



## ABRASION RESISTANCE OF SEWER PIPE MATERIALS

In the 1960's, the National Clay Pipe Institute conducted a study of the abrasion resistance of several commonly used sewer pipe materials. This early study was made on concrete, ductile iron and clay pipe. Very small amounts of abrasive wear were observed. Following the introduction of several types of plastic pipe, a second series of tests were run at an NCPI member's plant in cooperation with NCPI. These tests, conducted in 1985, showed the influence of abrasion on PVC pipe with different amounts of calcium carbonate as filler and the influence of abrasion on PVC and ABS pipe with thin inner walls. All of the abraded pipe were then subjected to an ASTM structural test specified for each product. The results of the abrasive wear and structural test from Research Report No. 141 are summarized in this Tech Note.

The test results were obtained by rotating pipe sections at 2.5 feet per second for 500 hours. The abrasive charge consisted of 7 pounds of #67 (ASTM D 448) limestone aggregate and 6.6 pounds of water which was changed every 48 hours.

The test is solely intended to: **1. rate the different pipe materials using a test method severe enough to cause some abrasive wear on all pipe materials and 2. determine if abraded pipe will have reduced structural capabilities.** No claims are made as to actual performance or life expectancy in actual field conditions and the results may not be indicative of pipe produced with filler materials other than calcium carbonate, with different quantities of filler material or with different wall thicknesses.

### ABRASION RATING OF SELECTED SEWER PIPE MATERIALS

#### WALL THICKNESS ABRADED

<u>PIPE (ALL 8" DIAMETER)</u>	<u>INCHES</u>	<u>PERCENT</u>
1. Vitrified Clay	.003	0.3
2. Solid Wall PVC	.027	10.5
3. Solid Wall PVC with filler	.043	19.4
4. Profile Wall PVC	.048 <sup>a</sup>	100.0 <sup>a</sup>
5. PVC Truss	.059 <sup>a</sup>	100.0 <sup>a</sup>
6. ABS Truss	.067 <sup>a</sup>	100.0 <sup>a</sup>

a - Complete abrasion through the interior lining.

**STRENGTH TESTS** - Following the abrasion test, 6” long sections were cut from each of the plastic pipe and a standard 5% pipe stiffness test was run (ASTM D24 12). The vitrified clay was subjected to a standard three-edge bearing strength test (ASTM C30 1). The test results are indicated on the following table.

**PIPE STIFFNESS TEST (ASTM D 2412 – 8”)**

<b>PIPE</b>	<b>MINIMUM REQUIREMENT</b>	<b>AFTER ABRASION</b>	<b>% UNDER MINIMUM</b>
1. Solid Wall PVC (ASTM D 3034)	46 psi	32.1 psi	30.2%
2. Solid Wall PVC (ASTM F 789)	46 psi	19.2 psi	58.3%
3. Profiled Wall PVC	46 psi	28.6 psi	37.8%
4. PVC Truss (ASTM D 2680)	200 psi	152.6 psi	23.7%
5. ABS Truss (ASTM D 2680)	200 psi	143.5 psi	28.3%

**BEARING STRENGTH TEST (ASTM C 301 – 8” diameter)**

<b>PIPE</b>	<b>MINIMUM REQUIREMENT</b>	<b>AFTER ABRASION</b>	<b>% OVER MINIMUM</b>
1. Vitrified Clay (ASTM C 700)	2200 lbs/Linear ft.	4067 lbs/Linear ft	84.9%

**CONCLUSIONS**

1. Vitrified clay pipe demonstrated superior abrasion resistant qualities and had a bearing strength after abrasion which greatly exceeded the ASTM minimum requirement.
2. The most abrasion resistant plastic pipe abraded at a rate which was nine times greater than clay pipe.
3. All of the plastic pipe demonstrated a substantial decrease in pipe stiffness following abrasion.