

- Please read these instructions carefully **BEFORE** you start testing!
- Please Return the Results by Friday, August 25, 2017.
- Late Submissions **WILL NOT BE ACCEPTED**.
- Include the name of the person submitting the results along with the Lab Number (assigned to your laboratory by MTO) on each Data Sheet.
- This worksheet contains instructions for Aggregate (page 2), Soil (page 9), and Superpave (page 10) testing.
- Complete all worksheets in this Excel file and any additional forms applicable to your testing, e.g., Forms PH-CC-343 and PH-CC-437.
- To improve efficiency and accuracy of data processing, your lab is required to submit the completed Excel Files by Email. Excel Files shall be saved prior to submission using the naming format as follows.
 - * **SASTP Import.xlsx saved as Lab # Lab name, e.g. Lab 47 ABC Lab.xlsx**
 - * **PH-CC-343.xlsx saved as 1.17 CPN analysts name Lab name, e.g. 1.17 CPN MacDonald ABC Lab.xlsx, 2.17 CPN MacDonald ABC Lab.xlsx**
 - * **PH-CC-437.xlsx saved as 1.17 FPN analysts name Lab name, e.g. 1.17 FPN MacDonald ABC Lab.xlsx, 2.17 FPN MMacDonald ABC Lab.xlsx**
- Input test results will be transferred to the SASTP worksheet. It is the responsibility of the person submitting the results to verify the test data in ALL worksheets and Forms prior to submission.
- Submissions shall be addressed to the attention of:

Zhiyong (Gem) Jiang, P.Eng.

Mail: Soils and Aggregates Section
Materials Engineering and Research Office
Ministry of Transportation
145 Sir William Hearst Avenue, Room 220
Toronto, Ontario M3M 0B6

Tel: 416-235-4901

Email: Zhiyong.Jiang@ontario.ca

2017 MTO Aggregate Proficiency Samples

Samples

Your lab should receive the following samples:

- 1 pair (2 large bags) of coarse and fine aggregate mixture labelled **1.17A** and **2.17A**,
- 1 pair (2 large bags) of coarse aggregate samples labelled **1.17ST** and **2.17ST**.
- 1 pair (2 large bags) of coarse and fine aggregate mixture labelled **1.17P** and **2.17P**, if you requested participation in Moisture-Density Relationship Test (MTO LS-706).
- 1 pair (2 bags) of fine aggregate labelled **1.17FS** and **2.17FS**, if you requested participation in any of Micro-Deval Abrasion (LS-619), Relative Density and Absorption (LS-605), Magnesium Sulfate Soundness (LS-606) and Uncompacted Void Content (LS-629).
- 1 pair (2 small bags) of Reclaimed Asphalt Pavement (RAP) samples labelled **1.17RAP** and **2.17RAP**.
- 1 pair (2 large bags) of coarse aggregate samples labelled **1.17CPN** and **2.17CPN**, if you requested participation in Petrographic Analysis of Coarse Aggregate (MTO LS-609).
- 1 pair of (2 small bags) fine aggregate samples labelled **1.17FPN** and **2.17FPN**, if you requested participation in Petrographic Analysis of Fine Aggregate (MTO LS-616).
- 1 pair (2 small bags) of soil samples labelled **1.17S** and **2.17S**, if you requested participation in the soil tests.
- 1 pair (2 small bags) of fine aggregate samples labelled **1.17IR** and **2.17IR**, if you requested participation in Determination of Acid Insoluble Residue of Aggregates (MTO LS-613).
- 1 set (6 small bags) fine aggregate samples labelled **Spratt, Cement, 1.17MI, 2.17MI, 1.17MII, 2.17MII**, if you requested participation in Accelerated Detection of Potentially Deleterious Alkali-Silica Reactive Aggregate by Expansion of Mortar Bars (MTO LS-620).
- 1 set (6 large bags) coarse and fine aggregate samples labelled **CtrlC, CtrlF, 1.17CPC, 1.17CPF, 2.17CPC, 2.17CPF**, if you requested participation in Concrete Prism Expansion (CSA A23.2-14A).
- If you requested participation and did not receive the appropriate samples, please contact Mr. Gem Jiang at (416) 235 – 4901, or Zhiyong.Jiang@ontario.ca.
- If you do not have a supply of **control aggregate** for MTO LS-606, LS-614, LS-618 and LS-619, please contact Mr. Gem Jiang at (416) 235 – 4901, or Zhiyong.Jiang@ontario.ca.

Testing

Test methods in the 2016 publication of the MTO Laboratory Test Manual (Revision 30) must be followed. The full manual is available at the following link (also attached in the email):

https://www.raqs.mto.gov.on.ca/RAQS_Contractor/RAQSCont.nsf/viewContractorBulletinQualifiedLabs/8F813018DDFE7AAD852572CE006B7CDA?OpenDocument

The tests must be carried out in pairs. The Operator who performs the sieve analysis on Sample 1.17A must also perform the sieve analysis on Sample 2.17A. The same Operator need not perform every test in which the laboratory intends to participate. For example, Operator 'A' may perform the Micro-Deval Abrasion (MDA) tests and Operator 'B' the moisture-density relationship tests, as long as the Operator 'A' or 'B' performs the particular test on both samples.

Carry out the non-destructive tests first. Material used for the non-destructive tests may be recombined to form samples to prepare for the remaining tests, as indicated below.

Each lab is advised to perform the tests in such an order to ensure sufficient material:

1. Preparation of Sample, MTO LS-600: Dry all aggregate samples to a constant mass at $110 \pm 5^{\circ}\text{C}$.

Tests to be performed on Samples 1.17A and 2.17A:

2. Sieve Analysis, MTO LS-602: Test the entire samples **1.17A** and **2.17A** to determine the coarse aggregate gradation. Both samples must be tested using the same coarse aggregate nest of sieves. Report percent passing each sieve, with the exception of 4.75 mm sieve, to the nearest 0.1% on a cumulative basis. Report the percent passing 4.75 mm sieve to 0.01%.

Prepare the Test Samples **3.17A** and **4.17A** for the fine aggregate gradation test by splitting the material passing 4.75 mm sieve from the samples **1.17A** and **2.17A**, respectively. Obtain sufficient quantity of samples as required by the test for the determination of fine aggregate gradation. Use the same fine aggregate nest of sieves for both samples.

Compute the fine aggregate gradation for each sample based on the **total mass, i.e., masses of 1.17A and 2.17A, respectively**. Report percent passing each sieve, with the exception of 75 μm sieve, to the nearest 0.1% on a cumulative basis. Report the percent passing the 75 μm sieve to 0.01%.

3. Percent Flat and Elongated Particles, MTO LS-608: Use the materials retained on 4.75 mm sieve, of samples **1.17A** and **2.17A** for this test. Compute the percent of each fraction using the guidelines provided in Section 7.2 of MTO LS-608. Do **NOT** determine the flat and elongated particles of 26.5 mm to 19.0 mm fraction. Assign the same flat and elongated value of the next smaller fraction, i.e., 19.0 mm – 13.2 mm, for the 26.5 mm to 19.0 mm fraction. **All 5 fractions shall be used to compute the weighted average.** Report the **percentage of each fraction, percent flat and elongated particles of each fraction**, and the **weighted average** to the nearest 0.1%. This material may be recombined to form the sample for other tests.

4. Micro-Deval Abrasion (Coarse Aggregate), MTO LS-618: Prepare the test specimens from the samples **1.17A** and **2.17A**. Prepare a 1500 g sample passing 19.0 mm and retained on 9.5 mm sieve according to the table in Section 4.2 of the test method. Run a control sample at the same time.

Record the Test Sample Loss to the nearest 0.1%. Report your control sample tested (Drain Brothers or Brechin No.2), and Loss to the nearest 0.1%. **DO NOT REUSE THIS MATERIAL.**

5. Freezing and Thawing of Coarse Aggregate, MTO LS-614: From the samples **1.17A** and **2.17A**, prepare the test samples from the materials passing 19.0 mm and retained on 4.75 mm sieves according to section 5 of the test method. Do **NOT** determine the freeze-thaw value for 26.5 mm to 19.0 mm fraction. Assign the same freeze-thaw value of the next smaller fraction, i.e., 19.0 - 13.2 mm, for the 26.5 mm to 19.0 mm fraction. **All 4 fractions shall be used to compute the weighted average.** Run a control sample at the same time.

Compute the percent of each fraction and the weighted average using the guidelines in Section 8 of MTO LS-614. Report the **percentage of each fraction, freeze-thaw loss of each fraction**, and the **weighted average freeze-thaw loss** to the nearest 0.1%. Report your lab **control sample tested (Drain Brothers or Brechin No.2), lab sample number** and **Loss** to the nearest 0.1%. **DO NOT REUSE THIS MATERIAL.**

Fine Aggregate Tests to be performed on Samples 1.17FS and 2.17FS

6. Relative Density and Absorption (Fine Aggregate), MTO LS-605: Prepare the test specimens according to MTO LS-605, from the fine aggregate samples **1.17FS** and **2.17FS**. MTO LS-605 requires removal of materials passing 75 μm sieve by washing prior to testing. Saturate the test specimens from both samples by immersion in water for 24 ± 4 hours. Report the **Relative Density (OD), Relative Density (SSD) and Apparent Relative Density** to the nearest 0.001. Calculate the absorption and report the results to the nearest 0.01%.

7. Micro-Deval Abrasion Loss (Fine Aggregate), MTO LS-619: Prepare 500 g test specimens from samples **1.17FS** and **2.17FS** according to Section 5 of LS-619. Run a control sample at the same time.

Report the test **Sample Loss** to the nearest 0.1%. Report your laboratory control sample tested (**Sutherland sand** or **James Dick**) and **Loss** to the nearest 0.1%. **DO NOT REUSE THIS MATERIAL.**

8. Magnesium Sulphate Soundness (Fine Aggregate), MTO LS-606: Prepare test specimens from the samples **1.17FS** and **2.17FS**. The test is to be run using magnesium sulphate. Run five cycles according to the test method.

Report the initial and final masses to 0.1 g, and test sample loss to the nearest 0.1%. Compute the percentages of each fraction. Report a weighted sample loss calculated using the percentages of each fraction for **1.17FS** and **2.17FS**. **DO NOT REUSE THIS MATERIAL.**

Tests to be performed on Samples 1.17ST and 2.17ST:

You will need to perform a coarse aggregate gradation on the samples (**1.17ST** and **2.17ST**) in order to calculate the weighted average for the percent crushed particles as per MTO LS-607.

9. Wash Pass 75 μm , MTO LS-601: Obtain an appropriate quantity of material as required by the test method from the samples **1.17ST** and **2.17ST**. Perform the test in accordance with Guideline A of MTO LS-601. Report the **Percent Loss** to 0.01%. This material may be recombined to form the sample for other tests.

10. Percent Crushed Particles, MTO LS-607: Use the materials retained on 4.75 mm sieve, of samples **1.17ST** and **2.17ST** for this test. Compute the percent of each fraction using the guidelines in Section 7.3 of MTO LS-607 and perform the test in accordance with Method B. Do **NOT** determine the crushed particles of 26.5 mm to 19.0 mm fraction. Assign the same percent crushed value of the next smaller fraction, i.e., 19.0 mm – 13.2 mm, for the 26.5 mm to 19.0 mm fraction. **All 5 fractions shall be used to compute the weighted average.** Report the **percentage of each fraction, percent crushed particles of each fraction and the weighted average** to the nearest 0.1%. This material may be recombined to form samples for other tests.

11. Relative Density and Absorption (Coarse Aggregate), MTO LS-604: Prepare the samples for this test from the samples **1.17ST** and **2.17ST**. Report the **Relative Density (OD), Relative Density (SSD) and Apparent Relative Density** to the nearest 0.001. Calculate the **Absorption** and report the results to the nearest 0.01%. This material may be recombined to form the sample for other tests.

12. Los Angeles Abrasion, MTO LS-603: Prepare the test specimens from the samples **1.17ST** and **2.17ST**. Carry out the test as outlined in the test procedure using **11-B grading**. Report the mass of the charge of spheres and the **Loss** to the nearest 0.1%. **DO NOT REUSE THIS MATERIAL.**

13. Magnesium Sulphate Soundness (Coarse Aggregate), MTO LS-606: Prepare test specimens from the samples **1.17ST** and **2.17ST**. The test is to be run using magnesium sulphate. Run five cycles on the following two fractions: P19.0 mm / R9.5 mm and P9.5 mm / R4.75mm.

Report the initial and final masses to 0.1 g, and test sample loss to the nearest 0.1%. Compute the percentages of each fraction, i.e., P19.0 mm / R9.5 mm and P9.5 mm / R4.75 mm, based on the total mass of both fractions tested. Report a weighted sample loss calculated using the percentages of each coarse fraction for **1.17ST** and **2.17ST**. **DO NOT REUSE THIS MATERIAL.**

Tests to be performed on Separate Samples for Individual Tests:

14. Petrographic Analysis of Coarse Aggregate, Method LS-609, Part A: The pair of samples provided, **1.17CPN** and **2.17CPN** each contain three fractions: 1) P19 mm/R13.2 mm ~1500g, 2) P13.2 mm /R9.5 mm ~500g, and 3) P9.5 mm/R4.75 mm ~200g. Examine each fraction provided separately. **DO NOT COMBINE THE FRACTIONS.**

The 2017 material is derived from a gravel pit in the Caledon, Ontario area. The 2017 material is specifically chosen for the abundance of partial and total cementations present. Please carry out the test as outlined in Section 6 of the procedure **with the following exceptions:**

Sample 1.17CPN:

Please classify any cementations and encrustations present in the material according to normal LS-609 test method procedures, i.e. Table 3, and rock type descriptions for rock types 52, 53 and 54 in Appendix of Test Method LS-609.

Sample 2.17CPN:

Please classify any **partial cementations** present in the material according to the modified rock type and quality classification scheme described below:

Partial Cementation, Good Category: cementations form less than 5% of the total surface area, host particle is hard (cannot be scratched) to medium hard (thin to relatively thick scratch possible)

Partial Cementation, Fair Category: cementations form between 5 and 20% of the total surface area, host particle is hard (cannot be scratched) to medium hard (thin to relatively thick scratch possible) to soft (easy to scratch and relatively easy to scratch), also includes particles ***where cementations form less than 5% of the total surface area where the host particle is determined to be soft (easy to scratch and relatively easy to scrape)***

Partial Cementation, Poor Category: cementations form greater than 20% of the total surface area - host particle hard (cannot be scratched) to med hard (thin to relatively thick scratch possible)) to very soft (easily scraped and relatively easy to peel) and ***cementations less than 20% - host particle very soft (easily scraped and relatively easy to peel)***

Please use the 'pull down' tabs under rock types on Form PH-CC-343a to enter the modified classification above accordingly.

Classification of total cementations remains the same, i.e. Rock type 54.
 Classification of encrustations remains the same, i.e. Rock type 52.

Report the Hot Mix and Concrete Petrographic Number for each fraction to the nearest whole number on Form PH-CC-343a (attached Link in the email). Calculate the Weighted Average Petrographic Number (PN) using the coarse aggregate gradation provided in the table below

Pass	Retained	Individual Retained %	Cumulative Retained %
19.0 mm	13.2 mm	35	35
13.2 mm	9.5 mm	30	65
9.5 mm	4.75 mm	35	100

Submit a copy of Form PH-CC-343a completed in full including the **name of the Analyst** for each sample. Please also indicate the **Card ID #**, e.g. P1201-XXXX, and the date of expiry if the Analyst is CCIL certified for LS-609.

Note: Additional samples must be requested if more than one analyst from a lab wishes to participate in this test. **DO NOT REUSE THIS MATERIAL.**

15. Determination of Acid Insoluble Residue of Aggregates, MTO LS-613: Prepare the test specimens by obtaining approximately 100 to 125g from each of the Samples **1.17IR** and **2.17IR**. Carry out the test as outlined in Section 5 of the test procedure and report the **Total Percentage of Insoluble Residue** and the **Percentage of Insoluble Residue Retained 75µm** to the nearest 0.1%.

16. Petrographic Analysis of Fine Aggregate, MTO LS-616, Part A: Prepare the test specimens from the samples **1.17FPN** and **2.17FPN**. Determine the gradation of the samples **1.17FPN** and **2.17FPN** in order to compute the weighted average of each rock, mineral or material type present in the specimen as indicated on Form PH-CC-437a. Appraise the quality of the fine aggregate sample provided as outlined in the test procedure. Calculate the weighted percent of each rock, mineral, or material type using the guidelines provided in Sections 7.2 and 7.3 of LS-616 Part A. Submit a copy of the petrographic analysis Form PH-CC-437a completed in full for each sample.

Note: Additional samples must be requested if more than one analyst from a lab wishes to participate in this test. **DO NOT REUSE THIS MATERIAL.**

17. Method of Test for Accelerated Detection of Potentially Deleterious Alkali-Silica Reactive Aggregate by Expansion of Mortar Bars, MTO LS-620: Perform the tests on the three different pairs of samples provided. Participants will also be required to test a sample of the Spratt control aggregate (provided) at the same time the provided samples are tested.

Approximately 2.5kg of standard cement is also supplied. **Use only this supplied cement to make the mortar bars.**

A summary of materials provided is presented in the table below.

INSTRUCTIONS - Please read carefully BEFORE you start testing!

Materials Provided	Label	Approximate Mass
Pair MI	1.17MI	2kg
	2.17MI	2kg
Pair MII	1.17MII	2kg
	2.17MII	2kg
Spratt #3	Spratt #3 2017	6kg
Cement	2017 Cement	2.5kg

Prepare the test samples from each of the samples labelled **1.17MI, 2.17MI, 1.17MII, 2.17MII and Spratt #3 2017**. Grade each of the aggregate samples using the sieve series shown in Section 7.2, Table 1 of LS-620. Wash each fraction of each sample carefully with a water spray over the retaining sieve to remove adhering dust and fine particles from the aggregate. Dry the portions retained on the various fractions thoroughly prior to mixing. Follow Test Method LS-620 procedure from 7.3 onwards, using water:cement ratio equal to 0.50 for the MI and Spratt control samples. Use water:cement ratio equal to 0.44 by mass for the MII samples.

Note: An approximately 6kg representative sample of Spratt #3 control aggregate that is pre-crushed to P4.75mm is provided for your convenience. As a reminder: this material must still be appropriately prepared as per Section 7.2, Table 1 of LS-620. Please do not forget to wash and dry the individual fractions prior to mixing and testing.

Measure and report the expansion after 1, 3, 7, 13, and 14 days in NaOH solution. If you are unable to take measurements on the appointed day, please make a measurement on the next convenient day closest to the one required – indicate this by including a note on the data submission sheet. **In any case, ensure that a reading is taken at 14 days.** Calculate the average expansion to the nearest 0.0001%. Report all the results of this test separately for each of the materials on "Mortar Bar Test" sheet.

If you have any questions, please contact **Carole Anne MacDonald at (416) 235-3738**.

18. Amount of Asphalt Coated Particles in Coarse Aggregate, MTO LS-621: Prepare the test specimens from the samples **1.17RAP** and **2.17RAP**. Carry out the test as outlined in the test procedure and report the **Percentage of Asphalt Coated Particles** to the nearest 0.1%.

19. Moisture-Density Relationship, MTO LS-706: Follow LS-706 (ASTM D698 Method C) to perform the test on the material obtained from samples **1.17P** and **2.17P**. Use all the materials for compaction. There is no correction for oversize particles.

Report the maximum **wet density** and maximum **dry density in t/m^3** , and **optimum moisture content in percentage**. **DO NOT REUSE THE MATERIAL.** (Note: $t/m^3 = g/cm^3$).

20. Potential expansivity of aggregates (procedure for length change due to alkali-aggregate reaction in concrete prisms at 38°C), Method CSA A23.2-14A

Three mixtures will be required for participation in the 2017 program. A summary of mixtures and materials provided is presented in the table below. You shall follow Test Method CSA A23.2-14A and report any deviation from the procedure in the supplied forms.

INSTRUCTIONS - Please read carefully BEFORE you start testing!

Mixture	Materials Provided	Label	Approximate Mass
Control	Coarse Aggregate	Ctrl C	25-30kg
	Fine Aggregate	Ctrl F	25-30kg
1.17CP	Coarse Aggregate	1.17CPC	25-30kg
	Fine Aggregate	1.17CPF	25-30kg
2.17CP	Coarse Aggregate	2.17CPC	25-30kg
	Fine Aggregate	2.17CPF	25-30kg

Please complete the included Equipment and Testing Questionnaire and Cement Sample Information Sheet. Please note that cement is **NOT** provided by MTO for this portion of the 2017 Correlation Program. Please note that as part of the concrete mix design process the density and absorption must be obtained for each of the aggregates provided for each of the three mixtures. Please report density and absorption of each of the aggregates provided in the supplied Concrete Mix Design reporting sheets.

Measure and report the expansion after 1, 2, 4, 8, 13, 18, 26, 39, and 52 weeks. If you are unable to take measurements on the appointed day, please make a measurement on the next convenient day closest to the one required – indicate this by including a note on the data submission sheet. **In any case, ensure that a reading is taken at 26 and 52 weeks.** Calculate the average expansion to the nearest 0.0001% and report all results on the supplied **Expansion Data Reporting** sheet.

Report the results of this test separately for each of the mixtures on the data submission sheet(s). If you have any questions or require clarification, please contact **Carole Anne MacDonald at (416) 235-3738 or Gem Jiang at (416) 235-4901.**

2017 MTO Soil Proficiency Samples

Samples

If requested, you should receive 1 pair (2 small bags) of soil samples **1.17S** and **2.17S**.

Particle Size Analysis of Soils, MTO LS-702:

Prepare individual test specimens from samples **1.17S** and **2.17S**. Use a freshly prepared dispersing agent with distilled water and **40 grams** of sodium hexametaphosphate per litre of solution and ensure the pH value of the solution is adjusted to 8 or 9. The soil samples supplied should be dispersed in the stirring apparatus for 10 minutes.

Compute the specific gravity correction factor α and constant K assuming a value of **2.775** for the specific gravity of soil particles (**DO NOT** use the values determined by your lab).

Upon completion of the test, please compute **Constant K**, **Coefficient of Viscosity η** , and **Particle Diameter D** to four significant digits (i.e., 0.0001), and record the results on the "**Hydrometer Analysis**" sheet. Report the **Percent passing the 425 μ m, 75 μ m, 20 μ m, 5 μ m and 2 μ m sieves** to the nearest 0.1 percent. Participants shall submit data using these sheets; otherwise test results shall not be accepted.

Liquid Limit, Plastic Limit and Plasticity Index of Soils, MTO LS-703/704:

Determine the Liquid Limit, Plastic Limit and Plasticity Index of soil samples **1.17S** and **2.17S** according to **ASTM D 4318**. Prepare the test specimens as outlined in Section 10.2 – Dry Preparation, and determine the Liquid Limit according to the procedure described in Section 11.0, Method A – Multi-point Liquid Limit. Determine the Plastic Limit using a minimum of two trials and report the mean value. Report the **Liquid Limit, Plastic Limit and Plasticity Index** to the nearest one decimal, i.e., 0.1

Specific Gravity of Soils, MTO LS-705:

Determine the specific gravity of soil samples **1.17S** and **2.17S** according to **MTO LS-705**. Carry out the test according to the procedures outlined in Section 8.1 – Procedures for Oven Dried Specimen.

Perform the test on **minimum of three specimens** and report the **Mean Specific Gravity** of the soil to the nearest three decimal places (0.001). The calculated test results from three specimens (range) should be within 0.02 of each other. If the range exceeds 0.02, the test must be repeated. Record the masses and other details of this test on the Specific Gravity Data Card under the "**Soil**" sheet. Participants shall submit data using these sheets; otherwise test results shall not be accepted.

2017 MTO Superpave Proficiency Samples

Samples

If requested, you should receive the following samples:

- 1 pair (2 large bags) of coarse and fine aggregate mixture **1.17A** and **2.17A**.
- 1 pair (2 bags) of fine aggregate **1.17FS** and **2.17FS**.

Preparation of Samples must be in accordance with the procedures described in each test method.

1. Uncompacted Void Content of Fine Aggregate, MTO LS-629:

Prepare the individual test specimens from **1.17FS** and **2.17FS**. Obtain sufficient quantity of samples from the material passing the 4.75 mm sieve, as required by the test method. Perform the uncompacted void content test in accordance with **MTO LS-629**. Compute the uncompacted void contents using the specific gravity values of Samples **1.17FS** and **2.17FS** determined according to **MTO LS-605**. Report the uncompacted voids to the nearest 0.1% and the bulk dry specific gravity values used, to the nearest 0.001.

2. Sand Equivalent Value of Fine Aggregate, AASHTO T 176 or ASTM D 2419:

Obtain at least 1500 g of fine aggregate sample from the material passing 4.75 mm sieve, i.e. the finer portion of samples **1.17A** and **2.17A**. Prepare the test specimens in accordance with Procedure A or B. Report the sand equivalent value of each of the 4 test specimens, the average sand equivalent value to the nearest 0.1%, and whether you used Procedure A or B.

3. Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate, Method ASTM D 4791:

Use the materials retained on 4.75 mm sieve from the samples **1.17A** and **2.17A**. Perform the test in accordance with Method B using 5:1 ratio. Do **NOT** determine the flat and elongated particles of 26.5 mm to 19.0 mm fraction. Assign the same flat and elongated value of the next smaller fraction, i.e., 19.0 mm – 13.2 mm, for the 26.5 mm to 19.0 mm fraction. All 5 fractions shall be used to compute the weighted average. Compute the percent of each fraction based on the gradation (MTO LS-602) of the coarse aggregate portion of the as-received sample. The computation should be based on the total mass of material retained on 4.75 mm sieve. Report the **percentage of each fraction, percent flat and elongated particles** for each fraction, and **weighted average** to the nearest 0.1%. This material may be recombined to form the sample for other tests

4. Percentage of Fractured Particles in Coarse Aggregate, Method ASTM D 5821:

Perform the test on the materials retained on 4.75 mm sieve, of the samples **1.17A** and **2.17A** for this test. Determine the percentage of fractured particles by mass. Report the **percentage of material with at least one fractured face** to the nearest 0.1%. This material may be

INSTRUCTIONS - Please read carefully BEFORE you start testing!

recombined to form samples for other tests.