

American **Concrete Pipe** Association

Transmitting Important Information  
to the Engineering Community

HDPE Pipe Material Requirements  
**YOU HAVE THE RIGHT TO KNOW**

# FIELD CONSTRUCTION PRACTICES DISCUSSIONS

VOL. 1 NO. 2

# HDPE Pipe Material Requirements **YOU HAVE THE RIGHT TO KNOW**

The American Concrete Pipe Association (ACPA) has worked for over 90 years to ensure that concrete pipe manufacturers supply a high quality product that will serve America's infrastructure today and for years to come. ACPA endorses the long-standing American Association of State Highway and Transportation Officials (AASHTO) policy of allowing industry to be involved with the development of standards that affect their product. Therefore, the concrete pipe industry has consistently improved the quality of our product in conjunction with the AASHTO material and testing standards that govern it.

Recent research by the National Cooperative Highway Research Program (NCHRP) has found that not only does high density polyethylene (HDPE) pipe produced in this country lack a reliable test to assure it does not crack prematurely in the field, but that the industry has been extremely complacent in its efforts to remedy the problem. AASHTO has kept the HDPE pipe industry actively involved in the process of trying to rectify this situation. However, the corrugated polyethylene pipe industry has found it more convenient to blame AASHTO and NCHRP for HDPE pipe's failings than to improve the product. In support of AASHTO and NCHRP, the American Concrete Pipe Association would like to provide the history behind the federally funded NCHRP Report 429, "HDPE Pipe: Recommended Material Specifications and Design Requirements" and its efforts to develop an adequate test for the determination of environmental stress-crack resistance in HDPE pipe.

## **NCHRP Report Recommends Developing a Reliable Slow-Crack Growth Test for HDPE Pipe**

In 1995 NCHRP Project 20-7, Task 68, was commissioned to review the current environmental stress crack resistance (ESCR) requirements in the AASHTO design and material standards. In 1996 the corresponding NCHRP report recommended that the Hydrostatic Design Basis requirement be removed from Section 18 of the AASHTO Standard Specifications for Highway Bridges, but that a "reliable post-production slow-crack growth test" be initiated. The report went on to say "work on this new test should proceed rapidly." HDPE pipe producers were in full support of this action.

## **NCHRP Project to Develop a Quality Control Test**

As a result of NCHRP Project 20-7, Task 68, and reported numerous slow-crack growth problems with installed HDPE pipe, additional public funds were appropriated for research into the slow-crack growth problem in HDPE gravity pipe. In early 1997, NCHRP Project 04-24 "HDPE Pipe Material Specification and Design Requirements" was initiated to develop a quality control test that could replace the Hydrostatic Design Basis (HDB) test and the Environmental Stress Crack Resistance (ESCR) test that currently exists in the AASHTO standards. The conclusions of this research were printed in NCHRP Report 429, released in 1999.

Since its inception into ASTM D 1693 in 1959, the ESCR test has been fraught with variances up to 290%. Although the unreliability of the test was known by the HDPE pipe producers, it was not until public money was invested in NCHRP Project 04-24 to "develop a more practical and reliable test protocol... to qualify resins with acceptable resistance to cracking under sustained loading" that any research effort was put into effect to resolve the problem.

Drexel University's Geosynthetic Research Institute was chosen to perform research for NCHRP 04-24 based on the research they had done for the Plastics Pipe Institute using ASTM D 5397 and published in "A Stress Crack Resistance Method for Evaluation of Polyethylene Materials Intended for Pipe Applications". In addition, the Executive Director of the Corrugated Polyethylene Pipe

Association, as well as the former Executive Director of the Plastics Pipe Institute were appointed to the NCHRP 04-24 panel to ensure that the industry was well represented. At the time, this was a major change in NCHRP policy, since the panels generally consist of non-biased DOT engineers and members of academia, and industry representation is not usually permitted.

### **Corrugated Polyethylene Pipe Association Contests NCHRP Report 429 Recommendations**

The researchers recommended to AASHTO that the Single-Point Notched Constant Tensile Load (SP-NCTL) test per ASTM D 5397 be used with an applied stress of 15% of yield stress with a failure time of 24 hours. The Corrugated Polyethylene Pipe Association (CPPA) and its parent association, the Plastics Pipe Institute (PPI), initially countered this recommendation with a recommendation of their own — requesting that the SP-NCTL test be used with 10% of yield stress for 10 hours. At both the Bridge Engineers' and the Materials Engineers' meetings in 1999, AASHTO officials refused to accept the CPPA/PPI recommendation. This was a logical choice when you consider:

- NCHRP 04-24 was initiated by AASHTO, and federally funded in an effort to “develop a more practical and reliable test protocol”.  
*The CPPA/PPI recommendations are an effort to avoid any changes to the product they currently manufacture.*
- The recommendations of NCHRP 04-24 were based on field and laboratory research of HDPE pipe failing from environmental stress crack resistance.  
*The recommendations of CPPA/PPI are not supported by field or laboratory research.*
- The current ESCR test is equivalent to the SP-NCTL test being run at 15% for 14 hours.  
*The CPPA/PPI recommendation of 10% for 10 hours would be a reduction in the current ESCR criteria.*

### **Basis for Recommendations in NCHRP Report 429**

To their credit, the NCHRP researchers did a thorough job and took 19 samples of HDPE pipe under field conditions, even though the NCHRP Panel only requested 10. Laboratory tests were performed on the samples to see their time to failure under the SP-NCTL test conditions.

The SP-NCTL test is already in use for geomembranes, and requires that they be tested at 30% yield stress for 100 hours. The objective of the NCHRP 04-24 research was to establish the testing requirements for high density polyethylene pipe. All samples tested in the lab to determine a failure criteria for HDPE pipe using the SP-NCTL test were taken from pipe that had failed in the field.

The recommended testing requirement of 15% of yield stress for 24 hours was taken as the failure time plus two standard deviations of a specimen that had experienced slow-crack growth in the field. The specimen had the longest test duration of any of the specimens taken from pipe with slow-crack growth problems in the field. The researchers generously developed a pass/fail requirement for a laboratory test based on specimens that had failed in the field. Amazingly enough, even the development of such a low standard of quality requires the corrugated polyethylene pipe industry raise their current standards.

### **CPPA/PPI Hinders the Development of a QA/QC Test**

NCHRP 04-24 took to task a problem that the HDPE pipe suppliers would not address on their own. NCHRP Staff went out of their way to ensure that the HDPE pipe industry was involved with the research. The NCHRP researchers did their best to not unduly burden the HDPE pipe suppliers with a difficult test to pass. The result of all this? Instead of wanting to improve their standards for the good of the public, CPPA/PPI attempts to lower their standards to avoid any changes to the product they currently manufacture.

## **AASHTO Bridge Engineers Approve Recommendations of NCHRP Report 429**

On June 8<sup>th</sup>, 2000, at their annual meeting, the AASHTO Subcommittee on Bridges and Structures voted to approve the recommendations provided in NCHRP Report 429. This was done despite the protests of CPPA/PPI during the previous year and CPPA's/PPI's efforts to obscure the issue with tests and reports of their own. While the Subcommittee on Bridges and Structures supports the recommendations of NCHRP Report 429, they are looking to the AASHTO Subcommittee on Materials to support the cause by adoption of the Report 429 recommendations at their annual meeting in August.

### **More Stall Tactics by CPPA/PPI**

When it became apparent in the months immediately prior to the AASHTO Subcommittee on Bridges and Structures meeting that the recommendations of NCHRP Report 429 would pass, PPI began to lobby for a two year grace period between the time the report is adopted until when their members would have to comply with the report's recommendations. Their contention is that it would require two years for resin suppliers to be able to mass produce a resin that could meet an SP-NCTL test of 15% for 24 hours. This is yet another stall tactic on their part. There are producers of HDPE gravity pipe who have stated that they currently are able to produce a pipe that meets the 15/24 requirements of Report 429. The natural gas industry has been using resin that greatly exceeds this requirement for years. If permitted to do so, the majority of HDPE pipe producers in PPI would probably produce an inferior product for the next two years while trying to develop even more stall tactics to further delay the implementation of the SP-NCTL test when the time drew near for its application.

In 1996, NCHRP research recommended that "work on this new test (slow-crack growth test) should proceed rapidly". The Hydrostatic Design Basis test was removed prematurely in anticipation of this new test being developed in a timely fashion. For over four years, corrugated polyethylene drainage pipe has been produced without a reliable slow-crack growth test in the AASHTO Standards. While slow-crack growth problems continue to appear in buried HDPE pipe, the NCHRP researchers painstakingly worked to develop a field verified test that was both accurate and fair. Can we really afford to allow the adoption and implementation of the recommendations of NCHRP Report 429 to be held up or stalled for two years while the Corrugated Polyethylene Pipe Association works to disprove the facts they have been aware of for years?

### **You Have the Right To Know**

This Dispatch provides the reader with the history leading up to NCHRP Research Project 04-24 as well as the conclusions found in NCHRP Report 429. While history can be misrepresented by CPPA/PPI, the recommendations of NCHRP Report 429 can not. ACPA strongly encourages anyone who specifies HDPE Pipe to obtain a copy of NCHRP Report 429. The report can be downloaded from NCHRP by going to web address [www4.nas.edu/trb/crp.nsf/NCHRP+projects](http://www4.nas.edu/trb/crp.nsf/NCHRP+projects). From here you click on "Area 4 – General Materials" and go to NCHRP Research Project 04-24. You have the right to specify a drainage pipe that has been appropriately tested to verify that it will perform in the installed condition.



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