



Accelerated full-scale experiment on foamed bitumen pavements at CAPTIF

Alvaro Gonzalez

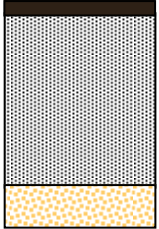
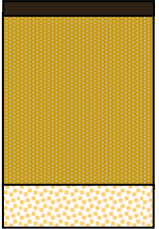
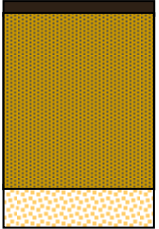
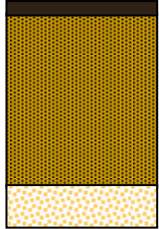
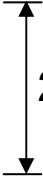
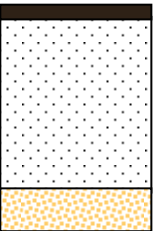
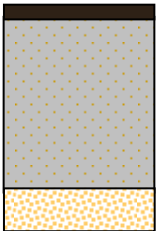

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Introduction

- Areas of New Zealand are facing a problem on good quality aggregate supply.
- An alternative is to improve the quality of materials using stabilisation, such as foam bitumen. However, there is little research about its performance.
- A research project to identify the potential benefits of foam bitumen was undertaken at CAPTIF.
- The objective was to measure the effects of foam bitumen in pavement performance (rutting, deflections, strains) and laboratory tests.

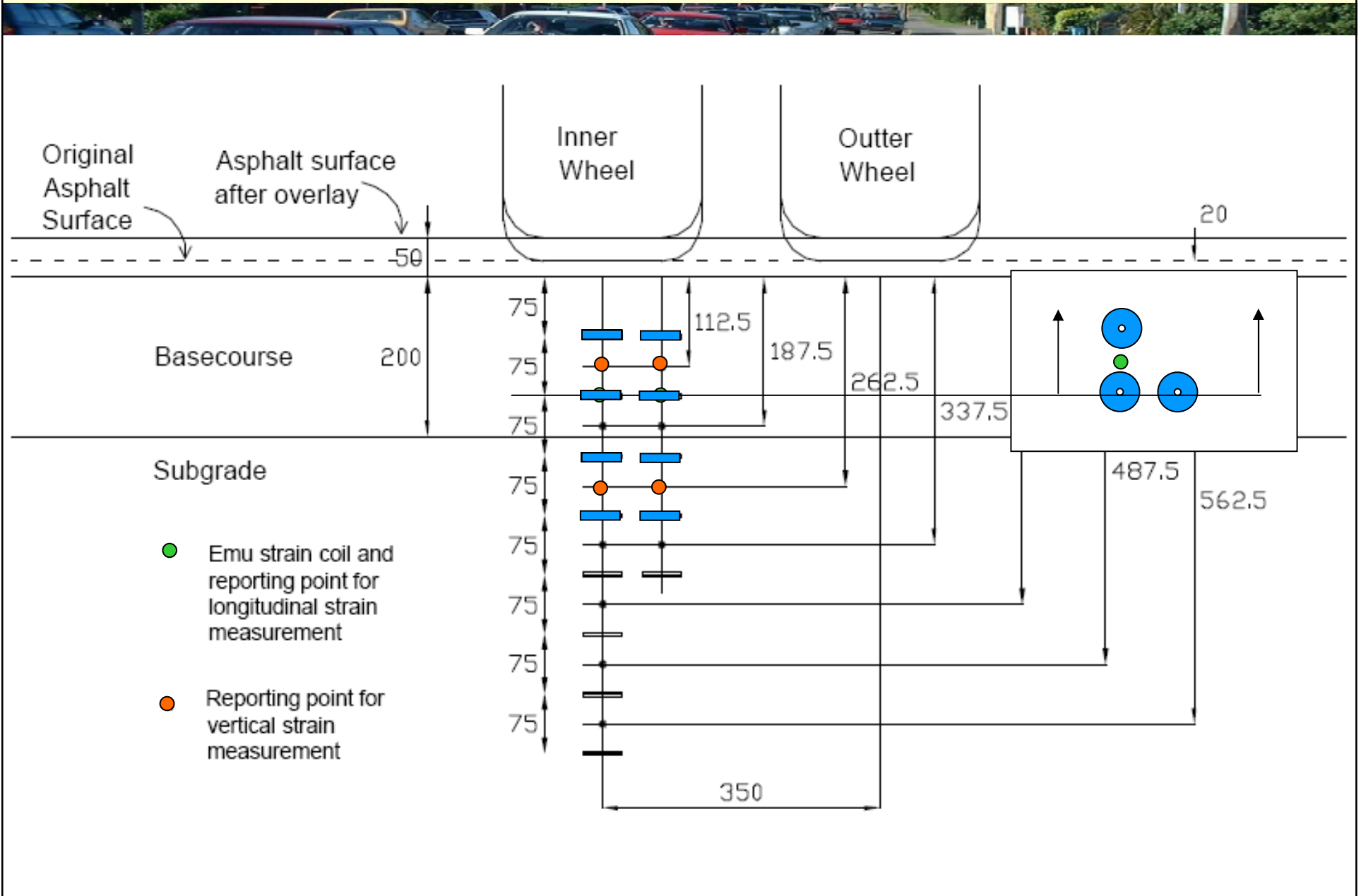
Pavement Experimental Design

- Six (6) pavements studied:

 <p>0.0%FB 1.0%C</p>	 <p>1.2%FB 1.0%C</p>	 <p>1.4%FB 1.0%C</p>	 <p>2.8%FB 1.0%C</p>	 <p>200 mm</p>	<p>1.0% Cement</p>
 <p>Control Unbound</p>	 <p>2.2%FB 0.0%C</p>	 <p>200 mm</p>			<p>0.0% Cement</p>

- Surface: 20 mm asphalt surface
- Untreated Unbound: 85% Greywacke + 15% Crusher Dust
- Subgrade: Clay, 60 MPa (Verified using Scala and FWD)

Pavement Strain Instrumentation



Pavement Construction



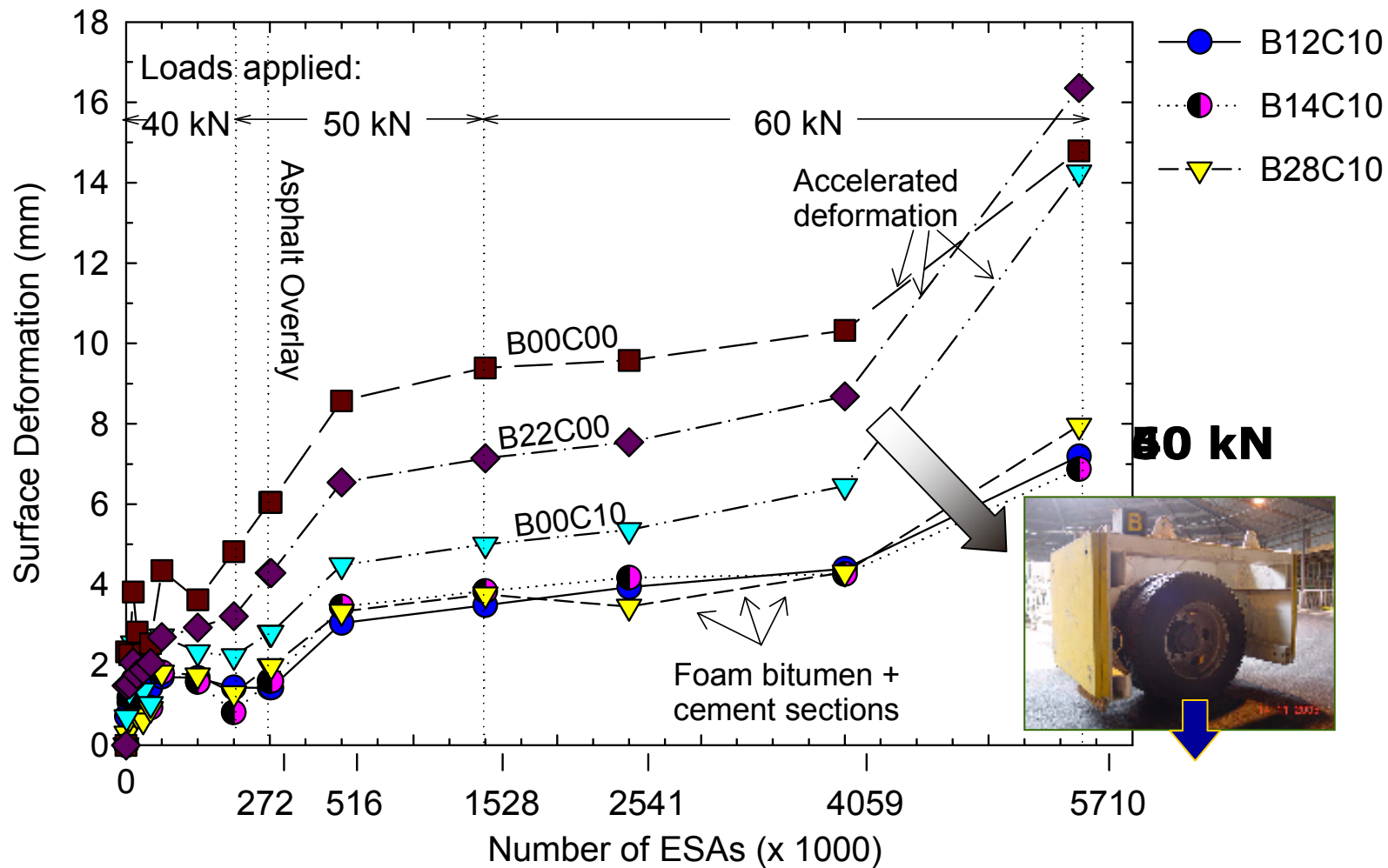
**Video
(1 min video)**



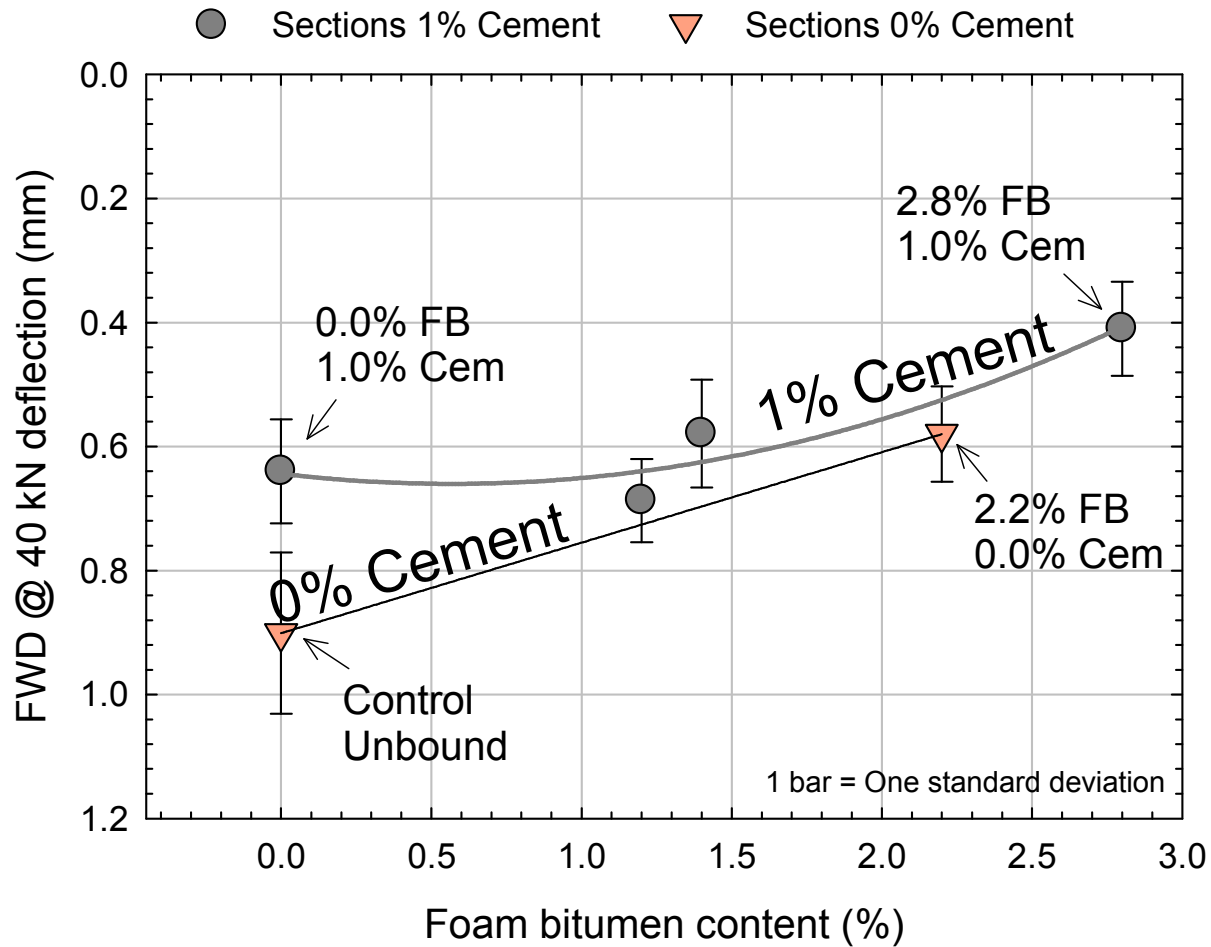
Pavement test results

- **Rutting**
- **Deflections**
- **Strains in stabilised layers**

Effect on pavement rutting

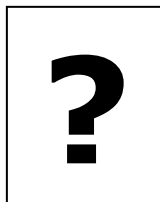
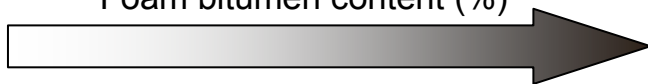
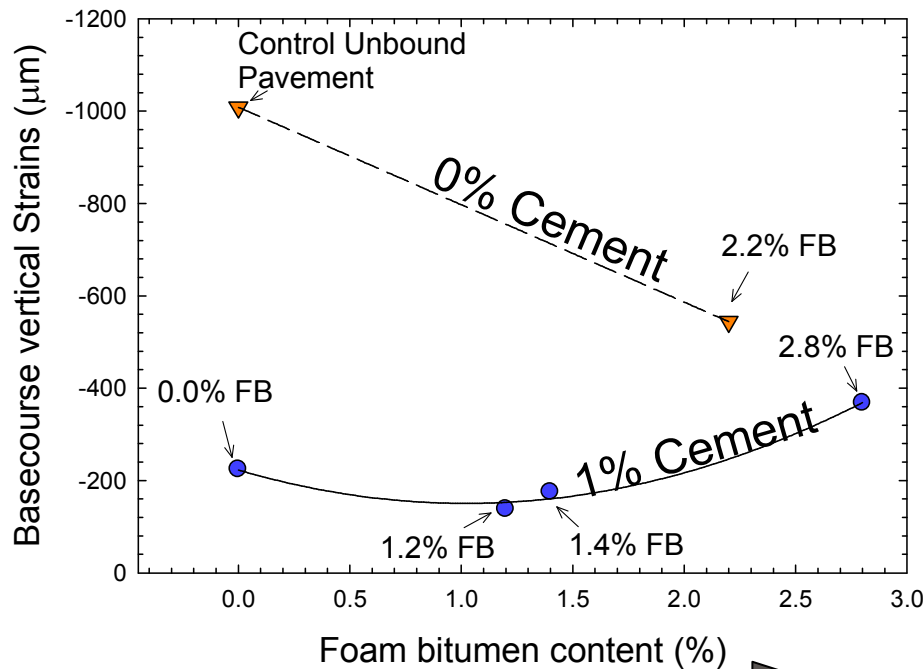


Effect on pavement deflections

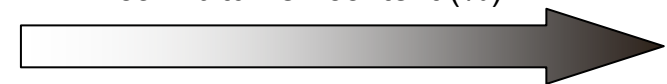
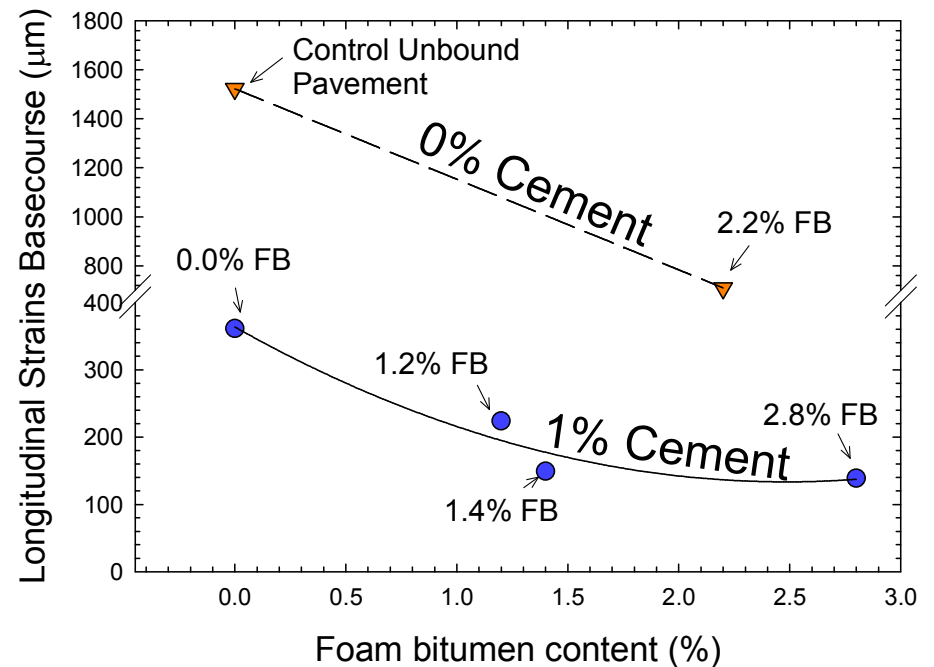


Effect on pavement strains

Vertical strains



Longitudinal strains



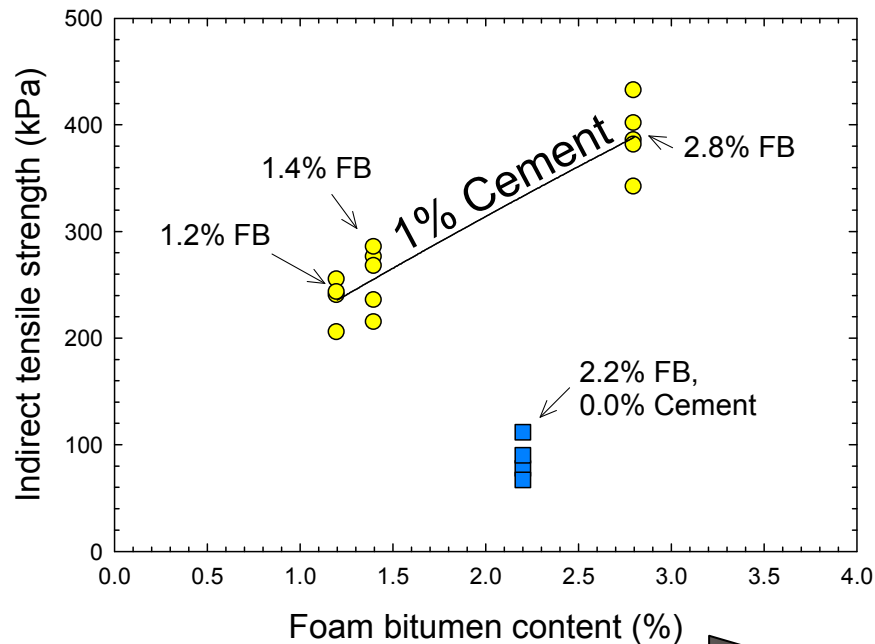


Laboratory test results

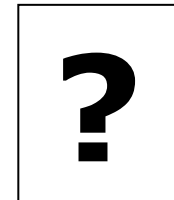
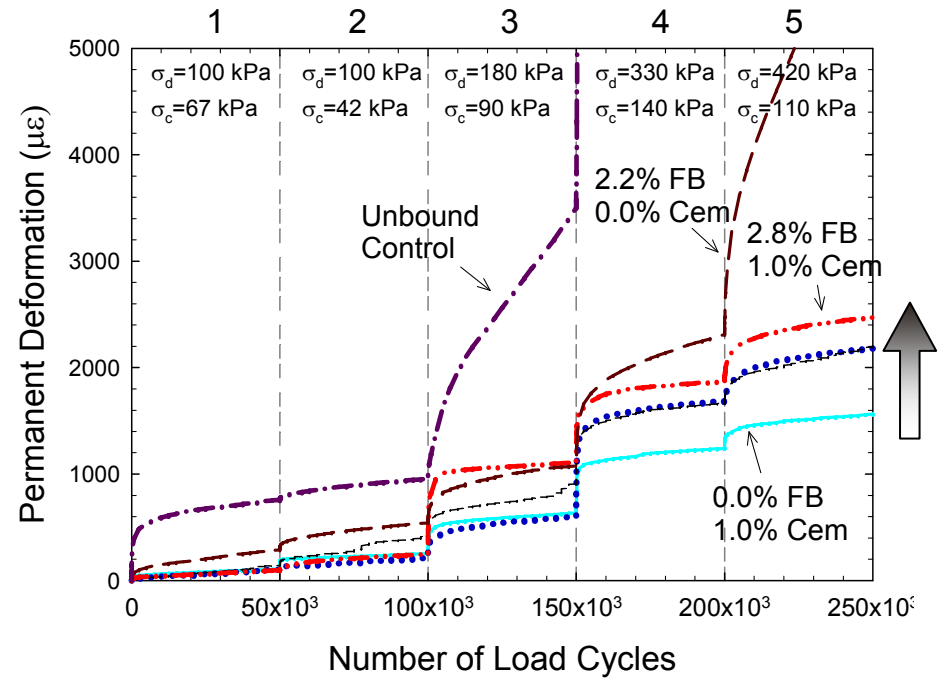
- **Indirect Tensile Strength (ITS)**
- **Repeat Load Triaxial Test**
- **Static Triaxial Tests**

Effect on Laboratory Tests

Indirect Tensile Strength

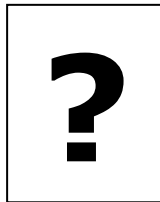
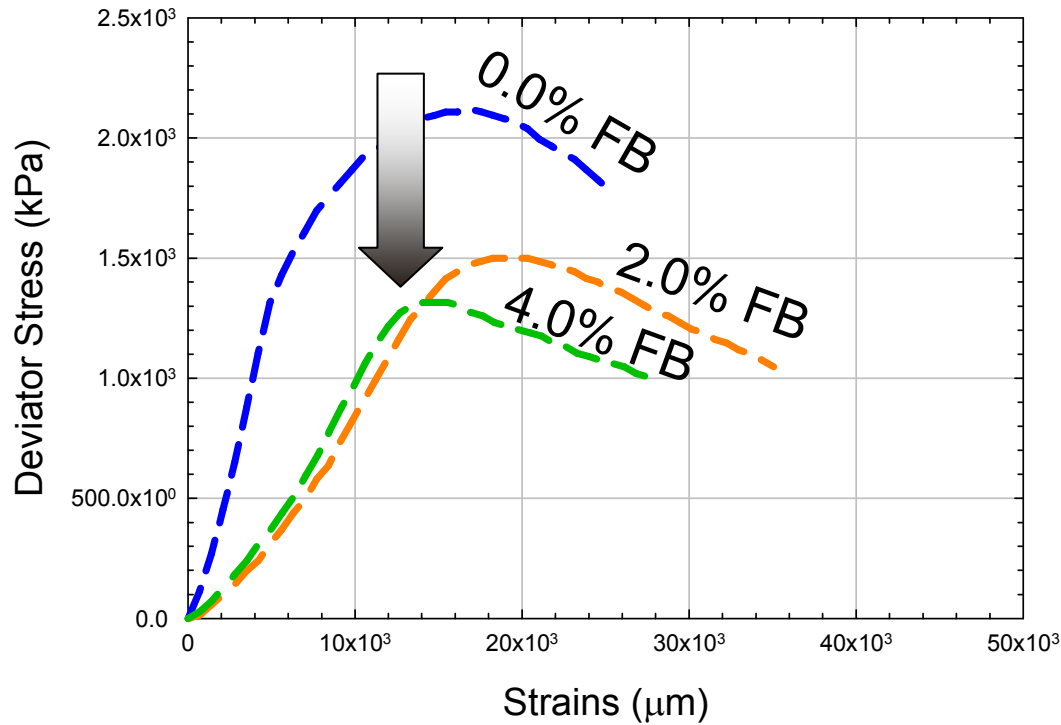


Triaxial TNZ T/15 Permanent Deformation

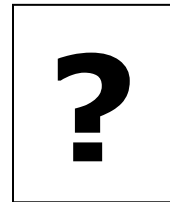
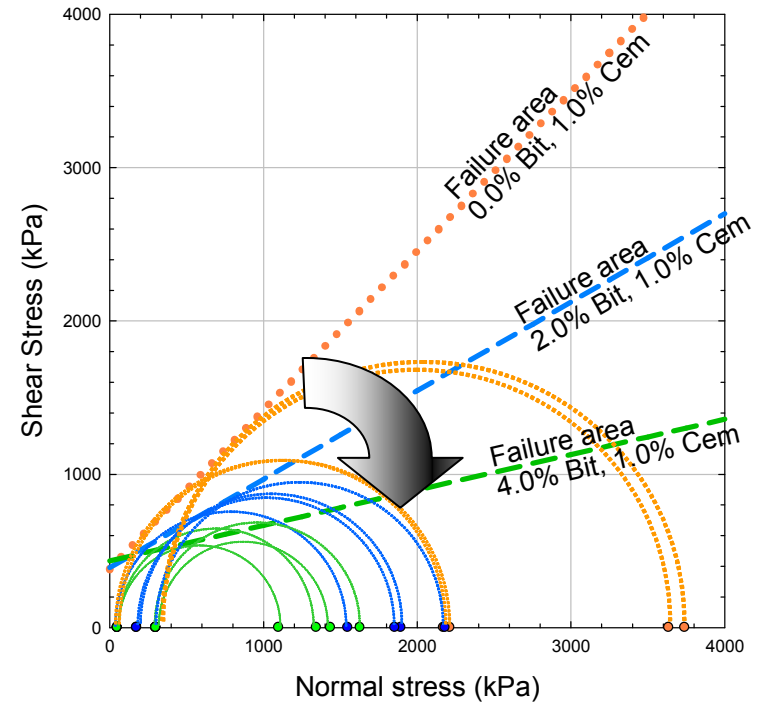


Effect on Static Triaxial Tests

Stress vs. Strain, 1% Cem (Confining = 50 kPa)



Mohr-Coulomb Failure envelopes



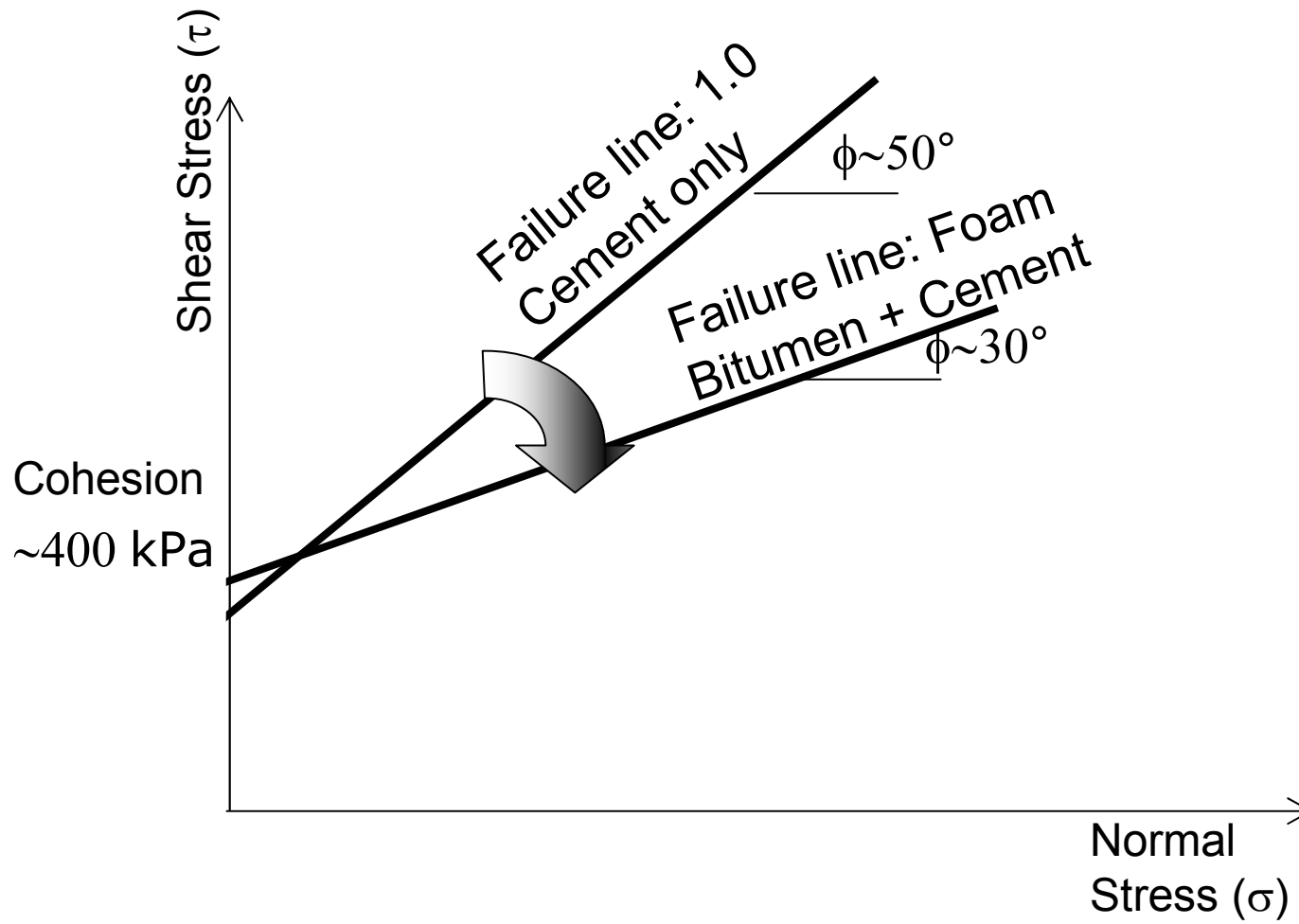


Interpretation of results

- **Shear Strength Parameters**
- **Stresses induced by wheels**
- **Interpretation ITS and UCS tests**

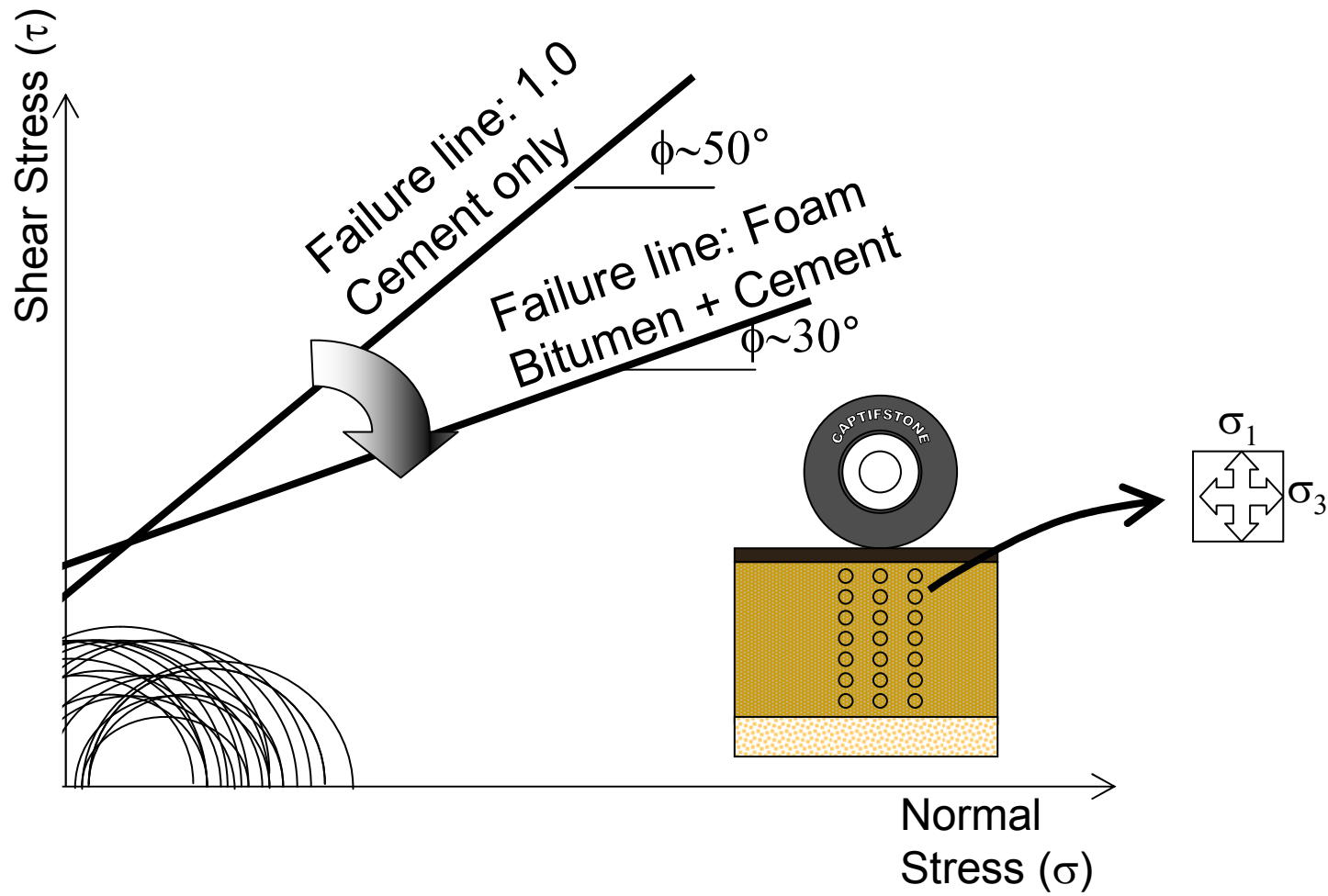
Effect on Shear Strength (ϕ, C)

Determined using Triaxial Static Tests



Effect on Shear Strength (ϕ, C)

Failure envelopes and Stresses



Summary & Conclusions

- Pavements with FB + 1.0% Cement show the smallest rutting, while pavement deflections decrease at higher foam bitumen contents.
- In pavements at 1.0% cement, the compressive vertical strains increase while longitudinal tensile strains decrease at higher bitumen contents.
- Laboratory ITS increase with addition of FB in mixes at 1.0% cement.
- Laboratory Triaxial specimens with 1.0% cement performed well, but deformation increased at higher foam bitumen contents.
- The overall behaviour of the materials could be explained by the reduction in the friction angle of the materials studied.
- The reduction in ϕ is actually improving the material performance by enhancing the tensile properties of the mix.

Special thanks to:

- PhD Supervisory team:
 - Dr. Misko Cubrinovski (Associate Professor, University of Canterbury)
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- Hiway Stabilizers
- NZ Stabilising Group