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Application of New Technological Decisions While Working by the Method of Cold Regeneration

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Abstract

Technical decisions applied at repeated use of materials obtained during the existing road destruction while road repairing and reconstructing.

There suggested the solutions of development of cold regeneration method with mineral binding application including the use of different additives for improvement of physical-mechanical properties of regenerated material and prolongation of repaired road constructions service life.

Keywords: method of cold regeneration, asphalt granulate, binding agent, technology, polymer additive, thick layered road base.

INTRODUCTION

Constant grow of the temps of roads building, reconstruction and repair needs the increase of delivery volume of building materials shortage of which is growing every year. Processing and repeated use of building materials is the main problem of all building branch. Repeated use of asphalt concrete and other materials which road structure consists of gives the possibility to reduce the volume of new materials delivering and also increase self cost of the executable operations.

Nowadays there are widely used the methods of cold regeneration at road repair and reconstruction. It allows using the materials of existing road base again. Traditional methods include treatment of asphalt concrete pavement with crushed stone foundation grab. But when this method is applied on thick- layered road surface there are often milled sand-under layer and top layers of road bed. As a result the mixture of asphalt granulates, crushed stone and soil is for treatment. Development of the method of repeated use of produced by this way material with application of different bindings and additives is the actual problem,

Use of different bindings and additives for asphalt granulate properties improvement with application of cold regeneration method.

Fulfillment of operations by the method of cold regeneration has been run for many years. There is existed the normative base allowing to use the very method and achieve perfect quality of the operations. Bu never the less the wider application of this technology the more questions are arisen.

For reinforcement of received material called asphalt granulate mixed with crushed stone of foundation there is used concrete, bitumen emulsion and complex bindings (concrete + bitumen emulsion). Foam bitumen is applied instead of bitumen emulsion. The more so there can be used different additives allowing increasing strength, water and frost resistance of obtained material. But all these technologies well work at structure thickness of more than 35cm which includes soil ingress into milled material.

Additional material such as soil is appeared after operations on thin layer road base and these influences on performances of material after reinforcement of obtained road base structural layer. Besides the amount of granulate can be equal to and sometimes even more than asphalt concrete granulate together with crushed stone.

Insignificant amount of asphalt concrete granulate and crushed stone after milling is explained by the building of thin layer surface on crashed stone foundation from crushed stone of trade M600 of limestone or other rocks. It is used during the

construction of the road base without high intensity having strong durability.

Under wheel load and atmospheric factors there is taken place destruction of the crushed stone foundation and its mixing with soil. As a result crushed stone after milling is not practically seen.

Fig.1 Implementation of operations on thin layer road structures by the method of cold regeneration. 2015

In this situation it is necessary to analyze interaction between binding and soil that is soil with impurities of asphalt granulates and crushed stone foundation remains.

Binding and soil interaction influences on strength performances most of all. Taking into consideration that soils used in road base have different characteristics it is to determine with what binding and in what proportion the performances conforming to normative should be received and also to find strength performances which will be considered at road base structure design,

There are suggested technological solutions for improvement of the cold regeneration method. Nowadays there are existed different additives for soil strengthening and they are also used in road industry and can be applied with and without concrete.

After laboratory testing there was constructed experimental site where concrete and concrete together with special polymer additive was applied as binding.

Milling was executed after previous distribution of concrete onto road carpet.

After mixing of the first compound of asphalt granulate composite containing asphalt concrete granulate, crushed stone and soil with concrete, the second compound with concrete together with polymer additive there were sampled experimental mixes and they were tested in road laboratory.

Based on received data (table 1) it is clear that performances of water resistance, frost resistance and strength at different temperature are better if apply concrete with polymer additive than without it.

After consolidation of obtained material and construction of one layer of asphalt concrete surface the traffic was open and the site was under observation for 5 years.

The destructions appeared on the 4th year of operation. The traffic intensity on this site corresponds to the III technical category and the road was built in accordance with the requirements of the IV technical category.

Nevertheless one lane is built with application of polymeric additive and the other without it the behavior of destruction and kinds of defects are approximately the same on both lanes. There are no any advantages of the samples received in laboratory and those sampled on experimental section (fig.2). The results are given in table 1.

Table 1.

Kind of applied binding	No of sample	Re-formed samples						Strength limit at tension MPa at age				Frost resistance		
		mc,g			m,g			m,г			$m_в$			
						Dense g/cm^3	Water saturation % by volume	R20	R20	R50	R20	F10	F15	F25
Concrete	1	619,87	629,78	343,60	651,79	2,17	11,15	3,68	3,84	2,06	4,13	0,78	0,72	0,64
	2	624,19	634,09	346,77	656,79	2,17	11,35	3,66	3,81	2,09				
Concrete and polymer additive	3	630,47	641,07	350,70	661,75	2,17	10,77	4,08	4,18	2,12	4,85	0,81	0,77	0,74
	4	632,18	640,16	350,26	663,16	2,18	10,69	4,06	4,2	2,11				

Fig.2. Sections nowadays

Lime or materials received on the base of the lime are the materials for soil consolidation. The opportunity of lime to sink water allows its using for over watering soils stabilization. Application of lime as binding agent is well known but not well studied.

Technology of road repair by the method of cold regeneration on fine -zoned road structures

Technology of operation mostly depends on applied material. It is necessary to finish the entire operation complex up to the moment of cement setting or at the same shift if cement is applied as binding. That is after cement milling or blending with milled materials and further water additive the following technological operations are ton necessary:

- levelling with designed slopes;

- finished consolidation

- asphalt concrete mixture laying with further compaction

Fullering of milt material, levelling with designed slopes;

- final consolidation;

- asphalt concrete lying with further consolidation.

The whole operation complex is difficultly can be executed at the particular time. In this case it is necessary to use additives which allow slowing the process of cement setting. Lime can be applied as such a an additive which slows the process of durability on the first stage but also improves the properties of obtained material being together with cement an additive.

The second method is:

- addition cement and water into milled material;
- previous compaction
- levelling
- finished compaction
- technological brake for seven days during which cement will have 70% of strength.
- asphalt concrete mixture placing and compaction

In this case it is necessary to stop traffic on the road for seven days which is only possible if there are alternative roads but there are practically such ones of regional significance or the bypass road is built. All these facts lead to multiple increasing of repair works cost. When traffic is stopped alternately the conjugation seam is appeared which gives the origin of longitudinal crack and does not provide perfect quality of operation.

Observation of constructional norms according to the above mentioned solutions is not always possible otherwise it leads to the destruction of fresh cement bounds which decrements designed durability road base structural course. It is possible to dispose this problem by the simple method that is to swell the amount of cement introduced into milled material.

Thus the traffic with limited speed can start practically after the finished compaction of milled course but blanking with asphalt concrete layer should be done during a day not during a shift. The swell of cement amount compensates destruction of bound formed at the beginning of strengthening and allows getting designed strength characteristics with the application of the simplest operation technology. Service life of repaired by this way road is three years and more which is seen in the photos (fig.2)

CONCLUSION

Implementation of works by the method of cold regeneration needs the application of modern methods and technological solutions allowing to do perfect quality works with less labor and material costs.

It is necessary to develop and use new binding agent and additives which improve strength, water resistance, frost resistance and other material performances; their application is possible only after tests in some independent laboratories with further laboratory maintenance during operations and also during guarantee period to receive objective results.

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