Emergency preparedness and response system in local level

Maharashtra

Research Study

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Regional Centre for Urban and Environmental Studies
All India Institute of Local Self-Government, Mumbai

Preface

The latest public health emergency caused by the recent pandemic of COVID-19, has taken multi-faceted and unforeseeable toll on cities around the world. National, State and Local Governments are undertaking numerous measures necessary to reduce the impact of COVID-19. Urban Local Bodies (ULBs) are at the forefront while dealing with the pandemic and implementing innovative practices. This recent crisis has highlighted the importance of emergency preparedness and disaster management at local level.

Disasters have a drastic effect on cities' physical, social and economic environment. Disasters, whether they are natural or man-made, have complex effects, and generally occur without warning. Urban Local bodies can deal more effectively with large- scale emergencies by planning and preparing for emergencies before they happen. Emergency preparedness and response system at city level is prerequisite in order to mitigate risks and vulnerability. To tackle any emergency and to reduce its impact it is necessary to have access to real time information and requires coordination between multiple agencies and departments.

Despite the many challenges tackled by the ULBs during the pandemic, availability of existing infrastructure and digital technologies with tier I cities have made them better equipped to tackle the spread of the virus. On the other hand, COVID-19 has revealed the high level vulnerability of smaller cities (tier II and III) to disasters. The impact of the pandemic has been a catalyst in transforming the current practices of disaster preparedness and has highlighted the importance of developing a rapid response system at local level.

This study on, 'Developing an emergency preparedness and response system at local level' aims at developing emergency response system for a tier II city of Maharashtra on a pilot basis. The system is being developed for easy replication by other cities. The study focusses on mapping of municipal infrastructure available in the city so as to create spatial database of municipal services impacted by disasters. Understanding that when faced with disasters, availability of information and services at fingertips is crucial this study has also developed an online dashboard depicting various sectors of municipal infrastructure and services.

Acknowledgement

I take this opportunity to put on record our deep appreciation for the Ministry of Housing and Urban Affairs for providing us an opportunity for working on this study. I would like to convey our gratitude to the Advisory Committee, RCUES Mumbai for providing us an opportunity to contribute to the task of rethinking public spaces and infrastructure.

I also take this opportunity to express my gratitude towards Shri Ranjit Chavan, President, All India Institute of Local Self Government, for showing confidence in us and valuable support to complete the Report. My sincere thanks are to Shri Rajiv Agarwal, IAS (retd.), Director-General, All India Institute of Local Self Government, Mumbai, who was instrumental in initiating the report and providing encouragement and valuable direction to the report.

This study has been undertaken by Dr. Pravin Kokane, Assistant Professor, University of Mumbai and his team with RCUES Mumbai. Their contribution and tireless efforts towards this study are highly appreciated. Their relentless work to make this study useful and worthwhile, despite the challenging circumstances of COVID is highly valued and appreciated. I would also take this opportunity to thank all the other stakeholders who have contributed to this study through interviews, discussions, data and knowledge sharing etc.

I would also like to thank team RCUES who worked towards the completion of the report.

I hope this work will be encouraging and helpful for the cities and the state governments in developing rapid response systems and be better equipped in dealing with disasters and emergencies in the post COVID era.

Director,
RCUES of AIILSG

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1. INTRODUCTION

1. INTRODUCTION

Emergency response has developed over time into policy based measures, and disaster policy is applied through a series of operations known as emergency management and response. Disaster preparedness is much beyond the policy based interventions and setting up paper based frameworks but rather action strategies that need to be implemented. Modern approaches to emergency management and response include multidimensional efforts to minimize our exposure to hazards; to reduce the effects of disasters; and to plan for, respond to and recover from disasters. Innovative methods for emergency preparedness and response include multidimensional efforts to minimize our exposure to hazards; to reduce the effects of disasters; and to adapt for, contribute to and recover from disasters. Many such responsibilities present crucial problems for governments, given the high demands that disaster events impose on decision-making systems and on the service delivery infrastructure of the communities they affect.

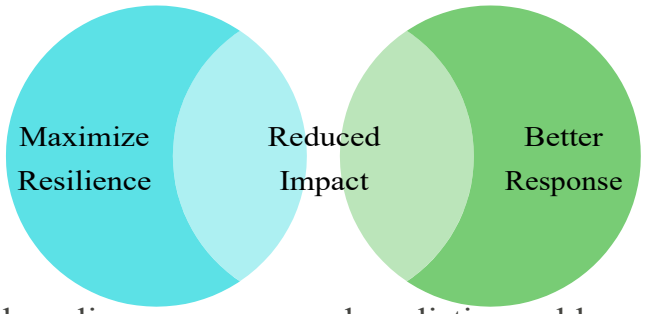
Moreover, by concept, a disaster is an incident which extends beyond the capacity of the government or governments in whose jurisdiction it happens. Disaster recovery thus needs extra support. In the scope of a centrally organized government, where the capability of the lower-level jurisdiction is strained, higher levels are called upon to help either by facilitating or supplementing the operations of the lower jurisdictions. In the same way, resources and skills in both the private and non-governmental sectors can be brought into play. As a consequence, emergency response and mitigation are primarily inter-jurisdictional concerns inthe execution of cross-sector policy implementation.

Furthermore, provided that disasters have a drastic effect on our physical, social and economic environment, geo - spatial specifications and capacities are incorporated in this dynamic system.

The primary aim of emergency response efforts is to minimize, as much of it as possible, the extent to which a community's situation is intensified by a disaster compared to its pre-disaster condition.

There are several actions performed by emergency response stakeholders to achieve this aim. These actions are both pre-disaster stage (predict or mitigate future damage) and post-disaster (to restore from real damage) and, potentially, these activities will reduce the possible impact of a disaster to the point of elimination. There are certain intrinsic characteristics of disasters that leave policymakers in a dilemma as to what to do to control them. More precisely, the size, magnitude, volatility, dynamism and sheer unpredictability of disasters give rise to some important questions:

- How do we maximize the resilience of cities to disasters for example, by installing dams, increasing living floors in houses, or enforcing zoning regulations?
- How do we reduce the effects of disasters, for example by more efficient emergency systems or improved evacuation plans?
- How else will we provide assistance to those affected most effectively - through the creation of a standard operational vision and mutual situational knowledge for all emergency responders, or through efficient search -and-rescue procedures?

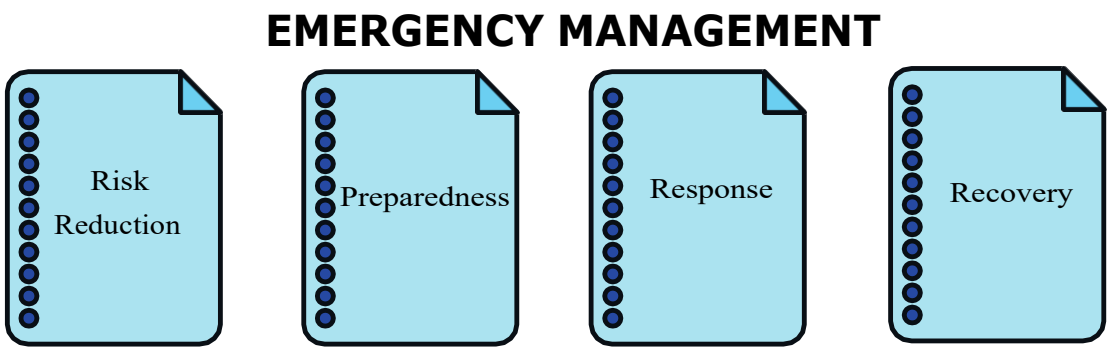


Therefore we face both policy concerns and realistic problems as we work to minimize the risk to which our communities are vulnerable and to protect people and facilities. As to any emergency preparedness and response issue has essential geospatial dimensions, and successful emergency management thus requires the proper use of geospatial data and tools. The strategy, identified as Integrated Emergency Management, describes four stages of current crisis management: risk reduction, preparedness, response and recovery. All of these phases puts specific criteria on emergency management and responders can be notified and strengthened with the use of geospatial data and resources.

1.1 EMERGENCY PREPAREDNESS AND RESPONSE SYSTEM DASHBOARD

Reliable decision-making visualization is crucial to operational, strategic and organizational management before and during a large-scale climatic disaster or severe weather emergency. Traditionally, many emergency management applications consist of a map-based situation and object visualization, which is important for operations but has a minor role to play in contributing to decision-makers. Numerical models and experiments that typically allow prediction and situation assessment are often analyst-oriented and disconnected from the functional system and monitoring system. However, emergencies tend to have unforeseeable consequences, which could involve new decision-making tools inreal-time based on alternate information or data sets.

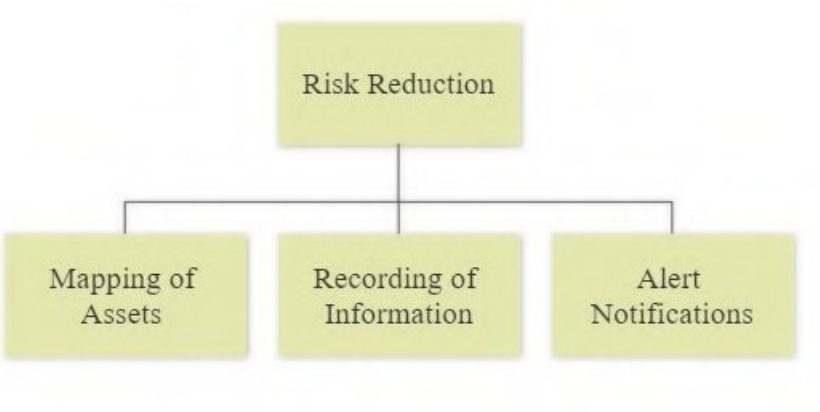
More specifically, using emergency management dashboards, implies to use and have an intelligent framework in place to support effective and efficient use of data and decision-making information through adaptive implementation and visualization of data streams and metric displays. This visualized presentation of data enables emergency managers to generate insights and observations from data that help them think more critically, take more accurate action, and develop more detailed strategies during a crisis. One of the primary purposes of response systems is to reduce risk, which explains why "emergency management" and "risk management" are often used interchangeably. These can assist in risk management by promoting decision making for risk probability and impact reduction. Therefore, each object or concept that generates significant risk or could be severely impacted by risk should be clearly visualized to the user, as well as the risk magnitude in order to promote prioritized treatment.



We follow the typical four levels of emergency management, which are risk mitigation, preparedness, response and recovery, and explain how information visualization through dashboards should be applied at each point.

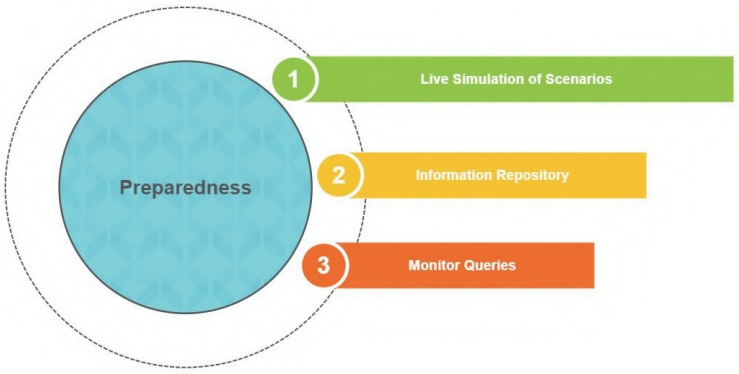
1.1.1 Risk Reduction

The emergency preparedness and response system can help the record of emergency risk mitigation information. Recent implementation of live dashboard technology will allow emergency management to analyze the reported data and generate warnings prior to the occurrence of the event. The system comprises of tools that can allow visualization of mapped assets in real time.



Location Intelligence and real time visualization of data enhances the credibility of analyzed data. The locations where the disaster incidents have already occurred or are prone to disaster occurrence, can be visualized leading to informed decision making. With recent advancements in the location intelligence technology, the power of utilising it for disaster risk reduction and preparedness can be captured for better emergency management.

1.1.2 Preparedness



The emergency preparedness and response system offer an incentive for having live modeling of scenarios and assist field exercises prior to a real disaster. Digital dashboards help people monitor their problems and queries.

Specific algorithms can detect and classify predetermined essential information in specific locations. This systems can be used in the case of a disaster. Information management could create a library of information focused on previous disaster experiences. Digital technologies facilitate the sharing of information on emergency preparedness.

1.1.3 Response

In a similar manner, the emergency preparedness and response system play a key role in the immediate reaction to the information exchange. Once a disaster has occurred, local governments should carry out the following operations:

(1) Confirming the location and safety of residents

(2) The establishment and operation of Evacuation centers

(3) The Transport and Management of relief goods

(4) Supporting evacuees and creating evacuee lists

These operations are quite different from daily tasks. It requires situational information that can be augmented through social media platforms to deliver these operations. The emergency preparedness and response systems enhance situational awareness and decision-making.

1.1.4 Recovery

After an immediate response, the local government is responsible for helping people to return to their normal lives. A number of natural disasters in the past, demonstrate the importance of the operation and maintenance of emergency departments. The identification of the necessary services for evacuees and the management of relief goods are important. The emergency preparedness and response systems can be used for coordinating available resources. Data produced in previous phases is important for recovery operations. However, the implementation of emergency preparedness and response systems should be carried out separately at any point of the process.

In the same manner, vulnerability information at the preparedness level may be compared to the real-time information gathered at the response stage. We assume that this will enhance situational awareness and community resilience.

1.1.5 Geospatial Perspective

From a geospatial perspective, the goals of risk reduction include the identification of data requirements, the creation of data sets and the exchange of data across agencies. This includes tasks as essential as the creation of framework data and datasets on facilities, hazards and dangers, the locations of facilities that are used for response and recovery.

Geo-spatial methods may be used to demonstrate the distribution of threats and risks as they actually happen and dangers as they could exist in various future planning scenarios. This encourages state and city planners to collaborate with emergency managers to plan more resilient futures through the elimination or reduction of higher-risk alternatives.

Geo-spatial models can be combined with in-situ monitoring data to determine conditions during a disaster event. Near-real-time geospatial modeling of disaster data can be beneficial for response activities like evacuation and transportation of goods and services.

Geospatial data can promote cost-benefit analysis by contrasting the cost of improvements (such as new building requirements) to savings figures that occur when the hazard is mitigated. Geospatial instruments are of particular value due to their potential to enable a fairly fast assessment of several alternatives.

1.3 CREATING SYSTEM FOR GOVERNMENT

With a rising emphasis on cities and disasters, it is important to take stock of the basis for our perception of urban risk. Even a short analysis of urban catastrophe literature shows that much of what we know derives from the perspective of big cities, national and state capitals, urban mega-regions, and other hubs of control and influence. Small urban hubs, those "less dense cities" that will account for the bulk of urban development in Asia over the coming decades, are missing in the context of management of disasters. The process of decentralization provides a chance to reinforce and enhance the role of local authorities in disaster management. Local authorities have been concerned with formulating their own emergency management policies and regulations.

1.3.1 Emergency Management Act 2005

The Emergency Management Act of 2005 called for a rigorous regulatory system to handle natural disasters. Since then, several states and union territories have established state disaster management plans (SDMPs). In addition, 80% of the districts of the nation have established district emergency response programs. However, following this and other milestones, there is room for further improving the policy framework for disaster risk management in India. As the primary responsibility for coping with disasters falls with state governments, SDMPs are the main organizational policies that direct disaster risk management actions throughout the world.

1.3.2 National Disaster Management Plan (NDMP)

Defines the functions and duties of the different stakeholders, including central ministries/departments, state governments, UT administrations, municipal authorities and local self-governments. The NDMP instructs all parties to establish comprehensive schedules in compliance with duties and obligations. Implementation of the strategy is an evolving process. Primary responsibility of disaster management rests with the States.

Information on the use of different innovations to increase the efficacy of NDMA's emergency risk management activities are as follows:

Leveraging the technology of GIS, NDMA have taken up a project for disaster risk management by establishing GIS Server and creation of database. Objective of the project is to integrate data obtained from various stakeholders on GIS platform to increase disaster preparedness, mitigation, damage assessment, response and relief management efforts. The Project envisages procurement of software and hardware, engagement of manpower, creation of data Inventory related to disaster management, integration of various other database system, development of Android Application for the responders, creation of applications and customization tools for better assessment of disaster scenario and creation of Decision Support System for the responders and decision makers etc.

1.3.3 State Disaster Management Authorities

State Disaster Management Authorities have been set up for laying down policies and plans for disaster management in their respective states and are in the process of becoming operational. At the state level, the State Relief Commissioner supervises and controls relief operations through Collectors or Deputy Commissioners, who are the main functionaries to coordinate the relief operation at district level. The State Governments are autonomous in organizing relief operations in the event of natural disasters and in developing the long-term rehabilitation measures. The State Government-s efforts are supplemented by central Government based on the recommendations of the Finance Commission.

1.3.4 District Disaster Management Authorities

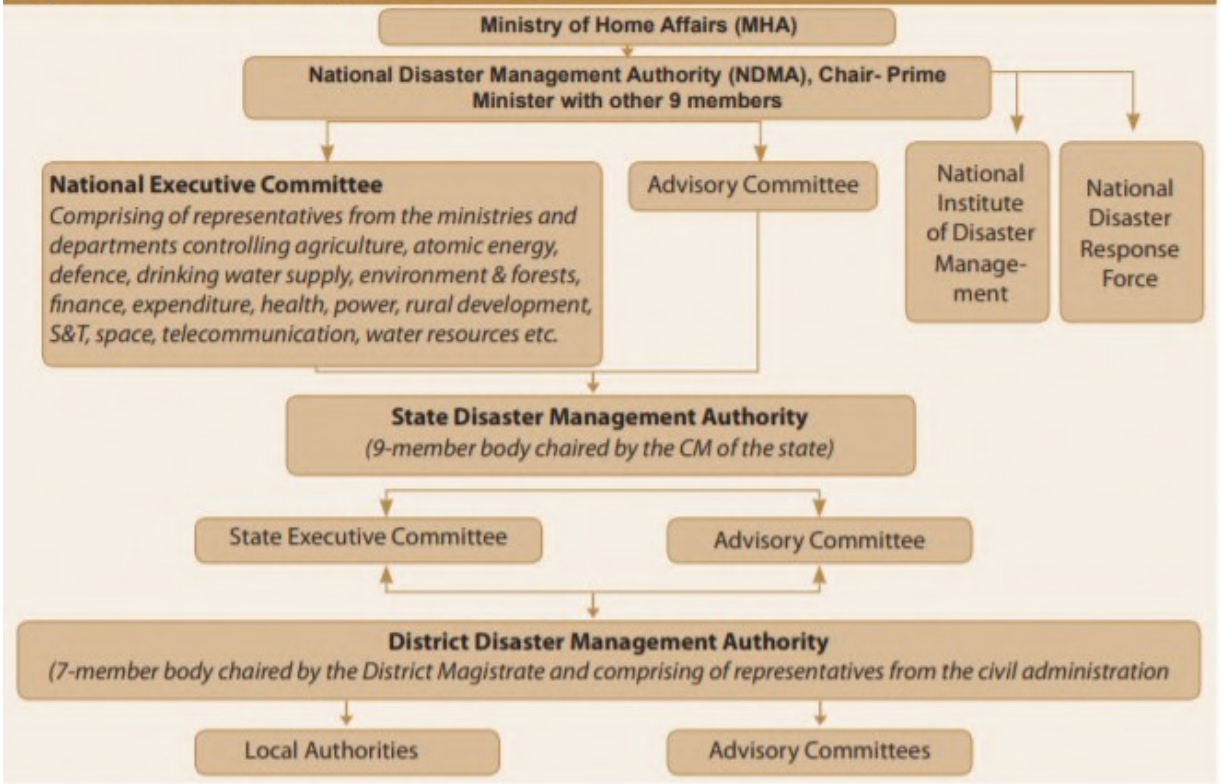
District Disaster Management Authorities have been set up as planning, coordinating and implementing bodies for disaster management and to take all measures in the district in accordance with the guidelines laid down by the National and State Authorities. The District Authority is responsible for planning, coordination and implementation of disaster management and to take such measures for disaster management as provided in the guidelines.

The District Authority also has the power to examine the construction in any area in the district to enforce the safety standards and also to arrange for relief measures and respond to the disaster at the district level.

1.3.5 Sub-District/Local Disaster Management Authorities

A District is sub-divided into sub-divisions and Tehsils or Talukas. The head of a sub-division is called the Sub-Divisional Officer (SDO) while the head of a Tehsil is generally known as the Tehsildar (Talukdar or Mamlatdar in some States). Contact with the individual villages is through the village Officer or Patwari who has one or more villages in his charge. When a disaster is apprehended, the entire machinery of the District, including officers of technical and other Departments, swings into action and maintains almost continuous contact with each village in the disaster threatened area. In the case of extensive disasters like drought, contact is maintained over a short cycle of a few days. The entire hierarchy right from the Central Government (the Department of Agriculture and Cooperation in the Ministry of Agriculture and irrigation) to the District level is connected by means of a telecommunication system.

Figure 2.3: Disaster Management Structure in India



1.3.6 Disaster Vulnerability of Maharashtra

Maharashtra is prone to various disasters such as drought, floods, cyclones, earthquake and accidents. While low rainfall areas of the state are under the constant risk of droughts, high rainfall zones of eastern and western Maharashtra are prone to flash floods and landslides. The Koyna reservoir and surroundings fall under the high risk of earthquake hazards. Similarly, Industrial belt of Pune, Mumbai and Nashik are prone to the risk of accident and industrial hazards. Other disasters like fire and road accidents occur in congested areas lacking proper infrastructure. The state has suffered huge losses, both direct and indirect, caused by various disasters.

The eastern parts of the state are more prone to floods. The Tapi, Wardha and occasionally the Pen Ganga are the rivers causing floods in the State. The 1996 floods in the state destroyed 2,899 lakh hectares of land, killing 198 people and 38 cattle. In some cities like Mumbai land reclamation over the years has disturbed the natural drainage system. Therefore, city-s low-lying areas are under the threats of floods even if there are minor rains. Earthquakes in Maharashtra are showing major alignment along the west coast and Western Ghats region.

Sr. No	Disasters	Effects
1	Floods	The rivers, which cause flood in the state, are the Tapi, Wardha and occasionally the Pen- Ganga. The eastern parts of the state are prone to floods. The 1996 flood in the state destroyed 2,899 lakh hectares of land, killing 198 people and 38 cattle.
2	Droughts	The Deccan plateau constitutes 50 percent of the drought-prone areas of the state. 12 percent of the population lives in drought-prone areas. Once in 5 years, deficient rainfall is reported. Severe drought conditions occur once every 8-9 years. The 1996 drought affected 7 districts and 266.75 lakh people. The 1997 drought affected 17 districts.
3	Earthquakes	This state lies in seismic Zone I. Latur in Maharashtra experienced a number of shocks between August and October 1992. An earthquake measuring 6.4 on the Richter scale shook Latur on September 30, 1993. Extensive damage was caused to life and property in the districts of Latur and Dharashiv. The earthquake was the strongest earthquake on Maharashtra Konkan coast in the 20th century. The magnitude ranged between 6.5 and 7.5 on the Richter scale and was felt all over western Maharashtra, Goa and Karnataka; the epicenter was near the Koyna Dam. Over 200 people died and hundreds more were injured. An earthquake measuring 3.7 on the Richter scale hit Maharashtra Koyna region as recently as March 2001.

1.3.7 Emergency Preparedness for Urban Local Bodies

When emergencies happen in smaller cities with low density of communities, especially disasters that are severe or prolonged, the demands on local response agencies and healthcare facilities can quickly consume available resources. Disasters have complex effects, whether they are natural or man-made, and can occur without warning. Urban Local bodies can deal more effectively with large-scale emergencies by planning and preparing for emergencies before they happen. Smaller city residents, communities, local governments, and others involved in emergency preparedness and response face challenges that can include:

- Resource limitations, such as equipment and supplies,
- Training, and Infrastructure
- Access to healthcare for higher levels of care
- Remoteness and Geography
- Low population density
- Communication issues

As per the government, cities with a population of between 50,000 and 100,000 are classified as Tier 2 cities, whereas those with a population of between 20,000 and 50,000 are classified as Tier 3 cities. In a populated country like India, cities of this size are popular and do not correlate with any potential for economic growth. Smaller cities particularly tier 2 and tier 3 cities, are increasingly important targets, given their demographic value and their comparatively weak capacity. Investing in the capacity to manage and mitigate risk in cities with a population of one million or less is expected to have the greatest overall effect on vulnerability reduction.

With a rising emphasis on cities and disasters, it is important to take stock of the basis for our perception of urban risk. Even a short analysis of urban catastrophe literature shows that much of what we know derives from the perspective of big cities, national and state capitals, urban mega-regions, and other hubs of control and influence.

Small urban hubs, those "less dense cities" that will account for the bulk of urban development in Asia over the coming decades, are missing in the context of management of disasters. If metropolitan area seems to be the largest object in the global realms, three-quarters of the burden of potential world population development will be borne by faintly visible second-tier cities and smaller urban areas where, as UN researchers point out, "there is hardly any planning to sustain or provide facilities to these people."

1.3.8 Need Assessment from Local Governments

Urban Local Bodies and consultation at the grassroot level is of utmost importance to understand the challenges faced by the smaller cities that lack infrastructure support. A detailed assessment of the reviews from various Urban Local Bodies in Maharashtra of tier 2 and tier 3 cities is presented below. The need assessment is categorized into three stages.

1. Database Assessment: Analyzing the availability of database with the ULB to understand the potential structure of available infrastructure.
2. Expectation Assessment: Understanding the expectation of ULB from an emergency preparedness and response system.
3. Support for EPRS: To analyze the support of particular ULB for formulating an emergency preparedness and response system for them.

ULB	Need Assessment		
	Database Assessment	Expectation Assessment	Support for EPRS
Pusad	Available	Assistance for increasing efficiency of tax collection personnel	Complete Support
Khamgaon	Limited	Lack of database and structured inter departmental information	Limited Support
Pathardi	Available	Assistance for locating on site staff and real time monitoring of them in the purview of Covid-19	Complete Support
Lonand	Limited	Electricity poles and flood light mapping – key focus	Limited Support
Akot	Available	Assistance for qualitative urban services	Complete Support
Chakan	Available	Ambulance tracking is the only expectation	Limited Support
Dondaicha	Limited	Oxygen availability monitoring and health infrastructure requirement.	Complete Support
Basmath	Limited	Regulation street vendors and market places in times of pandemic	Limited Support
Islampur	Limited	Disaster/pandemic mitigation and recovery	Complete Support

2. STUDY OVERVIEW

2. STUDY OVERVIEW

This Project Scope document should be read in conjunction with the Project Plan which will outline in detail:

1. Project description of the project components (systems, application interfaces, users, workflows (if applicable), integration with other systems/applications (as applicable), etc.
2. Project Methodology Clear layout of the life cycle methodology that will be adopted for the project, with major stages listed and described, and how they apply to the project.

2.1 SCOPE OF STUDY

The Scope of the project is to create an online dashboard for emergency preparedness from untimely disaster events. The scope also incorporates spatial database creation for better mitigation by mapping of infrastructure availability. Due to the limited duration of this pilot project, and the complex data requirements of modelling most of the natural hazards such as glacial bursts, avalanches, and mudslides are not taken into consideration. The project scope incorporates disasters like floods, pandemic, earthquakes and fire incidences.

1. Infrastructure Inventory of key sectors like power supply, storm water drainage, emergency services and transportation.
2. GIS based mapping for the key utility sectors that are mentioned above.
3. Online portal for showing near real time information related to disaster incidents.
4. Online web based system for accessing assessment of infrastructure to determine the preparedness of ULB in terms of disaster response.

Certain assumptions are taken into consideration for the entire life cycle of the project for better performance of study parameters. These assumptions are dependent on the area of study under consideration.

2.2 OBJECTIVES OF THE STUDY

Certain objectives are necessary for any project to successfully articulate the goals and achieve them in the set timelines. Objectives are important because they convert visions into clear-cut measurable targets

1) Mapping of Infrastructure availability on account of Municipal services present in the city.
2) Spatial Database creation of Municipal services directly impacted by disaster.
3) Online dashboard creation depicting sectoral details of the infrastructure affected.

2.3 METHODOLOGY

The general aim of project methodology is to be able to standardize, structure, and organize work methods. This helps focus all projects in the same way and allows us to repeat successful aspects and learn from mistakes, resulting in a continuous improvement process. The project methodology is divided into certain sections to categorize the work flow process.

2.3.1 System Needs Analysis

In this stage, the existing disaster information systems (both manual and computer based) of key institutions such as ABM Mainnet 2.0, existing disaster response websites of Municipalities and other portals with disaster management responsibilities will be assessed to determine if the current processes, data, and models, are in line with timely information on disaster reduction that meets the requirements of decision makers and users. Also the requirements and objectives of Disaster Response Management and Emergency Preparedness System are identified, gathered, and analyzed. Project goals are refined into defined functions and operations of intended application. Stakeholders and End-user information needs are also analyzed. This stage includes a detailed analysis of the requirements needs of organizations involved in disaster management in the Urban Local Body of Khopoli. This process is done through following: Interviews, surveys, and questionnaires.

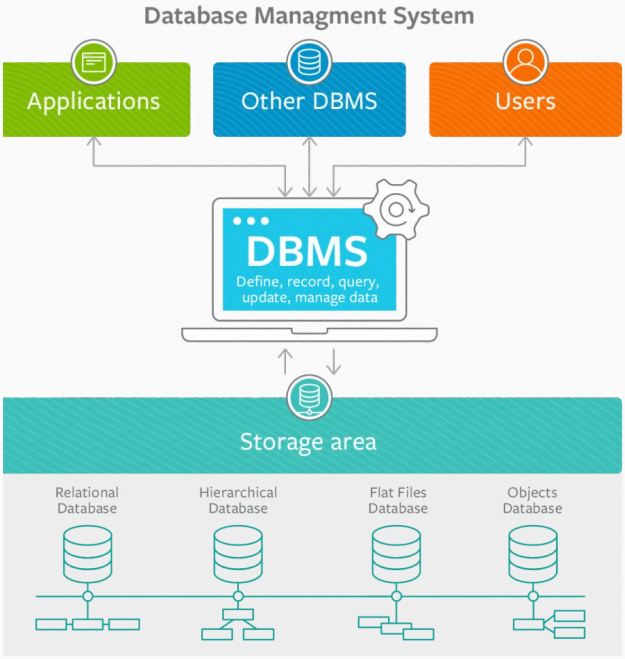
2.3.2 Data Collection

Several government departments have specific units that deal with disaster-related issues in the country, state and districts. Data was collected from all these sources for the individual databases and reporting. There is a specific need to collect disaster management data on standard formats for ease of uploading and updating the databases. Data received from varied sources was compiled and formatted in the database compatible structure.

2.3.3 Database Development

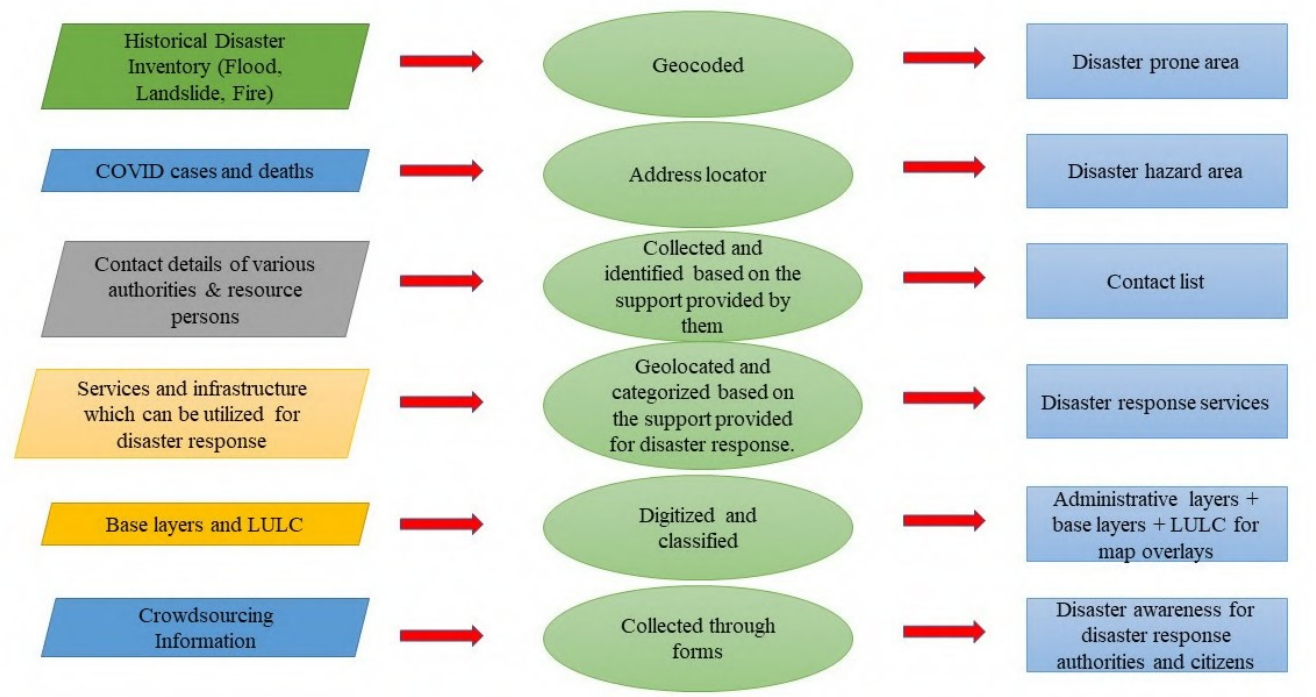
In this stage, the desired features and operations are decided in detail, including screen layouts, workflows and process diagrams (physical and logical), pseudo-code, and other information. This stage focuses on high-level design (what programs are needed and how are they going to interact), low-level design (how the individual programs are going to work), interface design (what are the interfaces going to look like), and data design (what data will be required).

The logical system of the application is also developed. During the analysis and design stage, the overall structure of the dashboard system is defined. Both the steps are very crucial in the whole development cycle. Oversight in the design phase can be very expensive to rectify in the later stages of development. The Database Management system DBMS is also defined in this stage.



2.3.4 GIS Development

An inventory of all the required datasets, their formats, scales, projections, & locations required to build the applications for the Disaster Response System. Identification of all datasets currently with the Municipal office in what formats, scales, projections, & locations. Taking an inventory of missing datasets or datasets not in the right formats, scales, projections. Performing all necessary data cleaning, reformatting, and bringing all datasets into one projection system, Design GIS applications,



The above mentioned GIS work flow is the methodology that has been adopted for the completion of this study. The datasets and types of data that has been input into the GIS Model is mentioned as the first input component. The processing of dataset and input data is explained in the second component of the diagram. The last component indicates the final product that is utilized for the study. This GIS data diagram helps us to understand in detail the processes and output required for creating an efficient disaster response and emergency preparedness system.

3. EXISTING FRAMEWORK REVIEW

CASE STUDY 1

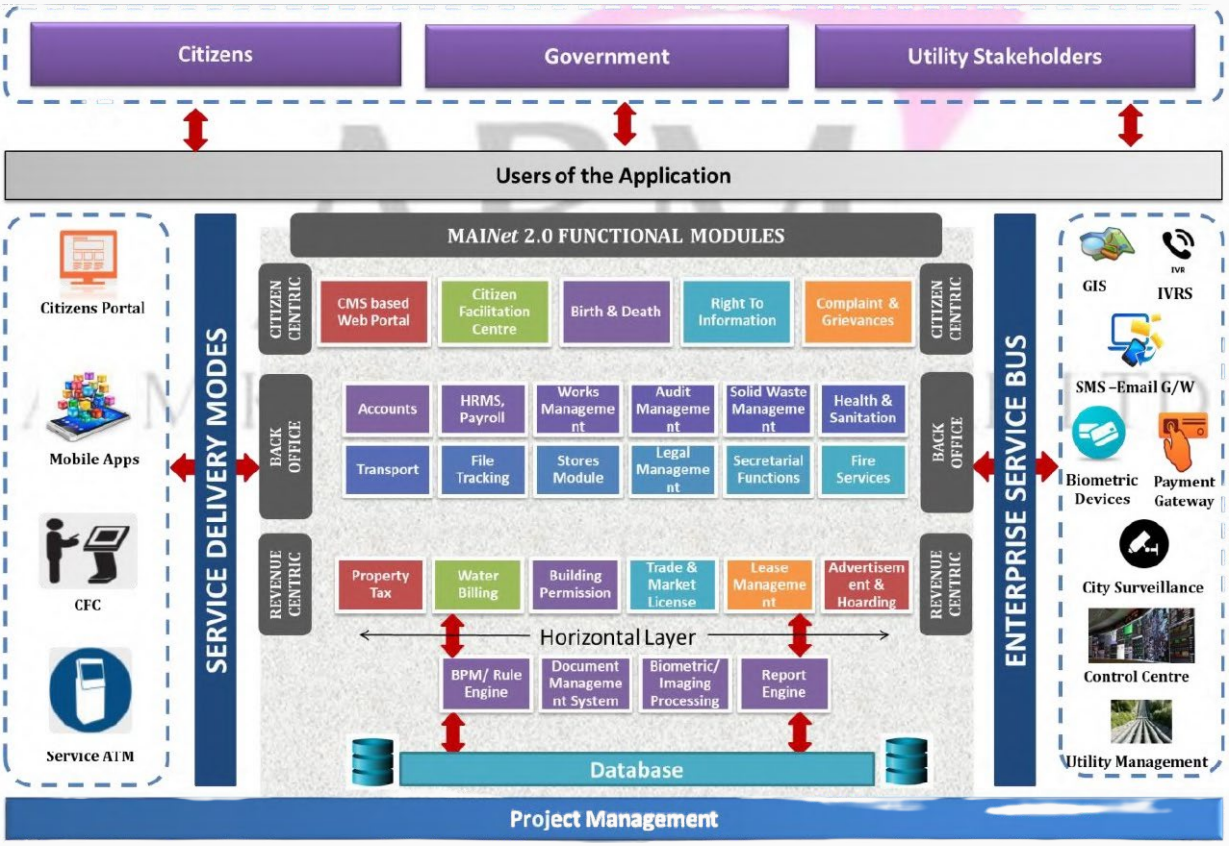
3.1 ABM KNOWLEDGEWARE - MaiNET 2.0

ABM MAINet 2.0 is developed as an integrated suite of applications products which helps in management of any municipality and smart city of any size. The suite was designed after the detailed study of the functions of municipal councils and corporations and it incorporates the best practices of the e-governance. The suite has full functionality with rich interface for the citizen engagement through web or mobile platform, through designated service centers called as Citizen Facilitation Centres (CFCs). The suite workflows can be configured according to specific needs and it has rule engine to accommodate processes or rules specific to a municipality or smart city.

Key Takeaway

1.Seamless integration of roles and responsibilities between citizen, government and stakeholders.

2.Use of IT and IOT for crowd sourcing, which provide the organization with valuable database.

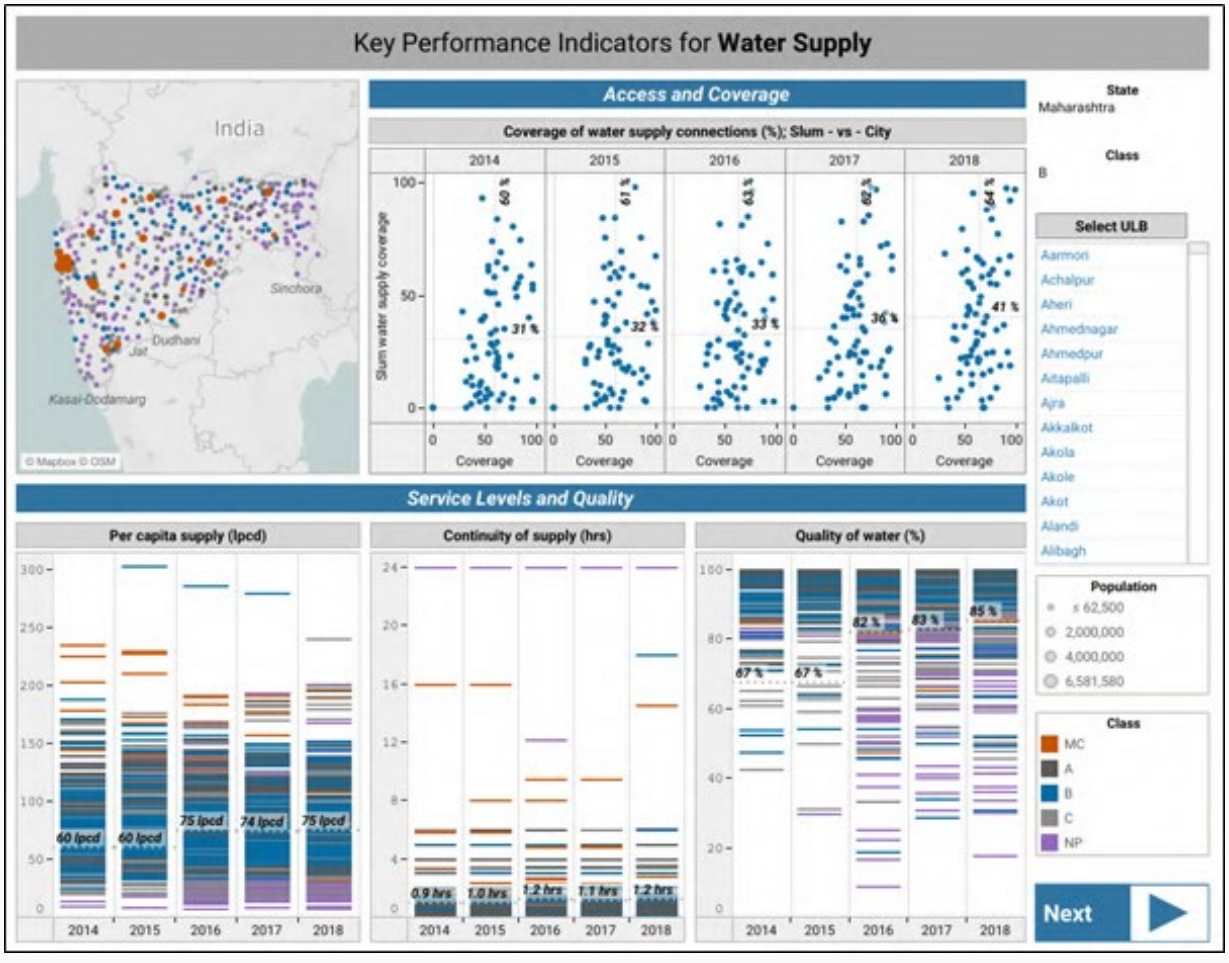


CASE STUDY 2

3.2 PERFORMANCE ASSESSMENT SYSTEM DASHBOARD (PAS)

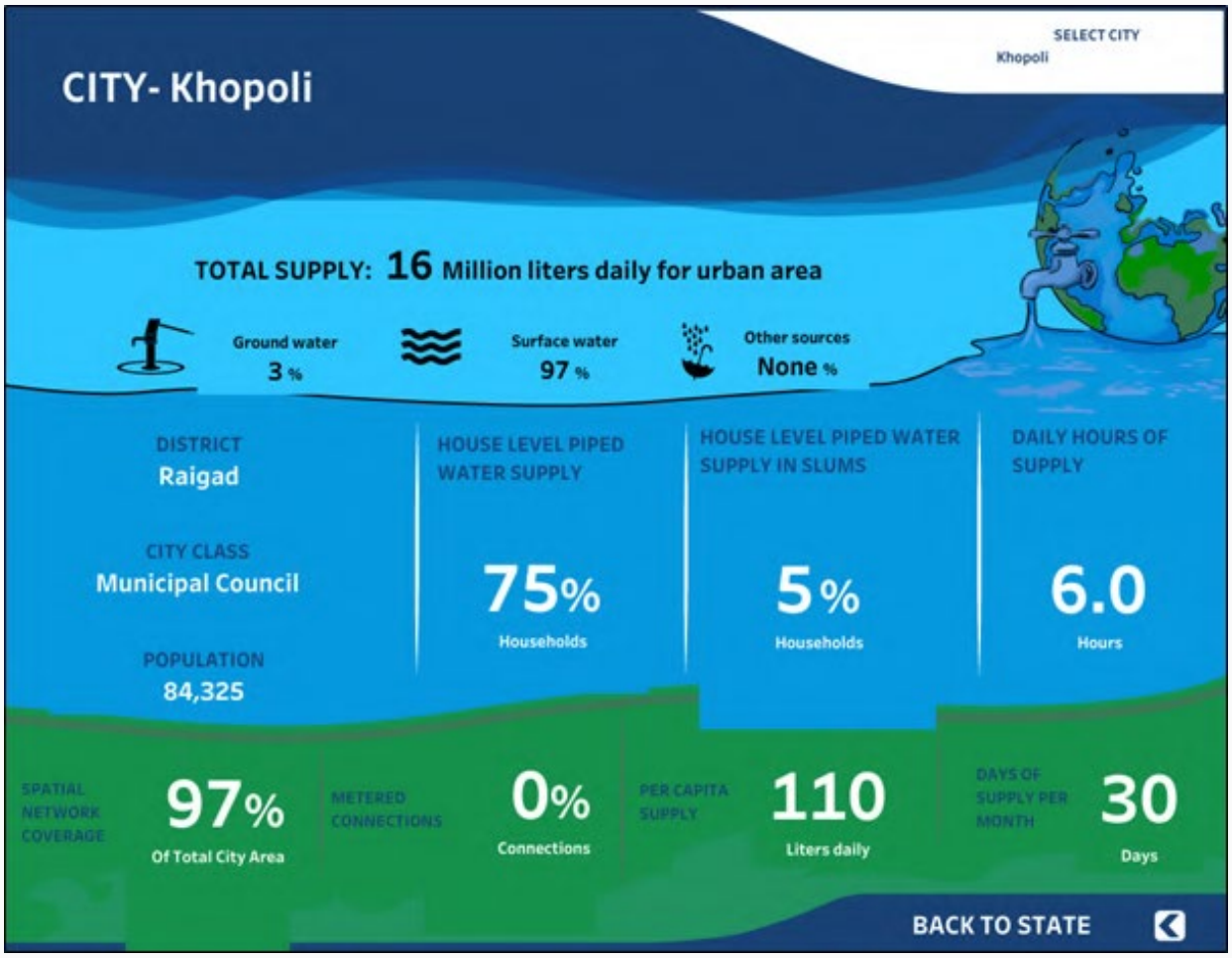
PAS dashboard stands for Performance Assessment System. These interactive dashboards were designed to get the insights into the performance of a particular infrastructure in a state or a particular ULB. Dashboards are configured in such a way that it enables a user to view a comparative assessment in the performance of ULBs of a particular state on the basis of infrastructure SLB (Service Level Benchmarks). The dashboard has following features:

- Dashboard allows user to access comparative analytical graphs of key performance indicators of various ULBs of a particular state.
- Dashboard allows selection of study area till ULB level by the user. The selection of ULBs can be made on the basis of population and class.
- This dashboard shows the historical timeline of key performance indicators of all the ULBs in an interactive manner.



3.2.1 CITY SPECIFIC DASHBOARD

This dashboard is designed primarily to show the city level infrastructure performance based on SLBs. It covers dependency on various sources, say for example water supply, which depends on ground water, surface water etc. It also shows the infrastructure coverage percentage and its coverage in the slum area. The supply and demand can be calculated using the data provided in the dashboard.



Key Takeaway

- The interactive dashboard configured to get the insights into the performance of ULBs of a state in terms of infrastructure service delivery.
- Standardized service level benchmarks are calculated to compare the performance of infrastructure services, which enables a quantitative and qualitative analysis in determining the performance.

CASE STUDY 3

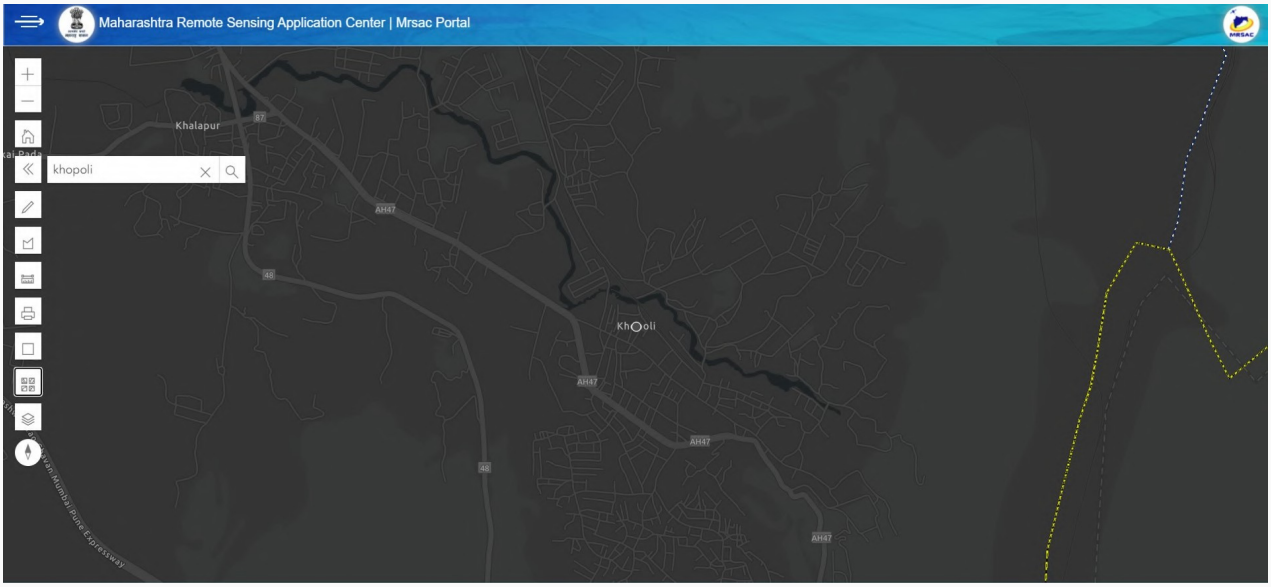
3.3 MRSAC PORTAL

MRSAC, works in tandem with the Planning Department, Government of Maharashtra, and has further established two more centers at Mumbai (2013) and Pune (2014) for smooth functioning and timely decisions in the various projects of the state. MRSAC is playing a pivotal role in making state-of-art remote sensing and Geographic Information System (GIS) technology, Mobile and Web based hosting of maps on internet for use in the G2G (Govt. to Govt.). MRSAC has the ambitious plan of making the data available on G2C (Govt. to Citizen) domain. The huge repository of thematic database on various scales follow the Maharashtra Geo-database Design Standards and are uploaded with proper topology, domain structure and migrated to the ambitious -State Data Centre- (SDC) of Government of Maharashtra, as digital web data services.

Features

- The portal is specifically made for the Maharashtra state. The portal can be used at the state level as well as at the ULB level.
- The aim of this portal is to update the users about the meteorological phenomenon which can result in disaster.

- The output data in the form of map can be customized by the user in varying degree.
- The users have access to various base layers, user can perform various measurements and analysis.
- The flexible nature of the portal makes it a useful tool for researchers and scientists.
- All the information stored within the portal are shown in the map after filtration. This portal cannot be used as a full fledged disaster response system, instead it can support a disaster response team in various ways.



Key Takeaway

- The data can be filtered and analyzed before showing it on the map. This feature makes it a boon for researchers and scientists to analyze their specific study area for research purpose.
- This portal acts as a supporting portal instead of a mainstream response system, which enables it to be a flexible and useful for multiple purposes also, other than disaster response.

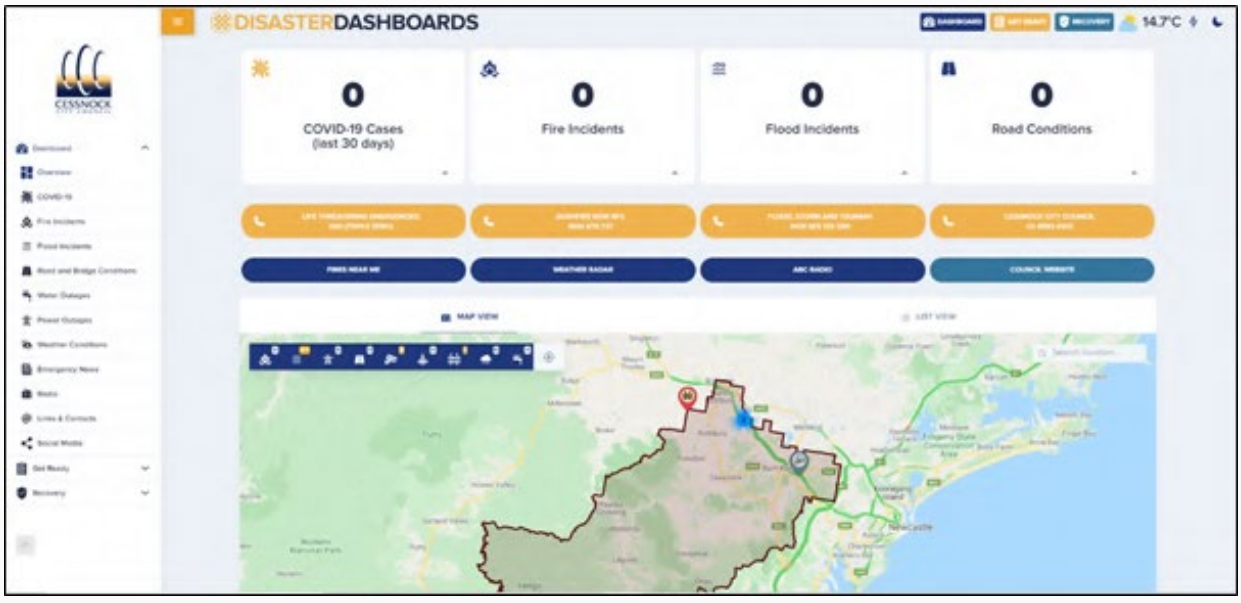
CASE STUDY 4

4.1 CESSNOCK COUNCIL DISASTER DASHBOARD

Cessnock located in New South Wales, Australia and the Cessnock City Council has launched an online Disaster Dashboard that provides real-time information to help residents and visitors of the Cessnock Local Government Area (LGA) be aware of, prepare for and respond in times of disaster.

Features

- The dynamic nature of the dashboard allows user to access near real time information about the disaster.
- The inclusion of location aspect in the form of geolocation of disasters on the map makes the dashboard more informative and helps in the correlation of disaster with the physiography and topography of an area.
- The location of disaster also helps citizen in evacuation before the disaster spread to their area and also planning their route while travelling.
- The demand and supply of infrastructure which are related to the disaster response are also addressed. The crowd sourcing and social media option allows citizen to update disaster incidents and help in spreading awareness.
- The access to news bulletin in the dashboard itself allows users to learn about the impacts of various disasters.



CASE STUDY 5

5.1 REVIEW OF KHOPOLI MUNICIPAL COUNCIL WEBSITE

Khopoli website is a typical municipal website which has all the major functions that a municipal website performs. The Khopoli Municipal Council website facilitates the proper functioning of various departments of the ULB. Website contains the information about the status of various infrastructures and services. This website lacks many e-governance features such as integrated infrastructure management system, transparency in the functioning of authorities, near real time information update of services etc.

Features

- All the administration structure and their functions are mentioned.
- It has many reports and publications of the projects which were either completed or on going.
- The basic infrastructure facilities details are mentioned and demand - supply of the infrastructure services are also available.
- Meetings and minutes of the meeting are available in the website.
- There is a separate column of disaster management activities.

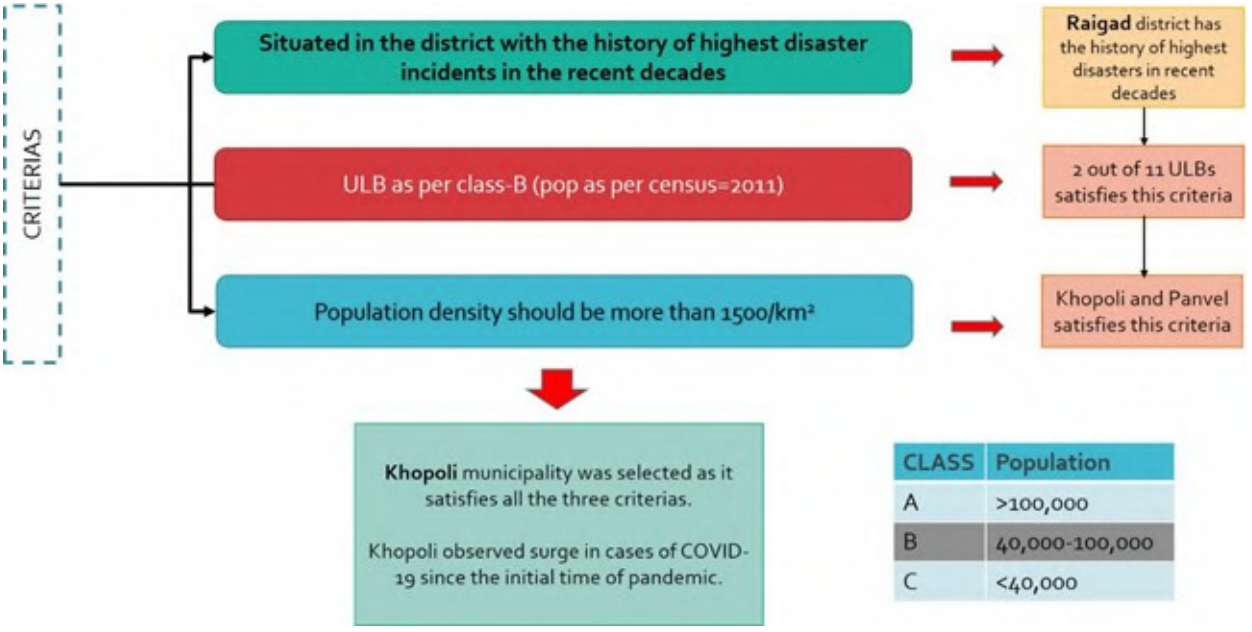
4. STUDY AREA SELECTION

STUDY AREA SELECTION CRITERIA

The Urban Local Body of Khopoli Municipal Council has been selected using Multi-Criteria Decision Making (MCDM) technique. MCDM is a widely used technique for solving complex issues involving multiple criteria. The factors should be accessible, differentiable, easy to rectify, understandable, verifiable, measurable, refinable and usable. The decision maker can select criteria in such a way that all the factors are directly related to the problem. Selection of criteria involves four stages-

- Personal Construct Theory for accessing the information
- Grounded Theory for differentiating clusters of constructs
- Critical Realism for abstracting their real meaning
- Nomology to understand how they fit into the criteria tree.

There are various MCDM techniques which are very popular such as AHP (Analytical Hierarchy Process), FR (Frequency Ratio), SVM (Support Vector Machine), MAUT (Multi Attribute Utility Theory) LR (Logistic Regression) etc. The technique adopted for this study is the multi attribute utility theory for selection of Khopoli Municipal Council as the case study area. The following chart represents the methodology that is utilized to delineate the study area.



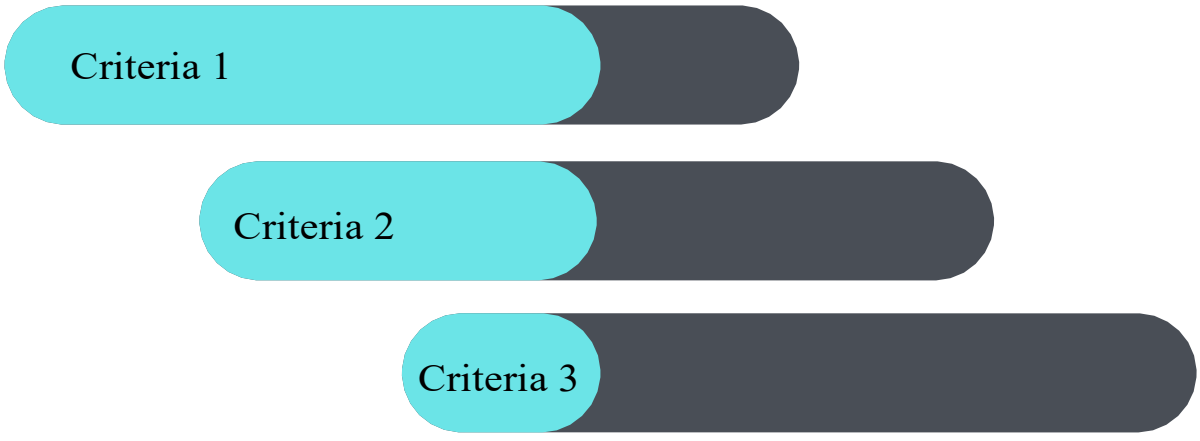
PRIORITIZING THE SELECTION BASED ON MAUT

Multi Attribute Utility Theory technique has been implemented to identify the suitable pilot case study area. The methodology involved selection of criteria and their priorities. These criteria were selected with the condition of availability of data and its impact on the vulnerability of various disasters.

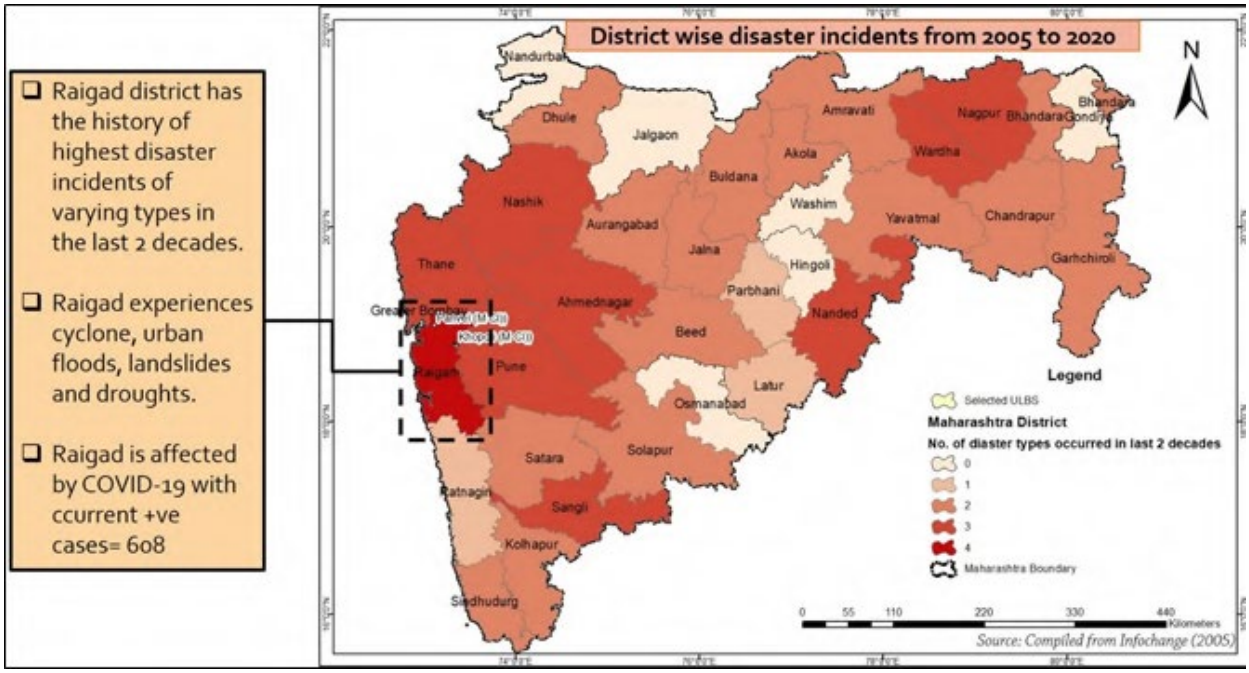
- Criteria 1 (Highest priority): ULB (Municipal Council, Municipal Corporations) location should be in the district with the history of highest disaster incident occurrence. For this filtering all the districts in Maharashtra have been considered into the model for filtering out. For the same the data of disaster incident occurrence of the past two decades has been analyzed for all the districts.

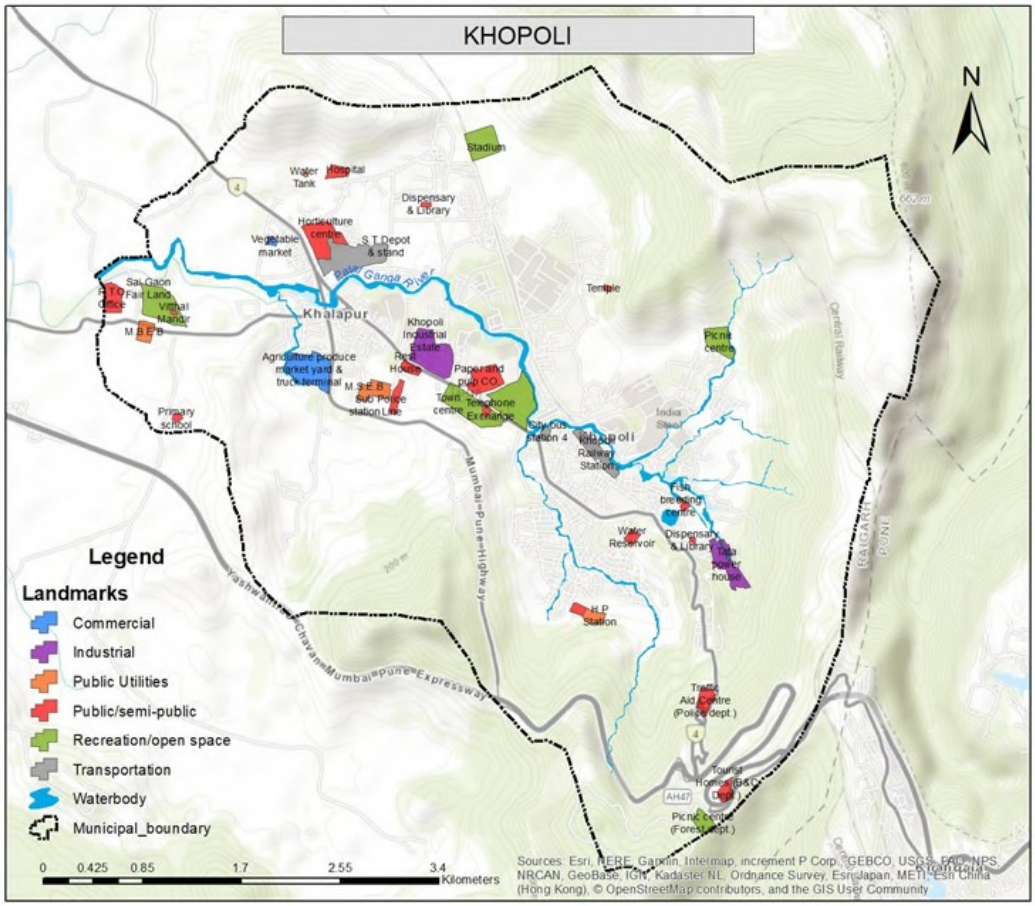
- Criteria 2 (Lower priority): The Urban Local Body must fall into the category of 'B' class municipal council. The population considered for this level of filtering of the data is according to the population of 2011 census.

- Criteria 3 (Lowest priority): Population density criteria should be more than 1500 per square km. According to the criteria two Urban Local Bodies have been filtered out namely were selected which has municipal council and are part of Raigad district. As per criteria 2, only two ULBs were selected out of twelve. After filtering according to the third criteria, the Khopoli Municipal Council has been selected.



Khopoli has the history of more disaster incidents when compared to other similar ULBs such as Panvel and Pen. Khopoli Municipal Council has faced, floods, earthquake, landslides and recently surge in COVID cases. This makes the Khopoli Municipal Council the right choice for the study area.



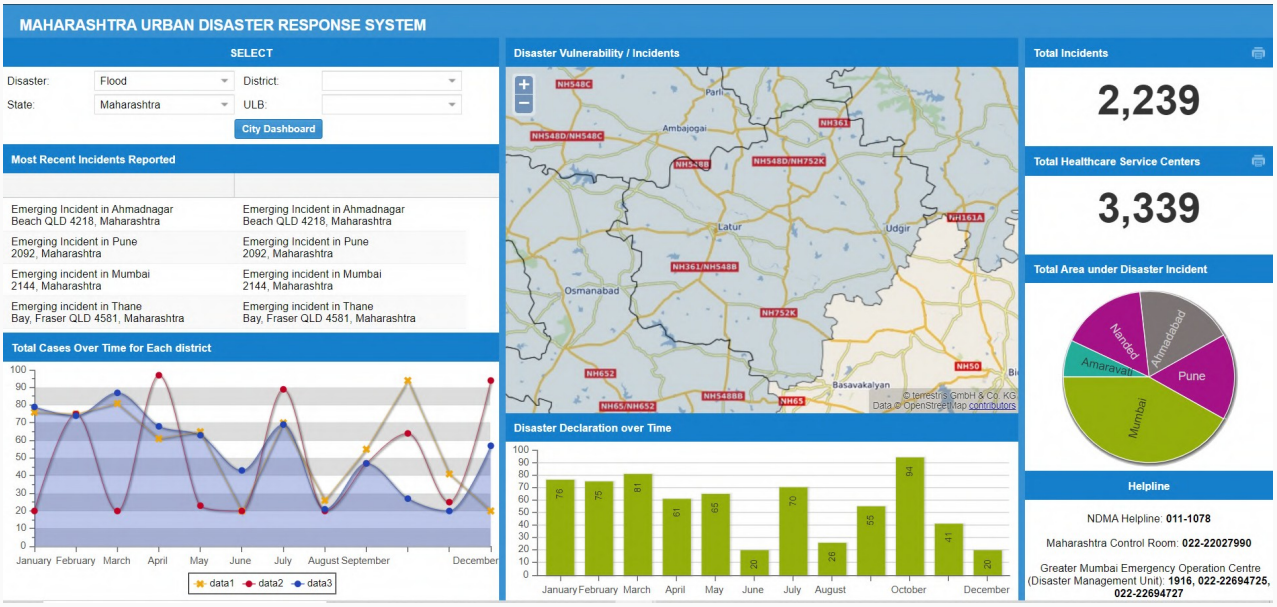


5. DASHBOARD PROTOTYPE

PROPOSED DASHBOARD PROTOTYPE

This chapter envisages the details about the proposed emergency response and preparedness system dashboard and the features available for the users pertaining to the usability of the system and details about the user interface.

USER INTERFACE



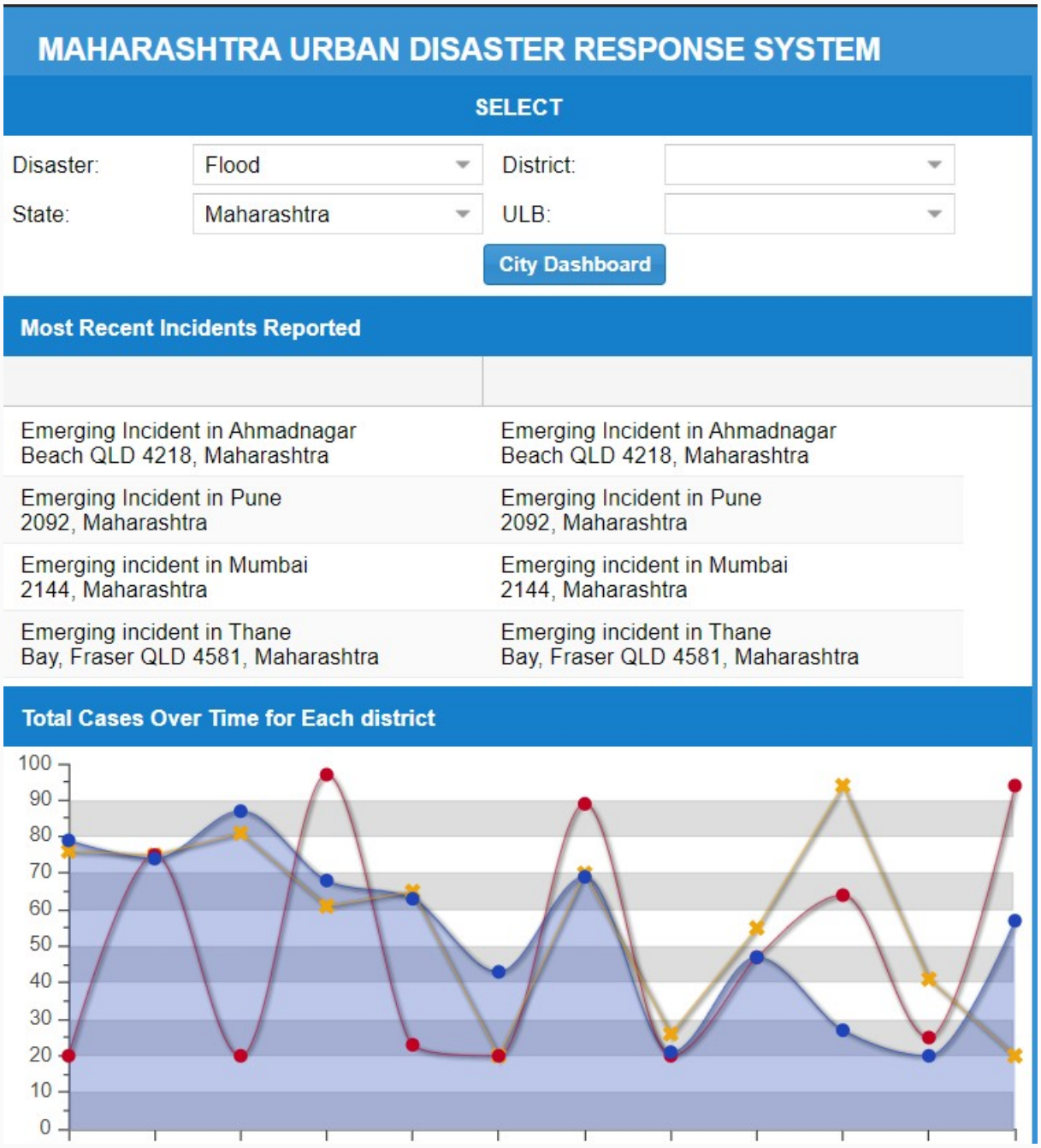
Left Section View | Middle Section View | Right Section View

The proposed dashboard prototype is categorized into two sections of the user interface. The first page of the dashboard comprises of State level information and details at the State Level that can be viewed at a glance on the page. This functionality enables the users to select the particular city that they want to access the information about. This page consists the use of analytical graphics to provide statistical comparison of entities.

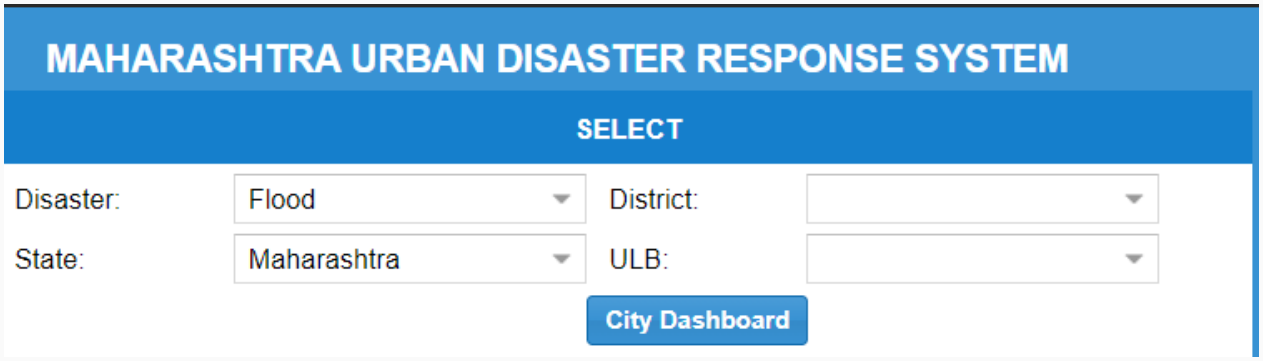
The first section of the dashboard is briefly categorized into three sections of views for enhanced visibility and easy access to information for the users. The three sections of the dashboard are Left Section View (LSV), Middle Section View (MSV) and Right Section View (RSV). The three sections are distinctly differentiated on the basis of separation by grids.

LEFT SECTION VIEW (LSV)

The Left Section View of the State Level Dashboard has a key selection feature at the top. This enables the users to select a particular disaster for which the statistics are required. The types of disasters currently provided are Floods, Cyclones, Fire and Covid-19 Pandemic. The user can select any one of these at a time. The next pane allows selection of the State. Currently, this feature is functional only for the State of Maharashtra.



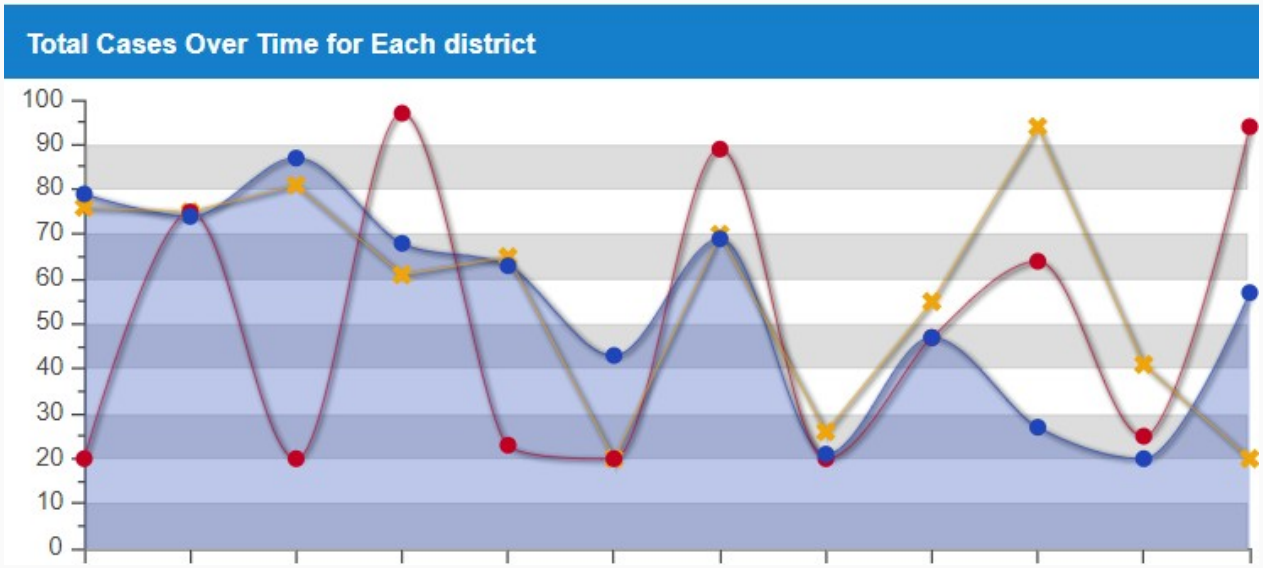
The selection of district allows the user to select a particular district and the Urban local body in that district. After selecting all the four options, the user will be redirected to section 2 of the user interface. The section 2 will comprise details of the particular Urban Local Body.



The lower panel reports all the recent incidences of the disasters that have occurred in the entire State and within various districts. This features acts like a news bulletin for the update on entire State level information. The last panel on the page includes a line graph which will indicate the total cases affected over time for different districts in the State. The graph can show up to three points of data.

Most Recent Incidents Reported	
Emerging Incident in Ahmadnagar Beach QLD 4218, Maharashtra	Emerging Incident in Ahmadnagar Beach QLD 4218, Maharashtra
Emerging Incident in Pune 2092, Maharashtra	Emerging Incident in Pune 2092, Maharashtra
Emerging incident in Mumbai 2144, Maharashtra	Emerging incident in Mumbai 2144, Maharashtra
Emerging incident in Thane Bay, Fraser QLD 4581, Maharashtra	Emerging incident in Thane Bay, Fraser QLD 4581, Maharashtra

The last panel on the page includes a line graph which will indicate the total cases affected over time for different districts in the State. The graph can show up to three points of data.



Enhanced Support for EPRS

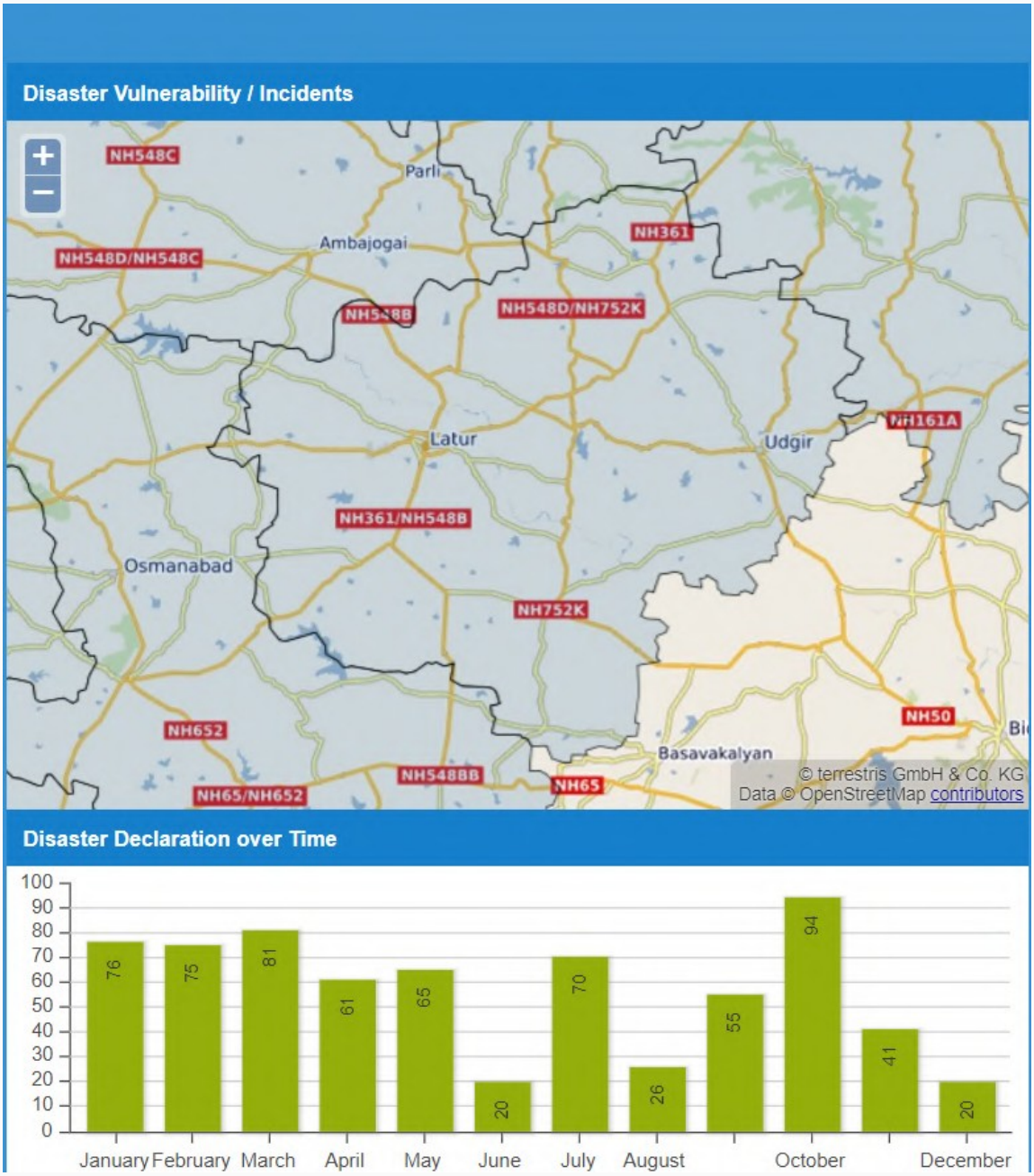
The above listed sections of the system are tools to have a one time view of the existing situation in the entire state and to determine the vulnerability of the districts. Following this the ULB's can understand the situation of the district and its performance in comparison with other districts in the State. The printer icon which is available at the corner of the RSV is an important feature for determining preparedness. This provides a list to the ULB's to determine the evacuation centers, hospitals providing service in every district as well as current working status of the hospitals.

This will help the ULB's to take informed decisions to mobilize the affected citizens within or outside the ULB.

It will provide them a clear picture of the scenario for transportation, medicinal requirements and other service requirements of the ULB. Also the graphical images and analytics are easy to understand for the users with easy navigation capacity of the map based features.

MIDDLE SECTION VIEW (LSV)

The Middle Section View of the State Level Dashboard interface consists of two panels one below the other. The above panel comprises of a State Level Map currently as the dashboard feature is only functional for Maharashtra. This map highlights the events of the disaster that has occurred all over the State. A graph for analyzing the disasters occurred over a particular period of time, that have taken place for a particular month. This graph can be updated as per the type of incident that is prevalent in the State to provide an overview of the situation in the State.



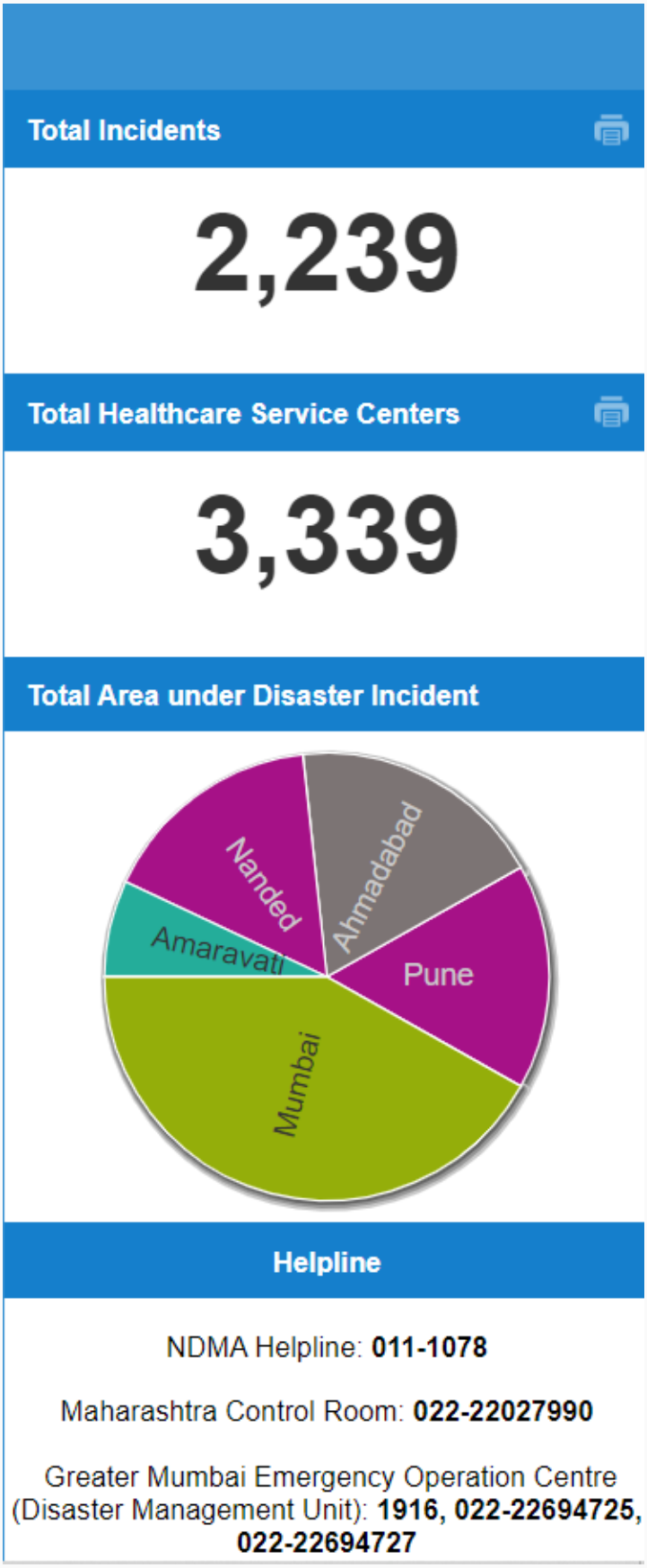
RIGHT SECTION VIEW (LSV)

The Right Section View of the State Level dashboard interface comprises of all the numerical and statistical information in place. Currently this feature is working on trial data and it can be updated subject to availability of the exact figures and datasets.

The above panel consists of numbers pertaining to total Evacuation Centers currently active in the State. On clicking the printer icon on the right side, a document containing all the locations of evacuation centers will be available to the user.

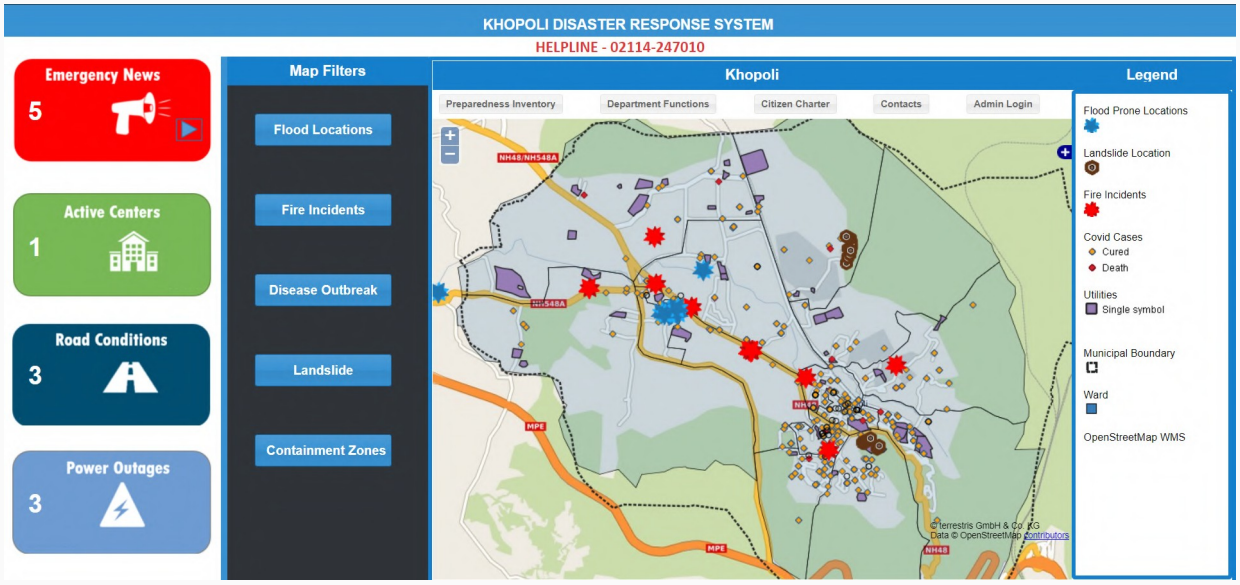
The panel below that consists of total active healthcare centers working towards particular disaster outbreak. The printer icon provides detailed downloadable list of the same. The pie chart below that indicates the area under a disaster district wise to provide at a glance view of the situation in the State.

The last panel includes helpline numbers and contact details of the authorities working towards the disaster at the State Level.

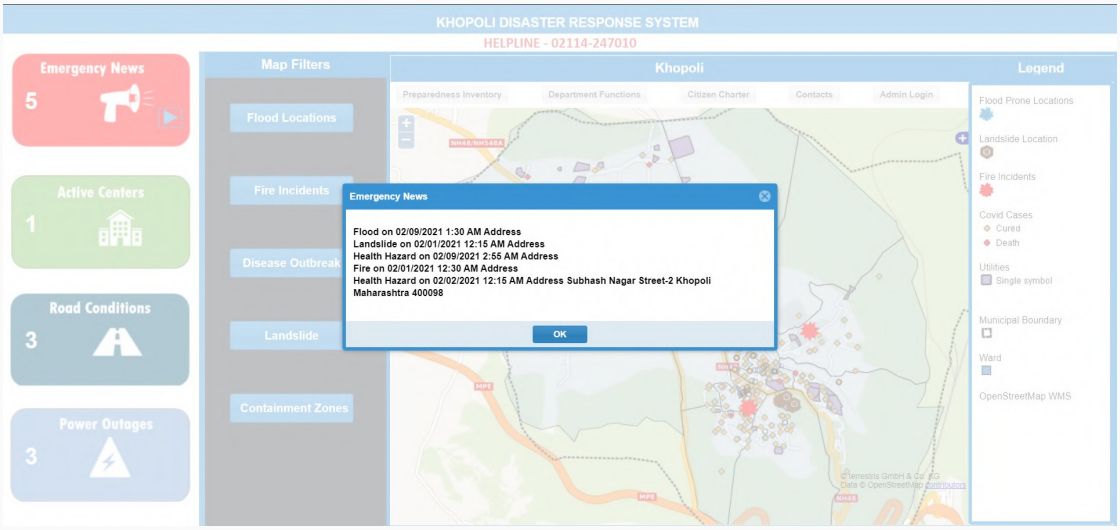


CITY SCALE DASHBOARD SYSTEM

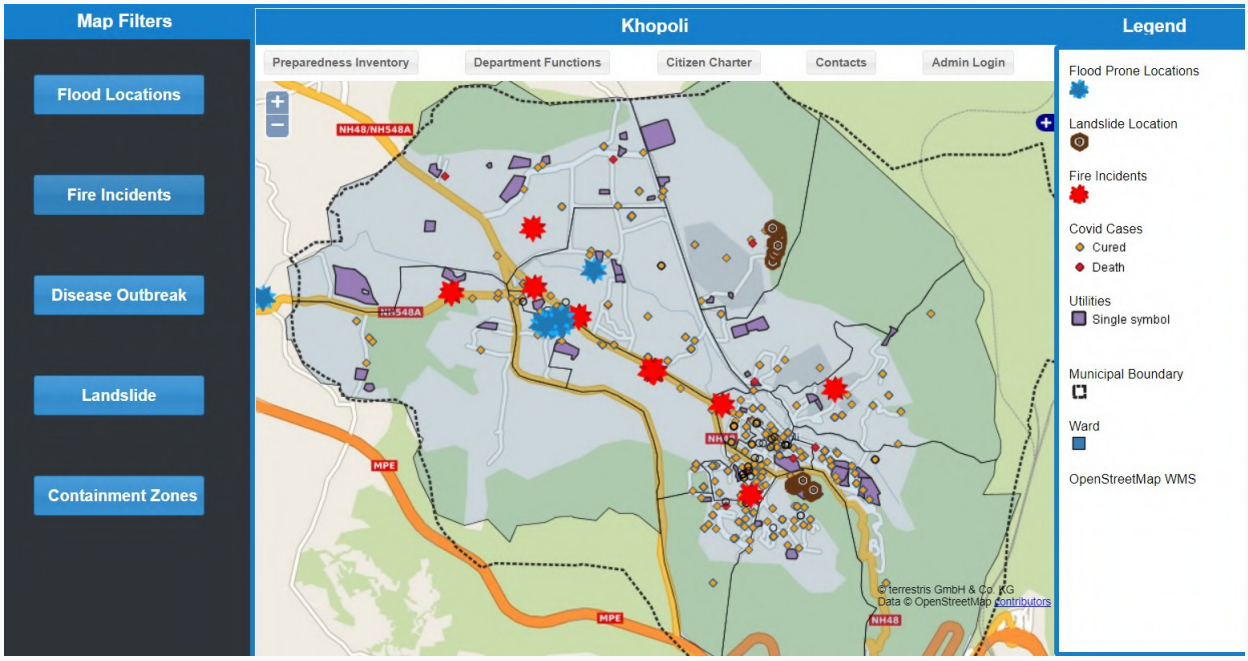
This part includes details of the dashboard interface available for use to the Urban Local Body. Currently, a working model of it is only for the Urban Local Body of Khopoli City as it is the selected study area for implementing the dashboard prototype. This section of the user interface includes two main sections. The section on the left consists of four panes highlighting Emergency News, Active Centers, Road Conditions and Power Outages respectively.



These four panes are dynamic in nature and when clicked will allow a pop-up to open up. This pop up feature will provide details about the current disaster scenario in the Urban Local Body. Active Centers, Road Conditions and Power Outages will also provide for numerical data on the pop-up.

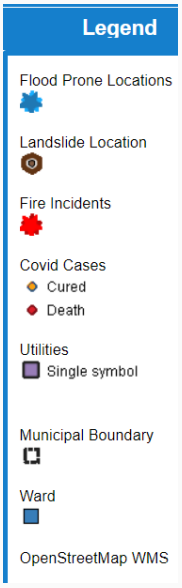


The section on the right consists of five dynamic options pertaining to the four disasters that most frequently occur in the city of Khopoli and a fifth tab for the containment zones that are located in the city. When the tabs on the disasters are clicked the subsequent locations on map for flood points, fire outbreak, pandemic outbreak and landslide locations are highlighted on the map alongside. The containment zones tab will highlight the active containment zones that are present in the city for controlling the outbreak. The map has zoom in and zoom out panning options for detailed view of the outbreak locations in the city.



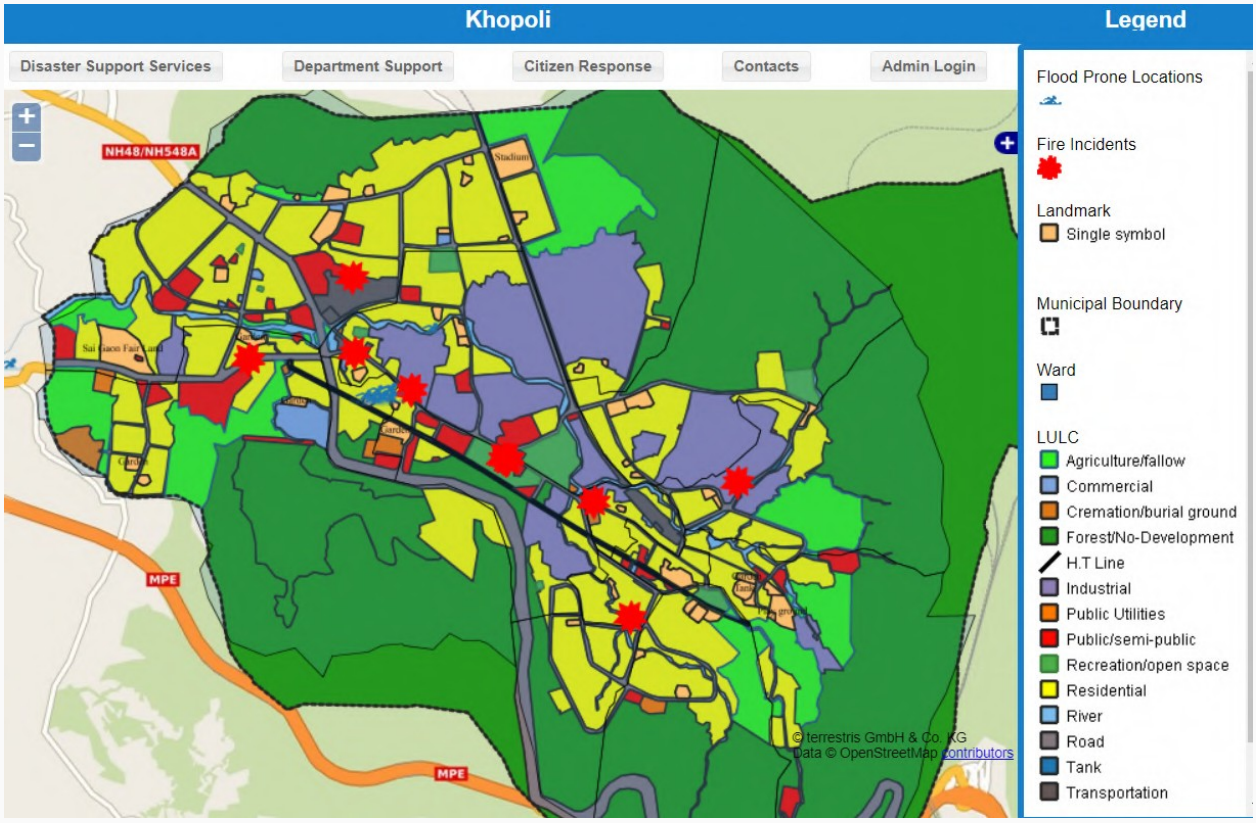
A legend on the right side of the map allows the user for enhanced readability of components in the map. The open street web map service has been utilized for the mapping purpose as it is open source and easy to access.

The Helpline number is highlighted at the top of the dashboard for immediate assistance. Five tabs have been made available on the top of the map for enhanced access to details.



Enhanced Support for EPRS

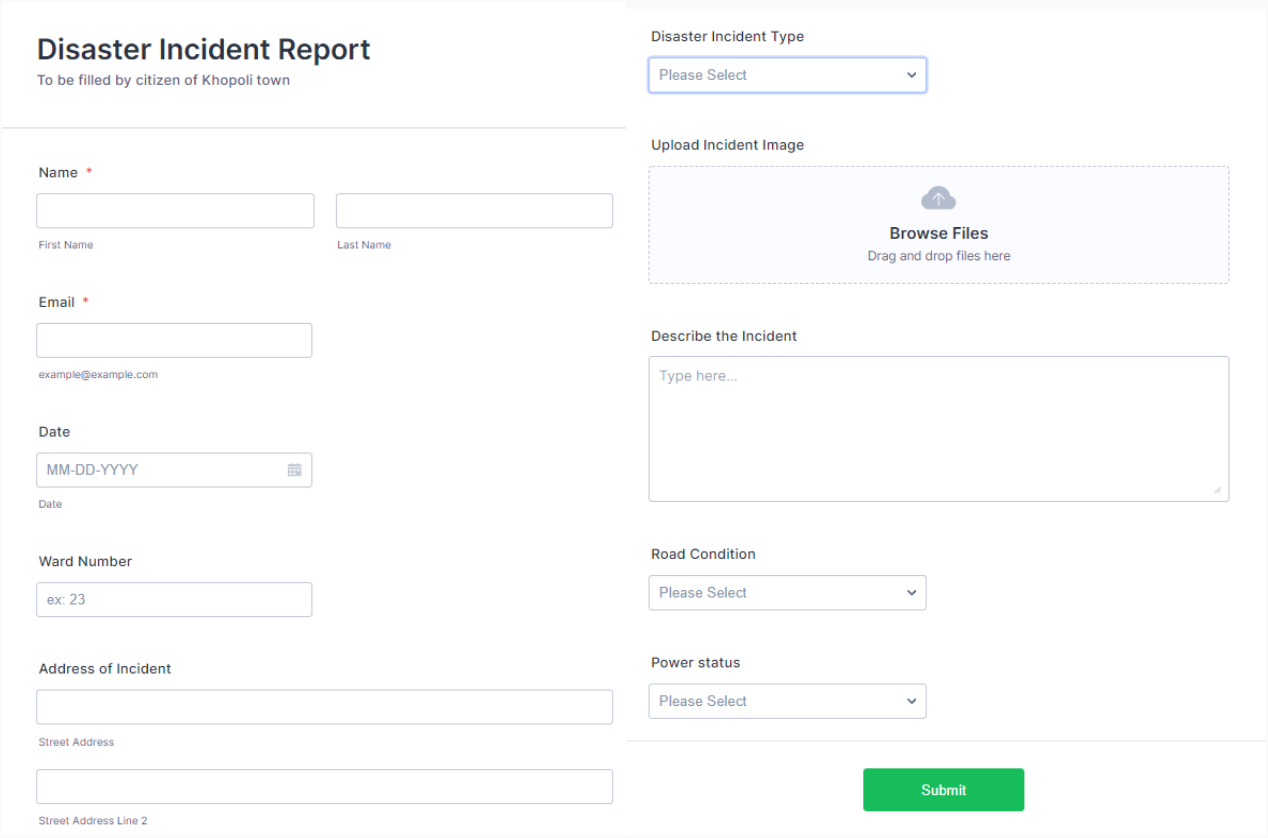
The mapping of Land Use Land Cover Map and overlapping it with various mapped disaster layers will help the local authorities to take informed decisions with regard to land use planning. Construction in the low lying areas and hazardous zones can be demarcated with the help of such features. Overlaying flood prone zones based on historical data on the residential land use, indicates that it is important to take measures in view of emergency preparedness and response post the event of any disaster. These map features also aid in taking decisions related to evacuation of residents in the event of any disaster.



Currently disaster events related to fire, flooding locations, disease outbreak and landslide zones have been demarcated on the map. Data pertaining to the disasters has been retained from municipal office and authorities. The locations are geocoded and tagged on the exact location in the city. This will help the decision makers to take valuable decisions as well as to understand the risk and hazardous areas. The administration as well as citizens will be able to view the potential risk areas and be well prepared for future mishaps. A one glance view makes this system an informed decision making and preparedness tool.

Enhanced Support for EPRS - Citizen Response

The EPRS is equipped with the facility of engaging citizens into the decision making process. The citizens are provided with a form in which they can upload all the details of the disaster incident. They can also upload details related to the scale of the disaster as well as the pictures of the incident or damage due to the incident. They can notify the authorities on the status of road condition and power condition in their area so the authorities can take steps accordingly.



The citizen responses will be updated in the form of a Microsoft Excel file which can be viewed by the municipal council authorities as well as the technical team in charge of the system. The admin can then update the details on the page of the dashboard for viewing. The information uploaded by citizens will be validated and authorized by the municipal council authorities and only then updated onto the dashboard. This type of feature can enhance the civic engagement into decision making process. This will also enable the local governments to have a participatory approach based on citizen engagement.

6. PROJECT SUSTAINABILITY

6.1 PROJECT SUSTAINABILITY

The sustainability of this project in terms of scaling it up to other Urban local bodies in the State of Maharashtra is categorized into two parts. One is Organizational Sustainability and other is Financial Sustainability. The viability of this project in terms of scalability to different levels is also mentioned in the latter part.

6.1.1 Organizational Sustainability

The organizational structure for all the Urban Local Bodies in Maharashtra follows the same level of hierarchy with the Chief Officer (CO) being in charge of the functioning of the Urban Local Body. Every ULB has departments assigned for disaster management but the only lacking part is the technological support that is unavailable to these departments. This dashboard system will help the ULB's to have all the preparedness inventory in place for effective response towards the occurrence of any untimely disaster.

The assessment of analyzing the sustainability is based on parameterization of key points that fall under Organizational structure and the readiness to adopt a particular system. This is analyzed from stakeholder consultation as well as available secondary data.

Sr. No	Parameter	Situational Analysis
1	Organisational Structure	✓ Similar for all the Tier 2 and Tier 3 cities
2	Department for Disaster Management	✓ Available in all the Urban Local Bodies
3	Computer Technical Assistant	✓ Available in all the Urban Local Bodies
4	Departmental Data	✓ Available in all the Urban Local Bodies
5	Preparedness Inventory	✗ Unavailable
6	Need for EPRS	✓ Yes
7	Willingness for Deployment	✓ Yes

6.1.2 Financial Sustainability

The financial sustainability of the project is an essential component of project management. Some of the key assessments in terms of financial viability are listed below that need to be analyzed before computing financial costs.

- Determine resources needed for the project
- Determine the fiscal needs
- Make the best use of existing resources
- Create partnerships
- Explore national and international revenue sources.

For analyzing the financial sustainability of the EPRS, following listed criteria and their quantification is taken into consideration. The categories follow the official listed categories by the Project Management Certification Organization.

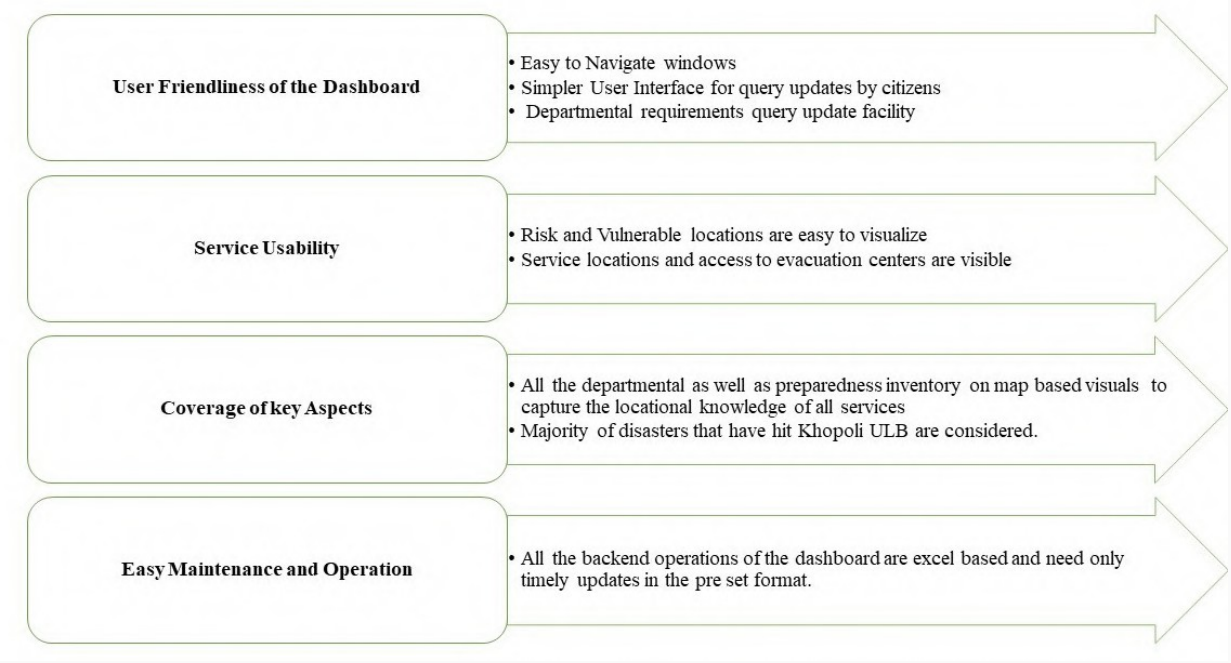
Sr. No	Category	Situational Analysis
1	Availability of Funds for Deployment	Financial support is from State Disaster Management Authority as well as District
2	Resource Availability	Already existing datasets with the Urban Local Body are utilised for database generation
3	Software Cost	Minimal; as the software and datasets are open source
4	Manpower Cost	Less human resource is required although depending on the scale of the project
5	Deployment Cost	Minimal and based on requirements of ULB
6	Operational Cost	Null

The categories that are a part of financial analysis are all a part of the cost matrix that should be checked for any project. All the costs and their potential sources to deal with as well as the extent of costs are mentioned in the situational analysis. The revenue generation aspect of this project is not considered as the system does not aim for revenue generation. However, if the system is fragmented into services like Applications (App based service), then there is also scope for revenue generation.

6.1.3 Viability for Khopoli Municipal Council

The deployment of any emergency preparedness and response system for the ULB involves consideration of major factors such as:

- User Friendliness of the Dashboard: Easy operation of online website based system for the citizens as well as the officials of the ULB.
- Service Usability: The usability of the services provided as a part of the dashboard and how are they beneficial in terms of emergency preparedness and as a response system.
- Coverage of key Aspects: The key aspects for a disaster response system includes availability of entire departmental data all at one place for easy access pre and post disaster events.
- Easy Maintenance and Operation: The major factor of service provision is that the ULB should be able to operate and maintain the dashboard on their own with as less technical support as possible.



This Khopoli Municipal Council lacks many e-governance features such as integrated infrastructure management system, transparency in the functioning of authorities, near real time information update of services etc. All these aspects are addressed with this system.

6.1.4 Potential Replicability to various Urban Local Bodies

The replicability of such an EPRS is important for other Urban Local Bodies in Maharashtra taking into account the series of disasters in the past decade in the State and the affect on tier 2 and tier 3 cities. It becomes even more important as the State has high population density and high occurrence of disaster events.

Having a Disaster response system for tier 2 and tier 3 cities is of utmost importance for efficient risk management as well as post disaster implications. Haphazard handling of post disaster scenario can be avoided by having a pre existing response system in place.

Sr. No	Challenges	Solutions
1	Different Regional Setting of all ULB's	The system is designed to incorporate all the regional factors and update itself accordingly.
2	Organization Hierarchy	Similar for all the ULB's
3	Frequency of Disaster occurrence	System acts as a preparedness tool rather than a response tool
4	Area and Population Differences	The system is independent of density and area and can accommodate all the available data

The catastrophic nature of disasters means that all levels of government and all sectors of society share responsibility for dealing with them. In general, disasters are managed through a federal structure of responsibilities and resources, where discretion and authority for management reside with the affected jurisdictions, and where requests for resource support travel upward from those jurisdictions until enough are garnered to stabilize the incident.

This system would be at the discretion of lower level governments that are devoid of technical capabilities and lack infrastructure inventory and required assessments for a better preparedness strategy and response that they can have to efficiently eal with the aftermath of any disaster.

Regional Centre for Urban and Environmental Studies
All India Institute of Local Self Government, Mumbai

Email: dir.rcues@aiilsg.org ; rcuestraining@aiilsg.org
Phone: 8657622550 / 51 / 52 / 54
Twitter: https://twitter.com/in/RCUESMumbai
Website: www.aiilsg.org/rcues

Address

M. N. Roy Human Development Campus, Plot No.6, ` F' Block,
Opp. Govt. Colony Bldg. No. 326, Near Uttar Bhartiya Sangh,
Bandra (East), Mumbai – 400051.