

Construction Testing for PCC Paving

Construction Testing

- Concrete Aggregates
- Cementitious Material
- Mixing Water
- Chemical Admixtures
- Freshly Mixed Concrete
- Curing Compound
- Hardened Concrete

Coarse Aggregate

CT 211-Abrasion by LA Rattler

- Indicator of wear due to impact and abrasion
- Frequency
 - initial (60 days prior to use)
 - acceptance (if initial test loss $\geq 40\%$)
 - every 3,000 m³ of PCCP
- Testing by some District lab's, or METS
- Spec. requirement, 90-2.02A
 - 45% maximum loss after 500 rev's

CT 211-Abrasion of Coarse Aggregate by LA Rattler

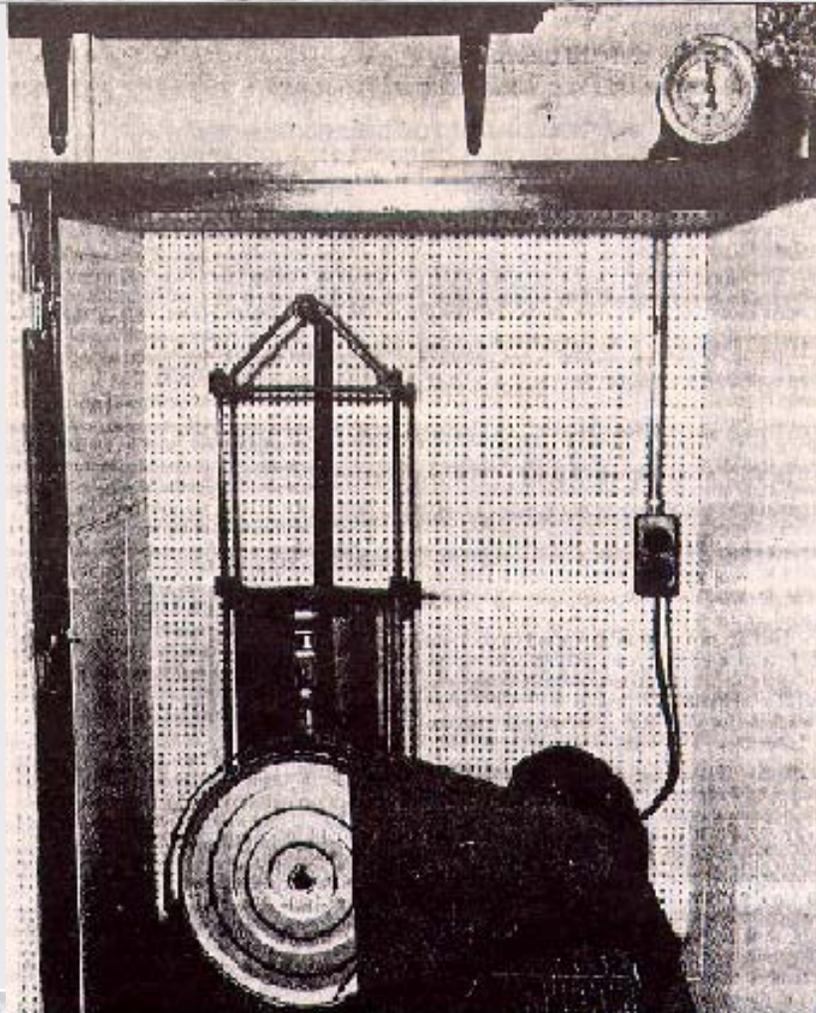


Coarse Aggregate

CT 227-Cleanness Value

- Measure of silt & clay sized particles
- Frequency
 - initial (60 days prior to use)
 - acceptance
 - every 400 m³ of PCCP, once per day minimum
 - 1 per day if CV>80 for 3 consecutive tests
- Testing by District
- Spec. Requirement, 90-2.02A
 - 75 minimum
 - 71 minimum, if pass CT 549

CT 227-Cleanness Value



Coarse Aggregate

CT 206-Specific Gravity (SSD)

- Results used in mix design calculations
- Frequency
 - initial (60 days prior to use)
- Testing by District or METS
- Spec. Requirement
 - no requirement

CT 206-Specific Gravity and Absorption of Coarse Aggregate



Fine Aggregate

CT 213-Organic Impurities

- Screen for presence of organic material
- Frequency
 - initial (60 days prior to use)
- Testing by District or METS
- Spec. Requirement, 90-2.02B
 - Satisfactory

CT 213-Organic Impurities



Fine Aggregate

CT 515-Relative Mortar Strength

- Relative measure of sand strength
- Frequency
 - initial (60 days prior to use)
- Testing by District or METS
- Spec. Requirement, 90-2.02B
 - 95% minimum

Fine Aggregate

CT 217-Sand Equivalent

- Measure of silt & clay sized particles
- Frequency
 - initial (60 days prior to use)
 - acceptance
 - every 400 m³ of PCCP, once per day min.
 - 1 per day if SE>80 for 3 consecutive tests
- Testing by District or METS
- Spec. Requirement, 90-2.02B
 - 75 minimum
 - 71 min, if passing CT 549

CT 217-Sand Equivalent



Fine Aggregate

CT 207-Specific Gravity (SSD)

- Results used in mix design calculations
- Frequency
 - initial (60 days prior to use)
- Testing by District or METS.
- Spec. Requirement
 - no requirement

CT 207-Specific Gravity and Absorption



Fine Aggregate

CT 229-Durability Index

- Indicator of resistance to wear by abrasion
- Frequency
 - initial (60 days prior to use)
- Testing by District or METS
- Spec. Requirement
 - Waive requirements for Soundness Testing if result of 60, or greater.

Coarse and Fine Aggregates

CT 214-Soundness by NaSO_4

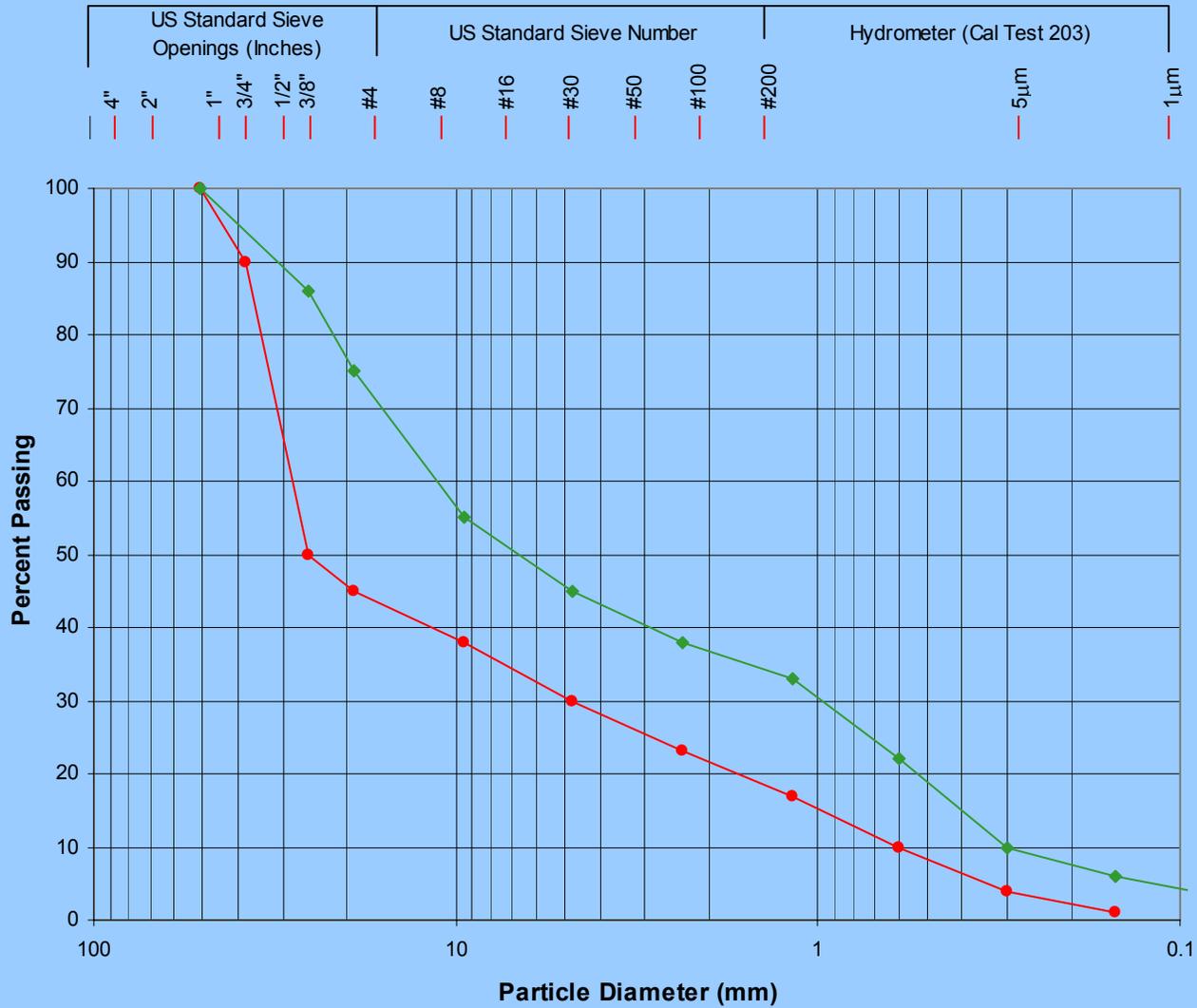
- Indicator of wear due to wetting/drying, heating/cooling, freezing/thawing cycles
- Frequency
 - initial (60 days prior to use)
- Testing by METS
- Spec. Requirement
 - 10% maximum loss

Coarse and Fine Aggregates

CT 202-Sieve Analysis

- Verify well-graded particle distribution with few fines
- Frequency
 - initial (60 days prior to use)
 - acceptance
 - every 400 m³ of PCCP, once per day min.
- Testing by District
- Spec. Requirement, 90-3.02 & 90-3.03
 - grading limits

Gradation Analysis Test Results



GRAVELS		SANDS			SILT	CLAY
Coarse	Fine	Coarse	Medium	Fine		

Coarse and Fine Aggregates

CT 528-Freeze Thaw

- Required only when specified in special provisions
- Frequency
 - initial (4 months before use)
- Testing by METS
- Spec. Requirement, 90-2.02
 - dilation less than 50 millionths
 - shrinkage less than 0.006% of gage length

Coarse and Fine Aggregates

CT 223-Surface Moisture by Displacement

- Rapid field method for determining moisture by displacement in water.
- Frequency
 - acceptance
 - every 400 m³ of PCCP, once per day min.
- Testing by District
- Spec. Requirement, 90-5.03
 - 8% maximum of SSD mass

Coarse and Fine Aggregates

CT 226-Surface Moisture by Oven Drying

- Frequency
 - acceptance
 - every 400 m³ of PCCP, once per day min.
- Testing by District
- Spec. Requirement, 90-5.03
 - 8% maximum of SSD mass

Cement

ASTM C150 (modified)

■ Frequency

– initial

- none with certificate of Compliance
- 14, 35 days prior to use depending if brand previously tested

– acceptance

- every 400 m³ of PCCP, once per day min.

■ Testing by District

■ Spec. Requirement, 90-2.01

Mineral Admixture

ASTM C618 (modified)

■ Frequency

- initial
 - refer to current list of approved brands
- acceptance
 - every 400 m³ of PCCP, once per day min.

■ Testing by METS

■ Spec. Requirement, 90-4.02 and 90-4.08

Water

CT 405- Chemical analysis of water

- Indicator of presence of Chlorides and Sulfates
- Frequency
 - initial
 - acceptance
 - don't need to test water supplies for domestic use
- Testing by METS
 - If total solids > 2,000 ppm, or pH is acidic or alkaline then test for sulfate & chloride content

Water

CT 417- Sulfate Content

- Control degradation due to sulfate attack
- Frequency
 - initial
 - acceptance
 - don't need to test water supplies for domestic use
- Testing by METS
- Spec. Requirement, 90-2.03
 - 1,300 ppm maximum

Water

CT 422- Chloride Content

- Control corrosion of embedded steel
- Frequency
 - initial
 - acceptance
 - don't need to test water supplies for domestic use
- Testing by METS
- Spec. Requirement, 90-2.03
 - 1,000 ppm maximum

Water

Set Time and Mortar Strength

■ Spec. Requirement

- shall not contain an amount of impurities that will cause a change in the setting time of portland cement of more than 25 percent nor a reduction in the compressive strength of mortar at 14 days of more than 5 percent when compared to the results obtained with distilled or deionized water

Air Entraining Admixture

ASTM C260

- Frequency
 - Initial (1 week prior to use)
 - refer to current list of approved brands
- acceptance
 - each delivery to the job site
- Testing by METS
- Spec. Requirement, ASTM C260

Chemical Admixture

ASTM C494

- Frequency
 - Initial (1 week prior to use)
 - refer to current list of approved brands
- acceptance
 - each delivery to the job site
- Testing by METS
- Spec. Requirement, ASTM C494

Freshly Mixed Concrete

CT 539-Sampling Fresh Concrete

- Obtain representative sample
- use clean, damp, non-absorbent sampling receptacle
- for non-agitating trucks obtain sample from 5 different portions of the load
- for ready-mix trucks obtain sample from 2 or more regular intervals from middle of batch
- remix composite sample
- start penetration, air, and temperature testing within 5 minutes from time of sampling
- complete all testing and beam fabrication within 15 minutes from the time of sampling

Freshly Mixed Concrete

CT 518-Density (Yield)

- Results used to verify cement content
- Frequency
 - Acceptance
 - every 4 hours of production
- Testing by field lab.
- Spec. Requirement
 - adjust batch proportions to obtain specified or ordered cement content

Freshly Mixed Concrete

CT 533-Ball Penetration

- Measure of consistency and uniformity
- Frequency
 - Acceptance
 - when beams are fabricated
 - when consistency and uniformity is questionable
- Testing by field lab.
- Spec. Requirement, 90-6.06
 - Nominal penetration, 0-25mm
 - Maximum penetration, 40 mm

Freshly Mixed Concrete

CT 533-Ball Penetration (cont.)

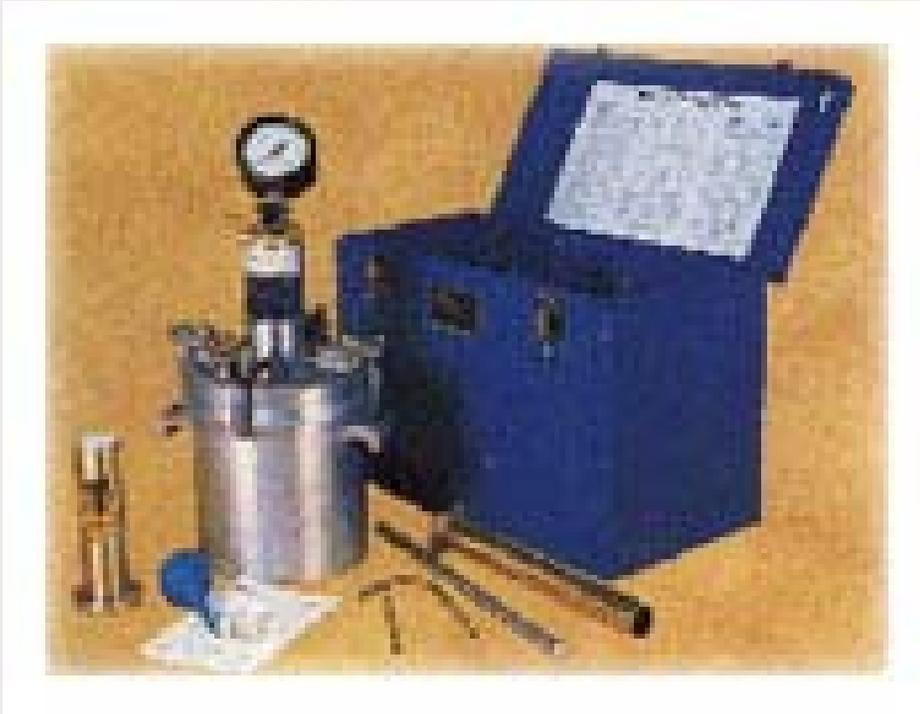
- Spec. Requirement, 90-6.01
 - 10mm maximum difference in penetration measurements from the same batch

Freshly Mixed Concrete

CT 504-Air Content (Pressure Method)

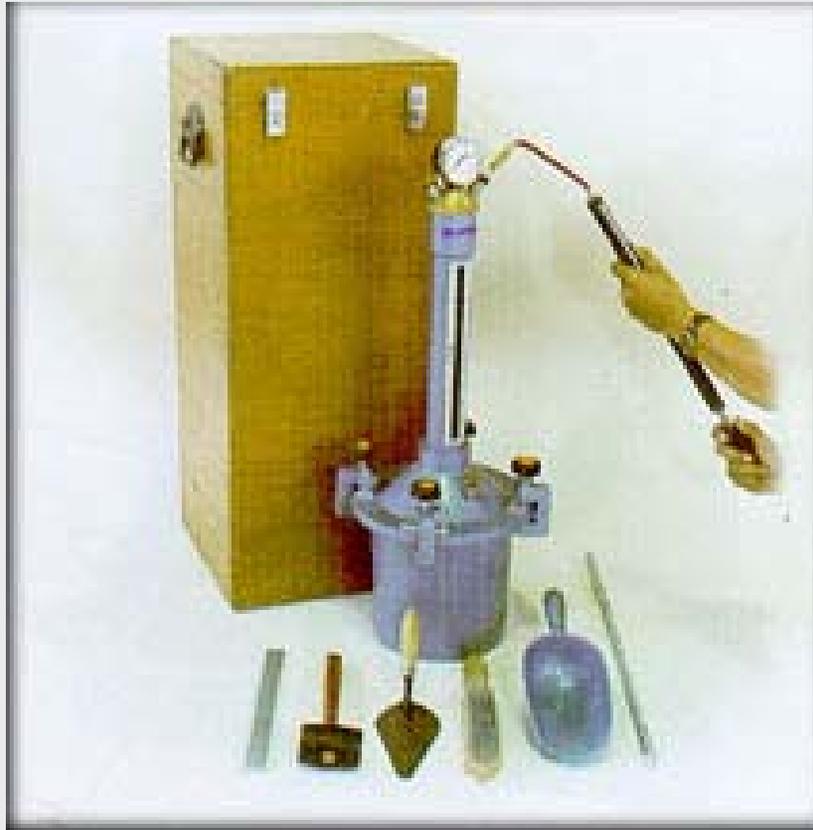
- Verify entrained air content
- Frequency
 - acceptance
 - when CT 518-Density (Yield) test is performed
- Testing by field lab.
- Spec. Requirement, 90-4.07
 - average of 3 tests, 4% max
 - individual tests, 5.5% max

CT 504-Air Meter Pressure Method



ASTM C173

Air Meter-Volume Method



Freshly Mixed Concrete

CT 529-Proportions of coarse aggregate

- Verify uniformity of concrete mix
- Frequency
 - acceptance
 - when CT 533-Ball Penetration test is performed to verify uniformity
- Testing by field lab.
- Spec. Requirement, 90-6.01
 - variation in coarse aggregate, 100 kg/m³ max

Curing Compound

CT 534-Water Retention

- Measure of water loss through curing compound
- Frequency
 - once a day sampled from spray bar
- Testing by METS
- Spec. Requirement, 90-7.01B, ASTM C309
 - moisture loss of 0.15kg/m^2 , maximum, in 24 hours

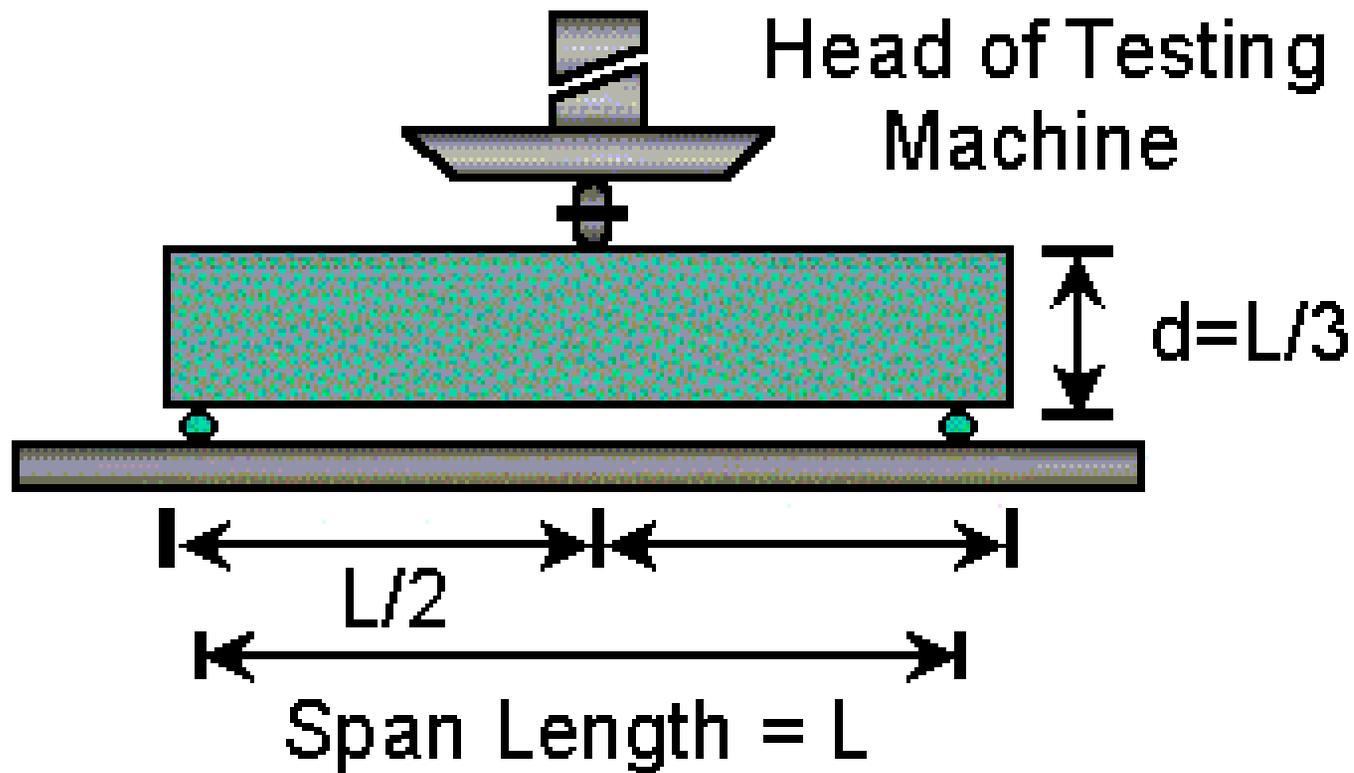
Hardened Concrete

CT 523-Flexural Strength

- Verify strength requirements
- Frequency
 - acceptance
 - 1 set of 3 beams for 3,000 m³ of PCC Paving
- Testing by field lab.
- Spec. Requirement, 90-8.03
 - 3.8 MPa prior to opening to public or contractor traffic

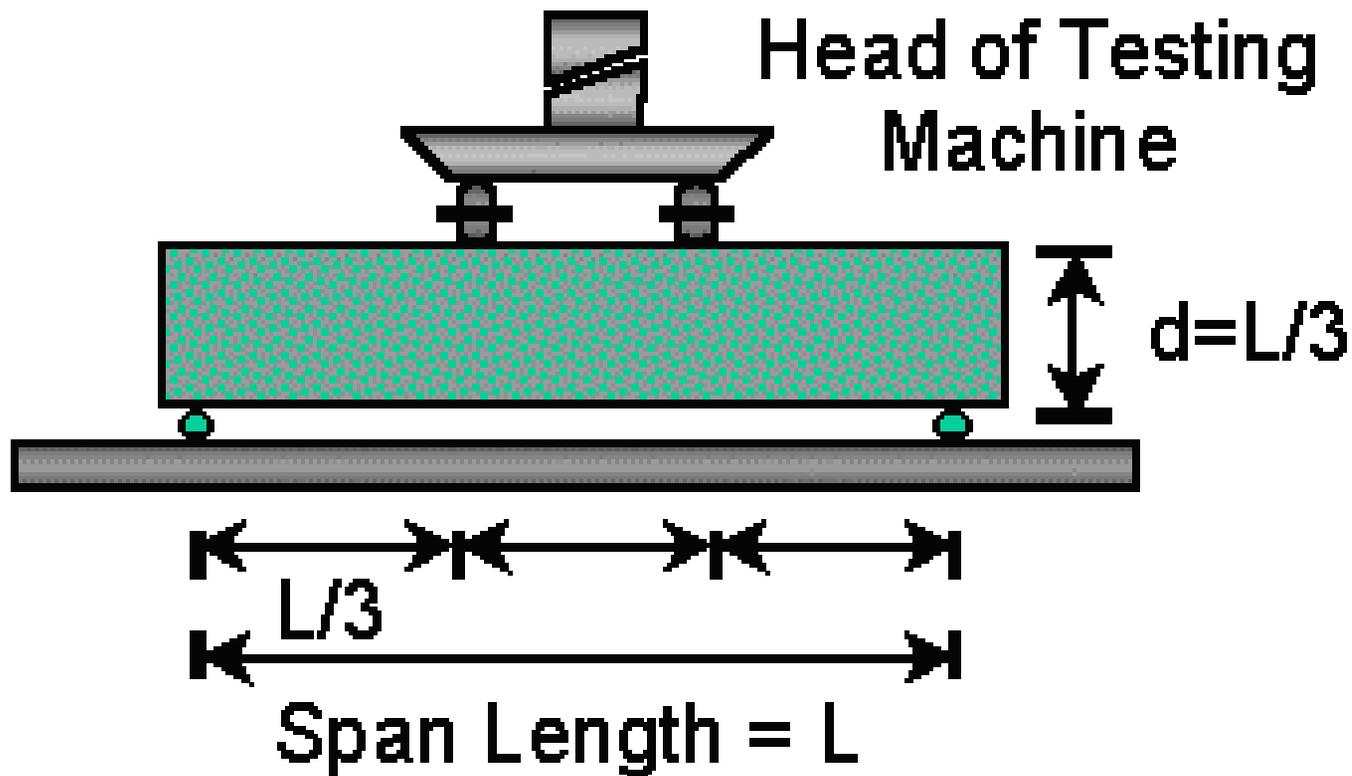
CT 523-Flexural Strength Method 1

Center-point Loading



CT 523-Flexural Strength Method 2

Third-point Loading



Hydraulic beam breaker



Hardened Concrete

CT 531-Pavement Thickness

- Measure length of drilled cores
- Frequency
 - one core per 300 linear meters of traffic lane for primary unit
- Testing by District lab.
- Spec. Requirement, 40-1.135
 - pay deduction for thickness deficiency greater than 2.5mm
 - thickness deficiency greater than 15mm maybe removed and replaced

Hardened Concrete

CT 526-California Profilograph

- Measure of pavement smoothness
- Frequency (within 10 days after paving)
 - Profiles made at 1m from edge of pavement and at longitudinal joints
- Testing by Contractor in presence of RE staff
- Spec. Requirement, 40-1.10

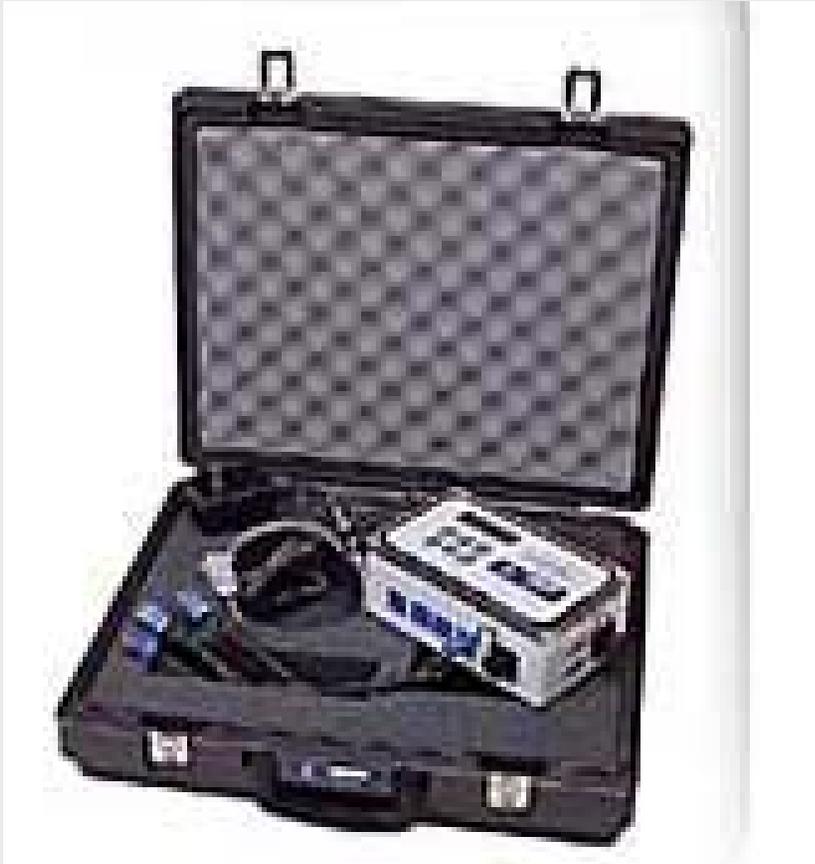
Hardened Concrete

CT 342-Coefficient of Friction

- Measure of pavement skid resistance
- Frequency (prior to opening to public traffic but no sooner than 7 days after paving)
- Testing by METS
- Spec. Requirement, 40-1.10
 - coefficient of friction of 0.3 minimum
 - less than 0.3 requires grooving of pavement

ASTM C1074

Concrete Strength by Maturity Method



ASTM C805

Rebound (Schmidt) Hammer



ASTM D4944

Moisture Content by Calcium Carbide Gas Pressure Tester

