

K You Should **Know**



A Message from the American Concrete Pipe Association

Bulletin No. 111

Metal Pipe Failure in Wisconsin

Lessons from the Kankapot Creek Culvert Collapse

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Note: The following information was obtained from published news reports and interviews with individuals involved in the project.

On June 7, 1996, a 21-year-old metal culvert used to convey Kankapot Creek beneath an Outagamie County road in Wisconsin collapsed, caving in a section of road near the town of Kaukauna. A truck plunged 20 feet into a pit of broken pavement and mud created by the cave-in, but the driver was not seriously injured.

The engineering consulting firm of Ayres Associates of Green Bay, Wisc., was hired by the county to recommend a replacement system for the failed metal culvert. The consultants recommended that the county use three lines of concrete box culverts, each approximately 230 feet long, to remedy the situation.

“We felt concrete would be the best choice for the long term,” said Ron Hernke, regional vice president of Ayres Associates. He explained that the culverts offered the structural strength the county wanted. Concrete box culverts also can be installed quickly, allowing the road to reopen as soon as possible. A bridge was considered for the site, but it would have cost \$100,000 more than the box culverts and could have taken a year to complete. Hernke also was quoted in the *Post-Crescent* as saying that box culverts do not require long-term maintenance like a bridge.

In the months that followed the collapse of the galvanized steel pipe, the Wisconsin DOT agreed to pay 80 percent of the \$451,168 bid cost for its replacement, with the balance to be paid by the county.

However, angry officials in Outagamie County wanted to hold someone responsible for the collapse. When the county board approved its share of the bill in September 1996, it added an amendment to pursue the cause of the collapse, including possible legal action, reported *The Post-Crescent*, a daily newspaper in nearby Appleton, Wisc.

The Milwaukee consulting firm of Wagner Komurka Geotechnical Group Inc. was hired to conduct a study of the collapse. That study identified three possible causes for the collapse, according to a news story published by *The Post-Crescent* on Feb. 4, 1997. The following statements are quoted directly from the newspaper article. For clarity's sake, the statements from the Geotechnical report that *The Post-Crescent* quoted in its story are italicized.

"The possible causes cited in the study were: increased weight of soils above the culvert's crown; decreased side thrust resistance; added load resulting from slope movement....

"Saturation of the soil very possibly played a part in all three of the possible causes, according to the report. The most likely source of saturation, the consultants concluded, would have been in a City of Kaukauna water transmission main installed over the culvert in 1994.

"Nineteen feet of fill were on top of the culvert. However, the consultants indicated that the saturation would have added only three to five pounds of pressure per cubic foot. '*This relatively small increase in soil weight would likely have caused collapse only if the culvert were previously on the verge of failure,*' they concluded.

"The ability of a culvert to support vast amounts of weight on top comes from the backfill soil on the sides of the culvert to prevent it from spreading out.

"According to the study, '*If even relatively small quantities of the backfill soil were lost due to water flowing from this material...the top of the culvert could buckle even with slight, or no increase in load above the top of the culvert.*'

"Movement of the soil slope at the south end of the culvert, where the collapse occurred, was the third possible cause."

James Jellish, Kaukauna Water Utility manager, was quoted as saying that the water main was pressure tested when it was installed and again after repairs were made when the collapse took out 120 feet of the water main.

In the end, however, the county officials were informed by their legal counsel that "The report was inconclusive and would make it difficult to prove liability," according to *The Post-Crescent*.

Although they will not recover their share of the replacement cost, at least Outagamie county officials can take comfort in knowing that with a concrete box culvert in place, a "small increase in soil weight" or shifting of "small quantities of backfill soil" won't cause another collapse at Kankapot Creek.