WTC 2019
Meet you in NAPLES
ITA - AITES General Assembly and World Tunnel Congress
TUNNELS AND UNDERGROUND CITIES: ENGINEERING AND INNOVATION MEET ARCHAEOLOGY, ARCHITECTURE AND ART
MAY 3 | 9
MOSTRA D'OLTREMARE

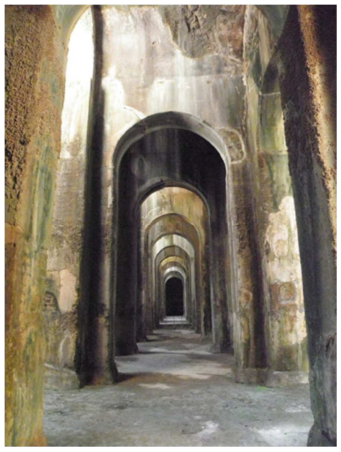
Tunnelling for water supply: from the underground of Naples to modern giant aqueducts in Manila and Nakuru cities

P. Galvanin, A. Socci – Alpina Spa

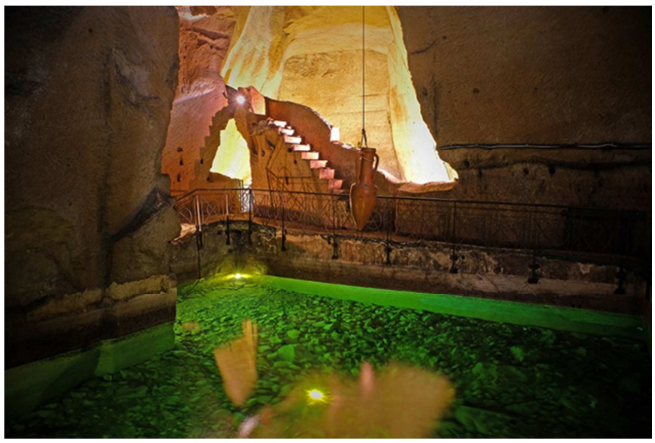
According to the last review of the Global World Urbanization Prospects, issued by United Nations: "*55 % of the world's population lives in urban areas in 2018; by 2050, 68 % of the world's population is projected to be urban*".

Urban growth is closely related to three dimensions of sustainable development: economic, social and environmental. For sure water is the most immediate and critical limiting factor to both human and environmental well-being.

For this reason, since ancient times, men were engaged in construction of big aqueducts for water supply: the ancient Romans built engineering and architectural masterpieces for water transport, like - for example - the 400 km of underground channels in Naples, excavated in the yellow tuff, connecting monumental tanks, among which the spectacular *Piscina Miarabilis* or the *Cisterna Imperiale*.



The Piscina Mirabilis built by Romans



The Cisterna Imperiale, Ancient Romans underground tanks

Nowadays, as in the past, engineers are involved in construction of aqueducts for megacities: tunnelling still plays a crucial role for development of water infrastructures.

YOUR HOST FOR THE CONGRESS

Società Italiana Gallerie
Italian Tunnelling Society
Via Scarsellini, 14
20161 MILAN (Italy)
Tel. +39 02 25715805
segreteria@societaitalianagallerie.it
www.societaitalianagallerie.it

ORGANIZING SECRETARIAT

AIM Group International - Milan Office
Via G. Ripamonti, 129
20141 MILAN (Italy)
Ph. +39 02 56601.1
Fax +39 02 70048578
wtc2019@aimgroup.eu
www.aimgroupinternational.com

COMMUNICATION PARTNER

PPAN srl
Via Nomentana, 63
00161 ROME (Italy)
wtc2019@ppan.it
www.ppan.it

WTC Napoli 2019 @wtcnapoli2019 WTC Napoli 2019

ITA AITES

www.wtc2019.com

There are roughly 40 cities in the world with more than 10 million inhabitants: Metro Manila in the Philippines is one of them, while Nakuru City in Kenia is an example of a rural area, experiencing a rapid growth of the resident population with approximately 5 million inhabitants within 2050.

The municipality of Metro Manila is investing billions to improve the reliability of the raw water transmission system towards the city, including seismic hazard mitigation. One of the most important projects is the so called AWTIP (Angat Water Transmission Improvement Project) which involves the Angat river, whose water is conveyed from IPO dam to Bigte through 3 existing tunnels. The project includes a new intake structure at Ipo Dam reservoir and the New tunnel n.°4 - having a total length of roughly 6,4 kilometres and an internal diameter of 4,2 m. The tunnel, conveying a minimum flow rate of 19 m^3/s, is excavated for its entire length with a double shield Tunnel Boring Machine (TBM).

The Itare Dam next to Nakuru City for the new water supply system © Alpina Archive

In Kenya, next to Nakuru city, a new giant aqueduct is under construction: this project is aimed at improving water supply in the Nakuru Municipality and its environs: Molo, Elburgon, Salgaa and Njoro towns. The integrated water system for the supply of the potable water from the new Itare Dam to the villages of Nakuru is mainly composed by a dam with a total storage volume of 11,6 Mm^3, a free surface water transfer tunnel - having a 3,2 m internal

YOUR HOST FOR THE CONGRESS
Società Italiana Gallerie
Italian Tunnelling Society
Via Scarsellini, 14
20161 MILAN (Italy)
Tel. +39 02 25715805
segreteria@societaitalianagallerie.it
www.societaitalianagallerie.it

ORGANIZING SECRETARIAT
AIM Group International - Milan Office
Via G. Ripamonti, 129
20141 MILAN (Italy)
Ph. +39 02 56601.1
Fax +39 02 70048578
wtc2019@aimgroup.eu
www.aimgroupinternational.com

COMMUNICATION PARTNER
PPAN srl
Via Nomentana, 63
00161 ROME (Italy)
wtc2019@ppan.it
www.ppan.it

diameter and a total length of roughly 12 km - and a more than 130 km long treated water pipeline. The machine chosen for the tunnel excavation is a dual mode "crossover" EPB/TBM, capable to excavate in hard or soft rocks.

The internal diameter - only 3.2 m - can be considered quite huge for an aqueduct, but very small for a modern tunnel. A width not so different from tunnels excavated beneath Naples by ancient Romans: admired engineers of the past, who are still teaching to young and modern engineers.

YOUR HOST FOR THE CONGRESS

Società Italiana Gallerie
Italian Tunnelling Society
Via Scarsellini, 14
20161 MILAN (Italy)
Tel. +39 02 25715805
segreteria@societaitalianagallerie.it
www.societaitalianagallerie.it

ORGANIZING SECRETARIAT

AIM Group International - Milan Office
Via G. Ripamonti, 129
20141 MILAN (Italy)
Ph. +39 02 56601.1
Fax +39 02 70048578
wtc2019@aimgroup.eu
www.aimgroupinternational.com

COMMUNICATION PARTNER

PPAN srl
Via Nomentana, 63
00161 ROME (Italy)
wtc2019@ppan.it
www.ppan.it