Concrete Roads: Why

21st March 2012

OUTLINE

1. Introduction
2. Concrete Roads in Malaysia
3. Why Concrete Roads/Advantages
4. Common Complaints/Disadvantages
5. Recent Breakthrough –10MP
6. Conclusions

1. INTRODUCTION

2 Types of Roads Available in Malaysia

Asphalt/Flexible Roads - 99%

Concrete/Rigid Roads - 1%

Percentage of Concrete Roads Available in Other Countries

Country	% Conc Rd	Country	% Conc Rd
US	15%	Philipines	40%
Germany	28%	Indonesia	10%
Australia	40% (major hwys)	Thailand	10%
China	10%	Myanmar	90%
S. Korea	40%	**Malaysia**	**1%**

INTRODUCTION-WHERE ARE CONCRETE ROADS USED?

- Road Ramps
- Roundabouts
- Heavy Traffic Areas
- Heavy Vehicle Parking Areas
- Toll Booths
- Major Highways (e.g. NKVE)
- …. heaviest traffic area.
- …. road repair/disruption is not an option.
- …. overloading
- …. flooding
- …. RURAL ROADS where it is difficult to repair

2. CONCRETE ROADS IN MALAYSIA

	Description	Year	Type	Lgh km	Thkmm
1	Jalan Seratus Tahun, Olak Lempit, Sgor	1986	JRCP	1.8	150
2	Muda Irrigation Scheme, Kedah	1988	JRCP	n/a	n/a
3	N-S Expressway, Gurun, Kedah	1988	JRCP	n/a	n/a
4	N-S Expressway, Ayer Keroh-Pagoh	1989	CRCP	19.0	230
5	North Klang Valley Expressway, Sgor	1990	CRCP	n/a	260
6	North South, Rawang -Tanjong Malim	1990	CRCP	n/a	230
7	Teluk Datai Road, P. Langkawi, Kedah	1992	n/a	n/a	n/a
8	Federal Route 5, Sitiawan1998, Perak	1998	JRCP	n/a	n/a
9	Kulim Industrial Area, Kulim, Kedah	2003	PCP	3.2	220
10	Kaki Bukit – Wang Kelian, Kedah	2006	PCP	1.6	220
11	Ulu Pauh – Chuping, Perlis	2006	PCP	6.4	230
12	Ringlet- Kg. Susu, Pahang	2009	JRCP	5.5	220
*	NSE(Total= 846 km) 743km (88%) asphalt, 104km (12%) concrete				

OLAK LEMPIT, BANTING, SELANGOR AKA JALAN SERATUS TAHUN

- Year 1986
- 1 Lane Single Carriageway
- Total Length: 1.8km
- Width: 3.66m
- Type: JRCP
- Thickness: 220mm
- Joints @ 5m c/c
- LMC: 150mm
- **Success-no repair since construction!**
- **(>25 years)**

CONCRETE ROADS IN MALAYSIA
KULIM ACCESS ROAD, KEDAH

- Year 2001-2003
- 2 Lane Single Carriageway
- Total Length: 3.2km
- Width: 3.5m +3m
- Type: PCP
- Thickness: 220mm
- Joints @ 5m c/c
- Grade 40PQC
- LMC: 150mm

Success-no repair since construction!

(>8 years)

"..I'm very happy with the performance of the Kulim road"
Ir. Dr. Azmi Hassan, Director of Highways MOW

KAKI BUKIT –WANG KELIAN, PERLIS

- Year 2006
- 2 Lane Single Carriageway
- Total Length: 1.6km
- Width: 3.5m +2m
- Type: PCP
- Thickness: 220mm
- Joints @ 5m c/c
- Grade 40PQC
- LMC: 150mm
- **Success-no repair since construction!**
- **(>6 years)**

ULU PAUH-CHUPING, PERLIS

- Year 2006
- 2 Lane Single Carriageway
- Total Length: 6.4km
- Width: 3.5m +3m
- Type: PCP
- Thickness: 230mm
- Joints @ 4.5m c/c
- Grade 40PQC
- LMC: 150mm
- Failure: Blacktopped

RINGLET, CAMERON HIGHLANDS, PAHANG

- Year 2010
- 2 Lane Single Carriageway
- Total Length: 5.5km
- Width: 3.5m +2m
- Type: JRCP
- Thickness: 220mm
- Joints @ 10m c/c
- Grade 30PQC
- LMC: 160mm
- Failure: Blacktopped

NORTH KLANG VALLEY EXPRESSWAY (NKVE)

- Year 1990
- 2 lane 3 carriage way
- Total Length: 50km
- Width: 3.5m +2m
- Type: CRCP (0.7% steel)
- Thickness: 260mm
- No Joints
- Grade 40PQC
- LMC: 150mm
- Success-no repair since construction!* (>20 years)

* Some repair due to ground settlement, not performance

NORTH SOUTH EXPRESSWAY

- Year 1988
- 2 lane 3 carriage way
- Total Length: 186km
- Width: 3.5m +2m
- Type: CRCP (0.7% steel)
- Thickness: 230mm
- No Joints
- Grade 40PQC
- LMC: 150mm
- Success-no repair since construction!*

  (>23 years)

* 75km blacktopped for 3rd lane widening

"North South Expressway is Malaysia's national asset" … Geoff Ayton, RTA, Australia.

3. WHY CONCRETE ROAD/ADVANTAGES

1. Low maintenance
2. Ability to Handle Increased Traffic and Loading
3. New Niche Industry
4. Save on Foreign Exchange
5. Avoid Dependence on Fluctuating and Rising Oil Prices
6. Use of Local Products/Assurance of Cement Supply
7. Safety
8. Greater Visibility at Night/Less Energy Usage
9. Fuel Savings
10. Less CO2 Emission
11. Savings on Raw Material Usage
12. Green Technology
13. No Disruption

LOW MAINTENANCE

- Little or no maintenance on Kulim Access Road since
- construction in 2003.
- We expect it to perform well for 40 years.

ABILITY TO HANDLE "ILLEGAL" INCREASED LOADING/OVERLOADING

NEW NICHE INDUSTRY

- Concrete Roads as an Alternative to Asphalt. Keep both industries competitive, healthy, alive and not have a monopoly.
- Export concrete road construction expertise overseas. IJM and Gamuda has already constructed concrete roads overseas.
- To be the Leader for Concrete Road Construction in ASEAN.

SAVE ON FOREIGN EXCHANGE

- Cement is 95% local (5% foreign content)
- Bitumen is 0% local (100% foreign content)

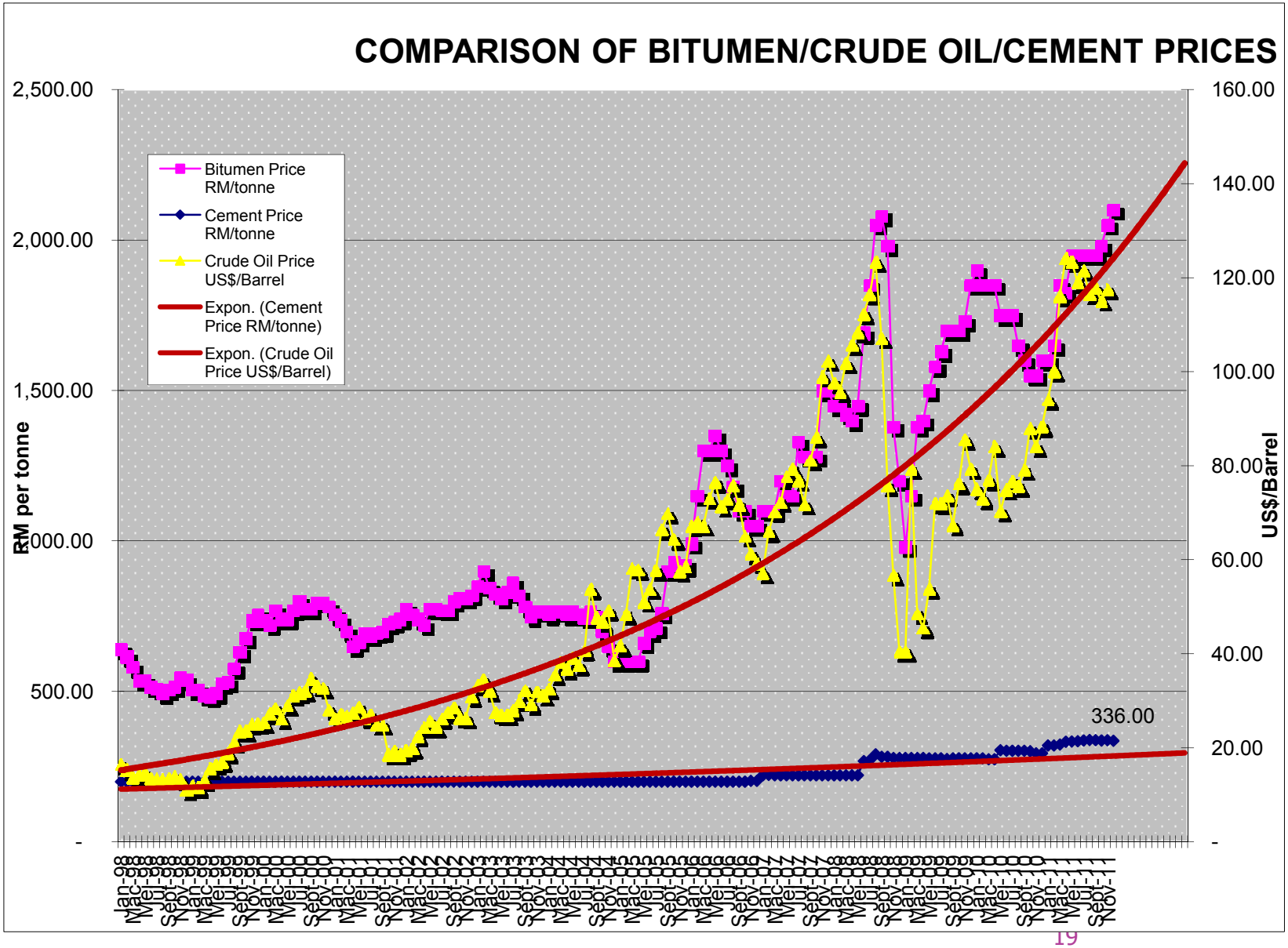
We are losing out on foreign exchange!
Better Balance of Trade by using local products

AVOID DEPENDANCE ON FLUCTUATING/RISING OIL PRICES

- Oil is a non-renewable energy.
- Bitumen prices fluctuates. Cost of Bitumen will only go up in future.
- Contractors refused to start work when bitumen price shot up in 2008.

Year	Bitumen Price, RM/ton
Jan 1990	387.50
Jan 1995	418.00
Jan 2000	735.00
Jan 2005	610.00
Jan 2006	990.00
Jan 2007	1,100.00
Jan 2008	1,459.00
Jan 2009	980.00
Jan 2010	1,900.00
Jan 2011	1,600.00
Apr. 2011	1,826.00

FLUCTUATING/RISING OIL PRICES



USE OF LOCAL PRODUCTS

- **Government Circular 7/2002**

" Bahan/barangan/perkhidmatan tempatan hendaklah digunakan sepenuhnya oleh agensi dalam perolehan masing masing"

Tindakan sewajarnya akan diambil keatas agensi yang gagal mematuhi peraturan diatas. Perunding akan disenaraihitam…

ASSURANCE OF CEMENT SUPPLY

Cement Supply and Demand in Malaysia, Year 2010

Unit: Million tonnes

	Actual
	2010
Cement Capacity	28.89
Cement Consumption	16.62
Excess Capacity	12.27
Cement Utilisation Ratio	58%

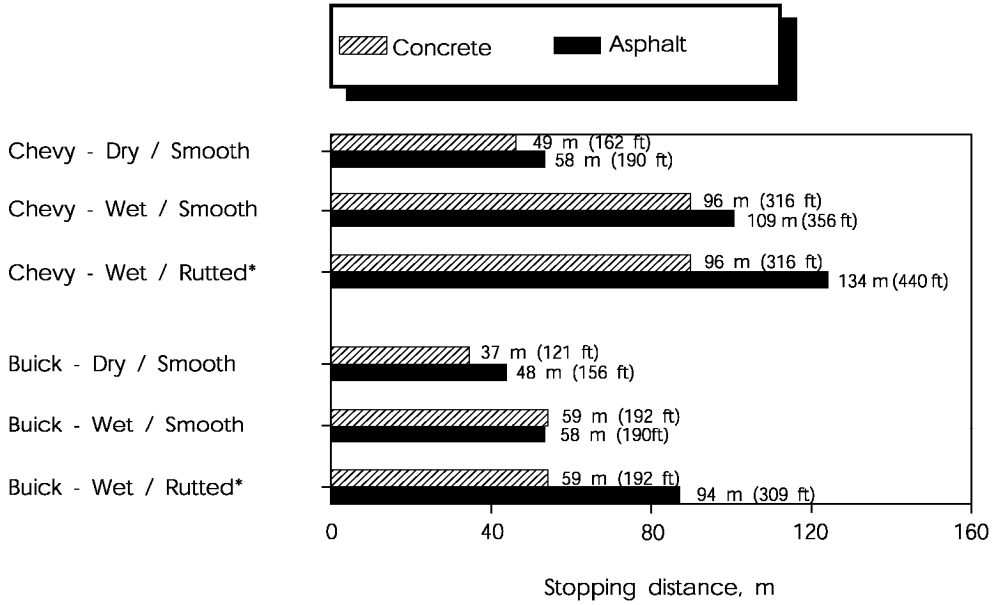
SAFETY

C&CA

Safer Stopping on Concrete

- Stopping distances for concrete surfaces are much shorter than for asphalt surfaces

  Especially when asphalt is wet and rutted



*Concrete does not rut

MORE VISIBLE AT NIGHT

Safer Driving on Concrete

Concrete

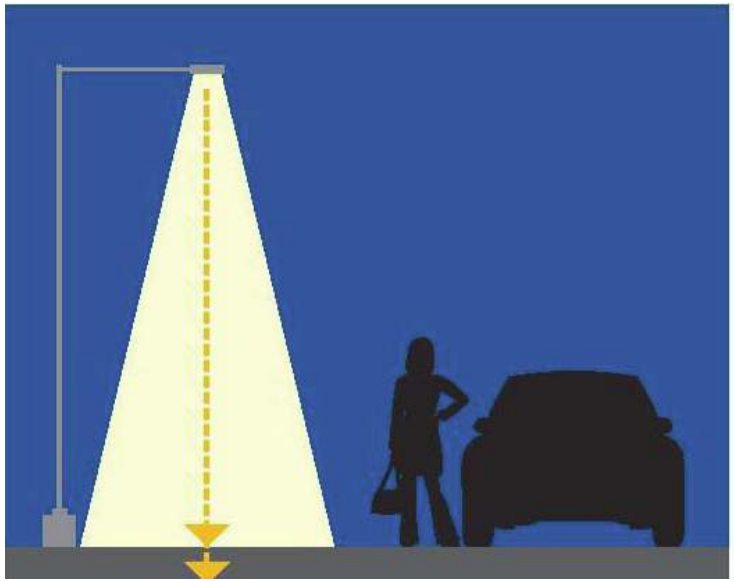
- Increased visibility:
  4 X Surface Reflectivity

Safety for both
Pedestrians and
Vehicles

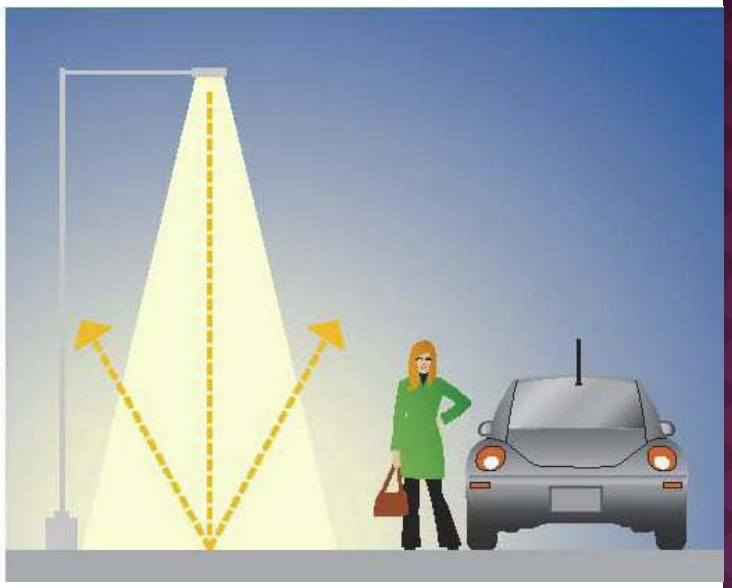
Asphalt

GREATER VISIBILITY AT NIGHT

Asphalt Road Lighting



Concrete Road Lighting



Safer for pedestrians, carpark and road user

FUEL SAVINGS/LESS CO_2

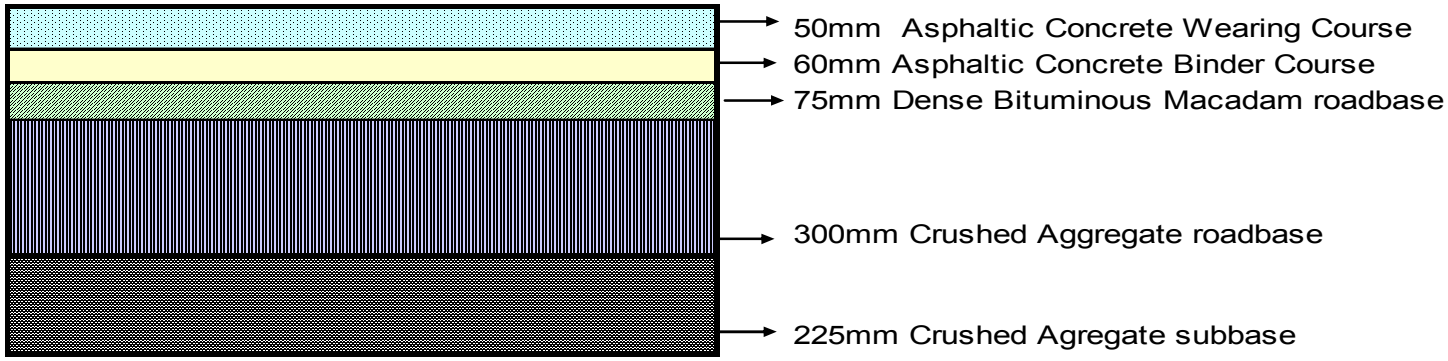
- **1-7% Fuel Savings (heavy vehicles) less "rolling resistance"**

"If 60% of the US National Highway System were converted to concrete pavements, the annual savings in diesel is about US$8.2 billion/year"
(G. Voigt, ACPA's testimony in US Congress).

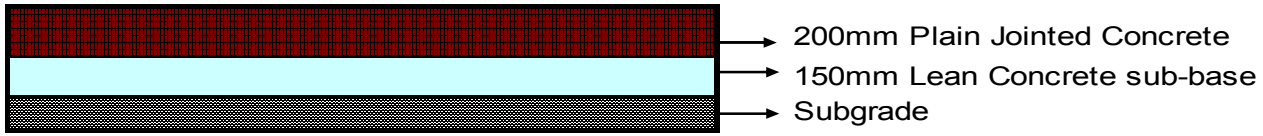
- **Less consumption of fossil fuel (non-renewable energy)**
- **Less emission of CO_2**
- **Consumes 5X less diesel to construct (thinner)** see next slide

SAVINGS ON RAW MATERIALS USAGE

- **Consumes 5X less diesel to construct.**



Cross-Section Detail - Asphaltic Concrete Pavement



Cross-Section Detail - Plain Concrete Pavement

GREEN TECHNOLOGY

- **Reuse Waste Material :** Pulverised Fly Ash (PFA), Ground Granulated Blastfurnace Slag (GGBS).

- **PFA and GGBS are cement replacement materials - reduce cement usage**

- **PFA used in concrete roads**
- **Note: 1ton cement ≈1 ton CO_2 emission**

LESS DISRUPTION (TO OWNERS AND USERS)

- Once project completed, road builders want to move on to new roads.

- Complaints by road users during road repairs – TRAFFIC JAMS
- More Road Accidents during repairs

- Antwerp's major roundabout repair scenario:
  1 time inconvenience = 40 years of convenience

- CONCRETE ROADS = LESS/NO MAINTENANCE

- end

4. COMMON COMPLAINTS

A. Higher Initial Cost
B. Difficult and more expensive to repair
C. Noise
D. Wear out Tyres
E. Slipform Machines not available
F. No Trained Crew

A. HIGHER INITIAL COST

- **Initial Cost (Construction Cost)**
  - Acquisition
  - Concept Planning
  - Preliminary Design
  - Detail Design
  - Construction Cost

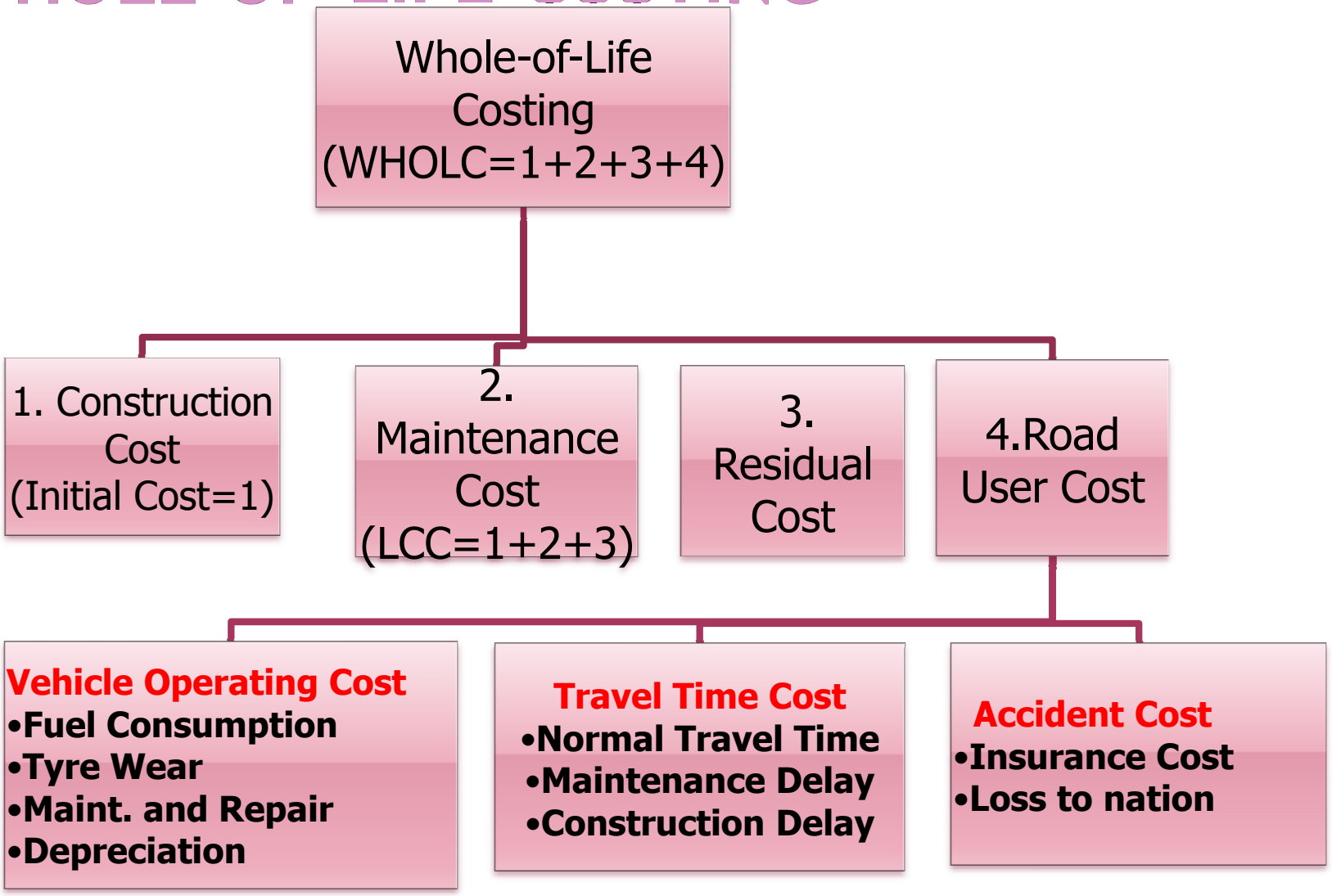
- **Life Cycle Cost (LCC)**
  - Initial Cost +Use & Maintain Cost + Disposal/Residual

- **Whole of Life Costing (WHOLC)**
  - WHOLC = LCC + Road User Cost

PRICE COMPARISON- INITIAL COST
CONCRETE VS. ASPHALT (MALAYSIAN RATES)

	Pavement Type	Initial Cost RM/m²	Vs. Asph. RM/m²	Vs. Asph. %
1	PCP -Truss Screed - No Dowels	95.85	8.5	9
2	PCP -Truss Screed – Dowelled	111.23	23.88	27
3	PCP -Slipform Paver - No Dowels	96.81	9.46	10
4	PCP - Slipform Paver - Dowelled	112.20	24.85	28
5	CRCP - Slipform pavers (PCP +RM48)	144.81	57.46	65
6	**Asphalt Road (Typical)**	**87.35**		

WHOLE-OF-LIFE-COSTING



WHOLE OF LIFE COSTING

- Source: Queensland Dept. of Main Roads

Item	Pavement Type	Initial Cost A$/m^2	WHOLC A$/m$^{2}
A	**Granular Overlay + AC**	**57.13**	**117.87**
B	**AC + CTB**	**66.31**	**120.52**
C	**Full Depth AC**	**95.81**	**148.02**
D	**PCP**	**65.46**	**77.15**
E	**CRCP**	**77.51**	**82.59**

WHOLE-OF-LIFE-COSTING

Australian Experience (Queensland report)

- **PCP < 2/3 cost of cheapest Asphalt**
- **PCP becomes the MOST POPULAR CHOICE of pavement for NEW ROADS IN AUSTRALIA**

DIFFICULT & MORE EXPENSIVE TO REPAIR

- Concrete roads if constructed well, no major repair is needed for 40 years.
- If repair is needed, it is similar to normal concrete repair

NOISE

- **Whisper (Exposed) Concrete – e.g.Belgium and Holland**
- **US research on Grinding and Grooving technology.**

WEAR OUT TYRES

- Safety or Cost of Tyres?
- Concrete road is rougher – more friction and stops vehicle better (shorter stopping distance)
- Better skid resistance

- Think Safety!

SLIPFORM MACHINES NOT AVAILABLE

Slipform Machines in Asia

Country	Slipform Machines
China	80
India	40
Korea	85
Japan	15
Philipines	40
Indonesia	20
Thailand	15
Vietnam	12
Myanmar	15
Malaysia (1990)	9
Malaysia (2011)	0

SLIPFORM MACHINES

(CLOCKWISE RIGHT: CHINA, INDIA, USA)

NO TRAINED CREW

- No new Projects
- No Continuity
- NSE (1988), NKVE (1990) , KLIA (1990) crew GONE
- CIDB to train and certify pavement workers
- Engage Airport Concrete Pavement (KLIA2?) or flatfloor specialist contractors as Temporary Measure

- end

5. RECENTY BREAKTHROUGH-10 MP- 5% CONCRETE ROADS

DEPUTY WORKS MINISTER, DATUK YONG

Copy to: Gm / mDm / Mdm Grace (C&CA)

18 Wednesday, July 21, 2010 HOME

Cement concrete method to be used in making new roads

PARLIAMENT

KUALA LUMPUR: At least five per cent of the construction of new roads under the 10th Malaysia Plan (10MP) would use the cement concrete paving method, said Deputy Works Minister Datuk Yong Khoon Seng.

He said the method had many advantages, as compared to the broad usage of the asphalt premix paving method currently, especially in terms of lifespan and road quality.

"It has also been proven capable of enhancing the quality of road surface as the density of cement concrete pavement is higher than that of asphalt pavement," he said in reply to Senator Zainun A Bakar during question time at the Dewan Negara sitting yesterday.

Zainun wanted to know whether the government was planning to use cement concrete paving method in the construction of roads under the 10MP.

Yong said the cost of using cement concrete paving method, however, was about 20 to 50 per cent higher than the conventional asphalt paving method.

Nevertheless, he said, the use of the cement concrete paving method would help the government reduce expenditure in terms of road maintenance, in the long run.

He said the ministry was in the midst of identifying suitable locations for the construction of new roads using the new method under the 10MP. — Bernama

Datuk Yong Khoon Seng

10 MP- 5% CONCRETE ROADS
MINISTER OF WORKS, DATUK SHAZIMAN

- Item 39 of keynote address delivered by Dato' Shaziman during the 8th Malaysia Road Conference, Oct. 2010

- "The Government has also approved 5% of new roads in the 10th Malaysian Plan to be constructed using cement concrete".

10 MP, NEW CONCRETE ROADS

New Roads	length, km	5% Conc, km
Sarawak	2,819	141
Sabah	2,540	127
Peninsular	6,312	316
Total	11,671	584

6. CONCLUSIONS

- Think Low Maintenance and WHOLC
- Think New Niche Industry : Alternative Competitor to Asphalt
- Think Safety

- Advantages of Concrete Road are numerous
- Common complaints/disadvantages of concrete road can be dispelled.

- Policy for 5% of roads in 10MP to be concrete roads

THANK YOU