

Freestanding Public Toilet Design and Location in Boston and Cambridge:
A Comparative Case Study

by

Emma Isabel Castaños

Submitted to the
Department of Mechanical Engineering
in Partial Fulfillment of the Requirements for the Degree of
Bachelor of Science in Mechanical Engineering

at the

Massachusetts Institute of Technology

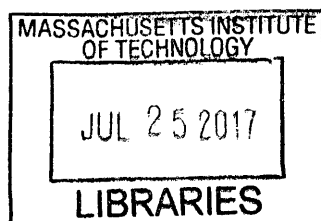
June 2017

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ABSTRACT

This paper explores urban sanitation provision in the United States via a comparative case study of the freestanding public toilets in Boston and Cambridge. The research attempts to capture the influence of municipal institutions and local actors on public toilet design and location, and further attempts to assess to what degree the resulting design and location meet project stakeholders' own communicated priorities as well as anticipated user needs. This is an IRB approved project that engaged stakeholders through interviews and further corroborated online research with toilet block site visits. The study concluded that the Portland Loo design, while it lacked many amenities of the Automatic Public Toilet design, it is a more robust and suitable toilet for a high-demand and high-risk urban environment.

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Abstract

This paper explores urban sanitation provision in the United States via a comparative case study of the freestanding public toilets in Boston and Cambridge. The research attempts to capture the influence of municipal institutions and local actors on public toilet design and location, and further attempts to assess to what degree the resulting design and location meet project stakeholders' own communicated priorities as well as anticipated user needs. This is an IRB approved project that engaged stakeholders through interviews and further corroborated online research with toilet block site visits. The study concluded that the Portland Loo design, while it lacked many amenities of the Automatic Public Toilet design, it is a more robust and suitable toilet for a high-demand and high-risk urban environment.

Acknowledgements

I would like to sincerely thank Kate Mytty, John Kennedy, and Maria Yang for their mentorship and support throughout this research project. Kate, I am extremely grateful for your thoughtful questioning, our coffee-thesis brainstorm sessions, and for your thorough thesis reviews. John, thank you for always asking first how I was doing, second how the thesis was going, and for always listening and making yourself available to bounce ideas around. Maria, I am immensely thankful for your shared excitement about my work, your lent expertise, and your ongoing encouragement. Without each of you, I wouldn't have been able to complete the work that exists today. Thank you all very much!

I would like to thank my friends for cheering me on and encouraging me during this semester, especially Hannah, Pepe, and Teresa. Hannah, thank you for being an infinite source of light and positive encouragement, especially through late nights on 5th Floor Stud. Pepe, thank you for lending me your laptop when mine was failing, for going to the library or cafes to work side by side, and for showing continuous excitement during the course of an entire semester of toilet conversation. Teresa, thank you a million times for your company during site visits, for always asking how I was doing, and for picking up my slack in other areas of our shared life when this project was taking up much of my time. All three of you are amazing and invaluable friends. Thank you!

I would like to thank Mom, Father, and Bassie for their continued love and support from back home. It means a lot to me that you guys always asked how I was doing and to know that you all are behind everything I do. I love you guys. Finally, I would like to thank my sister Carmen for her consistent mentorship, support, and sage advice. Through the entire semester (not to mention the previous three years) Carmen offered me advice, fed me food (thank you, Eric, as well!), let me nap in her apartment, coached me through times I was stressed, listened to my excited projected updates, laughed at my hysterical thesis-related site visit texts, and shared her laptop when mine was dysfunctional. Carmen, thank you for being an INCREDIBLE sister as well as a fantastic thesis supporter and financial adviser. I love you very much, and I appreciate all that you do for me!!

Chapter 1: Introduction

Defining Sanitation

The term sanitation consists of a variety of provision-based activities spanning multiple material streams and functional groups. “Sanitation” can include the following activities: “safe collection, storage, treatment and disposal/re-use/recycling of human excreta (faeces and urine); management/re-use/recycling of solid wastes (trash or rubbish); drainage and disposal/re-use/recycling of household wastewater (often referred to as sullage or grey water); drainage of storm water; treatment and disposal/re-use/recycling of sewage effluents; collection and management of industrial waste products; and management of hazardous wastes (including hospital wastes, and chemical/ radioactive and other dangerous substances)” (United Nations Water 2012).

For the purposes of this research, and hereafter, “sanitation” will refer to the “safe collection, storage, treatment and disposal/re-use/recycling of human excreta (faeces and urine)” (United Nations Water 2012).

Global Sanitation Overview

Sanitation requires attention because of the inherent risk associated with lack of sanitation provision or its mismanagement. Two primary risks connected with unmanaged sanitation are the risk of adverse effects on human health and the risk of environmental degradation. Untreated wastewater can pollute drinking water, enter the food chain via agricultural crops, be a concern for topical contact, and provide breeding sites for disease vectors (United Nations Water 2012)

Worldwide, approximately 2.4 billion people lack access to improved sanitation (United Nations Water 2017) which is defined as “a facility that safely separates human waste from human contact” (United Nations 2015). In addition, 1.8 billion people are estimated to drink water that is faecally contaminated and 783 million of those people do not have access to clean water (United Nations 2015).

Access to improved sanitation has important clean water access and general health implications. In 2004 the World Health Organization (WHO) estimated that “88% of diarrhoeal disease is attributed to unsafe water supply, inadequate sanitation and hygiene” (World Health Organization 2004). The nations with the lowest rates of access to improved sanitation are shown in blue in Figure 1 (Sanitation, WHO/UNICEF JMP for Water Supply and Sanitation 2016), with the lightness of the color indicating the severity of the problem, where lightest blue depicts the lowest rates of access. In general, the most affected countries are disproportionately low-income and developing countries. It is important to note that this figure represents access to improved sanitation only at the national level; it does not show the distribution of access within a nation.

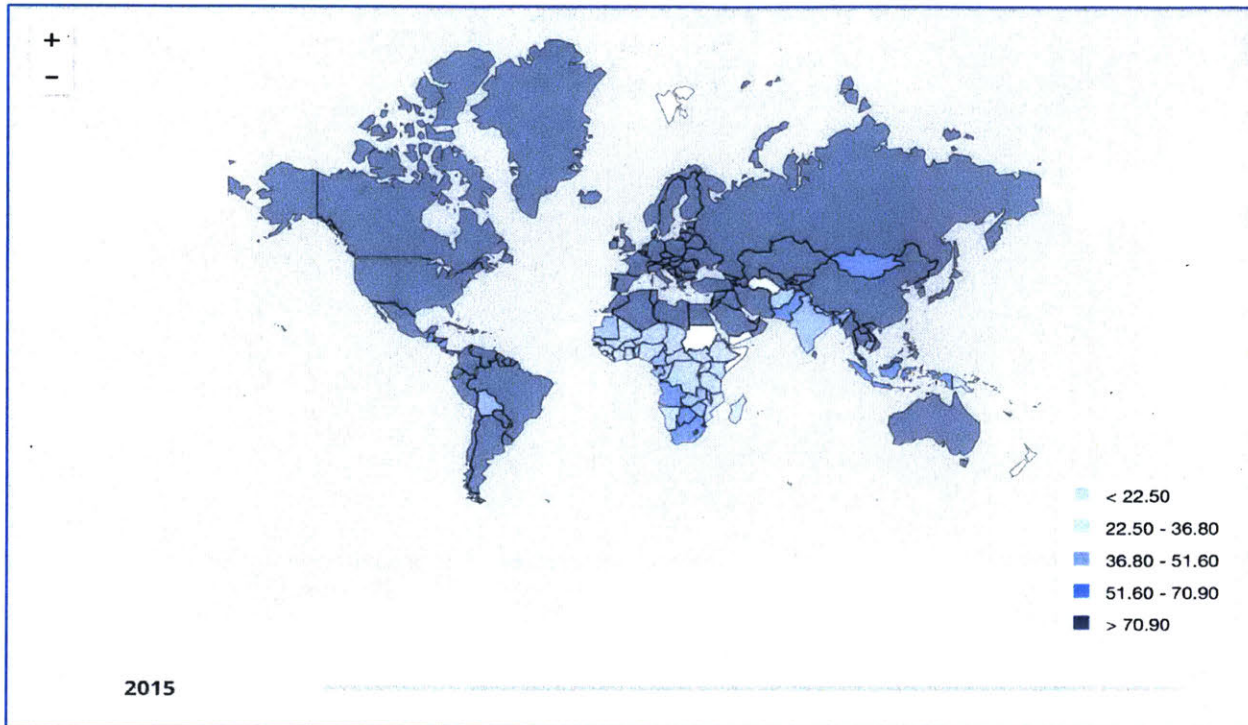


Figure 1: Improved Sanitation Facilities (% of Population with Access) in 2015

In 2000, the Millennium Development Goals set eight targets to be achieved by 2015 in order to improve “the lives of the world's poorest people” (Millenium Development Goals Achievement Fund n.d.). The goal that describes human access to sanitation is part of section seven, titled “ensure environmental sustainability.” Target 7C aimed to “Halve, by 2015, the proportion of the population without sustainable access to safe drinking water and basic sanitation” (United Nations 2015). By the UN definition of improved sanitation and their methods of measurement this goal would translate to increasing the percent of the world’s population using improved sanitation from 54% to 77%.

Then, in July 2010 the United National (UN) first formally recognized the right to water and sanitation (United Nations General Assembly 2010) and acknowledged “that clean drinking water and sanitation are essential to the realisation of all human rights” (United Nations Water 2011). The UN Human Rights Council affirmed that “the rights to water and sanitation are part of existing international law and confirms that these rights are legally binding upon States” in September of 2010 (United Nations Water 2011)

However, despite the Millennium Development Goals and despite the recognition of sanitation as a human right, by the end of 2015, target 7C had not been met. The projected rate for global improved sanitation use was only 68% of the world’s population (United Nations 2015). On a national level, only 95 countries met the Millennium Development Goal sanitation target, as shown in Figure 2 (UNICEF and World Health Organization 2015). Once again, the aggregation of the measurement of access to sanitation at a national level does not achieve the granularity that would represent the experience of all people within the nation.

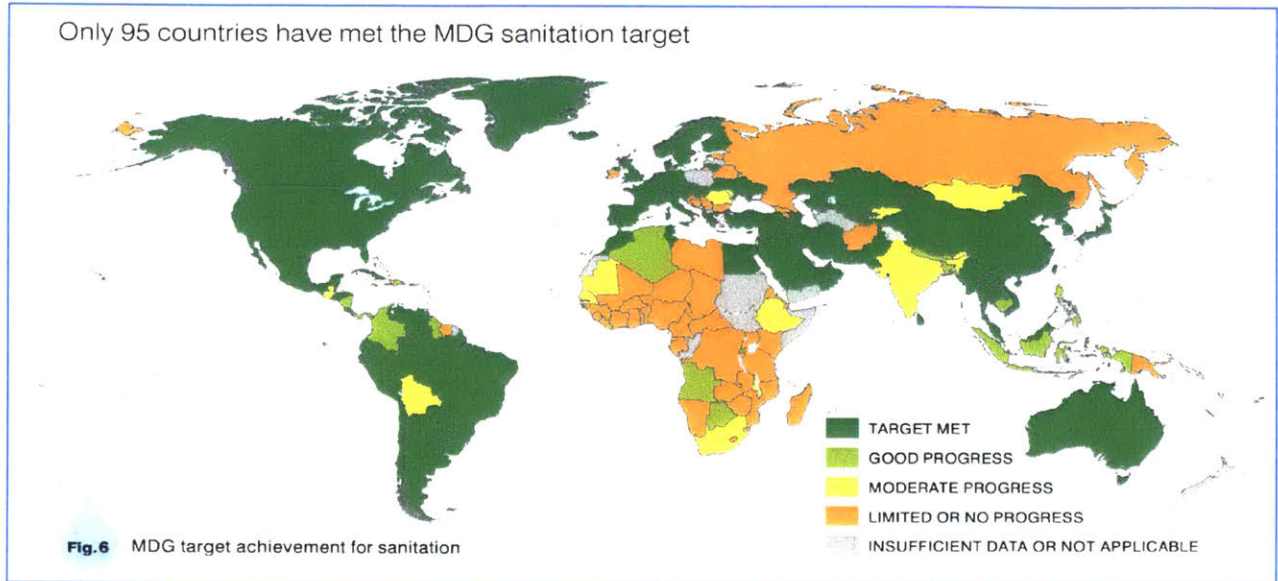


Figure 2: Progress on Millennium Development Goals as of 2015

The Sustainable Development goals, which are new UN development targets, aim “by 2030, [to] achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations” (United Nations Development Programme 2015).

U.S. Institutional Response to Sanitation

The Clean Water Act “establishes the basic structure for regulating discharges of pollutants into the waters of the United States and regulating quality standards for surface waters” (United States Environmental Protection Agency 2016). However, with regards to faecal contamination, the law controls point sources of pollution from existing sanitation facilities (i.e. septic tanks) via permitting; but does not recognize the lack of access to sanitation facilities as a potential source of faecal contamination. The issue of urban access to adequate sanitation is not explicitly acknowledged by this law, despite the sanitation implications for clean water security.

Similarly, Massachusetts state law lacks any specific legislation that guarantees the right to accessible sanitation. Bathrooms are regulated via building codes (Consumer Affairs and Business Regulation 2017) in homes and they are regulated via Occupational Safety and Health Administration (Occupational Safety and Health Administration n.d.) standards in workplaces. Neither body regulates access to sanitation for those without homes or those without a physical workplace. As such, there is both a gap in practice and in the literature with regards to the right to sanitation in the U.S. context.

An online search with the terms “Boston” and “public toilets” provides website links to online forums where individuals have aggregated information on free, public restrooms for tourists to use (Kersey 2013) (Maltzman 2016) (Universal Hub n.d.). A search with the terms “Cambridge” and “public toilets” provides reference to an advocacy organization (Parker 2013) (Cambridge Public Health Department 2014) that demanded the construction of a public toilet to provide a needed service to the homeless and to mitigate an open defecation challenge. These

websites, while they do not include all potential beneficiaries of public toilets, certainly highlight important user populations and the high demand for free, public toilets in the cities of Boston and Cambridge.

As a result, provision of public sanitation invariably becomes a municipal issue. In many U.S. cities, including Los Angeles, San Francisco, Portland, Seattle, Chicago, Miami, New York City, Boston, and Cambridge, the local governments have implemented public toilet programs in order to meet the urban demand for and need for public sanitation.

Personal Motivation

During my time in college I have seen the opportunity to pursue human equity through the field of engineering. My research experiences have taught me that this pursuit must be coupled with ethical thought and practice. The challenge of access to adequate and affordable sanitation lies at the intersection of my interest in equality and in technology.

In my junior year of college, I traveled with a team of MIT students to work on a sanitation project near Lima, Perú. While there, we collaborated with a local university group on a portable, dry toilet design for a community that lacked municipal access to water and sewage services. This was my first experience working in sanitation and I was originally apprehensive about the project topic. I later realized that my own hesitation about sanitation was not and is not singular. It lives in other individuals and institutions and perpetuates the undervaluation of the host of complexities and challenges associated with the lack of sanitation provision in all parts of the world. So, when the opportunity presented itself to continue research in this area, I was happy to continue in sanitation research. I traveled to Durban, South Africa during my senior year to work on a public sanitation evaluation project with a local NGO.

Although I was interested in continuing this work as part of my thesis project, I was unable to do so as a result of the challenges associated with remote work, especially as sanitation work is location-specific. Instead, I decided to explore sanitation issues in the City of Boston and the City of Cambridge, hereafter referred to as “Boston” and “Cambridge,” respectively. What I uncovered is that access to sanitation, while often branded as a developing world challenge, exists here in the United States as well.

Research Question

Given the challenge of access to adequate and affordable sanitation in Boston and Cambridge, the following research questions were defined to guide this study:

1. Why did the cities of Boston and Cambridge select the public toilet design and location that they did?
2. How well do the current freestanding toilet designs and locations satisfy the original design criteria of the municipalities?
3. What is the effect of current freestanding toilet designs and locations on the user experience?

The hypothesis is that a toilet design and location selection process that intentionally engages potential users will best suit the needs of these potential users and minimize costs to the city.

Chapter 2: Methodology

Case Study Approach

Two concurrent case studies were selected in order to answer the research questions. “The essence of a case study, the central tendency among all types of case study, is that it tries to illuminate a decision or set of decisions: why they were taken, how they were implemented, and with what result” (Yin 1989). It is with this guiding line of questioning that this research began; therefore, a case study is an appropriate research method to select for the study.

Rationale for Case Selection

This case selection allows for a general comparison of the infrastructure design process and community engagement practice in Boston and Cambridge using the freestanding public toilets as a point of comparison. This research was conducted at the municipal level because public toilet provision is provided at the municipal level in Boston and Cambridge. In addition, an examination at the municipal level would offer a level of granularity, especially with regards to access, that is not achievable at a higher level such as the state or national level.

The cities of Boston and Cambridge were selected for the comparative case study for a few particular reasons. A sanitation solution is necessarily contextual because sanitation is a private and often taboo subject in many cultures. As such, understanding local customs and perceptions is required for thoughtful and ethical research on this topic. As the researcher has spent the last four years in the greater Boston area, a case study of these municipalities would allow her to study the implementation of public toilets here while fully appreciating the greater context, the unique needs of each municipality and potential user populations, and the various challenges each municipality faces.

Boston and Cambridge are two separate municipalities that border each other. As a result, they experience similar climates and likely share populations of potential toilet users. Simultaneously, these municipalities are of different sizes and have different municipal structure and organization. For these reasons, Boston and Cambridge provide a unique opportunity for a comparative case study.

The freestanding toilet blocks were selected as the unit of analysis for the study because of the logical granularity they offer. The freestanding toilet blocks are a more fitting unit of analysis than toilets inside of municipal buildings because their main purpose is to provide access to sanitation, not to house government offices. Public toilets in municipal buildings were not studied because their access is limited by the location of the buildings, the location of the toilets inside of the buildings, among other barriers to entry listed in Table 1. The construction of the freestanding public toilets is a relatively recent development, and as they possess a specific,

intended functionality, the question of whether they are meeting their intended audience and use cases is of direct interest to the municipalities.

Public toilets occupy a niche space in design and management. As a public amenity, they are naturally “public” and are created to serve the needs a large quantity and variety of users. However, as they are also a toilet, they are required to be “private” enough for individuals to feel comfortable using them as toilets. From this dichotomy, a design trade off emerges: municipalities must strike a balance between providing an inclusive and necessary municipal service without encouraging illegal or illicit activities to take place inside of them.

Lenses of Analysis

With the challenges of inclusive and safe sanitation in mind, three lenses emerge to guide an evaluation of public toilet design: adequacy, affordability, and accessibility (Carolini 2017). These terms, as they are used in this study, are defined as follows.

Adequacy

The adequacy of a toilet design is determined by whether or not it is compliant with some minimum standard. In this study, an adequate public toilet is one that is operational and is able to safely dispose of human waste.

Affordability

The affordability of a toilet design and location is determined by any direct monetary cost to enter the toilet as well as any indirect costs associated with travel to the toilet and with time spent traveling to and using the toilet. In this study, affordability will only refer to the direct monetary costs of using the toilet.

Accessibility

The accessibility of a toilet design and location is affected by a variety of features, intentional and not, that either directly or indirectly limit someone’s ability to use the toilet. Accessibility can be impeded by real and perceived barriers to entry.

Data Collection

A variety of data collection methods including desktop research, site visits, and stakeholder interviews were used in this study. The design of these is detailed as follows.

Desktop Research

Desktop research was used to establish the context of Boston and Cambridge in order to understand the history of their freestanding toilet programs. Desktop research also established

how much and what kind of information is made publicly available in Boston and Cambridge about this topic.

Desktop research about public toilets in general and in Boston and Cambridge specifically guided the development of interview questions. These resources consisted of regional news publications (WGBH News 2001) (Parker 2013), city websites (City of Boston 2016) (The Cambridge Department of Public Works 2017), advocacy organization websites (Rose Fitzgerald Kennedy Greenway Conservancy 2017) (Harvard Square Homeless Shelter 2017), and informal websites that were created by users to help others locate toilets in Boston. Some sources established the demand for public toilet in Boston and Cambridge as advocacy websites called for the construction of toilets to end open defecation and the informal websites were designed to help tourists find free, public toilets. As the interviewing process progressed, additional topics and organizations recommended by interviewees were researched.

Desktop research was used to prepare for toilet site visits. Google maps (Maps n.d.) was used to search for terms such as “toilet” and “restroom”, among others, to find publicly listed toilet locations. Municipal Geographic Information System (GIS) data (ESRI n.d.) from both Boston and Cambridge were used to construct maps that show toilet locations geographically in each municipality.

Site Visits

Site visits consisted of an attempt to enter the toilets as well as photo documentation of the exterior and interior features of the toilets and the surrounding area. The two toilets featured in the photographs in Figure 3 and Figure 4 were selected for convenience. The Cambridge Portland Loo was selected because it is the only one currently constructed. The Boston Automatic Public Toilet (APT) was selected because it was the only Boston toilet that was operational during attempted site visits.

A summary of the visits and maintenance statuses of each toilet are in Appendix A and additional photos from site visits are in Appendix B.

Stakeholder Interviews

To comply with Committee on the Use of Humans as Experimental Subjects (COUHES), MIT’s Institutional Review Board regulations (Committee on the Use of Humans as Experimental Subjects 2016), interview questions were submitted to the COUHES office before anyone was contacted for interviews.

Initial interview contacts were selected based on information available online via the City of Boston website and the City of Cambridge website. The snowball sampling method (Exchange 2016) was used to find other stakeholders within and external to the municipal governments.

The interview questions asked about the background of the interviewee in order to understand their direct experiences with the public lavatories in Boston and Cambridge. Understanding their area of expertise and occupational role would inform how they internalize the needs and challenges associated with public toilets.

The background of the toilet program was explored in order to understand its history and begin to parse out the influencers and drivers of the public toilet projects. In particular, questions

aimed to understand how the needs of various stakeholders influenced the toilet design selection and construction location.

Understanding that physical and technical limitations of these projects would also be drivers in this process, especially with regards to the toilet construction locations. Therefore, the interview questions asked about regulatory or utility constraints that affected the projects. This would potentially illuminate why a toilet might not be situated in an optimal location based on a user's point of view.

The interview questions asked about potential users and use cases. Understanding the intended and discouraged use cases was important to framing the motivations behind the final design selection. This was an attempt to understand the needs and priorities that various actors were valuing. Unexpected answers to these questions could mean that there are user needs or priorities that are yet unmet, in addition to those of nearby stakeholders beyond the direct users.

Understanding the current management would help elucidate the effect maintenance activities have on municipal employees and toilet users. The interview questions asked about cleaning and maintenance because they would both affect the user's experience and ability to use the toilet. Additionally, the interview aimed to understand more about reporting cleaning or maintenance issues in order to gain a sense of the response time to any issues.

The interview questions asked about future plans in order to assess whether the initial priorities of the program were the same as they were at the outset of the project or if they had shifted over time. This would also determine whether the communicated priorities of various stakeholders were consistent over time.

A copy of the interview questions is in Appendix C.

Limitations and Assumptions

This study does not integrate feedback from toilet users. As such, the qualitative analyses presented are the researcher's individual attempt at an objective design analysis from the user perspective. This methodology by no means captures the variety of potential toilet users, their needs, and their challenges. Neither does it evaluate the toilet design from the perspective of cleaning or maintenance staff.

Some desired information was inaccessible during this study due to the regulations on proprietary information. Other limitations to information gathering included declined or ignored requests for interview. Of the fifteen people contacted to interview, only five were interviewed (one from Boston, four from Cambridge).

This study will not evaluate the definition of "improved sanitation" as applied by the United Nations nor will it debate the complete definitions of "adequate," "affordable," and "accessible," although the author certainly recognizes that these are key and contentious discussions.

Chapter 3: Results

Boston and Cambridge Toilet Overviews

The cities of Boston and Cambridge provide access to public lavatories inside of their respective municipal buildings. These buildings include City Hall, fire departments, libraries, and police departments, among others (E 2017). Despite the existence of public toilets in these buildings, there are many real and perceived barriers to entry that might limit their use, as described in Table 1.

Potential Barrier to Entry	Barrier Description
Ability to Locate	Someone is unable to use the toilet because they do not know it exists or they are unable to navigate towards it.
Cost	Someone is unable to use the toilet because they cannot afford the direct cost (i.e. \$0.25) or indirect cost (i.e. coffee at a cafe).
Journey Distance	Someone is unable to use the toilet because they are unable travel to the toilet because it is too far or too costly.
Operational Hours	Someone is unable to use the toilet because the toilet is not operational when they need it.
Operational Status	Someone is unable to use the toilet because it is out of service.
Physically Inaccessible	Someone is unable to use the toilet because they are physically unable to enter the toilet (i.e. toilet is not Americans with Disabilities Act (ADA) compliant) (United States Department of Justice Civil Rights Division 2010).
Presence of Other People	Someone is unable to use the toilet because they are uncomfortable with the other people in the area.
Presence of Security Officers or Camera	Someone is unable to use the toilet because they fear the presence of security or police or they are asked to leave by security or police.
Restricted Access	Someone is unable to use the toilet because access is explicitly restricted via key cards, codes, or a key.
Safety	Someone is unable to use the toilet because they fear for their safety.
Wait Time	Someone is unable to use the toilet because the wait time is prohibitive.
Weather	Someone is unable to use the toilet because the weather prohibits their travel or makes the toilet too cold or too hot.

Table 1: Potential Barriers to Entry

Within the last two decades both municipalities constructed freestanding public toilets on their sidewalks (A 2017) (E 2017). Figure 3 and Figure 4 show photos of each design. A summary of the toilet programs of Boston and Cambridge is listed in Table 2.



Figure 3: Automatic Public Toilet, Boston



Figure 4: The Portland Loo, Cambridge

Feature	Boston	Cambridge
Design Name	Automatic Public Toilet (APT)	The Portland Loo (The Portland Loo 2015)
Design Company	The Wall Co.	The Portland Loo
General Information	These toilets are part of a contract owned by JCDecaux (JCDecaux n.d.) and are installed and maintained by the company. Boston manages these toilets as part of the Boston Coordinated Street Furniture Program (E 2017).	These toilets are purchased from the Portland Loo and installed and maintained by Cambridge (A 2017).
Current Locations	Currently there are 7 toilets. Near Faneuil Hall on Congress Street, In the North End on Commercial Street, In Shipyard Park, Constitution Pier in Charlestown, At Central Wharf on Atlantic Avenue, At the EDIC, across from Design Center Place, At 2 Long Wharf, At Roxbury and Dudley Square (City of Boston 2016).	Currently there is 1 toilet. Harvard / Cambridge Common Park, 12 Garden Street, Cambridge, MA 02138 (The Cambridge Department of Public Works 2017).
Future Locations	The contract between the Boston and JCDecaux specifies that 3 more are to be built by 2026. The new toilet locations are not yet determined (E 2017).	A second toilet is currently being designed. Construction is slated for summer 2017. Western Avenue, just south of Massachusetts Avenue (The Cambridge Department of Public Works 2017).
Construction	JCDecaux	Cambridge Department of Public Works
Maintenance	JCDecaux	Cambridge Building Services

Table 2: Summary of Toilet Programs in Boston and Cambridge

The map in Figure 5 illustrates the geographic locations of the current freestanding toilets in Boston and Cambridge as well as the planned Central Square toilet. Red markers indicate the location of current toilets in Boston and Cambridge, while the yellow indicates the location of the planned Cambridge toilet. This was constructed using publicly available GIS data. A link to the online version of this map is in Appendix D.

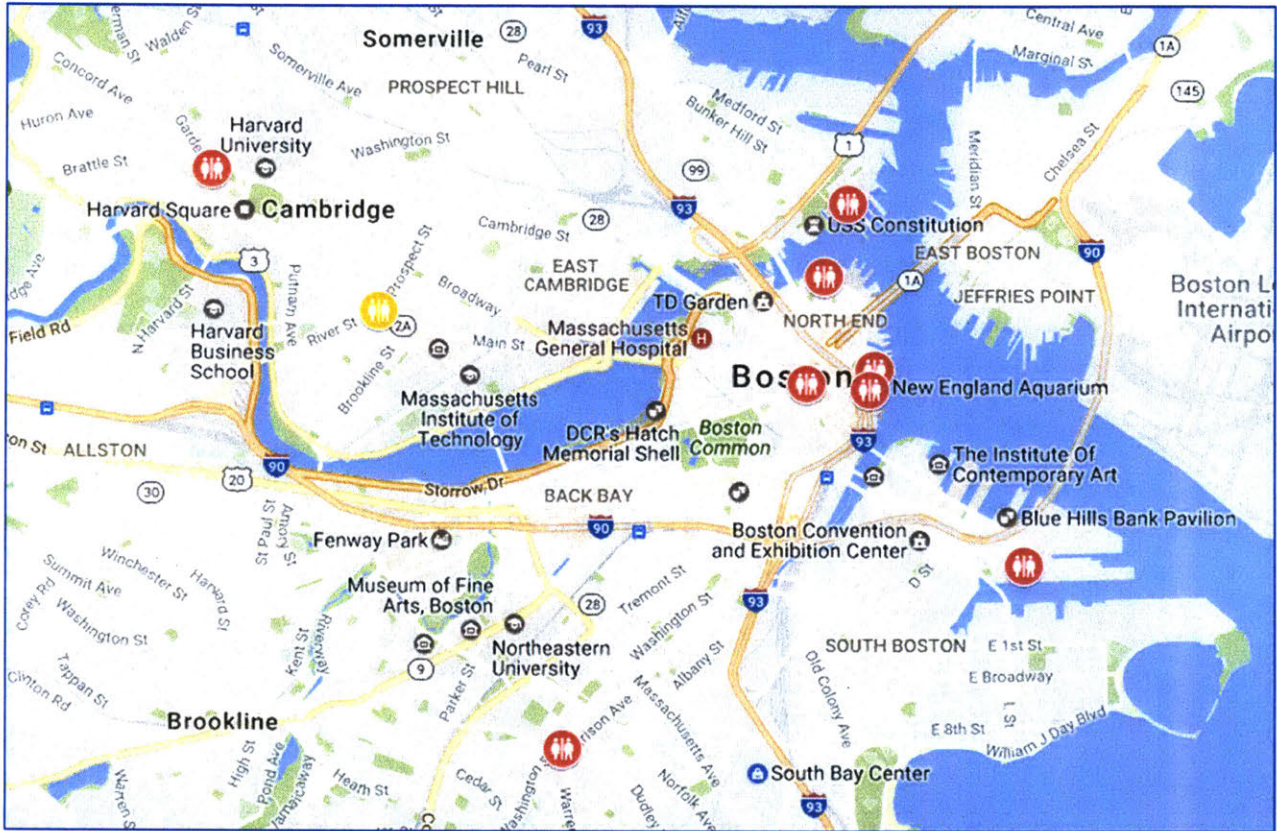


Figure 5: Map of the Boston and Cambridge Toilet Locations

Documentation of Toilet Planning and Construction

Timeline: Project Initiation

The program initiation process for the freestanding public toilets was less structured than originally anticipated for both Boston and Cambridge. Each process operated organically in its own way. In Table 3 and Table 4, the key events and actions that led to the toilet program initiation are shown.

In Boston, the main driver of the Automatic Public Toilet (APT) construction was the Mayor of Boston’s interest in a public toilet program, which major cities like San Francisco and Seattle had implemented with varying degrees of success (E 2017).

Year	Activity
1998	Former mayor of Boston attends a U.S. Conference of Mayors in San Francisco (E 2017).
1998	An RFP was opened for a 20-year contract for the installation, maintenance, and operation of street furniture (E 2017).
~2001	The contract was awarded to WALL USA, a German outdoor furniture company (WGBH News 2001).
2001	The first APTs were installed and opened to the public (WGBH News 2001).

Table 3: Project Initiation Timeline, Boston

In Cambridge, two events led to the beginning of the Portland Loo public toilet program. First, the closure of the Christ Church bathroom in response to drug activity there created an open defecation and urination issue that exacerbated the immediate need for public restrooms. Then, the lobbying of the Advocates for Common Toilet, which was an advocacy group made up of Christ Church parishioners, Harvard Square Business Association members, and Harvard Square Homeless Shelter advocates, resulted in Cambridge taking action to install the Portland Loo toilets (D 2017) (C 2017).

Year	Activity
~2011	Former Police Commissioner gives the direction to close the Christ Church public bathroom, his justification being that the toilet had become a hotspot for drug activity and overdoses (D 2017).
~2011	Christ Church toilet closes (D 2017).

~2011	Members of the Harvard Square Business Association (HSBA) begin expressing concerns about the appearance and/or increase in public urination and defecation in Harvard Square (D 2017).
~2011	Advocated for Common Toilet organizes and begins lobbying for a public toilet in Harvard Square (D 2017).
~2011	Cambridge installs porta potties in Cambridge Commons as a temporary solution (C 2017).
~2012	Cambridge acquires the funds to build a public toilet (C 2017).
2013	A city committee conducts interviews with Seattle, Portland, New York City, and Boston to learn about their public toilet programs and to evaluate their designs and management. The Portland Loo is selected (C 2017).
2013	Cambridge conducts a Public Toilets survey which indicates that the top two locations with identified need for public toilets (on municipal land, as opposed to state land) are Harvard Square and Central Square (City of Cambridge Public Toilets Working Group 2014).
~2014	Direction is given to the Department of Public Works to find a location for the Portland Loo and design for construction (A 2017).
February 12, 2016	The Portland Loo is installed and opened to public (The Cambridge Department of Public Works 2017).

Table 4: Project Initiation Timeline, Cambridge

Design: Notable Features

The interview process uncovered various design features and stakeholders' reactions to them. In Boston, a bidding process determined the contractor for the toilet project, and thus the APT design itself (E 2017). In Cambridge, a city committee conducted research about other municipal freestanding public toilet programs (in New York City, Portland, Boston, and Seattle). They interviewed officials from these cities to evaluate their toilet designs and maintenance structures and created "lessons learned" to apply to their own program (C 2017). In neither case were local stakeholders and advocates directly involved in the design selection decision. In Table 5 and Table 6 the most notable features of the toilets, as seen from the point of view of municipal employees and local stakeholders, are described. Based on the frequency that the features were mentioned and their communicated importance, they were qualitatively ranked as either an "Important Feature", an "Important Consideration", a "Peripheral Feature", an "Irrelevant Feature", or a "Vulnerable Feature."

This analysis highlighted a divergence in feature priorities between the APT and the Portland Loo. Although the toilets shared the same core functions and common user populations, the municipalities prioritized design features differently.

In Boston, the APT design features emphasize user comfort and ADA accessibility. The APT has light, music, and heat to increase user comfort. Additionally, the toilet boasts a variety of ADA accessibility options. First, users can select which side of the bathroom that the toilet will be on upon entry. This is so that wheelchair users (who generally have a stronger side) can more easily approach the toilet from the direction that best suits them. Second, there are a variety of buttons for operation inside the toilet distributed through the structure that allow for a variety of access points.

In Cambridge, the Portland Loo design features emphasize functionality and general safety. The design takes specific action to deter unwanted activities that will cause maintenance issues, such as writing graffiti (creates a visually unappealing problem and is difficult to clean) and clothes washing (usually causes flooding in indoor toilets and is difficult to clean). Additionally, the incorporation of the vents on the lower and upper portions of the structure are a key safety feature. They provide ventilation to the structure and also allow outside people, whether they are pedestrians or police officers, to view whether the toilet is occupied (The Portland Loo 2015). This is important for two reasons. First, in the event of an emergency, a passerby has the ability to view what is happening inside the Portland Loo and can act on this information to report any misuse or overuse to the authorities. Second, the lack of privacy as a result of the vents, similar to the gap underneath bathroom stalls in most U.S. restrooms, discourages unwanted behavior. In this way, the Portland Loo discourages an individual from misusing the structure and creates an opportunity for others to report misuse in the event that it occurs (A 2017) (C 2017) (D 2017).

Ranking	Feature	Description
Important Feature	Accessibility Features and Flexibilities (E 2017)	Publicized before the toilets were implemented, important to Boston.
	Lighting (E 2017)	Turns on automatically upon entry, required for toilet function.
	Sensors and Automatic Cleaning Capabilities (E 2017)	Required for toilet function.
	Timer (and Automatic Door Opening) (E 2017)	Deterrent for overuse, including use as a shelter or for illegal activity.
	Advertising and Revenue Source (E 2017)	Benefit of the private-public partnership, important for operation.
	Music (E 2017)	Improves the toilet comfort.

Peripheral Feature	Heat (E 2017)	Improves the toilet comfort.
	Exterior Color (E 2017)	Selected by Boston to be inoffensive to the historically designated areas of the city.
Irrelevant Feature	Option to Use Tokens Instead of Coins (E 2017)	Previously allowed homeless people to use the toilet at no monetary cost; however, this program was not renewed.
	Payphone (E 2017)	Appropriate for the time when the toilet was designed; however, not well-used today.
Vulnerable Feature	Glass Features (E 2017)	Often the target of vandalism.

Table 5: Highlighted Design Features, Boston

Ranking	Feature	Description
Important Feature	Vents (A 2017) (C 2017) (D 2017)	Allows outside people to view activity inside of the toilet (in order to report any emergency or misuse). Provides fresh air and ventilation to mitigate odors. Decreases toilet block comfort to discourage use as a shelter. Decreases privacy to discourage illegal activity.
	Lights (A 2017) (C 2017)	Turns on automatically at night. The light is blue to discourage drug use by making it difficult to locate veins at night.
	External Handwashing Station (C 2017)	Discourages use as a clothes-washing station or a shower.
	Graffiti Proof and Sticker Proof (A 2017) (D 2017)	Resistant to vandalism.
Important Consideration	Placed in a heavily trafficked and well-lit area (A 2017) (C 2017) (D 2017)	Provides unofficial monitoring of the toilet.
	Placed on regular police route (A 2017)	Provides official monitoring of the toilet.

Peripheral Feature	Visually Nondescript (A 2017) (D 2017)	Toilet is inoffensive to the historically designated areas of the city.
Irrelevant Feature	Toilet Flush Counter (A 2017)	Does not appear to be used by the municipality.

Table 6: Highlighted Design Features, Cambridge

Location: Advocates and Influencers

A variety of stakeholders within each municipal government and the larger community influenced the location decision making process. The locations of the toilets were more dependent, if not entirely so, on local advocacy and community participation. Some of the main influencers in each municipality are listed in Table 7, grouped by role.

The cities of Boston and Cambridge had different amounts of government and public participation affect their toilet construction location. In Cambridge, there was more direct oversight from various city departments and individual municipal employees on the design decision. Cambridge also intentionally engaged citizens via a survey in 2013 that identified Harvard Square and Central Square as the two locations in Cambridge with the most need for public toilets. This excludes land that belongs to the state of Massachusetts, such as the Charles River Esplanade (City of Cambridge Public Toilets Working Group 2014). In Boston, location decisions were influenced by the company employees of the JCDecaux company, who won the street furniture program contract. In general, the advocacy of local stakeholders and public engagement in Cambridge was more pronounced and more organized. While there was local advocacy in Boston, the involvement was on an ad hoc basis and it was limited in scale.

Category of Influencer	Boston	Cambridge
Public Employees or Elected Officials	Street Furniture Program Manager, City Engineer, City Planner, Historic and Landmarks Commissioner, Parks Commissioner, District Commissioner, City Mayor.	Department of Public Works, Buildings Services, City Engineer, City Planner, Community Outreach Coordinator, Cambridge Police Department, Historic and Landmarks Commissioner, Police Commissioner, City Manager.
Private Companies	Wall Co., JCDecaux Executives, JCDecaux Operations.	The Portland Loo Company, Cleaning Company.
Local Stakeholders	MBTA, Boston Fire Department, Local Businesses.	Christ Church Pastor, Christ Church Parishioners, Local Business Owners, HSBA Members, Survey Respondents.

Advocacy Groups	Greenway Conservancy.	Advocates for Common Toilet, Harvard Square Business Association, Harvard Square Homeless Shelter, Cambridge Health Alliance.
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Table 7: Influencers in Boston and Cambridge

Analysis of Current Toilet Design and Location

Toilet Adequacy

Each toilet design affects the user experience and can influence the behaviors of toilet users. Table 8 is the researcher’s analysis of potential toilet use cases and a qualitative assessment of whether the toilet designs in Boston and Cambridge either designed for these use cases, ignored these use cases, or specifically designed to discourage these use cases. The table is organized from most encouraged activities to least encouraged. This analysis is based on the researcher’s toilet block observations as well as feedback from interviews.

The Portland Loo and APT share a common encouragement of functional toilet usage, namely defecation and urination. They also share features that encourage assisting children, assisting adults, and ADA accessibility. They each discourage use of the structure as a space for sleeping, for street level drug use, and for intimate relations. For activities such as personal grooming or using the structure as a changing room, the APT offered more features than the Portland Loo.

Activity	Boston		Cambridge	
	Design Influence	Notes	Design Influence	Notes
Defecation	Intended Use	NA.	Intended Use	NA.
Urination	Intended Use	No urinal present.	Intended Use	No urinal present.
Washing Hands	Encouraged	Requires entry to toilet.	Intended Use	Does not require entry to toilet.
Assisting a Child	Encouraged	Appropriate time allotted (25 min).	Encouraged	Changing table provided.
Disability	Encouraged	ADA accessible with automatic door design, multiple buttons, choice of toilet side.	Encouraged	ADA accessible.
Assisting an Adult	Neutral	NA.	Neutral	NA.

Illness	Neutral	NA.	Neutral	NA.
Phone Usage	Neutral	NA.	Neutral	NA.
Feminine Hygiene	Neutral	No pad nor tampon dispenser.	Neutral	No pad nor tampon dispenser.
Breastfeeding	Neutral	Hook and small shelf present.	Neutral	No hook nor shelf present.
Personal Grooming	Encouraged	Mirror and hand towels present.	Discouraged	No mirror nor hand towels present.
Hanging Clothing or Bag	Encouraged	Hook present.	Discouraged	No hook present.
Change Oneself	Neutral	Hook and small shelf present.	Discouraged	No hook nor shelf present.
Clothes Washing	Discouraged	Shallow sink.	Discouraged	Interior: hand sanitizing station, Exterior: handwashing station.
Sleep	Discouraged	Automatic door opening system.	Discouraged	Lack of privacy and heat.
Drug Use	Discouraged	Automatic door opening system.	Discouraged	Lack of privacy, light is blue.
Intimate relations	Discouraged	Automatic door opening system.	Discouraged	Lack of privacy and heat.
Improper Disposal	Discouraged	Lid present on trash can.	Discouraged	Trash can size is small.

Table 8: Use Case Analysis

Toilet Affordability

There is a direct cost of \$0.25 per use for the APT in Boston. There is no direct cost for the Portland Loo in Cambridge (The Portland Loo 2015).

Toilet Accessibility

Design features and toilet locations have the potential to limit accessibility, either via real or perceived barriers to entry. During the course of this study, “ability to locate” emerged as a barrier to toilet use. The ability to locate a toilet is a primary barrier to entry because no other potential barrier to entry has the opportunity to affect usage if users cannot find the toilets to begin with.

A graphical examination of the toilet locations is in Figure 6. This map includes freestanding public toilets as well as toilets inside of municipal buildings, libraries, police stations, and fire stations. This map is missing data for Cambridge police departments and Cambridge fire departments as it was unavailable. Red markers indicate the location of current toilets in Boston and Cambridge, while the yellow indicates the location of the planned Cambridge toilet.

From this view, it appears that public toilets are spread relatively evenly across the Boston and Cambridge areas. However, this is misleading because of many of the barriers to entry (discussed in Table 1) severely limit toilet use in municipal buildings, especially in fire departments, police departments, and municipal office buildings, where security is present.

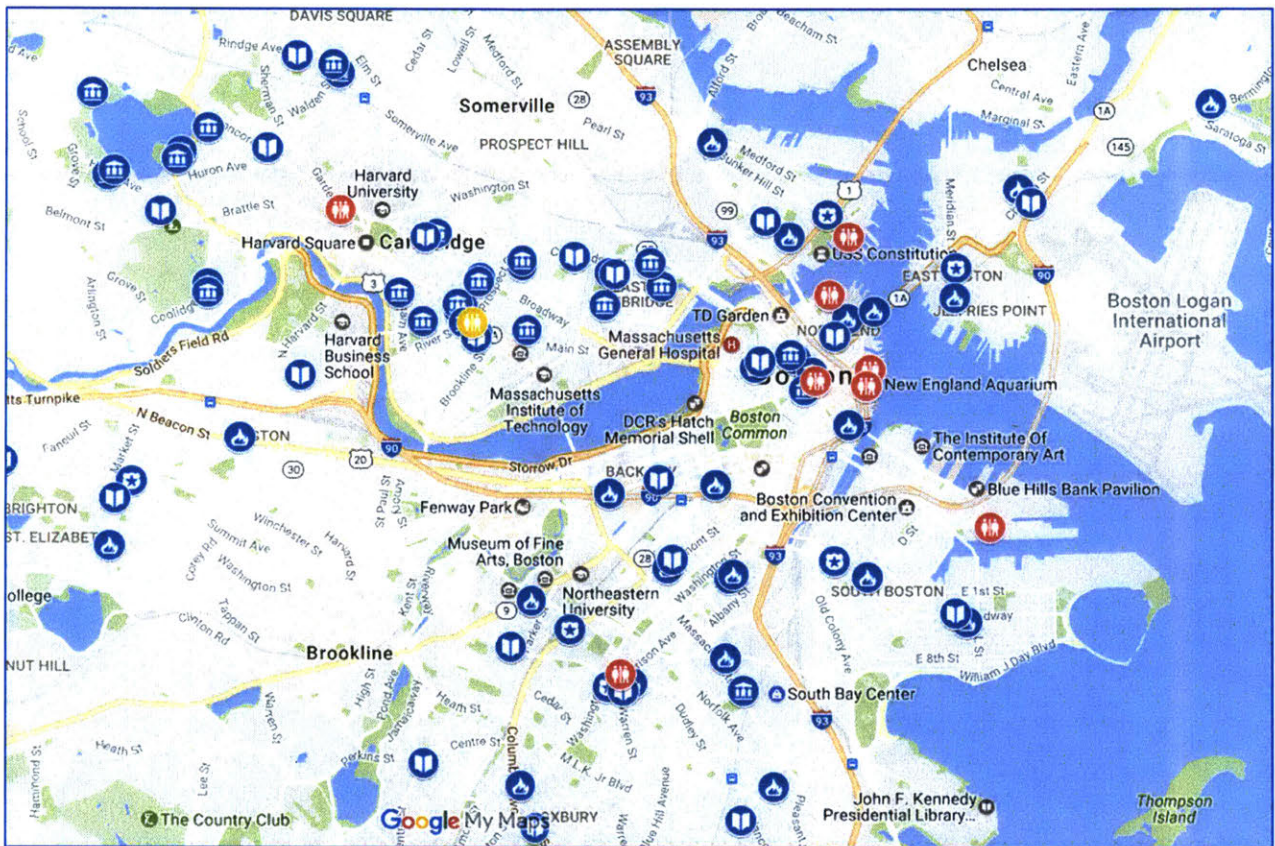


Figure 6: Public Toilets in Boston and Cambridge

Figure 7 shows the geographic locations of the freestanding public toilets in Boston and Cambridge. This map shows that the APTs in Boston are concentrated near the North End while the single Cambridge Portland Loo is located at the transportation hub in Harvard Square.

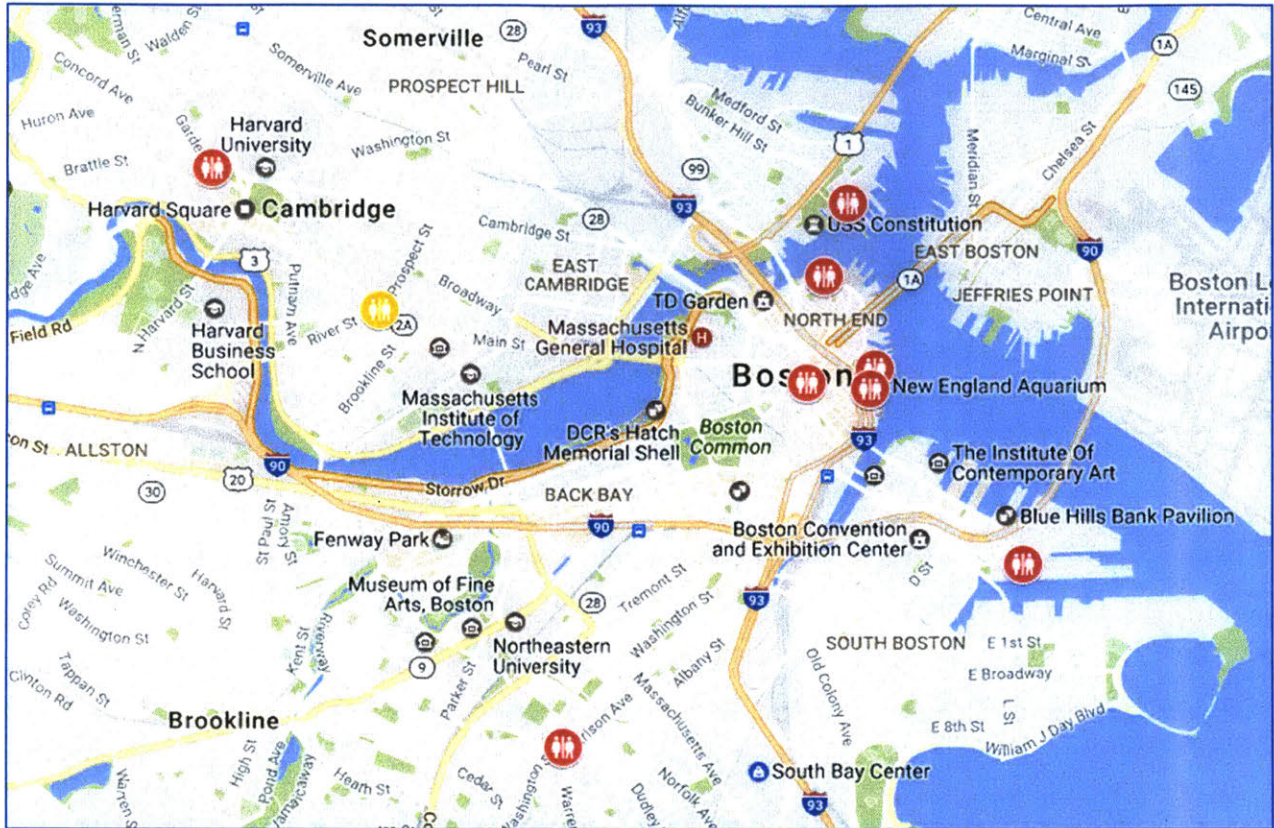


Figure 7: Freestanding Toilets in Boston and Cambridge

Figures 8 through 10 attempt to locate public toilets using various search terms on google maps. The results tend to refer to actual toilets for public use when the word “public” is included in the term. The Harvard Square toilet, the APT near the New England Aquarium, and the Somerville branch of the Cambridge Public Library are most often represented in the search data. Other, non-public toilet results include retailers (produced most often by the search terms “bathroom” and “toilet”), parks (produced most often by the search terms “public bathroom” and “public restroom”), and tourist attractions produced most often by the search terms “restroom” and “toilet). The top images in each figure show a search of “bathroom,” “restroom,” or “toilet” while the bottom images show these searches with the word “public” appended to the beginning of the phrase.

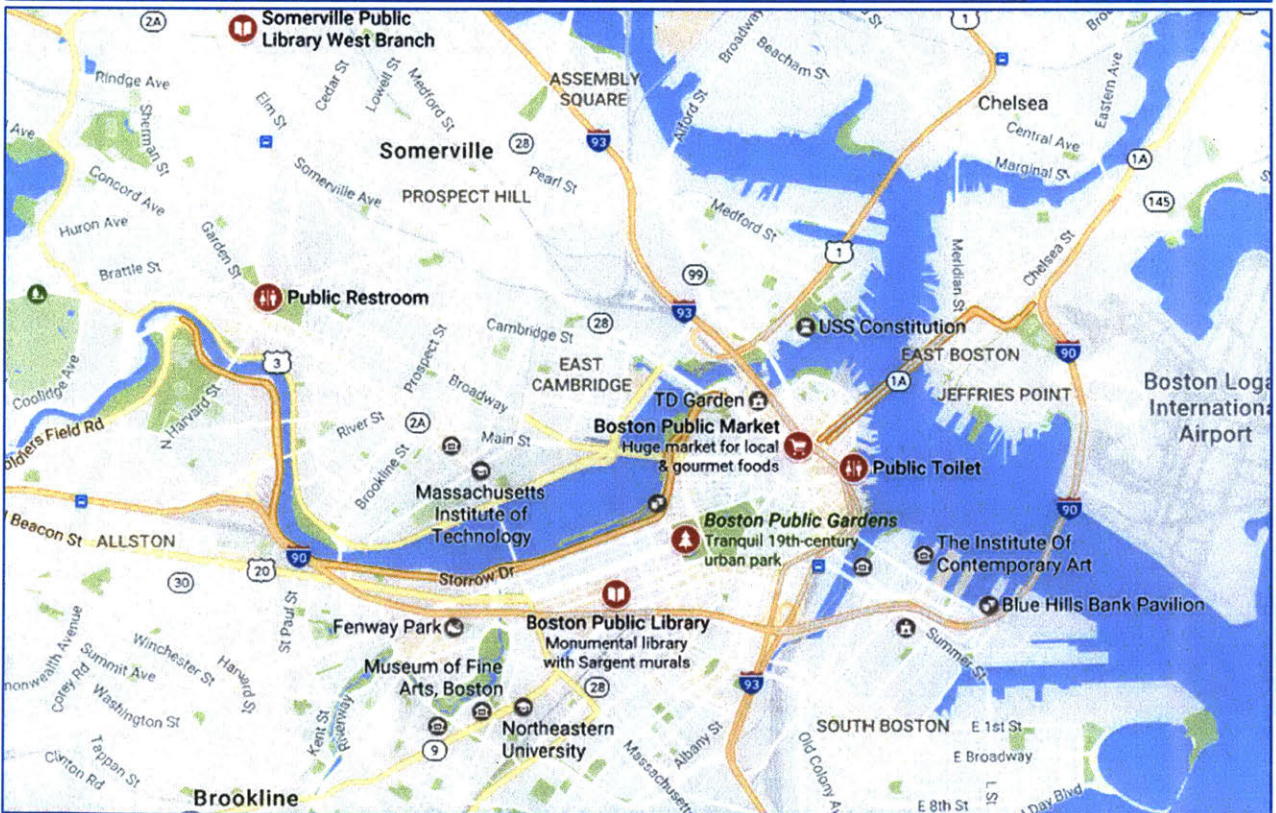
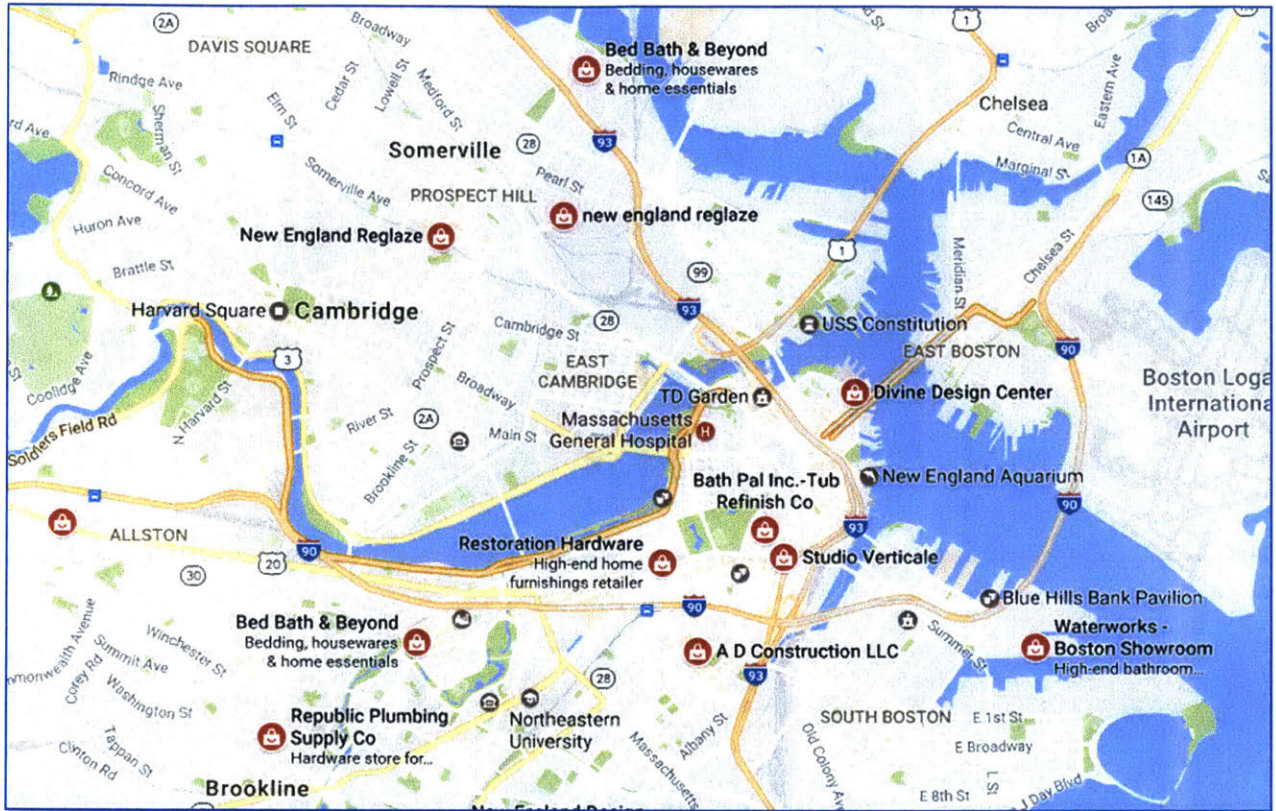


Figure 8: Google search results for "Bathroom" and "Public Bathroom"

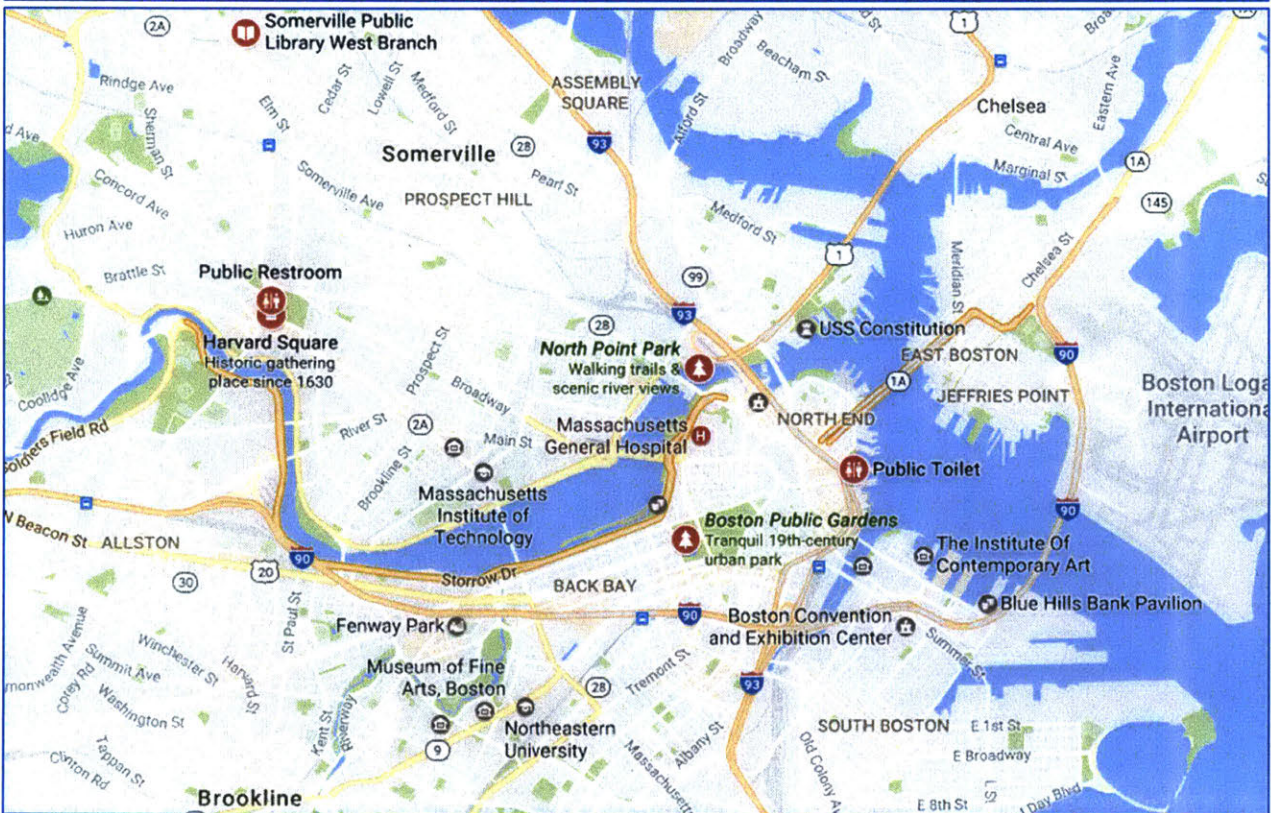
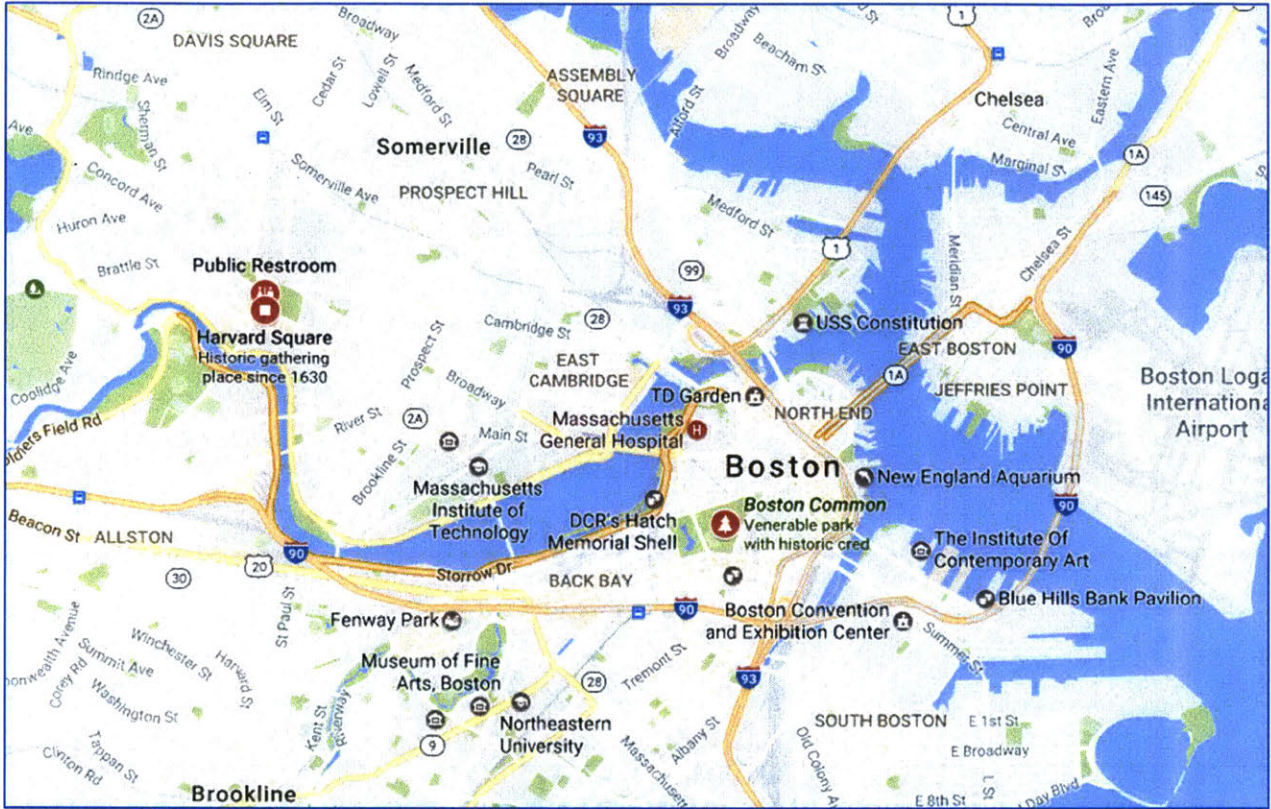


Figure 9: Google search results for "Restroom" and "Public Restroom"

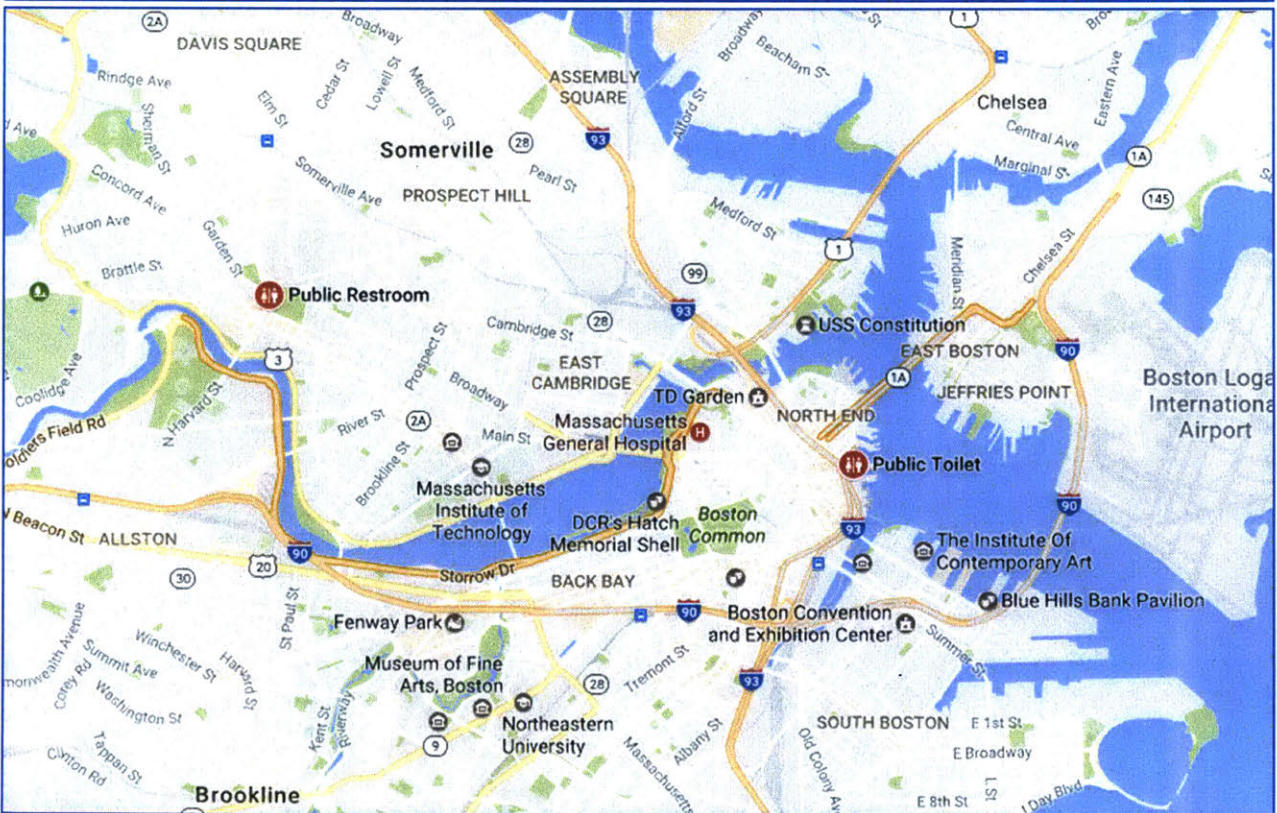
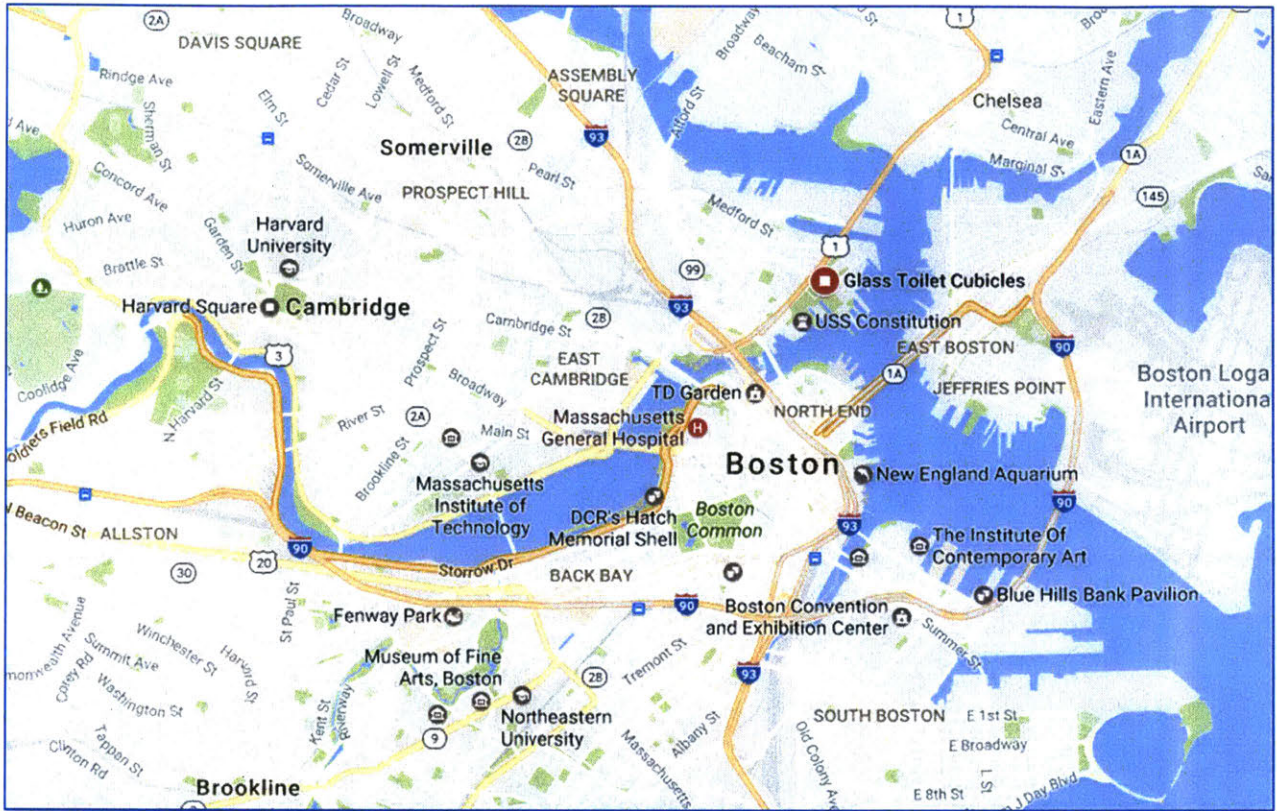


Figure 10: Google search results for "Toilet" and "Public Toilet"

In terms of location information provided on municipal websites, both Boston and Cambridge each had publicly available information describing their toilet locations. However, the level of detail of the description of the toilet locations varied between the municipalities. While Cambridge published the address, and listed the cross streets of their Portland Loo and planned toilet location (The Cambridge Department of Public Works 2017), Boston only listed general neighborhoods or plazas to indicate the APT locations (City of Boston 2016). Links to these websites are included in Appendix E.

In addition, the City of Cambridge website offered a Google Maps entry for their public toilet. Figure 11 is an image of the Google Maps (Maps n.d.) entry for the Portland Loo Harvard Square toilet, which includes photos and street view that makes the toilet easier to locate in real life.

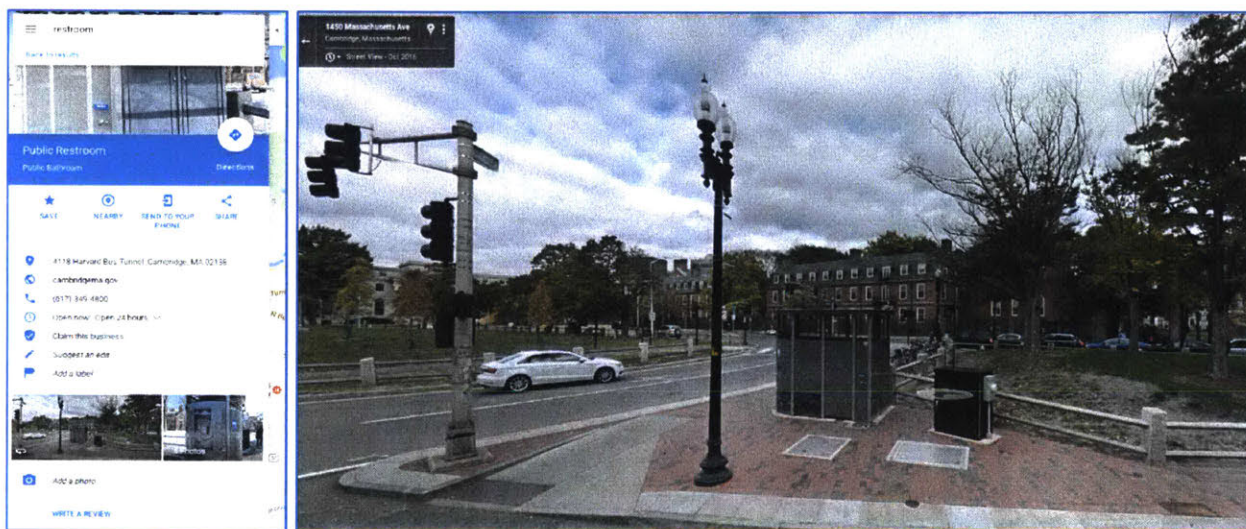


Figure 11: Harvard Square Google Maps Toilet Entry Detail

Unanticipated Findings

Access to Program Information

The City of Cambridge website dedicated individual pages to each of their Portland Loo locations: Harvard Square (completed) and Central Square (planned). Each page is organized into tabs that contain the following information, among other information: notes about past and planned construction, contact information of a municipal employee, and notes and slides from public meetings (The Cambridge Department of Public Works 2017) (The Cambridge Department of Public Works 2017). The City of Boston website does not have information to this level of detail. The contact information listed on the page goes to a program email, not an individual email. Besides a general introduction to the street furniture program, there is no historic information about completed projects and no current documentation of planned projects (City of Boston 2016).

Boston and Cambridge each offered downloadable data related to the locations of public libraries and municipal buildings via their websites (Cambridge Open Data 2017) (Analyze Boston

2016). Cambridge did not have location information for police stations or fire stations available while Boston did.

Institutionalized Participation

The planned Portland Loo toilet in Central Square, although not included in this study, would constitute an interesting case study in itself. This toilet is being funded through the Cambridge Participatory Budgeting Process which “is a democratic process through which community members directly decide how to spend part of a public budget” (City of Cambridge Participatory Budgeting 2017). This process is an important agent for change in Cambridge because it creates momentum for an idea and then uses the existing momentum to encourage a speedy project implementation (B 2017). The Participatory Budgeting Process requires some level of public participation and therefore is a prime example of institutionalized participation that has been applied to a public toilet project.

Ongoing Management Challenges

The interview process uncovered some ongoing challenges associated with each of the toilet programs. These are described in Table 9 and Table 10.

Boston and Cambridge face similar construction and maintenance challenges for their freestanding public toilets. The non-grid layouts of both municipalities caused significant challenges for above-ground location selection because of irregular sidewalk footprints (E 2017). Additionally, both Boston and Cambridge were required to have their toilet location selections approved by historic commissions to ensure that they were not offensive to historic buildings (A 2017) (E 2017). Boston in particular faced additional challenges because the APT features advertising on the sides of the structure, and advertising is specifically regulated in certain areas of Boston (E 2017).

Underground, both Boston and Cambridge host extensive subway networks, which inhibit each municipality’s ability to run water, sewage, and power lines to locations that they select for toilets (A 2017) (E 2017).

Boston and Cambridge face maintenance challenges as a result of their designs. The maintenance of the APTs is a challenge for the Boston because of the intricacy of the sensors, motors, and many moving parts inside of the structure. This design is complex and prone to breakdowns. Additionally, in the event of some breakdowns, replacement parts and maintenance expertise needs to be brought to Boston from overseas (E 2017). This is a challenge both for Boston, JCDecaux employees in the Boston area, and potential users of the APTs. The Cambridge Portland Loo maintenance is mostly affected by the weather. The vents on the toilet allow snow to drift inside during the winter, which requires an employee to visit the site in order to clean the snow. Additionally, the openness of the design and lack of heating poses challenges for the plumbing system. In sub-zero temperatures, the water inside of the toilet freezes and renders it dysfunctional. Cambridge is taking action this winter to mitigate the snow drift issue (Cambridge plans to mitigate this by adding mesh skirt to the exterior of the toilet to keep wind and snow out while allowing for continued visibility and airflow) and to prevent the water from

freezing (Cambridge plans to circulate hot water through the exterior of the bowl to prevent water from freezing) (A 2017). The success of these interventions is yet to be determined.

Category	Challenge	Description
Selecting Toilet Location	Geography of Boston	Many historically designated areas do not allow advertising. Landmarks and irregular streets additionally impede placement (E 2017).
	Sidewalk Geometry	A certain length and width of sidewalk is required to place the toilets (E 2017).
	Availability of City Amenities	Access to municipal water and sewage often determines location feasibility (E 2017).
Maintenance	Complexity of Design	The toilets are difficult to maintain although they were state of the art at the time of construction. According to one interviewee, “[APT is] too high tech” (E 2017) for the purpose it serves.
	Distant Owner	Boston needs to secure replacement parts and maintenance expertise from abroad, which delays the response to breakdowns (E 2017).
External Events	Renovations	There was previously a toilet on Boylston St. and Exeter St., but it had to be removed during the Boston Public Library renovation (E 2017).
	New Developments	New developments, especially in the Seaport district, make it difficult to site toilets because new building owners are concerned about the public toilets (E 2017).
Illegal Activity	Street Level Drug Use	There is illicit drug activity that police officers must check the toilets for (E 2017).
	Propping the Door Open	People prop the door open to avoid paying the cost of the toilet (E 2017).
	Illegal Disposal	People attempt to dispose of things they do not want anymore, including used needles (E 2017).
	Vandalism	These activities include graffiti, breaking glass, and placing stickers on the APT (E 2017).

Table 9: Ongoing Program Challenges, Boston

Category	Challenge	Description
Selecting Toilet Locations	Street Tree Protection	Massachusetts state law protects many of the trees located on the sidewalks, which restricts available construction locations (A 2017).
	Availability of City Amenities	Access to municipal water and sewage often determines location feasibility (A 2017).
	Red Line Tunnel	The Red Line Tunnel restricts the vertical distance that is available to run underground amenities to the toilet locations (A 2017).
Maintenance	Water Freezing	Cold external temperatures cause the water in the toilet to freeze and the toilet to become dysfunctional (A 2017).
External Events	Drifting Snow	Drifting of the snow into the toilet makes the toilet difficult to access and uncomfortable for users (A 2017).
Illegal Activity	Street Level Drug Use	Street level drug use is a concern (A 2017) (C 2017).
	Use as a Shelter	Use as a shelter is a concern (C 2017).

Table 10: Ongoing Program Challenges, Cambridge

Chapter 4: Discussion

The original research hypothesis was that a toilet design and location selection process that intentionally engages potential users will best suit the needs of these potential users and minimize costs to the city. While both Boston and Cambridge have been able to increase the number of public toilets available to potential users, this research concludes that the Portland Loo design is better suited for a high-demand and high-risk urban environment. The Portland Loo is more consistently operational than the Automatic Public Toilet and thus better serves potential users. The Portland Loo also minimizes management risks to the City of Cambridge by discouraging unwanted behavior through its design.

The research questions will be discussed individually as follows.

Design and Location Selection

The first research question is: Why did the cities of Boston and Cambridge select the public toilet design and location that they did?

During the course of this research, it became clear that the original catalyst for the toilet programs varied between the municipalities, despite sharing common goals. Boston's investment in a street furniture program appears to align with the trend of major U.S. cities at the time to begin street furniture programs. The Cambridge program was initiated because the closure of a church toilet caused open defecation and prompted extensive lobbying to Cambridge for a public toilet.

The design selection process for the municipalities also varied, potentially because of the difference in original program initiation as well as the differences in municipal size and municipal structure. In Boston, the APTs were part of a larger municipal program that was contracted through a Request for Proposal process. In Cambridge, the Portland Loo was landed upon after guided research by a city committee. These design selection processes are inherently different: the former solicits proposals and selects from the pool of submitted bids, the latter is a research process that selects from a potentially broader pool of toilet technologies available on the market. Cambridge intentionally interviewed representatives from Seattle, Portland, New York City, and Boston to learn about the public toilet programs there in order to inform their toilet design selection.

Additionally, as the APT was part of a larger street furniture program bid in Boston, other factors external to toilet design (including bus station design, advertising pillar design, specific terms and conditions of the contracts, among others) could have diluted the effect of the toilet design on Boston's contract decision. In Cambridge, as the toilet was not part of any larger program, the individual merits of the potential toilet designs could potentially have had a more direct impact on the final design selection.

Both Boston and Cambridge toilet location selections were and continue to be influenced by local stakeholders. Some of these actors include organized advocacy groups, an elected official, a local transportation authority, and a business association. This public participation seems to be a product of current events, challenges related to open defecation and public urination, and the desire to mitigate these issues. In addition, Cambridge took specific action to engage local residents via a survey that identified Harvard Square as the place in most need of a public toilet.

Assessment of Design

The second research question is: How well do the current freestanding toilet designs and locations satisfy the original design criteria of the municipalities?

The interview process uncovered municipal level priorities and anticipated user needs as understood by the municipalities. Both Boston and Cambridge officials emphasized the urgency and importance of the provision of public sanitation. This implies that they are concerned with the adequacy of toilets in their municipalities. Cambridge officials expressed that they intentionally selected the Portland Loo toilet design because it did not have a direct monetary cost. Although the APTs cost \$0.25 to enter, Boston previously had a token program that would allow homeless individuals to use the APT at no cost. Based on this feedback, it seems that affordability is important to both Boston and Cambridge, although the term is interpreted differently by the municipalities at different points in time.

Both Boston and Cambridge frame the freestanding public toilets as an important way to increase accessibility to sanitation by increasing the number of available toilets in each municipality. The construction of freestanding public toilets created access points outside of municipal buildings and in higher foot traffic areas. While increasing the number of toilets in the municipality contributes to greater accessibility for some populations, it seems that the APT and Portland Loo consider homeless individuals and tourists with varying levels of prioritization. Cambridge explicitly selected the Portland Loo design because it is a direct response to the anticipated challenges of building a public toilet that will be used by homeless individuals. Boston's APT design seems to be more focused on tourist populations.

Beyond the lenses of adequacy, affordability, and accessibility, safety also emerges as a shared design priority for both municipalities. Discouraging illegal activity is an important task in both Boston and Cambridge. Despite this shared need, the APT and Portland Loo have divergent designs. As an example, both toilet designs attempt to limit the amount of time spent in the toilet to limit the likelihood that it will be misused as a space for street level drug use or as a shelter. The APT attempts to directly prohibit extended use via the bell and automatic door opening system. The Portland Loo indirectly discourages extended use via architectural features that make the user slightly uncomfortable and encourage vacation of the toilet.

The challenge of appropriate toilet usage is a result of the "public" and simultaneously "private" design space that public toilets occupy. Some of the APTs struggle with tripping of the doors, which is when someone takes action to prevent the doors from automatically closing. This activity is a direct response to the automatic door and bell system of the APT. Thus, it appears that the Portland Loo, which attempts to curb unwanted behavior by discouraging it indirectly, appears to have more success than the APT which attempts to impose strict regulation of use.

Impact on Users

The third research question is: What is the effect of current freestanding toilet designs and locations on the user experience?

In general, it seemed that the APT design had more features that would accommodate a user's comfort in a bathroom (i.e. a hook to hang a coat, a mirror to check one's appearance, among others). The Portland Loo, however, intentionally omits features that provide non-essential benefits and focuses instead on providing key bathroom functionalities. Although this might cause slight discomfort for some Portland Loo users, in the eyes of Cambridge this design is able to provide its intended service while minimizing additional complexities and risks.

In terms of the effect that toilet location has on accessibility from the user perspective, Cambridge selected a location that was specifically requested by local advocates. This location also has the benefit of being located near a bus stop, a subway stop, and along a busy sidewalk. In this regard, the Portland Loo location is quite optimized for potential users to be able to access the toilet. In Boston, some APT locations similarly respond to local advocacy and are also located near transit hubs, such as the Dudley station MBTA stop. However, other toilet locations in Boston, such as the Design Center Place toilet, do not seem to be in high foot traffic areas and are not near public transportation. As a result, the APT locations have varied accessibility patterns.

The ability to access a toilet also relies on the proper functioning of the toilet. During this study, the Portland Loo was open and operational for each visit. However, of the size APTs that were visited, only one was open and operational on the second attempt to enter it. This experience highlights the influence of proper maintenance on toilet accessibility. For users, a toilet that is dysfunctional or locked provides no benefit or usage opportunity.

In short, it appears that Cambridge was better able to achieve the core functionality requirements of potential users while maintaining the municipality's key priorities. This seems to be a direct result of the reactionary design and location selection process; the necessity of responding directly to the lobbying of local stakeholders required Cambridge to specify key potential users from the outset of the project. This user identification guided their design and location selection process and also allowed them to prioritize the safety of the space based on their previous experiences with some anticipated user populations.

While Boston included additional design features that could be valuable to some users, the APT design introduced many complexities and created risk for vandalism, street level drug use, and frequent breakdowns. The breakdowns of the APTs, as well as their quasi-random locations increases the barriers to their entry and limits their accessibility. The APT design, while it might be appropriate for other contexts, is not well-suited for a high-demand and high-risk urban environment.

Chapter 5: Conclusion

This study elucidated the Boston and Cambridge freestanding toilet design and location selection processes, documented the priorities of municipal employees, and began a cursory user-centered analysis of the toilet designs and locations. However, there is more work to be completed in this area. Based on this research, there is a gap both in literature related to urban access to sanitation as well as its practice. In Boston and Cambridge specifically, there are opportunities for additional research in the following areas:

1. Quantifying, potentially via surveys, specific user priorities, needs, and challenges associated with the freestanding public toilet designs and locations in Boston and Cambridge.
2. Assessing, potentially via interviews, the effect of freestanding public toilet design on the responsibilities and experiences of the cleaning and maintenance staff.

These further inquiries would add to an understanding of the current status of public toilet accessibility, adequacy, and affordability in the urban contexts of Boston and Cambridge. The following themes are potential entry points for future research in this area.

Design for reparability makes an important connection between a design and its associated maintenance routine. There are both monetary and opportunity costs associated with unplanned downtime and with labor and resource intensive maintenance in general. If public toilet design for reparability is pursued during the design and implementation of a project, even in the event of an unplanned break down, the toilet will be more easily maintained and thus will spend less

total time as non-operational. It is important to minimize downtime for maintenance as it directly impacts user accessibility.

With regards to efficiency, design for sustainability is another value that deserves more attention because of the relationship between design and resource utilization. For toilets especially, a relatively large amount of water is used for each flush. Water is not only a scarce resource, but also an energy intensive one; therefore, design for energy efficiency is of paramount importance in our changing world. This thoughtfulness should not be limited to water usage; it similarly applies to electricity usage and other resource usage.

Finally, the balance between inclusivity and exclusivity is certainly delicate to maintain and imperative to strike. The built environment greatly influences human perception and action. This research established that while there are a few intentional use cases for a public toilet, there are a variety of other toilet uses that range from unassuming to potentially dangerous. The balance of design for inclusivity and design for exclusivity is location specific and sensitive to local perturbations. The variability of human behavior and needs is important to consider in order to design a toilet that will provide service to the public for an extended period of time.

The continued pursuit of an equitable public toilet design requires that people, and all their various complexities, are thoughtfully designed for in order to achieve an urban landscape that is environmentally and socially conscious.

Appendices

Appendix A

Freestanding Toilet Visit Log				
Locations	20 March	7 April	14 April	5 May
Cambridge	Service	Not visited	Functional	Functional
Boston 1	Service	Not visited	Not visited	Not visited
Boston 2	Service	Not visited	Not visited	Not visited
Boston 3	Not visited	Service	Not visited	Not visited
Boston 4	Not visited	Service	Not visited	Not visited
Boston 5	Not visited	Service	Not visited	Not visited
Boston 6	Not visited	Service	Not visited	Not visited
Boston 7	Service	Not visited	Not visited	Not visited

Appendix B

Boston Faneuil Hall Toilet





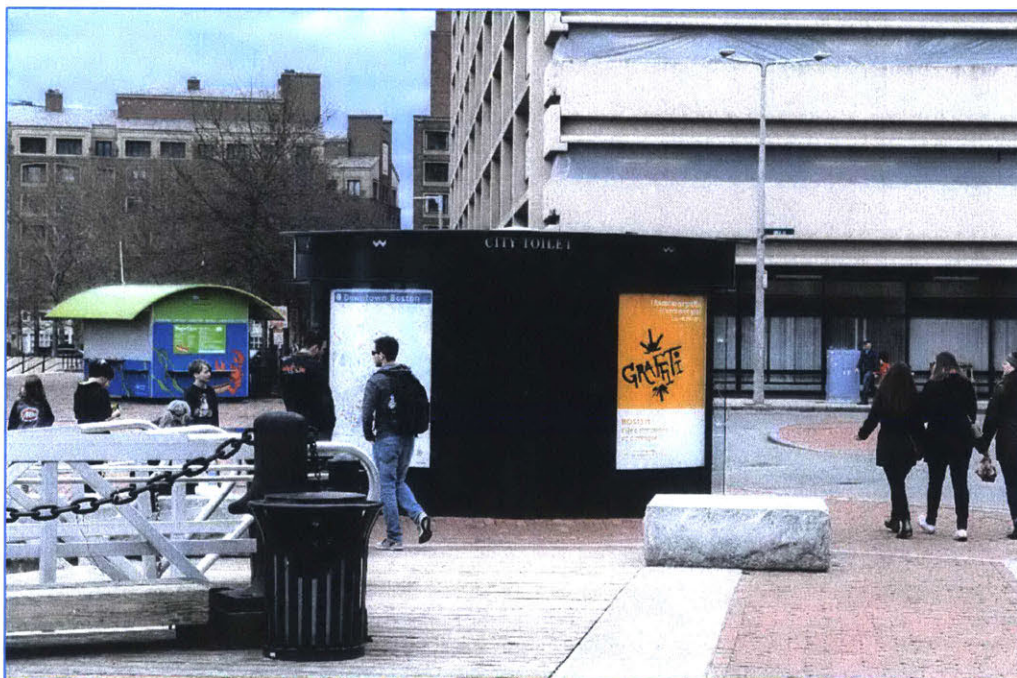
Boston Commercial Street Toilet

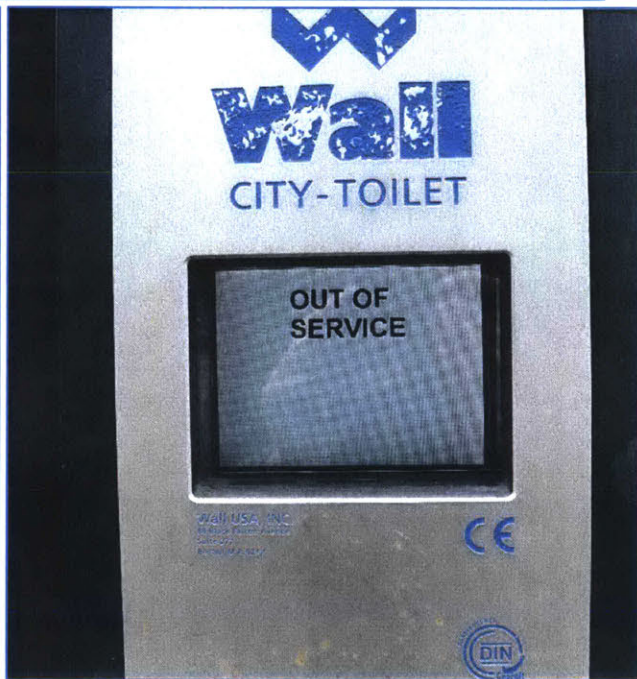
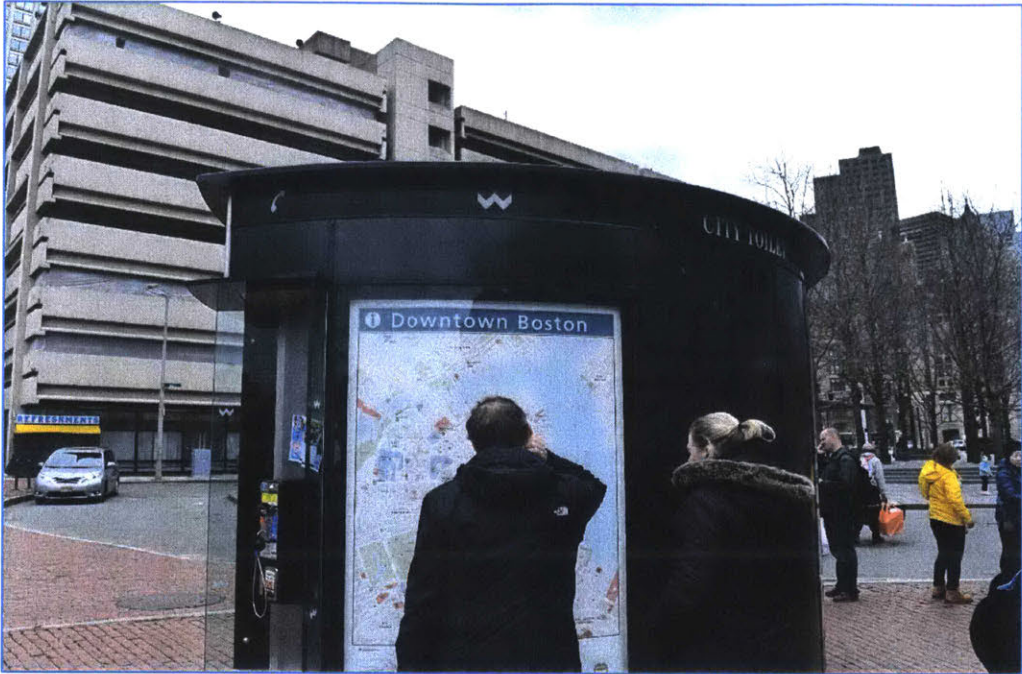


Boston Shipyard Park Toilet



Boston Central Wharf Toilet

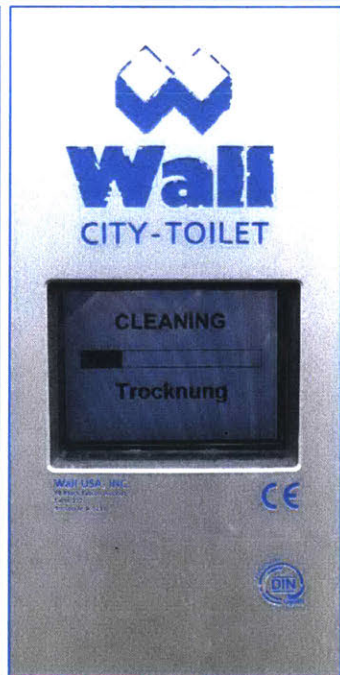
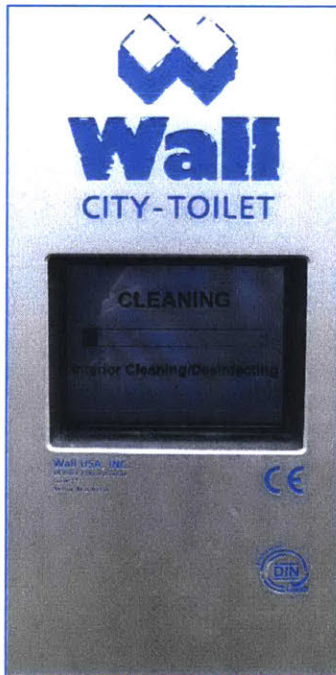
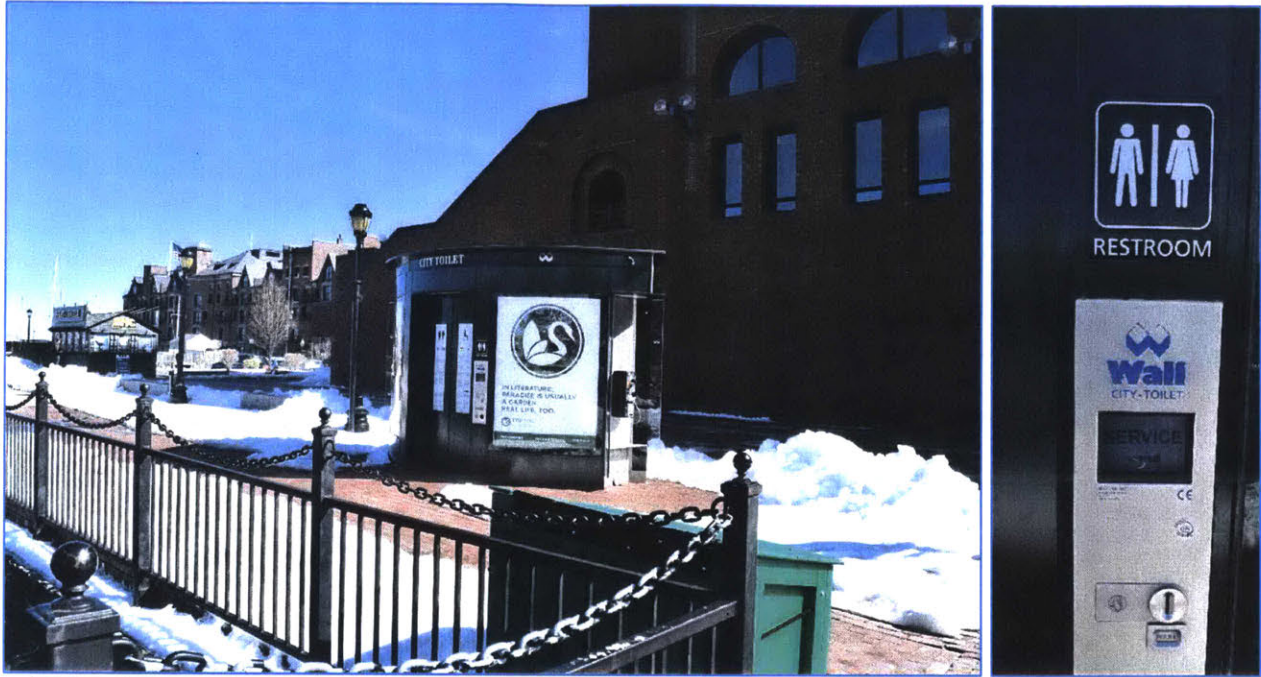




Boston Design Center Place Toilet

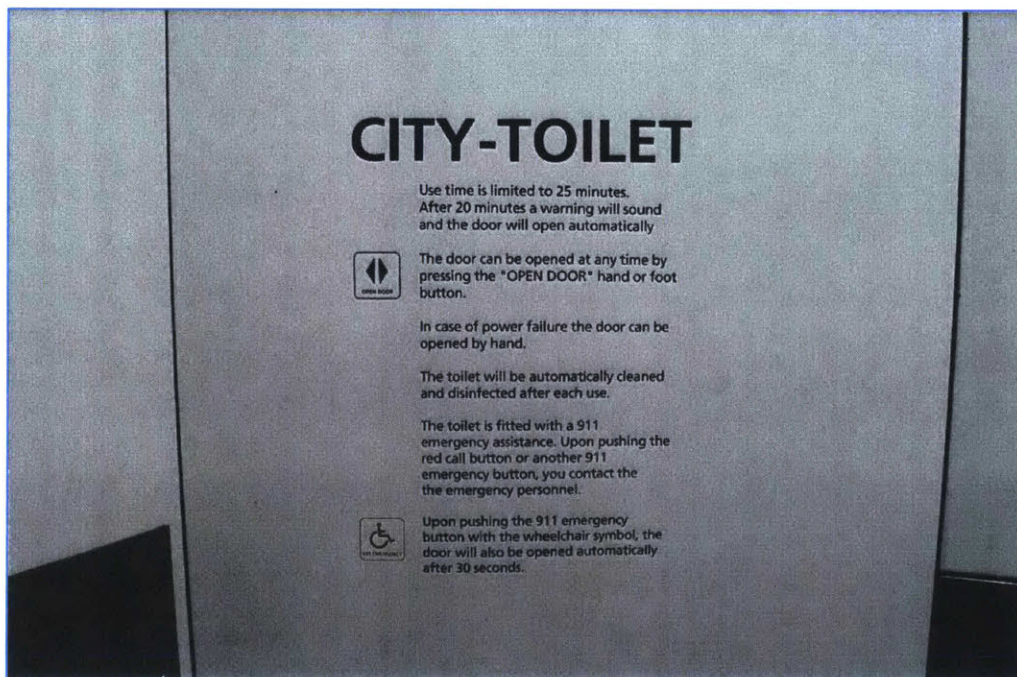


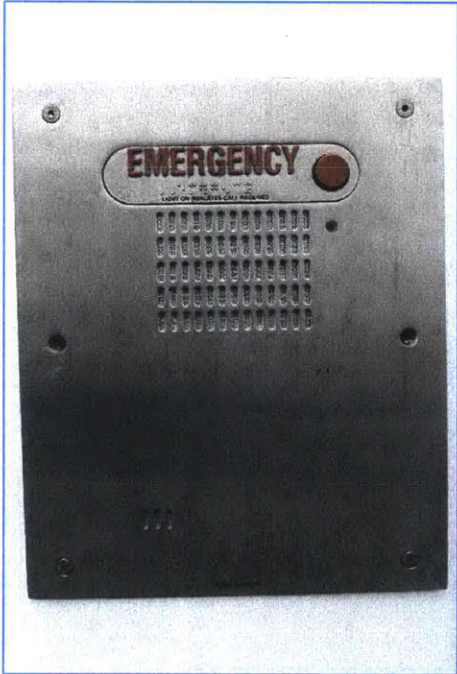
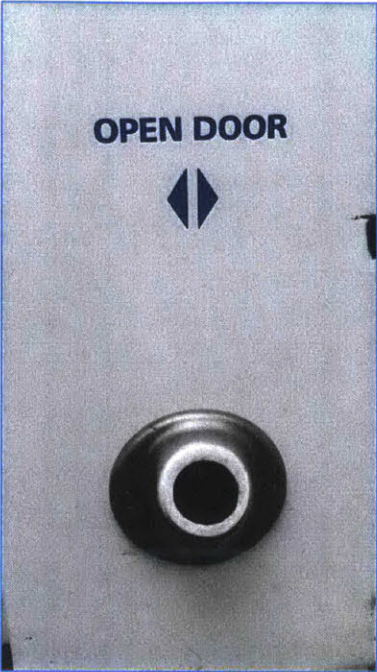
Boston Long Wharf Toilet (Exterior)



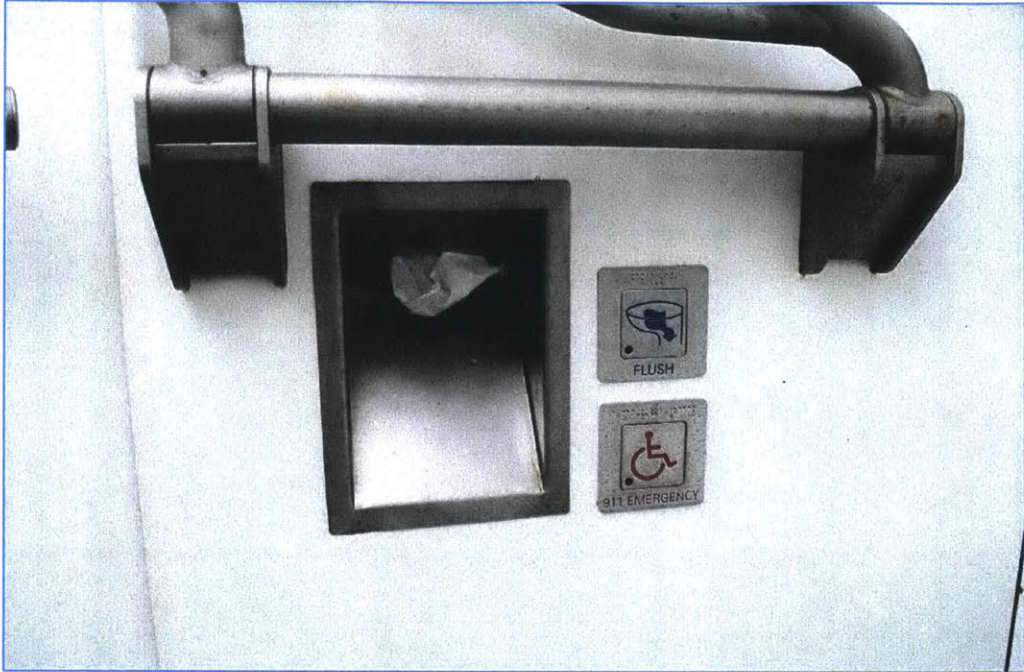


Boston Long Wharf Toilet (Interior)

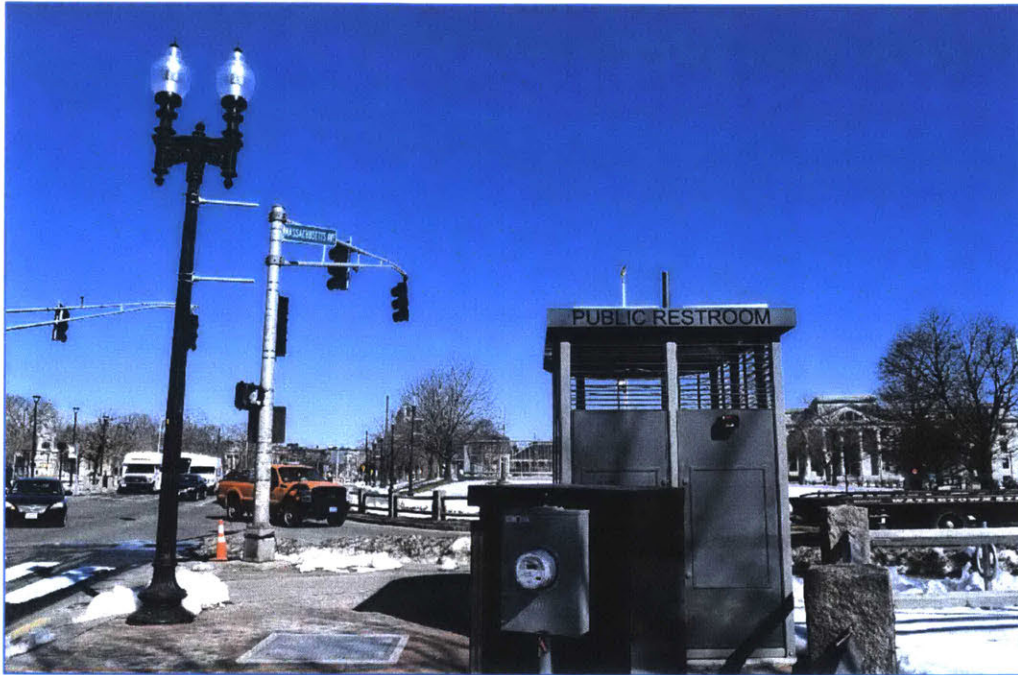


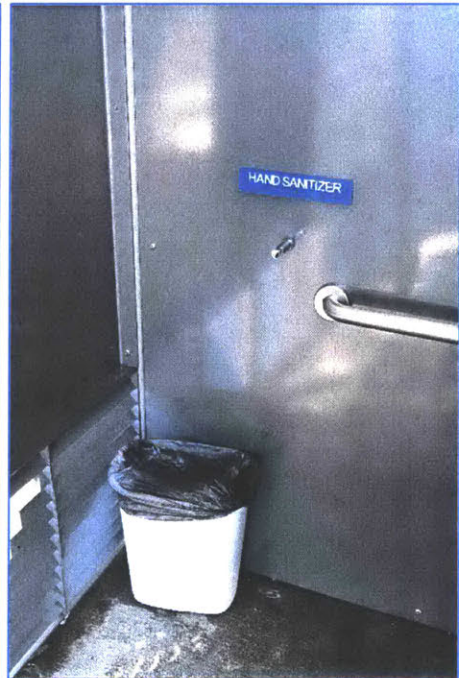
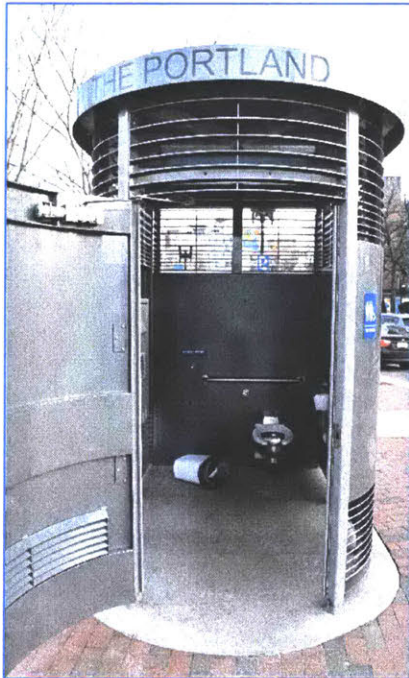
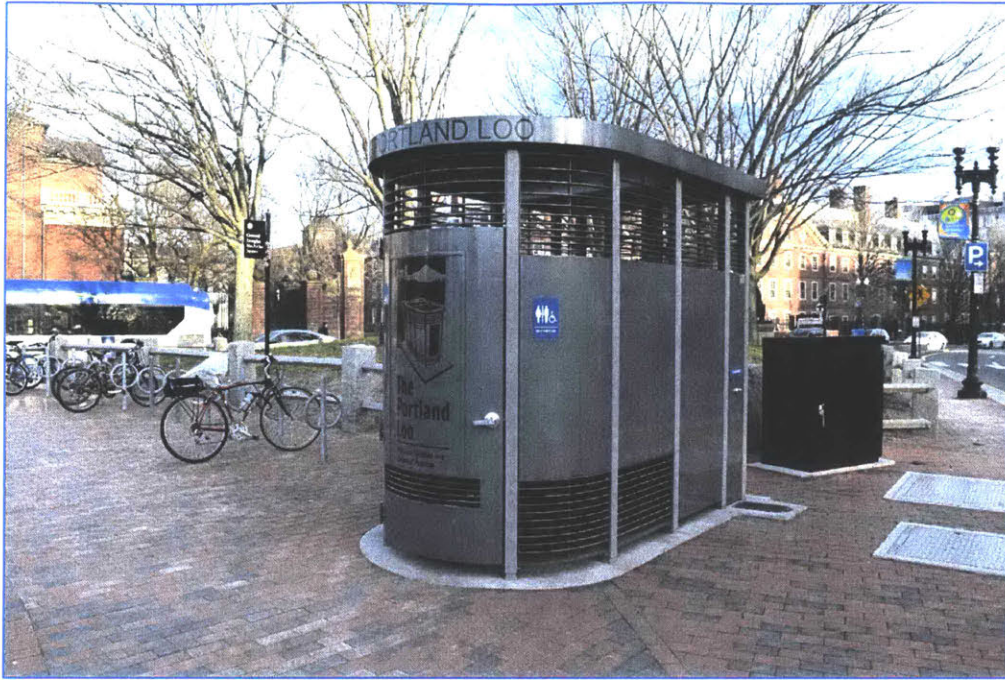






Cambridge Harvard Square Toilet (Exterior and Interior)







Appendix C

Background

What is your role with the city and experience with public lavatories in Cambridge?

Can you provide some background information about the program?

How do you interact with other city units or NGOs specifically around the public lavatories?

Project Development

Can you describe the toilet project planning process and timeline? What steps were taken? What stakeholders were involved in the decision-making process? How were various user concerns balanced?

What kinds of regulatory requirements, design concerns, and technical constraints were there on the project?

What additional priorities were taken into consideration during the project?

Who were the intended users? What use cases were designed for? What use cases were discouraged through design?

Encourage:

Discourage:

How did you determine the location of the lavatories?

How did you determine lavatory capacity / estimate number of users?

How did you determine what lavatory design to use?

How did you determine what contractor to hire?

(Cambridge only) How does the participatory budgeting process affect the design process?

Current Management

Can you confirm the number of toilets in the program?

Please describe the current toilets and their locations

Please describe the current management structure for the lavatories.

How often are the lavatories cleaned?

Who is responsible for the cleaning of the lavatories?

How often are the lavatories maintained? Please answer for preventive and breakdown maintenance and if possible, describe the frequency of different types of maintenance issues.

Who is responsible for the maintenance of the lavatories?

How are problems with the lavatories communicated or reported?

Are there aspects you would like to improve within current management?

Are you able to share information about the costs associated with management and/or maintenance?

Future Plans

Are there plans to install additional lavatories through the city?

If so, what is the estimated timeline?

If so, how will the location of the lavatories be determined?

If so, what design of toilets will be used?

If so, how will potential users be engaged in the design process?

If so, what contractor will the city hire?

Miscellaneous

Are there any additional resources you can share with me? Documentation or other contacts?

Appendix D

Link to the online version of the Boston and Cambridge public toilet map:

https://www.google.com/maps/d/edit?mid=1Gpn5exK86N63h0fW9ZZxD2E_t6g&ll=42.31448560674555%2C-71.08617449999997&z=12

Appendix E

Boston Coordinated Street Furniture Program Website Link:

<https://www.boston.gov/departments/property-management/coordinated-street-furniture-program>

Cambridge Harvard Square Public Toilet Website Link:

<https://www.cambridgema.gov/theworks/cityprojects/detail.aspx?path=%2Fsitecore%2Fcontent%2Fhome%2Ftheworks%2Fcityprojects%2F2014%2Fharvardsquaretoilet2014>

Cambridge Central Square Public Toilet Website Link:

<https://www.cambridgema.gov/theworks/cityprojects/detail.aspx?path=%2Fsitecore%2Fcontent%2Fhome%2Ftheworks%2Fcityprojects%2F2017%2Fcentralsqpublictoilet>

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