

Residential Drainline Challenges and Future Design Objectives

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Introduction/Problem Statement: Concerns of plumbing drainline issues are growing due to crumbling infrastructure, water conservation efforts, lower flows in drainline carry, outdated codes, pipe rigidity, and remodeling issues. The problem calls for a new drainline design, but first, the challenges of existing drainlines must be understood in order to develop new solutions. Plumbing codes have remained static for nearly 100 years despite dramatic changes in water usage in homes (Cole 2014). Documentation of drainline carry has not been collected outside of a laboratory environment (PERC 2016). This survey examines the challenges of drainline installation, remodeling, and service-repair issues in existing buildings from experienced plumbers.

Research Objectives: The primary aim of this research is to understand the current issues of existing drainlines in order to determine programmatic requirements for future innovations in drainline design. The following research questions were posed regarding the current state of drainlines in existing residential structures. What are the biggest challenges in drainline replacement? What are the causes of issues regarding drainline carry? Are water conservation practices influencing drainline carry?

Research Methodology: An online survey/questionnaire was emailed to plumbers in several states. Business email addresses were obtained using the Freedom of Information Act (FOIA) and with the cooperation of the California's Contractors State License Board (CSLB). It was critical to survey plumbers in California as the state laws for water conservation have been in place for the longest amount of time in the U.S. Plumbers answered questions regarding demographics, structure type, type of plumbing service, installation processes, layout, operating problems, and future drainline development goals and ideas. Most of the questions were objective in nature, but there were several questions where plumbers could give qualitative responses about drainlines to expand their answers.

Preliminary or Final Results: Of the objective questions, 105 to 139 plumbers responded to each question. Plumbers across 16 states responded, with 70% of respondents coming from California, Virginia, and Maryland. Seventy percent of plumbers specialized in residential work and 65% specialized working in existing structures doing service/repair work or remodeling. Plumbers encountered improper installation 25% of the time in existing structures. Primary causes for slow drains and stoppages were user behavior, i.e. wipes and towels (54%) and system failures (36%). Plumbers who noted "other" causes remarked that *tree roots* were a primary drainline issue. In remarking on 11 drainline system issues, sags and swales were the largest issues (69%), followed by tree roots (66%), incorrect slope (60%), and low-flow fixtures with plumbers suspecting this issue 43% of the time. Two-thirds of plumbers (and three-quarters in California) noticed that since the implementation of water conservation fixtures, there are more stoppages in existing drainlines and that it likely has an effect on drainline carry. Regarding drainline redesign, plumbers prioritized simplifying drainline installation and fitting connections, followed by increasing drainline flexibility, durability, and incorporating a lightweight solution.

Research Impact: This survey outlines and validates critical goals for designing future drainlines, specifically, easing installation in existing structures, and reducing bulky drainline components and connections that can result in improper slope. Additionally, water conservation has not addressed the back end of plumbing systems where drainline carry issues are becoming more problematic. At the same time, during these times of drought, tree roots seeking out water sources are becoming a growing issue as they infiltrate drainlines and cause plumbing back-ups.

References:

Cole, D. (2014). "Hunter's Horizontal Drain Capacities and the UPC." *Calculating Water Supply*, (Spring Edition 2014), 58–65.
Plumbing Efficiency Research Coalition [PERC]. (2016). *The Drainline Transport of Solid Waste in Buildings - Phase 2.0*.