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Analysis of ventilation parameters of excavated road tunnels by means of duct ventilation using Ventsim software

Zbigniew Kuczera[1], Andrzej Szmuk[1], Grzegorz Stacha[2], Marek Borowski[1]

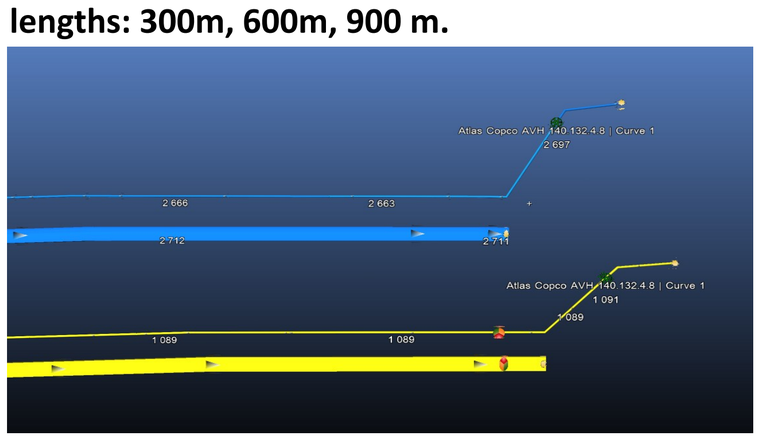
[1] AGH University of Krakow [2] MIRBUD S.A.

INTRODUCTION

This poster presents an analysis of the ventilation parameters for the consecutive bored road tunnels TD 2.1 and TD2.2 by means of a duct installation using the Ventsim software. The geometrical and technical parameters characterising the tunnels in question and the duct ventilation systems were used to create a mathematical model in VentSIM [1] using the plan, technical design and duct ventilation design. The distribution of air flows and temperatures was simulated for the next three tunnelling stages of 300m, 600m and 900m. In addition, simulation analysis of the changes in the composition and thermophysical properties of the air in the 140m long face zones was carried out for the maximum length of the tunnelling for the end of the duct 10m and 40m away from the face.

Case study – Simulation.

Stage 1: Operating points were determined for the selected fan considering three run-out lengths: 300m, 600m, 900 m.



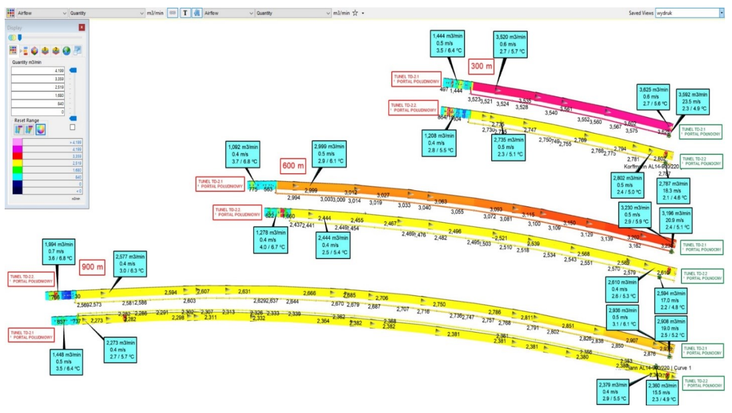
Case study - Drilling of the Węgierska Górka tunnel [2]:

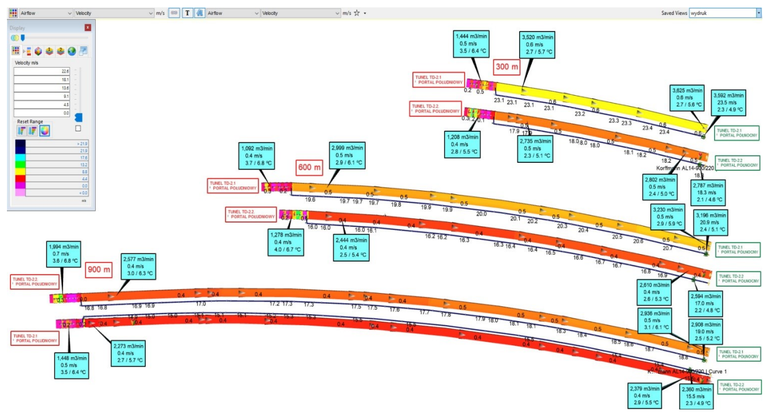
- case study: Węgierska Górka tunel TD-2 (two tubes)
- road: Expressway S1 Bielsko-Biała -- Żywiec – Zwardoń
- the length of the tunnel TD-2.1: 984 m
- the length of the tunnel TD-2.2: 975 m
- method of drilling: with explosives and breaking rocks with machines

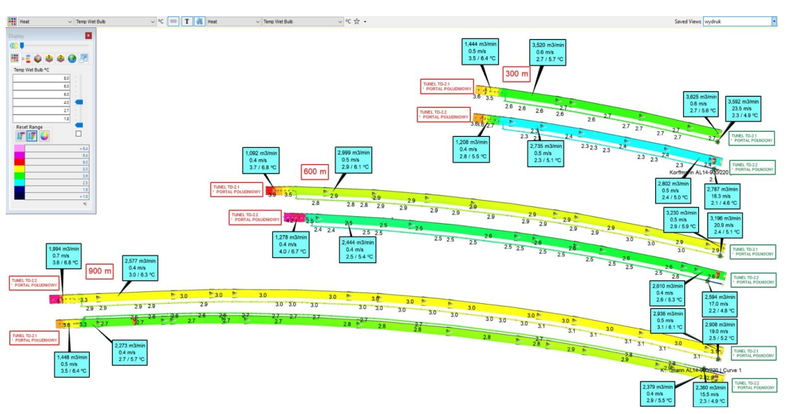
According to the design, the system consists of [2]:

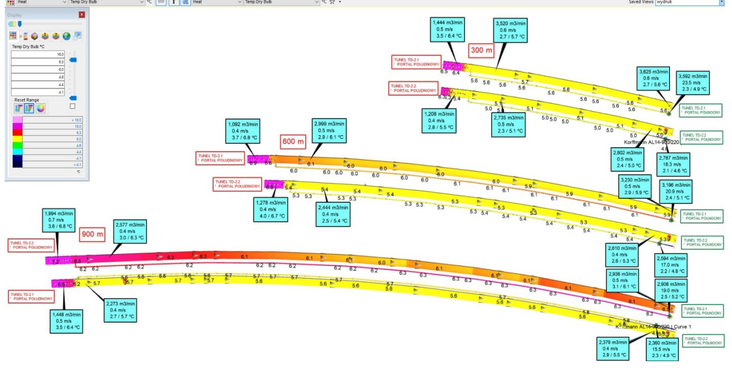
- flexible air ducts 1800 mm (maximum working pressure of 5000 Pa, air duct resistance of 0.00748 Ns^2/m^9).
- duct fans:
  - for the TD-2.1 tunnel of the Korfmann Al-14 900/220 fan,
  - for TD-2.2 tunnels of the Atlas Copco AVH140 fan.

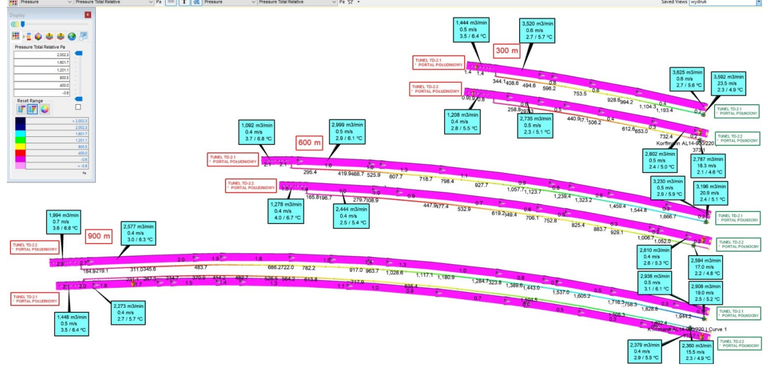
Stage 2: Determination of the distribution of parameters characteristic for three runways of the drilled tunnel: 300m, 600m, 900m, and average annual thermodynamic parameters of atmospheric air .



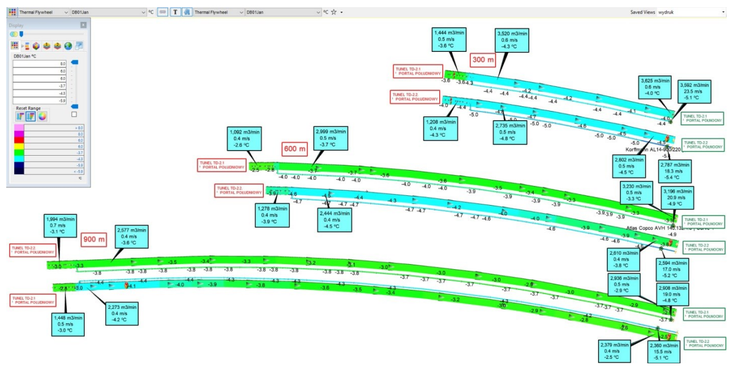


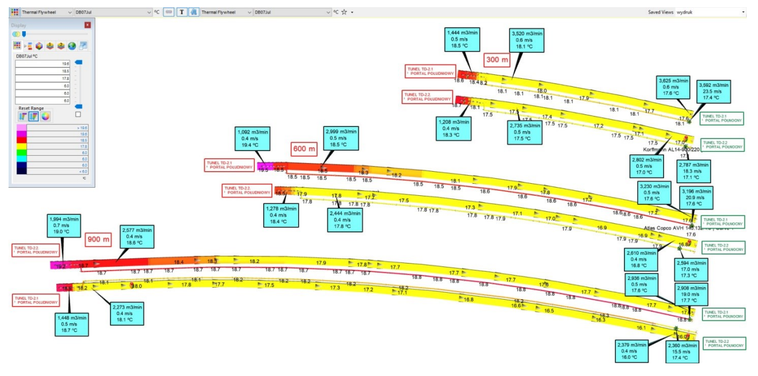






Stage 3: Analysis of temperature distribution depending on the month of work (extreme months selectedL: January and July).





CONCLUSION

- Control of air parameters during drilling is of key importance in order to ensure safe working conditions and thus enable effective tunneling
- A ventilation system is essential at the road tunnel construction stage. Many factors must be taken into account, including the selection of the appropriate equipment, the ability to achieve the assumed flows, temperature, and emission concentrations.
- The VentSIM software makes it possible to check variants of execution, including, for example, the use of different fans, and the location of air duct end at different distances from the face wall.
- In order to check the flows at the wall, it was necessary to use the diffusion option, which allowed to simulate the mixing of air masses and circulation in this area.

Literature: [1] User Guide VentSIM software HOWDEN Co. [2] Materials from Mirbud S.A.