya	15	0.00	0.00	0.00	0.00	0.00	0.00	15.15	223.60	321.07	1,153.44	12.60	1,725.86
Mizoram	31	0.00	0.00	0.00	0.00	0.00	0.00	10.10	326.80	251.56	1,665.36	26.04	2,279.86
Nagaland	29	0.00	0.00	0.00	0.00	0.00	17.16	90.90	365.50	377.34	2,562.84	24.36	3,438.10

State/UT	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
Orissa	126	0.00	0.00	0.00	0.00	0.00	17.16	717.10	2,416.60	3,958.76	17,884.80	105.84	25,100.26
Puducherry	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
Punjab	93	0.00	0.00	0.00	0.00	0.00	0.00	1,191.80	2,377.90	4,319.55	22,038.48	78.12	30,005.85
Rajasthan	641	0.00	0.00	0.00	0.00	19.20	177.32	2,100.80	7,976.50	7,563.35	44,122.32	538.44	62,497.93
Sikkim	15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	223.60	321.07	1,001.16	12.60	1,558.43
Tamil Nadu	102	0.00	0.00	0.00	0.00	0.00	0.00	802.95	1,728.60	2,353.41	16,119.00	85.68	21,089.64
Tripura	15	0.00	0.00	0.00	0.00	0.00	0.00	15.15	159.10	122.47	910.44	12.60	1,219.76
Uttar Pradesh	352	0.00	0.00	0.00	0.00	0.00	0.00	6,464.00	10,530.70	18,949.75	126,700.20	295.68	162,940.33
Uttarakhand	58	0.00	0.00	0.00	0.00	0.00	0.00	237.35	769.70	870.53	6,175.44	48.72	8,101.74
West Bengal	252	0.00	0.00	0.00	0.00	0.00	0.00	3,540.05	6,991.80	13,504.80	72,167.76	211.68	96,416.09
<b>Total</b>	<b>4272</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>51.20</b>	<b>549.12</b>	<b>32,809.85</b>	<b>79,868.20</b>	<b>116,439.18</b>	<b>644,416.56</b>	<b>3,588.48</b>	<b>877,722.59</b>

**Level 10:** Director General/ Director/Deputy Director/ Joint Director; **Level 9:** CFO/ CO; **Level 8:** Deputy CFO/Joint Director; **Level 7:** Assistant Director/Deputy Controller/Deputy Director/DO; **Level 6:** DO/DFO/Inspector/EO/Fire Supervisor; **Level 5:** ADFO/ADO/AFO/Fire In-charge; **Level 4:** St.O/Sub Inspector/Station In-charge/ASst O./AEO; **Level 3:** S O/Assistant Sub Inspector/ASO/Sub-Fire Officer; **Level 2:** LFM/ Mechanic Driver/Head Constable/Store Superintendent; **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.



### 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 42-32). The total estimated cost on vehicle maintenance & repairs, and PDL will be **Rs. 440.6 Crores** per year for filling the gap in operational and urban areas in entire India. The annual specialized equipment, building maintenance, office expanses, and training expanses will be about **Rs. 203.8 Crores**, **Rs. 441.9 Crores**, **Rs. 736.8 Crores** and **Rs. 128.6 Crores**, respectively.

**Table 42-31: Annual recurring cost estimates (in Lakhs Rupees) for petrol, diesel, and lubricants after filling the gap in operational and new urban Fire Stations**

State/UT	Num of Fire Stations	Annual Vehicle Maintenance	Annual PDL Cost	Annual Equipment maintenance	Annual Building Maintenance	Office Expenses	Training Expenses
Andaman and Nicobar Islands	20	87.96	65.97	129.93	145.00	278.72	48.67
Andhra Pradesh	381	1,567.67	1,175.76	1,470.29	3,249.00	5,790.09	1,010.97
Arunachal Pradesh	14	199.88	149.91	83.53	214.50	363.62	63.49
Assam	135	900.46	675.35	638.57	1,447.50	2,763.06	482.44
Bihar	184	1,170.91	878.18	958.29	1,743.00	3,225.80	563.23
Chandigarh	11	91.28	68.46	76.64	87.00	189.91	33.16
Chhattisgarh	47	450.26	337.69	215.16	542.00	290.20	50.67
Dadra and Nagar Haveli	2	44.68	33.51	23.49	25.00	63.42	11.07
Daman and Diu	6	58.29	43.72	46.11	62.00	143.58	25.07
Delhi	99	631.88	473.91	686.90	977.50	1,575.69	275.12
Goa	19	107.63	80.72	76.71	174.00	225.35	39.35
Gujarat	230	1,518.48	1,138.86	1,434.31	2,824.00	4,869.68	850.26
Haryana	116	649.43	487.07	558.32	977.50	1,847.03	322.50
Himachal Pradesh	36	272.52	204.39	206.39	394.00	644.75	112.57
Jammu and Kashmir	183	582.79	437.09	648.81	1,059.00	1,544.84	269.73
Jharkhand	43	554.80	416.10	280.70	658.00	371.28	64.83
Karnataka	245	1,579.76	1,184.82	1,178.85	2,799.00	5,013.40	875.36
Kerala	157	849.55	637.16	808.94	1,826.50	2,884.85	503.70
Lakshadweep	4	23.23	17.42	19.38	31.00	68.34	11.93
Madhya Pradesh	350	1,758.94	1,319.21	1,229.11	4,490.00	5,824.84	1,017.04
Maharashtra	408	2,425.03	1,818.77	1,907.96	3,600.00	5,708.59	996.74
Manipur	27	204.07	153.05	140.82	252.50	414.08	72.30
Meghalaya	34	192.44	144.33	127.82	273.50	581.49	101.53
Mizoram	20	171.62	128.72	109.89	192.50	314.44	54.90
Nagaland	19	192.20	144.15	127.79	220.00	449.97	78.57
Orissa	205	1,150.86	863.14	764.02	2,036.00	3,428.45	598.62
Puducherry	17	99.50	74.62	55.20	155.00	232.96	40.68

State/UT	Num of Fire Stations	Annual Vehicle Maintenance	Annual PDL Cost	Annual Equipment maintenance	Annual Building Maintenance	Office Expenses	Training Expenses
Punjab	82	587.50	440.63	492.88	810.50	1,551.89	270.97
Rajasthan	233	1,021.38	766.04	890.91	1,757.00	2,649.76	462.66
Sikkim	10	86.44	64.83	40.82	98.50	179.15	31.28
Tamil Nadu	349	1,803.52	1,352.64	1,501.17	3,744.50	6,394.03	1,116.42
Tripura	38	173.90	130.43	164.60	310.50	411.91	71.92
Uttar Pradesh	354	2,605.37	1,954.03	1,958.24	4,223.00	8,538.43	1,490.84
Uttarakhand	66	344.66	258.49	394.16	572.50	885.31	154.58
West Bengal	183	1,017.83	763.38	935.82	2,223.50	3,963.48	692.04
<b>Total</b>	<b>4,327</b>	<b>25,176.72</b>	<b>18,882.54</b>	<b>20,382.51</b>	<b>44,195.00</b>	<b>73,682.35</b>	<b>12,865.17</b>

**Table 42-32: Country 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	6,745.50	3,561.23	314.41	10,621.14
Gap in Operational Fire Stations	9,691.25	5,315.18	1,473.71	16,480.15
New Urban Fire Stations	5,660.75	1,613.89	759.69	8,034.32
Total Gap in New Urban and Operational Fire Stations	15,352.00	6,929.07	2,233.40	24,514.47
New Rural Fire Stations	19,182.75	4,781.08	1,446.56	25,410.38
Total Gap in New Urban ,New Rural and Operational Fire Stations	34,534.75	11,710.14	3,679.96	49,924.85

**Table 42-33: Country 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	1,697.32	85.47	25.15	64.10	134.91	106.93	18.67	2,132.56
Gap in Operational Fire Stations	7,435.96	127.56	117.90	95.67	193.83	468.47	81.80	8,521.18
New Urban Fire Stations	2,562.34	38.73	60.78	29.05	113.22	161.43	28.19	2,993.72
Total Gap in New Urban and Operational Fire Stations	9,998.29	166.30	178.67	124.72	307.04	629.89	109.98	11,514.90
New Rural Fire Stations	8,777.23	114.75	115.72	86.06	383.66	552.97	96.55	10,126.93
Total Gap in New Urban ,New Rural and Operational Fire Stations	18,775.52	281.04	294.40	210.78	690.70	1,182.86	206.53	21,641.82

## 42.5 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 entire India (Table 42-34 and Table 42-35).

**Table 42-34: Country level 10 year investment plan for Fire Services in entire India for filling gap in operational and new urban Fire Stations (in Crores Rupees)**

Year	Capital Expenditure		Recurring Expenditure					Total
	Building Infrastructure	Vehicle and Equipment	Annual Vehicle Maintenance & PDL AMC	Annual Staff Salary	Annual Office Expenses	Annual Training Office Expenses	Annual Bldg. maintenance	
First Year	3,070.40	3,394.46	345.29	5,415.31	341.16	59.57	231.82	12,858.02
Second Year	3,408.14	3,564.17	557.13	10,229.29	644.44	105.49	332.03	18,840.69
Third Year	1,891.52	523.37	631.69	12,099.64	762.28	116.98	358.45	16,383.93
Fourth Year	2,099.54	549.53	714.61	14,271.57	899.11	129.35	385.36	19,049.08
Fifth Year	2,330.59	288.51	789.27	16,387.34	1,032.40	139.25	401.00	21,368.36
Sixth Year	2,586.96	302.94	871.30	18,805.39	1,184.74	149.81	416.91	24,318.05
Seventh Year	2,871.44	318.08	961.41	21,567.78	1,358.77	161.08	433.09	27,671.65
Eighth Year	3,187.38	333.99	1,060.35	24,722.36	1,557.50	173.10	449.56	31,484.25
Ninth Year	0.00	350.70	1,168.98	28,323.48	1,784.37	185.92	466.32	32,279.76
Tenth Year	0.00	368.21	1,288.19	32,432.86	2,043.27	199.59	483.36	36,815.48
<b>Total</b>	<b>21,445.98</b>	<b>9,993.95</b>	<b>8,388.23</b>	<b>184,255.03</b>	<b>11,608.03</b>	<b>1,420.13</b>	<b>3,957.92</b>	<b>241,069.27</b>

**Table 42-35: Country level 10 year investment plan for Fire Services of entire India for filling gap in operational, new urban and new rural Fire Stations (in Crores Rupees)**

Year	Capital Expenditure		Recurring Expenditure					Total
	Building Infrastructure	Vehicle and Equipment	Annual Vehicle Maintenance & PDL AMC	Annual Staff Salary	Annual Office Expenses	Annual Training Office Expenses	Annual Bldg. maintenance	
First Year	6,906.95	3,394.46	345.29	5,415.31	341.16	59.57	231.82	16,694.57
Second Year	7,666.71	3,564.17	557.13	10,229.29	644.44	105.49	332.03	23,099.26
Third Year	4,255.03	1,896.57	705.53	14,301.67	901.00	138.27	436.72	22,634.79
Fourth Year	4,722.98	1,991.35	874.11	19,204.12	1,209.86	174.06	543.48	28,719.95
Fifth Year	5,242.72	1,045.48	1,004.59	23,292.88	1,467.45	197.92	600.62	32,851.66
Sixth Year	5,819.45	1,097.77	1,150.36	28,086.42	1,769.44	223.74	658.84	38,806.03
Seventh Year	6,459.38	1,152.65	1,313.02	33,694.97	2,122.78	251.64	718.17	45,712.61
Eighth Year	7,170.11	1,210.28	1,494.34	40,245.15	2,535.44	281.78	778.63	53,715.72
Ninth Year	0.00	1,270.83	1,696.27	47,882.22	3,016.58	314.29	840.22	55,020.41
Tenth Year	0.00	1,334.30	1,920.94	56,772.69	3,576.68	349.36	902.96	64,856.93
<b>Total</b>	<b>48,243.33</b>	<b>17,957.86</b>	<b>11,061.57</b>	<b>279,124.72</b>	<b>17,584.86</b>	<b>2,096.11</b>	<b>6,043.50</b>	<b>382,111.94</b>

## 42.6 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 individual State/ UT report submitted by RMSI.

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, there may be some change in priority of a new Fire Station depending upon the local situation and requirements.

## 42.7 Avenues of Fund Generation

Fire Services in India 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.

## 42.8 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, the National Fire Service College (NFSC), Nagpur and other State fire training centres across the country are key institutions involved in improving the level of fire personnel knowledge and their overall capabilities to face the challenges of fire-fighting.

The 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 Fire & Emergency Services across the country, 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 42.3.3) 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.). For more detailed information, please refer to the National Level Training report as well as individual State/ UT report submitted by RMSI.

#### **42.8.1 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 42-36. Additional requirement of Refresher Training Course for fireman after every 3-5 years of service is also shown the Table 42-36. 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, Fire Services in entire India would require to train 440,546 fire personnel in basic and 251,913 fire personnel in refresher training in next 10 years. Therefore, State/UT level training centre should have adequate capacity and infrastructure for meeting such training requirement.

#### **42.8.2 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 42-36. In total, Fire Services in entire India would need to train at least 71,323 leading fireman in next 10 years.

#### **42.8.3 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 42-36. In total, Fire Services in entire India would need to train at least 36,145 fire personnel for specialized courses to meet the requirement in next 10 years.

**Table 42-36: Estimated training requirements for fire personnel in Fire Services in entire India**

<b>Basic Training for Fireman</b>		
	Number of Fire Personnel in Operational Fire Stations	182,644
	Number of Fire Personnel in New Urban Fire Stations	59,008
	Number of Fire Personnel in New Rural Fire Stations	198,894
	<b>Total Number of Fire Personnel for Training</b>	<b>440,546</b>
<b>Refresher Training for Fireman</b>		
	<b>Total Number of Fire Personnel</b>	<b>251,913</b>
<b>Leading Fireman Training Course</b>		
	Number of Fire Personnel in Operational Fire Stations	27,369
	Number of Fire Personnel in New Urban Fire Stations	8,776
	Number of Fire Personnel in New Rural Fire Stations	35,178
	<b>Total Number of Fire Personnel for Training</b>	<b>71,323</b>
<b>Other specialized Training Course</b>		
	<b>Total Number of Fire Personnel for Training</b>	<b>36,145</b>
<b>Junior Officer Training Course</b>		
	Number of Fire Personnel in Operational Fire Stations	20,100
	Number of Fire Personnel in New Urban Fire Stations	6,990
	Number of Fire Personnel in New Rural Fire Stations	25,071
	<b>Total Number of Fire Personnel for Training</b>	<b>52,161</b>
<b>Divisional Officer Training Course</b>		
	Number of Fire Personnel in Operational Fire Stations	2,729
	Number of Fire Personnel in New Urban Fire Stations	564
	Number of Fire Personnel in New Rural Fire Stations	104
	<b>Total Number of Fire Personnel for Training</b>	<b>3,397</b>
<b>Fire Prevention Course</b>		
	<b>Total Number of Fire Personnel for Training</b>	<b>3,788</b>

#### **42.8.4 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 42.36. After filling gap in operational Fire Stations, new urban and rural Fire Stations, Fire Services in entire India would require to train 52,161 junior officers in next 10 years.

#### **42.8.5 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 42.36. About 3,397 fire officers in Fire Services in entire India would require this training in next 10 years.

#### **42.8.6 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 different State Fire Services in India 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.

## 42.9 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 has tried 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.

## 42.10 Recommendations for Fire Services in India

1. There is an urgent need for Fire Prevention and Fire Safety Act for every State and UT of India. In the Fire Act, there should be strict implementation of fire code in building design and construction. The National Building Code (NBC) should be strictly adhered to in high-rise buildings, schools, colleges, cinema halls, hospitals, industrial units including those dealing with hazardous materials, institutions and public and private buildings. Moreover, in areas of high seismic risk (Seismic Zone IV and V), even low-rise buildings need strict implementation of building code.
2. Computerization of Fire and Emergency Services is highly recommended across the country from modernization of Fire and Emergency Services point of view. All the Fire Stations in the States/ UTs should be connected through INTRANET and fire personnel should be trained properly. The Fire and Emergency Services in the country should be capable of making fire reports available online to public within 48-hours for an incident.
3. In order to provide best possible services to people against fire, the firefighting manpower should be recruited in a systematic manner. It has been observed that there is large number of vacancies present at all levels in the operational Fire Stations of various States/UTs. These gaps need to be filled up at the earliest.
4. Since availability of trained manpower in various States/ UTs is a key issue, there is a need that States/ UTs should fill up the gap of manpower in operational Fire Stations and provide at-least 6-months basic fireman training in the State training center or at NFSC, Nagpur.
5. Instead of having fireman, driver, and operator separately, the States/UTs should recruit fireman-cum-driver-cum-operators. This will help in optimizing the large manpower requirements. Since, the fireman-cum-driver-cum-operators may not be readily available, the State/UT should train the new recruit in a systematic manner, and encourage all existing staff, specially, firemen and leading firemen to obtain heavy vehicle driving license. The State may offer some incentive towards this, as this will help in optimization of resources. The other advantages are in terms of heavy additional vehicles that can be used as water carrier, in case of bigger fire incidence. This ensures that absence of lone driver, which can lead to whole of the fire crew immobile. This can also solve problem of drivers, who don't have promotional avenue during their long service leading to frustration, and last but not least, in terms of optimization of resources.
6. There is an urgent need to have merit-based promotion in State's/ UT's Fire Services organization, so that deserving employees would remain motivated and not leaving the organization at midst of their career.
7. Based on prioritization of Fire Stations, State/ UT Fire Services need to add new Fire Stations at a faster pace, as there is a huge gap both in urban and rural areas. The priority ranking for all the newly proposed urban and rural Fire Stations has already been mentioned in the State/ UT specific reports.
8. Though, some of the State Fire Services has online vehicle tracking through Global Positioning System (GPS) in place, there is a need for all the other State/ UT Fire

Services to develop a fully computerized integrated response system as part of the modernization process and better infrastructure management.

9. In order to reduce the frequency and extent of fire events, creating public awareness programs for schools, colleges, hospitals, Govt. offices, high-rise buildings, etc. plays an important role. 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.
10. The 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 State/ UT Fire Services.
11. The State/ UT Fire Services should ensure that for operational duty, physically unfit firefighters should not be part of the team, and he/she should be allowed to work in the areas, other than fire response.
12. 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 fastest response, supplemented by the Water Tenders and Water Bowsers by laying the large hose pipelines. Additionally, the State/UT Fire Services should identify congested areas with higher fire risk 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 these exercises are not one time matter and should be carried out regularly.
13. The State/ UT Fire Services should adopt a system of payment of incentives for driving specialized vehicles like ALP / TTL/Hydraulic Platform. Controlling these vehicle is difficult and requires specialized firefighters to handle it. State/ UT Fire Services are requested to perform regular fire drills with such specialized vehicles.
14. Fire Stations/ Fire Posts in areas under extreme cold temperature/ climatic condition such as Leh (J&K), Gurez (J&K), Keylong (Himachal Pradesh) etc. should have special heating and other means of arrangement for firefighting vehicles and equipment as water gets freezed up during extreme winter.
15. Fire statistics of the past fire events (last past 5 years) in the States/ UTs is not uniformly available for all the Fire Stations. The State/ UT Fire Services should issue strict order to all the Fire Stations to prepare fire statistics data in the prescribed performa for future fire/ rescue calls, and ensure their compliance.
16. Firefighting vehicles and equipment should not be used for cleaning drains, sewer lines, as well as water supply purposes. This may delay in response, if there is a fire

incidence at the same time. Such use of fire vehicles should be discouraged at all levels, as a small fire incident can turn into a major fire disaster.

17. The State/ UT Fire Services should ensure that higher fire personnel (ADFO/DFO upwards) should be provided with light official vehicle for inspection and fire prevention work, depending upon State/UT Policy.
18. The State/ UT Fire Services need to have well-equipped model workshop to take care of day-to-day repairs of fire vehicles. Because of the lack of connectivity of other stations with headquarter in a large State/ UT by road, there is need to have special arrangement for repairing staff and mobile/ small workshop for quick repairs.
19. The State/ UT should have Insurance for all the Firefighting vehicles and costly equipment, so that in case of an accident/malfunctioning there is sufficient cover available for any damage.
20. Each Municipal Corporation/ Municipality cannot be made self sufficient in isolation to deal with serious nature of Fire & Emergency. Moreover, there are plenty of sub-urban and large village areas that need to have good fire response adjacent to the Municipal areas. Because of these reasons, RMSI team recommends that Municipal Fire Services should come under the State/ UT Services. Accordingly, a hierarchy should be created to have proper co-ordination at all levels.
21. In many of the States/ UTs, roads are narrow in their width or not in a good condition. There is an urgent need for widening the roads, so that firefighting & rescue vehicles can reach to the fire scene and respond faster. For this, the State/ UT Fire Services should coordinate with State Administration to take quick and efficient steps.
22. The Fire & Rescue Services in the State should have audit by a central authority to ensure good finance mechanism for capital, and O&M expenditures.

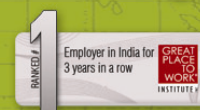




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