جمهورية العراق

وزارة التعليم العالي والبحث العلمي

كلية المستقبل الجامعة

Concrete Technology

Second Year

Chapter Four: Fresh Concrete

Lecture Name: Measurements of workability

قـــــــسم هندسة تقنيات البناء والانشاءات

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Measurements of workability:قياس قابلية التشغيل

1. Slump test
2. Compacting factor test
3. Flow test
4. Vebe test

1. Slump test

The concrete slump test measures the consistency of fresh concrete before it sets. It is performed to check the workability of fresh concrete, and therefore the easy with which concrete flows.

يقيس اختبار الركود الخرساني تناسق الخرسانة الطازجة قبل أن تتماسك. يتم إجراؤه للتحقق من قابلية تشغيل الخرسانة الطازجة ، وبالتالي سهولة تدفق الخرسانة.

Test Procedure

The test is carried out using a metal mould in the shape of a conical known as a slump cone or Abrams cone, that is open at both ends and has attached handles. The cone have internal diameter of 100 mm at the top and of 200 mm at the bottom with a height of 305 mm. 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 by metal rod

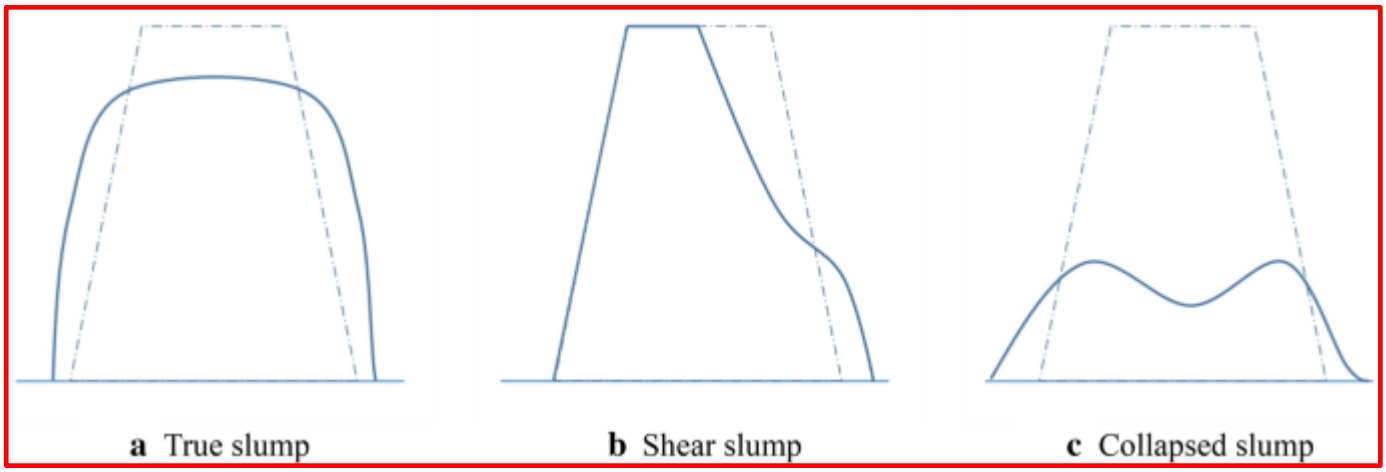
At the end of the third stage, the concrete is struck off with the top of the mould. The mould is carefully lifted vertically upwards, so as not to disturb the concrete cone.

Types of slumps:

1. **True slump**: Slumping evenly all around

2. **Shear slump:** One half of the cone slides down an inclined plane, the test should be repeated. Shear slump usually occur in **harsh mixes** الخلطات القاسية due to lack of cohesion تماسك in the mix.

3. **Collapse (zero slump) :** Occur in mixes of stiff consistence قوام صلب.



Description of workability	*Slump*	
	mm	*in.*
No slump	0	0
Very low	5–10	$\frac{1}{4}$–$\frac{1}{2}$
Low	15–30	$\frac{3}{4}$–$1\frac{1}{4}$
Medium	35–75	$1\frac{1}{2}$–3
High	80–155	$3\frac{1}{4}$–6
Very high	160 to collapse	$6\frac{1}{4}$ to collapse

Table shows Description of Workability and Magnitude of Slump

2. Compacting factor test

1- The sample of concrete to be tested is placed in the upper hopper up to the brim**.**
نملى المخروط العلوي بالخرسانة ونسوي سطحة بالمالج

2- The trap-door is opened so that the concrete falls into the lower hopper**.**
نفتح باب المخروط العلوي لكي تسقط الخرسانة في المخروط السفلي تحت تأثير وزنها

3- Then the trap-door of the lower hopper is opened and the concrete is allowed to fall into the cylinder**.**

نفتح بوابة المخروط السفلي لكي تسقط الخرسانة في الاسطوانة السفلية تحت تأثير وزنها

4- The excess concrete remaining above the top level of the cylinder**.**

نسوي سطحها بالمالج لازالة الخرسانة الزائدة وبدون ان نرصها

5- The outside of the cylinder is wiped clean. The concrete is filled up exactly up to the top level of the cylinder(."Weight of partially compacted concrete").

يتم تنظيف جوانب الاسطوانة ونوزنها ونسجل وزنها (الوزن الاسطوانة المرصوصة ذاتيا)

6- The cylinder was filled with concrete and fully compacted .This weight is known as "Weight of fully compacted concrete".

نملى الاسطوانة بالخرسانة مرة اخرى يدويا وبصورة مباشرة بثلاث طبقات مع رص كل طبقة 25 رصة ويتم وزنها (وزن الاسطوانة مرصوصة يدويا)

$$\text{The Compacting Factor} = \frac{Weight\ of\ partially\ compacted\ concrete}{Weight\ of\ fully\ compacted\ concrete}$$

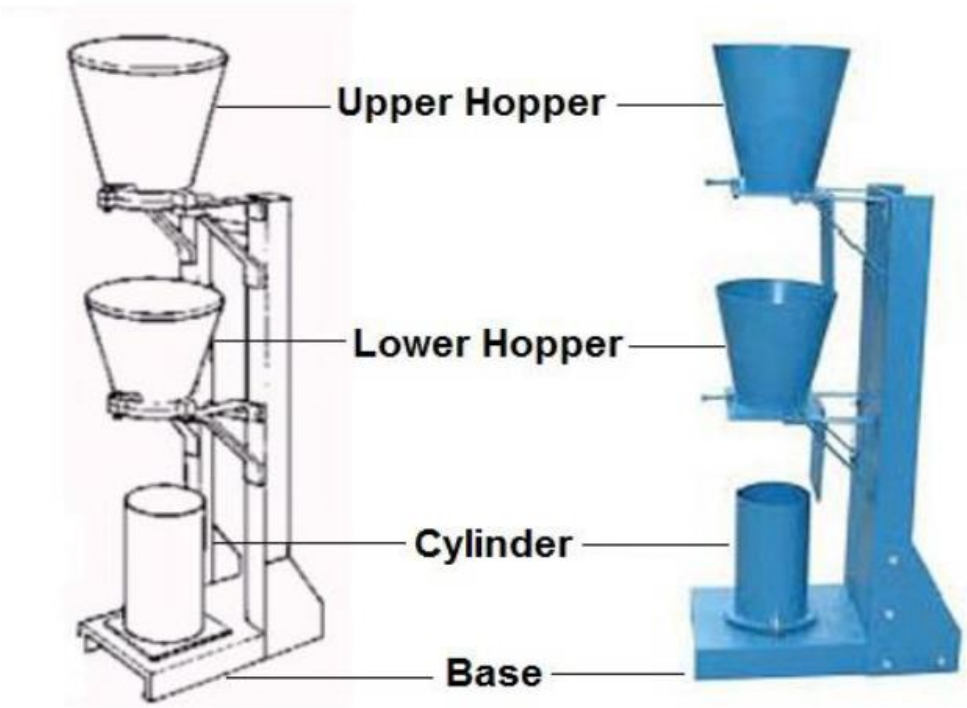


Figure (4-3): compaction factor apparatus.

3. Flow Test

Equipment of test

Flow table dimensions 70 centimetres (28 in) square. Abrams cone, open at the top and at the bottom - 30 cm (12 in) high, 17 cm (6.7 in) top diameter, 25 cm (9.8 in) base diameter. Tamping rod, 60 centimetres (24 in) long.

Conducting the test

- The flow table is wetted.
- The cone is placed in the center of the flow table and filled with fresh concrete in two equal layers. Each layer is tamped 10 times with a tamping rod.
- Wait 30 seconds before lifting the cone.
- The cone is lifted, allowing the concrete to flow.
- The flow table is then lifted up 40mm and then dropped 15 times, causing the concrete to flow.
- After this the diameter of flow of the concrete is measured

4. Vebe Test

The apparatus is paced on top of a vibrating table. The fresh concrete is compacted into a conical slump mould. The mould is removed and a clear plastic disc is placed on the top of the concrete. The vibrating table is started and the time taken for the transparent disc to be fully in contact with the concrete (the Vebe time), is measured.

The main advantage of this test is that it is a dynamic test and can be used on concretes that are too stiff for a slump test.

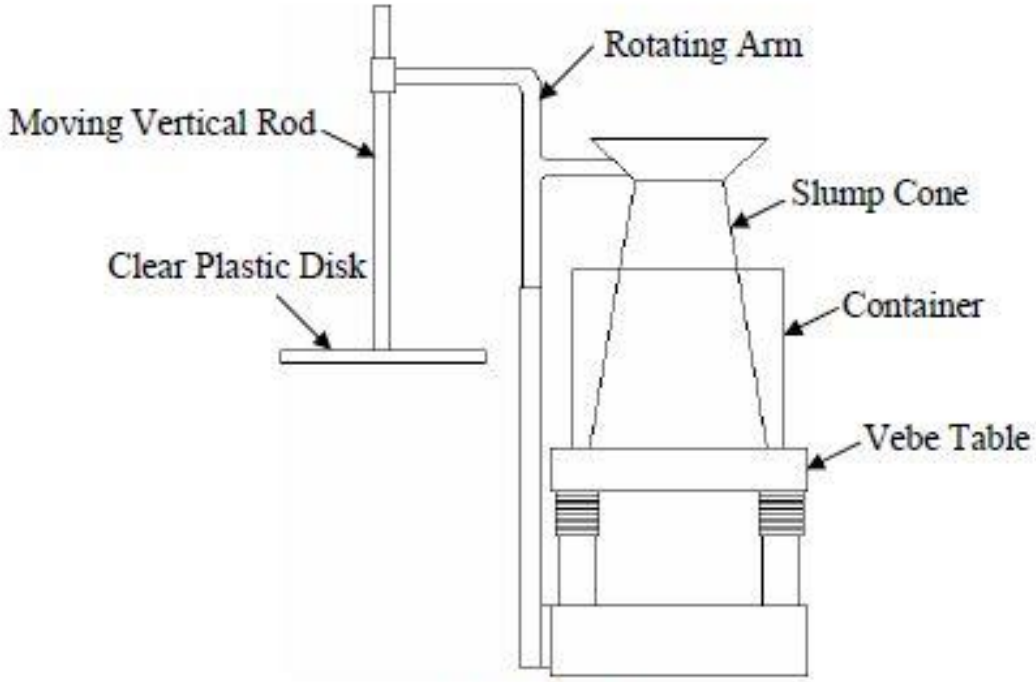


Figure 10: Vebe Consistometer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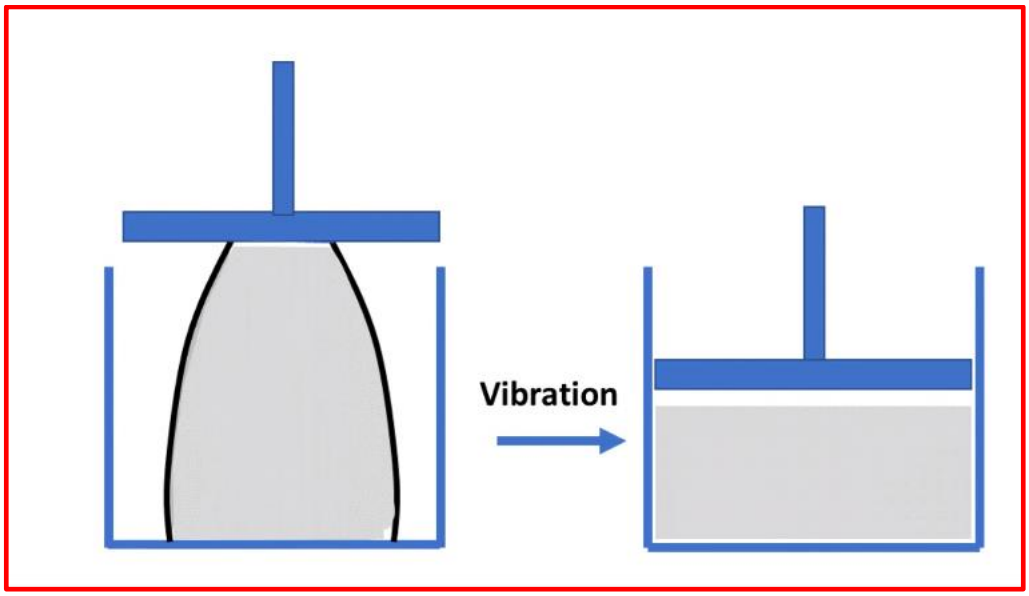
Vibration

Mixing Time : on a site the engineers like to mix concrete as rapidly as possible so it is important to know what is the minimum mixing time necessary to produce a concrete uniform in composition and a result of satisfactory strength.

وقت الخلط : في الموقع غالبا ماتخلط الخرسانة بأسرع وقت ممكن لإنهاء عملية الصب لذا يكون من الضروري معرفة الحد الأدنى اللازم لعملية الخلط لإنتاج الخرسانة متجانسة التكوين وذات مقاومة مناسبة .

The factors influencing the mixing time of concrete: عوامل تؤثر على وقت الخلط

1- The type of mixer and its capacity نوع الخلاطة وسعتها

2- The climatic conditions of site especially the temperature.
.الظروف المناخية للموقع وخاصة درجة الحرارة

3- The method of placing the materials in mixer. .طريقة وضع المواد في الخلاط

Effect of long period time of mixing the concrete تاثير زيادة وقت الخلط

Long period of concrete mixing may be lead to:

1- Evaporation of water from the mix. تبخر ماء الخلطة
2- Decrease in workability. نقصان قابلية التشغيل
3- Grinding of the aggregate particularly if soft. طحن حبيبات الركام خاصة اذا كانت رخوه
4- The friction effect also produces an increase in the temperature of the mix. تأثير الاحتكاك الحاصل بين الحبيبات يؤثر على زيادة درجة حراره الخلطة