AIR POLLUTION ABATEMENT WITH INNOVATIVE PHOTOCATALYTIC COVERING TECHNIQUES

N. Moussiopoulos and Ph. Barmpas
Aristotle University Thessaloniki
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Introduction

- In urban areas the levels of gaseous pollutants are relatively high due to increased emissions.
- The problem is particularly intense especially in urban hotspots like street canyons.
- Pollution has a negative effect on human health and results in the aesthetic degradation of the urban environment.
Photocatalytic Innovative Coverings (1/4)

Depollution

The addition of TiO$_2$ into the façade coverings results in increased pollutant absorption:

- NO$_x$
- VOC’s
- PM
- O$_3$
**Desoiling**

The surface will keep clean from urban classical soiling factors

- Bacteria
- Algae
- Organic compounds

**DESOILING**

The soils fixed onto the surface are dissociated from it under the effect of TiO₂, and then washed by rain water or sprinkling.
PICADA led to 3 different products: a mortar, a cementitious coating and a translucent coating.

Experimental application of the products:

- Conclusion regarding the correct method of application.
- Quality assurance plan.
Our contributions to PICADA

The Laboratory of Heat Transfer and Environmental Engineering was responsible for assessing the depollution potential of the PICADA products via:

- The participation in international coordinated experimental activities including
  - in situ measurements in field campaigns and
  - laboratory activities (physical modelling with the use of wind tunnel measurements).
- Numerical simulations with the CFD code MIMO.
Numerical simulations
Guerville experimental field campaign (1/2)

- Reference canyon
- TiO$_2$ treated canyon

Dimensions:
- Reference canyon: 5.18 m
- TiO$_2$ treated canyon: 2.44 m
- Width: 18 m
The photocatalytic surface is an effective “trap” for air pollutants.

- The use of the specific sample led to a pollution reduction by 50-60 %.

- Numerical simulation results agree very well with the experimental measurements.
Wind tunnel campaign (1/2)

Field site model (scale 1/50)

Horizontal plane, $Z = 0.5H$
Conclusions

- WD 90°: Pollution accumulated at the mid cross section; at even small deviations from WD 90°, flushing via one canyon side is enforced.

- Concentrations highest at the low levels.

- For WD 90°, street canyon ventilated mainly via the roof top.

- The wind tunnel measurements prove the validity of the numerical model results.
Application examples (1/2)

Sir John Cass Primary School, London
Application examples (1/2)

Sir John Cass School, London
Application examples (2/2)

Road Tunnel in Rome

entrance

exit

tunnel centre