

APPLICATION OF GEOGRIDS FOR REINFORCING THE ROAD PAVEMENT

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ABSTRACT

One of the methods of increasing the reliability is the reinforcing asphalt layers by nonwoven materials. The appeared design procedures confirm a practical positive experience of application of geogrids and show the dependence of efficiency of reinforcing and properties of geogrids. The results of calculations confirm that application of geogrids from fiber glass is more effective in 2 times, than application of polymeric grids.

1. Introduction

City conditions are recently characterized by heterogeneity of artificial covering basis (repairs, an abundance of underground communications, etc.). Various antislleet reagents (salts) operate negatively on the top layer of streets and sidewalks. The dependence of reliability of road clothes on their strength is sharply shown in connection with growth of intensity of transport movement and an increase of weight of cars. Insufficient strength of road designs leads to excessive operational and transport expenses, to premature output of clothes.

The requirement to strength of road clothes is increased during the construction, reconstruction and major overhaul of the main roads. New techniques, technologies and materials are also applied. The undertakings which have been directed to increase a traffic safety, a durability and reliability of work of road designs are developed for maintenance the program of progress of highways.

2. Method of reinforcing the asphalt pavements by fiber glass

One of the methods of increasing the reliability is the reinforcing asphalt layers by nonwoven materials (figure 1).

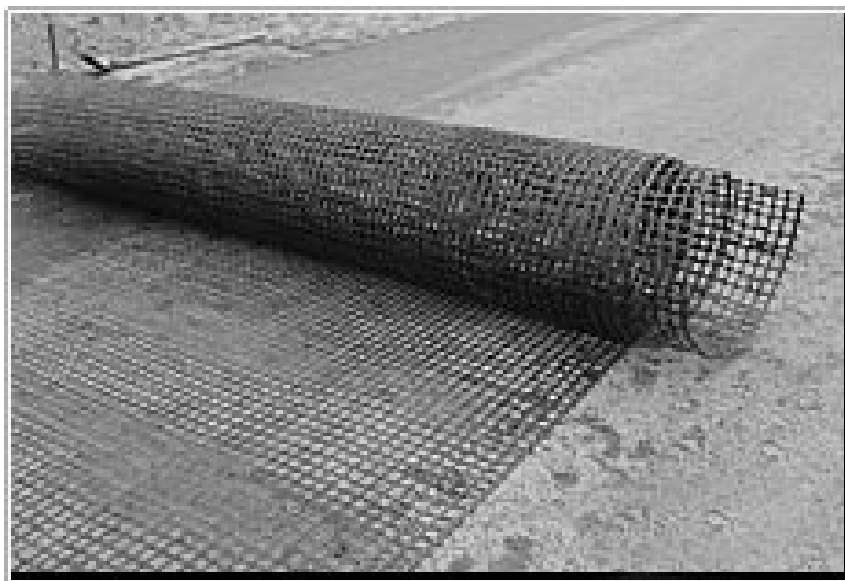


Figure 1. The nonwoven geogrid for reinforcing of asphalt pavements

Reinforcing of asphalt pavements by fiber glass allows reducing building expenses by decrease of the thickness of a covering (20-25 % of the top asphalt layer) (Kretov V.A., 2007). The lifetime of pavement is not reduced at the same time. The builders may not reduce a thickness of a covering geogrid, therefore the use of the grids will reduce the operational expenses, will increase the lifetime.

The fiber glass reinforcing allows to increase the lifetime of asphalt pavement due to increase the resistance of a covering to stretching temperature stress and to change the conditions of contact in a zone of cracks. Fiber glass, having low lengthening at break (up to 3 %) and creep of 0 %, possesses high resistibility to creation of cracks. For example, the geogrid is placed on an old asphalt layer with cracks. The effect of

preservation of old cracks is reached because the grid takes up horizontal pressure, and, thereby, interferes penetration of cracks from an old covering in the new (figure 2, 3, 4).

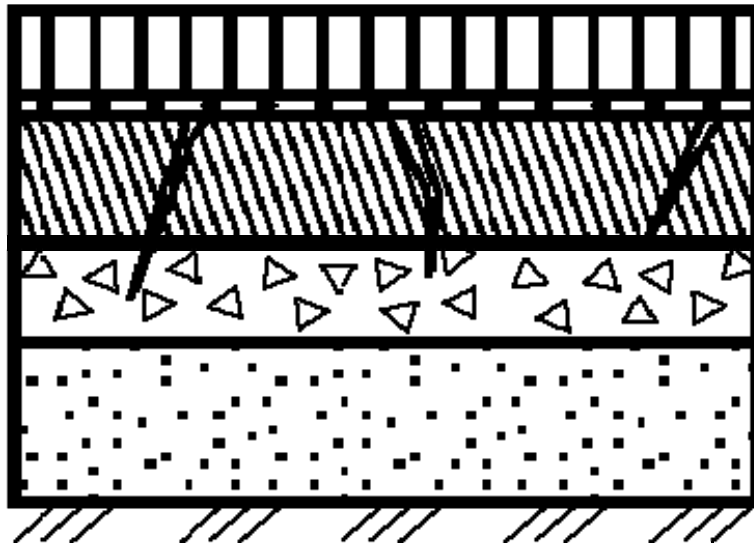


Figure 2. The construction of reinforcing asphalt pavements

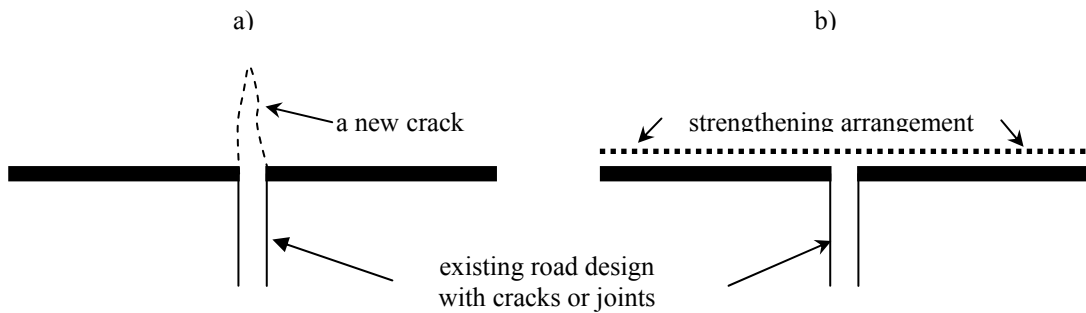


Figure 3. The road design

a) without strengthening, b) with strengthening
b)

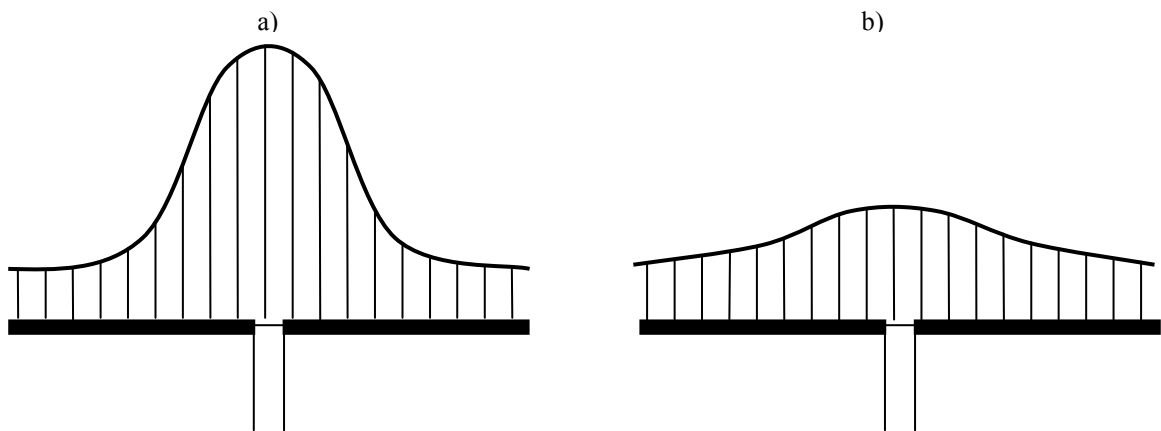


Figure 4. Horizontal pressure at stretching in asphalt

a) without strengthening, b) with strengthening

Fiber glass is capable to perceive loadings, without dependence from time of their appendix. For road asphalts the dependence of mechanical properties from temperature is one of the main characteristic. Plasticity at heats is replaced by fragility at negative temperature. Necessity of introduction to asphalt a material which properties would not depend on temperature is arised. Grids from fiber glass do not change properties from -70° to 350°C . Long-term operating experience of road clothes with reinforcing by geogrids from fiber glass testifies:

- the lifetime of asphalt pavement correctly reinforced by a qualitative geogrid, increases in 2-3 times;
- these coverings possess greater stability to rutting and to shift deformations;
- the use of geosynthetic materials in road construction gives a significant economic gain;
- the use of fiber glass completely excludes creep (0 %) that defines high resistibility to cracking;
- fiber glass does not lose the strength at contact to hot bitumen and asphalt and does not enter to chemical reactions with them (figure 5);
- the fibre shows sufficient resistance to dynamic loads of transport;
- the use of grids allows to low labor expenditures and energy consumptions;
- the facility to simplify technology, using geosynthetic materials;
- the improvement of quality and culture of work;
- the reduction of terms of construction;
- the top layer can be easily removed at regeneration coverings with glass-fiber strengthening (the grid is not reeled up on a mill in stead of polymeric materials), and removed asphalt can be used repeatedly.



Figure 5. The construction of reinforcing asphalt pavements

3. Principle of work of a geogrid

Reinforcing of asphalt by geogrids is based on their ability to increase structural durability of asphalt as units of a geogrid work as anchors: parts are a support for a large filler. Thus the geogrid puts into operation on a stretching at a bend, preventing transformation of microcracks into the opened cracks.

The following parameters of properties are produced to the geogrids used for reinforcing:

- thickness;
- durability at a oneaxle stretching;
- lengthening at a oneaxle stretching;

- the module of deformation at a oneaxle stretching;
- resistibility to local damages;
- adhesion to bitumen;
- temperature stability;
- the size of cells.

The requirements to parameters of properties of geogrids, used for reinforcing, the decrease of which for performance of the specified functions is not supposed are presented in table 1 (Kretov V.A., 2007).

Table 1. The requirements to parameters of properties of geogrids

Scope, functional purpose	Parameters of properties		
	Durability at stretching Rp, N/sm, not less	Relative deformation at stretching ϵ_{Rp} , %, no more	The conditional module of deformation at stretching E_{0i3RP} , N/sm, not less
Reinforcing of advanced coverings	80	30	600

Parameters of properties of geogrids are defined under following normative documents:

- the sampling in accordance with GOST 6943;
- the thickness in accordance with GOST 6943.16;
- the parameters of mechanical properties in accordance with GOST 6943.10.

4. Conclusions

It is possible to solve a problem of rutting in several ways. However, the method offered above allows not only to lower expenses for materials, repair and the maintenance of coverings, but also to simplify technology of the device of coverings.

References

Kretov V.A. (2007): The design, build and repair recommendations for asphalt coverings with the use of geogrids made by STECLONiT Company, SibADI, 2007. – 115 pp.