CET431-101	**AGGREGATE TESTING LAB**
CONSTRUCION TESTING	PROFESSOR WASHINGTON
NAME OF GROUP	**XYZ**
GRADING ITEMS	**COMMENTS**
COOPERATIVE LEARNING	ALL MEMBERS OF THE GROUP WERE NOT ALWAYS PRESENT DURING THE ENTIRE SESSION OF THE LAB AND AT THE BEGINNING OF THE CLASS.
ESSAY QUESTIONS	GOOD JOB WITH ESSAY QUESTIONS - IN YOUR DISCUSSION QUESTION #1 , YOUR GROUP ELUDED TO THE FACT THAT THERE WAS NOT ENOUGH TIME TO REPEAT LAB AND OTHER GROUPS WERE USING EQUIPMENT AND ALLYN LUKE NEEDED TO BE PRESENT. HOWEVER, MANY OF THE GROUPS IN YOUR CLASS SAID THAT THEY HAD TO REPEAT THEIR LABS AND THIS ISSUE OF NOT HAVING TIME TO DO ADDITIONAL LABS WAS NEVER MENTIONED TO THE INSTRUCTOR
VIDEO QUESTIONS	VIDEO QUESTIONS WERE COMPLETED WELL WITH A FEW MISTAKES AS NOTED
LAB CALCULATIONS	GOOD JOB ON THE CALCULATION FOR THE LAB. ALL OF THE WORK SEEMED TO BE COMPLETED. AIR DRY CALCULATION SHOULD HAVE BEEN PERFORMED FOR LAB #1 IN ORDER TO OBTAIN THE CORRECT SPECIFIC GRAVITY.
FINAL LETTER GRADE	B+

CONSTRUCTION TESTING MATERIALS
CET 431

DR. DAVID WASHINGTON
ASSOCIATE PROFESSOR

AGGREGATE TESTING LAB

ASTM Concrete Laboratory Testing

Lab#1: Specific Gravity and Absorption of Coarse Aggregate (CA) – ASTM C127
Lab#2: Specific Gravity and Absorption of Fine Aggregate (FA) – ASTM C128
Lab#3:Unit Weight and Voids in Aggregate – ASTM C29,C127, C128
Lab#4:Total Moisture Content & Surface Moisture Content of Aggregate ASTM C566,C127, C128
Lab#5: Sieve Analysis of Coarse Aggregate- ASTM C136
Lab#6: Sieve Analysis of Fine Aggregate- ASTM C136

Certification of Concrete Laboratory Testing Technicians – Grade 1, Tape#2 (52 minutes)

I. ASTM C702 - *Reducing Field Samples of Aggregate to Testing Size*
II. ASTM C117 – Material Finer than No. 200 Sieve in Mineral Aggregate by Washing
III. ASTM C136 – Sieve Analysis of Fine and Coarse Aggregate
IV. ASTM C29 – Unit Weight and Voids in Aggregate
V. ASTM C127 –*Specific Gravity and Absorption of Coarse Aggregate*
VI. ASTM C128 – *Specific Gravity and Absorption of Fine Aggregate*
VII. ASTM C566 – *Total Moisture of Aggregate by Drying*

Abbreviation Notes:
Air (g) – Weight of Air Dry Sample in grams
SSD (g) – Weight of Saturated Surface Dry Sample in grams
SUB (g) – Weight of Submerged Sample in grams
OD (g) – Weight of Oven Dry Sample in grams

Group XYZ

Captain : Steven Barbera

Chris SanFilippo
Neil Venezia
George Rodriguez
Mario Guglielmo

Directions: The following formal lab write-up will be used to put together your final report for concrete. Each group is responsible for submitting this write-up for grading. Answer all of the following sections and submit your work along with this document. Each write-up should be done by group with exceptions for shared data from the lab test. The final grade for this write-up will partially be based on the correct use of grammar.

Directions: Answer the following essay type questions justifying your explanations with the appropriate references and standards as needed. Please **type or print** all of your answers for the following section.

A. Essay Questions

I. Objective and Introductory Questions

(Try to answer these question before performing the test)

1. What is the overall objective of this lab? What will be done with the results of these tests?

O.K mention the ASTM C33 designation!

The overall objective of this lab is to determine the specific gravity and absorption of sand and gravel based on air dry conditions, submerged conditions, saturated surface dry conditions, and oven dry conditions. We also tested the percent void content and moisture content of materials as well as the weight retained after the sieve test. We will take the results of these tests to determine the bulk specific gravity, the apparent specific gravity, the absorption, the percentage retained, the percent void, average sizes of stone, total moisture contents etc. These tests will be essential when it comes to producing the concrete mix design.

2. Why is there a need for doing these type of test? How important are these test?

✓

We do these types of test in order to know the different qualities of the materials we are using and how they can affect the final product produced. These tests are very important when calculating the strength of the concrete mix design that is being used.

3. What is the difference between acceptance and quality control? Which one of these applies to the lab work that is being performed?

Acceptance is what applies to our lab in which we are creating an acceptable concrete mix design for our use. Quality control is designing a concrete mix based on no particular qualifications.

Acceptance is a part of the Quality control process!!

??, What does this means??

II. Narrative Questions

(Try to answer these questions during or after performing the test)

1. Mention any variations in the method that was used in the lab when compared to the specification. (i.e. sample was not immersed 24 hrs)

    1. Not having the 24 hours to immerse the aggregate in water. ← Why?
    2. The cloth we used to dry the aggregate was used by other groups prior to us.
    3. The wire basket, and all of the other instruments, were all used before.
    4. Not having the 24 hours to dry the samples in the oven. ← Why?

2. If the test method used in the lab varied from the specification, how will it effect the results? (i.e. absorption value would be less if voids were only partially filled with water)

The specifications in the lab are implied in order to get as close to exact results as one can. The effects of the variations are listed below:

1. Not following the specified amounts of time for absorption and drying can cause the voids in the aggregates to be only partially filled with water or be only partially dry.
2. Using a used cloth caused it to not be as absorbent as it should have been. It was also dirty which could have prevented the cloth from absorbing all of the visible films of water.
3. Using the used instruments led to aggregate, not from our sample, being caught in the wire basket, sieves, etc. and affected our weights recorded.

3. What factors contributed to possible errors in your results?

Throughout each of the labs there were many variations that existed which could account for the percent difference you can see in our results. All of the variations listed in question 1 above have played part in affecting our measurements. We also took notice to other groups adding aggregates to the pile that were put in water. The students adding the used aggregates to the pile caused the two samples, wet and dry, to be mixed which could have affected our results. Other mistakes took place while performing each of the labs. Small portions of the samples were spilled while shaking or dropped into the water. These examples of human error also contributed to the errors in our results.

4.How do you verify your results and show some consistency? Can your results be verified?

We compared our results to the other lab groups' results. Doing this, we were able to see if our results were similar or consistent with the others. Also using the information we learned in lecture we knew the characteristics of all of the moisture contents. This was a good reference as we recorded our results to see if our numbers seemed to be correct.

III. Discussion Questions

1. Did you repeat some of these test? Explain.

We did not get a chance to repeat any of the tests from the six labs we completed. This was due to the time given to us to complete all six labs, the hours the lab equipment was available to us, and the other four other lab groups also using the same lab equipment as our group. The time given to us to complete all the labs was only enough to complete them with only set of results and the lab equipment was only available to us when Allan was present and obviously when our group members were not at our other classes.

2. How will these results be useful in making concrete?

The results of these labs will be useful in making concrete because we were able to classify our aggregate, and the methods we used to calculate our results are the same methods used to classify all aggregates. Aggregates must be correctly classified because different concrete mix designs require specific size ranges of aggregate. The different classes of aggregate used in concrete mixes affect the properties of the concrete mix, such as its strength, weight, permeability to water, etc.

3. What was the classification of your aggregate?

The classification of our coarse aggregate was 56 stone. The gradation curve fit the allowable bounds for this classification. Other size classifications were tried, but our aggregate only met the classifications of this size stone.

4. Did it meet ASTM specifications or standards?

Our coarse aggregate met the specifications and standards of 56 stone while our fine aggregate met the classifications of the ASTM. The fine aggregate gradation curve fit in the upper and lower bounds specified by the ASTM.

5. How will the concrete industry benefit from these tests?

The concrete industry will benefit from these tests because these tests allow us to correctly classify all aggregates and all companies classify aggregates with these tests. These companies also use the same set of standards and specifications (ASTM) to determine whether the aggregates are within those allowable limits.

IV. Conclusion Questions

Did you achieve your objective or goal? What factors or parameters that you obtained in this lab, have a direct effect on the performance or the strength of your concrete mix design? Explain.

Yes we achieved our objective of determining the specific gravity and absorption of aggregate contents. There may be some factors or percent errors in our lab from loosing materials such as gravel or sand when weighing them. Some of the gravel may have been stuck in the sieve trays or may have fell out when the shaking was being done. The different weights will throw our results off slightly. There is a percent error that comes into play in the case.

FILL IN THE VALUES FOR ALL OF THESE PARAMETERS:

G (CA) for SSD	G (CEMENT)	%ABS (CA)	% TM (CA)	DRW (CA)	G (FA) for SSD	%ABS (FA)	%TM (FA)	FM (FA)
2.67	3.15	3.69%	.10%	106.66	3.95	3.25%	.53%	2.7

Ok

B. Video Questions

I. ASTM C702 Reducing Field Samples of Aggregate to Testing Size

1. Why was the field sample test method developed?

   The field sample test method was developed to minimize variations between large samples obtained in the field and portions of the field samples to be used in the individual tests.

2. What two factors determine the method to be used in reducing a field sample?

   The two factors that determine the method used in reducing a field sample is the aggregate's moisture content and whether the sample is fine aggregate only, course aggregate only or a mixture of the two.

   Coarse

3. Name three methods for reducing field samples?

   The three methods for reducing the field samples are Method A: the use of a mechanical splitter, Method B: the quartering technique, and Method C: miniature stockpile sampling.

4. Which method is mandatory for samples of fine aggregate drier than Saturated Surface Dry (SSD)?

   The use of a mechanical splitter is mandatory for samples of fine aggregates drier than Saturated Surface Dry.

5. What kind of aggregate samples are only used with Miniature Stockpile Sampling?

   Only fine aggregate samples containing free surface moisture use the miniature stockpile sampling method.

II. ASTM C117 – Material Finer than No. 200 Sieve in Mineral Aggregate by Washing

1. According to ASTM C33 (Standard Specifications for Concrete Aggregate), what limiting amount by percent weight of the total sample should pass the No. 200 sieve for concrete subject to abrasion? for all other concrete?

   1.5% of the amount by percent weight of the total sample should pass the No. 200 sieve for concrete subject to abrasion and for all other concrete if the material is essentially free of clay or shale.

   3.0% - #200
   5.0% - all others

2. Should we use the same test sample C117 and C136 for an aggregate with a nominal size of ½ inch or less?

No, because the nominal size of ½ inch is too large to be considered a fine aggreagate.

yes - for ½" or less in nominal size!!

III. ASTM C136 – Sieve Analysis of Fine and Coarse Aggregate

1. When sieving by mechanical apparatus or by hand, how long should sieving continue?

The sieving should continue so that after completion not more than 1% by weight of the residue on any individual sieve will pass that sieve during 1 minute of continuous hand sieving.

2. What is the fineness modulus?

Fineness modulus is an empirical number used for the acceptance and control of aggregate for concrete. It is the sum of the cumulative percent retained divided by 100.

3. What are the U.S. Standard sieve sizes used to calculate fineness modulus? What is the relationship between each consecutive sieve?

They are: 1-1/2-in. (38.1-mm), 3/4-in. (19.0-mm), 3/8-in. (9.5-mm), No. 4 (4.75-mm), No. 8 (2.36-mm), No. 16 (1.18-mm), No. 30 (600-μm), No. 50 (300-μm), and No. 100 (150-μm). The relationship between each consecutive size is that they decrease by a factor of .5.

4. The total weight of the sample after sieving should be within what percent of the total dry weight of sample before sieving?

The total weight of the sample after sieving should be within three tenths of a percent of the total dry weight of the sample before sieving.

5. Why is the weight of particles on a given sieve considered "Cumulative"?

It is considered cumulative in the sense that any particles retained on a sieve with a larger opening would also be retained on that sieve and therefore regarded as retained material.

IV. ASTM C29 – Unit Weight and Voids in Aggregate

1. What should the moisture content of the test sample be at the time of testing?

The test sample is to be oven dried to constant mass in an oven at 230 +/- 9°F, therefore the moisture content of the test sample at the time of testing should be 0.

2. What minimum capacity unit weight bucket should be used for an aggregate sample with a maximum aggregate size of ¾ in?

The minimum capacity unit weight bucket that should be used for an aggregate sample with maximum aggregate size of ¾ in should be 1/3 cubic foot.

V. ASTM C127 –Specific Gravity and Absorption of Coarse Aggregate

1. Should this method be used to determine the specific gravity and absorption of lightweight stones?

No → Yes, this method should be used to determine both specific gravity and absorption of lightweight stones.

2. Define the term Saturated Surface-Dry (SSD).

SSD is the condition in which the permeable pores of aggregate particles are filled with water to the extent achieved by submerging in water for the prescribed period of time, but without free water on the surface of the particles.

3. Define the term absorption.

Absorption is the percentage of the weight of water needed to fill the pores compared to the oven-dry weight of the aggregate.

4. What difference in calculations are made for Specific Gravity for SSD and Oven Dry stones?

For SSD specific gravity, the weight of the SSD sample in air is divided by the SSD weight in air minus the weight of the saturated test sample in water. For Oven Dry stones, the OD weight is divided by OD weight minus the submerged weight of the sample.

VI. ASTM C128 – Specific Gravity and Absorption of Fine Aggregate

1. How does one know when SSD has been reached in a sand sample?

SSD is reached when the sample has become free flowing with the help of a cone test.

2. What decimal place is recommended for recording all of the weights?

All weights should be recorded to the nearest one tenth of a gram.

VII. ASTM C566 – Total Moisture of Aggregate by Drying

1. Why is it important when drying a sample with a hot plate or electric heat lamps to avoid hot spots?

Hot Spots must be avoided to prevent uneven drying.

2. Define the term total moisture content.

← Not a formula a definition!!

Total moisture content is given as P = 100 (mass of original sample[g] – mass of dried sample[g]) / mass of dried sample[g]

3. What is the additional weight loss after further heating, when a sample is considered to be oven dry?

There is less than one tenth of a percent weight loss after further heating. This is considered to be thoroughly dry.

C. Lab Procedure Questions and Calculations

I. *Lab#1: Specific Gravity and Absorption of Coarse Aggregate (CA) – ASTM C127*

Define Specific Gravity, Bulk Specific Gravity, Apparent Specific Gravity, and Absorption.

Procedure:

Equipment: Balance, wire basket (of 3.35mm or finer wire mesh), water tank, oven

Sample: A minimum of 4000 gm (8.8lb) test sample for aggregate of maximum nominal size 1in (25 mm). The sample should not have particles of sizes less than 0.187 in. (4.75 mm).

Maximum size of CA [in.(mm)]	*Minimum Weight of Sample [lb(kg)]*
1 (25)	*8.8(4)*
¾ (19)	*6.6(3)*
½" or less (12.5)	*4.4(2)*

a. Weigh the test sample: Air (g)
b. Immerse the aggregate in water at room temperature for a period of 24±4h.
c. Remove the sample from the water. Roll it in a large absorbent cloth until all visible films of water are removed. The sample is now in Saturated Surface Dry (SSD) condition.
d. Weigh the sample and obtain its SSD weight: SSD (g)
e. Place the SSD sample in the wire basket and determine its weight in water: SUB(g)
Note that the wire basket should be immersed to a depth sufficient to cover it and the test sample during weighing.
f. Remove the sample from the wire basket.
g. Dry the sample to constant weight at a temperature of 110±5° C (≈ 24h.), and weigh: OD(g)

NOTES: Stones are submerged in a pail, so that you do not have to wait 24 hrs., therefore, by knowing the oven dry weight of this sample and finding the total moisture of the stone (lab#4), you can calculate the Air dry Weight (Air).

3. Calculate the following specific gravities and absorption.

I would like to see how Air Dry Was Calculated!!

Formulas:

Bulk Gs (Air dry)= $\frac{Air}{SSD - SUB}$ = (3671.47g)/(3803.3g-2380.7g) = **2.58**

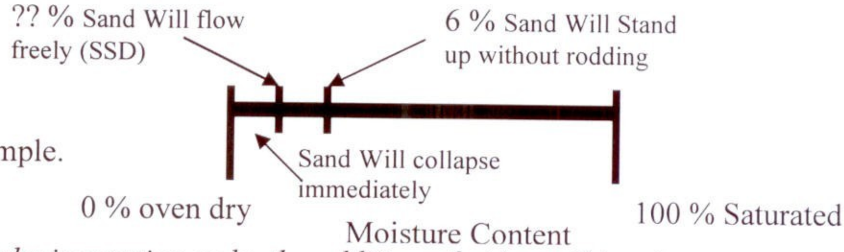
Bulk Gs (SSD) = $\frac{SSD}{SSD - SUB}$ = (3803.3g)/(3803.3g-2380.7g) = **2.67**

Apparent Gs = $\frac{SSD - OD}{OD} \times 100$ = (3667.79g)/(3667.79g-2380.7g) = **2.85**

Absorption = $\frac{OD}{OD - SUB}$ = ((3803.3g-3667.79g)/(3667.79g)) x 100 = **3.69%**

II. *Lab#2: Specific Gravity and Absorption of Fine Aggregate (FA) – ASTM C128*

Procedure:



Equipment: Balance, pycnometer & oven
Sample: About 500g of fine aggregate sample.

a. *Weigh the test sample: Air (g)*
b. *Cover the test sample with water, either by immersion or by the addition of at least 6% moisture to the sample, and permit to stand for 24±4h.*
c. *Decant excess water with care to avoid loss of fines. Spread the sample on a flat nonabsorbent surface exposed to a gently moving current of warm air, and stir frequently to secure homogeneous drying. Continue until the sample approaches a free-flowing condition. Weigh the specimen when it has reached a SSD(g).*
d. *Fill the pycnometer with water to the top, and weigh: PYC(g)*
e. *Remove part of the water, and introduce the SSD sample into the pycnometer.*
f. *Fill with additional water to approximately 90% of its capacity.*
g. *Roll, invert, and agitate the pycnometer to eliminate all air bubbles.*
h. *Bring the water level in the pycnometer to its calibrated capacity.*
i. *Determine the total weight of the pycnometer, specimen, and water: SUB(g)*
j. *Remove the sample from the pycnometer, dry to constant weight at a temperature of 110±5° C, cool , and weigh: OD(g)*

(Lab#2 continued)

Calculate the specific gravity and absorption.

Bulk Gs (Air Dry) = $\frac{Air}{PYC + SSD - SUB}$ = (578.6g)/(1443.9g + 585.9g – 1763.56g) = **2.17**

Bulk Gs (SSD) = $\frac{SSD}{PYC + SSD - SUB}$ = (585.9g)/(1443.9g + 585.9 g– 1763.56g) = **2.2**

Apparent Gs = $\frac{OD}{PYC + OD - SUB}$ = (567.45g)/(1443.9g + 567.45g – 1763.56g) = **2.29**

Absorption = $\frac{SSD - OD}{OD} \times 100$ = ((585.9g-567.45g)/(567.45g)) x 100 = **3.25%**

O.K

III. *Lab#3:Unit Weight and Voids in Aggregate – ASTM C29,C127, C128*

Define air voids, unit weight, and bulk density.

Procedure:

Equipment: Balance, 5/8 in. diameter tamping rod (24 in. long), cylindrical metal measure (minimum capacity of ½ cuft. for CA of size not larger than 1.5 in and of .1 cuft. for FA)

Sample: Aggregate dried to constant weight, preferably in an oven at 110±5° C.

Maximum size of CA [in.(mm)]	*Minimum Volume of Sample [ft³]*
1 (25)	*1/3*
½" or less (12.5)	*1/10*

a. Find the empty weight of the metal measure.
b. fill the measure with the dry sample one-third full.
c. Rod the layer of aggregate with 25 strokes. (Do not allow the rod to strike the bottom)
d. Fill the measure two-thirds full, level, and rod as in step c.
e. Fill the measure overflowing and rod as in step c.
f. Level the surface of the aggregate with a finger and tamping rod such that any slight projection of the larger pieces of the CA approximately balance the larger voids in the surface below the top of the measure.
g. Weigh the measure with the aggregate and find the net weight of the aggregate: WT (lbs)

NOTE: Be sure to measure the dimensions of the bucket to confirm its volume.

(Lab#3 continued)

1. Calculate the unit weight :

Unit Weight or Bulk Density or Dry Rodded Unit Weight (DRW) = $\frac{WT}{V}$,

where V is the volume of the pail (cu ft.)

DRW = 48/.45 = **106.66 lbs / cu ft.**

2. Calculate the void content or percent void.

$$\text{Void (\%)} = \frac{Gs_{(Air\ Dry)} \times \delta_w - DRW}{Gs_{(Air\ Dry)} \times \delta_w},$$

Void (%) = ((2.58 x 62.4 lb/cu ft) – (106.66 lbs/cu ft)) / (2.58 x 62.4 lb/cu ft) = **33.75%**

O.k

IV. ***Lab#4: Total Moisture Content and Surface Moisture Content of Aggregate- ASTM C566,C127, and C128***

Define Moisture Content, Absorption, and Surface Moisture.

Procedure:

Equipment: Balance, oven

Sample: A minimum of 4000 gm (8.8lb) of CA ***and*** *500gm of FA.(Please perform both test)*

Maximum size of CA [in.(mm)]	*Minimum Weight of Sample [lb(kg)]*
1 (25)	*8.8(4)*
¾ (19)	*6.6(3)*
½" *(12.5)*	*4.4(2)*

a. Weigh the sample: Air (g)
b. Dry the sample to constant weight in an oven at 110±5° C for approximately 24h and cool.
c. Weigh the dried sample: OD(g)

3. Calculate the moisture content.

$$\text{Total Moisture} = \frac{Air - OD}{OD} \times 100$$

TM (FA) = (845-840.57)/(840.57) x 100 = **.53%**
TM (CA) = (3359.6 – 3356.23)/(3356.23) x 100 = **.1%**

Surface Moisture Content = Total Moisture – Absorption

O.K

← Where Is Surface moisture calculations ???

V. *Lab#5: Sieve Analysis of Coarse Aggregate- ASTM C136*

[Draw the gradation curve for this sample and include the upper and lower bound limits.]

Procedure:

Equipment: Balance, sieves, mechanical shaker, oven

Sample: Coarse Aggregate of weight equal to:

Maximum size of CA [in.(mm)]	*Minimum Weight of Sample [lb(kg)]*
1.5 (37.5)	*33(15)*
1 (25)	*22(10)*
¾ (19)	*11(5)*
½" *(12.5)*	*4.4(2)*

Note : Use the same weight for ¾ in. when the maximum size is less than ¾ in.

a. Dry the sample to constant weight at a temperature of 110° C (230 F) if the sample is lightweight or is suspected of containing appreciable amount s of material finer than a No. 4 sieve.
b. Weigh the dry sample accurately.
c. Weigh each empty sieve and the pan.
d. Nest the suitable sieves in order of decreasing size of opening from top to bottom. Place the pan at the bottom of the set. Sieves: No. 8, No. 4, 3/8 in, ½ in, ¾ in, 1 in, 11/2 in (and higher if needed)
e. Place the sample on the top sieve.
f. Place the lid, and agitate the sieves in the mechanical shaker for about 10 min.
g. Weigh the sieves with the material retained.
h. Determining the weight retained in each sieve. The total weight of the material after sieving should check closely with the original weight of the sample. If the amount differs by more than 0.3% (based on the original weight) the results should not be used.

The gradation curve fits the upper and lower bounds of 56 stone.
Fineness Modulus = 7.14
average sieve = 3/8”
average size stone = .428”
effective size = 10.15mm
uniformity coefficient = 1.05

O,K

VI. *Lab#6: Sieve Analysis of Fine Aggregate- ASTM C136*

[Draw the gradation curve for this sample and include the upper and lower bound limits.]

Define Fineness Modulus.

Procedure:

Equipment: Balance, sieves, mechanical shaker, oven

Sample: Fine Aggregate of weight 500g.

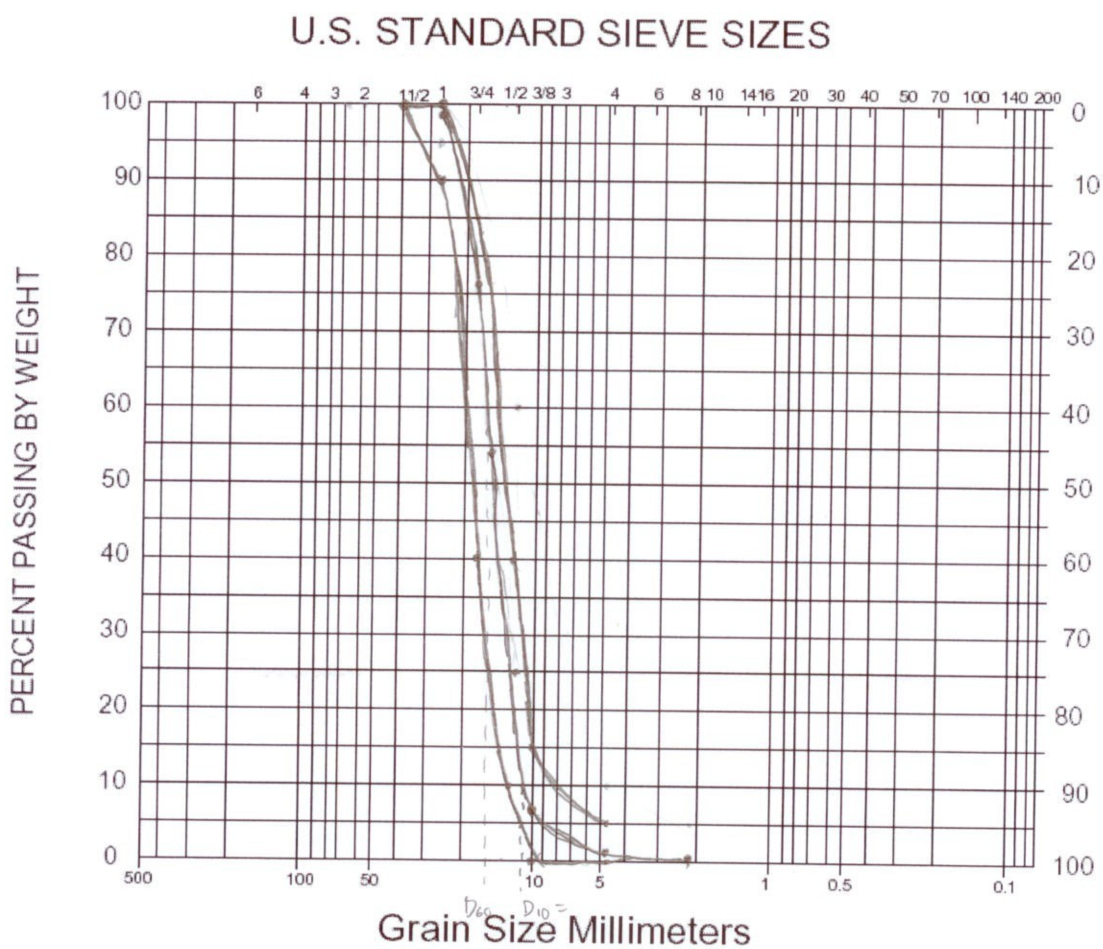
a. Dry the sample to constant weight at a temperature of 110° C (230 F).
b. Weigh the dry sample accurately.
c. Weigh each empty sieve and the pan.
d. Nest the suitable sieves in order of decreasing size of opening from top to bottom. Place the pan at the bottom of the set. Sieves: No. 100, No. 50, 30, 16, 8, 4
e. Place the sample on the top sieve.
f. Place the lid, and agitate the sieves in the mechanical shaker for about 10 min.
g. Weigh the sieves with the material retained.
h. Determining the weight retained in each sieve. The total weight of the material after sieving should check closely with the original weight of the sample. If the amount differs by more than 0.3% (based on the original weight) the results should not be used.

The gradation curve fits within the upper and lower bounds, therefore it meets the ASTM C33 acceptance criteria.
Fineness Modulus = 5.52
average sieve= No.50
average size stone=.029"
effective size= .32mm
uniformity coefficient= 2.09

O.K

Coarse Aggregate

SIEVE	WT. RET.	% RET.	%COARSER	%PASS
1"	.48	1.49	1.49	98.51
3/4"	7.2	22.38	23.87	76.13
5/8"	6.97	21.67	45.54	54.46
3/8"	15.27	47.47	93.01	6.99
1/4"	1.48	4.6	97.61	2.39
1/8"	.48	1.49	99.1	.9
Pan	.29	.9	100	0
TOTAL	32.17	100		



Upper & Lower Bounds of 56 Stone

Coarse Aggregate

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SIEVE SIZE	CUM PERCENT RETAINED	FM - TOTAL SUMMATION
6"	0	0
3"	0	0
1.5"	0	0
¾"	23.87	23.87
3/8"	93.01	116.88
#4	97.61	214.49
#8	99.1	313.59
#16	100	413.59
#30	100	513.59
#50	100	613.59
#100	100	713.59
TOTAL		

$$FM = \frac{713.59}{100} = \underline{7.14}$$

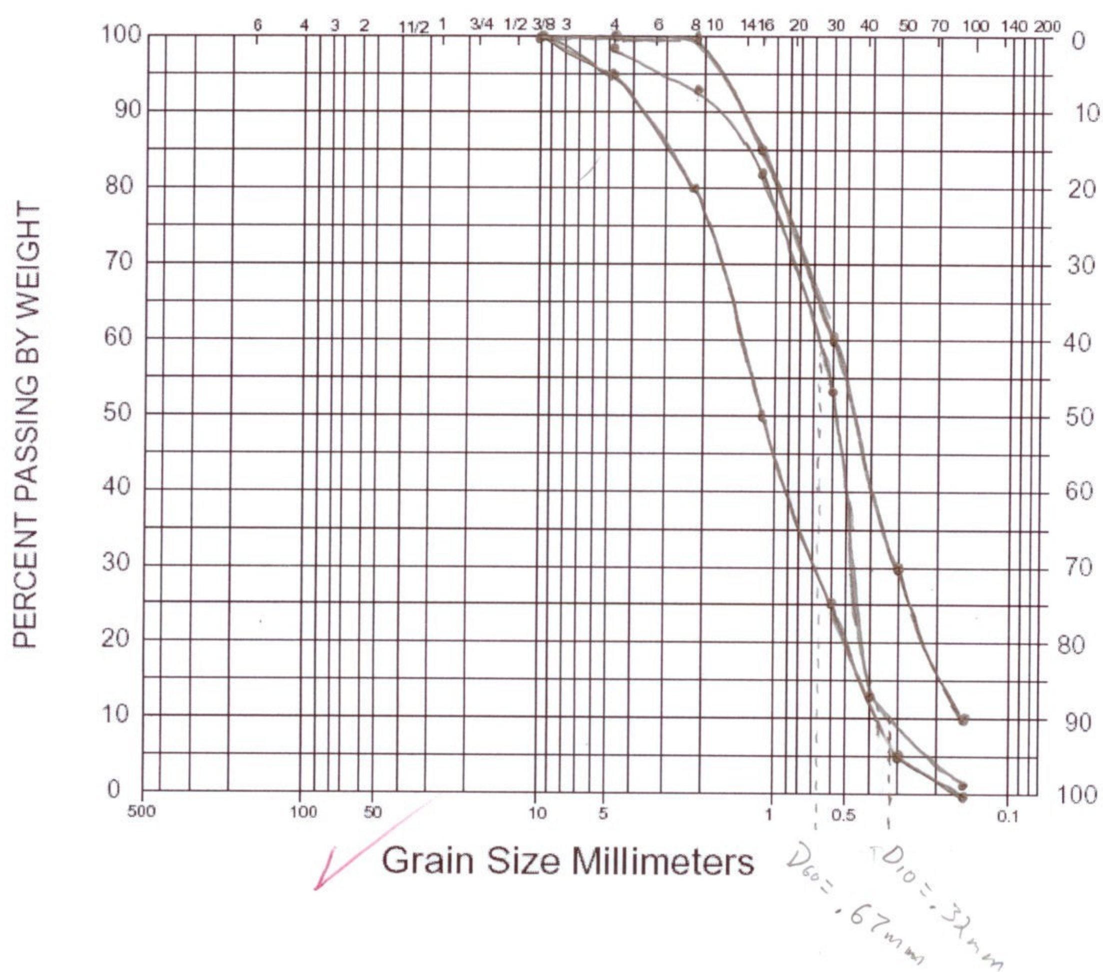
Avg. Size Stone = 3/8" + (.14)(.75 - .375) = <u>.428"</u>

Effective Size = D_{10} = <u>10.15mm</u>

Uniformity Coefficient = D_{60}/D_{10} = 10.7mm / 10.15mm = <u>1.05</u>

Fine Aggregate

SIEVE	WT. RET.	% RET.	%COARSER	%PASS
#4	11.85	2.37	2.37	97.63
#8	20.54	4.11	6.48	93.52
#16	56.14	11.24	17.72	82.28
#30	139.6	27.95	45.67	54.33
#50	201.7	40.38	86.05	13.95
#100	63.22	12.66	98.71	1.29
Pan	6.47	1.30	100	0
TOTAL	499.52	100		



Fine Aggregate

SIEVE SIZE	CUM PERCENT RETAINED	FM - TOTAL SUMMATION
6”	0	0
3”	0	0
1.5”	0	0
¾”	0	0
3/8”	0	0
#4	2.37	2.37
#8	6.48	8.85
#16	17.72	26.57
#30	45.67	72.24
#50	98.71	170.95
#100	100	270.95
TOTAL		

$$FM = \frac{270.95}{100} = 2.71$$

Avg. Size Stone = .02" + .71 (.013") = .029"

Effective size = D_{10} = .32mm

Uniformity Coefficient = $D_{60}/D_{10} = \frac{.67}{.32} = 2.09$

PUT THE DATE NEXT TO EACH WEIGHT THAT WAS TAKEN AND EMAIL!!

GROUP NAME:	CAPTAIN NAME:			EMAIL:
LAB#1	Pan weight = 248.4g			Wire under water = 1536g
AIR DRY	3671.47g			Wire + stone sub 3916.7
SSD	3803.3g		9/29	
SUB	2380.7g		9/29	
OD	3667.79g		9/30	3915.79 − 248g =
MC				
LAB#2	Pan = 239			
AIR DRY	817.6 − 239 = 578.6g			9/29
SSD	813.9 − 239 = 585.9g			9/29
PYC&WATER	1443.9g			9/29
PYC, WATER,&SSD (SUB)	1763.56g			9/29
OD	567.45			9/30 806.45 − 239
LAB#3				
VOLUME OF BUCKET	1.45 ft³		9/22	
BUCKET WT.	19.1 lb		9/22	
STONE WT.	48 lb		9/22	
LAB#4				
AIR DRY-SAND	845g		9/29	
OVEN DRY SAND	840.57g		9/30	1089.25 − 248.68
MC				
AIR DRY – C.A.	3359.6g		9/29	
OVEN DRY –C.A.	3356.23g		9/30	3604.37 − 248.14
MC				
LAB#5	Weights of Stones			
TOTAL WT. STONE	(51.8 − 19.1) 32.7 lb		9/22	
1"	17.09 − 16.61	.48	9/22	
3/4"	23.44 − 16.24	7.2	9/22	
~~1/2"~~ 5/8"	23.55 − 16.58	6.97	9/22	
3/8"	31.86 − 16.59	15.27	9/22	
~~#4~~ 1/4"	17.60 − 16.12	1.48	9/22	
#8 1/8"	15.41 − 14.93	.48	9/22	
LAB#6	Pan 14.43 − 14.14	.29		
TOTAL WT. SAND	500g			
#4	517.65 − 505.8g	11.85	9/22	
#8	506.64 − 486.1g	20.54	9/22	
#16	502.24 − 446.1g	56.14	9/22	
#30	550.9 − 411.3g	139.6	9/22	
#50	564.5 − 362.8g	201.7	9/22	
#100	434.12 − 370.9g	63.22	9/22	
PAN	349.67 − 343.2g	6.47	9/22	

$MC = \frac{Air - OD}{OD} \times 100$ 500 492.6

~~845g~~ −

$\frac{3359.6 - 3356.23}{3356.23} \times 100$

$OD \cdot \left(\frac{MC}{100}\right) + OD = Air$

$\left(OD\right)\left(\frac{MC}{100}\right) + OD =$