Exercise 9: Limitation of through cracking

Bessières Bridge kerbs

Background and objective

The kerbs of the Bessières Bridge were rehabilitated from May to July 2003 ($T_{e,ambient}$ ~ 22°C) according to the figure below.

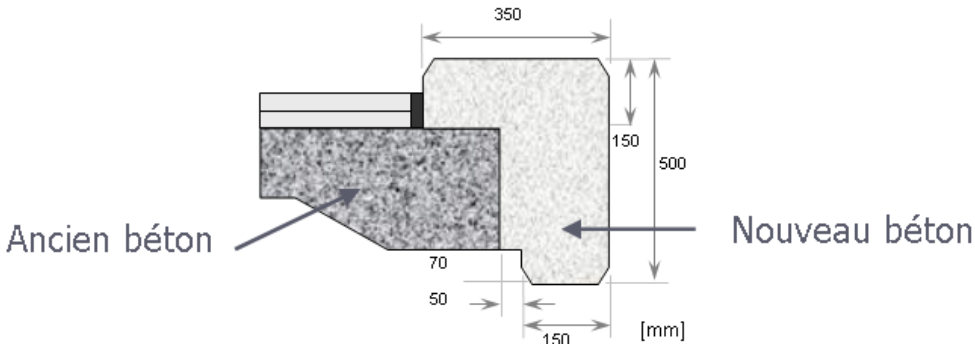

Figure 1: Geometry of the rehabilitated Bessières bridge kerbs.

The aim of this exercise is to study the risk of through cracking of the kerbs of the Bessières Bridge and the impact that cement and temperature have on this risk.

Using the chart below taken from Bernard (2000), answer the following questions.

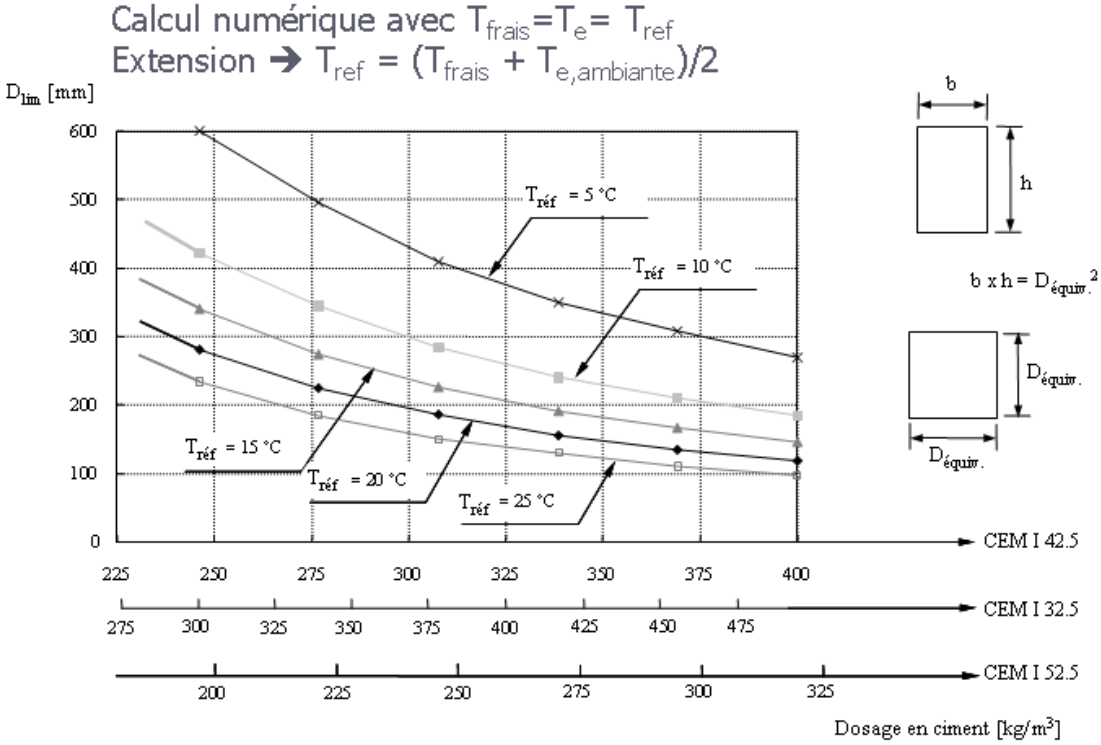

Figure 2: Chart of the dimension of the allowable equivalent section D_{lim}.

Question 1

Determine the equivalent section ($D_{équ}$) for the temperature rise.

Question 2

The concrete processing conditions impose a total binder dosage of 375 kg/m³. Check the risk of through cracking of thermal origin with a CEM I 42.5 and a CEM I 32.5, for a fresh concrete temperature of T_{fresh}=20°C.

Question 3

Is this risk reduced by replacing 50 kg/m³ of CEM I 32.5 cement with fly ash (it will be assumed that the heating potential of fly ash is half that of cement)?

Question 4

For a concrete with 325 kg/m³ of CEM I 32.5 + 50 kg/m³ of fly ash, what is the effect of lowering the temperature of the fresh concrete to a) 8°C, b) 16°C on the risk of through cracking of thermal origin?

References

Bernard O., (2000), "Comportement à long terme des éléments de structure formés de bétons d'âges différents", thèse EPFL No. 2283, Lausanne.

ED/ed – 08.09.2025