STREET ATMOSPHERE IS VENTILATED BY SOLAR ENERGY

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ABSTRACT Concentration of carbon oxcide on the limits of streets in windless day is shown in the report. If the wind velocity U<0,2 m/sec that concentration of carbon oxcide more than sanitary acceptable in 50 . . . 600 times.

A total heat released from car motors is 1,2. . . 1,5 of quantity of Solar energy passed to polluted air. That is why a total heat released must be used in the calculation. It allows us to determine volumetric consumption of air and an average velocity of the air lifting W more correctly. Volumetric consumption of air "pushed" by heating from Solar energy and car motors is approximality equal to volume of dangerous gases from cars.

The original mathematical modelcan is used in this work, includes 18 basic formulaes. The first and limited terms are from inquiry, specific, scietific and technical literature and experimental dates. The number of indicates, for example, the wind velocity is given as a prescribed variable value.

It is shown the principal opportunity of airing the city streets in windless days by heating of solar energy. The heated and polluted air is "pushed" by the clear cool air, which can be generated in special green plantation.

1. INTRODUCTION

An essential factor of polluting the air medium in large cities is a motor-car transport, the exhausts of which prezent danger because of a low altitude of their scattering at the level of children and teenagers breating and a considerable density of the people s moving along the streets.

On windy days some mixing and scattering of the exhaust gases of internal combustion engines and their carrying away to height above the level of breathing organs of a human being take place. On calm days harmful substances are accumulating at the surface of the ground polluting the air at the level of the human being breating and soil. The arrangement of

active measures of airing on windless days does not make them possible due to a considerable stretch of the streets opened in the cities for the car traffic.

The study of the available experimental and literary data [1] showed that in the conditions of the compacted building a reliable airing of the city streets could be provided only when harmful mixtures were eliminated upwards. Due to an active mixing the air flow moving above the buildings captures the harmful substances and ventilates streets, yards and the other spaces, if their relative "depth" is not considerable. Anyhow, it is very difficult to expect through airing of many spaces when the system of building is not ecologically-grounded and the wind velocity and direction are not steady.

2. CONCENTRATION OF CARBON OXCIDE IN WINDLESS DAYS

Method of determination of concentration of motor cars dangerous gases is discribed in [1].

The first task of study was comparison of present concentration of carbon oxcide and sanitary acceptable one. Calculations was made for a district road with one line of raffic (frequency of car is 200. . . 300 per hour). It is three variants of availability of equipment for purify car motor gases: 0%,50%,100%. A changes of wind velocity was from 0,1 to 10,0 m/sec with a step 0,05 m/sec.

Results of calculations showed that provision of equipment for purify car motor gases 100% cars decreases pollution of carbon oxcide in 19 times. If velocity of wind cutting down that concentration of carbon oxcide on the limits of streets increases. If the wind velocity is less than 0,2 m/sec that concentration of carbon oxcide more than sanitary acceptable in 50. . . 600 times.

3. THE SELECTION OF MATHEMATICAL MODELCAN

The author set the task to evaluate feasibility of a Solar energy (in combination of the other factors) to lift harmful mixtures upward and hence to air the streets.

Solar energy is supposed to heat the road bed which gives part of thermal energy to the air masses contacting the road bed. The air above the road is heated up to the temperature exceeding the value for ambient air. Density of "cool" road-side masses is higher than that of the heated air because of which the former is "pushed" up. Relatively cool air masses can be generated in specially formed (grown) road-side tracts of green plantations.

The road in common case is limited by "green" plots with different extent of shading the soil surface thus having various values of air

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temperature inside the plots. Height, density, varieties of green plantations and geometrical dimensions of the green plot determine quantity and temperature of a cool purified air which forces the heated and polluted air out of the opened plot.

Intensity of the processes of heating the air above the road or the other plot (heat transfer from the flat horizontal plate) and displacement of the heated air by that one having reduced temperature (natural circulation) depends on many parametres. The combinations of these two processes comprises a complicated problem of heat and mass exchange.

From physical point of view closest way to the solution of the problem is cited in the paper [2]. The mathematical model to calculate the spreading of ejections coming out of chimney of thermo-electric power station or boiler-room into atmosphere is given here. On the first approximation this mathematical model includes 18 basic formulas and can be used to evaluate the lift of the air heated above the road at the expense of a Solar energy. According to the theory of statistic method for calculate alration formulas are similar to the equations described in the work [3] for the case of calm weather (U=0).

4. THE FIRST AND LIMITED DATES

The results of measuring the air temperature at the opened plot and in a dense and scattered shade were taken as the basis of further studies by the author. Temperature measuring was carried out at the latitude of Krasnodar (in the latitude 45 north) by glass mercury thermometer at 3 p.m. of Moscow time dated from the 21st of September on a bright sunny weather. Following values of temperature were fixed: temperature of cool air (21 and 25 Celsius degree) and heated air above the road (30 Celsius degree). Intensity of falling Solar radiations for Krasnodar is g=0,6 kw/sq.m as per [4].

Area of the road single element "S" is determinated as the square with side "L" - the value L=3,0 m is assumed from minimum permisible with of public road (traffic rules). According to the source [2] C =33,3; tgB=0,1; E_y =Ez =1,0 were adopted for laminar flow. Efficiency of heat reception of air from the road surface can be assumed as varying within 0,5. . . 0,9 [5].

The main variable was the wind velocity "U" influencing considerably on the height of lifting the heated and polluted air. Its changes were set within the range of U=0,01. . . 0,50 m/sec (practically windless weather).

5. RESULTS AND CONCLUSIONS

The results of calculations of velocity of polluted and heated air lifting W and an effective height of lifting H under above-mentioned conditions were

drawn in the form of graphs. Analyzing the graphic relationships one can come to the following conclusions:

1.At a calm weather (when the wind velocity U<0,2 m/sec) a Solar energy provides for heating and lifting the polluted air beyond the layer of the human being to the height H>2,7m.

2.Volume of lifting air is approximately equal to volume of dangerous gases from cars.

3.A greated value of lifting height H corresponds to a greated value of heat quantity in the air carried upwards at the other equal conditions.

4.A value of velocity of the air lifting W depends from values of heat quantity and temperatures of cool air and polluted heated air.

There are following problems to be further researched:

- selection of optimum heat engineering characteristics of the road bed;
- determination of relation between the illuminated area of the road and the area of the shaded green plot.

6. SYMBOLS ADOPTED

U- wind velocity, m/sec
H,W- height and velocity of air lifting, m; m/sec
g- intensity of the falling Solar radiation, kwt/sq.m
S- area of a single element of the road, sq.m
C - coefficient of frontal resistance for ascending flow of the heated and polluted air
tgB- tangent of slope to the horizont of longitudinal axis for ascending air flow (the lifting is considered to be completed when the angle of lifting is small)
E_z , E_y - turbulence factor in a vertical and a horizontal plane

REFERENCES

[1] Beliozov,V.N.(1978), Town planning.
[2] Neporozhny, P.S. (1981), Preservation of water and air basins from ejections and effluents of thermoelectric power station.
[3] Retter, E.I. and Strizhenov, S.I. (1968), Aerodynamics of buildings.
[4] Strogoverov, I.G. and Shiller, U.I. (1990), Internal sanitary engineering devices.
[5] Gusev, N.M. (1975), The basis of building physics.

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ABSTRACT Nagoya is well-know
There are few water fronts familiar
been developed along the east-west
viewpoint of climate and attracting
Nagoya city. The authors proposed
design concept which introduced the ef
For the first time, a sea breeze and cli
Effective distance from the sea and
temperature was analyzed. On the
environmental planning "Wind Trail P
utilized as the trail on which sea bree
sewage treatment plant sites located a
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1. INTRODUCTION

The previous urban planning
inclined to equip infrastructures, e.
roads, bridges, costal and river structure
public buildings, residential areas, etc.,
cities and towns. Urban environme
problem have been peoples' concern, fro
the viewpoint of energy conservation an
global warning in recent years. It will b
necessary to establish an urban desig
method from the aspect of urban climate
Murakawa (1988)[1] pointed out that
river in a city has cooling effect, and als
Katayama (1990)[2] stated a view that
river acts as a wind trail. Nagoya is well