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TEST REPORT

PROJECT CODE	:	F0211
PROJECT NAME	:	TESTING OF AGGREGATE
SUBJECT	:	PETROGRAPHY TEST OF AGGREGATES FOR CONCRETE
TEST STANDARD	:	ASTM C295/C295M: 2012
JOB REF	:	ADM/14/2906A
SAMPLE TYPE	:	C.SAND
CLIENT SAMPLE REF	:	RIVER SAND-PROCESSED
SAMPLE SOURCE REF	:	PHILIPPINES
DATE RECEIVED	:	09-May-2014
DATE OF REPORT	:	30-May-2014
TOTAL PAGES	:	9 (including cover page)

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Cert No: LA-2013-0548-F

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A. TEST METHOD

The test is performed with accordance to ASTM C295/C295M-2012: Standard Guide for Petrographic Examination of Aggregates for Concrete.

B. TEST OBJECTIVE

Petrographic examination is made for the following purposes:

- To describe and determine the classification of the aggregate for concrete and its constituents
- To determine the risk of alkali silica reaction and alkali-carbonate reaction of the constituents, and recommend additional tests to confirm or refute the presence in significant amounts of aggregate capable of alkali reaction in concrete

C. AGGREGATE TYPE

Type of test specimen is sand.

D. TEST PROCEDURE

The following test procedure performed is with accordance to ASTM C295/C295M-2012. Dry sieve the samples to provide test specimen of each sieve size, in accordance with ASTM C136. Each sieve fraction will be examined separately. At least 150 particles of each sieve fraction are obtained (sample shall be reduced in accordance with ASTM C702), identified and counted. Grains that cannot be identified macroscopically will be examined with the stereoscopic and polarizing microscopes. A thin section will be prepared with fluorescent dye impregnation and will be examined by using Petrographic microscope under Plane Polarisation Light (PPL), Cross Polarisation Light (XPL) and Fluorescent light, when necessary. Calculation on the each constituent as a percentage of the total amount particles from each sieve fraction will be performed and tabulated in Table 1, Appendix A. Photomicrograph of some significant minerals obtained from microscopic examination will be included in this test report, Appendix B.

E. TEST RESULTS

E.1 MACRO-EXAMINATION RESULTS:

The sand sample is generally appeared grey in colour, associated with few dark grey particles, probably of andesite. Most of them are from rounded to sub-rounded shape. Mainly are of quartz with its clear appearance. Its maximum nominal size is 4.75 mm. Refer to Figure 1.

E.2 MICRO-EXAMINATION RESULTS:

This sand sample was comprised of Quartz, Feldspar and Andesite rock fragment.

Andesite rock fragment Figure 4 to Figure 6 (24%, in whole sample): A type of extrusive rock has a porphyritic texture. The phenocrysts (approximately 0.5 to 2 mm) are of plagioclase, amphibole and pyroxene, surrounded by fine grained to microcrystalline groundmass (approximately 0.05 to 0.01 mm) of plagioclase, quartz and volcanic glass. From the photomicrographs in Appendix B it can be seen that the andesite is characterized by the presence of about 55% of plagioclase, 20% of amphibole, 12% of microcrystalline quartz, 7% of volcanic glass, 5% of pyroxene and 1% of iron oxide. The observation of 12% microcrystalline quartz and 7% volcanic glass in this rock is deemed to be potential risk to cause an ASR in concrete

Quartz Figure 7 (58%, in whole sample): Quartz is the major mineral component in this fine aggregate sample. The quartz grains are mostly of mono-crystalline. Few strained quartz crystals were observed on the thin section under XPL by its evidence of undulatory extinction at certain angles (> 15°). There is presence of dark specks which are the inclusions of the fluid present at the time of crystallization in quartz crystals and are known as fluid inclusions or vacuoles.

Feldspar Figure 8 (18%, in whole sample): The plagioclase crystal exists as subhedral columnar texture. In the PPL view plagioclases are characterized by white, two cleavages intersecting at 86° and low relief (+). Figure 8, taken under crossed polars, show the polysynthetic twinning and zone of the plagioclase.

Particles / Minerals	Quartz	Feldspar	Andesite rock fragment	Overall, %
Macro-Quartz	99	-	-	**57.42**
Strained Quartz (R)*	1	-	-	**0.58**
Microcrystalline Quartz (R)*	-	-	12	**2.88**
Iron Oxide	-	-	1	**0.24**
Plagioclase	-	100	55	**31.2**
Amphibole	-	-	20	**4.8**
Pyroxene	-	-	5	**1.2**
Volcanic Glass (R)*	-	-	7	**1.68**
Total, %:	100	100	100	-
Total, in whole sample, %:	**58**	**18**	**24**	**100**

*(R) Reactive Mineral

Under the Fluorescent microscopy light, the quartz is observed to be low porosity. The weighted and composition of each sieve fraction are tabulated in Table 1.

F. FINDINGS & CONCLUSIONS

F.1 ALKALI-SILICA REACTIVITY:

Alkali Silica Reactivity: **Low Reactive**

This sample is consists of quartz (58%), feldspar (18%) and Andesite rock fragment (24%). The sample porosity is generally low.

Due to the presence of strained quartz (0.58%), microcrystalline quartz (2.88%) and volcanic glass (1.68%), the sample is deemed to be of potential risk of alkali silica reactivity.

F.2 ALKALI-CARBONATE REACTIVITY: Nil

F.3 OTHER RECOMMENDATION:

The degree of the alkali silica reactivity and whether the amount of reactive minerals found will produce a deleterious degree of expansion in concrete will be further studied with mortar-bar method, based on ASTM C1260.

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APPENDIX A: PARTICLE COUNTS

TABLE 1: COMPOSITION OF THE TEST SPECIMEN

Constituents (Particles)	Amount, as Number of Particles in Percent											
	In Fractions Retained on Sieves Shown Below								In Whole Sample			
	4.75-mm	2.36-mm	1.18-mm	600-µm	300-µm	150-µm	75-µm	<75-µm	Condition 1	Condition 2	Condition 3	Totals
Quartz	0%	14%	55%	62%	66%	70%	0%	0%	58%	0%	0%	58%
Feldspar	0%	8%	19%	23%	14%	17%	0%	0%	18%	0%	0%	18%
Andesite rock fragment	100%	78%	26%	15%	20%	13%	0%	0%	24%	0%	0%	24%
Total	100%	100%	100%	100%	100%	100%	0%	0%	--	--	--	100%
Weighted average, condition 1									100%	--	--	--
Weighted average, condition 2									--	0%	--	--
Weighted average, condition 3									--	--	0%	--

Note: Condition 1: Fresh
Condition 2: Moderately Weathered
Condition 3: Very Weathered

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APPENDIX B: PHOTOGRAPH & PHOTOMICROGRAPHS

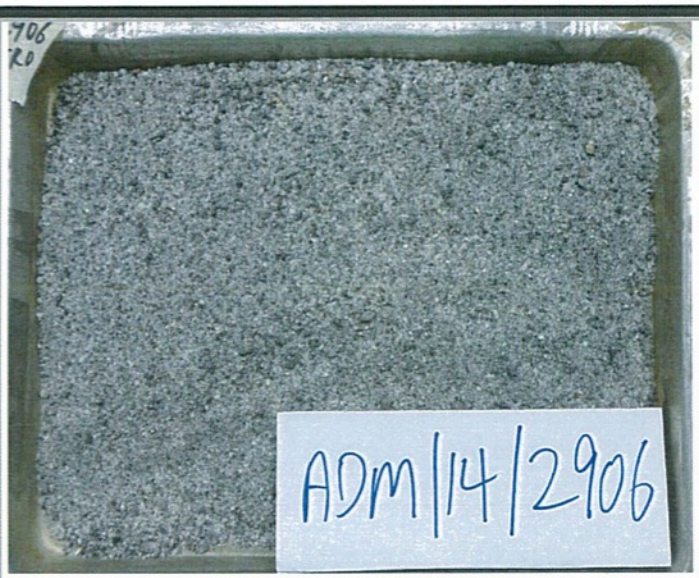

Figure 1: Photograph of sample before washing.

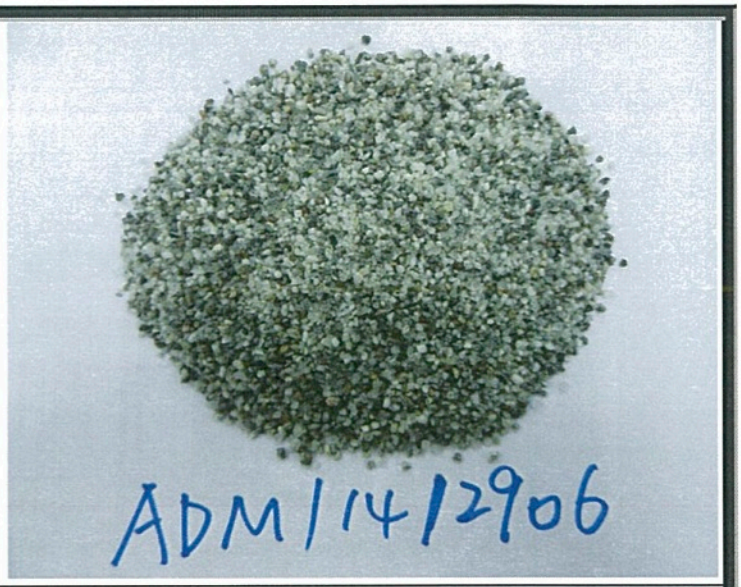

Figure 2: Photograph of sample after washing.

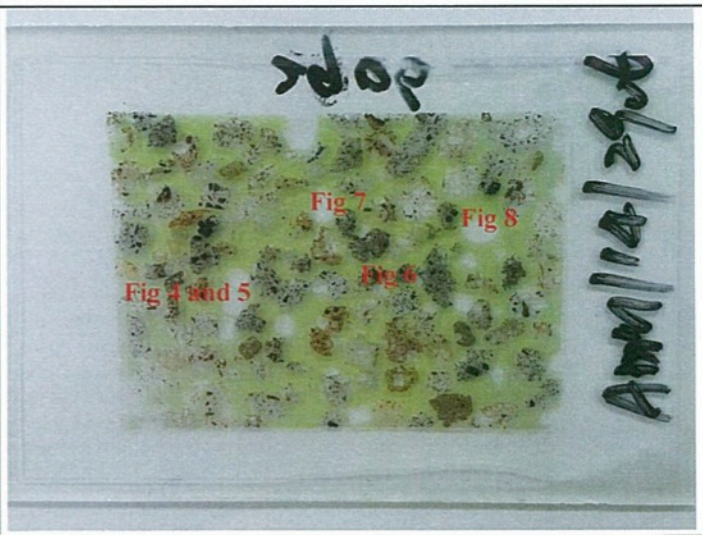

Figure 3: Photograph of the thin section.(0.6mm-4.75mm)

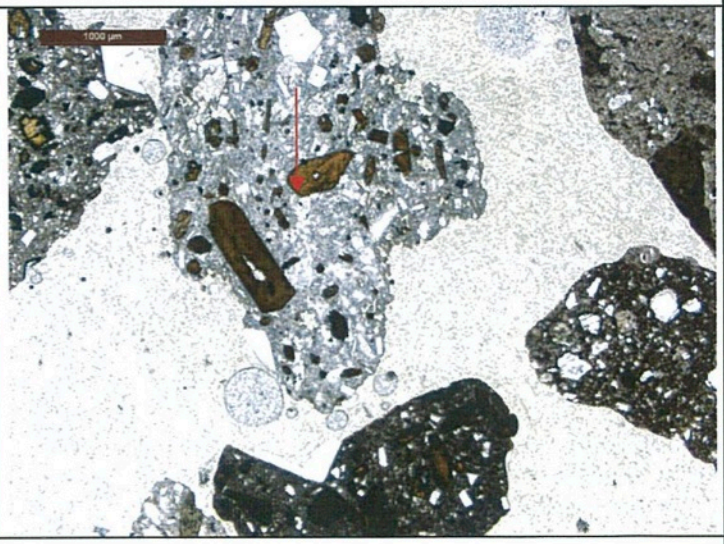

Figure 4: Photomicrograph of Andesite rock fragment.

Plane Polarized Light, 25X

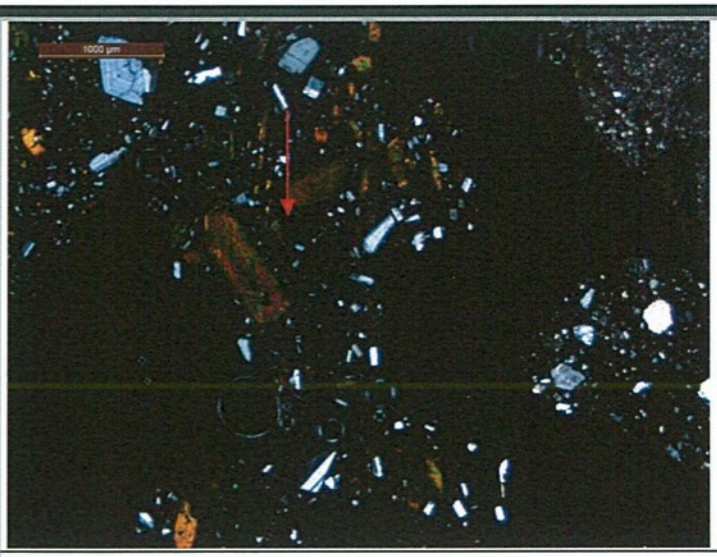

Figure 5: Photomicrograph of Andesite rock fragment.

Cross Polarized Light, 25X

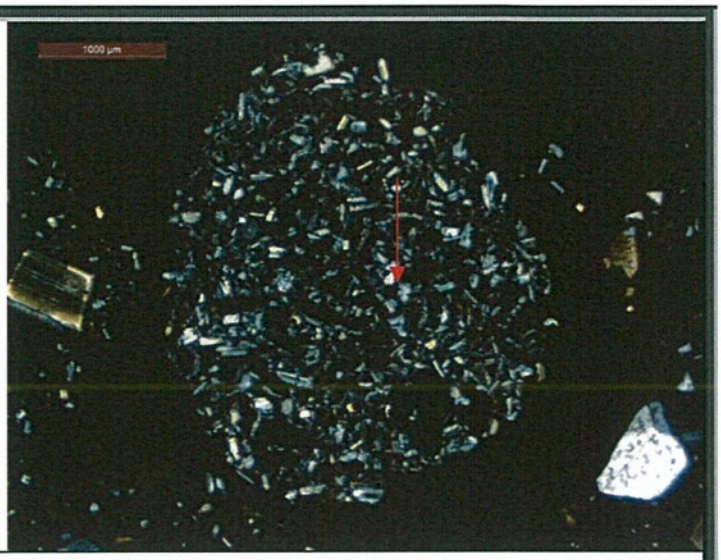

Figure 6: Photomicrograph of Andesite rock fragment

Cross Polarized Light, 25X

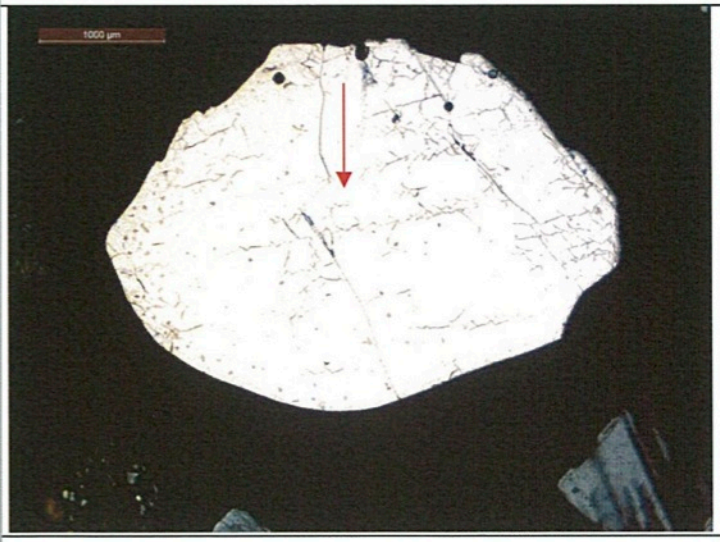

Figure 7: Photomicrograph of Quartz Arenite.

Cross Polarized Light, 25X

Figure 8: Photomicrograph of Plagioclase.

Cross Polarized Light, 25X