

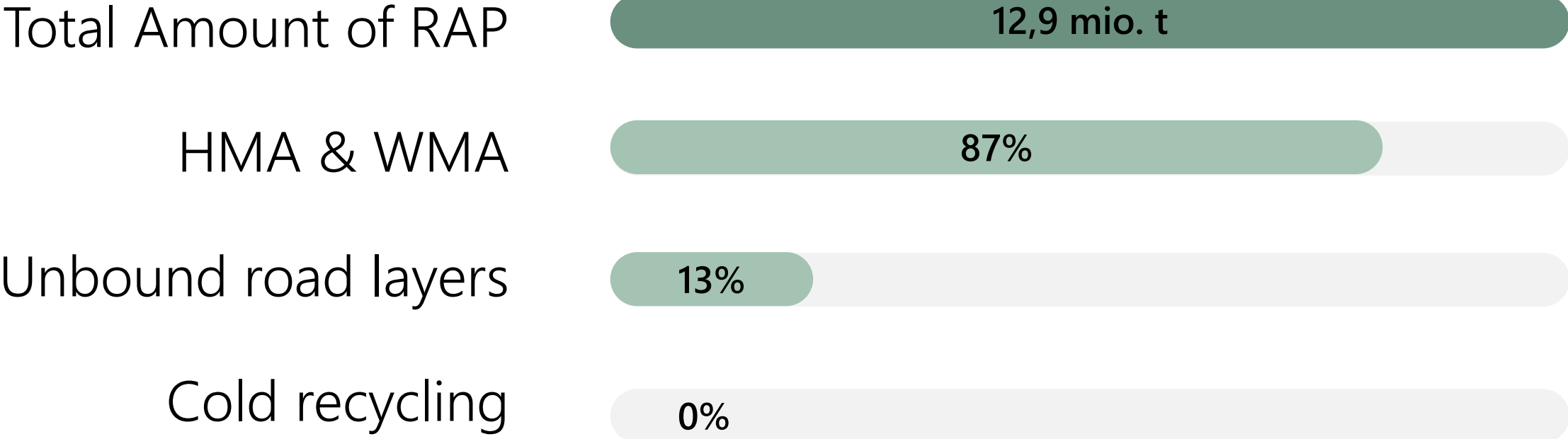


Deformation behaviour of

Bitumen Stabilized Material (BSM)

with different material compositions

RE-USE & RECYCLING OF RECLAIMED ASPHALT IN GERMANY 2022

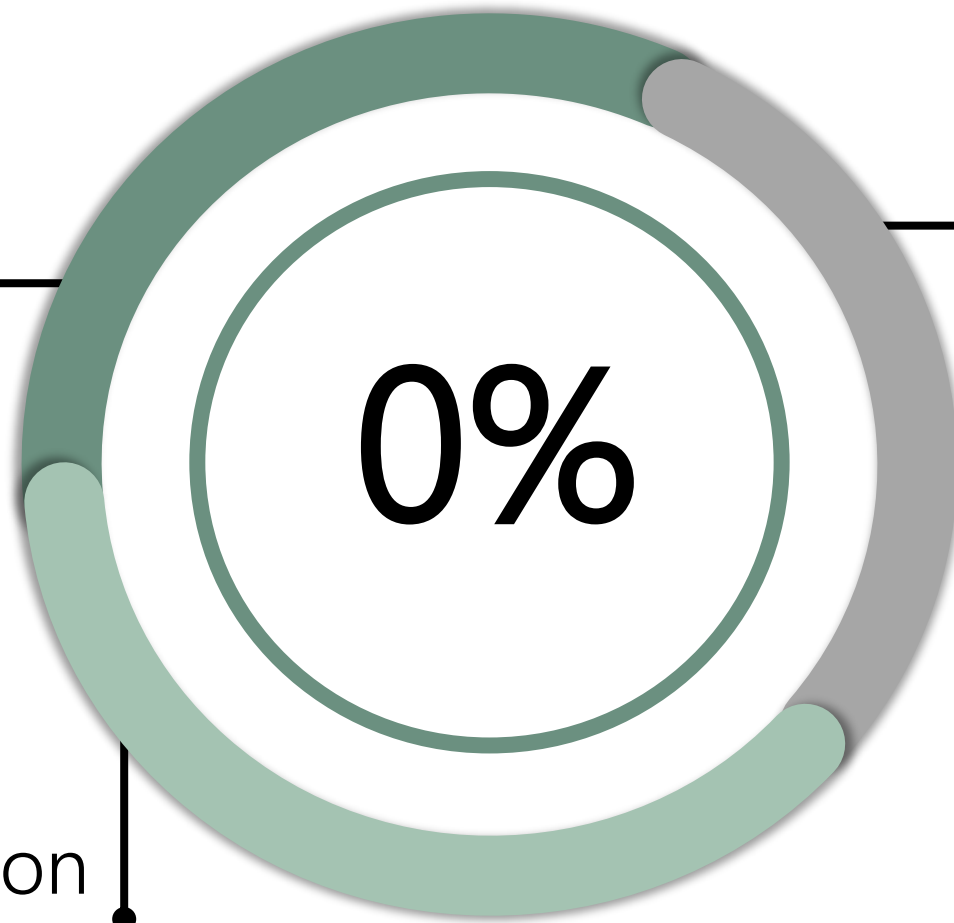


European Asphalt Pavement Association. (2022). *Asphalt in Figures 2022*. Brussels: EAPA. Retrieved on August 30, 2024, from <https://eapa.org/asphalt-in-figures/>

COLD RECYCLING IN GERMANY

Lack of practical experience

Lack of standardization
(M KRC 2005)



Economic viability?
Equivalent quality?
Durability?

BSM

Granular material

+

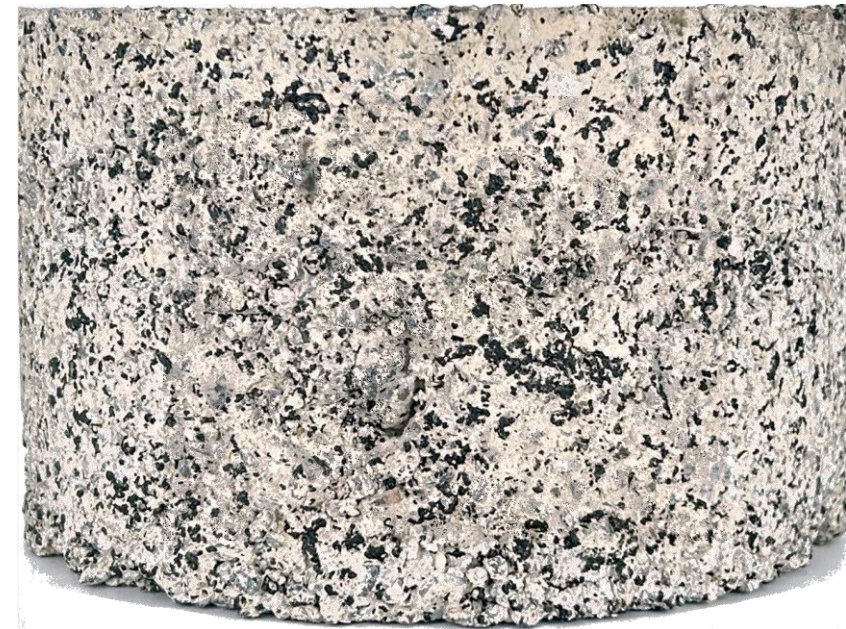
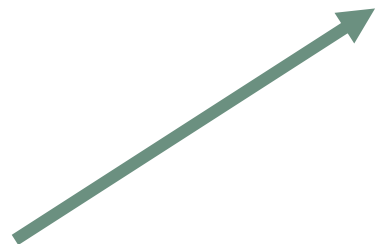
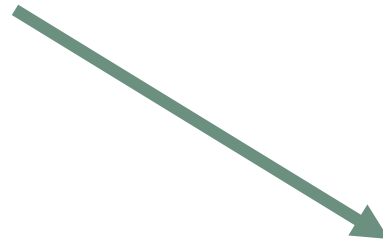
Bitumen

+

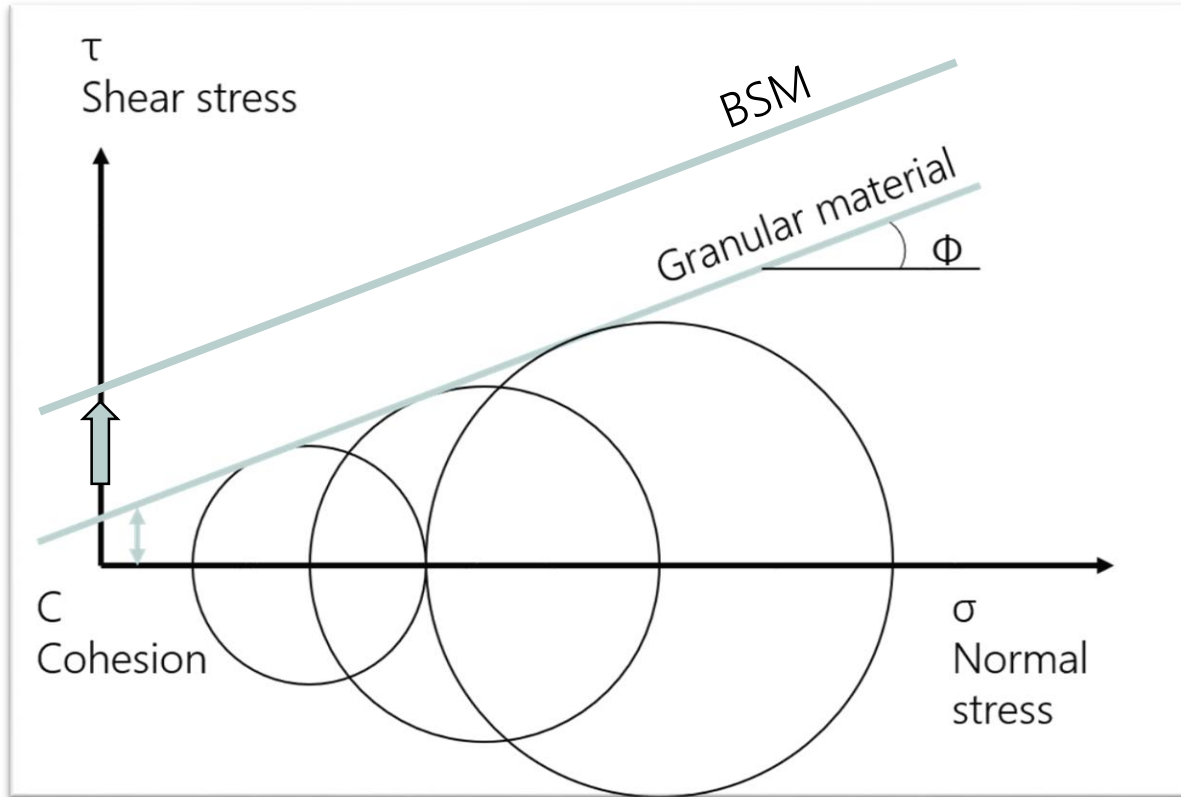
Active filler

+

Water



BSM



- Non-continuously bound material
- Mode of failure: permanent deformation

ROAD DESIGN - GERMAN GUIDLINES

RStO 12/24

standardized method for designing pavement structures

Tafel 1: Bauweisen mit Asphaltdecke für Fahrbahnen auf F2- und F3-Untergrund/Unterbau
(Dickenangaben in cm; ∇ E_{v2} -Mindestwerte in MPa)

Zeile	Belastungsklasse	Bk100	Bk32	Bk10	Bk3,2	Bk1,8	Bk1,0	Bk0,3	
	B [Mio.]	> 32	> 10 - 32	> 3,2 - 10	> 1,8 - 3,2	> 1,0 - 1,8	> 0,3 - 1,0	≤ 0,3	
	Dicke des frostsich. Oberbaus ¹⁾	55 65 75 85	55 65 75 85	55 65 75 85	45 55 65 75	45 55 65 75	45 55 65 75	35 45 55 65	
1	Asphalttragschicht auf Frostschutzschicht								
	Asphaltdecke	12	12	12	10	4	4	4	4
	Asphalttragschicht	22	18	14	12	16	14	10	14
	Frostschutzschicht	45	45	45	45	45	45	45	45
	Dicke der Frostschutzschicht	- 31 ²⁾ 41 51	25 ²⁾ 35 45 55	29 ²⁾ 39 49 59	- 33 ²⁾ 43 53	25 ²⁾ 35 45 55	27 37 47 57	21 31 41 51	

Figure 4: Construction methods with asphalt surfaces [RStO 12/24]

Unbound/granular material:
minimum deformation modulus (E_{v2})

RDO Asphalt 09/24

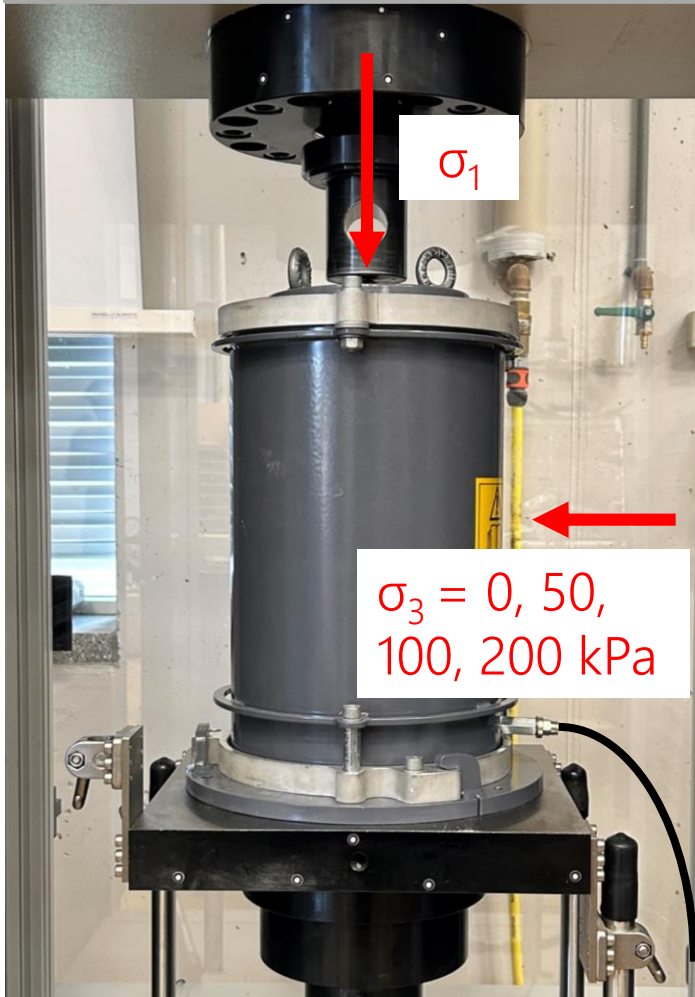
design process:
realistic material behavior

Unbound/granular material

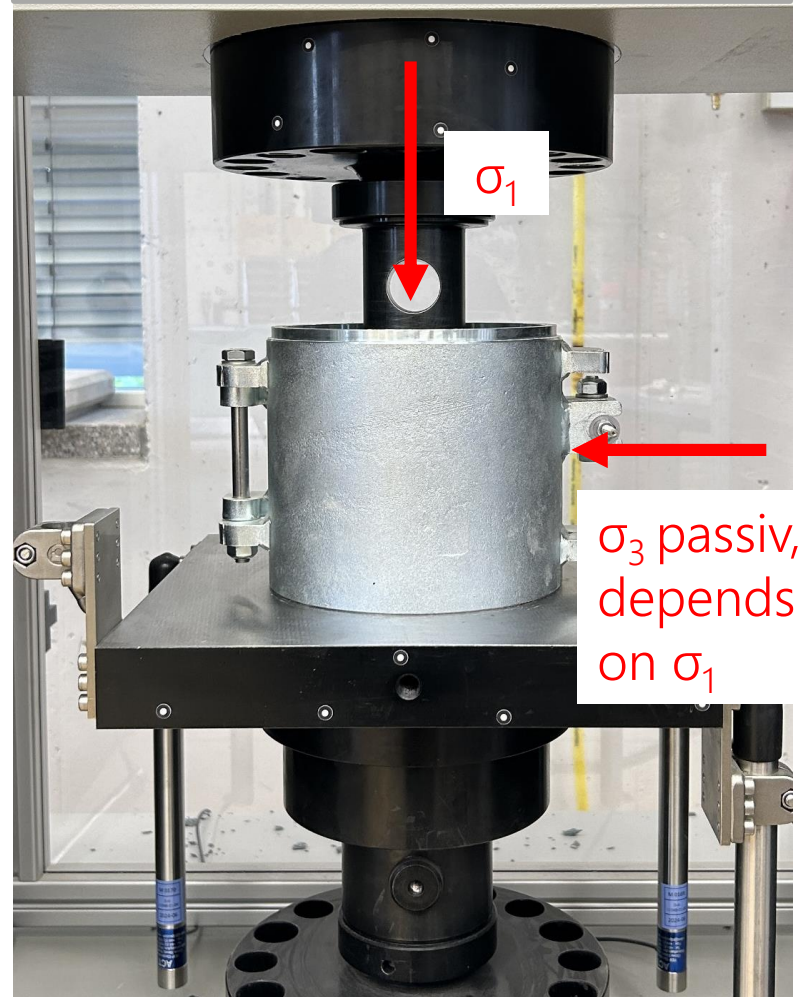
- linear elastic material model
- sufficient for pavements with thick asphalt layer (load-distributing effect)
- not accurate for pavements with thin asphalt layers

LABORATORY TESTS

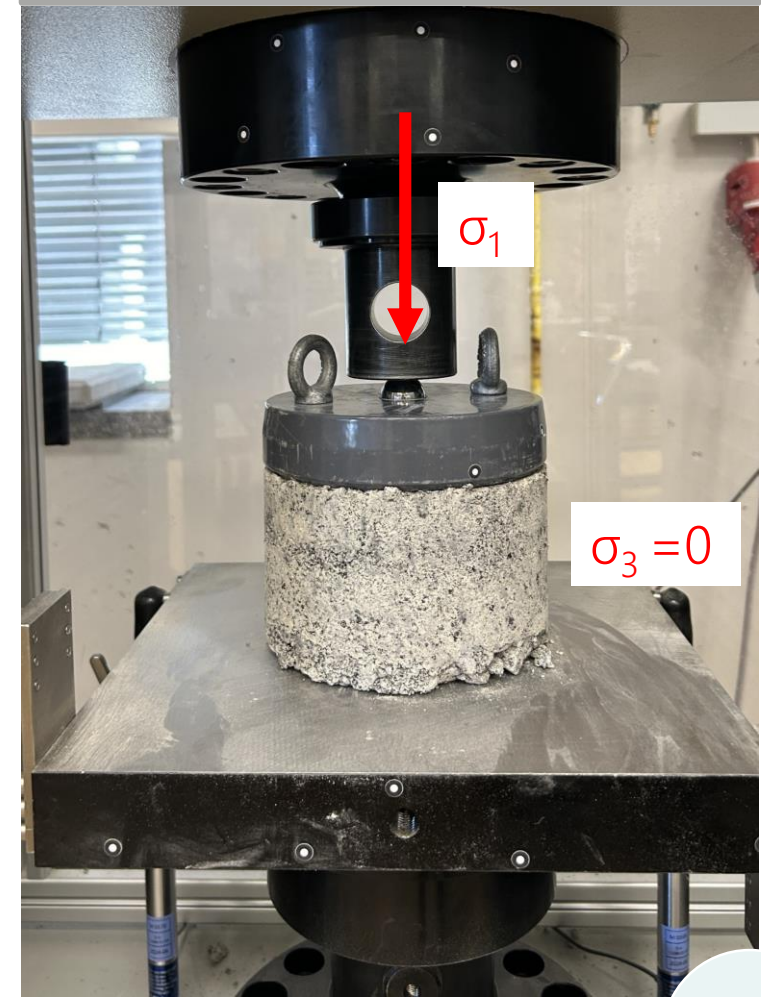
Triaxial Test



Oedometer (Consolidation) Test



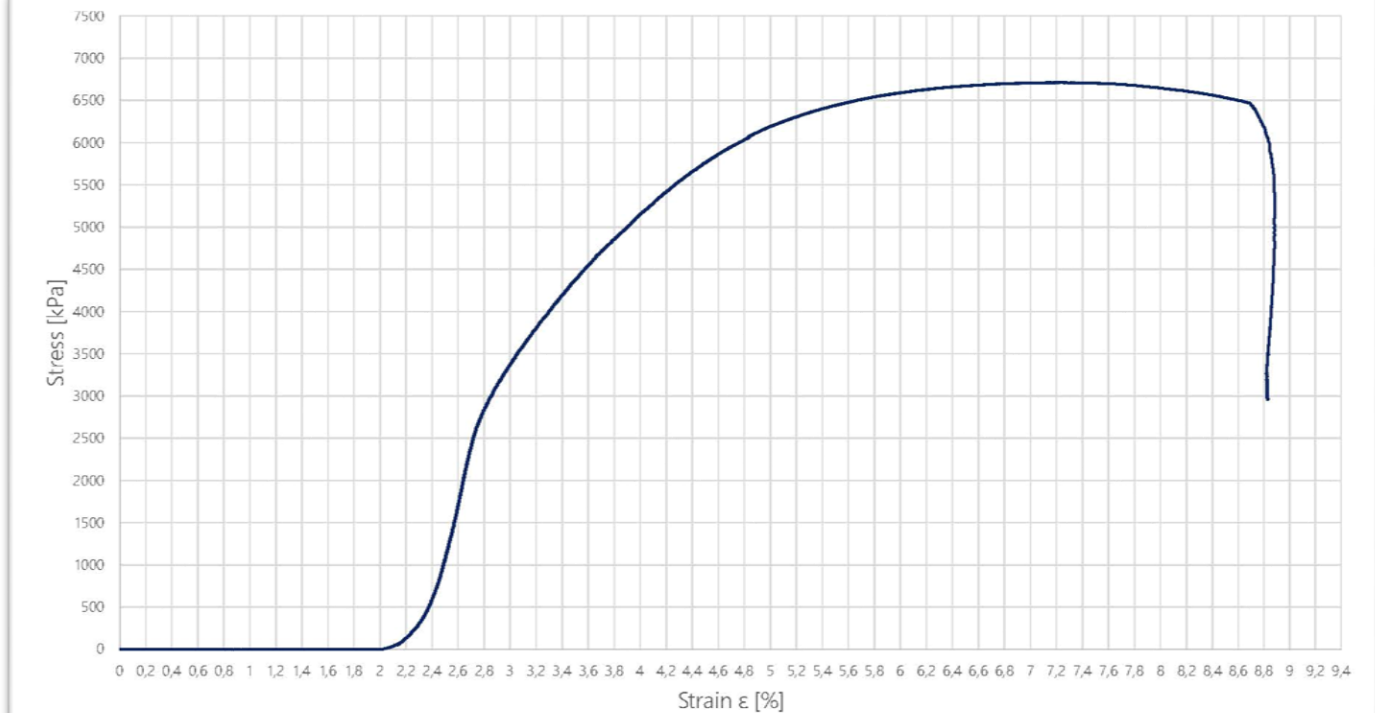
Uniaxial Compression Test



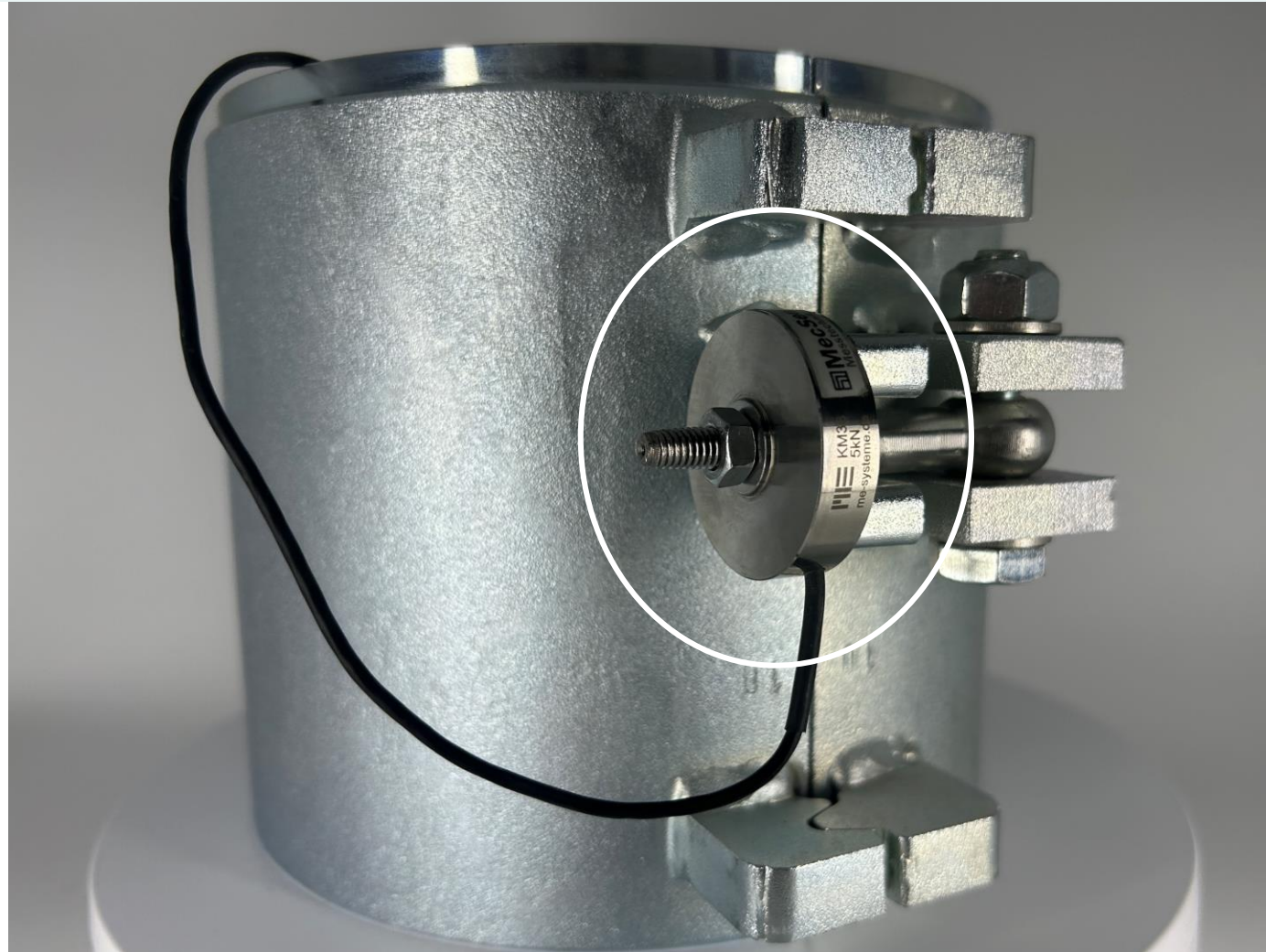
LABORATORY TESTS



Uniaxial Compression Test

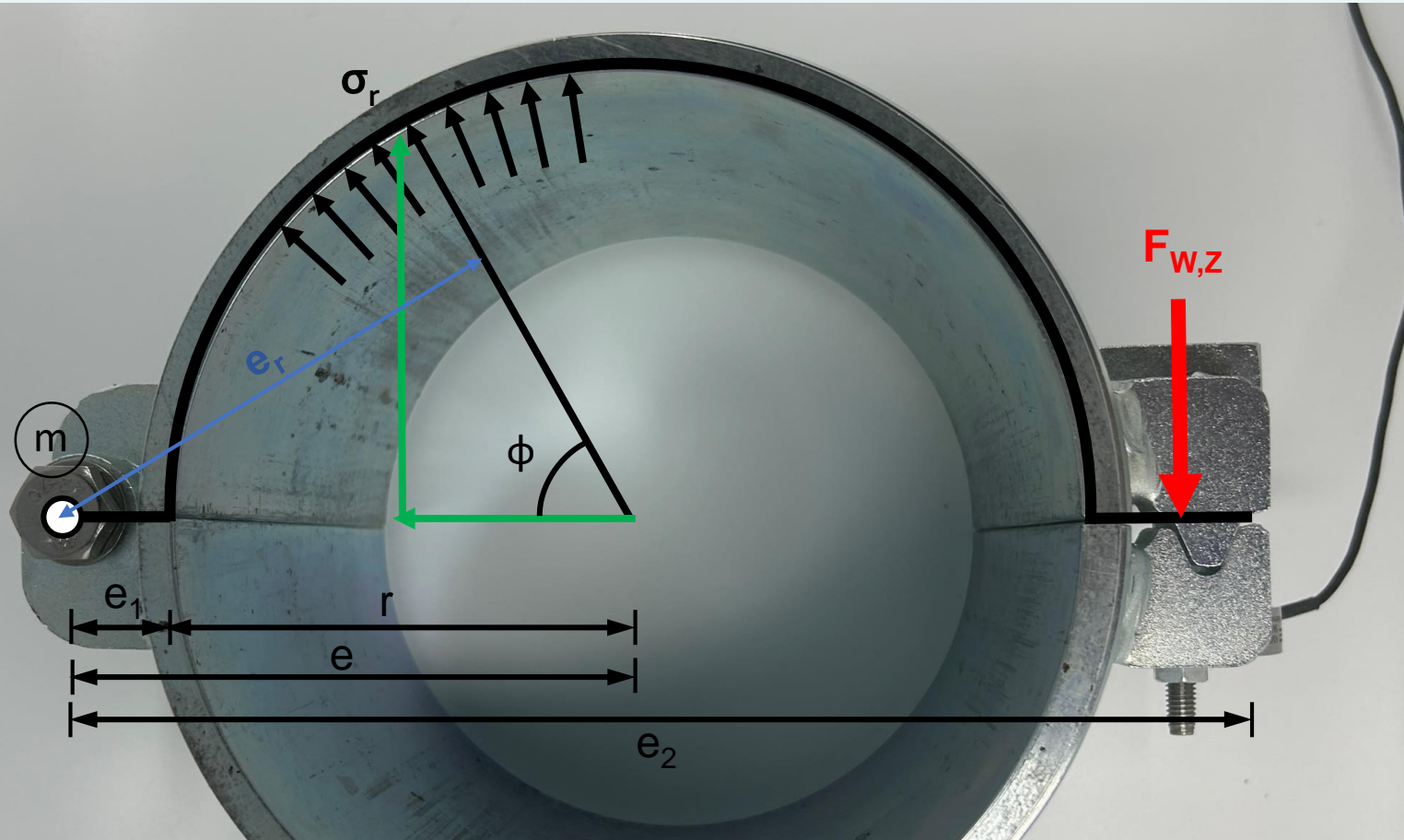


MODIFIED OEDOMETER (CONSOLIDATION) TEST



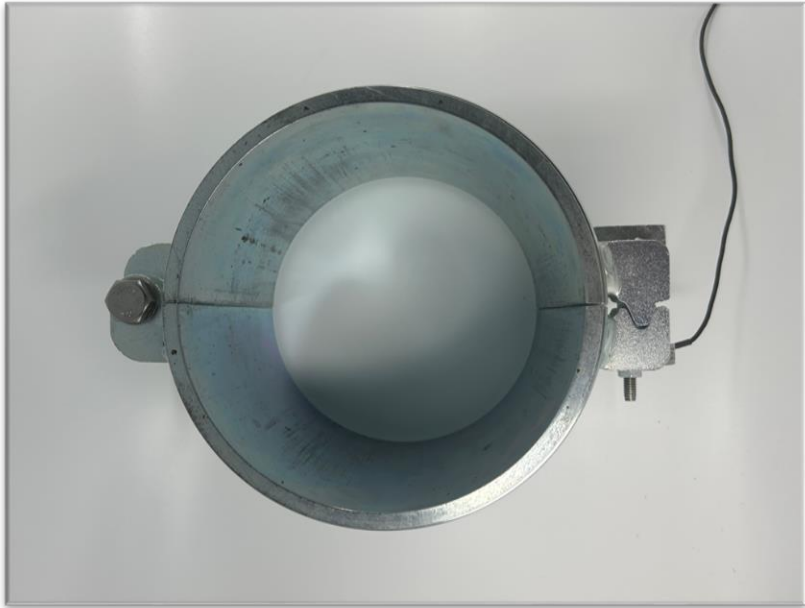
load cell for determining the radial tension

MODIFIED OEDOMETER (CONSOLIDATION) TEST

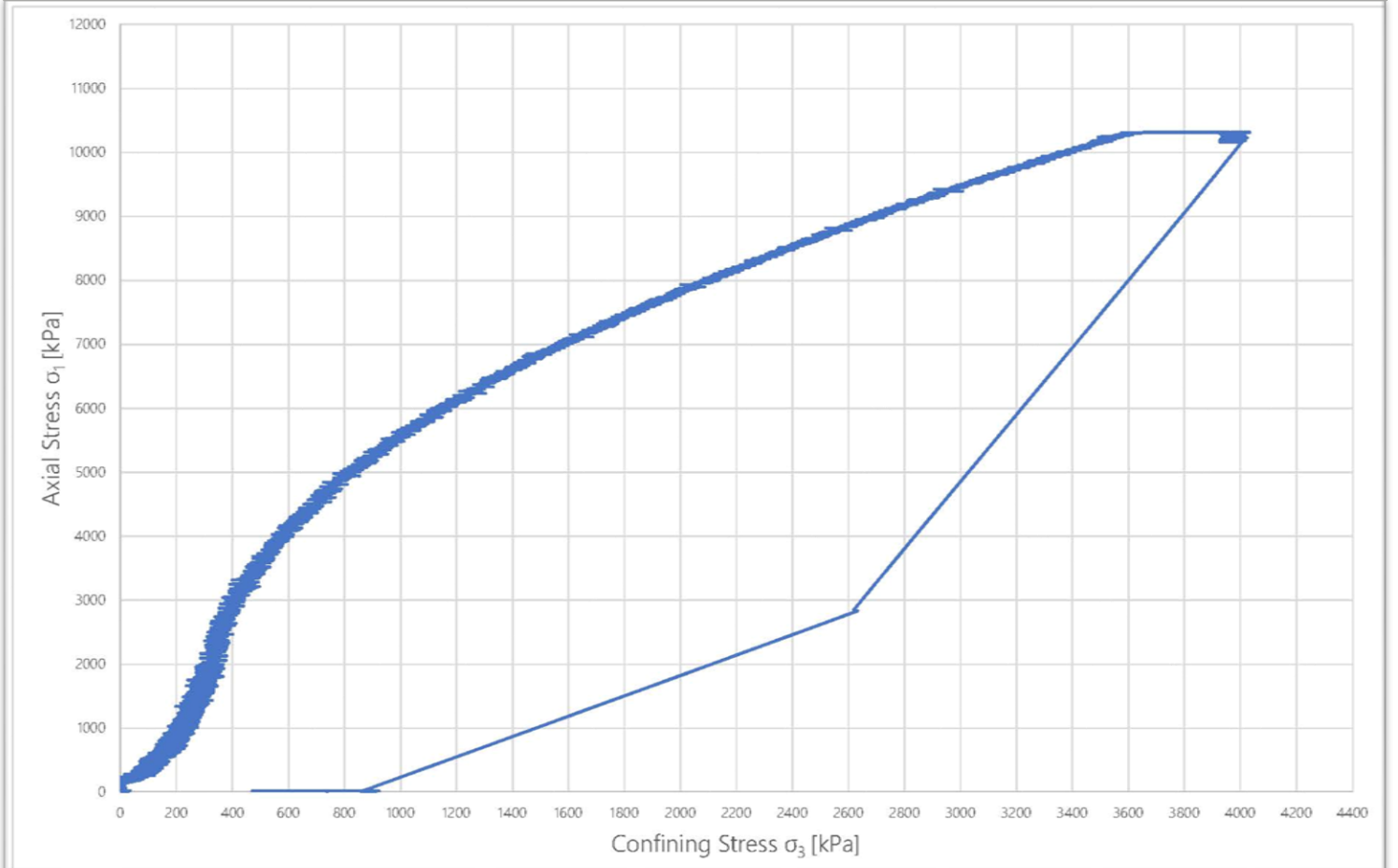


$$\sigma_r = \frac{F_{w,z} * e_2}{h * (r * e_2 + r^2) * 2}$$

RESULTS

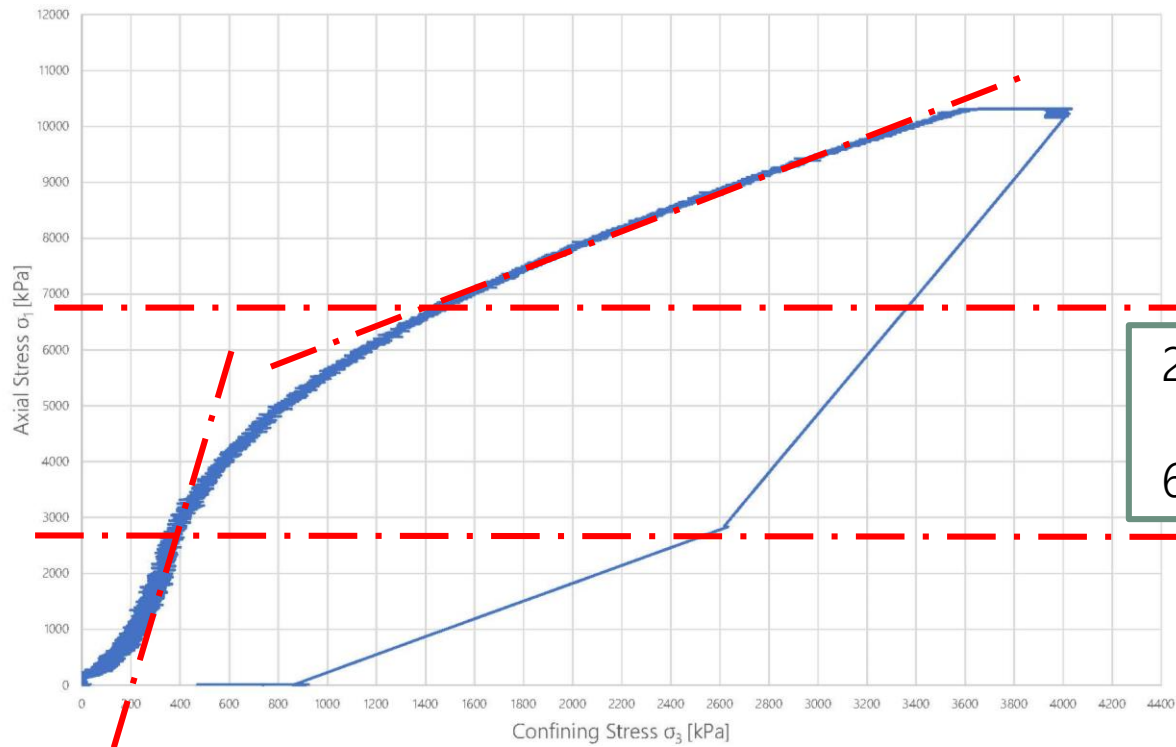


Mod. Oedometer (Consolidation) Test

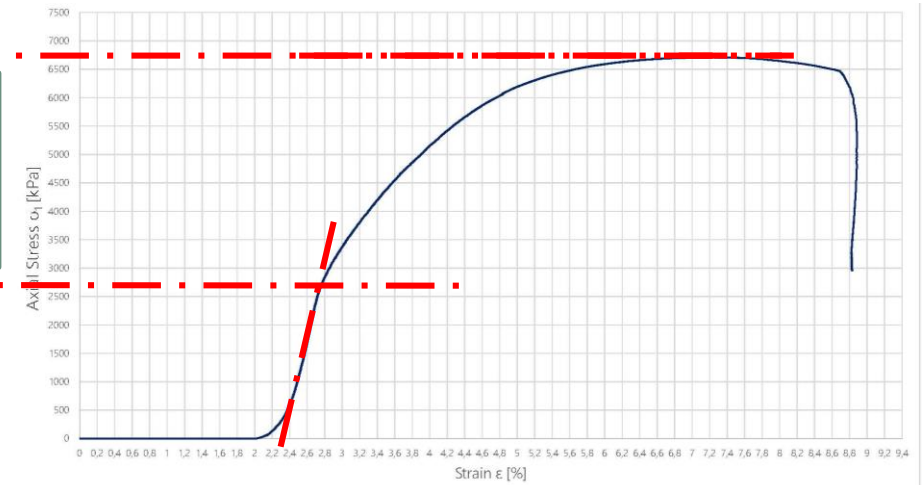


RESULTS

Mod. oedometer (consolidation) test

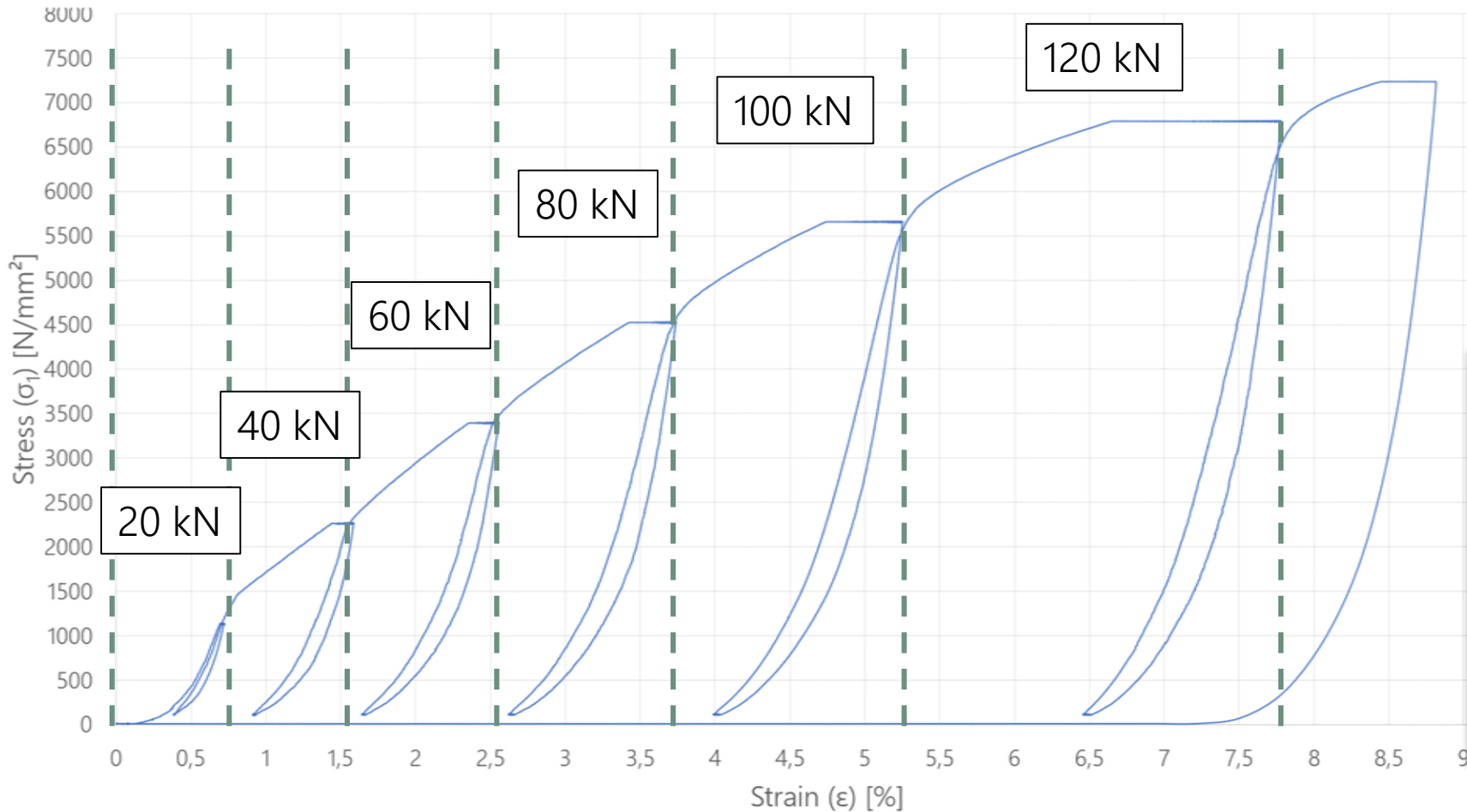


Uniaxial test

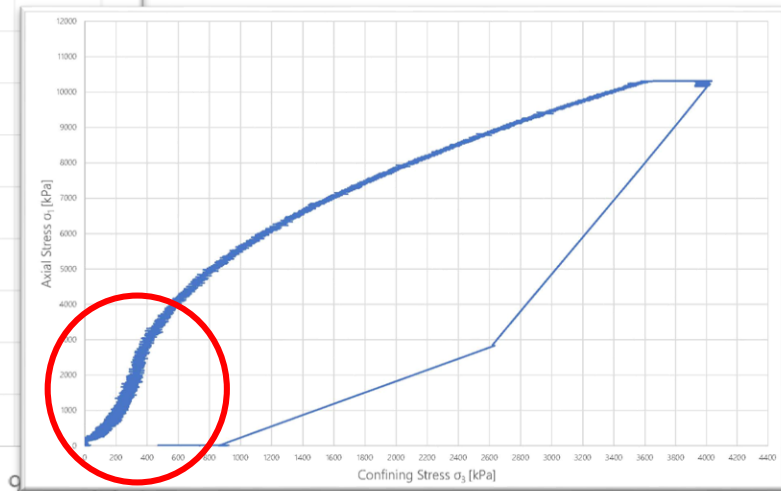


RESULTS

Mod. Oedometer (Consolidation) Test



Deformation depends on stress level & stress history



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Thank you!