A Novel Approach to Prevent Damage from Earthquakes and Tsunamis with the Utilization of a Proportional Surface Hexagonal Structure and Modified Underground Two-Part Hexagonal Damping Rubber Bearing Base Isolator

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Today, increased tectonic plate activity in the Cascadia Megathrust Subduction Zone, located on the Pacific American Coast, has the potential to cause a high magnitude earthquake and resulting tsunami that could cause severe architectural damage and large death tolls. Unfortunately, modern technologies used to reinforce buildings are not completely effective because they are unable to efficiently self-stabilize shock from earthquakes while resisting against the hydrodynamic and buoyant forces from tsunamis. Therefore, it becomes necessary to design a cost-effective structure resistant to the effects of both of these natural disasters. After constructing a hexagonal surface structure and two-part base isolation system utilizing 50 durometer neoprene rubber, alloy steels, and compression spring shock-absorbers, the model was tested against a scaled-down simulation of the 2011 Tohoku, Japan earthquake and multiple direct shear tests, and against various computer-generated waves to measure the model's stability against the impacting forces of tsunamis at increasing distances from the tsunami basin shoreline and at panel/angle-sided conformations. In both tests, the two-part base isolator was able to absorb over 50% of the shock acceleration from transmitting to the top structure. Also, both the isolator and the surface hexagonal structure were not subject to external damage or water absorption in either test, thus supporting the potential of life-size structures to be built along global coastlines to provide a safe-shelter during these natural disasters.

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