ATT-5/22 CORING

1.0 SCOPE

This method covers the procedures for obtaining representative core samples from compacted asphalt concrete pavement, cement stabilized base course and concrete, using a water cooled saw. Drilled cores of the actual construction material provide the best samples for lab testing to assess the material quality or verify compliance with project specifications.

2.0 EQUIPMENT

Coring Equipment (electric or gas powered) – portable, trailer or truck mounted
6" Coring Bit
Power Source – generator or gas powered drill
Water Source – truck bed water tank (35-55 gal) or portable pressurized water tank
Core Retrieval Tools
Marking Pens or Lumber Crayons

3.0 PROCEDURE

3.1 ACP Cores

3.1.1 Frequency and Location

ACP cores are used for quality assurance testing. Pavement sampling will be done using stratified random sampling procedures. A minimum of 5 tests per Lot will be selected as follows:

1. **The Lot will be divided into 5 (or more) segments of approximately equal quantity.**

2. ***In each segment a test site will be located by using random numbers to determine the longitudinal distance from the end of the segment and the lateral distance from the edge of the segment.*** In no case will a lateral distance be less than 0.5m from the shoulder or 0.3m from any other edge of a mat except when matching mats, in which case the test site may be within 0.3m of the joint.

A QA Acceptance Lot is a Lot in which all acceptance testing is conducted by the Consultant using quality assurance test procedures, and is defined in the contract specifications.

Generally, a Lot is a day of production, for each project, and each aggregate class. A Lot is divided into five (or more) Segments of equal lengths or quantities.

Core locations are randomly selected before coring begins, as described in ATT-56, Part II, Stratified Random Test Site Method.

Cores are usually obtained the following morning, after completion of construction of the previous days Lot.

3.1.2 Purpose and Sample Size

For all paving contracts, 150 mm diameter road cores are used for acceptance and payment. The core dry density, extraction asphalt content and the gradation of the extracted aggregate are then determined.

If extracting the cores, obtain enough cores for each sample to have a minimum weight of 2000 grams after sawing and trimming. The following table may be used as a guide to determine the minimum number of cores to be used for the extraction test. Refer to ATT-12 for further details.

Sawed Core Thickness (mm)	No. of Cores Required
From 100 to 75	1
From 60 to 40	2
From 30 to 25	3
20 mm or less	4

If a core obtained for quality assurance is too porous, a duplicate core should be obtained at the same site. One core will be extracted and its asphalt content and gradation determined. The density of the other core will be determined as described in ATT- 6 (wax method).

The following table shows the minimum required core thickness for the top and lower lifts. (see ATT-56 Part II)

LIFT	DESIGN LIFT THICKNESS	AGGREGATE TOPSIZE µm	MINIMUM CORE THICKNESS mm
Top Lift	all	all	30*
Lower lifts	greater than 35 mm	all	30*
Lower lifts	less than 35 mm	16 000	25**
		12 500	20**
		10 000	20**
* If core thickness is less than 30 mm, randomly select another core site.			
** If requirements are not met, select another core location closer to the wheel path.			

3.2 Core Drilling Machine

The purpose of the core drill is to extract high-quality, uniform cores for lab testing. This requires equipment with sufficient power and control to rotate a coring bit straight and true throughout the coring operation. Wet coring provides cooling during the drilling operation, and flushes away the cuttings.

A drill mounted on a sturdy frame, with even advancement of the bit, solidly anchored to prevent chatter, wandering, and seizing of the bit, all directly affect sample quality.

Asphalt pavement presents unique problems when extracting field core samples. ACP is softer than concrete, but also is more abrasive. The heat from the friction of diamond coring bits makes the bitumen softer and more viscous. As the material softens, it can pinch the diamond bit, stalling the drill and possibly damaging the core sample.

3.2.1 Sample Location

Mark the core sample locations before positioning the core drill over the test site.

3.2.2 Coring

1. Position the coring drill with the 6” core barrel directly over the ACP surface at each specified sample location.

2. Switch on the power to turn on the pump for delivering the water to the core barrel, and to turn on the core drill. Then gently lower the rotating core barrel with just enough pressure to start the cutting procedure.

3. Apply a firm uniform pressure on the feed wheel.
   DO NOT FORCE THE BIT into the material with excessive pressure, or repeatedly increase and decrease the pressure while drilling.

4. Ensure that water is circulating out and along the sides of the hole. Whenever no water is visible, raise the bit slightly until circulation is resumed.

5. When the desired lift thickness depth is reached, take all pressure off the bit, and slowly raise the core bit out of the hole.

Adjustable Hitch Mount Coring Rig

3.3 Using Dry Ice

Dry Ice is required when the pavement is warm, e.g. coring on a hot summer day, or when coring a thin lift, or if the location is on an extremely heavy traffic area and setting up traffic control on the following morning is not workable so coring is done directly after the finish roller has completed rolling while the plant mix is still hot.

To speed the cooling process, and enable coring to proceed right after paving and compaction has been completed, contractors use dry ice.

If dry ice is being used, place about 1 kg of dry ice at each coring site at the recommended time of 20 minutes prior to coring. Protect the site from traffic, so that the dry ice is not disturbed.

1. Assemble the coring unit and the bit assembly as directed in the applicable manufacturer's equipment manual.

2. Ensure that the water container is full.

3. At the job site, put on the appropriate PPE, such as coveralls, safety boots, safety vest and hard hat.

4. Turn on the truck roof top LED High Visibility Flashing Light Bar, four-way flashers, and if required, the vehicle headlights.

5. When required, properly position the appropriate qualified flag person(s) and road signs (e.g. Workers Ahead, Maximum 50).

   NOTE: At the start of the job, discuss Road Safety Requirements with your supervisor. Safety is the responsibility of the senior technologist on the road.

6. Park the vehicle away from traffic and locate the core site.

7. Move the vehicle so that the coring unit is centred over the site location.

8. Proceed with Section 3.2.2 Coring.

3.4 Extracting Cores

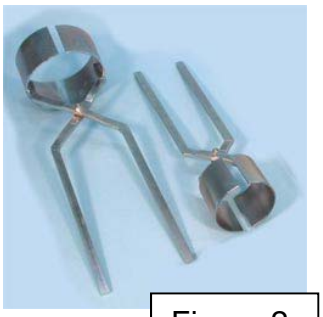

Figure 2

1. Tools designed and built for retrieval of drilled cores in pavement save time and frustration. If the core is loose in the hole, insert a core retriever (Figure 2), close it around the core, and lift it free. A thin wire loop can also be utilized to lift the core out of the hole.

2. Once the cores are drilled they often need to be “snapped off”, or broken off the lower lift before they can be lifted out of the hole for retrieval.

   a) Use a Core Debonder to snap the core loose (Figure 3). Place the debonder in the hole, then sharply tap the side of the handle near the asphalt surface with a heavy hammer or sledge hammer, **but take extreme care to avoid distorting the sample.**

   b) Then use a core retriever to lift the core out of the hole.

   c) ***NEVER USE*** screwdrivers, chisels or other sharpened tools to pry the core loose, as this will cause damage or distortion of the asphalt core samples.

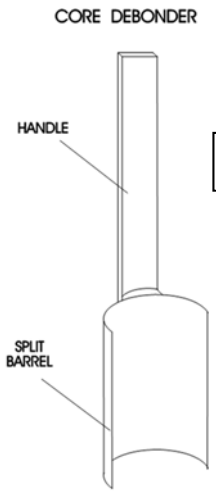

Figure 3

3. If the core is stuck inside the core barrel, dislodge the core by **lightly tapping** on the sides of the core barrel with a blunt instrument (such as a rubber hammer).

4. After the core is retrieved, use a battery filler (or sponge) to remove water out of the hole.

5. Mark the core. Except for appeal cores, use the lot and segment number. If duplicate cores were obtained, use "A" for the first core (for density) and "B" for the second.

   e.g. core number: 10 - 4 A indicates lot 10, segment 4, density core.

   10 - 4 B indicates lot 10, segment 4, this material to be added to 10 - 4 A (after the density), to obtain the req’d 2000 g for the ignition oven burn, or extraction.

6. Fill the hole in lifts of similar thickness to the existing pavement with hot mix. Each lift should be compacted with a “Kanga Hammer”, or suitable tamper.

7. Cores should be placed on a flat surface, top side down, or in half round pipe sections of suitable diameter, and firmly secured to avoid damage during transit.

4.0 HINTS AND PRECAUTIONS

1. Maintain the drill as directed in the applicable manufacturer's equipment manual.

2. For water cooling of the core bit, keep the flow of the water at a slow, steady stream. Excess water may scour the core, and wash away fines.

4. Apply a uniform firm pressure to the hand feed while drilling. Do not work the hand feed up and down, or increase and decrease the pressure, or apply an excessively high pressure.

   A steady even force assures true running, accurate holes and a longer bit life. Overloading damages the bit through overheating or crushing of diamonds, as well as overheating the motor. Too little pressure on the other hand, polishes the diamonds reducing their cutting efficiency.

6. Ensure that the drill is firmly attached to the truck, or trailer. Move the drill up and down the guide rails to ensure smooth operation, and that no binding or wobbling is being incurred. During drilling, any loose bolts will allow the unit to rise off the rails causing the bit to drill at an angle.

   When moving from hole to hole and the vehicle brakes are applied, loose bolts could cause the drill to move forward, slamming the extended drill assembly into the rear bumper or end gate.

7. There are advantages and disadvantages of using dry ice versus a water cooled core. ***The advantages of using dry ice are***:

   a) Cores may be obtained immediately upon completion of the rolling operation as the dry ice freezes the coring site.

   b) On very hot summer days, cores may be obtained during the day regardless of the air temperature.

   c) Specimen distortion is minimal while coring, or retrieving the core.

   d) If coring more than one lift, it is easier to separate the lifts, if frozen.

   e) Thin asphalt concrete pavement cores, e.g., overlays, levelling courses, or asphalt stabilized base course cores may be obtained, as the frozen mix will hold together while drilling and retrieving the core.

   The disadvantages of using dry ice are:

   a) Dry ice availability in remote areas is scarce.

   b) If dry ice is available, an extra person is required to pick it up daily, as dry ice storage is also a problem.

   c) As dry ice must be placed on the coring site at least 20 minutes prior to actual coring, traffic will have to be detoured around each site during that period of time. This requires a second person to set up signs, barricades, etc., to place the dry ice on each site, and to take down the detouring equipment immediately after the coring is completed.