

THE UNIVERSITY OF ZAMBIA  
SCHOOL OF ENGINEERING  
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING  
311 1– CIVIL ENGINEERING MATERIALS AND PRACTICES

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LAB No 1

SIEVE ANALYSIS OF AGGREGATES

The sieve analysis, commonly known as the gradation test, is a basic essential test for all aggregate technicians. The sieve analysis determines the gradation (the distribution of aggregate particles, by size, within a given sample) in order to determine compliance with design, production control requirements, and verification specifications. The gradation data may be used to calculate relationships between various aggregate or aggregate blends, to check compliance with such blends, and to predict trends during production by plotting gradation curves graphically, to name just a few uses. Used in conjunction with other tests, the sieve analysis is a very good quality control and quality acceptance tool.

Methodology

A known mass of material (1000g), the amount being determined by the largest size of aggregate, is placed upon the top of a group of nested sieves (the top sieve has the largest screen openings and the screen opening sizes decrease with each sieve down to the bottom sieve which has the smallest opening size screen for the type of material specified) and shaken by mechanical means for a period of time (2 minutes). After shaking the material through the nested sieves, the material retained on each of the sieves is weighed. Mass of soil retained is calculated by finding the difference between mass of sieve and mass of soil & sieve, there after the percentage retained is calculated. The same process was repeated for the other aggregate with a total mass of 2000g.

Findings

For the 1000g mass aggregate it was found that the mass retained after the test was 999.7g. For the 2000g mass aggregate it was found that the mass retained after the test was 1997.8g.

Discussion

The test was carried out successfully and the results was collected, but because of some errors it was found that the mass before testing was greater than the mass after.

## LAB No 2

### SLUMP TEST OF FRESHLY MIXED CONCRETE

The concrete slump test measures the consistency of fresh concrete before it sets. It is performed to check the workability of freshly made concrete, and therefore the ease with which concrete flows. It can also be used as an indicator of an improperly mixed batch. The test is popular due to the simplicity of apparatus used and simple procedure. The slump test is used to ensure uniformity for different loads of concrete under field conditions.

#### Methodology

The test was carried out using a metal Mould in the shape of a conical frustum known as a slump cone or Abram's cone, that is open at both ends and has attached handles. The tool typically has an internal diameter of 100 millimeters (3.9 in) at the top and of 200 millimeters (7.9 in) at the bottom with a height of 305 millimeters (12.0 in). The cone is placed on a hard non-absorbent surface. This cone is filled with fresh concrete in THREE stages. Each time, each layer is tamped 25 times with a 2 ft (600 mm)-long bullet-nosed metal rod measuring 5/8 in (16 mm) in diameter.[2] At the end of the third stage, the concrete is struck off flush with the top of the Mould. The Mould is carefully lifted vertically upwards, so as not to disturb the concrete cone.

The concrete then slumps (subsides). The slump of the concrete is measured by measuring the distance from the top of the slumped concrete to the level of the top of the slump cone. In order to reduce the influence on slump of the variation in the surface friction, the inside of the Mould and its base was moisturized at the beginning of every test, and prior to lifting of the Mould the area immediately around the base of the cone was cleaned from concrete which may have dropped accidentally.

#### Findings

The first test showed that no slump took place because of the water to cement ratio. And the result was as shown below



It was seen that there was no change in height.

The second slump test was carried out with an increased water to cement ratio which showed a true slump and was as seen below.



The difference in height of the true slump was calculated and was found to be 50mm.

The third and final slump was carried out with an even more increased water to cement ratio and the result showed that a collapse slump was given out and is as shown below.



After all, three slumps were carried out the concrete mix from the collapse slump was collected and made put into 5 Matel square cubes to make square concrete cubes. Which were then put on a vibrator to insure maximum compaction. After drying where later put in water for the curing process.

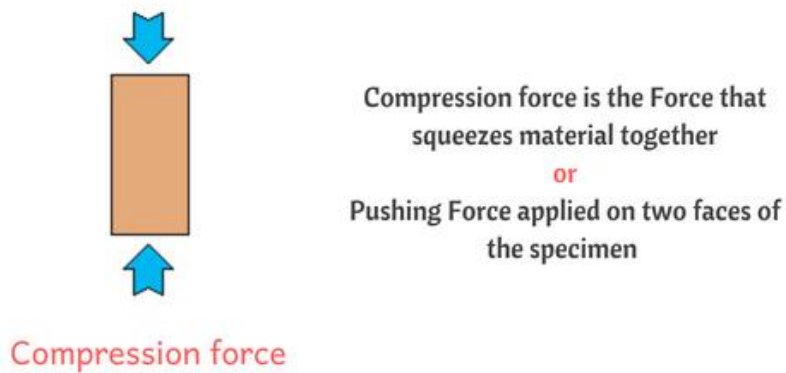
### LAB 3

#### COMPRESSIVE STRENGTH TEST OF CONCRETE SPECIMEN AND MASONARY UNITS.

Compressive strength is the capacity of a material or structure to resist or withstand under compression. The compressive strength of a material is determined by the ability of the material to resist failure in the form of cracks and fissure.

Methodology.

In this test, the push force was applied on both faces of concrete specimen and the maximum compression that concrete bears without failure in noted.



Findings: In this test three cubes made from the slump test were collected and tested for the compression test and was found that:

Cube 1

Mass of cube 8.02 kg

Area of cube 22500 mm<sup>2</sup>

Strength =(30000KGF) (9.81)/22500

= 13.08 N/mm<sup>2</sup>

= 13.08 \*1.5

= 19.62 less than C30

### Cube 2

Mass of cube 8.27 kg

Area of cube 22500 mm<sup>2</sup>

Strength = (31200 KGF) (9.81)/22500

$$= 13.6032\text{N/mm}^2$$

$$= 13.6032 * 1.5$$

$$= 20.4048 \text{ less than C30}$$

### Cube 3

Mass of cube 8.1 kg

Area of cube 22500 mm<sup>2</sup>

Strength = (24400 KGF) (9.81)/22500

$$= 10.6384 \text{ N/mm}^2$$

$$= 10.6384 * 1.5$$

$$= 15.9576 \text{ less than C30}$$

The results show that the compressive strength of the three cubes was less than the C30 strength and this would have been due to different reasons some of which would include

(i) the curing process started late; the cubes showed have been put in a moist container exactly after 24 hours but that was not the case.

(ii) The water to cement ratio, The higher the water/cement ratio, the greater the initial spacing between the cement grains and the greater the volume of residual voids not filled by hydration products. A lower water cement ratio means less water, or more cement and lower workability. However, if the workability becomes too low the concrete becomes difficult to compact and the strength reduces. For a given set of materials and environment conditions, the strength at any age depends only on the water-cement ratio, providing full compaction can be achieved.

(iii) coarse aggregate size, If the proportion of fines is increased in relation to the coarse aggregate, the overall aggregate surface area will increase and if the surface area of the aggregate has increased, the water demand will also increase. Assuming the water demand has increased, the water cement ratio will increase. Since the water cement ratio has increased, the compressive strength will decrease.

(iv) Since the collapse slump was used during the vibration some cement was lost which would have resulted in less strength of the cubes.

## Conclusion

The test was carried out and it was found that due to wrong use or rather wrong procedure the desired strength of the cubes was not reached.