**Longest single water supply line from the ancient world**

As a city rebuilt at the fourth century, Constantinople was placed in a favorable position both strategically and for trade purposes. Water was, and would continue to be a, main problem for the City's governors; it was simply not enough. Constantinople was a typical Roman (or late antique) city of its time; statues, hippodrome, a great palace and big public places in addition to public baths and water reserves; water was crucial for a city to function properly and of course, to sustain the army. Necessity being the mother of invention, combined with the roman (byzantine) ingenuity, the solution to the ever increasing water demand was to build long water supplies bringing in water to the city from over long distances; this attempt resulted in with the longest water supply line of the ancient world, and the so-called Aqueduct of Valens was linked to this system. Even today, a structure called Bozdogan Kemeri stands tall over the city landscape; it is a great water bridge of some 86 arches, 971 m-long bridge, and identified as the Aqueduct of Valens.

Figure 1. Aqueduct of Valens. Photo by James Crow, 1990's.

Taken from website (http://www.shc.ed.ac.uk/projects/longwalls/Water/images/Aqueducts/Valens1.jpg)

An aqueduct is a structure which brings water to a city for baths, for people in the city, generally for the public use. Aqueducts often have underground pipes, so that the water dropped gradually at an angle of less than 1 percent from the source (Oxford dictionary). In

Constantinople, population was growing in size and it did not have a water system in the form of local wells and springs. So the governors had to find other ways to supply the water needs of the city. It was a traditional Roman manner to build aqueducts (Juut, Petri, and Tapio, Katko, and Vuorinnen, Heikki 72). Valens Aqueduct was a long system which used water sources of Thrace. At over 250km, it is the longest water supply line known from the ancient world and it remains one of the greatest achievements of hydraulic engineering (Bayliss, 2001). With the help of more than 30 stone water bridges and underground tunnels, water carried over mountain and plain from the plentiful springs of the Istranja Mountains near Vize straight into the city (Bayliss). The city had two channels; the narrow channel built by Valens used water of Damamandira and Pinarca. Aqueduct of Valens, also known as Bozdogan Kemeri, carried water from forest of Belgrad and Halkali. But, it's important to say that the base of construction does not belong to Emperor Valens. It dated to 345 AD from the time of Constantius II (Bayliss). Emperor Valens (AD 364-78) rebuilt the construction and the longest water supply of ancient times completed. Aqueduct Bridge was carried a water channel at an elevation of 56-57m above the sea level and help the high level channel to supply the water needs of Forum of Theodosius and Constantine also Carosianae Baths and Binbirdirek Cistern ( Bono, Crow, Bayliss 118). The problem was that there were dry summer times. Aqueduct was more useful in spring times but in the dry summer times supplying enough water was still a problem for the city. Later, covered and open cisterns added to water system for summer time supplies (Juut, Petri, and Tapio, Katko, and Vuorinnen, Heikki 72).

I would like to explain the details of aqueduct bridge. Today, the aqueduct is still visible in Istanbul, in the Fatih region, and spans the valley between the hills. The surviving part of the aqueduct is 921 m long. The Ataturk Boulevard passes under its arches. Bridge is originally 971 m in length. The western end of the bridge has been partly torn down and cross-section can be seen today. Section displays a vaulted channel set towards the northern

flank of the bridge (Bono, Crow, and Bayliss 119). This has a width of 0.95m, has 4cm layer of hydraulic mortar on flanks. According to Bono, Crow and Bayliss; Cecen records that the channel was unblocked during lately restorations and traced for 9m eastwards along the bridge (119). Also there is a blocked channel on north side of Aqueduct of Valens. According to Çeçen, blocked channel may carry water from Halkali, and other unblocked channel may have carried water from Thrace (Bono, Crow, Bayliss 120). According to Bono, Crow and Bayliss upper part of bridge under Valens carried one channel and when sources at Vize started to use bridge had two channels (120). Other theory of them is that maybe first two channels used the same source which was from Thrace but then when it could not used any more one of the channels used the source of Halkali (120). According to Cecen, elevation of channel when entering the city was 63 m above sea level.

According to J. P Adam, Roman aqueducts have long lines of arches (239). I would like to explain the general characteristics of that type of Roman aqueducts in order to understand the Valens Aqueduct better. The length of long aqueducts was due to the distance from the water source and also to the position and lie of the land (Adam 241). Sometimes engineers make short falls in order to slow down the speed of strong water. According to the water that city needed the capacity of an aqueduct vary. If water needed for baths and public use usually 500litres of water per day is used (Adam 245).

If we look at history of Valens Aqueduct, repairs and destructions, I would like to restate some main events with the help of Oxford Byzantium Dictionary. Rome had 19 aqueducts and 32 km out of 428 rested on arches. Fourteen still functioned when destructed by the Goths in 537. Constantinople had a water supply originated from Halkali as I mentioned before, and Halkali was located about 15 km northwest of the Constantinople, through an aqueduct built by Hadrian. But the buildings name is known as Valens, which was

the aqueduct's restorer. In the late 4th century various aqueducts was constructed over 100 km west of Constantinople to satisfy the needs of the growing population as I said before, in the time of Valens. Aqueducts destructed in the times of attacks. Valens Aqueduct destructed by the Avars in 626, was rebuilt in 758; it was later had some restorations throughout the 12th century. Later cisterns were built to supply the water for the city. By the time population decrease, cisterns were enough for the city. After Ottomans invaded the city, a new system was constructed in the 16th century based on the sources at Halkali and in the Forest of Belgrade, this proves that Byzantine rulers knew which sources was best for a city with a big population.

Byzantine engineers were thinking about every detail, calculating the slopes, searching for water supplies which can supply clean water for a long time. Also their buildings, constructions stands still today and we can see and understand their technology even today. But I think, Valens of Aqueducts importance should be told to people in different methods. Maybe near the surviving part there should be an open area where we can read about it and how it functioned. Because people generally fail to understand that it was the part of the longest water supply system in the ancient times. They usually see the remains and think that it was simple aqueduct carrying water. They do not know how far it reached to the sources and how a complicated structure it was. In the open area some maps, locations of sources, building techniques of this aqueduct can be shown. Also with illustrations from ancient times to modern times, the view of the region can be displayed. I think Aqueduct of Valens is not just a great achievement of engineering but also a reminder of the importance in supplying clean water from various sources into the heart of the city with great water supply line in time of Byzantium.

*Z. Doğa Ortaköylü*

## Additional Photos:

**Figure 2. B&W Photo of Aqueduct of Valens by S. Murray, taken from Website http://www.artandarchitecture.org.uk/images/conway/fbaed277.html**

**Figure 3. View of Valens Aqueduct in present time Taken from website, Courtesy of Türsab. (http://guidesofistanbul.com/eng/images/bozdogan_2/766662-roman_aqueduct-Istanbul.jpg)**

**Bibliography**

The Water Supply of Constantinople, online article from website;

http://www.shc.ed.ac.uk/projects/longwalls/WaterSupply.htm

Valens Aqueduct Photo by James Crow, taken from website

http://www.shc.ed.ac.uk/projects/longwalls/Water/images/Aqueducts/Valens1.jpg

http://www.oxford-byzantium.com.libunix.ku.edu.tr

Valens Aqueduct Article and aerial photo from Türsab website.

http://guidesofistanbul.com/eng/valens.htm

B&W Photo of Aqueduct of Valens by S. Murray, taken from Website

http://www.artandarchitecture.org.uk/images/conway/fbaed277.html

P Bono, J Crow, R Bayliss.The water supply of Constantinople: archaeology and hydrogeology of an Early Medieval . Environmental Geology, 2001 - Springer

S. Juut, Petri, and Tapio, S. Katko, and Vuorinnen, S. Heikki. Environmental history of water. 2007.

Adam, Jean Pierre. Roman building : materials and techniques. **London : Routledge, 2001.**