Evaluation of Water Use Reduction Achieved Through Hotel Guest Room Toilet Fixture Replacements

Parc 55 Union Square Hotel

San Francisco, California U.S.A.

by

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INTRODUCTION

The purpose of this study was to measure the water savings achieved with toilet fixture replacements in a major hotel complex, with focus being on guest rooms. A secondary purpose was to determine the extent to which maintenance service calls could be reduced when aging toilet fixtures were replaced with new fixtures. The Parc 55 Union Square Hotel in downtown San Francisco volunteered the information they gathered over the past several years in connection with their fixture replacement program. That data was used for the analysis that follows.

A very special thank you goes to Mr. James Anderson, Chief Engineer for the Park 55 Union Square Hotel. Mr. Anderson was of immense assistance in furnishing information on the replacement program and its effects, including historical records on water use and maintenance service calls.

BACKGROUND

Hotel and Fixtures

The Parc 55 Union Square Hotel in downtown San Francisco[1] was originally constructed in 1984 and opened for business as a Ramada Inn, subsequently operating as a Crowne Plaza Hotel. With 1,012 guest rooms and 1,030 guest room toilet fixtures, the Parc 55 is one of the largest hotels in that city. At the time of construction, all guest rooms were fitted with 3.5 gallons per flush (13 litres per flush) gravity-fed toilet fixtures.

High-Efficiency Toilets (HETs)

In 1999, the first high-efficiency toilet (HET) fixtures were introduced to the North American marketplace, all of which were gravity-fed dual-flush units. Later, in 2001, the first pressure-assist single-flush HET fixtures were field tested in California by manufacturers and the water utilities. Upon completion of those trials and subsequent product refinement, the first pressure-assist HETs were introduced into the marketplace in 2003 by Mansfield Plumbing. All of those first units utilized the Sloan Flushmate IV pressure vessel and flushing system.

Since the original introduction of the Flushmate-equipped HETs, many toilet manufacturers have refined their bowl designs and improved the hydraulic matching of the Flushmate unit with their fixture bowls. As a result, flush noise levels have been much reduced and pressure-assist fixtures may now be found in residences, hotel guest rooms, and other areas where noise is a factor.

Toilet Replacement Project

The Parc 55 has been and is engaged in a major program to "green" its facilities and reduce operating costs (utilities and maintenance costs). Among the several projects related to water use reduction that the hotel has undertaken is the replacement of all 1,030 gravity-fed non-efficient 3.5 gallon (13 litre) toilet fixtures in the guest rooms. In late 2007, they undertook the replacement project by selecting a pressure-assist HET to replace the older non-efficient gravity-fed fixtures. The fixture selected was the Kohler Highline® Comfort Height®, Model K-3519, a 1.0 gallon (3.8 litres) per flush pressure-assist fixture (pictured) equipped with the Sloan Flushmate IV system[2].

In December 2007, the physical replacement of fixtures began, concluding in October 2008, a rate of about 100 replacements per month.

[1] Located at 55 Cyril Magnin Street – www.parc55hotel.com/

[2] http://www.us.kohler.com/onlinecatalog/detail.jsp?item=10452402&section=2&category=13&subcategory=117

STUDY RESULTS

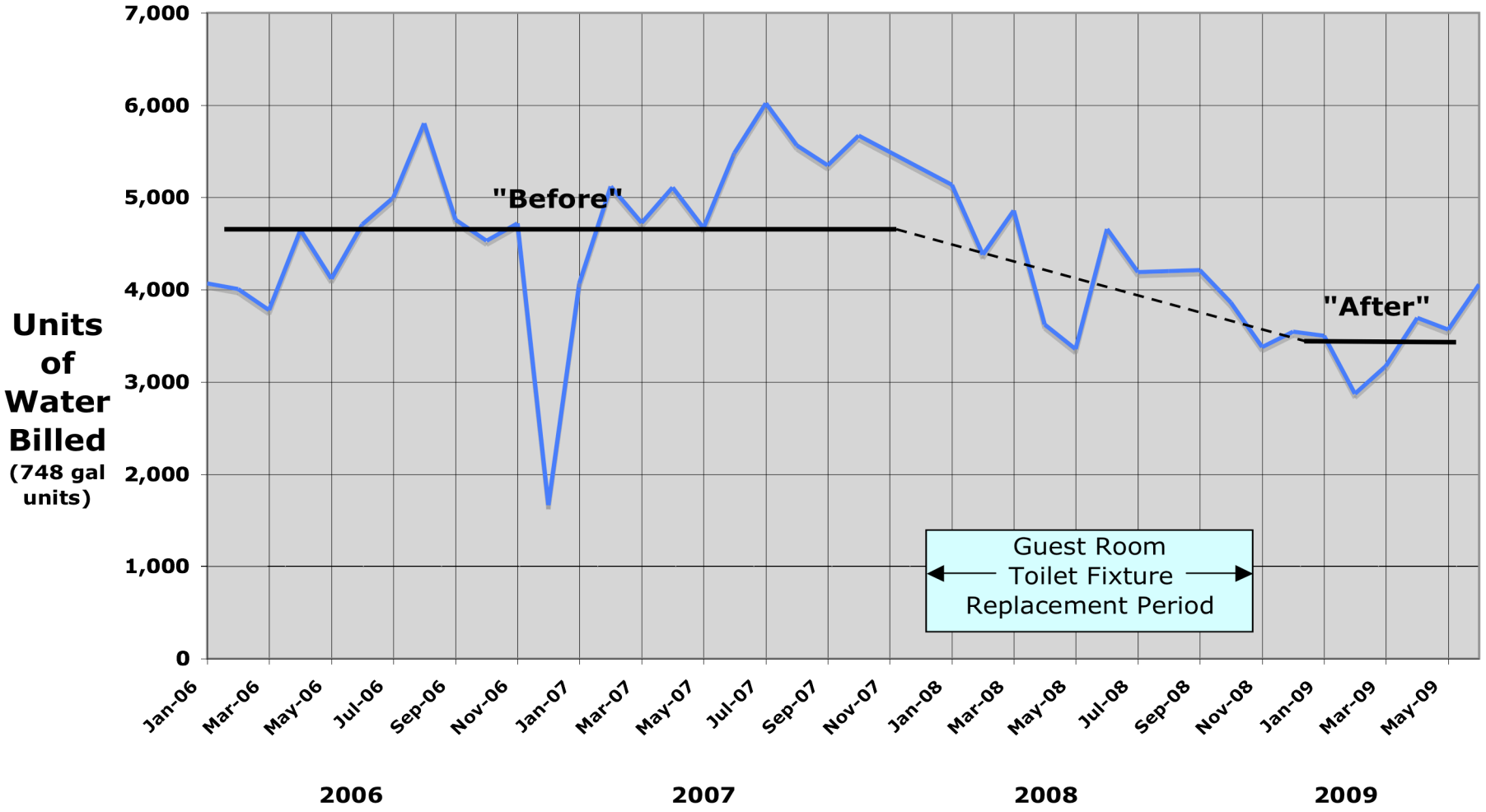
Utilities usage and maintenance service calls are continually tracked on a monthly basis by Parc 55 facilities management. Using data collected both before and after the guest room toilet fixture retrofits, it is possible to calculate both the water use reductions and the reduced maintenance hours resulting from the project[3]. Using meter data from utility bills and in-house maintenance records, a downward trend in water demands was clearly evident during the approximate 10-month retrofit period, yielding a significant savings in water consumption and maintenance hours.

Water Use

Figure 1 graphically displays water use by the hotel over the study period.

[3] It should be noted that the hotel has no irrigated landscape and, as such, water consumption is confined to interior uses and comfort systems.

Fig. 1 - Parc 55 Union Square Hotel - San Francisco
Monthly Water Consumption



Note: Variations in monthly water consumption are attributable primarily to varying room occupancy rates, utility billing cycles, and variances in other water uses within the hotel.

At the conclusion of the retrofit project and after the 2008 holiday season, the per unit (or per guest room toilet) reductions attributable to the retrofit program were determined as follows:

Table 1. Water Consumption – "Before" and "After" Replacement

	Water Consumption
"BEFORE" - Water use prior to retrofit project (22 months – January 2006 to October 2007)	4,707 units per month[4] = 3,521,000 gallons per mo.
"AFTER" – Water use following retrofit project (8 months November 2008 to June 2009)	3,474 units per month = 2,598,000 gallons per mo.
Water use reduction – 1,030 guest room toilet fixtures[5]	1,233 units per month = 923,000 gallons per month
Water use reduction – per guest room toilet fixture	893 gallons per month = 10,700 gallons per year (29 gallons per day)

While the approximate 29 gallons per day reduction in water demand appears larger than might be expected for a flush volume reduction from 3.5 gallons (13 litres) to 1.0 gallon (3.8 litres), there are several other factors contributing to the reduction beyond just guest use, such as:

(1) The replaced gravity-fed fixtures had been in use for approximately 24 years. Over that period of time, flush volume adjustments are frequently made to correct for performance problems, sometimes involving replacement of fill valves, flappers or entire flush valves. Because of such replacements and adjustments, it is likely that the flush volume of these fixtures was something other than 3.5 gallons (13 litres) at the time of replacement.[6]

(2) As evidenced by other studies involving the replacement or retrofit of aging gravity-fed toilet fixtures, leaks through the flappers or the overflow tubes within the tanks are a common condition. In the case of older fixtures fitted with ballcock-type fill valves[7], building water pressure changes[8] can cause the fill valve to open, releasing water into the tank, increasing the water level above the overflow point, and sending water to drain through the overflow tube. The replacement of an aging fixture with a new fixture usually eliminates those conditions[9] and contributes to water use reduction.

(3) Anecdotally, it has been reported to us that, on average, housekeeping staff in most high quality hotels flush a toilet an average of three times while cleaning the room. In addition to cleaning the fixture itself, some housekeeping staff use the toilet as a convenient means to dispose of various trash and other materials as well.

[4] A unit is equal to 100 cubic feet or 748 gallons, and is used for utility billing purposes.
[5] Savings based upon a nominal 90% occupancy
[6] Measurements of the actual flush volumes and physical condition of the replaced fixtures was not a part of this analysis.
[7] As opposed to pilot type fill valves that are resistant to pressure changes.
[8] Usually occurring in the very early morning hours when municipal system pressures are at their highest.
[9] Provided that the replacement fixture does not also use a ballcock-type fill valve. The replacement fixture in this case utilizes a flush technology and fixture design that does not contribute to such overflow conditions.

Other plumbing changes that might affect water use during the study period were minimal and, as such, the observed savings can be attributed to the fixture replacement program.

Service Calls, Maintenance & Repairs

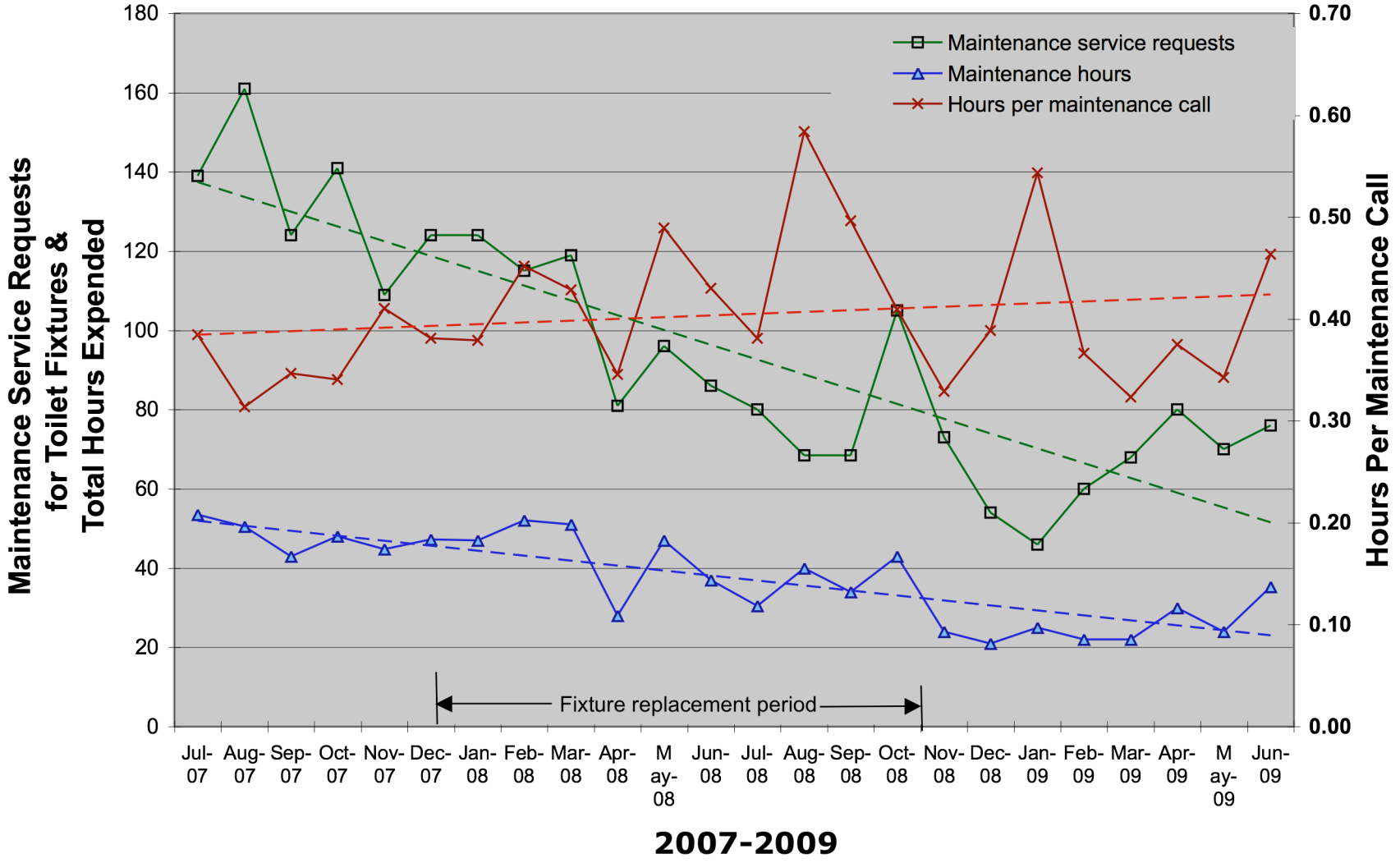
A second area of realized savings through the fixture replacement program was that of maintenance. Hotel guests expect that the fixture in their room will perform satisfactorily, usually without regard to water consumption. Dissatisfaction will frequently result in a service call, leading to a visit by maintenance staff. As noted earlier, service calls to maintenance for guest room toilet fixture issues are tracked by the hotel. Table 2 shows that this replacement project contributed to service calls being cut in half. It was reported that the hotel is experiencing no drain blockages with newly installed HETs.

Table 2. Monthly Service Calls for Guest Room Toilet Fixtures

	Average Service Calls for Fixture Maintenance	Avg. Hours Expended for Fixture Maintenance and Repairs	Average Hrs per Service Call
"BEFORE" Fixture Replacement	133	48	0.36
"AFTER" Fixture Replacement	65	26	0.40
Percent Change	-51%	-46%	+11%

Figure 2 illustrates trends in service calls and maintenance hours over the study period.

Fig. 2 - Parc 55 Union Square Hotel - San Francisco
Maintenance Trends - Guest Room Toilet Fixtures



CONCLUSIONS

As with any such project that replaces aging inefficient toilet fixtures with HETs, water savings will result. Previous analyses by the water utility industry concluded that the replacement of fixtures in hotel guest rooms would rank very low as a savings opportunity when compared to other commercial uses[10]. However, the daily per fixture water savings of 29 gallons (110 litres) as disclosed by this study were, in fact, significant. In San Francisco, this amounts to a savings of approximately $170,000 annually on water and sewer charges at 2009 rates.

The secondary major benefit to the replacement program was the reduction in service calls upon hotel maintenance (and associated labor cost reductions), due to improved flush performance and fixture reliability, and elimination of frequent repairs. Annually, the replacement is projected to reduce maintenance labor by several hundred hours per year.

[10] California Urban Water Conservation Council, 2005. BMP Cost and Savings Study, Section 2.15. *and* California Urban Water Conservation Council, 2001. CII ULFT Savings Study, Second Edition, Table 4-1, February.