CHAPTER 9
TESTS ON CONCRETE

9.1 Slump Test

9.1.1 Scope

The strength of concrete of a given mix proportion is seriously affected by the degree of its compaction. It is therefore important that the consistency of the mix is such that the concrete can be transported, placed and finished sufficiently easily and without segregation. A concrete satisfying these conditions is said to be workable. Workability is a physical property of the concrete depending on the external and internal friction of the concrete matrix; internal friction being provided by the aggregate size and shape and external friction being provided by the surface on which the concrete comes into contact with.

Consistency of concrete is another way of expressing workability but it is more confined to the parameters of water content. Thus concrete of the same consistency may vary in workability. One test which measures the consistency of concrete is the slump test. It does not measure the workability of concrete but it is very useful in detecting variations in the uniformity of a mix of given nominal proportions.

Mixes of stiff consistency have zero slump. In this dry range no variation can be detected between mixes of different workability. In a lean mix with a tendency to harshness a true slump can easily change to the shear slump or even to collapse. Different values of slump can be obtained from different samples of the same mix. Despite the limitations, the slump test is very useful on site as a check on the day-to-day or hour-to-hour variations in the materials being fed into the mixer.

An increase in slump may mean, for instance, that the moisture content of aggregate has unexpectedly increased; another cause would be a change in the grading of aggregate, such as a deficiency in sand. Too high or too low a slump gives immediate warning and enables the mixer operator to remedy the situation.

9.1.2 Apparatus

9.1.2.1 Mould. A mould made of metal not readily attacked by cement paste and not thinner than 1.5mm. The interior of the mould should be smooth and free from projections such as protruding rivets and shall be free from dents. The mould shall be in the form of a hollow frustum of a cone having the following dimensions:

a) diameter of base = 200mm plus or minus 2mm
b) diameter of top = 100mm plus or minus 2mm
c) height = 300mm plus or minus 2mm.

The base and top shall be open and parallel to the axis of the cone. The mould shall be provided with two handles at two-thirds of the height, and with foot pieces to enable it to be held steady. A mould which can be clamped to the baseplate is acceptable, provided that the clamping arrangement can be released without movement of the mould.
9.1.2.2 **Scoop**, approximately 100mm wide.

9.1.2.3 **Sampling tray**, 1.2m x 1.2m x 50mm deep made from minimum 1.6mm thick non-corrodible metal.

9.1.2.4 **Square mouthed shovel**, size 2 in accordance with BS 3388.

9.1.2.5 **Tamping rod**, made out of straight steel bar of circular cross section. 16mm diameter, 600mm long with both ends hemispherical.

9.1.2.6 **Rule**, graduated from 0mm to 300mm at 5mm intervals.

9.1.3 **Performing Slump test**

9.1.3.1 **Procedure**. Commence the slump test as soon as possible after sampling of concrete as per standard procedure described in Chapter 2.

9.1.3.2 **Preparation of sample for test**. Empty the sample from the container onto the sampling try. Thoroughly mix the sample by shovelling to form a cone on the sampling tray. and turning this over to form a new cone, the operation being repeated three times. When forming the cone deposit each shovelful of the material on the apex of the cone so that the portions which slide down the sides are distributed as evenly as possible and so that the centre of the cone is not displaced. Flatten the third cone by repeated vertical insertion of the shovel across the apex of the cone, lifting the shovel clear of the concrete after each insertion.

9.1.3.3 **Test**. Ensure that the internal surface of the mould is clean and damp but free from excessive moisture before commencing the test. Place the mould on a smooth, horizontal, rigid and non-absorbent surface free from vibration and shock.

Hold the mould firmly against the surface below. Using the scoop fill the mould in three layers, each approximately one-third of the volume of the mould when tamped. Tamp each layer with 25 strokes of the tamping rod, the strokes being distributed uniformly over the cross section of the layer. Tamp each layer to its full depth, ensuring that the tamping rod does not forcibly strike the surface below when tamping the first layer and only passes through the second and top layers into the layers below. Heap the concrete above the mould before the top layer is tamped. After the top layer has been tamped strike off the concrete level with the top of the mould with a sawing and rolling motion of the tamping rod. With the mould still held down, clean from the surface below any concrete which might have fallen onto it.

Remove the mould from the concrete by raising it vertically, slowly and carefully, in 5 seconds to 10 seconds, in such manner as to impart minimum lateral or torsional movement to the concrete. The entire operation from start to finish shall be carried out without interruption and shall be completed within 150 seconds. Immediately after the mould is removed, measure the slump to the nearest 5mm by using the rule to determine the difference between the height of the mould and of the highest point of the specimen being tested.

**Note.** The workability of a concrete mix changes with time due to the hydration of the cement, and loss of moisture.
9.1.3.4 Expression of result

9.1.3.4.1 General. The test result is only valid if it yields a true slump. The slump should be reported to the nearest 5mm and the type of slump (i.e. true, shear or collapse) should be stated as shown in Figure 9.1.1 a), b) and c).

9.1.3.4.2 Precision. For slump measurements made on concrete taken from the same sample, the repeatability is 15mm at the 95% probability level, for normal concrete having a measured slump within the range of 50mm to 75mm.

9.1.4 Report

The following information shall be included in the report:

a) Name of testing agency
b) Client
c) Contract name
d) Location of concrete in structure
e) Supplier of concrete
f) Date and time of test
g) Time of completion of test
h) Location of test
i) Time lapsed from sampling to commencement of test
j) Form of slump, whether true, shear or collapse
k) Measure of true slump
l) Name and signature of sampler and tester

A form of reporting the slump test results is shown in Form 9.1.1.

Figure 9.1.1

a) Intact and symmetrical b) Shear c) Collapse
# MEASURING THE SLUMP OF FRESH CONCRETE

<table>
<thead>
<tr>
<th>Name and designation of tester</th>
<th>Client</th>
<th>Contract name</th>
<th>Supplier</th>
</tr>
</thead>
<tbody>
<tr>
<td>BRRL, Mirpur, Dhaka.</td>
<td>The Engineers Ltd., Dhaka</td>
<td>Feni - Comilla Highway</td>
<td>Bangladesh Cement Factory, Dhaka.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Concrete grade</th>
<th>Concrete location in structure</th>
<th>Concrete temperature</th>
<th>Ambient temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class - C 20 N/mm²</td>
<td>Bridge No. 10 Deck Slab.</td>
<td>29° C</td>
<td>31° C</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>True slump</th>
<th>Type of slump</th>
<th>Date of sample</th>
<th>Time of sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 mm</td>
<td>Normal</td>
<td>20/5/2000</td>
<td>10:00 a.m.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration of test</th>
<th>Time between sampling and start of slump</th>
<th>Time concrete delivered</th>
<th>Time concrete manufactured</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 min 15 s.</td>
<td>1 min.</td>
<td>9:50 a.m.</td>
<td>9:00 a.m.</td>
</tr>
</tbody>
</table>

Any other remarks:

No admixtures added, no extra water added. Load no. 10 (Sample taken from truck at bridge no. 10 Deck Slab)