

# TSUNAMI EVACUATION SIMULATION AND THE EFFECT OF POPULATION DISTRIBUTION: A CASE STUDY OF PATONG, PHUKET, THAILAND

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## 1. INTRODUCTION

In southern Thailand, Phuket was one of six provinces heavily affected by the 2004 Indian Ocean Tsunami. Patong is one of the most populated beaches in Phuket province. There are not only outdoor activities on the beach, but people can also enjoy several indoor activities, such as shopping, eating, massaging, etc., across the area. Therefore, population distribution can be implied by these activities related to the building occupancy classes, such as hotels, restaurants, shops, etc.

Generally, tsunami evacuation simulation begins with a model of the departure locations, also known as population distribution. For example, individuals initially depart from each building uniformly distributed or based on the building occupancy classes (BDOC), such as residential, hotel, commercial, etc. The number of occupants for each building class can be assumed based on expert judgment [1] or the field survey [2].

## 2. METHODOLOGY

In this study, we focus on the effect of population distribution on tsunami evacuation using agent-based modeling and simulation. The population in Patong, Phuket province is estimated based on the unit area of each building's occupancy class and the building's floor area (m<sup>2</sup>).

Table 1. Overview of Building Distribution

Occupancy Class	%Building	Avg. Floor Area (m <sup>2</sup> )
Residential	51.68%	261
Hotel	31.71%	1,031
Commercial	15.25%	419
Others	1.35%	632
<b>Grand Total</b>	<b>100.00%</b>	

## 3. RESULTS

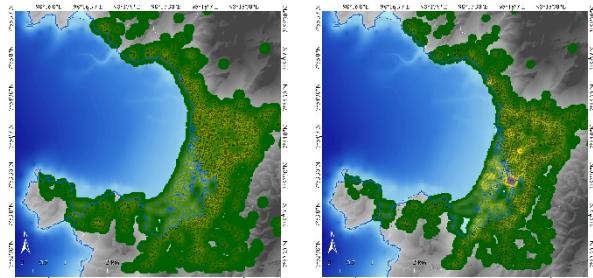
Table 2 shows that the population in commercial buildings based on the Uniform model is significantly less than in the BDOC model. Figure 2. shows that the BDOC model causes faster evacuation than the Uniform model, which may be caused by the high population being closer to safe places, such as tall buildings.

## 4. CONCLUSIONS

Population distribution significantly affected the tsunami evacuation and should be taken into consideration.

Table 2. Models of Population Distribution

Occupancy Class	%Pop. Dist. by Uniform Model	%Pop. Dist. by BDOC Model
Residential	36.06%	28.62%
Hotel	44.16%	37.66%
Commercial	17.63%	30.06%
Others	2.15%	3.65%



a) Uniform

b) BDOC

Figure 1. Map of Population Distribution

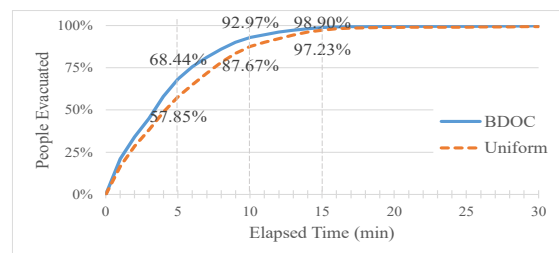


Figure 2. Effect of Population Distribution to the Results

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