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Flood Proofing Homes Using Amphibious Construction

Climate change is creating worldwide weather changes that include torrential rains that are placing full communities under water. Research recently published in Nature.com (www.nature.com/articles/s41586-021-03695-w#Abs1) discusses comparative analysis of satellite data that shows that since the start of this century the number of people worldwide that are now living in a flood zone has increased by 24 percent. The research expresses a need for “investing in flood adaptation strategies” that could allow people to comfortably build or rebuild their homes so that they can safely live in dry homes even in areas that tend to frequently flood.

Dr. Elizabeth English is an Associate Professor in the School of Architecture at the University of Waterloo in Ontario Canada. She has played a major role in getting Buoyancy Construction off the ground. She founded the Buoyant Foundation Project in 2006 and her efforts have led to the development of many creative solutions to building in flood zones.

In this column we will look at two solutions that allow a home to move vertically out of the way of rising flood waters. The amphibious construction envisioned by Dr. English creates a home that will be lifted by the rising waters when the area starts to flood. She developed her construction technology with the goal of using it to retrofit homes that already exist in flood zones. Dr. English adapted the construction concept used to build floating piers to house retrofitting construction. A floating pier has buoyancy pontoons so it floats and it also has vertical piers that keep the pier from floating away.

Dr. English and her students developed the following procedure to retrofit a home so it can float when flood waters enter its neighborhood. During recon-

struction the home would be jacked up so that a reinforcing steel frame and floatation pontoons could be attached to the bottom of the house. Just like a floating pier this floatation collar would have the buoyancy to float the entire house during a flood. To prevent the home from floating away from its proper location, the reconstruction would include a series of vertical piers that are properly anchored to the ground. Each one of these piers would have a movable riser which is physically attached to the house. As the water lifts the house off the ground the movable risers slide up their individual piers keeping the home properly aligned with its plot of land. As the water recedes the house slides back down its piers until it is safely back on the ground. This Buoyant Foundation project video (youtube.com/watch?v=qQWbtug32E) shows what her foundation has been working to achieve.

Baca Architects are building amphibious constructed homes on the shores of the Thames River in England. The system they are using is significantly different than the system developed by Dr. English. Their amphibious buildings are constructed inside what they call a “wet dock” foundation. The house that they construct inside the dry wet dock, has a basement that functions

like the hull of a ship. When there is no flood the house sits on the bottom of the wet dock. When the area begins to flood the water enters the wet dock and the water pressure pushes the basement hull foundation and its house upward elevating it above the height of the water. The house also has vertical guideposts that serve basically the same purpose as Dr. English’s piers. They keep the floating house properly aligned to the outer walls of the wet dock foundation. See illustration and photo. The houses are designed so they can be lifted higher than historic water levels and current global warming prediction levels for the Thames River. When the water level drops, the house just slides down to the bottom of the wet dock. The entire system simply works on Archimedes Principle as to why objects float. A video to further your understanding of this technology: (youtube.com/watch?v=Ukmb0heGyJk)

Taking it a step further:

How do the above examples of Amphibious Construction apply Archimedes Principle of floatation?

Tech Challenge: Your mission, if your teacher assigns it, is to build the floatation platform that can float the greatest weight. Specific design elements and construction materials will be determined by your teacher.



Photo Credit: Baca Architects

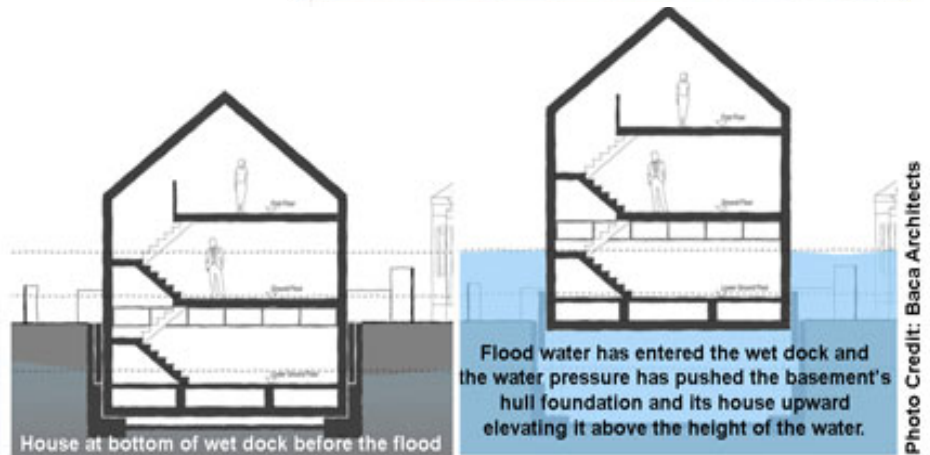


Photo Credit: Baca Architects

Alan Pierce, EdD, CSIT is a technology education consultant. Visit www.technologytoday.us for past columns and teaching resources