Sewer Sense

THE TESTS ARE IN AND VCP IS TOPS

The University of Houston has issued its final reports on Compression Joint Testing. Funded by a grant from the Environmental Projection Agency, the project was intended to demonstrate the cost of treating infiltration over the life of a sewer system. More specifically, infiltration through the joints of 30-inch diameter pipe from various participating pipe manufacturers was evaluated.

The National Clay Pipe Institute welcomed the opportunity of demonstrating the capability of its compression joint. Prior to the 1960's, clay pipe were joined in the field with either cement or tar, neither of which prevented root intrusion or leak-free joints.

The Houston tests were made possible by the development of an external bladder which surrounded the assembled joint. The bladder was capable of delivering 7 psi water pressure to the joint simulating an external groundwater head of over 16 feet.

OTHER PIPE TESTED

In addition to the National Clay Pipe Institute, trade associations representing concrete, PVC and FRP fiberglass pipe participated in the program. Each industry provided pipe and funds for testing. The ductile iron pipe industry declined to participate.

STEERING COMMITTEE FORMED

A steering committee, consisting of pipe and trade association representatives, engineering consultants, U. S. EPA, University of Houston staff and project administrator was formed to review and finalize the test protocol and test results.

TEST PROTOCOL

Two separate sets of pipe joints were tested. Each of the assembled joints was tested in straight alignment, angular joint deflection and shear load. The maximum water pressure would be 7 psi which was close to the maximum capacity of the external bladder.

TEST RESULTS

Straight Alignment - The test pipe were assembled on a structural frame and fitted with the external bladder. Each set of joints was tested in the same manner. **All of the pipe joints from all of the manufacturers passed the 7 psi external test pressure without leakage. (Table 1)**

PRINTED ON RECYCLED PAPER

TABLE 1 - STRAIGHT ALIGNMENT & ANGULAR JOINT DEFLECTION TESTS
30" INCH DIAMETER (7 psi External Hydrostatic Pressure)

ANGLE	CLAY [1]		CONCRETE		FIBREGLASS [2]		PVC [3]	
DEG.	SAMPLE 1	SAMPLE 2	SAMPLE 1	SAMPLE 2	SAMPLE 1	SAMPLE 2	SAMPLE 1	SAMPLE 2
0.0	No leakage	No leakage	No leakage	No leakage	No leakage	No leakage	No leakage	No leakage
0.5	No leakage	No leakage	No leakage	No leakage	No leakage	No leakage	No leakage	No leakage
1.0	No leakage	No leakage	No leakage	No leakage	No leakage	No leakage	No leakage	No leakage
1.5	No leakage	No leakage	No leakage	No leakage	No leakage	No leakage	No leakage	No leakage
2.0	No leakage	No leakage	No leakage	No leakage	No leakage	No leakage	No leakage	No leakage

1. Due to the high loads required to generate angular deflection in clay pipe there was a delayed increase in angular measurement which occurred following each incremental angle of joint deflection. In the final test of clay pipe Sample 2, the angle increased to 2.6°. There was no joint leakage reported at that test condition. No other pipe were tested to that limit.
2. FRP Pipe
3. PVC Sample 1 was ASTM F 949 and Sample 2 was ASTM F 794

The external pressure was raised incrementally to 3, 4, 5 and 6 psi. and held at each pressure for 5 min. At 7 psi, the pressure was held for 10 min.

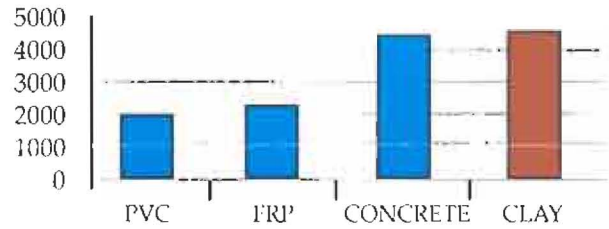
Angular Joint Deflection - Through the use of the external loading and support framework, one pipe could be moved from the straight position relative to the other pipe which was held in a fixed position. The joints were deflected in 0.5 degree increments until a maximum of 2 degrees was reached. At each angle, observations were made over the full range of test pressures. **All of the pipe joints from all of the manufacturers passed the 7 psi external test pressure without leakage. (Table 1)**

Shear Load - The shear load test is perhaps the most severe test of a sewer pipe joint. Uniform support of the bottom of the pipe may not always be achieved in the field as the foundation or bedding allows one pipe to settle differentially from an adjacent pipe resulting in shear load development at the joint. Shear load can also occur at transition areas where the bedding or foundation changes abruptly or at pipe to manhole connections.

The Steering Committee agreed that the shear load requirement in the test protocol should be 4500 lbs. for 30" diameter pipe. However, individual pipe manufacturers were allowed to stop the test at a lower shear load value if requested. This is reported in the final reports and demonstrated in Figure 1. Although all of the pipe passed the shear load test at 7 psi external water pressure without leakage, the maximum shear load varied with the type of pipe at the request of the manufacturer.

ASTM C 425 Standard Specification for Compression Joints for Vitrified Clay Pipe and Fittings Sections 7.1.1 and 7.1.2 specify that the ***"joints shall not leak when tested in straight alignment, angular deflection and under shear load."*** Clay pipe has the highest ASTM shear load test requirement in the industry with 150 lbs/inch of diameter applied directly to the spigot end with an unsupported bell. The shear load requirement for 30-inch diameter clay pipe is 4500 lbs.

FIGURE 1 - JOINT SHEAR LOAD TEST
30 Inch Diameter Pipe - 7 psi External Hydrostatic Pressure. Average of Two Samples
Maximum Shear Loads Reported for the Test Pipe



Note 1: There was no leakage reported for any of the joints which were tested.

Note 2: The manufacturer's representatives had the option of stopping the two shear load tests before attaining the maximum load of 4500 lbs. PVC was stopped at 1769 and 2169 lbs., FRP was stopped at 1759 and 2899 lbs., concrete was stopped at 4278 and 4580 lbs. and the clay pipe joints were tested to 4588 and 4594 lbs.

SUMMARY

1. Straight Alignment and Angular Joint Deflection
All of the pipe joints met the straight alignment and angular deflection tests equally.

2. Shear Load
The two clay pipe joints were tested to an average of 4591 lbs. maximum shear load without leakage. The PVC and FRP pipe were tested at lower shear load values at the request of the plastic pipe industry representatives. The concrete pipe joints were tested to 4278 and 4580 lbs. with an average of 4429 lbs.

The clay pipe industry is particularly pleased to have this independent verification of its leak free compression jointing system. Additional information on the Houston Infiltration study is available from NCPI, PO Box 759, Lake Geneva, WI 53147.

SOLDIER FIELD
RENOVATION PROJECT

The City of Chicago recently went through an extensive debate regarding the renovation of Soldier Field, the home of the Chicago Bears. Many professional sports teams have pursued renovation of existing stadiums as a means of preserving their current fan base and increasing revenues. During the pursuit of renovations at Soldier Field, the two primary concerns were preservation of the appearance of the lake front region and the provision of better facilities for patrons of the stadium.

Providing for larger parking areas was one of the items that needed to be addressed. Aboveground multistory parking facilities were not an option due to the need to preserve the appearance of the lakefront. The answer was to build underground parking structures to provide increased capacity as well as a park-like area above.

While this was a viable option, it caused several design concerns. Since the elevation of the original clay pipe trunk sewer in service since 1919 did not change, the new clay pipe sewer lines were routed around the parking structure. There would also have to be drainage provided for the grassy areas on the roof of each of the new underground parking structures. Once again Vitrified Clay Pipe provided solutions.

"Routing the sewer line around the parking structure to match the new site plan was not really a problem", said Gerald Giebelhausen of Reliable Construction. *"The City of Chicago uses clay pipe throughout its jurisdiction. We're very comfortable using it and we think it's a great material."* Reliable Construction used 9500 feet of 6" through 18" clay pipe to install the new sewer line and provide service to Soldier Field. In addition, 7,000 feet of 4" perforated pipe provided drainage for the areas above the parking garages that will preserve the beauty and enhance the appearance of the area surrounding Soldier Field and McCormick Place. *"The choice of 4" perforated VCP was natural for us when designing for Chicago"*, said Laura Sheffer of V3 Engineering in Woodfield, Illinois. *"It's Chicago's material of choice."*

The City of Chicago has used Vitrified Clay Pipe for more than a century and with the many improvements that have been made to the product, clay pipe will continue to serve for the next century as well.

Pipe supplied by Can Clay Corp. for the renovation at Soldier Field.

ONLY CLAY PIPE WILL DO

There are sewer applications where only clay pipe will do. This is a true story about a situation that arose at Ann Arbor, Michigan that even NCPI could not have predicted.

A massive concrete obstruction ranging from 2" to 12" deep was found in an 18" clay pipe sewer line on the University of Michigan campus. The source of the obstruction was believed to result from a construction error associated with recently poured concrete in a nearby building. The original pipeline was installed in the 1920's and a closed-circuit television inspection revealed that the line was in excellent condition except for the obstruction.

The city had tried several methods including a high-pressure water blaster to try to break up the concrete. These methods were not successful.

Hydro Chem Industrial Services Inc. eventually oversaw the removal of the concrete using a hydrochloric acid removal process. Samuel Winger, Field Engineer for Hydro Chem, stated that *"the equivalent of two full truckloads of finely grained concrete was dumped into the pipeline."*

"We blocked off the ends of the clay pipe so that we could recirculate the acid and test it at different intervals." said Winger. "We used extremely high concentrations of hydrochloric acid to completely dissolve the concrete and the acid had absolutely no effect on the clay pipe."

FORTUNATELY - THE PIPE WAS CLAY

Pete Perala, utilities engineer, for the city of Ann Arbor was the site engineer for the project. Perala said, *"The high-strength concrete, combined with the pipe depth and proximity to other utilities, made this an extremely difficult project. When we realized we needed to chemically dissolve the obstruction, it was our good fortune that the sewer pipe was clay."*

"This is another example of the superiority of clay pipe," said Dan DeFillipi, sales representative for The Logan Clay Products Company. *"This pipe was made and installed more than 80 years ago yet still serves where only clay pipe will do."*

NCPI

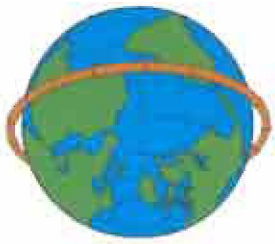
NATIONAL CLAY PIPE INSTITUTE

QUALITY • RESEARCH

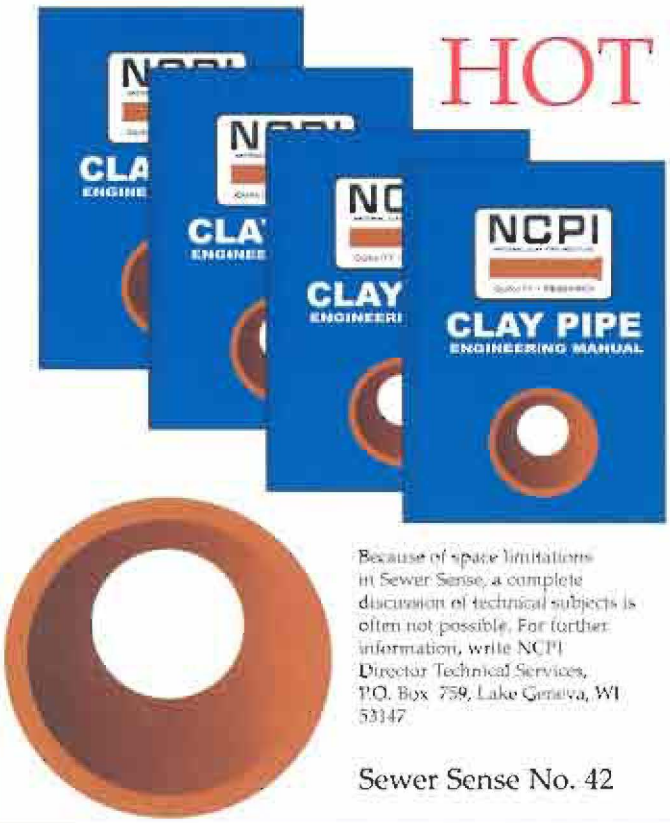
NCPI Member Companies
Building Products Co.
Can-Clay Corporation
Gladding-McBean
Logan Clay Products Company
Mission Clay Products
Superior Clay Corporation

Associate Members
England: Naylor Drainage Limited
Clay Pipe Development Association

AROUND THE WORLD:
IF IT HAS TO LAST IT BETTER BE CLAY



HOT OFF THE PRESS



The latest version of the NCPI Engineering Manual is now available. Copies may be ordered from NCPI directly or by contacting one of the NCPI Regional Engineers at the phone numbers shown below:

NCPI Headquarters: (262)248-9094
Eastern Region: (262)248-3439
Arizona: (602)228-1000
Southern CA: (909)721-6866
Northern CA: (209)577-2875

There is a charge of $25.00 per copy

Because of space limitations in Sewer Sense, a complete discussion of technical subjects is often not possible. For further information, write NCPI Director Technical Services, P.O. Box 759, Lake Geneva, WI 53147

Sewer Sense No. 42