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Recent Work on the Land Walls of Istanbul: Tower 2 to Tower 5

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Built during the reign of Theodosius II (408–450), the seven-kilometer land walls of Constantinople are one of the remarkable accomplishments of antiquity. The fortification was deemed invincible because of its superior design, the strength of its building materials, and details of its construction. The imagination and amount of manpower involved in the design and execution of this magnificent work is stupendous. Even in their ruinous state, the wall sections and towers bear testimony to the grandeur of fifth-century military architecture.

Today, the Theodosian walls stand as a landmark delineating the western border of the ancient city. The inhabitants of Istanbul are privileged to have a cultural heritage of outstanding importance and beauty, but preservation of such a gigantic monument is a difficult task, requiring substantial financial resources and expertise.

The municipality of Istanbul is the authority responsible for the land and sea walls surrounding the historic city. As early as 1939, with the first urban development plan for Istanbul, the land walls and their environs were designated as a conservation area. A large, green belt bordering the historic city on the west was envisaged in the master plan. After UNESCO's designation of the historic quarters and monuments of Istanbul as a World Heritage Site in 1985, the municipality initiated a project for the preservation of the land walls and their environs.[1] The first step was to free them from accretions. This included the transfer of the tanneries near the southern end of the land walls to another site and the demolition of dreary buildings on or near the walls. After pursuing several lawsuits, the municipality of Istanbul succeeded in removing industrial plants from the land wall conservation area and demolished the tanneries. Thus in 1991, the blighted area near the shore of the Sea of Marmara was cleared, revealing a 200 meter section of the wall that had been concealed for nearly a century.

Major changes had taken place around this part of the land walls since the nineteenth century (Fig. 1). About 1870, the railroad was introduced into the historic city, breaking

[1] During the first campaign, which took place between 1987 and 1989, the Belgrade, Silivri, and Mevlevihane Gates were restored according to projects developed by the Foundation for the Preservation of Turkey's Monumental, Environmental, and Touristic Assets. The second campaign started in 1991, and several teams worked along the land walls, Golden Horn, and sea walls until 1994. The project presented here is one of the six.

through the wall between Towers 6 and 8 (T6 and T8). At the beginning of the twentieth century, Kazlıçeşme,[2] an industrial district outside the city walls, started to grow toward the east. Factories were built very close to the wall, and some parts of the outer wall were damaged or totally lost during this process. Further changes were introduced in the late 1950s, during construction of the motorway along the Marmara coast of the historic center. The new road passed between the Marble Tower (the first tower of the sea wall) and the first tower of the land walls. Due to this construction, the coastal character of Tower 1 and its connection to the Marble Tower were lost.

A comprehensive survey of the land walls was carried out in the 1920s and 1930s and published in 1943 by B. Meyer-Plath and A. M. Schneider,[3] but since the tanneries prevented access to the wall between Tower 1 and Tower 5 (T1 and T5), there was almost no documentation of this sector in their work. After clearance of the area in 1991, it was possible to examine the state of the walls and towers. Since it had been restored in 1988, T1 was in a good state of preservation. Towers 2, 3, 5, and 6 had serious structural problems. The main wall was preserved almost to its full height between T1 and T6, but the outer wall had suffered severely. Nothing from the moat was visible above ground, except some merlons near T5a (Fig. 2). The wall surfaces had been stained by dyes or chemicals used in tanning; several cavities had been sunk in the wall surfaces and flues had been dug into the wall mass. A thick layer of earth was deposited above the rampart walk and towers, providing sufficient soil to support fully grown trees. The rundown appearance of the site was an eyesore at one of the main entrances to the historic city; its repair had priority for archaeological and cityscape reasons.

The work started in 1991.[4] Vegetation and the earth deposits above the rampart walk were carefully removed and 1:50 scale surveys (plans, cross-sections, and elevations) produced. The rampart floors were examined and documented with 1:20 scale plans and cross sections. On the eastern side of the wall, access to the towers was barely possible, because earth and debris had accumulated to a height of about three meters. Excavation was conducted near the towers until the original ground level was reached. To provide complete documentation and understanding of their structure, research continued within the towers—revealing interesting details about their history.

[2]Kazlıçeşme is an extramural settlement founded in the 15th century. It takes its name from a fountain with a marble plate depicting a bird (or goose?).

[3]A. van Millingen, *Byzantine Constantinople: The Walls of the City and Adjoining Historical Sites* (London, 1899), is one of the important early works on the subject. B. Meyer-Plath and A. M. Schneider, *Die Landmauer von Konstantinopel* (Berlin, 1943), furnishes short descriptions, historical and epigraphical data, and some architectural drawings. A concise presentation, including a list of publications after 1943, is found in W. Müller-Wiener, *Bildlexikon zur Topographie Istanbuls* (Tübingen, 1977), 286–300. C. Foss and D. Winfield, *Byzantine Fortifications: An Introduction* (Pretoria, 1986), 41–77, contributes a substantial analysis of a new chronology for the land walls of Constantinople.

[4]The Technical University of Istanbul (ITU) was appointed to prepare a restoration project for the wall section T1–T6. The present authors, M. Ahunbay (architect and archaeologist) and Z. Ahunbay (conservation architect) from the Faculty of Architecture directed the team, which comprised experts from several disciplines. Photogrammetric surveys were prepared by C. Örmeci and O. Müftüoğlu from the Faculty of Civil Engineering (İTU). The structural engineering team consisted of M. Yorulmaz and F. Çılı. N. Toydemir and E. Gürdal provided expertise in materials science. A large team of architect-restorers (D. Sarı, D. Mazlum, A. Kangüleç, H. Erdoğan, M. Demirer), architects, and students of architecture contributed to the preparation of the architectural surveys and restoration proposals.

Conservation Methodology

The main objective of the restoration work was to strengthen the existing fabric of the walls, so the towers would suffer less from climatic factors and future earthquakes. The selection and use of materials compatible with the originals were an important aspect of the project, requiring research into the original mortars, brick sizes, and types of stones used, as well as repair phases. Towers could not resist earthquakes; tremors caused serious vertical or diagonal cracks or led to total failure. After earthquakes some towers were totally renewed, others restored, preserving remaining wall sections. Different phases of construction and repair can be distinguished by the building materials and techniques used, and they provide a means for deriving a relative chronology. Inscriptions on some of the towers help in dating the repairs. Conservation of old repairs along with the original fifth-century fabric posed problems that had to be handled with care.[5]

Materials and Repair Techniques

The main wall is ca. 4.85 meters thick and was fortified by towers placed approximately 50 meters apart.[6] The curtain wall rises to a maximum height of about 12 meters. It consists of a rubble core, confined between two shells built of squared blocks, 30–50 centimeters deep. Facing stones in the fifth-century masonry exhibit fine quality, nearly ashlar, with very close joints of 0–10 millimeters. On the city side, the stone blocks are dressed and cut with less care, and the joints are generally wider than 1 centimeter.

Brick bands consisting of five courses were laid at intervals of between seven and eleven courses of dressed stone. They run through the entire thickness of the wall, binding the structure firmly at different levels. The thickness of the brick bands ranges between 38 and 40 centimeters.

The facing blocks of the fifth-century structures were made of a cream-colored sandstone quarried from the area outside the southern end of the land wall. These quarries are no longer in operation;[7] they were exhausted in Byzantine times by continuous use. Therefore, a matching sandstone had to be provided from another source. In accordance with the results of laboratory analysis of several samples, sandstone from Kandıra (Bithynia) was selected for use in repairs.

Bricks measuring 37/38 by 37/38 by 4.5–5 centimeters had been used in the fifth-century construction.[8] However, within the wall core bricks 35/36 centimeter square were

[5]The key to understanding the phases of repairs has been worked out by Meyer-Plath and Schneider, *Landmauer,* 22–26, and by Foss and Winfield, *Byzantine Fortifications,* 52–70, with however, different datings for some phases, cf. note 22.

[6]All the measurements given in the text refer strictly to the section studied for the restoration project.

[7]For these stones and quarries, see M. Sayar and K. Erguvanlı, *Türkiye Mermerleri ve İnşaat Taşları* (Istanbul, 1962), 21–27.

[8]Early buildings of Constantinople down to Hagia Sophia frequently use large-sized bricks; cf. J. B. Ward-Perkins, "Notes on the Structure and Building Methods of Early Byzantine Architecture," in *The Great Palace of the Byzantine Emperors, Second Report,* ed. D. Talbot Rice (Edinburg, 1958), 76. E. Reusche, "Polychromes Sichtmauerwerk byzantinischer und von Byzanz beeinflußter Bauten Südosteuropas" (diss., University of Cologne, 1971), 40. The physical properties of Byzantine bricks in Istanbul, including samples from the land walls, were investigated by Y. Kahya, "Physikalische und mechanische Eigenschaften der Mauerziegel byzantinischer Bauten in İstanbul," in *Werkstoffwissenschaften und Bausanierung,* Materials Science and Restoration (Ehingen bei Böblingen, 1993), 3.3:1878–95.

in abundance; they made for easier and quicker work. Smaller and/or thinner bricks were employed during Byzantine repairs and renovations.

The original mortar was basically a mixture of lime, crushed brick, and brick powder, the latter providing a hydraulic quality that simple lime mortar lacks.[9] During the later Middle Ages, lime-based mortars were used as well. For restoration the composition of mortar mixes was investigated and new mixes with matching color and composition were developed by laboratory research.

Curtain Wall between Tower 1 and Tower 2

Restoration work started in 1992 with the repair of the section between T1 and T2. Tower 1 and the eastern (city) side of T1–T2 had been repaired in 1988 by the metropolitan municipality, but the presence of tanneries had made it impossible to work on the western (field) side. We had to work on the western side and the rampart level.

The fifth-century fabric of the lower part of the western elevation was preserved, but the upper sections had been subject to alterations in the Middle Ages. We repaired the cavities that had been dug into the lower section of the wall, using a technique similar to the original work. Each missing stone course was carefully rebuilt with squared blocks and backed with rubble and mortar. The repair work in the upper part of the wall was more complex, since the masonry fabric was not homogeneous due to repairs at various dates. Missing or decayed parts of the facade were rebuilt using their original construction techniques, in an effort to make the small patches conform.

The efficacy of chemical and mechanical cleaning techniques was tested on stained areas. However, nondestructive methods did not prove very successful, due to the deep penetration of dyes in the stone, and, finally, no attempt was made to clean the surfaces of walls and towers.

During the restoration in 1988, a crenellated parapet had been added by contractors to the top of the wall in the section next to T1, although there is not enough evidence to prove the presence of such a battlement at this point. Our investigations in the area close to T2 disclosed the traces of two battlements, which were similar in size and construction to the battlements between T3 and T8. With the help of information obtained from the battlements between T3 and T4 and between T4 and T5, the traces of these two battlements around T2 were consolidated and partially restored, making their position and form legible on the rampart walk. By studying the better-preserved sections of the rampart walk, it was also possible to restore the brick-tiled floor, giving it an inclination toward the city side.

Tower 2

The second tower (T2) presented serious structural problems (Fig. 3). Its octagonal form had been damaged by earthquakes and mutilation by the tanneries. A passageway

[9]The traditional Turkish term applied to this type of mortar is "khorasan," see S. Akman, A. Güner, and I. H. Aksoy, "The History and Properties of Khorasan Mortar and Concrete," in *Turkish and Islamic Science and Technology in the Sixteenth Century,* Proceedings of Second International Congress on the History of Turkish and Islamic Science and Technology, 28 April–2 May 1986 (Istanbul, 1986), 1:101–11; A. Güleç and A. Ersen, "Characterization of Ancient Mortars: Evaluation of Simple and Sophisticated Methods," *Journal of Architectural Conservation* 4.1 (1998): 56–67.

had been bored through the west side to provide for easy access into the tower from the tanneries. Having lost its outer facing and weakened by cracks, the masonry on the south side had become loose and dangerous. More than a quarter of the dome covering the ground floor had been lost. At the northern side, the upper half of the tower was partially intact, with scanty remains of an upper dome. The upper parts of the southeastern, southern, and southwestern walls were totally lost.

The tower stood as an impressive ruin that merited preservation as it was. Yet, its structural instability necessitated measures against further losses. In order not to change the behavior of the historic structure, insertion of foreign elements during the strengthening operation was restricted to a minimum. The weak parts of the wall were stabilized and the missing portion of the lower dome was restored, returning the tower's structural integrity. Vertical cracks on the walls were stitched, and a reinforced concrete beam was inserted on top of the northern side of the tower, to hold the tall structure together.

Entrances to the towers are generally from the east, through vestibules crowned by brick arches, resting on attached piers (Figs. 4, 6). As observed in many of the towers along the main circuit of the land walls, the collapse of the vestibule arch had resulted in dangerously cantilevered wall sections above the entrance to T2. Considering the difficulty of preserving the stone blocks in position, the vestibule arch was reconstructed using bricks produced especially for this restoration.

On its northern side, the tower had a loophole that had been unrecognizably mutilated by the tannery. Cleaning and excavation within the window niche provided evidence about its original form and size (Figs. 5, 7). It measured 29.5 to 30 centimeters wide at the facade, and the lateral walls splayed out into a wide niche in the wall thickness. Vestiges of a similar window were found on the west elevation of the tower. During the restoration of the western facade, the outer facing was raised to the base of the dome, and the western window was partially reconstructed, using the northern one as a model.

Apparently the lower dome of T2 was a later addition, for it blocked the loopholes (Fig. 8). The present dome shell rests on a setback of the inner cylinder, above which the tower has a wider interior diameter. Originally, the setback must have supported a timber floor flush with the sill of the window niche (Fig. 9). Thus the loopholes did not serve as light sources for the ground floor but were apertures for archers or arrow- or bolt-shooting machines positioned in the upper room.

At a higher level on the northwest facade, enough had remained to prove the presence of a window, filled in at a later date with rubble stone (Fig. 10). Its brick vault is preserved on the inner side of the dome. It probably accommodated heavier artillery, such as a large catapult. Sockets for timber beams just below the base of the upper dome and at the same level as the window are indications of a second room with a timber floor. The position of the window at the northwest side of the tower shows that two or, at most, three artillery machines were employed in this room, which was confined within the hemisphere of the original dome. Access to this floor is from the rampart walk, through a passage leading down to the chamber (Figs. 8, 9). The passage was covered by an inclined vault; remains of its brickwork are visible in the masonry.

On the ground floor of the tower, a large number of limestone and marble blocks were found in a pile that rose to 1.5 meters. Some of the pieces were Corinthian capitals and impost blocks with crosses on their sides. The pile appears to have resulted from a

repair operation, during which the marble blocks were arranged in such a way that they surrounded three sides of a small rectangular area (Figs. 6, 8). The fact that the original entrance level from the vestibule was maintained during this operation suggests that the purpose was not to raise the floor level but to strengthen the structure.

The exterior facing of T2 is in harmony with the fine masonry of the fifth-century land walls. The interior masonry, however, is not uniform, and the upper parts are of inferior workmanship. Vestiges of fine masonry were preserved only in the lowest part of the interior wall, close to the entrance. The variation in the masonry is probably an indication that T2 was repaired after a disaster, possibly the earthquake of 447. A need for rapid rebuilding must be responsible for the crude masonry of the interior wall surfaces. A new series of earthquakes (862, 864, or 989) must have produced the large vertical cracks through the lower-level artillery slits on each of the tower's cardinal sides (Fig. 3).[10] The piling up of material on the ground level might have been a means of stiffening the structure after the second catastrophe. The timber construction of the first and second floors was demolished during the renovation of the tower. The ground level was vaulted over by a brick dome, and a new window was introduced above the tower entrance. The vaulting of the vestibule was also changed, as the semidome over the vestibule was replaced by a flat ceiling supported by timber beams. The history of the tower after this intervention remains obscure; there is no information about its later history, except in the very late period, when the floor level was raised in accordance with its immediate surroundings. Excavation within the tower revealed that after the collapse of the lower dome, its debris filled the rectangular area in the center. This collapse might be dated roughly to the end of the nineteenth century, when the tower became a total ruin and was used occasionally by the people growing vegetables in the gardens next to it (Fig. 1).

Curtain Wall between Tower 2 and Tower 3

The curtain wall between T2 and T3 had been seriously damaged on its eastern side. Only in the middle section of the wall was its original facing preserved from ground level to the top; the rest suffered from stone removal and serious damage caused by root action.

A peculiar intrusion in the form of a trapezoidal opening disrupts the regular course of the curtain wall at a point close to T2 (Fig. 11). This gap is visible from the east, while a thin wall screens it from the field side. The breach was probably a later defensive measure intended to isolate a strategically important section.[11] The slanting walls of the opening

[10] Recorded earthquakes in Constantinople up to 1000 A.D. are listed with sources and modern bibliography in E. Guidoboni, *Catalogue of Ancient Earthquakes in the Mediterranean Area up to the Tenth Century* (Rome, 1984); for a geophysical interpretation of earthquakes, N. N. Ambraseys and C. F. Finkel, "Long-Term Seismicity of Istanbul and of the Marmara Sea Region," *Terra Nova* 3 (1991): 527–39, with a list of earthquakes from 32 A.D. to 1912 and bibliography. The tectonic structure of Istanbul as a source for frequent tremors recorded in the historical times is assessed by A. Barka, "İstanbul'un Depremselliğini Oluşturan Tektonik Yapılar ve İstanbul için bir Mikrobölgelendirme Denemesi," in *İstanbul ve Deprem Sempozyumu*, 4 Mayıs 1991 (TMMOB İnşaat Mühendisleri Odası İstanbul Şubesi) (Istanbul, n.d.), 35–56; according to his estimations the most devastating earthquakes in Istanbul recur every 200 to 250 years, less hazardous ones in 100-year cycles. It is possible to deduce that the tremors of 447, 740, and 989 were major ones.

[11] As suggested by Robert Ousterhout.

exhibit a different masonry technique from that used elsewhere. Bands of three brick courses alternate regularly with five courses of squared blocks, sheathing the exposed rubble core of the curtain wall on either side of the interruption. This new rhythm in the refacing is extended to the field side of the curtain wall toward T2. A very hard, pink mortar pointing was used in the joints around the squared blocks, enclosing them in rectangular frames. The regular alternation of brick and squared block courses suggest Palaiologan style. A similar fabric was used in the upper level of Mermer Kule (the Marble Tower), which has been tentatively identified with a Palaiologan princely residence.[12] Consequently, the wall section up to T2 can be considered as an extension of Mermer Kule.[13] During examination of the wall walk between T2 and the V-shaped opening, cavities left by deteriorated timber beams and their missing traverses were partially uncovered under the much-repaired and disturbed floor tiles. They are probably remains of a palisade built to protect the rampart walk in front of T2 against attack from the field and from the northern side of the V-shaped gap. This might be a further indication of the defensive nature of the intrusion.

Excavation on the ground level along the eastern side of the main wall revealed the remains of double stairs leading to the rampart walk above T3 (Figs. 12, 14). This is an element not documented in Meyer-Plath and Schneider's survey. Only the lower parts of the stair and the springings of the vaults supporting the stairway were preserved *in situ*. They provided information about the original ground level at this side of the wall, as well as details about the stair construction. The masonry of the stairs was not bonded with the main wall, perhaps explaining the loss of the upper parts. The vault supporting the stairs was made of brick, while several large stone blocks were laid out to form the steps. No attempt was made to reconstruct the whole structure; only the missing blocks of the steps were replaced, and the ruin was stabilized.

An interesting detail was observed at the point where the south wall of T3 joined the curtain wall. One of the brick bands, third from the top, has eight brick courses (Fig. 13). The unusual number of brick courses at this point is explained by the meeting of brick bands from two adjacent structures, curtain wall and tower. The lower three courses of the band belong to the south side of T3; the two courses directly above are shared by both structures. This awkward transition from the tower to the curtain wall and the abrupt interruption of some brick courses after they join the curtain wall seems to have been intended to achieve a strong bond between the tower and the curtain wall—contrary to the advice of the military theoretician Philo of Byzantium,[14] who advised against bonding two elements of a fortification in order to avoid possible damage resulting from differences in settling. Brick bands act as both stiffeners along the walls and bonding agents between the facing blocks and the wall's rubble core. Inserting brick courses, even par-

[12] U. Peschlow, "Mermerkule—Ein spätbyzantinischer Palast in Konstantinopel," in *Studien zur byzantinischen Kunstgeschichte. Festschrift für Horst Hallensleben zum 65. Geburtstag* (Amsterdam, 1995), 93–97.

[13] A similar V-shaped gap interrupts the course of the main wall close to the Yedikule fortification and apparently isolated the Golden Gate, which was reorganized as a defensive citadel in the Palaiologan period, C. Mango, "The Date of the Anonymous Russian Description of Constantinople," *BZ* 45 (1952): 380–85, esp. 383 f; also, Peschlow, "Mermerkule," 96; Meyer-Plath and Schneider, *Landmauer,* 41 f.

[14] For Philon's *Poliorketika,* see Y. Garlan, *Recherches de poliorcétique grecque* (Paris, 1974), 298, 362 (62a–63); cf. translation and comments of A. C. Lawrence, *Greek Aims in Fortification* (Oxford, 1979), 84, 85.

tially, into the masonry of an adjoining structure established a strong bond. Whether it was adequate is less certain.

Tower 3

Tower 3, which is rectangular in plan, was in a very poor state of preservation. Its southern wall, half of its west wall, and the barrel vault over the ground level were completely lost. The north wall had a dangerous cavity running through its entire thickness (Fig. 15). Excavation within the tower revealed an unexpected feature: the lower parts of three piers within the fifth-century walls. The piers were probably part of a medieval renovation program, during which the original barrel vault was not rebuilt but, instead, replaced with a new vault resting on the piers.

The wall above the gateway leading from the vestibule to the interior of the tower had largely collapsed. The gateway arch had to be rebuilt as part of the reconstruction of the eastern wall. A reinforced concrete beam was inserted above this arch to relieve the load of the masonry above. The original barrel vault over the ground floor had left its mark on the eastern wall; during restoration, its contour was retraced (Fig. 17).

Although the northern wall of the tower had large areas dating from the Middle Ages, the evidence indicated that the large cavity on this elevation was limited to a portion from the fifth century (Fig. 15). During the repair, the original masonry techniques were used to rebuild the missing courses (Fig. 16).

Only half of the western wall was preserved (Figs. 14, 18). Its stone and recessed brick construction indicated a repair from the eleventh and twelfth centuries. By excavation, it was possible to reveal the southwest corner of the tower and a small portion of the south wall, which had fifth-century fabric intact. During restoration, the southwest corner of T3 was raised enough to project above the ground, so that the full perimeter of the tower would be visible, revealing its rectangular plan (Fig. 19).

Curtain Wall between Tower 3 and Tower 4

The city side of this wall section had a nearly horizontal band of damage within the fifth-century fabric (Fig. 20). Near the entrances to T3 and T4, the damaged surface widened, due to the collapse of the crowning arches of the vestibules and loss of their supporting piers. The wide band of missing courses, where the depth of the lost masonry was almost one meter, was repaired using material and workmanship similar to the originals. The upper levels of the wall had late Palaiologan repairs, which are distinguished by their roughly hewn stone blocks and insertion of some brick fragments into horizontal joints of the brick bands. This wall section was repaired using similar block sizes, surface texture, and pointing technique as the original.

The stone surfaces of the western elevation of T3–T4, were relatively well preserved, except in some parts damaged by smoke and tar from tannery chimneys. The deteriorated blocks were replaced with finely cut and chiselled new stone blocks of equal size. The upper part of the northern half of the curtain wall, a hastily repaired section, where irregular stone material had been employed, bulged dangerously. By grouting, the detached area was bonded to the intact core. On the rampart walk of this section, all of the

battlements except one were relatively well preserved. This offered the chance to study the battlements in more detail.

Two types of battlements have been identified on the main line of the land walls; one with a T-shaped plan, the other, a crenellated parapet. The latter, which is obviously of a later date, generally crowns the repaired sectors of the towers between T1 and T6. The former has been claimed to represent the earliest form of the battlements on the wall.[15] The following paragraphs detail the main features (with some variations) of the T-type battlements observed between T3 and T6.

The floor of the rampart walk is the uppermost course of a brick band, and this is reflected in the elevations as the last course of the topmost brick band. When viewed from the field side, one sees ashlar courses rising on top of this brick band (Fig. 22). They represent the exterior face of a parapet wall with a thickness of 55–60 centimeters and a height of approximately 80 centimeters. The brick merlons on top of the parapet are, in fact, the heads of T-shaped battlements. The leg of the T is constructed of a mixed masonry composed of brick and stone, and buttresses the merlon with its full height. The arms of the T rest partially on the floor of the wall-walk. An embrasure of 80–110 centimeters is reserved between two juxtaposed battlements for fighters.

Decorated marble spolia used within the masonry of the battlements provide evidence that the T-type battlement was not part of the original construction. At points between T4 and T5 and T3 and T4, where the T-type battlements were severely disturbed, the stone parapet yielded information about the earlier construction. The parapet wall has inward projections, each measuring ca. 60–62 centimeters wide and 50 centimeters deep. The fine finish of the blocks indicates that the whole inner face of the parapet was exposed to view. Though the projections were preserved only randomly, it was possible to measure the distance between two successive pilasters, connected by an unbroken line of parapet construction, as 2.50 meters (Fig. 21).

The role of the attached piers can be interpreted in two ways. Originally, the battlements could have been composed of a simple crenellated parapet with piers as traverses (the present parapet would then be the part remaining after the crenellations had been demolished). Each traverse would buttress a merlon 1.70–1.90 meters wide, with an embrasure 0.60–0.80 meters between merlons. If, on the other hand, the wall had a closed battlement, the extant parapet would represent the lower part of a high screen wall, which would have protected the walk and the fighters. Between two traverses, the screen would have had an embrasure. The traverses or wall piers could have equally buttressed the screen and joined with free-standing piers on the rear side of the walk or with the neighboring traverses to support a vault. The main wall would then have created a closed battlement and a vaulted gallery affording a second storey for defense. This reconstruction yields a battlement level with features common with the outer wall (Fig. 24).[16]

The walk level of the outer wall has a closed battlement and is roofed by a vault (Fig. 32). The lowest part of the screen wall consists of dressed sandstone blocks, surmounted by brick masonry with embrasures, which were at a later date converted to loopholes. The screen is buttressed by wall piers, set 1.50 meters apart. Corresponding to the but-

[15] Meyer-Plath and Schneider, *Landmauer,* 28, 82 with notes on curtain wall T6–T9.
[16] Ibid., 33 f and 85, fig. 21 with variations.

tresses are free piers along the rear edge of the walk. A second level of defense was supported by these vaults. The plan, taken at the base of the screen, below the brick masonry, shows the construction to be similar to the older parapet of the main wall not only in design but in some dimensions as well.

In addition to the analogy with the outer wall, further evidence from the wall walk supports the existence of a covered battlement on top of the main wall. Within the brick floor of the rampart walk, were uncovered thick flagstones with rectangular sockets (Fig. 23). They were observed mainly between T2 and T3, but several others have been detected and documented elsewhere, up to T6. These were placed very close to the parapet, but their positions were not quite in line with the embrasures between the T-type battlements. It can, however, be inferred from the matching spans of the parapet projections and stone slabs that the flagstones were evenly positioned between the parapet piers and were part of the earlier battlement system. The perforations in the flagstones extended as far as the five-coursed brick floor, that is, approximately 40 centimeters vertically. The sockets and perforations probably served to fix the vertical supports of catapults employed on the walk level. Although it is not certain which type of catapult engine was used, these weapons could have been heavier than those employed in the outer wall.[17]

The evidence from the rampart walk leads to the conclusion that up to eighteen artillery engines were positioned between the traverses of the parapet. Based on the model of the outer wall, it can be further assumed that the guns and their shooters (*ballistrarii)* were secured against hostile missiles by a screen wall with apertures for sighting and shooting—that is by a closed battlement (Fig. 24). Since it was highly desirable to keep the torsion engines roofed, the preference would have been to protect the artillery on top of the Theodosian fortification with a vault supported by the attached wall piers.[18] Since they were constructed directly on the floor tiles, the wall piers at the rear of the wall walk have disappeared without trace. Abandoning the slender structure with two shooting stories can be attributed to disuse of artillery in later centuries or simply to the structure's vulnerability to earthquakes.[19]

A difficulty arises, however, in the discrepancy between the heights of T2 and the two-storey battlement. The estimated height of the two-storey battlement reaches the level of the crenellated platform of T2 (Fig. 24). A similar height for both features can be considered, but this deprives T2 of a tower's normal dominating effect. Bearing in mind the fact that T1 has two storeys with domes, one wonders whether T2 originally

[17]According to E. W. Marsden, *Greek and Roman Artillery: Historical Development* (Oxford, 1969), 195, and idem, *Greek and Roman Artillery: Technical Treatises* (Oxford, 1971), 234 ff, only arrow and bolt-shooting torsion machines were used by the late Roman army, and the stone throwers were one-armed torsion engines, i.e., onagers.

[18]Lawrence, *Greek Aims,* 375. The height of T2 was the dictating element in the reconstruction proposal.

[19]Intact galleried curtains are still preserved in the Theodosian walls, however, with different functions, construction, and dimensions: for Pteron, the northern end of the defense line, see Meyer-Plath and Schneider, *Landmauer,* 102, pl. 42, for the sea wall near the Boukoleon Palace, Müller-Wiener, *Bildlexikon,* 314, fig. 360. For some other late Roman walls with a gallery in their curtains, see I. A. Richmond, *The City of Wall of Imperial Rome* (Oxford, 1930), fig. 3 and p. 67 f, for the Maxentian phase. The fortification of Amida (modern Diyarbakır) has a non-continuous gallery with shooting apertures: A. Gabriel, *Voyages archéologiques dans la Turquie orientale* (Paris, 1940), 1:107, fig. 78; see also M. van Berchem and J. Strzygowski, *Amida* (Heidelberg, 1910), 283, fig. 226; so probably Mayyafârikîn (modern Silvan), Gabriel, *Voyages,* 107 nn. 2, 3.

also had another room above its upper dome.[20] No other evidence offers proof for this proposed two-storied wall top.[21] Further research on other parts of the land walls, during the course of restorations, may provide new finds pertaining to the problem presented here.

Tower 4

Tower 4 is one of the best preserved along the main wall circuit, having been almost totally reconstructed after an earthquake. The inscription band near the top of the tower bears the name of Emperor Romanus, dating it to the second half of the tenth or the first half of the eleventh century.[22]

After clearing the entrance to the tower, excavation continued inside to the level of the original floor (Fig. 25). A postern connecting the tower to the peribolos (the inner terrace between the main and outer walls) was revealed. At ground level, interior of the tower is circular in plan, while the upper chamber is octagonal, with deep recesses on each side (Fig. 26). Nothing remains from the original floor covering of the upper chamber. Curiously, there is a circular hole in the center of the floor. The most serious damage to the structure is a diagonal crack that starts above the window level on the western facade and runs down about 6 meters after turning 45 degrees from the horizontal.

The external stairway leading to the platform level of T4 was partially preserved; in fact it is one of the rare well-preserved sections in the main circuit of the land walls. The floor had enough of its stone paving *in situ* to give an idea of the original design. The central part of the floor was higher; the slabs were inclined toward the sides of the octagon (Figs. 27, 28). Small waterspouts placed under the parapets helped to keep the crenellated platform dry.

Curtain Wall between Tower 4 and Tower 5

Between Towers 4 and 5 the western elevation of the wall was relatively well preserved, except for the upper part, which had been disturbed by the growth of trees. The fifth-century fabric could be followed up to the top of the wall. The eastern elevation, however, had been seriously damaged. Near the rampart level, areas repaired in the later Byzantine period had been detached from the wall. Sections about to collapse were carefully surveyed, and their individual stones and bricks numbered. Then they were dismantled and reassembled, using the original material.

[20] Meyer-Plath and Schneider, *Landmauer,* 71 f, notes on T1.

[21] Some features of Hellenistic fortifications, such as Philon describes, seem to have been reevaluated and reorganized into an efficient system in the Theodosian walls, see M. Spieser, "Philon de Byzance et les fortifications paléochrétiennes," in *La fortification dans l'histoire du monde grec,* Actes du Colloque International. La fortification et sa place dans l'histoire, Valbonne, December 1982 (Paris, 1986), 363–68. Whether a galleried artillery level on the curtains is also among Philon's recommendations is a disputed issue, cf. Garlan, *Poliorcétique,* 347 (A 17b), 348 (A 19), 359 (A 46a); and Lawrence, *Greek Aims,* 77 (1.17), 370.

[22] Romanus in the inscription had been identified as Romanus III Argyrus (1028–37) by Meyer-Plath and Schneider, *Landmauer,* 72, 124 no. 4a, but as Romanus II (959–963) by C. Foss, "Anomalous Imperial Inscriptions of the Walls of Constantinople," in *Studies Presented to Sterling Dow,* Greek, Roman and Byzantine Monographs 10 (Durham, 1984), 77–87, esp. 80 f.

In the northern half of the wall the battlements were preserved almost to their full height (Fig. 29). Also significant was the inclined rampart walk, which was partially preserved. Starting at a point near T4, the wall walk had an upward inclination toward the north, as the curtain ascended a mild slope. The floor was not uniform throughout T4–T5, but had level and inclined sections, following changes in the slope. Observations revealed that the inclined planes in the walk were constructed by a rubble fill over the last brick band of the wall. A single layer of brick over the fill served as paving. Some of the T-type battlements between T4 and T5 stood on the inclined floor of the walk. Their bottom courses were adapted to the rise in the wall walk; in the construction of the first two courses, stone blocks with different heights were used to correct for irregularity in the bedding courses caused by the slope.

Tower 5

Rectangular Tower 5, which had lost its floors and roof, stood as an empty shell. The interior was filled with earth and debris up to half its height. In the course of restoration, the vestibule was cleaned and the arch over the entrance repaired. It is unfortunate that the work had to stop before the survey could be completed. The inscription fragment in T5[23] should not be considered as a secure base for dating, since it is used as building material in a repair section. Two other fragments, not belonging to the former inscription, are incorporated in the same repair work. Another inscription block with letters AUTOKPATOP (Fig. 30) was unearthed during our work in 1992 in the peribolos between T4 and T5 (closer to the latter and now in the Archaeological Museums of Istanbul). The block is probably not from T4; it might have fallen from another tower between T2 and T6 or have been brought from elsewhere.

Work on the Outer Wall

The outer wall is positioned about 16 meters to the west of the main wall.[24] Its towers are placed so that they stand midway between the main towers, thus supporting the defense from the main towers at a lower level. Nothing was visible of the outer wall near T1 and T2. Because of the reluctance of the municipal administration to permit excavation within the new park, it proved impossible to trace the remains of the undocumented south end of the outer wall.

The outer wall becomes visible above ground starting at a point in front of T3 in the main wall. Tower 3a in the outer wall does not exist today, but it must have stood until the 1940s, since it is marked on Jacques Pervititch's map from 1939 (Fig. 1). By examining the outer wall closely and taking measurements it was possible to detect traces where the lateral walls of T3a bonded with the outer wall. Excavation was conducted to find the foundations of T3a, but this attempt was in vain because at a depth of about 1.5 meters the reinforced concrete foundations of the former tanneries were encountered.

[23] Meyer-Plath and Schneider, *Landmauer,* 124, no. 6.

[24] A new date for the construction of the outer wall, in 447, was provided by a recently recovered inscription, H. Kalkan and S. Şahin, "Ein neues Bauepigramm der theodosischen Landmauer von Konstantinupolis aus dem Jahr 447," *Epigraphica Anatolica* 23 (1994): 145–56; W. D. Lebek, "Die Landmauer von Konstantinopel und ein neues Bauepigramm," *Epigraphica Anatolica* 25 (1995): 107–54.

From T3a to T4a, the outer wall is only partially preserved (Fig. 31). The extant parts include the piers and the screen wall (with windows) as well as a latrine next to T4a.[25] Tower 4a is rectangular and has lost its floor and platform. There is a postern leading down to the lower terrace on the tower's north wall. A survey of the outer wall and Tower 4a was conducted, and a conservation plan developed (Fig. 32) but it could not be implemented, as work came to a close at the end of 1993.

As part of the World Cultural Heritage, the Theodosian wall (Fig. 33) deserves treatment with utmost care. We hope that, in the future, it will be possible to continue our research and preservation work up to the line of the railroad, as was foreseen at the start of the project.

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[25] Similar corbel stones for a latrine are preserved from the walls of Resafa: Karnapp, *Stadtmauer von Resafa*, 11.