

The University of Hong Kong
Department of Civil Engineering

**CIVL4101 Capstone Design Project
2023 – 24
Group FK to Group FT**

Design Brief for the North Island Line
– Causeway Bay North Station

CONTENTS

	Page
1. INTRODUCTION	1
1.1 Objectives	1
1.2 Project Schedule	1
2. PROJECT DESCRIPTION	2
2.1 Background	2
2.2 Proposed Railway Development	2
2.3 General Ground Condition	2
3. CLIENT'S REQUIREMENTS	3
4. SCOPE OF WORKS	3
4.1 Inception Report	3
4.2 Report on Feasibility Study and Preliminary Design	3
4.3 Report on Detailed Design	4
4.4 Format of Submissions	5
4.4 Poster	5
5. SITE VISITS	5
6. RECOMMENDED DESIGN STANDARDS AND REFERENCES	6
7. COMMONLY USED DESIGN SOFTWARE	7
Appendix A Conceptual scheme of the North Island Line	
Appendix B Reference drawings	

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:

- a. 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.
- b. 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.
- c. 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 railway network now carries over 4.5 million passengers per day, accounting for about 40% of all public transport passenger trips. The development of railway transport will not only significantly speed up passenger flow, but will also reduce the reliance on road-based transport, alleviate road congestion and lessen vehicle-induced air pollution.

It often takes eight to ten years for a railway project to take shape from idea formulation, conceptual stage, stakeholder consultation, detailed design, to actual construction and completion. As such, it should be forward looking by conducting an early review and update of the existing railway development strategy. Early consultation will allow the public to discuss and participate in the planning process, so that it can work together to map out future railway development to meet transport demand in a cost-effective manner, and facilitate the commencement of relevant detailed studies of individual projects in a timely manner.

The North Island Line is one of the railway lines as recommended in Railway Development Strategy 2014 (RDS-2014). This line will be an extension of the Tung Chung Line and Tseung Kwan O Line along the northern shore of the Hong Kong Island, connecting the vicinities of Tamar, the Hong Kong Convention & Exhibition Centre and Victoria Park with a total route length of about 5km.

2.2 Proposed Railway Development

The North Island Line will help support the expansion of the CBD to the new harbourfront of Central and Wan Chai North by providing more convenient railway access to the planned commercial development/redevelopment sites in the area.

This project allows students to plan and strategize the North Island Line. Students are required to propose feasible location of **Causeway Bay North Station** as well as the alignment with justification. Preliminary construction planning, architectural and structural layout of the station, public liaison, impact on existing buildings, environmental, traffic, utilities, etc. should be considered. The possible location of the future railway development is shown in Appendix A.

More information can be found at the following websites:

Railway Development Strategy 2014

<https://www.tlb.gov.hk/eng/publications/transport/publications/rds2014.pdf>

LCQ14: Implementation of railway projects

<https://www.info.gov.hk/gia/general/202211/16/P2022111600299.htm>

Project Profile for North Hong Kong Island Line

<https://www.epd.gov.hk/eia/register/profile/latest/esb060.pdf>

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/GINFOINT/>. 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. Outline the potential railway station and alignment for the future railway network and confirm which line is the most feasible.
- b. Preliminary design of the railway station.
- c. No adverse effects on adjacent roads and structures and underground structures should be incurred due to the development during construction and operation stages.
- d. Temporary traffic arrangement is required throughout the construction period.
- e. Provide construction method with graphical illustration.
- f. All the architectural plans, framing plans and foundation plans shall be generated and prepared by BIM-based techniques. A short video of not less than **30 seconds** by BIM-based techniques to demonstrate the overall design and construction of the proposed railway 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 present the methodology for developing a feasible scheme for the new railway station.
- 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 railway alignment and station. 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;
 - A general description of the excavation and lateral support (ELS) system for the station box and/or tunnels;
 - Engineering considerations including consideration of different options;
 - A preliminary assessment of traffic, drainage, environmental and visual impact, 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 alignment and location of the proposed railway station;
 - Proposed project schedule for implementation;

- Estimates of costs;
 - 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.
- d. The project team shall produce drawings showing the preliminary design of the proposed railway development. These include, but are not limited to, the following: -
- General layout plan that also shows the alignment and location of the proposed railway station;
 - General structural 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;
 - Architectural layout, sections, and elevations of the proposed railway station and/or associated tunnels;
 - 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 station box and associated tunnels;
 - 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;
 - Construction method and sequence of the station box;
 - 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 alignment and location of the proposed railway station;
 - General structural design for key structural elements with reinforcement (for reinforced concrete structures) and connection (for steelworks) details;
 - Foundation layout plans and sections with geological profile;
 - Construction sequences of the station box; and

- Traffic diversion plan.
- 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. Guide to Soil Nail Design and Construction, GEOGUIDE 7, 2008
- v. Structures Design Manual for Highways and Railways 2013.
- w. Highways Department Standard Drawings.
- x. Geotechnical Manual for Slopes, 2nd Edition (1984).
- y. Transport Planning and Design Manual.
- z. Stormwater Drainage Manual, Planning, Design and Management, Fourth Edition, May 2013, Drainage Services Department.
- a. Practice Notes for Authorized Persons, Registered Structural Engineers and Registered Geotechnical Engineers (PNAP), Buildings Department.
- b. Code of Practice 101 for Distribution Substation Design (COP101)
- c. Design recommendations for multi-storey and underground car parks (Fourth edition) 2011, The Institution of Structural Engineers.
- d. Technical Circular (Works) No.2/2020, Development Bureau
- e. (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.

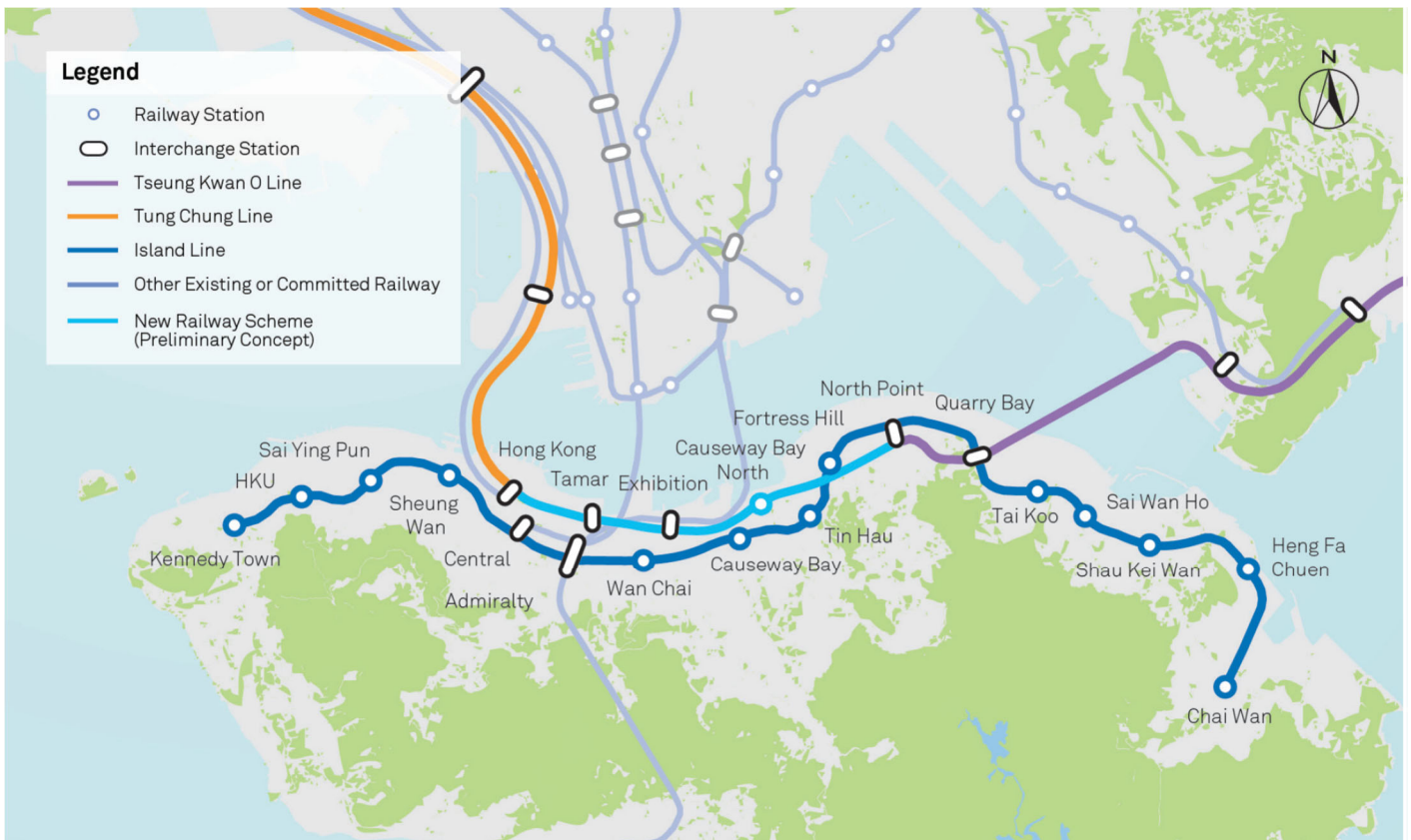
7. COMMONLY USED DESIGN SOFTWARE

The following design software 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

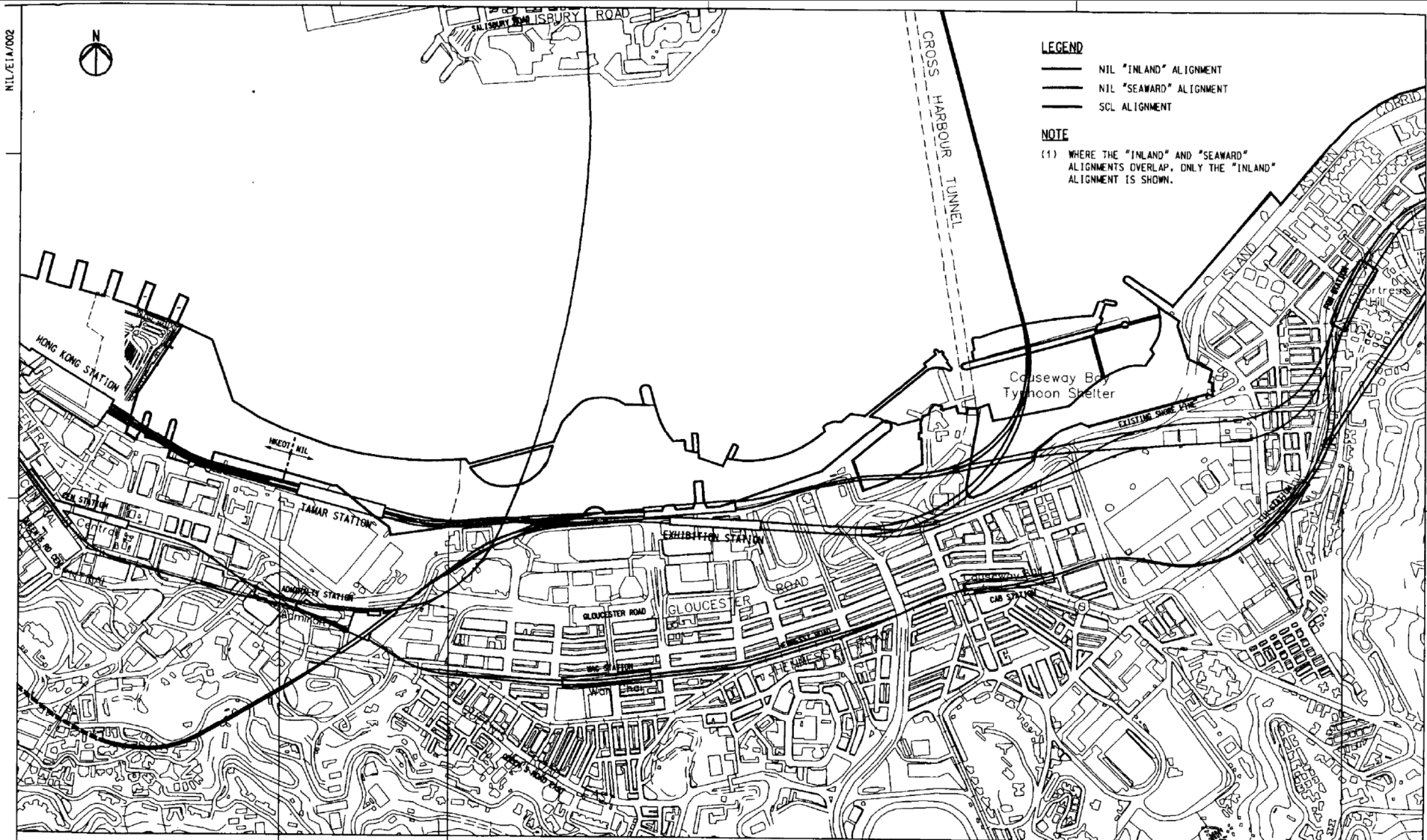
End of Text

Appendix A



Conceptual scheme of the North Island Line

Appendix B



LEGEND

- NIL "INLAND" ALIGNMENT
- NIL "SEAWARD" ALIGNMENT
- SCL ALIGNMENT

NOTE

(1) WHERE THE "INLAND" AND "SEAWARD" ALIGNMENTS OVERLAP, ONLY THE "INLAND" ALIGNMENT IS SHOWN.

NIL PRELIMINARY DESIGN CONSULTANCY AGREEMENTS

NEX/045

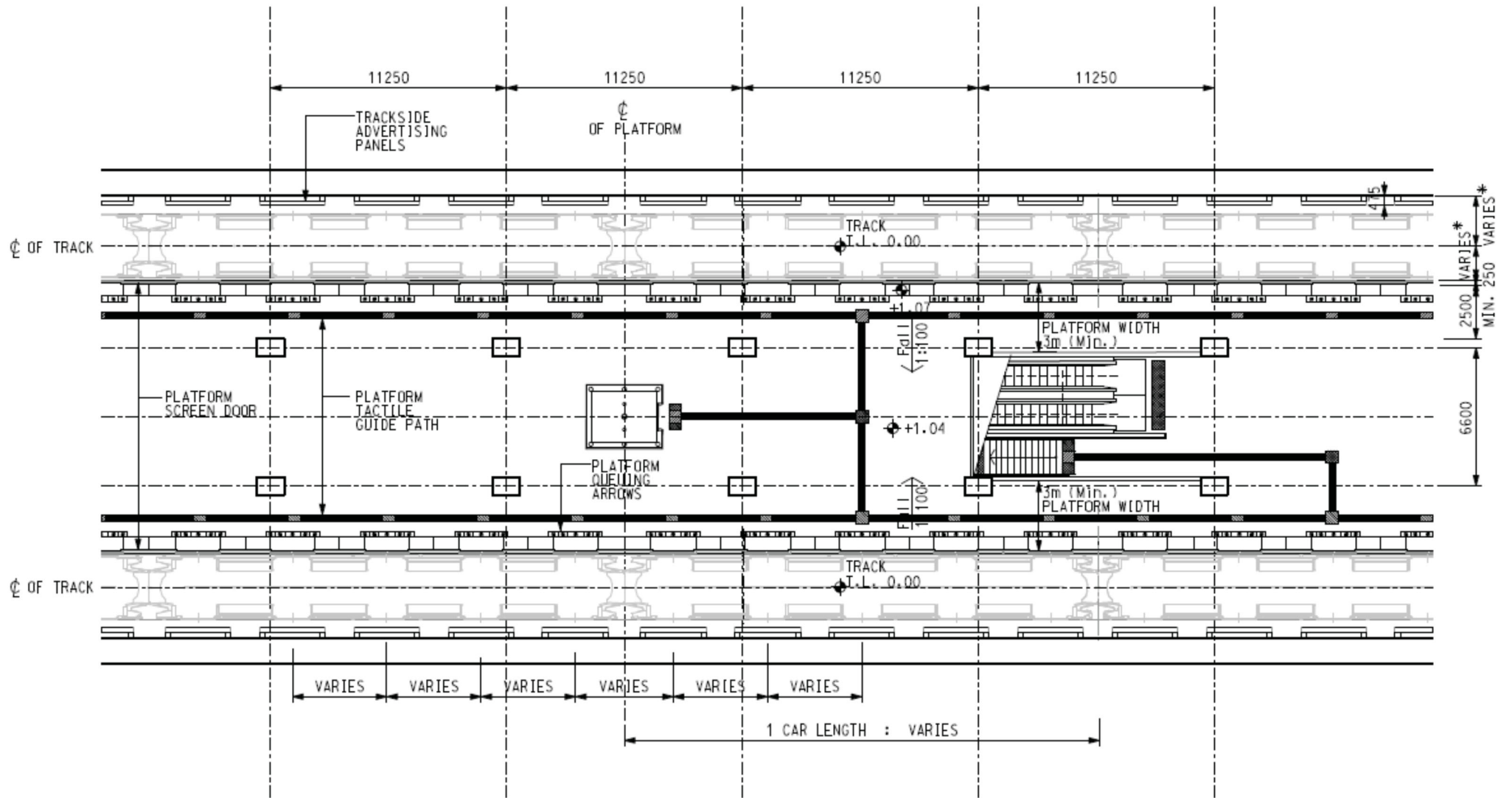
NEX/046

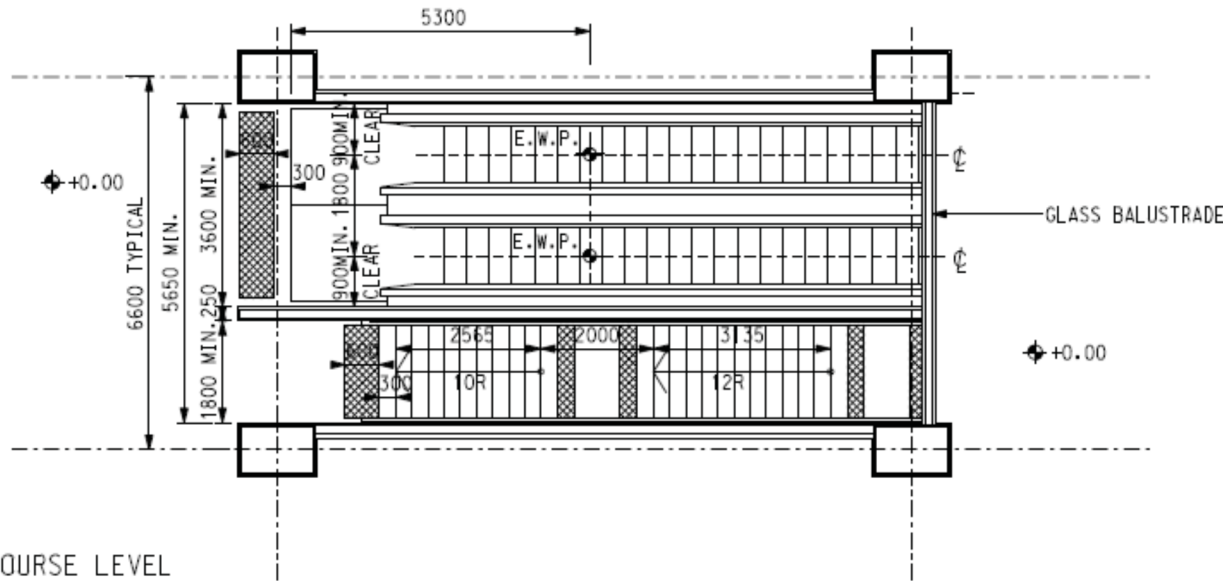
REVISION	DESCRIPTION	BY	DATE	APPROVED	IN THE NAME OF THE CLIENT

© AND ALL RIGHTS RESERVED BY THE CLIENT. NO PART OF THIS DOCUMENT OR THE INFORMATION CONTAINED HEREIN IS TO BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM, WITHOUT THE WRITTEN PERMISSION OF THE CLIENT.

MTRC PROJECT DIVISION		地鐵公司 MTR Corporation		MTR TOWER TILFORD PLAZA - HONGKONG BAY HONG KONG TEL : 8523 2111 FAX : 2728 8882	
ORIGINATOR MTR Corporation PROJECT DIVISION	DESIGN MANAGEMENT (LWS-14)	TITLE NORTH HONG KONG ISLAND LINE LOCATION PLAN (SCL VIA EXH/ADM)	SCALE 1:10000	CNO REF NILE1A02-DGN	AS BUILT APPROVED
			DATE 16 AUG 2000	AS BUILT DRAW NO	
			DRAWN DESIGNED	DRAWING NO NIL/E1A/002	REV
			CHECKED APPROVED		

DRAWN BY: [Name]

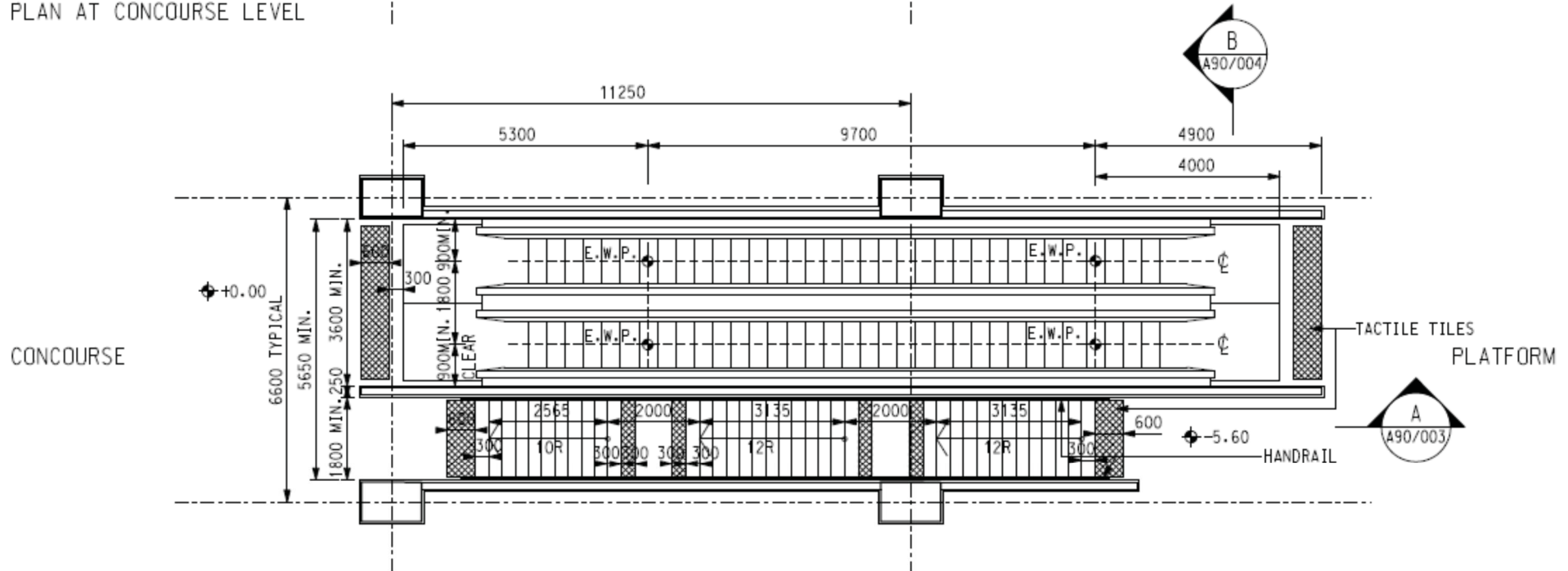




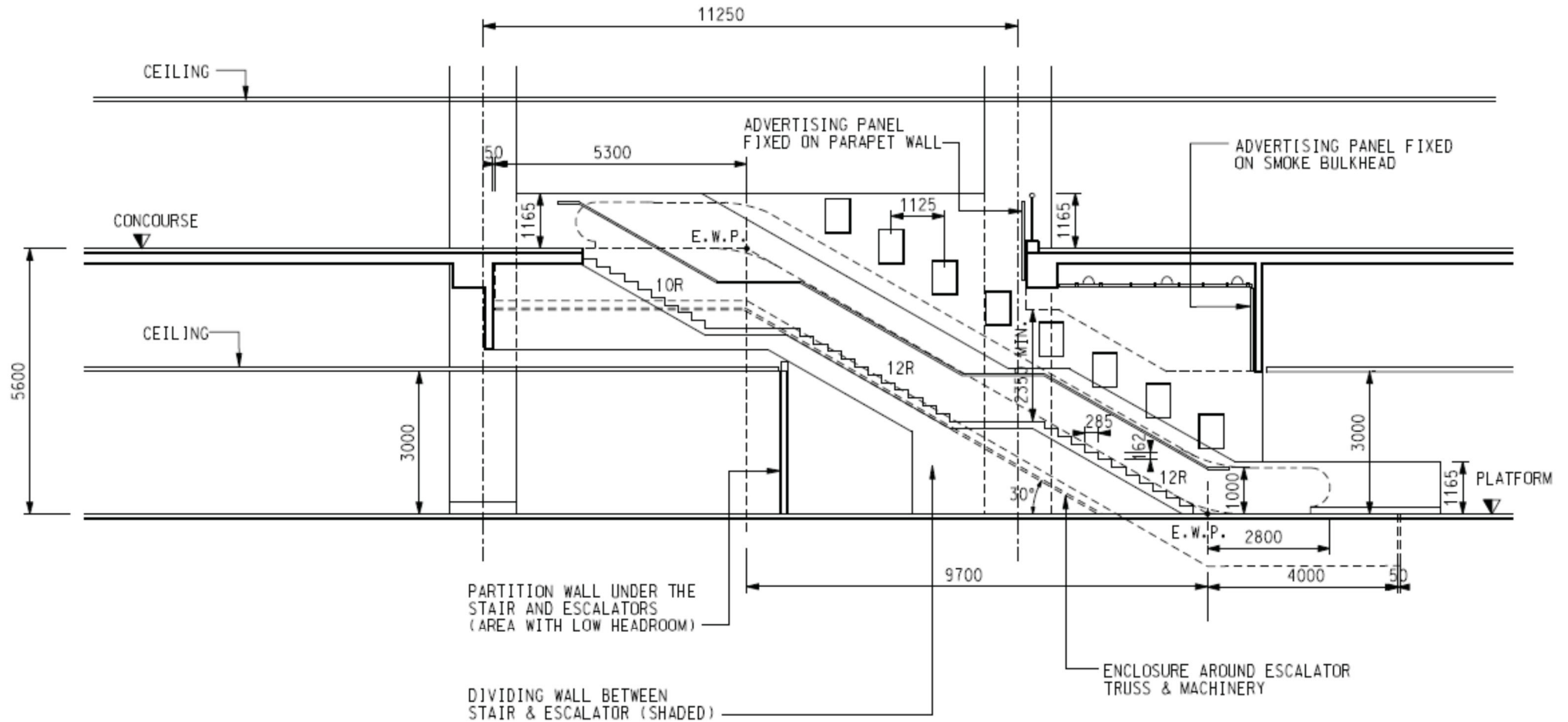
NOTES:

1. DIMENSIONS ARE MEASURED BETWEEN FINISHES.
2. MINIMUM CLEARANCE SPECIFIED FOR ESCALATORS SHALL BE MAINTAINED ALONG THEIR LENGTHS FREE OF ANY OBSTRUCTIONS OR PROJECTIONS FROM ADJACENT WALL.

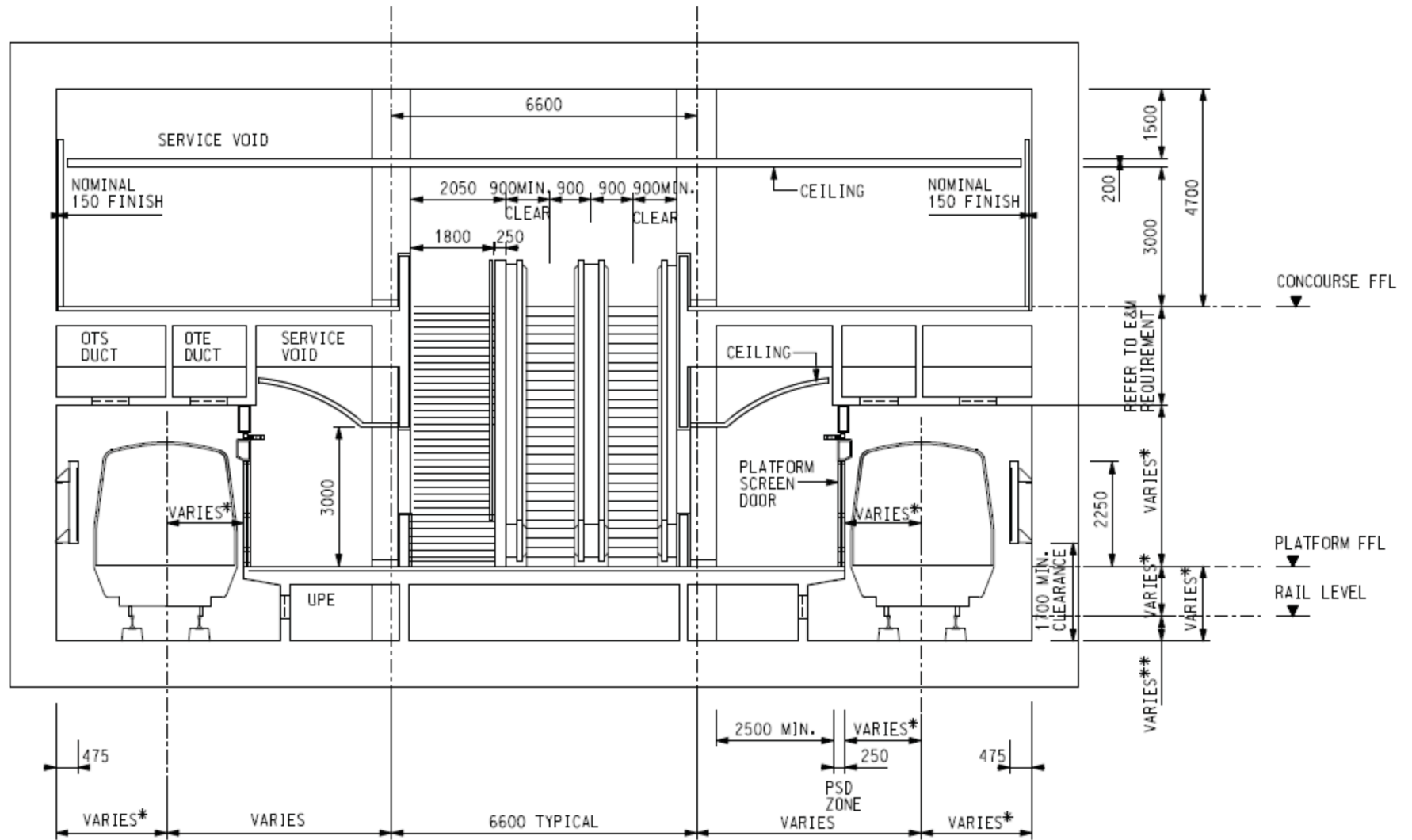
PLAN AT CONCOURSE LEVEL



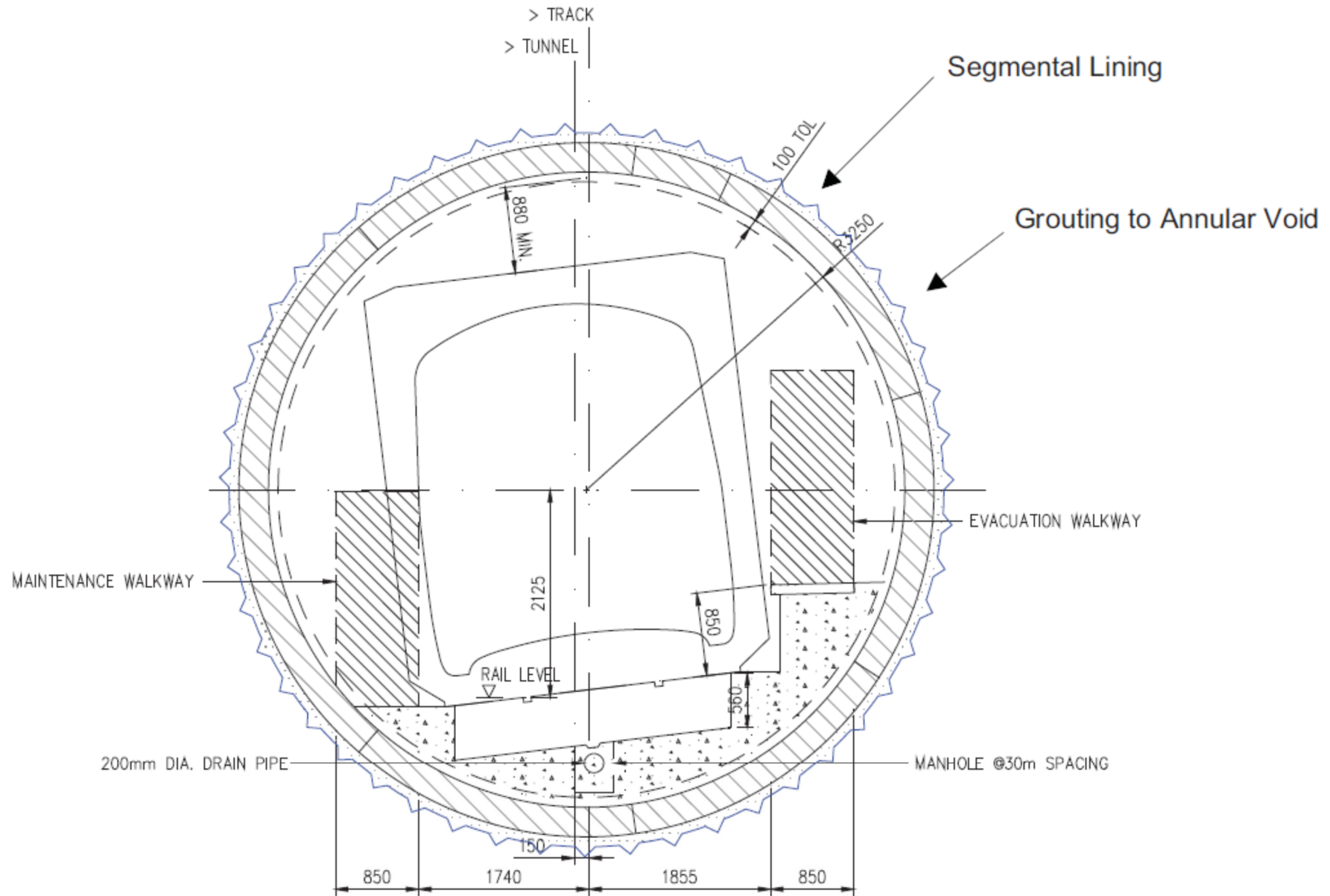
PLAN SHOWING ENTIRE ESCALATORS & STAIR ARRANGEMENT FROM CONCOURSE LEVEL TO PLATFORM LEVEL

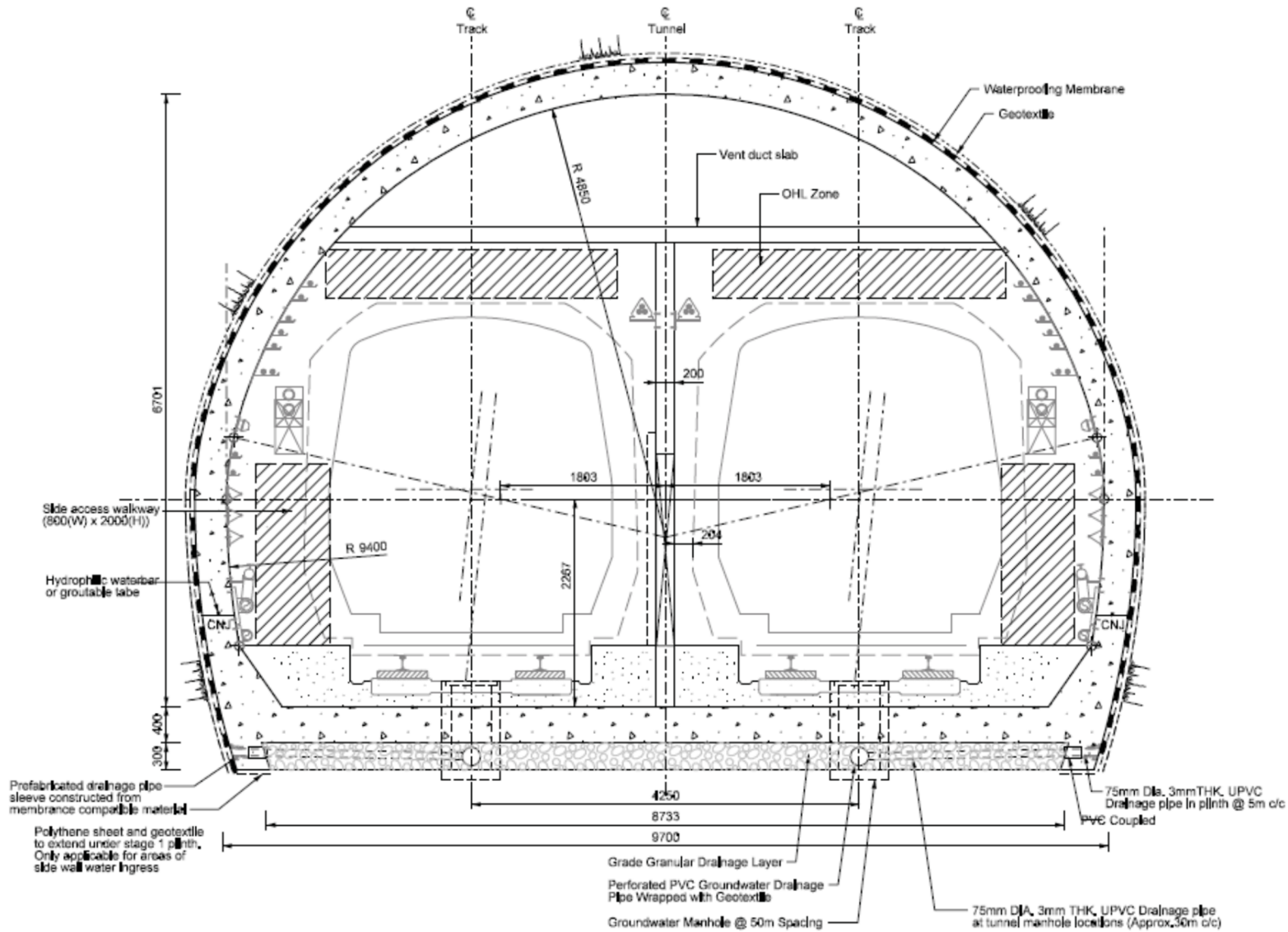


SECTION A



SECTION B










Tunnel Permanent Lining

Case	Q-Value Range	Permanent Lining Thickness t (mm)
1	$Q > 3.0$	350
2	$0.3 < Q \leq 3.0$	400
3	$0.1 < Q \leq 0.3$	500 (R.C.)
4	$0.01 < Q < 0.1$	600 (R.C.)

Legend :

-  Waterproofing membrane with protective geotextile liner
-  Permanent concrete
-  Mass concrete upstand
-  Construction Joint
-  Excavation Line and Temporary Support

