



Cold in-place recycling (CIPR)
Ringkas



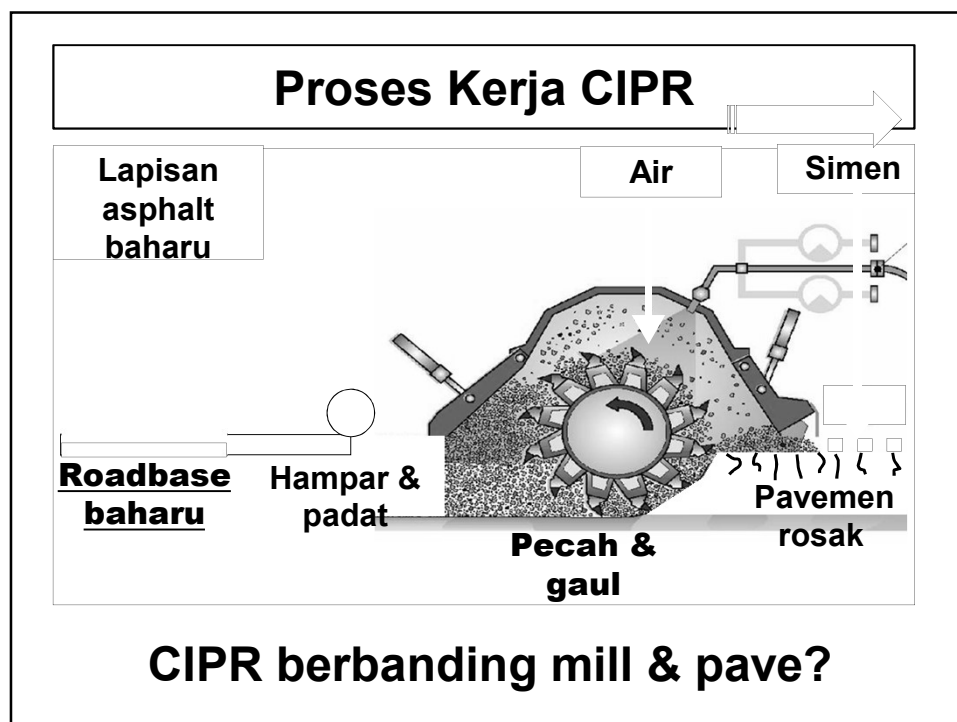
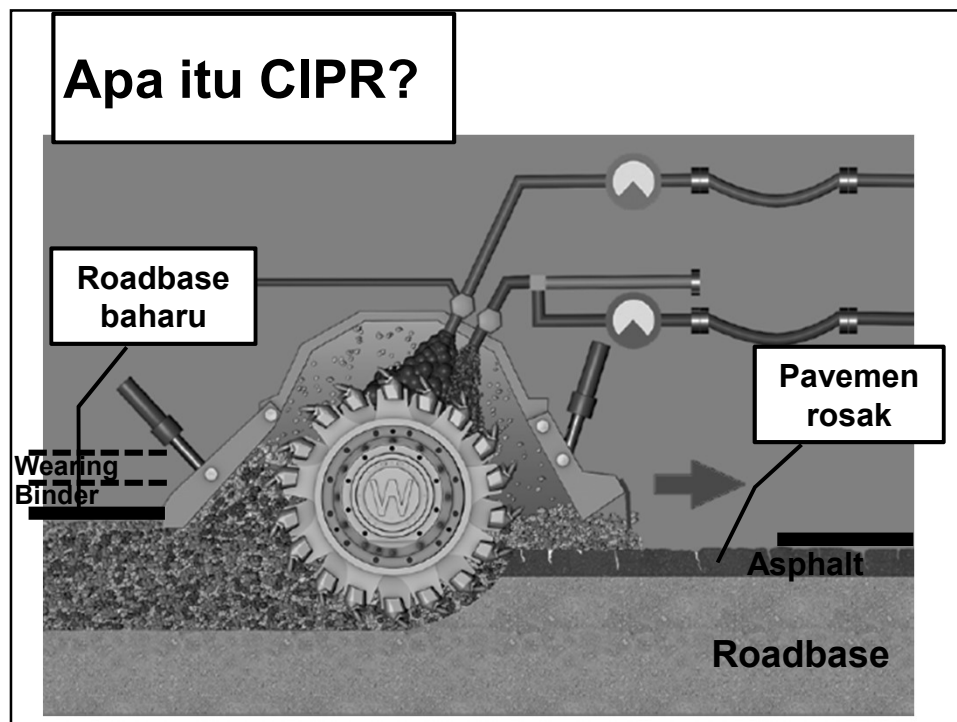
oleh
Ir. Mohd Hizam bin Harun
CREaTE, Alor Gajah, Melaka

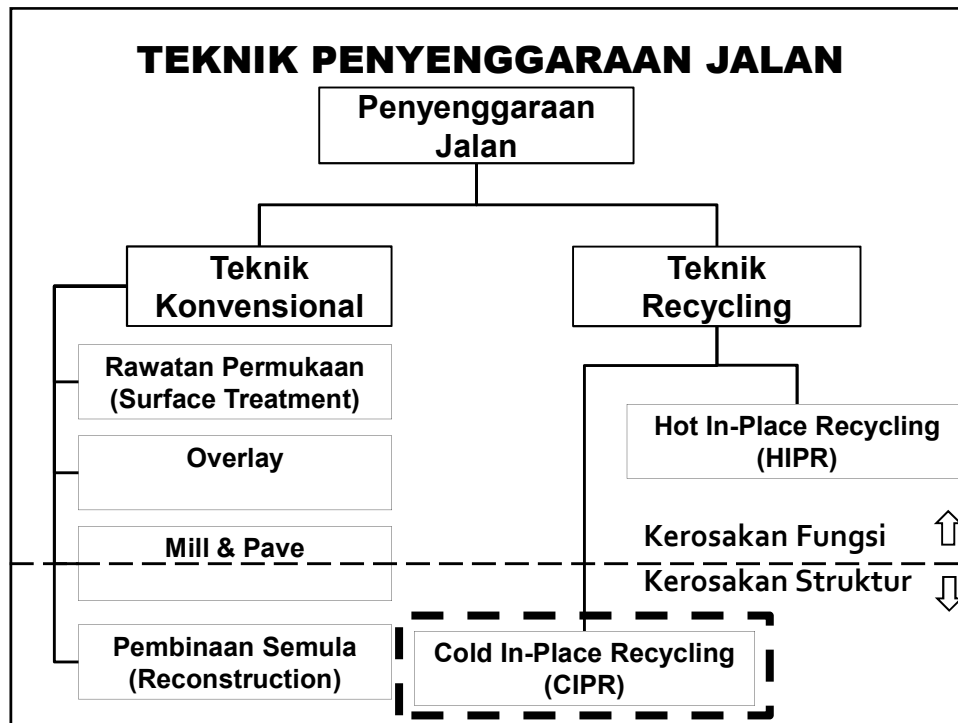
Apa itu CIPR?

Kitar semula lapisan pavemen sedia ada
(biasanya lapisan asphalt dan sebahagian
roadbase),
+ agen penstabil,
dapat lapisan roadbase yang lebih kuat.

Asphalt

Roadbase



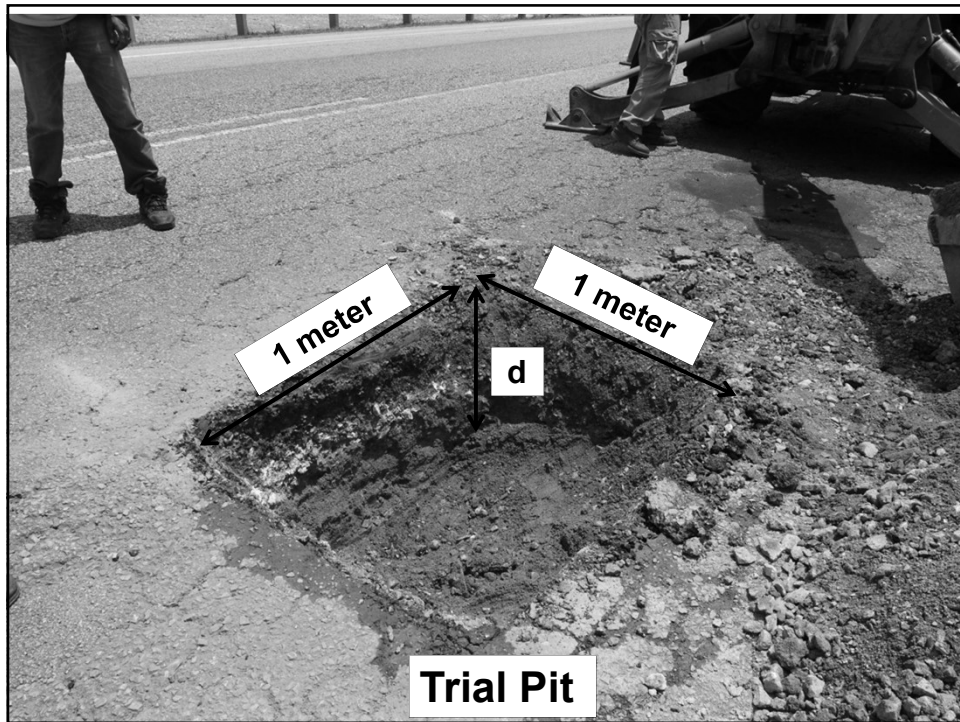


COLD IN-PLACE RECYCLING

Perbandingan Kos

(Mill and Pave)		(CIPR)	
40 mm WC 80 mm BC 80 mm BC Existing roadbase Sub-base	Cost/m² (RM) Milling 160 mm Deep = 21.80 Prime Coat = 1.60 BC 160 mm (Inlay) = 92.60 Tack Coat (2 layers) = 3.00 WC 40 mm (Overlay) = 23.90 Cost per m² = 142.90	50 mm WC 60 mm BC 200 mm recycle Existing roadbase Sub-base	Cost/m² (RM) Recycle 200 mm with 4% Cement = 20.90 Prime Coat = 1.60 BC 60 mm (Overlay) = 34.70 Tack Coat (1 layer) = 1.50 WC 50 mm (Overlay) = 29.90 Cost per m² = 88.60

➔ **38% lebih murah**



	Berapa banyak ambil? Minimum <u>100 kg</u> setiap lapisan.
Reclaimed Asphalt Pavement (RAP)	Roadbase / Crusher Run
	

Trial Pit

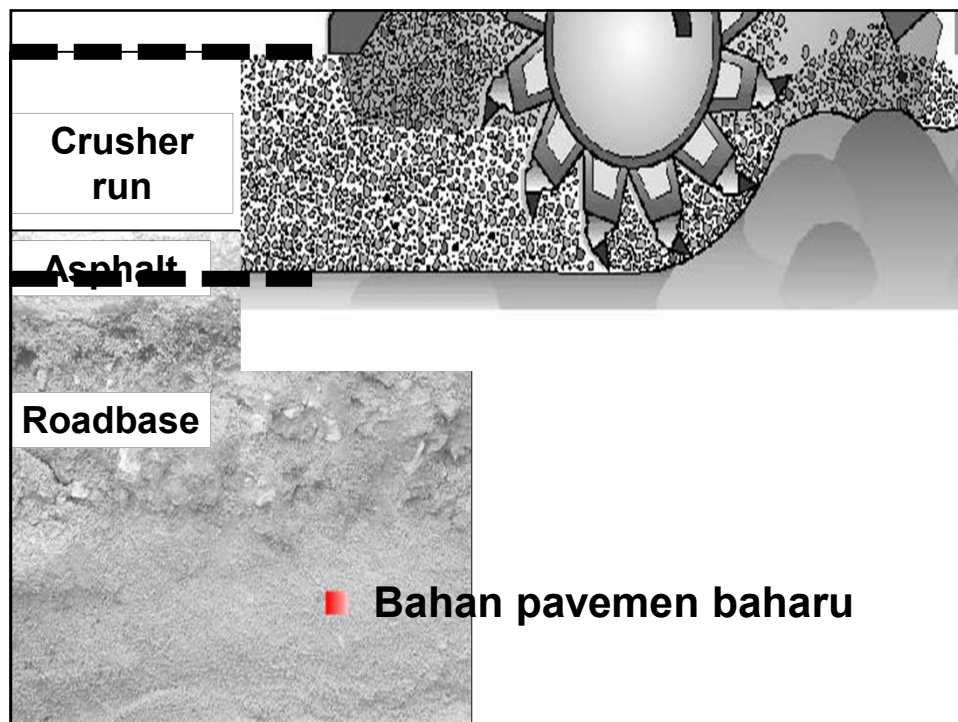
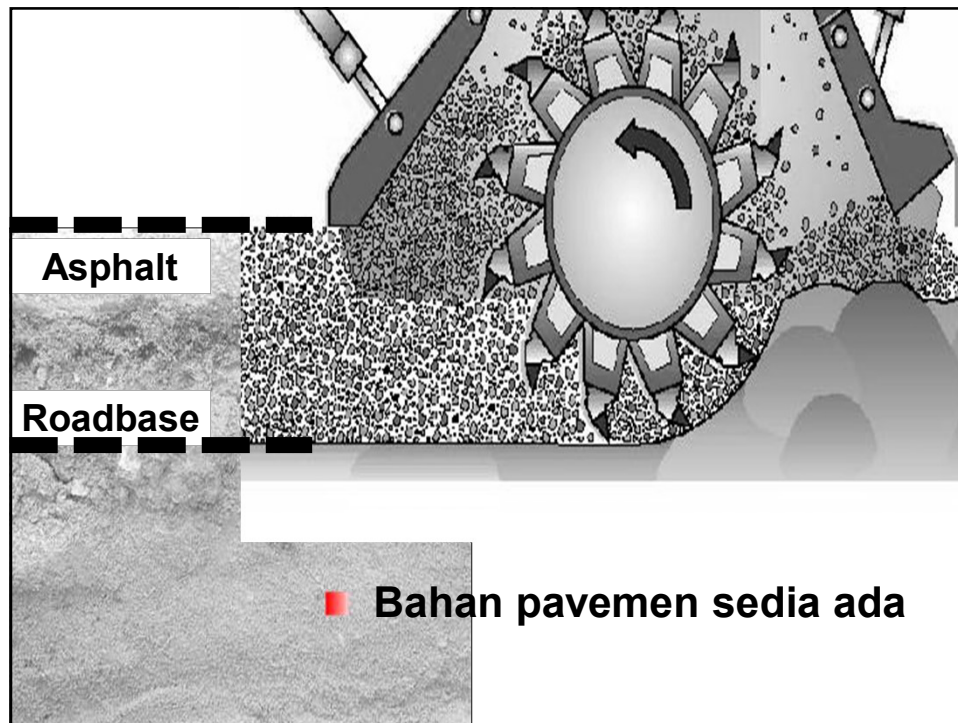
Objektif

- 1. Mengambil sampel asphalt dan roadbase.**
- 2. Menentukan ketebalan lapisan asphalt dan roadbase sedia ada.**
- 3. Menentukan kedalaman lapisan pavemen yang akan dikitar semula.**

Agen Penstabil		
Chemical	 Simen ✓	 Lime
	Bituminous	 Foamed Bitumen

Bila perlu tambah crusher run baru?





Roller



Smooth drum roller.

**Sheepfoot roller:
Ketebalan > 250 mm.**



Rolling Pattern



**Rolling Pattern lazim: 2 static,
6 – 10 vibrate.**

Roller

Berat minimum static roller

Ketebalan lapisan yang dipadatkan	Berat minimum static roller (tonne)
< 150 mm	12
150 mm – 200 mm	15
200 mm – 250 mm	19
> 250 mm	24

Bila perlu padat?

Tempoh maksimum selepas digaul dengan simen = 3 jam



JKR/SPJ/2008
Clause 4.10.5.5 Protection and Maintenance

The Contractor shall protect and maintain the completed layer until the next pavement layer or surfacing is applied.

KERJA CIPR DI TAPAK BINA

No.	AKTIVITI	YA	TIDAK
	1. Sembur tack coat minimum 0.25 liter/m ² sejurus selepas pemadatan.		



Curing

Objektif:

**Mendapatkan kekuatan lapisan CIPR
sebelum binder course diturap.**

Lapisan CIPR

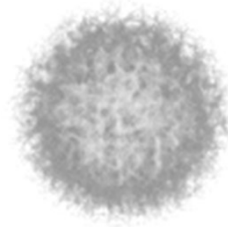
Protection

**Sembur tack coat/sediakan
temporary surfacing.**

Lapisan CIPR

Protection

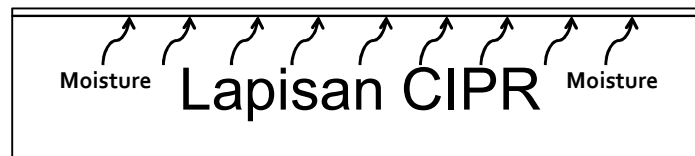
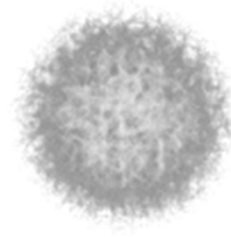
**Elak berlakunya
pengeringan/kehilangan
air dengan cepat.**



Moisture ↗ ↗ ↗ ↗ ↗ ↗ ↗ ↗ ↗ Moisture
Lapisan CIPR

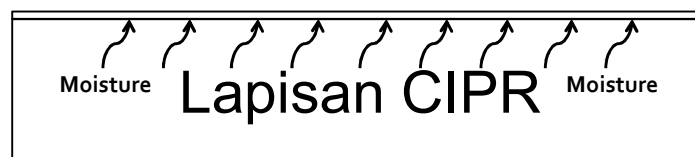
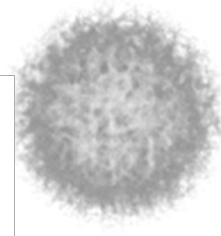
Protection

**Simen memerlukan air
untuk mengeras &
membentuk kekuatan
➔ Proses hidrasi.**



Protection

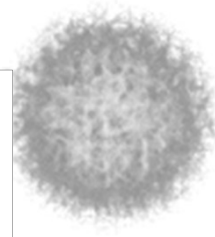
**Shrinkage cracks di
permukaan berlaku apabila
kadar pengeringan melebihi
kadar kekuatan diperolehi.**



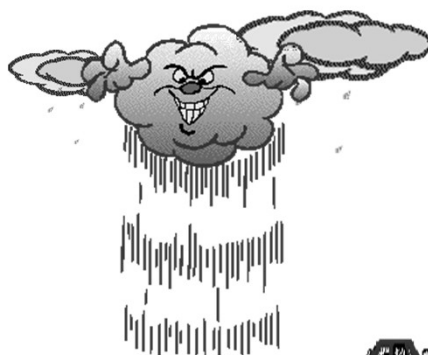
Protection

Permukaan yang kering
apabila dibuka pada trafik
boleh mengakibatkan;

1. Ravelling.
2. Kehilangan kekuatan di bahagian atas permukaan.
3. Pothole terbentuk.



Protection





KERJA CIPR DI TAPAK BINA			
No.	AKTIVITI	YA	TIDAK
	1. Sembur tack coat minimum 0.25 liter/m ² sejurus selepas pemadatan.		
	2. Curing (dibiarkan terdedah kepada persekitaran) minimum 72 jam sebelum binder course diturap serta-merta.		



Kenapa tack coat, bukan prime coat?



Roadbase konvensional



Lapisan CIPR

