StifPipe®: A Record-Breaking Solution for Detroit's Critical Sewer Rehab

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In the heart of Detroit, beneath the bustling streets and sprawling neighborhoods, lies one of Michigan's most critical yet largely invisible pieces of infrastructure: the Oakland-Macomb Interceptor Drain (OMID), a 17.5-foot diameter sewer tunnel constructed in the 1970s. Serving more than 800,000 residents across 23 communities in Oakland and Macomb counties, this massive concrete tunnel has been the silent workhorse of the region's wastewater system for decades.

However, like many aging sewer systems across the country, the OMID faced a formidable enemy—microbially induced corrosion. The high concentrations of hydrogen sulfide (H_2S) gas within the tunnel had begun deteriorating the concrete lining, threatening the structural integrity of the entire system and raising concerns about potential service disruptions for the hundreds of thousands of residents who depend on it daily.

Confronted with the urgent need to rehabilitate this essential pipeline, the project's engineers considered multiple technologies to line the deteriorated tunnel. The approved solutions included a segmental fiberglass pipe by Channeline, a segmental polymer concrete called P3 Polymer by Hard Rock and StifPipe®. The properties of the three systems are summarized in the table below. Two of the approved systems required sliplining the sewer with segmented liners—essentially assembling pipe sections piece by piece, like a giant underground jigsaw puzzle. While effective, this method presented significant logistical challenges, including extended installation times and the need for heavy machinery in confined spaces.

Table 1. Characteristics of the three approved pipes for the project

	StifPipe®	**Channeline**	**P3 Polymer (HardRock)**
Monolithic or Segment	Monolithic	Segment	Segment
Length (ft)	14	7.2	6
Wall Thickness. (in.)	1.95	3.54	4
Weight (lbs/ft)	570	1800	3080
Installation Speed (ft/month)	200	102	46.5

But one company, QuakeWrap®, Inc., brought a transformative approach to the table. Leveraging cutting-edge composite technology, QuakeWrap offered an alternative that not only met the technical demands of the project but also redefined what's possible in large-scale pipeline rehabilitation.

StifPipe®: The World's Largest Polymeric Pipe

QuakeWrap's StifPipe® system was selected as the third approved technology—but with a significant advantage: it was the only solution that could deliver 16-foot diameter liners as monolithic pipe segments, likely the largest polymeric pipes ever manufactured in one continuous

piece. In 2016, this groundbreaking technology earned StifPipe® the ASCE Innovation Award, recognizing it as the world's first green and sustainable pipe.

The design of StifPipe® reflects a fusion of patented innovation and engineering precision. Constructed from a proprietary blend of carbon and glass fiber-reinforced polymers (FRP) combined with a specialized core layer, StifPipe® delivers an unmatched combination of stiffness, lightweight performance, and corrosion resistance. Traditional design standards, such as AWWA or ASTM, do not account for pipes of such immense scale. As a result, QuakeWrap's engineers conducted detailed 3D Finite Element Analysis (FEA) and full-scale testing on actual pipe segments to validate their structural performance (Fig. 1).

Compared to its segmented competitors, StifPipe® offered several distinct advantages. It provided the longest individual pipe segments, required the smallest wall thickness, and weighed three to five times less than traditional alternatives. These attributes not only simplified logistics but also significantly reduced installation time, a critical factor when working within the narrow window allowed by urban infrastructure projects.

Localized Fabrication: Reducing the Project Footprint

One of the most impressive aspects of the Detroit project was the on-site fabrication of the StifPipe® segments. Unlike traditional concrete or steel pipes, which require large-scale production facilities and heavy transport equipment, StifPipe® is manufactured using lightweight composite fabrics and core materials that are saturated with resin and wound around a rotating mandrel.

This portable manufacturing process enabled QuakeWrap to construct the pipes near the job site, reducing transportation costs and environmental impact. Once the resin cured—a process that took approximately one day—the mandrel was collapsed, and the finished pipe was extracted, ready for installation. This innovative approach eliminated the need for large-scale fabrication plants and heavy equipment, offering a scalable model for pipeline rehabilitation worldwide.

Ensuring Long-Term Performance with Advanced Inspection

Quality assurance is at the core of QuakeWrap's engineering philosophy. To ensure the structural integrity of each StifPipe® segment, the company deployed state-of-the-art non-destructive testing (NDT) methods. Specifically, the guided wave ultrasonic technique was used to assess the health of the pipe's honeycomb core structure.

This advanced inspection method involves exciting ultrasonic guided waves through piezoelectric transducers to detect internal anomalies or defects. Since this technique only requires access to one side of the pipe—a crucial advantage when working with buried or inaccessible infrastructure—it accurately simulates real-world conditions. By monitoring changes in signal characteristics such as time of flight, frequency, and amplitude, engineers could verify the consistency and quality of each pipe segment, providing confidence in the system's long-term durability (Fig. 2).

Innovating Installation Techniques

In addition to its revolutionary product design, QuakeWrap brought equally innovative methods to the installation process. Each 16-foot diameter StifPipe® segment, weighing approximately 8,000 pounds, was fabricated in 14-foot lengths to minimize the number of joints and ensure the segments could pass under several low-clearance bridges on the route to the job site (Fig. 3).

Once delivered, the pipe segments were lowered vertically through a 30-foot diameter access shaft into the existing sewer tunnel. A custom pipe mover was then employed to transport the segments horizontally within the confined space of the host tunnel (Fig. 4). This specialized equipment ensured precise placement of each liner segment while avoiding the need for cumbersome machinery.

To complete the installation, the 9-inch annular space between the StifPipe® liner and the host pipe was filled with low-strength cementitious grout. This step stabilized the liner, prevented flotation, and ensured a snug fit, restoring the tunnel's structural integrity and protecting it from future corrosion.

Setting a New Standard for Sustainable Infrastructure

The Detroit sewer rehabilitation project stands as a landmark achievement in the field of infrastructure renewal. By combining advanced composite materials, localized manufacturing, and innovative installation techniques, QuakeWrap's StifPipe® system not only extended the lifespan of a vital piece of Detroit's infrastructure but also introduced a globally scalable model for sustainable pipeline rehabilitation.

For nearly three decades, QuakeWrap has been at the forefront of FRP-based solutions for structural repair and rehabilitation. Founded in 1994 by Professor Mo Ehsani, a pioneer in the field of fiber-reinforced polymers for civil infrastructure, the company has developed a portfolio of patented technologies that address some of the most pressing challenges in infrastructure maintenance and renewal.

The success of the OMID project reinforces QuakeWrap's position as a leader in innovative, sustainable engineering. It demonstrates that with the right blend of technology, creativity, and execution, even the largest and most complex infrastructure challenges can be overcome—setting new benchmarks for the industry and ensuring a safer, more resilient future for communities worldwide.



Fig. 1. Testing of StifPipe® sample.



Fig. 2. Non-Destructive Testing of pipe prior to delivery



Fig. 3. StifPipe® transportation and delivery to job site; segmental Channeline pipes can be seen in the background



Fig. 4. Pipe lowered into the tunnel and being moved horizontally by the pipe carrier