Disaster Risk Reduction in Greater Mumbai Project
MCGM-EMI Collaborative Project

DRMMP Handbook

Submitted by EMI to MCGM as Final Deliverable

Contents

Foreword

Mumbai is India's largest city, and is its financial and commercial capital. With an estimated population of 14 million, Mumbai is among the largest megacities of the world, crammed within a relatively small area of 437 square kilometres. Thirty three per cent of country's income tax collections, 60 per cent of customs duty collection, 20 per cent of central excise tax collection, a significant quantum of the corporate tax, and 40 per cent of India's foreign trade is generated from Mumbai.The economic opportunities attract thousands every month from different corners of the country. The city has been unable to cope with the rapid increase in its population, resulting in around 60% of the population living in slums. The city is also prone to both natural and man-made disasters. The most commonly occurring ones include floods, industrial disasters, terrorism and riots.

The Municipal Corporation of Greater Mumbai, which has been managing the civic affairs of the city for over a hundred years, is deeply committed to making the city resilient from both natural and man-made disasters. Mumbai was the first Indian city to develop its disaster management plan in the late 1990s. Since then, the MCGM has taken a large number of initiatives to improve its disaster risk management capability. Following the disastrous flood in July 2005, the MCGM has also undertaken several structural measures to reduce the city's vulnerability. Recently, the MCGM has been designated as the District Disaster Management Authority for Mumbai City and Suburban districts under the Disaster Management Act of 2005.

The MCGM has undertaken the task of developing a Disaster Risk Management Master Plan for the city in partnership with Earthquakes and Megacities Initiative (EMI). The broad objectives of the program are to develop a competent emergency management system with international standards of practice, institutionalise disaster risk management practice and to develop a coherent set of objectives and recommendations to reduce disaster risk in Mumbai.

Municipal Commissioner,
Municipal Corporation of Greater Mumbai

About the Handbook

The **Disaster Risk Management Master Plan (DRMMP)** is an analytical model of EMI in guiding local authorities and their local partner institutions in mainstreaming and developing a DRM master plan. This consists of strategies, policies, actions and processes. This comprehensive plan is formulated through a participatory[1] process of data provision and validation of information, anchored in the science of risk management while taking into account the sustainability of the plan.

This Handbook is specially designed for the officials of the **Municipal Corporation of Greater Mumbai (MCGM)**, the members of the Focus Groups, and other stakeholders to facilitate their understanding of the DRMMP methodology and to fully participate in its implementation in Mumbai. It integrates EMI's experiences of carrying out the **DRMMP** methodology in various cities into a step-by-step and easy-to-follow guide that is structured to support the advanced user as well as officials and other executives who cannot find time to read lengthy documents.

The structure of the handbook follows the DRMMP Process along its four phases, namely: the **Preparation Phase, Diagnosis and Analysis Phase and DRMMP Framework Development to Action Planning Phase.** The handbook also provides a brief conceptual discussion of *disaster risk management* (**DRM**), *DRM mainstreaming* concept, and DRMMP. These elements provide the rationale and the justification for using the DRMMP. It will also introduce the users to DRMMP's two major support strategies: *capacity development* and *collaboration tools*.

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[1] The participatory approach is at the core of mainstreaming DRM practice. By nature, it facilitates the communication of risk, the development of local ownership, and the inter-sectoral coordination among stakeholders. All key departments and functions of a city must be part of the development of a local DRM practice and its related strategic planning, and action planning processes.

How to Use the Handbook

*T*he handbook can be used as a material for presenting the *Disaster Risk Reduction Project in Mumbai* to various offices and organizations -- both internal and external to MCGM and as a step-by-step guide for MCGM officials and staff in implementing the DRMMP Process in Mumbai.

The handbook's content is categorized in two levels:

	First Level Summary and key points can be found here as indicated by this symbol at the edge of the page. These key points will be used to present the project to internal and external partners.
	Second Level Detailed discussions, case studies, and examples are included in the second level as indicated by this symbol at the edge of the page.

There are also added features to guide future DRMMP implementers in carrying out the steps and guidelines contained in the handbook. They are presented as sidebars with different functions, as follows:

	Definition- provides definitions of key terms used in the discussion of the handbook.
	Caution- includes practical tips on the things that future DRMMP implementers should look out for before moving to the next activity/phase of the DRMMP Process.
	Reminder- information that should be taken into account when doing a particular activity for DRMMP.

Acronyms

AS/NZS	Standards Australia/Standards New Zealand
CBO	Community-based Organization
DRM	Disaster Risk Management
DRMMP	Disaster Risk Management Master Plan
DRR	Disaster Risk Reduction
EM	Emergency Management
EMI	Earthquakes and Megacities Initiative
FI	Field Investigation
GAM	Greater Amman Municipality
HFA	Hyogo Framework for Action
IWOs	Implementation Work Outputs
KMC	Kathmandu Metropolitan City
MCGM	Municipal Corporation of Greater Mumbai
NGO	Non Government Organization
PIT	Project Implementation Team
TNA	Training Needs Assessment
UN/ISDR	United Nations International Strategy for Disaster Reduction
URR	Urban Risk Reduction

1 Introduction

What is Disaster Risk Management?

DRM is primarily a *proactive* approach to dealing with disaster risks. This means addressing the problem at the level of risk by:

- ✓ Understanding the nature of hazards;
- ✓ Developing scenarios to understand the impact of various potential events;
- ✓ Planning ahead to get ready before disaster strikes; and
- ✓ Integrating **operational processes** to manage post-event situations with **functional processes** to protect assets, minimize disruption of services, and improve the overall safety and welfare of the population (Figure 1).

The objective is to build disaster-resilient cities where population, communities and institutions are advocating and pursuing a culture of safety.

Disaster Risk Management –
The systematic process of using administrative directives, organizations, and operational skills and capacities to implement strategies, policies and improve coping capacities in order to lessen the adverse impacts of hazards and the possibility of disaster
-    Source: www.unisdr.org

Fig.1. Shift of Paradigm from Response/Crisis Management to DRM

"Risk management should be embedded in the entire organisation's practices and processes in a way that it is relevant, effective and efficient. The risk management process should become part of, and not separate from, those organisational processes."
-    Source: Draft ISO31000:2009 Risk Management – Principles and Guidelines, ISO, 2009

Evolution of Disaster Risk Management

From Product	To Process
Risk assessment *equals* risk management	Risk assessment is *part of* risk management
Exclusive science/technical approach	Inclusive participatory approach
Single institution task	Multi-institutional enterprise
Risk as a sectoral implementation issue	Risk as a multi-sectoral coordination issue
Risk as an agency-specific issue	Risk as a whole-of-society issue

DRM is based on the precept that disaster is not inevitable; its impacts can be managed and reduced through appropriate development actions. It involves a range of measures associated with the following:

- ✓ Hazard mitigation
- ✓ Education and advocacy
- ✓ Disaster preparedness
- ✓ Building resilience of essential services and communities
- ✓ Emergency management

Ultimately, DRM strategies and actions are meant to contribute to the safety and well being of communities, and protect (local) development gains.

DRM can be formal or informal, and may be undertaken by public and/or private entities. To be effective, it needs to take place at all tiers of government and society (see Figure 2: EMI's Mainstreaming Approach).

"The task of DRM is so huge such that several stakeholders – NGOs, academy, governments, private sector, donors -- need to all work together in areas encompassing technology, training and planning."

- Prof. Y.M. Desai, IIT-Bombay during the Asia

Mainstreaming Concept

Mainstreaming is the key word to accomplish urban disaster risk reduction. It refers to the process of incorporating the practice of risk management within the governance and operations of public and private institutions.

For local authorities, this translates into having processes and practices that inherently incorporate URR in the key functions that they undertake such as land use and urban development planning, construction and building licensing, environmental management, and social welfare as well as in the services that they provide or regulate.

Mainstreaming recognizes:

✓ Central authorities coordinating policies, regulations, and resources
✓ Civil society participation
✓ Local implementation of disaster risk reduction

Mainstreaming DRR means that local governments need to develop or modify laws, policies, and organizational arrangements as well as plans, programs, and projects to integrate disaster risk reduction within their governance and developmental processes.

Fig. 2. EMI's Mainstreaming Approach

The Need for Local Mainstreaming

The success of any national and international disaster risk management program and initiative depends to a great extent on the success of their implementation at the local level. The role of local authorities is explicitly recognized in the Hyogo Framework for Action. The DRMMP methodology, while anchored in the science of risk management, provides the mechanisms for policy formulation, strategy development, action planning, awareness and preparedness at the local level. This approach to disaster management attempts to merge the disaster reduction strategies defined by policymakers with the needs and resources of the local community.

The DRMMP is a proactive approach which recognizes that disasters are not just "setbacks" or "roadblocks" to development, but result from the paths that development is pursuing. Thus by changing planning processes, and incorporating disaster risk assessment in the planning of all projects, it can be ensured that in future natural hazards will encounter resilient communities that are capable of withstanding their impact and therefore remain mere emergencies rather than disasters.

2 The Disaster Risk Management Master Plan

What is DRMMP?

- ✓ DRMMP is a **"master plan", which comprises strategies, policies, actions and processes** for mainstreaming **disaster risk reduction at the local level** through a participatory planning process. A structured participatory process lays out the rationale and builds consensus for each of these elements.
- ✓ Follows the approach set out in **AS/NZS 4360-2004**, a standard in risk management developed jointly by Australia and New Zealand, and recently adopted by the International Standards Organization as **ISO31000** for risk management.

What are the principles underpinning DRMMP?

- ✓ Participatory Approach
- ✓ Locally developed and owned
- ✓ Scientifically-based
- ✓ Comprehensive
- ✓ Sustainable

Elements of Risk Management Standards	How ISO 31000 builds upon AS/NZS 4360:2004
Application of framework for risk management	Expands the framework and further develops the 2004 framework
Principles for managing risk	Far more clear and explicit
Enhanced risk management attributes	New additions included
Guide to establishing and implementing effective risk management process	New additions included compared with previously supplied in HB 4360:2004
Risk management context	Also applicable across all industries to any entity implementing organizational objectives which may involve uncertain outcomes

How can DRMMP benefit Mumbai?

Through the DRMMP process, MCGM and other key stakeholders in Mumbai will be able to:

✓ **UNDERSTAND** their vulnerabilities to hazards

✓ **DETERMINE** a series of options to reduce the risk given their priorities and implementation processes.

✓ **EVALUATE** the physical and socio-economic impacts of these hazards

✓ **DEVELOP** a coherent approach to managing the overall risk

✓ **ACQUIRE** the competency to plan for and effectively manage emergencies

THE DRMMP PROCESS

The DRMMP Framework presented in Figure 3 shows a sequential and iterative process with a feedback loop that allows continuous review, monitoring and evaluation of the plan. The process involves four phases namely:

- **Preparation**
- **Diagnosis and Analysis**
- **DRMMP Framework Development**
- **Action Planning**

It also recognizes the need for **stakeholders' participation** and **capacity development** mechanisms. The different phases are discussed in detail in the succeeding sections.

Fig. 3. DRMMP Framework
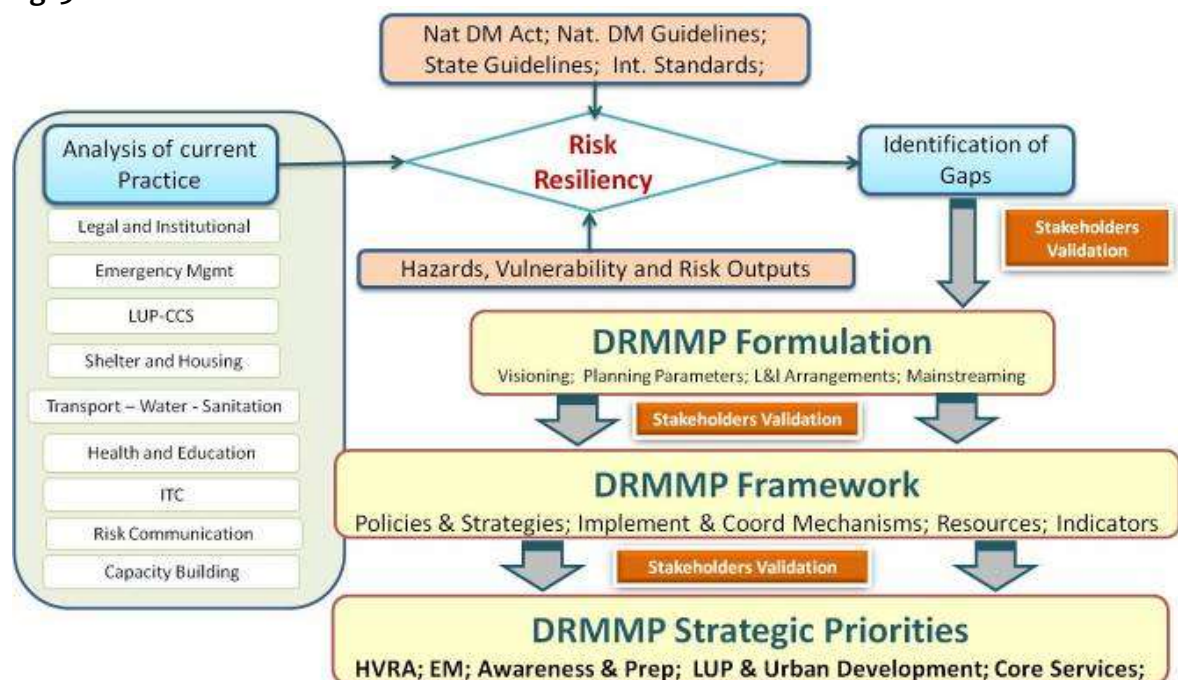
3 Phase 1: Preparation

The preparatory phase is most often overlooked, but is critical to the success of any planning undertaking. It is essential that it is given due importance as this will set the stage for productive collaboration and the timely implementation of the activities that need to be undertaken by the team to come up with the DRMMP. This stage of the process will also help ensure commitment and support from all critical stakeholders throughout the formulation process.

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Before moving ahead…

The DRMMP is a cooperative, joint undertaking between MCGM and EMI. This includes joint ownership of project goals and deliverables, co-sharing in expertise, in mobilizing resources, and even in completing the

Fig. 4. Components of Preparation Phase

✔ At this stage, the following were accomplished:

| Memorandum of Agreement Signed | Project Implementation Team Instituted |

| Project Resources Identified | Budget Allocated | Project Work Planned |

| Terms of Reference of EMI experts, consultant, local consultants and experts finalized | Focus Groups and Focus Group Leaders assigned |

In the Spotlight: Disaster Management Act, 2005

The Disaster Management Act 2005 envisages a paradigm shift from the erstwhile relief-centric response to a proactive prevention, mitigation and preparedness-driven approach, so as to conserve the developmental gains and also minimize losses to lives, livelihoods and property. The National Vision for disaster management is to build a safer and disaster-resilient India by developing a holistic, proactive, multi-hazard and technology-driven strategy.

The Disaster Management Act sets out the framework for institutional mechanisms at the National, State and District levels expressing that the task of disaster management should jointly be undertaken by different government levels. The entire process will centre-stage the community and will be provided momentum and sustenance through the collective efforts of all Government agencies and Non-Governmental Organizations (NGOs).

Urban Local Bodies play a significant role in the disaster management process, particularly in response and rescue operation, relief and rehabilitation, training and maintenance of resources related to disaster management, disaster preparedness, restoration of livelihood options and coordination with NGOs and civil society. The Government of Maharashtra has constituted the Greater Mumbai Disaster Management Authority under the Act. The Authority is headed by the Municipal Commissioner and is responsible for meeting the objectives of the Act.

> The most important activities in strengthening disaster preparedness include the preparation of Guidelines, the improvement in risk assessment, vulnerability analysis and early warning systems, capacity building, public awareness, mock drills, etc.

The DRMMP Team

DRMMP operates under an integrated Project Implementation Team (PIT). In principle, the organization of the PIT is more horizontal rather than vertical, and more functional than hierarchical, and recognizes the importance of every member's contribution to the Project as a whole. It is multi-disciplinary and structured as a single unit. The goal is to have meaningful interaction between Mumbai's Local Experts, Consultants, and national and local institutions and EMI Experts, Consultants and Technical Staff.

PROJECT MANAGEMENT	
PROJECT DIRECTORS	**Mr. S S Shinde, Jt Municipal Commissioner, DM, MCGM** **Dr. Fouad Bendimerad, Chairman, EMI**
PROJECT MANAGERS	**Mr. M L Narvekar, Chief Officer, DMP & CCRS, MCGM** **Mr. Jerome Zayas, Technical Manager EMI**
PEER REVIEWER	**Prof. Ravi Sinha, IIT Bombay**

PROJECT EXPERTS	
LEGAL AND INSTITUTIONAL ARRANGEMENTS	**Mr. Mohan Sajnani, Ex Director, Ministry of Home Affairs** **Atty. Violeta Seva, EMI**
HAZARD, VULNERABILITY AND RISK ANALYSIS	**Prof. Ravi Sinha, IIT Bombay** **Prof. Kapil Gupta, IIT Bombay** **Dr. Fouad Bendimerad, EMI**
SHELTER DISASTER RISK RESILIENCY	**Mr. Farouk Tebbal, EMI** **Mr. Bijan Khazai, EMI** **Dr. Craig Davis, EMI** **Dr. Noriel Tiglao**
LAND USE PLANNING AND CONSTRUCTION CODES AND STANDARDS	**Mr. V Phatak, Ret. Principal Chief, Town and Country Planning Division , MMRDA** **Mr. Suhas Gokhale, Retd Assistant Planner, CIDCO** **Dr.Renan Tanheuco, EMI**
EMERGENCY MANAGEMENT, SOCIAL MOBILIZATION AND EDUCATION	**Col. Shridhar Chitale, Ret.** **Mr. Jim Buika, EMI** **Mr. Troy Kindred, EMI**

The DRMMP Team

Focus Groups

Focus Groups (FG) serve as one of the mechanisms for stakeholders' participation. FGs provide the forum to stimulate discussion, develop a common understanding, build consensus and validate the assumptions, findings and recommendations of the DRMMP. At the same time, FGs provide the opportunity for stakeholders to enhance their core competencies throughout the DRMMP process and ensure sustainability of DRM practice in the long run.

Focus Group	Leader
Legal & Institutional Arrangements	Dr. Gita Kewalramani, Ret. Prof, University of Mumbai
Hazard, Vulnerability & Risk Analysis	Mr. G Rami Reddy, Scientific Officer, BARC
Shelter and Disaster Risk Resiliency	Mr. Arvind Parab, Superintendant (Electric Supply), BEST Undertaking
Land Use Planning and Construction Codes and Standards	Mr. V Phatak, Ret. Principal Chief, Town and Country Planning Division , MMRDA
Emergency Management, Social Mobilization & Education	Mr. Rajeev Kadam, Dy Director, Aniruddha's Academy of Disaster Management

See **Annex 1** for a complete list of organizations represented in Mumbai's Focus Groups.

Additional Municipal Commissioner Mr Gajbhiye, Municipal Commissioner Mr S.S.Kshatriya, Addl Municipal Commissioner Mrs Manisha Mhaiskar,with Shri Shantaram Shinde and other members of the DRMMP team.

Shri Shantaram Shinde, Prof. Ravi Sinha and Dr Fouad Bendimerad with EMI experts and local staff during the SDRR Focus Group Meeting, 6th Field Investigation,February, 2010

Advisory Committee Meeting, Nair Dental Hospital, May 2010

PIT meeting, July, 2010

Timeline of DRMMP Process

The seven tasks of the DRMMP process will be spread over a two-year project period during which experts from EMI will organize field investigations (FI). Their work will be complemented by a team of local experts who would undertake data gathering and analysis on the key areas of DRM.

Task Description	Apr09-Jun09	Jul09-Sep09	Nov09-Jan10	Feb10-Apr10	May10-July10	Aug10-Oct10	Nov10-Jan11	Feb11-Apr11
1 Analysis & Diagnosis								
2 Hazards, Vulner, Risk Analysis								
3 DRMMP Analysis & Planning								
4 DRMMP Framework								
5 Implementation Work Outputs								
6 Emergency/DRM Organisation								
7 Training & Capacity building								
8 Report and Wrap-up								
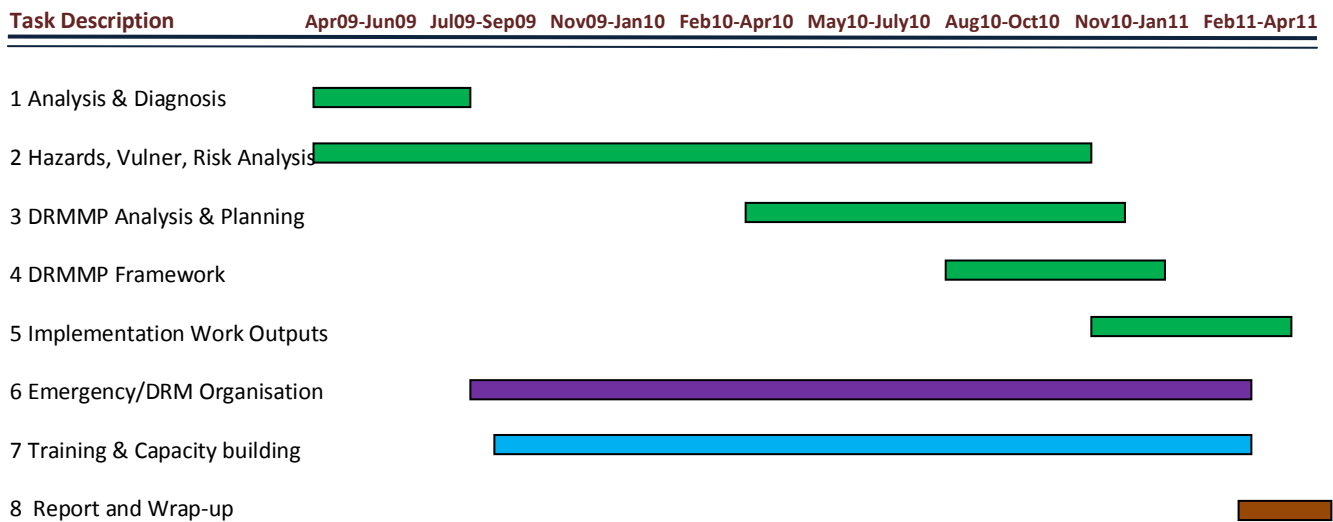
PIT meeting, May 2010

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Phase 2: Diagnosis and Analysis

This Phase aims to achieve two objectives:

- ✓ To understand the DRM context
- ✓ To understand the inherent risks of the city
- ✓ To collect the necessary data and information
- ✓ To identify the gaps and needs

These activities may be undertaken either sequentially or simultaneously depending on the availability of information and resources. However, risk analysis may take longer due to the nature and complexity of the tasks involved, especially when there are no existing scientific studies to build from.

Figure 5 outlines the components/activities under this phase.

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Before moving ahead…

By this time, the PIT was organized, with Task Teams both from MCGM and EMI clearly identified. The Task Leaders, with support from the Focus Groups, are responsible for planning and carrying out the activities related to this phase.

Fig. 5. Components of Diagnosis and Analysis Phase

At this stage, the following were accomplished:

|	
Emergency Mgt Framework	Draft City Profile
Draft Legal & Institutional Arrangement Handbook	Initial Diagnosis of Shelter and Disaster Risk Resiliency (SDRR) Practices
Initial Diagnosis of Land-Use Planning- Construction Standards and Practice	Earthquake & Flood Risk Assessments
	Draft Report of Training Agenda

See **Annexes 2 and 3** for Mumbai's City Profile and Legal and Institutional Arrangement Handbook Outlines, respectively while **Annex 4** is the outline of the proposed Emergency Management Framework for Mumbai.

In the Spotlight: Seismic Risk of Mumbai

- Mumbai has moderate earthquake risk
- Scenario results are developed and presented in easy-to-understand figures and tables
- Results of this scientific study are very significant in determining not only the seismic hazards that Mumbai is exposed to and the probable scenario earthquakes, but also in determining the physical, social, and economic vulnerabilities of communities and their economic assets to seismic hazards
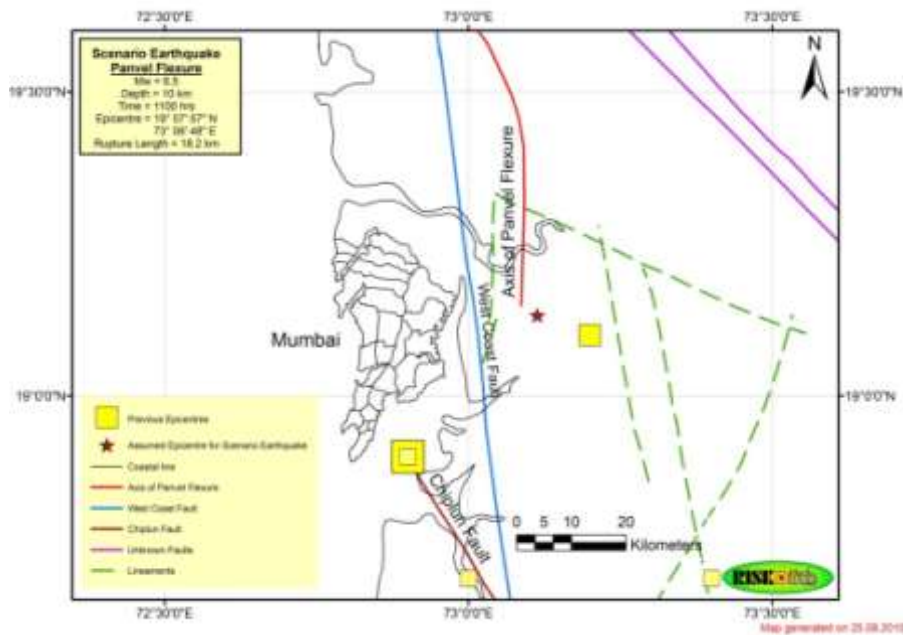
Previous and assumed epicenters of the Panvel Flexure Scenario Earthquake
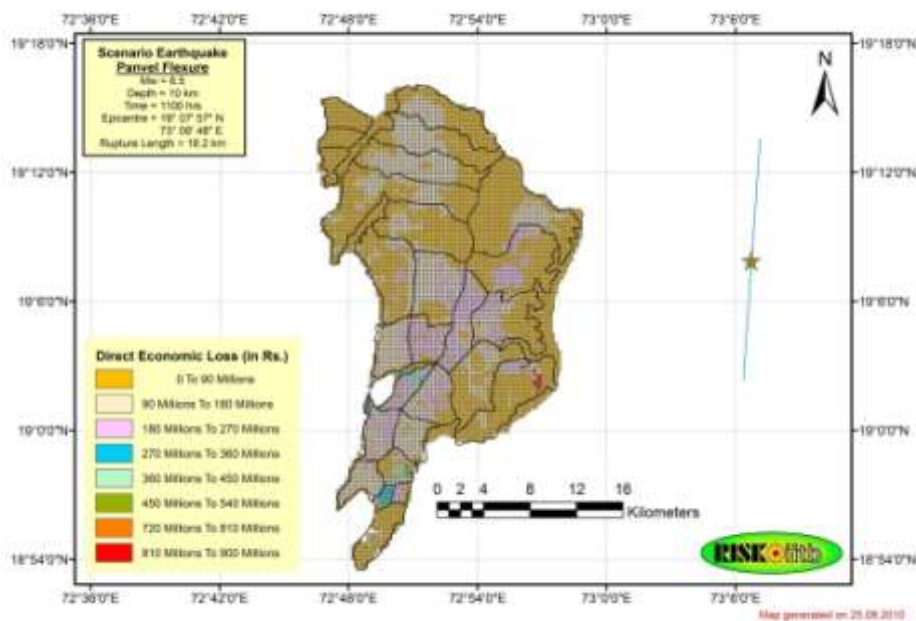
Direct economic loss from the Panvel Flexure Scenario Earthquake
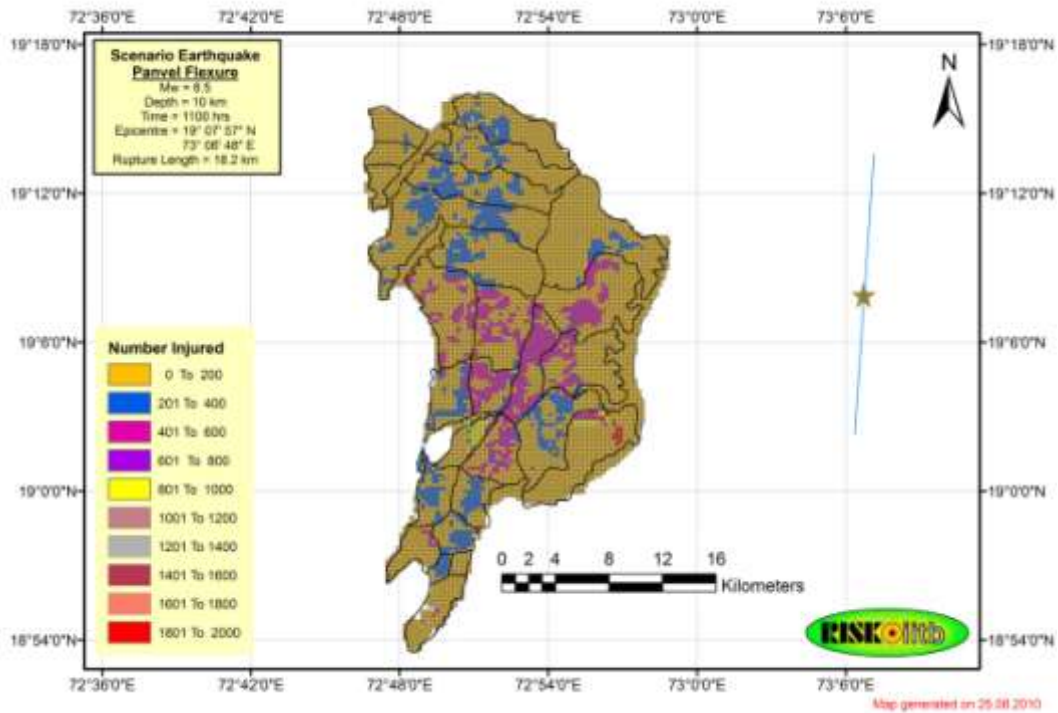
Estimated number of injured from Panvel Flexure Scenario Earthquake
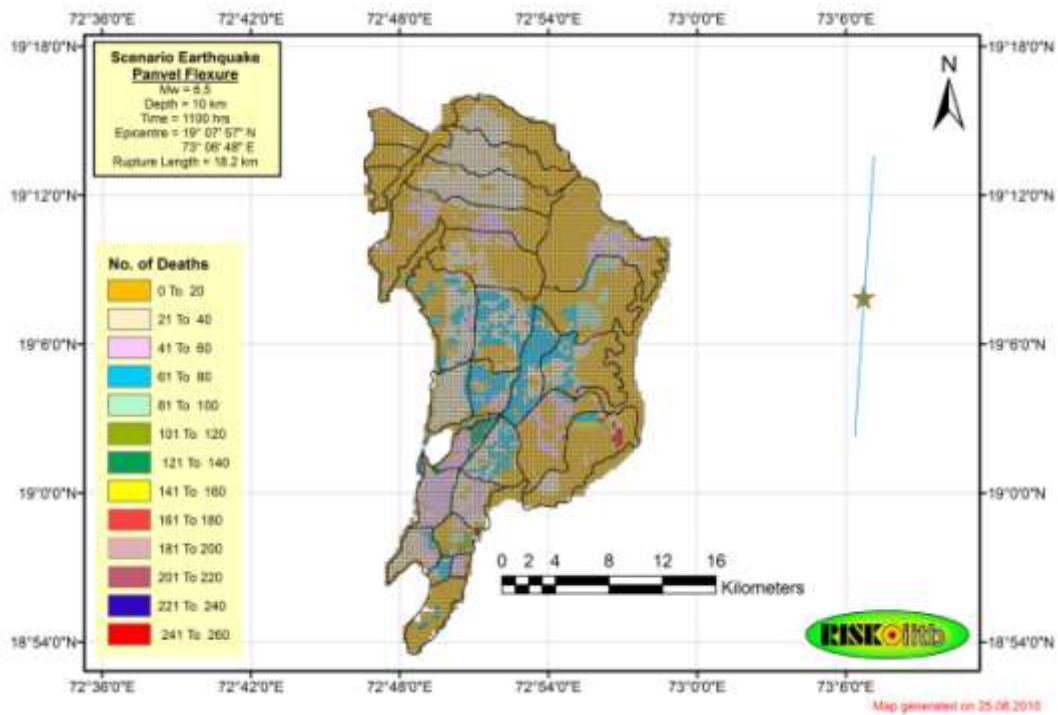
Estimated number of deaths from the Panvel Flexure Scenario Earthquake

In the Spotlight: Flood Risk of Mumbai

Flood plain assessment is being done using the following methodology

Contour generation using SRTM data generation using SRTM data

⬇

DEM generation using GIS Tools (Arc GIS 9.3 and Global Mapper 11)

⬇

Catchment area delination

⬇

Low lying area delination

⬇

Estimation of flood spread

Figure 6. Low lying areas of L Ward

5 Phase 3: DRMMP Framework Development

During this phasethe preliminary "master plan" (i.e. **DRMMP Framework**) is created through a series of multi-stakeholder, results-oriented, and participatory planning process.The DRMMP Framework includes:

1. Analysis and diagnosis of the current DRM practice in Mumbai
2. Mapping of the legal, institutional and organizational arrangements for DRM
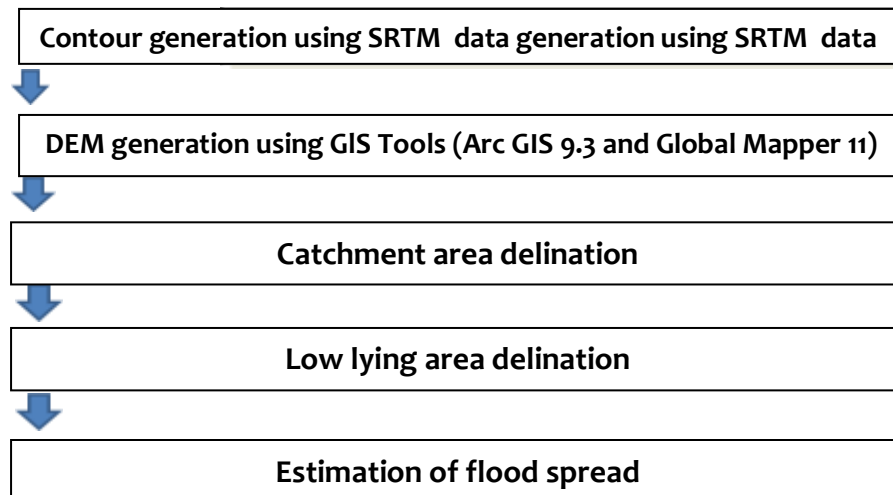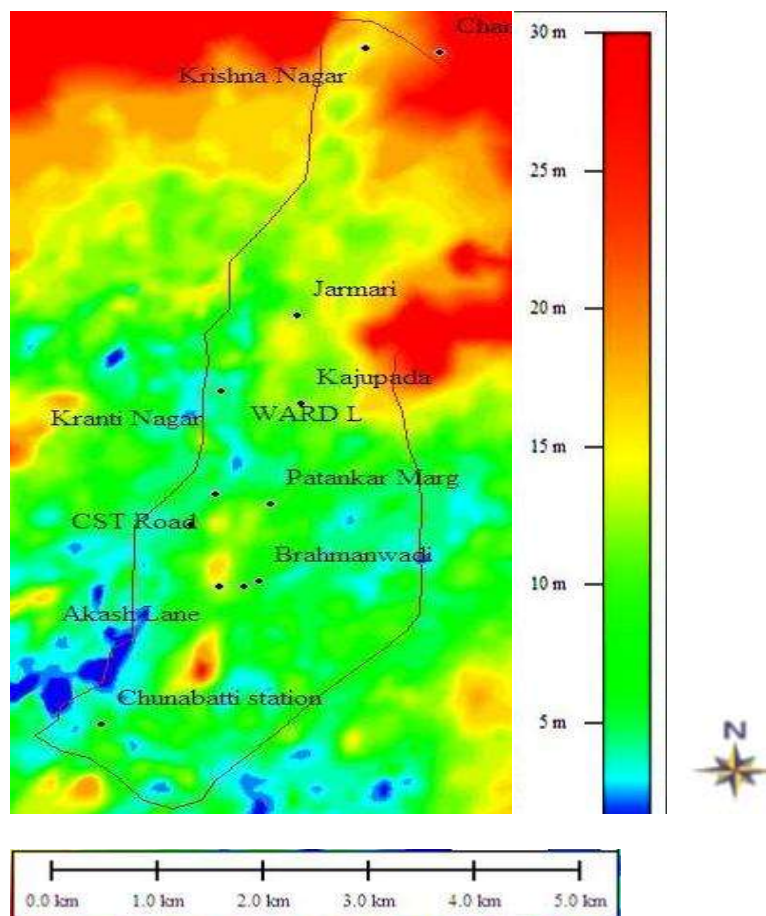3. The elements of hazards, vulnerability and risks for floods and earthquake in the city
4. An interpretation of these risks through indicators
5. A formulation of key policies that guide the disaster risk reduction agenda for the city
6. A set of recommendations for reducing disaster risk in Mumbai

This is the phase where various stakeholders through the Focus Groups participate in developing a set of recommendations along the following elements:

1. Legal and Institutional Arrangement;
2. Land Use Planning and Urban Development;
3. Construction Code and Standards Practice;
4. Shelter and Disaster Risk Resilience;
5. Emergency Management;
6. Training;
7. Information Technology;
8. Risk Communication

Before moving ahead…

By this time, the PIT and Focus Group leaders have developed an understanding of the legal, institutional arrangements, the risk assessment and the hazard profile for Mumbai.

Process for Phase 3

The process for the development of the DRMMP Framework begins with a review of the data gathered in Phase 2, so that all stakeholders have a similar level of knowledge on: a) the current DRM practice in the city, and b) the exposure to risk in the city. From there, a series of exercises are conducted with the goal of achieving three main outputs:

- ✓ Defining a new vision for Mumbai
- ✓ Defining baseline policy for disaster risk reduction in Mumbai
- ✓ Developing a set of recommendations for disaster risk reduction

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Before moving ahead...

Action planning requires the active participation of key stakeholders. Hence, at this point, members of the Focus Groups must have properly understood the context, risks, and DRM issues of the city.

The stakeholders will agree on the goals and objectives of the DRM strategies that they want to pursue, and engage in policy formulation and action planning, which constitute the core components of the DRMMP Framework.

Figure 7 summarizes this process.

✓ At this stage, the following must be accomplished:

DRMMP Framework

- A Vision for a Disaster Resilient Mumbai
- DRR Goals and Strategy
- Baseline Policy Framework for DRR
- Action Items
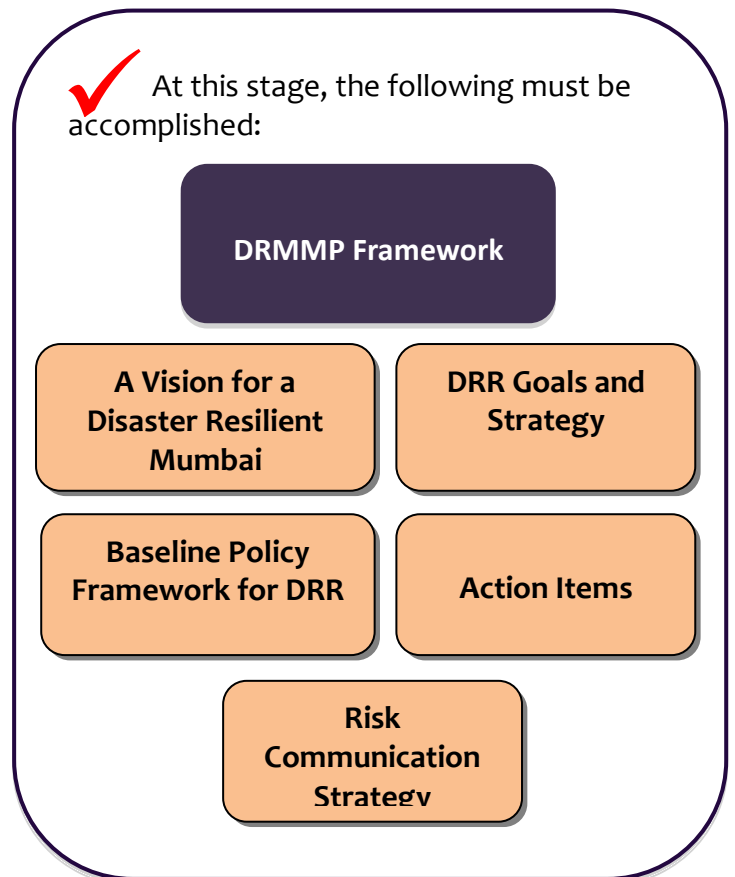- Risk Communication Strategy

Fig. 7. Components of DRMMP Framework Development Phase

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Phase 4: Action Planning

The "Master Plan" embodied in the DRMMP Framework is a long-term plan for DRR envisioned for about a decade. To enable immediate action, a series of practical and effective actions need to be developed in order to immediately engage MCGM and other agencies in disaster risk reduction. These are referred to as **"Implementation Work Outputs"** or **IWOs**. The IWOs are formulated for a time period of three to four years.

Before moving ahead…

The stakeholders are now fully informed and ready to engage into the action planning phase to develop consensus priority action items. They are guided by the vision and are familiar with the policies and recommendations of the

Oct. 2010 – February 2011

DRMMP Framework

Formulate parameters for prioritization
• Constraints
• Objectives

Identify IWOs

Develop the action plans
• Organizations involved
• Agencies responsible
• Implementation processes
• Budgeting process

Actual DRR Projects

Monitoring and Evaluation

} Post-DRMMP Activities
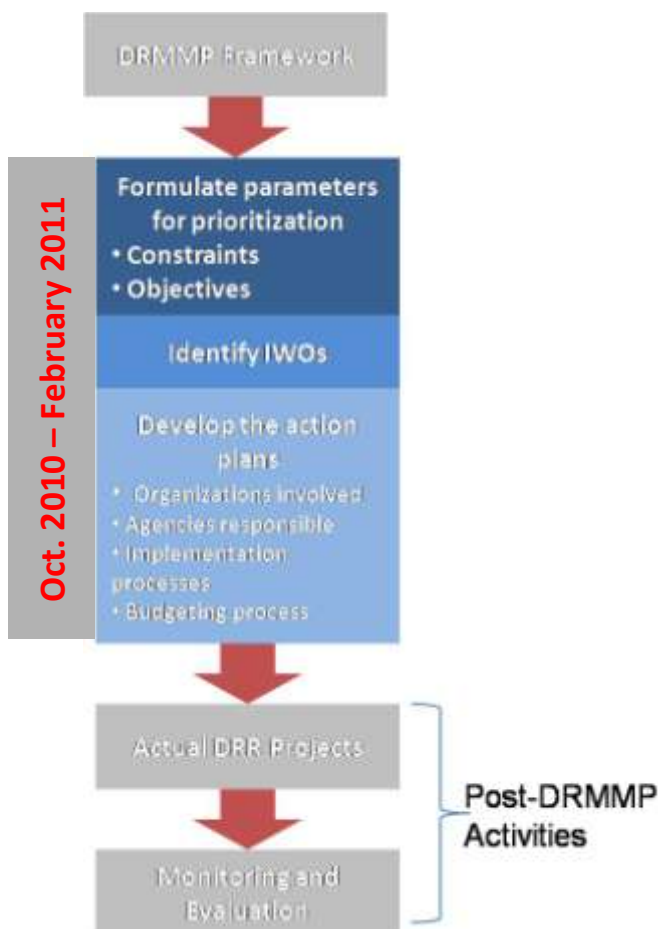
Fig. 8. Components of Action Planning Phase

✔ At this stage, the following must be accomplished:

- Constraints and Objectives
- Implementation Work Outputs
- Action Plans
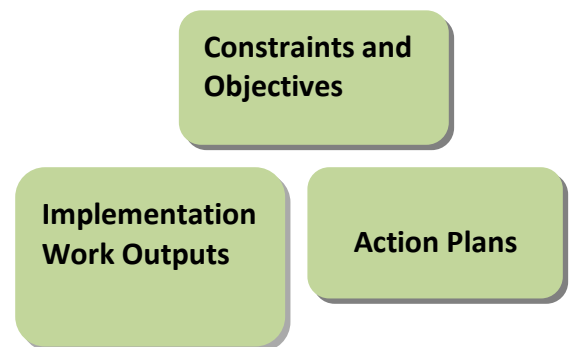
Implementation Work Outputs are priority items that are considered to be the most effective and feasible to undertake in the short term (3-4 years). These IWOs determine the immediate level of capital investment in DRR to be undertaken by the city.

The process of selecting the IWOs begins with a collective exercise of formulating the parameters for prioritization. These may include the DRM goals and objectives that MCGM would like to pursue and the constraints that might impede the realization of such goals. These are developed through an exercise with the stakeholders guided by the policy formulations and strategies developed in Phase 3.

Selecting IWOs

Some of the important factors that must be considered in selecting the IWOs are as follows[2]:

- ✓ Potential for mainstreaming
- ✓ Demonstrable link between the proposed DRM strategy and the risks faced by the city.
- ✓ Uneven distribution of benefits and implications
- ✓ Accessibility to intended beneficiaries
- ✓ Capacity to sustain operations over a period of time
- ✓ Enabling environment

The means to select IWOs depend on the level of investments that a city is willing to invest in DRM. Small to medium investments can make use of qualitative ranking and prioritization techniques while large investments may require more systematic quantitative analysis of costs and benefits.

Developing the Action Plans

Together with the development of the IWO's, an implementation framework for each IWO is likewise developed which indicates the organization responsible, organizations involved, legal and administrative processes for project implementation, and budget processes.

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[2] These factors, except for "potential for mainstreaming," were adapted from The Risk to Resilience Study Team, 2009. Catalyzing Climate and Disaster Resilience: Processes for Identifying Tangible and Economically Robust Strategies: Final Report of the Risk to Resilience Study, eds MOench, M., Fajber, E., Dixit, A., Caspari, E., and Anila Pokhrel, ISET, ISET-Nepal, Kathmandu Nepal

7 Capacity Development

Capacity development is an important part of DRMMP. Throughout the DRMMP process, activities are systematically undertaken with the aim of enhancing the competence of MCGM personnel and its partner institutions in various aspects of DRM. Specifically, under the banner of capacity development, the following activities are undertaken for MCGM:

- Emergency management training
- Training Needs Assessment (TNA) on emergency management
- Menu of international and local training programs (Training Agenda)
- TNA on disaster risk management
- Training schedule

Emergency Management Training

Mumbai's Emergency Operations Center/Control Room

Onsite trainings on local-level emergency management are undertaken to build the capacity of MCGM Disaster Management Cell and other pre-identified offices of MCGM involved in emergency management and response.

The training sessions highlight global experience and international standards of practice in the field to beef-up the capacity of the organization in the following areas:

- ✓ Emergency management concepts and organization
- ✓ Emergency planning
- ✓ Developing capacity
- ✓ Emergency operations
- ✓ Recovery and mitigation

TNA on Emergency Management

A TNA is a major instrument in determining the gap in capabilities of various institutions and offices involved in emergency management and disaster response operating in Greater Mumbai. A cursory evaluation is conducted on the following offices:

- Disaster Management Cell of MCGM;
- Other MCGM offices; and
- National and state organizations operating in Greater Mumbai.

The results of the TNA will guide the development of customized training interventions to fit the needs and conditions of MCGM and its partners. The results will inform the preparation and identification of training modules, subject matter, and the overall development of a training agenda for the organization.

Menu of international and local training programs (Training Agenda)

A menu of existing global and local training courses on all aspects of DRM is prepared for the following purpose:

- Provide an overview of training programs available on DRM and related topics; and
- Provide information to interested parties on training and other education opportunities on DRM.

Training Needs Assessment on Disaster Risk Management

In order to aid MCGM managers in determining appropriate courses for their personnel involved in DRM, a more rigorous TNA is undertaken using a mixed of methodologies:

> **Menu of Training Programs**
>
> The menu of courses provides a list of options on all aspects of DRM including:
>
> 1. **Framework Course on Disaster Risk Management**
> 2. **Specialized Courses**
>   - Risk Sensitive Land Use Planning
>   - Courses on Construction Standards and Practice
>   - Emergency Management
>   - Hazard, Vulnerability, and Risk Assessment
>   - Courses on Policy Development
>   - Courses in Risk Financing
>   - Courses in Climate Change
>   - Courses on Human Induced and Risk Vulnerability Analysis
>   - Community Based DRM
>   - Advocacy Courses

1. Consultation with MCGM and state government officials and technical personnel
2. TNA Survey among MCGM personnel;
3. Interview DRM experts in Mumbai and Delhi to get their opinion on training needs; and
4. Validation of training needs.

Additionally, the TNA provides important information such as the most appropriate modes of training delivery as well as the ideal training schedule for MCGM.

Training agenda and schedule

The TNA serves as a take-off point for the PIT in designing and developing a training agenda and schedule for MCGM. The training agenda incorporates the following features:

✓ Training objectives
✓ Proposed participants
✓ List of courses
✓ Course content and coverage
✓ Schedule

ANNEX 1

List of Organizations, City Departments, and Units involved in Mumbai's Focus Groups

Focus Group 1: Legal and Institutional Arrangements (Group Leader: Dr Gita Kewalramani)
1. Civil Defence
2. Indian Bank Association
3. MCGM-Legal Department
4. University of Mumbai

Focus Group 2: Hazard, Vulnerability, and Risk Assessment (Group Leader: Mr. G Rami Reddy)

1. Association of Hospitals
2. Automotive Research Association of India
3. DISH, Mumbai
4. Hindustan Petroleum Corporation Limited
5. Fire Services, GOM
6. Indian Meteorological Department
7. Indian Institute of Tropical Meteorology
8. Indian Navy
9. Institute of Engineering
10. Mahanagar Gas Limited
11. Maharashtra Housing and Area Development Authority
12. Maharashtra State Road Development Corporation
13. Maharashtra State Electricity Board (MSEB) Mahavitran
14. MCGM-City Engineer
15. MCGM- Sewerage Project
16. MCGM-Water Supply Projects
17. MCGM-Chief Engineer (Development Plan)
18. MCGM-Chief Engineer, Roads traffic and bridges
19. MCGM-Deputy Hydraulic Engineer
20. MCGM-Municipal Architect
21. MCGM-Storm Water Drain Department
22. Mumbai Fire Brigade
23. Mumbai International Airport Ltd.
24. Mumbai Metropolitan and Regional Development Authority
25. Mumbai Police (Traffic)
26. Professional Engineering Architect and Town planners Association Institute of Engineering (PEATA)
27. Government of Maharashtra, Public Works Department
28. Central Railway
29. Western Railway
30. Shipping Corporation of India
31. University of Mumbai

ANNEX 1

List of Organizations, City Departments, and Units involved in Mumbai's Focus Groups

Focus Group 3: Shelter and Disaster Risk Resiliency(Group Leader: Mr. Arvind Parab)

1. Maharashtra State Road Development Corporation
2. Central Railway
3. Western Railway
4. Bharat Petroleum Corporation of India
5. Brihanmumbai Electricity Supply and Transport Limited (BEST)
6. Mumbai Police (Traffic)
7. Aniruddha's Academy of Disaster Management
8. Reliance Energy
9. Directorate of Technical Education, Maharashtra State Board, Mumbai
10. Government of Maharashtra, Motor Vehicles Department
11. Slum Rehabilitation Authority (SRA)
12. Truck and Transport Association
13. Indian Army
14. Tata Institute of Social Studies
15. Maharashtra Institute for Labour Studies
16. Nirmala Niketan College of Social Work
17. Government of Maharashtra, Woman & Child Development Department
18. Society for the Promotion of Area Resource Centres (SPARC)
19. MCGM- Water Works, Hydraulic Engineering Department
20. MCGM- Sewerage Operations
21. MCGM-Water Supply Projects
22. MCGM-Water Works, Hydraulic Engineering Department
23. MCGM- Storm Water Management
24. MCGM- Health Department
25. MCGM- Roads Department
26. University of Mumbai
27. Mahanagar Gas Ltd
28. Hindustan Petroleum Corporation Limited
29. Mumbai Port Trust

Focus Group 4: Land Use Planning and Construction Codes and Standards (Group Leader: Mr. V Phatak)

1. CIDCO
2. MCGM-Architect Department
3. MCGM-Building Proposals Department
4. MCGM-Development Plan Department
5. MCGM-Dharavi Redevelopment Project
6. MCGM-Planning & Design Department
7. Maharashtra Housing and Area Development Authority, MHADA
8. Mumbai Metropolitan Regional Development Authority
9. Town Planning Department, Government of Maharashtra

ANNEX 1

List of Organizations, City Departments, and Units involved in Mumbai's Focus Groups

Focus Group 5: Emergency Management, Social Mobilization and Education (Group Leader: Mr Rajeev Kadam)

1. All India Radio
2. Aniruddha's Academy of Disaster Management
3. Bharat Petroleum Corporation of India
4. Bombay Hospital
5. Brihanmumbai Electricity Supply and Transport Limited
6. Central Railway
7. Civil Defence
8. CTDM
9. DIBH
10. Forbes India Ltd
11. Hinduja Hospital
12. Hindustan Petroleum Corporation Limited
13. Indian Meteorological Department
14. Institute of Chemical Technology
15. Lilavati Hospital
16. Mahanagar Gas Limited
17. Government of Maharashtra, Rationing Department
18. Maharashtra Pollution Control Board
19. Mahindra & Mahindra
20. MCGM-Public Health Department
21. MCGM-Hydraulic Engineering Department
22. MCGM-Law Department
23. Mumbai Fire Brigade
24. Mumbai International Airport Limited
25. Mumbai Maritime Board
26. Mumbai Police
27. Mumbai Port Trust Limited
28. Nair Hospital
29. Reliance Energy
30. Sardar Patel College of Engineering
31. Tata Institute of Fundamental Research
32. Tata Power Company Limited
33. University of Mumbai
34. Western Railway

ANNEX 2
Mumbai City Profile

I.   **Introduction**
    1.1. Location
    1.2. Area and Divisions

II.   **Administration**
    2.1. Municipal Corporation of Greater Mumbai
    2.2. District Collector

III.   **Physical Environment**
    3.1. Relief
    3.2. Drainage
    3.3. Geology
    3.4. Groundwater Conditions
    3.5. Soil Profile
    3.6. Climate
    3.7. Tides
    3.8. Vegetation

IV.   **Demographic Characteristics**
    4.1. Population size, Distribution, Density and Growth rate
    4.2. Age Structure and Sex ratio
    4.3. Literacy
    4.4. Ethnicity

V.   **Slums**
    5.1. Causes of Growth of Slums
    5.2. Distribution of Slum Population
    5.3. Slum Rehabilitation Initiatives
        5.3.1. Prime Minister's Grant Project
        5.3.2. Slum Redevelopment Scheme
        5.3.3. Slum Rehabilitation Scheme
        5.3.4. Dharavi Redevelopment Project

VI.   **Urban Morphology and Land use**
    6.1. Island City
        6.1.1. Central Business District
        6.1.2. Residential
            6.1.2.1 Redevelopment of the Old Residential Core
        6.1.3. Commercial
        6.1.4. Industrial
        6.1.5. Port Functions
        6.1.6. Open Spaces
    6.2. Mumbai Suburban District
        6.2.1. Residential
            6.2.1.1. Redevelopment of pre-1969 residential buildings in the suburbs
        6.2.2. Commercial
        6.2.3. Industrial
        6.2.4. Open Spaces

ANNEX 2
Mumbai City Profile
(Outline)

VII.   Economy of Greater Mumbai
7.1. Occupational Structure
7.2. Income Distribution
7.3. Spatial Clustering of Economic Activities

VIII.   Transportation
8.1. Road Transport
8.1.1. BEST
          8.1.2. The Mumbai Urban Transport Project – Road Transport Component
8.2. Rail Transport
          8.2.1. The Mumbai Urban Transport Project – Rail Transport Component
          8.2.2. Mumbai Metro Project
          8.2.3. Monorail Project
8.3. Water Transport
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IX.   Public Utilities and Service Amenities
9.1. Water Supply
          9.1.1. Distribution System
          9.1.2. Augmentation of Water Supply
                    9.1.2.1. Middle Vaitarna Water Supply Project
                    9.1.2.2. Gargai and Pinjal Projects
          9.1.2.3. Recharging groundwater
                    9.1.2.4. Water recycling systems
9.2. Storm Water Drainage
9.3. Sewerage
9.4. Solid Waste Disposal
          9.4.1. Zero Garbage Status
          9.4.2. Bio-Medical Waste
          9.4.3. E-Waste
          9.4.4. Advanced Locality Management
          9.4.5. Slum Adoption Scheme
          9.4.6. Slum Sanitation Programme
          9.4.7. Key Issues and Concerns
9.5. Education
9.6. Health
9.7. Fire Fighting

X.   Environment
10.1. Pollution
          10.1.2. Air Pollution
          10.1.2. Water Pollution
          10.1.3. Noise Pollution
          10.1.4. Land Pollution
10.2. Challenges

ANNEX 2
Mumbai City Profile
(Outline)

XI. **Planning**

11.1. Municipal Corporation of Greater Mumbai

11.1.1. Revised DP 1991-2013

11.1.2. Key Issues and Strategic Options with Regard to Current Development Plan

11.1.2.1. Demographic and Land-use Inconsistencies

11.1.2.2. Public Amenities

11.1.2.3. Slums

11.1.2.4. Housing

11.2. Mumbai Metropolitan Regional Development Authority

XII. **Disaster Profile of Mumbai**

12.1. Hazards in Mumbai

12.2. Vulnerabilities of Mumbai

XIII. Disaster Risk Management

13.1. National Perspective

13.2. Paradigm shift in India

13.3. The Disaster Management Act, 2005

13.4. Civil Defence

13.5. Disaster Management in Maharashtra

13.6. Disaster Management in Greater Mumbai

References

ANNEX 3
Mumbai's Legal and Institutional Handbook
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    Global Perspective
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    Paradigm shift in India
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    High Powered Committee on Disaster Management
    Key Institutions.
PART II. LEGAL, INSTITUTIONAL, POLICY AND REGULATORY FRAMEWORK.
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    Disaster Management Act, 2005.
    National Disaster Management Authority.
    National Executive Committee.
    National Plan.
    National Institute of Disaster Management
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    Disaster Management Plans by different authorities
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    National Policy on Disaster Management
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        Approach
        Salient Objectives of the Policy
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        Relief and Rehabilitation
        Reconstruction and Recovery
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        Other features of the Policy
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        Vulnerability profile of Maharashtra
        Deouskar Committee Report
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    Maharashtra State Disaster Management Plan
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        Department of Drinking Water Supply
        Department of Space
        Department of Telecommunications
        India Meteorological Department
        International Institute for Population Sciences
        Ministry of Agriculture
        Ministry of Defence
        Ministry of Environment and Forest
        Ministry of Health and Family Welfare
        Ministry of Home Affairs
        Ministry of Labor and Employment
        Ministry of Power
        Ministry of Rural Development
        Ministry of Science and Technology
        Ministry of Urban Development
        Ministry of Water Resources
        Western Railway
    State of Maharashtra Level
        Revenue and Forests Department
        Bhabha Atomic Research Centre (BARC)
        Mumbai Metropolitan and Region Development Authority (MMRDA)
        Mahanagar Telephones Nigam Limited.
        Maharashtra Housing and Area Development Authority (MHADA)
        Maharashtra Fire Services
        Maharashtra State Road Development Corporation
        Maharashtra State Electricity Board (MSEB) Mahavitran.
        Mumbai Police.
        Mumbai Port Trust (MPT)
        Slum Rehabilitation Authority (SRA)
        Brihanmumbai Electric Supply and Transport (BEST)
        Indian Institutes of Technology (IIT) Mumbai
        Private Companies
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        Reliance Infrastructure Ltd
        Tata Power Cos. Ltd.
        All India Institute of Local Self Government (AIILSG)

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PART IV. MUNICIPAL CORPORATION OF GREATER MUMBAI
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    Administrative Framework
    Legal Mandate
    Functions of MCGM
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        Fire Services
        Municipal Security Force
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    Inter-Agency Coordination

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PART VI. DRM INSTITUTIONAL LINKAGES IN GREATER MUMBAI
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>   DRM institutions

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>   2.   Civil Defense
>   3.   State Executive Committee
>   4.   State Disaster Management Policy
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>   10.   Solid Waste Management
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>   14.   Communications
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>   17.   MHADA
>   18.   Mumbai Police
>   19.   SRA
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>   21.   Gaps in adoption of an Integrated approach
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>   22.   Gaps in Convergence
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>   27.   Labor Department
>   28.   Finance Departments
>   29.   Engineering Departments
>   30.   Public Relations Department
>   31.   Health Department- MCGM Hospitals
>   32.   Fire Services
>   33.   Municipal Security Force
>   34.   Estate and Land Management (ELM) Department
>   35.   Markets Department
>   36.   Project Planning and Control Department
>   37.   Licensing Department
>   38.   Gardens and Zoos Department
>   39.   Shops and Establishment Department
>   40.   Ward Offices
>
>   **Conclusions and Recommendations**
>   **Path Ahead**

ANNEX 4
Emergency Management Framework
(Outline)

I.   International Standards of Practice for a City-level EM System
   A.   The Hyogo Framework for Action
   B.   The Guidance and Indicator Package for Implementing HFA Priority Five
   C.   The Emergency Management Standard
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   A.   Background for Enactment of Disaster Management Act of 2005
   B.   Organizational Structure Created by the Act
   C.   Disaster Response
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   F.   Analysis of the Legal Role of MCGM in Disaster Management
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   A.   Organizational Structure and Authorities
   B.   Mission/Scope of Work and Staffing
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   E.   Coordination with MCGM departments and external agencies
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   A.   Organizational Structure and Authorities
   B.   Mission and Staffing
   C.   Emergency Operations: Management System and Structure
   D.   Coordination with MCGM Departments and External Agencies
   E.   Alert, Warning, and Dissemination of Information to the Publi
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   G.   Ward Exercise Program & Training Program/Capacity Level
V.   Recommendations of the Emergency Management Framework for Disaster Reduction in Greater Mumbai
VI.   Action Plan, Emergency Management Systems, October 2009 - May 2011