

The University of Hong Kong
Department of Civil Engineering

CIVL4101 Capstone Design Project
2023 – 24
Group FA to Group FJ

Design Brief for
a 30-Classroom Primary School
in Kai Tak Development, Kowloon

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1. INTRODUCTION

1.1 Objectives

The objective of this capstone design project is to provide professional training to final year students to work on civil engineering projects through synergistic teamwork within a realistic working environment. Students are required to participate in the conceptual formulation of general arrangement, foundation and structural schemes, appraisal of the schemes and construction sequence, as well as traffic impact assessment, environmental impact assessment, and drainage impact assessment where appropriate, followed by preliminary design, preparation of drawings/figures, preliminary cost estimation for the selected scheme in the first semester and also preparation of drawings and calculations for detailed design in the second semester.

1.2 Project Schedule

The schedule of the design project is set out in Table 1 below.

Table 1 Project Schedule

Milestone Date	Component	Page Limit	Weight
21 Sep 2023 (Thu) by 5pm	Inception report	30	10%
24/25 Nov 2023 (Fri/Sat)	Oral presentation 1	-	10%
5 Jan 2024 (Fri) by 5pm	Report on feasibility study and preliminary design	100	25% *a
9 Jan 2024 (Tue) by 5pm	Poster	-	*a
	Peer review	-	*b
19/20 Apr 2024 (Fri/Sat)	Oral presentation 2	-	10%
26 Apr 2024 (Fri) by 5pm	Report on detailed design	100 (excl. calculations)	25% *a
30 Apr 2024 (Tue) by 5pm	Poster	-	*a
	Peer review	-	*b
See Moodle	Seminar reports	-	20%

* Notes:

- The report on feasibility study and preliminary design or the report on detailed design is assessed together with posters by staff tutors and moderators and progress meetings by industrial tutors in the same semester. It is also used for mark adjustment of the report in the same period among various groups working on the same project. The assessment results of various reports posted on Moodle are therefore tentative only and subject to subsequent adjustments.
- Peer review is used for possible adjustment of individual marks among group members at the discretion of staff tutor and moderator for report on feasibility study and preliminary design or detailed design.
- Students are required to attend regular progress meetings to report their progress and to consult the industrial tutors and staff tutors/moderators for advice. The detailed schedule is shown in the course arrangement.

2. PROJECT DESCRIPTION

2.1 Background

The Kai Tak Development (KTD) project is an enormous and highly intricate venture that spans over 320 hectares and boasts the largest land area facing Victoria Harbour. This development presents the chance to connect people with the harbour, create a high-quality living space for approximately 153,000 residents, and rejuvenate neighboring districts like Kowloon City, Wong Tai Sin, and Kwun Tong. The overarching vision for KTD is to create "a distinguished, dynamic, appealing, and people-focused community along Victoria Harbour."

2.2 Proposed Development

The project is to design and construct a 30-classroom primary school with one level of basement at Site 1B-4, KTD (refer to Appendix A for the site location). The primary objective of this project is to provide a state-of-the-art learning environment for students, encompassing advanced educational facilities, sustainable design elements, and ample recreational spaces. The total construction floor area (CFA) for the proposed 30-classroom school is about 11,540 m² (Note: the estimate of CFA is for reference only) and the school consists of 30 classrooms, 4 small group teaching rooms, 6 special rooms (including music room, a visual arts room, a general studies room, a multi-purpose room, a computer assisted learning room and a language room), 2 interview rooms, a guidance activity room, a staff room, a staff common room, a conference room, a study activity centre, a library, a multi-purpose area, an assembly hall, and other ancillary facilities (refer to Appendix B for the Diagrammatic Section). The existing ground level is approximately +5.3 mPD and the highest roof level shall not exceed +45.0 mPD.

Designers are required to propose a feasible architectural & structural layout with full justification for the building. The implementation of Building Information Modeling (BIM) techniques, construction planning and sequence, general arrangement of the building, public liaison, impact on adjacent buildings and utilities, environmental, traffic, etc., should be discussed and considered in the design.

To tackle the aggravating problem of urban decay and push sustainable urban renewal forward, the innovative technologies - DfMA (Design for Manufacturing and Assembly) and IoT (Internet of things) shall be explored and presented in the feasibility study and preliminary design for the construction and project management of the proposed development. As per the client's requirements, the designers shall provide explicitly a comprehensive design by using Modular Integrated Construction (MiC) for the types of room where applicable.

Design for Safety (DfS) process is to be implemented in this project with an aim to improve health and safety during construction and maintenance of the project.

The Consultant shall perform Systematic Risk Management in accordance with ETWB TC(W) No. 6/2005 and ETWB Risk Management User Manual to identify risks and uncertainties associated with the Project and recommend treatment measures aiming to reduce these risks and uncertainties to acceptable level and to ensure timely completion of the Project and within budget and to the required quality.

2.3 General Ground Condition

The ground information of the site can be retrieved in the Geotechnical Information Infrastructure system <https://www.geomap.cedd.gov.hk/GINFOINT2/>. The highest possible ground water level may be taken as the ground surface if no such information can be found.

3. CLIENT'S REQUIREMENTS

The project team shall meet, but not limited to, the following design requirements: -

- a. The minimum headroom requirements and fire resistance rating of the proposed development are specified as below.

Floor / Location	Main Usage	Minimum clear headroom* (m)	Fire resistance rating
R/F	E&M, Sky Garden, Water Tanks, Lift Machine Room, etc.	**	1 hour
L1/F & L7/F	Classroom / Staff Room	2.6 (underside of structural beam) / 3.0 (underside of false ceiling)	1 hour
G/F	Classroom / Staff/Administrative Office, Multi-purpose area, Assembly hall, etc.	3.0** (3.6** for assembly hall)	2 hours
Basement	Carpark, E&M Facilities, F.S. Water Tank, etc.	2.7	4 hours

* The minimum clear headroom is the floor height clear of all structures and building services. A service zone of minimum 300 mm depth shall be provided for the G/F and basement floor of teaching & learning building, while minimum depth of service zone of other floors / areas shall be justified by the project team.

** Relevant Code of Practice and PNAP shall be referred to.

- b. Minimum column spacing for all areas in the Podium and basement is 10.0 m (c/c), and minimum column spacing for all areas in the remaining floors is 7.0 m (c/c).
- c. No columns/walls are permitted inside the corridor, detailed design of the service core shall be provided but no column is permitted within the core(s).
- d. No building structure, including foundation/temporary structure of ELS, can be built outside the boundary line.
- e. The design of proposed development shall comply with the Schedule of Accommodation and Design Information/Requirements and Technical Schedule.
- f. Considerations and protection measures to the surrounding environment shall be provided in details in the foundation and ELS design.
- g. High-level technical advice for the seismic-resistant design of the building structure shall be provided in the feasibility study.
- h. The adoption of MiC for the proposed development shall comply with the requirements as specified in the Technical Circular (Works) No. 2/2020 by the Development Bureau, and PNAP ADV 36 - Modular Integrated Construction by the Buildings Department, and PNAP APP 161 - Exemption of Gross Floor Area for Buildings adopting Modular Integrated Construction, respectively.
- i. All the Architectural Plans & Framing Plans shall be generated and prepared by BIM-based techniques. And a short video of not less than **30 seconds** by BIM-based

techniques to demonstrate the overall design & construction of the proposed development. in the preliminary stage and detailed design stage, respectively.

4. SCOPE OF WORKS

4.1 Inception report

- a. The project team shall identify all the site constraints and the particular concerns as far as possible in environmental, geotechnical, structural, drainage, transportation and constructability aspects.
- b. The project team shall develop a feasible scheme for the new development.
- c. The project team shall report the progress of any work done.
- d. The project team shall develop a working plan and identify important milestones of the project with proposed dates.
- e. A task list and a duty roster indicating the apportionment of tasks among project team members shall be included in the report.

4.2 Report on feasibility study and preliminary design

- a. The project team shall develop a feasible scheme for the new development. The design scheme shall satisfy the Client's requirements as set out in this brief.
- b. Due considerations shall be given to the suitability, construction programme, cost, material, environment and safety.
- c. The project team shall submit a report on feasibility study and preliminary design which includes, but not limited to, the following details: -
 - The scope, purpose and background of the study;
 - An executive summary of the study;
 - Architectural considerations including consideration of different options;
 - Engineering considerations including consideration of different options;
 - A structural design appraisal with appropriate sketches indicating clearly the functional framing, material, load transfer path, overall stability, and vertical & lateral stability aspects of each scheme;
 - A preliminary assessment of traffic, drainage, environmental and visual impact, and etc.;
 - Development and evaluation of alternative design solutions;
 - Schematic plans and sections showing viable structural and foundation layouts;
 - Recommendation, with sound engineering justifications, of a preferred orientation and design for the new development;
 - Proposed project schedule for implementation;
 - Estimates of costs;
 - A project file including all letters, minutes, agenda, etc. in the Appendix;
 - A task list and a duty roster indicating the apportionment of tasks among project team members; and
- d. The project team shall produce drawings showing the preliminary design of the new development. These include, but are not limited to, the following: -
 - Site layout plan shows the location of the new development;
 - General building plans (architectural plans);
 - Loading intensity key plans;
 - Structural framing plans; and

- Foundation layout plans and sections with geological profiles.
- e. The project team shall deliver a 45-min. oral presentation at the end of the feasibility study and preliminary design followed by a 15-min. question and answer session. The schedule shall refer to the course arrangement. The presentation shall set out design considerations and illustrate key findings of the feasibility study and preliminary design. The recommendation and justification for the preferred scheme shall be fully covered in the presentation for the Client's agreement.
- f. The project team shall also prepare a poster which includes the most important findings of your feasibility study and preliminary design. Format of the poster shall refer to Section 4.5.

4.3 Report on detailed design

- a. The project team shall prepare a detailed design report for submission to the Client. The final design report shall include, inter alia, the following items: -
 - An executive summary;
 - Design memorandum including design criteria, geotechnical parameters, loading schedules, safety and environmental considerations, standard codes and references, etc.;
 - A general description of the proposed works and construction sequences;
 - Demonstration of the overall stability of the building;
 - Computer models for the lateral and gravity load analysis;
 - Structural design calculation for critical structural elements only;
 - Ground movements, if any, due to any foundation, ELS and geotechnical works;
 - Impact assessment reports for structure, traffic, drainage and environmental;
 - A risk assessment of the project;
 - An assessment of lateral (i.e. wind, soil and etc.) loads on the proposed building, as well as maximum top deflection and fundamental natural frequency shall be provided in details;
 - Construction method and sequence of the basement and the building;
 - Overall construction programme and cost estimation;
 - A project file including all letters, minutes, agenda, etc. in the Appendix; and
 - A task list and a duty roster indicating the apportionment of tasks among project team members.
- b. The project team shall produce drawings for the development. These include, but are not limited to, the following: -
 - General layout plan that also shows the location of the new development;
 - General building plans (architectural plans);
 - Loading key plans;
 - Structural framing plans;
 - Foundation layout plans and sections with geological profiles;
 - Reinforcement (for reinforced concrete structures/composite structures) and connection (for steelworks/MiC) details;
 - Construction sequences of the building; and
 - Traffic diversion plans.
- c. The project team shall deliver a 45-min. presentation at the end of the final detailed design and the schedule shall refer to the course arrangement. The presentation shall be followed by a 15-min. question and answer session.

-
- d. The project team shall also prepare a poster which includes the most important elements of the detailed design. Format of the poster shall refer to Section 4.5.

4.4 Format of submissions

- a. Just ONE PDF file shall be submitted in the sub-class Moodle site for each group. Students should combine all the materials into ONE PDF file with the consideration of the reading sequence of the markers.
- b. The maximum size of normal submission is 100 MB and that of Turnitin submission is 100 MB in Moodle. Students should resize the PDF file before submission if the limit is exceeded.
- c. If the file size of the submission exceeds the limit, students can divide the submission into several parts and name it properly, like Part 1, Part 2, etc. and upload them to Moodle by different student's accounts.

4.5 Poster

Each group shall submit a poster after the two milestones (feasibility study and preliminary design and detailed design). The use of posters is quite common in design competitions, research conferences, exhibitions, public engagement, etc. For the Capstone Design Project, the 10 groups who are working on the same project are similar to 10 consultant firms competing for an engineering job. The judging panel would be your client and relevant experts. Posters shall include the most important findings of your report and they are used for mark adjustment of the report in the same period among various groups working on the same project.

Students shall use Microsoft PowerPoint or equivalent to design the poster with the following requirements.

- a. Size - A1 (594 × 841 mm)
- b. Image resolution: 300 dpi
- c. Main Title: recommended font size between 54 to 60 pt
- d. Sub-heading: recommended font size between 40 to 44 pt
- e. Normal text: recommended font size of at least 28 pt

5. SITE VISITS

In order to familiarize with the site conditions, site visits to the proposed development shall be arranged in the early design stage, if necessary.

6. RECOMMENDED DESIGN STANDARDS AND REFERENCES

The following codes of practice, standards and references shall be used in the design of the development as applicable:

- a. Hong Kong Buildings Ordinance, Chapter 123
- b. Hong Kong Building (Planning) Regulations, Chapter 123F
 - i. B(P)R 24 & 39 on "storey & staircase height"
 - ii. B(P)R 29 to 37 on "lighting & ventilation"
 - iii. B(P)R 39 to 43 on "means of escape"
 - iv. B(P)R 72 on "use by persons with a disability"
- c. Hong Kong Building (Construction) Regulation 1990.
- d. Code of Practice for Foundations 2017, Buildings Department.
- e. Code of Practice for the Structural Use of Concrete 2013, Buildings Department.
- f. Code of Practice for the Structural Use of Steel 2011, Buildings Department.
- g. Code of Practice on Wind Effects 2019, Buildings Department.
- h. Code of Practice for Fire Safety in Buildings 2011, Buildings Department.
- i. Code of Practice for Dead and Imposed Loads 2011, Buildings Department.
- j. Code of Practice for Structural Use of Glass 2018, Buildings Department.
- k. Code of Practice on Design for Safety – External Maintenance 2019, Buildings Department.
- l. Code of Practice for Site Supervision 2009, Buildings Department.
- m. Code for Seismic Design of Buildings: GB-50011-2016
- n. EN 1998-1:2004 Eurocode 8: Design of Structures for Earthquake Resistance. CEN.
- o. Design of Buildings and Structures in Low to Moderate Seismicity Regions – Professional Guide: PG-002.
- p. Foundation Design and Construction, GEO Publication No. 1/2006.
- q. Engineering Geology Practice in Hong Kong, GEO Publication No. 1/2007
- r. Review of Design Methods for Excavation, GCO Publication No. 1/90.
- s. Guide to Retaining Wall Design, GEOGUIDE 1, 1993.
- t. Guide to Site Investigation, GEOGUIDE 2, 1987
- u. Stormwater Drainage Manual, Planning, Design and Management, Fourth Edition, May 2013, Drainage Services Department.
- v. Practice Notes for Authorized Persons, Registered Structural Engineers and Registered Geotechnical Engineers (PNAP), Buildings Department.
- w. Code of Practice 101 for Distribution Substation Design (COP101)
- x. Design recommendations for multi-storey and underground car parks (Fourth edition) 2011, The Institution of Structural Engineers.
- y. Technical Circular (Works) No.2/2020, Development Bureau
- z. (1) BIM Standards – General (Version 2.1), CIC;
(2) BIM Standards for Architecture and Structural Engineering (Version 2.1), CIC;
(3) BIM Standards for Underground Utilities (Version 2), CIC;
(4) BIM Standards for Mechanical, Electrical and Plumbing (Version 2), CIC;
(5) BIM Standards for Preparation of Statutory Plan Submissions, CIC;
- aa. (1) Reference Materials - Sample Clauses for Procurement of MiC Building Projects, CIC;
(2) Reference Materials - Adopting DfMA for MEP Works, CIC;
(3) Reference Materials on the Statutory Requirements for MiC Projects, CIC;
- bb. (1) Guidance Notes of Design for Safety, Development Bureau;
(2) Reference Materials on the Design for Safety Management System for the Hong Kong Construction Industry, CIC.

7. COMMONLY USED DESIGN SOFTWARES

The following design softwares are commonly used in the industry:

- a. ANSYS – structural analysis
- b. ETABS – structural analysis
- c. FREW – geotechnical analysis of deformation and stability of soil structures
- d. MIDAS – structural analysis
- e. PLAXIS – geotechnical analysis of deformation and stability of soil structures
- f. REVIT – Building Information Modeling
- g. PROKON – structural element design
- h. SADS – structural element design
- i. SAFE – analysis and design for concrete slabs and basement/foundation structures
- j. SAP 2000 – structural analysis
- k. SPACE GASS – structural analysis
- l. STAAD Pro – structural analysis
- m. STRAND7 – structural analysis

End of Text

Appendix A

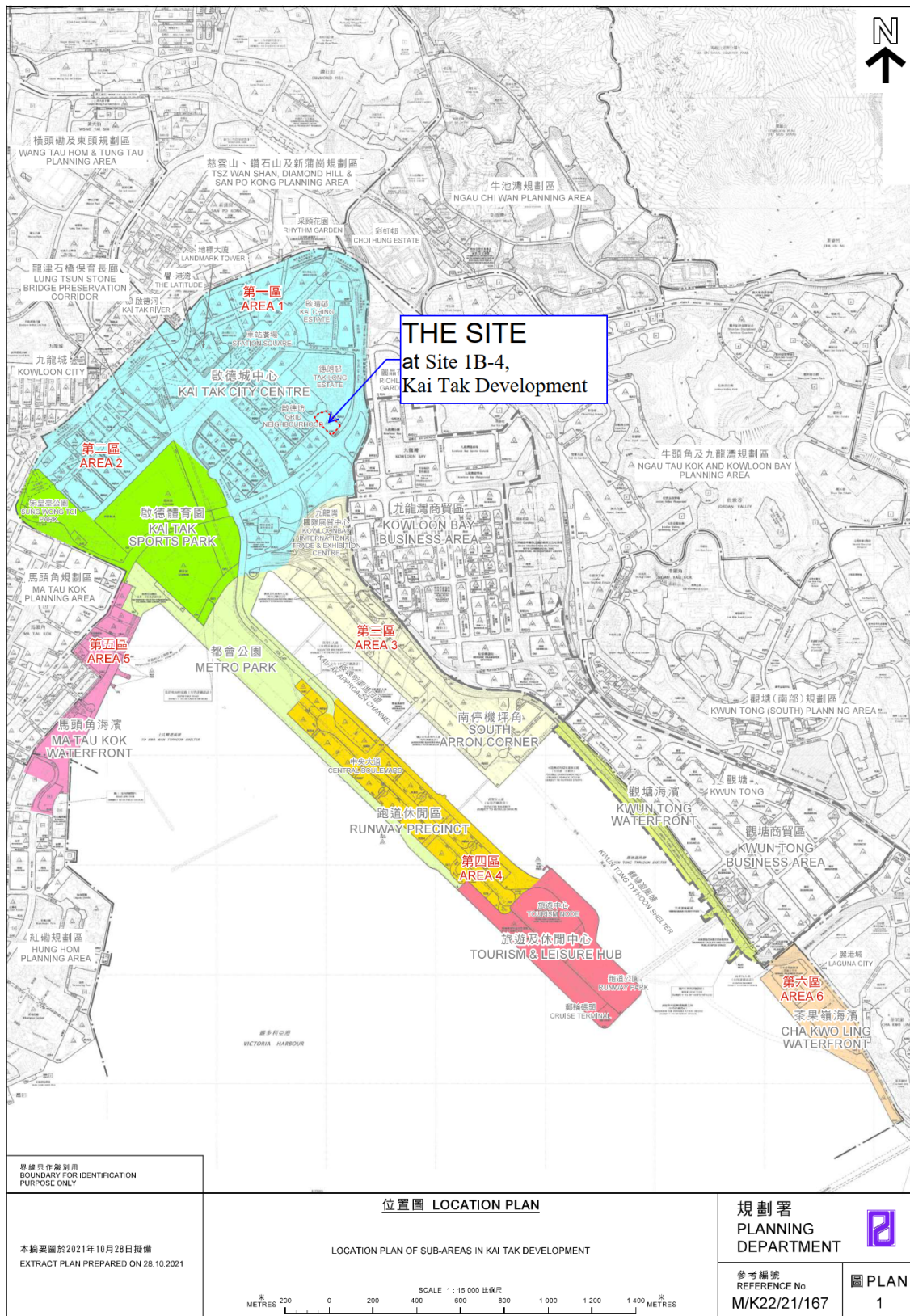
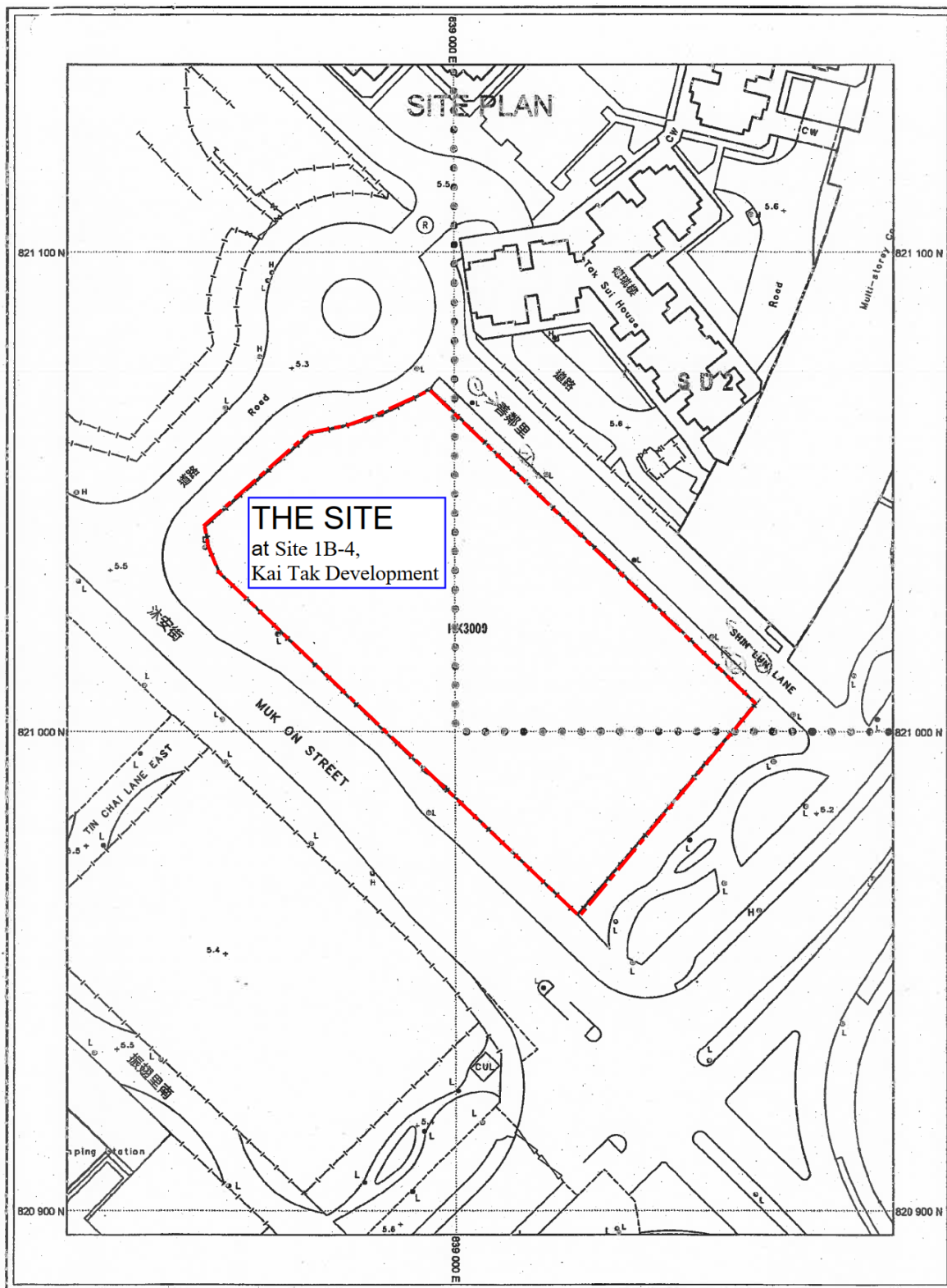


Figure 1 Site Location Plan (for information only)

(Reference: TFKT/07/2021: Further Review of Land Use in Kai Tak Development
and Proposed Amendments to the Approved Kai Tak Outline Zoning Plan)



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11-NE-11D 11-NE-12C

Figure 2 Enlarged Site Location Plan (for information only)

(Reference: Lands Administration Office, DLO/Kowloon)

Appendix B

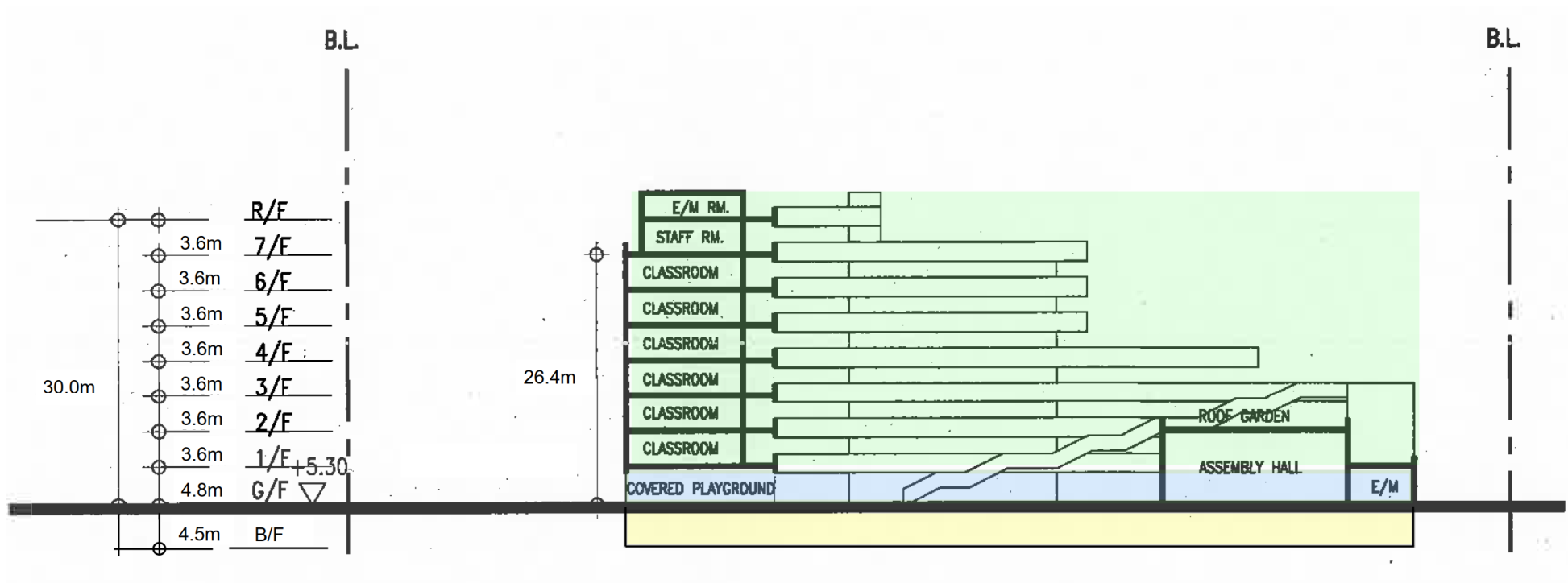


Figure 2 Diagrammatic Section (For Information Only)

N.T.S.