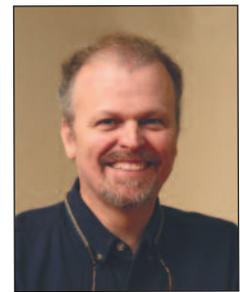


Efficient Design

By Winston Huff, CPD, LEED AP



Retrofitting plumbing fixtures in existing buildings for water efficiency

As reported by the U.S. Green Building Council (USGBC) last December, for the first time “LEED-certified existing buildings are outpacing their newly built counterparts ... square footage of LEED-certified existing buildings surpassed LEED-certified new construction by 15 million square feet on a cumulative basis.”

Water efficiency is an important part of upgrading existing buildings. The question for many plumbing designers is this: How much water is saved when old plumbing fixtures are replaced with new water-efficient fixtures?

Recent data shows that, in many cases, changing the fixtures can reduce water usage, yet it is important to remember that water usage varies in different locations, populations, types of installations and cultures. This data is helpful in choosing fixture types, but it is not a guarantee that your building will have the same results.

Case study: Sonoma County Water Agency

“High-Efficiency Plumbing Fixture Direct Install Water Savings Analysis” by Koeller and Company for the Sonoma County Water Agency offers some interesting data on the effect of replacing fixtures with water-efficient versions.

In 2009 – 2010, the Sonoma County Water Agency in Northern California created and managed a water conservation program encompassing the replacement of older water-using fixtures and fixture fittings with new high-efficiency products in both domestic (residential) and nonresidential applications. Qualified, licensed plumbers were used to install all items, which included toilet fixtures, urinals, showerheads and faucet aerators.

- Aerators: One of the easiest upgrades is to change out the faucet aerators. In fact, they should be changed every few years. Faucets in public toilet rooms should be 0.5 gallon per minute (gpm) or less. Kitchen and janitor sinks that are used to fill containers should be more.

- Showerheads: Reducing water flow in a showerhead can reduce water and energy use. 2.5-gpm showerheads are standard, but some older showerheads flow at 3, or even 5, gpm. Changing showerheads to those that flow 2 gpm or less is simple and relatively inexpensive.

- Urinals: Fixtures that use 1 gallon per flush (gpf) are standard, but fixtures installed prior to 1991 often use 2 gpf or more. While upgrading to low-flow fixtures requires removing the fixture and flushometer, which can be expensive, newer fixtures that use 0.5 gpf or even 1/8 of a gallon are common. Waterless urinals also are available and are a good alternative for the owner who understands the implications of their use.

- Water closets: Fixtures that use 1.6 gpf are the standard; newer models use 1.28 gpf. Pressure-assist fixtures

that use the municipal water pressure to aid in the flush can be as low as 1.1 gpf. Dual-flush fixtures allow the user to choose to use a full 1.6 gpf to flush solids or less water to flush liquid waste.

The study analyzed water use data when toilets, urinals, showerheads and aerators were replaced. The results are shown in Table 1. Notice that the study was not based on the number of people; rather, it was based on the number of toilets that were changed. (In this test, the term toilets is used for the fixture also known as a water closet.)

| | Residential | Commercial | Total |
|---|-------------|------------|-------|
| Number of Properties | 294 | 70 | 364 |
| Number of Toilets | 1,140 | 633 | 1,773 |
| Daily Water Savings per Toilet, gallons | 54.7 | 58.9 | 56.2 |

*Represents a mixture of aging toilets replaced: 1.6 gpf, 3.5 gpf and higher. Replacement toilets all qualified as HETs. Some properties and toilet installations are left out of this summary, due to lack of water use data or data inconsistencies.
Source: “High-Efficiency Plumbing Fixture Direct Install Water Savings Analysis”

This table is important because it shows that considerable water savings can be achieved by changing out fixtures. For both residential and commercial properties, approximately 56 gallons of water were saved per day per toilet fixture.

Residential water savings

Data is also available regarding water savings combining toilets and other fixtures in single-family and multifamily facilities. Table 2 shows the impact of changing the plumbing fixtures along with the toilets. This table shows that roughly 10 gallons a day can be saved from fixtures other than toilets. Thus, replacing both toilets and other water-using fixtures can have a large impact on residential installations.

| | Number of Toilets | Water Savings, gallons per day | |
|-------------------------------------|-------------------|--------------------------------|-------------|
| | | Single-family | Multifamily |
| Toilets “Alone”* | 813 | 27.6 | 59.4 |
| Toilets Combined with Other Devices | 327 | 36 | 70.8 |

*Toilets “alone” category excludes those instances where toilets were installed along with urinals, showerheads or aerators. However, the category includes instances where 3.5 gpf and 1.6 gpf toilets were installed together in the same property.
Source: “High-Efficiency Plumbing Fixture Direct Install Water Savings Analysis”

Commercial water savings

For commercial facilities, the data is broken down by the type of building, because employees in different types of buildings use the plumbing fixtures differently, which results in different water savings when toilets are replaced. Table 3 shows the data from the different types of commercial buildings. The data helps show general trends in the use of water when one type of building is compared to another. It should not be used to determine

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exact water usage in these types of buildings in different regions. It is meant to be used as a guide to help understand the magnitude of water savings by changing out

Table 3 Water savings by commercial-institutional category

| Nonresidential Category | Number of Properties | Number of Toilets Replaced | Average Water Savings per Toilet, gallons per day |
|-------------------------------------|----------------------|----------------------------|---|
| Office (including medical offices) | 21 | 96 | 34.6 |
| Retail & Services | 20 | 57 | 194.3 |
| Hospitality (lodging & restaurants) | 7 | 366 | 45 |
| Warehouse | 4 | 29 | 35.9 |
| Light Manufacturing | 4 | 52 | 7.6 |
| Religious Institutions | 4 | 19 | 150.8 |
| Mobile Home Park | 3 | 2 | 197.3 |
| Health Club/Spa | 1 | 12 | 443.8 |
| Combined | 64 | 633 | 64.6 |

Source: "High-Efficiency Plumbing Fixture Direct Install Water Savings Analysis"

Will Female Urinals Ever Gain Acceptance?

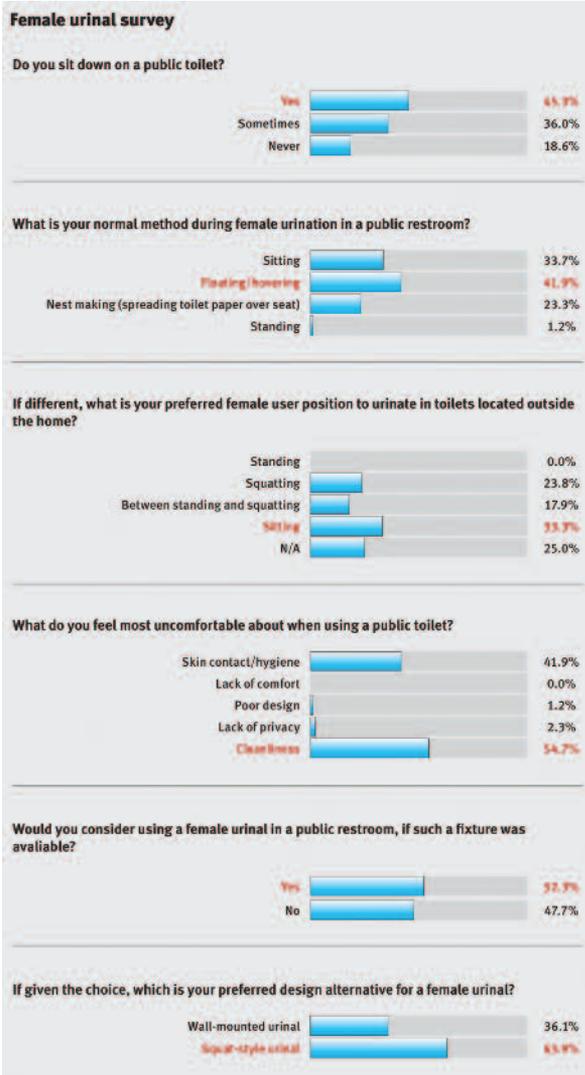
Female urinals have been discussed for years, and several fixtures have been on the market at varying times. Last year, the magazine *Plumbing Connection* surveyed women in Australia to find out their thoughts on introducing female urinals in public restrooms and published the results in the article "We Know Squat About Female Urinals."

According to the article, women have some concerns about public restrooms in general. One is the long lines that can form, resulting in long waits. Even more than the long lines, women are concerned about the cleanliness of public restrooms, and the thought of touching any fixture causes women to cringe.

While urinals may be the answer to these concerns, will women actually use them? Two types of female urinals are available: a stand-up type and a squatting type. Both of these fixtures receive mixed reviews from women who are not accustomed to standing while urinating.

An average male takes approximately 30 seconds to use a urinal, while women on average take approximately 60 seconds, so the issue for long lines at the women's toilet may be solved with urinals. (Water closets in women's toilets are used for urination approximately 90 percent of the time.) However, women have to remove some of their clothing when using either a urinal or a toilet, so the time reduction may not be significant.

In conclusion, the idea of a women's urinal maybe well intended, but it may not find wide acceptance.



Source: "We Know Squat About Female Urinals," *Plumbing Connection*, Autumn 2011. You can read the article at www.worldplumbinginfo.com/article/we-know-squat-about-female-urinals.

plumbing fixtures and toilets.

In this study the office building was accompanied by aerator installations along with the toilets. The retail and service installations were not accompanied by other fix-

Table 4 Water savings by replaced toilet

| Category | Number of Properties | Number of Toilets Replaced | Average Water Savings per Toilet, gallons per day |
|--------------------|----------------------|----------------------------|---|
| Residential | | | |
| Replace 1.6 gpf | 17 | 19 | 27.1 |
| Replace 3.5 gpf | 165 | 504 | 41.8 |
| Commercial | | | |
| Replace 1.6 gpf | 8 | 335 | 25.8 |
| Replace 3.5 gpf | 45 | 235 | 102.8 |
| Combined | | | |
| Replace 1.6 gpf | 25 | 354 | 25.9 |
| Replace 3.5 gpf | 210 | 739 | 61.2 |
| Total | 235 | 1,093 | 49.8 |

Source: "High-Efficiency Plumbing Fixture Direct Install Water Savings Analysis"

ture replacements. Half of the hospitality (lodging and restaurants) installations and half of the religious instal-

lations were accompanied by aerator installs. The health club/spa installation of 12 toilets was accompanied by the installation of three high-efficiency urinals. The sample size for the health club/spa and mobile home park categories is such that the savings data may not be representative of these facilities and cannot be applied with confidence to other similar end uses.

It is interesting to see the amount of water savings when fixtures are changed in retail and service facilities. Nearly 200 gallons of water per day can be saved.

Water savings from toilets

In this study, some of the toilets that were removed were 3.5 gpf fixtures, while others were 1.6 gpf. This is a hot topic with some in the industry. Can you achieve enough water savings to justify replacing 1.6 gpf fixtures with 1.28 gpf fixtures?

Table 4 shows that replacing 3.5 gpf fixtures does make a difference as expected. It also shows that replacing 1.6 gpf fixtures with 1.28 gpf versions can save almost 26 gallons per toilet in residential facilities.

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When an owner is considering reducing the water usage of an existing building, this study shows that it is important to consider changing the toilet fixtures, even if they are already 1.6 gpf. Existing building retrofits will continue to be an important market in the next few years, and owners will look at ways to save energy and water. When these renovations are done, changing the facility's toilets is an important option.

You can view the entire report at www.map-testing.com/view/reports.html. ■

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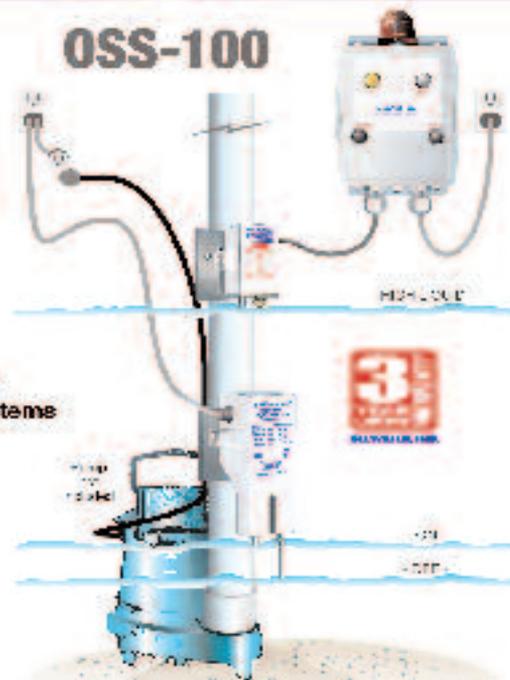
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