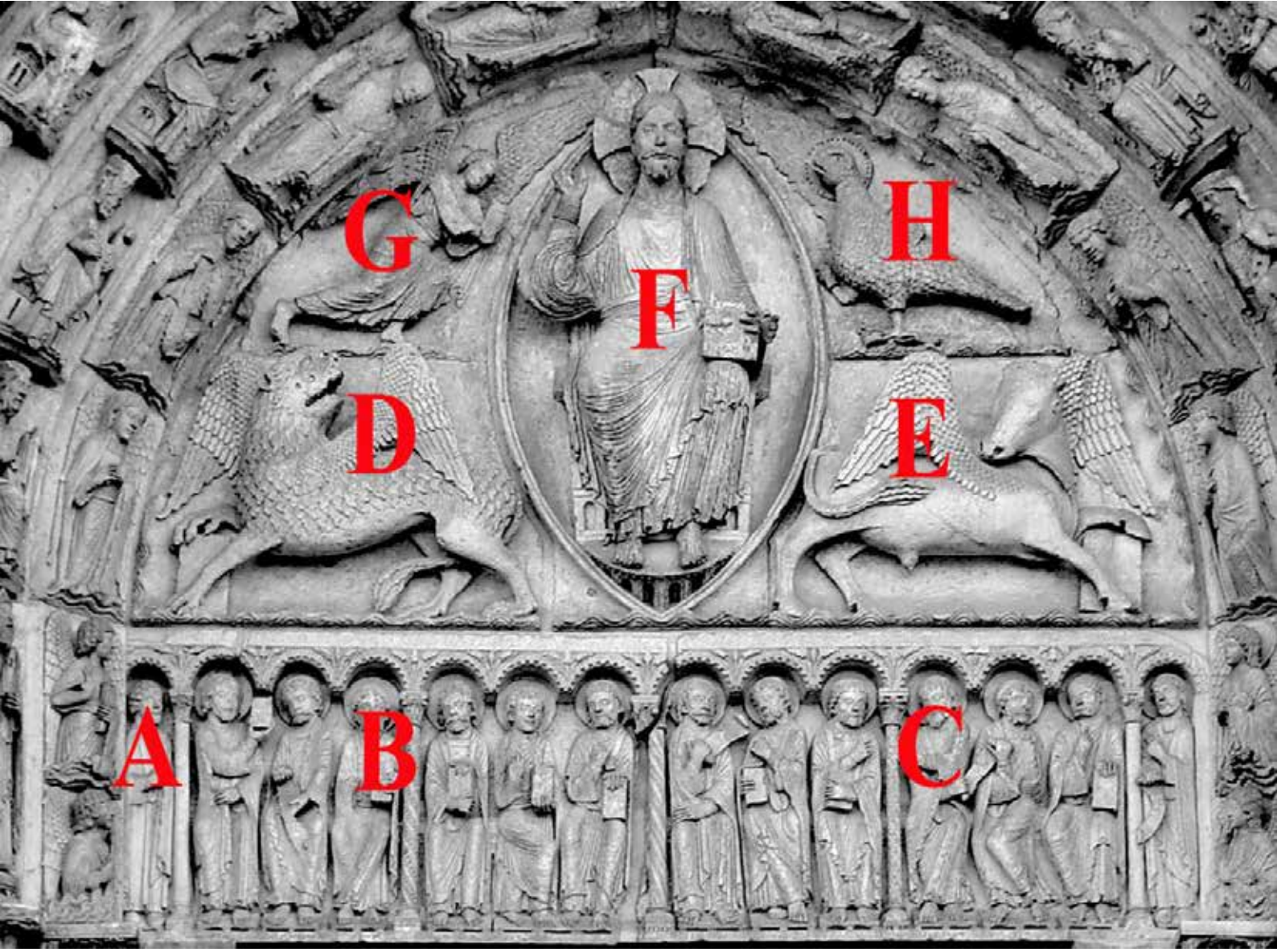

Part 6a of the Royal Portal Series

Chartres Royal Portal - the cracked central lintel[1]

John James

The lintel under the central tympanum of the Chartres Royal Portal is an enormous stone that would have weighed almost seven tons,[2] equivalent to a loaded six-wheel refrigerator truck. There are two vertical cracks through the lintel. The more obvious is in the middle, and passes through the shaft between the apostles. The other is on the left and passes through the second figure. The three parts of the lintel are marked A, B and C [a]. The lintel supports the five stones of the tympanum, in the centre for the figure of Christ within a mandorla, and four for the Evangelists.[3] The stones on the right meet as they should - C, E, F and H – as do the three on the left - B, D and G. The latter are twisted clockwise to leave a gap that gradually gets smaller from the crack in the lintel to the top of the mandorla F.

When a tall beam sags there is at first little movement at the ends. The movement comes as sag turns into collapse and the centre drops. As the

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In bold those that have been completed.

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6. Lintels, plinth geometry
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7. Central tympanum
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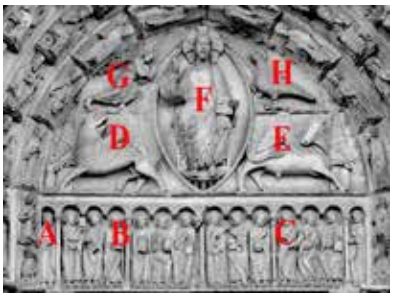
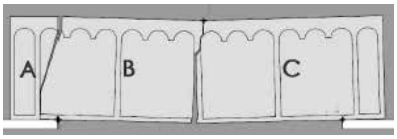




Cracks in the lintel adapted from Henige "Reassessment"

crack opens the beam pivots from the top, and as the opening at the bottom of the crack becomes wider the outer ends of the beam are pushed sideways. At Chartres the movement in the lintel pushed the stones apart, widened the space for the tympanum and shifted the axis to the south [r1]. If the lintel had broken after the abutments had been built the shift would have been minimal, for the encasing masonry would have resisted the lateral movement. This shows that the crack occurred before the encasing masonry had been placed.[4]

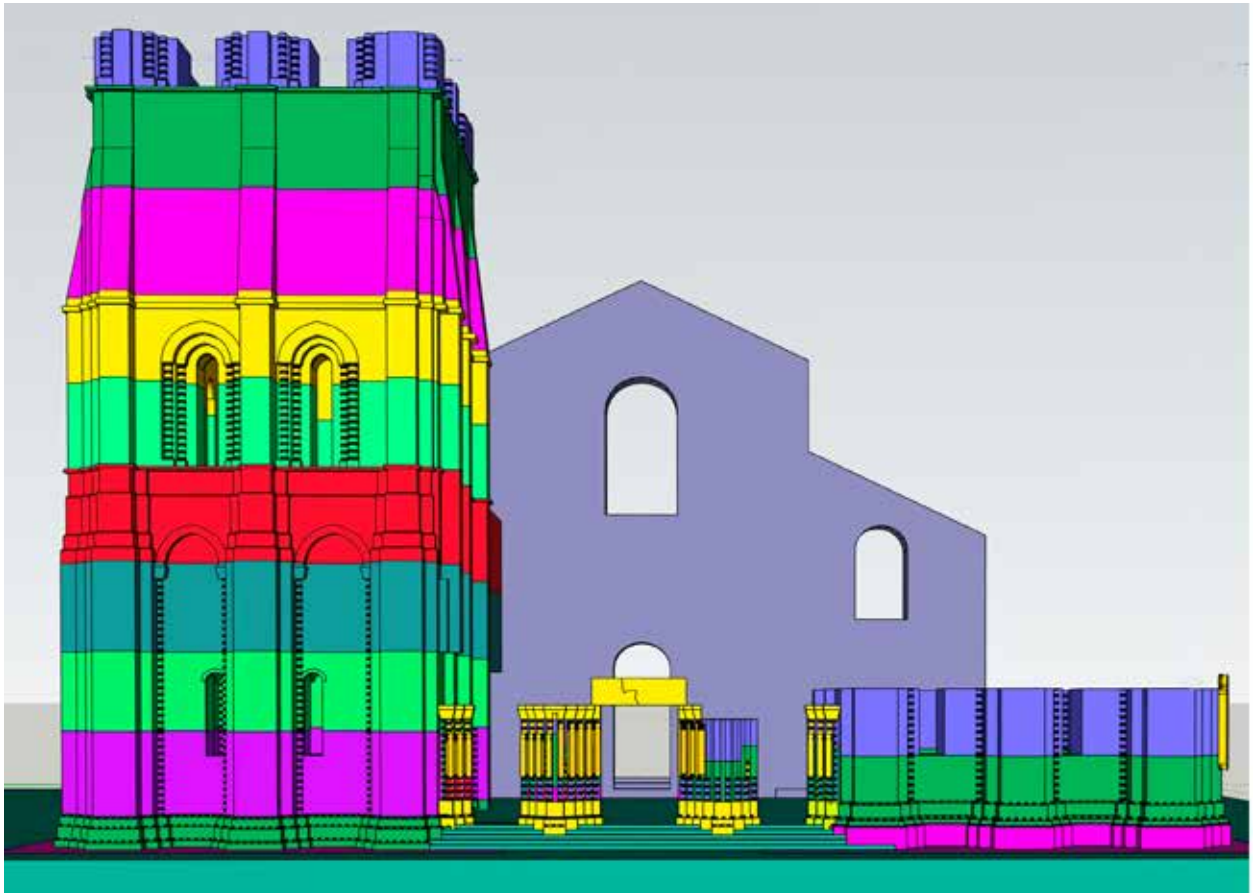
Medieval lifting gear was sophisticated, and if the lintel had been properly supported over its length it could have been raised and placed with safety, as in other portals. In retrospect, the combination of such an enormous weight held by ropes of hessian, cranes made of wood and a space encumbered with scaffolding to protect the column figures, the colonnettes and the delicate capitals, would have been a challenge for any gang, no matter how competent.

I will use the small discrepancies in position and measurement to show that the lintel cracked under its own weight as it was being lifted into position.[5] Direct measurements cannot be taken without scaffolding. The measurements used here come from the laser scan of the portal prepared by Andrew Tallon.[6] He considered the scan accurate to 5mm.

The scan shows that the vertical axis shifted. The centre through F is 5.5cm to the right of the axis through the door. When it cracked, lintel A was pushed 6cm to the north so that part of the canopy over the left figure disappears behind the archivolt, C was pushed 11cm to the right, while B twisted clockwise yet remained closer to its correct position over the centre of the doors. The net space for the lintel between the archivolts is today 10cm more than intended before the crack. These movements show that the tympanum was not placed until after the lintel had cracked.

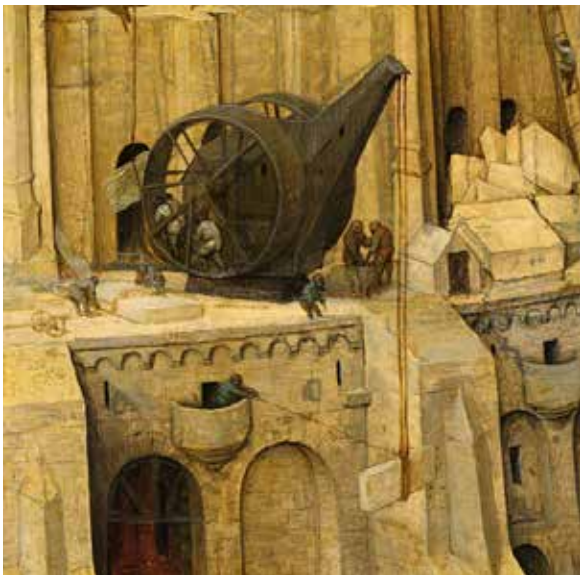
In the model prepared by Alain Menager [b], the north end of the portal was more advanced than the south as it was easier to build against the existing walls of the tower, while the south end was delayed by the tower

North end of lintel, arch over statue disappears behind architrave, approximate location of crack.

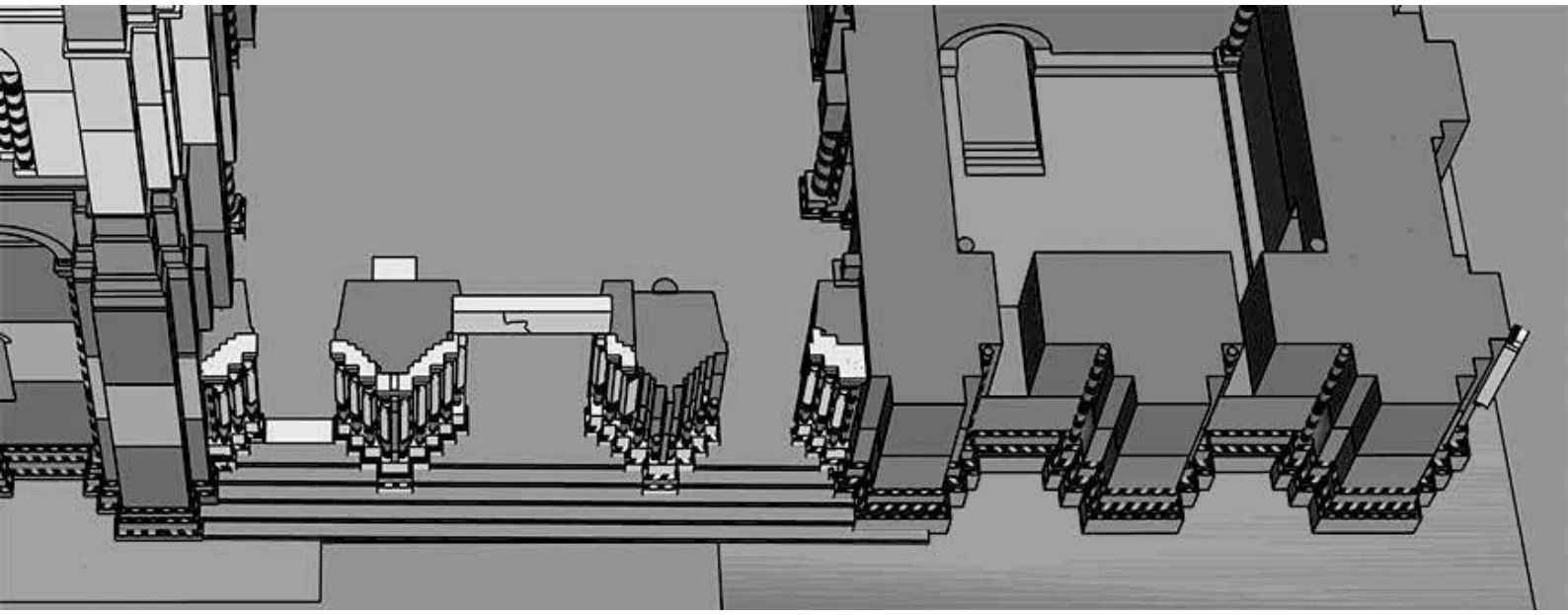


that was still emerging out of the ground.[8] The model shows the pier to the right of the central door unfinished, with only the capitals next to the door and the column figures under them in place [b].[9]

At this stage no other lintels or archivolts had been erected.[10] The master needed a level platform over the imposts to give ample space for men and equipment while manoeuvring the seven-ton lintel into position. A single crane would have been too unstable. Two static cranes on rotating platforms would have been needed, mounted on the platform with strong cantilevered arms so the lintel could be hoisted from the ground and the cranes swivelled to bring the lintel into position [r1]. The arms would have projected less on the eastern side of the pier than if they had been on the west, and raising from that side would eliminate any risk to the sculpture already in place [b].



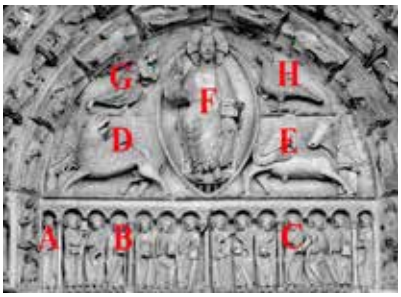
Double wheel crane in Peter Bruegal "Tower of Babel".



Model view of campaign-14 (ca. 1139) shows the connection between the portal and the south tower; the cracked lintel and platforms for the cranes. Nothing else had yet been erected above the imposts in the lateral doors.

The lintel would have been transported within a timber frame to protect the carvings and to distribute the weight evenly along its 4-metre length. I doubt they would have risked using Lewis bolts with this weight, though they may have used them in tandem with the frame as an insurance against failure. The lintel would have been moved from wherever the shed was located, passed through the door opening and turned so it faced the right way, and then lifted seven metres before it could be eased across the piers into position.

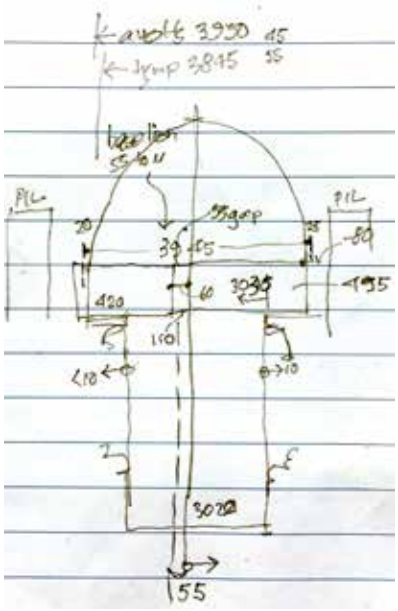
The two ends were secured with rope or wedges until it hovered above its mark waiting for the final position to be agreed. This was followed by the trickiest moment, removing enough of the supporting timber frame so the stone could be lowered the last few centimetres until it rested on the impost. It was probably at this critical moment that the lintel shuddered and broke. Did timber split? Were the fastening wedges too stuck to remove? Did the stone slip? Was somebody hurt and distracted the men? Was there too much support at one end and not enough at the other?



Whatever happened, as the lintel came to rest on the level plane of the imposts the lintel sundered, B twisted and pushed A to the north and C to the south. As the sag principally affected the right end of B, the break must have been caused by an adjustment in the supporting timber frame near the break, which could have happened as the timber under B was being dismantled.

The outcome was that A shifted 6cm into the empty space to the north and C was pushed southwards 11cm. In the middle the right corner of B sagged 3cm and C dropped less than 1cm.[11] Once settled, B and C would have been too heavy to move or jack-up,[12] each piece weighing at least three tons. The distortions that came from the accident are similar to what they would have seen on that fateful day. The slippage in both directions shows that neither end had been constrained by backup masonry,[13] which allowed the three stones to move, seemingly without resistance, into empty space.

Additional struts and toms would have been placed around the stricken lintel to prevent further movement, shoring it while masons and clients considered their options. They may also have called for advice from elsewhere.[14] Frankly, at this stage there were not many choices. They could put the whole project on hold and recarve the lintel and try to hoist better next time; they could work with what they had and make sure the encasing masonry at each end would be firm enough to secure the three parts and hold them in position; they could carve a trumeau to strut the middle with the added advantage that it would disguise the break. Jean Villette had good reasons for suggesting this option, and raised the possibility that it was removed in the seventeenth century.[15]



Dimensions estimated from the Tallon scan.

Chartres has the largest remaining lintel of any contemporary church. Their intention may have been to create a wide and open door without the middle support found in other portals, and therefore may not have intended a trumeau. If a trumeau had been prepared, would it not have been in place to support the lintel while it was lowered? In which case would the lintel have cracked? The big open door was more in keeping with the grandness of the concept, and closer to Saint-Denis than the more cramped arrangement in those with trumeaux,[16] as Saint-Loup-de-Naud and Bourges.

Above: the top of the right impost.
Below: the gap between archivolt and pilaster.

Though shattered, the lintel still had to support the five stones of the tympanum that weighed an additional eight tons. It would have been prudent to install a trumeau rather than rely on the broken lintel. If one had not been carved, time was needed to order a sufficiently large stone from the Oise quarries and have it delivered and carved. This may have taken much of the season. During the pause the cranes were removed and the platform raised on the encasing masonry built to buttress the broken pieces. This included the lower architraves and on the eastern side an arch to the full height of the tympanum to secure the five stones from tipping over. The cranes were then reassembled at this higher level to lift the massive stones of the tympanum onto the cracked lintel.

The sag in the lintel B and C determined where D, E and F were to be placed, for it shifted the axis through F to the right and opened a gap between Mark and Christ.[17] These actions widened space for the tympanum. The architraves were placed to suit the tympanum, not the other way round, and were therefore placed after the accident. The outcome is measurable in the space between the archivolts and the edge of the imposts [r2]. On the left the gap measures 42cm, which is the same as over the other piers,[18] but on the right the gap was enlarged to 49.5cm. After adjusting the archivolts, the 11cm movement in the tympanum was absorbed into the space between the right archivolt and the pilaster. This was reduced from 16cm to 8cm [r3].

The gap between G and F becomes smaller toward the top.[19] The upper

right corner of G may have been placed too close to the top of F because at some moment it broke. The pointed end that passed over the head of Christ may have been under strain as the stones were being manoeuvred into place and the narrow end broke. This may not have happened during erection, but when they removed the trumeau in the seventeenth century. That action could have caused a slight shift as the stones adjusted against each other and may have resulted in the small gap under the upper left archivolt [r].

The fact that the lintel has continued to support the tympanum with only small movement is testimony to their skill in making good what had been undone.

Broken end and upper edge to stone G above the halo to F, and the gap under the archivolt.

1. This is a part in my history of the portal included in the *Royal Portal Series* (RPS). The others are accessible in *https://www.creationofgothic.org/acoga/articles.php*.
2. The visible face between the archivolts was the same width as the tympanum, at 3,89cm, the height is 1,17cm and the depth 54cm. Limestone weighs approximately 2,700 kg per cubic meter, The volume of about 2.7 cubic metres would have weighed 6.8 tons: *https://www.aqua-calc.com/calculate/volume-to-weight/substance/limestone.* Chantal Hardy, David Booth, Dominique Bouleric, "The stones of the royal portal of Chartres", *International colloquium of stone. European Heritage 2005, Edition of the Committee for Historical and Scientific Works*, 2006.
3. The lintel had been carved for a wider portal, and was reduced some 23cm before erection. The impact of shortening the ends may have played some part in the cracking. The square base of the mandorla measures one fifth the width of the whole: John James, "RPS#7 - The central tympanum", 2020, *https://www.academia.edu/43630295.*
4. "The logical conclusion is that they were not in place when the lintel cracked", Chris Henige, "A Reassessment of the Erection of the Royal Portal at Chartres", 2021, *https://www.academia.edu/36133099;*
5. There are few attempts to analyse the cracks. Henige argued that the lintel broke as the three lower tympani stones were being placed. He interprets the cracks and the gaps between the stones from a modelled analysis of the process of erection. I have used his labels to save confusion. He wrote "Then stone F, the mandorla, was dropped into position. It is my opinion that at this point, when the weight of the mandorla was applied to the center of the lintel, the lintel cracked," Henige, "Reassessment"
6. Andrew Tallon, Vassar College *http//gothicstructure.org.* The laser scan was funded by the Andrew Mellon Foundation as part of the Mapping Gothic project *http://mappinggothic.org*. The sculpturewas cleaned earlier, Guy Niko, "Le Portail Royal restauré," *Notre-Dame de Chartres,* lix 1984, 5 15.
7. The gaps between the archivolts and D and E add a further 4.5cm (2cm on the left and 2.5cm on the right), so the space across D, E and F now measures 3,94.5cm. The width of the tympanum was intended to be 3,84.5cm, calculated theoretically as 395+6-11=3,84.5cm, and used in James, *RPS#7* to calculate the intended width of the central door.
8. This was in campaign-13 around 1139. Towers discussed in, John James, "La construction du narthex de la cathédrale de Chartres", *Bulletin de la Société Archéologique d'Eure-et-Loir,* lxxxvii 2006, 3-20, updated in John James, "RPS#2a Revised campaign dates, fatty mortar, footings begun 1127", *https://www.academia.edu/49969412.* Also Etienne Fels, "Die grabung an der fassade der kathedrals von Chartres", Kunst Chronik, 1955, 149-151 and Etienne Fels, "La façade de la cathédrale de Chartres au xile", Bulletin de la Société Nationale des Antiquaires de France, 1967, 232 33; traditional dates in Willibald Sauerländer, Das Kőnigsportal in Chartres, Frankfurt am-Main, 1984.
9. The story of the southern lintels and tympanum is complex, John James, "The upper sculpture - RPS#8a", 2021, *https://www.academia.edu/45626456.*
10. The archivolts in the lateral portals were reduced in height to accommodate a smaller tympanum that was itself delayed until the next campaign. John James, "Lower lintels and plinth geometry – James, RPS#6", 2020, *https://www.academia.edu/44377988.*
11. Lintel B would have rotated on the edge of the left impost, as one would expect as almost 3.5 tons was pivoted on that edge. As there is no sign of damage, I would expect that at the moment of cracking the lintel was still being supported off the edge. The capital on right of B was halved with 4.5cm to C.
12. Henige's "jack up" proposal with loads of many tons is unlikely in the medieval context. Chris Henige, "Observations on Project A - Comments - Consistencies and Anomalies", 1221, *http://www.fabricae.org/V8/Shared/PHP/Observations.php?Proj=T&id=CHARTRES&oproj=A.*
13. Henige argues that "none of this movement could have occurred had the archivolts been in place at the time the lintel cracked, further demonstrating that the lintel cracked early on," Henige, "Observations".
14. As later, Victor Mortet, "l'expertise de la cathédrale de Chartres en 1316", *Congrès Archéologique,* 1901, Paris, 308-329.
15. Jean Villette, "Le portail royal de Chartres a-t-il été modifié depuis sa construction?" *Société Archéologique d'Eure-et-Loir*, xxv 1970, 255-270.
16. Did Saint-Denis have a trumeau? Paula Gerson, "The lintels of the west facade of Saint-Denis", *Journal of the Society of Architectural Historians*, xxxiv 1975, 189-197.
17. The narrow base of the mandorla spans the gap over the crack and is an uneven joint less than 2.5cm.
18. Only to the north. The confusion in the south is another story.
19. Henige's drawing omits the gap, but one needs to look from the left to make it clear. 5.5cm gap where D met the lintel.