BY J. JOE SCOTT II, CPD

The Problem With Graphs

One of the problems that we as plumbing designers must deal with on a limited basis is a project that has a large number of fixture units and is tributary to a sanitary sewer system. I usually receive a phone call once a year or so regarding this situation. The caller typically asks if I know of any calculations or data to help translate a large fixture unit load into a gallon-per-minute flow rate. I know such information is available, but it is difficult to find.

The main roadblock to solving this problem is the primary difference between the way drainage systems within a building are designed and the way sewage systems outside a building are designed. Inside a building we are concerned with the number of fixtures and the potential use of those fixtures. The plumbing code most often dictates the size of the drainage piping. In an effort to make the engineering concepts more user friendly and available so that an inspector can check a pipe size in the field, tables and graphs were developed. The tables and graphs use the principles of engineering and the physics of the systems as their basis. However, most of us do not remember how the tables were developed or do not have the information used in the development of the tables. Such is the case with drainage systems and the plumbing code.

Municipal sanitary sewer and lift station capacities are calculated using a different basis of design than the drainage fixture unit. Their calculations are based on data and probability in gallons per person per day. Such data are available in many places and deal more with the type of building being served and its occupancy rather than the number of plumbing fixtures that are installed in the building. Data have been collected and used for a very long time and are broken down in many different ways, even by how the property is zoned. This is not a new concept, and many of the systems we design fall under the same type of situation. The sizing of water heaters and thermostatic mixing valves, for instance, deals more with the occupants of a building and how the fixtures are used than the exact quantity of fixtures that are available. For example, if a building has 20 showers and only three persons are in the building, then the load is for three individuals using the showers.

But finding the correct information to give to a civil engineer in a unit of measurement he can understand (usually cubic feet per second) is not always easy. Yes, we can interpolate the flow rate by taking the maximum number of fixture units that can be connected to any portion of the building drain and looking up the capacity of the piping at a given slope. Most of the time the flow rate obtained is more than adequate, but if the service is larger than 15 inches in diameter the answer becomes more difficult because such data are not readily available. The method itself presents some potential problems because sufficient information may not be available to make an engineering judgment on capacity.

By using this method we can determine the capability of the piping for a given flow rate, but we do not know the load of the building on the system. If we provide information on the capability of the piping instead of the load on too many systems, then the municipal system or lift station may be oversized. Oversized equipment and piping are sometimes more of a problem than slightly undersized equipment and piping.

Some years ago I received a copy of a graph that converts drainage fixture units to gallons per minute. The graph depicts two design flow curves for plumbing drainage systems. The first curve represents the peak discharge into the drainage system, which will not be exceeded more than 1 percent of the time during periods of heaviest use. The second graph is for comparison purposes and represents the average discharge into the drainage system during heaviest use computed from the discharge characteristics of water closets.

Unfortunately the graph is all that I have. I don't have the information about the development of the graph that typically you would want to better understand the potential shortcomings of the data provided. Otherwise we could misapply the information presented and run into problems later.

The graph I have is quite old, and, although I have tried, I have not been able to find out where it originated. I know this information is not included in many texts or design manuals, and it would be very helpful to locate the graph's original source. If you know where to locate some of this information, please let me know. It would be a great help to publish it in ASPE's *Plumbing Engineering Design Handbook*.

As always, I look forward to hearing from you. PSD

JOE SCOTT is senior plumbing designer for Cannon Design in St. Louis. To comment on this article, or for more information, contact **articles@psdmagazine.org.**