

Disaster Management Plan of Mumbai

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Greater Mumbai Metropolitan area or BrihanMumbai Municipal Corporation (BMC) area, is divided in two revenue districts viz Mumbai city District and Mumbai suburban District. Greater Mumbai of Maharashtra is entirely urban. It extends between 18° and 19.20° northern latitude and between 72° and 73.00° eastern longitude. It has an east to west extend of about 12 km. where it is broadest, and a north - south extend of about 40 k m.

Its height is hardly 10 to 15 meters above sea level. At some places the height is just above the sea level. Part of Mumbai City district is a reclaimed land on Arabian sea coast. Mumbai City is one of the first four metropolitan areas in India. It has global importance since Mumbai is an international sea port and the international Sahar airport.

Greater Mumbai covers an area of 437.71 sq. km. that constitutes 0.14 per cent of the total area of the State of Maharashtra. The Mumbai Suburban District covers an area of 370 sqkm. The District consists of one administrative sub-division comprising three Tahsils (that is, Kurla, Borivali and Andheri). The district covers 15 municipal wards of BMC, and is also referred as Eastern Suburbs and Western Suburbs.

BrihanMumbai receives rains from southwest monsoons, which commence usually in the first fortnight of June and last till the end of September. Pre-monsoon showers are received in May. In Mumbai the district receives average seasonal rainfall of 236.0 mm. during the average. In Mumbai city district, the average maximum temperature is 31.2 degree Celsius, while the average minimum temperature is 23.7 degree Celsius. The average total annual rainfall is 2146.6 mm. The maximum annual rainfall was recorded in 1954 at 3451.6 mm.

One Municipal Commissioner, 4 Additional Municipal Commissioner, 2 Joint Municipal Commissioner, 11 Deputy Municipal Commissioners and 30 Assistant Commissioners are handle Mumbai city and Suburban administrative work.

Slums are considered as vulnerable settlements due to their location and access to infrastructure. The

locations include hilltops, slopes, nallahs, low-lying areas (with tendency to flood during high tides), coastal locations, under high-tension wires, along highways, along railway lines, within industrial zones, pavements, along water mains, along open drainage etc.

As per the observation of above situations Mumbai Municipal Corporation prepared Disaster Management Plan with help of Govt. of Maharashtra and divided this plan into three phases.

Following information is given into first phase.

The sites vulnerable to different natural calamities are as follows:

Vulnerable settlements

There are in all 2335 slum settlements as per 1985 data in Mumbai. These slums are considered as vulnerable settlements due to their location and access to infrastructure.

1. Hill tops slums
2. Slopes
3. Nallahs
4. Low laying areas
5. Coastal locations
6. Under high tension wires
7. Along highways
8. Along Railway Lines
9. Within Industrial Zones
10. Pavements
11. Along water mains
12. Along Open drainage

These slums are located on the lands of state government (25 %), BMC (20 %), Housing Board and central government (5 %), private lands (50 %).

Most of these flooding points have been listed

in the ward plans and have a localised impact. However, some of these flooding points have a tendency to disrupt the traffic and paralyse city life.

A number of steps such as de-silting of drainage and clearing of nallahs are taken by BMC and Railways to avoid such flooding. However, a combination of heavy precipitation and high tide may make such flooding unavoidable.

Fires

Greater Mumbai is greatly diversified and practically has every type of fire risk. The fire risk can arise from the following sources:

- Large number of closely built old timber framed buildings
- High-rise buildings with inadequate fire-fighting facilities
- Commercial activities in City area
- Small, medium and heavy hazardous industries in suburban areas
- Widespread docks area
- Oil refineries in M-W ward
- Petrochemical industries
- Large slum settlements.

There are 26000 officers and men spread over 25 stations, to fight the fires.

Earthquakes: As per the 1991 census, Greater Mumbai has 2,768,910 dwellings, including residential, commercial and industrial establishments. Of these, only 9.08 % of the dwellings were made of re-inforced concrete while 31.35 % were engineered masonry constructions. Thus, 59.57 % of all constructions were non-engineered. This can partly be attributed to the large percentage of population living in the slums.

There are 19642 cessed buildings in Mumbai city district. Due to the Rent Control Act restrictions against raising the monthly rent, the landlord did not take up maintenance of buildings for several years. This has resulted in the deterioration of the buildings ultimately leading to their collapse. The Maharashtra Government intervened and took over the responsibility of maintaining these building by constituting the Bombay Building Repairs & Reconstruction Board in the year 1969.

Landslides

Greater Mumbai also faces the risk of Landslides With pressure on land, many vacant sites on hill slopes or bottoms of hills have turned into inhabited area and thereby become vulnerable to landslides. Most cases of landslides occur during heavy rain associated with high velocity winds. It sometimes results in loss of human lives and damage to structure.

Road Accidents

The major road sections in Mumbai, which are accident-prone in Mumbai city along with details of fatal and serious injuries.

Industrial and Chemical Accidents

There are approximately 900 industries either involved in the manufacture and processing of hazardous goods or in the storage of hazardous goods. A comprehensive list of these industries along with fact sheets are given in a separate volume. Many of these godowns are in the close proximity of the residential areas or other storages, thereby increasing the risk of fires and chemical explosions in residential as well as industrial estates.

The major concentration of the hazardous industries is seen in the Chembur-Trombay belt, spread over an area of about 10 square kilometres, having major chemical complexes, refineries, fertilizer plants, atomic energy establishment and thermal power station. Clustering of various operating units make them highly vulnerable.

Cyclones

Being an island city, the coastal wards (facing the Arabian Sea) are prone to gusty winds and cyclonic impacts. Originally, most of the fishing villages were located along the coast. Additionally, in most of these wards, a number of slums have also mushroomed along the coast. Given the quality of housing material used, these settlements are highly vulnerable and the possibility of their capacity to withstand the cyclonic storm is limited.

These areas may require evacuation to temporary shelters or identified safe sites.

Mitigation measures

In view of the risk and the vulnerabilities identified in the earlier sections, the mitigation measures proposed have been categorised into three

major headings :

- Infrastructure improvement
- Communication and Public Information Systems
- Land use policies and planning

Infrastructure improvement for Greater Mumbai has been examined in terms of transport, services and housing infrastructures. These include road and rail networks, sanitation and sewer disposal system, storm water drainage systems, slum improvement and housing repairs and retrofitting programmes. The dependent lifelines of Mumbai which include water supply, electric supply, telecom services, fuel, health, food supply etc, depend very much upon the effective functioning of these infrastructural facilities.

Transport infrastructure

The requirements of projected passenger traffic, rise in vehicular density, and the increase in number of vehicles, both private and public, will put tremendous pressure on the existing transport infrastructure and road network.

For reduction of road accidents, reducing disruptions resulting from floods and increasing the response time of the emergency services, a comprehensive mitigation strategy to improve the transport infrastructure becomes imperative.

Expansion of rail services

The proposals of additional railway corridors, that is, the Sixth Corridor and the Seventh Corridor, need to be reviewed and refined further for implementation.

Most of these projects have a component of resettlement as well. These projects will be implemented by different agencies and hence call for a co-ordinated approach of the technical and non-technical component with emphasis on participatory planning and management of resettlement.

Road over Bridges (ROB) and flyovers

In addition, Maharashtra State Road Development Corporation (MSRDC) is undertaking the work of construction of flyovers across MMR region. Fifty such flyovers have been sanctioned out of which 43 flyovers are in Greater Mumbai. Works on majority of them have already started. A comprehensive traffic review will be required once all these projects are completed.

Road widening

This is one of the major requirements on some of the important arterial roads. For example, L.B.S. Marg, S.V. Road, Cadell Road, Reay Road etc., have serious bottlenecks and need to be cleared and widened. In addition, there are many junction points or flyovers, which need improvements.

Additional roads

For clearing the heavy vehicle traffic between Sion and the city, the proposed truck terminus at Wadala should be made operational and the access to the terminal via Anik-Panjarapole section needs to be provided.

Provision of special corridors for Fire Brigade, Ambulances, Police

Keeping in view, the location of municipal and government hospitals, fire stations and police stations, special corridors for the movement of fire brigade, ambulances and police can be identified and reserved for these services. Plan should be evolved to ensure that no other traffic is allowed to block the movement of these emergency service units. This provision of reserved corridors requires identification of inter-connecting small lanes and by-lanes so as to ensure complete north-south and east-west mobility. No parking or any other encroachments should be permitted on such identified corridors.

Provision of special corridors for BEST

In order to ensure that BEST buses do not slow down the traffic movement and also get a required priority being a mass transport, lanes can be reserved on the main roads for these buses. On such roads with reserved lanes, the left-turn for other traffic should only be permitted at the signals.

Services and related infrastructure

Sanitation facilities

Although there has been no serious outbreak of any epidemic in the city during the last thirty years, and there has been a daily quality monitoring of water supply, sanitation facilities are inadequate. It is estimated that more than 40,000 toilets are required to achieve a ratio of 1:25 families. The Slum Sanitation Programme of the BMC may provide some relief, but it has serious limitations to reach out to all the population. Innovative and non-conventional approach to sanitation is required with sufficient

financial allocations and political back-up.

Sanitation infrastructure at places of mass congregation

Mumbai attracts a large domestic tourist traffic. Also it has a number of locations of mass congregation. It is essential that these tourist and mass congregation locations are provided with adequate water and sanitation infrastructure. Mobile sanitation facilities can be one of the options. Alternatively, permanent sanitation infrastructure need to be made available at these locations for the visitors to ensure health safety for the local residents.

Nallah training, soling and cleaning

The settlements along the nallahs are vulnerable to floods. Also, in the absence of training, soling and regular de-silting (cleaning), most of these nallahs have a tendency of flooding and choking. It is necessary that a programme of nallah training, soling and cleaning is undertaken rigorously through the Storm-water drainage department of the BMC. This may require shifting of some of the settlements along the nallahs.

Increasing capacity of storm water drainage

The present capacity of the storm-water drains needs to be augmented to a higher capacity which is under serious consideration with the Government of Maharashtra/BMC. In keeping with this present concern, care should be taken to ensure that no natural storm-water holding ponds are allowed to be encroached upon and reclaimed. The proposal of delinking sewer and storm water drainage system would further increase the capacity of storm water drainage and reduce the coastal pollution. The twin goals of the delinking need to be re-enforced through early implementation of these projects.

Upgrading Emergency Services

The response operations of the emergency services of police, fire brigade and hospitals are often hampered due to inadequate equipments and facilities. These departments are currently engaged in identifying specific items, which will help them in their response operations. Helping these services to obtain such identified items would be a part of the mitigation strategy.

Housing infrastructure

Retrofitting and renovation of cessed buildings

Repairs and Reconstruction Board of MHADA has been receiving a set-back in achieving their targets due to various reasons, especially financial reasons. As a part of mitigation efforts, the Board has to ensure that repairs carried out on these cessed buildings should also take into consideration earthquake and cyclone impacts. This would mean an additional financial requirements. Also, buildings for retrofitting need to be identified and appropriate technical options provided.

Informal settlements

Most wards in the western suburbs have a coastal line dotted with informal settlements. As mentioned earlier, these settlements are most vulnerable to cyclonic impacts because of the type of housing material used. In order to reduce such impacts, the quality of housing in these settlements need to be upgraded.

Under the current provisions of settlement improvement, various programmes have been promoted with limited success. Presently, Slum Rehabilitation Scheme (SRS) is a major programme for improving the shelter quality.

Communication and Public Information Systems

Public Information System (PIS) demands that people are kept aware and informed in the entire cycle of disaster management from the stage of risk assessment. A lot of community education, awareness building, plan dissemination and preparedness exercises has to precede if a meaningful PIS is made operational.

Wireless communication

For efficient co-ordination and effective response, communication amongst line departments such as BMC, police, fire brigade, municipal/ government hospitals, meteorological centre and BEST is essential. This can be ensured by upgrading the present communication system with a more efficient wireless system. The wireless system should be full-duplex and also enable communication with different line departments.

Display Boards

Also, as a part of mitigation measure, electronic information display boards should be installed which could be monitored from BMC control room. The messages displayed are essentially instructional during the time of disasters. The information

displayed will direct public response and help the administration in localising the impact. In the normal times, the same display boards can be used for community education on social issues and disaster preparedness messages.

The Traffic Police and BMC have jointly identified 44 locations where these display boards can be put-up.

Public address systems at railway stations and bus stations

All railway stations, BEST bus stations, MSRTC bus stations within MMR region, should have the facility of public address system to keep the passengers updated on traffic situation.

Land use policies and planning

The Draft Regional Plan for MMR Region 1996-2011, provides a basic framework for the land use policies and indicates the directions for planning. Within the context of the policy framework incorporated in this document and the priorities listed, the following can be brought within the purview of the mitigation strategy.

Improvement and protection of landfill sites

It is observed that at all the landfill sites, the current practice of crude dumping and absence of watch-and-ward has led to proliferation of informal settlements thereby adding to the already existing stock of vulnerable settlements. This also results in loss of opportunity to use such sites through compacting and providing layers of soil cover for alternate safe siting of vulnerable settlements and pavement dwellers.

Control on land reclamation

All existing water bodies and storm water holding ponds will have to be protected under strict development control rules. Clauses providing for any exceptions should be deleted from the development control rules.

Decongestion

Mumbai being an island city, has reached its maximum capacity in terms of services and infrastructure. The GOM has been pursuing the policy of guided land development schemes such as Bandra-Kurla complex, Oshiwara district centre, Powai area development scheme, transfer of development rights from south Mumbai to suburbs,

development of new townships such as Navi Mumbai, as strategies towards decongesting the island city. Simultaneously, efforts have also been made to shift employment opportunities by shifting some of the major commercial activities such as port, agriculture, steel and other wholesale markets outside Mumbai. The potentials of regional dispersions in the MMR needs to be further pursued by concerted strategies incorporating job location and infrastructure development.

The bifurcation of Greater Mumbai in Mumbai city and Mumbai Suburban districts is more a revenue administrative arrangement whereas the Greater Mumbai as a whole has a Municipal Corporation divided into wards for managing municipal services. The two District Collectors will assist the Municipal Commissioner in all aspects of disaster management.

The Municipal Commissioner vide order No.ENV/1093/DEA/CR/36/TK dated 16th February, 1994 is appointed as the District Disaster Officer for Greater Mumbai. In majority of the disasters within the managerial capacity of BMC, the BMC will manage the disaster situation without

Additional Chief Secretary	Chairman
Secretary, Relief and Rehabilitation	Member Secretary
Secretary, Home (Law and Order)	Member
Secretary, Housing	Member
Secretary, Medical Education	Member
Secretary, Food and Civil Supplies	Member
Divisional Commissioner (Konkan)	Member
Transport Commissioner	Member
Municipal Commissioner	Member

intervention from the State authorities. Micro-level plans at ward level have been prepared for all the 23 wards incorporating specific responsibilities of ward officer who will act as Ward Disaster Manager. The disaster management operations for functionaries at the ward level has been given in Section XI.

However, in cases of disasters of exceptionally large magnitude which requires co-ordination with wide range of lateral agencies including central government agencies, the Additional Chief Secretary (Home) will assume the responsibility of Disaster Manager for Mumbai.

Co-ordination arrangements for managing

receipt of warning and response operations on occurrence of disaster are given in separate charts.

There will be a Mumbai Disaster Management Committee under the chairmanship of Additional Chief Secretary (Home).

The Committee will consist of the following depending on the type of disaster and its intensity

Functions of the Mumbai Disaster Management Committee

Commissioner of Police	Member
General Manager, Central Railway	Member
General Manager, Western Railway	Member
General Manager, Konkan Railway	Member
General Manager, BEST	Member
Dy. Director General, Meteorology Department	Invitee
Secretary, Industries	Member
Chairman, Mumbai Port Trust	Member
Director, MPCB	Invitee
Secretary, Public Works	Member
Director, Airport Authority of India, Mumbai	Invitee
GOC, Maharashtra Gujarat Area	Invitee
Commander, Mumbai Sub Area	Invitee
Colonel General (Staff)	Invitee

- Ensure effective inter-departmental co-ordination between all state departments
- Provide policy decisions when required
- Keep the government informed about disaster situation
- Review disaster related activity reports received from BMC Control Room, Police Control Room and Army Control Room and provide appropriate directions.
- Co-ordinate the activities of lateral, and Central Government agencies like

Functions of Control Rooms:

- Cordoning of area to restrict movement of vehicular and pedestrian traffic
- Shifting the rescued/affected people to hospitals

Municipal Commissioner	Chairman
Deputy Municipal Commissioner - In-charge BMC Control Room	Member Secretary
Collector, Greater Mumbai District	Member
Collector, Mumbai Suburban District	Member
Collector, Thane	Member
Transport Commissioner	Member
Joint Commissioner of Police (Law and Order)	Member
Additional Commissioner of Police (Traffic)	Member
Chief Fire Officer, BMC	Member
General Manager, Central Railway	Member
General Manager, Western Railway	Member
Director, Medical Services, GOM	Member
Executive Health Director, BMC	Member
Director, Civil Defence and Home Guards	Member
General Manager, BEST	Member
General Manager, BSES	Member
Technical Director, MSEB	Member
Executive Engineer, Water and Sanitation, BMC	Member
Controller of Rationing	Member
Director, Industrial Safety and Health	Member
Chief Engineer, PWD, GOM	Member
Director General, Information and Public Relations	Member

- Providing easy access to rescue and relief personnel/vehicles
 - Corpse disposal
 - Law and order
 - Divert traffic on alternate routes as and when necessary in co-ordination with BEST
 - Request MPT for providing access through MPT roads during emergencies for specific time duration and monitor the requirement of such an access
 - Set-up an information centre to organise sharing of information with mass media and community
 - Co-ordinate with BMC Control Room
- BMC Control Room:**
- Emergency supplies of water and cooked food
 - Transfer of stranded and marooned persons

- Emergency transport for the seriously injured
- Setting up temporary shelters
- Salvage Operations
- Corpse disposal
- Assistance to other control rooms for movement/transport of staff including Rescue parties, Relief Personnel and Relief Materials
- Communicate to EOC additional resources required by various control rooms
- Establishing communication links with
 - ❖ EOC
 - ❖ Mutual Aid and Response Group
 - ❖ NGO coordinating committee
 - ❖ Private donors

Non-governmental Organisations (NGOs) and Voluntary Agencies

The non-governmental organisations and voluntary agencies play an important role in disaster management and provide a strong band of committed volunteers with experience in managing the disasters. Their strength lies in the choice of their manpower, the informality in operations and flexibility in procedures. These organisations enjoy a fair degree of autonomy and hence can respond to changing needs immediately.

However, in order to maintain uniformity in operations and effective co-ordination, it is desirable that they follow the standards of services (as given in the Guidelines), information exchange and reporting so as to enable the Municipal Commissioner to have a total picture of resource availability, disbursements and requirements. NGOs therefore have been assigned specific tasks by the Municipal Commissioner to undertake relief work within the overall institutional framework. As and where possible, NGOs may also be able to improve the quality of delivery of services. In addition, Mohalla Committees have been operating at the community level, especially in times of emergencies like house collapses, fires, floods. Such committees have been identified at the ward level.

Areas of Community Participation

BMC and NGOs at the disaster site should

ensure maximum community participation in all stages of operation in order to maintain community morale and confidence, maximise the use of local resources and promote a faster recovery. Disaster management situations offers a wide range of choice and demands a immediate decision making. The participation of communities and their representatives would reduce the pressures on the field agencies with regard to the choice and uncertainties of community's response to the decisions.

Based on local dynamics, ethos and the experience of Mumbai, an appropriate strategy to ensure community support has been evolved. Such efforts to enlist community support and participation have gone a long way in reassuring the community about the administration's intent and seriousness about managing the disaster.

Efforts to enlist community participation is being ensured by

- ❖ identifying situational, opinion and position leaders in the community and voicing administration's confidence in their capabilities to undertake the tasks.
- ❖ Consultations and dialogues expressly indicating the need for assistance would encourage the community and its leaders to come forward.
- ❖ Regular feedback meetings and an open book approach to demonstrate transparency.
- ❖ Involving community in decision making at local levels

During Evacuation

For appropriate security and law and order evacuation would be undertaken with assistance from community leaders and community based organisations (CBOs). The entire family would evacuate together as a unit. However, to avoid stampede and confusion and in cases of inadequate transport or limited time, emergency evacuation would be undertaken in the following order :

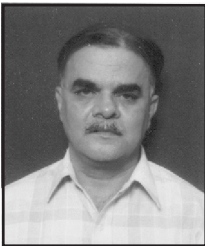
- seriously injured and sick
- children, women and handicapped
- Old
- Able-bodied

In case of evacuation, people would be advised to follow these steps

- Secure their homes/establishments. Close and lock doors and windows.
- Turn off the main water valve and electricity
- Leave early enough to avoid being trapped.
- Follow recommended evacuation routes. Not to take shortcuts. They may be dangerous.
- Not to move into flooded areas because the authorities may have removed the manholes for efficient drainage and the indicators may get shifted due to water currents.
- Stay away from downed power lines.

Community leaders could be given the responsibility for ensuring the following community behaviour

- People stay calm and panic behaviour is not encouraged. Regulate helter-skelter running or crowding of people.
- Encourage people to stay at a secured place and protect themselves from injuries.
- People do not enter damaged buildings or structures
- People do not touch electric poles, utility wires/cables
- People do not use telephones except in life-threatening situations.

About Author

Mr. V. V. Vaidya is a chief officer of disaster management cell, Municipal Corporation of Greater Mumbai. He has done his B.A. and has participated in workshop on disaster management in Kobe, Japan. He is also a member of disaster management committee.

ORAL PRESENTATIONS

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We Are An Iso 9001:2000 Certified Organisation
Engaged In The Manufacture of
Specialized Rubber Moulded Products,
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Your Requirement Of Critical
High Temperature & Fluid Resistant
O Rings, Seals, Gaskets And
Other Moulded Products Will Be Met By Us

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