

The Fortification of Gaul and the Economy of the Third and Fourth Centuries

An effort is made here to cast light on three areas related to converting the open urbs of Bordeaux into a fortress city during the later third and early fourth centuries. First, some tentative estimates are offered regarding various aspects of the expenditure of human, animal, and material resources that were involved in this project. Secondly, using Bordeaux as a guide, some even more tentative suggestions are made regarding the overall costs of the strategic initiatives that resulted in the fortification of some one hundred cites. Finally, some suggestions are made regarding whether this type of exercise can be of some value, if perhaps only heuristically, in helping us to understand the economic and demographic nature of the "Crisis of the Third Century" in light of its aftermath.

During the latter part of the third century CE, the Roman imperial government initiated what ultimately would be a vast program of military construction in Gaul. These efforts were executed during the remainder of the third century, throughout the fourth century, and into the fifth century. The program continued until at least some eighty-five percent of the 125 largely undefended or inadequately defended *urbes* were converted into fortress cities.¹ In recent years, archaeologists have undertaken numerous detailed studies of the great stone walls of these new fortress cities.² These studies provide a substan-

¹ On monumental fortress cities, see Stephen Johnson, *Late Roman Fortifications* (Totowa, N.J., 1983); older works include Adrien Blanchet, *Les enceintes romaines de la Gaule* (Paris, 1897), 13–219; and Albert Grenier, *Manuel d'archéologie gallo-romaine*, 6 vols. (Paris, 1924–1934), 5.281–361; see also Jean Hubert, "Evolution de la topographie de l'aspect des villes de Gaule du Ve au Xe siècle," *Settimane di Studio del Centro Italiano di studi sull'alto Medioevo* 6 (1959), 529–558. For chronology, see Marc Heijmans, "La mise en défense de la Gaule méridionale aux IVe–VIe s.," *Gallia* 63 (2006), 59–74. Not included here are a vast number of lesser fortifications; see Michel Reddé, Raymond Brulet, Rudolf Fellmann, Jan-Kees Haalebos, Siegmund von Schnurbein, *L'Architecture de la Gaule romaine. Les fortifications militaires* (Paris/Bordeaux, 2006).

² For Gaul, see, e.g., Pierre Varène, Jacques Bigot, *L'enceinte gallo-romaine de Nîmes: Les murs et les tours* (Paris, 1992); D. Barraud, J. Linères, L. Maurin, "Bordeaux"; L. Maurin, B.

tial corpus of information that permits estimates of various processes intrinsic to establishing the costs of urban fortification to be developed.³

In this study an effort is made to cast light on three areas related to converting the open *urbs* of Bordeaux into a fortress city during the later third and early fourth centuries. First, some tentative estimates are offered regarding various aspects of the expenditure of human, animal, and material resources that were involved in this project.⁴ Secondly, using Bordeaux as a guide, some even more tentative suggestions are made regarding the overall costs of the strategic initiatives that resulted in so many open cities in Gaul being converted into urban fortresses, a subject that has received insufficient attention.⁵ Finally, some suggestions will be made regarding whether this type of exercise can be of some value, if perhaps only heuristically, in helping us to

Watier, M.C. Mélenlez, "Dax"; C. Girardy-Caillat, "Périgueux"; and L. Maurin, J.-F. Pichonneau, "Bazas"; all in P. Garmy, L. Maurin, eds., *Enceintes romaines d'Aquitaine. Bordeaux. Dax, Périgueux, Bazas* (Paris, 1996), 10–80, 81–126, 127–154, 155–165, respectively; J. Guilleux, *L'enceinte romaine du Mans* (Saint-Jean-d'Angély, 2000); Bastien Gissinger, *Recherches sur la site fortifié de Strasbourg durant l'antiquité tardive: Le "castrum" d'Argentoratum* (Oxford, 2002); Dany Barraud, Pierre Régaldo-Saint Blancard, "La façade orientale de l'enceinte antique de Bordeaux: nouvelles données et nouvelles hypothèses," in Jean-Pierre Bost, Jean-Michel Roddaz, Francis Tassaux, eds., *Itinéraire de Saintes à Dougga: Mélanges offerts à Louis Maurin* (Bordeaux, 2003), 115–129; A. Simon Esmonde Cleary, Jason Wood, *Saint-Bertrand-De-Comminges III: Le rempart de l'Antiquité tardive de la ville haute* (Bordeaux, 2006); and A. Simon Esmonde Cleary, *Rome in the Pyrennees: Lugdunum and Convenae from the First Century B.C. to the Seventh Century A.D.* (London, 2008). More generally, see Marc Heijmans, *Arles durant l'Antiquité tardive: De la duplex Arelas à l'urbs Genesisii* (Rome, 2004); and Meike Droste, *Arles: Gallula Roma—Das Rom Galliens* (Mainz, 2003).

³ In addition to works cited above, see Esmonde Cleary, Wood, *Saint-Bertrand-de-Comminges III*, 143–146, 215–216, which indicates sufficient information to provide a discussion of the labor and material costs involved in the construction of fortifications at Saint-Bertrand-de-Comminges. Esmonde Cleary and Wood often use estimates different from mine for various work processes, but this is to be expected for a field, i.e., generating cost estimates, that still is in its infancy. I am somewhat worried, however, regarding the control of the written sources by Esmonde Cleary and Wood, who misdate the *Codex Theodosianus*, issued in late 437, "à la fin du IVE siècle" (145), and by Esmonde Cleary, *Rome in the Pyrennees*, 143, who misdates Gregory of Tours' *Ten Books of History* to the "late seventh century," when it was written a century earlier, contemporary with the siege of Saint-Bertrand-de-Comminges. See Bernard S. Bachrach, *The Anatomy of a Little War: A Diplomatic and Military History of the Gundobald Affair: 568–586* (Boulder, CO, 1994). Gregory affirms that he was personally acquainted with several of the participants in the siege and claims to have debriefed some of them. Regarding the contemporaneity of Gregory's work in regard to the events described, see Alexander Callander Murray, "Chronology and the Composition of the Histories of Gregory of Tours," *Journal of Late Antiquity* 1 (2008), 157–196.

⁴ For the topography of Bordeaux, see Barraud, et al., "Bordeaux," 10–80; see also Barraud, Régaldo-Saint Blancard, "La façade orientale," 115–129; and R. Etienne, P. Barrère, *Bordeaux antique* (Bordeaux, 1962), 203–234.

⁵ In spite of the attention drawn by J.F. Wachter, "Some Thoughts on Roman Urban Defences in the West," in John Maloney, Brian Hopley, eds., *Roman Urban Defences in the West* (Oxford, 1983), 142; note also useful observations of Johnson, *Late Roman Fortifications*, 59–65.

understand the economic and demographic nature of the “Crisis of the Third Century” in light of its aftermath.⁶

General Patterns of Construction

In the wake of the “Crisis of the Third Century,” a great many *urbes* throughout Gaul were converted into fortress cities and provided with massive stone and brick walls and other defensive assets for obvious military purposes.⁷ The walls averaged about ten meters in height and from four to five meters in thickness at the base while tapering to more narrow dimensions as they rose. The entire fortification usually was set into a stone foundation of several meters in depth.⁸ Generally, fortress cities were strengthened with proportionally massive mural towers that were placed at twenty-five to fifty-meter

⁶ See Wolf Liebeschuetz, “Was there a Crisis of the Third Century,” in Olivier Hekster, Gerda de Kleijn, Daniëlle Sloom, eds., *Crises and the Roman Empire: Proceedings of the Seventh Workshop of the International Workshop of the International Network, Impact of Empire* (Nijmegen, June 20–24, 2006) (Leiden/Boston, 2007), 11–20.

⁷ See Johnson, *Late Roman Fortifications*, passim; also Bernard S. Bachrach, “Imperial Walled Cities in the West: An Examination of Their Early Medieval *Nachleben*,” in James T. Tracy, ed., *City Walls: The Urban Enceinte in Global Perspective* (Cambridge, 2000), 192–218. The building of fortress cities was undertaken at an immense costs in terms of resources and the dislocation of the lives of many people. This does not mean that the ornamentation of walls was for defensive purposes, but the decoration of utilitarian objects within the Roman Empire, or throughout western civilization in general, is not evidence that the item was created for decorative purposes. I therefore reject the oft-proffered explanation that this initiative was undertaken primarily for propaganda or symbolic purposes; see, e.g., A.S. Esmond Cleary, “Fortificación urbana en la *Brittania romana*: ¿defensa militar o monumento cívico?” in A. Rodríguez Colmenero, Isabel Rodá de Llanza, eds., *Murallas de ciudades romanas en el occidente dell Imperio. Actas del Congreso Internacional celebrado en Lugo (26–29, XI, 2005) en el V aniversario de la declaración, por la UNESCO, de la muralla de Lugo como Patrimonio de la Humanidad* (Lugo, 2007), 155–165, who argues that town walls in fourth century Britain were constructed more because of “civic pride” than for defense. I even take issue on this matter with the otherwise excellent study by Simon T. Loseby, “Decline and Change in the Cities of Late Antique Gaul,” in Jens-Uwe Krause, Christian Witschel, eds., *Die Stadt in der Späntantike—Niedergang oder Wandel? Akten des internationalen Kolloquiums in München am 30. 31. Mai 2003* (Stuttgart, 2006), 67–104, who seems to espouse an equivocal position (p. 77): “Although all wall-circuits were *probably* [my emphasis] built with regard to defence first and decoration second, the priority given to these imperatives will have varied from case to case, and surely depended to a significant degree upon the specific context in which they were erected.” No one should suffer from the illusion that these fortress cities were constructed to satisfy an “imperative” for the execution of a decorative program however much anyone, unlike the Romans being studied, personally finds massive expenditures on the military to be distasteful; *pace* Cassiodorus (*Var.* 1.28.1), whose cynicism regarding this matter, “et ornatus pacis . . . et bellorum necessitas,” is too often read as plain text. There are limits to the misuse of Thorstein Veblen, *The Theory of the Leisure Class: An Economic Study of Institutions* (New York, 1912), especially in light of the putative damage done to the economy during the “Crisis of the Third Century.”

⁸ Johnson, *Late Roman Fortifications*, 82–117. Vitruvius, *De arch.* 1.5.1, advised that the depth of the foundation should be approximately one-fifth to one-sixth of the height of the wall. It

intervals, likely depending on the terrain, in order to create overlapping fields of fire for missile weapons.⁹ Additional and even more elaborate towers were constructed to protect the corners of the fortress and the gates.¹⁰ The entire urban complex often was reinforced further with an internal citadel of which the *praetorium* at Cologne is a well-known example.¹¹ Many *urbes* were provided, in addition, with fosses and some of these were filled with water, at least in part, by the diversion of nearby rivers and streams through the application of sophisticated hydrological engineering techniques.¹²

Merely to sketch, as is done below, a preliminary estimate of some small number of the costs, in both labor and resources, that were required to fortify any one of the many late Roman cities throughout Gaul, will, at best, convey a minimalist impression. This is the case because a great many thousands of relevant details, much less estimates of their costs, simply cannot be provided in a brief compass. In addition, all estimates here are made in the best case so as to avoid the criticism that the expenses have been exaggerated. With this warning in mind, it is hoped that the reader will be impressed positively by the order of magnitude of these very costly Gallic construction efforts, which were successfully undertaken in the wake of the putatively devastating “Crisis of the Third Century”.¹³

Creating Fortress Cities

Our understanding of governmental decision-making in regard to whether a particular *urbs* was to be fortified or to be left unfortified in a specific chronological context provides a brief glimpse of a rather complicated but poorly documented process. The initiation of any building project of this type, which had serious military implications, likely lay with the army’s high command

would seem, however, that Roman engineers and architects of the later third and fourth centuries preferred deeper foundations.

⁹ See Johnson, *Late Roman Fortifications*, 38–40, for towers, and Tracey E. Rihll, *The Catapult: A History* (Yardley, PA, 2007) for artillery.

¹⁰ See Johnson, *Late Roman Fortifications*, 44–50.

¹¹ Carlrichard Brühl, *Palatium und Civitas: Studien zur Profantopographie spätantiker Civitates vom 3. bis zum 13. Jahrhundert*, II, Belgica I, beide Germanien und Raetia II (Cologne/Vienna, 1990), 14, and esp. n.112; cf. Luke Lavan, “The Praetoria of Civil Governors in Late Antiquity,” in Luke Lavan, ed., *Recent Research in Late-Antique Urbanism* (Portsmouth, RI, 2001), 39–56; and Idem, “Residences of Late Antique Governors, a Gazetteer,” *Antiquité Tardive* 7 (1999), 135–165. For internal strongholds at lesser fortifications, see Reddé, et al., *L’Architecture de la Gaule romaine. Les fortifications militaires*, 89–90.

¹² Examples are provided by Grenier, *Manuel d’archéologie*, 5.330, 334, 407, 412–413, 416, 426. For fosses at lesser fortifications, see Reddé, et al., *L’Architecture de la Gaule romaine. Les fortifications militaires*, 88–89.

¹³ Johnson, *Late Roman Fortifications*, 59, for the immense costs of military building.

in Gaul, that is, by ca.350, and probably earlier, in the *officium* of the *magister militum per Gallias* and his advisers.¹⁴ It is possible that the process with regard to any of these great construction projects could have been initiated by a *vicarius*, a provincial governor, or even the *curia* of a particular *civitas* that was stimulated to petition up the chain of command to have its *urbs* fortified.¹⁵ In this context, it may be noted that the advisory council of the provincial governor was composed of local dignitaries drawn from the several *civitates* in his charge.¹⁶

Regardless of where the initiative was generated, the final decision, under Roman law, to convert an open city into a fortress city or for that matter to undertake any significant military construction of a permanent nature was made in the name of the emperor and presumably with his written approval.¹⁷ It is to be considered certain, however, that the *curiales* of an *urbs* that was to be fortified hoped and perhaps even expected that the central government would contribute substantial monetary subventions, the labor of specialists, and/or tax remissions to the costs of building these defenses.¹⁸

In general, scholars seem to be in agreement that various engineering and architectural specialists were provided by the central government. It has been argued persuasively, for example, that the emperor Gallienus (253–268) “sent teams of architects and engineers around to cities to organize their defenses.”¹⁹ Although the need to fortify had to be recognized and approved by the central government, the cooperation of the local government and the citizens of the *urbs* undoubtedly was crucial to the success of any particular project.²⁰ The impact of the plans on the inhabitants undoubtedly was significant as the discussion below makes clear.

After an initial assessment, the relevant imperial experts in military architecture and engineering, trained in various specialties, and in consultation

¹⁴ See A.H.M. Jones, *The Later Roman Empire, 284–602: A Social, Economic and Administrative Survey*, 2 vols. (Norman, OK, 1964), 116, regarding Silvanus.

¹⁵ See Loseby, “Decline and Change,” 76.

¹⁶ See Daniëlle Slootjes, *The Governor and His Subjects in the Later Roman Empire* (Leiden/Boston, 2006), 28–29.

¹⁷ *Digest* 1.8.9.4; 50.10.6. Regarding the primacy of the central government in these matters, see Loseby, “Decline and Change,” 76; Johnson, *Late Roman Fortifications*, 62–63.

¹⁸ Stephen Johnson, “Late Roman Urban Defences in Europe,” in Maloney, Hopley, eds., *Roman Urban Defences in the West*, 69; Johnson, *Late Roman Fortifications*, 63–64; Wachter, “Some Thoughts on Roman Urban Defences in the West,” 141; and Loseby, “Decline and Change,” 76.

¹⁹ Johnson, “Late Roman Urban Defences in Europe,” 69, 72. See also, Wachter, “Some Thoughts on Roman Urban Defences in the West,” 141.

²⁰ If, as is likely at Bordeaux, the army, which had no major bases in the area, did not participate in the construction, the effort would have been organized and carried out by the various guilds in the city and its environs: Ausonius gives no indication that the military played a role.

with the city leaders, likely drew up detailed construction plans.²¹ Men trained as *agrimensores* undoubtedly played an important role, at least initially, in the processes.²² In addition to being well versed in the technical aspects of military construction, at least some of these specialists had to understand not only how the walls and towers of a particular city were to be articulated in order to obtain maximum defensive efficiency but also how to evaluate and secure nonmilitary resources within a unique environment.²³ For example, some and perhaps much of Bordeaux's economic prosperity depended on the fact that it was a major Atlantic seaport. The city maintained commercial connections along the western and southern coasts of Spain and north to the western reaches of the British Isles and Ireland.²⁴ The fortifications thus were planned so as not to impinge negatively on this aspect of the city's economy. Rather, the port, which would be contained within the walls, was very well integrated.²⁵ The plans, which can be reconstructed from the archaeological remains, would have concluded no later than ca.278 that a perimeter defense of approximately 2,300m was to be constructed. And the surviving remains of these construction efforts show that, as the so-called "Crisis of the Third Century" was drawing to a close, the surplus human, animal, and material resources not only were regarded as being available, but, in fact, were available for the building of an elaborate fortification at Bordeaux over about two and a half decades.²⁶

The archaeological record demonstrates that the conversion of Bordeaux from an open *urbs* to a fortress city, was successful, presumably, at least in part, because the detailed plans were able to deal with an especially complicated situation. Subsequently, these defenses would be of exceptional value to the long-term survival, safety, and prosperity of the city and particularly

²¹ See J.G. Landels, *Engineering in the Ancient World* (Berkeley/Los Angeles, 1979). Based on stylistic evidence, Wachter, "Some Thoughts on Roman Urban Defences in the West," 143, argues in favor of crews of designers at work, also suggested by Stephen Johnson, "A Group of Late Roman City Walls in Gallia Belgica," *Britannia* 4 (1973), 210–223.

²² See J.B. Campbell, *The Writings of the Roman Land Surveyors: Introduction, Text, Translation and Commentary* (London, 2000); and Jean-Pierre Adam, *La construction romaine: matériaux et techniques*, 4th ed. (Paris, 2005), 9–22.

²³ See R.M. Butler, "Late Roman Town Walls in Gaul," *Archaeological Journal* 116 (1959), 25.

²⁴ See Etienne, Barrère, *Bordeaux antique*, 291–293; for Bordeaux's trade, see Hagith Sivan, *Ausonius of Bordeaux, Genesis of a Gallic Aristocracy* (London/New York, 1993), 41–44, especially for the archaeological evidence.

²⁵ See Barraud, et al., "Bordeaux," 32–33, 53–54, and fig. 30. Contemporaries, e.g., Ausonius (*Ordo urbium nobilium* 380–390) in the fourth century, and his grandson Paulinus (*Euch.* 44–47) in the fifth century, both recognized the central importance of the port to the city. See Sivan, *Ausonius of Bordeaux*, 42–44.

²⁶ See Etienne and Barrère, *Bordeaux antique*, 204, for dates of construction.

to the success of the port throughout the Middle Ages and beyond.²⁷ This is unlikely to have happened had the situation of the port not been effectively evaluated by the Roman engineers, who would have been well informed by urban informants regarding what was of greatest economic importance to the city's interest.²⁸ It thus is likely that the citizens of Bordeaux provided crucial detailed information to imperial engineers with regard to important technical matters such as the flooding patterns of the nearby rivers. This type of information likely included data on record high water and low water marks and perhaps flood averages as well as the seasonal behavior of the Atlantic tides in the estuary of the Gironde.²⁹ The famous academic and imperial adviser Ausonius, who was a teenaged youth when these walls were being completed, makes clear that his native city benefited greatly from its conversion into a fortress with its protected port facilities.³⁰

The Archaeological Evidence

The Roman walls of Bordeaux followed a quadrilateral plan and extended approximately 700m on the north and south sides and 450m on the east and west sides. This great stone defensive perimeter, when completed, ultimately would enclose more than thirty-one hectares, rising nine to ten meters above ground level on a stone foundation, which, on average, was more than six meters in depth. The thickness of the walls at their base averaged about five meters and tapered at the top to an average of about two and a half meters.³¹ In addition, the perimeter wall was strengthened by semicircular external

²⁷ See, e.g., Charles Higounet, *Bordeaux pendant le haut moyen âge* (Bordeaux, 1963).

²⁸ For the ongoing debate as to whether military architects drew up plans and, if so, what was the extent of their detail, see Andrew Pearson, *The Construction of the Saxon Shore Forts* (Oxford, 2003), 73–74. For the planning involved in projects such as the baths of Caracalla, see Janet DeLaine, *The Baths of Caracalla: A Study in the Design, Construction, and Economics of Large-Scale Building Projects in Imperial Rome* (Portsmouth, RI, 1997), 45–66.

²⁹ It is important to emphasize that construction of walls at Bordeaux began during a climate-cooling trend that likely had negative effects on the length of the building season, i.e., an increase in general humidity, rainfall, and higher river floods; see J. Bennema, "Holocene Movements of Land and Sea Level in the Coastal Area of the Netherlands," *Geologie et Mijnbouw*, n.s., 16 (1954), 254–256; also Aline Durand, Philippe Leveau, "Farming in Mediterranean France and Rural Settlement in the Late Roman and Early Medieval Periods: The Contribution from Archaeology and Environmental Sciences in the Last Twenty Years," in Miquel Barcelo, François Sigaut, eds., *The Making of Feudal Agricultures?* (Leiden/Boston, 2004), 179.

³⁰ Ausonius, *Ordo urbium nobilium* 13–14, 17–18: "Quadrua murorum species, sic turribus altis / ardua, ut aérias intrent fastigia nubes . . . tum respondentēs directa in compita portas / per mediumque urbis fontani fluminis alveum"; text at L. Di Salvo, ed., tr., *Ausonius. Ordo urbium nobilium. Intruduzione, testo critico, traduzione e note di commento* (Naples, 2000); see also Sivan, *Ausonius of Bordeaux*, 31–48.

³¹ Barraud, et al., "Bordeaux," 35–49, for the perimeter wall; 49, for the surface area; and 62–66, for the foundations. See also Etienne, Barère, *Bordeaux antique*, 205.

mural towers at approximately fifty-meter intervals. Each of these towers is thought by modern scholars to have resembled half of a circular medieval *château fort*. The half-round towers extended beyond the outer surface of the wall from four to five meters, depending on the terrain, and are believed to have overtopped the wall itself, perhaps by more than a meter.³²

The four corners of the rectangle that formed the city walls were from a tactical perspective more vulnerable to attack than any flat part of the wall that had been strengthened by mural towers. Thus, in order to strengthen these otherwise vulnerable parts, the government oversaw the construction of four very large and strong fully circular drum towers, approximately ten meters in diameter and also likely rising above the top of the walls on either side.³³ Finally, the gates, which were the most vulnerable parts of any mural defense, were provided with an extensive system of towers that provided positions for the deployment of overlapping missile fire in conjunction with both the mural towers and drum towers at the corners.³⁴

A moat, which enclosed the entire perimeter of about 2,300 meters, further strengthened the defenses of this stone complex of massive walls and towers. The least difficult segment of the moat to trace is that which protected the eastern wall and took advantage of the flow of the Garonne river. Unfortunately, the techniques required to excavate this area have yet to be effectively developed, and it is not at all clear what kinds of work were done to “shape” this part of the moat with some sort of canalization and perhaps dikes, as well. This construction undoubtedly was needed to regulate the flow of the river at various points as was the case with regard to several other rivers, discussed below, that formed part of the moat or fed the internal port facilities.³⁵

The Peugue river provided the southern course of the moat and flowed from the west into the Garonne. The Peugue, however, had to be diverted to run outside the planned southern wall of the city, and this resulted in the excavation of a new “river bed” or ditch of at least 1,200m in length. Massive dikes were needed to maintain the altered course of the river and the remains of this construction have been discovered by archaeologists. The north wall of the city also was protected by a moat, which has left its name in the toponymy

³² Barraud, et al., “Bordeaux,” 56–60, note fig. 35, for a very good example of a mural tower; 60–61, regarding the number of towers; and Etienne, Barère, *Bordeaux antique*, 206.

³³ Barraud, et al., “Bordeaux,” 56–60, see fig. 31, for a good example of a corner tower; and the discussion by Etienne, Barère, *Bordeaux antique*, 206.

³⁴ Barraud, et al., “Bordeaux,” 50–53, and fig. 33, with regard to the fortification of the gates. See also Etienne, Barère, *Bordeaux antique*, 208.

³⁵ Sivan, *Ausonius of Bordeaux*, 42, takes note of the difficulties encountered by archaeologists when they excavated in areas where the environment was exceptionally wet and of the work on the other rivers.

as “fossé de Campauria” and probably also as “fossé de Tropeta.” This ditch was cut for a distance of at least 1,000m before reaching the Garonne, where the “Port de Tropeta” was later established. The course of the west leg of the moat, connecting the fossé de Campauria on the north and the Peugue to the south, has yet to be identified. It could not, however, have been less than approximately 700m in length, and very likely was somewhat longer. The highly complicated engineering involved in this segment of the moat involved both damming and channeling the Peugue, the Devèze, and the Caudéran.³⁶

From the figures noted above, it seems clear that the Roman engineers found it necessary to have somewhere in the neighborhood of 3,000m of ditches cut, while at the same time temporarily controlling the flow of at least three rivers. These estimates do not include either the earthen and wooden dikes built for control of the Peugue or the walls for canalization of the Devèze, which maintained the internal port, and were based on a mortared stone foundation.³⁷ The problems of controlling running water, in this context, were not greatly dissimilar to those that faced Charlemagne’s engineers toward the end of the eighth century, when the Carolingians undertook an extensive effort to connect the Rhine and the Danube with a canal, and much likely can be learned by comparison with this effort.³⁸

The fosse at Bordeaux was established about thirty meters beyond the fortress walls and towers on the north and south sides of the city and probably at about the same distance on the west. In order to meet the specifications for a moat required by a permanent fortification, the ditches likely had to be at least thirty meters in width and ten in depth. This latter surmise, which either should be corroborated or undermined by future excavations, is given some support by Vegetius’ famous handbook, which initially was published ca.400 and embodied a vast quantity of information regarding military building drawn from centuries of Roman experience. Vegetius averred that the fosse should be as “wide and deep as possible.”³⁹

³⁶ In general, Barraud, et al. “Bordeaux,” 70, also 33, regarding the cutting of the ditch for the diversion of the Peugue.

³⁷ Sivan, *Ausonius of Bordeaux*, 40–42.

³⁸ See the detailed discussion by Hans Hubert Hofmann, “*Fossa Carolina*, Versuch einer Zusammenschau,” in W. Braunsfels, Helmut Beumann, eds., *Karl der Grosse: Lebenswerk und Nachleben*, 5 vols., (Düsseldorf, 1965), I, 437–453. For Roman techniques used for dams, see the works cited by Adam, *La construction romaine*, 314n10.

³⁹ Vegetius, *De re militari* 4.5. During the Early Middle Ages, the capacity to construct ditches of this type was available; e.g., Charlemagne’s engineers and work crews excavated a “ditch” thirty meters in width, 1,400m in length, and more than six meters deep, through which water ran. See Hofmann, “*Fossa Carolina*,” 446. The Ottonians also were able to excavate fosses of this order of magnitude. See, e.g., Paul Grimm, “Zum Befestigung der Burg Gernrode,” *Ausgrabungen und Funde* 10 (1965), 273.

In addition to the traditional view reiterated by Vegetius, it is to be emphasized that Bordeaux was located in a wet environment. A substantial flow of water entered the Garonne, which was greatest during the winter-spring rainy season. This situation permits the inference that the fosse, which was fed by various tributaries of the Garonne, had to be both deep and wide in order to avoid flooding during periods of heavy flow. In this context, it also should be noted that even after the walls of the *urbs* were constructed, the Devèze and the Caudéran rivers continued to run into the city itself, and together they provided a sufficient flow of water to keep the inner harbor at sufficient levels to accept oceangoing ships.⁴⁰ It was necessary to control the flow of these rivers within the *urbs* with a type of canalization that saw the construction of dikes to protect the inner city.⁴¹ Finally, it may be reiterated that the foundations of the walls, as noted above, were approximately two or more meters deeper than those at most of the other fortress cities built during this period. This very likely was due to the wet environment.

Construction Costs

The primary means of estimating construction costs is rather simple, although arriving at plausible results is considerably more difficult. *Au fond*, one selects a structure concerning which a considerable quantity of information is known because of effective archaeological and architectural studies.⁴² Sometimes there is even a considerable quantity of textual information as, for example, in Gregory of Tours' description of the *castrum* of Dijon, the accuracy of which has been confirmed by archaeological work.⁴³ From these data a "blueprint" can be developed comparable to a document drawn up by a modern architect. Then, like a modern construction engineer with blueprints and reference works at hand, the historical researcher estimates the costs of construction, taking into consideration all the details in order to make an accurate estimate of what it would cost to build the edifice. Accuracy in arriving at modern cost estimates is crucial so that a profit can be made. For the historian, accuracy is essential so that the cost to the society can be assessed.⁴⁴

Of course, estimating late antique or medieval costs must be done in consonance with the technology that was in use at the time, when possible,

⁴⁰ See, Barraud, et al., "Bordeaux," 36, fig.14.

⁴¹ Sivan, *Ausonius of Bordeaux*, 40.

⁴² See Bernard S. Bachrach, "The Cost of Castle-Building: The Case of the Tower at Langeais, 992–994," in K. Reyerson, F. Powe, eds., *The Medieval Castle: Romance and Reality* (Dubuque, IA, 1984), 46–62 (four plates) = Idem, *Warfare and Military Organization in Pre-Crusade Europe* (London, 2002). See also DeLaine, *The Baths of Caracalla*.

⁴³ Johnson, *Late Roman Fortifications*, 74, 84–86, 113, 249.

⁴⁴ Bachrach, "The Cost of Castle-Building," 52–53.

or at least prior to the invention of various mechanical techniques developed in more modern times.⁴⁵ Nevertheless, it is also important to recognize that there are at least some important constants. For example, the weight of a cubic meter of granite or oak has not changed over the centuries, although there are, of course, different grades of stone and different types of oak, whose relative dessication also is important.⁴⁶ In addition, human beings, depending on size, weight, and age, who are engaged in heavy construction work require, in addition to comparable quantities of water, approximately the same quantities of carbohydrates and proteins to maintain energy levels and remain reasonably healthy.⁴⁷

Draft animals, for example, horses, mules, and oxen, when hauling heavy loads required quantities of food and water in the late antique world just as they do in modern times, adjusting for size, climate, and the nature of the work being undertaken.⁴⁸ Perhaps more surprising is the fact that some purely physical activities, such as mixing mortar or laying brick or stone have not changed over time, although the modern worker can perhaps be more rapidly supplied with building materials on the scaffold than his late antique counterpart.⁴⁹

In total, the massive stone fortifications at Bordeaux likely required millions of man-hours of labor from scores of craft specialists and thousands of unskilled laborers and draft animals over the course of about a quarter-century.⁵⁰ It would require a monograph to describe in detail the interrelated admin-

⁴⁵ Note especially, "Fossa Carolina," 437–453, which serves as the basis for some of the estimates made here and, in part, inspired my "The Cost of Castle-Building," 46–62. For subsequent research in estimating costs, see, e.g., D.J. Breeze, B. Dobson, *Hadrian's Wall* (London, 1987); Pearson, *The Construction of the Saxon Short Forts*, 84–111; Roger Kendal, "Transport Logistics Associated with the Building of Hadrian's Wall," *Britannia* 27 (1996) 129–152; DeLaine, *The Baths of Caracalla*, 85–224; and Esmonde Cleary, Wood, *Saint-Bertrand-de-Comminges III*, 143–146, 215–216.

⁴⁶ See, e.g., Adam, *La construction romaine*, 24, for stone, and 91–92, for wood.

⁴⁷ See Colin Clark, Margaret Haswell, *The Economics of Subsistence Agriculture*, 4th ed. (London, 1970).

⁴⁸ Jonathan Roth, *The Logistics of the Roman Army at War (264B.C.–A.D. 235)* (Leiden/Boston, 1999), 66–67, for oxen, and 62–65, for horses; and Donald W. Engels, *Alexander the Great and the Logistics of the Macedonian Army* (Berkeley/Los Angeles, 1978), 12–16, for oxen, and 126–129, regarding horses.

⁴⁹ Bachrach, "The Cost of Castle-Building," 31–32.

⁵⁰ See Bachrach, "The Cost of Castle Building," 46–62, where advantage is taken of the extensive documentation available from medieval English building accounts. Cf. Esmonde Cleary, Wood, *Saint-Bertrand-de-Comminges III*, 145–146, whose figures for the quantity of man hours required for the construction of the walls of Saint-Bertrand seem to me to be much too small. Even more surprising is the acceptance as plain text by Johnson, *Late Roman Fortifications*, 62, of inscriptions that permit the inference that 8,000-meter stone walls were

istrative, logistical, and technical challenges that were met. The work also would have involved destroying a great many stone houses, temples, and other buildings, not to mention wooden structures, in an area of several thousand square meters in order to make room for the construction of the walls, for the moat, and to create a killing zone where tactically appropriate.⁵¹ In addition, new housing would have had to be found for those people dispossessed,⁵² probably not an easy task given Ausonius' observation a century later that Bordeaux was a very crowded city and very built-up, as evidenced by the construction of churches.⁵³

The following discussion will provide a brief introduction to a very limited number of the "costs" of the construction. These estimates are primarily heuristic in nature, with a threefold purpose. First, to stimulate discussion of a methodological nature regarding the making of estimates for monumental building projects in the premodern era. Second, to stimulate further research into estimating such costs. And finally, to integrate the costs of monumental construction into a discussion of the economic and demographic impact of "Crisis of the Third Century."

Digging Ditches and Foundations

From the few figures provided above, it is obvious that more than 70,000 cubic meters of earth, stones, and vegetation were removed in order to excavate

constructed at Verona and also at Constantinople in seventy days. Those who believe that the Romans could construct massive fortifications, of the type discussed here, in very short periods of time might well benefit from consulting with a contemporary construction engineer in regard to how long such efforts would take using modern equipment with a comparable number of skilled workers.

⁵¹ See the observations by Barraud, et al., "Bordeaux," 73, and cf. Loseby, "Decline and Change," 72–73, who takes note of the fact that much of the built-up area beyond the new walls of Bordeaux was not denuded of previous buildings. This, despite the fact that he estimates (75) that 64,000 cubic meters of *spolia* were put into the foundation alone. Sivan, *Ausonius of Bordeaux*, 40–44, provides a useful synthesis of land use outside the walls of Bordeaux within what had been the area of the open city. It is in the nature of the evidence that the identification of erstwhile wooden buildings in such a context varies from difficult to impossible. A. Simon Esmond Cleary, *Rome in the Pyrenees* (London/New York, 2008), 129–130, provides an interesting discussion of the destruction of the town center of Convenae prior to the construction of the fortress city.

⁵² See Sivan, *Ausonius of Bordeaux*, 40–43. Simon T. Loseby, "Arles in Late Antiquity: *Gallula Roma Arelas* and *Urbs Genesii*," in Christie, Loseby, eds., *Towns in Transition*, 45–70, discusses the impact of large numbers of new people moving into the walled center of Arles in the early fifth century.

⁵³ Sivan, *Ausonius of Bordeaux*, 38–40; Wandel Migeon, "Le groupe épiscopal de Bordeaux (Gironde)," *Gallia* 63 (2006), 117–119.

the ditch required for the foundation of the city wall. This figure, however, excludes the excavations required for the foundations of the semicircular mural towers, the drum towers at the four corners of the walls, and the elaborate gate defenses. All of these excavations were necessary so the foundation ditch could be filled with very large mortared stones in order to support the immense weight of the mammoth aboveground defensive walls.⁵⁴

The magnitude of the foundations was conditioned, at least in part, by the fact that the city was located on the banks of the Garonne, with two rivers, the Devèze and the Caudéran, running into the city itself, and one, the Peugue, being diverted in order to form the moat on the west side. As a result, a foundation that was deeper than usual in a drier area was a necessity. Based not only on the success of the Bordeaux defenses but also on riverfront construction in late Roman fortress cities such as Cologne,⁵⁵ it is clear Roman engineers thoroughly understood the many complex hydrological problems.⁵⁶

Under normal conditions, a cubic meter of excavated earth, rocks, and vegetation weighs approximately one metric ton.⁵⁷ It has been estimated that an experienced construction worker, using the tools of the period and with appropriate earth-removal support, could excavate approximately three metric tons during a ten-hour workday.⁵⁸ Thus, under optimal conditions, digging the ditch for the foundation of just the walls would have required approximately 240,000 man-hours of work for diggers or, more simply put, one hundred men could do the necessary excavation in 240 workdays. But optimal conditions rarely obtain over the course of complex construction projects. For example, the removal or burning of large numbers of tree stumps and roots could cause considerable delays.⁵⁹ In addition, large rocks that could not be integrated into the foundation would require more than one man to move or have to be broken up into smaller pieces. Furthermore, below about a meter into the earth some sort of machinery would be required to lift the earth so that it could be hauled away in carts pulled by draft animals and manned by a large complement of haulers.⁶⁰

⁵⁴ For construction techniques at Bordeaux with regard to the foundation, see Barraud, et al., "Bordeaux," 62–68.

⁵⁵ Hansgerd Hellenkemper, "The Roman Defences of Cologne—Colonia Claudia Ara Agrippensium," in Maloney, et al., *Roman Urban Defences in the West*, 21–23.

⁵⁶ See Adam, *La construction romaine*, 257–300.

⁵⁷ Averages based upon modern figures; see Bachrach, "The Cost of Castle-Building," 51–52.

⁵⁸ See Hofmann, "Fossa Carolina," 345, for a slower rate; Esmonde Cleary, Wood, *Saint-Bertrand-de-Comminges III*, 143–146, 215–216, for faster rates.

⁵⁹ See Victor Davis Hanson, *Warfare and Agriculture in Classical Greece*, rev. ed. (Berkeley, 1998), 32, 221–222.

⁶⁰ Adam, *La construction romaine*, 44–52, with, however, a focus on lifting stone.

Transport Technology

The vehicle used for these estimates is the two-wheeled *carrus* or *birota*, drawn by a pair of horses, mules, or oxen.⁶¹ According to the Theodosian Code and other sources, the standard load for a two-wheeled cart with two oxen is estimated to be about 500kg. and for a four-wheeled wagon hauled by two oxen the estimate is about 750kg.⁶² These weight limitations were due in some part to the failure of the Romans to develop a stiff collar that rested on the shoulders of the horse or the mule pulling the vehicle. Rather, the Romans relied on a “choke” technology, and modern experimentation has shown that the heavier the load and/or the harder the animal pulled against the collar, the more limited the oxygen intake became until the lactic acid built up to sufficient levels in the animal’s blood that its ability to function was undermined.⁶³ Only in the Early Middle Ages was the “modern” rigid and padded horse collar invented and diffused throughout Gaul.⁶⁴

⁶¹ Adam, *La construction romaine*, 32, fig. 37, and 79, fig. 164, depicts carts drawn by two oxen or horses. DeLaine, *The Baths of Caracalla*, 98–99, maintains that most land transport of material utilized carts drawn by a pair of donkeys, mules, or oxen. See especially Richard Lefebvre des Noëttes, *L’attelage et le cheval de selle à travers les âges*, 2 vols. (Paris, 1931), which has a strong experimental underpinning; Lynn T. White, Jr., *Medieval Technology and Social Change* (Oxford, 1962), 59–61; Albert Leighton, *Transport and Communication in Early Medieval Europe* (Devon, 1972), 77, 161; Bernard S. Bachrach, “Animals and Warfare in Early Medieval Europe,” *Settimane di Studio del Centro Italiano di Studi sull’alto Medioevo* 31, 2 vols. (Spoleto, 1985): 1, 707–764 = Idem, *Armies and Politics in the Early Medieval West* (London, 1993), 716–717; John Langdon, *Horses, Oxen and Technological Innovation: The Use of Draught Animals in English Farming from 1066–1500* (Cambridge, 1986), 8–10; and Paul Gans, “The Medieval Horse Harness: Revolution or Evolution? A Case Study of Technological Change,” in Marie-Thérèse Zenner, ed., *Villard’s Legacy: Studies in Medieval Technology, Science and Art in Memory of Jean Gimpel*, (Aldershot, 2004), 175–187.

⁶² The relevant edicts, CTh 7.5.17; 8.5.30; 8.5.47, were issued during the later fourth century; see Leighton, *Transport and Communication*, 77, 161.

⁶³ See Lefebvre des Noëttes, *L’attelage*, I, 159, summarized with approval by White, *Medieval Technology*, 59–60. Jean Gimpel, *The Medieval Machine: The Industrial Revolution of the Middle Ages* (New York, 1976), 32–33, notes experiments resulting in the “strangulation” of the animal.

⁶⁴ White, *Medieval Technology*, 61–62; Leighton, *Transport and Communication*, 77, 161; Bachrach, “Animals and Warfare,” I, 716–71. Controversy remains over the date of these developments; see, e.g., Georges Raepsaet, “The Development of Farming Implements between the Seine and the Rhine from the Second to the Twelfth Centuries,” in Grenville Astill, John Langdon, eds., *Medieval Farming and Technology: The Impact of Agricultural Change in Northwest Europe* (Leiden, 1997), 57 n.68, citing a tenth-century artifact as the earliest physical evidence. But Langdon, *Horses, Oxen and Technological Innovation*, 19, suggests experimentation can be traced to the sixth century. An important distinction also must be made between invention and diffusion; see, e.g., Gans, “The Medieval Horse Harness,” 181–182. For efforts to question the results of Lefebvre des Noëttes and subsequent refinements, see, e.g., Georges Raepsaet, “La faiblesse de l’attelage antique: la fin d’un mythe?,” *Antiquité classique*, 48 (1979), 171–176; Idem, “Attelage

It is possible that four-wheeled vehicles, which legally could transport much larger loads, 1,000 Roman pounds for the *raeda* and 1,500 for the *angaria*, also were used on occasion for the construction project at Bordeaux.⁶⁵ Such vehicles, which were drawn by two or more draft animals, are rarely depicted on Roman monuments, especially those illustrating building operations at large construction sites, because they were considerably less maneuverable than two-wheeled carts.⁶⁶ Four-wheeled vehicles did not have a whippletree that swiveled in consonance with a pivoting front axle,⁶⁷ and as a consequence, the Romans were unable to harness several horses or mules or two-animal teams in tandem.⁶⁸

Whereas the inability of the Romans to harness horses and mules efficiently for draft purposes should not be controversial, the use of ox-drawn vehicles is problematic. On the one hand, the technology used for harnessing oxen was far more efficient than that used for horses and mules.⁶⁹ But on the other, oxen in the later Roman and early medieval west were much smaller than modern oxen. For example, an upper weight limit in the neighborhood of 250kg was the norm, as compared to an upper weight limit of 650kg for oxen during the nineteenth century.⁷⁰ The low weight of late antique oxen, which would have had a serious negative impact on their capacity to pull heavy loads, also may have been a factor in the aforementioned limits in the Theodosian Code.

It also should be noted that during this period, horses and mules likely were proportionally larger in comparison to more modern oxen.⁷¹ In addition,

antiques dans le nord de la Gaule: les systèmes de traction par équides," *Trierer Zeitschrift* 42 (1982), 215–273; Idem, "The Development of Farming Implements"; and Jean Spruyette, *Early Harness Systems: Experimental Studies: Contribution to the Study of the History of the Horse* (London, 1983).

⁶⁵ See n.63 above; also Leighton, *Transport and Communication*, 77, 161.

⁶⁶ See illustrations in Lefebvre des Noëttes, *L'attelage*, II.

⁶⁷ See, e.g., Majorie Nice Boyer, "Medieval Pivoted Axles," *Technology and Culture* 1 (1960), 128–138; and Langdon, *Horses, Oxen and Technological Innovation*, 12; Leighton, *Transport and Communication*, 118–121; also Gans, "The Medieval Horse Harness," 184–185; cf. C.W. Röring, *Untersuchungen zu römischen Reisewagen* (Koblenz, 1983).

⁶⁸ See Gans, "The Medieval Horse Harness," 184–185.

⁶⁹ The observations by A. Burford, "Heavy Transport in Classical Antiquity," *The Economic History Review*, 2nd ser., 13 (1960), 1–18, are supported by White, *Medieval Technology*, 156, and Gans, "The Medieval Horse Harness," 178.

⁷⁰ George Comet, "Technology and Agricultural Expansion in the Middle Ages: The Example of France North of the Loire," in Astill, Langdon, eds., *Medieval Farming and Technology*, 20, and n.58.

⁷¹ See Gans, "The Medieval Horse Harness," 183.

some scholars believe that several ox teams could be harnessed in tandem,⁷² although this is controversial.⁷³ But even if this were the case, the drawing capacity of several such teams could not have been appreciably increased; Delaine claims this to be the case because each pair of oxen would require a handler because of the lack of an appropriate whippetree.⁷⁴

Hauling Costs

Teams of workers had to load the excavated earth and rock onto their vehicles, cart it to a dumpsite, and off-load it before it was piled up to a height that impeded the progress of the diggers.⁷⁵ Each man excavating three cubic meters of material during a ten-hour workday would have required, in addition to those operating machines to lift the earth to the surface, the services of one cart or more likely two carts capable of carrying a load of approximately a half-ton of debris five to six times each day along with the workers and animals needed to operate the vehicles.⁷⁶

Ox-drawn carts or wagons could not move as fast as horse- or mule-drawn vehicles for oxen worked at about half the pace of the other draft animals. Thus, if oxen were used as the primary draft animal, perhaps as many as twice the number of carters, carts, and animals would have been needed as compared to vehicles using horses or mules. In addition, mules and horses were stall-fed and required about half of their food ration in grain, such as

⁷² See, e.g., Burford, "Heavy Transport," 1–18; and Richard Kendal, "Transport Logistics Associated with the Building of Hadrian's Wall," *Britannia* 26 (1996), 142–143; Esmonde Cleary, Wood, *Saint-Bertrand-de-Comminges III*, 145, and Pearson, *The Construction of the Saxon Shore Forts*, 94.

⁷³ See, Langdon, *Horses, Oxen and Technological Innovation*, 7–8.

⁷⁴ DeLaine, *The Baths of Caracalla*, 98–99; also 108 on the need for many extra handlers at a very high cost.

⁷⁵ Esmonde Cleary, Wood, *Saint-Bertrand-de-Comminges III*, 145, following Kendal, "Transport Logistics," 144, believe that it requires only nine minutes to load or unload 100kg of material being hauled in a wagon and, thus, eighty-five percent of a ton could be loaded or off-loaded in the course of one hour and fifteen minutes. There is a problem here with the arithmetic as 850kg divided by nine comes to almost ninety-five minutes or more than an hour and a half. Neither Kendal nor Esmonde Cleary and Wood provide Roman or medieval sources for these estimates. They also do not provide reference to a modern experimental source for the time they believe it takes to load or unload a cubic meter of material from a wagon. Finally, they do not include estimates for the rest periods required by the workers.

⁷⁶ Esmonde Cleary, Wood, *Saint-Bertrand-de-Comminges III*, 145, following Kendal, "Transport Logistics," 143, assert that these vehicles, operating on difficult terrain, could manage to travel 3.20km per hour. However, at this rate of speed over the distance noted above, an ox-drawn vehicle could make only two and a half round trips between a work site and a dumpsite in the course of a working day. DeLaine, *The Baths of Caracalla*, 108, argues for a much slower rate. Regarding the total distances for an ox to be able to travel per day, see White, *Medieval Technology*, 62.

oats or spelt, that also was consumable by humans. As a result, there is a trade-off between speed and food supply in regard to the cost of using oxen and horses because oxen could be fed solely on hay and grass, and the expense for using oxen was about half that for the other draft animals. Thus, if costs were a factor to those orchestrating the project, oxen likely were preferred, but if speed in accomplishing the task were a factor, then horses or mules likely were favored.⁷⁷

The actual number of carts, draft animals, and carters required to support the digging of the foundation ditch depended, as noted above, on several factors in addition to whether or not oxen were used, including the time it took to load each cart with debris, to move the loaded cart to the dump zone, to unload the cart, and finally to return the cart to the building site.⁷⁸ In addition, draft animals for each cart required feeding and/or grazing, watering, and rest.⁷⁹ Moreover, the carters, like the diggers and the machine operators, also had to be fed and needed rest breaks.⁸⁰

Each vehicle required at least two carters. One man could not keep pace with the digger in helping to load the cart with debris while, at the same time, tending to the draft animals and keeping the cart stabilized. While the carts were being loaded, the draft animals would be led outside the construction site, released from their harnesses, and permitted to graze and water. Some attention thus had to be given them and they then had to be returned to the work site and reharnessed.

In addition to all of these, and certainly other details, other anticipated but unpredictable factors could slow down the work. Accidents would have occurred in the normal course of work. For example, on modern work sites, construction workers generally wear steel-tipped work boots and hard hats. Without such protection, it is likely that Roman workers suffered greater numbers of accidents and more serious accidents, especially to their feet, than do modern workers. Furthermore, draft animals are prone to suffer accidents and vehicles periodically break down and require repairs.⁸¹ In addition, illnesses occur among both men and animals. And

⁷⁷ White, *Medieval Technology*, 42, 57, 59, 61, 72–73.

⁷⁸ The estimates of Kendal, and Esmonde Cleary and Wood, discussed above, seem too optimistic, e.g., one man cannot either on-load or off-load a 100kg block of stone or even maneuver it into place to be unloaded by some sort of a “machine.” For machines needed for lifting heavy loads, see Adam, *La construction romaine*, 46–50.

⁷⁹ See Roth, *The Logistics of the Roman Army*, 62–67.

⁸⁰ See Clark, Haswell, *The Economics of Subsistence Agriculture*.

⁸¹ Esmonde Cleary and Wood, noted above, assert that on construction sites it was the norm to exceed the legal vehicle load limits by 75 percent. If this were so, the breakdown of animals and equipment certainly would have been particularly likely.

excessively rainy weather likewise could impede construction. All these conditions have a cumulative impact on the work process and its costs, for during such periods when building work was slowed or stopped, the workers and the animals still had to be fed and lodged. Thus, it is likely that even in the best case, one hundred diggers required considerably more than one hundred men to operate the earth lifting machines, one hundred carts, two hundred carters, and two hundred draft animals to carry out their duties.

Not only did the digging and hauling of the earth have to work very smoothly in an articulated manner, but the thousands of tons of excavated earth and stone had to be effectively disposed of. It could not simply be shoveled onto a pile of ever-growing height, for as the pile of debris rose above cart level, the off-loading would become increasingly more difficult and time consuming. For the greatest efficiency, which also would keep costs down, and to avoid the use of “machines” to off-load the carts, which was time-consuming and costly, it would have been necessary to spread the approximately 70,000 cubic meters of debris over an area approximately two meters in height covering an area of about 200 square meters.

Digging the Fosse

The efforts required to excavate the foundation ditch for the perimeter wall pale in comparison with the work required to dig the moat. In excess of 750,000 metric tons of debris were excavated, as noted above, to realize the 2,500m x 30m x 10m ditch for the part of the moat that had to be created *de novo* as a complement to the segment of the fosse based on the Garonne river. At an excavation rate of three cubic meters per day for each digger, one hundred men digging the moat and supported by one hundred machine operators, one hundred vehicles, two hundred carters and two hundred draft animals would take 2,500 workdays to accomplish the task, that is, in excess of eight years at 300 workdays per year. Some 1,500,000 cartloads were excavated in order to create only three segments of the moat. The 750,000 metric tons of earth and rock would have required a total dumpsite area in excess of 600 square meters by two meters in height.

The further the dumpsites were from the excavations, the more time would have been needed for the haulers to travel back and forth. This would have meant that more carts, more draft animals, and more haulers would have been needed to service the excavation site with a concomitant increase in food, lodging, and care for men and animals. For example, if two carts were needed, there would have to have been a proportional increase in the number of carts, animals, and personnel, perhaps as many as two hundred carts, four

hundred carters, and four hundred draft animals would have been needed to do the job.

As of yet, however, the actual dumpsites have not been located. It is probable that at least some of the debris from the moat was used to construct a rampart on the city side of the ditch. This would have created a fore wall that directly overlooked the fosse and from which defenders would enjoy an enhanced position and could launch missiles at a relatively close range. And the sheer height of such a redoubt, including a palisade, which easily would have exceeded ten Roman feet, would greatly increase the difficulties faced by the attacking force in ascending from the fosse in order to launch an assault across the killing zone in front of the city walls.

Earthen walls of this type were constructed within a wooden framework and topped by a palisade, and likely would have followed the schema discussed by Vegetius in regard to the fortification of military camps of more or less permanence with the exception of the foundation.⁸² Earth and wood military architecture, with deep, three- to four-meter foundations built on wooden pilings, is very well understood because it was widely adopted during the Early Middle Ages and its construction methods are well documented.⁸³ Obviously, the construction of secondary walls of this type at Bordeaux would have been far more costly in terms of the expenditure of human and animal resources than simply carting off the debris to a dumpsite several kilometers distant from the *urbs*.

Of all the efforts undertaken to convert Bordeaux into a fortress city, digging the moat likely was among the least costly in terms of materials, although the construction of an earthen fore wall required considerable labor and a great deal of wood.⁸⁴ Nevertheless, the earthen walls of the moat that were constantly being “washed” by moving water had to be reinforced either by stone or wooden revetments, that is, pilings, or some combination of both. Wooden revetments probably would have been strengthened and protected by mortar in order to inhibit erosion and the rotting of the wood as was the case, mentioned above, with regard to the canalization built within

⁸² *De re militari* 1.24: “Supra autem saepibus hinc inde factis, quae de fossa levata fuerit, terra congeritur et crescit in altum IIII pedes. sic fit, ut sit XIII alta et XII lata; supra quam sudes de lignis fortissimis, quas milites portare consueverunt, praefiguntur. ad quod opus ligones rastra qualos aliaque utensilium genera habere convenit semper in promptu.”

⁸³ See, e.g., Günther Binding, “Spätkarolingisch-ottonische Pfalzen und Burgen am Niederrhein,” *Chateau Gaillard* 5 (1972), 23–35.

⁸⁴ For the materials, see Werner Coblentz, “Die Sumpfschanze von Brohna bei Bautzen,” in *Archäologische Feldforschungen in Sachsen: Fünfzig Jahre Landesmuseum für Vorgeschichte Dresden* (Berlin, 1988), 360–365.

the walls to control the water flow into the internal port. Future excavations at Bordeaux are likely to provide information similar to that obtained in regard to Charlemagne's famous effort to build a Rhine-Main-Danube canal five hundred years later.⁸⁵ This would help to estimate in greater detail the cost of the moat walls.

Making Mortar

Whether or not mortar was used at Bordeaux to strengthen the walls of the moat, it was ubiquitous in most construction tasks. Some estimates can be made regarding a few aspects of the cost of making the mortar used to fix in place the stones used in the construction of one of the four drum towers.⁸⁶ Excluding the foundation, each corner tower was approximately ten meters in height, that is, about the same height as the walls or slightly higher, with a diameter of ten meters, and an average wall thickness of about five meters at the base tapering to about two and a half meters at the top, and required approximately 600 cubic meters of mortar.⁸⁷

The initial expenditure, a capital investment, would have been for the construction of a kiln in which to cook the lime.⁸⁸ Roman kilns varied greatly in size and thus also varied in terms of their cost to construct and their potential output.⁸⁹ Manufacture of mortar, however, was largely a constant; according to Vitruvius, a mix of one-quarter lime and three-quarters pit sand by volume, or one-third lime and two-thirds river or sea sand, was used.⁹⁰ This meant that one drum tower would have required 150 cubic meters of lime weighing about 100 metric tons and 450 cubic meters of sand weighing about 400 metric tons.⁹¹

⁸⁵ Pilings: Hofmann, "Fossa Carolina," 447.

⁸⁶ See Adam, *La construction romaine*, 69–79; Bachrach, "The Cost of Castle-Building," 48; DeLaine, *The Baths of Caracalla*, 88–89; and Pearson, *The Construction of the Saxon Shore Forts*, 87.

⁸⁷ The quantity of mortar estimated here for a single drum tower is twice that used in the *castrum* of Langeais, half the size of the Bordeaux fortification; see Bachrach, "The Cost of Castle-Building," 48.

⁸⁸ See Adam, *La construction romaine*, 69–76.

⁸⁹ Adam, *La construction romaine*, 69–76. The size of the kiln impacts not only its maximum output but also the work effort necessary to load it with fuel as well as the cooking time. Smaller kilns provided smaller amounts of lime but did so at a proportionally more rapid pace.

⁹⁰ Vitruvius, *De architectura* 2.5.1, "si erit fossicia, tres harenae et una calcis infundatur; si autem fluviatica aut marina, duo harenae, una calcis coiciatur"; see Adam, *La construction romaine*, 76–79. During the Early Middle Ages, the same system was used as noted in *Mappae Clavicula*, chs. 102, 103, 254. On late Roman building manuals, see H. Plommer, *Faventinus, Vitruvius, and Later Roman Building Manuals* (London, 1973).

⁹¹ Bachrach, "The Cost of Castle-Building," 48.

In order to manufacture the lime, approximately 200 cubic meters, or about 150 metric tons, of limestone were required.⁹² This meant that three hundred cartloads had to be hauled from the source of the limestone to the kilns. The limestone, moreover, had to be quarried or obtained from *spolia*, and then broken up into pieces that would fit the kiln.⁹³ In addition, approximately two and half metric tons of wood were needed for the production of each cubic meter of lime.⁹⁴ Thus, to produce the 150 cubic meters of lime weighing 100 tons, an average of over 600 metric tons of wood was required. Many scores of trees had to be cut down, sawed or chopped into kiln-sized pieces, and hauled to the kiln.⁹⁵ Or the trees could have been hauled or even, given the topography, floated to the kiln site and cut up there. And ground transport for the wood would have required a minimum of 1,200 carts to be loaded and hauled to the kiln site.⁹⁶

In the next stage of construction, the 100 tons of lime would have been arranged into a minimum of 120 cartloads and then hauled from the kilns to the work site and off-loaded. It also was very important to keep the lime dry, and it likely was kept in waterproof barrels.⁹⁷ To store 100 metric tons of lime in barrels, each with a twenty-five-kilogram capacity, would require approximately 4,000 well-constructed and waterproof containers that had to be manufactured and transported to the kilns in order to be loaded.⁹⁸ Once filled, these barrels probably were kept under cover in temporary sheds that had to be built and later torn down.

In order to make the mortar for the drum tower, 300 tons of clean and dry sand had to be excavated, likely from the banks of the Garonne river, at a pace of approximately three cubic meters per man day of work, arranged

⁹² For different types of limestone, see DeLaine, *The Baths of Caracalla*, 88; for weights, see C. Ramsey, H. Sleeper, *Architectural Graphic Standards*, 4th ed. (New York, 1951), 546.

⁹³ Quarrying: Adam, *La construction romaine*, 23–32.

⁹⁴ For various considerations in the use of wood, see Bachrach, “Cost of Castle-Building,” 48; L.T. Hendricks, “Economics of Wood Burning,” in *Heating the Home with Wood*, University of Minnesota Extension Bulletin, 436, rev. ed. (Minneapolis, 1980), 14–15; Adam, *La construction romaine*, 91–104; Janet DeLaine, “Bricks and Mortar: Exploring the Economics of Building Techniques at Rome and Ostia,” in David J. Mattingly, John Salmon, eds., *Economics Beyond Agriculture in the Classical World* (London/New York, 2001), 230–268, at 260–261.

⁹⁵ See Adam, *La construction romaine*, 91–109, and for felling trees, 93–94.

⁹⁶ For similar calculations, see DeLaine, *The Baths of Caracalla*, 113–114.

⁹⁷ Esmonde Cleary, Wood, *Saint-Bertrand-de-Comminges III*, 146, comment on the need for dry weather when using lime.

⁹⁸ Baskets could be used for carrying lime but would not be appropriate as storage containers; for the use of baskets, see DeLaine, *The Baths of Caracalla*, 93–94.

into six hundred cartloads, and transported to the construction site.⁹⁹ Finally, approximately 20,000 deciliters of clean fresh water to mix the mortar also had to be carted in.¹⁰⁰ This quantity of water, once placed in wooden barrels or ceramic amphorae, weighed in the neighborhood 200 metric tons, not counting the weight of the containers. These water containers then had to be loaded on to carts in order to be moved to the work site and unloaded there. A total of at least four hundred cartloads would have been needed.

Estimating the construction costs of the walls, including the foundations, also requires the identification of the quarries from which new stone was cut, as well as knowledge of the percentage of newly quarried stone to *spolia*. Much of the *spolia* also had to be recut. It is also necessary to identify the types of tools used in order to estimate the speed and efficiency of the work process in quarrying new stone and cutting it and *spolia* into blocks of the required sizes. For example, during the later Middle Ages, when high-quality steel tools, greatly superior to those used by the Romans, were available in great numbers, it took as much time for smiths and masons to repair and sharpen tools as it did to quarry the stone.¹⁰¹

It is possible to point out some salient orders of magnitude. For example, the walls of Bordeaux including the foundations but excepting the corner towers, mural towers, and gate complexes, required approximately 200,000 metric tons of stone, thus approximately 400,000 cartloads over some two to two and a half decades, or around 20,000 cartloads per year. Thus, each day of a 300-workday year, approximately sixty-five cartloads of building stone (or 100 cartloads for a 200-workday year) were loaded at quarries or *spolia* sites, hauled to the building site, and unloaded.¹⁰²

All of this transportation had to be done in a manner synchronized with a great many other activities, such as the availability of the right-sized building stones, mixed mortar, and masons with their assistants.¹⁰³ Above the height of about a meter to a meter and a half, scaffolds had to be in place for work on the walls, and these had to be constructed from wood provided as discussed

⁹⁹ Adam, *La construction romaine*, 78, argues that river sand was preferred, for sand washed by salt water does not make the best mortar.

¹⁰⁰ Regarding quantities of water in proportion to lime and sand, see Adam, *La construction romaine*, 78. These proportions remained constant during the Early Middle Ages as shown in *Mappae Clavicula*, chs. 102, 103, 254.

¹⁰¹ Bachrach, "The Cost of Castle-Building," 50.

¹⁰² For workday estimates, see Cleary, Wood, *Saint-Bertrand-de-Comminges III*, 146.

¹⁰³ See, e.g., the rather simple "flow chart" provided by Pearson, *The Construction of the Saxon Shore Forts*, 79, which, nevertheless, is an important beginning in dealing with a problem that requires detailed study.

above. And all of the delaying factors already discussed above would impede this work as well.

Some General Estimates

Without embarking on a further discussion of the vast quantity of detail needed for the construction of the walls of Bordeaux, it should be clear that millions of surplus man-hours were expended to convert the *urbs* from an open city into a fortress. A work force of one thousand men, each man working a ten-hour day through the course of a 300-day work year, would expend three million man-hours of labor. If only five hundred men worked at Bordeaux on average over a twenty-five year period, then in excess of thirty-five million man-hours would have been expended. For one hundred cities in Gaul, at an average of merely twenty million man-hours of labor per city, the imperial urban fortification strategy would have expended in the neighborhood of two billion man-hours of work in the course of a long century.

The “Crisis of the Third Century” in Gaul

For a very long time, scholars have argued vigorously for the collapse or near collapse, a massive political, social, economic, and demographic breakdown, of the Roman Empire during a period of some two generations between the reigns of Maximinus Thrax and Diocletian. Recently, some have begun to chip away at the received tradition and argue against this view.¹⁰⁴ The remainder of this study will offer some suggestions regarding the potential value of the great mass of quantitative information available from a detailed study of large-scale construction projects as these data relate to the demography and economy, that is, the production of goods and services throughout Gaul in the wake of the “Crisis of the Third Century.”

In addition to converting the overwhelming majority of *urbes* in Gaul into fortress cities, the imperial government saw to the construction or the improvement of a great many hundreds of lesser fortifications such as *castra* and *castella*.¹⁰⁵ Some, such as the *castrum* at Dijon, were quite formidable and superior in size and complexity to some *urbes*.¹⁰⁶ Lesser ones were rebuilt several times.¹⁰⁷

¹⁰⁴ See especially Christian Witschel, “Re-evaluating the Roman West in the 3rd c. A.D.,” *Journal of Roman Archaeology* 17 (2004), 251–281, an effective summary of his, *Krise-Rezession-Stagnation? Der Westen des römischen Reiches im 3. Jahrhundert n. Chr.* (Frankfurt am Main, 1999).

¹⁰⁵ See Reddé, et al. *L'Architecture de la Gaule romaine*, also Paul Bidwell, “Military Architecture in the Gauls,” *Journal of Roman Archaeology* 20 (2007), 556–558.

¹⁰⁶ See Johnson, *Late Roman Fortifications*, 84–86.

¹⁰⁷ See H. Schönberger, “The Roman Frontier in Germany: An Archaeological Survey”; and H. von Petrikovits, “Fortifications in the North-Western Roman Empire from the Third to the Fifth

The construction costs of these, likely undertaken at government expense, and of the hundreds of fortifications constructed at private expense, such as the stronghold known as “Burgus” built by Sidonius Apollinaris’ friend Pontius Leontius, also consumed surplus human, animal, and material resources.¹⁰⁸

The costs of monumental construction in Gaul in the wake of the “Crisis of the Third Century” must also take into consideration the massive program in ecclesiastical building that can be dated from Constantine’s Milan Edict of 313. In the course of the century following the institution of toleration, more than one hundred large cathedrals were built in Gaul. These were supported within the walls of the *urbes* by baptismal churches, ecclesiastical domiciles, numerous parish churches, and monasteries for both men and women. All told, thousands of churches were built in the cities, in the suburbs, in the *vici*, and in the countryside, throughout villages and on private estates.¹⁰⁹

The costs were immense for the construction of fortress cities, lesser fortifications, and ecclesiastical buildings in Gaul from the reign of Diocletian, or somewhat earlier, until the death of Theodosius I. These building efforts suggest that Gaul possessed substantial surpluses in human, animal, and material resources. It would be difficult to identify a comparable century in the history of Roman Gaul when greater investments were made in monumental construction than in the course of the short century that followed in the wake of the “Crisis of the Third Century.” These observations raise an obvious question: how could Gaul have recovered so rapidly if the so-called “Crisis of the Third Century” resulted in the massive destruction of the population of the region and the wholesale devastation of its infrastructure?

Centuries A.D.,” *Journal of Roman Studies* 59 (1969), 144–197, and 61 (1971), 178–218, respectively; also Reddé, et al., *L’Architecture de la Gaule romaine*.

¹⁰⁸ Neil Christie, “Landscapes of Change in Late Antiquity and the Early Middle Ages: Themes, Directions and Problems,” in Idem, ed., *Landscapes of Change: Rural Evolutions in Late Antiquity and the Early Middle Ages* (Burlington, VT, 2004), 17–19, speaks to the difficulties of defining and identifying private fortifications; see also Ross Samson, “The Merovingian Nobleman’s Home: Castle or Villa,” *Journal of Medieval History* 13 (1987), 287–315.

¹⁰⁹ See, e.g., Paul-Albert Février, et al., eds., *Topographie chrétienne des cités de la Gaule des origines au milieu du VIII^e siècle*, 13 vols. (Paris, 1975–2007); Carlrichard Brühl, *Palatium und Civitas: Studien zur Profanotopographie spätantike Civitates vom 3. bis zum 13. Jahrhundert*, I, *Gallien* (Cologne/Vienna, 1975) and II, *Belgica I, beide Germanien und Raetia* II (Cologne/Vienna, 1990); and May Vieillard-Troiekournoff, *Les monuments religieux de la Gaule d’après les oeuvres de Grégoire de Tours* (Paris, 1976), 84–95; also Paul-Albert Février, “*Vetera et Nova: le poids du passé, les germes de l’avenir, III^e–VI^e siècle*,” in *Histoire de la France urbaine. Tome I: La ville antique des origines au IX^e siècle* (Paris, 1981), 399–493; Jill Harries, “Christianity and the City in Late Roman Gaul,” in John Rich, ed., *The City in Late Antiquity* (London, 1992), 87–88; A.H.M. Jones, “Church Finance in the Fifth and Sixth Centuries,” *Journal of Theological Studies*, n.s. 11 (1960), 84–94; Adriaan Verhulst, *The Rise of Cities in North-West Europe* (Cambridge, 1999), 1–23; and J. Guyon, “La topographie chrétienne des villes de la Gaule,” in Krause, Witschel, *Die Stadt in der Spätantike—Niedergang oder Wandel?*, 105–128.

The picture suggested here of Gaul flourishing demographically and economically in the wake of the "Crisis of the Third Century" is provided a modicum of support from a variety of sources. For example, the hackneyed claim that the fortification of the late Roman *urbes* in Gaul during the later third and fourth centuries can be used as evidence for the diminution of the population appears finally to have been abandoned:¹¹⁰ as observed by Scheidel, "Smaller cities need not be less populous, only more compact."¹¹¹ Even though excavation is extremely difficult in thickly populated modern cities that are built on Roman sites,¹¹² Wells, using archaeology, has concluded that urban population decline "may have been the exception rather than the rule."¹¹³ And the writings of Ausonius, noted above, refer to overcrowding at Bordeaux and support the archaeological evidence.

In rural areas, the archaeological results based on excavations before and after 2000 are similar; thus, Van Ossel and Ouzoulias have observed, "it became overwhelmingly obvious that 'theories' based on the material picked up by field walking could not be reconciled with the rapidly increasing corpus of information developed as a result of excavation."¹¹⁴ Between 1992 and 2002, there has been an exponential increase in excavations of rural sites in northern France¹¹⁵ demonstrating that conclusions such as "depopulation of the countryside," "general abandonment of rural settlement," "the profound impoverishment of the countryside," a "return to the subsistence economy," and "autarchy" are no longer valid.¹¹⁶

As early as 1991, Lewit's pioneering megastudy of excavated sites in Gaul not only undermined the already suspect conclusions drawn from field surveys but affirmed that the countryside was flourishing.¹¹⁷ In the second edition

¹¹⁰ Ramsay MacMullen, *Corruption and the Decline of Rome* (New Haven, 1988), 21.

¹¹¹ Walter Scheidel, "Progress and Problems in Roman Demography," in Idem, ed., *Debating Roman Demography*, (Leiden, 2001), 65.

¹¹² See Brian Ward Perkins, "Urban Continuity?," in Christie, Loseby, eds., *Towns in Transition*, 4–17; also Bernard S. Bachrach, "Fifth Century Metz: Later Roman Christian *Urbs* or Ghost Town?," *Antiquité Tardive* 10 (2002), 363–381.

¹¹³ Peter S. Wells, *Barbarians to Angels: The Dark Ages Reconsidered* (New York/London, 2008), 73.

¹¹⁴ P. Van Ossel, P. Ouzoulias, "Rural Settlement Economy in Northern Gaul in the Late Empire: An Overview and Assessment," R. Bruce Hitchner, tr., *Journal of Roman Archaeology* 13 (2000), 134–135.

¹¹⁵ Edith Peytremann, *Archéologie de l'habitat rural dans le nord de la France du IV^e au XII^e siècle*, 2 vols. (Saint-Germain-en-Laye, 2003), 1, 13.

¹¹⁶ Van Ossel, Ouzoulias, "Rural Settlement," 133.

¹¹⁷ Tamara Lewit, *Agricultural production in the Roman economy, A.D. 200–400* (Oxford, 1991). For a critique of field walking, see Lewit, 2nd ed., *Agricultural Production*, v–xxi and passim; also Karl Heinz Lenz, "Late Roman Rural Settlement in the Southern Part of the Province of Germania Secunda in Comparison with Other Regions of the Roman Rhineland," in Pierre Ouzoulias, Christophe Pellecuer, Calude Raynaud, Paul Van Ossel, Pierre Garmy, eds., *Les campagnes de la*

of this work, published in 2004 and sustained by a great deal of post-1990 excavation, she observed:

In sum, the archaeological evidence presented here shows that the later empire was far from being a period of agricultural decline and crisis. Rural occupation was at its maximum level or close to it, except in a few specific regions, and in some regions the level of occupation exceeds that of the high empire. Farms continued to prosper, and even to expand, and very few suffered decline or were spontaneously abandoned in any region.¹¹⁸

A growing body of scholarship based on archaeological excavations in combination with the written sources thus supports the view that agriculture in the Late Roman Empire was in a growth phase. As Banaji recently put it, “The general implication of the later Roman expansion of settlement is a demographic upswing.”¹¹⁹ This is crucial because it is widely agreed by modern scholars that somewhere in the neighborhood of ninety percent of the population of the late antique west, the percentage likely being higher in Gaul than in Italy, lived in the countryside and that these people were engaged in agriculture or agriculturally related enterprises.¹²⁰ Thus, in terms of ascertaining demographic patterns, in general, the focus must be on the rural population, which if increasing, as now is frequently suggested, could also provide surpluses to feed and clothe an increased number of people living in urban and suburban contexts or working in the construction of fortifications and churches.

Conclusion

The vast quantities of surplus resources expended on fortifying Gaul has been termed a “fantastically expensive” effort.¹²¹ An estimate of the order of magnitude of building costs entailed in the construction of a massive system of churches and other ecclesiastical edifices in Gaul has not even been attempted.

Gaule à la fin de l'Antiquité: Actes du colloque Montpellier, 11–14 mars 1998 (Antibes, 2001), 113–146.

¹¹⁸ Tamara Lewit, *Agricultural Production in the Roman Economy, A.D. 200–400*, 2nd ed. (Oxford, 1991), 33; and more generally, Alexandra Chavarria, “Archaeological Research on the Late Antique Countryside: A Bibliographic Essay,” in William Bowden, Luke Lavan, Carlos Machado, eds., *Recent Research on the Late Antique Countryside* (Leiden/Boston, 2004), 3–51.

¹¹⁹ Jairus Banaji, *Agrarian Change in Late Antiquity: Gold, Labour, and Aristocratic Domination*, 2nd ed. (Oxford, 2007), 265.

¹²⁰ Ninety-percent figure noted by Chris Wickham, *Framing the Early Middle Ages: Europe and the Mediterranean, 400–800* (Oxford, 2005), 12.

¹²¹ Johnson, *Late Roman Fortifications*, 116, also 118 for attempts of scholars to diminish an appreciation of the costs of the imperial building effort.

These successes in the construction of monumental architecture would seem to permit the inference that the “Crisis of the Third Century” did not cause a massive decline in the population of Gaul and a concomitant shrinkage in the production of goods and services. It hardly seems unfair to suggest that scholars would be hard put to identify any comparable century in the history of Roman Gaul where a greater investment was made in monumental construction. The military and religious construction effort dwarfed governmental building projects executed in a similar period of time in the history of Roman Gaul that took place when both the economy and the population are seen to be on the increase. In light of what would seem to have been a very rapid “recovery” from the “Crisis of the Third Century,” it seems reasonable to suggest that we should reevaluate its supposedly devastating impact on the population and economic infrastructure in Gaul.

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