

Ollscoil na hÉireann, Gaillimh
National University of Ireland, Galway

SPRING EXAMINATIONS, 2001

THIRD CIVIL ENGINEERING

DESIGN OF STEEL STRUCTURES

Professor R. A. Falconer;
Professor P. E. O'Donoghue;
Dr. P. Ó hEachteirn;

Time allowed: *Two* hours

Answer *Two* questions, including Question 1

NOTES

The use of electronic calculators is allowed.

All dimensions are in mm, unless noted otherwise.

Assume all steelwork to be Grade S275, unless noted otherwise.

Member capacity tables in the steel handbook may be used to select members initially, but the capacity of the final choice of sections must be verified by calculation in accordance with the Codes. An accuracy, in calculations, of two significant figures is adequate for the purposes of this examination.

Sketches, with dimensions, of your designs as they progress are particularly welcome.

All loadings shown are factored, and have been calculated using dead and imposed loads of equal magnitude.

(Question 1 is Obligatory)

(Question 1 is Obligatory)

1. Figure Q1 shows a simply-supported welded truss, subject to the factored loading shown. Out-of-plane lateral support is provided at all loading and support nodes.
 - (a) Calculate the forces in the members. Present your results on a line diagram of the truss, showing each member's force beside it with a 't' or 'c' superscript, denoting whether the force is tensile or compressive.
 - (b) It is proposed to use rectangular hollow sections (RHS) throughout. Chose suitable sections for all members.
 - (c) Sketch a suitable annotated detail for Joint A, indicating type and location and dimensions of all sections, plates, bolts and welds.
The truss is simply-supported at Joint A by a 254x254UC73 stanchion.
 - (d) Sketch a suitable annotated detail for Joint B, indicating type and location and dimensions of all sections, plates, bolts and welds.

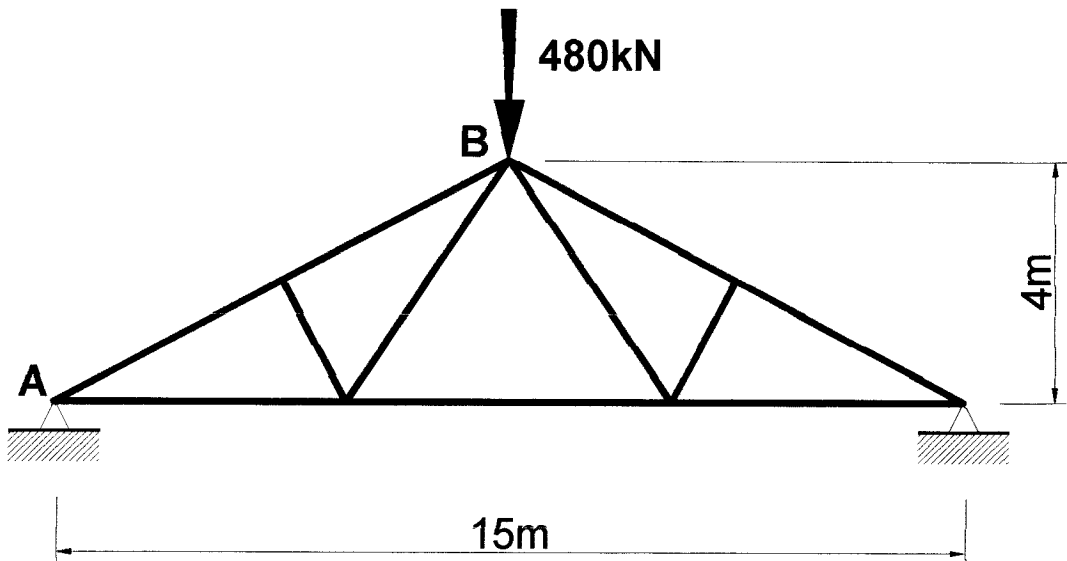


Figure Q1

2. Figure Q2 shows a simply-supported rolled I-beam, fully restrained laterally along its length and subject to the factored loading shown.
- (a) Sketch and annotate the bending moment diagram and the shear force diagram.
 - (b) Chose a suitable section for the beam.
 - (c) Sketch a suitable preliminary connection detail for support **A**. Do not complete the design.
 - (d) Sketch a suitable preliminary connection detail for support **B**. Do not complete the design.

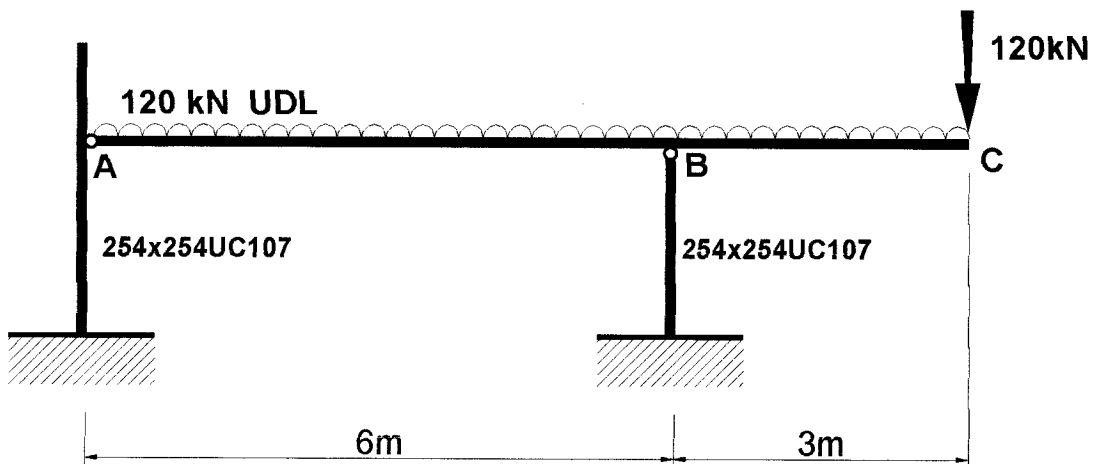


Figure Q2

3. Figure Q3 shows the near side of a typical two-plate support bracket.

- (a) Determine a suitable arrangement of **bolts** to connect the plate to the column.
Determine a suitable thickness for the plate.
- (b) Sketch your solution with full layout and details of bolts.
Dimension the detail fully.
- (c) Determine an *alternative* suitable **weldment** arrangement to connect the plate to the column.
Determine a suitable thickness for the plate.
- (d) Sketch your solution with full layout and details of the weldment.
Dimension the detail fully.

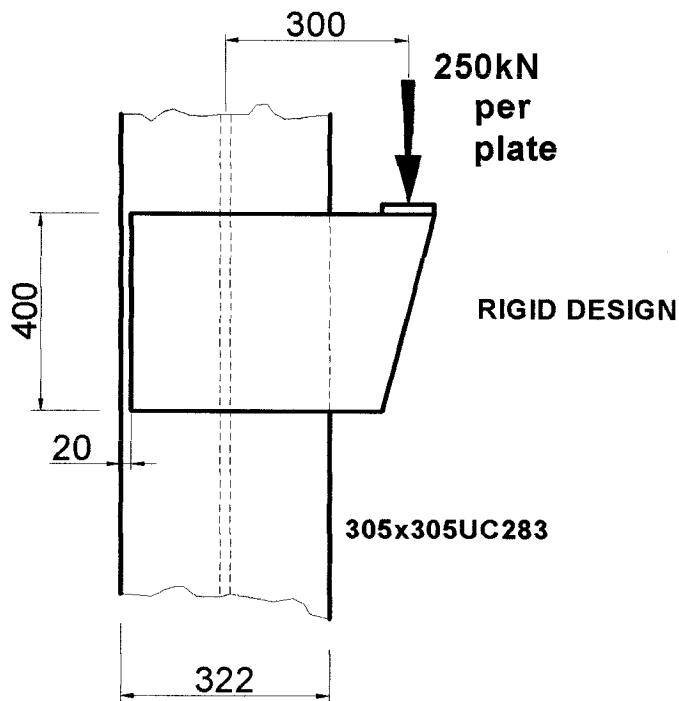


Figure Q3