National Examinations - May 2003

98-CIV-A2 ELEMENTARY STRUCTURAL DESIGN

3 Hour Duration

NOTES

1. If doubt exists as to the interpretation of any question, the candidate is urged to submit with the answer paper a clear statement of any assumptions made.

2. Any non-communicating calculator is permitted. This is an "**OPEN BOOK**" examination. Note to candidates: you must indicate the type of calculator being used, i.e. write the name and model designation of your calculator on the first inside left-hand sheet of the exam work book.

3. Solutions must be to the following standards:

Steel:	CAN/CSA-S16.1 (latest)
Concrete:	CAN/CSA-A23.3 (latest)
Timber:	CAN/CSA-086.1 (latest)

4. A total of **five** solutions is required. Only the first five as they appear in your answer book will be marked.

   Do **two** questions from Part A.
   Do **two** questions from Part B.
   Do the **one** question in Part C.

5. All questions are of equal value.

Part A (Do <u>two</u> of three questions)

A1. Figure 1 shows a steel cross-section fabricated from 16 mm G40.21-M300W steel plates. Determine the moment of resistance of the section when subjected to bending about the c-c axis.

A2. The steel cross-section of Question A1 is used as a column. The column, shown in Fig A2, is subjected to a vertical load P_F applied at an eccentricity of 1.2 m, producing bending about the c-c axis. The column is free-standing at the top and rigidly fixed at its base. Calculate the maximum factored load P_F that the column can carry.

A3. Figure A3 shows a fillet weld connection. A 20 mm steel plate, of G40.21-M300 W, is welded to a steel member with three 16 mm fillet welds, using an electrode E480 XX. Calculate the maximum factored load P_F kN that can be applied to the connection.

Part B (Do <u>two</u> of three questions)

B1. Figure B1 shows a hollow reinforced concrete column, with outside dimensions of 500 x 500 and inside dimensions of 300 x 300. The column is reinforced with 8-30 M longitudinal bars and 15 M ties spaced at 200 mm. If the column is considered short, calculate the maximum factored axial load P_F that it can carry.

Use $f_c' = 35$ MPa and $f_y = 400$ MPa.

B2. The concrete channel section shown in Fig. B2 is reinforced with 4 - 30 M longitudinal bars and 15 M ties spaced at 300 mm. Calculate the moment of resistance M_R, of the cross-section.

Use $f_c' = 35$ MPa and $f_y = 300$ MPa.

B3. For the channel cross-section shown in Fig. B2 calculate the shear resistance V_R of the cross-section.

Use $f_c' = 35$ MPa and $f_y = 300$ MPa.

Part C (Do question C1)

C1. A laminated timber girder has a cross-section shown in Fig. C1. The cross-section has 2 - 50 x 180 top and bottom glued laminated flanges, connected to 50 mm glued laminated web. Determine the moment and shear resistances of the cross-section.

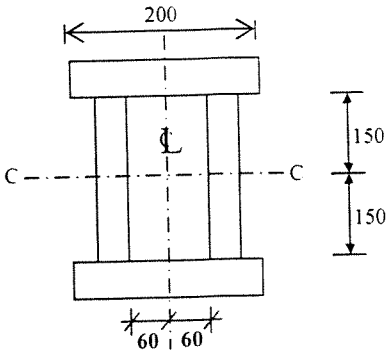

Figure A1

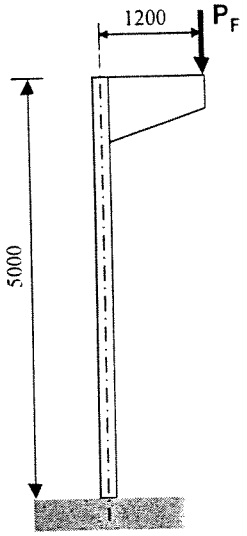

Figure A2

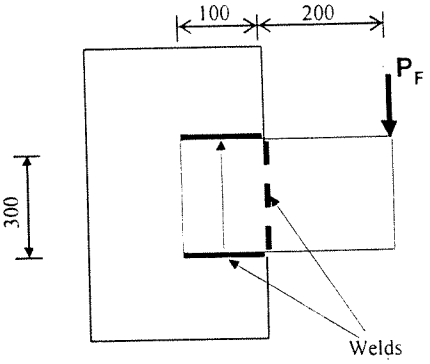

Figure A3

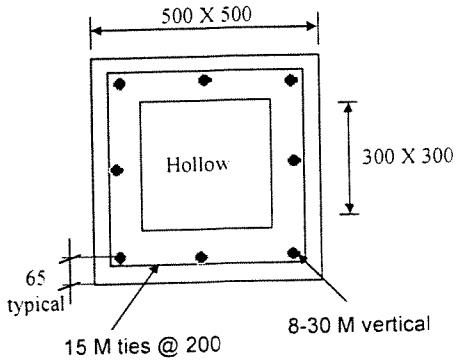

Figure B1

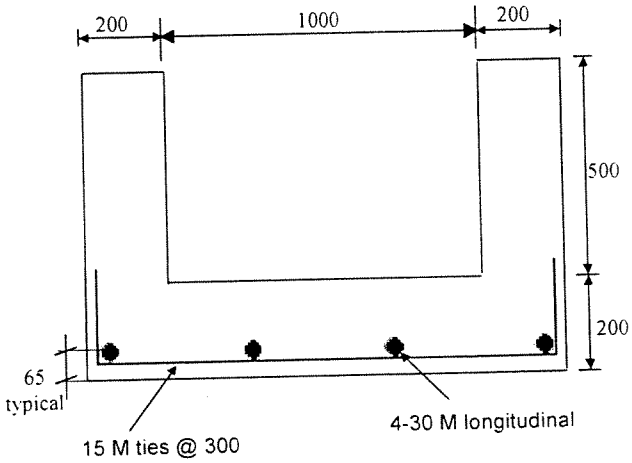

Figure B2

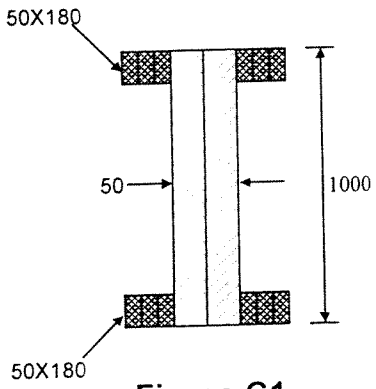

Figure C1