

Pavement Materials & Design

Liquid Asphalt

Cutback asphalt grading

Dr. Hamza Alkuime

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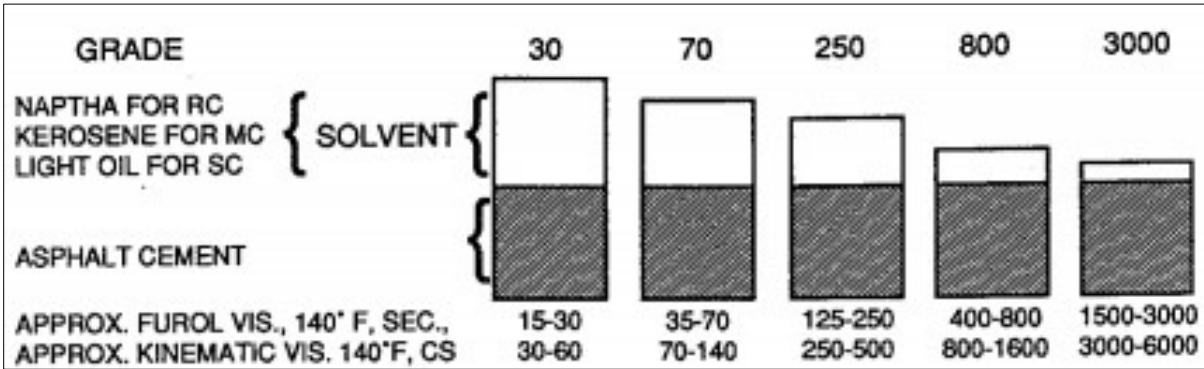
Cutback asphalt grading

- ❑ Based on the relative **rate of evaporation**, cutback asphalts are divided into
 - *Rapid -Curing (RC)*
 - ❖ Produced by adding a **high volatility solvent** (generally gasoline or naphtha)
 - ❖ **Rate of evaporation = 0.3 times more** than the evaporation rate of acetone.
 - *Medium - Curing (MC)*
 - ❖ Produced by adding a **intermediate volatility solvent** (generally kerosene)
 - ❖ **Rate of evaporation = 0.3 -0.8 times more** than the evaporation rate of acetone.
 - *Slow-Curing (SC) (or road oils)*
 - ❖ Produced by adding a **low volatility solvent** (generally diesel or other gas oils)
 - ❖ **Rate of evaporation = >0.8 times more** than the evaporation rate of acetone.
- ❑ Cutback asphalt **is also graded** based on the **minimum kinematic viscosity** at 60°C

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Cutback asphalt grading



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rate of evaporation XX - YY

Solvent Type

minimum kinematic viscosity

Solvent Amount

- Rapid -Curing (RC)
- Medium - Curing (MC)
- Slow-Curing (SC) (or road oils

Cutback asphalt grading

Grade	Kinematic viscosity, 60°C, centistokes (mm ² /S)	
	Min.	Max.
RC-70	70	140
RC-250	250	500
RC-800	800	1600
RC-3000	3000	6000

Grade	Kinematic viscosity, 60°C, centistokes (mm ² /S)	
	Min.	Max.
MC-30	30	60
MC-70	70	140
MC-250	250	500
MC-800	800	1600
MC-3000	3000	6000

Grade	Kinematic viscosity, 60°C, centistokes (mm ² /S)	
	Min.	Max.
SC-70	70	140
SC-250	250	500
SC-800	800	1600

Grade	Kinematic viscosity, 60°C, centistokes (mm ² /S)	
	Min.	Max.
XX-30	30	60
XX-70	70	140
XX-250	250	500
XX-800	800	1600
XX-3000	3000	6000

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Cutback asphalt grading

Rapid-Curing Type			Medium-Curing Type			Slow -Curing Type		
Grade	Kinematic viscosity, 60 °C, centistokes (mm ² /S)		Grade	Kinematic viscosity, 60 °C, centistokes (mm ² /S)		Grade	Kinematic viscosity, 60 °C, centistokes (mm ² /S)	
	Min.	Max.		Min.	Max.		Min.	Max.
RC-70	70	140	MC-30	30	60	SC-70	70	140
RC-250	250	500	MC-70	70	140	SC-250	250	500
RC-800	800	1600	MC-250	250	500	SC-800	800	1600
RC-3000	3000	6000	MC-800	800	1600	SC-3000	3000	6000
			MC-3000	3000	6000			

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Requirements for Cutback Asphalt (Rapid-Curing Type)

ASTM D2028

NOTE 1—If the ductility at 25°C [77°F] is less than 100, the material will be acceptable if its ductility at 15°C [59°F] is more than 100.

Designation	RC-70		RC-250		RC-800		RC-3000	
	Min	Max	Min	Max	Min	Max	Min	Max
Kinematic viscosity at 60°C [140°F], mm ² s	70	140	250	500	800	1600	3000	6000
Flash point (Tag open-cup), °C [°F]	...	...	27 [80]	...	27 [80]	...	27 [80]	...
Distillation test:								
Distillate, volume percent of total distillate to 360°C (680°F):								
to 190°C [374°F]	10	...	...	...	...	...	...	...
to 225°C [437°F]	50	...	35	...	15	...	...	...
to 260°C [500°F]	70	...	60	...	45	...	25	...
to 316°C [600°F]	85	...	80	...	75	...	70	...
Residue from distillation to 360°C [680°F], percent volume by difference	55	...	65	...	75	...	80	...
Tests on residue from distillation:								
Viscosity at 60°C [140°F], Pa · s ^A	60	240	60	240	60	240	60	240
Ductility at 25°C [77°F], cm	100	...	100	...	100	...	100	...
Solubility, %	99.0	...	99.0	...	99.0	...	99.0	...
Water, %	...	0.2	...	0.2	...	0.2	...	0.2

^A Instead of viscosity of the residue, the specifying agency, at its option, can specify penetration at 100 g: 5 s at 25°C [77°F] of 80 to 120 for Grades RC-70, RC-250, RC-800, and RC-3000. However, in no case will both be required.

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Requirements for Cutback Asphalt (Medium-Curing Type)

ASTM D2027

NOTE 1—If the ductility at 25°C [77°F] is less than 100, the material will be acceptable if its ductility at 15°C [59°F] is more than 100.

Designation	MC-30		MC-70		MC-250		MC-800		MC-3000	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Kinematic viscosity at 60°C [140°F], mm ² /s	30	60	70	140	250	500	800	1600	3000	6000
Flash point (Tag open-cup), °C [°F]	38 [100]	...	38 [100]	...	66 [150]	...	66 [150]	...	66 [150]	...
Distillate test:										
Distillate, volume percent of total distillate to 360°C [680°F]:										
to 225°C [437°F]	...	35	...	25	...	20	...	...	...	...
to 260°C [500°F]	30	75	10	70	5	55	...	40	...	15
to 316°C [600°F]	75	95	65	93	60	90	45	85	15	75
Residue from distillation to 360°C [680°F], percent volume by difference	50	...	55	...	67	...	75	...	80	...
Tests on residue from distillation:										
Viscosity at 60°C [140°F], Pa · s ^{A,†}	30	120	30	120	30	120	30	120	30	120
Ductility at 25°C [77°F], cm	100	...	100	...	100	...	100	...	100	...
Solubility in trichloroethylene, %	99.0	...	99.0	...	99.0	...	99.0	...	99.0	...
Water, %	...	0.2	...	0.2	...	0.2	...	0.2	...	0.2

^A Instead of viscosity of the residue, the specifying agency, at its option, can specify penetration 100 g: 5 s at 25°C [77°F] of 120 to 300 for Grades MC-30, MC-70, and MC-250, and 120 to 250 for MC-800 and MC-3000. However, in no case will both be required.

[†] Editorially corrected to match originally published D2027-97.

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Requirements for Cutback Asphalt (Slow-Curing Type)

ASTM D2026

TABLE 1 Requirements for Cutback Asphalt (Slow-Curing Type)

NOTE 1—If the ductility at 25°C [77°F] is less than 100, the material will be acceptable if its ductility at 15°C [59°F] is more than 100.

Designation	SC-70		SC-250		SC-800		SC-3000	
	Min	Max	Min	Max	Min	Max	Min	Max
Kinematic viscosity at 60°C [140°F], mm ² /s	70	140	250	500	800	1600	3000	6000
Flash point (Cleveland open cup), °C [°F]	66 [150]	...	79 [175]	...	93 [200]	...	107 [225]	...
Distillation test:								
Total distillate to 360°C [680°F], volume %	10	30	4	20	2	12	...	5
Solubility, %	99.0	...	99.0	...	99.0	...	99.0	...
Kinematic viscosity on distillation residue at 60°C [140°F], mm ² /s	400	7000	800	10 000	2000	16 000	4000	35000
Asphalt residue:								
Residue of 100 penetration, %	50	...	60	...	70	...	80	...
Ductility of 100 penetration residue at 25°C [77°F], cm	100	...	100	...	100	...	100	...
Water, %	...	0.5	...	0.5	...	0.5	...	0.5

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JORDAN PETROLEUM REFINERY CO. LTD

Specification for Cutback Asphalt (Rapid-Curing Type) RC – 250

S.N	Characteristics		Test Method	Control Limits
1	Kinematic Viscosity @ 60 °C	cSt.	ASTM D445 ASTM D2170	250 - 500
2	Flash Point (T.O.C)	°F	ASTM D1310	Min. 80
3	Distillation :		ASTM D 402	
3.1	Percent Recovered up to 190 °C	Volume %		Report
3.2	Percent Recovered up to 225°C	Volume %		Min. 35
3.3	Percent Recovered up to 260 °C	Volume %		Min. 60
3.4	Percent Recovered up to 316 °C	Volume %		Min. 80
3.5	Residue from Distillation to 360 °C	Volume %		Min. 65
4	Tests on Residue from Distillation			
4.1	Penetration @ 25 °C, 100g, 5sec.	0.1 mm	ASTM D5	80 - 120
4.2	Ductility @ 25 °C, 5cm / min.	cm	ASTM D113	Min. 100
4.3	Solubility in Trichloroethylene	Mass %	ASTM D2042	Min. 99.0
5	Water Content	Volume %	ASTM D95	Max. 0.2

¹ This specification is based on ASTM D 2028/D2028M – 15 (Standards specification for cutback Asphalt, Rapid-Curing Type).

² The asphalt shall not foam when heated to application temperature.

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Pavement Materials & Design

Liquid Asphalt

Emulsified asphalt grading

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Emulsified asphalt grading

- ❑ Emulsified asphalt is graded based on
 - *Asphalt droplet charge*
 - ❖ Anionic
 - ❖ Cationic
 - *The speed of separation [Setting" rate]*
 - ❖ Slow setting (SS)
 - ❖ Medium setting (MS)
 - ❖ Rapid setting (RS)

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Laboratory tests and properties of emulsified asphalts

- ❑ Composition
 - *Water Content (ASTM D244)*
 - *Residue and Oil Distillate by Distillation (ASTM D6997)*
 - *Residue by Evaporation (ASTM D6934)*
 - *Particle Charge of Cationic Emulsified Asphalts (ASTM D7402)*
- ❑ Consistency tests
 - *Viscosity (Saybolt Furol) (ASTM D7496)*
- ❑ Examination of Residue (ASTM D244)
- ❑ Identification Test for Rapid Setting Cationic Emulsified Asphalt (ASTM D244)
- ❑ Identification of Cationic Slow Set Emulsions (ASTM D244)

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Laboratory tests and properties of emulsified asphalts

- ❑ Field Coating Test on Emulsified Asphalts (ASTM D244)
- ❑ Stability tests
 - Demulsibility (ASTM D6936)
 - Settlement (ASTM D6930)
 - Cement Mixing (ASTM D6935)
 - Sieve Test (ASTM D6933)
 - Aggregate Coating (ASTM D6998)
 - Miscibility with Water (ASTM D6999)
 - Freezing (ASTM D6929)
 - Coating Ability and Water Resistance (ASTM D244)
 - Storage Stability of Asphalt Emulsion (ASTM D6929)

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Emulsified asphalt grading

Asphalt Emulsion Webinar Series Recordings



Registration:
You can register for FREE for this webinar series using this link:

<http://www.asphaltinstitute.org/training/webinars/asphalt-emulsion-webinar-series-recordings/>

Session 1 – Introduction, Chemistry

- Instructor: Chris Lubbers, KRATON Polymers
- [Register online to view the recorded webinar](#)

Session 2 – Storage, handling & sampling testing, selecting the right grade

- Instructor: Laurand Lewandowski, PRI Asphalt Technologies
- [Register online to view the recorded webinar](#)

Session 3 – Surface treatment (chip seals, slurry, micro, etc.)

- Instructor: Mark Ishee, Ergon Asphalt & Emulsions, Inc.
- [Register online to view the recorded webinar](#)

Session 4 – Emulsion aggregate mixtures

- Instructor: Artis Kadrmaz, BASF Corporation
- [Register online to view the recorded webinar](#)

Session 5 – Asphalt pavement recycling, miscellaneous applications

- Instructor: Keith Davidson, McAsphalt Industries Ltd.
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Pavement Materials & Design

Liquid Asphalt

Applications

Dr. Hamza Alkuime

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Jordanian Specifications for highway and bridge construction

٧- الوجه الختامي (Seal Coat) :
.....
١/٧- تستعمل حصمة ناتج تكسير حجر جيرى أو جرانيتي أو بازالتي وبالخواص المبينة في جدول رقم (٥) المرفق , وحسب مواصفات انشاء الطرق والجسور لعام ١٩٩١ .
٢/٧- يجب استعمال موزع حصمة ميكانيكي ورشاش أسفلت ميكانيكي .
٣/٧- يستعمل أسفلت أو (RC 800) أو (RC 250) ومعدل الرش حسب ما ورد في جدول رقم (٥) المرفق .

٨/١- الوجه اللاصق (Tack Coat) :
.....
- تتم هذه الأعمال وفقاً لمواصفات انشاء الطرق والجسور لعام ١٩٩١ .
- تتم أعمال الوجه اللاصق بحيث يكون الاسفلت المستعمل من نوع (RC 250) أو (RC 800) وحسب طلب المهندس المشرف وبالمعدل الذي يتطلب واقع العمل وحسب نوع السطح المراد رشه .

٦- الوجه التأسيسي (Prime Coat) :
.....
١/٦- يجب أن يكون الاسفلت من نوع (MC-70) على أن يرش بمعدل (٠.٧٥-٢.٠) كغم/م^٢ حسب نوعية السطح المراد رشه وبموجب تعليمات المهندس المشرف .

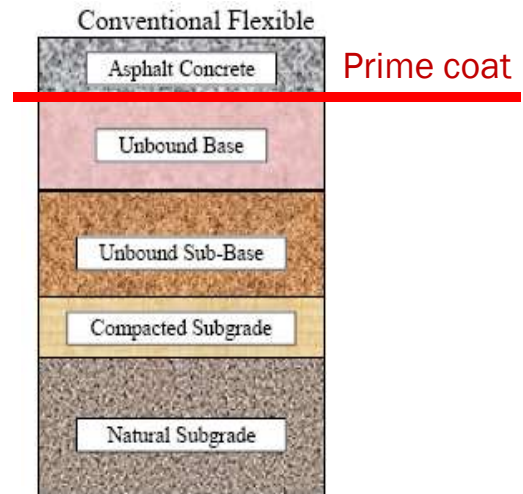
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Conventional flexible pavement layers

Prime coat

- ❑ Application of **low viscosity Cutback asphalt** to an **absorbent surface** such as
 - ❖ untreated granular base on which asphalt layer will be placed on.
- ❑ Uses
 1. **Minimize flow of asphalt cement** from the asphalt concrete to the aggregate base
 2. **Fill the surface voids and protect** the subbase from weather.
 3. **Stabilize the fines and preserve the subbase material.**
 4. **Promote bonding to the subsequent pavement layer**

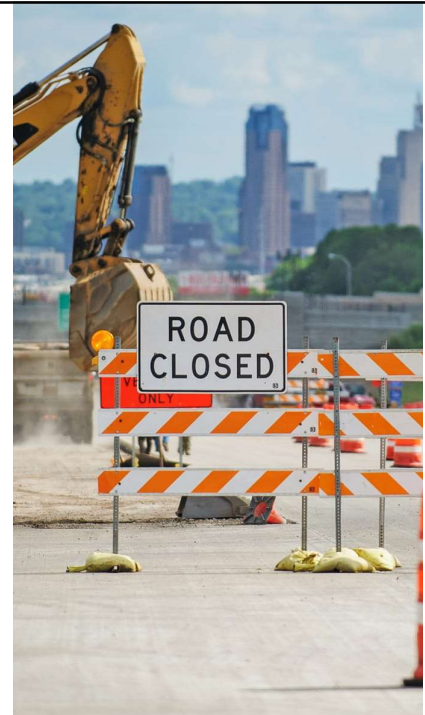


*Cutback asphalt = AC + Petroleum solvent

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Prime coat Layer



<https://www.youtube.com/watch?v=djOGL0v03k>

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Specifications for highway and bridge construction

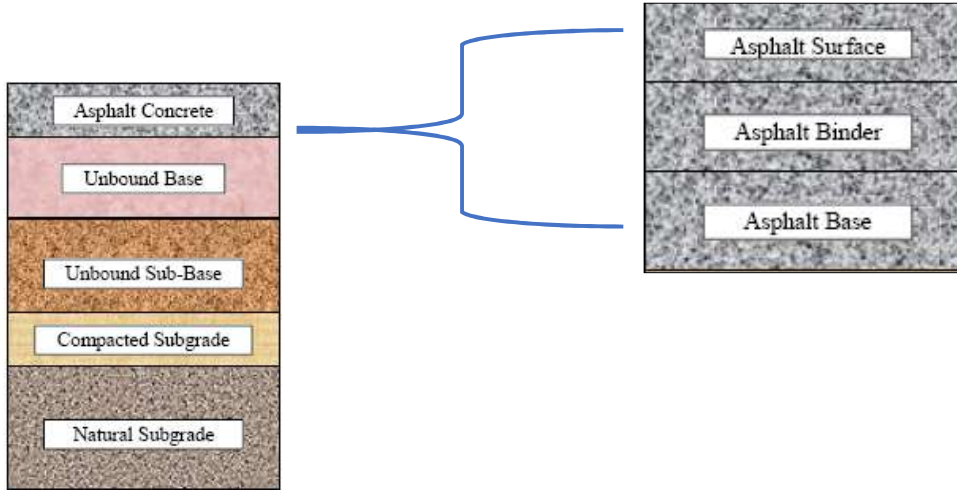
Prime coat

- ٦- الوجه التأسيسي (Prime Coat) :
-
- ١/٦- يجب أن يكون الاسفلت من نوع (MC-70) على أن يرش بمعدل (٠.٧٥-٢.٠) كغم/م^٢ حسب نوعية السطح المراد رشه وبموجب تعليمات المهندس المشرف .
- ٢/٦- يجب تنظيف السطح النهائي لطبقة الأساس بواسطة ضاغطه هوائية أو مكثفة ميكانيكية .
- ٣/٦- رش ودخل السطح بالماء وبصورة خفيفة قبل رش الاسفلت بثلاثة ساعات ووفقاً لتوجيهات المهندس المشرف .
- ٤/٦- يتم الرش بواسطة رشاش ميكانيكي مقبول وبدرجة الحرارة المناسبة (٤٥-٨٠) درجة مئوية .
- ٥/٦- يمنع الرش في الأجواء الماطرة وذات الرياح الشديدة أو العواصف الرملية .
- ٦/٦- يمنع حركة السير على الأسطح المرشوشة .
- ٧/٦- القحوصات المخبرية حسب الجدول رقم (٤) المرفق .

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Conventional flexible pavement layers

Asphalt Concrete



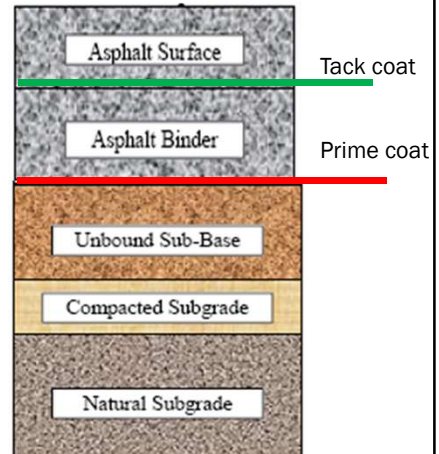
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Conventional flexible pavement layers

Tack coat

- ❑ A thin asphalt liquid asphalt, emulsion or cutback layer applied between HMA pavement lifts to promote bonding.
- ❑ It prevent of Inadequate bonding between layer
 - ❖ Which can result in delamination (debonding) followed by longitudinal wheel path cracking, fatigue cracking, potholes, and other distresses such as rutting that greatly reduce pavement life



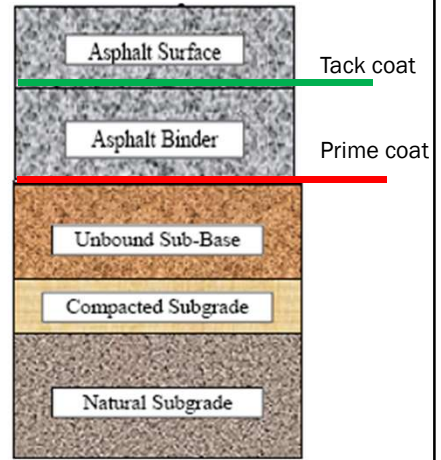
*Emulsified asphalt = AC + water + emulsifying agent

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Conventional flexible pavement layers

Tack coat

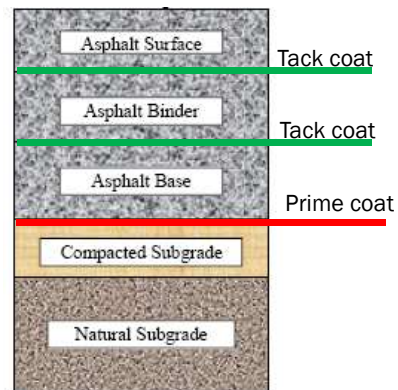
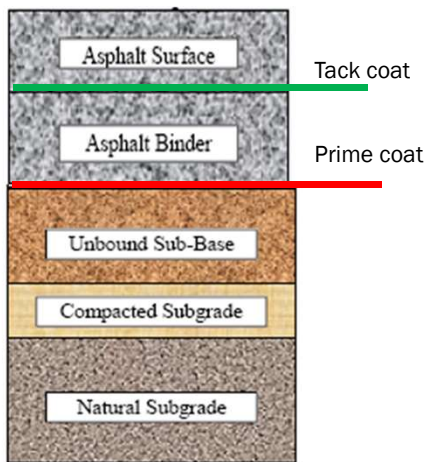


*Emulsified asphalt = AC + water + emulsifying agent
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Conventional flexible pavement layers

Tack coat



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Specifications for highway and bridge construction

Tack Coat

١/٨- الوجه اللاصق (Tack Coat) :

-
- تتم هذه الأعمال وفقا لمواصفات انشاء الطرق والجسور لعام ١٩٩١ .
 - تتم أعمال الوجه اللاصق بحيث يكون الاسفلت المستعمل من نوع (RC 250) أو (RC 800) وحسب طلب المهندس المشرف وبالمعدل الذي يتطلب واقع العمل وحسب نوع السطح المراد رشه .
 - يجب تنظيف السطح جيدا" بواسطة الضاغطة الهوائية (الكمبريسور) قبل رش الوجه اللاصق ولا يدفع سعر لهذا العمل وإنما يكون محملا" على أعمال الخلطة الاسفلتية.
 - يمنع الرش في الأجواء الماطرة وذات الرياح الشديدة أو/و العواصف الرملية
 - يكون معدل رش الوجه اللاصق ٠.٠٦-٠.٠٧ كغم/م^٢ وذلك اعتمادا" على نوع مادة الوجه اللاصق وعلى نوع السطح المراد رشه وحسب تعليمات المهندس المشرف .
 - تمنع حركة السير على الأسطح المرشوشة .
 - تتم هذه الأعمال وفقا لمواصفات انشاء الطرق والجسور لعام ١٩٩١ .
 - يتم رش الوجه اللاصق قبل وضع الخلطة الاسفلتية بساعتين على الأقل على أن يتم تزييت جميع الأسطح المرشوشة بهذه المادة في نفس اليوم ولا يسمح بوضع خلطة اسفلتية على هذه الأسطح في اليوم التالي مالم تؤخذ موافقة المهندس المشرف على ذلك .

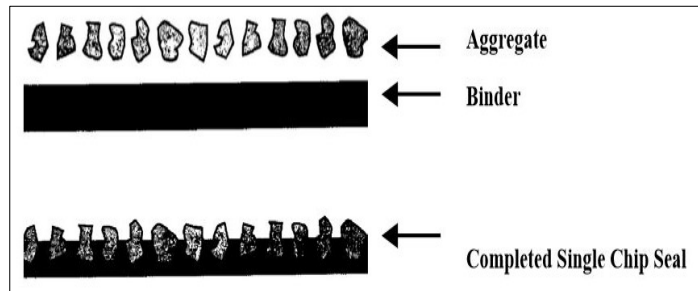
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Conventional flexible pavement layers

Seal coat (or chip seal)

- Thin asphalt surface treatment made of **crushed aggregates (chips)** embedded in asphalt binders.



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