Initiatives for Land Transport Infrastructure Decarbonisation

By Shahaanan Arulgnanapragasam

150 YEARS IN AOTEAROA

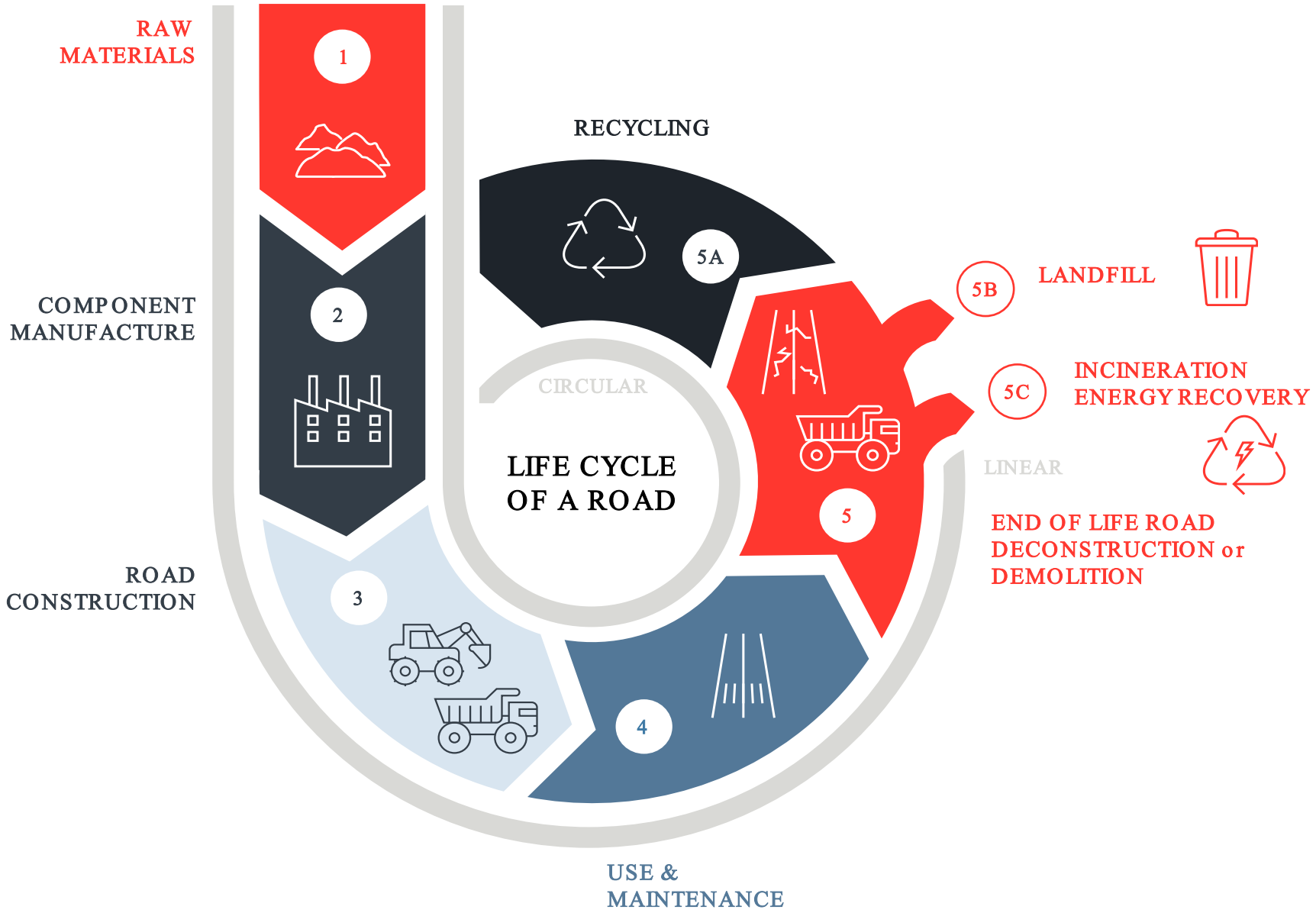
Learning Outcomes

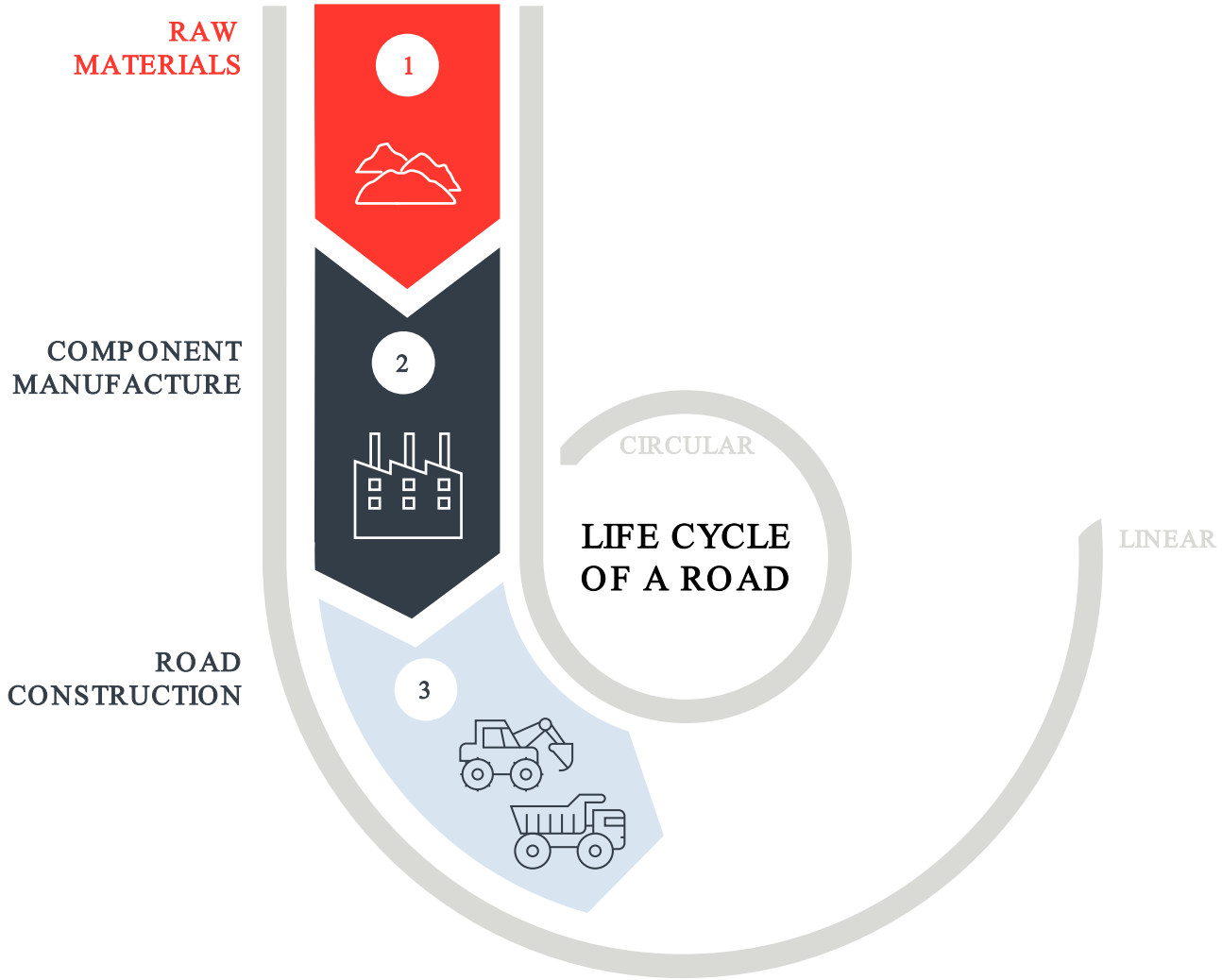
- What is decarbonisation for Land Transport Infrastructure and why does it matter now
- What do the various stages of an asset lifecycle look like
- What are the options for decarbonisation and how do they fit in with the lifecycle stages

Why?

- Paris Agreement to limit the global average temperature increase
- Emissions Reduction Plan May 2022
- Carbon Neutral Government Programme 2020
  - Crown agencies carbon neutral by 2025

Measure and reduce construction (embodied) and operational emissions in infrastructure projects and activities.


RAW MATERIALS
1
COMPONENT MANUFACTURE
2
ROAD CONSTRUCTION
3
USE & MAINTENANCE
4
RECYCLING
5A
5B
LANDFILL
5C
INCINERATION ENERGY RECOVERY
LINEAR
5
END OF LIFE ROAD DECONSTRUCTION or DEMOLITION
CIRCULAR
LIFE CYCLE OF A ROAD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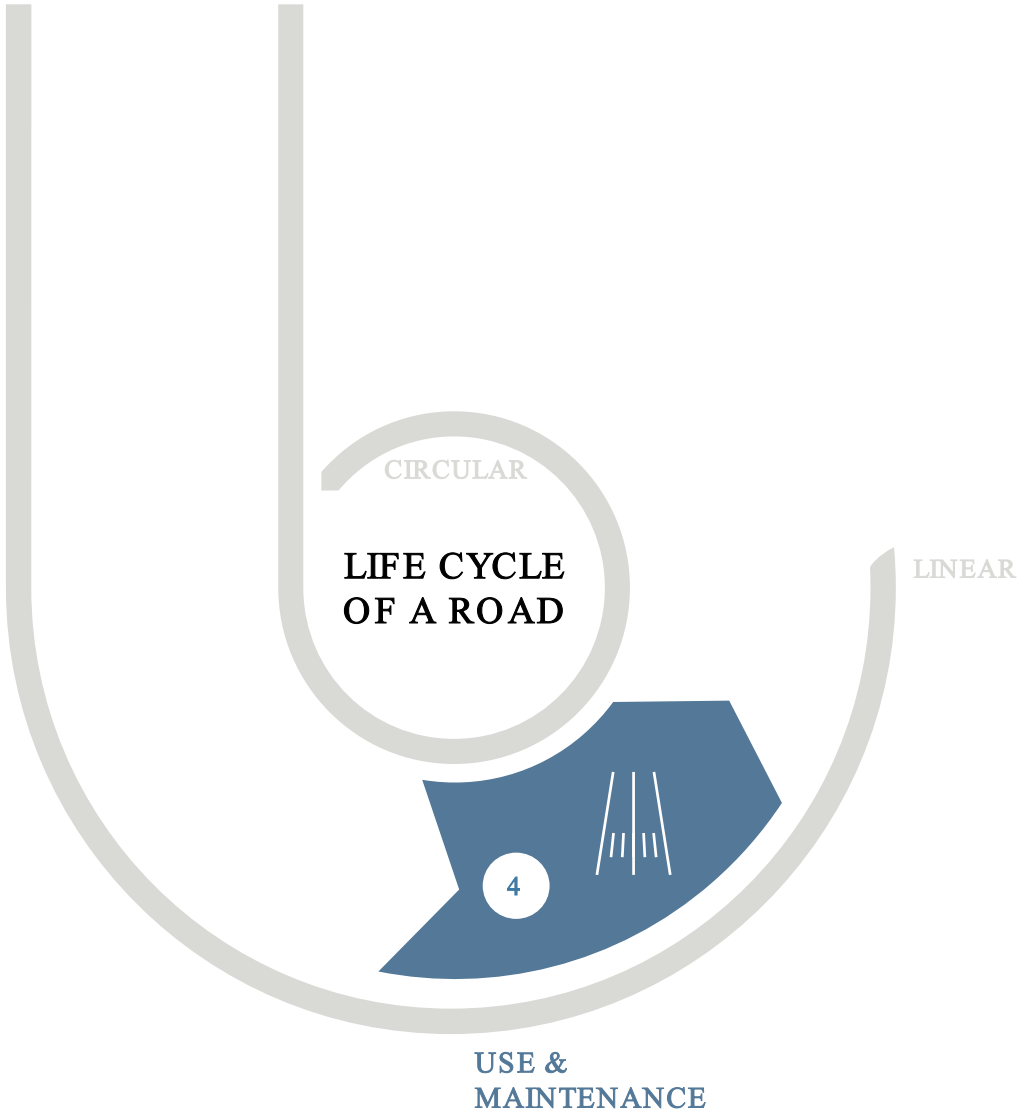
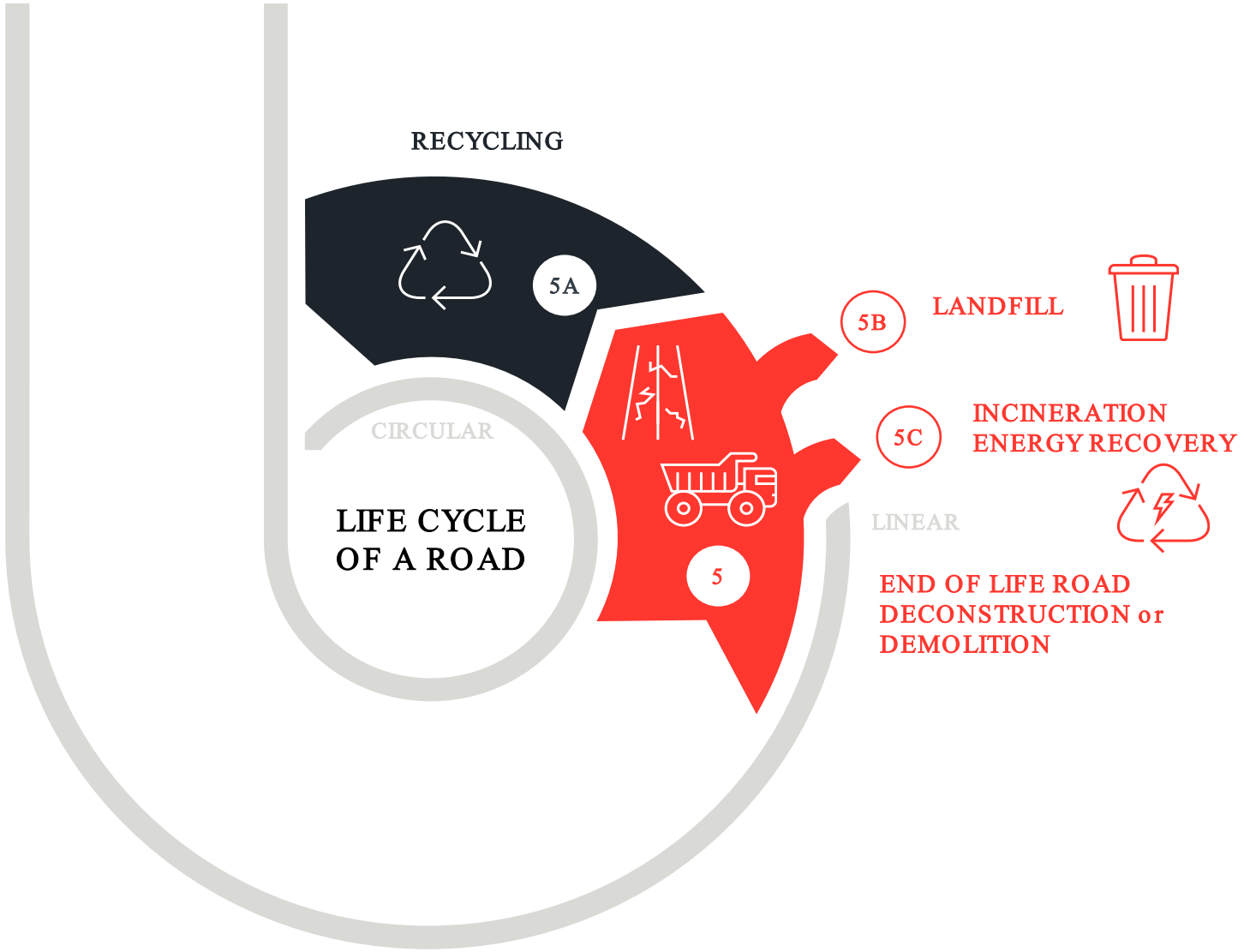

CIRCULAR
LIFE CYCLE
OF A ROAD
LINEAR
4
USE &
MAINTENANCE


RECYCLING
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END OF LIFE ROAD
DECONSTRUCTION or
DEMOLITION

Waka Kotahi Carbon Neutrality Options Research Project

Scope

- Identify opportunities to decarbonise pavement, structure and storm water assets
- Excluded enabled emissions from non infrastructure related activities
- Identify barriers to implementation

Methodology

1. Develop long list of opportunities in consultation with subject matter experts from Waka Kotahi and contractors.

2. Collaborative workshop split into pavement, structures and storm water.

3. Develop Evaluation criteria for what high, medium, and low impact would be for carbon impact, cost impact and opportunity feasibility

		High - 3	Medium - 2	Low - 1
Pavement	**Carbon Impact**	>25% reduction	5-25% reduction	<5% reduction
	Cost	Cost neutral	10% increase	30% increase
	Feasibility	Proven now	~2 years away	Significant uncertainty & investment
Structures	**Carbon Impact**	>30% reduction	10-30% reduction	<10% reduction
	Cost	Cost neutral	10% increase	30% increase
	Feasibility	Proven now	10 years away	Significant uncertainty & investment
Water and Nature Based Solutions	**Carbon Impact**	>50% reduction	10-30% reduction	<10% reduction
	Cost	Cost Negative	Cost neutral	100-200% increase
	Feasibility	Happening now and enabled	Possible, not prevalent or consensus	Significant uncertainty & investment

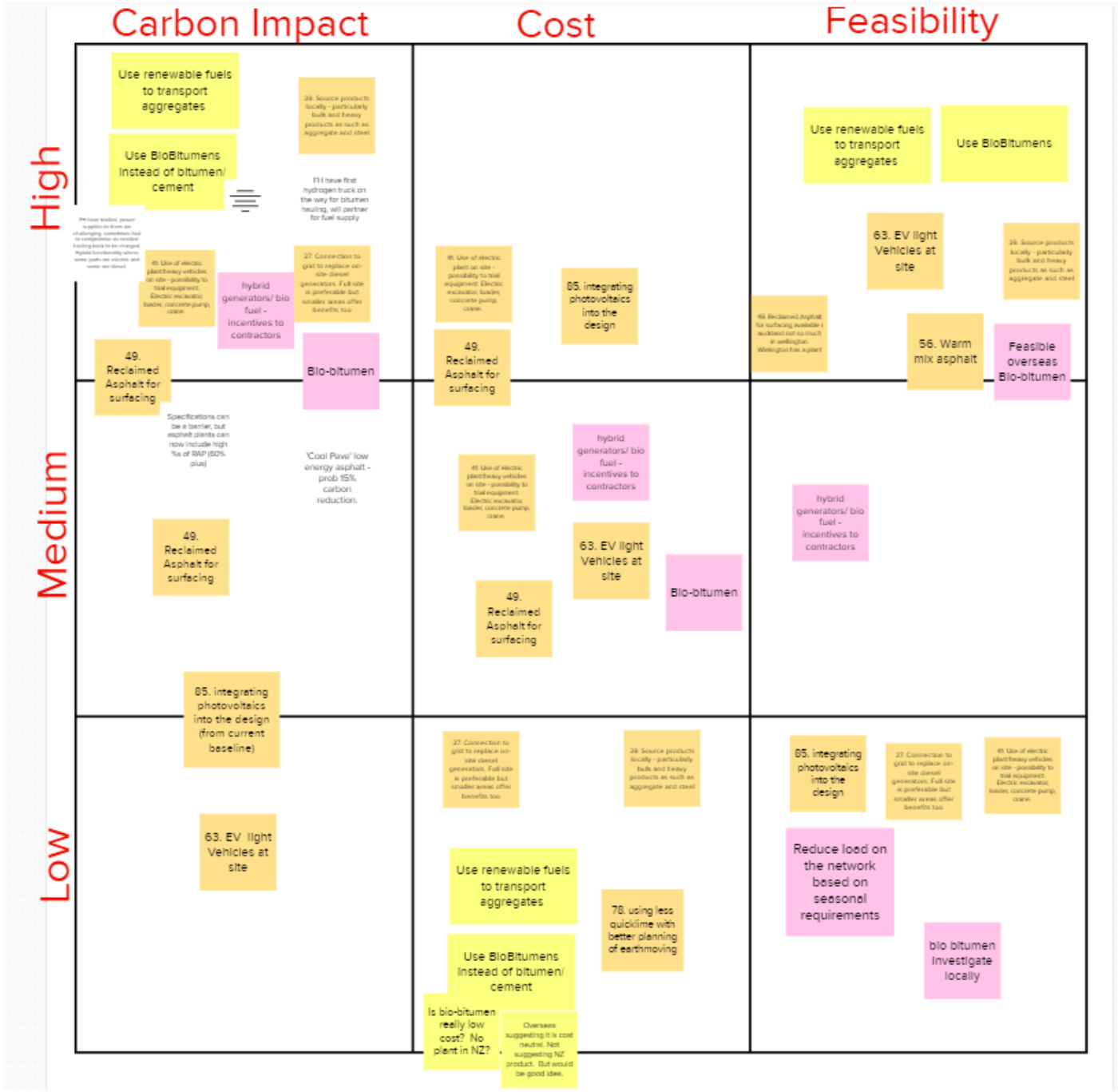
Methodology

1. Develop long list of opportunities in consultation with subject matter experts from Waka Kotahi and contractors.

2. Collaborative workshop split into pavement, structures and storm water.

3. Develop Evaluation criteria for what high, medium, and low impact would be for carbon impact, cost impact and opportunity feasibility

4. Rank opportunities against criteria

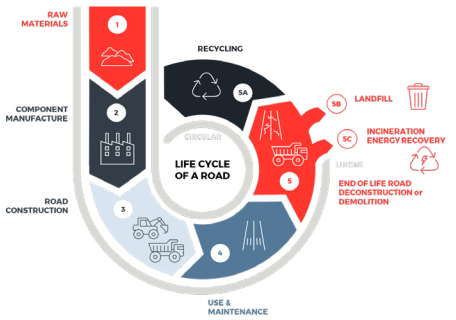

Carbon Impact
Cost
Feasibility
High
Medium
Low
Use renewable fuels to transport aggregates
Use BioBitumens Instead of bitumen/ cement
hybrid generators/ bio fuel - incentives to contractors
Bio-bitumen
49. Reclaimed Asphalt for surfacing
'Cool Pave' low energy asphalt - prob 15% carbon reduction.
49. Reclaimed Asphalt for surfacing
65. integrating photovoltaics into the design (from current baseline)
63. EV light Vehicles at site
65. integrating photovoltaics into the design
49. Reclaimed Asphalt for surfacing
hybrid generators/ bio fuel - incentives to contractors
63. EV light Vehicles at site
Bio-bitumen
49. Reclaimed Asphalt for surfacing
Use renewable fuels to transport aggregates
Use BioBitumens Instead of bitumen/ cement
Is bio-bitumen really low cost? No plant in NZ?
78. using less quicklime with better planning of earthmoving
Use renewable fuels to transport aggregates
Use BioBitumens
63. EV light Vehicles at site
56. Warm mix asphalt
Feasible overseas Bio-bitumen
hybrid generators/ bio fuel - incentives to contractors
65. integrating photovoltaics into the design
Reduce load on the network based on seasonal requirements
bio bitumen investigate locally

Whole life cycle 1-5

1. Minimise and eliminate resource consumption at design and planning stage

2. Haulage energy transformation (i.e., electrification, rail)

3. Include lifecycle methodology at business case level

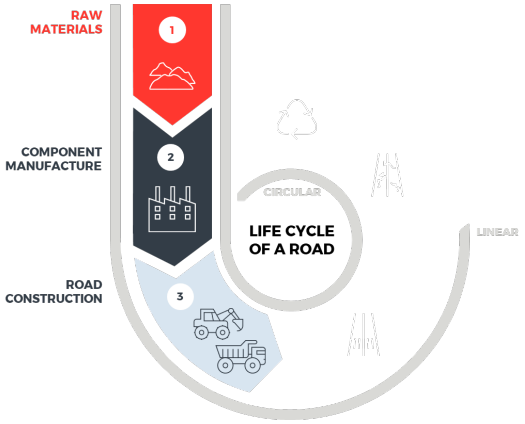


Embodied Emissions 1-3

1. Alternative low carbon material options (e.g., bio bitumen)

2. Minimise diesel used for haulage

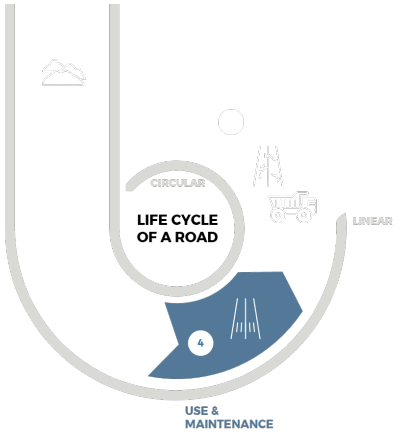
3. Optimisation in manufacturing process (e.g., warm vs hotmix)



Maintenance and Operational 4

1. Efficient planning of maintenance and renewals

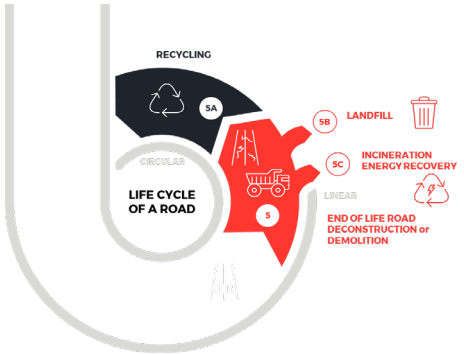
2. Switch to less power consumption (e.g., streetlights LED)



End of Life 5

1. Reduction of waste through reuse of construction materials

2. Recycling also decreases embodied emissions (e.g., RAP)



Key Takeaways

1. Start decarbonising early at business case, planning and procurement level

2. Minimising diesel use in haulage throughout lifecycle

3. Targeted research and investigation into low emissions alternative materials and manufacturing methods

4. Reduce – Reuse – Recycle

Thanks

- My colleagues Zoe Burkitt and Zara Balador who worked hard on the research project and helped with my presentation

- Waka Kotahi for allowing us to present this work to the wider industry

- A host of individuals and organisations that provided invaluable feedback during the workshop sessions

- REAAA for hosting this conference

Thank you

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