

Hot in-place recycling technology in asphalt concrete pavement repair

Wu Dengrui *

**Chongqing Jiaotong University (Address: No. 66 Xuefu Avenue, Nan'an District, Chongqing, China.)*

ABSTRACT : This paper describes the characteristics of the hot in-place recycling technology in highway asphalt pavement repair. Around the key and the key points of quality control and highway maintenance operations features, the article has been allocated production factors rationally and developed a practical quality assurance measures, which has played a huge role in enhance the quality of repair highway asphalt pavement and road maintenance promotion of new technology.

Keywords: Highway; hot in-place recycling technology; construction operation; process quality control

1 Summary

Asphalt concrete pavement recycling regeneration is a technology that put part of the waste asphalt concrete into use, thereby reduce the cost and environmental pollution. Asphalt concrete pavement recycling has two meanings: one is to recycle old asphalt concrete; the second is to restore physical and mechanical properties of aged asphalt. Asphalt pavement recycling technology in accordance with the construction temperature, contains cold regeneration and heat regeneration. Hot in-place recycling technology is that put the old asphalt concrete in the case of heating, by adding new asphalt or recycling agent (or a mixture of both) to reproduce the old asphalt concrete. Hot in-place recycling technology in asphalt concrete pavement repair is to use microwave heating curing equipment (microwave maintenance vehicle) heat and soft damaged old asphalt concrete or newly added asphalt concrete, and asphalt material is added according to needs identified, then turned mixed uniformly and artificial integer, finally rolling molding. Due to application of this process less routine maintenance, lack of mature experience, so there are still many problems, especially for construction work repair equipment need equipment operators continue to familiar with its performance carefully.

Hot in-place recycling technology in asphalt concrete pavement repair is applicable to asphalt concrete pavement of smaller area pit, severe cracking, network crack, loose and other diseases, and the original pavement should meet the following conditions: 1) The overall strength of original pavement should meet the design requirements, grass, subbase intact; 2) the original road surface disease mainly concentrated in the surface layer; 3) 25 °C penetration of original asphalt concrete pavement' asphalt is not less than 20 (0.1mm).

2 Asphalt recycling agent dosage and add style

2.1 Determine the amount

Old asphalt concrete experiences crushing, extraction with trichloroethylene, high-speed centrifugation to remove slag, recycling processes, get the old asphalt, through a series of tests to determine the content of the old asphalt pavement asphalt concrete, aggregate ratio, as well as the penetration of the old asphalt, softening point, ductility and other indicators, compare to ordinary asphalt, penetration decline and softening point rise, ductility decreases in old asphalt. According to the values that have been measured to determine the amount of

regenerated materials (regeneration dosage is 5% to 11% generally), so that improve the performances of the old asphalt effectively, make the indicators of recycled asphalt mixture are in line with requirements.

2.2 Adding ways

In the large areas of oil field hot in-place recycling construction, the regenerated material is added in the process of re-mixed directly into the complex mix machine, after uniformly stirred enter asphalt paver paving. In the oil field construction site of hot in-place recycling technology in repair, the old asphalt concrete mix without mechanical complex process, in order to ensure accurate additive amount of regenerated material and stirring uniformity, as well as the convenience of the oil patch, take add regenerant way in the preparation process of cold-feeding, that is: according to the amount that has been determined by tests, to add recycling agent in the cold patch mixture preparation, then put the right amount of cold patch material in the pit directly when the oil patch, together with the old asphalt concrete mixing paving rolling molding after microwave heating.

3 Construction preparation

3.1 Construction workers ready

According to the characteristics of hot in-place recycling technology in asphalt concrete pavement repair, set up operations team, include one site person in charge, one technician, one field security officer, microwave maintenance vehicle driver 2, one tool truck driver, ordinary workers 4.

3.2 Construction machinery ready

The major mechanical equipment of site is microwave integrated maintenance vehicle, model 164YHB type, the model of the device is a integrated maintenance vehicle consists of microwave heating system, emulsified asphalt spray system, electrical control system, small roller. Main performance parameters of microwave integrated maintenance vehicle are as follows:

The maximum heating area: 1638mm × 1233mm;

Surface temperature: 110 ~ 160 °C (12 ~ 15min);

Heating depth: 4cm, 6cm, 8cm, 10cm, 12cm,, the maximum heating depth can up to 20cm;

Pan around range of the hydraulic heating plate: ± 500mm. Microwave maintenance vehicle has the following technical advantages: Convenient operation, flexible control of the heating time and working conditions; use the microwave heating principle, heating and no fire occurs, do not burn the road, completely avoid the drawback that environmental pollution due to uneven heating and not achieve the depth of repair ; site hot recycled asphalt pavement can ensure consistent temperature between the old pavement and new material, good repair quality, save maintenance cost, repair quickly, in line with the requirements of national environmental protection and recycling economy development.

According to the requirements that site thermal regeneration technology of asphalt pavement repair, investment in machinery and small equipment are shown in Table I.

Equipment name	Quantity	Remark
Tool Cart	1	
Shovel	2	Flat head shovel
Microwave maintenance vehicle	1	Carrying roller and

		asphalt spray system
Broom	2	
Powerful hairdryer	1	

3.3 Main testing equipment ready

The main test items of hot in-place recycling technology in asphalt concrete pavement repair are construction of temperature, flatness, permeability coefficient, compaction and so on. According to the test items should be equipped with testing equipment are: three meters straightedge, infrared pyrometer, seepage meter, nuclear density apparatus and so on.

3.4 Main material ready

Technical workers calculate the amount of material timely that in accordance with the road repair plan, the results will inform the work team leaders who prepare the necessary materials according to the number required.

4 Repair technology process

To achieve conservation work fine, standardization, ensure site hot recycling patch orderly, managers should organize personnel and equipment based on site repair features of hot recycling technology and develop on-site thermal recycled asphalt pavement repair process as follows:

①pavement distress survey②repair scheme determination③closed traffic, set the work area④clear the debris inside the pit, spray the right amount of emulsified asphalt⑤add new asphalt concrete blocks of cold feeding in pits⑥heated by microwave cart⑦rolling and molding⑧conservation and quality inspection⑨clean up the construction site, open channels.

5 Process quality requirements and work standards

The process quality requirements and operating criteria based on the thermal regeneration of the oil patch process and the characteristics of each step are as follows:

1) Pavement distress investigation should be comprehensive and careful, analyze the causes of disease is the key, only the cause analysis is correct that can select an appropriate disease treatment method which ensures the quality of repair;

2) Clean-up the waste and old asphalt concrete pavement is not suitable for recycling disease in site construction, and then use the power hairdryer to clean thoroughly;

3) The addition of new asphalt cold patch material should be considered pavement damage and disease extent size, based on the experience of field technicians in the construction to add volume estimate, the amount of cold feeding block should be higher than the actual demand slightly surplus.

4) Control heating depth and temperature, set the appropriate heating depth according to the thickness of the pavement structure and damaged, the heating temperature should be controlled between 140~160°C, to ensure that the old and new material is completely softened, easy mixing and rolling.

5) After completion of the heating, old and new mixture should be immediately turned mixed, speed should be fast and make sure that old and new mixed evenly, and the second to ensure the mixture's temperature does not drop too much.

6) Rolling temperature of asphalt pavement on construction site should meet the technical specifications,

when rolling, the press temperature should be between 100 ~ 140 °C, and the roller are rolling should in accordance with the order that the static pressure twice, shock press four times, twice the static pressure, so that achieve the required degree of compaction.

7) Quality testing and maintenance, conservation and quality testing should be carried out after rolling, if there is the quality problems of appearance, should take timely measures to repair.

6 End

The microwave technology has been used for asphalt pavement site thermal regeneration is a new technological innovation, which uses microwave heating principle of heating asphalt concrete to make it meet to temperature that construction needs in order to repair the road, and it have "fast heating, uniform heating, energy efficient, easy to control, sanitation, selective heating, safe and sound" characteristics. Application of microwave integrated maintenance vehicle make the highway pavement maintenance more convenient. Not only it brings innovative conservation technology, but also directly contributes to the asphalt pavement repair process innovation.

References:

- [1]. JTGH10—2009, Highway Maintenance Technical Specifications [S].
- [2]. JTGF41—2008, Asphalt Pavement Recycling Technical Specifications [S].
- [3]. JTGF40—2004, Asphalt Pavement Construction Specifications [S].
- [4]. JTGF80/1—2004, Highway Engineering Quality Inspection and Evaluation Standards [S].
- [5]. JTJ075—94, Highway Maintenance Quality Inspection and Evaluation Standards [S].
- [6]. JTGH30—2004, Highway Maintenance and Safe Work Practices [S].