

AF2903 Highway construction and Maintenance

Introduction to Simple Performance Tester (SPT)



Royal Institute of Technology, Stockholm

Yohannes Kiflat(kiflat@kth.se)





What is SPT or AMPT ?

Simple Performance Tester (SPT) or Asphalt Mix Performance Tester (AMPT) is a computer controlled pneumatic testing machine used to measure dynamic modulus and flow number of asphalt mixtures according to AASHTO TP79 specification.

SPT helps to :

Improve mix design , structural designs and pavement life and reduce maintenance .

Analyse pavement failure.

Evaluate HMA mixes and Modified HMA

Create Master curves.

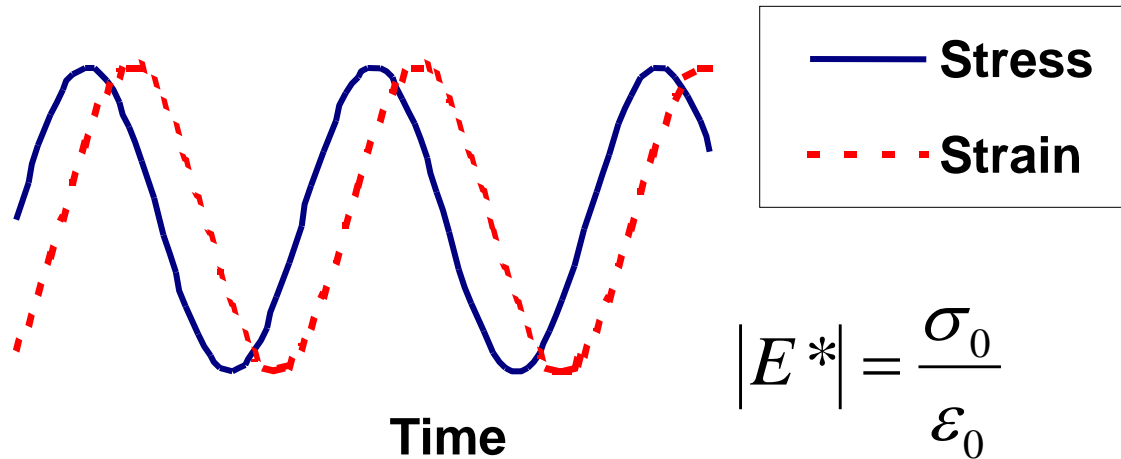


SPT is a direct result from the recommendation of NCHRP (National Cooperative Highway Research Program) project 9-29.

The Candidate tests from this recommendation are :

- Dynamic Modulus (Fatigue and Rutting)
- Static Creep Test(Rutting)
- Repeated Load Creep Test(Rutting)

Dynamic Modulus Test



$$|E^*| = \frac{\sigma_0}{\varepsilon_0}$$

Phase Angle

$$\varphi = \frac{T_i}{T_p} (360)$$

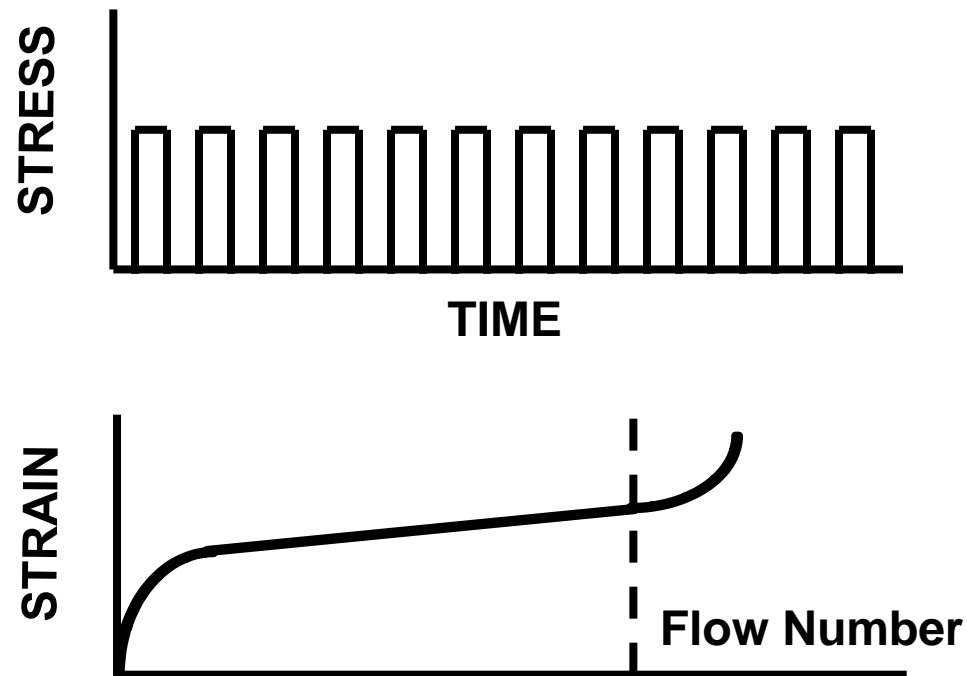
Rutting

Min $|E^*|$ at High Temp

Fatigue Cracking

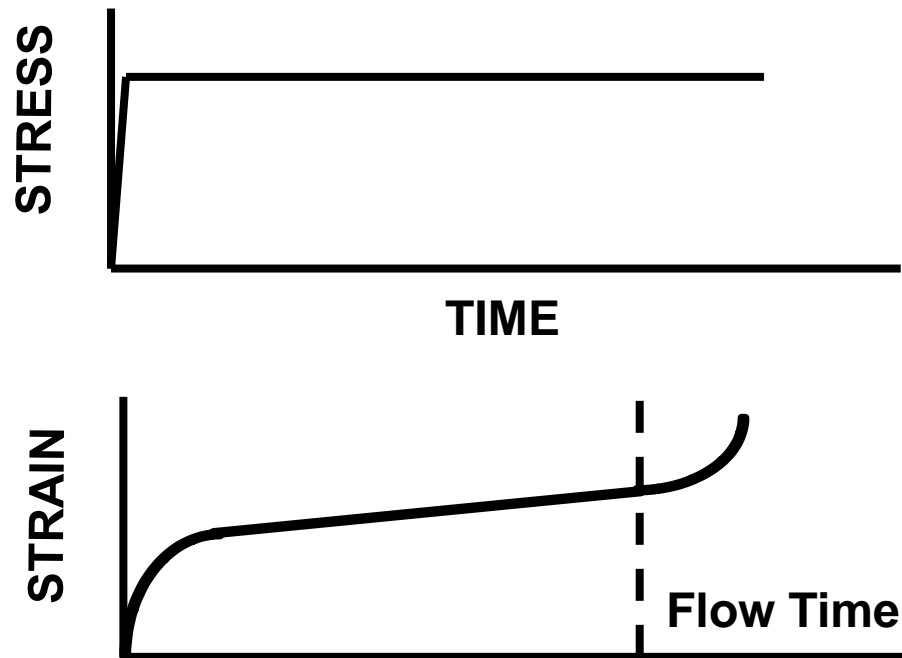
Max $|E^*|$ at Intermediate Temp

Repeated Load Creep Test (Flow number Test)



Rutting
Min FN at High Temp

Static Creep Test



Rutting
Min FT at High Temp



Advantages of SPT

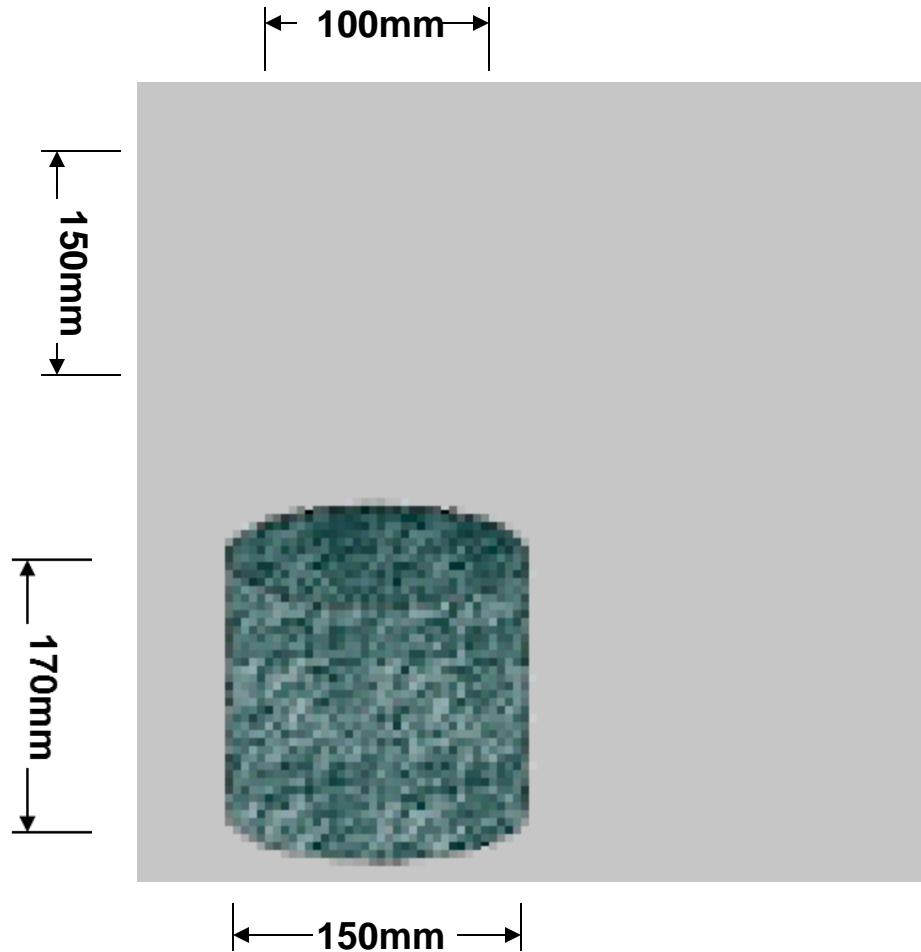
- **Dynamic Modulus**
 - Used For Structural Design in 2002 Design Guide
 - Addresses Rutting and Cracking
- **Static Creep (Flow time)**
 - Simple Test Equipment
 - Minimal Training
- **Repeated Load Creep (Flow number)**
 - Potentially Best Simulation of Actual Loading



Disadvantages of SPT

- Specimen Size
 - 100 mm Diameter by 150 mm High
 - Smooth Parallel Ends (Sawed)
- Sawed and Cored From Over-Height Gyratory Specimens
 - Some SGC Can Not Produce Tall Specimens

Preparation of Sample



Dynamic Modulus Test



A dummy Sample (Proving ring) Should be run at the calibration certificate stress level to calibrate the instrument.

The sample is subjected to a controlled sinusoidal(haversine)compressive stress at various frequencies.

The LVDT (Linear Variable Differential Transformer) sensors measure the deformation when the sample is subjected to stress.

The temperature in the chamber can be changed from -4 to 60 degree centigrade via an AC system.

UTS SPT Dynamic Modulus Test (General Test Layout and description).

Test Title Bar → UTS006 1.00 SPT Dynamic Modulus Test - Demos.D006

Main Menu → File Run Options View Help

Tool Bar → [Icons for file operations, New, Open, Save, Print, Rate, Lower]

Data Display Pages

General	Setup and Control	Test Data	Tuning	Dist
Test date and time: Mon, May 27, 2002, 13:45:14	Contact stress (kPa): 49.6	Dynamic modulus (kPa): 11212	25 Hz: 11212	20 Hz: 10514
Confinement data	Confining pressure (kPa): 90.0	Phase angle (Degrees): 29.99	10 Hz: 8727	5 Hz: 7090
Time (sec): 12	Temperature (°C): 25.3	Average temperature (°C): 25.3	2 Hz: 5067	1 Hz: 3902
LVD1 R1 (mm): 0.001	Warnings:	Average confining pressure (kPa): 50.0	0.5 Hz: 2759	0.2 Hz: 1963
LVD1 R2 (mm): 0.218	<input type="radio"/> Confining pressure	Average micro-strain: 94		
LVD1 R3 (mm): -0.343	<input type="radio"/> Temperature	Load drift (%): 0.3		
	<input type="radio"/> Permanent axial strain	Load standard error (%): 3.3		
		Average deformation drift (%): -307.6		
		Average deformation standard error (%): 8.6		
		Deformation uniformity (%): 5.7		
		Phase uniformity (%): 80.5		

Charting Area

1 Hz Plots: Measured Contoured Normalized

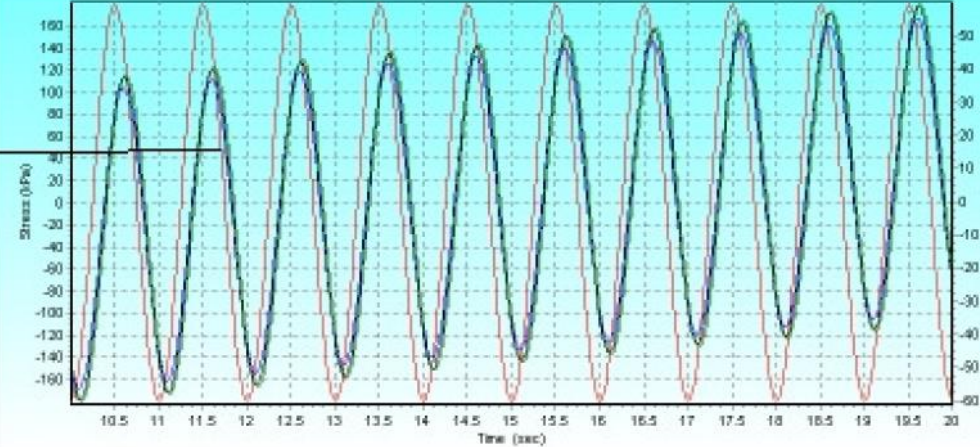
Axial Stress Axial Stress (fitted)

Strain #1 Strain #1 (fitted)

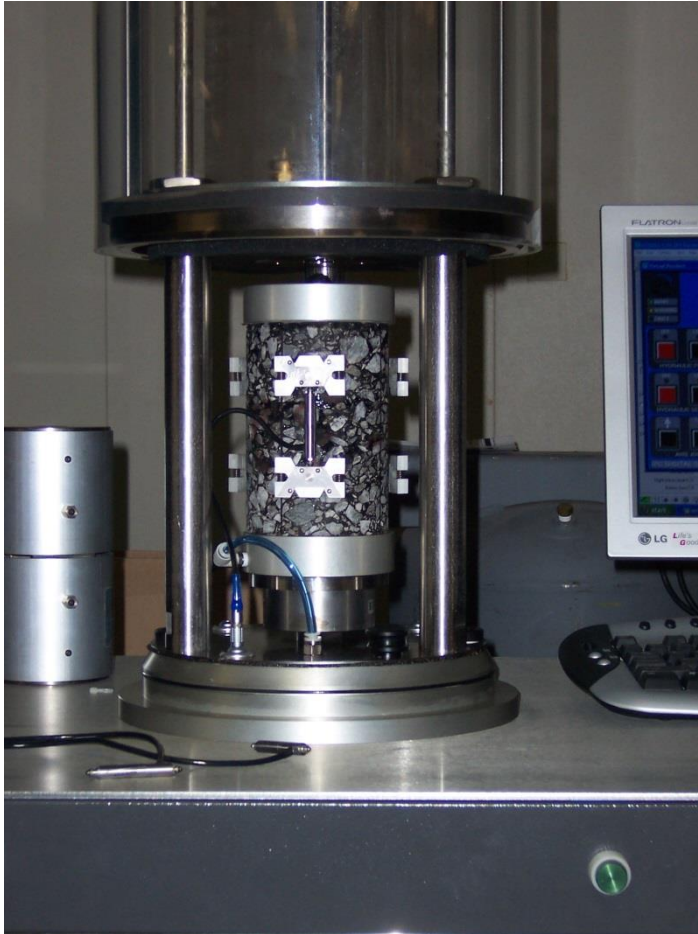
Strain #2 Strain #2 (fitted)

Strain #3 Strain #3 (fitted)

Left (kPa): -125.577
Right (micro-strain): -42.26801
Bottom (sec): 13.93954



Status Bar → REVIEWING DATA Axis 1 [I] Actuator displacement Axis 2 [I] Confining pressure



Dynamic Modulus Test Procedures

- Ensure the sample is perfectly centered.
- Place and adjust LVDTs.
- Condition the sample to the test temperature.(at least 20 min)
- Measure the sample diameter and height precisely in several locations.
- Choose the frequencies you require for the test.
- Name your test properly.
- Run the test.
- Inspect the results and verify with the specification requirements.



Simple Performance Test using IPC machine.



Questions?