

# **Material Inspection and Acceptance**

**Technical Specifications for Application of**

**RejuvaSeal**

**For Pavement Preventive Maintenance in China**

**Dr. M.Y. Fisekci**

**Canadian Research Scientist (Retired)**

**Dr. Xu Xijuan**

**Senior Research Scientist and Engineer, Xian Highway Research Institute,  
China**

**Charence Chiang**

**Canadian Registered Professional Engineer (P.Eng.)**

**Master in Law (Criminal), Hon. LLM**

**2016**

January 2016

## **Understanding of Asphalt Pavement Preventive Maintenance (PPM)**

Asphalt pavement is designed and constructed by engineers incurring much effort. Asphalt pavements do not come easy and are expensive and time consuming to construct. However, after years of investigation and research, Mr. Shen Jinan, Academic of The Chinese Academy of Sciences and researcher of Research Institute of Highway of the Ministry of Transport of the P.R.C., and myself expressed the same opinion in 2004, that the average life of asphalt pavements was between 7-8 years in China, only a half of what is expected for similar asphalt pavement in other countries. We cannot afford to delay asphalt pavement preventive maintenance.

Therefore, asphalt pavement PPM should be applied during the period from completion of construction to before the appearance of structural damage, to maintain its original form and value.

Effective PPM technology should be able to restore the pavement's original form and performance, render it resistant to aging, water, fuel oils and other chemicals, provide newly built asphalt pavement with optimum long term protection and ultimately maintain the original form and value of new and old asphalt pavement with minimum time, funds and labour.

High-tech asphalt pavement PPM technology avoids disposing of waste and minimizes human error in construction, realizing the simplest, fastest and environmentally friendliest approach. This allows repeated applications to maintain the original form and value of new and old asphalt pavements for a long time. This is real asphalt pavement PPM technology.



---

Dr. M.Y. Fisekci,  
Canadian Research Scientist (Retired)



# Table of Contents

<b>1. Specifications of Asphalt Rejuvenation Materials for Pavement Preventive Maintenance (PPM)</b>	<b>1</b>
<b>2. International Standard</b>	<b>2</b>
<b>3. Quality inspection standards of asphalt rejuvenation material for PPM</b>	<b>3</b>
<b>3.1 24-hour simple test</b>	<b>3</b>
3.1.1 Appearance	3
3.1.2 Odour	3
3.1.3 Specific gravity	3
3.1.4 Pour clean water into a small sample	3
3.1.5 Pour a small sample into clean water	3
3.1.6 PH value	3
3.1.7 Scratch pavement with a knife	3
3.1.8 Dig pavement with a knife (penetration depth)	3
3.1.9 Scratch pavement with a steel brush	3
3.1.10 Pour water onto pavement	3
3.1.11 Drop fuel oil onto pavement	4
3.1.12 Boiling point	4
<b>3.2 30-day lab test (changes in asphalt properties and evaluation)</b>	<b>4</b>
<b>4. Quality inspection and acceptance after construction</b>	<b>5</b>
<b>4.1 30 days after completion</b>	<b>5</b>
4.1.1 Appearance	5
4.1.2 Anti-skid properties	5
4.1.3 Water permeability	5
4.1.4 Penetration depth	5
4.1.5 Fuel resistance	5
4.1.6 Coring (changes in asphalt properties and evaluation)	5
<b>4.2 90 days and within 1 year after completion</b>	<b>5</b>
4.2.1 Appearance	6
4.2.2 Anti-skid properties	6
4.2.3 Water permeability	6
4.2.4 Penetration depth	6
4.2.5 Fuel resistance	6
4.2.6 Coring (changes in asphalt properties and evaluation)	7
<b>4.3 2 or 3 years after completion</b>	<b>7</b>
<b>4.4 Coefficient of friction and structural depth</b>	<b>7</b>
<b>5.0 Conclusion</b>	<b>8</b>

## **1. Specifications of Asphalt Rejuvenation Materials for Pavement Preventive Maintenance (PPM)**

The material is a product for pavement preventive maintenance. The material is produced by combining a high-purity, high-quality petroleum solvent, refined tar(RT12) that has undergone a special distillation process under extremely high temperatures (180°C-300°C) with an active asphalt rejuvenating agent. Besides sealing asphalt pavement to resist oils, water, ultraviolet rays, chemicals and other foreign matters, its chemical properties allow it to penetrate down to 2 cm deep or deeper, to revive and rejuvenate aged asphalt its original performance and allow new asphalt pavement to receive better protection for a long time.

Asphalt rejuvenation materials should be evenly sprayed or applied on an asphalt road, before the road shows signs of structural damage. The pavement will regain original ductility and pliability and become less rigid and brittle. The material can replenish the oil matrix of asphalt, prevent the asphalt pavement from chipping off, cracking or peeling, and extend the service life of the asphalt road by 3-5 years. The pavement will have an even black surface and its friction and structural properties remain almost unchanged compared with the pavement prior to the application.

In early 1990s, experts and scholars in the United States and Canada studied and developed a preventive asphalt pavement rejuvenating sealer and binder that was environmentally friendly, effective and convenient and would not pollute or damage existing pavement structures. They finally made a breakthrough. The product was introduced into China in 2000 and has become widely applied and recognized throughout the country.

## 2. International Standard

Property	Test Method	Value
Specific Gravity	ASTM D70	1.04 - 1.08
Water content (%)	ASTM D95	2.0 Max.
Flash point (°C)	ASTM D3143-98	72 °C
Viscosity	ASTM D2171	1.5 – 3.0, @25 °C
Boiling point (°C)	Heated to boil	100 °C
<b>Composition of Asphalt Rejuvenating Sealer &amp; Binder</b>		
Weight ratio and density of petroleum solvent & rejuvenator	Weight ratio: 42 – 52%; density: 0.8 - 0.9	
Weight ratio and density of RT12	Weight ration: 48 – 58%; density: 1.2 - 1.4	
Penetration of RT12	ASTM D5	100 – 250, @ 25 °C
Ductility of RT12 (cm)	ASTM D113	≥100, @25 °C
Softening point of RT12 (°C)	ASTM D36	40°C - 50°C
<p>Note: All petroleum solvents are of high purity (≥98%), without sands &amp; dirts or any nitrogen and sulfur compounds or any heavy metals which may cause environmental pollution. Water content must be less than 2%.</p>		

### **3. Quality inspection standards of asphalt rejuvenation material for PPM**

#### **3.1 24-hour simple test**

##### **3.1.1 Appearance**

By visual inspection, the well mixed material appears be a black viscous oily liquid resembling a paint and should without impurities.

##### **3.1.2 Odour**

It has an odour of aromatic oil. The odour dissipates in 1-2 hours after application.

##### **3.1.3 Specific gravity**

With reference to the cylinder and volume method (JTJ052-2000 T0), the measured specific gravity should be between 1.04 and 1.08, slightly higher than that of water. If 500g of the liquid is taken and heated to dry at 80°C, the residues are in black gum-like form like asphalt with a high viscosity and the weight of the residues is about 250g or above.

##### **3.1.4 Pour clean water into a small sample**

Pour a small amount of water into a small sample (about 20-30g). Reaction of water repellence apparent should be observed, that water is being isolated and stays afloat on top of the sample. Water should remains floating on the sample after mixing, and still remains clear indicating no contamination and no impurities should be witnessed.

##### **3.1.5 Pour a small sample into clean water**

Pour a small sample into clean water. The sample would form to in small round ball shaped droplets and sink to the bottom. The water should remains floating on top of the sample after mixing. It remains clean and clear with no contamination.

##### **3.1.6 PH value**

Test the water following the tests above with PH test strips paper. The paper should be neutral, with a PH value of about 7-8; it indicates that no pollutants exists in the water that would harm the environment.

##### **3.1.7 Scratch pavement with a knife**

Scratch the pavement with a knife 24 hours after the application. No gum-like overlay substance from the surface of the pavement should come off, indicating that the material has penetrated into the pavement and not remained on the surface.

##### **3.1.8 Dig pavement surface with a knife (penetration depth)**

Dig the pavement with a knife 24 hours after the application. Pavement

asphalt should have become relatively soft and the liquid has penetrated down 2-3mm into the pavement.

### **3.1.9 Scratch the pavement surface with a steel brush**

Scratch heavily the pavement surface with a steel brush 24 hours after the application. Pavement without application of the material is of grayish white aged asphalt, whilst pavement the applied is dark and the rejuvenator has penetrated down 2-3 mm beneath the pavement.

### **3.1.10 Pour water on pavement**

Water should run away in beads, without seeping the pavement.

### **3.1.11 Drop fuel oil on pavement**

Brush off the pavement surface after 24 hours, and it should remain shining black without being damaged by the fuel oil.

### **3.1.12 Boiling point**

Heat the material to boiling, the boiling point should be around 100°C. The material should give off an odour of aromatic oil.

## **3.2 30-day lab test (changes in asphalt properties and evaluation)**

An authoritative domestic organization should be engaged to conduct testing in accordance with the international standards (Figure 2) and conduct the 24-hour simple tests (See 3.1.1-3.1.12) as described above or conduct testing in a laboratory. Apply the RejuvaSeal on a dense asphalt block, polish the asphalt block and remove the overlay of pavement, polish the asphalt block to remove 1mm from its surface, cut the asphalt block into slices 10mm thick, extract asphalt, test the asphalt to check how the three major indicators (penetration, ductility and softening point) have been improved and how viscosity has changed. This test is to verify whether the material can penetrate pavement to a depth of 10mm and rejuvenate aged asphalt.

## **4. Quality inspection and acceptance after application**

### **4.1 30 days after completion**

Select 1km–2km length of pavement as the section to be evaluated for quality inspection and acceptance 30 days after the initial application has been completed. Test methods and requirements are detailed below:

#### **4.1.1 Appearance**

The pavement surface should be black evenly moist and pleasant. By visual check, no gluey signs of the overlay split in flakes, peeling off, surface fracture and fragmentation should be observed; No hair line cracks should be visually observed.

#### **4.1.2 Anti-skid properties**

The coefficient of friction should basically remain unchanged (with the test results before application); Use the portable pendulum test method T0964 for comparison; inspection frequency should be 5 points every 1km. The structural depth should basically remain unchanged (with the test results before application) use sand method T0961 for comparison; inspection frequency should be 5 points every 1km.

#### **4.1.3 Water permeability**

The permeability coefficient should be carefully evaluated; the comparative improvement should be higher; use water permeability test T0971 to draw a comparison. The inspection frequency should be 5 points every 1km.

#### **4.1.4 Penetration depth**

The penetration depth should be 2-3mm initially; visually check the results in with knife-picking. The inspection frequency should be 5 points every 1km.

Note: 60-70% of asphalt components are colourless i.e. oils and resins; therefore, the penetration depth with regard to measuring the three major indicators of the asphalt test in the lab should be deeper than that by simple visual check.

#### **4.1.5 Fuel resistance**

No sign of damage should be observed. The test method is to drop gasoline onto the road. No permeability or loss should be observed after 24 hours (by visually checking after brushing off dust on the surface); the inspection frequency should be 5 points every 1km.

#### **4.1.6 Coring (changes in asphalt properties and evaluation)**

Coring may be conducted. Take one 10mm thick slice from each core to conduct comparative testing to compare improvement in the three major indicators of asphalt, which are, penetration, ductility and softening point



(T0604, T0605 and T0606).(check whether the permeability reaches 10mm under the pavement surface)

Note: For comparative testing, comparative samples are taken from adjacent road sections.

## **4.2 90 days and within 1 year after completion**

Take 1km – 2km of the entire pavement length as the section to be evaluated for quality inspection and acceptance 1 year after the construction is completed. Test requirements and methods are described below:-

### **4.2.1 Appearance**

The pavement surface should remain evenly black even and pleasing. Visually check the road (pavement of the blackness of RejuvaSeal™ should appear, after dust on the pavement is brushed off); no fissures, hair crack should be observed by visual inspection;

### **4.2.2 Anti-skid properties**

The coefficient of friction should basically remain unchanged before and after, using portable pendulum tester method T0964 for comparison; inspection frequency should be 5 sections every 1km.

The structural depth should basically remain unchanged before and after; using sand patch method T0961 for comparison; inspection frequency of which should be 5 sections every 1km.

### **4.2.3 Water Permeability**

The permeability coefficient should be used in evaluation; the improvement of the comparative should be significant; using water permeability test T0971 to conduct comparison, inspection frequency of which should be 5 sections every 1km.

### **4.2.4 Penetration Depth**

The permeability depth should be deeper than 6mm by visual inspection and by comparing with knife-picking; inspection frequency of which should be 5 positions every 1 km.

Note: 60-70% of asphalt component are colourless oils and resins; therefore the penetration depth in measuring the three major indicators in the lab should be deeper than that in by visual check.

### **4.2.5 Fuel resistance**

No sign of damage should be observed. The test method is to pour gasoline onto the road surface. No permeability or loss of fines should be observed after 24 hours by visual check after dust on the surface is brushed off; inspection frequency of which should be 5 positions every 1km.

#### **4.2.6 Coring (changes in asphalt properties and evaluation)**

Coring may be conducted. Take two 10mm thick slices from each core to conduct comparative testing, to compare improvement in the three major indicators of asphalt, they are, penetration, ductility and softening point (T0604, T0605 and T0606) and check whether the permeability reaches 20 mm under the pavement surface.

Note: For comparative testing samples are taken from adjacent road sections.

#### **4.3 2 or 3 years after completion**

Pavement after proper treatment should not spall in flakes, peel off or break into fragments. Its viscosity (degree of hardening) three (3) years after treatment should remain/lower than the level before treatment. The end user may designate a piece of pavement no less than 10m<sup>2</sup> as the reference for all tests. Coring may be conducted, to compare improvement in the three major indicators of asphalt (T0604, T0605 and T0606), to verify that the asphalt three years after asphalt rejuvenation has better performance than the asphalt without asphalt rejuvenation three years ago.

#### **4.4 Coefficient of friction and structural depth**

Asphalt pavement ages. Due to the selection of gravel and asphalt and other factors, the coefficient of friction and structural depth, the pavement may experience the following changes to a certain degree:

- **Higher than the previous coefficient of friction and structural depth**

Original data obtained when the pavement was completed should be used for comparison with similar data of pavement after asphalt rejuvenation.

- **Unchanged coefficient of friction and structural depth**

- Normally the data of pavement after asphalt rejuvenation should basically remain unchanged. If slag can be introduced as part of the rejuvenation application, the coefficient of friction may be temporarily increased.

- **Lower than the previous coefficient of friction and structural depth**

## 5. Conclusion

If there are no basic international standards for the components of an asphalt rejuvenation material to be complied with; or if there are no major indicators of asphalt test data by technical authority or; if no site test data are available in the local area, the components of an asphalt rejuvenation material must be inspected by an organization for compliance with basic international standards (See Chapter 2), 24-hour simple test (See Chapter 3.1.1 - 3.1.12) and 30-day lab test (See changes in asphalt properties and evaluation) (See Chapter 3.2), by sampling upon delivery of the material to the site.

Test Strips should also be conducted about 200-500 meters apart for coring test (changes in asphalt properties and evaluation) (Chapter 4.1-4.3). The material should only be used after testing and approval. The test report or inspection report provided by the supplier must not be used to replace site testing. The material can only be used after having been found in compliance with relevant quality requirements and environmental protection requirements through thorough technical testing. Any material failing to comply with the environmental requirement should not be used.