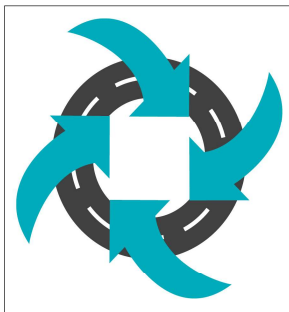


# Foamed Bitumen Recycling Pacific Freight Terminal – Roadway F Western Australia - Kewdale

Damien Edwards – Technical & Innovation Manager

*HIWAY*



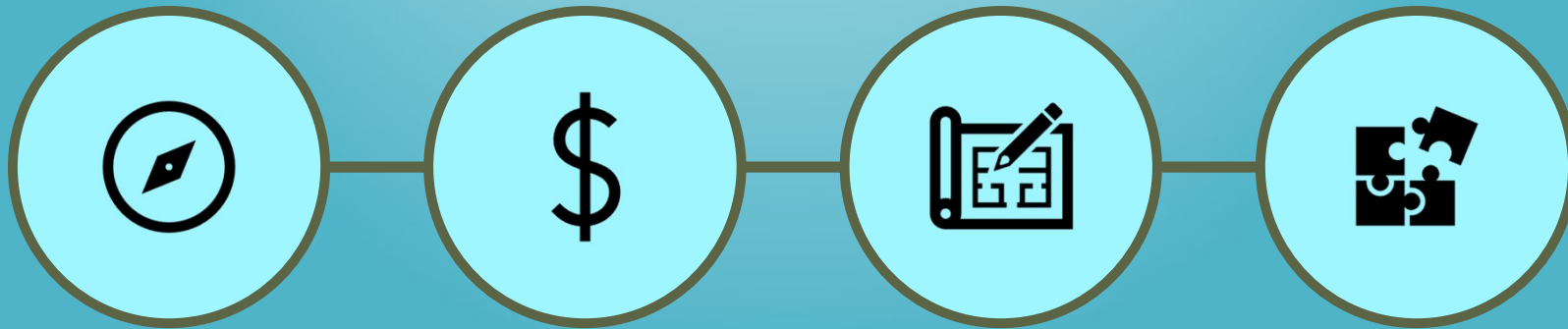
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# PROJECT ROADMAP



## LOCATION

Pacific Freight  
Terminal

Kewdale

Western Australia

## COST AND TIMING

Fixed Budget

Hard Start/Finish  
Date

Risk Management

## DESIGN

Fulton Hogan  
(Pavement Design)

HIWAY  
(FBR Mix Design)

## INNOVATION

Foamed Bitumen  
Recycling

AfPA – Design  
Supplement used for  
the 1<sup>st</sup> time



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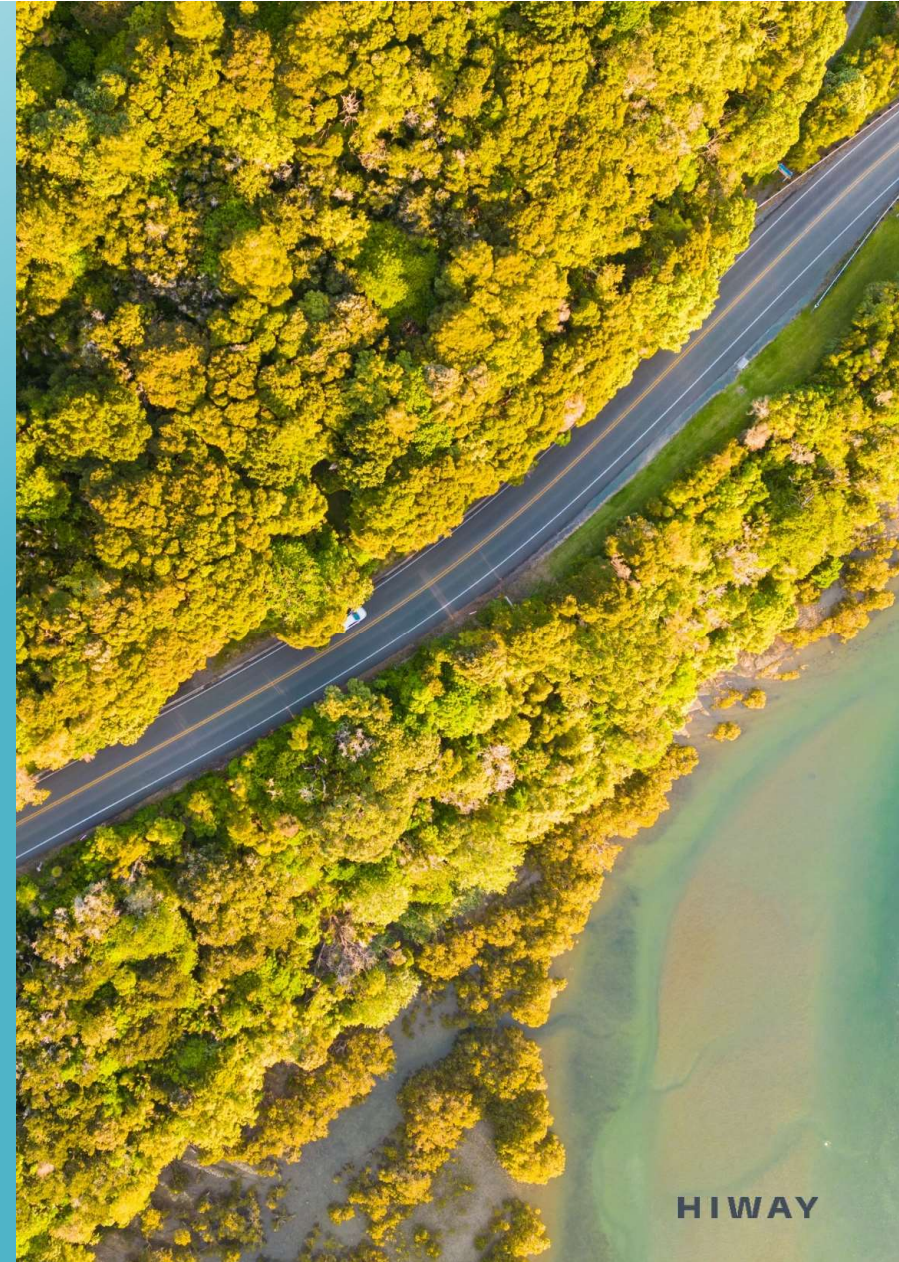
# RISK MANAGEMENT



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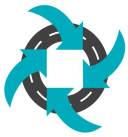
HIWAY

FULTON  
HOGAN

Safety  
Cost  
Timing  
Environmental  
Contractual  
Pavement Design

HIWAY

Safety  
Timing  
Environmental  
Contractual  
Construction  
Mix Design



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FULTON  
HOGAN

Safety  
Cost  
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HIWAY

Safety  
Timing  
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Construction  
Mix Design



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# FOAMED BITUMEN DESIGN PROCESS



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# PLANNING

## Area to be investigated

- Roadway F
- 850m length
- 10m wide
- Site Access
- Active Site



# GEOTECHNICAL INVESTIGATION PROCESS



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# PLANNING

## Area to be investigated

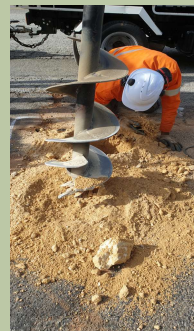
- Roadway F
- 850m length
- 10m wide
- Site Access
- Active Site



# FIELD SAMPLING

## Sampling

- 10 Test Pits (Depth to 600mm)
- 9 Bore Holes (Depth to 1.5m)
- Consistency of materials



# LAB TESTING

## Lab Testing

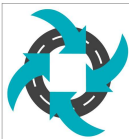
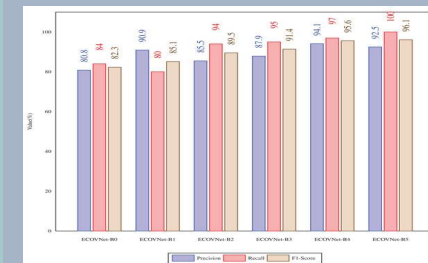
- Detailed laboratory testing program
- High workload had to share between two labs
  - Valuable information



# DATA

## Interrogation

- PSD
- Atterbergs
- Soaked CBR
- Summarised to give guidance on material profiles



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# PRELIM M

## FOR FOAMED BITUMEN RECYCLING



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# EXISTING PROFILE

- Existing pavement:
- Varying thickness of Asphalt
- Varying thickness of limestone
- Sand Subgrade



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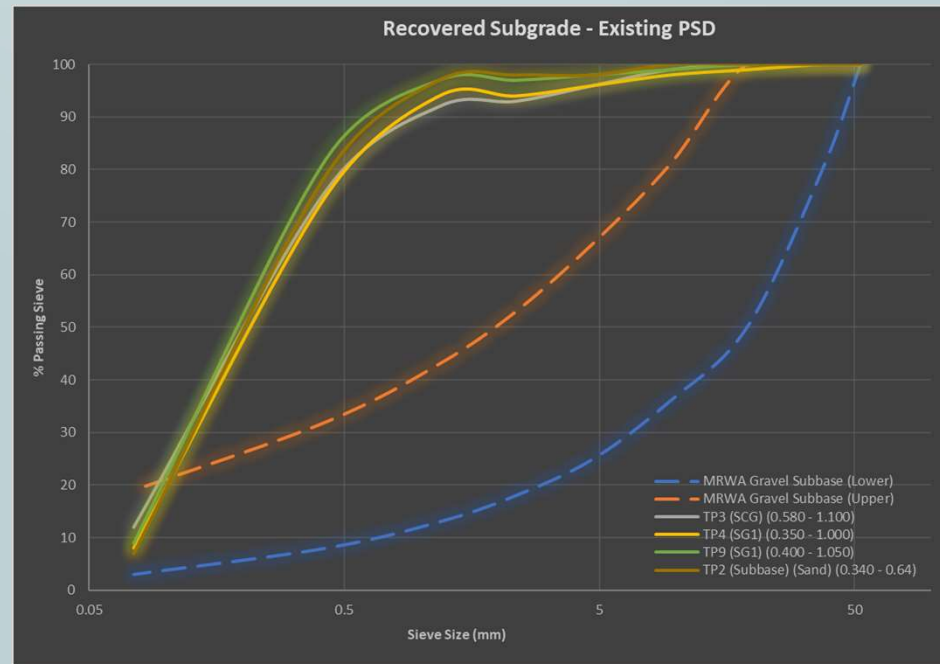
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# SUBGRADE

- Subgrade very consistent
- Classified as a Sand
- Angular shape
- Typical for Western Australia
- Fine grading
- Consistent grading



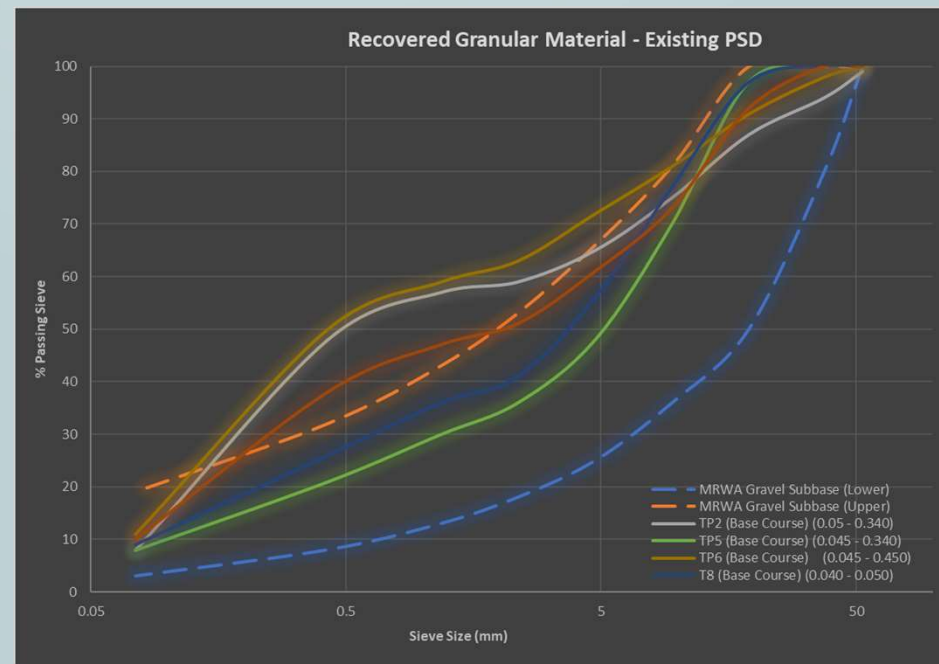
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# GRANULAR

- Granular material  
Limestone
- Assessed against MRWA  
grading specification for  
limestone material
- Gradings not within  
specified limits



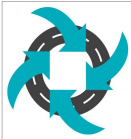
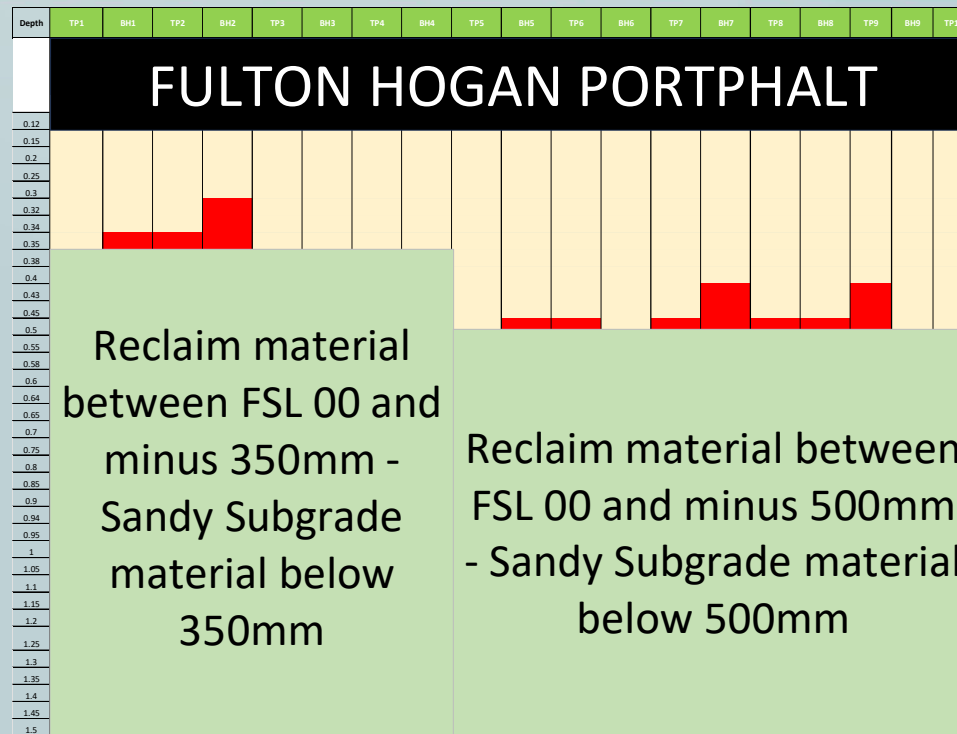
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# DESIGN PROFILE

- 120mm Fulton Hogan PortPhalt
- 350mm FBR
- Sandy Subgrade
- Divided into 2 Sections
- Section 1 - incorporate up to 120mm subgrade



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# MIX RESULTS

- Used a combination of primary and secondary binder contents to achieve 2000MPa modulus.
- 3-day modulus not achieved – revise gradings and blends.

Source Material	Bitumen Content %	Cement Content %	3-day cured modulus (MPa)	3-day cured and soaked modulus (MPa)	Average retained 3-day cured modulus (%)
TP8 (Subbase)	3	1.5	1800	1100	61
TP2 (Base)	3	1.5	2800	1650	59
TP2 (Base)	3.5	1.0	1450	850	59



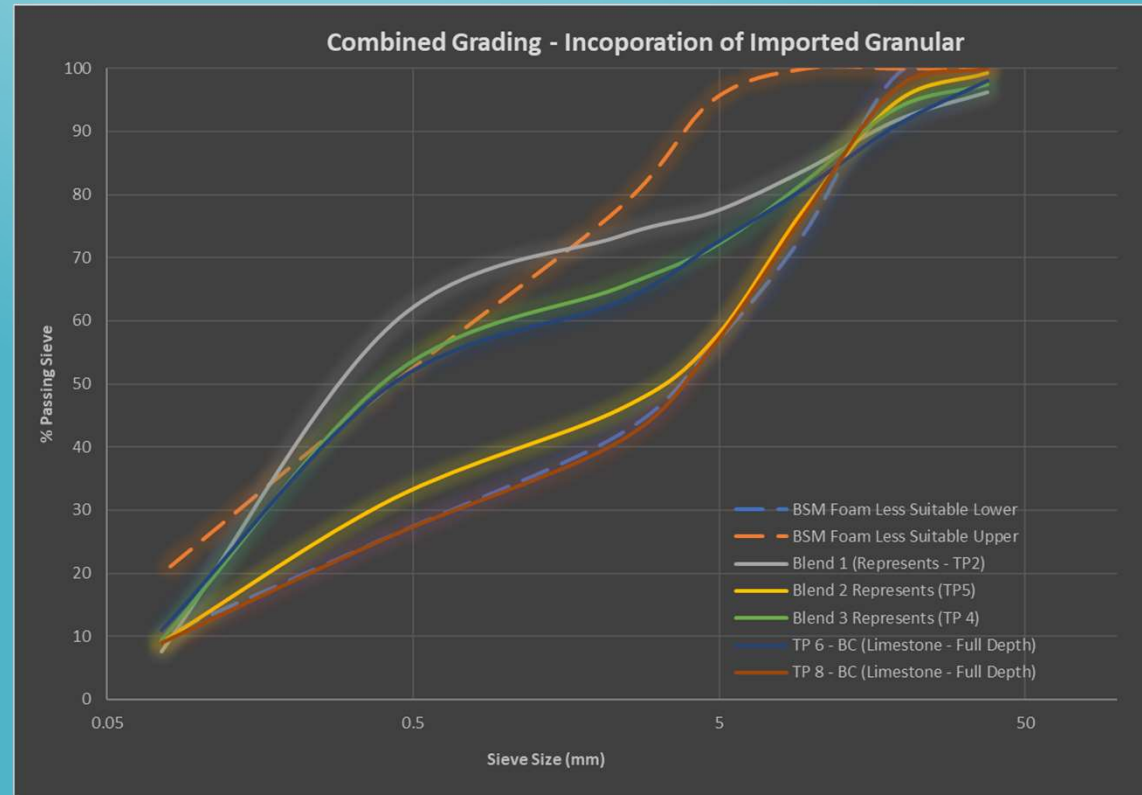
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# NEXT STEP

- Included imported granular material
  - Section 1 - 25%
  - Section 2 - 20%
- Assessed gradings
- Binder Selection
  - 3.0% Bitumen
  - 1.5% Cement
- 4 Blends Selected



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# FINAL MIX DESIGN RESULTS

Mix Design Reference	Location	Bitumen/Cement content %	Blend Composition	Initial Modulus (MPa)	3-day cured modulus (MPa)	3-day cured soaked modulus (MPa)	7-day cured modulus (MPa)	7-day cured soaked modulus (MPa)	3-day UCS (MPa)	7-day UCS (MPa)	Selected Construction
Package 1	TP8	3.0/1.5	80% TP8 Base + 20% Imported Granular	1400	3500*	2250	4250	2500	0.6	0.8	Selected
Package 2	TP8	3.0/1.5	60% TP8 Base + 40% Imported Granular	2000	3750	2250	5000	3750	0.9	1.1	Not Selected
Package 3	TP2	3.0/1.5	50% TP2 Base + 50% TP2 Subgrade	1300	2500	1250	3500	1750	0.2	0.3	Not Selected
Package 4	TP2	3.0/1.5	25% Imported Granular + 25% TP2 Base +50% TP2 Subgrade	-	3000*	1750	4000	2000	0.6	0.7	Selected

\*Achieve Design Modulus of 2000MPa @ 3 Days Cured



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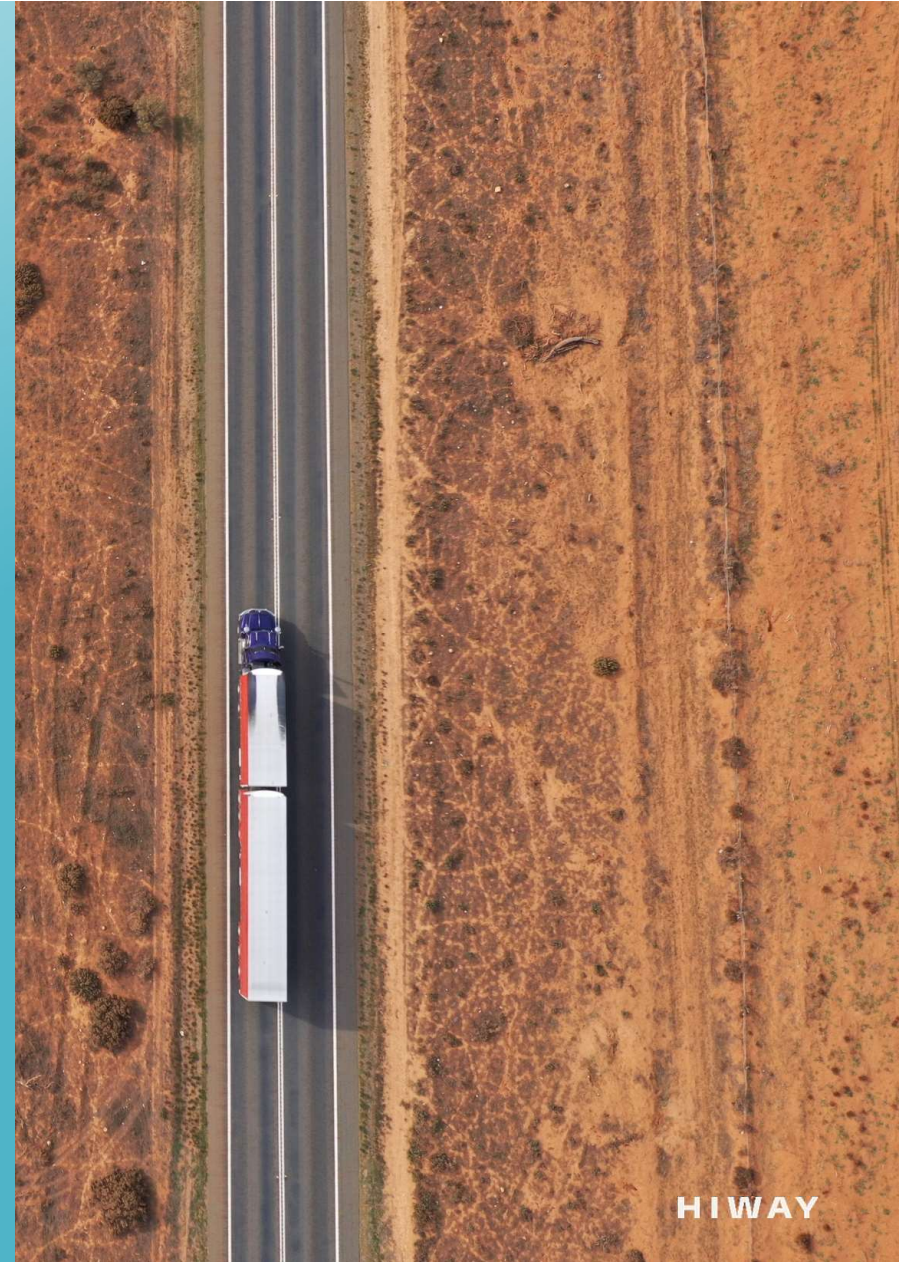
# FOAMED BITUMEN RECYCLING CONSTRUCTION



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# CONSTRUCTION PROCESS

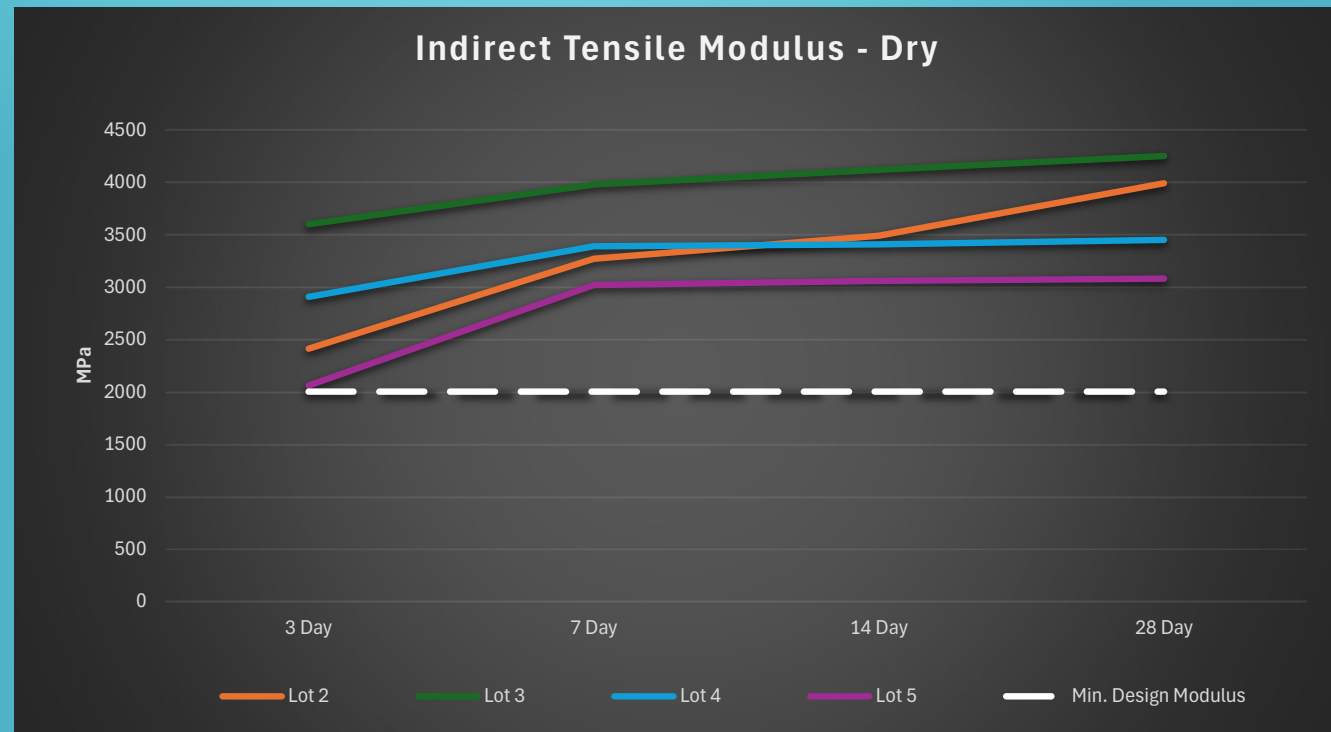
- Prepared detailed ITP's for construction.
- PFT Client versed in stabilisation and impressed with all works undertaken.
- Works carried out in 4 lots.
- Works completed on time and within budget.
- Client saw this project as successful due to:
  - Collaboration in design.
  - Construction was completed with no incidents and high-quality work.
  - Limited the amount of material sent to spoil.
  - Limited the imported amount of quarried material.
- Achieved FBR modulus during construction for lots.



# CONSTRUCTION MODULUS RESULTS

- Constructed samples to be tested at:
  - 3 Day
  - 7 Day
  - 14 Day
  - 28 Day

## DRY MODULUS



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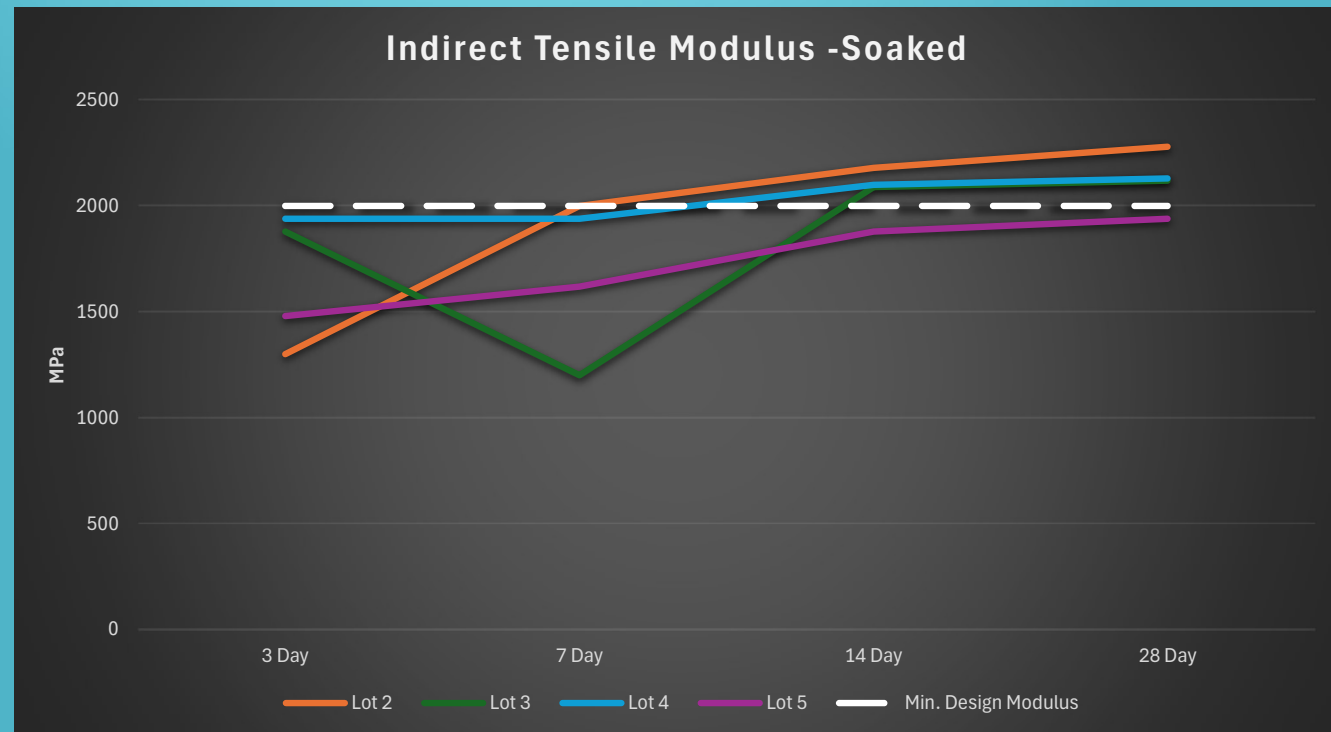
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# CONSTRUCTION MODULUS RESULTS

- Constructed samples to be tested at:
  - 3 Day
  - 7 Day
  - 14 Day
  - 28 Day

## WET MODULUS



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# PROJECT BENEFITS



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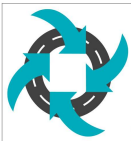
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# MATERIAL SAVINGS

## Section 1 - CH 000 – 350

- Remove in situ pavement material and replace with 25% imported granular material.
- Data used to calculate tonnages as reported on laboratory test reports.
  - Insitu MDD = 1.97t/m<sup>3</sup>
  - Imported Granular Material = 2.1t/m<sup>3</sup>

FBR Treatment Depth (350mm)	Material to be Excavated for 25% Replacement (85mm)	Imported Material for 25% Replacement (85mm)	Import Granular Tonnages saved (265mm depth)	CO <sub>2</sub> e Saved (kg)
350mm	586 tonnes	624 tonnes	1948 tonnes	60,712



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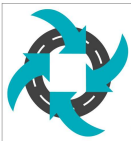
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# MATERIAL SAVINGS

## Section 2 - CH 350 – 850

- Remove in situ pavement material and replace with 20% imported granular material.
- Data used to calculate tonnages as reported on laboratory test reports.
  - Insitu MDD = 1.77t/m<sup>3</sup>
  - Imported Granular Material = 2.1t/m<sup>3</sup>

FBR Treatment Depth (350mm)	Material to be Excavated for 20% Replacement (70mm)	Imported Material for 20% Replacement (70mm)	Import Granular Tonnages saved (280mm depth)	CO <sub>2</sub> e Saved (kg)
350mm	620 tonnes	735 tonnes	2940 tonnes	86,733



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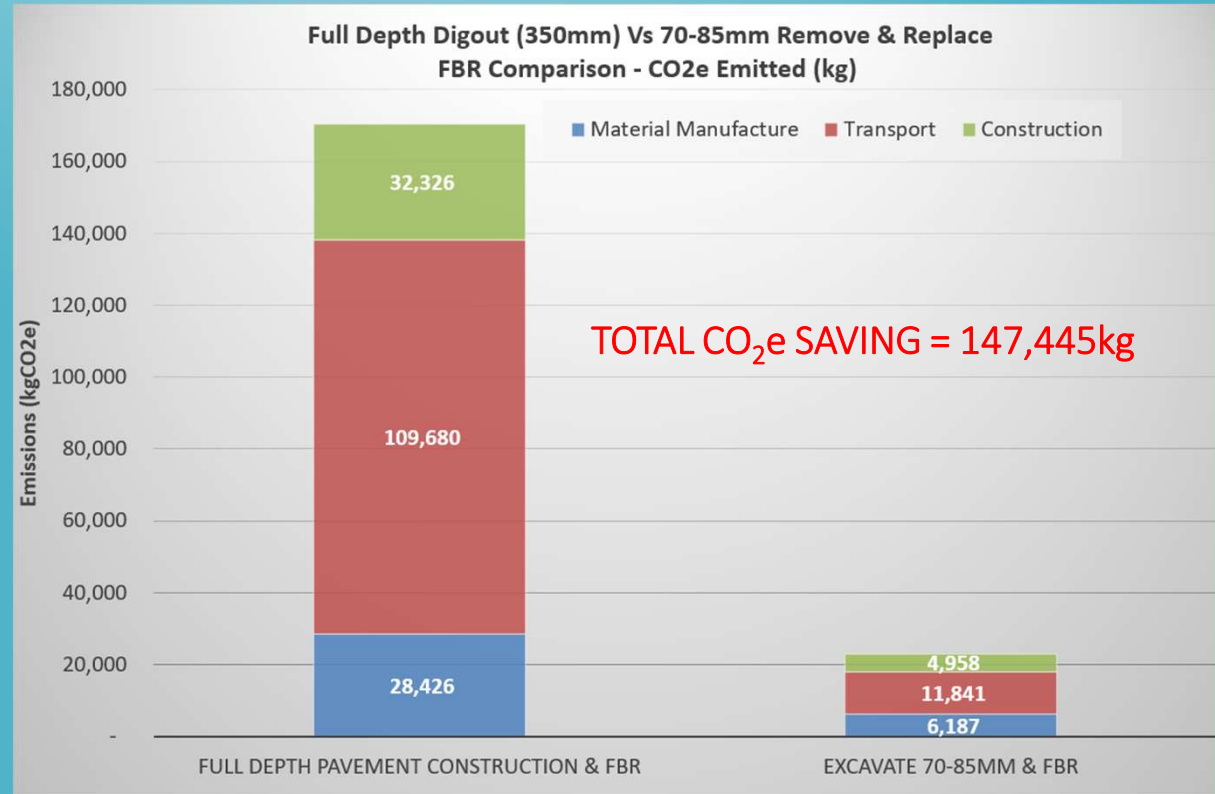
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# CARBON SAVINGS

Based on:

- Comparison of remove all poorly graded material and replace vs. remove 25% and 20% material to adjust grading
- Transport cut to waste 35km to dump site
- Import new granular material 30km from quarry
- For the purposes of this exercise – FBR emissions excluded as these are very close to like-for-like



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# ONGOING PERFORMANCE

- FBR provided a solid working platform to construct asphalt layers.
- Pavement been in operation for 1 year with no defects observed.
- No remediation works required during the defects liability phase.



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# THANK YOU



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