Test and Analysis of the Application of Waterproofing for Waterproofing of the High Speed Railway

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Abstract. Because of the influence of temperature and external force, Wuhan-Guangzhou high iron support layer and the surrounding structure without a frantic jumble rail track at the junction of seams and bearing layer construction appeared from the seam, and the rain for a long time erosion will cause certain influence to switch the use of safe, by using the combined methods of field and indoor experiment, with high content of iron without a frantic jumble switch waterproof processing technology method and relevant parameters, operating high-speed rail area waterproof renovation for the future to provide the reference. Introduce the process, technical plan, test and test results of the implementation.

Introduction

Wuhan-Guangzhou high speed railway as an important component of the Beijing-Guangzhou rail, from Wuhan to Guangzhou, across Hubei, Hunan, Guangzhou three provinces, the total length of 1068.8 km, on December 26, 2009 to begin formal operation has been used for six years. Due to temperature effect and the external force, Wuhan-Guangzhou high railway support layer and the surrounding structure without a frantic jumble rail track at the junction of seams and bearing layer construction appeared from the seam, and the rain for a long time erosion will cause certain influence to switch the use of safe, all 93 set of switch, waterproof parts for track plate and orbit between the cracks of post-cast strip, base plate and leveling layer and the base plate and the track plate between the two angles of the Yin, track plate and wire seal gap, the line between the seal grooves at the bottom of joints and switch in five parts for waterproof treatment.

The Characteristics of Water Damage in the Bifurcation Area

Post-cast strip between the track plate and track plate fracture, orbital plate seal gap between line and line seal between the joints of the three belong to high position into the water, solve the problem of switch from seam at pulp, the first thing to solve the problem of the three position of blocking, but these three position cracks under the extrusion of high-speed train daily, vibration frequency, changing structure cracks, adopt rigid waterproofing material is difficult to solve the problem, certainly must use elastic material, traditional use silicone sealant or block polyurethane sealant, silicone though better resistance to ultraviolet, but material performance under this high vibration and rain attenuation rapidly and is difficult to ensure the durability of the waterproof layer, and the ultraviolet resistance of polyurethane sealant application ability difference should not be more applications in the environment.

This experiment adopted complex control scheme, one is in filling cracks curing rubber, due to the material will never be cured, keep gel state, in the process of fracture changes from stress, on the one hand, effectively prevent moisture to enter, on the other hand can prevent material performance loss caused by the structural deformation; it is outside of the cracks in the spraying spraying quick-setting 2.5 mm rubber asphalt, because of its high extensibility, super high weather resistance and adhesion force between concrete and features outside the cracks can be formed a waterproof barrier.
Base plate and leveling layer and the base plate and the track between two internal Angle grooves, switch under the two position is mainly internal Angle structure, on the premise of the first three positions to waterproof, as long as the three position in Yin angular position do the width and height from 50 mm chamfering and coating a layer of 2.5 mm thick coating quick-setting rubber asphalt to prevent rain water flow backward.

**Properties of the Asphalt Material of Spraying Speed**

**Material Properties**

1. High elasticity: coating elongation at break can reach more than 1000%, suitable for expansion joint and deformation joint parts, can effectively solve various structures on the deformation and stress, crack, inflation caused by puncture or connection rickety leakage, corrosion, etc.; Effective coping structure deformation, guarantee waterproof effect.

2. Integral water repellent: the coating is perfect to cover the base, realize the seamless connection of the coating, so that it is difficult to realize the water without the requirement of stripping. It is more convenient and reliable for the complicated construction of the branch structure.

3. Durable thorn strong: the network structure of rubber forming in the coating, at the same time have a high elongation, so has good anti puncture performance, apply to vulnerable to puncture site.

4. Self-healing: high elasticity and high elongation make the self-healing function of the coating, which can be repaired by the general puncture, without leakage.

5. Excellent chemical resistance, good heat resistance, excellent resistance to chemical resistance, acid, alkali, salt and chlorine, high temperature and low temperature resistance.

**Material Indicators**

<table>
<thead>
<tr>
<th>Serial number</th>
<th>Item</th>
<th>Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Elongation at break</td>
<td>1227%</td>
</tr>
<tr>
<td>2</td>
<td>Low temperature flexible</td>
<td>−25℃No crack</td>
</tr>
</tbody>
</table>

| 3 | The rate of elongation | 2500h | artificial weathering | 975% |
|   |                       | 3000h | appearance           | No bubbles, no flaking, No crack |
|   |                       | 4000h | discoloration        | ClassI |
|   |                       | 5000h | appearance           | No bubbles, no flaking, No crack |
|   |                       |       | discoloration        | ClassI |

**Construction Characteristics and Process Flow**

1. Construction features

   (1) Satisfies the requirement of mechanical construction: mechanical spraying moments after forming, the professional spraying mechanical construction, saving construction cost and labor greatly, can greatly shorten the construction period.

   (2) Construction way agile diversity, in addition to the spray is used for the main construction way, also can brush, coating and other coating way, meet the bifurcation area of Yin and Yang Angle, construction joints, structure crack, etc. The special requirements of waterproofing work.

154
(3) Constructed on wet surface: it can be constructed in wet, unbright water.
(4) Environmental protection, energy saving water: in the process of production, construction and use, does not use organic solvent, spray cooling refrigeration, a virulent insipidity, no emissions, no pollution. During the whole construction, there is no need to heat, room temperature construction, no fire, guarantee the safety and reliability of the construction.

2 The sides of the bifurcated plate and the base and the base and the leveling concrete junction
   1) Chamfering and mending: repairing the corners of the horn and repairing the rough edges and edges.
   2) Basic processing: using the Angle grinder and wire wheel to clean up the dirt and dirt at the base level, make sure the grass roots are clean, neat, unangled and empty.
   3) Waterproofing material added layer: after the basic processing, the non-woven fabric and brush are required to make a waterproof layer in the inverted corner.
   4) After the additional layer is finished, it is required to spray the flame retardant type spray rubber asphalt waterproof paint.

3 The line between the switch and the line between the two lines is bounded by the wall
   1) Basic processing: the grinding machine with the steel wire wheel will be sanded, and the blower will blow up the putty and keep the grass roots clean.
   2) Injection of curing rubber asphalt waterproof coating: will not the curing rubber asphalt with hot water heated to above 70 °C, then by hand into the crack and putty knife flat, grooved ends with ceramic tile adhesive sealing side.
   3) The curing coating epoxy coating with silicone sealant junction, besmear to brush the length of deformation crack extension of 35 mm on each side, epoxy coating cover the curing with silicone sealant, uniform coating.
   4) Spread silicon oil paper, use different sizes of silicon oil paper according to different positions, and non-solidified rubber asphalt and epoxy paint paste for silicone oil paper.
   5) Orbital protection: the protection of the orbit and the equipment before spraying, avoiding the impact of the traffic.
   6) Waterproof coating of asphalt rubber asphalt.
   7) Inspect the discharge or damage area for repair.

Qualification

1 All fixed pieces, gaskets, and pressure bars are satisfied: ensure that they can be buried in or through the floor of the roof and other structures, and can be connected. The connection between the fixture and the gasket, the pressure bar, or the ground floor shall not be removed, removed and loosened. It should not break, separate, break.

2 All insulation shall be satisfied: the insulation shall not break, break, or pull out a fixed piece of cap, gasket and pressure bar. It should not be stratified or separated from the surface layer or adhesion of adjacent parts. The insulation board is not cracked, cracked and cracked.

3 All papers shall be satisfied: the coil shall not be torn apart, perforated, broken and any opening. The coil shall not be stratified or separated from the adjacent parts.

4 There should be no separation, layering, rupture or spin-off of 5.4.4 binder and binding site.

5 Roof basis satisfaction: maintaining the integrity of the structure. The test framework will not be shed, separated and loosened in any area. It does not break, crack, break, and fastener.

6 Other parts. There is no tear, perforation, disconnection, layering, or any other penetrating opening of the seam, the air layer, the steam layer, the bottom layer or the coil.

Theoretical Calculation and Test Detection

1 Anti-wind:
   High-speed trains pass at a speed of 350km/h, the maximum speed of the orbital surface is 97m/s.
   Wind pressure and wind pressure
   \[ W_p = 0.5 \, \frac{rv^2}{g} = 0.006 \, \text{MPa} \]
   R - air weight 0.01225 KN/m³, g - 9.8 N/s²
It is known that the positive and negative pressure on the coating surface under the maximum possible wind speed is well under 0.6 MPa.

2 Laboratory tests

According to GB/t16777-2008 and GB/t18244-2000, the bond strength test is shown in Table 2:

<table>
<thead>
<tr>
<th>Serial number</th>
<th>inspection</th>
<th>results of the project</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>cohesive strength</td>
<td>500h artificial climate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1000h artificial climate</td>
</tr>
</tbody>
</table>

Conclusion

1 The process of the application of the resistance of the asphalt in the construction joints of the high iron and non-laminates in the construction joints of the high speed rail is met with the requirement of water repellent.

2 Used in high frequency vibration environment.

Suggest

1 The quality of the waterproof coating should be monitored during the operation period.

2 After the use of 1000h, it shall be re-evaluated after the strength of the bond is re-evaluated, and if not satisfied, it shall be redone.

Reference


