

# The Study of Asphalt Mixture Anti-aging Performance Study

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**Abstract:** This paper is mainly about the aging asphalt mixture performance causes and aging asphalt mixture in the influence factors, the asphalt mixture of indoor simulation method and asphalt aging performance evaluation methods. And the reasons for the aging of asphalt mixture are put forward to prevent and solve the problem of aging.

**Keywords:** Asphalt mixture; Aging property; Cause of formation

## 1. Introduction

Aging properties of asphalt mixture is used in asphalt pavement course of transport, climate (mainly air, sunlight, temperature) comprehensive environmental effects, asphalt mixture performance remains stable of quality or smaller changes are generally also known as aging. Aging is divided into two stages, namely, asphalt mixture in the mixing process of aging and aging of asphalt in the road. Asphalt mixture in the mixing process of aging is asphalt thermal transport, storage, heating and thrown in a hot mix aggregates of aging aging refers to in the asphalt pavement asphalt during the long-term use, due to a variety of natural factors lead to changes in asphalt mixtures, eventually leading to pavement cracking damage. Asphalt surface development history has proved that, in order to ensure the quality of asphalt, apart from reasonable good asphalt pavement structure and material, is critical to the performance of asphalt mixtures. Many of the short service life of asphalt pavement, and asphalt mixture of nature, especially the aging properties are closely related. In order to guarantee the long usage period, the anti-aging performance of asphalt mixtures must be associated with asphalt pavements use technical indicators to describe, and propose an appropriate index bounds to control it.

## 2. Cause Analysis of Ageing of Asphalt Mixture

Process of asphalt mixture paving asphalt mixture in asphalt pavement using its aging resistance is the quality and life of the main factors. Pavement by heating, road built by natural factors and effect of traffic load, irreversible changes in the technical nature of the pitch that the aging of asphalt. From the effects of aging, physical and mechanical properties of asphalt mixture with the passage of time is decreasing, until the traffic load can not meet the demands and changes.

With the aging of asphalt, penetration is the most direct expression decreases. In the use of recycled asphalt at different times in the process caused by its penetration in General, synchronization of high assurance construction process does not occur because of a thousand with the aging of asphalt, penetration is the most direct expression decreases. In the use of recycled asphalt at different times in the course of its penetration in General is decreasing over time and then stop after a certain time. While for different layers of asphalt pavement of asphalt aging are very different. On the horizontal position of the figure and on the road, due to the different traffic distribution, degree of compaction in asphalt pavement (density) are not the same, the aging degree of asphalt are not the same. Asphalt mixtures using the process is a long and complex process, but there are certain rules.

Sharp decreases in the early penetration of asphalt pavement, and then continue to become smaller, but more slowly. Rapid change of time owing to a road area, climate, traffic, asphalt products, marking different from 1-4 sharp. Aging occurs mainly in road surface contact with the atmosphere, so development of pavement surface asphalt aging more rapidly than the surface layer of asphalt, especially at depth within the scope of 5cm; penetration range of the asphalt pavement surface is considerable. Asphalt mixtures voids are the main factors affecting asphalt aging. Edge of pavement deterioration of asphalt pavement driveway asphalt aging more than, the vehicle part of the traffic load is more dense, void ratio change little about. The amount of asphalt content in asphalt mixture, the physical and chemical properties of coarse and fine aggregate, aggregate factors such as the degree of density, and oil absorption capacity was also the cause of asphalt mixture age an important factor. Generally, mixture air voids, air and water interface in contact with asphalt, aging seriously; fewer asphalt, asphalt membrane is thin, aging is more appropriate. Generally considered recovered when the pavement asphalt

penetration is reduced to between 35 to 50 hours, the road is prone to cracking; penetration down to 30 use limit is reached for the following means of asphalt aging; penetration is less than 25 o'clock road prone to cracking. Aging of asphalt mixture due to aging of asphalt binders and asphalt aging is mainly for: volatilization and absorption of oil, with oxygen in the air react, the molecular structure of asphalt thixotropic lead resistance hardened. Due to the light weight of volatile components of asphalt and asphalt absorption occurs mainly in heating and in the process of asphalt mixture mixing, spreading, which is a major reason for short-term aging of asphalt, although during the construction process is oxidation reaction occurs, but its steric hardening is a major reason for long term aging of asphalt.

### 3. Process of Ageing of Asphalt Mixture

#### 3.1. Transport, storage, heating process of aging

Asphalt out of the refining in refineries, have been packed in insulated asphalt tank, transported to the user, users receive send asphalt is heated to temperatures and cool storage, when used for heating. Due to changes in temperature increases accelerating molecules, in addition to the asphalt caused by evaporation, but also would make react.

Heat light oils continuous volatile oil asphalt becomes hard and brittle, reducing adhesion.

Asphalt builds run in the pipe and the tank top down to the asphalt surface area increasing bitumen oxidation will occur. Asphalt deposits in closed tanks and bitumen quantity, depth, exposure to heat sources and air for its smaller, aging is not serious at this stage.

#### 3.2. Mixing and paving in the heating process of aging

Asphalt heating at a higher temperature, circulation in the pumping process, are more contact with the air, accelerated aging, heating time, the longer more serious aging. Asphalt heating time should not exceed 6h mixing temperature, mixing time, the thickness of asphalt membrane will affect the degree of ageing of asphalt. Mixer type can also affect the mixing process of aging. Batch mixer, heat, exposure to hot air, light oil that must be quickly and react with oxygen, resulting in a serious aging. Continuous mixing machine, in addition to the aggregate effects of heating temperature, heating effects of smoke, heat and oxygen in the air than batch mixing machine is more serious. When asphalt mixture when it is unloaded into storage silos, asphalt mixture with the air trapped in the gap material, oxidation occurs. Out of the silo must be sealed. Top of the air and effects on the surface of asphalt mixture of carbon dioxide, prevent further aging of asphalt mixtures. In order to reduce the aging of asphalt storage silos, in a number of countries have used to

save warehouse filling nitrogen and inert gases such as carbon dioxide method to cut down the opportunities for contact with oxygen, thereby reducing asphalt aging caused by oxygen.

#### 3.3. Asphalt pavement during ageing

Long-term in use of asphalt pavement process, due to a variety of natural factors, especially in water, UV, oxygen, and the role of vehicle loads, asphalt mixtures produce a lot of complicated physical and chemical changes, asphalt aging and hardening, final pavement cracks and damage. Factors that contribute to aging in addition to water and ultraviolet role, also associated with chemical constituents of three factors :

Due to evaporation or absorption of low molecular weight aggregates reduce oil content.

As a react with the oxygen in the atmosphere cause changes in the structure of asphalt.

Formed between molecular structure of thixotropic effects can lead to (steric hardening).

### 4. Asphalt Aging Performance Evaluation Methods

#### 4.1. Test method for aging of asphalt mixture

Asphalt mixtures of known composition, structure and strength theory, asphalt mixtures is a complex hierarchical structure, from the ageing of the asphalt itself study and evaluation of aging properties of asphalt mixture is clearly not enough, that it is wrong, must be taken into account between asphalt and mineral aggregate effect of structure of asphalt mixture and the mixture of the effects of aging. Asphalt aging properties and aging properties of asphalt mixtures is the difference between asphalt and mineral aggregate caused by interaction between.

According to the aging process and effect factors of asphalt mixtures, on the aging process of asphalt mixture, should give full consideration to the construction of the heating mixture, road use during several natural factors and combination of vehicles and other mechanical stresses, which close and the actual process, as much as possible.

Simulated ageing of the asphalt mixtures, the aging process of asphalt mixture can be divided into two stages, namely short-term aging and long term aging of short-term aging of asphalt pavement construction phase is characterized due to the heating of asphalt mixture of aging, from the mixing plant began to asphalt pavement compaction when the temperature falls below the natural temperature after termination. Characterization of long term aging of asphalt pavement using period due to light, temperature, oxygen, and other natural factors and traffic loads caused by the combination of ageing of asphalt mixture, since the road was built beginning, to road ser-

vice performance cannot be terminated when the normal operating requirements are met.

#### 1) The short-term aging method

SHRP well past the short-term aging of asphalt mixture three alternative methods of testing results, they are after mixing asphalt mixture and then conduct an accelerated aging process. Test method for short-term aging of asphalt mixture of mainly reflects the loose asphalt mixture in mixing, volatilization and oxidation due to heat in the storage and transport of effect, so as to simulate the aging effect of construction of asphalt mixture.

According to the construction site, two kinds of asphalt mixture recycling asphalt penetration ratio and the viscosity ratio compared with the laboratory simulation of the results of VonQuintas, who in 1988 raised the oven heating aging conditions for: 135 degrees, 4H, characterizes the degree of ageing of asphalt mixture is roughly equivalent to mix later compacted to cooling, open transport process. SHRP draw results, the oven is heated in the condition of aging developed test methods for short-term aging of asphalt mixtures (shortTimeovenAging, known as STOA). At this point, the short-term aging actually contains two procedures: of asphalt mixture in the mixing process of aging and accelerated aging in the oven.

#### 2) Long term aging method

SHRP Wei to the STOA aims at simulating construction process of asphalt mixture of aging, is from mixing in the beginning until the end of the construction process of aging and therefore is always loose asphalt mixture for experiment. Aging concrete steps are: mixing asphalt mixture, mixing good mixtures in accordance with uniform spreading loose paving thickness of about 21kg/m<sup>2</sup> ~ 22kg/m<sup>2</sup> in enameled pan, added 135 ± 1 °C in the oven, heating 4H ± 5min. Per hour during the heating process with a shovel in the specimen disc in the mix again. Removing the mixture from the oven is ready to make the prescribed performance tests. This has been included in the highway construction in our country of asphalt and asphalt mixture of test procedures as standard short term test method of asphalt mixture, short-term aging of asphalt mixture in this article is the use of this method.

### 4.2. Evaluation method of aging properties of asphalt mixture

Described in section of asphalt mixture on the short-term aging or long-term aging test methods provide an accelerated aging of asphalt mixture steps, and after aging of asphalt mixture evaluated how is another matter. At present, the General test method for aging of asphalt mixture can be divided into two broad categories.

Mechanical properties of aged asphalt mixture tests

After aging of asphalt mixtures and road performance of physical mechanics performance test.

As we all know, aging of asphalt mixture of asphalt pavement improvement of stiffness, which is good for the high-temperature rut resistance of asphalt pavement. Aging effects mainly reflects the life of asphalt pavement at low temperature anti-cracking performance and fatigue on performance. Due to the ageing of the asphalt, the stiffness modulus of asphalt mixtures, asphalt ultimate tensile strain of smaller, stress relaxation performance of smaller, low-temperature anti-cracking performance and traffic the ultimate failure strain fatigue and thermal stress fatigue becomes smaller, reduced number of fatigue failures, these are the factors leading to cracking. Due to the direct impact of aging of asphalt mixture at low temperature cracking and fatigue cracking performance, also affected to a certain extent of asphalt binder and aggregate adhesion and adhesion, test method for evaluation of mechanical properties of asphalt mixtures have resilient modulus testing, indirect tensile test, creep test and dynamic modulus testing of four. Selection of test methods is difficult, it needs to be built on the site on the basis of relevance and reliability, will also take into account the complexity of the operation, to assess the effectiveness of the four test methods.

These methods currently available data has not been associated with the field data, making it difficult to make the evaluation index value to determine which method is better. But resilient modulus and dynamic modulus testing as non-destructive testing throughout the aging process was SHRP modulus data obtained in different stages, incremental indirect tensile tests before and after the test clearly valued.

For recovering of asphalt of aged asphalt mixture performance

After aging of asphalt mixture recycling in asphalt, asphalt properties after aging test. From the laboratory and in the field of aged asphalt mixture recycling in asphalt, SH is used for penetration, ductility, high viscosity and component indexes as a method of evaluating the performance of asphalt mixture. Equally five ways to assess effectiveness.

Performance test of recycled asphalt, one is to consider the sample size, SHRP has suggested that a microviscometer and ductility of micro-instruments, samples not exceeding 5G; second, the recovery itself will break down the molecular structure of asphalt, affecting the performance of recycled asphalt. However, Lee and BenSon's study show that laboratory and field between the recycled asphalt is very well linked.

### 5. Asphalt Aging Prevention

It is fully said that, asphalt mixed material aging is divided into short-term aging and long-term aging, short-term aging main is refers to construction period of aging, including asphalt storage and transport process of aging, asphalt mixed material mix collection process in the of

aging, asphalt mixed material transport and Pu built process of aging; long-term aging main is refers to using period of aging, main for Pu built Hou temperature down to at room temperature yihou of aging.

### 5.1. Short-term aging of preventive measures

For short-term prevention of aging, asphalt storage and transportation process, asphalt sealing is very important to prevent the volatility of light oil. For asphalt mixture mixing process, the effect of temperature on aging plays a decisive role, especially in the mixing process due to asphalt heating or heating temperature is too high, temperature of asphalt asphalt with no mixing and heating the bottom of fits and starts, as well as greater. Mine temperature should not be too high, asphalt coated aggregates to form asphalt film is most likely due to the temperature caused by volatility of light oil, thereby resulting in decreased use performance of asphalt. In the paving process, effects of temperature as the main factor, so in the process of asphalt mixing and paving, attention to asphalt the heating temperature, and the temperature should not change too much, in the process of paving should be in high temperature season paved, reducing the effects of aging temperature on asphalt paving.

### 5.2. Prevention measures for long term aging

Prevention in the long term aging of asphalt is mainly on the use of pavement preventive maintenance.

#### Notching crack technology

Filling in the cracks in pavement technology uses sealed materials includes clean filling space-filling of cracks formation (such as cutting) and the fillers into the performance. To prevent water and debris into the pavement internal protection base delay pavement damage pavement widths of less than 19 mm vertical cracks, cracks, massive cracks or fatigue cracks, typical life depends largely on the crack severity and filler material types in 1-2.

#### 1) Fog seal construction technology

Due to the construction of Freeway asphalt pavement segregation or excessive porosity, That engineering early has some defects hidden problem effective of prevention road deck so and caused of seepage phenomenon has became very necessary and road fog seal layer technology is a is directly effective and economic of prevention sex conservation measures fog seal layer is in asphalt surface layer Shang spray a layer thin of high permeability modified sex emulsion asphalt formed a layer closely of waterproof layer will road closed up to across water anti-infiltration protection road using function maximum to reduced road of water damage increased road weight aggregate between of bond force, Extend pavement life saving maintenance funds. Fog seal as an asphalt pavement preventive maintenance measures its speed can prevent water damage of asphalt pavement applied to

highways special conservation conditions and requirements.

#### 2) Micro-surfacing technology

Micro-table at is used dedicated assessment Pu equipment will polymer modified sex emulsion asphalt set material filler, and water and additives, by reasonable tie than mixing into dilute pulp mixed material and quickly assessment Pu to original road Shang formed a layer and original road combined firm has good of anti-sliding wear performance in assessment Pu 13H within open traffic of thin layer 1cm structure, currently micro-table at cover surface technology main is for established and recovery road surface function in highway road conservation engineering in the, Micro-surfacing has become waterproof and anti-sliding wear-resistant durable road surface layer micro-surfacing applied in general do not apply slurry seal coat of high grade and heavy traffic road. Procedures for the construction of micro-surfacing preparation, closed to traffic, Road sweeping, lofting paver in place, paving and early conservation and open transport needs to focus on matters in this process are:

Micro-table at technology does not apply for has produced structural damage of road processing the species road Shi must first completely processing rear can application micro-table at construction control technology content high operation personnel should by system training to skilled grasp different temperatures road conditions Xia of site adjustment method to attention micro-table at early conservation not open traffic Qian is strictly prohibited vehicles broke into, with the construction process of standardized standardization and construction quality of improve and integrated cost of reduced, in highway asphalt road of prevention sex conservation Shang get widely promotion and application.

#### 3) Thin hot mixed asphalt concrete overlay

Craft THMO is aggregate and asphalt (Highway modified asphalt is generally used) mixtures of Expressway asphalt pavement preventive maintenance with the type of hot-mixed asphalt mixture suitable for fine-grain thin overlays can be used (20-30 mm thick) Performance protection of pavement structural delay pavement deterioration amended most of the pavement smoothness or quality defects to improve road pavement skid resistance and appearance are not increased or not increase the bearing capacity of roads road conditions good road conditions and basic condition, the damage is mainly caused by fatigue include moderate to severe degree of lateral longitudinal crack crack crack width is greater than 32-64 Mm crack needs filling loose surface wear and oxidation aging of moderate to severe bleeding or loss of Polish anti-sliding surface roughness the rut depth <12 mm medium but healthy patches of pavement seepage.

Typical life depends largely on the crack severity and filler material types in 1-2. Due to the aging of many influencing factors, prevention methods are also divided

into many types, the need for a comprehensive prevention.

## 6. Conclusion

Based on the evaluation of aging resistance of asphalt mixtures, from aging, influence factors, as well as in the process of oxidation and aging, and details the causes of asphalt aging process also requires further research, for the subsequent aging of asphalt mixture to make corresponding preparations.

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