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**Contents**

1. Introduction
2. Architectural Priorities of Ancient Rome
3. Architectural Advances: Arches & Concrete
4. Types of architecture of Ancient Rome
* Housing and Apartments
* Public architecture
* Thermae
* Forum
1. Civil engineering
* Aqueduct
* Bridges
* Walls
1. Impact of Politics and Religion on Roman Architecture

**Roman Architecture**

Unlike the more creative and intellectual Greeks, the Romans were essentially practical people with a flair for engineering, construction and military matters. In their architecture, as in their art, they borrowed heavily from both the Etruscans (eg. in their use of hydraulics for swamp-clearing and in the construction of arches), and also the Greeks, whom they regarded as their superiors in all visual arts. However, without Roman art - with its genius for copying and adapting Greek styles - most of the artistic achievements of Greek antiquity would have been lost.

**Architectural Priorities of Ancient Rome**

Roman architecture served the needs of the Roman state, which was keen to impress, entertain and cater for a growing population in relatively confined urban areas. Social elements such as wealth and high population densities in cities forced the ancient Romans to discover new (architectural) solutions of their own. Drainage was a common problem, as was security. This, together with Rome's growing desire to increase its power and majesty throughout Italy and beyond, required public buildings to be imposing, large-scale and highly functional. This is exemplified by Roman architectural achievements in drainage systems, aqueducts, bridges, roads, municipal structures like public baths, sports facilities and amphitheatres, even central heating systems. Numerous temples and theatres were also built. Later, as their empire spread, the Roman architects seized the opportunity to create new towns from scratch, designing urban grid-plans based on two wide streets - a north-south axis (the cardo) and an east-west axis (the decumanus). The town centre was located at the intersection of the two roads. They also built upwards; for example, Ostia, a rich port city near Rome, boasted a number of 5-storey apartment blocks.

Roman buildings were then built in the commercial, political, and social grouping known as a forum, that of Julius Caesar being the first and several added later, with the Forum Romanum being the most famous. The greatest arena in the Roman world, the Colosseum, was completed around 80 A.D. at the far end of that forum. It held over 50,000 spectators, had retractable fabric coverings for shade, and could stage massive spectacles including huge gladiatorial contests and mock naval battles. This masterpiece of Roman architecture epitomizes Roman engineering efficiency and incorporates all three architectural orders—Doric, Ionic, and Corinthian. Less celebrated but just as important if not more so for most Roman citizens, was the five-story *insula*or city block, the Roman equivalent of an apartment building, which housed tens of thousands of Romans.

It was during the reign of Trajan (98-117 A.D.) and Hadrian (117-138 A.D.) that the Roman Empire reached its greatest extent and that Rome itself was at the peak of its artistic glory— achieved through massive building programs of monuments, meeting houses, gardens, aqueducts, baths, palaces, pavilions, sarcophagi, and temples.

Architectural Orders. The Romans preferred more ornate columns to the simple Doric and Ionic. The name of the column was also the name of the architectural order. Columns were used to support structures as well as for decoration. A word like octastyle refers to the number (8) of columns on the front row of the porch.

Columns could be made by stacking drums, but many of the Roman columns were made of single pieces with the fluting left off. If made of porphyry or other hard materials, these columns would be polished. The Romans also increased the height of the columns by mounting them on pedestals. Romans also used columns as buttresses.

**Architectural Advances: Arches & Concrete**

During the Republican era, Roman architecture combined Greek and Etruscan elements, and produced innovations such as the round temple and the curved arch. As Roman power grew in the early empire, the first emperors inaugurated wholesale leveling of slums to build grand palaces on the Palatine Hill and nearby areas, which required advances in engineering methods and large scale design.

Roman architecture was assisted by major advances in both design and new materials. Design was enhanced through architectural developments in the construction of arches and roof domes. Arches improved the efficiency and capability of bridges and aqueducts (fewer support columns were needed to support the structure), while domed roofs not only permitted the building of larger open areas under cover, but also lent the exterior an impressive appearance of grandeur and majesty, as in several important secular and Christian basilicas, like the Pantheon.

The use of vaults and arches together with a sound knowledge of building materials, for example, enabled them to achieve unprecedented successes in the construction of imposing structures for public use.

Developments in materials were also crucial, as chronicled by Vitruvius in his book *De Architectura*. This is exemplified by the Roman invention of concrete (opus cementicium), a mixture of lime mortar, sand, water, and stones, in the 3rd century BC. This exceptionally strong and convenient substitute for stone revolutionized Roman engineering and architecture. As tile-covered concrete began to replace marble as the main building material, architects could be more daring. Buildings were freed from the rectangular Greek design-plan (with its undomed roofs and lines of pillars supporting flat architraves) and became less geometric and more free-flowing.

Because of these methods, Roman architecture is legendary for the durability of its construction; with many buildings still standing, and some still in use, mostly buildings converted to churches during the Christian era. Many ruins, however, have been stripped of their marble veneer and are left with their concrete core exposed, thus appearing somewhat reduced in size and grandeur from their original appearance, such as with the Basilica of Constantine.

The Roman use of the arch, the use of concrete building methods, the use of the dome all permitted construction of vaulted ceilings and enabled the building of these public spaces and complexes, including the palaces, public baths and basilicas of the “Golden Age” of the empire.

Like their Egyptian and the Greek predecessors, architects in ancient Rome embellished their public buildings with a wide range of artworks, including: Roman sculpture (especially reliefs, statues and busts of the Emperor), fresco murals, and mosaics. The concrete core was covered with a plaster, brick, stone, or marble veneer, and decorative polychrome and gold-gilded sculpture was often added to produce a dazzling effect of power and wealth.

**Types of architecture of Ancient Rome**

* **Housing and Apartments**

Although less visible level to the modern observer, ancient Romans developments in housing and public hygiene are impressive, especially given their day and age. Clear examples are public and private baths and latrines, and under-floor heating in the form of the hypocaust, double glazing (examples inOstia Antica), and piped water(examples in Pompeii).

Possibly most impressive from an urban planning point of view are the multi-story apartment blocks called insulae that catered to a wide range of residential situations. These buildings, solely intended for large scale accommodation, could reach several floors in height. Insulates were often dangerous, unhealthy, and prone to fires. There are examples in cities like the Roman port town ofOstia, that date back to the reign of Trajan and show how Roman architects met residential needs in a variety of situations.

As an example, consider the housing on Via della Focette: a large-scale real estate development that catered to up-and-coming middle class entrepreneurs. Rather like modern semi-detached housing, these residences had repeated floor plans intended for easy, economical, and repetitive construction. Internal spaces were designed to be relatively low-cost, yet functional and with decorative elements reminiscent of the detached houses and villas to which the buyers might aspire later in their lives. Each apartment had its own terrace and private entrance. External walls were in "Opus Reticulatum" and interiors in "Opus Incertum", which would then be plastered and sometimes painted. Some existing examples show that a popular choice of interior decor was to paint panels in alternating red and rainbow.

Early Roman houses were huts, of course, much like primitive people´s everywhere. Modern archaeological excavations have revealed foundations of similar huts dating to the eighth century BC.

What is generally considered the typical Roman house, or domus, was a plan adopted from the Etruscans, the people who dominated central Italy before the Romans. The Etruscans may have received elements of their style from Greece and Mesopotamia, or they may have developed it independently. The house of a wealthy man might consist of a dozen or so rooms arranged around a partially roofed court, one or two stories high, called an atrium. A rectangular opening in the center of the atrium roof was positioned over a pool, the impluvium, and surrounded by a peaked roof covered with terra cotta tiles. The arrangement allowed rainwater to be collected for household use, as well as providing a pleasant interior space. Water was vital to the lifestyle of the Romans, as witnessed by the aqueducts that remain from the time.

In ancient Rome most city people lived in several story-high fire traps. In the city of ancient Rome, only the wealthy could afford to live in a domus (in this case, house, like a mansion). For most of Rome apartments (or the back rooms of their ground floor shops) were the affordable alternative, making Rome the first urban, flat-based society. The Rome apartments were often in buildings called insula.

The Rome apartments may have contained 3 types of rooms:

1. *cubicula* (bedrooms)
2. *exedra* (sitting room)
3. *medianum* corridors facing the street and like the atrium of a *domus*.
* **Public architecture**

**Temple.** Roman architecture was sometimes determined based upon the requirements ofRoman religion. For example, the Pantheon was an amazing engineering feat created for religious purposes, and its design (the large dome and open spaces) was made to fit the requirements of the religious services.

**Amphitheatres.** In 50 B.C., C. Scribonius Curio built the first amphitheater in Rome to stage his father's funeral games. Curio's amphitheater and the next one, built in 46 B.C., by Julius Caesar, were made of wood. The weight of the spectators was at times too great for the wooden structure and, of course, the wood was easily destroyed by fire. Some of the most impressive public buildings are the amphitheatres, over 220 being known and many of which are well preserved, such as that at Arles, as well as its progenitor, the *Colosseum* in Rome. Elliptical in shape, the circus had a fixed central divider called a spina down the middle, which was useful in chariot races, but got in the way during fights. In addition, the spectators' view was limited in the circus. The amphitheater put spectators on all sides of the action. They were used for gladiatorial contests, public displays, public meetings and bullfights, the last of which survives in Spain. They are among the most impressive remains of the Roman empire at its height, and many of them are still used for public displays and performances.

**Circus.** The first and biggest circus in Rome, the *Circus Maximus* was located between the Aventine and Palatine hills. Its shape made it particularly suitable for chariot races, although spectators could also watch other stadium events there or from the surrounding hillsides. Each year in ancient Rome, from the early legendary period, the Circus Maximus became the venue for an important and popular celebration.

The *Ludi Romani* or *Ludi Magni* were held to honor Jupiter Optimus Maximus (Jupiter Best and Greatest) whose temple was dedicated, according to tradition, which is always shaky for the early period.

**Basilicas.** Before they became Christian buildings, basilicas were civil and administrative gathering places that could hold large numbers of people and were located in the town's forum. They would serve as courts of Roman law throughout the Empire. Rectangular in shape, the standard basilica had wooden ceilings and ended with semicircular niches called apses.

*The* *Basilica of Maxentius* or *the Basilica of Constantine* was the last non-Christian basilica built on the Roman forum. It was built for commercial and administrative purposes. Parts of the Velia ridge between the Esquiline and the Palatine hills had to be leveled for the basilica. The Basilica of Maxentius was built with arches of both the barrel and groined variety, but only three of the barrel vaults remain standing. The rectangle that formed the basilica was 100×65 m, which was divided into a central nave (80×25 m) and aisles to either side. Three groined vaults covered the nave, with a maximum height of 35 m. Eight Corinthian columns 14.5 m high supported them. There may have been large windows on the upper walls of the nave. Floors were marble and the roof was covered with gilded bronze tiles.

*The Severan Basilica* (and forum) in Leptis Magna was begun in 196 by Severus but completed in 216. The basilica was the chief administrative building in Leptis Magna. Its columns were red granite. It was 160 m long and 69 m wide with a 3-aisled colonnade. At either end of the rectangular structure was a decorated apse.

## *Roman Volubilis Judiciary Basilica* in Morocco was in the Roman province of Mauretania. It was built around A.D. 217. It had a second story supported by the columns and may have had a maximum height of 25 m. The shape is rectangular with apses on the short ends and an interior colonnade with Corinthian columns. The basilica is 42.2m long and 22.3m wide. The long side runs parallel to the forum whose open space the basilica increased with its partially protected area.

**Triumphal arch.** Triumphing generals and emperors erected enduring monuments like arches and columns to commemorate their victories.

*The Arch of Janus Quadrifrons (Arcus Constantini*), a quadrifrons triumphal arch, was built in the 4th century on top of the Cloaca Maxima. It was built of concrete covered with white marble 12 sq. m x 16 m high. The arches are 10.6x5.7m.

*The triumphal Arch of Septimius Severus* stands in the Roman Forum. Built in 203, it commemorates the emperor's victories in the east. The arch is 23m high, 25m wide and 11.85m deep. The middle archway is 12x7m; the side archways are: 7.8x3m. The style of the four columns is composite. The columns stand on high bases on which bas relief scenes of Severus' legionaries leading prisoners. There are scenes from the war across the top, as well.

## *Arch of Titus* located in the Roman Forum is the oldest surviving arch in Rome.

Pentelic marble monument (13.5m wide, 15.4m high, and 4.75m deep; with archway 8.3x5.36m) in A.D. 85, 4 years after Titus' death. There was originally a bronze quadriga on the top. The arch was damaged and then rebuilt/restored in 1822. Napoleon commissioned triumphal arches made in imitation of the Arch of Titus.

*Arch of Constantine* located in Rome between the Colosseum and the Palatine, commemorates Constantine's victory over Maxentius in A.D. 312 at the Milvian Bridge. It was probably finished in 315/16 as a celebration of the 10th year of the reign of Constantine. The Arch of Constantine is white marble 21m high, 25.7m wide, and 7.4m deep; the central archway is 11.5x6.5m and the side arches are 7.4x3.36m. There were 8 fluted Corinthian columns of giallo antico (yellow marble), of which 7 remain.

*The Arch of Trajan at Benevento (Latin, Beneventum)* was a triumphal arch built in 114 at the entrance to the city of Beneventum from the Appia Trajana, connecting Rome with Brundisium. This arch is one of about two dozen commemorative monuments to Trajan. The Arch of Trajan was known in the Middle Ages as the Golden Gateway.

**Trajan's Column.** Trajan's Column was dedicated in A.D. 113, as part of Trajan's Forum, and is remarkably intact. The marble column is almost 30m high resting on a 6m high base. Inside the column is a spiral staircase leading to a balcony along the top. The outside shows a continuous spiral frieze depicting events of Trajan's campaigns against the Dacians.

**Baths.** The Roman baths were another area where Roman engineers showed their ingenuity figuring out ways to make hot rooms for the public social gathering and bathing centers. The Baths of Caracalla would have accommodated 1600 people.Roman Baths might incorporate healing properties of native springs as they did at Aqua Sulis, known as Bath, in England.

*Baths of Caracalla.* The Roman Emperor Caracalla built baths for the public on a grand scale. The bath complex known as Thermae Antoninianae (Latin for the Baths of Caracalla), built between A.D. 212 and 216 (although the porticoes were completed later), covered about 13 hectares and could probably accommodate 1,600 bathers. It was built on a man-made terrace near the Via Appia 'Appian Way'.

The baths included:

* a hot bath (*caldarium*),
* a warm bath (*tepidarium*),
* the cold bath (*frigidarium*), and
* a swimming pool (*natatio*).

There were also changing areas (*apodyteria*), exercise areas (*palaestrae*), and a sauna in the bath complex.

*Frigidarium.* The frigidarium was the place to take a cold plunge after having enjoyed the hottest soak in the caldarium, followed by a somewhat cooler dip in the tepidarium.

*Hypocaust.* The word hypocaust refers to a subfloor radiant heating system: suspended floor with space for gases and hot smoke. The word hypocaust comes from the Latin *hypocaustum* which originally meant a 'burning underneath'.

Hypocausts were vital to the ancient Roman system of central heating that made the baths hot and heated other large rooms. In addition to the hypocaust, there were sometimes hollow walls to help maintain even temperatures and prevent condensation. The small pillars of stacked bricks, shown in the accompanying photo of a hypocaust at Bath, the ancient Roman Britain site, would have supported a fireproof floor that was heated by means of air circulation in the underfloor chamber with an external furnace as heat source. Ring (see references) suggests the hot gases at the top of the hypocaust below the floor would have been up to about 400° F, with the floor and wall surfaces about 100° F.

**Civil engineering**

* **Aqueduct**

The Romans constructed numerous aqueducts to serve any large city in their empire, as well as many small towns and industrial sites. The city of Rome had the largest concentration of aqueducts, with water being supplied by eleven aqueducts constructed over a p eriod of about 500 years. They served potable water and supplied the numerous baths and fountains in the city, as well as finally being emptied into the sewers, where the once-used gray water performed their last function in removing waste matter.

The first Roman aqueduct was the Aqua Appia, built in 312 BC during the Roman Republic. The methods of construction are described by Vitruvius in his work De Architectura written in the first century BC. His book would have been of great assistance to Frontinus, a general who was appointed in the late first century CE to administer the many aqueducts of Rome. He discovered a discrepancy between the intake and supply of water caused by illegal pipes inserted into the channels to divert the water, and reported on his efforts to improve and regulate the system to the emperor Trajan at the end of the first century AD. The report of his investigation is known as De aquaeductu. In addition to masonry aqueducts, the Romans built many more leats — channels excavated in the ground, usually with a clay lining. They could serve industrial sites such as gold mines, lead and tin mines, forges, water-mills and baths or thermae. Leats were very much more expensive than the masonry design, but all aqueducts required good surveying to ensure a regular and smooth flow of water.

* **Bridges**

Roman bridges, built by ancient Romans, were the first large and lasting bridges built. Roman bridges were built with stone and had the arch as its basic structure. Most utilized concrete as well; which the Romans were the first to use for bridges.

Roman bridges could be built of wood if they needed to go up quickly, but those didn't last. Roman bridges made of stone, with repairs made as needed, are still in use today. When they were built, they would have helped move armies, serving as part of the road system.

As with the vault and the dome - the Romans were the first to fully realize the potential of arches for bridge construction.

A list of Roman bridges compiled by the engineer Colin O'Connor features 330Roman stone bridges for traffic, 34 Roman timber bridges and 54 Roman aqueduct bridges, a substantial part still standing and even used to carry vehicles. A more complete survey by the Italian scholar Vittorio Galliazzo found 931 Roman bridges, mostly of stone, in as many as 26 different countries (including former Yugoslavia; see right table).

Roman arch bridges were usually semicircular, although a few weresegmental (such as Alconétar Bridge). A segmental arch is an arch that is less than a semicircle.http://en.wikipedia.org/wiki/Roman\_bridge - cite\_note-5 The advantages of the segmental arch bridge were that it allowed great amounts of flood water to pass under it, which would prevent the bridge from being swept away during floods and the bridge itself could be more lightweight. Generally, Roman bridges featured wedge-shaped primary arch stones (voussoirs) of the same in size and shape. The Romans built both single spans and lengthy multiple arch aqueducts, such as the Pont du Gard andSegovia Aqueduct. Their bridges featured from an early time onwards flood openings in the piers, e.g. in the Pons Fabricius in Rome (62 BC), one of the world's oldest major bridges still standing.

Roman engineers were the first and until the industrial revolution the only ones to construct bridges with concrete, which they called Opus caementicium. The outside was usually covered with brick or ashlar, as in the Alcántara bridge.

The Romans also introduced segmental arch bridges into bridge construction. The 330 m long Limyra Bridge in southwestern Turkey features 26 segmental arches with an average span-to-rise ratio of 5.3:1, giving the bridge an unusually flat profile unsurpassed for more than a millennium. Trajan's bridge over the Danube featured open-spandrel segmental arches made of wood (standing on 40 m high concrete piers). This was to be the longest arch bridge for a thousand years both in terms of overall and individual span length, while the longest extant Roman bridge is the 790 m long Puente Romano at Mérida.

The late Roman Karamagara Bridge in Cappadocia may represent the earliest surviving bridge featuring a pointed arch.

* **Walls**

*Hadrian' s Wall.* Hadrian' s Wall is one of the best known Roman walls. Located in northern England, it was started by the Roman Emperor to keep the northerners out of Roman Britain.

Hadrian was born on January 24, 76 A.D. He died on July 10, 138, having been emperor since 117. He counted his dies imperiiAugust 11, although his predecessor had died some days earlier. During Hadrian's rule he worked on reforms and consolidated the Roman provinces. Hadrian toured his empire for 11 years.

Not all was peaceful. When Hadrian tried to build a temple to Jupiter on the site of Solomon's temple, the Jews revolted in a war lasting three years. His relations with the Christians were generally not confrontational, but during Hadrian's stay in Greece (123-127) he was initiated into the Eleusinian Mysteries, according to Eusebius, and then, with new-found pagan zeal, persecuted local Christians.

It is claimed Trajan, his adoptive father, had not wanted Hadrian to succeed him, but was thwarted by his wife, Plotina, who covered up her husband's death until she could make sure of Hadrian's acceptance by the senate. After Hadrian became emperor, suspicious circumstance surrounded the assassination of leading military figures from Trajan's reign. Hadrian denied involvement.

Mementos of Hadrian's reign persist in the form of coins and the many building projects he undertook. Most famous is the wall across Britain that was named Hadrian's Wall after him. Hadrian's Wall was built, beginning in 122, to keep Roman Britain safe from hostile attacks from the Picts. It was the northernmost boundary of the Roman Empire until early in the fifth century.

Today many of the stones have been carted away and recycled into other buildings, but the wall is still there for people to explore and walk along, although this is discouraged.

*Antonine Wall.* The Antonine Wall is a sixty kilometer wall north of Hadrian's Wall built by the Romans in Britian to keep the Picts at bay during the reign of Antoninus Pius (A.D. 142-155). Hadrian died in July 138. Reversing his predecessor's policy of solidification instead of expansion, Antoninus Pius ordered a northward advance and built a new wall called the Antonine Wall. It was completed by soldiers from Legions II, VI, and XX in the 140s and stretched 37 miles from the Forth to the Clyde, following Scotland's Central Valley. In front of the wall was a ditch. Forts were located at about 8 miles intervals. There are also secondary forts too small for entire regiments. Hadrian's wall is thought to have been abanoned in around 140 in favor of the Antonine Wall and then re-occupied in 158. It was then thought that the Antonine Wall was reoccupied under the other Antonine emperor, Marcus Aurelius.

*The Servian Wall.* The Roman King Servius Tullius is credited with building the Servian Wall in the 6th century B.C. but archaeological study of the building material suggests it actually dates to the fourth century B.C. The Servian Wall ran from the Tiber to the Capitoline Hill to the Quirinal, to the valley between the Quirinal and the Pincian, towards the Esquiline, to the valley between the mons Oppius and the Caelian, along the cliffs on the south and southeast of the Caelian, then probably along the southwest side of the Palatine, then south of the forum Boarium and to the Tiber at the Sublician Bridge (*pons Sublicius*).

**Impact of Politics and Religion on Roman Architecture**

In 330 CE, about the time St Peter's Basilica was completed, the Roman Emperor Constantine I declared that the city of Byzantium (later renamed Constantinople, now Istanbul in Turkey), was to be the capital of the Roman Empire. Later, in 395 CE, following the death of Emperor Theodosius, the empire was divided into two parts: a Western half based first in Rome until it was sacked in the 5th century CE, then Ravenna; and an eastern half based in the more powerful and secure city of Constantinople. In addition, Christianity (previously a minority sect) was declared the sole official religion throughout the empire. These twin developments impacted on architecture in two ways: first, relocation to Constantinople helped to preserve and prolong Roman culture, which might otherwise have been destroyed by the barbarian invaders of Italy; second, the emergence of Christianity provided what became the dominant theme of architecture and the visual arts for the next 1,200 years.

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