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The Boundaries of Venice Digitally Mapping Historical Venetian Borders and their Modern Day Implications

An Interactive Qualifying Project Report submitted to the faculty of the
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requirements for the Degree of Bachelor of Science

Submitted by:

John DeVine, Jr.
Marcus Lundgren
Dimitar Vouldjeff
Jessica Wey

Submitted to:

Prof. N. Aaron Deskins
Prof. Fabio Carrera

Sponsor:

Venice Project Center

ve16-bounds@gmail.com

<https://sites.google.com/site/ve16bound/>

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Authorship

John DeVine, Jr. was one of the main co-authors and co-editors of the report. He came on 80% of the day trips to find markers scattered around the lagoon. He was also the main manufacturer of the final presentation and of Venipedia pages.

Marcus Lundgren was the main manufacturer of mappings in GIS software. He came on half of the day trips to find markers scattered around the lagoon. He also contributed to the construction of our presentation, data collection app, and final tool. He was the main manufacturer and keeper of our team website.

Dimitar Vouldjeff was the main manufacturer of the data collection app and the final tool. He also contributed to mappings in GIS software.

Jessica Wey was one of the main co-authors and co-editors of the report. She came on all of the day trips to find markers scattered around the lagoon. She also contributed to the mappings in GIS software.

All group members contributed equally to the amount of research done for the report.

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Abstract

Venice's mainland and lagoon regions are polarized due to their economic and demographic differences. The regions, formerly divided by many historical borders of Venice, are now merged into one city. There have been unsuccessful referendums to divide Venice into two cities. No referendum came along with a border which would be used in a Venetian separation, so citizens were unable to view the implications of a split. Our project focuses on researching historical borders and viewing the statistics for each city created by a division of Venice. We created a tool that allows users to see the data arising from a separation of Venice along historical or user-made borders. This information will help Venetian citizens to make an educated decision as to where a boundary should divide Venice.

Executive Summary

The City of Venice consists of two regions, *Terraferma* or the mainland, and *Estuario*, or the islands in the lagoon. These two regions have very different economies, as *Estuario* has a strong base in tourism while *Terraferma* is mostly based in industries like shipping, shipbuilding, and manufacturing. Not only do these regions have varying economies, but their populations have changed substantially over the past 100 years. In 1921, *Estuario* was home to over 80% of Venice's population. This number has shrunk to around 37% today, as many residents of *Estuario* have left to find employment opportunities in *Terraferma* or other cities in the area. In addition to their lower population and representation in the metropolitan government, *Estuario* also has a much older population, meaning they have proportionately less people in their workforce. Because of their differences in both economy and demographics, residents have discussed a separation of the city into two independent cities within the past 35 years. Referendums in 1979, 1989, and 1994 have been held to gauge the public's opinion of a split but, though support for a separation has risen, none of the referendums culminated in an official vote that would decide the fate of the ideologically-divided regions; therefore, Venice is still one city with two very different ideals and priorities.

When separation referendums were held in the past three decades, citizens were simply voting on whether they wanted Venice to divide. These were not an official vote, though, and therefore did not come along with an official border that would be used if Venice were to be separated. We have postulated that one reason these referendums have not led to an official vote is Venetians were unable to visualize the implications of a split without knowing a proposed border that would be used. Because there is another referendum scheduled for early 2017, our project

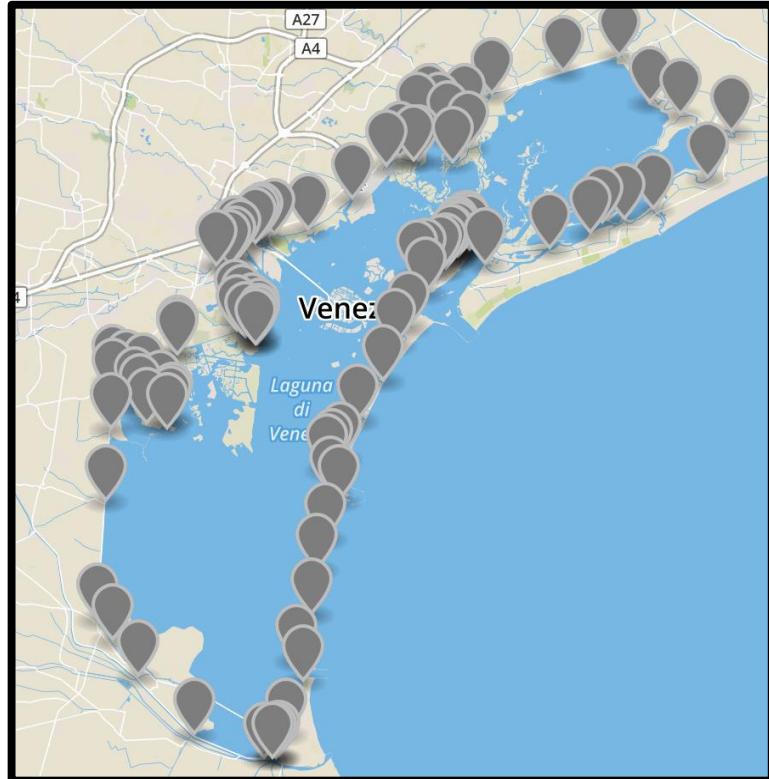
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focused on two main goals. Our first goal was to research, document, and preserve historical borders and proposed borders of Venice within the past 225 years. Furthering Venetian's knowledge on past border of the city and preserving the borders of the Venetian Republic would allow them to formulate borders that could be used to divide Venice. Our second goal was to design an interactive tool for Venetians to use to visualize the implications of a split along either historical or user-made boundaries. This tool would display the borders we researched to accomplish our first goal and, using data from the most recent census of Venice in 2011, would display the data of the cities created by either the historical boundaries we researched or by a border that a user could draw through the city themselves.

Over the course of our project, we researched political borders that have been used or proposed to delineate the border of Venice within the past 225 years. The oldest border researched was the border of the Venetian Republic in 1791. This border, which stretches around the Venetian Lagoon, is marked off by 100 stone or brick markers. In order to document and preserve this border, we visited the markers spread around Venice to document their location, to confirm the border of the Republic in 1791, and to document their condition to help to preserve the historic border of Venice. These markers are a part of Venetian history and culture, so our project also focused on documenting the markers to aid in efforts to restore the markers. Besides the border of 1791, we focused on the progression of Venice between 1883 and 1926. In 1883, Venice was just the historic center island in the middle of the lagoon. However, within 43 years, it was gradually combined with the other close by islands in the Adriatic Sea along with a large amount of territory on the mainland until it encompassed the land that it claims today. We lastly researched the borders of Venice today; we did not only focus on the exterior borders of Venice, but the subdivisions of

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Venice as well, as Venice is divided into *municipalità* (similar to boroughs in New York City) and further into *quartieri* and *località*. We also researched theoretical models on how to divide Venice as published in a 1990 case study, *Three Models for the Future of Venice*. Besides just researching the political borders of Venice, we also researched the ever-changing geographical borders of Venice. Land has been reclaimed in the lagoon throughout the past two centuries; this has caused debate over which side of Venice would retain this land if the city were to divide into two separate entities. Research into these borders would help to further educate Venetian citizens on how Venice could be divided in a future referendum.

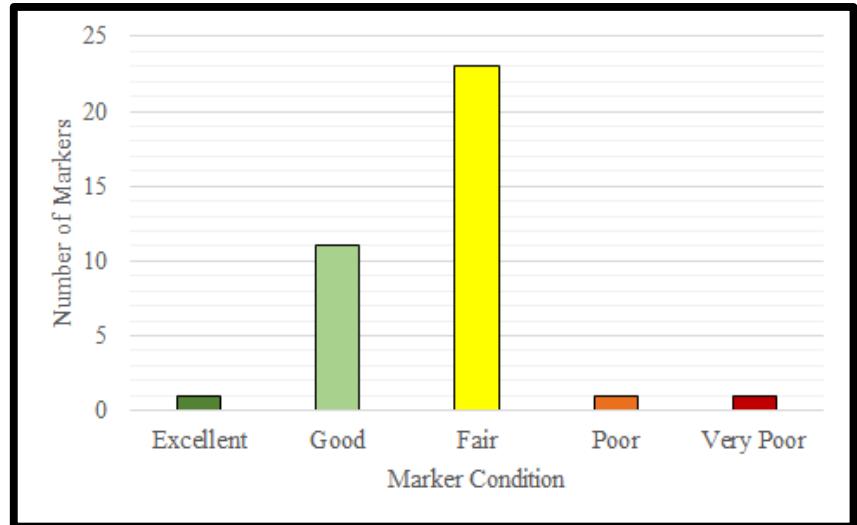


A large task within our project was visiting the markers spread throughout the city of Venice to further document the border of the Venetian Republic. Because a great deal of data was collected at each marker, and we had a large amount of markers to visit, we created data collection tool (bounds.herokuapp.com) to more effectively organize data and navigate to markers. The tool contained locations from a book written on the marker in 1990, *I Cento Cippi di Conterminazione Lagunare*, and directions from google maps helping us to find the markers. Additionally, this tool allowed us to input dimensional and geographical data on the markers as well as physical

characteristics of the marker (biological growth around the marker, biological growth on the marker, environmental discoloration, structural disintegration, and surface cracking) on a one to five scale. The tool then calculated the marker's condition and restoration potential; these values can be used to determine what markers should be repaired in any future restoration efforts. The tool also stored pictures of the marker and its surroundings that we took at each location.

Due to time and transportation restraints, we were able to visit the location of 69 border markers. Unfortunately, many markers were inaccessible due to either the marker's location in a canal, body of water, or heavily overgrown area, or its location on private property which were not allowed access to. We only ended up accessing 37 markers. Of the markers we visited, over 90% were considered to be between good and fair condition.

Overall, the average marker condition, a rating of the marker's overall physical state, was 2.51 (good/fair), with a standard deviation of 0.68. The average restoration potential, a measure of how easy the marker could be restored, was 2.43 (low/average) with a standard deviation of 0.66. Only three markers visited were in either poor or very poor condition. Similarly, three markers were determined to have a high restoration potential based on the five conditions we measured at each marker. Our team recommends a restoration of markers 73 (located near the Fort of Marghera), 92 (located on a popular walking path in Giare, a town south of Venice), of Jesolo,

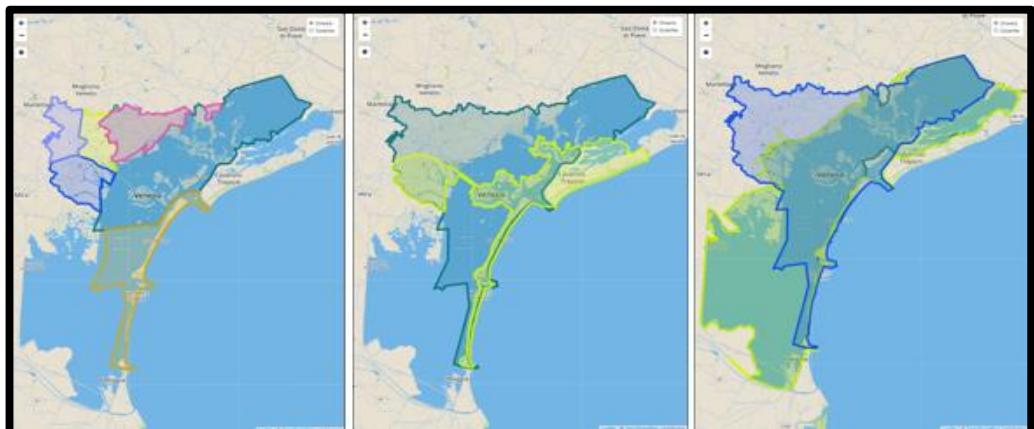


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northwest of Venice) if there are to be any efforts to restore the markers placed by the Venetian Republic in 1791. If restoration efforts were to be centered in one specific place, we would recommend the restoration of markers on the walking path in Giare. Out of the areas we visited, this area had the markers with the worst average marker condition (2.98). This area is a popular place to walk, so many see these markers every day, further cementing their potential to be restored.

After documenting the markers and confirming their location, our second task was to map the 1791 border in GIS software along with the other historical and geographical borders as mentioned above. We ended up outlining 37 different borders in GIS. These borders include the city borders of Venice along with the borders of its six *municipalità*, twelve *quartieri*, other nearby towns in Venice that were once part of the city and are still a part of the Venice Metropolitan Area, the lagoon boundary of 1791 and the two modifications that have been made to it since (after the advent of reclaimed land), the progression of the boundaries of Venice between 1883 and 1926,

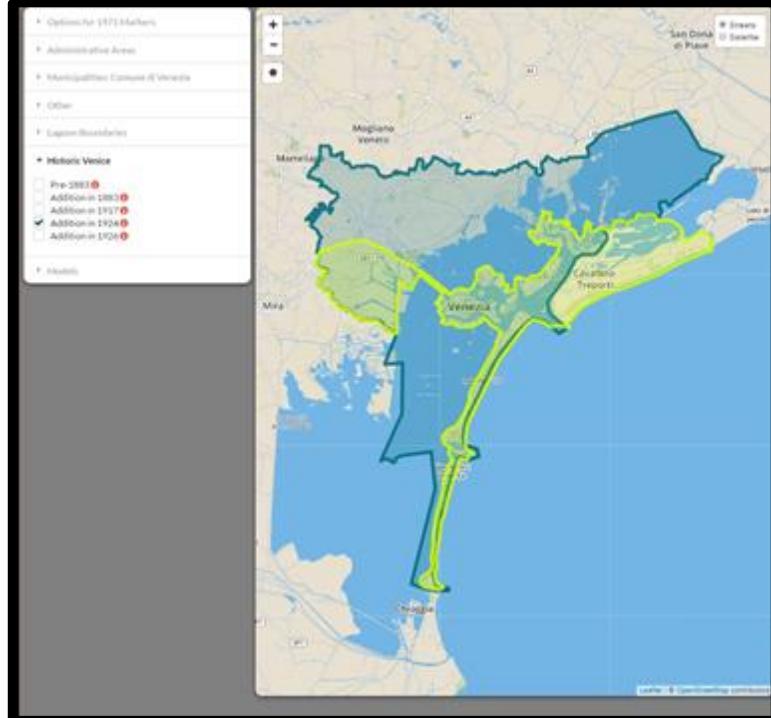
and the three models on how to divide Venice as published in a 1990 case



study. The GIS renderings of these borders are displayed alongside the marker data in our final tool (bounds.herokuapp.com).

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Our last and most important goal was to create a tool that would display the borders researched in the paragraph above and present data on what would happen if Venice were to be divided into two cities along that border. Using census tract information from the Venetian Census in 2011, we created a tool (also housed at bounds.herokuapp.com) that can display the information on the historical and proposed borders we outlined in GIS. This tool displays the population (broken down by age



and education), amount of people eligible to work, number of jobs, and number of companies in the region outlined. This data is imperative to anyone looking to visualize the implications of a division of Venice.

The tool is also built in a way where users can draw their own boundaries through the city of Venice, as shown on the left. Venetian citizens and lawmakers who use this tool are not restricted by the boundaries of Venice in the past, which may not be as relevant as borders they could draw themselves. This addition to our tool allows users to isolate certain parts of Venice which are the most important economically, like the Marco Polo International Airport or the Port of Marghera, both of which supply large amounts of income and jobs to the city. Like the borders

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we outlined in GIS, users of the tool are able to visualize the economic and demographic data of the borders they draw to see their potential implications.

Our documentation and preservation of historical borders of Venice as well as the creation of our tool relating them to today's census data will allow Venetians to educate themselves on the implications of a division of Venice. We are confident that, with the use of the tool we created, Venetian citizens and politicians will be able to make the most informed and educated decision on splitting Venice into two independent cities and where the border should lie between them.

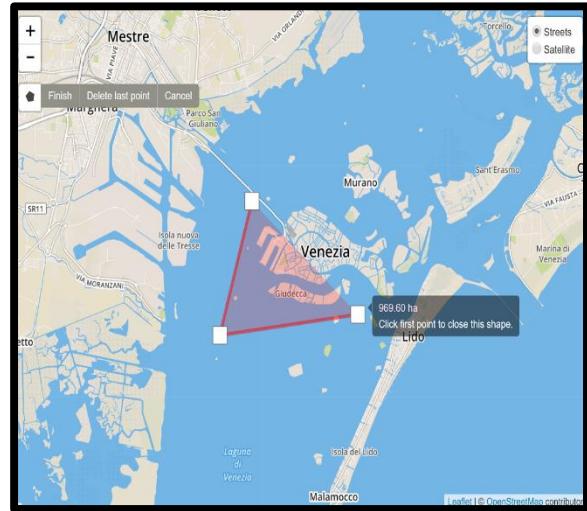


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1.0 - Introduction

Within the past 100 years, many regions have tried to separate or secede from their city, state or country due to economic, cultural, or demographic differences. Processes to initiate separation have taken a variety of forms, ranging from violent means, like rebellions and wars, to more peaceful means, like civil protests and government-held referendums. Movements towards peaceful separations are ongoing across the world today, including in the state of California, the countries of Georgia and Canada, and in regions throughout Italy (Goodyear, 2016; BBC, 2016; Montabaldo, 1994).

A separation movement has arisen in Venice due to differences between its two main regions (Montabaldo, 1994). The City of Venice consists of two regions: the mainland, or *Terraferma*, a region of 179,000 residents with a strong focus on shipping and manufacturing, and the historical city and islands of the Venetian Lagoon, or *Estuario*, a region of only 84,200 with a tourism-based economy (Comune di Venezia, 2016). Since 1979, four referendums have been voted upon to split the city, roughly dividing it into *Terraferma* and *Estuario*. Unlike other movements throughout the world, the citizens of Venice have not come to a compromise in these referendums on an official border to use for a separation.

As a result of the lack of consensus on an official border, past boundaries become useful to examine because they may subdivide regions of Venice in ways they may retain relevance today. For instance, in 1791, the Venetian Republic placed 100 stone markers around the perimeter of the lagoon. These markers still exist today (though their conditions are not well documented) and roughly separate Venice into its two regions of *Terraferma* and *Estuario*. The internal and external borders of Venice were defined differently in the 1800's under the control of France and then

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Austria-Hungary, as well as when it was ruled by Mussolini in the 1920's (Conto, 2009). Despite the political relevance these borders may hold today, Venetians have not been able to consider or visualize how their logic of the past boundaries can apply today.

Past borders could be used as baselines for a possible separation, but there is no documentation of past borders as they relate to the economic and geographic situation of Venice today. The book "*I Cento Cippi di Conterminazione Lagunare*," authored by Venetian archivist Giovanni Caniato, includes dated pictures, directions, and locations of the 1791 historical markers, though it is not in a digital format which is easily accessible. Maps of Venice under French, Austro-Hungarian, and 1920's Italian control are housed physically in the Venetian Archives. In order for the City of Venice to become more informed, baseline maps of past boundaries are not solely sufficient. Relating current economic and demographic data of Venice to these past borders is essential in making future decisions on potential separations. However, no tool exists allowing Venetians to relate these borders to the current day economic and demographic data.

The goal of our project is to make boundary information more accessible to citizens and government officials of the *Estuario* and *Terraferma* regions for a possible separation, as well as preserve information on the historical boundaries of Venice. This will involve digitally cataloging the condition and location on all of the historic markers of the Venetian Republic, digitally mapping of modern and historic boundaries as well as developing an intuitive, user-friendly interface to access this information. Previous boundary proposals and past territorial divisions will also be investigated and digitally converted to compare with economic and demographic data. Although information collection is the major priority, our interface will be the first aggregation of this data for Venetians to use for future redefinition and modification of any proposed boundary.

2.0 - Background

Comprised of *Terraferma* (the mainland), and *Estuario* (the islands in the Adriatic Sea), Venice is a city with a storied border history. In 1791, the waning Venetian Republic placed boundary markers denoting the borders of the lagoon. Between 1797 and 1866, Venice was ruled alternately by the Napoleon and the Austro-Hungarian Emperor before becoming part of the Kingdom of Italy in 1866. During this time period, the region (formerly the Republic of Venice), was broken up into self-ruling cities. The historic center, or *Centro Storico* was the only region referred to as Venice proper. Then, between 1883 and 1926, mostly under the rule of Mussolini, it was combined with small industrial villages on the mainland and islands in the lagoons, which established the territory that Venice maintains today. The timeline below in Fig. 1 shows the progression of who controlled Italy from 1797 to today.

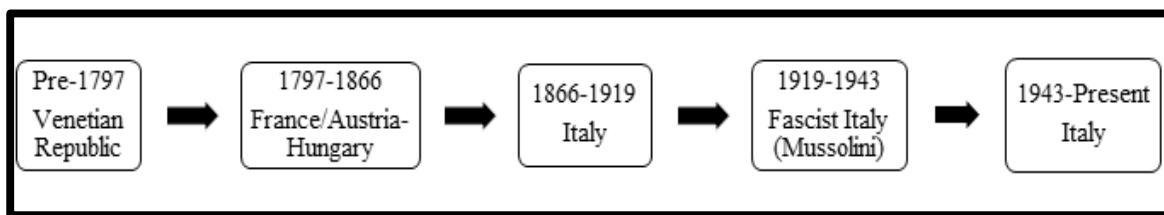


Fig. 1 shows the history of who controlled Venice.

These two regions have grown apart in the last 90 years due to their economic and political differences. Decentralization movements that spread through Europe in the 1970's led to the first of multiple referendums to split the two areas into independent cities, none of which have been successful. Our project will relate past and proposed borders to economic and demographic conditions of the present in a way which will assist in future border decisions.

Today, the *Comune di Venezia* (City of Venice) is subdivided into six different boroughs called *municipalità*. The *municipalità* of Venezia-Murano-Burano (Mun. 1), where transportation is entirely by boat, and Lido-Pellestrina (Mun. 2), which are served by ferries and boats but have cars, all together make up the so-called *Estuario*. The *municipalità* of Favaro Veneto (Mun. 3), Mestre-Carpenedo (Mun. 4), Chirignago-Zelarino (Mun. 5), and Marghera (Mun. 6) make up *Terraferma* (See Fig. 2), i.e. the mainland, where transportation is by road or rail, like most of Italy. These municipalities can be compared to the boroughs of New York City; each one has varying economies and priorities but they are all under the jurisdiction of the mayor of the City of Venice (Comune di Venezia, 2016).

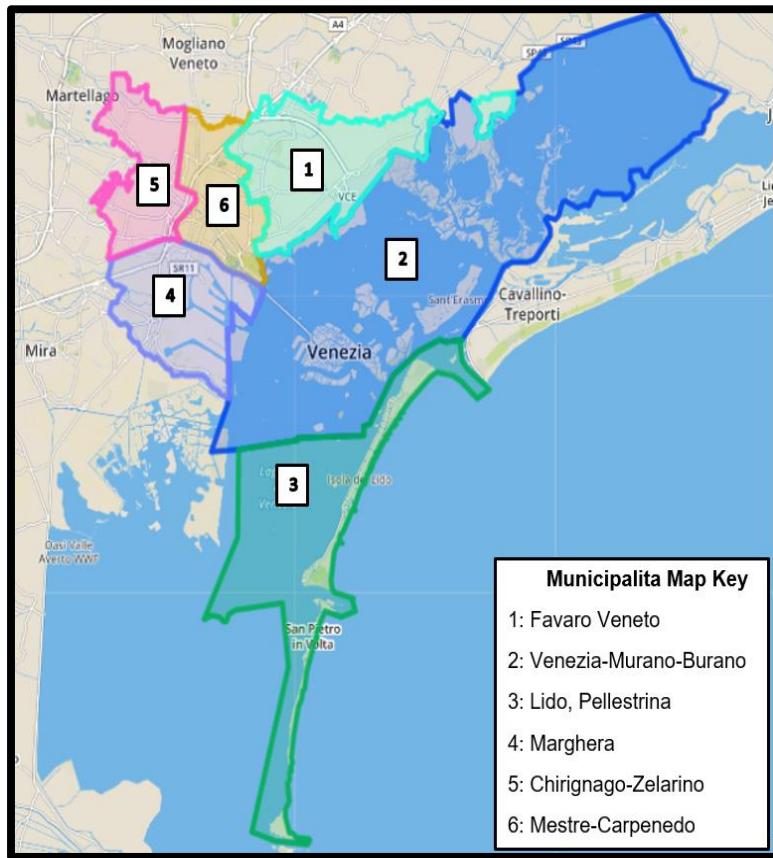


Fig. 2 shows the current *municipalità* of Venice.

2.1 - The Changing Landscape of Venice

Land area and coastal regions in *Terraferma* have not always been constant, but have changed over time. Historical land reclamation practices have led to further additions of land that have become economically significant. In the map shown in Fig. 3, that available land on the mainland has changed over time. This is due to the reclamation of land in the lagoon, which began creating land through drainage of water in the lagoon. A government association dedicated to drainage and irrigation on the mainland was called the *Provveditori Al Beri* (PAB), whose influence on the mainland was “hard to overestimate” (Whyte, 2004). Between 1560 and 1600, the

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association reclaimed over 580 square miles of *Terraferma* land from swamp or lagoon area by drainage (Whyte, 2004). Motivation for this extensive process was prompted by a shortage of food supplies which marked an important shift from maritime commerce to more agriculture based economic activity on the *Terraferma* (Whyte, 2004). Since 1800, reclamation continued to occur which allowed current economic centers to grow and expand, such as the seaport of Mestre, the port of Marghera, and the Marco Polo airport (Cessi, 2015). Regions of the *Terraferma* on reclaimed land have since shifted to become industrial sectors but still retain their economic importance in the present day.

The following figures show the evolution of reclaimed land in Venice. The first map is from 1809 (Fig. 3), when some land had been reclaimed in the Adriatic Sea, but not to the extent of present-day Venice. The second map is a map from the 21st century, with major sections of reclaimed land present. The encroachment of land from the mainland towards the lagoon in the past 200 years shows the instance of land reclamation by Venice.

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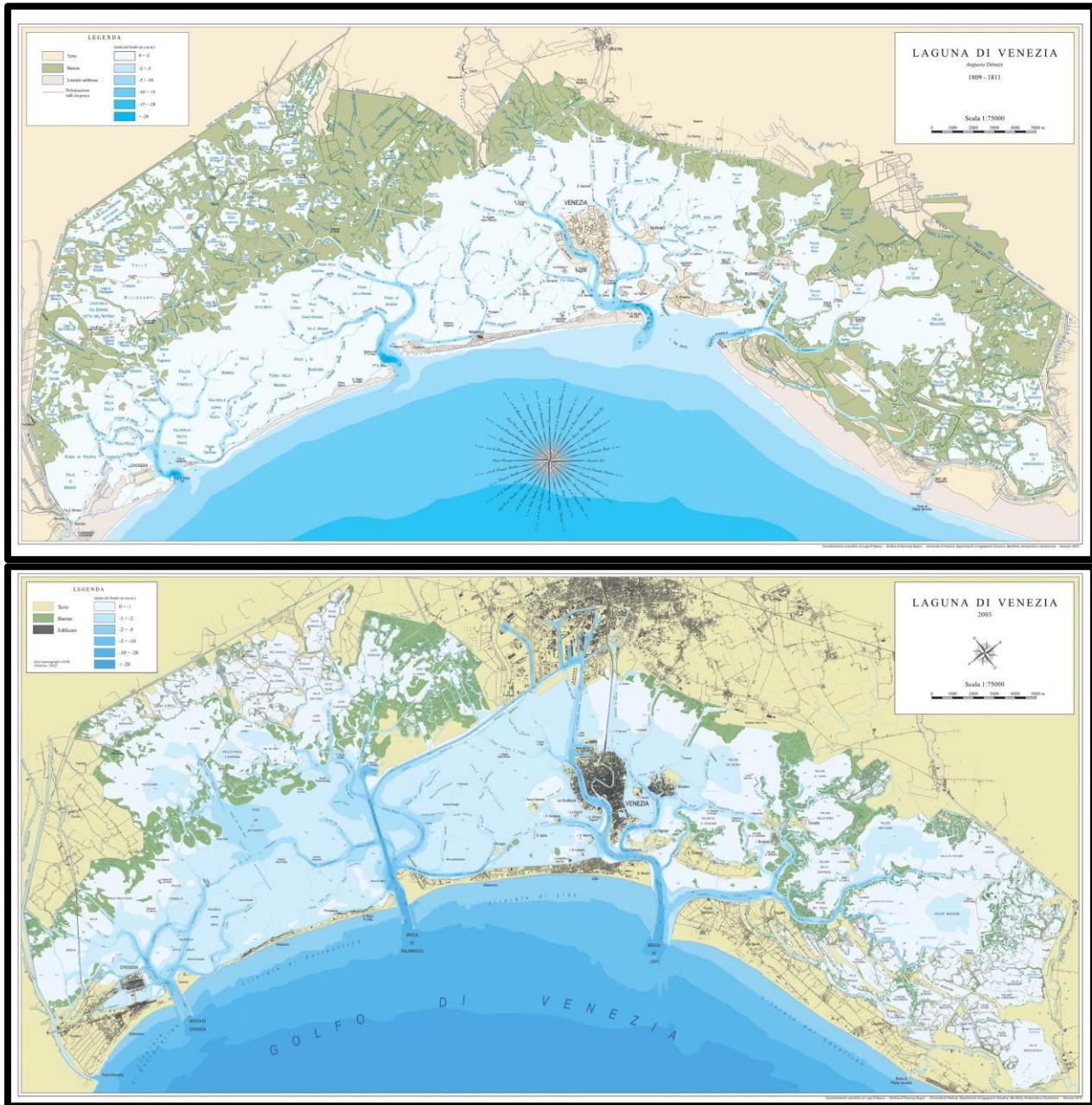


Fig. 3 shows a map of Venice in 1847 (top) and 2003 (bottom); Green parts of the map are unusable swampland, cream colors are usable land. This figure shows the evolution of land reclamation within the past 170 years.

2.2 - The Lagoon Boundary as Established in 1791

The lagoon, with its complex system of man-made islands and canals, was the socio-economic center of the Venetian Republic until its collapse in the late 18th century. In the early 16th century, the Republic created the *Collegio delle acque* (Water Authority) to protect and maintain “the infrastructure” of the area (Armani, 1991). The body was responsible for land reclamation, creation and maintenance of water canals, excavation and preservation, as well as protection and regimentation of the lagoon and its rivers (Armani, 1991). Members even had the inquisitorial powers to investigate and punish citizens for compromising hydraulic systems that “drained” the swamps (Armani, 1991). The complex set of responsibilities of the Water Authority reflected the Republic’s promise in guaranteeing the survival of the city and its economic importance.

In the late 1700s, the Water Authority introduced even stricter restrictions and severe fines for citizen of the lagoon who further constricted the water spaces, did not maintain their buildings, obstructed the development and modernization of the city, or diminished the quality of public spaces (Armani, 1991). To ensure that there was a clear boundary of the Water Authority’s jurisdiction, in 1784 the Venetian Republic ordered an unambiguous border to be devised and marked via physical markers placed across the lagoon.

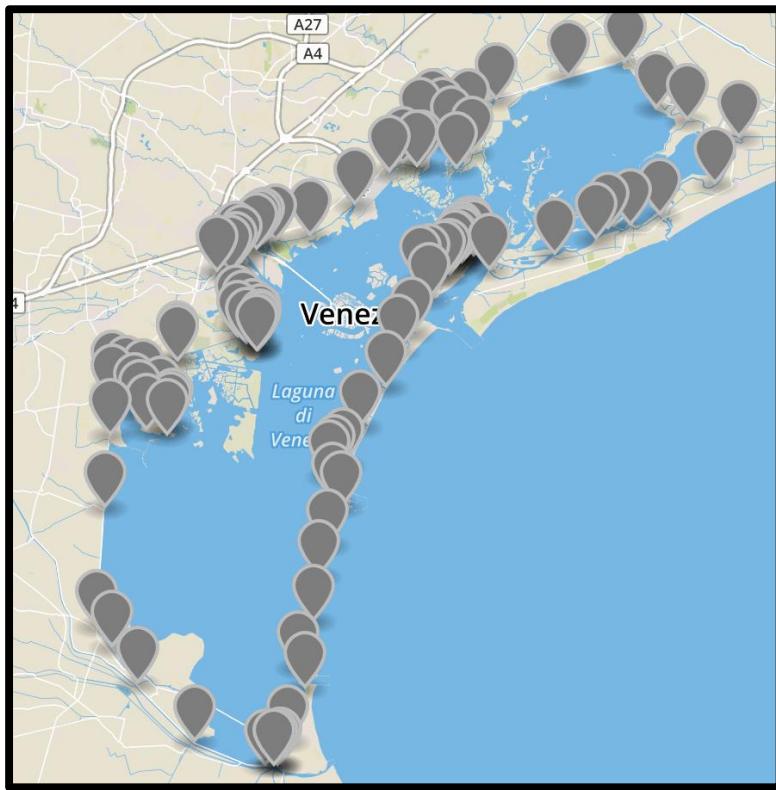


Fig. 4 shows the location of the 100 Markers placed around outline of the lagoon on the mainland and islands surrounding the historical center (Caniato, 1991).

In 1791, 100 *cippi*, or markers, were erected at carefully selected spots around the lagoon (see Fig. 4). Made of either Istria stone (a white stone) or brick (See Fig. 5), these markers were placed at river junctions, lagoon inlets, bridges and along canals; sometimes placed on the right bank of a river, others on the left (Armani, 1991). This seemingly random arrangement, in fact, divides fresh from salt water and is determined by the direction of the river - e.g. if river flows to the north, markers are placed on the right bank (Armani, 1991). The markers had a strategic placement based on the landmarks around them, and were a physical representation of the Water Authority's dominance.



Fig. 5 shows an example of an Istria stone marker (left) and a brick marker (right).

2.2.1 - Geographic Bumps in Mainland

A geographical bump is an extension of land that could be described as a mini peninsula. Though a part of the mainland of Italy, there are three bumps that were zoned to the lagoon region of Venice when the markers were placed in 1791, the Lugo bump (at the bottom of Fig. 6 circled in green), the Fogolana bump (at the top in blue) and the Conche bump (in the middle in red). These areas, used as pastures and farmland, were originally given to *Estuario* because of the canals that cut them off from the mainland (Caniato, 1990).

The Boundaries of Venice

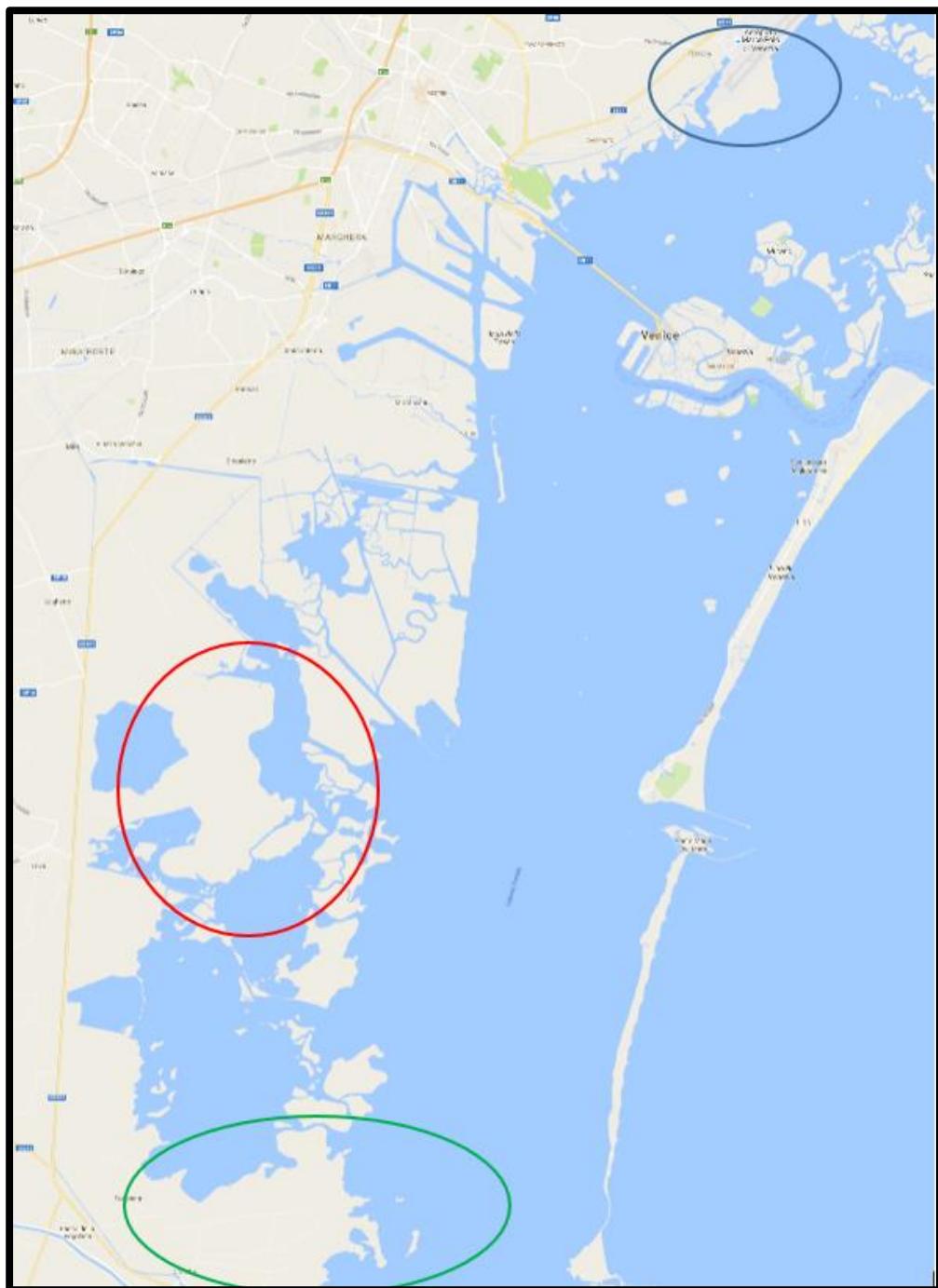


Fig. 6 shows geographical bumps (mini peninsulas) considered part of *Estuario* according to the 1791 boundaries of the lagoon (Lugo bump at the bottom in Green, the Conche bump in the middle in red, and the Fogolana bump at the top in blue) (Caniato, 1991).

2.3 - Venetian Boundaries after the Fall of the Republic

Between the fall of the Venetian Republic in 1797 and the early 1900s, Venice had been controlled by France, Austria-Hungary, and Italy, as well as a brief stint of independence in 1848. During this 130 year period, the borders of Venice were divided differently than today (Plant, 2002).

In May of 1797, the French invaded the historical center of Venice and ended the Venetian Republic and rule of the Doge in Venice. A democratic government was formed provisionally under the model of France. The new republic emblem was hung in the Doge's palace and subsequently the new branch of the French government was centered in San Marco in the historical center (Venice: Napoleon's Italian). In structural organization, Venice cities were organized with provisional municipalities or smaller subdivisions to break up the new "system of provisional representative government"(Venice: Napoleon's Italian). This new democratic government was overseen by a French Military Governor but legislative decisions were voted on by Venetian citizens (Venice: Napoleon's Italian). With the end of the Venetian Republic, both the government and territorial divisions were transformed.

In October of the same year, Austria was given the Venetian territories under that were renamed the "Venetian Province" under the treaty of Campo Formio. The provisional government was very similar to the French with a democratic system centered in San Marco (Venice: Napoleon's Italian). The elected governor of Venice was Daniele Manin, a well-liked lawyer in Venice.

Both France and Austria-Hungary created cadastres of Venice when they were in control. A cadastre is a very accurate and specific map of a region. These cadastres display larger

boundaries in groupings of land but also specifically include individual plots of land based on ownership. Information from these cadastres is incredibly helpful in determining how Venice was divided under French and Austro-Hungarian control. Unfortunately, information on these divisions are not available electronically; these maps can currently be found physically at the Venetian Archives (Conto, 2009).

After its annexation to the Kingdom of Italy, Venice was just defined as the historic center island. It remained this way until 1883, when Lido and Malamocco were added to the city of Venice. The city held these boundaries for 34 more years until, under the direction of Mussolini's predecessor Giovanni Giolitti, it was combined with the small industrial port of Marghera for economic reasons. When Mussolini won over the prime minister's seat, he followed Giolitti's lead and combined the rest of the surroundings of Venice with the city. In 1923, he combined Venice with Pellestrina. 1924 saw the annexation of Burano, Ca'Savio, and Murano with Venice. Lastly, in 1926, he combined the rest of the mainland that would bring Venice to its current day boundaries.

2.4 - Current Demographics and Economic Breakdown of Venice

The city of Venice is roughly split into its two main parts, *Terraferma* and *Estuario*. Differences between the two areas include not only the disparities in sheer population numbers but also the age breakdown of the population. According to the most recent census in June of 2016, the City of Venice is home to 262,000 residents split among six subdivisions called *municipalità* (Comune di Venezia, 2016). Fig. 7 shows the breakdown of citizens by *municipalità*.

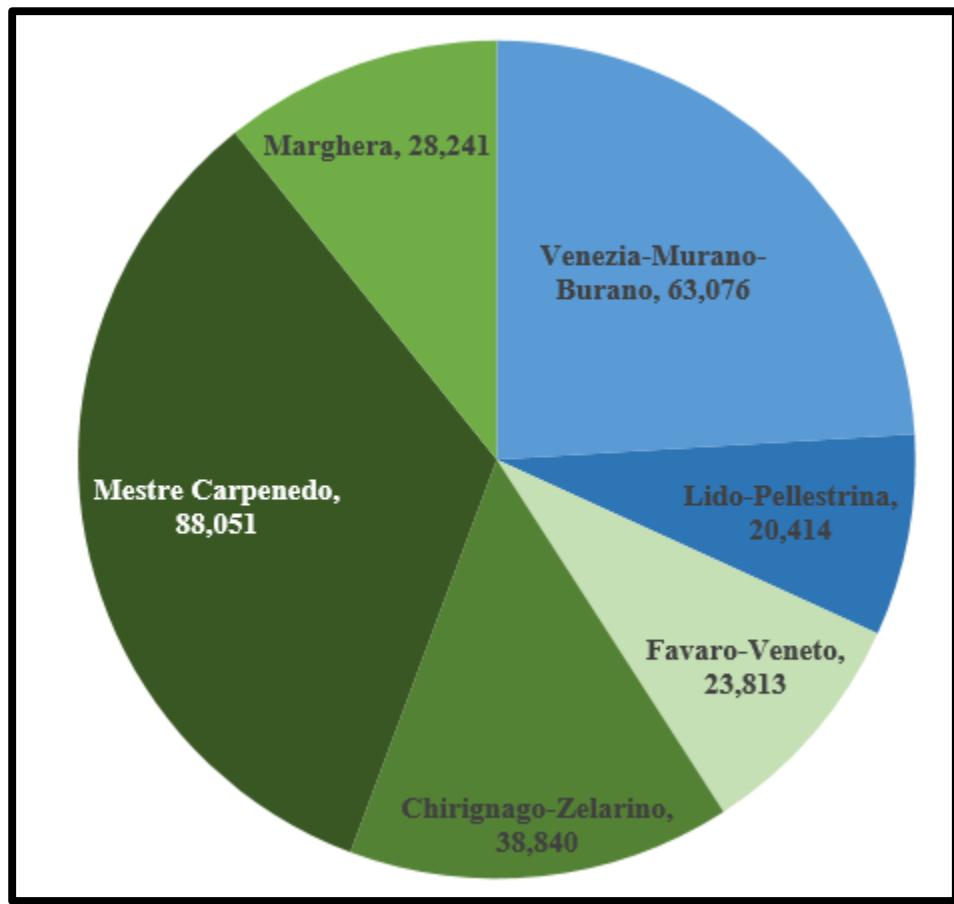


Fig. 7 shows the population of Venice by *Municipalità* [municipalities] (Blue Slices make up *Estuario*, Green Slices make up *Terraferma*) (Comune di Venezia, 2016)

2.4.1 - Demographics and Economic Breakdown of *Terraferma*

Terraferma is home to approximately 179,000, or 68.19% of the residents of Venice as shown in Fig. 7. The green slices in the chart represent the four *municipalità* in *Terraferma* (Favaro-Veneto, Chirignago-Zelarino, Mestre-Carpenedo, and Marghera). The *Terraferma* has not always been the most populated part of Venice; however, the percentage of Venetians living in *Terraferma* has increased steadily in the past 100 years. In 1981, only 60.99% of Venetians lived in *Terraferma*, 7% less than today's total of 68.19% (Comune di Venezia, 2016). *Terraferma*'s

larger population gives them significantly more voting power in Venice as well as more positions in the city council. *Terraferma* has a relatively high percentage of younger residents who are between 20 and 64 in its population. About 58% of the population of *Terraferma* are in this age range, compared to 51% in *Estuario*.

Terraferma's economy is based heavily on manufacturing, shipbuilding, and transport along with other industrial positions. As such, it has a higher percentage of people working in such jobs compared to *Estuario* (Comune di Venezia, 2016). See Fig. 8 for a breakdown of jobs in *Terraferma*.

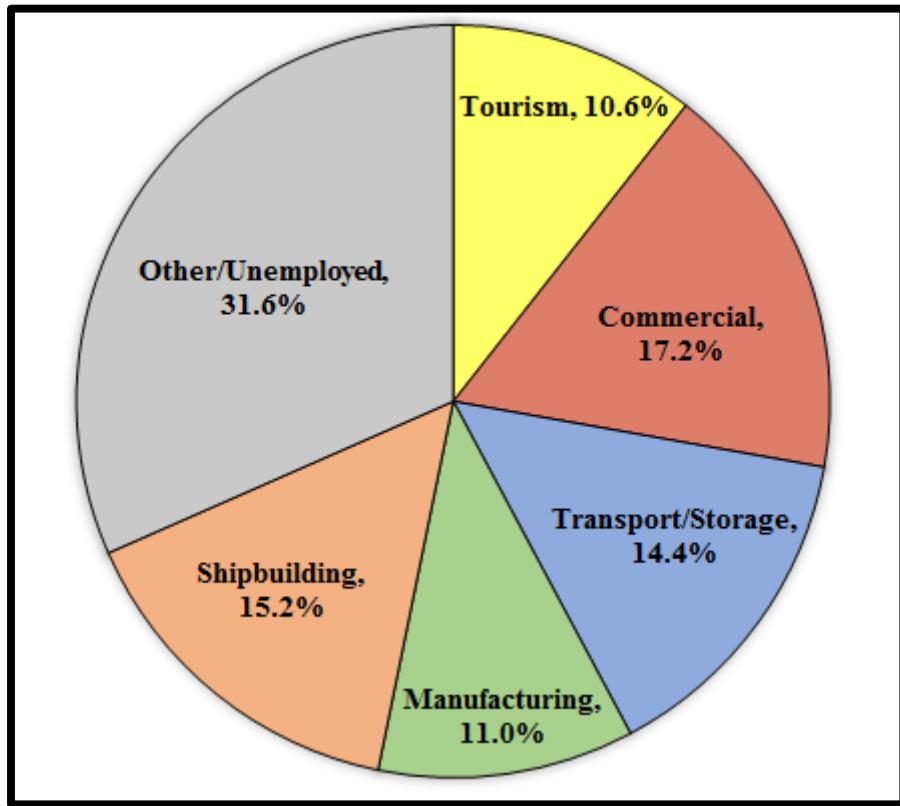


Fig. 8 shows the breakdown of how *Terraferma* residents are employed (Comitato Mestre-Venezia due grandi citta, 2016).

Because *Terraferma*'s economy is based in industries which likely appeal to young, unemployed Venetians, it attracts those living in the historic center of Venice to move closer to where they could get a job. The evolution of *Terraferma* from a small industrial village to an economic powerhouse has caused a large shift in population, turning *Terraferma* into a steadily growing blue collar region of Venice.

2.4.2 - Demographics and Economic Breakdown of *Estuario*

Estuario is home to about 84,200 residents (See blue slices of Fig. 7), which makes up about 32% of the population of the city of Venice (Comune di Venezia, 2016). Comprised of the *municipalità* of Venezia-Murano-Burano and Lido-Pellestrina, *Estuario* has declined in population since 1921, when it comprised of over 80% of the population of the city as a whole. Fig. 9 shows the total population of the city since 1921 and the population breakdown by region.

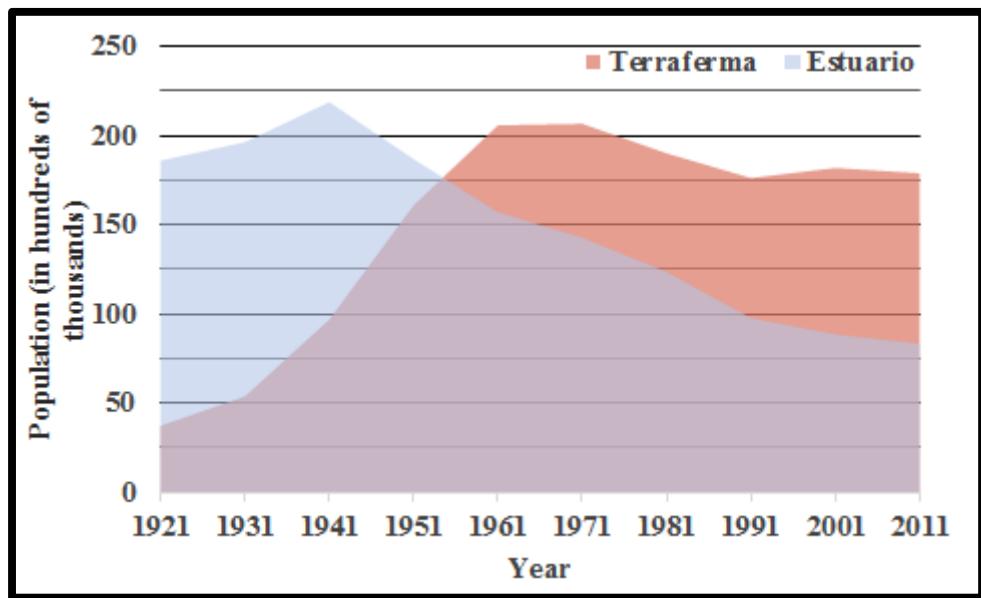


Fig. 9 displays total population of Venice throughout the last 90 years along with how many live in each section of Venice (Comune di Venezia, 2016).

It is clear from the figure that the percentage of Venetians living in *Estuario* has decreased since 1921. Its lower population and therefore lower representation in voting makes it hard for *Estuario* to pass legislation that benefits primarily *Estuario*. The city council is almost entirely composed of citizens of *Terraferma*. To compound this issue, only 51% of *Estuario* is between 20 and 64, which is 7% less than *Terraferma*. This divide in population and age brackets can be attributed to a high cost of living in *Estuario* and lower prevalence of jobs that appeal to young Venetians when compared to *Terraferma*. A 2002 study correlated cost of living with tourist popularity which explains why the cost of living in *Estuario* is so high (Ko, 2002).

Unlike *Terraferma*, *Estuario*'s economy is based heavily in tourism, as Fig. 10 shows. It employs almost 30% of its population in the tourism field, three times more than its mainland counterpart.

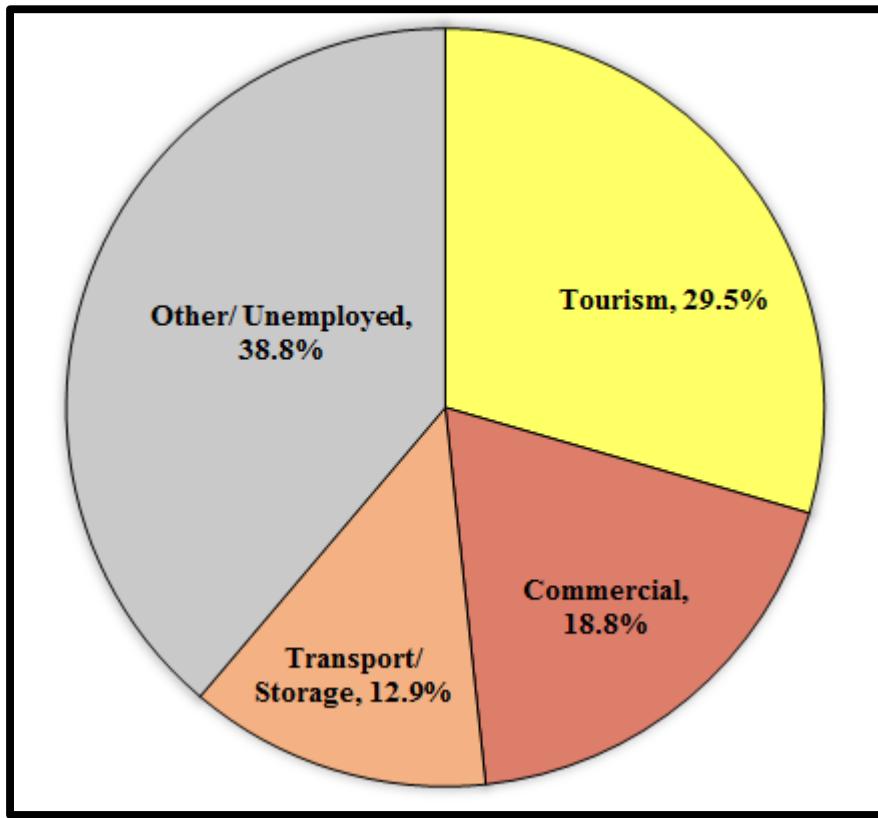


Fig. 10 shows the breakdown of how *Estuario* residents are employed. (Comitato Mestre-Venezia due grandi città, 2016).

With so many jobs based in tourism and commercial industries, *Estuario* can seem unappealing to those with a college education, which could cause them to move from *Estuario* to either *Terraferma* or another part of Italy altogether. In short, *Estuario* can be described as an expensive area thriving off tourism while dwindling in population and voting power.

2.5 - Separation Referendums and Boundary Proposals

Within the past 100 years, *Terraferma* and *Estuario* have developed into economically and demographically different areas, subsequently polarizing them. In 1926, Mussolini merged these differing regions under one municipality which has led to more disagreements between the regions,

both of which have since pushed for greater autonomy. In fact, construction of the new port in the 1950s greatly polarized the two regions because it caused a migration of working age people to this industrial center for jobs (Muscarà, 1990). Polarization of the two areas culminated in the late 20th century when referendums, or polls to gauge public opinion, about separation began, the first instance being in 1979 (Morris, 1994). If these referendums were to pass, no official legal action will occur in regards to a separation but likely an official vote would be called.

2.5.1 - 1979 Referendum

In June of 1979, a governmental referendum, or public poll, was presented to the communities of *Estuario* and *Terraferma* which would gather the public's opinion on a possible dissolution of Venice. This referendum did not come with any governmental proposal, but was purely a way to gauge the public's opinion on the matter. Though the major political parties were against this referendum, the communities had small movements voicing their separation interest for the decade leading up to the referendum.

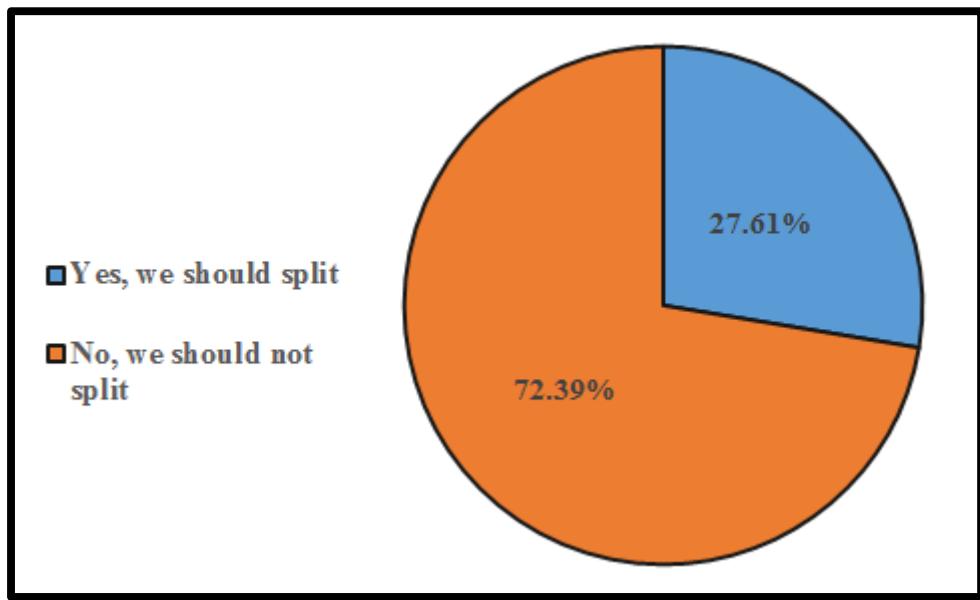


Fig. 11 displays 1979 Referendum voting results showing that 27.61% were in favor of separating Venice into two parts (OECD, 2001).

Displayed above (Fig. 11) is the total voting outcome of the referendum. Even though the public called for a vote, the results show a majority of the population did not want to separate. There is some debate over why the amount of people against the referendum was so high but a speculated reason was that people were influenced by the government's conservative or unfavorable views towards a separation. The majority of political parties, along with Mayor Mario Rigo, were greatly opposed to this movement. Government officials held the belief that a broader government holds wider ranging decision making powers, meaning they would be better at making laws that would compromise differences between the areas (Morris, 1994).

2.5.2 - 1989 Referendum

A decade later, separation movement's momentum in the *Terraferma* had increased greatly. Many people of the mainland felt "controlled" by the government because their economic

needs were not met by the government of Venice (Muscarà, 1990). The movement was considerably reinforced by the differences in economic base of industrialism versus tourism and was a main factor for 1989 referendum. It is important to note that after the 1989 referendum, amongst citizens of Venice, the amount of groups favoring separation increased. Additionally, they gained more footing and publicity. Along with a heightened level of approval for separation, a study about the split was written (*Three models for the future of Venice: A case study of territorial polarization in a growing area of urban periphery* (see more in Section 3.5.3)).

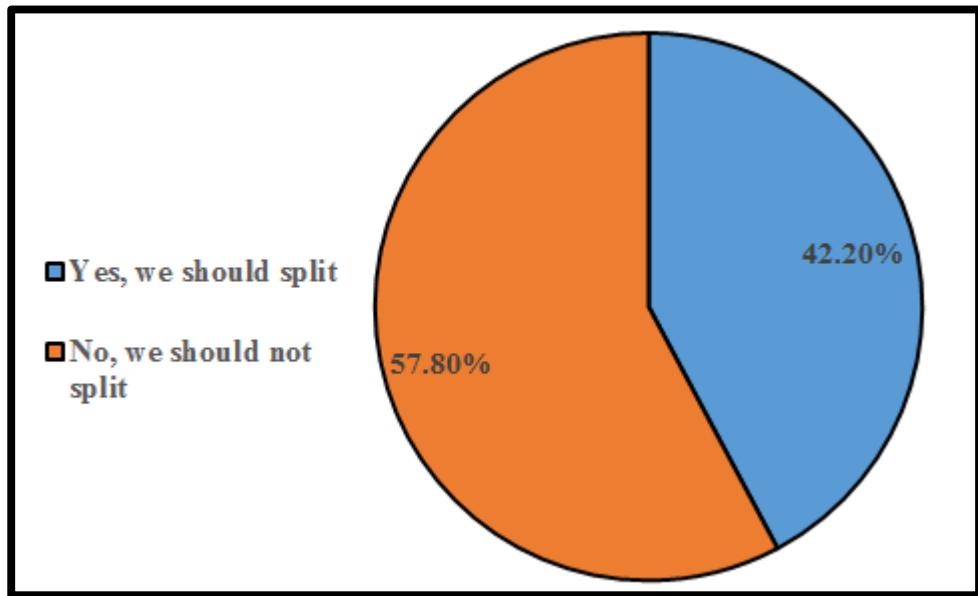


Fig. 12 displays 1989 Referendum voting results showing that 42.2% were in favor of a separation. (OECD, 2001)

In just one decade, there was a 15% increase (Fig. 12) in people wanting to split the city into two separate cities. Though the increase in support did not lead to an official vote, it portrays the rise in interest to split due to a widespread discrepancy between how Venice is administratively organized and how it functions economically (Calafati, 2011). It can be seen through independent polling data how *Estuario* individually increased 15% in “yes” votes instead of just a larger

increase in “yes” votes from *Terraferma*. This shows a proportional increase of both cities’ citizens wanting to separate.

Because of the increased support for a split compared to 1979, the push for greater governmental autonomy in Venice heightened in 1989, culminating in an additional referendum in 1994 and a case study about Venetian separation in 1990 (Muscarà, 1990).

2.5.3 - A Case Study for Venetian Separation

The case study *Three models for the future of Venice: A case study of territorial polarization in a growing area of urban periphery* written in 1990 (influenced by the outcome of the 1989 referendum) researched three different models concerning the restructure of the city of Venice. This paper, written on the study was authored by Calogero Muscarà, an Italian professor and official member of the Italian Geographical Society whose research centered on the reorganization of Italian territories. It was published by the Athens Center for Ekistics that sponsors programs of research and documentation of development of human settlements.

These three models were proposed to outline the different possibilities of border placement between *Terraferma* and *Estuario* based on different economic and population centers. These proposals were a result of a study done in 1990 investigating different models of Venice and Mestre based on economic factors. Each model is unique in its boundaries, with different economic, social and historical reasonings.

The following sections will solely describe the economic and historical logic behind each boundary model. Later in our report, the specific parts of this case study will be analyzed in order to determine where a boundaries of separate cities in Venice would fall based on the ideologies of

each model. The specific boundary location is a product of our team's interpretation of the case study and therefore will be included in our results section.

2.5.3.1 - Model 1: Greater Venice

The first model, Greater Venice, grouped the *Centro Storico* or historic center with certain economically significant municipalities of the mainland to form one city while the remainder of the mainland and islands formed a separate city. It prioritized the views and needs of the historic center of Venice. It focused on splitting Venice into two parts in such a way that the historic center would be able to focus on restoring its retaining its cultural significance. However, the economic income of the historic center is not enough to support those efforts, so it would be grouped with some industrial zones on the mainland. These industrial zones would act as support for the historic center of Venice. The report does not outline exactly how the city would be split, but rather alludes to how it might be separated.

2.5.3.2 - Model 2: Insular Venice

The model of Insular Venice is widely considered as being “separatist” in nature as it appears to split the *Centro Storico* (just the historic center) completely from the rest of the islands in the lagoon and mainland, dividing the city into two. This second model was first formulated after the lagoon islands suffered a devastating flood in 1966 (Popham, 2006). After this disaster, the two areas were in conflict because the mainland port of Marghera was found to be a large contributor to the island’s flooding due to improper hydraulic balance of the lagoon (Muscarà, 1990). This model is mostly supported by community members and officials concerned with environmental policy and lagoon infrastructure (Muscarà, 1990). A more local, thus representative

government for Venice would focus on dealing with environmental and structural issues with lagoon infrastructure. Although this model promises greater autonomy many recognize critical weaknesses such as the lack of economic infrastructure, population divide, and managerial class (the professional industrial class) present after a split (Muscarà, 1990).

2.5.3.3 - Model 3: Two Separate Towns

The third proposed model focuses on freeing the *Terraferma* from *Estuario* in creating two cities divided along the coast of the lagoon. Reasoning for this model is that many citizens of *Terraferma* feel that they have no emotional connection with those living in the lagoon area. This is the most widely supported of the three models because of the fueled autonomy movements based in the mainland part of Venice (Muscarà, 1990). This model looks to split Venice into two cities with the border between them being the border between *Terraferma* and *Estuario*. However, similar to the other two models, it is not exactly outlined where the border will be, so our project will work to further clarify where this border would lie.

2.5.4 - 1994 Referendum

Only 5 years after the last referendum, Venetians once again posed a referendum to gauge the public's opinion on a potential split of Venice into two independent cities. Conservative political parties had a great influence over the support for a split within *Estuario* and made claims that more representation in government was needed to solve the region's problems. However, progressive parties argued that many Venetian issues, such as tourism and lake pollution, were best solved as one city, not two. The referendum in 1994 saw roughly 56% of voters against the split and 44% for the split (See Fig. 13. Though Venetians in favor of a split were still in the

minority, support for a split was still increasing since the first referendum in 1979 (Montabaldo, 1994).

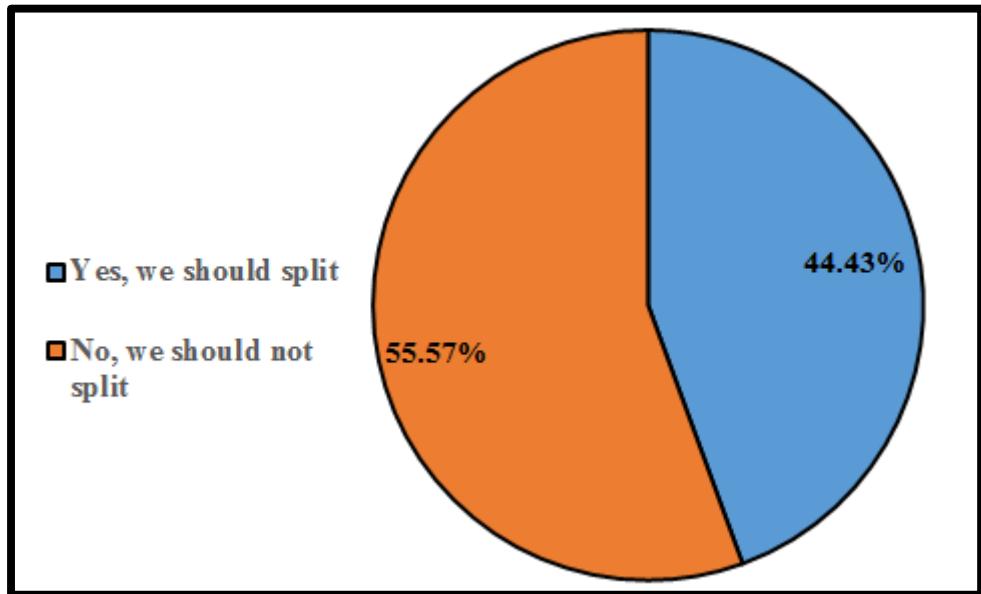


Fig. 13 displays 1994 Referendum Voting Results: 44.43% in favor of a separation
(OECD 2001)

2.5.5 - 2016/2017 Referendum

The recently passed Delrio Law in Italy has created a shift where cities have striven to diversify their economies and populations, much like US metropolitan areas. This law was created under the Secretary of State Graziano Delrio that gave the Italian cities more power through a city council, more money from the national government, and local taxation (D'Antonio, 2014). Cities that are close to each other (St. Paul and Minneapolis, MN in the US) tend to cooperate on transportation, infrastructure and other metropolitan policies though they remain independent

The Boundaries of Venice

cities (De Paoli, 2016). This movement towards the separation of a city into two cooperative cities has led Venice to once again consider a separation 22 years after the last referendum. Because many of the details on administrative reorganization were left to the regional governments, the Metropolitan area of Venice has yet to define subsections that would break up the regions.

A key driver in this latest movement is the organization “Comitato Mestre-Venezia due grandi citta” -- a civil, rather than political, group. It argues that Mestre and other urban centers (e.g. Marghera) need more autonomy to become economically competitive and bring back economic growth, and on the other hand, Venice (the historical center) needs more autonomy to resolve the problems caused by tourism (Comitato Mestre-Venezia due grandi citta, 2016). The organization proposes to split Venice (which contains both *Estuario* and *Terraferma*) into two separate cities – *Comune di Venezia & Comune di Mestre*. This split would create multiple opportunities for work and development as well as minimize administrative waste. In fact, a split into two cities could save €6m (\$6.8m) from administration costs every year according to Comitato Venezia, an organization aiming to preserve Venetian culture, history, and economy (Comitato Mestre-Venezia due grandi citta, 2016).

The civil group has collected enough signatures on a petition calling for a referendum. The latest development came on September 15, 2016 when the City Council said “no” because a referendum would be “expensive and meaningless,” but another referendum push is in the works for early 2017 (La Nuova di Venezia e Mestre, 2016).

2.6 - Select Points of Economic Interest

Venetians who want to make an informed decision about potential boundaries of Venice cannot solely depend on data about the population; they also need to know the details and location of important economic infrastructure in Venice. Three of historical Venice's main sources of income are shipping/trade, transportation hubs, and tourism. Ports, transportation hubs, and hotels lie on the coast of the lagoon and therefore near the 1791 and other past borders, information about them needs to be made more available to the public, so they can make an educated decision on potential border location and its economic impacts.

Some of the most significant economic points of interest are key hubs located on the mainland regions on reclaimed land such as the Port of Marghera and the Marco Polo Airport. These are specifically under contention because they were regions originally submerged in lagoon water, or technically part of the *Estuario*, but are now considered part of the mainland. They are also under contention because they provide thousands of jobs to Venetians. The Port of Marghera alone provides over 7,000 jobs, and the airport approximately 2,500 (Comune di Venezia, 2016).

2.6.1 - Ports of Venice

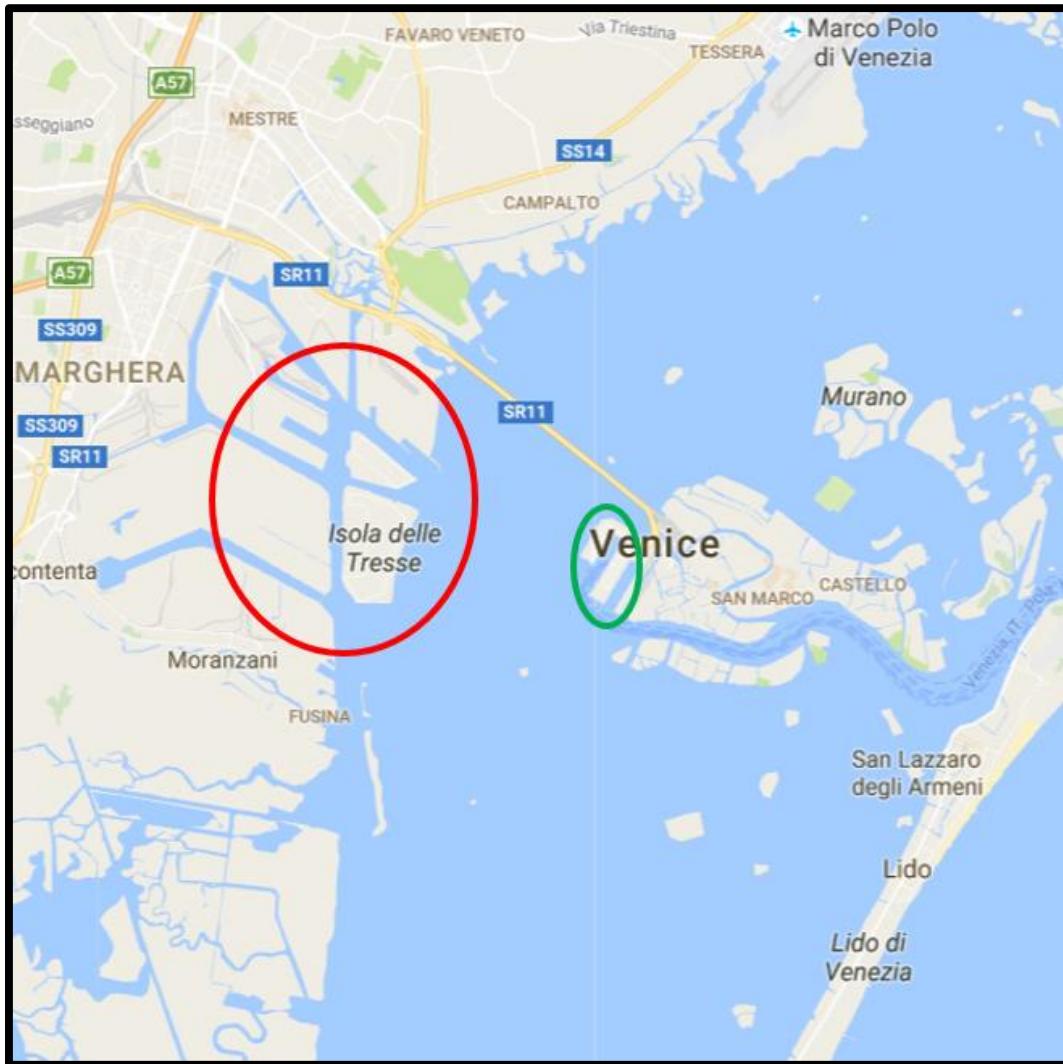


Fig. 14 shows major ports of Venice - Port of Marghera (circled in red) and Port of Venice (circled in green) Reference: (Zorzi, 2012).

Seaports in Venice are vital economic assets and are an important factor in deciding where future boundaries may lie for a future separation. There are two significant ports that specialize in differing economic activity -- the passenger port (at the end of the dashed yellow arrow on the

right in Fig. 14) in the historical city, and the industrial Port of Marghera (at the end of the yellow line on the left) on the mainland.

The passenger port terminal on western coast of *Centro Storico* (historic center) has increased its inflow of customers over the years as cruises have become more popular. Venice has an ideal location with the picturesque lagoon city as the starting point for passenger ships and easy access to the many tourist islands in the Northern Adriatic. For this reason, cruise ship related income has increased by approximately 41% in the period from 1979 to 2000 (Zorzi, 2012). Over half of the visitors to *Centro Storico* are daytrippers, so the *Centro Storico* is not gaining income from overnight tourist accommodation in the city and the passenger port becomes increasingly essential for the economy (Venice Project Center Dashboard, 2016). It is estimated that \$250 million in Venice's annual income comes from cruise ship passengers that only spend their day in Venice (Zorzi, 2012).

The other dimension of Venice's reliance on seaports is the Port of Marghera on the mainland (See. Fig. 14). With construction beginning in 1917, the port played a significant role in shaping the mainland into an economic powerhouse, especially in its peak from the 1950s to 1970s (Cessi, 2015). An immense provider of jobs, it sparked the population growth of the mainland of Venice, which by 1975 had 210,000 inhabitants (Comune di Venezia, 2016). Recently the port has transitioned from a petrochemical-based industry to expansion in manufacturing operations and a larger variety of other business services (Morris, 1994). The Port of Marghera and the industrial area surrounding it on the *Terraferma* still contains Italy's largest chemical works facility and has numerous factories, shipyards, and other high-employing assets. Currently it employs over 14,000

people in over 700 firms (Zorzi, 2012). Since the two ports of the Venice provide an economic base for both regions, it is a notable economic factor to consider when speculating separation between *Terraferma* and *Estuario*.

2.6.2 - Tourism Infrastructure

Location of tourism infrastructure is important to note in case of a split of Venice into two cities. As stated before, the inflow of tourists to the *Centro Storico* is very high and requires infrastructure of hotels and requires infrastructure both on the mainland and *Centro Storico* to maintain it. This infrastructure includes both hotels and transportation hubs that contribute income for both businesses in the regions and the government through taxation. One concerning trend discussed is the shift of tourism related income from businesses on the *Centro Storico* to businesses on the mainland. It is very important to document the location and economic impact of tourism accommodations in order for Venetians to make an educated, informed decision about how to split the two areas if a referendum calls for it.

2.6.2.1 - Transportation Hubs

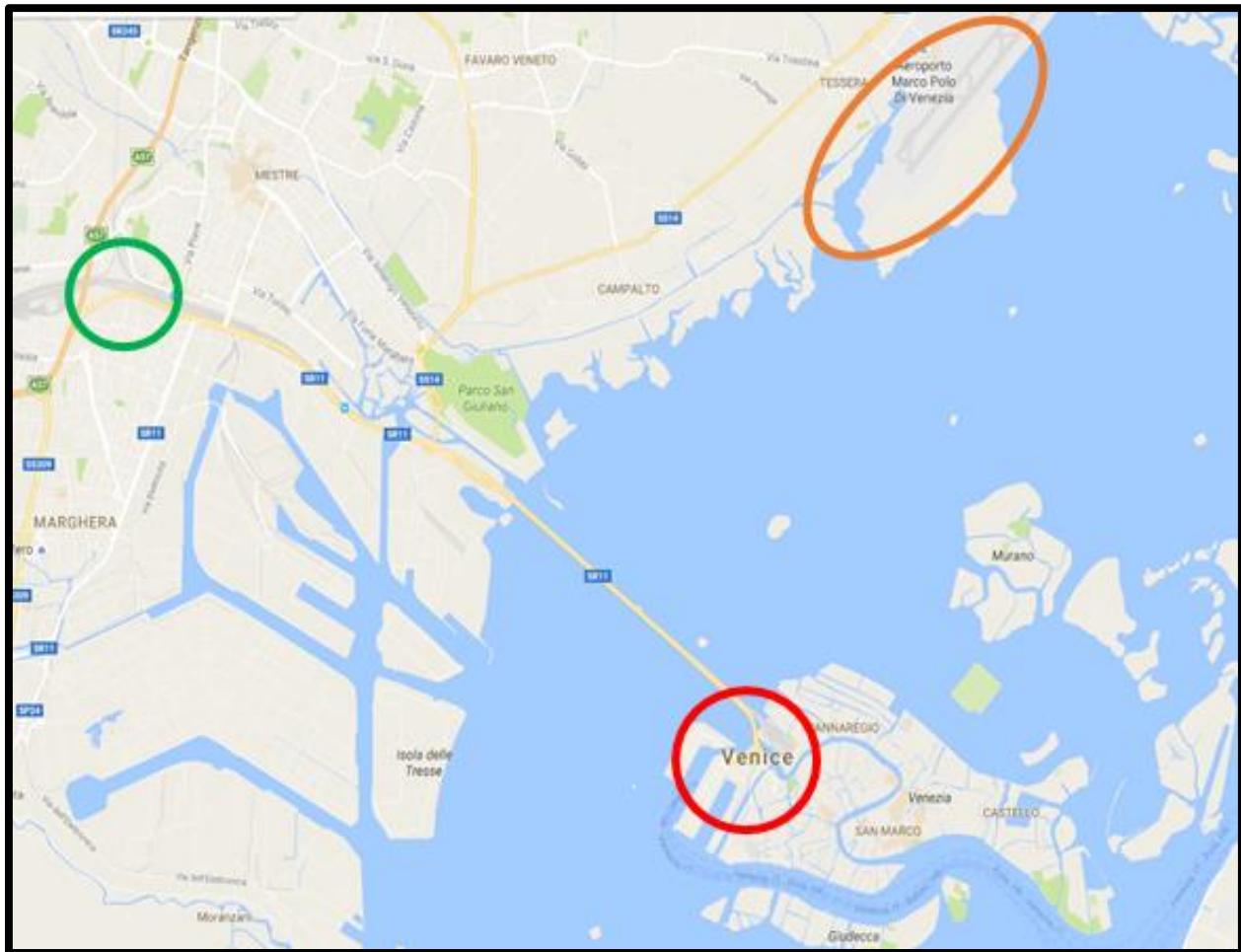


Fig. 15 shows the location of transportation hubs in Venice - Venezia Santa Lucia Train Station (Circled in Red), Venezia Mestre Train Station (Circled in Green), Marco Polo Airport (Circled in Orange).

Venice's airport, Marco Polo Airport, which is located in *Terraferma* (orange section of Fig. 15), handles 11.1 million passengers per year on just over 100,000 flights. The airport also brought in over 50,000 tons of goods imported by the city of Venice ("Facts and Figures," 2016). Aside from handling millions of tourists each year, Marco Polo Airport also provides jobs and

income to Venice. The airport profited just about 30 million Euros in 2012 and provides about 2,500 jobs to the surrounding areas (Gruppo Save, 2012).

There are also two large train/bus stations in the City of Venice. Venezia Santa Lucia Train Station (red section of Fig. 15) is located on the *Estuario* side of Venice. It acts as a link between the *Terraferma* and *Estuario*, because tourists who want to get from the airport to the *Estuario* can take the airport's shuttle to the train station. Venezia Santa Lucia is the main train station where tourists arrive/depart by train as well. This station is also used as a hub for Venetian motorboats, or *vaporetti* (Venice Santa Lucia Train Station, 2016).

The other major train station in the City of Venice is Venezia Mestre Train Station (green section of Fig. 15). Located on the *Estuario* side of the city, this train station is just as busy as Venezia Santa Lucia. It handles 85,000 travelers on 500 trains every day. Its main routes are trains to and from the train station on the *Estuario* and shuttle buses to and from Marco Polo Airport. The location of these transportation hubs will be important if borders are drawn near or around them in the future.

2.6.2.2 - Hotels in *Terraferma*

Venice is one of the most popular tourist cities in the world, with an average of 55,000 visitors coming to the historic city every day. However, not all of those 55,000 tourists stay in the *Centro Storico*. According to the Venice Project Center, about 55% of the tourists who visit Venice during the day will stay overnight (Venice Project Center, 2016). This number can be attributed to tourists on Mediterranean cruises who stay on the ship at night, tourists who just want to take day trips to the city, and tourists who opt to stay on *Terraferma* instead of in the *Estuario*. Tourists

often stay in hotels on the coast of *Terraferma*, because hotels in this area are less expensive (Ko, 2002). In analyzing costs of hotels in each region during each season of the year on booking.com, it is calculated that the cost of staying in *Terraferma* is between 28% and 40% of the cost of staying in *Estuario* (booking.com, 2016). Because many of these hotels are on the coast of the lagoon, they could end up as either part of *Terraferma* or *Estuario* if a split occurs. This is relevant information to the economies of the two possible cities because of the income potential of the hotels.

2.7 Background Summary

The Venetian Republic's border demarcated in 1791 still maintains relevance today, as it roughly splits Venice into its two main areas, *Terraferma* and *Estuario*. Throughout the last 225 years, however, Venice has been passed between ruling powers and merged with towns which do not currently share the same economic priorities as the *Centro Storico* (historical center). As a result this tangible boundary from 1791 is no longer in use. Separation referendums for a split have been voted on, but none of them had a proposed border at the time. Because of the economic and demographic relevance the past borders may have to this day, they could be used as baselines for proposed borders in the future. Understanding demographic and economic data about the city of Venice will help us to connect the past political subdivisions of Venice to the present economic and demographic data of the present.

3.0 - Methodology

The goal of The Boundaries of Venice team was to investigate and preserve different historical borders of Venice in order to provide information to Venetian legislators and citizens seeking to define a potential boundary between *Estuario* and *Terraferma*. In order to accomplish this goal, we outlined the following five objectives:

1. Catalogue the physical markers of the lagoon boundary placed by the Republic of Venice to further document the location of that border.
2. Analyze political boundaries of Venice from 1797-1924 from maps found in the Venetian Archives and outline them in GIS software.
3. Investigate and generate boundaries associated with past referendums for the separation of *Terraferma* and *Estuario*.
4. Collect current economic and demographic data relevant for future political boundary redefinitions.
5. Design an interactive tool to visualize the demographic and economic data of potential cities arising from a separation of Venice.

Our project culminated in our success of Objective 5, which displayed all of the data we collected. However, in order to get the baseline data necessary to display valuable information in the tool, we first needed to accomplish Objectives 1 through 4.

Our project focused on researching historic borders and proposed borders which could split the *Estuario* and *Terraferma* into two independent cities due to their economic and demographic differences. This involved photographing, cataloguing, and documenting location and conditions of the border markers placed in 1791 by the Venetian Republic to outline their claim to the lagoon.

We documented these borders intensively because of the geographic and economic relevance the border holds today. Additionally, other historic and recently proposed boundaries such as the French and Austrian cadastres and Pre-1924 boundaries were analyzed. We examined the location of the borders used in the past by Venice and related them to their current day social and economic implications. We used census data to help with our analysis of the potential effects of using past and proposed borders in future separation referendums. By understanding the economic and demographic implications of each boundary, more informed border decisions can be made.

The following sections of our methodology will describe the plan to locate and map the historical boundaries of the *Conterminazione Lagunare* (boundary of the lagoon), digitally documenting boundaries (both historic and proposed) of Venice since 1791, and connecting the socio-economic information to each boundary with a tool we designed.

3.1 - Catalogue the 1791 Border

Visiting the markers was essential for determining their exact location. The coordinates used to find these markers were given in Universal Transverse Mercator (UTM) coordinates (a coordinate system not based purely on latitude and longitude) and the translation of the coordinates into Geographic Coordinate System (latitudinal and longitudinal coordinates) was necessary to verify their locations. In confirming the location of the markers, the 1791 boundary which roughly divides Venice into the two regions of *Estuario* and *Terraferma* was verified. Besides further defining the 1791 border, examining the markers in person allowed us to establish marker conditions for future restoration efforts. Because these markers are physical objects and previously placed on the coastline, they are a tangible benchmark in exploring the lagoon's geomorphological

evolution. An example of this is how land has been reclaimed or destroyed by rising sea levels or the sinking of land into the sea. The 1791 border also forms a good baseline for comparisons with other historical borders and recent border proposals.

For the purpose of our project, we did not just stay in the *Centro Storico* (the historical center island). We traveled as far as the perimeter of the lagoon to find the markers laid in 1791 in order to further document the border formed by the markers, shown in Fig. 16.

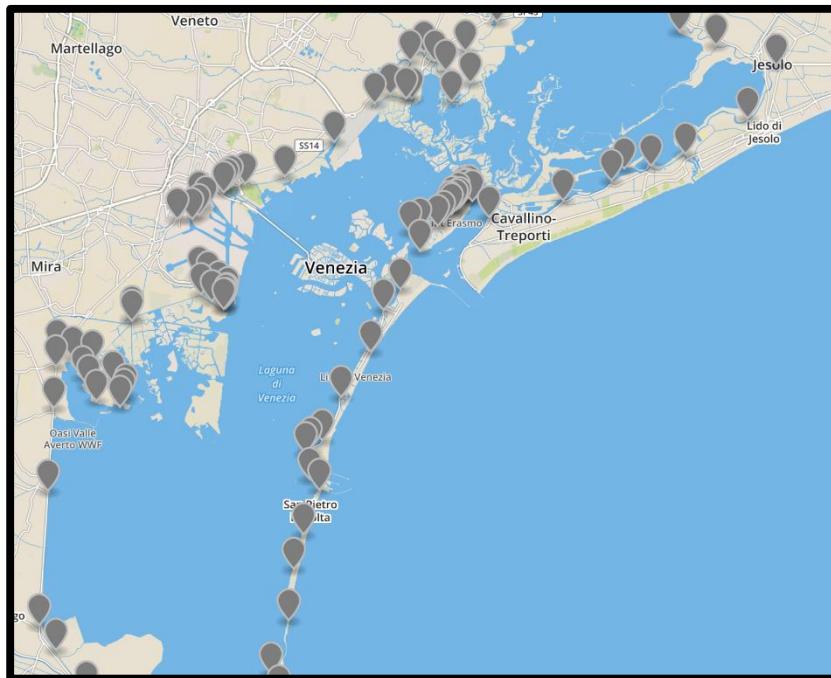


Fig. 16 shows the location of the 100 border markers (Caniato, 1990)

3.1.1 - Export Information from *I Cento Cippi di Conterminazione Lagunare*

The last time the 1791 markers were thoroughly studied was in 1991 by Giovanni Caniato. Caniato, who works at the Venetian Archives, did years of extensive research pertaining to this border and the markers of which it is comprised. Therefore his book *I Cento Cippi di Conterminazione Lagunare* which documents their findings was determined to be best baseline

source of information for us (Caniato, 1991). The book, which was our main source for 1791 boundary information, contained an appendix with information about all 100 markers (including UTM location, a photo, a description of its physical characteristics and location, nearby roads and buildings as well as any additional comments). Below in Fig. 17 is a photo of one of the marker's pages.

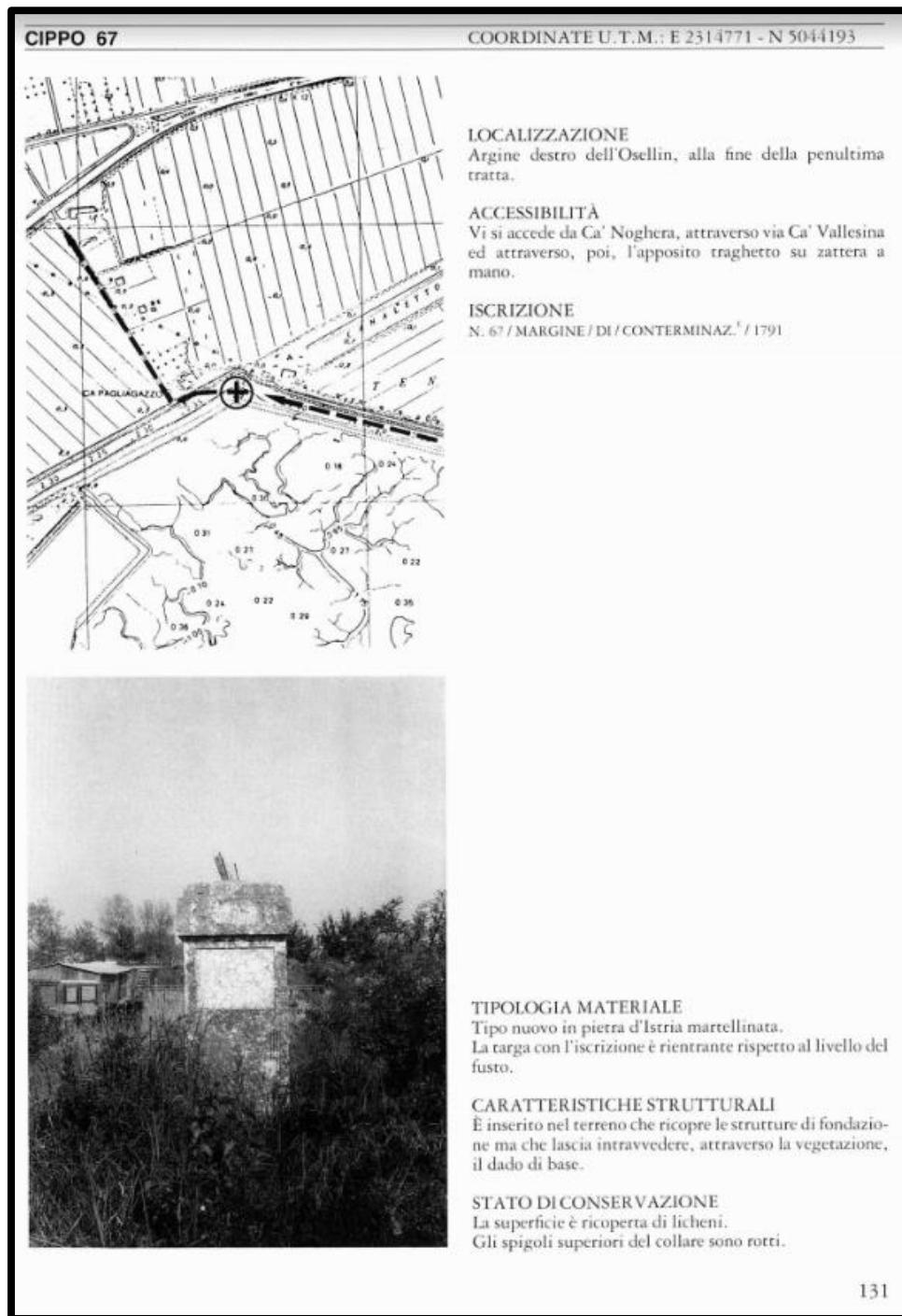


Fig. 17 shows one page from *I Cento Cippi di Conterminazione Lagunare* with Italian descriptions (Caniato, 1990).

After converting from UTM coordinates (a coordinate system not based purely on latitude and longitude) found in *I Cento Cippi* to the Geographic Coordinate System (latitude and longitude), we placed marker locations on a digital map allowing for a more accessible visualization of their layout. Digitizing the appendix manually, however, would have been a cumbersome task. Thus, we created a script to automatically convert pages of the book PDF found online to text and parse that information into a structured geojson file, a file format for map data. In the end, this can easily be visualized on a map inside a browser and also exported into Venipedia. The script was mainly used to automate the process of extracting information from the book such as position coordinates and whether or not the marker was present at the time of marker collection in *I Cento Cippi di Conterminazione Lagunare*. It was written using node.js which is Google's Chrome V8 engine, a high-performance JavaScript engine written in C++.

3.1.2 - Create a Marker Data Collection Tool

There is an abundance of information in Caniato's book which is relevant to locating and documenting these markers as well as information we collected upon visiting them. It was useful and more efficient when finding markers to have their location in a compact database. It also helped us to have fields for entering data collected in this database. To streamline the organization of this data, we created an intuitive online data management tool to input information we gathered while visiting the markers. This tool was a single-page web-based application where we are able to see the location of markers on a map and read previously documented information from *I Cento Cippi* book. The application permitted authorized users to input new information including but not

limited to photos and marker dimensions. On the homepage map the user is able to filter markers, for example to see only non-present markers.

The client-side code uses react.js and flux data architecture which not only allows the developer to easily build larger scale and modular applications, but also provides high performance and “instant” page updates. The server-side code was built using node.js and is currently deployed on Heroku (platform-as-a-service which allows developers to run apps without dealing with server configuration). The data storage is MongoDB and image uploads are stored on an Amazon S3 Bucket. These services were chosen because of the freedom and flexibility they provide, in addition to the ecosystems they have. This ultimately makes the codebase more maintainable for future teams.

The application contained fields to put in marker dimensions along with physical conditions. It also had places to input data from *I Cento Cippi di Conterminazione Lagunare* along with the markers location, address, and directions to the marker.

3.1.3 - Upload Information from *I Cento Cippi di Conterminazione Lagunare*

The pictures from *I Cento Cippi di Conterminazione* and the inscriptions on the markers were displayed on our data collection tool. These pictures made it easier to locate the markers more quickly by referencing the nearby surroundings of the marker. Unfortunately, the aforementioned script which digitizes the book cannot automatically extract the photos of each marker nor the description of its surroundings from the book unlike the coordinates and inscription information. This would be essential information if we were to later study how the areas around each marker evolved over the past 30 years or just capture the decay of the markers. However, the online data

collection tool allowed us to easily organize this manual process (of saving and uploading the pictures). We uploaded the scans of marker photos and maps from the book's PDF to our data collection tool as well as translated 100 descriptions from Italian to English via Google Translate.

3.1.4 - Organize Markers into Day Trips

After collecting the route to each marker, we devised separate day trips to document the markers at specific geographic regions by organizing them into groups based on their locations. Primarily, we used Google Maps to help plan these trips. By looking at the geographic layout of markers and considering the amount of time we had, we were able to see which markers are feasible to visit during daylight hours. Additionally, transportation to markers was important to consider since it was a determinant of the time it takes to reach the general location of the markers and the time between markers. Some markers were reachable by foot or bike, while others were more easily accessible by public transportation such as buses. Therefore, our group's strategy was to address the markers that were easiest to reach first, such as the islands close to the *Centro Storico* (the historic center of Venice) with short distances between the markers and then to find the markers on the mainland that are more widely spaced. The ACTV boat passes provided to our team by the VPC cover most public transportation including boats to reach the island and buses on the mainland.

3.1.5 - Visit and Catalog each Marker

After organizing the markers into manageable day trips, we visited markers individually. Upon reaching the marker, we took pictures and recorded quantitative data in order to quantify condition of the marker for preservation purposes. Quantitative data included dimensions of each

main face of the marker (outlined in red in Fig. 18), the ring (outlined in blue), the cap (outlined in yellow on only the Istria stone marker), and the spire (outlined in green) on each marker, and the inclination of each side from straight up. When collecting dimensions, the measurements for height were taken halfway across the width of the face and measurements for width were taken halfway up the height of the face. We also used a phone compass to determine the orientation of each side and collect that orientation in precise degrees from north. We did this by pointing the compass in the direction the front face (face with the inscription) demonstrated in Fig. 19. We used a phone leveling app to determine if the marker was tilted at all by pressing the phone against the face and seeing its inclination from straight up as shown in Fig. 20. Lastly, we used a phone GPS to pinpoint our GPS coordinates in order to cross-reference or compare for accuracy our coordinates with those in *I Cento Cippi di Conterminazione Lagunare*.



Fig. 18 shows the parts of an Istria stone marker (left) and a brick marker (right).



Fig. 19 shows the marker's front face orientation measurement using the compass on our phone.



Fig. 20 shows the measurement of the face's inclination by holding the phone level against the face of the marker.

Pictures of each side of the marker were taken along with an up close picture of the marker inscription for future use. We also photographed the marker from a distance so it is easier to find in the future, as someone looking for the marker would have a visual of around the marker. Lastly, we took 180 degree scope panoramic pictures from each side of the marker using our phone's camera to get an image of what the surrounding landscape is like. Examples of these pictures are in Appendix A.

Other data that was collected at the markers include the width and length of any structural cracks that could compromise the stability of the marker. Structural cracks are different from surface cracks because structural cracks are deeper and more dangerous for a marker to have when compared to surface cracks, which are relatively shallow and only compromise the appearance of a marker. Width and length of these cracks were measured with a tape measure.

To assure consistency in our measurements for individual team members before splitting up, we performed individual measurements for the same markers and verified that our technique was consistent for each team member. We repeated measurements of the all face dimensions, spire height, inclination, compass direction, and coordinates to confirm that anyone measuring a marker got answers within an acceptable degree of error. An acceptable degree of error is based on the precision of the instrument. For example, if an instrument accurately measures to the closest centimeter, then an acceptable degree of error is ± 1 cm from the actual value.

3.1.6 - Devise a Metric to Evaluate Marker Conditions

Aside from each markers' dimensions, we assessed six states as related to marker condition: biological growth on, biological growth around, environmental discoloration of, surface

cracking on, and structural disintegration of each face of each marker along with the legibility of the marker's inscription. Examples of these conditions are in the Fig. 21 below.



Fig. 21 shows examples of the different marker conditions we looked for at each marker.

Getting such data for each marker illuminated which markers have been degraded the most over time, and may require restoration. It may also spark efforts or measures for protection of the markers through a coating or other measures.

The difficulty of assessing marker conditions is that it is a subjective process and difficult to quantify. We used a Likert scale to assign 1-5 ratings of how present each conditions is (with the exception of legibility, which is given as a percentage). Legibility will have a more precise score based on each letter, described more discretely at the end of this section. A Likert scale allows us to quantify to the condition of each face of each marker and determine which markers are in the worst condition. In a Likert scale, we would decide which face is a “1” (almost no erosion/discoloration/etc. present), which is a “2,” and all the way up to which face is a “5”(most severe amount of erosion/discoloration/etc). This quantification allowed us to analyze the general state of the markers and obtain statistics on the marker conditions. In order to remain scientific in our determination of marker scores, we decided to assign one person in our group to each marker condition type. . This person was in charge of comparing all pictures gathered to create a suitable Likert scale for that condition type along with assessing the final scores for each marker in that condition type. In the creation of the Likert scale for a condition type, the group member was required to assign a face picture example for a “1,” “3,” and “5” scale and write a short description of what a face would look like with each score. This scale was examined and approved by the rest of the group members. Once a metric was devised, we assigned values to each face. These scales can be found in Appendix B. To prevent bias, one group member scored 10 different markers of a different group member’s condition. The two set of scores were compared to make sure that both

group member's scores were close to each other's scores. This prevented us from having a biased ranking of the marker's condition.

After we assigned values to each face, we averaged the values for each face to get values for the conditions of each marker. We used those average conditions to give each marker two overall scores: marker condition and restoration potential. Marker condition is a way to represent the overall state of the marker. Because something like structural disintegration weighs more heavily on a marker's condition than something like biological growth around the marker, we weighted things differently in how marker condition would be calculated instead of giving everything equal weight. We used the following scale:

- 40%: Structural Disintegration
- 20%: Surface Cracking
- 20%: Environmental Discoloration
- 15%: Biological Growth on Marker
- 5%: Biological Growth around Marker

This scale was determined after a deliberation between the team members. We decided structural disintegration was the largest contribution to marker condition because a bad enough structural disintegration rating could compromise the stability of the marker, causing it to crumble or topple. We ranked surface cracking and environmental discoloration next at 20% each. Surface cracking is not as significant as structural disintegration, but enough surface cracking has the potential to develop into disintegration. Environmental discoloration was also ranked this high because it can almost completely render the legibility of the marker impossible. Biological growth on marker, like moss or lichen, is slightly less because though it can compromise the legibility of the marker, it can be removed more easily than environmental discoloration. Lastly, biological

growth around the marker, like ivy or tall grasses at the marker base, is the smallest contributor to marker condition because it is easily removed from the area around the marker.

Marker condition was calculated on a scale from one to five, with one being a marker in excellent condition and a five being in very poor condition.

Restoration potential was calculated with a different scale than marker condition. While marker condition focused just on the state of the marker, restoration potential was based on how easy and feasible the restoration of the marker would be. We used the following weighting parameters:

- 30%: Biological Growth around Marker
- 25%: Biological Growth on Marker
- 25%: Environmental Discoloration
- 15%: Surface Cracking
- 5%: Structural Disintegration

This scale was formulated the same way the marker condition scale was formulated. Biological growth around the marker was given the highest weight because it would be very easy to remove any overgrowth. Biological growth and discoloration were the weighted the second highest because they would also be relatively easy to repair. Because of how difficult they would be to repair, surface cracking and structural disintegration were weighted at 15 and 5 percent, respectively.

The following shows an example of a calculation of total marker condition and restoration potential of a marker. The following numbers are example scores of one marker for each condition. To calculate the final marker score, these condition scores are multiplied by the weighted percent of each condition.

Average Biological Growth around Marker	2.6
Average Biological Growth on Marker	4.2
Average Environmental Discoloration	2.8
Average Structural Disintegration	3
Average Surface Cracking	1.8

Marker Condition: Structural disintegration: 40%, surface cracking: 20%, environmental discoloration: 20%, biological growth on marker: 15%, biological growth around marker: 5%.

$$0.4(3) + 0.2(2.8) + 0.2(1.8) + 0.15(4.2) + 0.05(2.6) = 2.88$$

Restoration Potential: Biological growth around the marker: 30%, biological growth on the marker: 25%, environmental discoloration: 25%, surface cracking: 15%, structural disintegration: 5%

$$0.3(2.6) + 0.25(4.2) + 0.25(2.8) + 0.15(1.8) + 0.05 (3) = 2.95$$

Restoration potential was calculated on a scale from one to five as well, with a one being a marker with no need to be restored and a five being a marker that both needs restoration and would be feasible to restoration.

3.1.7 - Export to VPC Database

By accomplishing the above steps, we collected important information about each marker. We wrote another automated script which exports the collected data into individual Venipedia pages for each marker, which will further our preservation efforts, as well as existing Venice Project Center datasets (PreserVenice), a non-profit organization that identifies and prioritizes at-risk Venetian Public Art. This script will also be written using node.js by our development team. The purpose of this script is to save our team time by automating the Venipedia page creation

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instead of manually inputting all the information. Below is a table of the data fields we filled out for each marker (Table 1).

Field Parameter	Units
General Information	
Accurate Latitude/Longitude	GPS Coordinates
Is the marker present today?	Yes/No
Travel Information	
Street address of marker	
Travel distance from previous marker	In meters
Travel route via car	In distance (meters) and time
Travel route via public transportation (distance, time, what transportation to be taken)	In distance, time, and what transportation to take
Accessibility	
Is the marker accessible?	Yes/No
Marker Geometry	
Dimensions of main face, ring, cap, and spire (cm)	In centimeters
Angle of inclination (degrees)	In degrees
Orientation of front face (degrees)	In degrees
Appearance	
Description of marker conditions from 1990s	From <i>I Cento Cippi</i>
Rating of biological growth on and around the marker, discoloration, surface cracking, structural disintegration for each face	Rated from 1-5 using Likert Scale
Pictures	
Pictures of each face	
Up-close picture of the inscription	
Picture of marker from an approach view (30-40 feet away)	
Panoramic pictures to get 360 degree view around marker	

Table 1 shows the data we collected at each marker.

Having all that information in a structured database allowed the team to later perform automated cross-linking of datasets, such as comparing the coordinates with location of restaurants and hotels, and display that in the final tool we develop as outlined in Section 4.5 (e.g. show key landmarks & infrastructure around each marker).

3.2 - Analyze political boundaries of Venice from 1797-2016 from maps found in the Venetian Archives and outline them in GIS software.

Since 1797, Venice has gone under many political and geographic changes, most of which have not been documented electronically. Venice had different internal divisions when under French and Austro-Hungarian Control, as well as when it was under Mussolini. Important information relating to the subdivisions of Venice under different governmental control is documented physically on maps located in the Venetian Archives or in an otherwise inaccessible format (not a GIS format). These maps are the most comprehensive display of Venice during these times and have Venetian subdivisions as specific as individual properties. To accomplish this objective, we obtained scans of the cadastres broken into map segments of the regions to be pieced together. General historical information about the boundaries of Venice at the time was also researched to understand the maps further. Then, we digitized the territorial division information using GIS software and compared it to the internal divisions of Venice today (*municipalità, quartieri*).

Our collaborator Giovanni Caniato, author of “*I Cento Cippi di Conterminazione Lagunare*”, works at the Venetian Archives and has access to the maps of Venice during the 1800’s

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that were vital to our completion of the project. Giovanni helped locate these maps within the archives for our use. A map scanner owned by the Venetian Archives digitized the maps so we could look at them on a computer. Both the French and Austro-Hungarian cadastres are several meters long and very delicate so the archive scanner had to use their 2 m by 3 m scanner to safely digitize these maps.

Once we obtained scanned maps of the Napoleonic and Austro-Hungarian Cadastres, we examined them as a group to see what information was relevant to our project. To examine them, we saw what land was encompassed in Venice's boundaries during French and Austro-Hungarian rule. It was necessary to see if France and Austria-Hungary's definition of "Venice" was just the *Centro Storico*, if it had claims to the other islands in the Adriatic Sea, or if it had claims to the mainland as well. We also examined the small industrial towns (Mestre, Marghera, etc.) and if they had been founded by the time of the cadastre. This helped us to further understand the subdivisions and size of Venice.

After we examined the territory held by the City of Venice, we looked closer at how Venice was subdivided. It was important to note not just how Venice was divided into different boroughs, but also which boroughs were similar to the subdivisions of today in order to see the logic behind why subdivisions were made in a certain way. In the scope of our project, it was not necessary to look at the specific plots of land in Venice; we looked at subdivisions closer in size to the relevant subdivisions of today (*municipalità*). This was important because if drawn similar to the *municipalità* of today, these borders could potentially be used in a separation movements today. We specifically examined the subdivisions of Venice as they relate to the 1791 border used by the

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Venetian Republic; it was important to see if the French or Austro-Hungarian rulers considered geographic and economic factors when modifying the subdivisions of Venice.

We also searched for maps of Venice from between 1883 and 1926, the 43 year period in which the historical center of Venice was combined with the other regions of Venice to bring the city to its modern day boundaries. If these maps were located, then they would be outlined in GIS. However, there was a chance that we would not find all of the maps we needed to outline the progression of Venice's boundaries. If we couldn't find all of the maps needed, we would assume how the boundaries progressed based on descriptions fond of the territories added. The regions added to Venice were very similar to the internal divisions of Venice today, so we could use today's divisions (*municipalità*) to conclude how Venice progressed between 1883 and 1926.

We were also given maps relating to the history of the land reclamation of the lagoon by the Venice Project Center. These maps of Venice from 1844 to today show how the geography of the lagoon has changed. Land reclamation creates areas with economic potential, so these maps were important to examine to see the changes Venice went through not just politically, but geographically as well.

All of the maps we were given or research were outlined in GIS software, which allows users to digitally draw borders. These mappings were then used in our final tool as outlined in Section 4.5.

3.3 - Boundaries from a 1990 Case Study

This section outlines the steps we took to generate boundaries as defined by the three theoretical proposed models of the 1990 case study, *Three Models for the Future of Venice* (See

Sections 3.5.5.1-3). The proposed models focus on demographic and economic implications which would arise from each model of Venetian separation. The report does not, however, provide any detail on specific coordinates and location of the boundaries. This made the delineation process more challenging since the physical boundary was discussed in a general manner. In providing reasoning behind which regions should be combined together or which regions should remain separate, boundaries for each model's cities can be determined.

Using the models proposed in this case study, we drew our own boundaries through Venice while considering the geographic modeling outlined in the study. We used QGIS, a professional, open source mapping software, to generate the boundaries theorized in each model. After analysis of each model, we were able to delineate three different boundaries based on factors discussed in the study. Important factors we looked for were regions mentioned in the model, location of economic infrastructure (e.g. seaport, markets) and the specific location of the governmental buildings post-split. These were closely examined because of the economic and governmental impacts they would have; if one city were to get all of the economic centers, then there would be one flourishing city and one withering city.

The boundary models included in this case study are useful to give people not only historical boundaries as examples, such as the 1791 model and the cadastral borders, but examples of borders that are based in a professional viewpoint of economic shifts of people and businesses between the mainland and islands in the past 100 years. This study has an in depth and quite lengthy analysis of the benefits of these boundaries based on the evolution of the territories of Venice. Therefore, we needed a process to decipher what regions would be combined to create

possible new cities. To make this process easier, we read this study closely and found key phrases in deciding where the boundaries lie.

The first list below gives examples of general key phrases under any model description which indicate that the sentence or following sentences will describe where this model border lies:

- “Main lines of economic and functional changes”
- “Territorial integrity of the city”
- “Modifying the geographical logistics”
- “The structural transformations linked to the changes that occurred in the last two centuries”
- “A point common to all these proposals”
- “A new built-up areas on the mainland are urging recognition of the autonomy”
- “New territorial structure with a new population and which is developing in a way that creates the conditions of a separate town”
- “The most serious problem may be a state of mind in Venice towards the political organization of urban space”

In Appendix D, E, and F we have listed phrases that provide a strong indication as to where the boundaries lie for each particular model. Using these phrases, we will, in our results section, provide a description for exactly where we determined the placement of these boundaries along with a GIS mapping of this boundary.

3.4 - Collect current economic, demographic and geomorphological data relevant to possible separation of Venice

After compiling information about *Terraferma* and *Estuario* as a whole, we obtained information about different subdivisions of Venice by looking at data from the Venetian Census in 2011. The data housed in the census will allow a more in-depth analysis of any potential separation of the city. We collected current data about population, social capital, and economic infrastructure of the regions analyzed in order to determine which of these factors carries the most weight in border information for our final product.

3.4.1 - Census Tract Analysis

To get the most accurate display of Venetian economic and demographic breakdown, we needed data from many small divisions of Venice, smaller than the *municipalità* or *quartieri*. As opposed to basic economic data of the regions of *Estuario* and *Terraferma* compared, information about smaller divisions allow citizens to decide with more scrutiny about which individual areas would be best within a city. We were given access to the 2011 Venetian Census data from the City of Venice that conducts a census every 10 years to generate raw statistical numbers in digital form in order to analyze important data on the city.

Census data is organized by small regions of Venice called census tracts, which are approximately the size of a normal city block. Measurable demographic data included in a census tract are population breakdown by number, age, and income. More specific data in the Venetian Census providing information on economics of an area were the amount of people employed, education levels (secondary, tertiary), and number of unemployed people with work experience

and number without work experience. Additionally, census tracts contain information about the location of businesses as it relates to the per capita income of the citizens living in the tract.

The census tract information provided us with a clearer and more specific picture of the entire City of Venice including the *Estuario* and *Terraferma*. Because voting power is a large factor in the separation, simple population quantification was essential for our final product. However, income, education, and employment information within the tracts assign further significance to these population densities as economic and social assets. More knowledgeable decisions are able to be made about which regions would be important to gain or lose for a city in a possible separation. In our final product, census tracts were the primary subsection that borders are based on and therefore it will be essential to provide a clear and accessible way to view information on each individual tract.

3.5 - Design an interactive tool to visualize borders and the demographic and economic data of potential cities arising from a separation of Venice.

The tool outlined in this section encompasses all of the data we collected in our first four objectives. We built a tool to display various historical and proposed boundaries using the data we collected from previous tasks. The main feature of this tool will allow users to examine and visualize all the aforementioned Venetian borders as layers on a main UI Map, as well as draw their own border. Upon selecting or drawing their border, the tool shows the combined economic and demographic data from the census tracts within the boundary. This tool will give the Venetian citizens and legislators an accessible and detailed way to visualize all of Venice's current administrative boundaries as well as historic and modeled separation boundaries. In addition the

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census information allows the user to explore socio-economic implications of the selected boundary, exemplified in Fig. 22, which allows them to view how two new cities would fare in any separation scenario of their choosing as seen in Fig. 23.

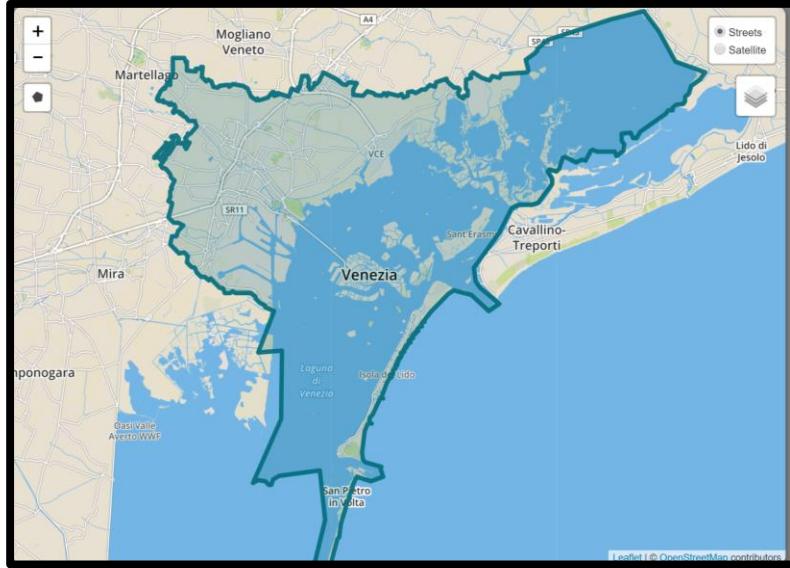


Fig. 22 shows an example of a proposed boundary through Venice.

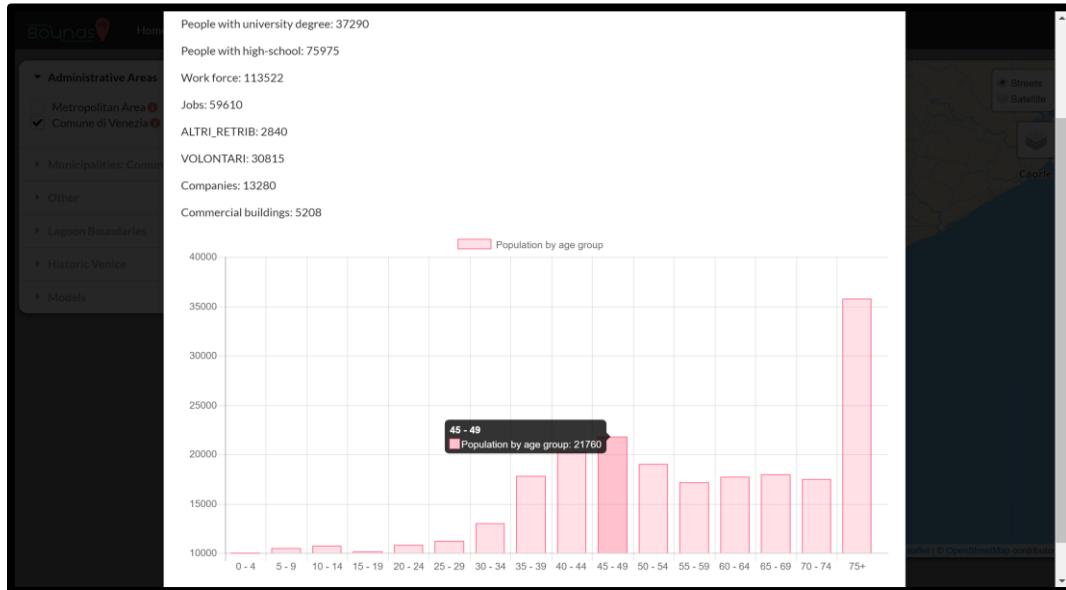


Fig. 23 shows an example of the visualization of economic and demographic information for the selected area.

In order to display all the boundaries on the dashboard map as layers they must be formatted as geoJSON polygons. A geoJSON is a format for encoding a variety of geographic data structures. From OpenStreetMap databases we were able to export all of the current administrative boundaries from the Metropolitan area down to the six municipalities. Using qGIS (Section BLAH BLAH), we are able to delineate and export any boundaries which we could not find online.

We received census tracts data in a qGIS shapefile (.shp) format which we immediately converted to geoJSON. Using a script we developed (found in our GIT repository, <https://github.com/veniceprojectcenter/bounds>), we calculated the centroids of all the census tract polygons (Fig. 24) for two essential reasons.

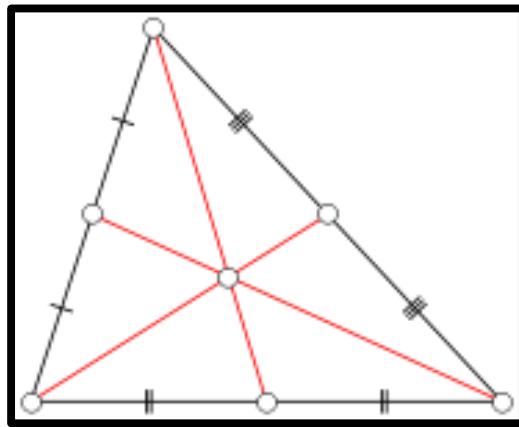


Fig. 24 shows an example of a polygon's centroid.

The first reason is mainly to speed up the process of the server-side calculations translating the polygon geo-information into points instead of areas. The second reason is because we understood the boundaries we would be drawing are large so they would not be impacted by the slight rounding of data caused by the centroid calculation. We also developed another script (in our GIT repository) which digested the census data CSV file moving it to our database to populate the centroids with the economic and demographic information which will be displayed. Every time

a boundary is selected or drawn the client asks the server for all the centroids contained within the area and the server groups these centroids and returns the data contained. The major benefit of using MongoDB for our database was because of its powerful geo-queries.

Because the tool outlined in this section was contained within the same application as the collection tool in Section 4.1, the location of each marker and therefore the information on each marker is viewable by users as well. This tool acted as a conglomeration of all of the data we collected over the course of our project not just so it is easy for us to view, but so that citizens and legislators can view all of the information in one accessible and informative spot.

3.6 - Methodology Summary

The five objectives outlined in this chapter helped us to accomplish our goal of researching and defining past and proposed borders used by Venice and relating those borders to the current economic and demographic relevance they may have. Our objectives all culminated in our final interactive tool to let people draw their own borders while actively viewing the implications of that border. This tool was the first aggregation of data surrounding historical borders and modern-day economic and demographic factors.

4.0 - Results and Analysis

The results chapter of this report show the data collected and analyzed arranged by objective. The first section contains the data collected on the markers in the lagoon. The next sections relate to the mapping of historical, geographical, and present day borders of Venice along with the separation models of Venice from the case study in 1990. Our last section introduces our final tool that allows users to examine the prior borders used in Venice and their modern day implications. There is also a summary of the implications of each border if it were used in a separation of Venice.

In addition to marker and boundary results ultimately compiled into one application in our tool, we created 12 Venipedia pages about topics related to our project. There are pages elaborated on Italian terms of regions defined within our report such as *Terraferma, Estuario, and Centro Storico*. There are pages defining what a simply marker itself is, what markers are as a whole, and the 1791 Venetian Republic boundary. The web addresses for these are located in Appendix G. Historical boundaries listed in our background each have a page and each referendum along with the 1990 case study models have a page. These pages contain information already included in our background but are an accessible way to review topics in a readily understandable format.

4.1 - Visitation and Documentation of Markers

Our first objective was to visit and document the 100 stone and brick markers placed around the lagoon by the Venetian Republic in 1791. This involved visiting the markers, taking their dimensions, quantitatively scoring their faces in five different categories, and storing the data in a database we created ourselves. Out of 100 markers, we visited the locations of 69. We were

restricted not only by the amount of time we had to complete the project, but also by the means of transportation we were allowed to use. Most of our travel was in the form of walking or biking, sometimes walking up to 18 or biking up to 35 miles per day. Out of the 69 markers whose locations we visited, we were able to access 37.

4.1.1 – Visited Marker Data

Upon visiting the markers, the dimensions of each face were taken along with inclination and orientation of the front face. Each marker's four faces were scored on a scale from 1 to 5 (with 1 being excellent condition, 5 being very poor condition) on biological growth on the marker, biological growth around the marker, environmental discoloration, surface cracking, and structural disintegration. The scores were then put into a formula to give the marker condition and restoration potential of the marker (See Appendix C). The legibility of the markers was also calculated.

4.1.1.1 - Marker Dimensions

There were two types of markers: markers made of Istria stone, a white limestone typical to Venice architecture, and markers made of brick. Istria stone markers were comprised of a main face, a ring, a spire base, and a spire, whereas brick markers had just a main face, ring, and spire. Tables 2 and 3 show the average dimensions and their standard deviations broken into Istria stone markers and brick markers, due to their large differences in size. They were split into two different sets by the marker material because the geometry of those markers were hugely different, as shown in Fig. 25.



Fig. 25 shows the geometry of an Istria marker (left) and a brick marker (right)

	Average (in cm)	Standard Deviation	Maximum	Minimum
Main Face Height	105.7	21.75	150	45
Main Face Width	49.2	4.78	51	47
Ring Height	17.7	0.91	18	14
Ring Width	55.2	0.73	56	53
Spire Base Height	6.0	0.30	7	5
Spire Base Width	49.8	0.50	51	48
Spire Height	7.3	1.35	11	5

Table 2 shows general information on measurements of Istria markers.

	Average (in cm)	Standard Deviation	Maximum	Minimum
Main Face Height	131.6	26.73	195	105
Main Face Width	106.5	2.87	110	100
Ring Height	17.25	1.30	18	14
Ring Width	113.3	1.20	115	111
Spire Height	104.0	20.21	132	85

Table 3 shows general information on measurements of brick markers.

4.1.1.2 - Marker Conditions

After visiting and photographing each face of each marker, our team documented the condition of each marker face based on five categories: biological growth around the marker, biological growth on the marker, environmental discoloration, surface cracking, and structural disintegration. To make the data easier to grasp, anything from 1 to 1.5 is considered “excellent (for marker condition)/very low (for restoration potential)”, from 1.5 to 2.5 is considered “good/low”, from 2.5 to 3.5 is considered “fair/average”, from 3.5 to 4.5 is considered “poor/high”, and from 4.5 to 5 is considered “very poor/very high” The table below, Table 4, shows the averages for each of these categories, along with the standard deviation for each data set.

	Average	Standard Deviation
Biological Growth on the Marker	2.97 (Fair)	1.40
Biological Growth around the Marker	1.93 (Good)	1.09
Environmental Discoloration	2.21 (Good)	1.14
Surface Cracking	2.51 (Good/Fair)	1.05
Structural Disintegration	2.51 (Good/Fair)	1.40

Table 4 shows averages and standard deviations for marker face conditions.

Taking the numbers in Table 4 into consideration, we were able to calculate the average marker condition and restoration potential, as well as the standard deviations for both. The average marker condition was 2.51, with a standard deviation of 0.68. The average restoration potential was 2.43, with a standard deviation of 0.66.

With the results from 36 markers we were able to visit, photograph, and grade, we compiled a graph of their results to show the distribution of their overall condition. This graph is shown below in Fig. 26.

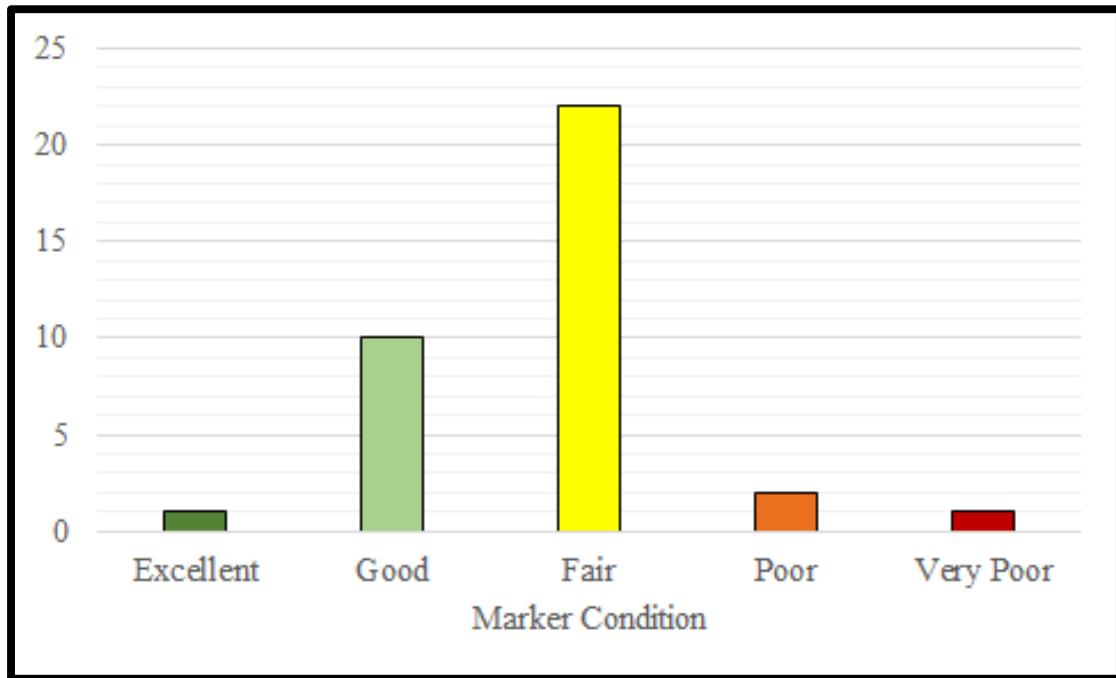


Fig. 26 shows the distribution of markers by their overall condition.

As shown by the graph above, over half the markers were considered to be in fair condition.

Only two markers were in poor condition (Markers 52 and 95) and only one marker was in very poor condition (Marker 73).

Like the graph that was compiled for marker condition, a distribution of restoration potential was also tabulated. This graph is shown in Fig. 27 below.

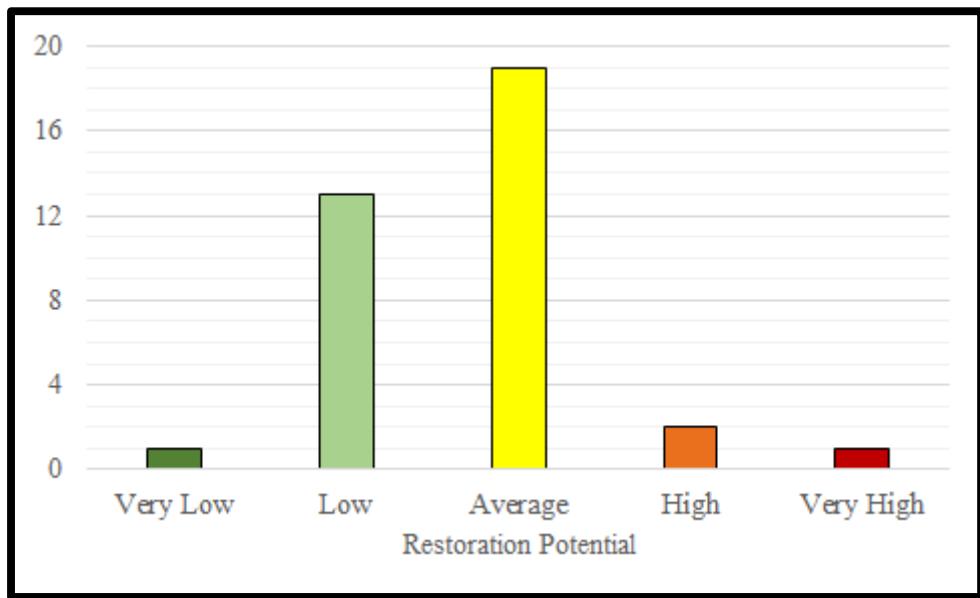


Fig. 27 shows the distribution of markers by their overall condition.

This distribution shows that just under half of the markers visited showed an average level of restoration potential. Just like the overall condition, Markers 52 and 95 showed a high level of restoration potential and Marker 73 showed a very high level of restoration potential.

4.1.1.3 - Inaccessible Markers

Though we visited the location of 69 markers (due to time and transportation constraints), we only documented 37 of them. This visitation percentage (53.4%) can be attributed to a few different factors. On some day trips, we passed the location of markers that were considered to be missing in 1990, when Caniato did his research on the topic. Though we visited the locations of these markers to get panoramic pictures and confirm that the marker was missing, we did not take any measurements or grade any conditions. Aside from this, there were some markers we attempted to visit which were completely surrounded by heavy brush or vegetation, so we were not able to get to their locations, as exemplified in Fig. 28.

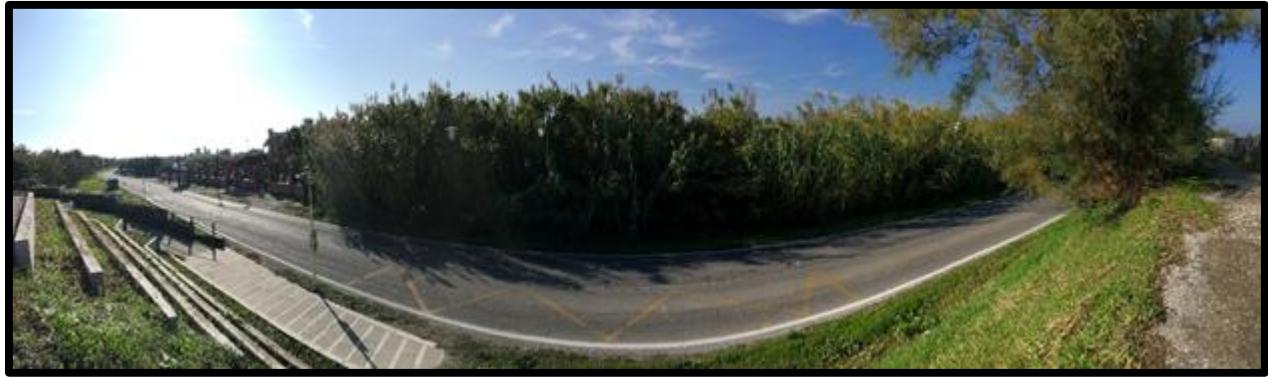


Fig. 28 shows Marker 22, inaccessible due to heavy brush. The marker's location was directly in the patch of trees.

There were some markers we tried to visit that were either in the middle of the water or on the opposite side of a canal. Though we tried to plan visits around having to cross a canal, there were times where that was not an option for us. In cases like this, we were only able to take a picture of the marker and confirm its GPS coordinates.

The main obstacle we faced was the presence of markers in private or otherwise accessible property. Most of the markers we were unable to reach were located in places like industrial plants, fenced in business areas, or private properties. When possible, we talked to those on the property to try to gain access to the markers. However, there was often no one present and no phone number for us to call in order to request access. In cases like this, we had no other option but to take a picture of the gate or other barrier which obstructed our visit and move on. Fig. 29 shows an example of an unreachable marker due to private property.



Fig. 29 shows Marker 18, inaccessible due to Private Property, as evidenced by “*Vietato L’Accesso*,” or Access Denied.

Markers were often placed just on the edge of a canal but were sometimes in the middle of a canal or a little ways into the lagoon on the mouth of a canal. Therefore they were inaccessible to us for measurements since we did not have use of a boat. Marker 85 is depicted in Figure 5.1.4, a short distance into the lagoon. Marker 48 in Jesolo was not seen by us because coordinates from *I Cento Cippi* indicated that it was now in the middle of a canal. However, in the old picture from *I Cento Cippi*, the marker was on the land. We hypothesize these markers were once on the land but are now in water as a result of rising sea levels or expansion of the canals.



Fig. 30 shows Marker 85 (circled in red) inaccessible due to water; placement in middle of canal.

4.1.2 - Marker Day Trip Breakdown and Accessibility

The accessibility and condition of markers varied significantly when broken down by day trips. Although we did not reach each marker, we visited a geographically diverse range of markers. Our strategy was to focus on clusters of markers in different regions of the mainland rather than track down markers what were more widely spaced between these clusters. We also used the Google Maps satellite imaging to decide which clusters would be most accessible based on their proximity to roads and public transportation stops.

The details and methods behind each completed trip are useful for future projects finding markers aimed at finding the markers and restoring those in poor condition. Students will have information about which regions contain the most accessible markers and the distance they will have to travel by foot or bike to reach these markers. Groups seeking to restore these markers will have marker location information as well as data on those with the highest restoration potential score and where they are conveniently clustered. Tables of each day trip are below.

Trip 1: Lido-Pellestrina (Markers 16-28)

Day Trip 1: Lido-Pellestrina, 13 Markers (Markers 16-28) - 30 miles, biking	
Found Markers	5
Missing Markers (Confirmed with 1990 Survey)	3
Newly Missing/Unconfirmed Markers	5
Unconfirmed markers were on private property, on unreachable terrain, or demolished.	
Markers Made of Istria Stone	3
Markers Made of Brick	2
Average Marker Condition	1.94
Average Restoration Potential	2.08
Marker in Worst Condition	17 (Overall Condition: 3.18)
Most Restorable Marker	17 (Restoration Potential: 2.93)

Trip 2: Sant'Erasmo (Markers 29-44)

Day Trip 2: Sant'Erasmo, 15 Markers (Markers 29-44) - 12 miles, walking	
Found Markers	13
Missing Markers (Confirmed with 1990 Survey)	0
Newly Missing/Unconfirmed Markers	2
Unconfirmed markers were on private property.	
Markers Made of Istria Stone	13
Markers Made of Brick	0
Average Marker Condition	2.52
Average Restoration Potential	2.35
Marker in Worst Condition	31 (Overall Condition: 2.95)
Most Restorable Marker	38 (Restoration Potential: 3.00)

Trip 3: Treporti-Jesolo (Markers 45-53)

Day Trip 3: Cavallino-Treporti, Jesolo; 9 Markers (Markers 45-53) - 35 miles, biking	
Found Markers	8
Missing Markers (Confirmed with 1990 Survey)	0
Newly Missing/Unconfirmed Markers	1
Unconfirmed marker was located in the middle of the lagoon.	
Markers Made of Istria Stone	6
Markers Made of Brick	2
Average Marker Condition	2.35
Average Restoration Potential	2.57
Marker in Worst Condition	49 (Overall Condition: 2.73)
Most Restorable Marker	47 (Restoration Potential: 3.17)

Trip 4: Fort of Marghera Region (Markers 68 bis, 68-73)

Day Trip 4: Marco Polo Airport to Fort Marghera, 7 Markers (68-73)	
Found Markers	3
Missing Markers (Confirmed with 1990 Survey)	1
Newly Missing/Unconfirmed Markers	3
Unconfirmed markers were surrounded by overgrowth, in the airport fences, or gated off.	
Markers Made of Istria Stone	2
Plaque Markers	1
Average Marker Condition	2.83
Average Restoration Potential	2.69
Marker in Worst Condition	73 (Overall Condition: 4.83)
Most Restorable Marker	73 (Restoration Potential: 4.64)

Trip 5: Mini Peninsula near Malcontenta (Markers 79-89)

Day Trip 5: Peninsula near Malcontenta; 11 Markers (Markers 79-89) - 10 miles, walking	
Found Markers	1
Missing Markers (Confirmed with 1990 Survey)	3
Newly Missing/Unconfirmed Markers	7
Unconfirmed markers were in industrial plants, in inaccessible swamps or on private farm land.	
Markers Made of Istria Stone	1
Markers Made of Brick	0
Average Marker Condition	N/A
Average Restoration Potential	N/A

Trip 6: Mini Peninsula near Giare (Markers 1,2 and 92-100)

Day Trip 6: Peninsula near Giare; 11 Markers (Markers 92-100, 1, 2) - 18 miles, walking	
Found Markers	7
Missing Markers (Confirmed with 1990 Survey)	0
Newly Missing/Unconfirmed Markers	4
Unconfirmed markers were inaccessible due to swamp land, on private property, or surrounded by overgrowth on the opposite side of a canal.	
Markers Made of Istria Stone	7
Markers Made of Brick	0
Average Marker Condition	2.98
Average Restoration Potential	2.62
Marker in Worst Condition	92 (Overall Condition: 3.52)
Most Restorable Marker	93 (Restoration Potential: 3.3)

4.1.3 – Analysis of Visitation and Documentation of Markers

At the beginning of the term, we hypothesized that markers in relatively poor condition would be clustered around each other, and our visitation to the markers confirmed our hypothesis. The location with the worst average marker condition was the small peninsula south of Giare. Though we were not surprised by the consistent poor marker condition, we were surprised to see that the area in which the markers were located was actually a popular spot. We passed dozens of people walking along the same path as us while we documented the markers, as this peninsula is a popular walking spot for local residents. The average marker condition in that area was 2.98, 19% worse than the overall average marker condition. Our analyses of the specific day trips we took allowed us to give recommendations for which area to restore first if marker repair efforts were to be centered on one area.

4.2 - Creation of Data Collection Tool

In order to keep the data collection process manageable and to display the data in a more accessible and user-friendly interface, a data collection tool was created (bounds.herokuapp.com). The tool has an overall view of the marker locations, shown in Fig 31.



Fig. 31 shows *Conterminazione Lagunare* Markers on tool with symbols for the marker condition.

As shown above in Fig. 31, a filtration for marker condition or a way for users to easily select markers of differing conditions there were various colored symbols were used to represent marker condition. The gray markers were used to represent markers that we did not visit or were unreachable. The green markers were the markers in good condition with a score of 2.5 or lower. The yellow markers with cracks were the markers of an average condition with a score of 2.5-3.5. The red, broken in half markers were the markers with a severe condition with a score of above

3.5. A clear visual of the condition of the markers across the geographic span of the lagoon was displayed.

To view data on a specific marker, any marker pin can be clicked on to view the data of the marker. The main display page, shown in Fig. 32 has general information about the marker and pictures of the approach, inscription, and surroundings, along with our visitation status.

Marker #45

General

Main info

Data from I Cento Cippi

Coordinates: 45.461293, 12.440772

Exact Address: Via di Portosecco, 70/A, 30013 Cavallino-Treporti VE, Italy

Visitation status: Reached

Clockwise North Delta Enter value

Spire Triangle Height 5

Inscription N. 45/ Margine/ Di/ Conterminaz/ 1791



Fig. 32 shows an example of a marker's main page on the data collection tool.

There are also four pages per marker with specific face dimensions and scorings of face conditions. These pages, exemplified in Fig. 33, also displayed pictures of the marker face. The tool calculated overall face condition and overall marker condition for us to make data analysis easier.

Marker #45

General

Main info

Data from I Cento Cippi

Directions

Photo Upload & Categorization

Sides

Side #1

Side #2

Side #3

Side #4

Side #1

Condition

Biological growth on marker:

Biological growth around marker:

Surface cracking:

Environmental discoloration:

Structural disintegration:

Overall condition: 2

Base

Height (in cm)	92
Width (in cm)	50

Ring

Height (in cm)	18
Width (in cm)	56

Spire

Height (in cm)	6
Width (in cm)	50



Fig. 33 shows an example of a marker's face page in the data collection tool.

One benefit of scoring the markers in this tool is that the marker condition score was automatically multiplied by its weight and then all four sides were averaged to obtain a total score for the marker. It eliminated the lengthy and mistake-prone manual calculation of marker score by our group members.

The app made by our team to collect and display data will affect anyone in the future who hopes to further document or restore the markers placed by the Venetian Republic. Projects to document the markers we were unable to visit will have a place to compile their data and group it with the data we have collected. The app we created will make certain that future data is compiled in one database that is accessible and user-friendly instead of it being in a separate place than the data we collected. The app will also aid anyone who aims to restore the markers as well. Though the markers' locations and general conditions had been documented 30 years ago, but the conditions have changed and worsened since their last documentation. There was also no quantitative measure of marker condition when they were last researched. The collection, analysis, and presentation of our data will help to decide which markers should be restored if there are any projects to do so in the future.

4.3 - Historical Boundaries of Venice

The second objective we set was to convert old maps of Venice to GIS format for more accessible use, and make these maps more readily available. These maps included the Napoleonic Cadastre, Austro-Hungarian Cadastre and pre-1924 borders of Venice. We also set an objective to outline or access the borders of Venice today and its internal divisions (*municipalitá, quartieri*) to help compare the past borders with present borders.

4.3.1 - Napoleonic and Austro-Hungarian Cadastres

Outlining the Napoleonic Cadastre and the Austro-Hungarian Cadastre essentially became the same objective for us, as the two cadastres mapped Venice in the same way. The only difference between them was that the Napoleonic Cadastre was divided into many small maps whereas the Austro-Hungarian Cadastre of Venice was all on one very large map. The capabilities of the Venetian Archives made it so we only got scans of the Napoleonic Cadastre. Because we were given scans of the Napoleonic Cadastre, the maps we got did not often stitch together and did not give a full overview of Venice when it was under French control. We decided the information we could extrapolate from the Cadastres was not significant or conclusive enough to publish in our tool or outline in GIS.

4.3.2 - Borders of Venice between 1883 and 1926

Our attempts to find complete maps of Venice between 1883 and 1926 from those time periods did not yield results for the whole region of Venice desired; most maps of Venice show just the historic center island, so we were unable to find anything portraying the progression of Venice. Because of this inconvenience, we were only able to assume how the borders progressed, though the progression of the land that Venice claimed was fairly easy to delineate. The following images show our delineation of the borders of Venice between 1883 and 1926.

In 1883, the city of Venice was just defined as the historic island of Venice, or the *Centro Storico*, as shown in Fig. 34.

The Boundaries of Venice

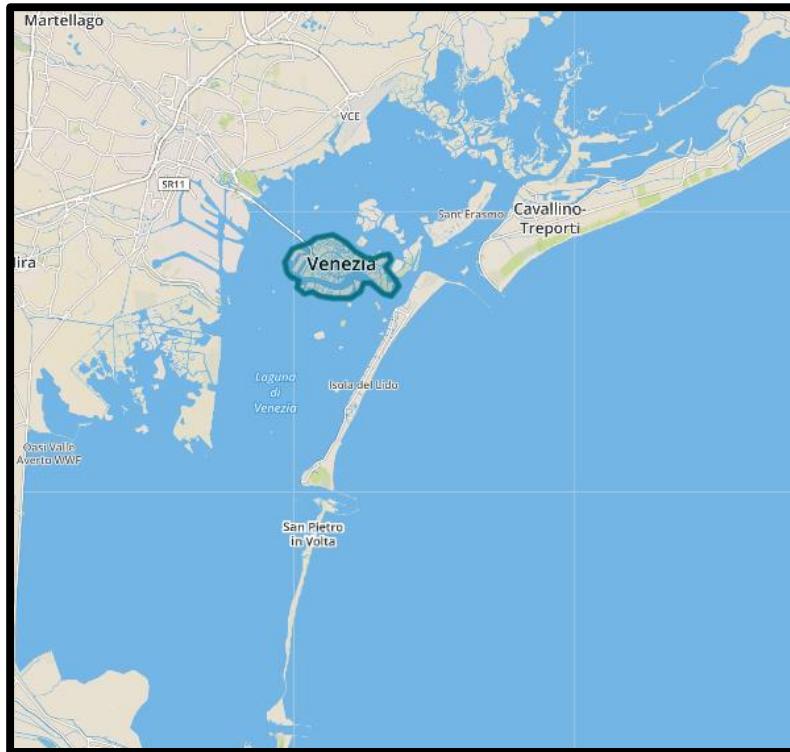


Fig. 34 shows the borders of Venice leading up to 1883.

In 1883, the historic center was combined with Lido and Pellestrina. This annexation as seen in Fig. 35 not only increased Venice's population, but gave them more land to use as farming land.

The Boundaries of Venice

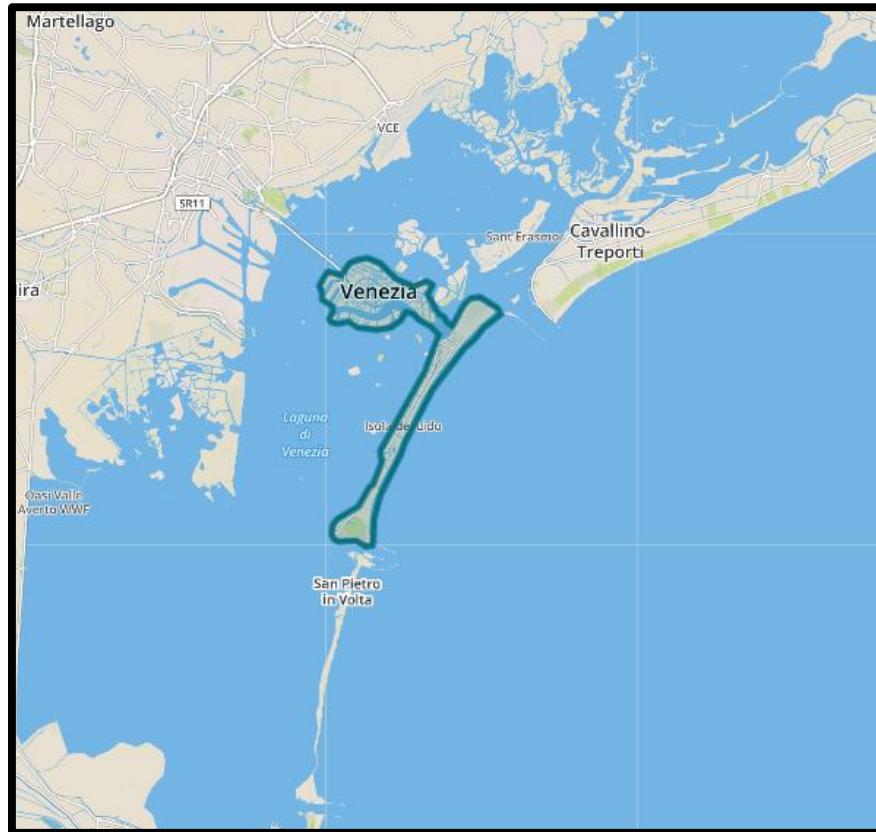


Fig. 35 shows the borders of Venice after the annexation in 1883.

34 years later, the city was combined with Marghera. One of the most impactful annexations for Venice, as shown in Fig. 36, Marghera gave the city a lot of new land, increased population, and increased the city's economic output because of the industry located in Marghera.

The Boundaries of Venice

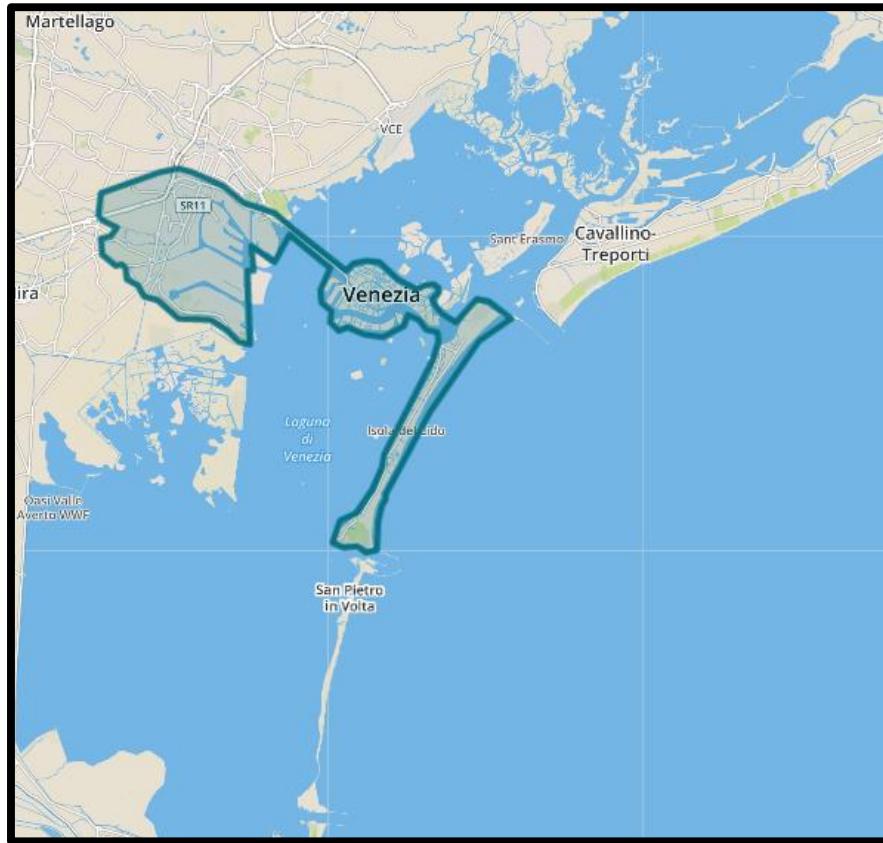


Fig. 36 shows the borders of Venice after the annexation in 1917.

In 1924, Burano, Murano, and Ca’ Savio were annexed to the growing city of Venice. This annexation, shown in Fig. 37 completed the modern-day *municipalità* of Venezia-Murano-Burano. The addition of these islands and Ca’ Savio helped bolster Venice’s economy. However, Ca’ Savio eventually broke off from Venice once again in the 1990s.

The Boundaries of Venice

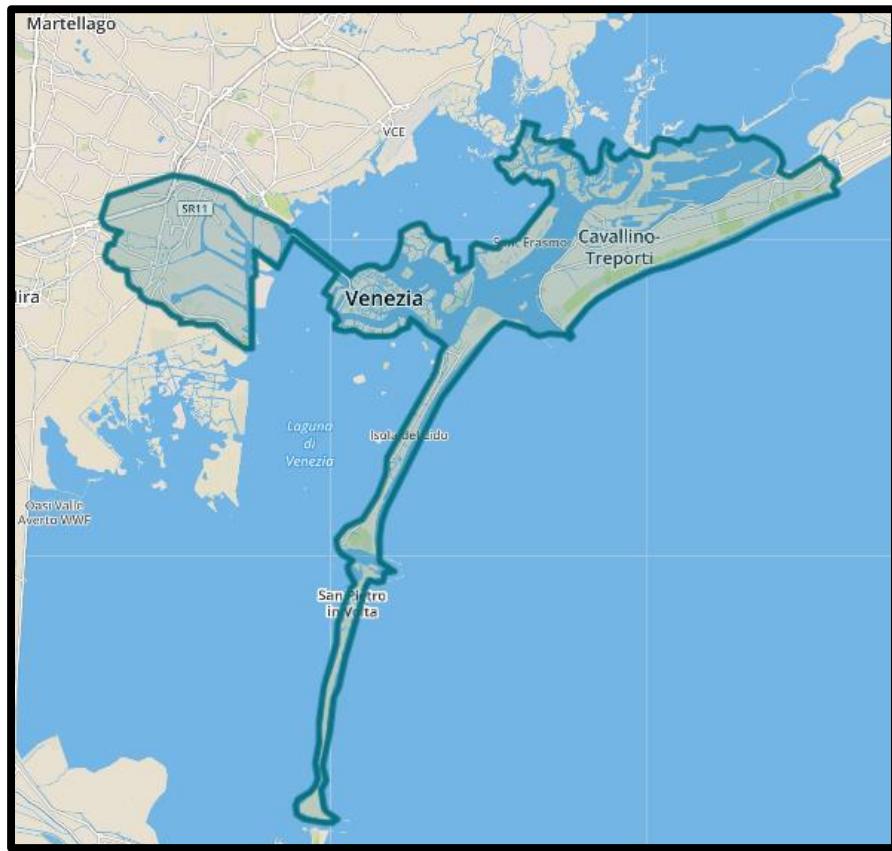


Fig. 37 shows the borders of Venice after the annexation in 1924.

The last and largest annexation occurred in 1926, when Venice was combined with the rest of the mainland (Chirignago, Favaro, Malcontenta, Mestre, and Zelarino), shown in Fig. 38. The increase in Venice's population and gave much more land for Venice to work with. In the following years, this area became a hotbed for industry and transportation hubs, as the airport and Mestre Train Station are located in this section of Venice.

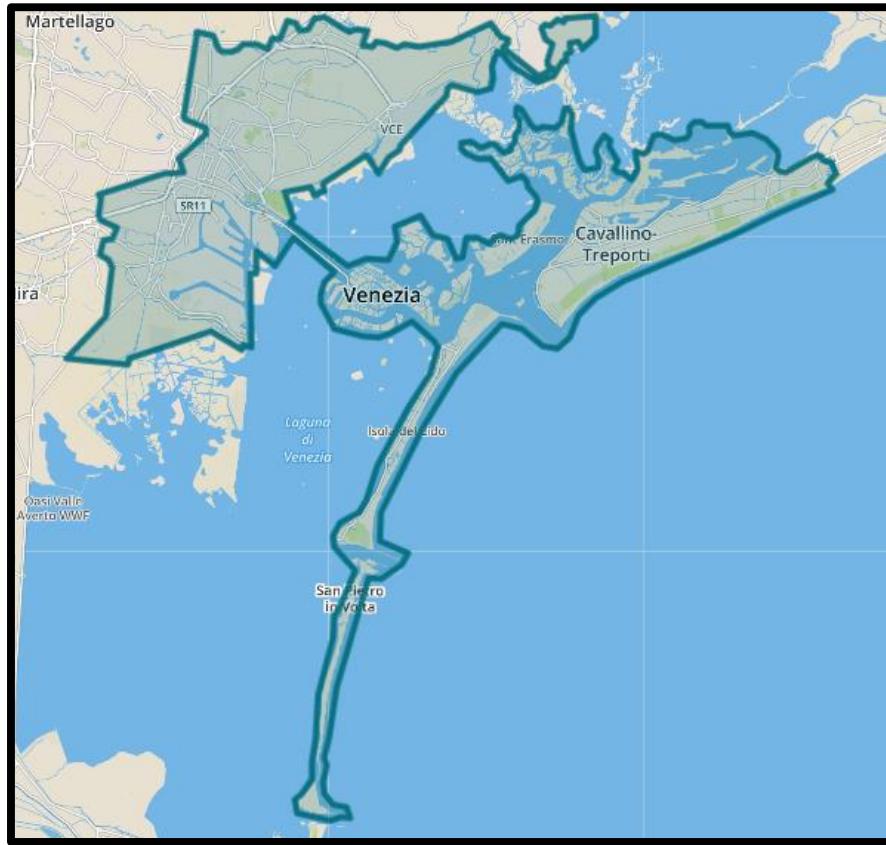


Fig. 38 shows the borders of Venice after the annexation in 1926.

Knowing the location of borders in Venice's past will give citizens other baselines to use if they want to formulate their own borders to split Venice. The outlining of the border in GIS will allow our group to upload the borders to our final tool for users to visualize.

4.3.3 - Internal Borders of Today's Venice

The last borders of Venice we mapped were the internal divisions used by Venice today. Venice is divided into 6 *municipalità* and then further divided into *quartieri*, both of which we needed to get mapped in GIS to use in our final tool. These subdivisions are significant in their resemblance to how the region was combined in the early 1900s. Additionally, the *municipalità*

The Boundaries of Venice

represent major population areas such as Mestre-Carpenedo and Marghera. The GIS mapping of the *municipalità* is below in Fig. 39.

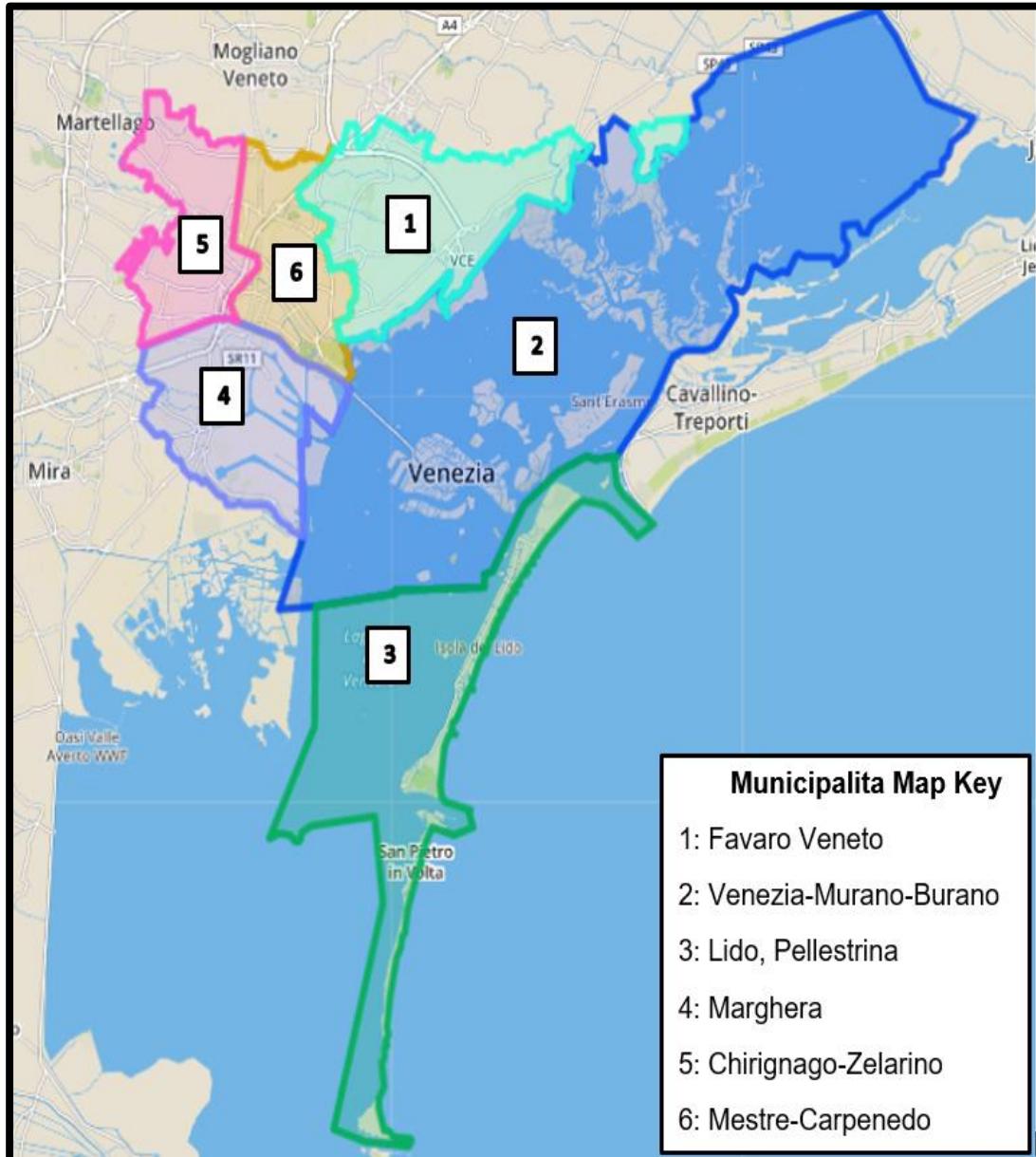


Fig. 39 shows a map of Venice *municipalità* numbered and with key of names

This map is useful for those who will use the final tool in the future to draw their own borders through the city. It was also helpful for our purpose as we used it to delineate the progression of Venice's boundaries between 1883 and 1926.

The *quartieri* are the 12 smaller divisions of the *municipalità*. Like the *municipalità*, they have very few administrative powers. They will however provide the closest division in our final tool that the user can view census and labor data for and draw borders around. These *quartieri* are depicted in Fig. 40 along with a key for their name

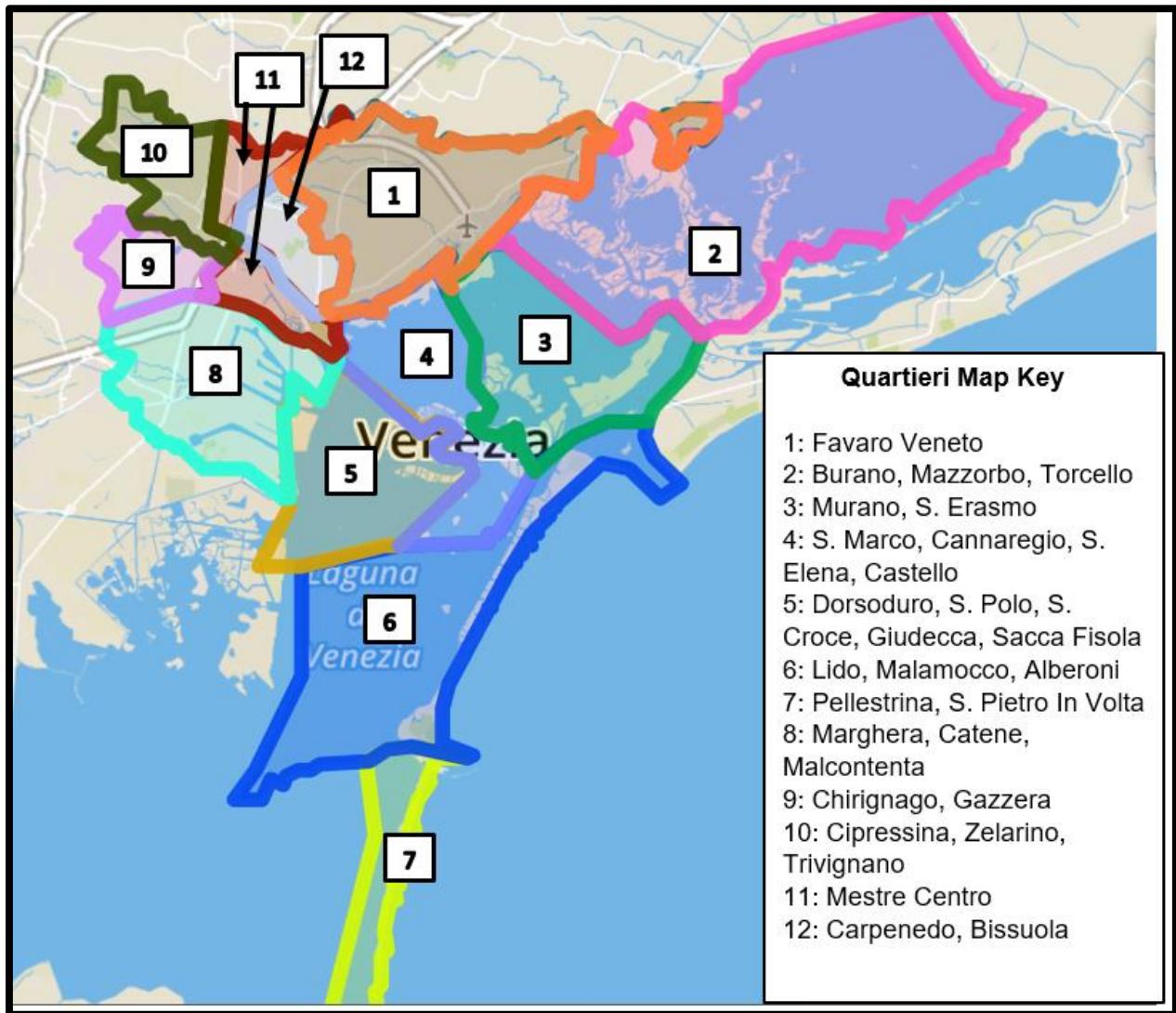


Fig. 40 shows a map of Venetian *quartieri* labeled with numbers and key with names

4.4 - Mapping of 1990 Case Study Models

Related to our third objective, we analyzed and outline the three boundary models as described by the 1990 case study *Three models for the future of Venice: A case study of territorial polarization in a growing area of an urban periphery* (Muscarà, 1990). The boundaries represented in the case study are ultimately drawn by our own interpretation and were placed in the final tool

as baseline boundaries or examples of how to divide Venice. The benefit of using these case studies as opposed to just our own judgement on placing example boundaries is that they were formulated by a professor and researcher of geographical reorganization in Italy, Calogero Muscarà. Through thorough research and analysis of the shifts in ideology and economy of the *Estuario* and *Terraferma*, boundaries were alluded to that are more representative of the needs of the regions. Particularly, the sources of information on which these boundaries were based were, “the conscious wishes of the Venetian inhabitants,” the predominant “philosophy of urban space” and “awareness of what moves life in a town” (Muscarà, 1990). The models contain logic behind the new roles of regions after being combined or separated and how this change would make the city more functional.

In the methodology, key phrases were chosen that most represent how the regions were divided within each lengthy model description. In the following, sections these key phrases are used as tools to deduce how each region should be separated.

4.4.1 Greater Venice Model Boundary Deduction

The first model of Greater Venice establishes parts of the mainland as an extension of the *Centro Storico* and creates two separate cities out of the commune of Venice. The study first states that the main population poles of the metropolitan system are Mestre, Padua, and Treviso on the mainland (Muscarà, 1990). However in order to have a balance of populations between the two new cities, it combines the *municipalità* of Mestre Carpenedo and Marghera with the *Centro Storico*. The other city generated would just be the other three *municipalità* of Venice (Lido-Pellestrina, Chirignago-Zelarino, Favaro Veneto) along with the smaller islands of Murano,

Burano and Torcello. The benefits of this division are that each city has an adequate population base and the *Centro Storico* has strong economic support from Mestre and Marghera.

The lagoon water would belong to the city containing the *Centro Storico*. The entire coastline would still belong to the other city besides the mainland areas of Mestre and Marghera since they are included in the city with the *Centro Storico*. An image of this model is below in Fig. 41.

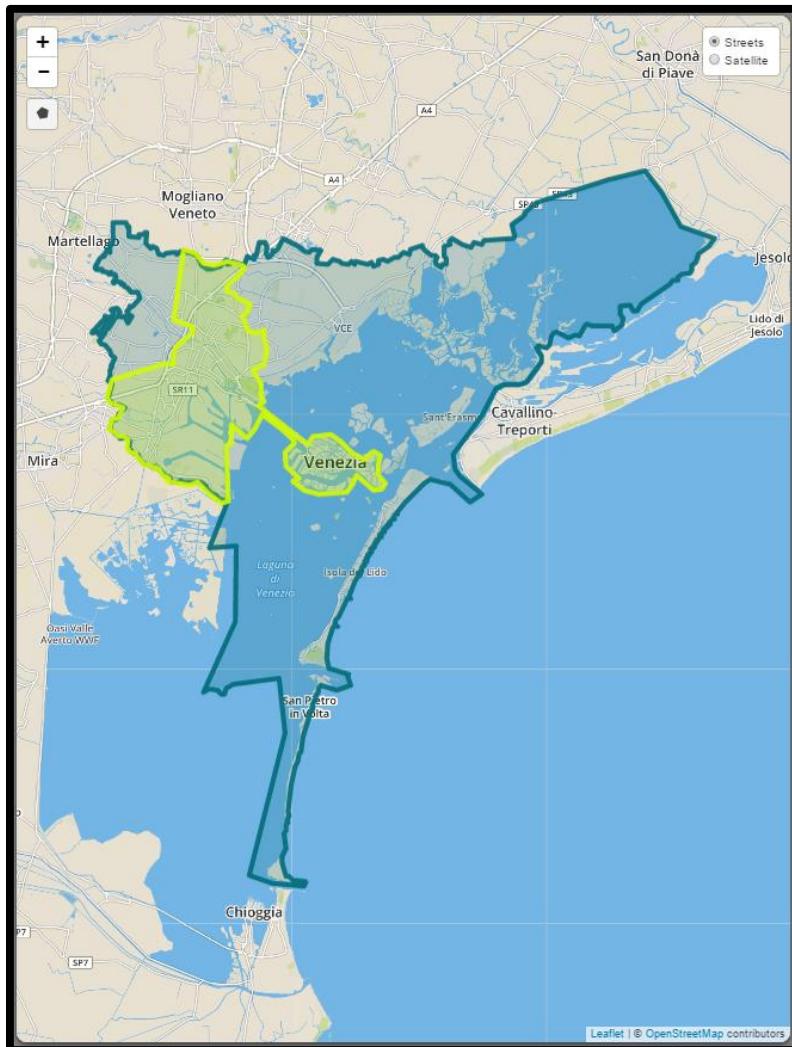


Fig. 41 shows a separation of Venice according to Model 1: Greater Venice.

This model prioritizes the *Centro Storico* or historic center as the central governmental power of the region that can enact its own ideas and priorities in preserving its historical infrastructure. The justification for placing the *Centro Storico* or historic center in control is that the industrial area of Marghera, a main economic support for the mainland, has always been a natural continuation of the port of Venice on the *Centro Storico*. It is a necessary adjunct to the Port of Venice with administrative ties as bases for the Port of Marghera were integrated with the ancient Port of Venice (Muscarà, 1990). Besides just administrative reasons, the municipalities of the mainland and islands were annexed historically to the municipality of Venice not the other way around. Therefore the *Centro Storico* has always taken a central role.

4.4.2 - Insular Venice Model Boundary Deduction

The second model proposed the most drastic split again into two cities one being the *Centro Storico* or historical center and its small island communities of Burano, Murano, and Torcello. The other city would be comprised of the entire *Terraferma* and the municipality of *Lido-Pellestrina*. This model completely centralizes the *Centro Storico* politically and economically and allows it to stand on its own. An image of Model 2: Insular Venice, is below in Fig. 42.



Fig. 42 shows a separation of Venice according to Model 2: Insular Venice.

The economic view behind this model is that the *Centro Storico* has not maintained a managerial class or system capable of governing the mainland. Industrial groups that have a larger role than Venice in directing the Marghera economic center are situated in Rome or Milan. Economically, this model also visualizes the *Centro Storico* as a world city similar to Geneva, Switzerland, a place for great organizations and international meetings. In this way, the economy of the city would take a new direction and its role would be essential as a central location for the collaboration of nations.

4.4.3 - Two Separate Towns Boundary Deduction

The third model proposes a basic split of the *Estuario* and *Terraferma* along the coastline with the lagoon forming again two cities shown in Fig. 43. The water belongs to the city containing the *Estuario* but the coastal area of the mainland still belongs to the city containing *Terraferma*.

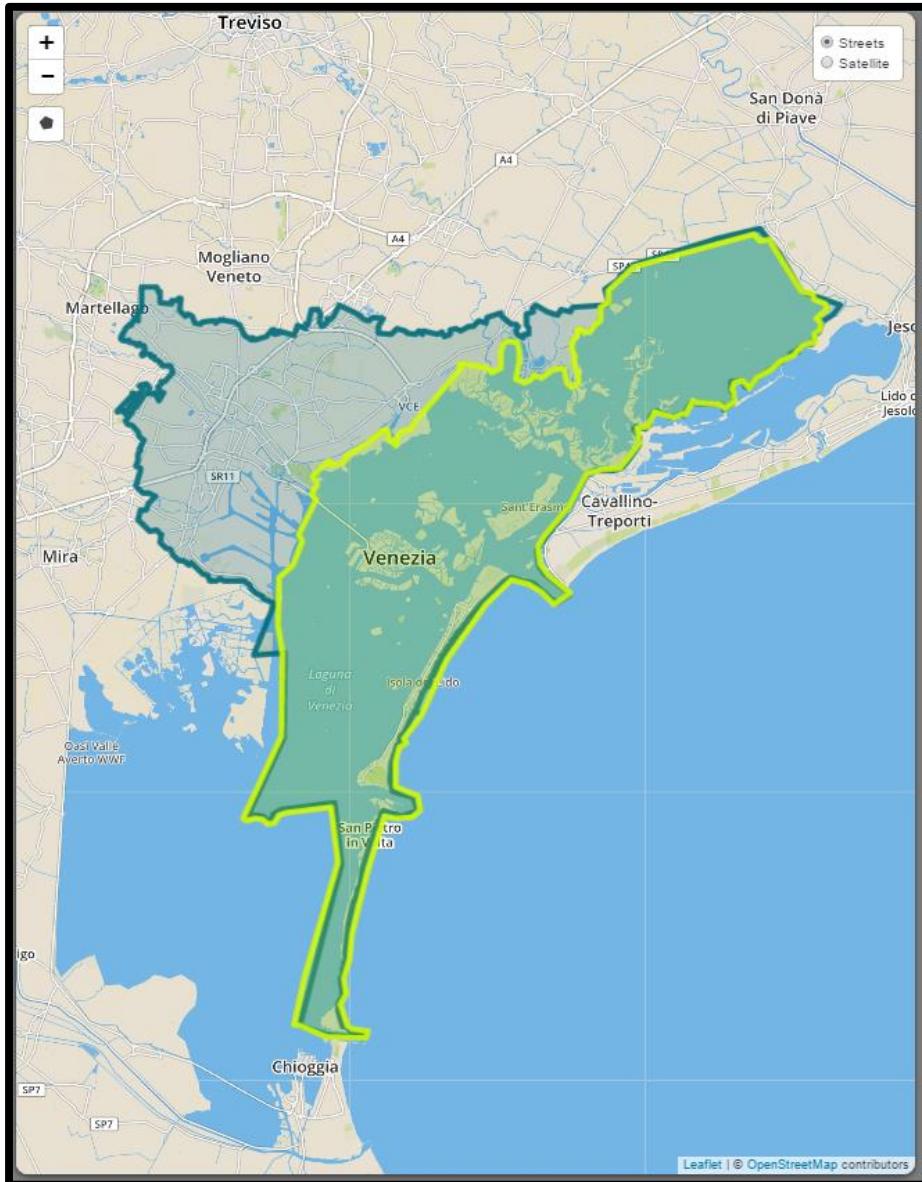


Fig. 43 shows the separation of Venice according to Model 3: Two Separate Towns.

This model holds that the mainland has developed independently from the *Centro Storico* and that the population and the economy has no real connections to the *Centro Storico*. This model would allow the mainland to acquire all of the features and law making abilities of an independent city that would allow them to expand and create more jobs. The *Centro Storico* would be able to legislatively focus more on preserving their infrastructure.

4.5 - Development of Mapping Tool

As described previously, the tool is built using react.js and flux architecture and styled using Semantic UI. The purpose of using semantic UI to style the web-app is because it allows designers and developers to create a well-documented shared vocabulary for UI, making future editing of the design easier. When a user first opens the web-app we wanted it to be as clean as possible by only presenting a map and sidebar so there is no informational overload. Below (Fig. 44 through 48) are examples of the information and functionality of the web-app.

Our tool was merged with our data collection tool, so it displays all the information we collected on the 1791 border of the Venetian Republic. Users are able to turn on and off the marker information. More information on this part of the app is in the pages above (Section 4.2).

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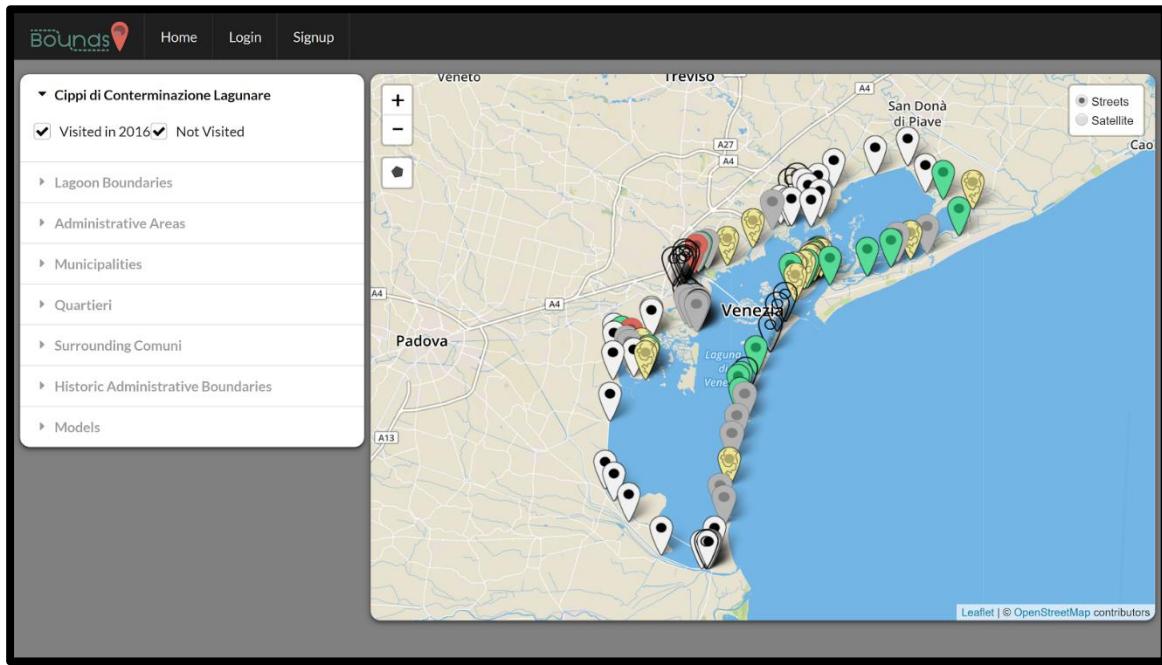


Fig. 44 shows the final tool with the markers displayed on it.

Because all of the borders we researched (both historical and theoretical) were outlined in GIS formats, they were uploaded into our tool. Users of the tool can visualize any of the *municipalità, quartieri*, historic boundaries of the city, models from the case study, and the official boundary of the city and Metropolitan Area of Venice. An example of a GIS boundary on our tool is displayed in Fig. 45.

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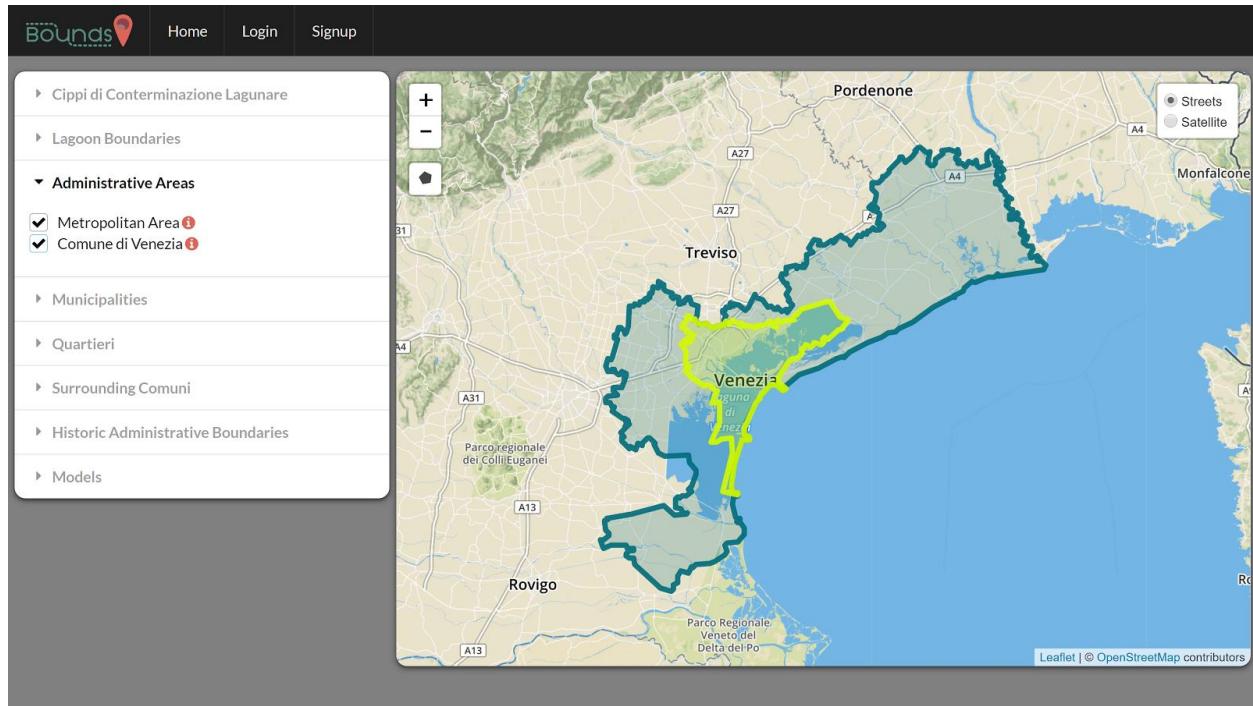


Fig. 45 shows an example of a GIS rendering of a border on a map of the Metropolitan Area of Venice.

As seen in Fig. 46, when a historical boundary is selected, a red information (“i”) button will bring up a pop up with census and labor data about the region within that border. This information includes total population, people with a university degree, people with a high-school diploma, workforce, jobs, and companies. Additionally a bar graph shows the breakdown of the population by 5 year ranges and then ages over 75. This information is the basis for our analysis of the boundaries in the following section. The workforce to job ratio and number of companies provided economic data while the college age proportion of the population was our more demographic data. This data allowed us to visualize whether or not the city created would be sustainable.

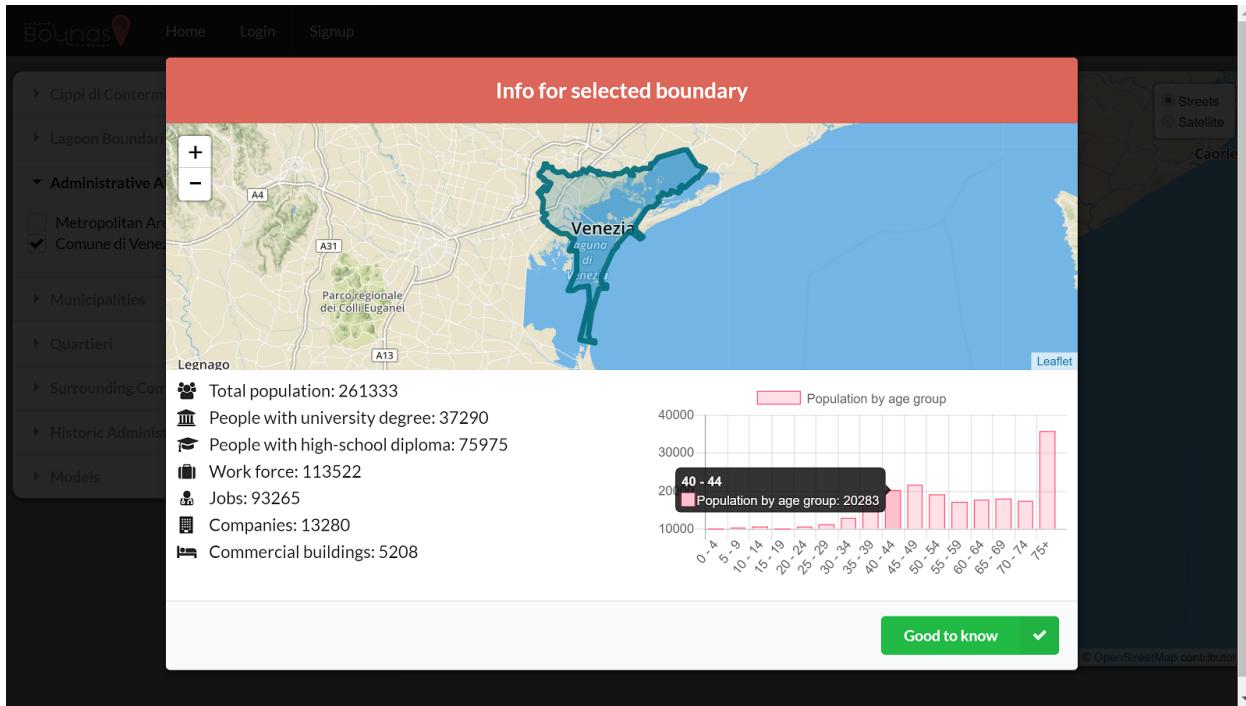


Fig. 46 shows the data generated from one of the GIS boundaries stored in our tool.

As seen in Fig. 47 and 48 above, the user of our tool can use a drawing tool to create their own boundaries and obtain census and labor data about that boundary in a pop up appearing as soon as the boundary is closed. The user can draw the boundary freehand or have any of the pre-set boundaries in place to draw around. The user is free to create any border they want or essentially alter any of the borders placed by us in the tool.

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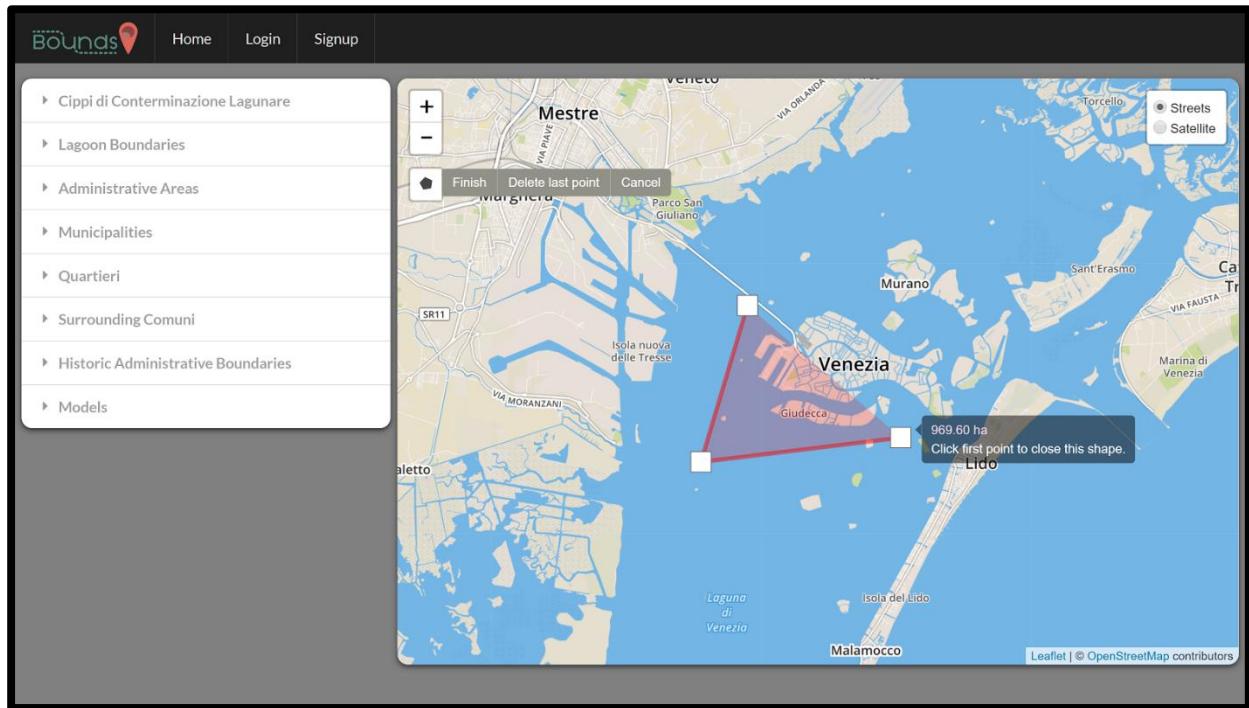


Fig. 47 shows the tool's capability to draw custom-made boundaries.

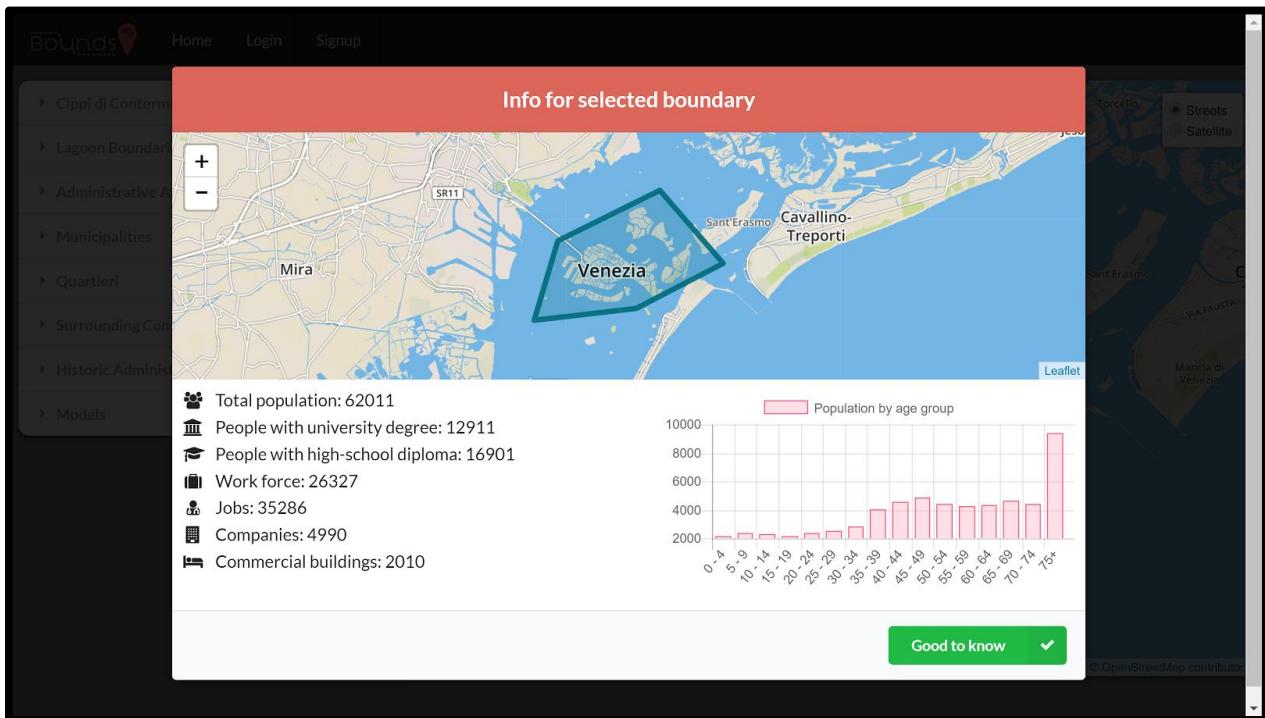


Fig. 48 shows the data generated by the custom drawn border exemplified in Fig. 47.

4.6 - Results and Analysis of Possible Borders through Venice

The above objectives led us to our final objective, which was to make a tool to visualize these borders and what modern-day implications they would have. Our tool, housed at bounds.herokuapp.com, allows users to draw borders and see the population of the two cities created by the borders. It was also combined with the data collection tool outlined in Section 5.1 so users can see more specific data on the 1791 borders. The tool displays all of the different borders we researched as well so people can use those boundaries as baselines for borders they draw. The following section will show the data relating to a split of Venice for the historic borders and models of Venetian separation as generated by our tool. Unless otherwise noted, the city containing the historic center (*Centro Storico*) of Venice will be called “Venezia” and the remaining city will be referred to as “Mestre.”

4.6.1 - Separation along 1791 Venetian Republic Border

The figure below (Fig. 49) shows how Venice would be divided if the exact border of the Venetian Republic in 1791 was used. That which is outlined in yellow-green would be Venezia and the rest, outlined in blue, would be Mestre.

The Boundaries of Venice

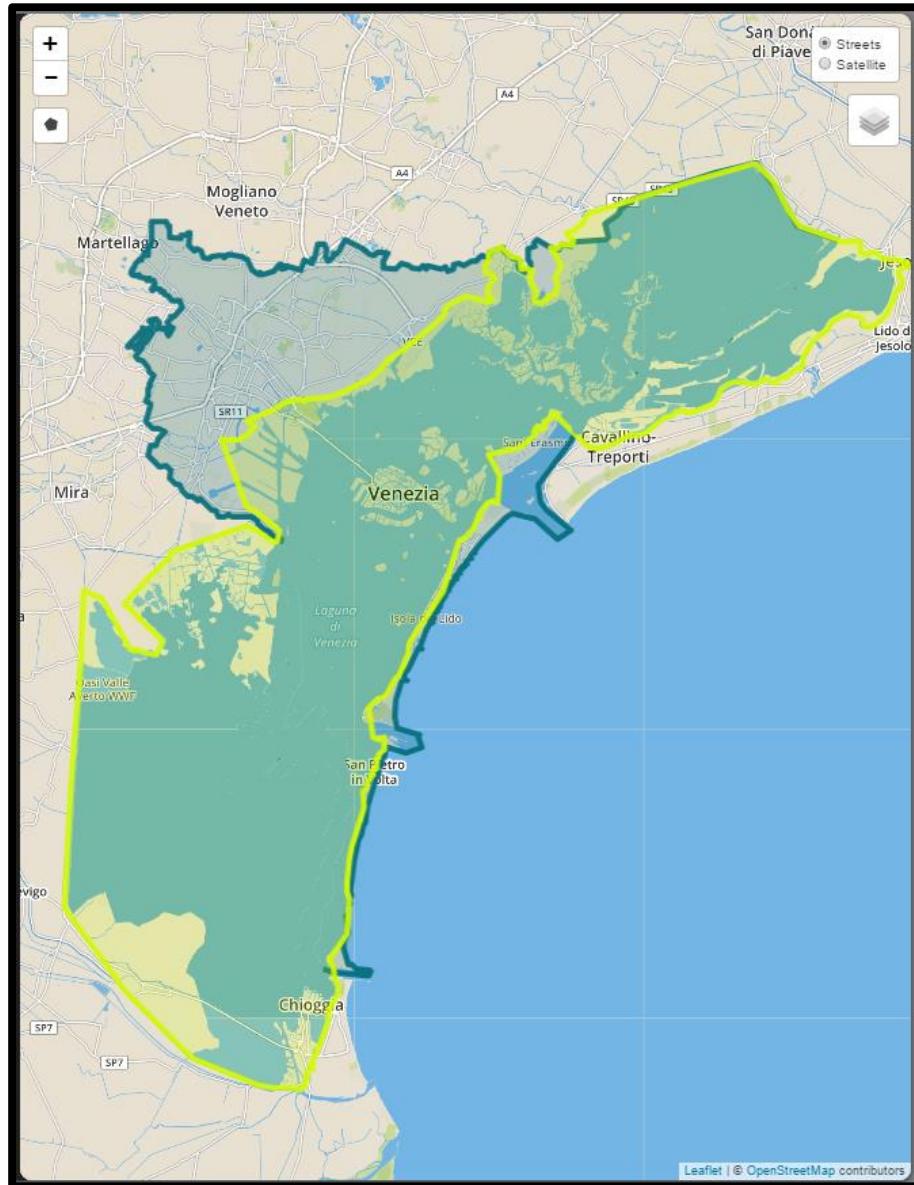


Fig. 49 shows separation of Venice according the 1791 boundaries into two cities, Venezia in yellow, Mestre in blue.

A separation of Venice along these boundaries would produce two cities. The economic and demographic information about these cities is displayed below in Table 5.

	Venezia (Yellow)	Mestre (Blue)
Total Population	90,376	170,957
Population with a College Degree	14,736	22,554
Citizens Eligible to Work	37,818	75,704
Number of Companies	5,840	7,440
Number of Jobs	26,607	59,610

Table 5 shows raw economic and demographic information pertaining to a split of Venice along the 1791 lagoon border of the Venetian Republic.

The creation of two cities divided by the border of the Venetian Republic in 1791 would make Mestre twice as large in population as Venezia. Venezia would have a much lower workforce population to job ratio than Mestre (1.42 to 1 in Venice compared to 1.26 to 1 in Mestre). This means that there are significantly more people seeking employment than there are jobs available in Venezia. Combining that with a higher percentage of the workforce with a college degree (38.9%, compared to 29.8% in Mestre), a dwindling, tourism based economy in Venezia, and a growing economy in Mestre, the use of these borders could contribute further to the brain drain event in Venezia where college educated citizens have left the city for a location where their career could flourish.

However, a closer look at these boundaries shows that Venezia would be given the Port of Marghera and Marco Polo Airport. Because these economic hotspots of the mainland are on reclaimed land and were once a part of the lagoon, citizens of the *Estuario* or the new Venezia feel they rightly belong to the islands. Additionally, an annexation of these economic points of contention would prevent Venezia's economy from collapsing. These two areas, though somewhat

based on tourism, would increase Venezia's reliance on transport and manufacturing, thereby making Venezia's economy more multidimensional and more stable. The influx in job availability brought about by these economic points of interest could cause a rise in working age population for Venezia.

The newly created city of Mestre, though, would lose the airport and Port of Marghera. Losing just these two points of economic support would cost the city almost 10,000 jobs may cause initial frustration among Mestre citizens. However, it is difficult to surmise that this would cripple Mestre's economy because they would still have industrial plants scattered around their land and the population centers of Mestre and Favaro Veneto could still commute to work in these economic centers. However, their economy would take a hit due to Venezia's control of the coastline, port, and airport.

With this boundary, a defined cultural divide would be drawn between a youthful, forward thinking population focused on economic expansion and an older population focused on preserving the historical city and minimizing issues caused by the influx of tourism.

Based on the census and labor date information within our tool, each city is likely to have the population and economic support it needs to be sustainable, Venezia with its key coastline economic centers and Mestre with its youthful, heavily populated mainland regions containing the remainder of industries.

4.6.2 - Separation along Borders of Venice between 1882 and 1926

Before the annexation of different islands and parts of the mainland to Venice, the city was just the small historic island in the middle of the lagoon. Analysis of the order in which these

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territories were annexed also allowed analysis of which regions are most closely connected. The figure below (Fig. 50) shows the location of where borders would lie if the City of Venice was divided based on how it was divided in the years leading up to 1883.

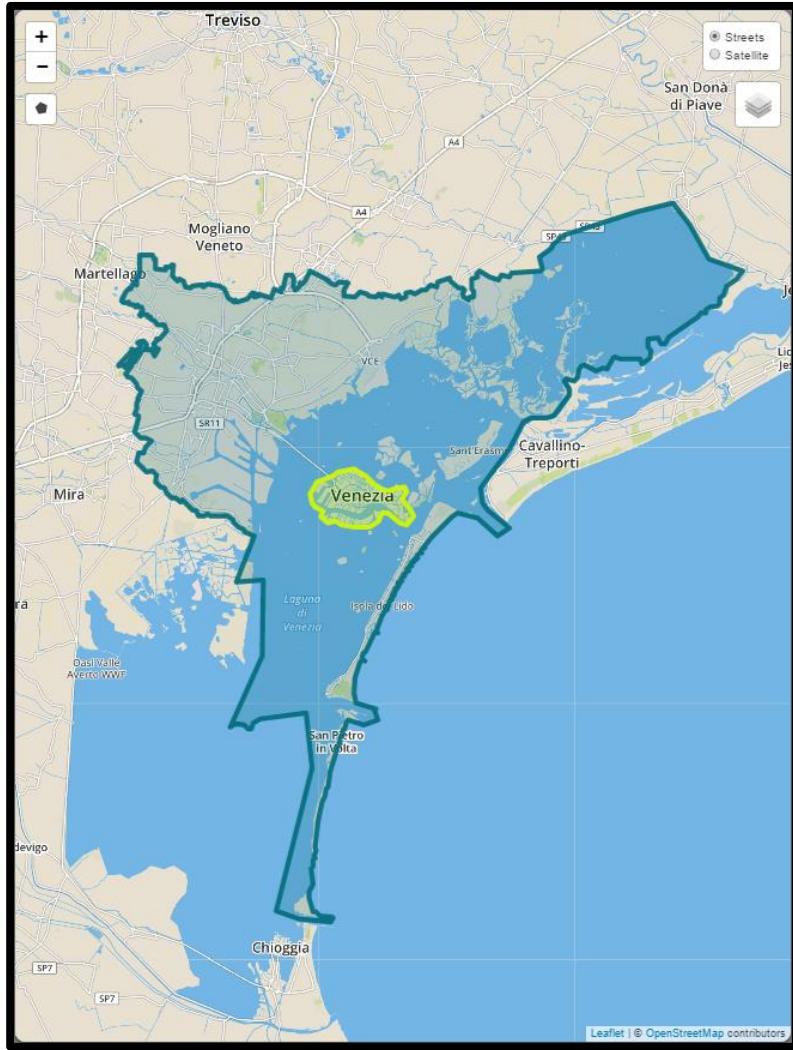


Fig. 50 shows a separation of Venice into two cities according to the boundaries of Venice leading up to 1883; Venezia in yellow, Mestre in blue.

A separation of Venice along these boundaries would produce two cities. The economic and demographic information about these cities is displayed below in Table 6.

	Venezia (Yellow)	Mestre (Blue)
Total Population	57,449	203,884
Citizens Eligible to Work	24,552	88,970
Population with a College Degree	12,642	24,648
Number of Companies	4,666	8,614
Number of Jobs	20,128	39,482

Table 6 shows raw economic and demographic information pertaining to a split of Venice along the border of Venice leading up to its first border expansion in 1883.

Limiting Venezia's territory to just the historic island (and Giudecca) would lower its population to just under 58,000 people, only about 25% of Mestre's population. Though a small city, it would be a relatively educated city, considering 51% of its workforce is college educated, compared to only 28% in Mestre. The type of jobs in Venice are mainly centered in the historic island are service jobs and therefore, college educated citizens in one area fighting for a small amount of college education-level jobs This can further the development drain event, where college educated citizens leave the city in search for better career opportunities. In Venezia, there would be a 1.21:1 ratio of working population:jobs population, which is a far more optimal ratio than that of Mestre (2.25:1). Though the numbers are not favorable for Mestre, a large majority of the citizens of that city would have little trouble traveling to nearby cities (Padua, Treviso, etc.) to find work.

Another part of the boundary which would appeal to those in Mestre is that Mestre would have control of the Port of Marghera and Marco Polo Airport. Retention of these two economic hotspots is important to a sustainable and stable economy being a source of over 10,000 jobs for

them. Mestre's possession of these two hubs is the biggest downside of this model for Venezia, whose economy would still rely very heavily on tourism. An over-reliance on tourism could help to exacerbate the brain drain event as described above.

The new city of Venezia would likely not be self-sustainable, as its lack of farming land would increase its dependence on nearby cities to import foods like produce and various meats. The lagoon area would be a contentious point between the two cities, as there would likely be debate over who gets to fish and where. Though Venezia would be a culturally homogeneous city, there would likely be an ideological divide between the other lagoon islands and the mainland within the newly created city of Mestre. A separation along these boundaries would neither support the economic future of Venezia or the ideological views of the other lagoon islands.

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Venice's border expansion began in 1883 when it annexed the island of Lido and Malamocco. If this boundary were used in a split today, it would look like the figure below (Fig. 51).

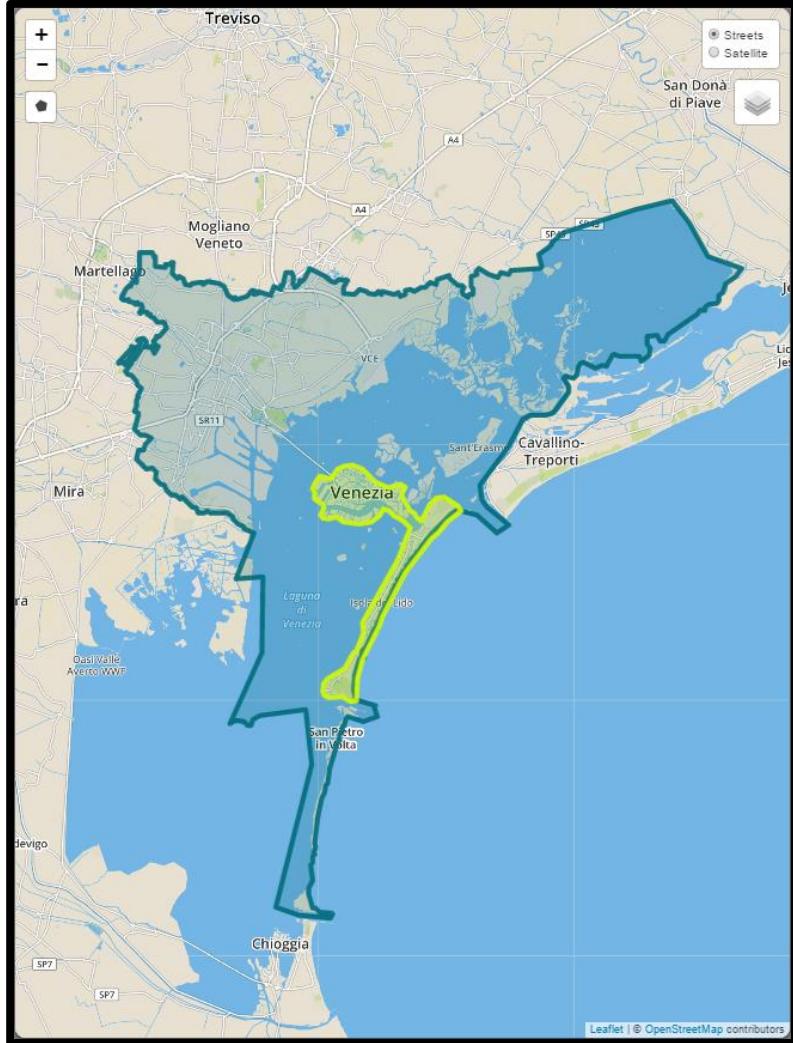


Fig. 51 shows a separation of Venice into two cities according the boundaries of Venice in 1883; Venezia in yellow, Mestre in blue.

A separation of Venice along these boundaries would produce two cities. The economic and demographic information about these cities is displayed below in Table 7.

	Venezia (Yellow)	Mestre (Blue)
Total Population	74,318	187,015
Citizens Eligible to Work	31,596	81,926
Population with a College Degree	15,327	21,963
Number of Companies	5,368	7,912
Number of Jobs	23,587	36,023

Table 7 shows raw economic and demographic information pertaining to a split of Venice along the border of Venice leading up to its first border expansion in 1883.

The implications of this border would not vary much from those of the border used by Venice leading up to 1883; the island of Lido has a relatively low population and would not make a large difference in population data. It also does not hold any spots of economic contention like the airport or significant ports. Like the model outlined above, Venezia would have a much more educated population (49% college educated workforce v. 27%) than Mestre. It also has more jobs per person in the workforce when compared to Mestre (0.75 jobs/person in the workforce compared to only 0.44). However, also similar to the previous model, the discrepancy in college education level and Venezia's one-dimensional economy based on tourism could cause a brain drain event.

Like the previous model, Mestre would gain control of Marco Polo Airport and the Port of Marghera. Their economy would have the potential to grow, whereas Venice's economy would not have as much room to flourish. It lacks space to contain high-employment industrial areas and therefore is mainly focused on service jobs within its existing tourist infrastructure.

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Because the boundaries in this model are only marginally different from the boundaries of Venice before the annexation of Lido, the implications for the boundary would not vary of the last border discussed. Venezia would become slightly more sustainable, as it would acquire control of some of the farming land on Lido; however, it would still need to import a lot of food. Like the last model, the lagoon would be a contentious area due to its economic impact on the two cities. This model would take steps to address the current ideological split between the mainland and islands, as Venezia would now gain control of other islands in the Adriatic. However, due to Mestre's claims to places like Murano, Burano, and Sant'Erasmo, among other islands, there would be some disputes as to how Mestre should govern itself - the islands are still going to have different priorities than the mainland even if they are under the same governing body. Though a slightly more even split of Venice when compared to our last model, this model still does not fully reflect the discrepant economic and cultural views of the city of Venice.

34 years after the previous annexation to Venice, the small town of Marghera was added to Venice's borders. In the last 100 years, however, Marghera has boomed into an industrial hub with a high population. If the borders from 1917 were used in a separation today, it would look like the figure below (Fig. 52).

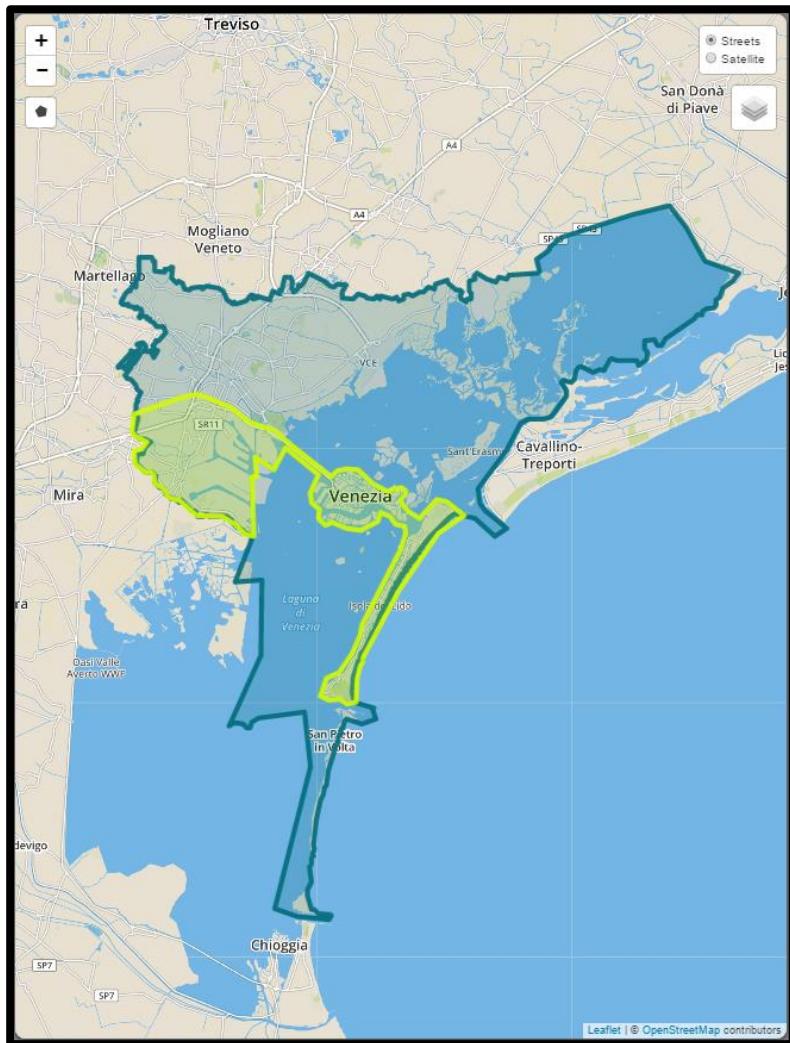


Fig. 52 shows a separation of Venice into two cities according the boundaries of Venice in 1917; Venezia in yellow, Mestre in blue.

A separation of Venice along these boundaries would produce two cities. The economic and demographic information about these cities is displayed below in Table 8.

	Venezia (Yellow)	Mestre (Blue)
Total Population	108,294	153,039
Citizens Eligible to Work	46,678	66,844
Population with a College Degree	18,017	19,273
Number of Companies	7,614	5,666
Number of Jobs	40,293	19,317

Table 8 shows raw economic and demographic information pertaining to a split of Venice along the border of Venice in 1917.

The data stemming from these borders appear to create two moderately balanced cities. Both cities have approximately the same percentage of people in the workforce (43.1% in Venezia, 43.6% in Mestre). This is important because both cities want enough people to be economically stable. Venezia would have approximately 38.5% of their citizens college educated, compared to 28.8% in Mestre. This discrepancy is a small gap than the models above, where the discrepancy is over 20%. The smaller difference in college education levels along with Venezia's gaining of the Port of Marghera, a center for jobs requiring a higher education, decrease the possibility of a brain drain for Venezia.

Drawing the borders of Venice like they were drawn in 1917 also promotes a stable economy for both Venezia and Mestre. Modern-day *Estuario* is very dependent on tourism, but this model would give Venezia the Port of Marghera. This port would increase their dependency on shipping and manufacturing, therefore diversifying its economic portfolio. Venezia's claim to

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modern-day Marghera would help to diversify their economy, because Marghera is home to a large amount of industrial plants. Additionally, the escalation of income that the Port of Marghera provides allows the historic center the fiscal means to restore its infrastructure and meet its unique needs.

Though Venezia would gain control of the Port of Marghera, Mestre could still flourish economically. It would retain control of Marco Polo Airport and other industrial plants in the area. Its thriving economic centers of Mestre center and Favaro Veneto would also remain in Mestre. Because of the multidimensionality of the two cities' economies, it is definitely feasible that the cities created by the boundary in 1917 would create two successful and stable cities.

Unlike the borders of Venice before and during 1883, the separation along this border would create two somewhat sustainable cities. Both cities would have some claims to the lagoon, but Venezia would gain even more land that is used for farming. This would lessen its dependence on Mestre or other nearby cities and towns for other foods. Mestre, though losing the current day *municipalità* of Marghera, would still be a relatively sustainable city as well. What this model does not address is the cultural divide between the regions of Venice. Both Venezia and Mestre would have claims to some of the mainland and some of the islands. This may cause some initial frustration and friction. However, the economic impact this model would have may negate the effects of some ideological discrepancy within the new cities.

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After the relatively insignificant annexation of sparsely populated Pellestrina in 1923, Venice annexed the islands of Murano and Burano in 1924, along with the region of Ca’ Savio. An image of those boundaries is shown below in Fig. 53.

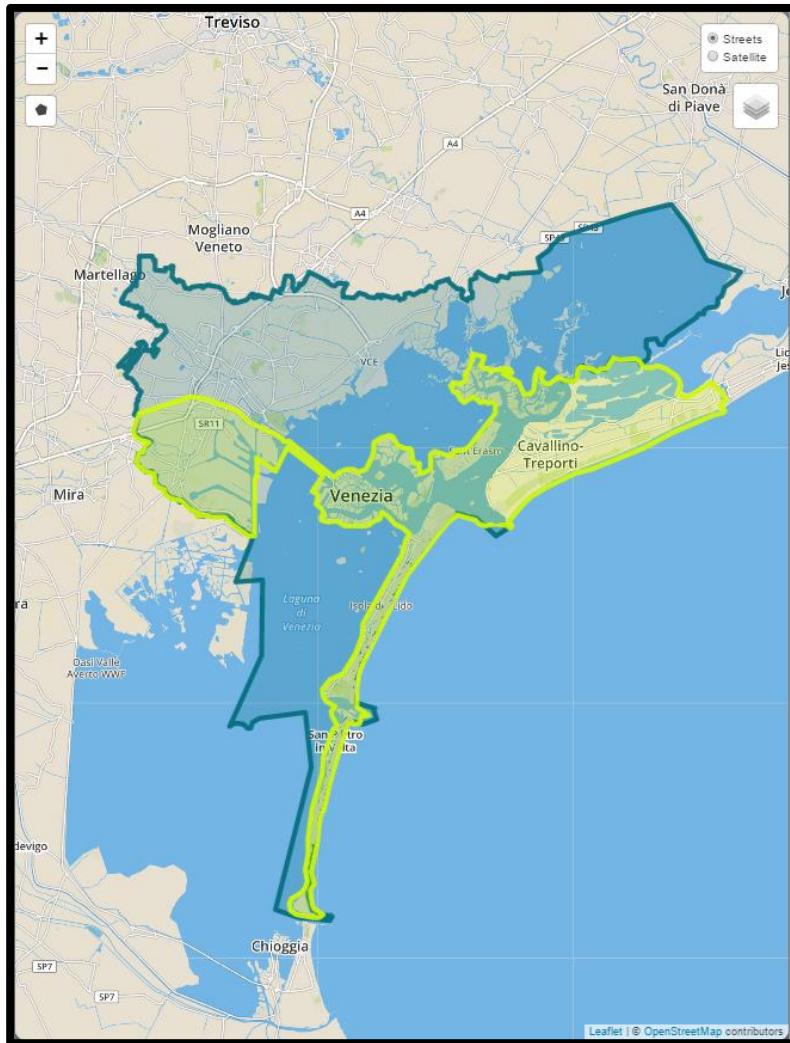


Fig. 53 shows a separation of Venice into two cities according the boundaries of Venice in 1924; Venezia in yellow, Mestre in blue.

A separation of Venice along these boundaries would produce two cities. The economic and demographic information about these cities is displayed below in Table 9.

	City 1 (Yellow)	City 2 (Blue)
Total Population	128,966	132,367
Citizens Eligible to Work	55,387	58,135
Population with a College Degree	18,652	18,638
Number of Companies	8,440	4,840
Number of Jobs	42,559	17,051

Table 9 shows raw economic and demographic information pertaining to a split of Venice along the border of Venice in 1924.

Since the annexation in 1917, Venezia gained the islands of Murano, Burano, Torcello, Pellestrina, and the territory of Cavallino by 1924. This contributed to its population but was not as economically significant as the 1917 addition of Marghera. Between the two new cities, the distribution of population and workforce are fairly even. The amount of people in Venezia and Mestre only differs by about 3,000 people and about 33.6% of the two cities' populations have a college degree. The similarity in college education and the retention of mainland economic hotspots reduced the chance of a brain drain in either city. The number of people available in the workforce in each city only differs by about 3,000 as well. However, the number of jobs in Mestre is only 40% of the amount in Venezia and the number of companies only 57% of the amount in Venezia.

A reason for this difference is that Venezia contains the high-employing industrial area of Marghera but not the Marco Polo Airport. The discrepancy in jobs is not as concerning for Mestre, however, because it would be easy for citizens of Mestre to travel for work. People from Mestre and Favaro Veneto could still travel to Marghera to work. However, the historical center would

still receive income from Marghera to support its restorative and infrastructural needs. Overall the population balance would allow the two new cities to have a backbone of support in the workforce, despite disparities in economy and jobs, and could cause both cities to flourish economically.

Similar to the last model discussed, this model would create two relatively sustainable cities. There would be less contention over the fiscally important lagoon and both cities would have land to grow food, so both cities would be somewhat self-sustainable. This model also addresses a lot of the cultural differences between the mainland and islands of Venice. All of the islands would be part of Venezia, though there may be some initial tension between the mainland and islands of that city. Mestre, on the other hand, would not have to deal with ideological heterogeneity, as all of its land would be mainland Italy. However, there would be one thing that increases the dispute related to this border. Venezia's annexation of Cavallino-Treporti would cause some friction. Cavallino-Treporti seceded from Venice in 1999, so a re-annexation of this area 17 years after it seceded could cause a lot of debate within Venezia. Though it may be a successful division economically, it may not be a feasible way to separate Venice.

4.6.3 - Separation along Borders from 1990 Case Study

The case study *Three Models for the future of Venice* gave rough outlines on how Venice could be separated. Concrete borders were formulated for each model in Section 5.3 and in this section, census and labor data from the tool was used to analyze each border's implications for the two new cities formed. Because in the case of the Greater Venice model, Mestre is included in the city with the *Centro Storico*, it does not make sense that the second city (the one not including the *Centro Storico*) would be called Mestre. Therefore, keeping names consistent with all models, the

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city containing the *Centro Storico* will be named after the model and the second city will be named the “Venice Remainder.”

The following results and analysis are based on Model 1: Greater Venice.

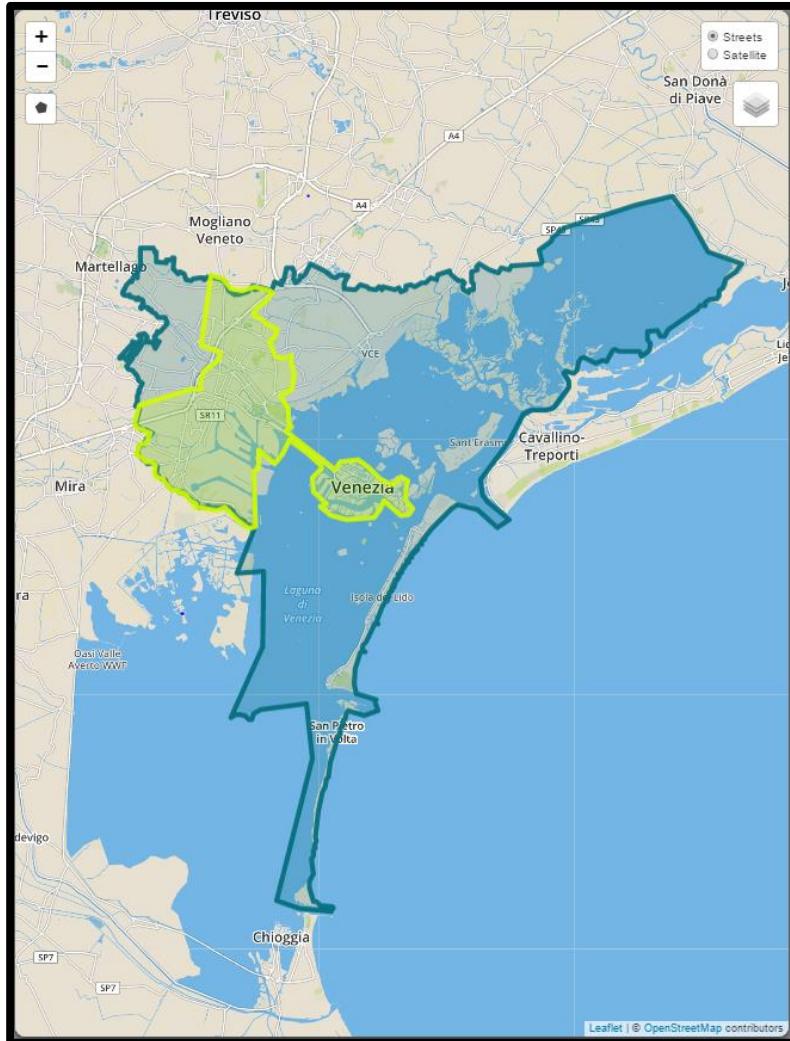


Fig. 54 shows a separation of Venice into two cities according to the case study model Greater Venice ; Greater Venice in yellow, Venice Remainder in blue

A separation of Venice along these boundaries would produce two cities. The economic and demographic information about these cities is displayed below in Table 10.

	Greater Venice (Yellow)	Remainder (Blue)
Total Population	173,033	88,300
Citizens Eligible to Work	75,556	37,966
Population with a College Degree	28,823	8,467
Number of Companies	10,087	3,193
Number of Jobs	48,051	11,559

Table 10 shows raw economic and demographic information pertaining to a split of Venice along the border in the Greater Venice model delineation from Section 4.3.1.

Because in the case of the Greater Venice model, Mestre is included in the city with the *Centro Storico*, it does not make sense that the second city (the one not including the *Centro Storico*) would be called Mestre. Therefore, keeping names consistent with all models, the city containing the *Centro Storico* will be named after the model and the second city will be named the “Venice Remainder.”

The model of Greater Venice places the *Centro Storico* or historic center as the central governing body supported by the economic and population centers on the mainland of Mestre and Marghera. The population result of this boundary model is that the “Venice Remainder” city which had only 51% of the people that “Greater Venice” has. The “Venice Remainder” city has a drastically lower employment opportunities with only 24% of the jobs and 31% of the companies that “Greater Venice” contains. In addition to having a large economic disadvantage, the “Venice Remainder” has less than 1% of their population with a college degree versus 16% with a degree

in “Greater Venice.” The “Venice Remainder” would be left with not only a significantly smaller workforce, but the low amount of college-educated citizens may incite a brain drain exodus in which those citizens move to Mestre-Marghera for employment better suited for them.

In this model, the *Centro Storico* would definitely have the economic and population resources it needs to be flourishing city and address its infrastructural issues. However, losing two *municipalità*, Mestre-Carpenedo or its primary population source and Marghera its primary income source, the remaining regions may not have the strength in people or jobs it needs to be a functioning, independent city. Finally, the boundary does not match the main cultural divide in Venice would still cause a contention between the older generations of the *Centro Storico* who prioritize restoration and measures to protect the historical center, while those of Mestre Marghera would rather allocate funds towards economic expansion.

The figure below (Fig. 55) shows how Venice would be divided along the border we delineated according to Model 2 (Insular Venice) of the case study.

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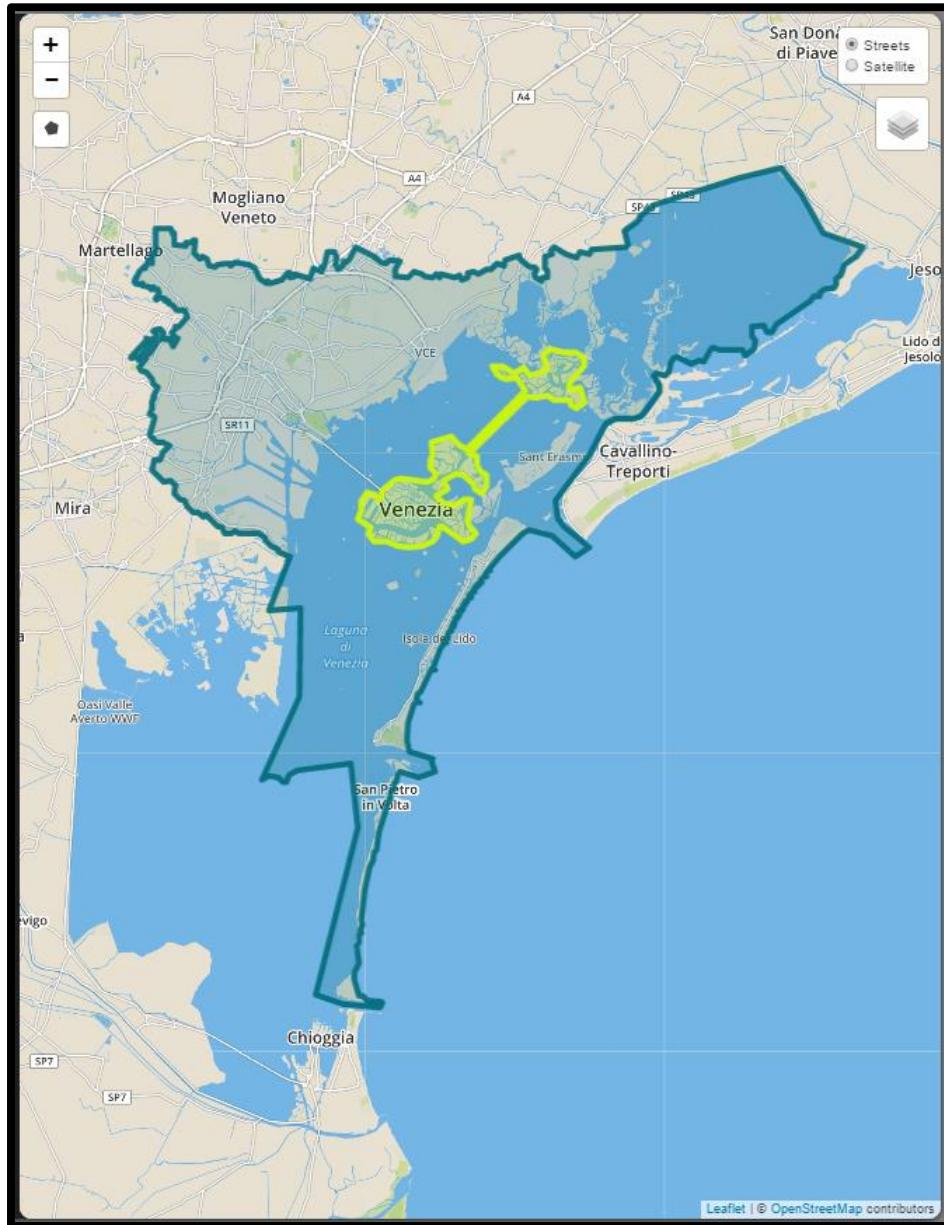


Fig. 55 shows a separation of Venice into two cities according to Model 2: Insular Venice.;
Insular Venice in Yellow, Venice Remainder in Blue.

A separation of Venice along these boundaries would produce two cities. The economic and demographic information about these cities is displayed below in Table 11.

	Insular Venice (Yellow)	Remainder (Blue)
Total Population	64,398	196,395
Population with a College Degree	12,996	24,294
Citizens Eligible to Work	27,359	86,163
Number of Companies	5,030	8,250
Number of Jobs	21,421	38,139

Table 11 shows raw economic and demographic information pertaining to a split of Venice along the border in the Insular Venice model delineation from Section 4.3.2.

The object of the Insular Venice model is that the *Centro Storico* or historic center could stand alone with a different role as a world city for international meetings and conferences without the economic support from the mainland. Therefore, the new “Insular Venice” city, containing just the *Centro Storico*, Murano, and Burano, resulting in about 61% of companies and about 56% of jobs that the “Venice Remainder” city is to be expected. Additionally, the population in the “Insular Venice” city would be about a third of the population of Mestre. About 48% of the working population of the “Insular Venice” city has a college level education, compared to about 28% of the population of the “Venice Remainder” city has a college level education. The “Insular Venice” city has the advantage of a generally more educated population, though as explained above in many models, this can exacerbate a brain drain event with a one-dimensional economy.

Insular Venice only has about 32% of the working work force as “Venice Remainder”. It also has significantly less employment opportunities through a lesser job and company count, due primarily to the economic hubs of the Port of Marghera and the Marco Polo Airport being on the “Venice Remainder” side. However, since in this model it is a city like Geneva for international

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conferences, it would hold more significance and income inflow outside of its tourism focus. If Insular Venice had an international politics focus, then there is a chance it could do well economically, but its lack of economic hubs could cause instability in their income.

In using the border as a baseline split with no consideration of Venice as an international city, the “Insular Venice” city may not have the economic diversity and workforce needed to be a stable, sustainable city, large reasons for a separation in the first place. The “Venice Remainder” could allocate all of its income towards the expansion and support of its industry to the detriment of the tourist industry in “Insular Venice.”

The last model from the case study talked about a clean split of *Terraferma* from *Estuario*. The borders for this model are shown in Fig. 56 below. For the purpose of this model, the two cities will be called *Terraferma* and *Estuario* instead of the precedent set above.

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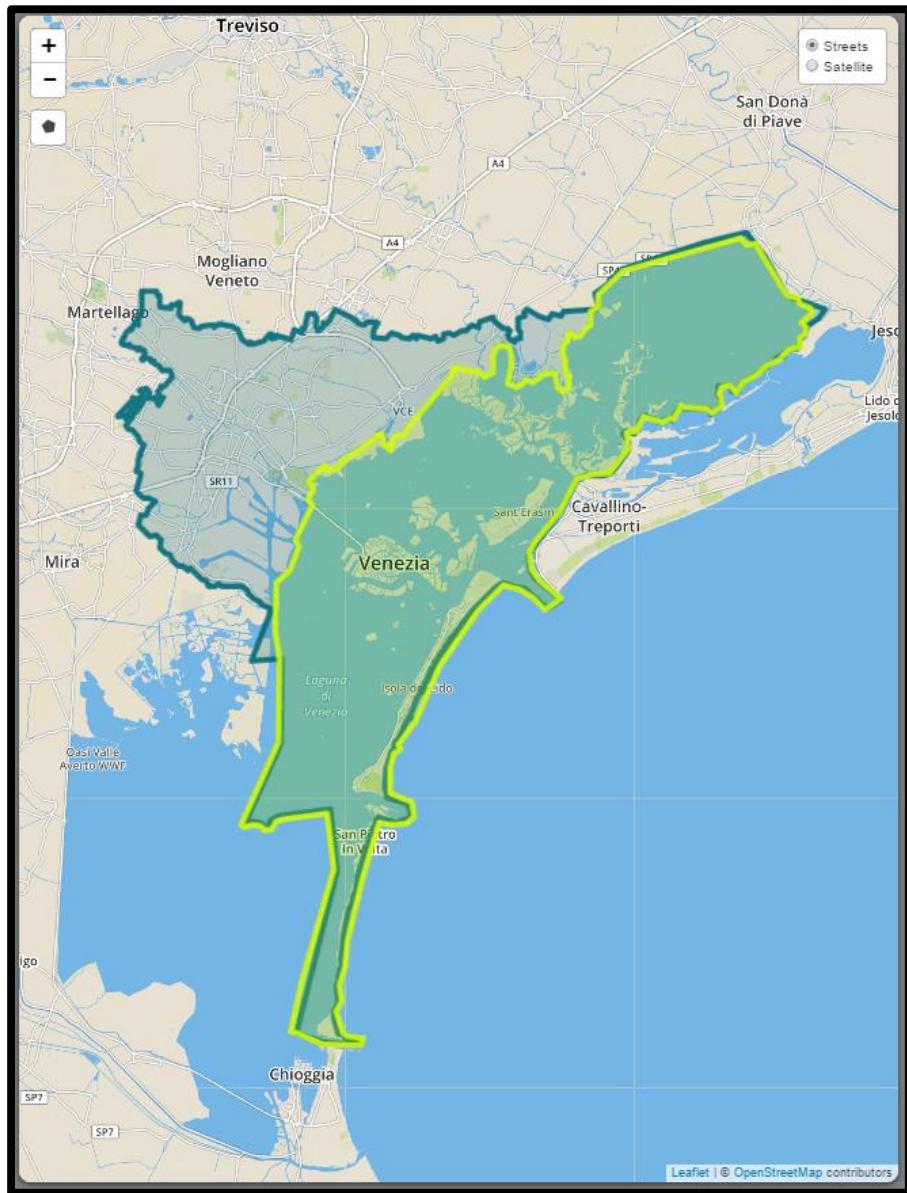


Fig. 56 shows a separation of Venice into two cities according to the case study model Two Separate Towns ; *Estuario* in yellow, *Terraferma* in blue.

A separation of Venice along these boundaries would produce two cities. The economic and demographic information about these cities is displayed below in Table 12.

	<i>Estuario</i> (Yellow)	<i>Terraferma</i> (Blue)
Total Population	86,608	174,725
Citizens Eligible to Work	36,313	77,209
Population with a College Degree	15,811	21,479
Number of Companies	5,870	7,410
Number of Jobs	25,301	34,309

Table 12 shows raw economic and demographic information pertaining to a split of Venice along the border in the Two Separate Towns model delineation from Section 5.3.3.

The separation along the coastline of the lagoon would create two cities, one (*Terraferma*) twice as large geographically and in population as the other (*Estuario*). This model has some similarities to Model 2: Insular Venice, as the only big additions are the relatively low-populated regions of Lido and Pellestrina and the lagoon itself would definitively belong to *Estuario*. *Estuario*, at 44%, has a much higher percentage of college educated citizens than *Terraferma*, at 27%. A movement from *Estuario* to *Terraferma* of college-educated people would likely escalate. It also has a lower, more optimal ratio of workforce population to jobs. *Terraferma*, though lacking in education and job count is only about 9,000 jobs larger than the *Estuario*, has an economy that has potential to grow whereas *Estuario* would still be based heavily in tourism.

This model is the closest to the underlying idea that the original separation movements were based on and the border that most closely divides regions that are ideologically, economically, and politically different. Although it is the most likely border to be used in a divide, it may leave the *Estuario* at a great economic disadvantage. To add to disparities in employment opportunities before mentioned, one drawback economically of this divide is that *Terraferma*

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would retain control of both the Port of Marghera and Marco Polo Airport. As a result, one of the points of contention and reasons for a separation, that these economic centers originally were part of the lagoon or *Estuario*, would not be addressed. Disregarding the economic and demographic data, this split would divide Venice into its two culturally polarized regions. *Terraferma* would truly be the young, modern, blue-collar city where as *Estuario* would be the historic, culturally significant region with an economy based on tourism.

5.0 - Conclusions/Recommendations

The Boundaries of Venice team has conclusions and recommendations about both the markers and the mapping tool for future students or groups. There are multiple projects that could further our research on a Venetian separation and the restoration of the 100 boundary markers spread throughout the mainland and islands of Venice.

5.1 - Marker Conclusions/Recommendations

After visiting markers spread throughout the borders of the lagoon, The Boundaries of Venice team has recommendations for any future groups who take on project about the markers.

5.1.1 - Marker Restoration Projects

As shown by the data displayed in Section 5.1, there are markers that are in dire need of restoration. These markers are a part of Venetian history and culture and should be preserved as artifacts and as public art. Marker 73, shown in the picture below, is by far the marker with the worst overall condition and the highest restoration potential.



Fig. 57 shows Marker 73, the marker with the worst condition and highest restoration potential.

This marker is also close to an area on the mainland of Venice (the Fort of Marghera) that could be appealing to tourists, so if any marker is to be restored, it should absolutely be Marker 73. Aside from Marker 73, Markers 52 (in the city of Jesolo) and 93 (on a popular walking path near the town of Giare) show high levels of restoration potential and should be restored. These marker are shown in Fig. 58 below.



Fig. 58 shows Marker 52 (left) in Jesolo and Marker 93 (right) in Giare, both in need of restoration.

If a project to restore these markers were to focus on one area in particular, we recommend they focus on the small peninsula near Giare (Markers 92 through 100). As mentioned above, this area is a popular destination among locals to walk; it is a picturesque peninsula along the lagoon. Out of the day trips we took, this area had the markers with the highest restoration potential (2.62) and worst average marker condition (2.98). The restoration of markers in this area is not only needed, but would enhance the cultural and historical significance of the area.

Besides just specific markers in need of restoration or certain important areas, all reachable markers could be restored with a focus on the poor conditions that are most easily resolved. In creating our weighting of conditions for marker restoration, growth around the marker and growth

on the marker had the highest potential for restoration. In an effort to restore a wide range of markers, just targeting these conditions would be less time consuming and would make these markers more visible and clearer in appearance.

Lastly, in order to educate Venetian citizens on the markers, a piece relevant to Venetian history and culture, The Boundaries of Venice team recommends the placement of signs near closely grouped markers, like those on the small peninsula near Giare. This area had a sign (shown below in Fig. 59) with some information about the markers and their significance to Venice. These signs would be relatively inexpensive to erect near groups of markers or near markers which will get a lot of tourist traffic. We would recommend further research into the feasibility of placing more signs like this around the lagoon.



Fig. 59 displays a sign near Giare with information about the markers denoting the boundary of the Venetian Republic in 1791.

5.1.2 - Future Marker Visit Recommendations

The Boundaries of Venice team was unsuccessful in finding all the markers because many markers were inaccessible due to their location on private property, surrounded by brush or overgrowth, or on the other side of canal or larger body of water. We would recommend further projects to visit the harder to reach markers. These projects would have to do extensive research before visiting the markers to see what would be necessary to access the markers. This may include researching the rental of cars or boats to reach markers either too far out from bus routes to be feasibly visited or on inaccessible sides of canals by foot. They may also have to visit areas of markers to scope out the area in order to see what obstacles may be in their way that are not

available from a satellite view. This includes things like private property lines, which would require students to personally ask property owners for access to their land, or fenced in businesses, which would require students to find a contact from the business to be allowed access to the fenced in area.

We would also recommend the use of a drone for some markers. There were some markers like those on the northern half of Pellestrina that we were not able to see because of the terrain; there was a thick patch of trees between us and the supposed marker location, so we were unable to access it. The use of a drone could allow future project groups to confirm or deny the existence of markers that we were not able to visit due to terrain. The use of a drone could also allow students to get pictures of the markers if they find them. Facilitating future projects to visit the hard to reach markers will help in the preservation of Venetian historic and cultural artifacts.

5.2 - Border Conclusions/Recommendations

After analyzing historical and proposed borders of Venice using our tool, The Boundaries of Venice team has conclusions and recommendations pertaining to a split of Venice and to projects that will help to further our research.

5.2.1 - Recommendations of Possible Border to Split Venice

After using GIS to outline various borders used by Venice and models of how Venice could separate, we analyzed the data on the two cities that would be created if these borders were used in a separation using the tool we created. Stemming solely from the data displayed on the tool and the research we did previously on the location of significant economic hubs (Marco Polo Airport,

the Port of Marghera, Venezia Mestre Train Station), there are certain boundaries that would make the most sense if Venice were to split based on a historical boundary.

Using the boundary of Venice in 1917 makes the most sense economically of the historic boundaries we researched. The 1917 boundary encompasses the historical island of Venice along with Lido and the *municipalità* of Marghera. This divide would create two cities with approximately equal percentages of population in the workforce. There would be a small but insignificant discrepancy (10%) between the percentages of the population with a college education, unlike other borders, where the differences is up to 25%. This low percent decreases the possibility of a brain drain where those living in Venezia would move to Mestre to find jobs and career opportunities.

The other reason why the 1917 boundary makes the most sense is that it creates two relatively balanced economies. Currently, the islands of Venice are very dependent on tourism and the mainland of Venice is much more focused on industry. The one-dimensional economy of *Estuario* may function now, but an economy based so heavily in one field is unstable; if the tourism market crashes, so would the economy of the islands of Venice. A similar thing can be said about *Terraferma* and their dependence on industry. However, the 1917 boundary gives some industrial land to Venezia, which helps to diversify their economy. Their annexation of the Port of Marghera increases their job capacity and income based on shipping, shipbuilding, and manufacturing. There are also other industrial plants spread throughout Marghera, so there would be more places where Venezia could have a varied, and therefore stable, economy. Mestre would clearly benefit from the industrial infrastructure that already exists in the region along with the claim to Marco Polo Airport. Hotels are also bound to continue popping up on the mainland, so the region's dependency

on tourism will continue to rise, thus diversifying their economy. Though there would be some initial differences within the cities due to their cultural and ideological discrepancies, we believe these would be outweighed by the economic benefits both cities would experience. Based on the similar demographics and stable economies of the two potential cities, The Boundaries of Venice team would recommend the use of the 1917 border if Venice were to split directly on a border used in Venetian history.

Despite our recommendation in the past two paragraphs to use the 1917 border of Venice as outlined in Section 4.5.3, it is probably not the perfect border to use in a separation. We would recommend the use of our tool to draw the “perfect” border through Venice. The 1917 border could be used as a baseline, but there are probably some places where the border should diverge from the exact border of Venezia and Mestre as outlined in the 1917 border. Use of the tool will allow Venetian citizens and lawmakers to fine tune the border to make the two most efficient and stable cities possible if Venice were to split into two independent cities.

5.2.2 - Mapping Tool Improvement Recommendations

Though the data our tool presents stands on its own as a very helpful tool for anyone looking to become more educated on a division of Venice, there are still some pieces of information that would be helpful to know. More specific economic information from the Chamber of Commerce or Internal Revenue Services could display economic information about the cities created by a border through Venice. This could be helpful as it would supply more information about a split. It would also be advantageous to show political party information and voting history in the tool. Getting this information would help people draw cities based not just on their

geographic and economic interests, but on their political interests as well. We recommend the researching of more economic and political information to input into our tool in order to make the tool as informative and assistive as possible.

Aside from inputting more data into the tool, there are some slight modifications that would be made to the tool to make it even easier to use. The borders we have put into the tool are outlined in GIS, so they cannot be altered in any way. We recommend adding a capability to our tool that allows for the modifications of the borders already loaded into the tool. This would allow users to make slight changes to pre-existing borders rather than making them draw a whole new border to reflect that slight change.

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7.0 - Appendices

Appendix A - Examples of Pictures to be Taken at Each Marker



Approach Picture – Taken at the first sight of the marker



Picture of Front Face



Picture of Face #2



Picture of Face #3



| Picture of Face #4



Picture of Marker Inscription

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2 Panoramic Pictures of the Surrounding Area to get a 360° View

Appendix B - Scales Used in Assigning Values for Each Marker's Face

For Biological Growth around Marker:



- | | | | | |
|-----------------------------|---|---|--|----------------------------------|
| 1 – No growth, visible base | 2 – Growth covers the bottom, base edge not visible | 3 – Growth covers about half of marker face | 4 – Growth covers a majority of the marker | 5 – Growth obscures a whole face |
|-----------------------------|---|---|--|----------------------------------|

For Biological Growth on Marker:



- | | | | | |
|--|---|--|---|---|
| 1 – No biological growth on the marker | 2 – Slight but unobtrusive formation of lichen or ivy | 3 – Growth Presence of growth somewhat compromises visibility of original marker | 4 – Most of the face is covered by lichens or ivy | 5 – Face surface is almost entirely covered by growth |
|--|---|--|---|---|

For Environmental Discoloration:



1 –
Completely
clear of
discoloration



2 –
Streakings
of dark or
minority of
marker is
dark

3 – Even
proportion of
light and dark

4 – Majority
of marker is
discolored



5 – Close to
completely
dark

For Surface Cracking:



1 – No visible surface cracks



2 – Low density of cracks across few sections



3 – Noticeable cracking across some sections

4 – Most sections covered by surface cracks

5 – High density of cracks across entire face

For Structural Disintegration:



1 – Very crisp,
defined edges,
no broken
pieces or
structural
cracks

2 – Very
slightly
eroded
edges

3 – Either
eroded edges
or rounded/
chipped
corners

4 – Most
edges
eroded,
structural
cracks
present

5 – Many
broken
pieces or
very worn
corners,
edges highly
eroded

Appendix C - Example Marker Condition and Restoration Potential Calculations

Average Biological Growth around Marker	2.6
Average Biological Growth on Marker	4.2
Average Environmental Discoloration	2.8
Average Structural Disintegration	3
Average Surface Cracking	1.8

Marker Condition: Structural disintegration: 40%, surface cracking: 20%, environmental discoloration: 20%, biological growth on marker: 15%, biological growth around marker: 5%.

$$0.4(3) + 0.2(2.8) + 0.2(1.8) + 0.15(4.2) + 0.05(2.6) = 2.88$$

Restoration Potential: Biological growth around the marker: 30%, biological growth on the marker: 25%, environmental discoloration: 25%, surface cracking: 15%, structural disintegration: 5%

$$0.3(2.6) + 0.25(4.2) + 0.25(2.8) + 0.15(1.8) + 0.05 (3) = 2.95$$

Appendix D: Key Phrases Analyzed for Delineation of Greater Venice Model

1. “The annexation by the municipality of Venice of the neighboring municipalities (fig. 7) in the lagoon of Pellestrina and San Pietro in Volta (south-east), of Murano, Burano and Torcello (north): basis for model”
2. “The bases for an industrial mainland port which was integrated with were integrated with the ancient Venetian commercial port”
3. “Century an artificial rectilinear channel parallel to the railway bridge was dredged in order to make possible the use of part of the foreshore (transfer of coal and petrol)”
4. “Economic development of the mainland can be considered as a natural continuation and enlargement of the port of Venice”

5. “Can ask the central government at Rome to consider the industrial port (In Marghera) as a necessary adjunct to the commercial port (In the historical center)”
6. “That it is the town of the lagoon(historical center) which is the heart and the brain of the new metropolitan area”
7. “Urban area of the lagoon and of the mainland is the periphery not only for historical and administrative reasons but” (because Venice annexed the surrounding areas not the other way around)
8. “Unified, and extended at least to the metropolitan system formed by Mestre, Padua and Treviso, which is one of the major poles of Venetia with around a million inhabitants”
9. “Mestre has no reason to claim more than a vice-mayor, some separate city offices where assessors may come every now and then”

Statements 1-4: Primary supporting statements for the model

Statements 5-6: The role of the historical center

Statements 7-8: Which exact territories would make up periphery and why

Statements 9: Mestre’s role in the new organization

Appendix E: Key Phrases Analyzed in Delineation of Insular Venice Model

1. “Since the development model based on industrialization is incompatible with a conservative policy(Conserving nature and history)”
2. “The separation of Venice from the expanding urbanization of the mainland and the establishment of a network of global relations for the town”

3. “From a financial and managerial point of view Marghera is governed from the outside, it’s great industrial groups being directed from Rome and Milan (not connected to historical center)”
4. “Venice would still suffer from the social lack of a managerial class capable of assuming the responsibilities that the imperatives of restoration and conservation demand”
5. “Proposed making Venice a capital of Europe, a kind of new Geneva, a seat for great organizations and international meetings”

Statement Importance:

Statements 2 and 5: Determining the role of the historical center separate from the mainland

Statements 1,3, and 4: Reasons Venice is an adequate center of management for the mainland

Appendix F: Key Phrases Analyzed in Delineation of Insular Venice Model

1. “The third model, the simple separation of Mestre and Venice, which is related politically to the model for an insular Venice”
2. “This movement pushed the campaign for the separation of Mestre from Venice and promoted the first referendum on this issue in 1979.”
3. 2 ideologies:
4. “Should give Mestre the possibility of acquiring all the features of an independent city”
5. “Mestre must provide the solution for the town in the lagoon as it could shoulder the difficulties that Venice on its own cannot solve.”

Appendix G: List of Venipedia Pages

- ***Estuario*** - <http://www.venipedia.org/wiki/index.php?title=Estuario>
- ***Terraferma*** - <http://www.venipedia.org/wiki/index.php?title=Terraferma>
- **Borders of the Venetian Republic in 1791** -
http://www.venipedia.org/wiki/index.php?title=Borders_of_the_Venetian_Republic_in_1791
- **Boundary Markers** -
http://www.venipedia.org/wiki/index.php?title=Boundary_Markers
- **Boundary Marker** - http://www.venipedia.org/wiki/index.php?title=Boundary_Marker
- **Separation Referendums** -
http://www.venipedia.org/wiki/index.php?title=Separation_Refere
- **1979 Separation Referendum** -
http://www.venipedia.org/wiki/index.php?title=1979_Separation_Refere
- **1989 Separation Referendum** -
http://www.venipedia.org/wiki/index.php?title=1989_Separation_Refere
- **1994 Separation Referendum** -
http://www.venipedia.org/wiki/index.php?title=1994_Separation_Refere
- **2016/2017 Separation Referendum** -
http://www.venipedia.org/wiki/index.php?title=2016/2017_Separation_Refere