This presentation premiered at WaterSmart Innovations

watersmartinnovations.com
Understanding the Implications of Reduced Flows in Building Drains

~Phase 2~
Why Drainline Transport?

- Toilet consumption reduced 3.5 gpf → 1.6 gpf → 1.28 gpf → ?
- Commercial installations
  - Isolated bathrooms
  - Long horizontal run building drains
  - Non-water consuming urinals, ultra low flow faucets (0.5 gpm)
  - Proliferation of other water efficient technologies; medical, food service, industrial and commercial processes
  - Toilets increasingly stressed
- Domestic installations
  - Reduced flow showerheads and appliances
  - Graywater reuse systems – long term potential to eliminate long duration flows
The PERC Approach

- PERC Design of Experiment
  - The “Real World”: Too Variable to Duplicate / Characterize
  - Need to Understand What’s Really Important
  - Build a Perfect Drainline

- The Test Apparatus
  - 4” Clear PVC
  - 135 feet long (~41 M)
  - Slope Adjustable

- Why only 4-inch diameter? $

- Clearing Flush: Low Cost Solution?
  - Past research (Swaffield) cited potential
  - Low cost solution using flushometer-valves?
The PERC Approach

Test Apparatus viewed from Flush Stand

Two 90 - Wide Sweep Bends at Far End
Test Media

- Uncased “MaP” Test Media
  - Proven “Realistic” in Toilet Testing
  - Deformable, “breaks down”

- Toilet Paper
  - Two US Brands
    - Low Tensile Strength
    - High Tensile Strength
The PERC Test Plan

Test variables

✓ 1 Diameter: 4-inch / ~100 mm
✓ 2 Pitches: 1.00%; 2.00%
✓ 3 Flush Volumes: 6.0/1.6; 4.8/1.3; 3.0/0.8 (Lpf / gpf)
✓ 2 Flush Rates: 3500; 2500 (ml/sec –peak flow)
✓ 2 Percent Trailing Water Levels: 75%; 25%
✓ 2 Toilet Paper Tensile Strengths: High; Low
Data Review

### Main Effects, All Data, Less 3L

#### Data Means

<table>
<thead>
<tr>
<th>Factor</th>
<th>Type</th>
<th>Levels</th>
<th>Values</th>
</tr>
</thead>
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<tr>
<td>Volume</td>
<td>fixed</td>
<td>2</td>
<td>4.8, 6.0</td>
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<tr>
<td>Flush Rate</td>
<td>fixed</td>
<td>2</td>
<td>2500, 3500</td>
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<tr>
<td>Trailing Water</td>
<td>fixed</td>
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<td>0.25, 0.75</td>
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<td>Slope</td>
<td>fixed</td>
<td>2</td>
<td>0.01, 0.02</td>
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<tr>
<td>Paper</td>
<td>fixed</td>
<td>2</td>
<td>1, 82</td>
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</tbody>
</table>

#### Variable P Value

- Volume: 0.000*
- Flush Rate: 0.216
- Trailing Water: 0.185
- Slope: 0.000*
- Paper: 0.000*

* P-values below 0.05 indicate significance of the test variable

R-Sq = 81.61 percent
PERC Phase 2 Focus Areas

- **Pipe Size Reduction** – Long a topic of debate at code hearings, the potential for reduced pipe size to improve drainline transport distances will be studied
  - A 3-inch test apparatus will be used in addition to the 4-inch diameter apparatus employed in Phase 1 to determine impact of reducing the pipe size

- **Additional Flush Volume Level** – Phase 1 results indicated a behavioral shift and a chaotic drainline performance condition resulted at the 3.0 Lpf / 0.8 gpf consumption level.
  - Phase 2 will investigate drainline transport performance at the 3.8 Lpf (1.0 gpf) volume level.
  - Many U.S. manufacturers are already producing toilets that flush at this consumption level for both commercial and residential applications.
The PERC Test Plan

Test variables

✓ 1 Diameter: 4-inch / ~100 mm; 3-inch / ~75 mm
✓ 2 Pitches: 1.00%; 2.00%
✓ 3 Flush Volumes: 6.0/1.6; 4.8/1.3; 3.8/1.0; 3.0/0.8 (Lpf / gpf)
✓ 2 Flush Rates: 3500; 2500 (ml/sec – peak flow)
✓ 2 Percent Trailing Water Levels: 75%; 25%
✓ 2 Toilet Paper Tensile Strengths: High; Low
**PERC Phase 2 - Deliverables**

- **Deliverable 1 – Pipe Size Reduction**
  - Phase 2 of the PERC study will show how a commonly suggested pipe size reduction (going from 4-inch diameter pipe to 3-inch pipe) will impact drainline transport in a long horizontal run.
  - Further, it will rank the significance of reducing pipe diameter to flush consumption level reductions, slope, toilet paper wet tensile strength, and toilet discharge characteristics of flush rate and percent trailing water.
  - The results from Phase 2 will provide needed data in understanding the implications of pipe size reductions and may advise future considerations of pipe sizing requirements.
PERC Phase 2 - Deliverables

- Deliverable 2 – **Added 1.0 gpf discharge level**
  - Evaluating a new flush discharge level at 3.8 Lpf (1.0 gpf) will provide for a better understanding of how the drainline performs at the critical consumption level between 4.8 Lpf (1.28 gpf) and 3.0 Lpf (0.8 gpf), where drainline performance in Phase 1 became chaotic.
  
  - This will provide additional insight into the “tipping point” flush volume level, below which chronic blockage problems are more likely to occur.
PERC Phase 2 - Deliverables

- Considering the two deliverables together, Phase 2 will evaluate how pipe size reduction in a building drain might allow for the successful use of lower consumption toilets in new installations that employ smaller diameter drains.
- Phase 2 will also provide data to help illustrate if we are indeed reaching a tipping point where further toilet consumption level reductions are risky in installations that do not provide for significant additional flows into the building drain.
Phase 2 of this research study will cost approximately $170,000.00.

A significant increase over the approximately $70,000.00 used to complete Phase 1.

~90% of the cost is related to labor.

Phase 2 is a 35 + week testing program – currently 5 weeks into the program - work is underway at the American Standard Design Center in Piscataway, NJ

Look for a full report on the Phase 2 Study here at WSI in 2015.

We thank all of the Utilities, Manufacturers and Associations that have chipped in to support this critical research!
THANK YOU

QUESTIONS?

Plumbing Efficiency Research Coalition
Part II

World Plumbing Council Research Committee and Database Project

Presented by:
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Database Functionality

- Use free and open source database application - Tiki Wiki [http://info.tiki.org/Tiki+Wiki+CMS+Groupware](http://info.tiki.org/Tiki+Wiki+CMS+Groupware)
- Membership – anyone will be allowed to register and input information into the database
- The Research Committee co-chairs will have the ability to review and delete any content that is inappropriate
- Signing Up / Registering:
  - Email address
  - Password
- Once registered, instant access to the database will be granted
Database Functionality

- Input fields for database entries:
  - Submitters name
  - Title(s)
  - Affiliation
  - Email address
  - Name / affiliation of other researchers involved (optional)
  - Title of research program (25 words max)
  - Scope (500 words max)
  - Key words (maximum of 8)
  - Status of research program (50 words max)
  - What is the goal of the research? (250 words max)
  - Link to completed published report / paper (optional)
  - How will the completed research benefit the public, the plumbing profession, or be implemented into the built environment? (250 words max)
Database Functionality

- Pull down menu boxes:
  - Plumbing aspects (water supply, waste/drainage, water efficiency, water quality, sanitation, safe water access, alternate water sources (rainwater, storm water, gray water), irrigation landscape (allow to select all that apply)
  - Has the output (research paper or report) been Peer reviewed? (yes/no/pending)
  - Can other researchers contact you via email to discuss this research? (yes / no)

- We will be able to track usage
- Again, we seek your participation
- **As a Wiki application, the success of the database and the usefulness to researchers and the plumbing industry depends on YOU!**

THANK YOU!
Part III

THE ANSI STANDARDIZATION ROADMAP
Energy Efficiency in the Built Environment

Presented by:
Pete DeMarco, IAPMO
Lead facilitator for the ANSI Energy Efficiency Standardization Coordination Collaborative (EESCC)
ANSI Energy Efficiency Standardization Coordination Collaborative (EESCC)

- **Standardization Roadmap: Energy Efficiency in the Built Environment**
  - Released June 2014 | FREE DOWNLOAD: [www.ansi.org/eescc](http://www.ansi.org/eescc)

  Developed by the Energy Efficiency Standardization Coordination Collaborative (EESCC), a cross-sector group of 160 experts
  - convened by the American National Standards Institute (ANSI)
  - chaired by representatives of the U.S. Department of Energy and Schneider Electric
  - involving more than 50 member organizations and 4 federal agencies from industry, standards and code developing organizations, energy efficiency-focused organizations, educational institutions, and other groups

- Establishes a national framework for action and coordination on energy efficiency standardization, and charts recommendations and timelines for action to advance energy efficiency within the built environment
EESCC Standardization Roadmap Overview

The EESCC roadmap details 125 recommendations and timelines for action in five distinct yet interrelated areas of focus:

- **Chapter One: Building energy and water assessment and performance standards** outlines 46 recommendations to address identified standardization gaps in these areas.
- **Chapter Two: System integration and systems communications** details 9 recommendations examining how building sub-systems could be integrated in order to manage the energy use of a building or campus of buildings for maximum efficiency.
- **Chapter Three: Building energy rating, labeling, and simulation** outlines 22 recommendations to address identified standardization gaps.
- **Chapter Four: Evaluation, measurement, and verification (EM&V)** details 32 recommendations to advance the field of EM&V.
- **Chapter Five: Workforce credentialing** puts forth 16 overarching recommendations to advance workforce credentialing for the energy efficiency field.
Next Steps: Tracking Progress and Implementation of Roadmap Recommendations

- Looking forward, the EESCC will monitor implementation of the roadmap’s recommendations, follow updates on work to close identified gaps, and create a mechanism by which this information can be broadly shared.

- A future report will highlight progress to close gaps and provide an update on new developments and updates:
  - The EESCC will work with relevant groups, as appropriate, to ensure gaps are addressed, and facilitate coordination and collaboration among domestic, regional, and international standardization activities, as needed.
Call to Action: Closing the Gaps

- Organizations interested in carrying out standardization activities to close a gap identified in the roadmap – either working collaboratively or on their own – are asked to notify the EESCC so that the collaborative can monitor the roadmap’s implementation and assist with coordination of standardization activities, as appropriate.

- Complete the online EESCC Standardization Action Form at www.ansi.org/eescc with details on:
  - Gap to be addressed
  - Brief description of work to fill gap
  - Anticipated timeline
Thank You!