

# Numerical Simulation of Tsunami Force Acting on a Floating/Submerged Tsunami Shelter

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## ABSTRACT

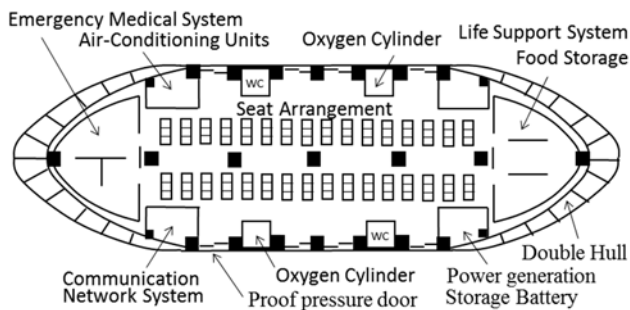
After the Tohoku earthquake tsunami in Japan, many evacuating options from a huge tsunami, e.g. tsunami tower, large building, moving onto hill, stronger breakwater, underground shelter and small lifeboat, have been proposed in recent years. This disaster is one of the strongly nonlinear coupled interactions problem between wave and structures.

We have proposed and developed one kind of a large-sized tsunami shelter with mooring that is capable of accommodating at least one hundred people or more to evacuate from a run-up tsunami. Figure 1 indicates the detailed design of the “Streamline type” of tsunami shelter including electric device and storage system. The size of the “Streamline type” is 75m length, 20m width, 9m height. The wall at the front and back face will be pre-stressed concrete to protect from several kinds of debris such as floating car, wood and ship. Figure 2 shows three dimensional numerical results of tsunami attacking on the tsunami shelter computed by the SPH method that we have developed using SMAC method in the previous work. The tsunami attack angle is 0 deg. and 45 deg. It can be seen that the “Streamline type” can vary smoothly tsunami flow going through downstream. On the other hand the other types generates large splashing at the front face and on the roof. Figure 3 shows comparison of time history of pressure between computational result and experimental one in Box type. This result is pretty good agreement with experimental result. This model can optimize the tsunami shelter to reduce tsunami force. The proposed tsunami shelter could be one of useful options for evacuating from a huge tsunami attacking near coastal area.

In future effort, the floating tsunami shelter with mooring system modifying the “Streamline type” would be developed to evacuate from a huge tsunami having 30m wave height predicted in Japan coast.



(a) Bird's eye view view



(b) Inside Arrangement

Fig.1 Overview of tsunami shelter

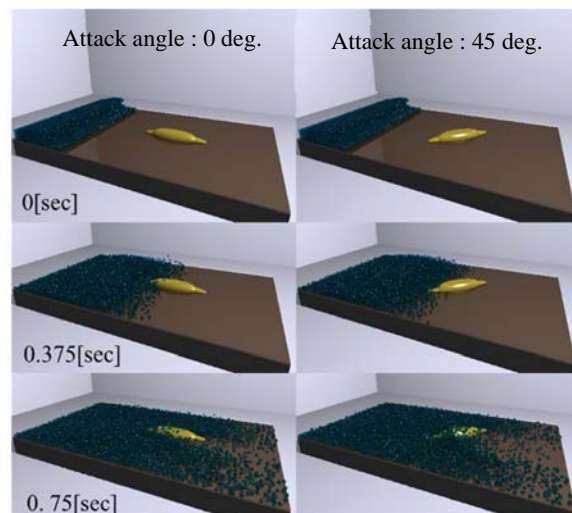


Fig.2 Tsunami attacking on tsunami shelter

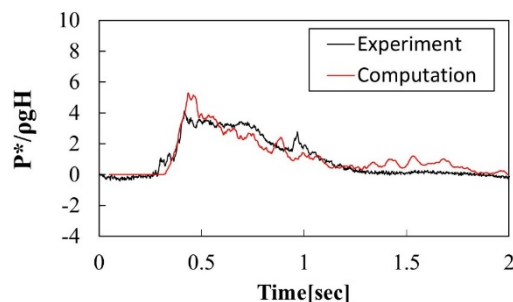


Fig.3 Comparison of time history of pressure between computational result and experimental one in Box type.