Pavement Materials & Design

3.3_Aggregates for road construction_ Application and specifications .pptx

Dr. Hamza Alkuime

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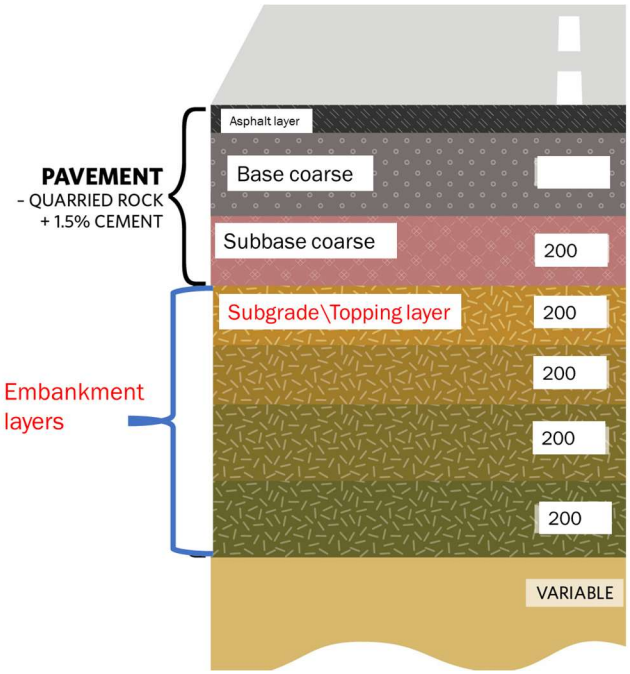
What is a Pavement

- Pavement is a multi-layered structure put as horizontal layers one above the other, which distributes the vehicular loads over a larger area



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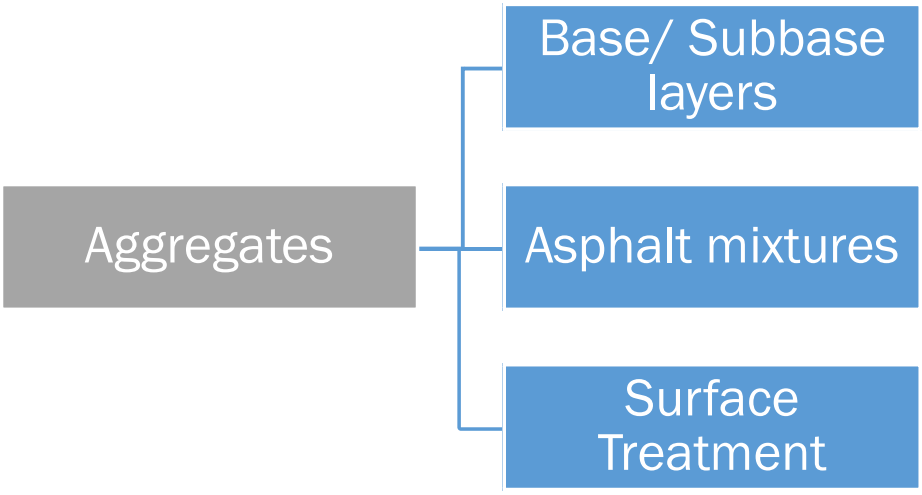
What is a Pavement



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Part A: Aggregates for

Bedding layers

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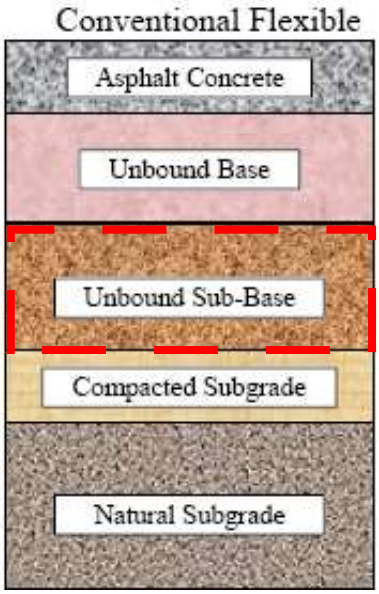
Conventional flexible pavement layers

Subbase

- A layer or layers of specified or selected materials of designed thickness placed on a subgrade
- The subbase course helps
  - ❖ to distribute traffic loads from the pavement to the subgrade.
  - ❖ To improve drainage by providing a pathway for water to flow away from the pavement structure.
- A subbase layer is not always included, especially with rigid pavements
- A subbase layer is typically included when
  - ❖ The subgrade soils are of very poor quality and/or
  - ❖ Suitable material for the base layer is not available locally, and is, therefore, expensive

➢ The thickness of the subbase course will vary depending on the type of pavement being constructed and the anticipated traffic loads, but is usually 100 to 300 mm thick.



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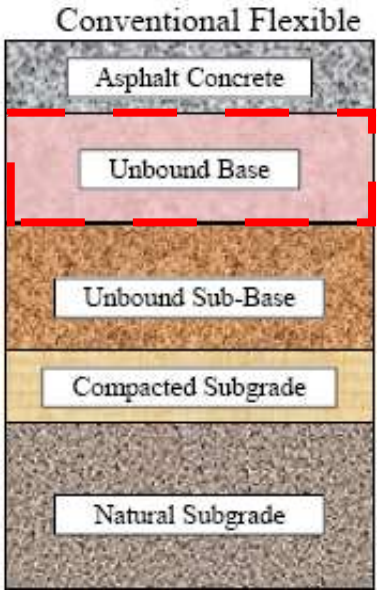
Conventional flexible pavement layers

Base course

- A layer or layers of specified or select material of designed thickness placed on a subbase or subgrade (if a subbase is not used)
- It is positioned above the subbase (or directly on the subgrade if a full-depth asphalt pavement) and below the surface or intermediate layers.
- The base course's primary purpose is

➢ to distribute traffic loads from the pavement's surface to the subgrade providing structural support.



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Pavement Cross sections

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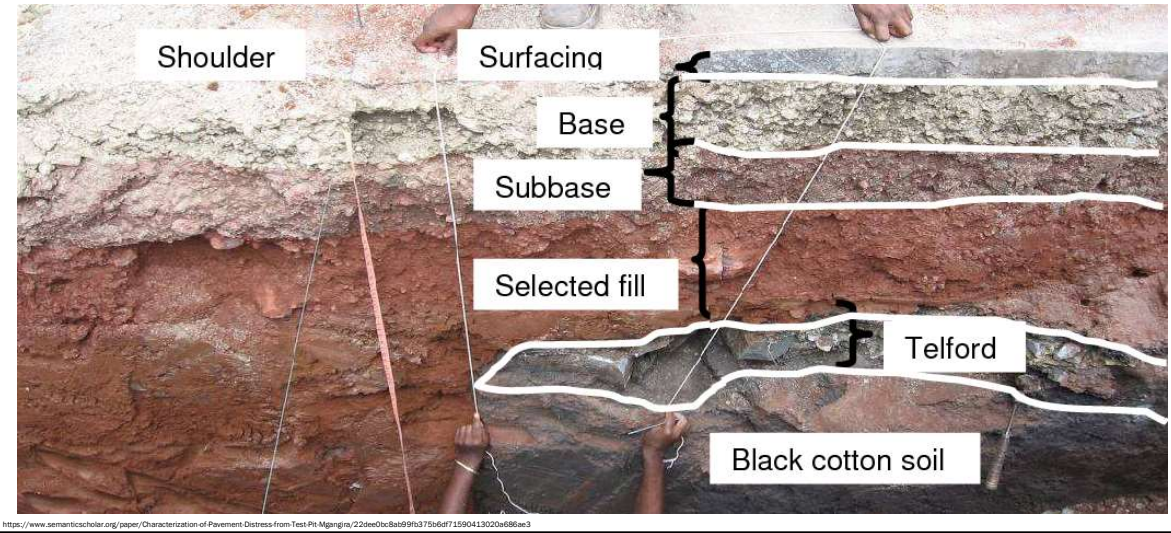

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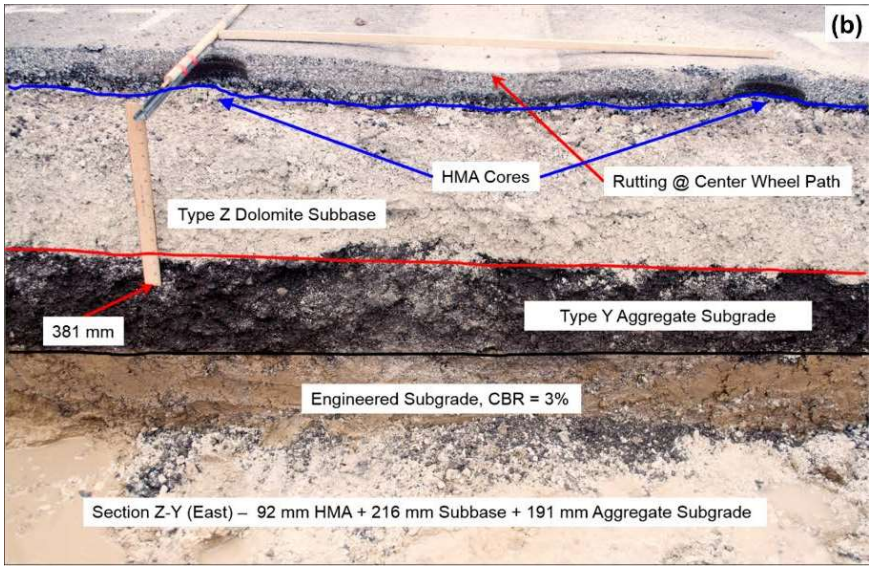

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Jordanian Specifications

11

11

وزارة الأشغال العامة والاسكان

" المواصفات الفنية لإنشاء الطرق القروية والثانوية "

لعام ١٩٩٤

12

١- الطرق الثانوية :

وهي الطرق التي تربط المدن بالقرى وتمر بأكثر من قرية باعتبارها طريقا" نافذا",
ويمكن لهذه الطرق أن تصل بين الطرق الرئيسية مرورا" بقرى أو مدن (غير مراكز المحافظات) .

٢- الطرق القروية :

وهي الطرق غير النافذة التي تتفرع من الطرق الرئيسية أو الثانوية أو تبدأ من المدينة وتؤدي الى قرية أو تجمعات سكانية وتنتهي عندها .

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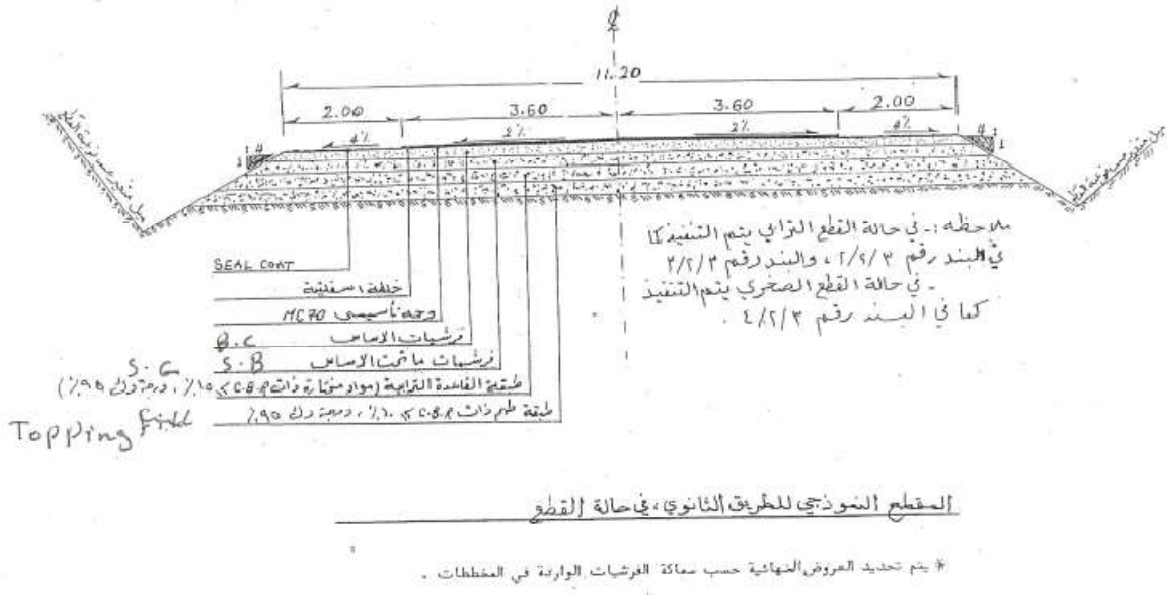
Cut typical cross section



المقطع النموذجي للطريق الثانوي ، في حالة القطع

* يتم تحديد العروض النهائية حسب سماكة الفرشات الواردة في المخططات .

13

13

Specifications for highway and bridge construction

٥- أعمال الفرشيات :

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٥/١- طبقة ما تحت الأساس (Sub Base) (الوجه الأول) :

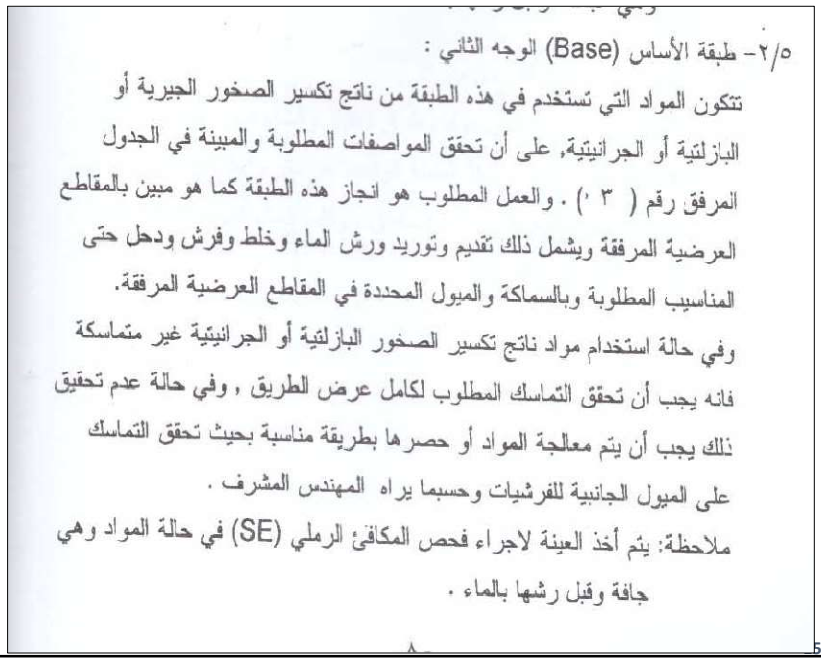
تتكون المواد التي تستخدم في هذه الطبقة من ناتج تكسير الحجر الجيري أو الصخور البازلتية أو الجرانيتية أو من مواد حصمة السيل المغربلة, على أن تحقق المواصفات الواردة في الجدول رقـــم (٢) المرفق , والعمل المطلوب هو انجاز هذه الطبقة كما هو مبين بالمقاطع العرضية المرفقة ويشمل ذلك تقديم وتوريد ورش الماء وخلط وفرش ودحل المواد حتى المناسيب المطلوبة وبالسماكة والميول المحددة بالمقاطع العرضية .

وفي حالة استخدام مواد ناتج تكسير الصخور البازلتية أو الجرانيتية أو حصمة السيل المغربلة أو أية مواد غير متماسكة, فانه يجب أن يتم معالجة المواد أو حصرها بطريقة مناسبة بحيث تحقق التماسك على الميول الجانبية للفرشيات وحسبما يراه المهندس المشرف .

ملاحظة: يتم أخذ العينة لاجراء فحص المكافئ الرملي (S.E) في حالة المواد وهي جافة وقبل رشها بالماء .

14

Specifications for highway and bridge construction



٥/٢- طبقة الأساس (Base) الوجه الثاني :

تتكون المواد التي تستخدم في هذه الطبقة من ناتج تكسير الصخور الجيرية أو البازلتية أو الجرانيتية, على أن تحقق المواصفات المطلوبة والمبينة في الجدول المرفق رقم (٣ ٠٠) . والعمل المطلوب هو انجاز هذه الطبقة كما هو مبين بالمقاطع العرضية المرفقة ويشمل ذلك تقديم وتوريد ورش الماء وخلط وفرش ودحل حتى المناسيب المطلوبة وبالسماكة والميول المحددة في المقاطع العرضية المرفقة.

وفي حالة استخدام مواد ناتج تكسير الصخور البازلتية أو الجرانيتية غير متماسكة فانه يجب أن تحقق التماسك المطلوب لكامل عرض الطريق , وفي حالة عدم تحقيق ذلك يجب أن يتم معالجة المواد أو حصرها بطريقة مناسبة بحيث تحقق التماسك على الميول الجانبية للفرشيات وحسبما يراه المهندس المشرف .

ملاحظة: يتم أخذ العينة لاجراء فحص المكافئ الرملي (SE) في حالة المواد وهي جافة وقبل رشها بالماء .

15

Gradation Specifications

Granular Subbase Course

GRANULAR SUP BASE COURSE

ITEM OF WORK	SUB BASE COURSE		
5 / 1	TESTS	LIMITS	REFERAE STANDARS
G R. SUB BASE	TYPE OF MATERIAL	CRUSHED LIME STONE, SCREENED WADI GRAVEL, CRUSHED AND SCREENED BASALT, OR GRANITE .	
	LAYER THICKNESS	AS SPECIFIED IN THE CROSS SECTION.	
	MAX . TOLERANCE IN LEVEL	(+10 MM)	
	ABRASION (%)	40 MAX	AASHTO T96
	RATIO OF WEAR LOSS REV 100/ REV500	0.25 MAX.	ASSHTO T96
	C.B.R (%)	40% MIN .	AASHTO T193
	L.L (%)	30 % MAX.	AASHTO T 90
	P.L	2-8 %	AASHTO T90 –T89
	* NOTE :		B.S 812
	NON PLASTIC CONDITION MIGHT BE ACCEPTED IF LIMESTONE IS USED	PROVIDED THAT ANGULARITY TEST (R) VALUE SHALL NOT BE LESS THAN 8.	

16

Gradation Specifications

Granular Base Course

GRANULAR BASE COURSE

ITEM OF WORK	G. BASE COURSE		
5 / 2	TESTS	LIMITS	REFERANCE STANDARDS
G R.	TYPE OF MATERIAL	CRUSHED LIME STONE,CRUSHED BASALT, CRUSHED GRANITE	
BASE	LAYER THICKNESS	AS SPECIFIED IN THECROSS SECTION.	
COURSE	MAX . TOLERANCE IN LEVEL	(+10MM)	
	ABRASION (%)	40 MAX	AASHTO T96
	RATIO OF WEAR LOSS REV 100/ REV500.	0.25 MAX.	ASSHTO T96
	-FRACTTURED FACES (%) (FOR AGGREGATE RETAINED ON # 4)	80% MIN .(ONE FACE OR TWO FACES)	
	C.B.R (%)	80% MIN .	ASTEM D1883 (MODIFIED) AASHTO T 89
	L.L (%)	25 % MAX.	
	P.I	2-6 % MAX	AASHTO T89 – T 90
	M.D DENSITY (GM/ CM3)	2.1 MIN	AASHTO T180 –D WITH REPLACEMENT
	Sieve analysis	Sieve No 2" zero Sieve No 1.5" 100 Sieve No 1" 75-100 Sieve No 3/4" 60-90 Sieve No 1/2" 45-80 Sieve No 3/8" 40-70 Sieve No 4 30–60 Sieve No 10 20–40 Sieve No 40 8-20 Befor comp 200 5-10-12 after comp200 +3%	

17

ULAR BASE COURSE

G. BASE COURSE

TESTS	LIMITS
TYPE OF MATERIAL	CRUSHED LIME STONE,CRUSHED BASALT, CRUSHED GRANITE
LAYER THICKNESS	AS SPECIFIED IN THECROSS SECTION.
MAX . TOLERANCE IN LEVEL	(+10MM)
ABRASION (%)	40 MAX
RATIO OF WEAR LOSS REV 100/ REV500.	0.25 MAX.
-FRACTTURED FACES (%) (FOR AGGREGATE RETAINED ON # 4)	80% MIN .(ONE FACE OR TWO FACES)
C.B.R (%)	80% MIN .

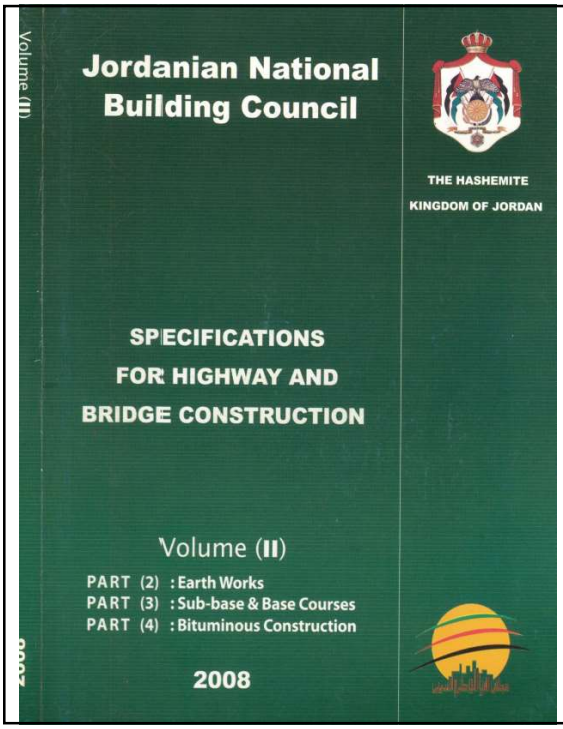
SUB BASE COURSE

TESTS	LIMITS
TYPE OF MATERIAL	CRUSHED LIME STONE, SCREENED WADI GRAVEL, CRUSHED AND SCREENED BASALT, OR GRANITE .
LAYER THICKNESS	AS SPECIFIED IN THE CROSS SECTION.
MAX . TOLERANCE IN LEVEL	(+10 MM)
ABRASION (%)	40 MAX
RATIO OF WEAR LOSS REV 100/ REV500	0.25 MAX.
C.B.R (%)	40% MIN . 30 % MAX.

SUBGARDE (TOPPING) :-

ITEM OF WORK	SUBG	
	TESTS	LIMIT
SUP GRADE LAYER	-MAX. STONE SIZE	3
	LAYER THICkNESS (CM.)	20 CM AFTER COMPACTON
	MAX. TOLERANCE IN LEVEL	(+10) OR (-30)MM.
	- PASS. # 200 (%)	20 % MAX.
	- C.B.R (%)	15% MIN.

18



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19

Jordanian Specifications

Granular Material For Sub-base

SECTION 3.01: MATERIALS

3.01.1 SCOPE

1. Materials specified for use in the construction of the sub-base and base courses for flexible and rigid pavements, may include any or all of the following:

1.1 Granular screened material, or partially crushed of approved classes, consisting of well graded gravel including sand and silt, or crushed stone or crushed gravel for sub-base course construction.

1.2 Crushed stone , of approved classes, for base course construction.

1.3 Stabilizing materials including portland cement, bitumen and lime, used where specified in sub-base and base courses (and in subgrades).

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Jordanian Specifications

Granular Material For Sub-base

3.01.3 GRANULAR MATERIAL FOR SUB-BASE

1. Granular material for use in sub-base courses, shall be a naturally occurring gravel, blended as necessary with fine or coarse material and screened to produce the specified gradation. Crushing of natural granular material shall not normally be required, unless for the purpose of meeting the gradation requirements, or when shown on the Drawings (to produce a higher quality sub-base with improved mechanical stability).

2. Gravel shall consist of hard, durable and sound stones, free from deleterious substances not mentioned below . Other requirements are:

21

21

Jordanian Specifications

Granular Material For Sub-base

SECTION 3.01

Table 3.1: Gradation of Granular Material by Class

Sieve Designation (square openings)		Per cent by weight passing	
		Class A	Class B
63	mm (2 - 1/2 in.)	100	
50	mm (2 in.)	80 - 100	100
37.5	mm (1 - 1/2 in.)	70 - 95	80 - 100
25	mm (1 in.)	55 - 90	60 - 95
12.5	mm (1/2 in.)	45 - 75	47 - 80
4.75	mm (No.4)	30 - 60	30 - 60
2.00	mm (No. 10)	22 - 48	22 - 45
0.425	mm (No.40)	10 - 30	10 - 30
0.075	mm (No. 200)	5 - 12	5 - 12

22

22

Jordanian Specifications

Granular Material For Sub-base

4. The material shall contain a minimum of 25% sand equivalent at any stage of construction .

5. The loss in weight of granular material shall not exceed 15% after 500 revolutions, when tested in accordance with AASHTO T 96 (Los Angeles Abrasion Test).

The ratio of wear loss = $\frac{\text{Abrasion after 100 Rev.}}{\text{Abrasion after 500 Rev.}}$, should not be more than twenty percent of the maximum allowed abrasion after 500 revelution .

6. The granular material shall have a 4-day soaked CBR of not less than 40 when compacted at 100% of modified proctor AASHTO (T 180-D) and tested in accordance with AASHTO T 193.

23

23

Jordanian Specifications

Granular Material For Sub-base

7. When tested for soundness in accordance with AASHTO T 104, the material shall not show signs of disintegration and the percentage loss in weight after 5 cycles shall not exceed 12% in the case of the sodium sulphate test and 18% in the case of the magnesium sulphate test.

8. The portion of granular material, including any blended material, passing the 0.425 mm (No. 40) mesh sieve shall have a liquid limit (L.L.) of not more than 30 and a plasticity index (P.I.) shall neither be less than 2 nor grater than 8 when tested in accordance with AASHTO T 89 and T 90.
Non Plastic condition might be accepted if crushed lime stone is use provided that angularity test (R) value shall not be less than 8 .

24

24

Jordanian Specifi

Aggregates For base

1. Aggregate for use in base course construction shall be crushed stone . Aggregate may be washed, if directed, to remove excessive quantities of clay, silty clay or salts.

2. Crushed stone and crushed gravel shall consist of hard, durable and sound particles or fragments of stone, free from other deleterious substances not mention below , other requirements are gypsum, or flakey particles. Other requirements:

Gypsum content (expressed as SO3)	2% max.
Clay Lumps and friable particels	8% max.
Elongated and flakey particles for crushed rock (Determined in accordance with BS812 Part 1: 1975)	
Granit & Basalt	40% max. each
Lime Stone	35% max. each
Maximum Dry density (g/cm3)	2.1 min.

Chert content (determined as percentage by weight insoluble in hydrochloric acid to be spesified in special technical specification .

3. Methods used in production of crushed rock shall ensure that the finished product will be as uniform as practicable. Crushing shall result in a product such that, for particles retained on 4.75 mm (No. 4) sieve at least 80% by weight shall have at least two factured faces.

25

Jordanian Specifications

Aggregates For base

Table 3.2: Gradation of Base Course Aggregate by Class

Sieve Designation (square openings)		percent by weight passing Class A	Class B
50	mm (2 in.)		100
37.5	mm (1 - 1/2 in.)	100	70 - 100
25	mm (1 in.)	75 - 100	55 - 85
19.0	mm (3/4 in.)	60 - 90	50 - 80
12.5	mm (1/2 in.)	45 - 80	-
9.5	mm (3/8 in.)	40 - 70	40 - 70
4.75	mm (No. 4)	30 - 65	30 - 60
2.00	mm (No. 10)	20 - 40	20 - 50
0.425	mm (No.40)	8 - 20	10 - 30
0.075	mm (No. 200)	5 - 10	5 - 15

The material shall contain a minimum of 35% sand equivalent at any stage of construction.

26

26

Jordanian Specifications

Aggregates For base

6. The loss in weight shall not exceed 45% after 500 revolutions, when tested in accordance with AASHTO T 96 (Los Angeles Abrasion Test).

The ratio of wear loss = $\frac{\text{Abrasion after 100 Rev.}}{\text{Abrasion after 500 Rev.}}$, should not be more than twenty percent of the maximum allowed abrasion after 500 revelution.

7. The crushed aggregate base course material shall have a 4-day soaked CBR of not less than 80 when compacted at 100% of modified proctor AASHTO (T180-D) and tested in accordance with AASHTO T 193.

27

27

Jordanian Specifications

Aggregates For base

8. When tested for soundness in accordance with AASHTO T 104, the material shall not show signs of disintegration and the loss by weight shall not exceed 12% in the case of the sodium sulphate test and 18% in the case of the magnesium sulphate test.

9. The portion of aggregate, including any blended materia, passing the 0.425 mm (No. 40) mesh sieve shall have a liquid limit (L.L.) of not more than 25 and plasticity index (P.I) of not more than 6 when tested in accordance with AASHTO T 89 and T 90. In case of using cohsionless base course material the exposed surface shall exhibit intact and coherent surface to resist water erosion and fretting, the contractor at his own expense shall ensure such property any solution should not applied unless approved in writing by Engineer , such solution may include single bituminous surface treatment , bonding material and other necessary treatment all as directed and approved by the engineer . Provided that angularity test should be more than 8 .

28

28

Bedding layers

Real Projects

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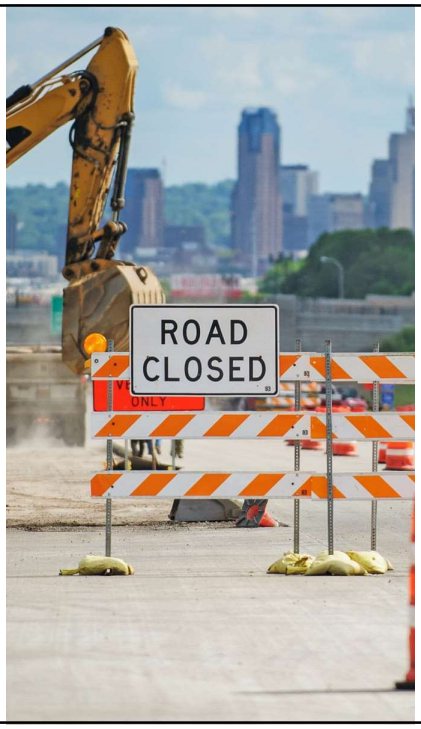
29

Subgrade Layer



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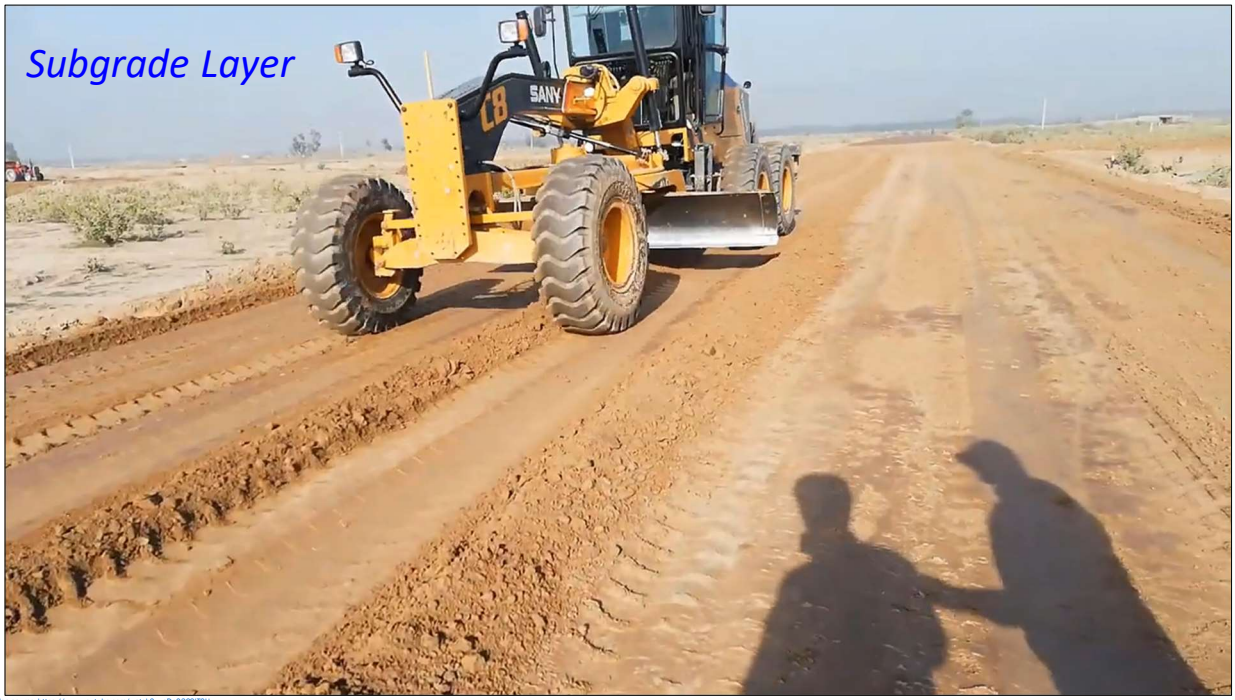

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Part B: Aggregates for

Asphalt mixtures

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What is Asphalt Mixture

- Asphalt mixture is combination of asphalt cement and aggregate that will give long-lasting performance as part of the pavement structure

Asphalt Cement/Binder
- About 4% to 6% of total mix by weight
- About 10% to 14% of total mix by volume

Aggregates
- About 94% - 96% of total mix by weight
- About 75%-85% of total mix by volume

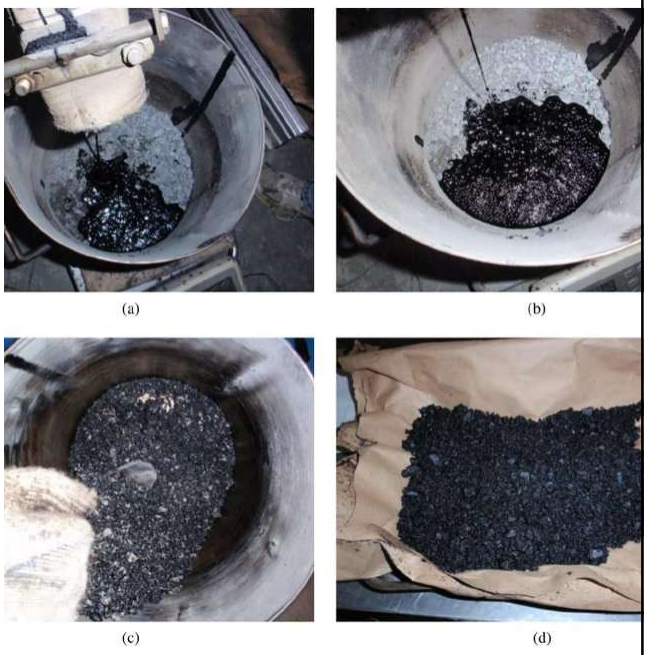

Image source: https://www.floridaridesonus.org/learning-center/asphalt-101/

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33

Asphalt Mixture Production

HMA Manufacturing

- HMA is produced in a plant that proportions, blends, and heats aggregate and asphalt to produce an HMA that conforming to job mix formula (JMF) requirements.
- There are two basic types of HMA plants commonly in use today:
  - The batch plant
    - Produce HMA in individual batches
  - The drum plant
    - Produce HMA in a continuous operation
- The choice of a batch or drum mix plant depends upon
  - business factors such as purchase price, operating costs, production requirements and the need for flexibility in local markets; both can produce quality HMA.

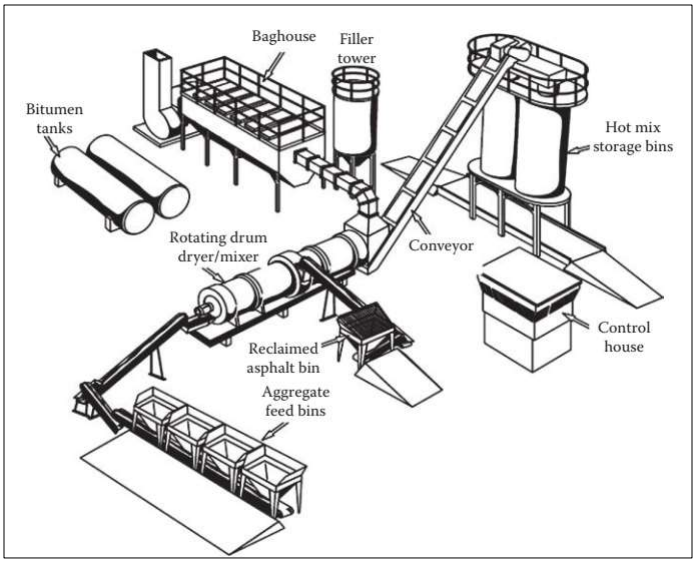
34

34

Asphalt Mixture Production

The drum plant

- generally, offer higher production rates than batch plants for comparable cost.
- Each type of plant can produce the same types of HMA and neither type of plant should impart any significant plant-specific HMA characteristics.



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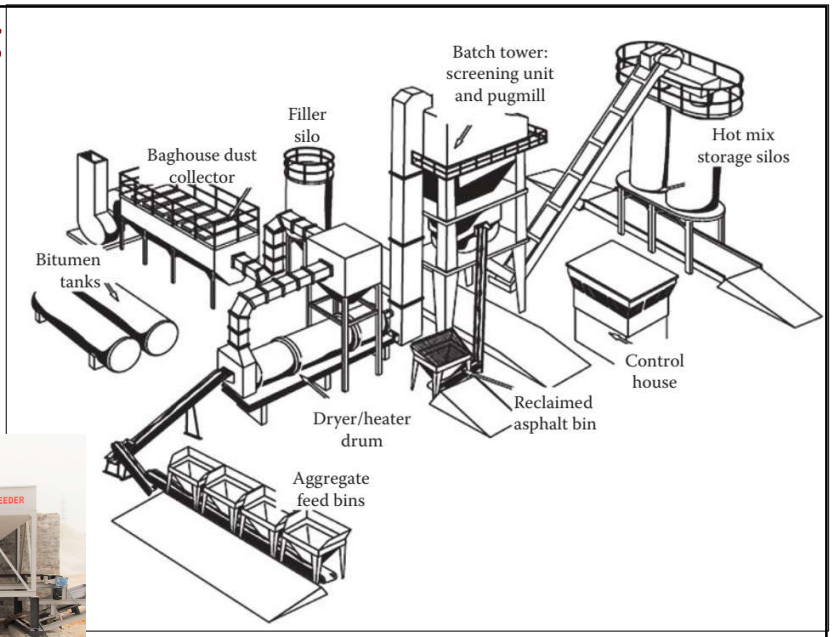
HMA Manufacturing

The batch plant



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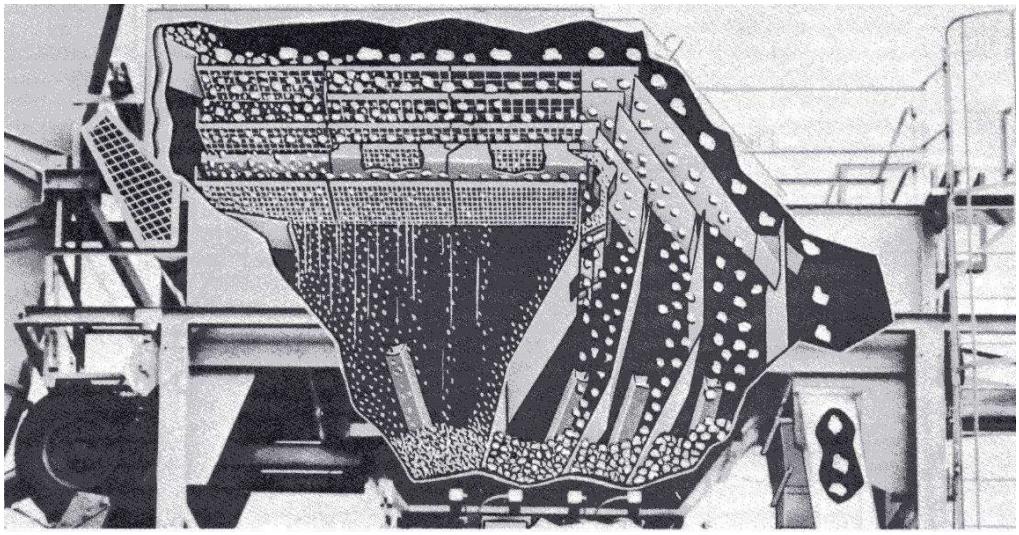
HMA Manufacturing



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The batch plant

https://www.youtube.com/watch?v=Q6UduQIuckQ&ab_channel=ParkerPlantIndiaPvtLtd.

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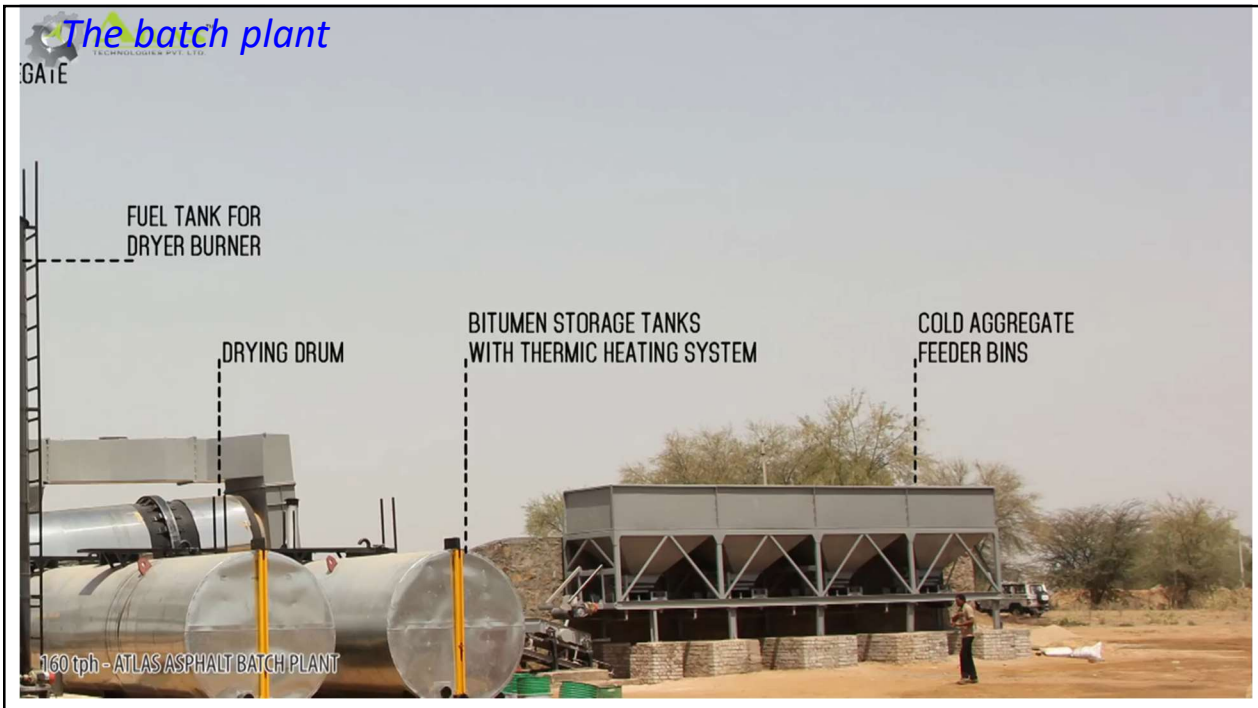
The batch plant



Video Source: https://www.youtube.com/watch?v=hxWinuC-Tas

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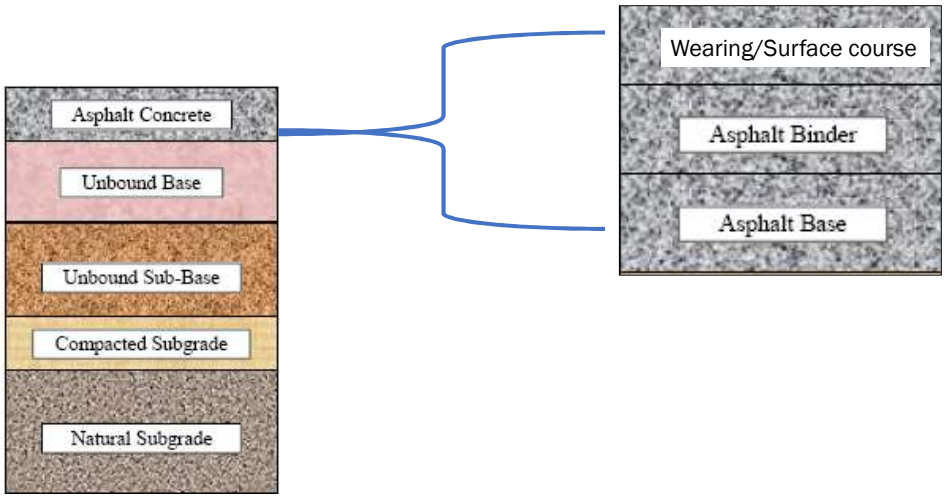
39

Aggregates For Bituminous Paving Mixes



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Aggregates For Bituminous Paving Mixes

1. Aggregates for use in bituminous base course, binder and wearing courses, leveling course, and macadam and cold mix courses, shall consist of crushed stone.

2. Coarse aggregate shall be the fraction of crushed aggregate material retained on 4.75 mm (No. 4) sieve. Fine aggregate shall be the fraction of crushed aggregate material passing 4.75 mm (No. 4) sieve. Mineral filler shall be added when the combined grading of coarse and fine aggregates is deficient in material passing 0.075 mm (No. 200) sieve.

3. The material from hot bins passing the number 40 sieve (0.425mm) when tested in accordance with AASHTO T90 shall be non plastic . In addtion the material from cold bins should not have PI larger than 4 .

4. Aggregates shall not contain gypsum more than 1% and the coarse fraction of the aggregate shall not contain more than :

5% chert and flint for aggregate to be used in the Wearing course.
5% chert and flint for aggregate to be used in the Binder course.

41

41

Aggregates For Bituminous Paving Mixes

5. Aggregates shall be of uniform quality, free from decomposed stone, organic matter, shale.

6. The percentage by weight of friable particles, clay lumps, and other deleterious matter shall not exceed 1% as determined by AASHTO T112.

7. Aggregate particles shall be clean, hard, durable and sound. Crushing shall result in a product such that, for particles retained on 4.75 mm (No. 4) sieve, at least 90% by weight shall have 2 or more fractured faces.

42

42

Aggregates For Bituminous Paving Mixes

8. The flakiness index and the elongation index test should be conducted in accordance with BS 812, the following are the maximum limits :

Course	Wearing Course	Binder & Asphalt Base
Flakiness Index F.I	25	30
Elongation Index E.I	25	30

9. Aggregates shall be washed if directed, to remove any clay lumps, organic matter, adherent dust or clay films or other extraneous or deleterious matter that may prevent or detract from proper adhesion of bitumen to the aggregate particles.

10. Mineral filler shall consist of finely divided mineral matter such as limestone dust if added sperately; hydrated lime; other non-plastic mineral filler, free from clay and organic impurities; or portland cement, conforming to AASHTO M 17.

43

43

Aggregates For Bituminous Paving Mixes

11. Combined coarse and fine aggregates for bituminous mixes, including mineral filler , when tested in accordance with AASHTO T 27 and T11, shall conform to the gradations shown in Table 4.1.

Table 4.1: Gradation of Aggregates for Bituminous Mixes

Sieve Designation	Binder Course	Wearing Course	Binder Cource	Wearing Course
1 1/2"	-	-	-	-
1 " (25.0mm)	100	100	100	100
3/4" (19.0mm)	70 - 100	90 - 100	70 - 100	90 - 100
1/2" (12.5mm)	53 - 90	71 - 90	53 - 90	71 - 90
3/8" (9.5mm)	40 - 80	56 - 80	40 - 80	56 - 80
No. 4 (4.75mm)	30 - 56	35 - 56	30 - 56	35 - 65
No. 8 (2.36mm)	23 - 38	23 - 38	23 - 49	23 - 49
No.20 (1.18mm)	13 - 27	13 - 27	14 - 43	14 - 43
No.50 (0.300mm)	5 - 17	5 - 17	5 - 19	5 - 19
No.80 (0.150mm)	4 - 14	4 - 14	4 - 15	4 - 15
No.200 (0.075mm)	2 - 8	2 - 8	2 - 8	2 - 8

44

44

12. The loss in weight of aggregate after 500 revolutions , when tested in accordance with AASHTO T 96, shall not exceed 35% .

$$\text{Ratio of wear loss} = \frac{\text{Abrasion after 100 revelution}}{\text{Abrasion after 500 revelution}} \text{ less than or equal 25 .}$$

13. When tested for soundness in accordance with AASHTO T104 the coarse aggregate (retained on No.4 sieve) shall not show signs of disintegration and the loss by weight after 5 cycles shall not exceed 9% in the case of the sodium sulphate test and 12% in the case of the magnesium sulphate test.

14. When tested for resistance to stripping in accordance with the AASHTO T-182 at least 95% coated particles should be achieved . Scandinavian test shall be carried out and at least 60% of the coarse aggregate surface area shall remain coated with a bitumen film especialy for exposed surfaces other wise anti stripping agent must be added to achivee the required coating .

15. The material shall contain aminimum 50% sand equivalnt . Test sample shall be taken from hot bins .

45

Aggregates For Bituminous Paving Mixes

12. The loss in weight of aggregate after 500 revolutions , when tested in accordance with AASHTO T 96, shall not exceed 35% .

$$\text{Ratio of wear loss} = \frac{\text{Abrasion after 100 revelution}}{\text{Abrasion after 500 revelution}} \text{ less than or equal 25 .}$$

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15. The material shall contain aminimum 50% sand equivalnt . Test sample shall be taken from hot bins .

46

46

Specifications for highway and bridge constru

Hot Mix Asphalt

جدول ٤ – خلطة اسفلتية

الخصائص الطبيعيه للحصمه والاختبارات (physical properties)جميع انواع الحصمه المستعمله بالخليط يج
ان تطابق المتطلبات الطبيعيه التاليه : متطلبات مواصفات الحصمه المستعمله في الطبقه السطحيه للخلطه السفلتي
الساخنه

الرقم	بند المواصفه	المتطلبات
١	نوعية المواد	حجر جيري او جرانيتي
٢	نسبة التاكل	٣٥%الحد الاعلى
٣	التاكل عند ١٠٠ دوره /٥٠٠ دوره	لاتزيد عن 22.
٤	نسبة الكتل الطينيه والاجزاء سهلة التفتت	١% الحد الاعلى
٥	نسبة القطع الرفيعه والمسطحه بالوزن	٢٠%الحد الاعلى لكل منها
٦	معامل اللدونه للمواد الماره من منخل ٤٠ من المحاقين الساخنه	N.P
7	المكافيء الرملي لخليط الحصمه المار من منخل رقم ٤	٥٠ كحد ادنى
٨	نسبة الصوان	لايزيد عن ٥%
٩	المحتوي الجبصي	لايزيد عن ١%
١٠	الاصاله Na Mg	لايزيد عن ٩% لايزيد عن ١٢%
١١	الاوجه المكسره (كنسبه من الوزن الكلي المتبقي على منخل رقم ٤ لوجهين او اكثر	لاتقل عن ٩٠%
١٢	نسبة الاسفلت	حسب التصميم على ان لاتقل عن ٥,١
١٢	التدرج الحجمي % المار من منخل ١" ¾" ½" ⅜" نمره ٤ ٨ ٢٠ ٥٠ ٨٠ ٢٠٠	 ١٠٠ ١٠٠-٩٠ ٩٠-٧١ ٨٠-٥٦ ٥٦- ٣٥ ٤٩-٣٢ ٤٣-١٤ ١٩-٥ ١٥-٤ ٨-٢

47

Part C : Aggregates for

Surface Treatment: Seal Coat

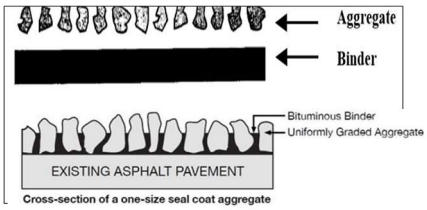
48

48

Seal coat (or chip seal)

Seal coat (or chip seal)

- Chip sealing involves spraying hot asphalt liquid onto the surface before having small chips of aggregates applied.



Cross-section of a one-size seal coat aggregate

49

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Seal coat (or chip seal)

Seal coat (or chip seal)

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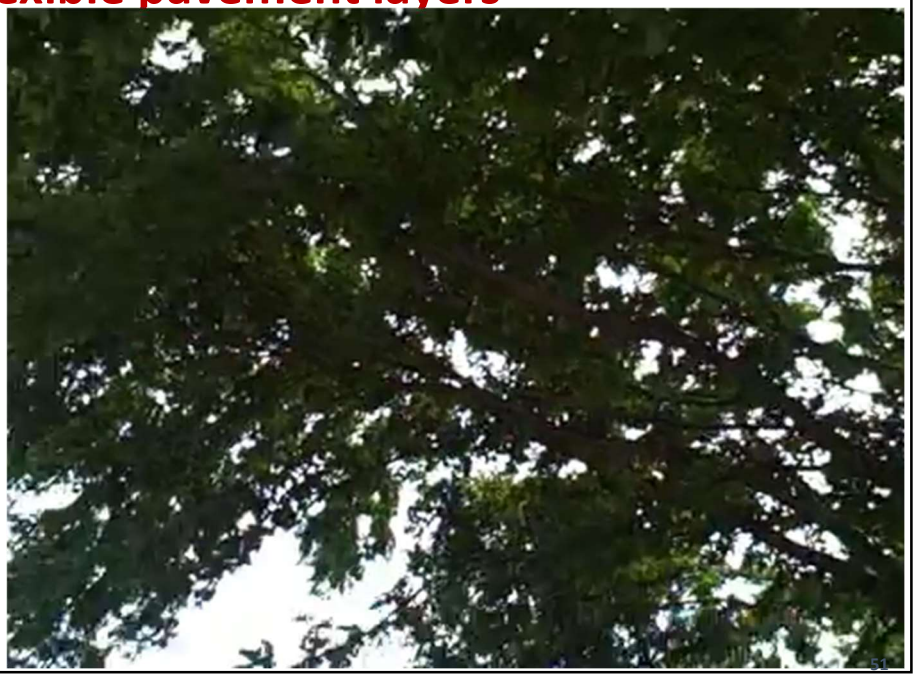
Conventional flexible pavement layers

Seal coat (or chip seal)



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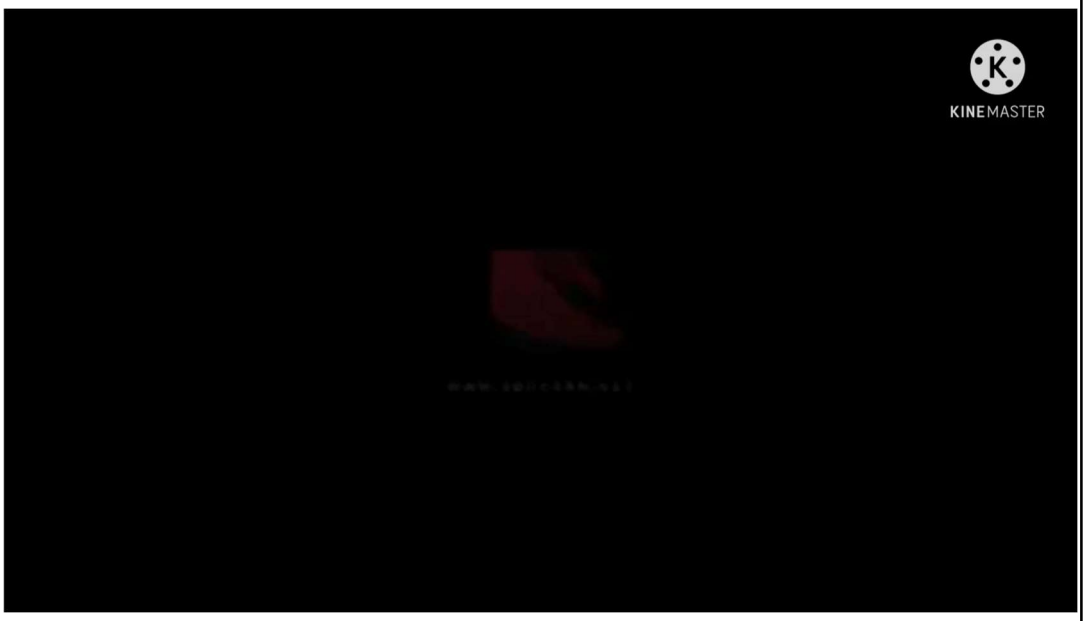
Conventional flexible pavement layers

Seal coat (or chip seal)



https://www.youtube.com/watch?v=SCjvtu2MwDU

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52

Seal coat (or chip seal)

Seal coat (or chip seal)

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

53

53

Seal coat (or chip seal)

54

Conventional flexible pavement layers

Seal coat (or chip seal)

56

56

Conventional flexible pavement layers

Seal coat (or chip seal)

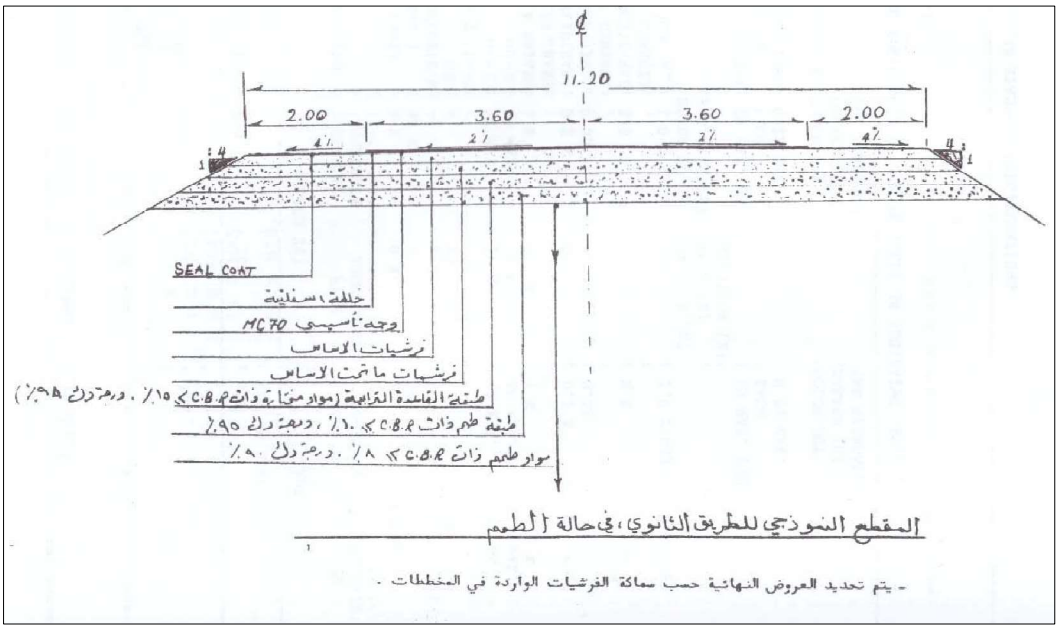
Uses:

- Very effective in improving the skid resistance of asphalt pavements
- Prevent moisture infiltration
- Retard the oxidation of asphalt in underlying layers
- Extend the service life of dry and weathered and deteriorated surfaces
- Excellent temporary surface, temporary cover of base layers until permanent HMA surface is placed
- Proper surface treatment for light to medium traffic roads; however it is used on higher volume roads
- Popular treatment; low cost

58

58

Specifications for highway and bridge construction



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Aggregates For Seal Coat

1. Cover aggregates for bituminous seal coats shall consist of screenings of crushed stone. Aggregate for slurry seals shall consist of crushed stone fines or natural sand blended with not less than 50% crushed stone fines. For heavy duty applications slurry aggregate shall consist of 100% crushed fines. Wadi

gravels shall not be used for seal costs, suitability of suggested crushed ston fines for use in slurry seal shall be demonstrated prior to use .

62

62

Aggregates For Seal Coat

2. Aggregates shall not contain crystalline or amorphous gypsum (expressed as SO3) more than 1% , and shall not contain more than 5% chert.

3. Aggregate particles shall be clean, hard, durable and sound. For particles retained on 4.75 mm (No. 4) sieve, at least 90% by weight shall have 2 or more fractured faces and 100% by weight shall have one or more fractured faces.

4. Flakiness Index and Elongation Index tested in accordance with BS-812 shall not be exceed 25% for each of flakiness and elongation index . The percentage by weight of clay lumps & friable particles as determined by AASHTO T 112 shall not exceed 3% . Light weight agregate of specific gravity of 2 or less shall not exceed 3% as determined by AASHTO T 113 .

5. If necessary aggregates shall be washed, or processed by any alternative approval method, to remove any clay lumps, organic matter, adherent dust or clay films or other extraneous or deleterious matter that may prevent or detract from proper adhesion of bitumen to the aggregate particles.

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Aggregat

6. Cover aggregates and aggregate for slurry seals, when tested in accordance with AASHTO T 27 and T11, shall conform to the gradations given in Table 4.2.

Table 4.2: Gradation of Aggregates for Seal Coats

Sieve Designation (Square openings)	1st Application Grading B	2nd Application Grading C	Slurry Aggregate
25.0mm (1 in.)	100		
19.0mm (3/4 in.)	90 - 100		
12.5mm (1/2 in.)	20 - 55	100	
9.50mm (3/8 in.)	0 - 15	58 - 100	100
4.75mm (No. 3)	0 - 5	10 - 30	90 - 100
2.36mm (No. 4)	-	0 - 10	65 - 90
1.18mm (No. 8)	-	0 - 5	45 - 70
0.60mm (No. 16)	-	-	30 - 50
0.30mm (No. 50)	-	-	18 - 30
0.15mm (No. 100)	-	-	10 - 20
0.07mm (No. 200)	0 - 0.5	0 - 0.5	5 - 15

64

Aggregates For Seal Coat

7. The loss in weight of aggregate after 500 revolutions, when tested in accordance with AASHTO T 96 (Los Angeles Test), shall not exceed 35%.

8. When tested for soundness in accordance with AASHTO T 104, the aggregates shall not show signs of disintegration and the loss by weight shall not exceed 10% in the case of the sodium sulphate test or 12% in the case of the magnesium sulphate test.

9. When tested for resistance to stripping in accordance with AASHTO T 182, at least 95% of the aggregate surface area shall remain coated with a bitumen film.

10. The material shall contain aminimum 50% of sand equivelant as determined by AASHTO T 176 .

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Part D : Aggregates for

Portland Cement Concrete

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