

Studies in 16th Century Construction Management

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Good morning everybody and thank you for joining us.

My research this quarter, as you know, has dealt with the construction management of San Pietro and that of El Escorial.

I thought it was pertinent to compare them because they are both architectural landmarks, they are cotemporary , but also because of the abundant cross polination between Italy and Spain in the fields of art, architecture, and construction

Driving Questions

- Patrons & Motivations
- Historical Context
- Source of Funding
- Sequence of Construction
- Organizational Structure
- Laborers' Working Conditions

My intention was to look past the ever researched role of the architect and delve into the actual construction of both buildings.

To do that, I look at the patrons , and what their motivations were.

I also attempted to historically contextualize the projects. So, Reconquista in Spain, Colonization in America, Crusades in the Middle East and North Africa, Sack of Rome in 1527

That inevitably lead me to understand the source of funding for both projects.

I then researched the sequence of construction,

and the organizational structure at each Fabbrica

I was also interested in the conditions of the workers at each site, one in the mountains north of Madrid, and the other in the city of Rome.



1505 - 1615
Area: 15,000 m²

I'll begin by briefly introducing the basilica of new San Pietro, which was built to replace a Constantinian basilica from the year 360 AD,

Construction took roughly a century.

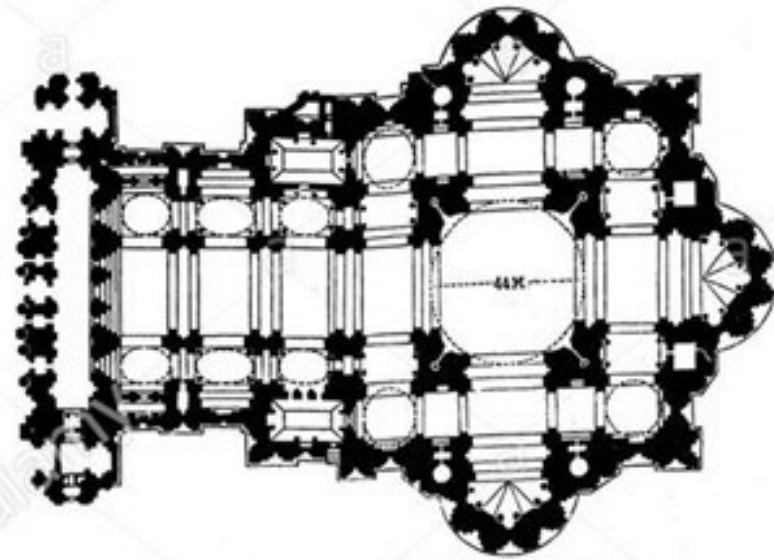


Fig. 4. Grundriß von St. Peter zu Rom.

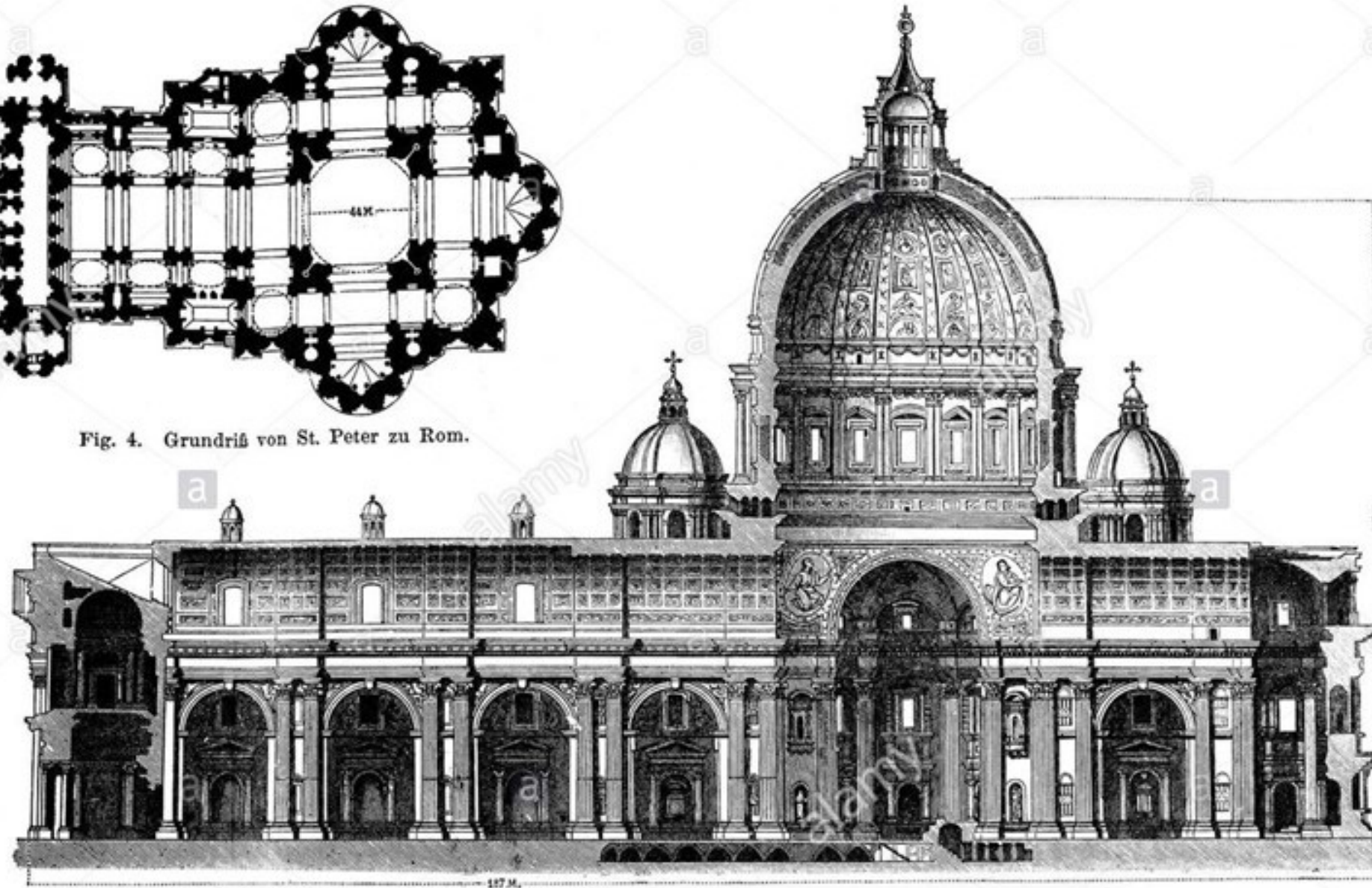


Fig. 3. St. Peter zu Rom. Längsschnitt.

Zu Fig. 2—4. Begonnen 1506 von Bramante, fortgeführt von Raffael, Peruzzi, San Gallo und 1546 von Michelangelo, vollendet 1626 von Maderna.

Here's a section as well to understand the scope of work of the 16th-century builders

About 9 architects participated in the design, some of the most famous names of the Renaissance and Baroque periods.



Julius II
(r. 1503-1512)



Leo X
(r. 1513-1521)



Clemens VII
(r. 1523-1533)



Paul V
(r. 1605-1620)

Fourteen more popes lived through construction of the basilica

New San Pietro was constructed under the mandate of 18 popes, four of which I have singled out for their role in construction.

Julius ordered the start of construction

Leo X formed the first administrative body to oversee the expenses of the project

Clement VII restructured the administrative body

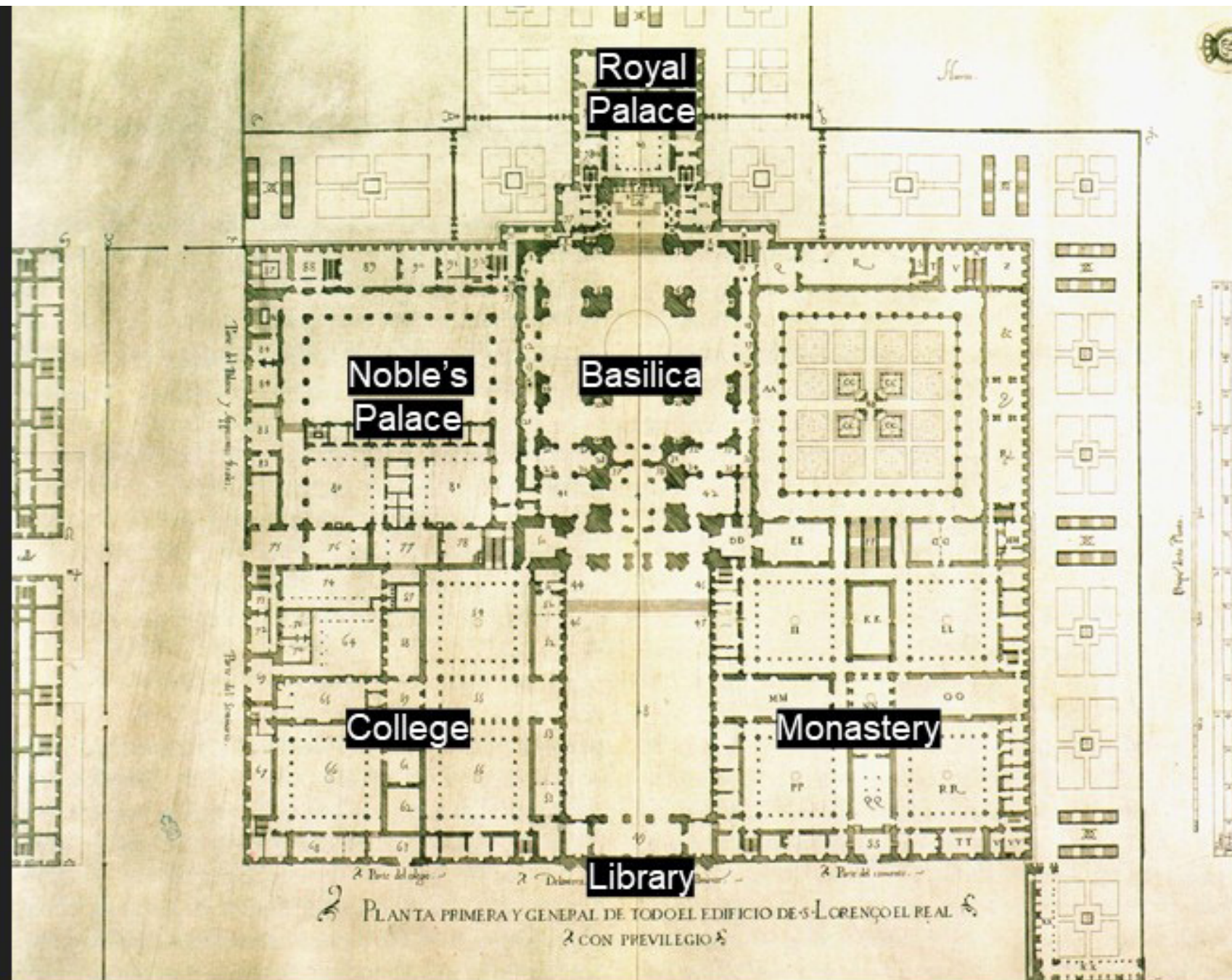
Paul V saw the completion of the church, up to its facade which bears his name.



1562 - 1584
Area: 33,000 m²

Next, let's take a look at El Escorial. It is twice the size of San Pietro, and was completed in 20 years.

It was designed partly by Juan Bautista de Toledo, partly by Juan de Herrera.



Pedro Perret "Primer Diseño, Planta primera y general de todo el edificio" 1587, Engraving

It is a huge complex with a monastery, basilica, royal palace, college, a library, and a palace for the nobles.



Pedro Perret "Cuarto Diseño, Sección transversal del templo, del patio del palacio y del Patio de los Evangelistas", 1587, Engraving

Another section, for context.



Charles I of Spain (V of the HRE)
(r. 1516-1556)



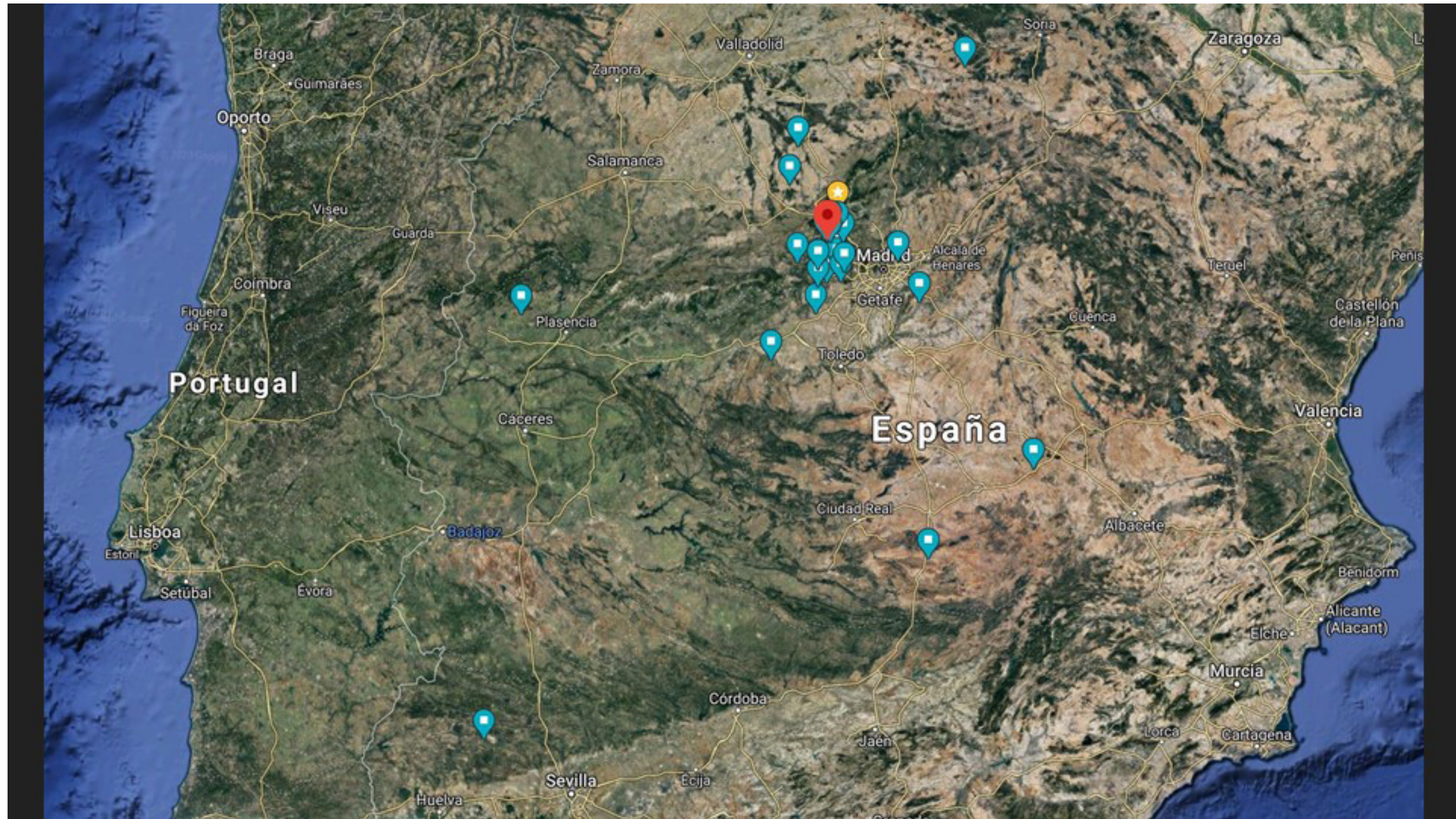
Philip II
(r. 1556-1598)

The patron was Philip II of Spain.

His father Charles was Holy Roman Emperor, and they both had allegiances with some of the popes in Rome, which actually affected funding for the Roman basilica, but more on that later.

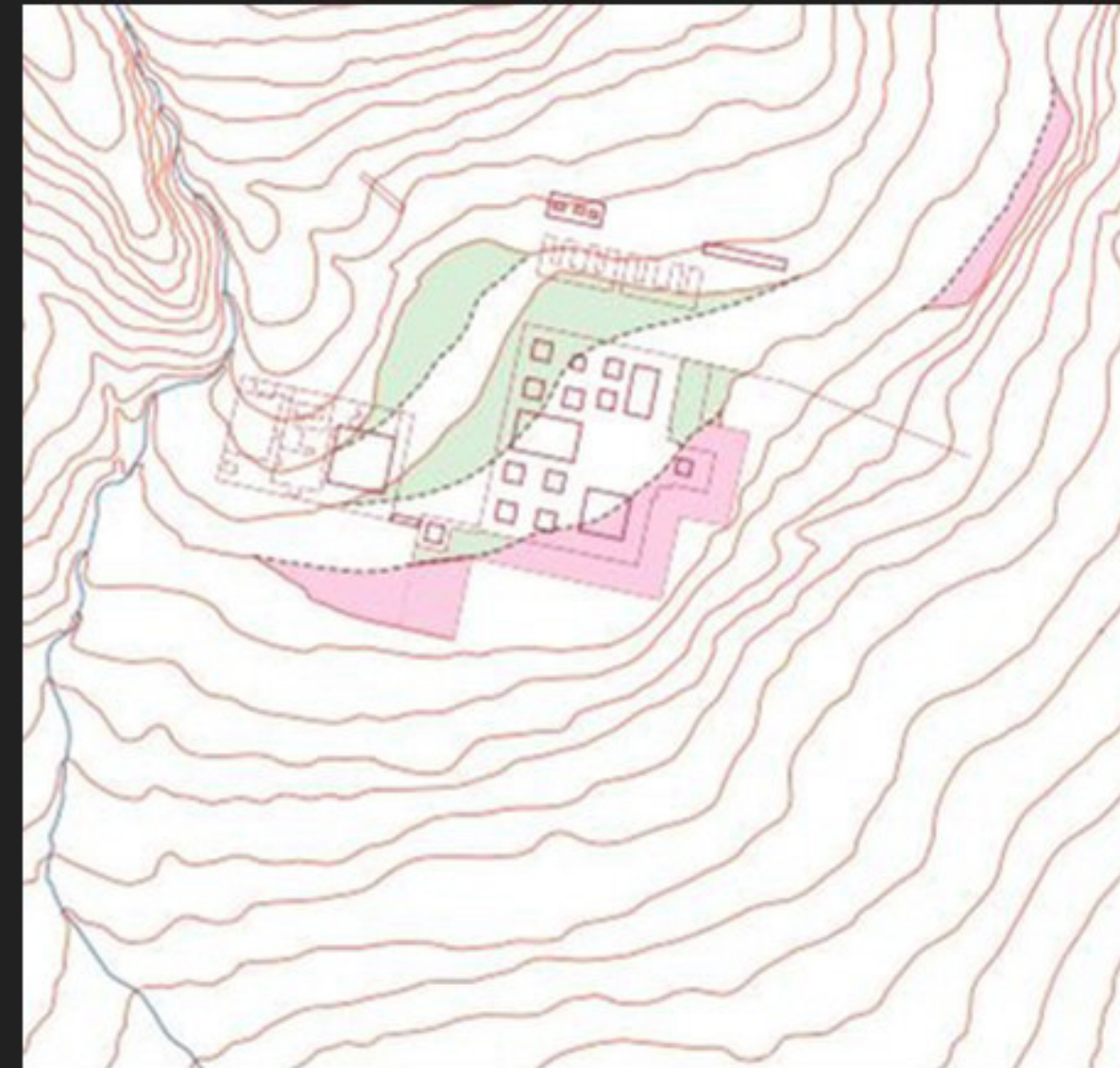
Philip II, like his father, wanted to retire and live his last days in a Monastery. Charles died in his room at a Hieronymite monastery. His room actually looked into the main altar of the church, and Philip's room at El Escorial had the same privileged view for when he was ailing and couldn't attend mass.

He set out to build a monument to faith and wisdom, to commemorate a military victory in 1557. It would house the monks of the Hieronymite Order.



Philip II purchased and arranged many crown properties all over his kingdom to furnish the construction of his dreamt monument.

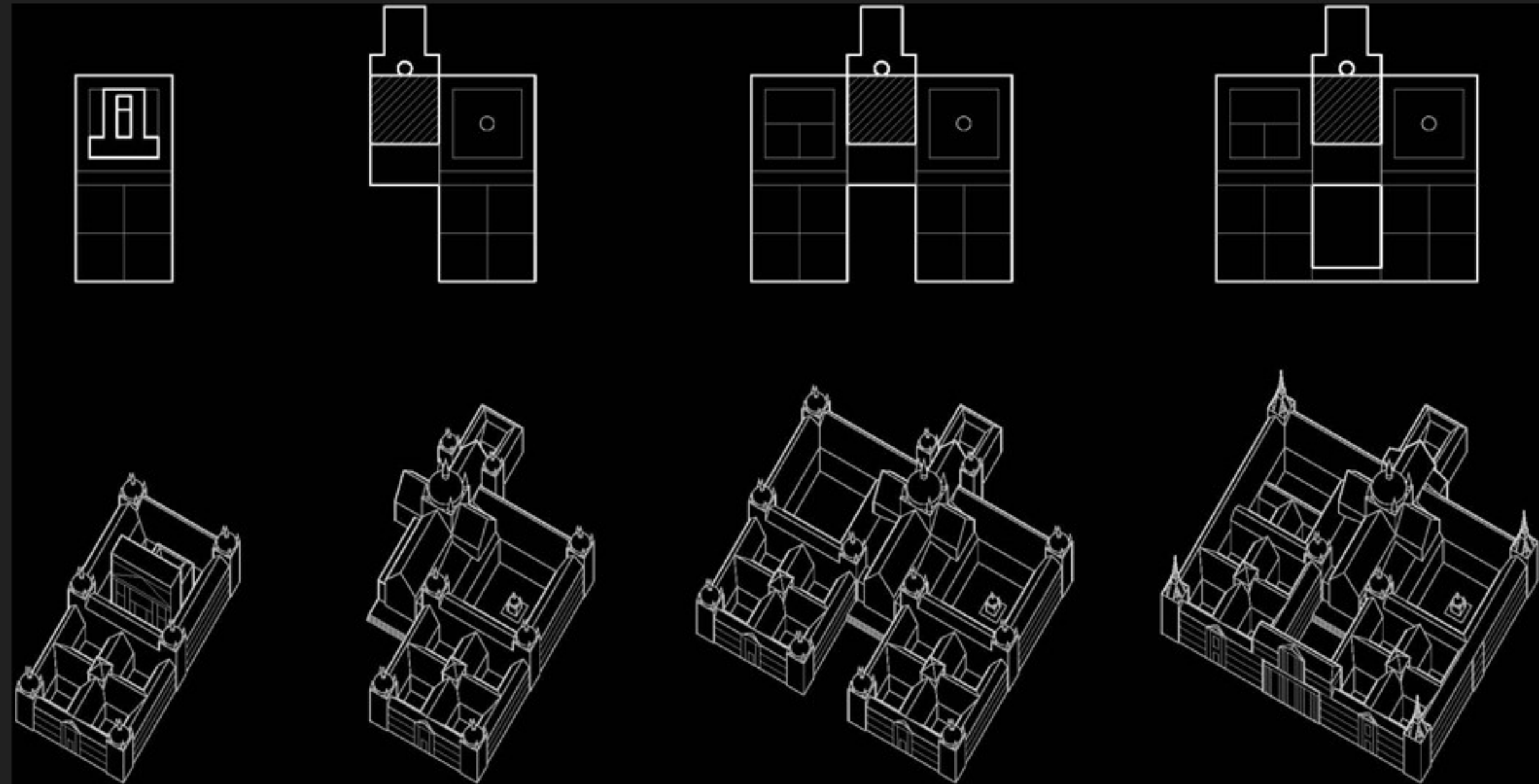
This map shows different royal hamlets, farms, woods, and quarries that all supplied the construction of the monastery, and the finished building as well.



Pilar Chías Navarro, Tomás Abad Balboa, 2016

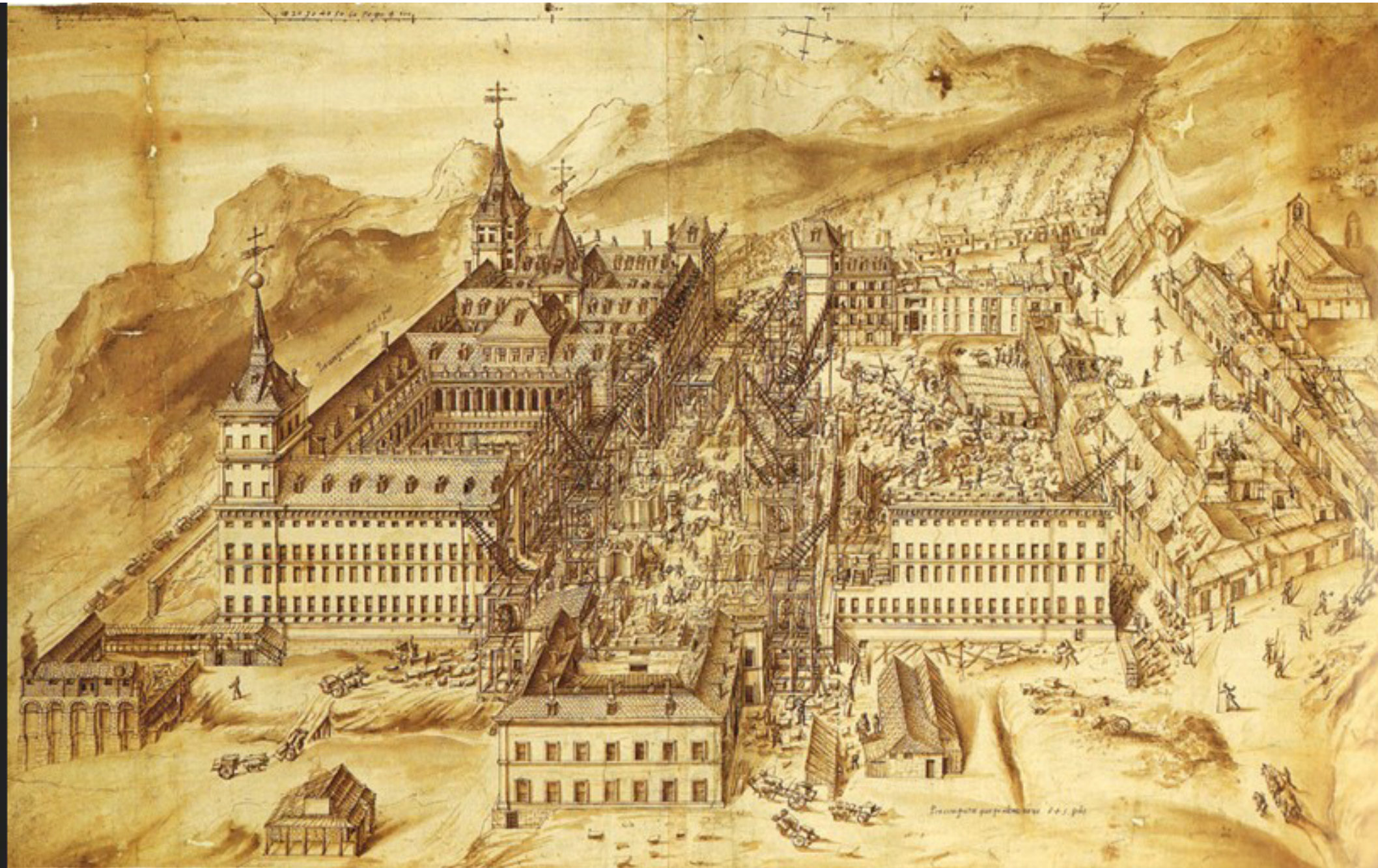
The location was in the mountains north of Madrid, near the village of El Escorial, where the builders resided during construction.

This map shows the earthmoving that was required to level out the project site, pink showing filled embankments and green showing cut earth.



Fernando Chueca Goitia, 1981

Construction progressed more or less in this order, starting from a retention wall in the South, moving towards the north, and around the footprint.



Attributed to Fabrizio Castello "El Escorial en obras." 1576, Drawing.

This engraving from 1576 taken from the East shows the southern half finished, the basilica piers underway, and the northern half still under construction.

Notice the houses and church built for the workers, since the original village was further down the mountain.

Notice the cranes, which were designed by Juan de Herrera, and the facade walls in the north that are not being shored or braced in anyway.

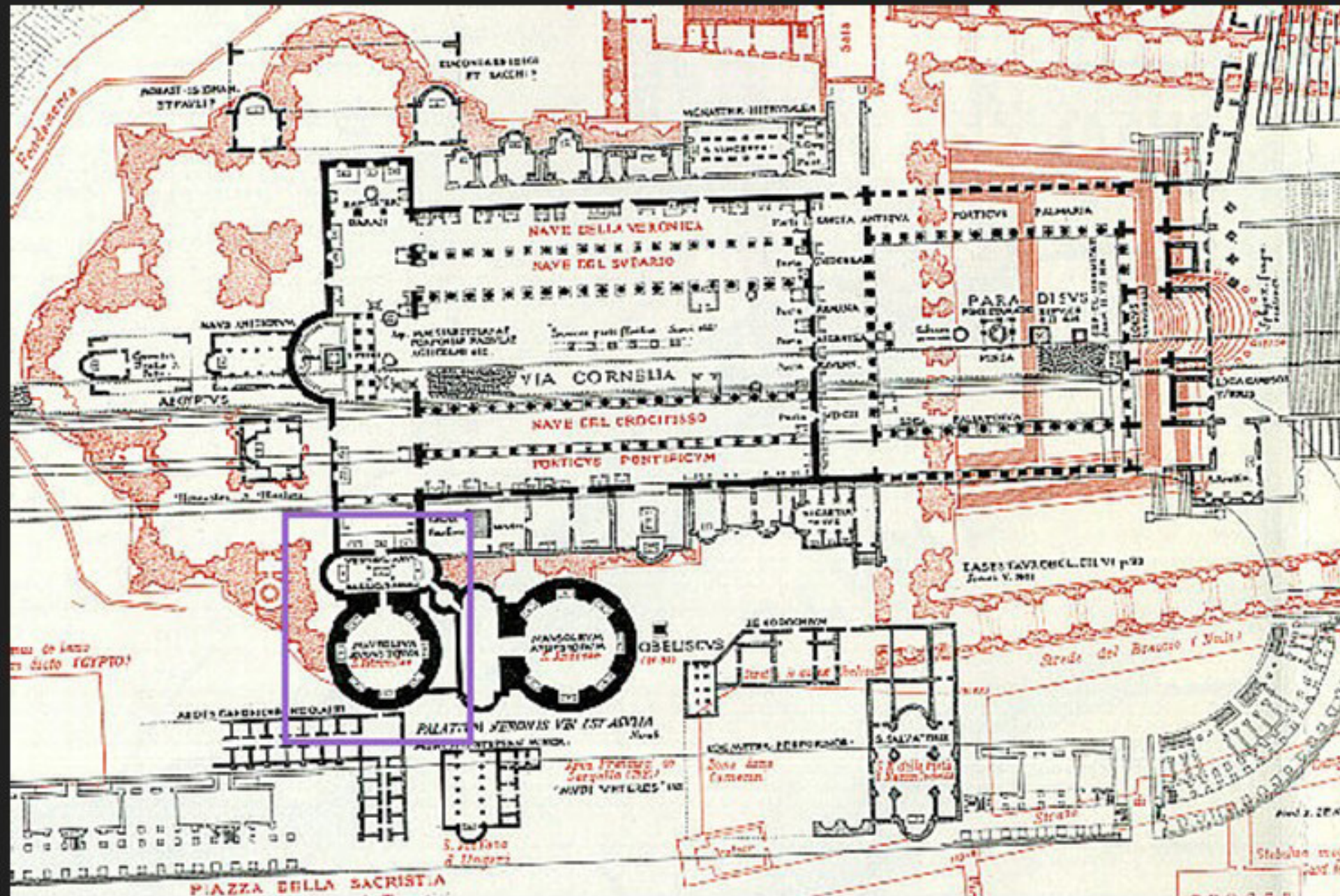
There was about 2,000 to 3,000 workers at the Fabrica, which had started with 650.

At this point, the monks who were going to occupy the monastery have already moved into their dependencies on the left portion, and they're living here while the basilica is built.



"Séptimo Diseño, Perspectiva general de todo el edificio" Petrus Perret Antuerpianus scalpsit 1587, Engraving

Here's a look at the completed product, looking on its main, Western facade.



Rodolfo Lanciani "Map Forma Urbis Romae" 1893-1901

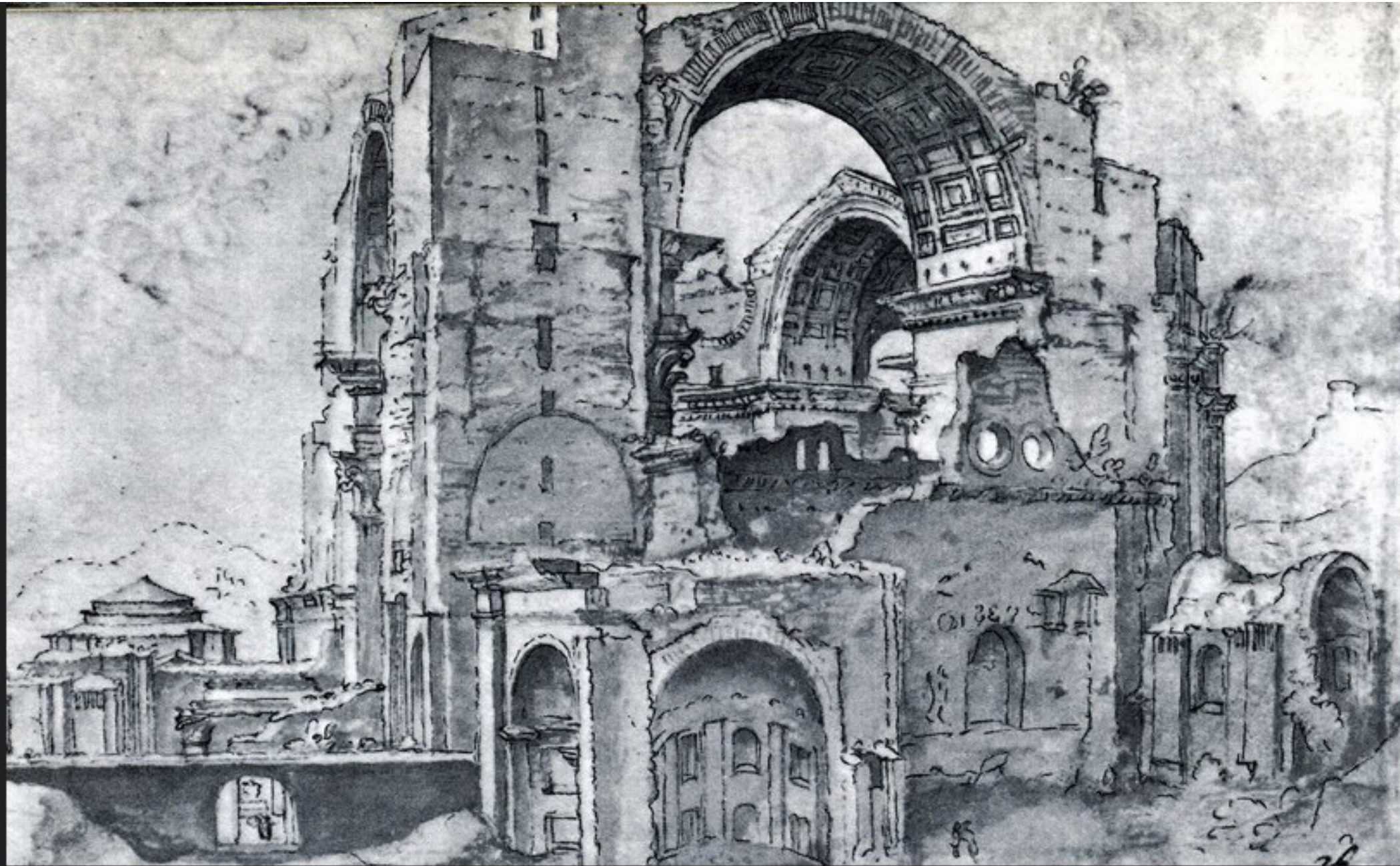
Let's rewind a few decades and move towards the Vatican.

Saint Peter was martyred in the Circus of Nero, which you can partially see in the image.

The Old Basilica was constructed right on top

And now the pope was ordering for a new basilica to replace it, in the marshy grounds north of the Tiber.

The challenge here was that each pope had different motivations and different political allegiances.



Maerten van Heemskerck. "Pillar of the Crossing of New Saint Peter's and Remnants of the Northern Transept Arm of the Old Basilica." *Roman Sketchbook I*, folio 13 recto. Drawing; pen and brown ink, wash. 1532-1536.

One important allegiance was that with the Spanish royalty, because research has shown that it was Spanish gold from the North African Crusade Indulgences that paid for about 60% of the basilica.

So the rhythm of construction went according with the pope's relationship with Spanish monarch, because the popes did not have the money to cover the whole project.

In fact, many times construction came to a halt because popes like Clement VII who we saw earlier was pro-French, and that did not sit well with Charles V whose troops sacked Rome in 1527, and left construction at a standstill.

This engraving shows the central piers of New San Pietro, with the ruins of the old basilica peeking out in the foreground.



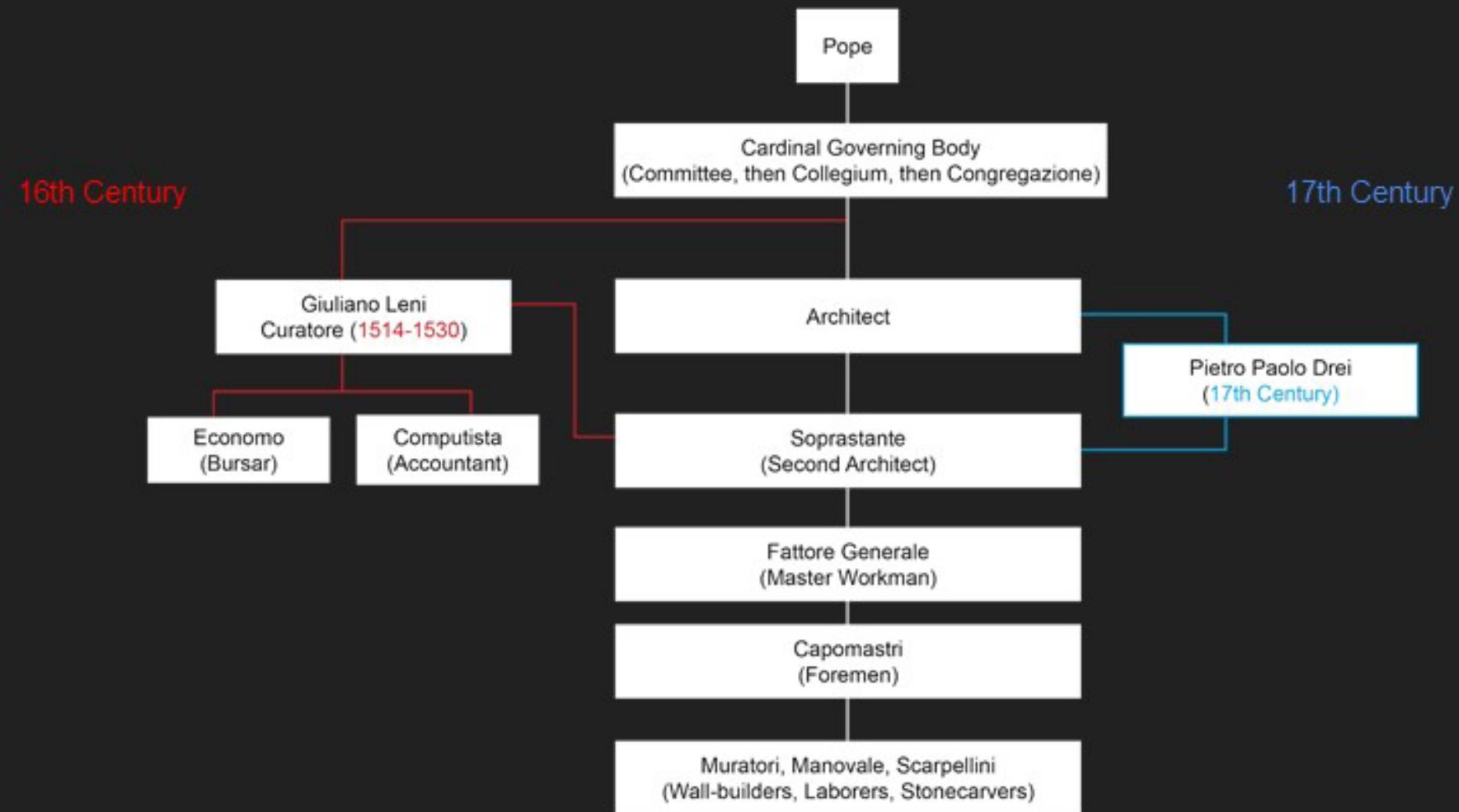
Maerten van Heemskerck. Interior View of the Nave of Old Saint Peter's Basilica with Glimpse of the New Building. Roman Sketchbook II, folio 52 recto. Drawing; pen and brown ink, wash. 1532-1536.

The way that construction happened in San Pietro, with the design changes and financial instability lead to entire portions of the building to be erected and vaulted while adjacent parts of the basilica were not even started.

Remember the unshored wall we saw at El Escorial earlier? These piers are also not meant to be left unbuttressed, and probably developed cracks because of that.

An aspect that both buildings also have in common is their use while construction is still happening. So like the monks were living in the half-finished monastery, there is a temporary construction designed by Bramante to cover the site of Saint Peter's tomb. So in this image we have the new arches, the old nave, and a temporary temple.

San Pietro



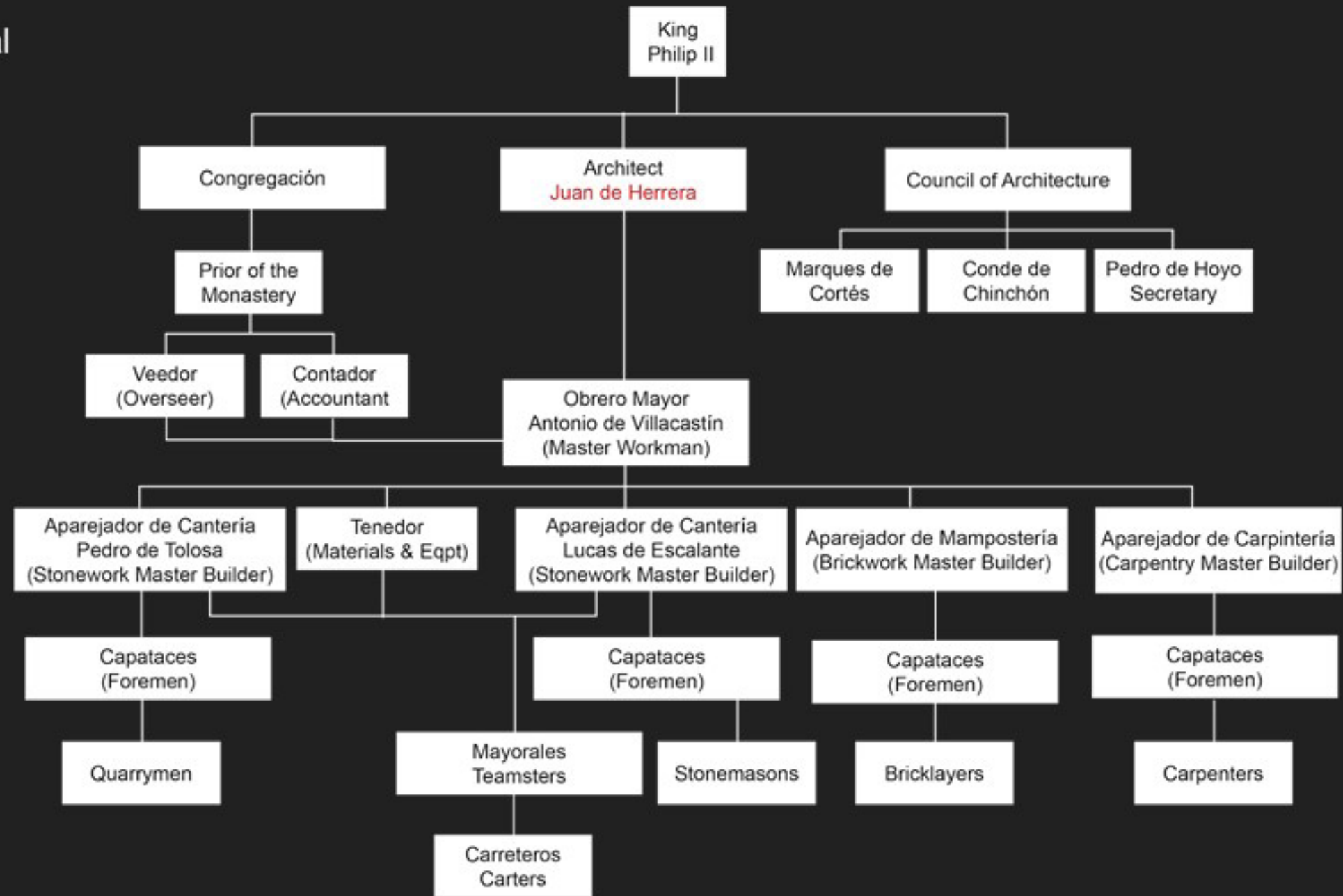
Let's take a look at the organization at the Roma fabbrica.

Under the pope there was a bureaucratic body of cardinals, which was amended over and over by Leo, Clement, and Paul. The challenge was mediating between the cardinals who handled the money, and the workers on the field.

In the early years of the basilica there was one individual, Giuliano Leni, who acted as a general contractor. He actually coordinated the different capomastri or foremen, paid the workers, addressed technical issues, and even furnished materials at some points.

In the 17th century, which is a scope slightly out of my study, there was another multifaceted individual, Pietro Paolo Drei, who communicated design decisions by drawing simplified details from the architect's design so that the workers understood.

El Escorial 1572



Let's look at the org chart for El Escorial.

Like in San Pietro, administration is done by the Congregation of monks, except that it is a master workman friar who mediates between admin and on-site staff. The aparejadores actually did similar to Drei, and drafted simplified details almost every evening so that they could communicate with the workers.

In both projects did they estimate the cost of work after the fact, and in both it looks like there was this sort of piecemeal construction, where a whole portion of the building goes up while next door they're still excavating foundations.

Remaining Questions

- Working Conditions in Rome
- Changes in Org. Structure in Rome
- Detailed Sequence of Construction at El Escorial
- Different Crews and Coordination of Crews in Rome

This is as far as I got in my study.

I came across some great information about the conditions of the workers at El Escorial, who received free lodging, free healthcare, and were exempt from taxes.

The king also set up a wheat deposit so that they would be well fed, and so construction would't slow.

I wish I'd had the time to get into the same depth with the Roman fabbrica. I also would have liked to better understand the changes in organizational structure in Rome.

I also would have liked to better understand the actual sequence of construction at El Escorial, but unfortunately a lot of that information is in the Vatican Archives and in the Royal Archives in Spain instead of PDFs online.

My knowledge of construction management is also limited, and I would love to hear what insights you might have thought of from what I've discussed here today as far as progress of construction, how politics affected the work.

Thank you for your attention, and let's have a conversation.



Juan GB. "South Façade and Retaining Wall at El Escorial." August 2017. 35mm Film Photograph