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CHAPTER TEN:

QC/QA PCCP

Quality Assurance specifications require that the acceptance of material be the responsibility of INDOT. The specification addresses specifically:

- 1) The units of material quantity used for acceptance.
- 2) The process of obtaining random samples
- 3) What mixture characteristics are considered of critical importance
- 4) At what test values may the mixture be accepted at 100% payment
- 5) At what levels may the mixture serve at less than design intent and still be of value, and be paid at some adjusted price.
- 6) At what level should rejection of the material be considered
- 7) An appeal procedure for resolving disagreements in QC and QA test results

This chapter discusses the procedures and requirements for sampling, testing, and payment of QC/QA Portland Cement Concrete Pavement.

SUBLOTS AND LOTS

Quality Assurance Specifications consider a subplot as typically 2400 yd². A partial subplot of 400 yd² or less is considered as part of the previous subplot and a partial subplot greater than 400 yd² is considered an individual subplot.

A lot typically consists of three sublots or 7200 yd² of concrete for each mix design. If there is one or two sublots in an incomplete lot, then the quantity of material is considered a lot. Therefore, a lot may contain one, two, or three sublots.

If the concrete is placed at several locations on one contract, then the sublots are determined in the order that the material was placed.

RANDOM SAMPLING

Sampling of material for acceptance testing is done by INDOT on a random basis using **ITM 802**. A random target area for plastic concrete within a subplot is determined and the location of the random quantity is established. Cores for thickness are determined by establishing random longitudinal and transverse locations. The random locations are not given to the Contractor so that there is no possible influence on the production operations.

RANDOM NUMBERS

A table of Random Numbers from **ITM 802** (Figure 10-1) is used to determine the random quantity to sample. The numbers occur in this table without aim or reason and are in no particular sequence. Therefore, samples obtained by the use of this table are truly random or chance and eliminate any bias in obtaining samples.

To use this table to determine the random square yard of concrete to sample, one block is selected in the table. After the block is selected the top left number in the block is used as the first random number. This number is the beginning number for the contract. Additional numbers are obtained by proceeding down the column. The top of the next column on the right is used when the bottom of the column is reached. When the bottom of the last column on the right is reached, the top of the column at the left is used. If all numbers in the table are used before the contract is completed, a new starting number is selected and the same procedure is repeated.

To use this table to determine the location of the pavement core, again a block in the table is selected and the top left number is used. This number is used to determine the test site station. The adjacent number within the block is used to determine the transverse distance to the random site. Additional numbers are obtained by proceeding down by pairs until the bottom numbers are reached and proceeding to the adjacent top block to the right, if available. When the bottom pair of numbers on the right are reached, the top block on the left in the table is used.

0.576	0.730	0.430	0.754	0.271	0.870	0.732	0.721	0.998	0.239
0.892	0.948	0.858	0.025	0.935	0.114	0.153	0.508	0.749	0.291
0.669	0.726	0.501	0.402	0.231	0.505	0.009	0.420	0.517	0.858
0.609	0.482	0.809	0.140	0.396	0.025	0.937	0.310	0.253	0.761
0.971	0.824	0.902	0.470	0.997	0.392	0.892	0.957	0.040	0.463
0.053	0.899	0.554	0.627	0.427	0.760	0.470	0.040	0.904	0.993
0.810	0.159	0.225	0.163	0.549	0.405	0.285	0.542	0.231	0.919
0.081	0.277	0.035	0.039	0.860	0.507	0.081	0.538	0.986	0.501
0.982	0.468	0.334	0.921	0.690	0.806	0.879	0.414	0.106	0.031
0.095	0.801	0.576	0.417	0.251	0.884	0.522	0.235	0.389	0.222
0.509	0.025	0.794	0.850	0.917	0.887	0.751	0.608	0.698	0.683
0.371	0.059	0.164	0.838	0.289	0.169	0.569	0.977	0.796	0.996
0.165	0.996	0.356	0.375	0.654	0.979	0.815	0.592	0.348	0.743
0.477	0.535	0.137	0.155	0.767	0.187	0.579	0.787	0.358	0.595
0.788	0.101	0.434	0.638	0.021	0.894	0.324	0.871	0.698	0.539
0.566	0.815	0.622	0.548	0.947	0.169	0.817	0.472	0.864	0.466
0.901	0.342	0.873	0.964	0.942	0.985	0.123	0.086	0.335	0.212
0.470	0.682	0.412	0.064	0.150	0.962	0.925	0.355	0.909	0.019
0.068	0.242	0.777	0.356	0.195	0.313	0.396	0.460	0.740	0.247
0.874	0.420	0.127	0.284	0.448	0.215	0.833	0.652	0.701	0.326
0.897	0.877	0.209	0.862	0.428	0.117	0.100	0.259	0.425	0.284
0.876	0.969	0.109	0.843	0.759	0.239	0.890	0.317	0.428	0.802
0.190	0.696	0.757	0.283	0.777	0.491	0.523	0.665	0.919	0.246
0.341	0.688	0.587	0.908	0.865	0.333	0.928	0.404	0.892	0.696
0.846	0.355	0.831	0.218	0.945	0.364	0.673	0.305	0.195	0.887
0.882	0.227	0.552	0.077	0.454	0.731	0.716	0.265	0.058	0.075
0.464	0.658	0.629	0.269	0.069	0.998	0.917	0.217	0.220	0.659
0.123	0.791	0.503	0.447	0.659	0.463	0.994	0.307	0.631	0.422
0.116	0.120	0.721	0.137	0.263	0.176	0.798	0.879	0.432	0.391
0.836	0.206	0.914	0.574	0.870	0.390	0.104	0.755	0.082	0.939
0.636	0.195	0.614	0.486	0.629	0.663	0.619	0.007	0.296	0.456
0.630	0.673	0.665	0.666	0.399	0.592	0.441	0.649	0.270	0.612
0.804	0.112	0.331	0.606	0.551	0.928	0.830	0.841	0.702	0.183
0.360	0.193	0.181	0.399	0.564	0.772	0.890	0.062	0.919	0.875
0.183	0.651	0.157	0.150	0.800	0.875	0.205	0.446	0.648	0.685

Figure 10-1. Random Numbers

SAMPLE LOCATION -- PLASTIC CONCRETE

The location where the random sample is obtained is calculated using the random target area procedure of **ITM 802** as follows:

- 1) Determine the subplot size from which a random location is required to the nearest 1 yd²
- 2) Divide the area by 100 and round down to the nearest whole number. The resulting number is the number of segments within the area that are available for sampling.
- 3) Divide the area by the number of sample segments to determine the sample segment size to the nearest 1 yd².
- 4) Select a random number
- 5) Multiply the number of sample segments by the random number and round down to the nearest whole number. The resulting number represents the random target area. The sample is taken from material placed within the random target area.
- 6) Divide the sample segment size by the width of the area and round to the nearest 0.1 foot length. The resulting number is the length of the random target area.
- 7) Multiply the random target area by the length of the random target area and round to the nearest whole foot. The resulting number is the distance to the beginning of the random target area as measured from the start of the area to be sampled.

The following examples explain the procedure for obtaining the random target area:

Example No. 1

A PCCP is being placed at a width of 12 ft and the starting station of the subplot is 102+50. The subplot size is 2400 yd².

$$\text{Number of Sample Segments} = \frac{2400}{100} = 24$$

$$\text{Sample Segment Size} = \frac{2400}{24} = 100 \text{ yds}^2$$

$$\text{Random Number} = 0.830$$

$$\begin{aligned} \text{Random Target Area} &= 24 \times 0.830 \\ &= 19.9 \text{ (Round down to 19)} \end{aligned}$$

$$\begin{aligned} \text{Length of Random Target Area} &= \frac{\text{Sample Segment Size (yd}^2\text{)}}{\text{Width (nearest 0.1 ft)}} \times \frac{9 \text{ ft}^2}{1 \text{ yd}^2} \\ &= \frac{100}{12} \times 9 \\ &= 75 \text{ ft} \end{aligned}$$

$$\begin{aligned} \text{Distance to the beginning of the Random Target Area} &= 19 \times 75 \\ &= 1425 \text{ ft} \end{aligned}$$

The sample is obtained at 1425 feet from the beginning station of the subplot (102 + 50).

Example No. 2

A PCCP is being placed at a width of 24 ft and the starting station of the subplot is 165+00. The subplot size is 550 yd².

$$\begin{aligned} \text{Number of Sample Segments} &= \frac{550}{100} = 5.5 \\ &\text{(Round down to 5)} \end{aligned}$$

$$\begin{aligned} \text{Sample Segment Size} &= \frac{550}{5} = 110 \text{ yd}^2 \end{aligned}$$

$$\text{Random Number} = 0.361$$

$$\text{Random Target Area} = 5 \times 0.361 = 1.8 \quad \text{(Round down to 1)}$$

$$\begin{aligned} \text{Length of Random Target Area} &= \frac{\text{Sample Segment Size (yd}^2\text{)}}{\text{Width (nearest 0.1 ft)}} \times \frac{9 \text{ ft}^2}{1 \text{ yd}^2} \\ &= \frac{110}{24} \times 9 = 41.2 \text{ ft} \end{aligned}$$

$$\text{Distance to the beginning of the Random Target Area} = 1 \times 41 = 41 \text{ ft.}$$

The sample is obtained at 41 feet from the beginning station of the subplot (165 + 00).

SAMPLE LOCATION -- CORES

The location where the random core for thickness is obtained using the random location per area procedure of **ITM 802** is as follows:

- 1) Identify the subplot from which a random location is required
- 2) Select a pair of random numbers from the random number table (Figure 10-1). Use the first number for the longitudinal location and the second number for the transverse location.
- 3) Determine the length of the subplot
- 4) Multiply the longitudinal length by the first random number
- 5) Multiply the transverse width by the second random number
- 6) The resulting numbers represent the random location

The station at which a core is taken is determined using the length of pavement required for the subplot of PCCP. The transverse distance is determined using the width of pavement being placed, and is measured from the right edge of the lane determined by looking in the direction of increasing station numbers. Computations for the longitudinal distance and the transverse distance are made to the nearest 1 foot. Cores are not taken at the following locations:

- 1) Less than 6 in. from the edge of pavement
- 2) Less than 2 ft from a D-1 contraction joint
- 3) Less than 3 in. from the longitudinal joint
- 4) Less than 5 ft from a transverse construction joint

If a core location is less than 6 in. from the edge of pavement, a new location is determined by subtracting or adding 6 in. from the random transverse distance. If a core location is over a dowel bar, a new location is determined by subtracting or adding 3 ft from the random station. If a core location is less than 5 ft from a transverse construction joint, a new location is determined by subtracting or adding 5 ft from the random station.

Example:

A PCCP is being placed at a width of 12 feet and the starting station of the subplot is 75+00. The subplot size is 2400 yd².

$$\begin{aligned} \text{Length of Sublot} &= \frac{\text{Sublot Size(yd}^2\text{)}}{\text{Width (nearest 1 ft)}} \times \frac{9 \text{ ft}^2}{1 \text{ yd}^2} \\ &= \frac{2400}{12} \times 9 = 1800 \text{ ft} \end{aligned}$$

Random Numbers = 0.935, 0.114

Longitudinal Distance = 1800 x 0.935 = 1683 ft

Random Station = (75+00) + (16+83) = 91+83

Transverse Distance = 12 x 0.114 = 1.4 ft (say 1 ft)

SAMPLING PROCEDURE

The Contractor is required to provide the concrete and necessary labor for obtaining a representative sample. Sampling for acceptance is done by INDOT in accordance with **AASHTO T 141**.

TRIAL BATCH DEMONSTRATION

A trial batch demonstration (TBD) is required for each proposed concrete mix design. The purpose of the TBD is much more than validating the required concrete properties to be within the specification requirements for the concrete mixture. The TBD also provides an opportunity for the Contractor Technician and the INDOT Qualified Technician to verify proper equipment calibration and testing procedures prior to any concrete placement in the pavement. The Contractor and the PE/PS are required to both be assured that QC testing accurately represents the concrete for any process control decision and acceptance testing assesses the proper price adjustment points, if any. Failure to accomplish this at the TBD may result in an inaccurate assessment of price adjustments or erroneous failed material investigations.

The results from a successful TBD provide the Contractor with baseline properties from which to plan process control of the concrete mixture. Future changes in properties of aggregates, pozzolans, cements, and admixtures may also be compared to the results at the time of the TBD so effects on concrete properties the day of placement may be anticipated.

The TBD also provides an opportunity for the Contractor and Engineer to witness the process upstream from the plant (i.e. material receipt, storage, and handling), through batching and actual concrete production. The complete process is inspected to provide insight as to any potential process control problems prior to job placement. A properly conducted TBD may work to resolve many problems which would otherwise become evident on the day of the pavement construction.

The trial batch is required to be of sufficient quantity to allow the Contractor and INDOT to conduct all the required tests from the same batch. The concrete is not to be used for more than one test, except the concrete used for the unit weight may be used to conduct the air content test.

The target unit weight and water/cementitious ratio of the concrete is determined by the trial batch. The flexural strength is determined by averaging a minimum of two beam breaks. All test results are given to the Contractor.

The TBD test results are required to be added to the CMD. Results of the TBD from a previous contract may be submitted instead of conducting the trial batch.

ACCEPTANCE TESTING

The Contractor is required to submit a mix design and provide verification of the design by the Trial Batch Demonstration. The concrete properties are required to meet the concrete parameters of the Specifications prior to placement.

Acceptance testing results are shared with the Contractor. The flexural strength, air content, unit weight, and water/cementitious ratio, are measured for acceptance. The frequency, test method, and precision of test results are as follows:

Test or Determination	Frequency	Test Method	Precision
7-Day Flexural Strength	Two beams per subplot	AASHTO T 97	10 kPa (1 psi)
Air Content	One per subplot	AASHTO T 152 or ASTM C 173	0.1
Unit Weight	One per subplot	AASHTO T 121	1
Water/Cementitious Ratio	Once per week	ITM 403	0.001
Thickness	Two per subplot	ITM 404	0.1

FLEXURAL STRENGTH

The average of the subplot values for flexural strength are required to be a minimum of 570 psi. Price adjustments for values below 570 psi are required.

AIR CONTENT

The average lot air content is required to not vary more than - 0.8 % or + 2.4 % from the 6.5 % target air content. Also, the range of values is required to not exceed 2.5 %. Range is defined as the difference between the highest subplot air content and the lowest air content subplot within a lot. Price adjustments are required for exceeding the tolerances for air content and the range of air content.

UNIT WEIGHT

The subplot unit weight is required to not vary more than $\pm 3.0\%$ from the target unit weight. A stop paving order is issued if the plastic unit weight exceeds the $\pm 3.0\%$ tolerance. Paving operations are not allowed to resume until satisfactory changes are made or an alternate CMD is used.

WATER/CEMENTITIOUS RATIO

The water/cementitious ratio is required to not vary by more than ± 0.030 from the target value or exceed a value of 0.450. A stop paving order is issued if the test results exceed these values. Paving operations are not allowed to resume until satisfactory changes are made or an alternate CMD is used.

THICKNESS

The PCCP thickness is required to be determined after all corrective grinding of the pavement, if necessary, is completed. The Contractor is required to obtain two 4 in. diameter cores for each subplot. The cores are taken the full depth of the PCCP at the locations determined by the PE/PS in accordance with **ITM 802**; however, cores are not taken within 2 ft of the edge of pavement, within 3 in. of the longitudinal joints, within 2 ft of D-1 contraction joints, or within 5 ft of a transverse construction joint. The cores are taken and measured in accordance with **ITM 404**.

The thickness of the PCCP for each subplot is the average lengths of both cores from the subplot. The subplot pay factor is determined by subtracting the design thickness from the average subplot thickness and comparing this value to the allowable tolerances. Values exceeding ± 0.2 inches are required to have a price adjustment.

SMOOTHNESS

The PCCP smoothness is required to be determined by means of a profilograph, 16 feet long straightedge, or 10 feet long straightedge as follows:

The profilograph is required for all full-width pavements of 250 ft or longer, unless otherwise specified.

The 16 ft straightedge is required for the following locations, unless specified:

- 1) All full-width pavement lanes shorter than 250 ft
- 2) On tapers
- 3) Within 50 ft of bridge ends
- 4) Within 50 ft of an existing pavement which is being joined
- 5) On ramps
- 6) On full-width pavement lanes having design speeds of 45 mph or less

The 10 ft straightedge is required for transverse slopes, approaches, and crossovers.

When the pavement smoothness is tested with a profilograph, payment is based on the final profile index after corrective action, if necessary.

PAY FACTORS

Pay factors are determined for flexural strength, air content, air content range, thickness, and smoothness. When the PCCP test results for these material properties exceed the allowable tolerances, pay factors are determined.

FLEXURAL STRENGTH

When test results for flexural strength exceed the allowable tolerance, a pay factor is assessed as follows:

Lot Average Flexural Strength	
psi	Pay Factors
570 and above	1.00
565 - 569	0.98
560 - 564	0.96
555 - 559	0.94
550 - 554	0.92
545 - 549	0.89
540 - 544	0.86
535 - 539	0.83
525 - 534	0.78
515 - 524	0.72
514 or less	*

*The PCCP is adjudicated as a failed material in accordance with normal INDOT practice as listed in Section **105.03**. The PCCP may be subject to removal and replacement or left in place with reduced or no payment.

AIR CONTENT

The lot average air content is assigned pay factors in accordance with the following:

Lot Average Air Content	
Percent %	Pay Factors
> 9.9	*
9.7 - 9.8	0.80
9.5 - 9.6	0.90
9.3 - 9.4	0.95
9.0 - 9.2	0.99
5.7 - 8.9	1.00
5.6	0.93
5.5	0.90
5.4	0.85
5.3	0.79
< 5.3	*

*The PCCP is adjudicated as a failed material in accordance with normal INDOT practice as listed in Section **105.03**. The PCCP may be subject to removal and replacement or left in place with reduced or no payment.

AIR CONTENT RANGE

The lot air content range is assigned pay factors in accordance with the following::

Lot Range for Air Content	
Percent %	Pay Factors
0.0 - 2.5	1.00
2.6 - 3.0	0.99
3.1 - 3.5	0.97
> 3.5	*

*The PCCP is adjudicated as a failed material in accordance with normal INDOT practice as listed in Section **105.03**. The PCCP may be subject to removal and replacement or left in place with reduced or no payment.

THICKNESS

The subplot core thickness is assigned a pay factor in accordance with the following:

Sublot Pay Factors For Thickness	
Average Core Depth (ACD) Design Depth (DD)	
ACD Minus DD	Pay Factor
> +0.5 in. (> +13 mm)	1.05
+ 0.3 in. to +0.5 in. (+ 7 mm to +13 mm)	1.02
0.2 in.(± 6 mm)	1.00
- 0.3 in. to - 0.5 in. (- 7 mm to - 13 mm)	0.96
- 0.6 in. to - 0.7 in. (- 14 mm to - 19 mm)	0.90
- 0.8 in. to - 1.0 in. (- 20 mm to - 25 mm)	0.80
< - 1.00 in. (< - 25 mm)	*

SMOOTHNESS

When pavement smoothness is tested with a profilograph, pay factors are determined for each 0.1 mile long sections represented by the profile index. The pay factors are calculated in accordance with the following table:

Section Pay Factors for Smoothness Zero Blanking Band	
Design Speed Greater Than 45mph	
Profile Index in./0.1 mi.	Pay Factor
Over 0.00 to 1.40 in.	1.06
Over 1.40 to 1.60 in.	1.05
Over 1.60 to 1.80 in.	1.04
Over 1.80 to 2.00 in.	1.03
Over 2.00 to 2.40 in.	1.02
Over 2.40 to 2.80 in.	1.01
Over 2.80 to 3.60 in.	1.00
Over 3.60 to 3.80 in.	0.96
All pavements with a Profile Index (PI _{0.0}) greater than 3.80 in. shall be corrected to 3.80 in.	

QUALITY ASSURANCE ADJUSTMENT

The pay factors are used to calculate a quality assurance adjustment quantity for the lot. The adjustment for flexural strength, air content, air content range, thickness and smoothness are calculated as follows:

FLEXURAL STRENGTH, AIR CONTENT, AIR CONTENT RANGE

For flexural strength, air content, and air content range determination:

$$q = L \times U \times (P - 1.00)$$

where:

q = quality assurance adjustment quantity

L = lot quantity

U = unit price for QC/QA-PCCP, (\$/yd²)

P = pay factor

THICKNESS

For subplot thickness determination:

$$q_T = I_T \times U \times (P - 1.00)$$

where:

q_T = quality assurance adjustment quantity

I_T = subplot quantity for thickness

U = unit price for QC/QA-PCCP, (\$/yd²)

P = pay factor

SMOOTHNESS

For section smoothness determination:

$$q_s = (PF_s - 1.00) \times A \times U$$

where:

q_s = quality assurance adjustment for smoothness for one section

PF_s = pay factor for smoothness

A = area of the section, (SYS)

U = unit price for the material, (\$/SYS)

The quality assurance adjustment for smoothness for the contract, Q_s , will be the total of the quality assurance adjustments for smoothness, q_s , on each section as follows:

$$Q_s = \sum q_s$$

TOTAL QUALITY ASSURANCE ADJUSTMENT

The total quality assurance adjustments are calculated as follows:

$$Q_T = \sum (q_{T1} + q_{T2} + q_{T3}), \text{ and}$$

$$Q = \sum (q_F + q_A + q_R + Q_T) + Q_s$$

where:

Q = total quality assurance adjustment quantity

Q_s = quality assurance adjustment for smoothness

q_F = lot quality assurance adjustments for flexural strength

Q_T = lot quality assurance adjustments for thickness

q_A = lot quality assurance adjustments for air content

q_R = lot quality assurance adjustments for range

Example:

The PCCP has the following test results. Determine the Quality Assurance Adjustments for the lot.

$$\text{Sublot 1} = 2400 \text{ yd}^2$$

$$\text{Sublot 2} = 2400 \text{ yd}^2$$

$$\text{Sublot 3} = 2400 \text{ yd}^2$$

$$\text{Design Depth (DD)} = 14.0 \text{ in.}$$

$$\text{Quality Assurance Adjustment for Smoothness (Qs)} = - \$1200$$

$$\text{Unit Price} = \$32.00 \text{ sys}$$

	<u>Sublot 1</u>	<u>Sublot 2</u>	<u>Sublot 3</u>	<u>Lot Avg.</u>	<u>Pay Factor</u>
Flexural Strength	565 psi	560 psi	570 psi	565 psi	0.98
Air Content	6.2%	7.4%	5.3%	6.3%	1.00
Air Content Range		7.4 - 5.3 = 2.1%			1.00

$$q_F = 7200 \times 32.00 \times (0.98 - 1.00) \\ = - \$4608$$

$$q_A = 7200 \times 32.00 \times (1.00 - 1.00) \\ = \$0$$

$$q_R = 7200 \times 32.00 \times (1.00 - 1.00) \\ = \$0$$

Thickness

	<u>Sublot 1</u>	<u>Sublot 2</u>	<u>Sublot 3</u>
Sublot Average	14.1 in.	13.9 in.	14.4 in.
Deviation from DD	+0.1 in.	-0.1 in.	+0.4 in.
Pay Factor	100	1.00	1.02
Adjustment Quantity	0	0	+1536

$$Q_T = 0 + 0 + 1536 = \$1536$$

Total Quality Assurance Adjustment

$$Q = \sum (q_F + q_A + q_R + Q_T) + Q_S \\ = (-4608 + 0 + 0 + 1536) + (-1200) \\ = - \$4272$$

FAILED MATERIALS

Sublot and lot values that are excessively out of tolerance are required to be submitted to INDOT for final payment. The test value criteria that requires such submittal include:

1. An individual sublot having an air content test value of less than 4.5 percent or more than 10.0 percent
2. An individual sublot having a flexural strength test value less than 500 psi
3. A lot having a flexural strength test value average of 514 psi or less
4. A lot having an air content test value average of less than 4.5% or greater than 10.0%
5. A range of air content of greater than 3.5%
6. A core thickness that is less than the design depth required pavement thickness by more than 1.00 in.

As a minimum, the Failed Materials Committee considers the above-noted items for no additional payment adjustment, an increased payment adjustment to offset potential maintenance costs, additional payment to cover the cost of the investigation, no payment, or removal and replacement

APPEALS

If the Contractor does not agree with the acceptance test results for a lot of QC/QA pavement concrete, an appeal may be submitted. The appeal is required to meet the following criteria:

1. Appeals are submitted in writing to the PE/PS within five calendar days of receipt of INDOT's written results for the lot.
2. The submission is required to contain quality control test data that equals or exceeds the number of tests required.
3. The difference between the acceptance test result and the nearest quality control test result is required to be at least 50 psi for flexural strength.
4. The difference between the acceptance test result and the nearest quality control test result is required to be at least 0.5 percent for air content.

Cores are obtained by the Contractor at locations determined by the PE/PS within the appealed subplot. The location of the cores is at the center of a lane at the acceptance sample location. Cores are not taken over dowels or within 5 ft of a header. Each core is required to be 4 in. in diameter for the full depth of the pavement. All core holes are filled by the Contractor with PCC within 24 hours of drilling.

FLEXURAL STRENGTH APPEAL FOR SUBLLOT

For a flexural strength appeal, two cores are taken within the appealed and adjacent sublots using the same CMD.

Each core is tested for split tensile strength in accordance with **ASTM C 496**. The cores are submerged in lime saturated water prior to testing for a minimum of 40 hours.

The average core split tensile strength is determined for the appealed and adjacent sublots. Flexural strength is calculated as follows.

$$F_D = S_D \times \left[\frac{F_{A1}}{2S_{A1}} + \frac{F_{A2}}{2S_{A2}} \right]$$

where:

F_D = flexural strength of the appealed subplot

F_{A1} = flexural strength of the previous adjacent subplot

F_{A2} = flexural strength of the subsequent adjacent subplot

S_D = split tensile strength of the appealed subplot

S_{A1} = split tensile strength of the previous adjacent subplot

S_{A2} = split tensile strength of the subsequent adjacent subplot

AIR CONTENT APPEAL FOR SUBLLOT

For an air content appeal, one core is taken from each subplot. The hardened concrete air content is determined in accordance with **ITM 401** and converted to a value representing the air content in the plastic state.

The core value is considered as the air content for the subplot in question. This value is used to determine all subsequent actions involving the subplot and lot.