CONCRETE PIPE GETS STRONGER WITH AGE

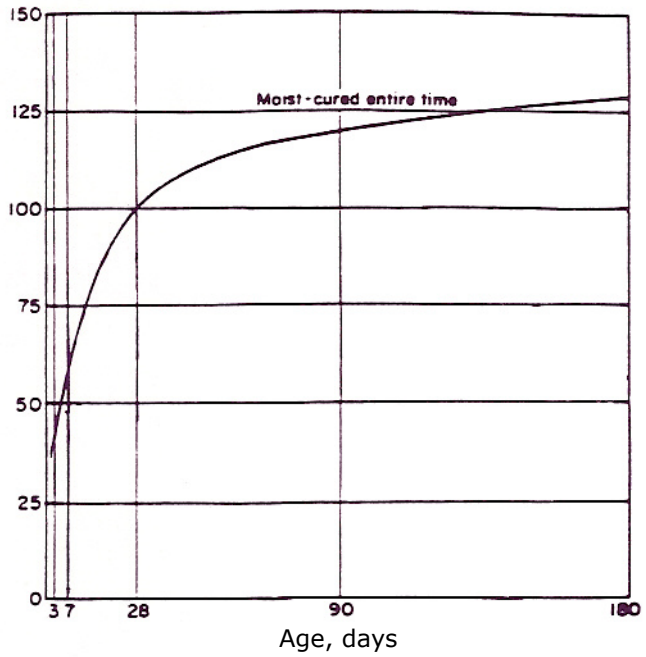
It is a well-established fact that concrete gets stronger with age. This is particularly true for concrete pipe which is installed in a moist buried environment. **Concrete pipe is the only pipe that gets stronger with age**.

"Increasing in strength with age continues as long as any unhydrated cement is still present, provided the concrete remains moist and the concrete temperature remains favorable. When the temperature of the concrete drops below freezing, hydration and strength gain virtually stops."(1) It should be noted that hydration can resume once the temperature rises above freezing.

Figure 1 illustrates the relationship between strength gain and moist curing:

Figure 1

Compressive strength, percent of 28-day moist cured concrete.



Concrete strength increases with age as long as moisture and a favorable temperature are present for hydration of cement.

"The principal factors affecting strength are water-cement ratio and age, or the extent to which hydration has progressed."(2)

The lower the water-cement ratio, the stronger the concrete. "When mixing concrete, therefore, no more water should be used than is absolutely necessary to

make the concrete plastic and workable."[3] Typically, concrete pipe is manufactured with zero slump concrete and with a water-cement ratio well below the limits set by ASTM and AASHTO specifications[4], thus providing high strength concrete.

HYDRATION

"The binding quality of portland cement paste is due to the chemical reaction between cement and water, called hydration."[3] The cement paste is composed of water and extremely fine cement particles, of which there are some 7 trillion particles per pound.

Factors that influence the rate of hydration include fineness of cement grinding, admixtures used, if any, water and temperature.

A typical concrete pipe mix having 5 sacks of cement and a low water-cement ratio produces 28-day concrete strengths well in excess of the ASTM and AASHTO requirements of 4,000 psi.

ABRASION RESISTANCE

On occasion, where high bed loads and steep slopes exist, hydraulic structures may be subjected to abrasion. Results indicate that abrasion resistance is closely related to the compressive strength of concrete. High strength concrete has more resistance to abrasion than does lower strength concrete. Since compressive strength depends on water-cement ratio and curing, low water-cement ratio concrete pipe provides superior abrasion resistance.

CONCLUSION

"Concrete pipe gets stronger with age."

Concrete gets stronger because there is an on-going chemical reaction between the cement particles and moisture in the concrete. Low water-cement ratio is essential to quality concrete. Concrete pipe differs from conventional concrete in that very low water-cement ratios are used. **Concrete pipe is the only pipe product that provides the consumer with the assurance of increased strength with time.**

References:
[1] Steven H. Kosmatka and William C. Panarese, "Design and Control of Concrete Mixtures", Thirteenth Edition, Portland Cement Association, 1988, p. 4
[2] Ibid, p. 5
[3] Ibid, p. 3
[4] ASTM C 76 and AASHTO M170, "Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe", para. 10.1