Compression Testing and Failure Modes of Steel-Concrete Composite (SC) Structures for Nuclear Containment

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Although being able to provide much cleaner power than burning coal and other fossil fuels, nuclear power plants are still a tough sell to the general public due to their history of being spontaneously dangerous. The containment structures surrounding these nuclear plants, however, can play a huge role in reducing the risks associated with them. Relatively new designs for these containment assemblies, known as SC (steel-concrete composite) structures, aim to increase the strength and durability of the containment facilities while keeping costs down. By varying the spacing between shear studs, the ratio of concrete to steel, and the ratio of width to thickness, many different properties of these structures change in a way that determines overall strength and failure mode (i.e. global vs. local buckling). In this research, several scaled-down specimens mimicking a theoretical SC wall were put into compression tests that yielded results exhibiting their behaviors under hypothetical loads that the structure may encounter. By observing the specimens with a high-speed camera (complete failure is observed over the course of a couple of seconds), results such as the failure mode and compressive strengths were observed. These findings will supply a portion of the research and information that is necessary in order to continue this design's development into nuclear-containment facilities. Research on the design must be continued to find relationships between variables that would allow an engineer to idealize the structural design for their specific needs. Such is necessary for their future implementation in real structures.