On the foundation of walls and the establishments of towns

Source: http://www.vitruvius.be/boek1h5.htm

1. Cum ergo his rationibus erit salubritatis moenium conlocandorum explicatio regionesque electae fuerint fructibus ad alendam civitatem copiosae, et viarum munitiones aut opportunitates fluminum seu per portus marinae subvectionis habuerit ad moenia conportationes expeditas, tunc turrium murorumque fundamenta sic sunt facienda, uti fodiantur, si queant inveniri, ad solidum et in solido, quantum ex amplitudine operis pro ratione videantur, crassitudine ampliore quam parietum qui supra terram sunt futuri, et ea impleantur quam solidissima structura.

Translation

1. When, therefore, by these methods there shall be ensured healthiness in the laying out of walls; and districts shall be chosen abounding in fruit to feed the citizens; and roads duly laid out, or convenient rivers, or supplies by sea through the harbours, shall have ready transport to the ramparts: then the foundations of the towers and walls are to be laid. If such foundations can be found, they are to be dug down to the solid and in the solid, as may seem proportionate to the amplitude of the work, of a breadth greater than that of the walls which shall be above the ground; and these foundations are to be filled with as solid structure as possible.

2. Item turres sunt proiciendae in exteriorem partem, uti, cum ad murum hostis impetu velit adpropinquare, a turribus dextra ac sinistra lateribus apertis telis vulnerentur. curandumque maxime videtur, ut non facilis aditus sit ad oppugnandum murum, sed ita circumdandum ad loca praecipitia et excogitandum, uti portarum itineria non sint directa sed scaeva. Namque cum ita factum fuerit, tum dextrum latus accedentibus, quo scuto non erit tectum proximum erit muro. Conlocanda autem oppida sunt non quadrata nec procurrentibus angulis sed circulationibus uti histis ex pluribus locis conspiciatur. In quibus enim anguli procurrunt, difficiliter defenditur, quod angulus magis hostem tuetur quam civem.

Translation

2. Towers, moreover, are to be projected on the outer side, in order that when the enemy wishes to approach the wall in an attack, he may be wounded on his exposed flanks by weapons on the right and left from the towers. And it seems that care must especially be taken that the approach be not easy for an enemy blockading the wall. The approach must be made to wind along the steep places, and so divised that the ways to the gates are not straight, but on the left of the wall. For when it is so done, then as the troops approach,
their right side will be next the wall and will not be protected by the shield. Moreover, towns are not to be planned square nor with projecting angles, but on the round, so that the enemy be seen from several sides. For when angles run out, defence is difficult, because the angle defends the enemy rather than the townsmen.

3. Crassitudinem autem muri ita faciendam censeo, uti armati homines supra obviam venientes alius alium sine impedione praeterire possint, dum in crassitudo perpetuae tabulæ oleaginæae ustilatae quam creberrime instruantur, uti utraque muri frontes inter se, quemadmodum fibulis, his taleis conligatae aeternam habeant firmitatem; namque ei materiae nec caries nec tempestates nec vetustas potest nocere, sed ea et in terra obruta et in aqua conlocata permanent sine vitiis utilis sempiterno. Itaque non solum in muro sed etiam in substructionibus quique parietes murali crassitudine erunt faciundi, hac ratione religati non cito vitiabuntur.

Translation

3. But I think the width of the wall should be so made that armed men meeting one another above can pass without hindrance. Then, in the width, through timbers of charred olive wood should be put very frequently, in order that both fronts of the wall, being tied together by these timbers, as though by pins, may have everlasting strength. For such timber can not be injured by decay or weather or age; even when it is covered with soil or placed in water, it remains unimpaired and useful for ever. And so not only the city wall, but the substructures, and those dividing walls which are made to be of the thickness of fortifications, when united in this manner, will not quickly be decayed.

4. Intervalla autem turrium ita sunt facienda, ut ne longius sita alia ab alia sagittae missionis, uti, si qua oppugnetur, tum a turribus quae erunt dextra sinistra, scorpionibus reliquisque telorum missionibus hostes reiciantur. Etiamque contra inferiores turrium dividendus est murus intervallis tam magnis, quam erunt turres, ut itinera sint interioribus partibus turrium contignata, neque ea ferro fixa. Hostis enim si quam partem muri occupaverit, qui repugnabunt rescedent et, se celeriter administraverint, non patientur reliquas partes turrium murique hostem penetrare, nisi se voluerit praecipitare.

Translation

4. The distances between the towers are so to be made that one is not further from another than a bowshot; so that if a tower is besieged anywhere, then, by 'scorpions' and other missile engines from the towers right and left, the enemy may be thrown back. And also opposite the lower part of the towers, the wall is to be divided by intervals as wide as a tower; and these intervals opposite the interior parts of the towers shall be joined with planks. These, however, are not to be fixed with iron nails. For if the enemy occupies any part of the wall, the defenders shall cut them down, and if they manage it quickly, they will not suffer the enemy to penetrate the rest of the towers and wall, unless he is willing to throw himself headlong.
5. Turres itaque rutundae aut polygoneae sunt faciendae; quadratas enim machinae celerius dissipant, quod angulos arietes tundendo frangunt, in rotundationibus autem, uti cuneus, ad centrum adigendo laedere non possunt. Item munitiones muri turriumque aggeribus coniunctae maxime sunt tutiores, quod neque arietes neque suffossiones neque machinae ceterae eis valent nocere.

Translation

5. The towers therefore are to be made round or polygonal. For engines more quickly demolish square towers, because the battering-rams beat and break the angles; whereas in the case of rounded surfaces, even when they drive the battering-rams wedge-fashion towards the centre, they cannot hurt them. Further, the fortifications of the wall and towers especially when joined by embankments are safer, because neither battering-rams nor undermining nor other contrivances avail to injure them.

6. Sed non in omnibus locis est aggeris ratio facienda, nisi quibus extra murum ex alto loco plano pede accessus fuerit ad moenia oppognanda. Itaque in eismodi locis primum fossae sunt faciendae latitudinibus et altitudinibus quam amplissimis, deinde fundamentum muri deprimendum est intra alveum fossae et id extruendum est ea crassitudine, ut opus terrenum facile sustineatur.

Translation

6. But not in all places is the method of embankment to be employed; only where there is an approach outside the wall from high ground by a level forroway for troops besieging the ramparts. Therefore in places of this kind, ditches are to be made of the ampiest possible breadth and depth; then the foundation of the wall is to be carried down within the hollow of the ditch, and is to be constructed of such thickness that the weight of earth is easily held up.

7. Item interiore parte substructionis fundamentum distans ab exteriore introrsus ampol spatio, ita uti cohortes possint quemadmodum in acie instructae ad defendendum supra latitudinem aggeris consistere. Cum autem fundamenta ita distantia inter se fuerint constituta, tunc inter ea alia transversa, coniuncta exteriori et interiori fundamento, pectinatim disposita quemadmodum serrae dentes solent esse conlocentur; cum enim sic erit factum, tunc ita oneris terreni magnitudo distributa in parvas partes; neque universa pondere premens poterit ulla ratione extrudere muri substructiones.

Translation

7. Also on the inner side of the substructure another foundation is to be laid, so far distant from the outer foundation that cohorts can drawn up in line of battle. Now when the foudantions are fixed at such a distance from each other, then between these let there be placed other transverse walls joined to the outer and inner foundation, arranged comb-fashion, as the teeth of a saw are wont to be. For when it shall so be done, then the
greatness of the load of earth being thus distributed into small parts, will not press with
the whole weight, so as to thrust out the substructures of the wall.

8. De ipso autem muro, e qua materia struatur aut perficiatur ideo non est praefiniendum,
quad in omnibus locis quas optamus copias, eas non possumus habere. Sed ubi sunt saxa
quadrate sive silex seu caementum aut coctus later sive crudus, his erit utendum. Non
enim, uti Babylone abundantes liquido bitumine pro calce et harena ex cocto latere
factum habent murum, sic enim possunt omnes regionibus seu locorum proprietates
habere tantas eiusdem generis utilitatis, uti ex his comparationibus ad aeternitatem
perfectus habeatur sine vitio murus.

Translation

8. Respecting the wall itself and the material of which it is build or finished, there must
be laid down no rule beforehand; because we cannot have in all places the supplies which
we desire. But where there are squared stones, or concrete or lava or baked bricks or
unburnt, we must use them. For whereas at Babylon, where they have plenty of liquid
pitch instead of lime and sand, they can have their walls built of burnt brick; other
regions or useful sites have their special advantages, so that with due preparation a wall
can be built perfect for ever and unblemished.

COMMENT

The Vitruvian description of the construction of walls finds a remarquable resemblance to
the description of the 'murus gallicus' which Caesar gives in his book VII, chapter 23 of
his 'De Bello Gallico'

[23] Muri autem omnes Gallici hac fere forma sunt. Trabes derectae perpetuae in
longitudinem paribus intervallis, distantes inter se binos pedes, in solo collocantur. Hae
revinciuntur introrsus et multo aggere vestiuntur: ea autem, quae diximus, inter valla
grandibus in fronte saxis effarciuntur. His collocatis et coagmentatis alius insuper ordo
additur, ut idem illud intervallum servetur neque inter se contingant trabes, sed paribus
intermissae spatiis singulae singulis saxis interiectis arte contineantur. Sic deinceps
omne opus contextur, dum iusta muri altitudo expleatur. Hoc cum in speciem
varietatemque opus deforme non est alternis trabibus ac saxis, quae rectis lineis suas
ordines servant, tum ad utilitatem et defensionem urbiun summam habet opportunitatem,
quod et ab incendio lapis et ab ariete materia defendit, quae perpetuis trabibus pedes
quadragenos plerumque introrsus revincta neque perrumpi neque distrahi potest.

Translation

23. But this is usually the form of all the Gallic walls. Straight beams, connected
lengthwise and two feet distant from each other at equal intervals, are placed together on
the ground; these are mortised on the inside, and covered with plenty of earth. But the
intervals which we have mentioned, are closed up in front by large stones. These being
thus laid and cemented together, another row is added above, in such a manner, that the
same interval may be observed, and that the beams may not touch one another, but equal spaces intervening, each row of beams is kept firmly in its place by a row of stones. In this manner the whole wall is consolidated, until the regular height of the wall be completed. This work, with respect to appearance and variety, is not unsightly, owing to the alternate rows of beams and stones, which preserve their order in right lines; and, besides, it possesses great advantages as regards utility and the defense of cities; for the stone protects it from fire, and the wood from the battering ram, since it [the wood] being mortised in the inside with rows of beams, generally forty feet each in length, can neither be broken through nor torn asunder.

Vitruvius describes the ground plan of a city. In his opinion the walls should follow a rounded layout, not a square one and be inforced by round towers build on shoot distance from each other. It could be interesting to investigate remains of Roman city walls to see if this prescription is followed. I made some investigation in publications and I can give following results:

1. Atuatuca Tungrorum, capital of the civitas Tungrorum, situated in Belgium, the actual Tongeren. A city wall was built in the first years of the 2nd century A.D. (A century after the work of Vitruvius). It has a length of 4.544 meter and a thickness of 2,10 meter (or 7 Roman feet). The layout is rather irregular and follows the area of the city. It is inforced by round towers on irregular distances from each other. These towers have a diameter of 9 meter. The foundation of the wall is slightly thicker with a gradual transition to the wall proper. The height must have been 5 à 6 meter.

This layout approaches the Vitruvian rules. The construction on the other hand is totally different. Here the wall is composed of an inner and an outer parement of regular silex blocks, filled in with silex and other rubble joined together with mortar.
2. Colonia Claudia Ara Agrippinensium, situated in Germany, the actual Köln. The building of a city wall started around 50 A.D. (a few years after Vitruvius' death). It has a length of 3.912 meter and a thickness of 2.40 meter (or 8 Roman feet). The layout is nearly square as a result of the Roman camp which was at the origin of the city. It is enforced by 21 round towers on regular distances from each other. The foundation of the wall is 0.6 meter (or 2 Roman feet) thicker than the wall (0.3 meter respectively on the outside and the inside). The best known tower is maybe the so called Römerturm.

This layout approaches the Vitruvian rule. There is a difference in the fact that there are straight walls instead of curved. The construction is the same as in the case of Atuatuca Tungrorum.

3. Augusta Treverorum, situated in Germany, the actual Trier. The building of a city wall started in the first half of the first century A.D. It has a length of ± 6.500 meter and a thickness of 3 meter (or 10 Roman feet). The layout is rather irregular, follows on one side the river Mosel, makes a slow curve to the east where it goes over in a straight line. On the south side the wall is also straight. It is enforced by 47 round towers on regular distances. The height is ± 7.5 meter.

This layout approaches the Vitruvian rule. There is a difference in the fact that there are straight sections. The construction is the same as in the case of Atuatuca Tungrorum.

4. Colonia Ulpia Traiana, situated in Germany, the actual Xanten. The building of a city wall started in the beginning of the 2nd century A.D. It has a length of ± 3.400 meter and a variable thickness: from 3 meter on the east side to 2 meter on the south side. The layout is almost square; on the east side it follows the former current of the old Rhine, while on the three other sides it is square. The wall is enforced by square towers on regular distances.
5. Conimbriga, Portugal near Coimbra. The history of the Roman wall is not completely known. It is maybe constructed in the late empire around the end of the second or the beginning of the third century A.D. It has square towers totally different from the Vitruvian rule.

6. Merida, Spain. There has been a city wall of irregular layout with round towers. But apart from a plan I have no further information on it.

7. I found references to Roman walls in Colchester and Silchester in England and Avenches in Switzerland but I have no description of these walls.

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