CVG2141 Quiz 9

1. **What are the functions, categories and types of masonry?**

to assemble the units or blocks together

Masonry is a building material composed of mortar and masonry elements. There are two categories of masonry elements, solid or hollow. The solid masonry elements have voids up to 25%, while the hollow masonry elements have voids of 25-60%. This can be further divided into two different types including concrete masonry elements and clay bricks. The concrete masonry units can be solid or hollow and the clay bricks can be structural (clay tiles) or non structural (clay bricks).

function

2. **Why do we sometimes use reinforcement in masonry elements? How do we place them in the elements?**

axial/horizontal load

Masonry can either be reinforced or unreinforced. Unreinforced masonry means that it does not have rebars in it while reinforced means that it has grout and rebar in it. Reinforcements in masonry elements are significant because they help to support constructions from lateral loads, they are typically used in shear walls. In the past, buildings were only designed while accounting for only gravity loads which lead to many accidents.

can be placed as vertical reinforcement, joint reinforcement or as bond beam reinforcement.

3. **What are CMUs? Indicate the classification of CMUs according to their weight, load-bearing capacity and exposure degree.**

Concrete masonry units (CMUs) are common construction building blocks and they come in different shapes and sizes depending on their position in a masonry wall (stretcher, single corner, double corner). They are typically classified by their weight, load bearing capacity, and exposure degree. There are three different types of CMUs when classified by weight including lightweight, medium weight, and normal weight. Based on their weight, they each will have different specific gravities and absorption capacities. Typically, the trend for ascending specific gravity is respectfully lightweight, medium weight, and normal weight and vice versa for absorption capacity. As well, lightweight can be beneficial to use since it provides a light structure with high fire and heat resistance, but also has low noise resistance. The classification by bearing capacity consists of two categories, load and non-load bearing. Load bearing means that the average compressive strength is greater than 13.1 MPa, while the non-load bearing has an average compressive strength of greater than 4.1 MPa. Lastly, the degree of exposure consists of two categories, building concrete masonry (building bricks) and concrete facing masonry (facing bricks). Building bricks are typically used for general purposes, while facing bricks have

stricter restrictions due to its higher exposure resulting in a lower absorption capacity and higher compressive strength being required.

4. **Describe the types of clay bricks according to their strength and exposure degree.**

Clay bricks are small, prismatic, solid blocks. There are three types which are classified by the strength and degree of exposure, SW, MW, and NW type. SW type has an average compressive strength greater than 20.7 MPa and has a low absorption allowance. MW type has an average compressive strength greater than 15.2 MPa and has a low absorption allowance. NW has an average compressive strength greater than 10.3 MPa and has no absorption allowance limit. As well, the absorption allowance determines the overall durability of the brick.

5. **What are the binders used in masonry? Explain their differences and functions.**

Binders in masonry include mortar and grout. Mortar is a material composed of portland cement, lime, sand, and water. There are four types based on their strength (from ASTM C270) including type M, S, N, and O. Type M has the highest compressive strength, type S has normal strength, type O has the lowest strength, and type S has high bending strength. They are used for binding masonry elements, supporting material for the brick elements, and improving aesthetics. Type O is also typically used for indoor applications due to its lower strength. Moreover, grout is another binder that is composed of cement, sand, gravel (depending on application), water, and chemical admixtures. The addition of chemical admixtures is what makes grout a very flowable mixture. The standard says that its compressive strength at 28 days has to be equal to or greater than 14 MPa. The application of grout is typically for filling the hollow spaces of masonry which helps to bond the steel reinforcements to the masonry, increase bearing surface, and increase fire resistance.

6. **What are the rehabilitation procedures of masonry existing constructions? Explain all of them and give some examples.**

There are four main rehabilitation procedures including adding reinforced concrete, rebars, FRPs, and anchoring masonry walls. The first strategy, adding reinforced concrete, involves increasing the capacity in which a building can withstand by adding reinforced concrete and rebars to the front and back of the structure. This helps to increase the strength while maintaining the aesthetic properties. The second strategy, adding rebars, consists of adding rebars in localized locations and pouring concrete between them. This results in a little loss of aesthetics and is dependent on the size of the wall and the possibility of higher lateral loads. The

third strategy involves the usage of fiber reinforced polymers (FRPs). FRPs are fibers with very high mechanical properties which are very strong in tension. There are two methods of usage, either using FRP regular or coarser fibers to reinforce masonry walls. Lastly, the fourth strategy is anchoring masonry walls. This involves building or using a pre-existing foundation and attaching it to a building with cables. This helps to provide the building support when lateral loads are applied, especially since cables can withstand high tensile loads.

7. **Describe the most common durability related problem in masonry.**

The most common durability issue relating to masonry is leaching which causes efflorescence. This occurs due to the water exposure leading to the removal of surface mortar. The mortar components then react to the CO2 in the air forming calcium carbonate ($CaCO_3$). This product has a white appearance which decreases the aesthetics of the building. Some control techniques include using a protective coating material or a more durable mortar.