

ORDRE DES INGÉNIEURS DU QUÉBEC

MAY 2023 SESSION

Open-book examination
Calculators : only authorized models
Duration : 3 hours

14-CI-A6 PAVEMENT DESIGN, CONSTRUCTION AND MAINTENANCE

This is a three-hour exam. It includes seven (7) questions for a total of 100 points. Structure and detail your answers clearly.

Question 1: (15 points)

Explain how a provincial department of transport prioritize the segments most worthy of funding for a single year.

Question 2: (15 points)

What is the advantage of using the Falling Weight Deflectometer (FWD) in pavement rehabilitation.

Question 3: (10 points)

List and explain the categories of the techniques that can be used to rehabilitate pavements in a given pavement section.

Question 4: (15 points)

A highway is being designed with a 100 km/h design speed, and at one section, an equal-tangent vertical curve must be designed to connect grade of +2,50% and -3,35%.

Determine the minimum length of curve necessary to meet stopping sight distance requirements.

Question 5: (15 points)

A horizontal curve on a two-lane highway is designed with a 850 m radius, 3,7 m lanes and 100 km/h design speed.

Determine the distance that must be cleared from the inside edge of the inside lane to provide a sufficient stopping sight distance.

Question 6: (20 points)

A flexible pavement has a structural number of 3,8.

The initial PSI is 4,2 and the terminal serviceability is 2,2.

The subgrade has a resilient modulus of 13 500 lb/in² (93,08 MPa).

The drainage coefficient is 0,8 for the base and subbase and 1,0 for the wearing surface (Hot-mix asphalt).

The overall standard deviation is 0,45 and the reliability is 95%.

The pavement is currently designed for 1800 equivalent 18-kip single-axle loads per day.

If the number of 18-kip single-axle loads were to increase by 20%, by how many years would the pavement's design life be reduced?

Question 7: (10 points)

A two-lane road (with only one lane in each direction) has an AADT of 42 650 during the first year of traffic. Determine the ESAL for a design period of 30 years if the following data were assumed:

- 8% truck;
- 2% annual growth rate;
- 50% on the design lane;
- 3,14 Truck factor for all trucks.