

## THE WINTER MAINTENANCE OF ROADS SITES WITH SNOWDRIFT

Tatiana Samodurova, Olga Gladysheva, Konstantin Panferov, Iurii Baklanov,

Natalia Alimova

*Department of Roads and Bridges Designing, Voronezh State Technical University,*

*20-letii Oktiabria, 84, Voronezh, Russia, 394006*

*samodurova@vgasu.vrn.ru, ov-glad@ya.ru*

Designing of snow protection is necessary for winter maintenance of roads sites with possible snowdrift. The solution of these problems is especially important in Russia, which have an extended road network and different climatic conditions during the winter.

The special road climatic map was made to solve the problems of designing snow protection of roads. The special road climatic map is a map with isolines for specific territory, corresponding to the same snowbring volumes to the road. The information on the map allows to reveal the prevailing direction of snow transfer and to estimate the possibility of snowdrifts formation in separate road sections with the given road direction.

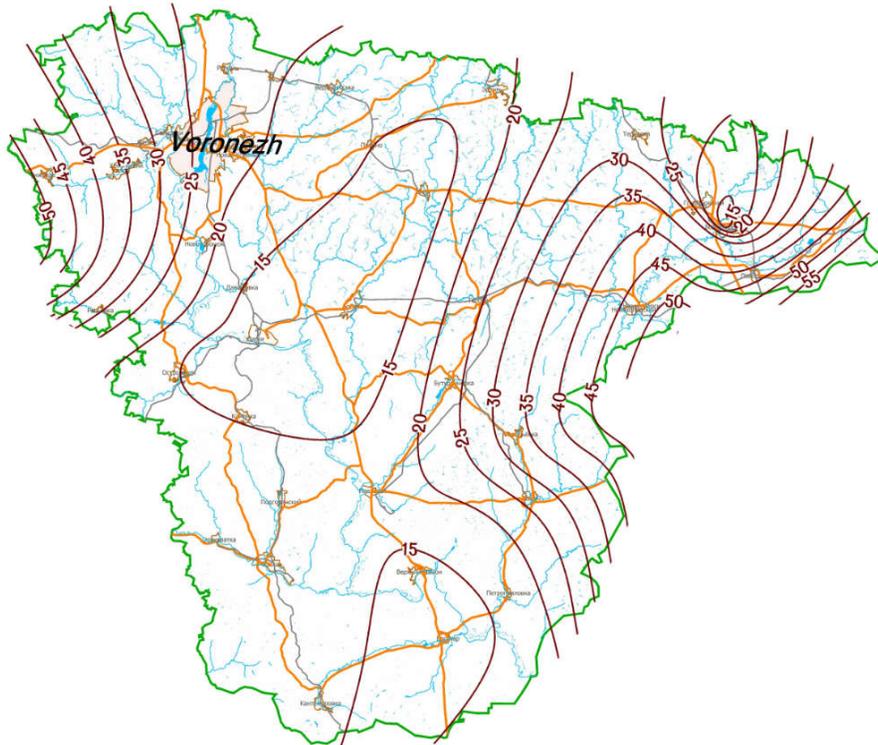
The maps set from 16 maps with the estimated snowbring volume for roads with different directions was created for each region of Russia. The maps of the distribution parameters that are used for designing snow protection were created additionally: the map with distribution of the blizzards duration, the map with distribution of the average density of the snow cover and the map with distribution of the coefficient of snow losses from melting and evaporation during thaw.

The example of map with the snowbring volume for roads towards the north (left) to the south (right) with the probability of exceeding 10% for Voronezh region is shown in Fig.1.

The map on the Fig.1 can be used for designing temporary snow protection to the left of the road for roads with direction to the north and to the right of the road for roads with direction to the south.

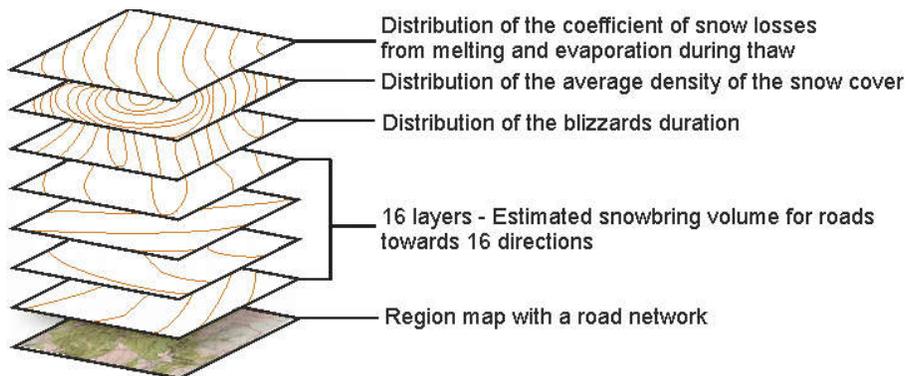
The snowbring volumes taken from the map allow to determine a type of snow protection, to determine the number of shields rows or nets, number of snow trenches, to determine the distance from the road. The full maps set allow to design any type of snow protection for a large area.

The maps set can be used for road winter maintenance, construction and reconstruction projects.



**Fig. 1.** The map with the snowbring volume for roads towards the north (left) to the south (right) with the probability of exceeding 10% for Voronezh region.

The maps can be represented as a set of layers for the designing of snow protection using information technology. The layers scheme is shown in Fig.2.



**Fig. 2.** The layers scheme.

The layered data organization allows the use of GIS technology for different stages of the road life cycle.

The integration of special road-climatic maps into GIS allows to automate the process of snow protection designing.

The technology of using the special road-climatic maps in the design of snow protection:

1. The location of the road section found on the map.
2. The direction of each road section (the azimuth) is determined from satellite images.
3. The selection of necessary maps (layers) with snowbring volumes and additional parameters is done in accordance with the direction of the road sites with possible snow drift.
4. The database is formed with addresses and direction of the road sites with possible snow drift, and snowbring volumes. The database can be supplemented with recommended snow protection options.
5. The variants of snow protection for the road section are selected according to the estimated snowdrift volumes using the recommendations of normative documents.

The special road climatic maps with the blizzard parameters also can be used to solve the following problems: detection of road sites with possible snow drifts; designing different variants of snow protection (forest belts, fences, etc.); planning snow removal (snow plowing); calculation of resources (equipment, anti-icing materials) for winter road maintenance.

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