Structural Integrity and Long-Term Performance of Permeable Pavements

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Presentation overview

• Background of permeable pavements

• Structural integrity of permeable pavements – Catherine Yung

• Long-term performance of permeable pavements – Sachi Kodippily
Why do we need permeable pavements?

- Reduces impact on the environment
- Controls water quantity
- Improves water quality
- Preservation of the hydrological cycle
Project objectives

- To investigate the permeable pavement design and its function
- To identify the limitations which affects the functionality of the permeable pavement
- Test to see if CIRCLY can be used to analyse this pavement
- To investigate the behaviour of permeable pavement in terms of its structural defects
- To analyse the life cycle costs of permeable pavements
What is a permeable pavement?
The functioning of layers in permeable pavement

Figure 2: Cross section of the North Shore permeable pavement
Some limitations of permeable pavements

- Land topography;
- Subgrade;
- Type of land use; and
- Geological stability.
Deflection measurements gave expected results.

Wheel Path Deflection

Geogrid Installation

Chainage of Permeable Pavement (m)

Deflection (mm)
Conventional pavement vs permeable pavement

A Comparison of the Deflection Bowl between the Permeable Pavement and the Conventional Pavement

Distance from Geophone (m)

Deflection (mm)

Permeable Pavement

Conventional Pavement
DO NOT use CIRCLY for analysing permeable pavement

Life Expectancy:

CIRCLY: 3.5 years
LOCKPAVE: 14 years.
Rut testing on the permeable pavement

Figure 3: Pavement rutting measured with a 2-m straight edge

Figure 4: Rut measurements taken at 2-m intervals along the pavement
Progression of rutting on the permeable pavement

Progression of rutting on the permeable pavement over time

Initial densification

Stable rut progression
Higher rut depths and a longer design life can be expected

- Predicted life – 40 years
- Actual design life – 15 – 20 years
- Maximum acceptable rut depths:
  - 25 mm – Service limit
  - 35 mm – Structural limit
Permeable pavement ARE more expensive

Life cycle cost comparison between a permeable pavement and an asphalt concrete pavement

- Permeable Pavement: $0.84 M, $1.69 M, $2.75 M
- Asphalt Pavement: $1.13 M

Cost ($ Millions) vs. Years
But what are the benefits?

• Environmental benefits:
  – Reduced sediments
  – Reduced contaminants in the runoff – Zinc, Copper, Lead

• Economic benefits:
  – Lower need for stormwater pipe networks
In summary

• Permeable pavement can be use as an alternative form of pavement
• The stiffness of the pavement increases with time
• This pavement can tolerate much higher deflection compare to the conventional pavement
• CIRCLY is not a suitable tool to analyse permeable pavements
• Actual pavement performance to date has been very well
• Overall life cycle costs of permeable pavements are significantly higher compared to asphalt pavements
• Expected environmental and economic benefits - unknown
Recommendations

• More analysis of the ground condition and the behaviour of the permeable pavement is still required

• Ongoing pavement monitoring is needed for more accurate pavement performance levels

• Economic and environmental benefits achieved in the long term are still to be quantified
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Thank You

Questions?