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ANALYSIS OF THE CONSTRUCTION OF THE KALYAN MINARET

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ANNOTATION

The article presents the results of research on the construction of the Kalyan minaret. Studied the research of Nilsson, and the construction technology and determined the radii of the minaret in different places. The high-rise proportions of the structure were installed and made, only the circumference at the edge of the basement was subjected to control measurements.

Key words: Kalyan Minaret, the highest, Minaret, majestic structure, during the reign, mosque, architect, circles, foundation, radius, diameter, base, height, module, spiral staircase, "lantern", full-scale dimensions, ganch, burnt brick, thinning upward, "floor" height, measurement, "necks" of the minaret, spiral staircase, area ratios, natural dimensions, proportions.

The Kalyan Minaret is a magnificent structure erected at the cathedral mosque of Bukhara during the reign of the KarakhanidArslan Khan in 1127-1129. The Kalyan Minaret was built during the reign of KarakhanidArslankhan. (fig. 1,) This Minaret is the tallest building

Fig 1.Kalyan minaret. General view of the lantern

city (46.5 m), the year of its construction is carved into the engraving of the middle part. The minaret is a round retaining one built of solid gakyil and baked bricks. It has a spiral staircase of 104 steps. There are 16 windows in the upper part of the cylindrical tower. The adhan sounded from the Minaret. From the adjacent side of the mosque, the Minaret is connected by a brick bridge. Every Friday 4 moazzins climbed the Minaret and sang the adhan, after which they summoned them to prayer from the other 200 minarets.

This very important construction could not be entrusted to an ordinary architect. We do not know who was the builder of the 12th century cathedral mosque. (on its foundation in the 15th century the building of the present-day mosque was erected). The minaret, judging by the building inscription, was built by the ustoz-Baki, who was obviously an outstanding architect of his time - he created an architectural masterpiece, a pearl of the medieval East.

The minaret of circular cross-section is placed on a ten-sided high base. This minaret was built of baked bricks, has a strong thinning upward, and ends with a "lantern" with sixteen arched openings, from where Muslims were called to Friday prayers.

The foundation of the minaret is deep (a 13 m pit did not reach the base), the minaret is relatively well preserved. It is widely covered in the scientific literature, but there are no publications on the analysis of the co-dimensions of the structure.

The side, and the decahedron of the base of the minaret is 338 sm.The radius of the circumscribed circle

$$R=a\ (\sqrt{5}-1)/2=338x1.618=546cmor9\ gyazam,$$

takinggyaz equal60,6 см.

The circumference at the base, measured in kind, is 3043 sm, the radius of which is

$$R_1=S/2\pi=3043/2x3.14=484.6\ cm$$

It is noteworthy that the difference between these radii

$$R-R_1=546-485=61cm$$

i.e. gyazu with small errors.

The radius (r) of the circumference of the top of the minaret at the "neck" is 300 cm. It is equal to a large segment when dividing the radius (R1) of the base in the average and extreme ratio:

$$r=R_1\ (\sqrt{5}-1)/2=485x0.618=300cm$$

This value corresponds to the side of the decagon, inscribed in the circumference of the base of the minaret, and is a modulus in establishing the height proportions of the structure:

The height of the base is 3 gyaz

Height, from the edge of the base to the beginning of the spiral staircase - 2 modules

The height of the "floor" is 2 modules.

The height of the "lantern" is 2 modules.

Centralpostdiameter - 1 module.

However, it should be noted that the height of the “floor” in nature is 288 cm, that is, 12 is less than the module equal to 300 cm. Such an error can be explained only by the fact that the ganch mortar used for laying the minaret was under pressure. laziness is able to thicken. If such a compaction of each seam occurred by 2-3 mm, then to the height of the "floor", that is, by 50 seams, it could be expressed in 10-15 cm of theoretical substantiation and application of the conoid on the soil of Central Asia.

Many publications are devoted to the Vabkent minaret. It has been studied in the most detail by V.A.Nielsen. The work provides a detailed description, dimensional drawings, unfortunately, not provided with dimensional indicators:

The conoid of the spiral staircase of the Kalyan minaret was designed by the architect Baki and made by craftsmen with great precision, as evidenced by on-site measurements and analyzes. The spiral staircase of the Kalyan minaret is of interest for the history of science - this is the first case

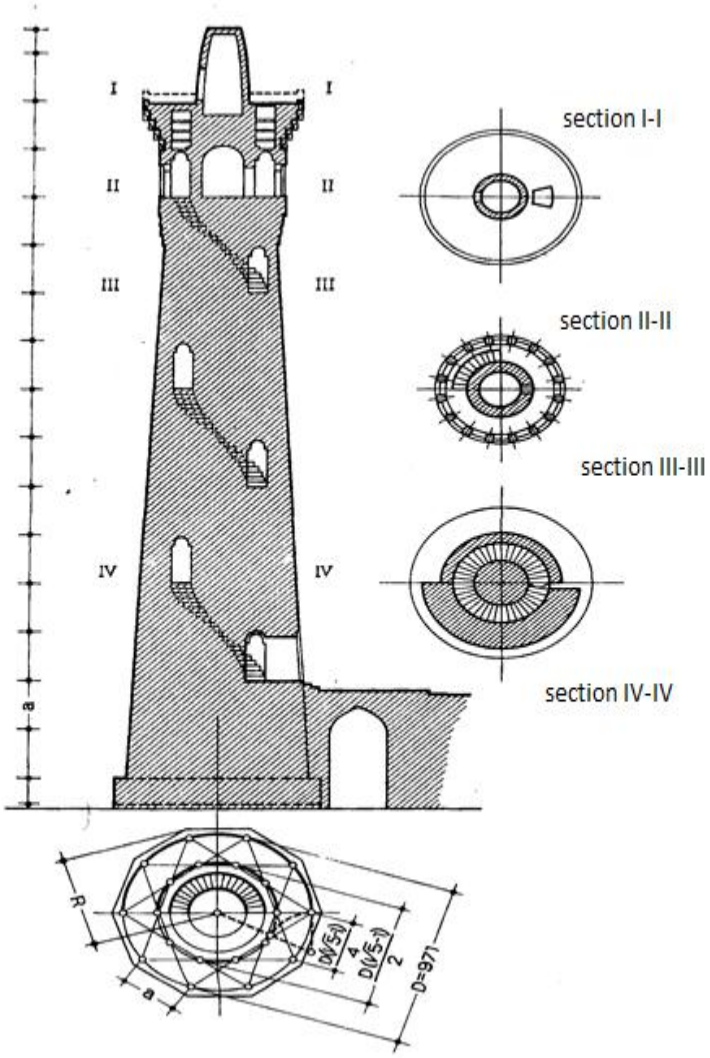

Figure: 2 KalyanMinaret. Plan and section. Buildanalysis

The Vabkent minaret in many ways resembles the Bukhara minaret, but it is smaller and slender than the Kalyan minaret - it has a strong thinning. The minaret has preserved well, while from the 12th century mosque. standing nearby, no traces were left The minaret stands alone in a small square at the city's transport crossroads.

Observations allow us to express only some considerations about the proportionality of this structure.

Control measurements were made only for the circumference at the edge of the base. It turned out to be equal to 1945 sm, that is, the diameter is 620 cm (or 10 gyaz, assuming 62 cmgyaz), which coincides with the data of V.A.Nielsen.

The base of the minaret is a regular dodecahedron, while the circular gallery of the "lantern" is tenspanned. Since the architects took the proportionality of the structure from the plan, it can be assumed that in this case the proportionality of the minaret; could be expressed by the derivatives of both a hexagon and a rectangular triangle of the peak with sides 1.2, √5, associated with dividing the circle into ten parts.

This assumption was confirmed, because the diameter of the circumference of the "neck" of the minaret is proportional

$$D/\sqrt{5}=620x0.447=277cm$$

Natural dimensions - 280 cm, error - 3 cm. At the same time, the base area is five times larger than the cross-sectional area of the "neck" of the minaret

Diameter (d) of the central pillar is commensurate with the small segment when dividing the diameter of the "neck" of the minaret in the middle and extreme ratio, that is

$$d=D(3-\sqrt{5})/2\sqrt{5}=277x0.382=106.8\ cm$$

Natural sizes - 105 cm; error - 1.8 cm.

The diameter of the "lantern" is proportional

$$D\sqrt{3}/3=D620\sqrt{3}/3=358\ cm$$

Natural sizes - 366 cm; error -8 cm.

The height of the plinth is proportional

Fig 3.Kalyan minaret in Bukhara (1127).General view

$$D\sqrt{5}/6=620\sqrt{5}/6=231cm$$

Natural dimensions - 230 cm. The height from the base to the "neck" of the minaret is commensurate with six diameters of the base.

From the consideration of the proportions of the Bukhara and Vabkent minarets, as well as the analysis of the proportions of a number of other minarets, given in the table, we have established the presence of regularities in the construction of their architectural form. So, for example, the ratio of the area of the base and the top of the minaret is presented as 2:1; 4:1; 5:1; 5:3; 4:3; 2.91:1; 2,618: 1 and even 25:1

Involuntarily the question arises: with what geometric constructions did the architects establish such relations of areas?

This question is answered by the information given in the appendix to the book of Abu-l-WafBuzdjani "About what artisans need from geometric constructions", in the section devoted to approximate calculations of the areas and ratios of the square of the side of many squares to the square of the diameter of the circumscribed circle.

In the first lines there are four architectural monuments of the XI-XII centuries - the Burana tower, the Uzgen minaret, the minarets in Mesh-hed-i-Misrian and in Jarkurgan. They are different in appearance and proportions; the first of them, built in mud brick, is the most squat, its height is expressed in three diameters of the base;

The Djarkurgan minaret is slimmer, its height is measured in six diameters of the base. However, these four minarets have something in common; the area of their bases is related to the area of the top as 4:1, which corresponds to the postulate from the treatise for architects, which says: “The ratio of the square of the hexagon to the square of the diameter The ratio of the areas of the base and the top of the minaret in Vabkent is 5:1 established according to Abu -l-WafaBuzjani.

The minaret in Mashhad-i-Misrian (XIII century). According to measurements by A. M. Pribytkova, it has a round base with a diameter of 8.25 m, the diameter of the top of the minaret is of the circumscribed circle of the fourth equal "

according to A.A.Asanov - 3.0 m. The area of squares of their diameters is 68.06 and 9.0 sq. m are relative to 36: 4.75. It is striking that in a treatise for an architect we read: "With the square of the diameter of the circumscribed circle equal to 36, the square of the side of the hexagon is 4 3/4"

In the architectural ensemble of Gur-Emir, four minarets, which once stood at the four corners of the square courtyard, now do not exist. According to measurements by A.V.Shchusev, the southeastern minaret had a round base with a diameter (D) of 290 cm, and the diameter of the top (d) - 245 cm.When the radius (R) of the base of the minaret, the diameter of the top (d) is R √3 , therefore V0: VB = 4: 3 It is possible that the architect Muhammad ibn Mahmud used the postulate to determine the proportions of the minaret "The square of the side of an equilateral triangle is so related to the square of the diameter of the circumscribed circle as 3: 4"

CONCLUSION

At the same time, a comprehensive analysis of the measures taken to develop tourism in the country, the changing environment of the world tourism markets and the increasing competition among the countries of the Silk Road require an integrated approach to the development and implementation of measures for the sustainable development of tourism in the country.

The purpose of this analysis is to develop the tourism potential of Uzbekistan and determine its future position. Demonstrate to tourists the construction of a minaret in this dasar to create a modern form of modern format.

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