Round 2

Experiment ID-1026: Slump Test

1. Story Outline:

The slump test indicates the behaviour of a compacted concrete cone under the action of gravitational forces. The slump test is a practical means of measuring the workability i.e., consistency of concrete, where the nominal maximum size of the aggregate does not exceed 38 mm. Changes in the value of slump obtained during a job may indicate changes in materials, in the water content or in the proportions of the mix, so it's useful in controlling the quality of the concrete produced.

2. Story:

1.1 Set the visual stage description:

The set up consists of a slump cone which is open at both ends, its attached with handle on the sides for manual use. The slump cone has a diameter of 10cm at the top and 20cm at the bottom with a height of 30cm. The cone is placed on a cleaned horizontal slump base. The slump cone consists of screw at the bottom on both sides, in order to fix the slump cone to the horizontal slump base.

1.2 Set User Objectives & Goals:

- State the meaning of workability and consistency of concrete
- Recall mix proportion and its effect on slump value
- Calculate the volume of the slump cone by measuring its dimensions
- Calculate the quantity of cement, water, coarse aggregate and fine aggregate based on the given mix
- Analyse the uniformity for different batches of similar concrete under load conditions
- Analyse the behaviour of compacted concrete cone under the action of load conditions
- Evaluate the different shapes of slump obtained during the test like true, collapsed, zero and shear

1.3 Set the pathway activities:

1. The set up consists of a slump cone which is open at both ends, its attached with handle on the sides for manual use. The cone is placed on a cleaned horizontal slump base. The

slump cone consists of screw at the bottom on both sides, in order to fix the slump cone to the horizontal slump base, other instruments like trowel, tamping rod, weighing balance are also used in the experiment.

2. Additionally, the volume of the slump cone is calculated by measuring its height and diameter.
3. After calculating the volume of the cone, the required quantity of coarse aggregate, fine aggregate, cement and water is calculated according to the given mix.
4. The required quantity of different materials is measured by using a weighing machine, by clicking on the start button and then tare it in order to set the initial value to 0.
5. The measured quantity of materials is then dry mixed by using a trowel for obtaining uniformity in the mix then measured quantity of water is added.
6. Once the mix is prepared it is filled into the mould which is placed on horizontal slump base, the mould is filled in 4 layers and each layer is tamped 25times by using a tamping rod, the extra concrete is removed with the help of trowel and tamping rod.
7. Remove the mould immediately by raising the mould slowly in vertical direction and note down the slump by keeping slump cone mould as reference.
8. Observations are noted down and the slump value is obtained.

1.4 Set Challenges and Questions/Complexity/variation

1. **Select the odd one out of these**
   a) Slump Test
   b) Compaction Factor Test
   c) Vee Bee Consistometer Test
   d) Standard Consistency Test
2. **Consistency is a term which indicates the**
   a) Degree of fluidity
   b) Degree of mobility
   c) Both a and b
   d) None of the above
3. **Which of the following is correct?**

   Collapse slump indicates

   1. High water cement ratio
   2. Low workability mix
   3. Harsh and Lean mix
   4. Slump test is unsuitable
      a. 1,2 and 3
      b. 2,3 and 4
      c. 1,2,3 and 4

d. 1,3 and 4

4. Slump test is not suitable for very dry or very wet concrete mix. (Say True or False)

5. Slump test is the more precise test to obtain workability of concrete. (Say True or False).

1.5 Allow pitfalls: NA

1.6 Conclusion:

Time required to perform the virtual experiment.

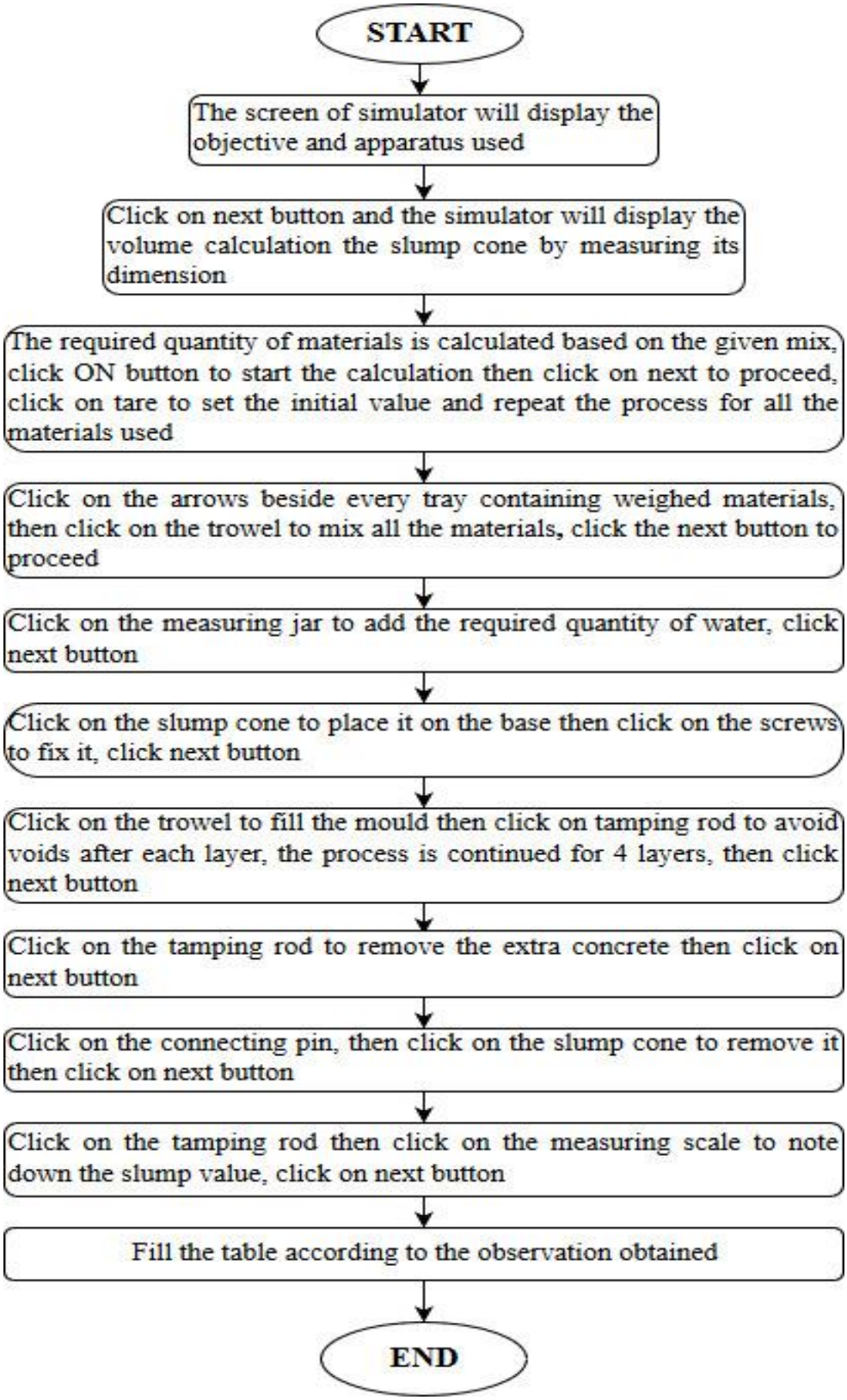
The approximate time required to understand the procedure to perform the experiment would take about 5 min. To generate data will take another 5 min. Calculating and entering the values of various entities in the Result table will take approximately 5 min. Answering the assessment questions will take about 5 min. Thus, the total time required to perform the experiment will require around 20 min.

1.7 Equations/formulas:

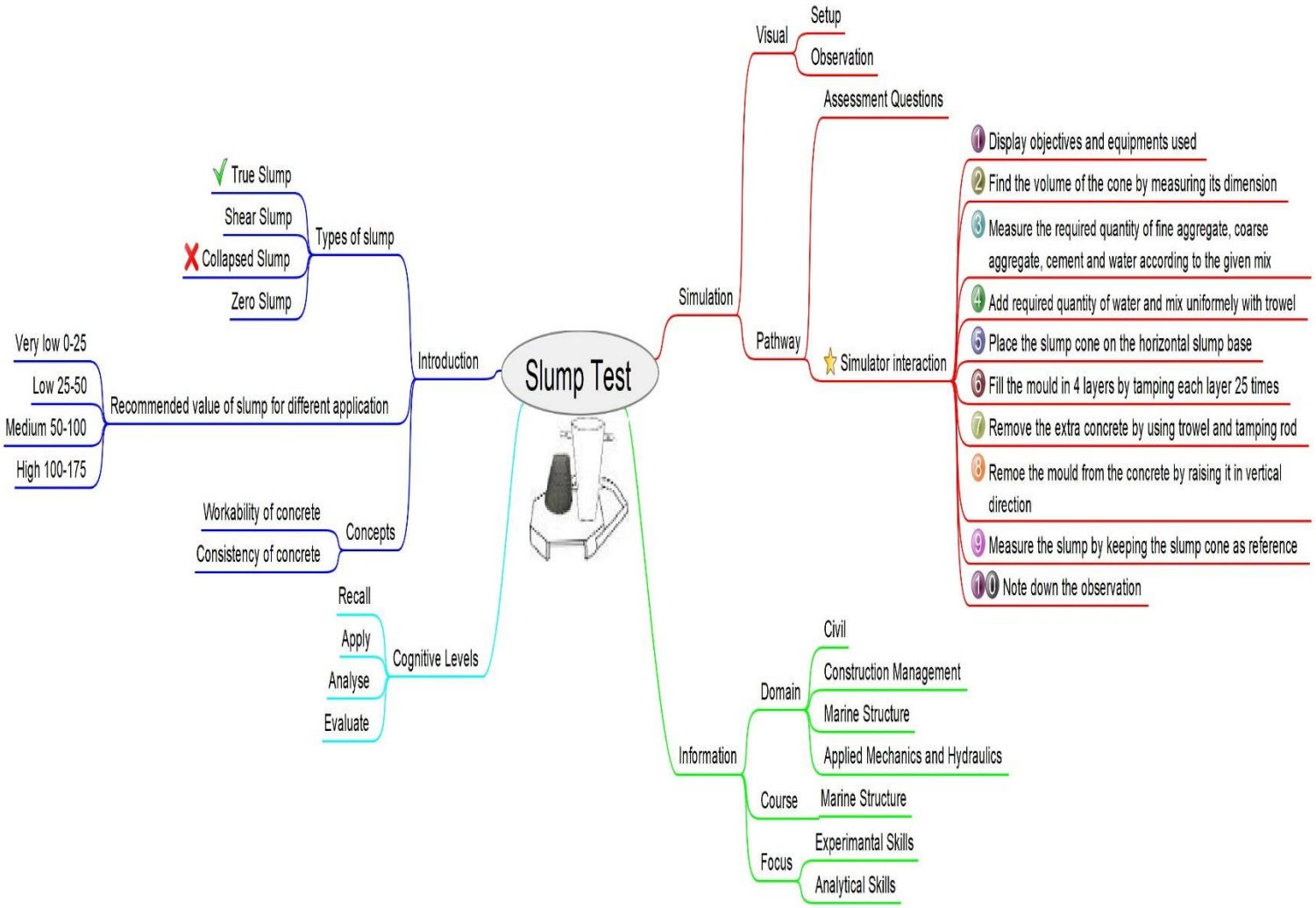
Equations used for calculating various entities in slump test

Volume of slump cone (Frustum),	$v = \frac{1}{3}\pi R^2 H - \frac{1}{3}\pi r^2 h$	Where, H is the height of Slump cone and R is the radius of slump cone.

3. Flowchart:


START
The screen of simulator will display the objective and apparatus used
Click on next button and the simulator will display the volume calculation the slump cone by measuring its dimension
The required quantity of materials is calculated based on the given mix, click ON button to start the calculation then click on next to proceed, click on tare to set the initial value and repeat the process for all the materials used
Click on the arrows beside every tray containing weighed materials, then click on the trowel to mix all the materials, click the next button to proceed
Click on the measuring jar to add the required quantity of water, click next button
Click on the slump cone to place it on the base then click on the screws to fix it, click next button
Click on the trowel to fill the mould then click on tamping rod to avoid voids after each layer, the process is continued for 4 layers, then click next button
Click on the tamping rod to remove the extra concrete then click on next button
Click on the connecting pin, then click on the slump cone to remove it then click on next button
Click on the tamping rod then click on the measuring scale to note down the slump value, click on next button
Fill the table according to the observation obtained
END

4. Mindmap:


Slump Test
Introduction
Types of slump
True Slump
Shear Slump
Collapsed Slump
Zero Slump
Recommended value of slump for different application
Very low 0-25
Low 25-50
Medium 50-100
High 100-175
Concepts
Workability of concrete
Consistency of concrete
Cognitive Levels
Recall
Apply
Analyse
Evaluate
Simulation
Visual
Setup
Observation
Pathway
Assessment Questions
Simulator interaction
Display objectives and equipments used
Find the volume of the cone by measuring its dimension
Measure the required quantity of fine aggregate, coarse aggregate, cement and water according to the given mix
Add required quantity of water and mix uniformely with trowel
Place the slump cone on the horizontal slump base
Fill the mould in 4 layers by tamping each layer 25 times
Remove the extra concrete by using trowel and tamping rod
Remoe the mould from the concrete by raising it in vertical direction
Measure the slump by keeping the slump cone as reference
Note down the observation
Information
Domain
Civil
Construction Management
Marine Structure
Applied Mechanics and Hydraulics
Course
Marine Structure
Focus
Experimantal Skills
Analytical Skills

5. Storyboard:

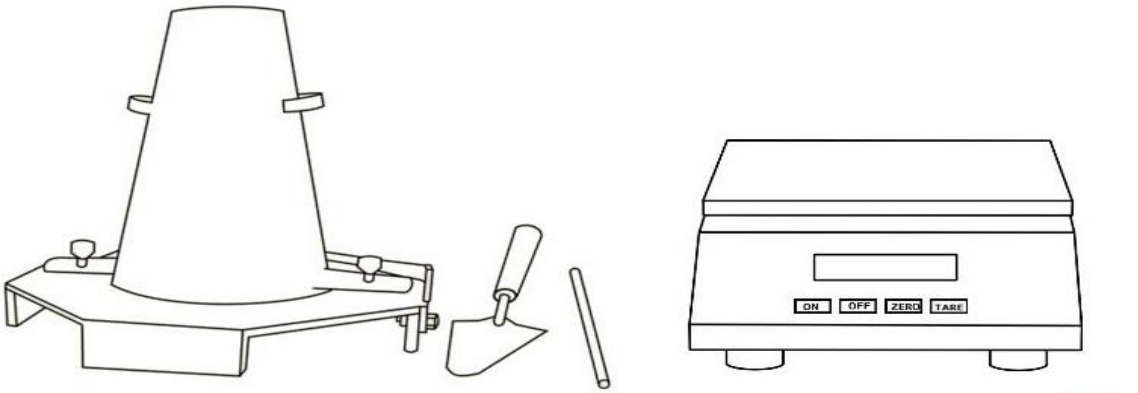
- Click on slump test following window will open, click NEXT button to proceed.

Objective

To find the slump of mix design M35 concrete.

Apparatus used:

Slump cone, tamping rod, trowel, measuring jar, weighing balance etc..



- Calculation of volume of slump cone is given here then click NEXT

STEP 1 Find the volume of the cone from its dimensions ie, by measuring its height and diameter.

Volume of slump cone (Frustum) $= \frac{1}{3}\pi R^2 H - \frac{1}{3}\pi r^2 h$

H = 60cm

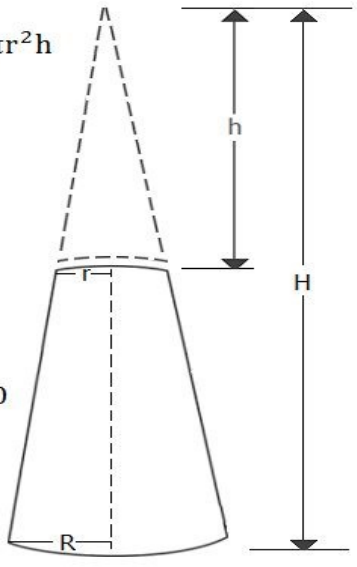
R = 10cm

h = 30cm

r = 5cm

Volume of slump cone $= \frac{1}{3}\pi \times 10^2 \times 60 - \frac{1}{3}\pi \times 5^2 \times 30$

Volume of slump cone = $5.498 \times 10^{-3} m^3$



- Here quantity calculations of coarse, fine aggregate cement and water is given.

STEP 2 Measure required quantity of water, coarse, fine aggregate and cement based on mix design.

Mix proportion is = 1 : 2.7 : 4.2

Water Cement ratio assumed is = 0.43

$$\text{Cement content} = \frac{1}{(1+2.7+4.2)} \times (5.498\times 10^{-3} \times 1500 \times 1.52)$$

Density of concrete = 1500Kg/m^3

52% increase in concrete=1.52

Cement content = 1.6Kg

$$\text{Quantity of fine aggregate} = \frac{2.7}{(1+2.7+4.2)} \times (5.498\times 10^{-3} \times 1500 \times 1.52)$$

Quantity of fine aggregate = 4.3Kg

$$\text{Quantity of coarse aggregate} = \frac{4.2}{(1+2.7+4.2)} \times (5.498\times 10^{-3} \times 1500 \times 1.52)$$

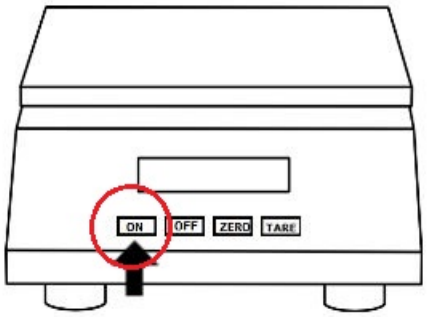
Quantity of coarse aggregate = 6.7Kg

Water content = 0.43 x Cement content

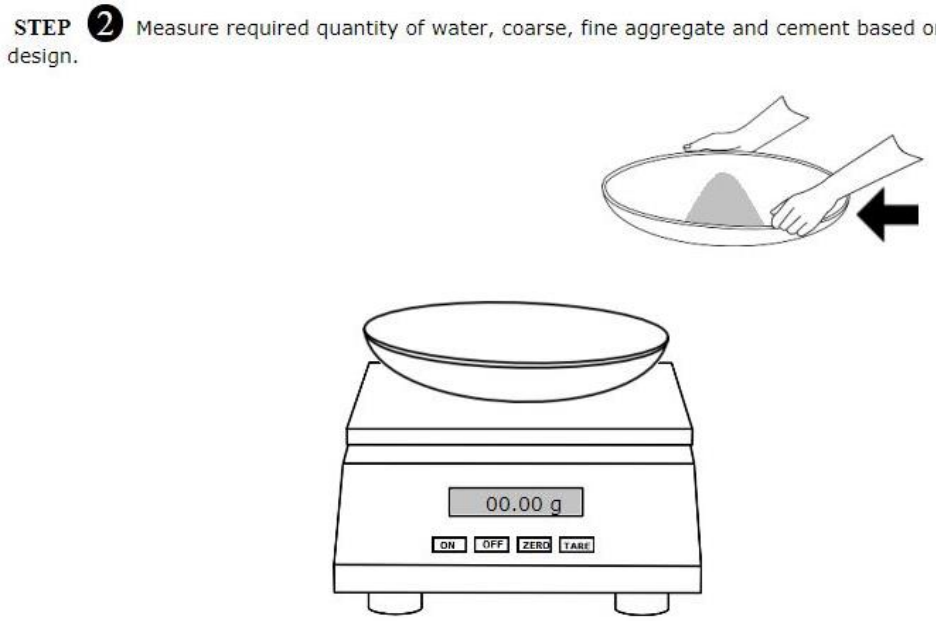
Water content = 0.43 x 1.6 = 0.67Liter

- Click on ON button and place the tray on the weighing balance.

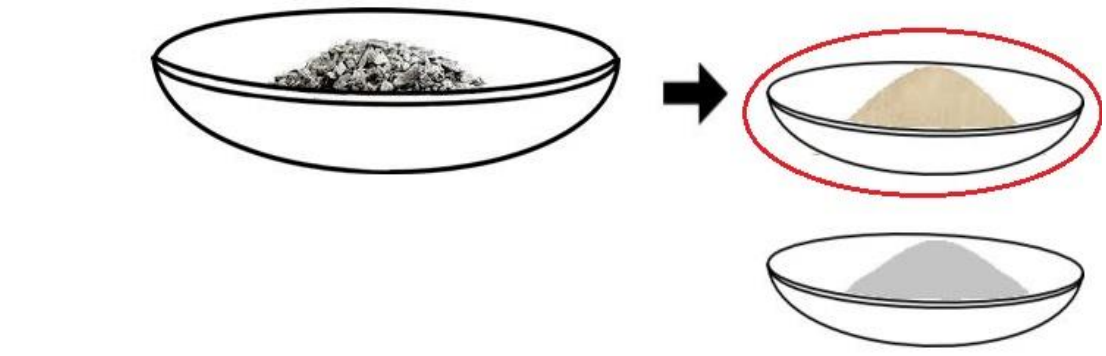
STEP 2 Measure required quantity of water, coarse, fine aggregate and cement based on mix design.



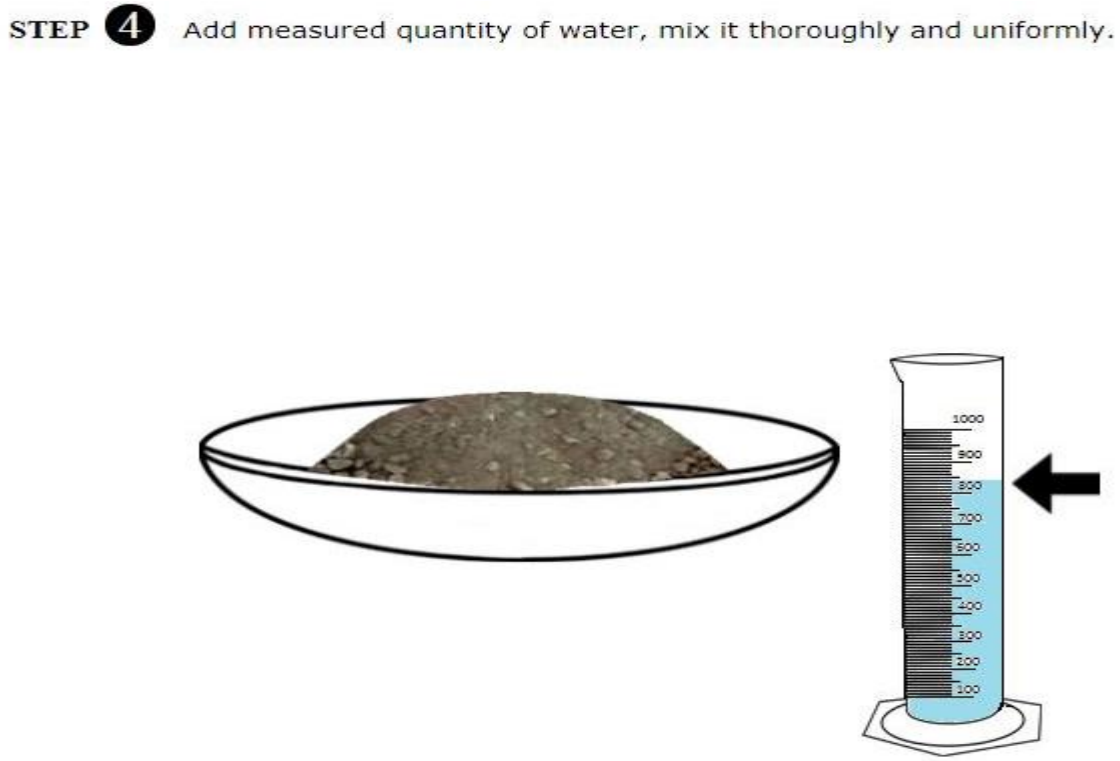
- Now click TARE and click tray with sample to weigh the materials, then click NEXT.



- Click on tray with weighed quantity of materials to mix it properly.

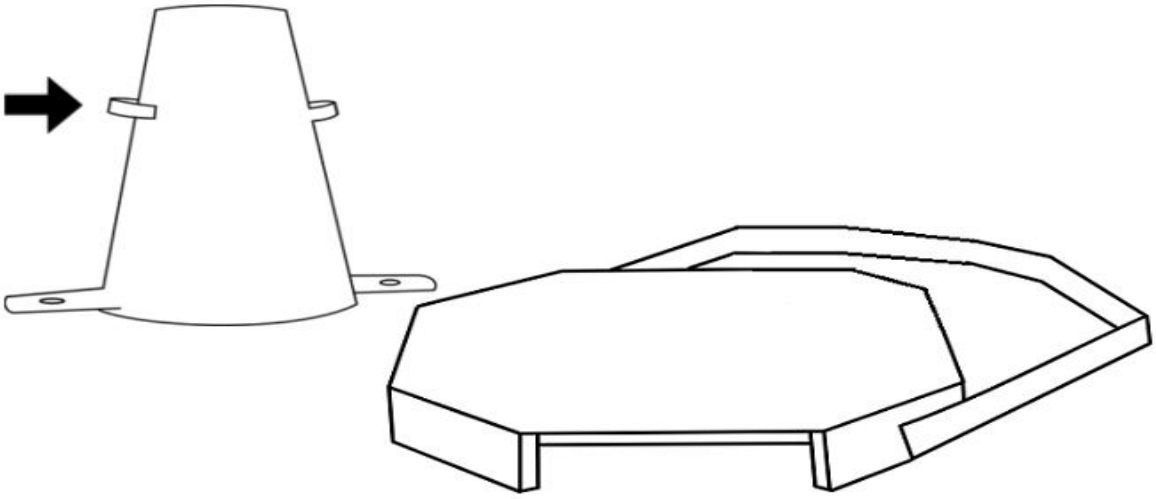


- Here click on beaker to add measured quantity of water into the mixture and click on trowel to mix it properly.



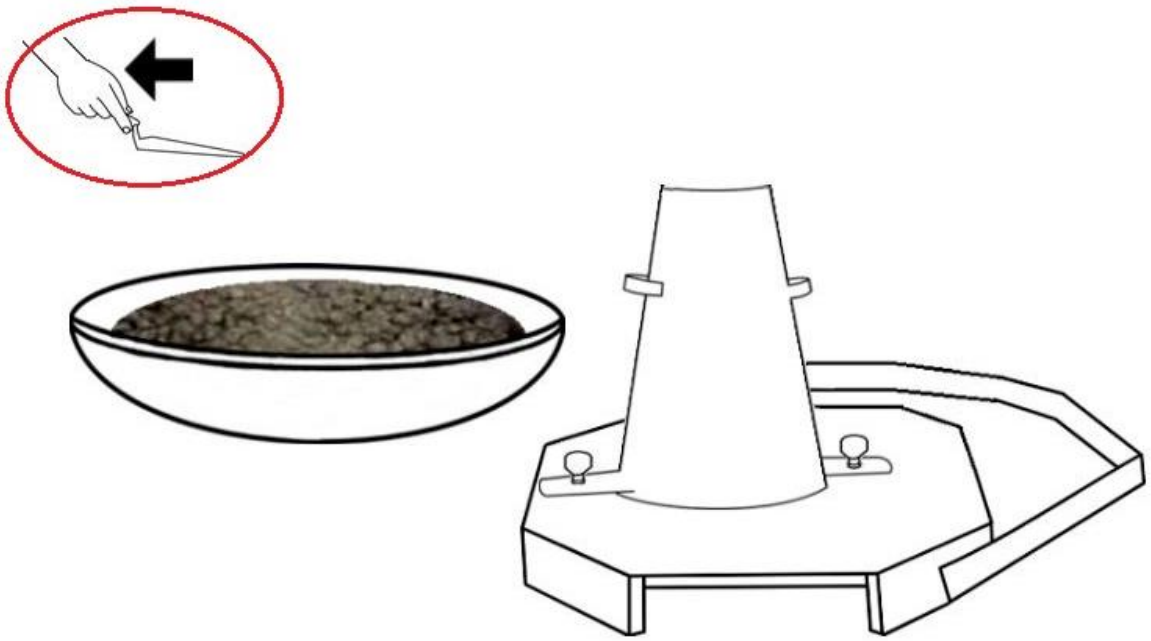
- Now click on slump mould to place it in slump base, click on connecting pin to tighten the position of slump cone.

STEP 5 Place the cleaned slump cone on a horizontal slump base.



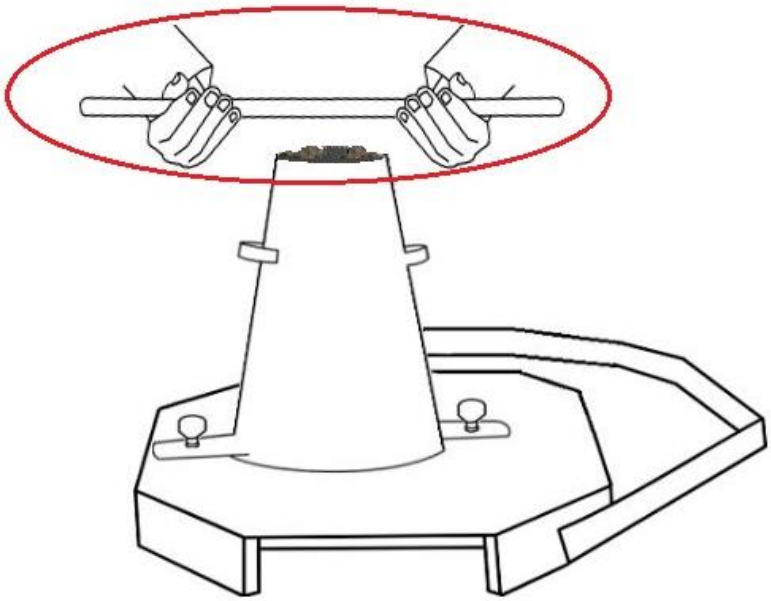
- Click trowel to add concrete to the slump cone, then click on tamping rod to tamp it properly, repeat the same steps and then click NEXT button.

STEP 6 Fill the mould in four layers, each layer is tamped 25 times by a tamping rod.



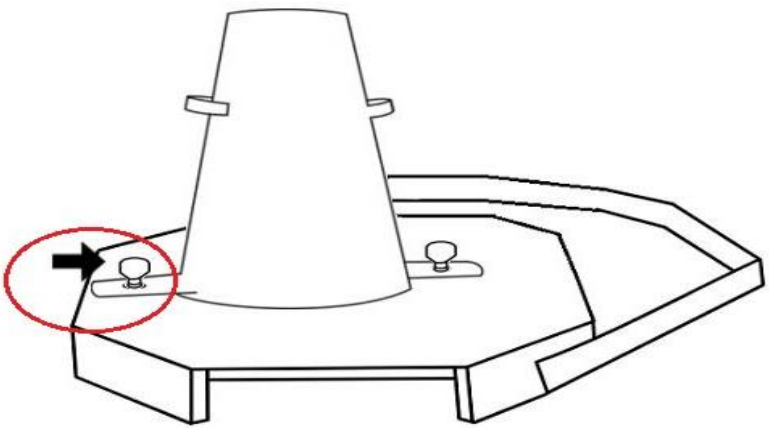
- Click on tamping rod to level the top surface of concrete then click NEXT button.

STEP 7 Remove extra concrete with the trowel and tamping rod.



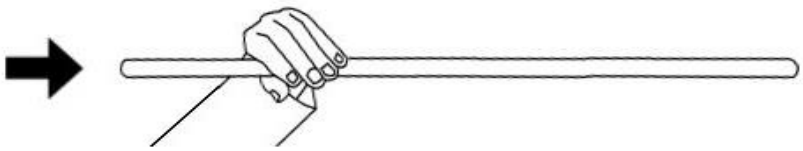
- Here click on the connecting pin to loosen the slump cone, click slump cone to remove it.

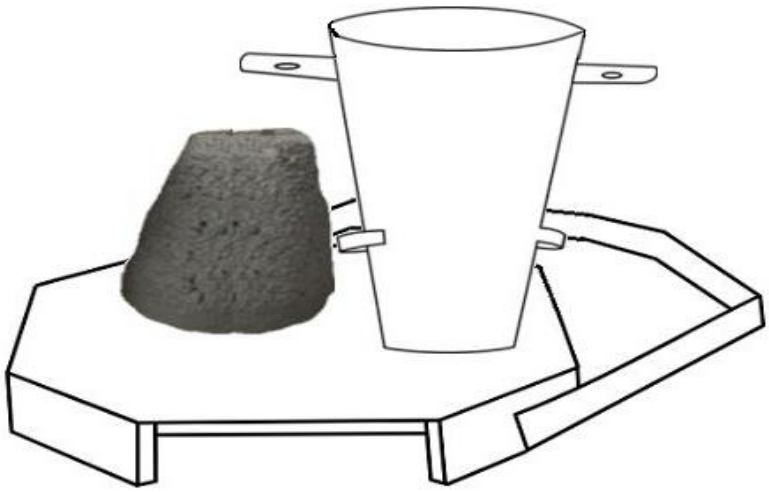
STEP 8 Remove the mould from the concrete immediately by raising it slowly in vertical direction.



- Click on tamping rod to place it above the slump mould and then click on scale to measure the slump value, click NEXT to view the observations.

STEP 9 Note down the slump by keeping slump cone mould as reference.





- The observations in detail is given here.

Observation

Volume of slump = 5.498×10^{-3} m^3

Quantity of cement = 2.7Kg

water cement ratio assumed is = 0.43

Quantity of fine aggregate = 1.6Kg

Mix proportion is = 1 : 2.7 : 4.2

Quantity of coarse aggregate = 6.7Kg

Slump value = 30 - 12 = 18cm

Volume of water = 0.67Liter