جامعة الموصل
كلية الهندسة
قسم الهندسة المدنية

مقرر مواد الانشاء 2
المرحلة الثانية
الفصل الدراسي الثاني

اعداد

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Properties of fresh Concrete

1. Consistency

Degree of wetness or degree of water content or plasticity of concrete.

2. Workability: fresh concrete must have the ability to be:
1. Easy to mix
2. Easy to transport and place into position
3. Easy to compact

Test of Workability (Consistency)

1. UNESCO : (hand test)

الفحص يكون بعد أن نعمل الخلطة الخرسانية:

نأخذ كمية من الكونكريت ونضعها في راحة اليد ونكبس عليها بضم الأصابع وبعد فتحها يلاحظ واحدة من الحالات التالية:

١. تبعثر الكونكريت على اليد، يعني ان كمية الماء داخل الكونكريت تكون قليلة (stiff) .

٢. نلاحظ تكتل الكونكريت مع ملاحظة طبعات أصابع اليد على الكونكريت، يعني كمية الماء داخل الخلطة متوسطة (plastic) .

٣. سيلان الكونكريت من بين أصابع اليد، يعني كمية الماء داخل الخرسانة عالية وقوام الخلطة ذات لدونة عالية جدا (very plastic).

يستفاد من هذا الفحص بالموقع لمعرفة مقدار الهطول عند عدم توفر مخروط الهطول.

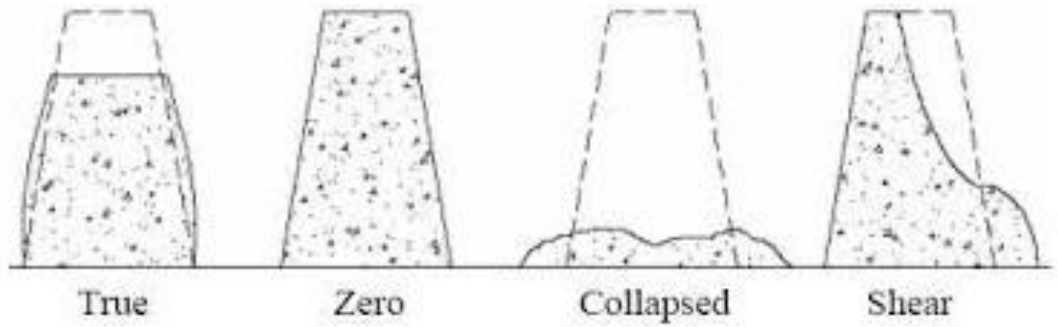
Degree of Plasticity	Slump (cm) (expected)
stiff	0-2
plastic	3-7
Very plastic	8-15

2- Slump test

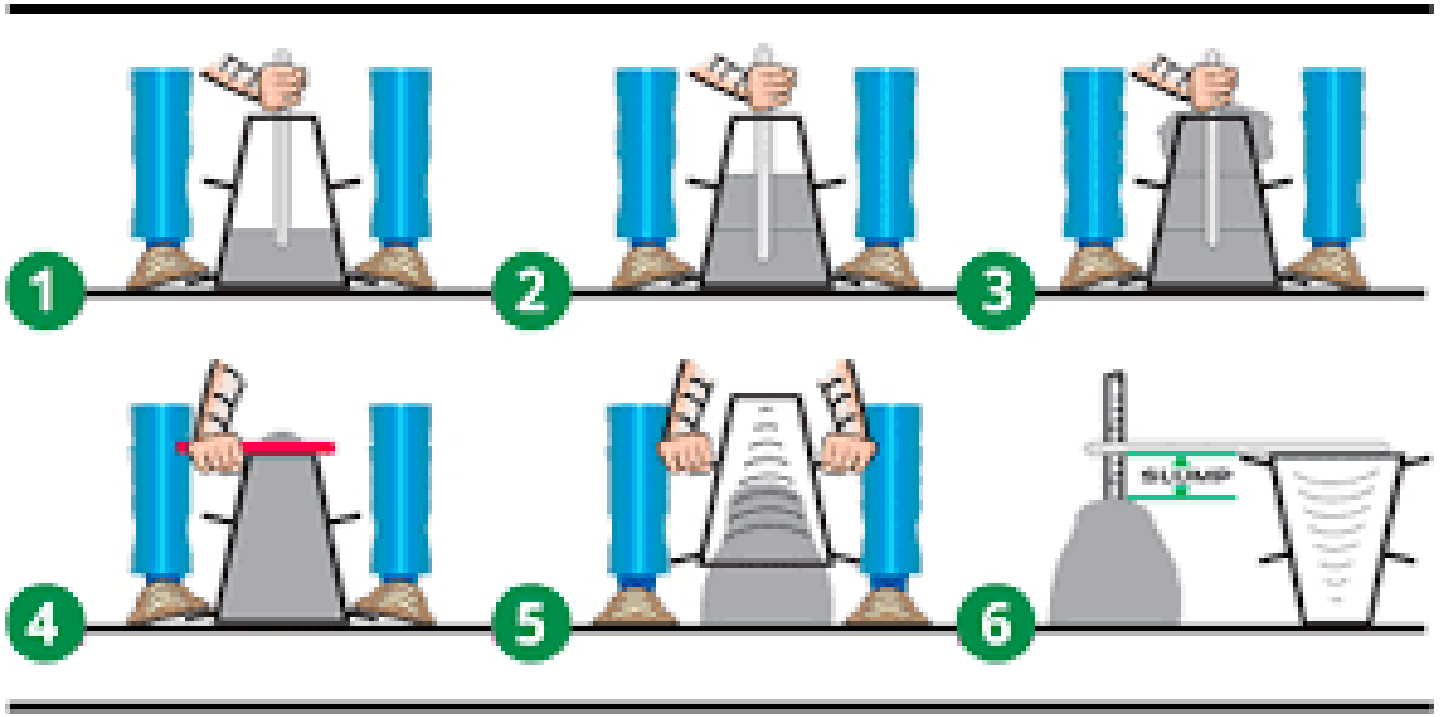
a. Fresh concrete is placed in concrete for 3 layers.

b. Taping 25 strokes/layer by taping rode (24″ long, 5/8 ″dia. steel rod).

c. After compacting raise the cone and flip it, then measure slump.



Types of concrete slump



3. V. B. Test

V.B. Consistometer , is suitable for very stiff concrete

V. B. Time Test: elapsed time for transfer of concrete from the cone into cylinder (sec.)

4. Compacting Factor Test or Density Ratio Test

is suitable for (no slump concrete)

$$C.F. = \frac{weight\ of\ (partially) compacted\ concrete\ (W1)}{weight\ of\ (totaly) compacted\ concrete\ (W2)}$$

Calculate (**W_1**) : weight of partially compacted concreter.
Calculate (**W_2**): weight of totally compacted concrete

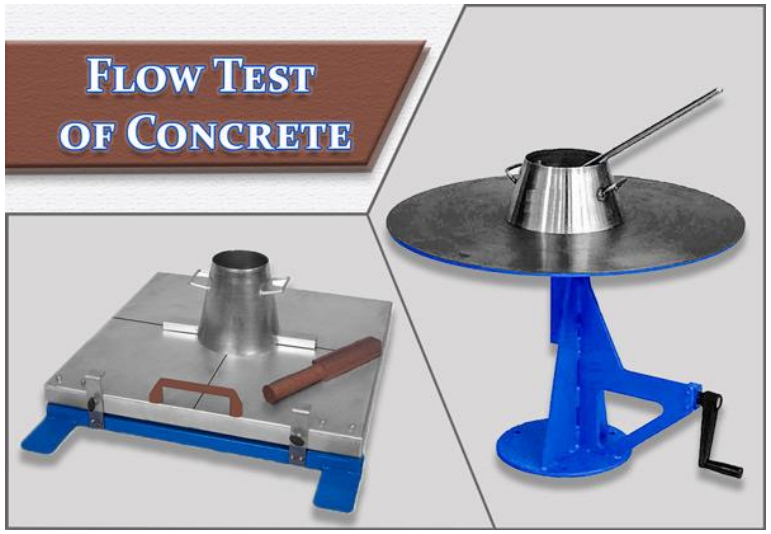
W_2 = يمزج الكونكريت ويصب في الاسطوانة بـ ٤
طبقات كل طبقة ترص ب ٢٥ ضربة وتساوي السطح وننظف الجوانب ويوزن

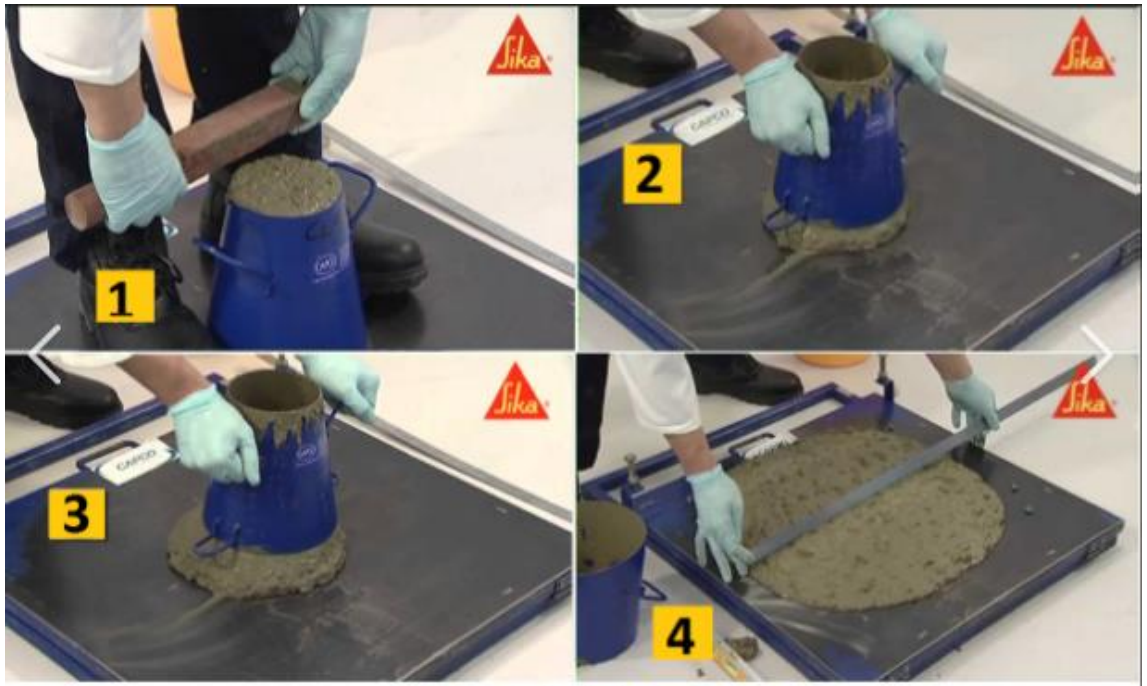
C.F. = كلما يقترب الرقم من الواحد قابلية تشغيل الخرسانة أعلى

5. Kelly ball (Penetration Test) ASTMC360

يجرى هذا الفحص لكل انوع الكونكريت، توضع الخرسانة الطرية في وعاء ويجلب الحامل وعليه الكرة تلامس السطح، تأخذ أول قراءة. يوجد عتلة عند سحبها تنزل الكرة داخل الخرسانة الطرية وننتظر الى أن تستقر تماما وتقرأ القراءة الثانية التي تعطي مقدار نزول الكرة في الخرسانة. الفرق بين القراءتين يعطي مقدار النفاذية.

4. Flow Table Test (ASTM C124)
is suitable for sloppy (very plastic concrete)





Flow Table Test

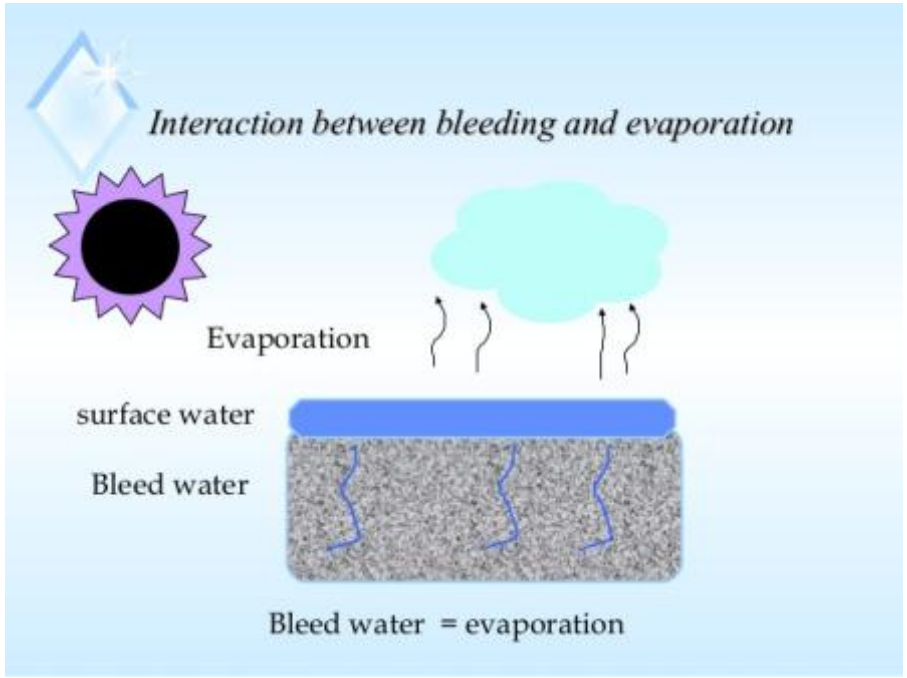
Degree of Plasticity (workability)	Compacting Factor	Corresponding Slump (cm)	Corresponding flow (%)
Dry (very low)	0.78	0 - 25	0 - 20
Stiff (low)	0.85	25 - 50	15 - 60
Plastic (medium)	0.92	50 - 100	50 - 60
Very plastic (high)	0.95	100 - 175	90 - 120
Sloppy (v...high)	1.0	175 - 250	110 - 150

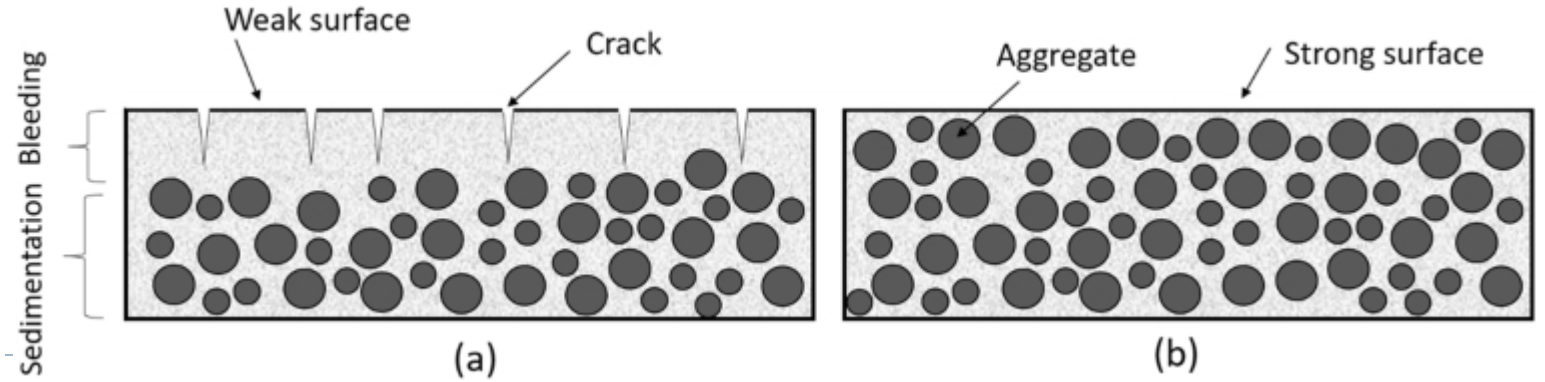
fresh Concrete

1. Consistency & Workability
2. Bleeding
3. Segregation
3. Plastic Shrinkage
4. properties of fresh concrete

Bleeding النزف

- Bleeding is the tendency of water to rise to the surface of freshly placed concrete.
  - It is caused by the inability of solid constituents of the mix to hold all of the mixing water as they Settle down.





Causes of bleeding.

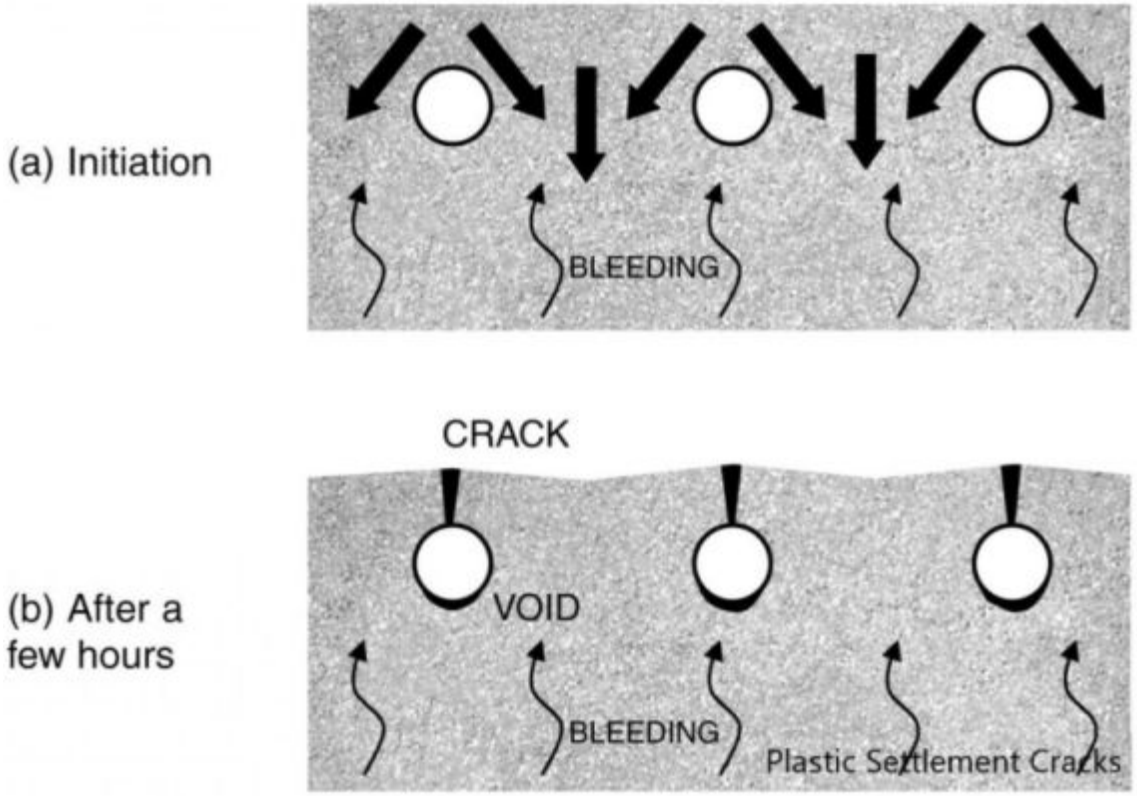
(i) presence of excess water.

(ii) Deficiency of fine aggregate.

(iii) Too much finishing.

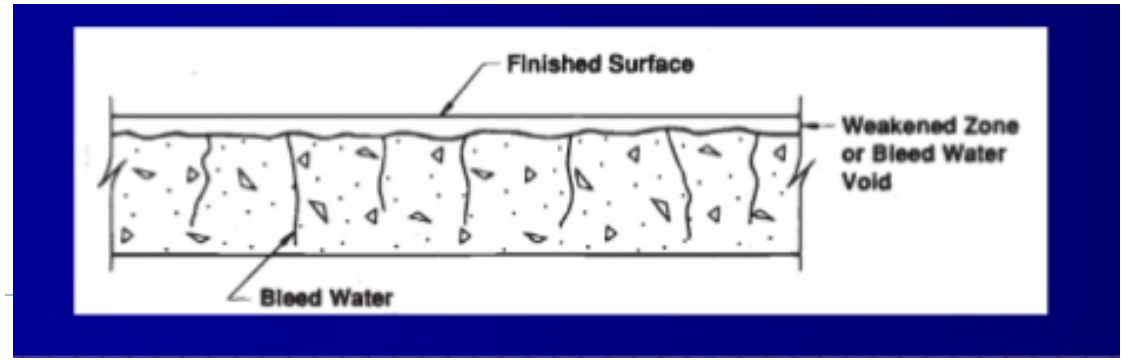
Disadvantage of bleeding:

2. Reduce the bond between the concrete and reinforcement and cracks.



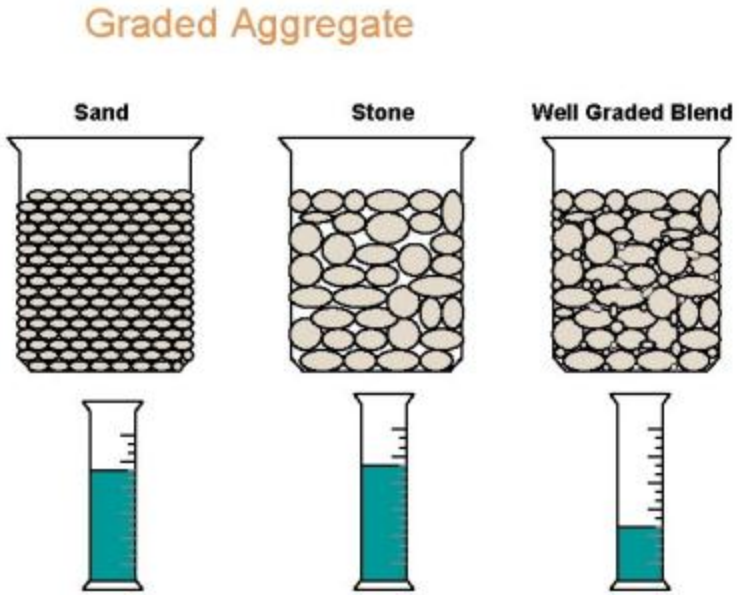
Disadvantage of bleeding:

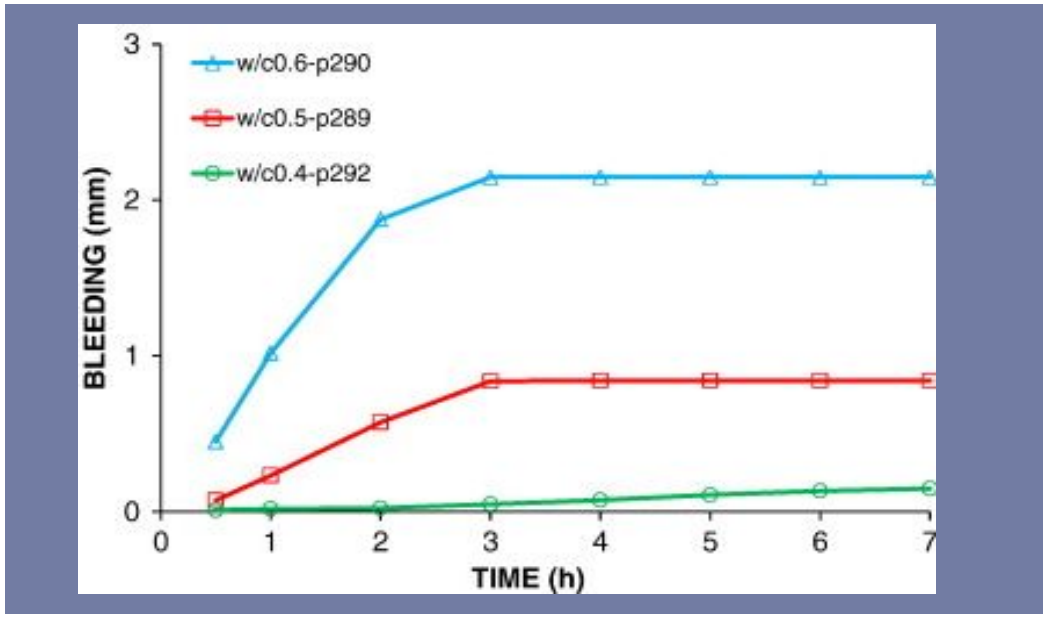
1. Weak concrete surface and cracks.



Factors tending to minimize bleeding

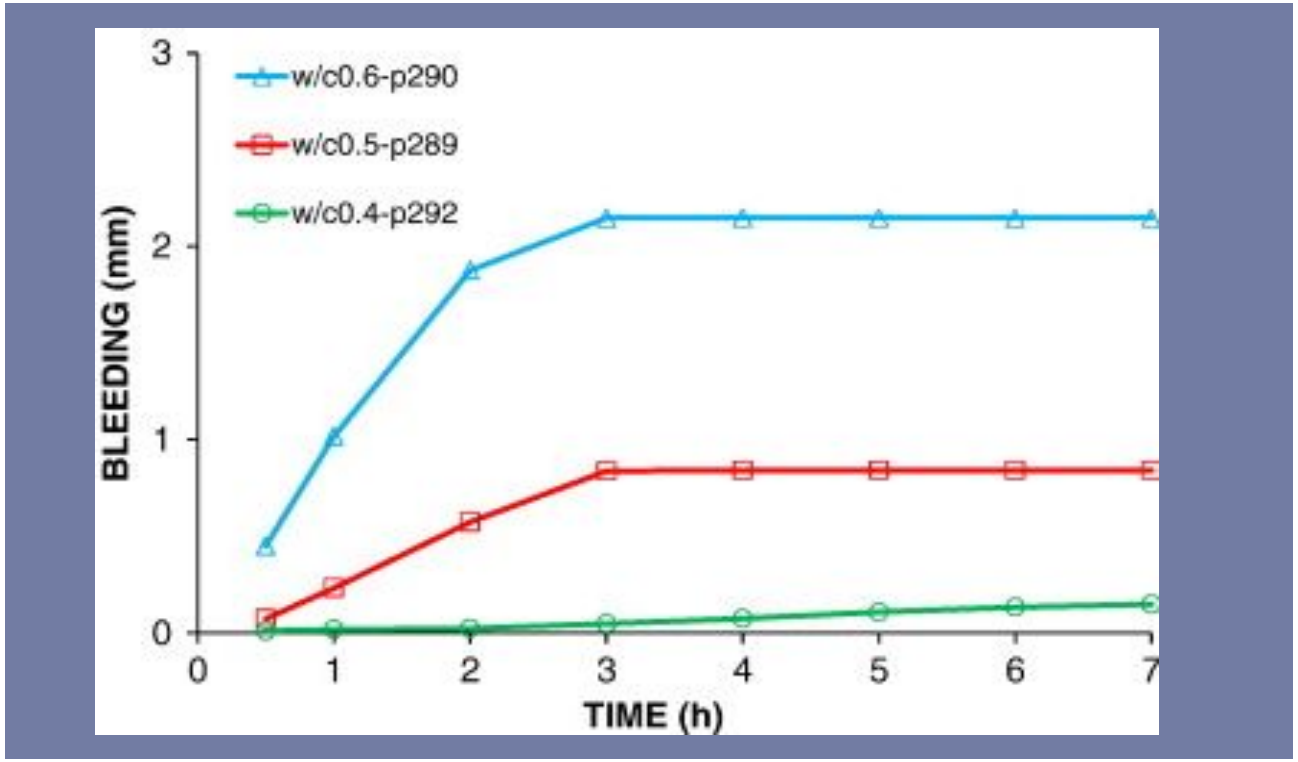
1. Well-graded aggregate.
2. Curing as soon as possible.
3. Relatively high cement content.
4. Low water content.
5. Using entrained air and admixtures.
.6. Using Fine cement



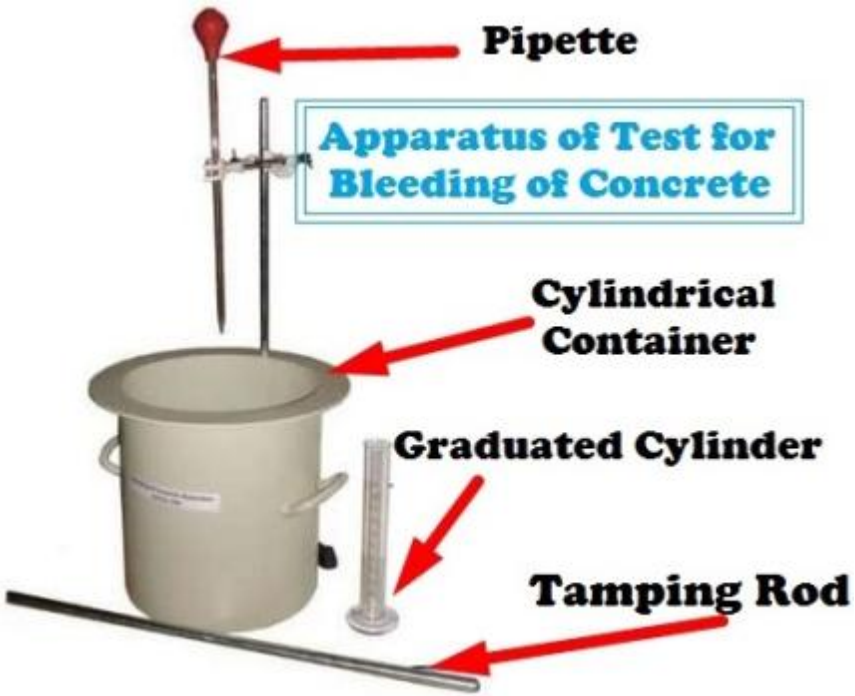


To measure bleeding rate of fresh concrete, Test (ASTM C323)

1. Capacity of Cylinder used for test (1/2 ft^3).
2. Every (10 min.), bleeding water is withdrawn (يسحب)
3. Record the accumulated time till ending of bleed water.



Bleeding rate with time for different w/c ratios



Recommendations to Reduce Plastic Shrinkage Cracks:

1. Wetting the subgrade , forms , and aggregate before casting concrete (ترطيب الارضية والقوالب والركام قبل الصب).
2. Start curing very soon, by using temporary covering or water spray after placing to reduce evaporation.

Bleeding النزف

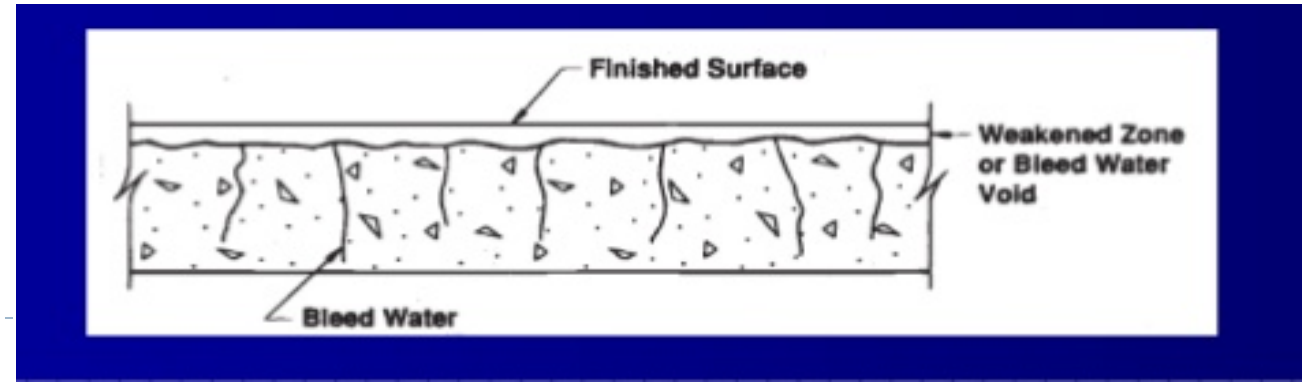
↓

Plastic shrinkage

الانكماش اللدن

↓

Cracks تشققات



Segregationالانفصال

Settlement of gravel downward

Hardened state

Fresh state

Causes of segregation

1- higher compaction of fresh concrete.
2- high gravel /sand (G/S) ratio in concrete mix.
3- poor mixing of fresh concrete

Properties of Fresh (Plastic) Concrete

Unit Weight (W), Yield (Y), and Cement Factor (C.F)

Ex. For the concrete mix of (1 : 2.5 : 3.5) by wt. The water content is (6 gallon / sack). Calculate
1. W , 2. Y , 3. C.F of the mix (Assume air volume in the mix is (1%).

Wt. 1 sack = 94 lb , sp. gr. for agg. = 2.65 , sp. gr. for cement = 3.15
1 gallon = 8.33 lb , 1 kg = 2.2 lb

$$\frac{w}{c} = \frac{6 \times 8.33\ lb}{94} = 0.53$$

$$volume = \frac{wt/1sack}{62.4 \times sp.gr.}$$

wt. of cement = 94 U.S sack

$$\text{volume of cement} = \frac{94}{62.4 \times 3.15} = 0.48$$

wt. of sand = 94 × 2.5 = 235 lb

$$\text{volume of sand} = \frac{235}{62.4 \times 2.65} = 1.42$$

wt. of gravel = 94 × 3.5 = 329 lb

$$\text{volume of gravel} = \frac{329}{62.4 \times 2.65} = 1.99$$

wt. of water = 94 × 0.53 = 50 lb

$$\text{volume of water} = \frac{50}{62.4 \times 1} = 0.8$$

Total volume = 0.48 + 1.42 + 1.99 +0.8 = 4.7 ft^3/ 1 sack (without air)

Total volume = 4.7 + 4.7 × 1/100 = 4.75 ft^3 (with air) (1.01 × 4.7)

Total weight = 94 +235 + 329 + 50 = 708 lb / 1 sack

1.*Unit Weight* $= \frac{weight}{volume} = \frac{708}{4.75}$ = 149 lb/ ft^3

2. ***Yield*** (Production of fresh concrete for one sack of cement.)

$$Yield = \frac{volume}{No.of\ sacks} = \frac{4.75}{1.0} = 4.74\ ft^3/sack$$

3. ***Cement Factor*** $C.F. = \frac{1}{Yield}$ $(\frac{sacks}{ft^3})$ C.F = $\frac{1}{4.75}$ = **0.21 sacks/ft^3**

C.F=0.21x(3.3) ^{3} = 7.54 **sacks/m^3** (SI units) C.F =0.21x(3.0) ^{3} = 5.68 **sacks/yd^3** (ft.lb units)

≈ **5.7** sacks/ yd^3

Checking:

$$\frac{C}{62.4 \times 3.15} + \frac{2.5\,C}{62.4 \times 2.65} + \frac{3.5\,C}{62.4 \times 2.65} + \frac{0.53C}{62.4 \times 1} + \frac{1}{100} = 27$$

C = 540 lbs/yd³ ÷ 94 = 5.73 sacks/ yd³ ≈ **5.7** sacks/ yd³

Ex. The volume of fresh concrete is 10 ft³ by using 4 sacks of cement. Calculate Yield of and cement Factor concrete

$$Yield = \frac{volume}{No.of\ sacks} = \frac{10}{4.0} = 2.5 \text{ ft}^3 / 1 \text{ sack}$$

$$C.F. = \frac{1}{Yield} = \frac{1}{2.5} = 0.40 \text{ sacks / ft}^3$$

$$C.F. = 0.4 \text{ x } (3.0)^3 = 10.8 \text{ sacks / yd}^3$$

1 Yd = 3 ft
1 ft = 0.3 m
1 Yd = 0.9 m
1 in. = 25.4 mm
1 gallon = 8.33 lb
1 kg = 2.204 lb

Properties of fresh Concrete – Temperature of fresh concrete

A – Concreting in Cold Weather

Minimum temperature of fresh concrete in cold weather is 60 ºF (15.5 ºC).

Low temperatures can cause:

1. Delayed setting: تأخر التماسك او التصلب

   The development of concrete strength in cold weather **is low** as compared with the strength development at normal temperature. The setting period necessary for removal of formwork.

2. Damage of fresh concrete structure: ضرر وتحطم ببنية الخرسانة الطرية

   If the fresh concrete is exposed to very low temperature (less than 0ºC), This causes the water to freeze and expand inside the pore structure. Then the damage of concrete.