

EVALUATION OF PAVEMENT CONDITION AND REPAIR PLANNING

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The text below describes the current state of the road maintenance and management. Also reviews the methods for evaluation of the road pavement condition, collection of data and analysis.

During the transition in Central and Eastern European countries the rapid growth of car ownership and all the other transport means leads to the growing necessity for adequate evaluation of the actual condition of the road networks and it's further development, methods of infrastructure planning and management.

Prior to the above there is a necessity to: improvement of the road management methods through administrative (procedure) changes, introduction to modern planning techniques, institutional reorganizations, improvement of the selection criteria for projects and executors. This also leads to the necessity of unification with European standards, rules and regulations for evaluation the road condition and planning the road repairs.

In this aspect, necessity of setting up a system which will improve the strategic road repair planning and infrastructure in response to the expected road transport needs over medium and long term planning periods turns out to be of utmost importance.

Key words: load bearing capacity, maintenance, techniques

1. Data collection

1.1. Surveillance

Information for the road network is collected through the regional road administration based on a methodology from the eighty's. Visual evaluation on place marks the sections which will need repair. Next step is to determine the roughness. Load bearing capacity is determined for the sections and based on that the repair works are classified – rehabilitation, partial or full reconstruction and technology of repair.

1.2. Data collection

For the condition of the road network in terms of construction and functionality condition (traffic load value, road history, pavement construction, load bearing capacity, data for the used materials, road surface evaluation, longitudinal and cross roughness, cohesion , accident history);

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- The intensity of the automobile traffic is essential to determination of the basic elements of a new road, and to the planning and selection of the road repair works. The first traffic counts was made in 1921 and it was included in the law for roads. From 1963 annual counting are made from about 120 stations and every 5 years a general profile count from over of 2000 stations. The collected data gives information for the whole traffic flow divided by type: cars, Lorries (light weight, heavy weight, trailer), buses and from this year due to the increased number a new category is included - bikes.
- Load bearing capacity characterizes the strength qualities and total working capacity of the road pavement. The equipments which we use are Benkelman's Beam (Image 1) and Lacroix's Deflectograph (Image 2).



Image.1



Image.2

Benkelman's beam is a mechanic device for measuring the deflection of the road structure under a defined static live load of 2-axle heavy vehicles. Measurement is taken manually at previously fixed points and intervals along the right rut of the traffic lane.

Lacroix's Deflectograph is a device for continuous automatic measuring of the elastic deflection of the road pavement under a specified axle load(range of 5-13 t/axle). Measuring is carried out on both wheel tracks of the inspected traffic lane at intervals of 6m. The obtained data is used for the analysis and assessment of the load bearing capacity of the road pavement and for the pavement design. Results of measurements are recorded on a disc and then processed with the respective software.

The falling weight deflectometer „FWD” (Image3)



Image 3

was introduced in Bulgaria a few years ago. Its use is mainly for Highways and for rehabilitated roads, where the road bearing capacity is homogenous. FWD is used for automatic measuring of the dynamic elasticity modulus of the road pavement. A drop-weight plate of diameter 300mm simulates the passing of a heavy vehicle at speed of 70 km/h. The loading force at a given point is in the range between 3 – 120 kN. Points are random (usually between 50 – 100 meters) and the distance is automatically stored. The collected data is processed by specialized software.

- The roughness of the road surface is a characteristic of the exploitation qualities of the road pavement. It exercises on the safety and comfort of the travelers, dynamic load on the pavement and to the prime cost. The devices used for measuring are Dynatest Road Surface Profiler 5051 Mark II (Image 4) and APL-25 (Image 5). RSP is an automated device for measurement and inspection of the longitudinal and transverse roughness, and the texture of the road surface. Geometric parameters, gps coordinates along with video images of the road and the surroundings .



Image 4.



Image 5.

APL-25 is based on the principle of a standard inertial pendulum. It serves to measure the amplitudes of irregularities with a precision of 1 mm for waves of 0.3 to 15m at constant speed of 21.6 km/h.

- The texture of the road surface defines the conditions for interaction between the wheels and the road surface.

„Sand patch” method is one of the ways to measure it. This method measures the average depth of the macro-roughness of the surface which indirectly characterizes the cohesion in accordance with BSS (Bulgarian state standard) EN (European norms) 13036-1. It's used for individual sections – junctions and etc. The roughness is determined by the measure of the length of the filled diameter without remains of fine-grained sand with fixed quantity.

Skid tester SRT also known as the "Pendulum Tester" (Image 6) is used to assess the pavement grip of the examined surface. It measures the frictional resistance which occurs between a rubber slider, mounted at the end of a pendulum arm and preliminary moistened surface.



Image 6.

The macro texture may be measured with the help of Road surface profiler too.

2 Data analysis

After collecting of all the data an economic base and a bill of quantities are made in which repair are separated based on the stage of urgency.

At the moment in Bulgaria we don't have a working system for pavement management. The collected data is processed manually and are entered in a general road database. HDM4 (Highway Development and Maintenance Management System) is used to give an economical ground but it's not bind with the load bearing capacity of the road pavement.

We are working on an automated Road Data Bank and Pavement Management System in cooperation with Finnish Company.

At the moment the focus is on rehabilitation without changes in longitudinal and transverse direction.

3 Organization, management and control

From 1986 due to the economical obstacles the level of maintenance of the road network was drastically lowered mainly due to lack of financial resources.

During the transition:

- Departments for maintenance were structurally reorganized in the aspect of the market requirements;
- Well organized and functional structure was decentralized;

- The IV class roads (municipality) were reassigned to the municipalities;
- Maintenance of the roads entirely went into the private sector.

Overall evaluation of the existing road maintenance is unsatisfactory.

At the present Road Infrastructure Agency is at the dispose of the Ministry of Regional Development and Public Works. Reassignment on several occasions to another ministry and back slows down the progress and worsen the road pavement management of the whole road network. Over the last decade 12 managements of the Road administration were changed and with them there were continuous structural and personal changes. All of that reflects unfavorably on the road maintenance works of the whole road network.

Programs are developed and ideas for improvement of the quality of our roads. At the middle of 2009 a renewal of the Technical Norms and requirements for the road pavement maintenance were accepted.

Contemporary types of materials are used in repair of the road pavement for achieving better exploitation characteristics – cohesion, safety, comfort, visibility, homogeneous.

From 1993 all rehabilitations of the road pavement are carried out for axle loads of 11,5t but there are still roads from I and II class which need to be unified with the EU requirements.

3 Conclusion

In accordance with the above ideas we consider that in the future the road administration should focus on:

- Improvement of the selection criteria for designer and contractor not only on the financial part;
- Preparation of a Technical Specification for road maintenance works;
- Planning and rhythmic collection of data for the condition of the roads, functionality and constructive qualities of the road network regarding long-term program for repair and maintenance in one general data base;
- Data analysis, focused on the so called ‚critical point‘ in which the road pavement loses the full functionality(this evaluation is a function of an adequate analysis of the road pavement data) – condition for effective road management and on that base optimization of road repair measurements;
- Preparation of a list made on the technical priority of the situation of the different roads. First on the highways and I class roads and then bit by bit on the rest;
- Planing (long-term and short-term) of the road repair works on divided sections based on a technical and economical ground;
- Focusing the efforts in future towards preventive repair works.

The described situation in Bulgaria, even though it's quite general present the perspectives for development of the road construction and maintenance of the road infrastructure as a result of functional and adequate program for road repair planning.