Peter's Problem 2017: Suggested Solution

Q1 ***Verify that there are approximately 10 blocks per square metre of the wall, allowing 10mm of mortar between the blocks.***

Block dimensions (in mm):440 x 215 x 100. With mortar (10mm) : 450 x 225 x 100.
The face area covered per block will be 450 x 225 = 101250mm^2 or 0.10125m^2.
The number of blocks required to cover 1m^2 is 1 ÷ 0.10125 = 9.87654321 blocks.

Conclusion: 9.8765 blocks per square metre is 10 blocks per square metre to the nearest block.
Or, 10 blocks will cover 1.0125m^2, slightly more than one square metre.
This verifies that there are approximately 10 blocks per square metre.

Q2. ***Calculate suitable dimensions for the window***

Visible wall: view D-D between the Book Store and the end wall.
Length of visible wall (in metres) = 14.2 – (3 + 0.1 + 2.16 + 0.1) = 14.2 – 5.36 = 8.84m.
Height of wall = 3.15m which allows for 14 block courses (3.15 ÷ 0.225 = 14).
Area of visible wall = 8.84 x 3.15 = 27.846m^2.
Window area = 40% of 27.846 = **11.1384m^2.**

Possibilities:
To calculate possible lengths and heights for the window we observe that we require a product of *height* x *length* which gives the result 11.1384.
However, for building purposes it may be more practical to consider heights which match the courses of blocks. This is the approach taken here.

Allowing for a minimum lintel space of 1 course and a minimum radiator space of 2 courses we could have up to 11 courses (2475mm) available for the window height.

Furthermore, a window height of less than 1350mm (6 courses) would produce a window length (11.1384 ÷ 1.125 (5 courses) = 9.9008m) greater than the 8.84m visible wall.

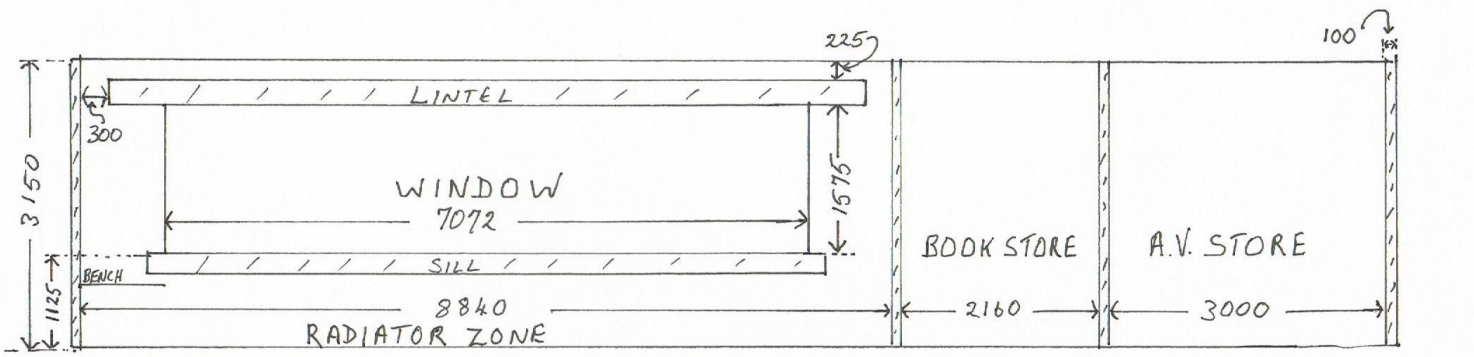
Thus, there are six practical possibilities of window design with heights ranging from 6 to 11 courses of blocks. Here we provide the calculations for a design which has a height of 1575mm (7 courses). This design allows for a radiator space of 5 courses (1125mm) and a course above the lintel. It also allows for the lintel overhang of 600mm at both ends.

Window Dimensions:
Height: 1.575m.
Length: 11.1384÷1.575 = 7.072m
Window lintel length: 7.072 + 2 x 0.6 = 8.272m.
Window sill length: 7.072 + 2 x 0.2 = 7.472m.

Q3. ***Make a scale drawing of the elevation D-D, to include the position of the window.***

Considerations:

The drawing will reflect the choice of window dimensions.



Note: All measurements are in mm

Q4. ***Calculate the number of concrete blocks required to complete the building, using the dimensions given in the DES file drawing.***

There are numerous valid methods of doing this calculation. One method is presented here.

Method: The gross wall area is calculated on a piece-by-piece basis without making allowances for doors or window. The total area of the doors, window, lintels and sill is calculated and removed from the gross total area.

Observations on Calculations: The height of the building is 3.15m. We must allow for overlapping end-joins, insulation width and both leaves of blocks when finding lengths.

Calculation of Gross Area of Walls (in m^2)			
View	Inner Wall (HxL)	Outer Wall (HxL)	Total area (m^2)
A-A	3.15 x 7 = 22.05	3.15 x (7 + 2 x 0.1 + 2 x 0.09) = 3.15 x 7.38 = 23.247	45.297
B-B	3.15 x (14.2 + 2 x 0.1) = 3.15 x 14.4 = 45.36	3.15 x (14.4 + 2 x 0.09 + 2 x 0.1) = 3.15 x 14.78 = 46.557	91.917
C-C	As for A-A: 22.05	As for A-A: 23.247	45.297
D-D	As for B-B: 45.36	As for B-B: 46.557	91.917
Total for A-A, B-B, C-C, D-D:			**274.428**

	AV Store (HxL)	Book Store (HxL)	Total area (m^2)
Side Wall	3.15 x 3 = 9.45	3.15 x 3 = 9.45	18.9
	AV Store with Book Store		
Front Wall interior	3.15 x (3 + 2.16 + 2 x 0.1) = 3.15 x 5.36 = 16.884		16.884
Total for AV Store and Book Store			**35.784**
Grand Total Gross Area:	**274.428 + 35.784 = 310.212**		

Observations on Areas to Remove:

Door height: 11 x 0.225 = 2.475m (Lintel is in 12th course of blocks).

Door width: Internal door 850 + 2 x 25 = 900mm = 0.9m (allowing for the frame width).

Internal door lintels length: 900 + 2 x 300 = 1500mm = 1.5m.

External door: 2.6 x 900 = 2340mm = 2.34m.

External door lintel length: 2340 + 2 x 300 = 2940mm = 2.94m.

Parts to remove	HxL	**Areas to Remove** (m^2)
Two Internal door openings	2.475 x 0.9	2.2275 x 2 = 4.455
Two Internal door lintels	0.225 x 1.5	0.3375 x 2 = 0.675
External door openings (inner and outer walls)	2.475 x 2.34	5.7915 x 2 = 11.583
External door lintel (inner and outer walls)	0.225 x 2.94	0.6615 x 2 = 1.323
Window area x 2	1.575 x 7.072	11.1384 x 2 = 22.2768
Window lintel x 2	0.225 x 8.272	1.8612 x 2 = 3.7224
Window sill	0.225 x 7.472	1.6812
Total area to remove		**45.7164**

Area remaining for blocks: 310.212 – 45.7164 = 264.4956m^2.

Number of blocks required @ 10 blocks per m^2 and rounded up: 2645

Added wastage @ 5% is 132.25 which requires 133 blocks.
Total number of blocks: 2645 + 133 = 2778.

Q5. ***Using the standard bale found on-line in Ireland, calculate the number of bales of blocks required to complete the building.***
Any suitable online reference may be used.
The number of blocks per bale is 44 for our calculations.

2778 ÷ 44 = 63.13636 bales.
This rounds up to 64 bales required.