

CVL 871 – Durability and repair of concrete structures

Semester II – 2021-22

(45 marks, 2 hours)

Answer only in single lines, bullet lists, charts and sketches. No paragraphs. Please read very carefully before answering! No extra sheets will be provided.

Question 1 (20 marks): Indicate with reasons whether the following statements are true or false (No marks without correct reasons. Give concise answers.):

- a) The rebound number is related to the compressive strength of concrete.
- b) The half-cell potential test measures the rate of corrosion.
- c) There is a better quality control while use the dry process in shotcreting.
- d) Polymer can be impregnated in concretes to increase their strength.
- e) Impressed current cathodic protection is safe for use in prestressed concrete.
- f) Electrochemical re-alkalisation of concrete can lead to other durability issues.
- g) Estimation of service life using mean values of parameters is generally acceptable.
- h) It is important to examine the compatibility of protection measures while estimating service life.
- i) When repair is carried out, the type of steel used in repair must be the same as the type of steel in the original structure.
- j) Concrete used for patch repair must contain shrinkage compensating or reducing agents.

Please read the description below for questions 2 to 5.

You have been engaged as a consultant for a client who would like to build a 25 storey building on a marsh land adjoining a river. The main information regarding the building is below.

1. The building will be of reinforced concrete type, will have 3 basement levels below the ground level
2. The building will be supported on piles below a raft foundation. The water table is immediately below the ground level and the piles will be resting on rocks 25 metres below.
3. The water in the marsh is contaminated with chlorides and sulphates.
4. The temperature goes down to 1°C in the winters and 45°C in the summers. While there is a 4 month rainy season, the relative humidity remains around 50% to 60% during most of the remaining year.
5. The building will have car parking in the basement, a commercial area in the ground floor and residences on the upper floors.

Q2) (5 marks): List the possible deterioration mechanisms that will influence various parts of the structure. (Hint: divide the structure into various parts based on their exposure conditions.)

Q3) (5 marks): Discuss the measures that you would take to protect various parts of the structure against deterioration. List in brief how each of these measures would work.

Q4) (5 marks): The client would like to consider designing the building for a life of 75 years instead of the usual 50 years. List the steps of the methodology you would follow to decide if increasing the design life to 75 years is feasible or not.

Q5) (10 marks): There is another similar 25 storey building with 3 basement levels adjoining the one above that the client would like to consider buying. This building is 10 years old. Discuss the steps you would like to take to ascertain the health of this existing building before advising your client on the purchase.