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<< Efforts to save money on pipelines in the 1970s will cost water systems billions in the years to come



MWD workers inspect a water main days after it exploded in December 1999, shutting down service to as many as 700,000 Orange County residents. (Don Bartlett / Los Angeles Times)

For the Metropolitan Water District, which serves 19 million residents of Southern California, the wake-up call sounded in December 1999.

That's when a water main on the outskirts of Irvine suffered a catastrophic blowout, spilling 5 million gallons and shutting off service to some 700,000 residents of south Orange County, some for more than a week. Although the blowout was later ascri-

bed to "operator error," it exposed some fundamental weaknesses in the MWD system and prompted the district to undertake a closer inspection.

The district found hundreds of leaks and breaks, which it blamed on premature deterioration in the prestressed concrete cylinder pipeline. That was just the beginning. So-called PCCP throughout the MWD system — at least 100 miles of the 160 miles of pipe

made from the material — has been judged suspect and possibly in need of repair or replacement.

< It takes only one bad pipe section to generate a significant pipeline failure.>

2012 engineering study delivering the bad news about concrete water mains

The first phase of that program was launched by the MWD board on Aug. 15 with the approval of a nearly \$40-million project to install steel pipe to reline 4.5 miles of PCCP under the streets of Long Beach and Lakewood. The work is scheduled to begin in September and take seven months to complete. A second phase of relining on the same trunk line will be presented to the board for approval next summer.

de of the infrastructure reconstruction facing water systems all over the country. Repairing or replacing PCCP mains nationwide could cost \$40 billion, according to a technical assessment produced in 2008 for the U.S. Environmental Protection Agency and the American Water Works Assn. Modernizing the nation’s aging water infrastructure, including ancient iron pipelines common in downtown parts of older Eastern cities, could cost many billions more.

In California, that task includes building the controversial delta tunnels to convey water from Northern to Southern California. The tunnels and associated works are estimated to cost more than \$16 billion, of which the MWD would pay 26%, adding \$2 to \$3 a month to the average residential water bill. The

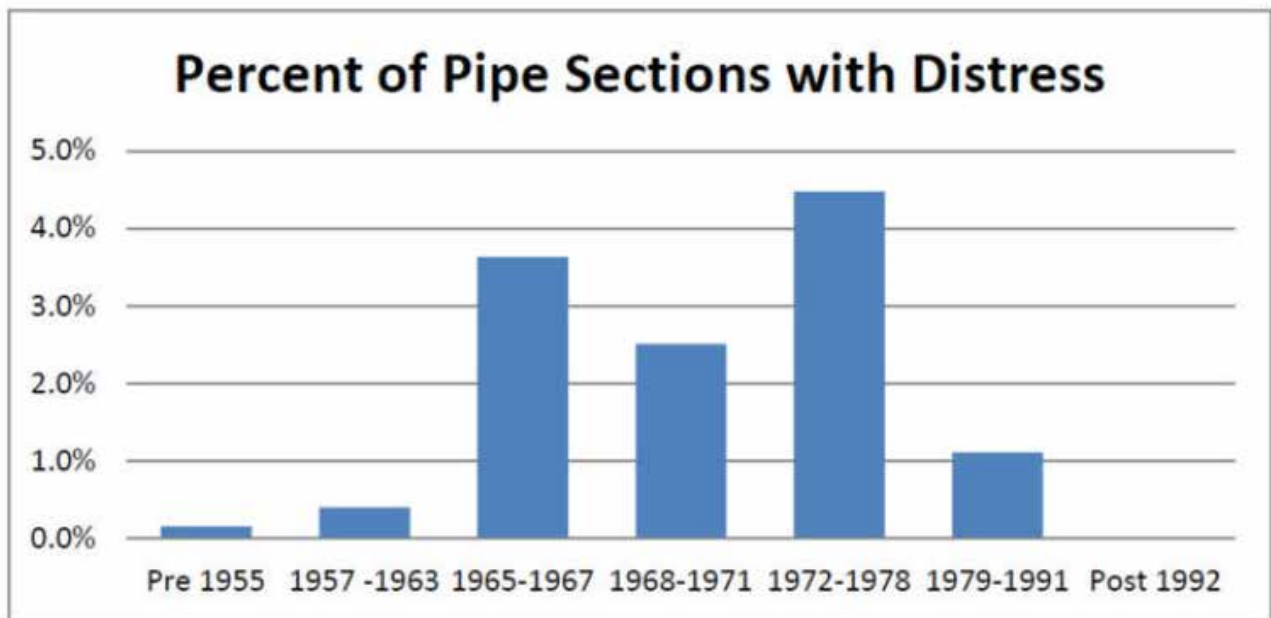


Figure 2- Distress levels by vintage

The MWD expects to spend as much as \$2.5 billion on the task over the next 20 to 25 years, but that only opens a window on the magnitu-

project is still uncertain, with litigation and doubts from water users and agencies around the state among the obstacles.

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We've written recently about the impact that infrastructure spending could have on water affordability in coming decades. But one often-overlooked aspect of the issue is how decisions taken in the past can reverberate down through the decades.

The problems caused by PCCP are a good example. The pipes, made from steel tubing wrapped in concrete and steel reinforcing wire, often were used for high-capacity, high-pressure water lines. As a result, their failures could be catastrophic and costly. Reports of pipe failures "can be sensational, particularly where the resulting flood damage provides spectacular footage for the 10 o'clock news," observed the 2008 study. Experts also noted that even limited deterioration could lead to major trouble. "It takes only one bad pipe section to generate a significant pipeline failure," a 2012 engineering study warned. That's what happened in the 1999 blowout, according to the MWD: Had the line not been already weakened by corrosion, it might have survived the operator error that resulted in the blowout.

PCCP lines have been a cause of increasing nervousness among water system managers since the 1990s. That's when the consequences of changes in standards for the lines in the 1970s became apparent.

When the MWD started installing PCCP lines in the 1970s, according to Gordon Johnson, the district's chief engineer, they were considered virtually interchangeable with steel pipelines. "We bid them against each other, and took the one that was the lowest bid," Johnson told me.

Both were expected to last 70 to 100 years. But while the steel pipelines are still mostly "as good as new," Johnson says, "PCCP just doesn't have the same life."

The problem appears to be the liberalization of manufacturing standards in the early 1970s, just as the MWD started using the material. Perhaps complacently, engineering organizations promulgated liberalized standards for PCCP, incorporating reinforcing steel wires that were stronger, but also thinner. Those wires turned out to be more vulnerable to corrosion and brittleness than expected.

"They thought they'd come up with a new technique that would be cheaper," says Jeffrey Kightlinger, general manager of the MWD. The reality is that the lifespan of PCCP from that era is about half that of steel pipe.

"When the standards changed, you came into pipe that was more stressed than before," says Graham E. C. Bell, a coauthor of the 2008 study. The majority of catastrophic PCCP failures have been traced to pipes of the 1972-1978 vintage, when the eased standards were in effect. By the early 1980s, manufacturing standards had been tightened up considerably.

Some engineers say PCCP is still a good pipeline material in many circumstances. "Some owners swear by it because it performs very well," says Michael Higgins, an executive at Pure Technologies, which assists utilities in assessing the condition of their mains, and a coauthor of the 2012 paper. The ove-

rall failure rate is less than 4%, he says. But PCCP pipes tend to fail suddenly and catastrophically, creating dangerous conditions and outsized disruption.

According to Bell's study, overpressure leads to cracks in the concrete coating, which allows water to enter the pipe from the surrounding soil and corrode the reinforcing wires, which break and in turn allow water to corrode other components of the pipe. Steel pipes tend to spring leaks, which can be patched; "the failure mode of PCCP is usually sudden," the study said.

The PCCP problem is most acute in the East, in part because the region was served by a now-defunct New Jersey company that allegedly manufactured some of the most troublesome lines. In 1997, Pinellas County, Fla., won a \$10-million judgment over a

13-mile PCCP line that was installed in 1978, failed in 1979 and exploded again during a 1980 pressure test and twice more by 1994 — all at pressures well below what the line had been built to bear.

The Maryland suburbs of Washington, D.C., have been particularly beleaguered by 350 miles of concrete mains "prone to exploding without warning," the Washington Post reported in 2013.

The MWD, to be sure, says it already had become wary of concrete pipelines when the Irvine blow-out occurred — the district had stopped using the pipe in the mid-1990s, after the first string of failures emerged, including several ruptures in San Diego County mains in the 1980s and 1990s. But the already-installed pipes remain underground, like time bombs. >>