

Application of mapping and GIS technologies initiated by EPC-Geographis to facilitate post-earthquake rehabilitation process - A case study of Gujarat earthquake

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Context

The massive earthquake happened on 26th January 2001 in Kachchh District of Gujarat State. Almost 15 districts of Gujarat were more or less affected by this disaster. Rescue teams from all the parts of the world came to the Kachchh and joined in rescue operations along with an army. They were unknown to this area and they were unable to find the ways to start their activities as well as unable to find out the affected areas and estimate the devastation. Communication and transportation systems were totally collapsed and regional government offices were severely damaged. In this critical time, there was an urgent need of road maps with all the village names, which can guide all the rescue teams to start their activities.

EPC is a non-government and not for profit organization based in Ahmedabad that provides planning and Development management services and its business partner Geographis provides GIS-based mapping services to various government and private organizations. EPC had recently prepared a Sub-Regional Plan for Kachchh, commissioned by Deptt. of Urban Development and Urban Housing, Govt. of Gujarat. EPC had collected spatial information on region in digital format including base maps, thematic maps and intensive database of the region as a part of the preparation of Sub-Regional Plan. EPC had worked in closed collaboration with Kachchh Nav Nirman Abhiyan (KNNA) a network of grass root NGOs during preparation of Sub-Regional Plan.

Role of GIS initiated by EPC-Geographis

Immediately after the earthquake, EPC-Geographis through an Earthquake Technical Assistance Cell (ETAC), took several initiatives to support the relief and rehabilitation efforts in general and those of KNNA in particular. The main initiatives taken were

1) Providing Base Maps of the Region

- Soon after the earthquake one thousand sets of maps (A set includes a Kachchh district maps and three enlarged parts of Kachchh districts covering all the Talukas) with the village boundaries and major road network were sent for distribution among the various agencies. These maps guided several organizations including Govt. officials to send the rescue team & relief materials to the devastated area.
- Simultaneously, maps for all the affected districts of Gujarat were prepared and distributed by EPC-Geographis to facilitate the relief and rehabilitation operations in other districts.
- Almost all the agencies involved in relief and rehabilitation operations used the maps including district administration, various NGOs and International aid agencies like World Food Program (WFP), United Nations Development Program (UNDP).

2) Setting up an Information Center at Bhuj

- In the next week after earthquake, Abhiyan decided to set up an information center at Bhuj with the support of EPC-Geographis and other partner organizations to increase pace of rehabilitation and reconstruction process by providing relevant, reliable information to the people, organizations and Government.
- EPC-Geographis setup (with Abhiyan's Resources) and managed an information-processing unit with five Computer terminals networked with each other (LAN) with facility of Internet within a week after the earthquake. Since then EPC-Geographis personnel managed the unit. Eventually, EPC-Geographis mobilized more computers from an information technology firm based at Ahmedabad (Applitech Solution Ltd.) for GIS data processing and set up GIS facility at the information center. Abhiyan invested resources to buy a plotter and EPC-Geographis began processing the data that is being collected on the GIS platform.

The type of data, which was available in Information center, included

- Base Data on Employment, Shelter, Rehabilitation, Health, Debris Management
- Damage Assessment
- Relief Material Required
- Details of NGOs involved in Relief and Rehabilitation Process
- Availability of Relief Material
- Details of Surveys carried out by various Government and Private Agencies

3) Preparation of GIS based Database and Linking with Maps

- EPC-Geographis personnel involved in the process of data collection by designing the data formats for collecting the data from the affected villages.
- Data collected at the village level was compiled and linked to the village boundary map to produce various thematic maps. This process was carried out as per the requirement of various relief agencies e.g. Janvikas, an Ahmedabad based NGO involved in rehabilitation of only dalit families of Surendranagar, Banaskantha and Patan districts.

4) Compilation and Analysis of Information to provide Decision Support System

- Abhiyan had carried out a rapid damage assessment of the affected area in Kachchh in collaboration with the Tata Institute of Social Sciences (TISS) and Gujarat Institute of Development Research (GIDR). EPC-Geographis personnel were involved in processing the data for producing thematic maps. These maps helped several agencies including government, World Bank and Asian Development Bank to make decisions on their areas of operation.
- Janvikas had carried out surveys through Navsarjan, an Ahmedabad based NGO to assess the household damages of dalit families in Surendranagar, Banaskantha, Patan, Jamnagar and Rajkot districts initially. This database was analyzed and thematic maps were prepared for the no. of below poverty line families, percentage of damages etc.
- Area Networking and Development Initiatives (ANANDI), a Rajkot based NGO was in process of providing temporary shelters to the poor families in Morvi and Maliya talukas of Rajkot district. They also had carried out survey for the damage assessment in these talukas. This data was analyzed and thematic maps were prepared, which had been used for presentation and report making.
- VIKAS, an Ahmedabad based NGO was involved in rehabilitation of affected villages of Bharuch District.
- National Centre for Disaster Management (NCDM) was in process of preparing model for Disaster Management Plan. They selected Santalpur taluka of Patan district of Gujarat state for this purpose. A GIS based map linked with database was provided by Geographis.
- Moreover, data from various agencies such as primary survey done by Abhiyan, TISS and GIDR, UNDP and government departments such as collector's office, district development officer's office was collected, analyzed and compiled by EPC-Geographis and thematic maps were generated regularly.
- This information was regularly shared with various agencies involved in rescue and relief operations including government departments. Various types of thematic maps were generated based on this information and census of 1991 (See Annexure-I for list of thematic maps).
- These maps were used by World Health Organization (WHO), Rural Development Trust, Youth for Unity and Voluntary Action (YUVA), National Institute of Fashion Technology (NIFT) -Delhi, Centre for Environmental Planning and Technology (CEPT), ISKCON, Oxfam, Hindustan Lever Limited, collector's office, HOPE Foundation etc. These maps helped NGOs in taking decisions regarding setting up of a center and prioritization of villages to start rehabilitation operations.

5) Setting up of Sub-Centres

ETAC was an immediate response to the critical circumstances but planning inputs are more crucial in long-term recovery. For this purpose, Initiative for Planned and Participatory

Reconstruction (IPPR) was conceived. The main objective of the project was to put together a Planning Guide for Post Disaster (Earthquake) Recovery through various experiments. Under this project, it was decided to set up a network of sub-centres across Kachchh to carry out massive relief and rehabilitation operations in participatory manner. EPC helped Abhiyan in setting up first sub-centre at Kodki, under which 18 surrounding villages were covered. The main tasks of sub-centre include,

- Serve as a nodal point to provide link between government and local people of the villages covered under each sub-centre
- Capacity building of village level samities to take care of their own affairs and planning and charting reconstruction methodologies and providing training inputs to community leaders, volunteers and field workers
- Collection and dissemination of information

About 23 sub-centres were set up by Abhiyan in Kachchh district. The information collected by each sub-centre in a specific format was sent to the information center. This information was processed in information center and thematic maps along with reports were generated. These maps were sent to sub-centres which helped them in prioritizing various activities and allocating funds.

6) **Setting up of Rehabilitation Information management System (RIMS)**

After that Kachchh Rehabilitation Information Cell (KRIC) was set up with clear and focused objective to speed up the process of information collection, collation, processing, dissemination, to improve coordination and to avoid duplicating efforts by UNDP and Gujarat State Disaster Management Authority (GSDMA). Major activities of this cell include,

- Designing formats for data collection
- Data collection
- Software development
- Mapping of information
- Data entry and analysis

Rehabilitation Information Management System (RIMS) was developed to put Setu information and government data on one platform, which can help generating various reports along with the maps periodically. For this purpose GIS was linked with RIMS to generate dynamic maps. This combination gave the user two front ends to view the reports in tabulated formats in RIMS and on maps.

7) **Preparation of Post Disaster Reconstruction Atlas for Bhuj, Anjar, Bhachau and Rapar, Kachchh District**

EPC was commissioned by United States-Asian Environmental Program (USAEP) to prepare an atlas for post-disaster reconstruction for four earthquake affected towns of Kachchh district viz. Bhuj, Anjar, Bhachau and Rapar to assess and document the damage caused by the earthquake through a set of thematic city maps. The main objective was to facilitate the reconstruction process by mapping information that would provide critical inputs for rehabilitation, reconstruction and preparation of development plans of towns. The base maps of four towns were provided by Gujarat Urban Development Company Limited (GUDC). EPC-Geographis updated these base maps using IRS 1C/1D PAN satellite images. A detailed field survey was carried out for all the plots/ buildings to collect information on

- Land use/Building use
- Intensity of damage
- Height of buildings

These thematic maps along with databases were provided to the town planning consultants of respective cities.

8) **Computerization of Land use, Geological, Geomorphological and Seismotectonic Maps of Bhuj, Anjar, Bhachau and Rapar Region**

Geographis was commissioned by GUDC for computerization of various regional level thematic maps of Bhuj, Anjar, Bhachau and Rapar Regions. These maps were prepared by Geological Survey of India from satellite images and ground survey. The series of maps include,

- Land use maps
- Geological maps
- Geomorphological maps

- Geohydrological maps
- Drainage maps
- Slope maps
- Seismotectonic maps
- Foundation Grade maps

These maps were overlaid with town maps for further analysis and provided to the town planning consultants of the respective towns.

9) Preparation of Development Plan of Bhuj

EPC was commissioned by GUDC to prepare development plan of Bhuj. The main components involved in the whole process were

- Physical Survey of whole area of Bhuj Area Development Authority using Total Station
- Base map preparation using City Survey Sheets, DILR (District Inspector of Land Records) Sheets, IRS 1D PAN Satellite Image and Physical Survey drawings
- Preparation of Existing land use map by carrying out field survey
- Studies and Analyses of information collected from various sources, which includes maps and database prepared in Disaster Reconstruction Atlas, Natural Resource mapping and consultations with local group of people.
- Proposals for Land use zones, Development zones, Relocation sites, Road network and Development Control Regulations for planned development of the city.

Mapping, GIS and Remote Sensing technologies were used in all these stages of Development Plan.

Thus GIS technology was utilized for post disaster rescue and relief operations and it has been proved as one of the most powerful tool to provide decision support system to various agencies involved in relief, rescue, rehabilitation and reconstruction activities. It has been felt that sharing information, and using GIS maps to display it, strengthens reconstruction planning. Everyone – state and district agencies, donors and NGOs benefited from agreeing to gather and share information after disaster. Supporting a common information cell conserved resources and facilitated coordinated action. Tapping a NGO with strong GIS mapping capability, and experience in the region, greatly facilitated sharing information at all levels and developing plans based on the best available current data.

Annexure-I: List of Thematic Maps prepared for Kachchh and Other Earthquake Affected Districts

Kachchh District:

1. Base Map of Kachchh District
2. Base Maps of 6 Talukas, viz. Bhuj, Anjar, Bhachau, Rapar, Mandvi and Nakhatrana
3. Population Density
4. No of Deaths/Village
5. No of Injured Persons
6. No of Families /Village
7. Status of School Buildings
8. Status of Panchayat Buildings
9. Status of Public Distribution System
10. No. of Cattle Deaths in each Village
11. Availability of Water
12. Status of Primary Health Centers
13. No. of Women Destitute/Village
14. No. of Physically Handicapped
15. Availability of Fodder
16. No of Water Harvesting Structures
17. Water Harvesting Structures constructed by various agencies
18. Damaged Assessment of Water Harvesting Structures
19. Repair Priority of Damaged Water Harvesting Structures
20. Progress of Dams Repairing
21. Suggestive alternatives for Drinking Water
22. Setu (Sub Centres)
23. Coverage of Relief Materials supplied by Setu

24. Demolished Houses
25. Village wise progress in Semi Permanent Shelters
26. Handicrafts in Kachchh
27. Village wise progress in Intermediate and Demonstration Shelters
28. Villages damaged more than 70% and adopted by Abhiyan
29. No. of Dispensaries
30. Availability of Education Facility
31. Availability of Electricity
32. No. of Family Planning Center
33. Availability of Maternity & Child Welfare Center

Districts other than Kachchh:

34. Base maps of all the earthquake affected districts, viz. Jamnagar, Rajkot, Patan, Surendranagar, Banaskantha, Ahmedabad, Anand, Kheda, Vadodara, Bharuch, Surat, Mehsana and Bhavnagar
35. Base maps of all the Earthquake Affected Talukas
36. No. of affected Dalit Households in Banaskantha, Surendranagar and Patan Districts
37. Population in Morvi and Maliya Talukas
38. Details of Deaths and Injuries in Morvi and Maliya Talukas
39. Facility of Electricity in Morvi and Maliya Talukas
40. Source of Water before and after Earthquake in Morvi and Maliya Talukas
41. Condition of Schools, Panchayats, PHCs and Community Centers in Morvi and Maliya Talukas