A Transforming Concept: On-Site Manufactured Joint-Free Pipe

A UA professor has invented a lightweight pipe that is environmentally friendly, that will help lower transportation costs and is theoretically infinite.

Mo Ehsani, a professor emeritus of civil engineering, was initially looking for a way to strengthen pipes. The project has since become a revolutionary concept allowing him to create the InfinitiPipe.

“often times you may not appreciate pipes because you don’t see them,” Ehsani said. “But there’s truly a lot of money that needs to be spent on fixing this buried infrastructure.”

The infinite pipe is made up of a honeycomb core, wrapped in carbon fiber fabric, that weighs about 10-15% of a typical steel or concrete pipe. Because there is less material, the pipe is more environmentally friendly, easier to transport and is less expensive.

To make it “infinitely” long, once 20 feet of pipe is made contractors can pull the finished pipe out of a mold, except for a couple of feet. Then more pipe is made on the tail of that and so on, according to Ehsani.

A typical pipe requires a joint every twenty feet, which increases the chances of a leak. However, the infinite pipe can be manufactured so that only one joint is needed every thousand or so feet.

“If you only have a joint every two thousand feet you can afford to monitor that joint very efficiently,” Ehsani said. “If there’s a leak you can have an alarm that alerts operators that something happened.”

Along with being environmentally friendly, the pipe will be easy to build in developing nations. Raw materials can be transported in a container and locals can make pipes for themselves, according to Ehsani.

“I can truly tell you that of all the things I’ve invented in my career, this is by far the most game changing and really revolutionary project that I’ve come up with,” Ehsani said.

Whether or not the InfinitiPipe is used by a large percentage of people the groundwork has been laid for showing people that an infinitely long pipe, without joints at every 20 feet, is a reality and can be made, he added.

“Even if nobody starts using this infinite pipe that I have developed, at least I hope that this will plant enough seeds in the minds of other creative people to pursue similar approaches.”

Ehsani taught at the UA for 28 years; time which he credits for his advancements in the invention of the infinite pipe.

“The very early stages of this technology is something we started at the UA back 25 years ago,” Ehsani said. “That’s really what laid the groundwork for these developments after some 20 years later.”

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Ehsani is president of a company called QuakeWrap, which he founded in 1994. In order to make business grow he decided to leave the university in 2010 and become a professor emeritus. As a professor emeritus Ehsani has access to the facilities on campus, but he does not have to be there every day.

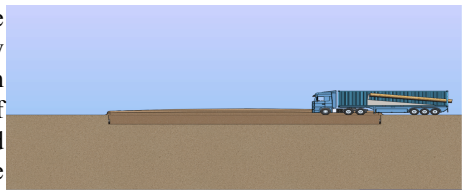
Initially, Ehsani wanted to focus on strengthening pipes, but as time went on he thought more on how to improve the pipes. There are always ways to improve something, as opposed to thinking it's the ultimate, according to Ehsani.

"There are so many improvements that can be made," Ehsani said. "It's just really having that creative mind and not accepting the status quo as being the best you can put up with it. Just be open to crazy ideas and give them a try."

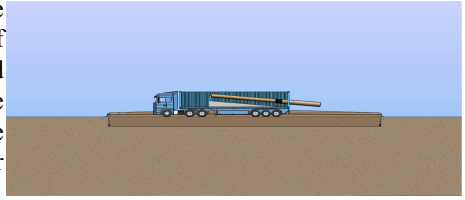
This paper presents a revolutionary concept that overcomes the above shortcomings. The newly-developed pipe takes advantage of engineering principles to manufacture a light-weight but stiff pipe whose construction does not require an elaborate manufacturing plant. The new pipe is comprised of a light-weight core covered with carbon or glass Fiber Reinforced Polymer (FRP) materials on both the interior and exterior surface. The pipe is made on-site on a moving platform in a continuous operation and is directly placed in the trench. The resins in the FRP can be selected from commonly used polymers to ensure proper durability; the reinforcing fibers in the FRP are designed to resist the internal pressure. The first application of this product is tentatively scheduled for 1500 ft of a 42 inch pipe in fall 2012.

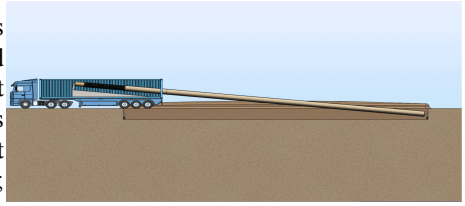
Construction of pipelines heretofore has required major manufacturing facilities; this leads to building the pipe in small segments in a plant, shipping and assembling the segments on the job site. The pipe sections are typically made in 20-feet (7-meter) long pieces and are shipped to the job-site for assembly in the field. This adds significant transportation and installation costs. Worst of all, joints are the weakest link in the pipe where water, gas or oil can leak and cause environmental damage. For sewer pipes, these joints become a source of penetration of roots and a constant maintenance expense.Depending on the site location, shipping charges could become very large. The resulting pipelines have joints every 20 feet or so. Joints are the major source of leaking and maintenance for pipelines.

InfinitPipe™ is the latest revolutionary product developed by Professor Ehsani that allows construction of a pipeline of virtually any size and shape on-site! Most pipes manufactured to date require extensive heavy equipment that necessitates manufacturing in a plant.



The revolutionary *InfinitPipe*™ overcomes all of these limitations. The pipe is manufactured on-site by raw materials that are very lightweight and compact and can be shipped in ordinary containers. The construction of *InfinitPipe*™ is very similar to *StifPipe*™ that is explained on this link. The process starts with a mandrel that has the same shape and size as the pipe being manufactured. Various layers of Carbon FRP and spacer products are wrapped in the field around the mandrel. The number of layers of Carbon FRP is designed based on the required internal pressure of the pipe. The spacer is what gives the pipe its overall stiffness and rigidity. The outer skin of the pipe is wrapped with layers of Glass or Carbon FRP for environmental protection.





Much like the construction of a steel I-beam, this innovative pipe takes advantage of this long-recognized engineering principle and uses an inexpensive light-weight core as the web, while the more expensive carbon fabric is used for the skin only. The epoxy resin is cured in a short time and the pipe is partially slipped off the mandrel;

used for the skin only. The epoxy resin is cured in a short time and the pipe is partially slipped off the mandrel; additional lengths of pipe will be made in a continuous manner with no joints -- resulting in an infinitely long pipe!

Pipe is manufactured continuoulsy on a mobile platform and is directly placed in the trench

Advantages:

- Built on-site to any length and diameter
- No joints to leak
- Reduces transportation costs
- Designed for any internal pressure
- FRP materials means no corrosion
- No cathodic protection required
- Pipe is directly placed in trench
- Construction can begin immediately – No waiting for pipes to be manufactured
- Provides employment opportunity for locally-trained workers
- Pipe weighs 15% of conventional pipes
- A sustainable green technology
- Significant time and cost savings