PLAINTIFF'S EXHIBIT

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THE CASE FOR NON-METALLIC PIPE

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Remember the famous old automobile advertisement that, for years, carried the simple but pointed message of, "Ask the man that owns one"? Even though this car is no longer manufactured, this slogan will live on as if reflects a very sound method of evaluating any product, This has been the basic approach of the Materials Performance Committee since it was set up by the California Section nearly three years ago when the Executive Committee recognized the increasing difficulty for all to keep informed on new materials. As there is no one pipe material ideally suited to every environment or water supply, the problem of evaluating the relative merits of the materials available is one faced by each water utility designer or operator.

This standing committee has met regularly with separate meetings in the northern and southern sections of the state with a meeting of the entire committee at each Spring and Fall Conference and has endeavored to gather from available sources information concerning the use and performance of water system construction materials. The two-page questionnaire mailed to the entire membership of the section was designed to acquaint all with the committee activities as well as to obtain as much information as possible. Although the response to this mailing was less than overwhelming, replies were received from individuals representing one hundred fifty-six utilities and districts as well as twenty-one engineers and consultants. Additional copies of the questionnaire are on hand and any who have not returned one are encouraged to do so as further mailings will be directed to those who have replied and to agencies known to have significant experience with specific materials

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and products.

The philosophy of the committee is also reflected by the anecdote which tells of the prim little old lady who, while walking down the sidewalk, observed a sloppy drunk lying in the gutter asleep. She leaned over looking down on him making disgusted noises and said, "Isn't it revolting!" The drunk opened one bleary eye, sized up the situation as best he could, and said, "Did you ever try it, lady?" Following her shocked reply of, "Oh! My goodness no -- of course not!", he ended the conversation with the admonition of, "Well, don't knock it if you haven't tried it." After all, the only one who can really speak with authority on any subject is the one who has actually put it to the test.

Activities of Committee

Throughout the past two years, the committee has concentrated on non-metallic pipe materials due to the continued high level of interest in these subjects. This is a broad field and it is beyond the scope of this paper to endeavor to cover more than a part of it. The time available will only permit the consideration of asbestos cement pipe and plastic service piping.

Asbestos Cement Pipe

Asbestos cement pipe which was developed in Europe prior to World War I, was introduced into the United States in 1929. Since that time it has experienced a steady growth, especially in the Pacific Southwest. Today over thirty per cent of all water system pressure pipe now being installed in this country is asbestos cement pipe.

This is one of the materials included in the Materials Performance

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Questionnaire and the following tabulation has been prepared presenting the evaluation of the results obtained by the reporting utilities and engineers.

Experience of 156 California Section Water Utilities and Districts

Amount of Experience	Evaluation of Results Obtained				
	Excellent	Good	Fair	Poor	Unknown
Extensive	66	14	1	-	-
Moderate	10	18	1	-	-
Limited	8	11	5	1	2

Experience of 21 Engineers and Consultants

Amount of Experience	Evaluation of Results Obtained				
	Excellent	Good	Fair	Poor	Unknown
Extensive	12	2	-	-	-
Moderate	-	3	-	-	-

Replies were received from some very small water systems as well as the largest. Consequently, the term "extensive" on one reply could represent only a few thousand feet in the case of a small utility and, with one of the large utilities, it could be hundreds of miles.

A number of the agencies reporting extensive use were contacted for a more detailed presentation of their experience which is shown in Table 1.

All of the agencies shown as extensive users report that they have obtained excellent results with asbestos cement pipe using the manufacturers standard methods of installation. All agreed that, if the proper care is used in handling, installing, bedding and backfilling, one can expect good results in a wide variety of soil conditions. Those

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Table 1

Extensive Users of Asbestos Cement Pipe -- 4-inch and Larger

Utility	Date of First Use	Date Used Extensively	Sizes	Miles of A.C. Pipe	Total Miles of Pipe	% A.C.	A.C. Miles Last Year	% of Pipe Installed
Tustin Water Works	1955	1956	4"-16"	90.6	127.0	71.3	3.85	100.0
Torrance Water Department	-	-	4"-12"	94.0	235.1	40.0	1.5	75.0
Palos Verdes Water Company	1947	1956	4"-16"	193.7	251.0	77.2	11.84	96.2
Long Beach Water Department	1940	1942	4"-12"	243.9	871.1	28.0	5.7	66.5
Helix Irrigation District	1946	1950	4"-18"	280.0	622.3	45.0	10.4	97.1
Contra Costa Cnty. Wtr. Dist.	1942	1951	4"-20"	317.0	449.4	70.5	7.8	80.4
Los Angeles Dept. Wtr. & Pwr.	1936	-	4"-12"	431.4	6,586.4	6.5	21.1	18.6
East Bay Munic. Util. Dist.	1937	1942	4"-12"	800.0	3,150.0	25.4	15.0	27.3
San Diego Utilities Dept.	1935	1950	4"-20"	850.9	1,663.95	51.1	21.6	99.8 *
Phoenix Water Department	-	1950	**4"-16"	1,345.16	1,999.52	67.3	28.6	69.8

* San Diego total does not include transmission mains 24-inch and larger installed last year.
** Phoenix reports 72.50 miles of 2-inch and 90.33 miles of 3-inch A.C. in addition to amount shown.

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who have kept detailed records of failures of pipe lines report approximately 70% of asbestos cement pipe breaks are caused by equipment operation or loss of support due to another excavation too close to the pipe line. In the City of Long Beach the two worst offenders have been back hoes and power company pole augers. These pieces of equipment are now referred to as "universal pipe locators".

The comments of some of these users who have installed hundreds of miles of asbestos cement pipe should be of interest to all.

The Los Angeles Department of Water and Power uses asbestos cement pipe in locations where the maximum static pressure does not exceed 150 psi and generally where hot soil conditions preclude the use of cast iron pipe. Asbestos cement pipe is not generally used in filled areas where excessive earth movement might be encountered. All pipe is class 200 pipe and 12-inch is the largest size used.

Contra Costa County Water District has been well satisfied with asbestos cement pipe as it has been found to work very well with the soil conditions encountered within their service area. Some breakage problems with 4-inch size have usually been found to be caused by a new or inexperienced contractor who tries to stomp the backfill too hard. A similar problem experienced by the City of Long Beach was virtually completely eliminated by changing to class 200 pipe in ten-foot lengths.

The Palos Verdes Water Company, which had some terrific problems as a result of the earth slides in the Portugese Bend area, reports that the asbestos cement pipe lines in this slide area performed better than any of the other types of pipe including cast iron with rubber ring joints

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and steel pipe. They were so favorably impressed with the performance of asbestos cement pipe in this slide area that they standardized on this type of pipe. The flexibility afforded by the shorter thirteen-foot lengths was thought to be the principle advantage.

East Bay Municipal Utilities District has found asbestos cement very satisifactory and reports the following maintenance costs per mile for the various types of distribution mains during the fiscal year 1966-67:

Cast Iron (1650 miles)	$75.60
Steel (700 miles)	67.00
Asbestos Cement (800 miles)	39.90

Asbestos cement pipe is used throughout the East Bay system with the exception of hilly areas where welded steel pipe is now used.

The City of San Diego has had very good results with sizes 4-inch through 20-inch with the one exception of one type of 16-inch. Some leakage problems resulted from insufficient compression of the rubber rings following a redesign which reduced their cross-section. They also found that the heavy wall of the 20-inch pipe required a modification of their tapping machines in order to cut completely through.

The growing acceptance of asbestos cement pipe is clearly indicated by the steady increase in the footage of pipe installed for all sizes from 4-inch to over 24-inch as shown in Table 2. The fact that eight of the extensive users shown in Table 1 reported that two thirds or more of the pipe installed in their systems last year was asbestos cement is further evidence of the satisfactory results obtained during the ten to thirty year periods it has been used in their systems.

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Table 2

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The following tables were computed from a report entitled Size and Regional Trends for Pressure Pipe in Water and Sewage Systems prepared for the Business and Defense Services Administration of the United States Department of Commerce by K. L. Kollar, Director, and A. F. Volonte, Commodity Industry Specialist, dated June 1965:

Footage of Pipe Installed by Type and Size in Five Year Periods
(Expressed in per cent of total footage)

Period	Total (Million Feet)	Cast Iron	Asbestos Cement	Steel	Reinforced Concrete
4-inch to 12-inch					
1941-45	257	76.3%	21.7%	1.8%	0.2%
1946-50	268	72.4	22.4	1.9	3.3
1951-55	416	69.7	27.2	2.6	0.5
1956-60	538	65.8	30.1	3.3	0.8
1961-65	576	64.2	31.1	3.8	0.9
14-inch to 24-inch					
1941-45	12.2	72.4%	5.3%	12.3%	9.0%
1946-50	17.5	62.4	7.3	16.2	14.1
1951-55	27.2	51.5	9.8	19.8	18.9
1956-60	41.7	44.6	12.0	21.2	22.2
1961-65	47.6	41.5	12.9	21.9	23.7
Over 24-inch					
1941-45	2.23	36.8%	0.0%	43.5%	19.7%
1946-50	4.89	26.0	1.0	46.0	27.0
1951-55	6.71	19.4	1.6	45.8	33.2
1956-60	7.49	16.3	1.5	46.2	36.0
1961-65	8.30	15.2	1.9	45.9	37.0

Ductile iron was not shown separately from cast iron due to the relatively small use during the periods reported. Plastic pipe, which is used principally in sizes 4-inch and smaller, was not reported due to insufficient information. With the ever increasing use of these materials, both will no doubt be included in future studies.