

Introduction

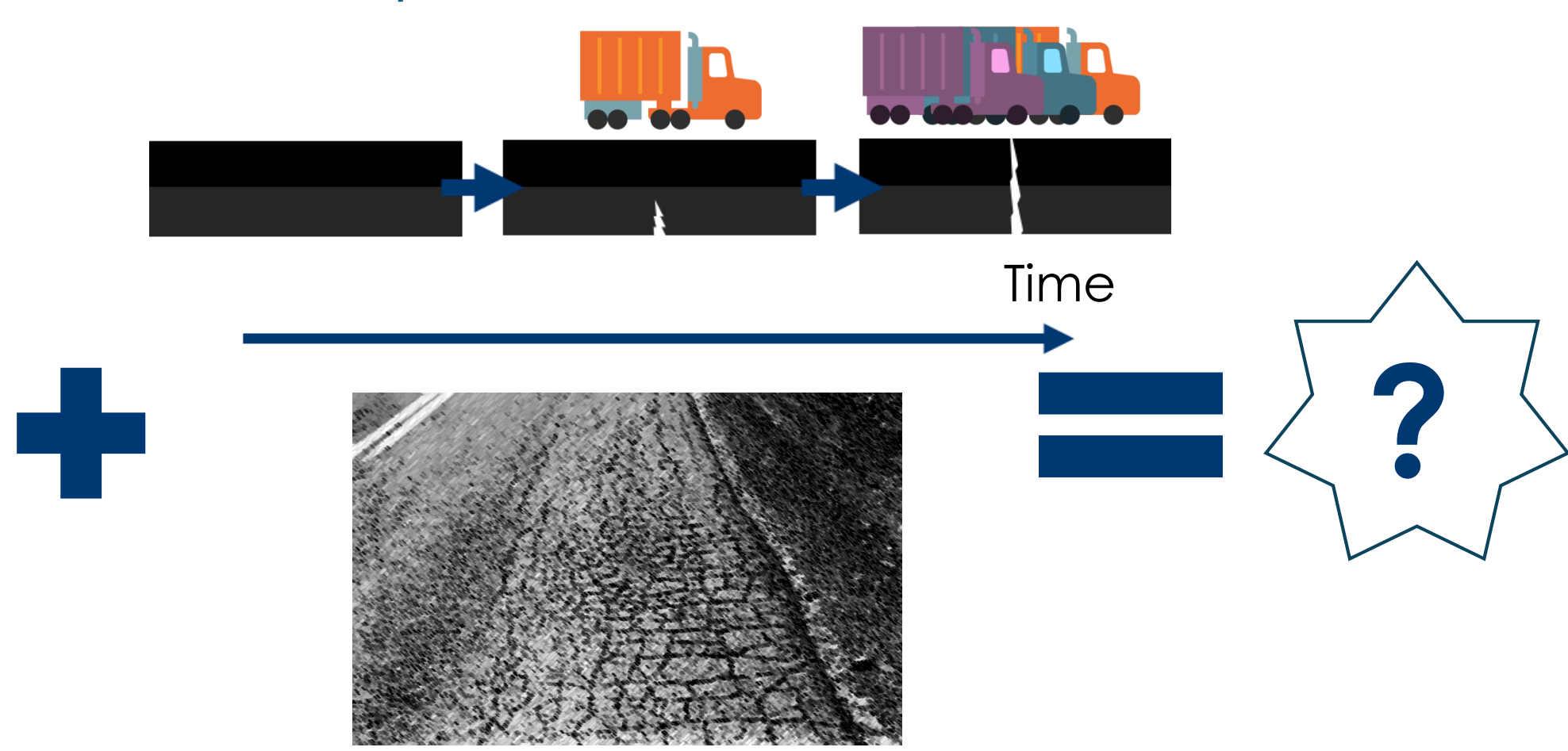
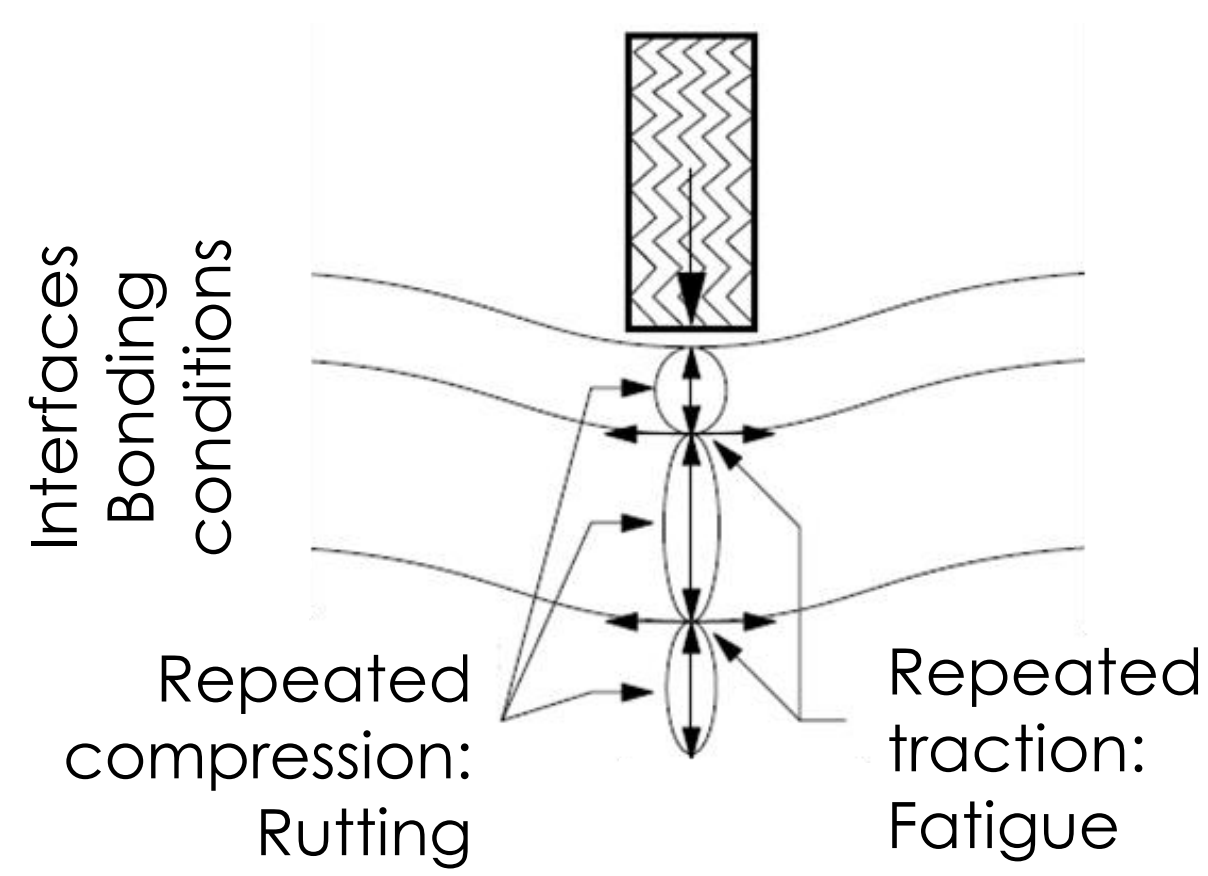
Climate change

Long-term shifts in temperatures and weather patterns

Temperature: increase due to global warming

Water content: variation in precipitation regimes

Fatigue



Experimental plan - variables

1 Mixtures	GB3 70/100 ($T_{mix} = 163^{\circ}C$)			GB3 Bio binder ($T_{mix} = 131^{\circ}C$)		
	Binder	Pen. (0.1 mm)	Soft. point ($^{\circ}C$)	Binder	Pen. (0.1 mm)	Soft. point ($^{\circ}C$)
Same gradation curve: GB 0/14 + 40% RAP	70/100	75	46.2	Bio binder	99	89.0
	RAP	11	73.8	RAP	11	73.8
	Binder mix	33	58	Binder mix	39	82.5

2 Test temperature
 • 10°C – reference temperature EN 12697-24
 • Increased temperatures 15°C 20°C 30°C

3 Water content
 • Dry: reference condition in laboratory
 • Saturated: saturation protocol EN 12697-12

4 Type of tests

Tension-compression (T/C)
 Thermal Sensor PT100
 Extensometers
 10 Hz
 Non-contact sensors
 Internal Thermocouple

Four-point bending (4PB)
 Force transducer
 LVDT
 Thermal sensor PT100
 Internal Thermocouple
 10 Hz

Two-point bending (2PB)
 Eccentric motor
 Displacement transducer
 Force transducer
 Thermal sensor
 25 Hz

5 Mode of tests

Conventional fatigue tests (CFT)
 Cyclic sinusoidal loading
 Frequency
 Strain amplitude
 Temperature

Fatigue test with rest periods (FRP)
 • Initial complex modulus test
 • Fatigue lag 100 000 cycles 10Hz
 • 48 h rest period
 • Short complex modulus test in specific times

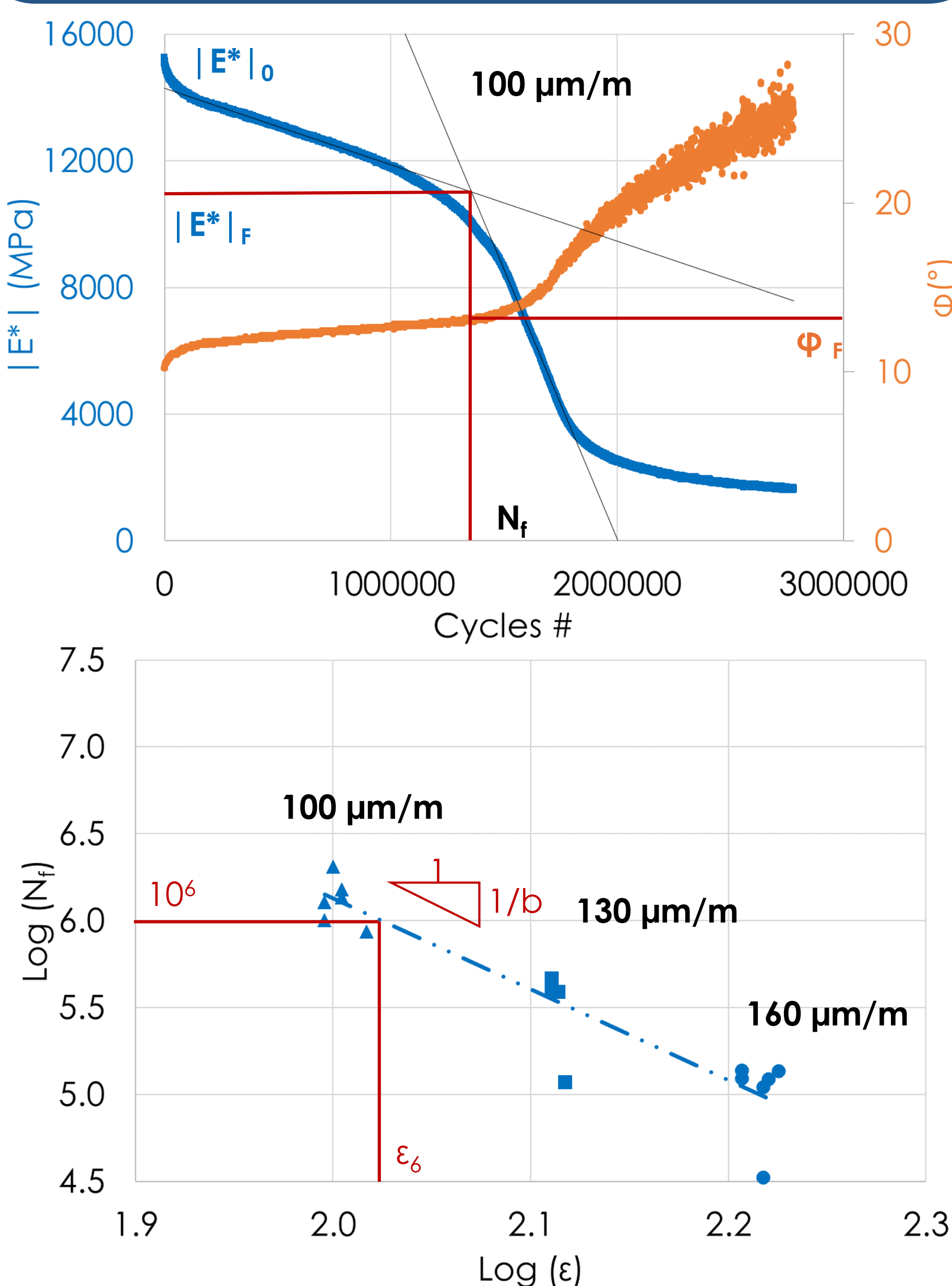
Objectives

Study the impact of temperature and water content on fatigue resistance of road infrastructures:

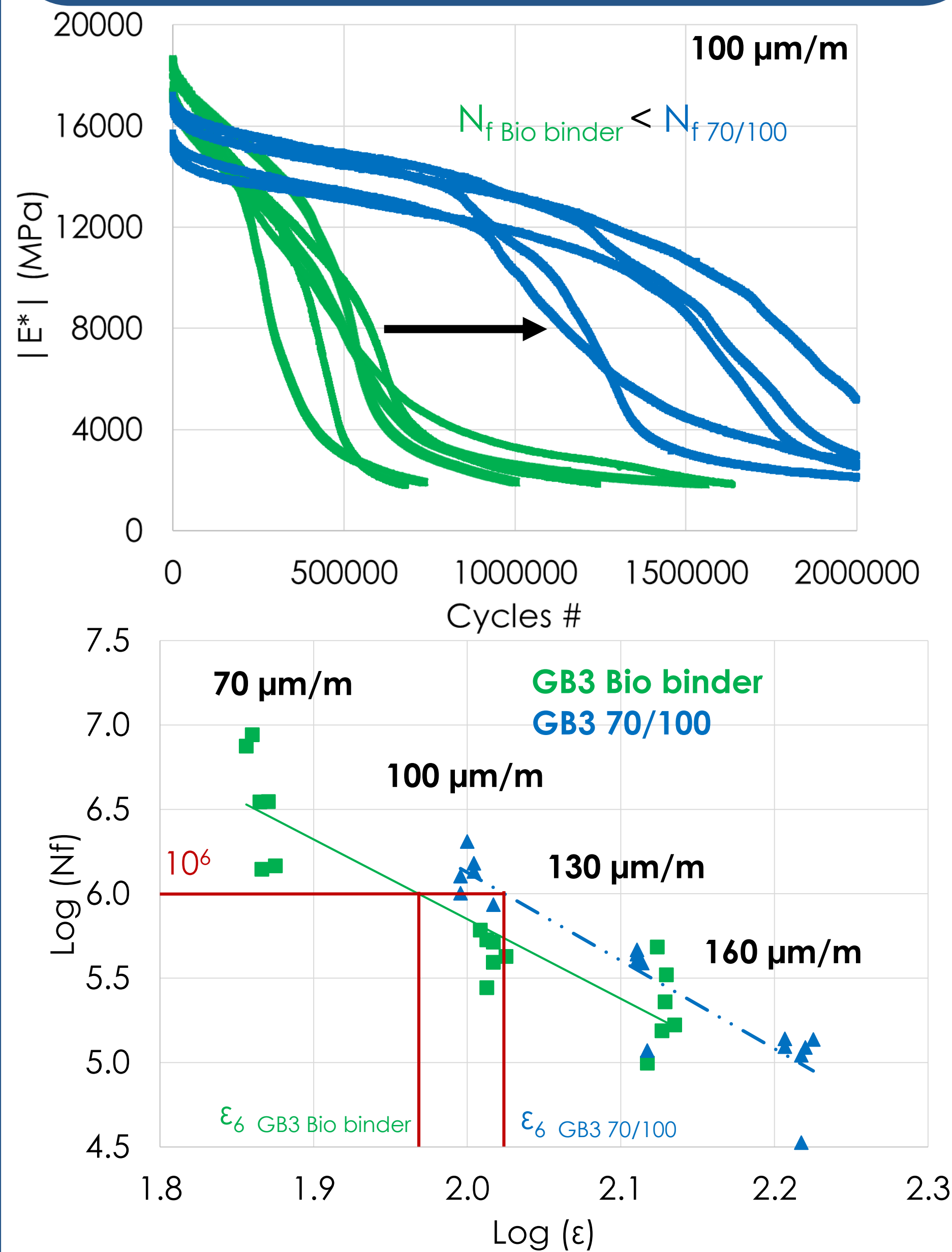
- Characterize experimentally the influence of temperature, water content, materials and types of tests on fatigue performances.
- Compare the performance of a control hot mix asphalt (HMA) and a warm mix asphalt (WMA) including a Bio binder with vegetal raw materials
- Quantify and isolate at different temperatures biasing effects during fatigue tests.
- Develop a fatigue model for bituminous materials with climatic conditions

Preliminary results (Dry – 2PB – CFT)

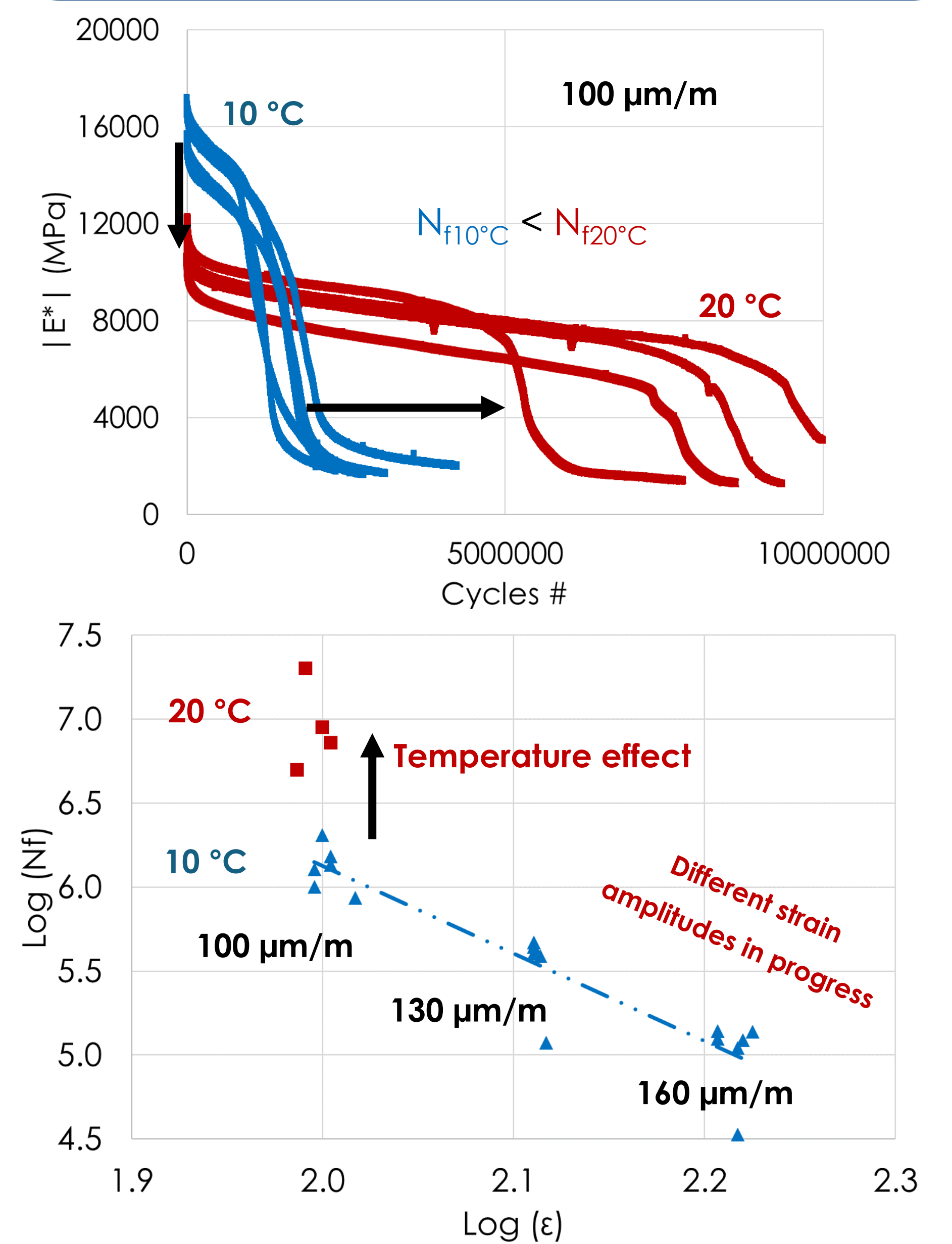
Base results GB3 70/100 - 10°C



Material comparison at 10°C GB3 70/100 & Bio binder

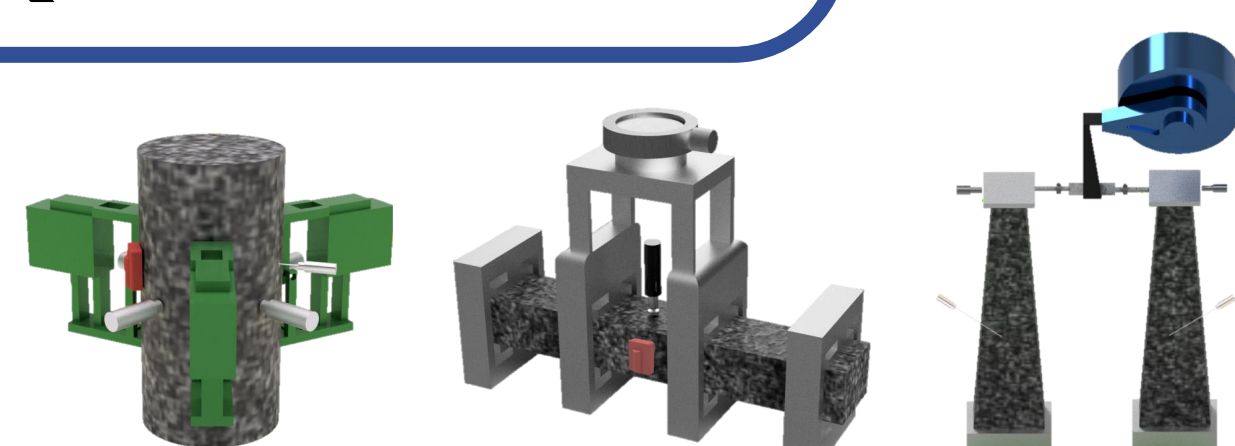


Temperature comparison GB3 70/100 10°C & 20°C



Future work

- Influence of water content
- Increasing test temperatures
- Relationship between various types of tests



- Fatigue tests with rest periods
- Quantify biasing effects in different test temperatures
- Fatigue model for bituminous materials