

## **The HKIE Structural Examination – Written Examination 2025**

### **Section 2: Design Questions**

Date: 26 November 2025 (Wednesday)

Time: 12:00 pm – 6:30 pm

(Duration: 6.5 hours)

|                       |
|-----------------------|
| <b>Question Paper</b> |
|-----------------------|

|              |  |
|--------------|--|
| Seat number: |  |
|--------------|--|

**Answer ONE question only**

### **NOTE**

All rights to the examination questions are reserved by the HKIE. Candidates are prohibited from recording the examination paper in any form or removing any pages from the examination paper.

## Question 1 Mountain Top Observation Deck

### Client's Requirement

The following client's requirements must be met:

1. An observation deck building with cantilever viewing platform is located at top of mountain overlooking scenic views at outlying Island of Hong Kong. See Figure 1 to 3.
2. The observation deck building has two levels including a semi basement and overall plan dimension of 24m x 30m. The cantilever viewing platform will have 180° unobstructed views.
3. The proposed use of the observation deck with the minimum headroom requirements and fire resistance rating is listed as follows:

| Floor Mark | Usage                               | Minimum Clear Headroom*(m)   | Fire Resistance Rating | Finishes & E/M Services Zone (m) |
|------------|-------------------------------------|------------------------------|------------------------|----------------------------------|
| Roof       | Inaccessible                        | N/A                          | 2 hours                | N/A                              |
| G/F        | Indoor sitting area and coffee shop | 4.5                          | 2 hours                | 0.5                              |
| G/F        | Outdoor Viewing Platform            | N/A                          | 2 hours                | N/A                              |
| B/F        | Kitchen, Back of House              | 2.4 (also refer to Figure 3) | 4 hours                | 0.5                              |

\* The minimum clear headroom is the floor height clear of all structures, finishes and building services.

4. The restrictions on the location of vertical structural elements are as follows:

| Floor Mark | Area                                | Restrictions*                                                                                                                                             |
|------------|-------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| G/F        | Indoor sitting area and coffee shop | Maximum one number of internal column is allowed.<br>No column or wall at location along the window wall.<br>No column or wall at location door openings. |
| G/F        | Outdoor Viewing Platform            | No column zone.<br>180° unobstructed views except glass balustrade.                                                                                       |
| B/F        | Kitchen, Back of House              | Minimum column clear space 5m.                                                                                                                            |

\* No restriction on spacing between column/wall and service core.

5. The roof structure shall not be inverted.
6. No foundation support at the slope between grid 2 to 3 is allowed.

7. The observation deck building G/F level (including the cantilever platform) and below is to be constructed with reinforced concrete.

### **Imposed Loads**

8. The imposed loads shall be in accordance with the latest version of the Hong Kong Code of Practice for Dead and Imposed Loads.

### **Wind Loads**

9. The wind loads shall be in accordance with the Code of Practice on Wind Effects in Hong Kong 2019.

### **Site Conditions**

10. The site is located at mountain top and there is a steep slope on the east side of the site.
11. Site boundary can be assumed to be 10m beyond the building envelope on all sides.
12. Ground conditions:

|                         |                                                                                                                |
|-------------------------|----------------------------------------------------------------------------------------------------------------|
| From +400mPD to +398mPD | Loose Sand, SPT average N-value = 10 [Category 4(d)] <sup>Note 1</sup>                                         |
| From +398mPD to +388mPD | Medium dense sand, SPT average N-value = 30 [Category 4(c)] <sup>Note 1</sup>                                  |
| Below +388mPD           | Moderately decomposed granite with total core recovery greater than 85% [Category 1(c) rock] <sup>Note 1</sup> |

Note 1: Categories of soil/rock refer to Table 2.1 of Code of Practice for Foundation 2017.

13. The highest possible groundwater level is at existing ground surface

### **Omit from Consideration**

14. Detailed layout and design of the structure of the service core.
15. Window Wall and sliding door.
16. Glass Balustrade.
17. Stability of the mountain slope.

## Section A

- a. Prepare a design appraisal with appropriate sketches for the following:
- i) Two distinct and viable schemes for the proposed observation deck building including two schemes for the cantilever viewing platform and two schemes for the building roof structure.
  - ii) One viable foundation scheme for the observation deck building on top of the slope crest. Indicate how the foundation system to resist horizontal loads.
- Indicate clearly the functional framing with sections, load transfer and stability aspects of each scheme to meet all clients' requirements. Provide sufficient preliminary design to justify your proposed structural arrangement. Identify the solution you recommend and give reasons for your choice.

**(30 marks)**

- b. Explain how the structure will resist wind load including detailed description of the structural wind loads and design assumptions. Prepare a detailed wind load calculation and stability checking for the proposed hotel building in both X and Y direction.

For the purpose of estimating Along Wind Force  $W_z$ ,  $Z_e$  can be taken as  $Z$  (effective height = actual height above ground level) and topographic multiplier  $S_t$  can be taken as 1.8. For the preliminary assessment of major direction wind induced deflection and/or stability check, the Along Wind Force could be multiplied by an overload factor of 1.4 to take into account of the combination of the two orthogonal directions and torsional loads. Torsional Force and Across Wind Base Moment could be ignored.

**(10 marks)**

## Section B

For the solution recommended in Section A:

- c. Prepare design calculations to establish the form and size of all principal structural elements for superstructure from B/F to Roof floor including cantilever and critical structures (if any).
- (15 marks)**
- d. Prepare full-dimensional framing plans for each of B/F, G/F and Roof floor.
- (20 marks)**
- e. Prepare structural details for the principal structural elements from B/F to Roof floor including cantilever and critical structures (if any), for cost estimation purposes.
- (10 marks)**
- f. Prepare the design calculation for the building foundation.
- (6 marks)**
- g. Prepare a preliminary foundation layout plan.
- (6 marks)**
- h. Prepare an outline construction program covering essential activities from commencement of foundation to the completion of structural works.
- (3 marks)**

# OBSERVATION DECK

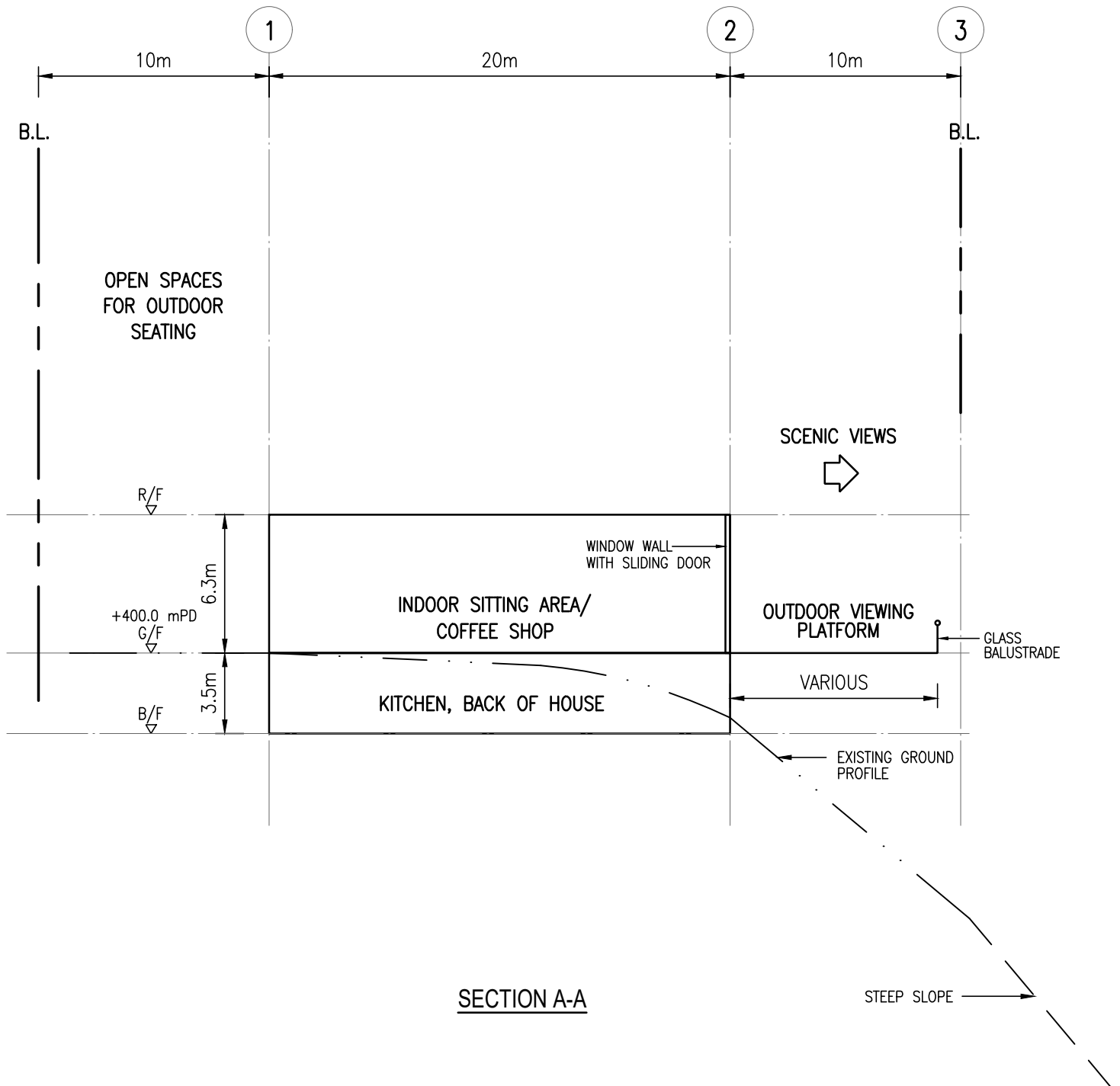
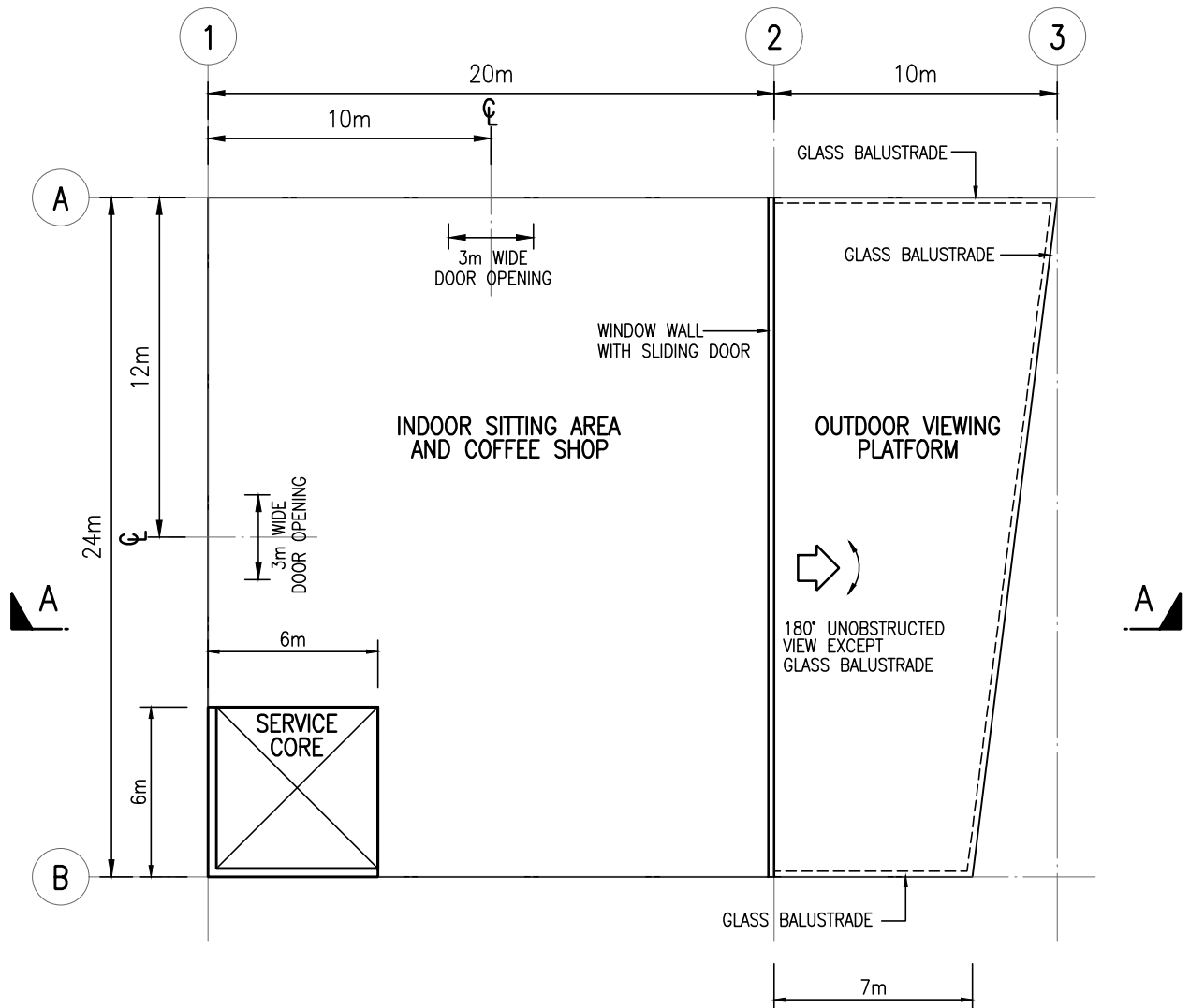
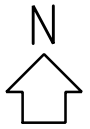
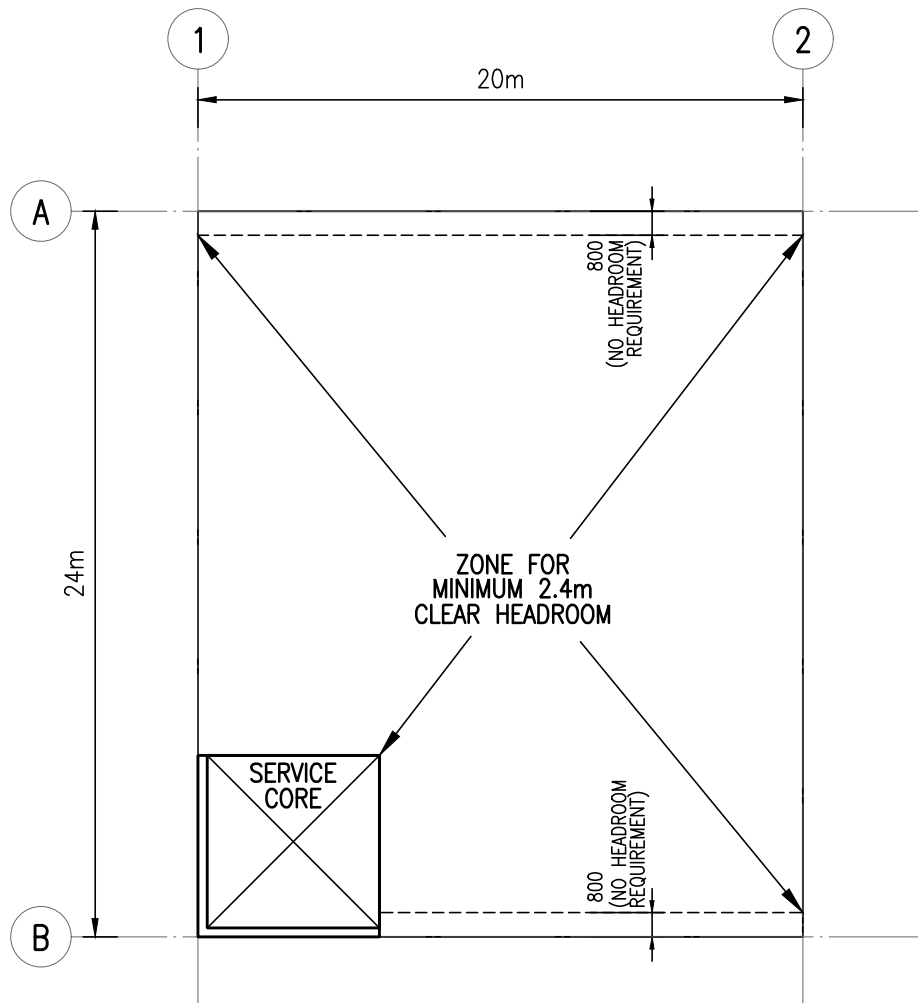


Figure 1



G/F PLAN

Figure 2



B/F PLAN

Figure 3

## Question 2      Pedestrian and Cycle Bridge across Waterfront

### Client's Requirements

The following client's requirements must be met:

1. A new naturally ventilated covered bridge for combined use of pedestrian and cyclist is proposed to run across the waterfront at Junk Bay area. See Figure 2a & 2b.
2. The footbridge is straight and will connect to both side of waterfront adjacent to Junk Bay. Lift and ramps will be required at the either side. There will be a straight ramp at the North side and a circular ramp at the South side. Metal parapets of 1100mm shall be provided along both sides of the bridge and ramps.
3. Minimum clear headroom of bridge is listed in clause 7 below, 300mm overhead services zone should be allowed for in the design. Landing of length of 1.5m shall be provided at vertical interval of not more than 3500mm. The maximum gradient allowed for the bridge including ramps (straight or circular) is 8.0%.
4. Column supports to the bridge are permitted only within seating area, green area, as well as outside the 15m navigation zone of Junk Bay. The minimum centreline distance between vertical support at straight or circular ramp is 8.0m.
5. The design of the structure should have a minimum longitudinal gradient of 1.0% to allow for stormwater drainage at the bridge and ramps.
6. To maintain ship navigation at Junk Bay, a proposed 15m zone with clear head room of 6m shall be provided within the Junk Bay (Location to be determined by the designer with reasons). The tidal variation of Junk Bay is from +0.0 to +2.5mPD. No column is allowed within the navigation zone of Junk Bay.
7. The minimum requirements on clear headroom over various area are as follows:

| <u>Location</u>                  | <u>Minimum Clear Headroom (m)</u> |
|----------------------------------|-----------------------------------|
| Pedestrian / Sitting Area        | 2.5                               |
| Cycle Track                      | 2.7                               |
| Promenade                        | 3.0                               |
| Junk Bay outside navigation zone | 4.0                               |

8. The construction is planned to complete in two and a half year.



## Design Requirements

9. The structural design shall be in accordance with the latest version of the Structures Design Manual for Highways and Railways published by the Highways Department of the HKSAR Government.

## Imposed Loads

10. The imposed loads shall be in accordance with the latest version of the Structures Design Manual for Highways and Railways published by the Highways Department of the HKSAR Government.

## Wind Loads

11. The wind loads shall be in accordance with the latest version of the Structures Design Manual for Highways and Railways published by the Highways Department of the HKSAR Government.

## Site Conditions

12. The site is located at open area with Degree 4 of exposure to wind.
13. Ground conditions as revealed by the Ground investigation boreholes are:

|                    |                                                                                               |
|--------------------|-----------------------------------------------------------------------------------------------|
| From 4 to -5mPD    | Loose Fill, SPT N-value = 0 – 10 [Category 4(d)] <sup>Note 1</sup>                            |
| From -5 to -12mPD  | Medium dense soil, SPT N-value = 10 – 40 [Category 4(c)] <sup>Note 1</sup>                    |
| From -12 to -25mPD | Very dense soil, SPT N-value > 50 [Category 4(d)] <sup>Note 1</sup>                           |
| -25mPD and below   | Moderately decomposed granite with total core recovery >85% [Category 1(c)] <sup>Note 1</sup> |

Groundwater is encountered at 2.5mPD.

Note 1: Categories of soil/rock refer to Table 2.1 of Code of Practice for Foundation 2017.

## Omit from Consideration

14. Design calculation of lift shaft, roofing, and railing.
15. EQ loading, temperature loading, and Vibration check.

## Section A

- a. Prepare a design appraisal with appropriate sketches indicating **two distinct and viable solutions** for the proposed bridge, **one viable solution** for ramp (both north and south ends) and **one viable solution** for foundation scheme to both bridge and ramps. Clearly indicate the functional framing, load transfer and stability aspects of each scheme to meet all client's requirements. Provide sufficient preliminary design to justify your proposed structural arrangement. Identify the solution you recommend and give reasons for your choice.

**(30 Marks)**

- b. Explain how the structural will resist wind loading including detailed description of the structural wind loads and design assumptions. Prepare detailed wind load calculations for the proposed bridge (include transverse, longitudinal, uplift wind and their combined effects).

**(10 Marks)**

## Section B

### For the solution recommended in Section A:

- c. Prepare sufficient design calculations to establish the form and size of all the principal structural elements including the foundation as well as demonstration of fulfilment of ramp and bridge longitudinal gradient (For the purpose of calculation of gradient, centreline of pedestrian path or cycle track can be taken).

**(20 Marks)**

- d. Prepare foundation plans and details, framing plans (including articulation of bearings, please indicate if any tension bearings), sections, and elevations to show the dimensions, layout and disposition of the structural elements, gradient of ramps and critical details for cost estimating purposes.

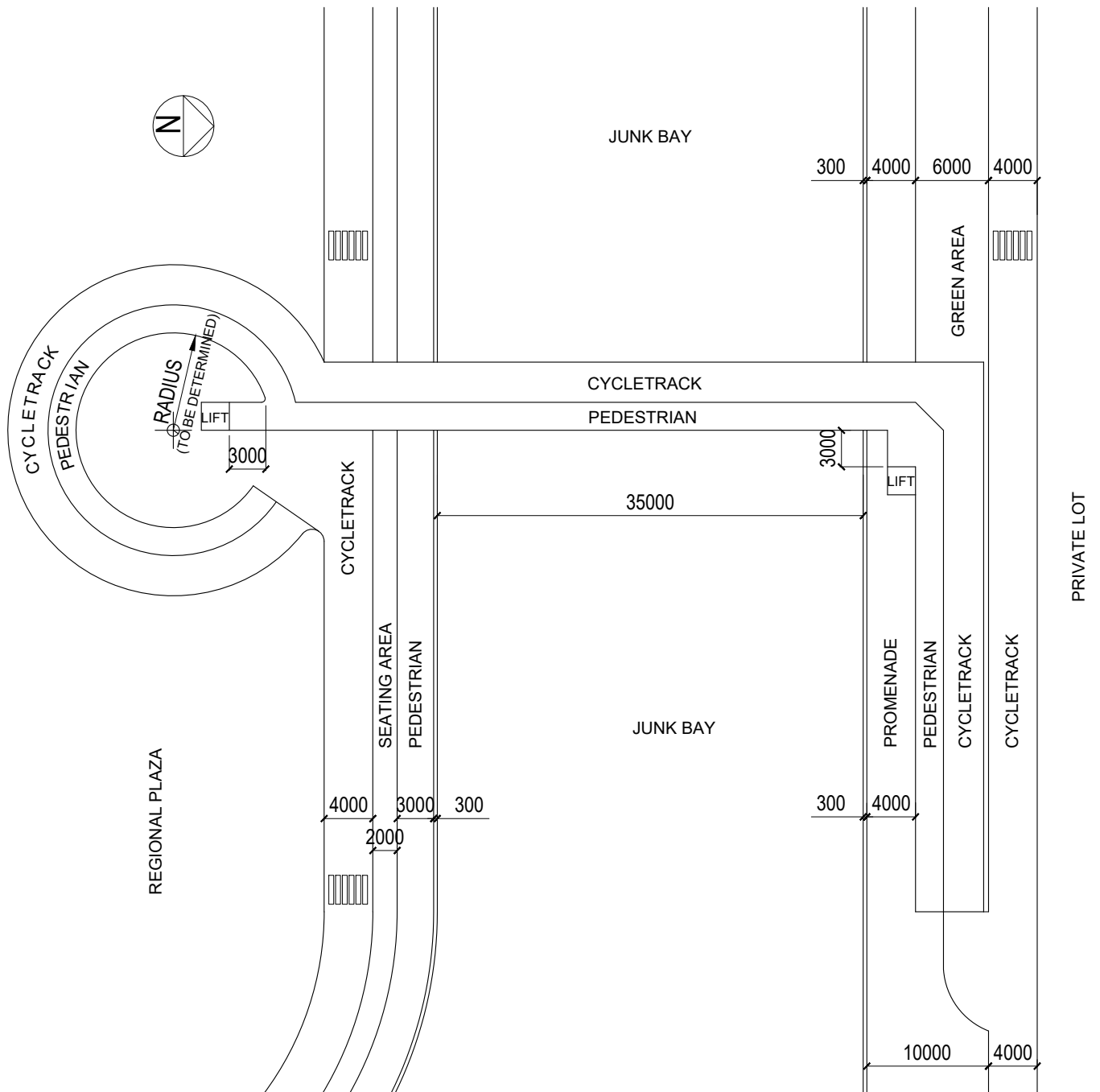
**(20 Marks)**

- e. Prepare a detailed method statement covering essential activities for the construction of the superstructure and sub structures of the footbridge including foundation works.

**(10 Marks)**

- f. Prepare a detailed construction programme covering essential activities from commencement of foundation to completion of structural works.

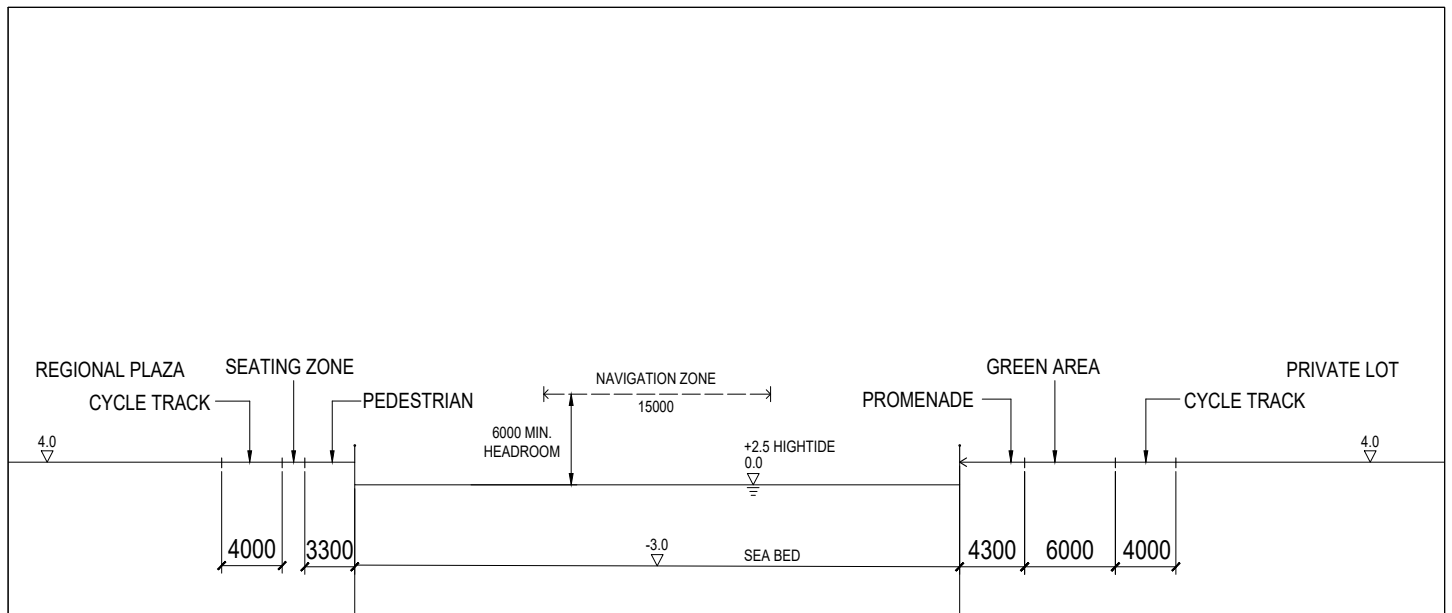
**(10 Marks)**



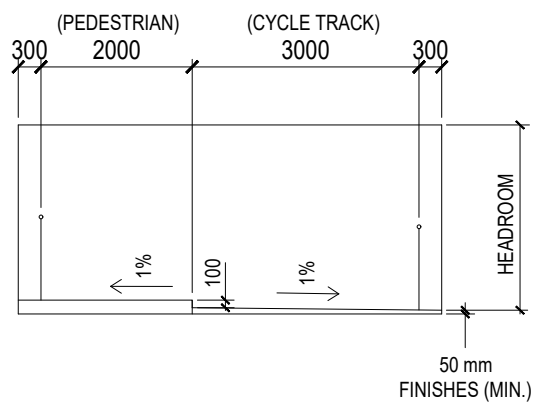
## PLAN

\*ALL DIMENSIONS ARE  
SHOWN IN mm

FIGURE 2a



## SECTION



## TYPICAL BRIDGE CROSS SECTION

\*ALL DIMENSIONS ARE  
SHOWN IN mm

FIGURE 2b

### Question 3      A Proposed Joint User Complex in Urban Area

#### Client's Requirement

The following client's requirements must be met:

1. Two adjoining lots (ABCD and DEFG) in Kowloon with site area 50m by 50m and 36m by 36m respectively are to be developed into a joint user complex (JUC) comprising a library, government offices, medical Consulting / X-ray floors and recreational facilities.
2. The library, government offices and medical consulting / X-ray floors will be housed in a 15-storey high-rise tower with 2-level basement for carpark and plant rooms. The recreational facilities including a community hall and an indoor sport hall will be housed in a 2-storey low-rise annex which overlaps with the high-rise tower due to site limitation. See Figure 1 and 2.
3. A service core of 12m by 14m is required for the high-rise tower and its location is to be adjusted according to the structural layout. A vehicle ramp of minimum 6m clear width and in 1:10 is required along the perimeter of the basement to access B1 and B2 levels.
4. For the high-rise tower, all the perimeter columns at 5/F and above shall be offset from the building edge for a minimum clear width of 2.5m, and the other restrictions on vertical elements are as follows:-

| Floor Mark      | Area                              | Restrictions*                                                                                                                                        |
|-----------------|-----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| High-rise Tower |                                   |                                                                                                                                                      |
| B2-B1           | Carpark & Plant Rooms             | Minimum clear distance between internal columns should be 10m and 12m respectively in the two orthogonal directions.                                 |
| G/F-3/F         | Library                           |                                                                                                                                                      |
| 4/F             | Mechanical Floor                  | A minimum 6 numbers 10m by 10m column free mechanical rooms should be provided.                                                                      |
| 5/F – 8/F       | Medical Consulting / X-ray Floors | Minimum clear distance between perimeter columns should be 10m and 12m respectively in the two orthogonal directions. No internal column is allowed. |
| 9/F – 14/F      | Government Offices                |                                                                                                                                                      |
| Low-rise Annex  |                                   |                                                                                                                                                      |
| G/F             | Community Hall A & B              | Minimum spacing between perimeter columns should be 6m centre-to-centre. Minimum spacing between internal columns should be 12m centre-to-centre.    |
| 2/F             | Indoor Sport Hall                 | Minimum spacing between perimeter columns should be 6m centre-to-centre. No internal column is allowed.                                              |

\* Same restrictions applied if walls are proposed. No restriction on spacing between column/wall and service core.

The proposed use of the JUC and the minimum headroom requirements and fire resistance rating are listed as follows:

| <b>Floor Mark</b> | <b>Usage</b>                      | <b>Minimum Clear Headroom* (m)</b> | <b>Fire Resistance Rating</b> | <b>Finishes &amp; E/M Services Zone (m)</b> |
|-------------------|-----------------------------------|------------------------------------|-------------------------------|---------------------------------------------|
| B2-B1             | Carpark & Plant Rooms             | 2.5                                | 4 hours                       | 0.5                                         |
| G/F-3/F           | Library                           | 3.0                                | 2 hours                       | 0.5                                         |
| 4/F               | Mechanical Floor                  | 2.3                                | 2 hours                       | 0.5                                         |
| 5/F-8/F           | Medical Consulting / X-ray Floors | 3.0                                | 2 hours                       | 0.8                                         |
| 9/F-14/F          | Government Offices                | 3.5                                | 2 hours                       | 0.5                                         |
| G/F               | Community Hall A & B              | 7.0                                | 2 hours                       | 0.8                                         |
| 2/F               | Indoor Sport Hall                 | 6.2                                | 2 hours                       | 1.0                                         |

\* The minimum clear headroom is the floor height clear of all structures, finishes and building services.

### **Imposed Loads**

5. The imposed loads shall be in accordance with the latest version of the Hong Kong Code of Practice for Dead and Imposed Loads except for the following usages:-
  - Library, the minimum live load shall be 10kPa;
  - Indoor Sport Hall Roof, which is a landscape deck accessible to public, the minimum live load shall be 25kPa and no inverted structure is allowed.

### **Wind Loads**

6. The wind loads shall be in accordance with the Code of Practice on Wind Effects in Hong Kong 2019.

### **Site Conditions**

7. Ground conditions:

|                                     |                      |
|-------------------------------------|----------------------|
| Fill                                | 0-3m below ground    |
| Completely Decomposed Granite (CDG) | Varies. See Figure 2 |
| Grade III Rockhead (TCR>85%)        | Varies. See Figure 2 |

8. The highest possible groundwater level is at existing ground surface.

### **Omit from Consideration**

9. Detailed layout and design of the service core.
10. Detailed settlement assessment for the Excavation and Lateral Support (ELS) works.

## Section A

- a. Prepare a design appraisal with appropriate sketches for the below:

- i) Two distinct and viable schemes for the JUC;
- ii) One viable foundation scheme.

Indicate clearly the functional framing, load transfer and stability aspects of each scheme and provide sufficient preliminary design to justify your proposed structural arrangement to meet all client's requirements. Identify the solution you recommend and give reasons for your choice.

**(30 marks)**

- b. Explain how the structure will resist i) soil load and ii) wind load including detailed description of the structural wind loads and design assumptions. Prepare a detailed soil and wind load calculation and stability checking for the proposed building.

For the purpose of estimating Along Wind Force  $W_z$ ,  $Z_e$  can be taken as  $Z$  (effective height = actual height above ground level) and topographic adjustment not required. For the preliminary assessment of major direction wind induced deflection and/or stability check, the Along Wind Force could be multiplied by an overload factor of 1.4 to take into account of the combination of the two orthogonal directions and torsional loads. Torsional Force and Across Wind Base Moment could be ignored.

**(10 marks)**

## Section B

For the solution recommended in Section A:

- c. Prepare design calculations to establish the form and size of all principal structural elements including transfer structures and critical structures (if any).

**(15 marks)**

- d. Prepare full dimensional framing plans for G/F, 2/F, 4/F, 5/F, and 7/F.

**(20 marks)**

- e. Prepare structural details for the principal structural elements including transfer and critical structures (if any), for cost estimation purpose.

**(10 marks)**

- f. Prepare the design calculation for the building foundation.

**(5 marks)**

- g. Prepare a preliminary foundation layout plan.

**(5 marks)**

- h. Prepare an outline construction program covering essential activities from commencement of foundation to ELS to the completion of structural works.

**(5 marks)**

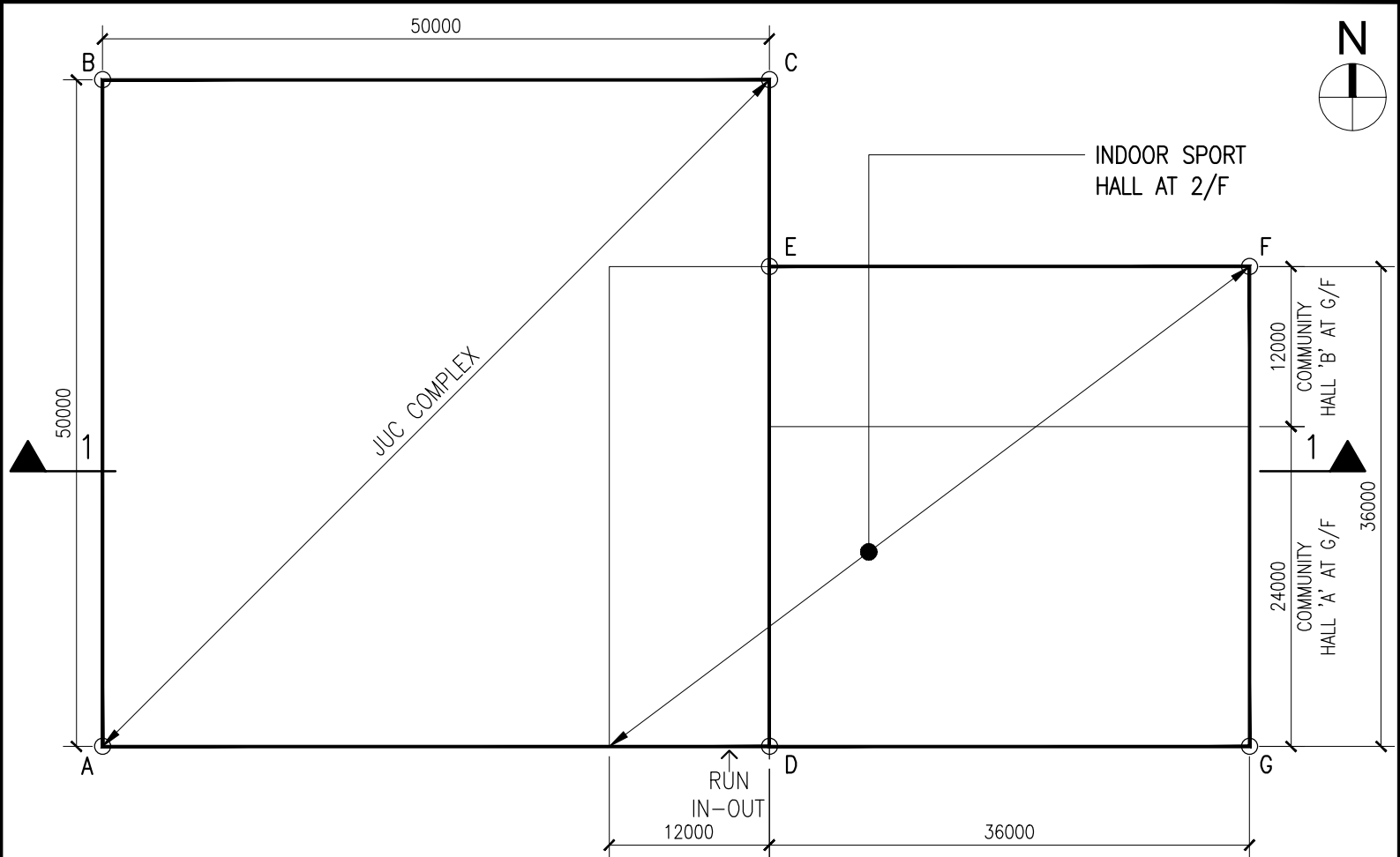


FIGURE 1 – PLAN

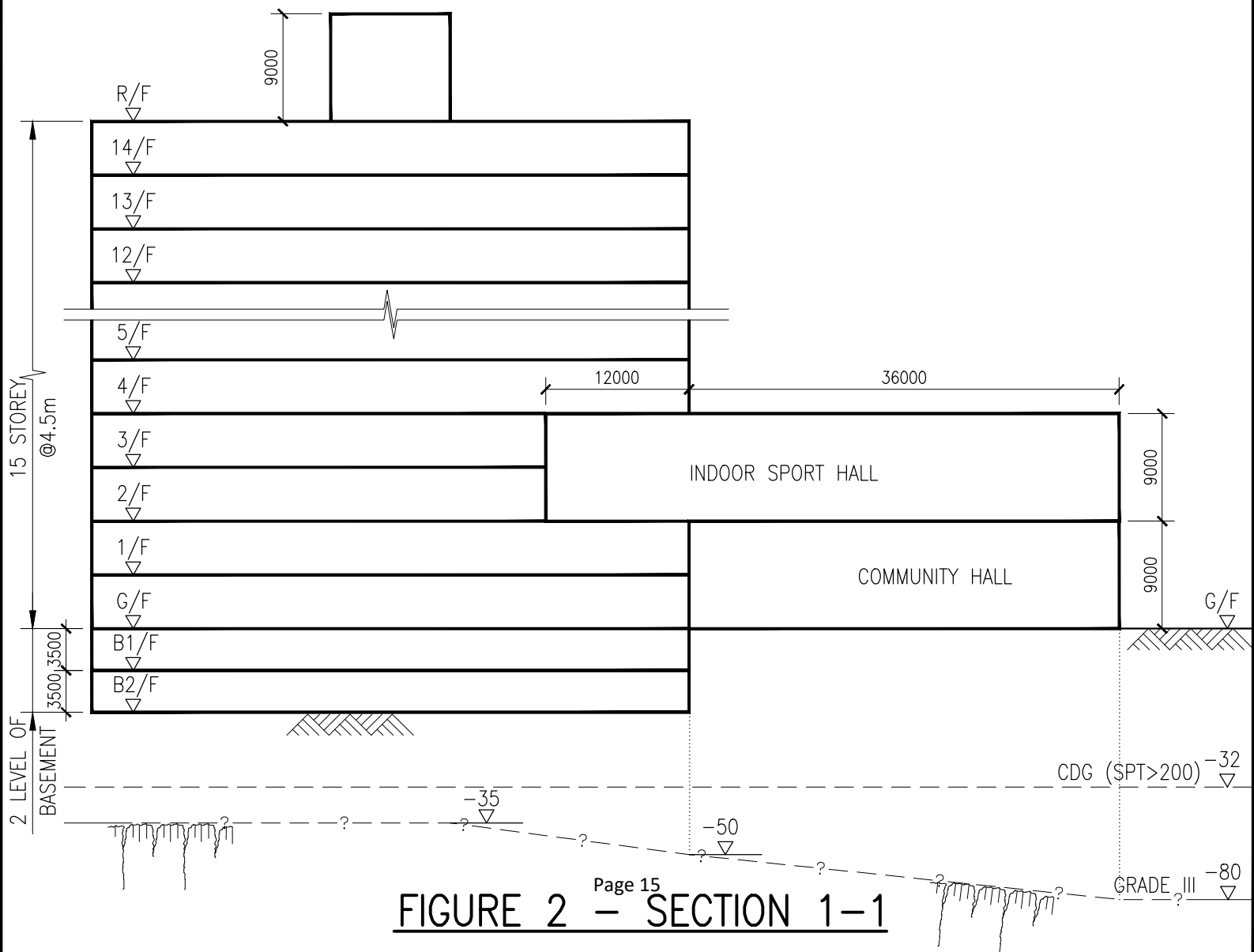


FIGURE 2 – SECTION 1-1



## Question 4 Shopping mall with Skylight Roof

### Client's Requirements

The following client's requirements must be met:

1. A new 5-storey shopping mall near the seaside is proposed. The mall includes a large central atrium with a skylight roof and 2 basement levels. Adjacent to the site boundary, there is an existing single-storey building supported by footing foundation.
2. The building height of the shopping mall is 27.8m (from external ground level) up to the main roof. Passenger lift access to the roof garden with the lift core top level 10m above the main roof. All structures should not higher than the core top level.
3. The footprint of the shopping mall is 120m by 120m. An atrium is located at the center of the building covered by a skylight roof. The layout of the building is shown in Figure Q4.
4. To permit transparency for natural lighting through the skylight system, the skylight system should be steel structure with glass panel system.
5. 2 double-storey-height theatres of 23m by 23m are located on the G/F.
6. The external walls along the building's outer perimeter are curtain walls and need to be maintained transparency.
7. There is carpark area at B1 and B2, ramp access from G/F is provided.
8. The proposed use of the shopping mall building with the minimum headroom requirements and fire resistance rating are listed as the following:

| Floor Mark | Usage                                                       | Minimum Clear Headroom * (m)                            | Fire Resistance Rating | Finishes & E/M Service Zone (m) |
|------------|-------------------------------------------------------------|---------------------------------------------------------|------------------------|---------------------------------|
| Top Roof   | Inaccessible roof                                           | N/A                                                     | N/A                    | N/A                             |
| Main Roof  | Accessible roof and additionally allow for 0.5m soil cover. | N/A                                                     | N/A                    | N/A                             |
| 1/F-4/F    | Shopping area                                               | 3.7                                                     | 2 hours                | 0.5                             |
| G/F        | Shopping area                                               | 5.2                                                     | 2 hours                | 0.5                             |
| G/F        | Atrium                                                      | No structural element is allowed below Main Roof level. | 2 hours                | N/A                             |
| G/F        | Foyer                                                       | 4.4                                                     | 2 hours                | 0.5                             |
| G/F        | Theatre                                                     | 8.4                                                     | 2 hours                | 0.5                             |
| B2-B1      | Carpark                                                     | 2.4                                                     | 4 hours                | 0.5                             |

\*The minimum clear headroom is the floor height clear of all structures, finishes and building services

9. The restrictions on the location of vertical structural elements are as the following:

| Floor Mark   | Area                      | Restrictions*                                                                                                                                                                                                                                         |
|--------------|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Main roof    | Landscape accessible roof | - All structural elements should not be higher than the Height Limit.                                                                                                                                                                                 |
| G/F, 1/F-4/F | Shopping area             | - The minimum column center to center spacing is 16m.<br>- Columns should be located with a minimum clearance of 2m from the building edge along the building's outer perimeter.<br>- The maximum cantilever length from the center of support is 4m. |
| G/F          | Atrium                    | - No internal column is allowed.                                                                                                                                                                                                                      |
| G/F          | Foyer                     | - The minimum column center to center spacing is 16m.                                                                                                                                                                                                 |
| G/F          | Theatre                   | - No Internal column is allowed.                                                                                                                                                                                                                      |
| B2-B1        | Carpark                   | - The minimum column center to center spacing is 8m.<br>- No columns inside the ramps.                                                                                                                                                                |

\*No restriction on spacing between the wall and the column.

10. No structural walls are allowed except for i) staircase & lift cores and ii) basement wall.

### **Imposed Loads**

11. The imposed loads shall be in accordance with the latest version of the Hong Kong Code of Practice for Dead and Imposed Loads.

### **Wind Loads**

12. The wind load should be in accordance with Hong Kong Wind CoP 2019.

### **Site Conditions**

13. Ground conditions based on borehole data:

- 0–10m: Loose Fill (SPT N = 5–10)
- 10–16m: Medium Dense Sand (SPT N = 11–30)
- 16–50m: Dense to Very Dense CDG (SPT N = 50–200)
- Below 50m: Moderately Strong Granite (Core Recovery >85%)

14. The highest groundwater table is at 1m below the existing ground level.

**Omit from Consideration**

15. Design of curtain walls and skylight glass panels.
16. Design of lift shafts and stair wells.
17. Design of significant resonant dynamic effects.

**Section A**

- a. Prepare a design appraisal with appropriate sketches and calculations indicating two distinct and viable solutions for the proposed skylight structure and one viable solution for the proposed shopping mall building structure. Candidate is allowed to prepare only one viable scheme for the foundations. Indicate clearly the functional framing, load transfer and stability aspects of each scheme to meet all client's requirements, provide sufficient preliminary design to justify your proposed structural arrangement. Identify the solution you recommend and give reasons for your choice.

**(30 marks)**

- b. Explain how the building structure will resist wind load including detailed description of the structural wind frame(s), design assumptions and how the uplift pressure, if any, in the basement is resisted.

For the purpose of estimating along Wind Force  $WZ$ ,  $Z_e$  can be taken as  $Z$  (effective height = actual height above ground level) and topographic adjustment not required. For the preliminary assessment of major directional wind induced deflection and / or stability check, the Along Wind Force could be multiplied by an overload factor of 1.4 to take into account of the combination of the two orthogonal directions and torsional loads. Torsional Force and Across Wind Base Moment could be ignored.

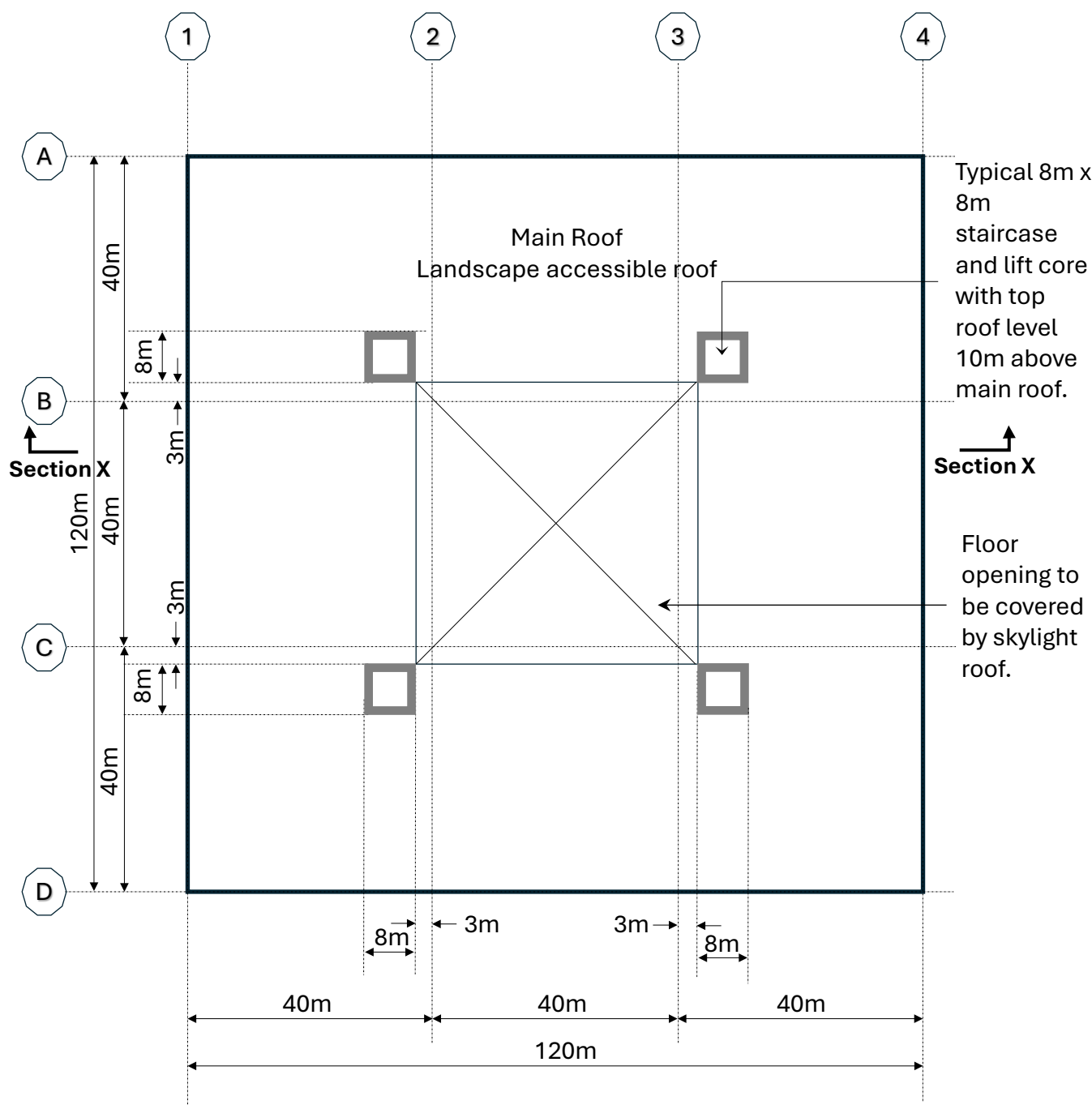
**(10 marks)**

## **Section B**

For the solution recommended in Section A:

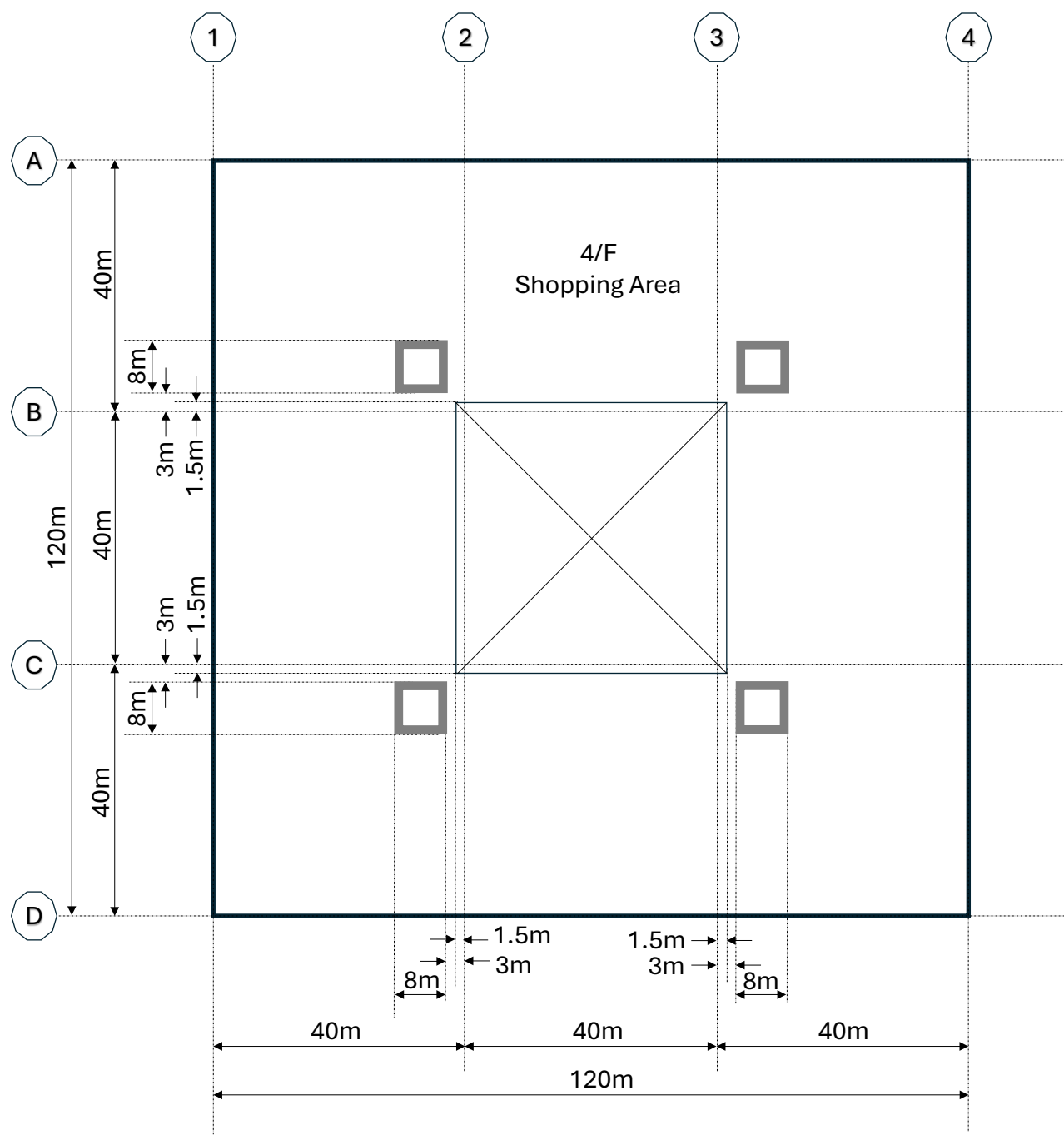
- c. Prepare sufficient design calculations to establish the form and size of all the principal structural elements including the foundation.  
**(20 marks)**
- d. Prepare general detailed structural framing plans (G/F, 1/F-4/F, main roof and skylight) to show the dimensions, layout, disposition of the structural elements for estimating purposes.  
**(22 marks)**
- e. Prepare clearly annotated sketches of the following details:
  - i) Sufficient details of the critical elements (columns, beams, major vertical elements, major horizontal elements, pile cap, foundation etc.) and critical connections such as column/beam, column/slab connections etc.
  - ii) Connection details between skylight structure and main roof structural element.  
**(10 marks)**
- f. Prepare a detailed method statement for the construction of the basement structure including any narratives, with emphasis on how ground movement and underground water are controlled during construction.  
**(8 marks)**

Figure Q4



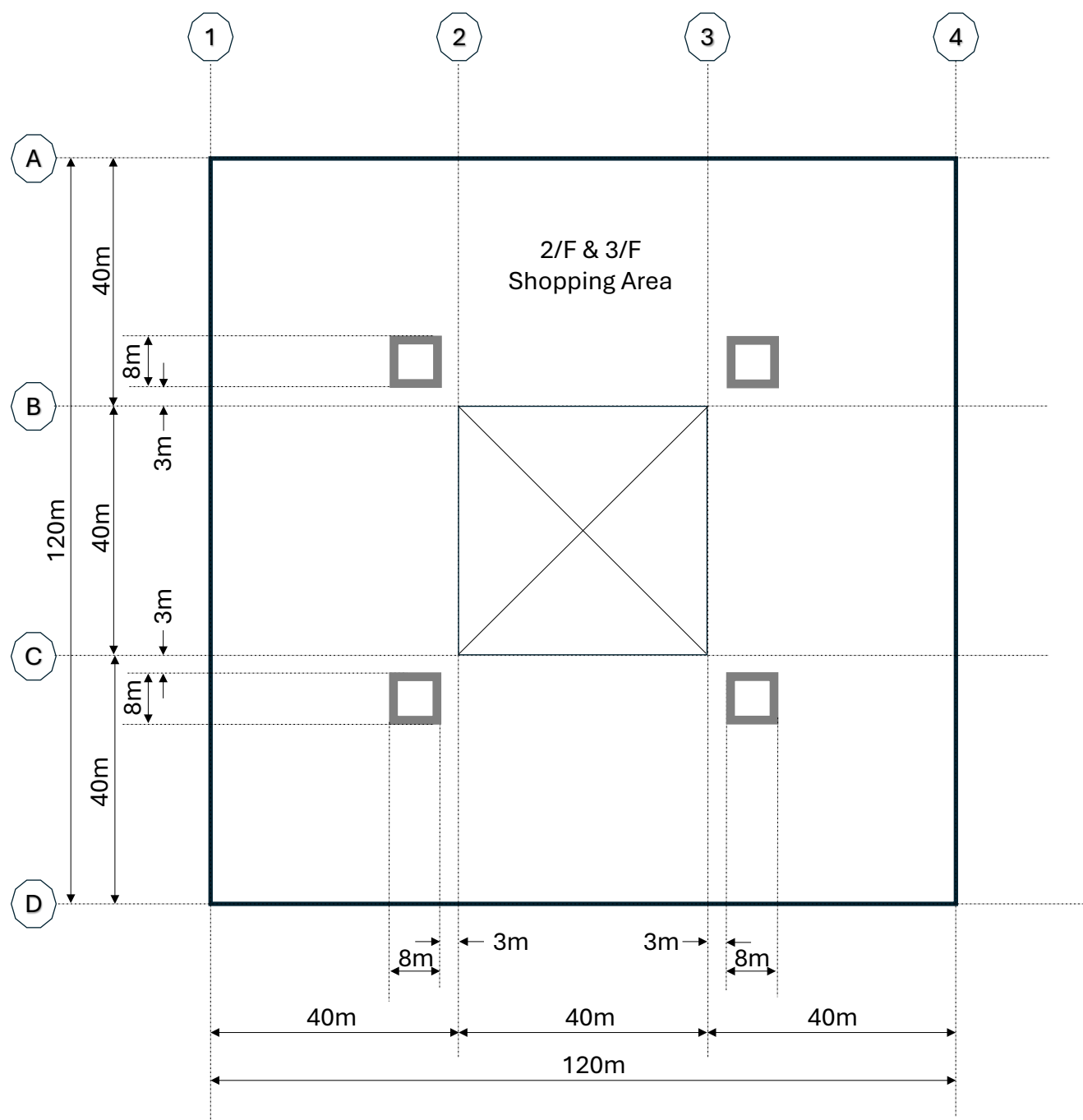
Main Roof Plan (Not to scale)

Figure Q4



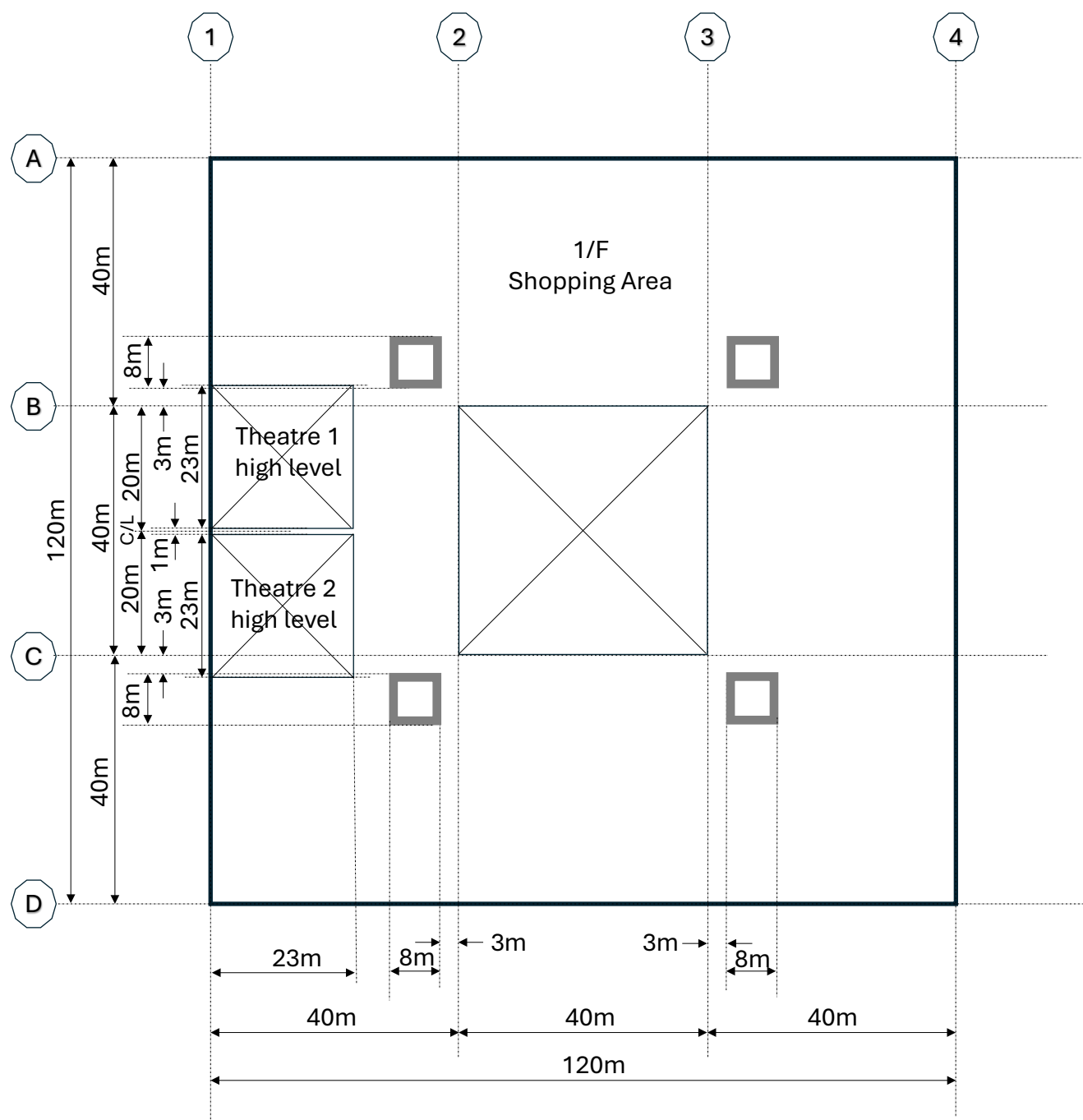
4/F Plan (Not to scale)

Figure Q4



2/F & 3/F Plan (Not to scale)

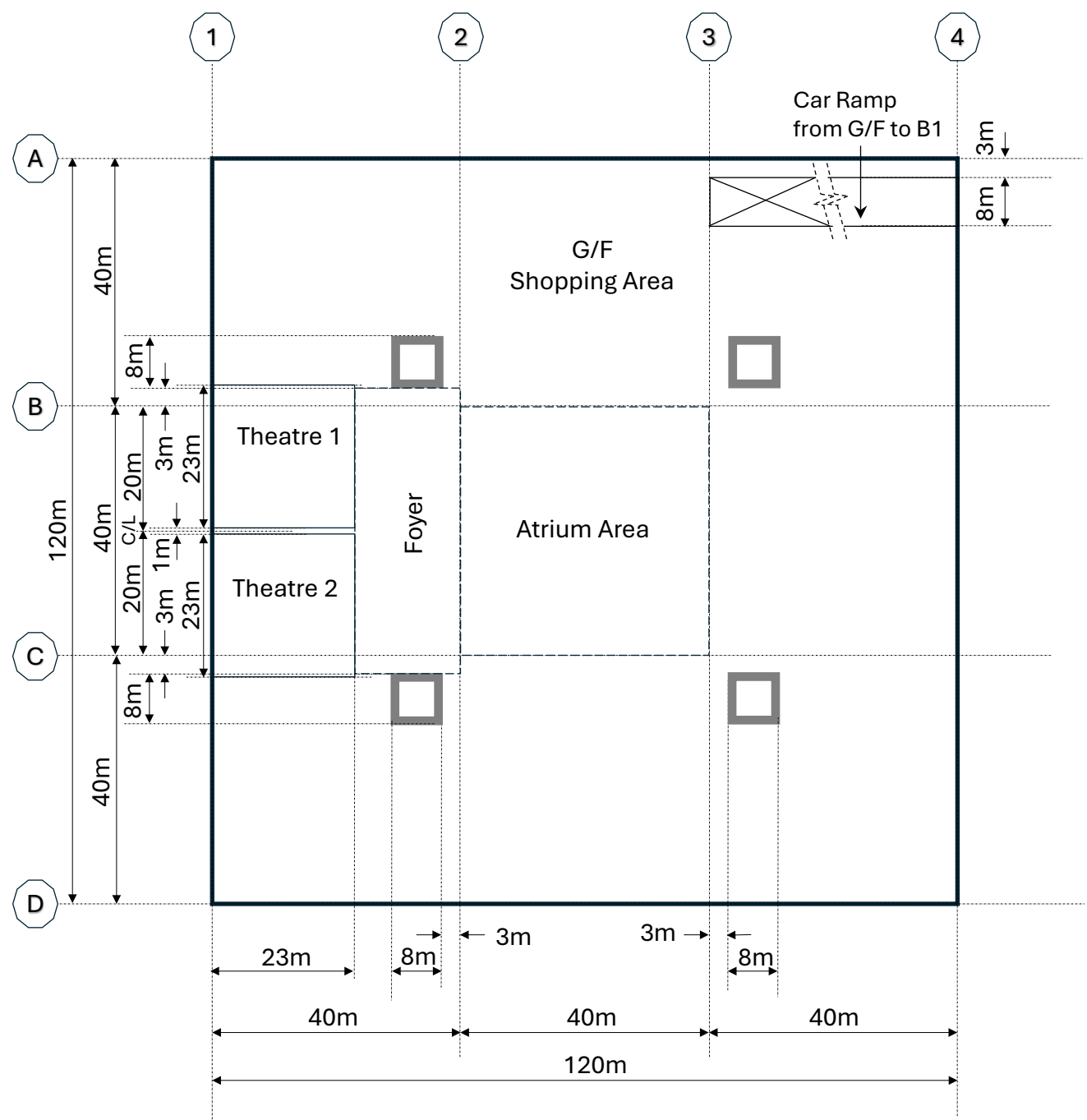
Figure Q4



1/F Plan (Not to scale)

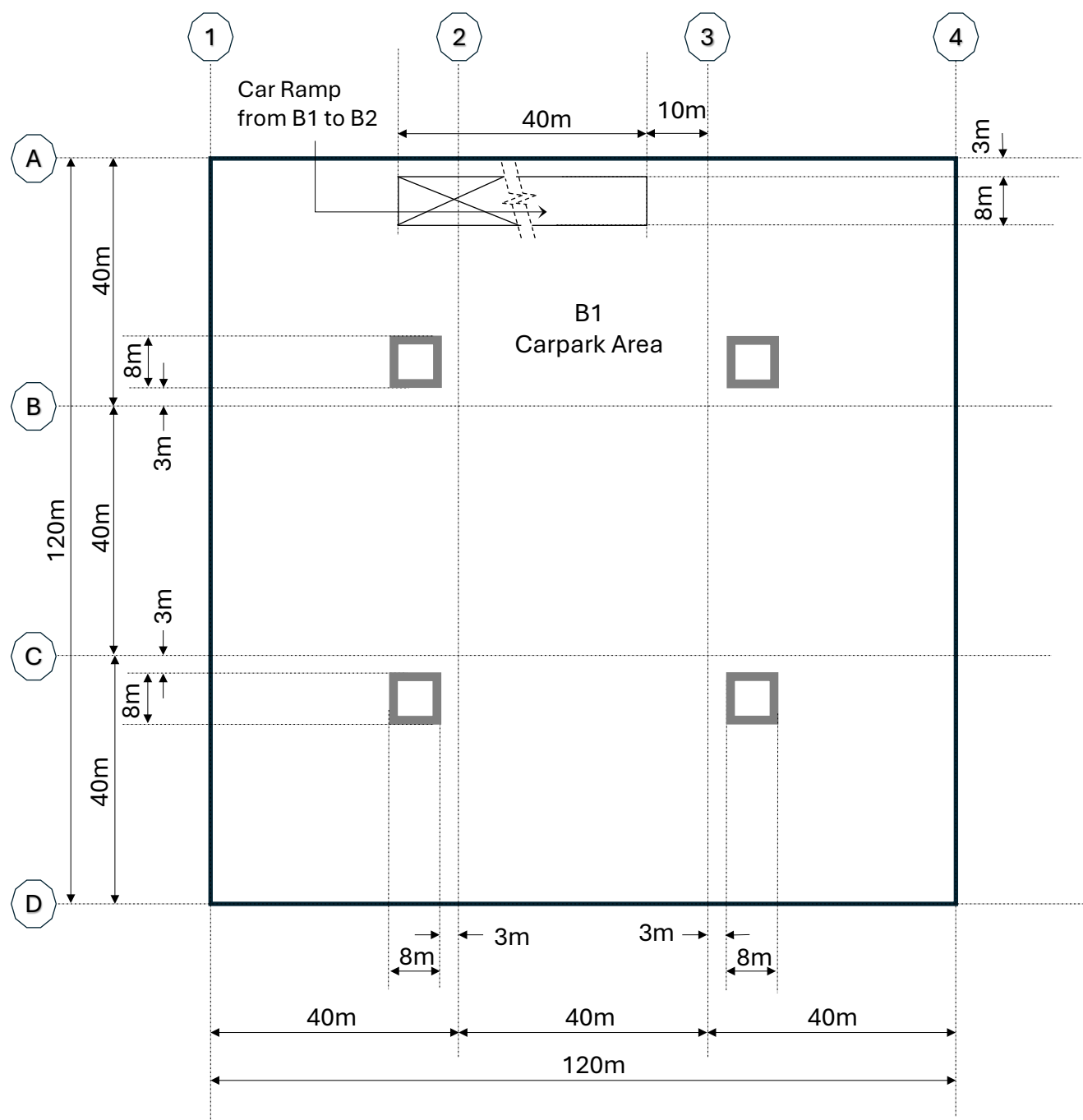


Figure Q4



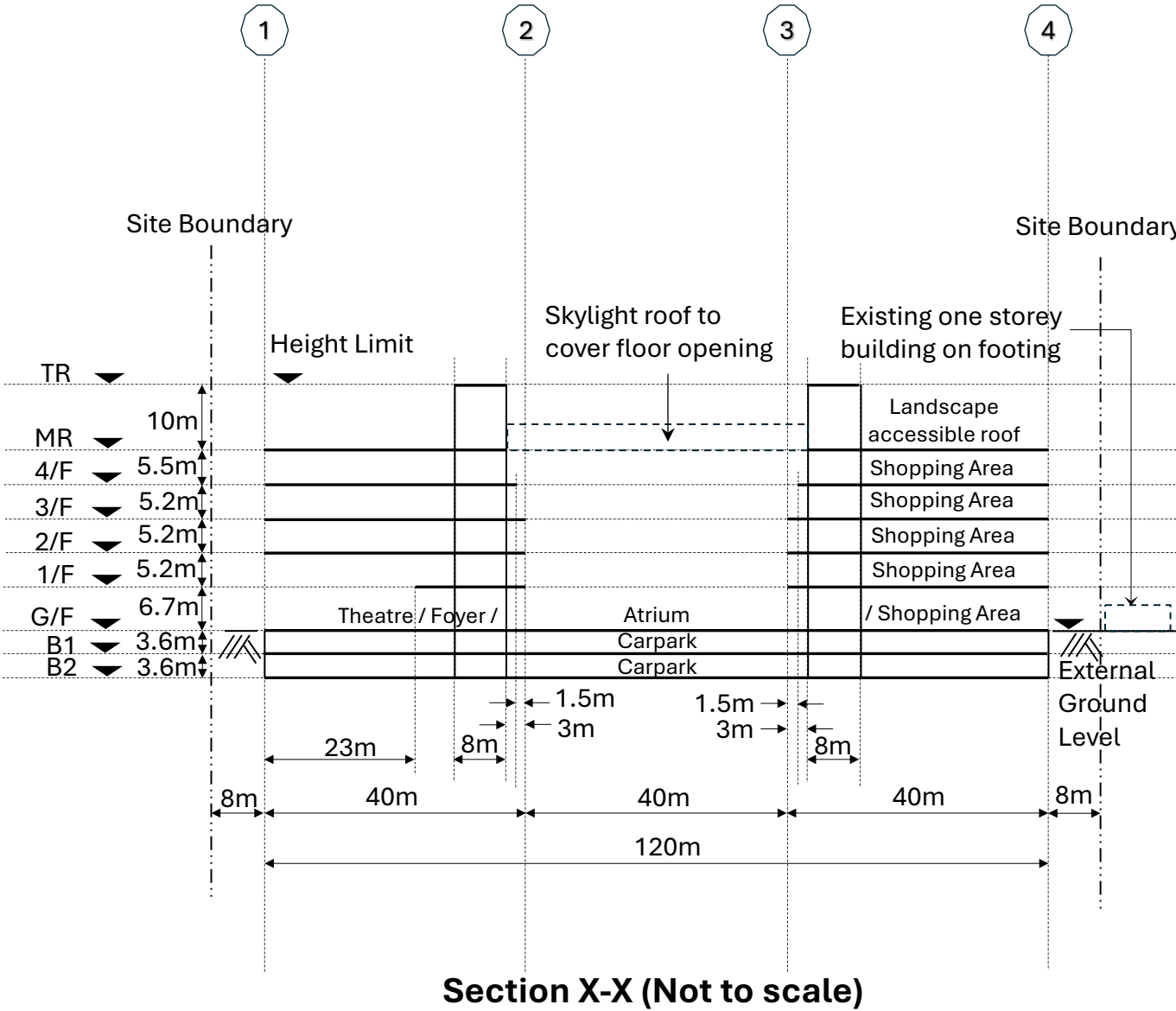
G/F Plan (Not to scale)

Figure Q4



**B1 Plan (Not to scale)**  
**(B2 Plan similar)**

Figure Q4



## Question 5      Laboratory cum Office Institutional Building

### Client's Requirements

The following client's requirements must be met:

1. A 9-storey institutional building with 1 level of basement is to be constructed within the urban area of Kowloon.
2. The proposed use of the building with the minimum headroom requirements and fire resistance rating is listed as follows:

| Floor Mark | Usage      | Minimum Clear Headroom* (m) | Fire Resistance Rating (hour) | Finishes & E&M Services Zone (m) |
|------------|------------|-----------------------------|-------------------------------|----------------------------------|
| 6/F – 8/F  | Office     | 3                           | 2                             | 0.5                              |
| 3/F – 5/F  | Laboratory | 4                           | 2                             | 0.5                              |
| 2/F        | Store Room | 3.7                         | 2                             | 0.3                              |
| 1/F        | E&M        | 4.4                         | 2                             | 1.0                              |
| G/F        | Auditorium | 12                          | 2                             | 0.5                              |
| B/F        | Library    | 3.5                         | 4                             | 0.5                              |

\* The minimum clear headroom is the floor height clear of all structures, finishes and building services.

3. The restrictions on the location of vertical structural elements are as follows:

| Floor Mark | Usage      | Restrictions*                                      |
|------------|------------|----------------------------------------------------|
| 6/F – 8/F  | Office     | Minimum spacing of columns is 7m center-to-center. |
| 3/F – 5/F  | Laboratory | Minimum spacing of columns is 7m center-to-center. |
| 2/F        | Store Room | No restrictions except column free at corridor.    |
| 1/F        | E&M        | No restrictions.                                   |
| G/F        | Auditorium | Column Free Zone                                   |
| B/F        | Library    | Minimum spacing of columns is 7m center-to-center. |

\* No restriction on spacing between column/wall and service core.

4. The main roof structure shall not be inverted.
5. No exposed structures are permitted above the garden.
6. A 42m x 24m column free zone to be provided at the auditorium.
7. A 4m width column free corridor to be provided at the store room.

### Imposed Loads

8. The imposed loads shall be in accordance with the latest version of the Hong Kong Code of Practice for Dead and Imposed Loads.

## Wind Loads

9. The wind loads shall be in accordance with the Code of Practice on Wind Effects in Hong Kong 2019.

## Site Conditions

10. Adjacent to the eastern boundary of the site is a 2-storey historical building with shallow footing foundation.

11. Ground conditions:

|                       |                                                                                                       |
|-----------------------|-------------------------------------------------------------------------------------------------------|
| From +30mPD to +20mPD | Loose fill, SPT average N-value < 10                                                                  |
| From +20mPD to -10mPD | Medium dense sand, SPT average N-value = 30                                                           |
| From -10mPD to -30mPD | Completely Decomposed Granite (CDG) / Highly Decomposed Granite (HDG), SPT average N-value $\geq$ 200 |
| Below -30mPD          | Moderately decomposed granite with total core recovery greater than 85%                               |

12. The highest possible groundwater level is at existing ground surface.

## Omit from Consideration

13. Detailed layout and design of the structure inside the service core.

## Section A

- a) Prepare a design appraisal with appropriate sketches including two distinct and viable solutions for the proposed building including one viable foundation scheme. Indicate clearly the functional framing, load transfer and stability aspects of each scheme to meet all client's requirements, provide sufficient preliminary design to justify your proposed structural arrangement. Identify the solution you recommend and give reasons for your choice.

**(30 marks)**

- b) Explain how the structure will resist wind load including detailed description of the structural winds loads and design assumptions. Prepare a detailed wind load calculation and stability checking for the proposed building.

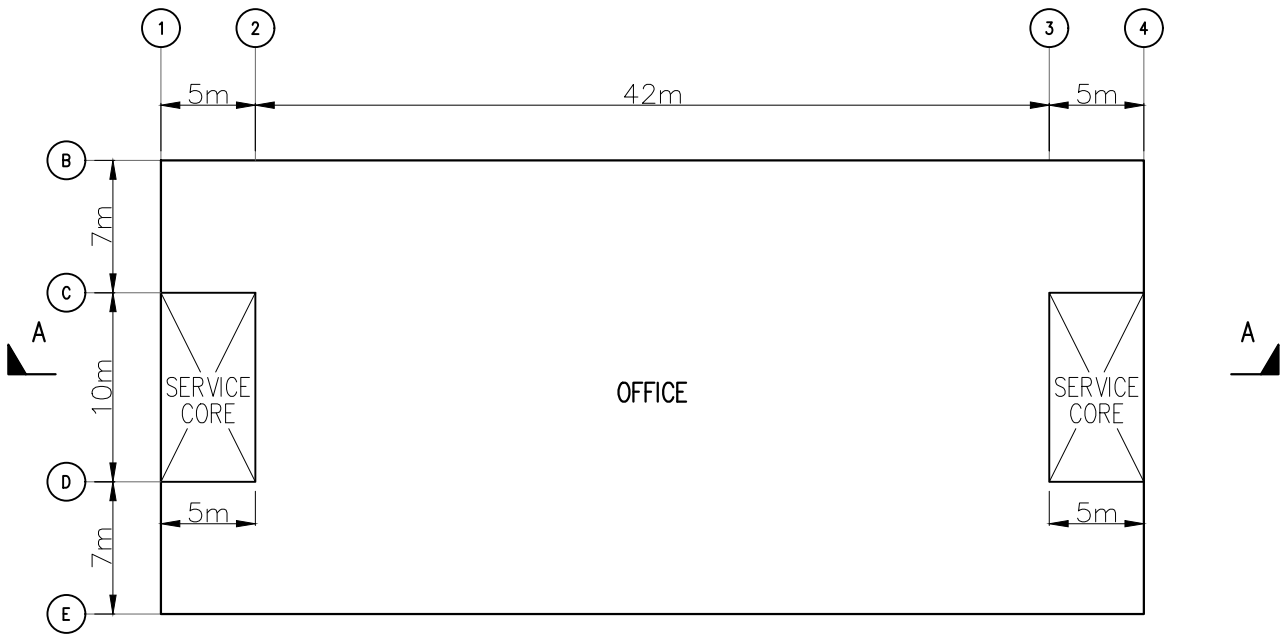
For the purpose of estimating Along Wind Force  $W_z$ ,  $Z_e$  can be taken as  $Z$  (effective height = actual height above ground level) and topographic adjustment not required. For the preliminary assessment of major direction wind induced deflection and/or stability check, the Along Wind Force could be multiplied by an overload factor of 1.4 to take into account of the combination of the two orthogonal directions and torsional loads. Torsional Force and Across Wind Base Moment could be ignored.

**(10 marks)**

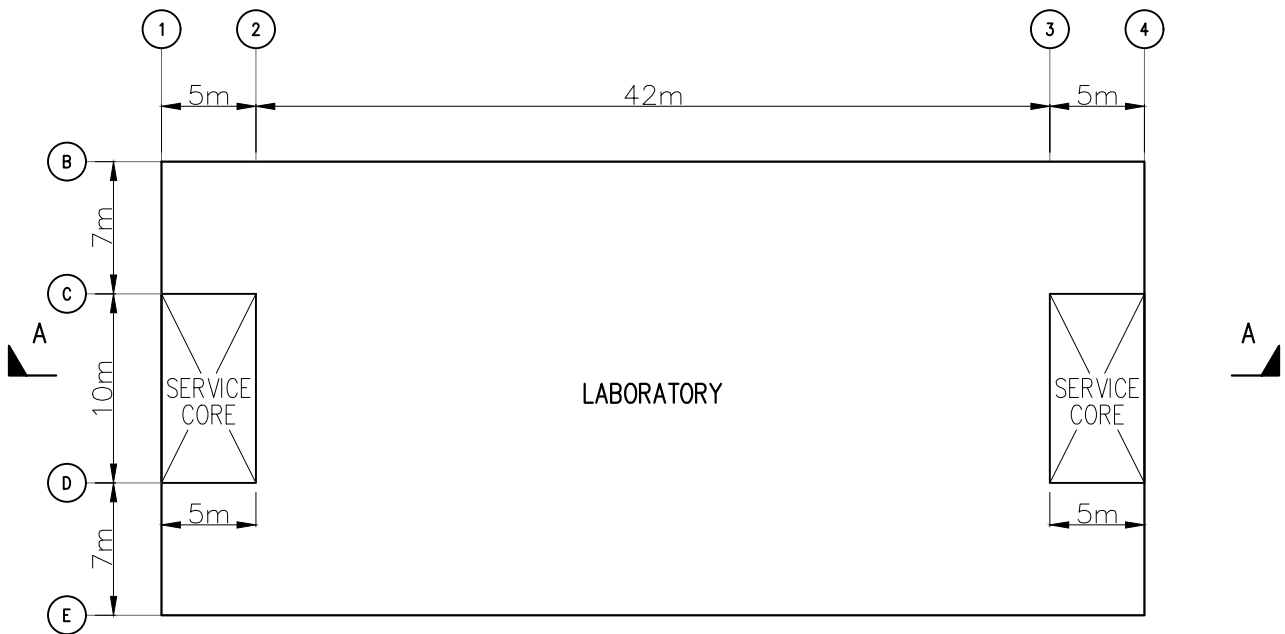
## **Section B**

For the solution recommended in Section A:

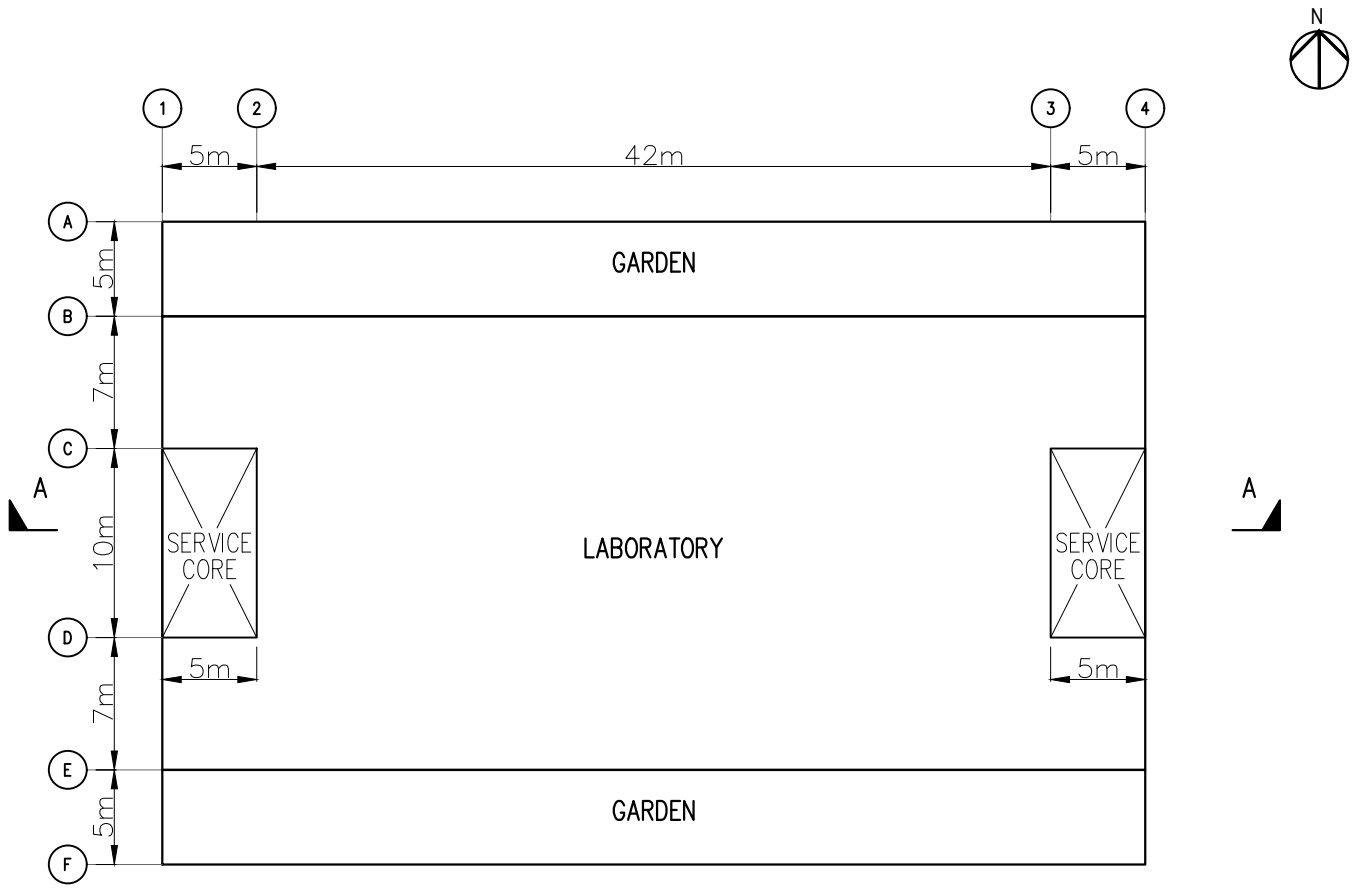
- c) Prepare design calculations to establish the form and size of all principal structural elements for superstructure from G/F to R/F including transfer structures and critical structures (if any).  
**(15 marks)**
- d) Prepare full dimensional framing plans G/F, 1/F, 3/F, laboratory floors / office floors, and all levels with transfer and critical structure (if any).  
**(20 marks)**
- e) Prepare structural details for the principal structural elements from G/F to R/F including transfer and critical structures (if any), for cost estimation purpose.  
**(10 marks)**
- f) Prepare a preliminary foundation layout plan.  
**(5 marks)**
- g) Prepare the design calculation for the building foundation.  
**(5 marks)**
- h) Prepare an outline construction program for the design and construction of the project including a method statement for construction adjacent to historical building.  
**(5 marks)**



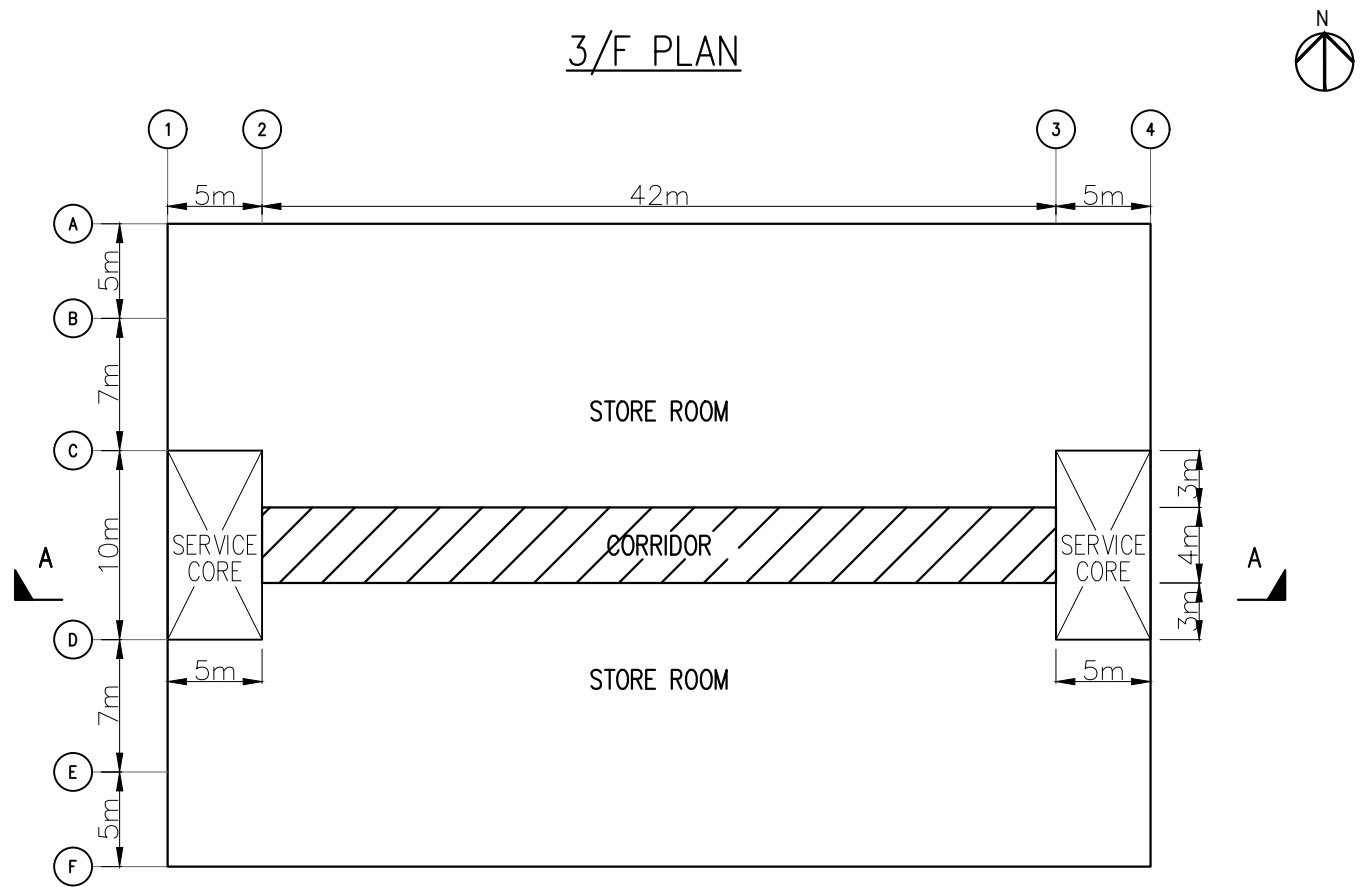
6/F ~ 8/F PLAN



4/F ~ 5/F PLAN

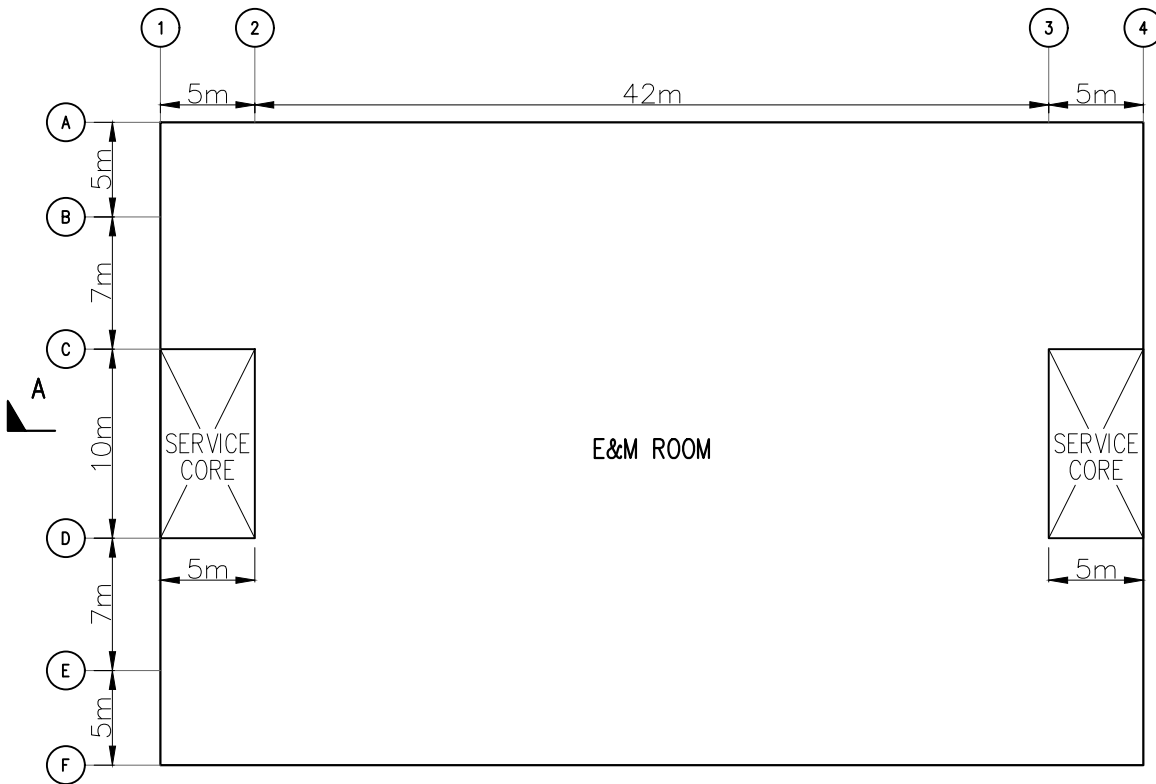


3/F PLAN

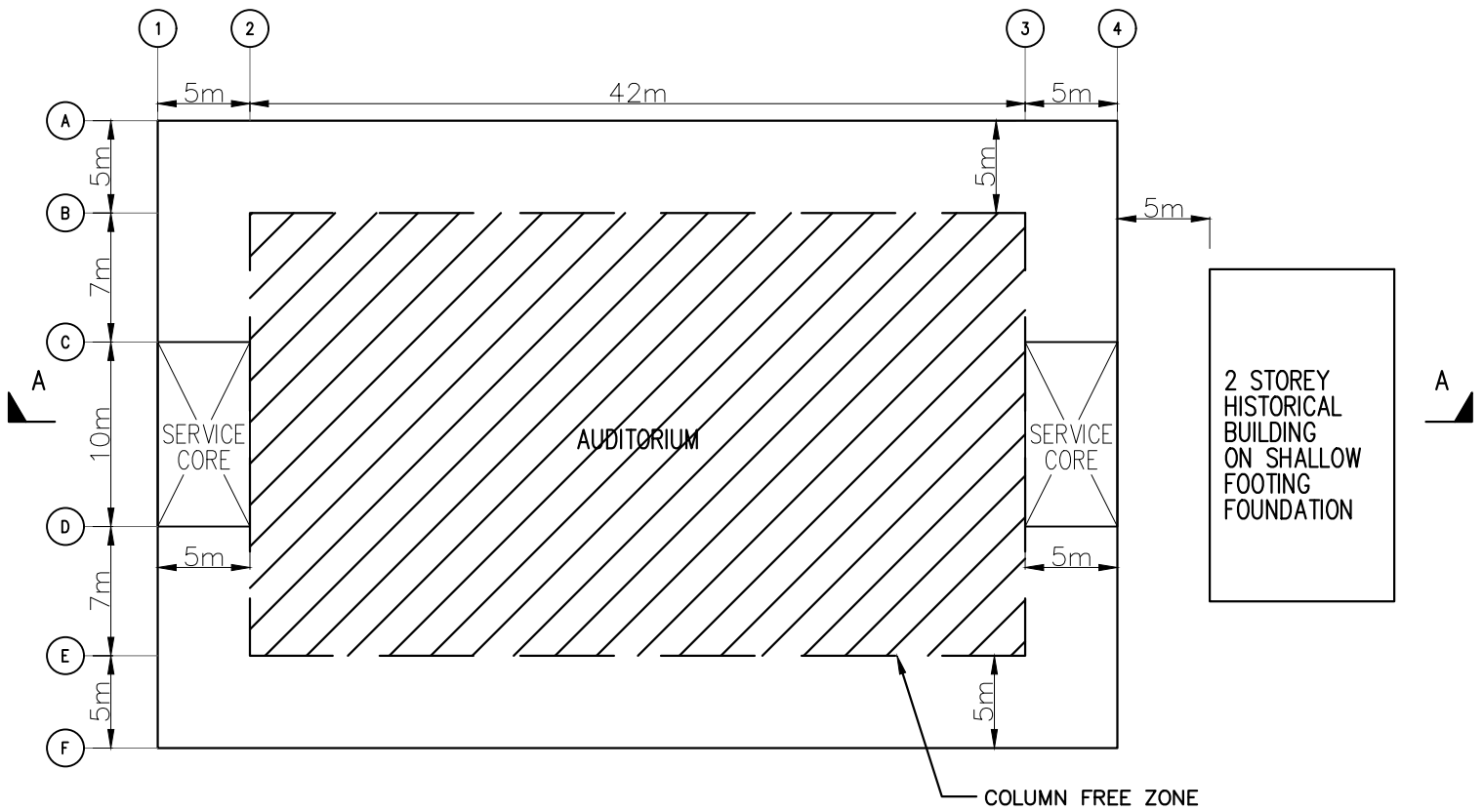


2/F PLAN

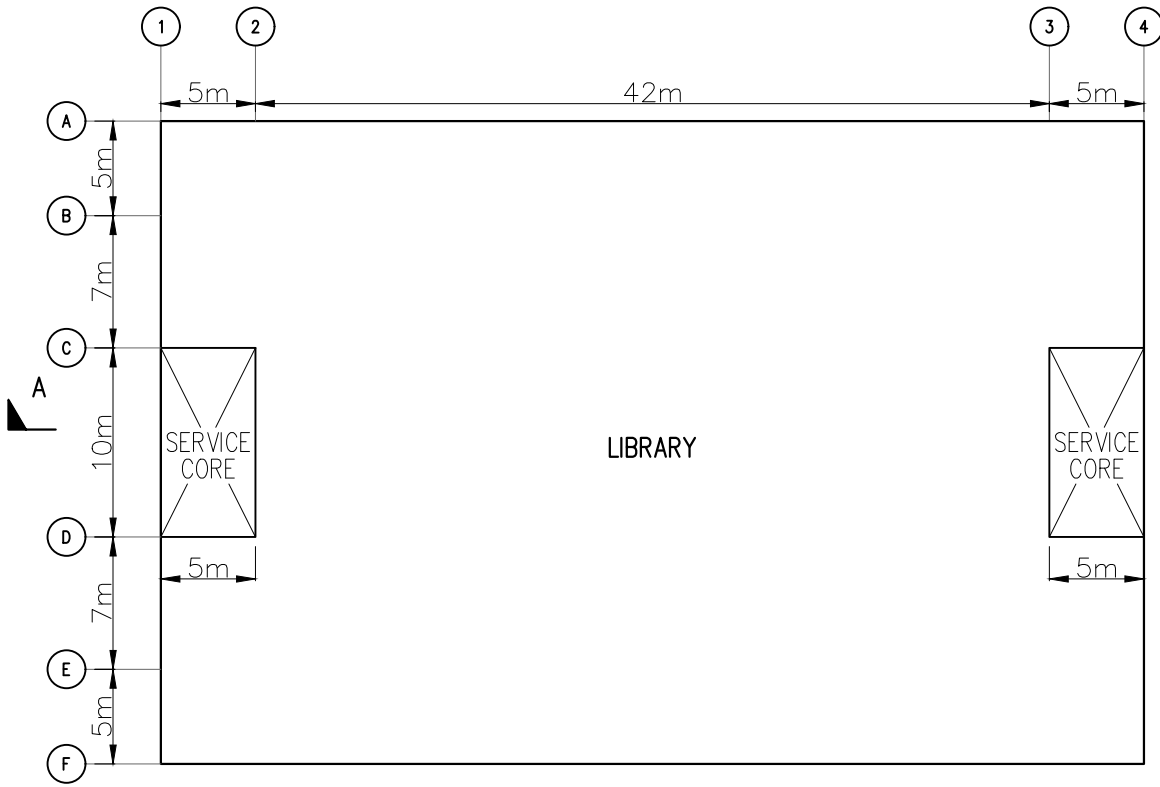




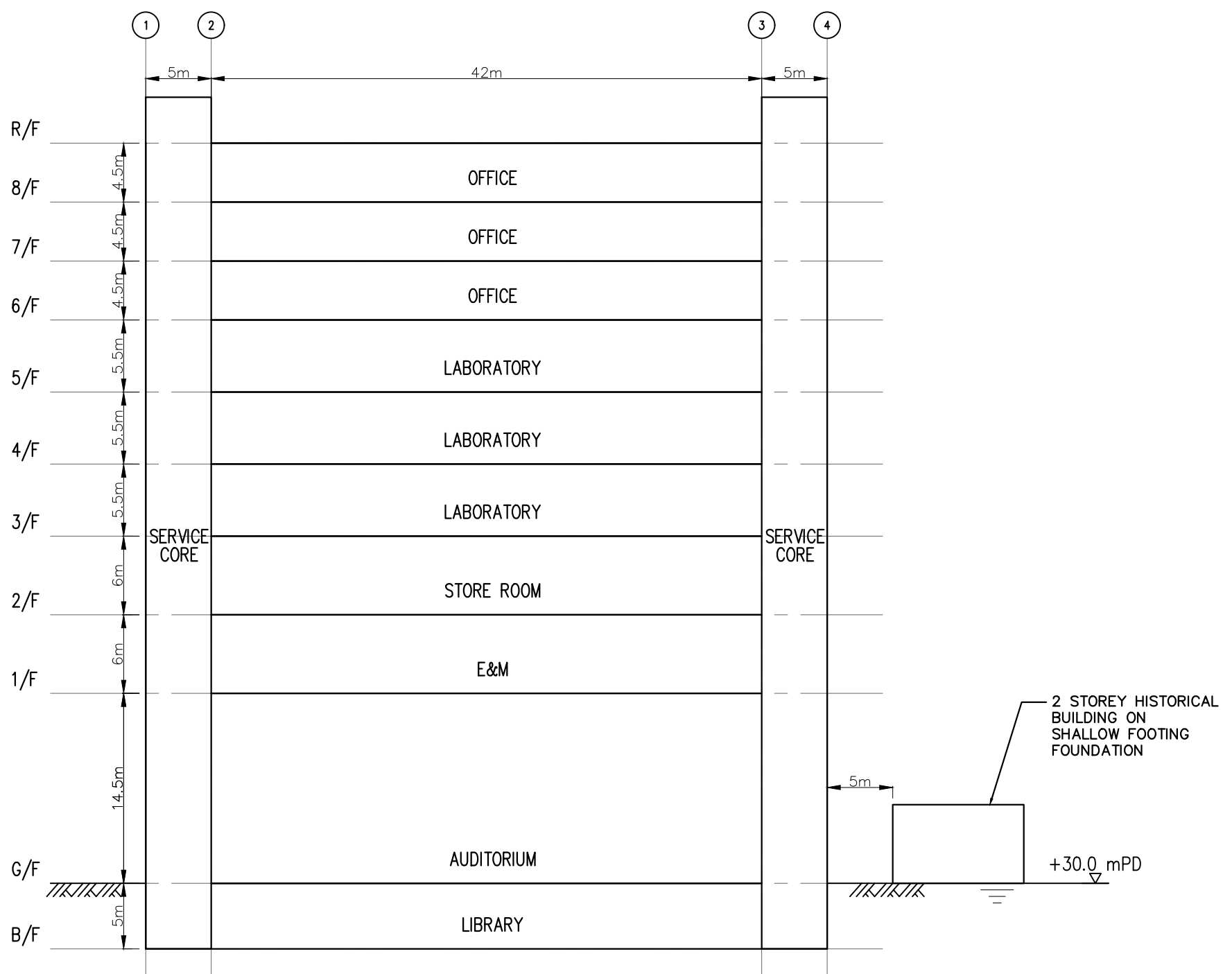
1/F PLAN



G/F PLAN



B/F PLAN



SECTION A-A