

EDGE WAVES AT PHI-PHI ISLAND DURING THE DECEMBER 26, 2004 SOUTH ASIAN TSUNAMI

K.T. Chau, O.W. H. Wai, R.H.C. Wong, and H.Y. Lin

Department of Civil and Structural Engineering, The Hong Kong Polytechnic University,
Kowloon, Hong Kong, CHINA

ABSTRACT

On December 26, 2004, a 9.0 magnitude earthquake hit the northern coastline off Sumatra Island of Indonesia. The massive tsunami induced by the earthquake swept across many countries in the Indian Ocean, and the death toll is believed to exceed 190,000 since there are still many people missing. More than 5 millions people had been displaced. Tsunami hazard for south Asia countries has evidently been underrated in the past. A research team on tsunami was formed at the Hong Kong Polytechnic University after the event to investigate the potential tsunami hazard for Hong Kong and China coastline. Among many key issues of tsunami hazard, it was identified that “edge wave phenomenon” associated with tsunami is of great importance to the irregular coastline of Hong Kong and China. “Edge wave” are waves that travel along the coastline and may concentrate as high run-up if the bathymetry and shape of coastline favor such focusing effect. This edge wave effect has been well-known for the 1960 Chile tsunami on Hilo Harbour, 1992 Flores tsunami on Babi Island, the 1993 Okushiri Tsunami in Japan. Therefore, a reconnaissance team from the Hong Kong Polytechnic University visited the disaster sites at Thailand to investigate whether this is evidence of edge wave. As expected, the tsunami run-up along irregular coastline is highly localized, and this is a strong evidence of the existence of edge wave. In particular, we have mapped the run-up heights around the Phi-Phi Island, at where more than 400 foreign tourists died. The hardest hit part of Phi-Phi Island is the Ton Sai Bay which is facing south. According to accounts of local people, the biggest tsunami surge came from the north via the Loh Dalam Bay. There are plenty of field evidences at Ton Sai Bay supporting this observation. The original tsunami was mainly coming from the west and somehow managed to go around the dumbbell shaped headland on the west of the Ton Sai Bay (probably due to the edge wave focusing effect), the highest tsunami run-up there is about 14 m estimated from markings left on the top of coconut trees. Along the northern coast of Phi-Phi Island, tsunami surge over-flown the land led to very high local flow velocity near Laem Tong. Boulders of up to 60 tons originally rest under the sea (it is evidenced from the one-side coverage of shells) were carried on land. Similar boulders field has been observed in other historical tsunami, including the 1960 tsunami at Hilo Harbor. Houses along the path of the flow in Laem Tong were all destroyed. The field observations are further investigated by conducting physical hydraulic model tests at our laboratory.