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RISK ASSESSMENT METHODOLOGY OF ENVIRONMENTAL HAZARD ON HIGHWAYS

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Abstract. This article deals with the risk assessment methodology of environmental hazard on highways. The main approaches to risk assessment of environmental hazards are considered. Characteristic features of the given approaches concerning the determination of the environmental situation on highways are analyzed. There was revealed the need for application of both integral assessment and generalized parameters of the system 'highway – environment – human'. The author has proposed to estimate the basic operational indicators of roads, real anthropogenic and technogenic influence and the ecological state of the roadside area in settlements.

Keywords: highway, roadside area, environmental hazard, environment, anthropogenic influence, environmental situation, environmental pollution, operational indicators.

Introduction

The problem of environmental protection is the most important global issue of the 21 century. On a global scale, the problem of environmental protection remains pressing for the entire world. The international community has made efforts to improve the environmental situation.

Operation and construction of highways have a substantial ecological impact on the environment. In connection with the constant development of the road-transport network it is necessary to take into account the environmental risk and conduct the assessment of the environmental hazard on highways. Thus it is necessary to prevent extraordinary environmental situations occurring in the roadside area in settlements (Khomyak and Skorchenko 1983).

Main part

There exist many methods of environmental situations assessment occurring on highways. This article

considers main approaches to risk assessment of environmental hazards:

- assessment of the operational state of road sections;
- assessment of the roadside area state in settlements;
- assessment of the environmental state.

Analysis of major ecological indicators is carried out by assessment of particular road sections state. The numerical values of the main ecological indicators are compared with the standard ones. These values are determined theoretically or by analogy (they compare the state of the object that is under conditions of anthropogenic influence). The degree of deviation from the norm determines the degree of approximation to environmental hazards. The level of environmental hazard is determined if ecological state of roads does not meet standard indicators (Silukov 2004).

The degree of deviation of the state of the object (highway) or the environment state from standard indicators is determined at assessment of the roadside area state

in settlements and the environment on the whole. NS and SU deviations are of great importance because they allow determining how much the object has approached the level of system's destruction. The N-U distance factually corresponds to the resistance indicator of the object (Fig. 1).

The reaction of the subject to the influence of the environment occurs with an insignificant delay. As a result, the functional link between the state of the environment and the subject is not observed.

For analysis of environmental situations it is necessary to estimate not only the real anthropogenic influence but also the potential of the technogenic influence related to accidents occurring on highways (Silukov 2004).

The environmental risk on highways is the probability of extraordinary environmental situations occurrence that can be determined by:

- Possible level of environmental pollution;
- Possible natural indicators of losses;
- Possible reduction in the quality of natural resources, degradation of natural systems.

Assessment of the environmental risk on highways can be determined theoretically according to statistical data by analogy with other objects (basic parameters are equal).

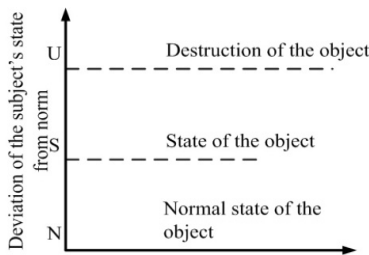


Fig. 1. Basic levels of Geosystems: NS –the degree of deviation from the normal state of the object; SU –the degree of approximation of the object to the level of its structure destruction.

Assessment of the environmental hazard on the highway based on calculations differs from the environmental hazard evaluation based on real situations.

When carrying out integral assessment of the environmental situation in settlements one must take into account assessments connected with the health of the population.

For integral environmental situation assessment they use the equation that consolidates all the generalized parameters of the system 'highway – environment – human' (Ukravtodor 2005).

Index
of the population =
health
 H

$$= f \left[\left(\begin{array}{c} \text{The operational} \\ \text{state Index} \\ \text{of the road} \\ R \end{array} \right), \left(\begin{array}{c} \text{Index} \\ \text{of Environmental} \\ \text{Quality} \\ F \end{array} \right), \left(\begin{array}{c} \text{Index} \\ \text{of the life} \\ \text{level} \\ D \end{array} \right) \right]$$

$$H = f(R, F, D). \quad (1)$$

The operational state index of the highway (R) is determined by the following dependence:

$$R = \frac{R_{oj} - R_{ij}}{R_{oj}} W_j, \quad (2)$$

where R_{oj} – state of the road at the start of its exploitation; R_{ij} – operational state of the highway within the t – period; W_j – coefficient, which takes into account the main operational indicators.

Index of environmental quality (F) can be estimated by using the following equation:

$$F = \frac{1}{1 - M}, \quad (3)$$

where M – the index of environmental pollution.

$$M = \frac{1}{m} \sum_i^m \frac{C_i - C_{if}}{[MPC]} K_i, \quad (4)$$

where C_i , C_{if} – concentration of admixture and background concentration at the time of assessment; m – the number of impurities pollutants; $[MPC]$ – maximum permissible concentration; K_i – coefficient characterizing the impact of pollutants on the environment.

Index of the life standard (D) is determined by:

$$D = \frac{D_t}{D_0}, \quad (5)$$

where D_t – gross domestic product per capita of income for a given region at the time of environmental assessment; D_0 – maximum profit.

Index of the population health (H) is determined by:

$$H = \frac{X_t - X_{\delta t}}{X_t}, \quad (6)$$

where X_t – rate of population in a given settlement at the time of ecological state assessment; $X_{\delta t}$ – the average number of people who suffered as a result of dangerous ecological state of the environment (Kavtaradze 1997).

Conclusions

Applying the method of risk assessment of the environmental hazard on highways, it is necessary to evaluate the basic operational indicators of highways, real anthropogenic and technogenic influence related to the accidents occurring on highways as well as the ecological state of the roadside area in settlements.

References

- Хомяк, Я. В.; Скорченко, В. Ф. 1983. *Автомобильные дороги и окружающая среда* [Khomyak, J.V.; Skorchenko, V. F. Highways and Environment]. К.: Высшая шк.. 198 с.
- Силуков, Ю.Д. 2004. *Экологическая безопасность на автомобильных дорогах* [Silukov, Y. D. Environmental Safety on the highways]. Екатеринбург. 221 с.
- М 218-02071168-416-2005. *Методика виявлення, оцінки та ранжування потенційних екологічно небезпечних місць автомобільної дороги* [Methods of identifying, evaluating and ranking potential environmentally hazardous road locations]. К.: Укравтодор. 35 с.
- Кавтарадзе, Д.Н. 1997. Экологические принципы оценки воздействия автодорог на окружающую среду [Kavtaradze, D.N. Environmental principles of impact assessment of highways on the environment]. *Наука и техника в дорожной отрасли*, No 2: 8-10.