WIND TUNNEL STUDY OF DISPERSION IN DIFFERENT URBAN AREA CONFIGURATIONS

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INTRODUCTON

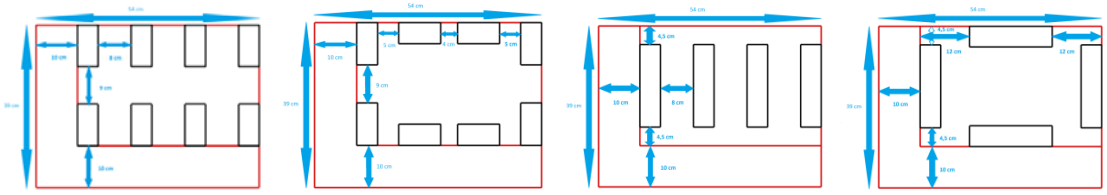
Accidental or intentional escapes of gas mean a huge risk. From this reason it is becoming to pay attention to this problem. Escapes of gas in densely populated zones of towns are especially grave. There are mainly soluted tasks finding a shape of plume from a given source. In this study it will be described a method to this inverse – a given location of detector of pollution and a net of points where we placed one by one a pointed source. We've studied this problem in different urban area set-ups. To explore this problem we've chosen the method of physical modelling.

EXPERIMENTAL SET-UP

We˘ve chosen buildings formed by individual blocks of two different lengths (named long (D) and short (K)) organized parallelly (r) and in unclosed yards (d) - see Fig. 1. These four different set-ups of buildings form base elements that are repeated in our models. Wind tunnel models were scaled down to 1:300. The short model buildings had these dimensions:

- height 10 cm (a building with 10 floors in full scale)
- length 10 cm (2 parts of estate with their own entrances in CR in full scale)
- width 10 cm (estimated average width of building creating housing developments in CR in full scale)

Long buildings had double length, other dimensions were the same.



(a) Kr *(b) Kd* *(c) Dr* *(d) Dd*

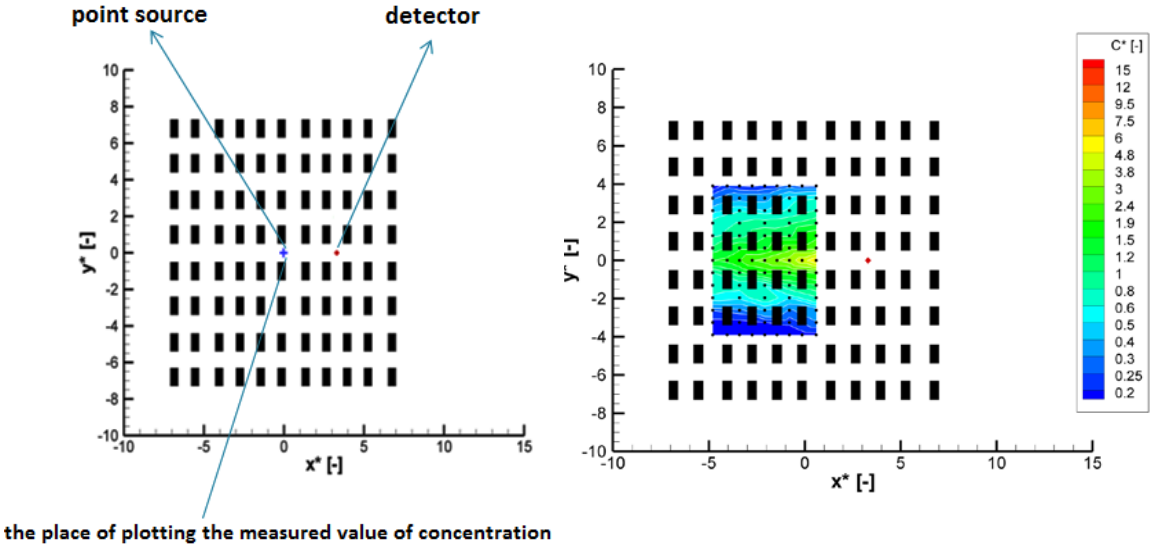
Figure 1: Basic elements of set-ups

The measurement took place in low-speed aerodynamic tunnel of Institute of Thermomechanics AS CR in Nový Knín. Fully turbulent boundary layer of desired quality was developed by spires and roughness elements placed in the tunnel. We used Fast Flame Ionisaton detector (FFID) for measurement of concentration and two-dimensional optical fibre Laser Doppler Anemometry (LDA) for flow measurements.
Passive contaminant was simulated by ethan. It was given off from a point source placed in height of 7 mm above the bottom of tunnel. The FFID detector was located 2 mm above the bottom of the tunnel.

MANNER OF SHOWING RESULTS

As we mentioned in the introduction we measured concentration in two fixed points and we were changing the placement of air pollution point source. By that we obtained the

inverse map of pollution modelled built-ups. The construction of this map is explained in figure 2 (a). It can be seen that we are giving off pollution in the place of blue cross. We measured pollution caused by this source in the place of red rhombus. Then we drew the value of concentration in the place of blue cross. So there's the difference by comparison with straight manner of measuring (a given source and a net of points, where we place detector), where we draw the measured value in place of red rhombus.
Just explained manner of inverse measurement could be apply for the location of getting off pollution and intensity of a source. That can come in handy for example if there is an accidental or intentional escape of gas (for example sarin during attacks of terrorists).



(a) plotting the inverse map of concentration (b) example of results for Kr
Figure 2: Inverse type of modelling

We use the following dimensionless quantities in figure 2: dimensionless coordinate x: $x^* = \frac{x}{H}$, *dimensionless coordinate y:* $y^* = \frac{y}{H}$, *dimensionless concentration C:* $C^* = \frac{C U_{ref} H^2}{Q}$. *In these relations H stands for the height of modelled buildings,* U_{ref} *value of flow speed in x direction in the height 2H, Q source intensity. Flow comes parallelly with the axis x* from left to right.*

CONCLUSION FROM THE RESULTS

From our experiments it has been shown that due to potencional risk of getting off gas in highways the best setting is long parallel (Dr). Conversely the set-up with the biggest value of concentration measured also in two fixed points is short unclosed yard. In general it can be said that we have measured smaller C* in parallel set-ups of buildings than in unclosed yard settings. Maybe that's because of the lower speed of flow inside yards. In unclosed yards more pollution is probably flown away through highways by comparision with parallel cases. Further we have measured smaller values of concentration for settings consisted of long buildings than the short ones. That might be caused by bigger width of corridors by comparision with the short ones.

ACKNOWLEDGEMENTS

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