

MANNING'S n VALUE RESEARCH

The first comprehensive testing program to accurately determine roughness coefficients (n values) was conducted at the University of Iowa in 1924 on pipes that would be classified today as poor quality from both the pipe surface and joints.

Since that time, many pipe producers and researchers have conducted independent tests at recognized universities and have promoted their "hydraulically improved" n values. This is particularly true of pipes and joints that were not available when the University of Iowa report was first published.

Based on these recent tests, PVC manufacturers recommend a n value of 0.009; HDPE manufacturers recommend 0.010; Spiral Rib manufacturers recommend 0.011 for Corrugated Steel Pipe and 0.012 for Corrugated Aluminum Pipe.

Both metal and plastic pipe producers currently promote their low laboratory values for design purposes. The low n values were achieved by assembling selected pipes in a straight line on blocks in a test flume to a very precise grade. Only clean water was used, which does not reflect real conditions. Since the flexible test pipes were not backfilled, they maintained a circular shape throughout the test line. This is not representative of the shape of typical flexible pipe installations.

Recently, three different universities conducted n value tests on concrete pipe and, in each case, determined that a Manning's n value of 0.010 was valid.

Utah State University and the University of Alberta, Canada were selected because both universities had previously conducted hydraulic tests on corrugated metal pipes and various types of plastic pipes. Therefore, there was no difference in testing methods between plastic, metal and concrete pipes.

In 1960, concrete pipe was tested at the St. Anthony Falls Hydraulic Laboratory (University of Minnesota) for State and Federal Highway Departments and it was determined that an n value of 0.010 was accurate.

The following table illustrates the results of hydraulic testing at three Universities on concrete pipe:

CONCRETE PIPE n VALUE RESULTS

Testing Facility	Diameter	n Value
Utah State University	8"	0.010
Utah State University	12"	0.010
Utah State University	18"	0.010
University of Alberta	8"	0.010
University of Alberta	10"	0.010
University of Alberta	15"	0.010
St. Anthony Falls Lab*	24"	0.010
St. Anthony Falls Lab*	36"	0.010

*St. Anthony Falls Laboratory, University of Minnesota

Even with three different universities establishing a n value of 0.010, the concrete pipe industry steadfastly maintains that a safety factor must be applied to the laboratory values for design to account for increased friction due to grade and angle changes, inlets, manholes, bed loads, and other factors that could affect flow characteristics. Therefore, the following values are recommended, **regardless of the type of pipe**[†]:

Storm Sewers	0.012
Sanitary Sewers	0.013

Values slightly higher than those for storm sewers are recommended for sanitary sewers. The reason for higher sanitary sewer values is to take into consideration slime layer build-up and the accumulation of grit on the invert, which would be independent of pipe materials.

[†] Does not apply to standard corrugated metal pipe patterns, such as 2-2/3" x 1", etc.