

National Examinations May 2002

98-CIV-A2 ELEMENTARY STRUCTURAL DESIGN

3 hours duration

NOTES

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.

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.

Solutions must be to the following standards:

Steel:	CAN/CSA-S16.1-M94
Concrete:	CAN/CSA-A23.3-M94
Timber:	CAN/CSA-O86.1-M94

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.

All questions are of equal value.

PART A (do two of three questions)

- A1. The steel section shown in Figure A1 is fabricated from 16mm G40.21-M300W steel plates adequately welded together. Determine its moment of resistance about the x-axis.
- A2. The G40.21-M300W steel section of Question A1 is used as a vertical column. The column is pin-ended but with end loads applied at an eccentricity, as shown in Figure A2. If the eccentricity produces bending about the y-axis, what is the maximum factored load P_F that may be safely applied?

A 16 mm steel plate is welded to a steel member with the two 12mm fillet welds shown in Figure A3. If the steel is G40.21-M300W and the electrode E480XX, what is the maximum factored load P_F that can be applied?

PART B (do two of three questions)

Figure B1 shows the cross section of a concrete column reinforced with 12 – 20M longitudinal bars and 10M ties spaced at 200 mm. Assuming a short column, what is the maximum factored axial load P_F permitted?

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

- B2. The double-tee section shown in Figure B2 is reinforced with one 30M bar in each leg. Calculate the moment of resistance M_R .
Use $f_c' = 35$ MPa and $f_y = 400$ MPa.
- B3. If the double-tee section shown in Figure B2 is reinforced for shear with 10M rectangular ties spaced at 200 mm in each leg, what is the shear resistance V_R of the section?
Use $f_c' = 35$ MPa and $f_y = 300$ MPa.

PART C (do question C1)

A load-bearing wall consisting of 38 x 140 No.1 S-P-F studs @ 600 o.c. supports a factored vertical load of 40 kN/m. Design a suitable lintel to span a clear opening of 2.4 m. Perform all the required checks.

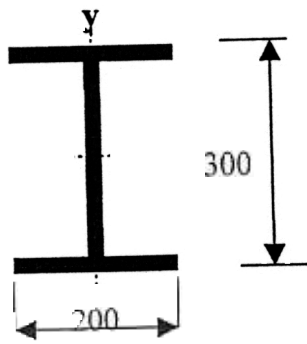


Figure A1

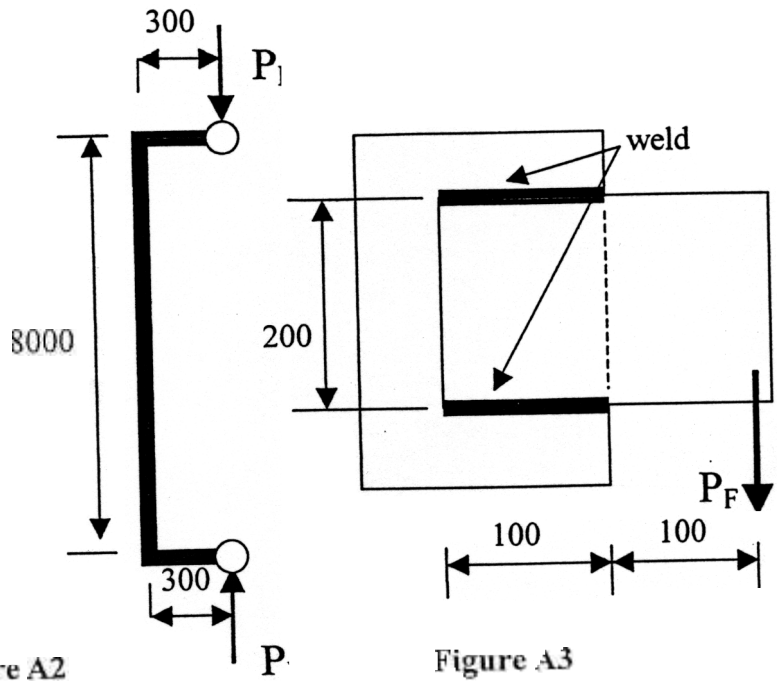


Figure A2

Figure A3

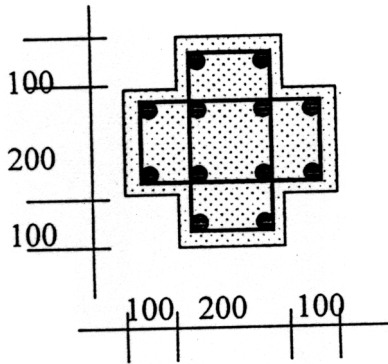


Figure B1

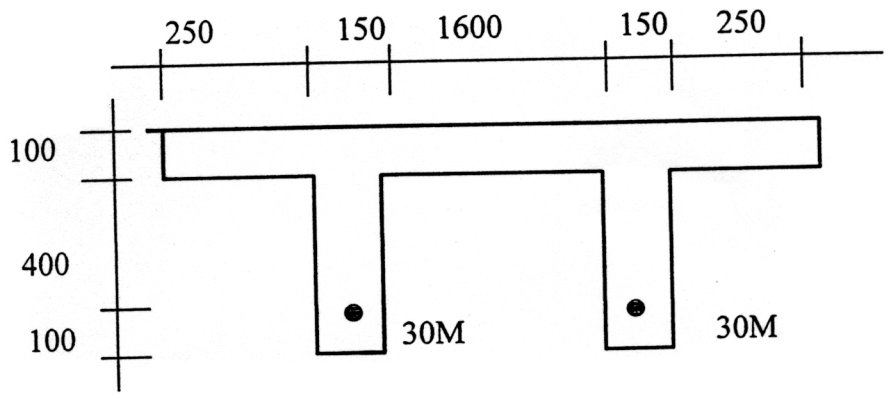


Figure B2