Bituminous Mixture Characterization

Indirect Tensile Test (IDT)

Working Principle (ASTM D6931, 2017)

- The IDT strength of bituminous mixtures is determined by loading a cylindrical specimen across its vertical diametral plane at a specified rate of deformation and test temperature.
- The peak load at failure is recorded and used to calculate the IDT strength of the specimen.

Application

- To evaluate the relative quality of bituminous mixtures in conjunction with laboratory mix design testing.
- To determine the potential for field pavement moisture damage using moisture-conditioned and unconditioned specimens.

AIMIL, India: Indirect tensile test apparatus

Dry Wheel Tracker

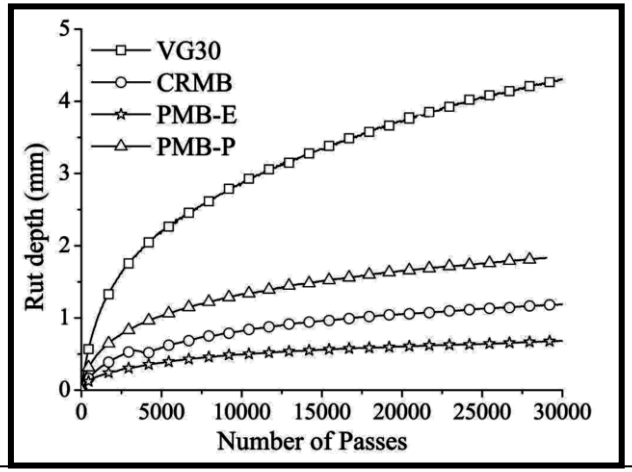
Working Principle (EN 12697-22, 2020)

- Simulative test apparatus used to assess the susceptibility of bituminous mixture to deformation by measuring the rut depth along the wheel path due to repeated passes of a loaded wheel.

Cooper technology, UK: Dry wheel tracker

Application

- Rutting resistance of bituminous mixtures can be qualitatively compared.



Dry wheel tracking test results for different bituminous mixtures

1. https://doi.org/10.1520/JTE20120229
2. https://doi.org/10.1016/j.sbspro.2013.11.102

Workability of Bituminous Mixture

Workability Equipment

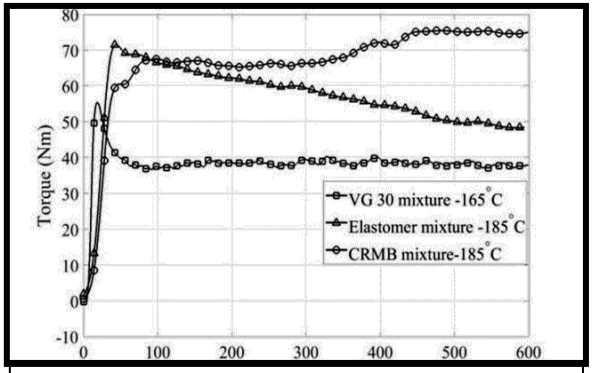
Working Principle

- The equipment has an in-line torque sensor, mixing paddles and a temperature controlled mixing drum.
- Mixing paddle arrangement can be varied to suit torque data collection of different types of bituminous mixtures
- The in-line torque sensor is used to measure the resistance of the bituminous mixture during mixing right from the start of mixing of aggregate with binder
- The torque can be measured at different paddle rotation (upto 50 rpm) and temperature (up to 200°C)

Application

- The torque data are used for quantitative comparison of workability of bituminous mixtures at their mixing and compaction temperatures
- Equivalency of bituminous mixtures in terms of workability can be evaluated
- It also serves as an automated mixing machine with a batch capacity of 35 kg

IIT Madras, India: Workability Equipment



Workability of bituminous mixtures

Asphalt Mixture Performance Tester (AMPT)

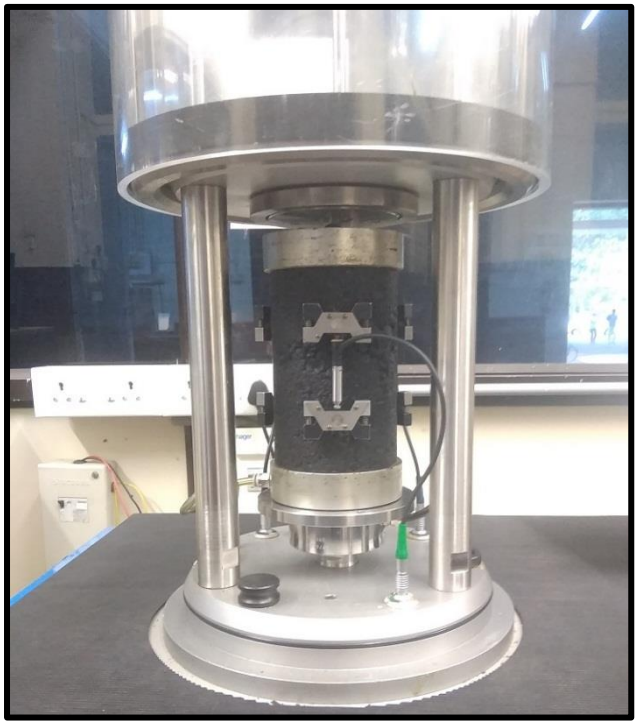
AMPT

Working Principle

- The experimental setup consists of a computer controlled servo-hydraulic testing machine which can apply cyclic loading over a range of temperature and frequencies.
- It is equipped with environmental chamber for precise temperature control.
- In-sample deformation can be captured using linear variable differential transformers (LVDT).
- Cyclic compression, cyclic tension and cyclic tension-compression loading protocols with and without confinement can be applied.

Application

- Repeated haversine compression test (with and without confinement).
- Flow number and flow time test (with and without confinement).
- Repeated direct tension and tension-compression test.

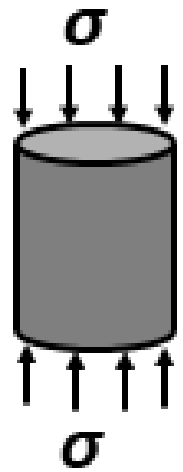


IPC global, Australia: AMPT testing jig

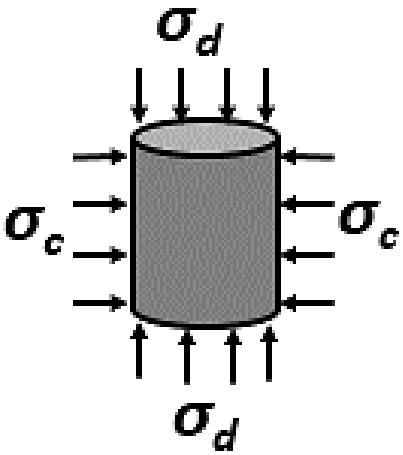
Repeated Haversine Compression Test (AASHTO T378, 2017)

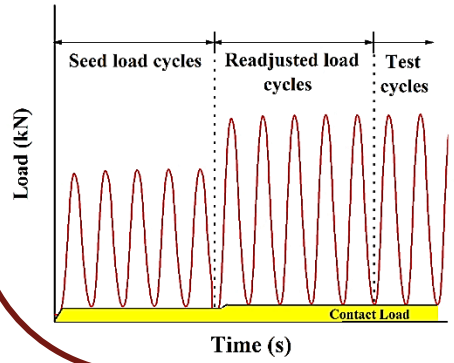
Loading Protocol

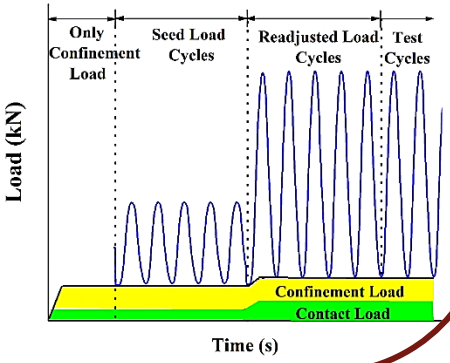
Unconfined



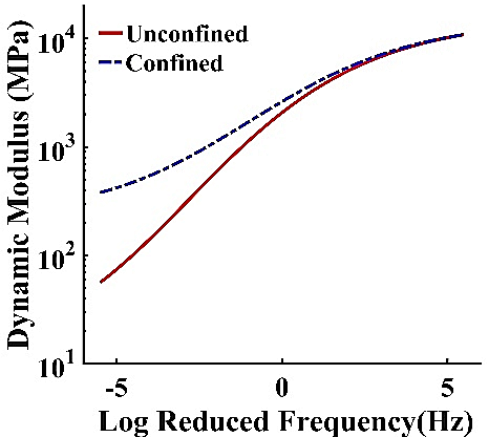
Confined

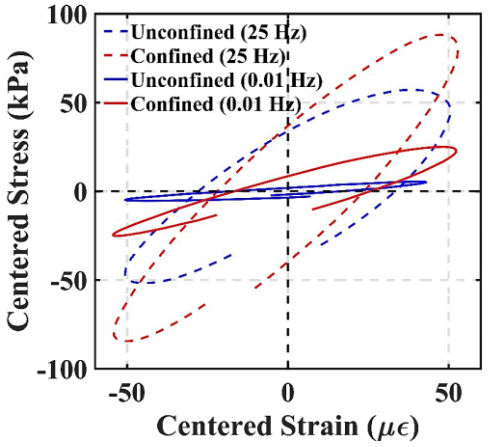






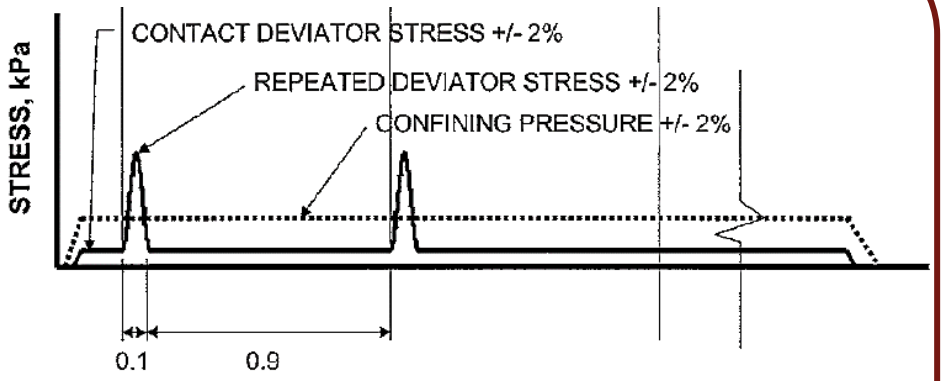
Mechanical Response



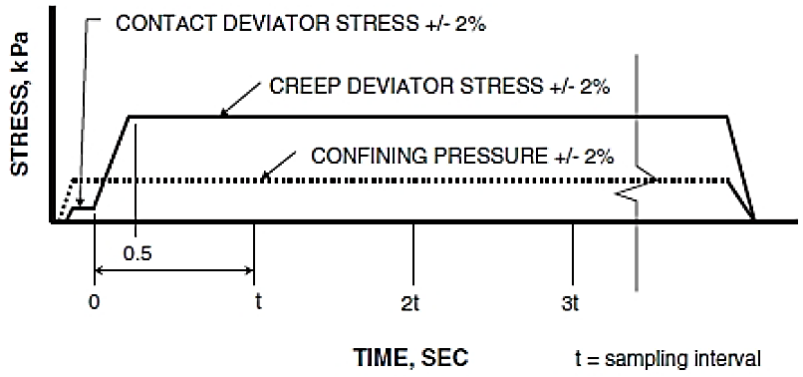


1.https://doi.org/10.1080/10298436.2017.1380809
2.https://doi.org/10.1016/j.conbuildmat.2016.12.116
3.https://doi.org/10.1520/JTE20120229

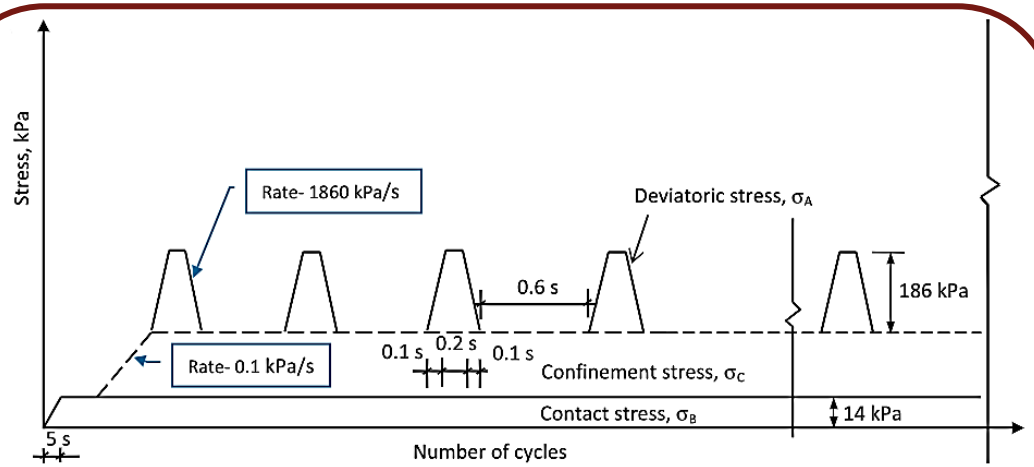
Flow Number and Flow Time test (AASHTO T378, 2017)



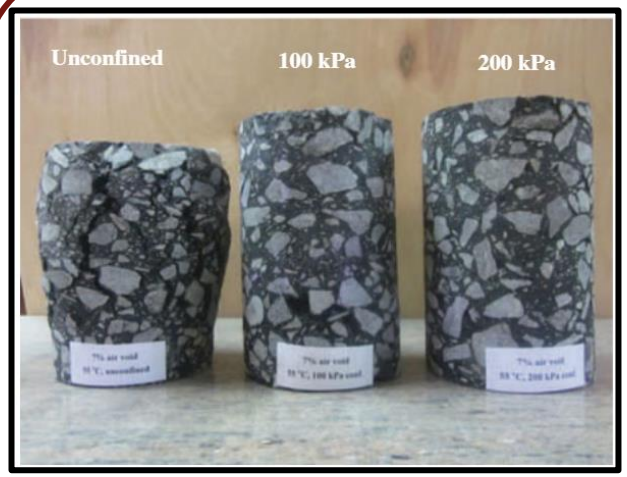
Flow number test



Flow time test



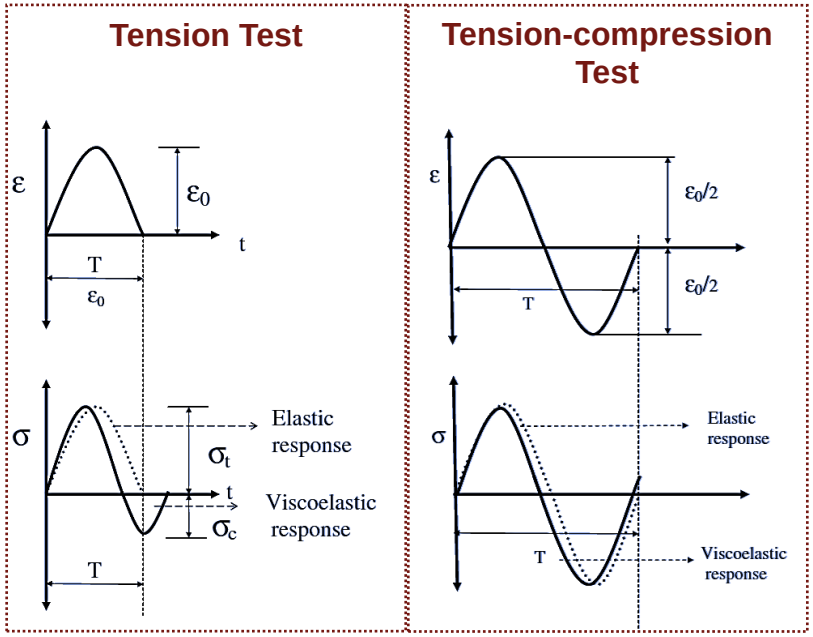
Modified test protocol (IIT Madras)



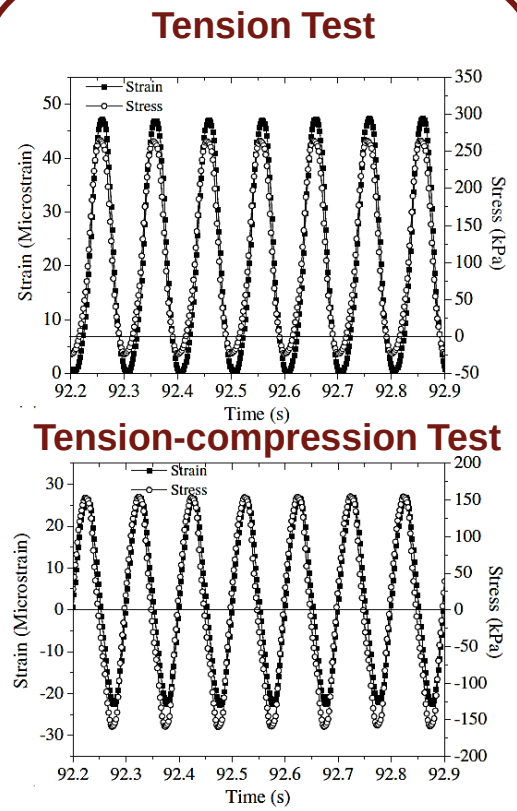
Tested samples

1.https://doi.org/10.1080/10298436.2014.925622
2.https://doi.org/10.1520/JTE20120229
3.https://doi.org/10.1016/j.conbuildmat.2020.120138s

Direct Tension and Tension-Compression Test



Loading Protocol



Strain Response

1.https://doi.org/10.1061/(ASCE)MT.1943-5533.0001967

European Standard Tester (ENST)

European Standard Tester (ENST)

Working Principle

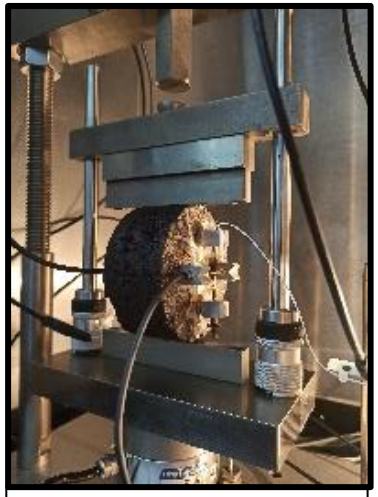
- Hydraulic power controlled equipment with a load capacity of 25 KN.
- The temperature control cabin can maintain temperature from -20 ºC to 80 ºC.
- Different tests can be carried out using this equipment by changing the jig.

Application

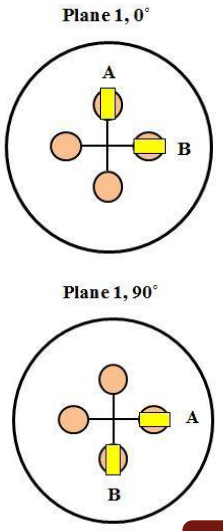
- Resilient Modulus Test (Indirect tension)
- Fatigue Test (4-point beam bending)
- Pull off Test
- Semi-Circular Bending (SCB) Test

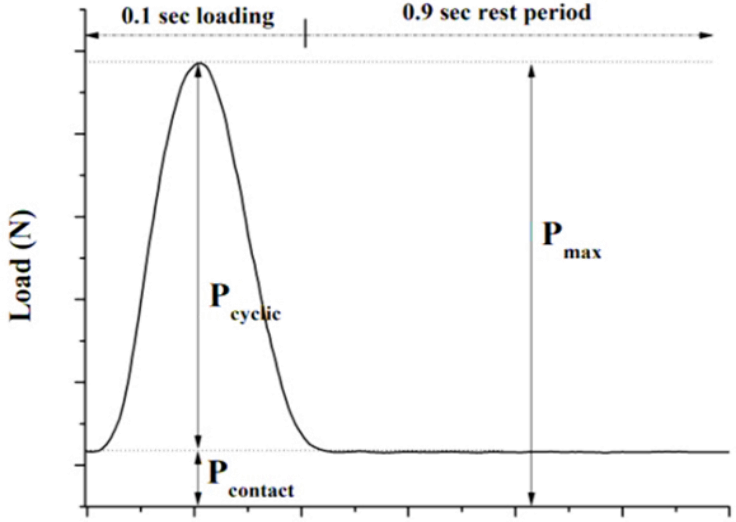
IPC global, Australia: ENST

Resilient modulus test (ASTM D7369, 2020)

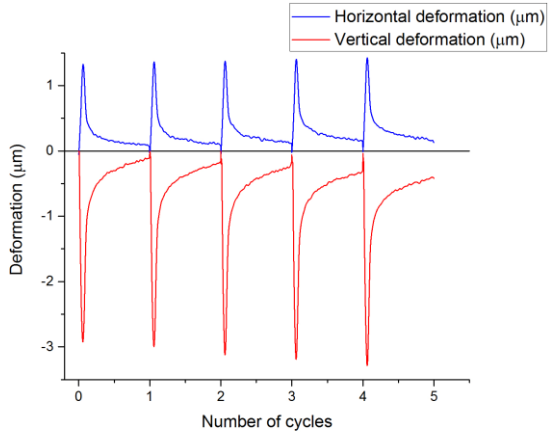


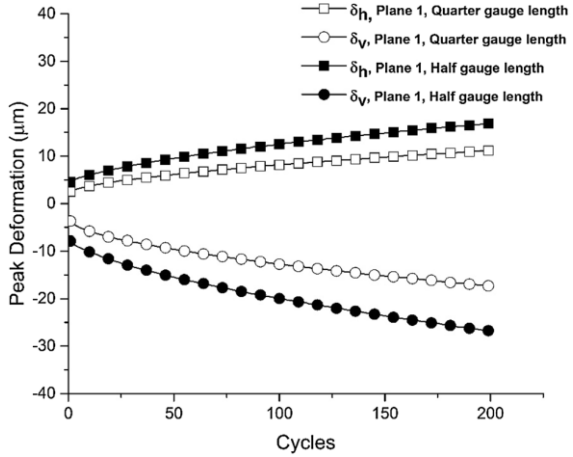
IPC global, Australia:
IDT testing jig

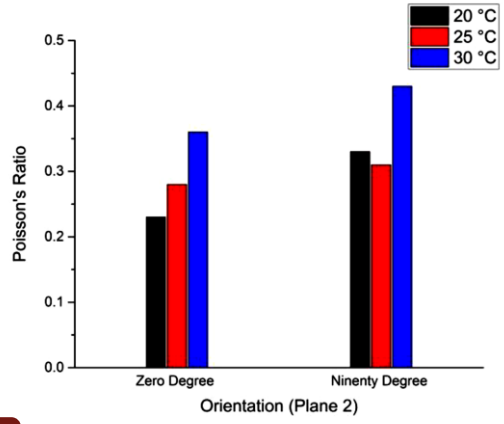




Loading Protocol



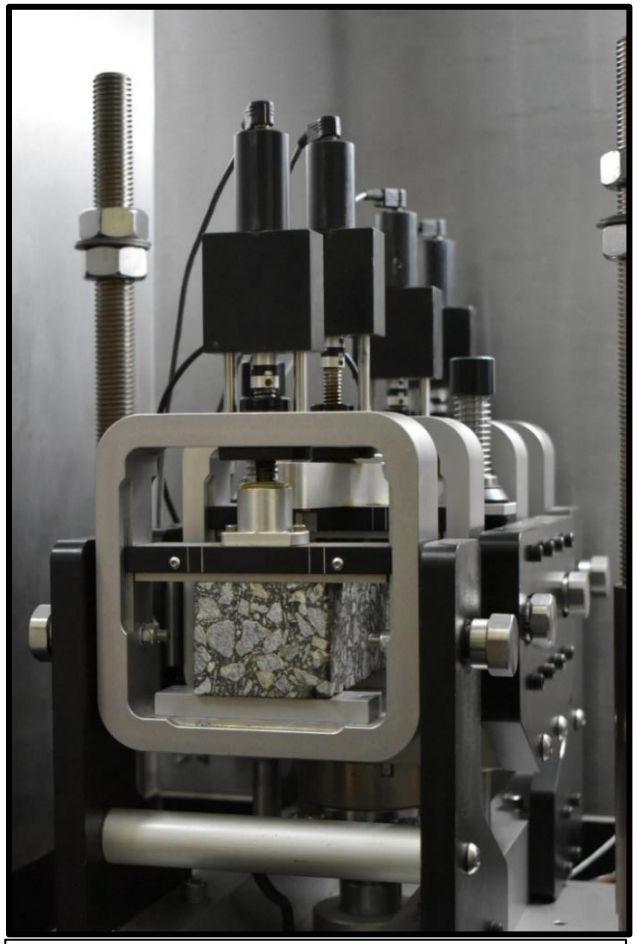




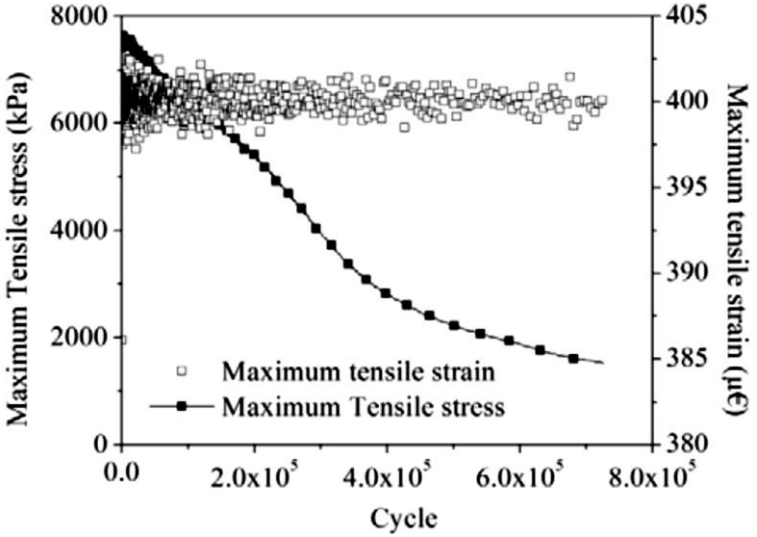
Mechanical Response

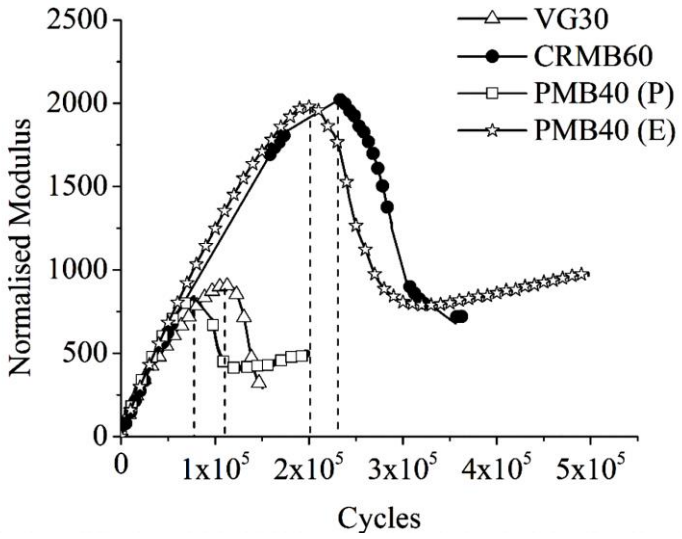
1.https://doi.org/10.1007/s42452-018-0087-7
2.https://doi.org/10.1007/978-981-32-9042-6_71

Fatigue Test (4-point beam bending) (AASHTO T 321, 2017; ASTM D 8237, 2018)



IPC global, Australia: 4PB testing jig

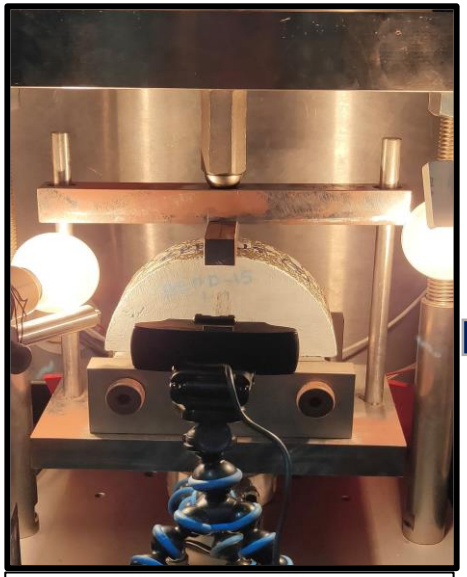




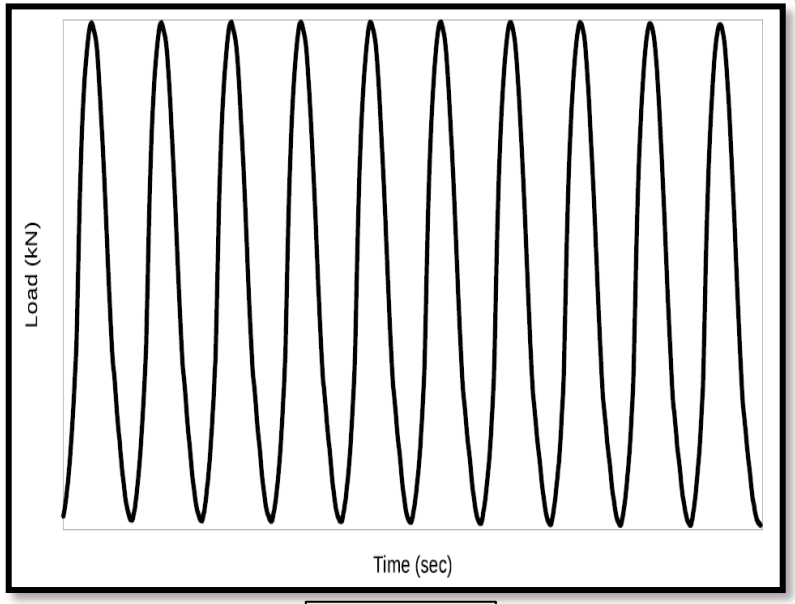
Fatigue distress characterization of bituminous mixtures

1.https://doi.org/10.1061/(ASCE)MT.1943-5533.0002938
2.https://doi.org/10.1016/j.trpro.2016.11.111
3.https://doi.org/10.1080/14680629.2017.1304252
4.https://doi.org/10.1007/s40890-019-0072-x
5.https://doi.org/10.1080/10298436.2019.1654101
6.https://doi.org/10.1061/(ASCE)MT.1943-5533.0003354

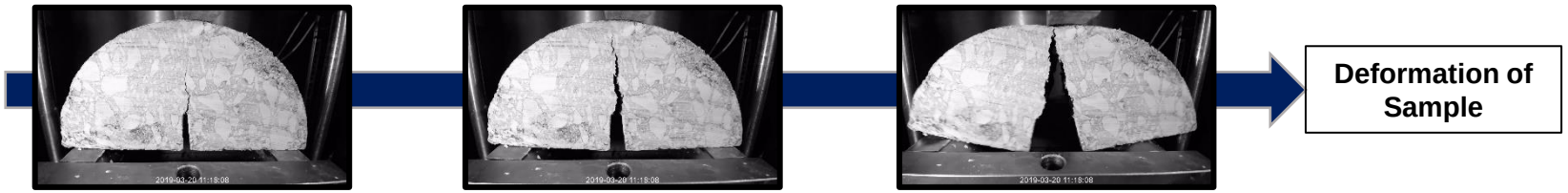
Semi-circular bending (SCB) test (ASTM D8044, 2016)



IPC global, Australia:
SEB testing jig



Load Input

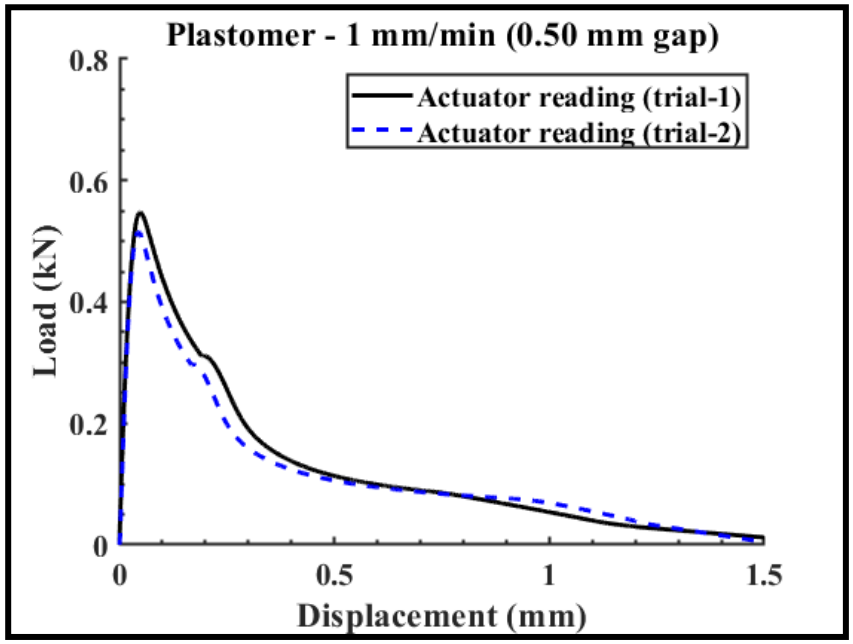


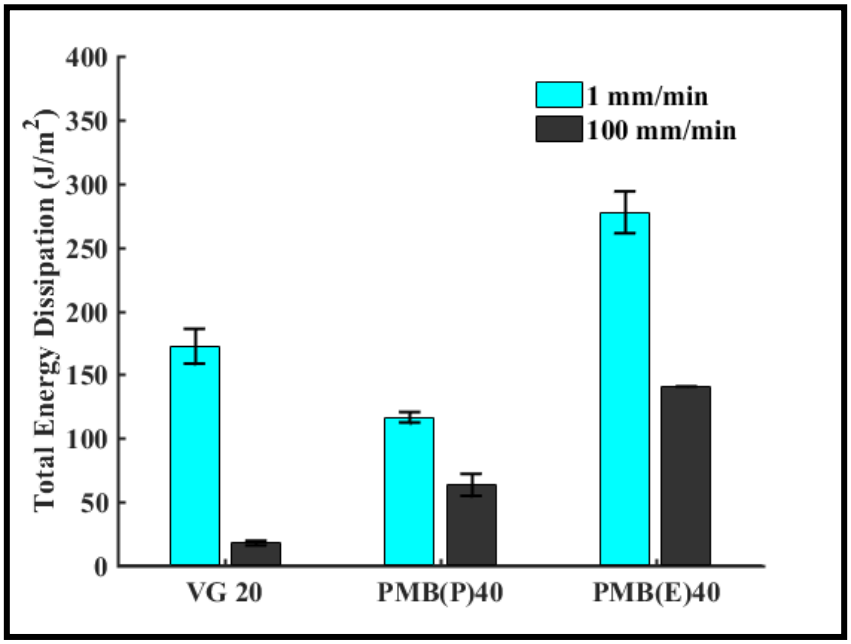
Deformation of Sample

Estimation of the energy dissipation due to fatigue failure of bituminous mixture.

Pull-off test

IPC global, Australia:
Pull-off testing jig

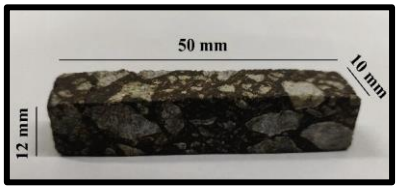




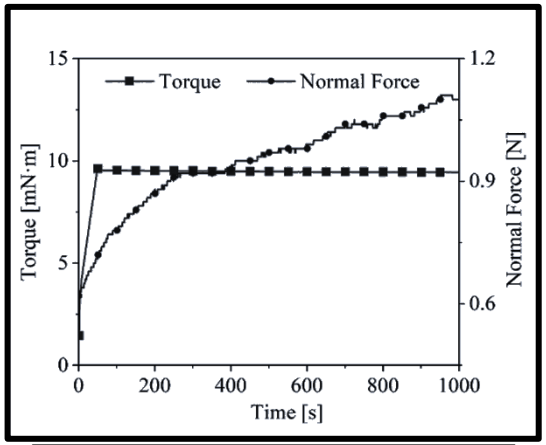
Dynamic Shear Rheometer (DSR)

Solid Rectangular Fixtures (SRF) (ASTM D7552, 2014)

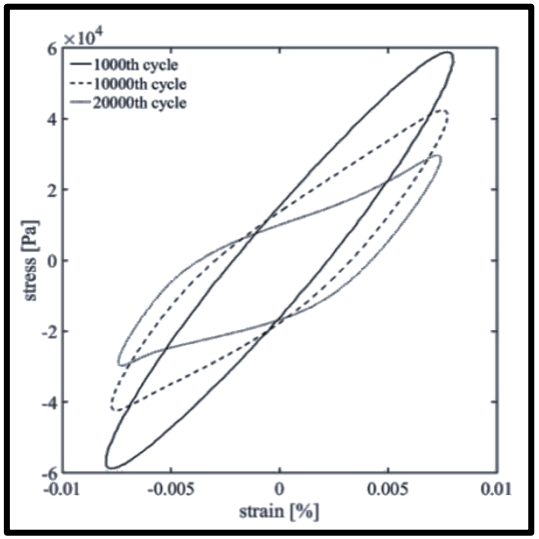
Courtesy: Anton Paar



Anton Paar, Austria: MCR 702 and SRF



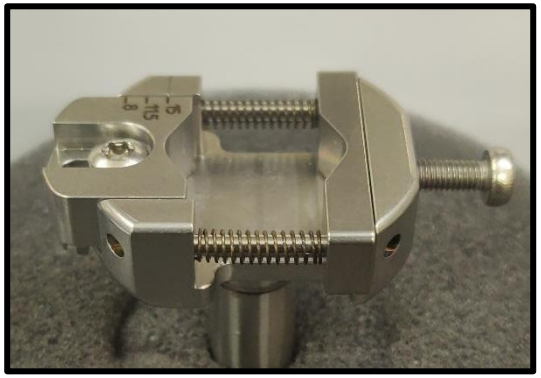
Normal force in shear

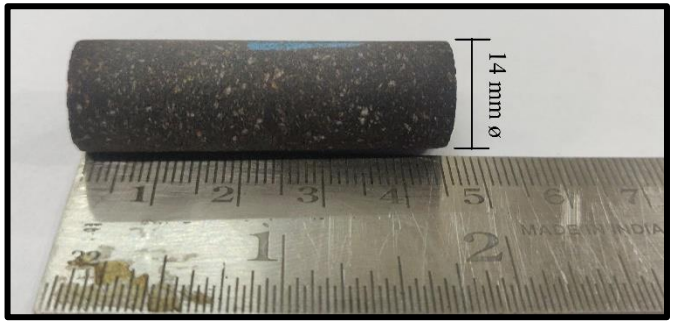


Lissajous Plot

Solid Circular Fixtures (SCF)

Courtesy: Anton Paar





Anton Paar, Austria:
MCR 702 and SCF