

Los Angeles Abrasion

Hardness

- Hardness is the aggregate's resistance to abrasion (wear)
- Hardness is an important property for aggregates in pavement surfaces
- Tested by LA Abrasion or Micro Deval

Los Angeles Abrasion

- Measure of resistance of coarse aggregate to degradation (breakdown) by
 - impact
 - abrasion
 - grinding
- Note: LA Abrasion test is not just a measure of abrasion!

Los Angeles Abrasion

- Coarse Aggregate < 1 1/2 in.
 - Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
 - AASHTO T96
 - ASTM C131
- Coarse Aggregate > 3/4 in.
 - Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
 - ASTM C535

Significance

- Indicates relative quality of aggregate sources having similar mineral compositions
 - Example: compare different sources of granite
- Cannot necessarily compare distinctly different sources
 - Example: granite vs. marine limestone
- 'Hard' rock = Lower percentage loss
- 'Soft' rock = Higher percentage loss

Los Angeles Abrasion Local Variability in Granite

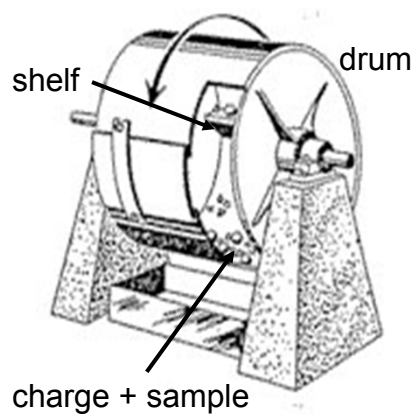
- 16% (Martin Marietta – Augusta, GA)
- 25% (Martin Marietta – Cayce, SC)
- 38% (Hanson – Demorest, GA)
- 43% (Hanson – Jefferson, SC)
- 43% (Vulcan – Anderson, SC)
- 53% (Vulcan – Lyman, SC)

Values from SCDOT January 2013 QPL

Required Apparatus

- Los Angeles Machine
- Standard Sieves
- Scales
- Drying Oven
- Steel Charge
- #12 Sieve

Los Angeles Machine



Los Angeles Abrasion Machine

Los Angeles Machine Drum

- Hollow steel cylinder, closed at both ends
- Inside diameter of 28 ± 0.2 in.
- Rotates on horizontal axis
 - slope tolerance of 1 in 100
- Dust-tight cover for opening

Los Angeles Machine Shelf

- Removable, steel shelf
- Extends full length of cylinder
- Dimensions of Shelf = $3\text{-}\frac{1}{2}$ " wide x 1" thick x 20" length (each ± 0.1 ")
- Mounted to be firm and rigid

Charge

- Steel spheres
- 6 to 12 spheres
 - Average 1-27/32 in. diameter
 - Weigh 390 to 445 g (slightly less than 1 lb.)

Charge

Sample Grading*	No. of Spheres	Total Mass of Charge
A	12	5000 g \pm 25 g
B	11	4584 g \pm 25 g
C	8	3330 g \pm 20 g
D	6	2500 g \pm 15 g

* A is coarsest grading, D is finest grading

Type B Grading

- Total Sample: $5,000 \pm 10$ g (about 11 lbs)
- $\frac{1}{2}$ in. Stone (passing $\frac{3}{4}$ in. sieve)
 - $2,500 \pm 10$ g
- $\frac{3}{8}$ in. Stone (passing $\frac{1}{2}$ in. sieve)
 - $2,500 \pm 10$ g

Test Procedure

Sample

- Wash and oven-dry 5,000 g of aggregate sample
 - Dry to constant mass at 230°F (± 9) (110°C (± 5))
- Separate sample into individual size fractions by sieving
- Recombine the sieved material to the required grading
 - Record total mass to nearest 1 g

Test Procedure

- Rotate the drum for 500 revolutions at a constant speed of 30 to 33 rpm
 - approximately 15 minutes
 - shelf picks up charge + sample at bottom of drum
 - charge + sample dropped as drum rotates □ “crushing”
 - charge + sample roll at bottom □ “grinding”

Test Procedure

- Remove the sample from the machine
- Sieve dry over a No. 12 sieve
- Material passing = degraded
- Material retained = intact
- Wash and oven-dry material retained (if required)
- Weigh to nearest 1 g

Los Angeles Abrasion Hardness

- Mass (weight) placed in abrasion machine
- Mass (weight) of intact particles left after test
- Percent Loss

$$= \frac{\text{Initial Mass} - \text{Final Intact Mass}}{\text{Initial Mass}} \times 100\%$$

Example

- Mass placed in abrasion machine 5008 g
- Mass of intact particles left after test 3891 g

(1 pound = 454 grams)

$$\% \text{ loss} = \frac{(5008 \text{ g} - 3891 \text{ g})}{5008 \text{ g}} \times 100 = 22.3\%$$

- Report results as 22% (nearest whole number)

SCDOT QC Test Frequency Type B

Materials	Value Range	Minimum Testing Frequency
Stone (non-slag)	55.0 & above	1 daily
	50.0 – 54.9	1 weekly
	40.0 – 49.5	1 monthly
	Less than 40.0	1 every 6 months
Slag	35.0 & above	1 weekly
	Less than 35.0	1 every 6 months

SCDOT Specifications Type B

Material Use	Specification
Slag for Concrete	40 Max
Slag for Asphalt Concrete	45 Max
Interstate/Primary Surface Courses	55 Max
Secondary Surface Courses	60 Max
Interstate/Primary Intermediate Courses	55 Max
Secondary Intermediate Courses	60 Max
HMA Base Courses	60 Max
Asphalt Double Treatment	60 Max
Concrete	60 Max
Marine Limestone Base	65 Max
Soil-Aggregate Sub-base	65 Max

Common Errors

- Sample not representative
- Incorrect number of spheres
- Total charge mass outside tolerances
- Not setting (or resetting) counter
- Drum not rotated at constant speed
 - slip and backlash
- Not removing all material from drum
- Sample not dried to constant mass
- Improper seal between hatch and drum