

1. Introduction

A case study shows how the program BISTRA can be used to evaluate the efficiency of frost insulation protecting a foundation.

2. Data

BISTRA data [foundation.bst](#) / VOLTRA data [foundation frost V.vtr](#)

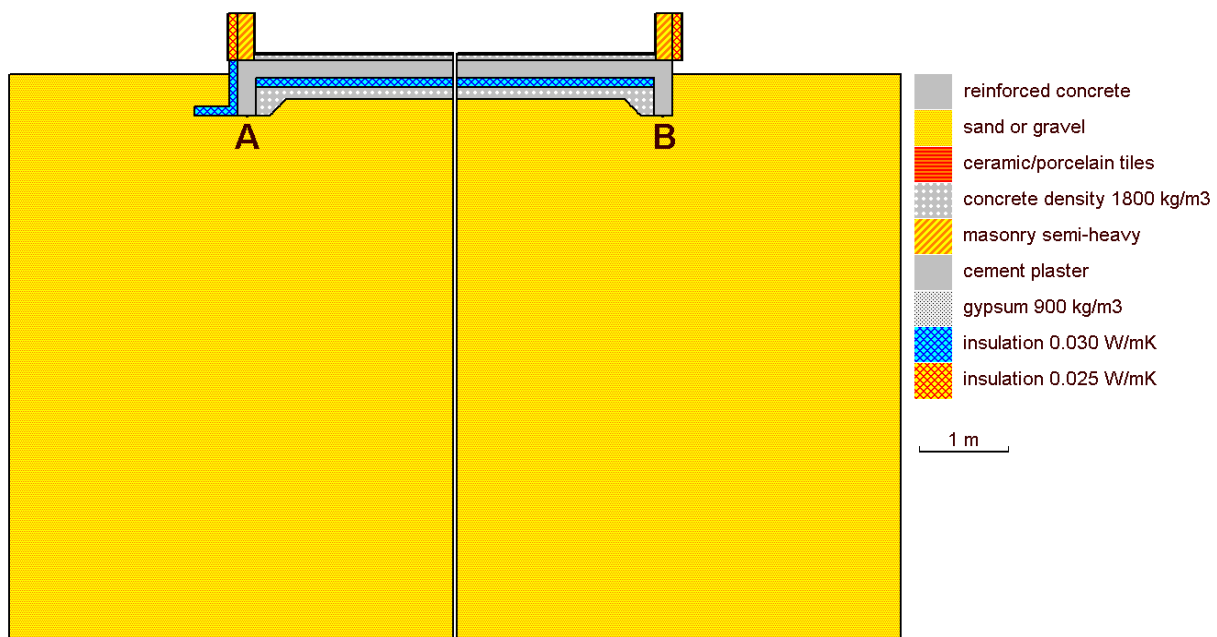


Figure 1: cross section through a foundation with (left) and without (right) frost insulation

The temperature course under two foundations, one with and the other without frost insulation (Figure 1), is simulated for the climate of Warsaw. It can be expected that the thermal inertia of the large ground massive is important and therefore a transient analysis is done using the program BISTRA. Both cases are simulated together. This is done applying an adiabatic boundary condition in the center.

The file [foundation.bst](#) contains the complete data in BISTRA format. The major data part is given in Figure 2. We will discuss here some data highlights only.

- Material properties were taken from ISO 10456¹
- For the external temperature, daily mean values for Warszawa (Figure 4) were used. The function was derived from hourly temperature values during a reference year.
- The following calculation parameters are defined:

¹ ISO 10456:2007 Building materials and products -- Hygrothermal properties -- Tabulated design values and procedures for determining declared and design thermal values

- time step = 1 day
- start-up calculation duration = 1095 days = 3 year
- calculation duration = 365 days = 1 year
- start day number = day 91 (1 April)

The 3 year start-up time is required because of the important thermal inertia. The start date (1 April) is chosen because on that day, the outdoor temperature is about the yearly mean temperature.

To register the temperature course in the points A and B (Figure 1), 2 bitmap pixels are used (Figure 2, colours 58 and 59). Through the Report Definition window the temperatures in these sensors will be registered in an output text file that can be processed using a spreadsheet program.

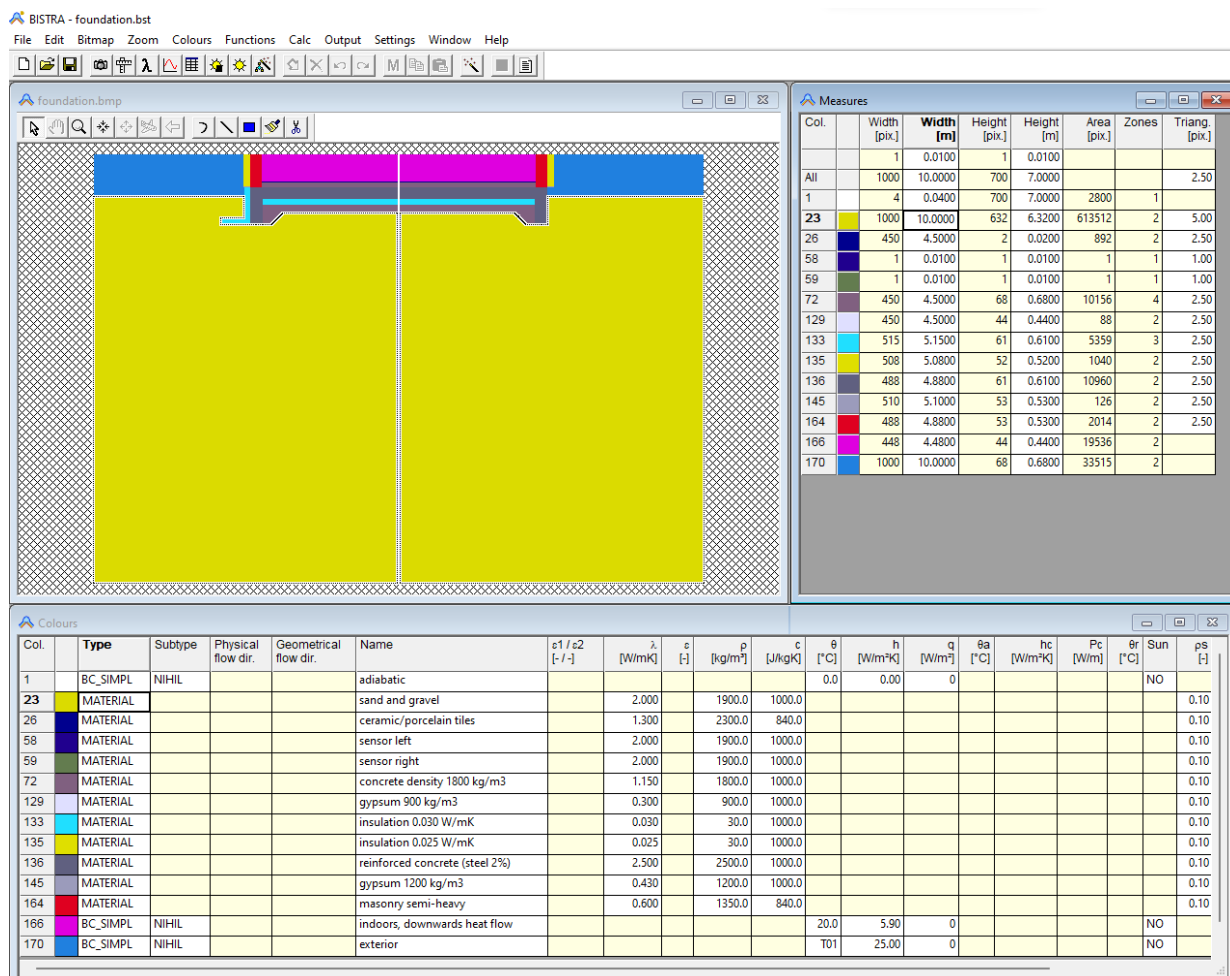


Figure 2: BISTRA data foundation.bst

3. Results

- Animation of the temperature course during 1 year: [foundation.mp4](#).
- Temperature course on 21 January: Figure 3.
- Temperature evolution in points A and B: Figure 4 and [foundation_results.xlsx](#).

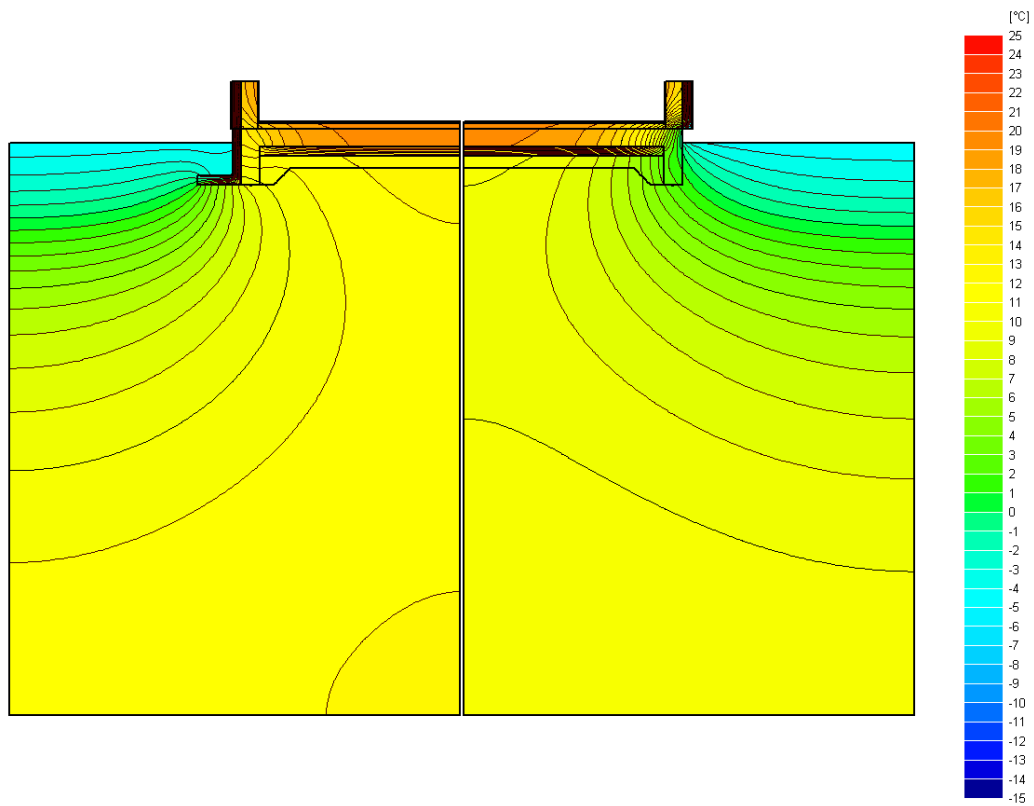


Figure 3: isotherms (increment 1 °C) on 21 January.

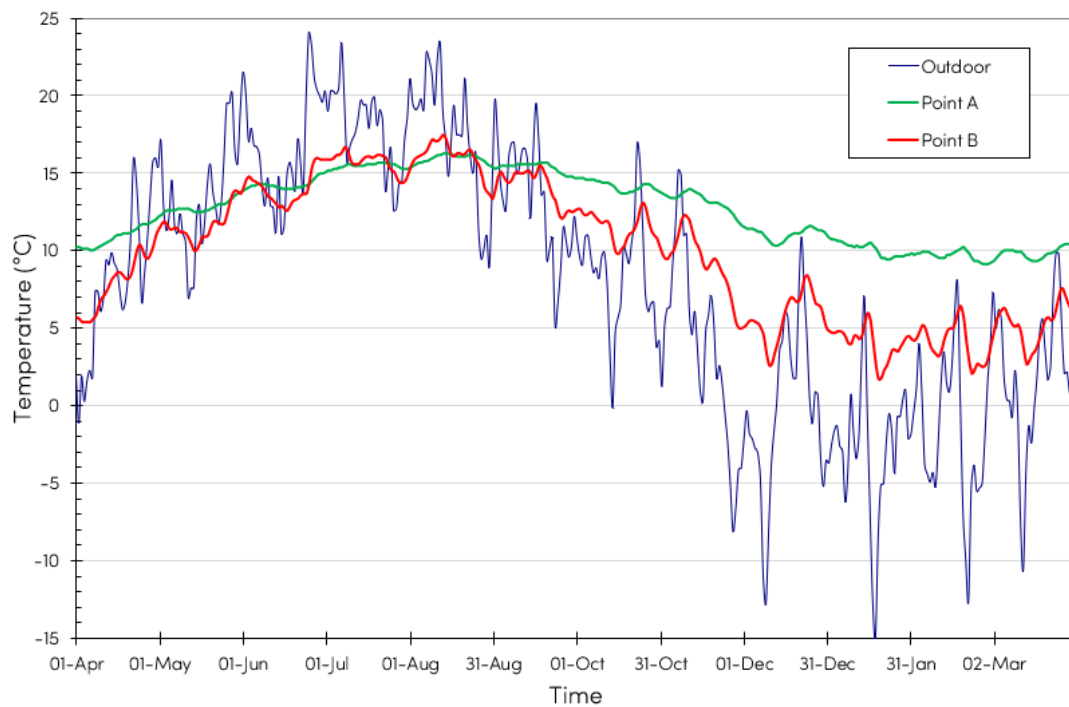


Figure 4: Daily outdoor temperature and temperature evolution in points A and B.