

American Concrete Pipe Association, Irving, Texas 75063-2595, USA

America's concrete pipe industry is prepared for change

America's infrastructure owners continue to face challenging times when facing needs to expand and improve existing transportation modes, while maintaining elements of existing systems. Proper inspection, management, and maintenance of aging infrastructure seems to be consuming more resources, time, and money than ever before. The concrete pipe industry has been working with DOTs and municipalities for years to accommodate the combination of trenchless installation technology with concrete pipe. The result is added value to infrastructure assets while states accelerate new construction, and repairs to existing drainage systems.

■ Margarita Takou, Ph.D., Technical Resource Manager,
American Concrete Pipe Association ■

Trenchless installation accommodates many Accelerated Precast Construction attributes that DOTs and public works agencies may wish to consider when faced with replacing small and large culverts under heavily travelled road and rail transportation systems. Jacking concrete pipe is not a new concept. The equipment used, construction techniques, and quality of the concrete pipe are modernized and competitive in cost in many situations where open cut is considered the only construction method. Records suggest that in the 1930s Northern Pacific (railway) standardized the use of concrete jacking pipes with internal diameters from 4 to 72 inches (100mm - 1800mm). Today, reinforced concrete pipe 18 to 144 inches in diameter can be installed using jacking installation procedures.

Pipe jacking is a trenchless technique for installing pipelines and culverts without open-cutting the entire length of the pipe run. Microtunneling is a jacking method using remotely controlled equipment to install pipelines beneath highways, railroads, runways, harbors, rivers, and environmentally sensitive areas. Support at the excavation face is a key feature of microtunneling, distinguishing it from traditional open-shield pipe-jacking. Concrete pipe producers have the experience working with contractors, owners, and design engineers to supply pipe and boxes that can be designed for the loads and pressures required for a trenchless installation. Staff are



144-in. dia. Jacking Pipe for Blue Plains Influent Sewers.
Photo: Mike Barna, Concrete Pipe & Precast, LLC,
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Applications	Benefits (based on FHWA: Accelerated Bridge Design)	Limitations
<ul style="list-style-type: none"> • Pipelines beneath highways, railroads, runways, harbors, rivers, and environmentally sensitive areas. • Culverts • Gas mains • Watermains • Subways • Transmission ductwork • Sewer replacement and new construction 	<ul style="list-style-type: none"> • Reduce construction time • Reduce weather-related time delays • Reduce impact on road users • Reduce environmental impact • Reduce impact in roadway alignment • Can be utilized in most soil types 	<ul style="list-style-type: none"> • Coordination among the contractor, owner/engineer and producer of the jacking pipe • Direction change in shafts • Friction from pipe and liners

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knowledgeable and product has been improved through quality certifications of plants and products along with continuous education of industry personnel in the details of design, inspection, and proper installation of these products.

Close coordination of responsibilities between the key members of the project team will ease the complexities of a trenchless installation. The contractor designs the jacking pit, selects the excavation method and equipment, selects jacking equipment, and schedules the operation. The owner/engineer defines the intended use of the pipeline or culvert, determines the pipe inside diameter, and designs the pipeline plan and profile. The concrete pipe producer provides design data of the pipe (or boxes), produces the product, and delivers according to the contractor's schedule.

The loads applied to the pipe during the jacking procedure have two components: jacking force and earth load. The jacking pressure is applied during installation mainly at the periphery of the pipe. This load should be uniformly distributed to prevent localized stresses which may lead to failure at the applied area, due to concrete crushing. A cushioning material should be used between the pipe segments to assist with distributing the jacking loads evenly over the cross section of the pipe. The most common type of material used is plywood and particle board 5/8 in. to 3/4 in. in thickness.

To move the pipe horizontally, jacking forces must overcome the frictional force between the soil and the pipe. Friction from pipe and liners is reduced with lubrication that is designed into the installation methodology to accommodate soil type and lubricant loss to the soil. Lubrication of the jacked pipe is accomplished mechanically by overboring the excavated material.

When long jacking distances are required, higher concrete strengths, lubricants, and greater care are required. Factors that can affect lubrication are: soil type; lubricant loss to soil; and mechanical means—overbore.

The earth loads imposed on the pipe have vertical and horizontal components which should be analyzed using national standards that account for all the components of the installation. The final condition of a jacked pipe is usually treated in the same manner as a pipe installed in an embankment. Other loads applied to the system are: live loads; dead load; fluid load; and additional earth fill or surface surcharge loads.

Concrete pipe producers understand that key elements of a trenchless installation include: the soil investigation; proper design of the shield and selection of the tunneling machine; working shaft design; drive lengths; jacking and friction loads; design of intermediate jacking stations; lubrication selection and port designs; surface equipment and facilities; the design of the jacking pipe itself; and ground movement.

Concrete pipe plant facilities of the 21st century are designed for ultimate safety and ability to meet production schedules that can accommodate various standard pipe and box sizes and strengths, along with special designs for trenchless projects. Robotic and automated production equipment can quickly adapt to new technology. The concrete pipe industry is prepared for change as the applied science of trenchless technology becomes a more conventional method of installing drainage pipelines. ■

FURTHER INFORMATION



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