technology today

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Constructing Tall Buildings Using SpeedCore

Ron Klemencic is the 2018 recipient of the Engineering News Record (ENR) Award of Excellence for his team's development of their SpeedCore method of construction. Klemencic conceived the basic concept for this construction paradigm shift many years ago and started doing preliminary testing in 2006 at Purdue University. The first building to use the SpeedCore construction method to create a Composite Plate Shear Wall Core superstructure is now under construction in Seattle, WA (Photo 1). When it is completed, at 850', it will be the second tallest tower in Seattle, an area that is known for its earthquakes.

Wright Runstad & Company

Photo 1—The Rainier Square Tower, under construction in Seattle. The construction is using the new SpeedCore building system to construct the building's core superstructure. This technology will cut construction time by about 40%.

The methodology and structural integrity of this new construction technology had already been tested before it received final approval to move from the testing lab to the construction of the Rainier Square Tower. Under laboratory conditions, it has proven itself to be a superior earthquake-proof method of construction when compared to the current traditional concrete core system used today.

Photo 2 shows a prefabricated SpeedCore metal shell that was used during testing. Photo 3 shows one of the many testing machines that were used to test SpeedCore's ability to stand up to everything that nature might throw at it including the lateral loads of extremely high winds as well as the ground shaking and moving of earthquakes.

American Institute of Steel Construction (AISC)

Photo 2—During the original testing of the SpeedCore building system, prefabricated metal cavities like this one were used.

It is important to point out that the steel walls of the SpeedCore shells are extremely thick structural steel. The steel is so thick that all cutouts need to be created during fabrication, which means that each section's final resting place needs to be charted so that these openings end up in the correct location.

Photo 4 is a labeled diagram of a SpeedCore partially filled with concrete; here you can see how the cutout has a pipe sleeve that will be used to feed wires or pipes through the wall. The thickness of these SpeedCore shells removes the need to wait for the concrete to harden since the steel alone is strong enough to support the structure during construction.

Reports have called the Rainier Square Tower a proof-of-concept construction of this new building paradigm. The strength of the core has already been proven and the only thing that the architects, engineers, and the builder hope to prove is that this construction technology will reduce the time it takes to build a new building by about 40%.

The current method of building tall office buildings combines a steel frame with a traditional reinforced concrete core. To build a traditional reinforced concrete core superstructure, wood forms must first be assembled for the eventual casting of the concrete. After the forms are assembled, the steel rebar goes in using a labor-intensive procedure to cut, bend, and tie the different pieces of rebar into their proper locations.

Next the concrete is poured in; once it has had sufficient time to

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American Institute of Steel Construction (AISC)

Photo 3—One of the many testing machines the engineering team used to determine if the SpeedCore construction system would be able to stand up to everything that nature might throw at it.

harden the wood forms are removed. This procedure is performed repeatedly floor by floor until the concrete

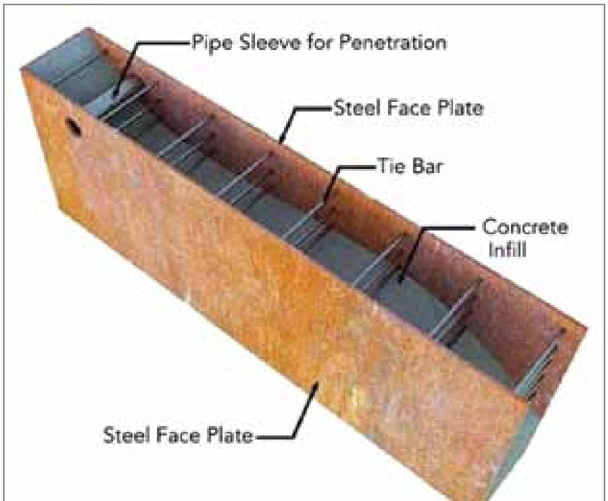

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Photo 4—Each casting cavity has all the necessary reinforcements built in. The steel cavities are welded together during construction; they are so thick and strong the entire core can be built without waiting for the concrete to harden.

core superstructure is completed. Basically, construction slows to a crawl during many of these steps especially while waiting for the concrete to harden enough to support the load of all the higher floors of the core.

SpeedCore does away with the wood forms and the custom bending and placement of rebar. These new prefabricated composite steel frame casting cavities, with all the necessary reinforcement built in (Photo 4), are assembled at the construction site and welded together. They do the job that was once done by the wood forms and rebar and add further strength since the steel that originally served as a casting form now remains as a permanent part of the structure.

Once the individual SpeedCore casting cavities are properly placed and welded together, they are instantly ready to be filled with concrete. Since the steel shell provides sufficient strength to support all the floors before the concrete fully hardens, construction moves forward very quickly.

The added cost of the prefabricated SpeedCore casings are easily absorbed by the money saved by the speed of construction and reduced labor costs. Quicker occupancy of the building is obviously another plus of this technology. In the end the building goes up faster and is better prepared to survive the mega storms that global warming might throw at it during the building's lifetime.

The engineering firm Magnusson Klemencic Associates is responsible for the full development of this technology. They have created a YouTube video, *Rainier Square Core Side-By-Side Comparison,* to help people understand the advantages of the SpeedCore construction system. You will find it online at: https://www.youtube.com/watch?time_continue=21&v=_joMFRHgwCg

Taking It a Step Further

1. Tech Challenge: Your mission, if your teacher assigns it, is to build the tallest tower possible. (Materials and amount of each material that can be used to construct the towers will be determined by your teacher.)

2. To further test the different towers that the class builds, design a testing procedure to see which groups' tower is most wind resistant and best able to withstand the shaking of an earthquake.