

INTERNATIONAL APPROACHES TO URBAN ENVIRONMENTAL PLANNING TAKING TO ACCOUNT GAS EMISSIONS AND NOISE IMPACT

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Presently in urban territories there is a number of ecological problems caused by negative impact of chemical and physical factors. Negative impact of chemical factors is mainly caused by gas emissions. CO₂ emissions are typically very significant in modern towns. A set of chemical equations to determine emission and absorption of CO₂ inside the municipality boundaries is developed. Based on these equations, authors have developed an accounting methodology for CO₂ emissions and absorptions that is applicable to the municipal territory. It is expected this methodology to become a tool for planners and designers as well to be used in territorial emissions trading. The measures of noise reduction among of town planning solutions are described. In total, effective noise reduction in living areas may be achieved by provision of complex administrative-organizing, urban development and building-acoustic measures.

Keywords: towns, urban planning, methodology, gas emissions, noise

Международные подходы к городскому экологическому планированию с учетом выбросов газа и воздействия шума

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Негативное воздействие химических факторов в условиях урбанизированных территорий главным образом связано с выбросами газов. Разработан ряд уравнений для определения выбросов и абсорбции CO₂ внутри границ города. Базируясь на этих уравнениях, авторы разработали методологию подсчета выбросов и абсорбции CO₂. Предполагается, что эта методология станет инструментом для специалистов по планированию и дизайнеров, а также будет использована для территориальной торговли квотами на выбросы. Описаны мероприятия по снижению шума наряду с решениями по городскому планированию. В целом эффективное снижение шума в жилых зонах может быть достигнуто путем обеспечения комплекса административно-организационных, строительно-акустических мероприятий, а также путем городского планирования.

Ключевые слова: города, городское планирование, методология, выбросы газа, шум

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Presently in urban territories there are many ecological problems caused by negative impact of chemical and physical factors. Negative impact of chemical factors is mainly caused by gas emissions [2, 3, 4, 7]. CO₂ emissions are typically very significant in modern towns.

A team of researchers at Lisbon University — Architecture Faculty, developed a set of chemical equations to determine emission and absorption of CO₂ inside the municipality boundaries. Based on these equations, an accounting methodology for CO₂ emissions and absorptions have been de-

veloped [2, 4] that is applicable to the municipal territory. It is expected this methodology to become a tool for planners and designers as well to be used in territorial emissions trading — this tool enables planners and architects to apply the knowhow gained in the approach to land planning and architecture for



Fig. 1. Production and emission of CO₂
Рис. 1. Генерация и выбросы CO₂

development of general trading rules for territory as a whole, in favour of sustainability.

A CO₂ tool for sustainable planning and design based on the Green Gas Protocol (GHG Protocol) [3, 6] is proposed in this paper, using a methodology for CO₂ accounting, relating emissions of all kind (from stationary combustion, from purchased electricity, heat or steam, from transport or mobile sources and forest fires).

Noise negative impact is presently one of the main factors of inhabitants discomfort [1, 8-11]. Damaging influence of intensive noise to the human's health is not restricted only by impact to ears. It is known, that noise is affecting to the human's central and vegetative nervous systems, influencing to the human's psychological condition etc. Results of noise measurements and calculation are showing that equivalent noise levels in such cities as New York, Paris, Rome, Mexico, Moscow, Samara etc. are achieving 75-85 dBA. The city noise is tend to increase. More than 60% of population of large cities is living in exceeding noise conditions [8]. Russian experience of urban noise planning is described in this paper.

Proposed methodology of CO₂ emissions estimation

In local and territorial level of planning policies, it is necessary to develop urban and municipal plans incorporating measures and methodologies to minimize or counterbalance the CO₂ emissions.

The proposed methodology analyses the subject as follows:

Applying different levels of municipal taxes, it encourages planning measures to allow the use of balance between CO₂ absorption and emissions in the municipality [5].

This means, decision makers and citizen voters are interested to implement measures inside the municipal planning policies in order to decrease the municipal taxes.

The proposed methodology intends to establish an accounting of CO₂ emissions in municipal areas, having as an objective to verify whether the impact on people's life, with its higher capacity of the existing natural territory drains (natural CO₂ absorption) it is worthy [1, 2, 4, 5] (fig. 1).

The absorption of CO₂ in the standard counties in Portugal are essentially water surfaces of rivers and reservoirs, and the forest surface present in the municipality. Engineering has established the chemical equations to determine the amount of CO₂ absorbed by water lines and forest [2, 4, 7]. This knowledge allows designing methods of CO₂ emissions on the municipal territory.

Patterns of CO₂ production in the municipality are essential due to electric energy production, CO₂ emissions from the transport sector, (public and private transportation) due to combustion engines with fossil fuel and forest fires.

Design Methodology:

- Regroup the territory based on limits of the municipality quantifying watersheds area.

- Apply the methodology calculation of CO₂ emissions rocking (balance).

- Verify whether rocking emissions for the municipality area in study is positive or negative; (i.e., if these areas are drains or emission CO₂).

- Apply a new border to territory planning, with a new fiscal tax if result of absorption is negative.

- This fiscal organization related to CO₂ liquid rocking in municipality will originate a bigger rationalization of ground use, and will include penalties for the emitting areas, that will have to develop PDM (Municipal Master Plan) policies and instruments of territorial management forcing investment in solutions to create absorption [2, 4, 5].

- If the balance is negative, in other words CO₂ emission are greater than absorption, it is necessary to redraw the population groups borders, by adjusting the urban perimeters decreasing duration and extensions of collective and individual transportation, with the goal of reduce CO₂ emissions.

The important role in this Design Methodology is the typology of urban occupation (house/building) and defines the urban perimeters of agglomerates (villages and towns), with implications to mobility and transportation. This management document defines the amount and forest planning, agricultural and urban areas. In a similar way it conceives a management to the watersheds, i.e., planning construction of new dams, because water dams are a CO₂ absorption drain. In

situations where it occurs positive rocking, with absorption of higher CO₂, is considered in the autarchic tax (IMI –real estate municipal tax), so the proprietors will pay less IMI tax. If the reduction in the IMI value is relevant it will initiate “a process of pressure from population”, so the PDM must be adjusted and contemplate measures to correct the negative deficit in balancing of emissions and absorptions.

Russian approaches to urban noise planning

Noise sources of urban territories may be divided on two main groups: separate noise sources and complex noise sources. Separate noise sources are: separate vehicles, electric transformers, holes of ventilation systems, plants of industrial or energetic enterprises etc. Complex noise sources are transport flows at highways and street roads, train flows at railway, industrial enterprises with complex noise sources, stadiums, sports grounds etc.

Thus, main noise sources of urban territories may be determined as following:

- Noise of separate vehicles;
- Noise of automobile transport flows;
- Noise of railway transport;
- Aviation noise;
- Noise of trolleybuses and trams;
- Noise at the open lines of metro and underground lines;
- Noise of industrial enterprises and energetic;
- Noise, generating during different kind of construction works;
- Noise inside of living areas etc.

The degree of impact of above mentioned sources to inhabitants is depending on the many factors: mutual dislocation of noise sources and living area, intensity, dislocation of industrial enterprises, characteristic of transport flows etc.

In Russia every town must have 3 kinds of planning documentation: general plan of development (reconstruction);

projects of planning and of building of total towns and of its separate parts; plan of land-economical gradation of town's territories.

General plans of development (reconstruction) of towns are having significant meaning for provision of the required state of environment in long-term prospect. General plans are developing for the period of 25–30 years. General plans of construction and reconstruction of Moscow, Saint-Petersburg, large regional centers are approved by Government of Russian Federation. Every 5 years general plans are prised according to variation of conditions of development of towns.

There are three main principles used during development of general plans of towns: zoning principle, ecological safety principle, rational territory organization principle.

Zoning principle means division of all the territory of town to four parts — industrial, living, culture-domestic and recreational. Requirements of ecological safety are admitting taking into consideration of norms of roads displacement, of living and administrative buildings, rest zones, fitting to the requirements of sanitary norms of maximal permissible concentrations and exhausts, for the displacement of sanitary-protective zones, waste disposal etc.

General plans of towns are the basis for development of projects of planning and building of town and of its separate parts. According to the requirements of Russian legislation planning and building of towns must foresee creation of the most favorable conditions for life, rest and health of population. The main task determining the order of complex improvement of towns is prevention and liquidation of harmful and dangerous influence of environmental factors to the living conditions of man.

Before to allow to make the construction of living houses or

industrial objects it is necessary to receive positive conclusions of Russian State organizations of ecological and sanitary-epidemiological control and oversight for organizations of all forms of propriety. It is one of the guaranties of provision of ecological safety of population.

Plans of land-economical gradation of cities are considering dislocation of communications for energy, water and heat supply, as well as waste management, rainwater escape etc. Plans are developing and realizing according to the sanitary norms and rules under control of sanitary-epidemiological organizations.

Some other kinds of town's planning are also significant. Among of them are complex plans of town's social-economical development; territorial complex schemes of town's environmental protection; different targeted scientific-technical programs.

Plans of social-economical development are intend for determination of the prospects of town for the nearest 5–10 years taking to account construction and reconstruction of enterprises, increasing of culture-domestic sphere, of residential building. Territorial complex schemes of environmental protection of towns are the main document which is forecasting for creation of plans of social-economical development of towns. The schemes are forming the informational-methodical and normative-technical basis of the plans. These schemes may be used for development of measures for prevention and liquidation of damage to environment from economic and social development of town, increasing of it territory.

During acoustical planning of towns it is necessary to take into consideration a number of architecture-planning solutions. Some of them are:

- rational acoustical solutions of plans of industrial areas and of general plans of objects;
- rational dislocation of technological equipment;
- rational displacement of working places in enterprises;

- creation of noise-protective zones etc.

The most noisy transport highway streets of towns may be considered as "transport corridors" with the main task of transportation of people and of loads. Transport highway streets are causing significant influence to the environment (not only noise but also air and soil chemical pollutions etc.) and should be isolated from the living areas. This requirement is necessary to take into consideration in architecture-planning decisions of building of living areas.

For provision of acoustical comfort it is reasonable to use first of all the solutions deciding not only noise-protective, but also architecture-planning questions. Earth mounds and artificial hills protecting the living area from transport noise should look as landscape elements and to have pictorial form.

During towns planning it is necessary to take into consideration correct zoning of territories surrounding the traffic interchanges which are traditionally the most noisy part of highways. In the zone near to transport highway it is not reasonable to dislocate living and social buildings of high этажности, because to protect it from negative noise impact it is necessary to erect noise barriers of high height.

Among of the town planning solutions for noise reduction it should to point out the following measures:

- observing of the principle of zoning, giving the separation of noisy sources from urban territories;
- transferring of noisy enterprises beyond the bounds of living area;
- construction of special noise-protective living buildings.

Values of admissible gaps between single noise source and the object to be protected may vary in very wide range: from 8–10 up to 500–1000 meters. In zone of gaps auxiliary buildings and areas (garages, car parks, storehouses etc.) are dis-

located. For many cases the gaps are should be considered as auxiliary measure.

Efficient town planning solution is using of noise-protective planting trees and shrubs. Results of measurements are shows that mean decay on the distance 10 meters of stripe of planting trees and shrubs is 1,5–2,0 dBA for trees and 2–4 dBA for rich trees and shrubs. But it is necessary to point out that for low frequencies sound decay by using of planting trees and shrubs is insignificant.

High efficiency measures of transport noise reduction are development and using of alternative transport as well as more intensive using of public transport.

As alternative to automobile transport using of bicycle transport may be suggested. In this case during the planning of town's territory it is necessary to foresee special bicycle roads, places for bicycles parking etc.

In many towns noise protective barriers are using for noise reduction. But the installation of noise barriers in towns may significantly change external look of town, that is why before to make the decision to install noise barrier (even the acoustical effect is good) it is necessary to have the detailed consultations with architects.

Reduction of noise of living territories of urbanized complexes up to admitted hygiene requirements in present conditions is sophisticated scientific-research problem, which may be decided only by complex measures.

In whole all measures of noise reduction in the urban territories may be conditionally divided into several big groups:

1. Urban development and building-acoustic methods of noise control: rational acoustic planning of neighborhood units, industrial enterprises and highways, erection of noise-protecting shields, noise-protecting planting trees and shrubs, increasing of sound-insulating qualities of buildings, development of noise-protecting screens constructions,

foaming of the systems of settling groups on the basis of mass velocity passenger transport with definite functional zoning of the territory, removal of dwelling areas from intensive noise sources, using of compositional grouping of buildings etc.

2. Administrative-organizing measures of noise reduction: noise levels reduction due to decreasing of intensity and noise of transport flows; improvement of roads quality, using of road surface with lower noise; provision of rational velocity of movement; provision and even exclusion of automobile (especially lorry) transport traffic in central parts of town and in living area streets etc.

3. Legal acts, technical norms, prohibitions of noise generation in living zones etc.

4. Using of the technical means of acoustical radiation reduction.

In total, effective noise reduction in living areas may be achieved by provision of complex administrative-organizing, urban development and building-acoustic measures: acoustic screening, noise-protecting planting trees and shrubs, increasing of noise insulation of buildings windows etc.

Conclusions

Efficient urban environmental planning and improvement of ecological situation in towns may be achieved only by complex reduction of negative impact of chemical and physical factors.

Architects and urban planners must play a vital role in reversing the trends and negative consequences related with CO₂ emissions and negative noise impact. Developing this platform, it is up to architects and planners to assume a role in "the process of land planning and natural resource management" [4].

In the Design Methodology developed, it is necessary to select an unit area where we apply the calculations (production and absorption). Thus, we have chosen the municipal territory as unit area. This criterion is justified by

political administration now in force in Portugal — the county.

Russian experience of urban noise planning is described. In Russia every town must have 3 kinds of planning documentation: general plan of development (reconstruction); projects of planning and of building of total

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