Types of Soft Ground Disease and Its Treatment in Expressway

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Abstract: With the increasing mileage of expressway in China, the soft roadbed disease is frequent, which seriously affects the highway traffic safety and road service life. Therefore, the weak roadbed must be taken seriously, combined with the common form of disease, put forward the treatment of weak roadbed disease targeted measures.

Keywords: Weak roadbed, Disease, Treatment

1. Introduction

Subgrade is the main body of the road load. Under the roadbed for the foundation, the foundation is supported by the roadbed. The geological characteristics of foundation engineering are directly related to the quality of subgrade engineering. The quality of the roadbed is directly related to the situation of the pavement structure, the foundation, the roadbed and the surface layer to form a whole to support the vehicle load, the weight and various natural factors rain, temperature and so on. In the deep soft road section, due to the large soil porous ratio, water content, water permeability, low shear strength, high compressibility characteristics, in the embankment under the effect of high fill, to go through a long time roadbed stability, Its deformation and stability will generally continue to the highway operating period, coupled with the load and the surrounding uncertainties (such as farmland, shrimp ponds, fish ponds and other drainage), often roadbed pavement disease. Therefore, the study of roadbed disease types and causes, and make targeted treatment, in order to ensure the stability of highway subgrade.
2. The main disease

Roadbed exposed in the atmosphere, withstood the weight, pavement structure layer weight and car load and a variety of natural factors, all parts of the roadbed will be deformed. If it is a defective subgrade, this deformation will greatly exceed the specification. The deformation of the subgrade is divided into recoverable deformation and irreversible deformation. The failure of the defective roadbed is much greater than that of the normal roadbed. The large irreversible deformation will inevitably cause the subgrade elevation and the slope gradient and the shape change, Will cause serious soil displacement, endanger the integrity and stability of the roadbed, resulting in a variety of roadbed damage.

(1) Subgrade subsidence

Subgrade subsidence means that the subgrade surface produces a large sink in the vertical direction. The subsidence of the subgrade can be divided into two cases, one is the lack of strength of the embankment fill in the load and water, the temperature under the combined effect of consolidation subsidence, the second is a bad foundation or weak foundation in the roadbed construction without reinforcement, Load and self-weight under the ground subsidence or to the two sides of the extrusion, causing subgrade subsidence. Uneven subsidence can cause cracks in the embankment, slope feet outside the ground often appear uplift and horizontal displacement.

(2) Slope slump

Subgrade slope slip is a common roadbed disease in postganglionic defect area. According to the classification of slope soil type, the reason and size of the damage can be divided into two aspects: slip square and landslide. The slip is mainly caused by the erosion of the slope or the improper construction of the flow water, especially in the subgrade cross section of the existence of local or soft soil layer is more prone to slump. The main reason for the slope slope is that the slope height and slope are incompatible with the nature of the natural soil. The cohesive soil layer and the impounded gravel layer are alternately layered, especially when there is a slope stratification that tends to be cut in the direction of the road. If the fresh layer of the next layer of fresh rock for the step-shaped, then in the holding layer of the roadbed will appear to pull cracks, wrong and other diseases.

(3) The roadbed slides along the hillside

In the steep hillside to fill the roadbed, if the natural slope of a certain thickness of the soft soil layer, in the case of saturated water, will form a sliding surface, slope foot without the necessary support, in the roadbed weight and traffic load, The entire roadbed may slide down along the sloping floor, and the roadbed as a whole will lose stability.
(4) Subgrade damage
The road through the bad geological conditions such as debris flow, cave, goaf and so on and the occurrence of large natural disasters such as heavy rain can lead to instability in the roadbed deformation.

3. Disease treatment technology

Roadbed disease, the need to deal with the foundation or at the same time dealing with the two parts of the foundation and embankment, at this time either urgent construction of the road, or the road has been the end of the construction requirements of the treatment of traffic interference, small damage to the pavement, reinforcement period is shorter. Obviously, not all of the foundation treatment technology is appropriate, generally comprehensive analysis of the foundation and embankment situation. Common treatment methods are:

(1) Digging over the cover
The road surface with a slight damage, the occurrence of a smaller width of the cracks, and a number of longitudinal joints and transverse joints through the cracks in the road sections, to improve the road material excavation Overlay treatment. After digging the surface layer, the general base will also find cracks, or crack subtle, the first with cement grouting, in the digging of the asphalt pavement parts with elastic sealing paste first potting treatment, and then cover. When digging the surface layer found that the crack width is large, because the elastic seal paste will automatically sink after pouring, it is difficult to seal the cracks, can be used asphalt pouring, and then use the elastic sealant sealing effect is better. The above layer should be selected as fine grained asphalt mastic or modified asphalt concrete; in the middle layer with medium-grained modified asphalt concrete; the following layer with coarse-grained modified asphalt concrete or heavy traffic road asphalt concrete. The upper layer selection SMA structure, can effectively reduce the rut, to prevent cracking, to overcome the road crack and other diseases.

(2) Steel flower tube grouting method
Steel flower tube grouting method is the first buried grouting steel flower tube, and then the first time outside the steel tube for grouting, and then the secondary split grouting within the steel pipe, the formation of cement steel pipe pile composite foundation, together bear the role of the upper load. The width of K48 + 310 ~ K48 + 435 of Guangzhao Expressway is on the side of the old river. The foundation is the interlayer of clay and siliceous clay. After the opening of the vertical cracks, 1 year after the width of 5.0 cm, the use of steel flower tube grouting reinforcement. The average grouting amount of 180 kg / m was formed by the simultaneous use of PVC pipe and
the secondary split grouting in the tube, forming the cement steel pipe pile composite
foundation, effectively controlling the crack propagation.

(3) High pressure rotary spray method

High-pressure rotary spray method is the use of high-pressure rotation of the nozzle
to the cement slurry into the hole and the surrounding soil mixed with stirring, and
finally formed a solidification of condensation and hardening. The surrounding soil is
gradually consolidated due to the slurry immersion, and its bearing capacity is also
improved. Xinjiang Wukui Expressway after the completion of a year later found that
individual sections of deformation subsidence, the road surface cracks and longitudinal
cracks, the majority of the settlement difference of 5.0 ~ 10.0 cm, the maximum gap
of 12 cm. Subgrade for the thickness of about 4.2 m natural graded gravel compaction
layer and loess-like low-liquid-limited silt piles in the thin layer of fine sand and gravel
foundation. The drilling distance is 2.0m, the diameter of the pile is 60cm, the triangle
is arranged, and the pile length passes through the natural silt (clay) layer, and the
effect is good.

(4) Pressure Grouting Gravel Pile Method

Pressure grouting gravel pile method is the first drilling (diameter 8 ~ 10cm), and
then install the grouting tube, backfill gravel and grouting, cement slurry through the
flower tube diffusion, so that grouting pipe, gravel cement and trees The root-like
cement mesh is tightly integrated into one body, forming a small rigid pile, which is
composed of cement-soil consolidation body and surrounding soil. A road about 165 m
in the length of the road, the road settlement is large, about 30 cm, after investigation
found that the roadbed subsidence caused by pavement disease, and then determined
by pressure grouting method reinforcement. Subgrade grouting reinforcement
treatment, the damaged cement concrete plate to do the disease treatment and
irrigation joints, add geotextile and asphalt concrete surface layer, the effect is good.

(5) Anti - pressure method

Anti-pressure escort is through the full use of open road terrain, the use of
large-scale ladder backfill back pressure, as far as possible within the roadbed force
balance to ensure roadbed stability. According to the thickness of the mud and fill the
different height, the sub-pressure back pressure reinforcement. When the height of K5
+ 360 ~ K5 + 500m in Fujian Province is close to 8 m, the silt layer thickness of the
road section is 10.5 m, and the continuous failure of the road gene, the depth of soft
soil treatment and the monitoring of the settlement are not in place. After the
treatment of anti-backcourt program, the monitoring shows that the single-day
settlement of the section has obviously converged. Through the on-site inspection, the
section of the current situation is flat, the right side of the sidewalk stone close, no
obvious signs of deformation, and stability and settlement calculation results are
consistent, indicating that the anti-pressure treatment program is reasonable and effective.

(6) Mixing pile method of dry-mixed cement concrete

Mixing pile method of dry-mixed cement concrete is to dry the cement concrete dry mix after filling in the hole diameter of 150 mm micro-drilling. Construction procedures include pile position measurement, drilling rig in place, into the hole, ramming dry mixing cement concrete and sealing. It rammed before filling the first ramming 10 times, and then backfill ramming expansion. Orifice 0.25 ~ 1.00 m with dry hard concrete backfill (i.e., add dry water in the dry mix of water), hole 0.25 m C30 concrete vibrating dense slurry after the face. Some of the subgrade of a highway in Xi'an is seriously depressed due to persistent heavy rain. The maximum depth of subsidence is 60 ~ 70cm, and the longitudinal crack width of lane and overtaking lane is 2 ~ 20cm. As the soil close to saturation, take dry mixing cement concrete ram expansion pile for reinforcement. After the opening of the cracks no longer develop.

4. Conclusion

Due to the design or construction and other reasons, the highway weak roadbed disease often occurs, resulting in decreased subgrade strength, a direct impact on the use of road and traffic safety. Therefore, for the weak roadbed disease must be given sufficient attention to the roadbed disease for accurate classification, and then put forward targeted measures to ensure the safety of highway traffic.

References