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## THE PROGRAM OF NON-RIGID PAVEMENT COMPUTER-AIDED CALCULATION UKRRDO 15

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**Abstract.** A program for computer-aided calculation of non-rigid road coating UKRRDO 15 is considered in the given article. The program interface, a set of input data and the results of calculations are considered in detail. Calculations are performed for three strength criteria: permissible elastic deflection, shear strength of subsoil and monolithic layers resistance of tensile bending.

**Key words:** computer-aided calculation, non-rigid pavement, interface panel, economic surveys data, performance data for soil subgrade forming, performance data for pavement forming, pavement layers data, pavement strength criteria.

## ПРОГРАММА ДЛЯ АВТОМАТИЗИРОВАННОГО РАСЧЁТА НЕЖЁСТКИХ ДОРОЖНЫХ ОДЕЖД УКРРДО 15

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**Аннотация.** Рассмотрена программа для автоматизированного расчёта нежестких дорожных одежд УКРРДО 15. Детально рассмотрен интерфейс программы, компоновка исходных данных и результатов расчётов. Расчёты проведены по трём критериям прочности: упругому прогибу, сдвигоустойчивости, растяжению при изгибе.

**Ключевые слова:** автоматизированный расчёт, нежесткая дорожная одежда, интерфейс программы, инженерно-экономические изыскания, характеристики дорожной одежды, характеристики грунта земляного полотна, упругий прогиб, сдвигоустойчивость, растяжение при изгибе.

## ПРОГРАМА З АВТОМАТИЗОВАНОГО РОЗРАХУНКУ НЕЖОРСТКИХ ДОРОЖНІХ ОДЯГІВ УКРРДО 15

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**Анотація.** Розглянуто програму для автоматизованого розрахунку нежорстких дорожніх одягів УКРРДО 15. Детально розглянуто інтерфейс програми, компоновка вихідних даних та результатів розрахунків. Розрахунки проведено за трьома критеріями міцності: допустимому пружньому прогину, зсувостійкості, розтягу під час згинання.

**Ключові слова:** автоматизований розрахунок, нежорсткий дорожній одяг, інтерфейс програми, інженерно-економічні вишукування, характеристики дорожнього одягу, характеристики ґрунту земляного полотна, допустимий пружній прогин, зсувостійкість, розтяг під час згину.

### Introduction

The non-rigid pavement calculation by Ukrainian standards – is very complex process. An en-

gineer must spend a lot of time for manual calculation. During this time he can make many mistakes, so increasingly specialists use com-

puter-aided calculation for solving such problems.

**Analysis of modern programs for non-rigid pavement computer-aided calculation**

Usually, Ukrainian road designers used program Radon UA for non-rigid pavement computer-aided calculation from the company CREDO. Ukrainian standards were involved in this program. Now this version is not supported (fig. 1).

So in Ukraine we do not have domestic computer program for non-rigid pavement calculation and this research direction is very important.



Fig. 1. The screenshot from the website of the CREDO Consortium [1]

The work purpose – to create domestic computer program for non-rigid pavement computer-aided calculation. It had been planned to involve the Ukrainian standards in calculation (fig. 2).

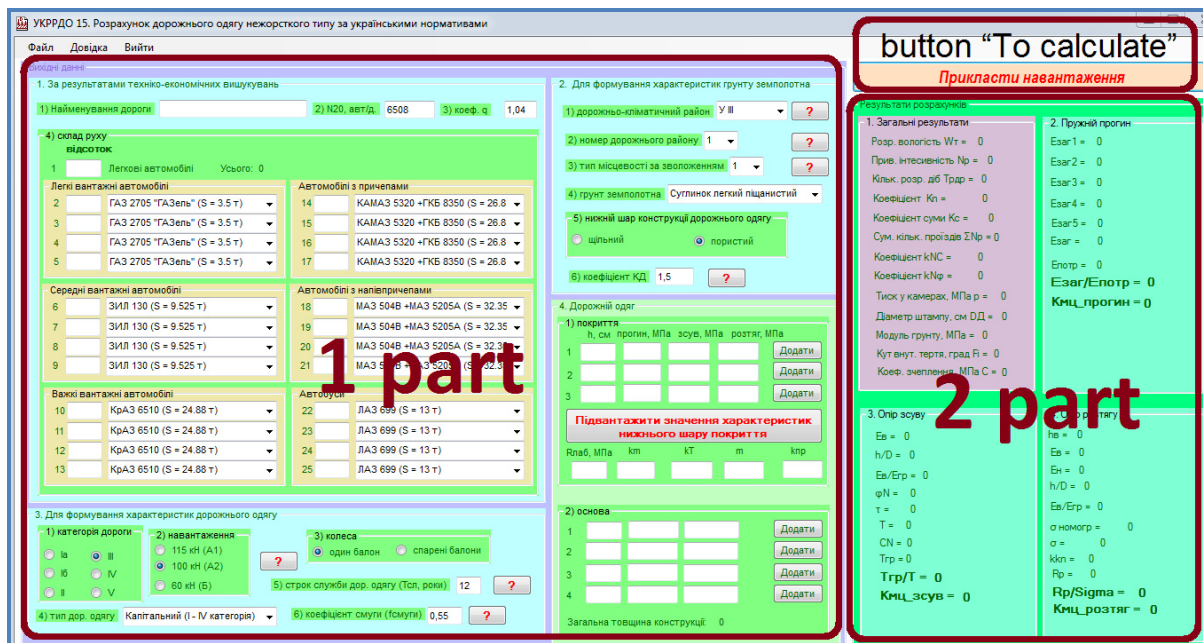


Fig. 2. The general window of program УКРРДО 15

The first experimental version of the program for non-rigid pavement calculation UKPPDO has been developed at the Department of survey and engineering of highways and airfields (KhNAHU). The program has been written in C#, using Windows Form technologies.

**The research problems**

- Problems, that have been solved (fig. 3):
- 1) creation of the road-building materials database;
- 2) creation of the vehicles database;
- 3) creation of the class library for computer-aided calculation;

- 4) creation of the user-friendly interface.

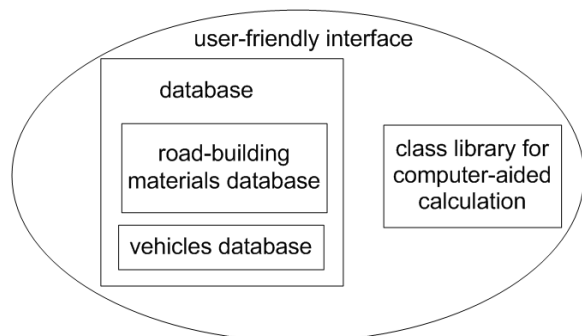


Fig. 3. The structure of non-rigid pavement computer-aided calculation

The program interface consists of two main parts and applying load button (button «To calculate»):

- 1) the data input part;
- 2) the results of calculations part (fig. 2).

The data input part consists of four blocks (fig. 4):

- 1) economic surveys data;
- 2) performance data for soil subgrade forming;
- 3) performance data for pavement forming;
- 4) pavement structure data.

The economic surveys data consists of four item:

- 1) object title;
- 2) traffic;
- 3) rate of change in traffic;
- 4) transport flow.

Transport flow may consist of the seven components. This component has required fields: percentage of cars and percentage at least one of the types of trucks (or buses).

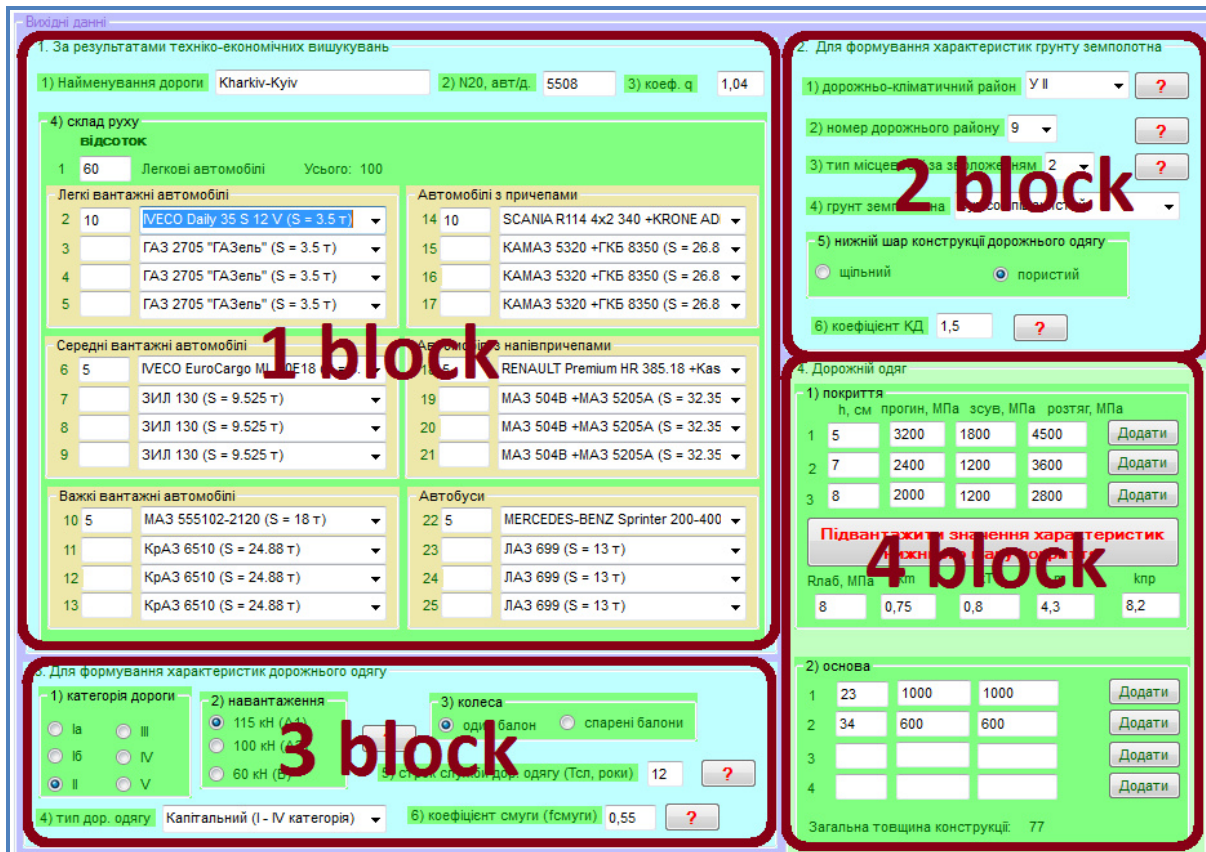


Fig. 4. The data input part

Checkboxes of trucks or buses are generated from the vehicles database (fig. 5). The vehicles database had been filled out the normative document [2].

The performance data for soil subgrade forming consists of five item:

- 1) the road-climatic area;
- 2) the number of road region;
- 3) the type of terrain humidification;
- 4) the soil subgrade;
- 5) the density of the lower layer of the pavement.

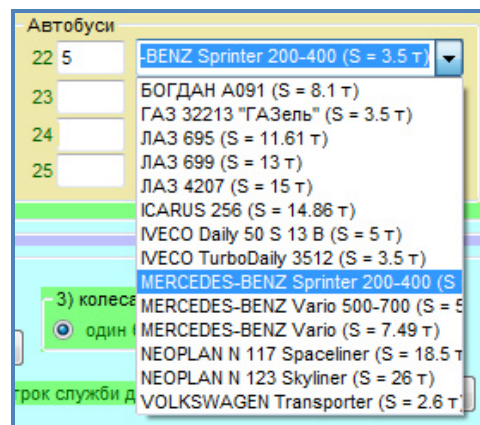


Fig. 5. The example of buses checkbox from the vehicles database

The road-climatic region item and the number of road area item have help button – map from Album of typical pavement structures for I and II categories roads [3] (fig. 6).

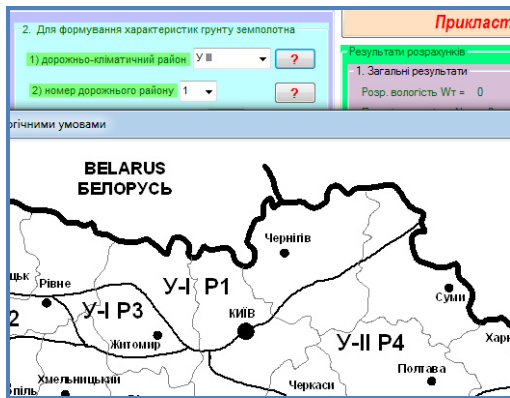


Fig. 6. The help button – road-climatic region map

The performance data for pavement forming consists of six item (fig. 4):

- 1) technical road category;
- 2) axial load;
- 3) RadioBaton to determine the wheel scheme;
- 4) type of pavement;
- 5) service life of the pavement;
- 6) traffic lane coefficient.

The pavement structure data consists of two GroupBoxes (fig. 4): asphalt layers and other layers of pavement structure. A road designer assigns thickness of pavement layers and forms characteristics of material through two windows: asphalt layer (fig. 7) and pavement structure layer. These windows open by the Add buttons (fig. 4).

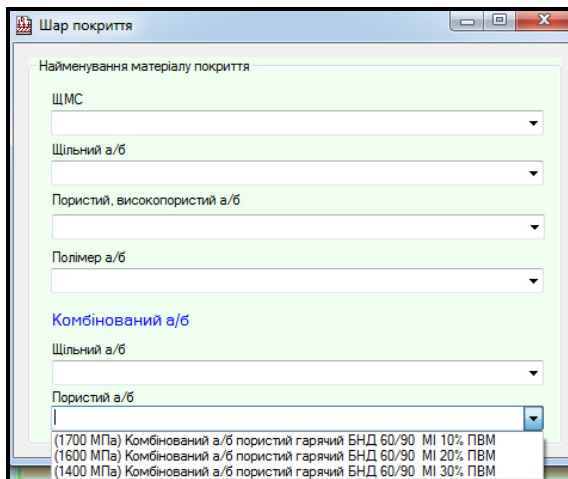


Fig. 7. Window asphalt layer

Automatically TextBoxes are filled in characteristics of materials from the road-building materials database (fig. 8).

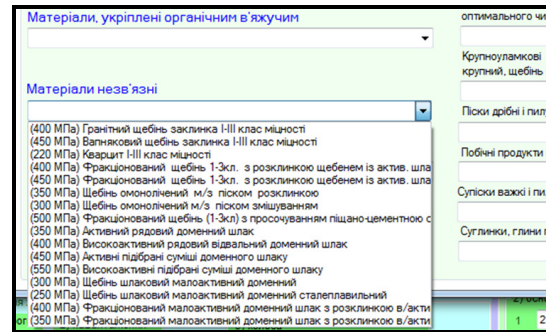


Fig. 8. Detail of pavement structure layer windows

After forming initial data, a road designer must press applying load button (button «To calculate», fig. 2). Calculations are performed for three strength criteria: permissible elastic deflection, shear strength of subsoil and monolithic layers resistance of tensile bending (fig. 9). The calculations are conducted according to Departmental building norms [2]. Features of nomogram digitalization were presented in [4]. Correctness of design solutions is controlled via the indicators: satisfactorily and unsatisfactorily.

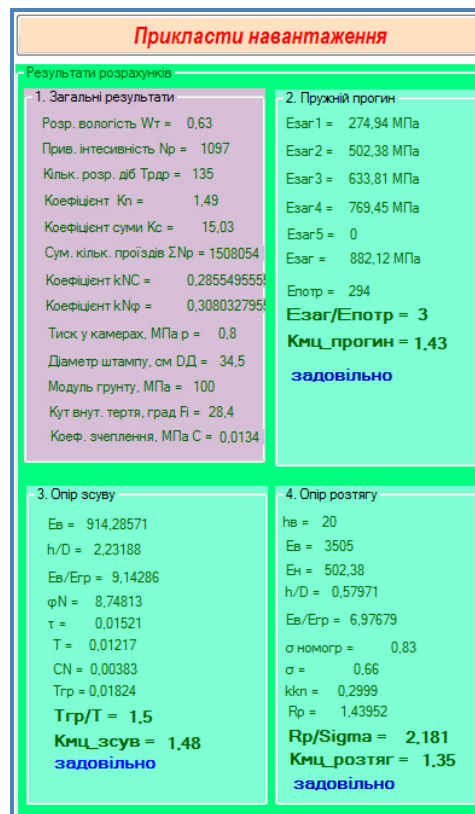


Fig. 9. Calculation results window

### Conclusions

In this article general problem of non-rigid pavement computer-aided calculation by Ukrainian standards has been considered. Actuality of the research has been proved. The interface of computer program УКРРДО 15 has been shows in detail.

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