

Extreme Moves

Can Reinforced Concrete Pipe carry the load—you bet, all 825 tons



Just like a scene from the History Channel's "Mega Movers" Fagioli, Inc. of Houston, Texas and Areva NP Inc. Lynchburg Va. move two 510 ton steam generators to Exelon's TMI-Unit I Nuclear Power facility in Middletown PA.

There are not a lot of roads, bridges or stream crossings designed to handle 825 tons at any one time but this is exactly what **AREVA NP Inc.** (AREVA), **Kinsley Construction** (Kinsley), **Fagioli, Inc.** (Fagioli) and **Michael Baker Jr., Inc.** (Baker) would face when moving two new steam generators to **Exelon Nuclear's** Three Mile Island Unit I, nuclear power plant in Middletown, Pa. "For Kinsley, this would be a first" said Ron Brown, Project Manager for Kinsley. "Not that we haven't built highways, bridges and stream crossings before, but the uniqueness of this project and the amount of planning and detail that went into it, is mind boggling" Brown went on to say. Kinsley is a prominent York, Pennsylvania-based, heavy highway contractor with over 50 years of highway building experience, employing some 1,300 people throughout the company and is no stranger to large, complex projects.

AREVA and Exelon's planning for this journey began in 2005 and for the average person would be considered a logistical nightmare. It would be 75 miles from start to finish and every inch of the trip would need to be meticulously planned. Baker provided all of the engineering for highway, bridge structure and traffic control design, environmental investigations and permitting, utility coordination, construction management and logistical support during the move. Other services included the Time and Motion study to determine the length of daily travel and pre- and post move bridge inspections.

Using quality-based Early Contractor Involvement method, Kinsley was selected to be part of the team in December of 2008. Early inclusion of Kinsley to the team enabled important design decisions to be made, based on constructibility issues and equipment and materials availability. Their involvement provided input into complex logistics issues and helped establish an efficient construction plan. One prime example was the concrete pipe to be used in the bypass designs. Construction was planned to begin in July 2009, shortly before the steam generators were to arrive.



825 ton transport vehicles (26 axles and 208 wheels) and some the 100+ people that it took to make sure the move went off without a hitch.

There would be involvement of approximately 150 different entities; everybody from the US Army Corps of Engineers, multiple Pennsylvania and Maryland state agencies, local agencies, churches, school districts, state police, and emergency management authorities. Public meetings were held in advance to introduce the project and identify potential conflicts. Challenges along the 75-mile route included narrow roadways, 90-degree turns, 51 stream crossings as well as hundreds of culverts, storm drains and overhead utility lines. The journey would end up taking 18 days with no worries about speeding tickets due to a top speed 3 m.p.h. The longest distance moved in any one day was 9.8 miles with the shortest being .5 mile. (The short day was scheduled to minimize daytime impacts to a residential neighborhood and to position the convoy for a 2am Sunday morning closure and crossing of a freeway.)

The Self Propelled Modular Transport (SPMT) vehicles were manufactured by **Cometto (Italy) & Scheuerle (Germany)** and supplied by Texas based Fagioli. These 315 ton behemoths are 153 feet long, 7.5 feet high and 17.5 feet wide. Combined with the steam generator they tipped the scales at 825 tons loaded and a total height slightly over 24 feet. These modular units were configured with 26 axles (13 steering and 13 braking) and 208 wheels. The SPMT's are completely adjustable depending upon payload and conditions. The journey started at the AREVA facility in Chalon, France and ended inside the TMI-Unit 1 facility in Middletown. These generators were first delivered into the port in Claymont, De and moved by barge to the Tomes Marina in Port Deposit, Md -- this is where the over-land trip would begin.

AREVA was able to utilize overbridges (30', 50' & 80') for many of the 51 crossings. In some circumstances, additional steel would be added to the existing structures to accommodate the extreme loads or shored using towers or screw jacks. When there were no other options, bridge bypasses would have to be built



PA. State Rt. 272, Pequea Creek, Lancaster County PA, bridge bypass utilizing Oldcastle's 48" CL-4 RCP and the Kinsley's composite stone construction.

using **Oldcastle** Reinforced Concrete Pipe from its Croydon facility. "To the best of my knowledge this is the first time our pipe has been used for this specific type of project and it performed flawlessly" said Ed Pentecost, PA Regional Sales Manager for **Oldcastle Precast Pipe**. Oldcastle supplied some 1700 feet of 48" CL-4 reinforced concrete pipe to this project. The pipe was used on the bridge bypasses to allow water to continue to flow through the temporary roads constructed to carry the generators. This pipe would later be removed and would be reused.

A major concern for Kinsley was the fact that even though pipe was placed to allow the continued flow of rivers and streams, Kinsley still needed to be concerned about heavy rainfall conditions. The team had several sleepless nights as a result of heavy rainfall. "In the end, everything functioned exactly as designed and constructed" commented Brown.

The Bridge bypasses were basic yet very functional. Back-fill material consisted of R-4 Rip Rap, AASHTO No. 1 and No. 57 stone being placed over and around the pipe. This composite of materials made for an extremely strong structure but at the same time was porous enough to allow for the passage of water through the structure. The pipe, 48" CL-4 reinforced concrete is designed for a D-Load of 64,000 lbs. or D-Load= 2000 lbs per/ft of length per/ft of inside diameter for the 0.01 crack. Testing demonstrated failure or ultimate at over 96,000 lbs. and this is under "Three Edge Bearing" conditions which represents the worst case scenario. These sites, and the pipe in particular, were inspected before, during, and after passage with absolutely no signs of stress or failure, certainly making concrete pipe the right choice for this job. An

excavator would crawl across the previously placed pipe sections to complete the bypass construction. Once the initial structure was completed, 18 inches of 2A coarse aggregate was placed as a cap and driving surface for the bypasses.

All in all there were 16 sites along the route that required an engineering solution to accommodate this tremendous load. Two sites required the use of over 1700 ft of Reinforced Concrete Pipe to complete the crossings. Once the move was completed the bypasses would be deconstructed and the pipe would be used again. In other cases, it was additional bracing, beams or rock buttressing. Two sites required micropiles; at one site, they were used to support an 80' overbridge that spanned a small arched bridge. The second site required micro-piles to support two gantry cranes needed to temporarily widen the SPMT's to allow them to cross a 293', 4-span bridge.

Kinsley played a significant role in the success of this project, being involved in many of the aspects of moving these giants. Kinsley staff and subcontractors provided traffic control and protection, detours, utility protection, signaling and overnight parking area improvements for the 18-day journey. After all, you couldn't leave these monsters in the middle of the road overnight.

Along the 75 mile route there were thousands of onlookers, local media coverage and the occasional dignitary. Maryland Delegate David Rudolph was there to see the generators arrive in Port Deposit and Pennsylvania Senator Mike Brubaker stopped by Columbia Borough as the transporters passed through.

Even though this was a meticulously planned operation it was still somewhat fluid with really 75 miles of "anything could happen," but when asked, Ron Brown responded by saying "at first I couldn't wait until it was over, but now I look upon it as a great experience and would love to do it again".

In the end, it was an extremely successful journey for all involved. The project went off flawlessly with the engineering, construction and products supplied performing perfectly.

Ultimately the **Pennsylvania Department of Transportation** (PennDOT) and **Maryland State Highway Administration** shoulder the responsibility for the quality of their roads along with the safety and convenience of their motoring public. Both would need to issue the proper permits to prepare pre-move works with the condition to insure that the changes that were to be made were sufficient for the intended purpose and that once the move was completed everything would be returned to its pre-move condition.

Owner: AREVA NP Inc., 3315 Old Forest Road, Lynchburg, VA

Contractor: Kinsley Construction, Inc., 2700 Water Street, York PA

Recipient: Exelon Energy Corporation
Owner/Operator of Three Mile Island

Transport Company: Fagioli Inc.,
8434 Brookside Road, Pearland Texas

Engineer: Michael Baker Jr, Inc.
4431 North Front Street, Harrisburg, PA

Supplier: Oldcastle Precast, 1900
Pennsylvania Ave. Croydon Plant, PA.

PA Highway Owner: Pennsylvania
Department of Transportation,
Engineering District 8-0 & Engineering
District 6-0, 2140 Herr St. Harrisburg PA

MD Highway Owner: Maryland State
Highway Administration, Hanover, MD

In charge of PennDOT's District 8-0 oversight was **Mazhar A. Malik**, Highway Occupancy Permit Manager for PennDOT. It would be Mazhar and his team's responsibility to issue the permits and thoroughly inspect every inch of highway, bridge and temporary structures within its District. Mazhar and his group thoroughly inspected every inch of these stone and concrete pipe structures and were completely satisfied pre and post move of what Mazhar described as a "Super Load." The District 8-0 Team would also be responsible for

the inspection of the temporary stream bypasses, which were constructed by Kinsley, to insure that they met all of PennDOT's standards. PennDOT along with the large contingency from AREVA, Kinsley, Baker and Fagioli would follow the generators to their final destination in Middletown.

"Everything went perfectly, with services, products, people and Pennsylvania Highways performing tremendously well," commented Mazhar. "We were quite satisfied with the entire project."

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