



## Quality Control and Quality Assurance

### Learning Objectives

- Role of the Sponsor in Quality Management
- Understand Quality Assurance Requirements
- Understand Contractor Quality Control Requirements
- Understand Acceptance versus Process Management



## What is Quality?

### American Society of Quality

- A subjective term for which each person or sector has its own definition. In technical usage, quality can have two meanings: 1) the characteristics of a product or service that bear on its ability to satisfy stated or implied needs; 2) a product or service free of deficiencies.

### Who is Responsible Quality?

## What About for Airport Improvement Program Projects?

- **Sponsors Role:** AC 150/5370-12B Quality Management for Federally Funded Airport Construction Projects—Must submit a QMP > \$500,000
- **Engineers/RPR Role:** Quality Assurance
- **Contractor's Role:** Contractor Quality Control



## Quality Assurance versus Quality Control

- **Quality Assurance:** all the planned and systematic activities implemented within the quality system that can be demonstrated to provide confidence that a product or service will fulfill requirements for quality.
- **Quality Control:** the operational techniques and activities used to fulfill requirements for quality.

### Quality Airfields:

- Functional
- Proper Drainage
- Good Surface Characteristics
- Slab size/thickness/layer strengths
  - If incorrect = cracked slabs





## Quality Concrete:



- Durable Concrete
- No sliver spalls
- No scaling, surface spalls
- No reactivity / aggregate durability issues

## Is Quality Concrete about:

- Strength?
- Air content?
- Slump?
- 100% Inspection?





## Acceptance vs. Quality Control

- Acceptance – criteria that must be met for the contractor to receive full payment for work performed
- Quality Control – activities that the contractor uses to develop processes that result in acceptable work

## Quality Control

- ☐ CQCP in accordance with C-100
  - Key is corrective action plans
  - Advance planning of how to keep production under control and what to do when it gets out
  - Control charts (all materials and mix)

## Quality Control

- P 501-6.1 – 12 items only?
  - a. Mix Design
  - b. Aggregate Gradation
  - c. Quality of Materials
  - d. Stockpile Management
  - e. Proportioning
  - f. Mixing and Transportation
  - g. Placing and Consolidation
  - h. Joints
  - i. Dowel Placement and Alignment
  - j. Flexural or Compressive Strength
  - k. Finishing and Curing
  - l. Surface Smoothness



### 501-6.6 Acceptance criteria.

**a. General.** Acceptance will be based on the following characteristics of the completed pavement discussed in paragraph 501-6.5b:

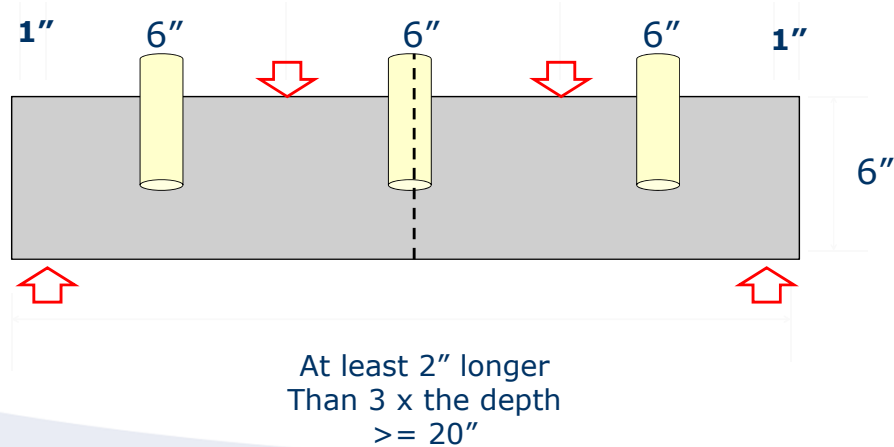
- (1) Strength
- (2) Thickness
- (3) Grade
- (4) Profilograph smoothness [ Not used. ]
- (5) Adjustments for repairs

## QA/QC Coordination Meeting

- Agenda
  - Review Contractor's QC Plan and the Engineers QA Plan
  - Shared use of laboratory facilities and equipment?
  - QC & QA Testing Plans
  - Review Test Methods
  - Shared/Split samples
  - Reporting test results – timing
  - Handling of informational QC tests and results
  - Handling of deficiencies, rework, retesting, reporting, and closeout
  - Dispute resolution
  - Clarify ambiguous provisions (i.e., how bonus is applied, Open to traffic, etc.)

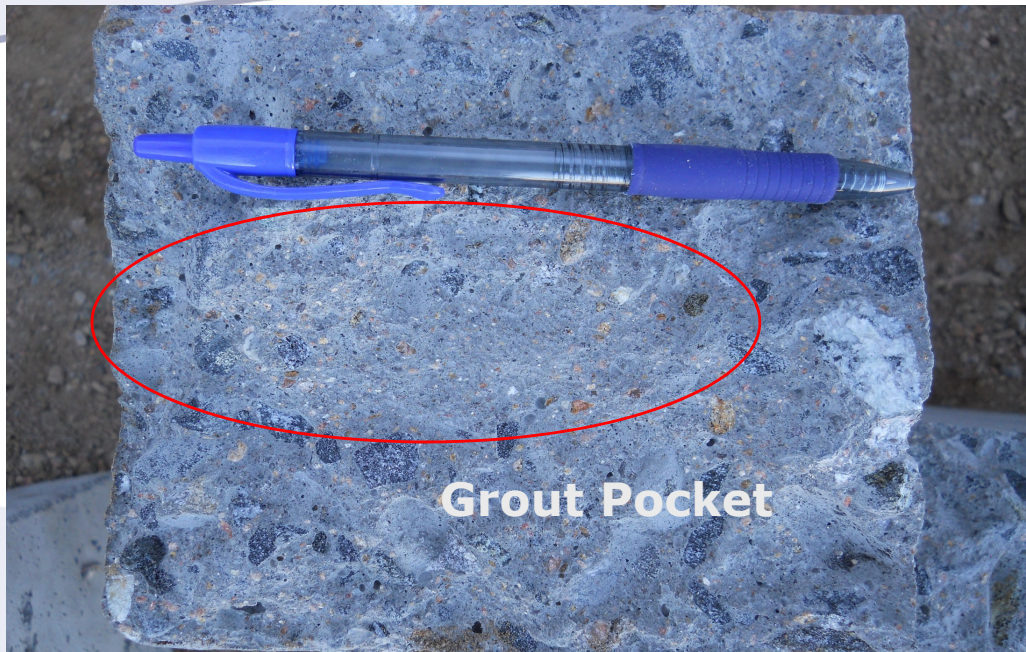
### Vibrating a Beam ASTM C 31

Insert vibrator at intervals not exceeding intervals of 6"



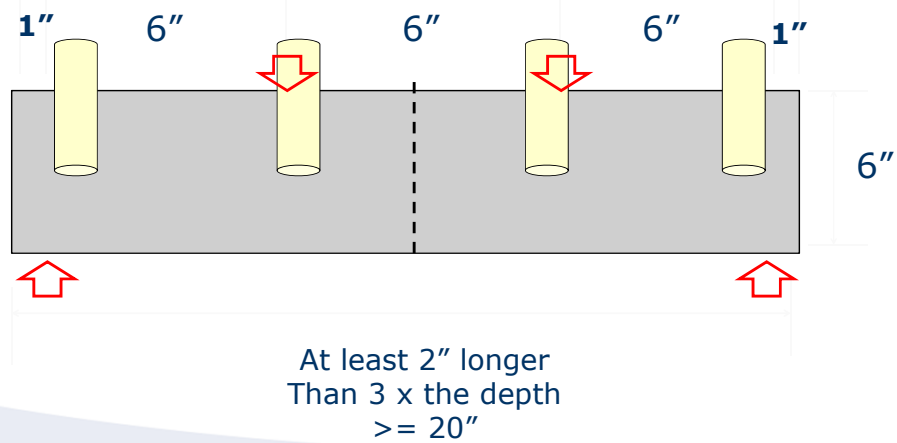


## Broken Beam X-Section



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Insert vibrator at intervals not exceeding intervals of 6"





## Broken Beam X-Section



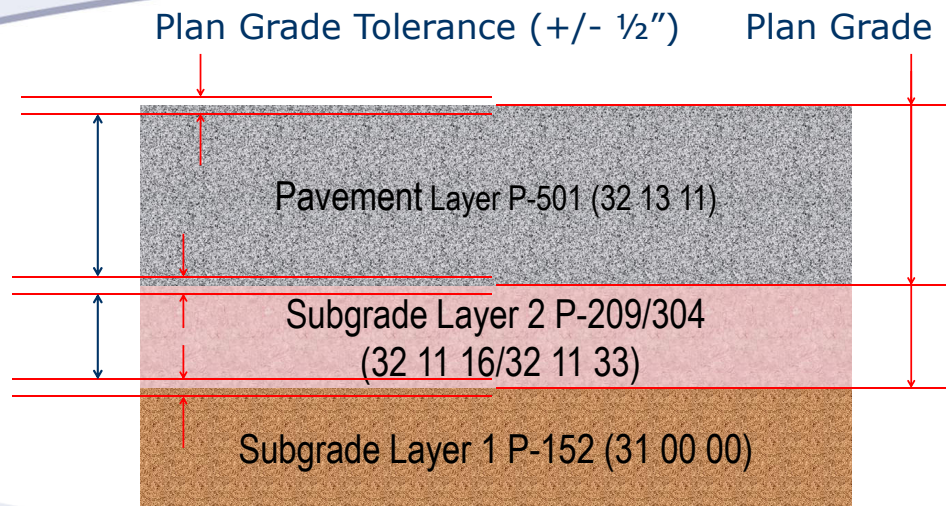
## Control or Acceptance??

**501-4.12 Surface texture.** The surface of the pavement shall be finished as designated below for all newly constructed concrete pavements. It is important that the texturing equipment not tear or unduly roughen the pavement surface during the operation. The texture shall be uniform in appearance and approximately 1/16 inch (2 mm) in depth. Any imperfections resulting from the texturing operation shall be corrected to the satisfaction of the RPR.

## Grade vs. Thickness Tolerance—Control or Acceptance?

- Exceeding Tolerances  
Plan Grade/Thickness
- P-152 (31 00 00) +0/-1/2"
- P-304 (32 11 33) +0/-1/2"
- P-501 (32 13 11) -0/+1/2"

### Exceeding Requirements Grade vs. Thickness Tolerance



Thickness Tolerance  
 $\leq 1/2"$

Control vs. acceptance



## Where does this fit in?

- P 501-4.10 Joints
  - Joints shall not vary more than 1/2 inch (12 mm) from their designated position and shall be true to line with not more than 1/4 inch (6 mm) variation in 10 feet (3 m).



## Non-Conforming Work

- **The work fails to meet the contract acceptance requirements. The condition may require either removal & replacement, payment reduction, or some other corrective action to allow the work to remain in place. A Stop Work Order may be issued for this failure to meet contract requirements..**





# Who is responsible?

- Grooving Sub's QC Plan defined their actions.
- Prime QC Plan required to have action when process failed
- QA/Engineer had a QMP— defines what action will be taken
- Specifications defined construction requirements—but also acceptance requirements

## ACCEPTANCE

**621-3.1 Acceptance testing.** Grooves will be accepted based on results of zone testing. All acceptance testing necessary to determine conformance with the groove tolerances specified will be performed by the Engineer RPR.

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The Engineer RPR will measure grooves in five zones across the pavement width. Measurements will be made at least three times during each day's production. Measurements in all zones will be made for each cutting head on each piece of grooving equipment used for each day's production.

The five zones are as follows:

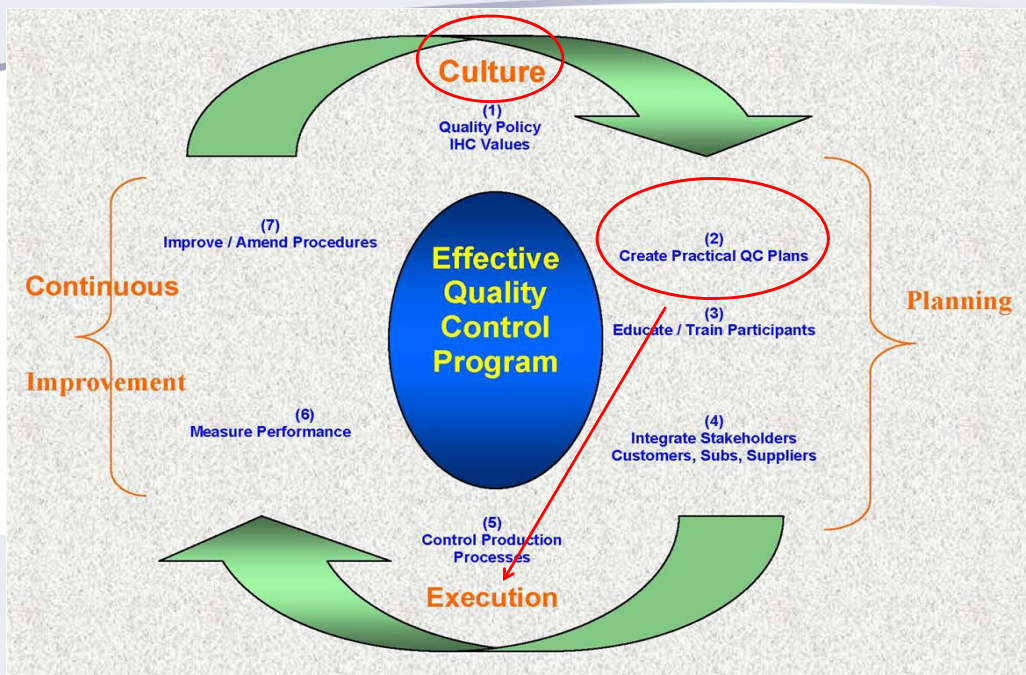
- Zone 1 Centerline to 5 feet (1.5 m) left or right of the centerline.
- Zone 2 5 feet (1.5 m) to 25 feet (7.5 m) left of the centerline.
- Zone 3 5 feet (1.5 m) 25 feet (7.5 m) right of the centerline.
- Zone 4 25 feet (7.5 m) to edge of grooving left of the centerline.
- Zone 5 25 feet (7.5 m) to edge of grooving right of the centerline.

At a random location within each zone, five consecutive grooves sawed by each cutting head on each piece of grooving equipment will be measured for width, depth, and spacing. The five consecutive measurements must be located about the middle blade of each cutting head  $\pm 4$  inches (100 mm). Measurements will be made along a line perpendicular to the grooves.

- Width or depth measurements less than 0.170 inch (4 mm) shall be considered less than 3/16 inch (5 mm).
- Width or depth measurements more than 0.330 inch (8 mm) shall be considered more than 5/16 inch (8 mm).
- Width or depth measurements more than 0.235 inch (6 mm) shall be considered more than 1/4 inch (6 mm).

Production must be adjusted when more than one groove on a cutting head fails to meet the standard depth, width, or spacing in more than one zone.

## Elements of an Effective QC/ Program





## Questions/Discussion

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