Department of Transport and Main Roads

2021 Engineering, Innovation, and Technology Forum

Sustainability Assessment Tool (SAT)

A tool for economic and sustainability win-wins

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Queensland Government

Agenda

1. Background
2. Tool development
3. Function and benefits
4. Implementation

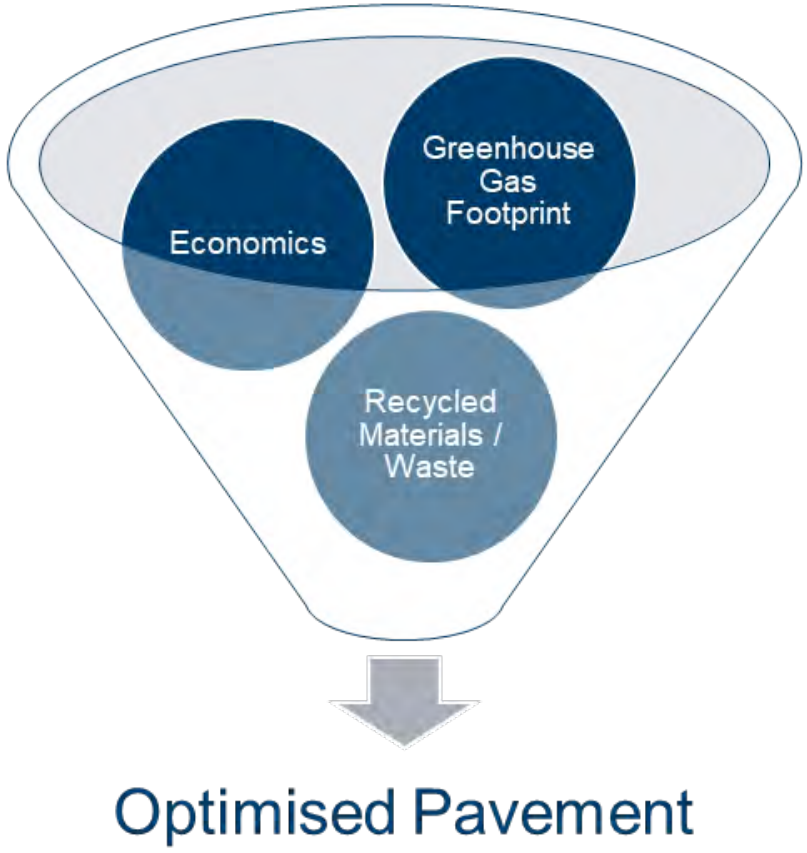
An initiative of Main Roads Western Australia and ARRB.

An initiative of the Queensland Department of Transport and Main Roads and ARRB.

SAT background

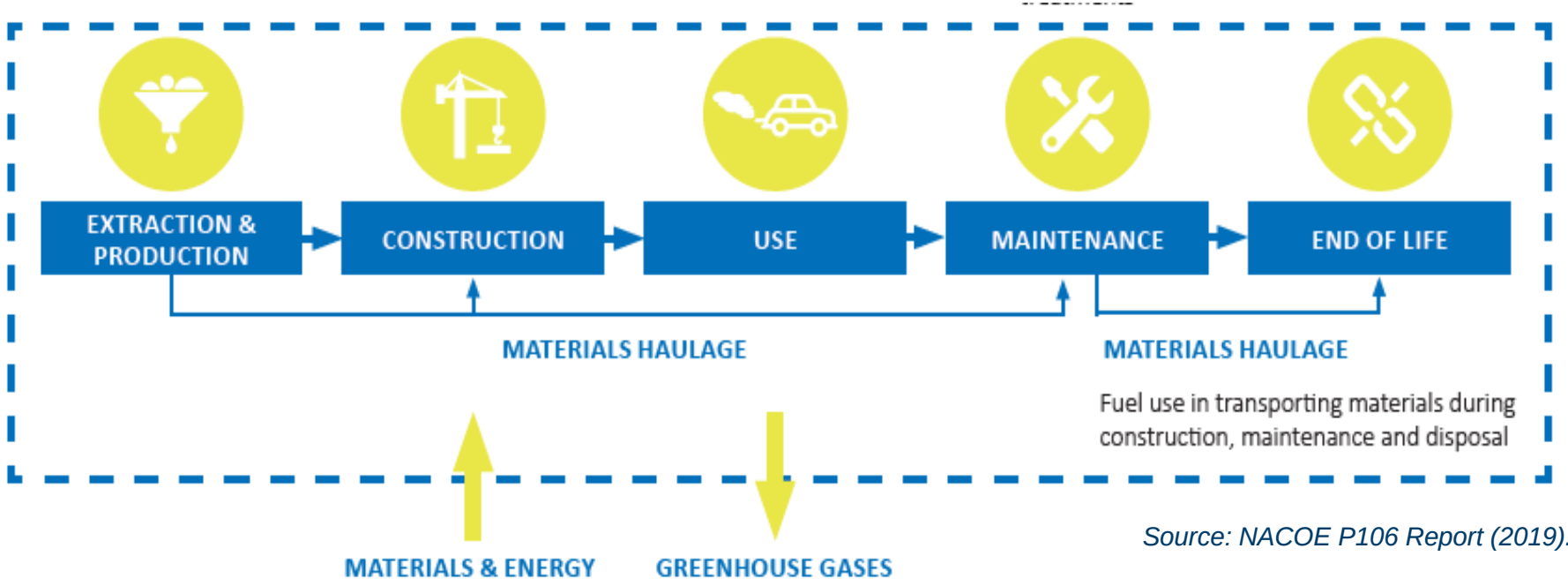
Pavement innovations

- The National Asset Centre of Excellence (NACOE) has delivered a number of innovations in pavement materials and technologies
- Poor uptake across Queensland
- Initial research project indicated pavement innovations provide both economic and environmental wins
- Sustainability could be one driver to increase uptake.



SAT development

- NACOE – WARRIP Partnership
- Aim: A user-friendly tool that enables a comparative assessment of traditional and innovative pavement designs in terms of lifecycle greenhouse gas emissions and economics.

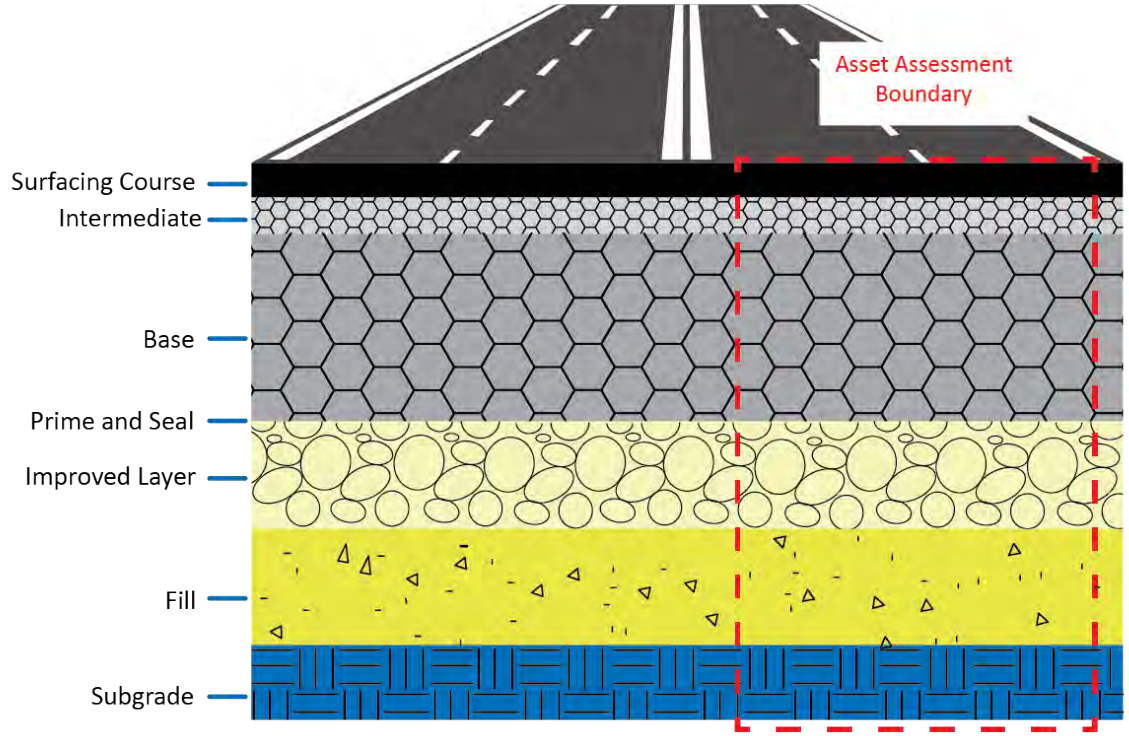


Source: NACOE P106 Report (2019).

Sustainability assessment tool development

Tool components:

1. Build your own pavement layer by layer using constituent materials, and/or products
2. Construction methodology
3. Transport requirements
4. Maintenance regime and methodology
5. End of life
6. Use phase
   a) traffic volumes and composition
   b) geometry of road.



Source: AARB Figure. From NACOE page 117 project.

SAT capabilities and benefits

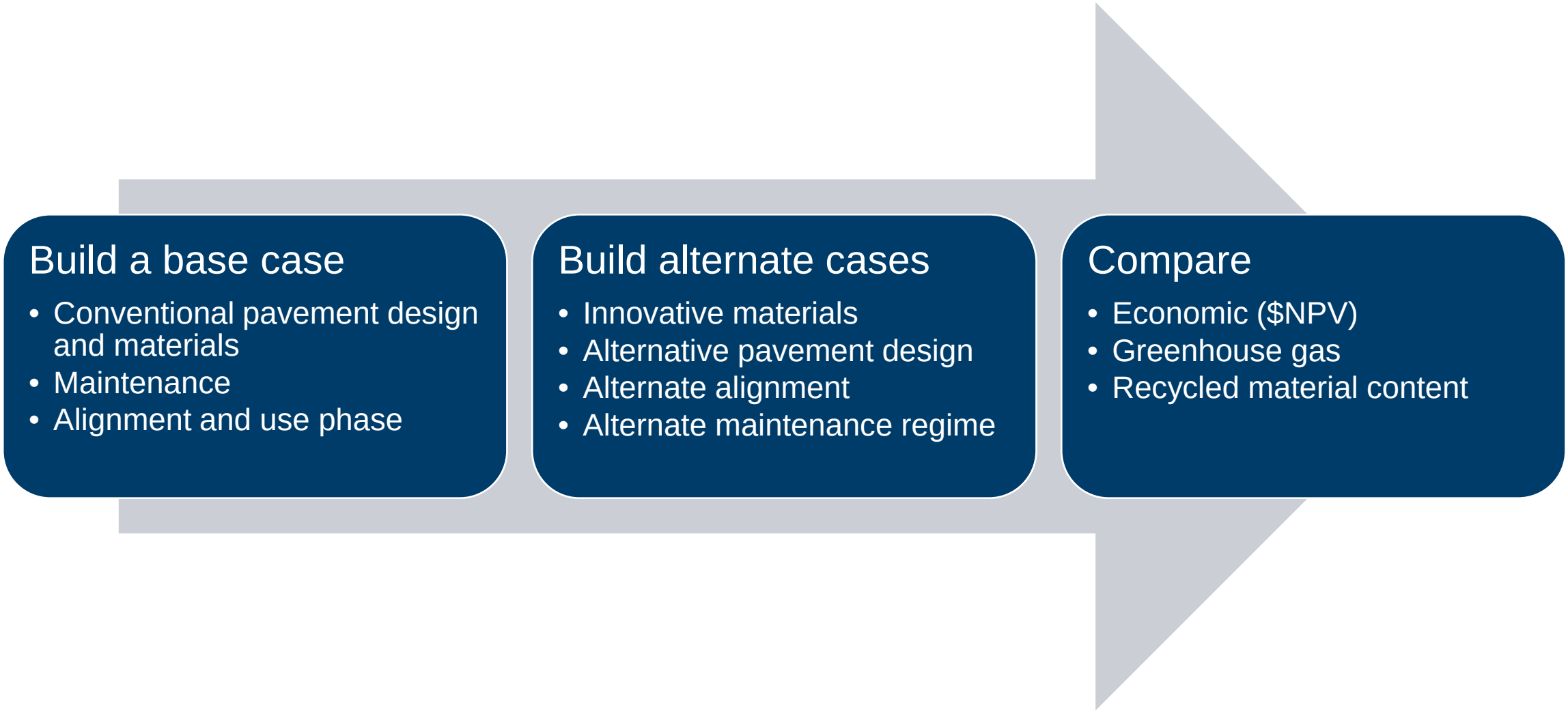
Sustainability

- Sustainability outputs:
  - lifecycle greenhouse gas emissions (tonnes CO_2-e)
  - other air-pollutants
  - energy use
  - water use
  - material quantities (tonnes)
  - infrastructure Sustainability (IS) Enviropoints
- ISC alignment.

Economics

- Economic outputs:
  - costs ($Net Present Value)
  - Benefit-Cost Ratio (BCR)
- Calculates the whole-of-life economics of pavement options
- Costings based on materials, construction methodology, maintenance, residual asset value, carbon price.

SAT analysis process

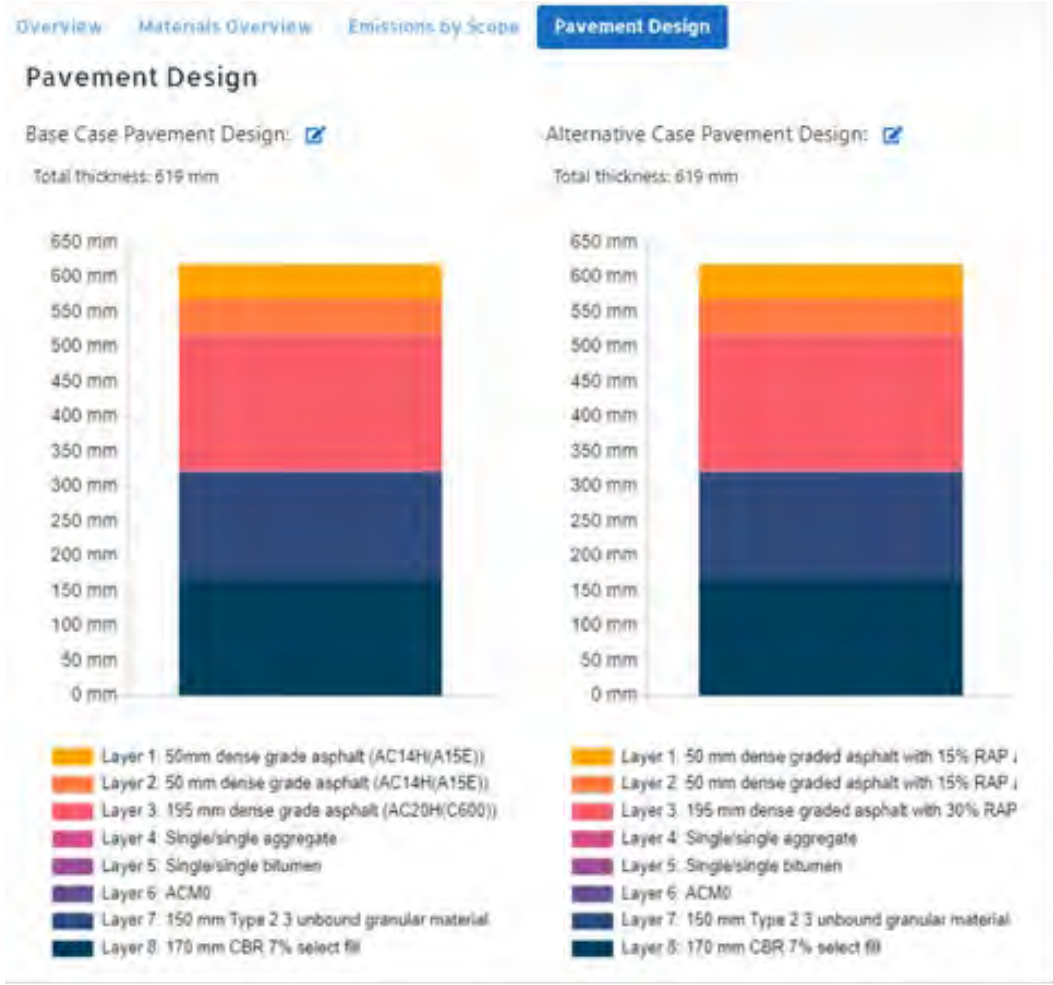


Infrastructure project applications

Options analysis	Business case	Detailed design	Construction	Maintenance
• Comparison to “do nothing” • High level assessment • Use phase primarily	• Carbon footprint of reference design	• Compare pavement design options • Compare alignment options	• Compare material options • Compare salvage and disposal options	• Compare maintenance schedules • Compare rehab treatments • Optimise roughness reset

SAT implementation

- Free public website
- Due for release in March 2022
- Facilitates greater optioneering of design elements and evaluation of benefits
- Users can develop their own libraries of
  - pavement designs
  - pavement products.
- Data libraries are tailored to Queensland and Western Australia but could easily be refined for other states.
- Whole of life assessment considers use phase emissions.



Source: ARRB Sustainability Assessment Tool.

Case study: urban arterial road, asphalt innovations

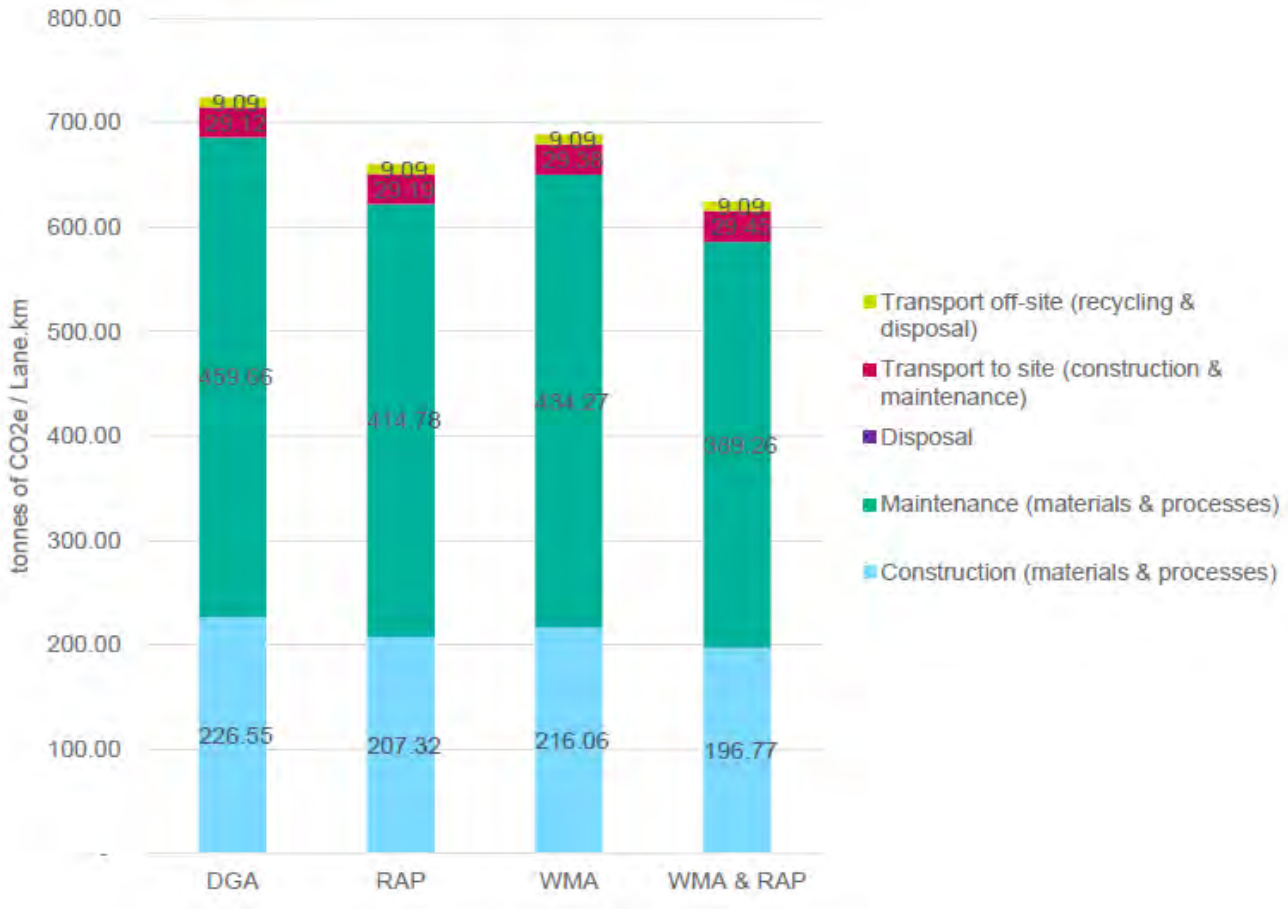
Design scenario

- Urban Arterial road
- Design cumulative equivalent standard axle – 30,000,000
- AADT – 6507 (5 per cent heavy vehicles)
- Design Life – 20 years
- Assessment Period – 40 years
- Assumed unchanged sub-base of prime and seal and improved layer.

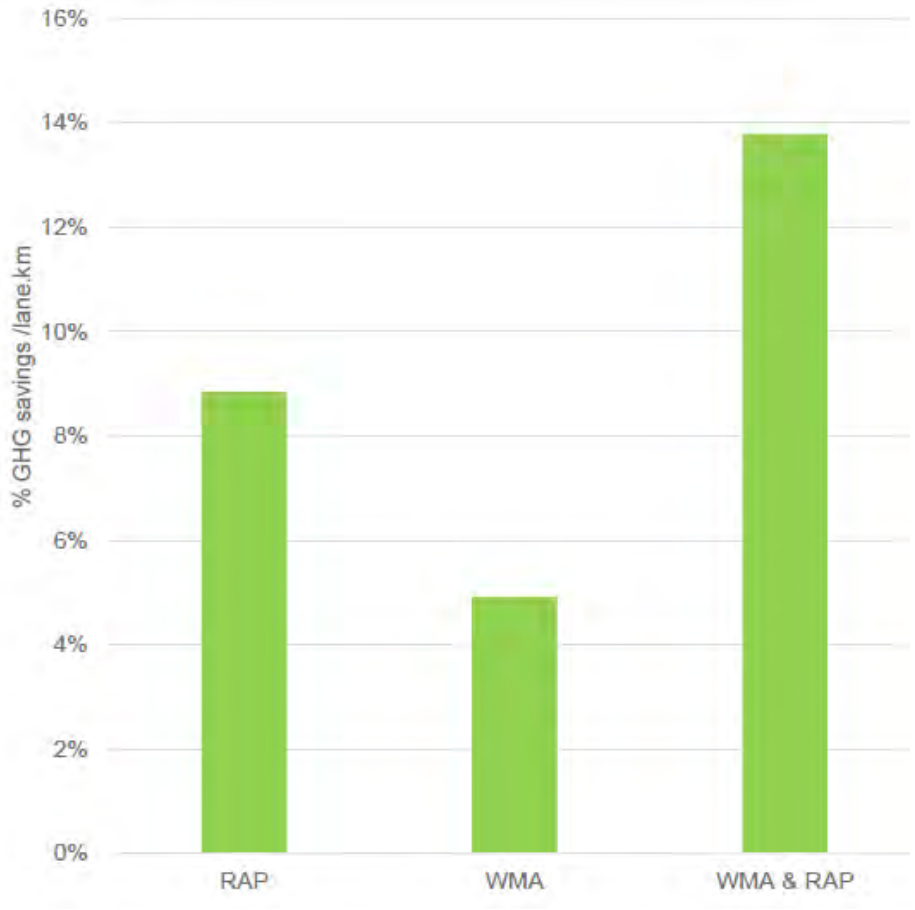
Pavement technology	Layer	Materials
Dense graded asphalt (DGA) (hot-mix)	Surface Intermediate Base	50mm DGA 50mm DGA 195mm DGA
DGA and Reclaimed Asphalt Pavement (RAP)	Surface Intermediate Base	DGA 15% RAP DGA 15% RAP DGA 30% RAP
DGA Warm-Mix Asphalt (WMA)	Surface Intermediate Base	DGA (WMA) DGA (WMA) DGA (WMA)
DGA with RAP & WMA	Surface Intermediate Base	DGA 15% RAP (WMA) DGA 15% RAP (WMA) DGA 30% RAP (WMA)

Case study: Urban arterial road, asphalt innovations

Total lifecycle GHG emissions, excluding use phase



Percent emissions reduction, excluding use phase



Source for both: ARRB Sustainability Assessment Tool.

Case study: Urban arterial road, asphalt innovations

Present value (7% discount rate, Carbon price $31.36/tone CO_2 -eq ($/lane.km)

Source: ARRB Sustainability Assessment Tool.

Thank you
and stay connected…

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