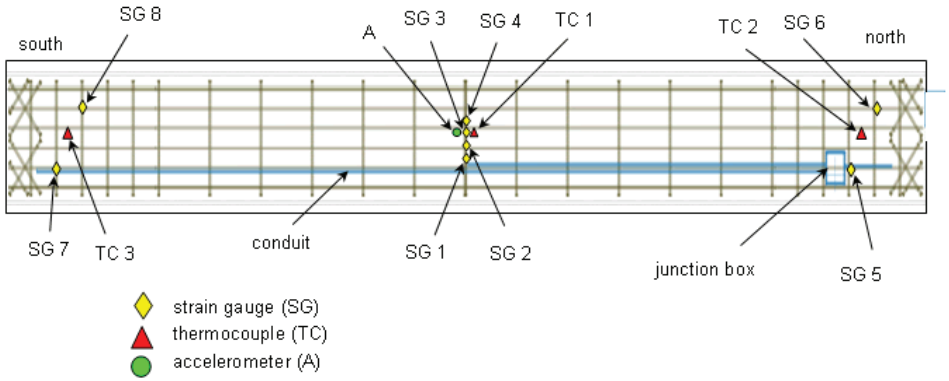
Assignment 2

- This assignment is based on the periodic monitoring of the Brookside Cemetery beam which is instrumented and monitored by ISIS Canada. The concrete beam has GFRP bars as internal reinforcements and the instrumentation details are given below.



- Dynamic tests have been performed in August, 2004 (before and after installing the headstones or markers), and in February, 2005. The data from the tests are posted on the course website.
- The purpose of this assignment is to review the monitoring system and analyze the data from these tests.
- Please note that the data can be used only for this course and not for any other research or commercial purpose without prior permissions from ISIS and VAC, Public Works and Government Services Canada.
- The expected deliverables of the assignment are given in the next page.

The assignment is due on Feb 15, 2017.

Assignment 2 (contd.)

- Review the monitoring system and comment on the placement of various sensors (1 page).
- Calculate the natural frequency of the beam using the Fast Fourier Transform (FFT) analysis of the accelerometer data from the test on August 2004 before installation of the markers (Case 1). Use MATLAB for the FFT analysis.
- Repeat the above step with the data obtained after the installation of the markers (Case 2). There are multiple data sets corresponding to this test. Calculate the frequency from each data set and find the average and standard deviation.
- Explain the difference in the natural frequency between Cases 1 and 2.
- Assuming that the span of the simply-supported beam is 7 m and the beam was excited with a 68 kg mass at the centre, estimate the values of flexural rigidity (EI) and the intensity of the distributed mass (m) in both cases. Please note that while the value of EI will remain unchanged, the value of m will be different in Cases 1 and 2. You may use the analytical solution or a computer program to calculate the frequency.
- Determine the equivalent distributed mass of the markers from the above analysis.
- Perform an FFT analysis of the accelerometer data from February, 2005 (Case 3) and compare the results with Case 2 and explain.
- Assuming that the flexural rigidity of the beam is reduced by 40% due to extensive cracking and weathering, calculate the change in the natural frequency as compared to Case 2.