ANALYSIS and DESIGN of R.C. FRAMES

Systematic arrangement of calculations and clear neat drawings are essential. Any data not given can be reasonably assumed according to the Egyptian Code of Practice.

Figure (1) shows an industrial area ($21.0 \times 44.0m$).It is required to cover this area with one of the frames shown in Figure (2). The spacing between the main supporting frames is **5.50m**.

For any frame shown in Figure (2), It is Required:

- Complete design of roof slabs and beams.
- Draw to scale 1:50 plan of the slab to show details of reinforcement, also draw sectional elevation (1:50) and cross sections (1:25) for the first two and half spans of the longitudinal beams to show details of reinforcement.
- Calculate the vertical and the horizontal loads acting on the intermediate frames. Choose a suitable statical system for the frame, then determine the internal forces (B.M., S.F. & N.F.).
- Design the critical sections for flexure or flexure and axial load in the frame.
- Calculate the shear stresses and design the shear reinforcement.
- Draw a sectional elevation (1:50) and cross sections (1:25) showing the reinforcement details of the main frame for the chosen frame. (Max. steel bar length = 18.0m).

Given Data:

The characteristics properties of the used materials are, the concrete is 25N/mm^2, the main steel is High Tensile Steel of grade 36/52 and, the stirrups steel is Mild Steel of grade 24/35. The used bricks for the walls have a natural density equals to 12 kN/m^3 and the thickness of the used walls is 25cm.

- Live Load (L.L.) =2.0 kN/m^2, for Flat Roofs
- Live Load (L.L.) =1.0 kN/m^2, for Inclined Roofs
- Floor Cover (F.C.) =2.0 kN/m^2, for Flat Roofs
- Floor Cover (F.C.) =1.5 kN/m^2, for Inclined Roofs
- Wind Load (W.L.) =1.0 kN/m^2, on Vertical Projections

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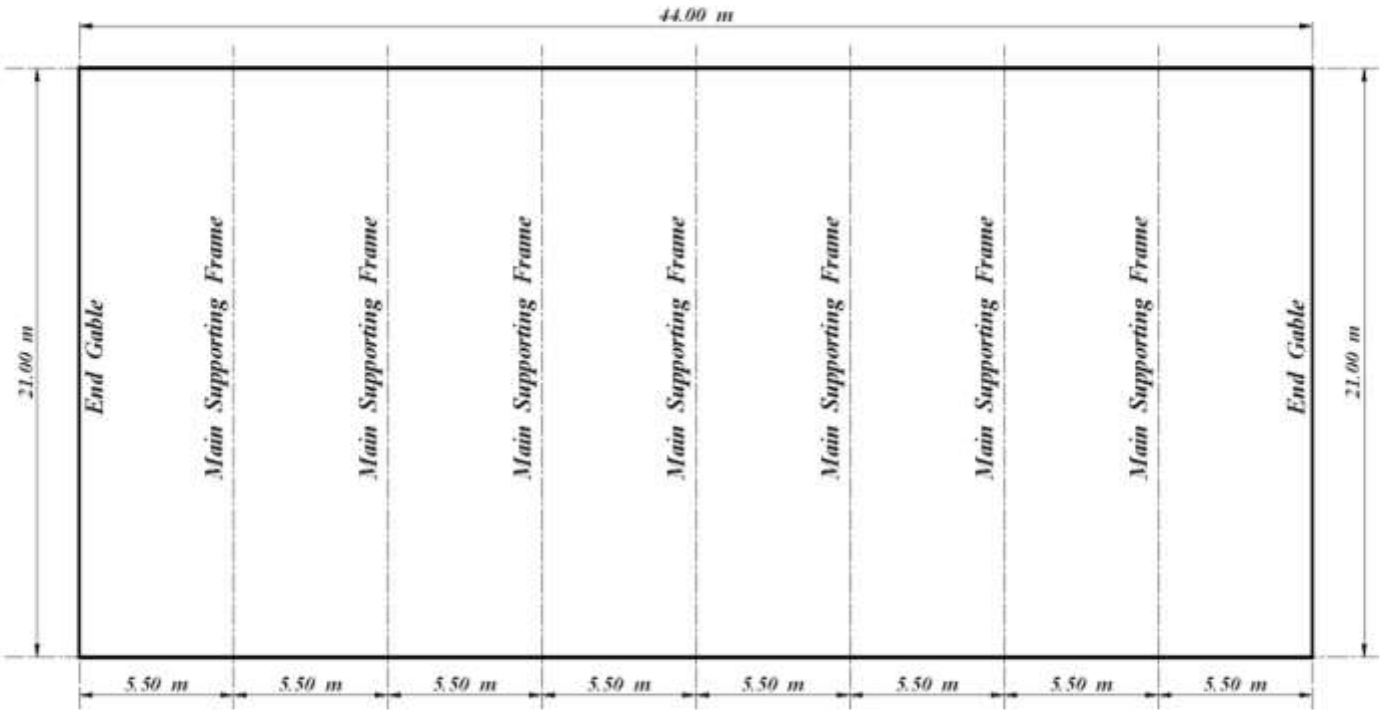

Figure (1)

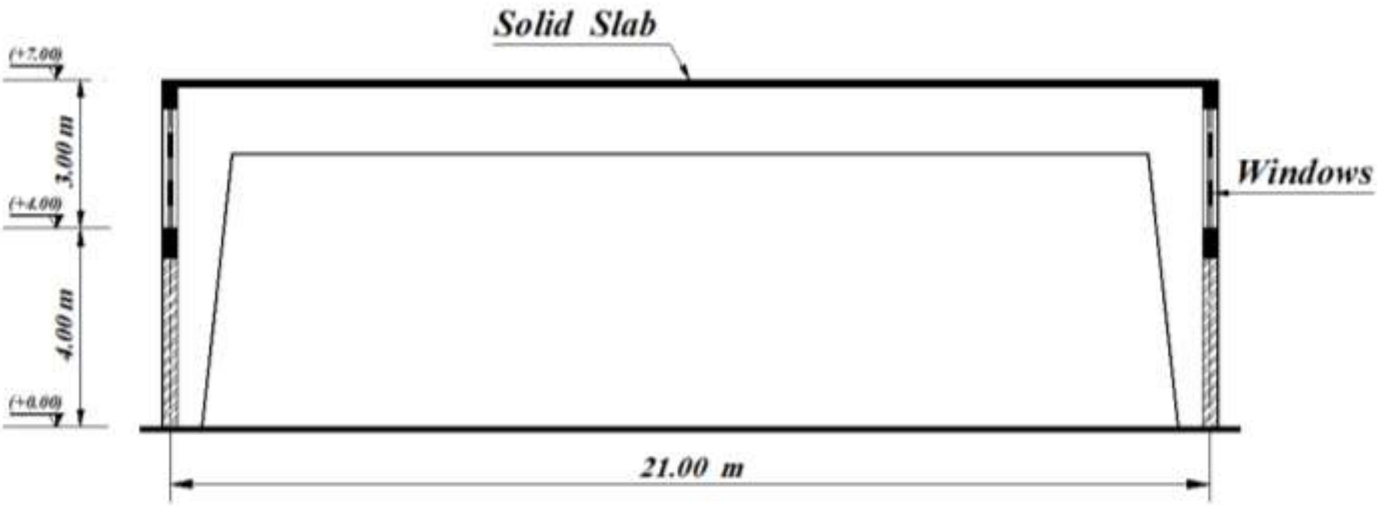

Figure (2-a)

ANALYSIS and DESIGN of R.C. FRAMES

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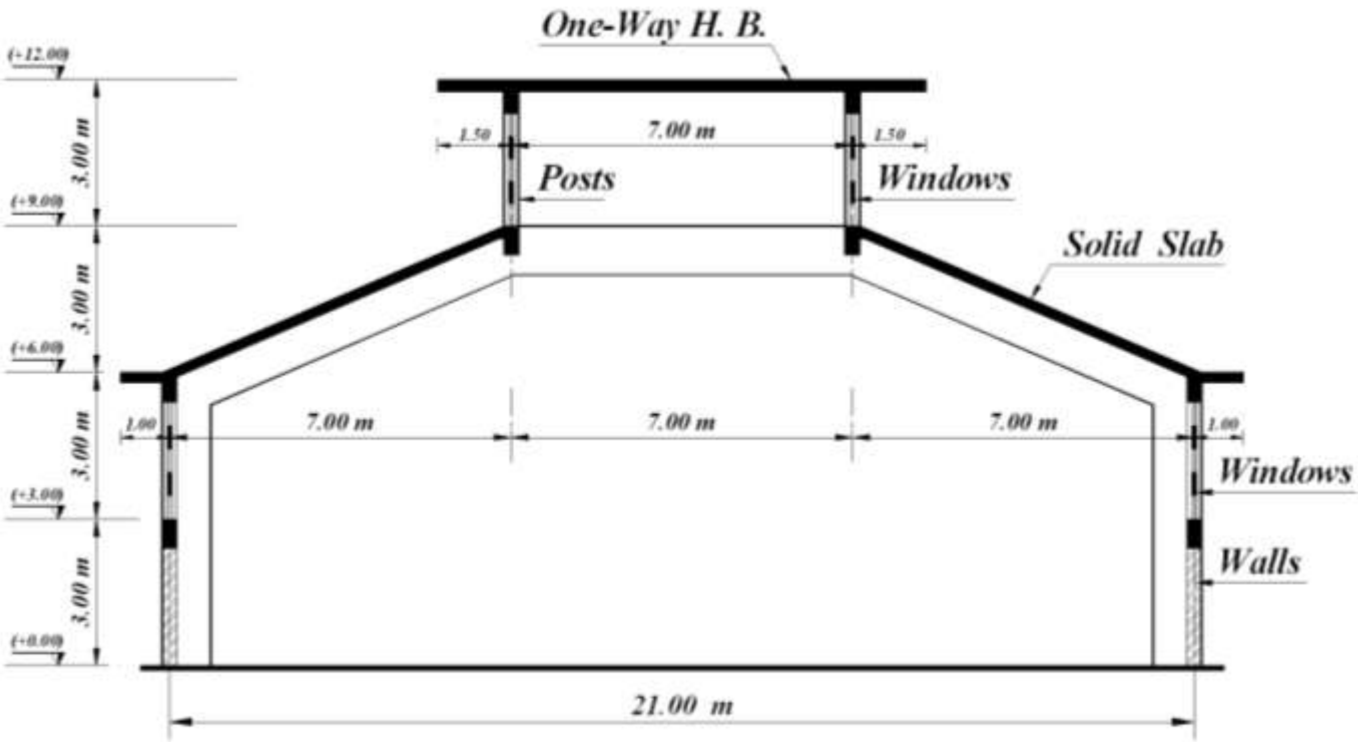

Figure (2-b)

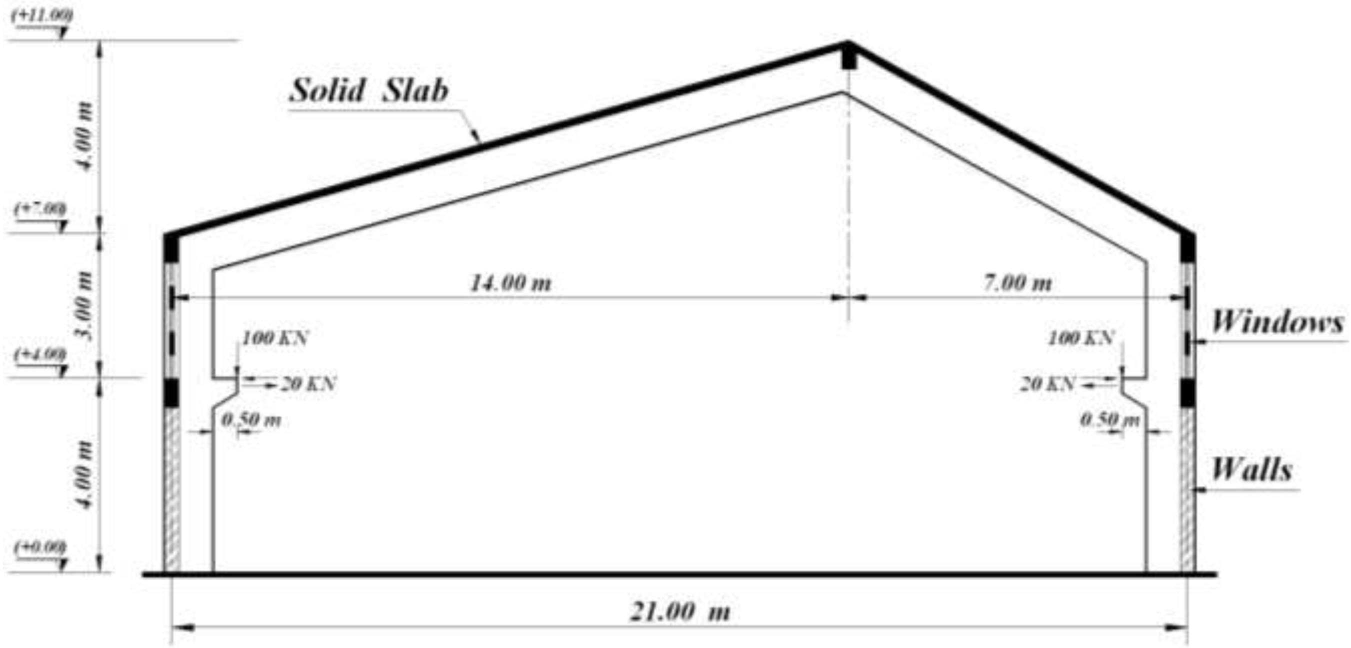

Figure (2-c)

ANALYSIS and DESIGN of R.C. FRAMES

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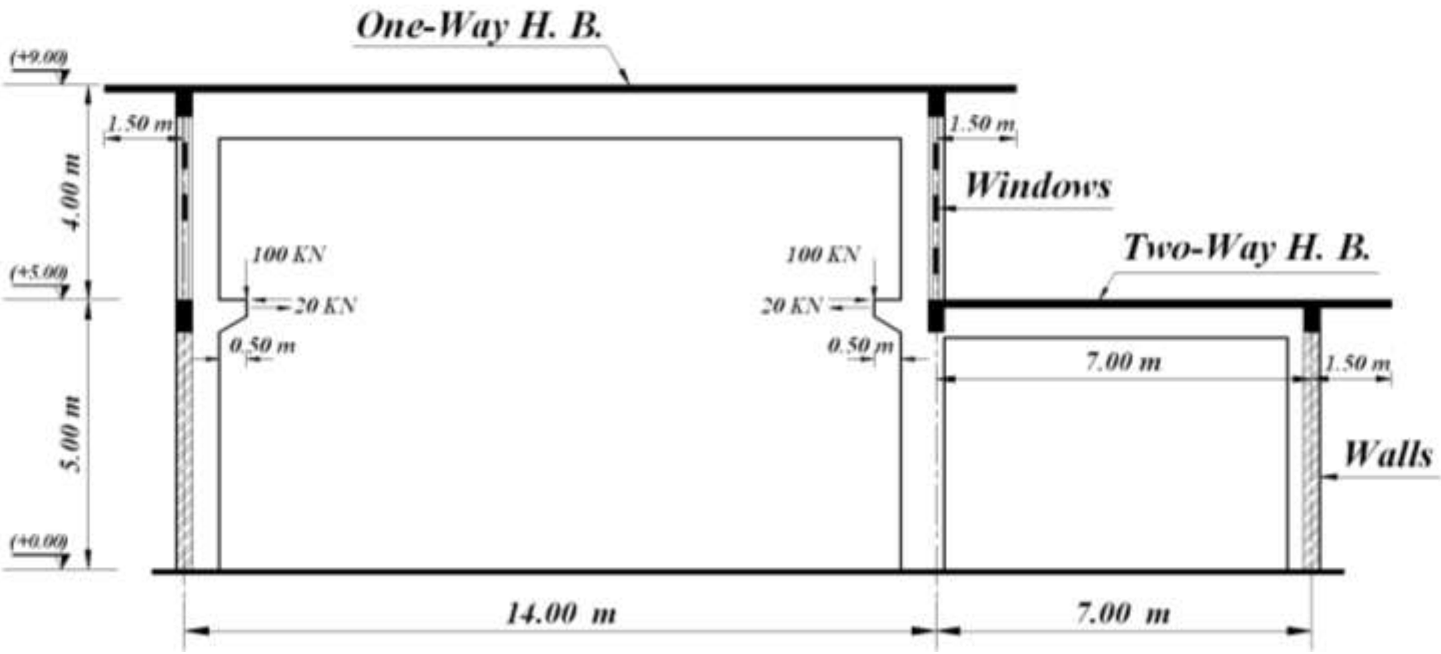

Figure (2-d)

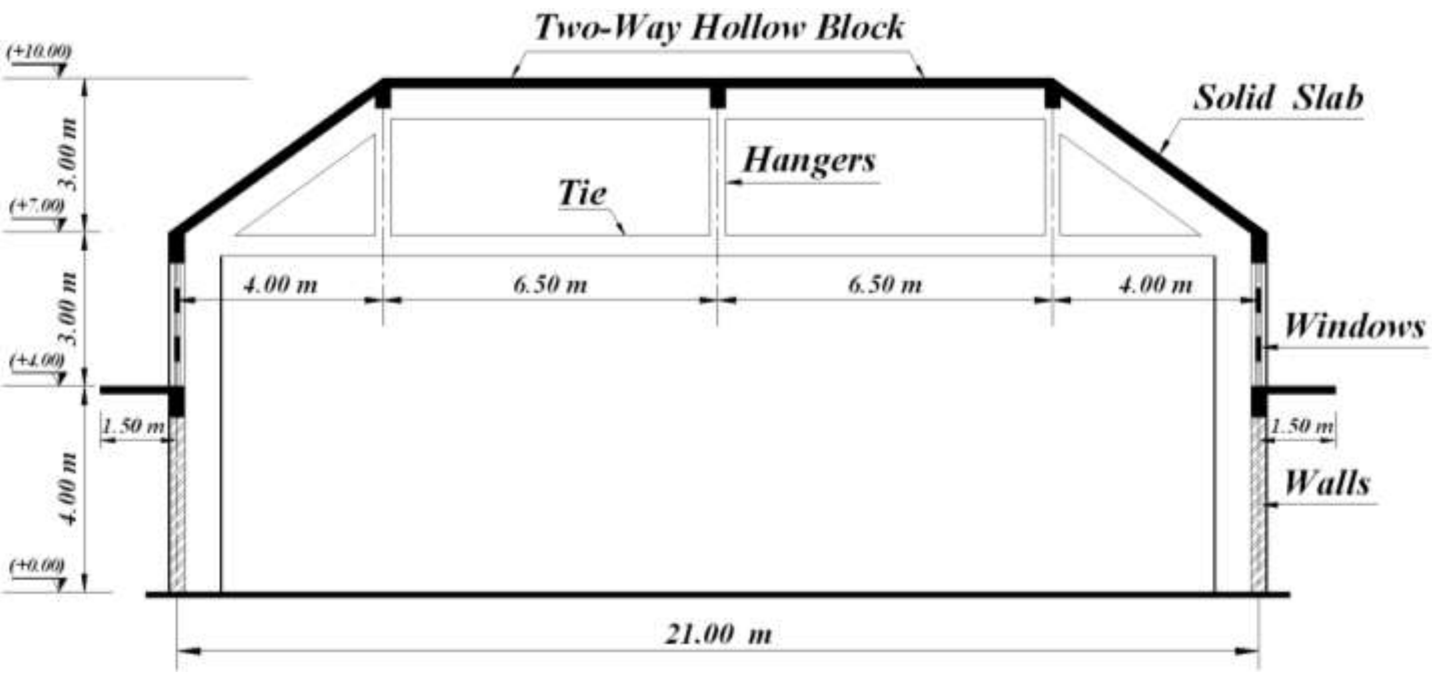

Figure (2-e)

ANALYSIS and DESIGN of R.C. FRAMES

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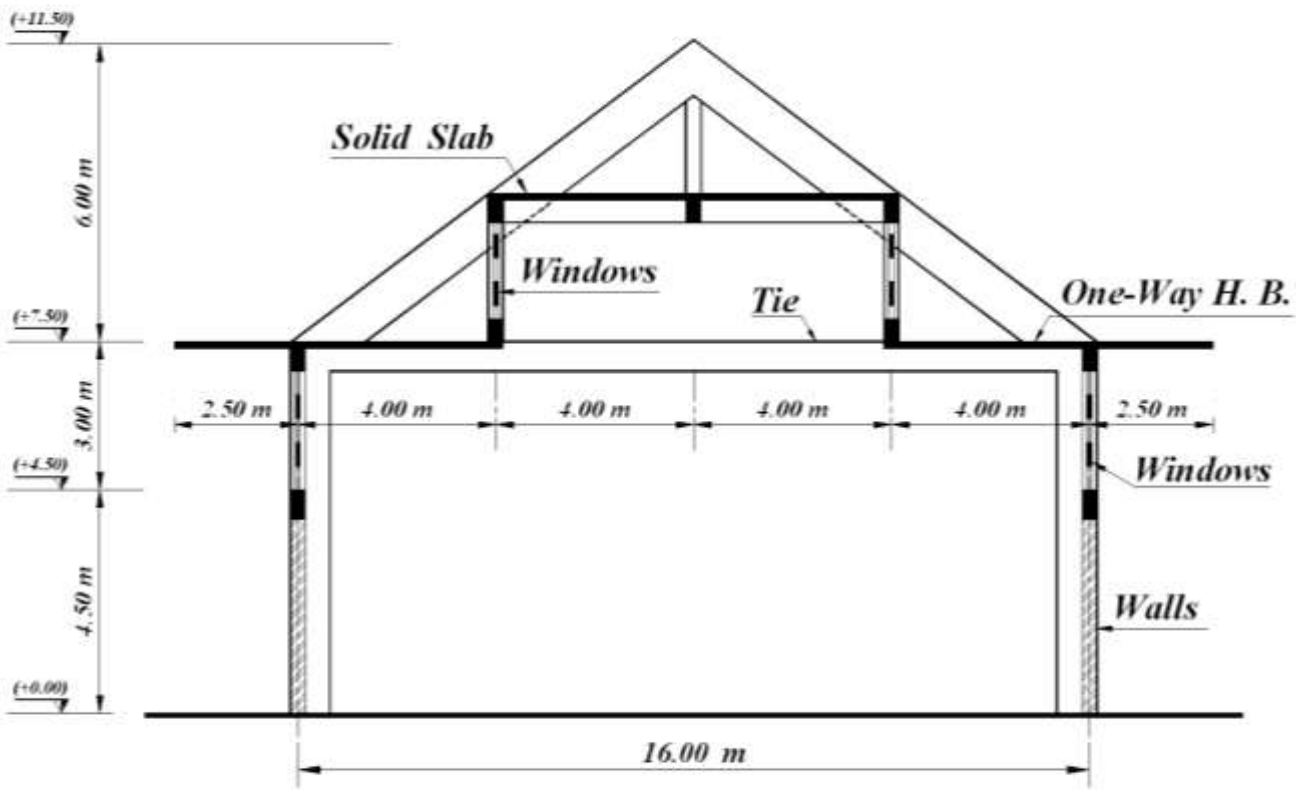

Figure (2-f)

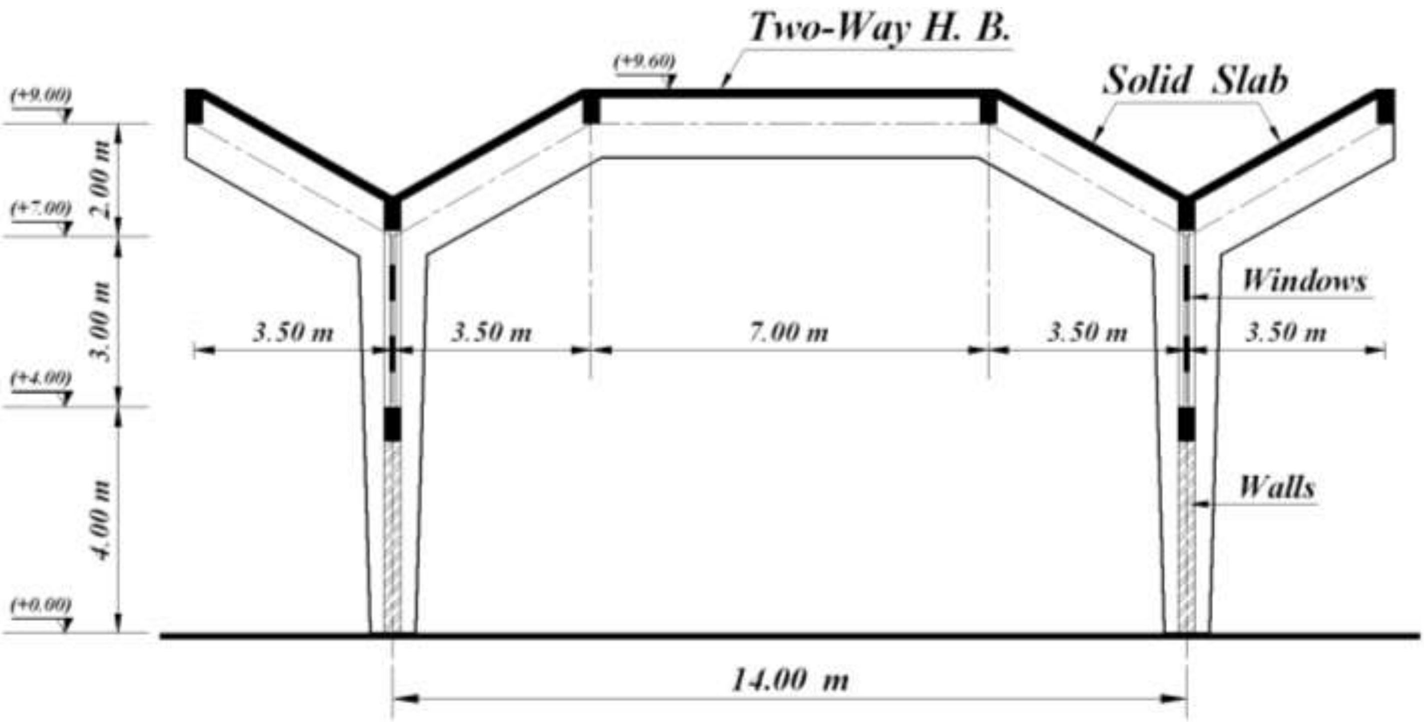

Figure (2-g)

ANALYSIS and DESIGN of R.C. FRAMES

Systematic arrangement of calculations and clear neat drawings are essential. Any data not given can be reasonably assumed according to the Egyptian Code of Practice.

Figure (3) shows a plan of sporting hall with total diameter 23.5m .It required to cover this area with ten radial frames along the rays of the hall as shown in section (A - A). All secondary beams dimensions are (25cm×60cm). It is required to design all elements of the hall (Slabs, Beams and Frames.) using the same give data in the previous question.

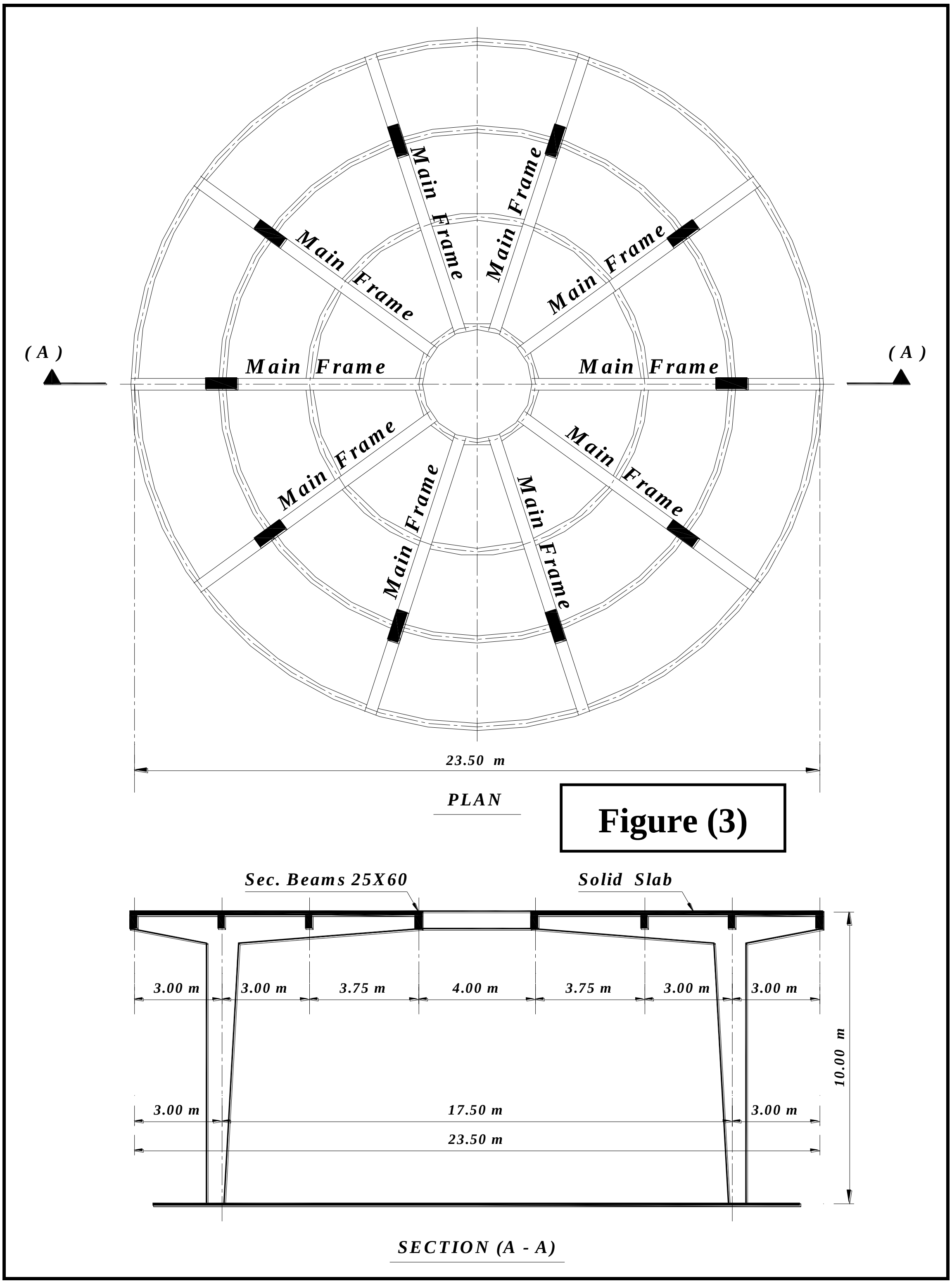

Figure (3)

ANALYSIS and DESIGN of R.C. FRAMES

Systematic arrangement of calculations and clear neat drawings are essential. Any data not given can be reasonably assumed according to the Egyptian Code of Practice.

Figure (4) shows a vertical cross section in one of a series of frames spaced at **6.00m** and supporting saw-tooth roof covering an area (*22.5×48*.0m). Roof cover is 2.00 kN/m^2 and Live Load is 1.5 kN/m^2. (Wind load may be neglected). The characteristics properties of the used materials are, f_{cu} = 30 N/mm^2, f_y = 360 N/mm^2, f_y (stirrup) = 240N/mm^2. The wall natural density is 12 kN/m^3 and the wall thickness is 25cm.

Required:

(a) Without any calculations but based on reasonably assumed dimensions draw to scale 1:50 a vertical cross section showing all the concrete elements for a main supporting frame.

(b) Complete design for one of the slabs (**S** & **S1**) and the marked Beams (**B** & **B1**) as shown in Fig (1).

(c) Draw to scale 1:50 plan of the slabs (**S** & **S1**) to show details of reinforcement, also draw sectional elevation (1:50) and cross sections (1:25) for the first two and half spans of the longitudinal marked beams (**B** & **B1**) to show details of reinforcement.

(d) Calculate the vertical and the horizontal loads acting on the intermediate frames, then determine the internal forces (B.M., S.F. & N.F.), considering the statical system as two hinged frame.

(e) Design the critical sections for flexure and axial load using the assumed sections in question (a).

(f) Calculate the shear stresses and design the shear reinforcement.

(g) Design the frame hinge (H) at the base as a Lead Hinge.

(h) Draw a sectional elevation (1:50) and cross sections (1:25) showing the reinforcement details of the **Main Frame**. (Max. bar length = 18.0m).

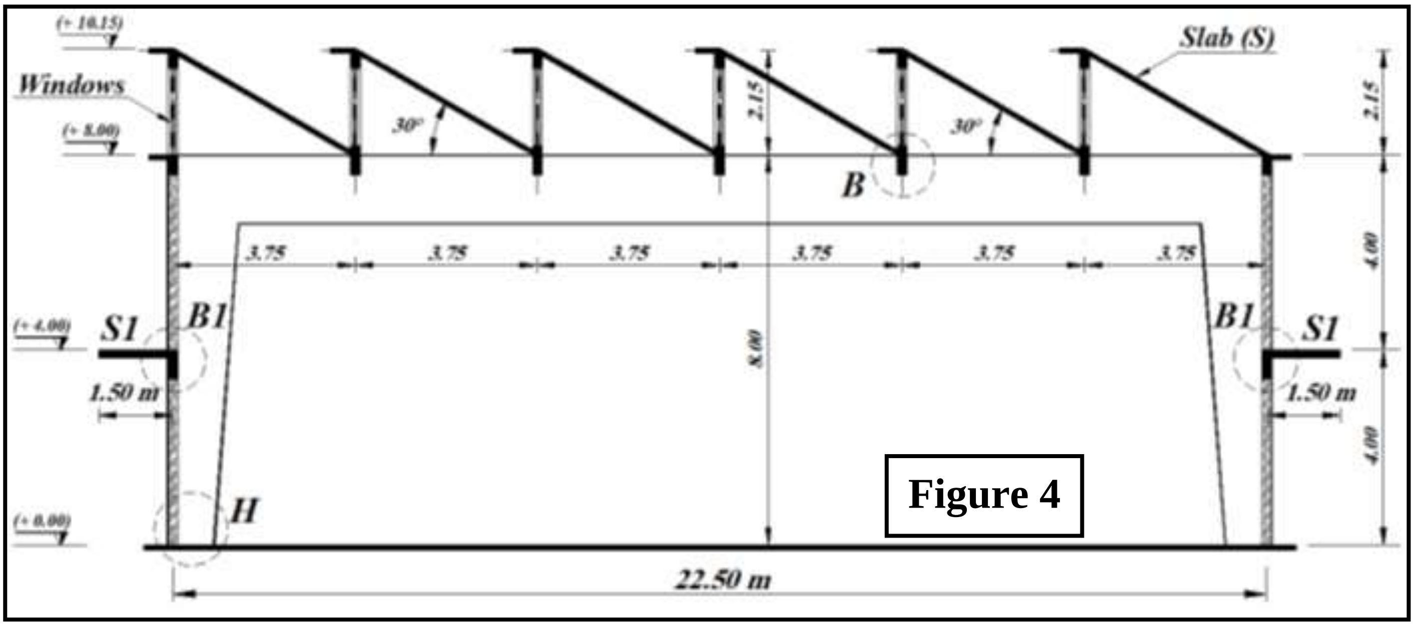

Figure 4