Transport Roads & Maritime Services

NSW GOVERNMENT

Test method T655

Water permeability of asphalt samples (Falling head laboratory permeameter)

NOVEMBER 2012

Revision Summary

Ed/Rev Number	Clause Number	Description of Revision	Authorisation	Date
		New Issue – Adapted from Test Method Q304 by Craig Brady	Gavin Donald	Nov 2006
Ed 2/ Rev 0	All	Reformatted RMS template	J Friedrich	November 2012

Note that Roads and Maritime Services is hereafter referred to as 'RMS'.

The most recent revision to Test method T655 (other than minor editorial changes) are indicated by a vertical line in the margin as shown here.

Test method T655

Water permeability of asphalt samples (Falling head laboratory permeameter)

1. Scope

This method describes the procedure for the determination of the permeability of asphalt using the laboratory Permeameter. It is applicable to asphalt having permeability values within the range 0.1 to 3000 µm/s. The method is based on Queensland Department of Main Roads Test Method No. Q304.

2. Apparatus

(a) A clear perspex cylinder of length 225 mm with etched measuring marks at 165 and 185 mm (see Figure 1). The outside diameter of the cylinder is either a nominal 100 mm or 150 mm depending upon the size of the asphalt specimen being tested

(b) Pouring jug of capacity one litre

(c) Beaker of capacity 200 mL

(d) Sealer gun

(e) Silicon sealant

(f) Spatula

(g) Stop watch

(h) Tripod

(i) Collecting funnel

(j) Balance accurate to 0.1g

3. Procedure

(a) If wet, dry asphalt specimen in front of fan or in oven set at 40°C. The specimen is dry when no weight loss is recorded over a 24 hour period. (Note: if field samples to be tested, make sure that sample is washed with cold water and the surface is cleaned before testing)

(b) Measure and record the diameter (D) and thickness (L) of the specimen in millimetres. Report to the nearest 0.1 mm

(c) Measure the internal diameter (d) of the perspex cylinder

(d) Apply a thin layer of silicone sealant to completely seal the circumferential wall of the asphalt specimen

(e) Attach the perspex cylinder to the top of the specimen using silicone sealant. Allow the silicone sealant time to set

(f) Pour water into the cylinder until the water level is above 185 mm

(g) Let water run through the specimen for 5 minutes or until the water level drops about 50 mm

(h) Pour extra water into the cylinder until the water level is just above 185 mm. Record the time for the water level to drop from 185 mm to 165 mm

(i) Repeat Step 3(h) twice

(j) Calculate the permeability as shown in Section 4

4. Calculations

(a) Calculate the volume in the cylinder between the 165 mm and 185 mm marks to the nearest 0.1 mL using the formula:

(b) $$V = \frac{\pi d^2}{200}$$

(c) Calculate the flow rate using the formula (see Note 6(a))

(d) $$F = \frac{V}{t}$$

(e) Calculate the effective head of water using the formula (see Note 6(b))

(f) $$h_e = \frac{h_1 + h_2}{2}$$

(g) Calculate the hydraulic gradient using the formula:

(h) $$i = \frac{h_e + L}{L}$$

(i) Calculate the cross-sectional area of the specimen using the formula:

(j) $$A_s = \frac{\pi D^2}{4 \times 10^6}$$

(k) Calculate the permeability using the formula:

(l) $$k = \frac{F}{A_s i}$$

(m) Where:

d = internal diameter of cylinder (mm)
V = volume in cylinder between 165 mm and 185 mm marks (mL)
t = average time for water to drop from 185 mm to 165 mm (s).
F = flow rate (mL/s)
h_1 = initial head (mm)
h_2 = final head (mm)
h_e = effective head (mm)
L = thickness of specimen (mm)
i = hydraulic gradient (ratio)
D = diameter of specimen (mm)
A_s = cross-sectional area of specimen (m^2)
k = permeability (µm/s)

5. Reporting

Report the following:

(n) Record if core or laboratory prepared specimen

(o) If core, record test location including a longitudinal (chainage) and a lateral (offset) reference

(p) If laboratory prepared specimen, record mix and compaction details

(q) Permeability to three significant figures (µm/s)

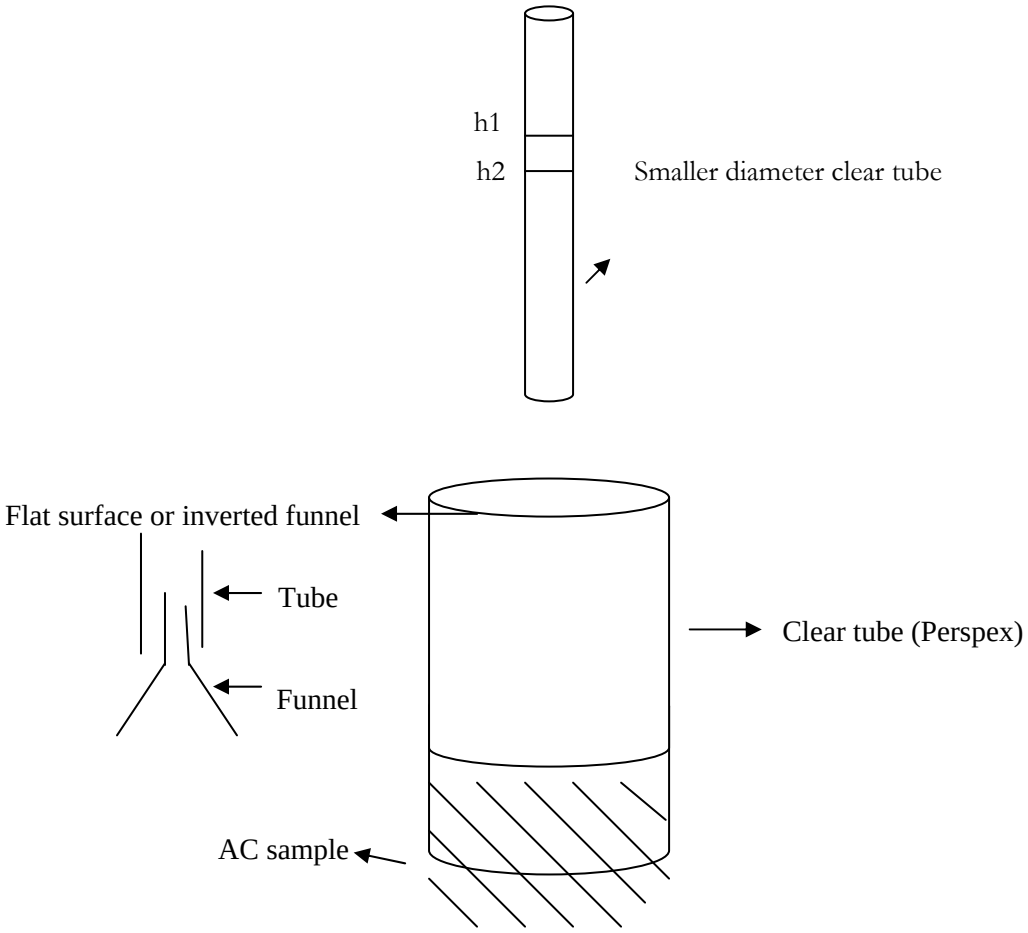
Category	Permeability (μm/s)	Description
A	0.1 - 1	Almost impervious
B	1 - 10	Moderately impervious
C	10 -100	Pervious
D	100 - 1000	Moderately free drainage
E	1000 - 10000	Free drainage

6. Notes on Method

(a) Normally the volume (V) is the volume in the cylinder between 165 mm and 185 mm marks. However, if the flow rate is slow (say less than 0.05 mL/s) the volume can be that collected in the beaker positioned beneath the specimen. The time (t) then becomes the time for the volume of water to be collected

(b) Normally the effective head is 175 mm. However, if flow rate is slow (say less than 0.05 mL/s) the effective head is the average of the initial and final head over the period when the water is collected beneath the specimen

(c) Alternatively, a clear plastic tube with smaller diameter'd' can be placed on top of Perspex cylinder (A flat plastic or inverted funnel is to placed on top the 100mm clear tube on top of the AC sample) and marked with h1 and h2 to record time in water level drop if the flow rate is very slow to minimise recording time in water drop from h1 to h2 in the 100mm Perspex (see below)



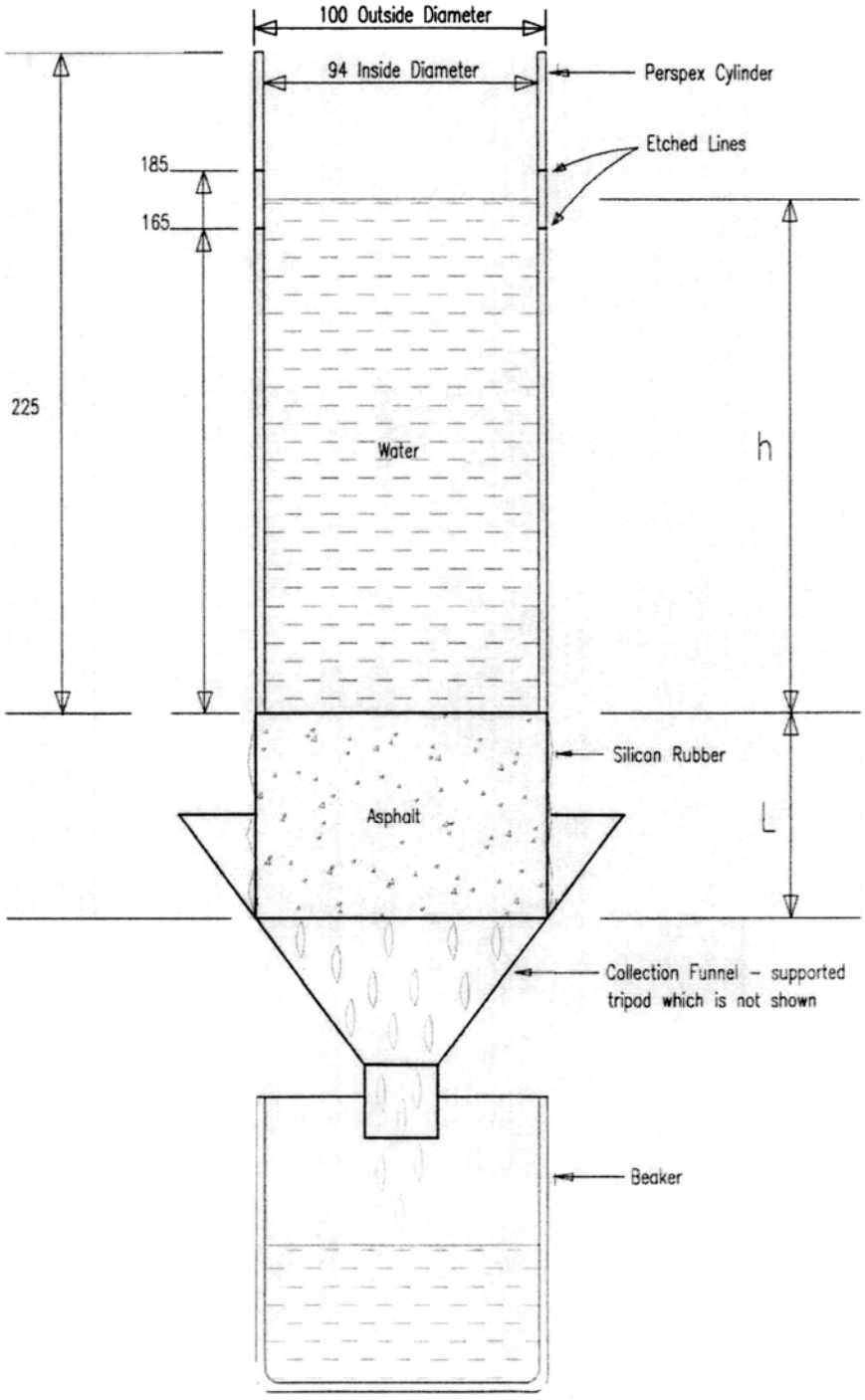


Figure 1 – Laboratory Permeameter

Test Method T655
Permeability of Asphalt
(Falling Head Laboratory Permeameter)

CLIENT:…….. PRODUCERS MIX CODE:…….....
LOCATION:……... CORE/LAB PREPARED SAMPLE:……....
ASPHALT SUPPLIER AND PLANT:……. PAVING START POINT:…….
TESTED BY:…… DATE:……..

TEST DETAILS

SAMPLE NUMBER		1	2	3
Thickness 1 (mm)				
Thickness 2 (mm)				
Thickness 3 (mm)				
Thickness 4 (mm)				
Thickness 5 (mm)				
Thickness 6 (mm)				
Thickness 7 (mm)				
Thickness 8 (mm)				
Average Thickness (mm)	L			
Diameter 1 (mm)				
Diameter 2 (mm)				
Diameter 3 (mm)				
Diameter 4 (mm)				
Average Diameter (mm)	D			
Mass of dry Specimen in Air (g)	m_{air}			
Mass of specimen in water (g)	m_{water}			
Mass of SSD specimen in air (g)	m_{SSD}			
Density of water (t/m^3)	r			
Bulk density of core (t/m^3) = (m_{air} * r)/(m_{SSD} - m_{water})	r_{bulk}			
Maximum Density (t/m^3)	r_{max}			
Air Voids (%) = 100*(r_{max}-r_{bulk})/r_{max}				
Internal diameter of cylinder (mm)	d			
Volume in cylinder between 165 mm and 185 mm marks (mL) = $pd^2/200$	V			
Time for water to drop from 185 mm to 165 mm (s)				
Time 1 (s)				
Time 2 (s)				
Time 3 (s)				
Average Time (s)	t			
Flow rate (mL/s) = V/t	F			
Initial Head (mm)	h_1			
Final Head (mm)	h_2			
Effective head (mm) = (h_1 + h_2)/2	h_e			
Hydraulic gradient (%) = (h_e + L) /L	i			
Cross Sectional Area of Specimen	A_s			

(m^2) = $\pi D^2/(4*10^6)$				
Permeability (μm/s)= F/(A_si)	k			