

WHY SKEWED?

- random error
- contingency
- symbolism

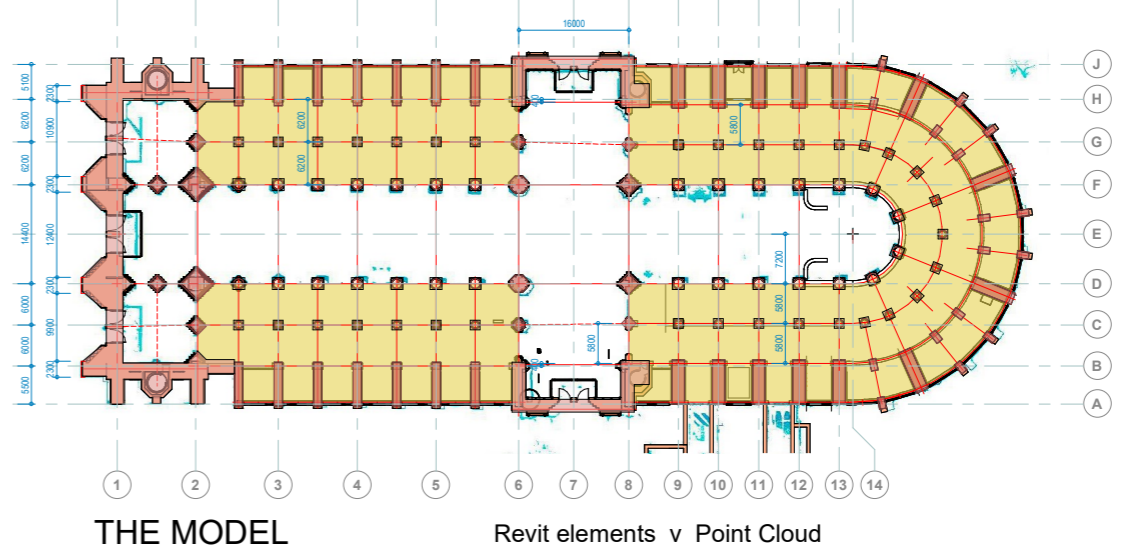
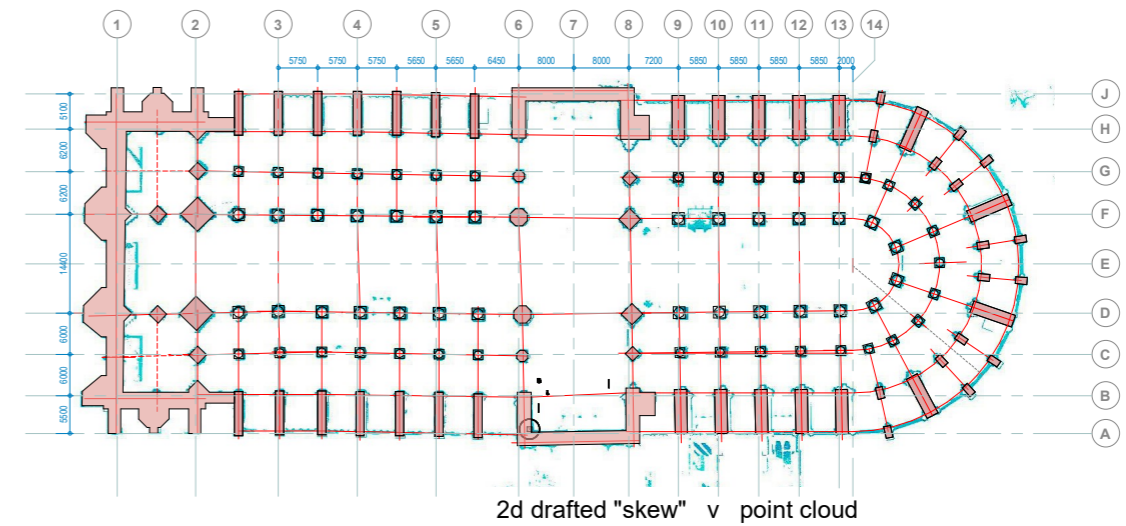
WORK SEQUENCE

We began by setting up a completely regular and symmetrical grid, based on various plans downloaded from the internet. Over time as we understood the building better the grid has been adjusted to reflect important irregularities.

However, a strategic decision was made to keep the grid orthogonal. We do not have access to a point cloud and our aim is to understand the fundamental logic of the building. Trying to model every small accidental misalignment would hugely complicate the work.

We did find a horizontal cut through Andrew Tallon's point cloud on the publicly accessible Leica TruView site, and this is the primary reference used here.

The Skewed Grid is a drafting study for reference only: an attempt to record the main deviations from square / orthogonal alignments. We have kept the East End fully symmetrical. Any other approach would be problematic, because the aisles are continuous as they wrap around the apse. There are subtle transitions across the transept to allow the aisles of the Nave to be wider: slightly wider to the South and significantly wider on the North side. More transitions under the bell towers result in the North tower being about a metre wider than the South tower.



## INTRODUCTION

Notre Dame de Paris, Our Lady of Paris  
There were previous churches on the site.  
The current building was begun in 1160 by Bishop Maurice de Sully and was substantially complete 100 years later, but continued to be modified periodically.

It was desecrated in the 1790s during the French Revolution but restored in the 19th century by Eugene Viollet-le-Duc. This was partly motivated by Victor Hugo's novel, known in English as "The Hunchback of Notre Dame"

## SPIRE

the original spire was removed in 1786 but restored a century later by Viollet-le-Duc

## TRANSEPTS

## APSE

with Flying Buttresses

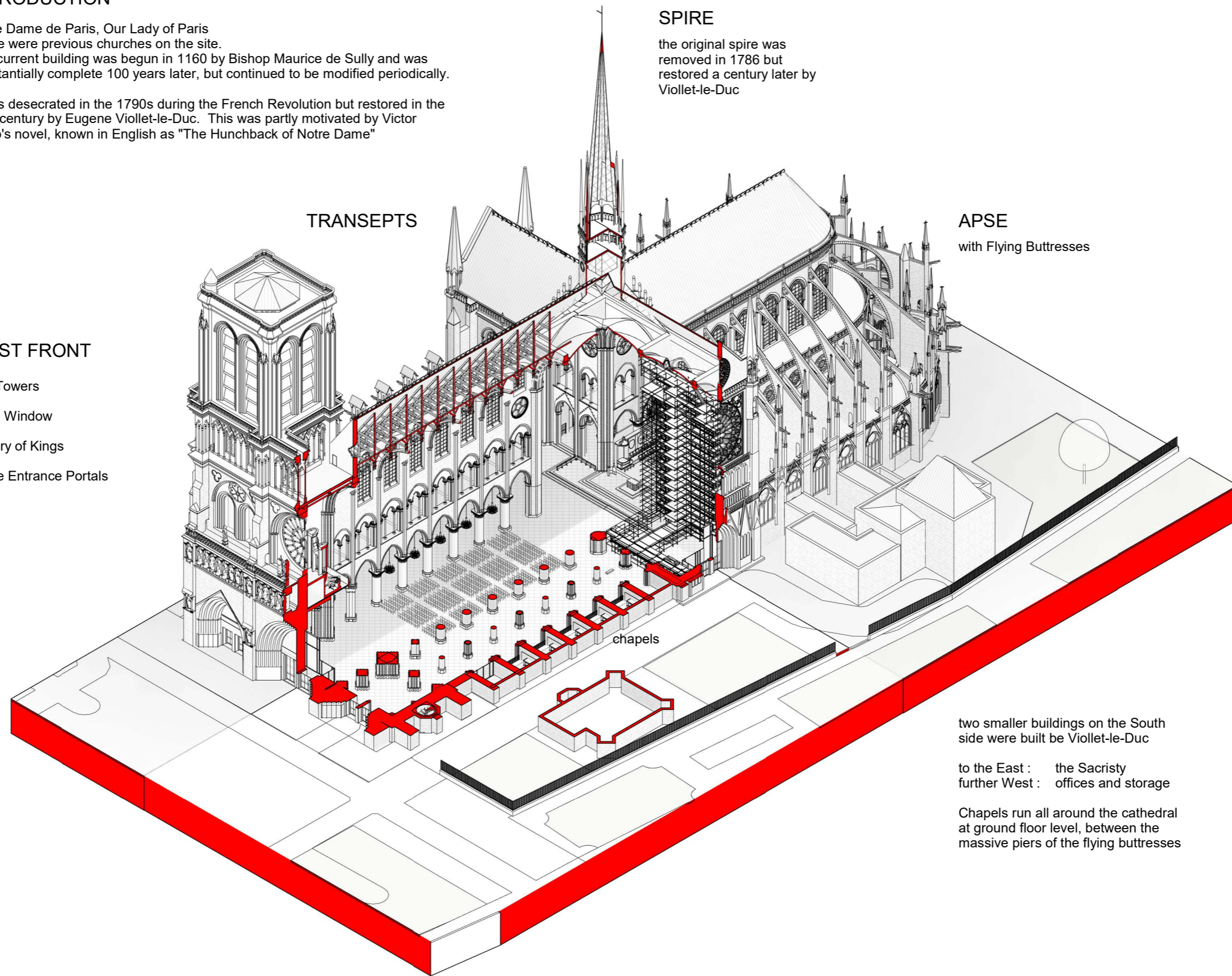
## WEST FRONT

Bell Towers

Rose Window

Gallery of Kings

Three Entrance Portals

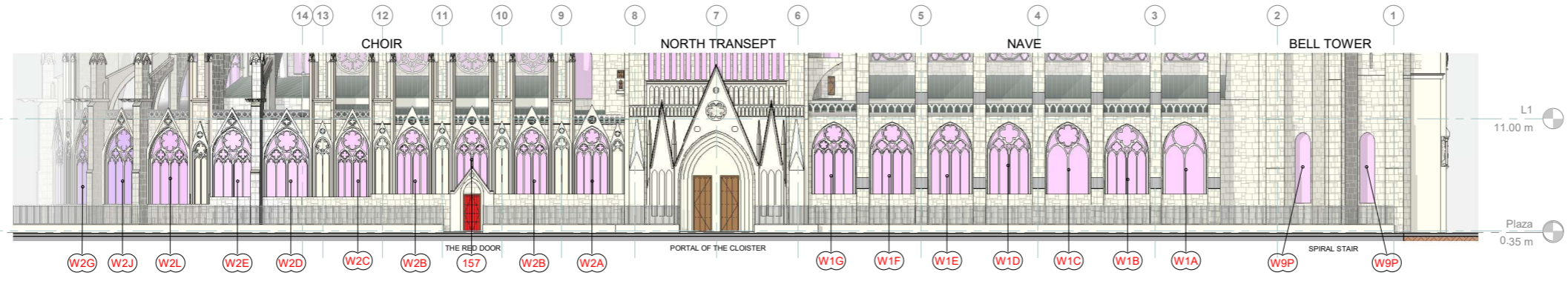


chapels

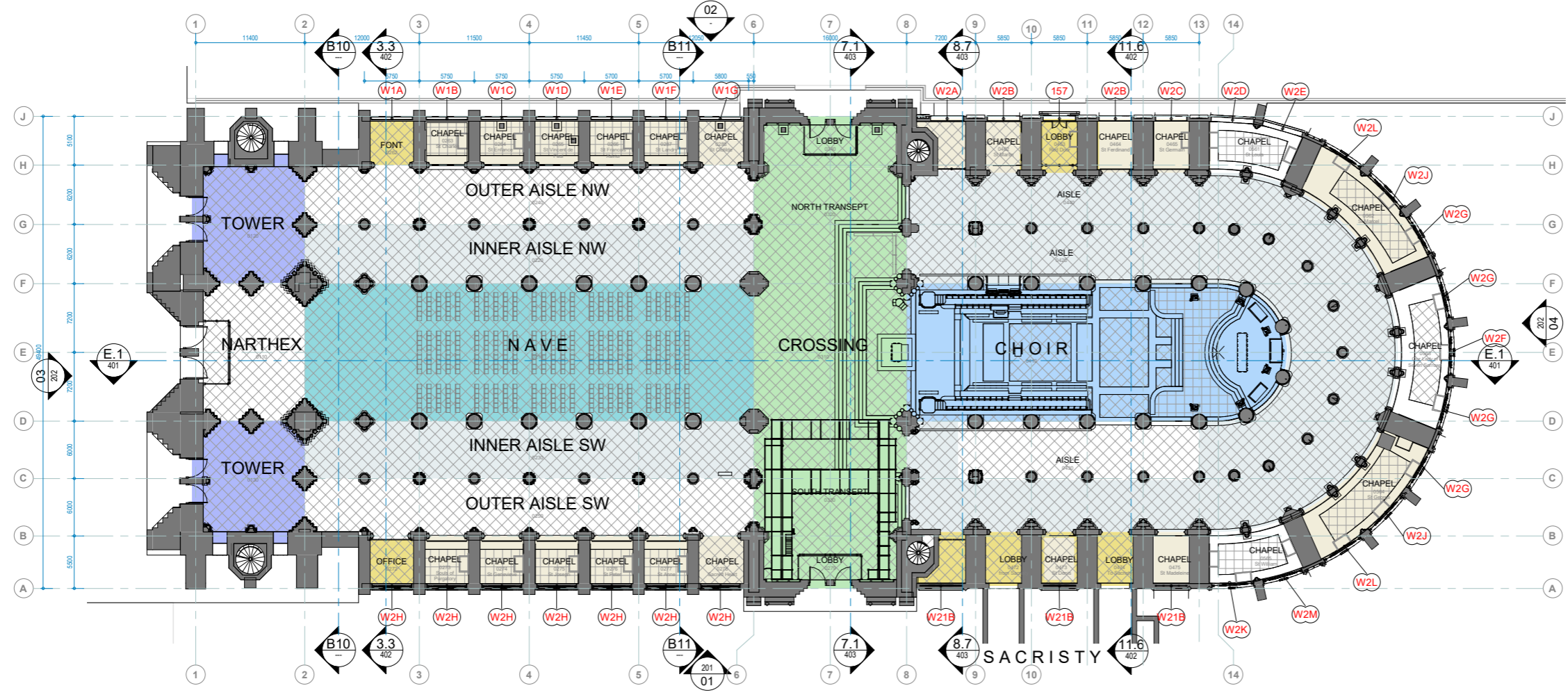
two smaller buildings on the South side were built by Viollet-le-Duc

to the East : the Sacristy  
further West : offices and storage

Chapels run all around the cathedral at ground floor level, between the massive piers of the flying buttresses



PART SOUTH ELEVATION



**PUBLIC REALM**

Notre Dame cathedral is a national symbol, a sacred space of great value to the people of France. It has also become a tourist attraction and a source of wonder to the whole world. Its towers and spires act as landmarks from a distance, across the rooftops. The sound of its bells hold a special place in the collective imagination.

As a tourist experience Notre Dame includes a climb to the heights of the Bell Towers, but as a place of worship it is largely experienced from the ground plane, articulated by subtle changes of level at the crossing.

In a way, the public realm is one continuous space, but also a four-deformation of subtle transitions and demarcations. There are small, "private" spaces for silent meditation, linear routes for grand processions and personal journeys, towering volumes for mass gatherings, echoing with magnificent musical devotion.

**FILTERED DAYLIGHT**

What proportion of ambient lighting do the ground floor windows contribute? To the central spaces, probably very little, to the outer aisles much more. Each one has a very powerful presence in within a chapel or lobby, both as a source of illumination, and as a story-telling device.

For us, the modelling and analysis of the window tracery is an ongoing exercise, and source of great delight. The sequence of variations along the North facade seem quite willful and arbitrary. It would be fascinating to know more of their history.

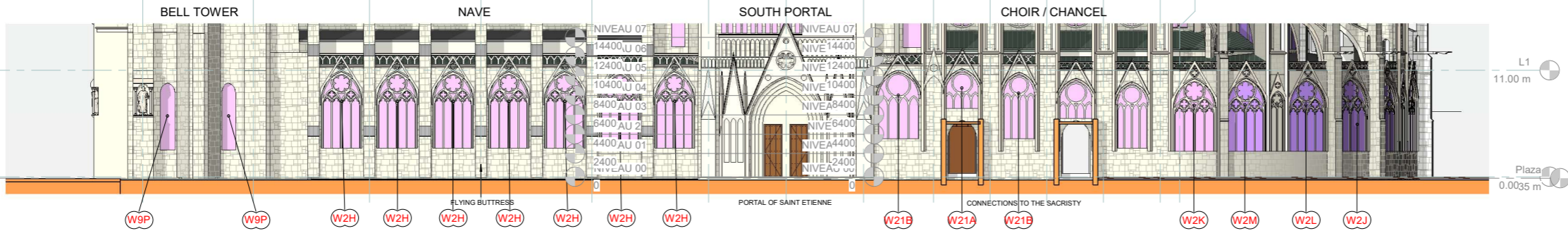
The chapels were added a century or so after the initial construction phase. Were they inserted piecemeal, one-by-one in response to donations by wealthy individuals and families? Does this account for the apparently random arrangement of different designs? Were the chapels to the South of the nave built in a more orderly manner as the regularity of their designs suggests? Lots of questions.

**ZONE**

- AISLES
- CHANCEL
- CHAPELS
- nave
- OTHER
- Transept
- WEST FRONT

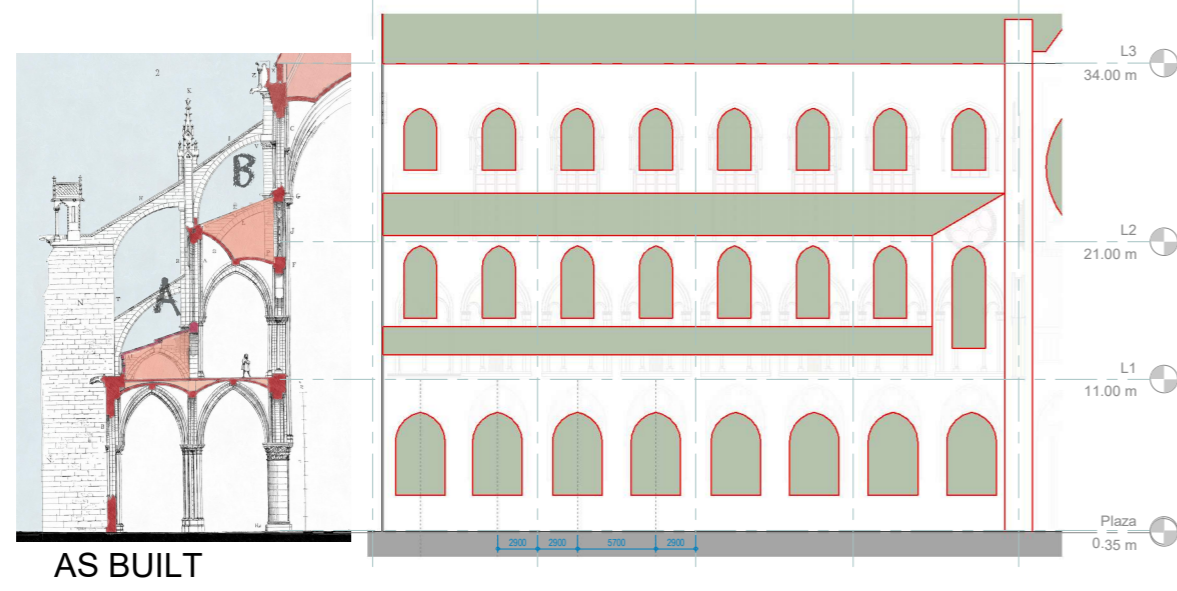
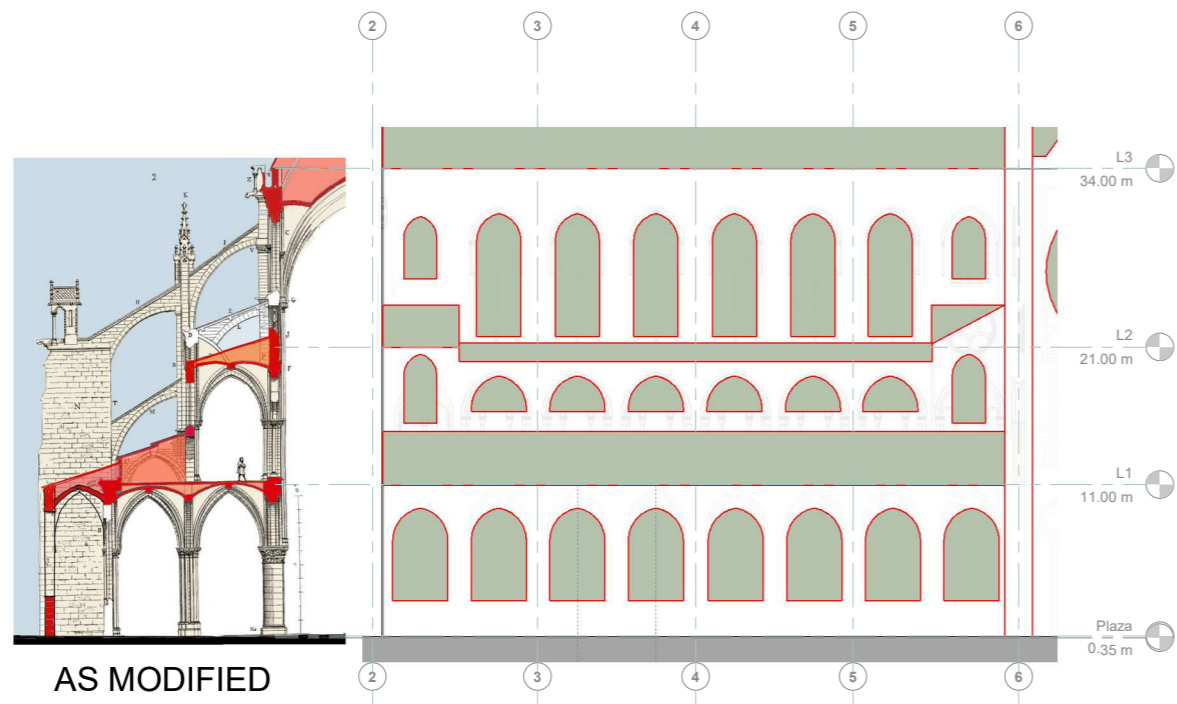
**DIRECTORY**

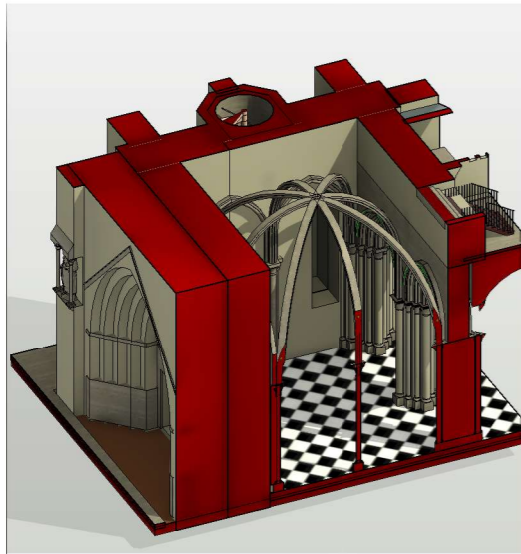
NO	TYPE	ZONE	NAME
0110	NARTHEX	WEST FRONT	
0120	TOWER	WEST FRONT	
0130	TOWER	WEST FRONT	
0210	N A V E	nave	
0220	INNER AISLE NW	AISLES	
0230	INNER AISLE SW	AISLES	
0240	OUTER AISLE NW	AISLES	
0250	OUTER AISLE SW	AISLES	
0262	FONT	OTHER	
0263	CHAPEL	CHAPELS	St Charles
0264	CHAPEL	CHAPELS	St Enfant
0265	CHAPEL	CHAPELS	St Vincent de Paul
0266	CHAPEL	CHAPELS	St Francois Xavier
0272	OFFICE	OTHER	
0273	CHAPEL	CHAPELS	Souls of Purgatory
0274	CHAPEL	CHAPELS	St Genevieve
0275	CHAPEL	CHAPELS	St Joseph
0276	CHAPEL	CHAPELS	St Peter
0277	CHAPEL	CHAPELS	St Anne
0278	CHAPEL	CHAPELS	Sacred Heart
0279	LOBBY	Transept	
0287	CHAPEL	CHAPELS	St Landry
0288	CHAPEL	CHAPELS	St Clotilde
0310	CROSSING	Transept	
0330	NORTH TRANSEPT	Transept	
0330	SOUTH TRANSEPT	Transept	
0340	LOBBY	Transept	
0410	C H O I R	CHANCEL	
0420	AISLE	AISLES	
0430	AISLE	AISLES	
0440	AISLE	AISLES	St Martin
0462	CHAPEL	CHAPELS	St Martin
0463	LOBBY	OTHER	Red Door
0464	CHAPEL	CHAPELS	St Ferdinand
0465	CHAPEL	CHAPELS	St Germain
0472	LOBBY	OTHER	from Sacristy
0473	CHAPEL	CHAPELS	St Denis
0474	OTHER	OTHER	To Sacristy
0475	CHAPEL	CHAPELS	St Madeleine
0561	CHAPEL	CHAPELS	St Louis
0562	CHAPEL	CHAPELS	St Marcel
0563	CHAPEL	CHAPELS	Our Lady of Seven Sorrows
0564	CHAPEL	CHAPELS	St George
0565	CHAPEL	CHAPELS	St William
1220	TRIFORIUM GALLERY	AISLES	
1230	TRIFORIUM GALLERY	AISLES	
1240	TRIFORIUM GALLERY	AISLES	



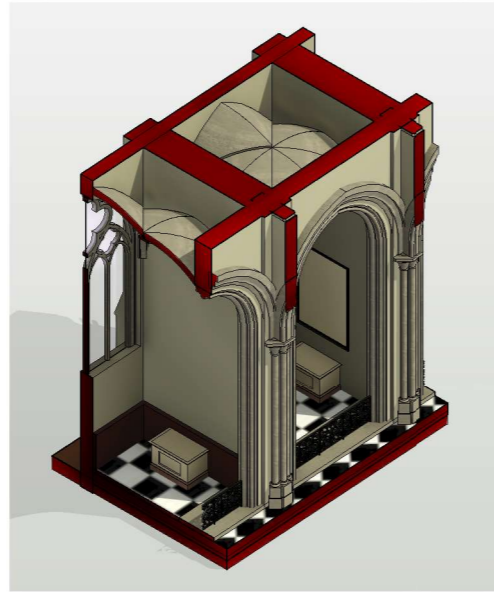
PART SOUTH ELEVATION



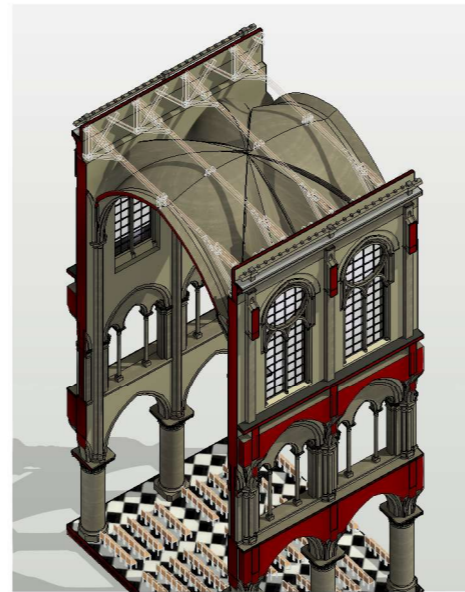




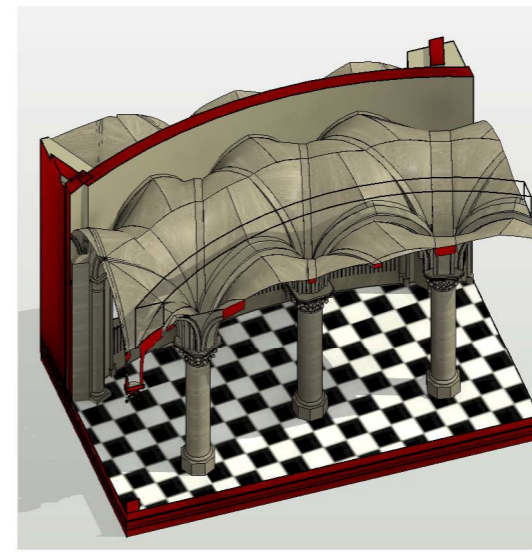
**A** **8 PART VAULTS**  
 rectangular space, each wall divided into 2 arched bays  
 ridged infill vaults meet at the centre



**C** **ONE SIDE HIGH**  
 the arched windows on the outside of the chapels stand  
 higher than the internal arches, the vault adapts to suit



**D** **6 PART VAULTS**  
 column spacing down the length is less than half the  
 span across the width, the result is a 6 part vault



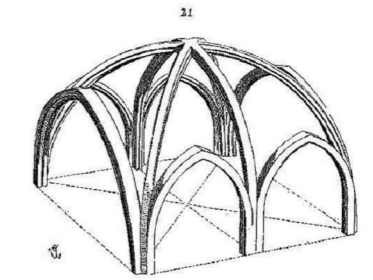
**E** **ZIGZAG VAULTS**  
 to bend around the curve of the apse we have  
 interlocking triangular vaults, arranged in groups

**RIBBED VAULTS**

The Gothic ribbed vault is a spectacular technology, apparently imported from the East during the crusades. It proved to be a very flexible vehicle for the evolution of an architectural style, rooted in the hands-on experience of skilled artisans.

Ribbed vaults can cover rectangular, triangular, octagonal, trapezoidal and many other shapes of space, using exactly the same principles. Text books often explain that a pointed arch allows rectangular spaces to be covered by a vault, because the arches can be adjusted in height, which would not be the case with a semi-circle. But in a way, this misses the point. Gothic vaulting achieves its incredible richness and variety by allowing arches of different heights and shapes to be connected together by triangular segments curved vaulting which span between the ribs.

It has been a revelation to us, how many different varieties of vault were used in the construction of Notre Dame.



6 part vault

illustrations from the Dictionary of French Architecture by Viollet-le-Duc

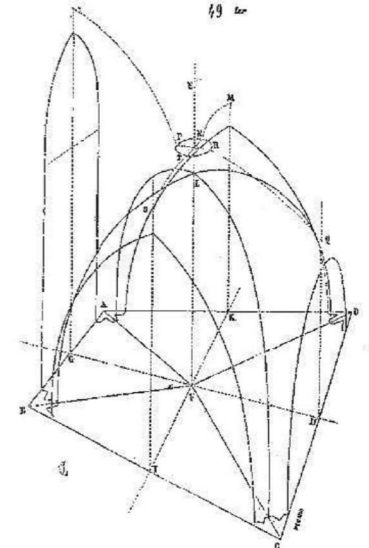
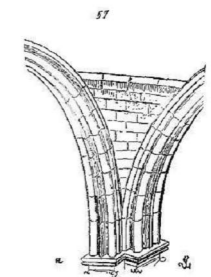
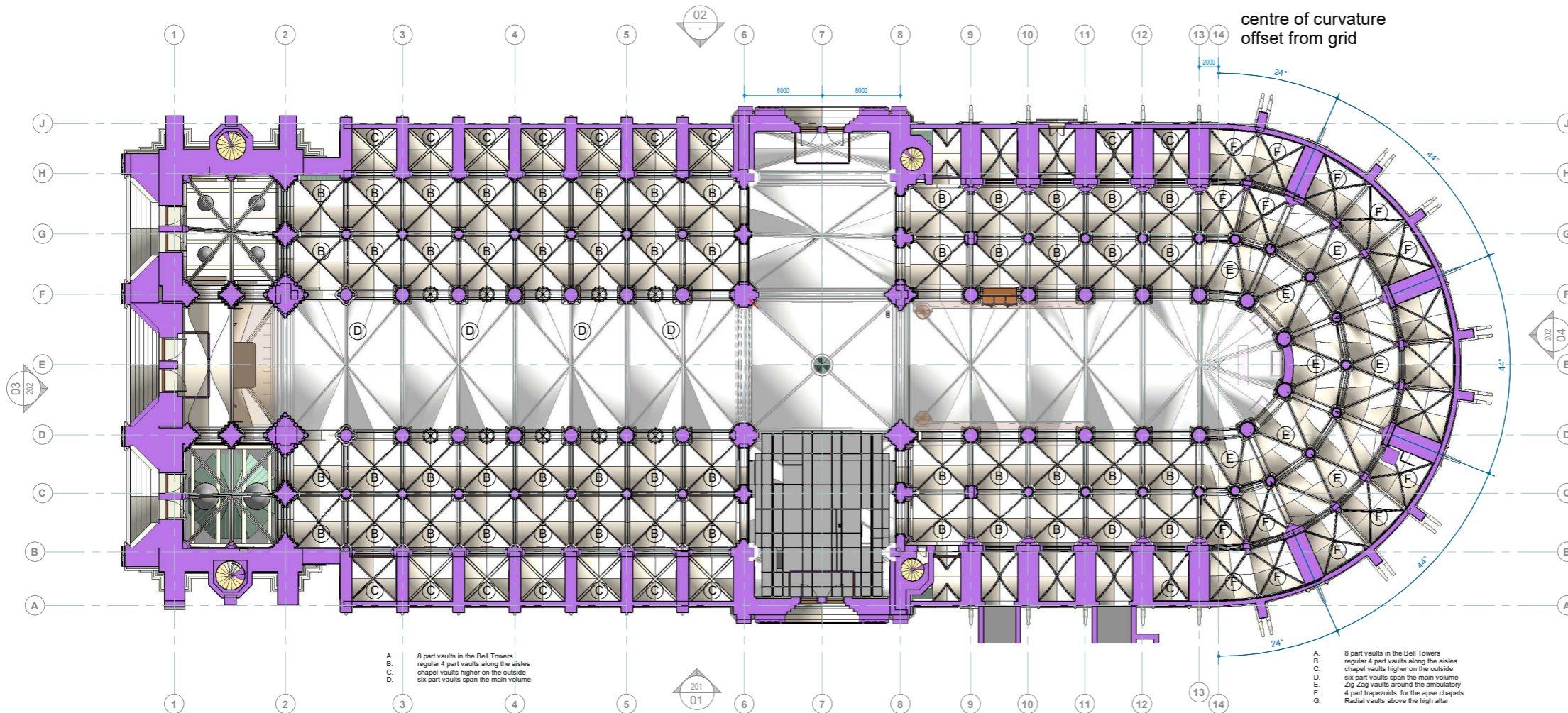
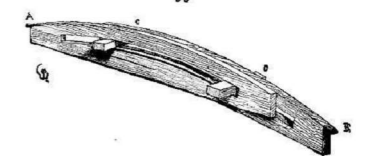


diagram illustrating the extreme versatility of the ribbed vault method

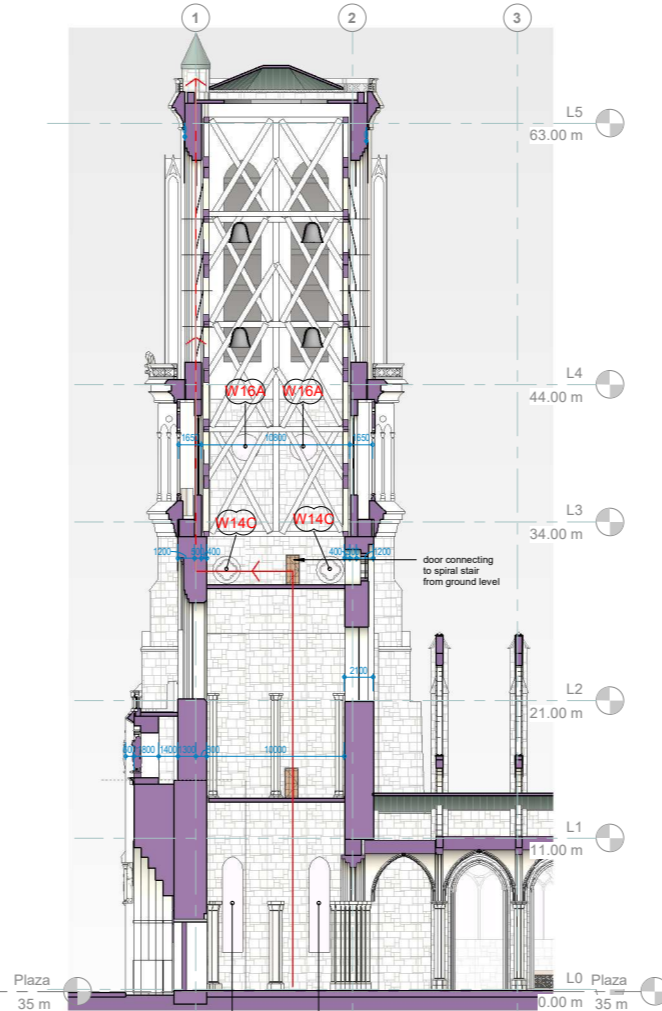
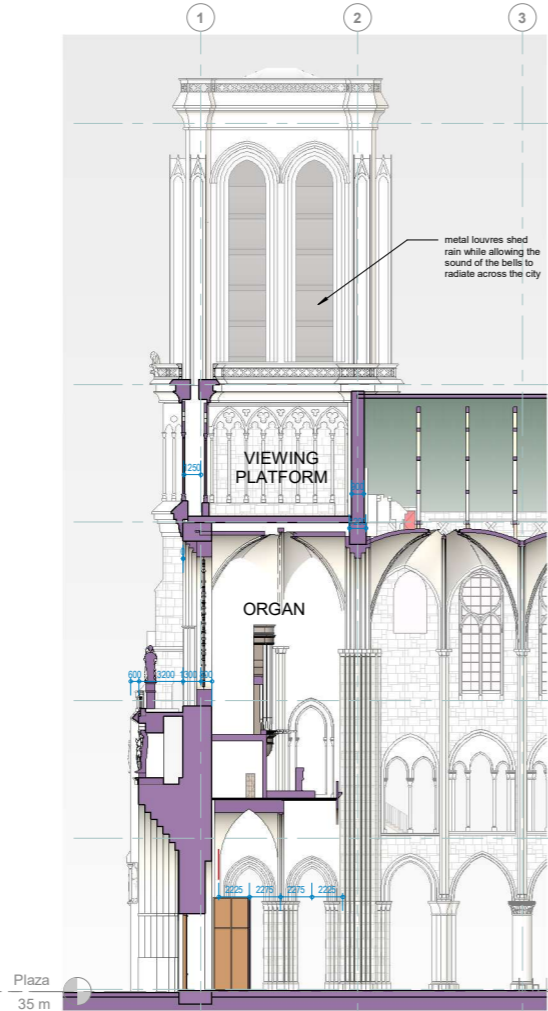
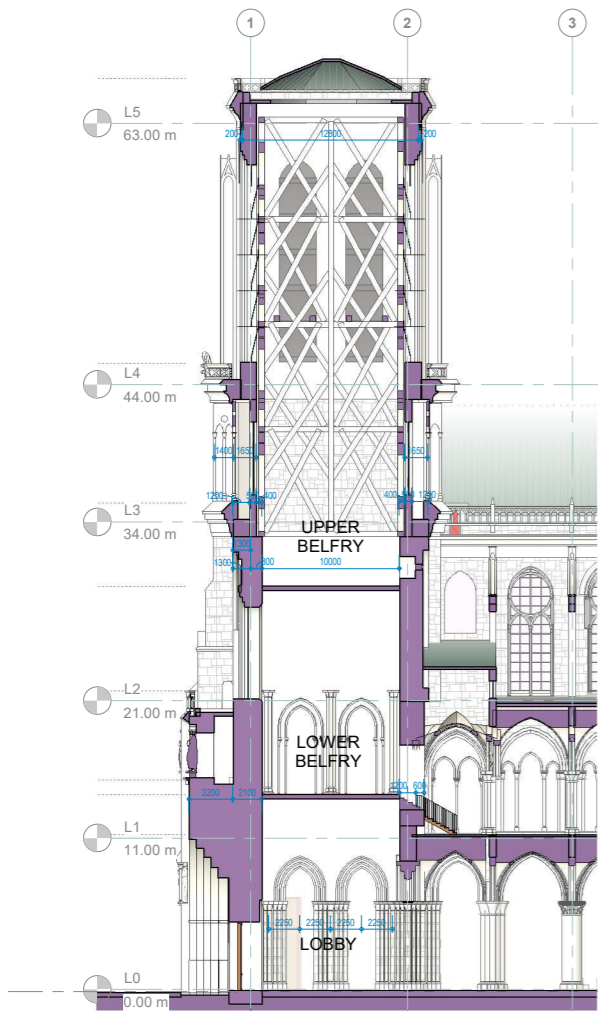


wooden turning pieces can be used to support each course of infill while it is being laid



A. 8 part vaults in the Bell Towers  
 B. regular 4 part vaults along the aisles  
 C. chapel vaults higher on the outside  
 D. six part vaults span the main volume

A. 8 part vaults in the Bell Towers  
 B. regular 4 part vaults along the aisles  
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 E. zig-zag vaults around the ambulatory  
 F. 4 part trapezoids for the apse chapels  
 G. Radial vaults above the high altar



## BELL TOWERS

The Bell Towers have three levels.

- At base, a rectangular lobby with an 8-part vault
- Above this a taller chamber also covered by an 8-part vault, here called the "Lower Belfry"
- On top, the upper belfry with a timber framework supporting the bronze bells

There are several access galleries at different levels.

## ORGAN LOFT

The organ sits above the central entrance bay, partly supported by a stone vault and partly by a timber deck.

Above the organ is a six-part vault, similar to the ones above the nave, but separated from the nave by a heavy, ribbed arch.

## VIEWING PLATFORM

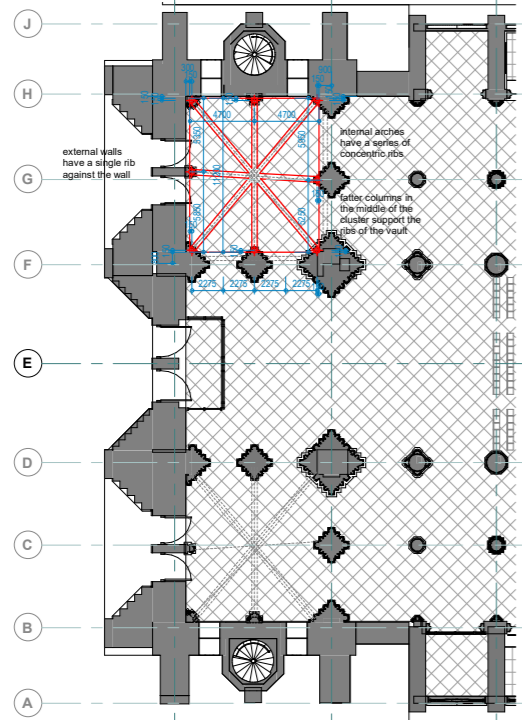
Between the towers is an external courtyard, connected to open loggias that encircle both towers. Above these loggias are open balconies with a stone parapet and statues of grotesques, commissioned by Viollet-le-Duc. These are the famous mythical beasts of Notre Dame: birds, elephants, griffins, etc

3 Section T5 1 : 250

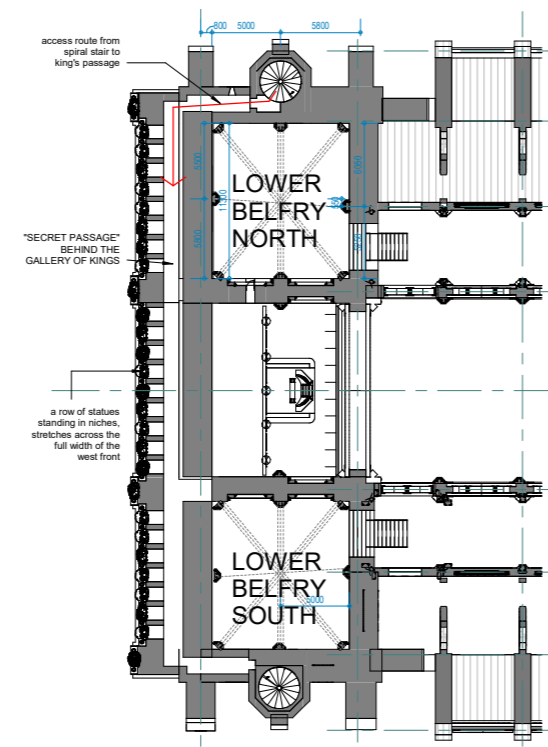
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1 Section T3 1 : 250

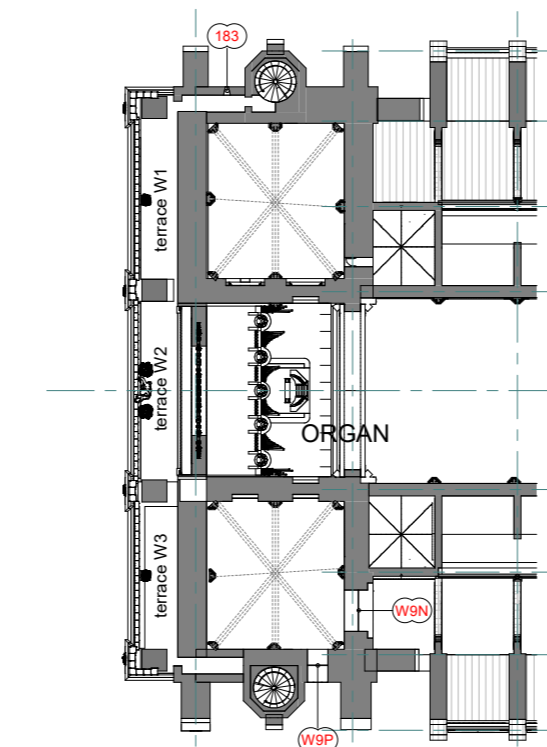
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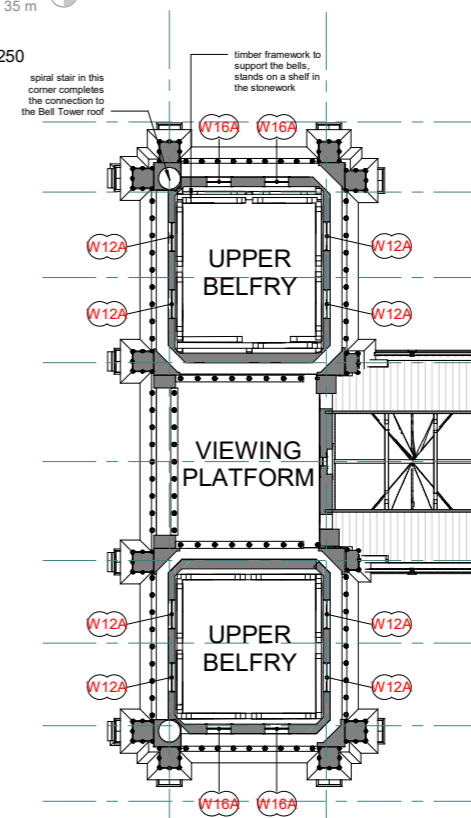
BELL TWR L0 1 2 3



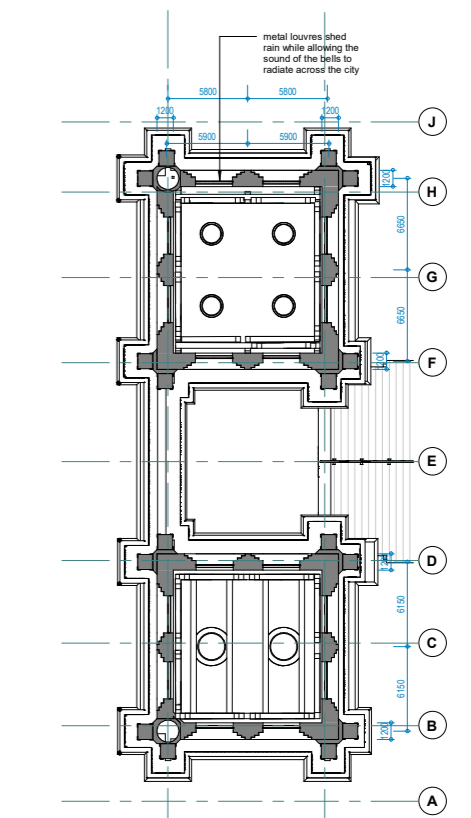
BELL TWR L1A 1 3



BELL TWR L1B 1 3



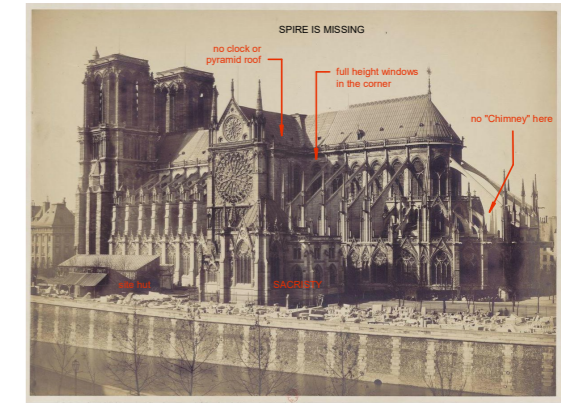
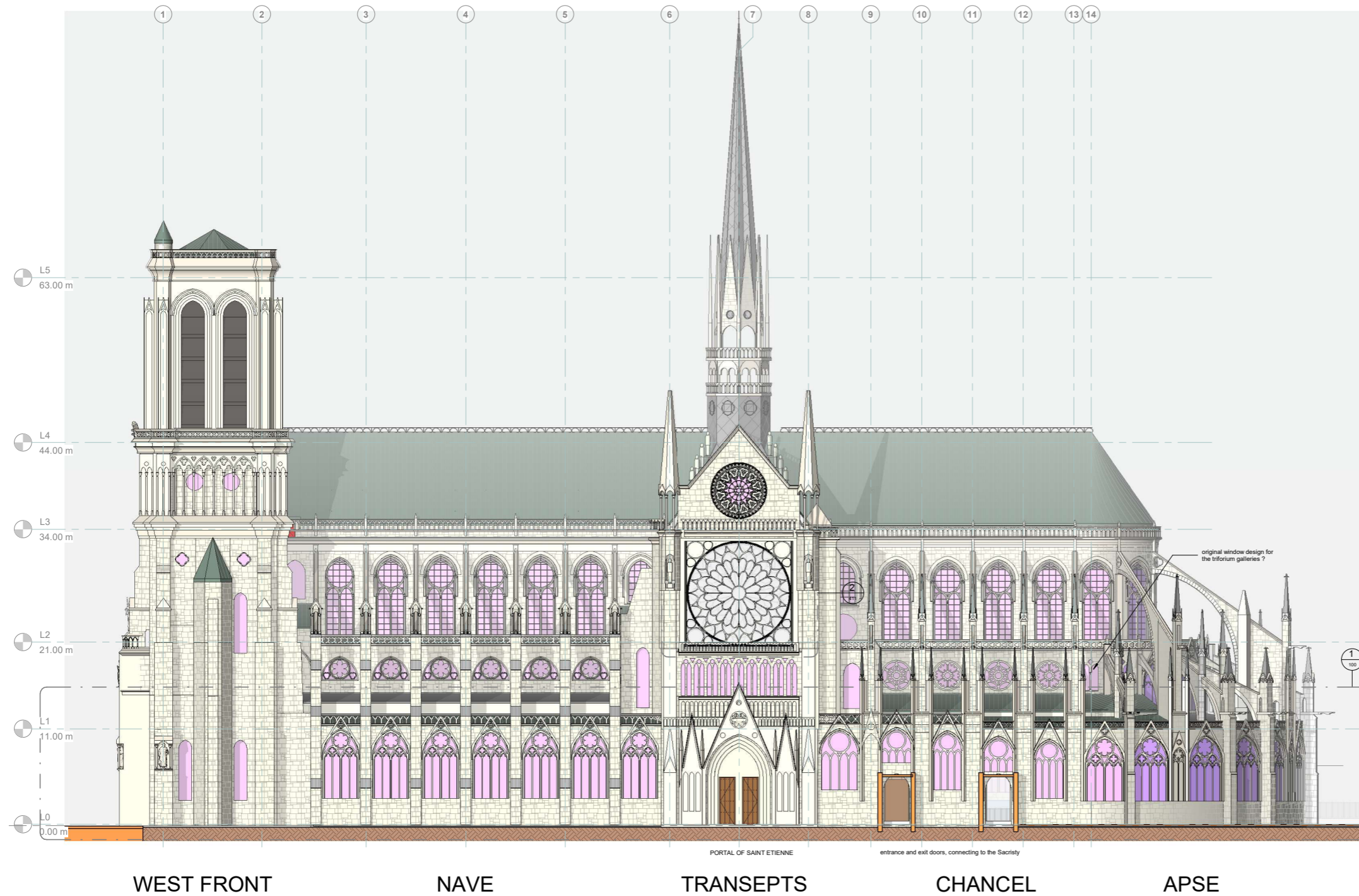
BELL TWR L2 1 2



BELL TWR L3 1 2

## FROM A DISTANCE

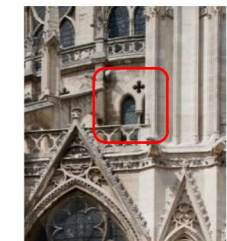
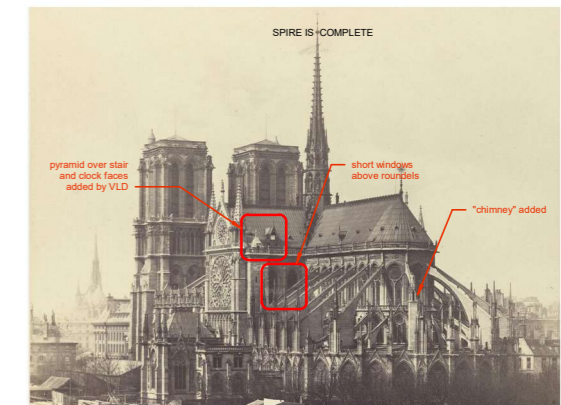
The South Facade can be seen from across the river, unlike the North side, which faces a narrow street



## WORK IN PROGRESS

The photograph above was taken during the progress of Viollet-le-Duc's restoration. The spire has not yet been built, and the windows around the four corners of the crossing are still full size, like the other clerestory windows. The four clock faces that were added to the sides of the transepts just above the eaves are also missing, as is the small pyramid-roofed structure at the top of the spiral stair. (We have not yet added the clocks to the model.)

The sacristy has been built, but the space where the administrative building now sits is occupied by a site hut. Blocks of stone can be seen all along the river bank. VLD seems to have added a rather mysterious "chimney" structure at one end of the Chapel of St George, which occupies the South East quadrant of the apse. Its purpose is yet to be established. There is no matching feature on the North East side (Chapel of St Marcel)



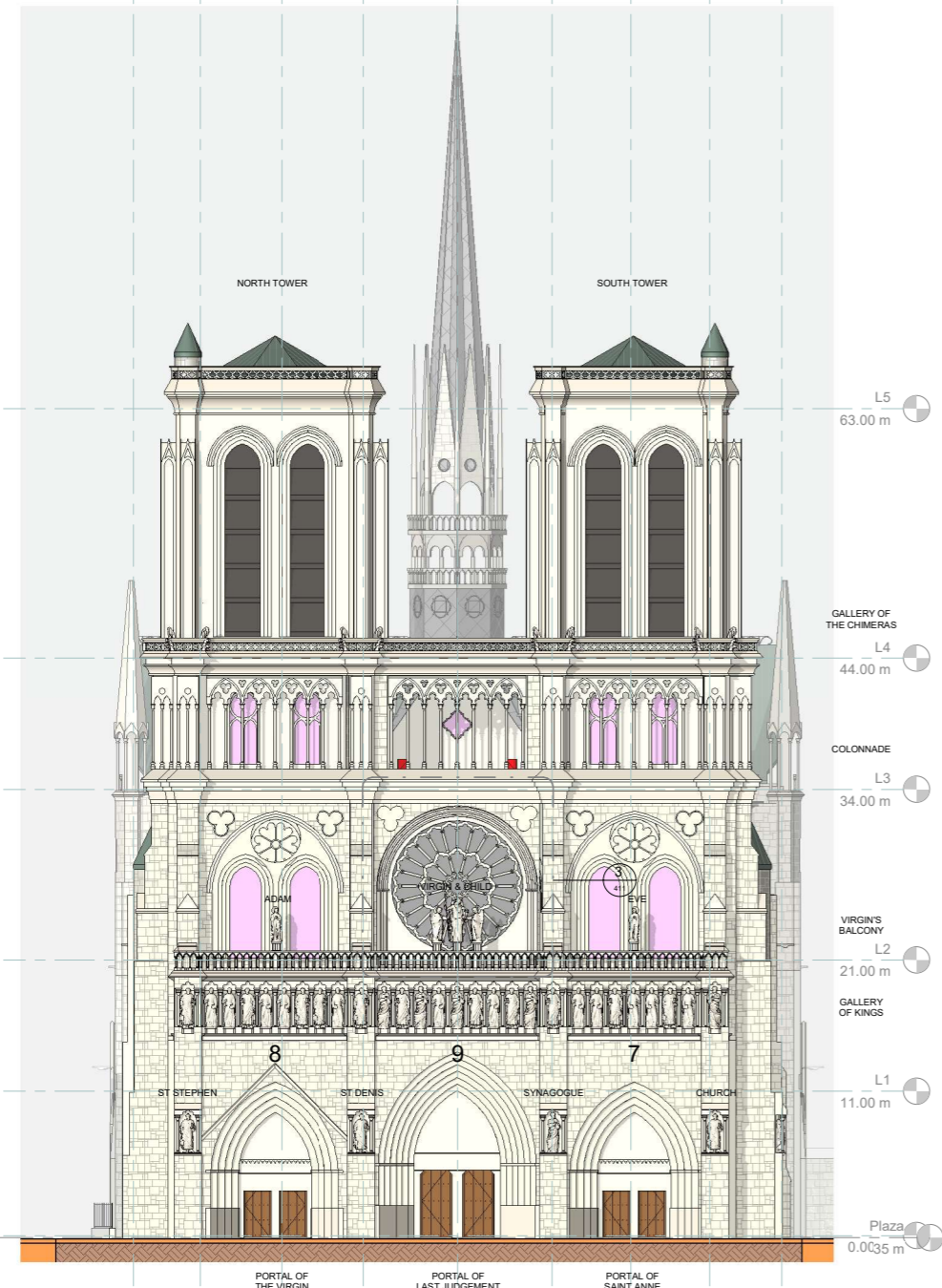
## OLDER DRAWINGS

Various drawings exist from before the advent of photography, but how do we gauge their accuracy? There are two windows on each side where the triforium galleries begin to curve into the apse. It seems that these may represent the original window design, which was replaced by VLD, using roundels along the chancel, and convex triangles along the nave.





J H G F E D C B A

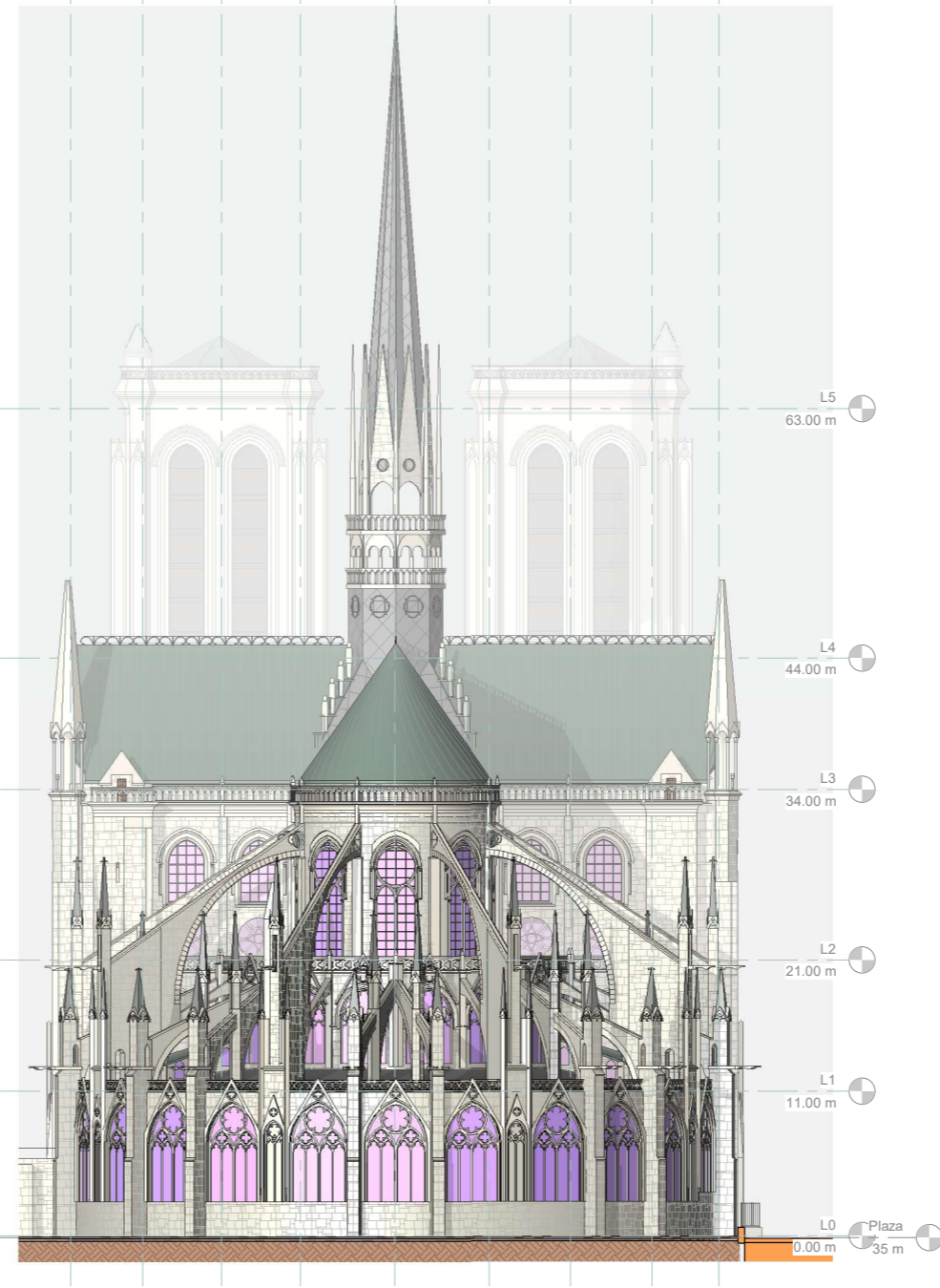


**THE WEST FRONT**

Overlooking a large public square, the public face of Notre Dame can be seen as five horizontal bands stacked on top of each other

- Two bell towers, the north one slightly wider than the south
- A colonnade, wraps around both towers and supports an open balcony
- Behind the Virgin's Balcony, the West Rose, flanked by paired windows
- The Gallery of Kings: biblical figures in medieval dress
- Three portals, profusely decorated with sculptural detail

A B C D E F G H J



**THE EAST END**

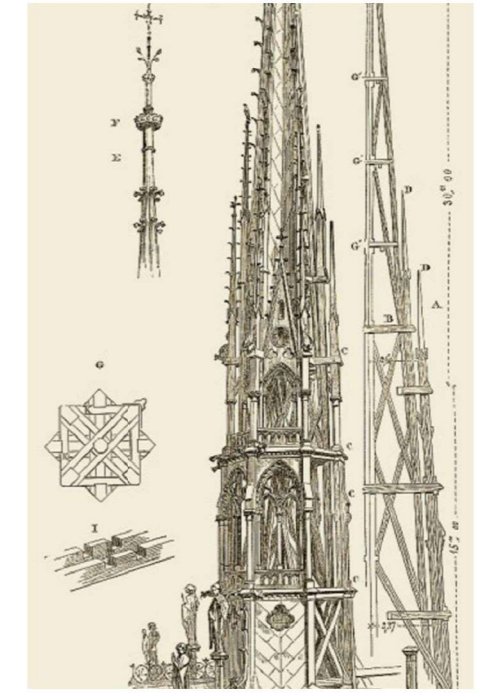
The apse is based around a complex radial geometry. At its heart, the high altar, protected by a curved screen. Two aisles run around, forming the ambulatory, between the altar and the chapels around the edge.

At first glance the buttresses, though complex and intricate seem quite regular, but on closer inspection there are many minor variations: in the height of pinnacles, the design of tracery

**THE SPIRE**

Designed by Viollet-le-Duc to reinstate a feature that had been demolished a century earlier. It was a wooden structure clad in lead.

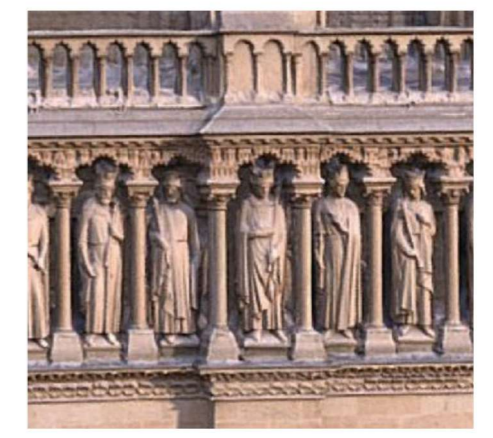
At the base, stepping down the valleys of the main roof were copper statues of the apostles, one of them in the likeness of VLD himself.



**GALLERY OF KINGS**

The statues were desecrated during the French Revolution and the niches stood empty for many years. They were restored by Viollet-le-Duc.

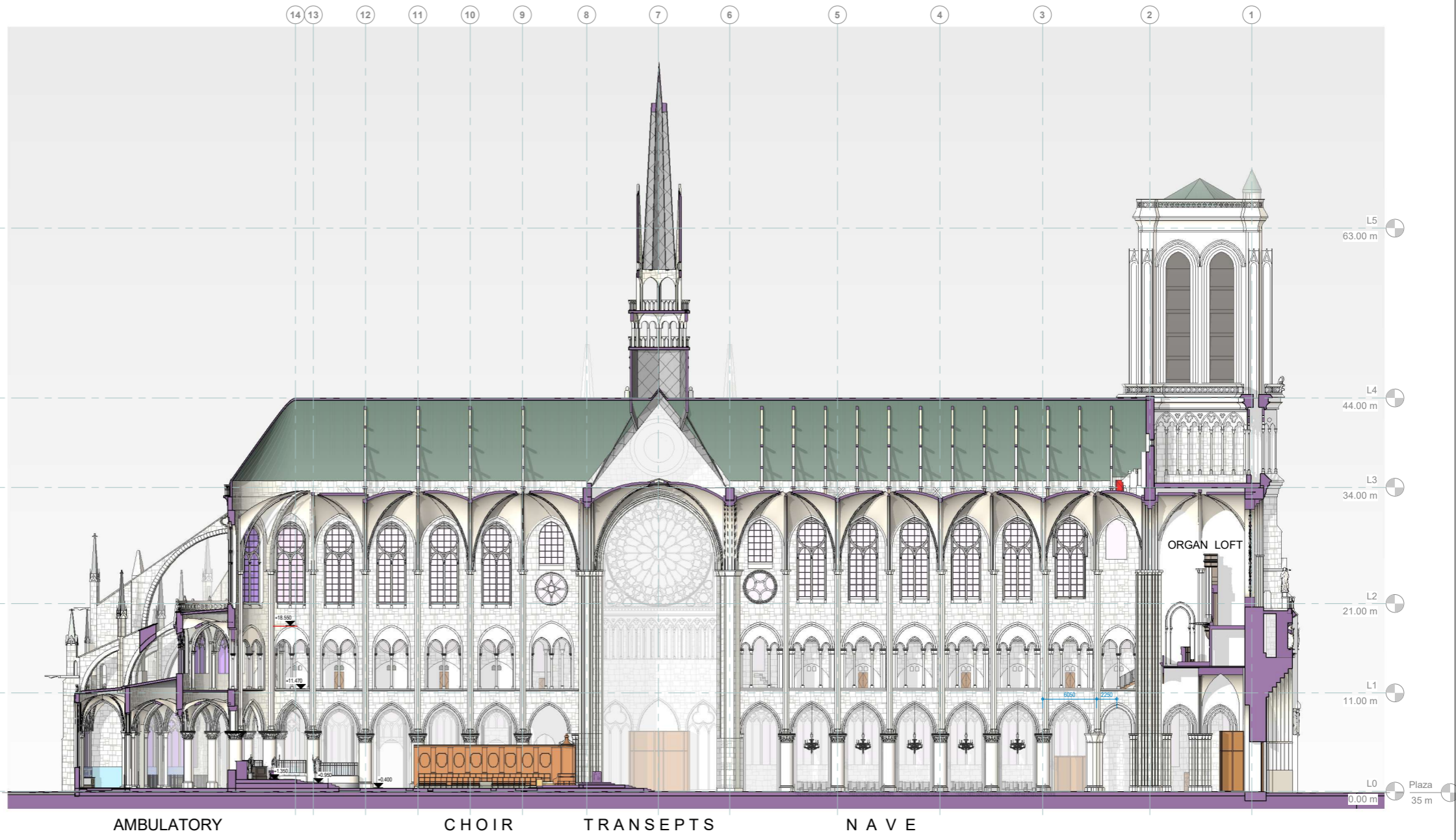
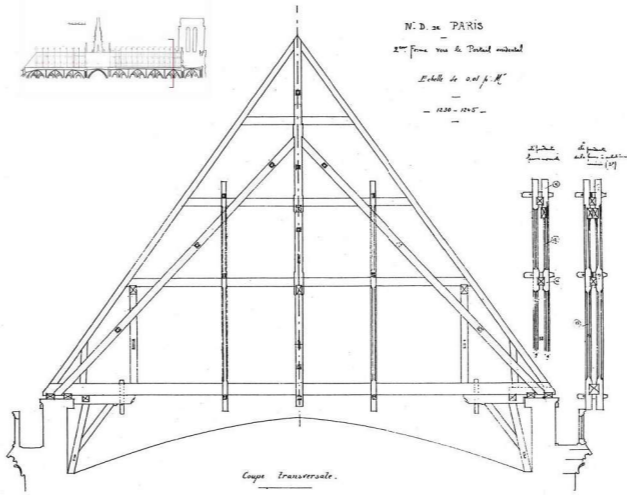
Because the North Tower is significantly wider than the South Tower, there is space for one more statue, although this fact is not obvious at first glance.



**THE FOREST**

The roof structure of Notre Dame was estimated to have required 13 thousand oak trees to build. The lead sheet covering weighed over 200 tons. Running the length of the roof space was a wooden gangway and various openings allowed sufficient light into the space to allow the eyes to adjust.

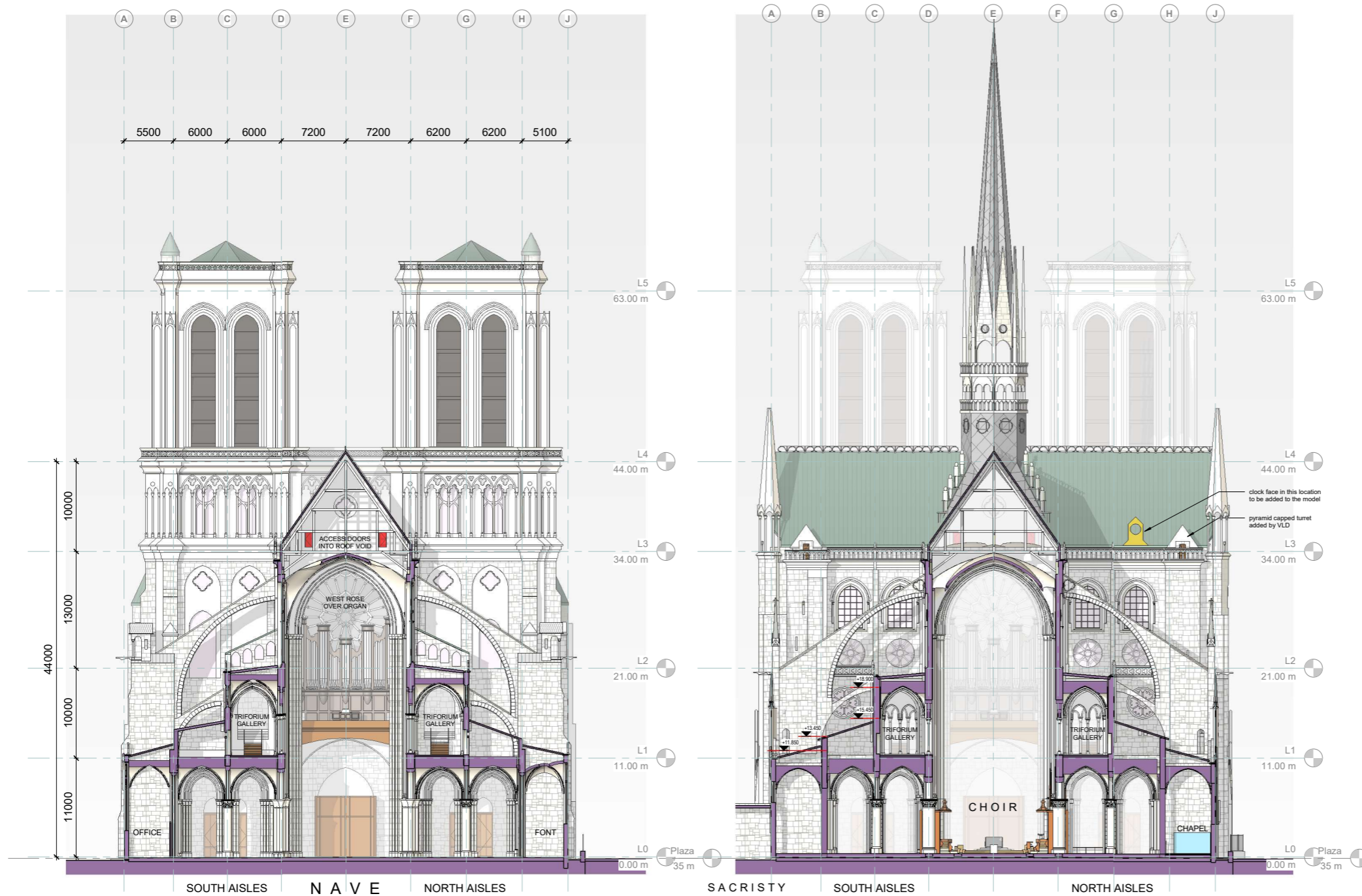
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Project Notre-Dame  
SECTION E.1

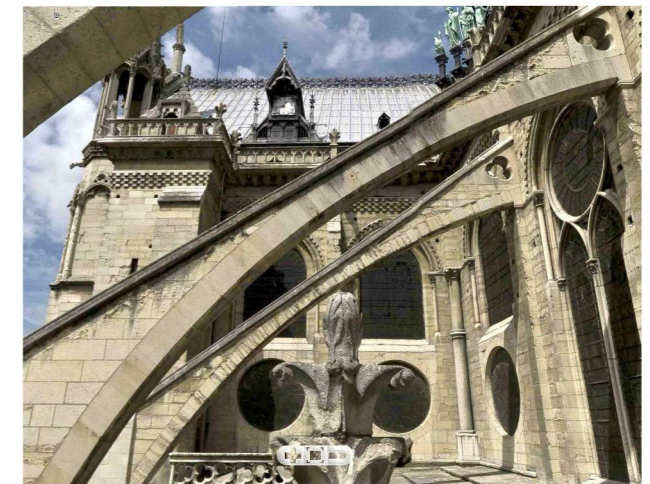
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THE WAY WE BUILD



### TRANSEPT CORNERS

The four corners where the transepts meet the nave and chancel are all slightly different. On the East side there are external towers for spiral stairs.



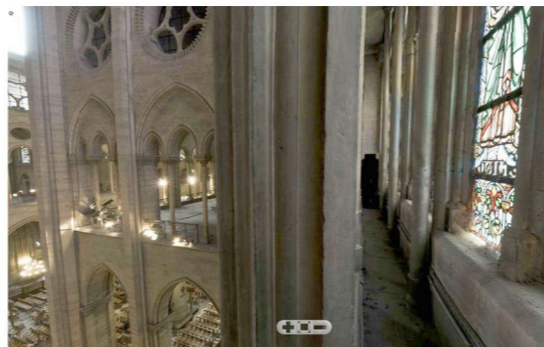
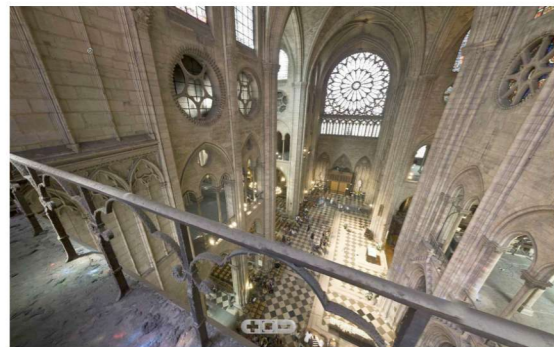
### VIEWING PLATFORM

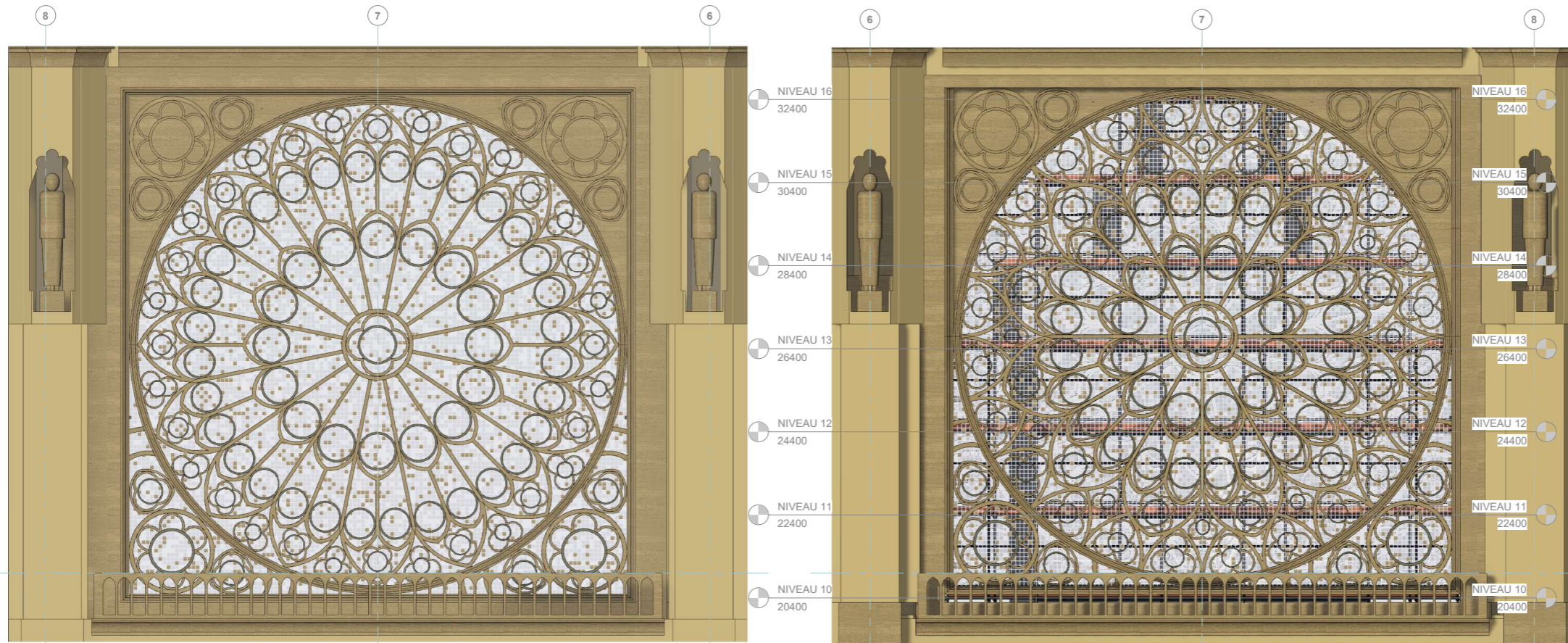
Between the towers is a rectangular courtyard, enclosed on the West by a lightweight arcade, and on the East by the gable end of the main roof. The arcaded screen runs all around both towers, on two levels. The gable wall has three doors which give on to the roof space.

The middle door leads directly to the wooden walkway which runs the length of the entire roof and branches off sideways at the transepts.

The side doors lead down short stairways to the eaves of the roof and through a door to the outside. It is possible to walk all around the eaves of the building with a stone balustrade on one side, and







NORTH ROSE WINDOW

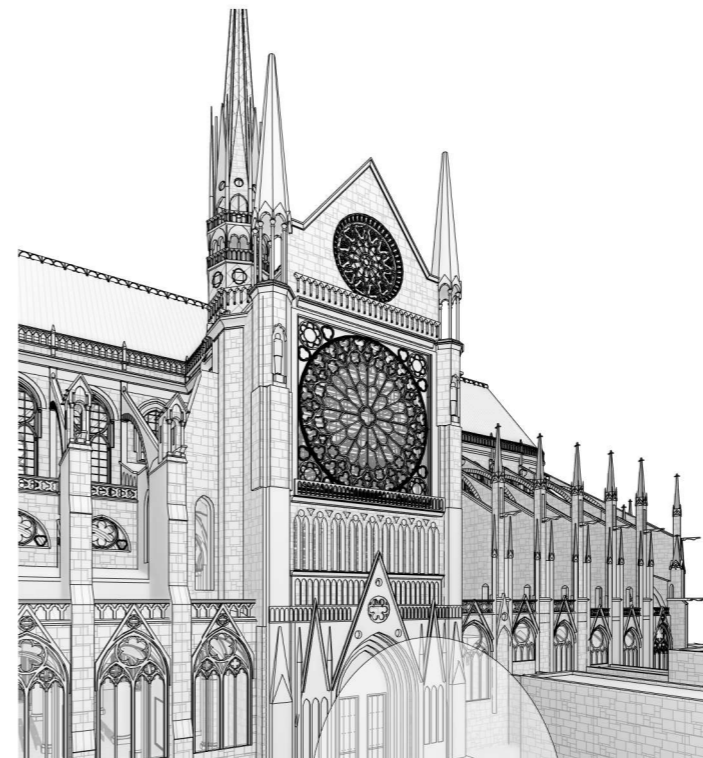
SOUTH ROSE WINDOW



NORTH ROSE WINDOW FROM INSIDE



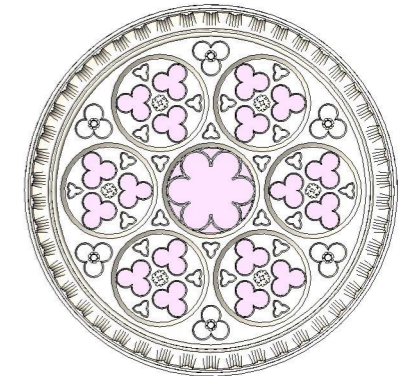
WEST ROSE WINDOW



SOUTH ROSE WINDOW FROM OUTSIDE

### CONSTRUCTION

There are two layers to the rose windows. First of all the Stone Tracery and secondly the glass, which is held together in a metal framework. The glazing layer is generally clipped to the back of the stonework and can often be removed without dismantling any stone.



NORTH TRANSEPT GABLE



SOUTH TRANSEPT GABLE

### LOCATIONS

Notre Dame has large rose windows at three of the four compass points North, South & West. In each case the underlying geometry is quite different. There are also round windows at high level in the North & South Transepts. These are not fully glazed however and let light into the roof space.

