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CVG 2141 – CIVIL ENGINEERING MATERIALS

Quiz II
Dr. Leandro F. M. Sanchez **September 30th, 2020**

1. **Why the particle size distribution (PSD or grading) is so important in a concrete mixture?** It's important because it aims to reduce the amount of voids present in each mixture. In turn, the amount of cement paste used is reduced which helps save money and be more sustainable.

2. **What's the preferred aggregate type for a better workability?**
   a) Gravel: Rounded and smooth;
   b) Crushed stone: Angular and rough.

3. **What's the preferred aggregate type for better mechanical properties?**
   c) Gravel: Rounded and smooth;
   d) Crushed stone: Angular and rough.

4. **When the moisture content (MC) > absorption capacity (AC) :**
   a) Aggregate contributes with water to the system;
   b) Aggregate absorbs water from the system.

5. **Calculate the FM of the sand below:**

Sieve size (mm)	Weight retained (g)	% retained	cumulative % retained
4.75	**20**	2.0	2.0
2.36	**120**	12.0	14.0
1.18	**250**	25.0	39.0
0.60	**262**	26.2	65.2
0.30	**220**	22.0	87.2

FM = Σ(cumulative % by mass retained on each sieve) / 100
= 305.4/100
= 3.054

0.150	**108**	10.8	98.0
Pan	**20**		305.4

Total

6. What's the maximal and the maximal nominal size of the coarse aggregate below?

The max size is 28mm and the maximum nominal size is 20.

Sieve size (mm)	Weight retained (%)
28	**-**
20	**5**
14	**30**
10	**30**
5	**30**
2.5	**7**
1.25	**0**
Pan	**0**
Total:	**100%**

7. What is (in general) the moisture condition of the aggregates stored for using in concrete construction?

a) OD;
b) SSD.
c) AD;
d) Wet.

8. An aggregate sample weighs 830g. The aggregate has an OD mass = 821g and SSD mass of 840g. Then, the aggregate is:

a) Close to OD condition;
b) Close to SSD condition;
c) In a wet condition;
d) In a AD condition.

AC (%) = [W(ssd) - W(od)/W(od)] x100
= [(840-821)/821] x100
= 2.314%

MC (%) = [W(agg) - W(od)/W(od)] x100
= [(830 - 821)/821] x100
= 1.096%

MC < AC, therefore it is in the air dry condition

9. You work for a company and your next job is the construction of a concrete dam in a remote area in Ontario. Your boss requests you to study the availability of coarse aggregates in the construction region. Amongst the possibilities, you found the following aggregates:

- An aggregate that is known to be reactive (i.e. AAR reactive) and;
- A recycled concrete aggregate (RCA).

With **only** these two possibilities (i.e. there is no other solution that using these two aggregates), please describe: a) the issues that might arise while the using of those aggregates in the construction of the dam, and b) the actions to be taken to avoid (totally or at least partially) the potential issues mentioned in a).

a) Aggregates that are AAR reactive may present issues relating to the durability of the concrete. This is because is a chemical reaction between the minerals (concrete and aggregate) occur and silica gel is produced. Over time, the silica gel starts to swell which creates cracks in the concrete. Once this damage has started, it is very difficult to fix it and really compromises the strength of the material. While the issues relating to recycled concrete aggregate is that the properties differ from conventional concrete and these properties are dependent on the amount of residual mortar attached. The uncertainty presented from this material poses safety concerns for larger projects. Also, they sometimes have residual chemical contaminants which can react and form by-products.

b) Mitigation techniques for reducing the damage caused from AAR reactive aggregates is to add reinforcements (ex- steel rods). This helps to restrain portions of the concrete from expanding and cracking, and thus helping to maintain the integrity of the concrete. Moreover, the properties of the recycled concrete aggregate should be closely studied and the use of chemical admixtures can be considered to help counteract the possible reactions.