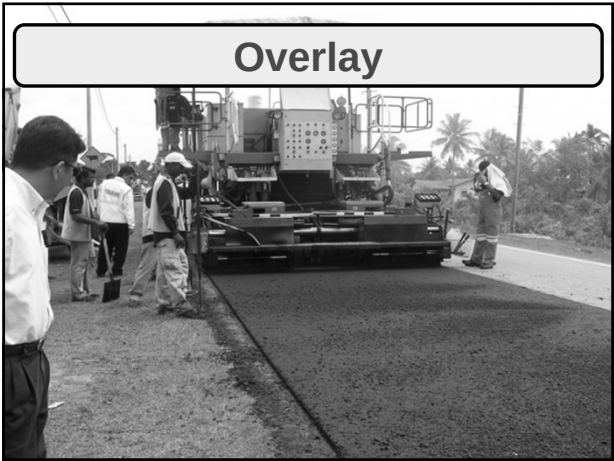
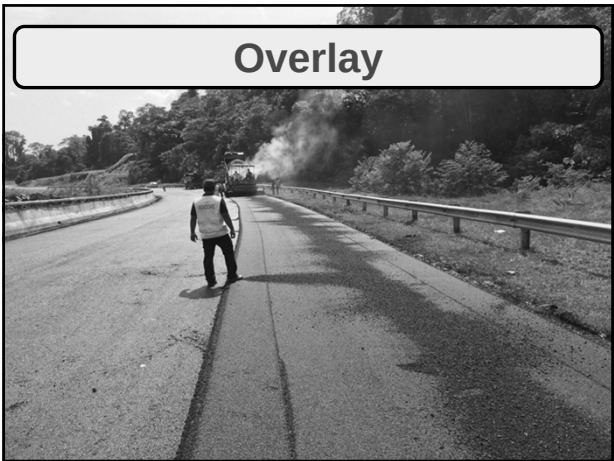












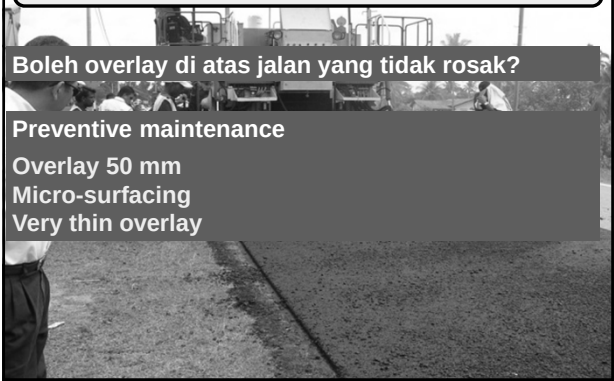


Overlay



Ketebalan (selepas dipadat) setiap lapisan turapan
min $\geq 2x$ saiz batu paling besar, max ≤ 100 mm.

Overlay



Boleh overlay di atas jalan yang tidak rosak?

Preventive maintenance
Overlay 50 mm
Micro-surfacing
Very thin overlay

Overlay



Boleh overlay di atas jalan yang rosak (ada cracks, potholes)?



Kos overlay?
Kos mill and pave?
Kos cold in-place recycling (CIPR)?

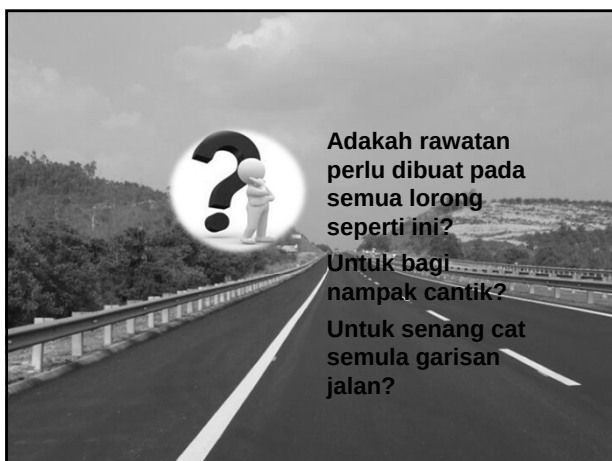


Tack coat	RM	1.50/m ²
Prime coat	RM	1.60/m ²
AC 14	RM	597.60/m ³
AC 28	RM	578.70/m ³
Milling 0 – 50 mm	RM	7.70/m ²
Milling 50 – 100 mm	RM	12.20/m ²
Milling 101 – 150 mm	RM	17.40/m ²
Milling 151 – 200 mm	RM	21.80/m ²
CIPR 150 mm	RM	17.30/m ³
CIPR 200 mm	RM	20.90/m ³
CIPR 250 mm	RM	23.80/m ³



Bagi 1 km, 2 lorong (1000 m x 7 m = 7000 m ²):		
Tack coat	RM	10,500.00
Overlay 50 mm	RM	209,160.00
Mill 50 mm	RM	53,900.00
Mill 100 mm	RM	85,400.00
Mill 110 mm	RM	121,800.00
Mill and pave 50 mm	RM	273,560.00
Mill and pave 80 mm	RM	430,556.00
Mill and pave 100 mm	RM	514,220.00
Mill 110, BC 60, WC 50	RM	595,014.00
CIPR 250, BC 60, WC 50	RM	514,864.00
CIPR 250, BC 60, WC 50	RM	661,968.00 (1 km x 9 m)















Bituminous tack coat

TUJUAN: Untuk memastikan lapisan turapan baru melekat pada permukaan jalan sedia ada.



Bituminous tack coat

SEMBURAN: Rata pada permukaan yang bersih & kering. Kadar semburan 0.25 – 0.55 liter/m²



Aplikasi: 0.25 – 0.55 liter/m², semburan rata, tidak berbelang-belang.




Tidak rata

Aplikasi: 0.25 – 0.55 liter/m², semburan rata, tidak berbelang-belang.




Terlalu sedikit

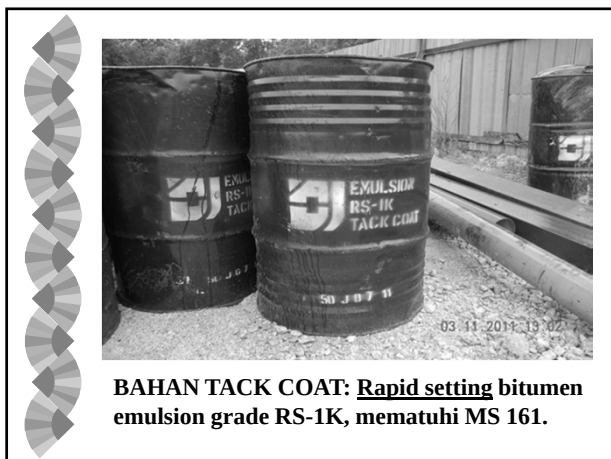
Aplikasi: 0.25 – 0.55 liter/m², semburan rata, tidak berbelang-belang.

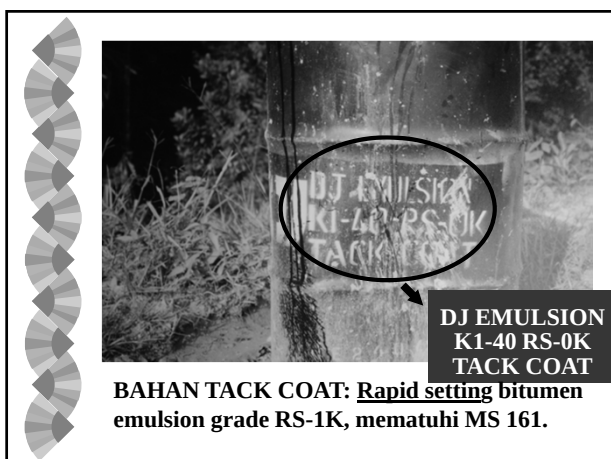



Terlalu banyak

Aplikasi: 0.25 – 0.55 liter/m², semburan rata, tidak berbelang-belang.







MS 161				
	RS-0K	<u>RS-1K</u>	RS-2K	RS-3K
Bitumen, %*	38	50	60	65
Air, %	62	50	40	35
(K1-40)				
* minimum				

MS 161	
Bituminous prime coat	
SS-1K	
Kadar aplikasi: 0.5 - 1.0 litre/m ²	
Tujuan:	
* Menyediakan permukaan roadbase kalis air.	
* Menutup rongga.	
* Mengikat butiran longgar.	
* Mengeraskan permukaan roadbase.	
* Mengikat permukaan roadbase kepada asphalt.	
Prime coat seharusnya dibiarkan kering selama 24 jam.	











MS 161

	RS-0K	<u>RS-1K</u>	RS-2K	RS-3K
Bitumen, %*	38	50	60	65
Air, %	62	50	40	35

(K1-40)

* minimum

Boleh atau tidak RS-0K disembur dengan lebih banyak bagi menggantikan kuantiti bitumen yang kurang (38% berbanding 50%)...?



MS 161

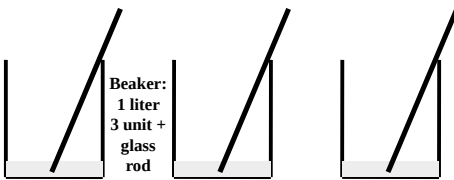
	RS-0K	<u>RS-1K</u>	RS-2K	RS-3K
Bitumen, %*	38	50	60	65
Air, %	62	50	40	35

(K1-40)

* minimum

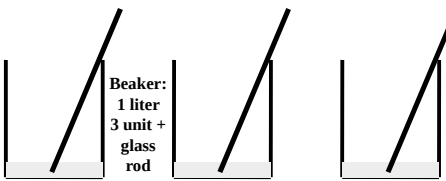
Sekiranya hujan turun selepas tack coat disembur, apa yang perlu dilakukan?





Beaker:
1 liter
3 unit +
glass
rod

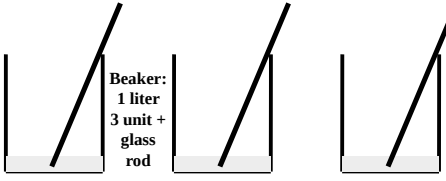




Beaker:
1 liter
3 unit +
glass
rod

Sampel: 50 g

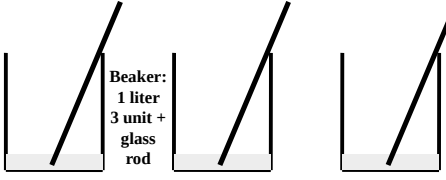




Beaker:
1 liter
3 unit +
glass
rod

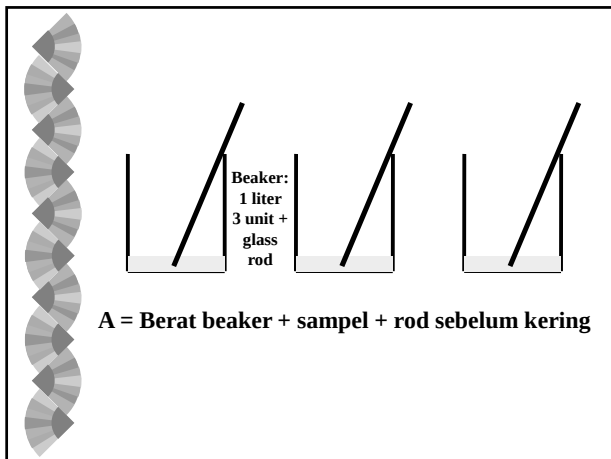
Sampel: 50 g
Pengeringan: Oven @ 163 °C, 2 + 1 jam,

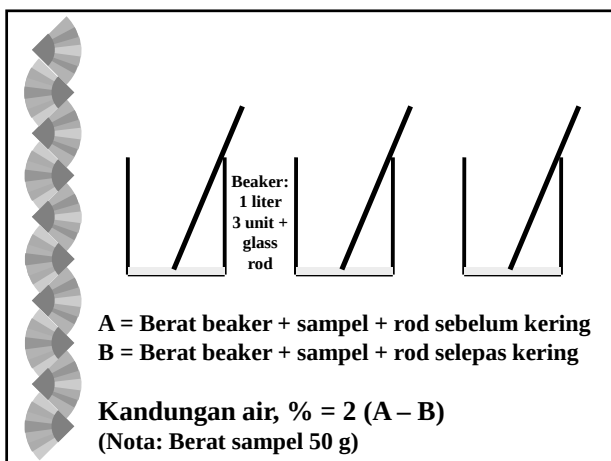




Beaker:
1 liter
3 unit +
glass
rod

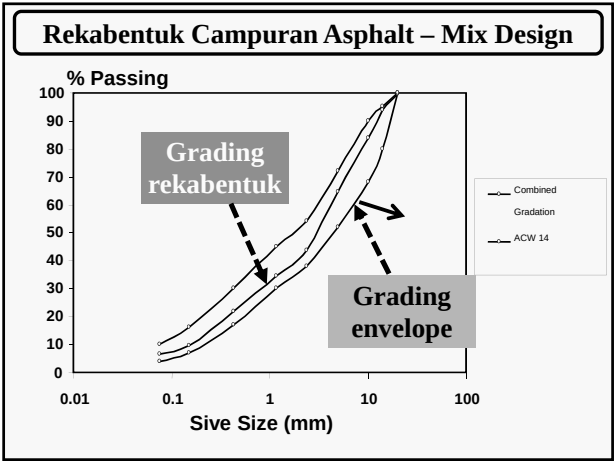
Sampel: 50 g
Pengeringan: Oven @ 163 °C, 2 + 1 jam, atau
Hot plate, dan oven @ 163 °C, 1 jam















Sukatkan kandungan bitumen

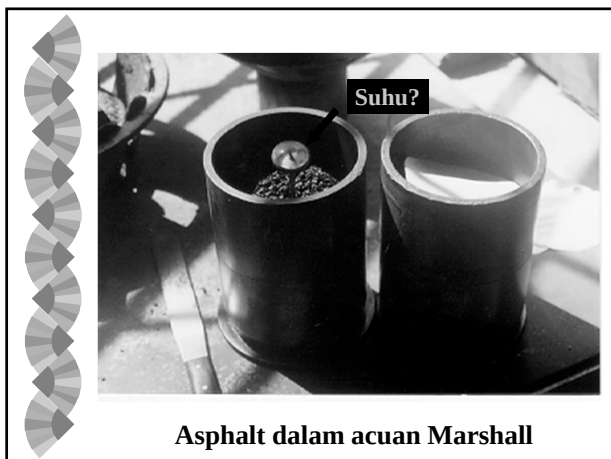


Sukatkan kandungan bitumen

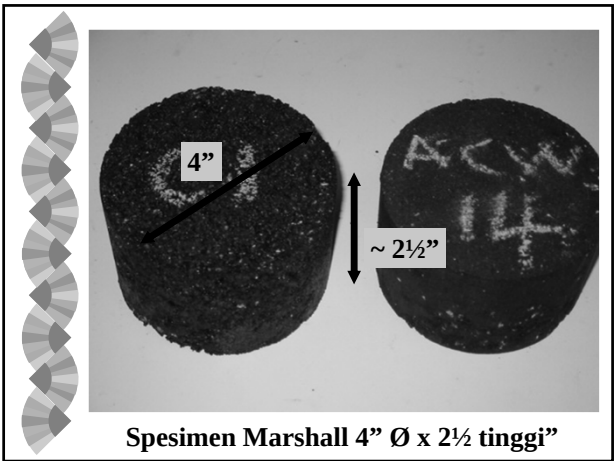


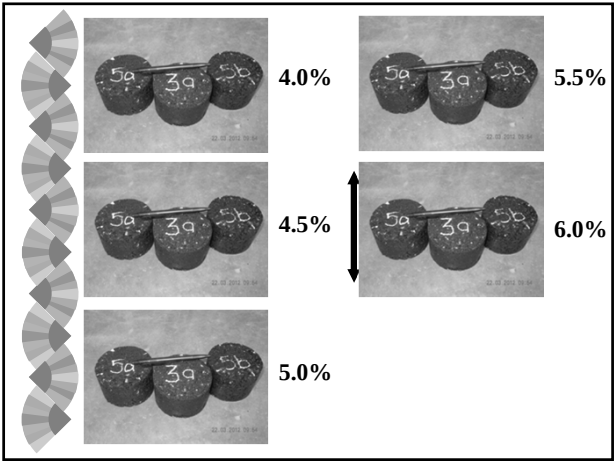
Bancuhan aggregate & bitumen (asphalt)

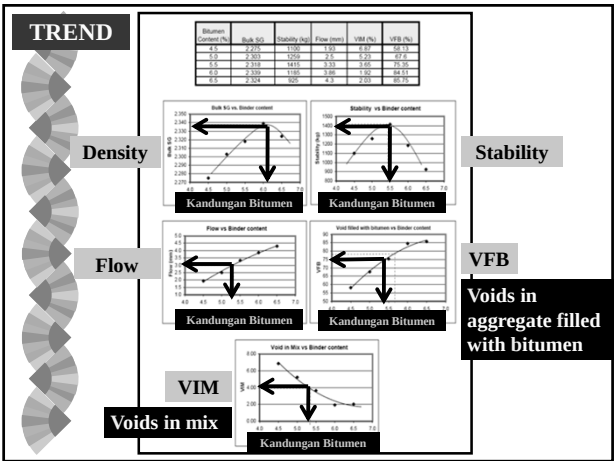




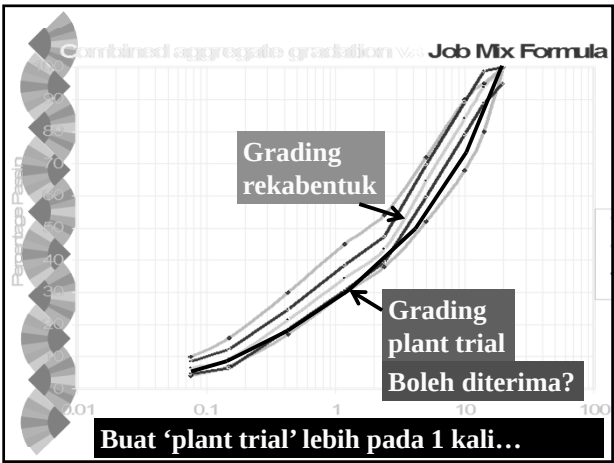


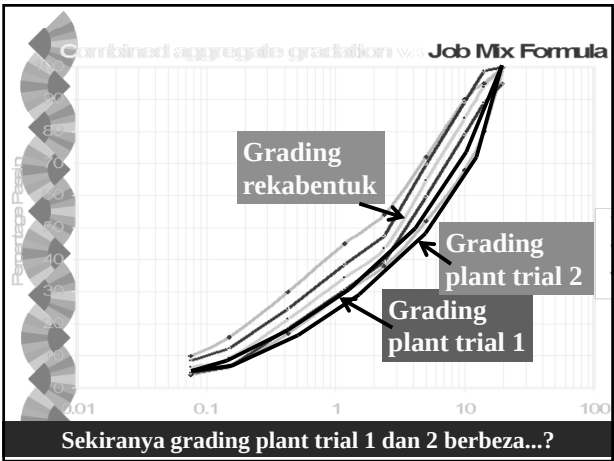


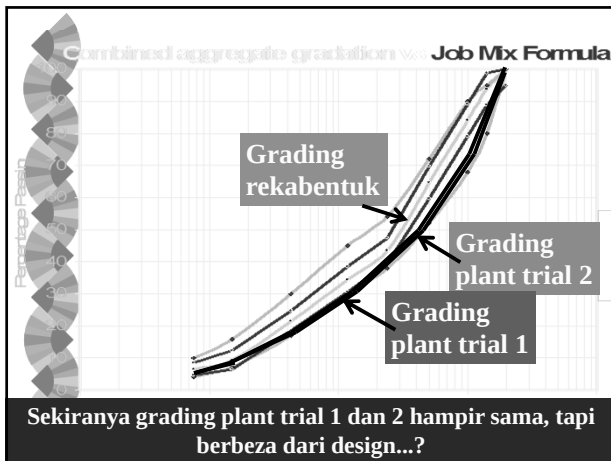




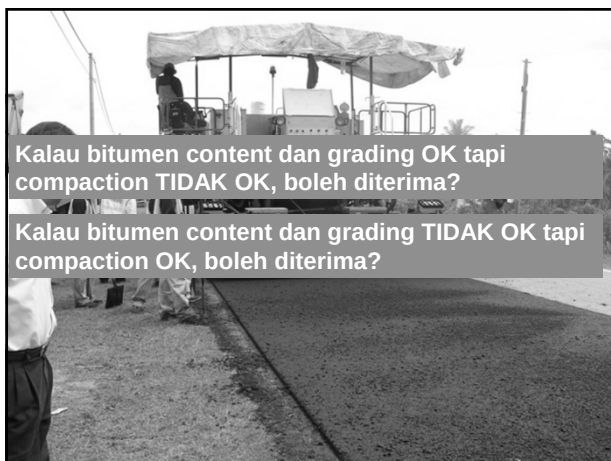
Jadual 4.11 JKR/SPJ TOLERANSI bagi Asphaltic Concrete	
Parameter	Variasi yang dibenarkan (% berat asphalt)
Kandungan bitumen.	$\pm 0.2 \%$
Batu baur yang telus ayak 5.0 mm dan ayak yang lebih besar.	$\pm 5.0 \%$
Batu baur yang telus ayak 3.35 mm dan 1.18 mm.	$\pm 4.0 \%$
Batu baur yang telus ayak 0.425 mm dan 0.150 mm.	$\pm 3.0 \%$
Batu baur yang telus ayak 0.075 mm.	$\pm 2.0 \%$













Pemadatan



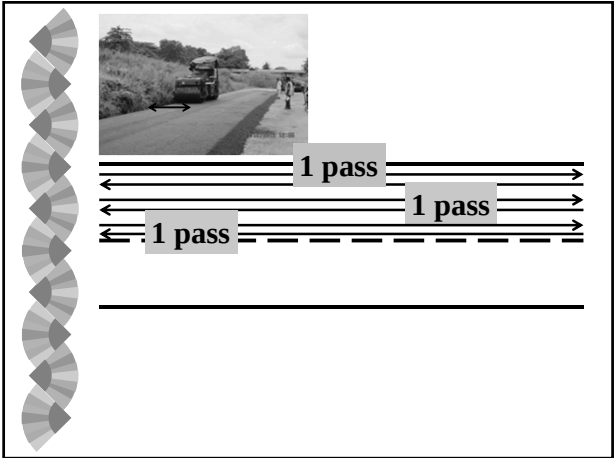
Steel wheel roller

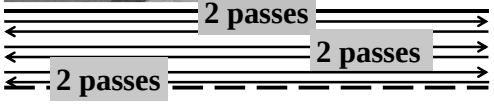


Pneumatic tyre roller

Rolling pattern: 2-2-10-2

- 2 – Steel wheel roller (statik)
- 2 – Steel wheel roller (getaran)
- 10 – Pneumatic tyre roller
- 2 – Steel wheel roller (statik)

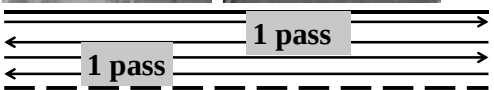




2 passes

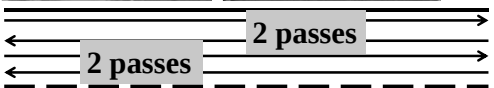
2 passes

2 passes



1 pass

1 pass



2 passes

2 passes

PEMADATAN ASPHALT



**JKR/SPJ/1988 Clause 4.2.4.4 (e)
Rollers**

★ A pneumatic tyre roller and two steel wheel tandem rollers shall be provided.

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★ A pneumatic tyre roller and two steel wheel tandem rollers shall be provided.



**JKR/SPJ/1988 Clause 4.2.4.4 (e)
Rollers**

★ A pneumatic tyre roller and two steel wheel tandem rollers shall be provided.



Minimum 15 tan

+



1



2

Minimum 8 tan

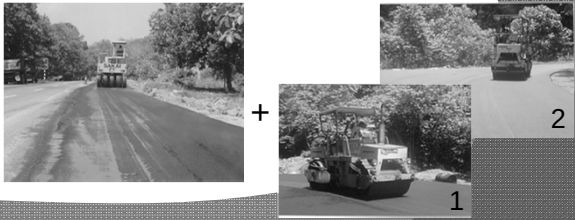


**JKR/SPJ/1988 Clause 4.2.4.4 (e)
Rollers**

★ A pneumatic tyre roller and two steel wheel tandem rollers shall be provided.
However, a three wheel steel roller may be substituted for one of the tandem rollers if the S.O. shall so approve.

**JKR/SPJ/1988 Clause 4.2.4.4 (e)
Rollers**

★ However, a three wheel steel roller may be substituted for one of the tandem rollers if the S.O. shall so approve.



**JKR/SPJ/1988 Clause 4.2.4.4 (e)
Rollers**

★ However, a three wheel steel roller may be substituted for one of the tandem rollers if the S.O. shall so approve.



**JKR/SPJ/1988 Clause 4.2.4.5 (i)
Compaction of Asphaltic Concrete**

★ **Initial** (or breakdown) rolling shall be carried out with an approved steel wheel tandem roller or three wheel steel roller.
The **final** rolling shall be carried out with an approved steel wheel tandem roller.







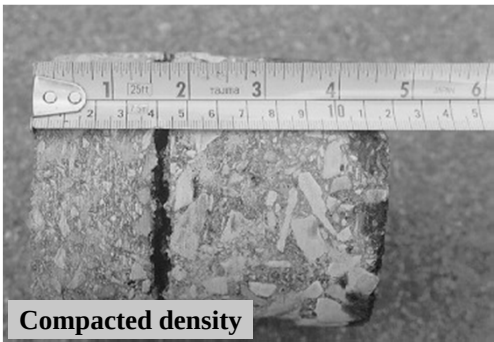






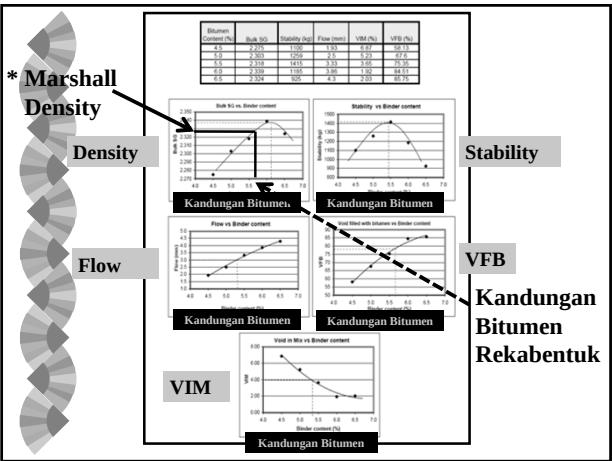
Pengambilan sampel core

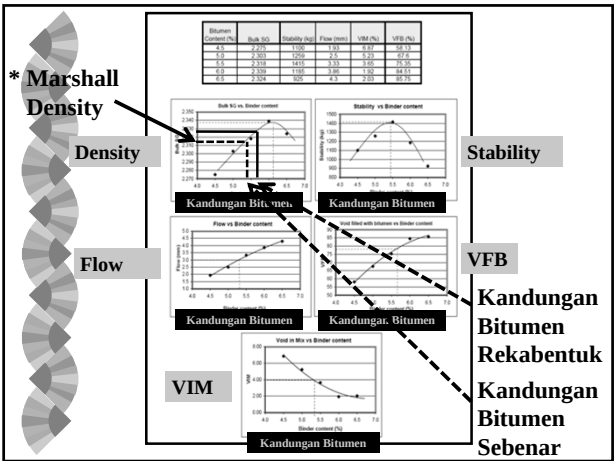
Satu sampel setiap 500 m², ≥ 2 sampel bagi setiap sesi penurapan, dalam tempoh 24 jam.



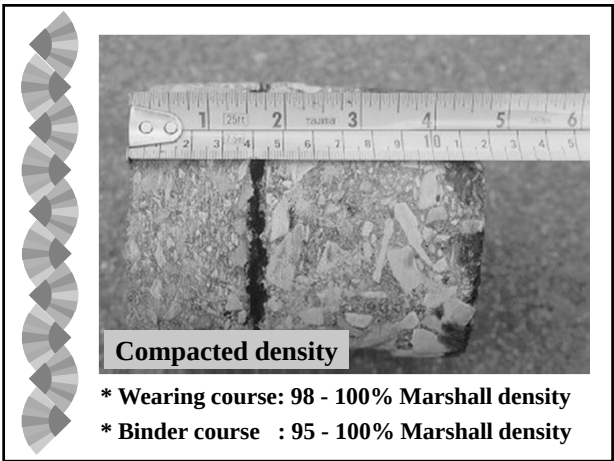
Compacted density

- * Wearing course: 98 - 100% Marshall density
- * Binder course : 95 - 100% Marshall density

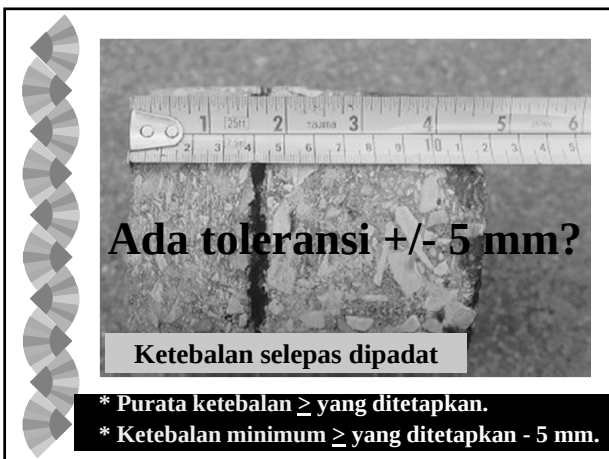


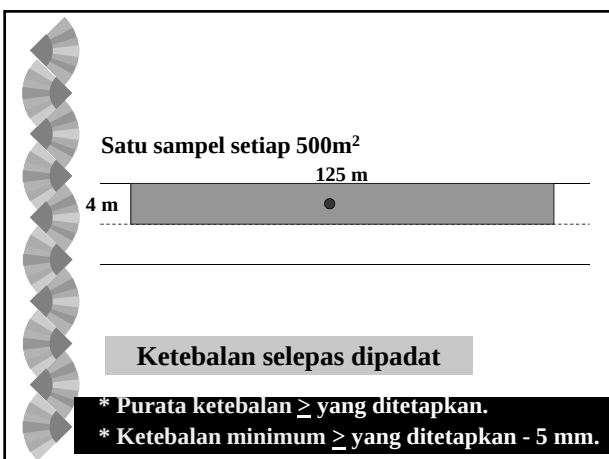


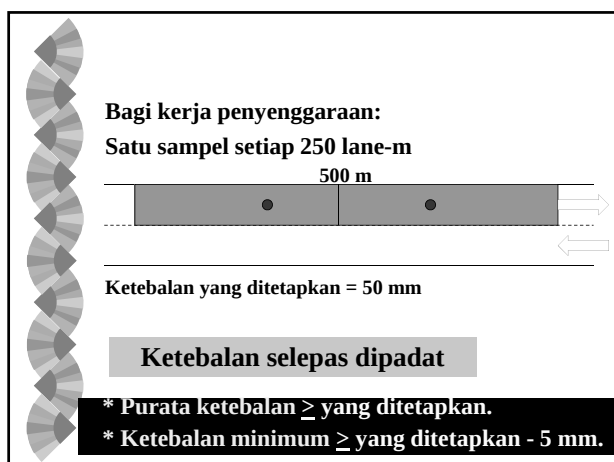


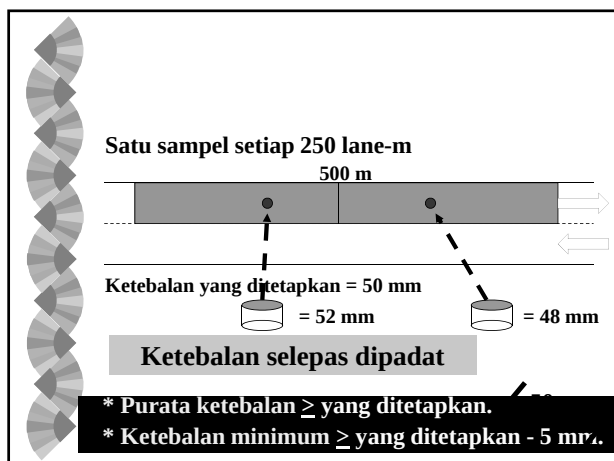


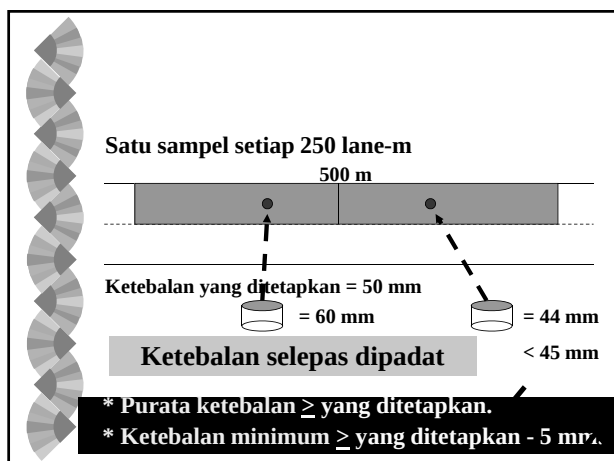


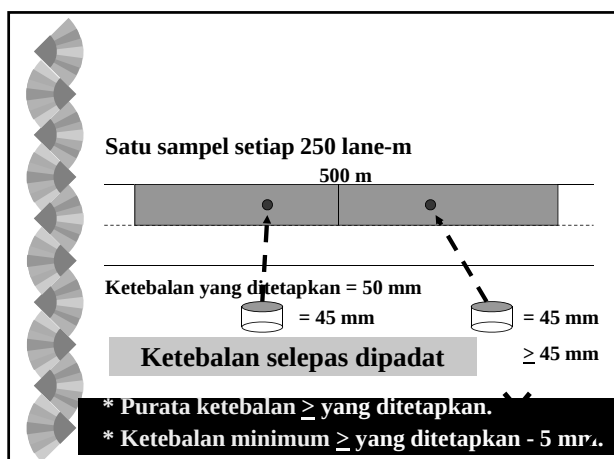




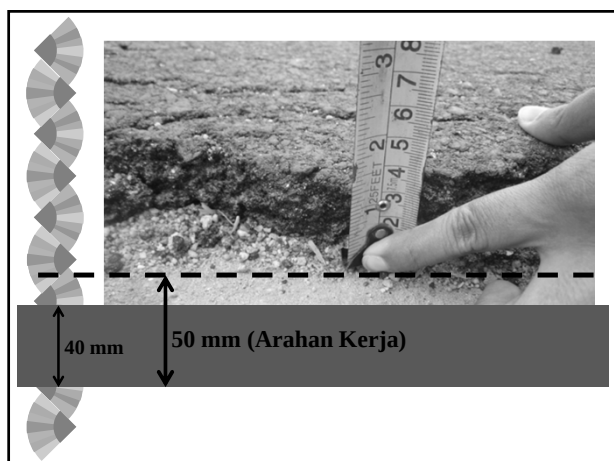


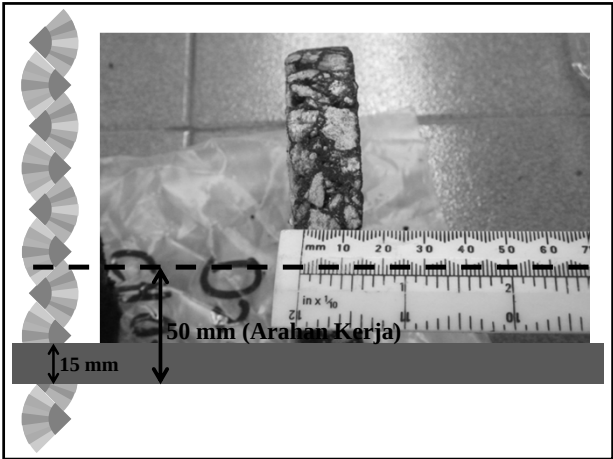




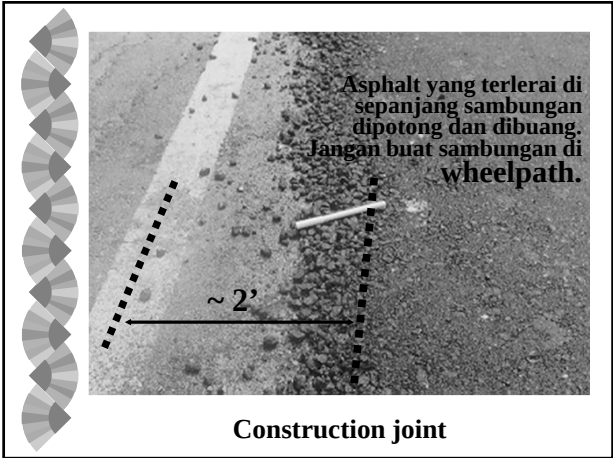




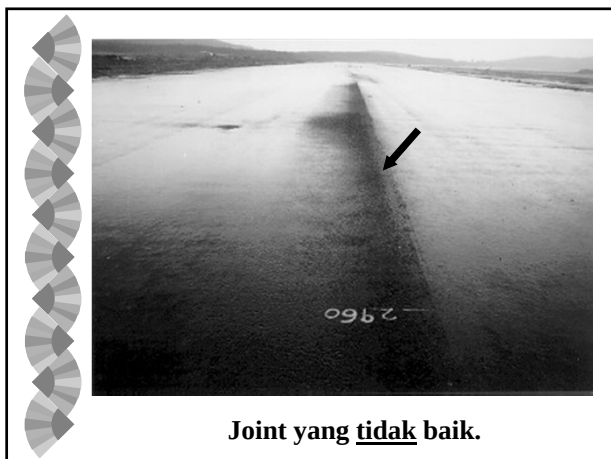
















Mesin pengelek mesti ada tangki air & sistem perenjis untuk memastikan semua tayar basah & bersih semasa mengelek.









PENGUNAAN BITUMEN GRED 60 – 70 DI ASIA TENGGARA

Singapura: sejak 1970an

Filipina: sejak 1980an

Thailand: sejak 1988

Vietnam: sejak 1990an

Indonesia: gred 60 – 70 dimasukkan dalam spesifikasi pada 1987, gred 80 – 100 dikeluarkan dari spesifikasi pada 2008.

Malaysia: gred 60 – 70 dimasukkan dalam spesifikasi pada 2008, gred 80 – 100 dikeluarkan dari spesifikasi 1 Mei 2017.



PERBEZAAN ANTARA BITUMEN GRED 60 – 70
DENGAN 80 – 100

Penetration Grade	Softening Point	Flash Point
80 – 100	45 – 52 °C	> 225 °C
60 – 70	48 – 56 °C	> 250 °C





Wheel Tracking Test

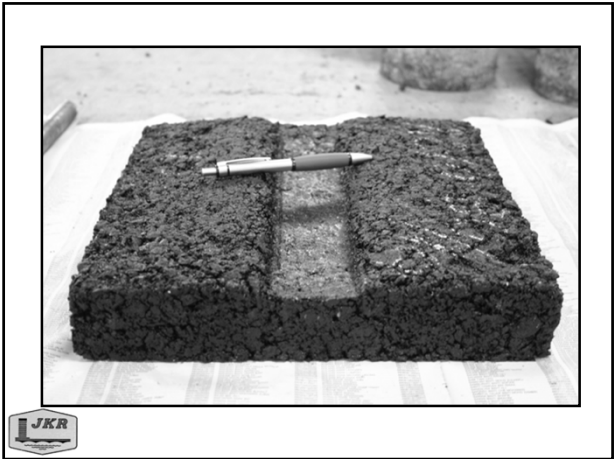




Wheel Tracking Test

Applied load = 700 N, Test temperature = 60 °C

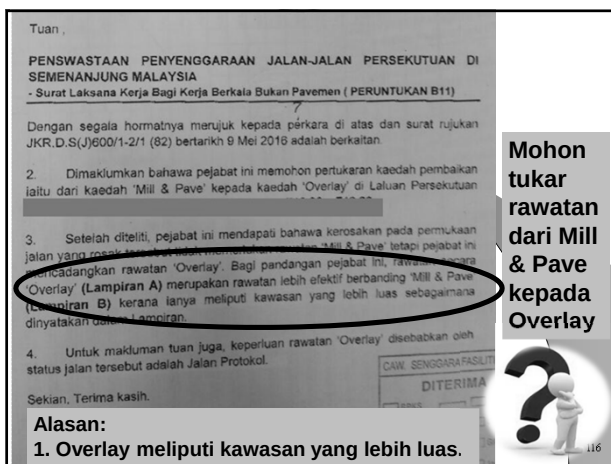


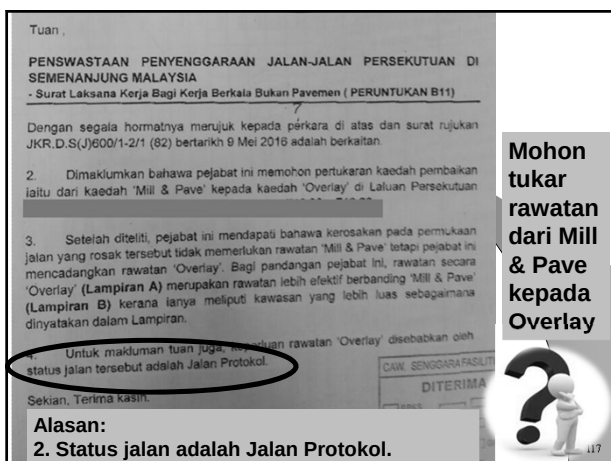




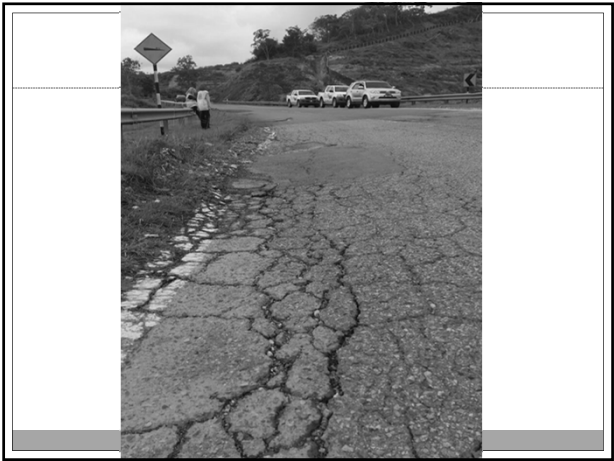
Materials	Wheel Tracking Rut
ACW 20 + 80-100	17.9 mm
ACW 20 + 60-70	7.3 mm
ACW 20 + Polymer	2.1 mm
ACB 28 + 80-100	14.8 mm
ACB 28 + 60-70	8.7 mm
ACB 28 + Polymer	1.6 mm











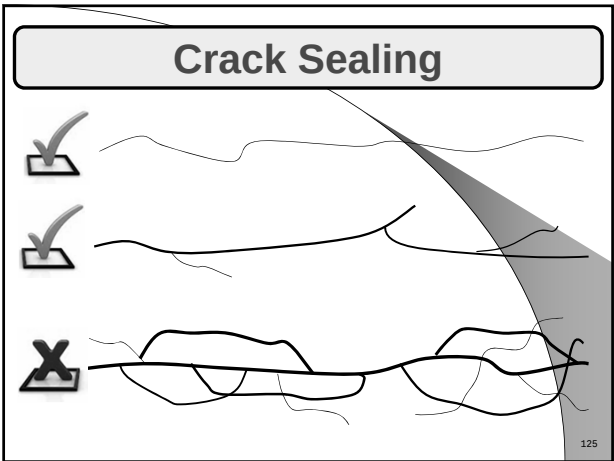


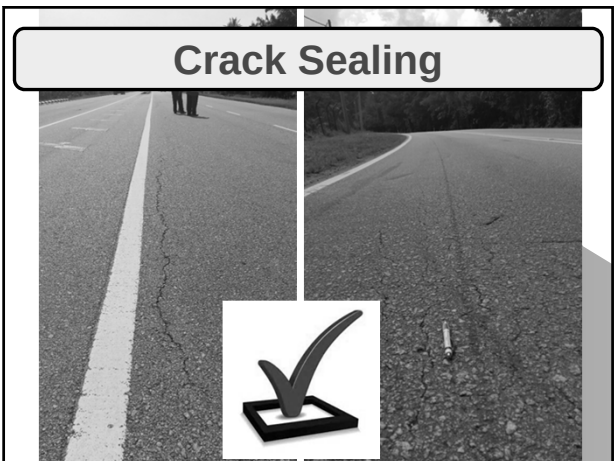


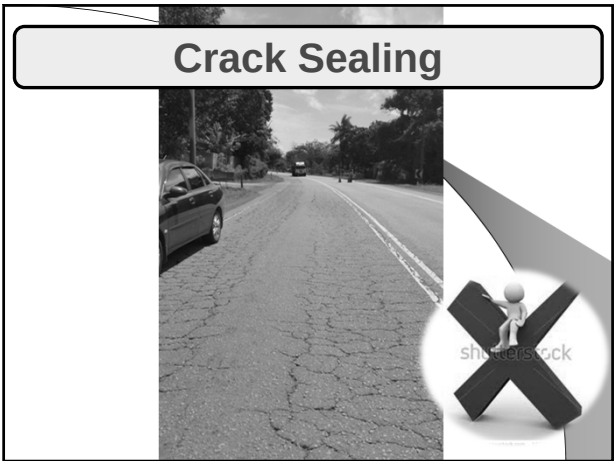


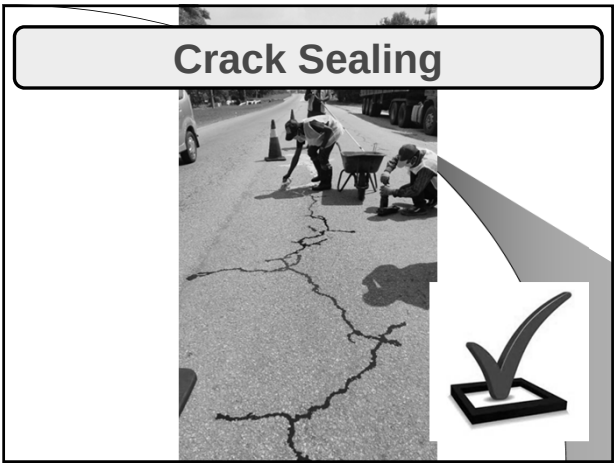




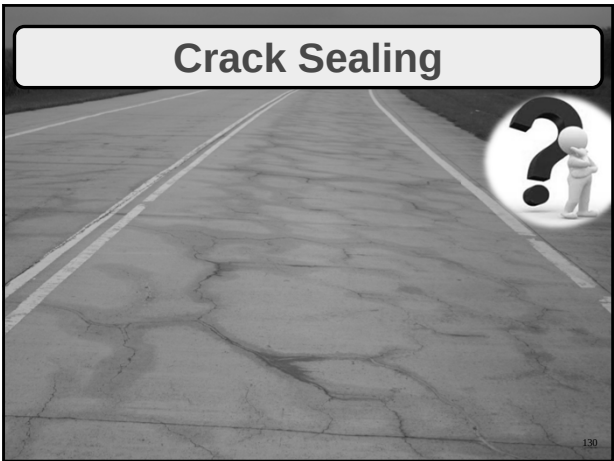






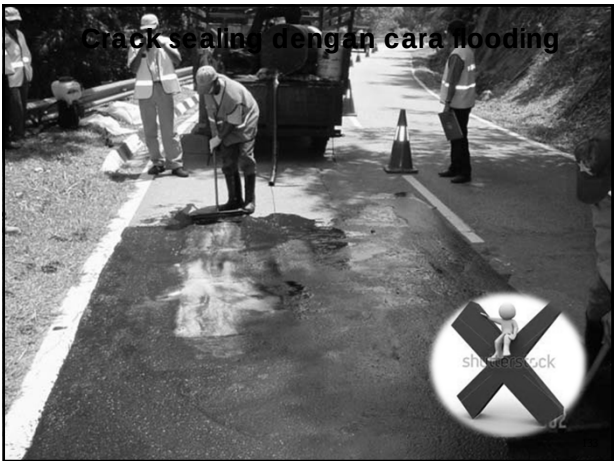


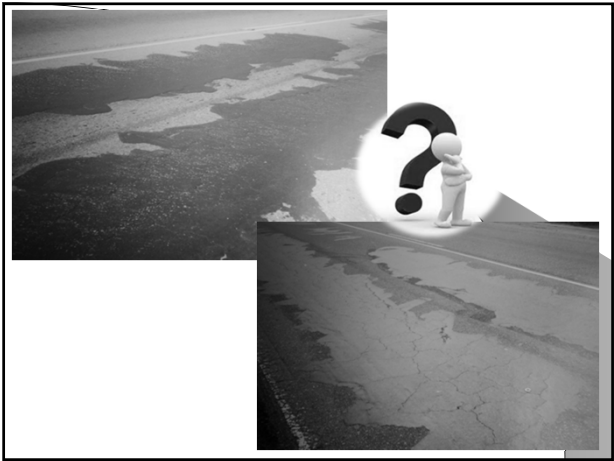


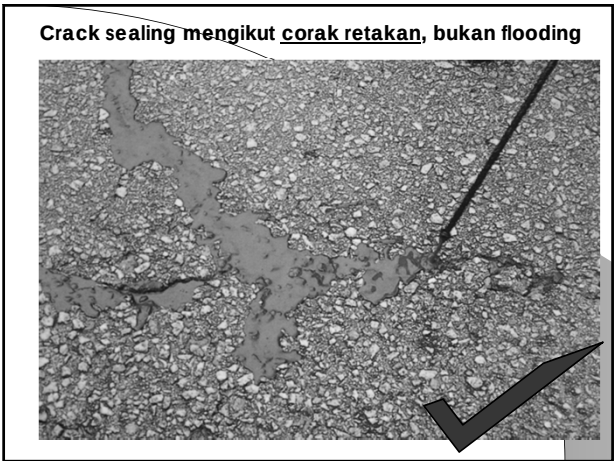




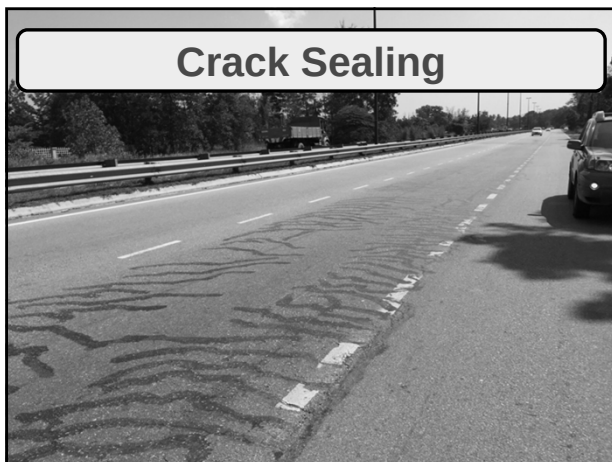


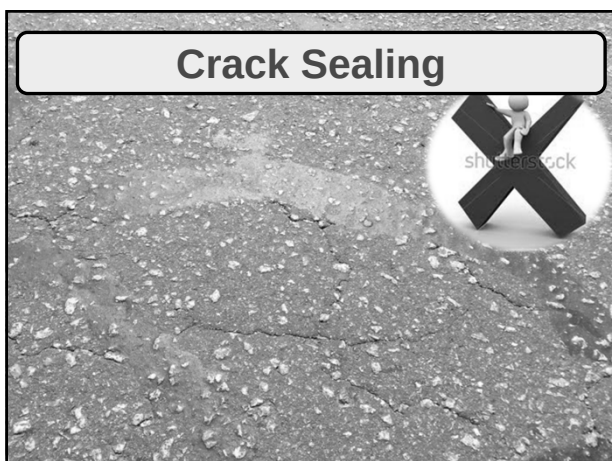


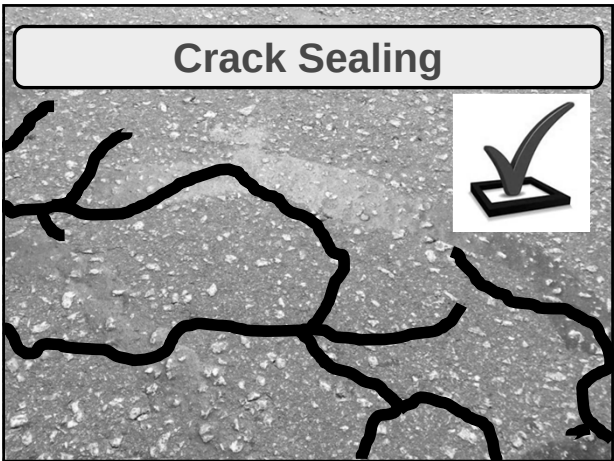


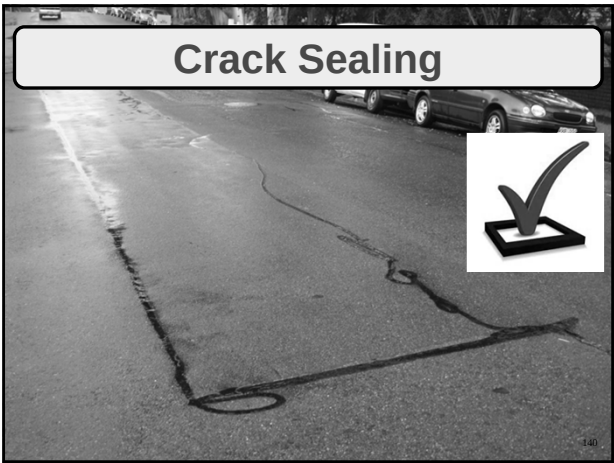


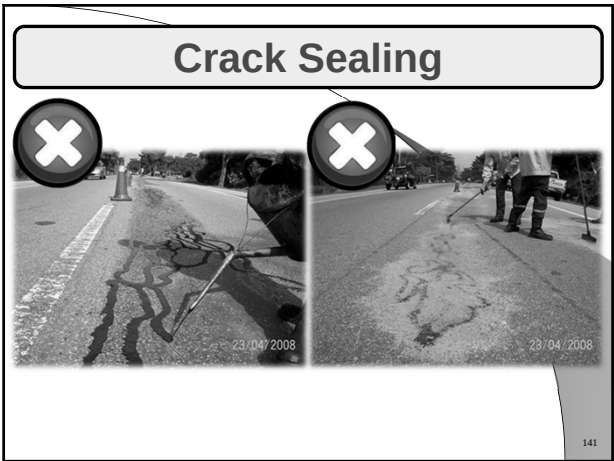












Crack Sealing



Bersih dan keringkan rekahan

Crack Sealing

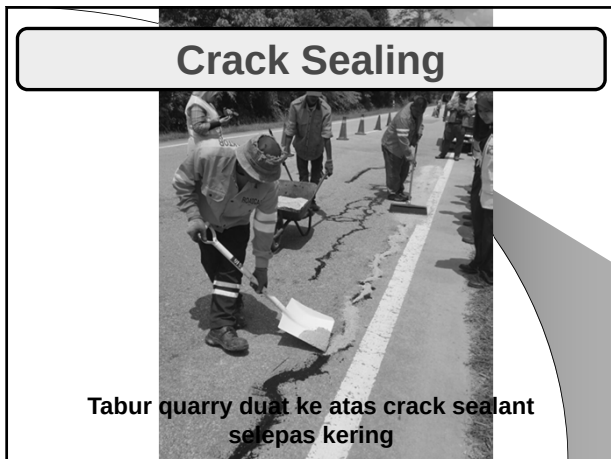


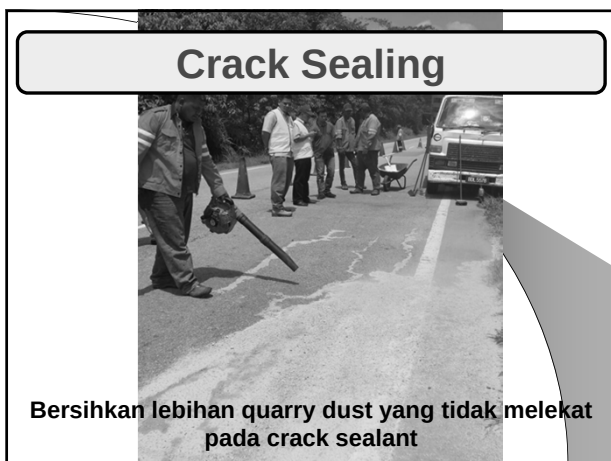
Spray crack sealant ikut urat rekahan

Crack Sealing



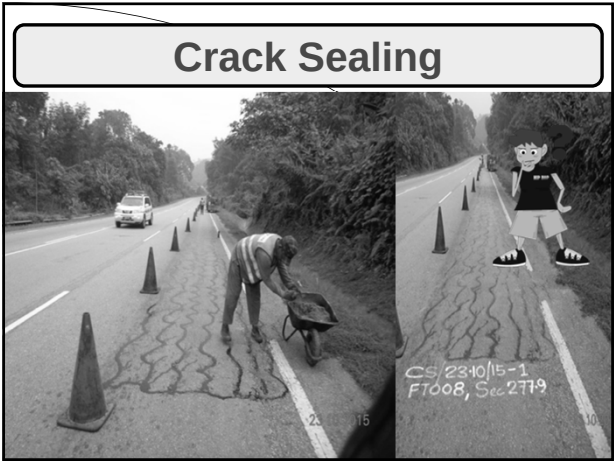
Sapu crack sealant ke dalam rekahan















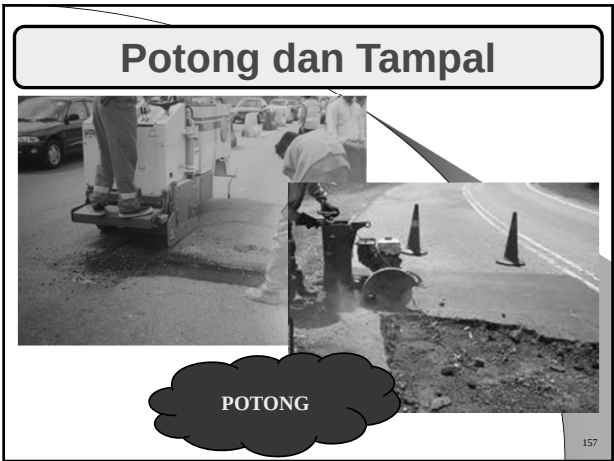












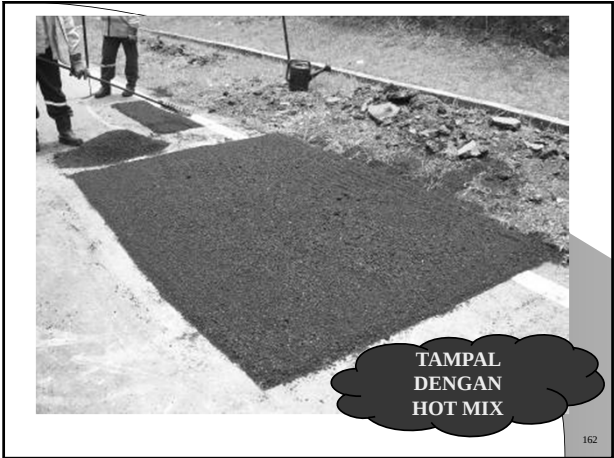




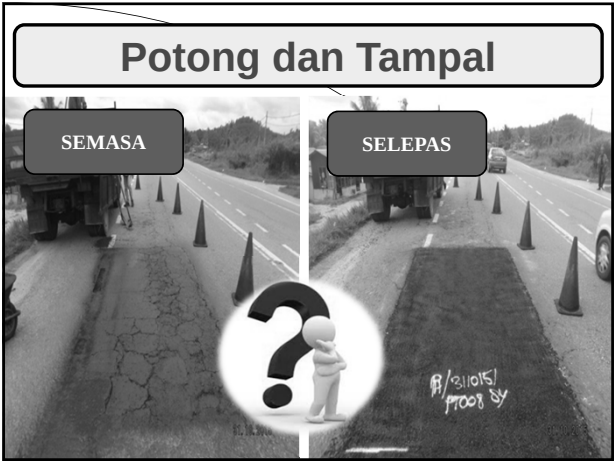


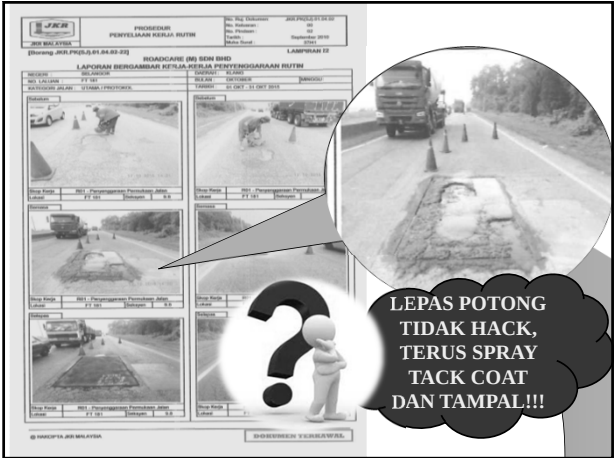
Potong dan Tampal

- Tack coat perlu disapu di bahagian tepi keratan.



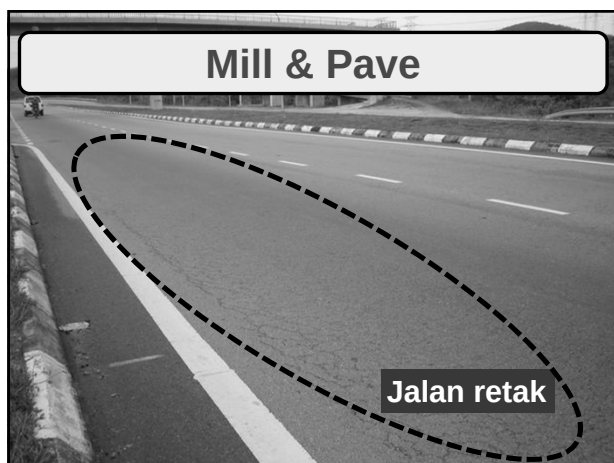


















Bagaimana menentukan kedalaman milling?

- Berdasarkan kepada kedalaman kerosakan.

Permukaan jalan



- Ambil kira kedalaman lapisan permukaan.

60 mm { 50 mm { Wearing course

Bagaimana menentukan kedalaman milling?

- Berdasarkan kepada kedalaman kerosakan.

Permukaan jalan



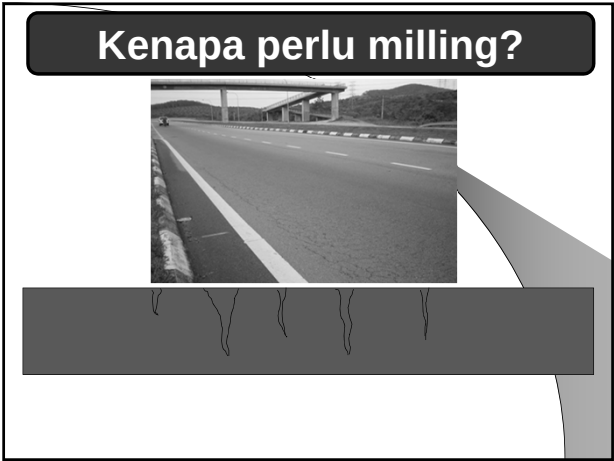
- Ambil kira kedalaman lapisan permukaan.

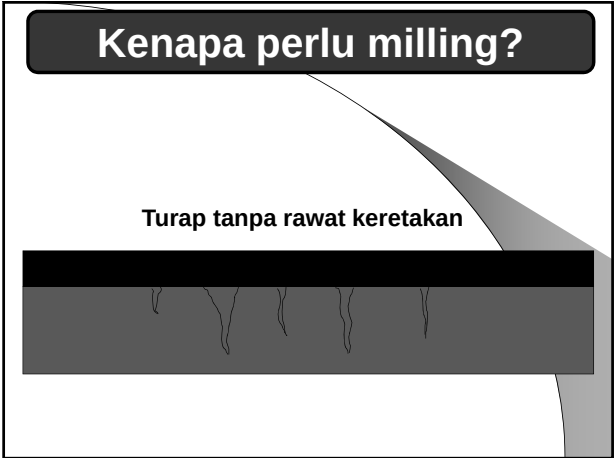
10 mm {  Wearing course

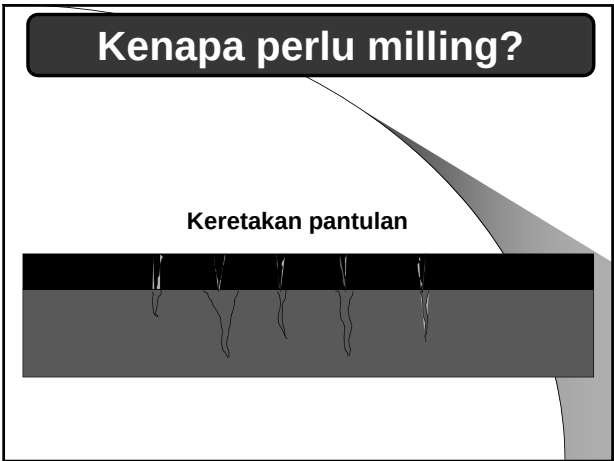
Milling















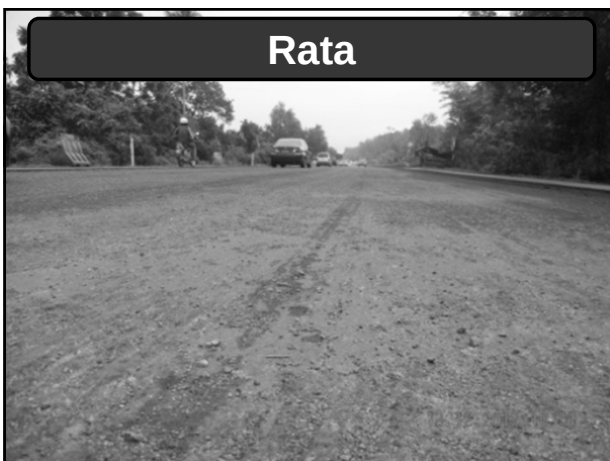




































Berlekuk



Lapisan nipis yang tidak stabil

Lekuk

Lekuk tidak mungkin dapat diisi oleh asphalt semasa penurapan. Asphalt bukan cecair!

Berlekuk



Masalah pemadatan

Lapisan nipis yang tidak stabil

Lekuk

Lekuk tidak mungkin dapat diisi oleh asphalt semasa penurapan. Asphalt bukan cecair!

Berlekuk



Lapisan nipis yang tidak stabil

Lekuk

Lekuk tidak mungkin dapat diisi oleh asphalt semasa penurapan. Asphalt bukan cecair!

Berlekuk

Sampel core



Lekuk tidak mungkin dapat diisi oleh asphalt semasa penurapan. Asphalt bukan cecair!

Serpihan asphalt lama

Serpihan asphalt lama



Serpihan asphalt lama yang tidak dibuang juga boleh menjejaskan keputusan ujian ke atas sampel.

Spray tack coat di permukaan milling.





Rumusan

1. Semasa milling, wearing course lama mesti dibuang semua.
2. Milling depth ditentukan melalui sampel core.
3. Permukaan jalan selepas milling semestinya rata dan tidak berlekuk.
4. Serpihan asphalt lama dan lekuk akan menjejaskan prestasi turapan.
5. Serpihan asphalt lama akan menjejaskan keputusan ujian ke atas sampel core.
6. Habuk milling mesti dibersihkan sebelum sembur tack coat - permukaan milling mesti bersih dan kering.