DEFENSIVE MECHANISM OF THE FORTRESSES

A fortification consisting of ramparts, parapets, gate ways, towers, as well as devices, digging of wells, tanks, trenches to ward off insecurity of the palace makes it beautiful and more defensive. *Samaranganasutradhara* chapter 13th -15th deals with the fort architecture, planning of the Royal palace of varrieties both residential and pleasure palaces together with their architectural details of floors, pillars, storeys and ornamentation.\(^{59}\)

In India architecture, is called *Shilpa – Shastras* as wellas *Vastu-Vidya*. In *Manasara* also the palaces are devided into nine classes with regard to their sizes. Thus, the *Samaranganasutradhara* bestows its attention upon its defence and external look of fortification.

The St. Angelo fortress represents the European military and economic interest in the port town of Cannanore and the fort Bekal at Kasragod represents only a military and regional trade interest of Nayakas of Ikkeri, and later of Tippu Sultan and then Britishers. The St. Angelo fortress served as a safe haven in which the Portuguese interest was able to flourish for more than one century and a half. Both the St.Angelo and Bekal fortresses are built on a rocky pinnacle jutting out into the Arabian Sea. The roadstead provided the best defense, encircling one-third of the fortress premises and providing only a single openig towards the land. St. Angelo fortress built by the Portuguse is considered the most formidable structure from point of view of defence. The land side fortress was protected by three bastions and wall, stretching from one end to the other end on the water. The main centre of the fort built on a rocky cliff was completely detached from the rest by a moat around. The citadel was built along the edge of the moat on the other side making it even more inaccessible. The safety of fortress from an outside attack was assured by the rocky cliff on the sea side which was almost inaccessible by nature and was reinforced by strong walls and flanks on its

\(^{59}\) Pushpendra Kumar, ed., *Bhoja’s Samaranganasutradhara.*, New Delhi., 1998, pp.iii-liii.
slopes. After the Portuguese, the fort was continuously occupied by the Dutch, the British, and the Arackal family. During these periods there was continuous fluctuation in the size of the Cannanore garrison. In the period of the Dutch earmarking Cannanore as the key to the north and the frontier of Cochin, Van Goens recommended a garrison of eighty to one hundred men at St. Angelo fortress to control the local trade and protect the commercial interest of the Jan Company.

The soldiers were drawn from various European nationalities but were mostly of Portuguese, Dutch or German origin. This policy on occasions created trouble as there was a risk that these soldiers could run away to other European settlements near by. There were also instances of desertions by the soldiers and it was considered a criminal offence and if caught these renegades were given severe punishments. The comparative technological superiority of the European fortress in the employment of firearms and navigational techniques encouraged a growing demand of soldiers from local communities like Nayars, and the pulayas were usually categorized as coolies in the muster roll of the factories. A detailed study has been made on the defence mechanism of the fortresses herebelows.

A. GROUND PLAN OF ST. ANGELO AND BEKAL FORTRESSES.

St. Angelo fortress at Cannanore and Bekal fortress at Pallikare in Kasaragod have been constructed on elevated hillocks near the Arabian Sea situated north to south direction.

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61 Ibid, P. 97.
On plan St. Angelo fortress is triangular, having 11.97 acres of total area and Bekal fortress is roughly polygonal and very large in size and having 36.4 acres. (Figures.6 & 7)

Both the fortresses are important from military and strategic points of view and they are well protected by natural environment. The deep sea on all three sides and a deep moat on the landside provide extra security to the fortresses.

In St. Angelo and Bekal fortresses the natural laterite outcrop with faults and folds looking like an artificial foundation and walls serve the purpose of the rampart and it is stronger than the structural wall. The landscape of boulders, the rocky outcrop and the way in which the fortresses and other buildings are integrated with landscape make St. Angelo and Bekal fortresses beautiful historical sites. There is seldom more than one entrance to the fort and this is generally the strongest part and the most remarkable feature. The outer main gateway is protected by bastions on both the sides and covered with screen walls which make narrow passage which automatically renders approach to the main gate hazardous. The Cannon balls could not make any impression on the walls of the St. Angelo fort which was impregnable.\textsuperscript{62}

i. Foundations

There is no significant information about what the original building looked like; it may have had the triangular design that can be seen today. Gaspar da India was probably exaggerating in considering it to be stronger than the Rhodes fortress, but it is certain that at least a part of it was built in stone.\textsuperscript{63} Coastal fortresses are built on some natural cliff or a spit of land more than half surrounded by the sea which naturally provides military advantage. The target of construction was the whole top of the hill or a wall relieved by numerous bastions.


\textsuperscript{63} Genevieve Bouchon, Regent of the Sea, Cannanore’s Response to Portuguese Expansion, 1507-1528, trans. by Louise Shackley, Delhi, 1988, P-78.
surrounding the end of the promontory. If there is any slope or place likely to invite outsiders approach, a profrunding work is projected and connected with the main fort by a passage between double walls.

The Foundation of the ramparts of the fortresses was laid on a laterite outcrop by deep excavation in certain places and gripping the battered bases of the fortifications in between the jutting out laterite rocks providing safety to the superstructure of the wall against lateral thrust. Some of the land fortresses like Thangassery near Kollam, and Housdurg in Kasaragod where the foundation is simply studded between the pockets of the produced rocks on a precipice hill, such types of foundations of the fort wall cannot sustain the impact of cannon and mortar on account of brittle nature of the gripping rock looking like an artificial stone masonry due to the fortification and lamination.

St. Angelo and Bekal fortresses are situated on the mounds of mixed soil with hard moorums and laterite stone bed, having resistance power against erosion because it posseses a high bearing capacity. They are raised over a firm starter of the hill, gripping the protruding rock faces. An offset of masonry is left upto the plinth level wherever the wall is raised over the laterite outcrop and then the superstructure is built in tapering upto the bottom most course of the merlons. The walls are remarkable for their loftiness rising straight out of the sea, and covered with trees and shrubs as to be very picturesque.

ii. St. Angelo Fortress: Main Entrance or Gate Way

The main entrance of St. Angelo fortress as of now is located almost at the north eastern side with a draw bridge built in between the land side moat and the entrance of fortification. The moat is measured 225.70 meters’ length from Northeast to North West
direction and 19.30 meters’ width and 8.50 meters’ depth. St. Angelo fortress has a zig-zag narrow passage reaching to the main entrance door facing east at north eastern side. The entrance door to the fortress has two panels of teak wooden doors measured 3 meters’ length and 1.40 meters’ width for each door. The overall door way along with doorjambs and lintels is of 3.41 meters’ height and 3.15 meters’ width. The doors are studded with sharp iron spikes. On the left side door a postern (wicket gate) measuring 1.10, meters’ height, 60 cm width is arranged. Machicolation and sculptured figure are not found in the door. (Figure. 8, 9, & 10)

Immediately in front of the main entrance on the eastern side below the triangle bastion a parallel curtain screen wall as mentioned earlier in order to render entry hazardous to the stranger. The curtain screen wall runs towards the moat in zig-zag manner and it is measured 33.53 meters’, 14.63 meters’, with 9.14 meters’, again 21.34 meters’, 14.63 meters’ and 46.63 meters’ wall joins along with Draw Bridge. Thus the free movement or easy escape is restricted from moat to the main entrance. The zigzag entrance and the trenches on land side of the fort show the defense strategy connected with the fort. A subsidiary arch type gate measuring 2.63 meters’ height and 2.10 meters’ width facing eastern side with flight of steps is noticed in front of the main entrance. Through this subsidiary gate all the materials might have been taken into the fortress (vide-main entrances. Pl.37 A&B)
iii. **Bekal Fortress: Main Entrance Gate (Gopura or pratoli)**

Entry is through the main gateway facing the north, and is surrounded by sea on the east, west, and the south (Pl.2A). There was also an inner fort. The fort consists of many bastions and a watchtower in the centre. Inside the fort there are four subterranean passages all leading to the sea. Temple dedicated to the Lord Hanuman is found in one of the front bastions, and two sunken wells are noticed in the middle of the dry moat.

The principal entrance of the Bekal fortress is facing the northern side connected by the drawbridge over the moat as at St. Angelo fortress. Since both the fortresses are having single main entrance they can be called *ekamukha-durga*. The moat in front of the fort on the land side dug out and the dug out laterite blocks have been used for the construction of the rampart. The moat measures 14.50 meters in width and 3.25 meters at the present level of depth. After crossing the drawbridge one can find the first entrance facing north with 6 meters’ hight and 2.90 meters’ width (Pl.11A). Construction of this gateway is based on trabeate style having antechamber and semi circular bastion, built on either side of guards’ chambers. The walls are built with laterite veneer stones. The opening has been bridged by heavy stone architraves supported on both facade of the gate by corbelled brackets of homogenous stones coupled together. The brackets have been employed to distribute the dead load of the superstructure just above the gate equally to the foundation soil. The entrance gateways to the citadel built with thicker stone slabs have been used in the structure in decreasing order upto the top of the merlons.

Once we enter through the first gate of the Bekal fort the zig-zag passage leads to the second entrance which is measured 7.10 meters high and 4.05 meters wide connected with square guard chambers (PL.2B) measuring 15.40x15.40 meters on either side reached by five flights of steps. There are two bastions of rectangular shape in front of the gate on eastern and western sides. They are 37.50x11 meters respectively. The western side bastion having an
image of Hanuman indicating the northern side protection has been worshiped even till today by local devotees and converted into a semi functional Hanuman temple. The Hanuman temple and the ancient Muslim Mosque nearby hold testimony to the age-old religious harmony that prevailed in the area.

The height of rampart wall is 6.30 meters; on top of the eastern bastion a magazine powder grinding stone of laterite measured 1.70 meters’ length and 30 meters’ width in oval shape still lying in the entrance of the bastion.

Both these main entrances might have been provided with wooden doors, which are now missing. In the second main entrance an iron gate has been provided. The entrance of the Bekal fortress shows similarity with that of Vijayanagara architecture and the indigenous style, whereas that of St. Angelo betrays the Indo-Portuguese style of architecture.

In the first entrance of the Bekal fort we can see the subterranean passage within the guardroom through the thick wall connecting the bastion on western side. In Bekal there must have been decorated torana dwara (entrance traditional decoration) on the façade of the gateway, which is missing now. Gateway at Bekal is typical of indigenous Hindu construction; the unique features are sharp and abrupt curves, steep ascends, most suitable to trap the enemies while they approach to enter the fortress. Mud mortar has been used for plastering the battlement parapets, kiosk and merlons.

B. **Bastions, Ramparts, Merlons, loopholes, and gunpoints at St. Angelo Fortress**

St. Angelo fortress is having only three bastions in good condition and they are situated at eastern side, northeastern corner and northwestern corner of the fortress. On plan, the fortress is almost triangular and part of the fortification rampart walls and bastions on the western side are breached out by the sea waves. [PL. 40 A] The fortification-wall or Prakara of Cannanore fort is found to be immensely massive in construction, besides being fairly
compact in consolidation so as to defy artillery attacks. Like the Prakara fortification-wall, the bastions (attalaka) too are built with the excavated laterite stone from the moat (Parikha) endowed with conspicuous dimensions. These bastions are still fairly intact and well preserved.

i. **East side bastion:**

It is situated near the entrance facing eastern side measured about 19.30 x 12.15 x 12.10 meters in triangle form, on the top of the bastion there is a basement with a wall measuring 19.30 x 6.0 meters long. This might have been a structure raised over the bastion for watch and ward staff. Steps’ leading towards the northeastern side bastion along the top of the fortification rampart wall is a unique feature noticed in Portuguese fortress. The height of the bastion is about 8.35 meters from the ground level. (Pl 38 A)

**North Eastern Bastion**

Eighteen steps lead to the top of the bastion from the walk wall of the fortification, the bastion measured 34x 25.30 meters almost square in shape, and on the top of bastion there is a square platform made of granite slabs measuring 30 x 30 cm with 10 cm thickness of each slab in order to make the bastion bear the impact of the cannon firing as well as smooth mounting and moving of cannon vehicle on the top of the bastions these granite stone slabs are paved on the surface of the bastion by the Portuguese architect, which are not noticed at Bekal fortress. The height of the bastion is almost 10.70 meters from the ground level. (Pl 38 B)

Altogether there are eight medium size cannons mounted on all sides of north east bastion, they are 2 meters long, 1.15 diameter at bottom and 65 cm at mouth portion. In some
of the cannons floral designs are noticed. There are some more cannons mounted in different location altogether about 21 cannons are noticed. (Pl 44 A & B)

**North Western Bastion:**

Between Northeastern bastion and Northwestern bastion the length of fortification rampart wall is about 370.50 meters and about 17-meters broad. On the top of the rampart wall in the middle portion the Portuguese built a tall lighthouse with ladder for directing the ships’ movement and a Dutch inscription carved in granite slab is also found. (40 B, & 41 A) The bastion measured 24.30 x 16.50 meters inside; there are eight gun points along with embracers. The thickness of the embracer wall is 3.75 meters. Here also the flooring is the paved granite stone slabs, and in one of the corner a flag post also is found. The stone floors over the bastion technically helped in lifting up the guns mounted on the vehicle so smoothly and brought them down (Pl 43 B).

**Light house and Flag-Staff:** The following information is traced out from the table of lighthouses round the coast of the Madras presidency west to East including Ceylon, pp. 147-148, Appendix no XLII, Chronolgical list of Territories acquired by the British within the presidency and their brief subsequent history page 275(30) fort of Mount Delly, year 1754.

Cannanore fort flag-staff in lat 11 51’ 20’’ N, long 75 21’ 45’’ E bears from mount Delly fort south-east ½ east 14 miles and is about 9 miles to the north-west of Tellicherry. The point is 2 cables long west-south- west of the flag-staff and has a reddish appearance to the west of the fort. There are British barracks, between which and the sea are three or four coconut trees overhanging the sea. To north of these, there are several houses amongst trees on slightly elevated red cliffs about 40 or 50 feet above the sea. To the north-north- east of
the flag staff is the English church on elevated ground and other houses and trees beyond. The houses of Cannanore cantonment extend along the cliffs some distance north of the fort.

Four and half miles north-west of it there is a projecting rocky point of elevated red land with high coconut trees, and 3 miles further north—west is the mouth of Baliapatam river below which excellent poon spars for ships’ masts are brought. Between the above red point and the base of mount Delly the sea-shore is low, sandy and fringed with coconut trees, 3 or 4 miles further inland the country becomes hilly and there is a backwater communication for boats from this river to Hosdoorg, nearly 30 miles to the north, passing to the east of mount Delly. Good water may be obtained from the wells on the beach to north-east of the fort. Fresh provisions and refreshments of various kinds and excellent fruits may be procured. There are government commissariat and ordinance department at Cannanore. Vessels may anchor during the fine season in 5 ½ to 6 fathoms with the flag-staff from north east by north to north east by east about 2 ½ miles off shore. Large ships should be careful not to approach the point too close. The best anchorage is reported to be with flag staff bearing north by west in 3 fathoms low water. Ships and boats can easily land in the bay to north-east of the fort. The custom-house is on the sandy beach more than ½ mile east of the fort. There are a few sunken rocks off Cannanore point but not outside of 4 fathoms. With a south or south-west wind a heavy swell prevents landing in Cannanore bay.64

ii. Cells and secret passage:

When Vasco da Gama reached Goa as the new Portuguese Viceroy in September 1524, he came to Cannanore and stayed there for three days. During his stay at Cannanore he prompted Kolathiri to grant one of his important demands. Kolathiri obliged and handed over Baliahassan described as ‘Pirate’ in Portuguese records—a great naval fighter who posed a big

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64 Appendix no XLII Chronological list of Territories Acquired by the British within the Presidency, and their brief subsequent history, 1754, fort of mount Delly, Madras Archives, (30) p.275.
threat to the Portuguese ships through his light raids in his small boats. The reason behind the Kolathiri’s action to hand over one of his subjects and a great naval fighter who had been threatening the Portuguese power for years, was to please the new Viceroy. After the death of Vasco da Gama, the mysterious prisoner remained in the Cannanore fortress dungeon (Cell) for some months. D. Henrique-D. Menesse- Vasco da Gama’s successor condemned the ‘Pirate’ to death on 26 January 1525; his hands were cut off and his corpse was displayed on the battlements of the citadel.⁶⁵

In the light of the above statement, we can understand the importance and use of these cells at St. Angelo fortress and it is noticed that altogether there are five secret cells and one passage inside the St Angelo fortress. Four cells are found in inner side of the underground fortification wall. The maximum width of the rampart wall built with double wall system which helped the Portuguese architect technically making such domeshaped underground cells inside the wall with curved domeshaped ceiling clearly reveals the intelligence of the fort architectural technique under the Portuguese. The cells are not visible to the naked eyes while walking on the top of the fortification walls. No one except the Portuguese soldiers knew it. The soldiers must have been housed in straw huts built under cover of the rampart.

**Cell No 1:**

It is located just below the eastern side bastion with small entrance and a window measuring 1.35-meter in height and 90 cm in breadth. Inside the cell the floor length is 4.85 meters, and breadth is 2.33-meters. The floor of the cell is paved with the laterite stone.

(Pl 42 A)

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**Cell No 2:**

It is noticed below the steps, which lead to the top of the main entrance of the fortification rampart wall. It has 1.32-meters’ height, 0.60-meters’ breadth. One can go inside by kneeling down.

**Cell No 3:**

It is located below the northeastern side bastion having 2.30 meters’ height, and 90 cm breadth in door way. The remains of doorjambs are seen in wood, inside the cell 5.23-meters long and 3.75 meters broad 3.60-meters high in domeshape ceiling noticed. (Pl 42 b)

**Cell No 4:**

It was most probably used as a prison cell or underground jail, because it is located below the northwest corner bastion. It measures 1.70 meter in height, 1.20 meter in breadth from the entrance and the inside cell is measured 6.60 meters long, 3.30 meter broad, and 2.90 meter high with a domshaped ceiling. It was believed that there was a deep hole inside the chamber deliberately made by the builders in order to fool the prisoner if any one tries to escape through this hole he himself will be falling into the deep sea. (Pl 42 c)
Cell No 5:

It is dug out on the ground itself in circular shape towards southern side of the inner side fortification and only one person can go down by jumping inside, and there is enough space inside to keep ammunitions. It is believed traditionally that this particular cell must have been used as underground passage from Cannanore fortress to Tellicherry fortress.

Underground passage

This particular underground passage underneath of the 17 meter’s broad fortification wall most probably was used for crossing the outside moat and connecting the ancient triangular barrack on the land side through the drawbridge which was existing along the moat and the evidence of the drawbridge four pillar bases have also been visible during the dry season inside the moat. Most probably through this passage horses and ammunitions were brought through the northern side moat. This is also another significant feature of the of St Angelo fortress.

The underground passage is 3.60 meters’ deep and 2.40 meters wide. Thus the passage, moat, and newly excavated ancient fortress (triangular barrack) on northern side are directly connected. (Pl 52 A)

iii. Horse Stables

Samaranganasutradhara gives an elaborate description of the royal stable (Asvasala ch. 33). The stable forming a part of palace, should be laid to the south of the inner chamber (Antahpura) so that while entering into it, their neighing should be heard on the right and this is deemed as auspicious.66

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66 Pushpendra Kumar, Samaranganasutradhara, Delhi, 1998, p. (Xci).
Horse stables at St. Angelo fortress are situated in North-West side of the fortification in “L” shape, and it runs towards north east then it takes a turn towards the south. They have been numbered, as building no 4, 13, and 14, by the builders, on one side it is double horse stable and on the other side it is single horse stable. The double horse stables having 8.25-meters broad, with 1.5-meters wide from the center-dividing wall. The length of the stable is 82.65 meters, and altogether 42 of double horse stable in one row and 9 single row horse stables can be seen. Stables are provided with door, which must have been of wood, and the floor has been paved with laterite stone; the ceiling portion is in domical shape plastered with lime mortar. The entrance of the stable is 2.75-meters broad. Presently a stable has been converted into information gallery for displaying photographs of the centrally protected monuments in India, with special reference to Kerala. In 1512 Afonso de Albuquerque announced the presence in Cannanore of the king of Comorin’s envoy who had been instructed to buy horses for gold fanams. In addition, ships specially adapted for the transport of large animals, were brought elephants to Cannanore from Ceylon

iv. Moat

Moat is excavated towards the land on the northern side of the fortress and submerges with Arabian Sea on east and west sides. The moat is man made (artificial) (parikha). This has been caused by scooping the laterite outcrop upto a considerable depth. It extends to the northern side. The ditch is found to be fairly deep, its basin too is very wide and natural water is still available. It is connected to sea water. Unlike Bekal moat the Cannanore moat still has water and is well protected and preserved from the human vandalism. It is about 225.70 meters long with 30.05-meters broad and 8.50-meters’ depth; (PI 49 B) It was connected by natural sea water during its hey days of the Portuguese. On the southern side of the inner

fortification area inorder to give extra security to the citadel where the Captain’s bungalow is situated, there is another small moat observed which is running to east west direction with 68.70 meters’, length, 7.75 meters, broad, and 4.50 meters depth. It is bridged by a drawbridge for free movements. (Pl.53 B)

C. Bastions, Ramparts, Merlons Loopholes, and Gunpoints of Bekal Fortress:

The massive and extensive Bekal fortification rampart walls are pierced through fifteen bastions with two main entrances on northern side. On western side a mall subterranean gate or passage, which leads towards the Arabian Sea, has been noticed. The basic difference between St Angelo and Bekal is that the Bekal bastions are crowned by Merlons with large number of loopholes and crenulations especially towards the main entrance and all along the rampart walls. Whereas, at St. Angelo fortress, the Portuguese had not given much importance to the loopholes. They have given only embracers on the bastions and exclusively depended on huge cannons rather than small weapons like bow and arrows etc. In both the fortresses the walls are built in ‘L’ shaped design with battlement, and only in Bekal fortress the walk wall is horizontally provided along the inner side of the fortress. Heavier blocks of stone have been used in the base while the smaller stones were set in diminishing order. Both the fortresses could not be aimed at by cannons from any nearby site on account of the topography of the surrounding sea on three sides. The incoming enemy could be shot by the cannon mounted on bastions of the fortresses due to their strategic location. St Angelo and Bekal fortresses are interspersed and strengthened by well equipped bastions which are located at appropriate strategic points, hence both the fortresses still remain in their original shape and sizes except at certain points where the walls are breached by sea waves and other natural calamity. As already mentioned the Bekal fortress has fifteen bastions of semi circular, octagonal, oval, square, and rectangular shapes. Whereas in St
Angelo fortress there are only three bastions at northeast, northwest, corners and at the central point of eastern side. The bastions on the western side are almost breached out by erosion of sea waves. In Bekal most of the bastions are drum shape with slight tapering towards the top just below the merlons and have been built with massive chiseled and well dressed laterite stone masonry in mud mortar binding and using rough tool cut-stone at the base. The size of the cut stones decreases as the height of the masonry wall of the bastions increase. At the apex, small cut stones have been utilized. Loopholes and crenulations for cannons and also for pouring hot water through the loopholes on enemies pierce the bastion walls. The fortification varies in diameter, thickness and height at all places and has been built according to the contour of the hill with its undulated features. It is composed of immense block of stones with mud mortar. The parapet of the fortification is surmounted by merlons resembling miters. A horizontal band of masonry with perforation separates each merlon. Merlons are provided with vertical loopholes for discharging the cannon, through these slots while peeping through the perforation to aim the enemy. Arguably the fort was built exclusively for fulfilling the defence requirements. The holes on the outer walls of the fort are specially designed to defend the fort effectively. The holes at top are meant for aiming at the farthest points, the holes below are meant for hitting when the enemy is nearer and the holes underneath facilitate attacking when the enemy is very near to the fort. This is a remarkable evidence of medieval technology in defence strategy. At the points of strategic importance particularly on the straight walls and additional ramparts, walk-wall has been built all along from inside the fortress and it is reached by a flight of steps. Besides this, the fighting platforms have also been provided. Bastions are the integral parts of the fortification and they function in two ways, as buttress in the form of bastions to withstand the lateral

thrust and the watchtower. Bastions at Bekal fortress have been counted starting from eastern side of the northern main entrance.

**i. Bastions and watchtowers**

**Bastion No 1:** The outer diameter of this bastion no I is approximately 31.80 meters with five gun points and embracers. Along the bastion, copingstones are provided.

**Bastion No 2:**

It is connected to bastion one by 71.30 meters long rampart wall and the bastion is 39.90- in diameter. There are five gunpoints of arch type. The height of the bastion is 14.20 meters from bottom to top. It is a two-tired bastion. (Pl 5 B)

**Bastion No 3:**

It is connected with bastion two by 74.90 meters long rampart wall and it is 11 in diameter. Drainage is also noticed towards the moat passing through below the bastion. There is a well dug out in the middle of the moat. (Pl 7 B)

**Bastion No 4:**

It is connected by bastion three with 39.70-meters long rampart wall and it is 17.10 in diameter. Three gunpoints and two embracers are noticed.

**Bastion No 5:**

It is connected by bastion four through 102-meters long rampart wall. It is situated in southeast corner of the fortification. It is 29.60 in diameter. Three gunpoints and, three embracers have been noticed. Near this bastion an underground passage also been noticed and it is 2.30 meters in deep and 1 meter in wide. It provides entrance towards the sea through the underneath fortification wall.
Bastion No 6:

It is connected with bastion five by 83 meter long rampart wall and it is almost breached out by sea erosion and now a long wall has been provided in order to support the bastion about 8.50 in diameter.

Bastion No 7:

It is connected with bastion six by 94.70 meters long rampart wall having about 19.80 diameter. There is only one gunpoint facing the sea. There are nearly fifty loop holes in the bastion.

Bastion No 8:

It is connected with bastion seven by 59.10 meters long rampart wall having 16.25 in diameter. A magazine powder grinder measuring 74x74cms of laterite stone is found in situ of the bastion. Only one gunpoint facing the sea and almost thirty-five loopholes of various sizes are noticed around the bastion.

Bastion No 9:

It is 18.30 in diameter, and is connected with bastions eight and ten by 85 and 66.70 meters long rampart walls respectively. Two loopholes of arch type for gunpoint have been noticed.

Bastion No 10:

It is 21.10 in diameter and is connected through bastion nine and eleven by 66.70 and 9.30-meters long rampart walls. There are about forty-two loopholes of gun points noticed.

Bastion No 11:

It is 21.90 in diameter and is connected with bastions ten and twelve by 79.30 and 72.10 meters long rampart walls respectively. There are about thirty loop holes of arch type in 40x40 cms height and width. In the middle of the rampart wall a small subterranean gate or
passage is provided to enter into the western side of the Arabian Sea. The passage measures 0.95mtr wide and 1.65mtr high. (Pl.3 B)

**Bastion No 12:**

It measured 22.90 in diameter, and is connected by bastion thirteen with 45.70 meters long rampart wall decorated with series of merlons numbering 29, measuring 75 x 95 cm with loopholes. This bastion is located in the northwest corner of fortification wall and the bastion is 5.60 meters high. There are two archetype gunpoints. There is also gunpowder grinding laterite stone of 90 x 90 cm with 20 cm depth.

**Bastion No 13:**

The bastion no 13 is 23.85 in diameter and is connected with bastion fourteen by 63.30 meters long rampart wall. There are three gun points of 1.40 meters in height and 50 cm in width. The height of the bastion is 9.30 meters.

**Bastion No 14:**

It is square in shape, having 7.80-meter in width, 11-meter in height. There are four gunpoints along with four embracers measured 1.9-meter height, and 1.10-meter thick.

**Bastion No 15: Three Tired Bastion**

It is one of the most significant bastions with regard to the construction. It is a three tired bastion connected with bastion fourteen and northern side main entrance by 47.85, and 33.50 meters long rampart walls respectively. It is built one over the other. First tire is the lowermost one having 38.70 in diameters, and 5.70-meter high. It is built over the 4-meters laterite outcrop itself designed as foundation. There are twenty-five merlons. The second tire is built over the first one having 30.10 in diameter with 5.30 meter high along with 2.25 meter broad in the path way noticed, over this the three tired bastion is built with 4.20 in diameter, and 5.40 meters high, over this three gun points with eight number of loophole are noticed (Pl.5 A).
**Eastern seaside outer Watch Bastions**

The outer bastions are utilized as watchtowers built near the seaside. One is noticed at the eastern side having semicircular shape with 7.50 in diameter, with 4.25-meters’ width entrance of the bastion- shape watchtower. The watch bastion is with 6 meters height built over the granite outcrop. The thickness of the wall is 1.90 meters and twenty loopholes are seen along with five gunpoints, and six embracers. It is built about 30 meters away from southeast corner of the main fortification wall. (Pl 6 A)

**Western seaside outer watch bastion:**

The bastion is situated about 79.20 meters away from the main fortification wall towards the western seaside on the natural granite outcrop with 30.60 diameter, with three gunpoints of 10 cm in width, and 1.30 meter in width of the bastion wall. Still it is in good condition. (Pl 6 B) Similarly there are two more watch towers in the form of bastion. One at south east corner and the other at south west corner of inner fortification.

**Southeast Inner watchtower:**

It is an octagonal one, having 4.90-meters’ height, and 4.60 in diameter. Near this watchtower an underground passage is noticed which leads to the sea below the fortification wall.

**South West Inner watchtower:**

It is an octagonal bastion cum watchtower of 37.25 in diameter, having slopping approach from ground level of 7.60 meters’ length; there are five gunpoints with five embracers. The embracers’ walls are 1.40-meters in height and 80 cm in width.

**The highest watch tower of Bekal Fortress**

From architectural point of view, this type of octagonal high watchtower comes under colonial architecture. It is in an Indo Portuguese style. This is the highest watchtower and the
entire area can be seen from this watchtower. The broad and wide steps lead to the observation tower which is a rarity. From there one has ample view of towns in the vicinity like Kanhangad, Pallikare, Bekal, Kottikkulam, Uduma; etc. This observation centre had strategic significance in finding out even the smallest movements of the enemy and ascertaining safety of the fort. It is about 13.80 meters in height with 8.40-meters long slope pathway leading to the top of the watchtower. There are about eight-gun points, with nine embracers all around the watchtower (Pl.4 A)

ii. Citadel at Bekal Fortress:

The eastern inner side of the Bekal fortress is given extra protection with watch tower and an inner rampart wall along with small moat and a bastion in the eastern side for the citadel where it is believed that the king must have resided. This is proved through excavation in this spot which brought to light the long rectangular structural remains believed to be the Durbar Hall. The moat excavated deep into laterite outcrop with 86.30-meters long, 3.90-meters broad, and at present 1.90-meter deep, along the moat a rampart walk wall has also been raised with 1.80-meters’ width. A semicircular bastion is raised over the 1.50-meter outcrop 29.30 in diameter. There are about twenty merlons of square shape with arch type loop holes around the bastion, ten flights of steps leading to the bastion from the walk wall. Within the moat a square water tank of 4.50 x 4.50 meters is noticed.

iii. Magazine Room

It is a mixed type of Indo-Portuguese architecture. On plan it is rectangular with wagon-vaulted roof, with 18.45-meters in length and 6.15-meter broad, the walls are only 2-meters’ height, with three windows of 60x55 cm, inside it is 15.20-meters’ length, 3.70-meters wide, and 3.10-meters in height. The entrance doorway is decorated with Hindu architectural style built with laterite and lime plaster. During the period of Tippu Sultan and the British probably it must have been used for keeping ammunition. (Pl.17 b)
iv. Water Management system inside the St. Angelo and Bekal fortresses

There are two main sources of water supply for the forts and palaces.

a. Natural sources of water supply

b. Artificial sources of water supply.

The natural source always depends on rain water and through the Bekal puzha. Main source of water supply was through artificially made deep wells, baolis, (vapi) reservoirs, shallow water ponds, (kripa) pushkarnis, kunda (deep pond) Tadaga (lake) and so on. In the Bekal and St Angelo fortresses only excavated tanks, and dug out wells are noticed. Water was carried by the manual laborers or bullock cart in earthen pots from the different sites to its use. Both the fortresses faced scarcity of water that always remained a great problem. Therefore wells, step wells, cisterns and tanks were dug out within the fortresses and in the moat for water supply.

Mechanical power:

Mechanical power was applied for raising the level of water for its supply to the palace complexes through subterranean earthenware pipes. Water was elevated by Persian wheel over elevated tanks by hydraulic forces. The same was allowed to pass through these pipes into the main water bodies of the Salas of the palace complexes. The channels were either lined by brick masonry or by natural bed rock itself. It was be cut out and earthen conduits were made of terracotta with socket and spigots arrangements. The joints of the socket and spigot were covered with lime mortar. However this particular type of water supply is not noticed in any other fortress.

Wells and water Tanks:

The most essential aspect of fort engineering was to make arrangements for water supply in the fortress. Artificial tanks, and wells were dug out by the builders inside the
fortresses and they have usually utilized the raw materials taken out of digging for raising the massive walls, and buildings. Hence the digging of tanks played double roles in raising the fortresses of St. Angelo and Bekal. Both the fortresses are situated in a dry region and rocky area and surrounded by sea hence the need for drinking water was met by the tanks and wells dug out within the fortresses, and most of the wells and tanks are in good condition providing drinking water to the inmates of the fortresses till today.

**Water Management system inside the St. Angelo fortress**

There are altogether three deep wells inside the St. Angelo Fortress and all the three wells are still providing water to the fortress. Two are situated in northwest side near the horse stable, one is 4.0 in diameter and the other is 3.75- in diameter respectively. Since they are situated within the fortified-area, it can be reasonably presumed that they were the principal source of supply of water to the occupants of the fortress. The third well is situated outside the fortress near the entrance. It has covered tiled conical roof (Pl.46 A & B). These three wells are still well preserved.

**Water Management system inside the Bekal fortress**

**Well No 1:** It is noticed in front of the main watchtower inside the fortress and it is square in shape measuring 2 x 30 x 2 x 30 meters with water

**Well No 2:** Well no 2 Measured 7.9 in diameter, about 50 feet depth and still water is available.

**Well No 3:** It is circular in shape having 12.10 in diameter. Well no 4, is circular in shape with 13.10 diameters, well no 5, is an excavated tank with sloping entrance, water is available even now. Well no 6, is circular in shape and is of 9.20 in diameter dug out from the laterite rock bed. Well no 7 is rectangular tank of 11.80x 8.20 in diameter and water is available. Well no 8, it is a square tank. Well no 9, is also of tank type with nine steps leading to the slop again circular cutting, at present there is no water; it is about 7.60 meters deep. Well no
10 measures 11.40 in diameter and water is available. Well no 11 is noticed inside the moat near bastion number three. Well no 12 is also found inside the moat near bastion two. Well no 13 is noticed inside the moat on eastern side, water is available. Well no 14, is situated inside the citadel moat near magazine room, square in shape measuring 4.50 x 4.50 meter. Well no 15 and 16, are on the eastern side of the inner fortification and they are abandoned (Pl.47 a, b, c). Some of the wells are deliberately located in the basin of the moat with primary aim of fetching water even during the worst times of the season, i.e., summer when water table drips considerably everywhere.

v. **Portuguese Arms and Methods of warfare.** The local powers copied from the Portuguese the European technique and weapons of warfare. Artillery assumed special importance in the wars of the period\(^69\). Matchlocks, guns that could be carried by foot-soldiers were introduced in 1512. The ingredients for making gunpowder had to be imported. Indian guns were generally of Iron and could be easily burst when discharged, causing more damages to the user than the enemy. Indians did not know how to design sailing vessels that could withstand the recoil from the discharge of the big guns. The main arms of the Indian forces were lances, swords, and shields, generally highly decorated. The swords were of iron, some curved, some short, and resound and the points were seldom used, as they did not have backing of iron. There were no hand guards, but only small pieces of elaborately moulded iron that barely covered the fingers. They were also adorned with several brass rings and bells that rattled during swordplay. They wore coats waded with cotton and similarly wedded caps or turbans. The Portuguese wore armour but found body armour difficult to keep clean in the moist Indian climate. Weather cuirasses replaced them. Albuquerque prescribed detailed instructions for upkeep of arms and ammunition as well as armour. He emphasized,” Men

must be encouraged to take pride in their arms”. In defensive armour the Portuguese were better protected than their opponents and the mail clad Portuguese though he might be suffocated in his armour could hardly be killed by any offensive weapon of his opponents. However highly we rate the superiority of the Portuguese in arms, their success did not rest on that alone. They had a vast moral superiority, trained by facing the dangers of unknown seas.  

The Portuguese power was primarily and essentially their dominance at the sea only. They could never assume taking offensive on the main land in south India, where they kept themselves busy defending their factories and fortresses alone, when exposed to external dangers.

Soldiers: The Nayars were the martial class though not exclusively of the society. The rulers and Naduvazhis of medieval Kerala employed them as their bodyguards. Because of their martial credentials, Barbosa commented all Nayars are mighty warriors, Barbosa also mentions that the Nayars of Cannanore were ‘knighted’ directly by the raja himself. The Nayars recieved military training from their childhood at training centres known as Kalaris. Reports of foreign travellers indicate that Nayars sold their military poficiency in the local job market and earned their livelihood from doing so.

Arms: The arms used by the Hindus were lances, swords, and shields. By the middle of the 14th century gunpowder had come into use in Europe and by the end of 15th century a considerable advance came about in the manufacture of gun-carriage which had become lighter and quick to move on wheels. Vasco da Gama’s ship had cannons that were only known on the Malabar Coast but were never in use there. This is evident from the fact that when Vasco da Gama visited Calicut for the second time in A.D. 1502, and took to bombarding it, Zamorin had only two inferior pieces in action and those who worked them

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had no idea of proper aiming in shooting and took a good deal of time in loading them. It was in 1505 A.D. that one finds four Venetians coming to Malabar to cast artillery and since then the art of artillery casting gained a permanent footing here. Indian guns were made generally of iron and not of steel and the Portuguese destroyed them very quickly treating them as if useless. In defensive armours, the Portuguese were better protected than their opponents and the male clad Portuguese thus could hardly be killed by any offensive weapon of the Indians.\textsuperscript{72}

**Naval force:** Fighting ships were manned by disciplined sailors at the direction of a central command responsible to the political leadership of a state. It is in the fifteenth century that the concept of naval power exercised by a fighting ship for the purpose of influencing events inland began to germinate. The ship called “Caravel” which could sail closer to the wind than any other contemporary vessel, and displayed great military innovativeness by fitting cannons on their warships out- distanced similar weapons of the same era. Better technology eventually gave rise to better tactics and better employment of warships. Portuguese caravels could sail for longer duration and closer to the wind than any other vessel of the time. They had lateen rigged sails making them more manoeuvrable. The heavy artillery fitted on board gave them long-range firepower. Technologically, the Indian states were outclassed. True, there was no shortage of bravery or heroism in Indian blood\textsuperscript{73}.

\textsuperscript{72} *Ibid*, pp.33-36.