# Contractor Quality Control

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Count on Concrete PAVEMENT

# Contractor QC Program

- FAA - The Contractor shall establish, provide, and maintain and **effective** Quality Control Program …

- UFGS – Establish and maintain an **effective** quality control (QC) system in compliance with the Contract.

# Contents of a QC Plan/Program FAA

- FAA (Contractor QC Only) (Process Control).
  1. QC Organization
  2. Progress Schedule
  3. Submittal Schedule
  4. Inspection
  5. Process Control Testing
  6. Documentation
  7. Corrective Action Deficiencies

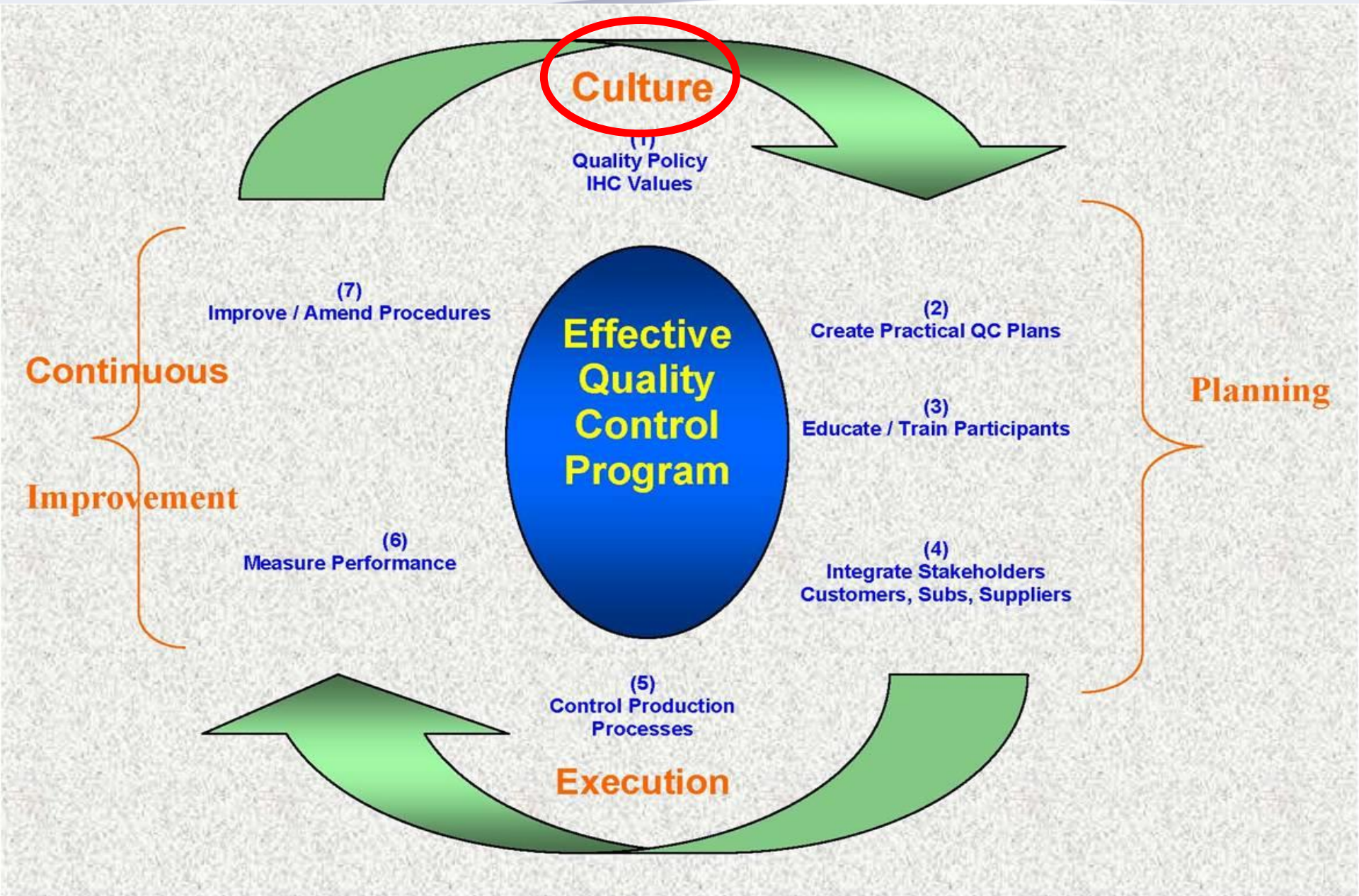
# Contents of a QC Plan/Program UFGS

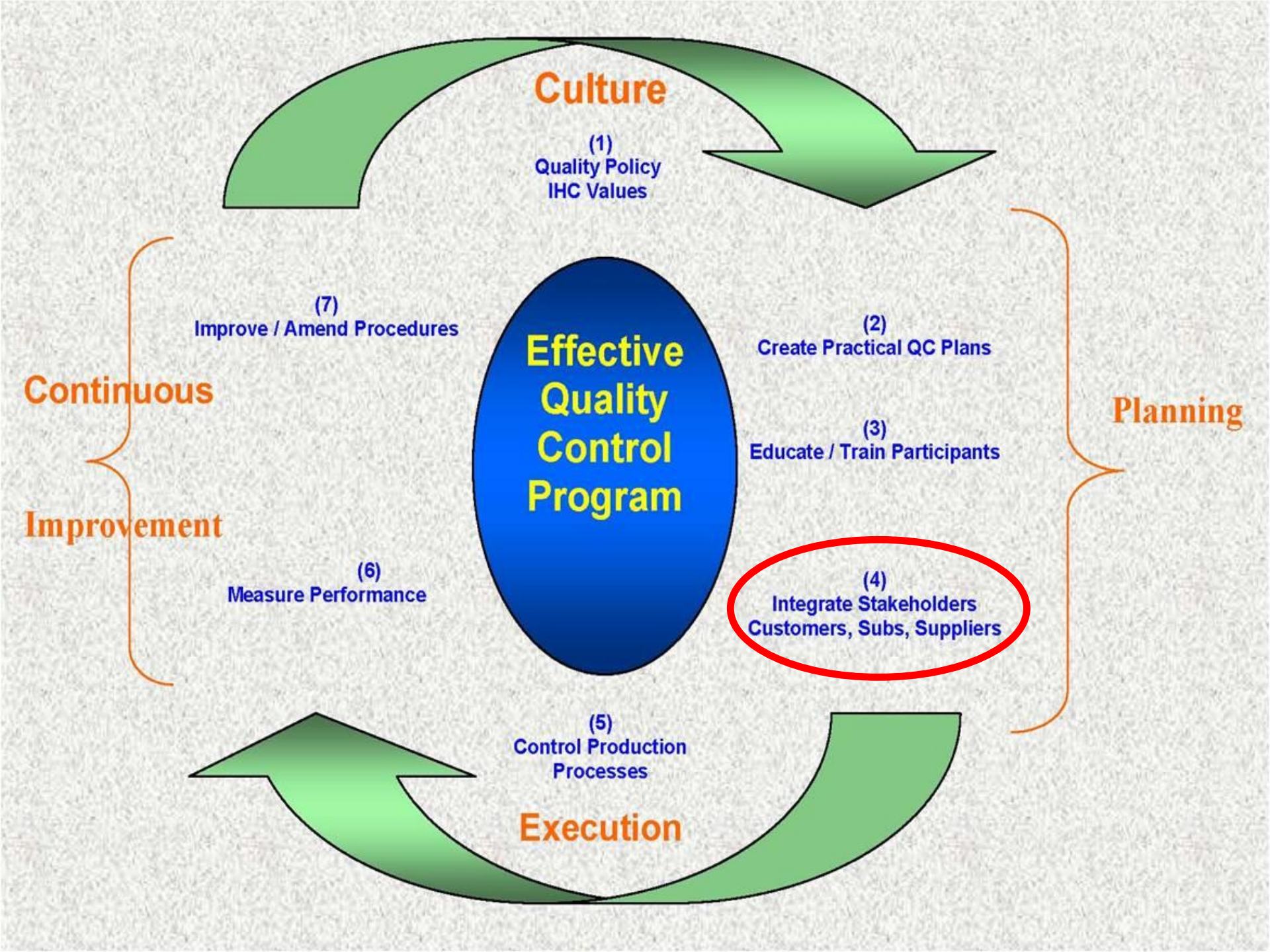
- UFGS Contractor QC and QA (Acceptance)
  1. QC Organization
  2. Submittal Management
  3. QC/QA Testing Plan
  4. Inspection Plan
  5. Deficiencies
  6. Reporting and Record Keeping

# What are the objectives of QC

- FAA
  1. Adequately provide for the production of **acceptable** quality materials.
  2. Provide sufficient information to assure both the the contractor and the Engineer that specification requirements can be met.
  3. Allow the Contractor as much latitude as possible to develop his or her own standard of **control**.

# Elements of an Effective QC Program



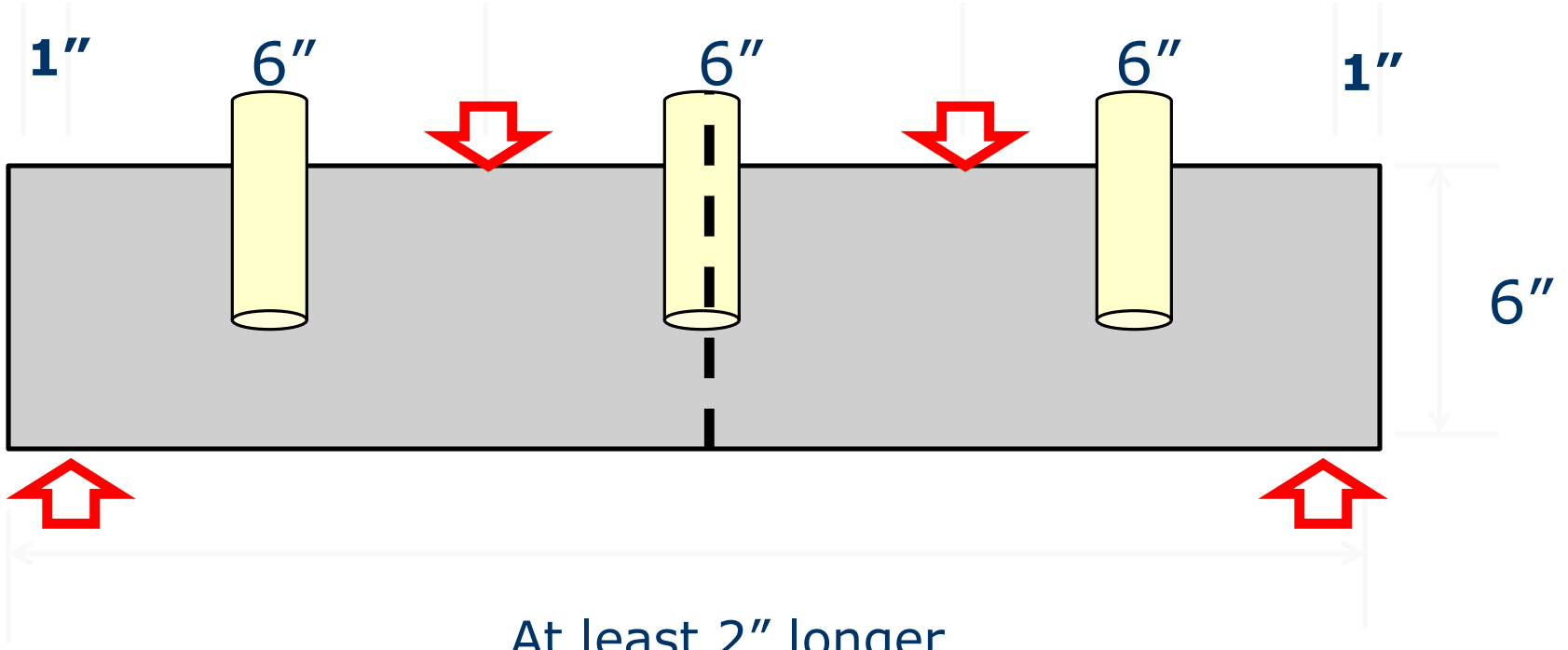

Culture
(1)
Quality Policy
IHC Values
Planning
(2)
Create Practical QC Plans
(3)
Educate / Train Participants
(4)
Integrate Stakeholders
Customers, Subs, Suppliers
Effective
Quality
Control
Program
(5)
Control Production
Processes
Execution
(6)
Measure Performance
(7)
Improve / Amend Procedures
Continuous
Improvement

# 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

# Vibrating a Beam ASTM C 31

Insert vibrator at intervals not exceeding intervals of 6”

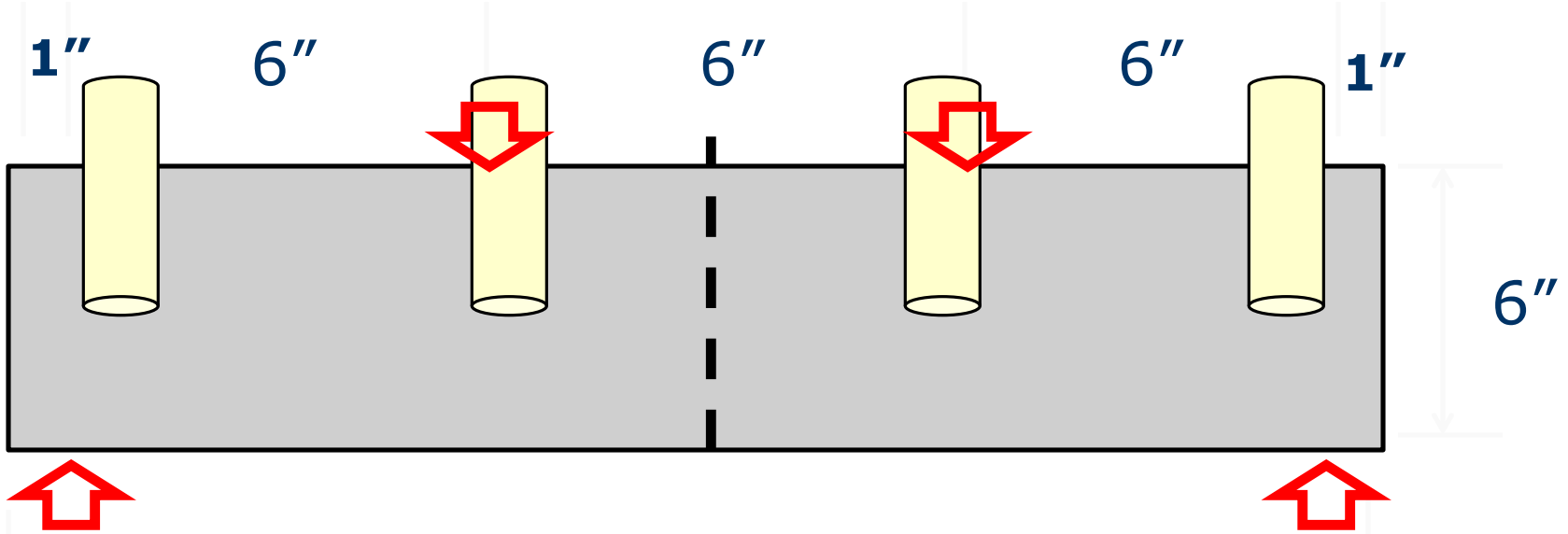



At least 2” longer
Than 3 x the depth
>= 20”

# Broken Beam X-Section

# Vibrating a Beam ASTM C 31

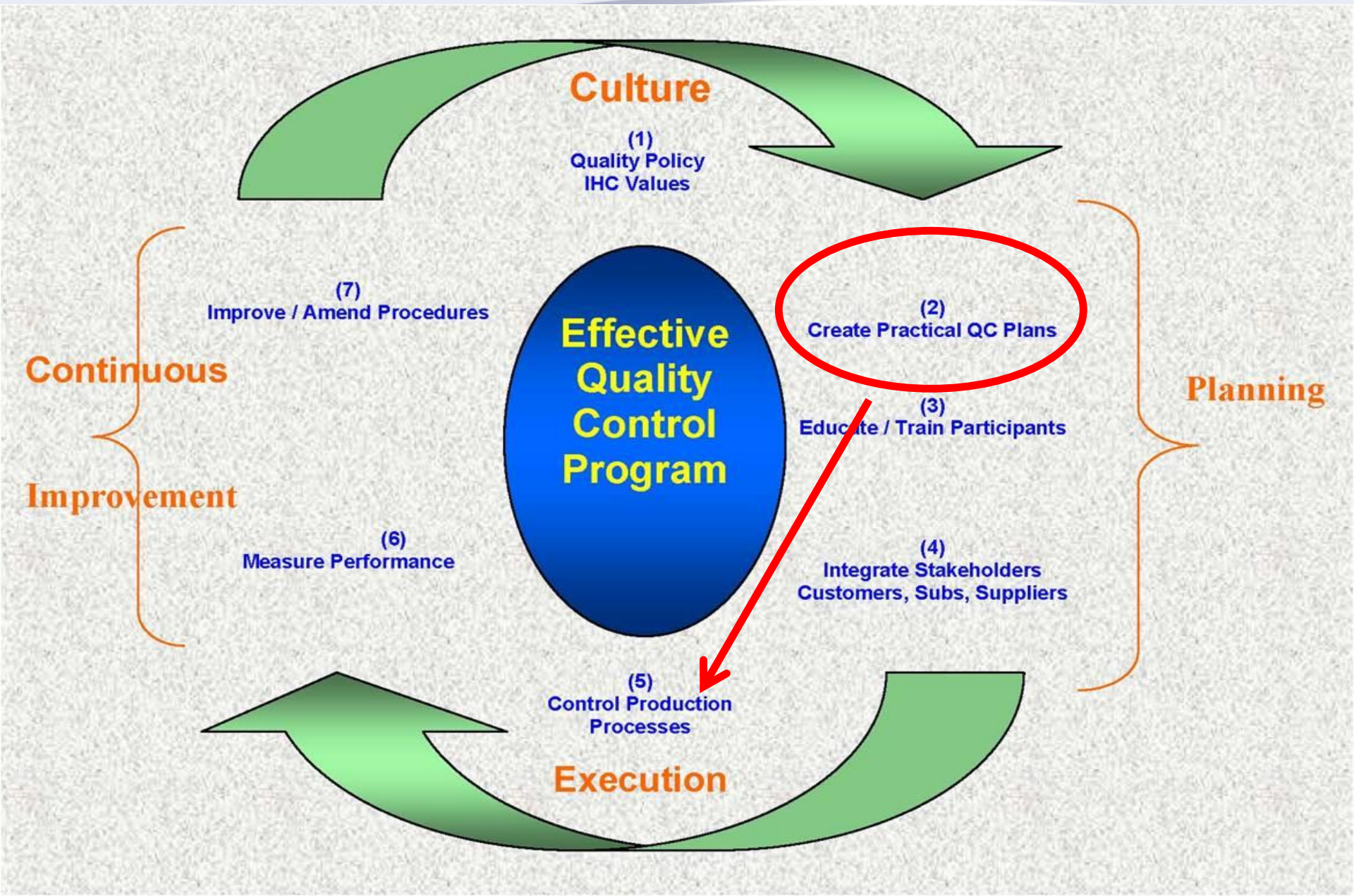
Insert vibrator at intervals not exceeding intervals of 6”



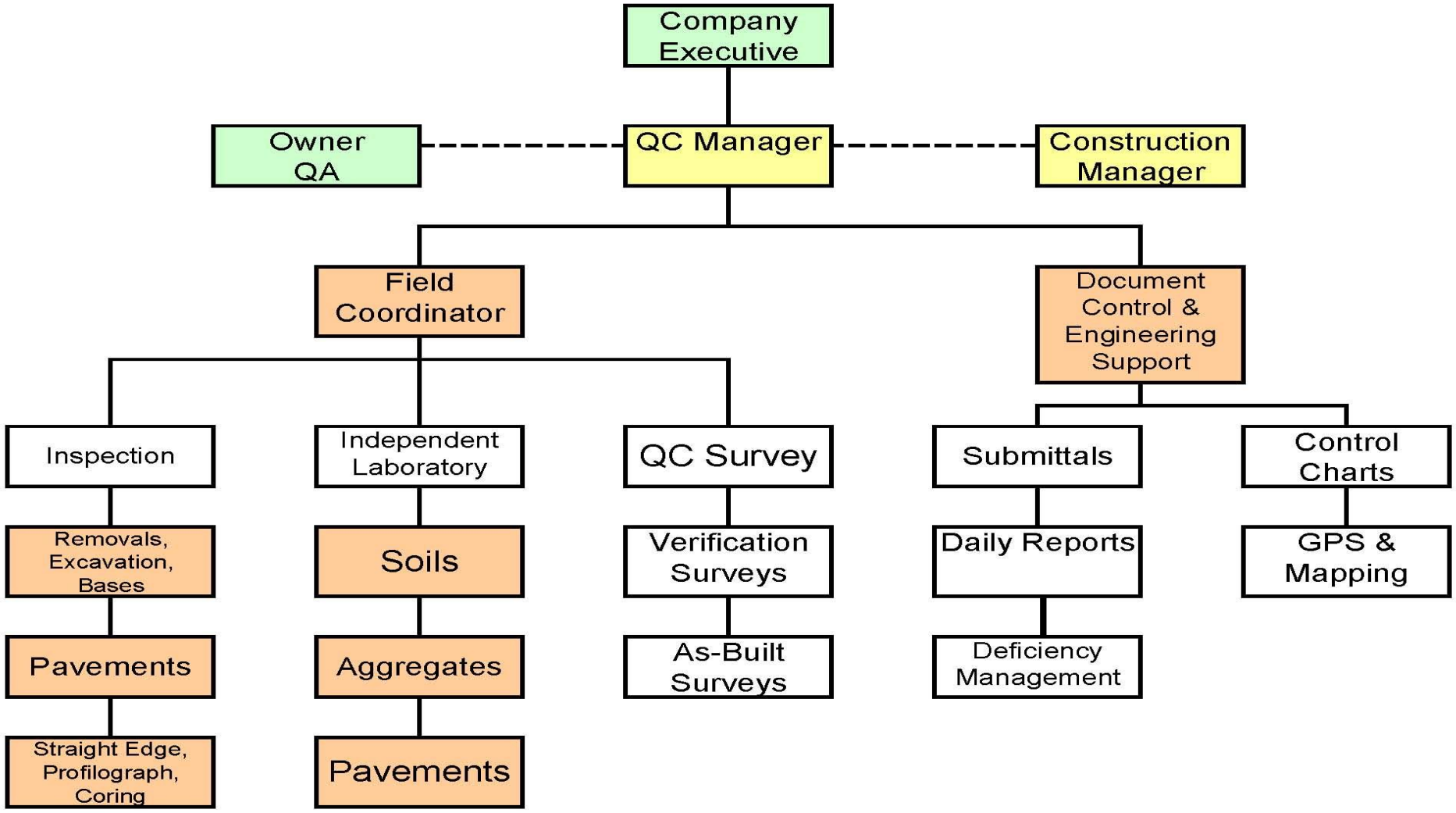

At least 2” longer
Than 3 x the depth
>= 20”

# Broken Beam X-Section

# Elements of an Effective Program

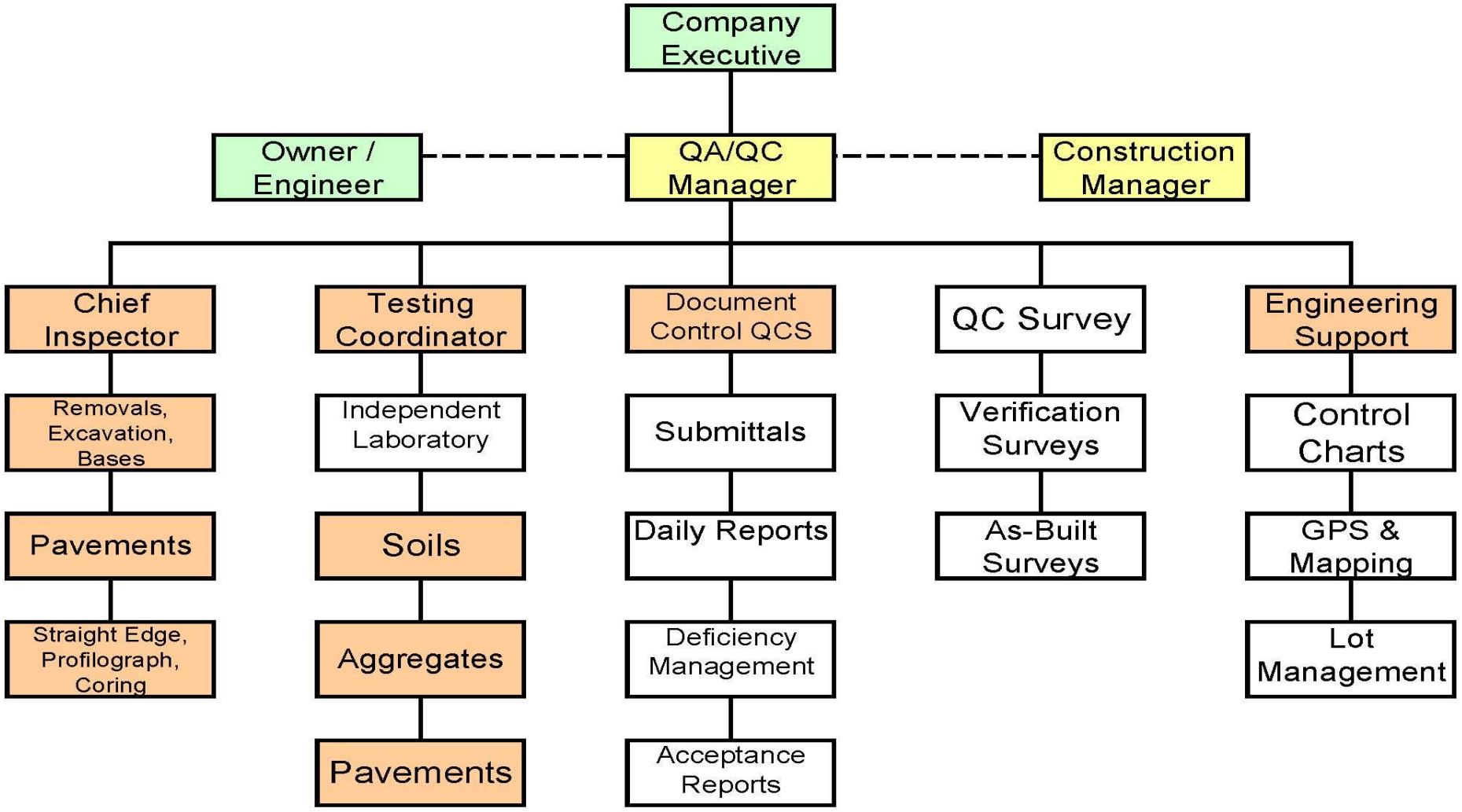


# Standard FAA Organization Chart



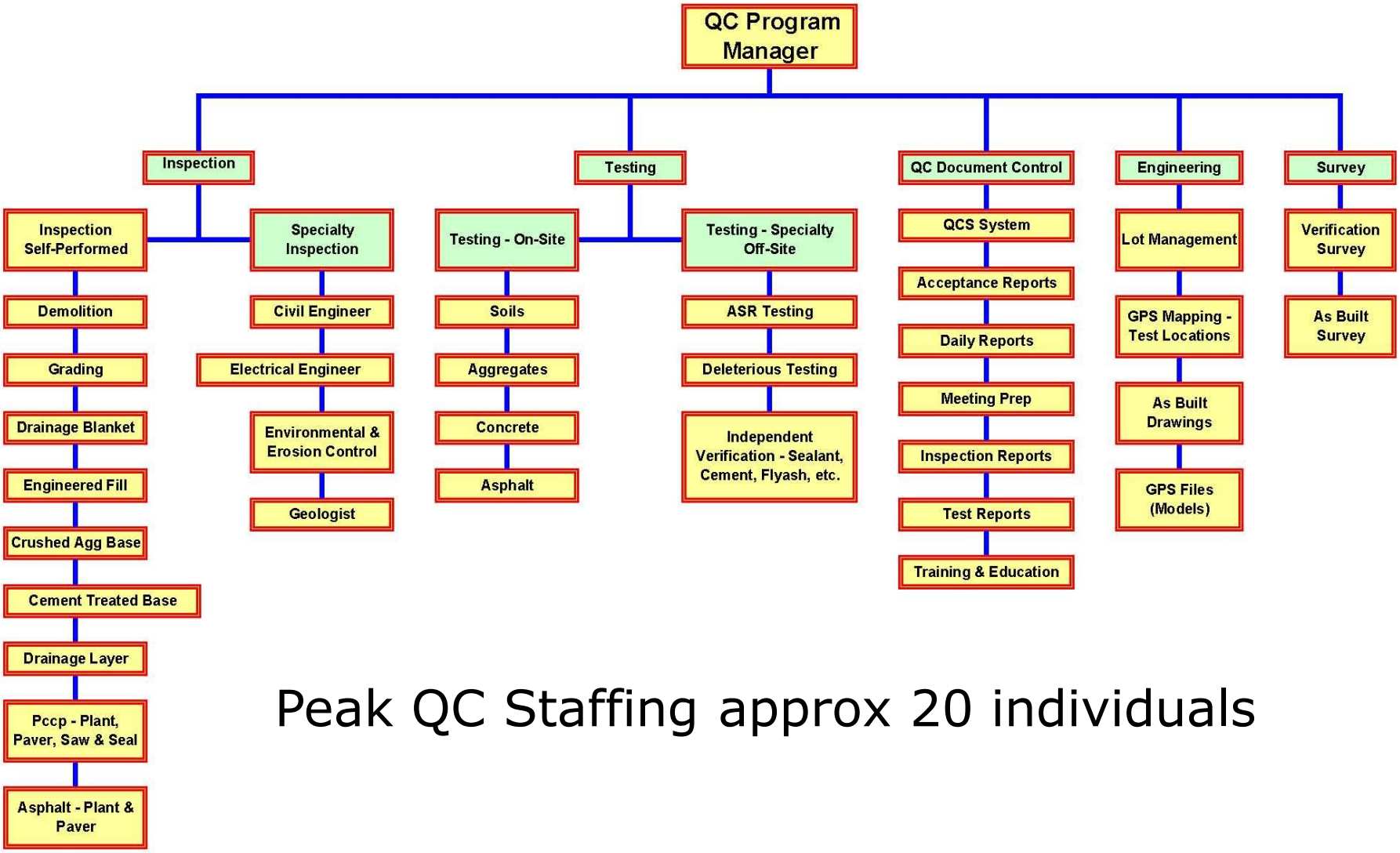

Colored boxes indicate part-time or full-time employee positions (Yellow and orange indicate on-site, green off-site). White boxes represent functions.

# Standard DoD CQC Organization Chart




Colored boxes indicate part-time or full-time employee positions (Yellow and orange indicate on-site, green off-site). White boxes represent functions.

# DoD Mega Project Organization Chart




Peak QC Staffing approx 20 individuals

# 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

# P-501 Acceptance Criteria

- P-501-5.2
  a. Acceptance will be based on the following characteristics of the completed pavement discussed in paragraph 501-5.2e:
     1) Flexural Strength (PWL)
     2) Thickness (PWL)
     3) Grade – Lateral & Vertical meet or correct
     4) Profilograph for roughness (runways)
     5) Adjustment for Repair
     6) Adjustment for Grinding

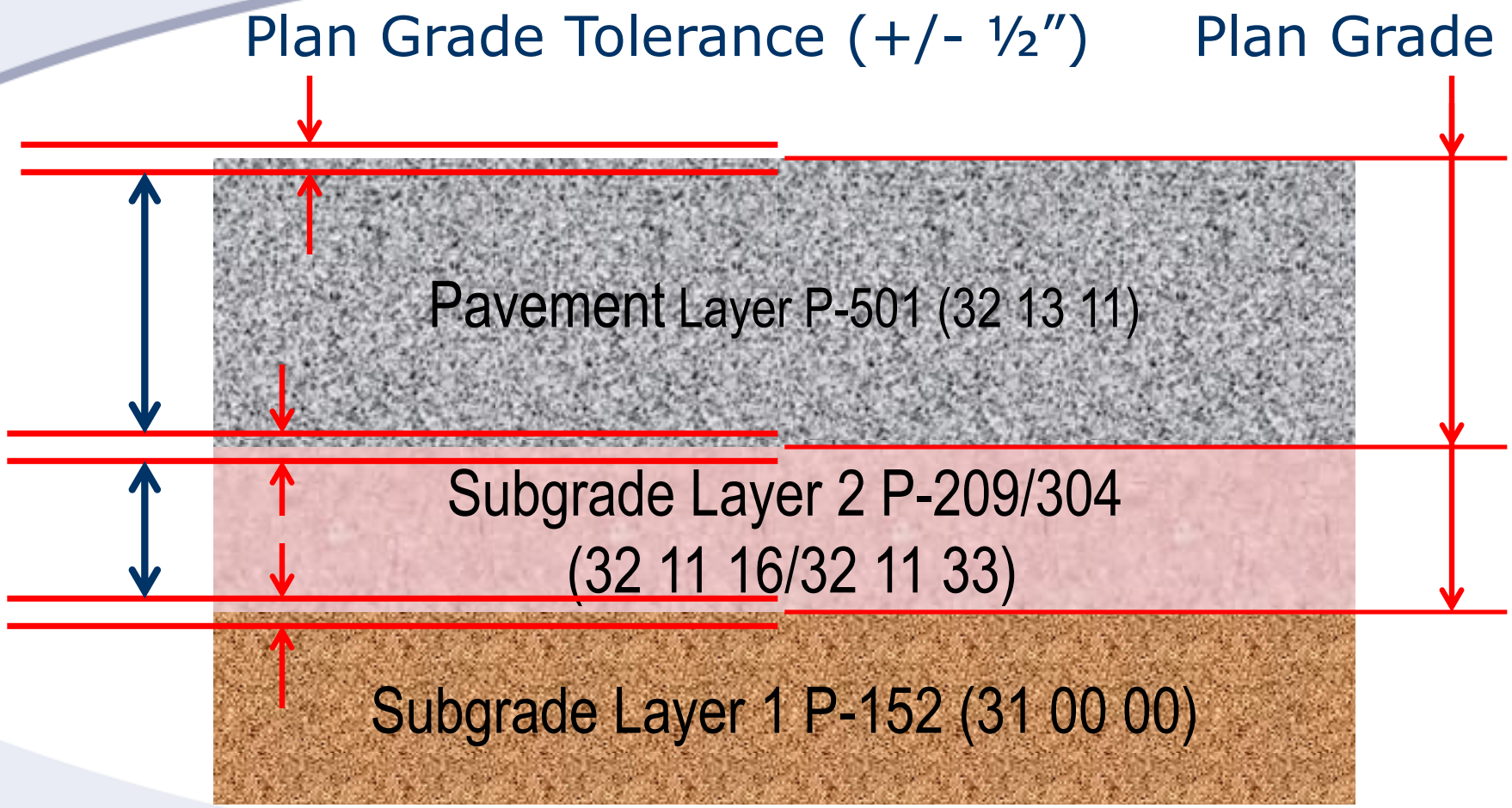
# Contractor Quality Control

- P 501 – 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

# Control or Acceptance??

- P 501-4.6
  - “Mixed concrete from the central mixing plant shall be transported in truck mixers, truck agitators, or non-agitating trucks. The elapsed time from the addition of cementitious material to the mix until the concrete is discharged from the truck ***should*** not exceed **[** 30 **]** minutes when the concrete is hauled in non-agitating trucks, nor 90 minutes when the concrete is hauled in truck mixers or truck agitators. In no case shall the temperature of the concrete when placed exceed 90°F (32°C).
- P 501-4.8 (b)
  - Side forms shall remain in place at least 12 hours after the concrete has been placed, and in all cases until the edge of the pavement no longer requires the protection of the forms.

# Exceeding Requirements
# Grade vs. Thickness Tolerance




Thickness Tolerance
<= ½"

Control vs. acceptance

# Grade vs. Thickness Tolerance

- 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”

# Deficiency Management (Defects)

- Identify
  - 3 levels of defects based on severity and level of effort to correct
- Acknowledgement
- Correct
- Prevent recurrence
- Documentation – Original Form
- Deficiency Logs

# Level One Defects

- Level One – Remedial
  - **adverse to high quality construction practices, environmental and/or biological protection, non-hazardous waste, safety, or other conditions that require remediation. <u>This condition is expected to remain over night.</u>**

**A written reminder**

# Level One Examples

- P 501-4.10 €
  - All slurry and debris produced in the sawing of joints shall be removed by vacuuming and washing.
- P 501-4.17
  - All new and existing pavement carrying construction traffic or equipment shall be kept clean and spillage of concrete and other materials shall be cleaned up immediately.

# Level Two Defects

- Level Two – Corrective Work Needed
  - **This condition is caused by failure to comply with the requirements of the drawings or technical specifications for materials, workmanship, or appearance but may be corrected without removal of the work.**

# Level Two Examples

- P 501-4.8b
  - Curing compound shall be applied to the concrete immediately after the forms have been removed.
- P 501-3.3b
  - If the concrete is to be used for slipforming operations and the air temperature is expected to be lower than 55°F (13°C) the percent GGBF slag cement shall not exceed 30% by weight.

# Level Two Examples

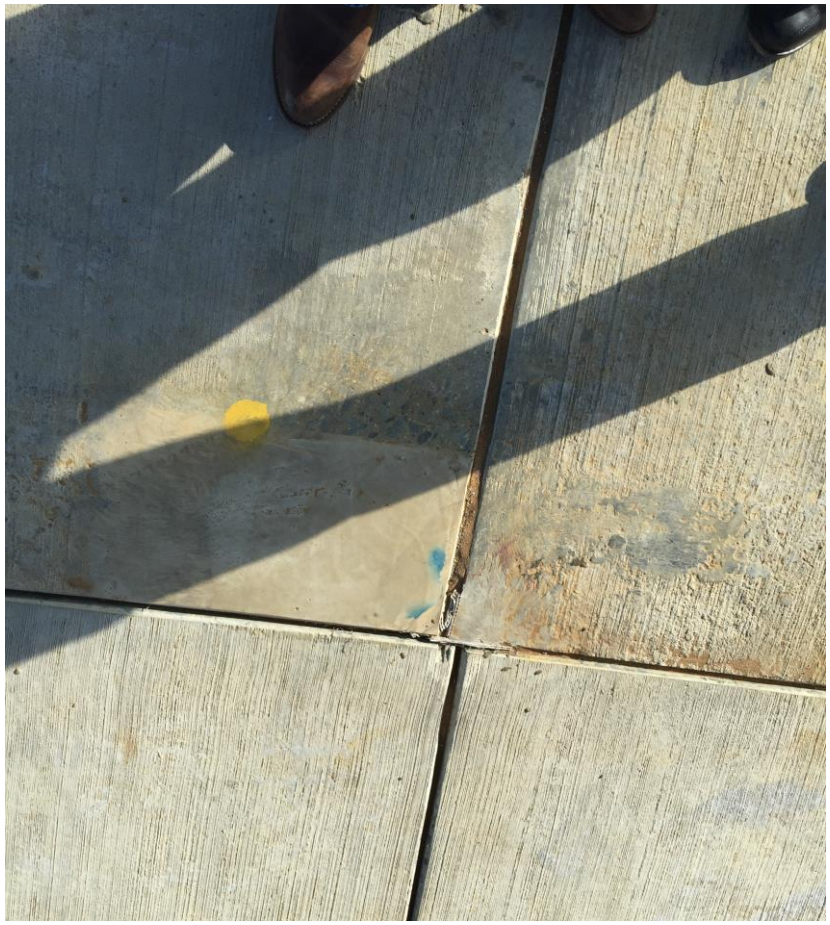
- 501-4.12 Surface Texture
  - Brush, Broom, Turf, or Burlap Texture
    - “providing corrugations that are uniform in appearance and **approximately** 1/16 inch (2 mm) in depth”
- 32 13 11-2.10.5
  - Paver Finisher
    - The paver-finisher shall weigh at least 3280 kg/m 2200 lb/foot of lane width, and shall be powered by an engine having at least 15,000 W/m 6.0 horsepower/foot of lane width.

# Level Three Defects

- Level Three – 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..**

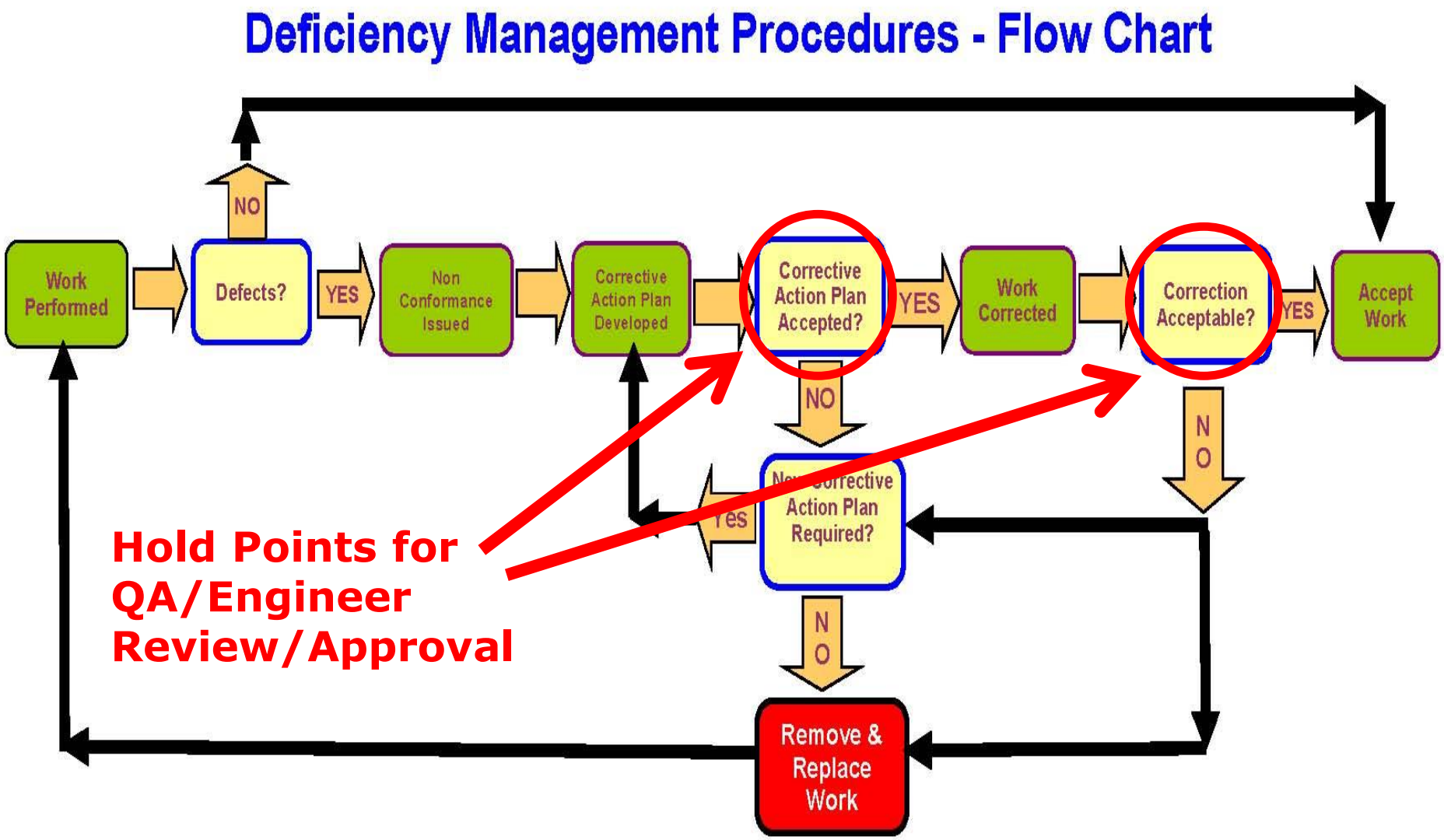
# Where does this fit in?

- 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).



# How about this one?

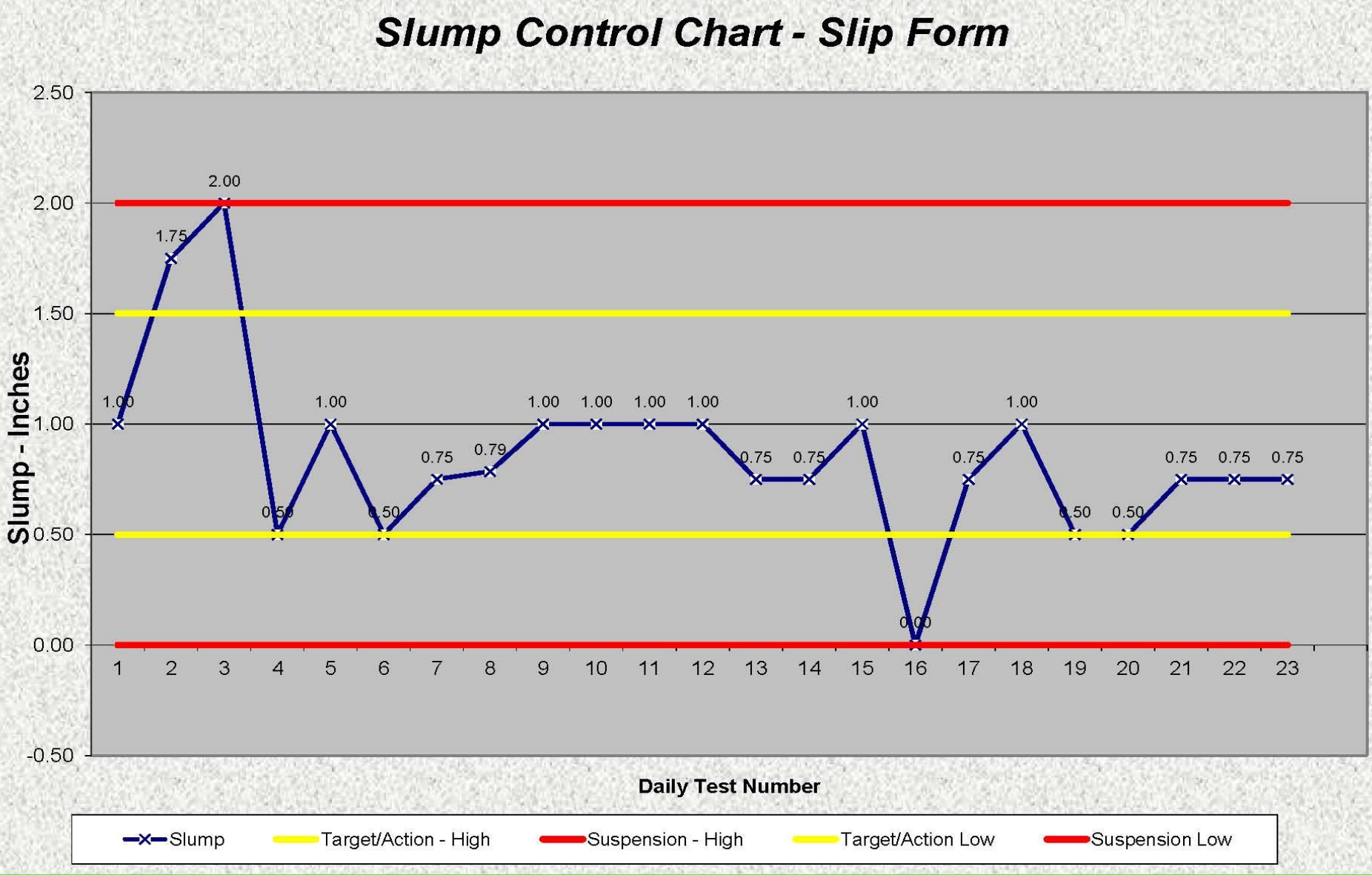
# Deficiency Flow Chart



# Defects QA – QC Coordination

- Who is responsible for identifying defects and at what level (1, 2, & 3)?
- Who is responsible for developing a corrective action plan?
- Who approves the corrective action plan?
- Who approves the corrected work?

# Control Testing



# Mixer Uniformity Testing

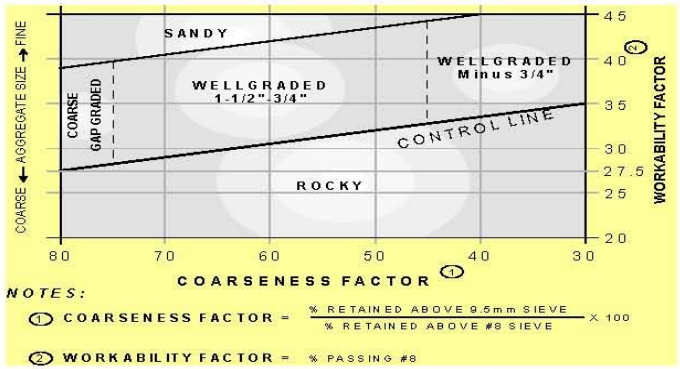
# Combined Aggregate Gradations

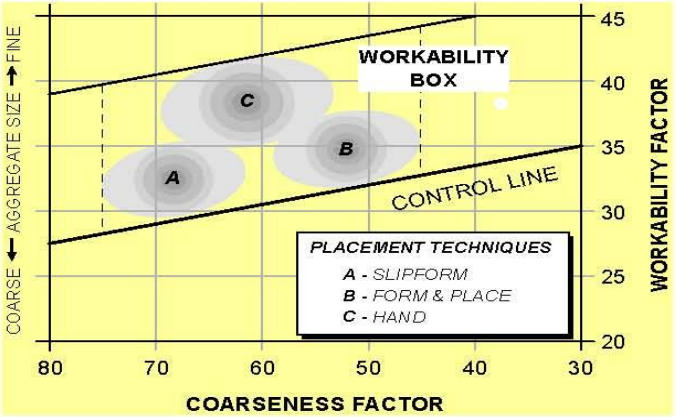
| SIEVE | #57 | # 89 | Sand | Combined | |
|---|---|---|---|---|---|
| | | | | Tot % Passing | % Retained Ea Sieve |
| Blend % | 0.490 | 0.130 | 0.380 | | |
| 2.0" | 100.00 | 100.00 | 100.00 | 100.00 | - |
| 1.5" | 100.00 | 100.00 | 100.00 | 100.00 | - |
| 1.0" | 98.00 | 100.00 | 100.00 | 99.02 | 0.98 |
| 3/4" | 73.00 | 100.00 | 100.00 | 86.77 | 12.25 |
| 1/2" | 36.00 | 95.00 | 100.00 | 67.99 | 18.78 |
| 3/8" | 21.00 | 49.00 | 100.00 | 54.66 | 13.33 |
| # 4 | 2.30 | 8.00 | 99.00 | 39.79 | 14.87 |
| # 8 | 0.90 | 2.00 | 92.00 | 35.66 | 4.13 |
| #16 | 0.80 | 1.00 | 77.00 | 29.78 | 5.88 |
| #30 | 0.70 | 1.00 | 50.00 | 19.47 | 10.31 |
| #50 | 0.60 | 1.00 | 12.00 | 4.98 | 14.49 |
| #100 | 0.50 | 1.00 | 1.50 | 0.95 | 4.04 |
| # 200 | 0.32 | 0.50 | 0.50 | 0.41 | 0.53 |

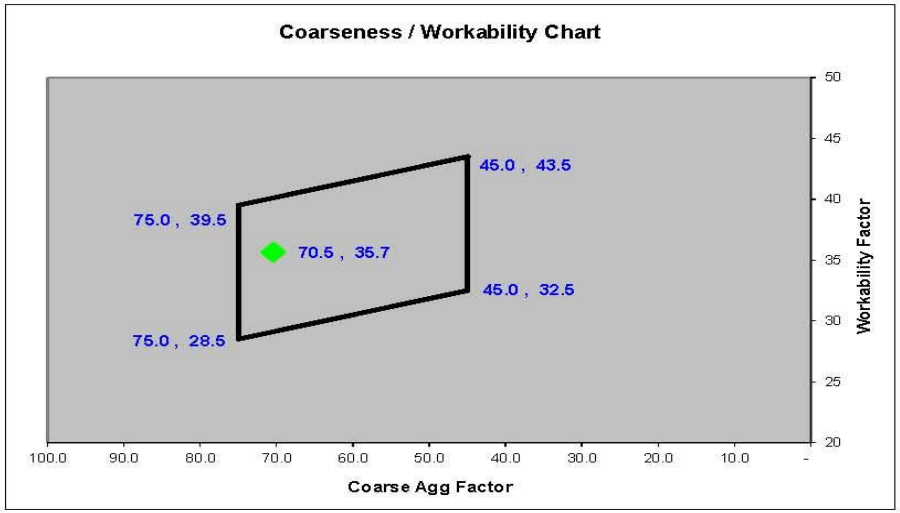
| | | | |
|---|---|---|---|
| Cement Content | 520 | Coarsness Factor | 70.47 |
| Cement Workability | - | Workability Factor | 35.66 |

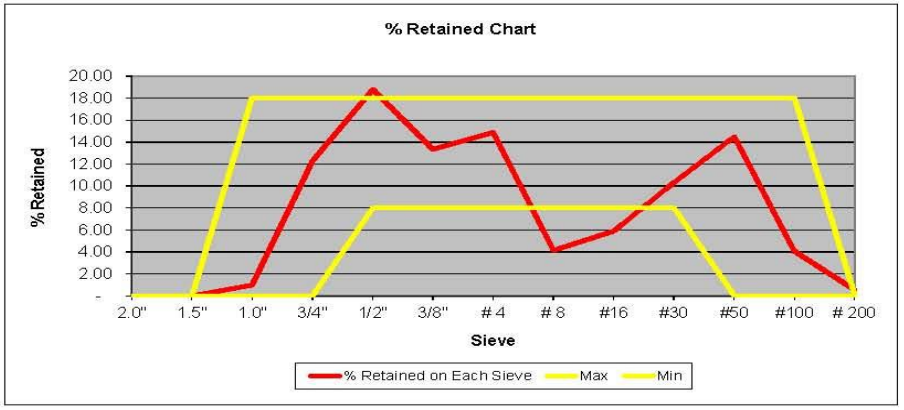
Coarseness/Workability Box Corners

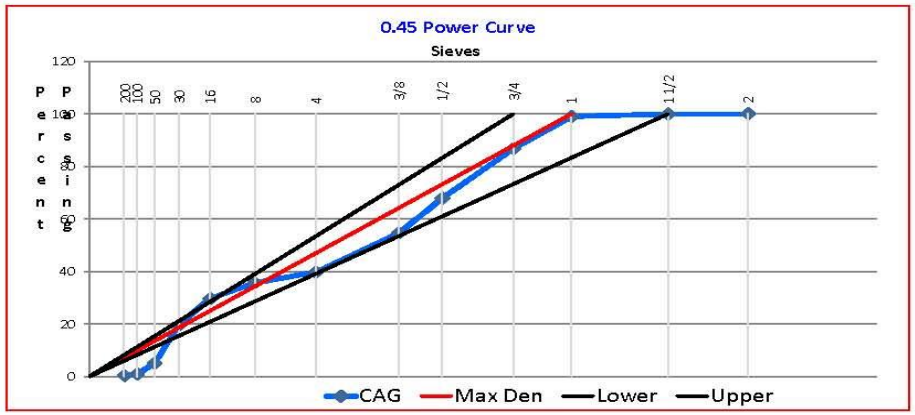
| | | | | | |
|---|---|---|---|---|---|
| CF= | 75.0 | 75.0 | 45.0 | 45.0 | 70.5 |
| WF= | 28.5 | 39.5 | 32.5 | 43.5 | 35.7 |



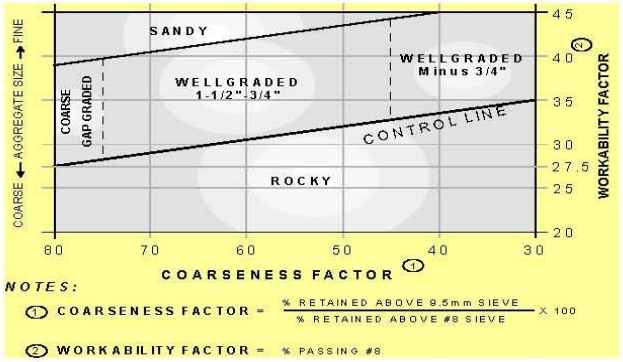
# Combined Aggregate Gradations

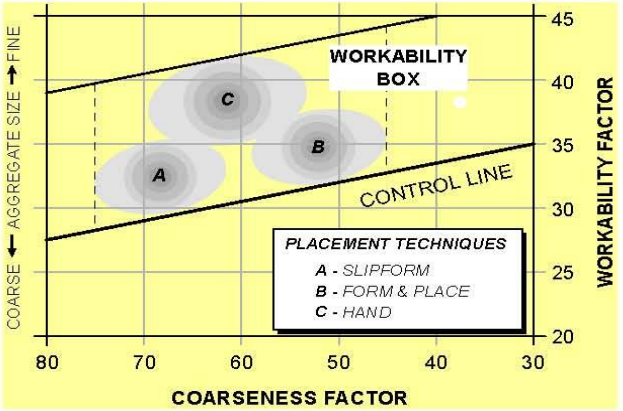
| SIEVE | #467 | # 89 | Sand | Combined | |
|---|---|---|---|---|---|
| | | | | Tot % Passing | % Retained Ea Sieve |
| Blend % | 0.470 | 0.150 | 0.380 | 1.00 | |
| 2.0" | 100.00 | 100.00 | 100.00 | 100.00 | - |
| 1.5" | 98.00 | 100.00 | 100.00 | 99.06 | 0.94 |
| 1.0" | 77.00 | 100.00 | 100.00 | 89.19 | 9.87 |
| 3/4" | 58.00 | 100.00 | 100.00 | 80.26 | 8.93 |
| 1/2" | 31.00 | 100.00 | 100.00 | 67.57 | 12.69 |
| 3/8" | 14.00 | 97.00 | 100.00 | 59.13 | 8.44 |
| # 4 | 4.00 | 43.00 | 96.00 | 44.81 | 14.32 |
| # 8 | 2.00 | 3.00 | 88.00 | 34.83 | 9.98 |
| #16 | 1.00 | 1.00 | 69.00 | 26.84 | 7.99 |
| #30 | 1.00 | 1.00 | 44.00 | 17.34 | 9.50 |
| #50 | 1.00 | 1.00 | 13.00 | 5.56 | 11.78 |
| #100 | 1.00 | 1.00 | 2.00 | 1.38 | 4.18 |
| # 200 | 1.00 | 0.50 | 1.00 | 0.93 | 0.46 |

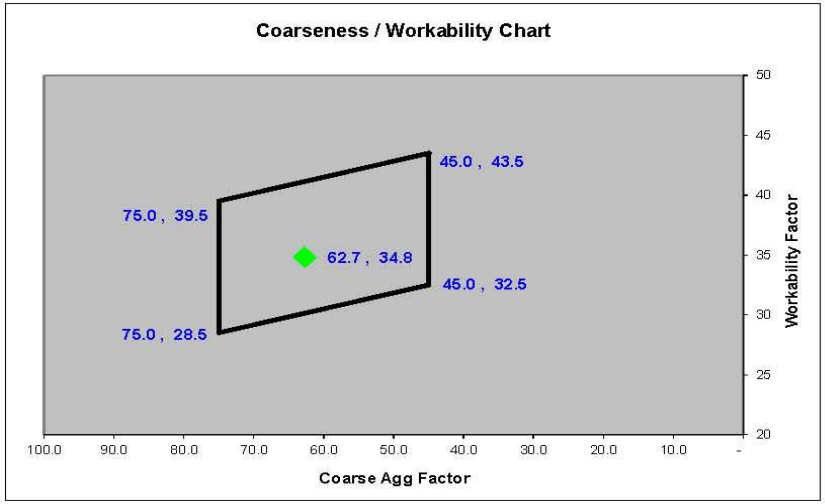
| | | | |
|---|---|---|---|
| Cement Content | 564 | Coarsness Factor | 62.71 |
| Cement Workability | - | Workability Factor | 34.83 |

Coarseness/Workability Box Corners

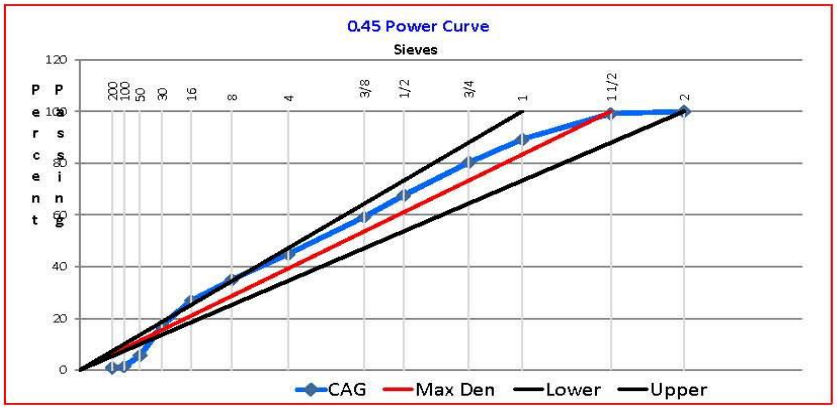
| | | | | | |
|---|---|---|---|---|---|
| CF= | 75.0 | 75.0 | 45.0 | 45.0 | 62.7 |
| WF= | 28.5 | 39.5 | 32.5 | 43.5 | 34.8 |







# "Fill-In" Lane Construction – Joint Quality Concerns

**-Reconsolidate Joint Interface with 1 ½" Diameter Vibrator 2" – 4" Deep**

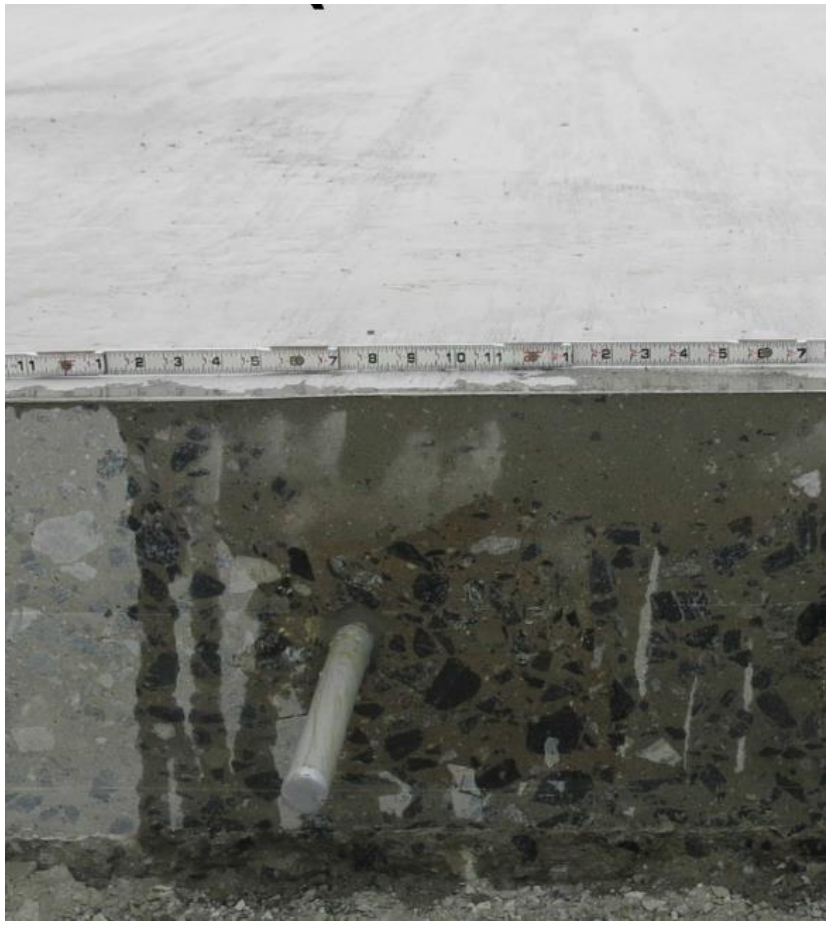
**- Do Not Allow The Surface To Be Finshed Off Without Reconsolidation.**

**- If Joint is Not Reconsolidated, Spalling Will Occur.**

# Side dumping in fill in lanes…

# High mortar content mixture

Results in segregation and mortar rich surface




05/14/2013


05/14/2013

# When it is right, you know it...

## Thank You!

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