DEVELOPMENT OF COLD BITUMINOUS STABILISED MATERIAL FROM RECLAIMED PAVEMENTS

"RITUMIX 3"

RESOURCECO
THE SUSTAINABLE RESOURCE COMPANY

Government of South Australia
Zero Waste SA

arrb GROUP

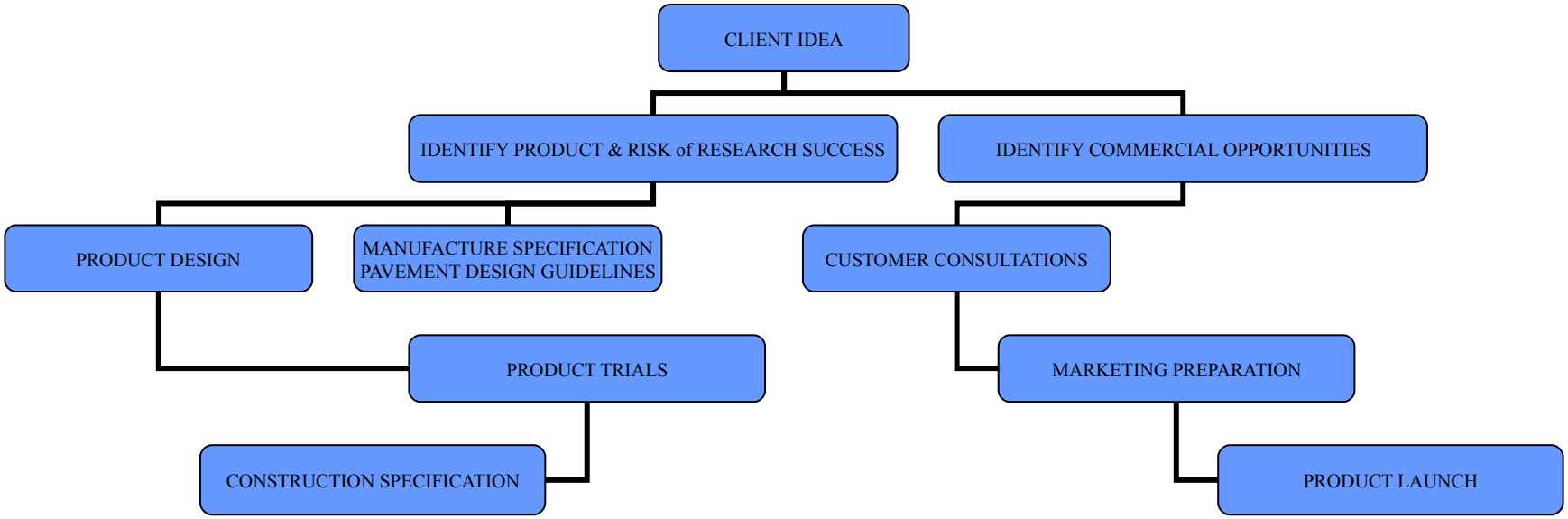
Project initiation

To increase the recycling volume of reclaimed asphalt by stabilisation with bitumen emulsion

Current sales - 20,000t out of 80, 000t processed as granular material marketed as **"BITUMATE"**

FROM THIS WASTE **TO THIS "ASPHALT" PAVEMENT**

Research process



Client requirements

- Selection of practical research agency
- Use of bitumen emulsion & other binders suited to pugmill blending
- Structural capacities similar to hot asphalt
- Trafficable on same day as placement
- Asphalt Paver or grader laid
- Surface characteristics suitable for industrial applications

Commercial opportunities

- Intermediate asphalt in deep asphalt pavements
- Industrial pavements – e.g. freight yards and grain storage
- Haul roads & heavy duty pavements
- Boxed out road widening & shoulders
- Bus stop pavements
- Bikeways and walkways

Product development

- **LABORATORY**
- Selection of appropriate emulsion
- Determination of lab compaction characteristics
- Determination of constituent binder contents (Modulus)
- Predictive lab performance tests, i.e. rutting & fatigue
- Effective bitumen content for mechanistic fatigue model

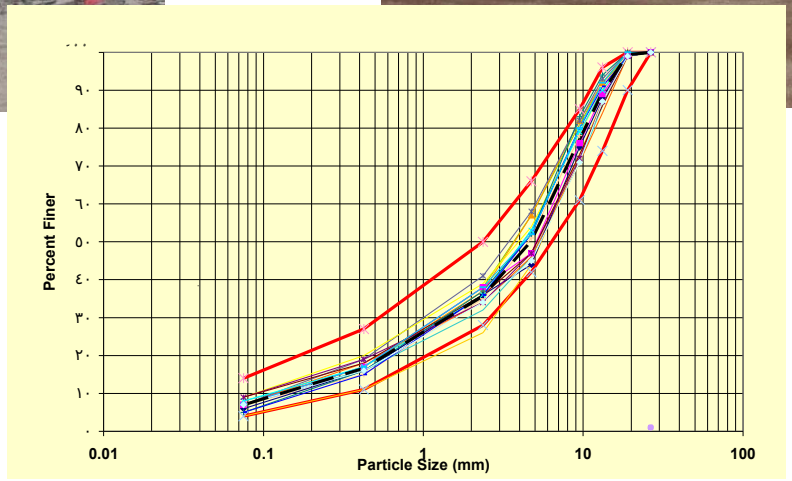
- **FIELD**
- Constructability and surface condition
- Back analysis of stiffness (FWD & cores)
- Permeability & voids
- Monitoring under trafficking

- **OUTPUTS for CLIENT**
- Manufacturing Specification
- Construction specification
- Structural design guidelines
- Suggested applications & marketing literature

Bitumate – The Raw Feed Stock

Manufactured to a specification under QA system

Max 3% old Bitumen



Pugmill manufacture

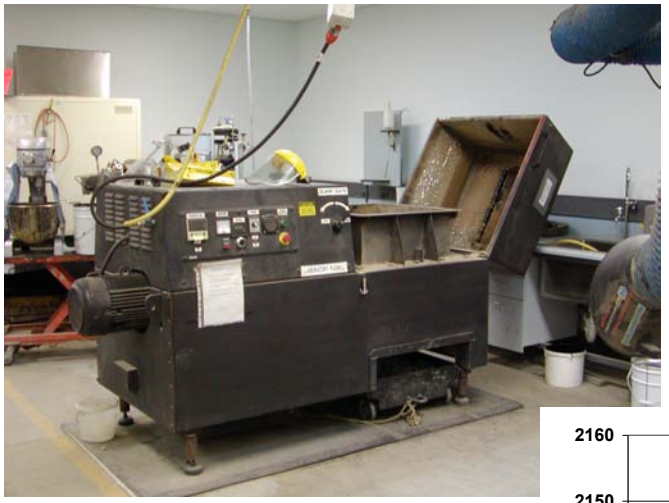
3% Purpose made bitumen emulsion added with or without other binders

Specification BITUMIX 3

TEST PROCEDURE	MANUFACTURING TOLERANCE			
QUALITY CONTROL TESTS				
Particle Size Distribution TSA-MAT-TP134	Product	20 mm Bitumix	14mm Bitumix	10mm Bitumix
	Sieve Size (mm)	Percent Passing		
	53			
	37.5			
	26.5	100		
	19	90 – 100	100	
	13.2	74 – 96	95 - 100	100
	9.5	61 – 85	74 - 96	90 - 100
	4.75	42 – 66	61 - 85	60 - 85
	2.36	28 – 50	42 - 60	35 - 55
	0.425	11 – 27	11 - 35	10 - 45
	0.075	4 - 14	4 - 14	5 - 15
AS1289.3.1.2	Liquid Limit	Maximum 28%		
AS1289.3.3.1	Plasticity Index	Minimum 1% - Maximum 8%		
AS1289.3.4.1	Linear Shrinkage	Maximum 4%		
TSA-MAT-TP470	Bitumen Content	Maximum 4%		
	Contaminants	Type F NEPC Guideline		
Added Binder	EMULSION	3% HFMS emulsion		
Added Binder	Cement, Lime or Polymer	nominated to order		

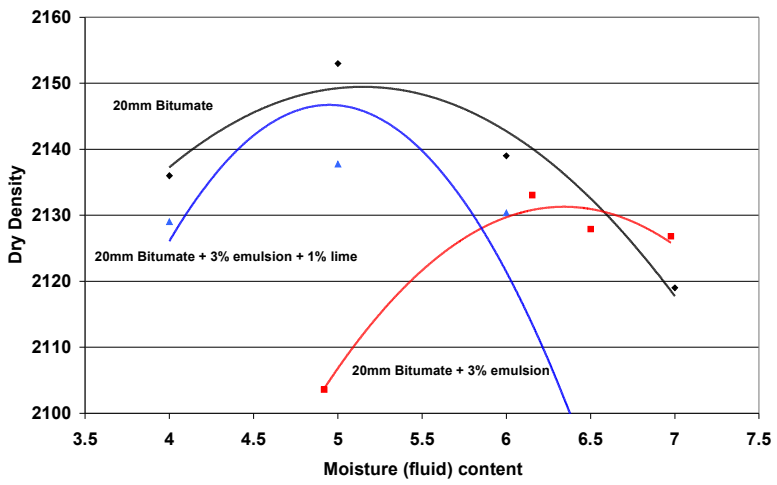
Bitumix 3 design - Compaction

PUGMIL MIXING



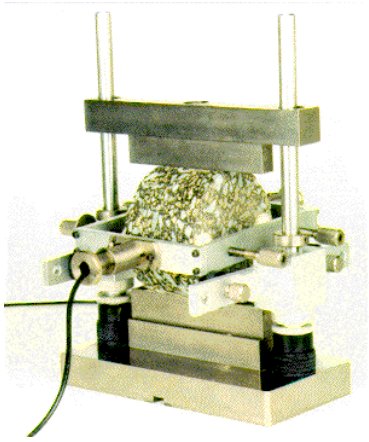
COMPACTION

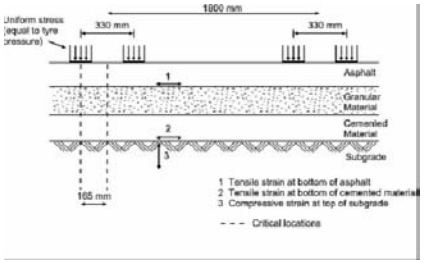
Max Density 2.15 t/m3



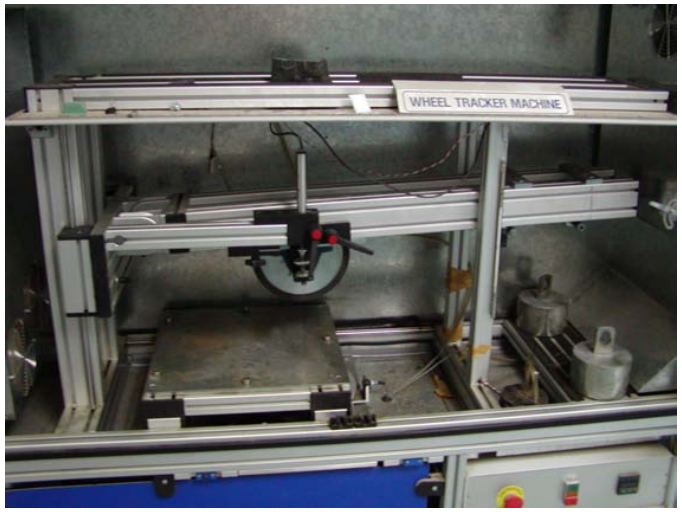
Bitumix 2 design - Structural properties

Resilient Modulus (for pavement design)

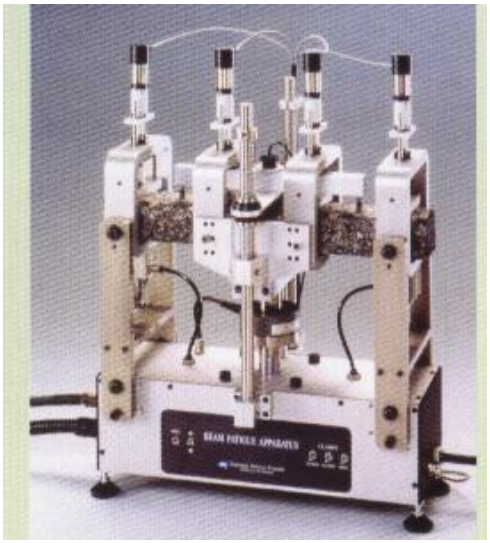




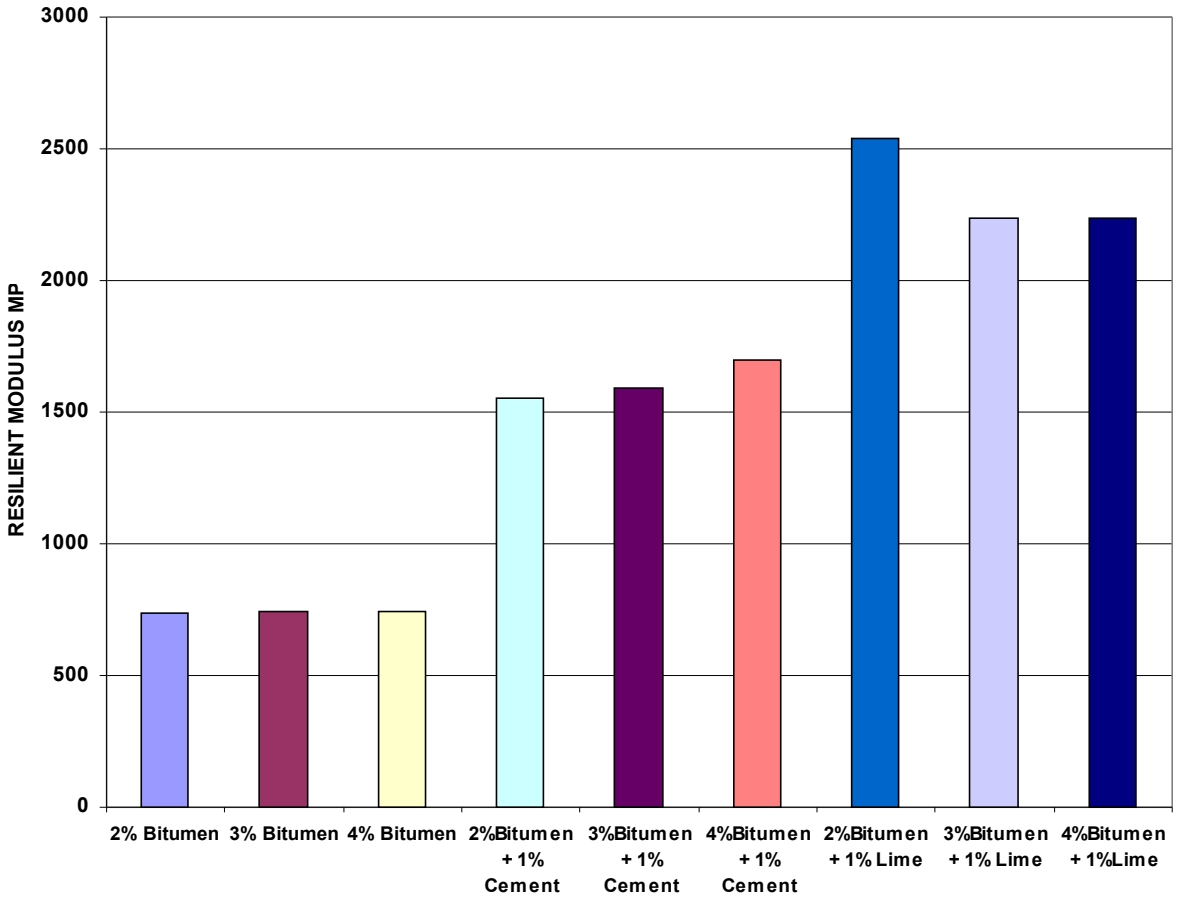
Rutting Resistance



Fatigue resistance

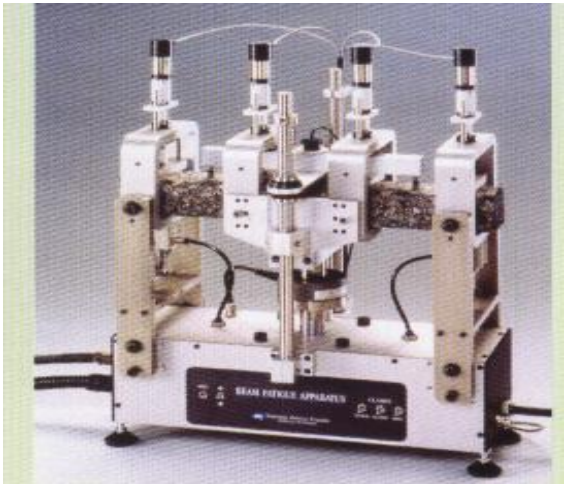


Bitumix 3 design – Resilient modulus



Bitumix 3design – Rutting & fatigue

FATIGUE

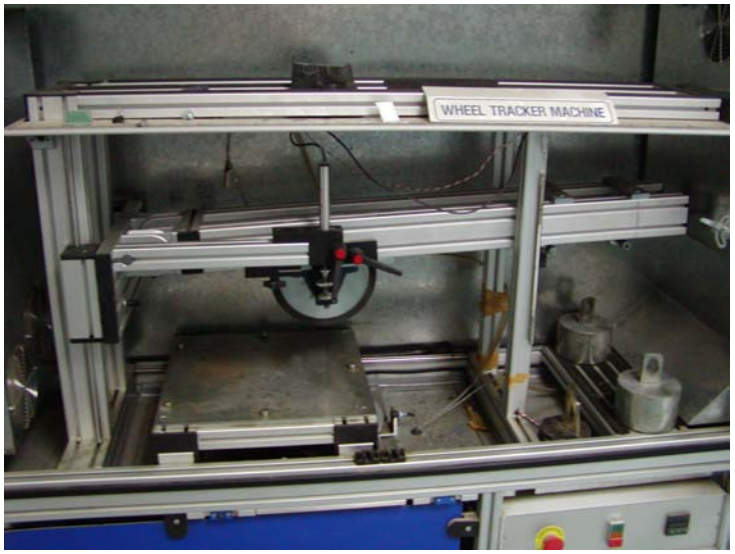


1. Cycles to failure
2. Effective bitumen content i.e.

$$N = \left[\frac{k}{\mu\varepsilon}\right]^5$$

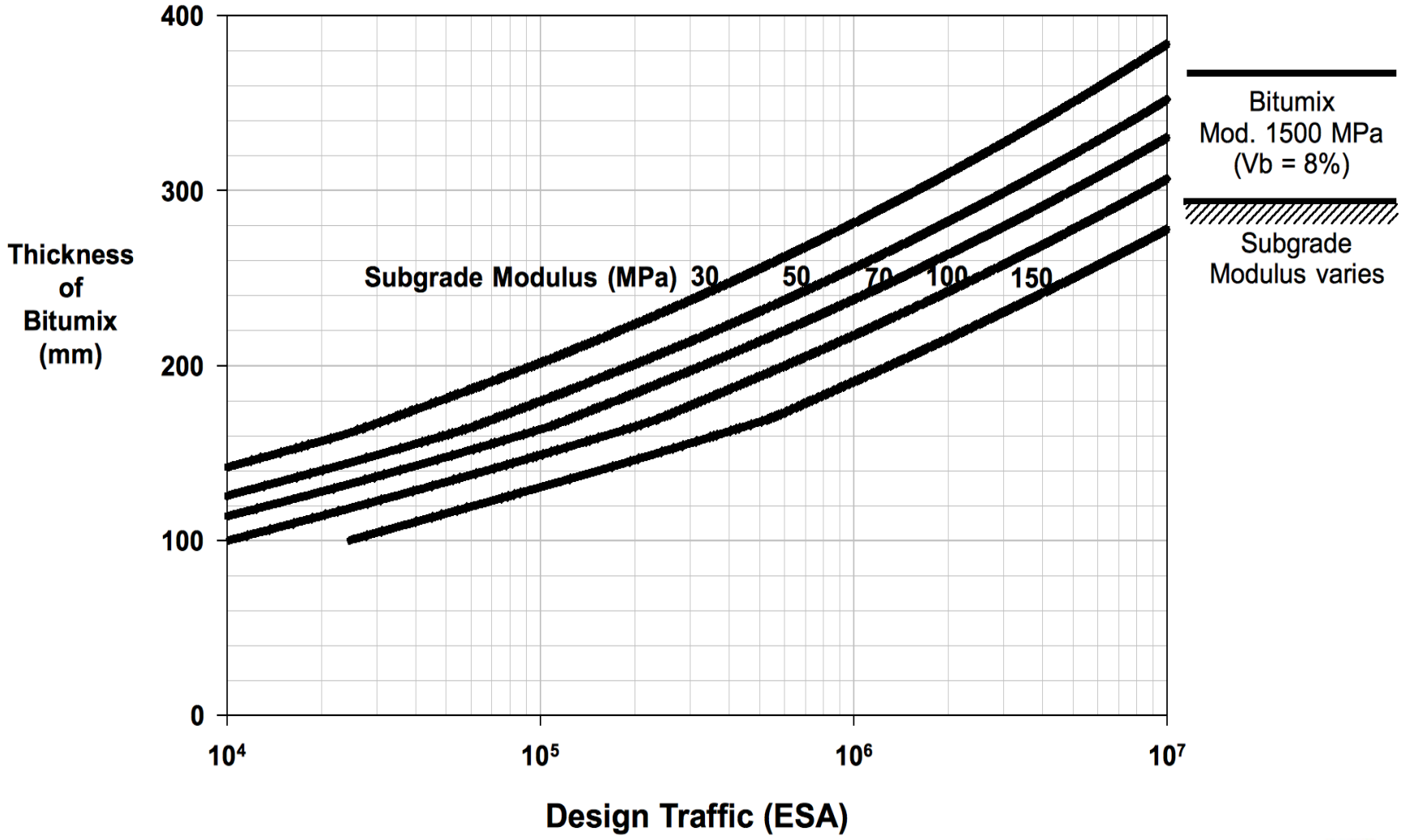
$$k = \left[\frac{6918 * (0.856Vb + 1.08)}{Smix^{0.36}}\right]$$

RUTTING



0.1mm/10000 cycles at 60⁰C

Sample design chart



Field trials

Resourceco haul road
2 x 65mm + 50mm surface

Salisbury Industrial Park
2 x 140mm + 50mm surface

Design 10^7 ESA

Field trials - Placement

Field trials - Compaction

140mm layers

65mm layers

Field trials – Immediate trafficking

Field trials – Surface characteristics

After 8 months

After 3 months

RESOURCECO
THE SUSTAINABLE RESOURCE COMPANY

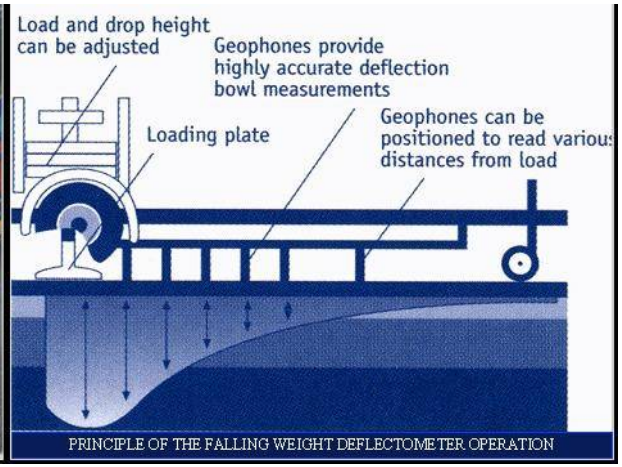
Costs – Salisbury Park

PAVEMENT	COST	DIFFERENCE
280mm Bitumix 3 + 50mmAC	$159,138	$0
270mm AC	$189,063	$29,925
210AC+ 300mmGranular	$252,850	$93,712

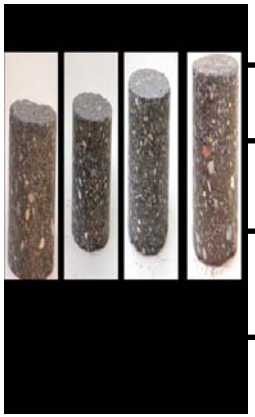
Post construction evaluations

To confirm laboratory results and structural design assumptions

FALLING WEIGHT DEFLECTOMETER MEASURES PAVEMENT STRENGTH



FIELD CORES



1800MPa

2100MPa

1800MPa

Other applications

Summary

- A Project in progress
- $200k research project + in kind costs
- Support funded from Zero Waste SA

- Market potential $2 million per annum miscellaneous sales

- Research  Practice  Commercial reality

= WIN - WIN PROFIT