

A Mathematical overview of the Measuring rods of Tamils that are inscribed in the temple walls

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Abstract: This paper deals with the measuring rods that are being inscribed in the various temple walls of Tamil Nadu. The name and the length of such rods are inscribed below it and some are mentioned in the inscriptions. The main aim of inscribing the rods is to standardize the measure and make it out for the lay man while measuring his land. It also helps the ruler to calculate the area of the land under cultivation and to access the land revenue. This paper depicts a clear picture of these rods.

Key words: Alavu Kol, Kol, San, Adi, Mulam, Punjai, Nanjai, etc.,

Introduction

In ancient days, the linear measures are engraved on temple walls, on the base and walls of the temple structures and so on. Inscriptions do specify a particular type of linear that was employed during a particular period. Hence, linear measures are valuable from the point of view of revenue. A scientific and systematic approach undertaken in measuring the land by using different land surveying techniques will go a long way to find out the fluctuations in land surveys and the resultant effect in terms of land yield. Many temples in Tamil Nāḍu are the repositories of information on the economic subject with respect to linear measure. In order to assess the revenue, the extent of land is measured. For this, the measuring rods were used. The linear measure represents the measure of length.

Measurements of early Pallavas

Many Pallava inscriptions furnish us with some details regarding methods of measuring the land viz. the plough, *nivartanā* and *paṭṭikā*. The measured lands had their boundaries demarcated. The early Pallavas seem to have had no knowledge of the modern devices of land measures but they knew to measure the land by the plough i.e., a piece of land cultivated by a person with a plough and a pair of bullocks (vide the Sangam period expressions *Ōr uḷavan*). This was standardized in course of time and was referred to as a 'unit of land'. Besides this, they adopted a system of fixing the extent and demarcating the boundaries of a piece of land by adopting as a unit the distance covered by a man walking round the area in a specified time at an agreed pace. This is called *nivartana*. *Paṭṭikā* was the unit of land used as a sheep pen. *Vēli*, *kūli*, and *pādagam* were the names of unit of land used. These were not constant in the entire Tamil country. They varied with time and place.

The measuring rod --- Kōl

In the ancient days the land was measured with the help of the rod which is described as *kōl* in the inscriptions. The *kōl* was usually made of a wooden stick and are named after the ruling king, deity, profession, caste and their measurements, etc.. The rod is carved to its full length with its denominations on the wall of the *abhishheka mandapā* of the temple. By the side of this rod the label is carved. Perhaps this served as the correct standard length to be referred to in case of any doubt or controversy. A few examples are *Gaṇḍarāgaṇḍan kōl*, *Rajavibhadān kōl*, *Rāja Rājan kōl*, *Ādavallān kōl*, *Uḷavan kōl* and *16 sān kōl*, etc.

The earliest of the available inscriptions referring to *kōl* belongs to the reign period of Parāntaka I. Dated in his 16th year (923 A.D.); it refers to the rod that was used for measuring the area of the four



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directions. Different types of *kōl* have been used in the different regions for the revenue survey and the settlement carried out in the different reign periods.

It is well known that Rāja Rāja I, the great administrator had introduced a revenue survey. The revenue settlement carried out during his reign period finds mentioned in the Tañjāvūr inscriptions. Inscriptions from the place called Tiruvisalūr in Tañjāvūr district, dated in the 24th year (1009 A.D.) of Rāja Rāja I refer to a similar revenue survey apparently carried out sometime before the date of Tañjāvūr inscription. An officer of Rāja Rāja I who took an active part in survey operations was perhaps the general named Kuṛavaṇ Ulagaḷaṇḍaṇ *alias* Rāja Rāja-Mahārājaṇ mentioned frequently in other inscriptions. The title Ulagaḷaṇḍaṇ that is one who measured the earth might be attributed to him in recognition of his services in connection with the survey operations. It was probably as a result of this survey and settlement that the king issued his orders in the 24th year of his reign.

Though the fundamental practice of revenue survey was known to the pre- Chōḷa rulers, yet a systematic land survey has been taken up from the time of Rāja Rāja I. Such a survey has been called in the inscriptions as *Nilam aḷantu* and *Nilam naṭappiṭṭu*. The Tañjāvūr inscriptions bear an ample testimony to the accuracy of the operations executed by the king. Land to the minutest fraction 1/5242880000 of a *vēli* was measured and assessed to revenue. It is an awe inspiring issue even to the epigraphist and cartographers. There are references to such a survey made with the help of a linear standard measure called *Ulagalaṇḍaṇ kōl* from a record at Uttaravēṭisvara temple, Kuṭṭālam, in Tañjāvūr during the reign period of Rājēndra Chōḷa I dated in his 8th regnal year (1020-21 A.D.).

Various types of measuring rods are found mentioned in the epigraphs of different reign periods. They are called the *kōl*. Different names have been coined to these *kōls*. There are 44 types of *kōl* mentioned in the Tamil inscriptions

Now the question arises whether the rods having similar names were equal in length throughout the area where they were distributed. This is really difficult to answer. Unless a government takes some interest and prescribes a particular person as the standard person, a uniform span or foot would be difficult to obtain. Well, a king could act as the standard person, in which case a particular strip of the country over which his rule was effective would be lucky to have a uniform rod for a decade or so. The *aḍi* rods which came into vogue after 1100 A.D. may be royal attempts at introducing some standards. An inscription of 1262 A.D. in the reign of the famous king Jaṭāvarmaṇ Sundara Pāṇḍya I, from Maṇimaṅgalam, Chiṅglepuṭ district, give some direct supporting information for this suggestion. It is said that the crown prince sent an officer to enquire into the famine conditions prevailing then in Puliyūr- kōṭṭam of Toṇḍai-maṇḍalam. This officer's representative is said to have arranged for a new rod of 16 feet and for a new weighing scale. Then there is the rod called *tiru-Ulagaḷanda-śrī-pādā-kōl* or *tiru-Ulagaḷanda-paḍi-kōl*, etc. mentioned in a few inscriptions of early half of the 12th century. The phrase *tiru-Ulagaḷanda* meaning "that one who surveyed the world" is believed to be indicative of country-wide surveys of land undertaken by kings like Rāja Rāja I, Kulōttuṅga I, etc. If this is accepted, then the *tiru-Ulagaḷanda-paḍi-kōl* may be another instance of standardizing the attempt. In two cases this rod gives the length of 12 *aḍi* and in the other cases the length is not specified.

Measurements engraved on temple walls:

Location

Mostly we can observe the ancient linear measuring scales being marked on the base (*adhisṭhana*) of the *vimana*, *mandapa*, walls (*bhitti*) of temples, temple floor, and temple vestibules and nearby the entrance gateway of temples.

Identification

Two or three or more plus (+) marks are engraved on the temple walls. Some cases only with the vertical lines and few were found with plus (+) mark at the ends and vertical line or lines in the middle. The distance in between both the marks at extreme end was the actual measurement of the scale. One can find the plus marks on the base of the inner gopura of the temple of Brihadīśvarā at Tañjāvūr.

A measuring rod is found engraved on the southern walls of the inner *parakārā* in the Shapriśvarā temple, Tiruttavaturai. Here the scale is marked between 2 short vertical lines measuring 3 feet. This measuring rod is mentioned as *alavu kōl* in Tamil.

There is a reference to the biggest measuring rod which is found engraved on the *vimana* of the temple of Tiruchchendurai in Trichy district. According to this scale drawn in the temple itself the lands assigned for the garden have been measured. This rod is called *Perung-kōl* used during the reign period of Rāja Rāja I.



Fig.(1)



Fig.(2)

Fig.(1) : The ancient linear measuring scale *Puñjai Kōl* with + (plus) mark (at the right) is seen in the temple wall.

Fig.(2) : The pictures showing plus marks inscribed on the mandapa walls of the big temple at Tañjāvūr measures two *Muḷam* in length. The ancient inscription within the scale, identify that this scale was marked, based on the inscription from Rājarājēśvara temple situated at Tañjāvūr, in Tañjāvūr district. Another scale with the measurement of 28.5 inches is also found with extended plus (+) marks adjacent to the main scale. If the main scale is divided by four and a half, we find the result 28.55555556 inches, which is almost equal to 28.5 inches. An ancient linear measuring scale dated (800 A.D.).



Fig.(3)



Fig.(4)

Fig.(3) : Temple mason's scale named *TachchaMuḷam* in Varadharaja Perumāl temple at Kanchipuram - 14th Century A.D.

Fig.(4) : Specimen of Cloth Measuring Rod found in Tirumalalvādi, Perambalūr District - 13th Century A.D. The text reads as '*idu maḍi aḷavvattu muḷam*'



Fig.(5) : Land measuring rod named *Gandara gandan kōl* engraved in Varadarāja Perumāl temple, at Kanchipuram- 14th Century A.D

Two short inscriptions, one with a short straight line and another with a long line incised next to them, are found engraved in the Varadarāja Perumāl temple at Kāñchipuram. These two inscriptions belong to the 14th century A.D. While one inscription with just the two Tamil words *Gaṇḍaragaṇḍaṇ kōl* has a long line, running to several metres etched next to it, another called *TatchuMuḷam* has a short line, about two feet long, chiseled close to it. They have sub-divisions marked on them.

Length of the kōls as known from inscriptions

The lengths of the kōls are available from some inscriptions. The length of the *Tanikōl* is mentioned in a record from Vīrattaneśvara temple at Tirukkōyilūr in South Ārcoṭ district. It states that

ulagiyal sān pannirandara samainda tanikkōl
cyfpay; rhz; ge;epuz;lw rike;j jdpf;nfhy;

which means the length of the tani kōl is 12 sān . It is mentioned in a record of Rāja Rāja Chōla III dated in his 27th regnal year.

Also, an inscription from Apatsahāyēsvara temple, Ālañkuḍi in Nannilam taluk, dated in the 35th regnal year of king Kulōttuṅga dēva (1105 A.D.) states as follows

gjpgdhwb;nfhyhy; E }w;wpUgj;J vl;Lf;Fop nfhz;IJ
xUkthf te;j Ch;f;nfhyhy; Ch;gl;b epyk;

**Paḍiṇāraḍi kōlāl 128 Kuḷi koṇḍadu 1 māvāga
vanda ūrk kōlāl ūr paṭṭi nilam.**

It means that the length of the ūrkōl is 16 aḍi

A record at Vaḷarmathīśvarar temple, Nīrpaḷaṇi in Kuḷathūr at taluk, contain figures of 2 fishes being engraved between the letters q and f. It may be assumed that it is the length of the rod which should be measured and verified. It is a record of the reign period of Māvarman Sundara Pāṇḍyadēva dated 1216 A.D. It states as follows.

,th;fs; kidapy; 16 mbf;nfhyhy; nfhz;l Fop 100f;F
ivargaḷ Maṇaiyil 16aḍi kōlāl konda Kuḷi 100kku .

Dry lands and wet lands were measured using different rods of various lengths in the Pudukottai state. The length of the nañjai and puñjai kōls can be classified from the following statement from the inscriptions at Pidari temple in Tirumalai taluk.

eQ;irapy; 18abf;nfhyhy; epyk; 10 kh
GQ;ir 24 mbf;nfhyhy; epyk; ...

**nañjaiyil 18aḍi kōllāl nilam 10 mā
Puñjai 24 Aḍi kōllāl nilam**

It means *nañjai* lands is measured using 18 *aḍi kōl* and *Puñjai* land is being measured using 24 *aḍi kōl*. The length of *Vīra Pāṇḍyan kōl* is 18 *aḍi* which is revealed from the following inscription.

,lj;Jk; gjpnd;l;lbahd tpughz;bad; nfhyhy; epykse;J ...
yidattum 18 aḍi yana vīra pāṇḍyan kōllāl Nilam aḷantu

It is a record from Śoḷapuram in Rāmanāthapuram district during the reign period of Koṇēriemeikoṇḍāṇ (13th century).

In a similar fashion the length of *SundraPāṇḍyan kōl* is stated as 24 *aḍi* in an inscription from Nellaiyappar temple, in Tirunelvēli district during the 8th regnal year (1277 A.D.) of Sundara Pāṇḍya. The text of the inscription is



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,Ugj;Jehybahd Re;jughz;bad; nfhhy; epy kse;J gaph; ghj;j;J

24 Adiyāna SundaraPāṇḍyan kōlal nilam aḷanthu

An instance from inscription can also be given. A record of Kulōttuṅga Chōḷa in his 14th regnal year dated 1192 A.D., at Sundara Perumāl temple in Chingleput district records as follows,

பண்ணியிருப்பிடி பம்புப்பட அளவில் குழிகோலால் 40க்குழி

“Paṇṇiirupidi parappupada aḷavil kuḷikōlal 40Kuḷi”

It means that the length of the *kuḷikōl* is 12 *piḍi* where *piḍi* is the distance from the index finger to the small finger of folded hand.

Hence 1 *kuḷi kōl* = 12 *piḍi*

Area of 1 *kuḷi* (using *kuḷi kōl*) = 12 x 12 sq *piḍi*
= 144 sq *piḍi*

Therefore, area of 40 *kuḷi* = 144 x 40 sq *piḍi*
= 5760 sq. *piḍi*

The Chōḷa kings had devised a system to measure agricultural lands and classify them. In the temples at Tiruchattankudi in Nannilam division, near Tañjāvūr and at Tirupagalūr, near Tiruvārūr, the length of measuring poles has been incised on the temple walls. Both the temples belong to the Chōḷa period.

Another temple that has several inscriptions dealing with the measuring rods that prevailed then is the Mulanathasvami temple at Tenkarai village, near Chōḷavandān in Madurai district. Tenkarai was also called ParakramaPāṇḍyapuram, named after the Pāṇḍya king Parākrama Pāṇḍya of the 11th century.

An inscription of the Pāṇḍya king Vikrama Pāṇḍya engraved in this temple mentions a measuring pole called *Vīra pāṇḍya Padinettaḍikōl*. Besides, measuring poles with the titles *Padagakkōl*, *Malaikudikkōl*, *Maṇaikkōl* and *Tatchu Muḷam* and their lengths are inscribed on this temple walls.

Two measurements of *Padagakkōl* have been incised on the *adhishtana* of the southern wall of the *mahamandapa* of the Tenkarai temple. From the paleography of the words *Padagakkōl*, it may be surmised that they belonged to the 12th century A.D.. Since Tenkarai was a brahmanical settlement and *Pāḍagakkōl* was used to measure the lands in the village. The word *Pāḍagam* refers to land or village itself besides being a measuring device.

Maṇaikkōl which is used to measure the area of houses is also inscribed in the Tenkarai temple measuring three meters long. Paleographically the record referring to this measure belongs to 11th - 12th century.

Through an undated record from Periyakulam in Madurai district, we come to know of a scale being marked in the temple of Kailāśanātha. This seems to indicate a linear measure of a cubit (*Muḷam*) which was caused to have been drawn by Perran Chokkan, a lady of the Terkil-nilai-maravar community. It was the practice in ancient days to find the interest evinced by the rulers and merchants in getting the rods marked on temple walls.

On the other hand, the *nāḍalavu* or *nāṭṭavḷavu kōl* was widely used and under the control of the administrator of the *nāḍu*. A 15th century record from the Siva temple at Tiruppaṇaṅkāḍu in North Ārcot district is an ample proof to understand the length of a rod called *nāḍalavu-kōl*. The length can be measured easily from the engravings. Interestingly it is said to have been incised in a space of about 6 feet between 2 Palmyra trees which bear a small horizontal arrow in this middle portion to indicate the length. The record states that this is a linear measure used by the *nāḍu* or measuring lands of the temple.

A diagrammatical representation of *nāḍalavu kōl*.

An ancient linear measuring scale (1000 A.D), *ulagaḷanda kōl*, with two plus (+) marks having total length of 128.5 inches was found at the tower of Vaṭavarṇēsvarar temple, at Tiruvālaṅgāḍu says Kuḍavāsāl Bālasubramaṇiaṅ.

Maṇai Kōl with two plus (+) marks having total length of 113.5 inches can be seen in the Kailāśanātha temple situated at Ālambākkam, in Tiruchirapalli District. In the nearby stone inscription, a land of *Maṇai kōl* four and a half with this measurement, the land was measured and given as gift. So, the actual measurement of the linear scale *Maṇai* was 510.75 inches. We can observe the linear scale shown in ancient period has to be multiplied with some factors for actual measurement.

Interestingly an ancient linear measuring scale (1200 A.D.), *Nilamañantha kōl* with two plus (+) marks having total length of 157.5 inches was found in Tiruchchendurai temple situated at Jiyarpuram, in Trichy district, Tamil Nāḍu . It is surprising to note 157.5 inches is half of 315 inches.

The *garuḍamaṇḍapa Muḷam*, a cubit measure is engraved at the entrance of the *gopuram* of Murugan temple at Viralimalai in Trichy district with 6 small lines.

A temple for Natarāja near Tiruvanaika temple, in Trichy district has two + symbols engraved on the wall whose length is 88cm.

Two + marks are found on the northern wall of Valisuramuḍaiyanāyanār temple at Valikaṇḍapuram whose length is 6.72 m in length. Kodumudi Shanmugam remarks that it is 8 times of 24 *Viral kōl*. In a temple on the way to Vilupuram from Pondichery two *kōls* are found with 87cm and 79.5 cm in length. The land at Tenkarai was divided into squares and numbered as 11th or 12th or 13th Padakam. Dr.Vedachalam opines that this is comparable to the survey the numbers associated to modern lands. *Malaikudikkōl* was used to measure the area of land on top of hills and the valleys below. A chain of hills called Nāgamalai lies to the south of Tenkarai.

The Manimangalam inscription in Chingleput district mentions that the crown prince sent an officer to enquire into the famine conditions that prevailed in the Puliyurkottam of Tondaimandalam. The officer's representative is said to have arranged for a new rod of 16 *aḍi* and a new weighing scale. The rod has been marked by two fish marks on both ends in the wall where the inscription is engraved.

The inscription from Pralayakēsvara temple at Pennadam in Viruddhachalam taluk gives the length of *Muvayiravan kōl* by two marks which are cut neatly and are nearly 15 feet apart.

The Vijayaraghava Perumāl temple at Tiruppukkuḷi in Kāñchipuram taluk mentions the measuring rod *Rājavibhāḍaṇ kōl* in the context of distribution of land to several servants of the temple, by Lakkappa Nayaka. Maṛakatavallināchchiyār shrine in the same temples has an inscription in its *mandapa* south wall mentioning the measuring rod *Rājavibhāḍaṇ kōl* and *Gandragandan kōl*. They are engraved on stones.

The above discussed details are tabulated below.

Kols engraved in temple walls.

S.no	Name of the kōl	Length
1.	Tani kōl	12 <i>sān</i>
2	Ūr kōl	16 <i>aḍi</i>
3	Nañjai kōl	18 <i>aḍi</i>
4	Puñjai kōl	24 <i>aḍi</i>
5	Vīrapāṇḍyan kōl	18 <i>aḍi</i>
6	Sundara Pāṇḍyan kōl	24 <i>aḍi</i>
7	Nāḍaḷavu kōl	6 <i>aḍi</i>
8	Ulaḡaḷanda kōl	128.5 inch
9	Maṇai kōl	113.5 inch
10	Nilamañanta kōl	157.5 inch
11.	Garuḍamaṇḍapa <i>Muḷam</i>	1 <i>Muḷam</i>

12	Natarāja temple, Tiruvānaika	88 cm
13.	Kol engraved in Valikandapuram temple	6.72
14.	Kol engraved in Vilupuram temple	87 cm
15.	Kol engraved in Vilupuram temple	79.5 cm
16.	Maṇai kōl	3m

From the foregoing discussion it may be pointed out that the surveys have been undertaken by the rulers to assess the production or to seek more output from the lands. The length of measures used with reference to śey lands and garden lands vary. This will give us a picture of the agricultural growth and the income through lands.

Conclusion

We can find that though the usage of the measuring rod is found throughout the state, from the early days, we could see the variation in the length of the rods. Also, the practice of engraving the length of the rod on the temple walls was prevalent throughout. The mean of the measured value and calculated value is 295.3 cm and 353.69 cm respectively. It may be suggested that on an average of 3m to 3.5m scale was used. Whereas, the mean value of *Thachcha Muḷam* is 92.5cm hence the rods used to measure the land is bigger in size than that used by masons and other artisans, in order to do the work conveniently. Also measuring lands using this is a painstaking and time consuming job. Therefore, a rod of larger size is used and the area calculated using the formulae. Therefore, knowing or mentioning the length of the rod plays a major role in the calculation of area of land. To measure smaller lengths, the same scales with markings might have been used or some other scales with greater precision might have been employed. This is yet to be known. Whatever be the case, the measuring was done and the area was calculated and recorded in the inscription without any flaws.

The choice of the measuring rod in a particular place depends also on the economic condition of the period, the climatic condition, the availability of building materials, fertility of the soil, the taxation policy of the ruling king, availability of water for irrigation etc., Though all these factors affect the priority of the rod the mathematical knowledge behind its selection remains ahead.

Notes and references.