CHAPTER V

ENGINEERING AND TOWN PLANNING

(a) Roads

The subject has been discussed under the heading 'Communications'.

(b) Bridges

Although no mention of a road-bridge is found in the Kadamba records, we get the expression 'nā, setu-bandhō na cha ṣarga-bandhō, etc., in the Vēgāva inscription, which indicates that bridges were constructed wherever necessary.

(c) Tanks

A number of tanks were constructed during the period of the Kadambas of Goa. The very first inscription, viz., the one at Gudikatti refers to a tank constructed by Nigambara Dāsa. Some of the tanks were big ones like those at Gudikatti and Nūgad. They are surviving till now. The engineering skill of the builder in the selection of the site, the design and the material of the bunds, is revealed in the fact that the tanks have lasted for such a long period of about eight hundred to a thousand years and are still in service. The accompanying system of canals, channels, gates, waste-walls, locks, etc., is also still existing. The subject of tanks has been discussed in greater details under the heading 'Agriculture'.

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(d) **Buildings**

No secular buildings are surviving to this day. Some of the temples, however, are surviving. The best examples of temple building in the Kadamba dominion are found in the Kamala-Nārāyana temple at Pagava, the Varaha-Narasimha temple at Halā, Chamundēśvara temple at Tamūr, the Śiva temple at Deśavattāli, the Mahādeva temple at Siva Tamhādi (Goa territory) and so on. The construction of temples must have presented various difficulties such as selection of materials, adoption of design suitable for the site, difficulties in execution such as lifting of stone-beams, erecting of pillars, fixing them in proper position, etc. The engineers were experts in all such matters. The qualifications of the engineers, who were called śītramālakā, are mentioned as prasādā-lakṣaṇa-pratima-lakṣaṇa-pravāna (experts in the characteristics of buildings and idols). Some of them were also varinata in the Bharat-āgama-śāstra-kalā.

Temples were constructed variously with wood, bricks or stones (dāra-karma, jñātika-karma and sīla-karma). Only stone temples have survived while others have perished in course of time.

Walls of the buildings were polished both inside and outside in some cases. An idea of the interior walls of the apartments in the royal palace is obtained from the description in the Halā inscription. The simple minded
damsels who went to the sleeping apartments of Permadidevs were confounded with the reflections of the king in the four walls and were perplexed as to who was the real one and which were the images or how could they multiply themselves into five. We have several examples of finely polished pillars in existing temples, wherein we can see our reflections.

The description of Manigandage pattana in the Manasuni inscription B gives an idea about mansions and buildings in a town. Thus, it is stated: "The goddess of that city appeared beautiful having for her hair the lapis-lazuli-hued turrets, for her eyes the lotus-like windows, for her upper garment the fluttering banners, for her round face the arches in the surrounding moat. Further the reflections of elephants moving in the streets of that town, in the bright polished marbles of the walls of rows of houses appeared like the paintings of elephants on those walls."

Besides the walls being constructed with polished stones in some cases as indicated above, they were plastered and white-washed wherever necessary. This is indicated by the expression dhavelikritis digbhittishu and ātā-gunna. Occasionally paintings were drawn on the walls. Arches were constructed in front of the houses as revealed in the phrase grīha-torsana.

Tall buildings and spacious mansions had an attraction in those days as in the present days. Mavalli is described as having lofty mansions (unmat-saudha-salayim). Likewise
Tanvār is described as having beautiful palaces and charming rows of mansions (śubhpa-saṃdha-grihāgalī maula-goliyyavā hasya-rajyīna). Gōva is described as having white plastered palaces (chavāla).

(e) Ship-building

With the Kadamba dominion abounding in teak and other variety of wood, the ship-building industry appears to have been quite flourishing. The Narādā inscription states that Chattāyya constructed as though a bridge of ships up to Lānka. As discussed under the heading navigation, the Gōa Kadambas had a formidable navy. Besides war-ships, vessels were used for coastal as well as deep-sea navigation. All this presupposes the building of ships of various kinds on a large scale.

Construction and maintenance of forts

As the times required, kings in those days constructed and maintained various kinds of forts. The Kāṭhār inscription (c. A.D. 1380) refers to four kinds of forts, viz., jale-durga, nela-durga, gir-durga and van-durga. The Kadaṃba country was so situated, that all these kinds of forts existed in that dominion. We have a few surviving parts of nela-durgas in Dharwar, Misrikoti, Šaktī, etc. Kīravatti is called Kōte-kīruvatti, perhaps owing to a strong fort existing there. References to kōte and kōte-galaga (fort and fort-fight) inscriptions are found in here-stones.
(f) Town planning

Cities, towns and villages were well planned and constructed according to the needs and requirements of the times. Generally important towns and villages had encircling walls with gates in different directions. Tāmbūr is described as balāda kōterindolage, i.e., inside the surrounding rampart. The principal gate was called dhrvagāla or habbagāla. A dhrvagāla is mentioned in Kamadhanu and another at Golihalli. A habbagāla is mentioned at Śimaskop and in another inscription at Kamadhanu.

In Amminbhādi (A.D. 1112) we meet with a nakara-vagala. Important places had moats outside the ramparts. In suitable places tōrmas (arches) were erected. Inside the towns, lanes were provided for different communities. Thus, in Tāmbūr we find mention of beautiful lanes of courtesans, lanes of brahmins where the sound of vedas never faded and an attractive lane of agriculturists. The capital of Chāttayya is described in the Nārendra inscription as follows:

_Bahavatvan dhavalāraven karakālēm valahali pū-

domatavim-

bana tal-tāngadā sul-gēri keregal-kang-

oppavam=maṇa ne-

ettē bhaitragālas mēlā cove-veva=abhārādyol

līleim

vanadīsan nāladen māha-mahīmayim Saurashtra-

dējan baram II

—Iṣaṇaśēka vikidita.
The land of the ocean (Chattaya) proceeded to Saurashtra on the open sea with sport (from his capital Chandrapura) with ships lined unto Goa, making the eyes of the on-lookers fruitful by the sight, on-lookers thronging the parks and gardens on every side, the white-plastered mansions, the streets, the stables, the flower-gardens, the pleasant looking lanes of shops and houses of courtesans and tank-bunds.

In Buttage we find mention of the mud-gerrya (eastern ward) and the nāduva-gerrya (western ward). In Ammabhāvi (A.D. 1112) we find a gorava-gārd. In Gōliheli, the lane of potters was situated in the southern part of the village. In the Mānagundi inscription B we come across a hole-gārd (Harijana lane), when there was no place for extension, houses were constructed outside the town. In the Tanbur inscription of A.D. 1125 (1383) we get such a mention as Ṣurīda horagā teλligā-gārīva.

The market area appears to have been in the centre of the village with sufficient accommodation for different kinds of shops, such as grain shops, cloth-shops, shops dealing with cosmetics, grocery shops, etc.

More important temples had their own compounds (paulli) and establishments called devara-pura.

In agraharas and other important places the brahmans had their separate locality called brahma-pura.
There were a number of public buildings in some places. There was a sābhā- mantapa at Bāgāvē, a sābhā-grīha at Tāmbūr and a saṅghā-
sthāna in Hubli. They were meeting halls or assemblies like the town halls of the present days, where merchants, mahājanas or others held meetings. Tāmbūr had a music hall and a bed chamber. We find mention of a
nātakā-śāla in Mūgad.

Villages and towns had suitable roads. Generally the principal street was called rāja-vīthi or rāja-bīḍi. We meet with angadi-bīḍis elsewhere.

Several towns had parks, and flower gardens. Some tanks and wells were kept apart for use of the villagers (urumba kere, urumba hokkarini). There were other lakes (wakkarini, same as hokkarini in Kannada) and wells for recreation (vīlāsa-vāpi for jala-kāli) in some places.

(g) Communications

There are several references in the Kadamba inscriptions to tracks, roads and highways. A country track is mentioned in the Kūlvallī inscription. A similar track is mentioned in the Kāṇḍikottā inscription, as savana-palliya batte. The Kēṭnūr inscription refers to the Nūleya batte. The Sūmanakottā inscription refers to the Hāgadage road. The Nēdakottamullālī inscription refers to the Bēgūra road. The Bālīr inscription refers to the Kārēvāda road. The Vēnagundi inscription refers to the Hāppavallī road. The Bālī inscription refers to the Unukal road. The
Degave boundary inscription refers to a bhandiya dani (cart-road) from Kakkara to Kulevalli. The Managundi inscription A also refers to a bhandiya dani coming from Hallamgore. The Managundi inscription B, perhaps refers to the same bhandiya dani leading from Navillura to Hallamgore. The Hald inscription refers to a sakata-marga (same as bhandiya dani in Kannada).

Coming to bigger roads, we find the Mugal inscription referring to the amilapura high-way (per-yvatta) and the Menteysy per-yvatta. The Kirthalasige copper-plates refer to two high-ways (maha-marga in Sanskrit for per-yvatta or heryvatta in Kannada). The Siddanhalli tablet refers to another heryvatta. The Degave boundary inscription refers to a high-way leading from Mindavalli to Kerevada and another highway leading to Mindavalli. The Narendra inscription A refers to a hedy-dani (similar to her-vatta), a big road. It also refers to a highway leading to Kendele. The Hald inscription refers to two former roads (puryva-vithi-dwayam). Likewise the Kirthaladige plates refer to an ancient road (purata-sahva).

Lastly we came to the Dodwad plates which mention a national high-way, as it were, which was a hundred dandas wide leading to places like Nuchchapikke, Sindura and Maniyura and passing through the western side of Dodwad. The high-way is qualified by the phrase anavarta-sukha-samchar-artha i.e., for the sake of constant and easy movements.
Likewise we find mention of roads inside a town or village. The Devara-Hulik inscription refers to a bazar street (ṣaḡaḍa Ṛḍi) to the west of the royal street (rāja-Ṛḍi). A similar reference to a rāja-Ṝṭhai is found in the Deva inscription. In fact every village seemed to have a rāja-Ṝṭhai, better translated as the principle street. In the Kirimalaśe plates we get a reference to a kṣapakaḥys-grha Ṛṭhi, i.e., the Jain mendicant's house road. In the Managundal inscription B we get mention of a road passing through the town and leading to Ṛimāṣāgra and to another passing from the Harijana lane and leading to Kaṅgāilehalli. In the same inscription we find a description of elephants moving in the streets of the town Manigundal.

We do not, however, find any references as to how the roads, highways and streets were constructed or how they were maintained.

(h) Means of conveyance

The cart (bhändi) appears to be the most common means of conveyance both for the movement of people and the agricultural produce. Other merchantile commodities were transported on oxen, mules and he-buffaloes (śṛṃ, ḫatte and ḱena) as mentioned in the Goli halla inscription A. People also carried on their heads articles for sale to the market places. For those who could afford, the horse must have been a popular mode of conveyance owing to its
strength, nimbleness and fastness. Princes, nobility and the like might be moving on elephants.

The cultured (like panditas, etc.) and the ladies of high status and means were moving in the palanquin (nādālīka) as mentioned in the Dehāve inscription.

(1) Navigation

We have seen in chapter II, of Part I, that navigation was already developed during the days of the Śimha Śilāharas. The Kadambas of Goa carried it further and also put the ships for military use. The Narāndra inscription describes a sea voyage undertaken by Chatṭāyya II to Saurāshtra. In the missing copper-plate grant of Jayakṣṇḍi I, Jayakṣṇḍi is stated to have permitted his minister Sada to levy customs on coastal and other ships which came to Goa with goods from various places. As to the development of navy we have ample evidence. The Bhālali I and Narāndra II inscriptions describe the naval attacks made by Chatṭāyya against the kings of Goa. Vījayaditya, the father of Jayakṣṇḍi II, is stated to have led naval expeditions with a number of vessels to various dvāpas, in the Dehāve inscription. All the Goa Kadamba kings have been called paschima-samaudrādhiṣvara. Various kinds of ships were in use such as vahitra (bhāitra), vōla, tarama, nasa, pārāda-vāra-tarma, etc. Likewise devices for throwing missiles were fixed on war-vessels as is learnt from the expression 'Nāma-vastra-āndhā-umkhanita-nabhaśah kṣapa-ādhaṁ-kanah.' The navy of the Kadambas of Goa
was quite formidable in so far as at least three of the kings are stated to have held offensive naval expeditions. Chattayya is described as:

"Jitva Simhala-Paragka-Kapaka-dvip-adhipam=
abudha I
sajjimta-bhatai-vahitra-nivahab " etc, and
"bahitra-smatigalimdam setuvam katti I"

Jayakshé I is described as having attacked Léka with naa-chakra with k bases as mentioned above. Vrjayaditya I is also stated to have led naval expeditions to various dvipas with peta-paramabhih in the Dégha inscription.