

# Minimum Plumbing Fixture Requirements

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During the past several months, several architects have called me to discuss minimum plumbing fixture requirements. Several expressed concern that there is no consistency in the code as to the number of plumbing fixtures required for different types of buildings.

To bring some light to the issue of minimum plumbing fixture requirements, the following question was asked.

**In chapter 4 of each of your plumbing codes, a table shows minimum plumbing fixture requirements for different types of buildings. In comparing the two tables, it becomes evident that there are many similarities between them but also many dissimilarities. Two examples of the dissimilarities are the drinking fountain requirements for a church and the water closet requirements, for a restaurant.**

**Please explain to our readers where the numbers in your code's table originated. Were any studies done to back up the table, or are these just arbitrary values?**

Here are responses from Carl Marbery of the International Conference of Building Officials (ICBO) and Allen Inlow of the International Association of Plumbing and Mechanical Officials (IAPMO).

## From ICBO

The first edition of the International Plumbing Code (IPC) was published in 1995. The minimum plumbing fixture requirements were selected from several sources, including the 1993 Building Official and Code International (BOCA) National Plumbing Code, the 1994 Southern Building Code Congress International (SBCCI) Standard Plumbing Code, and the 1994 ICBO Uniform Building Code. Some of these requirements had evolved over many years as a result of observation by enforcement personnel and comments

and reports from property managers and owners.

The fixture requirements for assembly buildings with large occupancies were based on one-quarter to one-third of the population using the facilities during a major break. The numbers differ based on the anticipated break time. For example, half-time at a football game lasts 12–15 minutes. The intermission at a theater lasts 15–25 minutes. The values in the table attempt to adjust fixture usage based on anticipated length of the heavy-use period.

These required fixture values have been changed in the 2000 edition of the IPC, based on studies by HOK Sport, a specialist in the design of major sports facilities. In the past 15 years, the required fixture values in the IPC have increased in the percentage of female attendance to more of a 50% male and 50% female proportion. However, it is not uncommon for plumbing fixtures in older facilities to be provided based on a ratio of 60% male to 40% female.

The requirements for restaurants and nightclubs are based on a study performed by the National Restaurant Association. The study determined that nightclubs require almost twice as many plumbing fixtures as restaurants because of the consumption of alcoholic beverages.

Fixture requirements for factories and industrial facilities are based on the requirements for storage facilities. This method establishes realistic minimums for factory occupancy. The numbers were established through a limited study of factory projects in Henrico County, VA.

For prisons and dormitories, fixture studies by the military were utilized.

The military distinguished between a highly regimented and partially regimented facility. In a prison, there is a level of discipline similar to that of a highly regimented military facility. In a dormitory or lodge, there is less regimentation and therefore a need for additional plumbing fixtures.

The most lightly used plumbing fixtures are in mercantile establishments, where the general population has a low demand for fixture use. The table takes this fact into consideration. Various studies have shown the values to be too restrictive. The studies were based on moderate use in covered mall buildings. During periods of heavy use, the population of a covered mall increases and a greater demand is placed on plumbing fixtures.

Various methods have been used to evaluate the need for plumbing fixtures. For office buildings, studies have indicated that design guidelines based on occupancy times, arrival rates, and duration, along with patterns of fixture use, provide the number of required plumbing fixtures for a desired level of service. The Building Technology Research Laboratory at Stevens Institute of Technology conducted a study based on queuing theory to determine the number of plumbing fixtures for a preferred level of service, expressed as waiting time during peak periods of use, fixture utilization, and the probability of finding a vacant fixture. This type of method provides answers to use in designing service systems.

For residential buildings and healthcare facilities, the number of plumbing fixtures is based on the minimum need. The result is a

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requirement for at least one water closet and one lavatory for each dwelling unit, guest room, or hospital room.

As to the adequacy of existing requirements, it is important to note that the minimum fixture requirements in the code will change as our culture changes. As far as I am aware, the most comprehensive study of minimum required plumbing fixtures was conducted by Works Consulting Services for the New Zealand Building Industry Authority. The purpose was to satisfy the performance criterion in the New Zealand Building Code: "Sanitary fixtures shall be provided in sufficient number and be appropriate for the people who are intended to use them." If similar research was to be conducted in the United States, undoubtedly the results for some categories would be different. How much different is unknown until we undertake similar research.

—Carl Marbery

*Note:* The views expressed here are those of Carl Marbery, senior staff engineer at the International Conference of Building Officials, and do not necessarily reflect the opinion of the International Conference of Building Officials or the International Code Council.

**From IAPMO**

Looking back through the nearly 80-year history of the Uniform Plumbing Code (UPC) and its predecessor documents was very interesting, to say the least. Finding the origin of all the requirements for fixtures proved to be a very time-consuming and difficult task, but the search did provide some interesting thoughts. For example, we could find no evidence of any minimum requirements for plumbing fixtures of any kind until 1952. Before then the codes simply spoke to safe and sanitary installation when any fixtures were to be used.

What possessed the industry representatives in the 1952 UPC code

meetings to begin adding minimum requirements? I don't know for sure, but I'm confident that some of the people who participated will let me know when they read this. We do know that the 1950s were a time of great economic expansion in the United States. The Great Depression had curtailed private development for nearly a decade, and it was immediately followed by World War II. When the war ended everyone began to develop or resume a normal life, so construction boomed. It is easy to imagine that structures were being built with only minimal sanitation facilities. There were no requirements for either commercial or residential structures, and perhaps those who felt "underserved" said "There ought to be a law."

Until someone provides different information about the development of minimum fixture requirements, I think the above is a reasonable explanation.

In 1952 most of those who attended UPC code development meetings were inspectors or representatives of municipal and state health departments, who generally had oversight responsibilities for plumbing. Representatives from dedicated inspection departments or agencies were rare at that time, but they did represent a growing trend. The delegates in that meeting voted to include a requirement for theaters. It was one water closet and one urinal for males and only one water closet for females.

During the next 40 years the UPC minimum fixture requirements were expanded and changed many times through the public participation process and code change hearings. Everyone seemed to wrestle with the appropriate numbers for places of assembly that were to be occupied (or fully occupied) only once or twice a week, while other places of assembly would be occupied daily.

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In the late 1980s and early 1990s, potty parity for women became a huge issue. Many entities conducted studies, including universities and even ASPE. The results were somewhat divergent, but all carried the same message: "Something needs to be done to improve the minimum number of fixtures for women—and perhaps for men, too." Nearly every plumbing code in existence began to respond with new requirements. The UPC in 1988 added Footnote 14 to Table 4.1, "Minimum Plumbing Facilities," which states "The total number of water closets for females shall be at least equal to the total number of water closets and urinals required for males."

A number of cities and states responded as well, adopting their own numbers. In Alaska a 2:1 ratio was submitted, a 3:1 ratio was considered, and a 2.7:1 ratio was adopted. Pittsburgh adopted a 3.75:1 ratio, Tennessee and Texas led the way for six other states to adopt a 2:1 ratio, Minneapolis–St. Paul adopted a 3:1 ratio, and Washington State adopted a 4:1 ratio.

The current UPC requires a 4:1 ratio in theaters. The minimum requirement is one water closet and one urinal for males and four water closets for females, based upon occupancy of 100 persons. This is a vast improvement over the 1952 requirement!

The question points out that there are differences between the UPC and the IPC. In a church with an occupancy of 300, the UPC requires two drinking fountains and the IPC requires one. If the occupancy is increased to 1,000, the UPC requires seven and the IPC one drinking fountain. For a restaurant with an occupancy of 100 people, the IPC requirement is two water closets for males and two water closets for females, contrasted with two water closets and

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the bottom of dry wells to remove any accumulated water. A simplex or duplex sump pump can be selected, depending on the critical nature of the station's application. Because they typically are low-voltage motors with simple controls, the sump pumps can easily be connected to the emergency back-up power systems through the system's control section. Solid state technology has made sump pump control panels both inexpensive and technologically advanced and has made their operation compatible with SCADA technology. The discharge from these sump pumps usually is minimal, so it is feasible to pump the discharge into the wet well.

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one urinal for males and three water closets for females in the UPC. If the restaurant occupancy is 1,000, both codes require 14 fixtures for males and 14 fixtures for females.

Even though the two codes are developed under different procedures, with major differences in philosophy regarding participation, both encompass a public code submission and hearing process. It would not be fair to characterize either as having arbitrary values. The absolute best values can be obtained with the participation of every ASPE member in every step of the code process. The UPC looks forward to seeing you there!

—Allen Inlow

### Conclusion

Both responses show that the requirement for the minimum number of plumbing fixtures in a building

### Installation

Engineering specifications typically require the contractor and supplier to provide fabrication and installation shop drawings, including all data on components and products as well as wiring diagrams. To avoid contractual responsibility disputes during the installation, it is recommended that all prefabricated lift stations come from a single supplier. The fabricator or manufacturer also should be responsible for final start-up and training of operating personnel.

The quality control section of the specifications can include the requirements for certified pump curves. Many fabricators and manufacturers of lift station pumps have testing facilities. The quality control paragraphs can be

written to ensure that pumps are tested before shipment and the test reports are certified to verify pump performance upon installation. The installation contract can be written to compensate the manufacturer's authorized representative for field inspections during the installation. ■



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