The Pont du Gard: A Marvel of Roman Technology

Anne-Charlotte Hampe*

The Pont du Gard is the second-highest roman structure right after the Colosseum. The Pont du Gard*, a marvel of Roman technology, is a Roman aqueduct built in 60 CE. It is near the city of Nîmes, in the South of France. This elegant masterpiece is a small yet important part of a larger aqueduct that spans over 50km[1].

The Pont du Gard is one of the most impressive constructions of the ancient aqueduct. It stands at the height of 48.77 meters tall with a series of three-level arches. Its mighty height makes it the tallest aqueduct of the ancient Romans[2]. It strides over the river Gard, its namesake.

1 The Purpose

The purpose of an aqueduct is to transport water from one location to another. Aqueducts were an important part of ancient Rome because water was an immense part of their lifestyle. It was used for bathhouses, private and public fountains, drinking water, and irrigation. However, only important and large cities had the luxury of an aqueduct for their city; construction took many years and significant manpower.

The Pont du Gard is part of the aqueduct for the Roman city of Nemausus or modern day Nîmes[3]. It brings water from a spring, called Fontaines d'Eure, to the city. Bringing water from the Fontaine d'Eure to Nîmes was a large task.

*Freshman Student, Fulton Science Academy.
Contact: ahampe@fultonscienceacademy.org

As the crow flies, the distance between the fountain and the city was only 20 km, but it would be inefficient to construct an aqueduct by that shorter path[1].

The first part of the aqueduct is located on the left side of the Valley of the Alzon river, because not many major constructions were needed. Later on, it reached the other side of the river with the help of multiple bridges and tunnels, crossing the Gard with the Pont du Gard. The aqueduct overlaps multiple natural obstacles in the region.

2 Construction of the Pont du Gard

The Pont du Gard is a limestone arch-bridge aqueduct. The aqueduct was built sometime in the first century CE by Marcus Vipsanius Agrippa, the son-in-law of Augustus Caesar, the Emperor of Rome[3]. The construction of the Pont du Gard took 5 of the 10-15 years of the construction of the whole aqueduct.

Like all aqueducts, the Pont du Gard has a slight incline in order for the water to flow by gravity. This is especially important in the Pont du Gard because the Pont du Gard's incline is only 2.5 cm per 156m, a gradient of 1 in 18,241. This is a much smaller incline compared to other roman aqueducts that have a gradient of 1 in 15,000[1].

The Pont du Gard is made of three levels of arches. The first floor has the least number of arches, but has a greater span. It has 6 arches, which are 142.35m long, 6.36m wide, and 21.87m tall. The second level has more arches with a longer span. In total it has 11 arches with a length of 242.55m, a width of 4.56m, and a height of 19.50m. Finally, the third has the most and smallest arches. It has 35 arches that are 4.80m long, 3.06m wide, and 7.4m tall. In total the uppermost level is 490 meters long[1].

The canal is located on the top of the third level. It is between 1.4m to 1.9m wide, because some places may have accumulated of limestone over the years. The inside was covered by a Roman red-brown waterproof plaster called malthe[1]. The top of the canal was covered by slabs of stone, which are domed to avoid rain water stagnation.

3 Arches

The aqueduct is modeled after the technique of the Roman arch. Most arches of the time were built with cement or mortar. However, the Pont du Gard

was built without such materials—the structural design of the arches makes it unnecessary to use them. Romans would build the arches with the help of supports in the shape of the arch till the end of the construction.

To form the arch, the stone pieces were placed on the wooden structure. When the slabs of stones almost reached the center of the arch, the keystone (the centerpiece of an arch) would be put in place, acting like the final piece of the puzzle. Then the wooden structure would be taken apart to be used for another arch[4, Pg. 35]. The arch could then stand without the need for any support or mortar. The weight above is pushed downward in the keystone of the arch, the compression is then spread through the arch, stone by stone directed downwards and outwards. This structure makes mortar unnecessary for the support of the arch.

However, this can only work if the keystone has sloped sides. This makes it possible for the compression to spread through the other stones. The compression force of the arches leaves at its points. If there is a series of arches (such as the ones used in the Pont du Gard), the compression forces of arches counter the compression of the arches beside them. This allows for a long series of arches without the need for extra stone in between them.

4 Stonework

The limestone needed for construction of the Pont du Gard was mined in the Roman Estal quarry located 400m upstream. The technique for extracting the stone was called havage. The workers would cut around the blocks of stone to separate them from the rock face with the help of a roman pickaxe called escoude[1]. The escoude leaves diagonal traces on the rocks which can still be seen today.

The ochre shell limestone from this quarry has a good resistance to absorbing water. Even if the stone is brittle, it has survived the centuries because of its large size.

The Romans went with large slabs which could go up to 6 metric tons. In the quarry, the stone would be given a marking signifying its future location in the bridge. The markings would be either roman letters or numbers. The numbers reference the place in the arc the stone would be in. The stones were carved in specific shapes based on their location. Then the blocks would be transported to the river bank of the Pont du Gard by boat. On the Pont du

Gard there are still the remains of the supports for the scaffolding and evidence of the use of hoists[3].

5 Further History

With the fall of the Roman empire and multiple invasions, the population of Nîmes shrank considerably. Because of this the aqueduct was no longer used for its original purpose around the 9th century, roughly 8 centuries after it was built. Instead, the stones of the aqueduct were recycled into the buildings of the new population. However, in the Middle Ages, the lower and the top levels were both used as a bridge. Because of its location near new highly important cities, the traffic grew. With such a large amount of traffic, people cut parts of the arches on the second level and added a second bridge. Thus, facilitating the passage for donkey lead wagons. These modifications fragilized the aqueduct. Thankfully Napoleon III decided to restore the Pont du Gard to its original beauty. The renovation lasted three years[2].

6 The Pont du Gard Today

The Pont du Gard was classified as a UNESCO (Organization of United Nations for Education, Science and Culture) World Heritage site in 1995. The site is located in a large natural area. Because of its classification as an UNESCO monument, the site benefits from a protection and educational program[1].

Today, the Pont du Gard is visited by more than a million visitors each year. It is one of the most visited sites in France. The site consists of a large forest area with remains of other parts of the aqueduct, a restaurant, and a museum dedicated to educating the public about the Pont du Gard from its construction to what it is today. The site is also a location for many cultural events throughout the year, including the Tour de France.

The Pont du Gard is a marvel of Roman architecture in France. The construction was on a large scale and goes above and beyond the normal standards of Roman aqueducts. Its mixture of art and science gives it an elegant quality to the structure. This is why it not only has historical importance but it helps keep Roman culture alive. If you are interested in ancient history and you are ever in Europe, don't forget the Pont du Gard!

References

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