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CIVL 284 MATERIALS OF CONSTRUCTION  
MATERIALS OF CONSTRUCTION LABORATORY  
GAZİMAĞUSA

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Group No : 9

Experiment No : #2

Name of the Experiment : Bulk Density (Unit weight ) and Voids in Aggregate (ASTM C 29)

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# Experiment (ASTM C 29)

## Bulk Density ("Unit Weight") and Voids in Aggregate

### I. Object and Scope

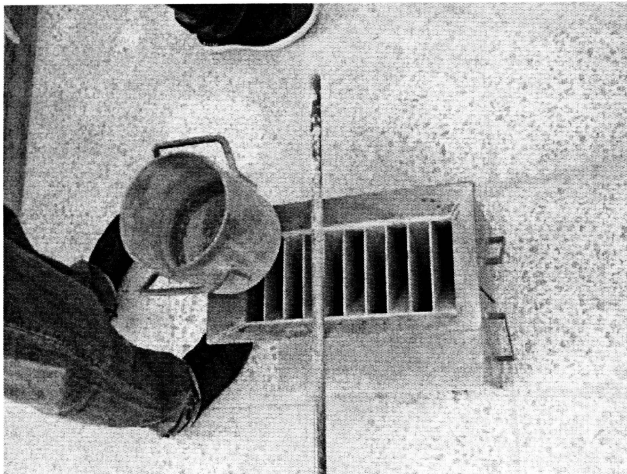
This test method covers the determination of bulk density of aggregates. Bulk density means unit weight of aggregates in a compacted or loose condition and calculated voids between particles in fine, coarse or mixed aggregates based on the same determination.

### II. Preliminary Remarks

This method often used to determine bulk density values that are necessary for use in many methods of selecting proportions for concrete mixtures.

### III. Apparatus

Balance, Tamping Rod, Cylindrical Measure with Handles, Shovel, Aggregate



## IV. Test Procedure

### a) Mechanical Splitter

Aggregates with sizes  $D_m = 14 \text{ mm}$  &  $D_m = 10 \text{ mm}$  placed in the hopper and uniformly distributed from edge to edge in this way it is equally flowed when introduced into chutes. After distribution completed from edge to edge aggregate poured into feed chute in order to prepare mechanical splitting process.

### b) Filling Measure with Aggregate

First of all the weight of empty measure is recorded then, one third of the measure is filled with tested aggregate. After that by using rod, layer compressed by tamping or with evenly distributed manner over the surface layer 25 times. At first normal pressure applied such that rod never struck bottom of the measure. After the first layer, both second and third layers filled as the first layer. When filling done, any aggregate that passed top level of measure was cleaned to make a full flat layer with the same level as the top level of measure had. Last step for testing was weight measurement step. Last weight of measure with aggregate is taken.

## V. Calculations

### Required data

$$T = 3.35 \text{ kg}$$

$$M = \dots\dots \text{ kg/m}^3$$

$$G = 7.85 \text{ kg}$$

$$V = 0.0029 \text{ m}^3$$

$$S = 2.7$$

$$M = \frac{(G - T)}{V}$$

$M$  = bulk density of the aggregate,  $\text{kg/m}^3$   
 $G$  = mass of the aggregate plus the measure, kg  
 $T$  = mass of the measure, kg  
 $V$  = volume of the measure,  $\text{m}^3$   
 $S$  = Bulk specific gravity,  $\text{kg/m}^3$   
 $W$  = density of water  $\text{kg/m}^3$

$$M = \frac{(7.85 - 3.35)}{0.0029} = 1551.7 \text{ kg/m}^3$$

$$\%voids = \frac{100 * [(s-w) - m]}{(s+w)} = 100 * \frac{[(2700 * 0.0029) - 1551.7]}{2700 * 0.0029} = 14 \%$$

## VI. Results

Bulk specific gravity is found as;

$$M = 1151.7 \text{ kg/m}^3$$

and

percentage voids is found as ;

$$\text{Voids \%} = 14 \%$$

## VII. Discussion of Results

This experiment was made in order to create an uniform sample. This is very useful during a cement production process. Experiment shows how much the bulk density and percentage of voids within aggregate are. For better strength less void is desired for cement. Whenever size of aggregate increases void percentage and volume increases steadily . As space within aggregate increases less strength occurs at cement.

## VIII. Conclusion

Aggregate is the mainly used in concrete. Test clearly shows that compacted aggregate(which has bigger bulk density) provides better cement strength. Bulk density values used for many methods of selecting proportions for concrete mixtures. Bulk density values can also be used as economical means like purchase agreements.