John Grady, New York State Department of Transportation Regional Construction Engineer
Interviewed by Mountain Lake PBS

Part 1: July 12, 2011

"My name is John Grady. I'm the Regional Construction Engineer for NYSDOT Region 1 and I'm in charge of overseeing all of the construction projects in our eight county area.

Well, the old bridge was built in a truss, which is comprised of lots of little pieces, with lots of rivets. Steel back then wasn't available in long pieces like it is now. So it was painstakingly put together [with] much different equipment, very simple equipment, old wood derricks and lifting equipment and train tracks on the bridge to push concrete carts on. It was a much different time of construction, used a lot more labor and a lot less equipment.

Pretty amazingly, they were able to build that bridge in 14 months and that was over a winter period, so that original construction was very fast. We're trying to do this one in 16 and it's very difficult, even with all of our modern equipment and methods.

The new Lake Champlain Bridge is going to be 2200 feet long. It will have a center arch span that is 402 feet long, that's about 80 feet over the water and the arch itself is about 83 feet tall. So the total bridge is almost 160 feet.

The original bridge was somewhat similar. It was actually a little bit taller. The original bridge had about 90 feet of clearance and that was because back in 1929, steam ships travelled the lake had very massive smoke stacks and they needed to be able to clear the bridge.

The way this bridge is being built is the center arch is being built off-site as a way to fabricate it and be able to lift it in one piece. It needs to be built on land where it can be built easily and then floated in. So it's being built at a marine facility in Port Henry about two miles from here. It's being built on temporary supports there, being built in its entirety. It will then be transferred onto two barges and floated here to the bridge site where it will be lifted into place to finish the main span of the bridge.

Well, certainly it will be a big finale of at least getting the bridge, looking like it's done. Certainly after that's done, we have a lot of work left to do to deck that arch, it won't have its concrete deck. I think it will be a big point. It will be very interesting to see it floating down the lake. It'll take a long time to lift it up, but certainly I think that will be a big point, but the real big point will be when we can finally open the bridge.

A magnificent bridge

The old bridge was a magnificent old bridge and I remember sitting in a meeting when we came to the conclusion that the bridge had to be closed and that was very difficult. And then over the next several months when we did our analysis and looked at the bridge and the conclusion came that we couldn't save the bridge, we had to take it down, which was kind of sad. It was such a beautiful bridge but we couldn't save it, so we had to find a way to build a new bridge and we needed to build the bridge in the exact same spot because of the difficulty with the land restrictions we have here.

The old bridge was demolished by a controlled demolition that was done because it is very difficult to take apart piece by piece, you can't just take a truss apart, if you take a few pieces out, they collapse. So, it had to be taken out the entire truss portion about 1780 feet of it in one controlled detonation. I was here that day. I guess it was exciting but sad at the same time.

All the steel that we use for building the bridges in New York, we require our steel fabricators to preassemble them at the fabrication shop to make sure all of the steel fits together before it gets to the site. So, this entire bridge both the approaches and the arch section were all preassembled at the fabrication shops in Pennsylvania. They put them together in pieces on the ground, to make sure all of the connections line up, all of the pieces fit, so that when we get it here in the field, we don't have a big problem trying to put it back together.

Often times we have the public involvement when we're designing a bridge but not to the level we did here. We had a tremendous group of individuals, our advisory committee, just individuals from the area, who participated in some of our meetings and in our talks about the design of the bridge and that's a bit unusual. But because it was such an important bridge to the people of this area, we wanted to make sure the new bridge was going to be important and fit the needs as well.

The final design that was chosen is a beautiful structure and in many ways, it silhouettes the old structure, it's very similar in look, very similar in proportion. I think the people really took to that bridge because although it's modern, and technically a different type of bridge, a cable bridge, it really still looks the same from a distance and I think that really was important to the folks living here.

Some of the challenges when we built this bridge were the fact that we were trying to build a bridge, where there used to be a bridge that we just demolished. And we went to great measures to try and find every piece of steel we dropped in the lake. Unfortunately with the very soft soil conditions and the mud at the bottom of the lake, we missed a few and we found those, a couple of those, when we were drilling our shafts, the large 6-foot diameter shafts that support this bridge's bedrock. So that was a challenge, building it right in the same spot. Certainly trying to build a bridge continuously through the winter in this climate was very, very difficult. And unfortunately this winter was a very severe one, both the cold and very heavy snows. And then this spring unfortunately when all of that snow melted and we had a lot of rain, as we all know, the lake set new record highs and the flooding was devastating in this area and certainly impacted the construction of our project, especially the construction of our arch site at Velez [Marina] in Port Henry where that site was underwater for about six weeks.

Collaborative effort

Throughout the construction of our project from the very beginning, even when we were building the ferries and building the new bridge, we've worked very closely with archaeologists on both sides of the lake in both Vermont and New York and they've worked hand in hand with us. It's been a very cooperative mission and as a matter of fact, as part of our bridge construction a fort that was thought to be located on the Vermont side from 1731, a French fort, was actually found and preserved as part of our construction project so, I think we're at least able to find it and document it and they now know where it is.

As far as a counterpart on the other side, this bridge is being built under the jurisdiction of New York State DOT [Department of Transportation]. When the Lake Champlain Bridge Commission was dissolved in the 1970s I believe it was, the bridge at Rouses Point was under the jurisdiction of Vermont DOT [Vermont Agency of Transportation], with joint ownership that they manage that bridge and this one became the responsibility of New York State DOT. So while we have Vermont Agency of Transportation folks that we deal with and we interact with, the actual construction of the project is managed by New York State DOT."

The whole project between the two states was progressed in a collaborative manner, we certainly had lots of meetings, they participated in the design process with us, in the public meeting process and all of the arrangements with all of the locals and meetings and it's been very collaborative. It's just that the actual building of the bridge is under the jurisdiction of New York.

Construction challenge

Back when the bridge closed, it became very clear to us that the folks needed another way to cross. The existing ferries on the lake were more than 20 miles north of here or 12 miles south and one of them closes every winter and the other one often closes. So the land detour to get over without a bridge is over 80 miles, so we quickly learned that the best thing we could do because we couldn't find a place to put the temporary bridge because of the width of the lake and the difficult soil conditions, was to build a temporary ferry. And through cooperation with the state of Vermont and their cultural folks, in the Chimney Point Museum and with the cooperation of the New York State DEC [Department of Environmental Conservation] on the New York side, we were able to build a ferry access adjoining the old bridge site. And we did that through a long and very difficult winter and those ferries opened up on Feb 1st of 2010 and it was a great relief to folks in that area to finally be able to cross the lake again near where they always had.

The soil conditions at this site are very difficult. The soils in this lake are fine, very silty soils, very unstable. I describe them best as being like yogurt. And in the middle of the lake there's about 45 feet of water and about 60 feet of that very soft soil that really has no engineering value. So our shafts that hold up this bridge, drilled shafts go down through all that mud and into the bedrock. There's 32 of those six-foot diameter shafts that support this bridge. They support six of those piers. The seventh pier in Vermont is actually founded up on bedrock on the shore. But the soil conditions are just very troubling for engineers they offer very little lateral support, so we had to go all the way to that bedrock and tie deep into that bedrock in order to support this bridge.

Well over my career, I've dealt with a lot of big projects. I used to cover construction in New York City and Long Island for the departments. So, I've had the honor of working on bridges like the Brooklyn Bridge and the Manhattan Bridge, Robert Mosses Causeway out on the beaches in Long Island. So, certainly I've been on some bigger projects, but most of those were rehabs or fixing up old structures. This is certainly the largest new bridge, I've worked on. We have another large bridge in the region that's going on as well, but certainly it [Lake Champlain Bridge] is a special bridge, it really is a beautiful bridge and we'll become what people will call a landmark bridge. So, it certainly is an honor to be involved.

Demise of 1929 bridge

The original Lake Champlain Bridge really had two problems that were plaguing it. One was corrosion of the steel, as we put salt on roads, unfortunately it's really difficult on the steel. But the real problem that caused us to have to demolish it was that the concrete was deteriorating badly and worse than that it was unreinforced concrete. It had no real steel reinforcement in it to help hold it together. So, some of the things we've done on this bridge, to make it much more durable is certainly all of the concrete piers are reinforced. We used what's called epoxy-coated reinforcing in and around areas where it's exposed to salt and certainly the steel will be much more durable. We're using a self-weathering steel which protects itself and as well, rather than painting it, we're flame coating it with a zinc-aluminum mixture, so it's sprayed on like a galvanizing mixture but sprayed on with heat and this bridge will never need to be painted. This metal protection will offer double protection of the steel and all of our cables in our tied arch are jacketed and greased, so none of those cables should deteriorate and if they do, there's actually a way to replace them one at a time, while the bridge is still open to traffic.

This bridge should require very little maintenance. We do wash bridges, that's one of the things we do to get the salt off them, but other than some minor cleaning and washing, it really shouldn't need much maintenance.

Well the new bridge, the official design we always design for 75 years but I'm pretty comfortable that it will last much longer than that. The original bridge with far less protection lasted 80 years, so I'm pretty comfortable this one will last much longer than that.

As far as progress on the bridge, we're very pleased with the progress we've seen. Certainly this past spring was very difficult on the project, with the high water levels. Especially it impacted our work both here and where we're assembling the arch. But as you can see right now, all of the approach steel is up here at the bridge site. We began casting our concrete decks and that work is ongoing and will continue. And over at our marina site where we're putting our arch together, the entire floor of the arch, 402 feet long is in place and we've begun just this week, erecting our arch ribs, so that will quickly start to look like a real arch over there and we're very pleased with the progress we've made to date."

Part 2: Demolition

Interviewed by Mountain Lake PBS on August 22, 2011

"Well our emergency bridge contractor, Harrison & Burrowes, was the prime contractor for the demolition. They used two primary subcontractors on that work. Sessler Wrecking did a lot of the mechanical demolition work and AED, Advanced Explosives Demolition, took care of the controlled detonation.

This was a truss bridge and as truss bridges are erected, they're erected with supports under their entire length, so they're supported from beneath. To take it apart piece by piece we would have had to build supports once again and under the entire length of the truss structure, which would have been very expensive and very difficult. So truss structures just lend themselves to be taken down with an implosion which is an easy way to bring it down, all in one piece. If you try to take them apart piece by piece, they're prone to collapsing.

Setting the charges

Well it was a lot of work to prepare for the implosion but once the charges were set it was a single charge. There was no delay in the charge. It all was set off at one time so we had nearly 500 linear shaped charges on the bridge, almost 800 pounds of explosives, and those all went off literally within a second of each other. There is a slight delay due to the time it takes the det [detonation] cord to travel, but in essence it was one single controlled detonation.

The demolition, the explosive demolition, was actually under AED's control. They have a blast master who's licensed and certified to do that so that portion of the work was truly under their control; that's their specialty.

The work of setting the charges was very difficult because prior to setting the charges we had to do a lot of preliminary cuts on the steel where we would cut the flanges of beams so that the charge could cut the remaining sections. That work was very difficult. The steel was cold and icy and very hard to work. Your hands get cold very quickly when you're climbing and sitting on steel 150 feet in the air, but they were able to get through it and it took us a little longer to prepare the bridge than we planned but in the end the detonation did work properly.

The actual crews working on, preparing for the implosion, it was probably about 15 folks working; some doing preparation work and some actually doing the cutting and setting of charges. And the work that was afterwards, when we were trying to recover all the steel from the lake, we had a crew of about 20 people working. When we were trying to remove all the steel pieces from the lake it was very difficult. It did take us longer than expected, especially in the deeper water. Because of the soft soils the steel sunk and the visibility when we did use divers was very limited. So it took us a little longer; plus the winter conditions, we had to break ice and work throughout the winter as we took out those pieces.

The removal of the steel after the implosion began within an hour of when the bridge was detonated and continued for months. It was a non-stop process. We broke ice all winter long. We used boats and different methods to keep the ice from forming in the area where we were working. We were able to work all winter long, as well as to keep a channel open from the bridge to here in Port Henry, about a two-mile travel, because we had to constantly empty our barges of the steel we were recovering to make room for more.

Implosion best removal method

We really thought we needed to get this bridge down pretty quickly once we made the decision to remove the bridge. That was because the bridge was very fragile and the stability and cold weather was difficult because as the temperatures kept dropping the bridge would move more as it shrunk. We were very concerned that it would, there was a potential for a collapse of that bridge and if it collapsed in an uncontrolled manner the removing of it from the lake would have been very, very difficult. So we were very interested in getting the bridge down as quickly as we could in a manner that we could control the fall and break it into pieces that we know we could recover so that it would make the recovery easier and more effective.

This implosion was done using what are called linear-shaped charges or what some folks might call cutting charges. There was no traditional dynamite or TNT, traditional explosives used. These linear-shaped charges are a copper tube that's filled with a high explosive, and the shape of them causes them to explode and form a cutting edge that cuts the steel at hypersonic speed. So we cut the steel at the bridge in places where we wanted to, where we knew it would work properly based on a demolition plan. We used nearly 500 linear shaped charges, about 800 pounds of explosives, to bring that bridge down.

What a linear-shaped charge is, is a copper tube, as I said filled with a high explosive. It has an inward V shape and, as it explodes, it thrusts outward and it forms a cutting edge. This is actually a piece of, [shows example] one of the linear-shaped charges we found after the detonation. This is the cutting edge that went against the bridge and would actually slice the steel moving at hypersonic speed. This is the kind of tool we use to do that.

The main channel of the lake is about 45 feet deep so we had to retrieve steel that fell to the bottom of the lake in that depth. The central spans on this bridge span six, seven and eight [feet] over the deepest water. We segmented the bridge in 20 foot and 30 foot sections. That allowed us to cover those much easier. In the deep water we used both divers and cranes and also grapples to reach down and pull that steel out of the water. In the shallow areas near the shores we actually dropped entire spans in single pieces because we were able to move in with either barges or work from our causeways to recover that steel [using]more traditional methods and cut it and remove it.

Recovering bridge steel

In some of the deepest areas where we couldn't reach the steel with our grapples, long in essence backhoes, we did use dive teams. They would go down and rig the steel with cables, attach it to cranes and then we used a very large crane to remove those pieces.

We worked very hard to make sure we got as much of the steel as we could. We used side scan sonar and ground penetrating radar to scan the bottom looking for pieces. Unfortunately we did miss a few, the smaller pieces, which unfortunately we hit when we were building our new bridge. But I'm pretty confident that any significant pieces have been retrieved. If any steel did get left behind, it would be deep in the very soft mud at the bottom of the lake.

It's possible that in the future that somebody could go down and find pieces of steel, but as I said they would be deep in the mud and so we wouldn't expect boaters or divers or swimmers or anyone to find any of that steel, especially since it would be in the deepest parts of the lake.

Piers susceptible to collapse

One of our concerns when we demolished the bridge was that several of the piers could fall over. That would be very difficult for us to get those piers out of the water if they fell over during the demolition. One pier did. Pier four did fall over during the implosion. We were fortunate it was in shallower water and we were able to subsequently get that pier out of the water. That was the only one that did go over. Everything else pretty much on this demolition went as we expected. It went to the plan we had.

After we demolished the bridge and we started working on demolishing the piers, we were very alarmed that we found what in essence, are cold joints. When they poured a concrete layer they would bring it up to a certain level and let it cure and then pour the next layer on top of that. There was no mechanical interconnect and it was a very smooth plane that the next layer was poured on which really made us very concerned that this bridge was probably more unstable then we even thought and supported our decision to take the bridge down because some of these piers, the way they were built, could have been very susceptible to a collapse.

You know this was a bridge of great historic significance. It was a bridge of great engineering significance. And it was a bridge of great sentimental significance to the people in this area. So the decision to take it down was difficult but one that we had to do."