

Dholavira '*prime ratio*' of Indus valley civilization

In my last blog post, I discussed the "*divine ratio*" and this time around it is about another amazing ratio - the "*Dholavira prime ratio*". It belonged to the ancient Indus valley civilization and was discovered in our own backyard, Dholavira in Kutch, in the state of Gujarat.

The Indus valley civilization, which dates back to 4000 BC, was a Bronze Age civilization that thrived in the basins of the river Indus, across Afghanistan, Pakistan and India. Its matured phase, however, flourished during the period circa 2600 to 1900 BC and is revealed in the famous cities of Harappa, Mohenjo-Daro (Pakistan) and in Dholavira, Lothal and Junj Kuran in India.

Dholavira 'prime ratio'

The ancient site at Dholavira lies in the island of Khadir in Bhachau, Kutch, in Gujarat. The island is one of the three prominent landmarks, the Bela, Khadir and Paccham bet islands, surrounded by the salt waste of the Great Rann of Kutch and known for their unique geologic significance. Incidentally, I led the ONGC gravity-magnetic survey party to Kutch, in 1962, which camped in Bachau. As an observer, I did a '*parikrama*' of the site by moving around the three islands, recording gravity and magnetic data, but had no inkling then of the great buried site, till Dholavira was discovered in 1967-68 and excavated in 1990, unraveling the marvels of the amazing civilization.

Dholavira city is unique with the buildings built of stone, whereas most other Indus civilization sites including Harappa and Mohenjo-Daro cities are almost exclusively built of brick. However, the most striking feature is the lay out and architecture of the city, planned precisely with dimensions using a proportion (ratio) 5:4 as is found in several instances. The city castle's internal and external dimensions 114 m x 92 m and 151 m x 118 m, both display the ratio 5:4. The ratio is also used at other sites, Lothal and Junj Kuran in Gujarat. In Lothal, in Saurashtra, the settlement dimensions of 280 m x 225 m and in Junj Kuran (near Dholavira) the acropolis measuring 92m x 72 m, again approximate the ratio 5: 4. The ratio known as *Dholavira prime ratio*, can also be found in Harappa and Mohenjo-Daro sites in Pakistan. A granary at Harappa measuring 51.5 m x 41.1 m, and a major building in Mohenjo-Daro measuring 18.9 x 15.2 m proves the point.

Interestingly, the *prime ratio* 5:4 is also found in other forms at many sites. At Dholavira, there are 5 salients on the northern side of the middle town's fortification, against 4 on its eastern and western sides. In Mohenjo-Daro, the ratio 5: 4 can be seen repeated in another form in the "assembly hall," also called "pillared hall," having four rows of five pillars each, clearly pointing to the grandiose eminence of the ratio 5:4 in planning and architecture of the cities, prevalent extensively during the Indus civilization.

Over a thousand years later the Hindu text *Satpatha Brahmana* and *Sulabha sutra* mention the ratio to build fire altars for Vedic ceremonies. Another millennium later the same ratio is mentioned in *Vastu Shastra*. Down the time line, in the sixth century AD, *Varahamihira*, wrote

in his *Brihat Samhita*: “The length of a king’s palace is greater than the breadth by a quarter...” the ratio being 5:4. Incidentally, this addition to the unit by a fraction of itself ($1+1/4$) perhaps was perceived as a process of expansion, and an auspicious symbol for inviting prosperity.

The pretentious belief that *Dholavira ratio* 5:4 is auspicious can be traced historically continuing to later times. For example, the iron pillar of Delhi is designed with the ratio 5:4; the pillar being 7.67 m long while the section above the ground is 6.12 m. On another note, the Mughal Emperor Aurangzeb in 17th century praised his vassal Maharaja Jai Singh of Jaipur by giving him the title “*Sawai*”, meaning a quarter more than any other man. The title continued to be used by Jai Singh’s descendants till the state was merged with Indian union in 1947. The *Sawai Madhopur* railway junction on main Delhi Mumbai route, was named after the city built by Maharaja Sawai Madho Singh which serves as the gateway to the famous Ranthambore National Park and the fort. Even today in Jaipur one can see a small flag of extra length of a quarter fluttering above the old royal flag signifying the eminence of Sawai and the ratio 5:4.