

REPORT ON ASBESTOS/CEMENT PIPE USE
IN THE
BOARD OF WATER WORKS OF PUEBLO, COLORADO

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AT

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Introduction

The Board of Water Works of Pueblo, Colorado is the tenth of ten water systems studied under the Municipal Analysis Program of the A/C Pipe Producers Association. In this detailed site visit, as well as the other nine, the objective was to investigate the use of A/C pipe from every perspective. The broad functional categories covered by this fact-finding mission are as follows:

- o Operational
 - Decisionmaking, Specification, and Procurement
 - Installation and Testing
 - Operation and Maintenance
 - Repair and Replacement
 - Detection and Prevention
- o Financial
- o Institutional

Each of these categories of information is discussed in detail in this report.

Background on the Pueblo Site Visit

The two-day site visit to Pueblo was conducted on March 11-12, 1982. Unlike the adverse weather conditions encountered in visiting other systems, the weather was ideal except for gusting winds of 40-50 miles per hour. This shortened one of the field trips, but otherwise had no impact on the visit.

The Pueblo Water Board people are enthusiastic about the study and, as in some other systems (e.g., San Antonio, EBMUD) viewed the AACPP site visit as a perquisite or bonus for buying A/C pipe. Every person interviewed was extremely courteous, generous of his time, and pleased to provide the data and information requested. Officials interviewed consisted of the following:

Owen G. McKinney, President of the Board of Water
Works
Larry C. Fountaine, Executive Director
Alan C. Hamel, Operations Manager
James M. Blasing, Transmission and Distribution
Division Assistant Supervisor
Terry R. Book, Civil Engineer
Robert E. Long, Purchasing Agent

The Board is interested in additional contacts with the AACPP. Pueblo would have to be ranked in the top three systems visited in terms of quality of records, enthusiasm and quality of personnel, and interest in participation. Pueblo would be a good candidate as a "pilot city" for the upcoming seminar program if such an exercise is planned.

Owen G. McKinney, President of the Board, is a former Johns-Manville employee, having served as a field salesman and in other capacities for about 18 years. He knows several people in J-M headquarters. Mr. McKinney, who is now 70 but still a "mover and shaker" in Pueblo, offered several anecdotes related to selling pipe in the "old days." Mr. McKinney was responsible for the Water Board's decision to purchase A/C pipe initially in the late 1940's.

Institutional and Background Information

The Board of Water Works was formed in 1957 as the result of the consolidation of the Pueblo Water Works and the Pueblo Water Works District No. 2, the two previous suppliers of water service in the city. Pursuant to the charter, the entire control, management and operation of the City's waterworks system is vested in the Board, although title to the properties of the waterworks is held by the city. However, the Board technically is an independent authority which can exercise all powers granted to first-class cities under the Constitution and laws of Colorado.

The Board of Water Works is fiscally autonomous from the city except in the case of selling bonds. The Board floats general obligation bonds; the bond indebtedness is assessed against the per capita debt ceiling of the City as allowed by Colorado law.

The City Council has no jurisdiction or control over the Board, and it is required to adopt all ordinances requested by the Board which are reasonably necessary to assist the Board in management of the system. The only perceived impact of the city on Board operations in recent years has been the adoption of a more stringent compaction requirement in downtown streets.

The Water Works is governed by a five member Board, all of whom are elected at large for staggered six-year terms. Board members typically are local businessmen interested in serving the community.

The Executive Director of the Board is Larry C. Fountaine, a former city manager who has held this position since 1975. Mr. Fountaine's most noteworthy accomplishment has been to regain "control" from a local union which was dictating actions to the Board; Mr. Fountaine endured a 7-week strike, fired a couple of the more outspoken members, and has had control ever since. Mr. Fountaine, a public administrator by training, does not get involved in "nuts and bolts" issues of operation, but appears to concentrate heavily on financial management, organization, and selection of quality personnel.

The Board is divided into five operating divisions: operations, finance, engineering, meter service, and supply and maintenance. The Operations Division, headed up by Alan Hamel, was consolidated recently from two divisions: pumping and treating and transmission and distribution. Total employees currently number 116.

The water system serves approximately 109,000 persons, representing the city's estimated population of 101,686 plus an estimated 7500 persons living in areas outside the city limits. Present annual potable water demand is 28,000 acre-feet. This amounts to a per capital usage of 230 gallons per day, including business and industry. Total number of metered service connections is approximately 33,000. The estimated growth rate is about 250-300 service connections per year.

Pueblo's water supply consists of water flowing from watersheds high in the Rocky Mountains. The water derived from this runoff is directed into and becomes part of the Arkansas River. Water used by Pueblo is diverted from the Arkansas River through intake structures for treatment in one of the Board's two filtration plants.

The Transmission and Distribution System

Pueblo's transmission and distribution system is made up of 377 miles of main, ranging in diameter from 4 inches to 48 inches. Pipe construction materials in the system include redwood staves and steel bands, cast iron, galvanized metal, steel, and asbestos cement. Transmission mains comprise about 53.46 miles. Of this total, about 14.5% is 20-inch A/C, 15.3% is cast iron, 9.97% is wood, and the remainder is steel.

Distribution mains can be characterized as follows:

<u>Size</u> (inches diameter)	<u>Construction Material</u>	<u>Amount</u> (feet)	<u>Amount</u> (miles)
16	Steel	15,675	2.97
16	Cast Iron	20,216	3.83
16	Asbestos Cement	32,344	6.13
12	Steel	57,462	10.88
12	Cast Iron	22,071	4.18
12	Asbestos Cement	147,332	27.90
10	Cast Iron	15,084	2.85
8	A/C and Cast Iron	475,896	90.13
6	Cast Iron	475,600	90.08
6	A/C	216,209	40.95
6	PVC	207	0.04
4	A/C and Cast Iron	116,973	22.15
3 & 2	Miscellaneous	<u>112,473</u>	<u>21.30</u>
	TOTAL	<u>1,707,542</u>	<u>323.40</u>

Most of the cast iron pipe in the system is unlined and therefore is heavily tuberculated and corroded. The Board has budgeted about \$1,555,000 for "improvement and replacement" of its distribution system for fiscal year 1982. Since fiscal year 1977, the Board has expended an average of \$1,390,000 annually for distribution system improvement and replacement. The pipe being replaced is cast iron and wood; almost all replacement is with A/C pipe.

Pueblo purchases A/C pipe "almost exclusively" in sizes 6 inches - 20 inches in diameter. They have a stockpile of some 4-inch pipe which they are trying to get rid of. Alan Hamel states emphatically that the Water Board will not buy any more 4-inch A/C. They have experienced substantial structural integrity problems with this material. This is a familiar refrain; Abilene, San Antonio and El Paso have encountered similar problems.

Pueblo is only the second of ten systems (the other is EBMUD) visited which buys and stores all pipe installed either by water system forces or contractors. Only developers buy their own pipe. The Board feels it saves money by furnishing materials. This may be an erroneous assumption; the Board has an inventory currently of 32,424 feet of 4-inch A/C, 35,526 feet of 6-inch A/C, 44,733 feet of 8-inch A/C, 49,855 feet of 12-inch A/C, 4,781 feet of 16-inch A/C, 6,195 feet of 20-inch A/C, and about 2,000 feet of 10-inch A/C.

Developers recently have inquired about the use of PVC. Although the Water Board purchased 3500 feet of PVC in 1981 (2000 feet was 6-inch), developers and contractors are allowed to use only A/C or cast iron. PVC is used by the Board primarily for repairs and to replace 4-inch A/C or cast iron mains.

Trends in purchasing favor A/C. The 1980 purchase of A/C amounted to \$260,000 in 1980, \$134,000 in 1982, and a contract in the amount of \$225,000 has been awarded recently to Johns-Manville. Ductile iron purchases amount to about \$30,000 per year. A/C is the preferred pipe material because of 1) cost and 2) non-corrosiveness. Officials note if A/C every gets high enough in price, they would consider going to ductile iron primarily "because of the health issue."

OPERATIONS

Specification, Decisionmaking, and Procurement

The Pueblo Water Board purchases A/C through an annual contract which specifies an anticipated usage amount. The total contract amounts, including pipe, gaskets, couplings, and short sections both MEO and MOA's, for the past four years (1979-82) are summarized below.

<u>Year</u>	<u>Contract Amount</u>	<u>Successful Bidder</u>	<u>Feet of Pipe (Full Sections)</u>	<u>Feet of Pipe (Short Sections)</u>
1979	\$345,866	CertainTeed	1,000 (4 in.)	18,226
	less 2%	Corporation,	10,000 (6 in.)	
	discount	Englewood, CO	17,500 (8 in.)	
			100 (10 in.)	
			13,500 (12 in.)	
			3,000 (16 in.)	
			2,000 (20 in.)	
		Total	<u>47,100</u>	
1980	\$345,749	Southwestern	1,000 (4 in.	12,949
		Supply,	dia., 10 ft.	
		Pueblo, CO	sections)	
			12,500 (6 in.)	
			25,000 (8 in.)	
			100 (10 in.)	
			13,500 (12 in.)	
			3,000 (16 in.)	
			2,000 (20 in.)	
		Total	<u>57,100</u>	

<u>Year</u>	<u>Contract Amount</u>	<u>Successful Bidder</u>	<u>Feet of Pipe (Full Sections)</u>	<u>Feet of Pipe (Short Sections)</u>
1981	\$320,285	CertainTeed Corporation, Englewood, CO	1,000 (4 in. dia., 10 ft. sections) 5,000 (6 in.) 25,000 (8 in.) 100 (10 in.) 10,000 (12 in.) 3,000 (16 in.) 2,000 (20 in.) <u>46,100</u>	12,948
		Total		
1982	\$217,442	Johns-Manville Corporation, Denver, CO	5,000 (6 in.) 26,000 (8 in.) 100 (10 in.) 5,000 (12 in.) 1,000 (16 in.) 500 (20 in.) <u>37,600</u>	12,916
		Total		

The purchase specifications contain a number of interesting provisions. Most notable among these is the following statement:

The Board reserves the right, at its option, to allow substitution of P.V.C. 6'6" and 3'3" short lengths for part or all of the MEO's and FM's contained on the Bill of Material. Said substitution shall be at the unit prices bid for AC MEO's. Any substitution request must be submitted in writing by manufacturer for consideration by Board.

Other specifications of note are:

- o all A/C pipe shall be Class 150 and manufactured to confirm to AWWA standard specification C-400-80 and C-402-77;
- o pipe of foreign manufacture shall not be acceptable for bid;
- o All A/C reducers shall have a positive stop. Approved A/C reducer couplings are J-M, CertainTeed Bureau Reducers, or Board approved equal.
- o A/C pipe approved for purchase is CertainTeed, J-M, and Capco.

A special notice in the specs announces the policy of requiring suppliers to have their pipe approved 30 days prior to bid opening. The approval procedures consist of

- submission of working sample per Pueblo Water Works specifications;
- submission of detailed drawings with sample;
- furnish list of users in and out of State of Colorado; and
- availability, cost of parts, and time for delivery.

The acceptable bidders list is shown on the following page.

Purchasing decisions are actually based on the Board's policy to take the "lowest responsible bidder." As noted above, bidders are pre-qualified. For many years, Capco was not an approved supplier. The Operations Manager (Hamel) initiates the bid process. He reviews current specifications and modifies if necessary. The Engineering Department (Terry Book) reviews the specs and, upon concurrence with the Operations Manager, allows the Purchasing Agent to go to bid. The award normally goes to the low bidder; therefore, decisionmaking is minimized. According to both the Operations and Engineering Departments, there are no consumer constraints on decision-making.

Design Considerations

External design considerations are developed by the Engineering Department. Local soil conditions are obviously a factor. The soils are aggressive and a lot of shifting occurs. Soil types range from sand to silty sand, coarse sand, gravel, blue shale, clay of the caliche type, and crumbly shale. Most of the problems with shifting soils occur in shale areas.

Flex load, live load, and flexural are taken into consideration. On small installations, 12 inches and smaller, the Engineering Department does not do soil borings; these are done only for larger pipe sizes (16 inch and 20 inch). Black and Veatch does most of the major engineering design jobs and also assists on an as-needed basis.

With regard to internal design considerations, the design service pressure ranges from 40-110 psi. Actual operating pressures range from 35-125 psi. Due to the topography of the area, the System's water distribution facilities are divided into seven pressure zones. Black and Veatch, in a recent report, recommended development of an eighth pressure zone.

BIDDERS LIST

Westburne Supply
P.O. Box 715
Pueblo, CO 81002

Mountain States Pipe & Supply
P.O. Box 698
Colorado Springs, CO 80901

Dana Kepner Company
700 Alcott Street
Denver, CO 80204

Waterworks Sales
600 W. 48th Avenue
Denver, CO 80216

Industrial Materials
P.O. Box 585
Denver, CO 80201

Johns-Manville
P.O. Box 5771
Denver, CO 80217

CAPCO Pipe Company
Jerry Kilgore
6497 South Teller Court
Littleton, CO 80123

Pipeline Materials
4150 Elati
Denver, CO 80216

Johns-Manville Corp.
Jerry Post
1943 S. Leyden
Denver, CO 80224

CertainTeed Pipe
Wayne Johnson
5115 S. Valley Highway, #156
Englewood, CO 80111

As noted earlier, all pipe specified is Class 150. Pressure surge is designed for using a sliding scale; it ranges from 100 psi on the lower end to about 70 psi in larger sizes. Design for head loss is 3-5 feet loss per 1000 feet. Fire flow also is a design criteria, normally factored in by Black and Veatch when designing major jobs.

Technical Service Needs and Information

When asked what the industry can do to serve them better, the answer was "the suppliers could speed up claim response." They have had a faulty piece of 8-inch pipe on which a claim has been registered. J-M promised repeatedly to come in and take care of the problem, but have not shown up.

The Board's Quality Control Chemist is a sharp fellow named Brian Elson. He does not understand why or how iron is precipitating on the A/C pipe, especially since the finished water has little iron in it. He would like someone to explain the precipitation mechanism to him.

Also the chemist is getting what he termed "pyrite formation" in the tubercles of CI pipe. Acid washing is yielding H₂S. He does not understand why this is occurring. He wonders if a sulfate reducing bacteria grows in CI pipe. I directed him toward DIPRA for that answer.

Installation and Testing

Pipe is installed by water works forces, by developers, and by contractors. Total installations and the entities who laid the pipe are listed for the past six years:

Installation (feet)

<u>Year</u>	<u>Water Works</u>	<u>Developer</u>	<u>Contractor</u>	<u>Total</u>
1976	17,445	41,062	34,829	93,336
1977	12,489	35,931	32,700	81,120
1978	7,692	38,953	34,158	80,803
1979	7,989	42,487	26,353	76,829
1980	6,561	26,361	47,991	80,913
1981	13,087	8,897	36,616	58,600

Except for 1981, the total amount of pipe installed has remained fairly consistent. The substantial reduction in 1981 occurred because of fewer developer installations, reflecting the softness in the housing construction market.

Installation costs for 1982, based on a main extension model and using actual cost data for construction materials, labor and equipment, are estimated by the Board as follows:

<u>Pipe Size</u>	<u>Material Cost</u>	<u>Labor Cost</u>	<u>Equipment Cost</u>	<u>Total Cost/ Linear Foot</u>
6"	\$3.02	\$5.13	\$4.14	\$12.29
8"	4.36	5.13	4.14	13.63
12"	8.87	5.13	4.14	18.14
16"	14.03	5.13	4.14	23.30

In 1977, unit costs were computed at \$6.84, \$8.05, \$9.95, and \$12.99 respectively for the four sizes of mains. The cost model assumes a hypothetical quantity of 10,000 feet and also is specified for main extension only. Main replacement costs could be expected to be higher.

Specifications for the installation of water mains were developed by Terry Book, a civil engineer in the Board's Engineering Department. The specs were revised in July, 1981.

Construction Materials

Only pipe of asbestos cement or cast iron with "slip" type or mechanical joints is allowed. Standard lengths of 13 feet for A/C and either 18 feet or 20 feet for cast iron are specified.

Trenching

The maximum trench width allowed is as follows:

<u>Pipe Diameter</u>	<u>Maximum Width</u>
6"	24"
8"	24"
10"	24"
12"	30"
16"	36"
20"	40"
24"	48"

Normal depth of cover is 48 inches. This has been increased from 42 inches due to problems with frozen mains. The frost line in Pueblo ranges from 30 inches to an extreme of 38 inches.

For trenches dug in rock, excavation to a depth of at least six inches below the pipe bottom is required. Special bedding with select granular material, fine gravel, or coarse sand of quality which will pack when moistened and tamped is required when these conditions are encountered. Minimum thickness of this special bedding is specified at 4 inches.

Backfilling and Compaction

Except in areas where unstable subgrade conditions are encountered, backfill is with native materials. In unstable grade conditions, rock or gravel backfilling may be required. If crushed gravel or pit run gravel is used, a 3/4 inch maximum size is specified for use with A/C pipe and a 1½ maximum for cast iron.

A minimum of 90 percent standard proctor density is required on all compacted backfill. When contractors are performing installations, the method of attaining this density is left to his discretion. Water Board forces use hydrohammers for compaction. Water system forces typically break one or two pipe sections per job with hydrohammers. Mainly 8-inch A/C has been broken in this manner.

Pipe Handling Procedure

The policy in handling is to try and minimize the number of unloadings. If possible, deliveries are made directly to jobsites. All pipe delivered by supplier must be on pallets. When the Board first started using A/C, palletizing was not required and they "lost some pipe." Careful handling procedures such as palletizing and unloading by fork lift have now resulted in losses being minimized.

Disinfection and Pressure Testing

Contractors are required to thoroughly clean and pressure test installed mains, according to the specs. Disinfection with chlorine or HTH tablets also is required. HTH tablets are furnished by the Board and affixed to the top interior wall of the pipe with permatex. The chlorine solution must remain in the line for 24 hours; after flushing, samples are then collected for bacteriological analysis.

According to the Board engineer, hydrostatic testing is not performed. The reason given is too many leaky valves which would render the test meaningless. To try and ensure that contractor installations are leakproof, Pueblo has instituted a leak detection program which calls for checking of mains for leaks one month prior to the expiration of the one-year performance warranty.

Tapping

Wet taps are made with either Mueller or McDonalds tapping machines. Fabricated steel tapping saddles are used for 6-inch and 8-inch lines. The Board has encountered problems in tapping 20-inch lines. They have experienced failures of the pipe about 6 inches outside the corporation stop. In extreme cases, the corp blows out. A two-step tapping procedure is being considered; the first step would be to drill a hole, then going back and cutting threads with a second bit. Pueblo would like some technical assistance from the Association in this area.

Recommended Work Practices

Water Board officials are aware of Recommended Work Practices and observe these practices when Board forces are installing pipe. However, contractors are not required to observe these practices nor are they made aware of the potential health hazards associated with inhalation of asbestos. A low-cost service which could be provided to major A/C users is an advisory reviewing recommended work practices and explaining the potential legal recourse of the contractor or his employees if not informed of recommended work practices.

Operation and Maintenance

If the degree of efficiency and structural integrity of a water distribution system can be measured by 1) the number of pipe failures occurring annually and 2) the percentage of unaccounted for water, then Pueblo is a good system.

Unaccounted for water is estimated at 7 percent, although it is difficult to arrive at an accurate number. The reason is that city parks and city buildings are not metered; the city does not pay the Board for water used. The Board also supports a beautification program through which they give the highway department free water for three years, then charge them only 50 percent of actual metered value.

The number of pipe failures (main breaks) has averaged 151 over the 14-year period 1968-81. The number of breaks annually ranges from 115-196. In the past two years (1980, 1981), A/C breaks have amounted to 19.3 percent (1980) and 13.5 percent (1981) of the total. By contrast, cast iron breaks have constituted 62.2 percent (1980) and 66.7 percent (1981). The other breaks have either been unspecified (on work orders) as to construction material or have occurred in wooden mains or steel. One break occurred in PVC.

According to Board officials, "90 percent of breaks are not in A/C; most breaks occur in unlined 4-inch and 6-inch unlined cast iron mains." The nature of A/C breaks are 1) a few breaks around corporation stops, 2) split couplings on 16- and 20-inch lines, 3) broken gaskets, and 4) a few beam breaks.

Most main breaks are associated with cold weather, with shifting soils causing most of the breaks. The majority occur in winter, either when the ground first begins to freeze, when the ground begins to thaw, or during an extended cold period. Records support this statement. Over the past 14 years, main breaks in December and January have averaged 21.6 and 21.8 respectively. The only other month in which the average is greater than 15 is November (16).

Although most repairs are made with leak clamps, within his one-year warranty period, a contractor cannot use clamps. The Board requires him to make the repair with a new 13-foot section. In larger sizes of A/C, the Engineering Department notes one is "kidding oneself" to think 16- or 20-inch A/C can be repaired with clamps.

They have experienced substantial problems with uniformity in 20-inch pipe. The nominal size is 23.94 inches, but actual diameters can range from nominal to more than 26 inches. Pueblo has not had an A/C break in either a 16- or 20-inch line in the past three years, only leaks and broken collars.

Repair costs for all types of pipe are estimated at \$750-\$1000 average, including labor, paving, equipment, and materials. If a break occurs in a downtown street, the number can be doubled to \$1500-\$2000.

The Aggressiveness Index (AI) of Pueblo's finished water was calculated from laboratory data provided. The AI in July 1981 was 11.61, 11.31 in August, and 11.51 in September.

Repair and Replacement

Black and Veatch prepared an extensive report on Pueblo's water distribution system in 1979. Among their numerous recommendations were substantial main improvements. Black and Veatch recommended three stages of improvements and estimated probable construction costs:

<u>Stage</u>	<u>Total Main Length (feet)</u>	<u>Probable Construction Costs</u>
I	33,900	\$1,719,000
II	208,300	7,426,000
III	<u>230,900</u>	<u>7,523,000</u>
Totals	<u>473,100</u>	<u>\$16,668,000</u>

The Board is moving to implement these recommendations as rapidly as possible. Approximately \$1.45 million was budgeted for main improvements and replacements in FY-82 and this trend is expected to continue in the future.

In addition to its main replacement program, the Board plans to initiate a major cleaning and relining (of CI mains) in 1983-84. Ameron claims it can clean and reline for 65 percent of replacement costs on smaller mains and 45 percent of replacement costs in larger sizes. Pueblo plans to try out this theory on some of their 12-, 16-, and 24-inch unlined cast iron mains.

Repair costs budgeted in 1981 amounted to \$61,800 and increased to \$65,000 in the fiscal year ending on June 30, 1982. This amount covered asphalt, backfill, concrete, landscaping, pipe, fittings, repair clamps, and sewer line repair and supplies. It does not include labor or the cost of operating heavy equipment.

Detection and Prevention

Pueblo has leak detection equipment of the geophone type. Their leak detection program is a response type program, not based on surveys. However, they are currently checking for leaks on systems under one-year warranties at the 11-month mark.

FINANCIAL

The Pueblo Board of Water Works is in very good condition financially. It has total assets of about \$80 million and long-term debt amounting to only \$26 million; total equity amounts to \$48 million. The debt-asset ratio is about 1:3, extremely good for a public utility. The debt service coverage ratio also is healthy, amounting to about 1.82 (1.25-1.5 is average for the industry).

All pipe expenditures are funded out of earnings. The pipe repair account is part of the operating budget while the replacement account is a capital outlay. No main extensions or replacements are funded from bond proceeds. Therefore, there are no interest costs.

Comparative bid data have been obtained for A/C, PVC, and ductile iron. These data, representing costs for 13-foot sections in the case of A/C and 18-foot and 20-foot sections of PVC and ductile are summarized below.

<u>Material/Size</u>	<u>Price Paid 1978</u>	<u>Price Paid 1979</u>	<u>Price Paid 1980</u>	<u>Price Paid 1981</u>	<u>Price Paid 1982</u>
4 inch A/C	1.86	1.68	1.83	1.77	--
6 inch A/C	2.19	2.37	2.33	2.40	2.30
8 inch A/C	3.19	3.50	3.44	3.55	3.35
10 inch A/C	5.60	5.65	5.30	5.60	6.00
12 inch A/C	6.29	6.50	6.66	7.23	6.88
16 inch A/C	10.21	10.75	11.02	11.40	11.25
4 inch Ductile MJ	--	--	4.44	4.46	--
4 inch Ductile Tyton	--	--	4.24	4.09	--
6 inch Ductile MJ	--	--	4.47	5.24	--
6 inch Ductile Tyton	--	--	4.12	4.71	--
8 inch Ductile MJ	--	--	6.06	7.04	--
8 inch Ductile Tyton	--	--	5.64	6.43	--
10 inch Ductile MJ	--	--	8.01	9.34	--
12 inch Ductile MJ	--	--	10.14	11.66	--
12 inch Ductile Tyton	--	--	9.53	10.79	--
16 inch Ductile MJ	--	--	14.95	17.24	--
4 inch PVC	--	--	--	1.93	--
6 inch PVC	--	--	--	2.62	--
8 inch PVC	--	--	--	4.57	--
12 inch PVC	--	--	--	9.04	--

Two conclusions can be reached from studying this cost data. First, the selling price of A/C has remained almost constant in 4-, 6-, 8-, and 10-inch diameters. It has risen only about 15 percent in the 12-inch size and 11.65 percent in the 16-inch size over a 5-year period. Second, A/C pipe enjoys a huge price advantage over ductile iron; ductile costs almost twice as much in smaller sizes and 50-75 percent more in larger sizes. Asbestos/cement is only marginally more inexpensive than PVC in 4- and 6-inch sizes, but PVC is substantially higher in 8-inch and 12-inch sizes.

All pipe in the Pueblo system is depreciated on a 50-year schedule.

Conclusions

Asbestos/cement pipe is the water pressure pipe of choice in Pueblo. Although PVC is used, there appears to be no trend toward increased use. The Water Board is pleased with A/C performance, but could benefit from some technical assistance by the Association. Pueblo is a quality water supply system and a staunch supporter of A/C pipe use. If possible, the Association President should conduct a seminar there, if for no other reason than to keep the customer happy.