

محاضرة بعنوان :

إنتاج وتنفيذ الخلطات الاسفلتية
المصممة بنظام السوبريف

المحاضر :

سعادة الدكتور
إبراهيم بن أحمد الضبيب



يوم الثلاثاء ٠٥ / ٠٧ / ١٤٣٧ هـ
الموافق ١٢ / ٠٤ / ٢٠١٦ م
الساعة التاسعة صباحاً

قاعة المؤتمرات بمبنى الإدارة
العامة للتشغيل والصيانة

الدعوة
عامة





ADEC®

المركز المتقدم لاستشارات الهندسة المدنية

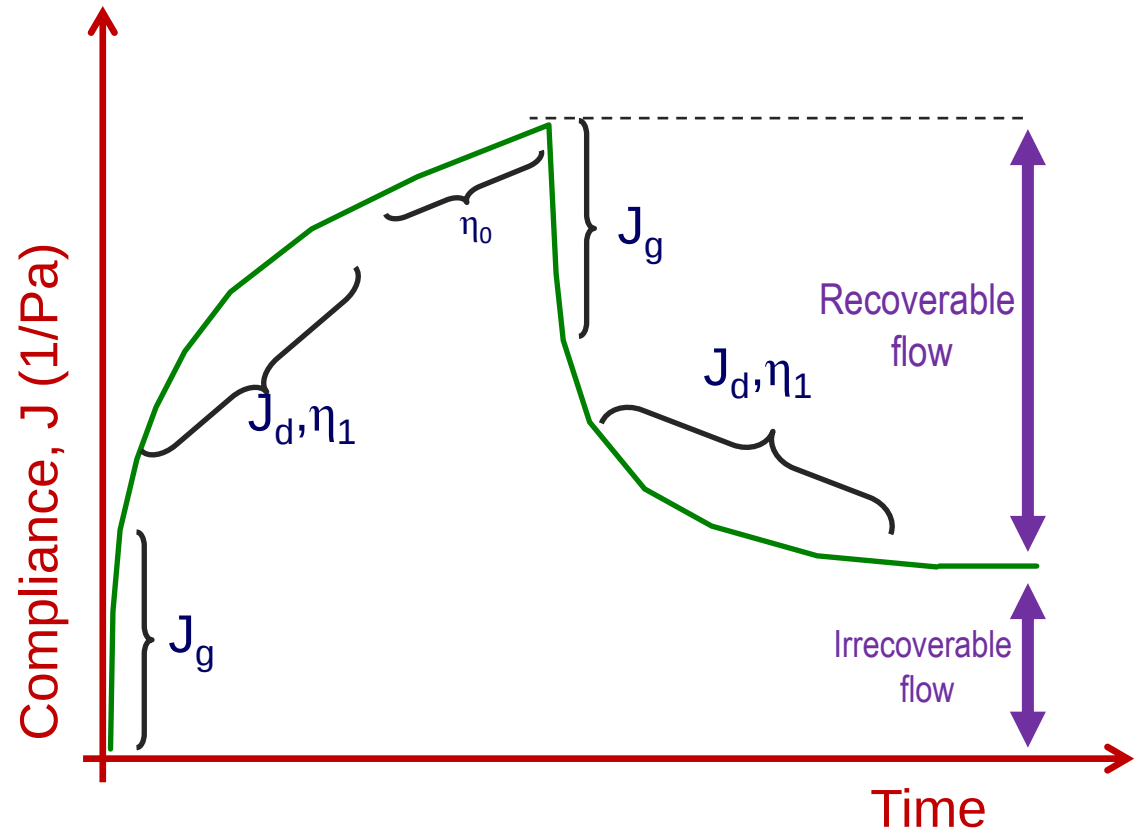
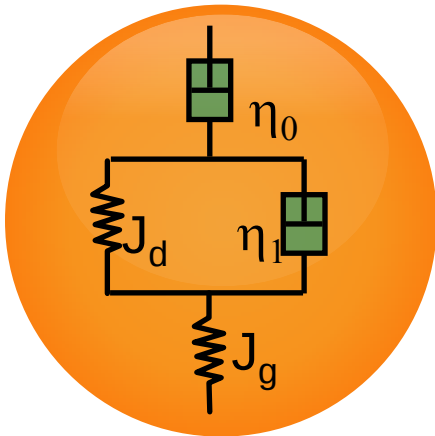
Advanced Center for Civil Engineering Consultancy

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مواصفات الأداء الجديدة

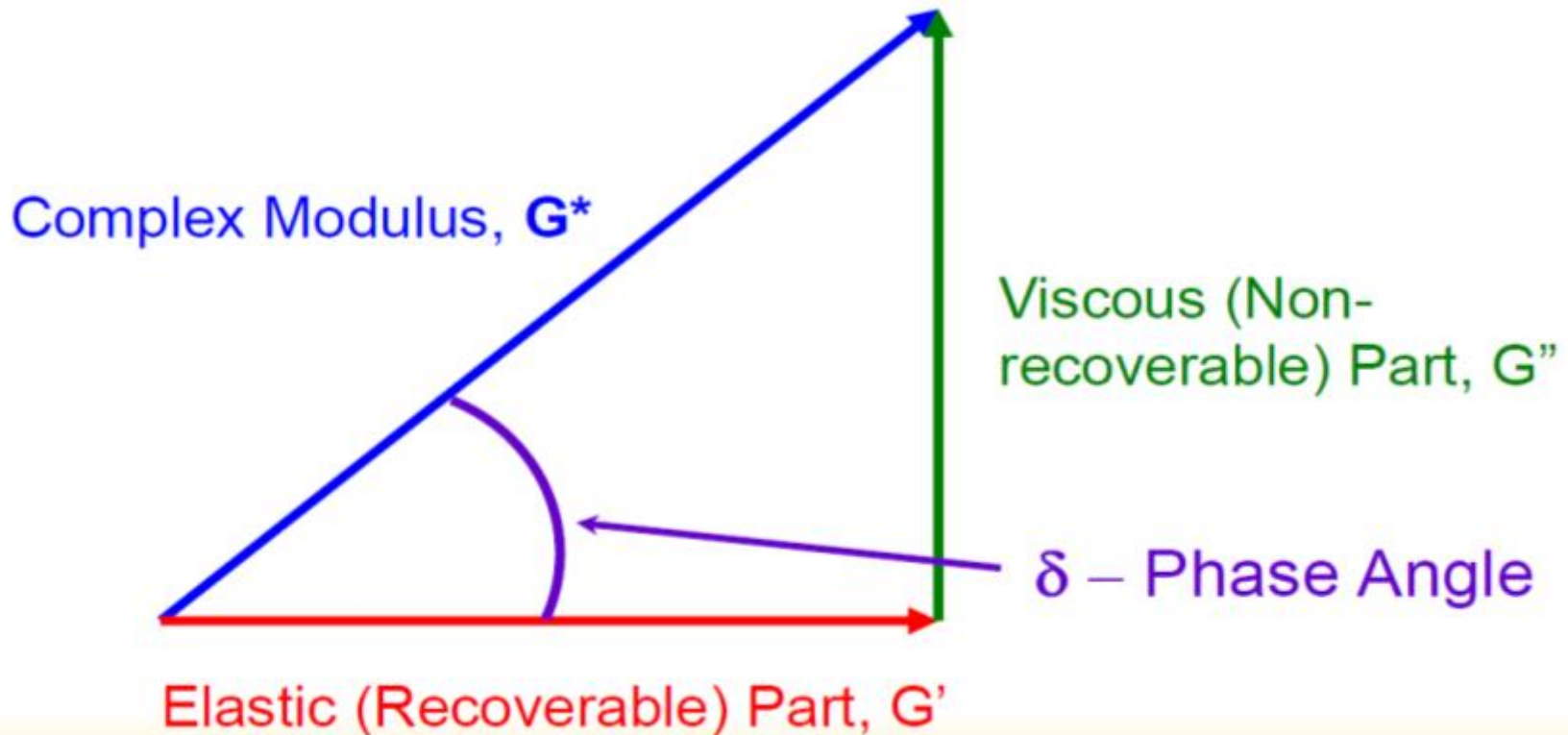
New Performance Specification

Burger Model



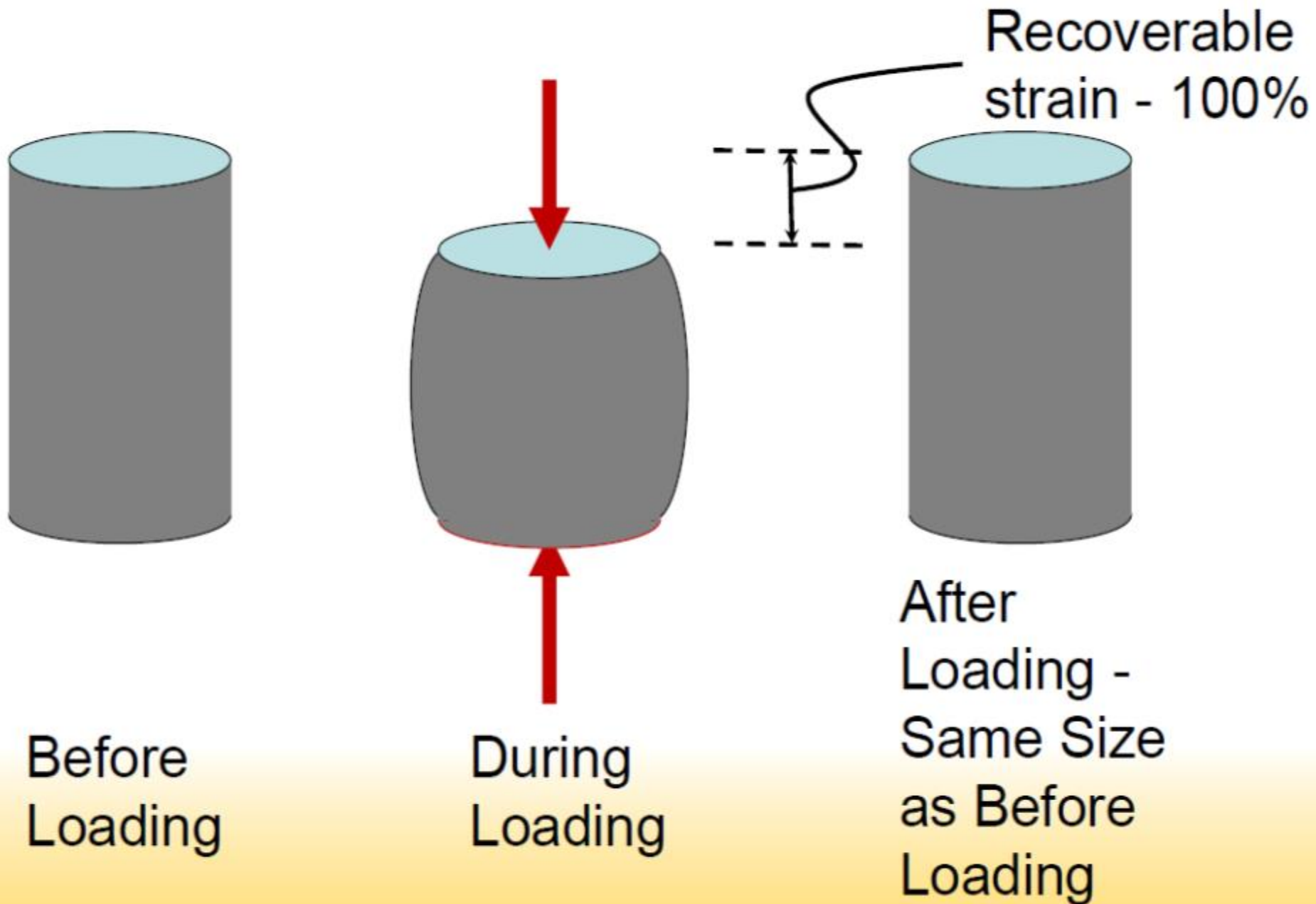
G^* is a measure of resistance to deformation

Rutting Factor $G^*/\sin\delta$



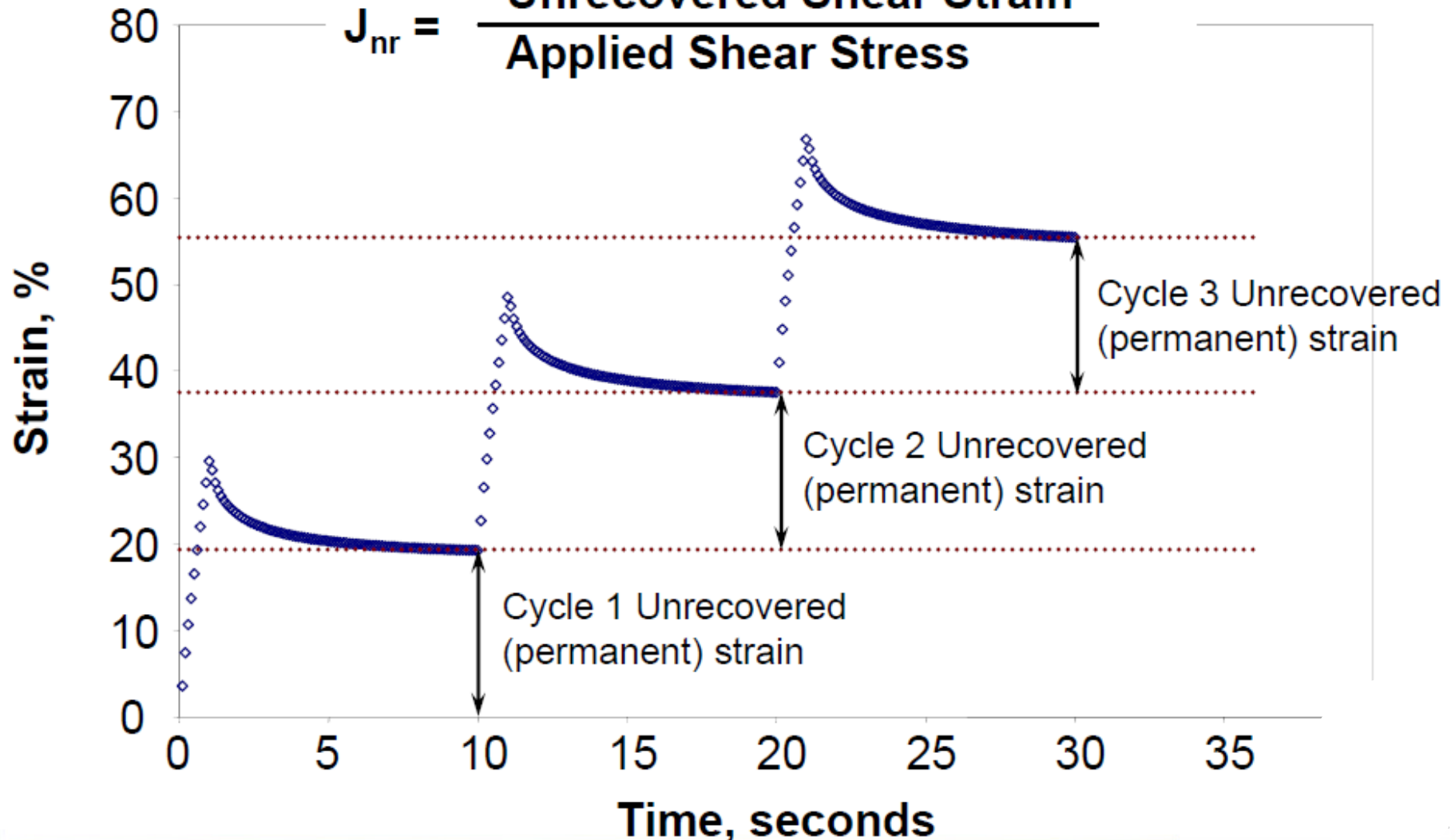
Complex Modulus is the vector sum of the elastic and viscous modulus

How an Elastic Material Behaves



Concept

$$J_{nr} = \frac{\text{Unrecovered Shear Strain}}{\text{Applied Shear Stress}}$$

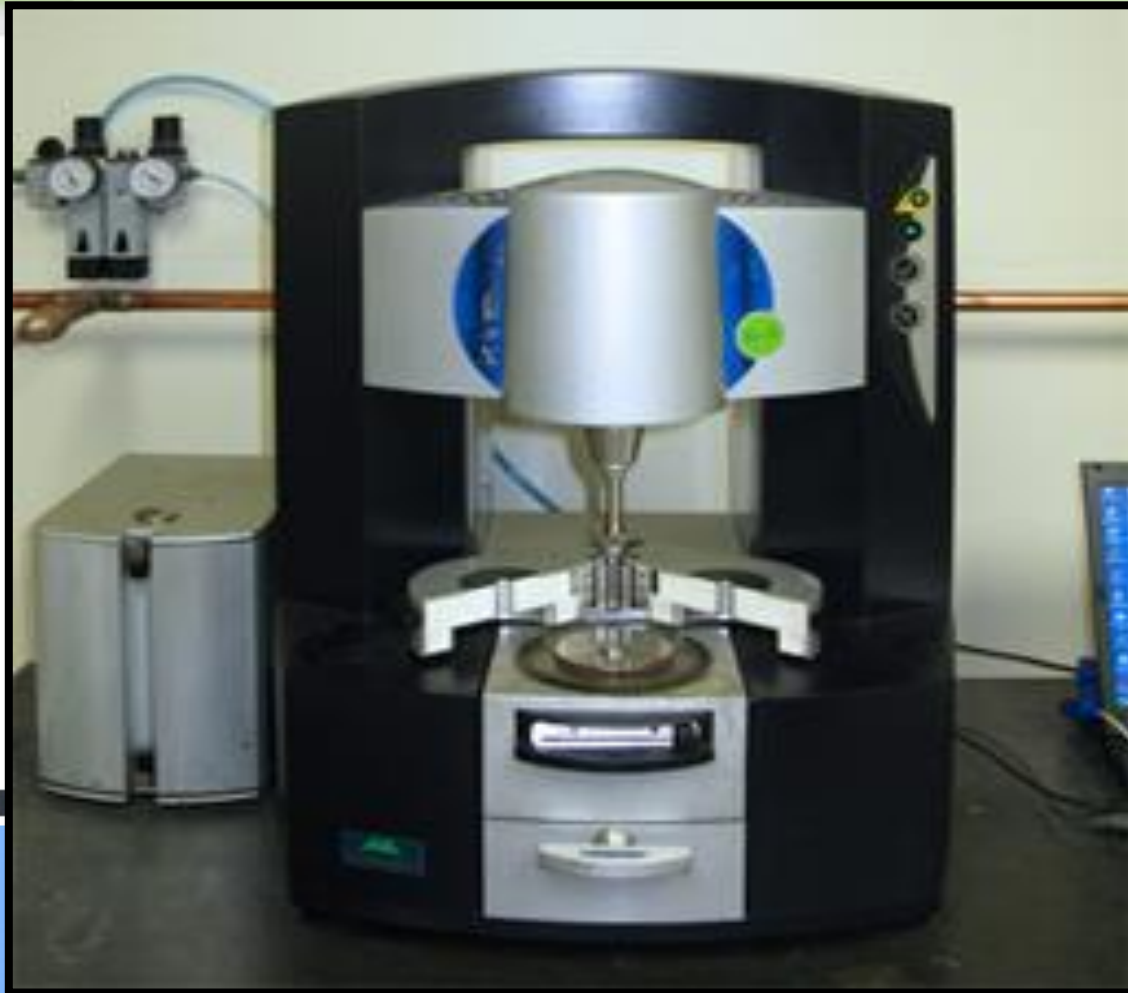


Summary

- According to AASHTO M332, asphalt binder performance graded using the Multiple Stress Creep Recovery (MSCR) test; it is similar in concept of AASHTO M 320.
- New MSCR test according to AASHTO T350 for determining non-recoverable creep compliance (J_{nr}), of RTFOT sample for standard (S), Heavy (H), very heavy (V) or extreme (E) traffic loading at the desired temperature.
- In this specification grade bumping is **NOT** required.

AASHTO T350: Multiple Stress Creep Recovery Test of Asphalt Binder Using Dynamic Shear Rheometer (MSCR)

8



Terminology

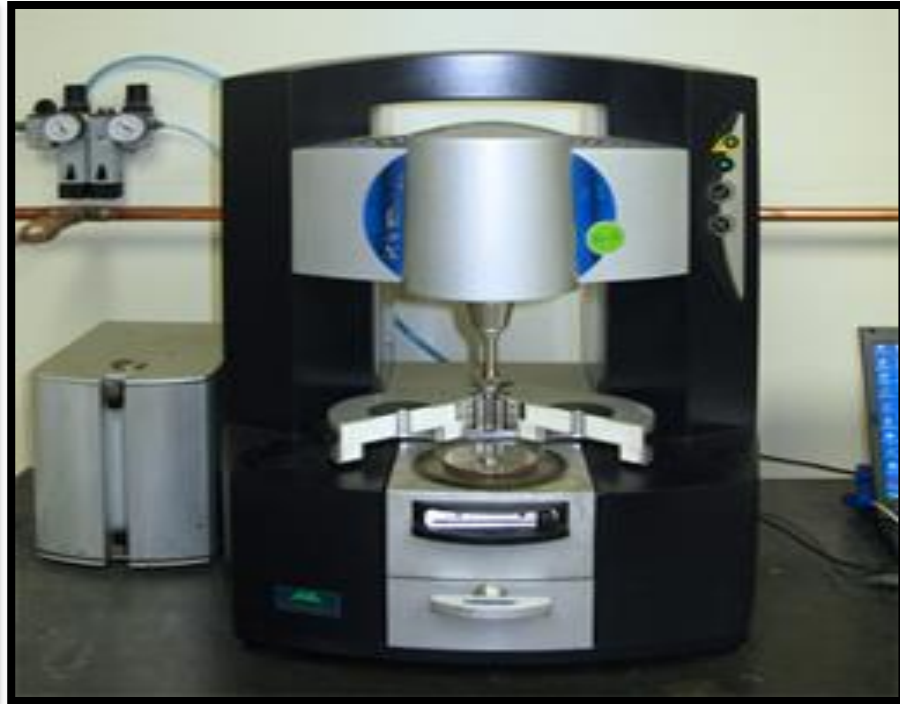
- ❑ **Creep and recovery:** a standard rheological test protocol whereby a specimen is subjected to a constant load for a fixed time period and then allowed to recover at a constant zero load for a fixed time period.
- ❑ **Percent Recovery:** A measure of how much a sample returns to its previous shape after being repeatedly stretched and then relaxed
- ❑ **Nonrecoverable creep compliance (J_{nr}), kPa^{-1} :** the residual strain in a specimen after a creep and recovery cycle divided by the stress applied. It has been shown to be an indicator of the resistance of an asphalt binder to permanent deformation (rutting, shoving , ..) under repeated traffic.

Overview of the MSCR Test

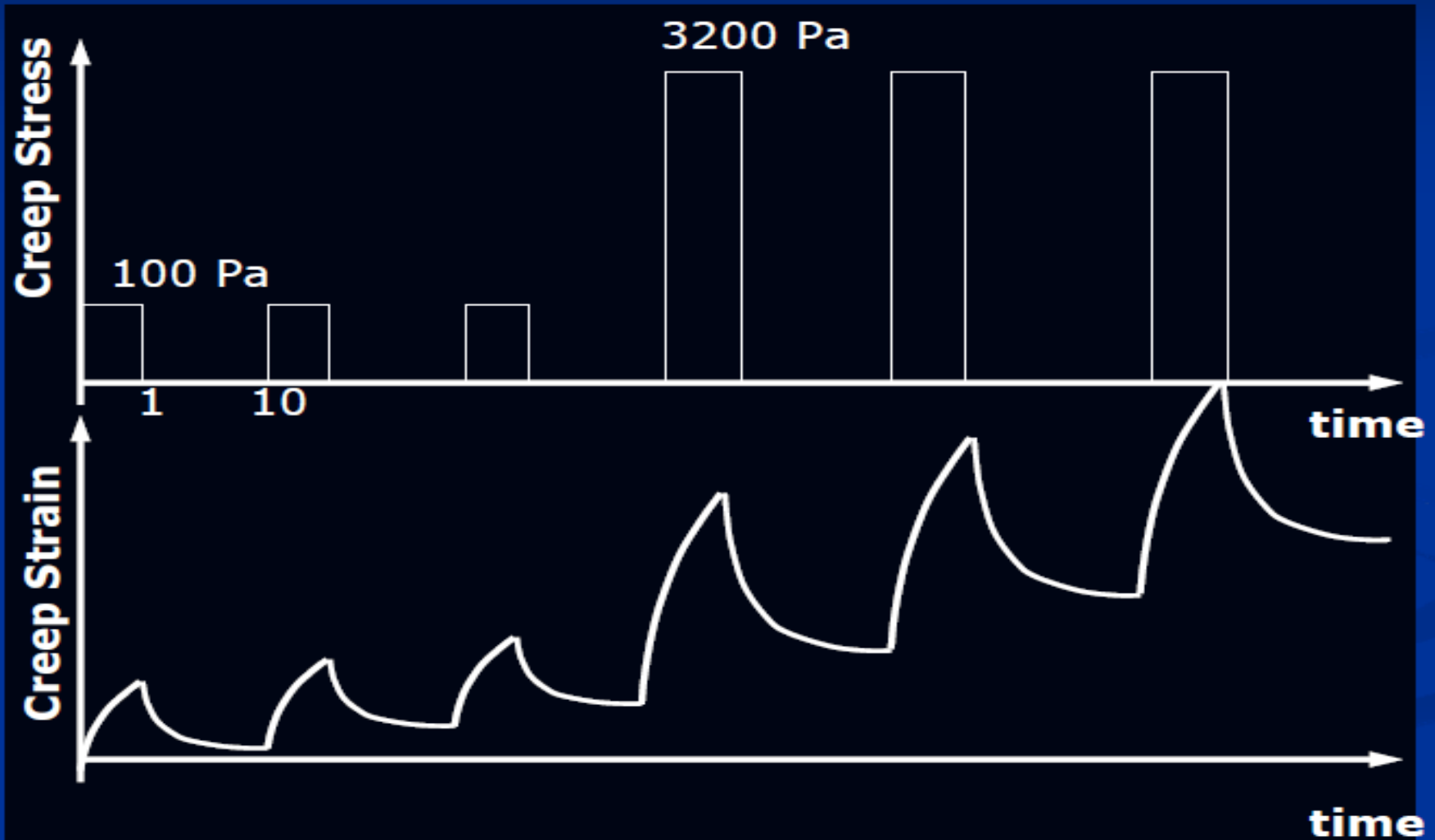
- ❖ According to AASHTO TP70, MSCR test is conducted using the DSR for the determination of percent recovery and nonrecoverable creep compliance of RTFOT aged asphalt binders.
- ❖ Percent recovery provides a means for determining the elastic response and stress dependence of NAB and PMB under shear creep and recovery at two stress levels at the desired temperature.
- ❖ The 25.0 mm plate is used with a gap of 1.0 mm; applying a 20 cycles of constant shear stress of 1.0 s duration followed by zero stress recovery for 9.0 s. Two stress levels are used 0.10 kPa and 3.2 kPa 10 cycles for each.

MSCR Setup

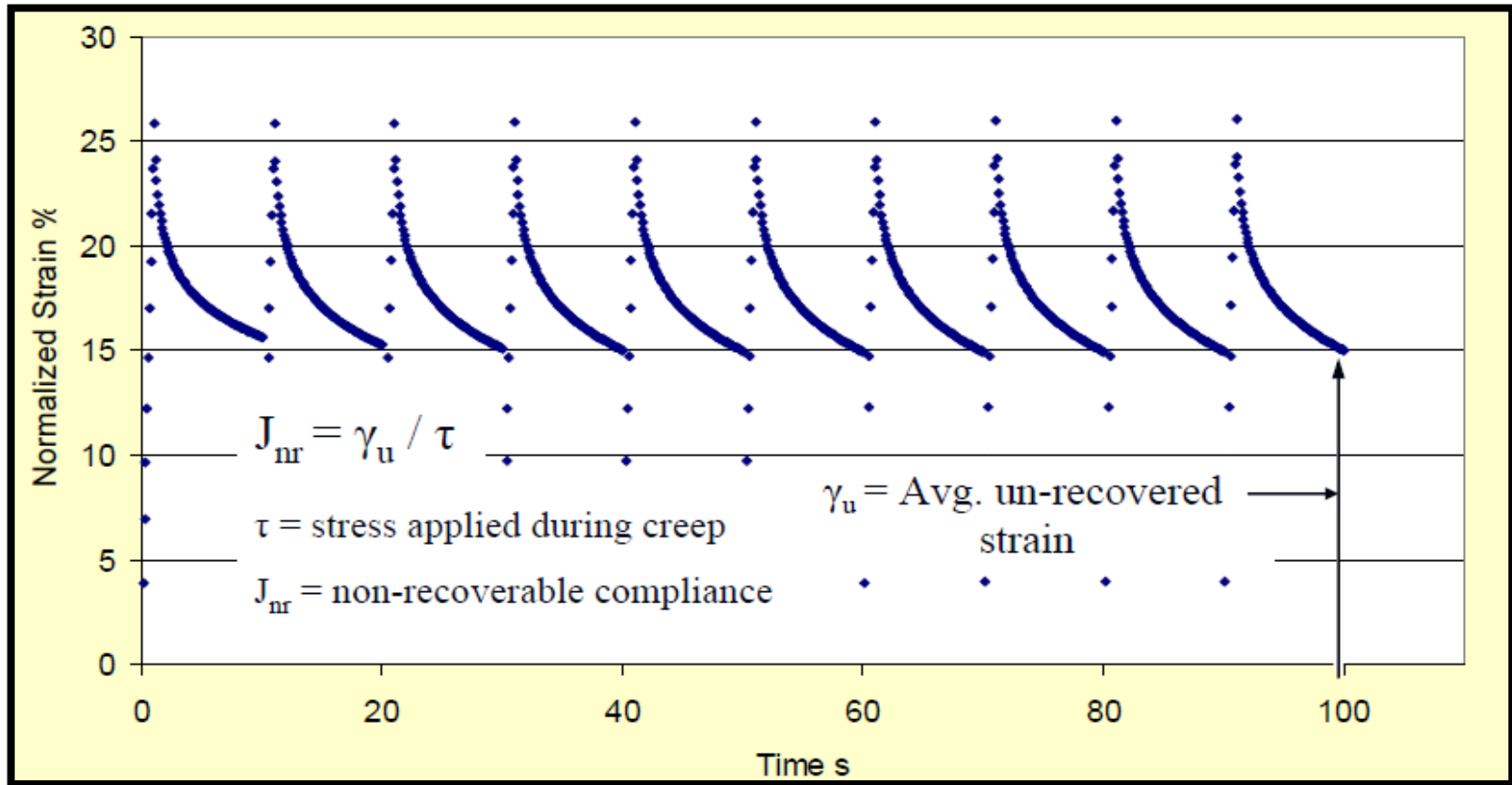
11



MSCR Loading Cycles

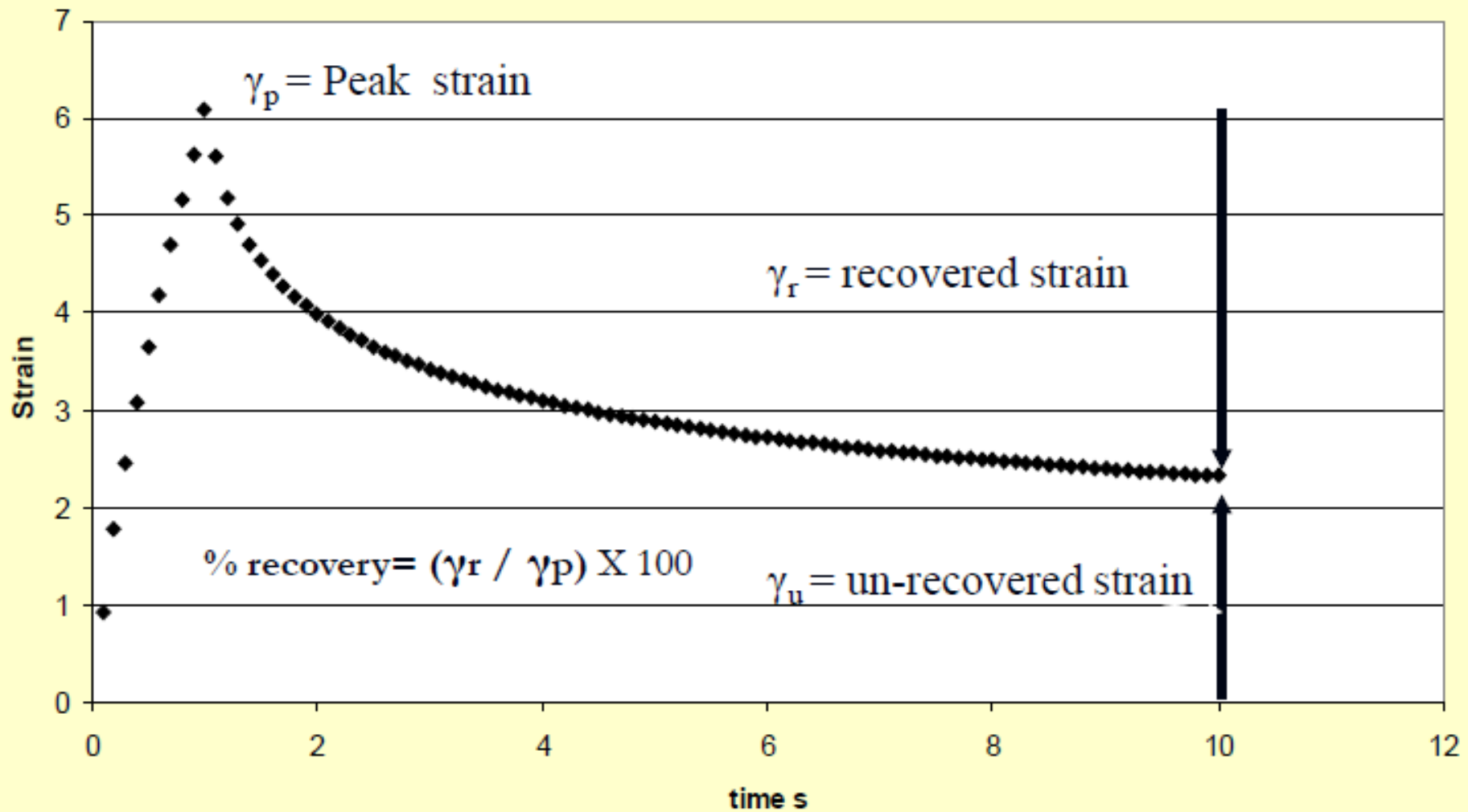


Determination of non-recoverable creep compliance (J_{nr})¹³



J_{nr} = Average unrecovered strain divided by stress applied during creep

Typical Plot of Creep and Recovery

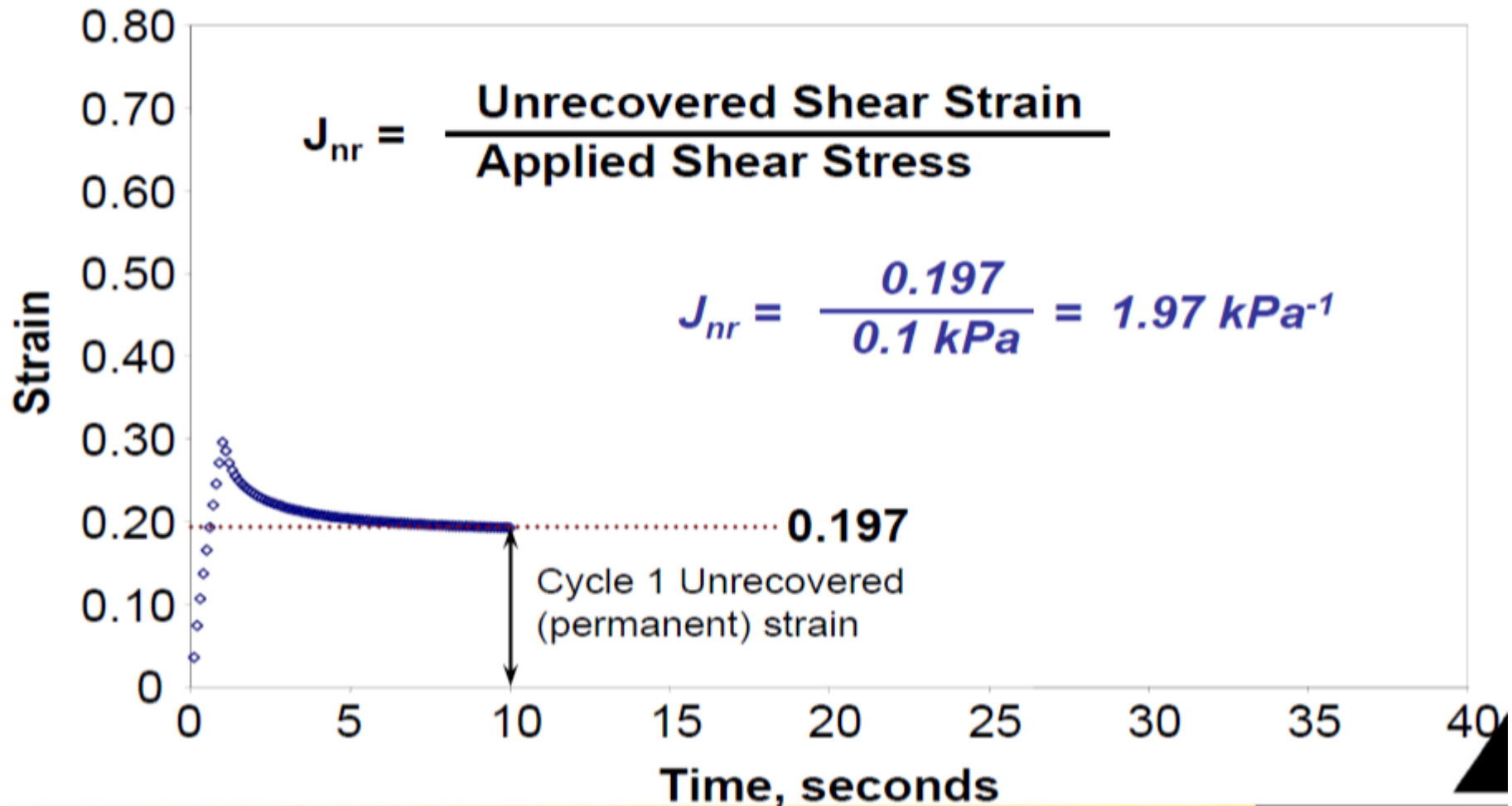


MSCR Calculation

0.1 kPa Shear Stress

$$J_{nr} = \frac{\text{Unrecovered Shear Strain}}{\text{Applied Shear Stress}}$$

$$J_{nr} = \frac{0.197}{0.1 \text{ kPa}} = 1.97 \text{ kPa}^{-1}$$



MSCR Calculation for M332 Compliance

Two parameters are important and used in the new PG grading system, these are as follows:

$$1) J_{nr3.2} = \frac{\text{Sum} [J_{nr} (3.2 \text{ kPa}, N)]}{10} \quad \text{for } N \text{ from } 1 \text{ to } 10$$

$$2) J_{nr\text{diff}} = \frac{[J_{nr3.2} \text{ kPa} - J_{nr0.1 \text{ kPa}}]}{J_{nr0.1 \text{ kPa}}} \times 100$$

AASHTO M332 المتطلبات حسب

Traffic designation	$J_{nr3.2}$ at the PG high temperature, max.	$J_{nr diff}$ at the PG high temperature, max.
S	4.5 kPa ⁻¹	75%
H	2.0 kPa ⁻¹	
V	1.0 kPa ⁻¹	
E	0.5 kPa ⁻¹	

Traffic Classes in AASHTO M 332

Traffic Class	Designation	ESAL, Repetition	Condition	Speed, km/h
Standard	S	< 10 million	and	> 70 km/h
High	H	10 to 30 million	or	20 to 70 km/h
Very High	V	> 30 million	or	< 20 km/h
Extreme	E	> 30 million	and	< 20 km/h

M 332 Binder Specification

Performance
Grade

Minimum
pavement design
temperature, °C

PG 64S - 10

Average 7-day
maximum pavement
design temperature , °C

Traffic Class
Designation
(S, H, VH or E)

M332 Vs M320

