30" PVC Force Main Helps Natchitoches Grow

The City of Natchitoches, Louisiana takes economic development seriously. This west-central Louisiana municipality has recently attracted major new industries such as Con-Agra Poultry and Trane Air Conditioning. To serve today's and tomorrow's growth, Natchitoches installed a 24,651 foot 30-inch DR 32.5 PVC force main.

According to Lee Johnson of N & A, Incorporated, the project engineers, the AWWA C905 PVC pipe was selected for several reasons. First, a careful value engineering analysis selected 30" DR 32.5 PVC over alternatives such as concrete and ductile iron. Secondly, the force main followed a high-voltage overhead electrical line for roughly a mile. The engineers wanted a light-weight product which could be handled without cranes or other heavy lifting equipment. In addition, the force main is designed to handle 20 million gallons per day. PVC's good hydraulic characteristics and low head loss offered real design and operating advantages.

"...engineering analysis selected 30" PVC over concrete and ductile iron."

The payoff? According to Ed Hislop of Ates Construction, the installation contractor, "The 30-inch pipe laid easily and tested perfectly."


Major new industries required the installation of a new force main.


The large 30" diameter was specified because of its light weight.

Understanding Transients In Pipeline Systems

Computer Power and Engineering Insight

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The purpose of this article is to provide a basic understanding to the problem of predicting hydraulic transients in pipeline systems. Yet, as was pointed out in an earlier article (Vol, 16, No. 1), transient phenomenon are frequently one of the most non-intuitive–possibly even the most counter-intuitive–challenges facing the pipeline designer. Yet, we need not give up in despair. As is true in so many areas, our minds, once they have been properly trained, are incredibly good at appreciating patterns. To a school child first facing the challenge of reading, a page may seem a bewildering collection of arbitrary symbols; to the skilled reader, the same page may profoundly record human insight and experience. The purpose of this article is thus to point out key principles and concepts so that the pipeline engineer may begin to adequately "read" and interpret computer-generated predictions of transient conditions

Physical Considerations

The transport of water through a pipeline requires control of the fluid and its forces; and control requires an understanding of both material properties and physical law. Under steady conditions, the fluid generally moves down hydraulic gradients. Specific devices such as valves and transitions cause local pressure drops and dissipate mechanical energy; operating pumps do work on the fluid and increase downstream pressures; pipe friction creates head losses more or less uniformly with distance. In transient applications, however, the situation is more complex. Large and sudden variations of discharge and pressure can propagate, reflect and change in the pipe system in a manner bewildering to those accustomed to steady state concepts. Physically, these transient events are often critical and may determine the success or failure of a given design or system.

The Nature of Transient Flow

An air of mystery often surrounds the development, role and significance of transient phenomena in closed conduits. However, considerable understanding can be obtained with only the barest knowledge of fluid properties and a few common conservation laws.

Whenever water flows in a closed conduit such that no free surface is present–for example, a typical water supply line–the properties of the flowing fluid have some important implications. For a water pipeline, two properties are particularly significant: water has a high density and a large bulk modulus. In other words, water is heavy and difficult to compress. Surprisingly, these two facts largely explain why transient conditions in a pipeline can be so dramatic (see also Karney and McInnis, 1990).

Implication 1:

Water has a high density. Because water has a high density ($\approx$1000 kg/m^3) and because pipelines are relatively long, typical lines carry huge amounts of mass, momentum and kinetic energy. To illustrate, assume a pipeline with area A = 1.0 m^2 and length L = 1000 m is carrying fluid with a velocity v = 2.0 m/s. Then the kinetic energy contained in this pipe is

$$KE = {}^1\!/\!_2 mv^2 = {}^1\!/\!_2 \rho LAv^2 = 2{,}000{,}000 \text{ J}$$

Note that this is quite an ordinary situation; the discharge is moderate and the pipe is not long. Yet the pipe still contains an equivalent

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