

The Summarization of the Asphalt Pavement Diseases and Preventive Measures

Ming YANG

School of Civil Engineering, Chongqing Jiaotong University, Chongqing, 400074, CHINA

Abstract: In recent years the number of asphalt pavement diseases is growing rapidly, analysis factors to cause the asphalt pavement diseases is a key work of road construction and it can bring great economic and social benefits. In this paper, it discuss the asphalt pavement common diseases and analyses the cause of diseases briefly. Providing the reference for the asphalt pavement construction and operation to avoid common asphalt pavement diseases

Keywords: Asphalt pavement; Disease; Preventive measure

1. Introduction

The asphalt pavement has the advantages of smooth surface, solid, no seams, short construction period, simple maintenance, and good vibration reduction, to make driving stable, comfortable and low noise. But due to the increase of traffic volume, the increase of overloaded vehicles, temperature changes, humidity changes, the role of freezing, design and construction materials and maintenance management and other factors, a variety of asphalt pavement diseases, such as cracks in the asphalt pavement, pit and subsidence, and so on. This paper will respectively introduce the causes of these three types of diseases and summarize the corresponding prevention and treatment methods.

2. Crack

Crack disease has three kinds of longitudinal crack, transverse crack, and net crack.

2.1. Longitudinal Crack

There are two kinds of longitudinal cracks: One is mainly occurred in the emergency strip or shoulder position, the shape is gradually enlarged along the edge of the shoulder, show crescent, this kind of cracks easily causes the roadbed to slip, it is very harmful and dangerous; Another kind is to happen in the lane position, multiple longitudinal bands, both ends of the crack are not extended to the edge of the embankment.

Causes of longitudinal cracks

1) Foundation cause. Some sections of the road is located in the hills and valleys, natural water content of foundation soil is higher, In the design and construction is not done, after high fill, due to the difference of the bearing

capacity of foundation, uneven settlement, bringing about the longitudinal cracking of pavement.

2) Reasons for subgrade construction. If the subgrade construction in dry weather, local embankment clod crushing shortage, uneven compaction of subgrade, buried structure due to the limitation of the length of the structure, roadbed edge can not be super wide rolling, causing the roadbed edge compactness is not enough, or the mixed material spreading when the longitudinal construction overlapping quality is not good, will cause the longitudinal crack.

3) The water seepage of the central separation zone, the road surface, the slope and so on, causes the local roadbed to be reduced after the water immersion. Under the action of static and dynamic load, the crack of the roadbed is produced, In addition, if the filler is weak expansive soil, such as the construction of the treatment is not done, the water content changes, also can lead to cracks. The main measure to prevent the longitudinal cracks is to deal with the foundation of the foundation, If the subgrade layer is filled and compacted well, so that the roadbed as evenly as possible, especially in the prevention of measures to prevent surface water infiltration of the foundation, it will greatly reduce the number of longitudinal cracks, while significantly delaying the time of longitudinal cracks appear.

Prevention and cure of longitudinal cracks

4) For crack width less than 3mm of the cracks can not be processed, longitudinal cracks greater than 5mm less than 3mm, the gap brush can be swept clean, and the compressed air is used to blow the dust, and the hot asphalt or emulsified asphalt is used to fill the gap.

5) If the further development of the longitudinal cracks, the edge of the crack, and the crack width is greater than 5mm, you must first plane in the upper layer and the

surface layer (milling width for cracks on both sides of the 1m), and the crack by method 1) first tamped, along the lengthways paving glass fiber grid, paving surface layer and in the surface layer along the vertical every 5m laying width of 1.2m glass fiber grid. Finally, then spread layer above.

6) For not yet stable longitudinal cracks, except by method 1) treatment, should also according to the causes of cracks and take drainage, slope reinforcement, in order to make the stable crack does not continue to develop.

2.2. Transverse crack

Transverse cracks is nearly perpendicular to the crack with the centerline of the pavement, crack at first mostly appear on both sides of the road of the hard shoulder, develop gradually through railway amplitude. Through the cracks along the road is roughly uniform distribution. Causes of transverse cracks

1) Material shrinkage causing transverse cracks. On the one hand, in the process of forming, the horizontal cracks formed by the shrinkage of the base material. On the other hand, the low temperature shrinkage cracking occurs at the base of the temperature drop. The two contraction deformation on the surface layer bottom surface is subjected to a tensile force, when tension over asphalt surface layer tensile strength makes the asphalt surface layer at the bottom of the crack and with cyclic variation of temperature and traffic load repeatedly function caused ground crack of asphalt layer.

2) Cracks caused by temperature of asphalt and concrete. Because asphalt is a kind of viscoelastic material which is more sensitive to temperature change, the temperature of the asphalt mixture becomes hard and brittle, and the shrinkage deformation occurs. When the shrinkage tensile stress exceeds the tensile strength of asphalt concrete and asphalt pavement surface will be ripping, and gradually down to the development, formed on the wide and narrow transverse cracks, the temperature shrinkage cracks in the region of large temperature difference between the North width is generally 3 ~ 5mm, to winter can be widened to 10mm, the widest reach 20mm and spring retracts.

3) Transverse cracks caused by differential settlement. In soft soil and soft soil base junction, soft soil foundation treatment methods change or structure abutment back and road junction, because of foundation and subgrade and the structure difference settlement lead to cracking of the base, and reflection to the asphalt surface layer, forming transverse cracks.

4) Due to temperature changes caused by the asphalt surface itself is a major cause of the contraction of the transverse cracks, so the more the asphalt content, the more cracks. The selection of asphalt, which is in line with the requirements of heavy traffic asphalt technology, can effectively reduce the cracks by controlling the amount

of asphalt, the selection of mineral materials, the accurate composition of the gradation, or the use of fiber and other additives. In addition, the pavement structure should be designed and constructed carefully.

Prevention and cure of transverse crack

5) Transverse cracks caused by reflection cracking and temperature shrinkage of asphalt concrete, such as slit width can not deal with, such as width of more than 3mm, the slit to brush clean, and use compressed air blowing machine to clean the dust, or crack slot along with compressed air blowing machine net, the sand material or fine style hot mix asphalt mixture filling tamping and iron sealing.

6) For subgrade subsidence due to the transverse cracks caused by, such as the emergence of wrong station, while eating, crack width greater than 5 mm or more, two of the 50cm~100cm range of slotting along the transverse joints and, digging in addition to the above layer. According to the method of 1) first crack infill, and then along the transverse seam paving glass fiber grid, grid mesh size 24.4mm*25.4mm, tensile strength of not less than 50KN/m, maximum load extension rate is less than 3%. On the whole line of disease treatment, there is still a vertical and horizontal slope surface is not smooth, road surface deflection can not meet the requirements of the original design deflection, so across the board overlay minimum thickness lane is 5cm, the hard shoulder 4cm AC-16I type concrete cover layer, using asphalt as domestic SBS modified asphalt, in order to improve the performance of the pavement surface.

2.3. Net crack

Net crack is mutually staggered fatigue crack, formation consisting of a series of small polygonal mesh cracking and its initial form is along the wheel track with single or multiple parallel longitudinal seam and in longitudinal seam between appear transverse and oblique to the joints, in the form of fracture network.

Cause of the network crack

Net crack is mainly caused by the lack of the overall strength of the road. A may be due to the unreasonable structure and design of pavement, subgrade and pavement compaction degree is insufficient, pavement materials with improper or not uniform mixing, the bond between asphalt and stone difference; Another reason may be due to the transverse or longitudinal cracks in the pavement not timely fill and seal, resulting in infiltration of moisture in the lower, at the grassroots level encoding surface have been soaked until soft, under the action of repeated vehicle load, slip through the cracks in the surface layer and the gap is pressed onto a surface to produce a clamorous pulp, grassroots surface by step hollowing, cracking appearance on the network. Also asphalt aging and car overloads badly, roots resulting in fatigue failure is the leading cause of asphalt surface

layer formed an important reason for net crack, for preventing crack must strengthen the truck load management in pavement cracks should be promptly repair processing.

Prevention and cure of network crack

For the slight net crack can be glass fiber cloth cover, for a large area of the net crack, often shop emulsified asphalt seal coat or in strong grass-roots repair, re cover and repair the road.

3. Pothole

Pothole in the asphalt pavement, is the result of the further development of cracks, loose and other damage.

3.1. Cause of pothole

At the beginning of the water damage, the rain water is infiltrated by the large voids or damage of the asphalt pavement, which is stuck on the surface of the base layer, water erosion of semi rigid base of fine material in the repeat function of vehicle load and gradually formed a mortar and asphalt surface layer and the base disengaged, mortar was driving load extrusion, through cracks in the surface layer or surface layer mixture void pumping to the surface. Position in the clamorous pulp, the asphalt surface layer generated net crack, and then some broken small surface layer or of the base materials, is take the wheel, and gradually form a pothole, and continued to expand, and finally the formation of pothole.

3.2. Prevention and cure of pothole

1) Cold repair method

Firstly to determine the pit depth, draw cut the scope of patching, hydraulic pneumatic cutting groove, with high-pressure air gun will be at the bottom of the groove and a groove wall waste and dust clean. The bottom of the tank, and then use a blowtorch drying tank wall, and spraying a thin layer of adhesive layer on the surface of oil. Finally will be ready to fill the hot material to the pit, such as the thickness of more than 6cm will be layered filling, from the surrounding to the middle of the roller.

2) Hot repair method

First thermal radiation heating plate area is determined according to the scope of pothole repair, heating plate transferred to the appropriate location, heating for 3-5 minutes to be repaired area pavement softening, and will be ready for a good hot material is put into repair, stirring flattening, and from the surrounding to the middle roller.

4. Subsidence

The degree of compaction of roadbed is not enough or the structure of the soil is poor, and the vertical deformation under the action of water and load is not uniform.

4.1. Cause of subsidence

1) Poor construction quality at the basic level. Due to the lack of thickness of the grass roots or due to the lack of basic materials, construction, maintenance and so on, the overall strength of the grass-roots level is not enough, and the strength of each layer of the pavement is more than the strength of the pavement, so that the deformation of the road surface is too large to form a settlement.

2) High groundwater level. Underground water can cause soil or grass is weak, resulting in road surface subsidence.

4.2. Prevention and cure of subsidence

- Increase of the subgrade and base strength.
- The stability increase of the subgrade and base.

5. Conclusion

Once the highway pavement disease, maintenance is not only time-consuming and laborious, but also affect the normal use of the highway, so the various diseases of highway pavement should be based on prevention. For the effective prevention of disease and the occurrence of must be in-depth study of a variety of diseases of the formation mechanism, preventive measures and treatment methods, so as to eliminate the hidden disease and to provide theoretical support as soon as possible in the design, construction and maintenance and management of the link. On diseases of promotion and application to make full use of the local road resources, save construction cost and maintenance cost, improve design quality and road pavement quality, prolong pavement service life is of important practical significance.

References

- [1] Ye Jianshu. Highway disease and inspection[M]. The one edition. Beijing: People's communication press, 24-30(2012).
- [2] JTG H11 – 2004 Specification for maintenance of highway bridges and culverts[S]. Beijing: People's communication press,18-40(2004).
- [3] JTG F40 – 2004 Technical specification for construction of highway asphalt pavement[S], 30-38(2004).
- [4] Zhao Limin. The analysis of soft soil foundation abutment forward principle and method of comprehensive treatment[J]. Journal of Railway Science and Engineering, 2006, issue3(4): 54-58.
- [5] Liao Yufeng. Analysis of the characteristics and causes of the disease of existing concrete pavement[J]. Building Science Research of Sichuan, 2006, issue32(5):63-66.