Roman Architecture

SECOND EDITION

Frank Sear

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Roman Architecture

In this fully updated new edition, Frank Sear offers a thorough overview of the history of architecture in the Roman Empire.

Arranged logically in six historical sections interspersed with material on Roman architects and their techniques, the building types found in Roman cities and the different buildings found in the Roman provinces, this volume now contains the latest insights into Roman architecture and takes account of the past 20 years of scholarship. This seminal work covers the architecture of the Republic, the Age of Augustus, the imperial period, Pompeii and Ostia, the eastern and western empire, and the Late Antique period, exploring subjects such as patronage, building techniques and materials, Roman engineering, town planning and imperial propaganda in a concise and readable way.

Illustrated with nearly 300 photographs, maps and drawings, *Roman Architecture* continues to be the clearest introductory account of the development of architecture in the Roman Empire.

Frank Sear is a graduate of Cambridge University, where he did both his undergraduate and postgraduate work. As a Scholar at the British School he did research on Roman Wall and Vault Mosaics, and as a Cotton Fellow he excavated in Benghazi and Lepcis Magna, Libya. In 1975 he took up a lecturing position at the University of Adelaide where he taught Latin, Greek and Classical Archaeology. He has since been a visiting scholar at the German Archaeological Institute in Berlin, a Fellow of Corpus Christi College, Oxford, and Hugh Last Fellow at the British School at Rome. He is also a Fellow of the Society of Antiquaries of London and a Fellow of the Australian Academy of the Humanities. He was Professor of Classical Studies at the University of Melbourne from 1991 to 2009 and is now Professor Emeritus. He was the co-director of the Australian Pompeii project from 1978 to 1988, and since 1990 has directed the Australian Roman Theatres project, surveying the theatres at Gubbio, Taormina, Benevento and Pompeii in Italy; Jerash in Jordan; and Orange in France. He has written numerous articles on his archaeological work and published a number of books including *Roman Wall and Vault Mosaics*, *Roman Architecture* and *Roman Theatres*.

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Preface

In writing this book I often found myself mentally explaining and discussing difficult points with the students I have taught in London, Oxford, Cambridge, Adelaide and Melbourne, who always find Roman architecture more difficult than Greek – perhaps not surprisingly because it covers such a large time span and is the product of such culturally and ethnically diverse people. The fact that the Romans were also skilful engineers makes it an even more complex subject. Bearing this in mind I have aimed to be clear rather than comprehensive. I avoid or briefly summarise contentious theories in order to present the actual material as clearly as I can. I have selected what I regard as the most significant buildings of each era or province, and have in each case attempted to put then into their historical or cultural context. Another author may have chosen different buildings – the choice is a subjective one, and I will not pretend that I have not included many of my own favourite buildings.

The first eight chapters are mainly concerned with Italy, Rome in particular, and I have selected the end of the Antonine period as a suitable place to break off to discuss the provinces in three chapters. The Late Empire, when provincial cities were as important as the capital, draws all the threads together and is a fitting subject for the last chapter. Rather than constantly interrupting the narrative with explanations about materials and techniques I have devoted a separate chapter to these matters. I was also aware that a purely chronological and geographical approach neglects the development of particular buildings, such as theatres, houses and baths. Therefore I have summarised building types in a separate chapter.

My first contact with architectural history was when as an undergraduate I was reading Classics at Cambridge with Dr. Hugh Plommer and Prof. R.M. Cook. I was fortunate to have as my research supervisor Prof. D.E. Strong, whose many perceptive articles on Roman architectural ornament have greatly added to our understanding of the subject. The Director of the British School at Rome, John Ward Perkins, enlarged my knowledge of Roman buildings when I was a Rome Scholar there. I was lucky enough to accompany him on several of his trips around the Roman Campagna, and once to the top of the Pantheon dome. I would also like to mention my former student, Dr. Janet DeLaine of Wolfson College Oxford, whose grasp of engineering principles has saved me from many a pitfall in my chapter on building methods. That chapter also owes a great deal to Prof. Lynne Lancaster of Ohio University, who has read it and offered many useful comments. Another former student of mine, Prof. Andrew Wallace Hadrill, who later became the Master of my Cambridge college, also very kindly read some of the manuscript. Finally I would like to thank the many others, too numerous to mention, who have offered useful help.

This edition is a new one, almost completely rewritten. Much of it was written in the library of the British School at Rome, which prompts me to pay tribute to its librarians, particularly Valerie Scott, who provided a perfect working environment for me. In writing a work of such a historical sweep I am sure I have made many errors. These are of course all my own.

FS
Melbourne 2019

Acknowledgements

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1 Republican Rome

Etruria was the area north of Rome, bounded on the south and east by the river Tiber and on the north by the Arno Valley and the Apennines. Its land was very fertile, it was excellent cattle country and its forests abounded in deer and wild boar. Its many lakes, such as Lake Bracciano, and the sea gave good fishing. Perhaps most importantly, it had metal resources: iron, copper, silver, tin and lead. The Etruscans seem to have become dominant in the region by the eighth century BC. Their origins are still unknown, but they were clearly a gifted people. They built road cuttings to improve communications; they were efficient metallurgists and built open-cast mines, shafts and galleries; they were good agriculturalists who understood something of crop rotation; and, they were skilful at building drainage tunnels to prevent their land from flooding. By 750 BC they were making contact with the newly arrived Greeks of Cumae. Soon a number of powerful cities dominated: Caere (Cerveteri), Veii, Tarquinia, Vulci, Volsinii (Bolsena), Clusium (Chiusi), Perusia (Perugia) and Volterra. As these cities grew stronger, they began to expand outside Etruria, establishing the towns of Verona, Mantua and Cremona. By the late seventh century BC there was an Etruscan dynasty ruling Rome, and Etruscan influence began to be felt in Latium, for example at Praeneste (Palestrina). By 600 BC the Etruscans had established Capua, their first colony, and by about 540 BC expanded as far south as Salerno. In 535 BC they allied with the Carthaginians to oust the Greeks from Corsica and in 524 BC they attempted to invade Cumae. However, they were defeated and thereafter Etruscan power in the south declined.

Etruscan temples probably derived from the simple hut form but began to be influenced by Greek architecture in the sixth century BC, when a columnar porch was added in front. Etruscan temples usually rested on a podium and the emphasis was frontal. The back wall was closed and usually there were columns only at the front (Figure 1.1b). To judge by rock-cut tombs, especially at Caere, large Etruscan houses had the rooms grouped around a large hall or *atrium*. The second century BC tomb of the Volumnii at Perusia (Figure 1.2a) had a layout reminiscent of that of a Roman atrium house like the House of the Surgeon at Pompeii (Figure 1.2b), except that it had a staircase leading down into the tomb instead of a doorway and *fauces* (entrance passage). The main rooms were symmetrically grouped around a hall with a beamed ridged roof, which in a house would be termed a testudinate atrium. Opposite the doorway was the *tablinum* (reception room) with a coffered ceiling. As for Rome itself, Cicero praises the natural advantages of its site (*de Rep*. 11). It is only 25 kilometres from the coast, and because of its river combines the advantages of a safe inland position with easy access to the sea (Figure 1.3). The river Tiber, rising in northern Etruria, as well as the river Anio provided easy communications with the centre of Italy. An island in the middle of the Tiber facilitated the crossing, and the hills of Rome, especially the Palatine and Capitoline, offered good natural defence (Figure 1.4).

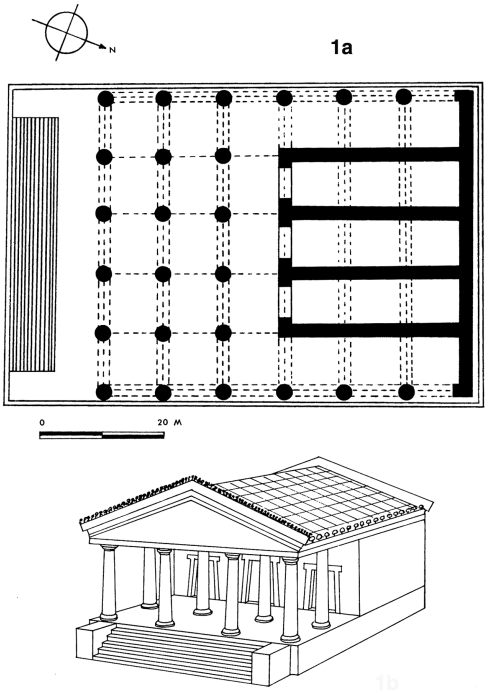

Figure 1.1 (a) Rome, Capitoline Temple: plan. (b) Typical Etruscan temple: drawing.

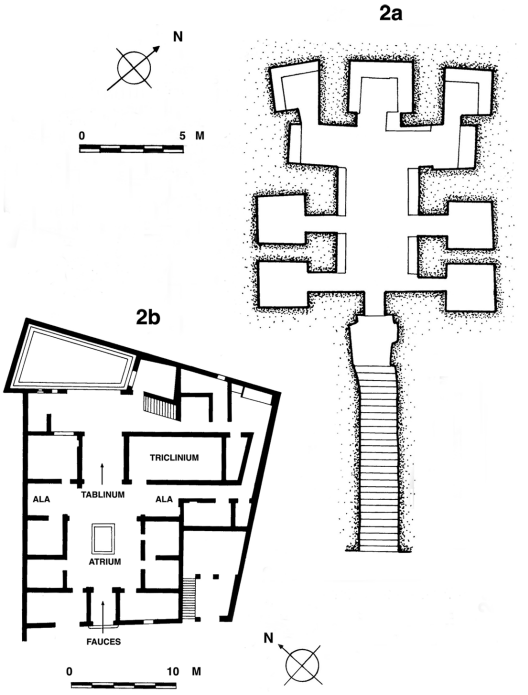

Figure 1.2 (a) Perusia (Perugia), Tomb of the Volumnii, second century BC: plan. (b) Pompeii, House of the Surgeon, fourth/third century BC, plan.

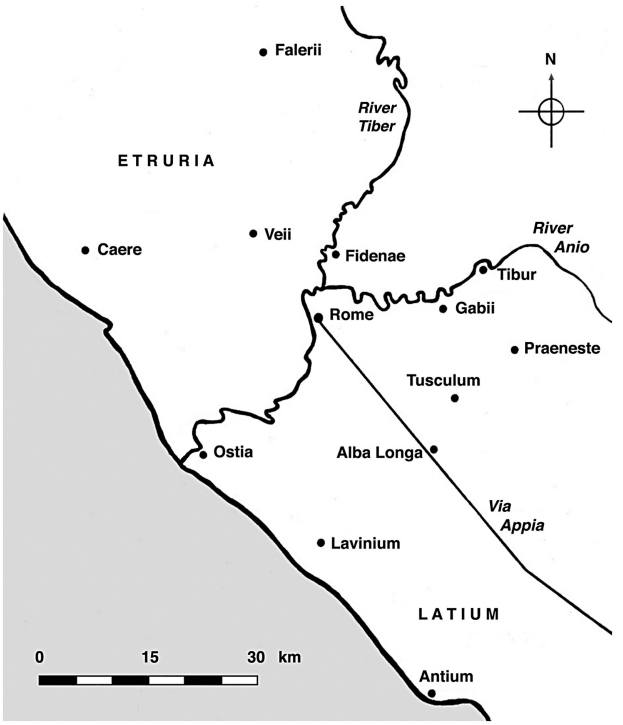

Figure 1.3 Central Italy showing the position of Rome and the rivers Anio and Tiber: plan. (After M. Grant, *The Roman Forum* [London: Spring Books, 1974], 31.)

The traditional date for the foundation of Rome is 753 BC, although there were settlements there before that date. The Palatine, a steep naturally defensive hill at the centre of the hills on which Rome is built, has from time immemorial been associated with the legendary foundation of Rome by Romulus. The importance of the foundation legends is that, whether Romulus existed as a historical figure or not, the Romans themselves believed in them and venerated the places associated with them. The story of Romulus became part of folklore, and in the 4th and 3rd centuries BC, following contact with Greece, the Romans began to assimilate the legends of Romulus with those of Troy. The result was that in the minds of the Romans the foundation of their city was one of the turning points of history. As Livy put it: 'The Fates decreed the founding of this great city, and the beginning of the mightiest Empire next to that of the gods' (Livy, 1.4.1).

It may be useful here to summarise these legends, which have so much bearing upon the building history of Rome and which shaped the subsequent development of the city. Livy began his history with the flight of Aeneas after the fall of Troy, an event which archaeology places at the beginning of the 12th century BC. Aeneas, whose mother was the goddess Venus, had a son, Ascanius or Iulus, who founded Alba Longa and established a dynasty. Many generations later Rhea Silvia, a daughter of one of the kings of Alba Longa, was ravished by Mars and gave birth to the twins Romulus and Remus. The twins were suckled by a she-wolf in a cave (*lupercal*) at the foot of the Palatine Hill and were found under a fig-tree (*ruminal*). Romulus, following a quarrel which resulted in the death of his brother Remus, founded Rome. This legend was an axiom of Roman belief and assumed particular importance at the

time of Augustus, who, as the adopted son of Julius Caesar, claimed descent from Venus through his familial links with Iulus.

The discovery in 1948 of Iron Age huts on the Palatine Hill confirms the statement of Dionysius of Halicarnassus (*Ant.Rom*. 1.79.11) that one of them still survived in his day (late first century BC) and was constantly kept in repair. The largest of the huts measured 4.90 × 3.60 metres and its floor was excavated into the tufa along with the post-holes. The huts were supported on seven posts, one at each corner and one in the middle of three of the walls. On the fourth side there was an entrance porch, as shown by four smaller post-holes. There was also a post-hole in the middle of the hut, to support the roof. The walls were probably made of reeds and mud, and the roof of thatch. The town was laid out according to religious rites within a sacred boundary, the *postmoenium* or *pomerium* (Varro, *Ling.Lat*. 5.143). The earliest *pomerium* of Rome seems to have taken in only the Palatine and a generous space around, so that the sacred area was almost a square, perhaps the *Roma Quadrata* of tradition (Tacitus, *Ann*. 12.24). Soon walls were built around the base of the hill and later extended to include the Capitoline. The construction of drains began which made the valley bottoms habitable, and under the early kings the city grew to include the Caelian, Velian, Viminal, Quirinal and Esquiline hills. Tradition attributes the Temple of Vesta in the Forum, a circular building perhaps originally a thatched hut where the sacred fire was kept, to the second king of Rome, Numa Pompilius (715–674 BC). He is also said to have built the first Regia (royal palace).

The reign of Ancus Marcius (640–616 BC) was of great importance for the early growth of the city, which he expanded to include the Aventine (Livy, 1.33.1–2). He also built the first bridge over the Tiber, the Pons Sublicius, to connect the city to the Janiculum Hill, on the other side of the Tiber (Figure 1.4), which had been annexed, not for expansionary reasons,

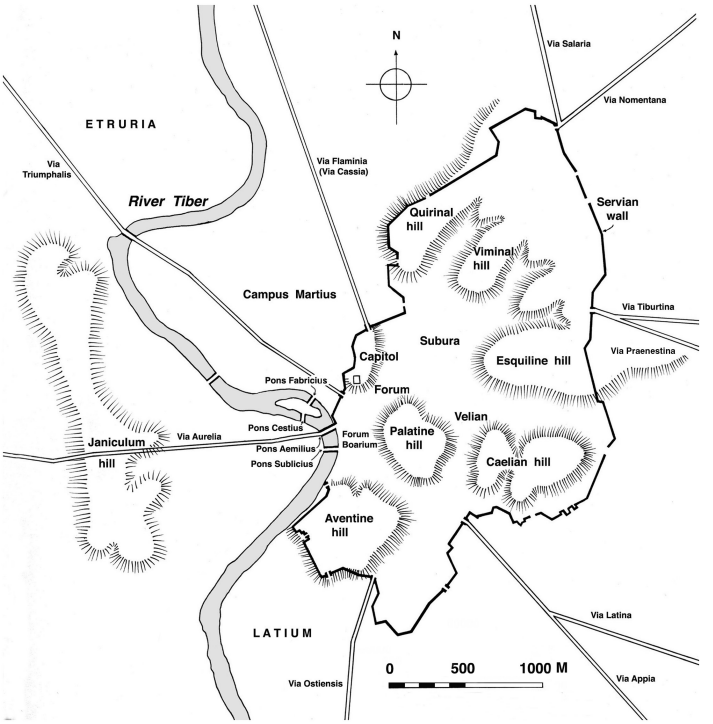

Figure 1.4 Rome showing the hills, the Tiber and the roads leading out of the city: plan. (After M. Grant, *The Roman Forum* [London: Spring Books, 1974], 30.)

but to deny Rome's enemies a stronghold (Livy, 1.33.6). The bridge was built on wooden piles or *sublica*, its religious significance reflected in the name of the College of Pontiffs who were in charge of it (*pontifex* means 'bridge-builder'). The period around 630 BC marked the beginning of the transformation of the Forum into a public and political area. It was also a period during which public buildings began to be built of more permanent materials. In the period 625–620 BC hut after hut was pulled down and the area which was to become the Forum was levelled and then paved in pebbles.

In the period 616–509 BC Rome was ruled by three Etruscan kings whose military, engineering and architectural achievements raised Rome to be the leading city of Latium. It was also the largest city in central Italy, the 'great Rome of the Tarquins'.[1] Tarquinius Priscus (616–578 BC) began the vital work of dredging the Cloaca stream and its tributaries, which crossed the low-lying, swampy area destined to become the Roman Forum, into a stone-lined culvert. Priscus then apportioned building sites in the Forum (Livy, 1.35.10) and surrounded it with shops and porticoes (Dion.Hal., *Ant.Rom*. 3.67.4). He marked out the ground for the Circus Maximus and presumably made some provision for drainage there too, as the area is prone to flooding. Retaining walls were built around the Capitoline Hill because of its steepness and it was levelled for the building of a huge temple, but Priscus died before he could begin it (Dion.Hal., *Ant.Rom*. 3.69.2).

Rome's population had grown rapidly, and in 578 BC, when Servius Tullius became king, the *pomerium* was extended to include the Quirinal, Viminal and Esquiline hills. He built a defensive wall around the extended city with an *agger* (embankment) between the Esquiline and the Quirinal (Dion.Hal., *Ant.Rom*. 4.13). The substantial remains of tufa walling which can be seen near Rome's railway station (Figure 1.5) were thought to belong to the Servian Wall, until it was discovered that the blocks were made of Grotta Oscura tufa from Veii, which was available to the Romans only after the fall of Veii in 396 BC. Therefore, the wall must have been built after that date. However, some parts of the wall in the vicinity of the Palatine and Capitoline seem to have incorporated portions of an older circuit in cappellaccio, a material which was available from the seventh century BC. This opens up the possibility that the fourth century BC wall was partly following the course of a sixth century BC wall. Servius Tullius is known to have built a number of temples, one of which, the Temple of Mater Matuta, has been uncovered near the church of St. Omobono in the Forum Boarium (Livy, 5.19.6). It was square in plan (10.30 × 10.30 metres), resting on a tufa podium 1.70 metres high, and had a cella of mud-brick flanked on each side by *alae* (wings). There were two columns *in-antis* in front, and the entablature was of wood sheathed in decorated terracotta plaques, exemplifying the richness of temples of this period.

The last Etruscan king, Tarquinius Superbus (534–509 BC), finished many of the projects of his predecessors, completing the Circus Maximus, draining the Forum and uniting the various drains into one enormous sewer, the Cloaca Maxima (Livy, 1.56.2). The drain seems to have still been an open channel in the middle of the second century BC, when the philosopher Crates of Mallus broke his leg falling into it (Suetonius, *de gramm*. 2.1). The temple of Mater Matuta was burnt in a fire and restored by Tarquinius Superbus, who rebuilt it on a rectangular plan, 13.20 × 11.20 metres, with four columns in the *pronaos*. The entablature was of wood, with terracotta plaques showing a procession of carriages. In the pediment were two panthers of terracotta and at the angles two sphinxes. The *acroterion* was an almost life-size terracotta group of Heracles brought to Olympus by an armed female deity, perhaps Athena. The king's greatest achievement was building the huge Temple of Jupiter, Juno and Minerva on the Capitoline Hill, the largest Etruscan temple ever built (Figure 1.1a). For this immense project workmen were brought in from all over Etruria and local labourers were conscripted into service. During these works a human head (*caput* in Latin) was unearthed,

showing that 'here was to be the citadel of the empire and the head of the world' (Livy, 1.55.5). The dimensions of the temple were astonishing, comparable to those of the truly enormous archaic temples at Ephesus and Samos.[2] Built of cappellaccio blocks, it had the typically Etruscan high podium, parts of which still survive under Palazzo dei Conservatori. The remains measure 53.50 × 62 metres with foundations about 8 metres deep, which conforms fairly closely with the description of it given by Dionysius of Halicarnassus (*Ant.Rom*. 4.61.3–4). It had a ground plan more elaborate than that of any surviving temple of the Etruscan type, with the three cellas which Vitruvius prescribes for the Tuscan temple (*de Arch*. 4.7.1–2), but instead of two rows of four columns in the *pronaos* it has three rows of six columns, with further columns running down the sides. The temple was of the type called *sine postico*, with no columns along the back. In 179 BC the columns were coated with a white substance, which may suggest that they were of stone (Livy, 40.51.3), but their spacing suggests that the entablature must have been of wood, probably covered with brightly painted terracotta revetments like those of other Etruscan temples of the period. Vitruvius mentions this temple by name in connection with its heavy statues of terracotta (*de Arch*. 3.3.5). Its eaves would have been widely spread and the roofline crowned with large-scale terracotta sculptures, such as the enormous clay four-horse chariot made in Veii and mentioned by Plutarch (*Publicola*, 13). For the central cella, Vulca of Veii was commissioned to make a seated clay statue of Jupiter (Pliny, *Nat.Hist*. 35.12.45). Superbus probably made himself unpopular by instituting forced labour on his big projects, with the result that, according to a tradition which places the event at about the same time as the Athenians overthrew the Peisistratid tyranny, the Etruscan kings were expelled in 509 BC (Livy, 1.60.3).

Once free of Etruscan control the Romans began to shape their own destinies. The new Roman Republic was governed by elected magistrates and a senate. There was also a popular assembly (*comitia*) with limited powers. The civic life of the new state was centred on the Forum. The Temple of Jupiter was dedicated in the first year of the Republic (Dion. Hal., *Ant.Rom*. 5.35.3) and the Temple of Saturn, begun by Superbus, was finished in 497 BC (Livy, 2.21.1–2). The Regia, which had been destroyed by fire, was rebuilt. There was a great flowering of temple architecture in Rome and Etruria in the early fifth century BC, for example, the temples of Mercury (495 BC), Ceres, Liber and Libera on the Aventine (493 BC), Fortuna Muliebris (486 BC) and Castor and Pollux (484 BC), built in honour of the Dioscuri, who appeared on the side of the Romans in the battle of Lake Regillus (496 BC) against the Latin League led by Tarquinius Superbus. These temples had been funded from booty gained after victory (*ex manubiis*), but at this time Rome started to suffer a number of military defeats. After 484 BC no further building is mentioned in the records until the end of the century, except the Temple of Apollo in 433 BC, which was a special case because it was built following a plague (Livy, 4.25.3).

During the fifth century the Romans won over the Sabines, and their chief, Attus Clausus, became head of a new *gens*, *Claudia*, and Latinised his name to Claudius. They drove back the neighbouring Volsci and the Aequi, and in 405 BC entered into a war with the Etruscans aimed at their subjugation. In 396 BC after a ten-year siege the dictator Marcus Furius Camillus captured Veii, the first Etruscan city to fall to the Romans. He celebrated his victory with a triumphal military parade along the road from Veii to Rome, later called the Via Triumphalis. There was, however, a great setback in 391 BC when a large force of Gauls invaded Etruria and defeated a Roman force sent out to meet them. They captured and sacked Rome in 386 BC, withdrawing only when the Romans had paid them a ransom in gold. Archaeological evidence does not suggest major destruction to monuments such as the Temple of Jupiter Optimus Maximus, the Forum or the Comitium (place of popular

assembly). Livy's description suggests that houses were the Gauls' main target (Livy, 5.55). After the withdrawal of the Gauls, the inhabitants, who had fled at their approach, slowly returned to their damaged city and began rebuilding at once (Livy, 6.4.6), aided by a grant of free tiles. The layout of the city was haphazard, probably because the streets were unplanned before the invasion. People simply reclaimed their land and built on the same plots.

The next essential was to fortify the city against future attack. In 378 BC money was levied to build a new wall circuit and the censors contracted for it (Livy, 6.32.1), the first recorded contract let out by the censors. This remarkable project involved an enormous circuit, 11 kilometres long, which enclosed an area of 426 hectares, making Rome the largest city in Italy (Figure 1.4). The 'Servian Wall', laid in uniform blocks of Grotta Oscura tufa, measuring 0.59 × 0.59 × 1.77 metres, was punctuated by towers (Livy, 7.20.9; 22.8.6–7; 26.55.8). Wherever possible it followed defensive features, mostly the edges of the hills, but along a flat section on the Esquiline, a sloping embankment (*agger*), 42 metres wide, had to be built for a distance of 1,350 metres. It was contained between an outer wall, about 10 metres high and an inner one, 2.6 metres high. The best-preserved portion of the wall, in front of Rome's main railway station, is 94 metres long and preserved to a height of 17 courses, or ten metres (Figure 1.5). An examination of this section reveals that it was built entirely of tufa blocks laid alternately in headers and stretchers and had a total thickness of nearly 4 metres. The blocks bear masons' marks using the rectilinear letters of the Greek alphabet, the closest analogies of which are fortification blocks in Sicily or south Italy.

Seeking to establish a buffer against any future enemy attack, Rome formally assumed leadership of her Latin allies (358 BC), but in 341 BC the great Latin war broke out, in which

Figure 1.5 Rome, so-called Servian Wall, c. 378 BC.

Rome defeated the Latin forces at Antium (Anzio) and dissolved the Latin League (338 BC). Between 343 and 290 BC Rome was also involved in three wars with the Samnites, who occupied the mountainous area to the SE, in which Rome ultimately triumphed. Meanwhile the Etruscans had resumed hostilities, but by 351 BC Rome had overrun Falerii Veteres (Civita Castellana) and Tarquinia. The other Etruscan cities one by one met the same fate, with the result that by the beginning of the third century BC Rome dominated central Italy. As her power spread over Italy Rome consolidated her conquests by a network of colonies and garrisons defended by imposing fortifications. Some were for coastal defence, such as Ostia (mid fourth century BC), Pyrgi (third century BC) and Minturnae (296 BC), all surrounded by rectangular walls. Others were on the coastal plains, for example Ardea (c. 300 BC), with walls built of square tufa blocks, in a style similar to that of the co-called Servian Wall of Rome, or in the hills, where the walls were built of well-cut polygonal work. Examples of the latter include Arpinum with walls of polygonal masonry and a corbelled gateway (Figure 1.6); Circeii with fortifications composed of big polygonal blocks (393 BC); Norba (second half of fourth century BC) with walls built of beautifully fitting polygonal work; and the enormous citadel of Alatrium (late third century BC) built of huge polygonal blocks with a big lintelled gateway. The citadel of Ferentinum (mid second century BC), built on a terrace measuring 165 × 80 metres, changes as it rises from polygonal work to limestone *opus quadratum* and finally to smaller blocks of peperino (Figure 1.7). Near the top is a row of small arched windows lighting a *cryptoporticus* (covered passage) behind, and below them is a long inscription indicating that the citadel was built by the censors Aulus Hirtius and Marcus Lollius.

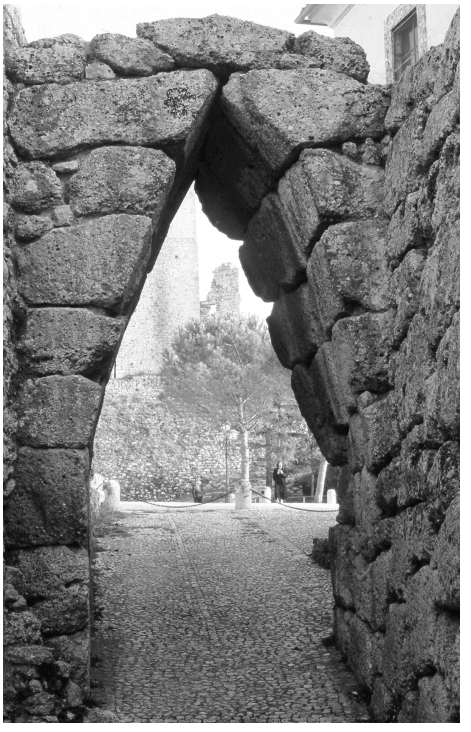

Figure 1.6 Arpinum, polygonal walls and corbelled gate, c. 300 BC.

Figure 1.7 Ferentinum (Ferentino), the citadel, mid second century BC.

The Romans also established colonies to keep watch over recently conquered territory. Two colonial cities are of particular importance, Cosa and Paestum, both established in 273 BC. Cosa, north of Rome, is built on the plain and surrounded by 2 kilometres of well-cut polygonal walls. On the highest points, one to the north and one to the south, are situated the most important temples. The higher point is dominated by the Capitolium (c. 175–150 BC), which in style must have been similar to the old Etruscan temples with its high podium, three cellas and deep tetrastyle *pronaos* taking up approximately half the area of the stylobate (Figure 1.8). The roofline too must have been reminiscent of Etruscan temples with rich terracotta revetments and overhanging eaves. By the second century BC the long, rectangular forum seems to have been completely surrounded by buildings, the most important being the group on the NE side (Figure 1.9). The circular *comitium* surrounded by steps/seats seems to date from the earliest building period (c. 270–250 BC). Behind the comitium is a rectangular building which has been identified as the *curia* or senate-house. Access to it was by way of the steps/seats of the comitium, an arrangement which may have imitated that in Rome. The other important colonial city is Paestum, a refoundation of the old Greek city of Poseidonia in south Italy. It was surrounded by a wall circuit of squared limestone blocks, and a circular building similar to that at Cosa has been found facing a rectangular forum, perhaps also a comitium. Next to it was a temple with an Italo-Etruscan ground-plan. It had a high podium, steps at the front and a deep columnar porch. The columns also ran along the sides of its single cella but not around the back. It is thought to have been built shortly after the foundation of the colony, but remodelled about 100 BC with unorthodox Corinthian capitals supporting a Doric entablature.

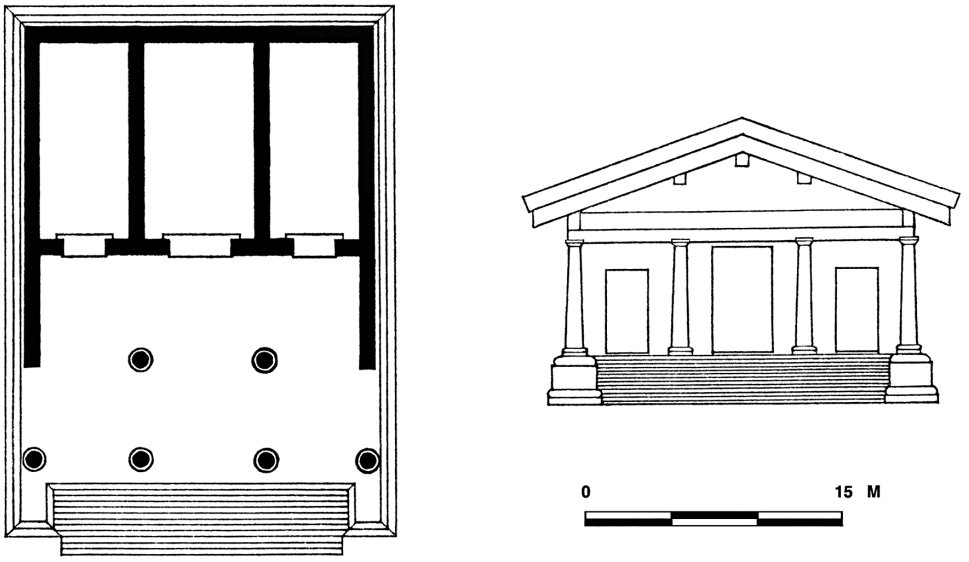

Figure 1.8 Cosa (Ansedonia), Capitolium, c. 150 BC, elevation and plan. (After A. Boethius and J. B. Ward Perkins, *Etruscan and Roman Architecture* [Harmondsworth: Penguin, 1970].)

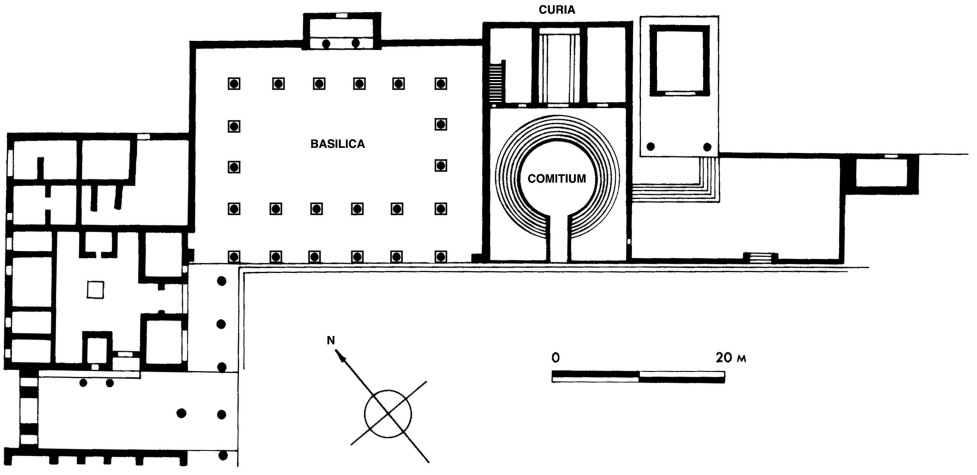

Figure 1.9 Cosa (Ansedonia), buildings on the north side of the forum as they appeared in the late second century BC, plan. (After A. Boethius and J. B. Ward Perkins, *Etruscan and Roman Architecture* [Harmondsworth: Penguin, 1970].)

Roads were one of the greatest building achievements of the Romans (Strabo, *Geo*. 5.3.8). A number of local roads, whose origins are largely unknown, led out of Rome in all directions (Figure 1.4). One of the oldest of these, the Via Salaria, was the old salt road (*sal* = salt) used by the Sabines from early times. It ran to Fidenae and was later extended across the Apennines to Asculum (Ascoli Piceno). Another was the Tiburtina which linked Rome and Tibur (Tivoli). It was extended by the censor M. Valerius Maximus in 308 BC as the

Via Valeria, and again by Claudius as far as Aternum (Pescara) on the Adriatic. The Via Praenestina originally ran to Gabii but was later extended to Praeneste (Palestrina). Other early roads followed Rome's military expansion throughout Italy, such as the Via Latina, probably built in the course of the second Samnite war to connect Rome with Cales (Calvi Risorta), the first colony to be founded after the great Latin war (334 BC).

Other roads bore the names of the magistrates who built them, such as the Via Flaminia, begun by the censor C. Flaminius in 220 BC, which eventually reached Ariminum (Rimini). The most famous road of all was the Via Appia, 'the queen of the long roads' (Statius, *Silv*. 2.2.12). Because the censor Appius Claudius Caecus had to cut through hills and fill ravines the road consumed the entire revenue of the state, but 'he left behind an immortal monument to himself' (Diodorus Siculus, 20.36.4). Begun in 312 BC (Livy, 9.29.5), it was at first a gravel road, but eventually it had camber and drainage ditches on each side and was paved in large, well-fitting polygonal blocks of basalt, which are still partly visible along its first few kilometres out of Rome (Figure 1.10). At first it ran as far as Capua, but it soon became the principal route to south Italy and was extended to Beneventum (Benevento) and then to Brundisium (Brindisi) in 264 BC. Roman roads, notable for their straightness, ran through cuttings and tunnels and over bridges and viaducts, the longest of which, 31 kilometres long, was built for the Via Appia across the Pontine marshes. Eventually 29 roads radiated from Rome, including the Via Aurelia to Genua (Genoa), probably the work of the censor C. Aurelius Cotta (241 BC); the Cassia to Luna (Carrara), where it joined the Aurelia; and the Flaminia which crossed the river Nera at Narnia (Narni) by the largest Roman bridge ever built.

In 312 BC the first aqueduct, the Aqua Appia, was built by the same Appius Claudius Caecer who built the Via Appia (Livy, 9.29.6). It brought water through an underground

Figure 1.10 Rome, Via Appia, 312 BC onwards: the first few kilometres of the road.

conduit from a point between the eighth and ninth milestones on the Via Praenestina to the Aventine. It entered the city near the locality called *ad spem veterem*, which is close to the later Porta Praenestina (Porta Maggiore), one of the highest points of the city. It then ran across the Caelian and Aventine hills to its termination near Porta Trigemina in the Forum Boarium, where local distribution began. The second aqueduct was the Anio Vetus built by the censor Manius Curius Dentatus in 272 BC. With a capacity of 176,000 cubic metres a day at the intake, it brought water from the river Anio at a point between Vicovaro and Mandela, 64 kilometres away. It entered the city in the same place as the Aqua Claudia and crossed the Esquiline in an underground conduit to terminate near where Rome's main railway station (Stazione Termini) now stands. The water it delivered was not rated very highly at the time of Frontinus, Nerva's water commissioner (*curator aquarum*), and it was recommended only for watering gardens and 'dirty uses' (Frontinus, *de Aquis* 2.92).

By the mid second century BC these two aqueducts did not supply enough water for Rome's burgeoning population. Besides, the Aqua Appia and Anio Vetus had started to leak and water was being diverted from them before they reached the city. It is interesting to note that at the end of the first century AD Frontinus measured the Aqua Appia and found that its capacity was 1,825 *quinariae*, the equivalent of about 73,000 cubic metres a day, but it was discharging only 704 *quinariae* or 28,000 cubic metres (Frontinus, *de Aquis* 2.65). As a result, an even bigger aqueduct, the remarkable Aqua Marcia, had to be built at great expense by the praetor, Q. Marcius Rex, in 144–140 BC. Its source was the river Anio at a point upstream of the Anio Vetus. It was carried in an underground channel, and for 11 kilometres on heavy arches, over a total distance of 91.3 kilometres (Frontinus, *de Aquis* 1.7), making it the longest aqueduct supplying Rome. It entered the city at the same place as the earlier aqueducts and ran along the course of the later Aurelianic wall to Porta Tiburtina. From there it arrived at the point where Stazione Termini now stands and split into several branches, one of which went as far as the Capitol. Its capacity was 187,600 cubic metres (Frontinus, *de Aquis* 2.67, 81), and its water was considered to be of high quality (Vitruvius, *de Arch*. 8.3.1; Pliny, *Nat.Hist*. 31.24.41). Martial says its waters were so clear as to be invisible (*Epigr*. 6.42). The last Republican aqueduct (125 BC), called the Aqua Tepula because its waters were so warm, brought water from near Marino in the Alban hills and had a capacity of only 17,800 cubic metres.

An inscription of AD 365–366 lists 13 bridges over the Tiber, which means that Rome had more river crossings than any other city in the world at that time. The Pons Aemilius, probably the oldest stone bridge, stood a little upstream from the wooden Pons Sublicius. It has been connected with the opening of the Via Aurelia, which may have taken place in 241 BC. However, the first reference to it states that the pylons were built in 179 BC by the censor M. Fulvius Nobilior and the arches by the censors Publius Scipio Africanus and Lucius Mummius in 142 BC (Livy, 40.51.4). It crossed the river just after the island at a point where the stream becomes a little wider. The next bridge, the Pons Mulvius, carried the Via Flaminia across a bend in the Tiber, 5 kilometres to the north. It probably dates to about 220 BC, when the road was built (Livy, *Periocha*, 20), and it certainly existed in 206 BC (Livy, 27.51), but the censor M. Aemilius Scaurus replaced it in 109 BC with the present six-arch stone bridge, 132 metres long. In 62 BC the Pons Fabricius was built by L. Fabricius, the roads commissioner (*curator viarum*), as inscriptions over each arch affirm (Figure 1.11). An elegant bridge, it was built to link the southern Campus Martius with the island. It has two arches, each 24.5 metres wide, with pilasters flanking a smaller flood arch, 6 metres wide, over the abutment in the middle. Faced in brick in 1679, it was originally faced in travertine, which survives only over the arches and in the pilasters. Inscriptions on each side above

Figure 1.11 Rome, Pons Fabricius, 62 BC.

the central arch affirm that its solidity had been tested by Fabricius, and further inscriptions record that it had been tested again by M. Lollius and Q. Lepidus, the consuls of 21 BC, who probably had to repair it after the flood of 23/22 BC. The Pons Cestius was built to link the island with Transtiberim (Trastevere), the plain between the Janiculum and the river, either by C. Cestius, who was praetor in 44 BC, or L. Cestius, who was praetor the following year. It was 48.4 metres long and originally had a single depressed arch in the middle and two smaller flood arches at the sides. In 1888 it was partly demolished; the smaller arches were replaced by larger arches and the central one was rebuilt.

Corbelled gateways, such as the late fourth century BC gate at Arpinum (Figure 1.6), have a long history dating back to before the Mycenaeans. They do not embody the principle of the true arch, but instead consist of horizontal courses of stone, each corbelled out a little further than the last.[3] The true arch was said by Seneca (*Epist*. 90, 32) to have been invented by Democritus at the end of the fifth century BC. The oldest arched gate in Italy is the Porta Rosa at Velia, which seems to date to the mid fourth century BC. The gate at Falerii Novi (c. 240 BC), composed of well-cut *voussoirs* with a hood moulding running around the top, shows how quickly the Romans grasped the potential of the arch (Figure 1.12). Other early examples include the Porta Marzia and the so-called Arch of Augustus with its double voussoirs, both at Perusia (Perugia); the gates at Volaterrae (Volterra) and Cosa; and the twin-arched gateway, the Porta dei Leoni at Verona, in its original first century BC form. The arched emissary of the Cloaca Maxima, also belonging to the first century BC, has triple *voussoirs*. Arches with *voussoirs* cut to bind into the wall surface became common by the time of Augustus.

Roman concrete evolved during the third and second centuries BC. Early examples are mortared rubble, such as, for example, in the Villa of the Mysteries at Pompeii (mid third

Figure 1.12 Falerii Novi (S. Maria di Falleri), gate, c. 240 BC.

century BC), and behind the polygonal walls of Alba Fucens (303–302 BC). Some early Pompeian walls consist of rows of orthostates with smaller rough stones between and a cement/rubble core, a system developed by the Carthaginians in North Africa and called *opus africanum*. During the second century BC concrete was faced with irregular stones, usually of tufa, a system called *opus incertum* (Figures 4.6 and 4.7). It was soon used in large-scale projects like the Porticus Aemilia (Figure 1.13), built in 193 BC (Livy, 35.10.12) and restored in 174 BC (Livy, 41.27.8).[4] By the last decades of the second century BC a more regular facing began to be used, *opus quasi-reticulatum*, with squarer stones laid along diagonal joints. Concrete facings may have developed faster in the late second century BC to provide buildings for a rapidly growing population. Rome's population may have been about 300,000 by 125 BC , which explains the need for better sewerage and water supply. It is thought to have reached a maximum of 440,000 at its peak.[5]

The Roman Forum contained buildings whose ancestry goes back to remote antiquity (Figure 1.14). The circular Temple of Vesta was perhaps first built at the time of Rome's second king, Numa Pompilius (715–673 BC). In it the sacred flame was tended by the Vestal Virgins and the Palladium, the wooden statue of Pallas Athena brought from Troy by Aeneas, was kept there (Ovid, *Tr*. 3.1.29). Nearby was the frequently rebuilt atrium Vestae, where the Vestals lived. Close to the atrium Vestae and also said to go back to the time of Numa is the Regia (royal palace), a building sacred to Mars where the Pontifex Maximus and the College of Pontiffs met. The most important Republican temples in the Forum were the Temple of Saturn, dedicated in 497 BC; the Temple of Castor and Pollux, vowed in 496 BC; and the Temple of Concord, which was said to have been vowed by L. Furius Camillus in 367 BC at a time of unrest when the plebeians wanted to elect a consul from their own ranks (Ovid, *Fast*. I.641–644; Plutarch, *Cam*. 42).