AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS

AASHTO

COMMITTEE ON MATERIALS AND PAVEMENTS (COMP)

2018 Annual Meeting – Cincinnati, OH
Wednesday, August 8, 2018
1:00 p.m. - 3:00 p.m. EDT

TECHNICAL SUBCOMMITTEE (TS) 2c
Asphalt-Aggregate Mixtures

Meeting Date:	August 8, 2018	
Items approved by the TS for Committee and or Technical Subcommittee Ballot:		
Standard Designation	**Page Numbers/Section Titles for Proposed Changes in Minutes**	**Technical Subcommittee and/or Committee?**
R 79	Pg. 1, IV. Old Business, A. Review of 2017 SOM Ballot 17-05, Item 22	Concurrent
R ABC (ignition oven)	Pg. 2, IV. Old Business, B. 2018 TS 2c Ballot, Item 1	Concurrent
R XYZ (sampling)	Pg. 2, IV. Old Business, B. 2018 TS 2c Ballot, Item 2	Concurrent
R 67	Pg. 2, IV. Old Business, B. 2018 TS 2c Ballot, Item 3	Technical Subcommittee
T 209	Pgs. 2-3, IV. Old Business, B. 2018 TS 2c Ballot, Item 4	Concurrent
T 324	Pg. 3, IV. Old Business, B. 2018 TS 2c Ballot, Item 5	Concurrent
T 166	Pg. 4, IV. Old Business, C. Task Force Reports, Task Force 2c-2017-02	Technical Subcommittee
T 209	Pg. 5, V. New Business, B. AASHTO Technical Service Programs Items, Item 1	Concurrent
R 47	Pg. 6, V. New Business, D. Correspondence, calls, meetings, Item 2	COMP
T 30	Pg. 6, V. New Business, D. Correspondence, calls, meetings, Item 3	COMP

I. Call to Order and Opening Remarks

A. Brief summary of activities *(to ensure all attendees up to speed)*

II. Roll Call

The following agencies were present at the meeting: AL, AZ, AR, CO, CT, DE, DC, FL, ID, IL, KS, KY, LA, ME, MD, MN, MS, MO, MT, NV, NH, OH, OK, OR, PA, TN, UT, VA, WA, WV, WI, and ONT.

III. Approval of TS 2c Minutes from Mid-Year Web Meeting (February 5, 2018) – ATTACHMENT 1

Motion to approve the minutes: MT, second – UT. The motion passed unanimously.

IV. Old Business

A. Review of 2017 Subcommittee on Materials (SOM) Ballot 17-05 (Rolling Ballot 3, November 2017 – January 2018)

1. Item 22, AASHTO R 79 (*Vacuum Drying Compacted Asphalt Specimens*)
   a. Practice revised according to ballot comments – **ATTACHMENT 2**
   b. Correct version of standard will be balloted The wrong version was inadvertently included in the previous Subcommittee on Materials ballot. Motion to send the correct version of R 79 to a concurrent ballot: WI, second – PA. The motion passed unanimously. **CONCURRENT BALLOT ITEM # 1**
2. Item 23, AASHTO T 195 (*Determining Degree of Particle Coating of Asphalt Mixtures*)
3. Item 24, AASHTO T 308 [*Determining the Asphalt Binder Content of Hot Mix Asphalt (HMA) by the Ignition Method*]
4. Item 25, AASHTO T 355 (*In-Place Density of Asphalt Mixtures by Nuclear Methods*)
5. Item 26, AASHTO TP 82 [*Bulk Specific Gravity (G_{mb}) of Compacted Asphalt Mixtures Using Water Displacement Measured by Pressure Sensor*]
   a. Provisional test method will be discontinued
6. Item 27, AASHTO TP 114 [*Determining the Interlayer Shear Strength (ISS) of Asphalt Pavement Layers*]
7. Item 1, AASHTO R 47 [*Reducing Samples of Hot Mix Asphalt (HMA) to Testing Size*]
8. Item 2, AASHTO T 164 [*Quantitative Extraction of Asphalt Binder from Hot Mix Asphalt (HMA)*]
9. Item 3, AASHTO T 269 (*Percent Air Voids in Compacted Dense and Open Asphalt Mixtures*)
10. Item 4, AASHTO T 287 (*Asphalt Binder Content of Asphalt Mixtures by the Nuclear Method*)
11. Item 5, AASHTO T 305 (*Determination of Draindown Characteristics in Uncompacted Asphalt Mixtures*)
12. Item 6, AASHTO TP 82 [*Bulk Specific Gravity (G_{mb}) of Compacted Asphalt Mixtures Using Water Displacement Measured by Pressure Sensor*]
    a. Provisional test method will be discontinued

B. 2018 TS 2c Ballot # 1 (May-July 2018)
   1. Item 1, AASHTO R ABC (*Installation, Operation, and Maintenance of Ignition Furnaces*) – **ATTACHMENT 3** The proposed standard was a product of NCHRP 9-56 (Report 847). Tim Ramirez (PA) brought it forward for ballot consideration by TS 2c.
      a. Ballot results – 26 affirmative/0 negative/7 not returned
      b. Comments from Arizona, Illinois, Maine, Pennsylvania, and Wisconsin – **ATTACHMENT 4** Adding this information to the existing T 308 method would result in very long annex. Some of the comments received may be more appropriate for T 308 rather than including them in the new standard practice. Chairman Allen Myers (KY) and Vice-Chairman Rick Bradbury (ME) will revise the standard in preparation for ballot. Motion to move the new standard practice to a concurrent ballot, incorporating the proposed changes as appropriate: AL, second – OH. The motion passed unanimously. **CONCURRENT BALLOT ITEM # 2**

2. Item 2, AASHTO R XYZ (*Sampling Asphalt Mixtures*) – **ATTACHMENT 5**
   a. Ballot results – 26 affirmative/0 negative/7 not returned
   b. Comments from Arizona, Illinois, Missouri, Ontario, Pennsylvania, and Wisconsin – **ATTACHMENT 6** Motion to move the standard practice to a concurrent ballot, incorporating the proposed changes as appropriate: UT, second – MT. The motion passed unanimously. **CONCURRENT BALLOT ITEM # 3**
3. Item 3, AASHTO R 67 [*Sampling Asphalt Mixtures after Compaction (Obtaining Cores)*] – **ATTACHMENT 7**
   a. Ballot results – 25 affirmative/1 negative/7 not returned
   b. Negative vote from Pennsylvania The negative was found persuasive.
   c. Comments from Arizona, Arkansas, Florida, Illinois, Louisiana, Ohio, Oregon, Pennsylvania, Virginia, Washington, and Wisconsin – **ATTACHMENT 8** Chairman Myers (KY) considered the negative vote from Pennsylvania to be persuasive. Due to the negative vote and numerous comments, Chairman Myers recommended that the proposed changes to R 67 be presented to TS 2c again prior to including it on a COMP ballot. Brian Egan (TN) agreed to modify R 67 according to the comments received on this year's TS ballot. An updated version of R 67 will be presented on a future TS 2c ballot.
4. Item 4, AASHTO T 209 [*Theoretical Maximum Specific Gravity (G_{mm}) and Density of Asphalt Mixtures*] – **ATTACHMENT 9**
   a. Ballot results – 26 affirmative/0 negative/7 not returned
   b. Comments from Arkansas, Colorado, Idaho, Illinois, Kansas, Pennsylvania, and Wisconsin – **ATTACHMENT 10** The technical subcommittee discussed changing "short-term" mixture conditioning in T 209 from two hours to four hours as provided in R 30. Ultimately it was determined that two hours is still acceptable for volumetric mix design. Motion to move the revised standard method to a concurrent ballot: VA, second – OR. Garth Newman (ID) and Desna Bergold (consultant) have already incorporated many of the comments received on this year's TS ballot. The motion passed unanimously. **CONCURRENT BALLOT ITEM # 4**
5. Item 5, AASHTO T 324 (*Hamburg Wheel-Track Testing of Compacted Asphalt Mixtures*) – **ATTACHMENT 11**
   a. Ballot results – 26 affirmative/0 negative/7 not returned
   b. Comments from Illinois, Louisiana, Missouri, Ohio, Ontario, Pennsylvania, and Wisconsin – **ATTACHMENT 12** Motion to move the revised standard method to a concurrent ballot: UT, second – WI. The motion passed unanimously. **CONCURRENT BALLOT ITEM # 5**

C. Task Force Reports
   1. Task Force 2c-2008-02
      a. Rich Barezinsky, Chair (Kansas), Matthew Corrigan (FHWA), Oak Metcalfe (Montana), and Tim Ramirez (Pennsylvania)

   b. Provide recommendations for amplitude and frequency for mechanical agitation devices in AASHTO T 209 [*Theoretical Maximum Specific Gravity (G_{mm}) and Density of Hot Mix Asphalt (HMA)*]
      i. NCHRP 20-07 research submittal, *Energy Criteria for Maintaining Fully Animated Particles of Loose Asphalt in AASHTO T 209*, selected for funding in September 2015 (NCHRP 20-07/Task 391)
   c. Task force awaiting results of research project for incorporation into AASHTO T 209 as appropriate
   d. Update from Rick Kreider (Kansas) Rich Barezinsky (KS) gave a presentation on NCHRP 20-07/Task 391 on Rick Kreider's behalf. This presentation is included in these minutes. The desired outcome from this research may not be feasible. TS 2c requests that AASHTO re:source personnel inform the subcommittee if they encounter the use of more mechanical washers in the field.
2. Task Force 2c-2012-01
   a. Scott Andrus, Chair (Utah), Matthew Corrigan (FHWA), Oak Metcalfe (Montana), Tim Ramirez (Pennsylvania), and Joe DeVol (Washington)
   b. Implement findings from NCHRP 20-07/Task 361, study into AASHTO T 324 (*Hamburg Wheel-Track Testing of Compacted Asphalt Mixtures*)
   c. Generally maintain AASHTO T 324 to reflect latest features and ideas
   d. Update from Scott Andrus (Utah) The comments received on this year's TS ballot will be addressed. The modified standard method will be presented on a concurrent ballot as discussed in Section IV. B. 5 of these minutes.
3. Task Force 2c-2015-01
   a. Garth Newman, Chair (Idaho), Mike San Angelo (Alaska), Matthew Corrigan (FHWA), Rick Bradbury (Maine), Oak Metcalfe (Montana), Tim Ramirez (Pennsylvania), and Kurt Williams (Washington)
   b. Address negative votes and incorporate comments as appropriate from 2014 SOM ballot into AASHTO T 209 [*Theoretical Maximum Specific Gravity (G_{mm}) and Density of Hot Mix Asphalt (HMA)*]
   c. Suggestions from Richard Giessel (Alaska)
      i. Clarify application of vacuum in method summary
      ii. Improve figure depicting arrangement of testing apparatus
      iii. Modify and add notes concerning removal of water vapor
   d. NCHRP Project 20-07/Task 375, *Improvements to Dry-Back Procedure of AASHTO T 209*, final report issued
      i. No changes to AASHTO T 209 recommended at this time
4. Task Force 2c-2017-01
   a. Scott Andrus, Chair (Utah), Georgene Geary (GGfGA Engineering), Allen Myers (Kentucky), Rick Bradbury (Maine), and Tim Ramirez (Pennsylvania)
   b. Address negative votes and incorporate comments from 2017 TS 2c ballot into AASHTO R XYZ (*Sampling Asphalt Mixtures*) The new standard practice will replace the existing T 168. The modified standard will be presented on a concurrent ballot as discussed in Section IV. B. 2 of these minutes.

c. Proposal from Western Alliance for Quality Transportation Construction (WAQTC)

5. Task Force 2c-2017-02
   a. Brian Johnson, Chair (AASHTO re:source), Bob Lauzon (Connecticut), Matthew Corrigan (FHWA), Garth Newman (Idaho), and Oak Metcalfe (Montana)
   b. Consider AASHTO standards related to measuring or calculating specific gravity
   c. Issue resulting from FHWA negative vote on AASHTO T 166 [*Bulk Specific Gravity (G_{mb}) of Compacted Asphalt Mixtures Using Saturated Surface-Dry Specimens*] as presented on 2015 SOM ballot
      i. Basis for negative vote was definition of bulk specific gravity
   d. Add "gas-free distilled water" to Apparatus section
      i. Concern about availability of distilled water in remote laboratories
      ii. Richard Giessel (Alaska) provided guidance for using non-distilled water and correction factors
   e. Update from Brian Johnson (AASHTO re:source) Brian Johnson reported that the work of the task force continues. His goal is to ensure that the effort is not overly complicated. The task force must consider technicians working in remote laboratories. When completed, suggested revisions to T 166 as recommended by this task force will be presented on a TS ballot.

D. Previous Correspondence
   1. Montana inquiry regarding Federal Lands Highway Division addendum to AASHTO T 308 [*Determining the Asphalt Binder Content of Hot Mix Asphalt (HMA) by the Ignition Method*]
      a. Provides guidance in proportioning and calculations of correction factor when mixture contains RAP
      b. Include as annex in AASHTO T 308? No one on the subcommittee expressed an interest in working on this item.

V. New Business

A. Research Proposals
   1. Quick turnaround RPS
   2. Full NCHRP RPS

B. AASHTO Technical Service Programs Items
   1. Correspondence from AASHTO re:source about manual agitation of vessel in AASHTO T 209 [*Theoretical Maximum Specific Gravity (G_{mm}) and Density of Hot Mix Asphalt (HMA)*] – **ATTACHMENT 13** Maria Knake of AASHTO re:source discussed using a rubber mallet to strike the side of the container. She asked if that procedure is considered to be an acceptable method of "manual agitation." Is the intent to actually pick up the container and shake it rather than striking it with a mallet? The current wording leaves the procedure open to different interpretations. The use of a rubber mallet is specified in the

standardization portion of T 209. Motion to clarify the applicable wording in T 209 as a separate ballot item: VA, second – CT. This item will be separate from the other ballot item involving T 209 (discussed in Section IV. B. 4 of these minutes). This item will be presented on a concurrent ballot. The motion passed unanimously. **CONCURRENT BALLOT ITEM # 6**

C. NCHRP Issues
   1. Update from Amir Hanna (NCHRP) Ed Harrigan from NCHRP gave an update on current research projects involving asphalt mixtures.

D. Correspondence, calls, meetings
   1. New York inquiry about requirement for mercury thermometer in AASHTO R 59 (*Recovery of Asphalt Binder from Solution by Abson Method*) – **ATTACHMENT 14** The technical subcommittee briefly discussed this issue during the mid-year web meeting in February.
      a. Allow use of electronic thermometric devices?
      b. Maria Knake (AASHTO re:source) to develop wording on alternatives to mercury thermometers R 59 does not allow an alternative to mercury thermometers. Maria Knake had previously volunteered to modify R 59 to address this issue. However, given the current NCHRP 20-07 project on this topic, Chairman Myers recommended that no action be taken on R 59 until the research is completed.
   2. WAQTC-proposed revisions to AASHTO R 47 [*Reducing Samples of Hot Mix Asphalt (HMA) to Testing Size*] – **ATTACHMENT 15** Motion to revise R 47 according to the WAQTC suggestions and move these changes to a COMP ballot: VA, second – ID. The motion passed unanimously. **COMP BALLOT ITEM # 1**
      a. Change maximum temperature for heating equipment in Section 8.1 to maximum mixing temperature
      b. Add heating of equipment to Sections 10.1 and 12.1
      c. Change "hot mix asphalt" and "HMA" to "asphalt mixtures" throughout standard
   3. WAQTC-proposed revisions to AASHTO T 30 (*Mechanical Analysis of Extracted Aggregate*) – **ATTACHMENT 16** The modifications suggested by WAQTC involve more reorganization of the method rather than revising technical content. Motion to move these changes to a COMP ballot: WI, second – MT. The motion passed unanimously. **COMP BALLOT ITEM # 2**
      a. Move information about overloading sieves and minimum time requirement to annex
      b. Reword calculations section for clarity

E. Presentation by Industry/Academia None.

F. Proposed New Standards None.

G. Proposed New Task Forces None.

H. Standards Requiring Reconfirmation or Extension Technical Subcommittee 2c is responsible for 26 full standards and three provisional standards.

1. AASHTO M 17-11 (2015) (*Mineral Filler for Bituminous Paving Mixtures*)
2. AASHTO R 59-11 (2015) (*Recovery of Asphalt Binder from Solution by Abson Method*)
3. AASHTO T 30-15 (*Mechanical Analysis of Extracted Aggregate*) This standard method should be removed from the reconfirmation list because it is scheduled to appear on a COMP ballot this fall (see Section V. D. 3 of these minutes).
4. AASHTO T 319-15 (*Quantitative Extraction and Recovery of Asphalt Binder from Asphalt Mixtures*)
5. AASHTO T 329-15 (*Moisture Content of Asphalt Mixtures by Oven Method*)
6. AASHTO TP 114-18 [*Determining the Interlayer Shear Strength (ISS) of Asphalt Pavement Layers*]
7. AASHTO TP 115-16 (2017) (*Determining the Quality of Tack Coat Adhesion of an Asphalt Pavement in the Field or Laboratory*)
8. AASHTO TP 128-17 (*Evaluation of Oxidation Level of Asphalt Mixtures by a Portable Infrared Spectrometer*)

I. COMP Ballot Items (including any ASTM changes/equivalencies/harmonization) Technical Subcommittee 2c authorized six concurrent and two COMP ballot items for this fall. The TS also discussed two future technical subcommittee ballot items.

VI. Open Discussion None.

VII. **Adjourn** Motion: OH, second – FL. The TS 2c meeting adjourned at 2:59 p.m.

NCHRP 20-07/Task 391: Energy Criteria for Maintaining Fully Animated Particles of Loose Asphalt in AASHTO T 209

Rick Kreider, P.E. Research Bureau Chief

Rick Barezinsky, P.E. Materials Engineer

Kansas Department of Transportation

AASHTO T 209 (16):

TEST METHOD A—MECHANICAL AGITATION

10. APPARATUS

10.1. In addition to the apparatus listed in Section 6, the following apparatus is required for Method A:

10.1.1. *Mechanical Shaker*—Shaker for removing air from asphalt mix.

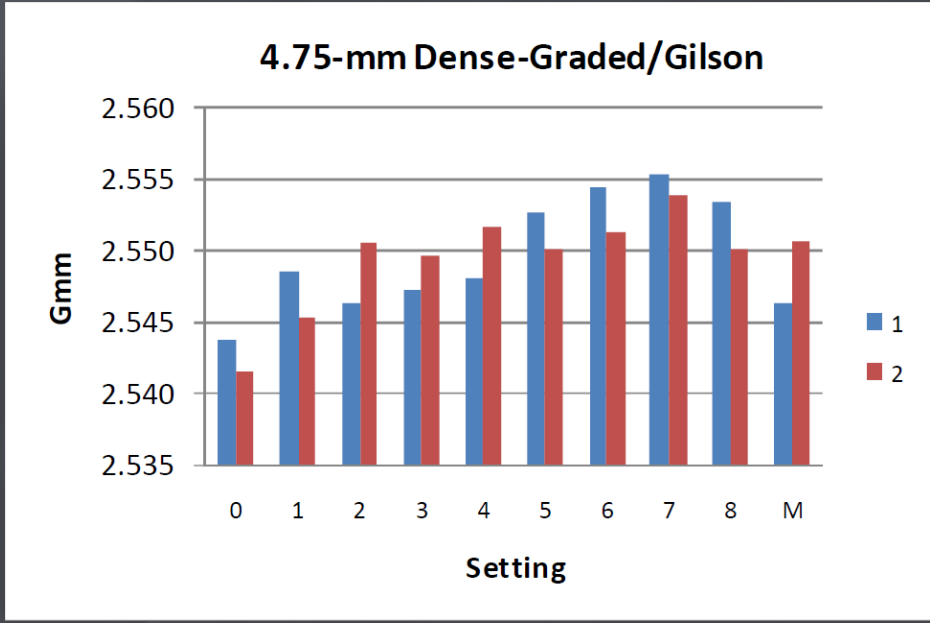
11. PROCEDURE

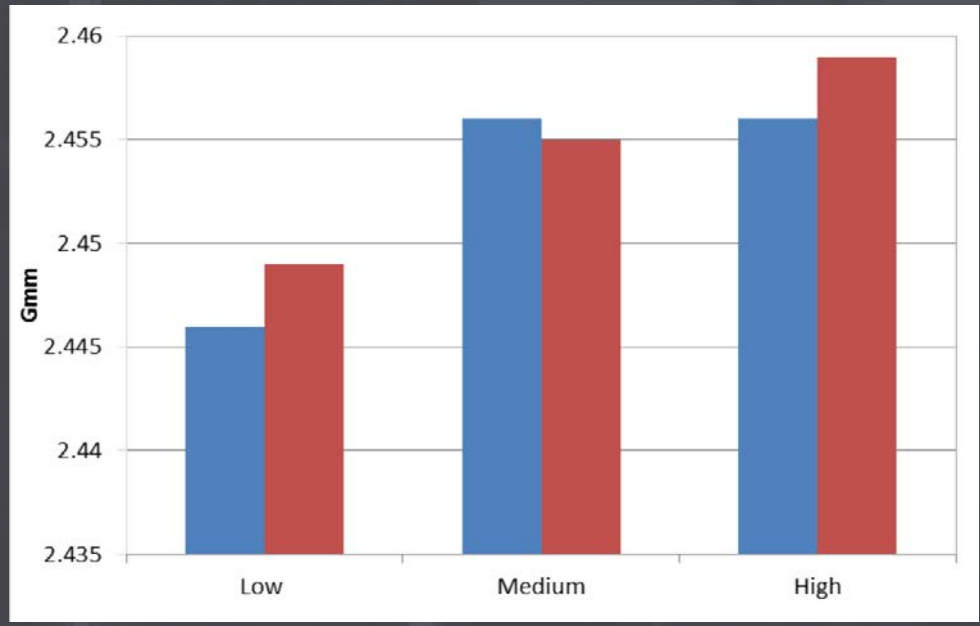
11.1. Remove air trapped in the sample by applying gradually increased vacuum until the residual pressure manometer reads 3.7 ± 0.3 kPa (27.5 ± 2.5 mmHg). Maintain this residual pressure for 15 ± 2 min. Agitate the container and contents using the mechanical device during the vacuum period. Glass vessels should be shaken on a resilient surface such as a rubber or plastic mat, and not on a hard surface, so as to avoid excessive impact while under vacuum.

11.2. At the end of the vacuum period, release the vacuum by increasing the pressure at a rate not to exceed 8 kPa (60 mmHg) per second and proceed with one of the mass determination methods in Section 13.

Effect of Agitation Equipment Type on Maximum Theoretical Specific Gravity Measurements (NCHRP 10-87 ('14), Dr. Haleh Azari)

NCHRP 20-07/Task 391 Energy Criteria for Maintaining Fully Animated Particles of Loose Asphalt in AASHTO T 209 (ongoing research by NCAT)





$Max_7 - Min_1 \sim 0.008$

Max – Min ~ 0.013

Current Research Objective:

Establish a mechanical shaker criterion to determine the optimum amplitude and frequency, defined as achieving full animation of individual sample particles, for each unique mix sample.

Research Early Comments:

Although the relative energy values may roughly correlate to G_{mm} values for individual mixes as it was found for the 4.75 mm NMAS mix,

it doesn't seem feasible to recommend an energy range to provide the level of agitation to set individual particles in motion that will ensure the complete removal of air from the sample.

Table 3. Energy and G_{mm} for 4.75mm and 12.5 NMAS Mixes at Different Settings.

Setting	Time(min)	4.75 mm			12.5 mm		
		Sample ID	Energy $(m/sec)^2$	G_{mm}	Sample ID	Energy $(m/sec)^2$	G_{mm}
Low	2	414	8.62E-006	2.443	512	1.83E-007	2.446
	8		2.60E-005			1.62E-007	
	13		1.95E-005			4.41E-007	
	Average		**1.80E-005**			**2.62E-007**	
Low	2	411	9.84E-003	2.449	513	4.33E-005	2.445
	8		1.01E-002			1.58E-005	
	13		1.03E-002			2.10E-005	
	Average		**1.01E-002**			**2.67E-005**	
Medium	2	415	2.30E-002	2.456	514	9.27E-003	2.46
	8		2.35E-002			9.31E-003	
	13		2.26E-002			9.15E-003	
	Average		**2.30E-002**			**9.24E-003**	
Medium	2	416	1.45E-002	2.455	515	7.05E-003	2.463
	8		1.43E-002			7.14E-003	
	13		1.44E-002			7.95E-003	
	Average		**1.44E-002**			**7.38E-003**	
High	2	417	2.63E-002	2.459	516	1.81E-002	2.456
	8		2.30E-002			1.88E-002	
	13		1.92E-002			1.86E-002	
	Average		**2.28E-002**			**1.85E-002**	
High	2	418	1.14E-002	2.459	517	6.01E-003	2.458
	8		1.11E-002			6.51E-003	
	13		1.04E-002			6.42E-003	
	Average		**1.10E-002**			**6.32E-003**	

Complexities with the Research

- Mix Size (size of test sample)
- Mix Type (dense vs SMA)
- Aggregate (gradation, angularity, texture)
- Asphalt Binder (neat vs modified)
- T 209
  - 6.2.3 (Bowl)
  - 6.2.4 (Flask)
  - 6.2.5 (Pycnometer)

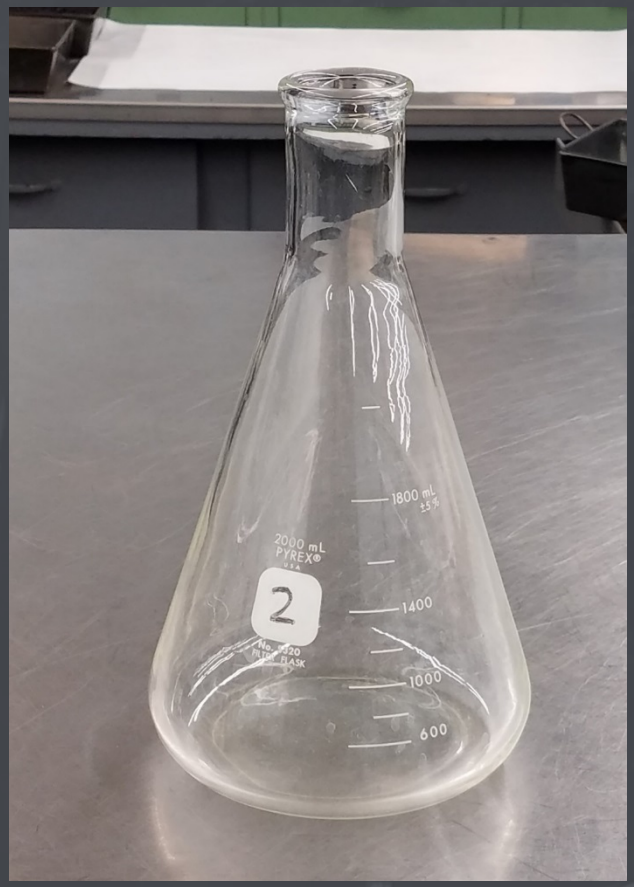
Apparatus: 6.2.3, 6.2.4, 6.2.5

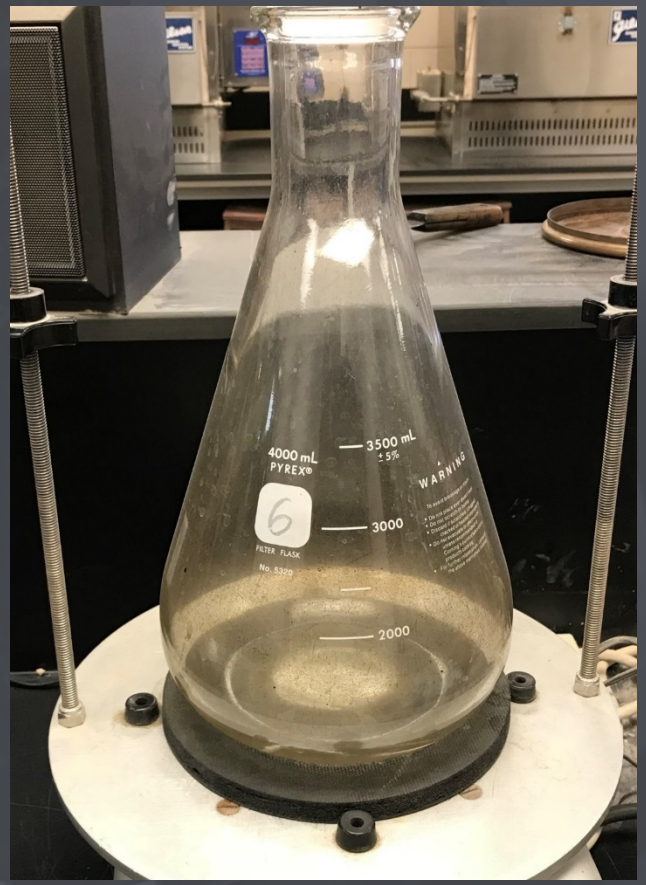
Vacuum Bowl—Either a metal or plastic bowl with a diameter of approximately 180 to 260 mm (7 to 10 in.) and a bowl height of at least 160 mm (6.3 in.) equipped with a transparent cover fitted with a rubber gasket and a connection for the vacuum line.

Vacuum Flask for Mass Determination in Air Only (Section 13.2)—A thick-walled volumetric glass flask and a rubber stopper with a connection for the vacuum line.

Pycnometer for Mass Determination in Air Only—A glass, metal, or plastic pycnometer.

Size matters!





Size matters!

Figure 1. G_{mm} samples on 2L Flask, 4.75mm Mix (left), and 19mm Mix (right)

some preliminary observations

- Achieving full animation for mixes with NMAS higher than 12.5 mm can't be accomplished with the unit that was evaluated…

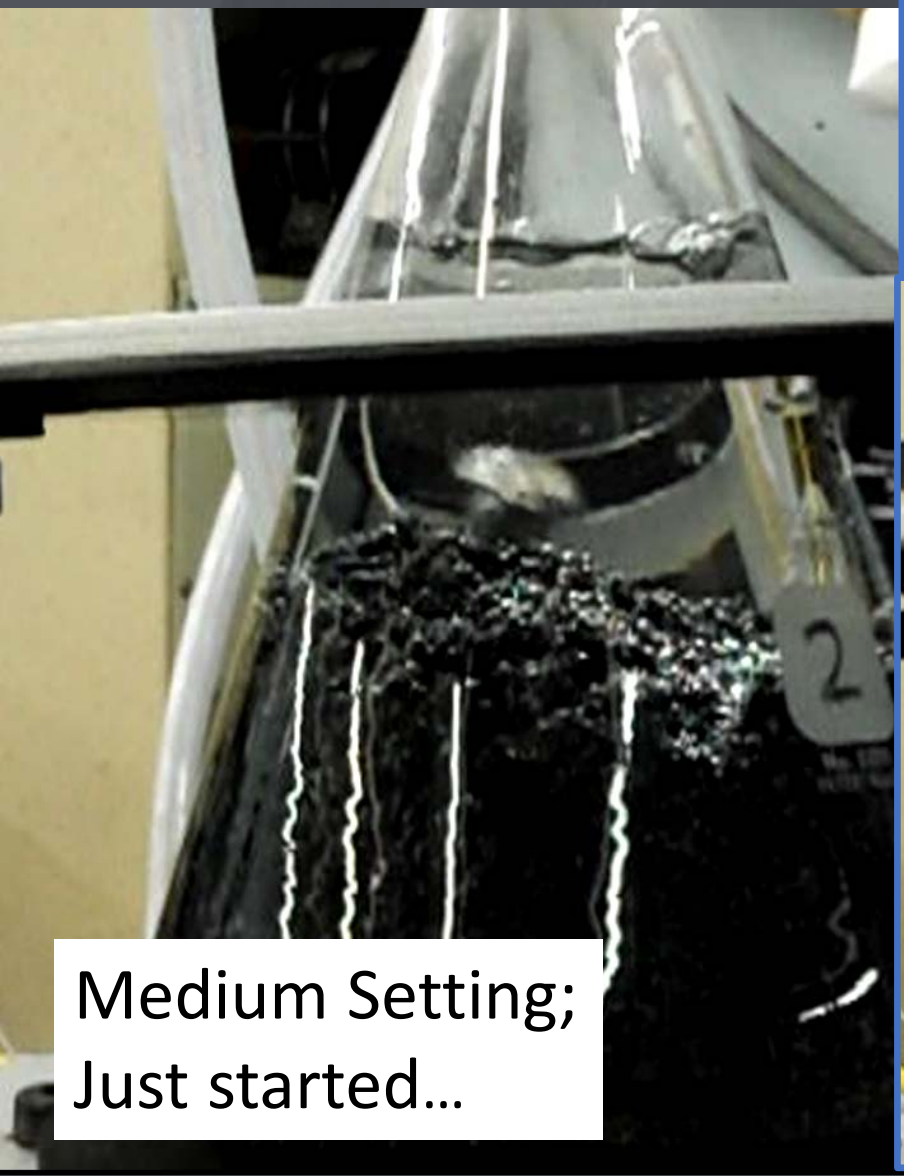
- When full animation was achieved using high unit setting, problems with the cloudiness of the water were observed.

some preliminary observations

- It appears that the low setting provide significant lower G_{mm} values. This indicates that this setting may not be recommended.

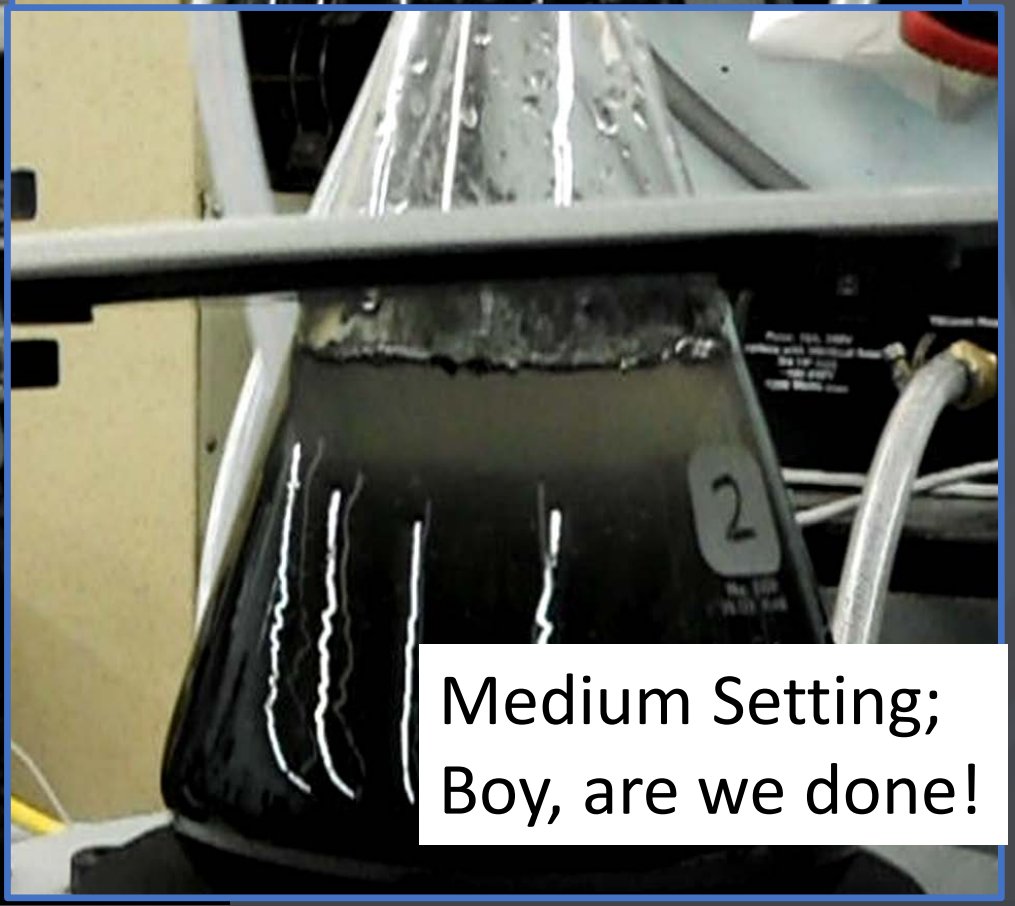
- …it doesn't seem feasible to recommend an energy range to provide the level of agitation to set individual particles in motion that will ensure the complete removal of air from the sample. Each mix type at the same setting (low, medium, high) yielded different values, which indicates that each mix will have its own energy requirements.

Water Cloudiness



Medium Setting;
Just started…

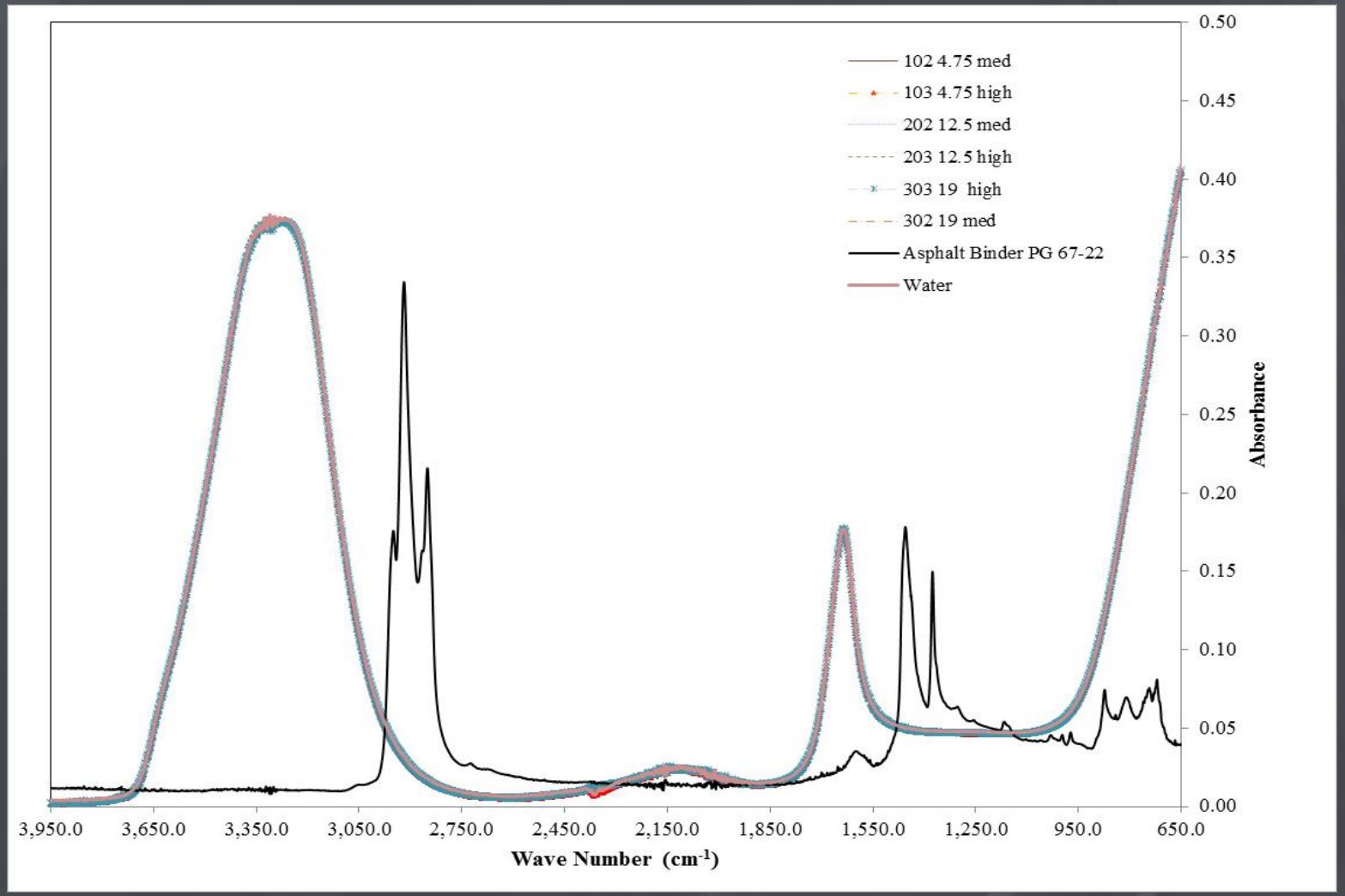
Medium Setting;
Half done…



Medium Setting;
Boy, are we done!

Task 391:Water Samples after Mechanical Shaking

Task 391: FTIR-ATR Results



Spectrum of water is exactly the same as the spectrum of the residue in water.

Task 391: Quarterly Report

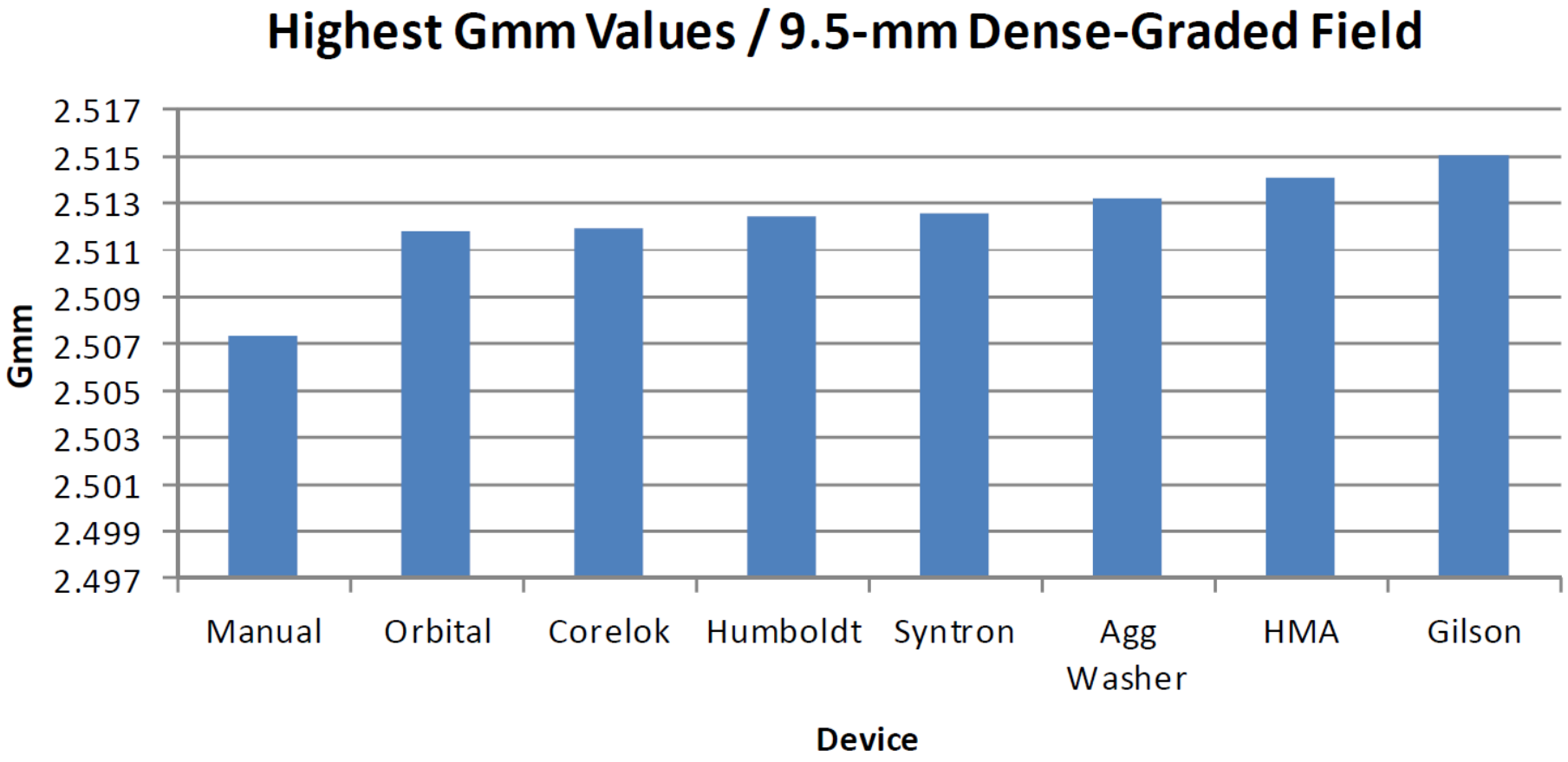
Quarterly Progress Report
July 2018

In addition, a comparison of the G_{mm} results for all mixes for medium and high vibration setting do not seem to indicate significant differences, suggesting that the more vigorous vibration may not improve the G_{mm} measurements.

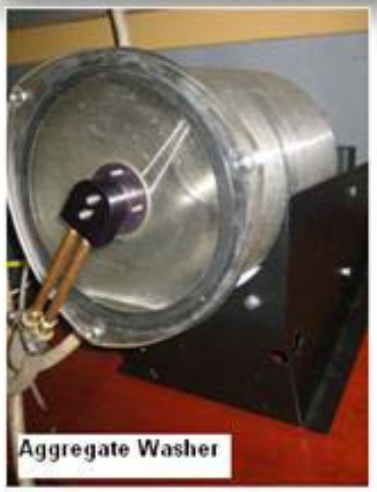
Table 1. G_{mm} Test Results Before and After Dryback procedure

NMAS	Vibration Setting	G_{mm} Before Dryback			G_{mm} after Dryback			Average Difference
		Sample 1	Sample 2	Average	Sample 1	Sample 2	Average	
4.75	Medium	2.458	2.466	2.462	2.458	2.463	2.461	0.001
	High	2.463	2.465	2.464	2.460	2.463	2.462	0.002
12.5	Medium	2.477	2.481	2.479	2.475	2.482	2.478	0.001
	High	2.479	2.478	2.478	2.478	2.476	2.477	0.001
19	Medium	2.571	2.560	2.565	2.567	2.560	2.564	0.002
	High	2.565	2.564	2.565	2.566	2.565	2.565	0.000

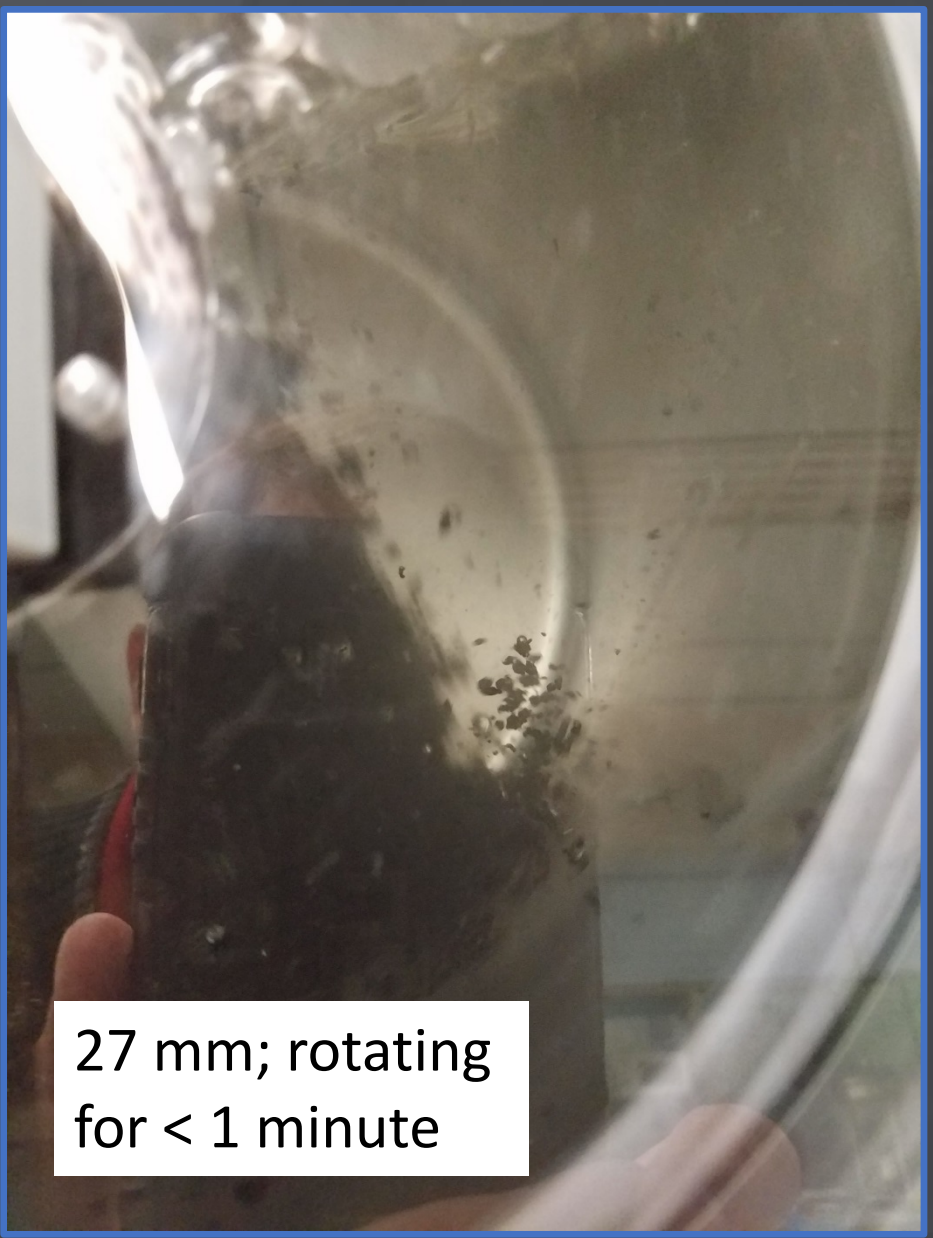
Effect of Agitation Equipment Type on Maximum Theoretical Specific Gravity Measurements (NCHRP Project 10-87)

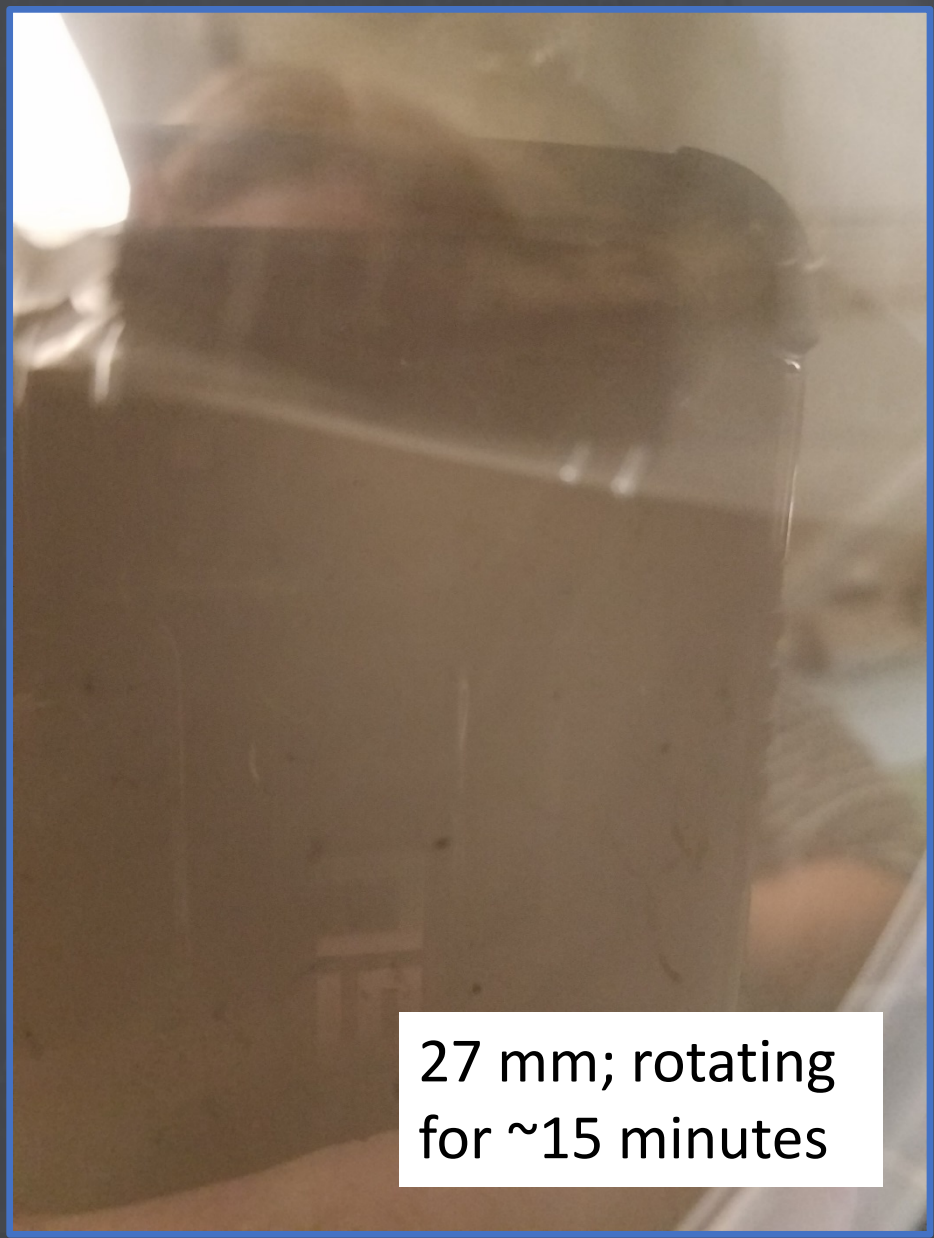


Effect of Agitation Equipment Type on Maximum Theoretical Specific Gravity Measurements (NCHRP Project 10-87)



Water Cloudiness…





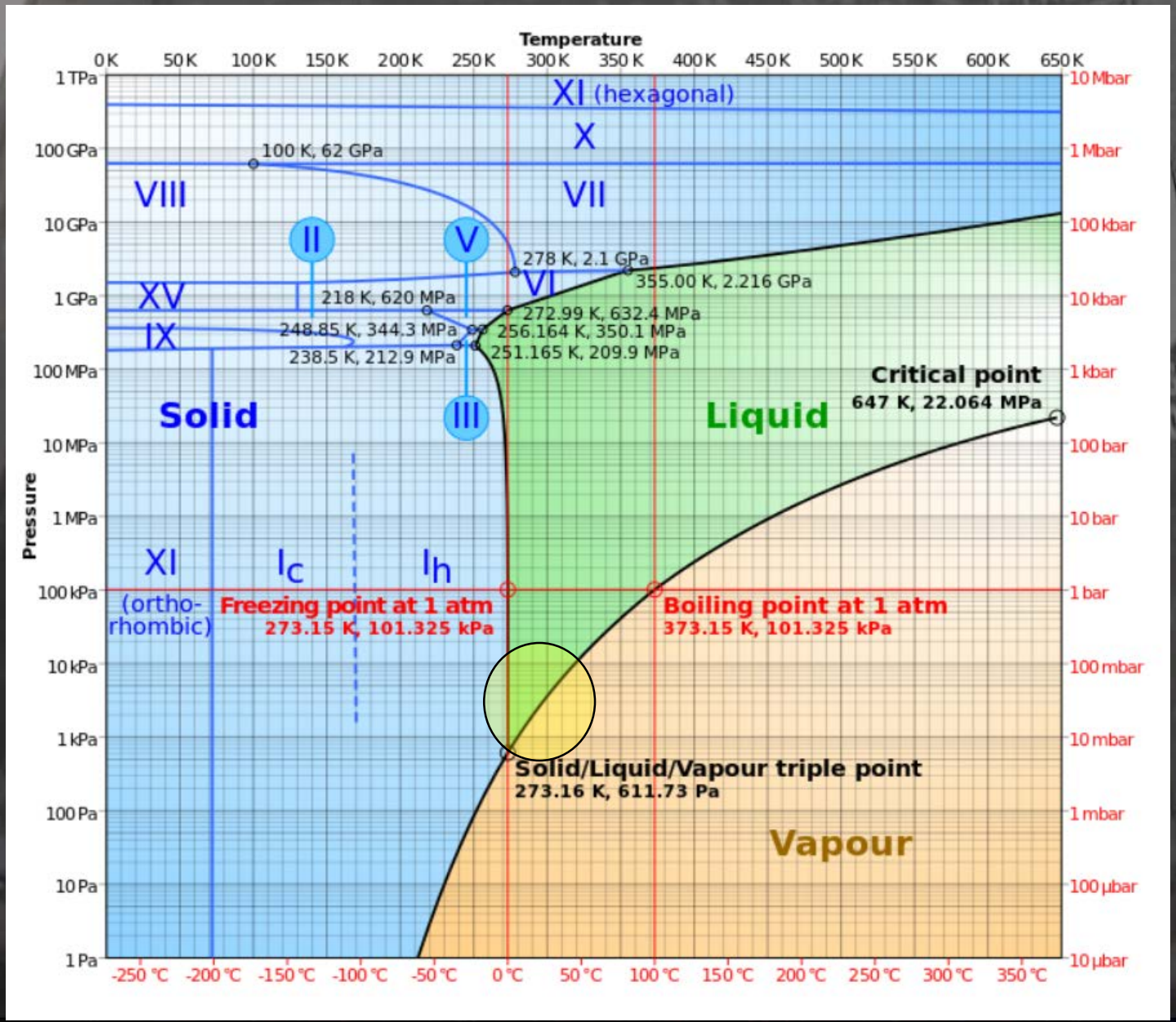
AASHTO T 209 (16):

PROCEDURE

Remove air trapped in the sample by applying gradually increased vacuum until the residual pressure manometer reads 3.7 ± 0.3 kPa (27.5 ± 2.5 mmHg). Maintain this residual pressure for 15 ± 2 min. Agitate the container and contents using the mechanical device during the vacuum period. Glass vessels should be shaken on a resilient surface such as a rubber or plastic mat, and not on a hard surface, so as to avoid excessive impact while under vacuum.

At the end of the vacuum period, release the vacuum by increasing the pressure at a rate not to exceed 8 kPa (60 mmHg) per second and proceed with one of the mass determination methods in Section 13.

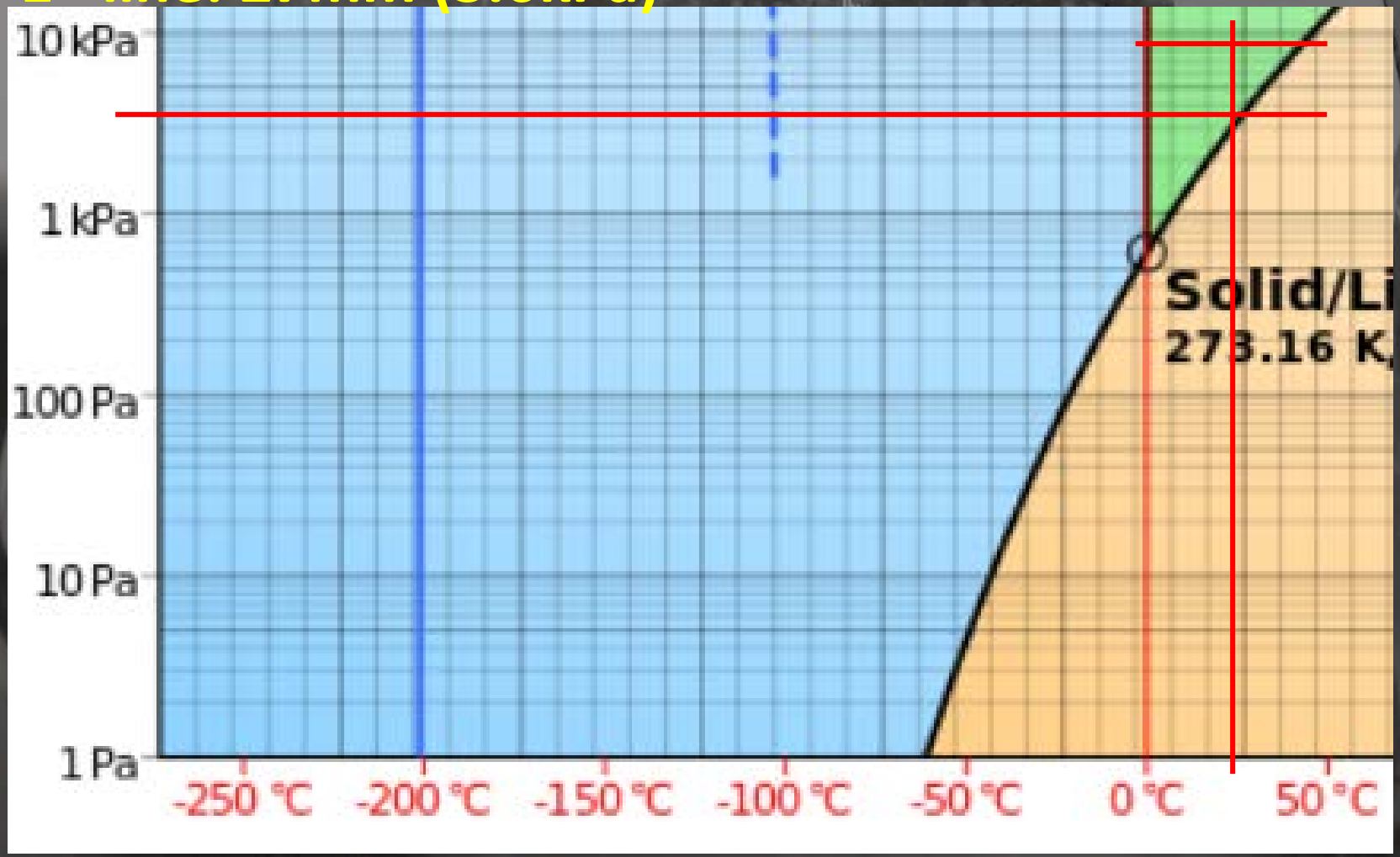
Fundamentals of H_2O (absolute pressure)



Fundamentals of H_2O (absolute pressure)

2nd line: 67mm (8.9kPa)

1st line: 27mm (3.6kPa)



AASHTO T 209 (16):

PROCEDURE

Remove air trapped in the sample by applying gradually increased vacuum until the residual pressure manometer reads 3.7 ± 0.3 kPa (27.5 ± 2.5 mmHg). Maintain this residual pressure for 15 ± 2 min. Agitate the container and contents using the mechanical device during the vacuum period. Glass vessels should be shaken on a resilient surface such as a rubber or plastic mat, and not on a hard surface, so as to avoid excessive impact while under vacuum.

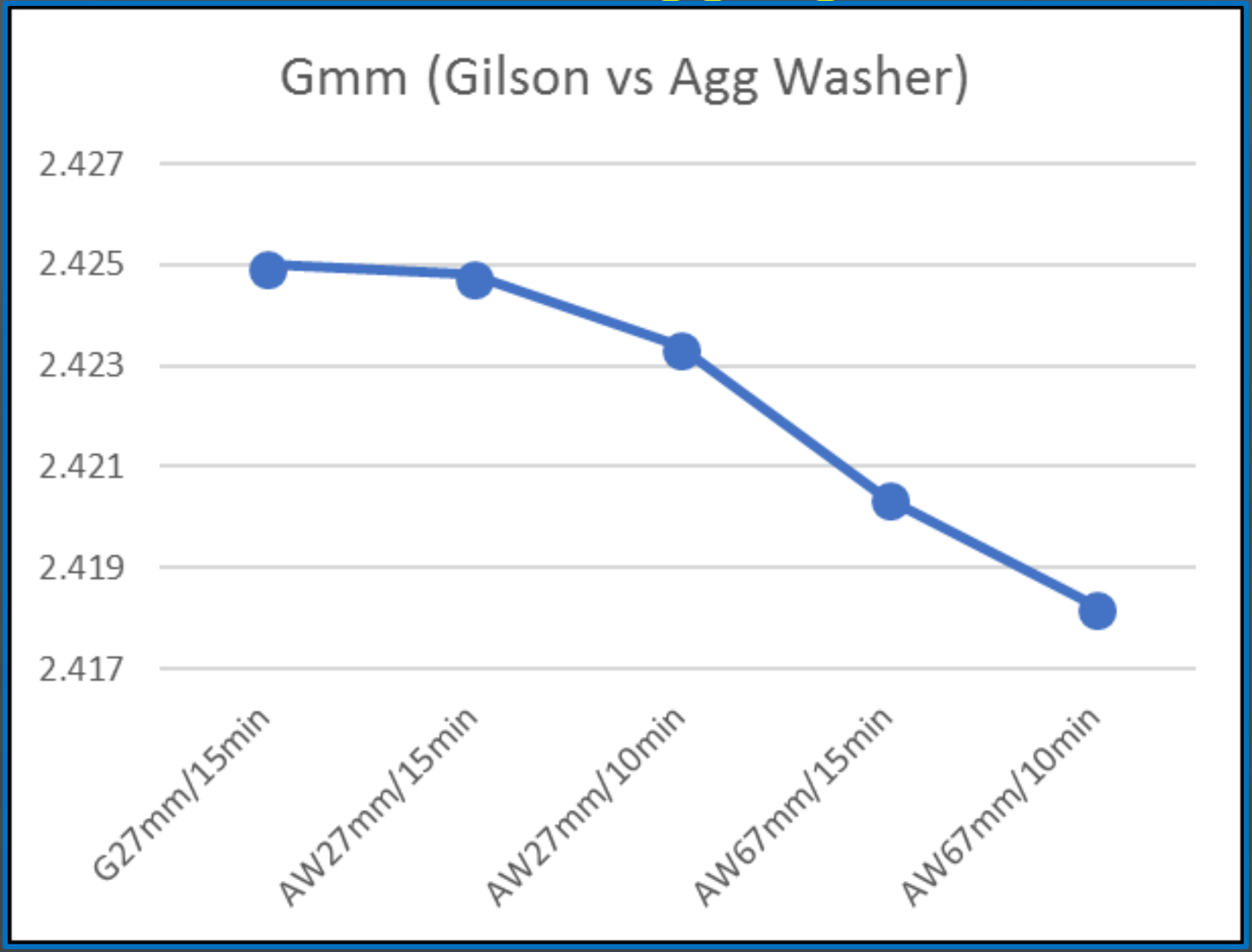
At the end of the vacuum period, release the vacuum by increasing the pressure at a rate not to exceed 8 kPa (60 mmHg) per second and proceed with one of the mass determination methods in Section 13.

KDOT: Gilson vs. Aggregate Washer

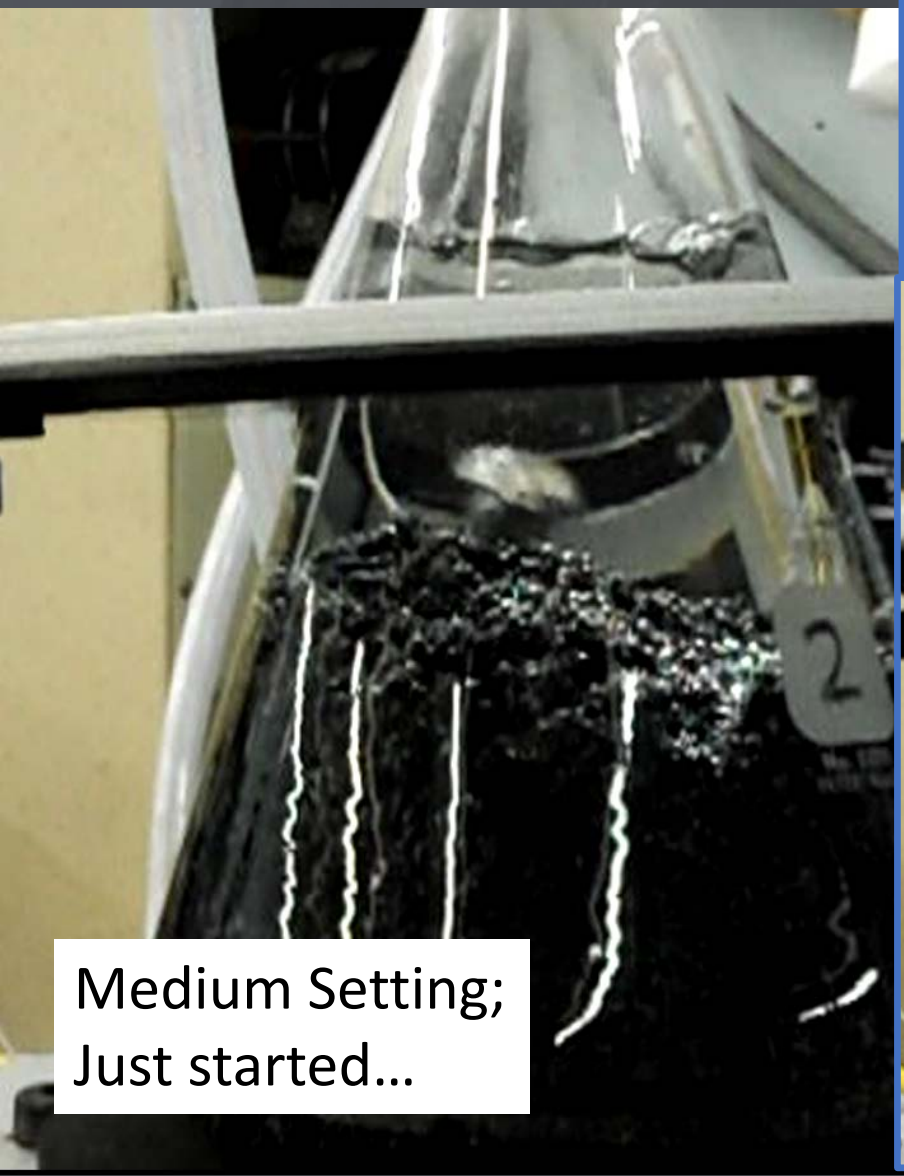
Gmm Study Using the Aggregate Washer						
Gilson vs Agg Wshr	S1	S2	S3	S4	S5	AVG
G27mm/15min	2.428	2.425	2.425	2.423	2.424	2.4250
AW27mm/15min	2.427	2.426	2.423	2.424	2.424	2.4248
AW27mm/10min	2.421	2.426	2.428	2.421	2.421	2.4234
AW67mm/15min	2.424	2.423	2.416	2.420	2.419	2.4204
AW67mm/10min	2.419	2.419	2.419	2.417	2.418	2.4183

G – Gilson;
AW – Aggregate Washer;
S1 – Sample #1;
27mm – 27 mm of vacuum;
15min – 15 minutes

KDOT: Gilson vs. Aggregate Washer

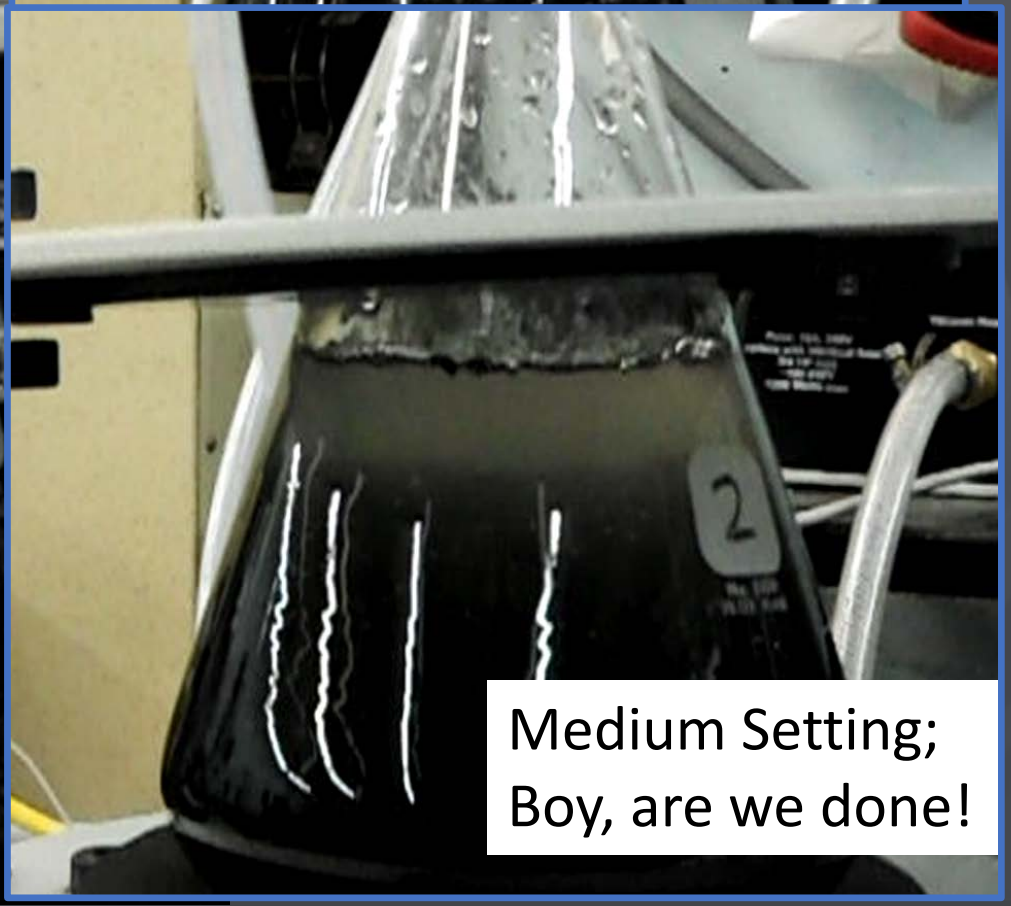


Water Cloudiness



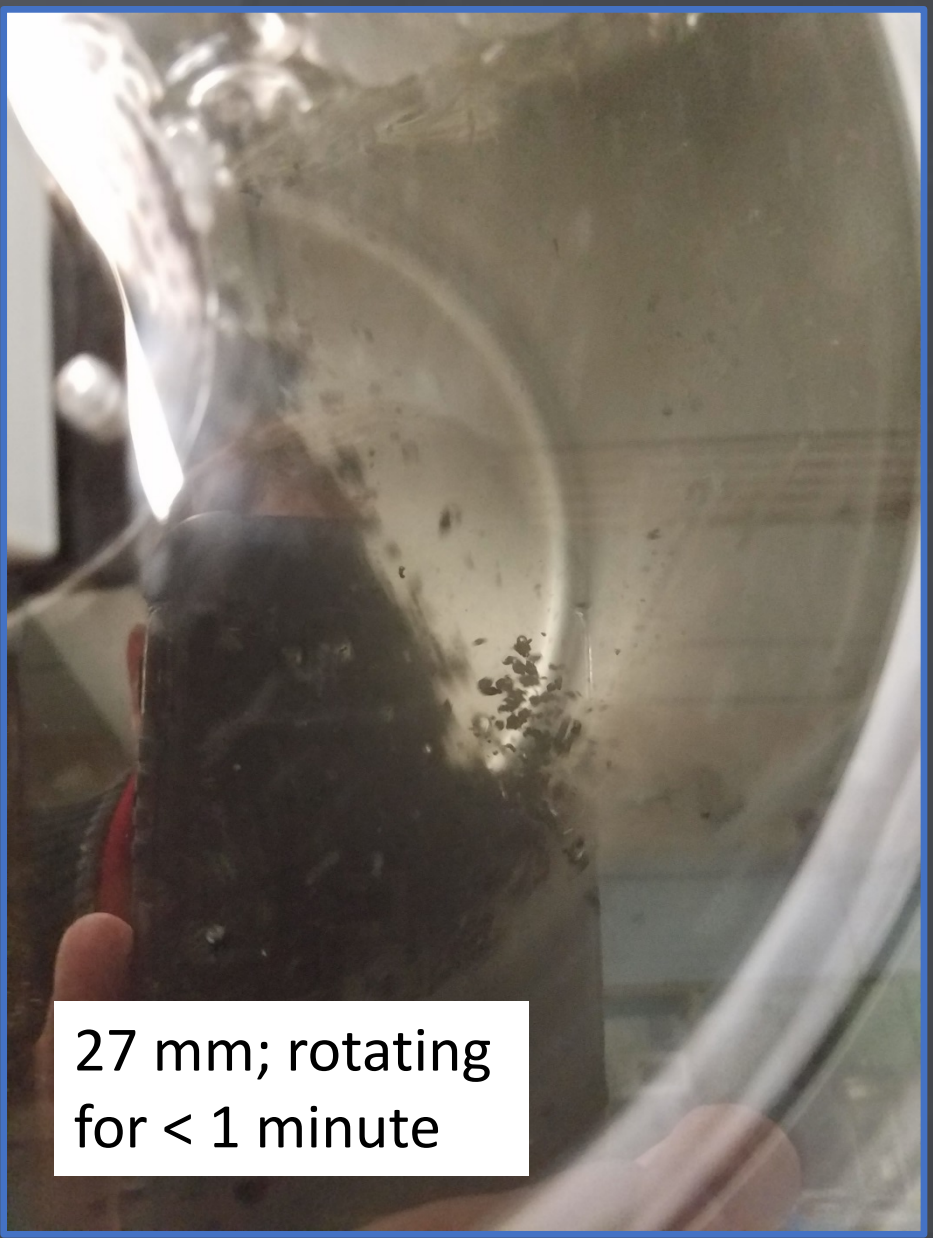
Medium Setting;
Just started…

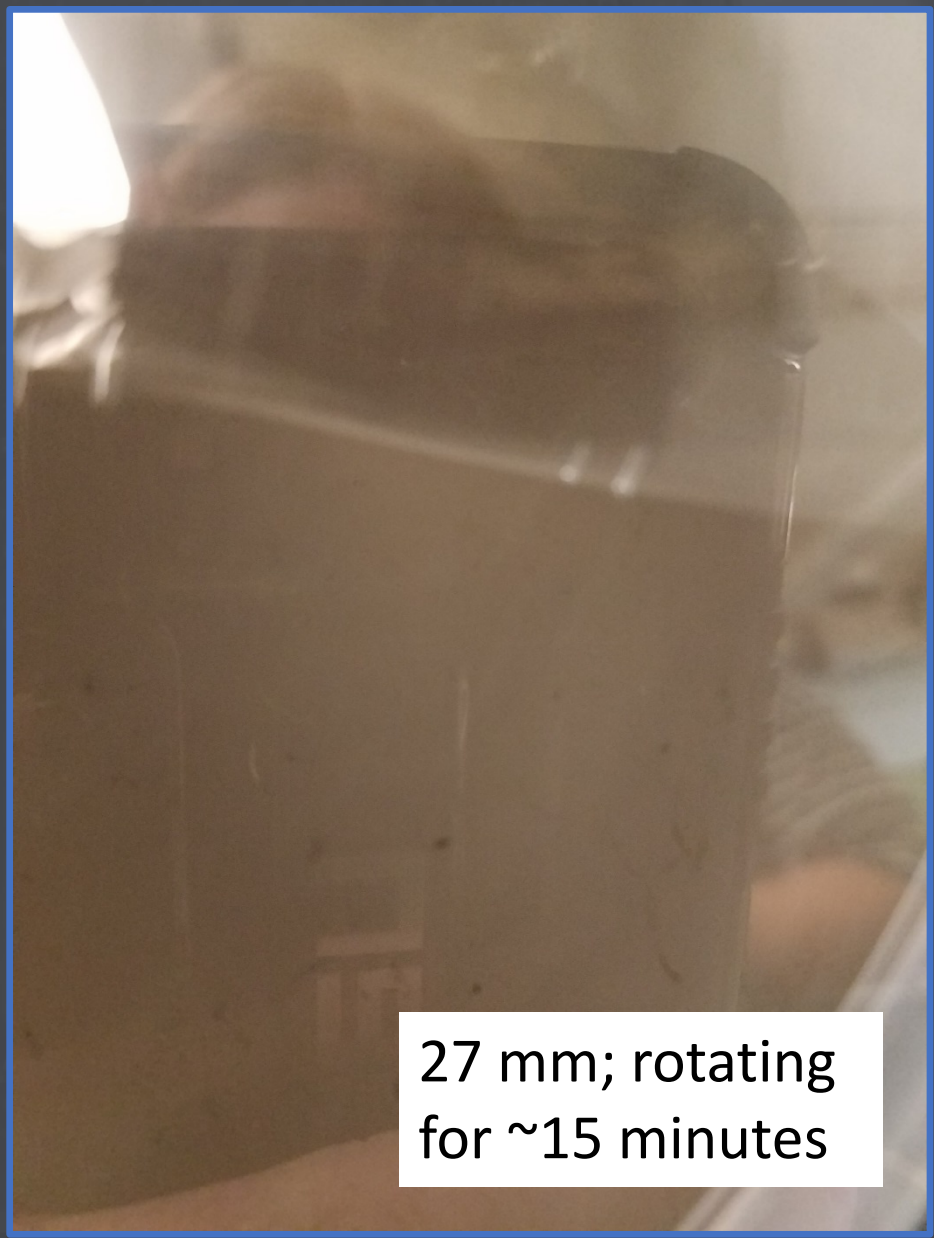
Medium Setting;
Half done…



Medium Setting;
Boy, are we done!

Water Cloudiness (AW27mm/15min)



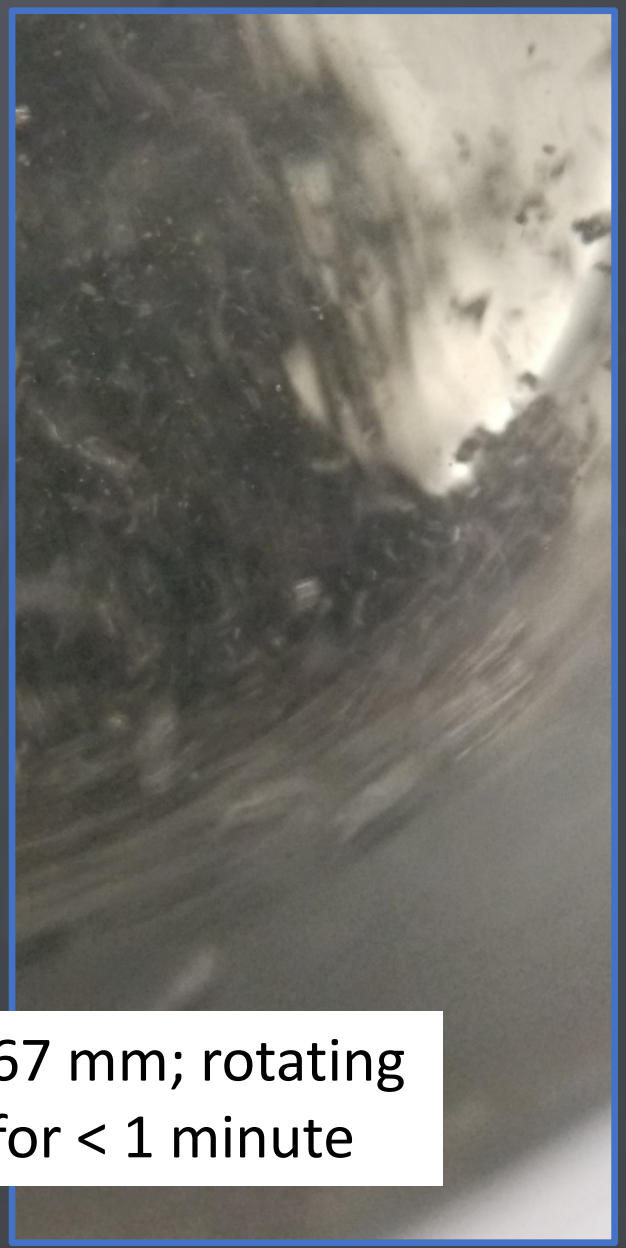


Water Cloudiness (AW27mm/10min)

27 mm; rotating for ~ 3 minutes

27 mm; rotating for ~10 minutes

Water Cloudiness (AW67mm/15min)



67 mm; rotating for < 1 minute

67 mm; rotating for ~15 minutes

KDOT: Aggregate washer observations

- Rotates faster than needed for Gmm. Personally believe the device could rotate at half the current number of revolutions. This could also reduce the potential of damaging HMA sample (cloudiness).

- Will need to either split the larger HMA mix sizes or make available two container sizes (larger container for 19mm or larger)

- Possible weak point is the center seal.

KDOT: Aggregate washer observations

- Need to continue pursuing the possibility of reducing the vacuum and time to help minimize damaging HMA sample.

- It does permit you to observe the sample during the test!

AASHTO T 209 (16):

Table 2—Precision Estimates

Test and Type Index	Standard Deviation (1s)	Acceptable Range of Two Results (d2s)
Test results obtained without use of Section 15		
Method A[a]		
Single-operator precision	0.0051	0.014
Multilaboratory precision	0.0084	0.024
Method B[b]		
Single-operator precision	0.0064	0.018
Multilaboratory precision	0.0103	0.029

[a] Basis of estimate: 1 replicate, 1 material, 344 laboratories.

[b] Basis of estimate: 1 replicate, 1 material, 134 laboratories.

More Research Needed!

THANK YOU!

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