



INTERNATIONAL JOURNAL OF PURE AND APPLIED RESEARCH IN ENGINEERING AND TECHNOLOGY

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SPECIAL ISSUE FOR NATIONAL LEVEL CONFERENCE "Recent Trends and Development in Civil Engineering"

STUDY ON TSUNAMI EVACUATION SYSTEM FOR SOMNATH CITY

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Accepted Date: 27/01/2018; Published Date: 01/03/2018

Abstract: This thesis presents the mapping of some cities of western coast of Gujarat for Tsunami evacuation. We have taken Somnath city as a case study for that we have studied various coastal region of Gujarat. The need for the study is to aware people for the hazard of tsunami and saving maximum lives in minimum time when tsunami occurs there. After the great earthquake of Sumatra on 26 December 2004, tsunami waves were generated that affected coast of Indian coast. Because of this tsunami large amount of property and lives were lost. Studies show that if proper protective measures are adopted, this damage can be reduced. For saving property in coastal area during tsunami is very difficult task because it is a natural disaster. The most important challenge is to save lives during such events. In evacuation planning efforts are made to save lives during tsunami. In this thesis the past historical earthquakes of Tsunami-genic source of Makaran Subduction zone which is responsible for generating tsunami on western coast of Gujarat are studied.

Keywords: Tsunami, Evacuation, Plan, Emergency, Natural Disaster



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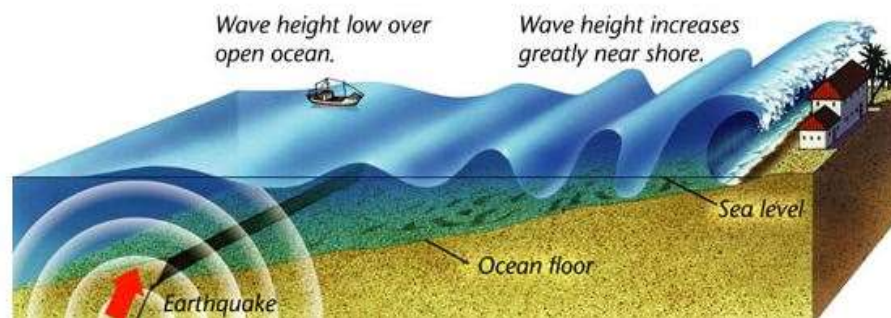
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How to Cite This Article:

Dhaval M Patel, IJPRET, 2018; Volume 6 (7): 170-177

INTRODUCTION

The term tsunami is derived from Japanese word which means harbor waves. A tsunami, from the Japanese word for “harbour wave” is a series of enormous, long ocean waves (10 or more) created by an underwater disturbance such as an earthquake, landslide, volcanic eruption, falling of meteorite. A tsunami can move hundreds of miles per hour in the ocean and hit into land with waves as high as 100 feet or more. Tsunamis are generated by any large, impulsive disturbance of the sea bed level. Earthquakes leads to tsunamis by vertical movement of the sea floor. If the sea floor movement is horizontal, a tsunami is not generated. Earthquakes of $M > 6.5$ are critical for tsunami generation. Tsunamis are also generated by landslides into or under the water surface, and can be generated by volcanic activity and meteorite impacts.



(Fig. 1 :- Tsunami Wave generation (source:
<http://science.howstuffworks.com/nature/natural-disasters/tsunami2.htm>)

II. HORIZONTAL AND VERTICAL EVACUATION SYSTEM

Based on the location and type of tsunami wave, there are basically two types of evacuation methods which are explained as below. 1) Horizontal evacuation .2) Vertical evacuation. Horizontal evacuation method can be used in case when you have sufficient time to evacuate people and also when there is availability of sufficient routes for horizontal movement. In this method, evacuation plan is prepared which highlights the main roads and other routes which can lead people to safer zones by means of horizontal movement. Vertical evacuation methods can be used when you do not have sufficient time to evacuate people as well as when there is shortage of routes for horizontal evacuation. In this method, tall vertical structures are built up which can help people to survive during the occurrence of tsunami. Also in this method, evacuation plan is prepared which highlights the places which have tall structures and also highlights the places which are at higher altitudes so that people can reach areas which are at higher altitudes and survive from tsunami.[2]

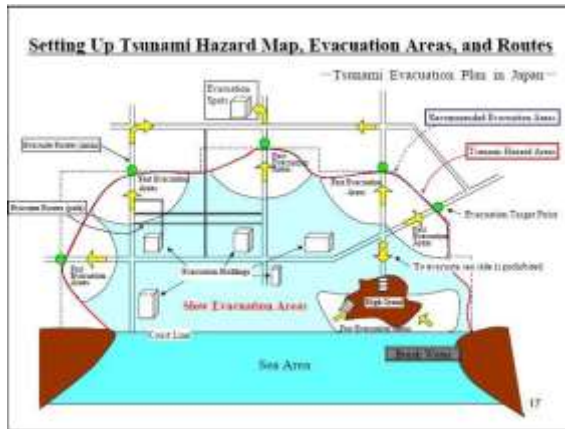


Fig. 2 (Setting up tsunami hazard map(Source :Newcomb, K.R. et al 2001)

III. POSSIBILITIES OF TSUNAMI IN WESTERN COAST OF GUJARAT

Five of the great earthquakes in Makran may have ruptured the plate boundary in four different rupture segments of lengths of about 200 km each in 1483 (58–60°E), 1851 and also 1864 (61–63°E), 1945 (63–65°E), and 1765 (65–67°E). Out of all these earthquakes only the 1945 earthquake is known to have caused a large tsunami, followed by a large aftershock in 1947 immediately to the south. The western Makran zone has no clear record of historic great earthquakes. Absence of frequent earthquakes indicates either that seismic subduction occurs or that the plate boundary is currently locked and experiences great earthquakes with long repeat periods. One of the most deadly tsunamis ever recorded in the Arabian Sea occurred with its epicenter located in the offshore of Pansi in the northern Arabian Sea, about 100 km south of Churi (Baluchistan), Pakistan, at 21.56 UTC (03.26 IST) on November 28, 1945. More than 4000 people lost their life along the Makran coast of Pakistan by both the earthquake and tsunami. The tsunami was responsible for great loss of life and destruction along the coasts of India, Pakistan, Iran. The earthquake's Richter Magnitude (M_s) was 7.8 (Pendse, 1948) & the Moment Magnitude (M_w) was reevaluated to be 8.1. Different points of bathymetry from Makran Subduction Zone to Cities of interest are shown in figure 2. Different points indicating depth of sea floor is prepared by using global mapper. This profile is prepared using World Bathymetry data of 30 grid SRTM Data.[1]

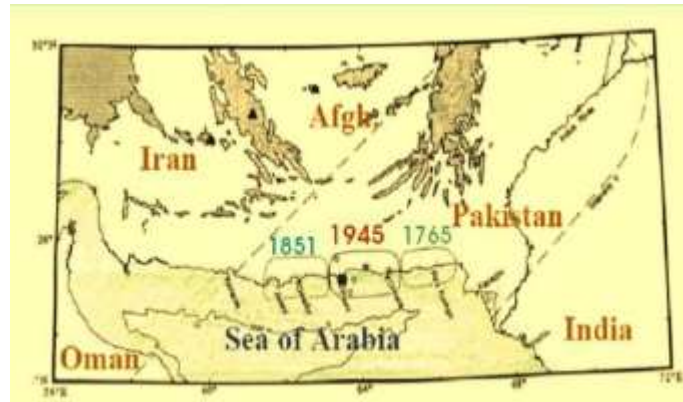


Fig.3 : Great Earthquakes in MSZ (Dhaval M Patel. at 2014)

iv. NEED OF STUDY

To reduce loss of the life and the destruction due to tsunami. It helps to evacuate the people from prone zone and reach to the safer place in the minimum time, Also prepare Tsunami evacuation plan which is made for the local public in order to save maximum lives.

V. PROBLEMS DUE TO TSUNAMI

Impact due to smashing forces of the wall of water which is travelling at high velocity will result into massive destruction, also telephone and electric lines, building, boats, religious places etc. are intensely affected. The worst and the biggest problem due to tsunami is the loss of human lives, especially those who leaves in coastal area. Sea water damages sullage and fresh water supplies resulting contamination of the same. The diseases such as malaria will spread illness and infection due to stagnant water. It leads to the devastating effect on insects, plants, animals, birds, etc. Reconstruction and cleaning up the affected areas requires massive cost. Psychological effects of the tsunami will retain in the minds of victims which will last for a year or may be whole life.

VI. OBJECTIVES

The main aim of our project is to suggest tsunami evacuation map for Somnath and its surrounding region and to find out tsunami hazardous zones in that region. To find Tsunami risk and their sources for cities of west coast of Gujarat. To analyze the site conditions from the map and to suggest type of evacuation system for the same region. The main objective of our project is to save as many people as possible by guiding them to safer zones in quickest time and zones that will least affected by tsunami during tsunami conditions with the help of the tsunami evacuation maps that will be suggested by us.

VII. STUDY AREA



Fig. 4 Somnath city (google images)

Name of place: Somnath, headquarter: Veraval, Latitude: 22 04' 00" N, Longitude: 71 23' 00" E, Area: 3755 km², Density: 250/km sq., Total population: 9,46,790 lacs approx., Major river: Triveni Sangam, Somnath has plain topography, the hillocks are at a maximum height of 30m above the sea level.(Wikipedia)

VIII. METHODOLOGY

The stepwise procedure is as follows:

- Step 1: selection of project
- Step 2: problem definition
- Step 3: literature review
- Step 4: reports & objective finalization
- Step 5: collecting tsunami data
- Step 6: analysis of the data
- Step 7: suggesting horizontal – vertical system
- Step 8: conclusion

IX. IMPORTANT LOCATION

The locations which are shown below are those important locations of Somnath city which are prone to the tsunami destructions. There is famous ancient Hindu religious temple name as

Somnath temple which is one of the 12 jyotirlingas in India. Apart from this Prabhas Patan museum, Laxmi Narayan temple, Gita temple, Somnath sarovar etc are also important and famous places which are prone to tsunamigenic factors because all places are situated near the coastal line of Somnath city. Hence these all places are need to be protected during such emergencies.



1.Somnath temple



2.somnath beach



3.Prabhas patan museum



4.Gita temple Somnath



5. laxmi Narayan temple

Fig 5: From Google Images

XI. ACKNOWLEDGMENT

This research paper is made possible through the help and support of our faculty guide Mr. Dhaval M Patel, Mr. Abhijitsinh Parmar. for their affection throughout guidance, advice and encouragement. Thanks to all our family members for their, care and encouragement. Special thanks to our college for giving the invaluable knowledge. Above all we are thankful to almighty god for everything.

XII. CONCLUSION

The most important and effective method to save human lives during a tsunami is evacuation. An important factor in evacuation is precise representation of the timing of people's responses to the emergency. In this study, with the help of satellite technology evacuation plan is

generated for western coast of Gujarat state. These Vertical Evacuation Suggestions are provided based on various parameters related topography and geology of study area. These results of this study can be utilized by public policy and decision makers in developing disaster management strategies.

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