

## CVG2141 Quiz 4 - Fresh State

1. What is the difference between consistency and workability?

Consistency describes the ability of the material to flow and depends on the wetness of the fresh concrete. Workability consists of the easiness of handling fresh concrete without causing segregation. A slump test which determines the consistency of a concrete mixture can be used to determine its workability. *They might be linked depending on application of use. SCC → yes, need high slump. Pumped → no need cuz will vibrate anyways*

*doesn't tell anything about segregation*

2. What is self-consolidating concrete (SCC)? When should one use it in practice?

Self-consolidating concrete is a low viscosity concrete that is able to flow under its own weight. It helps the ease of application and requires no vibrating to help compact it. It is typically used when there is heavy reinforcement involved, one desires an easily pumped material, or if the compaction of the construction members is limited. It is beneficial since it helps to improve workability with less water content, while still maintaining cohesion and reduces risk of segregation.

3. When do I need to use chemical admixtures in concrete? What are the three main types of chemical admixtures?

Chemical admixtures are used to enhance or obtain desired properties of concrete and reduce costs for construction and manufacturing. They are chosen based on the goal of the concrete, ingredients in the mix, and environment of the structure. The three main types of chemical admixtures are air entrained admixture, water reducer, and accelerators and retarders. Air entrained admixtures are used to prevent the freezing and thawing of concrete by adding air voids to allow enough space for the water to become ice and vice versa without applying additional stresses on the concrete. Water reducers aim to enhance concrete properties while maintaining or reducing water content. This occurs in two ways, chemically or physically. The chemical aspect involves the repulsion of the particles and the physical aspect consists of a barrier that forms on the particles. This reduces the attraction of the cement particles thus allowing for a lower viscosity without the usage of more water. Moreover, accelerating admixtures are used to speed up the process of concrete setting. These tend to have many restrictions due to the fact that they reduce durability, cause corrosion to steel, are reactive with reactive aggregates and sulphates, etc. Lastly, retarding admixtures aim to increase the setting and hardening period of concrete. *However, chemical admixtures CANNOT replace or make up for a bad mix design*

4. Air-entraining admixtures can protect concrete against freeze-thaw cycles due to:

(c) distance among voids (spacing factor) < critical distance

5. How does the water-reducing admixtures work?

(b) / "(c)" a et b, depending on the admixture type

Can be useful if the concrete is applied like shotcrete since the concrete needs to stick like glue when it touches the surface (fast dry)

6. When should one select an accelerating admixture to be used? What are the potential problems of its use?

Accelerating admixtures should be used when one wants to reduce the typical 28 days setting time of the fresh concrete. This is beneficial in the winter as it speeds up the constructing process, provides early strength gain, and protects against frost. As well, this is suitable for tunnels since they are constructed by compacting several layers of concrete and reinforcements and faster hardening will allow for a quicker construction process. However, there are a few restrictions when using this admixture. This includes the inability to use it with reinforced concrete, prestressed concrete, hot weather, massive structures or if exposure to reactive aggregates (AAR) or sulphates. This is due to the fact that it lessens the durability of the concrete and can cause corrosion due to the reaction between the steel and the chlorides in the admixture.

7. You work for a consulting company that is participating in a project with a contractor to build a concrete tunnel (total thickness: 60 cm; concrete cover: 10 cm). You were told that the structure will be in contact with a soil in presence of a high amount of sulphates. Moreover, the service life (i.e. life span) of the structure should be 75 years or more. What are the advices you would provide the contractor with regarding the materials selection? Please, discuss on the selection of the following materials:
- Type (s) of chemical admixture (s) to be used.

I would recommend the usage of a permeability reducer since it would reduce the amount of water that is able to pass through the material, thus lessening cracking and improving durability. As well, a corrosion inhibitor would help to prevent corrosion caused by the high exposure to sulphates. In turn, this would help to improve the lifespan of the tunnel. These admixtures would both help the contractor to reach their service goal of 75 years or greater.

Could have been water reducer too → reduce w/c ratio & decrease porosity → decrease problems relating to durability & increase strength

also could mention accelerator → but cant be used bc of sulfates