Boats and Bottlenecks

Improving Mobility in Venice

An Interdisciplinary Qualifying Project submitted to the faculty of Worcester Polytechnic Institute in partial fulfillment of the requirements for the Degree of Bachelor of Science.

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Venice, Italy

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WPI

Authorship

This Interactive Quantifying Project consisted of many different parts and each team member contributed primarily to their own sections. Kelsey Brofford produced the Introduction and collaborated with Riley Larkins on the Public Transportation and Defining Congestion: Level of Service in Venice sections. Riley also wrote the abstract for this project. Alexandra Shea wrote the section on Measuring Pedestrian Traffic. Luis Rovayo produced the Executive Summary and wrote the sections on Pedestrian Infrastructure and Impediments to Mobility.

Abstract

Our project focused on the topics of public transportation, pedestrian infrastructure, and pedestrian congestion. As Venice has a very unique transportation infrastructure as a whole, our group adapted and re-purposed methods and tools that were developed for more conventional applications.

The public transportation system, while restricted to waterways, has many elements in common with other cities' metropolitan bus routes. To help unfamiliar users learn the ins and outs of the system, we adapted an informative mobile application developed by the Santa Fe project center for use in Venice.

Unlike public transportation, the pedestrian infrastructure in Venice is truly unique. With no cars or bicycles permitted in the historic city, the only way to move is by foot. As part of our project we studied various facets of the pedestrian network, such as dead ends and plateatici, and compiled a database of Venice's streets' histories.

With unique infrastructure comes unique difficulties. Congestion at bottlenecks is a common occurrence, which the bulk of our project worked to quantify. By adapting an industry standard approach to measuring congestion, we were able to collect and analyze data at bottlenecks, as well as predict future trends based on demographic reports.

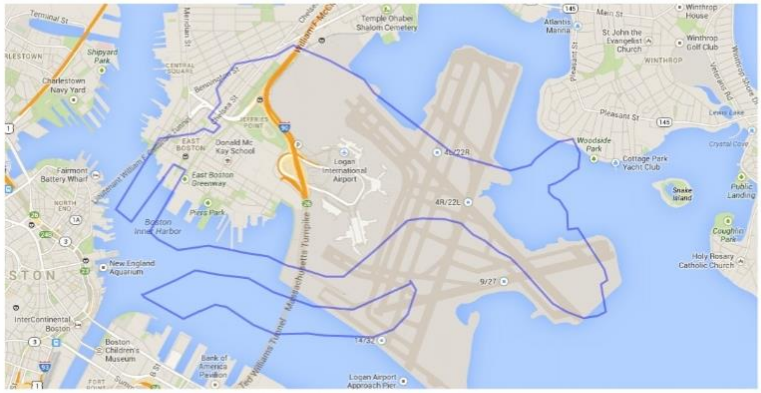
Executive Summary

Moving Around Venice

125 Islands

437 Bridges

Venice Size Comparison



6.3 km^2

Surface Area

Venice = Boston Airport

Street Network

2,650 Streets

1.07 km^2 Area

17% Of Total Surface Area

Total Length of Streets: **178** km

= 

BOSTON ATHLETIC ASSOCIATION
BOSTON MARATHON
2013

X4

Main Arteries

6 Major Arteries

Connect

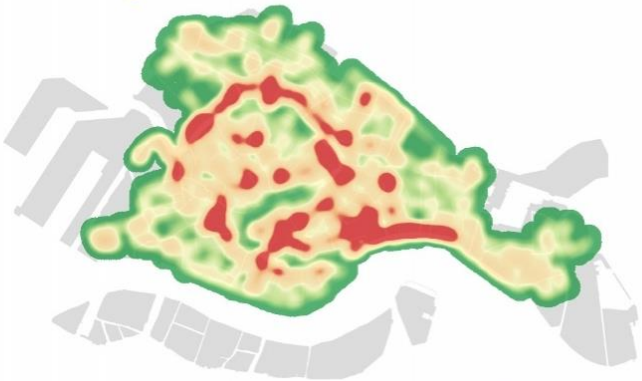
4 Points Of Interest

Surface Area: 720,000 m^2

= 67% Of total street area in Venice

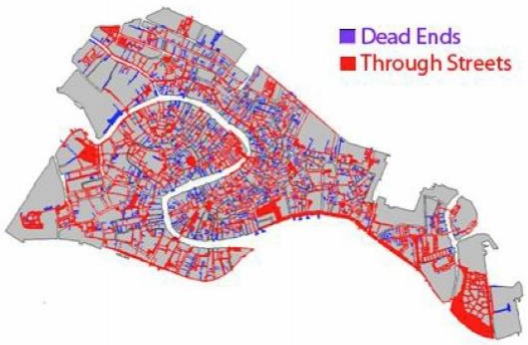
Pedestrian Traffic

Congestion



Impediments to Mobility

Dead Ends



Plateatici

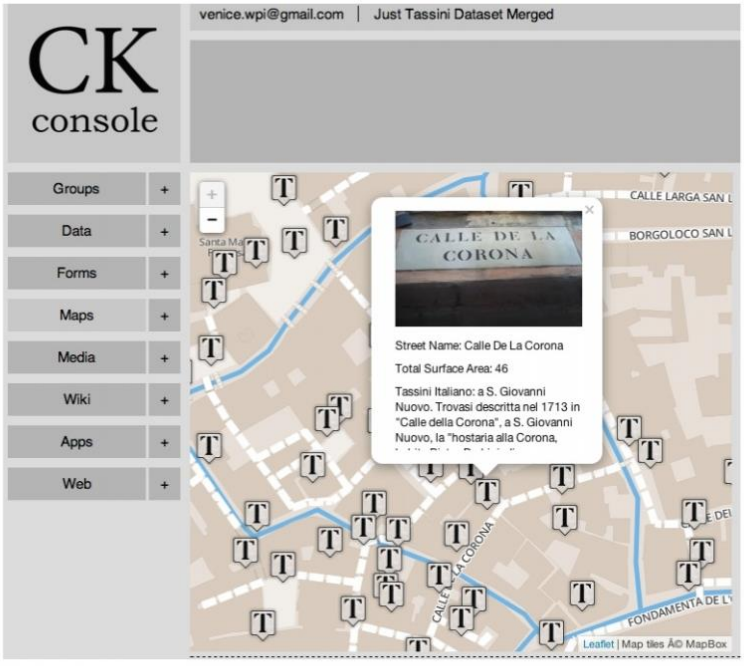
Etymology of Street Names

Street Database

Created online database of Guiseppe Tassini's book "Curiosita Veneziane"

1,448 Street Entries

Tassini Explorer



Database Contains:

- -Street Name
- -Street Surface
- -Italian Tassini Entry
- -Translated English Tassini Entry
- -Street Sign

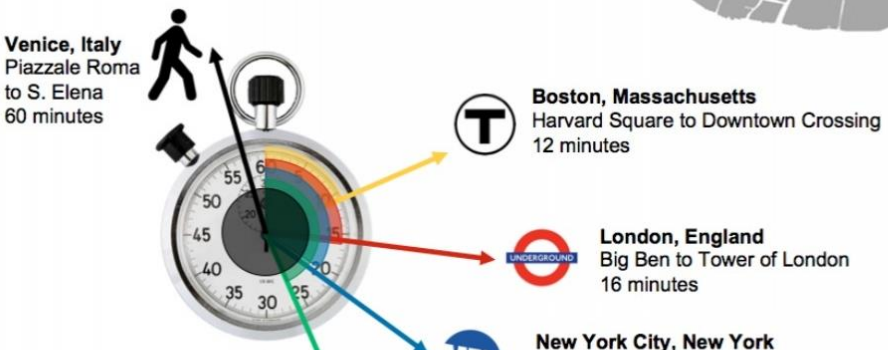
Public Transportation

ACTV

29 Lines

160 Boats

Traghetti



Boston, Massachusetts
Harvard Square to Downtown Crossing
12 minutes

London, England
Big Ben to Tower of London
16 minutes

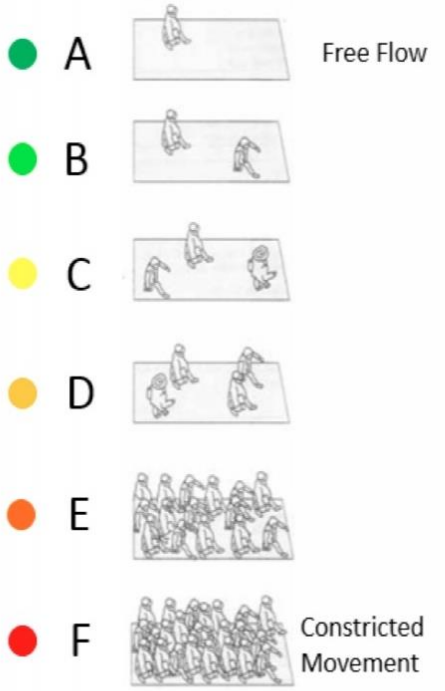
New York City, New York
Grand Central Station to Central Park
21 minutes

Distance Traveled:
4.8 km

Venice, Italy
Piazzale Roma to S. Elena
26 minutes

Congestion and Capacity

Levels of Service



Source: NYC Department of City Planning

mobility.veniceprojectcenter.org

LOS Application

-Calculates past LOS
-Predicts future LOS

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2 Introduction

A city's population density can have a large impact on its functionality. Population density is defined as the measurement of population per unit area. In most cases the population refers to the number of residence but this density can encompass all people in the area at any given time. A city's density can directly impact the area's transportation ability. Large numbers of people in small areas cause congestion problems, making it harder to move around. This mobility problem occurs in many cities around the globe and can be solved by expanding roads or sidewalks or by creating a public transportation system to facilitate mobility.

Venice has some of the worst congestion problems in the world. With small streets and canals, it is difficult for people to travel within the city. With an increase in tourists and commuters this problem gets increasingly worse every year. On average, tourists in Venice outnumber residents two to one. At peak there are 150,000 tourists per day, making it increasingly difficult for 60,000 residents to go about their daily lives. The average commute time across the city of Venice is nearly equal to that of the average American despite the fact that Venetians commute across a 1.9 square mile island and Americans commute an average of 16 miles in the same time span.

There have been many projects conducted on minimizing congestion in the streets of Venice, most of which have been completed by the Venice Project Center. Partial data for the ACTV, the public transportation system, has been recorded and put into the Generalized Transit Feed Specification format. Past project groups have calculated the carrying capacity of various streets of Venice to determine the maximum density of pedestrians that a street could sustain. Several simulation models of Venice's pedestrian infrastructure have been created by past project groups, each with different strengths and downfalls.

Though there has been much work done in the past, there is still much more to be done. The Generalized Transit Feed Specification data is incomplete and is not accessible in a format that is useful to the user. Pedestrian and passenger counts only encompass certain districts of the city. The frameworks of past models have been inadequate for simulations of the magnitude and detail needed for the city of Venice.

Our project will work to calculate Venice's carrying capacity by continuing work of past projects. The Generalized Transit Feed Specification data will be put into the City Knowledge Transit Application. Once completed it will display the ACTV boat lines in a format similar to the bus routes on google maps. We will continue pedestrian counts at bridges and boat stops to get a better understanding of

pedestrian movement and work to implement our new information into the pedestrian model. We will use the model to better understand the capability of the Venetian pedestrian infrastructure.

3 Background

2012 was a monumental year for the world in terms of tourism. According to the United Nations World Tourism Organization's 2012 annual report, approximately 1.1 billion people, roughly 15% of the world's population, participated in international travel[1]. This annual report stated that out of all the regions in the world, Europe was the most visited. Within Europe, the Central and Eastern sub-regions experienced the highest numbers of tourism. Venice is located right in the middle of these two regions, making it a prime tourist destination. Venice is a city that lives and dies by its tourism.

Tourism has a huge impact on pedestrian movement in Venice. Venice has a fixed pedestrian network that has no room for expansion. With a limited amount of bridges and streets to facilitate the transportation of people, the increased pedestrian influx from tourism is causing congestion in various areas of the city.

Venice is an ancient city full of some of the most architecturally beautiful churches, canals, and bridges in Europe. Tourists travel from all around the world to enjoy the sights, eat great food, and experience the traditional gondola ride down a canal. One of the most popular attractions in Venice is Piazza San Marco, St. Mark's Square, which is the main public square. The plaza is named after the patron saint of Venice, St. Mark the Evangelist, and is home to the *Basilica Cattedrale Patriarcale di San Marco* (St. Mark's Basilica). Built in 1063 and consecrated in 1093[2], this Roman-Catholic cathedral is the most famous church in Venice and a symbolic religious monument. It has been estimated that it experiences approximately around 15,000 visitors per day[3]. Alongside the basilica resides *Palazzo Ducale* (The Doge's Palace), another structure of great historical importance. This palace served as the residence of the Doge of Venice, the supreme authority and ruler of Venice until the fall of the Republic in 1797[4]. Today, the palace is a museum, much like many other historical buildings in Venice. The areas around these attraction points also serve as great locations to study the movement of many people to one common central location.

With Saint Mark's square and all of these historical buildings being in such close proximity to each other, it is not surprising that Venice experiences such high tourism numbers. Most of the city is easily

[1] Wolrd Tourism Organization, "UNWTO Annual Report 2012," (Madrid, Spain2012).
[2] I. Fenlon, *Piazza San Marco* (Harvard University Press, 2009).
[3] Elio Canestrelli and Paolo Costa, "Tourist carrying capacity: A fuzzy approach," *Annals of Tourism Research* 18, no. 2 (1991).
[4] Fondazione Musei Civici di Venezia C.F, "Palazzo Ducale," http://palazzoducale.visitmuve.it/en/il-museo/building-and-history/.

accessible by foot or by the public transportation system, making it very appealing to tourists. In addition to all of the historical landmarks, Venice also offers a wide variety of local restaurants with amazing Italian cuisine and some of the best wines in the world. Venice offers tourists the opportunity to experience a lot of great culture, food, and history all in one place.

The high and rising cost of living in Venice has led to a dramatic decline of its residential population. Fifty percent of the city's population has declined over the past decade[5], dropping from about 200,000 after WWII to around 60,000 in 2009[6]. It costs close to three times as much to live in Venice than to live in surrounding areas such as Mogliano, a mainland town located 20 kilometers away[7]. In addition to these costs, many of the local residents are also finding themselves becoming annoyed with pedestrian traffic congestion. The number of tourists has risen close to 21 million visitors per year[8], and this includes both overnight and day tourists. One would think that with a decreasing Venetian population there would be less pedestrian congestion, but this is not the case. Not only is tourism contributing to higher living costs, but it is also leading to higher levels of pedestrian congestion. These are two factors that are contributing to decline of the Venetian population.

Venice is a city that is constantly under maintenance and repair. It is quite astonishing that the majority of the city has retained its architectural framework for hundreds of years. Over the years Venice has thrived off the tourism industry, opening many stores and shops specifically catered for tourists. Although the large quantity of tourists is great for businesses, it also takes a toll on the physical condition of the city. According to an interview with National Geographic, the former mayor of Venice, Massimo Cacciari, said "There is not enough money from the state to cover it all—the cleaning of canals, restoration of buildings, raising of foundations. Very expensive."[9]

[5] World Monuments Fund, "The Watch: Venice, Italy," http://www.wmf.org/project/venice.
[6] Cathy Newman, "Vanishing Venice," *National Geographic*, August, 2009. 2009.
[7] Ibid
[8] Ibid
[9] Ibid

For a city like Venice, limited space and resources make it very challenging to maintain the city in a clean and attractive condition. The high level of foot traffic that Venice experiences in a year leaves a physical impact on all public spaces and facilities. The massive influx of tourists generates higher volumes of sewage waste and pollution. This is problematic since the sewage system in Venice flushes out all the waste into the canals, causing them to smell foully during low tides. In addition to increased pollution, the high level of tourist traffic has also contributed to pavement and canal damage throughout the city.

Figure 1: Venice, Italy

4 Public Transportation

The traditional form of transportation in Venice, boat traffic has evolved throughout the years. Gondolas are no longer used for transportation purposes, but are now primarily a tourist attraction. Today there are two primary types of public transportation in Venice, traghetti crossings and waterbuses. Traghetti only serve to cross the Grand Canal, while waterbuses serve all major waterways.

4.1 Public Transportation in Venice

Venice has a public transportation system unlike any other major city. Where most cities have subway systems or bus routes, Venice operates almost solely on water transportation. Traveling across the entirety of Venice takes an hour by foot.

Figure 2: Walking Across Venice

This time is significantly decreased by taking the water based public transportation system, to 26 minutes on the fastest line, but is still not as efficient as other major cities public transportation railways. Traveling the same distance, 4.8 km, in Boston, MA on the T takes a mere 12 minutes, less than half of Venice's time on public transit.

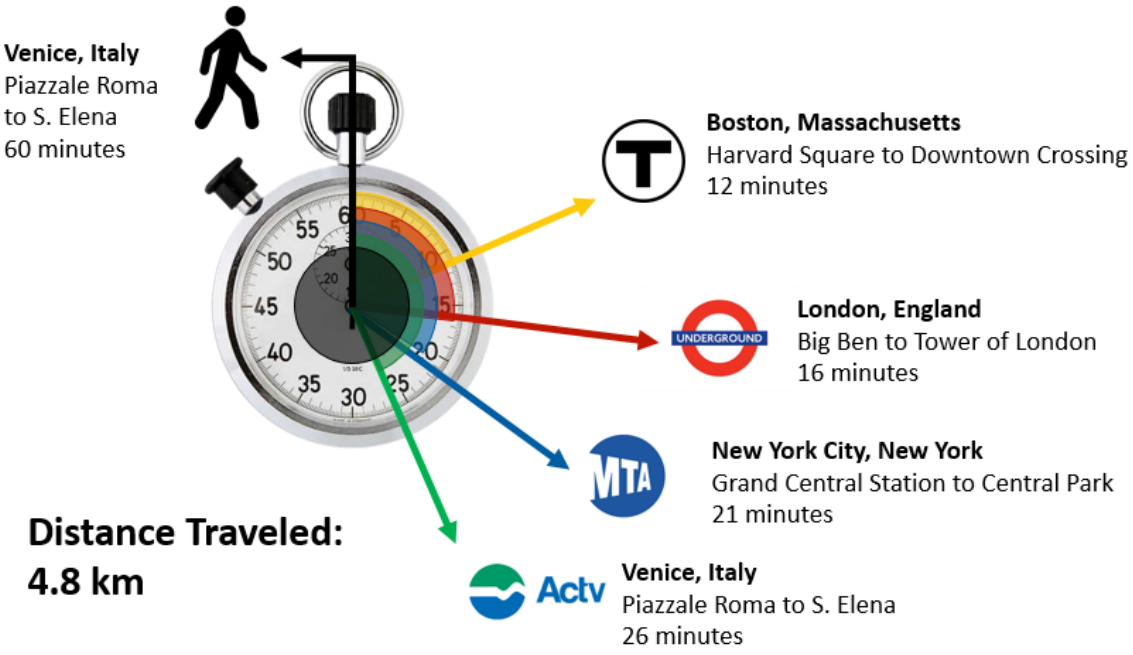

Figure 3: Public Transit Comparison

Our project worked to make this public transportation system more user friendly to assist in improving efficiency.

4.1.1 Traghetti

Only four bridges span the Grand Canal; with a total length of four kilometers, for an average of only one bridge each kilometer. To avoid either a long walk to a bridge or crowds at a bridge, traghetti crossings may be used. Similar to the gondolas used by tourists to see the canals, traghetti, or "ferries", are larger and designed to carry larger numbers of people, not for pleasure rides. While the ride across the Grand Canal costs a fee, the €0.50 for Venetians and €2.00 for tourists is often worth the extra convenience.

Figure 4: Traghetti

There are seven *traghetti* lines spanning the grand canal; San Marcuola, Santa Sofia, Riva del Carbòn, San Samuele, San Tomà, Giglio, and Santa Lucia. These crossings are more often utilized by Venetians over tourists, according to data from past groups.

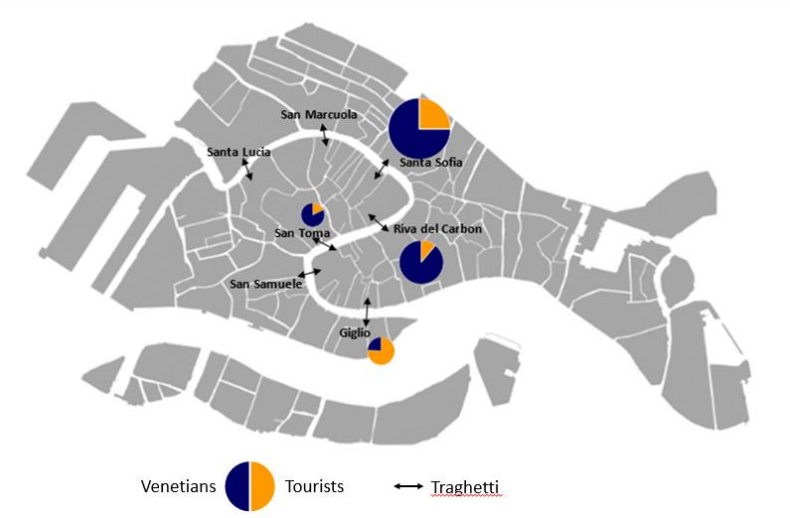

Figure 5: Traghetti Demographic Count

4.1.2 Azienda del Consorzio Trasporti Veneziano (ACTV)

The *Azienda del Consorzio Trasporti Veneziano,* or ACTV, is Venice's primary provider of public transportation services. Venice's first public transportation system began in 1881 with mechanically propelled vessels and, later that year, the *"Regina Margherita"* the first waterbus on the Grand Canal. Nearly 100 years later several of the smaller public transportation companies that had formed, including *Azienda Comunale di Navigazione Interna Lagunare* (ACNIL), *Società SVET, Società Veneta Lagunare* (SVL), combined to form the *Azienda del Consorzio Trasporti Veneziano* (A.C.T.V.) - the Venice Public Transport Company. ACTV now owns 600 land buses and 160 water vessels traveling on 28 different lines and carrying approximately 194 million passengers a year, as of 2010

4.1.2.1 Boat Types

ACTV's public transportation system uses four different boat types. The most common are the *vaporetti* and the *motoscafi* which are used for transporting passengers around the perimeter of the city and through the Grand Canal. The two other boat types are the *nave tragetti* and the *motonave*.

4.1.2.2 *Vaporetti*

The *Vaporetti* is the most prevalent type of public transportation vessel in Venice, holding up to 220 passengers, with luggage. The *vaporetti* is driven by two operators, a captain and sailor, who follow routes within Venice and along the outer circle. Due to their capacity these boats used for the more popular public transportation lines, Lines 1 and 2. A *vaporetti* can be seen below.

Figure 6: A Vaparetto

4.1.2.3 *Motoscafi*

Motoscafi translating to "motor boats" are very similar to the vaporetti. These boats also transport passengers along the Grand Canal. They are somewhat smaller than the *vaporetti* but still have a capacity of 160 passengers and also require a captain and sailor for operation.

Figure 7: A Motoscafi

4.1.2.4 *Other*

ACTV operates two other boat types, the *motonave* and the *nave tragetti.* The *motonave* carry 1,000 to 1,200 passengers and cycle through routes less frequently because of this. Their capacity makes them for transporting passengers to and from different islands in the lagoon. The *nave tragetti* serves a different primary function than the other boat types in that it is used for transporting cars rather than people. The *nave tragetti* can carry up to 28 to 30 cars to be delivered to the mainland or the islands such as the *Lido* or *Pellestrina.*

4.1.3 Water Taxis

Water taxis are a common mode of public transportation in Venice. The company in control of the taxi service, *Consorzio Motoscafi*, runs their one hundred plus boats for 24 hours a day.[10] All boats are equipped with a GPS system that helps to reduce taxi wait and travel times. Due to the high ticket price of the water taxis, ranging upwards of €110, they are mainly utilized by tourists because of convenience.[11]

Figure 8: Water Taxi

4.1.3.1 Boat Stops

There are 70 different ACTV boat stops throughout the main island and surrounding islands of Venice. Each stop is made up of rectangular dock with a metal roof and walls and labeled with the stop name.

Depending on the popularity of the particular stop, some stops may be split into multiple docks. The *Piazzale Roma* stop is very high traffic, with seven different lines feeding to it. This particular stop has 5 dock whereas many others may just have one.

Similar to American, "big city," subway systems the boats stop to unload and reload passengers at each station. Upon arrival, the disembarking passengers will exit the boat and follow the exit ramp. Once all of these passengers leave, embarking passengers may be allowed to board from their waiting area. Once all passengers have boarded, the boats will leave, but not before their scheduled departure time.

4.1.3.2 Lines and Special Conditions

The ACTV public transportation system is composed of 28 different lines that travel throughout Venice's canals and islands. Each line has its own specifies route through the many canals and islands. Some of the major lines are 1, 2, 4.1, 4.2, 5.1 and 5.2. Each major line has either *vaporetti* or *motoscafi*

[10] Consorzio Motoscafi Venezia, "The Consorzio Motoscafi," http://motoscafivenezia.it/eng/consorzio.php.

[11] Consorzio Motoscafi Venezia, "Our Boats," http://motoscafivenezia.it/eng/imbarcazioni.php.

traveling its route and stopping at the specified boat stops for that line. A map of the different lines is shown below.

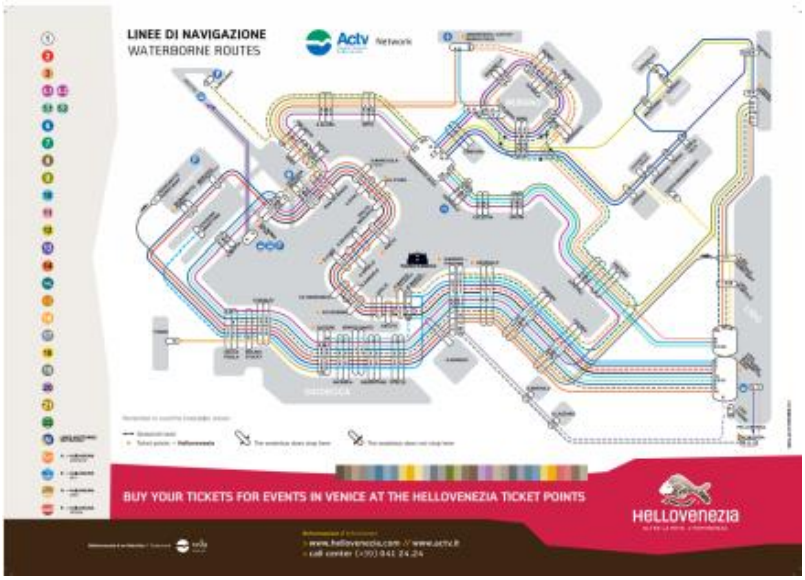

Figure 9: Map of ACTV Lines

4.1.3.2.1 Line 1

Line 1 travels through the Grand Canal and is one of the most popular lines. Stopping at nearly every boat stop along the canal, starting with *Piazzale Roma*, and making its way out to the *Lido* this line makes stops every ten minutes throughout most of the day, starting at 5 AM.

4.1.3.2.2 Line 2

Line 2 seems to be designed more with tourists in mind, with fewer stops along the Grand Canal and the majority of the stops being major tourist attractions. The fewer stops also allow Line 2 to move more quickly along the Grand Canal, making it even more attractive to tourists. Line 2 starts at 5 AM at *San Marco – Giardinetti* and moves up the Grand Canal then travels around to *Tronchetto*, down to *Guidecca* and to its final stop at *San Marco – San Zaccari.* It will then repeat the route backwards, with ten minutes at each stop until midnight. A map Line 2's route is shown below.

Figure 10: ACTV Line 2

Past groups took passenger counts at boat stops along ACTV Line 2 to have a better understanding of the riders' demographics. Their data supported the notion that the riders of ACTV Line 2 are mainly tourists.

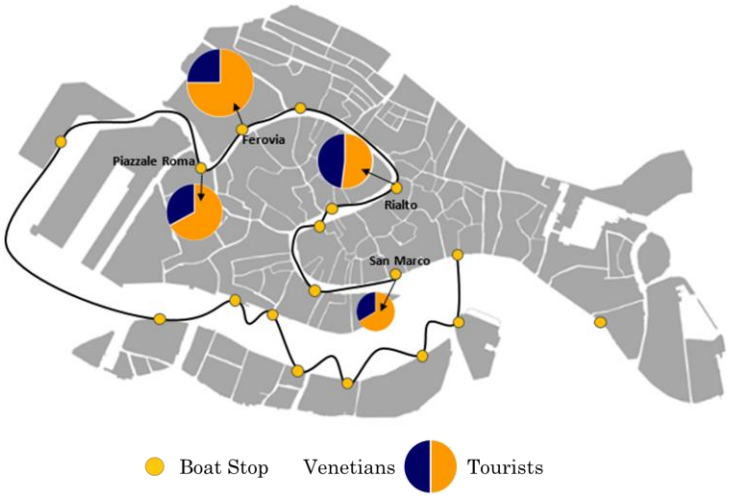

Figure 11: ACTV Line 2 Demographics

4.1.3.2.3 Line 4.1 and 4.2 Line 5.1 and 5.2

Lines 4.1, 4.2, 5.1 and 5.2 circle the main bulk of the island of Venice. Lines 4.1 and 4.2 also travel to *San Michele and Murano* whereas 5.1 and 5.2 detour to the *Lido*. 4.1 and 5.1 travel counterclockwise, 4.2 and5.2 travel counterclockwise.[12]

[12] RosDunford Belford, Martin, *Italy: The rough guide* (Rough Guides).

4.1.3.2.4 ACTV Notte

ACTV offers a night service that runs from midnight until 5am. The boat lines were coordinated with the mainland bus lines in the *Mestre* and on the *Lido* to make it easier for people to travel throughout the islands at night without having to wait. After starting in September of 1996, ACTV extended the service to include lines to and from *Fondamente Nuove – Murano,* the Northern Lagoon and buses on the *Lido.*[13]

Figure 12: ACTV Notte Logo

4.1.3.2.5 Special Conditions

Flooding is a regularly occurring problem in Venice that also effects the public transportation system. ACTV has taken into account passenger safety risks in regards to flooding has a plan to accommodate for changes in routes if there need be.

Fog is also a recurring problem that must be taken into account. Fog in the canals often hinder visibility and routes must be changed accordingly. Electronic "eyes" are placed in twelve different locations that cover all the important routes to measure visibility during non-ideal weather.[14]

4.2 Venice Transit Application

From its complex boat system to its narrow winding streets, the city of Venice is very difficult for travelers to navigate. In order make daily travels less of a hindrance, the group will further develop the general transit specification feed data. The fourteen of the higher traffic lines of ACTV and Alilaguna lines have been put into the general transit specification feed format shown below. This is the format used for Google's public transportation feeds on their map web application

[13] ACTV, "Night Service," http://www.actv.it/en/movinginvenice/nightservice.

[14] ACTV emergency service

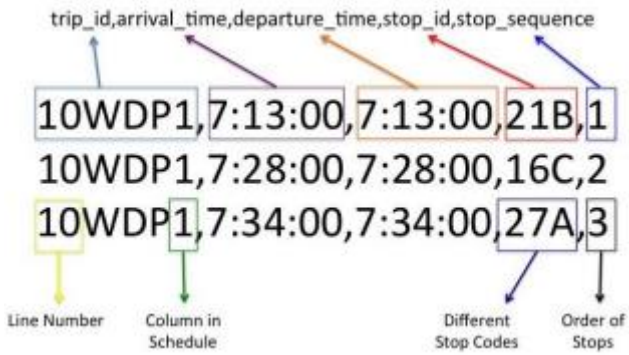

Figure 13: General Transit Specification Feed Code

Our group used this data to add the lines to the City Knowledge Transit Console to display the ACTV lines in a user friendly interface, similar to the City Knowledge Application for the bus lines of Santa Fe developed by a previous IQP group from that site. A more specialized analog of Google Maps, the Santa Fe Transit app on cityknowledge.net provides comprehensive information on the public bus routes in Santa Fe. This app also accepts data in GTFS format and uses it to display the routes and stops of each bus. Users are able to display nearby bus stops and then get directions either by car, bike, or foot to the stop.

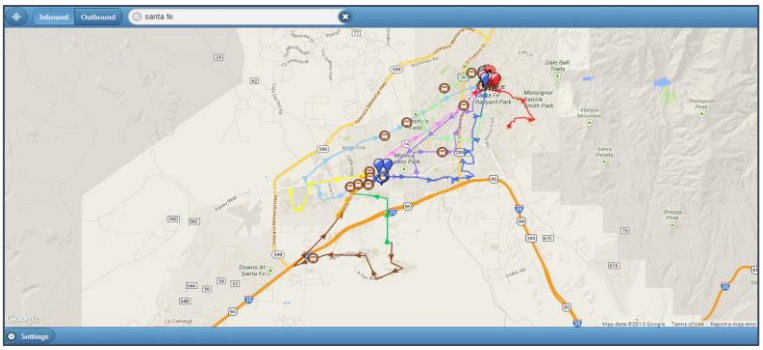

Figure 14: Santa Fe City Knowledge App

Our group adapted this application by first moving the map itself to Venice. We then reviewed the past groups data and adjusted it to be up to date with the latest ACTV schedules and information.

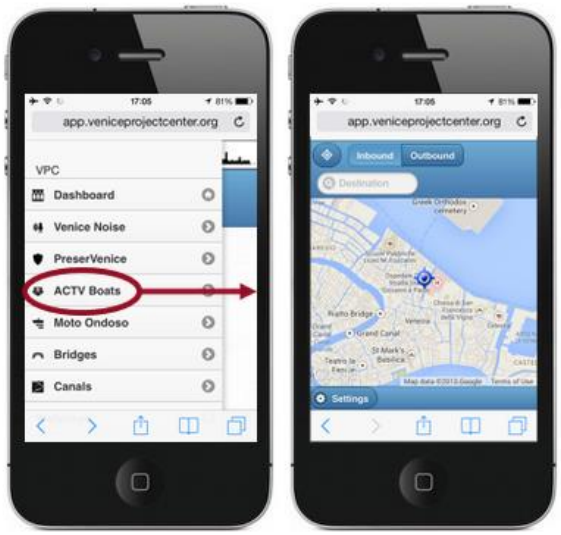

Figure 15: Transit Application Mobile Interface

In order to make the data easier for future groups to update we included a frequencies file in the feed data files. The frequencies method is an alternate way to specify the times for trips that requires less information to be provided explicitly. Rather than specifying each trip, only the initial trip is given precise times and following trips on the same schedule are declared by the period between them. Also included in our updates was a "shapes.txt" file. This file specifies a series of points that the trip is then routed though. By including additional points beyond the basic set of boat stops, connections that would otherwise be shown crossing dry land can be routed along the route actually followed. After making these changes we added ACTV Line 1 to the application as a test before expanding to additional lines.

The application is now able to show the boat stops closest to user, using the devices' GPS.

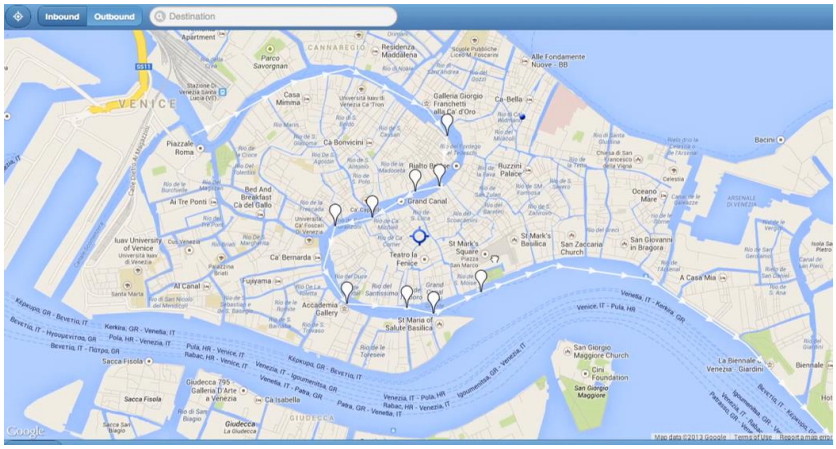

Figure 16: Transit Application Boat Stops

From there each boat stop can be clicked on, and the schedule of boats that will arrive at that dock will appear.

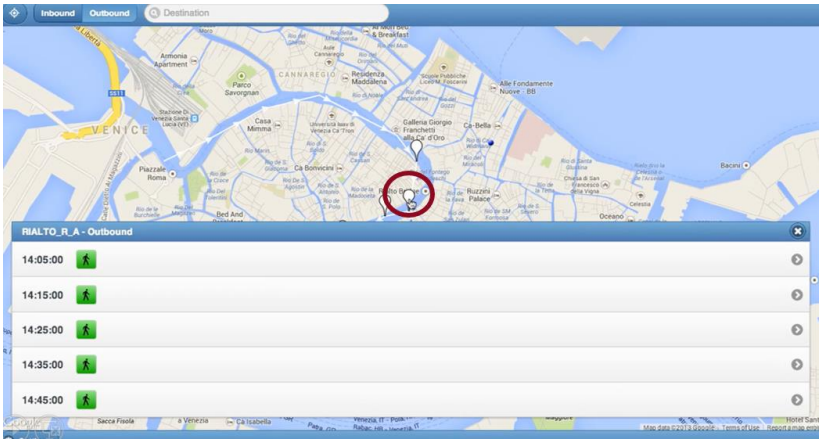

Figure 17: Transit Application Boat Stop Selected

The user can then click on a time of a boat to catch. The application will only allow the user to select times of boats that can reached at a reasonable walking speed. It will then display turn by turn directions to the boat stop and what time you need to leave in order to catch the boat.

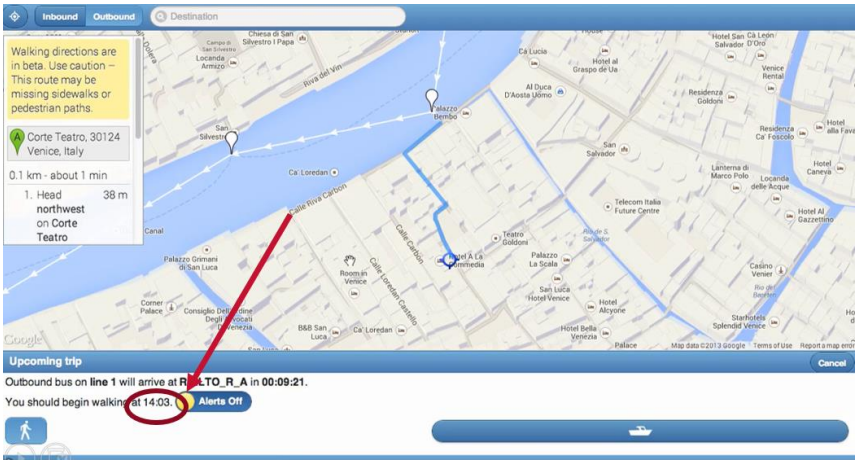

Figure 18: Transit Application Directions and Countdown

You have the option of enabling alerts, which will give you updates on if you are on schedule to catch the boat you selected.

4.3 Public Transportation Recommendations

Future work on the app should focus on developing methods to automate the creation of the feed data file. By following Line 1 as a template, updating data on the feed could potentially be automated. However, one area that should be focused on before working on automation is ensuring that the name data used to specify lines is both correct, and scalable.

5 Pedestrian Infrastructure

When the physical infrastructure of Venice was built, it was not designed for the high pedestrian volume that it currently experiences. Originally, Venice did not contain any bridges and it contained more canals than it does currently. Over time, many of the smaller canals were drained and turned into some of the streets still utilized today. Venice's urban layout is one that is filled with multiple twists and turns, comparable to that of a maze. The city is full of narrow streets that range anywhere from a few meters wide to widths barely large enough fit one person. To add to this intricacy, there are many dead ends scattered throughout various parts of the city. One of the focuses of our project is to study how increase in pedestrian traffic impacts the mobility of pedestrians in this fixed network.

5.1 Pedestrian Infrastructure in Venice

Venice is a collection of 125 islands, which makes it an archipelago. In previous centuries, during Venice's earlier development, the only way people got across from island to island was on boats that were very much like the traghetti seen today. Over the years bridges were added and now the total number connecting these islands stands at 437. These bridges serve as the main passageway between islands and are usually areas of high congestion because their widths are much narrower than the streets connecting to them.

Figure 19: This map displays all the bridges in Venice

5.1.1 Size of Venice

Although Venice is comprised of many islands, altogether Venice only takes up a total surface area of 6.3 square kilometers. This area is precisely equivalent to that of Boston's Logan International

Airport, one of the most heavily traversed in the United States. This surface area includes the island of Guidecca, which is just South of the historic center. If Guidecca is excluded, the main islands have a total surface area of 5.4 square kilometers. At the farthest points, Venice is 4.8 kilometers wide across and 2.4 kilometers (excluding Guidecca) from North to South.

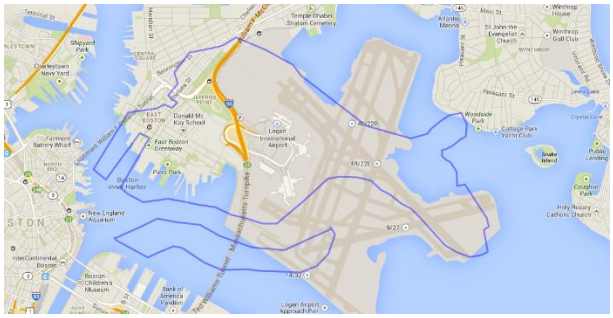

Figure 20: Venice overlaid over Logan International Airport

5.1.2 Streets and Walkways

There are a total of approximately 2,650 streets in Venice, all which vary in different widths and span across all parts of the city. The total surface area of all these streets is 1.07 square kilometers,

Figure 21: Map displaying all the streets in Venice

which is 17% of the total land area taken up by the islands. If you were to take the length of all the streets in Venice and add them up, the total sum would be 178 kilometers. This distance is a little more than 4 times the distance of a marathon, which is 26.2 miles of 42.2 kilometers. If you were walk down every street in Venice it would take you approximately 33.5 hours, assuming an average walking speed of 3.3 miles per hour.

5.1.3 Major Arteries

Within Venice's vast and complicated street network there are six major arteries that combine four major points of interest in Venice. These points are: 1) Piazzale Roma/Ferrovia, 2) Rialto, 3) San Marco, and 4) Accademia. Piazzale Roma is the location of the one and only bus station in Venice. Ferrovia is the name of the boat stop that services Santa Lucia station, the major train station in Venice. Santa Lucia and Piazzale Roma are only minutes apart by walking across the Ponte della Costituzione. Together these stations serve as the major entry points into Venice. The second point of interest in Rialto, which is where the Rialto Bridge and market are located. The Rialto Bridge is only one of four bridges that cross the Grand Canal. It serves as the main passageway into the San Marco district and Saint Mark's Square, which is the biggest tourist attraction in Venice. Accademia the where the Ponte dell' Accademia is located, which is another of the four bridges that crosses the Grand Canal. This bridge serves as the main connector between San Marco and the university district.

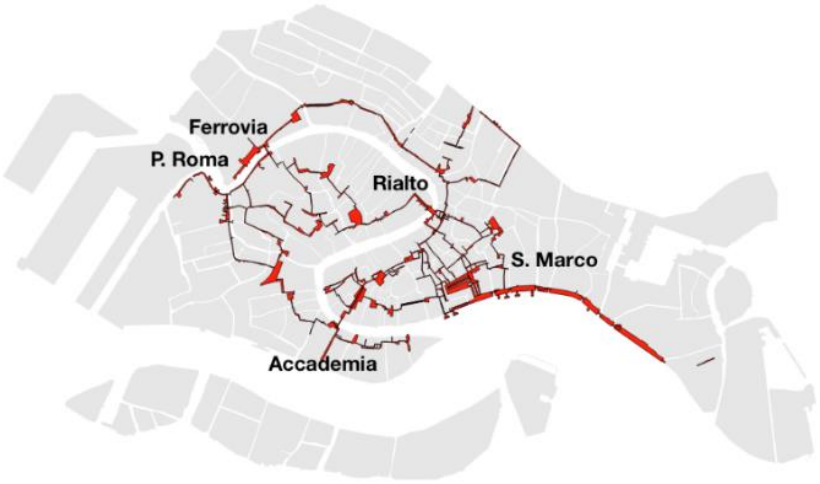

Figure 22: Major arteries of Venice

The major arteries connect these major points of interest and are areas of higher pedestrian foot traffic. These major thoroughfares will be the areas that will most likely experience higher levels of congestion.

5.2 Venice Street Information System

One of the major deliverables that our team worked on this past semester was the Tassini street database or better known as the "Tassini Explorer" project. This database was a compilation of entries extracted from Giuseppe Tassini's book "Curiosita' Veneziane". Giuseppe Tassini was an Italian historian that focused on Venetian topography. In his book he wrote about the history of the streets and squares

in Venice. The information in his book is very valuable and important to the people of Venice, so for this project our team focused on creating a digital database to store this information. In the future, this database could serve as a platform for the creation of applications that could display this information and make it viewable to the public.

5.2.1 Tassini Explorer

Curiosita Veneziane was first published in 1863. It was written in Italian and all of his entries were listed alphabetically. To our knowledge, there has never been a digitally recreated English database with all of the book's entries. The first step in this process was to search the Internet for any websites that could contain Italian digital entries where we could extract the information. We were able to find a website called "venicexplorer.net", which had online entries in Italian that were already alphabetized.

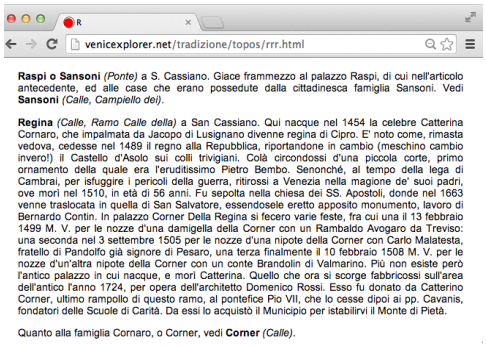

Figure 23: Venicexplorer.net

Using a website scraper tool on Google Chrome, we were able to extract all the information for all the entries and then save them to an excel file. To make sure that the information was accurate and valid, it was cross-referenced with an actual copy of *Curiosita Veneziane* that was available in the Venice Project Center office.

Although our team was able to successfully extract all the information from venicexplorer.net, much of the data was extremely unorganized. Our team organized the data and formatted the structure in a way so that it could be uploaded to the CityKnowledge console and used for multiple web-based applications. In total there were 1,448 entries and from this point further, we will refer to this excel file as "Tassini". Each entry contained the following fields: type of street, street name, Italian Tassini entry, and a translated English Tassini entry. The English translations were done using Google Translate.

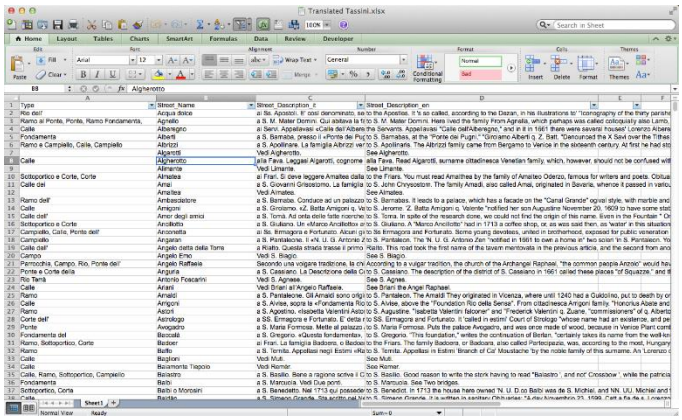

Figure 24: Organized Tassini Entries

5.2.1.1 Integrating Tassini Information with Street Database

After the Tassini entries were successfully extracted and structured in an excel file with proper columns, the Tassini Excel file contained 1,448 entries. Each entry corresponded to the name of a bridge, street, or square in Venice. Venice, however, has over 3,800 of these type of walkways. This meant that there were some streets in Venice that did not have corresponding Tassini entries. Conversely, there were also Tassini entries that corresponded to multiple places in Venice such as two streets that had the same name, but were located in different districts.

Street information for the entire city of Venice was already available to our team through the Venice Project Center Google Drive. We extracted the information from a shape layer file that was created by a previous IQP group using QGIS, a geographical information systems (GIS) software program. This layer was comprised of polygons for every walkway in Venice and contained GPS coordinates as well as other important street information. Using QGIS, we were able to extract this information and save it as a comma separated value (CSV) file that we could open in Excel. From this point on, we will refer to this excel file as the “streets dataset”.

Figure 25: Shape layer file of all the streets in Venice

Both these excel files contained street names, but the major difference was that the streets dataset contained GPS Coordinates and the Tassini dataset contained important information regarding the history of each street. The goal of the project was to successfully integrate these two datasets into one master dataset that would contain geographical, technical, and historical information for each street in Venice. In order to integrate this information, an Excel plug-in had to be used to perform partial lookup functions between the datasets. This allowed common string characters between both files to be used as the link for merging the data.

5.2.1.2 Visualizing and Displaying Information

After creating the master file, which contained both the historical and geospatial information for every street in Venice, our team uploaded it to the CityKnowledge Console. From this point on, this console will be referred to as the CK Console. The CK Console is an online database platform that was created by Professor Carrera and his collaborators to serve as a tool for displaying information through various mediums. These mediums include the creation of Venipedia (venipedia.org) pages or displaying the information on the Venice Project Center Website (veniceprojectcenter.org). Our team utilized the CK Console to create a prototype application called the Tassini Explorer.

To visualize the information, the Tassini Explorer displays the information from the master spreadsheet file on a Google Map utilizing the GPS coordinates linked to each entry. It displays the selected streets name, its surface area in meters, the Italian Tassini entry, and a translated English Tassini entry. As an additional feature, our group took photos of a few street signs that could be displayed in addition to the previous entry information. The map generated by the Tassini Explorer displays each entry as an icon using the GPS Coordinate for the data. The icon is a Venetian street sign known as a “nizioleti” with the letter T in the center, which stands for Tassini.

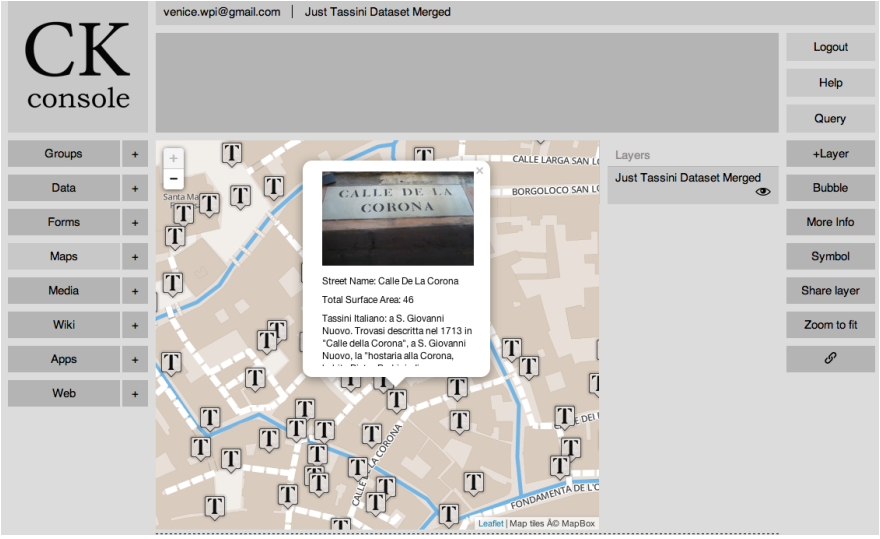

Figure 26: Tassini Explorer in the CK Console

5.3 Recommendations for Future Applications

Although much work was done to get the data structured and organized for the Tassini Explorer, the application is still in its developmental phase. This application is just one example of the many ways that this dataset can be displayed. There is still much room for improvements that can be made both to the dataset and the application. The

5.3.1 Revision of Datasets

The majority of the information in the master spreadsheet was transferred using an Excel plug-in. Due to a time constraint, this method of transferring information was able to meet our basic requirements for the prototype application, but it was not entirely perfect. When trying to perform these transfers by hand, our team encountered some obstacles that were due to nature and complexity of the Venetian street network. Some examples these obstacles include:

1) Street names corresponded to multiple Tassini entries
2) Differences in street name spellings disrupted the link between the two datasets
3) Tassini entries did not correspond to a street name

Our team strongly advises that future IQP groups go through and manually revise and edit any entries that may possibly contain grammatical errors or that may have been incorrectly transferred.

5.3.2 Street Venipedia Pages

After the data is revised and proofread by future IQP groups, it could be uploaded and displayed on the Venice Project Center website, where it could be viewed by the public. From the CK Console this information could also be used to create Venipedia pages for each street. On each page it could display the street name, the history of the street, a picture of the street or street sign, as well as links to other connecting street segments.

5.3.3 Plateatici

During this term, our team mainly focused on pedestrian counts at bridges located on the major arteries of the city. As stated in a previous section, plateatici are one of the major impediments of pedestrian mobility. We strongly recommend that future project groups focus more closely on how plateatici impacts pedestrian flow and how the levels of service are affected. With this information, future groups could address these issues to the city of Venice in hopes that legislative action could be taken to reduce plateatici in high pedestrian traffic areas. We also recommend that all this information could be displayed on a plateatici Venipedia page.

6 Pedestrian Traffic

One of the projects our group wanted to work on was consolidating all of the bridge count data from 2009 and 2012. Figure 27 shows the locations of all the past mobility data, which includes boat stop counts and bridge counts that were used mainly to count mobility impairments. Our group took only those years that used bridge counts but also used them to track congestion within the city.

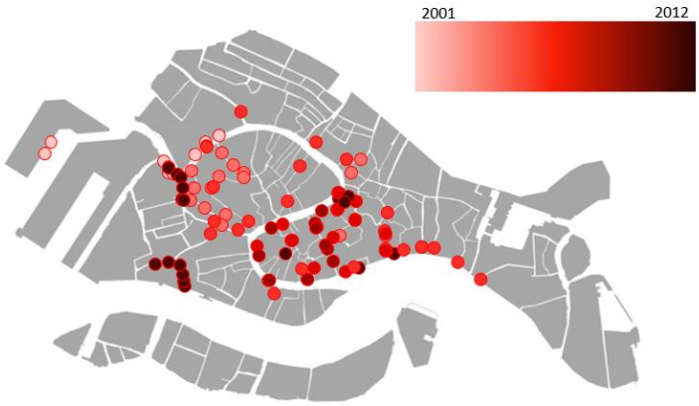

Figure 27: Past Mobility Counts (2001-2012)

From there, our group streamlined the data into one spreadsheet with the following headers: Bridge Code, Bridge Name, Day/Year (the count was taken in), Start Time, End Time, From Island (code), Island Name, To Island (code), Island Name, Number of Tourists, Number of Locals, and Total. This format will allow for easy upload to the CityKnowledge Console as well as having one format for future groups to use so that all data can be compared and would be easier to show graphically. Instead of cardinal direction, the count direction was indicated from which island the pedestrians would move from and move towards during their walk across the bridge. This allows for less confusion for future groups when attempting to figure out which direction the counts were in. Also, QGIS has both an islands and bridges layer that could be used to help locate these bridges and their associated islands.

After streamlining the data, the raw data with 15 and 20 min segments everywhere was converted into hourly data in order to better study the flow patterns across the length of a day. From there, the maximum number of people was extracted per hour, per direction, and per bridge. This was done to show the most amount of people that crossed the bridge from any of the years and times. Figure 28 shows the maximum number of people crossing each bridge and, for those who recorded such things, the percentage breakdown of tourists versus Venetians. It is shown that the greatest concentrations of people are along those main arteries, between Piazzale Roma, Ponte dei Rialto, San

Marco, and Ponte della Accademia. Also, as people get closer to San Marco, there is a greater percentage of tourists crossing the bridges.

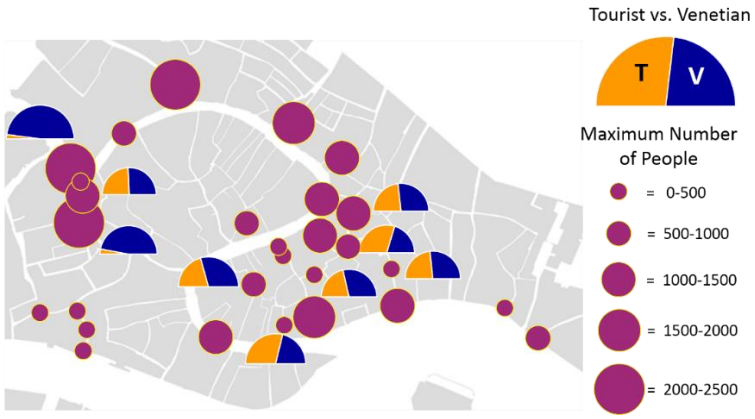

Figure 28: Past Bridge Counts- Maximums

Then, while looking at this maximum data, it was determined, for each bridge, which direction maximum was higher and that was recorded as well. This was done to show, given the maximum number of people counted so far, which direction people are more likely to cross over each bridge. This was done in order to show how people flow throughout the city given a high, or maximum, number of people crossing each bridge. These overall maximums can be found in Appendix A i. From there, this maximum data was broken up and again calculated for both morning and afternoon/evening in order to show differences in the flow of movement in the city throughout the day. These maximums for the morning and evening can be found in AppendixA ii-iii

Figure 29 shows the flow of movement of pedestrians through the city during the morning. This image shows that, in the morning, people are flowing into the city, away from Piazzale Roma and Ferrovia and toward the heart of the city and, from there, heading mainly towards Rialto. The greatest concentration of people are by Rialto and Piazzale Roma, showing where most pedestrians congregate. There is also a high concentration of people by Ponte delle Guglie, which receives a lot of high volume traffic as tourists enter the city and head along a long stretch of street called Strada Nuova

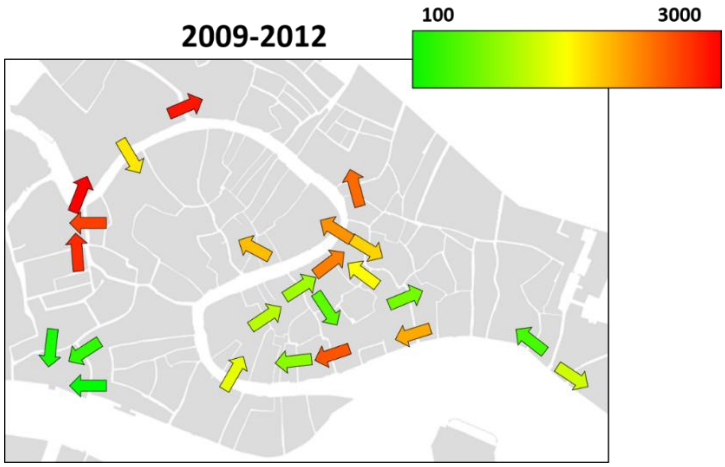

Figure 29: Past Pedestrian Flow (7:00-12:00)

Figure 30 shows the flow of movement of pedestrians through the city during the afternoon/evening. This image shows that, in the afternoon and evening, people are concentrating in Strada Nuova, Piazzale Roma, San Marco, and Rialto. Pedestrians, at this time, are attempting to flow out of the city towards Piazzale Roma and Ferrovia b heading towards Rialto and walking along the waterfront of San Marco towards Ponte della Accademia. At this time, pedestrians are still concentrating in San Marco because of all of its tourist attractions but a good portion are also leaving the city. There is such a discrepancy because of the wide time interval. This was done to include all of the past bridges, even those who only had hours between 13:00-14:00. If the time intervals were different, the flow of pedestrians throughout the city would surely change.

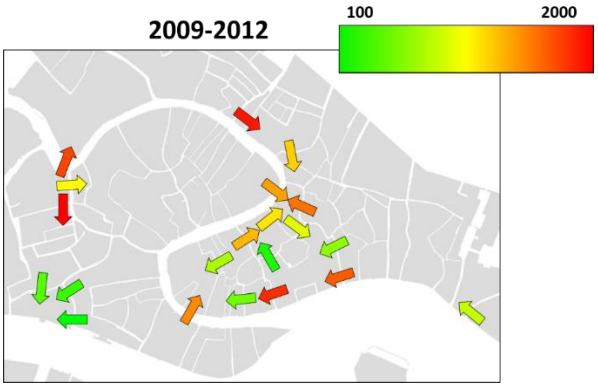

Figure 30: Past Pedestrian Flow (13:00-19:00)

6.1 Impediments to Mobility

During our research of pedestrian movement in Venice, our team came across several major impediments to mobility: dead ends, plateatici, acqua alta and bottlenecks. We discovered that sometimes even tourists can impede mobility

6.1.1 Dead Ends

Many people have referred to Venice as a labyrinth because of its puzzling street network and complicated address numbering system. It is very easy to get lost in this maze and it does not help that in addition to having limited walking space, there is a good portion of streets that are dead ends. Dead ends impact mobility because they limit the number of options for pedestrian to move between the major arteries of the city.

For tourists who are unfamiliar with the area, this is especially true. Venetians, however, know which streets are through streets and which are dead ends. This knowledge is what allows Venetians the ability to avoid some areas that are heavily congested because of tourists.

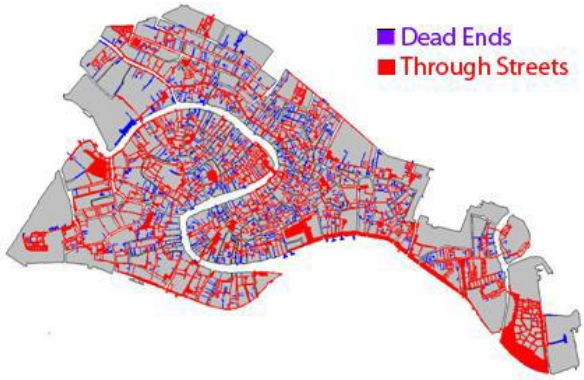

Figure 31: Dead ends in Venice

6.1.2 Plateatici

Many restaurants and cafés in Venice lease the space in front of their establishments from the city to provide additional outdoor seating for their customers. These spaces are known as *plateatici*, and are usually occupied by tables, chairs, merchandise stands, and displays. Although this allows businesses to provide a scenic seating option for their customers, *plateatici* take up valuable space in the streets throughout the city. Regulation of these public spaces has become a top priority for Venetian city officials, especially because businesses sometimes encroach on their set upon limits for these outdoor

seating areas[15]. The expansion of *plateatici* reduces and impedes the flow of people in these designated areas, contributing to pedestrian congestion. The figure on the right depicts a *plateatico*.

Figure 32: Plateatici

6.1.3 Effect of High Tide on Pedestrians

As a result of Venice's close proximity to ocean level, there are many times when the high tide reaches over and floods the streets of the city. For Venetians this is nothing out of the norm, but for tourists the sight of a completely flooded square can be quite alarming. An abnormal level of flooding is known as *acqua alta*[16], and it can have severe consequences on pedestrian congestion. To combat the tide, the city builds temporary raised sidewalks, known as *passerelle*, for people to walk on[17]. This keeps the people dry and out of the water, but it reduces pedestrian flow significantly because it turns narrow streets and squares into even narrower passageways. If the water is not too high, some pedestrians choose to walk right through the water in rain boots. This is not the most popular option however, because the city's sewage, which gets displaced into the canals, rises up along with the tide.

[15] Fabio Carrera, A. Gallo and A. Novello, "Street Performances: the role of visual analysis in the micro-zoning of public space in Venice, Italy," in *GIScience Conference* (Muenster, Germany2006).
[16] Citta de Venezia, "Acqua Alta (high tide)," http://www.comune.venezia.it/flex/cm/pages/ServeBLOB.php/L/EN/IDPagina/1066.
[17] Ellen Hale, "Can Venice Be Saved?," *USA Today*, March 5, 2003 2003.

Figure 33: Passerelle in Saint Mark's Square

The tides are at their worst during the fall and winter months. These raised sidewalks are only at a height of 120 cm[18]. This means that in some extreme cases the water could rise above and flood the passerelle, making it even more difficult for people to move around. If the flooding is severe enough it can cause parts of the city to close until the water clears. Alta acqua limits the number of routes that a pedestrian can take. Streets and alleyways that are located in the lower parts of the city closer to the water are more likely to flood during high tide. For residents that rely on these streets, their normal routes would be disrupted and they would be forced to utilize the heavily crowded streets where the passerelle are located.

Figure 34: Passerelle routes during acqua alta

6.1.4 Bottlenecks

Most of the bridges around Venice have still maintained the architectural structure and aesthetic design appeal that they were originally created with centuries ago. Venice was not originally built with the design of bridges, and Venetians used to have to cross the canals on boats or on extended

[18] Ibid

wooden planks until the addition of bridges centuries later[19]. Figure 35 shows a QGIS layer of all the bridges in Venice.

Figure 35: QGIS Bridge Layer

Across the numerous canals, there are over 400 bridges, "ponti", that connect the 118 islands to each other, and are the main way pedestrians use to travel throughout the city. All of the bridges were once made out of marble, but many have now been replaced by wrought iron structures[20]. The Grand Canal itself has 4 bridges that cross over it. The most famous and oldest is the Ponte di Rialto, a grand marble structure that is 23 meters wide and 29 meters long, looming at a height of 7 meters over the canal, built in 1580[21]. The Ponte dell'Accademia was a wooden bridge reinforced with steel that was built in the 1930s in order to replace an Austrian-built bridge from the 19th century. The Ponte degli Scalzi connects to the railway station at the western end of the city and was constructed out of marble in 1932. Finally, the Ponte della Costituzione was built in 2008 with the design of Santiago Calatrave to connect the railway station to Rome Square[22].

These bridges now serve as the main walkways between islands. Since most boats cannot traverse the smaller canals around the city, bridges are now the main way to get around the city on all of its various islands. Because of this, these bridges have also become a sight of congestion. Figure 36 below shows congestion on Ponte de l'Anconeta, one of many bridges along the main artery of Strada Nuova.

[19] Mobility in the Floating City- IQP 2010

[20] Cessi, Robert and Foot, John. "Venice". Britannica Academic Edition. Encyclopedia Britannica. *http://www.britannica.com/EBchecked/topic/625298/Venice*

[21] Structurae. "Rialto Bridge" *http://en.structurae.de/structures/data/index.cfm?ID=s0000461*

[22] Cessi, Robert and Foot, John. "Venice". Britannica Academic Edition. Encyclopedia Britannica. *http://www.britannica.com/EBchecked/topic/625298/Venice*

Figure 36: Congestion on Ponte I'Anconeta

Bridges have become a bottleneck in Venice because these bridges are usually narrower than the streets or squares that they connect. Because of this, the same amount of people that traverse these streets or squares are attempting to cross these bridges and the density of people is higher on these bridges because of it. This causes a constriction in the flow of people through the city of Venice, and causes time delays as people wait for others to cross certain areas before they are allowed to because of the more confined space on a bridge. This causes more congestion and a more difficult time of trying to walk through the city. This is why bridges were studied and why data was collected on them for this current year.

6.1.5 Tourists and Venetians

Although nearly impossible and highly unlikely, walking in congested areas in Venice can sometimes be avoided. For locals this comes much easier than for tourists that are unfamiliar with the area. Experiencing pedestrian traffic is an inevitable part of daily life in Venice. Although there are many locals that rely on the public transportation system, the majority of travel is done on foot.

Most people will agree that on any given day there are only two types of people in Venice: Venetians and tourists. Understanding the difference between Venetian and tourist walking patterns is a fundamental part of analyzing pedestrian congestion. Some of the main differences between resident and tourist walking behavior are: destined locations, speed, and route selection. Since tourists are only in Venice for limited periods of time, the majority of their day consists of traveling to all the historical and cultural attractions that the city has to offer. Venetians on the other hand, travel to and from work (or school) everyday with frequent trips to the grocery store (or other businesses to fulfill errands). Venetians walk quickly with their destination in mind, trying to minimize as much of their travel time as

possible. If they see that a certain street is congested, they can choose to take side streets and alternate routes to get to their destination. Conversely, tourists typically tend to wander through streets and squares trying to figure out where they are and how they are going to get to their destination. They also stop to enjoy and take photos of the beautiful architecture, which creates a lot of standstill traffic and contributes to citywide congestion.

6.2 Measuring Pedestrian Traffic

Our group counted pedestrians at bridges that created bottlenecks along the main arteries of Venice. We established clear guidelines to ensure consistency and used this data to study the flow of pedestrians at these points.

6.2.1 Observing Pedestrian Traffic

First of all, each group member would use two clickers in order to differentiate between tourists and Venetians. One clicker would be used to count tourists while the other would be used to count Venetians. The group was split up into groups of two which one pairing studying a bridge at a given time. One member of the pair would study and count pedestrians walking in one direction which the other member would study the other direction. This allowed for each person to not have to split their focus between multiple directions and have them face that direction and focus on counting and differentiating.

Next, our group established how we would differentiate between tourists and Venetians, which was discussed earlier. In order to clear, we counted students and commuters as non-tourists, meaning we counted them along with our Venetian category. Also, we did not count pets or children that were carried or in strollers at all for either category. One of the first things done when the group arrived into Venice was to take a couple of days studying pedestrians and practice differentiating between tourist and Venetian. Members of the group for the most part were consistent with one another near the end, and once that was accomplished, the next phase began.

Finally, the group established that the counts would be done for 15 minutes at a time and then have a break of 5 minutes afterwards.

The first bridge to be studied was il Ponte delle Guglie. This bridge was studied for an entire weekday, from 7:00 AM to 19:00 PM, in order to find those peak times that people cross bridges. The group used these times to base all of the other data collections on the other bridges. Appendix B i

shows the data collected in its raw form while Figure 37, shown below, is a graph shows the progression of the data collected.

This graph shows that there no peaks that stand out by a great amount. It also shows that, for the most part, the number of residents that crossed over il Ponte delle Guglie was consistent throughout the day. Because of that, our group mainly focused on when tourists arrived throughout the day. This graph shows that tourists start arriving or adventuring out across Venice around 10:00-11:00, so one of the peak times was decided to be from 11:00 to 13:00 because that was decided to be when tourists would arrive in Venice and also be venturing out to find a place to eat for lunch. The graph also shows a peak around 16:00-17:00, so the other peak was decided to be from 15:30-17:30 in order to accommodate that peak.

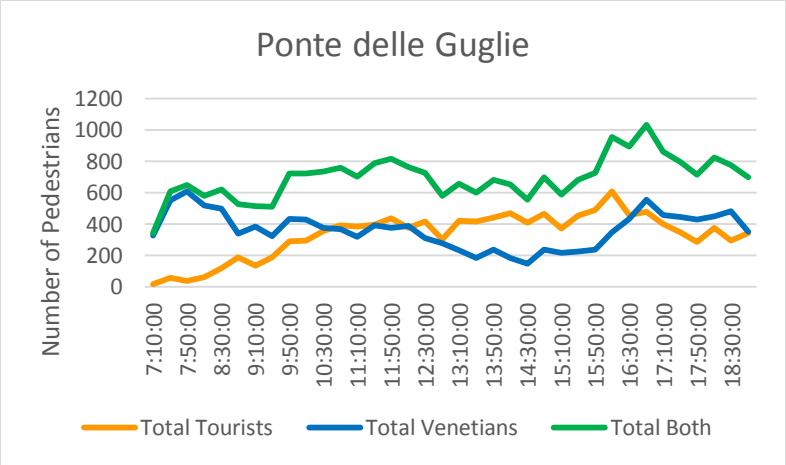

Figure 37: Ponte delle Gugle Counts (7:00-19:00)

From there, 7 other bridges were decided to be the locations for the 2013 data collection. Figure 38 below shows the locations of the bridges from which data was collected for this year. These bridges were decided to be along the main arteries between Piazzale Roma, Ponte dei Rialto, San Marco, and Ponte della Accademia. This was done in order to extract the maximum number of people possible crossing bridges in order to study congestion at its highest throughout the city. Congestion needed to be at its peak, both with location and time, in order to show how congestion affects the city at its worst during this off-season. The same methodology that was used on Ponte delle Gugle was duplicated for all of these bridges, except for only during those peak hours of 11:00-13:00 and 15:30-17:30 and they were all done during the week.

Number	Bridge
1	Ponte della Costituizone
2	Ponte delle Guglie
3	Ponte de I'Anconeta
4	Ponte de I'Olio
5	Ponte de I'Ovo
6	Ponte dei Bareteri
7	Ponte de le Ostreghe
8	Ponte della Paglia

Table 1: Key for 2013 Bridge Locations

Figure 38: Locations of 2013 Bridge Traffic Counts

For some of the those bridges within the San Marco area, numbers 4-8, there were also weekend counts done in order to show how congestion differs during the week versus the weekend. The same peak hours were used as for the weekend. However, not all of the counts were able to be done for all of the bridges because of time constraints. Table 2 shows which times and days each of the bridges had data collected on them.

Bridge	Weekday (11:00-13:00)	Weekday (13:30-15:30)	Weekend (11:00-13:00)	Weekend (13:30-15:30)
Ponte della Costituzione	X	X		
Ponte delle Guglie	X	X		
Ponte de l'Anconeta	X	X		
Ponte de l'Olio				X
Ponte de l'Ovo	X	X	X	X
Ponte dei Bareteri	X	X	X	X

Ponte de le Ostreghe		X	X	X
Ponte della Paglia				X

Table 2: Days and Times for Data Collection for Specific Bridges

6.2.2 Results

For this current year, the counts were broken up both by two time brackets, 11:00-13:00 or 15:30-17:30, and by time of the week, weekday or weekend. Similarly to the past bridge counts, this year's counts were streamlined in the same format as before and converted into hourly and maxima. Because of the nature of hourly counts, the second peak time bracket, 15:30-17:30, was changed into 15:00-18:00 for all purposes of analyzing. All of the raw counts, hourly counts, and table of the morning/evening maxima can be found in Appendix B i-iv.

Figure 39 shows the weekend morning results done in the Cannaregio area, including Ponte della Constituzione, Ponte delle Gugle, and Ponte de l'Anconeta. This graphic shows that most pedestrians are heading away from Piazzale Roma and Ferrovia towards Strada Nuova in order to get closer to the center of the city and San Marco. There is a clear direction for all of these bridges. Also, for the tourist percentage breakdown, most of these bridges show a 50-67% dominance of tourists over Venetians.

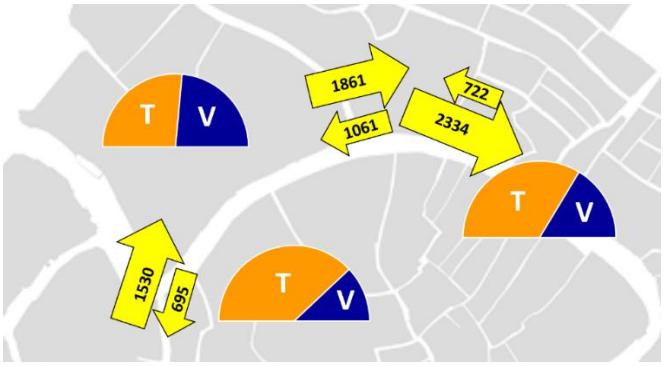

Figure 39: Cannaregio Weekday Morning Bridge Counts (11:00-13:00)

Figure 40 shows the weekend evening results done in the Cannaregio area, including Ponte della Constituzione, Ponte delle Gugle, and Ponte de l'Anconeta. This graphic shows that most pedestriants are heading towards Ferrovia in order to exit the city through the train station, although there is still a high number of pedestrians also heading towards Piazzale Roma in order to take the bus home or to a hotel or even the airport. In these counts, there were some close numbers for each bridge, so pedestrians were heading in both directions of the bridge pretty frequently and equally. The tourist

percentage breakdown is fairly similar to that of the weekend morning counts with a slight increase in the percentage of Venetians crossing these bridges at this time.

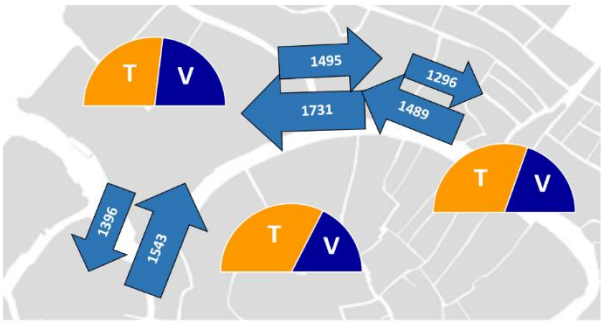

Figure 40: Cannaregio Weekday Evening Bridge Counts (15:00-18:00)

Figure 41 shows the weekday morning results done in the San Marco area, including Ponte de l'Ovo and Ponte dei Bareteri. This graphic shows that most pedestrians are heading away from Rialto and towards either Ponte della Accademia or San Marco. There is a pretty even distribution of tourists heading in both directions over the bridge at this point, although there is a definite lean towards heading towards San Marco at this time. The tourist percentage breakdown is split. On one hand, more Venetians are heading towards Ponte della Accademia at this time while more tourists are heading towards San Marco. In both cases, the dominant part in over 67% dominant so the split is very definite in this case.

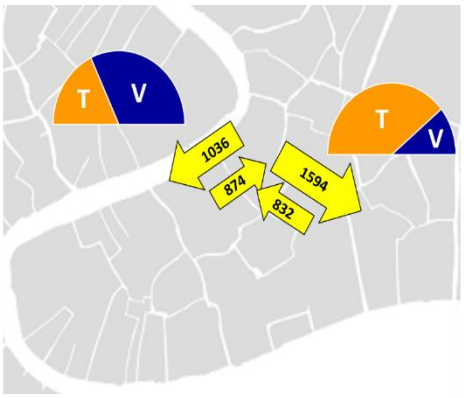

Figure 41: San Marco Weekday Morning Bridge Count (11:00-13:00)

Figure 42 shows the weekday evening results done in the San Marco area, including Ponte de l'Ovo, Ponte de le Ostreghe, and Ponte dei Bareteri. This graphic shows that most pedestrians are heading towards Rialto or along the waterfront towards Ponte della Accademia. For Ponte de le Ostreghe, there are not a lot of people crossing the bridge, but there is definitely more tourists crossing, mainly due to the amount of hotel in the area. As for the other two bridges, there is a clear dominance of people heading towards Rialto versus the other direction and, again, more Venetians were headed over Ponte de l'Ovo versus more tourists heading over Ponte dei Bareteri. Both were clear dominances of their respective breakdowns.

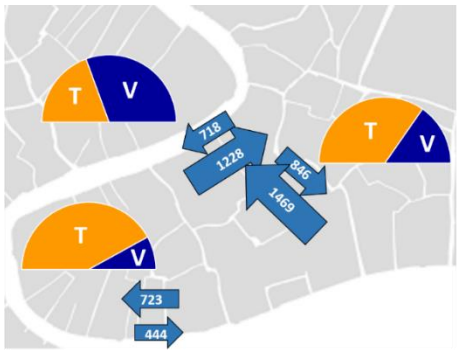

Figure 42: San Marco Weekday Evening Counts (15:00-18:00)

Figure 43 shows the weekend morning results done in the San Marco area, including Ponte de l'Ovo, Ponte de le Ostreghe, and Ponte dei Bareteri. This graphic shows that most pedestrians are heading towards Rialto at this time, or along the waterfront in either direction. There is an even split of pedestrians headed in both direction for Ponte de le Ostreghe , and, for the other two bridges, although there is a clear dominance of which direction people are heading, there is still a high amount of people headed the other direction as well. On all of the bridges, there is an overwhelming amount of tourists crossing the bridges versus Venetians. This is to be expected on the weekends, when more people are able to travel and visit.

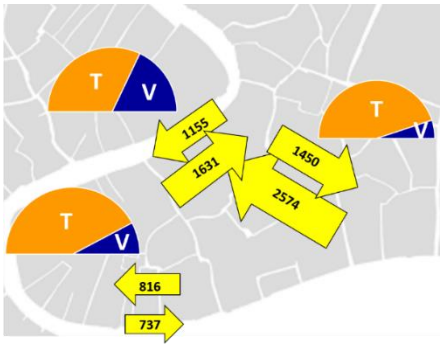

Figure 43: San Marco Weekend Morning Bridge Counts (11:00-13:00)

Figure 44 shows the weekend evening results done in the San Marco area, including Ponte de l'Ovo, Ponte de le Ostreghe, Ponte dei Bareteri, Ponte de l'Olio, and Ponte della Paglia. This graphic shows pedestrians heading in every different direction within San Marco, and in high volumes, however, the majority of the pedestrians are heading towards Rialto and Strada Nuova, as well as along the waterfront towards Ponte della Accademia. In most places, there is a clear dominace in the direction of the flow of pedestrians, but near Rialto towards Strada Nuova, there is a huge mix of people heading in all directions. What is definitely clear is the overwhelming dominance of tourists over Venetians, even more so than the morning. At this point in time, tourists are everywhere, looking at all of the sights, and Venetians are almost nowhere to be found, except for near Cannaregio on Ponte de l'Olio.

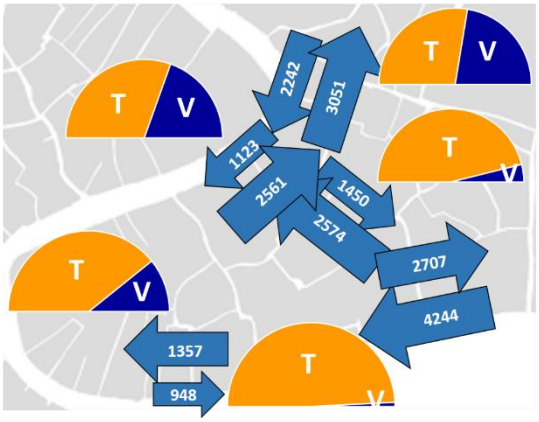

Figure 44: San Marco Weekend Evening Bridge Count (15:00-18:00)

Now, to compare to the past bridge counts, our group also extracted the maximum number of people that crossed each bridge at a particular hour and placed into flow graphics to show how pedestrians flow throughout the city. Again, it was broken up into morning and evening images. Figure 45 shows the flow of movement of pedestrians throughout the city during the morning. This graphic is very similar to that of the past bridge counts in that pedestrians are moving away from Piazzale Roma into the center of the city, although from there it is different than the past. This year's counts shows pedestrians moving away from Rialto rather than towards it, however the greatest congestion of people is still Piazzale Roma and Strada Nuova.

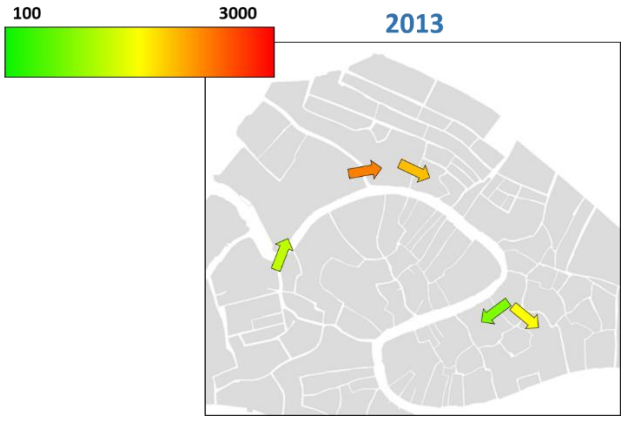

Figure 45: 2013 Pedestrian Flow (7:00-12:00)

Figure 46 shows the flow of movement of pedestrians throughout the city during the afternoon/evening. This graphic is differnet that that of the past bridge counts. In this year's graphic, pedestrians are heading towards Piazzale Roma, Ferrova, and, within San Marco, Ponte dei Rialto. There are differences in the way pedestrians move around Piazzale Roma, but the concentrations of people near Ferrovia and San Marco are similar to the past bridge counts. Most people are headed towards Rialto to Ferrovia in order to exit the city, or walking along the waterfront towards Ponte della Accademina.

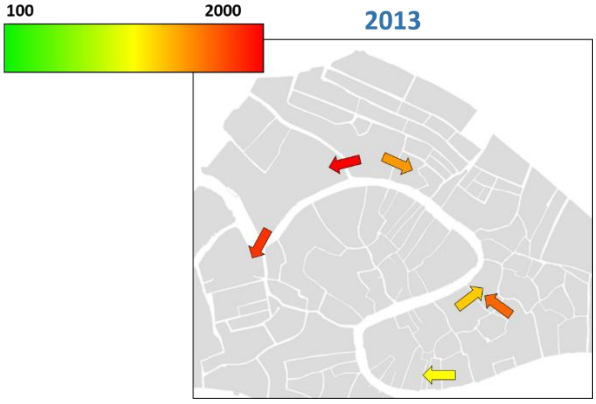

Figure 46: 2013 Pedestrian Flow (13:00-19:00)

6.3 Defining Congestion: Level of Service in Venice

Level of Service is a standard of measure that was first established in the Highway Capacity Manual (HCM) by the Transportation Research Board in 1950. It served as a way of grading civil infrastructures, mainly highways, to see if they were safe and fit for use. The highways were given a

grade, A-F, based on the ease and flow of traffic. Since then, Level of Service (LOS) has been developed for other modes of transportation, including public transportation and pedestrian infrastructures. [23]

The pedestrian LOS defined by the HCM provides a standardized method for pedestrian analysis. It is calculated by counting pedestrians who cross a point over a certain period of time (the HCM suggests collecting pedestrian flow for 15 min intervals) reducing the total to pedestrians per minute then dividing by the effective width of the pedestrian walkway. This calculation gives the flow rate, which can then be looked up in the table (Figure 27) to determine the pedestrian LOS grade.[24]

LOS	Space (m^2/p)	Flow Rate (p/min/m)	Speed (m/s)
A	> 5.6	> 16.4	> 1.3
B	> 3.7-5.6	> 16.4-23.0	> 1.27-1.3
C	> 2.2-3.7	> 23.0-32.8	> 1.22-1.27
D	> 1.4-2.2	> 32.8-49.2	> 1.14-1.22
E	> 0.7-1.4	> 49.2-75.5	> 0.76-1.14
F	≤ 0.7	variable	≤ 0.76

Figure 47: LOS Table

The LOS grades range from A, at which traffic is flowing freely, to F, where there is virtually no possible movement. For a walkway at LOS A pedestrians move in desired paths without altering movements or changings speeds because there are no pedestrians impeding flow. At LOS B there is still sufficient space, speeds are still freely selected but paths must be chosen to avoid other pedestrians. At LOS C bypassing pedestrians begins to become restricted in multidirectional streams, crossing may cause minor conflicts and flow rate and speed are somewhat impeded. At LOS D crossing the stream or bypassing pedestrians is restricted and cause frequent changes to speed and position, flow is still fluid but contact between pedestrians is likely. At LOS E all pedestrians' speeds and movements are restricted, it is not possible to pass slower pedestrians, the walkway's capacity is nearly reached and stoppages in flow are to be expected. At LOS F walking speeds are restricted to a shuffle, there is unavoidable frequent contact with other pedestrians, and flow is sporadic and similar to pedestrian queuing rather than a stream.[25]

[23] Bloomberg, M. R., & Burden, A. M. (April 2006). New York City Pedestrian Level of Service Study Phase I. New York City: New York City Transportation Division.

[24] Ibid

[25] Ibid

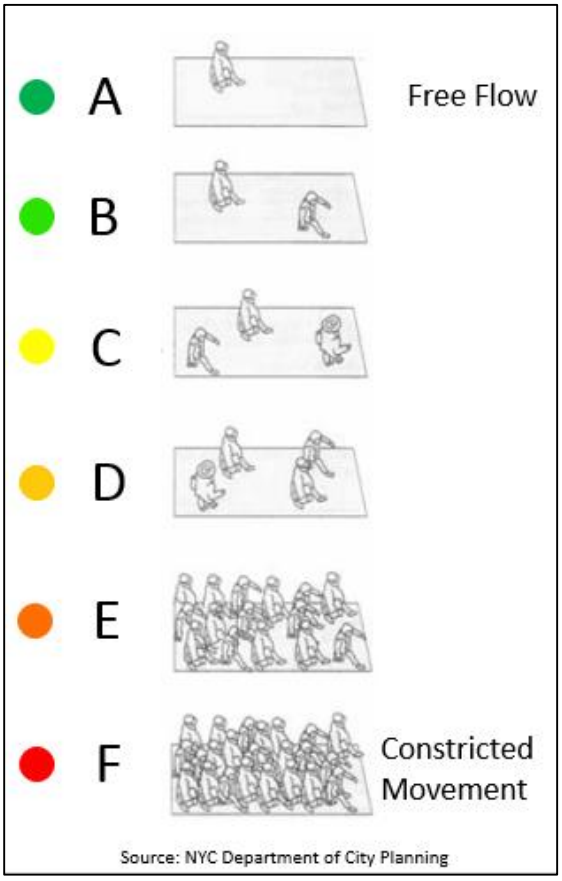

Figure 48: LOS Grades

In order to translate these LOS grades to an application in Venice our group created several visualizations on how changes in LOS could affect life in Venice. First, we looked at how impediments to mobility, from the pedestrian infrastructure chapter of our report, would affect LOS. Plateatici, the seating that restaurants put out on walkways, severely affect LOS. With every additional row of seating the LOS grade decreases.

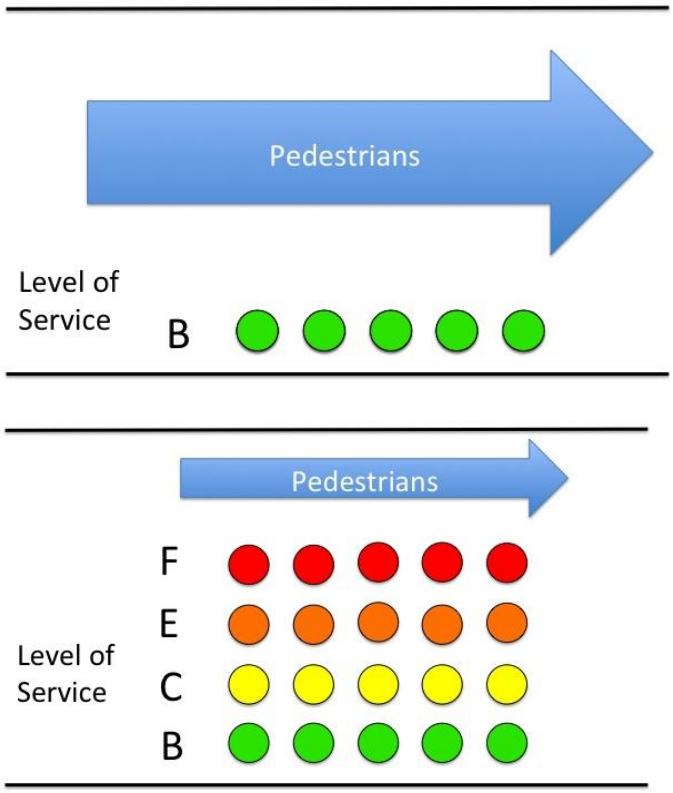

Figure 49: Plateateici Effect on LOS

Next we looked at how a change in LOS could affect daily travels in Venice. We looked at walking from the Rialto Bridge to the San Zaccaria boat stop.

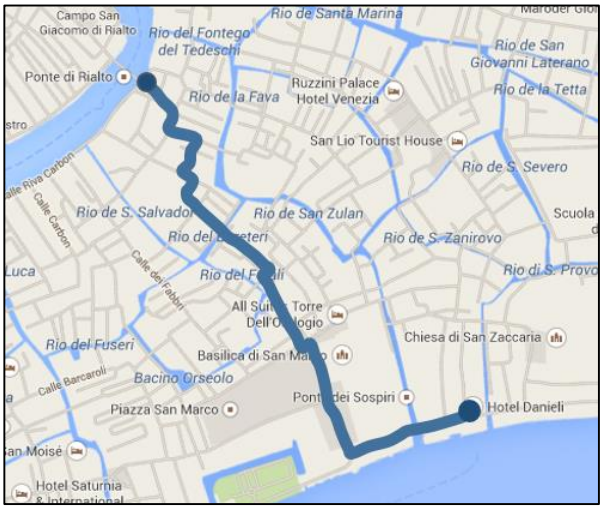

Figure 50: Route Map

This route – 850 m, at LOS A, takes a mere ten minutes to travel, according to google maps. We calculated how long this route would take at each LOS base off the walking speeds give for each LOS in the table in Figure ####. The graphic below shows the times for each LOS. LOS F more than doubles the amount of time it would take to reach the destination.

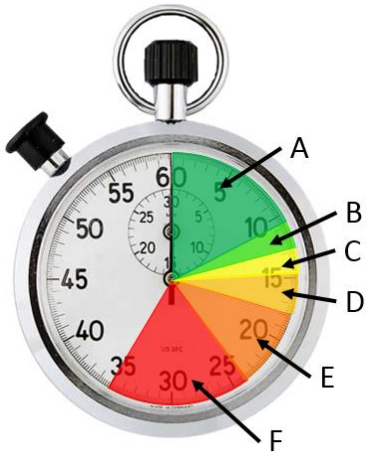

Figure 51: LOS Time Comparison

Next we looked at this same route, but only walking for ten minutes at each level of service. At LOS A the destination is reached, however, at LOS F the pedestrian would make it less than halfway to the destination.

Figure 52: LOS Distance Comparison

These graphics gave us a reference point and visualization of how changes in LOS would affect Venice life both for tourists and Venetians alike.

6.3.1 Calculating Level of Service in Venice

Our group used the LOS grading to draw conclusions in Venice. We used our data collected at bridges to calculate level of service by dividing the total number of people who crossed the bridge in a 15 minute period by 15 minutes, to get people per minute, then by the width of the bridge. This gave us people per minute per meter, which one of the LOS scales is based on. We were then able to give each bridge a grade for current LOS. All LOS for the month of November were in the A-B range, appendix D.

Using the COSES report table of demographics of Venice by month, we were able to scale our data to the peak month by multiplying the total tourists and total venetians each by their percent increase, see appendix D.[26] We then recalculated LOS for the peak month on each of the bridges. This showed a somewhat significant change in LOS, some bridges changed to as bad as a D, appendix D.

Month	Tourists	% of Average
January	32,000	60.7
February	41,000	77.7
March	39,000	73.9
April	56,000	106.2
May	57,000	108.1
June	62,000	117.5
July	65,000	123.2
August	70,000	132.7
September	71,000	134.6
October	69,000	130.8
November	38,000	72.0
December	33,000	62.6

Table 3: COSES Monthly Tourism Stats

From this peak data we went one step further to calculate probable LOS at times in the past, as well as predict future LOS based on tourism and population numbers. First we analyzed trends in tourism and residence from 1950 to 2005, as this was the longest period of time for which we had reliable figures.[27] Based on our analysis we were able to develop equations that approximated the trends shown by the data. For tourists, including both excursionists, or day trippers, and overnight tourists, we found that the following equation best approximated the trend.

[26] Scaramuzzi, I., Di Monte, G., Pedenzini, C., & Santoro, G. (March 2009). COSES Report: Sustainable Tourism for Venice. Venice, Italy: Venice Government and Department of Tourist Strategies.

[27] Scheppe, Wolfgang et al, Migropolis: Venice/Atlas of a Global Situation Vol. I., 2009.

$$y = 63.569x^3 - 3971.7x^2 + 173396x + 2E+06$$

For residents of Venice, a different equation was needed. We eventually settled on the following equation, but as we do not have data on commuters and other non-resident locals we were not able to include them in our estimations.

$$y = 173000e^{-0.02x}$$

The data that was used to generate each equation and is included in appendix C.

Next, we calculated the total flow at each location by scaling our numbers based on the percent change between the year for which we had data and the year to be calculated. For years from 1950 until 2005 the actual numbers of tourists for that year was used, for years after 2005 the projected number of tourists was used to scale the traffic. All of this data was then presented on a web-app visualization and interpretation of the data more accessible.

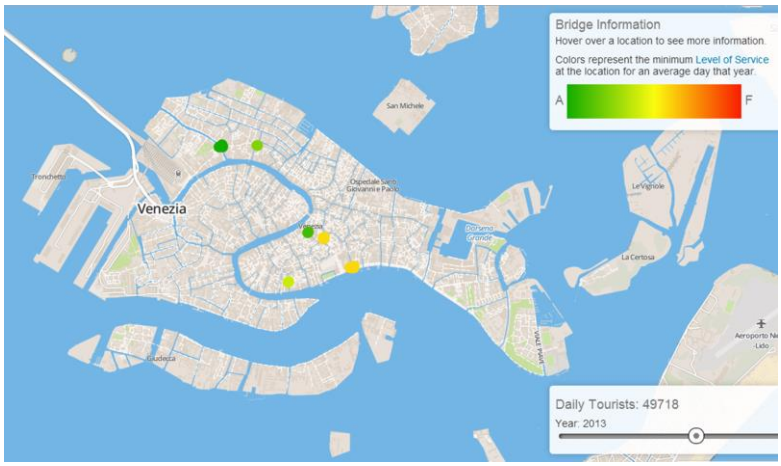

Figure 53: LOS App – 2013

This data visualization tool allows users to see how changes on tourism and population become changes in pedestrian congestion. Upon opening the page, it shows the present day levels of congestion, with the colors based on our A to F three color gradient. Hovering over a bridge pulls up more detailed information in the top right hand corner, giving facts such as the name of the bridge, and the year in which the data was collected. Additionally, the app is able to show the projected congestion for years other than when data was collected. Below is an image showing how the colors on the map change for the first year for which we give information, 1950.

Figure 54: LOS App – 1950

Although tourism and residency information is available only up until 2005, general trends can be found and used to predict future congestion. Based on our analysis the app will display what congestion would be like in the next four decades if tourism numbers continue to follow current trends.

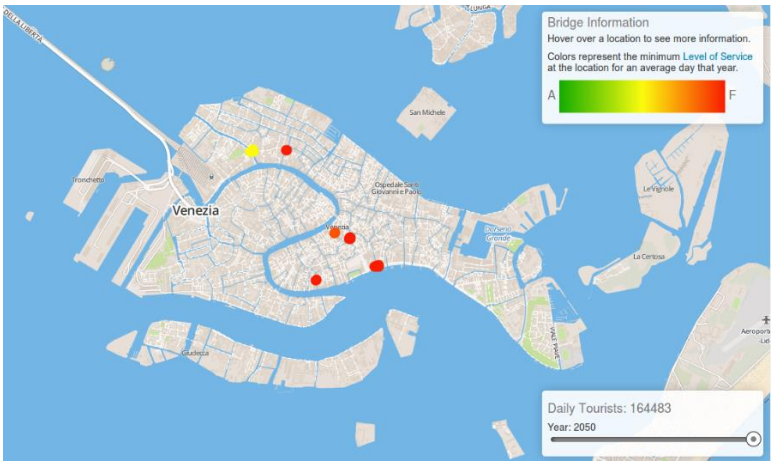

Figure 55: LOS App - 2050

6.4 Pedestrian Traffic Conclusion and Recommendations

We have shown how pedestrians flow throughout the city, both in the morning and evening, using data collected in this year as well as the past 5 years. This has shown that, in the morning, pedestrians flow away from points of entry such as Piazzale Roma and the train station and head through into the center of the city and congregate between San Marco and Rialto. In the evening, pedestrians flow all throughout San Marco and Rialto, but mainly head towards Rialto and Piazzale Roma in order to exit the city. Pedestrians also flow along the waterfront heading towards Ponte della Accademia. This group has also shown that, at the moment, there is a decent amount of congestion within the city but, the city will

probably reach failing levels of congestion within the next couple of decades if the current rate of tourism continues to increase. Our recommendation to future groups is to count pedestrians for 15 minute increments from 11:00-1300 and 16:00-18:00 on all bridges or bottlenecks along the main arteries of Venice. By doing so the groups will be able to calculate LOS for the main thoroughfares of Venice, where LOS is most will most likely deteriorate the fastest. After doing so the data should be incorporated into the LOS application in order to better visualize the changes in LOS. Future groups should also update the counts done on bridges for this year and update the trend lines that are used to predict future tourism and residence numbers with any more recent tourism or local statistics in order to ensure an accurate prediction of future levels of service. All data collected in the form of bridge counts should be incorporated into the spreadsheet that streamlines the data in order to keep consistency throughout the years. This data should, eventually, be incorporated into the CityKnowledge console and the Venipedia pages about each bridge.

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Appendices

A. Past Bridge Counts

i. Maximums- One Direction

Bridge Name	Year	Start	End	From Island Name	To Island Name	Max Tourists	Max Locals	Maximum Total Per Hour
Ponte San Paternian	2011	16:00	17:00	San Luca	Sant'Anzolo			50.6667
Ponte del Teatro	2011	9:00	10:00	San Luca	Sant'Anzolo			112
Ponte San Basegio	2012	13:00	14:00	Carmini	San Sebastiano			161
Ponte San Chiara	2012	8:00	9:00	Giardini Papadopoli	Piazzale Roma	140	148	288
Ponte de la Maddalena	2012	8:00	9:00	Carmini	San Sebastiano			160
Ponte de la Ca'di Dio	2009	10:00	11:00	San Martin	Bragora			324
Ponte Dei Fuseri	2010	11:00	12:00	San Luca	San Marco	144	192	336
Ponte Molin della Stazione Marittima	2012	13:00	14:00	Carmini	San Sebastiano			192
Ponte de la Piova	2012	13:00	14:00	San Nicolò dei Mendicoli	San Sebastiano			399
Ponte De Le Ostreghe	2010	11:00	12:00	San Moisè	Santa Maria Zobenigo	244	180	424
Ponte Della Canonica	2010	16:00	17:00	San Filippo e Giacomo	San Marco	220	252	472
Ponte dei Frati	2010	16:00	17:00	Sant'Anzolo	Santo Stefano	260	368	628
Ponte de la Veneta Marina	2009	14:00	15:00	Arsenale	San Martin			727.5
Ponte Dei Bareteri	2010	17:00	18:00	San Bortolomio	San Marco	432	296	728
Ponte dei Scalzi	2009	8:30	8:50	San Geremia	Toletini			819
Ponte della Madoneta	2009	9:00	10:00	Meloni	San Polo			910.5
Ponte L'Ovo	2009	9:00	10:00	San Bortolomio	San Luca			1012.5
Ponte de la Cortesia	2011	14:00	15:00	Sant'Anzolo	San Luca			1233
Ponte Dell'Accademia	2009	18:00	19:00	Accademia	Santo Stefano			1117

Ponte de Rialto	2009	12:00	13:00	San Silvestro	San Bortolomio			1125
Ponte Sant'Antonio	2010	16:00	17:00	Santa Maria della Fava	San Bortolomio	536	620	1156
Ponte Santi Apostali	2009	10:00	11:00	San Cancian	Santi Apostoli			1254
Ponte della Paglia	2009	16:00	17:00	San Filippo e Giacomo	San Marco			1419
Ponte Papadopoli	2011	7:00	8:00	Giardini Papadopoli	Piazzale Roma			1310
Ponte San Moisè	2011	18:00	19:00	San Marco	San Moisè			1824
Ponte Nuovo di San Felice	2009	12:00	13:00	San Felice	Santi Apostoli			1890
Ponte Dei Tre Ponti	2012	17:00	18:00	Piazzale Roma	Santa Maria Maggiore	119	1920	2039
Ponte de le Guglie	2009	9:00	10:00	San Geremia	San Leonardo			2577.6
Ponte della Costituzione	2012	8:00	9:00	Piazzale Roma	San Geremia	112	2657	2769

ii. Maximums- Morning (7:00-13:00)

Bridge Name	Date/Year	Start Time	End Time	From Island Name	To Island Name	Max Tourists	Max Locals	Maximum Total Per Hour
Ponte San Paternian	2011	9:00	10:00	Sant'Anzolo	San Luca			38
Ponte del Teatro	2011	9:00	10:00	San Luca	Sant'Anzolo			112
Ponte San Basegio	2012	8:00	9:00	Carmini	San Sebastiano			125
Ponte Molin della Stazione Marittima	2012	9:00	10:00	Carmini	San Sebastiano			186
Ponte de la Piova	2012	8:00	9:00	San Nicolò dei Mendicoli	San Sebastiano			273
Ponte de la Maddalena	2012	8:00	9:00	Carmini	San Sebastiano			285
Ponte San Chiara	2012	8:00	9:00	Giardini Papadopoli	Piazzale Roma	63	37	288
Ponte de la Ca'di Dio	2009	10:00	11:00	San Martin	Bragora			324
Ponte Dei Fuseri	2010	11:00	12:00	San Luca	San Marco	36	48	336
Ponte Della Canonica	2010	10:00	11:00	San Marco	San Filippo e Giacomo	31	65	384

Ponte De Le Ostreghe	2010	11:00	12:00	San Moisè	Santa Maria Zobenigo	61	45	424
Ponte de la Cortesia	2011	11:00	12:00	Sant'Anzolo	San Luca			426
Ponte dei Frati	2010	10:00	11:00	Santo Stefano	Sant'Anzolo	28	94	488
Ponte de la Veneta Marina	2009	10:00	11:00	San Martin	Arsenale			586
Ponte Dell'Accademia	2009	11:00	12:00	Accademia	Santo Stefano			638
Ponte dei Bareteri	2009	9:00	10:00	San Marco	San Bortolomio			676.5
Ponte dei Scalzi	2009	8:30	8:50	San Geremia	Toletini			819
Ponte Sant'Antonio	2010	10:00	11:00	San Bortolomio	Santa Maria della Fava	36	172	832
Ponte della Madoneta	2009	9:00	10:00	Meloni	San Polo			910.5
Ponte della Paglia	2009	11:00	12:00	San Filippo e Giacomo	San Marco			994.5
Ponte de Rialto	2009	11:00	12:00	San Bortolomio	San Silvestro			1009.5
Ponte del'Ovo	2010	11:00	12:00	San Luca	San Bortolomio	74	190	1056
Ponte Santi Apostali	2009	10:00	11:00	San Cancian	Santi Apostoli			1254
Ponte San Moisè	2011	11:00	12:00	San Marco	San Moisè			1462
Ponte Papadopoli	2011	7:00	8:00	Giardini Papadopoli	Piazzale Roma			1598
Ponte Dei Tre Ponti	2012	8:00	9:00	Santa Maria Maggiore	Piazzale Roma	0	525	1918
Ponte de le Guglie	2009	9:00	10:00	San Geremia	San Leonardo			2577.6
Ponte della Costituzione	2012	8:00	9:00	Piazzale Roma	San Geremia	59	508	2779

iii. Maximums- Evening (13:00-19:00)

Bridge Name	Date/Year	Start Time	End Time	From Island Name	To Island Name	Max Tourists	Max Locals	Maximum Total Per Hour
Ponte San Paternian	2011	16:00	17:00	San Luca	Sant'Anzolo			50.6667
Ponte del Teatro	2011	15:00	16:00	San Luca	Sant'Anzolo			105

Ponte San Basegio	2012	13:00	14:00	Carmini	San Sebastiano			161
Ponte San Chiara	2012	18:00	19:00	Piazzale Roma	Giardini Papadopoli	0	36	250
Ponte Molin della Stazione Marittima	2012	13:00	14:00	Carmini	San Sebastiano			192
Ponte Dei Fuseri	2010	17:00	18:00	San Marco	San Luca	49	26	300
Ponte de la Maddalena	2012	13:00	14:00	Carmini	San Sebastiano			318
Ponte de la Piova	2012	13:00	14:00	San Nicolò dei Mendicoli	San Sebastiano			399
Ponte De Le Ostreghe	2010	13:00	14:00	San Moisè	Santa Maria Zobenigo	59	41	400
Ponte Della Canonica	2010	16:00	17:00	San Filippo e Giacomo	San Marco	55	63	472
Ponte dei Frati	2010	16:00	17:00	Sant'Anzolo	Santo Stefano	65	92	628
Ponte de la Veneta Marina	2009	14:00	15:00	Arsenale	San Martin			727.5
Ponte Dei Bareteri	2010	17:00	18:00	San Bortolomio	San Marco	108	74	728
Ponte Papadopoli	2012	17:00	18:00	Piazzale Roma	Giardini Papadopoli	18	279	816
Ponte del'Ovo	2010	17:00	18:00	San Luca	San Bortolomio	76	140	864
Ponte Santi Apostali	2009	12:00	13:00	Santi Apostoli	San Cancian			993
Ponte de la Cortesia	2011	14:00	15:00	Sant'Anzolo	San Luca			1077.333
Ponte de Rialto	2009	13:00	14:00	San Silvestro	San Bortolomio			1093.5
Ponte Dell'Accademia	2009	18:00	19:00	Accademia	Santo Stefano			1117
Ponte Sant'Antonio	2010	16:00	17:00	Santa Maria della Fava	San Bortolomio	134	155	1156
Ponte della Paglia	2009	16:00	17:00	San Filippo e Giacomo	San Marco			1419
Ponte della Costituzione	2012	17:00	18:00	Piazzale Roma	San Geremia	63	256	1630
Ponte San Moisè	2011	14:00	15:00	San Marco	San Moisè			1887
Ponte Nuovo di San Felice	2009	12:00	13:00	San Felice	Santi Apostoli			1890

Ponte Dei Tre Ponti	2012	17:00	18:00	Piazzale Roma	Santa Maria Maggiore	36	526	2039

B. 2013 Bridge Counts

i. Raw Data

Bridge Name	Date/Year	Start Time	End Time	From Island Name	To Island Name	Tourists	Locals	Total
Ponte della Guglie	2013	7:10	7:25	San Leonardo	San Geremia	5	94	99
Ponte della Guglie	2013	7:10	7:25	San Geremia	San Leonardo	14	233	247
Ponte della Guglie	2013	7:30	7:45	San Leonardo	San Geremia	32	124	156
Ponte della Guglie	2013	7:30	7:45	San Geremia	San Leonardo	26	428	454
Ponte della Guglie	2013	7:50	8:05	San Leonardo	San Geremia	15	185	200
Ponte della Guglie	2013	7:50	8:05	San Geremia	San Leonardo	24	425	449
Ponte della Guglie	2013	8:10	8:25	San Leonardo	San Geremia	44	165	209
Ponte della Guglie	2013	8:10	8:25	San Geremia	San Leonardo	18	355	373
Ponte della Guglie	2013	8:30	8:45	San Leonardo	San Geremia	68	142	210
Ponte della Guglie	2013	8:30	8:45	San Geremia	San Leonardo	53	357	410
Ponte della Guglie	2013	8:50	9:05	San Leonardo	San Geremia	120	93	213
Ponte della Guglie	2013	8:50	9:05	San Geremia	San Leonardo	68	246	314
Ponte della Guglie	2013	9:10	9:25	San Leonardo	San Geremia	69	92	161
Ponte della Guglie	2013	9:10	9:25	San Geremia	San Leonardo	65	291	356
Ponte della Guglie	2013	9:30	9:45	San Leonardo	San Geremia	109	88	197
Ponte della Guglie	2013	9:30	9:45	San Geremia	San Leonardo	81	234	315
Ponte della Guglie	2013	9:50	10:05	San Leonardo	San Geremia	102	162	264
Ponte della Guglie	2013	9:50	10:05	San Geremia	San Leonardo	188	272	460
Ponte della Guglie	2013	10:10	10:25	San Leonardo	San Geremia	86	127	213
Ponte della Guglie	2013	10:10	10:25	San Geremia	San Leonardo	210	301	511
Ponte della Guglie	2013	10:30	10:45	San Leonardo	San Geremia	108	110	218

Ponte della Guglie	2013	10:30	10:45	San Geremia	San Leonardo	250	266	516
Ponte della Guglie	2013	10:50	11:05	San Leonardo	San Geremia	92	109	201
Ponte della Guglie	2013	10:50	11:05	San Geremia	San Leonardo	299	259	558
Ponte della Guglie	2013	11:10	11:25	San Leonardo	San Geremia	122	106	228
Ponte della Guglie	2013	11:10	11:25	San Geremia	San Leonardo	264	212	476
Ponte della Guglie	2013	11:30	11:45	San Leonardo	San Geremia	134	144	278
Ponte della Guglie	2013	11:30	11:45	San Geremia	San Leonardo	263	247	510
Ponte della Guglie	2013	11:50	12:05	San Leonardo	San Geremia	140	169	309
Ponte della Guglie	2013	11:50	12:05	San Geremia	San Leonardo	299	209	508
Ponte della Guglie	2013	12:10	12:25	San Leonardo	San Geremia	143	139	282
Ponte della Guglie	2013	12:10	12:25	San Geremia	San Leonardo	233	248	481
Ponte della Guglie	2013	12:30	12:45	San Leonardo	San Geremia	160	128	288
Ponte della Guglie	2013	12:30	12:45	San Geremia	San Leonardo	257	184	441
Ponte della Guglie	2013	12:50	13:05	San Leonardo	San Geremia	111	95	206
Ponte della Guglie	2013	12:50	13:05	San Geremia	San Leonardo	191	184	375
Ponte della Guglie	2013	13:10	13:25	San Leonardo	San Geremia	239	109	348
Ponte della Guglie	2013	13:10	13:25	San Geremia	San Leonardo	184	126	310
Ponte della Guglie	2013	13:30	13:45	San Leonardo	San Geremia	206	113	319
Ponte della Guglie	2013	13:30	13:45	San Geremia	San Leonardo	210	72	282
Ponte della Guglie	2013	13:50	14:05	San Leonardo	San Geremia	250	73	323
Ponte della Guglie	2013	13:50	14:05	San Geremia	San Leonardo	192	167	359
Ponte della Guglie	2013	14:10	14:25	San Leonardo	San Geremia	270	97	367
Ponte della Guglie	2013	14:10	14:25	San Geremia	San Leonardo	200	89	289

Ponte della Guglie	2013	14:30	14:45	San Leonardo	San Geremia	245	52	297
Ponte della Guglie	2013	14:30	14:45	San Geremia	San Leonardo	165	96	261
Ponte della Guglie	2013	14:50	15:05	San Leonardo	San Geremia	281	79	360
Ponte della Guglie	2013	14:50	15:05	San Geremia	San Leonardo	184	157	341
Ponte della Guglie	2013	15:10	15:25	San Leonardo	San Geremia	249	75	324
Ponte della Guglie	2013	15:10	15:25	San Geremia	San Leonardo	123	141	264
Ponte della Guglie	2013	15:30	15:45	San Leonardo	San Geremia	298	101	399
Ponte della Guglie	2013	15:30	15:45	San Geremia	San Leonardo	157	125	282
Ponte della Guglie	2013	15:50	16:05	San Leonardo	San Geremia	315	91	406
Ponte della Guglie	2013	15:50	16:05	San Geremia	San Leonardo	174	148	322
Ponte della Guglie	2013	16:10	16:25	San Leonardo	San Geremia	248	181	429
Ponte della Guglie	2013	16:10	16:25	San Geremia	San Leonardo	363	166	529
Ponte della Guglie	2013	16:30	16:45	San Leonardo	San Geremia	283	231	514
Ponte della Guglie	2013	16:30	16:45	San Geremia	San Leonardo	176	204	380
Ponte della Guglie	2013	16:50	17:05	San Leonardo	San Geremia	318	291	609
Ponte della Guglie	2013	16:50	17:05	San Geremia	San Leonardo	160	266	426
Ponte della Guglie	2013	17:10	17:25	San Leonardo	San Geremia	251	195	446
Ponte della Guglie	2013	17:10	17:25	San Geremia	San Leonardo	150	265	415
Ponte della Guglie	2013	17:30	17:45	San Leonardo	San Geremia	203	206	409
Ponte della Guglie	2013	17:30	17:45	San Geremia	San Leonardo	145	241	386
Ponte della Guglie	2013	17:50	18:05	San Leonardo	San Geremia	146	212	358
Ponte della Guglie	2013	17:50	18:05	San Geremia	San Leonardo	140	218	358
Ponte della Guglie	2013	18:10	18:25	San Leonardo	San Geremia	172	215	387

Ponte della Guglie	2013	18:10	18:25	San Geremia	San Leonardo	204	234	438
Ponte della Guglie	2013	18:30	18:45	San Leonardo	San Geremia	108	147	255
Ponte della Guglie	2013	18:30	18:45	San Geremia	San Leonardo	187	336	523
Ponte della Guglie	2013	18:50	19:05	San Leonardo	San Geremia	136	146	282
Ponte della Guglie	2013	18:50	19:05	San Geremia	San Leonardo	210	207	417
Ponte de l'Anconeta	2013	11:10	11:25	Maddalena	San Leonardo	51	115	166
Ponte de l'Anconeta	2013	11:10	11:25	San Leonardo	Maddalena	303	112	415
Ponte de l'Anconeta	2013	11:30	11:45	Maddalena	San Leonardo	93	119	212
Ponte de l'Anconeta	2013	11:30	11:45	San Leonardo	Maddalena	372	116	488
Ponte de l'Anconeta	2013	11:50	12:05	Maddalena	San Leonardo	56	101	157
Ponte de l'Anconeta	2013	11:50	12:05	San Leonardo	Maddalena	453	156	609
Ponte de l'Anconeta	2013	12:10	12:25	Maddalena	San Leonardo	71	126	197
Ponte de l'Anconeta	2013	12:10	12:25	San Leonardo	Maddalena	559	188	747
Ponte de l'Anconeta	2013	12:30	12:45	Maddalena	San Leonardo	80	98	178
Ponte de l'Anconeta	2013	12:30	12:45	San Leonardo	Maddalena	494	146	640
Ponte de l'Anconeta	2013	12:50	13:05	Maddalena	San Leonardo	84	88	172
Ponte de l'Anconeta	2013	12:50	13:05	San Leonardo	Maddalena	467	135	602
Ponte de l'Anconeta	2013	14:35	14:50	Maddalena	San Leonardo	266	176	442
Ponte de l'Anconeta	2013	14:35	14:50	San Leonardo	Maddalena	362	133	495
Ponte de l'Anconeta	2013	14:55	15:10	Maddalena	San Leonardo	250	170	420
Ponte de l'Anconeta	2013	14:55	15:10	San Leonardo	Maddalena	300	83	383
Ponte de l'Anconeta	2013	16:10	16:25	Maddalena	San Leonardo	185	111	296
Ponte de l'Anconeta	2013	16:10	16:25	San Leonardo	Maddalena	174	96	270

Ponte de l'Anconeta	2013	16:30	16:45	Maddalena	San Leonardo	193	200	393
Ponte de l'Anconeta	2013	16:30	16:45	San Leonardo	Maddalena	177	94	271
Ponte de l'Anconeta	2013	16:50	17:05	Maddalena	San Leonardo	188	135	323
Ponte de l'Anconeta	2013	16:50	17:05	San Leonardo	Maddalena	139	68	207
Ponte de l'Anconeta	2013	17:10	17:25	Maddalena	San Leonardo	211	175	386
Ponte de l'Anconeta	2013	17:10	17:25	San Leonardo	Maddalena	226	175	401
Ponte de l'Anconeta	2013	17:30	17:45	Maddalena	San Leonardo	174	166	340
Ponte de l'Anconeta	2013	17:30	17:45	San Leonardo	Maddalena	123	133	256
Ponte de l'Anconeta	2013	17:50	18:05	Maddalena	San Leonardo	161	158	319
Ponte de l'Anconeta	2013	17:50	18:05	San Leonardo	Maddalena	80	114	194
Ponte de l'Olio	2013	15:30	15:45	San Bortolomio	San Zuane Grisostomo	141	186	327
Ponte de l'Olio	2013	15:30	15:45	San Zuane Grisostomo	San Bortolomio	417	159	576
Ponte de l'Olio	2013	15:50	16:05	San Bortolomio	San Zuane Grisostomo	84	192	276
Ponte de l'Olio	2013	15:50	16:05	San Zuane Grisostomo	San Bortolomio	374	87	461
Ponte de l'Olio	2013	16:10	16:25	San Bortolomio	San Zuane Grisostomo	99	296	395
Ponte de l'Olio	2013	16:10	16:25	San Zuane Grisostomo	San Bortolomio	365	132	497
Ponte de l'Olio	2013	16:30	16:45	San Bortolomio	San Zuane Grisostomo	327	711	1038
Ponte de l'Olio	2013	16:30	16:45	San Zuane Grisostomo	San Bortolomio	571	128	699
Ponte de l'Olio	2013	16:50	17:05	San Bortolomio	San Zuane Grisostomo	583	809	1392
Ponte de l'Olio	2013	16:50	17:05	San Zuane Grisostomo	San Bortolomio	541	96	637
Ponte de l'Olio	2013	17:10	17:25	San Bortolomio	San Zuane Grisostomo	506	774	1280
Ponte de l'Olio	2013	17:10	17:25	San Zuane Grisostomo	San Bortolomio	432	120	552
Ponte della Constituione	2013	11:30	11:45	San Geremia	Piazzale Roma	66	75	141

Ponte della Constituione	2013	11:30	11:45	Piazzale Roma	San Geremia	296	61	357
Ponte della Constituione	2013	11:50	12:05	San Geremia	Piazzale Roma	98	107	205
Ponte della Constituione	2013	11:50	12:05	Piazzale Roma	San Geremia	342	42	384
Ponte della Constituione	2013	12:10	12:25	San Geremia	Piazzale Roma	120	83	203
Ponte della Constituione	2013	12:10	12:25	Piazzale Roma	San Geremia	406	55	461
Ponte della Constituione	2013	12:30	12:45	San Geremia	Piazzale Roma	71	70	141
Ponte della Constituione	2013	12:30	12:45	Piazzale Roma	San Geremia	353	48	401
Ponte della Constituione	2013	12:50	13:05	San Geremia	Piazzale Roma	95	84	179
Ponte della Constituione	2013	12:50	13:05	Piazzale Roma	San Geremia	288	33	321
Ponte della Constituione	2013	13:10	13:25	San Geremia	Piazzale Roma	112	116	228
Ponte della Constituione	2013	13:10	13:25	Piazzale Roma	San Geremia	266	35	301
Ponte della Constituione	2013	15:30	15:45	San Geremia	Piazzale Roma	138	118	256
Ponte della Constituione	2013	15:30	15:45	Piazzale Roma	San Geremia	369	99	468
Ponte della Constituione	2013	15:50	16:05	San Geremia	Piazzale Roma	130	133	263
Ponte della Constituione	2013	15:50	16:05	Piazzale Roma	San Geremia	247	116	363
Ponte della Constituione	2013	16:10	16:25	San Geremia	Piazzale Roma	152	137	289
Ponte della Constituione	2013	16:10	16:25	Piazzale Roma	San Geremia	263	64	327
Ponte della Constituione	2013	16:30	16:45	San Geremia	Piazzale Roma	156	141	297
Ponte della Constituione	2013	16:30	16:45	Piazzale Roma	San Geremia	299	129	428
Ponte della Constituione	2013	16:50	17:05	San Geremia	Piazzale Roma	216	164	380
Ponte della Constituione	2013	16:50	17:05	Piazzale Roma	San Geremia	456	143	599
Ponte della Constituione	2013	17:10	17:25	San Geremia	Piazzale Roma	292	173	465
Ponte della Constituione	2013	17:10	17:25	Piazzale Roma	San Geremia	178	112	290

Ponte dei Bareteri	Weekday 2013	11:00	11:15	San Marco	San Bortolomio	121	22	143
Ponte dei Bareteri	Weekday 2013	11:00	11:15	San Bortolomio	San Marco	187	43	230
Ponte dei Bareteri	Weekday 2013	11:20	11:35	San Marco	San Bortolomio	160	23	183
Ponte dei Bareteri	Weekday 2013	11:20	11:35	San Bortolomio	San Marco	265	48	313
Ponte dei Bareteri	Weekday 2013	11:40	11:55	San Marco	San Bortolomio	270	16	286
Ponte dei Bareteri	Weekday 2013	11:40	11:55	San Bortolomio	San Marco	231	349	580
Ponte dei Bareteri	Weekday 2013	12:00	12:15	San Marco	San Bortolomio	219	24	243
Ponte dei Bareteri	Weekday 2013	12:00	12:15	San Bortolomio	San Marco	411	82	493
Ponte dei Bareteri	Weekday 2013	12:20	12:35	San Marco	San Bortolomio	178	31	209
Ponte dei Bareteri	Weekday 2013	12:20	12:35	San Bortolomio	San Marco	317	73	390
Ponte dei Bareteri	Weekday 2013	12:40	12:55	San Marco	San Bortolomio	159	24	183
Ponte dei Bareteri	Weekday 2013	12:40	12:55	San Bortolomio	San Marco	324	61	385
Ponte dei Bareteri	Weekday 2013	15:20	15:35	San Marco	San Bortolomio	166	457	623
Ponte dei Bareteri	Weekday 2013	15:20	15:35	San Bortolomio	San Marco	298	43	341
Ponte dei Bareteri	Weekday 2013	15:40	15:55	San Marco	San Bortolomio	228	74	302
Ponte dei Bareteri	Weekday 2013	15:40	15:55	San Bortolomio	San Marco	178	41	219
Ponte dei Bareteri	Weekday 2013	16:00	16:15	San Marco	San Bortolomio	193	107	300
Ponte dei Bareteri	Weekday 2013	16:00	16:15	San Bortolomio	San Marco	86	46	132
Ponte dei Bareteri	Weekday 2013	16:20	16:35	San Marco	San Bortolomio	203	69	272
Ponte dei Bareteri	Weekday 2013	16:20	16:35	San Bortolomio	San Marco	85	14	99
Ponte dei Bareteri	Weekday 2013	16:40	16:55	San Marco	San Bortolomio	213	87	300
Ponte dei Bareteri	Weekday 2013	16:40	16:55	San Bortolomio	San Marco	149	11	160
Ponte dei Bareteri	Weekday 2013	17:00	17:15	San Marco	San Bortolomio	253	95	348

Ponte dei Bareteri	Weekday 2013	17:00	17:15	San Bortolomio	San Marco	206	18	224
Ponte dei Bareteri	Weekend 2013	11:00	11:15	San Marco	San Bortolomio	237	51	288
Ponte dei Bareteri	Weekend 2013	11:00	11:15	San Bortolomio	San Marco	220	14	234
Ponte dei Bareteri	Weekend 2013	11:20	11:35	San Marco	San Bortolomio	314	49	363
Ponte dei Bareteri	Weekend 2013	11:20	11:35	San Bortolomio	San Marco	269	36	305
Ponte dei Bareteri	Weekend 2013	11:40	11:55	San Marco	San Bortolomio	325	44	369
Ponte dei Bareteri	Weekend 2013	11:40	11:55	San Bortolomio	San Marco	349	26	375
Ponte dei Bareteri	Weekend 2013	12:00	12:15	San Marco	San Bortolomio	332	49	381
Ponte dei Bareteri	Weekend 2013	12:00	12:15	San Bortolomio	San Marco	348	16	364
Ponte dei Bareteri	Weekend 2013	12:20	12:35	San Marco	San Bortolomio	442	63	505
Ponte dei Bareteri	Weekend 2013	12:20	12:35	San Bortolomio	San Marco	278	24	302
Ponte dei Bareteri	Weekend 2013	12:40	12:55	San Marco	San Bortolomio	434	51	485
Ponte dei Bareteri	Weekend 2013	12:40	12:55	San Bortolomio	San Marco	331	18	349
Ponte dei Bareteri	Weekend 2013	15:20	15:35	San Marco	San Bortolomio	457	116	573
Ponte dei Bareteri	Weekend 2013	15:20	15:35	San Bortolomio	San Marco	334	26	360
Ponte dei Bareteri	Weekend 2013	15:40	15:55	San Marco	San Bortolomio	587	50	637
Ponte dei Bareteri	Weekend 2013	15:40	15:55	San Bortolomio	San Marco	394	13	407
Ponte dei Bareteri	Weekend 2013	16:00	16:15	San Marco	San Bortolomio	607	59	666
Ponte dei Bareteri	Weekend 2013	16:00	16:15	San Bortolomio	San Marco	324	18	342
Ponte dei Bareteri	Weekend 2013	16:20	16:35	San Marco	San Bortolomio	537	56	593
Ponte dei Bareteri	Weekend 2013	16:20	16:35	San Bortolomio	San Marco	322	10	332
Ponte dei Bareteri	Weekend 2013	16:40	16:55	San Marco	San Bortolomio	628	42	670
Ponte dei Bareteri	Weekend 2013	16:40	16:55	San Bortolomio	San Marco	334	12	346

Ponte dei Bareteri	Weekend 2013	17:00	17:15	San Marco	San Bortolomio	644	38	682
Ponte dei Bareteri	Weekend 2013	17:00	17:15	San Bortolomio	San Marco	336	28	364
Ponte de l'Ovo	Weekday 2013	11:00	11:15	San Luca	San Bortolomio	76	102	178
Ponte de l'Ovo	Weekday 2013	11:00	11:15	San Bortolomio	San Luca	84	151	235
Ponte de l'Ovo	Weekday 2013	11:20	11:35	San Luca	San Bortolomio	78	122	200
Ponte de l'Ovo	Weekday 2013	11:20	11:35	San Bortolomio	San Luca	89	154	243
Ponte de l'Ovo	Weekday 2013	11:40	11:55	San Luca	San Bortolomio	93	146	239
Ponte de l'Ovo	Weekday 2013	11:40	11:55	San Bortolomio	San Luca	91	180	271
Ponte de l'Ovo	Weekday 2013	12:00	12:15	San Luca	San Bortolomio	84	139	223
Ponte de l'Ovo	Weekday 2013	12:00	12:15	San Bortolomio	San Luca	87	176	263
Ponte de l'Ovo	Weekday 2013	12:20	12:35	San Luca	San Bortolomio	90	155	245
Ponte de l'Ovo	Weekday 2013	12:20	12:35	San Bortolomio	San Luca	94	187	281
Ponte de l'Ovo	Weekday 2013	12:40	12:55	San Luca	San Bortolomio	85	141	226
Ponte de l'Ovo	Weekday 2013	12:40	12:55	San Bortolomio	San Luca	80	181	261
Ponte de l'Ovo	Weekday 2013	15:20	15:35	San Luca	San Bortolomio	54	116	170
Ponte de l'Ovo	Weekday 2013	15:20	15:35	San Bortolomio	San Luca	58	103	161
Ponte de l'Ovo	Weekday 2013	15:40	15:55	San Luca	San Bortolomio	70	144	214
Ponte de l'Ovo	Weekday 2013	15:40	15:55	San Bortolomio	San Luca	43	91	134
Ponte de l'Ovo	Weekday 2013	16:00	16:15	San Luca	San Bortolomio	106	155	261
Ponte de l'Ovo	Weekday 2013	16:00	16:15	San Bortolomio	San Luca	63	107	170
Ponte de l'Ovo	Weekday 2013	16:20	16:35	San Luca	San Bortolomio	148	207	355
Ponte de l'Ovo	Weekday 2013	16:20	16:35	San Bortolomio	San Luca	82	113	195
Ponte de l'Ovo	Weekday 2013	16:40	16:55	San Luca	San Bortolomio	161	251	412

Ponte de l'Ovo	Weekday 2013	16:40	16:55	San Bortolomio	San Luca	91	122	213
Ponte de l'Ovo	Weekday 2013	17:00	17:15	San Luca	San Bortolomio	153	233	386
Ponte de l'Ovo	Weekday 2013	17:00	17:15	San Bortolomio	San Luca	84	114	198
Ponte de l'Ovo	Weekend 2013	11:00	11:15	San Luca	San Bortolomio	178	103	281
Ponte de l'Ovo	Weekend 2013	11:00	11:15	San Bortolomio	San Luca	198	110	308
Ponte de l'Ovo	Weekend 2013	11:20	11:35	San Luca	San Bortolomio	262	101	363
Ponte de l'Ovo	Weekend 2013	11:20	11:35	San Bortolomio	San Luca	194	105	299
Ponte de l'Ovo	Weekend 2013	11:40	11:55	San Luca	San Bortolomio	283	107	390
Ponte de l'Ovo	Weekend 2013	11:40	11:55	San Bortolomio	San Luca	197	140	337
Ponte de l'Ovo	Weekend 2013	12:00	12:15	San Luca	San Bortolomio	311	146	457
Ponte de l'Ovo	Weekend 2013	12:00	12:15	San Bortolomio	San Luca	141	123	264
Ponte de l'Ovo	Weekend 2013	12:20	12:35	San Luca	San Bortolomio	308	157	465
Ponte de l'Ovo	Weekend 2013	12:20	12:35	San Bortolomio	San Luca	135	117	252
Ponte de l'Ovo	Weekend 2013	12:40	12:55	San Luca	San Bortolomio	329	161	490
Ponte de l'Ovo	Weekend 2013	12:40	12:55	San Bortolomio	San Luca	143	130	273
Ponte de l'Ovo	Weekend 2013	15:20	15:35	San Luca	San Bortolomio	227	141	368
Ponte de l'Ovo	Weekend 2013	15:20	15:35	San Bortolomio	San Luca	143	132	275
Ponte de l'Ovo	Weekend 2013	15:40	15:55	San Luca	San Bortolomio	327	211	538
Ponte de l'Ovo	Weekend 2013	15:40	15:55	San Bortolomio	San Luca	160	104	264
Ponte de l'Ovo	Weekend 2013	16:00	16:15	San Luca	San Bortolomio	378	238	616
Ponte de l'Ovo	Weekend 2013	16:00	16:15	San Bortolomio	San Luca	171	111	282
Ponte de l'Ovo	Weekend 2013	16:20	16:35	San Luca	San Bortolomio	434	253	687
Ponte de l'Ovo	Weekend 2013	16:20	16:35	San Bortolomio	San Luca	154	108	262

Ponte de l'Ovo	Weekend 2013	16:40	16:55	San Luca	San Bortolomio	471	277	748
Ponte de l'Ovo	Weekend 2013	16:40	16:55	San Bortolomio	San Luca	180	124	304
Ponte de l'Ovo	Weekend 2013	17:00	17:15	San Luca	San Bortolomio	485	299	784
Ponte de l'Ovo	Weekend 2013	17:00	17:15	San Bortolomio	San Luca	174	116	290
Ponte della Paglia	2013	15:20	15:35	San Marco	San Filippo e Giacomo	608	11	619
Ponte della Paglia	2013	15:20	15:35	San Filippo e Giacomo	San Marco	889	27	916
Ponte della Paglia	2013	15:40	15:55	San Marco	San Filippo e Giacomo	956	5	961
Ponte della Paglia	2013	15:40	15:55	San Filippo e Giacomo	San Marco	1128	20	1148
Ponte della Paglia	2013	16:00	16:15	San Marco	San Filippo e Giacomo	628	12	640
Ponte della Paglia	2013	16:00	16:15	San Filippo e Giacomo	San Marco	937	19	956
Ponte della Paglia	2013	16:20	16:35	San Marco	San Filippo e Giacomo	580	8	588
Ponte della Paglia	2013	16:20	16:35	San Filippo e Giacomo	San Marco	1260	26	1286
Ponte della Paglia	2013	16:40	16:55	San Marco	San Filippo e Giacomo	700	6	706
Ponte della Paglia	2013	16:40	16:55	San Filippo e Giacomo	San Marco	1187	23	1210
Ponte della Paglia	2013	17:00	17:15	San Marco	San Filippo e Giacomo	587	8	595
Ponte della Paglia	2013	17:00	17:15	San Filippo e Giacomo	San Marco	986	14	1000
Ponte de le Ostreghe	Weekend 2013	11:00	11:15	San Moisè	Santa Maria Zobenigo	122	52	174
Ponte de le Ostreghe	Weekend 2013	11:00	11:15	Santa Maria Zobenigo	San Moisè	153	16	169
Ponte de le Ostreghe	Weekend 2013	11:20	11:35	San Moisè	Santa Maria Zobenigo	140	42	182
Ponte de le Ostreghe	Weekend 2013	11:20	11:35	Santa Maria Zobenigo	San Moisè	164	19	183
Ponte de le Ostreghe	Weekend 2013	11:40	11:55	San Moisè	Santa Maria Zobenigo	155	49	204
Ponte de le Ostreghe	Weekend 2013	11:40	11:55	Santa Maria Zobenigo	San Moisè	176	17	193

Ponte de le Ostreghe	Weekend 2013	12:00	12:15	San Moisè	Santa Maria Zobenigo	168	32	200
Ponte de le Ostreghe	Weekend 2013	12:00	12:15	Santa Maria Zobenigo	San Moisè	185	21	206
Ponte de le Ostreghe	Weekend 2013	12:20	12:35	San Moisè	Santa Maria Zobenigo	195	47	242
Ponte de le Ostreghe	Weekend 2013	12:20	12:35	Santa Maria Zobenigo	San Moisè	173	22	195
Ponte de le Ostreghe	Weekend 2013	12:40	12:55	San Moisè	Santa Maria Zobenigo	179	42	221
Ponte de le Ostreghe	Weekend 2013	12:40	12:55	Santa Maria Zobenigo	San Moisè	145	14	159
Ponte de le Ostreghe	Weekend 2013	15:20	15:35	San Moisè	Santa Maria Zobenigo	0	0	0
Ponte de le Ostreghe	Weekend 2013	15:20	15:35	Santa Maria Zobenigo	San Moisè	245	20	265
Ponte de le Ostreghe	Weekend 2013	15:40	15:55	San Moisè	Santa Maria Zobenigo	424	124	548
Ponte de le Ostreghe	Weekend 2013	15:40	15:55	Santa Maria Zobenigo	San Moisè	256	25	281
Ponte de le Ostreghe	Weekend 2013	16:00	16:15	San Moisè	Santa Maria Zobenigo	403	111	514
Ponte de le Ostreghe	Weekend 2013	16:00	16:15	Santa Maria Zobenigo	San Moisè	260	22	282
Ponte de le Ostreghe	Weekend 2013	16:20	16:35	San Moisè	Santa Maria Zobenigo	419	91	510
Ponte de le Ostreghe	Weekend 2013	16:20	16:35	Santa Maria Zobenigo	San Moisè	192	19	211
Ponte de le Ostreghe	Weekend 2013	16:40	16:55	San Moisè	Santa Maria Zobenigo	406	87	493
Ponte de le Ostreghe	Weekend 2013	16:40	16:55	Santa Maria Zobenigo	San Moisè	201	21	222
Ponte de le Ostreghe	Weekend 2013	17:00	17:15	San Moisè	Santa Maria Zobenigo	189	49	238
Ponte de le Ostreghe	Weekend 2013	17:00	17:15	Santa Maria Zobenigo	San Moisè	182	17	199

Ponte de le Ostreghe	Weekday 2013	15:20	15:35	San Moisè	Santa Maria Zobenigo	98	22	120
Ponte de le Ostreghe	Weekday 2013	15:20	15:35	Santa Maria Zobenigo	San Moisè	73	17	90
Ponte de le Ostreghe	Weekday 2013	15:40	15:55	San Moisè	Santa Maria Zobenigo	118	26	144
Ponte de le Ostreghe	Weekday 2013	15:40	15:55	Santa Maria Zobenigo	San Moisè	75	21	96
Ponte de le Ostreghe	Weekday 2013	16:00	16:15	San Moisè	Santa Maria Zobenigo	144	31	175
Ponte de le Ostreghe	Weekday 2013	16:00	16:15	Santa Maria Zobenigo	San Moisè	94	33	127
Ponte de le Ostreghe	Weekday 2013	16:20	16:35	San Moisè	Santa Maria Zobenigo	161	37	198
Ponte de le Ostreghe	Weekday 2013	16:20	16:35	Santa Maria Zobenigo	San Moisè	110	25	135
Ponte de le Ostreghe	Weekday 2013	16:40	16:55	San Moisè	Santa Maria Zobenigo	157	36	193
Ponte de le Ostreghe	Weekday 2013	16:40	16:55	Santa Maria Zobenigo	San Moisè	77	37	114
Ponte de le Ostreghe	Weekday 2013	17:00	17:15	San Moisè	Santa Maria Zobenigo	172	49	221
Ponte de le Ostreghe	Weekday 2013	17:00	17:15	Santa Maria Zobenigo	San Moisè	84	30	114

ii. Hourly Data

Bridge Name	Date/Year	Start Time	End Time	From Island Name	To Island Name	Number of Tourists	Number of Locals	Total Per Hour
Ponte della Guglie	2013	7:00	8:00	San Leonardo	San Geremia	69.3333	537.3333	606.6667
Ponte della Guglie	2013	7:00	8:00	San Geremia	San Leonardo	85.3333	1448.0000	1533.3333
Ponte della Guglie	2013	8:00	9:00	San Leonardo	San Geremia	309.3333	533.3333	842.6667
Ponte della Guglie	2013	8:00	9:00	San Geremia	San Leonardo	185.3333	1277.3333	1462.6667
Ponte della Guglie	2013	9:00	10:00	San Leonardo	San Geremia	373.3333	456.0000	829.3333
Ponte della Guglie	2013	9:00	10:00	San Geremia	San Leonardo	445.3333	1062.6667	1508.0000

Ponte della Guglie	2013	10:00	11:00	San Leonardo	San Geremia	381.3333	461.3333	842.6667
Ponte della Guglie	2013	10:00	11:00	San Geremia	San Leonardo	1012.0000	1101.3333	2113.3333
Ponte della Guglie	2013	11:00	12:00	San Leonardo	San Geremia	528.0000	558.6667	1086.6667
Ponte della Guglie	2013	11:00	12:00	San Geremia	San Leonardo	1101.3333	890.6667	1992.0000
Ponte della Guglie	2013	12:00	13:00	San Leonardo	San Geremia	552.0000	482.6667	1034.6667
Ponte della Guglie	2013	12:00	13:00	San Geremia	San Leonardo	908.0000	821.3333	1729.3333
Ponte della Guglie	2013	13:00	14:00	San Leonardo	San Geremia	926.6667	393.3333	1320.0000
Ponte della Guglie	2013	13:00	14:00	San Geremia	San Leonardo	781.3333	485.3333	1266.6667
Ponte della Guglie	2013	14:00	15:00	San Leonardo	San Geremia	1061.3333	304.0000	1365.3333
Ponte della Guglie	2013	14:00	15:00	San Geremia	San Leonardo	732.0000	456.0000	1188.0000
Ponte della Guglie	2013	15:00	16:00	San Leonardo	San Geremia	1149.3333	356.0000	1505.3333
Ponte della Guglie	2013	15:00	16:00	San Geremia	San Leonardo	605.3333	552.0000	1157.3333
Ponte della Guglie	2013	16:00	17:00	San Leonardo	San Geremia	1132.0000	937.3333	2069.3333
Ponte della Guglie	2013	16:00	17:00	San Geremia	San Leonardo	932.0000	848.0000	1780.0000
Ponte della Guglie	2013	17:00	18:00	San Leonardo	San Geremia	800.0000	817.3333	1617.3333
Ponte della Guglie	2013	17:00	18:00	San Geremia	San Leonardo	580.0000	965.3333	1545.3333
Ponte della Guglie	2013	18:00	19:00	San Leonardo	San Geremia	554.6667	677.3333	1232.0000
Ponte della Guglie	2013	18:00	19:00	San Geremia	San Leonardo	801.3333	1036.0000	1837.3333
Ponte de l'Anconeta	2013	11:00	12:00	Maddalena	San Leonardo	266.6667	446.6667	713.3333
Ponte de l'Anconeta	2013	11:00	12:00	San Leonardo	Maddalena	1504.0000	512.0000	2016.0000
Ponte de l'Anconeta	2013	12:00	13:00	Maddalena	San Leonardo	313.3333	416.0000	729.3333
Ponte de l'Anconeta	2013	12:00	13:00	San Leonardo	Maddalena	2026.6667	625.3333	2652.0000
Ponte de l'Anconeta	2013	14:00	15:00	Maddalena	San Leonardo	1032.0000	692.0000	1724.0000

Ponte de l'Anconeta	2013	14:00	15:00	San Leonardo	Maddalena	1324.0000	432.0000	1756.0000
Ponte de l'Anconeta	2013	16:00	17:00	Maddalena	San Leonardo	754.6667	594.6667	1349.3333
Ponte de l'Anconeta	2013	16:00	17:00	San Leonardo	Maddalena	653.3333	344.0000	997.3333
Ponte de l'Anconeta	2013	17:00	18:00	Maddalena	San Leonardo	728.0000	665.3333	1393.3333
Ponte de l'Anconeta	2013	17:00	18:00	San Leonardo	Maddalena	572.0000	562.6667	1134.6667
Ponte de l'Olio	Weekend 2013	15:00	16:00	San Bortolomio	San Zuane Grisostomo	450.0000	756.0000	1206.0000
Ponte de l'Olio	Weekend 2013	15:00	16:00	San Zuane Grisostomo	San Bortolomio	1582.0000	492.0000	2074.0000
Ponte de l'Olio	Weekend 2013	16:00	17:00	San Bortolomio	San Zuane Grisostomo	1009.0000	1816.0000	2825.0000
Ponte de l'Olio	Weekend 2013	16:00	17:00	San Zuane Grisostomo	San Bortolomio	1969.3333	474.6667	2444.0000
Ponte de l'Olio	Weekend 2013	17:00	18:00	San Bortolomio	San Zuane Grisostomo	2024.0000	3096.0000	5120.0000
Ponte de l'Olio	Weekend 2013	17:00	18:00	San Zuane Grisostomo	San Bortolomio	1728.0000	480.0000	2208.0000
Ponte della Constituione	2013	11:00	12:00	San Geremia	Piazzale Roma	328.0000	364.0000	692.0000
Ponte della Constituione	2013	11:00	12:00	Piazzale Roma	San Geremia	1276.0000	206.0000	1482.0000
Ponte della Constituione	2013	12:00	13:00	San Geremia	Piazzale Roma	381.3333	316.0000	697.3333
Ponte della Constituione	2013	12:00	13:00	Piazzale Roma	San Geremia	1396.0000	181.3333	1577.3333
Ponte della Constituione	2013	13:00	14:00	San Geremia	Piazzale Roma	448.0000	464.0000	912.0000
Ponte della Constituione	2013	13:00	14:00	Piazzale Roma	San Geremia	1064.0000	140.0000	1204.0000
Ponte della Constituione	2013	15:00	16:00	San Geremia	Piazzale Roma	536.0000	502.0000	1038.0000
Ponte della Constituione	2013	15:00	16:00	Piazzale Roma	San Geremia	1232.0000	430.0000	1662.0000
Ponte della Constituione	2013	16:00	17:00	San Geremia	Piazzale Roma	698.6667	589.3333	1288.0000
Ponte della Constituione	2013	16:00	17:00	Piazzale Roma	San Geremia	1357.3333	448.0000	1805.3333
Ponte della Constituione	2013	17:00	18:00	San Geremia	Piazzale Roma	1168.0000	692.0000	1860.0000
Ponte della Constituione	2013	17:00	18:00	Piazzale Roma	San Geremia	712.0000	448.0000	1160.0000

Ponte dei Bareteri	Weekday 2013	11:00	12:00	San Marco	San Bortolomio	734.6667	81.3333	816.0000
Ponte dei Bareteri	Weekday 2013	11:00	12:00	San Bortolomio	San Marco	910.6667	586.6667	1497.3333
Ponte dei Bareteri	Weekday 2013	12:00	13:00	San Marco	San Bortolomio	741.3333	105.3333	846.6667
Ponte dei Bareteri	Weekday 2013	12:00	13:00	San Bortolomio	San Marco	1402.6667	288.0000	1690.6667
Ponte dei Bareteri	Weekday 2013	15:00	16:00	San Marco	San Bortolomio	788.0000	1062.0000	1850.0000
Ponte dei Bareteri	Weekday 2013	15:00	16:00	San Bortolomio	San Marco	952.0000	168.0000	1120.0000
Ponte dei Bareteri	Weekday 2013	16:00	16:15	San Marco	San Bortolomio	812.0000	350.6667	1162.6667
Ponte dei Bareteri	Weekday 2013	16:00	16:15	San Bortolomio	San Marco	426.6667	94.6667	521.3333
Ponte dei Bareteri	Weekday 2013	17:00	18:00	San Marco	San Bortolomio	1012.0000	380.0000	1392.0000
Ponte dei Bareteri	Weekday 2013	17:00	18:00	San Bortolomio	San Marco	824.0000	72.0000	896.0000
Ponte dei Bareteri	Weekend 2013	11:00	12:00	San Marco	San Bortolomio	1168.0000	192.0000	1360.0000
Ponte dei Bareteri	Weekend 2013	11:00	12:00	San Bortolomio	San Marco	1117.3333	101.3333	1218.6667
Ponte dei Bareteri	Weekend 2013	12:00	13:00	San Marco	San Bortolomio	1610.6667	217.3333	1828.0000
Ponte dei Bareteri	Weekend 2013	12:00	13:00	San Bortolomio	San Marco	1276.0000	77.3333	1353.3333
Ponte dei Bareteri	Weekend 2013	15:00	16:00	San Marco	San Bortolomio	2088.0000	332.0000	2420.0000
Ponte dei Bareteri	Weekend 2013	15:00	16:00	San Bortolomio	San Marco	1456.0000	78.0000	1534.0000
Ponte dei Bareteri	Weekend 2013	16:00	17:00	San Marco	San Bortolomio	2362.6667	209.3333	2572.0000
Ponte dei Bareteri	Weekend 2013	16:00	17:00	San Bortolomio	San Marco	1306.6667	53.3333	1360.0000
Ponte dei Bareteri	Weekend 2013	17:00	18:00	San Marco	San Bortolomio	2576.0000	152.0000	2728.0000
Ponte dei Bareteri	Weekend 2013	17:00	18:00	San Bortolomio	San Marco	1344.0000	112.0000	1456.0000
Ponte de I'Ovo	Weekday 2013	11:00	12:00	San Luca	San Bortolomio	329.3333	493.3333	822.6667
Ponte de I'Ovo	Weekday 2013	11:00	12:00	San Bortolomio	San Luca	352.0000	646.6667	998.6667
Ponte de I'Ovo	Weekday 2013	12:00	13:00	San Luca	San Bortolomio	345.3333	580.0000	925.3333

Ponte de l'Ovo	Weekday 2013	12:00	13:00	San Bortolomio	San Luca	348.0000	725.3333	1073.3333
Ponte de l'Ovo	Weekday 2013	15:00	16:00	San Luca	San Bortolomio	248.0000	520.0000	768.0000
Ponte de l'Ovo	Weekday 2013	15:00	16:00	San Bortolomio	San Luca	202.0000	388.0000	590.0000
Ponte de l'Ovo	Weekday 2013	16:00	17:00	San Luca	San Bortolomio	553.3333	817.3333	1370.6667
Ponte de l'Ovo	Weekday 2013	16:00	17:00	San Bortolomio	San Luca	314.6667	456.0000	770.6667
Ponte de l'Ovo	Weekday 2013	17:00	18:00	San Luca	San Bortolomio	612.0000	932.0000	1544.0000
Ponte de l'Ovo	Weekday 2013	17:00	18:00	San Bortolomio	San Luca	336.0000	456.0000	792.0000
Ponte de l'Ovo	Weekend 2013	11:00	12:00	San Luca	San Bortolomio	964.0000	414.6667	1378.6667
Ponte de l'Ovo	Weekend 2013	11:00	12:00	San Bortolomio	San Luca	785.3333	473.3333	1258.6667
Ponte de l'Ovo	Weekend 2013	12:00	13:00	San Luca	San Bortolomio	1264.0000	618.6667	1882.6667
Ponte de l'Ovo	Weekend 2013	12:00	13:00	San Bortolomio	San Luca	558.6667	493.3333	1052.0000
Ponte de l'Ovo	Weekend 2013	15:00	16:00	San Luca	San Bortolomio	1108.0000	704.0000	1812.0000
Ponte de l'Ovo	Weekend 2013	15:00	16:00	San Bortolomio	San Luca	606.0000	472.0000	1078.0000
Ponte de l'Ovo	Weekend 2013	16:00	17:00	San Luca	San Bortolomio	1710.6667	1024.0000	2734.6667
Ponte de l'Ovo	Weekend 2013	16:00	17:00	San Bortolomio	San Luca	673.3333	457.3333	1130.6667
Ponte de l'Ovo	Weekend 2013	17:00	18:00	San Luca	San Bortolomio	1940.0000	1196.0000	3136.0000
Ponte de l'Ovo	Weekend 2013	17:00	18:00	San Bortolomio	San Luca	696.0000	464.0000	1160.0000
Ponte della Paglia	Weekend 2013	15:00	16:00	San Marco	San Filippo e Giacomo	3128.0000	32.0000	3160.0000
Ponte della Paglia	Weekend 2013	15:00	16:00	San Filippo e Giacomo	San Marco	4034.0000	94.0000	4128.0000
Ponte della Paglia	Weekend 2013	16:00	17:00	San Marco	San Filippo e Giacomo	2544.0000	34.6667	2578.6667
Ponte della Paglia	Weekend 2013	16:00	17:00	San Filippo e Giacomo	San Marco	4512.0000	90.6667	4602.6667
Ponte della Paglia	Weekend 2013	17:00	18:00	San Marco	San Filippo e Giacomo	2348.0000	32.0000	2380.0000
Ponte della Paglia	Weekend 2013	17:00	18:00	San Filippo e Giacomo	San Marco	3944.0000	56.0000	4000.0000

Ponte de le Ostreghe	Weekend 2013	11:00	12:00	San Moisè	Santa Maria Zobenigo	556.0000	190.6667	746.6667
Ponte de le Ostreghe	Weekend 2013	11:00	12:00	Santa Maria Zobenigo	San Moisè	657.3333	69.3333	726.6667
Ponte de le Ostreghe	Weekend 2013	12:00	13:00	San Moisè	Santa Maria Zobenigo	722.6667	161.3333	884.0000
Ponte de le Ostreghe	Weekend 2013	12:00	13:00	Santa Maria Zobenigo	San Moisè	670.6667	76.0000	746.6667
Ponte de le Ostreghe	Weekend 2013	15:00	16:00	San Moisè	Santa Maria Zobenigo	848.0000	248.0000	1096.0000
Ponte de le Ostreghe	Weekend 2013	15:00	16:00	Santa Maria Zobenigo	San Moisè	1002.0000	90.0000	1092.0000
Ponte de le Ostreghe	Weekend 2013	16:00	17:00	San Moisè	Santa Maria Zobenigo	1637.3333	385.3333	2022.6667
Ponte de le Ostreghe	Weekend 2013	16:00	17:00	Santa Maria Zobenigo	San Moisè	870.6667	82.6667	953.3333
Ponte de le Ostreghe	Weekend 2013	17:00	18:00	San Moisè	Santa Maria Zobenigo	756.0000	196.0000	952.0000
Ponte de le Ostreghe	Weekend 2013	17:00	18:00	Santa Maria Zobenigo	San Moisè	728.0000	68.0000	796.0000
Ponte de le Ostreghe	Weekday 2013	15:00	16:00	San Moisè	Santa Maria Zobenigo	432.0000	96.0000	528.0000
Ponte de le Ostreghe	Weekday 2013	15:00	16:00	Santa Maria Zobenigo	San Moisè	296.0000	76.0000	372.0000
Ponte de le Ostreghe	Weekday 2013	16:00	17:00	San Moisè	Santa Maria Zobenigo	616.0000	138.6667	754.6667
Ponte de le Ostreghe	Weekday 2013	16:00	17:00	Santa Maria Zobenigo	San Moisè	374.6667	126.6667	501.3333
Ponte de le Ostreghe	Weekday 2013	17:00	18:00	San Moisè	Santa Maria Zobenigo	688.0000	196.0000	884.0000
Ponte de le Ostreghe	Weekday 2013	17:00	18:00	Santa Maria Zobenigo	San Moisè	336.0000	120.0000	456.0000

iii. Maximums- Morning (7:00-13:00)

Bridge Name	Date/Year	Start Time	End Time	From Island Name	To Island Name	Tourists	Locals	Maximum Total Per Hour

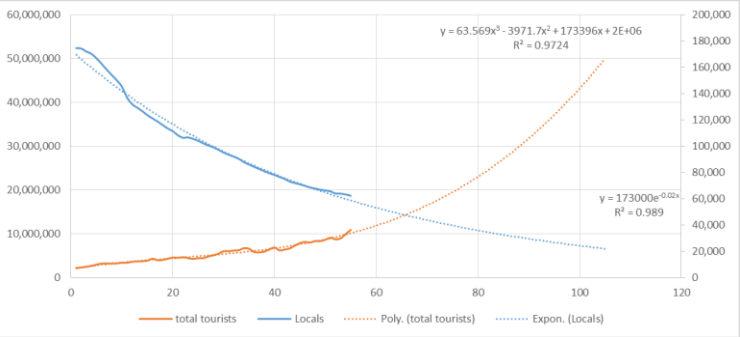
Ponte de l'Ovo	Weekday 2013	12:00	13:00	San Bortolomio	San Luca	348	725.3333	1073.333333
Ponte della Constituione	2013	12:00	13:00	Piazzale Roma	San Geremia	1396	181.3333	1577.333333
Ponte dei Bareteri	Weekday 2013	12:00	13:00	San Bortolomio	San Marco	1402.667	288	1690.666667
Ponte de l'Anconeta	2013	11:00	12:00	San Leonardo	Maddalena	1504	512	2016
Ponte della Guglie	2013	10:00	11:00	San Geremia	San Leonardo	1012	1101.333	2113.333333

a. Maximums- Evening (13:00-19:00)

Bridge Name	Date/Year	Start Time	End Time	From Island Name	To Island Name	Tourists	Locals	Maximum Total Per Hour
Ponte de le Ostreghe	Weekday 2013	17:00	18:00	San Moisè	Santa Maria Zobenigo	688	196	884
Ponte de l'Ovo	Weekday 2013	17:00	18:00	San Luca	San Bortolomio	612	932	1544
Ponte de l'Anconeta	2013	14:00	15:00	San Leonardo	Maddalena	1324	432	1756
Ponte dei Bareteri	Weekday 2013	15:00	16:00	San Marco	San Bortolomio	788	1062	1850
Ponte della Constituione	2013	17:00	18:00	San Geremia	Piazzale Roma	1168	692	1860
Ponte della Guglie	2013	16:00	17:00	San Leonardo	San Geremia	1132	937.3333	2069.333333

C. Past Demographic Data

Year	Locals	Day Trip	Overnight	total tourists
1951	174808	582718	1559028	2141746
1952	174448	651036	1670085	2321121
1953	172195	704428	1744339	2448767
1954	170446	770312	1885590	2655902
1955	167069	890826	2076202	2967028
1956	162834	932536	2256091	3188627
1957	158466	923803	2301126	3224929
1958	154268	926851	2259100	3185951
1959	150242	961194	2277062	3238256
1960	145402	1000912	2411309	3412221
1961	137150	1006446	2388800	3395246
1962	132148	1072455	2554411	3626866
1963	129468	1111920	2600909	3712829
1964	126808	1128943	2611861	3740804
1965	123733	1208392	2659009	3867401
1966	121309	1349793	2951401	4301194
1967	118889	1271014	2693694	3964708
1968	116270	1284339	2737121	4021460
1969	113587	1387524	2929025	4316549
1970	111550	1481504	3083123	4564627
1971	108426	1480550	3040507	4521057
1972	106516	1528088	3126076	4654164
1973	106806	1466346	2971888	4438234
1974	105656	1396219	2869660	4265879
1975	104206	1486203	2947316	4433519
1976	102269	1468229	2968905	4437134
1977	100608	1622863	3217350	4840213
1978	99189	1691889	3398400	5090289
1979	97280	1807296	3661863	5469159
1980	95222	1970761	4047724	6018485
1981	93598	1953492	4073366	6026858
1982	92118	2000094	4173689	6173783
1983	90414	2048787	4222612	6271399
1984	87936	2202620	4514751	6717371
1985	86072	2169012	4417902	6586914
1986	84355	1887227	3970277	5857504
1987	82703	1872484	3897569	5770053
1988	80988	1950765	3986832	5937597
1989	79487	2086108	4352906	6439014
1990	78165	2214471	4655629	6870100
1991	76644	1936833	4271574	6208407
1992	75159	2027163	4389854	6417017
1993	73149	2104595	4565431	6670026
1994	72037	2378895	4932575	7311470
1995	71053	2525051	5345176	7870227
1996	69906	2626351	5530119	8156470
1997	68600	2551785	5446480	7998265
1998	67838	2650367	5710226	8360593
1999	66945	2606907	5725794	8332701
2000	66386	2748614	5909236	8657850
2001	65695	2813878	6286780	9100658
2002	64076	2721656	6033325	8754981
2003	63947	2748733	6212412	8961145
2004	63353	3018609	6930073	9948682
2005	62296	3237623	7670433	10908056



D. LOS Calculations

Level of Service November:

	Ponte de la Guglie	Ponte De L'Anconeta	Ponte dei Bareteri	Ponte de L'Ovo	Ponte de la Paglia	Ponte de le Ostreghe
Max LOS	9.04	20.37	22.35	17.21	21.56	19.06
Min LOS	3.02	11.87	7.93	5.30	15.70	4.83
Average LOS	6.09	15.34	14.76	10.24	18.11	9.98

COSES Report Change by Months

Month	Total Locals	Total Tourists	%Change in Locals	% Change in Tourists
January	90000	32000	0.9	0.842105263
February	100000	41000	1	1.078947368
March	100000	39000	1	1.026315789
April	100000	56000	1	1.473684211
May	100000	57000	1	1.5
June	100000	62000	1	1.631578947
July	100000	65000	1	1.710526316
August	71000	70000	0.71	1.842105263
September	103000	71000	1.03	1.868421053
October	100000	69000	1	1.815789474
November	100000	38000	1	1
December	90000	33000	0.9	0.868421053

Level of Service September (Peak Month, Calculated)

	Ponte de la Guglie	Ponte De L'Anconeta	Ponte dei Bareteri	Ponte de L'Ovo	Ponte de la Paglia	Ponte de le Ostreghe
September Max LOS	9.04	31.83	40.58	26.58	40.08	32.74
September Min LOS	4.47	16.68	13.32	6.97	29.00	8.27
September Average LOS	6.18	23.34	26.01	15.09	33.58	17.24

E. LOS Full Table

	Ponte de la Guglie			Ponte De L'Anconeta			Ponte dei Bareteri			Ponte de L'Ovo			Ponte de la Paglia			Ponte de le Ostreghe		
Venetians	357			318			68			427			26			153		
Tourists	1142			1004			1831			1231			3894			1271		
Width	7.63			3			3.12			4.16			6.52			2.9		
Time	15			15			15			15			15			15		
	Tourists	Venetians	LOS	Tourists	Venetians	LOS	Tourists	Venetians	LOS	Tourists	Venetians	LOS	Tourists	Venetians	LOS	Tourists	Venetians	LOS
1950	175	1260	12.5	154	1122	30.7	281	240	11.1	189	1507	27.2	597	91	11.0	195	541	11.8
1955	243	1140	12.1	214	1015	29.6	389	217	13.0	262	1364	26.0	828	82	14.6	270	490	12.2
1960	297	1032	11.6	262	919	28.4	477	196	14.4	321	1234	24.9	1014	74	17.4	331	443	12.4
1965	343	933	11.2	302	831	27.3	550	178	15.5	370	1116	23.8	1170	67	19.8	382	401	12.5
1970	384	845	10.7	338	752	26.2	615	161	16.6	414	1010	22.8	1309	61	21.9	427	363	12.7
1975	424	764	10.4	373	681	25.4	680	145	17.6	457	914	22.0	1445	55	24.0	472	328	12.8
1980	467	692	10.1	411	616	24.7	749	132	18.8	504	827	21.3	1594	50	26.3	520	297	13.1
1985	518	626	10.0	456	557	24.4	832	119	20.3	559	748	21.0	1768	45	29.1	577	269	13.6
1990	581	566	10.0	512	504	24.4	933	108	22.2	627	677	20.9	1983	41	32.4	647	243	14.3
1995	660	512	10.2	581	456	25.0	1059	97	24.7	712	613	21.2	2253	37	36.7	735	220	15.3
2000	760	464	10.7	668	413	26.0	1218	88	27.9	819	554	22.0	2591	33	42.1	845	199	16.7
2005	883	419	11.4	777	373	27.7	1416	80	32.0	952	502	23.3	3012	30	48.8	983	180	18.6
2010	1035	380	12.4	911	338	30.0	1660	72	37.0	1116	454	25.2	3530	27	57.0	1152	163	21.1
2013	1142	357	13.1	1004	318	31.8	1831	68	40.6	1231	427	26.6	3894	26	62.8	1271	153	22.8
2015	1220	343	13.7	1073	306	33.2	1956	65	43.2	1316	411	27.7	4160	25	67.1	1357	147	24.1
2020	1441	311	15.3	1268	277	37.2	2312	59	50.7	1554	372	30.9	4915	22	79.1	1604	133	27.8
2025	1704	281	17.3	1499	250	42.1	2732	53	59.5	1837	336	34.8	5811	20	93.4	1896	121	32.3
2030	2011	254	19.8	1769	227	48.0	3226	48	70.0	2169	304	39.6	6860	18	110.2	2238	109	37.6
2035	2368	230	22.7	2083	205	55.1	3798	44	82.1	2554	275	45.3	8078	17	129.7	2636	99	43.8
2040	2779	208	26.1	2444	185	63.3	4457	40	96.1	2997	249	52.0	9478	15	152.1	3093	89	51.0
2045	3247	188	30.0	2856	168	72.8	5208	36	112.0	3502	225	59.7	11075	14	177.7	3614	81	59.2
2050	3777	171	34.5	3323	152	83.6	6058	32	130.1	4074	204	68.6	12882	12	206.6	4203	73	68.5