Building for Tomorrow

The Indian River Inlet Bridge Newsletter

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Leon O'Neill (DelDOT)

This month's issue of *Building for Tomorrow* will be looking at one of the most noticeable features of the new Indian River Inlet Bridge: the cable stays. As we mentioned in our September edition, the color of the cable stays, blue, was voted on and chosen by people like you. Other than making the bridge look really nice and different from many other bridges, the cable stays play a big role in making the bridge safe and secure. They work together with other bridge features to hold up the weight of the structure and help it last for a long time.

This month's featured guest is Leon O'Neill, Site Manager for Freyssinet International, which is the company that is in charge of the cable stays. Leon is one of the people working on the bridge who has traveled a long way for his job. Freyssinet is a company that is based in France and Leon is from England. He has worked on these types of bridges all over the world and brings a lot of experience to the job site.

The Science Behind Cable Tensioning

A lot of science and math go into the tensioning of the cables on the new Indian River Inlet Bridge. With the system being used on the bridge, each of the strands is individually tensioned using a hydraulic jacking system. The system grips the strand and pulls it to the required force, which is measured by a mechanism built into the jack itself.

The jack is controlled by a computer system that measures the load on the bundle of strands that make up one stay, while a second mechanism ensures that all the strands will reach the same tension.

The load to be applied is given by the bridge design team who calculate the position and load on every part of the bridge, at all the stages of construction, and prior to the opening of the bridge.

The History of Cable Stay Bridges

Brooklyn Bridge

Cable Stay type bridges have been around a lot longer than a lot of people think and can be traced back more than four centuries.

Many early bridges using cable stays incorporated both cable stays and suspension cables. One very famous example of this is the Brooklyn Bridge in New York City, which was completed in 1883.

In recent years, starting around the 1970s, cable stay bridges have become increasingly popular, as improvements in materials and technology have resulted in cable stays bridges becoming a fast and economical way to cross medium to long spans (300 to over 3000 feet).

Cable stays also have the advantage of being able to easily incorporate extra towers, creating multi-span bridges which can be several miles in length.

The cable stay bridge system, which is a unique feature of the new Indian River Inlet Bridge, was a development of the post-tension system invented by Mr. Eugene Freyssinet, in France, in the early 1900's. The system has been continually developed and improved since that time.

What Is A Cable Stay and How Do They Work?

Workers at the new Indian River Inlet Bridge work to install the stay cables (Skanska USA Civil Southeast).

The cable stay system being used on the new Indian River Inlet Bridge is a parallel strand system, where the stays are made up of several individually protected strands inside a protective plastic tubing, also known as an HDPE (High Density Polyethylene) sheath. This tubing, which is blue, offers additional protection from the ultraviolet rays from the sun, as well as giving an aerodynamic profile to help the cable withstand bad weather conditions, such as high winds and heavy rain.

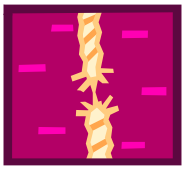
Each strand is made of seven steel wires, which are wound into a single strand, .62 inches diameter. The strand is then coated with a protective wax and placed in the plastic tubing.

This strand is capable of withstanding over 25 tons of load, providing exceptional resistance to the fatigue caused by the various changing loads on the bridge. It also has the multiple levels of corrosion protection needed in the harsh marine environment at the Indian River Inlet.

The steel part of the strand is what carries all the load of the bridge deck and all the traffic that will drive across it. Each strand is individually anchored and is gripped tighter and tighter as more load is applied. The anchor blocks themselves are resting on steel bearing plates that are cast into the concrete deck and pylon.

With the cable stay system, all the vertical loads from the deck are carried by the cables up into the pylon which then transfers the weight into the ground through the foundation piles. All the horizontal loads, that occur as a result of the angle of the cable stay, are passed through the deck itself, and balanced out as the main span and back span push against each other. It's this balancing effect, which leaves only a vertical force in the foundation, which is one of the main reasons that cable stays bridges can be built so efficiently compared to other types of bridges.

A (Kind Of) Cable Stay Activity



If you are wondering what the cable stays look like up close, you can see a picture on the last page of this newsletter, but here's a way to see how they work.

Ask your parents to get a piece of thick rope and ask them to cut it so that the rope begins to unwind. The cables on the new Indian River Inlet Bridge operate under almost the same principle. Though the cables on the bridge are steel, they still wrap around a central core to create strength. The rope is also made up of many smaller strands that are all wrapped around the central core to create a stronger, better piece of rope. Apart, the strands are not very strong, but together they have a lot of strength.

Now you know how the cable stays work!

Do you want to see the bridge being built before your eyes?

You can view up-to-date time-lapse video that shows construction from the start.

Click Here to Visit!

Do you know what pieces of the bridge look like?

It takes a lot of different equipment and materials to build a bridge, like:

Cranes
Cement Mixers
and A lot More!

Test your skills at the Indian River Inlet Bridge website today!

Click Here to Start

Cable Stay Bridges Everywhere!

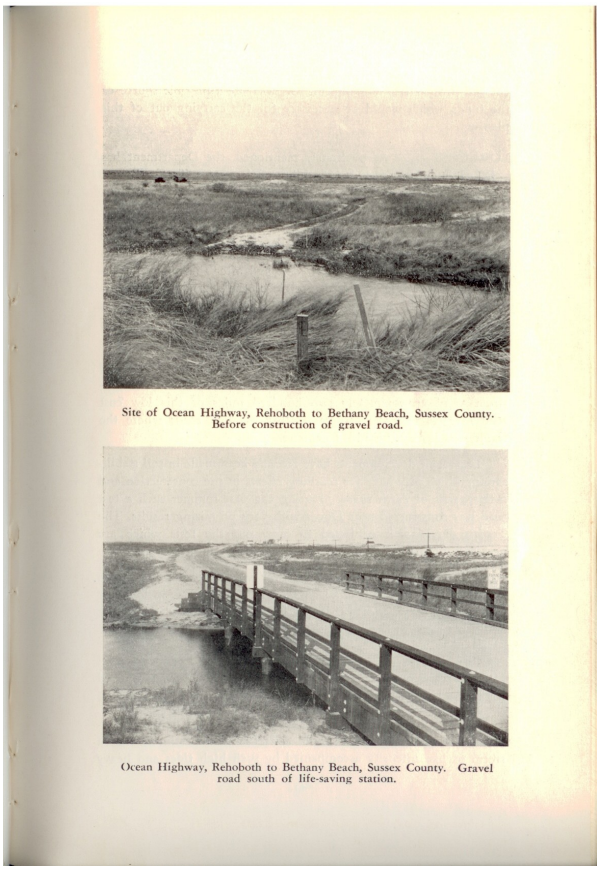
Some other cable stay bridges in the United States include the William V. Roth, Jr. Bridge here in Delaware. The bridge crosses the C & D Canal and is 4,650 feet long with a 750-foot deck. It was also Delaware's first cable stay bridge. The Arthur J. Ravenel Bridge over the Cooper River in Charleston, South Carolina is currently the longest span in North America, with a main span of over 1,500 feet. The Bunker Hill Bridge in Boston with 10 traffic lanes and an overall width of over 180 feet, is the world's widest span.

The cable stay system has also been used on many bridges worldwide, including the Rion-Antirion Bridge in Greece, across which the Olympic torch travelled on its way to the 2004 Olympic Games in Athens. It was designed to allow the pylons to move around during an earthquake without damaging the road deck.

Opened at the end of 2004, the Millau Viaduct in France, is the world's longest span with a cable stay supported length of 8,070 feet. The pylons of the bridge top out at over 1,120 feet and are the world's tallest.

Another is the Oresund Bridge, linking Denmark with Sweden, that used a combination of cable stays, a viaduct, and a tunnel to cross the 10 mile straits between the two countries. With a total length of over 25,700 feet, the double decked bridge is the longest combined road/rail bridge in Europe. Its cable stayed main span of 1,600 feet make it the longest of its type in the world.

A Moment of Bridge History



Site of Ocean Highway, Rehoboth to Bethany Beach, Sussex County. Before construction of gravel road.

Ocean Highway, Rehoboth to Bethany Beach, Sussex County. Gravel road south of life-saving station.

These photos show Ocean Highway, now modern day Route 1, before and after it was turned into a gravel road. Before being covered with gravel the road was very difficult to travel. The Indian River Inlet Bridge also makes it a lot easier for travelers on Route 1 to make their way over the Indian River Inlet to points north and south.

Employee Spotlight!

This is where you get to meet someone who is building the Indian River Inlet Bridge!

What's your name?: Marx Possible

Who do you work for?: DelDOT for 5 years

What is your job title?: Civil Engineer

Where are you from?: Mahwah, NJ

Where do you live now?: Smyrna, DE

What are some special skills that you bring to the project?: Bachelor of Science in Civil Engineering, overall general knowledge of construction.

What do you enjoy most about working on this project?: The overall project due to its scale and the type of construction. It's rare to have a cable-stay bridge in this country, as well as having the chance to work at the beach.

Photos from the Job Site

October 2010

Workers at the Indian River Inlet Bridge attach the cable stays that will support the bridge (Skanska USA Civil Southeast).

Cable stays with their signature blue covering are installed on the pylon of the Indian River Inlet Bridge (Skanska USA Civil Southeast).

Cable stays that have been anchored into one of the anchor boxes inside of a pylon at the new Indian River Inlet Bridge (Skanska USA Civil Southeast).

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