INFORMATION DISSEMINATION FOR REALITY-BASED TSUNAMI DISASTER EDUCATION

H. Iemura[1], M. H. Pradono[2], A. bin Husen[3], T. Jauhari[3], and M. Sugimoto[4]

[1] *Professor, Department of Urban Management, Kyoto University, Kyoto, Japan*
[2] *Researcher, Agency for the Assessment and Application of Technology, Jakarta, Indonesia*
[3] *Professor, Syiah Kuala University, Banda Aceh, Indonesia*
[4] *Delegate, Disaster Management, Japanese Red Cross Society, Aceh Besar, Indonesia*
Email: iemura@catfish.kuciv.kyoto-u.ac.jp, mulyoharris@yahoo.com

ABSTRACT :

Huge earthquake and tsunami on December 26th, 2004 has caused a great number of casualties around Indian Ocean rim countries especially in Banda Aceh city, in Sumatra Island, Indonesia. In a quick response to the disaster, a Japanese group of researchers led by the first author departed to Banda Aceh and surrounding areas in attempt to study the lessons by the huge earthquake and tsunami. Questionnaires were distributed to the affected people. The questionnaire's result shows that the local people's awareness of tsunami was very low. Other important result is that even if people had started running away just after the big earthquake, the percentage of expected survivors would have been less than 100%. The practical implication is that education, socialization, escape structures, warning system, wave resisting structures are among important factors for people to be safer against future earthquake and tsunami attacks. However, since tsunami is a rare event, the future generations may forget the disaster easily. One of the ideas prompted by the first author to local people is to build poles with the height of tsunami run up throughout the affected areas in the city. The poles have many important purposes. The idea was supported by local people and Embassy of Japan in Indonesia. To date, 85 tsunami height memorial poles are standing throughout Banda Aceh city and surrounding areas. The poles are expected to last long and convey the important message of tsunami disaster to the present and next generations.

KEYWORDS: questionnaire, survival rate, tsunami height, memorial poles, education

1. INTRODUCTION

During a survey led by the first author in Banda Aceh and surrounding areas in Indonesia after the great Sumatra earthquake, questionnaires have been distributed to the people affected by the earthquake and tsunami. One important result of the questionnaires shows that even if people had started running away just after the big earthquake, the percentage of expected survivors would have been less than 100% (Iemura, et al, 2006). The practical implication from this result is that education, socialization, escape structures, warning system, and wave resisting structures are among important factors for people to be safer against future earthquake and tsunami attacks. Moreover, for learning and educational purposes, institute or center for earthquake and tsunami research, tsunami and earthquake museum, international collaborations among research institution, tsunami and earthquake safe structural design, and tsunami poles and disaster education shall be realized.

2. IMPORTANT RESULTS FROM THE QUESTIONNAIRES

The important results from the questionnaires are that the local people's knowledge on tsunami was very low. The question was "Did you know that tsunami would come after a big earthquake?" Figure 1 shows the result.

Other important result is that, according to the respondents, even if people had started running away just after the big earthquake, the percentage of expected survivors would have been less than 100% (Figure 2). The practical implication is that education, socialization, escape routes, escape structures, warning system, wave resisting structures are among important factors for people to be safer against future earthquake and tsunami attacks.

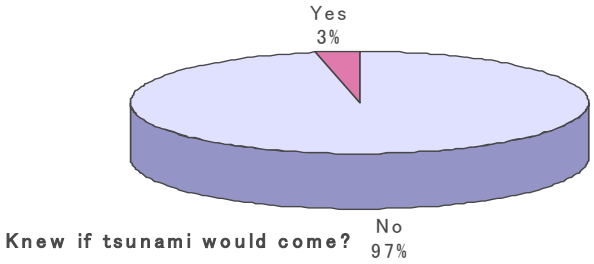

Figure 1 Respondents' Knowledge on Tsunami

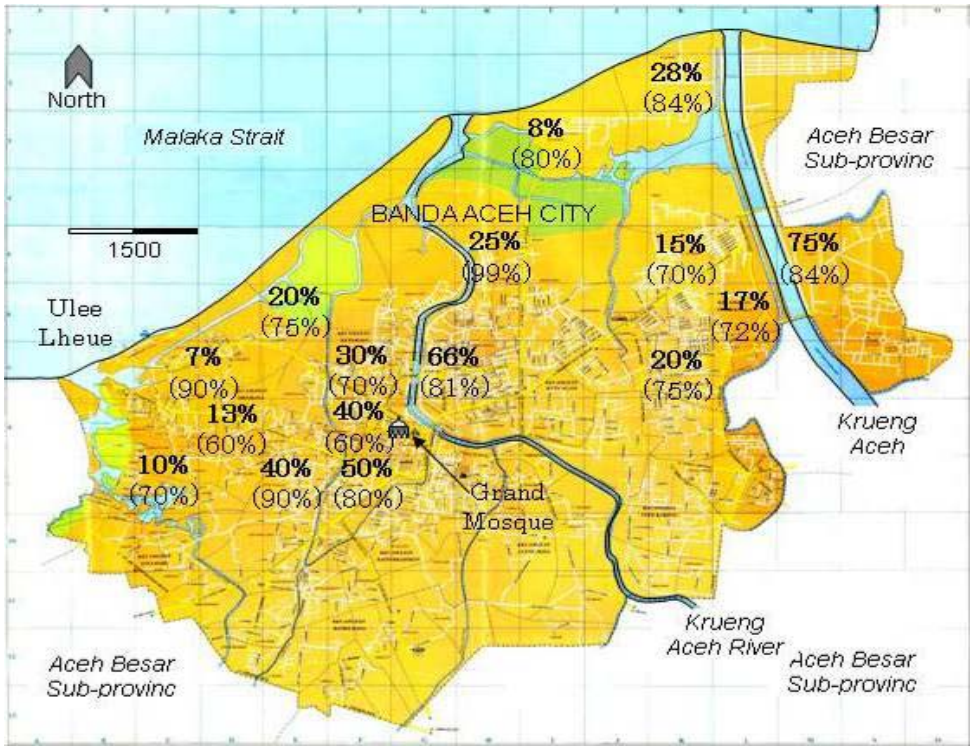

Figure 2 Percentage of Survivors in Banda Aceh City (Number in parenthesis shows percentage of survivors if people had escaped immediately after the earthquake)

3. TSUNAMI HEIGHT MEMORIAL POLES AND DISASTER EDUCATION

Since tsunami is a rare event, the future generations may forget the disaster easily. People need encouraging and reminding words that would be written on lasting memorial structures. One of the ideas prompted by the first author to local people is to build poles with the height of tsunami run up throughout the affected areas in the city.

The poles have many important purposes: (1) to encourage people to be prepared for the next one, (2) to keep the memory of tsunami attack, (3) to educate next generation the important lessons from the tsunami, (4) to mourn the passed away people and to restore and reconstruct Banda Aceh from the disaster, (5) to keep accurate data of tsunami height for future planning, (6) to be escaping sign with the tsunami height, (7) to encourage local people to live with hope and ease under tsunami risk, and (8) to be a symbol of Banda Aceh as the tsunami-attacked city.

The idea was supported by local people and the Embassy of Japan in the Republic of Indonesia. The Embassy made available a grant up to US $ 91,411 (Ninety one thousand four hundred-eleven US Dollar) by March 31, 2006. It contributes to the execution of the construction by the Yayasan Umi Abasiah. The project entitled "The Project for Supporting Education of Tsunami Disaster Prevention in Nanggroe Aceh Darussalam".

The first author also provides technical assistance. The pole structure should be strong and yet reasonably

economical and feasible in the material availability point of view. Hybrid structure consisting of masonry and reinforced concrete was finally adopted as the material. The first drawing for designing the poles is shown in Figure 3.

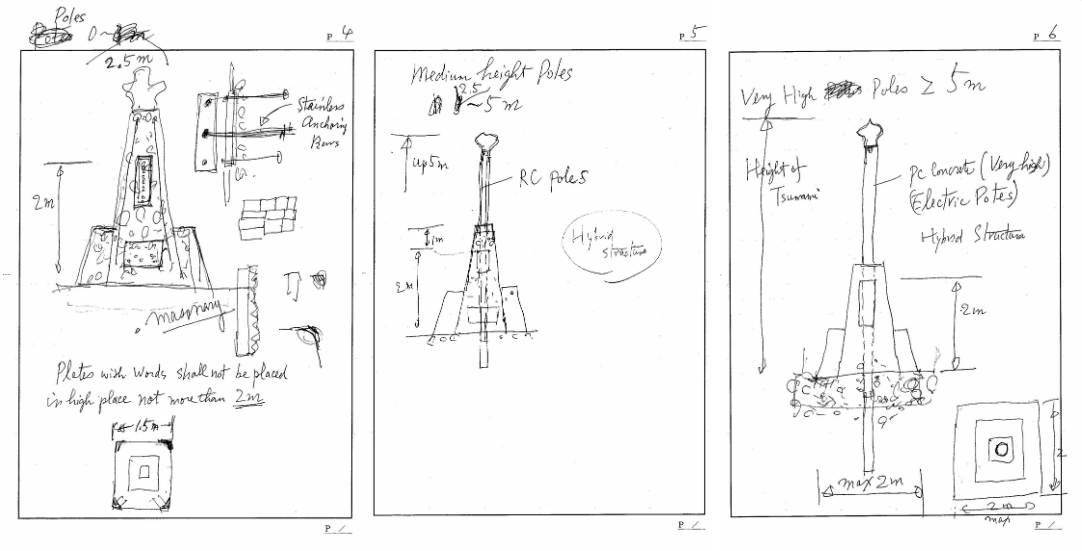

Figure 3 First Drawing of the Pole for Design Purpose

The poles would be built along the evacuation routes. The purpose is for providing evacuees with escaping sign with height, so that the evacuees escape toward the lower poles. After considering many aspects, including limitation of the land for construction, the realized location of the poles is as shown in Figure 4. The height of the poles is the inundation of tsunami water, when the tsunami wave was relatively flat and around ten minutes later, the tsunami water returned back to the sea.

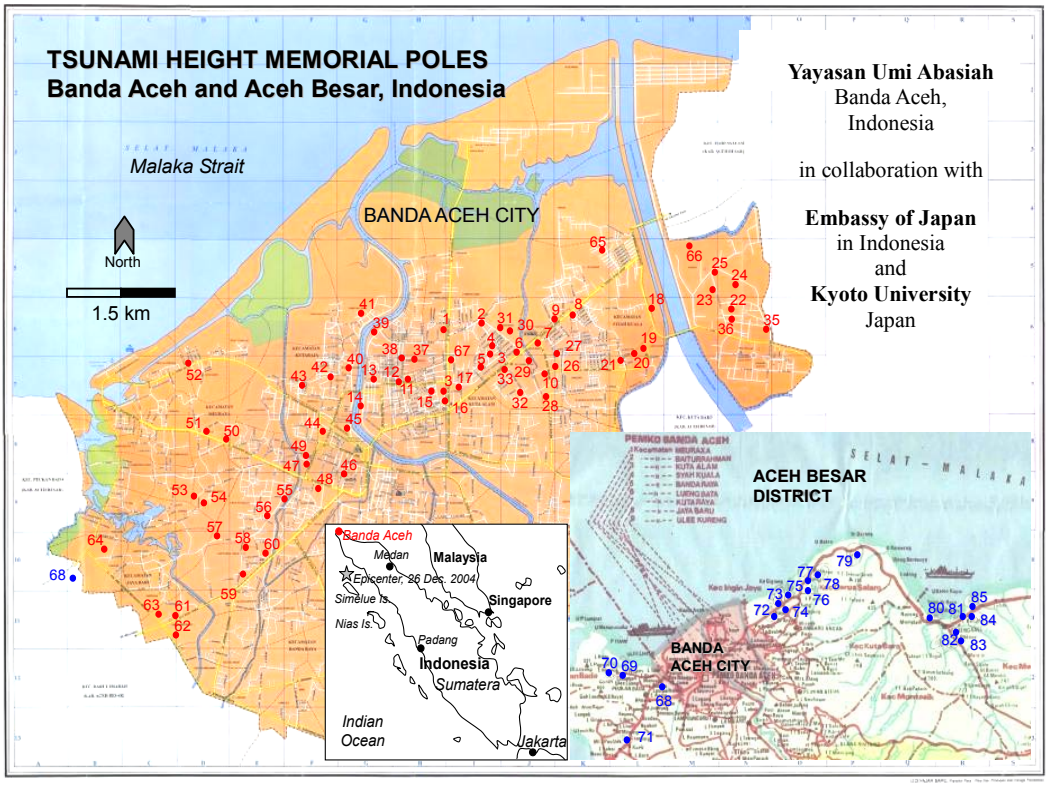

Figure 5 Locations of 85 Tsunami Height Memorial Poles in Banda Aceh and Aceh Besar

Figure 6 The Firstly Built Tsunami Pole (February 2006)
Pole No.: 01, Height: 3.15 m, Distance from Shore: 2.80 km, Location: Gampong Lamdingin, Kecamatan Kuta Alam, Banda Aceh.
The placard in front of the pole shows the inundation height, distance from shore, time of tsunami arrival, time of earthquake, location name, words of wisdom, developer, and donor

Figure 7 The Lowest Tsunami Pole
Pole No.: 28, Height: 0.90 m, Distance from Shore: 4.30 km, Location: Dinas Pertanian dan Tanaman Pangan, Banda Aceh.

Figure 8 Tsunami Pole at a School, Pole No.: 15, Height: 1.52 m, Distance from Shore: 3.90 km, Location: SD Negeri 28, Kp. Keuramat, Banda Aceh

Figure 9 The Tallest Tsunami Pole
Pole No.: 69, Height: 9.00 m (w), Distance from Shore: 0.50 km, Location: Masjid Lam Tengoh, Peukan Bada, Banda Aceh.
The wave height was justified from witnesses, because there was no inundation mark left by the tsunami.

Figure 10 Tsunami Pole at a School, Pole No.: 49, Height: 3.80 m, Distance from Shore: 3.10 km, Location: SDN 2, Punge Jurong, Banda Aceh

Table 1 List of 85 Tsunami Height Memorial Poles in Banda Aceh and Aceh Besar

1. 3.15 m 2.80 km GPG. LAMDINGIN KEC. KUTA ALAM	23. 1.75 m 3.50 km Asrama Mahasiswa Unsyiah, Darussalam	45. 2.30 m 3.20 km Kantor Pengadilan Negeri Banda Aceh	67. 1.30 m 3.30 km RUMAH BP. ALAMSYAH UMAR JALAN SYIAH KUALA
2. 2.90 m 3.00 km GPG. LAMBARO SKEP KEC. KUTA ALAM	24. 1.45 m 3.60 km Kantor Rektorat Iain Ar-Raniry, Darussalam	46. 2.00 m 3.50 km Taman Kanak2 YKA Taman Sari	68. 5.70 m 1.50 km MASJID BAITUL MAGHFIRAH PEUKAN BADA
3. 1.40 m 3.75 km MAN 1	25. 2.00 m 3.40 km MAN 3, RUKOH	47. 3.40 m 3.20 km SMA NEGERI 1 BLANG PADANG	69. 9.00 m (w) 0.50 km MASJID LAM TENGOH PEUKAN BADA
4. 1.95 m 3.40 km SMP NEGERI 2	26. 1.00 m 4.00 km SMP NEGERI 18	48. 1.80 m 3.40 km SMPN 17 BLANG PADANG	70. 7.00 m 0.40 km MASJID INDRA PURWA LAMGURON
5. 1.39 m 3.55 km SD NEGERI 25	27. 1.80 m 3.85 km SMP NEGERI 6	49. 3.80 m 3.10 km SDN 2 PUNGE JURONG	71. 2.50 m 2.50 km MEUNASAH TANJONG KEC.LHOKNGA
6. 1.84 m 3.70 km Masjid Agung Al Makmur Bandar Baru	28. 0.90 m 4.30 km DINAS PERTANIAN TANAMAN PANGAN	50. 4.50 m 2.00 km Rumah Ny. Zulkifli Narukaya Blang Oi	72. 5.50 m 2.50 km SDN KAJHU KEC.BAITUSSALAM
7. 2.60 m 3.60 km SMK NEGERI 2/STM NEGERI	29. 1.60 m 3.80 km SMK NEGERI 3	51. 5.80 m 1.90 km Masjid Syech Abdul Rauf Blang Oi	73. 7.00 m 2.20 km Tanah Widari Dawam Dawood Sp, Cot Paya
8. 2.60 m 3.40 km SD NEGERI 80, PRADA	30. 2.45 m 3.50 km Kantor Dekranas Taman Ratu Safiatuddin	52. 7.00 m 0.50 km Rumah Bp. Bachtiar Zakaria Deah Baro	74. 3.50 m 2.70 km SMAN-1 BAITUSSALAM
9. 2.60 m 3.50 km Kanwil Kehakiman Dan HAM	31. 2.65 m 3.40 km KANTOR BAWASDA	53. 3.90 m 1.80 km SMPN 11 LAMJABAT	75. 5.10 m 1.50 km MASJID LAMBADA LHOK BAITUSSALAM
10. 1.55 m 4.10 km DINAS KOPERASI DAN UKM	32. 1.00 m 3.85 km Direktorat Politeknik Kesehatan	54. 3.70 m 2.10 km SDN 95 GAMPONG BARO	76. 4.60 m 2.00 km GAMPONG LABUI BAITUSSALAM
11. 3.20 m 3.50 km SMA NEGERI 2	33. 1.80 m 3.75 km Politekkes NAD Jurusan Keperawatan	55. 2.20 m 2.90 km Masjid Baitul Muqarrabin Punge Blang Cut	77. 4.00 m 1.50 km GAMPONG LAMNGA JALAN KRUENG RAYA
12. 2.70 m 3.70 km SD NEGERI 20, POCUT BAREN	34. 2.00 m 3.40 km SD 35 LAMPRIET	56. 2.20 m 2.90 km SDN 18 PUNGE BLANG CUT	78. 3.40 m 1.30 km MEUNASAH NEUHEUN MASJID RAYA
13. 3.50 m 3.60 km SMP NEGERI 9, PEUNAYONG	35. 1.80 m 3.35 km MASJID JAMIK SILANG RUKOH	57. 3.40 m 2.70 km Universitas Iskandar Muda, Surien	79. 2.20 m 0.40 km MEUNASAH DURONG MASJID RAYA
14. 2.57 m 3.90 km KANTOR BKPMD	36. 1.20 m 3.80 km SMP NEGERI 8 DARUSSALAM	58. 2.30 m 3.00 km SDN 97 LAMTEUMEN TIMUR	80. 3.30 m 1.00 km Meunasah Paya Kameng Masjid Raya
15. 1.52 m 3.90 km SD NEGERI 28, KP. KEURAMAT	37. 3.40 m 3.40 km SDN 27 GAMPONG MULIA	59. 2.00 m 3.10 km SDN 93 LAMTEUMEN TIMUR	81. 3.40 m 0.50 km MASJID KRUENG RAYA
16. 0.89 m 3.90 km DARUL ULUM, YPUI	38. 3.50 m 3.35 km MIN Merduati Jalan Malahayati, GP.MULIA	60. 1.40 m 3.30 km PGSD FKIP Unsyiah Goheng	82. 3.20 m 0.80 km GAMPONG MEUNASAH KULAM
17. 1.52 m 3.70 km SD KARTIKA XIX-I, LAMPRIET	39. 4.60 m 3.00 km MASJID AL MUKARRAMAH GP. MULIA	61. 2.00 m 3.30 km MIN TELADAN LAMTEUMEN	83. 3.20 m 0.80 km GAMPONG MEUNASAH MON
18. 1.91 m 3.40 km Badan Perpustakaan Wilayah	40. 4.50 m 2.50 km Masjid Tgk. Dianjong PEULANGGAHAN	62. 1.00 m 3.50 km Rumah Zakaria Ismail Lamteumen	84. 2.50 m 0.30 km MASJID LAMREH KRUENG RAYA
19. 1.80 m 3.80 km MASJID LAMGUGOB	41. 7.00 m 1.80 km SMPN 12 GAMPONG JAWA	63. 2.35 m 3.30 km Biro Logistik Polda NAD Lamteumen	85. 3.10 m 0.50 km Pasantren/Dayah Al Mahfuzhah Krueng Raya
20. 1.40 m 3.80 km MIS LAMGUGOB	42. 6.00 m 2.00 km SDN 6 KEUDAH	64. 3.80 m 2.30 km SMPN 15 LAMPOH DAYA	Notes: - Data in [m] is height and data in [km] is distance from shore - Poles 43 & 69 show wave height. Others show inundation height - red in Banda Aceh, blue in Aceh Besar
21. 1.00 m 3.90 km STIES/AMBA	43. 8.00 m (w) 1.80 km SDN 8/38 MERDUATI	65. 3.70 m 2.70 km SDN 61 JEULINGKE	
22. 1.30 m 3.70 km SD NEGERI 69, DARUSSALAM	44. 2.70 m 2.70 km SD MUHAMMADIYAH LAMPASEH	66. 3.20 m 2.70 km SDN 106 RUKOH	

Figure 11 Tsunami Height Memorial Poles as part of Education Tools on Hazard Mitigation

In May 2007, all of the 85 poles were constructed throughout Banda Aceh city and surrounding areas. Some photos are shown in Figures 6 to 10 and the list of the poles is shown in Table 1.

The tsunami height memorial poles are also education tools for hazard preparedness. One example is by showing the students the record of the data mentioned in the poles and why they were built (Figure 11). The on going survey now is to map the three dimension coordinate of the poles. This data is invaluable for future tsunami disaster mitigation.

The tsunami height memorial poles will not only provide hazard data dissemination but also education for the present and next generations. The poles are expected to last long and convey the messages to every generation.

4. RECOMMENDATION FOR THE RECONSTRUCTION

Other than the tsunami poles and disaster education above (Not forget but understand) above, institute or center for earthquake and tsunami research, tsunami and earthquake museum (monuments, facts, data, education materials, and so on), international collaborations among research institution, and tsunami and earthquake safe structural design (technologies and codes), shall be realized.

5. ACKNOWLEDGEMENT

The authors would like to express their sincere gratitude to the Embassy of Japan in the Republic of Indonesia, to the Japan Society for the Promotion of Science, to the Ministry of Education, Culture, Sports, Science, and Technology, and to the people of Nanggroe Aceh Darussalam, Indonesia, for their strong interest and support.

REFERENCES

Iemura, H., Takahashi, Y., Pradono, M. H., Sukamdo, P., and Kurniawan, R. (2006). Earthquake and Tsunami Questionnaires in Banda Aceh and Surrounding Areas. *Disaster Prevention and Management*, Emerald, **Vol. 15, No. 1**, pp. 21-30.