TEST METHOD **WA 705.1 – 2013**

PREPARATION OF ASPHALT FOR TESTING

1 SCOPE

This method describes procedures for the preparation of loose asphalt or asphalt core or slab specimens for various tests.

2 SAFETY

This method does not attempt to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this method to establish appropriate occupational health and safety practices that meet statutory regulations.

3 REFERENCED DOCUMENTS

The following documents are referenced in this method:

WA 701.1	Sampling Procedures for Asphalt
WA 731.1	Stability and Flow of Asphalt : Marshall Method
WA 733.2	Bulk Density and Void Content of Asphalt – Vacuum Sealing Method
AS 2891.1.1	Sampling of Loose Asphalt
AS 2891.2.2	Compaction of Asphalt Test Specimens Using a Gyratory Compactor
AS 2891.5	Determination of Stability and Flow : Marshall Method

4 DEFINITIONS

a) A **test sample** is the material for examination and/or testing and may be derived from a bulk sample, by sample division or may consist of a single sample increment.

b) A **test portion** is the material derived from a bulk sample or test sample by sample division.

c) A **bulk sample** is produced by taking a set of sample increments of approximately equal quantities from a lot or section and thoroughly mixed to provide a single uniform sample. A bulk sample may be reduced by sample division.

d) **Constant mass** is defined to be achieved when individual weighings, at intervals of no less than four hours (unless otherwise stated), have a difference between successive determinations of the mass not exceeding 0.1 percent of the previous mass of the core specimen or test portion.

e) **Reheating** – any addition of heat to the sample after the initial batching of the asphalt at the plant.

f) **Heating cycle** – the process of heating an asphalt sample from a cool state to a specified temperature and then returning the sample to a cooled state.

g) **Sample division** is the process whereby a bulk sample is reduced to one or a number of small representative portions. The two main sample division techniques are quartering and riffling.

5 APPARATUS

a) Thermostatically controlled **drying oven** with mechanically forced air circulation capable of maintaining temperature within the range of 105°C to 110°C and 145°C to 155°C, and a **heating oven** capable of maintaining temperature within the range 100°C to 200°C.

b) Digital PT100 **thermometer** probes readable to 0.1°C and capable of handling temperatures up to 200°C without damage to the probe or lead.

c) **Circular saw** with an appropriate diamond tip cutting blade for asphalt and capable of wet cutting.

d) An appropriate size **vacuum desiccator** capable of maintaining a vacuum of not less than -90 kPa for a period of not less than four hours. The vacuum desiccator shall contain indicator silica gel to absorb moisture. A **Pressure gauge** or **Manometer** with a range of ±120 kPa to verify the vacuum within the desiccator. Guidance on the set up and use of a vacuum desiccator is available in Appendix A.

NOTES

i. There is potential for an implosion with the reduction of atmospheric pressure within the vacuum desiccator. A protective shield that covers the entire desiccator is recommended to protect from an implosion when the vacuum is applied.

ii. A minimum of 500 grams of silica gel dispersed throughout the desiccator has been found to be suitable.

e) A **vacuum pump** capable of evacuating air from the vacuum desiccator to a pressure of not less than -90 kPa within ten minutes of the commencement of evacuation.

f) **Steel rule** or **vernier callipers** with markings to the nearest 1mm.

g) **Trays, dishes** and **scoops** as appropriate.

h) **Balance** readable to at least 0.01 g having a Limit of Performance (F) of not more than 0.05 g.

i) **Fan** to move air across core specimens.

j) A **rack** made of wire for drying of core specimens. The rack shall be flat and have gaps of 5mm or greater between the wires.

Note: A laboratory or domestic oven shelf has been found to be suitable for this purpose.

k) **Cling wrap** to seal core specimens for moisture content testing.

l) **Cold chisel** or **brick bolster** for separating core specimens into layers.

6 PROCEDURE

6.1 PREPARATION OF LOOSE MIX FOR TESTING

6.1.1 Hot Plant Mix or Laboratory Mix

This procedure is applicable to hot, freshly made plant or laboratory mix and is not applicable to samples of asphalt that have been cooled to ambient conditions and stored before testing.

a) Prepare test portions in accordance with AS 2891.1.1.

6.1.2 Reheated Plant Mix

This procedure describes the process of heating samples of asphalt that have been cooled to ambient conditions and stored before testing.

a) Retrieve the bulk sample for testing, complying with the requirements of WA 701.1 as necessary. Where there are multiple containers comprising the bulk sample then all containers shall be heated.

Note: Where a bulk sample has been mixed and divided prior to the asphalt being placed into containers then individual containers may be heated.

b) Preheat the oven to a temperature applicable to the requirements of the relevant test methods. The maximum oven temperature shall be 160°C.

c) Loosen the lids from the sample containers and place the sample containers in the pre-heated oven. Samples shall not be left in the pre-heated oven for periods longer than those shown in Table 1.

TABLE 1

Sample Location	Time Limit
Loose Mix in Sample Containers or Mixing Bowl or Tray	Reheating not to exceed 3 Hours in Total
Mix in Marshall or Gyratory compactor mould	Maximum of 1 hour after the mix has been placed in the mould.

d) Transfer the sample from its sample container(s) into a mixing bowl or tray when the sample has warmed.

e) Mix the bulk sample and prepare test portions in accordance with AS 2891.1.1. Specimens to be compacted in the laboratory in accordance with WA 731.1, AS 2891.2.2 or AS 2891.5 shall not be heated to temperatures in excess of those specified in Procedure 6.1.2 (b) or 6.1.2(f). This shall be verified by placing a thermometer into the centre of each compaction mould. Asphalt in a compaction mould shall not remain in the oven for a period longer than that shown in Table 1.

f) When reheating a sample for a second time repeat Procedures 6.1.2 (a) to 6.1.2 (e) except the maximum oven temperature shall be 155°C.

6.1.3 Coldmixed Asphalt

a) Prepare test portions in accordance with AS 2891.1.1.

b) Dry test portions for bitumen content and particle size distribution (PSD) to constant mass in an oven set at 105°C - 110°C.

6.2 PREPARATION OF CORES FOR TESTING

Procedure 6.2.1 to 6.2.4 describes the process for preparing a core specimen for properties such as bulk density, resilient modulus or permeability.

Procedure 6.2.5 describes the process to be followed when preparing test portions from core specimens to determine, amongst other properties, bitumen content and PSD or maximum density.

Procedure 6.2.6 describes the process for preparing a core specimen for determining moisture content.

6.2.1 Thickness

This procedure is applicable to core specimens for determination of bulk density but can be used to measure the thickness of other core specimens.

a) Support the core on its edge under good lighting conditions and identify the upper and lower interface of each layer of asphalt.

b) Using a steel rule or a vernier calliper, measure the thickness of each layer to the nearest 1 mm at four approximately evenly spaced locations around the circumference of the core specimen.

c) Determine the average of the four measurements and record the mean thickness to the nearest 1 mm.

6.2.2 Trimming Cores

Core specimens shall be cut to isolate the layer(s) of asphalt to be tested. In doing so the maximum thickness of the layer being tested shall be retained in the prepared core specimen with any seal coat or layer(s) not required for testing to be removed from the core specimen.

a) Cut the core specimen using a circular saw with water in one cutting action to produce a smooth face in a single plane.

b) Remove all loose material off the core specimen.

6.2.3 Drying of Cores – Vacuum Drying Method

This method is applicable to all types of asphalt other than that specified for the air drying method in Procedure 6.2.4. Guidance on the vacuum drying method is available in Appendix A.

a) Clean the core specimen to remove dust, mud or other detritus.

b) Check that the indicator silica gel is dry (indicated by colour status i.e. bright). If not, dry the indicator silica gel in an oven not exceeding 105°C - 110°C. If the indicator silica gel does not clearly show its status after oven drying it shall be discarded and replaced with fresh indicator silica gel.

c) Check the vacuum desiccator for any damage prior to use.

d) Determine and record the mass of the core specimen to the nearest 0.01 g and place the core specimen in a vacuum desiccator.

e) Seal the vacuum desiccator and attach the vacuum pump and cover with a protective shield.

f) Apply a vacuum of not less than -90 kPa. Maintain this vacuum during a drying period of at least four hours.

g) Verify that the vacuum after the drying period is still not less than -90 kPa. If the vacuum has not been maintained repeat the test from Procedure 6.2.3 (e).

h) Return the vacuum desiccator to ambient pressure and remove the core specimen.

i) Determine and record the mass of the core specimen to the nearest 0.01 g.

j) Repeat Procedure 6.2.3 (b) to 6.2.3 (i) until constant mass has been achieved.

6.2.4 Drying of Cores – Air Drying Method

This method is **ONLY** applicable to dense graded asphalt with a nominal size of 20mm or greater placed at a compacted thickness of 60mm and greater. Procedure 6.2.4 must not be used for the drying of other types or sizes of asphalt.

a) Clean the core specimen to remove dust, mud or other detritus.

b) Determine and record the mass of the core specimen to the nearest 0.01 g.

c) Place a wire rack at a height of at least 25mm above the bench surface. Place the core specimen on the rack with its cut or lowest surface facing downwards. Ensure that an air space is left between all core specimens.

d) Dry the core specimen at a temperature of 25 ± 5°C for a period of 14 to 20 hours. A fan shall be used to blow air across the drying area.

e) Determine and record the mass of the core specimen to the nearest 0.01 g.

f) Place the core specimen on the rack on its opposite face to that of the previous drying period.

g) Dry the core specimen at a temperature of 25 ± 5°C for a period of at least 4 hours. A fan shall be used to blow air across the drying area.

h) Determine and record the mass of the core specimen to the nearest 0.01 g.

i) Repeat Procedure 6.2.4 (f) to 6.2.4 (h) until constant mass has been achieved.

6.2.5 Preparation of Test Portions for Bitumen Content, Particle Size Distribution (PSD) and Maximum Density

a) Cut the sore specimen, if necessary, in accordance with Procedure 6.2.2.

b) Place the core specimen in an oven at a temperature not greater than 160°C and heat it until the asphalt is soft enough to be broken apart by hand. When preparing the core specimen for a PSD, break off asphalt from the outer cut edges and discard.

c) Continue heating the core specimen and prepare a test portion in accordance with AS 2891.1.1.

d) Dry the test portion, if necessary, to constant mass in an oven at a temperature of 105°C to 110°C.

6.2.6 Preparation of Core Specimens for Moisture Content

Core specimens shall be separated to isolate the layer(s) of asphalt to be tested for moisture content. The maximum thickness of the layer being tested shall be retained in the prepared core specimen with any seal coat or layer(s) not required for testing to be removed from the core specimen.

a) Remove the core specimen from the plastic bag and remove cling wrap from the core specimen. During

preparation the core specimen shall be kept out of direct sunlight.

b) Separate the core specimen using a cold chisel. The core shall not be cut using any form of circular saw or other cutting apparatus.

Note: The process of separating the core specimen shall not generate heat or introduce water in the core specimen.

c) Remove all loose material off the core specimen.

d) Immediately determine the moisture content of the core specimen in accordance with Procedure 7.

6.3 PREPARATION OF SLABS FOR TESTING

This procedure describes the process for preparing test portions for Bitumen Content, PSD and Maximum Density from an asphalt slab.

a) Invert the slab on a tray so that the top surface is face down and place the slab in an oven at a temperature not greater than 160°C and heat it until the asphalt is soft. Remove any adherent seal or asphalt layers using a suitable tool to separate the layers. When preparing the test portion for a PSD break off asphalt from the outer cut edges and discard.

b) Continue heating the slab and prepare a test portion in accordance with AS 2891.1.1.

c) Dry the test portion to constant mass in an oven at a temperature of 105°C to 110°C.

7. MOISTURE CONTENT OF CORE SPECIMENS

(a) Prepare a core specimen in accordance with Procedure 6.2.6.

(b) Determine and record the mass (m_1) of a clean dry container to the nearest 0.01g.

(c) Place the core specimen in the container.

(d) Determine and record the mass (m_2) of the container and core specimen to the nearest 0.01g.

(e) Place the container and core specimen in an oven at 150 ± 5ºC for at least 10 hours.

(f) Remove the container and core specimen from the oven and determine and record the mass of the container and core specimen to the nearest 0.01g.

(g) Repeat Procedures 7(e) to 7(f) at intervals of no less than 4 hours until constant mass has been achieved.

(h) Record the mass (m_3) of the container and core specimen when constant mass has been achieved.

(i) Calculate the moisture content as a percentage of the mass of the dry core specimen using the formula:

$$w = \frac{m_2 - m_3}{m_3 - m_1} \times 100$$

Where:

w = moisture content as a percentage of the dry core specimen mass in grams
m_1 = mass of container in grams
m_2 = mass of container plus wet core specimen in grams
m_3 = mass of container plus dry core specimen in grams

8. REPORTING

a) Report the mean thickness of each core specimen to the nearest 1 mm.

b) Report the moisture content of each individual core specimen to the nearest 0.1 percent.

9. ISSUING AUTHORITY

Document Owner	Delegated Custodian
Manager Materials Engineering	Pavements Manager

10 REVISION STATUS RECORD.

Date	Section	Revision Description / Reference
July 2013	5a and 5l	Requirements for oven, chisel and cling wrap
July 2013	6.2.6	Revision of method for preparing core specimens for moisture content
July 2013	7	New method for determining moisture content of core specimens.
July 2013	8	New reporting requirement for moisture content of a core specimen
Aug 2012	Clause 1 Scope	Now includes core and slab specimens
Aug 2012	Clause 4 Definitions	Added bulk sample and removed test increment
Aug 2012	Clause 5 Apparatus	Added a wire rack and fan for use in air drying of core specimens Added pressure gauge under vacuum desiccator
Aug 2012	6.1.1	Clarified statement of when the procedure is not applicable
Aug 2012	6.2	Reference to 6.2.6 added and reference to 6.2.5 amended
Aug 2012	6.2.1	Procedure only applicable to cores for bulk density testing
Aug 2012	6.2.2	Wording clarified for trimming of core specimens
Aug 2012	Clause 6.2.3 Drying of Cores – Vacuum Drying Method	Scope of vacuum drying method is now applicable to all core specimens other than 20mm Dense Graded asphalt placed at a compacted thickness of 60mm and greater
Aug 2012	Clause 6.2.4 Drying of Cores – Air Drying Method	New method applicable only to the drying of core specimens of 20mm Dense Graded asphalt placed at a compacted thickness of 60mm and greater
Aug 2012	6.2.6	New method for preparing core specimens to be tested for moisture content of in-situ asphalt.

APPENDIX A

Guidance on the set up and use of the vacuum drying method

The following information is provided to assist a laboratory in effectively setting up and using the vacuum drying method.

A1 APPARATUS

(a) **Vacuum Pump** able to achieve a minimum of -90 kPa

(b) Large glass Vacuum **Desiccator**

NOTE: Plastic desiccators are rated at about 100 kPa, Glass desiccators are rated at about 240kPa which gives a greater safety margin.

(c) **Stop cock** to fit desiccator lid

(d) Suitable **Vacuum Grease**

(e) On/off **Air Taps**

(f) Indicator **Silica gel**

(g) Protective shroud

(h) **Pressure gauge** or **Manometer** with a range of ±120 kPa

(i) **Suitable hose** that will not collapse whilst under vacuum.

(j) **Racks** that allow air to flow through them such as masonite pegboard

(k) **Vacuum flasks** to be water traps

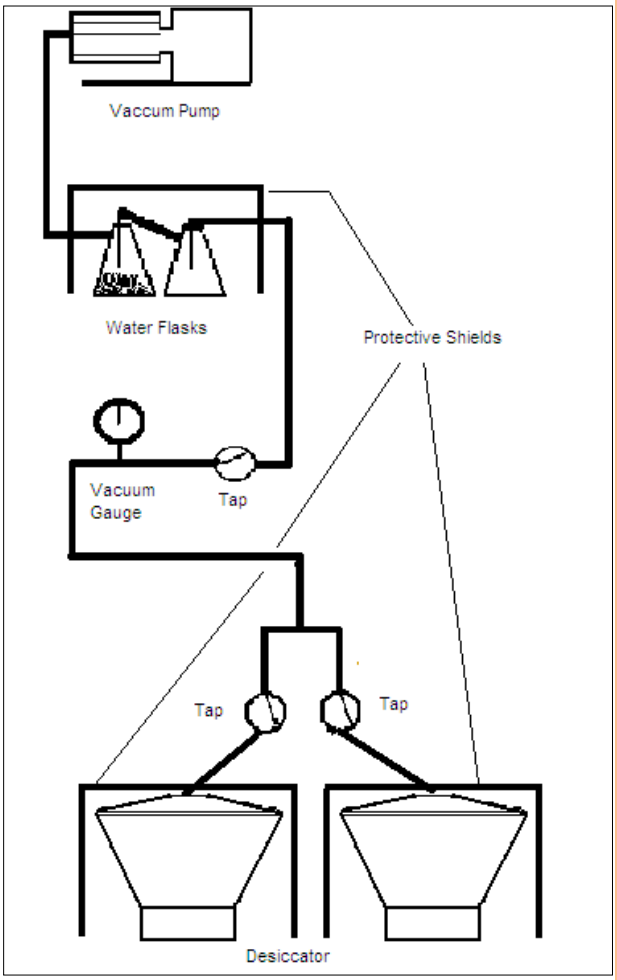
A2 SET UP

Plumbing

The following plumbing is required to connect all the pieces of equipment.

- From pump to flask with silica gel.
- From flask with silica gel to flask with water trap.
- From flask with water trap to on/off air tap.
- From on/off tap to vacuum pressure gauge.
- Vacuum pressure gauge to air T-piece.
- T-piece to on/off air tap.
- On/off air tap to stopcock.

The following diagram shows a typical setup of the apparatus.



Desiccator

- To be a glass vacuum desiccator large enough to accommodate core specimens (to maximize the amount of cores placed in the desiccator, have them lying flat as shown in the photo below, the racks allow the moisture to exit the cores).

- The flat seating surfaces between the desiccator and the lid to be clean and have an adequate amount of vacuum grease.
- The surface between the lid and the stopcock to be clean and to have adequate amount of vacuum grease.
- To have a protective safety shield.

A3 PROCEDURE

(a) Place dried silica gel inside the bottom of the desiccator.

(b) Place a rack above the silica gel.

(c) Place first layer of specimens in the desiccator.

(d) Place more racking and cups with silica gel with specimens.

(e) Place the lid on the desiccator (make sure seating faces are clean and there is vacuum grease between the desiccator and the desiccator lid).

(f) Place the protective shield over the desiccator.

(g) Open all air taps between the pump and the desiccator.

(h) Open the stopcock on the top of the desiccator.

(i) Ensure that the seal between the stopcock and the air hose is tight to ensure no air will leak from it.

(j) Turn the pump on.

(k) Once the required pressure has been reached turn off the tap closest to the pump.

(l) Turn the pump off.

(m) Check that the desiccator is not losing vacuum by viewing any change in the vacuum gauge. If the pressure is changing check for leaks in the plumbing and seals and restart the test.

(n) If there is no indication of vacuum change then close the stopcock on top of the desiccator.

A4 CHECKING THE VACUUM IS CONSTANT

(a) This should be done at intervals during the 4 hour drying period by opening the stopcock and the tap between the stopcock and the vacuum gauge. This will allow the vacuum gauge to indicate the level of vacuum within the desiccator.

(b) If the vacuum has reduced but is still above the minimum of -90 kPa turn the pump on again to increase the vacuum. (A good vacuum system will maintain a vacuum in excess of -95kPa)

(c) If the system has not maintained the minimum vacuum repeat the procedure from Procedure A3(e)

A5 OPENING THE DESICCATOR

DO NOT release the vacuum quickly!

(a) Remove the hose from the desiccator stopcock.

(b) Slowly open the stopcock and allow the air to vent into the desiccator gently.

(c) Once the air has stopped venting in remove the protective shield and slide the lid off with caution.

(d) Samples are ready to be weighed.

A6 OPERATIONAL HINTS

- Always use dry indicator silica gel.
- Maintain good serviceability of the vacuum pump.
- Regularly inspect the oil in the pump for any water contamination and replace the oil if necessary.
- Maintain dry indicator silica gel in the water trap flask connected before the vacuum pump.
- Always sit a vacuum desiccator on a clean and soft shock proof surface such as rubber or carpet.
- Always maintain adequate vacuum grease on the seating surface of the stopcock and do not force it into the opening of the lid.
- Do not remove the desiccator lid and place face down on a surface as this will enable dirt to stick to the vacuum grease and prevent a good seal when next used. Always carefully place the lid in a position that will protect the seating surface from being contaminated. (A tin in a safe place filled with sand is a good option, that way the stopcock and the grease surface will not be damaged).
- Maintain calibration of the vacuum gauge or manometer used in this system.