UNIVERSITY OF BOLTON

SCHOOL OF THE BUILT ENVIRONMENT & ENGINEERING

MSc CIVIL ENGINEERING

SEMESTER TWO EXAMINATION 2009/2010

APPRAISAL AND RE-USE OF OLD BUILDINGS

MODULE NO: BLT4016

Date: Thursday 3 June 2010 **Time: 2.00 pm – 5.00 pm**

INSTRUCTIONS TO CANDIDATES:

This is an OPEN BOOK Examination. You may bring your own notes and documents into the Examination Room.

Sketches should be neat and approximately to scale.

There are four questions. Marks for each question are shown.

Attempt ALL questions.

All answers are to be written in the answer book provided. Pre-prepared material will not be accepted.

Total 100 marks for the paper.

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Introduction

Read this Introduction, the Further information and the exam questions and review all of the eight A3 drawings before attempting to answer the exam questions.

The client has acquired a group of buildings, shown in the attached drawings, including: the Calender room and its extension, shown on the drawings as “Proposed Calender Room Alterations”. The Calender room extension building is on three levels: First Floor, Ground Floor and Basement.

The Calender room and its extension form one part of a group of buildings that have collectively been used for a variety of light industrial and warehouse uses over almost 130 years. Over this time, their maintenance has been rudimentary.

The client is proposing conversion of the First Floor and Ground Floor of the Calender room and its extension to classrooms for a university.

You have received a brief from the client to provide advice on the buildings shown in the drawings attached. The advice is to be based on:

- The structure of the buildings shown in the drawings
- Your knowledge of buildings of this age and type
- Further information provided in this exam paper

The information provided in the exam paper and the archive drawings is not sufficient on its own to allow you to fully answer the questions in the exam paper. You must use your engineering judgement and experience gained in relation to old buildings to set the information provided in context and to help you to make realistic and useful assumptions. All assumptions made must be clearly explained in your answers.

Additionally, in all cases, make clear which of your answers you consider to be provisional and explain what is required for their confirmation.

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Further information

The client has measured the thickness of the walls of the cast iron columns at two locations, at Basement and Ground Floor levels, by drilling a single pin hole at each location, at mid-height of the columns:

Location	Thickness of column wall (mm)
First Floor	20
Basement	24.5

BS6399 – Part 1: 1996
Extract from Table 1:

Type of activity/occupancy	Minimum imposed uniformly distributed floor loads (kN/m^2)
Classrooms	3
Associated corridors, hallways, aisles, stairs, landings	3

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Question 1
Describe the structural form, load transfer and lateral stability of the Calender Room extension building. Use clearly annotated sketches to illustrate your description.

(10 marks)

Question 2
(a) The architect's drawings provided are dated July 30th 1881. Drawing 6 is an extract from a drawing titled "Pillars for Extension of Calender Room for Messrs. Blair and Sumner, Mill Hill". This is dated July 28th 1881 and is by Jackson and Brother, Wharf Foundry, Bolton.

Drawing 6 by Jackson and Brother appears to show cast iron beams supported on cast iron columns. The architect's drawings describe the beams spanning between the cast iron columns as 2 Rolled Iron Girders, 12" x 6".

Write a brief email to a fellow structural engineer discussing the contradictory information and stating the material and form that you consider most likely that the beams will be. State the strength of the material. Justify your conclusions and comments in the email.

(10 marks)

(b) With regard to the Calender room extension, consider a typical bay (26'8" x 11'4") within the building and provide answers in kN/m^2. Carry out sufficient structural calculations to provide answers to the following:

i. What is the live load capacity of the First Floor considering the primary timber floor beams (spanning 26'8") at First Floor level?

ii. What is the approximate live load capacity of the First and Ground Floors considering the cast iron columns at Basement Floor level only? Assume that the timber beams spanning onto the "Rolled Iron Girders" have similar spans in both the original Calender room and in its extension (i.e. about 26'8").

Discuss the appropriateness of using Goodman's formula and Euler's formula for checking the cast iron column and also calculate the answer making use of the working stresses from the London County Council (General Powers) Act, 1909. State and justify your preferred answer.

(30 marks)

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Question 3
Write an extract from a structural appraisal of the Calender room and extension buildings. The appraisal should not be in a formal report format. It should be structured in a letter form and written in a professional manner, addressed to the client. The extract must only include the following:

i. Advice on the load carrying capacity of the First Floor with regard to the proposed conversion of the building to an educational facility.

ii. Brief discussion of the issues relating to further work that you recommend to the client (for example: sampling, testing and site inspection of the buildings) to improve upon the quality of the information provided in the letter report.

(35 marks)

Question 4
Make the assumption that the First Floor requires strengthening. Consider two ways of strengthening the floor. One way is to be “cheap and cheerful” and should provide an economic solution for the client. The second way is to provide a solution that will have least impact on the appearance of the building.

Provide clearly annotated sketches to illustrate the two possible structural schemes for strengthening the First Floor together with a brief explanation of their appropriateness. Do not carry out detailed calculations for this question. Instead, use your experience and engineering judgement. You may carry out brief calculations based on fundamental structural engineering principles.

(15 marks)

END OF QUESTIONS