

# A possible interpretation of the orientation of the main streets of Stara Zagora, according to the construction plan made by the engineer Libor Bayer in 1879

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**Abstract:** This scientific report presents data from observations of the sunrise over Stara Zagora, by specialists Pencho Markishki from NAO Rozhen and Georgi Georgiev, PhD student in cultural history at Unibit Sofia. In the process of reviewing and researching the information, the task was initially set to determine the orientation of the main boulevards in the city of Stara Zagora - "Tsar Simeon the Great" and "St. Patriarch Evtimiy" Blvd. These are the tentatively called "decumanus maximus" and "cardo maximus" by us from the new plan of the modern city, made by the genius architect Libor Bayer. In the scope of the research it was necessary to determine on which dates in the old style the Sun disk / the Sun / rose, from an azimuth coinciding with the azimuth on "Tsar Simeon the Great" Blvd, at the time when this construction plan was prepared and implemented - in 1879. Specific field observations and measurements were performed. In the context of the historical situation and specifically of the possible justification for the orientation of these main streets, by Libor Bayer, the important historical events after the Liberation are analyzed. The results of this study can help scientists, PhD students and researchers on the way to the search for historical truth, intertwined through the prism of astronomical observations, provided the basis for the creation of ancient Augusta Trayana, and subsequently contribute to the understanding of modern urban environment as a unity of spirit, culture, past and present.

**Keywords:** Libor Bayer, urban plan, Augusta Trayana, Liberation, Principality of Bulgaria, Stara Zagora

## **Introduction**

The city of Stara Zagora, whose history dates back 8,000 years, was reduced to ashes during the Russo-Turkish War (1877-1878). The war brought the dream freedom of the Bulgarians, but many cities, including Stara Zagora, had to be built from the beginning. The Czech construction technician Libor Bayer (1850-1912) was entrusted with the task of restoring Stara Zagora. Many questions remain unclear about Libor Bayer's life, and it is still unknown when and where he was born and what education he received. Libor Bayer came to Bulgaria before the Liberation (1878) as a "construction technician" and worked on the construction of the railway section of the then famous Hirsch railway near the town of Pazardzhik. In 1879, Bayer was invited to Stara Zagora, where he was appointed city engineer and undertook the difficult task of developing a zoning plan for the burned city. It is known that for the development of the plan of the city of Stara Zagora, Bayer was recommended by the Prefect of Tatar-Pazardzhik, Georgi Benev. He /Bayer/ moved to Stara Zagora in April 1879 with his family (he married a Bulgarian widow with a 6-year-old son). Due to the housing crisis, there was no time to make a detailed study of the city's earlier situation, but Bayer diligently sketched and studied the ancient remains of Augusta Trayana where possible. After taking into

account the situation in May, the plan was completed. Bayer applies a freely orthogonal geometric network that does not take into account old streets and buildings during the Ottoman period. This makes the new layout contemporary of European civilization and urban planning rules.

On May 21, 1879, the municipality adopted the plan and it was sent for approval to the Directory of Public Buildings of Eastern Rumelia. Before approving the director, Georgi Valkovic sent the chief architect of Eastern Rumelia, the Italian Pietro Montani, to Stara Zagora to properly check the plan on the spot. On August 2, 1879, the plan was approved by Montani, and then by the Governor-General of Eastern Rumelia, Alexander Bogoridi, by decree № 194 of August 27, 1879. The final plan was completed at a scale of 1: 4000 (**Fig. 2**). A month later, on September 23, 1879, the foundation stone of the new city with a memorial plaque for future generations was laid by Alexander Bogoridi. Thus, finally in 1879 the construction of new houses began and at the end of the year there were about 310 new houses.

But over time, the plan was realized and the city of Stara Zagora became a modern European city.

Bayer's plan was developed in an orthogonal geometric way, and is closer to the planning of the ancient Roman

city of Ulpia Augusta Trayana, whose remains lie below the city of Stara Zagora and were discovered during the war. The main objects of the urban archetype have been adopted - the rectangular insulae, the wide streets and the urban squares.

The streets were arranged in a regular grid and oriented in the four geographical directions, but with a small deviation of  $11^\circ$  in the direction of Northeast and Southwest.(Fig.1)

This fact has not been studied so far by the scientific community and presupposes our main task - to answer why the deviation was accepted. According to some, this brings the city a favorable southwestern position, without arguing about profitability, the state of winds and currents of air masses, for example.

Then the author had several questions that had to be answered.

Is it possible that Bayer took into account the displacement of the main street - Decumanus, in relation to the sunrise on a certain historical date from the nearest Bulgarian history at that time?

Did the genius engineer know the design of the ancient cities according to the position of the sun, as Vitruvius justifies in his ten books on architecture from the first century BC?

I think the answers to both questions are positive and I will try to prove this in the next main task.

## Methodology

This article uses historiographical methods based on a heuristic research and includes some new facts discovered during the author's research. Astronomical software was used by Mr. Markishki, as well as the Internet application [suncalc.org](http://suncalc.org)

## Historical context

An analysis of the urban plan of Stara Zagora from 1879 shows that it was conceived in the style of the rationalism imposed in the XIX century, expressed primarily in the orthogonal / rectangular; chess / planning. Stara Zagora is the first example in support of the thesis of applying the orthogonal planning system as a symbol of independence and complete break with the oriental image of the city. Thanks to the foresight of engineer Bayer, Stara Zagora received its most optimal urban plan for its time.

Bayer was unequivocally called the "urban engineer" of Stara Zagora from 1879 to 1882 and was probably such until 1883-4, while in the meantime he designed / 1881-

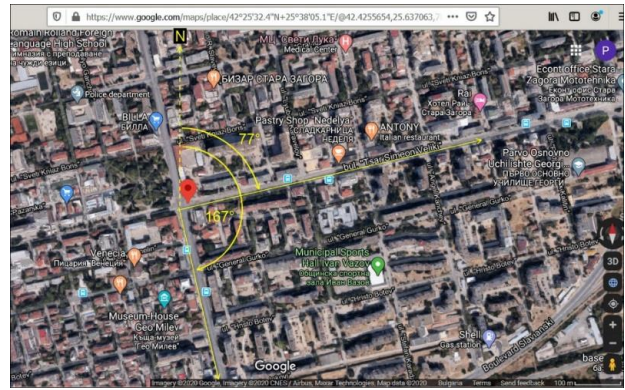


Fig. 1. Directions and geodetic azimuths.

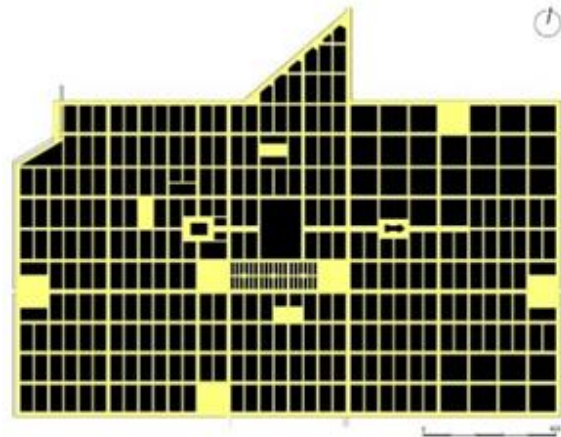


Fig. 2. The urban plan of Stara Zagora, made by Lubor Bayer, 1879, Stylized

82 / and the plan of Kazanlak. Unfortunately, the plan of Kazanlak has not been preserved, but there are written data about it, which shows that it was also planned on a grand scale - wide streets and squares.

According to other sources, he is working on the planning of Kyustendil, author of the zoning plan of Nova Zagora.

## The historical period of knowledge about the architecture of ancient cities

In the sixteenth and nineteenth centuries, Vitruvius' treatises in his Ten Books on Architecture were widely discussed, applied, and taken into account in modern urban planning at the time. The invaluable knowledge of the Roman genius from the first century BC is an integration into architectural education as early as the Italian Renaissance, after it was discovered in 1460 and spread throughout Europe. It is very likely that Pietro Montani and Lubor Bayer, who worked closely together in 1879, were aware of the Roman city's approach to sunrise. In addition, Pietro Montani is an amateur archaeologist and was acquainted with the discovery of ancient history within the Ottoman Empire, in the service of the Sultan. In 1873, Heinrich Schliemann discovered

Troy and the archaic city-related treasure, which instantly became known throughout the world. As early as the 18th century, the Scottish nobleman James Bruce (1730-1794) rediscovered Timgad, the Roman provincial center of North Africa (Colonia Marciana Ulpia Traiana Thamugadi). According to Dr. Barthel, the street which joins the east and west gates was laid out to point to the sunrise of September 18, the birthday of Trajan.

Robert Lambert Playfair organized an expedition and mainly explored the Roman colony of Timgad in 1876-1881.(Fig.3)



Fig. 3. JAMES BRUCE OF KINNAIRD (1730-94)-Thamugadi / Timgad/, 1873, The arch of Gods, British Royal Court, source internet.

In today's Bulgaria, the decumanus of Nicopolis Ad Istrum / The City of Victory on the Danube /, outlined and erected by him after the victory over the Dacian kingdoms, is oriented towards the same date of sunrise / birth date of Emperor Trajan /.

#### **The epic battles of Shipka peak, 11-14 / 23-26 august 1877 (Fig.4)**

The Russo-Turkish War of 1876-1877 changed its course after the bloody and fierce battles at the Shipka Pass, where the Bulgarian militia took part. The battle broke the spirit of the Ottoman troops and raised the military glory of the Bulgarian and Russian soldiers to unprecedented proportions. About the battle Suleiman Pasha sent the following message to the Sultan and the Headquarters -Never before has such a fierce and bloody battle been seen!

The town of Stara Zagora has been mercilessly set on fire three times, and the victims are over ten thousand civilians.It is no coincidence that the battles were celebrated decades later as a national Bulgarian holiday.



Fig. 4. The Defence of the Eagle's Nest, Popov.A.N./1858-1917/oil, canvas, source internet.

#### **Archaeoastronomical research**

##### **The main task**

1. To determine the orientations of the main boulevards in the city of Stara Zagora: the "Tsar Simeon the Great" (as a modern "Decumanus Maximus") and the Blvd. Patriarch Euthymius "(as today's "Cardo Maximus") in a place around their crossroads, with coordinates  $42^{\circ} 25' 32.4''$  N and  $25^{\circ} 38' 05.1''$  E.(Fig.5)

2. To determine on which dates the Sun rose from an azimuth coinciding with the azimuth of Tsar Simeon the Great Blvd. during the time of the architect Lubor Bayer (in 1879).

According to the author's observations made on the morning of August 10, 2020, the upper end of the solar disk is shown above the local horizon around 06:30:00 official time, from a geodetic azimuth of  $69^{\circ} 49'$ .

On the same date (August 10) the sunrise relative to the mathematical horizon for the city center was around 06:19:24. Then the upper end of the solar disk appeared above the mathematical horizon of the geodetic azimuth  $68^{\circ} 01'$ .

The measurement of the moment of sunrise as the one in which the upper end of the solar disk is shown is in accordance with the definitions valid today in astronomy for sunrise and sunset of the Sun and the Moon.

The delay between sunrise on the mathematical and local horizons is 10 minutes and 36 seconds, during which time the upper end of the solar disk has risen to a height of  $1^{\circ} 35'$ , which can be considered the height of the local horizon at sunrise. We accept this height as valid for the entire horizon in the northeast-east direction, to which Tsar Simeon the Great Blvd. points.

Data in tabular form:

Sunrises:	Sunrise time in Bulgarian official time (summer time) [hh: mm: ss]	Geodetic azimuth [° ']
At the mathematical horizon	06:19:24	68 01
At the local horizon	06:30:00	69 49
Delay between the two sunrises and height of the local horizon	Delay: 10 minutes and 36 seconds. Height of the local horizon $\approx 1^\circ 35'$	

Table 1.Sunrises

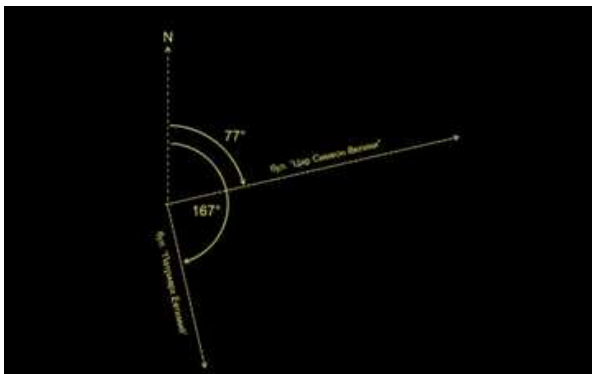


Fig. 5. The azimuths of the two boulevards in the east-northeast and south-southeast directions, respectively, for an observer at the crossroads.

2. Determining the orientations of the main boulevards in the city: Tsar Simeon the Great Blvd. and St. Patriarch Euthymius "in a place around their crossroads, with coordinates  $42^\circ 25' 32.4''$  N and  $25^\circ 38' 05.1''$  E (decimal:  $42.425667^\circ$  N and  $25.634750^\circ$  E).

The measurements were performed on a map from Google Maps <https://www.google.com/maps/place/42%C2%B025'32.4%22N+25%C2%B038'05.1%22E/@42.4256667,25.6329701,387m/data=!3m2!1e3!4b1!4m6!3m5!1s0x0:0x0!7e2!8m2!3d42.4256723!4d25.6347427>

Results:

Geodetic azimuths on Tsar Simeon the Great Blvd. at the crossroads:  $77.0^\circ$  (east-northeast) and  $257.0^\circ$  (west-southwest).

Geodetic azimuths on Patriarch Evtimiy Blvd. at the crossroads:  $167.0^\circ$  (south-southeast) and  $347.0^\circ$  (ie -  $13.0^\circ$ , north-northwest). There is a very slight curve of the boulevard - probably due to later corrections of curbs, gardens, etc.

Explanation:

The geodetic and meteorological azimuth, in contrast to the astronomical azimuth, begins to be reported from the north, in the east-south-west-north direction (right). The astronomical one starts from the south and increases in the same direction (again to the right, ie west-north-east-south).

We are interested in the direction with the azimuth  $77^\circ$  on Tsar Simeon the Great Blvd.

Since this direction makes a greater angle to the north than the azimuth of the sunrise at the date of the summer solstice (then the sun rises from Az  $56.5^\circ$  at the mathematical horizon), there will be two periods of the year when the sun rises of azimuth about  $77^\circ$  at a local horizon height of  $1^\circ 35'$ .

Since the astronomical software allowing simulations of celestial phenomena in past epochs takes into account the correction of the calendar by Pope Gregory XIII in 1582, but not the introduction of the Gregorian calendar in Bulgaria in 1916, we will first look for the dates of these sunrises, according to the Gregorian calendar (new style).

And then we will equate to the old style.

In 1879, the sun rose from an azimuth of  $76^\circ 46'$  at a local horizon of  $1^\circ 35'$  on August 26 in a new style, at 04:46:56 (EET winter time).

However, it is good to round the moments to a minute, as the software makes errors of about +/- 4 seconds).

On August 27 at 04:48:00 the sunrise looked almost the same - from azimuth  $77^\circ 15'$ , i.e. with minimal displacement of the Sun to the south.

These are the closest summer sunrises to the direction (azimuth) of Tsar Simeon the Great Blvd. of  $77.0^\circ$ , at the indicated height of the local horizon.

In the spring of 1879 we also have sunrises in this direction at a local horizon with the indicated height:

On April 16 at 04:47:20 (EET in winter time) from azimuth  $77^\circ 36'$ ;

On April 17 at 04:45:46 from azimuth  $77^\circ 07'$  (here is the closest match to our requested azimuth  $77.0^\circ$ );

On April 18 at 04:44:11 from the azimuth  $76^\circ 38'$ .



Below, the same data are given in tabular form, with dates from new to old style equated (second column of the table).

Here we explain the alignment of dates to the old style:

As the difference between the Julian and Gregorian calendars - after its introduction in 1582 grows over time (from 10 days that Pope Gregory I added then, to 13 days with the introduction of the Gregorian calendar in Bulgaria in 1916), then the difference in days is calculated on the basis of the time elapsed after 1582.

To match from old to new style you should:

From October 5, 1582, to February 28, 1700, 10 days are added - as many as Pope Gregory XIII added in 1582 (for example, May 1 in the old style = May 11 in the new style for this period);

From March 1, 1700, to February 28, 1800, 11 days are added (for example, May 1 in the old style = May 12 in the new style for this period);

From March 1, 1800, to February 28, 1900, 12 days are added;(this is our case, but we will subtract 12 days, because we have to equate from new to old style, ie vice versa!);

From March 1, 1900 to February 28, 2100, 13 days are added, incl. and after 2000, because it is a multiple of 400 and remains high (the so-called 2nd exception in the system of Grieg. calendar).

In our case we have to subtract 12 days from the specified dates in a new style:

Sunrise date in a new style	Sunrise date in the old style	EET sunrise time at 1 ° 35 ' local horizon	Geodetic azimuth of sunrise [° ']
April 16, 1879	April 4, 1879	04:47:20	77° 36'
April 17, 1879	<b>April 5, 1879</b>	04:45:46	77° 07'
April 18, 1879	April 6, 1879	04:44:11	76° 38'
August 26, 1879	<b>August 14, 1879</b>	04:46:56	76° 46'

August 27, 1879	August 15, 1879	04:48:00	77° 15'
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Table 2. The best coincidences.

The best coincidences with the direction of the boulevard were on April 5 and August 14, 1879 in the old style. As the date of April 5 does not correspond to significant events in our history, we will not consider it.



Fig. 6. Unveiling of the Monument of Freedom - August 26, 1934 / August 14 in the old style! / - The inscription reads: Here rises the Freedom of Bulgaria!, source internet.

## Conclusion

Therefore, based on the above, we can confirm the following facts:

Undoubtedly, the orientation of the main street / decumanos - east-west / of Stara Zagora, according to the plan of Lubor Bayer, shows the sunrise on August 14, 1879.

The date is associated with the victory at Shipka Peak and St. Nikola and has been celebrated for almost two or more decades as a national holiday in the town of Kazanlak with celebrations and wide participation of the Bulgarian public, surviving volunteers and soldiers of the Russian Imperial Army.(Fig.6)

Lubor Bayer attended the festivities every year, and in 1912, when he was commissioned to design the Arc de Triomphe by the town hall, he suddenly fell ill and died in Kazanlak.

The interpretation of this fact leads to an important and significant contribution, regardless of the conscious or unconscious deviation of 11 degrees in the direction of the world by the genius Czech engineer.

Stara Zagora is a city of victory at Shipka undoubtedly and uncontroversially, even if only according to its urban orientation to the important date in Bulgarian history of

courage and heroism - the sunrise of the New Bulgarian statehood!

### Acknowledgements

We would like to thank and to express my deep gratitude to Prof. Dobrina Jeleva - Martins Viana and Mr. Pencho Markishki to the National Astronomical Observatory - Rozhen, for their collegiality and nobility!

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