

# Analysis on Quality Control of On-site Construction of Municipal Road Asphalt Pavement

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**Abstract:** This paper analyzes the on-site quality control of municipal road asphalt pavement construction stage, and mainly discusses the construction quality control precautions from five aspects, including test section, construction preparation, paving, rolling, and special part treatment, to ensure the scientific nature of municipal road construction and provide excellent travel environment for people.

**Keywords:** Municipal road; asphalt pavement; quality control

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## INTRODUCTION.

In municipal roads, asphalt pavement has been used more and more widely because of its advantages such as no joints, low noise, good flatness, comfortable driving, and convenient maintenance. In the construction of asphalt pavement, many factors affect quality, such as the construction quality of base course, mixing, transportation of asphalt mixture, spreading and rolling technology, etc. This paper will only discuss quality control from the perspective of site construction.

## 1 TRIAL PAVING STAGE

Before formal construction, a section of road shall be selected as the test section, with a length of about 200 M-300 m. It aims to obtain primary data through trial laying, such as loose paving coefficient, distribution amount of emulsified asphalt, temperature control, speed control, etc., and provide a reference basis for constructing the whole line.

## 2 CONSTRUCTION PREPARATION

### 2.1 Treatment of the basic level

Before paving the asphalt surface layer, the cleaning of the base course shall be done carefully to ensure that the surface of the base course is clean and free from loose aggregate, soil block, and other sundries. And it can be washed with water if necessary. Given the common quality problems that it is prone to sinking around various wells, vibration rammer or small roller shall be used for further compaction.

### 2.2 Spreading emulsified asphalt

According to different parts, it can be divided into permeable oil and viscous oil. Before spraying, the plastic cloth should be used to cover the side stones to prevent pollution. In large-scale operation, the asphalt distributor can be used to spray emulsified asphalt. The spraying width and amount shall be adjusted according to the design requirements and test data. The sprayed emulsified asphalt shall be foggy and evenly distributed into a thin layer within the pavement's

whole width, without whitening, leakage, or accumulation. After the oil is sprinkled, vehicles are strictly prohibited. After the emulsion is broken and the water evaporates, the asphalt surface should be laid to ensure that the emulsified asphalt is free from contamination.

### **3 PAVING ASPHALT MIXTURE**

Paving is an essential link in the quality control of asphalt pavement construction, directly affecting the surface construction's thickness and flatness.

#### **3.1 Mechanical selection**

The paper's selection should be based on the road's design width, the thickness of the surface layer, the adjustment range of the paving speed, the leveling and material distribution requirements, and the ability matching between the mechanical equipment should be considered for a comprehensive selection.

#### **3.2 Component adjustment and parameter setting**

The paver has a large size and many components, mainly composed of frame, power, electric control system, feeding system, ironing device, leveling system, etc. Before paving, it is necessary to adjust and set parameters for different parts, mainly including the width, camber, initial working angle of the screed, the distance between the distribution screw and the front edge of the screen, and the stroke of the vibrating beam, etc.

#### **3.3 Key technologies**

##### **3.3.1 Setting of baseline**

There are two methods to determine the datum line, which should be selected according to different structural layers.

a. The bottom layer adopts the "steel wire" method: 2 mm ~ 3 mm steel wire rope is used, the steel wire spacing should be moderate; generally, the straight-line section is 10 m, and the curve section should be properly densified to avoid the insufficient tension of steel wire rope caused by over large steel wire spacing, thus affecting the smoothness of paving.

b. The middle and upper layers adopt the "sled walking" mode: the floating reference beam is used to keep the height difference between the front and back of the paver consistent to ensure the paving thickness and flatness. Special personnel shall be assigned on both sides to clean the mixture particles or other foreign matters on the walking track to ensure that the "sled" is parallel to the surface of the lower bearing layer.

##### **3.3.2 Paving speed**

The paver's operating speed is a comprehensive technical index, which should be considered according to the production, transportation capacity, spreading width, and thickness of the mixing plant. Generally speaking, the middle and lower layers are controlled in 3 M / min-5 M / min, and the upper layer is maintained at 2 m / min ~ 3m / min. During actual operation, the spreading speed shall be adjusted continuously according to the construction needs. If the supply is tight, the speed can be appropriately reduced, and the speed can be appropriately increased when the supply is sufficient. Only in this way can the paving operation's continuity be ensured, without the phenomenon of stopping the machine and waiting for material or excessive surplus.

##### **3.3.3 Paving temperature detection.**

The temperature of the asphalt mixture is one of the critical factors related to the quality of paving. A special person should be arranged to be responsible for the material's temperature detection, including the factory temperature, the entry temperature, and the paving temperature. Generally speaking, the ordinary asphalt mixture's paving temperature should not be lower than 155°C, and the modified asphalt mixture's temperature should not be lower than 165°C.

### **3.4 Paving operations**

#### **3.4.1 Material receiving**

The material carrier should be stopped at a 10 cm ~ 30 cm position in front of the paver and waited in a neutral position. After the paver slowly pushes the car body, the material can be unloaded. During the entire process, the special person should be arranged to direct the entry, parking, unloading, and departure of the material transporter and clean the sprinkled mixture to prevent affecting the walking of the paver's crawler and destroying the flatness of the paving. According to the materials used in the hopper, the unloading speed of the material truck should be reasonably controlled to ensure the continuity and uniformity of the receiving material.

#### **3.4.2 Paving operation**

It shall be carried out during the whole paving process at a constant speed, slowly, continuously, and without interruption, and it shall not be stopped halfway. The screw feeder should rotate continuously, and the height of the material level should be 2 / 3 of the blade above the central shaft. The mixture transported to the construction site shall be strictly checked, and the use of white material or overheated material is strictly prohibited. Once it is paved into the surface, it shall be removed in time and filled with qualified mixture; relevant information shall be fed back to the asphalt mixing station to strengthen monitoring. When two or more pavers work in echelons and combination, the adjacent two pavers should overlap by 10 cm; the distance between the front and back of pavers is about 10 m to avoid longitudinal cold joint. When the paver is turning, due to the vast body and the pile of the unpaved mixture at the back, it will produce great resistance. In addition, the longer the ironing plate, the easier it is to appear noticeable lateral slip marks. Therefore, the turning must be carried out slowly, and must not be turned and stopped abruptly. In the process of paving, when obvious segregation, waves, cracks, and drag marks are found on the new pavement, the causes shall be analyzed and eliminated in time.

## **4 ROLLING OF ASPHALT MIXTURE**

Rolling is the last link of asphalt pavement construction, and it is also an important process to ensure the smoothness and compactness of the paving layer.

### **4.1 Mechanical selection**

The optional roller should be chosen based on factors integrated structure of the type of asphalt, the width, and the thickness of the surface layer. If the type selection is not appropriate, it will bring adverse effects on the project's quality. For example, when the low frequency and high amplitude roller is used, it will produce a "jumping" ramming phenomenon and damage the pavement's smoothness; if the cargo is too heavy, it will cause the rigid paved pavement to produce extrusion deformation, etc.

### **4.2 Rolling methods and requirements**

The rolling of asphalt mixture should be carried out in three stages: initial rolling, re-rolling, and final rolling.

#### **4.2.1 Initial compression**

It is the initial stage of compaction following the paving. The purpose is to level and stabilize the mixture. A double drum roller can be used with a static pressure of 2 to 3 times and a speed of 1.5 km/h to 2 km/h.

#### **4.2.2 Recompression**

It is the main stage of compaction, which is closely followed by the initial compaction, with the purpose of forming under pressure. A vibratory roller or tire roller can be used to roll 4-6 times at a speed of 3.5 km / h-4.5 km / h.

#### **4.2.3 Final compaction**

It is the final stage of compaction, closely followed by re-compaction, to eliminate wheel marks. A double drum roller can be used with a static pressure of 2-3 times and a speed of 2.5 km / h-3.5 km/h.

## **4.3 Key technologies**

### **4.3.1 Basic principles**

During the operation, the principle of “high temperature, following closely; high frequency, low amplitude; first edge, then middle; first static, then vibration” should be followed to ensure the compaction quality.

### **4.3.2 Rolling speed**

The appropriate rolling speed is the premise to ensure the road compaction, flatness, and other technical indicators. If the speed is too slow, the paving and rolling process can not be well connected; if the speed is too fast, there will be problems such as displacement and transverse cracks.

### **4.3.3 Rolling temperature detection**

During the rolling process, special personnel shall be arranged to detect the material temperature before, during, and after rolling. Generally, the initial pressure temperature is controlled at 110°C~130°C, the re pressure temperature is held at 100°C~110°C, and the final pressure is not lower than 80°C.

### **4.3.4 Length of the rolling section**

According to the actual operating conditions, the compaction section's length is reasonably determined, generally 40 m to 50 m. The position where the roller folds back from both ends each time should be stepped forward with the paver, and the folds cannot be on the same cross-section.

## **4.4 Rolling operation**

When in the future, the roller's driving wheel is in the front, and the driven wheel is in the back; when going backward, the direction is opposite, and the roller should drive along the pressed route. The rolling route and direction shall not be changed at will to prevent the mixture from moving. The adjacent rolling strips shall overlap at least 1 / 3 of the wheel width. The roller shall be started and stopped slowly, and shall not be turned around, braked, or stopped at will during rolling. When the vibratory roller is running on the formed road surface, it should turn off the vibration. For the joints of structures, dead corners, and road corners that can not be compacted by self-propelled roller, hand-held roller or plate vibration rammer shall be used for compaction. After the whole line's rolling is completed, it is still necessary to set up roadblocks, forbid vehicles irrelevant to the pavement construction, and do an excellent job in protecting finished products. After the road surface cools naturally, traffic can be opened.

## **5 TREATMENT OF SPECIAL PARTS**

In contrast, the continuous operation section's construction effect is better, and the quality problems are most likely to appear in the special parts such as joints, connecting sections, and the surrounding of Inspection well, which needs special treatment.

### **5.1 The location of joint**

The joint location should be scientific and the treatment method should be appropriate, otherwise, it is easy to cause the joint depression or bulge, and crack or loose due to insufficient compaction. The joint treatment shall be closely bonded, fully compacted and smoothly connected.

#### **5.1.1 Longitudinal seams**

When multiple pavers work in the echelon, hot joints can be used. During the construction process, leave the paved mixture part with a width of 10 cm to 20 cm and not roll it temporarily, as the elevation datum level of the later paved part, and finally roll it across the joints to eliminate seams. The longitudinal seams of the upper and lower layers should be staggered by more than 15 cm. When hot joints cannot be used for half-width construction, cold joints are required. Milling should be done on the sideline part of half of the road surface that has been rolled, the edges of the joints should be cleaned, and the adhesive layer oil should be painted, and then continue to lay the other half, and finally, be rolled across the joints. The upper and lower layers' longitudinal seams should be staggered by more than 30 cm to 40 cm.

### 5.1.2 Transverse seams

This is a working joint, all of which are cold joints. The transverse joints of two adjacent sheets and the upper and lower layers should be staggered by more than 1 m. The transverse joints shall be cut perpendicular to the middle line of the road, and the ends shall be cleaned and coated with adhesive oil before the new paving operation can be started. When rolling, the roller should first cross the seam and then change to longitudinal rolling.

## 5.2 Connecting sections

For the connection part between the new road and the surrounding road network, the milling machine must be used for milling, and the smooth connection treatment shall be done. The milling direction, width, depth, and other technical points should be reasonably determined, and the water consumption should be strictly controlled. The principle is that the ballast material is damp and not wet, and there is no trace on the ground after milling. It shall use the wire brush to remove loose residue, and use a high-power air compressor with an air duct to blow dust. After that, pavement and rolling operations can be carried out.

## 5.3 Around the Inspection well

Compared with highway engineering, there will be many pipelines and wells under the municipal road, which increases the difficulty of pavement construction. For all kinds of inspection wells, steel plate can be used to cover before coarse material paving, to avoid lifting the paver when meeting the good body, which will affect the continuity of construction; before fine material paving, the top of the inspection well can be lifted to the road surface elevation at one time, and then subsequent construction can be carried out. After rolling, the well cover and road surface shall be smooth.

## 6 CONCLUSION

The construction of asphalt pavement is tough and requires high quality. Only by strengthening the management of every process of on-site construction and strictly controlling the quality can we create a high-quality project and provide a good road travel environment for the public.

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