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WORKABILITY OF STORABLE ASPHALT MIXTURES, MEASURING DEVICES

BY

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Abstract. The need to improve repair technologies for bituminous pavements especially during cold season, is studied.

As a result of laboratory tests it was found the need for other attempts. These are attempts regarding the storable asphalt mixtures workability at various temperatures for the installation period, but also for the storage period.

Through the laboratory tests was shown the complex interaction between mechanical behavior of asphalt mixtures and variability factors acting on the road structure, this complex framework is determined by fundamental mechanical properties that influence long-term performance.

Key words: technology; repair; laboratory; road structures.

1. Introduction

To ensure the safe conduct of road traffic in any season is necessary to ensure continuity of maintenance and repair of pavement surface throughout the year.

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Bituminous pavements degradation repair in the season, the time period between October 15 and March 15 with temperatures generally below 10 ° C, when there is no precipitations, filling whith storable asphalt mixtures is recommended.

Holes filling of the bituminous street pavements is necessary for ensuring traffic safety and the prevention of holles development under the combined action of traffic and water.

2. **Workability of Storable Asphalt Mixtures Workability**

Workability is the property of asphalt mixtures which allows the production, handling, placing and compaction of asphalt mixtures with minimal energy consumption. This test method is used to generate information on potential characteristics handling, laying, compaction and performance of asphalt mixtures. This test method is also used on storable asphalt mixtures for control improvement regarding the storage of these materials, timing and method of packing, climate conditions of storage and application.

3. Measuring Devices

Workability measuring device was designed in the Road Laboratory of the Faculty of Civil Engineering and Building Services of Iaşi.

Fig. 1 – Workability measuring device.

This device is composed of a mixer used to make building materials, produced by Humboldt HL200, an electronic device manufactured by UNI-TREND Technology for measuring the electric intensity and a computer on which is installed the software for data interpretation recorded by electronic measuring device of the electric intensity. (Fig. 1).

HL200 mixer used is equipped with a timer that can be set during the mixing of mixture, a stirrer with transmission speeds that can provide three speeds of: 107, 198 and 361 rpm plus an addition lower speed necessary for liquid material composition of 53 rpm. Mixing vessel has a capacity of 20 L and is made of aluminum.

Determination of the storable asphalt mixture workability is made as follows:

a) Storable asphalt mixture is placed in the mixing bowl.

b) The mixing bowl is place in the mixer device.The machine ensured to carry out tests under normal safety conditions.

c) The thermometer is placed to display mixture temperature during the determination.

d) The speed and duration of mixing is established.

e) The engine is turnd on. When pallets are rotating the mixture from the vessel is opposing. The engine needs more power wich leads to an increase of current intensity. The current intensity is measured with a ampermeter and represents current intensity required for asphalt mixture mixing.

f) Measurement results are automatically transmitted to a computer and interpreted.

4. Workability of Laboratory Studied Storable Asphalt Mixtures

In laboratory were studied four storable asphalt mixtures:

1. Control asphalt mixture (*M*0), without flow agent.
2. Storable asphalt mixtures with bitumen mixed with a flow agent (*M*1); the flow agent used is an oil called STAROIL GL30.
3. Storable asphalt mixtures with bitumen mixed with a flow agent (*M2*); the flow agent used is a solvent (white-spirt).
4. Storable asphalt mixtures RRD standard (*M*3).

To study the workability of *M*1, *M*2 and *M*3 storable asphalt mixtures comparisons have been made between these mixtures and control mixture (*M*0). The tests on *M*1, *M*2 and *M*3 mixtures aimed the same workability as the control mixture (without flow agent) at the laying time, at 120°C (laying temperature of hot asphalt mixtures).

Were made three batches of each control mixture, 8 kg each, and were put in the mixing vessel. When the mixture temperature reached 120°C, the first speed started (107RPM) for 1 min registering values of intensity within 5 s. In the end were obtained three results for each batch of control mixture.

The test was repeated at 110°C, 100°C and 90°C registering three intensity values for the three temperatures.

In Table 1 values have been calculated by averaging between each batch of the four temperature.

Were made three batches, 8 kg each, for *M*1 mixture (storable asphalt mixtures with bitumen mixed with a flow agent; the flow agent used is an oil called STAROIL GL30) and for *M*2 mixture (storable asphalt mixtures with bitumen mixed with a flow agent; the flow agent used is white-spirit). The two storable asphalt mixtures were tested at 20°C, 15°C, 10°C, 5°C, 0°C, –5°C, –10°C.

Table 1
Values of the Current Intensity forM0 Mixture

Batch	Current intensity at 120°C A	Electric intensity at 110°C A	Electric intensity at 100°C A	Electric intensity at 90°C A
I	2.149	2.183	2.278	2.454
II	2.141	2.181	2.276	2.457
III	2.145	2.185	2.280	2.456
Average	2.145	2.183	2.278	2.456

In Tables 2 and 3 values were calculated by averaging between the values obtained for each batch to determine the four temperatures, for *M*1 and *M*2 mixtures.

Table 2
Values of the Current Intensity forM1 Mixture

Batch	Current intensity at –10°C A	Current intensity at –5°C A	Current intensity at 0°C A	Current intensity at 5°C A	Current intensity at 10°C A	Current intensity at 15°C A	Current intensity at 20°C A
I	2.919	2.652	2.399	2.271	2.244	2.162	2.138
II	2.917	2.725	2.405	2.280	2.241	2.169	2.132
III	2.914	2.730	2.413	2.278	2.250	2.159	2.131
Average	2.917	2.702	2.406	2.276	2.245	2.163	2.134

Table 3
Values of the Current Intensity for M2 Mixture

Batch	Current intensity at –10°C A	Current intensity at –5°C A	Current intensity at 0°C A	Current intensity at 5°C A	Current intensity at 10°C A	Current intensity at 15°C A	Current intensity at 20°C A
I	3.121	2.986	2.621	2.371	2.291	2.219	2.182
II	3.130	3.002	2.625	2.365	2.287	2.228	2.186
III	3.112	2.995	2.617	2.367	2.274	2.221	2.177
Average	3.121	2.994	2.621	2.368	2.284	2.223	2.182

The storable asphalt mixtures RRD standard (*M*3), a storable asphalt mixture ready prepared and packaged in the bucket was warmed up for reaching the desired temperature.

The storable asphalt mixtures RRD standard (*M*3) was tested at 20°C, 15°C, 10°C, 5°C, 0°C, –5°C, –10°C.

In Table 4 values were calculated by averaging between the values obtained for each batch to determine the four temperatures.

Table 4

Values of the Current Intensity for M3 Mixture

Batch	Current intensity at –10°C A	Current intensity at –5°C A	Current intensity at 0°C A	Current intensity at 5°C A	Current intensity at 10°C A	Current intensity at 15°C A	Current intensity at 20°C A
I	2.727	2.427	2.325	2.276	2.250	2.176	2.155
II	2.728	2.433	2.316	2.274	2.246	2.175	2.149
Average	2.728	2.430	2.321	2.275	2.248	2.176	2.152

In Fig. 2 is the workability variation of asphalt mixtures according to the temperature and the temperature range ,considered optimal, that can be achieved under optimal laying and compacting conditions for each mixture type.

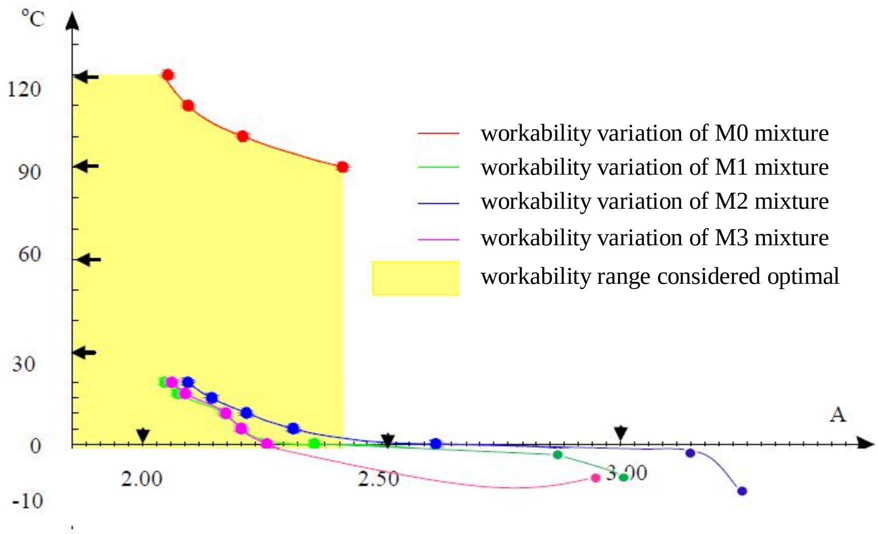

Fig. 2 – Storable asphalt mixtures workability variation according to the temperature.

4. Conclusions

Having established the storable asphalt mixtures workability in the temperature range 100°C...200°C, were observed the following aspects:

1. *M*1 mixture meets the required workability for laying and compaction in optimal quality conditions, up to a temperature of 0°C.

2. *M*2 mixture meets the required workability for laying and compaction in optimal quality conditions, up to a temperature of 5°C.

3. *M*3 mixture meets the required workability for laying and compaction in optimal quality conditions, up to a temperature of –5°C.

From a comparison of the three mixtures, *M*1, *M*2 and *M*3, was found that although we have close granulometric curves, the difference is made by the flow agent. The flow agent for *M*3 mixture provides workability at low temperatures.

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DISPOZITIVE DE MĂSURARE A LUCRABILITĂȚII MIXTURILOR ASFALTICE

(Rezumat)

Se arată necesitatea de a îmbunătăți tehnologiile de reparative pentru îmbrăcăminți asfaltice mai ales în timpul sezonului rece. Ca urmare a testelor de laborator,s-a constatat necesitatea de a realiza şi alte încercări. Aceste încercări, se referă la lucrabilitatea mixturilor asfaltice stocabile la temperaturi diferite pentru perioada de punere în operă, şi de asemenea pentru perioada de stocare.

Prin testele de laborator s-a demonstrat interacțiunea complexă dintre comportamentul mecanic al mixturii asfaltice şi variația factorilor care acționează asupra structurii rutiere, acest cadru complex fiin determinat de proprietățile mecanice fundamentale care influențează performanța pe termen lung.