



# WPI

## Increasing Visitation to the Tower Bridge Engine Room

An Interactive Qualifying Project submitted to the faculty of Worcester Polytechnic Institute in partial fulfillment of the requirements for the degree of Bachelor of Science

**Submitted To:**

**The Tower Bridge Exhibition**

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June 28, 2023

# Abstract

The Tower Bridge Museum in London welcomes about 3,000 visitors a day, but 20-40% of visitors leave before viewing the last exhibit, the Engine Room. This project explored ways to increase the percentage of visitors who go to the Engine Room. We conducted visitor observations and staff interviews to generate hypotheses for visitation patterns, and tested low-cost implementations involving leaflets and verbal prompts. Additionally, we analyzed historical visitation data. Our implementations were unsuccessful in raising the Engine Room percentage. We found some correlations between the Engine Room percentage and other visitor statistics. We make recommendations that cover language barriers, gathering more information about visitors, and further analysis of existing data.

# Acknowledgements

Our IQP team would like to thank our project advisors, John-Michael Davis and Jason Davis, as well as our project center director Dominic Golding, and our host, Dirk Bennett and Tower Bridge.

# Table of Contents

- Abstract ..... i**
- Acknowledgements ..... ii**
- Table of Contents ..... iii**
- List of Figures ..... v**
- List of Tables ..... vi**
- Executive Summary..... vii**
  - Methods ..... vii
  - Implementations* ..... viii
  - Analyzing Additional Variables such as Precipitation and Visitor Patterns* ..... viii
  - Findings ..... ix
  - Recommendations ..... ix
- Introduction ..... 1**
- Background ..... 3**
  - History of Tower Bridge ..... 3
  - Recent Changes to the Tower Bridge Museum ..... 4
  - Visitor Engagement ..... 6
  - Wayfinding..... 6
  - Exhibition Narratives..... 7
  - Visitor Fatigue..... 7
  - Low-Cost Data Collection Methods ..... 8
  - Visitor Lack of Time..... 9
  - Audience Segmentation and Demographics ..... 9
  - Hypotheses for Low Visitation to the Engine Room ..... 10
- Methods ..... 11**
  - Initial Observations and Interviews ..... 11
  - Implementations ..... 12
  - Mentioning the Engine Room in the Entrance Queue ..... 12
  - Verbal Engine Room Promotions in the North Tower Lift ..... 13
  - Lift Speech and Verbal Promotion at the Stairwell Along the Blue Line ..... 14
  - Additional Analysis ..... 14
  - Data Analysis ..... 16
  - Limitations ..... 16

<b>Findings .....</b>	<b>18</b>
Introduction.....	18
Crowdedness .....	18
Time of Year.....	19
On-Line/Walk-up Percentages .....	20
London Pass and Pre-Booked Group Visits .....	22
Precipitation .....	23
Wayfinding/Lack of Awareness.....	23
Entrance Queue Leaflets .....	24
Entrance Queue Leaflets & North Tower Lift Speech.....	25
North Tower Lift Speech & verbal promotion at the Engine Room stairwell.....	25
Additional Analysis - West Walkway Renovations .....	25
Language Barrier .....	26
<b>Conclusion .....</b>	<b>27</b>
Recommendations .....	27
<b>References .....</b>	<b>30</b>
<b>Appendices .....</b>	<b>32</b>
<b>Authorship.....</b>	<b>35</b>

# List of Figures

Figure Title	Page Number
Figure 1: Tower Bridge Exhibition Schematic (Bartlett et. al., 2022)	viii, 5
Figure 2: The Construction of Tower Bridge (Tower Bridge, 1886)	3
Figure 3: Tower Bridge Leaflet	13
Figure 4: Additional Promotion of the Engine Room within the West Walkway	15
Figure 5: Scatter plot comparing the total number of visitors to the Engine Room percentage. Line of best fit included	18
Figure 6: Scatter plot comparing the days since beginning of 2023 to the total number of visitors. Line of best fit included	19
Figure 7: Scatter plot comparing the days since beginning of 2023 to the Engine Room percentage. Line of best fit included	20
Figure 8: Scatter plot comparing the percentage of on-line visitors to the Engine Room percentage. Line of best fit included	21
Figure 9: Scatter plot comparing the percentage of walk-up visitors to the Engine Room percentage. Line of best fit included	21
Figure 10: Scatter plot comparing the total number of visitors to the percentage of on-line visitors. Line of best fit included	22
Figure 11: Table and graph showing the distribution of the Engine Room visitor percentage	24

# List of Tables

Table Title	Page Number
Table 1: Data showing the $n$ sample size, $r$ Pearson's correlation coefficient, and $p$ probability between every set of numerical data	23
Table 2: Data for the week of the first implementation, where we distributed leaflets and verbal promotion of the Engine Room while near the entrance to the bridge. Note that Saturday the 10th is not included in the average	33
Table 3: Data for the week of the second implementation, where we distributed leaflets, verbally promoted the Engine Room, and gave lift speeches. Note that Saturday the 17th is not included in the average	33
Table 4: Data for the week of the second implementation, where we gave lift speeches and verbally promoted the Engine Room along the blue line stairs	34
Table 5: Data for the week following West Walkway renovations.	34

# Executive Summary

Tower Bridge completed its construction in 1894 and was made to relieve traffic on the London Bridge. It opened as a historical museum in 1982. The museum contains the North and South Towers, the East and West Walkways, and the Engine Room. Over the past few years, Tower Bridge has noticed that approximately 20-40% of the Tower Bridge museum visitors are leaving the bridge before visiting the Engine Room. Skipping this exhibit has a negative impact on both the visitor and Tower Bridge, as the visitor will miss out on part of the experience they have already paid for as part of their ticket. Tower Bridge will also see decreased footfall in its Gift Shop (which is attached to the Engine Room, separate from the towers).

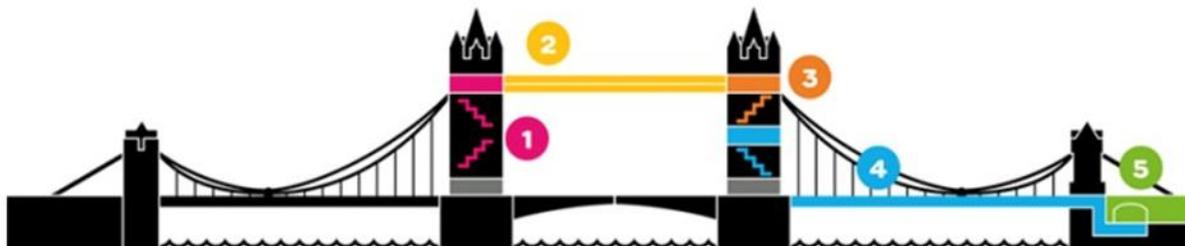
The goal of this project was to identify factors that affect the percentage of visitors who visit the Tower Bridge Engine Room and to test implementations that could increase that percentage. Below are our project objectives that helped us achieve this goal.

1. Understand visitor behavior and conduct semi-structured staff interviews at Tower Bridge.
2. Identify and test implementations to increase the Engine Room percentage.
3. Analyze historical Engine Room visitation to identify variables that may affect visitation.

## Methods

*Observation, Small Sample Interviews/Surveys with Visitors, and Staff Interviews:*

We began our project by understanding visitor behavior patterns within Tower Bridge through observations and staff interviews. We observed visitors from the South Tower exit point (See Figure 1) and checked to see if they walked to the Engine Room or not.



**Figure 1: Tower Bridge Exhibition Schematic (Bartlett et. al., 2022).** Point 1 represents the North Tower. Point 2 represents the East and West walkways. Point 3 represents the South Tower. Point 4 represents the South Tower lower level. Point 5 represents the Engine Room.

If visitors left the path before reaching the Engine Room, we would attempt to stop and talk to them to get a better understanding of why they were leaving. Additionally, we conversed with Tower Bridge staff members and asked them the following questions:

1. What do you think is the biggest cause of the decline in visitation to the Engine Room?
2. During your time here, what efforts have you seen by the staff to combat the visitation issue?
3. What do you suggest as a solution?

### *Implementations*

After our staff interviews and observations were conducted, we researched and created potential solutions with our host liaison, Dirk Bennett. Given the complex ownership of Tower Bridge, we only proposed solutions that could be implemented by Tower Bridge staff with a minimal budget and without requiring special permissions from the owners of the bridge. In cooperation with Dirk Bennett, we tested three different weekly implementations to increase the Engine Room percentage, with each one adding to the prior version. The implementations were as follows:

- Week 1: Handing out a Tower Bridge leaflet and verbal promotion of the Engine Room at the Entrance Queue
- Week 2: Entrance Queue verbal promotions and handing out leaflets, coupled with a short speech about visitor attractions (with an emphasis on the Engine Room) in the North Tower Lift
- Week 3: North Tower lift speech, coupled with a person at the stairwell along the blue line directing visitors to the Engine Room

### *Analyzing Additional Variables such as Precipitation and Visitor Patterns*

Our group conducted data analysis on visitor data provided by Tower Bridge, including the total number of visitors, the percentage of visitors who used a London pass, the percentage of visitors who had on-line/walk-up tickets, and the percentage of visitors that were large groups.

We also gathered data about precipitation. From our data, we analyzed variables that affect the percent of visitors who go to the Engine Room.

## **Findings**

It was found that crowdedness was the biggest statistical predictor of the Engine Room percentage. Time of year, on-line percentage, and walk-up percentage also showed a correlation with Engine Room percentage. However, that may be due to those values being connected to crowdedness. London Pass percentage, visitor group percentage, and precipitation were found to have no effect on the Engine Room percentage. We found that wayfinding and visitor awareness of the Engine Room were not the main issues behind the visitation issue, contrary to what we initially believed. Language barriers were unaddressed by our implementations and remain a possible cause of this issue.

## **Recommendations**

While on the bridge, our group encountered a language barrier that could not be overcome. This was not unexpected; many staff experience the same barrier every day due to Tower Bridge's diverse audiences.

Based on the results of our implementations and data analysis, we recommend that the Tower Bridge management further research language barriers within the museum and ways to implement aids that would decrease the language barrier for visitors who are not proficient in English. One possible way to address this would be for Tower Bridge to expand the Smartify app audio tour, so it includes additional languages. This could be done by hiring a translator. Alternatively, Tower Bridge could add additional signage and leaflets for other common languages. To do this, Tower Bridge could survey visitors in the Entrance Queue about the languages they speak and accordingly provide materials to the most common languages.

To alleviate the correlation between crowdedness (total visitor numbers) and the Engine Room visitor percentage, we recommend that Tower Bridge implement a guided tour starting at the Engine Room. This tour would select batches of people (around 20 at a time) from the Entrance Queue to start their Tower Bridge experience directly at the Engine Room. This would alleviate the large crowds at the Entrance Queue and would likely increase the percentage of

visitors who visit the Engine Room. Alternatively, the Tower Bridge should consider starting all tours at the Engine Room.

We also recommend that Tower Bridge should hire an analytics consultant to further research correlations between Engine Room visitor percentages and more specific visitor data. A professional could give Tower Bridge more detailed analyses and more accurate evaluations of implementations' success. Additionally, our data analysis was limited by the fact that we only worked off of half a year's worth of data, meaning that it could be beneficial for Tower Bridge to observe the statistical trends over a larger period of time.

# Introduction

Since 1894, Tower Bridge has been one of London's most famous landmarks, featured in events such as coronations and the 2012 London Olympics. Since its opening as a historical museum in 1982, Tower Bridge has become a popular tourist destination and now attracts approximately 850,000 visitors every year (Bennett, 2023). There are exhibits located in the North and South Towers, the walkways in between the towers, and the Engine Room. The Engine Room is separated from the rest of the exhibits, as it's located at the south end of the bridge. This exhibit houses the engines that operated the bridge for most of its history. To reach it, visitors must exit the South Tower, walk to the end of the bridge and make their way down a staircase or go down in a lift. Approximately 20-40% of visitors leave before visiting the Engine Room (Bennett, 2023). Skipping this exhibit has a negative impact on both visitors and Tower Bridge. The visitor misses out on part of the experience that they already paid for as part of their ticket, and Tower Bridge sees decreased footfall in their Gift Shop (which is attached to the Engine Room, separate from the towers).

Extensive research analyzed how visitors move within museums (Bitgood, 2009; Bowe et al., 2019; Nielsen, 2017; Nubani et al., 2018; Roussou et al., 2018). This research has found that wayfinding, storytelling, visitor fatigue, a visitor's background, and reason for visiting impact how visitors experience museums. In combination, these topics describe how visitors move through a space and why they choose to do so. These studies also describe some techniques that can be employed regarding these topics to help visitors navigate museum exhibits. The geographic layout of the Tower Bridge museum offers a unique challenge compared to museums analyzed in the existing literature. Due to its structure, visitors can choose to leave halfway through the experience at the bottom of the South Tower. With this study, we will investigate how these topics apply to a uniquely laid out landmark like Tower Bridge.

Tower Bridge made changes to address topics such as wayfinding and storytelling in order to bolster engagement with the Engine Room. These changes included adding signage, adding a blue line that directed visitors toward the Engine Room and having staff point guests in the direction of the Engine Room. Additionally, some of the other exhibits on Tower Bridge

reference the Engine Room to entice more visitors to attend. However, the percentage of visitors who go to the Engine Room has continued to fluctuate daily since 2015 (Bennett, 2023).

The goal of this project was to identify factors that affect the percentage of visitors who attend the Tower Bridge Engine Room and test implementations that could increase that percentage. To achieve this, our first objective was to understand visitor behavior at Tower Bridge and Engine Room visitation. Our second objective was to identify and test various changes the bridge could make and analyze their impact on visitation to the Engine Room. Our final objective was to analyze historical visitor statistics to identify variables that consistently affect the Engine room percentage.

This report discusses recent changes to Tower Bridge and how they could affect our research objectives. We also cover the existing literature regarding visitor engagement, storytelling, museum fatigue, demographic studies, and data collection analysis. We discuss the data collection methods we plan on using to investigate these issues. Our research was done in three stages: field research, development and testing of mitigation strategies, and statistical analysis. From our findings, we recommend possible strategies the Tower Bridge Museum could employ to increase visitation to the Engine Room.

# Background

## History of Tower Bridge

Tower Bridge is a feat of Victorian-era engineering that allows pedestrians to cross the Thames River without blocking the passage of boats. Over its lifetime, the bridge has transitioned to become an iconic landmark and popular visitor attraction. The City of London Corporation, the sole trustee of the charity of Bridge house estates, was put in charge of designing a passage across the river Thames in 1876. The bridge was then under construction for the next ten years (see Figure 2), and it subsequently was presented in a grand opening by the Prince and Princess of Wales on June 30th, 1894.



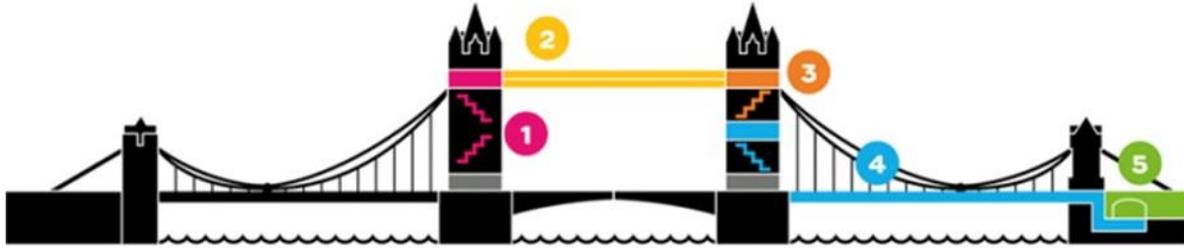
**Figure 2: The Construction of Tower Bridge (Tower Bridge, 1886)**

When Tower Bridge was built, it was regarded as the largest and most sophisticated bascule bridge. The term ‘bascule bridge’ is derived from the French word bascule (“see-saw” is the direct translation). When it was first engineered, the bascules were powered via hydraulic pump presses that drove steam as an input. Despite its large size and complex nature, this system was extremely fast, only taking 60 seconds to raise to a maximum angle of 86 degrees. Today, the bascules still use hydraulic power, but rather than use steam as a driving input, they use oil and electricity, as they have since 1976. The original pumping engines, accumulators, and boilers are currently on display within Tower Bridge’s Engine Room. Now that the bridge is a museum, these features of the bridge are exhibits.

## **Recent Changes to the Tower Bridge Museum**

In 2014, an audit of the Tower Bridge experience found that there was little to no cohesion between exhibits (Bennett et al., 2015). The exhibits offered little emotional impact to the visitors, and the content delivered was not catered to its diverse audience. Additionally, the audit found that virtually every part of the Tower Bridge experience was ignored by visitors besides the glass floors in each walkway. Many of the other exhibits were deemed physically or intellectually inaccessible to a range of audiences, and often not engaging enough to hold the audience’s attention.

Since then, Tower Bridge implemented a series of alterations meant to improve the visitor experience and address problems with the exhibitions, including the drop-off in visitation percentage to the Engine Room. These changes were made in three phases. Phase one, which was completed in 2017, encompassed the changes to the Engine Room and the walk leading up to it. Phase two covered all of the changes to each tower’s exhibits and was finished in May 2018. Phase three encompassed the changes to the exhibitions in the walkways and were scheduled to be completed over the fiscal year 2019-2020 (Mills, 2018). However, due to COVID-19, phase three was completed in May 2023. Pictured below is a layout of the Tower Bridge exhibition. A visitor to Tower Bridge starts at the North Tower [1] and finish at the Engine Room [5], as shown in Figure 1.



**Figure 1: Tower Bridge Exhibition Schematic (Bartlett et. al., 2022).** Point 1 represents the North Tower. Point 2 represents the East and West walkways. Point 3 represents the South Tower. Point 4 represents the South Tower lower level. Point 5 represents the Engine Room.

Each exhibit's new and existing content was tailored to a variety of audiences with different backgrounds, expectations, and pre-existing knowledge. For example, the new exhibits catered to audiences from more diverse backgrounds through the use of global English and the addition of more auditory and visual elements to the visitor experience. Global English is a simplified form of English that makes the language easier to understand for non-native speakers. Visitors are now offered many ways to learn, such as interactives, hands-on exhibits, auditory loops, and traditional paneling. There is also a new emphasis placed on the stories of people who helped create Tower Bridge, in the hopes that visitors can connect with these stories and become more interested in the history of the bridge. Together, these changes are meant to offer an educationally deep and engaging experience that caters to visitors' interests (Bennett et al., 2015). Additionally, on June 15th, Tower Bridge implemented a partnership with Smartify. This gave visitors access to an English audio tour and a written description of exhibits to maximize their Tower Bridge experience.

While visitation to Tower Bridge has rebounded since the COVID-19 pandemic, the visitation issue for the Engine Room has only persisted, as approximately 60-80% of visitors currently visit the Engine Room (Bennett, 2023). This indicates that the changes to exhibits have been unsuccessful in increasing the Engine Room percentage.

## **Visitor Engagement**

Visitor engagement can be a useful metric for evaluating the quality of exhibits within museums. For this report, visitor engagement is defined as the level of interest visitors show in an exhibit. If there is a lack of engagement at one exhibit compared to others, then something could be causing that area to be less noticeable or interesting to guests. Taheri (2014) states that finding a link between engagement levels and factors such as repeat visits can be useful, as it can influence future decisions on improving exhibits. Further research into this area has led to the identification of common topics that can cause visitors to avoid certain exhibits. These factors can help pinpoint the main issue behind a lack of engagement and help create a solution. Some of these factors include wayfinding, exhibition narratives, visitor fatigue, and visitor perspective.

## **Wayfinding**

Wayfinding refers to how individuals process information related to navigation, such as using signage and other visual elements of a space. Museums can use wayfinding to help visitors navigate from one exhibit to the next. Ghamari & Pati (2018) recorded how frequently volunteers looked at certain visual elements and for how long, defined as eye fixation frequency and eye fixation time, respectively. The collected data confirmed that signage, architectural elements, and maps are the most prominent visual elements that people use to navigate in unfamiliar environments. Signage accounted for approximately 50% of eye fixation time and frequency, followed by architectural elements at 14% and maps at 8%. This indicates that signage and maps contribute to effective wayfinding.

When in a new environment without proper guidance, navigation can be difficult and anxiety-inducing for visitors. Studies show that a visitor's ability to properly orientate themselves within new environments was inversely correlated with their anxiety levels (Chang, 2013; Lawton, 1996; Lawton & Kallai, 2002). Not only does this negatively impact their experience, but visitors also lose motivation to explore additional unfamiliar environments. Hence, it's important to provide clear directions with plenty of visuals that lead guests through an exhibit. Researchers have found that pictograms and symbols serve as an effective tool for improving signage clarity, overcoming language barriers and enhancing visitor navigation, which

allows museums to focus more on the exhibit itself and the story it needs to portray (Clara & Swasty, 2017).

## **Exhibition Narratives**

Recent studies show that low visitation to an exhibit can indicate a lack of overall narrative within a museum. Storytelling is an important factor when it comes to keeping visitors engaged throughout a museum, as it can smooth transitions between exhibits, giving visitors a more immersive experience. Nielsen (2017) found that storytelling and communication were important for engaging visitors, connecting visitors with the exhibits, and led to an increase in their personal value of the exhibit. Roussou et. al (2018) investigated which types of storytelling were most effective in capturing visitors' attention. A large part of their study was a prototyped mobile guide that was meant to lead guests around while delivering the narrative of the exhibition. The visitors were interviewed before and after their visit to analyze the impact of the mobile guide on their experience in the museum. The data showed that "more unconventional, e.g., storytelling approaches to engage with cultural content may greatly contribute towards more compelling visiting experiences." The study concluded that having an interactive, personal guide that leads guests through exhibits can keep visitors immersed in the experience. If the digital guide also utilizes navigation assistance, the guide can incentivize visitors to explore less popular sections by integrating those areas into the overall narrative.

## **Visitor Fatigue**

One obstacle with keeping visitors engaged in exhibits is a phenomenon known as visitor fatigue. Too much information at once can be overwhelming and lead to a sense of mental exhaustion. It can also lead to a decrease in interaction and engagement among visitors. To ensure visitors enjoy their experience, museums tailor the experience to specific audiences, address different learning styles, use different types of media, provide specific interest tours, and prioritize accessibility. However, this isn't always successful, as some visitors slowly gain a sense of fatigue as they continue to walk through the exhibits. Bitgood (2009) analyzed the effect

of fatigue on visitor experience and found that it negatively impacted a visitor's interest in an exhibit. The fatigue that visitors experience may encourage them to step away from the museum and not explore the rest of the exhibits, which could take away from their experience. Bitgood (2009) concluded that there isn't enough research on fatigue and that everyone experiences fatigue in a different way. This study shows that collecting data from visitors about their own fatigue can sometimes be useful when trying to understand the cause of guests' fatigue and aid in refining exhibits. These refinements can increase visitor engagement.

### **Low-Cost Data Collection Methods**

Interviews are one of the most commonly-used data collection methods in museums because they are both easy to conduct and versatile. For example, a 2013 study explored how art museums can be more appealing to teenagers and utilized interviews to collect data (Striepe, 2013). One strength of interviews is that you get information directly from the interviewee, which contrasts with observations, where visitor information is collected indirectly. When museum visitors are given a chance to voice their opinions on certain areas that they may or may not find appealing, it gives the museum a chance to improve its exhibits and cater more to the interests of visitors. For example, Packer (2008) found that interviewing directly with guests was the best way to find what guests valued and liked the most about their experience within the museum. In the event that one exhibit is less engaging than another, a visitor's perspective can give context as to why they didn't go to see that exhibit and also show what caught their attention in the museum. These details can be analyzed and applied to the less visited areas to improve upon the exhibit.

One way to gauge wayfinding effectiveness and the popularity of exhibits is through traffic analysis. For example, Nubani et al. (2018) analyzed the movement patterns of guests within the Broad Museum. The amount of time spent within exhibits, the visitor's engagement with the exhibits, and their point of exit were all recorded. The study analyzed the effect of exhibit positioning on visitation to that exhibit. Exhibit positioning includes both the position of an exhibit within an exhibition and the position of that exhibition within the museum. The research team concluded that the visibility and ease of access for each exhibit were "two

variables... important in guiding visitors through the spaces and, more importantly, in visiting certain exhibits while skipping others,” (Nubani et al., 2018). They found that when an exhibit was integrated better with the rest of the museum, the exhibit was 1.15 to 1.7 times more likely to be visited than other exhibits. Both the ease of access and the visibility of an exhibit can be improved using effective wayfinding techniques.

### **Visitor Lack of Time**

A visitor’s perspective and their experience can be shaped by the amount of time they have. This is especially true for visitors who are also tourists. As tourists, they may be on a tight schedule given to them by a travel agency or may have an itinerary of their own. A study on tourist movement in Hong Kong found that tourists are likely to rush from destination to destination if they have limited time (Lau & McKercher, 2006). This can cause tourists to visit many primary destinations and few secondary destinations. Primary destinations are generally well-known and considered a landmark of the region the visitor is in, while secondary destinations are considered interesting but not essential. A visitor’s rush to leave generally has a negative impact on their experiences. If they are in a rush, visitors may not engage with the content of each attraction as much as they normally would, and they may skip certain exhibitions. This could come into play at Tower Bridge. Many of the visitors at Tower Bridge may be tourists who are in a rush due to a tight schedule. This could lead to visitors exiting prematurely and skipping the Engine Room.

### **Audience Segmentation and Demographics**

When trying to understand the target audience of a museum and how to increase visitation and engagement, demographic data can be useful. Finding and analyzing data pertaining to the identity of a visitor could help find common types of visitors and how they experience the exhibits. Mokatren (2019) and other researchers investigated quantitative factors such as age, education level, the number of times the visitor had gone to museums within the last year, and how much time visitors spent listening to/reading explanations about exhibits. They concluded that identifying the main type of visitors coming to a museum can greatly aid the

improvement of exhibits and how visitors engage with them. It is important for museums to know their main demographic, as they can understand their main audience and adjust their exhibits and content accordingly. Visitation numbers to each exhibit can increase if exhibits are refined to cater towards their target audience, especially if guests engage with the exhibits enough to visit the rest of the museum.

### **Hypotheses for Low Visitation to the Engine Room**

Visitors could choose to skip the Engine Room for a variety of reasons. One of these reasons could be wayfinding issues or a lack of narrative. Tower Bridge's current methods of helping visitors navigate the exhibits include signage, a painted blue line and series of plaques leading to the Engine Room, and staff instructing them to follow the blue line. However, these methods may not be effective for helping all visitors. For example, if a visitor is not proficient in English they may get lost. Additionally, signage is used for both wayfinding and storytelling, which can have some potential drawbacks. Using signage for both of these purposes may lead to a more cluttered visual space that can be confusing. It is also possible that the Tower Bridge experience lacks a cohesive overall narrative. However, it should be noted that these reasons were taken into consideration during their alterations, and the Engine Room is now referenced in other exhibits. Additionally, Tower Bridge recently implemented a Smartify mobile tour that visitors can use on their phones. Smartify is an app that visitors can use to scan exhibits, or look them up, and access information about them.

# Methods

The goal of this project was to identify factors that affect the percentage of visitors who visit the Tower Bridge Engine Room and test implementations that could increase that percentage. Below are our project objectives that helped us achieve this goal:

1. Understand visitor behavior and conduct semi-structured staff interviews at Tower Bridge.
2. Identify and test implementations to increase the Engine Room visitor percentage.
3. Analyze historical Engine Room visitation to identify variables that may affect visitation.

In the following sections, we explain why these methods were used, what they helped us achieve, and their limitations. We also cover the steps taken that led us to the finalized weekly testing cycle.

## Initial Observations and Interviews

We observed visitors and conducted staff interviews to understand visitor behavior at Tower Bridge. We observed approximately 500 visitors leaving the South Tower Exit in order to see where visitors left early from, and if possible, ask them why they were leaving early. We were also able to note down what points visitors would exit from. We conversed with visitors in the Entrance Queue in order to learn what visitors expected to see. In the Engine Room, we asked visitors whether they enjoyed the Engine Room and if they had any problems finding it.

In addition, we conducted light, casual interviews with Tower Bridge Staff to explore the visitation issue in the Engine Room. Since the staff members interact with visitors every day, they were familiar with common visitor behaviors. At the end of the interview, we asked each participant if they had any suggestions for what Tower Bridge could do to address the Engine Room visitation issue. We asked staff the following questions:

1. What do you think is the biggest cause of the decline in visitation to the Engine Room?
2. How long have you worked at Tower Bridge?
3. During your time here, what efforts have you seen by the staff to combat the visitation issue?
4. What do you suggest as a solution?

## **Implementations**

After our observations of visitor behavior and interviews with Tower Bridge staff, we developed the following weekly implementation plans with our host liaison Dirk Bennett. The implementations required little to no budget and caused no disturbance to visitor traffic at Tower Bridge. The plans for each week were as follows:

1. Emphasize the Engine Room to visitors in the Entrance Queue using leaflets and verbal communication
2. A combination of Entrance Queue leaflets, verbal communication in the Entrance Queue and a short speech given in the North Tower lift which emphasizes going to the Engine Room
3. A combination of a short speech on the North Tower lift and directing visitors towards the Engine Room by standing next to the stairway along the blue line

We wanted to see if each implementation resulted in a higher percentage of visitation to the Engine Room. To gauge the effectiveness of each implementation, we compared the percentage each week to the average Engine Room visitor percentage over the five months prior to the implementations. The control data was collected prior to the start of the project.

## **Mentioning the Engine Room in the Entrance Queue**

We hypothesized that by informing visitors about the Engine Room at the beginning of their visit, visitors would be more likely to visit the Engine Room. Our first implementation involved the promotion of the Engine Room at the Entrance Queue to the bridge. Visitors were handed a leaflet by one of our team members or a member of staff before they entered the queue. The Engine Room was physically pointed out on the leaflet, and we verbally emphasized that visitors should make sure to visit the Engine Room. This implementation was conducted from 6 June 2023 - 11 June 2023. The leaflet provided by Tower Bridge can be seen in Figure 3.



**Figure 3: Tower Bridge Leaflet**

### Verbal Engine Room Promotions in the North Tower Lift

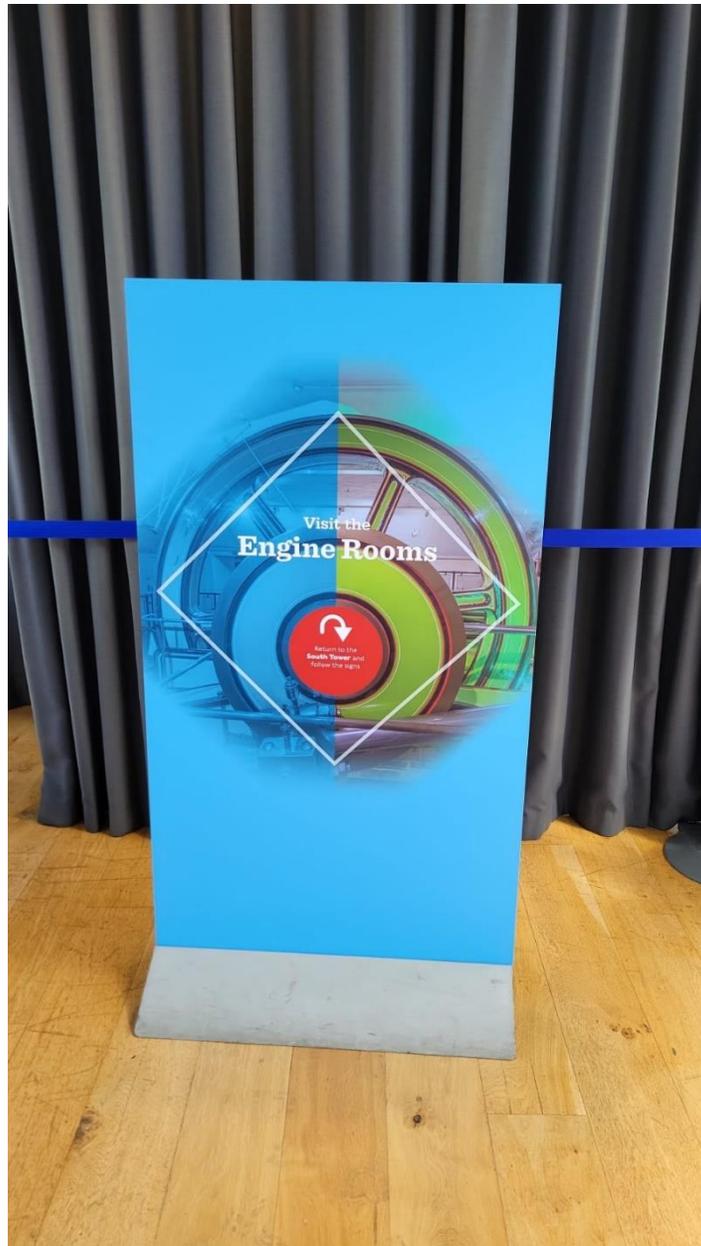
We hypothesized that visitors would be more likely to visit if they were given a more detailed explanation of the Engine Room and instructions on how to navigate there. To test this, our team gave 50-second speeches in the North Tower Lift in addition to another team member distributing leaflets and verbally promoting the Engine Rooms in the Entrance Queue. Visitors would enter the lift, and a team member would deliver a short speech to visitors, which included short descriptions of each exhibit and instructions on how to navigate the bridge. The Engine Room (and the blue line leading to it) was emphasized at the end of the speech. The speeches, provided by the Tower Bridge staff, followed the format labeled in Appendix A. This implementation was conducted from 13 June 2023 - 18 June 2023.

## **Lift Speech and Verbal Promotion at the Stairwell Along the Blue Line**

We hypothesized that visitors would be more likely to visit if they were encouraged to go to the Engine Room at the stairwell along the blue line, as we observed that many visitors tended to leave from that point. To test this hypothesis, our team gave the same lift speech from the previous method, alongside verbally promoting the Engine Room down by the stairwell leading to the Engine Room. A team member would often call out for visitors with tickets to follow the blue line to the Engine Room. This implementation was conducted from 20 June 2023 to 23 June 2023.

## **Additional Analysis**

Our team did an additional analysis of the West Walkway, which was renovated on 19 May 2023, during our time at the bridge. This renovation made the exhibits more interactive and contained additional promotion of the Engine Room as shown by Figure 4 below:



**Figure 4: Additional Promotion of the Engine Room within the West Walkway**

We hypothesized that the changes (such as Figure 4) could remind more visitors to visit the Engine Room before they leave. We conducted data analysis for the renovated West walkway, measuring its effect on the percentage of visitors who attended the Engine Room. New data was taken over the week following the renovations and compared to the visitation data from earlier that year.

## **Data Analysis**

We conducted a statistical analysis on prior visitor data obtained from 1 January 2023 to 31 May 2023. We were given daily statistics that consisted of total visitor numbers, Engine Room visitor numbers, and percentages of different types of visitor bookings (On-line ticket purchase, walk-up ticket purchase, and visitors who used a London Pass). We were also provided the total number of visitors in a group visit on a given day, but we were only provided this data for the month of April 2023. From the data, we could also calculate the percent of the total visitors who visit the Engine room on a given day, the percent of total visitors with the London Pass, and the percent of total visitors in a group visit. With this data, we conducted Pearson product-moment correlation tests to analyze the effect each variable had on the Engine Room percentage (Kumar, 2021; Nickolas, 2021). This analysis was conducted using JASP (Introduction to Jasp, 2023). We focused on finding variable(s) that were correlated to the percentage of visitors who visited the Engine Room. We also analyzed the effect of precipitation on the percentage of visitors who visited the Engine Room. To do this, we grouped each day into one of two groups— days with precipitation, and days without precipitation. With this data, we conducted an independent sample T-test in JASP to find if there was any notable difference in Engine Room percentage between the two groups (Draws, 2018). Our theory was that certain variables (such as precipitation or crowdedness) might dissuade visitors from visiting the Engine Room.

January 5th was excluded from this data set, as the Bridge had an unusually low number of total visitors in a day and had a disproportionately large percentage of visitors who went to the Engine Room. Additionally, we were missing the statistics for five other days<sup>1</sup>, so those days were excluded as well.

## **Limitations**

Our methods were subject to limitations based on language and Tower Bridge stakeholders. The Tower Bridge welcomes visitors from across the globe every year, a sizable portion of whom are not proficient in English. This meant that our implementations— which relied on visitors knowing English—were ineffective for a large portion of visitors. Tower Bridge

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<sup>1</sup> The five incomplete dates were: 5 March 2023, 12 March 2023, 5 April 2023, 14 April 2023, 1 May 2023

is owned by multiple stakeholders, meaning we could not immediately implement any modifications to the bridge without the full approval of every relevant group. Therefore, we avoided any implementations that used additional resources, be that operational expenditures or required special permissions. There were limitations on the execution of our methods as well. Our group was only able to conduct our first two implementations for five days a week (Tuesday-Friday and Sunday), and the last week was only conducted Tuesday-Friday. During the weeks of implementation containing the lift speech, the effectiveness was limited by the number of visitors that took the lift. In general, most visitors opted to take the stairs, so our team only interacted with a limited percentage of visitors. When attempting to converse with visitors while handing them the leaflets, some visitors would not stop for us to give an explanation of the Engine Room. They may not have known what we were saying or were rushing to make it to their time slot. Also, some visitors were not interested in taking the leaflet.

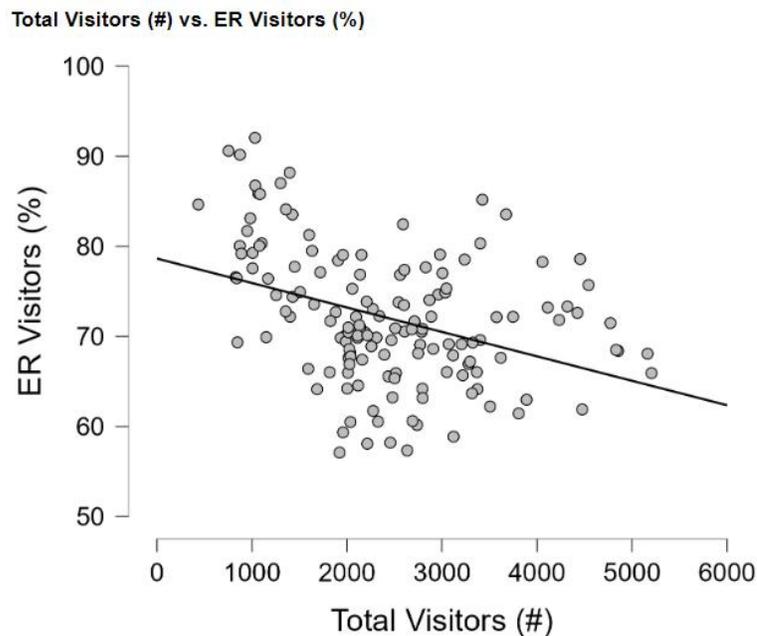
# Findings

## Introduction

It was found that crowdedness was the biggest statistical predictor of the Engine Room percentage. Time of year, on-line percentage, and walk-up percentage also showed a correlation with Engine Room percentage. However, that may be due to those values being connected to crowdedness. London Pass percentage, visitor group percentage, and precipitation were found to have no effect on the Engine Room percentage. We found that wayfinding and visitor awareness of the Engine Room were not the main issues behind the visitation issue, contrary to what we initially believed. Language barriers were unaddressed by our implementations and remain a possible cause of this issue.

## Crowdedness

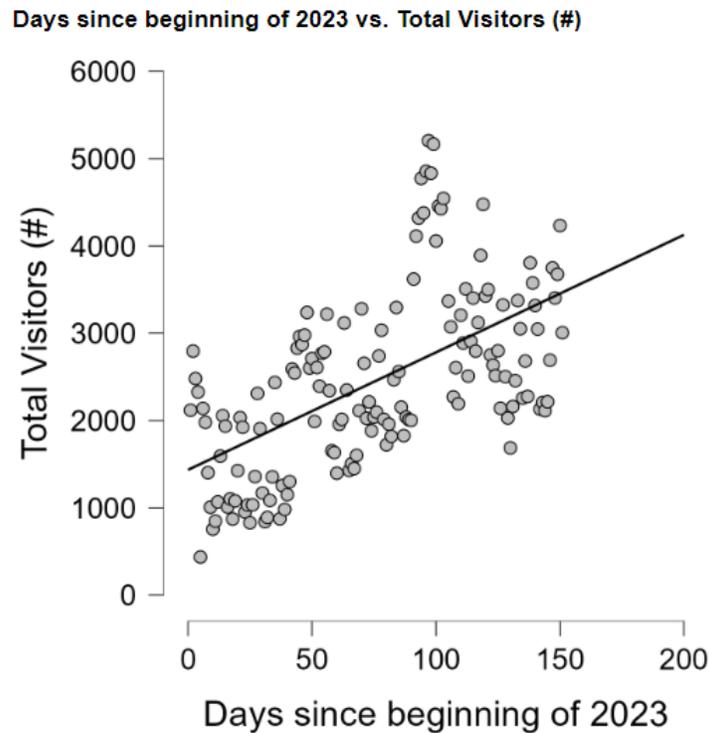
The total visitor number was the biggest predictor of the Engine Room percentage. The total visitor number had the strongest correlation with the Engine Room percentage out of all the variables we analyzed. We found that the two have a negative correlation,  $r(146) = -0.376$ ,  $p < .001$ . A scatter plot comparing the two statistics is shown in Figure 5.



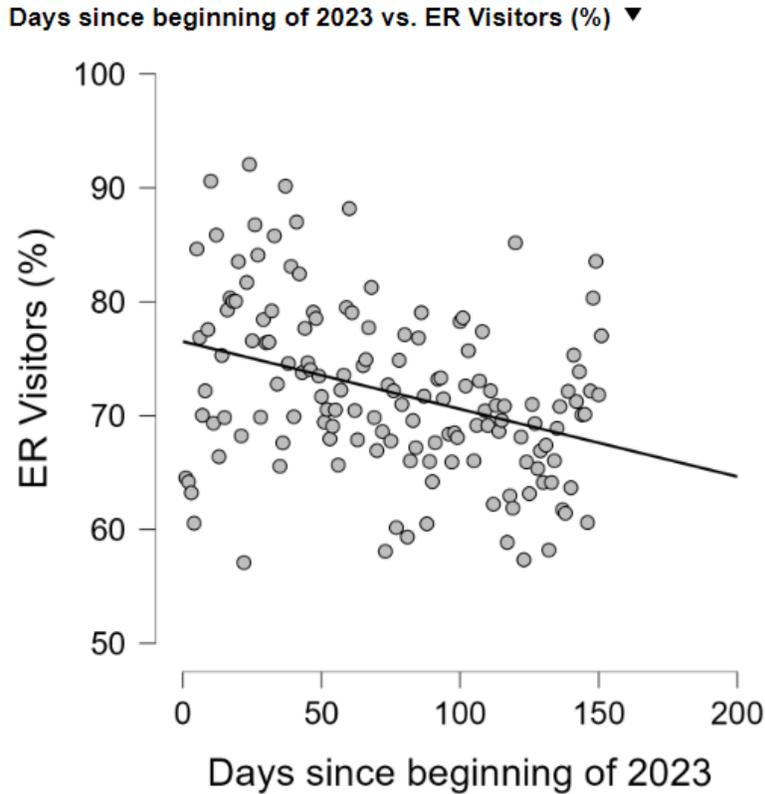
**Figure 5: Scatter plot comparing the total number of visitors to the Engine Room percentage. Line of best fit included.**

### **Time of Year**

The time of year has a notable correlation with the total number of visitors. As the year progressed from January to May, the total number of visitors tended to increase,  $r(150) = 0.574$ ,  $p < .001$  (see Figure 6) while Engine Room percentage tended to decrease,  $p(146) = -0.355$ ,  $p < .001$  (see Figure 7). The decrease in the Engine Room percentage as the year progresses may be due to the overlap with the total visitation numbers increasing.



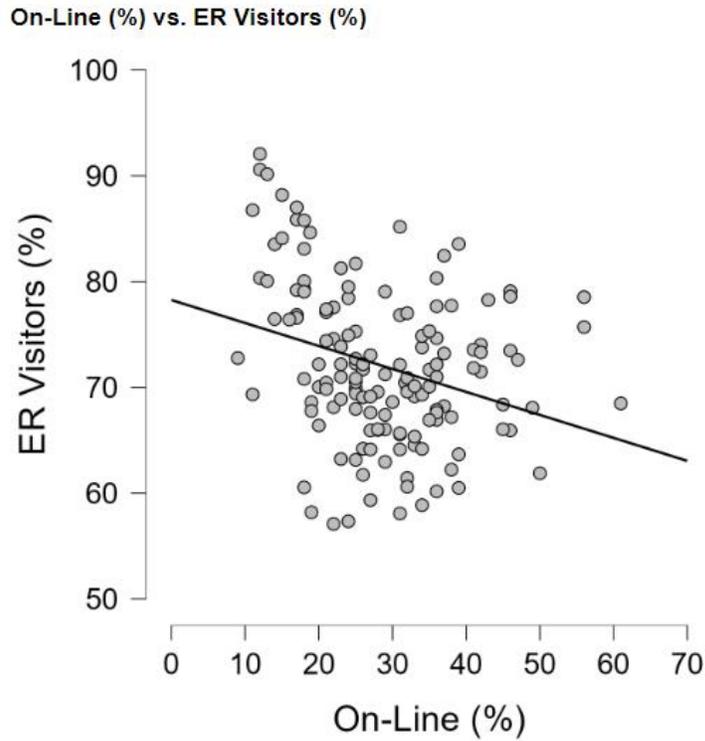
**Figure 6: Scatter plot comparing the days since beginning of 2023 to the total number of visitors. Line of best fit included.**



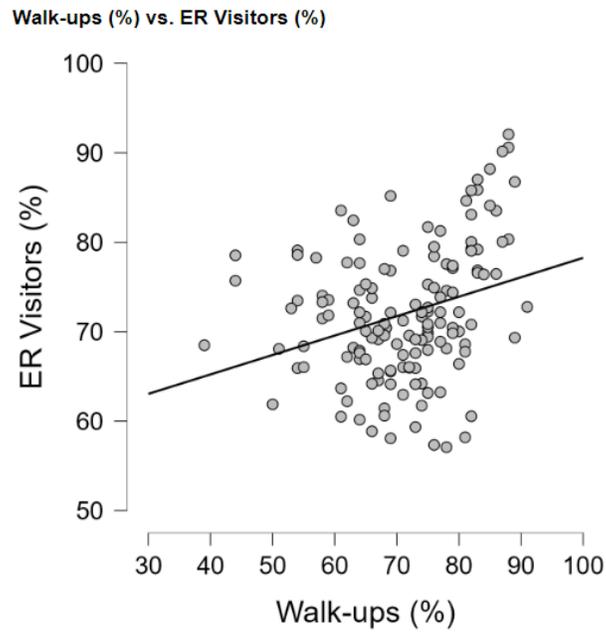
**Figure 7: Scatter plot comparing the days since beginning of 2023 to the Engine Room percentage. Line of best fit included.**

### **On-Line/Walk-up Percentages**

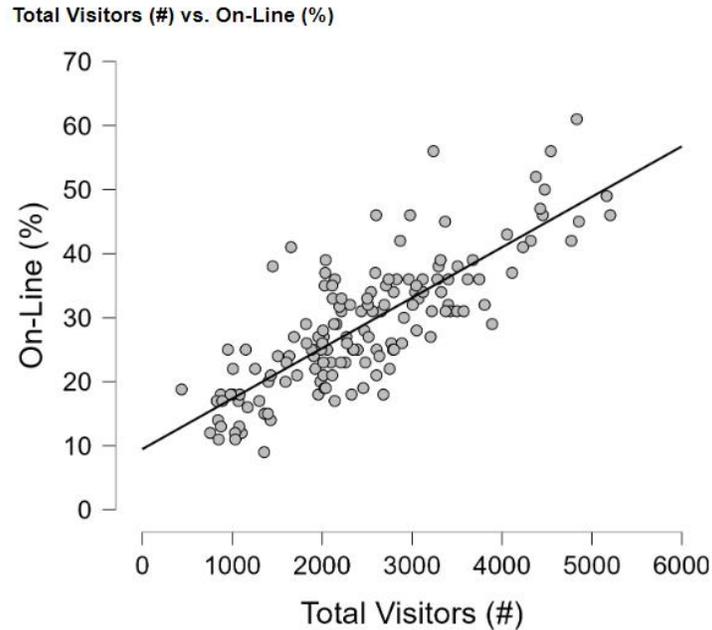
The next strongest correlation for Engine Room percentage is the on-line percentage,  $r(146) = -0.295$ ,  $p < .001$  (see Figure 8). Conversely, the Engine Room percentage had a positive correlation from the walk-up percentage,  $r(146) = 0.295$ ,  $p < .001$  (see Figure 9). This was due to the fact that the on-line and walk-up percentages are directly inversely related. While there was a correlation found between the Engine Room visitor percentage and the on-line/walk-up percentages, this also may have been influenced by crowdedness. As the total number of visitors increased, the percentage of on-line visitors increased,  $r(150) = 0.801$ ,  $p < .001$  (see Figure 10). This meant that the observed trend of an increase in on-line visitors causing a decline in visitation to the Engine Room may be due to the total visitation numbers increasing as the online percentage increases.



**Figure 8: Scatter plot comparing the percentage of on-line visitors to the Engine Room percentage. Line of best fit included.**



**Figure 9: Scatter plot comparing the percentage of walk-up visitors to the Engine Room percentage. Line of best fit included.**



**Figure 10: Scatter plot comparing the total number of visitors to the percentage of on-line visitors. Line of best fit included.**

### **London Pass and Pre-Booked Group Visits**

We found that the percentage of visitors who used a London Pass had no correlation with the Engine Room percentage,  $r(145) = 0.00$ ,  $p = 0.993$ . We also found that there was no relationship between the Engine Room percentage and the percentage of visitors in a group,  $r(28) = -0.121$ ,  $p = 0.540$ . However, it should be noted that the data for the percentage of visitors in a group was limited to only one month, resulting in 28 data points (see Table 1).

Pearson's Correlations

		n	Pearson's r	p
ER Visitors (%)	- Total Visitors (#)	146	-0.376***	< .001
ER Visitors (%)	- Days since beginning of 2023	146	-0.355***	< .001
ER Visitors (%)	- On-Line (%)	146	-0.295***	< .001
ER Visitors (%)	- Walk-ups (%)	146	0.295***	< .001
ER Visitors (%)	- LP Visitors (%)	145	$-7.041 \times 10^{-4}$	0.993
ER Visitors (%)	- Visitors in VG (%)	28	-0.121	0.540
Total Visitors (#)	- Days since beginning of 2023	150	0.574***	< .001
Total Visitors (#)	- On-Line (%)	150	0.801***	< .001
Total Visitors (#)	- Walk-ups (%)	150	-0.801***	< .001
Total Visitors (#)	- LP Visitors (%)	149	0.064	0.439
Total Visitors (#)	- Visitors in VG (%)	29	-0.453*	0.014
Days since beginning of 2023	- On-Line (%)	150	0.427***	< .001
Days since beginning of 2023	- Walk-ups (%)	150	-0.427***	< .001
Days since beginning of 2023	- LP Visitors (%)	149	0.412***	< .001
Days since beginning of 2023	- Visitors in VG (%)	29	0.351	0.062
On-Line (%)	- Walk-ups (%)	150	-1.000***	< .001
On-Line (%)	- LP Visitors (%)	149	-0.170*	0.038
On-Line (%)	- Visitors in VG (%)	29	-0.562**	0.002
Walk-ups (%)	- LP Visitors (%)	149	0.170*	0.038
Walk-ups (%)	- Visitors in VG (%)	29	0.562**	0.002
LP Visitors (%)	- Visitors in VG (%)	29	0.110	0.571

\* p < .05, \*\* p < .01, \*\*\* p < .001

**Table 1: Data showing the *n* sample size, *r* Pearson's correlation coefficient, and *p* probability between every set of numerical data**

## Precipitation

We found that precipitation had no impact on the percentage of visitors who go to the Engine Room. From preliminary data screening, we found that both groups met the assumptions of normality within a Shapiro-Wilks test ( $p > 0.07$ ). Levene's test was found to not be significant ( $F = 0.118$ ,  $p = 0.732$ ), meaning our data met the assumption of homogeneity of variance. The two groups did not differ significantly,  $t(146) = 0.45$ ,  $p = 0.655$ , 95% CI [-2.53, 3.98],  $d = 0.098$ . The mean for the days with no precipitation ( $M = 72.183$ ,  $SD = 7.243$ ) was not significantly different from the days with notable precipitation ( $M = 71.455$ ,  $SD = 8.035$ ). This data does not support the notion that there is a difference between the percentages of visitors who visit the Engine Room on a day with precipitation and a day without precipitation.

## Wayfinding/Lack of Awareness

Increasing visitor awareness of the Engine Room and providing additional wayfinding resources had no effect on the Engine Room percentage.

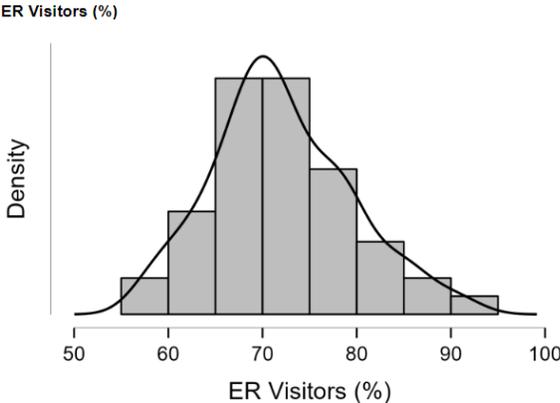
From our observations and interviews, our group theorized that wayfinding and visitor awareness of the Engine Room were two of the most likely causes of the Engine Room visitation issue. Staff members recommended adding more signage about the Engine Room to help visitors navigate. Many visitors seemed to disregard other wayfinding resources in place such as the blue line. Additionally, when asked why they were skipping the Engine Room, some visitors replied that they did not know it existed. Our implementations were then created as low-cost efforts to address these hypotheses.

To test if the weekly implementations had any effect, we compared the average Engine Room percentage over the past five months to the Engine Room percentage each week. The density distribution of our data for Engine Room percentage from January 1st, 2023 to May 31st, 2023 (see Figure 11). It was found that the mean percentage was 72.0% and the standard deviation was +/- 7.390%.

Descriptive Statistics

ER Visitors (%)	
Valid	146
Missing	5
Mean	72.033
Std. Deviation	7.390
IQR	9.516
Range	34.956
Minimum	57.098
Maximum	92.054

Distribution Plots



**Figure 11: Table and graph showing the distribution of the Engine Room visitor percentage**

**Entrance Queue Leaflets**

Our first implementation encouraged Engine Room visitation through leaflets and verbal promotion at the Entrance Queue. The average Engine Room visitor percentage over the five

months prior to the implementations was 72.0%. Throughout the week of our implementation, the average Engine Room visitor percentage was 71.4%. There was a lack of improvement with there being a -0.6% difference (see Appendix B). We can conclude that our implementation had no effect on the Engine Room percentage.

### **Entrance Queue Leaflets & North Tower Lift Speech**

Our second implementation encouraged Engine Room visitation through Entrance Queue leaflets and a speech delivered to visitors in the North Tower lift. The average Engine Room visitor percentage in the five months prior to our implementations was 72.0%. Throughout the week of our implementation, the average Engine Room visitor percentage was 71.3% (see Appendix B). There was a lack of improvement with there being a -0.7% change. We can conclude that our implementation had no effect on the Engine Room percentage.

### **North Tower Lift Speech & verbal promotion at the Engine Room stairwell**

Our third implementation encouraged Engine Room visitation through a speech delivered to visitors in the North Tower lift and verbal promotion/directions given by a team member located at the stairwell near the Engine Room. The average Engine Room visitor percentage over the five months prior to the implementations was 72.0%. Throughout the week of our implementation, the average Engine Room visitor percentage was 73.7% (see Appendix B). There was a lack of improvement with there being a +1.7% change. We concluded that our implementation had little to no effect on the Engine Room percentage.

### **Additional Analysis - West Walkway Renovations**

Tower Bridge conducted renovations to their West Walkway, starting on May 19th and completing on May 23rd, adding additional signage and infographics to the walkway. The week directly after the completion of the renovations had an average Engine Room visitor percentage of 72.7%. Compared to the yearly Engine Room percentage of 72.0%, there was little to no improvement, with the percentage only increasing by +0.7% (see Appendix B). We can conclude that the West Walkway renovations had little to no effect on the Engine Room percentage.

Our implementations' lack of success suggests that wayfinding and a lack of awareness are not the leading causes behind the low Engine Room visitor percentage. However it is also

possible that these implementations were limited by our resources and time. For example, we were unable to implement additional signage in other languages because we would have needed to acquire special permissions from the owners of the bridge to do so.

### **Language Barrier**

We are unable to confirm or deny language barriers' effect on the Engine Room percentage. Based on our observations, we hypothesized that many visitors and groups were not proficient in English. From interviews with staff, we confirmed that many visitors do not pay attention to verbal directions, usually due to a language barrier. This makes sense given that a large portion of visitors to Tower Bridge are not from the UK (Bennett 2023). This means that both our implementations and Tower Bridge's current resources— which rely on visitors knowing English—were ineffective for a large portion of visitors. Unlike wayfinding and visitor awareness, we were unable to test this hypothesis with an implementation. Therefore, language barriers may still be a key factor in the Engine Room visitation issue.

# Conclusion

For almost a decade, Tower Bridge has noticed that approximately 20-40% of Tower Bridge museum visitors leave before visiting the Engine Room. The goal of this project was to identify variables that affect the percentage of visitors who visit the Tower Bridge Engine Room and to test implementations that could increase that percentage. In this final chapter, we outline some key recommendations from our research that could improve the percentage of visitors who go to the Tower Bridge Engine Room. We determined two key areas that Tower Bridge management should focus on: language barriers and gathering specific visitor data.

## Recommendations

### *Language Barriers*

All of our implementations relied on communication in English. However, many Tower Bridge visitors are tourists who may not be proficient with English. If a visitor did not understand what we were saying, our implementations would have no effect and they would remain unaware of the Engine Room and would not be able to utilize any written or verbal wayfinding resources. The language barrier was an unavoidable limitation of our project.

Since Smartify has now been implemented on the bridge, we recommend that Tower Bridge adds Smartify tours in other languages. By discussing the Engine Room in a visitor's first language, visitors who are not proficient in English will hear about the Engine Room and might choose to explore it before the end of their visit. To do this, Tower Bridge could hire translators to write and record the current script in other languages. They could also have their current staff, who are proficient in other languages, record new audio clips as well. Visitors would benefit from this recommendation because they would be able to consume content within Tower Bridge in a language they understand. We believe this would be the best option as Tower Bridge has already implemented Smartify as a larger part of the experience and helps visitors download it while in the Entrance Queue through QR codes.

Alternatively, Tower Bridge could update some of its other resources as well. This would include updating the signage and leaflets to be in other languages. However, this solution comes with more downsides. It is impossible to account for many languages with these measures, while Smartify tours can be implemented in as many languages as Tower Bridge desires. Additionally,

adding more signage in a variety of different languages could lead to visually cluttered spaces and confuse visitors.

In addition to this, we recommend Tower Bridge surveys visitors within the Entrance Queue to gauge their proficiency with English and ask what language(s) they speak. Tower Bridge would benefit from this recommendation as they would generate a list of some of the most common languages used by visitors, which can be used to improve Smartify, signage and leaflets.

### *Crowdedness & Total Visitation*

Through data analysis, we found that days with a high number of visitors usually had a low Engine Room percentage. To reduce large crowds of visitors in the Engine Room, Tower Bridge could consider starting some visitors at the Engine Room. A staff member would collect around 20 people at a time from the Entrance Queue and bring them straight to the Engine Room to start their experience. This could be effective on busy days as it would limit the size of the queues. However, towards the middle of the day, some visitors would be simultaneously starting and finishing their visit in the Engine Room, so this recommendation may only be effective towards the beginning or end of the day. This also means that visitors would traverse in both directions on the walkways, which could cause even more congestion.

### *Further Analysis*

We recommend that Tower Bridge hires an analytics consultant to further research correlations between Engine Room visitor percentages and visitor data. A professional could give Tower Bridge more detailed analyses and more accurate evaluations of implementations' success. For example, our implementations were deemed unsuccessful because the Engine Room percentage stayed near the yearly average. However, our data analysis found the number of total visitors during each week of our implementations was above average. Despite the negative correlation between number of people and the Engine Room percentage, our implementations were able to maintain the average Engine Room percentage. This may indicate that our implementations were actually successful. An experienced statistician may be able to create an expected percentage metric that could be used to accurately evaluate new implementations and exhibits. For this reason, we recommend Tower Bridge hires an analytics consultant.

Our study was meant to identify areas of improvement for Tower Bridge that may help increase the Engine Room visitor percentage in the future. If visitation to the Engine Room increases, visitors will get the full value of their ticket, while Tower Bridge will see more footfall in the Gift Shop.

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# Appendices

## Appendix A: TB North Tower Lift Document

### 2.4.02 North Lift Procedure

**The Lift speech** should be consistently delivered to all visitors going up via the lift.

- It should last no more than 50 seconds
- Staff should use the map on display in the lift when referring to specific stages to ensure visitors understand the lay out of the visit
- While the exact text of the speech is not prescribed and **staff are encouraged to ad lib**, the following is the information that visitors should be given:

- **Good morning/afternoon** ladies and gentlemen. **My name** is...
- Going up **110 feet or 33.5 metres above road level**
- This is a **self-guided** tour
- There are **five stages** to the visit:

**Stage 1:** North Tower level 4 - film of circa 1900s London lasting 3 m 30 s, including the first filmed Bridge lift known

**Stage 2:** The Walkways

- 2 different views of London East & West
- 2 glass floors
- 1 mirror overhead in the West

**Stage 3:** South Tower:

- this is about the Bridge NOW – its maintenance and the attraction. It includes a 3min film about the daily operation of the Bridge
- toilets facilities on level 2

**Stage 4:** ground level – follow the blue line to find the original Victorian ER entrance.

**Stage 5:** the original Victorian Engine Rooms and Gift Shop

- **Keep your ticket** to show at the Engine Rooms
- **Take as much time** and **as many photographs** as you wish
- **Feel free to touch** the metallic structure, the rivets and open the windows on the WW
- **Any questions:** please just ask one of my colleagues wearing blue.

As per **End of Day Procedure**, from 16.00, staff positioned in the lift must inform visitor of the closing time and that last admission to the Engine Rooms is 17:30.

**Appendix B: Weekly Visitor Data**

Table 2: Data for the week of the first implementation, where we distributed leaflets and verbal promotion of the Engine Room while near the entrance to the bridge. Note that Saturday the 10th is not included in the average.

<b>06/06/23 - 11/06/23: First Implementation</b>					
Day of the Month	Total Visitors	On-Line (%)	Walk-ups (%)	ER visitors (#)	ER visitors (%)
6	2,883	29	71	2,177	75.51161984
7	2,752	26	74	1,701	61.80959302
8	3,132	32	68	2,057	65.67688378
9	3,139	29	71	2,327	74.13188914
10	3,540	41	59	2,239	63.24858757
11	2,594	23	77	2,073	79.9151889

Table 3: Data for the week of the second implementation, where we distributed leaflets, verbally promoted the Engine Room, and gave lift speeches. Note that Saturday the 17th is not included in the average.

<b>13/06/23 - 18/06/23: Second Implementation</b>					
Day of the Month	Total Visitors	On-Line (%)	Walk-ups (%)	ER visitors (#)	ER visitors (%)
13	2,661	34	66	1,790	67.26794438
14	2,108	27	73	1,682	79.79127135
15	2,536	32	68	1,473	58.08359621
16	2,859	31	69	2,219	77.61455054
17	2,728	38	62	1,891	69.31818182
18	3,019	32	68	2,219	73.50115932

Table 4: Data for the week of the second implementation, where we gave lift speeches and verbally promoted the Engine Room along the blue line stairs.

20/06/23 - 23/06/23: Third Implementation					
Day of the Month	Total Visitors	On-Line (%)	Walk-ups (%)	ER visitors (#)	ER visitors (%)
20	2,374	27	73	1,700	71.60909857
21	2,573	29	71	1,898	73.76603187
22	2,823	34	66	1,957	69.32341481

Table 5: Data for the week following West Walkway renovations.

24/05/23 - 30/05/23: Post-West Walkway Renovations					
Day of the Month	Total Visitors	On-Line (%)	Walk-ups (%)	ER visitors (#)	ER visitors (%)
24	2,112	35	65	1,480	70.07575758
25	2,215	33	67	1,553	70.11286682
26	2,691	32	68	1,631	60.60943887
27	3,748	36	64	2,705	72.17182497
28	3,404	36	64	2,734	80.3172738
29	3,676	39	61	3,071	83.54189336
30	4,234	41	59	3,041	71.82333491

Appendix C: Table of Authorship

# Authorship

Title	Author	Editor
Abstract	James, Jean-Luc	Maxwell, Jean-Luc, James
Executive Summary	Maxwell, Krish	Maxwell, Krish, Jean-Luc, James
Introduction	Krish, Jean-Luc	Maxwell, James, Krish, Jean-Luc
History of Tower Bridge	Krish	James, Krish, Maxwell
Recent Changes to Tower Bridge	James	James, Jean-Luc, Krish, Maxwell
Visitor Engagement	James, Maxwell	Maxwell, James, Jean-Luc, Krish
Wayfinding	James, Maxwell, Jean-Luc, Krish	Maxwell, James, Jean-Luc, Krish
Exhibition Narratives	James, Maxwell, Jean-Luc	Jean-Luc, Maxwell, James, Krish
Visitor Fatigue	James, Jean-Luc	Jean-Luc, Maxwell, James
Data Collection Methods	Krish, James	Jean-Luc, Maxwell, James, Krish
Visitor Perspective	Maxwell	Jean-Luc Maxwell, James
Audience Segmentation and Demographics	Maxwell	Maxwell, James, Krish
Initial Observations and Interviews	James, Krish	Krish, Maxwell, James, Jean-Luc
Implementations	Maxwell	Krish, Maxwell, James, Jean-Luc

Additional Analysis	Krish	Krish, Maxwell, James, Jean-Luc
Data Analysis	Jean-Luc, James	Maxwell, James, Jean-Luc
Limitations	Jean-Luc, Krish, James	Krish, Maxwell, James, Jean-Luc
Findings	Jean-Luc, James, Maxwell	Krish, Maxwell, James, Jean-Luc
Conclusions & Recommendations	Krish, James, Maxwell, Jean-Luc	Krish, Maxwell, James, Jean-Luc
References	Maxwell, Krish, Jean-Luc	N/A
Appendices, List of Tables, and List of Figures	Jean-Luc, Maxwell	N/A