



GOVERNMENT OF TAMIL NADU

HIGHWAYS AND  
MINOR PORTS DEPARTMENT

**DISASTER MANAGEMENT PLAN**

2017



# HIGHWAYS AND MINOR PORTS DEPARTMENT

**DISASTER MANAGEMENT PLAN**  
**2017**

# PART I

## GENERAL

## Chapter-1

### INTRODUCTION

Tamil Nadu, with an area of 1,30, 058 sq.km is situated in the southeastern part of the Indian Peninsula between latitudes 08°00'00"N and 13°30'00"N and longitudes 76°15'00"E and 80°18'00" E. It is bounded in the east by the Bay of Bengal, south by the Indian Ocean, west by Kerala state and the Arabian Sea and north by the States of Karnataka and Andhra Pradesh. Tamil Nadu covers an area of 130,0582 kms and has a coastline of about 1,076 kms which is about 15% of the coastline of India. More than 40% of the fisher population lives within 1km of coast and 50% of them live within 2km of the coast.

The geographical setting of Tamil Nadu makes the state vulnerable to natural disasters such as cyclones, floods and earthquake-induced tsunami. About 8% of the state is affected by five to six cyclones every year, of which two to three are severe. Cyclonic activities on the east coast are more severe than on the west coast, and occur mainly between April-May and October-November.

Within the borders of Tamil Nadu, the north south trending east coast extends over 675 km. with an average width of 100 km. Along the eastern coast the Cauvery delta extending over 150 km. is an important physiographic unit.

#### Vision

To build a safe and disaster resilient State road network by developing a holistic, proactive, multi-disaster oriented and technology driven strategy. Highways is the pioneer Department of the State established in the year 1946 with a **vision** to **"increase the capacity, connectivity, efficiency and safety"** of the road network so as to enable balanced socio-economic development of all sections of the people and all regions of the State. Better connectivity, broader roads, Ring roads, Bridges, ROBs / RUBs and development of minor ports are aimed to achieve this vision.

This department is maintaining **62,460 km of road network** spread across the entire State with a mandate of creating, augmenting and maintaining the Road

and Port infrastructure of the State. The department is also incharge of improvement and maintenance of the National Highways in the State.

### Details of Road Network

Sl. No.	Classification of Road	Length (Km)
1	National Highways (NH)	1985
		3009
	NH Total	4994
2	State Highways (SH)	12093
3	Major District Roads (MDR)	11617
4	Other District Roads (ODR)	33756
	<b>Grand Total</b>	<b>62460</b>

### Theme

The main theme is the belief that a disaster resilient community, duly empowered by a newly created Disaster Management Structure, working in cohesion multi-sectorally, will help realise the national vision.

### Objectives

The aim of this plan is to set out Highways Department's approach to disaster management in accordance with the legislative responsibilities of the DM Act 2005. The objectives of preparing DM plan are:

- Promoting a culture of prevention and preparedness by ensuring that DM receives the highest priority at all levels.
- Ensuring that community is the most important stakeholder in the DM process.
- Encouraging mitigation measures based on state-of-the-art technology and environmental sustainability.
- Mainstreaming DM concerns into the developmental planning process.
- Putting in place a streamlined and institutional techno-legal framework for the creation of an enabling regulatory environment and a compliance regime.

- Developing contemporary forecasting and early warning systems backed by responsive and fail-safe communications and Information Technology (IT) support.
- Promoting a productive partnership with the media to create awareness and contributing towards capacity development.
- Ensuring efficient response and relief with a caring approach towards the needs of the vulnerable sections of the society.
- Undertaking reconstruction as an opportunity to build disaster resilient structures and habitat.
- Undertaking recovery to bring back the community to a better and safer level than the pre-disaster stage.

## Chapter II

### Vulnerability Assessment and Risk Analysis

Disaster Management in today's context means a rigorous of continued and integrated process of planning, organizing, co-ordinating and implementing measures which are necessary for

- 1 Prevention of disaster
- 2 Mitigation or reducing the risk of any disaster
- 3 Preparedness to deal with any disaster
- 4 Evacuation, rescue and relief, rehabilitation and reconstruction aftermath to the disaster.

As per the United Nations, 'Disaster' is the Occurrence of sudden or major misfortune which disrupts the basic fabric and normal functioning of a society.

### CLASSIFICATION OF HAZARDS

I	Water and Climate related	1	Floods and Drainage Management
		2	Cyclone
		3	Tornadoes and Hurricanes
		4	Hailstorm
		5	Cloud burst
		6	Snow avalanches
		7	Heat and Cold waves
		8	Thunder and Lightening
		9	Sea Erosion
		10	Droughts
II	Geologically related	1	Earthquake
		2	Landslide & Mudflows
		3	Dam burst and Dam failures
		4	Mine fires

The Common Natural Disasters likely to hit the State are Incessant Rainfall, Flash Floods, Hailstorms/Cyclones and Earthquakes. The Time and potential impact of those Disasters are given below.

Sl. No.	Type of Hazard	Time of Occurrence	Potential Impact
1	Flash Flood	September to January	Loss of life, crops infrastructure and animals
2	Incessant Rain	September to January	Loss of life, crops infrastructure and animals
3	Earthquake	Any time	Loss of life, crops infrastructure and animals
4	Tidal waves (Tsunami)	Aftermath of any earthquake	Loss of life, crops infrastructure and animals

## DISASTERS

Disasters are of two different types. One is Natural and other is man made. The following types of Disasters are

- Earthquake
- Flood
- Landslide
- Drought and
- Major accident



## History of Vulnerability of the state to the disasters of different types

### Cyclones:

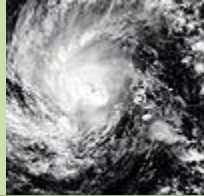




Cyclone refers to a whirl in the atmosphere with very strong winds circulating around it in anti-clockwise direction in the Northern Hemisphere and clockwise in the Southern Hemisphere. Cyclones are intense low pressure areas with pressure increasing outwards. Cyclones can be hazardous as Cyclones are normally associated with strong winds. A storm surge is an abnormal rise of sea level near the coast caused by a severe tropical cyclone; as a result, sea water inundates low lying areas of coastal regions drowning human beings and lives-stock, eroding beaches and embankments, destroying vegetation and reducing soil fertility.


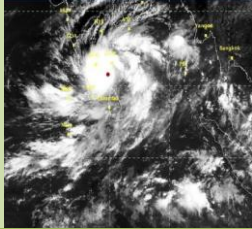

The climate of the state is tropical monsoon type. In the plains, the temperature during winter seldom goes below 18°C while in peak summer it rises to 43°C. Southwest monsoon (June, July, August, and September) and Northeast monsoon (October, November and December) are the two climatic conditions of the State. Tamil Nadu receives rains from both the northeast and southwest monsoons. Maximum rainfall and occasional cyclones occur during the northeast monsoon. The Nilgiris receive the maximum rainfall while Ramanathapuram and Tirunelveli districts receive low rainfall. The annual rainfall varies between 60 cm and 118 cm.

"Thane" cyclone was formed by northeast monsoon period of the Dec 30th in the year of 2011. In Tamil Nadu, North West monsoon gives maximum rainfall of 44cm. In the year 2015 "Roanu" Cyclone was formed and according to Skymet data, during the month of November 2015, Chennai

recorded a whopping 1218.6 mm of rain - three times its monthly rainfall. The normal rainfall figures for November 2015 stand at 407.4 mm. On the first day of December 2015 itself, Chennai recorded 374 mm.

#### Various Cyclones occurred in Tamil Nadu

Name	Lowest Pressure (mbar)	Year	Image
Fanoos	998	2005	
Nisha	996	2008	
Jal	988	2010	
Thane	972	2011	
Nilam	992	2012	

Name	Lowest Pressure (mbar)	Year	Image
Madi	986	2013	
Roanu		2015	
Vardah		2016	

"VARDAH" the severe cyclonic storm had a landfall near Chennai Port in the heart of the city causing unprecedented damage to infrastructure and properties. At the time of landfall Chennai City and Districts of Tiruvallur, Vellore, Tiruvannamalai and Kancheepuram witnessed very heavy rainfall on 12th December of 2016 pouring a 200mm rainfall on the same day causing the uprooting of trees and very strong winds with a velocity of 80 to 130Kms per hour.









## Earthquakes:

Tamil Nadu is also prone to very severe damaging earthquakes. Its people feel much more vulnerable to earthquake-induced tsunamis since the 2004 Indian Ocean tsunami, which affected the coast of Tamil Nadu destroying much of the marine biology and severely damaging the ecosystem. Crops, settlements, trees, birds, fishes, wildlife, and properties were destroyed. Precious coral reefs and mangrove areas were crushed by the huge tsunami waves that devastated South India, an environmental and economic setback that could take years to reverse. Power and communications were totally disrupted. The damage to humans, especially women and children, and animal life, was tremendous, resulting in emotional and mental trauma.

### History of Earthquakes in TamilNadu in recent times:

#### **26 September 2001 - [Off the coast of Puducherry, Mw 5.5](#)**

11.984 N, 80.225 E, D=010.0 kms, OT=14:56:55 UTC; A moderate earthquake occurred in the Bay of Bengal, off the coast of the union territory of Puducherry, on 25 September 2001 at 20:26 PM local time resulting in three deaths and minor damage to property in Puducherry and coastal Tamil Nadu. It had a magnitude of Mw=5.5.

#### **26 December 2004 - [Sumatra-Andaman Earthquake, Mw 9.1](#)**

03.298 N, 95.778 E, D=010.0 kms, OT=00:58:50 UTC; A "very great" earthquake struck the North Indian Ocean & the Bay of Bengal at 00:58 UTC on 26 December 2004. 2,30,210 people were are estimated to have been killed in the Indian Ocean-wide tsunami generated by this earthquake, including at least 8,010 in Tamil Nadu and 599 in Puducherry. Most deaths in Tamil Nadu occurred in the district of Nagapattinam.

#### **7 June 2008 - [Palar Valley region, Mw=3.8](#)**

12.800 N, 78.800 E, D=033.0 kms, OT=18:05:23 UTC; A mild earthquake occurred in the Palar Valley region in Tamil Nadu, on 7 June 2008 at 23:35 PM local time. It had a magnitude of Mw=3.8 and was felt in many parts of Vellore district.

12 August 2011 - [Ariyalur area, Tamil Nadu, Mw=3.5](#)

11.100 N, 79.100 E, D=033.0 kms, OT=06:06:32 UTC; A mild earthquake occurred in the Kaveri basin in Ariyalur district, Tamil Nadu on 12 August 2011 at 11:36 AM local time in India. It had a magnitude of Mw=3.5 and was felt in several districts in southern Tamil Nadu. It was blamed for one death and minor damage in the districts of Kudalur, Perambalur, Tiruchirapalli and Villupuram.

### India Map Seismiczone



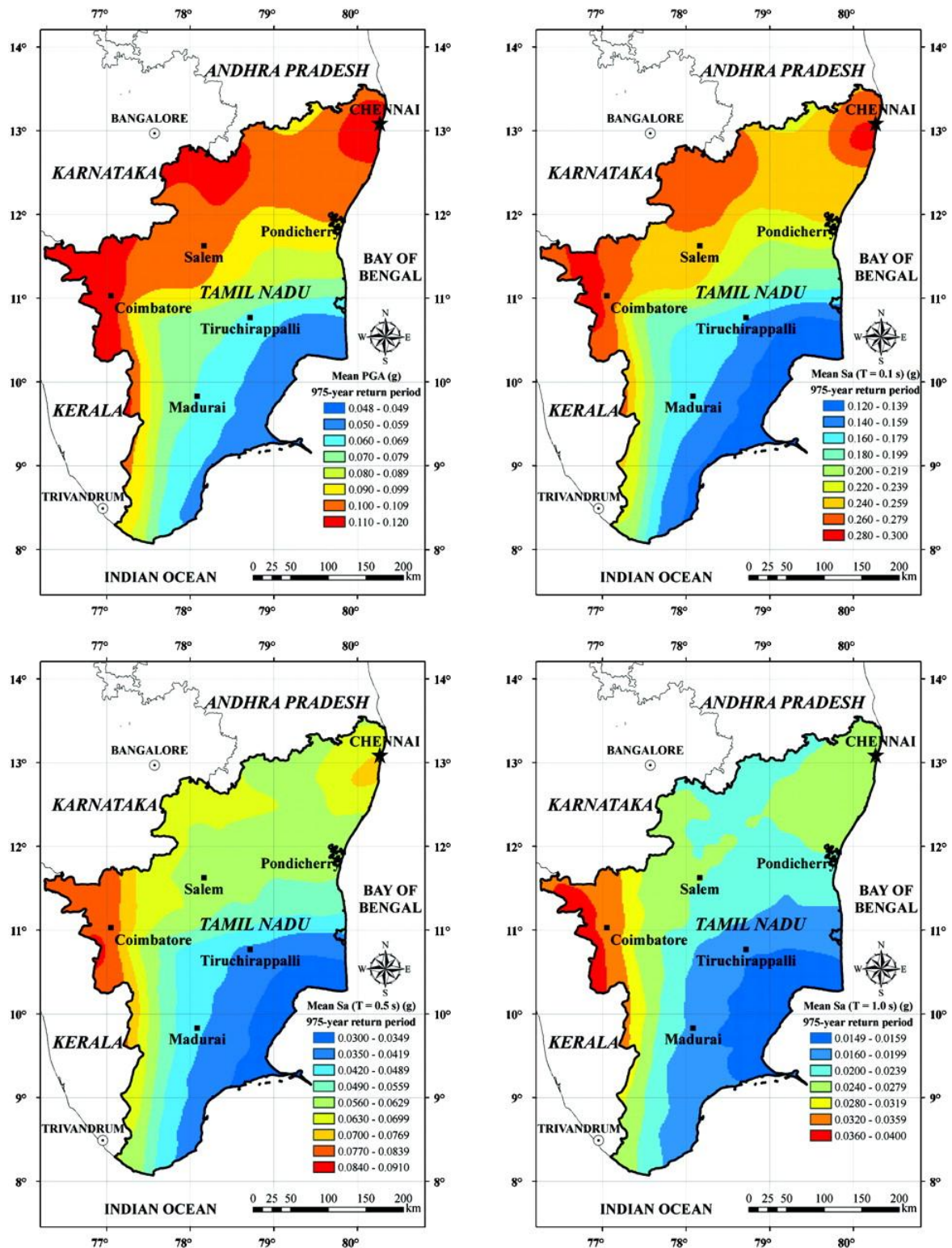




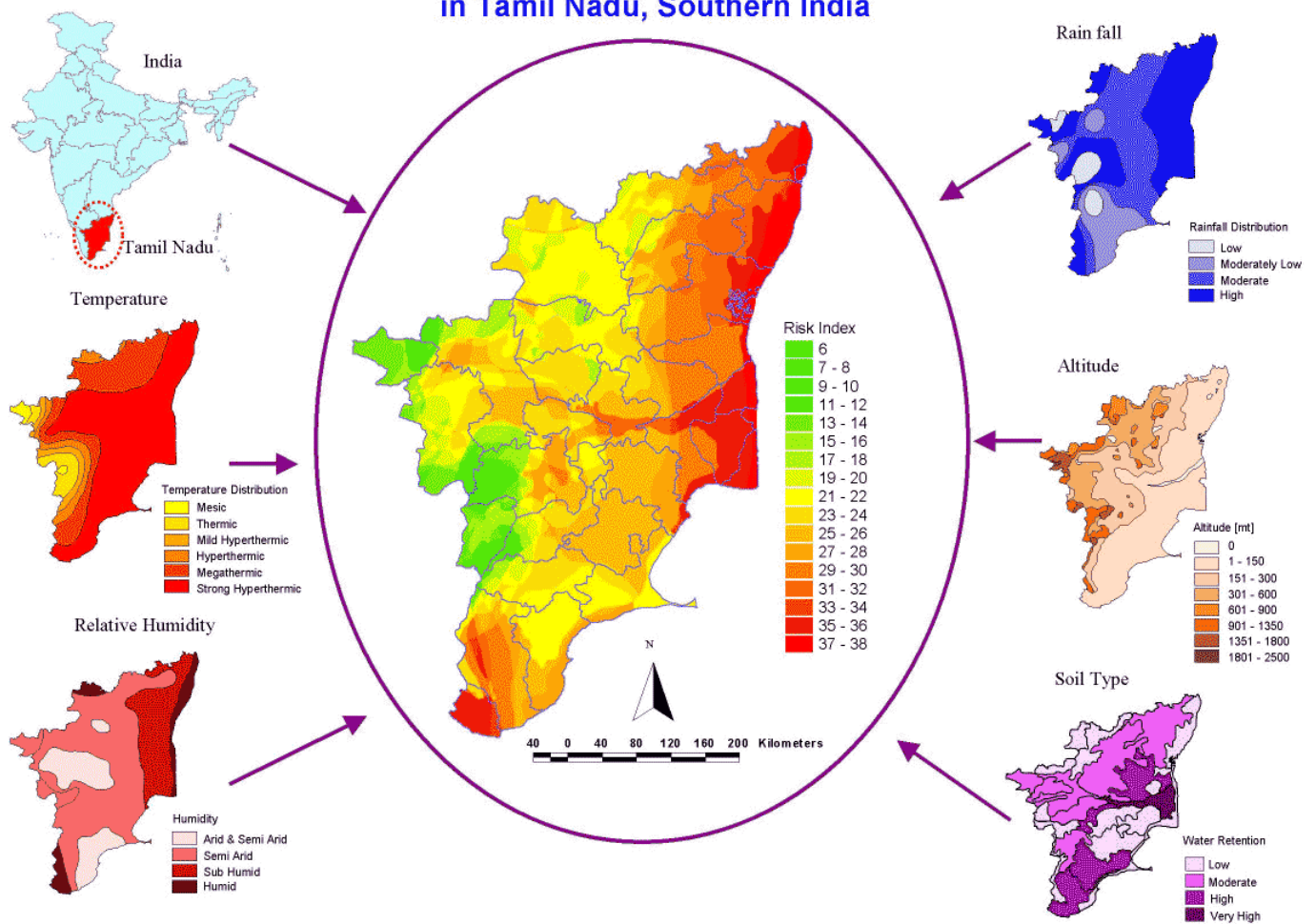


## Probabilistic Seismic Hazard Macrozonation of Tamil Nadu in Southern India.

### TN hazard maps for PGA and spectral accelerations



## A Geo-Environmental Risk Map showing Areas in Tamil Nadu, Southern India



## Chapter III

### Preventive Measures

#### **MAN MADE DISASTER -ROAD ACCIDENTS**

**Sustainable safe mobility** must be a key foundation stone of the 'social protection floor', like access to education, supply of clean water and sanitation, and provision of health care - the minimum level of social provision that makes life civilised. Today, we consider ourselves to live in advanced and modern societies and still people lose their lives in a road crash everyday which is not acceptable. Road traffic injury is one among the cause of death and disability for people, everywhere. Road safety must be recognised and included in the framework for Sustainable Development Goals.

#### **Road Accidents and its Effects**

The increasing loss of human lives due to Road Traffic Accidents has earned notoriety of being tagged as 'Man Made Disaster'. Many a times, accidents cause irreversible or irrecoverable damage to the victim and their close kith and kin.

Statistics also reveal that, the victims of road accidents are the bread-winners of the families, in their prime of youth, between 18 and 40. Any loss of life or disability of any form, to this category causes huge loss to the near family of the victim.

#### **Causes of Accidents**

The latest technological innovations in the Automobile Industry, Globalization of the economy, increased foreign direct investments; all have propelled the Infrastructure development in the country and resultant cascading effect on the road traffic. The increased buying power of the common public, have resulted in the exponential increase of automobile population. This has resulted in comfortable journey of the road user but on the other hand resulted in increased the vulnerability of the road user to road accidents.

In our country the road crashes are attributable to the following pattern/causes;

Driver's fault	77.10%
Pedestrian fault/passenger fault	1.50%
Mechanical defect of the vehicles	2.30%
Bad roads	1.50%
Bad Weather	1.20%
Others	7.70%

(Source: Ministry of Road Transport and Highways Transport Research Wing 2015)

## Preventive measures for elimination of road accidents

### **1. Road Safety Action Plan**

Government of Tamil Nadu approved a comprehensive Road Safety Policy and a Road Safety Action Plan. Road Accident Data Management System (RADMS) was developed using the funds provided by the World Bank. The details of each accident that occurs across the state are recorded by Police, Transport and Highways departments in RADMS and analysis reports are used for the road safety action plan. Measures has been taken to reduce the road accidents by improving the identified frequent accident locations utilizing the accident data received from the State Crime Record Bureau of Police department.

### **2. Road Safety Audit**

Safety status in the roads upgraded under TNRSP has been reviewed, to identify safety related problems, deficiencies and shortcomings for suggesting remedial measures. The suggestions from the Road Safety Audit, for 724 Km of roads have been implemented. Efforts are being taken to extend the road safety audit to select stretches every year.

### **3. Road Safety Awareness Programme**

State wide Road Safety awareness programme has been conducted extensively involving stakeholders to reduce the road accidents involving pedestrians, two wheelers, buses and other heavy vehicles so as to create awareness among the road users. Road safety awareness programme have been conducted under supervision of the Institute of Road Transport, Chennai utilizing the consultancy services to educate the drivers and road users. The students were also trained on various road safety aspects. The World Bank has appreciated Highways Department on the efforts taken to reduce the accidents.

### **4. Road User Satisfaction Survey (RUSS)**

The benefits of better road construction are ultimately passed on to the Road User. The quality and efficiency of the road systems impinge on road user satisfaction. Feedback from the Road-User regarding the quality of the road and an effective system to incorporate

such feedback would help optimal allocation of budgetary resources for road projects and evaluation of utility of such projects.

Maintenance and improvements works are taken as and when feedback is obtained from the public representatives and road users. A web site is being maintained to share with the road users information about various projects under execution, their current status etc.

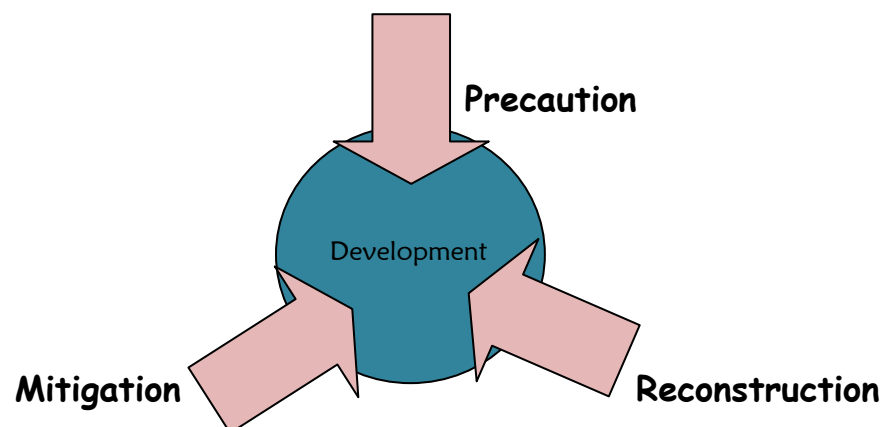
### **NATURAL DISASTERS:**

State is vulnerable to following main Natural Disasters.

- ❖ Drought
- ❖ Floods
- ❖ Earthquake
- ❖ Whirlwind
- ❖ Land Slide

Disaster Management comprises three main factors

- 1 Precaution (Risk Identification and Preparedness)
- 2 Mitigation
- 3 Rehabilitation and Reconstruction



Vulnerability assessment involves two different phases:

1. Hazard Assessment
  - Frequency
  - Magnitude
  - Location
2. Vulnerability Assessment
  - Type of hazard (Cyclone, Flood, ..)



- Impending Impact (Loss of life, crops, infrastructure, livelihood, Scarcity of resource...)
- Location

## Specific Measures to attend to the Natural Disasters

The main motive of the Highways Department during Disaster time is to provide uninterrupted transport communication facility at the time of Disaster and thereafter thereby saving invaluable lives and properties.

### 1. Cyclones and Flood

As the North East Monsoon period in the state June to September may bring incessant rain and this may result in flash floods and the following precautionary measures are taken to confront the situation.

- Information of any emergency request received from the public or by anyone is given immediate attention. Men and material are mobilized through the nearest Sub Division Head Quarters to the specific area within fraction of hours so that any delay could deteriorate the situation. Local participation is also encouraged in the relief works. Details of all water logging areas are collected and drainage works were immediately put to force to drain out the logged water so as to make roads free from obstructions and to provide uninterrupted traffic to migrate affected people. All wind fallen trees are immediately removed through Power saws and with required equipments. Temporary arrangements were made to make roads motor able conditions which were washed away during floods.

- Preventive measures to be taken

- ❖ Vulnerable points which were affected in previous floods are to be identified and listed.
- ❖ Sliding Trees and Plantation on road sides are identified and removed.
- ❖ All Culverts and Bridges are cleared from vegetations and debris to avoid stagnation of water and making water passage free.



- ❖ Weak bridges & Culverts vulnerable flood damage are to be identified.
- ❖ High berms should be either cut or smoothened in order to avoid stagnation of water in the riding surface. All road side drains should be cleared from debris.



- ❖ Weak structures are identified and are strengthened.
- ❖ All roads towards Major Hospitals and Health care institutions are given special attention so that People who need immediate medical attention could reach these places without any fuss.
- ❖ To carry out all the emergency works prior to the Disaster, a minimum Natural Calamity Fund should be guaranteed in advance.
- ❖ A Minimum incentive may be provided to all the staff at various levels who are working round the clock during the Disaster Period.



## **CHAPTER IV**

### **DEVELOPMENTAL PLANS/ PROGRAMMES/ PROJECTS**

The core objective of the department is to provide an efficient all weather road network. The development plans and programmes of the department are basically designed to cater the needs of providing connectivity to interior vulnerable places with the Major Arterial corridors. This ensures better uninterrupted connectivity during emergency situations and the following are the programmes being implemented by the department towards this;

#### **1. CAPACITY AUGMENTATION**

Roads cater to the rising demands of the traffic. In view of the exponential growth of the traffic due to industrialization and urbanization, the existing capacity of roads is planned to be increased.

##### **❖ Widening of roads**

National Highways roads are widened and strengthened to the capacity of two lane with paved shoulders, four lane and six lane with the funds provided by the Government of India.

*To augment the traffic capacity of state roads, widening works of all Intermediate lane State Highways to Double lane (7.0m width) and all Single lane Major District Roads (MDR) to Intermediate lane (5.50m width) are being executed.*

##### **❖ Providing additional connectivity, formation of Bypasses / Ring Roads**

Roads are being formed along new routes to connect important towns.

Tamil Nadu has the unique distinction of having more number of bypasses. Bypasses are an integral part of the transport system which helps in reducing, traffic congestion in towns and cities, reduction of

travel time, savings in fuel and vehicle maintenance cost and assumes top priority in managing the traffic growth in major cities.

The State Government has taken up construction of 88 bypasses to the Corporations, Municipalities and Town Panchayat of which 30 bypasses have been completed. Besides the above, 78 bypasses have been completed by the National Highways Authority of India (NHAI) and 46 are in progress.

#### ❖ **Construction of ROB / RUBs**

With a view to reduce the accidents, traffic congestion and travel time at railway level crossings, the level crossings where the TVU (Train Vehicle Unit) exceeds 1 Lakh are replaced with ROB/RUB.

So far, 299 Level Crossings across the state have been converted into ROB/RUBs under various schemes. At present, there are 1262 manned Level crossings and 778 Unmanned Level crossings in the State. These will also be converted into ROB/RUBs in a phased manner.

#### ❖ **Construction / Rehabilitation of Bridges**

Construction of bridges across un-bridged crossings and Rehabilitation / Reconstruction of dilapidated and narrow bridges are undertaken to ensure safe uninterrupted traffic flow.

## **2. CAPACITY BUILDING**

Government have come up with integrated e-pathai system under Institutional Development comprising of Road Maintenance Management System (RMMS), Geographical Information System (GIS) and Project, Human Resources and Finance Management System (P&FMS) for effective, efficient and transparent functioning of the department. These systems help in all the processes starting from plan formulation till monitoring the execution of works. Utilizing the state of art

facilities, the department is striving to improve the condition of all roads to achieve service levels on par with International Standards by fixing suitable indicators based on roughness. The GIS based road maps are made available in the [www.tnhighways.gov.in](http://www.tnhighways.gov.in) and the GIS link provided in the said official website. e-pathai GIS of the Highways Department is a web enabled GIS based solution which helps in graphical view of all the roads and bridges. The public can utilize it for searching shortest routes and its alternates.

In respect of training of personnel, analysis being undertaken to identify skill gaps at all levels of technical and non-technical staff on all components and training has been imparted for effective delivery of various IT solutions. Periodical training on quality assurance and refresher courses are being extended to all the Engineering staff through Highways Research Station.

Training on various aspects of latest technological developments and administrative skills are being given to all the staff, utilizing the services of various training institutions in the country. To augment the infrastructure facilities of the department, Government have sanctioned construction of Training Center with state of art facilities and Hostel at Highways Research Station campus.

All the above measures to strengthen the institutional capacity helps to programme in a better efficient way of building safe road infrastructure of the State.

### **3. MAINTENANCE WORKS**

Appropriate maintenance of road infrastructure is essential for hassle free movement of traffic. Periodical maintenance of roads reduces construction cost and routine maintenance of bridges enhances the life span of these structures.

In addition, maintenance of cross drainage works will facilitate easy drainage of flood water during monsoon and reduces the damage to the riding surface.

Maintenance of roads and bridges are carried out as per Indian Roads Congress norms utilizing Non-plan maintenance fund including Special repairs and Periodical renewal.

#### **4. ROAD SAFETY MEASURES**

The identification, analysis and treatment of road accident black spots are widely regarded as one of the most effective approaches to mitigate road accidents. It is well established that considerable safety benefits may accrue from the application of appropriate road engineering or traffic management measures at hazardous road locations. Results from such applications at "black spots" demonstrate high returns from relatively low cost measures.

In spite of the precautionary measures undertaken, certain inadequacies in the existing road infrastructure lead to accidents. In order to mitigate the road accident levels and improve safety measures, Government announced a special project to attend the black spots in highly accident prone areas including urban roads. A Comprehensive proposal to improve the black spots in the Government Roads has been prepared which includes the following engineering measures:

- Widening of Narrow Culvert (where width of the culvert is less than carriage way).
- Widening of Narrow Culvert (where width of the culvert is narrow as per IRC).
- Realignment of 'S' curve (radius of the curve is less than 90m).
- Realignment of 'S' curve (radius of the curve is more than 90m).
- Construction of Safety wall/Crash barrier around the road side Open well/Tank bunds.
- Construction of Safety wall/Crash barrier along High embankment.
- Construction of Safety wall/Crash barrier along Hill road.

- Construction of Center median.
- Provision for Road furniture (Gantry boards, studs, delineators, center line marking).
- Junction Improvements.

### Other General Recommendations / Suggestions to Improve Road Safety and Avoid Accidents

Though, each location/spot may be unique, in its own way, the recommendations / suggestions may apply to most of the situations;

- Junctions with minor roads to be improved to proper standards, which would help in channelising the traffic flow, improve inter-visibility, ensuring accident-free traffic flow.
- Segregation of traffic based on speed and carrying-capacity.
- Special safety zones for moving alongside/across the roads, during peak hours.
- Providing Bus-bays, wherever possible, for safe commuter travel and usage and Relocating/Shifting of the Ill-located Bus-stops.
- Sparing/Limited use of One-way, exercising maximum restraint, in choosing the options.
- Pedestrian safety as the "Top-most" priority, in considering the provisions for roads.
- Providing signages, proper reflective strips, enhancing the nighttime visibility, which reduces the accidents.

Promoting and Encouraging Use of Public Transport in a Bigger Way and Discouraging the preference of private transport - with an objective of carrying more people than more vehicles.

## CHAPTER V

### Preparedness Measures

The Highways Department is maintaining 62,460 km road network and 1003 Major River Bridges, 164 Road Over and Under Bridges at railway level crossings and 117576 Cross Drainage structures spread across the state.

The State of Tamil Nadu is likely to get intense rainfall in the forthcoming months due to firm onset of North East Monsoon. In this connection, certain precautionary measures are necessary which are to be scrupulously adopted as a pre-monsoon activity as listed below and these instructions have been communicated to the Divisional Engineers (H) vide memo no. 7755/Salai/2015 dated:26.07.2017.

1. The month of August will be observed as "Month of Bridges maintenance". The vents of all culverts and bridges should be cleared off all the vegetative debris so as to avoid stagnation and inundation of surrounding areas thereby making way for free flow of flood water. The protective works of bridges and culverts should be kept in good condition.
2. Repair works of Bridges taken up under Bridge maintenance should be completed well in ahead of monsoon.
3. The Pre monsoon inspection of roads and bridges has to be carried out to identify the vulnerable locations identified. It should be ensured that the areas where breaches have occurred during last monsoon are to be strengthened.



## BEFORE



## AFTER



4. High berms should be cut and removed in order to avoid stagnation of water in the riding surface as well as berms. Action should be taken to clear the road side drains of all debris so as to drain the storm water to nearby culverts.

Announcement was made by the Hon'ble Minister for Highways and Minor Ports Department during the Budget Session on 04.08.2016, as permanent remedial measures to prevention of stagnation of water during floods in and around Chennai City and sub urban areas under Comprehensive Road Infrastructure Development Program for the year 2016-17 Scheme 28nos. of works to an amount of Rs.30.59Crores for enhancing the pumping capacity of subways, to increase the storm

water drainage capacity, to construct the storm water drains which are discontinued or damaged and to construct Culverts in the important connectivity roads to mitigate the water stagnation.

#### THILLAI GANGA NAGAR SUBWAY – CONSTRUCTION OF CROSS CULVERT





## CONSTRUCTION OF DRAIN



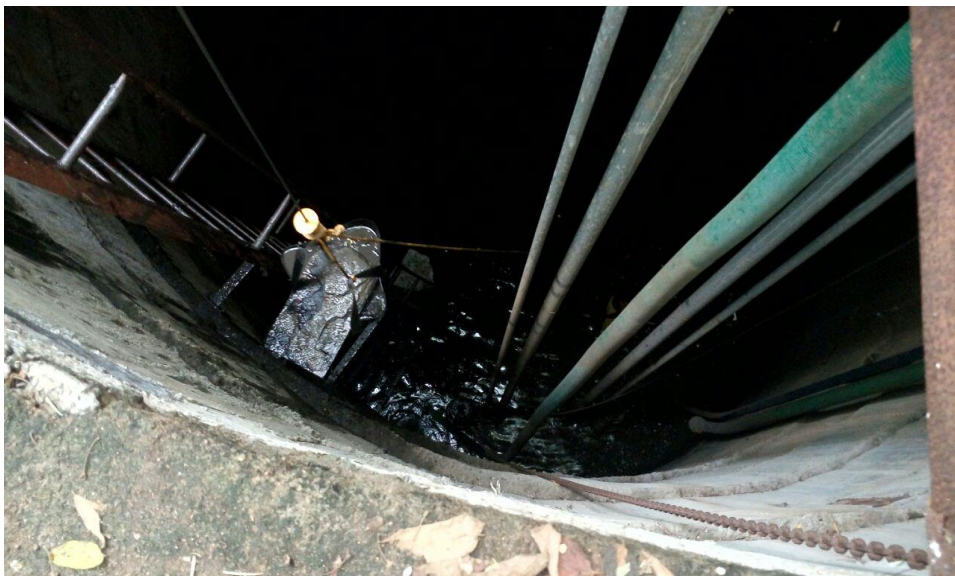
## DESLITING OF DRAINS



DESLITING OF DRAINS



DESLITING OF SUB WAY WELLS



5. Speedy action should be taken to remove wind fallen trees for which the power saws and portable generators must be kept ready, either by purchase or arrangements to be made to hire them as and when required.
6. The required quantity of stitched, sand filled bags must be kept ready at a safe accessible place.
7. All machineries like bulldozers, power saws etc. of adequate quantity and in good condition for the purpose of clearing obstructions / road blocks caused by uprooted trees, electric posts etc. during the time of cyclone, flood etc. must be kept ready.
8. In ghat sections, the choked drains have to be cleared to drain off the rain water immediately.
9. Road works nearing completion may be hastened up to completion before the onset of monsoon.
10. The Department vehicles with crews must be kept ready for attending to emergency work during flood time.
11. The report of damages must be communicated to the authorities concerned immediately.
12. Detailed report on the heavy damages caused to the roads / structures due to the intense rain situation with photographs of damages before and after completion of restoration works should be sent to this office, Secretary to Government, Highways Department and to the Collector concerned directly. Video should be taken for severely damaged works.
13. The Divisional Engineers (H) are instructed to view the prevailing flood situation seriously and to take sincere efforts to combat the

situation and to report this office about the damages as and when it occurs.

14. To contact Chief Engineer (H) (C&M), directly in case of emergency and to report on heavy damages caused due to flood.
15. To have constant touch with the District Collector of the concerned district for collection of weather report and inform about the damages caused to road/ structures as and when it occurs.
16. In urban areas the subways are to be maintained properly. Necessary men and machinery to pump out the rain water should be kept ready to combat the situations.
17. Flood gauges should be fixed at all causeways at once as per specifications. The flood gauges already fixed should be maintained properly by painting.

Further the steps are taken at the district level by the district level authority (Divisional Engineers, Construction and Maintenance wing of Highways Department)

- i) Identify all the vulnerable points
- ii) Prepare contingency plan for each district in consultation with the district administration
- iii) Identify and keep ready set of gangs in each sub-division, in shift system so that they may be utilized in flood affected areas during any emergency, in the peak monsoon period and materials required to any exigencies.
- iv) Set up a flood control room in each division headed by Divisional Engineer (H) in order to monitor effectively and assess the

damages and report on damages must be sent to the higher authorities.

- v) Prepare a list showing the telephone number of each sub division, division and send to this office.
  - vi) Prepare a list showing the telephone number of all field officers (office, residence and mobile No.) and display in all control rooms to be set up in each division office.
  - vii) Identify contractors (sub division wise) for mobilising machinery, men and materials for flood restoration works with their contact numbers.
  - viii) To give necessary instructions to the subordinate officers under their control that during the cyclonic spells the field officers should be available at their respective head quarters to organise the work force, men and material. The field officers must be alert and vigilant on duty round the clock to take up immediate restoration.
- A Control Room is to be set up at the Division Office connecting all control rooms at the Sub Division level. Staff will perform duties round the clock in all the Control Rooms. These Control Rooms acts as nerve centre for Disaster Management. It has three main components called the three C's - Command, Control and Communication for effective response in emergency. Its function is to monitor co-ordinate and implement action.
  - Department Vehicles with crews are kept ready to attend emergency work during flood time.



- Adequate numbers of RCC hume pipes & Gunny bags, Casurina poles & Red flog with post are to be procured.
- Places for emergency landing of Helicopter are to be identified.
- All the Sub Division Control Rooms are also connected with the respective Taluk Offices for co-ordinating the rescue work.
- All information of damages is informed to the Head Offices from time to time.
- A system of Patrolling of rivers and streams is put to effect to make preemptive measures to avoid any breaches during water flow above the danger level. A constant communication is also maintained with the Public Works Department to achieve this.

### **RELIEF AND RECONSTRUCTION WORK**

All data regarding damage of Roads, Culverts and Bridges are collected and value for restoration of these damages assessed and informed to the higher authorities. Requisite funds to carry out temporary restoration and permanent restoration are clearly drawn and forwarded through the District authorities to the Government. All restoration works are immediately carried out on receipt of these special funds.

"VARDAH" the severe cyclonic storm had a landfall near Chennai Port in the heart of the city causing unprecedented damage to infrastructure and properties. At the time of landfall Chennai City and Districts of Tiruvallur, Vellore, Tiruvannamalai and Kancheepuram witnessed very heavy rainfall on 12th December of 2016 pouring a 200mm rainfall on the same day causing the uprooting of trees and very strong winds with a velocity of 80 to 130Kms per hour.

During Vardah cyclone storm, 1857 uprooted trees were removed immediately and traffic was restored, the tree debris also removed from the road sides using 1200 manual labour, 117 power saws, 131 JCB's and 40 tippers. Around 200 work men with required machineries have been diverted from Coimbatore, Tiruppur and Trichy circles. A sum of **Rs.25Crore** was allotted by the State Government for taking necessary temporary measures to restore the damages caused by the Vardah Cyclone. Using which, a total length of 178Km of damaged road surface was temporarily restored, 63km length of eroded berms, 33nos of damaged culverts/causeways and 31nos of damaged footpaths/ drains/ center medians were restored.

#### REMOVAL OF WIND FALLEN TREES





Due to the above tremor / earthquake no major damages to roads & Bridge were reported.

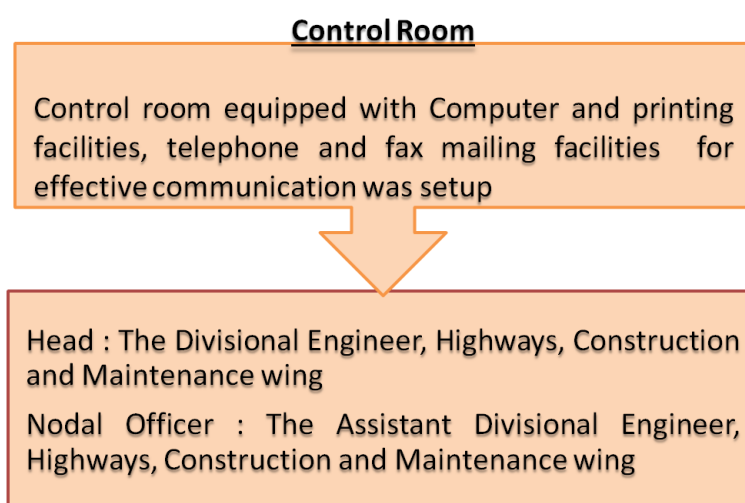
Information of any emergency request for earthquake received from the public or by anyone is given immediate attention. Men and material are mobilized through the nearest Sub Division Head Quarters to the specific area within fraction of hours so that any delay could deteriorate the situation. Local participation are also encouraged in the relief works.



Transportation infrastructure is critical for delivering relief supplies. Importantly all State Highways Roads are to be given top most priority so that uninterrupted relief supplies, access by rescue agencies and safe passage for the injured to the nearby Hospitals could be guaranteed.

After emergency restorations of Roads and Bridges, a clear proposal for funds should be drawn up to permanently restore the damaged structures and to make all roads motor able conditions.

Team of offices involved in the disaster management programme



	Circle		Division (District Level)		Sub-Division (Taluk Level)
1	Chennai	1	Chennai	1	Chennaicityroads
				2	Tambaram
		2	Thiruvallur	3	Ambattur
				4	Gummidipoondi
				5	Pallipattu
				6	Ponneri
				7	Thiruttani
				8	Thiruvallur
		3	Chengalpattu	9	Chengalpattu

	Circle		Division (District Level)		Sub-Division (Taluk Level)
				10	Kanchipuram
				11	Maduranthagam
				12	Sriperumbudur
				13	Uthiramerur
		4	<b>Vellore</b>	14	Arakonam
				15	Arcot
				16	Katpadi
				17	Vellore
				18	Walajah
		5	<b>Vaniyambadi</b>	19	Gudiyatham
				20	Thirupattur
				21	Vaniyambadi
		6	<b>Tiruvannamalai</b>	22	Tiruvannamalai
				23	Thandarampattu
				24	Chengam
				25	Polur
		7	<b>Cheygar</b>	26	Arani
				27	Cheygar
				28	Vandawasi
2	<b>Villupuram</b>	8	<b>Villupuram</b>	29	Gingee
				30	Tindivanam
				31	Vanur
				32	Villupuram
		9	<b>Kallakurichi</b>	33	Kallakurichi
				34	Sankarapuram
				35	Tirukkoyilur
				36	Ulundurpettai
		10	<b>Cuddalore</b>	37	Chidamabaram
				38	Cuddalore
				39	Kattumannarkoil

	Circle		Division (District Level)		Sub-Division (Taluk Level)
				40	Kurinjipadi
				41	Panruti
				42	Tittakudi
				43	Vridhachalam
		11	Ariyalur	44	Ariyalur
				45	Jayankonadam
				46	Sendurai
		12	Perambalur	47	Perambalur
				48	Kunnam
				49	Veppanthattai
3	Trichy	13	Trichy	50	Lalgudi
				51	Manapparai
				52	Musiri
				53	Thuraiyur
				54	Trichy
		14	Pudukottai	55	Alangudi
				56	Aranthangi
				57	Avudayarkoil
				58	Keeranur
				59	Pudukottai
				60	Thirumayam
		15	Tanjavur	61	Kumbakonam
				62	Orathanadu
				63	Papanasam
				64	Pattukottai
				65	Peravurani
				66	Thanjavur
				67	Thiruvaiyaru
				68	Thiruvaidaimaruthur
		16	Tiruvavur	69	Kudavasal

	Circle		Division (District Level)		Sub-Division (Taluk Level)
				70	Mannargudi
				71	Nannilam
				72	Thiruthuraipoondi
				73	Tiruvarur
		17	Nagapattinam	74	Mayiladuthurai
				75	Nagapattinam
				76	Sirkazhi
				77	Vedaranyam
4	Salem	18	Salem	78	Salem
				79	Athur
				80	Vazhapadi
				81	Yercaud
		19	Edapadi	82	Edapadi
				83	Sankari
				84	Mettur
				85	Omalur
		20	Namakkal	86	Namakkal
				87	Rasipuram
				88	Senthamangalam
				89	Tiruchengodu
		21	Dharmapuri	90	Dharmapuri
				91	Harur
				92	Palacodu
				93	Pappireddipatti
				94	Pennagaram
		22	Krishnagiri	95	Hosur
				96	Krishnagiri
				97	Thenkanikottai
				98	Uthangarai
5	Tiruppur	23	Tiruppur	99	Avinashi

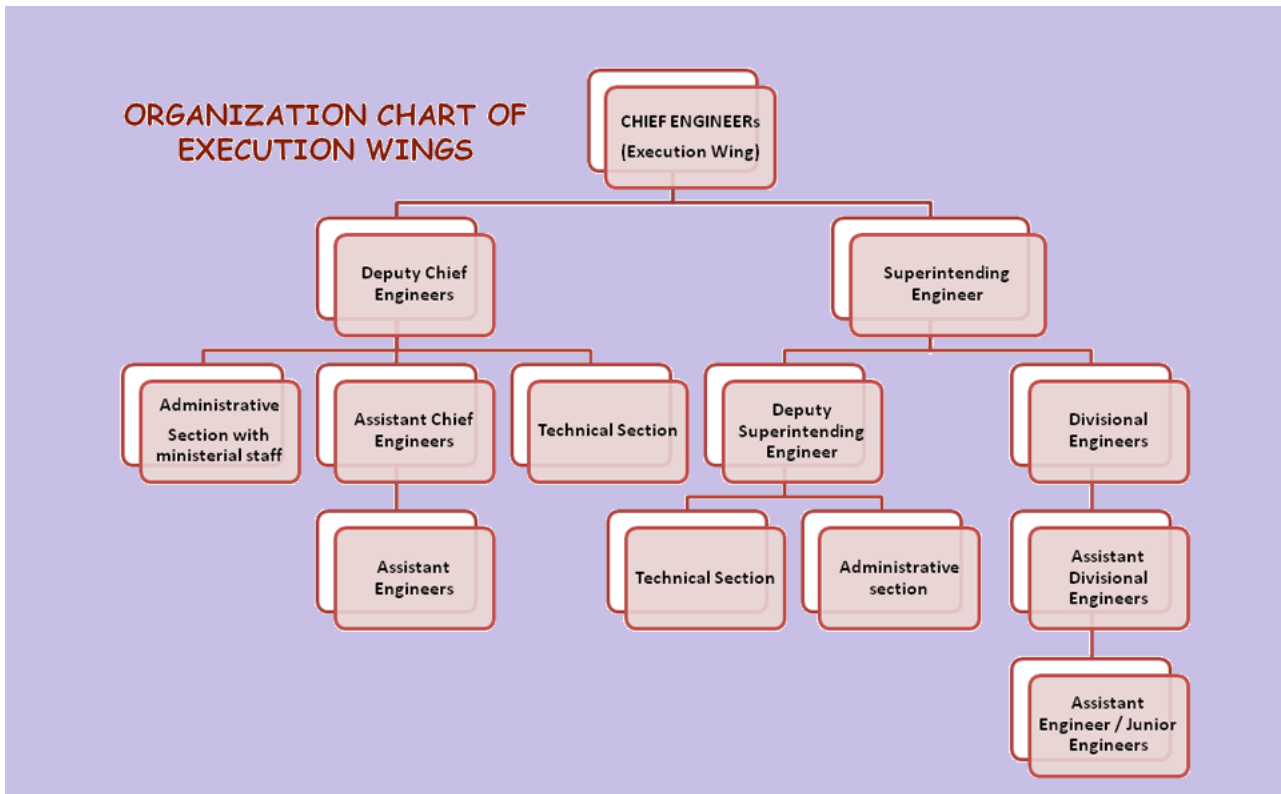
	Circle		Division (District Level)		Sub-Division (Taluk Level)
				100	Kangeyam
				101	Palladam
				102	Tiruppurnorth
				103	Tiruppursouth
		24	Dharapuram	104	Dharapuram
				105	Madathukulam
				106	Mulanoor
				107	Udumalapet
				108	Vellkivil
		25	Erode	109	Bhavani
				110	Erode
				111	Kodumudi
				112	Perundhurai
		26	Karur	113	Aravakurichi
				114	Karur
				115	Krishnarayapuram
				116	Kulithalai
6	Coimbatore	27	Coimbatore	117	Annur
				118	Coimbatorenorth
				119	Coimbatoresouth
				120	Mettupalayam
				121	Sulur
		28	Pollachi	122	Aanamalai
				123	Kinathukadavu
				124	Pollachi
				125	Valparai
		29	Gobi	126	Gobieast
				127	Gobiwest
				128	Sathyamangalam
				129	Thalavadi

	Circle		Division (District Level)		Sub-Division (Taluk Level)
		30	Udhagai	130	Coonoor
				131	Gudalur
				132	Kotahgiri
				133	Uthagamandalam
7	Madurai	31	Madurai	134	Maduraieast
				135	Maduraiwest
				136	Melur
				137	Peraiyur
				138	Thirumangalam
				139	Usilampatti
				140	Vadipatti
		32	Theni	141	Andipatti
				142	Bodinayakanur
				143	Periyakulam
				144	Theni
				145	Uthamapalayam
		33	Dindigul	146	Athoor
				147	Dindigul
				148	Kodaikanal
				149	Natham
				150	Vathalagundu
		34	Palani	151	Palani
				152	Oddanchathiram
				153	Vedachandur
		35	Sivagangai	154	Devakottai
				155	Karaikudi
				156	Manamadurai
				157	Sivaganga
				158	Tirupattur
		36	Ramnad	159	Kamuthi

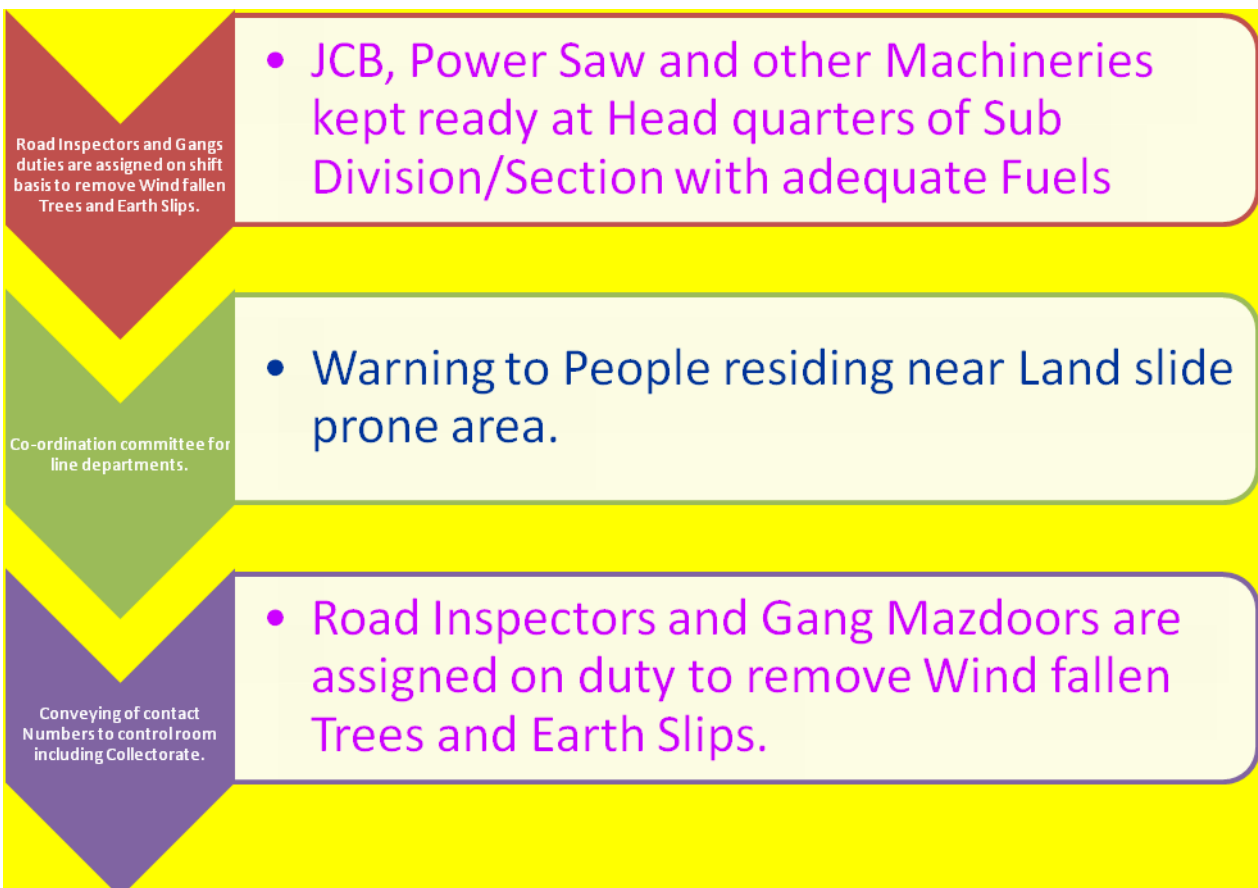


	Circle		Division (District Level)		Sub-Division (Taluk Level)
				160	Mudhukulathur
				161	Paramakudi
				162	Ramanathapuram
				163	Tiruvadanai
8	Thirunelveli	37	Tirunelveli	164	Ambasamudram
				165	Nanguneri
				166	Palayamkottai
				167	Radhapuram
		38	Tenkasi	168	Chenkottai
				169	Sankarankoil
				170	Sivigiri
				171	Tenkasi
		39	Tuticorin	172	Kovilpatti
				173	Ottapidaram
				174	Sathankulam
				175	Srivaikundam
				176	Thiruchendur
				177	Thoothukudi
				178	Vilathikulam
		40	Virudhunagar	179	Aruppukottai
				180	Rajapalayam
				181	Sattur
				182	Sivakasi
				183	Srivilliputhur
				184	Thiruchuli
				185	Virudhunagar
		41	Nagercoil	186	Kuzhithurai
				187	Nagercoil
				188	Thakkalay
				189	Thovalai

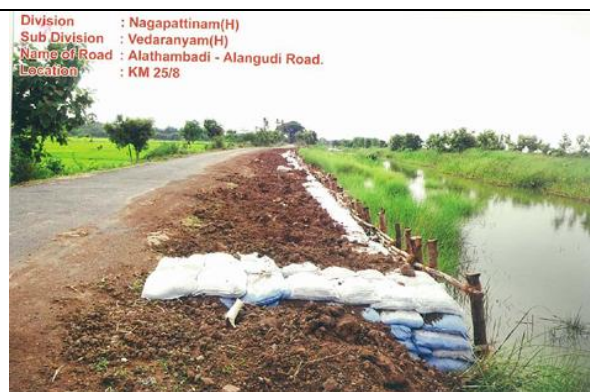
## General Organisational structure of the executive wing:



## Preparation on receipt of emergency warning



## Resource Mobilisation



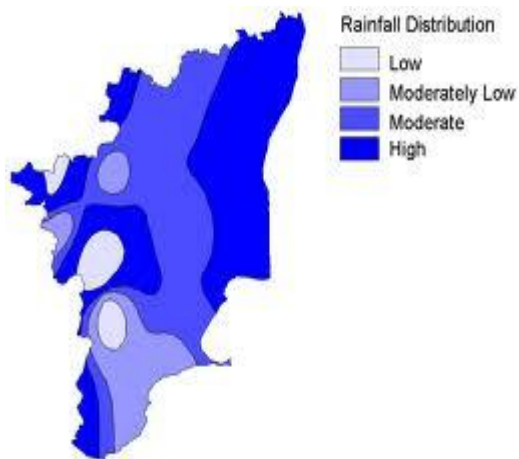
## PART II

# DISASTER SPECIFIC ACTION PLAN

## CHAPTER VI

### CYCLONES AND FLOODS

Floods are high stream flow that overflows the natural banks of the rivers and most of the times become calamitous. Floods are the most frequent and often the most devastating. The cause of flood is mainly the peculiarities of rainfall in North east monsoon period in the state. Out of the total annual rainfall in the state, 90% is concentrated over short monsoon season of three months. As a result, heavy discharges from the rivers during this period causing widespread floods in the delta regions. Floods occur mainly in the coastal districts basin that carries 100% of the state total river flows. Tamil Nadu is also subjected to annual flooding, including flash floods, cloudburst floods, monsoon floods of single and multiple events, cyclonic floods, and those due to dam bursts or failure. Every year, on average thousands of people are affected, a few hundred lives are lost, thousands are rendered homeless and several hectares of crops are damaged.



Bay of Bengal Coastal areas of the state are prone to Cyclones and Floods. Cyclones and floods have wreaked havoc in the state several times in the past few centuries. As the North East Monsoon period in the State from June to September may bring incessant rain and this may result in flash floods, ***precautionary measures*** are taken to confront the situation.

The criteria followed by the Indian Meteorological Department to classify the low pressure systems in the Bay of Bengal and Arabian Sea as adopted from the World Meteorological



Organization (W.M.O.) classifications are as given in the following table.

Category	Wind speed (km per hour)
<b>Super Cyclonic Storm</b>	> 222
<b>Very Severe Cyclonic Storm</b>	119 to 221
<b>Severe Cyclonic Storm</b>	89 to 118
<b>Cyclonic Storm</b>	62 to 88
<b>Deep Depression</b>	50 to 61
<b>Depression</b>	31 to 49
<b>Low Pressure Area</b>	< 31

Cyclones on the east coast originate in the Bay of Bengal, the Andaman Sea or the South China Sea, and usually reach the coastline of Tamil Nadu, Andhra Pradesh, Orissa and West Bengal, which are most vulnerable to this type of hazards. Two of the deadliest cyclones of this century, with fatalities of about 10,000 people in each case, took place in Orissa and Andhra Pradesh during October 1971 and November 1977 respectively. The super cyclone of Orissa in 1999 caused large scale damage to life and property. Vulnerability to storm surges is not uniform along Indian coasts. TamilNadu coast between Chennai and Tuticorin is recognized as vulnerable to high surges among the segments of the east coast.

The Bay of Bengal accounts for seven percent of the annual tropical cyclone activity worldwide; the recorded frequency of cyclones per year along the Bay of Bengal is four and inevitably one of the four transforms into a severe cyclone causing human and property losses. Although the percentage of cyclonic activity along the coast is relatively low, the level of human and property loss that cyclones cause around the Bay is very high. Cyclonic landfall usually lead to heavy rains accompanied with high speed winds and eventually translate into floods, as was the case with the damaging cyclone-induced floods. While the entire coast of TamilNadu is vulnerable to Cyclones, thirteen districts identified in the map below are most vulnerable.

## **EMERGENCY WORK DURING FLOODS**

Information of any emergency request received from the public or by anyone are given immediate attention. Men and material are mobilized through the nearest Sub Division Head Quarters to the specific area within fraction of hours so that any delay could deteriorate the situation. Local participation are also encouraged in the relief works. Details of all water logging areas are collected and drainage works were immediately put to force to drain out the logged water so as to make roads free from obstructions and to provide uninterrupted traffic to migrate affected people. All wind fallen trees are immediately removed through Power saws and with required equipments. Temporary arrangements were made to make roads motorable conditions which were washed away during floods.

## **RELIEF AND RECONSTRUCTION WORK**

All datas regarding damage of Roads, Culverts and Bridges are collected and value for restoration of these damages assessed and informed to the Higher authorities. Requisite funds to carry out temporary restoration and permanent restoration are clearly drawn and forwarded through the District authorities to the Government. All restoration works are immediately carried out on receipt of these special funds.

### **Wind fallen trees.**

The wind fallen trees will be removed by using power saw or JCB and department Gangs for free flow of traffic.



## REMOVAL OF WING FALLEN TREES

Earth Slips during heavy downpour:





### Breaches and eroded berms and damaged protective walls

The Breaches are attended immediately after the flood by using sand bags. If water flow is not receding immediately RCC Pipes are provided at the breaches. The traffic is allowed immediately by providing latrite and metal.





The erode berms are attended immediately by using sand bags and casuarina poles.

### Pot holes

The pot holes are attended by providing laterite and Metal. The WBM or WMM are provided as temporary restoration on riding surface.



### Damaged Culverts

The RCC 900 mm dia Pipes are provided for immediate restoration of damaged culvert. The Mudasal are provided on either side of the pipe. The traffic is allowed by providing earth and Metal over pipes.





## CHAPTER VII

### EARTHQUAKES

As an Earthquake is a phenomenon which could occur any time, there is no possibility of precautionary measure. But aftermath to the earthquake it is atmost necessary to draw up a management plan.

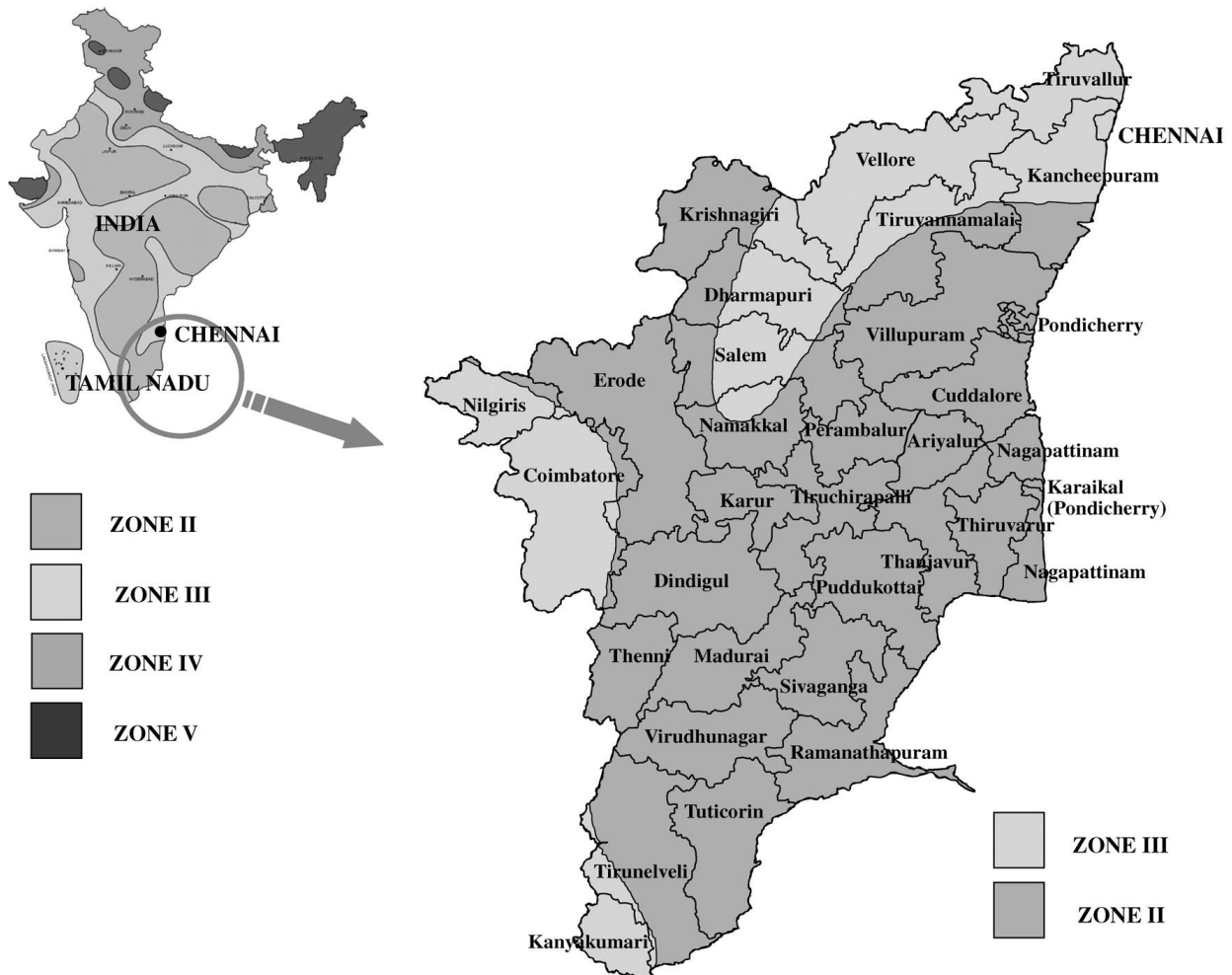
Transportation infrastructure is critical for delivering relief supplies. Importantly all State Highways Roads are to be given top most priority so that uninterrupted relief supplies, access by rescue agencies and safe passage for the injured to the nearby Hospitals could be guaranteed.

After emergency restorations of Roads and Bridges, a clear proposal for funds should be drawn up to permanently restore the damaged structures and to make all roads motorable conditions.

Region falling in various zones of the country (Source: Earthquake Manual, GoAP)

<b>Zone Damage risk and Intensity Region</b>	
Zone V (Earthquake Very high damage risk zone - areas may expect intensity maximum of MSK IX or more)	The entire North-east, including all the seven sister states, the Kutch district, parts of Himachal and J & K, and the Andaman and Nicobar islands.
Zone IV (Earthquake High damage risk zone - areas may expect intensity maximum of MSK VIII)	Parts of the Northern belt starting from J & K to Himachal Pradesh. Also including Delhi and parts of Haryana. The Koyna region of Maharashtra is also in this zone.
Zone III (Earthquake Moderate damage risk zone - areas may expect intensity maximum of MSK VII)	A large part of the country stretching from North including some parts of Rajasthan to the South through the

	Konkan coast, and also the Eastern parts of the country.
Zone II & I (Earthquake Low damage risk zone - areas may experience intensity MSK VI)	These two zones are contiguous, covering parts of Karnataka, Andhra Pradesh, Orissa, Madhya Pradesh, and Rajasthan known as low risk earthquake zones



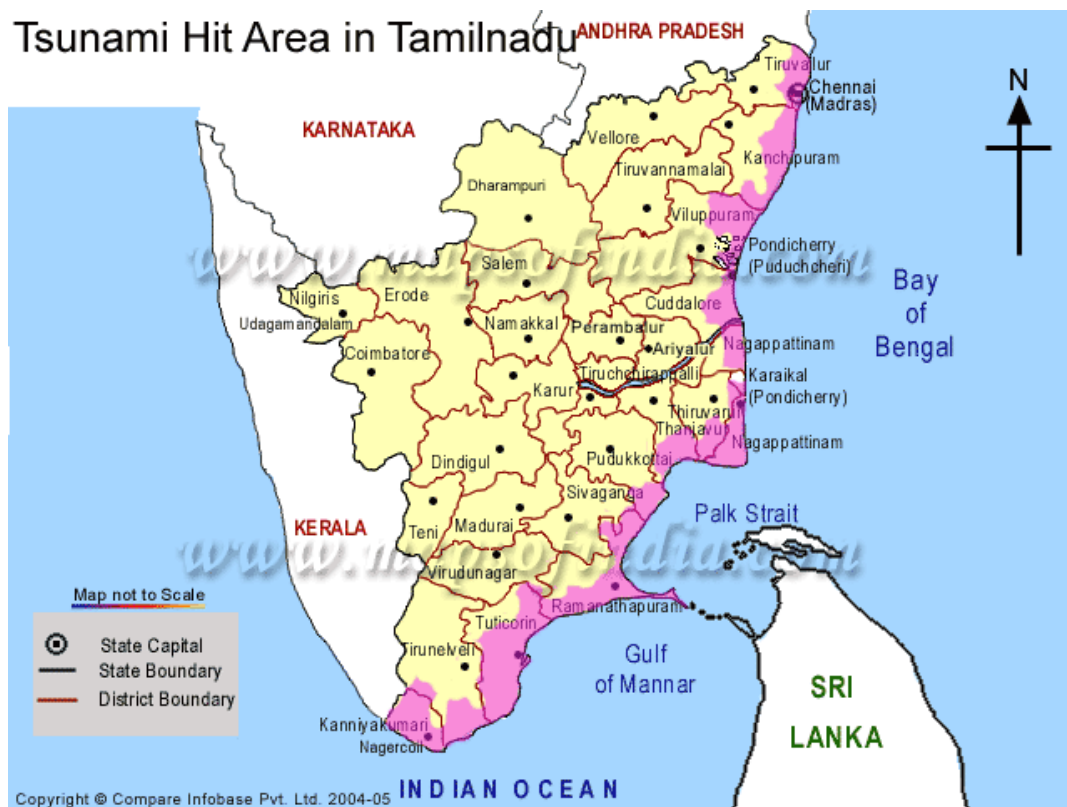
## CHAPTER VIII

### TIDAL WAVES (TSUNAMI)

The East Coast of the state is likely to be affected by Tidal waves. As far as Tidal waves is concerned there are early warning system installed in seas which could send warning signals of Tidal waves to the offshore centres in land.

#### Precautionary measures

All fishermen hamlets are to be interconnected through roads and these roads should be link with the Major Escape route. This will pave the way for escaping from the Tidal waves whenever Tsunami warning is given. Therefore it is necessary to ensure that all fishermen hamlets have escape routes and if it is not done proposal for connecting all the hamlets and to the major road should be drawn and forwarded to the Government.



## Devastation of Tsunami



## After Reconstruction



நாகப்பட்டினம் மாவட்டம் – சீர்காழி ஒன்றிய எல்லைக்குள் வெள்ளப்பள்ளம்  
உப்பனாறு ஆற்றின் குறுக்கே எடமணல் மற்றும் திருநகரி இணைப்பு பாலம் கட்டுதல்  
(எடமணல் பக்கம் அணுகுசாலை 1.60 கி.மீட்டர், திருநகரி பக்கம் 0.90 கி.மீட்டர்)

## CHAPTER IX

### Landslides

Landslides are mass movement of rocks and debris that usually follow a cyclone, volcano or earthquake under the influence of gravity. In the hilly areas of India, the sliding of huge masses of land has been a common natural disaster causing havoc to life and property. One of the worst and most disastrous landslides has been recorded in the year 1998 in the state of Uttarakhand, when nearly 380 people were killed. As a measure of concern many committees and other measures have been taken to protect from this natural havoc in India. In India, the regions of Himalayas and the Western Ghats are the most vulnerable to these land-slides.

The main causes of landslides are weak, weathered materials, physical property variation, Ground Uplift, erosion, Earthquake, Volcanic eruptions etc. The general and simple mitigation that are adopted or should be adopted are drainage correction, proper land-utilization, reforestation and spreading of awareness. Landslides have represented 4.89% of the total natural disasters that occurred worldwide during the years 1990 – 2005. Landslide is one of the major natural hazards that are commonly experienced in hilly terrains all over the world. Landslides affect at least 15 per cent of the land area of India—an area which exceeds 0.49 million km<sup>2</sup>. In India the incidence of landslides in Himalayas and other hill ranges is an annual and recurring phenomenon. There is a variation in the degree of landslide incidences in various hill ranges (Table below).



### Incidences of landslides in India.

Region	Incidences of landslides
Himalayas	High to very high
North-eastern Hills	High
Western Ghats and the Nilgiris	Moderate to high
Eastern Ghats and Vindhayachal	Low

For example, the landslide incidences are high to very high in Himalayas, high in Northeastern hill ranges, high to moderate in Western Ghats and Nilgiris and low in the hill ranges of Eastern Ghats and Vindhyas. The landslide hazard zonation atlas of India published by Building Materials and Technology Promotion Council (BMTPC), Government of India reveals that the Nilgiris district of Tamil Nadu state is one of the severe to very high landslide hazard prone areas of India. Unprecedented rains triggered about a hundred landslides within an area of 250 sqkms in the district during 1978. Nearly 200 landslides were recorded during 1979 and causing loss of life and severe damage to property.

Though the Nilgiri and other mountainous areas are known to be susceptible to landslides, occurrences of such magnitude were unknown earlier. A total of 28 landslides of medium to large size occurred on 14 November, 2006 along NH67 between Kallar and Pudukkadu villages and along Mountain Railway track between Adderley and Barliyar stations. In the recent times casualties and damage due to landslides have increased in the Nilgiri Hills. More than 110 landslides were reported within five days from 10 to 15 November, 2009, and taken away about 80 human lives, also the vast damage reported on houses, roads and railway lines.

## **Some of the major landslides of Nilgiris**

23rd October 1865: Worst Storm on record occurred around Ooty and Coonoor. Coonoor Railway station was covered with water up to 5 feet deep. In Ooty Lake rose up to top of willow bound and threatened to breach it. November 1891: Storm caused many landslips on the Coonoor Ghat, and did great damage to the Kotagiri Metuppalayam road.

December 1902: Twenty one inches of rain (three times the average amount) fell in that month in Coonoor, and at Kotagiri 24 inches (six times the average amount) was received, of which 8.45 inches fell in a single night. The Coonoor railway was blocked for a month the old and new Coonoor railway was blocked for a month the old and new Coonoor ghat roads for nearly as long; and all the traffic of the eastern side of the plateau was thrown upon the Kotagiri ghat, which was itself in a perilous condition slips having occurred throughout and being serious in six places out of its twenty one miles length.

4th October 1905: 6.8 inches of rain fell at Coonoor in three hours and the Coonoor river and its effluents came down in heavy and sudden floods, the former sweeping right over the parapet of the bridge near the railway station. The families of the station staff had to be rescued by breaking open the back windows of their quarters with crowbars.

5th November 1978: 323mm of rain was recorded at Ooty of which 243 MM was during the night between 5.00 pm of 4th and 8.00 am of 5th. Many people were killed in Ooty on account of houses collapses, landslides and drowning. Reports were also received regarding the casualties due to landslides and floods in

Kookalthorai; Madithorai; Adashola and Kallatti areas of Uthagamandalam Taluk and Manthada of Coonoor Taluk.

November 1979: Heavy rainfall started from 12<sup>th</sup> November 1979 and the highest rain fall was 114.5mm at Kodanad. On 13th it was 149.4 mm at Coonoor and 169.9 mm at Kodanad. On the 15th night heavy landslide had occurred at Doddacombai, on 16th night there was heavy rain at Coonoor resulting in washing away of one woman and 2 Children. The rainfall recorded at Coonoor and Kodanad was 145.2 mm and 142.2 mm respectively. On 19th there was heavy landslide of 100 yards in width and about 1.00 km in length in Selas of Ketti Village of Coonoor Taluk resulting in filling up of a Valley of 30'- 50'. The heaviest rainfall of the day was 187.6 mm at Coonoor. On 20.11.1979 also, there was heavy rain of 102.2 mm at Coonoor and a heavy landslide at Selas in which a house was completely buried in the debris along with 2 women and 3 children. The rainfall recorded on that day at Kotagiri, Kodanad and Kundah was 90.4 mm, 99.8 mm and 78.0 mm respectively. There was heavy rainfall of 71.0 mm at Devala on 21st. On 28.11.79 also there was heavy rain of 144.2 mm at Coonoor.

25th October 1990: The North East Monsoon was heavy and there was a 'cloud burst'. More than 35 families were buried alive in a place called Geddai.

November 1993: There was another 'cloud burst' on 11- 11-1993 in the upper reach of Marappalam of Coonoor Taluk, about 18 huts situated below the road and washing away Coonoor MTP ghat Road for about 1½ km. The Road traffic was suspended for more than a fort night. 12 persons lost their live and 15 persons missing. It is laid that 21 passengers were washed away with two buses. An important highway, sheared stretched of rail road for about 300 m.

11<sup>th</sup> December 1998: Due to continuous rain fall, one big boulder weighing about 20 m tones fell on the Coonoor Mettupalayam main road and the road was closed for traffic, the rock was blasted and earth slips were removed and traffic was resumed from 14.12.98.

December 2001: Due to continuous rainfall, two massive landslides occurred near pudukadu on the Coonoor- Mettupalayam high way damaging two bridges resulting in the complete closure of traffic. In addition a closer damage was also caused to the railway track between Coonoor and Mettupalayam. Bridge no 55 near hill grove railway station was completely damaged and Bridge No 56 was also damaged.

November 2006: Consequent upon continuous heavy rains in the Nilgiri Hills, numerous landslides were reported to have occurred at the early hours on 14.11.2006 killing one and injuring three persons and disrupting traffic in NH 67 and blocking of Mountain Rail track between Mettupalayam and Coonoor.

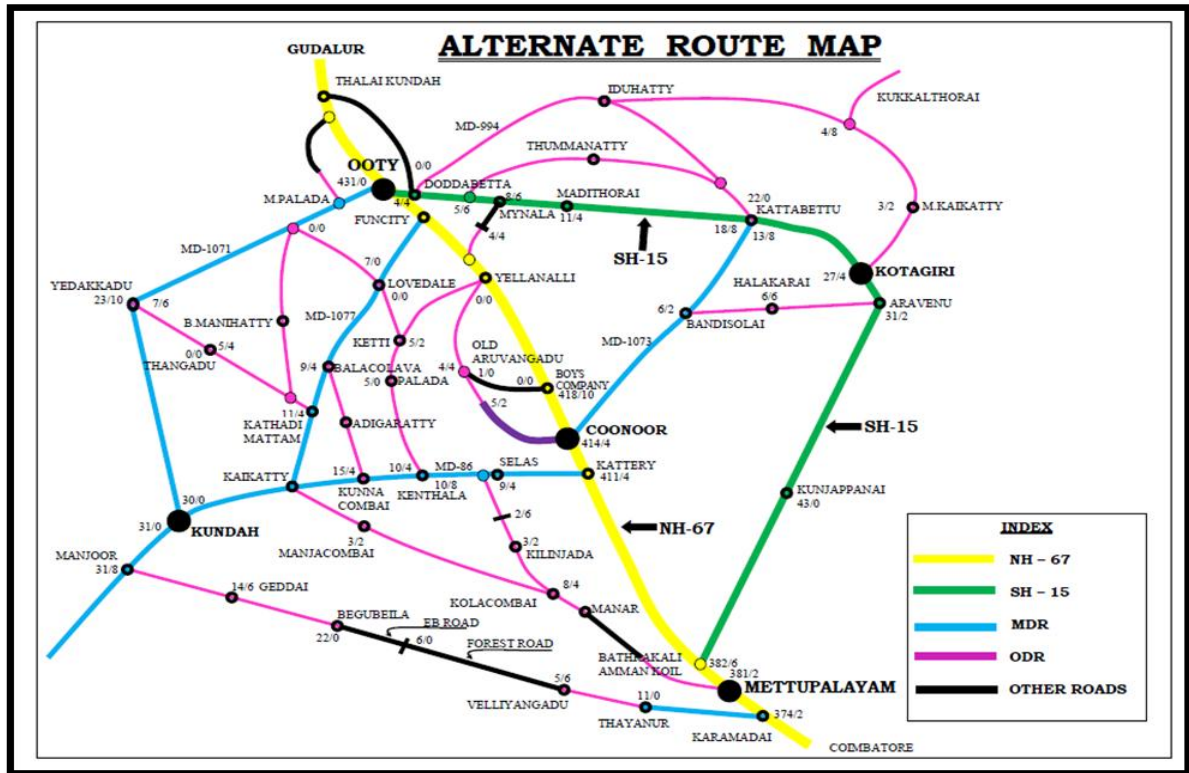
## Land Slide before restoration

**Km 35/6 of Udhagai Avalanchi Kundah Thaishola Road**





### Identified Alternate Routes in case of land slide



**HIGHWAYS DEPARTMENT**  
**PRE-MONSOON PREPAREDNESS PLAN UP TO 2027**

The development of the road network plays an important role in the economic development of a country. The kilometerage of paved roads existing in a country is used as an index to assess the extent of its development. The proper development of the road network not only reduces the cost of transportation, both in terms of money and time, but also helps in the integration of various regions within the country. Roads act as great feeders to other means of transportation. By developing road infrastructure in relation to traffic demand and road safety characteristics, safety of men and material transport is ensured.

The implementation of works like widening/improvements of roads, construction of bridges, flyovers and formation of bypasses are done through Highways Department.

Total lengths of 57474Km Government roads are being maintained by Highways Department. They are classified in to the following three categories.

Sl. No.	Category	Length of roads in Km
1.	State Highways Roads	12095
2.	Major District Roads	11628
3.	Other District Roads	33751
Total		57474

The roads connecting inter states, major cities and the roads linking two National Highways roads or hookup with National Highways roads are

categorized under the State Highways Roads. The State Highways road plays an important role in the development of the states infrastructure by concatenating various National Highways, cities, towns, industries with the trade centers, ports and airports to export or import goods and boosting the economy. They also aid in the development of industries, employment, fast transportation of passengers, raw materials, agricultural products by providing easy access and interconnectivity.

The roads anchoring the village roads with the state highways, district head quarters, towns and other major roads to provide easy access for trauma care center, education, marketing centers for trading agricultural products are categorized under the Major District Roads. These roads contribute a major part in the development of production agricultural products like rice, paddy, vegetable, fruits, sugarcane products etc. They also assist in the development of small villages, towns, agricultural growth of the state.

The State Highways and Major District roads are the major roads which contributes most of the road transportation interconnectivity of the states. The vehicular traffic volume in these two category of roads are growing at an astonishing pace that require widening of the roads to cope up with the volume of vehicular traffic year of after year to provide road transport connectivity during disaster time for uninterrupted access to hospitals, shelter, foods to avoid loss of lives.

These roads consist of Major bridges, minor bridges and culverts to overcome the intrusion of interlinking of water resources, to prevent water flooding in the urban area, as well as rural areas damaging agricultural products. These cross drainage structures also require reconstruction to incorporate the arising storm water

according the Palar Basin diverting them to water storage locations and for widening to accommodate the futuristic volume of traffic for uninterrupted connectivity.

There are around 700nos of Major Bridges, 4400nos of Minor bridges and around 47500nos of culverts exists in these roads which require reconstruction / widening of the existing bridges/culverts to provide diversion of flood waters away for cities and towns to various channels, river, lakes, etc., for storage and uninterrupted road transport connectivity during disaster period. It is planned take up the widening and reconstruction of above mentioned major bridges, minor bridges and culverts in a phased manner in the upcoming years, it requires about Rs.500Crores per year to achieve the goal.

**ROAD LENGTH AS ON 31.03.2016 - SH,MDR,ODR AND SUGARCANE-AS  
PER DIVISIONS ROAD LENGTH**

Sl.No	Division	SH	MDR	ODR	SUGARCANE	OVER ALL LENGTH
1	Chennai City Roads	186.25	18.71	47.895	-	252.855
2	Chengalpattu	555.89	341.98	1205.73	51.6	2,155.20
3	Vellore	387.71	194.9	902.605	45.175	1,530.39
4	Cheygar	221.014	210.75	764.2	23.4	1,219.36
5	Vaniyambadi	298.7	74.563	644.285	56	1,073.55
6	Tiruvannamalai	332.98	179	864.11	29.37	1,405.46
7	Villupuram	274.135	239.067	1096.22	105.63	1,715.05
8	Cuddalore	249.133	448.619	937.059	205.646	1,840.46
9	Kallakurichi	312.946	289.15	816.684	118.75	1,537.53
10	Ariyalur	157.67	131.19	416.674	55.615	761.149
11	Perambalur	90.075	152.6	404.83	32.585	680.09
12	Salem	183.21	334.32	692.912	18.235	1,228.68
13	Edappadi	334	178.229	694.932	15.525	1,222.69
14	Namakkal	380.156	323.655	1046.75	96.4	1,846.96
15	Krishnagiri	335.553	262.755	1050.71	3.8	1,652.82
16	Dharmapuri	322.7	253.24	794.491	64.5	1,434.93
17	Tiruppur	416.525	199.38	700.714	4.86	1,321.48
18	Erode	322.893	302.2	765.941	76.905	1,467.94
19	Karur	214.701	407.777	339.807	110.67	1,072.96
20	Dharapuram	309.416	269.56	948.186	100.721	1,627.88

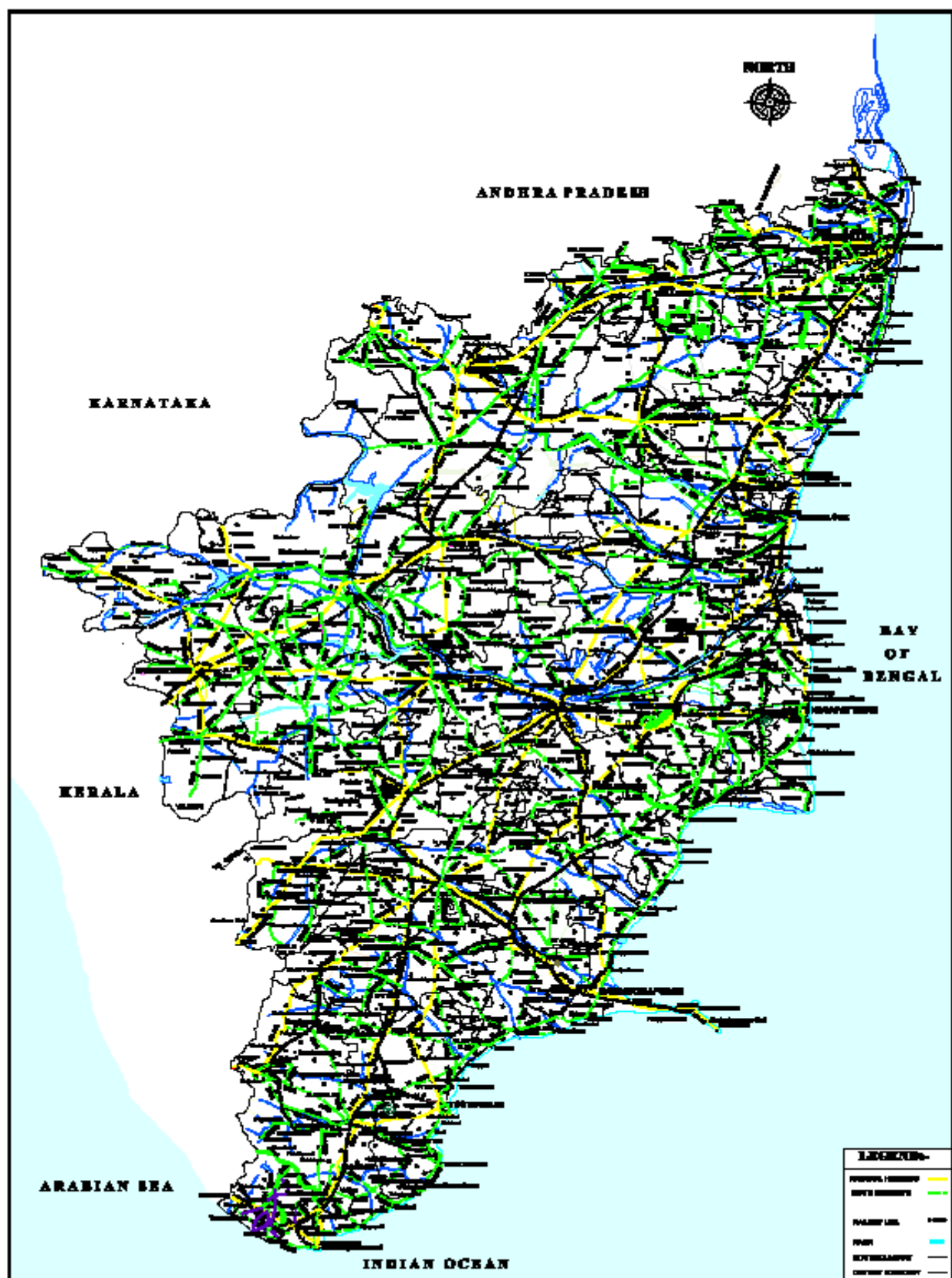


Sl.No	Division	SH	MDR	ODR	SUGARCANE	OVER ALL LENGTH
21	Coimbatore	212.32	357.61	598.795	-	1,168.73
22	Pollachi	191.4	203.188	621.954	-	1,016.54
23	Gobi	141.1	235.5	739.93	95.4	1,211.93
24	Udhagai	114.6	202.77	653.804	-	971.174
25	Tuticorin	388.212	333.922	1311.827	-	2,033.96
26	Trichy	279.413	411.04	1214.625	61.15	1,966.23
27	Pudukottai	352.598	507.74	1125.69	25.3	2,011.33
28	Tiruvavarur	328.04	230.05	649.27	39.367	1,246.73
29	Nagapattinam	241.582	336.817	658.235	32	1,268.63
30	Madurai	355.715	536.723	628.667	54.07	1,575.18
31	Dindigul	233.505	468.91	476.352	35.54	1,214.31
32	Palani	235.795	344.983	527.045	18.74	1,126.56
33	Thiruvallur	505.88	316.565	838.511	13.07	1,674.03
34	Theni	230.34	221.93	372.24	5.3	829.81
35	Sivagangai	240.911	361.361	1119.934	17.9	1,740.11
36	Tanjavur	482.304	448.204	1187.976	50.868	2,169.35
37	Ramnad	354.684	355.871	762.851	-	1,473.41
38	Tirunelveli	505.904	202.27	1117.304	-	1,825.48
39	Virudhunagar	357.543	304.544	1020.854	4.5	1,687.44
40	Tenkasi	221.745	159.96	598.349	8	988.054
41	Nagercoil	228.167	266.3	698.017	-	1,192.48
	<b>GRAND TOTAL</b>	<b>12092.635</b>	<b>11617.903</b>	<b>32082.065</b>	<b>1676.592</b>	<b>57,469.20</b>

**ROB, RUB, MAJOR BRIDGES, MINOR BRIDGES & CULVERTS**

Sl.No	Division	ROB	RUB	Major Bridges	Minor Bridges	Culverts
1	Chennai City Roads	8	6	24	13	358
2	Tiruvallur	6	0	39	169	2915
3	Chengalpattu	5	0	26	228	4555
4	Vellore	10	4	11	151	2999
5	Cheygar	0	0	11	13	2932
6	Vaniyambadi	6	1	23	325	1818
7	Tiruvannamalai	0	0	16	105	3249
8	Villupuram	1	0	14	79	3521
9	Cuddalore	4	1	33	264	3300
10	Kallakurichi	1	0	19	140	3557
11	Ariyalur	0	0	13	60	1573
12	Perambalur	0	0	14	42	1180
13	Salem	3	1	32	96	2517
14	Edappadi	2	1	6	88	2276
15	Namakkal	19	2	14	75	3501
16	Krishnagiri	0	0	39	122	4209
17	Dharmapuri	1	1	38	143	3393
18	Tiruppur	4	1	11	39	2049
19	Erode	1	5	8	103	3672
20	Karur	0	0	23	173	1530
21	Dharapuram	1	0	33	106	2682
22	Coimbatore	7	7	17	106	1884
23	Pollachi	3	3	8	88	2090
24	Gobi	0	0	8	100	3263
25	Uthagai	0	0	0	74	6077
26	Trichy	11	2	31	324	3751
27	Thanjavur	7	2	124	219	5204

Sl.No	Division	ROB	RUB	Major Bridges	Minor Bridges	Culverts
28	Pudukottai	0	0	80	263	4669
29	Tiruvarur	2	1	49	153	3127
30	Nagapattinam	2	0	12	315	2774
31	Madurai	7	0	21	263	3717
32	Dindigul	0	0	49	475	4275
33	Theni	0	0	25	301	1564
34	Sivagangai	0	0	16	99	4335
35	Ramnad	1	0	6	1491	1071
36	Tirunelveli	3	0	27	201	3250
37	Virudhunagar	2	1	23	178	3202
38	Tenkasi	1	0	6	198	1636
39	Thoothukudi	5	1	38	986	1600
40	Nagercoil	1	0	16	118	2301
	<b>TOTAL</b>	<b>124</b>	<b>40</b>	<b>1003</b>	<b>8486</b>	<b>117576</b>



<b><u>TELEPHONE NUMBERS OF DIVISIONAL ENGINEERS</u></b>			
DESIGNATION	CODE	OFFICE	FAX
<b>CE (C&amp;M)</b>	<b>`044</b>	<b>2235 0690</b>	<b>2235 5798</b>
<b>CHENNAI CIRCLE</b>			
<b>SE (H) CHENNAI</b>	<b>`044</b>	<b>24342377</b>	<b>24354909</b>
DSE (H) Chennai	<b>`044</b>	<b>24342377</b>	<b>24354909</b>
DE (H) City Roads	<b>`044</b>	<b>24330001</b>	<b>42010405</b>
DE(H) Tiruvallur	<b>`044</b>	<b>27661605</b>	<b>27661605</b>
DE(H)Chengalpattu	<b>0'4144</b>	<b>27431496</b>	<b>27431496</b>
DE(H) Vellore	<b>`0416</b>	<b>2970094</b>	<b>2970093</b>
DE (H) Vaniyambadi	<b>04174</b>	<b>228059</b>	<b>225 959</b>
DE(H) TV Malai	<b>`04175</b>	<b>252308</b>	<b>251222</b>
DE(H) Cheyyar	<b>04182</b>	<b>225 050</b>	<b>225 050</b>
<b>VILLUPURAM CIRCLE</b>			
<b>SE(H)VILLUPURAM</b>	<b>`04146</b>	<b>259 195</b>	<b>258 638</b>
DSE (H) Villupuram	<b>`04146</b>	<b>259 195</b>	
DE(H) Villupuram	<b>`04146</b>	<b>259524</b>	<b>258 642</b>
DE(H) Cuddalore	<b>`04142</b>	<b>294555</b>	<b>295 500</b>
DE(H) Ariyalur	<b>`04329</b>	<b>220064</b>	<b>224 548</b>
DE(H) Kallakurichi	<b>`04151</b>	<b>225445</b>	<b>222743</b>
DE(H) Perambalur	<b>04328</b>	<b>224 477</b>	<b>276062</b>
<b>TRICHY CIRCLE</b>			
<b>SE(H) TRICHY</b>	<b>`0431</b>	<b>231 6636</b>	<b>231 2166</b>
DSE (H) Trichy	<b>0491</b>	<b>231 6636</b>	
DE(H) Trichy	<b>`0431</b>	<b>2311634</b>	
DE(H) Tiruvarur	<b>`04366</b>	<b>220666</b>	<b>224179</b>
DE(H) Pudukottai	<b>`04322</b>	<b>236258</b>	<b>266560</b>
DE(H) Thanjavur	<b>`04362</b>	<b>237201</b>	<b>237 201</b>
DE(H) Nagapattinam	<b>`04365</b>	<b>252 596</b>	<b>250 135</b>
<b>MADURAI CIRCLE</b>			
<b>SE(H) MADURAI</b>	<b>`0452</b>	<b>2537578</b>	<b>2537579</b>
DSE(H) Madurai	<b>`0452</b>	<b>2537578</b>	
DE(H) Madurai	<b>`0452</b>	<b>2537568</b>	<b>2537579</b>
DE(H) Dindugal	<b>`0451</b>	<b>2423641</b>	<b>2423 641</b>
DE (H) Palani	<b>04545</b>	<b>241320</b>	
DE(H) Theni	<b>`04546</b>	<b>252234</b>	<b>255742</b>



<b><u>TELEPHONE NUMBERS OF DIVISIONAL ENGINEERS</u></b>			
DE(H) Sivaganga	`04575	240240	244 687
DE(H )Ramnad	`04567	226370	223999
<b>SALEM CIRCLE</b>			
<b>SE(H) SALEM</b>	<b>`0427</b>	<b>2445266</b>	<b>244 5297</b>
DSE(H) Salem	`0427	2445266	
DE(H) Salem	`0427	2412904	2412 904
DE(H) KGRI	`04343	232674	232 669
DE (H) Dharmapuri	04342	230113	230113
DE(H) Namakal	`04286	230351	230351
DE (H) Edappadi	04283	224 800	
<b>THIRPPUR CIRCLE</b>			
<b>SE(H) THRIUPPUR</b>	<b>0421</b>	<b>2242 300</b>	<b>2242 300</b>
DSE (H) Thiruppur			
DE (H) Thiruppur	0421	2242 533	2242 300
DE (H) Erode	0424	2281 398	2281 398
DE (H) Dharapuram	04258	225368	225 368
DE (H) Karur	04324	236789	263 194
<b>COIMBATORE CIRCLE</b>			
<b>SE(H) CBE</b>	<b>`0422</b>	<b>2303918</b>	<b>2306196</b>
DSE(H) CBE	`0422	2303918	
DE(H) Coimbatore	`0422	2302775	2306196
DE(H) Pollachi	`04259	233433	229677
DE (H) Gobi	04285	226080	226060
DE(H) Ooty	`0423	2444018	2224 562
<b>THIRUNELVELI CIRCLE</b>			
<b>SE(H)T.VELI</b>	<b>`0462</b>	<b>2578287</b>	<b>2560640</b>
DSE(H) T.Veli	`0462	2578287	
DE(H) Tirunelveli	`0462	2560460	2560640
DE(H) Tuticorin	`0461	2345411	2329518
DE (H) Nagercoil	`04652	222192	234 818
DE(H) V.Nagar	`04562	244915	248915
DE (H) Thenkasi	04633	220 024	222086

## **ANNEXURE**

- **DAMAGE / NEED ASSESSMENT FORMAT**

### **FORMAT –A**

### **ABSTRACT**

Sl.No.	Division	Road Category	Nature of Damage					Amount required in Lakhs			Remarks
			Breaches in No.	Surface Damage in km.	Bridges Damaged in No.	Culvert Damaged in No.	Land Slides in No.	Temporary restoration	Permanent restoration	Total	
		SH									
		MDR									
		ODR									
	TOTAL										

### **FORMAT –B**

#### CATEGORY OF THE ROAD: STATE HIGHWAYS

Sl.No.	Division	Name of the road	Nature of Damage					Amount required in Lakhs			Remarks
			Breaches in No.	Surface Damage in km.	Bridges Damaged in No.	Culvert Damaged in No.	Land Slides in No.	Temporary restoration	Permanent restoration	Total	

**FORMAT –C****CATEGORY OF THE ROAD: MAJOR DISTRICT ROAD**

Sl.No.	Division	Name of the road	Nature of Damage					Amount required in Lakhs			Remarks
			Breaches in No.	Surface Damage in km.	Bridges Damaged in No.	Culvert Damaged in No.	Land Slides in No.	Temporary restoration	Permanent restoration	Total	

**FORMAT –D****CATEGORY OF THE ROAD: OTHER DISTRICT ROAD**

Sl.No.	Division	Name of the road	Nature of Damage					Amount required in Lakhs			Remarks
			Breaches in No.	Surface Damage in km.	Bridges Damaged in No.	Culvert Damaged in No.	Land Slides in No.	Temporary restoration	Permanent restoration	Total	

**FORMAT –E (Tamil & English)**

Sl.No.	Division	Name of Road and Location of the BREACH	Category of Road	Name of Nearest Village where breach occurred	Date on which Breach occurred	Date on Which Breach closed	Remarks