Flood Inundation Mapping of Surat City
A Prospective View of Flood Return Period

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Introduction

• Flood is defined as extremely high flows or levels of rivers, lakes, ponds, reservoirs and any other water bodies, whereby water inundates outside of the water bodies area.

• In India, About 40Mha land flood prone, 12% of the total geographical area of 328 Mha

• Causing major damage to:
  1. Property (human, housing, industry)
  2. Productivity (agriculture, industry)
  3. Infrastructure (road, bridge)

Therefore, Flood Prevention, Mitigation, Assessment are MUST! and MOST- URGENT!!
History of Flood at Surat City

- The flood of 7-14 August 2006 is the major flood in the history of Surat city.
- 25485-25768 m³/s discharge from Ukai dam, spill from river section and result flood.
- 300 People Killed and INR 21000 Crore property loss
- 40 years back Tapi river could carry 28316 m³/s water. It has been reduced to 11326 m³/s in 1998 (According to SMC and Irrigation department).
- After 2006 flood, discharge carrying capacity of Tapi river near Hope Bridge is 5663 m³/s and warning level is 5.5 m which estimated 8.5 m at 1998 Flood.
Research problems

• Low discharge carrying capacity of river Tapi surrounding Suart city
• Lack of Information about inundation of water in low laying areas
• Lacking of Advance Flood Forecasting System (AFFS)
• Uncertain discharge lead by VareKhadi watersheds in lack of river gauge network
• Lack of information of Tidel flood due to Arabian Sea
Study area: Lower Tapi Basin-Surat City
Surat city
Ukai Dam:

- **M F L**: 106.98m (351 ft)
- **F R L**: 105.15m (345 ft)
- **Live Storage**: 7369 Mm³
- **Water spread Area**: 600 Km²

**Plan**
- **25768 m³/s**
- **P.M.F**: 59747.9 m³/s
Sutrat city: Surat city affected Catastrophic flood by once in every five years.
Population: 2 million people Rural area/Surat city)
Flood Event: 2006


Inflow hydrograph

Outflow hydrograph

Reservoir level

25768 m³/s (910000 ft³/s)
FRL: 105.32 m (345.5 ft)
Datasets

• Survey of India (SOI)Toposheet, 1:50000.
• Google earth image ([http://earth.google.com](http://earth.google.com))
• 0.5 m, Contour map (SMC)
• River gauge-discharge data, Ghala and Nehru bridge (CWC, SWDC, Irrigation department)
Methodology:

I: Preparation Phase
- Literature Study
  - NEWS Report
  - Journalspapers
  - Articles
- Data Collection
  - Spatial data & Hydrological data
- Fieldwork

II: Fieldwork and Data Collection
- Spatial Data
  - Toposheets map, High resolution Google earth image, contour maps, Flood map of City, zone boundary map
- Hydrological Data
  - Gauge –discharge data of Ghala and Hope bridge, Manning Coefficient, Observe Velocity, flood event

III: Modelling Phase
- Contour (0.5m) Toposheets Map + Google Earth Image (± 1m)
- Geometric Data Creating (GIS)
- DEM generation (0.5m)
- Hydrological Data Creating
- Gumbel’s (Flood frequency analysis)
- Integration of DEM and flood return period
- Flood inundation Mapping

IV: Flood Inundation Mapping

Continue..
IV: Flood Inundation Mapping

- Flood frequency analysis
- Discharge at flood return period-20, 25, 30, 35 years and Corresponding Gauge level at Hope Bridge
- Inundation area of Surat city at different return period and flood inundation mapping

V: Reporting Phase/Conclusion
Results

• The flood frequency analysis and flood return period the discharge equation is obtained:
  \[ Q = 247.61 \cdot e^{0.1508T} \text{ (m}^3\text{/s)} \]
  Where, \( T \) = Flood return period
Through flood return period

- Discharge at 20 years is 4973.17 m³/s
- Discharge at 25 years is 10528.21 m³/s
- Discharge at 30 years is 22288.24 m³/s
- Discharge at 35 years is 47184.2 m³/s
# Inundation area of Surat city at different return period

<table>
<thead>
<tr>
<th>Flood Return Period in years</th>
<th>Discharge in m³/s</th>
<th>Corresponding Gauge level at Hope Bridge in m.</th>
<th>Inundate Area in m²</th>
<th>% Submerge</th>
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</table>
Flood Inundation
Gauge level +DEM= Inundation (Risk assessment)
Conclusions

• High resolution remote sensing combined with field data of river hydraulics is very powerful tool for delineating flood prone area.

• Flood frequency analysis $Q = 247.61 e^{0.1508T}$

• Discharge carrying capacity of river Tapi near Surat city is less than 25768 m$^3$/s

• West zone and South west zone low laying area and highly flood prone while East zone is least

• About 99.43% Surat city under water for flood return period of 35 years
References


Thank you

Questions and Suggestions