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CENTER FOR UNDERGROUND INFRASTRUCTURE RESEARCH AND EDUCATION

AMERICAN WATER, CUIRE EVALUATE IPVC

The Center for Underground Infrastructure Research and Education (CUIRE) along with American Water (AW), Voorhees, New Jersey, and Pyungwha Pipe Industry Inc., South Korea, are joining efforts to evaluate strength characteristics of a new pipe manufactured by Pyungwha Pipe Industry called iPVC.

Pyungwha Pipe Industry's product is a slightly thicker PVC with a new formulation that appears to display impressive pipe strength that might rival ductile iron pipe. The innovative iPVC offers some unique features in strength, most notably not failing when pressurized water is frozen inside. CUIRE and AW are seeking to highlight the characteristics and demonstrate the true installation requirements for iPVC in water applications.

The research project is summarized in five tasks as below:

1. **Literature Review** – CUIRE and AW will collect verifiable data from prior testing of the iPVC and other variants of PVC products as well as ductile iron pipe. The review will also include gaining full familiarity with bedding, backfill and loading criteria for iPVC.
2. **Material Testing** – Since iPVC is an untested product in the United States, CUIRE will perform the testing on the pipe material to evaluate the characteristics and authenticate the results, which would be available to utilities in the United States.
3. **Testing Review and Analysis** – CUIRE will report the findings of the test, which will be assessed by AW and compared to characteristics of ductile iron and the criteria for installation required. Further, the data will be communicated to Missouri AW to gain their acceptance for the installation criteria to be used on the iPVC pipe.
4. **Field Installation** – Missouri AW will install 1,500 ft of iPVC and the available PVC pipe (PVCO) will also be installed for comparison. Missouri AW staff (installation and engineering) will provide key comments on the products installed and will assist in developing an installation manual for iPVC.
5. **Project Output** – AW with CUIRE will be monitoring the field installation and preparing installation guides tailored to the products installed. The findings from the test results will be communicated to the utilities in the form of a research report clearly stating the pipe characteristics as well as user's manual for installation. The project aims to create awareness among water utilities about the new PVC alternative and to introduce a potentially innovative new PVC product in the United States.

NEW CUIRE PROGRAM MANAGER

In May 2016, the Center of Underground Infrastructure Research and Education (CUIRE) will have a new program manager. Niloofar Rezaei is currently a graduate research assistant with CUIRE and plans to graduate in May 2016. Rezaei received her bachelor's degree from Shiraz University in Iran in January 2015 and started her graduate studies in civil engineering, majoring in construction engineering and management at the University of Texas at Arlington. She is enthusiastic about working at CUIRE, and is active in trenchless technology and has participated in trenchless and pipeline conferences such as ASCE, No-Dig and UCT.

UNDERGROUND FREIGHT TRANSPORTATION PROJECT MOVES FORWARD

The Texas transportation system is the critical system in the United States due to the North American Free Trade Agreement (NAFTA) and freight transportation in the Port of Houston as a first-ranked U.S. port in foreign tonnage. Through 2030, NAFTA trade will increase nearly 207 percent by tonnage, resulting in profound impacts on the Texas highways and rail systems. Larger ships with higher capacity will arrive in Port of Houston due to expansion of the Panama Canal. Therefore, increasing the capacity of the freight transportation system is a must.

The purpose of this project is to investigate the feasibility of employing a variety of underground freight mobility technologies that allow for the optimized use of the available highway capacity. Underground freight transportation (UFT) is a class of unmanned transportation systems in which close-fitting capsules or trains of capsules carry freight through tubes between terminals.

Being able to use part of the underground space of the existing right of way of highways, especially of interstate highways, will greatly facilitate the construction of such tubes and reduce the construction costs. By considering planning and design, construction methods, cost analysis, environmental impacts, financing means and stakeholder committee, this project examines the use of UFT in three proposed routes in Texas, specifically, Port of Houston to City of Dallas, Port of Houston to a distribution center within 15 miles, and the border crossing with Mexico in Laredo.

The objective of the planning and design task is to develop schematic designs for standard shipping containers. The design components include the conduit system, the vehicles (capsules and bogies), the conveyance system (tracks and power systems), the access and ventilation shafts, and the terminal design and intermodal load transfer systems.

The purpose of the construction method task is considering different options for tunneling, open-cut and propulsion systems. This task will provide a decision support system for determining an optimal construction method for the routes proposed in the planning and design task. Both open-cut and tunneling for two parallel tunnels, and one single tunnel with two tracks will be considered.

The tunneling and open-cut costs are about 80 percent of the cost of UFT system. Based on the literature and consultation with industry experts, a proper approach is carefully selected and used to estimate the costs. The estimated construction costs of the UFT system was compared with highway construction costs. This comparison clearly shows that construction cost of the UFT system is compatible with highway construction and maintenance.

Environmental impacts and social costs are becoming more important as public awareness grows and the need to conserve and protect our environment and quality of life is better understood. The UFT system will increase the freight transportation capacity and decrease the social costs and environmental impacts of conventional method. Government agencies may lose revenue due to fuel taxes, but overall UFT has many benefits such as decreasing air pollution, noise, and reducing traffic congestion and accident rates.

Task 5 of this project will evaluate financial aspects. The project delivery methods that were considered were design-build-finance-operate-maintain (DBFOM) and design-bid-build. The contributions of both private and public sectors were critical for the success of this project. The investigation of the case studies shows that the potential for significant private investment in UFT, can be as high as two thirds or even all the project costs.

A stakeholder committee was formed to guide the researchers in all aspects of this project. The stakeholder committee is in support of the project and has recognized the needs for UFT for future of freight transportation in Texas.

By considering planning and design, construction methods, cost analysis, environmental impacts, financing means and the stakeholder committee input, this project has determined that underground freight transportation will be an important part of intermodal freight mobility in Texas.

CUIRE BOARD MEMBER DIRECTORY