

CONCRETE PIPE PROPERTIES

There are certain concrete properties that influence the performance of concrete pipe. These properties include concrete compressive strength, density, absorption, water-cementitious ratio, cementitious content & type, and aggregates.

CONCRETE COMPRESSIVE STRENGTH

Compressive strengths for concrete pipe normally range from 4000 psi to 6000 psi. Concrete strength is a function of many factors including, aggregates, cementitious material, manufacturing, curing process and mix design. Concrete pipe design strengths refer to 28 day concrete strengths but in actuality, the design strengths are obtained much earlier than 28 days and it is not uncommon for 28 day tests to substantially exceed the specified design strengths.

DENSITY

Quality concrete pipe densities typically range from 145-155 pounds per cubic foot. Usually the higher the density, the greater the concrete durability unless the increased density was obtained by only using heavier weight aggregates.

ABSORPTION

Absorption is primarily used to check the density and imperviousness of the concrete. As with compressive strength, the absorption can be greatly influenced by both the aggregates and the manufacturing process used. ASTM C 76 specifies a maximum allowable absorption of 8.5% or 9%, depending on the test method used, for concrete pipe.

WATER-CEMENTITIOUS RATIO

Low water-cementitious (W/C) ratios are one of the trade marks of quality concrete pipe with corresponding high compressive strength as a function of the low W/C ratio. Typical precast concrete pipe have W/C ratios that range from 0.33 to 0.45 with 0.53 being the maximum allowed by ASTM C 76.

CEMENTITIOUS MATERIAL

Cementitious content which has always been a topic of concern with engineers and manufacturers includes both cement and fly ash. The key to proper cementitious content is proper design of the mix, with consideration of all material properties, manufacturing and curing processes. All types of cement have been used in the

manufacture of concrete pipe but generally a Type II cement is used (see Information Series 102 Types of Portland Cement) and both Type F and Type C are also used (see Info Brief 1005 Fly Ash). Typical minimum cementitious content allowed by ASTM C76 is 5 sacks (470 lbs) per cubic yard of concrete. ASTM C 76 does allow the use of lower cementitious contents (less than 5 sacks per cubic yard) provided performance is verified by testing.

AGGREGATES

Concrete pipe aggregates, both coarse and fine, meet the requirements of ASTM C 33 except for gradation. Both natural and manufactured aggregates are suitable for use in concrete pipe. Aggregates are a key element in producing quality concrete and in turn, quality pipe. With regards to strength, durability and performance, all aspects of the aggregates should be considered, these include gradation, absorption, specific gravity, hardness, and in some cases alkalinity.

Considering the properties listed above when designing concrete pipe will provide the engineer with a high quality, durable product. Concrete pipe is a time proven, versatile and durable product whose excellent structural and durability properties gives it virtually an unlimited service life under normal conditions (see Info Brief 1003 Life Of Concrete Pipe).