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CONSTRUCTION SYSTEMS AND PROBLEMS OF PROTECTION OF BASTIONED FORTIFICATIONS IN ANATOLIAN/THRACE REGION

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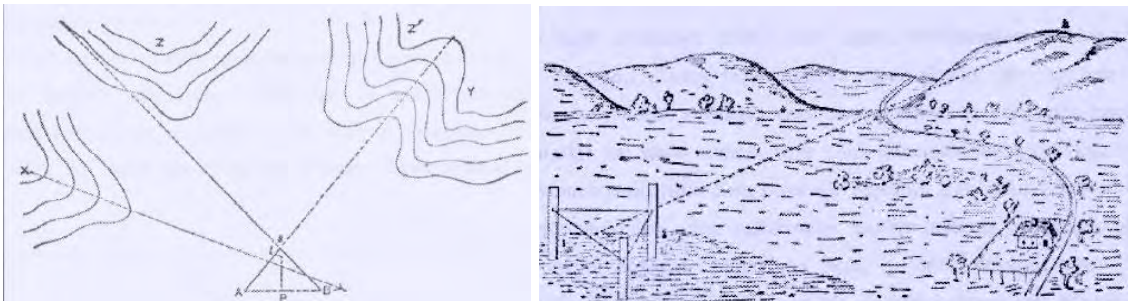
Abstract: *In terms of determining the strategy of war "defense constructions" and "offensive constructions" has an important place in the history of military architecture. Especially, the defense structures have come to the fore because of being built to protect a region.*
The Thracian Region has been a region of strategic importance throughout history because of its geographical position. The region which exposed to occupations and attacks has strategic importance because it serves as a gateway to the Black Sea, the Marmara Sea and the Aegean Sea and a passageway to Anatolia. Especially, in the late 18th century, bastioned fortifications first started to be built along the Dardanelles to defend the Thracian region and they have an important place in Ottoman military architecture.
Today, although bastion fortifications have lost their primary function of preliminary defence of the city, they still stand as cultural assets that need to be protected and are special historical sites with their architectural, military and historical value.
Based on this approach, to provide bastion fortifications in Thrace region to preserve their original qualities and maintain their architectural and spatial integrity, this paper presents detailed research and documentation about their differentiating construction systems and material use. In structural units of bastioned fortifications, differences in construction systems will be explained through plans and sections. Structural units will be dealt with in terms of construction materials and dimensional differences especially in structural elements which can be traced by examining arches of door and window, ventilation shafts, ventilation holes, stove and niches. In addition, considering the regional differences of bastioned fortifications developed as land and coastal bastion in the study area, the problems about protection of construction systems and material use will be identified and preliminary assessment about how to carry them preserved into the future will be made.

1 INTRODUCTION

The words "defense" and "war" are included in the military terminology. Defense constructions are built in order to protect a region during wars which last for years and have different properties in military architecture. These constructions, which are used as offensive and defense bases during war, have come into prominence with the description of “defense constructions” instead of “offensive constructions” in the history of military architecture since it is considered that defense arrangements and preparations are more important than offensive power in order to win a war. Defense constructions show periodic differences; nevertheless, they have similar qualities in terms of preparation and building [1].

Prior to building defense constructions, it is necessary to examine the region in a detailed way for location assessment. In analyzing the region and in building the main construction after the determination of settlement organization, the prediction regarding which direction the enemy will approach from and which direction they will be shot at (2). Primarily, determination of the region's geographical properties is an important factor that determines the shape and direction of the construction (Figure 1).



(a) (b)

Figure 1: (a) Plan, and (b) outlook of a sketch for determining the region on which the defense construction will be built [2].

In the 12th century, the beginning of using gunpowder for military purposes in war caused changes in military techniques. As well as the changes in units' offensive techniques, defensive measures were also developed accordingly [3]. Military writer Conde indicated that the first use of fire cannons took place in 1118 in order to surpass the city walls of Saragossa in Spain and that culverin balls were used for offense[1]. During the end of the 13th century and the beginning of the 14th century, cannons[2] were used within city walls. In Italy, cannon use was observed in city wars at the end of the 14th century. The powerful cannons that were used in sieges during this period facilitated bringing city walls down and the siege of cities [4].

During defense, precautions taken against powerful cannons required thick and high city walls [5]. It is observed that the height of walls decreased and wall thickness increased with the advancements in weapon technology and that roundly tower and city walls lines provided a more effective defense [4]. The most effective defense system against artillery fire was bastioned fortifications which were first used in Europe in the 15th century. Bastioned fortifications were built to strengthen castle walls in Italy and reached their highest level of development in the 17th century in France with the bastions that used to create the urban defense systems in France.

[1] The information provided by Conde on the first use of cannons were excerpted from Woolwich’s book (1858, p. 40).

[2] During this period, cannon balls were referred to as “iron cannons”.

The Ottomans started to use the bastioned fortification system for city defense in the 18th century. The fortifications were first tried in the border cities of the Balkans and then were used for defending east border cities[3] and the straits[4]. In addition, during this period, most Anatolian cities defended themselves against attacks by fortifying and repairing existing castles and city walls.

2 STUDY SCOPE AND METHOD

The Thracian Region has been a region of strategic importance throughout history because of its geographical position. The region was exposed to occupations and attacks throughout history due to its strategic importance as a gateway to the Black Sea, the Marmara Sea and the Aegean Sea and a passageway to Anatolia. During the Ottoman-Russian War of 1768-1774 in particular, all old and new castles located near the Bosphorus were repaired and fortified in order to fortify the Aegean Region and the straits against the Russian threat. In addition, considering the topographic status of the Bosphorus, fortifications that would increase the defense power were built on strategic capes at the Bosphorus/Black Sea Strait [6] and the Canakkale/Mediterranean Sea Strait [7]. Due to the attacks on the Thracian Region in the 19th century, bastions, which are large and organized defense constructions, were built in cities of Istanbul and Catalca in the east, Kirklareli in the northeast, Edirne in the northwest, and Canakkale in the southwest in order to defend the region.

The present study was limited to the cities of Kirklareli, Edirne, and Canakkale in the Thracian Region. Due to high abundance in numbers and to transportation difficulties, Istanbul and its surroundings were excluded from the scope of the study. A total of 54 bastions, out of which 2 are in Kirklareli, 24 in Edirne, and 28 in Canakkale were examined in terms of construction systems and material properties (Figure 2).

Construction systems and material properties pertaining to the bastions were reported by making generalizations due to the similarities in construction units of bastions; however, differences were also discussed. In order to facilitate comprehension, plans, sections, and photographs of construction units that generate the bastion were provided in the text. The construction system and material properties were explained via construction components including foundation, wall, flooring, top covering, doors and windows, niche, ventilation shafts and ventilation channels and holes. In addition, considering the regional differences in bastioned fortifications which were developed as land and coast bastions in the examined region, protection problems regarding the construction system and material use were detected and a preliminary evaluation was conducted on their protection and future use.

[3] The Ottoman Empire first made defense fortifications against attacks from Iran, which is a threat at the east border, in the form of soil bastions on the castle and its surroundings of the frontier city of Kars. The fortification of the Kars castle and the provision of the bastion system were probably completed between 1720-1730 (O. Ulku, Kars and Ardahan bastions, Ataturk University, School of Social Sciences, Dissertation, Erzurum, p. 59, 2006

The documents dated 1740 and 1827 in the Prime Ministry Ottoman Archives show that new bastions and castles were built around the Erzurum castle (N. Çam, Erzurum Bastions, Historical art series:283, Ministry of Culture publications, Ankara, 1993, p. 5)

[4] According to the notes of Müller-Wiener, Eyupgiller indicated that a series of coast defense batteries were built on the east entrance of the Bosphorus in 1769 due to the Kazak raids in 1624 and the continuance of raids in the 18th century (K.K., Eyüpgiller, Preliminary Results From The Survey of Rumelikavağı Fort, Pihans, Nederlands İnstituut voor het Nabije Oosten Leiden, Vol:115, s:129-142, 2010).

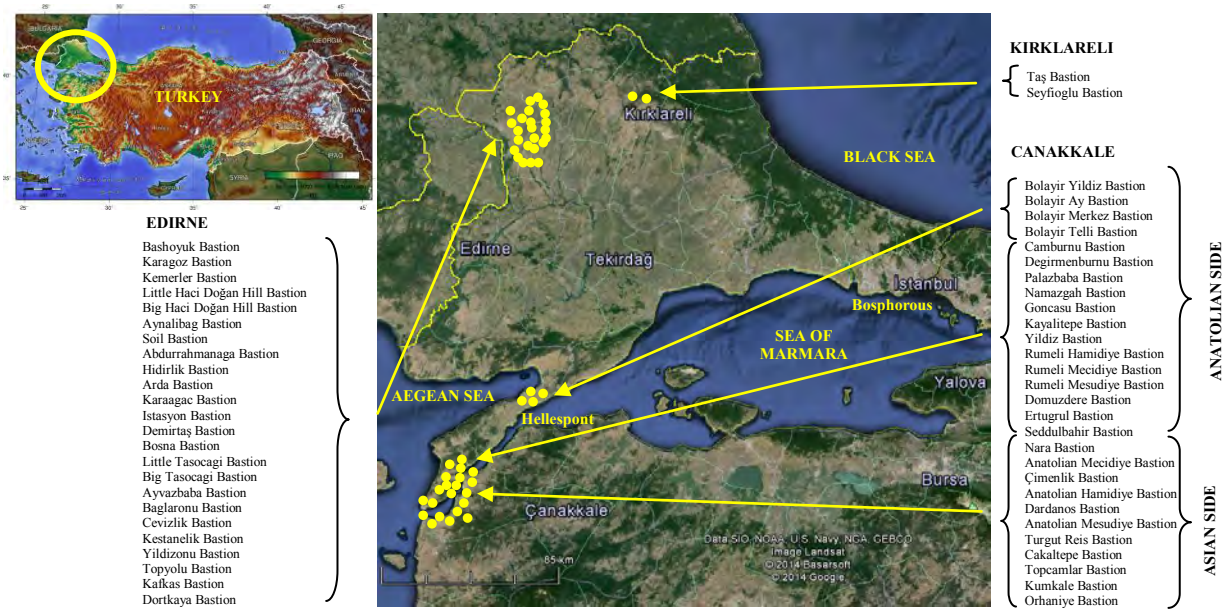


Figure 2: The locations of Thraces Bastion, 2014 [8]

3 CONSTRUCTION SYSTEMS AND MATERIAL PROPERTIES OF THE BASTIONS IN THE ANATOLIAN/THRACE REGION

The bastions were built solely for military purposes instead of aesthetic worries and therefore their architectural planning requires specialty. The construction units that generate the bastions form a specific plan organization due to their function and in addition to the planning of construction units in defense, the relationship between the units come into prominence. In general, construction units such as the guardhouse building, quarter and/or headquarters, powder magazine, ordnance depot (arsenal) and the caponiers are placed within bastions (Figure 3).

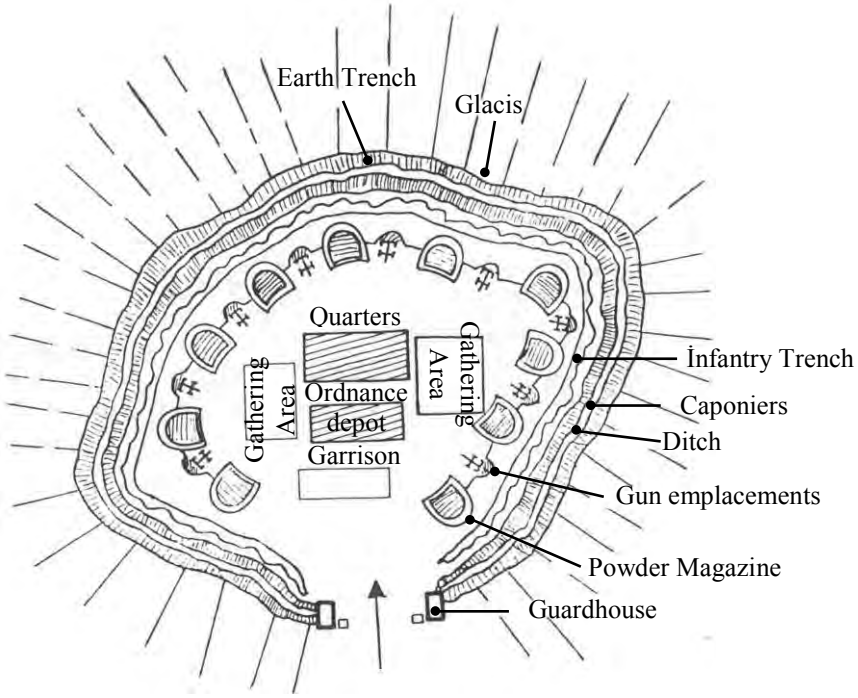


Figure 3: Sketch of the layout of the bastion in 18-20th century [9]

The construction system and material properties pertaining to construction components of construction units that form the bastions in the Thracian Region are explained below. The construction system of the bastions was generally solid masonry; whereas the construction system of bastions found in Anatolia Mesudiye and Turgut Reis in Canakkale was reinforced concrete and the system was supported with steel profiles. The differences in construction systems and materials were thought to be a result of the availability of materials and technology during the period when bastions were built and of the desire to build stronger and more reliable constructions due to the rapid enhancements in weapon technology and to regional circumstances (see Figure 4-5).

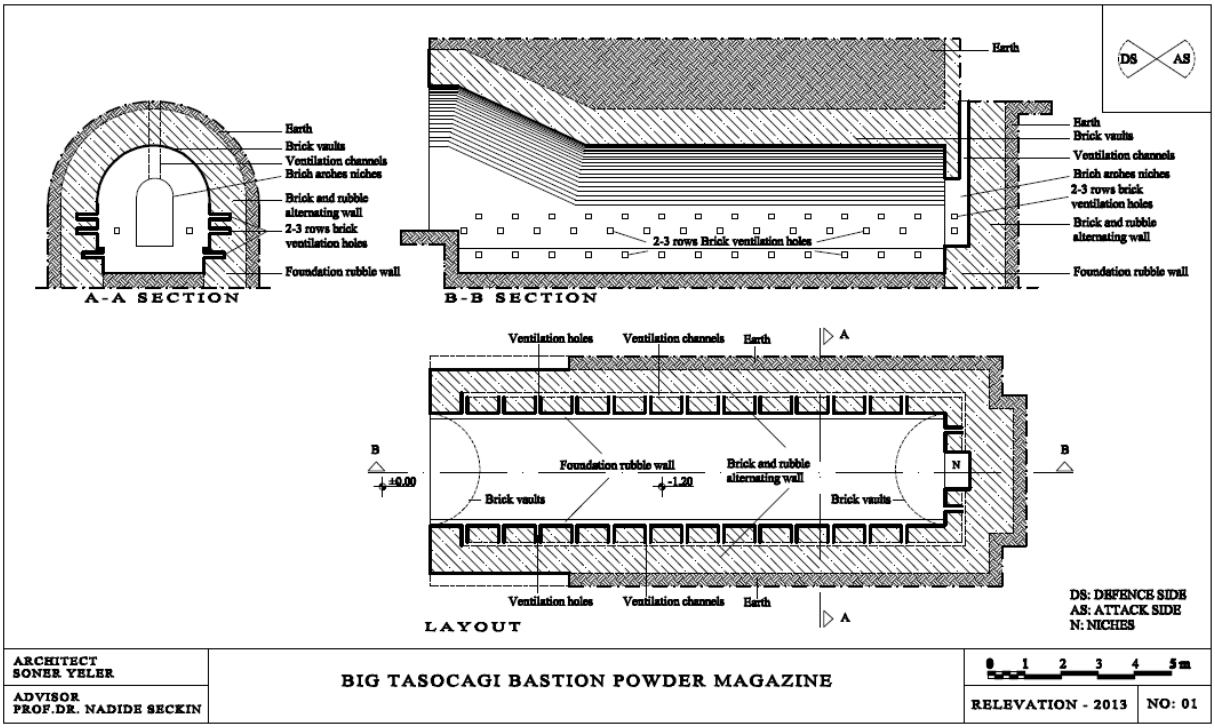


Figure 4: The example of masonry construction system, Big Tasocagi Bastion, 2012 [8]

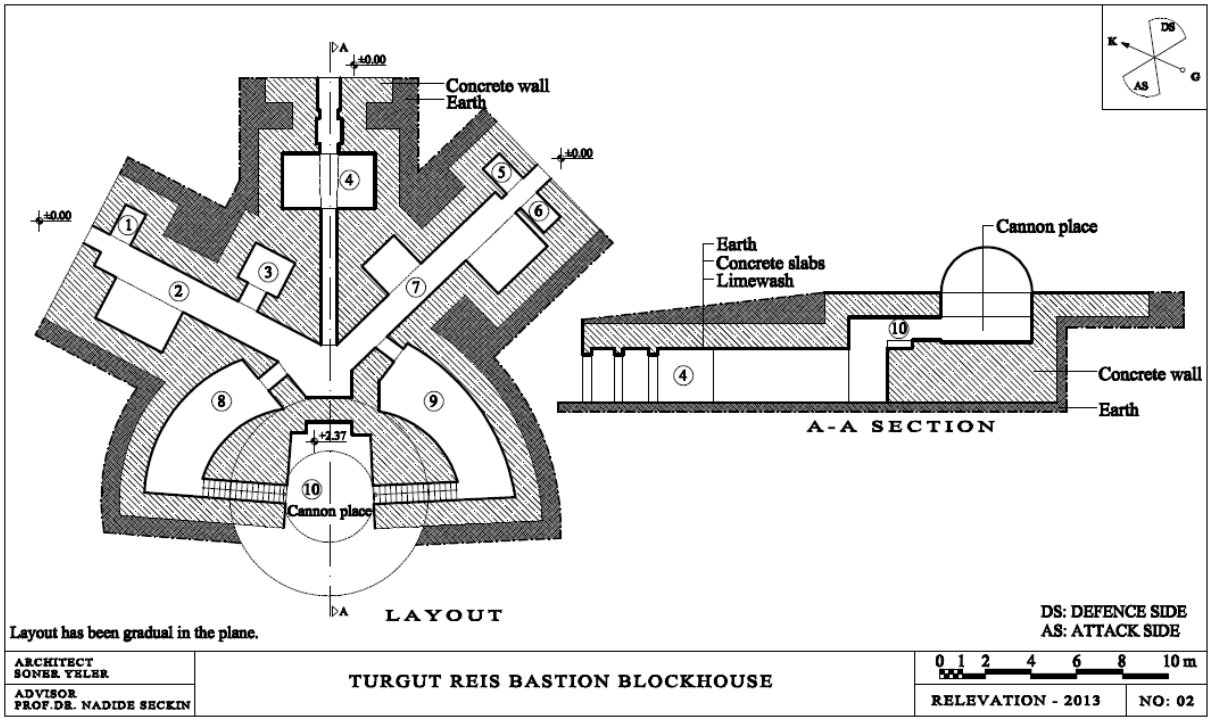


Figure 5: The example of concrete construction system, Blockhouse of Turgut Reis Bastion, 2013 [8]

3.1 Walls

The foundation walls of single or two floored construction units of the bastions were predominantly rubble stone walls (see Figure 6). The height of foundation walls could not be determined since an excavation could not be performed. Rough sculpture stone and alternating and random fabric systems were used in addition to rubble stone in the inner and outer walls which were placed on foundation walls. On the rubble stone wall, brick horizontal beams were used in the form of maximum 3 vertical rows (Figure 6). Outer wall thickness ranged from 1.00 to 2.10 m, whereas the thickness of walls used in between-space passages ranged from 0.45 to 1.85 m.. The surface of inner walls was made of horasan (mortar made of brick dust and lime) and was covered with limewash. The facade coating of outer walls was made of ashlar. In the reinforced concrete system, outer wall thickness ranged between 0.50 and 1.00 m. The surface of inner walls was generally covered with limewash (Figure 7).

(a) (b) (c)

Figure 6: Powder magazines of Namazgah Bastion, (a) brick arche and niche 2013, (b) vault and brick walls which were placed on ruble stone foundation walls, 2007, (c) brick and rubble stone alternating wall and ventilation holes, 2013.

(a) (b) (c) (d)

Figure 7: (a) ashlar facade wall of powder magazine of Rumeli Mecidiye Bastions, 2013 (b) spilled stone cladding of quarters of Big Tasocagi Bastion, 2013 (c) ashlar facade wall and stone stairs of powder magazine of Anatolia Mecidiye Bastions, 2013 (d) reinforced concrete facade wall of blockhouse of Anatolia Mesudiye Bastion, 2013.

3.2 Floorings

The floorings of bastions that were not restored was compressed soil. The floors of places that were subject to intervention were made of cement finish. The floors of places in bastions that were subject to restoration were stone covering and the mezzanine floor sections had timber floor over timber covering.

3.3 Top covering

Top covering systems of bastions were brick vault and can be classified according to places as drop vault, semicircular vault or quarter vault. Vault thickness changed between 0.50-1.20 m, and the thickness of soil on vaults ranged between 0.50-6.50 m. according to construction units and the location of measurement. The soil layer is a mixture of soil-clay-horasan [5]. Bastions that were built with the reinforced concrete and mixed systems had a top covering of flat slab (Figure 8).

(a) (b)

Figure 8: (a) brick vault on masonary foundation walls of garrison and quarter of Kirklareli Seyfioglu Bastion, 2004, (b) reinforced concrete slab supported by steel profiles of Canakkale Anatolia Mesudiye Blockhouse, 2013

3.4 Doors and windows

Brick and coarse sandstone was used in arches of door passage and window opening areas that are on the rubble stone walls of inner spaces. The door and window opening on facade were also placed with a specific arrangement and the arches were made with the same material. Doors and windows in restored bastions were made of timber woodwork (Figure 9).

[5] This information was obtained from the restoration report of the Namazgah bastion. This report of 2005 was prepared by Architect Nilgun Olgun and Architect Asuman Divan for Nik Construction and Trade Ltd.

(a) (b) (c) (d)

Figure 9: (a) brick door and windows arches and vault of Garrison building of Seyfioglu bastion, 2005 (b) coarse sandstone passageway wall of garrison and quarter building of Dortkaya bastion, 2013 (c) ashlar window of ordance depot of Namazgâh Bastion, 2013, (d) segregated, rubble stone retaining of walls powder magazine of Aynalibag Bastions, 2011.

3.5 Ventilation holes, channels, and niches

The ventilation holes and channels in bastions were built in order to protect the ammunition in the ordnance depot, where military equipment was stored, and in the powder magazine from moist and to provide air circulation. Ventilation holes were opened on inner spaces, foundation walls, and other interior walls in a specific order that contains 1-3 rows (on ground level and higher). The size of squarely and rectangularly cross-sectioned holes changed between 10x10-10x15-17x17 cm and their depth ranged between 50 and 140 cm. On some walls, the holes continued to exist throughout the wall depth. The ventilation channels which connect with stove niche, other niches and holes and which are the same size as holes, were placed between the wall surface and hole depths. On some walls, the channels continued to exist throughout door and window openings. The holes and the channels were formed with spaces left within the brick horizontal beams or rubble stone walls. Brick and coarse sandstone was used in the stove niche and other niches (Figure 10).

(a) (b) (c)

Figure 10: brick stove nich, ventilation holes and vault of garrison of Kırklareli Seyfioglu bastion, 2005 (b) brick horizontal beams, stove niche and ventilation holes of Garrison of Kirklareli Tas bastion, 2009 (c) A detail of ventilation shaft of garrison and quarter building of Hidirlik Bastion, 2009

3.6 Ventilation shafts

The ventilation shafts made of brick materials on the vault continue until the soil top level and their numbers and sizes differ according to space size. In powder magazine and ordnance depot, there were no ventilation shafts.

In construction components, bricks which were sized 4-6x8-12x22-30 cm were used. Considering the writings and dates on the bricks, it can be said that these bricks were exclusively produced for bastions (Figure 11).

(a) (b) (c) (d)

Figure 11: Bricks (6x10x23 cm.) used in building components of Edirne Ayvazbaba bastion (a) "Dimitri" script on the brick (b) "1888" dated brick (c) symbols on the brick, 2011, (d) "fortification" script on the brick Aynalibag Bastion, 2011.

4 PROTECTION PROBLEMS OF BASTIONS

Responsibility of protecting and managing monuments according to international standards is an important topic which is mentioned in international regulations. Also defining the historical defense that took place at the location, bastions possess the quality of being historical landmarks. The first step of protection is to investigate factors that cause the deterioration of monuments [10, 11, 12].

Previous evaluations have shown that the causes of deterioration affect each bastion differently according to the location of bastions, climate of the location and status of occupation. Factors that cause deterioration of bastions were evaluated under two titles, which are natural factors and man-made damage.

Five bastions[6] included in our study were used as military museums following renovation. Three bastions[7] , which are currently under construction for renovation, were projected to serve as museums. Forty six bastions, which are owned by or assigned to different parties, are vacant or are used as warehouses.

Neglect is the most important cause of deterioration in bastions that are completely abandoned or are unused even though they were assigned to an institution. In addition, natural factors such as wind, rain, and temperature differences between day and night accelerate deterioration; therefore, moist, loss of equipment and collapsing occurred on the vault covering and inner walls. Efflorescence on coated surfaces and corrosion of metal construction components occurred due to moist. Abrasion, disengagement, and spillage were observed on façade surfaces; whereas color changes and pollution were observed on stone coverings. In addition to moist, drops with dense salt which were cast from the sea by the wind and dust were more effective in deteriorating Canakkale bastions compared to other bastions. Furthermore, seeds blown about by the wind led plant and tree roots to develop within the surrounding of bastions and these roots shut some of the space entrances as well as deteriorating materials and fracturing walls (Figure 12).

It was determined that bastions which were assigned to an institution and used were in better condition compared to abandoned bastions. However, as a result of interventions such as building new additions, adding bearing or sectioning walls, and changing the location of

[6] The Namazgah, Rumeli Mecidiye and Ertugrul bastions in Canakkale, which are property of the Gallipoli National Parks, are used as museums; whereas the Cimenlik bastions in Canakkale are used as military land and navy museums.

[7] Hidirlik bastion in Edirne and Anatolia Hamidiye and Camburnu bastions in Canakkale.

stairs, the original plan and facade organization of the bastions have changed. Also, there were newly coated and painted surfaces on building facades (Figure 12).
"Treasure hunters", who constitute another threat to bastions, caused partial collapse in the constructions since they make excavations and demolitions.

(a) (b) (c) (d)

Figure 12: (a) Interior walls covered with moss of powder magazine of Kumkale Bastion, 2013, b) Vegetation problems in entrance of powder magazine of Bosna Bastion, 2013, (c) Vegetation problems on the exterior walls and plasters of powder magazine of Bolayir Merkez Bastion, 2013.

5 CONCLUSIONS

Bastions of the Thracian Region, which were examined in the present study, are of paramount importance since they are considered to be monuments and military architectural heritages even though they do not serve as defense constructions any more. In order to protect these heritages and maintain their existence in the future, it is important to conduct strategic planning aimed at protection and to promote their functionality. The present study demonstrates the bastions' level of strength in maintaining existence in the future. The nine bastions in the study site protected their original status; however, the spatial integrity of six bastions was deteriorated due to latter interventions. In terms of the status of materials and construction components, immediate precautions should be taken in four bastions. The structural integrity of two bastions was in danger. Other bastions were abandoned. It was determined that traditional materials including stones, bricks, and bounding materials, which were used in defense constructions until today, were not investigated sufficiently. Future studies should rectify the shortcomings in material knowledge via experimental studies and determine the strength of materials used for repairing these constructions.

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