8.36.1 GENERAL

This section addresses the standard specification for Quality Management Program (QMP), Asphaltic Mixture.

The QMP for Hot Mix Asphalt (HMA) is detailed in standard spec 460.2.8. The following information is provided as additional reference, interpretation, and guidance for procedures outlined in those specifications.

Overview - WisDOT QMP Requirements:

- Personnel and required certifications.
- Laboratory facilities.
- Random sampling and sampling frequency.
- Required testing (and calculated properties).
    - Mixture bulk specific gravity (G_{mb}).
    - Mixture maximum specific gravity (G_{mm}).
    - Air voids (V_a).
    - VMA (voids in mineral aggregate).
    - Aggregate gradation.
    - Percent binder content.
- Documentation.
    - Records.
    - Control charts.
- Control limits.
- Warning bands.
- Job mix formula adjustments.
- Corrective action.
- Optional contractor assurance.
- Verification program.

The following sections identify and further attempt to explain those procedures used during field production of HMA under the QMP.

8.36.1.1 Definitions

Rule of Retained: Split samples for comparison testing are retained. In order to test a retained portion of any sample, communications must occur between the department and contractor QMP teams. The department has ownership of QMP required split samples. There is implied joint ownership between contractor and department on any additional QC samples taken.

Limiting Liability: Additional assurance testing can be performed to validate contractor production data. Identifies conforming material for consideration during the dispute resolution process in determining any need for price adjustments (does not exclude price reductions within contractor QMP).

Mixture production days: Days of production of a specific design mixture being tested under QMP. No more than two working days is intended for getting test results.

Working days: Calendar day, except Saturdays, Sundays, and department-specified holidays.

Non-Conforming materials: Mixture not meeting acceptable verification parameters, but allowed to be left in place with appropriate payment reduction.

Unacceptable materials: Mixture not meeting acceptable verification parameters and being required to be removed and replaced.

Teams: Personnel listed on QMP organizational charts.

8.36.2 PERSONNEL REQUIREMENTS (THROUGH HTCP)

The following list summarizes minimum personnel requirements and associated certifications to satisfy QMP Asphalt activities.

1. QC: Production process.

- Sampling and testing: HMATech at a level recognized for mixture production testing (formerly known as HMATech 1).
- Production process changes: HMATech at a level recognized for production process control and troubleshooting (formerly known as HMATech 2).
- Mix design: at a level recognized for doing mix design work (formerly known as HMATech 3).

2. CA: Production assurance.
   - Sampling and testing: HMATech at a level recognized for mixture production testing (formerly known as HMATech 1).
   - In the event other properties are being evaluated, have an appropriate certification.
3. QV: Department quality verification.
   - Sampling and testing: at a level recognized for mixture production testing (formerly known as HMATech 1).
   - Production process change review: at a level recognized for doing mix design work (formerly known as HMATech 3).

8.36.3 LABORATORY REQUIREMENTS

The laboratory must be:

- Furnished with equipment to comply with specification requirements (calibrated testing equipment, phones, faxes, copy machines, etc.).
- Located at the plant site and operational before production.
- A Wisconsin Laboratory Qualification Program participant (for acceptance sampling and testing).

Any laboratory producing air void test data to comply with QMP requirements must have a Superpave Gyratory Compactor (SGC). The intent is for the G_{mm} and G_{mb} materials to be tested at the same facility.

8.36.3.1 CA Laboratory

A separate set of equipment must be used (inclusive of SGC) to compare QC split samples.

8.36.4 SAMPLING HOT MIX ASPHALT

At the beginning of each day the contractor specifies the anticipated tonnage to be produced. The frequency of sampling (minimum number of required tests for the day) is then determined from the latest (QMP) HMA mixture specification. The anticipated daily tonnage is divided into equal increments and a sample is obtained randomly from each increment.

Example 1

Expected production is 1,900 tons per day. The number of samples per day = 3 (per QMP specification).
Increment tonnage = 633 (days production divided by required samples).
Sample 1 – from 50 to 633 tons.
Sample 2 – from 634 to 1267 tons.
Sample 3 – from 1268 to 1900 tons.

The approximate location of each sample within the increments is determined by selecting random numbers using ASTM Method D-3665 or by using a calculator that has a random number generator. The random numbers selected are used in determining when a sample is to be taken and will be multiplied by the tonnage increments defined for the day. This number will then be added to the final tonnage of the previous increment to yield the approximate total tonnage of when the sample is to be taken.

To allow for plant start-up variability, the procedure calls for the first random sample to be taken at 50 tons or greater per production day (not intended to be taken in the first two truck loads). Random samples calculated for 0-50 ton should be taken in the next truck (51-75 ton).

Example 2

Required Sample	Sample Tonnage Range	Random No. ASTM D-3665	Increment Sample Ton (Random No. x Increment ton)	Previous. Increment tons.	Cumulative Sample Tonnage
1	50 - 633	0.572	362	0	362
2	634 - 1267	0.353	223	633	856
3	1268 - 1900	0.656	415	1267	1682

This procedure is to be used for any number of samples per day.

In the event that actual daily production exceeds projected daily tonnage, the original increment will remain the same and additional samples will be randomly taken from each ensuing increment.

If production doesn't allow obtaining the next randomly generated sample, then a non-random, arbitrary sample will be taken to fulfill the increment testing requirement whenever practical (document reasons for any non-compliance).

It's intended that the plant operator not be advised ahead of time when samples are to be taken. If the plant operator is involved in recording a Pb (%AC) to match up with the mix sample tonnage, then notification need not be earlier than 60 minutes before the mix sample being taken.

If belt samples are used during troubleshooting, the blended aggregate will be obtained when the mixture production tonnage approximates the sample tonnage. For plants with storage silos, this could be up to 60 minutes in advance of the mixture sample that's taken when the required tonnage is shipped from the plant.

QC Sample:

- Sample size only requires one "test" portion and one "retained" portion.

CA Sample:

- Must be a companion/split sample with QC (for direct data comparison).
- If an arbitrary CA sample is taken, the QC team must test the companion split in order to be considered for limiting liability.

QV Sample:

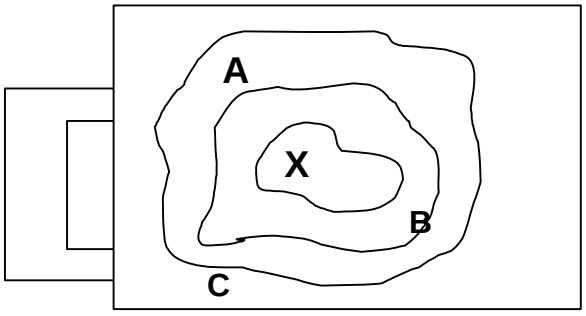
- Must be directly observed by the engineer.
- Engineer takes immediate possession.
- The initial split of QV and QV-retained, can be performed by using a quartermaster. If the contractor performs this split, the engineer, before taking possession, must directly observe it.

8.36.4.1 Sampling from the Truck Box

Sampling will be the contractor's responsibility. Truck box sampling presents some safety hazards because it is necessary to climb atop the truck box and stand on the hot mixture while sampling. Special care should be exercised by the contractor or his designated representative as the sample is procured to prevent falls or burns.

The shovel or other sampling device should be of such size and configuration that each increment of a sample can be obtained in one attempt without spilling or roll off. To satisfy this requirement with a flat bottom shovel, it is necessary to attach 2- to 4-inch vertical sides to the shovel.

8.36.4.2 Sample Location in Truck



The total sample for a 1/2" mix will weigh at least 70 lbs.

X = high reference point

A = sample point

B = sample point

C = sample point

When the last batch has been dumped into the truck box, the sampler must establish a reference point on the surface of the load, either at the high point, if a conical shape exists, or near the middle of the truck box if the

surface shows no such conical shape. Then at least three incremental sample points should be established about midway between the previously established point and the sides if the truck and equally spaced around the load as seen below in Figure 1. The sampling shovel or other approved device can be inserted into the upper two to three inches of mixture to extract the sample increments.

Figure 1: Truck Box Sampling

8.36.4.2.1 QC Sample Sizes:

- Minimum sample sizes are referenced below and are guidance for meeting requirements for test completion.

Mixture NMAS	Sample Size
≤ 12.5mm (1/2")	70 lb
19.0mm - 25.0mm (3/4" – 1")	100 lb
≥ 37.5mm (1-1/2")	160 lb

- The total sample for larger NMAS (nominal maximum aggregate size) mixtures will be enough to provide the required minimum testing sample size as defined in Figure 3.
- The "retained" split must be half of the QC sample.

8.36.4.2.2 CA Sample Sizes:

Test sample size may vary based on the tests chosen, but still needs to be large enough to accommodate a split for parallel testing and data comparison.

8.36.4.2.3 QV Sample Sizes:

Use same guidance as QC sample size (trouble shooting may involve need for a gradation).

8.36.5 SAMPLE IDENTIFICATION

The contractor is responsible for obtaining and splitting samples. When the sample is an aggregate sample it must be split, placed in bags with plastic liners, and labeled as directed below.

When a mixture sample is procured, it must be quartered, place in a bag, and labeled as directed below. Figure 2 provides an example label. The label must include the following items.

1. Contractor
2. QC, QC-ret, QV, QV-ret
3. State project ID
4. Date
5. Sample number
6. Type of asphaltic mixture
7. State mix design ID (250-XXXX-YR)
8. Percent binder
9. Daily tonnage sampled
10. Current G_{sb}

ABC Paving, Inc
QC
Prj. ID : 115201-70
7 / 15 / 01 sple 8-2
E – 3 12.5 mm
250-0125-2001
5.5% AC
current G_{sb}: 2.722
1,206 ton (day's)

Figure 2: Example of Sample Labeling

NOTE: The cumulative/total tons representing mix design production are to be recorded on the QC data sheets.

8.36.5.1 Reduction of HMA Samples to Testing Size

For QC sample reduction the HMA sample in the containers is mixed and quartered. The quartering process should then proceed as follows:

8.36.5.1.1 Step 1:

1. Quarter the sample into “Test” and “Retained” samples. Place entire sample on table, quickly re-mix and quarter to minimize temperature loss. Quarter the Test & Retained samples as shown on Figure 3. For 1/2" mixes start with at least a total of 70 lbs of HMA.

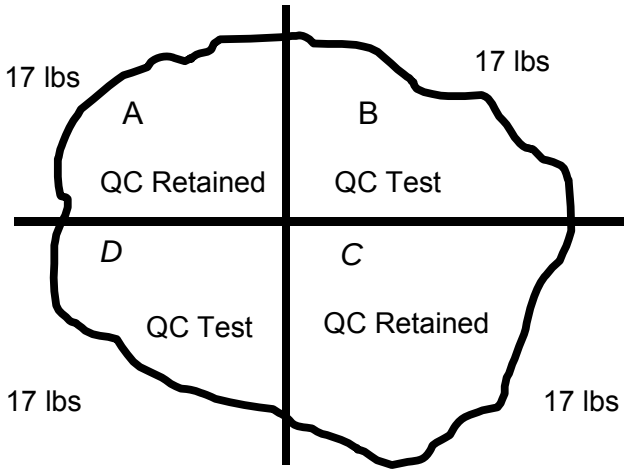


Figure 3: Superpave Sample, 70 lbs

2. Diagonal quarters, as indicated on the sketch, must be combined to form the retained sample (A + C) and the test sample (B + D). The retained sample must be bagged, labeled, and stored in a safe dry place. The retained samples may be tested using the “rule of retained” (see “Definitions” section).
3. The test sample (B + D) is then further quartered for the specified tests. Continue the quartering process in Step 2 for the test materials until individual samples are in the oven.

8.36.5.1.2 Step 2:

The 35 lbs of HMA material for testing from Step 1 is to be further reduced for testing according to the following sketch (see Figure 4).

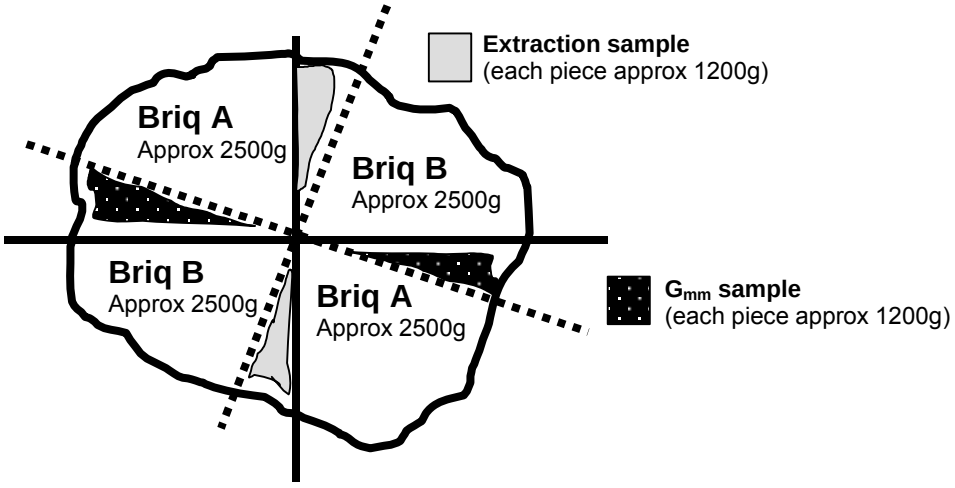


Figure 4: Superpave Sample, (35 lbs)

Gmm (RICE) Sample Size – T209	
37.5 mm	4000 grams
25.0 mm	3000 grams
19.0 mm	2000 grams
12.5 mm	1500 grams
9.5 mm	1000 grams
4.75 mm	1000 grams

DOT 1560 Extraction Sample Size –T164	
37.5 mm	4500 grams
25.0 mm	2500 grams
19.0 mm	2000 grams
12.5 mm	1500 grams
9.5 mm	1000 grams
4.75 mm	1000 grams

Figure 5: Minimum Testing Sample Sizes

For QV (and some CA) samples a Solvent Extraction Gradation (WisDOT Test Method1560) isn't routinely required.

8.36.5.2 Use of Alternative Quartering Devices (Quartermaster)

Use of other devices to assist in the quartering procedures may be used with approval of the department. The Quartermaster is one such device. A picture of a Quartermaster device is shown in Figure 6.

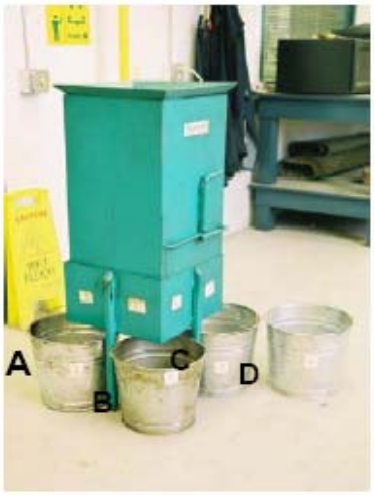


Figure 6: Quartermaster Quartering Device

Example 3

1. Dump initial truckbox samples into the machine, noting the chute capacity limit.
2. Throw lever to allow material to flow into the four quartering buckets. Repeat until all material has been quartered.
3. Combine diagonally opposite buckets to form the test sample (A + C) and the retained sample (B + D) making sure to distribute any clinging fines into each bucket.
4. From this point, remove the QC test material to a heated splitting table for further reduction to testing portions. Bag the retained sample, label, and store appropriately.
5. Clean sides and quartering slats before next use.

8.36.6 REQUIRED TESTING AND CALCULATED PROPERTIES

8.36.6.1 QC Tests

QC testing must be completed, and data posted, on the day the sample was taken.

8.36.6.2 CA Tests

CA tests, by definition in the standard specifications, are at the contractor's option.

It should be noted that CA testing not completed before department QV samples are taken might not impact recommendations made during dispute resolution unless other communications have occurred between QC/QV teams.

The contract language mentions "two working days after the sample has been obtained by the contractor" as the

time within which the CA personnel must respond with data to the QC team. The intent is to provide information and feedback to the QC team as soon as practical in case there is data disagreement. The interpretation is to mean that the time starts when the QC team procures the sample (ex: a QC/QC-ret sample obtained on day 4 and intended to be tested, would need to be selected by CA on day 4, 5 or 6, with results reported no later than day 6).

If assurance testing is being performed by the department, as part of determining, standard spec 460.2.8.3.1.6, Acceptable Verification Parameters; paragraph 3, air voids and VMA will both be determined unless otherwise mutually agreed on by the contractor and the engineer. Department assurance personnel will make every effort to pick-up the sample on the day the QC personnel procures the test sample.

If the QC-retained mixture sample temperature is 230F or higher when delivered to the testing facility, quartering may start immediately. If the temperature is below 230F, place in a 300F oven, until workable for quartering, not to exceed two hours.

If the difference between the QC and CA test results are outside the allowable differences, the reason must be investigated immediately.

8.36.6.3 CA Data Analysis

CA test results are evaluated according to the flow chart Evaluation of CA Test Results, located at the end of this procedure.

8.36.6.4 QV Tests

The following tests are to be performed in determining product Quality Verification:

- Bulk specific gravity of the mixture (G_{mb} per AASHTO T 166).
- Maximum specific gravity of the mixture (G_{mm} per AASHTO T 209).
- Air voids (V_a per AASHTO T 269, calculation).
- Voids in the mineral aggregate (per AASHTO R 35, using current field G_{sb}).

8.36.6.5 HMA Compaction – AASHTO T 312

1. Preheat specimen molds (charging funnels, spatulas, etc.) to 300F.
2. Heat sample, in an open container, to a compaction temperature of 275F $\pm$ 5F in an oven between 285F – 320F for no more than 1 hour. After quartering to test size, if the mix sample is within the proper compaction temperature range, then the specimen can be compacted without further heating.
3. Place specimen protection disc into the bottom of the mold and charge the mold with the mix sample. The sample size should be enough to attain a final specimen height of 115mm $\pm$ 5mm and is unique to the mix design. For Wisconsin aggregates and designs a range of 4700 – 4900g is generally appropriate. Charging the mold should be accomplished in one lift action or motion so as to avoid segregating the sample inside the mold. Additional funnels or scoop chutes may be used in order to accomplish this.
4. Lightly level off the top of the sample and place a specimen protection disc on top.
5. Load the mold into the SGC and compact to the appropriate N_{des} for the mixture type being produced by applying 600kPa $\pm$ 18kPa, at an internal angle of 1.16° or its corresponding/recommended external angle.
6. After compaction is completed the specimen is extruded, protection papers removed, the briq is labeled, and cooling by fan is required for a period of 1 hr 45 min, not to exceed 2 hrs. If the mixture is extremely fine or tender, then the initial 5-10 minutes of cooling should take place while the specimen is only partially extruded to aid in handling.
7. Height measurements should be recorded and retained with each specimen.
8. Reheat the mold for a minimum of 5 minutes if reusing for the second specimen.

All SGCs being used for QMP specimen preparation will conform to the requirements for calibration as listed in the departments Laboratory Qualification Program. Recalibration may be necessary if the testing variation between labs exceeds allowable differences or when a continued bias exists in the data attributed to the preparation of the specimen.

8.36.6.6 Bulk Specific Gravity (G_{mb}) AASHTO T 166

Determine bulk specific gravity, G_{mb}, using AASHTO T166.

Weigh the specimens in air and record (designated this weight as A).

- Immerse the specimens in 77 ± 2F water bath for 3 to 5 minutes.
- Weigh in water, and record (designating this weight as C).
- Surface dry the specimens by blotting quickly with a damp towel and then weigh in air (include any water than may drain from voids in specimens), and record (designating this weight as B).
- Calculate the G_{mb} to three decimal places (0.001).

$$G_{mb} = \frac{A}{(B - C)}$$

Determine the average bulk specific gravity for both specimens. If one of the individual specimens deviates by more than ±0.015 from the average, results are considered suspect and a new set of specimens is to be compacted from the contractor retained sample (following the rule-of-retained).

If excessive variability exists between QC and reheated samples, then a G_{mb} Reheat Correction Factor is to be determined to aid in troubleshooting.

G_{mb} Reheat Correction Factor (*Calc'd to 0.001*) = $\frac{G_{mb}\text{ (Un-reheated)}}{G_{mb}\text{ (Reheated)}}$

Then apply the correction factor to the reheated sample by:

Corr G_{mb} = G_{mb} (Reheated)

When comparing the uncorrected G_{mb} to the corrected G_{mb}, if the difference is less than 0.005, then the correction factor will not be used.

8.36.6.7 Maximum Specific Gravity of the Mixture (G_{mm}) - AASHTO T 209

Determine maximum specific gravity, G_{mm}, using AASHTO T 209.

- Use the appropriate sample size Figure 5.
- Subject the G_{mm} sample to the same heating condition and time period as the G_{mb} material.
- Begin to cool the sample. While sample is cooling, break up sample to pieces no greater than ¼", and continue to cool to an ambient room temperature.
- Place material into a calibrated container and determine the actual dry weight of the sample.
- Add 77F water to cover the sample.
- Apply required vacuum for 15 ± 2 minutes, agitating material every 2 minutes minimum.
- After the vacuum time period, completely fill the container with 77F water and determine the volume of the sample.
  - Bowl Method: by suspending the container underwater and weighing
  - Flask Method: by weighing the container filled with water and sample (in air).
- Correct the G_{mm} with a dryback test procedure or by applying a dryback correction factor if aggregates have a moisture absorption of > 2.0% (see next subsection).
- Calculate the G_{mm} to three decimal places, 0.001.

$$G_{mm} = \frac{A}{(A + B - C)}$$

Where: A = dry sample wt
B = pycnometer volume (pot + water)
C = pot + water + mix

8.36.6.8 Dryback Procedure (Corrected G_{mm}) for Absorptive Aggregates (AASHTO T 209, Supplemental Procedure for Porous Aggregates)

- Run a dryback procedure on Day 1-Sample 1, and determine a dryback correction factor for that test. Average the test dryback correction factor with the design JMF dryback correction factor and apply to the test data for a new G_{mm}. If the new average correction factor changes the G_{mm} by less than 0.010 then use the design JMF dryback correction factor until otherwise determined by additional testing.
- Run a dryback procedure every other day of production on the first test sample, or any time there is a change in binder content greater than 0.1%, or a change in component blend percentages greater than 10% (or 20% combined), using the same averaging method as above to validate the original design JMF dryback correction factor.

- If any average dryback correction factor changes the G_{mm} by more than 0.010, check for math or testing error first, otherwise a new dryback correction factor must be established by running drybacks on the next three samples. Average the new dryback correction factors and establish that average as the new JMF dryback correction factor.

If excessive variability exists between QC and reheated samples, then a G_{mm} reheat correction factor is to be determined to aid in troubleshooting. It should be calculated to 0.001.

G_{mm} Reheat Correction Factor = G_{mm} (Un-reheated) / G_{mm} (Reheated)

Then apply the correction factor to the reheated sample: Corrected G_{mm} = G_{mm} (reheated) * correction factor.

When comparing the uncorrected G_{mm} to the corrected G_{mm}, if the difference is less than 0.005, then the correction factor will not be used.

8.36.6.9 Air Voids (%V_a) – AASHTO T 269

The air void (%V_a) determination is a relationship between maximum specific gravity (G_{mm}) and bulk specific gravity (G_{mb}). Calculate to one decimal place.

$$V_a,\ \% = \frac{(G_{mm} - G_{mb})}{Gmm}\ x100$$

8.36.6.10 Voids in Mineral Aggregate (VMA)

VMA is calculated using the aggregate bulk specific gravity, G_{sb}, from the contractor mix design (unless a blend change has provided cause for recalculating), the asphalt content (P_b determined at the time of sample), and the average SGC specimen bulk specific gravity, G_{mb}, as follows (calculate and record to one decimal place, 0.1.):

$$100 - P_b = P_s \text{ (or \% stone)}$$

$$VMA,\% = 100 - \frac{G_{mb} \times (100 - P_b)}{G_{sb}}$$

8.36.6.11 Aggregate Effective Specific Gravity, (G_{se})

In the G_{se} calculation, the volume of the aggregate includes all the aggregate internal void spaces except those that absorb asphalt. Calculate and record to three decimal places (0.001).

$$G_{se} = \frac{100 - P_b}{\left[\left(\frac{100}{G_{mm}}\right) - \left(\frac{P_b}{G_b}\right)\right]}$$

Where:

G_{mm} = end of previous days average.

P_b = end of previous days tank stick.

G_b = binder specific gravity from the mix design.

Calculate this G_{se} at the beginning of each day and use that value for current day's calculations. If there is a change in binder content then recalculate a new G_{se} with the next available sample (consider it being non-random) and average with the previous G_{se}:

Where:

G_{mm} = current sample test result.

P_b = reflecting the intended change (assumed).

G_b = from the mix design.

A change in binder source or grade requires a check of the G_b.

8.36.6.12 Percent Of Asphalt Content (P_b)

Option is to use a plant gauge reading method (as approved by the engineer) and record the Pb reading as close to representing the sample as possible.

When calculating the Pb use the following equation:

$$P_b = 100 \times \left(\frac{G_b}{G_{mm}} \right) \times \frac{(G_{se} - G_{mm})}{(G_{se} - G_b)}$$

Where:

G_{mm} = current sample test result.

P_b = previous day.

G_b = mix design.

8.36.6.13 Additional Formulas and Example Calculations

1. Determining the asphalt absorption, P_{ba}, for the following:
   Given:
   G_{se} = 2.761
   G_{sb} = 2.703
   G_b = 1.030

$$P_{ba} = 100 \times \frac{(G_{se} - G_{sb})}{(G_{sb} \times G_{se})} \times G_b =$$

$$100 \times \frac{(2.761 - 2.703)}{(2.703 \times 2.761)} \times 1.031 = 100 \times \frac{0.058}{7.463} \times 1.031 = \mathbf{0.8}$$

2. Determining the effective asphalt content, P_{be}, of the asphaltic mixture for the following:
   Given:
   P_b = 5.3
   P_{ba} = 0.8
   P_s = 94.7

$$P_{be} = P_b - (\frac{P_{ba}}{100}) \times P_s = 5.3 - \left(\frac{.8}{100} \right) \times 94.7 = \mathbf{4.5}$$

3. Determining the percent voids filled with asphalt (VFA) for the following compacted mixture:
   Given:
   VMA = 14.4
   V_a = 3.7

$$VFA = 100 \times \frac{(VMA - V_a)}{(VMA)} = 100 \times \frac{(14.4 - 3.7)}{(14.4)} = \mathbf{74.3}$$

4. Determining the dust to binder ratio (or DP: Dust Proportion):
   Given:
   Pbe = 4.5
   % passing 0.075 = 5.0

$$Dust\ to\ Binder\ Ratio = \frac{\%\ \ pas\sin g\ \ 0.075}{P_{be}} = \frac{5.0}{4.5} = 1.1$$

8.36.6.14 Field Adjusted JMF

The JMF may be adjusted in the field based on production test results according to the procedures in WisDOT method 1559.

When the JMF asphalt content is changed by 0.2% or more (start new running average for G_{mm}), the

compaction target maximum density for the day of the target change can be calculated using the most recent G_{se} and percent asphalt binder (P_b) for the new JMF and G_b (binder specific gravity) at 77/77 F from the mix design.

8.36.6.15 Field TSR Tests

The tensile strength ratio is determined according to the procedures in ASTM Method D 4867. After manufacturing the specimens at the plant, they may be tested in an off site laboratory. Use distilled water for saturating and soaking the test specimens.

8.36.6.16 Aggregate And Rap Sampling And Testing

In addition to testing the hot mix asphalt, the specification requires the contractor to test the aggregates before incorporation to the mix.

Take the first sample after the stockpiles have been established at the plant and before the first day of production. Additional samples must be obtained at the required daily frequency at a time during the day convenient to the contractor.

The minimum test sample size must be 2000 gm for coarse aggregate and 500 gm for fine aggregate.

The results of the stockpile gradations must be recorded on gradation running average calculation sheets. For each aggregate, the results for four key sieves (those sieves with the greatest potential for variability) need to be maintained.

8.36.6.16.1 Rap Stockpile Samples

The minimum test sample size must be determined from extracted aggregate gradation size per AASHTO T164. That has been divided into aggregate gradation numbers as follows:

Nominal Max Size (mm)	Minimum Weight of Test Sample (grams)
25.0	3000
19.0	2000
12.5	1500
9.5	1000

When test results indicate that a change has occurred in the RAP asphalt content, a change in the design RAP asphalt percentage may be requested by the contractor or the engineer. The request will include at least two recent RAP extractions from the contractor's mixture design laboratory. The requested change will be reviewed for the department by an HTCP Certified HMA Technician at a level recognized for mix design, and a revised JMF can be issued.

8.36.6.16.2 Blended Aggregate Samples

The minimum belt sample size will be 50 pounds.

The minimum test sample size which is split from the belt will be as specified below:

Nominal Max Size (mm)	Minimum Weight of Test Sample (grams)
25.0	5000
19.0	3000
12.5	2000
9.5	1000

The minimum field extraction sample size quartered from the mixture sample must be as specified below:

Nominal Max Size (mm)	Minimum Weight of Test Sample (grams)
25.0	3000
19.0	2000
12.5	1500
9.5	1000

8.36.7 OPTIONAL PRETESTED AGGREGATE AND RAP STOCKPILE PRODUCTION TESTING

The specification allows the engineer to waive testing of the aggregate stockpiles during HMA production

provided the contractor provides data from testing conducted during the production of the stockpiles in accordance with procedures described for sieve analysis in CMM 8.34.

8.36.7.1 Personnel Requirements

The contractor must provide at least one Certified Aggregate Technician I to conduct the sampling and testing for stockpile production. Sampling must be conducted by a certified technician or by plant personnel under the direct observation of a certified technician. All testing, data analysis, and data posting must be performed by the Certified Aggregate Technician I or by an Assistant Certified Technician under the direct supervision of the level I technician. Certification must be in accordance with the department's Highway Technician Certification Program.

8.36.7.2 Laboratory Requirements

The contractor must have access to a suitable laboratory to perform quality control testing. The laboratory must be located within a reasonable distance of the stockpile site.

The laboratory must contain the equipment and supplies necessary to meet the required test methods. The laboratory must be set up before production.

The engineer must be allowed to inspect measuring and testing devices to confirm both calibration and condition. The contractor must calibrate all testing equipment in accordance with CMM 8.34 and must maintain a record of calibration results at the laboratory.

8.36.7.3 Sampling and Testing for Aggregate and RAP Stockpile Production

The contractor is required to sample and test randomly selected samples according to procedures set forth in the Aggregate Stockpile Gradation (AASHTO T-11 and T-27), at a frequency not less than that indicated in the following table:

Daily Individual Stockpile Production (Tons)	Number of Tests per Day
0-1,500	1
1,501+	2

Tests must be conducted on aggregate material from either the belt or stockpiles. One sample selection process will be used throughout a project unless otherwise approved by the engineer. When 2 tests are required, the planned daily production must be divided into two even increments.

8.36.8 HMA QUALITY MANAGEMENT PROGRAM DOCUMENTATION

The contractor is responsible for documenting all observations, records of inspection, and test results on a daily basis. Results of observations and records of inspection must be noted as they occur in a permanent field record. The testing records and control charts must be available in the QC laboratory at the asphalt plant.

The contractor must maintain standardized control charts. Test results obtained by the contractor must be recorded on the control charts the same day the tests are conducted. The aggregate gradation test data must be recorded on the standardized control charts for all randomly selected production samples tested.

Sieve sizes for aggregate gradation tests must include the maximum aggregate sieve size, the NMAS sieve, and any following sieves falling below: 1" (25.0mm), 3/4"(19.0mm), 1/2"(12.5mm), 3/8"(9.5mm), # 4 (4.75mm), #8(2.36mm), # 16 (1.18mm), # 30 (600µm), # 50 (300µm) # 100 (150µm) and # 200(75µm).

8.36.9 DOCUMENTATION

8.36.9.1 QC Records

In addition to the requirements of the “Records” subsection of the standard specification, the contractor must provide a cumulative tonnage value to the engineer on a daily basis. The QC team posts results from any CA or QV testing on the appropriate property chart. These data points are not factored into running average calculations, but may impact troubleshooting activities.

8.36.9.2 CA Records

When CA testing is completed a CA worksheet is filled out and sent to the QV team. Results from CA testing are posted on the QC charts for the appropriate property. The CA data point should be represented by a unique symbol (ex: blue “X”).

8.36.9.3 QV Records

Results of QV testing are posted to the appropriate QC charts for air voids and VMA and represented with a unique symbol (ex: red "X").

8.36.10 QUALITY VERIFICATION PROGRAM

8.36.10.1 Monitoring Contractor QMP

8.36.10.1.1 Pre-Construction

The QV team is responsible for obtaining the following information:

- Obtain WisDOT test number of the quality test report for the aggregate source being used. If source quality testing hasn't been completed, notify the department's Bureau of Technical Services laboratory.
- Obtain the WisDOT test number of the mix design intended for use or a copy of the contractor's mix design, the review report, if available, from department's Materials Tracking system, and any contract special provisions.
- Verify that the QC team personnel have the proper certifications.
- Verify that the QC Laboratory facility is WisDOT qualified and has the equipment required by the QMP specification (inclusive of communication devices).

Review any procedures for determining reheat correction factors and for the G_{mm} dry back correction factor (if applicable). Discuss any necessary calibrations, or pending recalibrations, for the gyratory compactor and what procedure will be used.

8.36.10.1.2 During Production

During production, the QV team should, as often as they feel necessary:

1. Random Sampling:
   - Check the QC procedures for proper random number generation for all samples.
   - Verify the QC team is aware they are not to inform the plant before the random sampling will occur.
2. Samples:
   - Ensure all required samples are being taken for mixture properties and blended aggregate gradations.
   - Ensure that proper sampling and splitting procedures are being used and the field sample size is large enough to accomplish required testing.
   - Ensure that stockpile samples are taken and tested for aggregates and reclaimed asphaltic pavement (RAP) when applicable.
   - Ensure tensile strength ratio (TSR) tests have been conducted at proper intervals when using anti-stripping agents.
   - Ensure that the retained samples (mix and blended aggregate) are properly labeled and stored in a dry protected area.
3. Testing:
   - Observe the reduction of the field samples to test size.
   - Observe the testing procedures paying attention to temperature of test samples before compaction, compaction efforts, times allotted between tasks, dry backs, etc.
   - Review data calculations (adjusted with the calibration correction factors when applicable).
4. Control charts:
   - Check to see that required control charts are present and up to date.
   - Check to see that control limits and warning bands are accurately drawn.
   - Check to see that the proper values are being plotted correctly.
5. Documentation:
   - Check to see that records of compliance are being documented and are up to date.
   - Check to see that adjustments to mixtures and JMF changes are noted on field records.
   - Check to see that records have been provided to the QV team on a daily basis.

8.36.10.2 Verification Sampling

Product quality verification sampling is the responsibility of the department's QV team.

8.36.10.2.1 Aggregates

The QC and the QV teams must come to a consensus on where aggregate samples will be procured. The aggregates must be sampled in accordance with the method allowed in CMM 8.60 that fits the situation. If none

of the allowed sampling methods fits the situation, one will be written by the QMP team, posted in the QC laboratory, and a copy sent to the department's Bureau of Technical Services Materials Lab.

The QC team is required to procure "stockpile" samples from each individual feed bin or stockpile at the frequency required in the QMP. The QV team needs only to ensure this sampling is being accomplished.

8.36.10.2.2 Design Mixtures

Samples from the truck box will be taken by a member of the contractor QC team, and directly observed by the QV team member. In addition, if the initial split (QV / QV-retained) is performed by the contractor, it is also to be directly observed by the QV team member.

The QV team will determine and document the random sampling procedure employed for mixture verification samples. Any or all of the following methods may be used:

- Production tonnage.
- Specific week during production.
- Specific day-of-the-week during production.
- Time-of-day.

If some other method is used, it should be mutually agreed upon between the QV and QC teams and documented before taking place.

The contract language specifies "two mixture production days" after the sample has been obtained by the contractor as the time within which the QV personnel must respond to the QC team relative to the agreement of data results. The intent is to provide information and feedback to the QC team as soon as practical in case there is data disagreement and the potential need to stop mix production.

If the QV mixture sample temperature is 230 degrees F or higher when delivered to the testing facility, quartering may start immediately. If the temperature is below 230F, place in a 300F oven, until workable for quartering, but not to exceed two hours.

8.36.10.3 Determining Acceptable Verification Parameters

Whenever a flag has been raised by disagreement of QV test results with the defined acceptable parameters, immediate investigation will occur using additional testing, troubleshooting, and dispute resolution actions.

8.36.10.3.1 Additional Testing

WisDOT's Bureau of Technical Services laboratory is to test QV-retained and nearest available backward QC-retained sample.

Example 4

> A QV sample taken after QC test 5-3 falls outside acceptable parameters. The WisDOT – BTS lab tests retained portion of non-compliant QV sample, along with QC-ret sample 5-3. If that retained sample doesn't exist, the next nearest backward sample is 5-2, etc. If there are no backward retained QC samples, then liability for that mixture may include back to production start-up.

The QV team is to provide assurance (CA) split sample testing on any forward QC sample as soon as practical, and continue at a minimum frequency of 1 in 10 until the QC and QV team mutually agree that the problem has been solved in a forward direction. In addition, when the QV team is back on the site to obtain the additional QC-retained samples, another QV sample will be taken.

Example 5

> The QV sample taken after QC test 5-3 falls outside acceptable parameters. The QV team returns to the plant site on day 7 and obtains QC-ret sample 5-4 for testing, QC-ret 5-3 to send to the WisDOT-BTS lab, and directs a new QV sample be taken representing day 7.

8.36.10.3.2 Troubleshooting

The following points are to be considered and re-checked:

- Calculations.
- QC data trends.
- Any CA testing trends or bias.
- Equipment calibration records.

- Sampling and splitting observations/notes.
- Proper use of re-heat correction factors.

8.36.10.3.3 Dispute Resolution

For the test results of the QV retained portion, the contract language specifies “two working days” after receipt of the sample. The receipt day refers to receipt of the sample at the department’s Bureau of Technical Services AASHTO accredited laboratory. The intent is to provide test information and feedback to the QC/QV team as soon as practical.

At the completion of dispute resolution testing (QV-ret and nearest backward QC-ret) the WisDOT - Bureau of Technical Services AASHTO accredited laboratory personnel dealing with asphalt mix designs will determine and recommend a range of non-compliant tons based on, but not limited to, the following information:

- Project QC data and production trends.
- Project CA data.
- Any additional forward testing.
- JMF changes and cause for change.
- Differences between QV, QC and CA comparison testing (single points and running averages).
- Affected mixture properties in conjunction with intended application.
- Design mixture production and performance history.

In determining unacceptable or non-compliant materials, the department’s Bureau of Technical Services AASHTO accredited laboratory personnel dealing with asphalt mix designs will provide documentation to the QV team recommending tonnages to be affected. A standard recommendation will be assessed based on data meeting established tolerance levels for split sample testing. Example scenarios are provided in Figure 7.

In the event that the range of liability is determined to be at the QV tonnage point (isolated problem), a standard pay adjustment equivalent to 50 tons will be assessed, unless QMP Quality Control pay adjustments are controlling (standard spec 460.2.8.2.1.7). There is no intent to use multiple pay adjustments, but the lowest percent pay will supersede others.

The QV team will further complete documentation responsibilities by determining the dollar amount for any affected mixture tonnage and will forward that information to appropriate project personnel and the QC team.

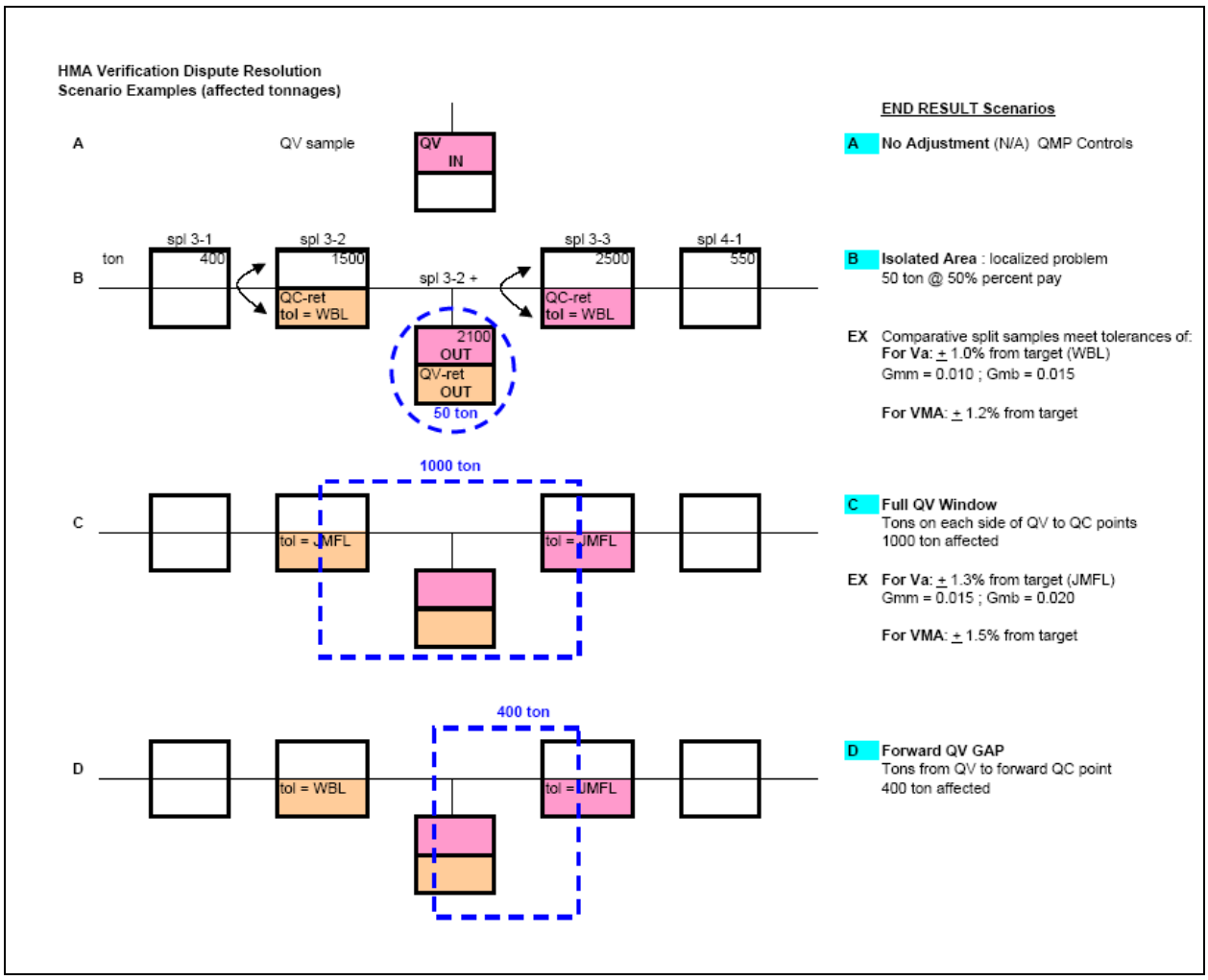


Figure 7: Example of HMA Verification Dispute Resolution Scenario

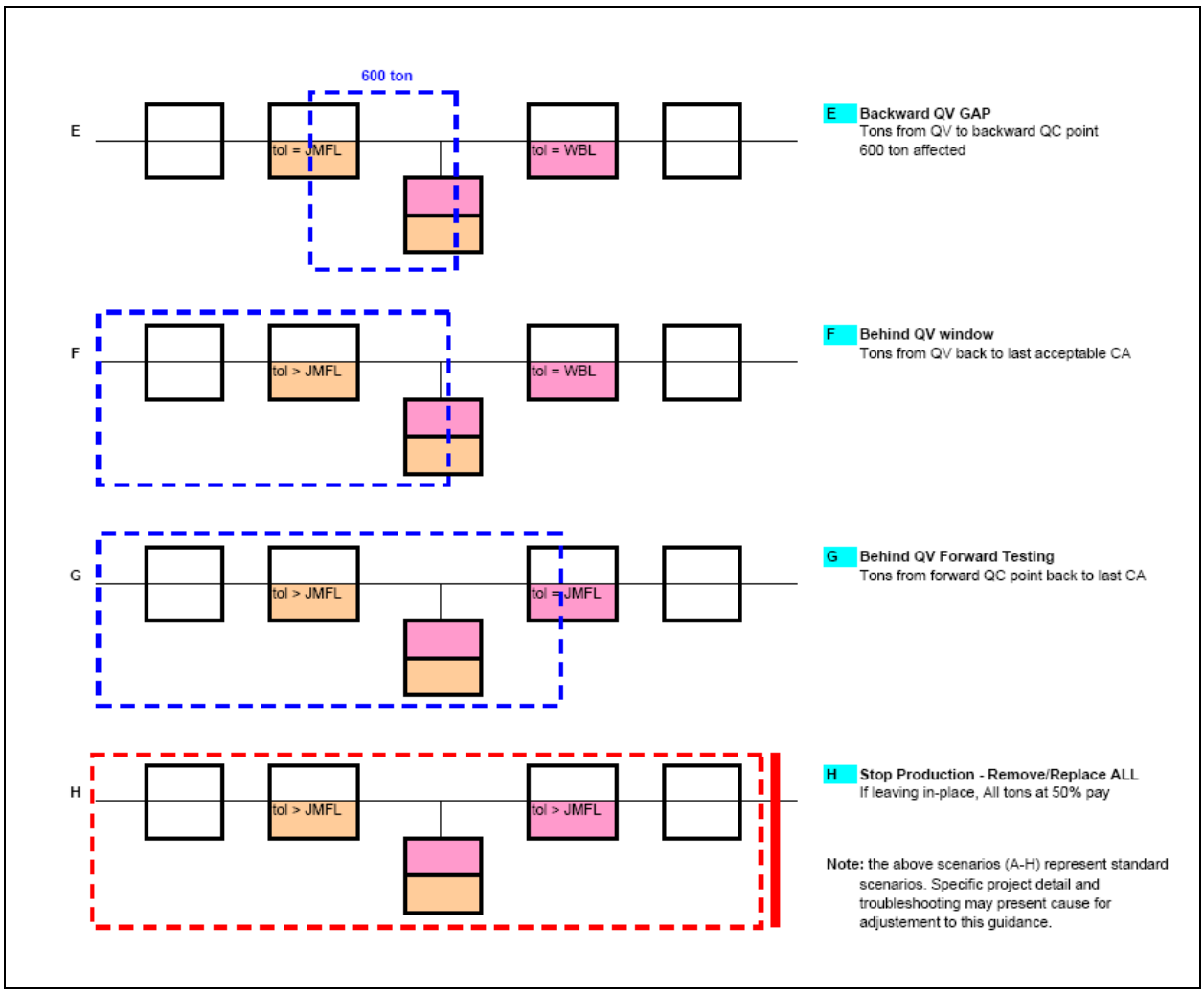
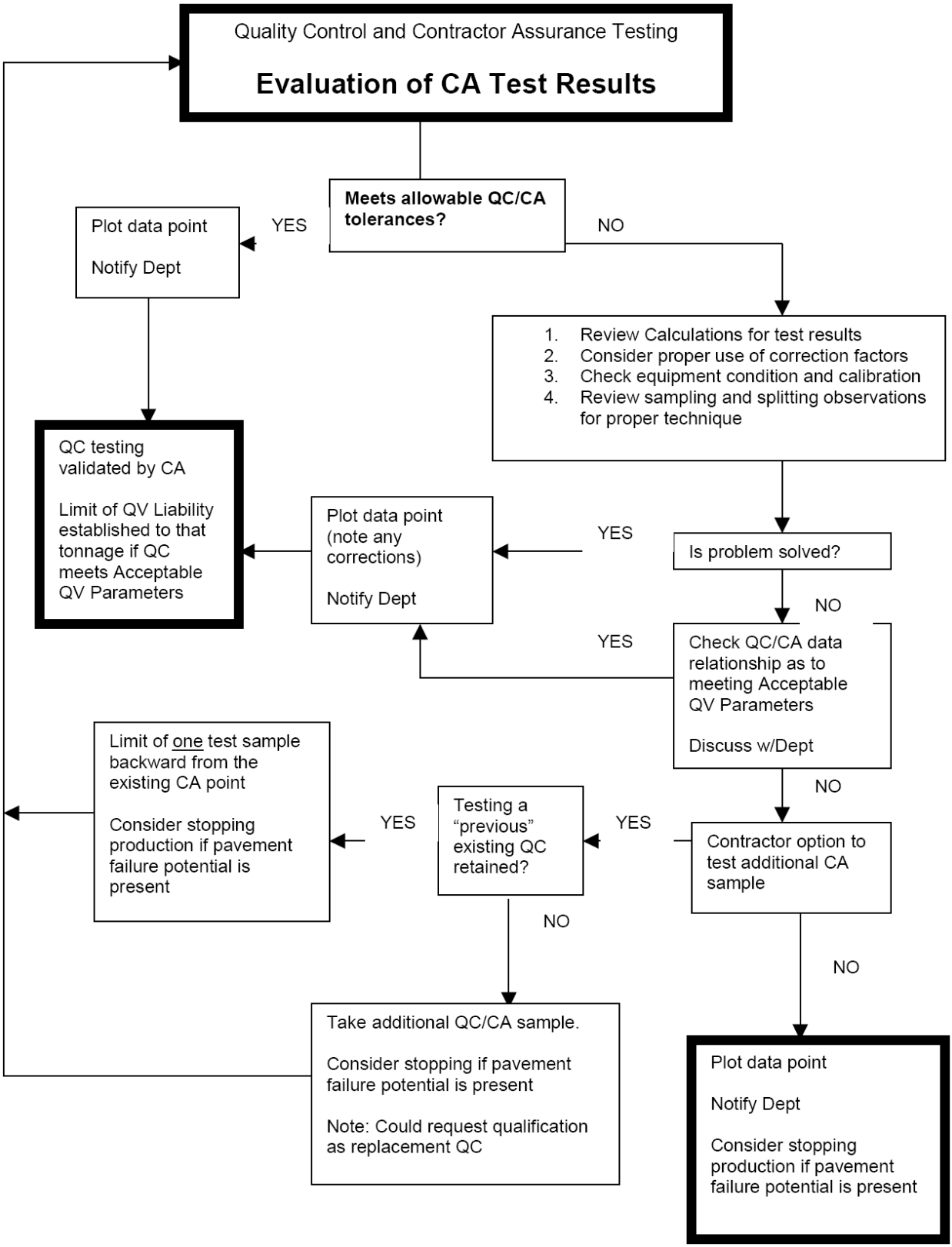


Figure 7: Example of HMA Verification Dispute Resolution Scenario (cont'd)

8.36.10.4 Evaluation of CA Test Results



8.36.10.5 Evaluation of QV Test Results