The Church Floors in Venice, Italy: An Archeological Study and Analysis

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Abstract

This project, completed at the Venice Project Center, was sponsored by the Archeology Superintendent Luigi Fozzati and focuses on the churches of Venice, specifically on church floors and the artifacts embedded within. The project necessitated formulating an effective and accurate method in data collection and condition assessment, supplementing past databases with the collection of data pertaining to Venetian church floors located in the *Canneregio*, *Dorsoduro* and *San Polo* sestieres, the construction of multiple map layers of church floor plans using the GIS system MapInfo, and the analysis of the information gathered in order to determine which church floors were most valuable historically and artistically, and therefore in most need of restoration.

Authorship

Each member of our project group contributed equally to the writing, revising, and editing of each chapter of this report.

Executive Summary

Historical sites and artifacts are an important window to past cultures and traditions of a society. In many places throughout the world, these sites and artifacts are in danger of being lost forever. Venice, Italy is one such place where many great historical and irreplaceable works of art, architecture, and other such objects are in danger of being damaged or lost. It was not until a great flood in 1966 that the world became aware of the continual damage to Venice that was caused by high water. Following this disaster, many organizations and committees around the world were created to assist in the protection, restoration, and preservation of Venice.[1] With many treasures contained within their walls, the churches are one of the main focuses of these organizations.

Figure 1: Flooding in San Marco in June of 2002.

The churches of Venice hold many great historical works of art and are among the many places that accrue damage throughout Venice. Many different causes have led to the deterioration and damage of these buildings. One of the major causes is high flood waters that are occurring more frequently and at greater heights (Figure 1). UNESCO and students at WPI have conducted many projects in the past for the safeguarding of Venetian churches and the works of art associated with them. These studies include cataloguing the facades and architecture of the churches as well as some interior studies of the altars. Also, WPI students have completed past projects to designate where restoration is needed most to preserve the natural heritage of the churches.

Up to this point, however, little or no analysis has been conducted on floors within the churches, which could contain great historical treasures such as grave stones, tombs or plaques. Objects such as these could contain important text that would be lost

[1] United Nations Educational, Scientific and Cultural Organization website. n.d. <http://www.unesco.org/> (23 March 2002).

should the floor's condition be overlooked. Floors are the part of the church most subject to flooding, which can ultimately deteriorate materials or seriously fade the coloring of artwork. In addition, the numerous tourists that visit the church add to the amount wear the church floor receives. As in the past, churches have laid new floors over the old ones to avoid the rising waters. In this process, great historical works of art or historical treasures are sometimes lost or misplaced.

Figure 2: An artifact found in the Santa Maria di Nazareth

The goal of our project was to obtain information about the current and past church floors and artifacts located within them. We performed an analysis that determined the major risks to these floors such as the *acqua alta* and foot traffic, and proposed ways to deal with these risks. We also gave this information to the Archeology Superintendence through a database and written report.

In order to accomplish our goals, extensive research was conducted on the church floors of Venice. Past Venice projects and databases gave us basic information on each church, such as their names, locations and floor plans. Other historical information was obtained through various texts, books and pamphlets supplied by the church, as well as through forms we created and distributed to priests.

Our data collection encompassed 22 churches located in the *Cannaregio*, *San Polo* and *Dorsoduro* sestieri. The data collected included height above the *Punta di Salute* (the absolute 0 sea level), the condition of the floors through an assessment of different types of damage (Figure 3), the material the floors were made of and how many artifacts were located on the floor. We collected artifact information by photographing each artifact (Figure 2), transcribing any text found on the artifact, measuring the artifact, finding the artifacts


Figure 3: Severe wearing found in the San Marcilliano

coordinates with respect to the church walls, and performing a condition assessment. The materials and size of the artifact were important, but the most important features of these artifacts were the artwork and text on them.

With the information gathered from the churches, various correlations between different types of data were found. We analyzed several different relationships such as the condition of the artifact in relation to its location on the floor with respect to pathways of foot traffic, floor and artifact damage in relation to the church floor height with respect to sea level, and number of artifacts with respect to church floor height. These associations gave us insight on how the artifacts are being damaged, as well as which artifacts and floors are at more risk of complete deterioration and which churches might contain floors than have been overlaid. Based on these findings, recommendations were made as to which churches are in the worst condition, as well as effective methods to protect their floors and any artwork or text located on the floor itself.

Practical methods we found to prevent damage to church floors and artifacts included roping off areas of importance, increasing the price of admission and implementing various guided tours involving the churches of Venice to raise funds for restoration. We also suggested using redesigned pews in order to prevent damage to the floor and artifacts the pews are placed upon (Figure 4).

Figure 4: Raised pews in the *Sant' Alvise*.

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1 Introduction

Historical sites and artifacts are an important window to past cultures and traditions of a society. In many places throughout the world, these sites and artifacts are in danger of being lost forever. Venice, Italy is one such place where many great historical and irreplaceable works of art, architecture, and other such objects are in danger of being damaged or lost. It was not until a great flood in 1966 that the world became aware of the continual damage to Venice that was caused by high water. Following this disaster, many organizations and committees around the world were created to assist in the protection, restoration, and preservation of Venice.[2] With many treasures contained within their walls, the churches are one of the main focuses of these organizations.

The churches of Venice hold many great historical works of art and are among the many places that accrue damage throughout Venice. Many different causes have led to the deterioration and damage of these buildings. One of the major causes is high flood waters that are occurring more frequently and at greater heights. UNESCO and students at WPI have conducted many projects in the past for the safeguarding of Venetian churches and the works of art associated with them. These studies include cataloguing the facades and architecture of the churches as well as some interior studies of the altars. Also, WPI students have completed past projects to designate where restoration is needed most to preserve the natural heritage of the churches.

Up to this point, however, little or no analysis has been conducted on floors within the churches, which could contain great historical treasures such as grave stones, tombs or plaques. Objects such as these could contain important text that would be lost should the floor's condition be overlooked. Floors are the part of the church most subject to flooding, which can ultimately deteriorate materials or seriously fade the coloring of artwork. In addition, the numerous tourists that visit the church add to the amount wear the church floor receives. As in the past, churches have laid new floors over the old ones

[2] United Nations Educational, Scientific and Cultural Organization website. n.d. <http://www.unesco.org/> (23 March 2002).

to avoid the rising waters. In this process, great historical works of art or historical treasures are sometimes lost or misplaced.

This project is expected to support the Archeology Superintendence in obtaining pertinent information on church floors. Many ground surfaces in Venice have been excavated or altered in some way whereas church floors have been little tampered with over the years. Churches contain large surfaces that were protected from high tides by simply overlaying new floors; therefore this makes them a source of valuable stratographic information. With this information, a better understanding of the history and changes of the city can be gained.

Chapter 2 discusses the background information that we gathered which includes many topics relevant to this project. This includes the history of architecture and religion in Venice, the construction of floors on such an unstable land, floor materials which were used and why, and finally, the organizations who are assisting us in completing this project.

Chapter 3 illustrates the methodology we will utilize to assist the Archeology Superintendent and UNESCO in preserving the churches of Venice. This chapter also describes our objectives, some important definitions, and the area in which we will be studying.

Chapter 4 explains the results of our project.

Chapter 5 contains our analysis.

Chapter 6 includes our recommendations and conclusion.

Chapter 7 is our bibliography.

Appendix A contains our annotated bibliography.

Appendix B contains our sponsor information.

Appendix C includes other organizations related to our project.

Appendix D describes our database structure.

Appendix E contains the forms we used in our field research.

2 Background and Literature Review

This project supported the Archeology Superintendence in obtaining pertinent information on church floors. Church floors are of particular interest to the Archeology Superintendence for the reason that many ground surfaces in Venice have been excavated or altered in some way whereas church floors have been little tampered with over the years. Church floors are large surfaces that were protected from high tides by simply overlaying new floors; therefore this makes them a source of valuable stratographic information. With this information, a better understanding of the history and changes of the city can be gained. The project team conducted in depth research, recording both changing and unchanging characteristics of the floors. We entered this data into a database created by us for the Archeology Superintendence and also used the database for our own evaluations. Through our research and analysis, we determined what threats exist to the current floors and the artwork embedded within them.

The marine environment that surrounds Venice is responsible for the majority of the damage inflicted on the buildings of the city. Water is capable of eroding building materials over time, and Venice is showing evidence of this decay. The high levels of humidity over time can cause decay in organic materials such as wood or cloth, and mildew and mold to stone and brick. UNESCO states that "brickwork should never be in contact with sea water since it penetrates its pores, and once the water evaporates, the salt left in the walls crystallizes."[3] Once these salt crystals are in the brickwork, the brick becomes brittle and starts to crack.

Water erosion is a force that cannot be stopped, only slowed down. High tides in Venice, also known as *acqua alta*, often flood the city, which makes everyday activities difficult and contributes to the long-term damage of building foundations. In some cases, floors have been built over existing floors in order to get above the flood level.

The need for preservation is very high for historically rich cities such as Venice. There are buildings in Venice that have survived for centuries, and many of them are still in original form. Venice is a city built unlike any other and the majority of the buildings, such as the churches, hold many architectural wonders. The foundations of these

[3] UNESCO *Venice, Safeguarding Campaign: Venice and its Lagoon.* 14 June 2001, (5 April 2002). <http://www.unesco.org/culture/heritage/tangible/venice/html_eng/lagunecon.shtml>.

buildings are slowly decaying and need a significant amount of work to ensure that they will not degrade beyond repair.

2.1 Archeological Heritage[4]

According to the American Heritage Dictionary, archeology is "the systematic study of past human life and culture by the recovery and examination of remaining material evidence, such as graves, buildings, tools, and pottery."[5] It is a main door towards the exploration and preservation of history, culture and tradition throughout a society. This door to the past has given present and future generations the opportunity to enjoy the cultural heritage of past civilizations.

Usually artifacts or sites of interest to archeologists are composed of materials that do not deteriorate over many years, such as stone, bones, and baked clay. Sometimes other substances are found, such as metals, that were either sealed off tightly from outside conditions or have not yet fully oxidized or been destroyed through time. Archeologists study these artifacts and sites to produce an analysis of the past. Since conclusions can only be made from what limited resources are found, even one missing artifact can lead archeologists to possibly interpret the evidence incorrectly. Archeologists have made later discoveries that are known to change past conclusions by bringing forth new information.

The study of archeology is very broad and can be further divided into a number of different fields. Although we will not be excavating, there are two fields of study that have some interest and possible usefulness in our project. These fields of study are salvage archeology and restoration archeology.

Salvage archeology deals with the preservation of sites from destruction or from loss due to other circumstances. In our case this might consist of churches adding new floors on top of old and possibly covering something that the church might not know to be an archeological treasure. A project that has been done in the recent past to a few churches was to replace the floor and place cement "liners" to preserve what was under

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[4] McGowan, Nicola, Reinaldo Niella, Pierre Schrappe, and Jennifer Smith. Lagoon Archeology. An Interactive Qualifying Project for Worcester Polytechnic Institute, 1990 p. 20-37, 63-68.

[5] The American Heritage dictionary of the English language, fourth edition Houghton Mifflin 2000 <http://www.dictionary.com/search?q=archeology> (4 April 2002).

the previous floor and to protect the current floor. Our project will identify those churches that have not yet undergone this process. As the liners are constructed, archeologists will have a chance to observe and study what is under the existing floor and preserve what they find.

Through restoration archeology, archeologists attempt to restore artifacts or sites to their original appearance. Some archeologists hope that this will present to the public the great qualities that these sites or artifacts once held. However, other archeologists are afraid that these restorations might actually destroy some of the information that could be obtained from examining the ruins or fallen stones from these sites or objects. Some of the artifacts we help uncover could be in need of restoration. It would then be important to think about if any important information might be lost by the restoration of these artifacts.

2.1.1 Archeological Regulations in Italy [6]

The laws in Italy regarding archeological and historical artifacts are in many ways similar to those in the United States. An Italian law[7] contains 73 articles that were formed with the intention of guarding or protecting any material, moveable or immovable, which is greater than fifty years old and has any artistic or historic value. Through this project we are helping to identify such objects so the Ministry of Culture has the knowledge that the objects exist and can protect the objects.

The Ministry of Culture acts as the main defender of this law. Materials under this law can not be demolished, removed, modified, or restored without the permission of the Ministry of Culture. The superintendent of each region is authorized to make inspections to reveal the existence and/or the condition of any items that are subject to this law.

Before an archeological study can be conducted, authorization must be obtained from the Ministry of Culture. If any individual or group of individuals happens to discover any material subject to this law, they are required to notify the local

[6] McGowan, Nicola, Reinaldo Niella, Pierre Schrappe, and Jennifer Smith. Lagoon Archeology. An Interactive Qualifying Project for Worcester Polytechnic Institute, 1990 p. 158-160

[7] Law # 1.6.1939 n.1089

superintendence of their findings. All findings are thereafter considered State property, and possibly a prize is rewarded to those who discovered it.

The Ministry of Culture also has the power to verify that the material under this law is being properly conserved and not in danger of being lost. The Superintendent can enforce any provisions of the law necessary to accomplish this at the owner's expense. If the owner cannot afford to pay for such provisions to keep the objects safe, the State can purchase part of or the complete material. Those who violate the law must pay any damages incurred to materials subject to this law. This individual or individuals are then subject to laws under the Italian Penal Code.

2.1.2 Archeology Superintendence

Any study or work that relates to the art or architecture in Italy falls under the jurisdiction of the Ministry for Culture Activities and Treasures. In 1998, there was a major reform in the Ministry of Culture, resulting in expansion of its authority. Prior to the change, the Ministry was composed of 3 different departments: the archives, the national libraries, and the superintendence. With the reform, there are now eight different departments. The departments are now *Archivi* (archives), *Lo Sport* (Sport organizations), *Biblioteche e Istituzioni Culturali* (libraries and cultural institutions), *Beni Paesaggistici e Architettonici* (architectural and landscape treasures), *Spettacoli dal Vivo e Cinema* (live theaters and movies), *Arte e Architettura Contemporanee* (contemporary art and architecture), *Beni Storico - Artistici* (historical and artistic conservation and protection), and the *Archeologia* (archaeology). The area in which we are studying falls under the jurisdiction of the department of *Archeologia*.[8]

The department of *Archeologia* is separated into two different administrations, the Central Administration and the Peripheral Administration. Within the Central Administration, there is *la Direzione Generale*, or the General Directorate, and in the Peripheral Administration there is le *Soprintendenze*, or the Superintendence.

The General Directorate deals with the financial and professional aspects of the Archeology department. The General Directorate has four *Servizi* (services) of

[8] Supervisory Offices for Architectural and Landscape Treasures
<http://www.ambiente.beniculturali.it/eng/index_eng.html>. (19 April 2002).

management which are "*SERVIZIO I - Affari generali, personale e bilancio* [general transactions, staff and budget*] SERVIZIO II - Documentazione dei Beni* [documentation of the assets] *SERVIZIO III -Tutela e Conservazione dei beni* [protection and conservation of assets] *SERVIZIO IV - Musei e parchi archeologici* [archaeological museums and parks]." [9] Before the reformation of the Ministry of Culture, the Superintendence was in charge of all four services, causing operations to be much unorganized. Due to the conflicting jurisdictions of the old Superintendence, there were arguments between who had control over different works of art.[10] This reformation was made in order to resolves these conflicts.

The Superintendence relies on the services that the General Directorate provides. The services help organize what the Superintendence does. The Superintendence has different offices for each of the regions in Italy. These offices contain three departments which define their jobs and jurisdictions. The first and major department is Le *Soprintendenze per i Beni Archeologici* (Superintendence of Archaeological assets), which deals with the preservation and control of archaeological aspects of Italy. Before the change in 1998, two Superintendents controlled this job and the only difference was the time period that defined their jurisdiction. Before the reform, there were disputes over which Superintendence had jurisdiction of a project because the site contained objects of two different time periods. The regions in Italy separate this Superintendence and there are Superintendents in charge of each region. The other two Superintendence *Le Soprintendenze Miste* (Mixed Superintendence) and *Le Soprintendenze Speciali* (the Special Superintendence) are much smaller parts of the Superintendence and control museums, landscapes and other miscellaneous aspects that are not covered by *Le Soprintendenze per i Beni Archeologici*.[11]

[9] MBAC – Ministero per i Beni e le Attività Culturali. <http://www.archeologia.beniculturali.it>. (19 April 2002).

[10] McGowan, Nicola, Reinaldo Niella, Pierre Schrappe, and Jennifer Smith. Lagoon Archeology. An Interactive Qualifying Project for Worcester Polytechnic Institute, 1990

[11] Direzione Generale per I Beni Archeologici. <http://www.archeologia.beniculturali.it/>. (19 April 2002).

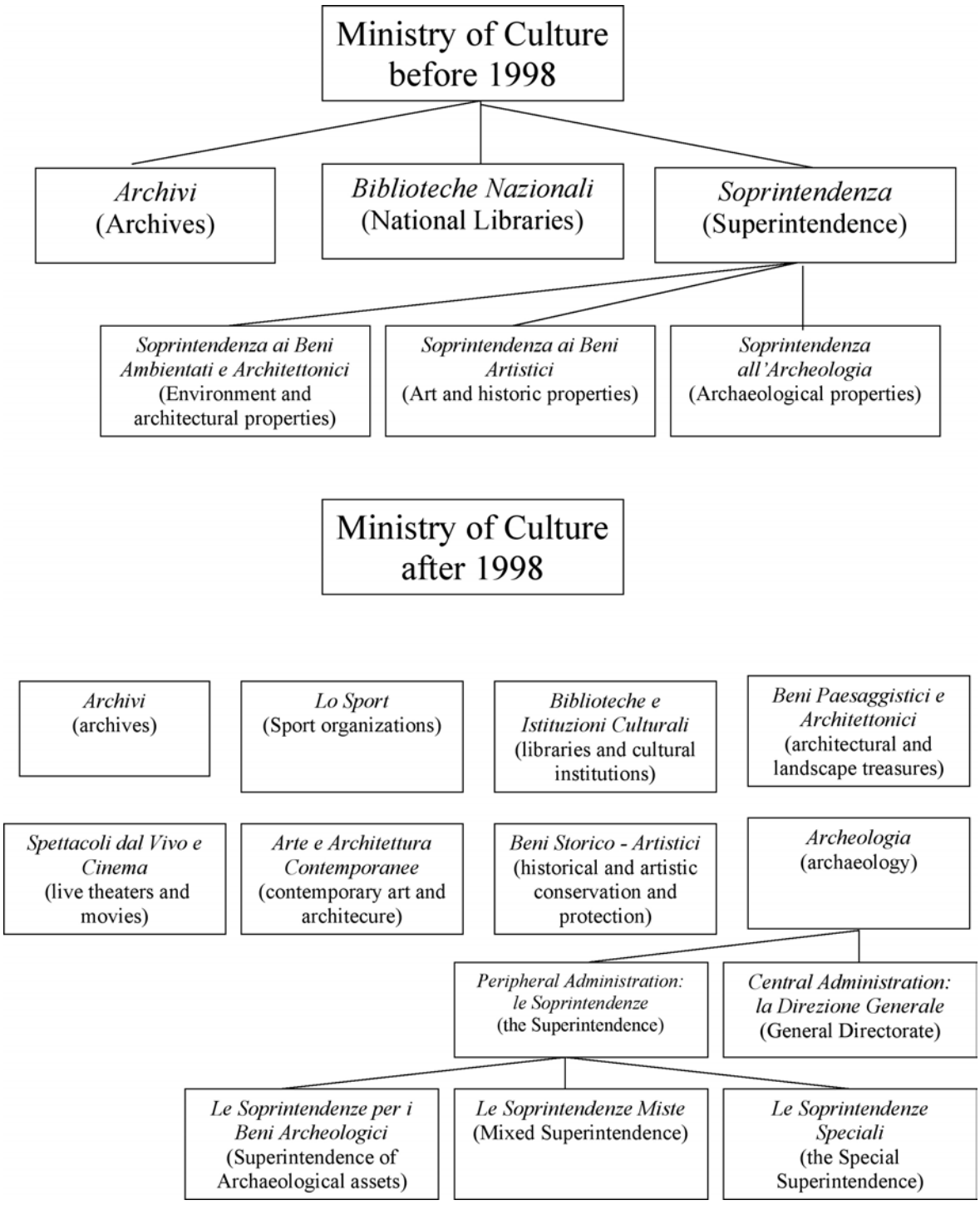

Figure 6: Organizational Chart of the Ministry of Culture

2.2 Architecture in Venice

The islands of Venice have many different and unique architectural styles. Being completely surrounded by a lagoon, the city of Venice developed and grew much differently than any other city in Europe. Architects and builders had to develop a new way to construct buildings on the soft terrain.

One of the most challenging aspects of building communities on Venice was the construction of churches. The canals weave through the islands, splitting Venice into many neighborhoods. Every neighborhood in Venice had its own church, and because of the even distribution of wealth, there were many more small churches as opposed to large cathedrals.

This section will describe seven architectural periods ranging from the 6th through 18th centuries. Although much of Europe experienced the same styles, Venice modified and transformed its architecture to a technique that was exclusively Venetian. By identifying the key features of each architectural style, we were able to identify correlations between style and other aspects such as number of artifacts, size and condition.

2.2.1 Byzantine

The Byzantine style was the longest lasting period of architecture in Venetian history. Lasting from the 8th to the 12th centuries, many churches that were constructed in this style still exist today. The two main characteristics of this style are tall, narrow arches and large domes. The Venetians added their own flair to this style by covering the walls and ceiling with elaborate mosaics.

Byzantine arches are unique in that the pillars rise vertically from the floor and form a semicircle at the top. Arches were not widely used before the 8th century, but their popularity grew throughout most of Europe during the next few centuries.

The dome was considered an architectural wonder during the Byzantine period. Usually, it was located directly above the center of the church and covered with ornate detailed mosaics. The content of these mosaics include one main figure with a biblical event surrounding it.

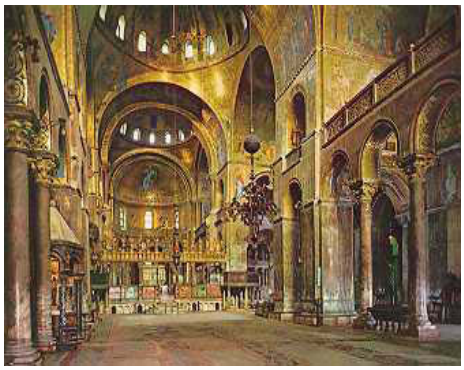

Figure 7: St. Mark's Basilica[12]

A perfect example of a large Byzantine church is the Basilica di San Marco (Figure 2). The interior of the church is covered in mosaics and has several large domes. It is interesting to note that while the main structure of the basilica is built in the Byzantine style, its façade is constructed in the Gothic fashion. This is a good example of transitions that architectural style underwent in Venice.

The floor of the Basilica di San Marco consists of many different styles of mosaic and *opus tesellatum*. Relying predominantly on geometric shapes and symmetry, the floors also include some detailed images of animals.[13]

2.2.2 Gothic

Following the Byzantine period, the primary architectural style increasingly became Gothic. This style stemmed from a change in the Catholic Church's architectural philosophy, which emphasized light, airy open spaces and more vibrant colors. Mosaics were now placed at the eye level of the churchgoer instead of being placed far above their heads on a large dome. This was the Church's way of making religious devotion a more personal experience.

Figure 8: Santa Maria Gloriosa dei Frari[14]

Some of the key features of Gothic architecture tall spires, large windows, and pointed arches. In the rest of Europe, Gothic

[12] http://www.muspe.unibo.it/period/MA/index/number1/fenl1/basili1.jpg

[13] Sammartini, Tudy Pavimenti a Venezia, Ponzano, Italy: Vianello Libri, 1999

[14] http://www.umich.edu/~hartspc/histart/VENICE/VC050.jpeg

style was identified by the construction of flying buttresses to support massive walls. Due to Venice's unstable ground, the supports were constructed on the inside of the church in the form of long pieces of wood. The Venetians felt that these reinforcements did not take away the light airy feel of the church. The interior of the Santa Maria Gloriosa dei Frari (Figure 3) is a prime example of a Venetian Gothic structure.

2.2.3 Renaissance

At the end of the 15th century, Venetian architecture began to show signs of Renaissance style. The Renaissance, which means "rebirth", was a return to the classical Roman architecture. While the Renaissance had been in full force outside of Venice since the 14th century, Venice did not experience much of this style due to strong Byzantine and Gothic influences.

Figure 9: Il Redentore[15]

There are two distinguishing features of a Renaissance style church. The first major characteristic is the use of pediments over windows and doorways instead of arches. This caused the church to look simple and symmetric, both characteristics of Roman architecture. The second characteristic is the combination of the Byzantine and Gothic style in a way that they compliment each other. For instance, a dome would be constructed to not overshadow the smaller details of Gothic art.


Figure 10: An artifact in the Miracoli.

An excellent example of how the Venetians adapted the Italian Renaissance style to a unique Venetian design is the Il Redentore (Figure 4) and the Santa Maria dei Miracoli. Both churches extensively use tile mosaic in many different colors. The floor of the Miracoli has an

[15] http://www.archivision.com/images/1.5/53090.jpg

overwhelmingly beautiful marble floor with many large and small artifacts. Figure 5 pictures an artifact from the Miracoli. The surrounding floor can be seen.

2.2.4 Mannerism

Mannerism, which emerged around the 16th century, is often considered an extension on the classic Renaissance style. Both styles rely heavily on symmetry and accord. However, emphasis on simplicity was abandoned in the Mannerist style. Andrea Palladio was one of the most famous Venetian Mannerist architects. He developed an efficient method for fitting the Mannerist style to the Latin cross floor plan. An excellent example of his work would be the San Giorgio Maggiore church (Figure 5).

Figure 11: San Giorgio

Mannerism broke away drastically from Byzantine style. Much of the Gothic and Renaissance churches were constructed with a Byzantine starting point. The Mannerist style tended to be completely unique and nothing like churches constructed in the past.

The interior floors of the San Giorgio Maggiore consist of a constant pattern of interweaving octagons in varying earthy colors.

[16] http://www.doge.it/immagini/sgiorgio/08a.jpg

2.2.5 Baroque

The Baroque style, like Mannerism, draws strongly from the Renaissance styles of earlier centuries. Baroque architecture was constructed with the sole purpose of overwhelming the observer. Almost every element of architecture, like pediments, domes, arches, spires, and windows, were combined to create quite a complex piece of art.

Figure 12: Santa Maria della Salute[17]

A good example of Baroque style is the Santa Maria della Salute (Figure 6) which was built to celebrate the end of the plague of 1630. The base of the building was constructed in the Byzantine style, but the decorative ornamentation makes it noticeably Baroque.

The Salute strongly resembles a crown and the floor further emphasizes this theme with concentric circles spreading out around the center rose design. The main colors used are black, yellow, white and red.

[17] http://www.travelnet.co.il/italy/picsArt/SantaMariaDellaSalute-Venice.jpg

2.2.6 Neoclassic

The Neoclassical era of architecture occurred during the 18th century. Basically, it was a return to the classical approach taken during the Renaissance and Byzantine periods. Although many different building techniques were still used, this style was more simplistic than the flashy Baroque style with its return to Roman classical symmetry.

Figure 13: Santa Maria del Rosario[18]

The most famous Venetian Neoclassical architect was a man named Giorgio Massari. He took a more Palladian approach to his designs, but refrained from the Baroque fashion. His most renowned work is the church of Santa Maria del Rosario which was constructed in 1726. This church was noticeably simpler than churches constructed during the baroque period and drew more from the simplistic Renaissance style.

Massari also constructed the church of San Marcuola in 1738. The floor of this church is a geometric design made of Istrian stone and blue bardiglio marble. It is said that the optical effect of the church floor corrects the misalignment of the two church entrances in relation to the high altar.[19]

2.3 Church Floors

For this project, an understanding of the structure of Venetian church floors and the materials that make up the floor is necessary. The following sections will explore the unique way in which Venetian architects erected buildings on the unstable soil of the lagoon. Also, the materials that were used to construct the buildings of Venice were chosen carefully with the erosive qualities of salt water in mind.

18 http://www.si.umich.edu/Art_History/UMMA/VC03/VC035.jpg

19 Sammartini, Tudy Pavimenti a Venezia, Ponzano, Italy: Vianello Libri, 1999

2.3.1 Church Floor Layout[20]

In the collection of our data and the outlining of church floor plans, it is imperative to be familiar with the different sections of the church floor and their proper terminology.

When considering the different sides of the church, the wall the seated congregation faces is called the east wall. The wall to the right of the seated congregation is the epistle side of the church and the left wall is the gospel side.

The nave is the large portion of the floor in which the congregation sits. This is usually the largest section of the church floor. The front section of the church, usually elevated, where mass is conducted is called the sanctuary, which can also be called the chancel. Within the sanctuary there are several subsections including the lectern, pulpit and altar. The lectern is located on the right side of the sanctuary and the pulpit is on the left side. The altar is positioned in the center of the sanctuary.

2.3.2 Floor Styles

Different patterns and floor styles were used throughout the churches in Venice. The floor styles depended on the material available, certain trends during different time periods, and the choice made by the architect. The most commonly used floor styles in Venice are mosaic and opus sectile.

Mosaic floors are defined as "an inlay of small pieces of various kinds of materials (stone, marble, glass paste and so on) used to decorate floors and walls."[21] Mosaics were most commonly used in the design of Venetian church floors, especially within the classical styles of churches. Different patterns were used to symbolize connections with God and Heaven.

Within the generic category of mosaic, there are different patterns and styles. One of the most common for Venice is *terrazzo*, or Venetian Mosaic. Venetian Mosaic is described as being "the classic flooring surface for interiors, comprising pieces of marble in different shapes, colours and dimensions strewn over a bed of lime or cement mortar

[20] http://www.kencollins.com

[21] Sammartini, Tudy Pavimenti a Venezia, Ponzano, Italy: Vianello Libri, 1999, 200

and abraded to a perfectly smooth finish." Other forms of mosaic are *battuto*, similar to *terrazzo* but pounded to make smooth and *litostròto*, made from marble of different sizes, shapes and colors using simple geometric patterns. [22]

There are four specific kinds of mosaic which are designated by use of shape and color. *Opus Alexandrium* is a mosaic pattern which consists of two different colored marble on a plain background. *Opus Sectile* is a floor with different colored marble slabs that are cut into geometrical shapes to make other geometrical patterns. *Opus Tessellatum* is made up of small cubes of colored marble. *Opus Vermiculatum* creates irregular channels that resemble worm tracks using blocks of stone and marble.

Another common floor style that is seen throughout many churches in Venice is a red and white checkered pattern usually made out of marble or Istrian stone, which dates to early Renaissance styles. Other larger geometric designs were made using different colored slabs of marble, but this practice was not as popular as mosaic or the classic red and white pattern.

2.3.3 Construction Techniques

When sections of Venice were first constructed in the 9th century, Venetian architects developed a technique for building on soft, wet, and often unstable terrain. This technique involved two major components to increase stability: wood pilings and light materials such as brick or mortar.

[22] Sammartini, Tudy Pavimenti a Venezia, Ponzano, Italy: Vianello Libri, 1999, 201

The top layer of the lagoon is mostly mud and sand, it cannot sustain any type of building without additional support. To solve this problem, Venetian architects drove wood pilings vertically into the ground to create firm land upon which they could safely build. These pilings were from three to four meters long and were often placed in a round or spiral formation to spread the weight of the edifice. Builders then covered this firm foundation with a wood platform on top of which mortar was spread. Builders often mixed with shards of marble or stone, creating a firm, smooth surface on which to build once dry. A cross-section of a floor can be seen in Figure 8.

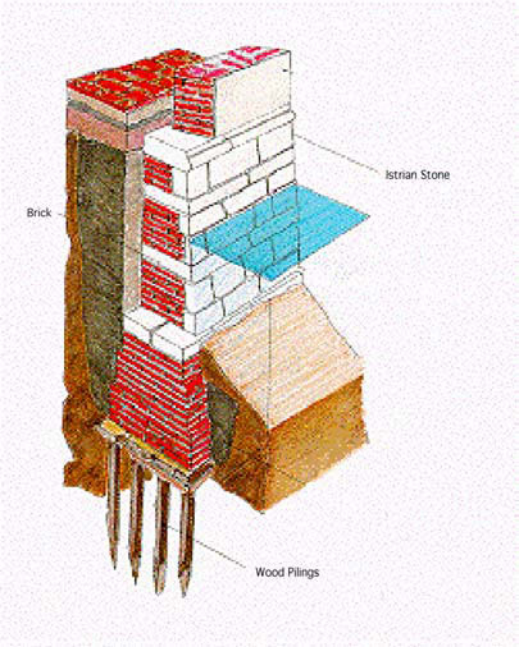

Figure 14: Cross section of floor.

Architects chose materials, such as wood, stone or brick, due to their resistance to compression and flexible properties. Despite the strong wooden groundwork, the soil would undoubtedly shift throughout the years. It is for this reason that builders used stone in large vertical structures and used wood in horizontal structures. Sometimes, wood and stone were used together to give a stone structure some flexibility if the ground were to shift.

Although brick allows for greater stability, salt water causes the brick to crack and split. Venetian builders used a kind of material that was not adversely affected by salt water called Istrian stone. It is non-porous and would survive everyday high tides.

2.3.4 Materials

Although Venetian style architecture was unique, the materials used to construct buildings were not. The most common building material used in Venice was wood because of its light weight and flexibility. The properties of wood made it the best building material at the time, as it gave both strength and flexibility. Unfortunately, it did not have good resistance to the environment and because of this, other materials were of

use where wood is likely to fail. Brick also proved to be a lightweight and strong material.

Marble and Istrian stone were also used because they are less porous and more resistant to erosion than brick or wood. Due to their weight, however, marble and Istrian stone were mostly used for walkways and floors. These two types of stone come in a wide variety of colors, which helped make church floors unique and elegant. Marble is also very easy to work with as it is easy to cut and shape. Marble is used in many forms including slabs, crushed into small pieces, and even made into powder to mix into mortars.

The cost was also a consideration when deciding on which materials to use. Venice did not have a large number of resources so builders had to obtain most of their materials and resources from the mainland. According to UNESCO, "building materials such as wood and stone came from afar (wood from the Alps or the Balkans, marble from the Euganei hills south of Padua or from Greece, and limestone from Istria, in Croatia)."[23]

The salt water that surrounds Venice is slowly corroding these materials, endangering those who occupy the buildings. It is essential to prevent further damage to the foundations of Venice so that the future of this city can be preserved.

2.3.5 Catholic Burial Practices[24]

While incredible works of art can be seen covering the surface of church floors, these floors are also obscuring ancient relics of powerful religious and political figures. The remnants of a Saint's remains are often buried under the altar of Catholic churches. In fact, the tombs of martyrs were believed to be the first alters. An example of this would be St Mark's remains being located in San Marco's Basilica. Many privileged or important individuals in the Catholic faith wanted their remains to be buried within the church as well, in order to attain the novelty of being buried near God's holy ones and the sensation of being closer to God. Roman emperors started this trend, with Emperors Constantine and Theodosious' remains are located under the portico of the church of the

[23] 1.UNESCO *Venice, Safeguarding Campaign: Venice and its Lagoon.* 14 June 2001, (5 April 2002). <http://www.unesco.org/culture/heritage/tangible/venice/html_eng/lagunecon.shtml>.

[24] Curran, J.J. Cemeteries" Catholic Encyclopedia <http://www.newadvent.org/cathen/03504a.htm> (April 14, 2002) "

Apostles in Constantinople. The Chiese de San Pietro contains the remains of Popes and other distinguished people.

The ironic thing was that this practice of burying remains within the churches was forbidden. A decree in the capitularies of Theodulfus (c. 790) stated that burials in churches were restricted to only members of the priesthood. The graves of the already deceased would not be disturbed, but it was required that the graves be dug deeper or the floors be raised in order for the grave to no longer be apparent. If the number of graves that were present in the church prevented this solution from being viable, the altar was to then be removed and placed in a new church, with the old church to be converted into a cemetery. Despite this decree however, arrangements were for powerful and important figures to have their remains placed under churches.

2.4 Other Organizations

Although this project does not involve our full collaboration with the following two organizations, we will be utilizing their assistance in the successful completion of our project.

2.4.1 Church Administration [25]

In gathering field information on Venetian churches, our group simply cannot just enter these churches unannounced and disrupt the business of the church. Learning about the church administration is crucial in making sure we conduct ourselves in a professional manner while representing WPI and our sponsors. The Roman Catholic administration is known as the Roman Curia.

The Roman Curia assists the Pope in carrying out his duties and helps carry out the proper mission of the Church throughout the entire world. The vast number of tasks the Curia is responsible for is divided among numerous departments. The most important parts of the Curia are the Secretariat of State and a number of Congregations.

The Secretariat of State is divided into two sections, a "General Section" and a "Section for Relations with States", and is headed by the Cardinal Secretary of State (currently Angelo Cardinal Sodano). The "General Section" is responsible for tasks such

[25] "The Roman Curia" Catholic Church Factbook < http://www.catholic-pages.com/vatican/curia.asp > (April 11, 2002)

as regulating the functions and activities of the of the representatives of the Roman Curia, examining matter which fall outside the competence of the other departments of the Holy See, and maintaining the statistical bureau of the Church. The second section of the Secretariat of State is responsible for such things as the Roman Curia's diplomatic corps, its relations with civil society, and ensuring representation of the Curia before international organizations.

There are nine Congregations in the Roman Curia. The most important Congregation is the Congregation for the Doctrine of the Faith. Prior to this title, this Congregation used to be called the "Holy Office", and prior to that title, the "Holy Roman Inquisition". The primary responsibility of this Congregation is to promote and preserve the Catholic Faith throughout the Church. Any topic dealing with the doctrine of the faith or on morals is within this department's jurisdiction.

Tribunals are the Curia's court system. The Tribunal section of the Curia consists of three sections: the Apostolic Penitentiary, the Supreme Tribunal of the Apostolic Signature, and the Tribunal of the Roman Rota. These Tribunals deal with transgressions committed by members of the clergy, as well as conducting events such as marriages of royalty.

The fourteen Pontifical Councils of the Roman Curia are smaller departments that concentrate on one specific task. These tasks range from maintaining relations with other Christian Churches, to protecting and promoting the "Family", to being responsible for expressing the care of the Church to those in need.

The three Offices of the Roman Curia either deal with essential functions that do not involve religion, or only become active during specific and seldom occurring instances. The Office of the Camerlengo is responsible for running the Roman Curia in between the time period when the Pope dies and a new Pope is not yet elected, and the Office for the Economic Affairs of the Holy See (Holy See is another term for the Roman Curia) is essentially the Curia's treasury department.

Pontifical Commissions are departments directly under a specific Congregation. Our project would fall under the jurisdiction of the Pontifical Commission for the Preservation of the Artistic and Historical Patrimony. This department operates under the Congregation for the Clergy, and is responsible for preserving the artistic and historical

heritage of the entire church. Our liaison, Luigi Fozzati, will most likely need to contact this sector of the Curia in order to arrange for us to gather field information.

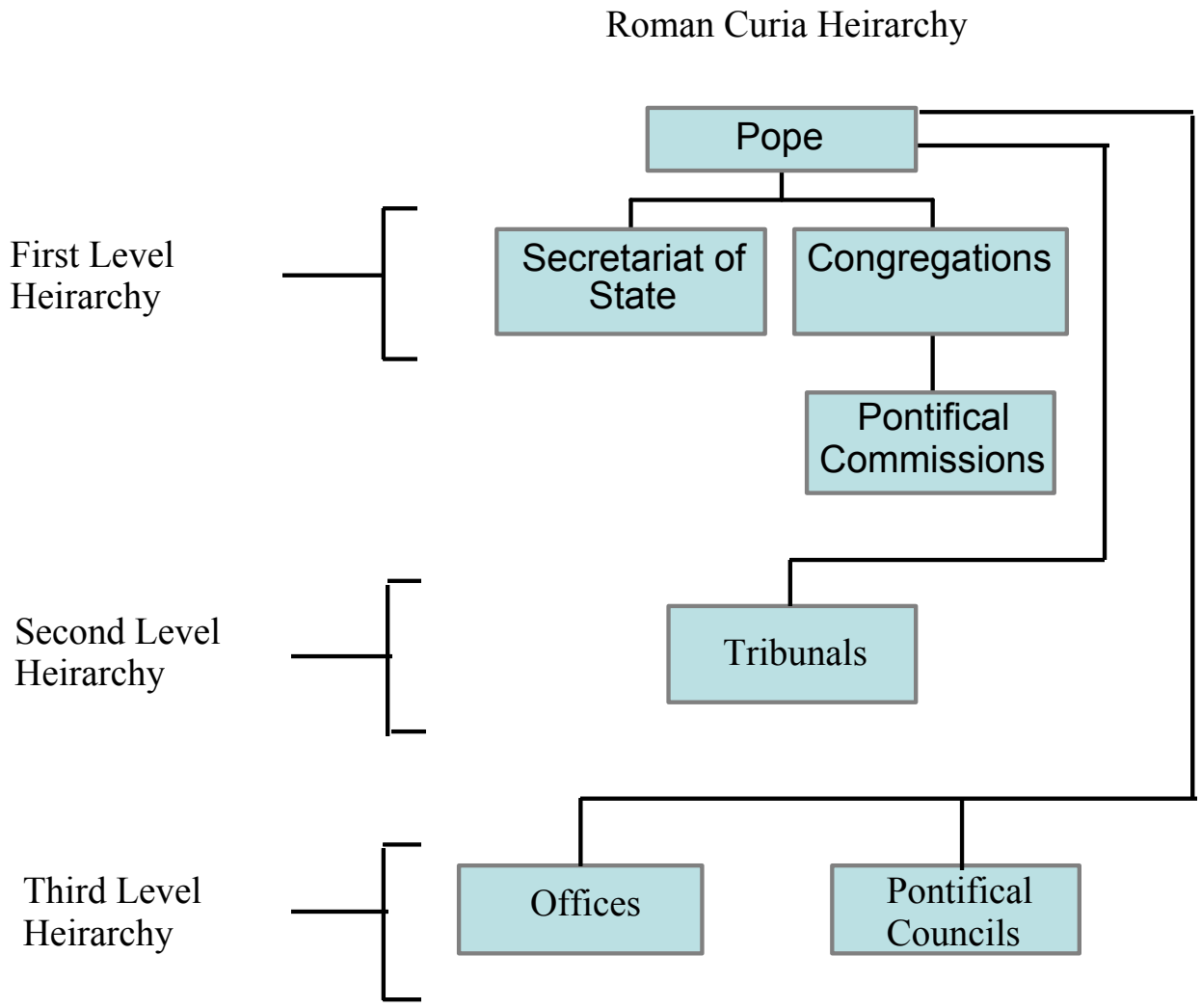

Figure 15: Church Hierarchy

2.4.2 UNESCO

On November 4, 1966 Venice experienced the highest recorded flood of its city. Due to a number of simultaneous factors, including seasonal variation in the sea level and low atmospheric pressure, the flood reached an all time high of 1.94 meters above sea level as indicated by measurements taken at Punta della Salute. The damage to Venice

was enormous as many works of art were destroyed and close to five thousand Venetians lost their homes. Many started to realize that the increasing number and height of the floods, or *acqua alta*, were becoming a real danger to the city. Many people then realized that this flood alone had not led the city to such great disaster but it was from the continuing effect of erosion from the constant flooding over the past years.[26]

The devastating effects of this flood brought Venice to the attention and concern of the world. Later that month UNESCO took responsibility for safeguarding Venice at the request of the Italian representatives. By looking towards UNESCO, Italy was not looking for an organization to try and help the country all by itself, but UNESCO worked to stimulate public and private interest into the preservation and restoration of Venice. UNESCO as well tried urging member countries to offer what help the countries could provide. UNESCO has the task to supervise and watch over programs and projects that are set up by private organizations.

Past UNESCO projects will prove to be a valuable source of information to us. UNESCO sponsored projects have already gathered information within Venice that would be useful to our project. To not waste time collecting data that has already been collected, we will use this past information to gather what information is important to our project.

[26] United Nations Educational, Scientific and Cultural Organization website. n.d. <http://www.unesco.org/> (23 March 2002).

3 Methodology

This project supported the Archeology Superintendence in obtaining pertinent information on church floors. Church floors are of particular interest to the Archeology Superintendence for the reason that many ground surfaces in Venice have been excavated or altered in some way, whereas church floors have been little tampered with over the years. Church floors are large surfaces that were protected from high tides by simply overlaying new floors; therefore this makes them a source of valuable stratographic information. With this information, a better understanding of the history and changes of the city can be gained. The project team conducted in depth research, recording both changing and unchanging characteristics of the floors. We entered this data into a database created by us for the Archeology Superintendence and also used the database for our own evaluations. Through our research and analysis, we determined what threats exist to the current floors and the artwork embedded within them.

In order to conclude our project successfully, we completed the following objectives:

1. Collect information on previous church floors and artifacts.
2. Catalog current church floors and artifacts.
3. Identify floors and artifacts at risk.
    3.1 Identify risk factors
    3.2 Identify floors at risk
    3.3 Identify artifacts at risk

The rest of our Methodology chapter includes these sections:

- Section 3.1 is our Domain of Inquiry and Definitions segment. It contains information on the specific types of data we gathered, and also defines any key terms we used throughout this paper.
- Section 3.2 is our Study Area segment, containing various maps showing the locations of the churches we studied.
- Section 3.3 describes the creation of the database which contains all the data we gathered.

- Section 3.4 explains how we gathered data such as the history of the church or any changes done to the floors known to the priest.
- Section 3.5 explains the methods we used in gathering field data on Venetian church floors and artifacts, which included numerical measurements, photographs, and descriptions.
- Section 3.6 details how we integrated all the collected data together and analyzed that information to make conclusions. These conclusions include identifying risk factors, which affect the floors and artifacts, as well as specifically which floors and artifacts are at risk.

3.1 Domain of Inquiry and Definitions[27]

Floor: The floor included the nave, the sanctuary and any chapels that may have been located to the side of the church and directly accessible from the main floor.

Nave: The architectural term for where the congregation gathers.

Sanctuary: The front part of the church where service is conducted and is usually elevated.

Chapels: An alcove within the church which contains an altar. The chapel performs the same function as the church, but in a smaller scale.

East Wall: the wall the seated congregation faces.

Epistle Wall: the wall to the right of the seated congregation.

Gospel Wall: the wall to the left of the seated congregation.

Artifact: An artifact is any kind of artwork or other work of human craftsmanship such as a plaque, tombstone, or other engravings which is separated from the design of the floor.

Church Code: A 4-letter code, used to designate each church. (Example: MIRA designates Santa Maria dei Miracoli)[28]

Floor Code: A code consisting of the 4-letter church code followed by the year in which the floor under observation was built, or the date inscribed on the oldest artifact,

[27] http://www.kencollins.com

[28] Aldrich, Brian, Kevin Shea, and David Youkstetter. The Churches of Venice II: A System for Artistic Restoration Analysis. An Interactive Qualifying Project for Worcester Polytechnic Institute, 1993.

and a capital letter which designates a section pre-defined on the floor plan. (Example: MIRA1729A)

Artifact Code –The floor code plus an underscore, and a number (starting with 1). (Example: MIRA1729_1)

3.2 Study Area

The study area of this project involved the *Canneregio*, *Dorsoduro* and *San Polo* sestieri, located in the historical center of Venice. We gathered information on church floors from 22 of the 57 churches located throughout the three sestieri mentioned. We started by gathering the information for churches located in *Canneregio*, proceeded on to *Dorosduro*, then *San Polo*, trying to complete one sestiere before moving on. Following is a map showing the locations of the churches of Venice (Figure 16).

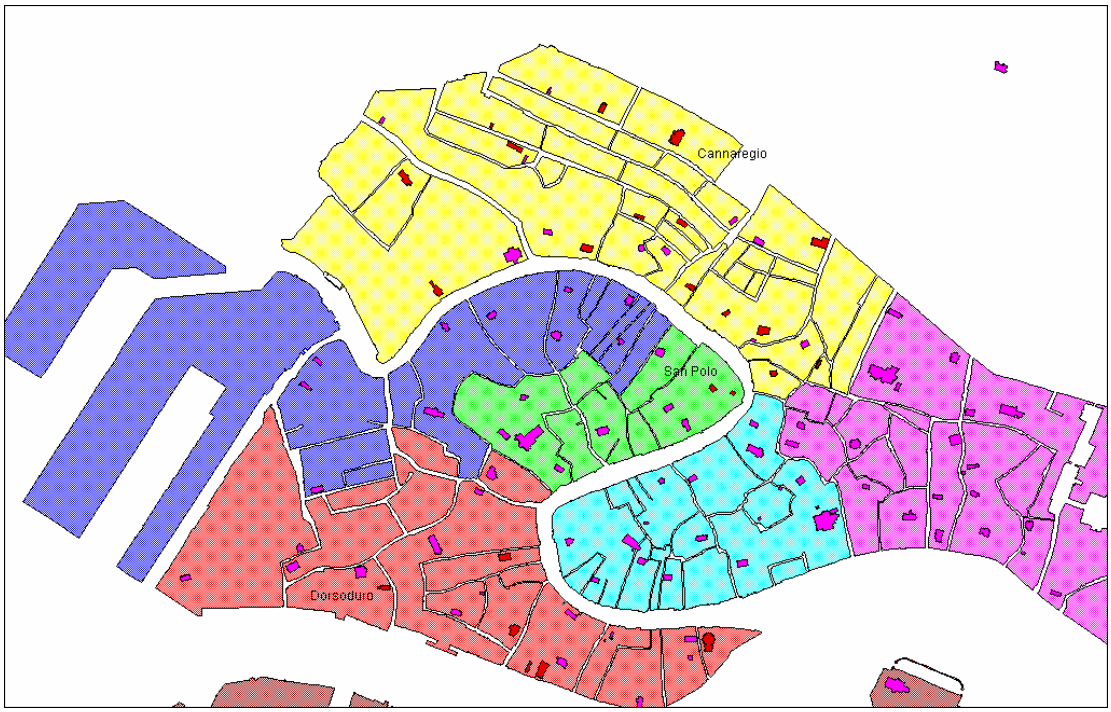

Figure 16: Churches located in the Canneregio, Dorsoduro and San Polo sestieri of the historical center of Venice.

3.3 Creation of the Database

All the data we collected was stored in a database, as well as several map layers. After the completion of the project, the finished database was given to the Archeology Superintendence. This information was useful in determining which church floors are most in need of restoration and what important stratigraphic information might lay underneath existing floors.

The database that we created was based on several past databases created by both UNESCO and past projects in Venice. Our database has five main components: ***Informazioni Fondamentali, Pavimenti, Reperti, Condizioni Pavimenti, and Condizione Reperti.***

Informazione Fondamentale delle Chiese contains basic information about the church such as address, telephone number and a brief history. The information contained within this table was gathered through the past databases mentioned previously and through forms that we created and distributed to the priests of each church. ***Pavimenti*** contains the information we gathered about the church floors such as height of the floor above sea level and how many artifacts are embedded within the floor. The ***Reperti*** table contains basic information about the different artifacts contained within the church. This includes its surface area, the text inscribed upon the artifact and its location on the church floor. ***Condizioni Pavimenti*** contains information on the current condition of the church floor. This table includes information on the number of problem cracks, warping measurements and missing floor pieces of a given floor quadrant. Lastly, ***Condizioni Reperti*** contains information on an artifact's text readability, wearing/fading and number of cracks.

Forms and reports were developed within the database to make the system more user friendly. We developed the forms to make editing, adding, or deleting information to the database to be simple and straight forward to even a user who might not have much knowledge with the database software. We created the reports to show the contents of the database in a better organized and more professional manner. The reports can also be found in "pdf" format files on the CD, for all the churches or for any single church, for ease of printing out specific information if an interested party wished to.

3.4 Objective 1: Collect information on previous church floors and artifacts

Due to the fact that church archives are written in Italian and church officials may be hesitant to give individuals who are not members of the clergy access to church archives, we created forms in Italian and distributed them via mail or in person to priests (See Appendix E.5 to view form). The information these forms yielded include restorations done to the floors, knowledge on the number of floors that may be located underneath the current floor, and any other information on past floors.

3.5 Objective 2: Gather data on current church floors and artifacts

By scouting out the churches and finding when the churches were open to the public we arranged times at which to enter each church and gather data. We performed our data gathering quickly and quietly so as not be intrusive to the church or church patrons who might enter the church.

The four members of our project team completed a test run of our data gathering procedures at the *Santa Maria Assunta dei Gesuiti* in the *Canneregio* sestiere. We discovered that the most efficient way to collect the field data was to split into two groups who performed specialized tasks all within the same church. One team of two completed the measurements and other information pertaining to the floor and artifacts while the other performed the condition assessment of both the floors and artifacts. Data collection began with all four group members entering one church, but if for some reason one team finished before the other they were free to move on to the next church in order to maximize efficiency.

In addition to being an efficient way of collecting the data, we concluded that the entire condition assessment process would be more precise if two group members, who had similar views on the rubric, evaluated the floors and artifacts. To determine which two group members would perform the condition assessment, a number of calibration tests were devised. We chose several sections of the church floor and several artifacts for each group member to perform a condition assessment on. After several separate trials, the two group members who had the closest assessments throughout the test runs were the group members who performed all the condition assessments.

To clarify the procedures that we followed in gathering data on current church floors and artifacts, we created a flow chart (Figure 17).

3.5.1 Flow Chart of Data Collection

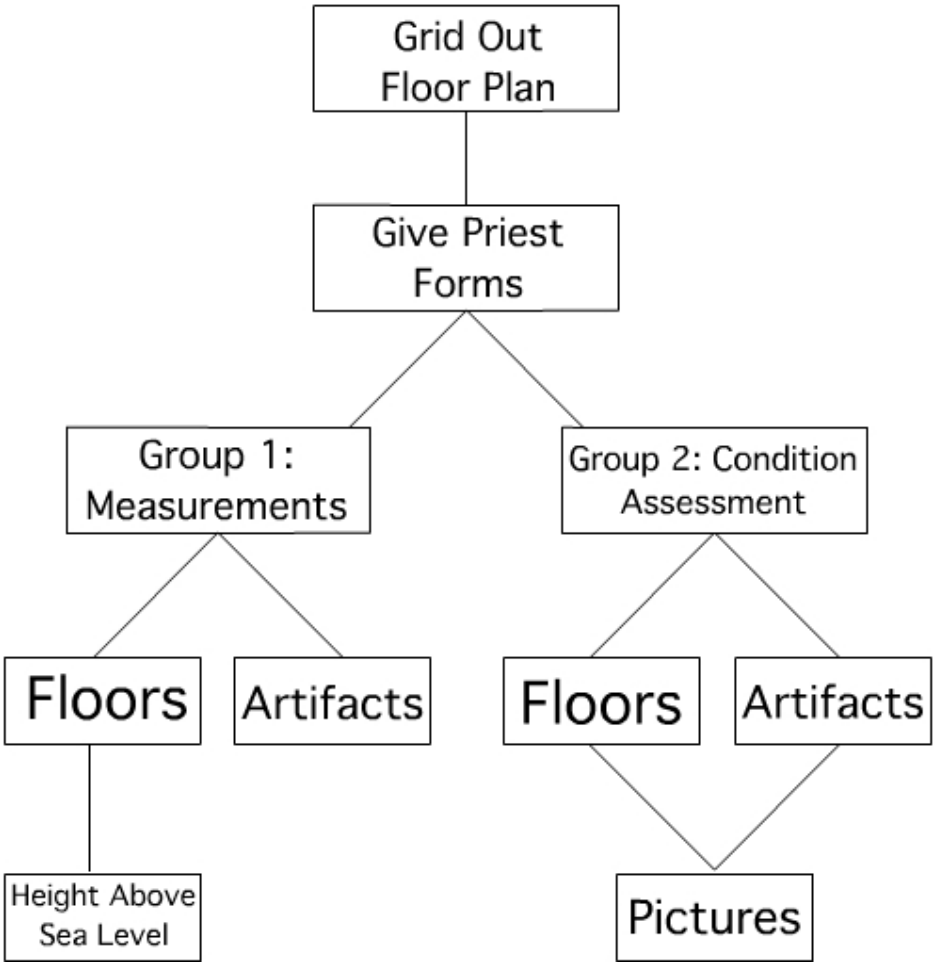

Figure 17: Flowchart of Data Collection

3.5.2 Explanation of Flow Chart

3.5.2.1 Grid Out Floor plan

To create the grid, we first separated any sections that were not a direct part of the nave or the sanctuary. The grid was made based on the floor plan and the size of the church. We had no set method in creating the grid due to the variation of sizes and shapes of the church floors. When possible we used support columns, or other such objects, to determine where to split the quadrants. For instance, some grids were based on round floors, some were based on rectangular floors, and some floors had a combination of the two. Side altars were considered a floor quadrant if their floors were greater than 3 square meters in surface area. The grid should have no less than 4 quadrants and no more than 26 quadrants. This limit is to ensure that not too much time was spent on the largest churches and that there was some consistency in the way the grids were made. Each group of two had a copy of the floor plan.

Figure 18: A complete grid of the *Chiesa S. Giovanni Grisostomo*

3.5.2.2 Give Priest Forms

Upon arriving at the church, we gave a form in Italian to the priest asking him to fill in as much information as he could, or give it to someone who knew or had access to such information. We notified the priest that we would return one week later to retrieve the completed forms at approximately the same time at which the form was given to him. Numerous churches we visited did not have someone present who could answer our questions. However, with the past databases holding address information on churches we

were able to mail out priest forms to all 144 churches in Venice. After these forms were completed, directions were provided to send the forms back to Luigi Fozzati, our sponsor and the Archeology Superintendence of Venice.

3.5.2.3 Group 1: Floors and Artifacts (Measurements)

The measurements team used the Floor Information and Artifact Information forms found in Appendix E.1 and E.3 respectively.

Floors

Using the metric tape measure and the electric tape measure, we measured the length and the width of the church if necessary. The length and width for many of the churches were found with the floor plans we obtained through the past projects. The length of the church floor was perpendicular to the wall with the main doorway. The width is parallel to the east wall.

We then measured the height of the floor with regards to an absolute zero marker in Venice. The heights of many building corners and other objects at ground level were obtained in the early to mid 1990's by the Magistrate Alla Acqui, a government agency part of the Ministry of Public Works, and were all recorded. An example of a few of their recorded points can be seen around the *Santa Maria Assunta dei Gesuiti* in Figure 19. Using these known heights, we used a leveling device with a laser and tripod to obtain the heights we needed. To use this device, we set the laser level on the point or area we wanted to find the height and aimed the laser at the location of known height. The laser was leveled, and then the heights of the laser device and the difference between where the laser hit and the known height were recorded. Through a simple calculation, the new height could then be determined.

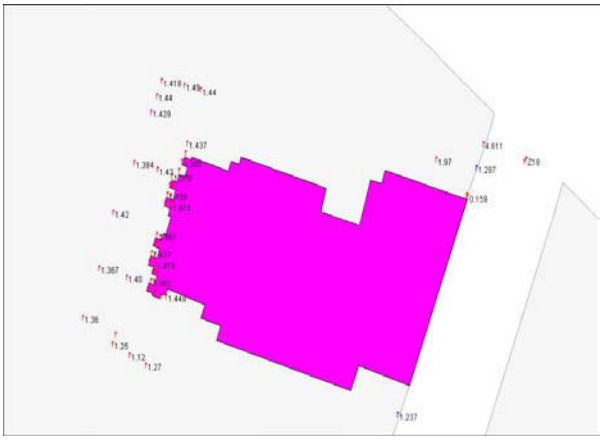

Figure 19: The Santa Maria Assunta dei Gesuiti labeled with known heights in surrounding areas.

For example, to obtain the height at the bottom of the steps of the church, we placed the laser at the bottom of the steps and aimed the laser towards a known height location. After the laser was leveled, we recorded the difference between where the laser hit and the known height and subtracted the height of the laser. If the known height was not visible from where we measured, we found a point that was visible by both the known height and the unknown height. We could then determine the height of the midpoint, and through the original method we could then find the height of the wanted location.

Artifacts

After the condition assessment team located all the artifacts in the church, performed an assessment, and made note of how many artifacts there were, this information was copied over to the measurement team's floor plan. This way, the condition assessment team could perform an assessment on the floor quadrants while the measurement team could begin taking measurements and transcribing the discovered artifacts. The position of the artifact was noted by the distance from two of the closest perpendicular walls, measured from the wall to the center of the artifact. There was an x and y measurement for each artifact. The x measurement is how far the artifact is from the gospel wall (Figure 20), the y measurement is how far the artifact is from the wall which contains the main doorway.

Figure 20: Taking the x coordinate for an artifact in the *Santa Maria Assunta dei Gesuiti*.

Next, the material of which the artifact is made was recorded on the form. After that, a brief description was written pertaining to the artifacts subject matter and we transcribed any text that the artifact contained.

Regarding transcribing the text on artifacts, we used empty brackets ([]) to designate letters that were missing or could not be read. We also placed brackets around unreadable letters or missing letters that were known. Curly brackets ({ }) designated

symbols within the text, such as triangles. Carrots (^) designated a superscript above the letter we placed it after. We also used parentheses to designate any artwork that might have come between the text, such as a coat of arms. Lastly, we placed quotation marks around any letters that were not completely recognizable or readable, but enough is still readable to recognize what letter was written there. Here is a chart clarifying the text transcription process (Figure 21):

Symbol	**Denotation**
[ ]	Missing letters
[asdf]	Missing letters but known to be "asdf"
(Coat of Arms)	A coat of arms symbol is located in between text
M{^I}	"M" with a superscript "I"

Figure 21: Text transcription of artifacts.

3.5.2.4 Group 2: Floors and Artifacts (Condition Assessment)

The two group members designated to perform all condition assessment first located and marked off the approximate location of the artifacts on the other floor plan. To be sure that no artifact was missed the group members started at the wall closest to the door and worked first back and forth parallel to the door and moved in a direction away from the door. When they found an artifact and marked it off on the grid the group also took a picture of the artifact. Artifacts with text were marked off by circling the location on the floor plan, while artifacts with no text were marked with a cross. Pictures were saved into the database as a JPEG file named with the artifact code (Example: MIRA1729_1.jpg). If we needed more than one picture to accurately capture the artifact, a lowercase letter followed the last number starting with "a". (Example: MIRA1729_1a.jpg and MIRA1729_1b.jpg).

In order to devise a way to prevent the degradation and loss of the floors, we developed an assessment on the condition of the floors. Using past projects and a paper written by Fabio Carrera, we formulated a system to rate the damages done to floors and the artifacts. This assessment takes many factors into account when rating the floors and artifacts.

Floors

For the condition assessment of the floors, the two group members filled out the form from Appendix E.2

Cracks

In each quadrant, a varying number of cracks can be present (Figure 22). Cracks indicate weakness in the floor, and these cracks can cause a major stress failure to occur in the near future. A few different factors were assessed when rating cracks, such as the size of the cracks and whether the cracks could be considered problematic.

The first step was to determine where the problem cracks in the quadrant were and measuring them. A problem crack is a crack that is more than 2mm at its widest point. Furthermore, problem cracks must actually cut into the floor material. This decisive factor helps us differentiate between actual problem cracks, and cracks that have already been repaired with caulking or other material. The number of problem cracks was then counted and lengths added up to find the total for the quadrant.

Figure 22: An example of cracks seen in the *Santa Maria Assunta dei Gesuiti*.

The next step was to write down the percentage of the quadrant that is surface/hairline cracks. All cracks that were not considered problem cracks, including repaired problem cracks, were included in the amount of surface/hairline cracks.

At the end of our data gathering process, we created a scale in terms of the total lengths of problem cracks we observed in all the churches. This made sure that churches accurately represented the condition of the floor in comparison to all floors observed.

Surface Damage

We discovered other types of surface damage besides fading and wearing as we looked at the churches. One of the common examples of this is pitting (Figure 23). When these conditions arose we noted the percentage of surface area that was affected within the quadrant.

Figure 23: Pitting of the floor seen in the *Santa Maria Assunta dei Gesuiti*.

Figure 24: A pair of holes found in the *San Giovanni Elemosinario*.

Holes

Holes in the floors were counted for each region of the floor. A hole is any kind of missing floor with a depth greater than 1.5 cm (Figure 24). This number was recorded and was used in relation to the surface area of the church in order to help determine the condition of the floor.

Floor Detachment

At times we found pieces of the floor to be entirely missing. A missing corner of a floor tile or the loss of multiple whole tiles, as depicted in Figure 25, would qualify as floor detachment. When this occurred we recorded the percentage of the quadrant that was affected by this problem.

Figure 25: Floor detachment in the *Santa Maria Assunta dei Gesuiti*.

Figure 26: An example of floor replacement found in the *Santa Maria Della Salute*

Floor Replacement

Pieces of the floor were also completely replaced with new materials (Figure 26). Whole tiles used to replace damaged sections of the floor, as well as the filling of pitting or floor detachment with a different material would qualify as floor replacement. When we observed this, we recorded the percentage of the quadrant that had been replaced.

Artifacts

For the condition assessment of the artifacts, the two group members filled out the form from Appendix E.4.

Text Readability

Text readability is the most important factor because it is the text of the artifact that gives the most information about the past. This assessment rated the ability to read the text that was written on the artifacts. The more wear the artifact is subject to, the more likely it is of losing its information. For this assessment all of the letters were counted and split into three different weights as shown below:

3 – Readable but damaged letters. If there is any damage whatsoever on the letter, but the letter remains legible, then it belongs in this category. It is given the greatest weight because damaged letters are in greater need of restoration as opposed to letters that are perfect or completely unreadable.

2 – Completely unreadable letters. A vast majority of the letter is missing due to wear or surface damage. This letter is given an intermediate weight because while it is not high priority for restoration, it should receive restoration consideration before the letters that are perfectly readable.

1 – Perfectly readable letters. Letter must be perfect and intact. Letter carving must be sharp and crisp. This letter is given the lowest weight because it needs no kind of restoration.

The number of letters for each of these categories was then divided by the total number of letters in the inscription and multiplied by a hundred, giving us a percentage for each type of letters within the inscription. The percentages were then weighed against the weights given above. The letters that were somewhat readable were given the highest weight since they still contained possibly important information but were the most in danger. Letters that were already completely unreadable were not as important due to the fact that they would not be restored. What letters had once existed there might be important to figuring out the importance of the artifact. If the letters were still in perfect condition there is not much that could be done or would really have to be done at that point, and so they hold the least amount of importance. The scale is from 100 to 300. 100 means that the artifact needs no restoration. A rating between 200 and 300 would indicate that the artifact is a likely candidate for restoration.

For example, the artifact seen in Figure 27 has all three categories of letters. The total amount of letters is 133. The amount of perfectly readable, damaged, and unreadable letters are 121, 11, and 1 respectively. Therefore the equation is as follows

Figure 27: Artifact from the *Santa Maria Assunta dei Gesuiti*.

(121/133 * 100) * 1 = 91

(1/133 * 100) * 2 = 2

(11/133 * 100) * 3 = 25

91 + 2 + 25 = 118

From this number, it can be seen that the text of the artifact is in fairly good condition and is not high priority for restoration.

Fading/Wear

Fading and wear was evaluated with a rating scale.

0 – Artifact is perfect. No signs of fading or wear.

1 – Artifact is slightly worn. Color and/or design are still visible, but there is noticeable wear and possible need for restoration.

2 – Artifact is moderately worn. Color and/or design are not entirely visible, and are in need of restoration.

3 – Artifact is heavily worn. Color and/or design is barely visible and in need of immediate restoration or conservation.

4 – Artifact has lost all signs of color and/or design where it is known that there was color and/or design. Artifact is unsalvageable.

For this condition assessment, we determined the percentage of the artifact that would fall under each rating on the scale (Figure 28). For example, the rating scale on he right would mean that 20% of the artifact would be rated with a 0 for fading and wearing, 10% would be given a 1 rating, 35% would be rated with a 2, 5% would be rated with a 3, and 30% would be rated with a 4. Then, we found the overall wearing and fading rating using the following mathematical formula:

Rating	%
0	20
1	10
2	35
3	5
4	30

Figure 28: A scale breaking down the wearing and fading assessment.

(.20)*0 + (.10)*1 + (.35)*2 + (.05)*3 + (.30)*4 = 2.15

This indicates that the artifact is a 2.15 on the wearing and fading scale of 0-4. This number will then be compared to the rest of the artifacts observed.

Figure 29: This artifact found in the *San Giobbe* contained a high percentage of surface cracks

Cracks

We used the same crack assessment that was utilized for the floor crack assessment.

Surface Damage, Holes, and Floor Detachment/Replacement

The same assessment will be given to the artifacts as was mentioned that was conducted on the floors.

Joint Gaps

We measured the length and width of any gaps that occurred between slabs or blocks of material (Figure 30). These gap measurements were then added together in order to find the total surface area of the artifact that must be caulked.

Figure 30: A joint gap example

3.6 Objective 3: Identify floors and artifacts at risk

All of the information we gathered in the two previous objectives were added into a database and mapping software. We then used these two programs together in our results, to produce charts and graphs, and in analysis, to find patterns and trends.

This database can then be combined with other databases from past projects and organizations like UNESCO. This will allow for a large amount of assorted information on the churches to be found in one location. All of this combined information can be

useful reference to any individual, group or organization looking for detailed information either for further studies or looking to protect or restore Venice churches.

Once completed, this database enabled us to make correlations between different factors and to identify the floors and artifacts that are at risk.

4 Results

This project assisted the Archeology Superintendence in obtaining current and past information on the church floors of Venice. During our project we completed research on the current floors within twenty-two churches in the *sestieri* of *Canneregio*, *Dorsoduro* and *San Polo*. Adding to the collection of basic information on the twenty-two church floors, we also conducted condition assessments on 252 quadrants that were formed from these twenty-two floors. Of these twenty-two churches, we located, recorded the existence of, and performed condition assessments on 527 artifacts embedded within the floors.

4.1 Data Collected About Floors

Out of all of the churches in *Cannaregio*, we came across many similarities in the architectural styles, such as the floor layout, and in religious practices, such as the burials made in the churches. There were differences though, that made each church unique. We observed that the most common floor style was the red and white checkered pattern usually made out of white Trani marble and red Verona marble. Out of the fifteen churches that were visited in *Cannaregio*, twelve had the red and white style floor. Four of the red and white floors looked new in comparison to other churches, and these newer floors usually didn't contain any artifacts except for the *Santa Sofia*, which contained one artifact (Figure 31). Floors that appear newly reconstructed and contain no artifacts have a better chance of having old floors underneath, and thus containing more hidden archeological information. However, floors that were recently restored do not have the most interest to the Archeology Superintendence because it has already undergone a recent restoration and it is unlikely that archeologists will be given permission to dig up the new floor, or information of what was under the floors was already gained during the process of restoration. It is for this reason that church floors soon to be restored are of most interest to the Archeology

Figure 31: The red and white checkered floor pattern in the Santa Sofia.

Superintendence because they can study what lies beneath the floors while the floors are being restored.

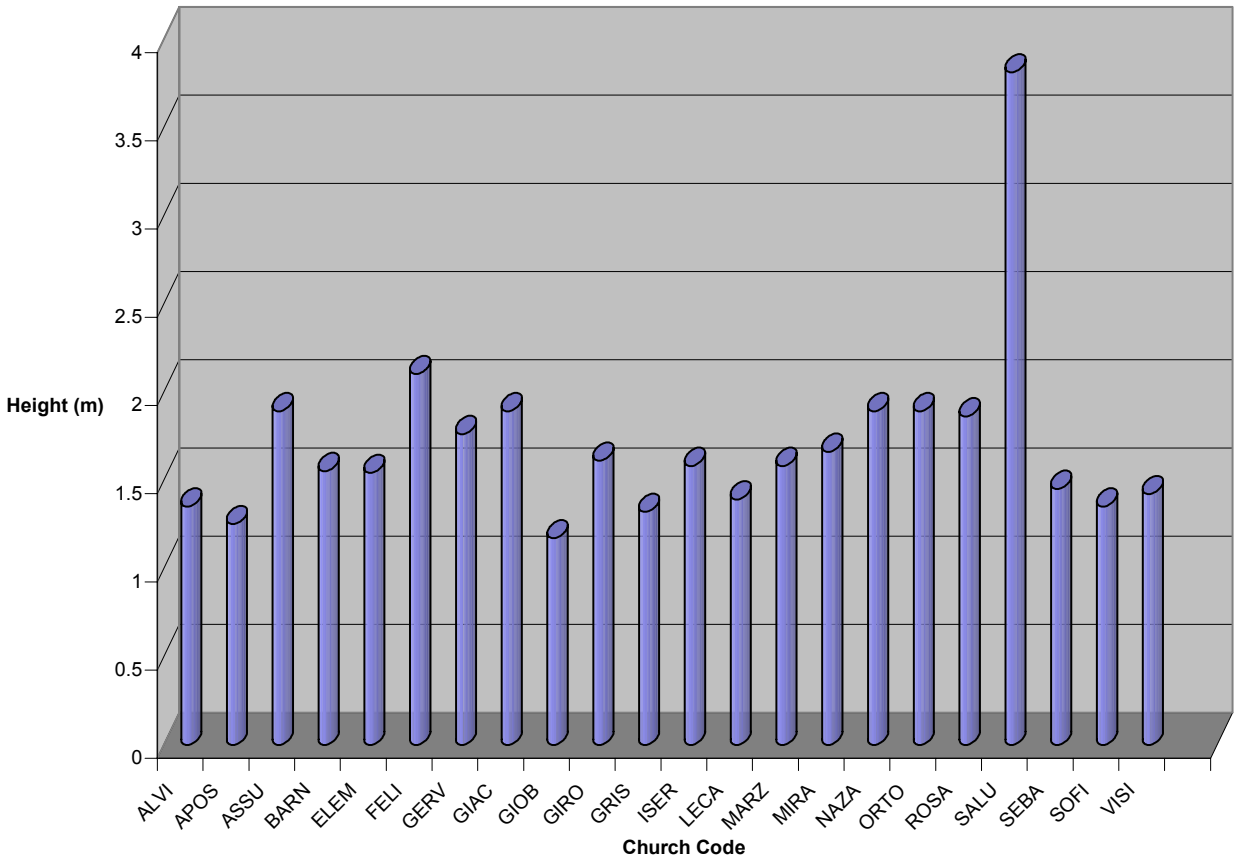

Figure 32: Heights of main church floors in meters. A list of church codes and names is in the Appendix.

Shown in the chart above, Figure 32, are the heights of the main floors of the church floors. These heights will be important to the assessment of the threat from high floods. As seen in this chart the *San Giobbe* (GIOB) has the lowest main floor, while the main floor of *Santa Maria della Salute* (SALU) is well above the heights of the other floors.

4.2 Floor Conditions

A condition assessment of the church floors was one of the main components of this project. The results of the assessments were used to analyze the current condition of the existing church floor and to designate the condition of the churches.

4.2.1 Surface Damage

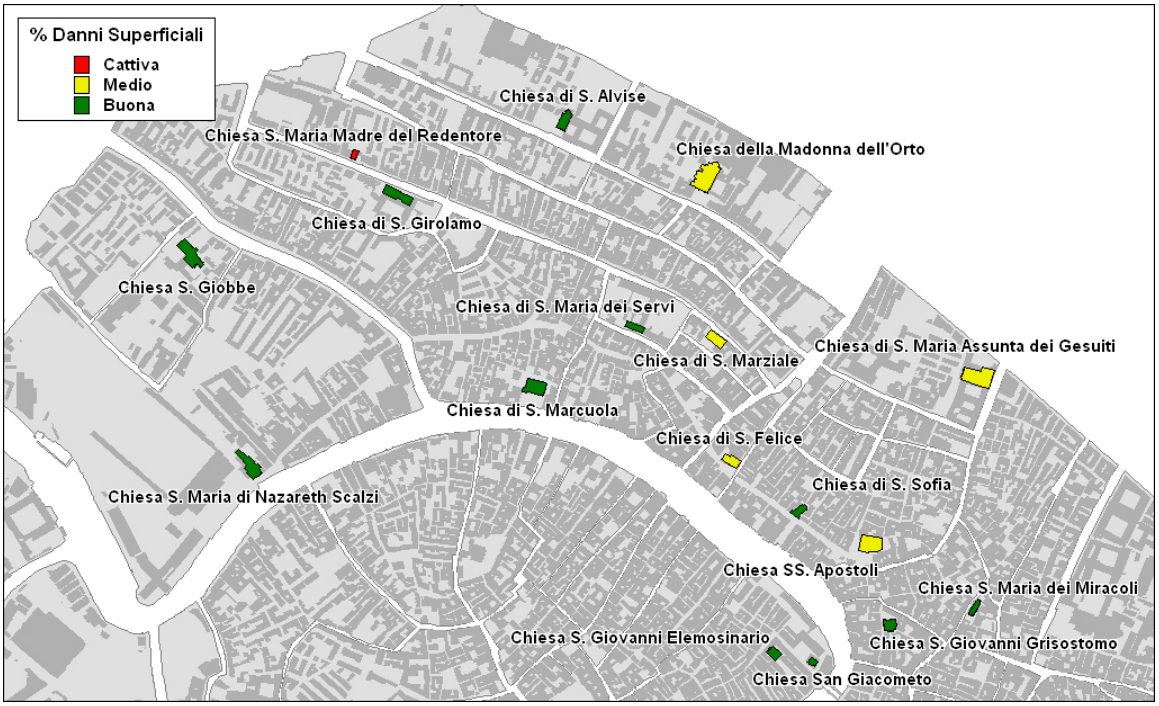

Figure 33: Surface damage for Cannaregio and San Polo

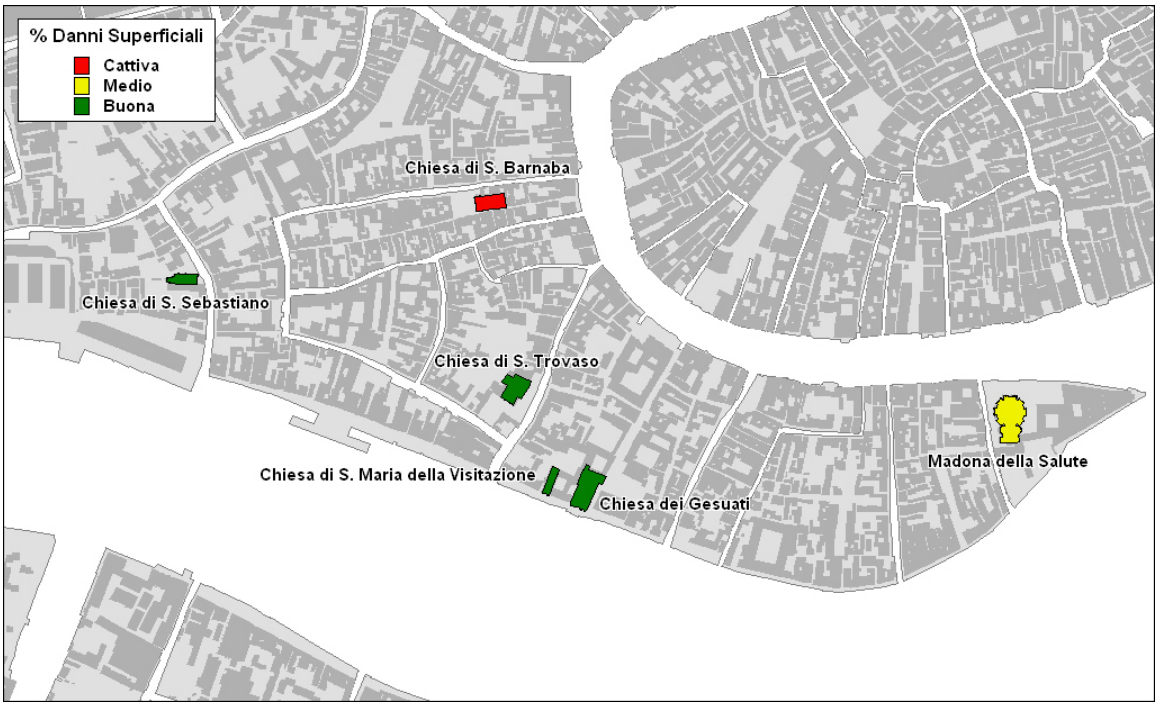

Figure 34: Surface Damage in Dorsoduro

Figure 33 and Figure 34 show the amount of surface damage to the floors of the churches. The church of San Barnaba and Le Cappuccine, also known as Santa Maria Madre del Redentore, are found to be in the worst conditions.

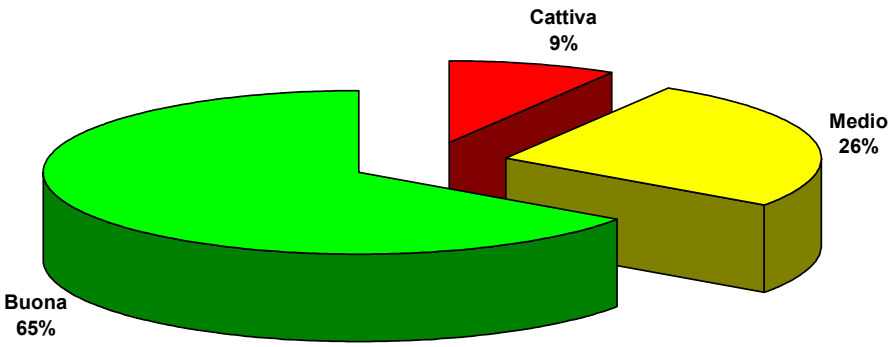

Figure 35: Percentage of Surface Damage

The above chart, Figure 35, the percentages of churches falling under each category is displayed. A majority of these churches are in fairly good condition. This data was used to determine what churches are in the worst conditions and to make recommendations to the Archeological Superintendence on what churches they may want to watch.

4.2.2 Floor Detachment

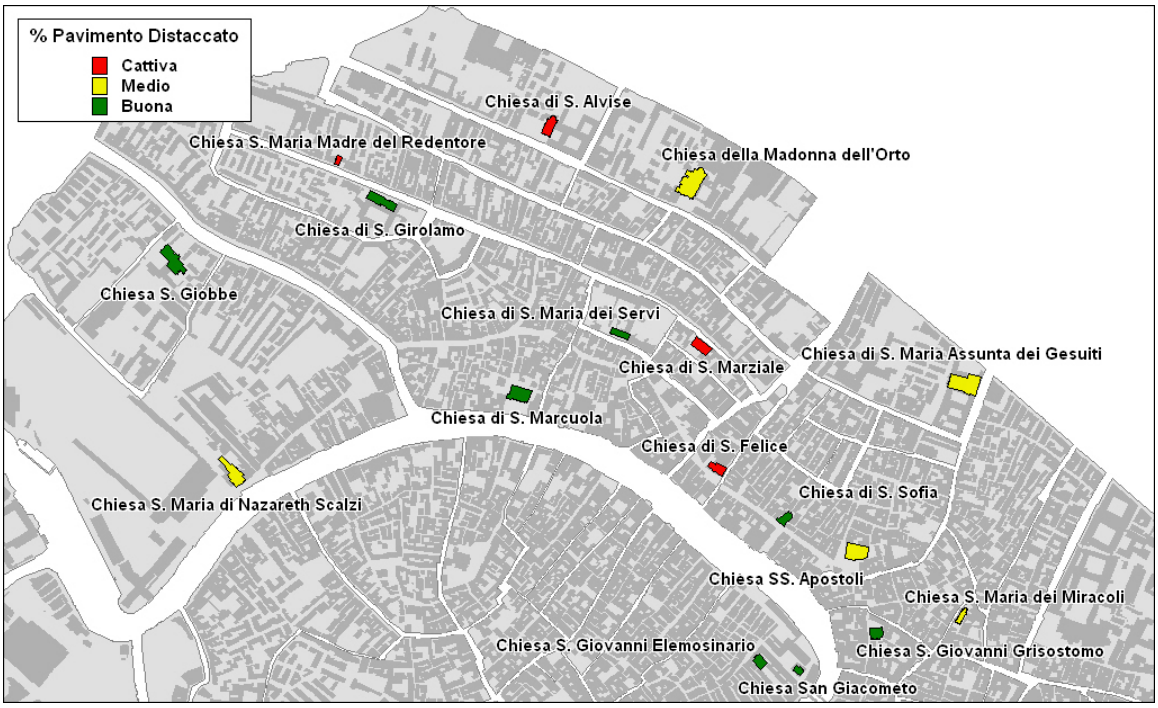

Figure 36: Floor Detachment in Cannaregio and San Polo

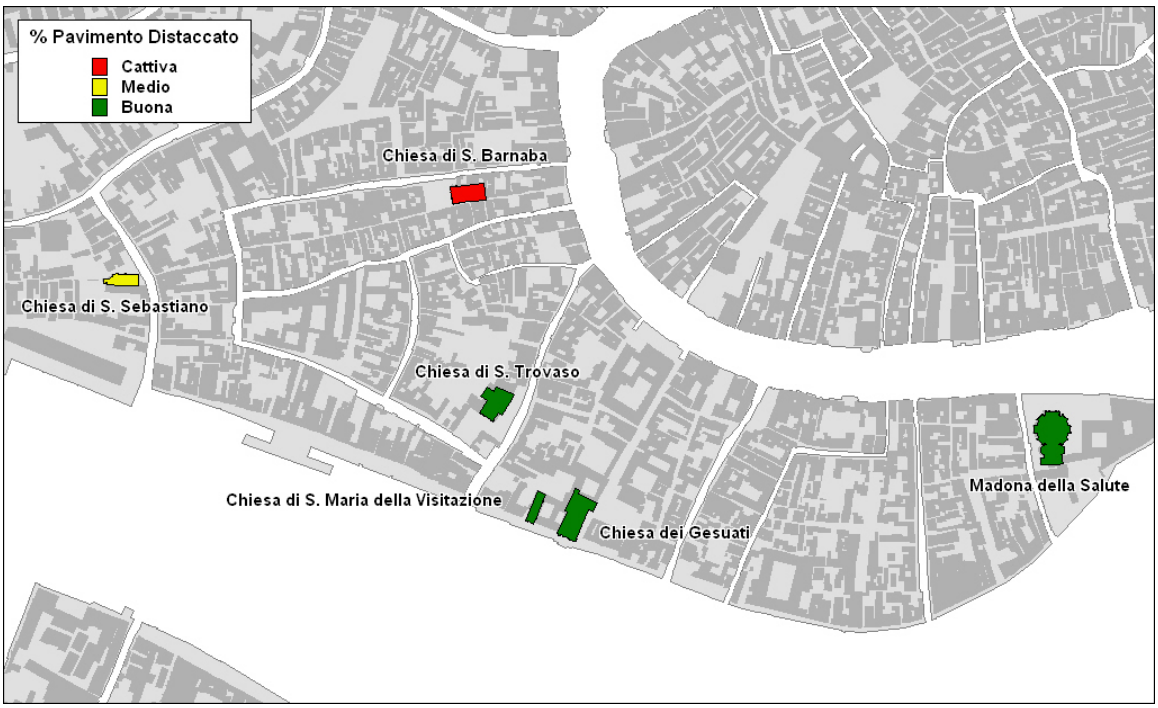

Figure 37: Floor Detachment in Dorsoduro

In the above two figures, Figure 36 and Figure 37, the amount of floor detachment is classified in three categories based on percentages of the floor per square meter. Some of the worst churches included San Barnaba, San Felice, San Alvise, Le Cappuccine, and San Marziale, also known as San Marcilliano.

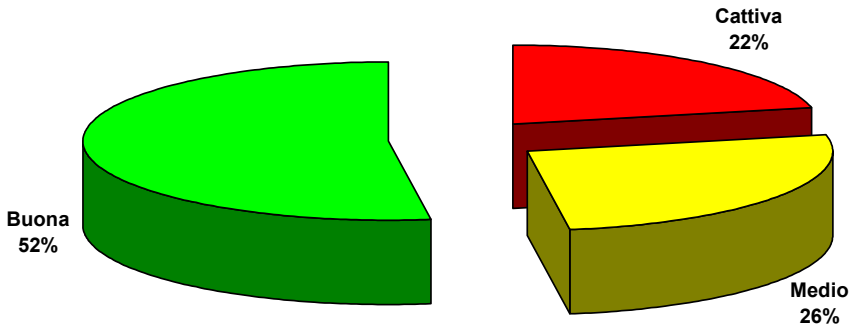

Figure 38: Percentage of Floor Detachment

In Figure 38 the percentage of churches within each category of floor detachment are illustrated. We can see that around half of the church are in good condition and almost a fourth are in bad condition. This data is also used to help determine what churches are in the worst condition. Actual data can be found in the Appendix.

4.2.3 Floor Replacement

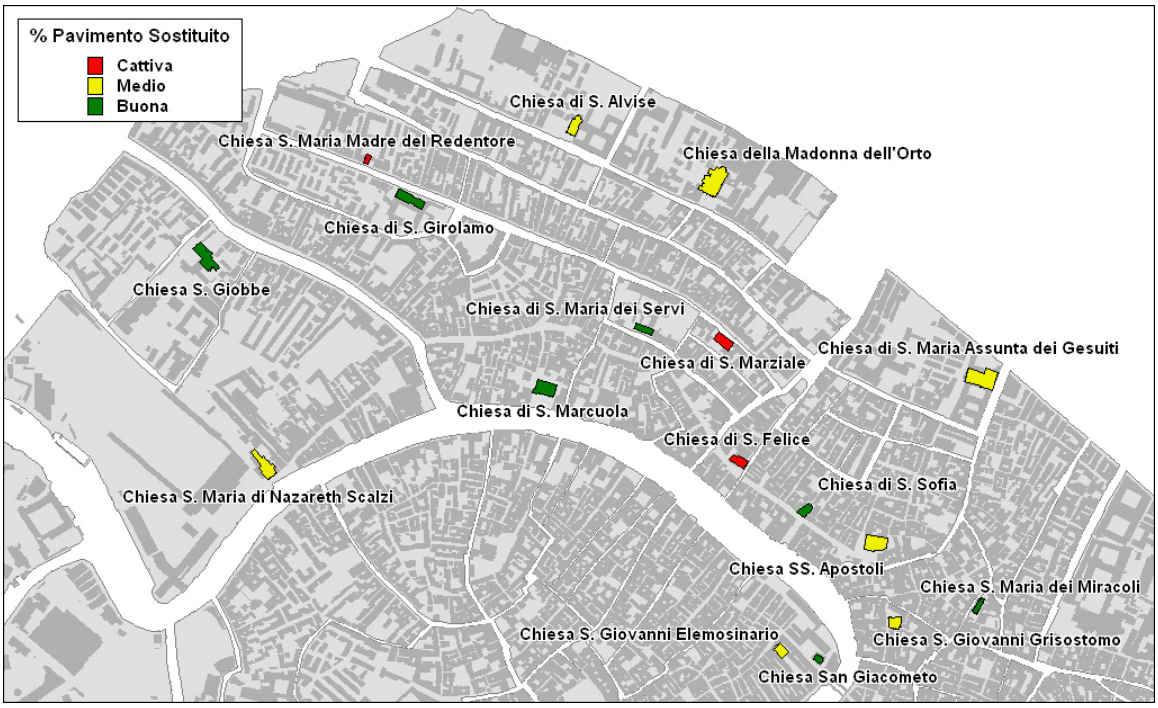

Figure 39: Floor Replacement in Cannaregio and San Polo

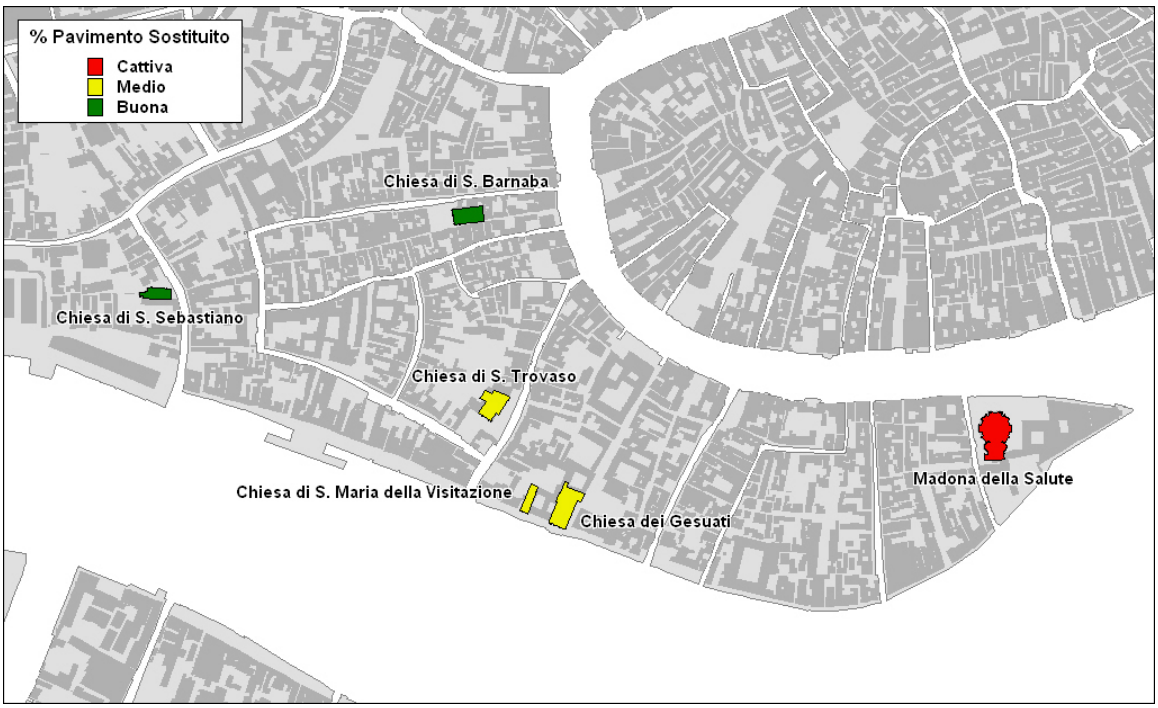

Figure 40: Floor Replacement in Dorsoduro

The degree of floor replacement for each church is shown in Figure 39 and Figure 40. Floor replacement is when a section of floor is replaced with new materials, such as the filing in of pitting or of areas of floor detachment. Some of the worst churches with floor replacement were the Madonna della Salute, San Felice, San Marziale, and Le Cappuccine.

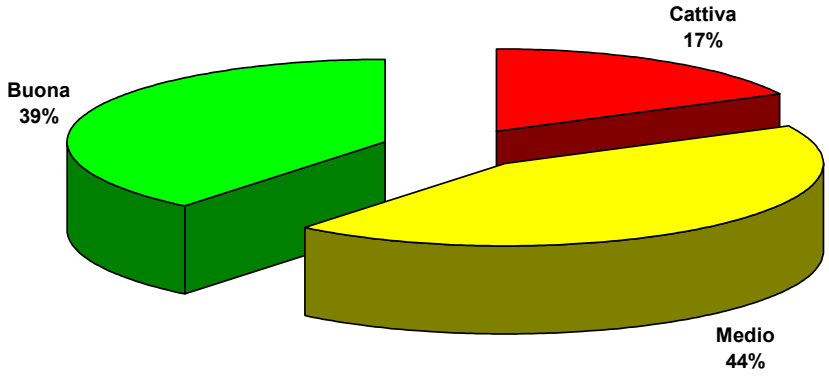

Figure 41: Percentage of Floor Replacement

Almost half the churches are in a medium state of condition with respect to floor replacement as shown in Figure 41. This will help in determining which churches are in the worst conditions. Actual data for these conclusions can be found in the appendix.

4.2.4 Problem Cracks

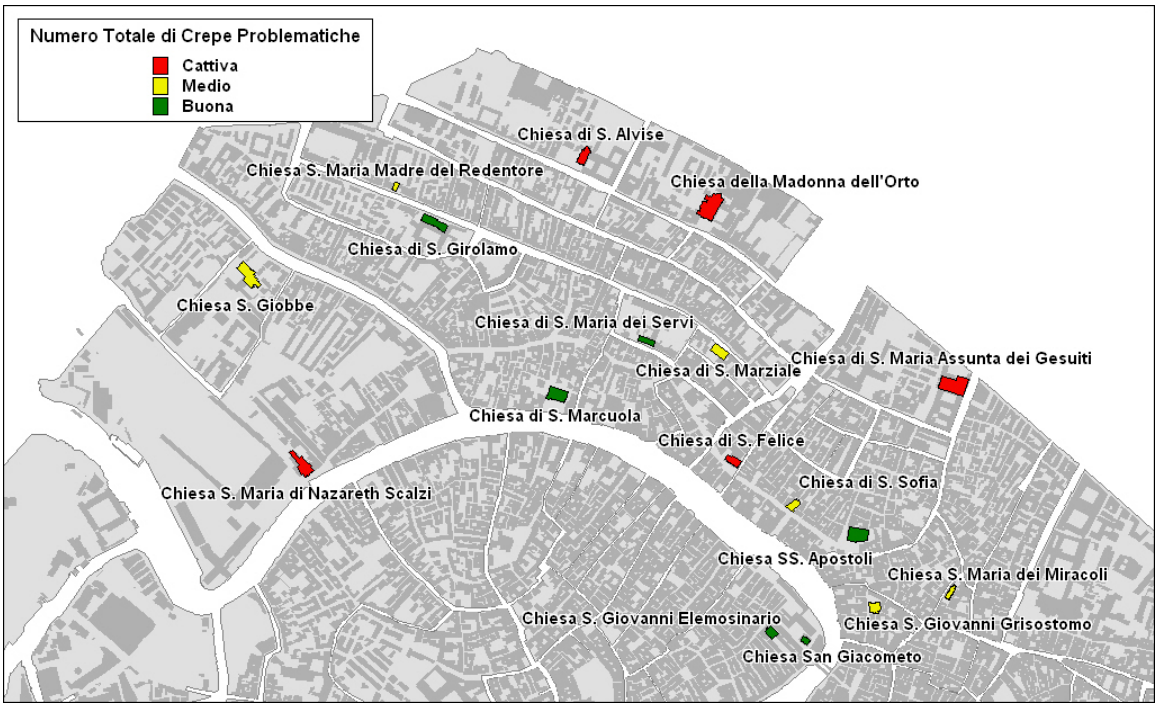

Figure 42: Number of Problem Cracks in Cannaregio and San Polo

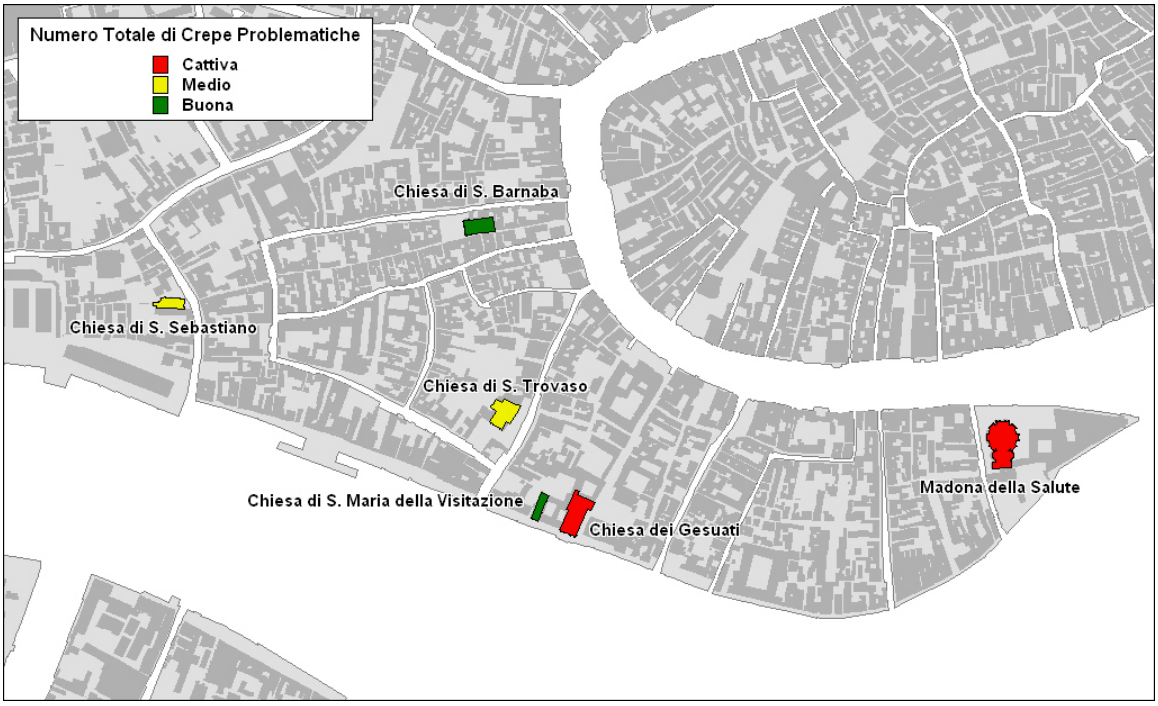

Figure 43: Number of Problem Cracks in Dorsoduro

In Figure 42 and Figure 43, the total number of cracks per church is classified in three categories. The three churches, the *Santa Maria della Salute*, *San Felice* and *Santa Maria Assunta dei Gesuiti* showed some of the worst conditions in number of problem cracks.

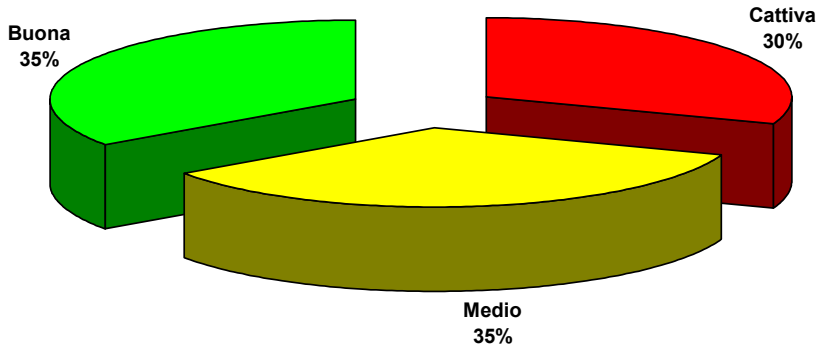

Figure 44: Total Number of Problem Cracks

The pie graph above, Figure 44, shows the percentage of churches that fall into each category due to the number of problem cracks. Each category is separated pretty evenly into the three different conditions. Actual data to support this can be found in the appendix.

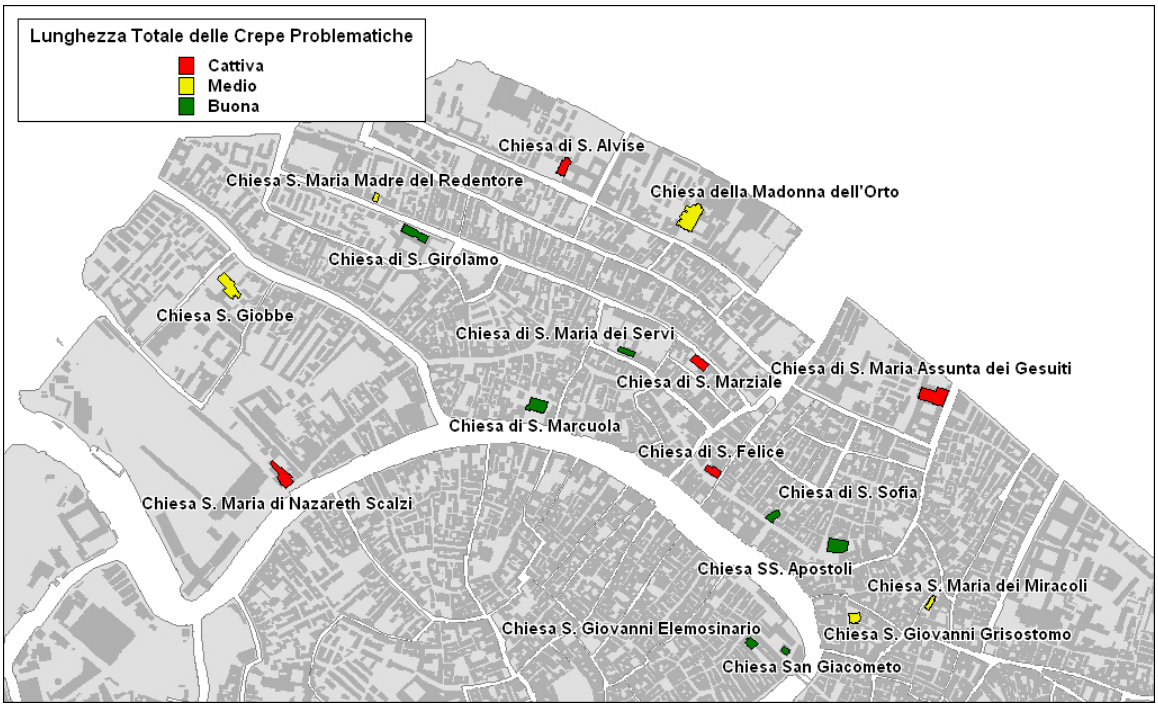

Figure 45: Total Length of Problem Cracks in Cannaregio and San Polo

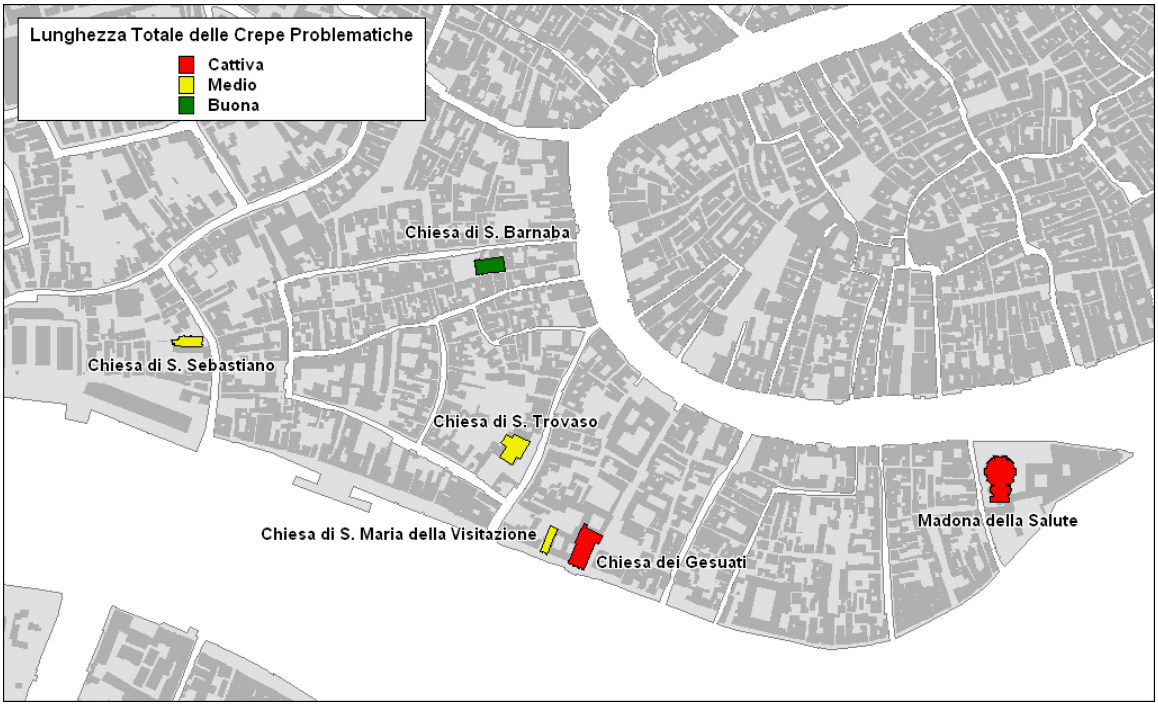

Figure 46: Total Length of Problem Cracks in Dorsoduro

Figure 45 and Figure 46 show the churches by the total length of problem cracks found on their floors. The *Santa Maria della Salute* was the worst case with its total almost doubling that of the second worst church (*Santa Maria di Nazareth*). Five of the twenty-two churches (the *San Giacomo Apostolo, San Girolamo, I Santi Apostoli, San Barnaba* and *Santa Maria de Servi*), had no cases of problem cracks whatsoever.

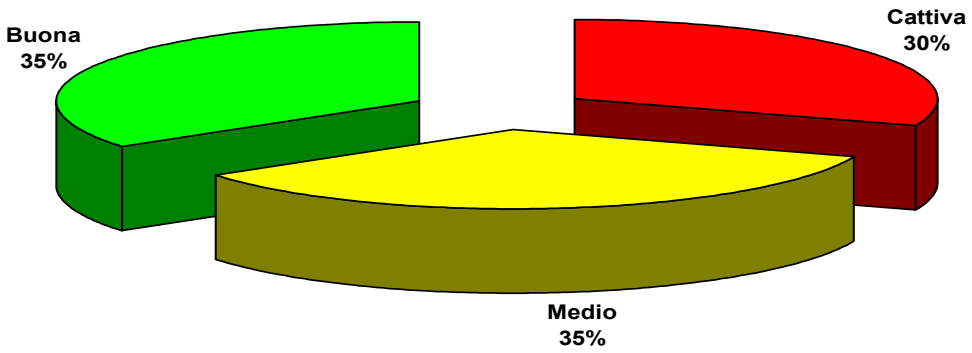

Figure 47: Total Length of Problem Cracks

The pie graph above, Figure 47, shows the percentage of churches that fall into each category due to the number of problem cracks. Each category is separated pretty evenly into the three different conditions. Actual data to support this can be found in the appendix.

FELI	2.76
NAZA	1.71
SALU	1.49
ALVI	1.37
LECA	1.28
ROSA	0.98
MARZ	0.97
MIRA	0.85
GRIS	0.64
ASSU	0.63
SEBA	0.37
GERV	0.36
VISI	0.33
ORTO	0.32
GIOB	0.29
SOFI	0.18
ELEM	0.07
GIRO	0.00
GIAC	0.00
APOS	0.00
BARN	0.00
ISER	0.00

Table 1: Average problem crack length per square meter (cm)

Table 18 shows the average length of problem cracks per square meter of floor. The San Felice had the highest average, greater then the second church in the table (*Santa Maria di Nazareth*) by over one centimeter.

4.2.5 Overall Floor Conditions

San Felice	5
Sant' Alvise	4
Santa Maria della Salute	4
Le Cappuccine	3
San Marcilliano	3
Santa Maria di Nazareth	3
Santa Maria Assunta dei Gesuiti	2
San Barnaba	2
Santa Maria del Rosario	2
La Madonna dell'Orto	1

Table 2: Number of times a church received a bad rating

Table 2 shows the number of times a church received a bad rating in terms of the categories we assessed. According to the table, the *San Felice* had the worst overall floor condition obtaining a bad rating five times out of the six categories. The Sant'Alvise and *Santa Maria della Salute* also had floors in poor condition, obtaining bad ratings four times.

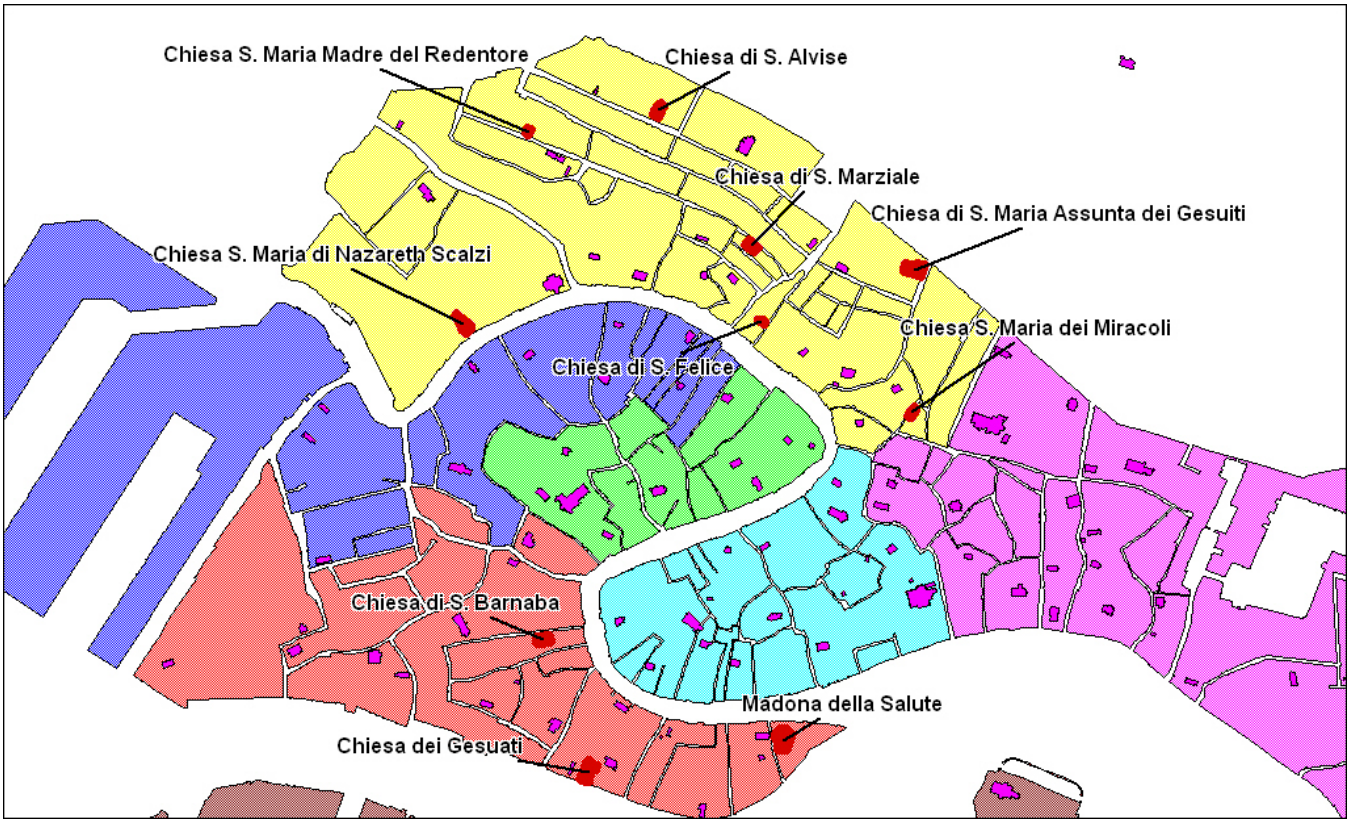

Figure 48: Location of the churches with the worst floors

In the above figure, Figure 48, the locations of the churches with the worst floors are highlighted in red and labeled. The San Felice, located in the Canneregio sestiere, contains the worst floor of the ten shown.

4.3 Artifact Condition Assessment

Another main component of this project is the condition assessment of all the artifacts in the churches. We gathered many pieces of information about each artifact in order to extrapolate an accurate assessment of an artifact's condition. These are the results taken from all the information collected:

- Percentage of Artifacts with a Text Readability between 200-300
- Total Number of Problem Cracks
- Total Lengths of Problem Cracks
- Average Percentage of Surface Cracks per Artifact

- Average Percentage of Surface Damage per Artifact

Much like the floor condition assessment, our team produced tables which ranked the artifacts from worst to best for the five categories above. Then we made note of which churches ranked in the top five spots of each category and created a list of the churches with the artifacts in the worst condition.

4.3.1 Text Readability

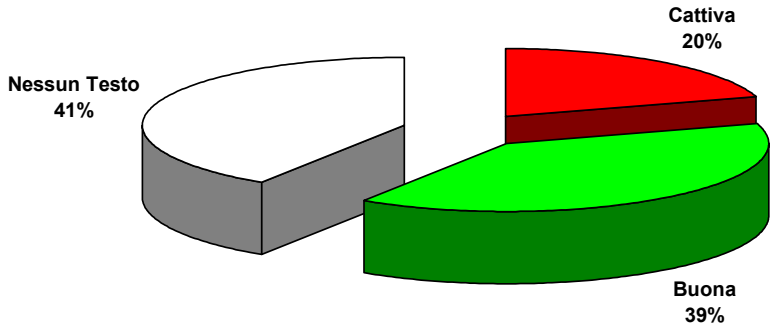

Figure 49: Percentage of total artifacts in each of the three categories

Figure 49 shows the percentage of artifacts that are mostly damaged or unreadable in all churches. The artifacts within *San Felice* show the most harm to the text with 65 percent being highly damage. *Le Cappuccine* and *I Santi Apostoli* followed next with 50 percent of their artifacts' text being highly damaged or unreadable. These specific numbers can be seen in Appendix G.

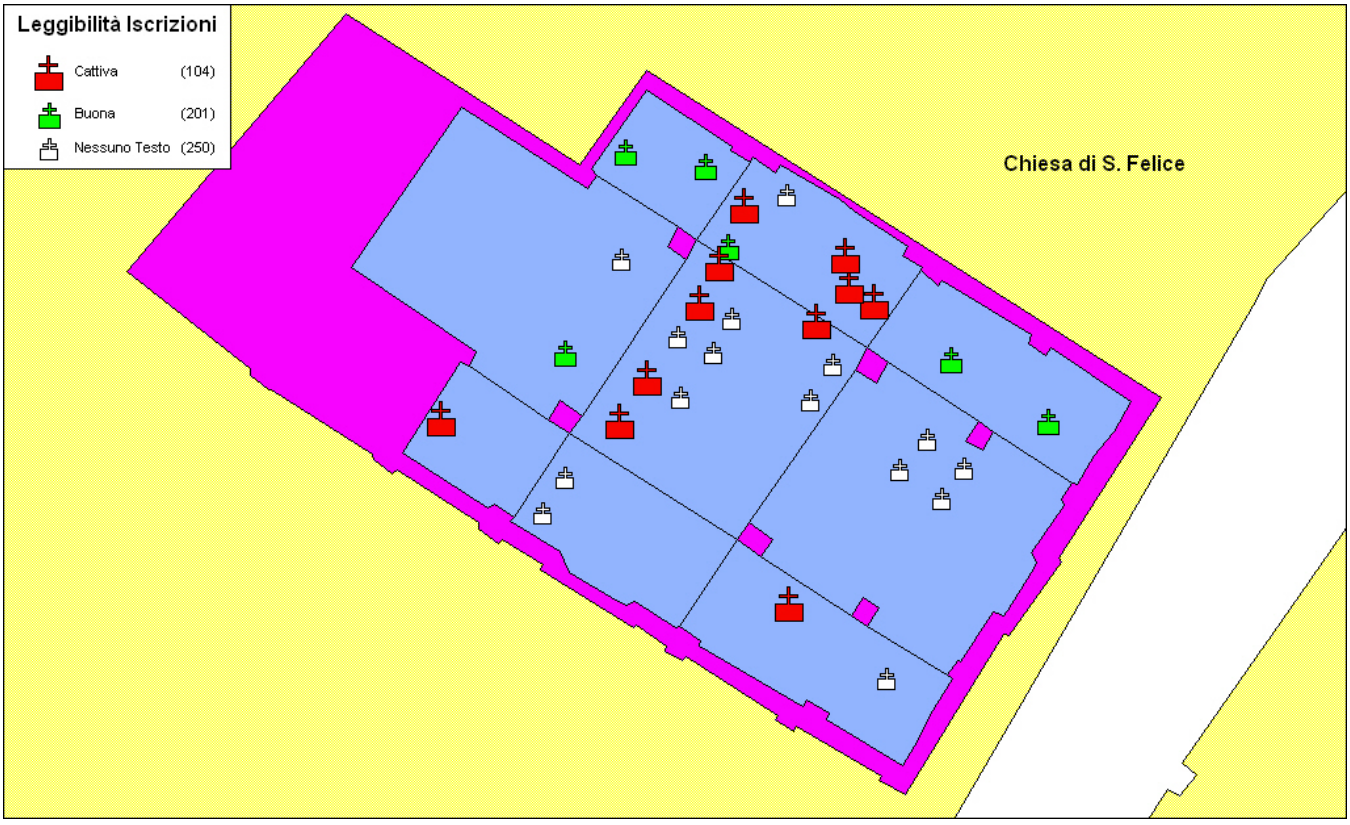

Figure 50: The Text Readability Ratings of the San Felice

The text readability of the artifacts of the *San Felice* is illustrated above in Figure 50. Of the seventeen artifacts that contain text in *San Felice*, eleven had bad text readability.

4.3.2 Problem Cracks

NAZA	270
APOS	220
GIOB	143
MIRA	124
FELI	124
GERV	94
ALVI	74
MARZ	70
GRIS	57
ROSA	56
ORTO	30
GIAC	18
SEBA	16
ELEM	10
ASSU	5
BARN	1
SOFI	0
LECA	0
GIRO	0
VISI	0
SALU	0
SERV	0

Table 3: Total number of problem cracks on the artifacts within the church.

Table 3 shows the total number of problem cracks on the artifacts in each church. The *Santa Maria di Nazareth* and *I Santi Apostoli* had the highest figures, 270 and 220 problem cracks respectively. There was a gap to the next worst church, *Santi Giobbe e Barnardino*, with 143 cracks.

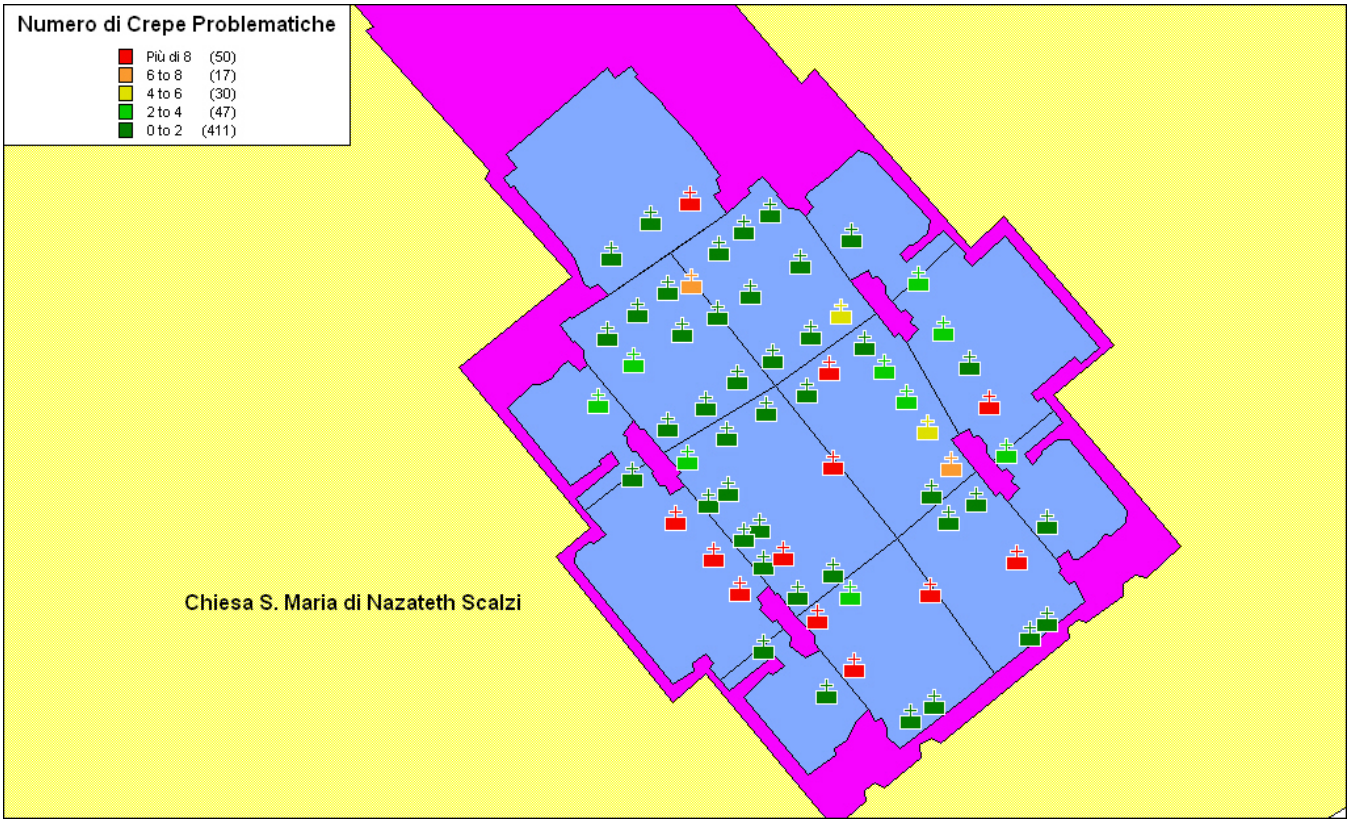

Figure 51: Total Number of Problem Cracks on artifacts in the Santa Maria di Nazareth

Figure 51 visually shows the number of problem cracks found on each artifact within the *Santa Maria di Nazareth*. Many artifacts found in this church are in fairly good condition, but twelve artifacts each contained more then eight problem cracks.

NAZA	2455
APOS	1962
GIOB	988
GERV	835
MIRA	796
FELI	657
ALVI	592
MARZ	500
GRIS	346
ROSA	330
GIAC	215
ELEM	140
ORTO	130
SEBA	124
ASSU	62
BARN	5
SOFI	0
LECA	0
GIRO	0
VISI	0
SALU	0
SERV	0

Table 4: Total length of the problem cracks on the artifacts.

Table 4 lists the total length of problem cracks found on artifacts. The *Santa Maria di Nazareth* and *I Santi Apostoli* were the worst cases for problem cracks, having total problem crack lengths at least doubling that of any other church included in data collection.

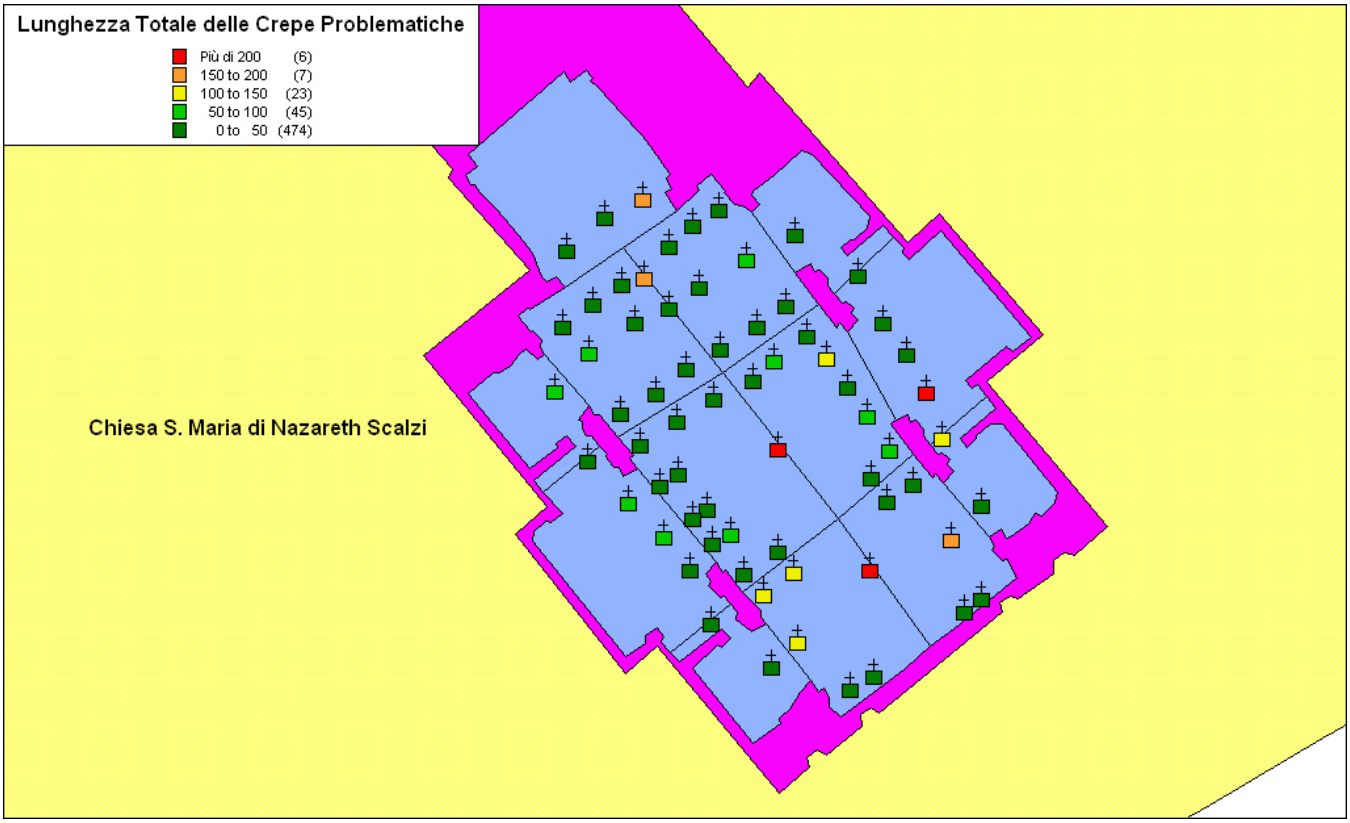

Figure 52: The Total Length of Problem Cracks on Artifacts in the Santa Maria di Nazareth

Illustrated in Figure 52 is the total length of problem cracks found on the artifacts within *Santa Maria di Nazareth*. Many of the artifacts within this church were in good condition, while eleven artifacts produced a greater part of the total length. Three of the six worst total lengths of problem cracks per artifact can also be found within this church, having lengths greater then 200cm.

4.3.3 Surface Cracks

ALVI	18
MARZ	12
GIOB	11
ASSU	10
SEBA	10
APOS	9
GIAC	9
MIRA	9
GRIS	8
NAZA	8
ELEM	7
FELI	6
BARN	6
ORTO	5
GERV	5
ROSA	4
SALU	3
LECA	1
GIRO	0
SOFI	0
VISI	0
SERV	0

Table 5: Average percentage of surface cracks on the artifacts.

Table 5 ranks the churches by the average percentage of surface cracks on the artifacts. The *Sant' Alvise* had the highest average of eighteen percent, followed by the *San Marcilliano* averaging twelve percent.

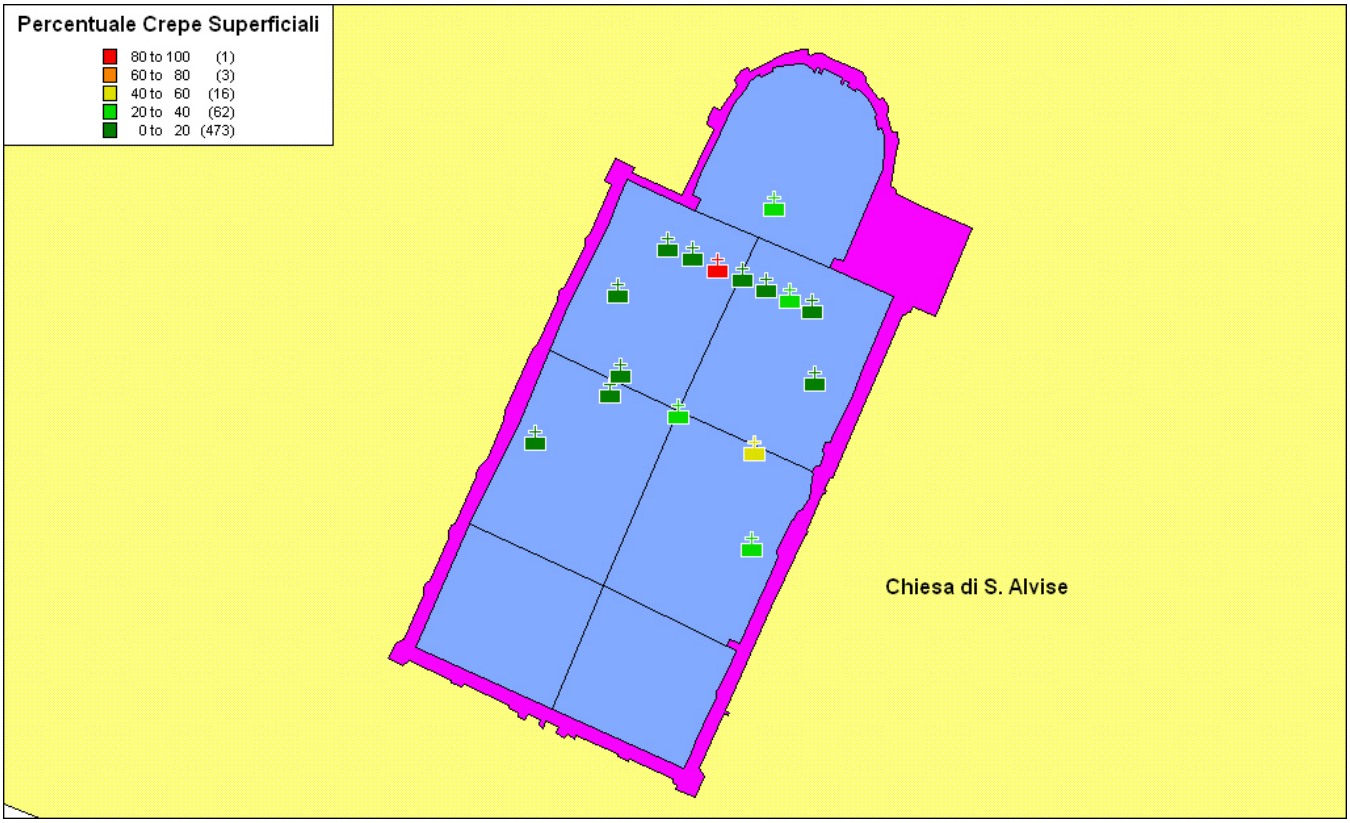

Figure 53: Percentage of Surface Cracks Found on the Artifacts in the Sant' Alvise

Figure 53 displays the percentage of surface cracks found on the artifacts in the *Sant' Alvise*. The worst case artifact can be found within this church, sustaining damage on greater then 80 percent of the artifact. Most of the church's artifacts remain in good condition.

4.3.4 Surface Damage

ALVI	29
GIOB	27
APOS	20
GIAC	18
SEBA	17
MIRA	16
GRIS	16
MARZ	15
ASSU	14
ORTO	11
BARN	10
NAZA	9
FELI	6
GERV	6
ROSA	5
SALU	5
ELEM	5
LECA	4
GIRO	0
SOFI	0
VISI	0
SERV	0

Table 6: Average percentage of surface damage on the artifacts.

The average percentage of surface damage on artifacts is noted in Table 6. The *Sant' Alvise* again had the highest average of twenty-nine percent. The *Santi Giobbe e Barnardino* followed close behind with an average of twenty-seven percent.

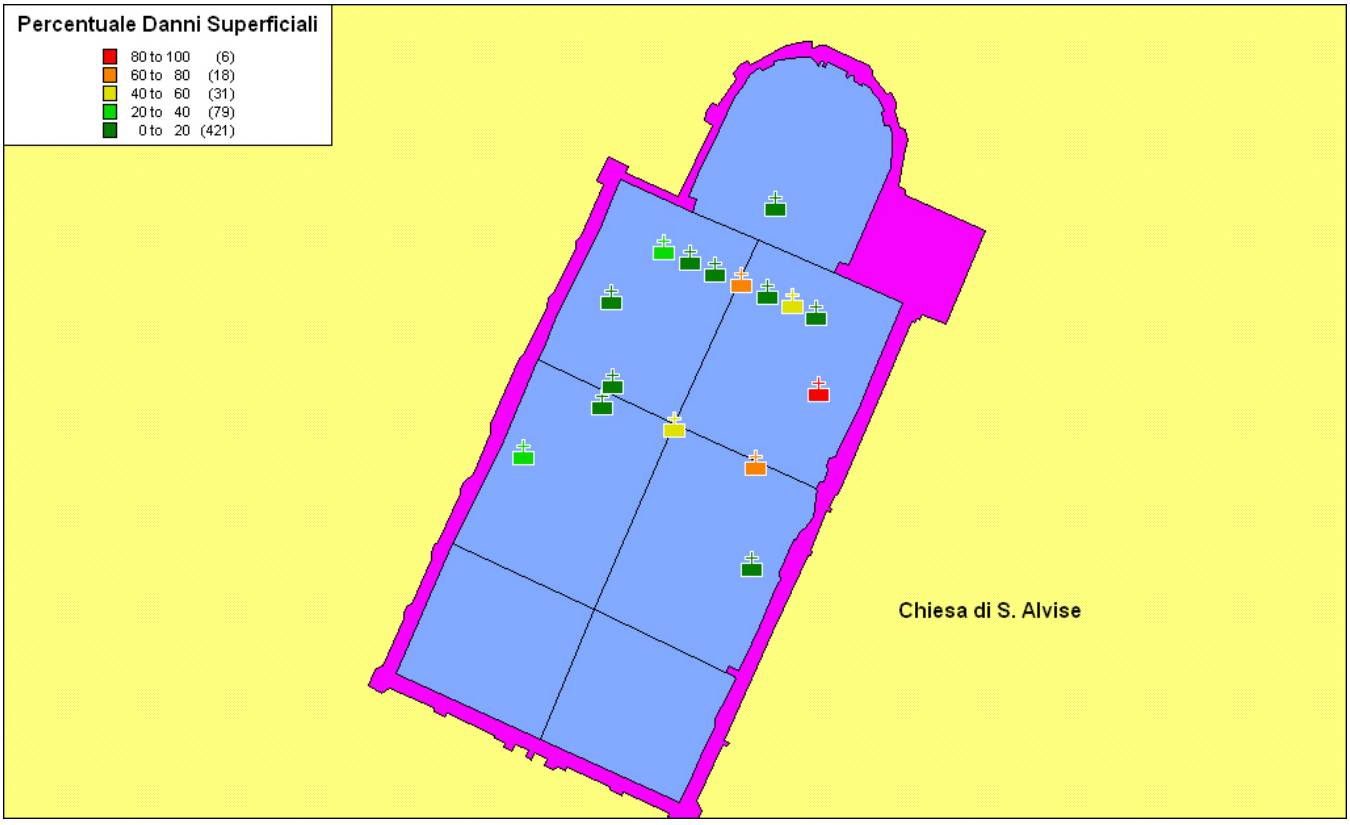

Figure 54: The Percentage of Surface Damage found on Artifacts in the Sant' Alvise

The percentage of surface damage found on the artifacts in the *Sant' Alvise* is shown in Figure 54. One of the six worst cases of having over 80 percent surface damage can be found within this church.

GIOB	5
APOS	4
FELI	2
MARZ	2
NAZA	2
MIRA	2
ALVI	2
SEBA	2
LECA	1
GERV	1
ASSU	1

Table 7: Number of times a church placed in the worst five.

Table 7 noted the number of times churches placed in the worst five rankings in the five categories show above pertaining to the artifacts. The *Santi Giobbe e Barnardino*

showed the worst results, having come up in the worst five for all five categories. The artifacts in the *I Santi Apostoli* also were in poor condition, having shown up in the worst five for four of the five categories.

5 Analysis

The information gained by this project supplemented previous work completed on Venetian churches in past projects by performing extensive research and data collection, developing a floor and artifact condition rating scale, as well as assessing the condition of church floors and the artifacts located within. Our main focus of analysis was to expose the threats that exist to the current church floors and the artwork that is embedded within. There are many threats that have been exposed through the course of our research. By doing an in depth analysis of our data, we also determined ways to deal with the threats that were discovered.

5.1 Floor Vulnerability with High Tides

The first threat to church floors are the detrimental effects of high tides. The *acqua alta* season is in its peak from October to April, where in recent years tides reached over 1.1 meters approximately 4 times per season. The overall level and frequency of the high tides affecting the city of Venice have been increasing over the past century (Figure 55).

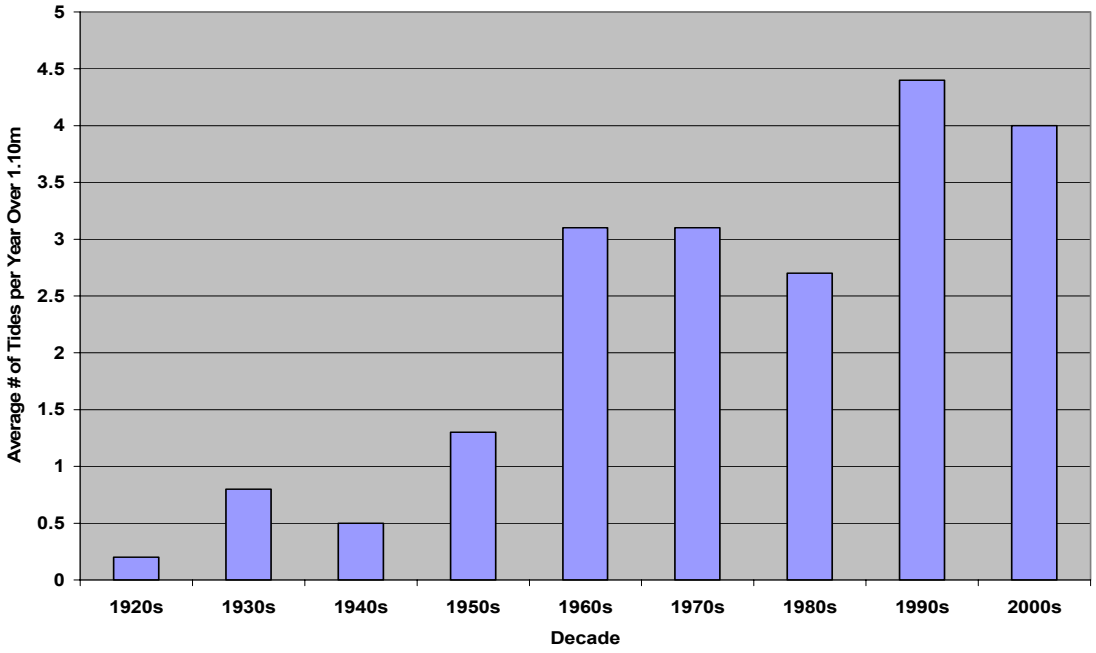

Figure 55: The average number of tides per year over 1.10cm from 1920-2000.[29]

Water is a powerful force that is known for eroding through stone over time. With the frequency of tides increasing over the years, the erosion caused by the water is also increasing. The water coming up to the floor often aids in the slow destruction of the materials, which is often overlooked because it is not an immediate or obvious threat.

The inconvenience of floods and the damage that has occurred has caused churches to try and solve the problem by simply laying a new floor on top of the previous one. Since there are floors that have been built upon, there is a very high chance that archeological or historical treasures have been lost or misplaced in the process. Our project has given the Archeology Superintendence headway in determining what churches contain hidden archeological information under the floors.

The solution which entails laying a new floor over the previous one is not always the best however, because water still gets under the floors during flooding and deteriorates the material that is the foundation of the church. Structural damage is then caused and the whole church is in danger and not just the floor.

[29] Valori Astronomici. Citta di Venezia, Presidenza del Consiglio dei Ministri, C.N.R. 2002

Knowing the heights of the floors related to the absolute zero point in Venice has helped us to determine which churches are most threatened by *acqua alta*. The churches with the lowest heights are most at risk and likely to consider a means of protecting or avoiding the high waters. Some solutions include churches building the floors higher or deciding to build a concrete liner below the floor. The concrete liner is a new process and requires removing the floors down to the foundation and pouring concrete to keep water out from under the floor. It is very effective of keeping water out from under the floors, but it is a long process and fairly expensive. The process usually uncovers many archeological treasures that are very valuable to the Archeology Superintendence, however. The churches that are at risk from *acqua alta* are among some that the Archeological Superintendence needs to be aware of to get an opportunity to study beneath the floor while the church is undergoing construction.

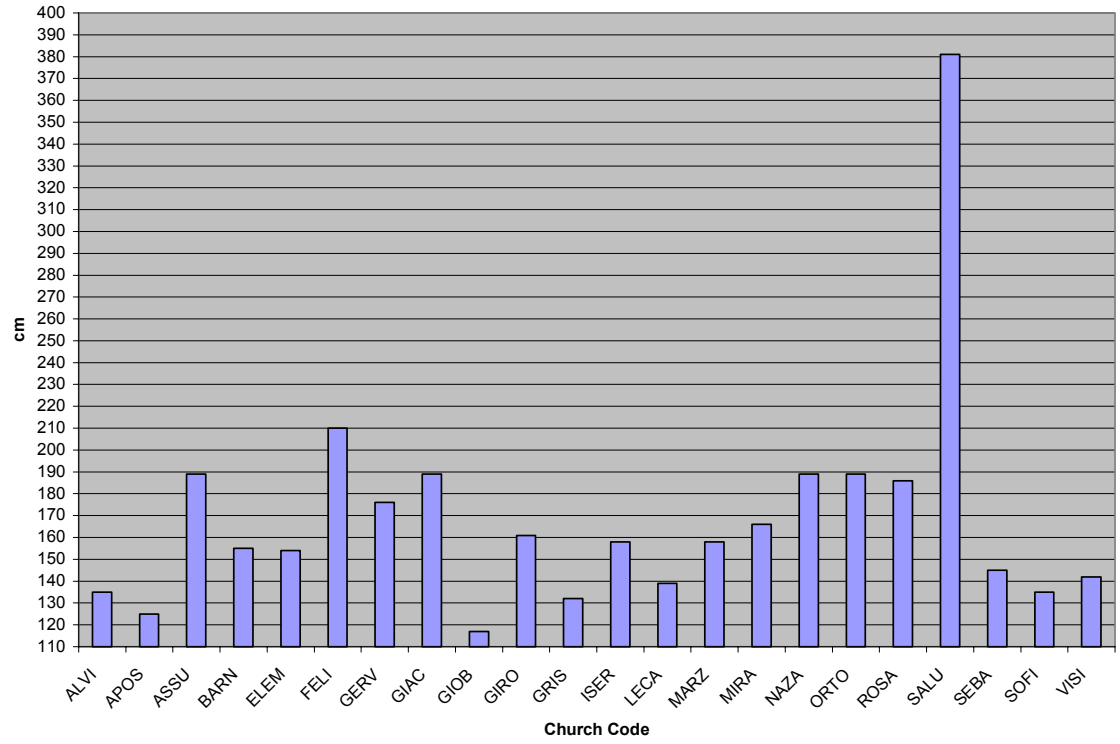

Figure 56: Heights of church floors above 110cm.

This chart exhibits the heights of the main church floors above 110cm. In the past ten years, a flood over 110cm has occurred about 4 to 6 times per year.[30] A church like the *Santi Giobbe e Barnardino* (GIOB) is more likely to flood during those times than the *San Felice* (FELI) or the *Santa Maria della Salute* (SALU). The church that had the lowest section of floor however was the *I Santi Apostoli* (APOS), which contained a small chapel off to the side that had a height of only 91 cm above the absolute zero level. This data was also represented on a map of Venice in a more visual manner and can be seen in Figure 58 and Figure 59. In Figure 57 it can be seen that over half of the churches we studied are at a pretty safe level above the sea height.

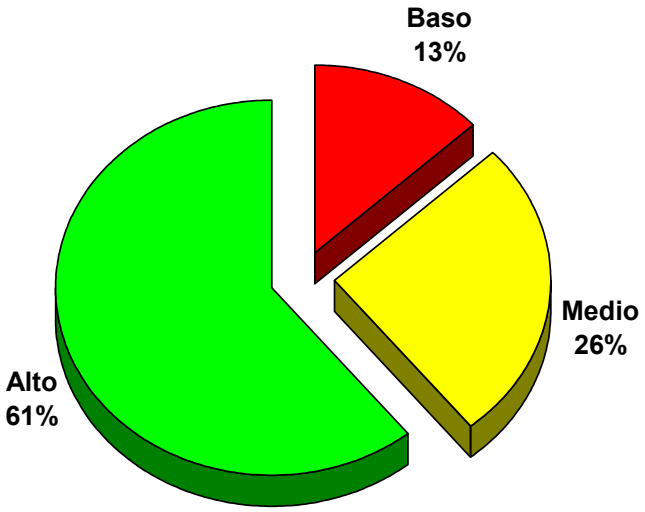

Figure 57: Main Floor Heights of Churches

[30] Idem.

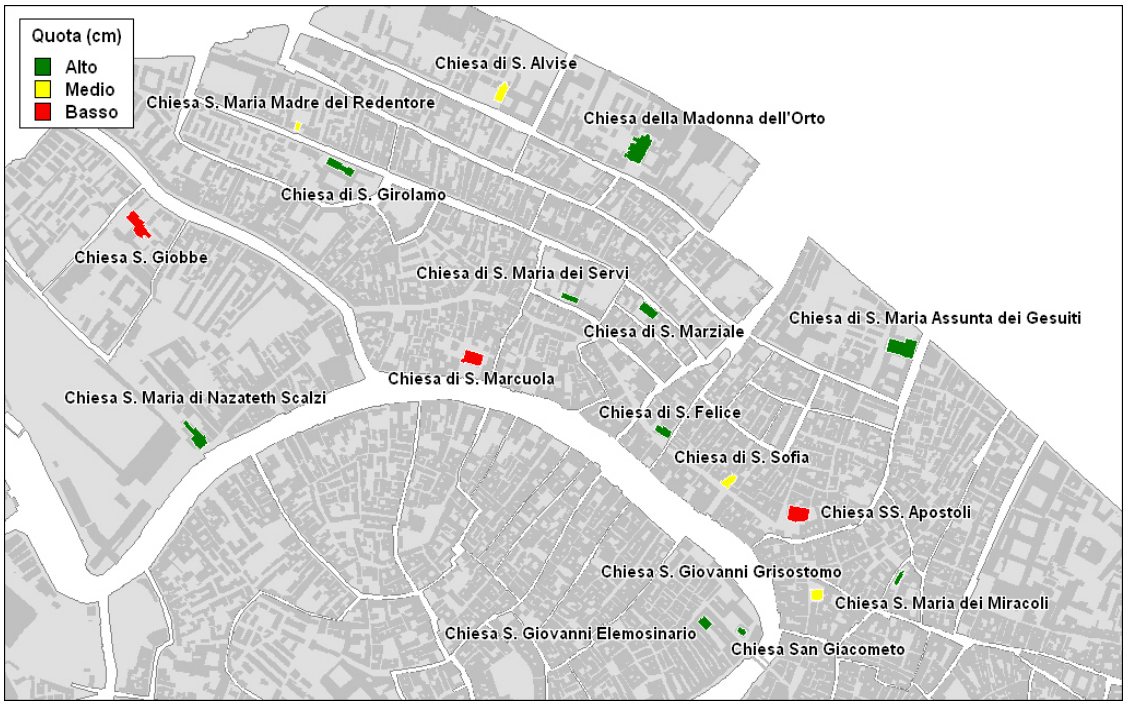

Figure 58: Church floor heights in the Canneregio and San Polo sestieri.

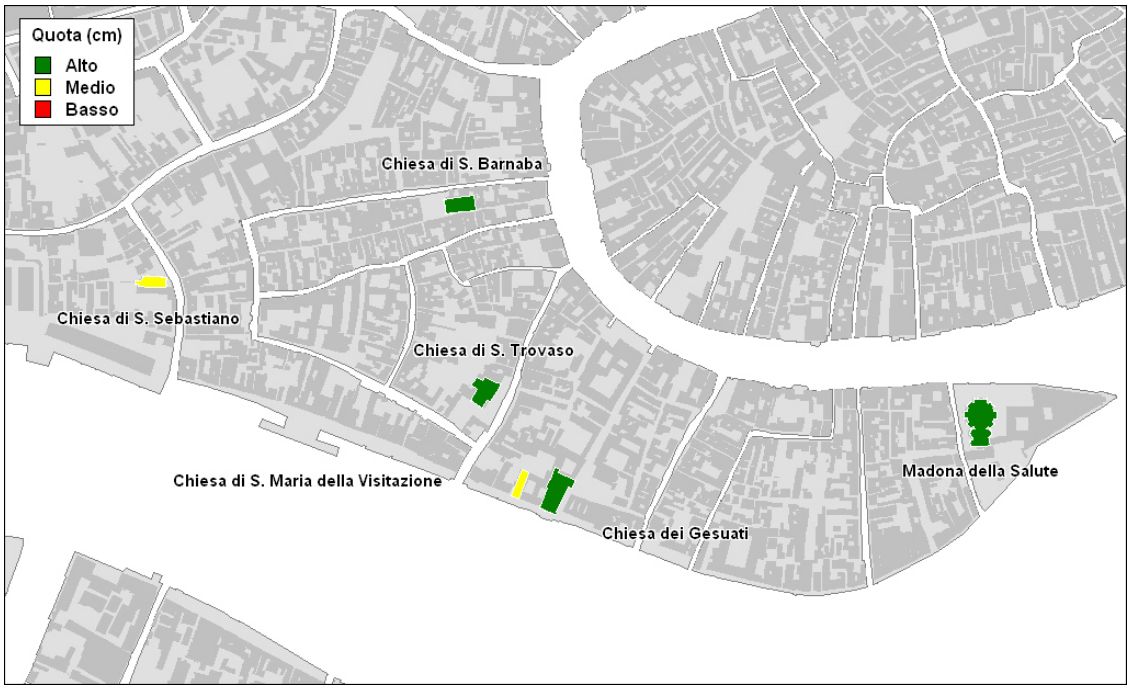

Figure 59: Church floor heights in the Dorsoduro sestiere.

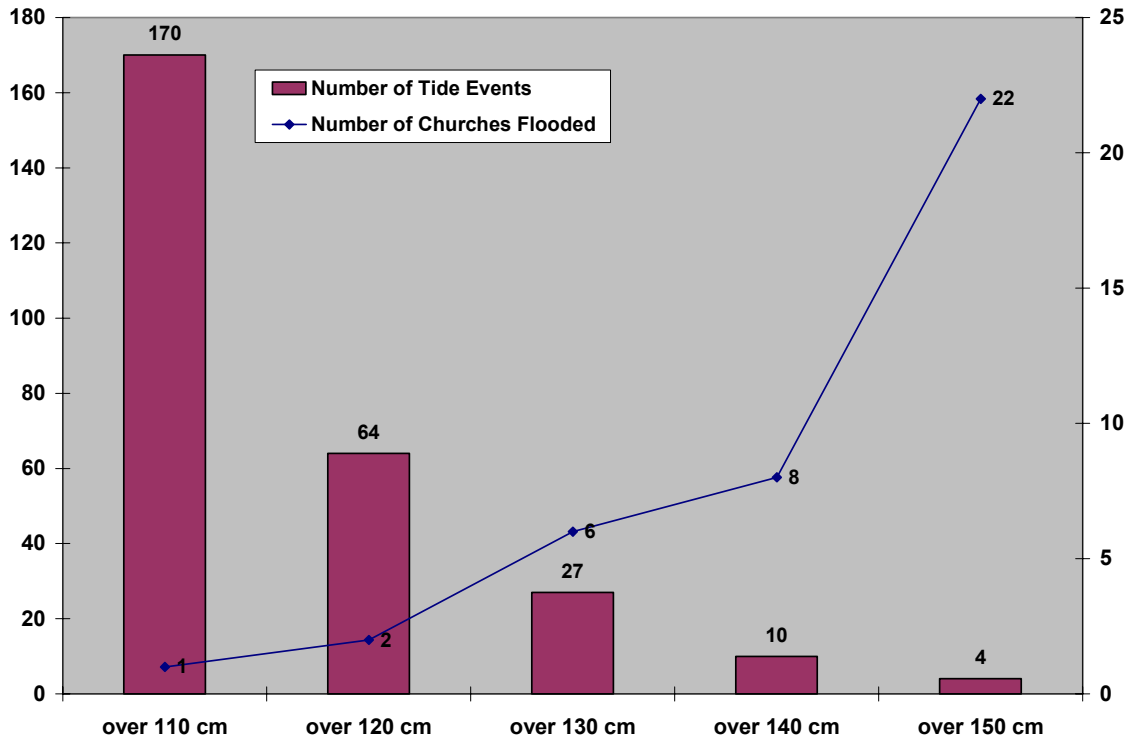

Figure 60: Number of high tides since 1927 and number of churches affected by each.

Figure 60 displays the number and severity of high tides that have occurred since 1927 and the number of churches that are affected by the various tide heights. Bars were used to symbolize tides and data points used to represent the number of churches affected. This is important in visualizing which churches have been consistently flooded. With this chart we found that *I Santi Apostoli* and the *Santi Giobbe e Barnardino* together have been affected by the tides approximately 140 times since 1927.

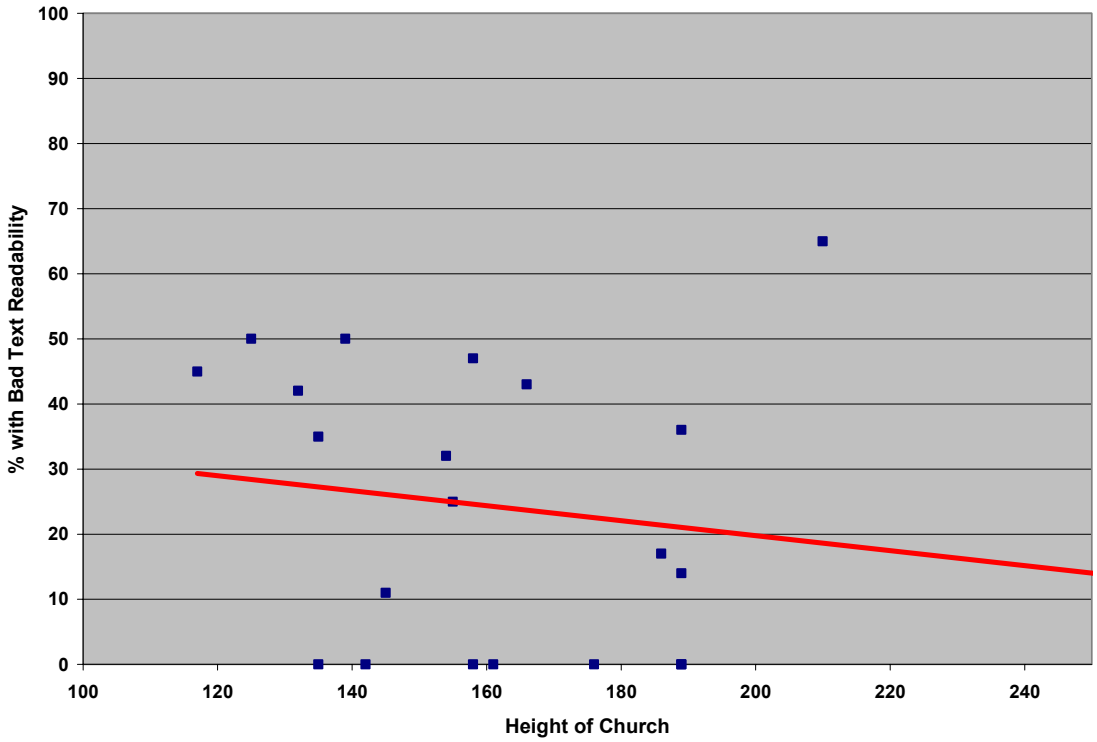

Figure 61: Church height in relation to text readability

Figure 61 illustrates that high tides have a tendency to adversely affect the text readability of artifacts. The *I Santi Apostoli* and the *Santi Giobbe e Barnardino* both have low heights and a high percentage of artifacts with damaged and/or unreadable text. The *Sant' Alvise* has a higher floor and the percentage of artifacts with bad text readability is less than the *Apostoli* and the *Giobbe*. Finally, the *San Sebastiano* has a higher floor and few artifacts that have damaged text. This brought us to the conclusion that artifacts located within lower church floors, which are susceptible to a greater number of high tides, are in fact being damaged by the water and the chemicals that might be present within the water.

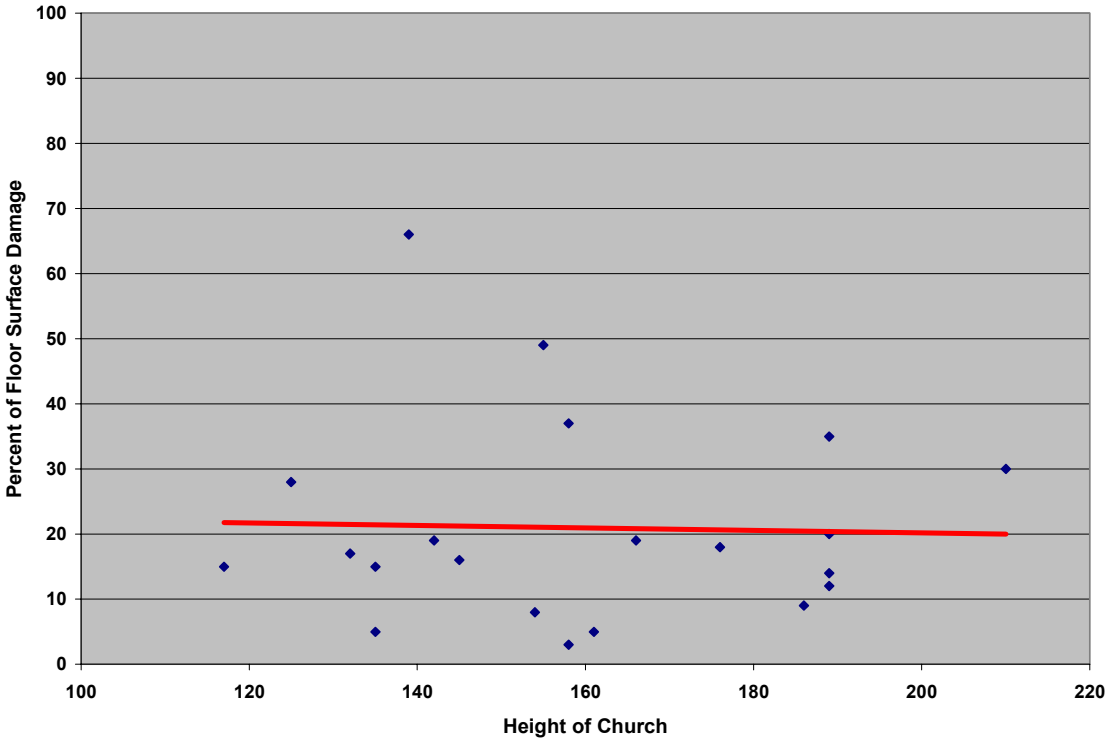

Figure 62: Church height in relation to floor surface damage.

Figure 62 demonstrates the effect that high tides have on church floors. The church floors that are higher from the absolute zero point, therefore less susceptible to greater number of floods, are not being damaged as greatly as those churches which are closer to the absolute zero. Ultimately, these charts lead us to the conclusion that the high tides cause damage to both the floors and artifacts of churches that are closest to sea level.

5.2 Hidden Artifacts Due to Raised Floors

Churches that contain little or no artifacts and have high floors that are not likely to be affected by high tides should be of concern to the Archeology Superintendence. If there are no artifacts on the floor and the floor is higher and/or not affected by tides very often then it is possible that the floor has been raised at some point or replaced. This leads to the speculation that there is archeological information in the floor that has been covered up.

I Santi Apostoli	68
Santa Maria di Nazareth	65
Santa Maria del Rosario	50
Santa Maria dei Miracoli	43
San Trovaso	36
San Felice	32
San Marcilliano	31
San Sebastiano	29
San Giovanni Elemosinario	28
San Giovanni Grisostomo	28
Santi Giobbe e Barnardino	25
San Barnaba	24
Sant' Alvise	16
Santa Maria Assunta dei Gesuiti	15
San Giacomo Apostolo	13
Le Cappuccine	10
La Madonna dell'Orto	8
Santa Maria della Salute	2
Santa Sofia	1
San Girolomo	0
Santa Maria della Visitazione	0
Santa Maria de Servi	0

Table 8: Churches and the number of artifacts within them. Names and codes can be found in the Appendix.

This table, **Table 8**, shows that the *Santa Sofia* (SOFI), *San Girolomo* (GIRO), *Santa Maria della Visitazione* (VISI), and the *Santa Maria de Servi* (SERV) have little or no artifacts in the current floor.

Santa Sofia	135
San Girolomo	161
Santa Maria della Visitazione	142
Santa Maria de Servi	158

Table 9: Four churches with little or no artifacts and their heights in centimeters.

As seen in,

Table 9, these four churches, which have very few artifacts, are not in immediate danger of flooding. This leads us to believe that these church floors may have been covered over at some point to prevent flooding and there are artifacts hidden beneath.

5.3 Damage Caused by Foot Traffic

Another threat that exists for current artwork embedded in the floor is the foot traffic of visitors. Artwork that exists in major walkways will get worn down more quickly than artifacts that are not, due to the many people who constantly walk over it. These pieces of artwork are more endangered than pieces of artwork that exist in a corner of the church that is out of the way of foot traffic.

	Text Readability	Number of Problem Cracks	Surface Cracks (%)	Surface Damage (%)
Main Walkways	166	2.43	8.87	13.4
No Traffic	147	4.37	12.1	19.1

Table 10: The average damage for artifacts in walkways and non-walkways

Table 10, illustrates the average artifact assessments in four separate damage categories for artifacts that are often walked on and ones that are not. In terms of text readability, artifacts that are often walked upon are suffering more damage. However, the averages for problem cracks, surface cracks, and surface damage, which are higher in less traveled areas, do not indicate that the artifacts in main walkways are suffering structural damage. Despite the fact the artifacts are not structurally damaged by being walked upon, the readability of the text, which is the most important attribute of an artifact, is being negatively affected.

Figure 63: Artifacts in the San Felice with foot traffic paths marked in grey.

As can be seen in Figure 63, the artifacts within the paths of the *San Felice* have mostly damaged or unreadable text. This is the visual representation of a trend can be seen in 13 of the 19 churches that we studied that have artifacts.

5.4 Damage Caused by Furnishings

Another major threat to the church floors and artifacts are the pews and other church furniture. Pews are often moved around causing wear and surface damage to the floor and any artifacts that lie beneath them. Often artifacts were obscured by other pieces of furniture such as altars, organs and confessional booths. These all contribute to the damage done to the floor and artifacts both through the added weight and because these pieces of furniture attract foot traffic. In order to compare damage under pews and other areas we recorded where the pews were located and analyzed the condition assessment of the artifacts under the pews.

	Text Readability	Number of Problem Cracks	Surface Cracks (cm)	Surface Damage (cm)
Underneath Pews	185	1.92	6.91	12.27
No Traffic	147	4.37	12.1	19.1

Table 11: The average damage for artifacts situated underneath pews and artifacts that are not.

Table 11 illustrates that the text on artifacts underneath pews is in worse condition than artifacts that are neither walked upon nor underneath pews. Like the artifacts located in main walkways, the other three damage assessments do not confirm that artifacts underneath pews suffer structural damage.

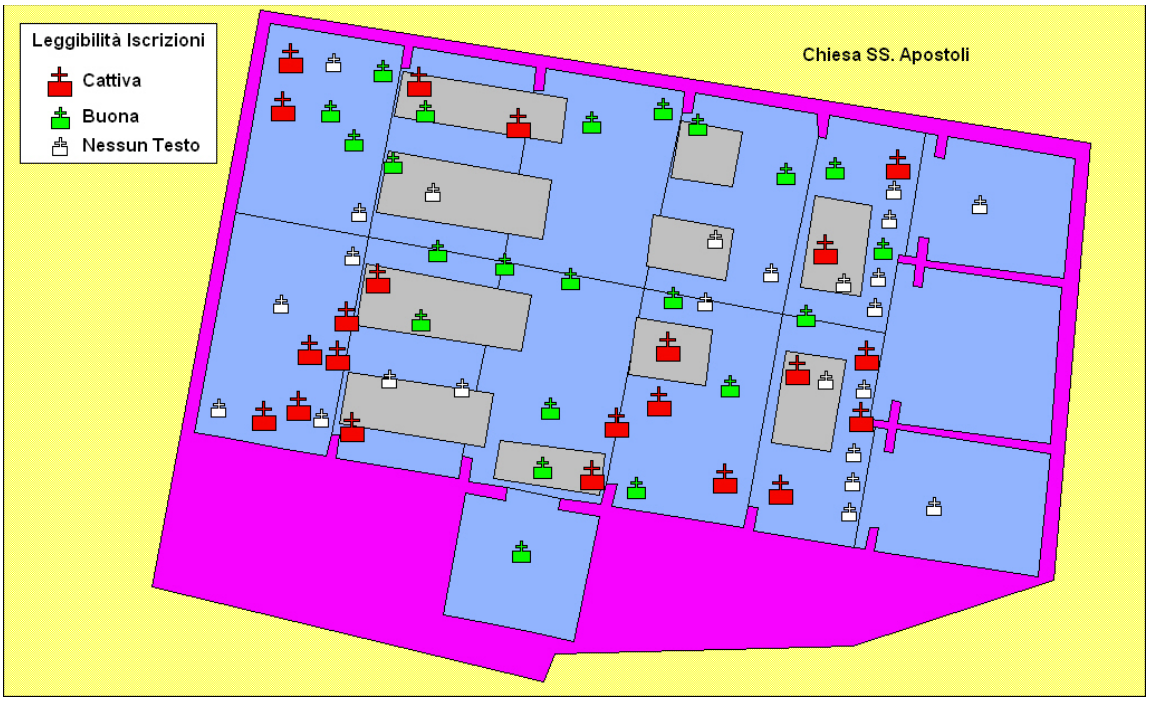

Figure 64: Artifacts in the *I Santi Apostoli* with the pews shown in grey.

Figure 64 further demonstrates that an artifact's text readability is adversely affected if it is located underneath a pew. This trend can be seen in 8 of the 12 churches we studied that contain artifacts with text located under pews.

5.5 Damage Due to Canal Proximity

Through our study we have encountered churches that had major structural damage in the form of cracks. A common characteristic that churches with the largest problem cracks share is the close proximity to a canal.

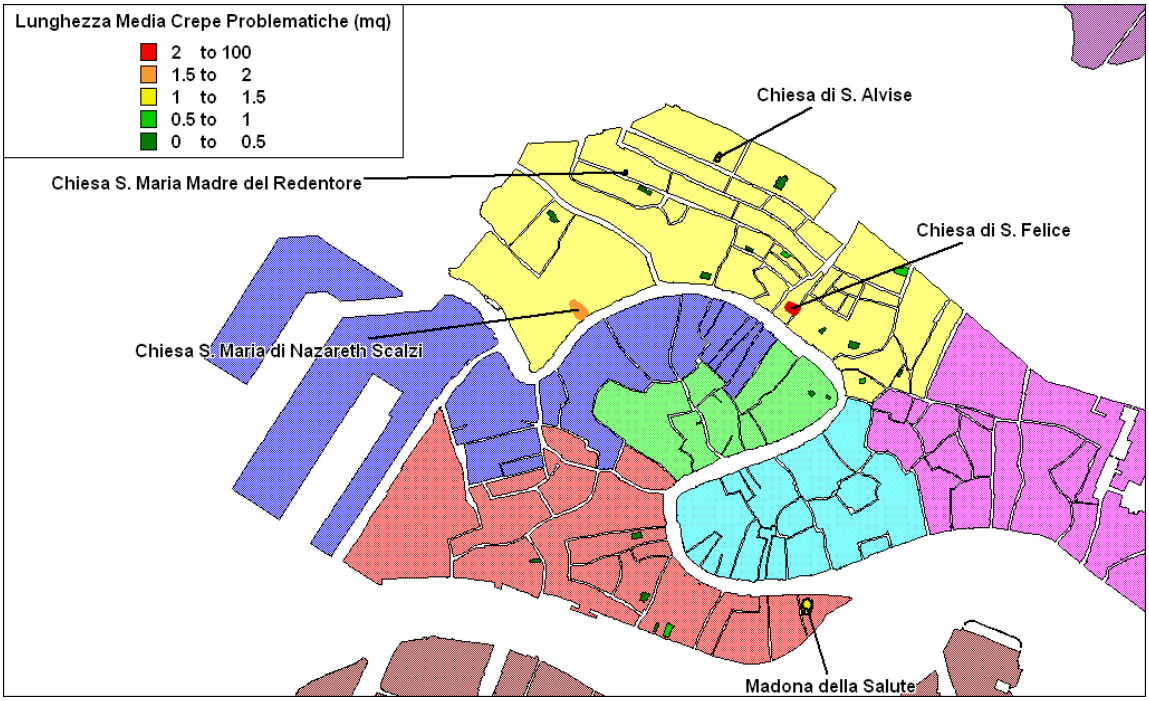

Figure 65: A map indicating the five churches that have the longest problem cracks in relation to the size of the church.

Figure 65 shows the location of five churches that have the largest problem cracks per square meter. It is interesting to note that three of the churches are close to the Grand Canal, while the other two are located on other canals. This leads to the assumption that churches located close to canals are more susceptible to structural damage.

6 Recommendations & Conclusion

After we collected church data in three different sestieri, we determined the major threats to the floors of these churches. Based on our findings, we are submitting recommendations on ways to prevent these threats from causing further damage. Many of these recommendations are intuitive, but our research and data collection confirm that these threats exist to the church floors.

A piece of artwork is chosen for preservation or restoration according to its importance. Artwork and architecture will not be restored if the meaning is completely lost from the piece, such as all or most of its writing and/or art. Since Italy, specifically Venice, contains an overwhelming amount of art, once the majority of the piece is lost, it is not considered worth the time, effort and cost to the owner or the Ministry of Culture to restore. Focus is instead placed on the pieces that are in danger of becoming completely lost, but are still salvageable. We identified these specific pieces of art and parts of floor that are in need of attention.

6.1 Low Cost Solutions

With the heavy flow of tourism in Venice, buildings and artwork are at the mercy of tourists. Heavily trafficked areas of floors show major signs of wear and must be protected. A simple and economic solution would be to rope off areas of the floor that are in danger. Churches already rope off their altars and other sacred areas to prevent tourists from entering, and as a result we found that altar floors were in better condition than other quadrants of the church that are open to everyone. There were a few exceptions, such as was seen in the Santa Maria Assunta dei Gesuiti, because the main floor had been restored but the side altars and altar had not. The only instance we've observed in which the church protected artistic designs in the floors, that were not sacred areas, was the *Santa Maria della Salute* (**Figure 66**). Roping off certain areas diverts foot

Figure 66: The center of the *Santa Maria della Salute* has been roped off.

traffic from these sections, keeping damage to a minimum. The traffic flow would also be controlled to avoid areas that are of historical, artistic or informational importance. Areas that contain intricate floor designs, artifacts that commemorate the remains of someone, or artifacts that hold some significance due to its artwork are important sections that should be roped off if they are being considerably damaged.

Yet another solution includes closing the church to the public while still keeping it open for Mass. Although tourist donations would decrease, offerings would still be collected at Mass and the damage being done to the church floor over time would decrease. This solution should be used for churches that have floors which have received a poor rating as far as surface damage and floor detachment. If tourists continue to walk on these floors that are already very damaged and falling apart, the situation will only continue to become worse.

6.2 Raising Restoration Funds

Cost is a major factor when restoration and preservation is concerned. If roping off areas or closing the church is not an option, action needs to be taken to uphold the value of the floor and artifacts. When these artifacts need to be restored but the necessary funds are insufficient, the artifacts are inevitably left to degrade beyond repair. While many churches charge an entrance fee (Figure 67), not all choose to do so. Those that do require paid admission all charge two Euros per person. One solution we came up with was to have all churches charge admission during visiting hours and keep Mass free. The price would vary depending on the quality and quantity of artwork and church architecture. Raising prices would yield more funds that could be used for the restoration of damaged works. Raising prices could also deter tourists from entering the church as well, which would mean less damage would be incurred onto the floor and artifacts. Even if charging a fee decreased the number of the

Figure 67: A sign from the *Santa Maria dei Miracoli* notifying visitors of a €2 fee.

tourists, they would still be accruing more money from the tourists than if they were to not charge a fee. Either of the possible outcomes from the implementation of this admission fee would result in the floors and artifacts receiving less damage or money being raised to help preserve the floors and artifacts.

An idea that could be used in conjunction with the raising admission prices would be the operation of guided tours involving the churches of Venice (Figure 68). These different tours could have themes, concentrating on certain aspects like the burial places of important figures or a tour of churches constructed in the Baroque style. Tours would charge a larger sum, but this price would be more affordable than entering each church planned on the tour individually. Since going on these guided tours would be more attractive to tourists than visiting churches on their own due to the appealing pricing plan and the superior information and entertainment value, tourist flow is now regulated. An example brochure of a church tour is located in the Appendix. Rather than have tourists enter churches on their whim and stay as long as they like, they are filed in and out in an orderly fashion and in a designated amount of time. This would also prevent the annoyance of tourists entering a church for sightseeing when Mass is being conducted, since these tours will be scheduled at the church's convenience.

Figure 68: A guided tour, like this one at the *Basilica S. Marco*, would help raise money for the churches of Venice.

6.3 Furnishing

There is damage that is not directly caused by walking tourists, but by furnishings within the church. We have discovered through analysis that pews cause damage to the floor, both by their weight and from the movement of the pews themselves. The weight of pews themselves only adds about 100-200 pounds depending on size, but once the pews are filled with people, the total weight can be over 1000 pounds. Also, most pews are not completely stable and as people sit on the pews and get up off the pews, they have a tendency to shift or move. The pews cause both structural and surface damage to the floors and artifacts due to the pew's weight being distributed through three to four legs. Churches such as the *Sant' Alvise*, have placed their pews on wooden platforms in order to remedy this problem (Figure 69), but this solution obscures the majority of the floor and floor embedded artifacts. A better solution would be to replace their existing pews with ones have the weight distributed throughout the whole pew. An example can be seen in Figure 70. This way, rather than have the entire weight of the pew localized in small areas, it would be dispersed throughout the whole length of the pew. There would be more contact area with the floor, but since the pressure applied by the pew would be less the amount of damage is reduced. To prevent surface damage, such as pitting, that is not prevented by these pews, the bottom of the pew could be covered in rubber or another soft material.

Figure 69: Raised pews in the *Sant' Alvise*.

Figure 70: Prototype of a redesigned pew

6.4 Future Floors and Restorations

We recommend that if the church decides to replace the floor or restore the current floor, a few suggestions should be followed. The first suggestion would be to place liners under the floors of the church being restored. The concrete liner is only a new

process and requires removing the entire floor, exposing the foundation and pouring concrete to keep water out from under the floor. The liners are rather effective, but unfortunately the cost and labor required to complete the task are very high. Liner installation would also require the church to be closed for extended periods of time, resulting in the loss of revenue from tourists and mass collection. The benefit though is that it will need less restoration in the future. This solution also does not prevent the water from seeping through the doorways of the church when the water rises over the liners.

The second suggestion is taking material properties into account when constructing a new floor. Some of the most colorful stones we found had some of the most surface damage. The color of marble is caused by imperfections within the stone. Unfortunately, these imperfections cause the marble to weaken and corrode over time. Cararra marble is one of the most pure, and most commonly used, marbles in Italy.31 From our observations, we have noted that this material had the least amount of overall damage. Red Verona marble, which is seen often in many churches, seems to be the most damaged of all the types of marble we observed. We recommend that when constructing a new floor, materials with structural properties such as strength, durability, and impermeability should be used if possible.

6.5 Recommendations and Conclusion for Each Church Studied

This following section goes into detail on the types of restoration or preservation that each church we studied needs, if any at all.

I Santi Apostoli – The condition of the floor in this church is better than most we observed. However, the condition of the artifacts should be of some concern. We recommend that, to preserve the historical value of these artifacts, areas with many damaged artifacts be roped off. These areas include the back two corners of the church as well as in front of the altar.

Le Cappuccine – The floor is in need of restoration as it is the one of the most damaged floors we studied which leads us to believe this is the original floor.

[31] The American Peoples Encyclopedia Grolier Inc. New York, 1962.

San Cristoforo Martire/Madonna dell'Orto – Both the condition of the floor and artifacts of this church do not cause immediate preservation/restoration concern.

San Felice - In the Felice, we have shown in our analysis that the artifacts in the high traffic areas have bad text readability and the artifacts are in need of attention. Our recommendation for this problem would be to rope off the area where these artifacts are located during tourist hours. The area can not be roped off during Mass times because it would get in the way of the normal functions of the church, and for that reason this solution is only temporary. Most of the artifacts located in the front of the church near the altar have too much damage to be restored, and preservation is the only solution left to help the artifacts.

San Trovaso – Although this church contained artifacts with many problem cracks, the condition of both the artifacts and floors does not cause immediate preservation/restoration concern.

San Giovanni Grisostomo – There seemed to be the most damage to the floor and artifacts right inside both doorways of the church. The church is also in a busy area which we believe is the main contributing factor to the damage in these areas. Therefore, we recommend that the church charge an entrance fee as it would surely raise money to help preserve/restore the floor.

San Girolamo – This church had no artifacts and the floor is in excellent condition. However, we feel that there could be hidden artifacts underneath because the present floor appears so new.

San Luigi/Alvise – The condition of the floor and artifacts do not cause immediate concern for preservation/restoration.

San Marcilliano – Both the floors and artifacts are in need of some kind of restoration/preservation. The surface damage to the floor is significant in the back of the church and there are many artifacts with damaged/unreadable text. Roping off of floor in the back left corner of the church would be beneficial until restoration funds can be raised.

Santa Maria Assunta dei Gesuiti – The main floor of the Gesuiti was restored in 1999, but the floors of the side altars and the sanctuary were not. The side altars have large areas of floor detachment, and because the overall pattern is still present, the floors

can be restored. The first recommendation is to restore the missing parts of the floors in the side altars. The next major problem in the Gesuiti is the warping in the sanctuary. As noted in the analysis, this is a major structural problem in the floor. Unfortunately, fixing this problem will be costly. Our recommendation for fixing this problem is to remove the floor and place liners under the sanctuary. Placing liners under the sanctuary will keep the water out from under the floor and prevent that part of the church from sinking into the water and becoming uneven. If this problem is not fixed in the near future, the church will have more major structural failures to fix.

Santa Maria de Servi – The Servi is no longer a church but it may still hold valuable information. Due to the good condition of the floor, lack of artifacts and high floor height, we believe that a new floor was laid over a previous one which contained artifacts.

Santa Maria dei Miracoli – The Miracoli just finished 10 years of restoration, but the artifacts located on the floor should not be ignored. The test readability was not perfect for the artifacts located there. We recommend that the artifacts that have low text readability ratings should be roped off and that the pews located there should be redesigned and replaced.

Santa Maria di Nazareth – Both the floor and artifacts of the church are in need of preservation/restoration attention. Preventing access to the side altars should alleviate damage to those areas. Also, the Nazareth is situated in a busy enough area that charging an entrance fee would be useful in raising restoration funds.

Santa Sofia – The floor at the Santa Sofia was in good condition and was only about 100 years old. At this time, this church does not need any preservation or restoration. However, the church needs more research as there was only one artifact located on the floor and it is a new floor so the chances of more floors being located under the current one is highly possible.

Santi Giobbe e Barnardino – While the floor is not a major concern, the Giobbe had the artifacts that are in the worst condition. We feel that this is due to the low height of the floor and its exposure to many flood waters. This church is in need of concrete liners to preserve the valuable artifacts contained within the floor. This church should be of concern to the Archeology Superintendence as it is most likely next to be restored.

San Barnaba – The floor in this church is in terrible condition. There is a hole due to warping and structural faults in the center walkway. Also there are artifacts that move when walked on. This church has high priority for restoration.

San Sebastiano – This church is not high priority for preservation/restoration.

Santa Maria del Rosario – This church is not priority for preservation/restoration.

Santa Maria della Salute – The Salute has a lot of warping in the center of the church, but it is already roped off so that people do not walk there. Problem cracks also riddle various quadrants of the church. We suggest that the warping problem cracks be repaired before there are more problems.

Santa Maria della Visitazione – This church had no artifacts and the floor is in good condition. However, we feel that there could be hidden artifacts underneath because the present floor seems new.

San Giacomo Apostolo – This church is not a high priority for preservation/restoration.

San Giovanni Elemosinario – This church is not a high priority for preservation/restoration.

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Appendix A: Annotated Bibliography

A.1 Preservation

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This website contains a good basic overview on historic preservation within the United States. It goes into a number of laws and acts that were developed for historical preservation. Overall it is a good starting place for general information on preservation within the United States.

Bovard, James. "Is preservation a price too high to pay?" Insight on the News, 7 March 1994, p. 16.

This article dives into issues that are arising within the United States due to historical preservation movements. Although these issues related to homeowners in this case, it also has an example with a church, and similar problems do have the possibility of occurring in Venice.

Bullock, Orin M. The Restoration Manual. Norwalk, Conn.: Silvermine Publishers, 1966.

This book looks very useful for our project. It goes into detail on the process of getting information about a structure all the way through excavating the structure. It also has ways to restore old materials. It is a book written for basic restoration that could be used in any country.

CICOP - Internation Centre for the Preservation of Architectural Heritage n.d. <http://associazioni.comune.firenze.it/cicop/english/homeeng.htm> (23 Mar. 2002).

This is an Italian web site (also translated into English) about he preservation of architecture in Italy. You can find information on this organization and what they do. It looked like it would be a very useful site, but the publications section of the site is empty. There is still a little more information on the site that might be useful tough, such as the types of conferences and classes they give.

Fitch, James Marston. Historic Preservation: Curatorial Management of the Built World. Charlottesville: University Press of Virginia, 1990.

This book is very detailed on why you should preserve and how to preserve art and architecture. It has preservation information for all over the world, including Venice, Italy. It has information about different materials and different places,

such as Venice, Italy. It also has information on excavations and what you can find, which will be very useful to the group.

"Protecting the Irreplaceable." National Trust for Historic Preservation Website. 2002 <http://www.nationaltrust.org/> (23 March 2002).

This is the main website of a major non profit organization in the United States. Some articles on issues dealing with historic preservation can be found here as well as what can be done to help the preservation of many different types of historical treasures.

Salter, Walter L. Floors and Floor Maintenance. London: Applied Science Publishers, 1974.

This book discusses the many materials floors are made of and how to keep them in good shape. This may or may not prove to be a good source as we continue with our research.

Saving Venice. Mar. 23, 2002 <http://www.architectureweek.com/2001/0815/building_1-1.html>

Another article that relates that problems of tides and the rising water levels in Venice, and described the planned flood barrier solution. Other than some diagrams and pictures of the proposed floor barrier system, this information could be found in numerous other articles.

Save Venice Inc. n.d. <http://www.Savevenice.org/> (Mar. 23, 2002).

Save Venice is one of the 30+ international organizations that were founded under UNESCO, in response to the flood damage caused in November 1966. The organizations' main purpose is to "restore and protect Venice's threatened masterpieces." Save Venice has conducted more than 100 restorations in their 30 year history, many of which were landmark churches. As well as having a brief history of the churches they've restored, they also have virtual tours of some churches and information on the various pieces of art located in said churches.

"Venice in Peril: The British Committee for the Preservation of Venice." The Venice in Peril Website. n.d. <http://www.veniceinperil.org/> (17 March 2002).

This website deals with preservation of many parts of Venice due to the damage that is produced through high tides and other such problems. A good amount of the past projects by this organization have dealt with different aspects of the churches throughout Venice. There is also some limited but good information on a few select churches that the organization has done work with.

Vio, Ettore. The Basilica of St. Mark in Venice. Florence, Italy : Scala ; New York: Riverside Book Company, 1999.

This book provides extensive information on the St. Mark Basilica in Venice. This would be a good book for us to draw detailed information about the materials of which the church was made. Also, it discusses the changes it has undergone over time.

A.2 Effects of Tides

Monastersky, Richard. "Science News: Against the Tide." (Venice, Italy). 24 July 1999. Science News. 18 Mar. 2002 <http://www.findarticles.com/cf_dls/m1200/4_156/55553310/print.jhtml>.

This article was about various studies conducted to determine exactly how much time Venice has left before the rising water levels would have the city uninhabitable, as well as a brief history on how Venice was slowly inhabited. The article also touched on the implementation of permanent flood gates in order to protect the city. The article had some good general information, but unfortunately, nothing useful on churches specifically.

Nadeau, Barbie. "The Plan To Refloat Venice." Newsweek, Atlantic Edition, 12 March 2001, Europe pg. 18.

This article contains a good deal of information on the troubles Venice has been facing due to the rising of the sea level and the hide tides. It continues to then go on about some measures that have been tried and are at the time being worked on to try and save the city of Venice from these hazards. Overall the information gained here is a good overview of this problem that the city of Venice has to endure.

Ravera, Oscar. The Lagoon of Venice: the result of both natural factors and human influence. Insituto Italiano di Idrobiologia, 2000.

Although the main topic is about the lagoon, this paper has some good information on the continuing threat of high tides in Venice. The issue of Venice falling closer to sea level and being open to more frequent attacks of the high tides is discussed briefly within the paper.

A.3 Archeology

Ackerman, James S. Art and Archaeology. Englewood Cliffs, N.J.: Prentice-Hall, 1963.

This book gives a lot of information concerning art and archaeology. This will help us to better understand what UNESCO is trying to do to preserve the art that it uncovers in Venice. While this broadly covers art as a whole, it offers a lot of useful information concerning the archaeology aspect.

de Grummond, Nancy Thomson. An Encyclopedia of the History of Classical Archaeology. Wesport, Conn.: Greenwood Press, 1996.

This set of two books is very useful if looking up a particular 'artifact' or any other piece of historical art. These books list a number of pieces of artwork as well as the artist and other information about archeology in the Mediterranean Region. This encyclopedia will be important to our project when looking up information on certain churches and the history of archeology in Venice.

A.4 Churches of Venice

Brown, Patricia Fortani. Venice & Antiquity. New Haven: Yale University Press, 1996.

This book examines the changes in Venice during its Golden Age (thirteenth to sixteenth century), and how these changes were represented in the art, architecture, literature and cultural life throughout that time period. The book contained information on various pieces of art and sculptures located on or in churches, but it seems as if this information is scattered all throughout the book, making it a difficult resource to compile information from.

Concina, Ennio. A History of Venetian Architecture. Cambridge; New York: Cambridge University Press, 1998.

This book offers an extensive index of churches and chapels in Venice. It also gives information on each church as to its history, architecture, and the materials of which it was made. There are several pages on which it discusses individual mosaic floors contained within some of the Venetian churches.

Donnelly, Brian C, Brynn G Hart, Matthew J. Pilotte, and Thomas C. Scherpa. Safeguarding the Churches of Venice, Italy: A Computerized Catalogue and Restoration Analysis. An Interactive Qualifying Project for Worcester Polytechnic Institute, 1999.

This project, sponsored by UNESCO, was written by past WPI students. The paper was a study on the churches in Venice, Italy and they created a database system which contains information on all of the churches, such as where they are, the art, and other historical information. This project is very useful because our project will be built upon it.

Howard, Deborah. Jacopo Sansovino: Architecture and Patronage in Renaissance Venice. New Haven: Yale University Press, 1975.

This book is about the architecture of Jacopo Sansovino. It is somewhat useful because it contains information on some of the churches. All of the architecture in the book is in Venice.

Huse, Norbert. The Art of Renaissance Venice: Architecture, Sculpture, and Painting, 1460-1590. Chicago: University of Chicago Press, 1990.

This book contains an entire section on Sacred Buildings, going over churches and monasteries in the time period encompassing 1460-1530. The section describes the church's architectural style, in addition to the architects responsible for the churches. It also includes a section on Andrea Palladio's Convent of S. Maria della Carita, the façade of S. Francesco Della Vigna, and the plans for the S. Pietro di Castello, S. Giorgio, and Il Redentore.

Meeks, Carroll L.V. Italian Architecture 1750-1914. New Haven and London: Yale University Press, 1966.

This book discusses the change in church structures throughout 2 centuries. It touches upon renovations and rebuilding that have been done to some churches in Venice. This book will help us to understand the changes in architectural styles from 1750-1914.

Tavernor, Robert. On Alberti and the Art of Building. New Haven: Yale University Press, 1998.

This book is on the works of Alberti. It has information on all of the buildings he designed and how he designed them. There is a little information on how he used the tiling of the floors for grids, which could be useful for our project. There is a good amount of information on historical architecture in the book.

Venice Churches, Italy: paintings, maps, open... n.d. <http://www.invenicetoday.com/art-tour/churches/churches.htm> (16 Mar. 2002).

This web site contains pictures and a brief description on 60+ churches in Venice. Information such as when the church was established, its architectural style, and historical events pertaining to the church are documented. The site also has a map which shows the specific region of Venice each church is located. This source had good general information on a great number of churches, but nothing specific on the church's floors.

Zuffi, Stefano. Art in Venice. New York: Harry N. Adams Incorporated, 1999.

This book contains over 500 color pictures/illustrations of art in Venice. Much of these pictures were taken within churches in Venice. Church floors are visible in these pictures so this might better prepare us for the kind of floor materials we should be researching. Also, this book discusses the changes that art made from the Byzantine style to Modernism.

A.5 Religion in Venice

Benigni, U. Catholic Encyclopedia: Venice. 1999. <http://www.newadvent.org/cathen/15333a.htm> (Mar. 23, 2002).

This web site contains a description of Venice's ecclesiastical history (history pertaining to the Catholic religion) a small history of St. Mark's, and a list of churches located in Venice. Good source if we were to add a small section in our Background on the history of Catholicism in Venice.

Willis, Gary. Venice: Lion City. Simon & Schuster, 2001.

This is a newly published book about Venice and its history. There is a fairly large section on the history of religion within Venice and it offers some good information about most of the major Venetian churches.

A.6 UNESCO

United Nations Educational, Scientific and Cultural Organization website. n.d. <http://www.unesco.org/> (23 March 2002).

This site offers a good amount of background into UNESCO. General information on the history of UNESCO and why they were developed can be found here. Also they have a section devoted to Venice on their site, including why they got involved and what they have been doing in Venice.

A.7 Methodology

Quine, W.V. Methods of Logic. New York, Chicago, San Francisco, Atlanta ... [et al.]: Holt, Rinehart, and Winston, Inc, 1950.

This book deals with the method of carrying out a scientific study and applications of the knowledge acquired. It also discusses quantification which could be helpful in working with different variables in our observations.

Research Methodology and Statistics. n.d.
<http://pscw.uva.nl/sociosites/TOPICS/research.html> (1 Apr. 2002).

This site has many useful documents and links for researching and methodology. They have detailed explanations on taking down information and analyzing it. There is a lot of information on this web site.

Research Methodology. Victoria University. n.d.
<http://vicu.utoronto.ca/staff/branton/RESEARCH.html> (31 Mar. 2002).

Scientific Methodology in Archeology. Carnegie Museums. n.d.
<http://www.carnegiemuseums.org/cmnh/hartman/history/2_2methodology.html> (31 Mar. 2002).

Searles, Herbert L. Logic and Scientific Methods. New York: The Ronald Press Company, 1956.

This book will help us to create a scientific method and better understand scientific and statistical strategy in carrying out our work in the churches.

Sociological Methodology. n.d. <http://depts.washington.edu/socmeth2>(1 Apr. 2002).

This web site talks about research methods in the Social sciences. It explains problems that might occur when researching and also explains how to come up with a research design and ways of collecting and analyzing data.

Trochim, William M.K. "Unobtrusive Measures." Research Methods Knowledge Base. 2002 <http://trochim.human.cornell.edu/kb/unobtrus.htm> (31 March 2002).

This webpage talks about different unobtrusive methods that can be used to collect data and some of the benefits of collecting data in this manner.

"'Unobtrusive' data collection." Toolpack website. 2001
<http://www.toolpack.com/d/unobtrusive.html> (31 March 2002).

This website looks briefly into some benefits and possible downfalls in using unobtrusive data collection.

Appendix B: Sponsor Information

Appendix C: Database Structure

The following database structures can be found in the next few pages in the order shown below.

Floors Database

Floor Condition Assessment Database

Artifact Database

Artifact Condition Assessment Database

Priest Forms Database

Appendix D: Forms

The following forms can be found in the next few pages in the order shown below.

Floors

Floor Condition Assessment

Artifact

Artifact Condition Assessment

Priest Forms

Appendix E: Church Codes

APOS	I Santi Apostoli
LECA	Le Cappuccine
ORTO	San Cristoforo Martire
FELI	San Felice
GERV	San Trovaso
GRIS	San Giovanni Grisostomo
GIRO	San Girolamo
ALVI	San Luigi
MARZ	San Marcilliano
ASSU	Santa Maria Assunta dei Gesuiti
ISER	Santa Maria de Servi
MIRA	Santa Maria dei Miracoli
NAZA	Santa Maria di Nazareth
SOFI	Santa Sofia
GIOB	Santi Giobbe e Barnardino
BARN	San Barnaba
SEBA	San Sebastiano
ROSA	Santa Maria del Rosario
SALU	Santa Maria della Salute
VISI	Santa Maria della Visitazione
GIAC	San Giacomo Apostolo
ELEM	San Giovanni Elemosinario

Table 12: Church codes and the corresponding church names.

Appendix F: Results Data

Le Cappuccine	66.19
San Barnaba	48.86
San Marcilliano	36.74
La Madonna dell'Orto	34.51
San Felice	30.28
I Santi Apostoli	28.06
Santa Maria della Salute	28.00
Santa Maria Assunta dei Gesuiti	19.59
Santa Maria dei Miracoli	19.23
Santa Maria della Visitazione	18.94
San Trovaso	18.03
San Giovanni Grisostomo	16.54
San Sebastiano	16.12
Santi Giobbe e Barnardino	14.90
Sant' Alvise	14.83
Santa Maria di Nazareth	14.01
San Giacomo Apostolo	12.40
Santa Maria del Rosario	9.41
San Giovanni Elemosinario	8.30
San Girolomo	4.60
Santa Sofia	4.52
Santa Maria de Servi	2.51

Table 13: Percent of Surface Damage to Floor

Le Cappuccine	18.20
San Barnaba	14.88
San Marcilliano	14.30
San Felice	12.33
Sant' Alvise	11.79
Santa Maria dei Miracoli	6.48
Santi Apostoli	6.40
Santa Maria di Nazareth	5.92
La Madonna dell'Orto	5.25
Santa Maria Assunta dei Gesuiti	4.60
San Sebastiano	4.52
San Trovaso	4.19
Santa Maria della Salute	4.10
San Giovanni Grisostomo	3.14
Santa Maria della Visitazione	3.00
San Giacomo Apostolo	2.24
San Giovanni Elemosinario	2.13
Santi Giobbe e Barnardino	1.83
Santa Sofia	0.45
Santa Maria del Rosario	0.06
San Girolomo	0.00
Santa Maria de Servi	0.00

Table 14: Percentage of Floor Detachment to floor

Le Cappuccine	7.29
San Marcilliano	5.44
San Felice	3.47
Santa Maria della Salute	3.38
Santa Maria Assunta dei Gesuiti	2.44
Sant' Alvise	2.42
I Santi Apostoli	2.23
San Giovanni Grisostomo	2.07
La Madonna dell'Orto	1.76
San Trovaso	1.59
San Giovanni Elemosinario	0.95
Santa Maria di Nazareth	0.88
Santa Maria del Rosario	0.70
Santa Maria della Visitazione	0.55
San Sebastiano	0.46
San Barnaba	0.00
San Giacomo Apostolo	0.00
Santi Giobbe e Barnardino	0.00
San Girolomo	0.00
Santa Maria de Servi	0.00
Santa Maria dei Miracoli	0.00
Santa Sofia	0.00

Table 15: Percentage of Floor Replacement to floor

SALU	411
FELI	355
ASSU	305
NAZA	139
ROSA	110
ALVI	92
ORTO	52
MIRA	43
GRIS	39
GIOB	37
MARZ	31
LECA	28
GERV	21
SOFI	14
SEBA	10
VISI	5
ELEM	2
GIAC	0
GIRO	0
APOS	0
BARN	0
ISER	0

Table 16: Total number of problem cracks on floor

SALU	3370
NAZA	1740
ROSA	1365
FELI	1320
ASSU	1050
ALVI	825
MARZ	600
ORTO	565
GIOB	345
MIRA	335
GERV	335
GRIS	291
LECA	210
SEBA	195
VISI	140
SOFI	72
ELEM	45
GIAC	0
GIRO	0
APOS	0
BARN	0
ISER	0

Table 17: Total length of problem cracks on floor

FELI	2.76
NAZA	1.71
SALU	1.49
ALVI	1.37
LECA	1.28
ROSA	0.98
MARZ	0.97
MIRA	0.85
GRIS	0.64
ASSU	0.63
SEBA	0.37
GERV	0.36
VISI	0.33
ORTO	0.32
GIOB	0.29
SOFI	0.18
ELEM	0.07
GIRO	0.00
GIAC	0.00
APOS	0.00
BARN	0.00
ISER	0.00

Table 18: Average problem crack length per square meter (cm) on floor

FELI	65
LECA	50
APOS	50
MARZ	47
GIOB	45
MIRA	43
GRIS	42
NAZA	36
ALVI	36
ELEM	32
BARN	25
ROSA	17
GIAC	14
SEBA	11
SOFI	0
SERV	0
ASSU	0
SALU	0
GIRO	0
GERV	0
VISI	0
ORTO	0

Table 19: Percentage of artifacts that have text that is mostly damaged or unreadable

NAZA	270
APOS	220
GIOB	143
MIRA	124
FELI	124
GERV	94
ALVI	74
MARZ	70
GRIS	57
ROSA	56
ORTO	30
GIAC	18
SEBA	16
ELEM	10
ASSU	5
BARN	1
SOFI	0
LECA	0
GIRO	0
VISI	0
SALU	0
SERV	0

Table 20: Total number of problem cracks on the artifacts

NAZA	2455
APOS	1962
GIOB	988
GERV	835
MIRA	796
FELI	657
ALVI	592
MARZ	500
GRIS	346
ROSA	330
GIAC	215
ELEM	140
ORTO	130
SEBA	124
ASSU	62
BARN	5
SOFI	0
LECA	0
GIRO	0
VISI	0
SALU	0
SERV	0

Table 21: Total length of the problem cracks on the artifacts

ALVI	18
MARZ	12
GIOB	11
ASSU	10
SEBA	10
APOS	9
GIAC	9
MIRA	9
GRIS	8
NAZA	8
ELEM	7
FELI	6
BARN	6
ORTO	5
GERV	5
ROSA	4
SALU	3
LECA	1
GIRO	0
SOFI	0
VISI	0
SERV	0

Table 22: Average percentage of surface cracks on the artifacts

ALVI	29
GIOB	27
APOS	20
GIAC	18
SEBA	17
MIRA	16
GRIS	16
MARZ	15
ASSU	14
ORTO	11
BARN	10
NAZA	9
FELI	6
GERV	6
ROSA	5
SALU	5
ELEM	5
LECA	4
GIRO	0
SOFI	0
VISI	0
SERV	0

Table 23: Average percentage of surface damage on the artifacts

Appendix G: Walking Tour

Appendix not included
in original submission

IQP/MQP SCANNING PROJECT

George C. Gordon Library
WORCESTER POLYTECHNIC INSTITUTE