PLAINTIFF'S EXHIBIT

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Technical Bulletin

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TO: VF P&PG MARKETING AND SALES PERSONNEL
ALL DISTRICT MANAGERS
ALL TERRITORY MANAGERS
ALL ADMINISTRATIVE ASSISTANTS
ALL A-C PRODUCT MANAGERS
ALL FIELD SERVICE MANAGERS
ALL SALES ENGINEERS

FM: T. SWITALSKI T. Switalski

RE: CRUSHING STRENGTH OF A-C VS. CLAY SEWER PIPE

We have recently begun a series of tests to thoroughly evaluate vitrified clay sewer pipe and to compare the advantages and disadvantages of vitrified clay sewer pipe with asbestos-cement sewer pipe.

Initially, we have begun by testing our asbestos-cement pipe and clay sewer pipe in crush tests. The pipes were subjected to crush tests using the 3-edge bearing method. This test method is described in ASTM C500-73a for asbestos-cement sewer pipe and C301-72 for clay sewer pipe. The required crushing strengths are found in C644-71 and C428-73d for asbestos-cement sewer pipe and C700-71T for clay sewer pipe. These requirements are listed on the attached table.

Basically, the difference between the ASTM testing methods is that the clay sewer pipe is crush tested using rubber or plaster blocks, while asbestos-cement sewer pipe is crush tested using wood blocks. Also, the clay pipe standard specifies that a complete length of pipe be tested, usually 5 or 6 ft., while the asbestos-cement standard specifies that a 1 ft. sample be tested.

The first tests run were performed on 8 inch extra strength clay sewer pipe and 8 inch Class 2400 asbestos-cement pipe, since this is the most frequently used size and class. As a result of these tests, we have derived the equivalent crushing requirement for asbestos-cement pipe using rubber blocks and plaster blocks instead of wood blocks. Our tests show that using rubber blocks increase the crushing value of asbestos-cement pipe by 37 percent and using plaster blocks increase the crushing value of asbestos-cement pipe by 30 percent over that with wood blocks. This results in the following equivalency table:

Comparative Minimum Requirements of 8" A-C & Clay Sewer Pipe

Method	8" Extra Strength Clay	8" Class 2400 A-C
Wood		2400
Rubber	2200	3290
Plaster	2200	3120

Similar tests were run to determine what the requirement for clay pipe would be if wood blocks were used to test the clay pipe. The results were varied and therefore not conclusive enough to make general statements about. Also, tests were run on 8" Extra Strength Clay sewer pipe manufactured by different companies and the crushing strengths were found to vary considerably.

Tests were also run to determine the crush strength of recently manufactured 4" Vitrified Clay sewer pipe as compared to 4" VC sewer pipe which had been sitting in a distributor's yard for 6 years. The results of these tests show that the modulus of rupture for crushing strength was lower for the 6-year-old pipe by 10 percent. The 6-year-old pipe, however, still passes the minimum requirements for VC pipe. The small number of crush tests run restricts us from making this a general statement for all clay pipe. However, it is understood from various sources that clay sewer pipe does loose some degree of strength as a result of weathering.

It should be noted that vitrified clay sewer pipe would be at a disadvantage if it was tested using wood blocks since clay pipe is brittle and has an uneven surface. Wood blocks cannot fill these surface irregularities in a crush test while rubber and plaster can. These irregularities and brittleness are the reason that clay pipe comes only in short lengths and has a thicker wall than A-C pipe.

The equivalent to 8" Extra Strength Clay sewer pipe is 8" Class 2400 asbestos-cement sewer pipe and as noted in the above table, the required minimum crushing strength of the asbestos-cement pipe is greater by at least 43 percent. This relationship between the crushing strengths of A-C and clay sewer pipe is true only for 8" pipe and is a function of the diameter. Further tests are to be run to determine what the relationship is in larger sizes.

MINIMUM CRUSHING STRENGTHS, lb./linear ft.

Nominal Pipe Size, In.	Asbestos-Cement Non-Pressure Sewer Pipe C644-71, C428-73d					Clay Sewer Pipe ASTM C700-71T	
	Class 1500	Class 2400	Class 3300	Class 4000	Class 5000	Standard Strength	Extra Strength
4"	1500	2400	3300	----	----	1200	2000
5"	1500	2400	3300	----	----	----	----
6"	1500	2400	3300	----	----	1200	2000
8"	1500	2400	3300	----	----	1400	2200
10"	1500	2400	3300	4000	5000	1600	2400
12"	1500	2400	3300	4000	5000	1800	2600
14"	1500	2400	3300	4000	5000	----	----
15"	----	----	----	----	----	2000	2900
16"	1500	2400	3300	4000	5000	----	----
18"	----	2400	3300	4000	5000	2200	3300
20"	----	2400	3300	4000	5000	----	----
21"	----	----	----	----	----	2400	3850
24"	----	2400	3300	4000	5000	2600	4400

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