
Drainline Transport of Waste

A Comparison: Washdown vs. Siphonic Toilets

When you work with toilets as we do, and especially water-efficient toilets, you are bound to hear some statements over and over, especially these:

1. Water-efficient toilets don't flush as much waste as the old water guzzling toilets, and
2. Water-efficient toilets don't actually save water because they require double flushing.

Of course, these two statements have consistently been proven entirely false on every level, but sometimes facts just get in the way of a good story.

A less popular statement that we have heard for years is that washdown toilets (the kind used in Europe and Australia) transport waste further along a building drainline than siphonic toilets (the kind used in most homes in North America).

The reasoning behind this statement is the belief that washdown toilets have a higher percentage of 'trailing' water (i.e., water following the waste) and a lower percentage of 'leading water' (i.e., water in front of the waste) than siphonic toilets. Washdown toilets quickly "dump" the entire volume of flush water from the tank into the bowl and onto the surface of the water in that bowl. This 'plug' of water pushes the water and waste in the bowl through the toilet trapway and down the drainline. Siphonic toilets, on the other hand, use the siphonic action of water discharging from the fixture to pull the bowl water and waste through the trapway and into the drainline.

The theory behind the washdown statement seems to make sense, i.e., that a flush with a greater volume of trailing water will push the waste further along the drainline. In fact, some toilet manufacturers view the ratio of 'trailing water' to 'leading water' as one of the key indicators of how well a fixture will transport waste through the drain lines. But what really happens in our drainpipes?

The truth is that it would be extremely rare for a single flush of any reasonable volume to transport solid waste all the way from the toilet to the sewer system in the street. In reality, a toilet flush only moves the waste out of the toilet fixture and some distance along the drainage system. Subsequent flushes, as well as supplemental flows from showers, baths, faucets, clothes washers, etc., help move the waste along until it ultimately reaches the sewer.

The further truth is that the distance that a single flush can transport waste is really not very critical since no single flush should be expected to get the waste all the way to the sewer. Testing that we completed in 2005 (Evaluation of Water-Efficient Toilet Technologies to Carry Waste in Drainlines, CMHC¹) showed that waste resting in a drainpipe will form a loose dam that will cause an upstream backup of water (and potentially more waste). The water will continue to backup behind the dam until a sufficient mass of water (and waste) is accumulated to overcome the friction between the dam and the pipe wall, thereby essentially 'flushing' the pipe in one large

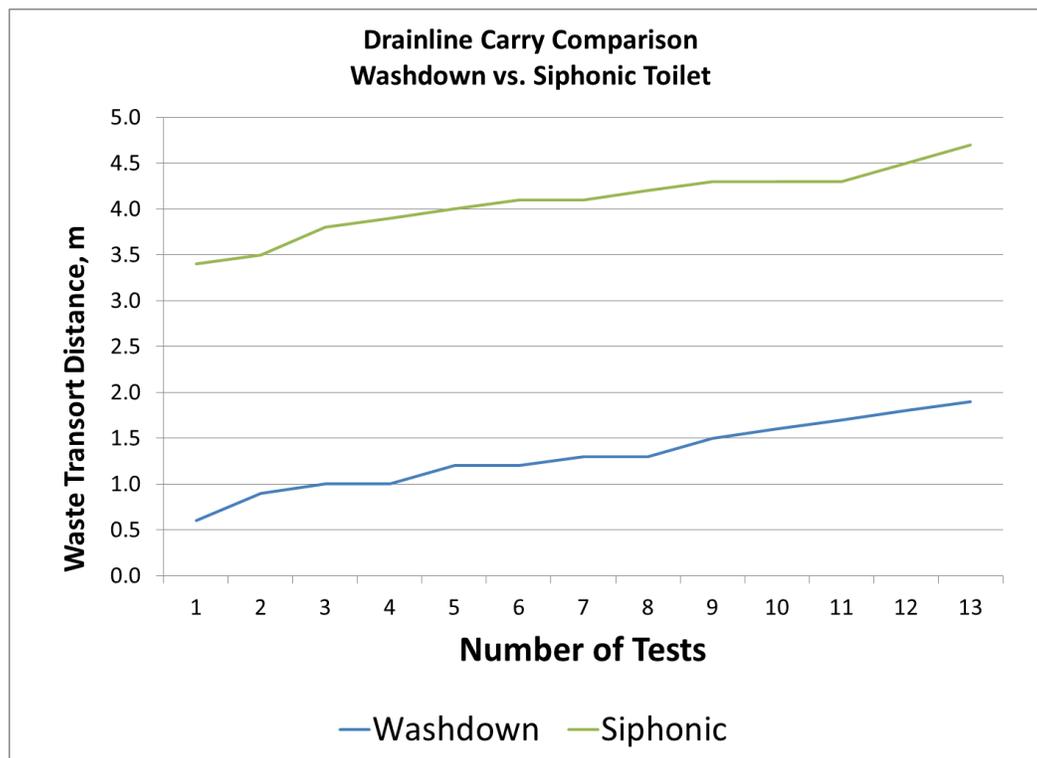
¹ Download the full study report at:

http://www.map-testing.com/assets/files/Gauley-Koeller_Drainline-Report-3-11-05.pdf

surge. Unless the blockage in the pipe is severe or unnatural, such as a blockage caused by tree root intrusion, a faulty drain pipe, or the flushing of a child’s toy, etc., it is very unlikely that a dam formed by “normal” waste would ever be sufficient to cause a toilet to backup.

That said, we thought it might be interesting to do a quick experiment to see if washdown toilets really do transport waste further than siphonic toilets. We chose two contemporary toilet models with the same flush volume for the test and we flushed a single test specimen during each test. Each toilet was flushed 13 times and the distance that the test specimen traveled with one flush was recorded. The results were sorted from shortest distance to the longest distance and then plotted – the results are presented in the chart below. Although not entirely conclusive, the results of our testing do not support the claim that washdown toilets will transport waste a greater distance along a drainline – in fact, the results are the opposite.

We expect that the PERC drainline study² results (to be released by October 2012) will help to shine much more light on the subject of drainline waste transport.



² For information on the Plumbing Efficiency Research Coalition (PERC) and the drainline transport study commissioned by that group, go here: <http://www.map-testing.com/info/menu/perc.html>
Additional drainline transport studies/issues at: <http://www.map-testing.com/view/reports.html#building-drainlines>