

Remedial measures for flash flood in Trivandrum city

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Abstract—Flash flood is a type of flood. Trivandrum city is prone to flash-flood for several years. No suitable mitigation measures were implemented successfully, till to date. This area is in low lying area. Water comes from high land area to this low lying area. Conversion of low lying area to built up area cause obstruction to free runoff water. This paper deals with finding the causes and impacts of flash flood at Thampanoor and East fort area. Suitable mitigation strategies are also provided.

that affect drainage pattern of the area and formulation of mitigation strategies for flash flood at inter transit node of Trivandrum city. Objectives of the study are to find causative factors and after effects of flashflood.

Keywords—Flash flood; Contour; Land use; built up area

I. INTRODUCTION

Due to urbanization and increase in population, availability of land is decreasing by decades. Since this increase in population is higher in urban areas where the availability of dry land is very limited, demand for land has been met by converting low lying wetland areas into built-up area. The built environment of urban areas transforms the natural environment into impermeable areas that prevents infiltration of precipitation. The increase in impermeability increases flooding. In Trivandrum city naturally flood occurs in Thampanoor area due to low lying. In this low lying region have high built up density due to economic benefits of that area. Intermodal transit nodes are also exist in this area. So the passengers have difficult to use in this area The two main flood reduction strategies are structural and non structural measures.

II. PROBLEM STATEMENT

In Trivandrum Flooding occurs frequently in Thampanoor and East Fort areas. The central Railway Station and the main KSRTC bus station are located here. The Pazhavangadi Thodu starting from Observatory hills and Kerala Water Authority carries the surface water of the upstream reaches and passes through Thampanoor, crosses under the railway line and reaches East Fort area. Flooding in this area occurs 3 to 6 times during monsoon with water depth of 0.6 to 1.2m, and persists for 2 to 24 hours in the central part and 3 to 4 days in the southern part of the city [1]. The study aims at identification of the impact of land use characteristics

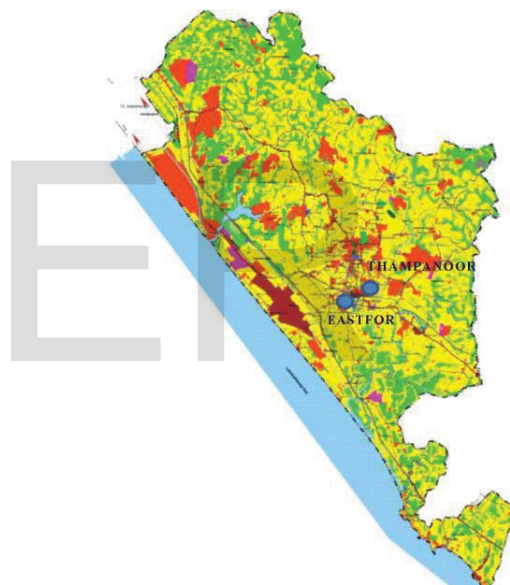


Fig.1.Study area

Source: Regional town planning office, Trivandrum

III. SECONDARY STUDY

Flood is a natural event that can have far reaching effects on people and the environment. Flashfloods occur with little or no warning and cause the biggest loss of human life than any other type flooding. Different types of floods are coastal flood, river flood, ponding flood, urban flood and flash flood. According to disaster management act 2005 the NDMA has the responsibility of laying down the policies, plans and guidelines for effective Disaster Management emphasize:-

- Importance of non-structural measures which are very effective in reducing loss of life and property and can be implemented in a short time.
- Proposed to set up establishment of River Basin Organizations as a mechanism for interstate coordination.
- Proposed to set up a National Institute of Flood Management for taking up training, research and development activities related to floods and their management.
- The guidelines envisage that the states will enact and enforce the flood plain zoning regulations on the lines of model bill circulated by the ministry of water resources.

Flood control measures are Structural measures include reservoirs, embankments, channel improvements etc. ,Non-structural measures include flood plain zoning, watershed management, flood forecasting and flood warning.

IV. PRIMARY STUDY

Interviews and discussions were conducted with various persons such as Engineers, Planners, and Architects etc. Field visits and questionnaire survey was also conducted.

2. Details regarding conversion of low lying areas, maps and tables showing required data were collected from various offices.

3. For the collection of data, a questionnaire was prepared on the literature reviews and expert opinions in the field. The questionnaire was divided into five sections and relevant questions were included under each section.

- The demographic section dealt with details regarding the number of members in each house, their age, sex education etc.
 - The section for physical aspects was for information about the houses, type of ownership, housing typology etc.
 - The section on infrastructure dealt with the type and condition of the different services such as water supply, waste disposal, sewage and surface drainage
- Analyzing contour map with study area
 - Finding reasons for flooding
 - Mitigate measures for flash flood

A. Delineation of study area

Trivandrum is located at 8.5°N 76.9°E on the west coast, near the southern tip of mainland India. The city is sandwiched between the Western Ghats and the Arabian Sea. Pazhavangadi Thodu is the main storm water discharge channel of Trivandrum city [1].Area covering Observatory hills, Vazhuthacaud, Mettukada and regions contribute to the flood discharge at Thampanoor. Area covering Padmanagar, East Fort, Thakaraparambu and regions contribute to the flood discharge at East fort area. Thampanoor and East fort area are low lying in the Trivandrum Corporation; it can be identified from the contour map. And also these two areas are main

intermodal transit nodes of Thiruvananthapuram city. Shape of the delineation area is just like a bowl. Flood affected areas are Masjid lane, Thampanoor thopu,Pazhavangadi, Rajaji Nagar,Manjalikulam.

B. Observation and findings

The reasons for flash flood in Thampanoor and Eastfort area are due to landuse changes in low lying areas, encroachment near thodu, improper solid waste management.



Fig. 2. Study area overlapped with contour map
Source: Author generated

Flat topography and absence of drains is the main cause of flooding in coastal areas. Few existing road side drains in such area also have very flat slopes and are inadequate to carry the runoff especially of short duration storms with high intensities.

When the entire area is low lying especially near water courses or near sea coast the water gets accumulated during normal rains. The flooding is more if persistent rainfall is accompanied by high tides. Almost all the primary drains in Thiruvananthapuram have such low lying areas which are getting developed for residential purposes mostly near downstream stretch of the majority of the water courses.

V. SURVEY ANALYSIS

Residential areas are classified as two. They are economically forward group(HIG & MIG) and economically backward group(LIG).Economically forward group includes Thampanoor thopu,SSKovilroad,Manjalikulam,Pazhavangadi.Economically backward group includes Rajaji nagar colony. In economically forward group 112 houses are in flood affected region.22 houses were surveyed with 5 houses interval.In economically

backward region 206 houses are there. 41 houses were surveyed with 10 houses interval. Based on health aspect, physical aspect, demography aspect, economic aspect, infrastructure aspect analysis was done.

Health aspect skin diseases are more in flooded season.

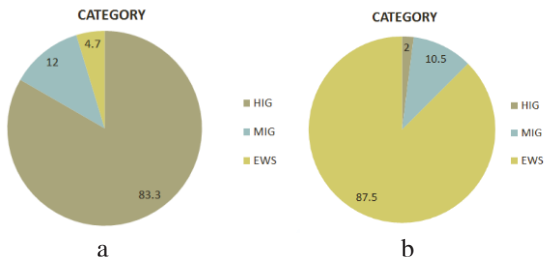


Fig .4.a)Economically forward group b)Economically backward group
Source:Author generated

A. Recommendations at the policy level

- 20% of the total area should be kept as open space which can include both recreational and greenery. As far as possible they should be in one piece. Greenery can be of any form-lawns, gardens etc. Trees and plants with high affinity to water are more preferred. Besides this minimum 20% of the plot area should be provided with vegetation in the residential plots which will prevent soil erosion and also provides transpiration.
- No construction should be permitted in the flood way and can be permitted in flood fringes after ensuring adequate storm water drainage facilities.
- Where ever the land, filling should be done above the flood level of that area. All the buildings constructed in the converted area should be limited to a maximum coverage of 40%.

B. Recommendations at the implementation level

- Entire area should be divide into different sectors and each sector should be provide with detention ponds of sufficient holding capacity with respect to the rainfall in the catchment which enable in ground water recharge. It can be any form recreational or water supply. An outlet drain should be connected to the major drain to drain out excess water.
- Materials used for filling should be sandy soil as far as possible or at least top layers should be sandy. Filling should be compacted in layers of 10-20cm to have uniform compaction by means of any compaction equipment.

C. Recommendations at the planning stage

- A well planned layout and an organized development should be provided without blocking the natural drainage. Individual development should not be allowed. It should be accompanied with the layout of the surface drainage system having sufficient capacity covering the entire area.
- Roads and service lines should be laid before starting the construction of buildings.

D. Recommendations at the construction stage

- Damp proof course should be provided for the floor.
- Water tight septic tanks with dispersion trenches for the disposal of effluent should be provided. For this open jointed tile drains made of porous materials can be used which will provide diffusion of effluent slowly. Plants with high affinity to water can be planted in this area.
- Surface drains should be designed for the peak flow. It should be provided with RCC cover in order to avoid debris falling in it resulting clogging. Man holes to be provided in 75 mts to 100 mts interval.

VI. MITIGATION MEASURES

- Provide sufficient drains and prevent blockage in drainage system
- Provide Recharge basins at source-Proposed recharge basin at EK Nayanar Memorial Park, Putharikandam Maidanam, East Fort Bus stand, Gandhi park, Ponnara park, Railway parking area, University stadium, KSRTC Shopping complex
- Provide recharge basins at source and opens paces. Open spaces are observatory hill, ponnara park, railway car parking areas, Bus stand ground
- Thodu widening across encroachment
- Provide Pedestrian over bridge across railway and bus station
- Provide rain water harvesting system
- Provide interceptors as recharge basins. First interceptor is Rajaji Nagar. Second interceptor is Manjalikulam ground.

VII. CONCLUSION

Due to the non-availability of land low lying areas are converting into built-up areas. The study reveals that both environment and development are essential for balance in nature and also there exists relation between surface drainage and conversion of low lying areas. The study reveals that change in landuse pattern especially in low lying areas of

Trivandrum city, had led to adverse effects. Suitable remedial measures, that has to be adopted, at the policy level and implementation level is recommended in the study.

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