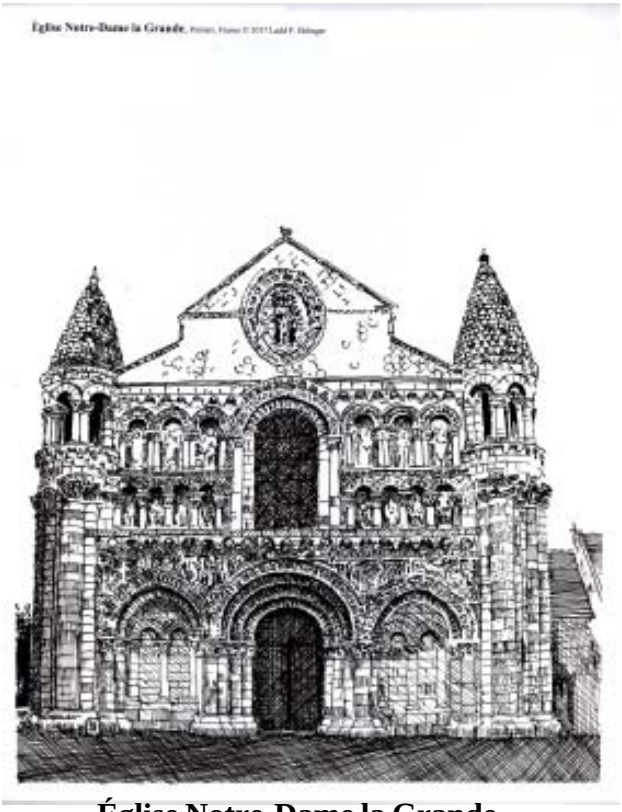
ARCHITECTURE

EHLINGER & ASSOCIATES FIRST QUARTER 2017



**Église Notre-Dame la Grande**

The west front of Église Notre-Dame la Grande has one of the finest arrays of Romanesque sculptures on display of any Romanesque church. The limited edition print of a sketch by Ladd P. Ehlinger of this church is indicative of the quintessential Romanesque church.

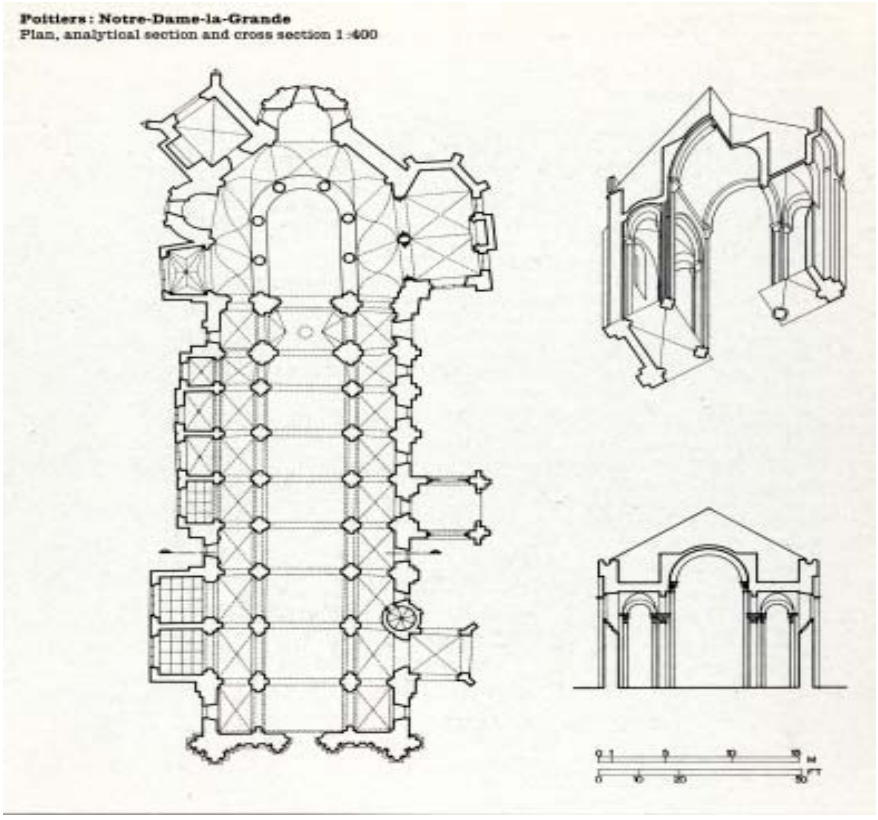
After the "Dark Ages" and ending of the feudal system, when civilization began to revive, the Roman period of history was emulated as it was thought to be of a more refined nature than the period then ending, so all things Roman, including the distinctive broad round arches were reinterpreted, as were the barrel vaults and domes. Sculpture and painting saw a revival as well.

The plans of Romanesque churches were a reinterpretation of the basilican plan of the Romans, which were halls of justice and commercial enterprises. The Roman basilicas were entered in the middle of the long side, but when reinterpreted as a church were entered in the short side to facilitate the Christian processional rituals.

The central hall of this church, the nave, is a barrel vault with ribs marking each bay columnar support below that also support Romanesque arches parallel to the long axis of the vault. The side aisles however are of groin vaults (intersecting barrel vaults) at a lower level. There is a magnificent conical dome at what would be the crossing of the transept, except there is no transept (wings at right angles to the nave). The east end of the church terminates in a rounded apse or chevet where the aisles from each side join.

Poitiers is a very old city and has been inhabited since Roman times. Julius Caesar conquered Gaul (modern day France) in 59 through 49 BC. Constantine built buildings in what is now Poitiers. Later, when he Muslims invaded southern France, they were defeated by Charles Martel at Poitiers in 732, which changed the future of Western Europe until our current time, when it again is under assault by Muslims with a much different "battle plan" - that of the ***hijrah***, by immigration and political demands rather than physical battles.

The eleventh century saw an increase in religious fervor and more strife with the Muslims. This led to the founding of numerous convents and monasteries, as well as the Crusades in further response to continuous Muslim invasions at many point is Europe and Asia Minoe. The Aquitane, the region around Poitiers, was very involved in raising and financing Crusade armies.

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## 3D Printing and Construction

Technological advancement will rapidly be hitting the architectural and construction industry, as 3D printing technologies mature and scale up to construction capabilities. While not a common sight yet, soon large robotic arms on portable tracks, printing new buildings will be ubiquitous. The advantages to 3D printing are enormous, and not just from the creative aspect of design (where every building can be a Frank Gehry/Zaha Hadid explosion of curves, if desired). There is very little material waste, the structure can be fine tuned to be stronger using less material than with 'standard' component design, and the labor costs can be reduced to a fraction of standard construction.

There are many different 3D printing technologies, using different materials; but the following are closest to reaching widespread use on a large scale:

3d Concrete Printer by Scott Lewis

**Concrete**
Currently the most advanced of the construction printers, concrete printing has already showcased its capabilities on a variety of well publicized test projects, the latest a cylindrical house in Russia being printed in a day. The implications are much greater than rapid housing, however, as the flexibility of concrete with 3D printing will allow for concrete to reach its full potential in shell strengths and curvilinear applications that are usually too expensive or difficult to achieve with standard construction techniques using forms and molds.

**Clay**
This is one of the most promising technologies, as it would allow using soil directly at the location of construction to be used for the construction. Being developed by the Institute for Advanced Architecture of Catalonia, the printer mixes additives to clay which allows it to cure in place after printing without needing to be kiln fired. This allows for rapid construction, on site, of nearly any structure type, with just a handful of chemicals and the printer itself.

**Carbon Fiber Composite**
While already being applied towards the automotive and aerospace industries, expect this 3D printing technology to be adapted to the construction industry without great difficulty. Instead of using heavy steel framing, or even light wood framing, the core structure of buildings might be uniquely printed carbon fiber beams and columns. Another promising use for Carbon Fiber would be in the building envelope - where 3D printing could create patterns and textures that help protect against water intrusion and wind loads in a fashion that current sidings and curtain walls can't achieve.

**Cellulose**
What will the future be without wood in our architecture? While not yet to construction scales, advances in printing with cellulose into 'wood' products is reaching the same level of advancement as plastic printing has reached. Imagine a robot that comes in and simply prints out the baseboards, crown molding, highly decorative wainscott, along with all of your custom shelving and an entertainment bar.

**Metal**
Theoretically, a 3D printed metal frame could be up to 10,000 times stronger than current factory produced beams - or, more accurately, it could achieve the same strength with a fraction of the material, being designed for a specific support condition. Unfortunately, metal printing is still expensive, and hasn't scaled well... yet. When it does, expect to see skyscrapers, bridges, and large structures the like of which have barely been imagined. A bridge over the Straight of Gibralter - why not? The 'mile high' skyscraper - why not 2 miles high?

**Glass**
There are two different processes for 3D printing with glass. One is called 'sintering', where the sand is directly converted into glass with lasers. This is another process where the materials can be found directly on a site and used. Simply provided enough power, and melt together any shape you desire directly from the sand around you. Unfortunately, the results aren't 'clear', even after polishing. While amazing sculptural shapes can be created, or building blocks for construction, the result isn't really glass in an architectural use.

Using glass in an additive printing process, however, can achieve some very interesting effects to use light and shapes in a creative fashion. While the layers of the printing are clearly delineated, they can be used to great effect to scatter light.

**The End Results**
Once 3D printing becomes more accessible on the scale of construction, expect a radical shift in design philosophies to take advantage of the capabilities. Currently, decorative and sculptural elements are expensive and labor intensive to create and install, but when that step is removed and there are no limits between the design and the end result - expect a level of detail, decoration and elaborate ornamentation to rival or exceed the Baroque era of architecture.

*R. Perrin Ehlinger*