Test Method Q050: Random selection of sampling or test locations

1 Source
This method applies the principles of AS 1289.1.4.1: Selection of sampling or test sites – Random number method and AS 1289.1.4.2: Selection of sampling or test sites – Stratified random number method. The principles within these methods have been modified and enhanced to provide procedures which better suit local methodology and practices.

2 Scope
This method describes the procedure for establishing sampling locations, sampling intervals or test locations within a lot, which has been defined in terms of mass, volume, area or batches, using random selection techniques. The method contains procedures which allow locations or intervals to be selected using either Random Sampling, Random Stratified Sampling or Systematic Random Stratified Sampling. These procedures ensure that samples or tests are taken at locations or intervals which are distributed within a lot in such a way that bias is removed from the selection process.

3 Application
3.1 Where the procedure for the selection of sampling and test locations is not specified in the appropriate specification, sampling plan or test method, the following shall apply:
   a) random stratified sampling procedures will be used for the selection of all sampling locations, sampling intervals or test locations, and
   b) stockpiles, windrows or heaps are to be sampled using random stratified sampling described in Subsection 8.2: Selection of Location – Available Perimeter.

3.2 Where the process for re-sampling or re-testing a lot is not specified in the appropriate specification, the following shall apply:
   a) new sampling or testing locations will be determined for the entire lot, that is, no original sampling or testing locations will be used.

4 Apparatus
The following apparatus is required:

4.1 Tape measure, wheel meter, and staff and level as required.

4.2 Marking system, suitable marking equipment appropriate for the lot under consideration (for example, spray paint, flagging tape or pegs).

5 Lot size and sampling or testing frequencies
5.1 Determine the size or extent of the lot, together with the number of samples or tests to be taken, using the specification, sampling plan or test methodology as appropriate.

5.2 Where more than one representative sample is to be taken, divide the lot into the same number of approximately equal size sub-lots (Note 12.1). Mark the boundaries of each sub-lot using a suitable marking system.

6 Random numbers
6.1 Obtain a listing of sequential random numbers using Table 1 for the monthly date on which the work is undertaken (Note 12.2).
6.2 Each random number shall be used for the calculation of only one:
   a) longitudinal, lateral or vertical coordinate
   b) position on the perimeter of a lot or sub-lot, or
   c) sampling or testing interval.

7 Random sampling

The procedure for random sampling shall be as follows:

7.1 Selection of location – available area

7.1.1 Determine the extent of the area within the lot or sub-lot which is available for sampling or testing by referring to the specification, sampling plan or test methodology as appropriate (Note 12.3).

7.1.2 Measure the length of the available area and, for an area with a uniform cross section, its width. Where a lot or sub-lot is comprised of multiple layers or is a stockpile, measure the height.

7.1.3 Determine the longitudinal coordinate for each sample, sample increment or test location as follows:

\[ x_i = r_i L \]

where

- \[ x_i \] = longitudinal coordinate for the \( i^{th} \) sample, sample increment, or test number, measured from one end of the available area (m)
- \[ r_i \] = random number specific quantity of material produced, processed, batched or loaded before taking the \( i^{th} \) sample, sample increment or test number
- \[ L \] = length of the available area (m)

7.1.4 Determine the lateral coordinate for each sample, sample increment or test location as follows (Note 12.4):

\[ y_i = r_{w_i} W \]

where

- \[ y_i \] = lateral coordinate for the \( i^{th} \) sample, sample increment or test number, measured from one side of the available area (m)
- \[ r_{w_i} \] = random number specific to the lateral coordinate for the \( i^{th} \) sample, sample increment or test number
- \[ W \] = width of the available area at the actual longitudinal coordinate for the \( i^{th} \) sample, sample increment or test location number (m)

7.1.5 For lots or sub-lots containing multiple layers or for a stockpile, determine the vertical coordinate for each sample, sample increment or test location as follows:

\[ z_i = r_h (H-D)+D \]

where

- \[ z_i \] = vertical coordinate for the \( i^{th} \) sample, sample increment or test number measured from the bottom of the lot or sub-lot (m)
- \[ r_h \] = random number specific to the vertical coordinate for the \( i^{th} \) sample, sample increment or test number
\[ H = \text{height of the lot or sub-lot (m)} \]
\[ D = \text{depth to which sampling or testing is to be undertaken (m)} \]

7.2 Selection of location – available perimeter

7.2.1 Measure the accessible perimeter of the lot or sub-lot (Notes 12.5 and 12.6).

7.2.2 Determine the sample or test location as follows:

\[ p_i = r_i L \]

where

\[ p_i = \text{position on the perimeter for the } i^{th} \text{ sample, sample increment or test number measured from the starting point (m)} \]
\[ r_i = \text{random number specific quantity of material produced, processed, batched or loaded before taking the } i^{th} \text{ sample, sample increment or test number} \]
\[ L = \text{length of the accessible perimeter (m)} \]

7.3 Selection of location – interval

7.3.1 Determine the sampling or testing interval as follows (Note 12.7):

\[ t_i = r_i Q \]

where

\[ t_i = \text{quantity of material produced, processed, batched or loaded before taking the } i^{th} \text{ sample, sample increment or test number (m}^3, \text{t or batch)} \]
\[ r_i = \text{random number specific quantity of material produced, processed, batched or loaded before taking the } i^{th} \text{ sample, sample increment or test number} \]
\[ Q = \text{quantity of material in the lot or sub-lot (m}^3, \text{t or batch)} \]

8 Random stratified sampling

The procedure for random stratified sampling shall be as follows:

8.1 Selection of location – available area

8.1.1 Determine the extent of the area within the lot or sub-lot which is available for sampling or testing by referring to the specification, sampling plan or test methodology as appropriate (Note 12.3).

8.1.2 Measure the length of the available area and, for an area with a uniform cross section, its width. Where a lot or sub-lot is comprised of multiple layers or is a stockpile, measure the height.

8.1.3 Stratify the length of the available area as follows:

\[ l = \frac{L}{n} \]

where

\[ l = \text{length of each stratum (m)} \]
\[ L = \text{length of the available area (m)} \]
\[ n = \text{number of samples, sample increments or tests} \]

### 8.1.4 Determine the longitudinal coordinate for each sample, sample increment or test location as follows:

\[ x_i = l(i-1+r_i) \]

where \( x_i \) = longitudinal coordinate for the \( i^{th} \) sample, sample increment or test number measured from one end of the available area (m)

\( l \) = length of each stratum (m)

\( i \) = particular sample, sample increment or test number

\( r_i \) = random number specific quantity of material produced, processed, batched or loaded before taking the \( i^{th} \) sample, sample increment or test number

### 8.1.5 Determine the lateral coordinate for each sample, sample increment or test location as follows (Note 12.4):

\[ y_i = r_w W_i \]

where \( y_i \) = lateral coordinate for the \( i^{th} \) sample, sample increment or test number measured from one side of the available area (m)

\( r_w \) = random number specific to the lateral coordinate for the \( i^{th} \) sample, sample increment or test number

\( W_i \) = width of the available area at the actual longitudinal coordinate for the \( i^{th} \) sample, sample increment or test location number (m)

### 8.1.6 For lots or sub-lots containing multiple layers or for a stockpile, determine the vertical coordinate for each sample, sample increment or test location as follows:

\[ z_i = r_h (H-D) + D \]

where \( z_i \) = vertical coordinate for the \( i^{th} \) sample, sample increment or test number measured from the bottom of the lot or sub-lot (m)

\( r_h \) = random number specific to the vertical coordinate for the \( i^{th} \) sample, sample increment or test number

\( H \) = height of the lot or sub-lot (m)

\( D \) = depth to which sampling or testing is to be undertaken (m)

### 8.2 Selection of location – available perimeter

#### 8.2.1 Measure the accessible perimeter of the lot or sub-lot (Notes 12.5 and 12.6).

#### 8.2.2 Stratify the accessible perimeter as follows:

\[ l = \frac{L}{n} \]

where \( l \) = length of each stratum (m)

\( L \) = length of the accessible perimeter (m)
number of samples, sample increments or tests

8.2.3 Determine the sample or test location as follows:

\[ p_i = l(i-1+r_i) \]

where

- \( p_i \) = position on the perimeter for the \( i^{th} \) sample, sample increment or test number measured from the starting point (m)
- \( l \) = length of each stratum (m)
- \( i \) = particular sample, sample increment or test number
- \( r_i \) = random number specific quantity of material produced, processed, batched or loaded before taking the \( i^{th} \) sample, sample increment or test number

8.3 Selection of location – interval

8.3.1 Stratify the volume, mass or batches in the lot or sub-lot as follows:

\[ q = \frac{Q}{n} \]

where

- \( q \) = quantity of material in each stratum (m³, t or batch)
- \( Q \) = quantity of material in the lot or sub-lot (m³, t or batch)
- \( n \) = number of samples, sample increments or tests

8.3.2 Determine the sampling or testing interval as follows (Note 12.7):

\[ t_i = q(i-1+r_i) \]

where

- \( t_i \) = quantity of material produced, processed, batched or loaded before taking the \( i^{th} \) sample, sample increment or test number (m³, t or batch)
- \( q \) = quantity of material in each stratum (m³, t or batch)
- \( i \) = particular sample, sample increment or test number
- \( r_i \) = random number specific quantity of material produced, processed, batched or loaded before taking the \( i^{th} \) sample, sample increment or test number

9 Systematic random stratified sampling

The procedure for systematic random stratified sampling shall be as follows:

9.1 Selection of location – available area

9.1.1 Determine the extent of the area within the lot or sub-lot which is available for sampling or testing by referring to the specification, sampling plan or test methodology as appropriate (Note 12.2).

9.1.2 Measure the length of the available area and, for an area with a uniform cross section, its width. Where a lot or sub-lot is comprised of multiple layers or is a stockpile, measure the height.
9.1.3  Stratify the length of the available area as follows:

\[ l = \frac{L}{n} \]

where \( l \) = length of each stratum (m)
\( L \) = length of the available area (m)
\( n \) = number of samples, sample increments or tests

9.1.4  Determine the longitudinal coordinate for each sample, sample increment or test location as follows:

\[ x_i = l(i-1+r) \]

where \( x_i \) = longitudinal coordinate for the \( i^{th} \) sample, sample increment or test number measured from one end of the available area (m)
\( l \) = length of each stratum (m)
\( i \) = particular sample, sample increment or test number
\( r \) = random number

9.1.5  Determine the lateral coordinate for each sample, sample increment or test location as follows (Note 12.4):

\[ y_i = r_w W_i \]

where \( y_i \) = lateral coordinate for the \( i^{th} \) sample, sample increment or test number measured from one side of the available area (m)
\( r_w \) = random number specific to the lateral coordinate for the \( i^{th} \) sample, sample increment or test number
\( W_i \) = width of the available area at the actual longitudinal coordinate for the \( i^{th} \) sample, sample increment or test location number (m)

9.1.6  For lots or sub-lots containing multiple layers or for a stockpile, determine the vertical coordinate for each sample, sample increment or test location as follows:

\[ z_i = r_h (H-D) + D \]

where \( z_i \) = vertical coordinate for the \( i^{th} \) sample, sample increment or test number measured from the bottom of the lot or sub-lot (m)
\( r_h \) = random number specific to the vertical coordinate for the \( i^{th} \) sample, sample increment or test number
\( H \) = height of the lot or sub-lot (m)
\( D \) = depth to which sampling or testing is to be undertaken (m)

9.2  Selection of location – available perimeter

9.2.1  Measure the accessible perimeter of the lot or sub-lot (Notes 12.5 and 12.6).
9.2.2 Stratify the accessible perimeter as follows:

\[ l = \frac{L}{n} \]

where

- \( l \) = length of each stratum (m)
- \( L \) = length of the accessible perimeter (m)
- \( n \) = number of samples, sample increments or tests

9.2.3 Determine the sample or test location as follows:

\[ p_i = l(i - 1 + r) \]

where

- \( p_i \) = position on the perimeter for the \( i^{th} \) sample, sample increment or test number measured from the starting point (m)
- \( l \) = length of stratum (m)
- \( i \) = particular sample, sample increment or test number
- \( r \) = random number

9.3 Selection of location – interval

9.3.1 Stratify the volume, mass or batches in the lot or sub-lot as follows (Note 12.7):

\[ q = \frac{Q}{n} \]

where

- \( q \) = quantity of material in each stratum (m³, t or batch)
- \( Q \) = quantity of material in the lot or sub-lot (m³, t or batch)
- \( n \) = number of samples, sample increments or tests

9.3.2 Determine the sampling or testing interval as follows:

\[ t_i = q(i - 1 + r) \]

where

- \( t_i \) = quantity of material produced, processed, batched or loaded before taking the \( i^{th} \) sample, sample increment or test number (m³, t or batch)
- \( q \) = quantity of material in each stratum (m³, t or batch)
- \( i \) = particular sample, sample increment or test number
- \( r \) = random number

10 Records

The following shall be recorded:

10.1 Date of sampling/testing.
10.2 Random numbers used.
10.3 Longitudinal, lateral and, if required, vertical coordinates of each sampling/test site.
10.4 Position on the perimeter of each sampling/test location.
10.5 Quantity of material produced, processed, batched or loaded at which a sample/test is taken.
10.6 Lot identification, sub-lots, field sample numbers, increment numbers.
10.7 Name of sampler.
10.8 Specific sampling procedure used with reference to the relevant sub-section of this method.
10.9 For selection of locations by available area or perimeters, a dimensioned plan of the lot/sub-lots showing sample increment locations together with points of reference and, where appropriate, sub-increment locations.
10.10 Any other relevant information.

11 Reporting

The following shall be reported:

11.1 Date of sampling/testing.
11.2 Longitudinal, lateral and, if required, vertical location of each sampling/test site.
11.3 Quantity of material produced, processed, batched or loaded at which a sample/test is taken.
11.4 Lot identification.
11.5 Specific sampling procedure used with reference to the relevant sub-section of this method.

12 Notes on method

12.1 The sample increments for each representative sample are taken randomly throughout a particular sub-lot in the same way that spot samples and tests are taken throughout a lot.
12.2 When using Table 1, where more than 30 random numbers are required in a day, obtain additional numbers from the listing for the previous day.
12.3 For compaction lots when exclusions have not been specified, exclude any parts of the lot or sub-lot which are within 200 mm of any top edge or construction joint.
12.4 For a lot or sub-lot with a non-uniform cross-section, measure the width at each determined longitudinal coordinate.
12.5 It is not always possible to obtain free access to all sides of some lots or sub-lots (for example, a stockpile lot). In such cases, determine the combined accessible length.
12.6 For windrows, it is only necessary to measure the length of each lot or sub-lot.
12.7 When determining a sampling or testing interval for batches:
   • any determination that identifies a batch already selected can be ignored and the next random number used
   • the result should be rounded up to the next whole integer.
### Table 1 – Table of random numbers

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Test Method Q060: Representative sampling of soils, crushed rock and aggregates

1 Source

This method applies the principles of AS 1141.3.1: Sampling – Aggregates but expands the scope to include soils and crushed rock. The method provides for sample increment sizes and numbers of increments that are considered more appropriate for the testing of construction materials. In addition, the procedure contains enhanced techniques for the sampling of materials both in motion during production and when stationary.

2 Scope

This method describes the procedures for obtaining representative samples of soils, crushed rock and aggregates having a nominal size up to 63 mm. The method is applicable to produced materials in motion on a conveyor belt or at the point of discharge, as well as stationary materials contained within a stockpile, truck, bin, heap or windrow. The method may not be applicable to circumstances where spot sampling techniques are more appropriate (for example where determining stockpile segregation).

3 Application

Generally, it is preferable to sample produced materials when in motion prior to or during discharge. However, this may not be safe or practical for all such circumstances and this approach is not applicable for sampling non-processed materials or stationary produced materials. Adequate samples can be obtained from stationary materials provided due care is exercised.

Consider each procedure for sampling moving or stationary material as contained within this method to be of equal technical validity. Where a number of sampling options is available for a particular situation, there is no hierarchy of preference and each procedure will provide an adequate representative sample.

Consider the following limitations when selecting a sampling procedure:

- a sampling tube can only be used for sampling free flowing fine grained material, and
- the use of hand tools to sample aggregates from a stockpile, heap or windrow is limited to those aggregates having a nominal size of up to and including 28 mm.

4 Apparatus

The following apparatus is required:

4.1 Sample containers, woven sample bags or other suitable sealable containers that will prevent fines loss. Airtight containers are required for moisture content samples. Containers are to be of a size or so configured that their maximum capacity is approximately 20 kg.

4.2 Sampling frame, of rigid construction with parallel end plates. With end plates shaped to fit the full width of the conveyor belt while preventing leakage of material. The distance between the end plates is to be such that the minimum sample increment mass in Table 1 can be obtained.

4.3 Flat bottomed scoop or trowel and brush.

4.4 Loader, having a bucket with a capacity of at least 1 m³, capable of obtaining a slice of material from the total height of the side of the stockpile under consideration in a single movement (Note 14.1).
4.5 Excavator, having a bucket with a capacity of at least 1 m³, capable of reaching to the total height of the stockpile.

4.6 Shovels:

4.6.1 Standard shovel, a standard square mouth shovel with raised sides having a blade of approximate dimensions 300 mm length and 200 mm width.

4.6.2 Posthole shovel, a square mouth posthole shovel having a blade of approximate dimensions 300 mm length and 200 mm width.

4.6.3 Farmer's shovel, with a minimised square mouth having a blade of approximate dimensions 300 mm length, 240 mm width and mouth width of 130 mm for coarse materials such as railway ballast.

4.7 Shield board, a rigid sheet of material such as timber or metal of suitable size. A plywood sheet of dimensions 800 mm length, 400 mm width and 12 mm thickness has been found suitable.

4.8 Sampling tube, consisting of a 75 mm to 100 mm diameter thin walled tube with an opening or a series of openings in a straight line parallel to the longitudinal axis.

4.9 Digging tools such as a pick or crowbar.

4.10 Mechanical stream cutter, a bucket cutter complying with the requirements of ISO 11648-2, capable of moving through the entire discharge stream at a constant rate.

4.11 Tape measure, wheel meter and staff and level as required.

4.12 Sample divider, complying with the requirements of AS 1141.2.

5 Definitions

For the purpose of this method the following definitions shall apply:

5.1 Sample Increment – The amount of material taken to form part of a sample. The number of sample increments required to form a sample is dependent on the lot or sub-lot size (see Table 2). When sampling material from a truck, heap or stockpile using hand tools, each sample increment is comprised of a number of sub-increments. The minimum mass of an increment or sub-increment is determined from Table 1.

5.2 Sampling Interval – The mass or volume of material to be produced, processed or loaded before a sample increment or a number of sub-increments is obtained.

5.3 Sampling Point – The position within a body of material, where a sub-increment is obtained for combination with other sub-increments to form a sample increment. The term "sampling point" is only used when material is taken from more than one position for a particular sampling location or sampling interval.

6 Sampling procedure and locations

The procedure for selecting a sampling procedure and locations shall be as follows:

6.1 Taking into account the type of material to be sampled and the type and scope of testing, select a sampling procedure which is appropriate for existing conditions and available resources.

6.2 Determine the number of samples to be taken within the lot in accordance with the requirements of the specification, sampling plan or testing methodology as appropriate.
6.3 Where more than one sample is required, divide the lot into the same number of approximately equal sub-lots. Determine the number of sample increments to be taken from the lot or each sub-lot from Table 2 to form a sample (Note 14.2).

6.4 Determine the minimum mass of material for each sample increment or sub-increment from Table 1 (Note 14.2).

6.5 Use random stratified sampling to determine sampling locations, or sampling intervals during production, for each sample increment as detailed in Test Method Q050.

7 **Sampling during discharge**

The procedure for sampling during discharge shall be as follows:

7.1 **Moving stream – mechanical cutter**

7.1.1 Ensure that the production plant is in a stable phase of production operation (that is, not in a start-up or wind-down phase).

7.1.2 At the predetermined sampling interval, activate the mechanical cutter ensuring that it moves through the entire stream of material production at a constant rate and at right angles to the direction of discharge.

7.1.3 Transfer all of the collected material into the sample container to form a sample increment. The collected material may need to be first split, to an appropriate sample increment size. Use a sample divider where it is necessary to reduce the quantity of any collected material. However, coning and quartering may be used for large essentially single-sized aggregates such as ballast.

7.1.4 Label or otherwise identify the sample container with the field sample number and increment number. The increment number has to include the number of sample increments required for the sample. For example, 1/4 identifies the first sample increment in four increments.

7.1.5 Repeat Steps 7.1.1 to 7.1.4 until the required number of sample increments, having a similar quantity of material, is obtained for each sample.

7.2 **Stopped conveyor belt**

7.2.1 Ensure that the production plant is in a stable phase of production (that is, not in a start-up or wind-down phase). At the predetermined sampling interval, have the belt stopped and isolated by an authorised operator.

7.2.2 Place the sampling frame on the material with the end plates perpendicular to the direction of travel. Use a sawing motion to cut cleanly the material stream with the frame.

7.2.3 Obtain a sample increment by removing all material from within the frame using the scoop and brush and place it in the sample container.

7.3 Label or otherwise identify the sample container with the field sample number and increment number. The increment number has to include the number of sample increments required for the sample. For example, 1/4 identifies the first sample increment in four increments.

7.3.1 Allow the plant to be restarted. Once production is again stable, repeat Steps 7.2.1 to 7.2.4 until the required number of sample increments, having a similar quantity of material, is obtained for each sample.
7.4 **Moving stream - loader bucket**

7.4.1 At the predetermined sampling interval, have an authorised operator position a loader bucket of at least 1 m³ to capture the discharge of the plant.

7.4.2 Have the loader parked in a safe location away from other traffic with the bucket resting on the ground.

7.4.3 Locate the highest point of the material and flatten the load by removing material to a depth of at least 200 mm in order to form a level surface approximately 500 mm wide and 750 mm long.

7.4.4 Obtain a sample increment from near the centre of the levelled surface using the standard shovel. Insert the blade vertically into the surface for the full depth of the blade, then place the excavated material into the sample container. If more material is required, widen the hole helically by obtaining adjacent shovels-full of material using the excavation technique described in this step.

7.4.5 Label or otherwise identify the sample container with the field sample number and increment number. The increment number has to include the number of sample increments required for the sample. For example, 1/4 identifies the first sample increment in four increments.

7.4.6 Repeat Steps 7.3.1 to 7.3.5 until the required number of sample increments, having similar quantities of material, is obtained for each sample.

7.5 **Moving stream - truck**

7.5.1 At the predetermined sampling interval, have an authorised operator discharge at least 1 m³ of material into a truck. Have the selected truck parked in a safe location away from other traffic.

7.5.2 Gain access to the tray of the truck using a ladder or platform. Locate the longitudinal axis of the load or, if the truck is loaded off-centre, the axis which passes through the highest points.

7.5.3 Locate the centre of the longitudinal axis. At this location, flatten the load by removing material to a depth of at least 200 mm in order to form a level surface approximately 500 mm wide and 750 mm long.

7.5.4 Obtain a sample from near the centre of the levelled surface using the standard shovel. Insert the blade vertically into the surface for the full depth of the blade, then place the excavated material into the sample container. If more material is required, widen the hole helically by obtaining adjacent shovels-full of material using the excavation technique described in this step.

7.5.5 Label or otherwise identify the sample container with the field sample number and increment number. The increment number has to include the number of sample increments required for the sample. For example, 1/4 identifies the first sample increment in four increments.

7.5.6 Repeat Steps 7.6.1 to 7.6.5 until the required number of sample increments, having similar quantities of material, is obtained for each sample.

8 **Sampling from formed stockpiles**

The procedure for sampling from formed stockpiles shall be as follows:

8.1 **Single layer formed stockpile – loader remove and mix**

8.1.1 At a predetermined sampling location, expose a fresh face by removing a slice of material from the total height of the side of the stockpile. Dump the removed material on the stockpile at a location that will not interfere with the sampling process.
8.1.2 Remove sufficient material from the total height of the fresh face to form a level mixing pad adjacent to the stockpile. The pad needs to be of sufficient area to accommodate material from each of the nominated sampling locations and allow uniform mixing.

8.1.3 Obtain material for depositing on the mixing pad by removing a further slice of at least 1 m³ from the total height of the exposed face. Deposit the material in the centre of the prepared mixing pad, ensuring that the bucket discharge height is as low as possible.

8.1.4 Repeat Steps 8.1.1 and 8.1.3, obtaining a similar quantity of material from each nominated sampling location.

8.1.5 Thoroughly mix the deposited material with the loader, working from various points around the pad, ensuring that the material deposited on the pad is uniformly mixed. While it is acceptable that some pad material may be included in the mixing process, terminate the sampling exercise if the mixture becomes contaminated with foreign material from the stockpile floor. Level the mixed material to form a layer approximately 500 mm thick above the mixing pad.

8.1.6 Obtain the required number of sample increments at uniformly distributed positions across the surface of the layer and not less than 500 mm from any top edge. If the surface of the levelled material is rippled due to the loader bucket, remove sufficient material to expose a fresh and level surface at each sampling position. At each position undertake the following:

a) Insert the blade of the standard shovel vertically into the layer for the full depth of the blade, then place the excavated material into the sample container. If more material is required, widen the hole helically by obtaining adjacent shovels-full of material using the excavation technique described in this step.

b) Label or otherwise identify the sample container with the field sample number and increment number. The increment number has to include the number of sample increments required for the sample. For example, 1/4 identifies the first sample increment in four increments.

8.1.7 Repeat Steps 8.1.1 to 8.1.6 for each sample.

8.2 Single layer formed stockpile – loader remove

8.2.1 At a predetermined sampling location, expose a fresh face by removing a slice of material from the total height of the side of the stockpile. Dump the removed material on the stockpile at a location that will not interfere with the sampling process.

8.2.2 Obtain a further slice of at least 1 m³ from the total height of the exposed face. Deposit the material near the base of the stockpile, ensuring that the bucket discharge height is as low as possible.

8.2.3 Level the material to form a layer approximately 500 mm thick.

8.2.4 Obtain a sample increment from near the centre of the layer using the standard shovel. If the surface of the levelled material is rippled due to the loader bucket, remove sufficient material to expose a fresh and level surface at each sampling position (Notes 14.3). Insert the blade vertically into the formed layer for the full depth of the blade, then place the excavated material into the sample container. If more material is required, widen the hole helically by obtaining adjacent shovels-full of material using the excavation technique described in this step.

8.2.5 Label or otherwise identify the sample container with the field sample number and increment number. The increment number has to include the number of sample increments required for the sample. For example, 1/4 identifies the first sample increment in four increments.
8.2.6 Repeat Steps 8.2.1 to 8.2.5 until the required number of sample increments, having similar quantities of material, is obtained for each sample.

8.3 Single layer formed stockpile – loader back blading

8.3.1 At a predetermined sampling location, climb the loader up the side of the stockpile, then dig the bottom lip of the bucket into the top of the stockpile. Drag at least 1 m³ of material down the face and form a level layer approximately 250 mm thick at the base of the stockpile.

8.3.2 Repeat Step 8.3.1 adding the material to the existing layer.

8.3.3 Obtain a sample increment from near the centre of the layer using the standard shovel. If the surface of the levelled material is rippled due to the loader bucket, remove sufficient material to expose a fresh and level surface at each sampling position (Note 14.3). Insert the shovel blade vertically into the formed layer for the full depth of the blade, then place the excavated material in the sample container. If more material is required, widen the hole helically by obtained adjacent shovels-full of material using the excavation technique described in this step.

8.3.4 Label or otherwise identify the sample container with the field sample number and increment number. The increment number has to include the number of sample increments required for the sample. For example, 1/4 identifies the first sample increment in four increments.

8.3.5 Repeat Steps 8.3.1 to 8.3.4 until the required number of sample increments, having similar quantities of material, is obtained for each sample.

8.4 Single layer formed stockpile – hand tools

8.4.1 At a predetermined sampling location, mark sampling points at approximately 1500 mm spacing up the side of the stockpile, measured from the base. Exclude any point that is within 500 mm of the top of the stockpile.

8.4.2 At each sampling point, obtain a sub-increment to form a sample increment as follows:

a) Insert the shield board vertically into the material. Remove the material down face from the shield, using a horizontal digging action, to a depth of 200 mm to form a bench. Adjust the position of the shield as necessary to prevent material falling onto the bench. Remove material from the front of the bench in order to form a vertical face (Note 14.4).

b) Obtain at least two shovels-full of material by driving the standard shovel horizontally into the stockpile for the full depth of the blade, at a point approximately 100 mm below the bench. Each shovel insertion is to be at least 300 mm apart. Place the excavated material into the sample container (Note 14.5). If necessary, extend the length of the excavation horizontally using the excavation technique detailed in Step 8.4.2 (a), ensuring that successive shovel insertions are separated by at least 300 mm.

c) Label or otherwise identify the sample container with the field sample number and increment number. The increment number has to include the number of sample increments required for the sample. For example, 1/4 identifies the first sample increment in four increments.

8.4.3 Repeat Steps 8.4.1 and 8.4.2 until the required number of sample increments, having similar quantities of material, is obtained for each sample.

8.5 Multiple layer formed stockpile – excavator remove and mix

8.5.1 At a predetermined sampling location, expose a fresh face for the total height of the side of the stockpile and at least to twice the width of the excavator bucket by dragging material down
with the excavator bucket. Dump the removed material on the stockpile at a location that will not interfere with the sampling process.

8.5.2 Remove sufficient material from the total height of the fresh face using the technique described in Step 8.5.1 to form a level mixing pad adjacent to the stockpile. The pad is to be of sufficient area to accommodate material from each of the nominated sampling locations and allow uniform mixing.

8.5.3 Obtain material for depositing on the mixing pad by removing a uniform slice, at least one excavator bucket wide, for the total height of the exposed face using the technique described in Step 8.5.1. Deposit the material in the centre of the prepared mixing pad, ensuring that the bucket discharge height is as low as possible.

8.5.4 Repeat Steps 8.5.1 and 8.5.3, obtaining a similar quantity of material from each nominated sampling location.

8.5.5 Thoroughly mix the deposited material using a loader, working from various points around the pad, ensuring that the material deposited on the pad is uniformly mixed. While it is acceptable that some pad material may be included in the mixing process, terminate the sampling exercise if the mixture becomes contaminated with foreign material from the stockpile floor. Level the mixed material to form a layer approximately 500 mm thick above the mixing pad.

8.5.6 Obtain the required number of sample increments at uniformly distributed positions across the surface of the layer and not less than 500 mm from any top edge. If the surface of the levelled material is rippled due to the loader bucket, remove sufficient material to expose a fresh and level surface at each sampling position. At each position undertake the following:

a) Insert the blade of the standard shovel vertically into the layer for the full depth of the blade, then place the excavated material in the sample container (Note 14.3). If more material is required, widen the hole helically by obtaining adjacent shovels-full of material using the excavation technique described in this step.

b) Label or otherwise identify the sample container with the field sample number and the increment number. The increment number has to include the number of sample increments required for the sample. For example, 1/4 identifies the first sample increment in four increments.

8.6 Multiple layer formed stockpile – loader remove and mix

8.6.1 At a predetermined sampling location, expose a fresh face for the total height of the side of the stockpile and at least to twice the width of the loader bucket. Achieve this by removing material from the stockpile base in order to cause the face above to collapse.

8.6.2 Remove enough material from the total height of the fresh face using the technique described in Step 8.6.1 to form a level mixing pad adjacent to the stockpile. The pad is to be of sufficient area to accommodate material from each of the nominated sampling locations and allow uniform mixing.

8.6.3 Obtain material for depositing on the mixing pad by removing a uniform slice, at least one loader bucket wide, from the total height of the exposed face using the technique described in Step 8.6.1. Deposit each bucket of material in the centre of the prepared mixing pad, ensuring that the bucket discharge height is as low as possible.

8.6.4 Repeat Steps 8.6.1 and 8.6.3, obtaining a similar quantity of material from each nominated sampling location.
8.6.5 Thoroughly mix the deposited material with the loader, working from various points around the pad, ensuring that the material deposited on the pad is uniformly mixed. While it is acceptable that some pad material may be included in the mixing process, terminate the sampling exercise if the mixture becomes contaminated with foreign material from the stockpile floor. Level the mixed material to form a layer approximately 500 mm thick above the mixing pad.

8.6.6 Obtain the required number of sample increments at uniformly distributed positions across the surface of the layer and not less than 500 mm from any top edge. If the surface of the levelled material is rippled due to the loader bucket, remove sufficient material to expose a fresh and level surface at each sampling position. At each location undertake the following:

a) Insert the blade of the standard shovel vertically into the layer for the full depth of the blade, then place the excavated material into the sample container (Note 14.3). If more material is required, widen the hole helically by obtaining adjacent shovels-full of material using the excavation technique described in this step.

b) Label or otherwise identify the sample container with the field sample number and increment number. The increment number has to include the number of sample increments required for the sample. For example, 1/4 identifies the first sample increment in four increments.

9 Sampling from heaps or windrows

The procedure for sampling from heaps or windrows shall be as follows:

9.1 Heap - hand tools

9.1.1 At a predetermined sampling location, mark sampling points at approximately 1500 mm spacing up the side of the heap, measured from the base. Exclude any point that is within 500 mm of the top of the heap.

9.1.2 At each sampling point, obtain a sub-increment to form a sample increment as follows:

a) Insert the shield board vertically into the material. Remove the material down face from the shield, using a horizontal digging action, to a depth of 200 mm to form a bench. Adjust the position of the shield as necessary to prevent material falling onto the bench. Remove material from the front of the bench in order to form a vertical face (Note 14.4).

b) Obtain at least two shovels-full of material by driving the standard shovel horizontally into the stockpile for the full depth of the blade, at a point approximately 100 mm below the bench. Each shovel insertion is to be at least 300 mm apart. Place the excavated material into the sample container (Note 14.5). If necessary, extend the length of the excavation horizontally using the excavation technique detailed in Step 9.1.2(a), ensuring that successive shovel insertions are separated by at least 300 mm.

c) Label or otherwise identify the sample container with the field sample number and increment number. The increment number has to include the number of sample increments required for the sample. For example, 1/4 identifies the first sample increment in four increments.

9.1.3 Repeat Steps 9.1.1 and 9.1.2 until the required number of sample increments, having similar quantities of material, is obtained for each sample.

9.2 Heap – sampling tube

9.2.1 At a predetermined sampling location, mark sampling points at approximately 1500 mm spacing up the side of the heap, measured from the base. Exclude any point that is within 500 mm of the top of the heap (Note 14.6).
9.2.2 At each sampling point, obtain a sub-increment to form a sample increment as follows:

a) Insert the tube horizontally into the side of the heap with the slot facing downwards. Rotate the tube through 180°, then withdraw the tube. Place the material from the tube into the sample container (Note 14.7).

b) Label or otherwise identify the sample container with the field sample number and increment number. The increment number has to include the number of sample increments required for the sample. For example, 1/4 identifies the first sample increment in four increments.

9.2.3 Repeat Steps 9.2.1 and 9.2.2 until the required number of sample increments, having similar quantities of material, is obtained for each sample.

9.3 Windrow – hand tools

9.3.1 At a predetermined sampling location, level the top of the windrow by removing material to a depth of at least 200 mm in order to form a level surface approximately 500 mm wide and 750 mm long.

9.3.2 Obtain a sample increment from near the centre of the levelled surface using the standard shovel. Insert the blade vertically into the surface for the full depth of the blade, then place the excavated material into the sample container. If more material is required, widen the hole helically by obtaining adjacent shovels-full of material using the excavation technique described in this step.

9.3.3 Label or otherwise identify the sample container with the field sample number and increment number. The increment number has to include the number of sample increments required for the sample. For example, 1/4 identifies the first sample increment in four increments.

9.3.4 Repeat Steps 9.3.1 to 9.3.3 until the required number of sample increments, having similar quantities of material, is obtained for each sample.

10 Sampling from bins and trucks

The procedure for sampling from bins and trucks shall be as follows:

10.1 Bins

10.1.1 At the predetermined sampling interval, have an authorised operator discharge at least 1 m³ of material onto a level surface such as a truck body.

10.1.2 If the material appears segregated, thoroughly remix using the standard shovel. Level the heap to form a layer that is approximately 500 mm thick.

10.1.3 Obtain a sample increment from near the centre of the layer using the standard shovel (Note 14.3). Insert the blade vertically into the layer for the full depth of the blade, then place the excavated material into the sample container. If more material is required, widen the hole helically by obtaining adjacent shovels-full of material using the excavation technique described in this step.

10.1.4 Label or otherwise identify the sample container with the field sample number and increment number. The increment number has to include the number of sample increments required for the sample. For example, 1/4 identifies the first sample increment in four increments.

10.1.5 Repeat Steps 10.1.1 to 10.1.4 until the required number of sample increments, having similar quantities of material, is obtained for each sample.
10.2 Trucks

10.2.1 At the predetermined sampling interval, have the selected truck parked in a safe location away from other traffic.

10.2.2 Gain access to the tray of the truck using a ladder or platform. Locate the longitudinal axis of the load or, if the truck is loaded off-centre, the axis which passes through the highest points.

10.2.3 Locate the centre of the longitudinal axis and points on the axis approximately 1000 mm either side of the centre. At each of these points, flatten the load by removing material to a depth of at least 200 mm in order to form a level surface approximately 500 mm wide and 750 mm long.

10.2.4 At each sampling point, obtain a sub-increment to form a sample increment as follows:

a) Insert the blade of the standard shovel vertically into the layer for the full depth of the blade, then place the excavated material into the sample container (Note 14.3). If more material is required, widen the hole helically by obtaining adjacent shovels-full of material using the excavation technique described in this step.

b) Label or otherwise identify the sample container with the field sample number and increment number. The increment number has to include the number of sample increments required for the sample. For example, 1/4 identifies the first sample increment in four increments.

10.2.5 Repeat Steps 10.2.1 to 10.2.4 until the required number of sample increments, having similar quantities of material, is obtained for each sample.

11 Layer of pavement or earthworks

The procedure for sampling from layers of pavements or earthworks shall be as follows:

11.1 Uncompacted

11.1.1 Determine the quantity of material required for the testing programme, ensuring compliance with the minimum sample mass requirements in Table 1.

11.1.2 At the predetermined sampling location, remove any foreign material making a note of its presence in the sampling record.

11.1.3 If required, level the surface using a shovel.

11.1.4 If not sufficiently loose, the layer shall be loosened using suitable tools. Take care not to break down discrete rock particles.

11.1.5 Excavate a hole with approximately vertical sides and a flat bottom to the full depth of the sampled layer. Recover all loose material and retain all material removed as the sample increment.

11.1.6 When sampling coarse materials such as rail ballast, the farmer’s shovel should be used. To facilitate removal of aggregate, place the shovel mouth on the surface of the material to sample. Stabilise the shovel by placing two hands on the upper half of the shovel handle and one foot on the broad footing area on the top of the shovel head. Step up on the footing area of the shovel head and, by placing the second foot together with the operator’s jolting body weight, drive the shovel home.

11.1.7 For a moisture content sample, take all necessary precautions to prevent moisture loss, both during and following sampling. Seal each sample container at the completion of sampling.
11.1.8 Label or otherwise identify the sample container with the field sample number and increment number. The increment number has to include the number of sample increments required for the sample. For example, 1/4 identifies the first sample increment in four increments. Record sampling information on a sampling log or worksheet provided there is a clear and unambiguous link from the record to each container.

11.1.9 Repeat Steps 11.1.1 to 11.1.8 until the required number of sample increments, having similar quantities of material, is obtained for each sample.

11.2 Compacted

11.2.1 Determine the quantity of material required for the testing programme, ensuring compliance with the minimum sample mass requirements in Table 1.

11.2.2 At the predetermined sampling location, remove any foreign material, making a note of its presence in the sampling record.

11.2.3 If not sufficiently loose, the layer shall be carefully loosened using suitable tools. Take care not to break down any discrete rock particles.

11.2.4 Excavate a hole with approximately vertical sides and a flat bottom to the full depth of the layer sampled. Recover all loose material and retain all material removed as the sample increment.

11.2.5 For a moisture content sample, take all necessary precautions to prevent moisture loss, both during and following sampling. Seal the sample container at the completion of sampling.

11.2.6 Label or otherwise identify the sample container with the field sample number and increment number. The increment number has to include the number of sample increments required for the sample. For example, 1/4 identifies the first sample increment in four increments. Record sampling information on a sampling log or worksheet provided there is a clear and unambiguous link from the record to each container.

11.2.7 Repeat Steps 11.2.1 to 11.2.6 until the required number of sample increments, having similar quantities of material, is obtained for each sample.

12 Records

The following information shall be recorded on each sample container or on a tag affixed to the container using a durable permanent marker (Note 14.8).

12.1 Date of sampling.

12.2 Material type.

12.3 Source of material.

12.4 Nominal size (mm).

12.5 Sampling location including GPS reference if required.

12.6 Amount of material represented.

12.7 Lot identification, sub-lots, field sample numbers, increment numbers.

12.8 Name of sampler.

12.9 Specific sampling procedure used with reference to the relevant sub-section of this method.

12.10 For material in a stockpile, heap or windrow, a dimensioned plan of the lot showing sample increment locations together with points of reference and, where appropriate, sub-increment locations.
12.11 Any other relevant information.

13 Reporting
The following shall be reported:

13.1 Date of sampling.
13.2 Material type.
13.3 Source of material.
13.4 Sampling location.
13.5 Lot identification.
13.6 Specific sampling procedure used with reference to the relevant sub-section of this method.

14 Notes on method

14.1 Since the loader is capable of stockpiling to a height approximately 300 mm more than its reach, it is acceptable to use the same loader for sampling as was used for stockpile formation.

14.2 The increment numbers and masses of sample increments and sub-increments are the minimum requirements to obtain a representative sample. For particular testing programmes, more increments and/or larger increment masses may be needed in order to obtain sufficient representative material.

14.3 When sampling coarse materials such as rail ballast, the farmer’s friend shovel should be used. To facilitate removal of aggregate, place the shovel mouth on the surface of the material to be sampled. Stabilise the shovel by placing two hands on the upper half of the shovel handle and one foot on the broad footing area on the top of the shovel head. Step up on the footing area of the shovel head and, by placing the second foot together with the operator’s jolting body weight, drive the shovel home.

14.4 A step will now be formed consisting of a horizontal bench with a vertical face below. For some materials, a step can be cut without the need to use a shield board. Other materials, particularly consolidated soils, may need to be loosened in order to form the step and facilitate sampling.

14.5 If material falls onto the shovel from above the bench during sampling, discard the shovel-full of material. If the sampling point cannot be repaired, select a new point adjacent to the benched area.

14.6 When sampling for moisture content, it is necessary to consider the likely moisture gradient within the heap. Select additional sampling points in order to achieve a distribution which is consistent with the cross-section of the heap.

14.7 For a moisture content sample, take all necessary precautions to prevent moisture loss both during and following sampling.

14.8 Sampling information may be recorded on a sampling log or worksheet provided there is a clear and unambiguous link from the record to each container.
Table 1 – Sample increment or sub-increment masses

<table>
<thead>
<tr>
<th>Nominal size (mm)</th>
<th>63</th>
<th>53</th>
<th>40</th>
<th>28</th>
<th>20</th>
<th>16</th>
<th>14</th>
<th>10</th>
<th>7</th>
<th>5</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum mass (kg)</td>
<td>30</td>
<td>25</td>
<td>20</td>
<td>14</td>
<td>10</td>
<td>8</td>
<td>7</td>
<td>5</td>
<td>3.5</td>
<td>2.5</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 2 - Number of increments

<table>
<thead>
<tr>
<th>Lot or sub-lot size (t)</th>
<th>&lt; 1000</th>
<th>1000 - 2000</th>
<th>&gt; 2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of increments</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
Test Method Q061: Spot sampling of soils, crushed rock and aggregates

1 Source

This method was developed in-house using techniques evolved through internal departmental investigations.

2 Scope

This method specifies the procedures for obtaining spot samples of soils, crushed rock and aggregates of nominal size up to 63 mm from pavements, earthworks or the discharge of plant such as pug mills.

This method does not cover sampling soils for environmental purposes or representative sampling of lots or sub-lots. Representative sampling is covered by Test Method Q060.

3 Apparatus

Following is a comprehensive listing of apparatus required for this method. While some items are common to all procedures, others are specific to particular procedures.

3.1 Sample containers which prevent fines loss. Airtight containers are required for moisture content samples. Containers are to be of a size or so configured that their maximum capacity does not exceed approximately 20 kg.

3.2 Flat bottomed scoop or trowel, broom and brush.

3.3 Shovels:

3.3.1 Standard shovel, a standard square mouth shovel with raised sides having a blade of approximate dimensions, 300 mm length and 200 mm width.

3.3.2 Post hole shovel, a square mouth post hole shovel having a blade of approximate dimensions, 300 mm length and 200 mm width.

3.3.3 Farmer’s shovel, with a minimised square mouth having a blade of approximate dimensions, 300 mm length, 240 mm width and mouth width of 130 mm for coarse materials such as railway ballast.

3.4 Hand digging tools such as a pick, crowbar or light electric hammer with variable speed control.

3.5 Plant (Note 9.1):

a) bobcat with a profiling / milling head

b) excavator with a profiling / milling head

c) profiler, or

d) insitu stabiliser.

3.6 Tape measure, wheel meter, and survey levelling equipment as required.

3.7 Sample divider, complying with the requirements of AS 1141.2.

3.8 Marking system, suitable marking equipment appropriate for the lot under consideration (for example, spray paint, flagging tape or pegs).
4 Sampling location
The procedure for determining the number of samples and locations shall be as follows:

4.1 Determine the number of samples to be taken within the lot in accordance with the requirements of the specification, sampling plan or testing methodology as appropriate.

4.2 If not documented in the specification, sampling plan or testing methodology, use random stratified sampling as detailed in Test Method Q050 to determine sampling location for each sample.

5 Compacted layer of earthworks or pavement
The procedure for sampling from compacted layer of earthworks or pavement shall be as follows:

5.1 General sampling – hand tools
5.1.1 Determine the quantity of material required for the testing programme, ensuring compliance with the minimum sample mass requirements in Table 1.

5.1.2 At the predetermined sampling location, remove any foreign material, making a note of its presence in the sampling record.

5.1.3 If not sufficiently loose, the layer shall be carefully loosened using suitable tools. Care should be taken not to unnecessarily break down any discrete rock particles.

5.1.4 Excavate a hole with approximately vertical sides and a flat bottom to the full depth of the layer being sampled. Ensure all loose material is recovered and that all material removed is retained as the sample.

5.1.5 For a moisture content sample, take all necessary precautions to prevent moisture loss, both during and following sampling. Ensure the sample container is sealed at the completion of sampling.

5.1.6 Label or otherwise identify the sample container with the field sample number. Sampling information may be recorded on a sampling log or worksheet provided there is a clear and unambiguous link from the record to each container.

5.2 Reference density sample – sand replacement
5.2.1 Determine the quantity of material required, ensuring compliance with the minimum sample mass requirements in Table 1.

5.2.2 Ensure the location for the sample and the surrounding surface is cleaned of loose density sand and any other foreign material.

5.2.3 Enlarge the test hole to obtain sufficient compacted material to determine the laboratory reference density. Ensure the enlarged hole is to the same depth as the sand replacement test hole, the sides are approximately vertical and the bottom of the hole is flat.

5.2.4 If not sufficiently loose, the layer shall be carefully loosened using suitable tools. Care should be taken not to unnecessarily break down any discrete rock particles.

5.2.5 Ensure all loose material is recovered and that all material removed is retained as the sample.

5.2.6 Label or otherwise identify the sample container with the field sample number. Sampling information may be recorded on a sampling log or worksheet provided there is a clear and unambiguous link from the record to each container.
5.3 Reference density sample and/or moisture content sample – nuclear gauge

5.3.1 Determine the quantity of material required, ensuring compliance with the minimum sample mass requirements in Table 1.

5.3.2 Ensure the location for the sample and the surrounding surface is cleaned of loose sand and any other foreign material.

5.3.3 Locate the sampling position for the sample as shown in Figure 1.

5.3.4 Excavate a hole to one of the following depths:
   a) The full depth of the layer where the sampled material is from a pavement or earthworks, or
   b) The depth used in the nuclear gauge measurement of wet density where the sampled material is from earthworks and no layer depth is applicable.

5.3.5 Excavate a hole to obtain sufficient compacted material to determine the laboratory reference density and/or moisture content. Ensure the excavated hole has approximately vertical sides and a flat bottom.

5.3.6 If not sufficiently loose, the layer shall be carefully loosened using suitable tools. Care should be taken not to unnecessarily break down any discrete rock particles.

5.3.7 Ensure all loose material is recovered and that all material removed is retained as the sample.

5.3.8 For a moisture content sample, take all necessary precautions to prevent moisture loss, both during and following sampling. Ensure the sample container is sealed at the completion of sampling.

5.3.9 Label or otherwise identify the sample container with the field sample number. Sampling information may be recorded on a sampling log or worksheet provided there is a clear and unambiguous link from the record to each container.

5.4 Sampling for stabilisation testing – plant excavation

Plant such as a bobcat or excavator with a milling/profiling head may be used to expose and pre-treat earthworks or pavement intended for in situ stabilisation so that sampling may be performed.

5.4.1 Determine the quantity of material required for the testing programme, ensuring compliance with the minimum sample mass requirements in Table 1. Also determine if any material is to be excluded from the sample such as sprayed surfacing, asphalt or stabilised patches.

5.4.2 Ensure the location for the sample and the surrounding surface is cleaned of loose material.

5.4.3 If the seal is not to be incorporated into the in situ stabilisation use the plant to remove the seal before sampling.

5.4.4 Using the plant mill in lateral strips to the depth required by the stabilisation process.

5.4.5 Using a broom or shovel push any material outside the excavated strip back into the excavation.

5.4.6 Repeat Steps 5.4.4 to 5.4.5 two more times to simulate three passes of an in situ stabiliser.

5.4.7 Recover the material from the strip to the full depth of the layer being sampled. Ensure all loose material is recovered and that all material removed is retained as the sample.
5.4.8 Label or otherwise identify the sample container(s) with the field sample number. Sampling information may be recorded on a sampling log or worksheet provided there is a clear and unambiguous link from the record to each container.

6 Uncompacted layer of earthworks or pavement

The procedure for sampling from uncompacted layer of earthworks or pavement shall be as follows:

6.1 Determine the quantity of material required for the testing programme, ensuring compliance with the minimum sample mass requirements in Table 1.

6.2 At the predetermined sampling location, remove any foreign material making a note of its presence in the sampling record.

6.3 If required, level the surface using a shovel.

6.4 If not sufficiently loose, the layer shall be loosened using suitable tools. Care should be taken not to unnecessarily break down discrete rock particles.

6.5 Excavate a hole with approximately vertical sides and a flat bottom to the full depth of the layer being sampled. Ensure all loose material is recovered and that all material removed is retained as the sample.

6.5.1 When sampling coarse materials such as rail ballast, the farmer’s shovel should be used. To facilitate removal of aggregate, place the shovel mouth on the surface of the material to be sampled. Stabilise the shovel by placing two hands on the upper half of the shovel handle and one foot on the broad footing area on the top of the shovel head. Step up on the footing area of the shovel head and, by placing the second foot together with the operator’s jolting body weight, drive the shovel home.

6.5.2 For a moisture content sample, take all necessary precautions to prevent moisture loss, both during and following sampling. Ensure the sample container is sealed at the completion of sampling.

6.6 Label or otherwise identify the sample container with the field sample number. Sampling information may be recorded on a sampling log or worksheet provided there is a clear and unambiguous link from the record to each container.

7 Sampling during discharge

The procedure for sampling during discharge shall be as follows:

7.1 Moving stream - loader bucket

7.1.1 At the predetermined sampling interval, have an authorised operator position a loader bucket of at least 1 m³ to capture the discharge of the plant.

7.1.2 Have the loader parked in a safe location away from other traffic with the bucket resting on the ground.

7.1.3 Locate the highest point of the material and flatten the load by removing material to a depth of at least 200 mm in order to form a level surface approximately 500 mm wide and 750 mm long.

7.1.4 Obtain a sample from near the centre of the levelled surface using the standard shovel. Insert the blade vertically into the surface for the full depth of the blade, then place the excavated material into the sample container. If more material is required, widen the hole helically by
obtaining adjacent shovels-full of material using the excavation technique described in this step.

7.1.5 Label or otherwise identify the sample container with the field sample number. Sampling information may be recorded on a sampling log or worksheet provided there is a clear and unambiguous link from the record to each container.

7.2 Moving stream - truck

7.2.1 At the predetermined sampling interval, have an authorised operator discharge at least 1 m³ of material into a truck. Have the selected truck parked in a safe location away from other traffic.

7.2.2 Gain access to the tray of the truck using a ladder or platform. Locate the longitudinal axis of the load or, if the truck is loaded off-centre, the axis which passes through the highest points.

7.2.3 Locate the centre of the longitudinal axis. At this location, flatten the load by removing material to a depth of at least 200 mm in order to form a level surface approximately 500 mm wide and 750 mm long.

7.2.4 Obtain a sample from near the centre of the levelled surface using the standard shovel. Insert the blade vertically into the surface for the full depth of the blade, then place the excavated material into the sample container. If more material is required, widen the hole helically by obtaining adjacent shovels-full of material using the excavation technique described in this step.

7.2.5 Label or otherwise identify the sample container with the field sample number. Sampling information may be recorded on a sampling log or worksheet provided there is a clear and unambiguous link from the record to each container.

8 Recording

Record the following information using a durable permanent marker on each sample container, sampling log, worksheet or tag affixed to the container:

8.1 Date of sampling.

8.2 Name of sampler.

8.3 Material type.

8.4 Sampling location, including GPS reference if required.

8.5 Lot identification, field sample number and increment number.

8.6 Specific sampling procedure used with reference to the relevant section or sub-section of this method.

8.7 Any other relevant information.

9 Reporting

The following shall be reported:

9.1 Date of sampling.

9.2 Material type.

9.3 Sampling location, including GPS reference if required.

9.4 Lot identification.
9.5 Specific sampling procedure used with reference to the relevant section or sub-section of this method.

10 Notes on method

10.1 Generally a bobcat will be used as the use of a profiler or in situ stabiliser will be impractical in most situations.

Table 1 – Minimum sample masses

<table>
<thead>
<tr>
<th>Nominal size (mm)</th>
<th>63</th>
<th>53</th>
<th>40</th>
<th>28</th>
<th>20</th>
<th>16</th>
<th>14</th>
<th>10</th>
<th>7</th>
<th>5</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum mass (kg)</td>
<td>30</td>
<td>25</td>
<td>20</td>
<td>14</td>
<td>10</td>
<td>8</td>
<td>7</td>
<td>5</td>
<td>3.5</td>
<td>2.5</td>
<td>1</td>
</tr>
</tbody>
</table>

These sample masses are based on material with an apparent particle density of 2.65. The masses may need to be adjusted for exceptionally heavy or light material to provide a sample of equivalent volume.

Figure 1 – Sampling location

A: gauge probe access hole location (smaller circle).

B: location for reference density sample and/or moisture content sample (larger circle).
Test Method Q070: Dry coring of bound materials

1 Source
This method was developed in-house using techniques evolved through internal departmental research investigations.

2 Scope
This method describes the procedure to obtain core specimens from stabilised materials such as soils and crushed rock. The method is suitable for most lightly bound materials. However, difficulty may be encountered if coring is attempted at an early age before substantial strength development has occurred.

This method also describes the procedure for the preparation of the core specimens prior to testing. It involves cleaning, separation and sectioning of the core specimen as appropriate.

3 Apparatus
The following apparatus is required:

3.1 Coring machine, consisting of:
a) Motor is to be equipped with a swivel assembly and hollow output shaft to allow air to flow via the inside of the coring bit to the cutting face during operation.
b) Drill stand able to be held securely in position during coring by either using ballast, applying a vacuum or engaging a mechanical locking device. The drill stand needs to allow linear vertical movement of the coring bit.

3.2 Thin walled coring bit, capable of producing core specimens having a diameter complying with the requirements of Table 1.

3.3 Core extraction equipment, including pincers with curved blades, a length of 20 mm diameter rod and rubber mallet. The rod and mallet are to facilitate removal of cores retained within the coring bit.

3.4 Mechanical compactor, such as an electric demolition hammer for the compaction of patching material other than non-shrink grout. The compactor is to be equipped with a circular compaction plate having a diameter similar to that of the core hole.

3.5 Vacuum extraction system, capable of removing expelled air and dust from the region of the coring bit. The system should:
a) provide an adequate seal around the coring bit and with the surface to ensure removal of dust
b) be fitted with high efficiency particulate air (HEPA) filters
c) include a detachable hose that can be fitted with a nozzle to allow removal of dust from the surface and equipment.

3.6 Masonry saw.

3.7 Stiff wire brush.

3.8 Marking crayon.
4 Materials

The following materials are required:

4.1 Patching material, of a type which is compatible with the material being cored:

4.1.1 Concrete - non-shrink grout (Note 9.1).

4.1.2 Stabilised granular - fresh mixture of the material under test or a low strength non-shrink grout (Note 9.1).

4.2 Compressed air, a continuous supply to remove cuttings from the cutting face and to cool the coring bit.

4.3 Water-proof marker and plastic bags.

4.4 Bituminous emulsion for priming holes (asphalt patching only) (Note 9.1).

5 Sampling procedure

The procedure shall be as follows:

5.1 Select a coring bit which is suitable for the material being cored and which will provide specimens with a diameter specified in Table 1. Carefully examine the selected bit to ensure that it is not damaged or excessively worn. Out of shape bits, bits which rotate eccentrically or bits without sufficient diamond matrix must not be used since they are prone to produce cores which are irregularly shaped or fractured.

5.2 Assemble the coring machine and configure the machine to provide the appropriate rotational speed (Notes 9.2 and 9.3).

5.3 Locate the coring bit centrally over the selected test site and adjust the drill stand so that the coring bit is at right angles to the surface being cored.

5.4 Check the alignment of the bit by lowering it to the surface. Adjust the stand until the cutting face makes full contact with the surface, then secure the drill stand into position.

5.5 Raise the coring bit, and then start the motor. Adjust the air flow to ensure there is sufficient air return to flush fines from the cutting face and to cool the coring bit. Ensure the flow rate does not exceed the capacity of the dust extraction system. Start the dust extraction system.

5.6 Lower the bit and bed it into the surface using slight downward pressure if necessary. Once the bit is bedded, apply sufficient pressure to allow coring to proceed at a uniform rate without clogging the bit or significantly reducing the speed of rotation. Monitor and adjust the air flow to ensure there is sufficient air return to flush fines from the cutting face and to cool the coring bit without exceeding the capacity of the dust extraction system (Note 9.4).

5.7 Continue coring until the full depth of the layer has been cored or, where the coring is to be terminated partway through a layer, to a depth of at least 75 mm greater than that specified.

5.8 When coring is complete, raise the coring bit carefully from the hole and stop the motor and air flow. Remove any dust from the surface with the dust extraction system.

5.9 Remove the core without damage as follows:

5.9.1 Where the core is sitting in the core hole, use the pincers to remove the core.

5.9.2 Where the core is still attached to its base, use the pincers to grip and support the core over as much of its length as possible. Apply either a slight sideways pressure or a twisting action to detach the core. A twisting action is preferred if the core is to be separated at a layer interface.
5.9.3 Where the core is retained within the coring bit, use the rubber mallet to gently tap the sides of the bit to facilitate removal. If the core cannot be freed easily, remove the coring bit and use the 20 mm rod to push the core from the threaded end of the coring bit.

5.10 Inspect the core to ensure that it is intact, of the required length, cylindrical in shape, free from unwanted defects and that it has not been damaged or fractured during coring or extraction (Note 9.5).

5.11 Discard any defective core and obtain a replacement core in close proximity to the nominated site as detailed in Steps 5.4 to 5.11 (Note 9.6).

5.12 Label the core using a waterproof marker, and seal cores other than asphalt in plastic bags. All cores are to be packaged and stored so that they are not damaged in transit nor subjected to any artificial temperature conditions.

5.13 Reinstate the cored surface using an appropriate patching material as follows:

5.13.1 Concrete pavement
   a) Remove loose fines from the hole using the vacuum system.
   b) Mix and fully compact the patching material in accordance with the manufacturer's instructions. Finish the surface flush with the cored surface and protect the patching material from traffic and the environment until final set has occurred.

5.13.2 Stabilised granular pavement
   a) Remove loose fines from the hole using the vacuum system.
   b) Prepare a patching material by obtaining either fresh stabilised material, mix unbound material with the stabilising agent or obtain a low strength low shrink grout.
   c) Compact the patching material in 50-75 mm lifts using the mechanical compactor to fully compact each layer.
   d) Slightly overfill the hole so that the compacted patching material is at a height of approximately 5 mm above the cored surface.
   e) Use the mechanical compactor to form the patching material into a convex mound.

6 Preparation of specimens

Preparation of the core sample using the masonry saw shall be as follows:

6.1 Cut any base material, seal, tack coat or other foreign matter from the core sample using the masonry saw, ensuring that as much of the sample as possible remains (Notes 9.5, 9.7 and 9.8).

6.2 Where the core sample is required to be sectioned or where different bound layers within the core sample are required to be separated, perform the following procedure:
   a) Cut the core sample at the required position(s) using the masonry saw (Notes 9.5 and 9.7).
   b) Remove any loose material from the cut section(s) using the wire brush.

6.3 Mark the core sample or core sample sections as appropriate with an identification number.
7 Records
The following information shall be recorded for each sample:

7.1 Date of sampling.
7.2 An identification number for each core.
7.3 Type of material.
7.4 Nominal size (mm).
7.5 The location of each core including a longitudinal (chainage) and a lateral (offset) reference. Where appropriate, include a plan to show the location of each test site.
7.6 Manufacturer of material.
7.7 Name of sampler.
7.8 A description of each core in terms of general condition, defects and density appearance.

8 Reporting
The following shall be reported:

8.1 Date of sampling
8.2 Type of material.
8.3 Nominal size (mm).
8.4 The location of each core including a longitudinal (chainage) and a lateral (offset) reference.
8.5 Manufacturer of material.

9 Notes on method
9.1 Before handling any patching materials, the operator should consult the relevant SDS.
9.2 The appropriate rotational speed will vary for different coring machines. Typical speeds will be in the range of 700 to 1000 rpm for 100 mm cores and 350 to 650 rpm for 150 mm cores.
9.3 When coring interlayers such as PMB seals, use the highest speed of rotation available.
9.4 Some common causes of defective cores are as follows:
   a) Rounded edges on the upper surface are caused by poor coring bit seating or by a bit which rotates eccentrically.
   b) Irregular sides are a result of incremental change in the rotational plane of the coring bit due to the use of a worn bit and/or excessive downward pressure during coring.
   c) Loss of fines from the surface of weakly bound (stabilised) materials can be due to the abrasive action of loose pieces of aggregate.
9.5 Should fines build up on the surface around the rotating bit, do not remove these with compressed air. They should be removed using the dust extraction system.
9.6 Where the cutting depth of the saw blade is smaller than the diameter of the core sample, the sample shall be rotated slowly during the cutting process.
9.7 Either compressed air or dry ice can usually be used to cool the saw blade. Where the core specimen is to be tested for properties which may be affected by water penetration into the sample, for example, compacted density, voids properties, cooling by dry ice is preferred.
9.8 The intention is that all material not belonging to the bound layer is removed. This may result in the loss of some of the bound layer. Where measurement of layer thickness is required, such measurement will then need to be performed prior to cutting the core specimen.

**Table 1 – Core diameter**

<table>
<thead>
<tr>
<th>Material/application</th>
<th>Test</th>
<th>Nominal size (mm)</th>
<th>Core diameter (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete* or stabilised material#</td>
<td>UCS and density</td>
<td>Aggregate &gt; 20</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Aggregate ≤ 20</td>
<td>100# or 150</td>
</tr>
</tbody>
</table>

*It is preferred that concrete UCS specimens have a height to diameter (h/d) ratio of 2. Where the stipulated diameter isn’t practical for thin layers, cores having lesser diameters can be taken provided the diameter is 4 times the nominal maximum particle size and the h/d ratio is not less than 1.

#It is preferred that stabilised material UCS specimens have a height to diameter (h/d) ratio of 1.15. Generally 100 mm diameter cores should always be taken provided the height diameter ratio is not less than 1.15 or greater than 2.0.
Test Method Q080: Sampling of bituminous binder

1 Source

This method is based on the Main Roads Western Australia Test Method WA 700.1: Sampling procedures for bitumen and oils.

2 Scope

This method describes the procedure for sampling for testing purposes of bituminous binders (including cutting or fluxing oils or combinations thereof) from bulk storage tanks, ship tankers, rail or road tankers, sprayers, drums and pavements.

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

Exercise extreme caution when sampling hot binders, cutbacks or blends, as there is a severe risk of injury due to burns or fire. Wear protective clothing when sampling. No smoking in the general vicinity when sampling. Do not sample through an open hatch of a tank.

Install low pressure in-line sampling cocks on the suction side of a pump and never install on the pressure side.

3 Apparatus

The following apparatus may be required depending on the procedure used for sampling:

3.1 Sample containers, minimum 1 litre capacity double-tight friction-top tins (Note 10.1).
3.2 Low pressure in-line sampling cock. An example is in MRWA Test method WA 700.1 Figure 1.
3.3 High pressure in-line sampling cock. An example is in MRWA Test method WA 700.1 Figure 2.
3.4 Weighted sampling bottle.
3.5 Core cutter with a diamond bit minimum 100 mm diameter, complete with air or water supply.
3.6 Flat trays, sample tins or clean bags for pavement samples.
3.7 Diamond or compound saw.
3.8 Sampling tools, for example, shovel or scoop.

4 Bulk storage - sampling during transfer or circulation

The procedure for sampling from bulk storage during transfer or circulation shall be as follows:

4.1 Perform sampling during transfer or circulation when material in storage tanks, rail or road tankers, ship tankers, sprayers or is flowing through a pipeline or hose and a suitable in-line sampling cock is available. For road tankers or sprayers, circulate the binder for a minimum of 15 minutes prior to sampling.
4.2 Select the quantity of material or duration of transfer that will constitute the sampled lot.
4.3 Determine the number of test samples required.
4.4 Take each test sample in accordance with Step 4.7 or 4.8.
4.5 If only a representative value of a material property is required and not its variability, then combine all test samples from a lot to give a single bulk sample provided the test samples are of approximately the same size and the test property is not distorted by this procedure.

4.6 Label or otherwise identify the sample container with the field sample number and increment number. The increment number has to include the number of sample increments required for the sample. For example, 1/4 identifies the first sample increment in a total of four increments.

4.7 Sampling from other than spray bars
4.7.1 Fit a thoroughly clean and dry sampling cock in position (if not already fitted).
4.7.2 Open the sampling cock and discharge to waste about 4 litres of material to ensure there is no contamination of subsequent samples.
4.7.3 Take each test sample by discharging material from the sampling cock into a clean container taking care to avoid spillage (Note 10.2). Take a test sample of about 1 litre. Seal the container as soon as possible after sampling.

4.8 Sampling from spray bars
4.8.1 This sampling can only be undertaken while the sprayer is stationary.
4.8.2 Place a container on the ground and carefully turn on the nozzle manually. Discharge to waste about 4 litres of material to ensure there is no contamination of subsequent samples.
4.8.3 Take each test sample by discharging material from the spray bar by carefully turning the nozzle on manually into a clean container placed on the ground taking care to avoid spillage (Note 10.2). Take a test sample of about 1 litre. Seal the container as soon as possible after sampling.

5 Bulk storage - sampling when there is no transfer or circulation
5.1 This section refers to sampling material from storage tanks, rail tankers, road tankers, sprayers or mobile storage tanks when the material is not being transferred or circulated through a pipeline or hose. The nature of bulk storage tanks only permits the use of spot sampling. Sampling cocks fixed directly to the tank or its outlet may be used. The use of fixed sampling cocks only allows a sample increment to be taken from material in the immediate vicinity of the sampling cock. This material may not be representative of the contents of the tank. Only use this sampling method where there are no other options for obtaining a test sample.
5.2 Open the sampling cock and discharge to waste about 4 litres of material to ensure there is no contamination of subsequent samples.
5.3 Take at least one sample increment for each test sample by discharging material from the sampling cock into a clean container taking care to avoid spillage (Note 10.2). Take a test sample of at least 1 litre. Seal the container as soon as possible after sampling.
5.4 Label or otherwise identify the sample container with the field sample number and increment number. The increment number must also include the number of sample increments required for the sample. For example, 1/4 identifies the first sample increment in a total of four increments.
6 **Sampling from drums**

The procedure for sampling from drums shall be as follows:

6.1 Perform random sampling from drums only when the material can flow easily.

6.2 Select the quantity of material that will constitute sampled lot.

6.3 Determine the required number of drums to sample.

6.4 Take each test sample in accordance with Step 6.7 or 6.8.

6.5 If only a representative value of a material property is required and not its variability, then combine all test samples from a lot to give a single bulk sample provided the test samples are of approximately the same size and the test property is not distorted by this procedure.

6.6 Label or otherwise identify the sample container with the field sample number and increment number. The increment number must also include the number of sample increments required for the sample. For example, 1/4 identifies the first sample increment in a total of four increments.

6.7 **Liquid Material**

6.7.1 Agitate the drum to provide a single uniform sample then take a test sample or sample increment using either a sampling cock, a sampling bottle or a pump.

6.7.2 Transfer the material to a clean container taking care to avoid spillage (Note 10.3).

6.7.3 Take a test sample of at least 1 litre and seal the container as soon possible after sampling (Note 10.2).

6.8 **Solid Material**

6.8.1 Take a test sample or sample increment from a sample site at least 100 mm below the surface and at least 100 mm from the side of the container. A clean hatchet may be used if the material is hard enough to shatter or a broad stiff knife if the material is soft.

6.8.2 Transfer the material to a clean container.

6.8.3 Take a test sample of at least 1 litre and seal the container as soon as possible after sampling (Note 10.2).

7 **Sampling from pavements**

The procedure for sampling from pavements shall be as follows:

7.1 This method is for the sampling of bitumen for pavement investigations. Cut the sample from the pavement using a cutting disc, corer or manual tools such as crowbar or pick. This method is not for sampling for quality control or quality assurance testing.

7.2 Determine the number of test samples required.

7.3 Determine the boundaries of the section to sample.

7.4 Take each test sample by cutting around the boundary of the sample site taking care to ensure minimum disturbance of the slab. Use suitable cooling if required.

7.5 Cut the test sample to or beyond the full depth of the layer sampled.

7.6 Remove the test sample with the minimum disturbance of the slab and place in a clean container. Sample sufficient material to satisfy the requirements of all proposed tests.
7.7 Label or otherwise identify the sample container with the field sample number and increment number. The increment number must also include the number of sample increments required for the sample. For example, 1/4 identifies the first sample increment in a total of four increments.

8 Recording

Record the following information using a durable permanent marker on each sample container, sampling log, worksheet or tag affixed to the container:

8.1 Identification of storage vessel.
8.2 Date of sampling.
8.3 Name of sampler.
8.4 Material type, classification of binder.
8.5 Supplier.
8.6 Sampling location.
8.7 Lot identification, field sample number and increment number.
8.8 Amount of material represented.
8.9 Specific sampling procedure used with reference to the relevant sub-section of this method.
8.10 Any other relevant information.

9 Reporting

The following shall be reported:

9.1 Date of sampling.
9.2 Material type, classification of binder.
9.3 Sampling location.
9.4 Lot identification.
9.5 Specific sampling procedure used with reference to the relevant sub-section of this method.

10 Notes on method

10.1 New paint tins with handles are suitable.
10.2 Allow sufficient room for expansion or contraction of the material in the container.
10.3 To avoid contamination it may be necessary to discharge to waste the initial material withdrawn.