

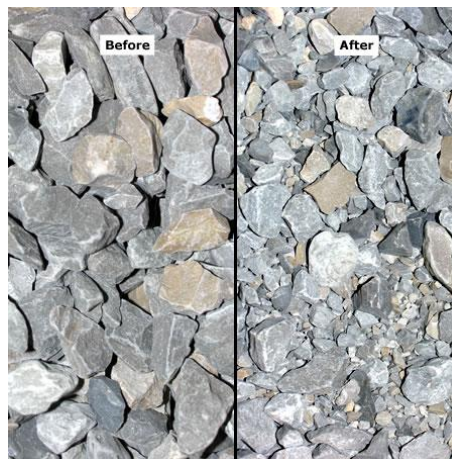
# Abrasion Test Using Los Angeles Machine

Aim: To measure aggregate resistance to degradation due to mechanical action.

Examples of Mechanical Actions:

- During mixing.
- During compaction.
- During service, by traffic.
- The standard L.A. abrasion test subjects a coarse aggregate sample (retained on the No. 12 sieve) to abrasion in a rotating steel drum containing a specified number of steel spheres.
- Number of spheres is determined according the gradation of the sample.
- After being subjected to the rotating drum, the aggregate that is retained on a No. 12 sieve is weighed.
- Calculate loss percentage.

$$\text{Loss \%} = \frac{\text{Original Weight} - \text{Weight Retained on Sieve\#12}}{\text{Original Weight}} \times 100$$



Standards:

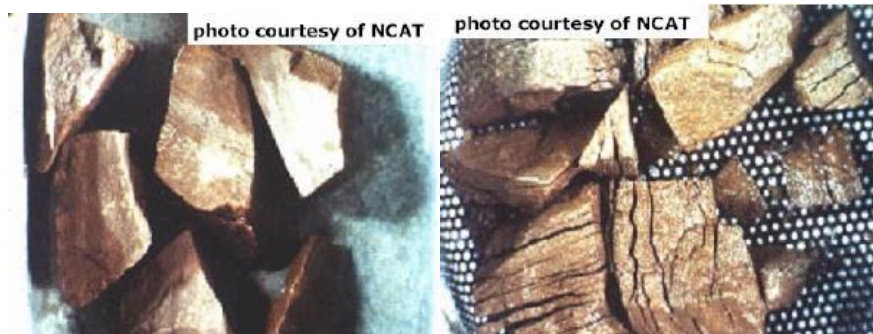
- Rotational speed = 30 rpm
- Number of revolutions = 500 revolution
- An abrasion loss value of 40 indicates that 40% of the original sample passed through the No. 12 sieve and 60% of the original sample retained.
- The higher abrasion loss value the weaker the aggregate.

## Soundness test

Aim: To measure aggregate resistance to disintegration due to chemical action.

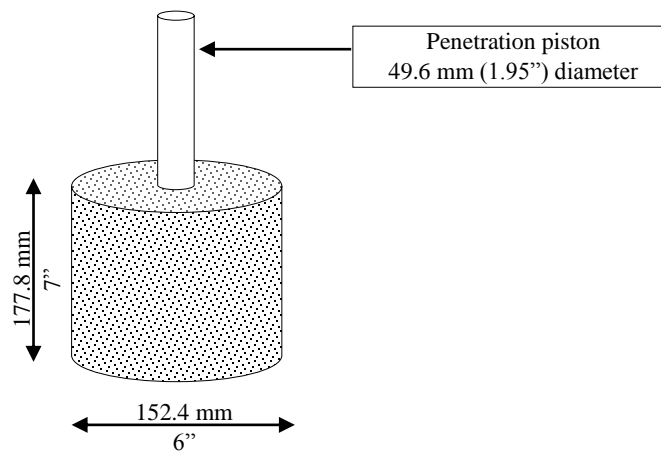
Examples of Chemical Actions:

- Polluted rain.
  - Water runoff.
  - Ground water.
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- The soundness test is a durability test.
  - The soundness test repeatedly submerges an aggregate sample in a sodium sulfate or magnesium sulfate solution.
  - This process causes salt crystals to form in the aggregate's water permeable pores.
  - The formation of these crystals creates internal forces that apply pressure on aggregate pores and tend to break the aggregate.
  - A quantitative measurement is applied to determine percentage loss of material.
  - A qualitative measurement is applied to determine percentage loss of quality.

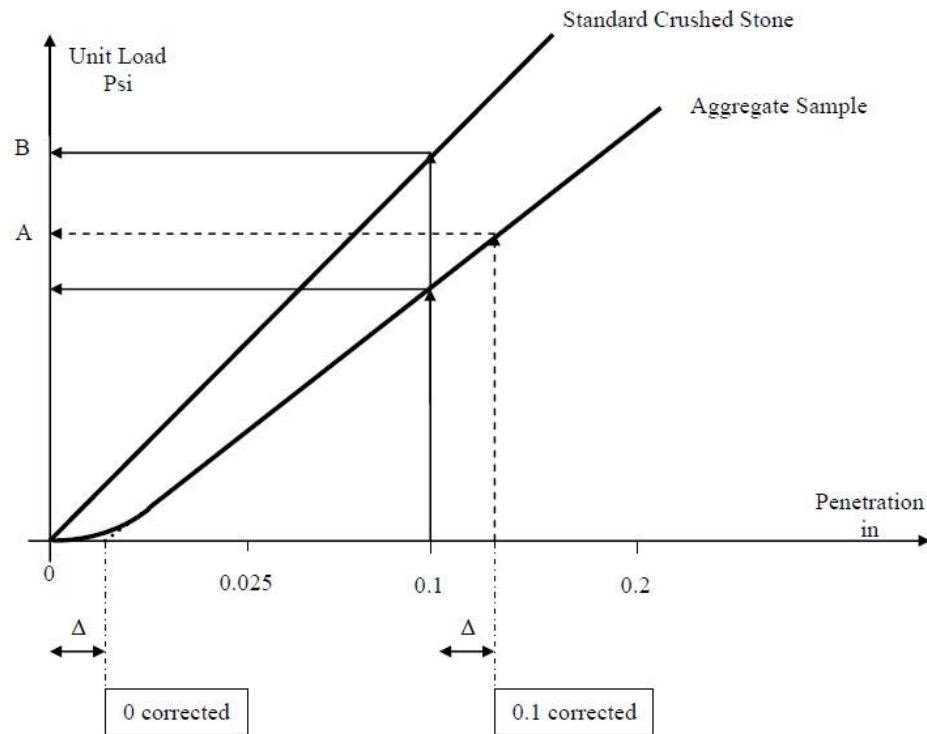


## California Bearing Ratio Test for Aggregate and Soil

- California Bearing Ratio (CBR) test is a simple strength test that compares the bearing capacity of a material with that of a well-graded crushed stone.
- A high quality crushed stone material should have a CBR @ 100%.
- The basic CBR test involves applying load to a small penetration piston at a rate of 0.05" per minute and recording the total load at penetrations ranging from 0.025" up to 0.3"



- Sample should be compacted at optimum water content,  $w_o$ .
- CBR is used in thickness design.
- For any layer, if it has a low CBR, the above layer shall have a larger thickness so it can reduce the load concentration.



Values obtained are inserted into the following equations to obtain a CBR value:

$$CBR\%_{0.1} = \frac{\text{unit load at 0.1" penetration for the sample}}{\text{unit load at 0.1" penetration for standard crushed stone (1000 Psi)}} \times 100$$

$$CBR\%_{0.2} = \frac{\text{unit load at 0.2" penetration for the sample}}{\text{unit load at 0.2" penetration for standard crushed stone (1500 Psi)}} \times 100$$

- If Soil A has a CBR of 50% and Soil B has a CBR of 70% that means Soil B has a higher strength than Soil A.
- Recent test used is Resilient Modulus; MR, which is a modulus of elasticity of a material, resulted from dividing the stress by the strain.