

WAQTC EXECUTIVE COMMITTEE

**Executive Committee Meeting
Spring Meeting
Teleconference
April 3, 2012**

Meeting called by:	Matt Strizich, MDT	
Facilitator:	Desna Bergold; DB Consulting	
Committee Members:	Garth Newman, ITD	Absent:
	Scott Andrus, UDOT	Richard Duval, CFLHD
	Mike San Angelo, AKDOT & PF	Bryce Simons, NMDOT
	Howe Crockett, WFLHD	Mike Santi, ITD
	Cole Mullis, ODOT	
	Jim Zufall, CDOT	
	Tom Baker, WsDOT	

Agenda Items/Objectives

Pooled fund update	From November Teleconference
Strategic Plan update: See draft proposal	From teleconference – continuous spring agenda item
Website update	Mike San Angelo
Contract	
Billing	
Process for revisions	
T 99 / T 180 mold volume – QAC members did not reach consensus on mold factor vs. mold volume: see white papers	QAC
Use of TM 11	QAC meeting
AASHTO revisions, sent for prior review	T 23 comments from Bryce
TP 68 – needs to become a standard	Garth
T 312 and others– do not have dual units, is this something AASHTO should address	Garth
TM 8 will not be proposed as a TP this year	Garth
Advanced notification of meetings for travel arrangement	Howe
Meeting at AASHTO SOM	

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ISSUE	DISCUSSION / DECISION	ACTION REQUIRED BY:
	<p>New member from ITD, Mike Santi could not make it due to the short notice. Garth Newman, ITD confirmed his (Garth's) role will remain the same.</p>	
Pooled Fund Update	<p>Scott Andrus, UDOT, reports that the pooled fund is set up and ready to go until 2016. The current balance is \$199,165.</p> <p>Mike San Angelo, AkDOT, says that at one time Alaska had set aside some funds in their budget to contribute to WAQTC and may be able to contribute those funds at this time. Mike asked for help in transferring the fund.</p> <p><i>Scott will help Mike transfer these funds.</i></p> <p>Discussion of yearly commitment. Agreed there should be a commitment from each state. During the Spring meeting 2011 it was decided what the commitment should be (from the minutes).</p> <p><i>Yearly commitment per state: \$10,000 per year for 5 years.</i></p> <p>Scott asks who is still participating. Hawaii may no longer participate. Texas donated an initial lump sum and there may not be any more participation from them.</p> <p><i>Matt Strizich, Chair, will contact both states.</i></p> <p>Matt asks if anyone contacted North Dakota and Wyoming when WAQTC was formed, originally they were not interested. Tom Baker, WSDOT thinks that it may be worthwhile to send a letter to see if there is any interest in other states.</p> <p><i>Matt will write a letter to the Western states to determine if there is interest in WAQTC.</i></p> <p>WASHTO – other groups are meeting. Start sending emails and try to get something going for next spring.</p> <p>To get the funding going for the pooled fund a 'solicitation' will need to be sent to member states.</p> <p><i>Scott will send 'solicitation' for the pooled fund.</i></p>	<p>Mike San Angelo and Scott Andrus</p> <p>All states</p> <p>Matt Strizich</p> <p>Matt Strizich</p> <p>Scott Andrus</p>

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ISSUE	DISCUSSION / DECISION	ACTION REQUIRED BY:
Advanced notification of meetings for travel arrangements – AASHTO SOM	<p>Notices for travel need to go out sooner so that participants can reserve travel. Need to have a (tentative) date and draft agenda months in advance. Date should be certain at least 90 days in advance for AkDOT. Should set a definite date 120 days minimum in advance for maximum participation to minimize scheduling conflicts.</p> <p><i>Send travel invitations and draft agendas a minimum of 90 days in advance.</i></p> <p>There will be an Executive Committee meeting at AASHTO SOM – plan to hold a meeting before the ‘Social Hour’ and plan around whatever other meetings may come up.</p> <p><i>Plan to attend a meeting before the social hour on 8/5/12 at AASHTO SOM.</i></p> <p>Would federal land people be interested in attending? Garth has talked to a few that may be interested; Howe offered to help get some interest.</p> <p><i>Garth will see if anyone from federal lands is interested in attending.</i></p>	<p>Matt and Desna</p> <p>Everyone</p> <p>Garth Newman</p>
Draft Strategic Plan	<p>The draft strategic plan was reviewed and there was some concern with removing completed items. It was recommended that an appendix be added to each year’s strategic plan with previous year’s accomplishments and archive earlier plans. Desna will draft the appendix with accomplishments by Mon. Each Executive Committee member will meet with their state’s groups. Then they will email out new items for discussion. At that time determine if a call is necessary or if it’s time for final draft and voting. Try to have final version ready to vote on no later than the SOM meeting.</p> <p><i>Desna will send out new draft of Strategic plan. EC will respond with comments and new goals to Desna by April.</i></p> <p>Under long term goals is ‘Develop WAQTC equipment calibration standards’ – Bob Briggs, WSDOT, was going to work on this – is there anything new?</p> <p><i>Tom Baker will check with Bob and get an update.</i></p> <p>The newsletter effort has stalled because it was assigned to Jeff Miles who is no longer the ITD representative. A subcommittee needs to be assigned to move this item forward.</p>	<p>Desna Bergold</p> <p>Tom Baker</p>

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	<p>The newsletter would be a good tool to begin discussions with WASHTO and could be used as a WAQTC selling point.</p> <p>There was a discussion of how to distribute when it is produced. It should be posted on the website and distributed to the western states as well as members.</p> <p>Need to determine format, details, and content.</p> <p><i>Matt will start working on this; he will solicit help from the EC and QAC. Target for first one in October.</i></p> <p><i>This will be added as a short term goal in Strategic Plan.</i></p>	<p>Matt Strizich</p> <p>Desna Bergold</p>
Website	<p>Mike San Angelo reported on progress with the new Website. Things have been going slow but steady. Website is transferred to its new 'location.' He thanks everyone for their input to ensure everything has made the transfer. Everything has not been posted yet; some details are still being ironed out.</p> <p>Trying to determine how to 'contract' with the group to allow consultant input. The funds will be transferred to pooled fund and the consultant can work with the group for changes.</p> <p>At this time all the work is being covered by Mike's budget. At some point soon the pooled fund will have to start paying for the hosting through the pooled fund.</p> <p>There are still some decisions to be made about the functionality and future options when things get to that point. There was a discussion of the potential uses of an enhanced webpage from a Q&A blog to auto notification of procedure updates. Potential to effectively reach many participants for minimal cost.</p> <p>Howe brought up that there are some things at the bottom of the original page that is still missing. Mike will look into this and let Howe know.</p> <p>Matt asked for approval of the expenditures. 0 Nays.</p> <p><i>When Mike approves the website it will be time to work through the pooled fund to pay for the website hosting and other work that the website requires.</i></p>	<p>Mike San Angelo</p> <p>Scott Andrus</p>
T 99 / T 180 mold volume	<p>Garth summarized the history of discussions regarding many of the potential changes to T 99, T 180, T 224, and T 272. He began to prepare a</p>	

ISSUE	DISCUSSION / <i>DECISION</i>	ACTION REQUIRED BY:
	<p>'white paper' to present to the AASHTO working group to explain the proposed revisions to these test methods. While presenting the paper to the QAC the discussion raised an issue that needed to be put to the Executive Committee.</p> <p>The issue is whether or not to exclude use of the 'mold factor' and propose only allowing use of the 'measured mold volume' when calculating the density of material in the mold when performing T 99 and T 180. QAC members from MDT, WSDOT, and UDOT felt that the 'mold factor' should remain as an option. These members prepared a 'rebuttal' to the proposition. Both are attached.</p> <p>WSDOT and UDOT feel that the accuracy was not worth the potential issues that may arise from the change. MDT would have a problem with their state wide spreadsheet and programs.</p> <p>Cole Mullis, ODOT, says that they tried to eliminate the mold factor option and found that there was not that much of a discrepancy between the two methods and that using the mold volume was somewhat difficult for the average technician.</p> <p>Garth made the point that the volumes are being determined if the agency is following R 18 and ASTM test methods do not allow a mold factor. In fact some agencies are not allowing molds out of tolerance.</p> <p>There is a double standard in the procedure: if a mold is out of the initial tolerance the mold factor cannot be used and the measured mold volume must be used.</p> <p>The question is asked: Is the accuracy worth the extra effort? The amount of extra effort is arguable as the volumes must be determined anyway.</p> <p>Mike points out that WAQTC proposes test method revisions and fine tuning in an attempt to advance the technology. Perhaps refuse to move forward is inconsistent with this philosophy.</p> <p>Cole feels that the curve generation is also a point of discrepancy.</p> <p>Mike points out the philosophy should remain consistent. We should do the very best we can with the data generation even though admittedly there is some wiggle room in drawing the curve.</p> <p>Matt notes that MDT will have issues with their program if this change is approved.</p>	

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	<p>Tom asked if quality is being compromised with the way the procedure stands or not.</p> <p>Response is that by removing every possible error in a procedure it lowers the ‘accrued’ error.</p> <p>Matt struggles with this issue because he felt that making it more accurate is what we should be trying to do, but there is the possibility of many technicians compounding the error during the transition.</p> <p>Matt leans towards leaving the procedures as they are.</p> <p>When there isn’t a consensus the issue goes to a vote and the majority decides the next step. Matt asks: Does WAQTC want to take anything to AASHTO that there isn’t a consensus on?</p> <p>Tom pointed out that it would be worthwhile to send the revision to AASHTO and see what the rest of the country thinks.</p> <p style="text-align: center;"><i>Move forward with presenting Garth’s ‘white paper’ and revisions to the AASHTO working group (TS 1b).</i></p> <p>Garth reviewed the other points made in the in the ‘white paper’.</p> <p>The QAC had not decided to propose T 272 as an annex along with T 224. This group feels it could be an Annex. Tom says that T 272 and T 224 should be added as annexes and sent out to ballot.</p> <p style="text-align: center;"><i>Garth will prepare 99 and T 180 with both annexes.</i></p>	<p>Garth Newman</p>
<p>Use of TM 11</p>	<p>Many of WAQTC member states do not use the Test Method.</p> <p>Tom asks if the proposal is to take this to the SOM. It wasn’t the intent today but eventually when the member states are happy with it.</p> <p>Scott asks if the intent is to introduce this as an AASHTO standard. Yes, that is always the intent. Tom says that since every state obtains cores of HMA for one reason or another WAQTC should send the Test Method to the tech section. The name needs to be changed to ‘SAMPLING HMA AFTER COMPACTION.’</p> <p>Desna will incorporate ODOT and WsDOT changes into TP –XX. Desna will work up AASHTO format and solicit comments from other states after AASHTO formatting. Request quick turnaround.</p>	<p>Executive Committee</p>

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ISSUE	DISCUSSION / DECISION	ACTION REQUIRED BY:
	<i>Desna will try to get it ready for last week in April and submit it to Tom.</i>	Desna Bergold
TP 68	<p>Density of In-Place Hot Mix Asphalt (HMA) Pavement by Electronic Surface Contact Devices</p> <p>Idaho would like to see it become a standard and would like to solicit WAQTC's support in the proposal.</p> <p>Tom informed the group that this was balloted last year; this test procedure is now it is now T 343.</p> <p><i>This is done.</i></p>	
T 312 and others	<p>Question for Tom: What is AASHTO doing about the test methods that have the units in metric only?</p> <p>Tom proposes that the AASHTO technical writer add US parenthetically to all standards that have metric only. A letter should be written on behalf of the WAQTC states that request all procedures that do not have both be addressed.</p> <p><i>Garth will write to the SOM AASHTO liaison, Greta Smith, for the Executive Chair.</i></p>	Garth Newman
TM 8	<p>QAC has not been able to come to consensus on this procedure. This will not be proposed as a TP this year.</p> <p>Cole would like the QAC to look at a more statistically sound method for determining outliers. Cole will provide a recommendation.</p> <p><i>This will be on QAC agenda for the next AASHTO revision meeting.</i></p>	<p>Cole Mullis</p> <p>QAC</p>
T 22	<p>Cole brought up that ASTM has requirements for technician qualifications and suggested that T 22 should have the same requirements. After reviewing the QAC minutes it was pointed out that the QAC determined that this requirement was covered sufficiently by R 18. The QAC also felt that by starting to put this requirement in test methods would imply that it needed to be all the methods.</p> <p>The change that was proposed by the QAC, a perpendicularity conversion for 4 X 8" cylinders, is acceptable to all the members.</p> <p>Cole brought up that ASTM has different diagrams. The QAC also</p>	

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	<p>reviewed this proposal and determined that two of the ASTM breaks were not complete breaks and that one of the break types in AASHTO is not in ASTM. Cole felt that the descriptions in ASTM of the break types were helpful. The QAC will look at adding descriptions of the break types to T 22.</p> <p><i>This will be on the QAC agenda for the next training materials meeting.</i></p>	QAC
T 23	<p>First change, making the requirements for the vibrator consistent in the conversion, is approved.</p> <p>Second change, sieving out material retained on the 1 ½” sieve instead of the 2”, is rejected because the procedure states that the mold diameter needs to be at least 3 times the maximum aggregate size and this is consistent with the use of a 6 X12” mold. The group felt that contradicting this statement was not appropriate.</p> <p>The third change, allowing concrete with a 1” slump to be consolidated by rodding as well as vibrating was discussed. Bryce Simon’s concern that it is difficult to consolidate 1” slump concrete was acknowledged. Although it was felt that this affects very few situations as concrete with a measured slump of 1 ¼” could already be consolidated by rodding. Also there is a proposed note stating ‘Unless allowed by specification, the method of consolidation shall be the same as used for T 121 or T 152 or both.’</p> <p>This change is approved, this will make it will be consistent with other test methods and ASTM.</p> <p><i>T 23 will be sent to the TS with the first and third changes.</i></p> <p><i>Champion – Scott Andrus</i></p>	Scott Andrus
T 84 and T 85	<p>The changes made to address the inconsistent use of the ‘approximately 15-hours’ are approved and should be considered editorial in both procedures.</p> <p>In T 85 one change was proposed to address the action taken if the sample is dried past SSD. Language and time frames were taken from T 85. Desna will note this on the proposed procedure. This change is not editorial. This is approved.</p> <p>Cole will send them to the TS chair if he cannot make it to the AASHTO SOM meeting perhaps Mike will champion.</p>	Desna Bergold

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ISSUE	DISCUSSION / DECISION	ACTION REQUIRED BY:
	<i>T 84 and T 85 will be sent to the TS for ballot. – Cole Mullis and Mike San Angelo</i>	Cole Mullis and Mike San Angelo
T 119	This change, penetrating 1' into underlying layers on the second and third lifts, matches ASTM. Approved <i>T 119 will be sent to the TS for ballot – Scott Andrus</i>	Scott Andrus
T 152	The method now states that if the material contains aggregate retained on the 2" sieve it is screened over a 1½" sieve. This appears inconsistent. The change to screening concrete with material retained on the 1½" to be screened on the 1½" sieve will make it consistent with what is required for the slump test. Approved <i>T 152 will be sent to the TS for ballot – Scott Andrus will Champion, perhaps Bryce Simons will help Champion</i>	Scott Andrus
T 166	Garth asked Tom if the change is editorial. ($\pm 2^\circ$ instead of $\pm 1.8^\circ$). <i>Get the opinion of the Tech Section to determine if it is editorial.</i>	Mike San Angelo
T 231	This replaces a poor statement about cap thickness with a reference to the Table. Approved <i>T 231 will be sent to the TS for ballot – Bryce Simons</i>	Bryce Simons
T 312	Address the 'mold in use' tolerances (in-service inside diameter tolerance to 150.20) and the use of the method on plant produced material in the field. Approved <i>T 231 will be sent to the TS for ballot – Mike San Angelo</i>	Mike San Angelo
T 329	Constant mass changes. Garth asked Tom if the change is editorial. It may need to be taken to tech section for balloting. Tom will introduce the proposed language. <i>Get the opinion of the Tech Section to determine if it is editorial.</i>	Tom Baker Cole Mullis

ISSUE	DISCUSSION / <i>DECISION</i>	ACTION REQUIRED BY:
	<i>Cole will champion if necessary.</i>	
T 335	Are these changes editorial? – <i>Matt will call Scott Seiter to determine if he can make this change editorial.</i>	Matt Strizich
Other items	Garth thanked the Executive Committee for supporting the QAC and each state’s methods.	
QAC meeting	Next QAC meeting will be held in Portland. Get out basic agenda and dates for invitation.	Desna Bergold

WAQTC QAC REVIEW

OF

AASHTO T 99, T 180, T 224 & T 272

Prepared by Garth Newman, ITD

Background:

AASHTO T99 was developed early in the 20th century as a way of measuring the maximum dry density of a soil. This method allows construction personnel to determine compaction of disturbed soils whether at the surface of a cut or anywhere in a fill section, by providing a maximum density and optimum moisture standard. As construction and post-construction equipment and transport vehicles became larger, the standard (T 99) was modified. AASHTO T 180 was developed in mid-century as construction equipment became larger, applying greater forces during the soils compaction process and after construction. Development of this new standard gave DOTs the ability to increase field density/compaction, limiting settlement due to increased loadings during and after construction.

A Maximum Dry Density / Optimum Moisture Content curve is unique to each soil type and or combination of soils types. T 99 and T 180 allows the tester to use either -#4 material, for Methods A & B, or -3/4" material, for Methods C & D, when developing such a curve. However, when "oversized particles" exist in a sample obtained during pre-construction or construction activities, these particles must be considered as part of the tested sample and they will affect the maximum dry density and optimum moisture content. For the last 70 years or so, two options have existed for re-incorporating these oversized particles into the test sample. One is the introduction of more coarse material equal to the percent retained on the scalp sieve; this is known as the replacement process. The second option involves developing a maximum density curve on the fine material then mathematically adjusting that maximum dry density for the percent retained on the scalp sieve. Both of these processes: replacement and calculation increase the specific gravity and reduce the surface area of the tested sample, thus increasing the maximum dry density and decreasing the optimum moisture content. In both cases the final answers, expressed as dry density and moisture content, have been adjusted so that they represent the material that was initially sampled. In the initial publications of T 99 and T 180 the replacement process was the preferred operation. In 1997 the replacement process was removed from both T 99 and T 180. T 224, the method for mathematical calculation, was added by reference.

The molds used in T 99 and T 180 have both tolerances and limits. For molds within the tolerance, the test method formerly required, but now allows, multiplying the wet soil mass by a factor, 30 for the 4" mold or 13.33 for the 6" mold. All molds which are outside the tolerance but inside the limits are required to be calibrated to an exact volume. The use of a multiplication factor as opposed to the division of the wet mass by a volume goes back to the use of slide rules and the ease of multiplying compared to dividing.

Example: T 99, 4" mold. The volume of this mold has an allowable tolerance of 0.0330 to 0.0336 ft³.

At the extremes of that tolerance, a sample with a mass of 4.00 lbs will have a wet unit mass from 121.2 lbs/ft³ to 119.1 lbs/ft³

When using the allowed factor of 30 because the mold is within the tolerance, there is a possibility of an immediate sample error of ± 1.1 lbs. To put this into perspective, this is an error of one-half the single operator repeatability.

AASHTO T 272 must be included in this discussion as it represents a single point on a T 99 Moisture Density curve or T 180 Moisture Density curve and addresses the use of a family of curves.

Revisions:

Recommended changes to AASHTO T 99, T 180, T 224, and T 272.

- 1) Any time a material has oversized particles another AASHTO method, T 224, must be performed to complete the process of determining Maximum Dry Density and Optimum Moisture. The reason is that the replacement process was removed in 1997. T 224 was inserted with minimal reference in the "Sample" area of each method (A, B, C, & D) but does not contain specific direction on implementing T 224. T 224 in its present form is not linked well with T 99, T 180, or T 272.

Recommended revision:

Delete AASHTO T 224 and move it into AASHTO T 99 and T 180 as an annex.

- 2) Currently T 99 and T 180 allow use of molds which are within tolerances or limits. The volume of a new mold must be determined to verify whether the mold is within the tolerances or limits. Each laboratory's Quality Management System equipment review requires the volume to be determined yearly, as per R18, again to confirm whether the mold is within tolerance, limits, or must be discarded. Molds outside tolerance but within limits require exact volumes when used as part of the existing test methods.

Many agencies are using consultant services to perform testing. In addition, T 99 curves are being developed at many different times, both in pre- construction and during construction. This creates opportunities for different molds to be used in the development of the initial moisture /density curves (T 99 or T 180) and significantly different molds for field use when performing T 272. This practice introduces a variable, a possible 1.1 lb error, which can be eliminated. With AMRL round robin proficiency samples molds should be calibrated, reducing the probability of testing variability. The use and development of a family of curves, T 272, could be hindered with this possible error.

As the volume must be determined and use of the measured volume in calculations would increase accuracy it seems reasonable to require its use.

Recommended revisions:

- All molds will be required to be calibrated to an exact volume. This follows ASTM D698 reducing testing variability.
 - Molds shall have the same required dimensional standards as ASTM D698. This creates uniformity in the manufacturing of the molds.
- 3)** AMRL round robin samples are required to be reported to 0.1lbs/ft³ and 0.1 percent moisture which is to a different standard than the test method requires. The Precision Statement requirements are to 0.1lbs/ft³.

Recommended revision:

Calculate and report density to 1 kg/m³ (0.1 lb/ft³) and optimum moisture content to 0.1 percent for all tests.

- 4)** AASHTO T 272 has a direct relationship to T 99 and T 180.

Recommended revisions:

Any applicable revisions to T 99 and T 180 must also be made to T 272.

This method also needs a good clean up. Either the sections should be referenced to T 99 in all cases where they overlap, or the method needs to be totally separated from T 99.

- 5)** Ensure that any revisions to these methods which affect T 310 are incorporated into T 310.

Rebuttal of Proposed Change to AASHTO T 99, T 180, T 224 & T 272

Prepared by Misty Miner, MDT and Linda Hughes, WSDOT

Background:

At the January 2011 QAC Meeting in Henderson, Nevada the committee was asked by Jeff Miles to review a request from Larry Lockett

Task force 10-03 for T 99, T 180, and T 272 – “charged with reviewing, updating the tolerance of the molds and how it affects T 272. Also charged with adding verbiage to the text of T 99 and T 180 related to scalped material and how T 224 should be utilized perhaps in the calculation section.” Jeff Miles assigned the QAC to work up a rough draft of changes.

One issue that was discussed was the requirement of using the mold factor instead of the mold volume. This was not acceptable to the group because many used the mold volume. It was agreed that the mold volume is the more accurate of the two measures and should not be replaced with a less accurate measure.

During the Reno, Nevada meeting in January of 2012 Garth Newman, ITD, introduced a revised T 99, T 180 for review. Misty Miner, MDT, requested that the mold factor not be eliminated due to Montana’s use of this method and the cost of changing their computer program to comply with this change. During the discussion Linda Hughes, WSDOT, and Wendy Tripp, UDOT, recommended that both methods remain in the procedure.

It was decided that each viewpoint be submitted, in the form of a white paper, to the WAQTC Executive Committee at their spring meeting. This will allow the Executive Committee to decide how to proceed.

Discussion of Revision:

Revisions:

- 6) Currently T 99 and T 180 allow use of molds which are within tolerances and limits. Many agencies are using consultant services to perform testing. In addition, T 99 curves are being developed at many different times, both in pre-construction and during construction. This creates opportunities for different molds to be used in the development of the initial moisture/density curves (T 99 or T 180) and significantly different molds for field use when performing T 272. This practice introduces a variable, a possible 1.1 lb/ft³ error, which can be eliminated. With AMRL round robin proficiency samples molds should be calibrated, reducing the probability of testing variability. The use and development of a family of curves, T 272, could be hindered with this possible error.

Recommended revisions:

- All molds will be required to be calibrated to an exact volume. This follows ASTM D 698 reducing testing variability.

Reason for not making revision:

While it is agreed that a difference of approximately 2 lbs/ft³ can be identified mathematically by comparing the results of using a mold that meets the low end of the volume tolerance with one that meets the high end of the tolerance allowed by AASHTO T 99, it is not agreed that this error has a great impact on the final product which is the satisfactory compaction of the soil.

Using the same data but different mold volumes the optimum moisture and maximum dry density were calculated:

Mold Volume (ft ³)	Maximum Dry Density (lb/ft ³)	Optimum Moisture Percent	Assumed gauge average reading (lb/ft ³)	Percent compaction (No oversize)
0.0330	120.9	14.1	113.9	94.2
0.0333	119.8	14.1	113.9	95.1
0.0336	118.7	14.1	113.9	96.0

If the mold factor of 0.0333 is used the furthest apart the actual volume should be is 1.1 lb/ft³ from either extreme which is in the 4.5 lbs/ft³ for precision of two operators. For the out of tolerance mold using the same data the Maximum Dry density is approximately 118.2 lbs/ft³ a 1.6 lbs/ft³ difference from the 0.0333 ft³. This equates to a 1.3% higher density when compared to the curve built using a 0.0333 ft³ mold.

After looking at the data, there does not seem to be a significant reason to eliminate the mold factor when there are so many other variables (moisture calculation, specific gravity) that have more influence on the results of the test.

A user performing the T 99 or T 180 would use the same mold in compacting all points during the test there by eliminating the error variation of less than 1.0 lb/ft³ another point is on accuracy versus precision of taking a density by a density to determine a percentage with the variation still less than 1% the extreme is 0.7%.