DeSPACE (International) Limited

Date: 24th May 2024

Secretary, Town Planning Board
15/F, North Point Government Offices
333 Java Road, North Point, Hong Kong

Dear Sir/Madam,

SECTION 16 APPLICATION
TOWN PLANNING ORDINANCE (CHAPTER 131)

****

SUBMISSION OF APPLICATION FOR PERMISSION UNDER SECTION 16 OF THE TOWN PLANNING ORDINANCE (CAP. 131) FOR PROPOSED EXHIBITION HALL AND SHOP AND SERVICES IN "OTHER SPECIFIED USES" ANNOTATED "PIER" ZONE, PREMISES AT UPPER DECK, HUNG HOM (NORTH) FERRY PIER, HUNG HOM

Planning Application No. A/K9/287

<u>Further Information (2) – Technical Clarifications</u>

Reference is made to the captioned Section 16 planning application. In order to address the departmental comments of Architectural Services Department (ASD), Civil Engineering and Development Department (CEDD) and the Planning Department (PlanD) regarding the captioned application, attached please find the table of responses-to-comments (R to C) and the updated Structural Proposal (Annex 1 refers). **<u>No in-principle comment or no comment has been obtained from ASD and CEDD respectively before this submission</u>**. (Annex 2 refers)

Please be advised that this FI(2) should be exempted from the publication requirement and/or the recounting requirement in accordance with TPB PG-No. 32B due to the following reasons:

- The updated Structural Report is a technical clarification/response to comments of relevant Government department without changing the nature of the application, the proposed uses nor the proposed scheme;
- The updated Structural Report relates to aspects of ancillary utility installation; and
- The updated Structural Report does not involve major changes in the assumptions and methodologies, findings and proposed mitigation measures.
- The responses to PlanD involves technical clarifications only.

Should you have any queries, please feel free to contact Mr. Endy CHENG at 24933626 or myself at 35906333.

Yours faithfully,
FOR AND ON BEHALF OF
DeSPACE (INTERNATIONAL) LIMITED

Greg Lam

DeSPACE (International) Limited 構建(國際)有限公司

Town Planning Application No. A/K9/287

(Further Information 2)

Response-to-Comment Table (Departmental Comments)

Departmental Comments	Response
Email dated 29 April 2024 refers: **Property Services Manager/Kowloon City & Sai Kung, Architectural Services Department**	
Please be advised our comments on maintenance aspect of the concerned existing building structure under ArchSD's ambit arisen in consideration of the proposed works as follows:	
1. Refers Appendix 2 Structural Proposal under the Document Section 16 Town Planning Application Supplementary Planning Statement Item III Design Data, design loads including the weight and operation load of the proposed pump, design imposed load for the proposed floor usages e.g. Sprinkler Pump Room, "Exhibition Hall / Shop and Services", etc. shall be clarified. In Appendix A Calculations, the adopted "self-weight of the slab" of 10.0kPa per storey shall be substantiated with breakdown calculations;	Please note that design loads including the weight and operation load of the proposed pump, design imposed load for the proposed floor usages, Sprinkler Pump Room, "Exhibition Hall / Shop and Services", etc. are clarified in the updated Structural Proposal. For the adopted "self-weight of the slab" of 10.0kPa per storey, according to the available structural record plans, • Deck Floor slab has a thickness of 200mm（s/w=0.2*24.5=4.9kPa）; • Upper Deck Floor slab has a thickness of 175mm（s/w=0.175*24.5=4.29kPa）; • R/F slab is a thickness 150mm（s/w=0.15*24.5=3.675kPa）
2. Structural implication (e.g. the adopted finishes and partition load, etc.) for the proposed works of the concerned areas shall be assessed and clarified;	The finish load and service load of the proposed works of the concerned areas have been specified in the updated Structural Proposal.
3. Schematic structural drawings shall be included e.g. layout and details of the proposed works, connection details between the proposed works and the existing structure, etc;	Schematic structural drawings are included in Appendix C.

4. The structural drawings and report shall be endorsed by a Registered Structural Engineer;	Please note that the updated Structural Proposal has been endorsed by a Registered Structural Engineer.
6. The applicant shall be responsible for design, planning, construction, supervision of proposed works and reinstate all affected area and waterproofing layer up to the Government's satisfaction;	Noted with thanks. The applicant will be responsible for design, planning, construction, supervision of proposed works and reinstate all affected area and waterproofing layer up to the Government's satisfaction.
7. The applicant shall submit detailed layout and proposal of the proposed exhibition hall and shop and services for further comment before conducting any alteration/ addition/ improvement works to the venue. The applicant shall ensure the alteration/ addition/ improvement works shall comply all relevant statutory requirements;	Noted with thanks. The applicant will submit detailed layout and proposal of the proposed exhibition hall and shop and services to your department for further comment before conducting any alteration/ addition/ improvement works to the venue. The applicant shall ensure the alteration/ addition/ improvement works shall comply all relevant statutory requirements.
8. The applicant shall clarify if future maintenance of the completed works shall be undertaken by the applicant at his own expenses.	The future maintenance of the completed works will be undertaken by the applicant at his own expenses.

Departmental Comments	Response
Email dated 6 May 2024 refers: **Senior Property Services Manager/Kowloon City & Sai Kung, Architectural Services Department**	
(5) Noted Para. 1 in PlanD's memo dated 10.4.2024 the "... structural proposal for the additional structures (i.e. two sprinkler water tanks and a sprinkler pump room) for the proposed sprinkler system at the roof of the subject pier ..." which will affect the existing foundation of the Pier.	Results of the updated Structural Proposal confirm that the bearing capacity of all structural members, including the existing substructure of the Pier, are capable of supporting the new loading from the proposed water tanks in compliance with the requirements. The proposed addition of water tanks on the roof is structurally feasible.

Departmental Comments	Response
<u>Email dated 6 May 2024 refers:</u> **<u>Chief Engineer/Port Works, Civil Engineering and Development Department</u>**	
1. Please ask the consultant to confirm that the proposed sprinkler system at the application premises with ancillary water tanks and pump room at the roof of the subject pier will not cause any adverse impact to the structural integrity and stability of the substructure of the pier.	Results of the updated Structural Proposal confirm that the bearing capacity of all structural members, including the existing substructure of the Pier, are capable of supporting the new loading from the proposed water tanks in compliance with the requirements. The proposed addition of water tanks on the roof is structurally feasible.

Departmental Comments	Response
<u>Email dated 24 May 2024 refers:</u> **<u>District Planning Office/Kowloon, Planning Department</u>**	
According to Para. 4.4 of the Planning Statement, a passenger path will be reserved for passengers' circulations should the upper deck is required to be resumed for embarking and disembarking in the future. However, it is noted on Figure 6 that both passengers and visitors of the proposed exhibition hall and shop and services uses under the current application will share the same access under this situation. Please clarify on the followings:	
1. How will the separate access arrangement between ferry passengers and visitors to the application premises be carried out?	Subject to detailed arrangements at the time when upper deck is required to be used for passengers' circulations, the access arrangements for ferry passengers and visitors of the proposed uses will be separated by differentiated time zones of access. The ferry schedules involving the upper deck and the opening time of the proposed uses will be planned together in due course to ensure an acceptable level of order if such need arises in future. When planning the schedules, the ferry schedules will be prioritized and TD will be consulted.

2.	Will the ‘Crowd Management Point/Queueing area’ currently proposed at the Lower Deck as shown on Figure 4 be affected? Will it be required to provide a new waiting area for visitors on the Upper Deck?	The ‘Crowd Management Point/Queueing area’ currently proposed at the Lower Deck will be used for crowd management for both ferry passengers and visitors of the proposed uses to ensure an acceptable level of order in accordance with the said access arrangements.
3.	Taking into account the future passengers at the Upper Deck, will it be necessary to reduce the proposed maximum capacities of 100 people at the application premises?	The proposed maximum capacities of visitors at the application premises will be adjusted accordingly, eg. to 60, subject to detailed arrangements in future when such need arises.

Annex 1

Updated Structural Proposal

S. T. Wong & Partners Ltd
Consulting Engineers
黃成增顧問工程師有限公司

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Email	stwong@stwong.com.hk
Website	www.stwong.com.hk

PROJECT:

HUNG HOM BAY RECLAMATION PHASE II, HUNG HOM (NORTH) FERRY PIER, HONG KONG

Structural Proposal
May 2024

Title	AP/RSE
Name	Wong Shing Tsang (RSE 12/00)
Signature	
Date	22 May 2024

WONG SHING TSANG
REGISTERED STRUCTURAL ENGINEER
BEng CEng MIStructE MHKIE RPE
RSE 12/00

TABLE OF CONTENTS

I. *Introduction*

This report presents a structural appraisal calculation for addition of a proposed sprinkler water tank and sprinkler pump on the roof floor, and usage changes at G/F & 1/F (Former MD/F & UD/F) from Pier deck to exhibition hall of Hung Hom (North) Ferry Pier, Hung Hom, Kowloon, Hong Kong.

II. *Relevance Regulations and Code of Practices for Checking*

The design of the steel frame under the newly added water tank shall be carried out in strict compliance with, but not limited to the following:

- Hong Kong Building (Construction) Regulation
- Code of Practice for the Structural Use of Steel –2011
- Code of Practice for Structural Use of Concrete – 2013
- Code of Practice for Dead and Imposed Load – 2011
- Code of Practice on Wind Effects in Hong Kong – 2019

The feasibility study of existing building all structural members shall be carried out in strict compliance with, but not limited to the following:

- Building Construction Regulations
- Code of Practice For Structural Use of Concrete Hong Kong - 1987

III. Design Data

1.1 Dead Load:

Reinforced Concrete Self-weight = 24.5 kN/m^3,

Water Density =10 kN/m^3,

Sprinkler Water Tank Self-weight = 2150kg,

Sprinkler Pumps Self-weight in total= 2600kg,

Finishing at G/F & 1/F = 1.5kPa ; Service st G/F & 1/F = 0.5kPa

1.2 Live Load at G/F & 1/F = 5.0kPa ;R/F = 2.0kPa

1.3 Wind Pressure: Water Tank = 3.62kPa

Effective height = 13.65m, Qo,z = 2.08kPa, Cp = 2.0, Ss = 1.024, $L_{0.5p}$ = 10

IV. Existing Structural Data

a). Concrete Grade of structural elements to be designed concrete mix with following minimum strength at 28 days and maximum size of aggregate 20mm:

Column, wall, beam, slab and staircases - 40MPa

b). All reinforcement bars to be High Yield Steel Bars ,Yield stress =Fy=210 N/mm^2;

c). Concrete Cover:

40mm above +4.000 Chart Datum (C.D.)

60mm at or below +4.000 C.D.

75mm bottom of pile cap unless otherwise specified.

d). All reinforcement to comply with B.S. 4449.

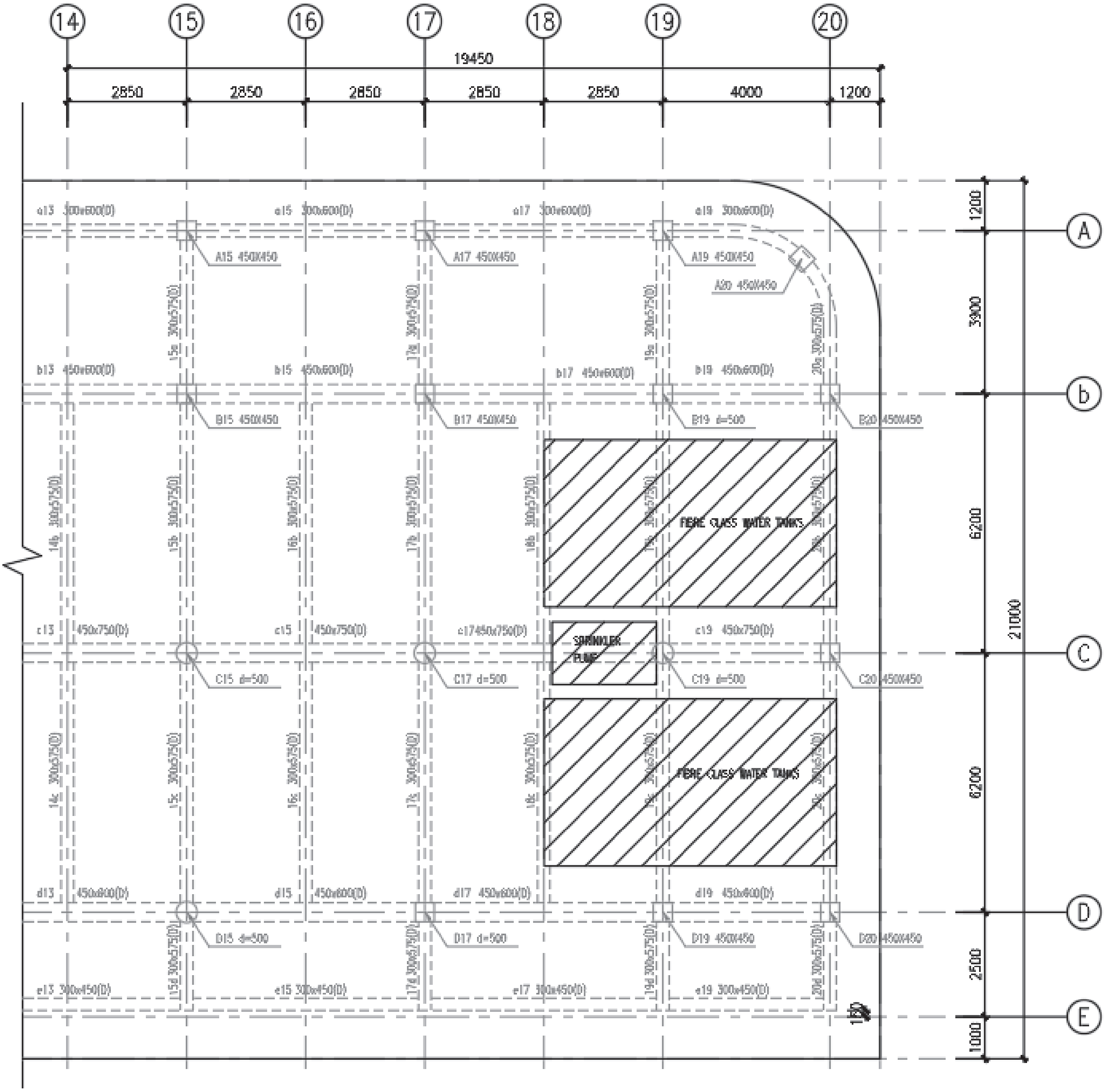
e). Existing Slab Thickness R/F= 150mm， Upper Deck level (1/F)= 175mm , Main Deck level (G/F) = 200mm

V. Conclusion

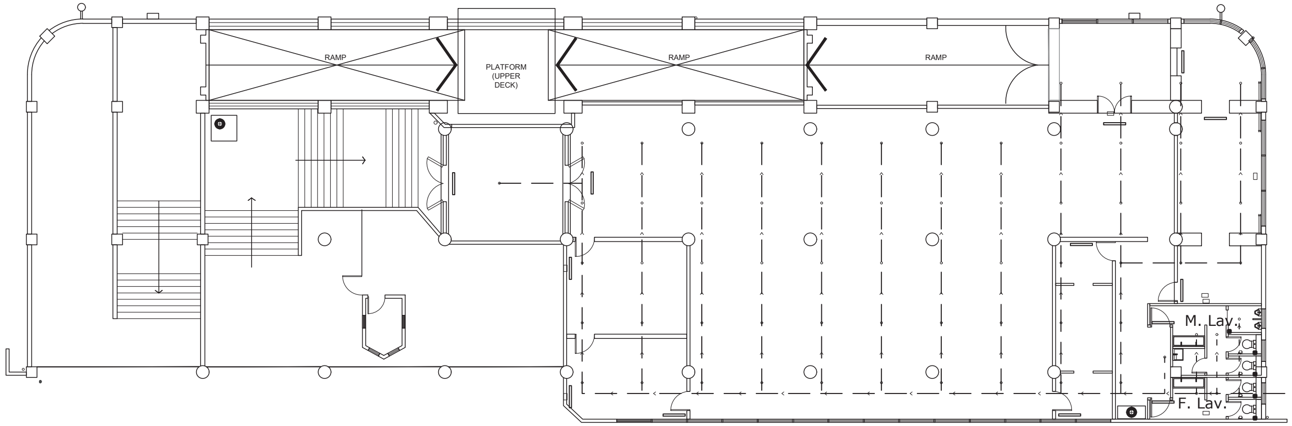
1.In conclusion, the proposed addition of water tanks on the roof is structurally feasible. Steel beams are proposed to transfer the extra load of the water tanks to the columns directly,the existing structures (columns and piles) are capable for supporting the new loading from the proposed water tanks.

2.The conversion of UD/F, MD/F into exhibition halls is structurally feasible

Appendix A
Water tank location



ROOF LAYOUT PLAN FOR WATER TANK LOCATION



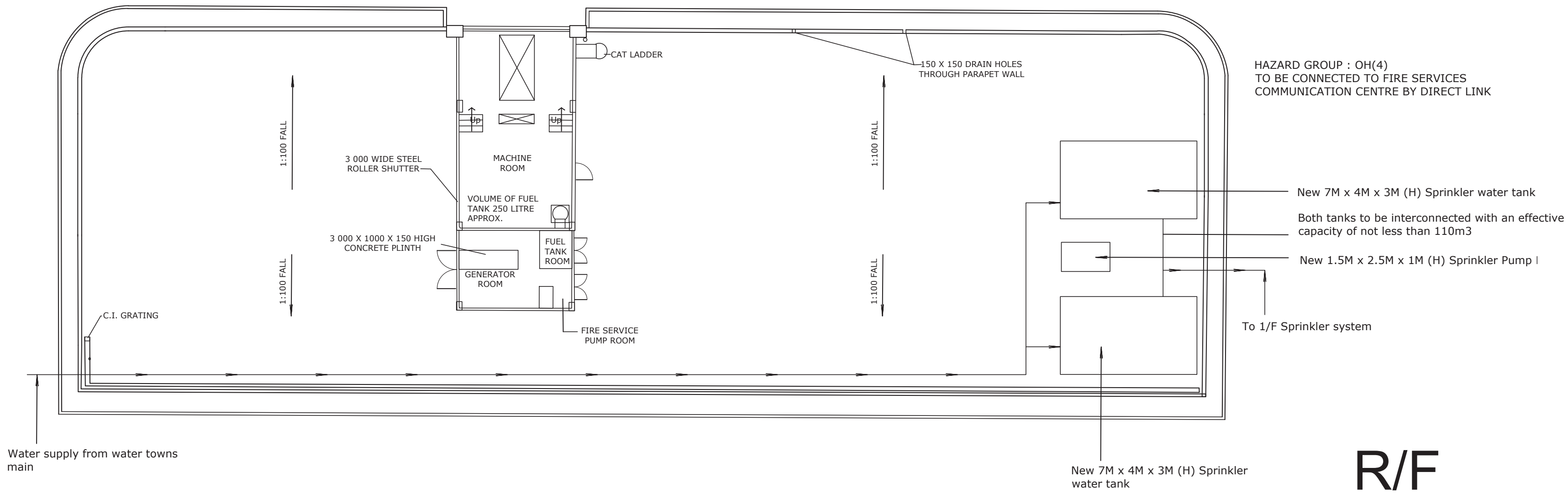
1/F

- ◦ Total 66 new fire sprinkler head
- ▭ Total 13 new Emergency light
- ▯ Total 13 new Exit sign

N

0 5m 10m

Subject to Detailed Design



R/F

DeSPACE (International) Limited	Title: Sprinkler System Proposal (Subject to Detailed Design)	Legend	Drawn By: EC	Figure No.: FI2-1
			Date: February 2024	Scale: 1:250 in A3

- Total area of rooptop structures: About 147 sq. m. (about 12%) < 50% of roof area of the floor below.
- The proposed ancillary roof-top ancillary structures do not exceed 3 metres for building with height of not more than 30 metres.
- The proposed roof-top structures shall not be counted towards the height of the buildings for the purpose of BHR under JPN no. 5.

DeSPACE (International) Limited	Title: Coverage of existing and new structures on roof-top of the Pier	Legend	Drawn By: EC	Figure No.: FI2-2
			Date: February 2024	Scale: 1:300 in A4

Appendix B
Structural Calculation

1.0 Loading

REF.	CALCULATIONS			OUTPUT

<u>Loading</u>

Loading due to two new sprinkler water tanks and sprinkler pump room

(Assume Size = 7m x 4m x 3m (H) = $84m^3$ x 2 tanks = $168m^3$ with capacity of not less than $110m^3$

Assume Size = 1.5m x 2.5m x 1m (H) = $3.75m^3$

Loading due to New Steel Platform (Assume 8.3m x 5.3m x 3.9m(H)) and New Steel Catwalk

(Assume Size = 3.35m x 0.6m)

Dead Load (D.L.), Live Load (L.L.) and Wind Load (W.L.) should be considered are as follows:

<u>D.L.: Include Self-Weight of Water Tank, steel works, etc.</u>

Assume Dead Weight of New Steel Platform with Barrier Railing	=	1.00 kPa
Self-weight of Water Tank, D.L. = 2150kg x $9.81ms^{-2}$/1000/(7x4)	=	0.75 kPa
Self-weight of sprinkler pump, D.L. = 2600kg x $9.81ms^{-2}$/1000/(1.5›	=	6.80 kPa

<u>L.L.: Imposed Load for Roof and Water Load</u>

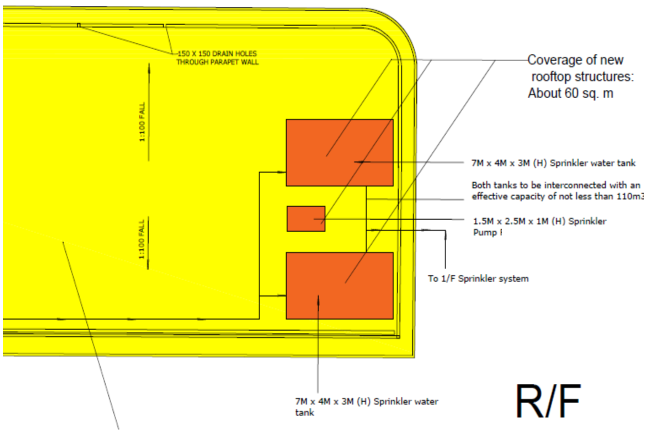
Water Load （max）

For the water tanks, water height = 2m

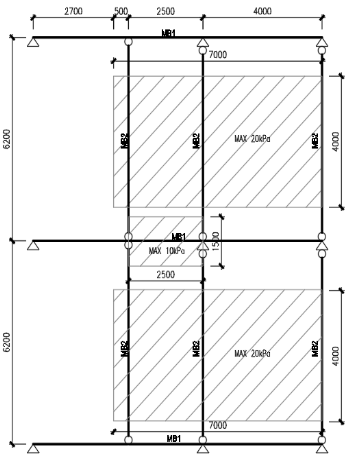
= 2m x $10kN/m^3$	=	20.0 kpa

For the 1.5mx2.5mx1m pump, working load

	=	7.5 kpa



R/F



<u>W.L: Wind force acting on sprinkler water tank</u>

Breadth of the sprinkler water tank	=	4.000 m
Height of the sprinkler water tank	=	3.000 m
Pressure coefficient (C_p)	=	2.000
Effective height (Z_e)	=	13.650 m
Design wind reference pressure ($Q_{o,z}$)		
= 3.7 x $(13.65/500)^{0.16}$	=	2.080 kPa
Topography factor (S_t)	=	1.000
The wind directionality factor (S_θ)	=	0.850
Design wind pressure (Q_z)		
= $Q_{o,z}$ x S_t x S_θ = 2.08 x 1 x 0.85	=	1.768 kPa
Size of loaded area ($L_{0.5p}$)		
= (7x2+3x2) / 2	=	10.000 m
Size factor (S_s)		
= exp(0.17-0.07x$10^{0.32}$)	=	1.024
Design wind pressure (P)		
= Q_z x C_p x S_s = 1.768x 2.0 x1.024	=	3.620 kPa

S. T. Wong & Partners Ltd Consulting Engineers	Project	Structural Study for the Existing Ferry Pier To Kwa Wan (DeSpace)		
Sectior	R/F PLAN Additional loading -2	Rev.		Page:
Subjec		Date		

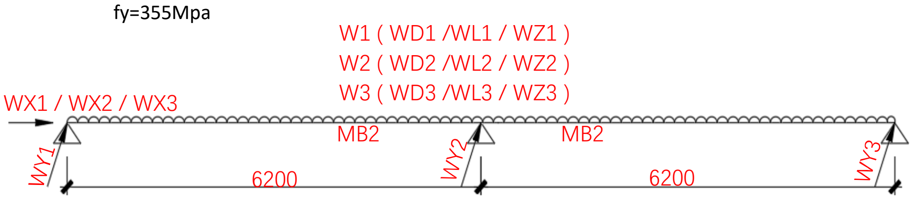
REF.	CALCULATIONS	OUTPUT

Steel beams are arranged under the water tank

take: MB1: UC 356x406x287

MB2: UC 305x305x158

fy=355Mpa



Dead Load (D.L.)

W_{D1}（DL）=0.75kpa x (2.5/2+0.5)m =1.31 kN/m

W_{D2}（DL）=0.75kpa x ((4+2.5)/2)m =2.44 kN/m

W_{D3}（DL）=0.75kpa x (4/2)m =1.5 kN/m

W_{Dp}（DL）=6.8kpa x (2.5/2)m =8.5 kN/m

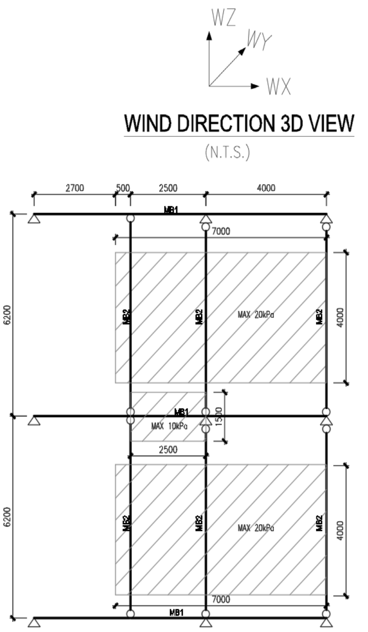
Live Load (L.L.)

W_{L1}(water)=20kpa x (2.5/2+0.5)m =35 kN/m

W_{L2}(water)=20kpa x ((4+2.5)/2)m =65 kN/m

W_{L3}(water)=20kpa x (4/2)m =40 kN/m

W_{Lp}(water)=7.5kpa x (2.5/2)m =9.38 kN/m



Wind Load (W.L.)

for water tank

Wz

Wz1(wind water tank)=3.62kpa x (2.5/2+0.5)m =6.34 KN/n

Wz2(wind water tank)=3.62kpa x ((4+2.5)/2)m =11.77 KN/

Wz3(wind water tank)=3.62kpa x (4/2)m =7.24 KN/m

Wzp(wind water tank)=3.62kpa x (2.5/2)m =4.53 KN/m

Wy

Wy1(wind water tank)=3.62kpa x(3m x 7m) x ((2.5m/2+0.5m)/7m) =19.01kN

Wy2(wind water tank)=3.62kpa x(3m x 7m) x (((4m+2.5m)/2)/7m) =35.30kN

Wy3(wind water tank)=3.62kpa x(3m x 7m) x ((4m/2)/7m) =21.72kN

Wx

Wx1(wind water tank)=3.62kpa x 3m x ((2.5m/2+0.5m)/7m) =2.72kN/m

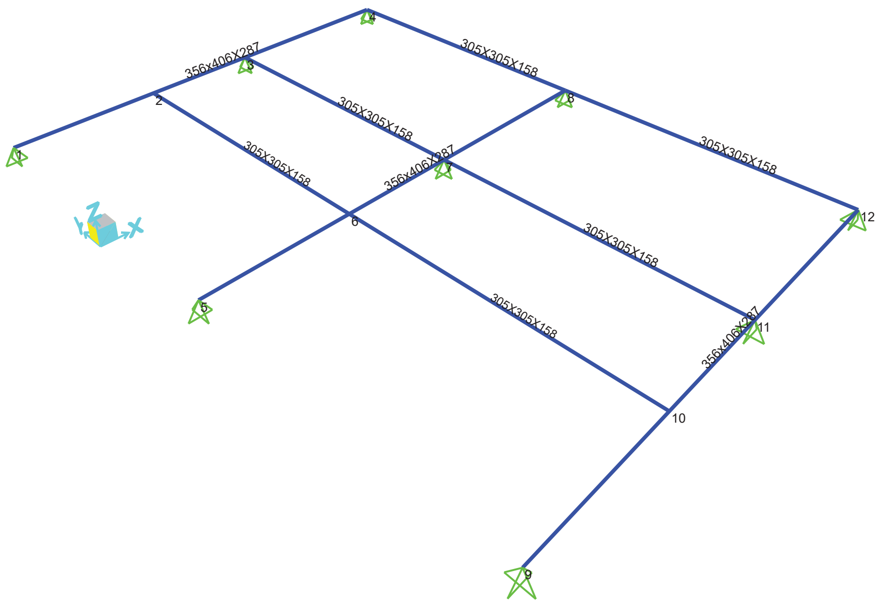
Wx2(wind water tank)=3.62kpa x 3m x (((4m+2.5m)/2)/7m) =5.04kN/m

Wx3(wind water tank)=3.62kpa x 3m x ((4m/2)/7m) =3.10kN/m

Wxp(wind water tank)=3.62kpa x 1m x 0.5 =1.81kN/m

Calc.

2.0 R/F Feasibility calculation of new structure scheme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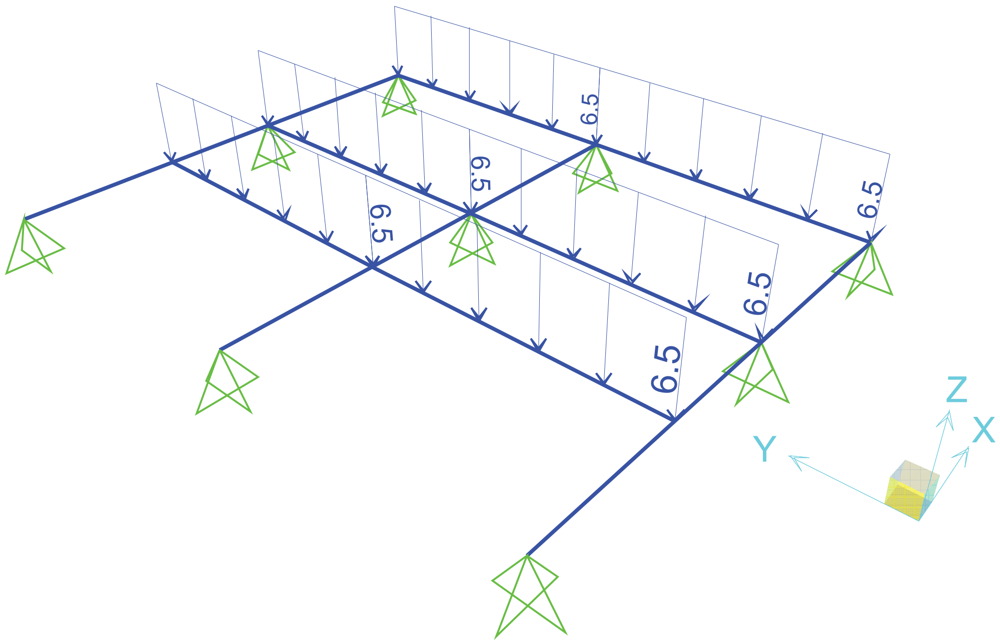
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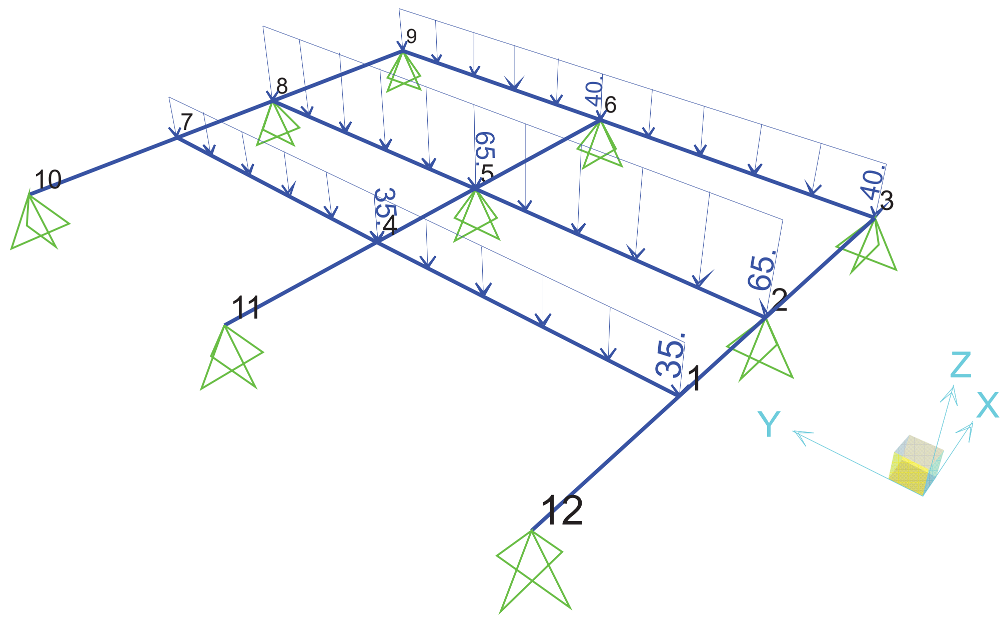
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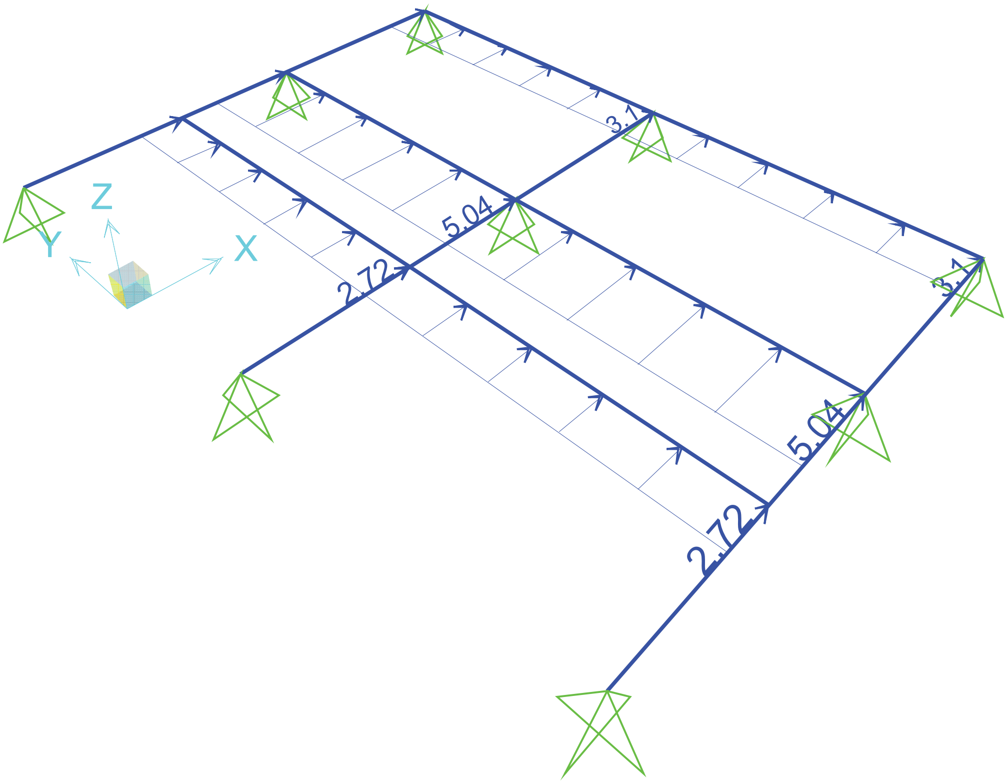
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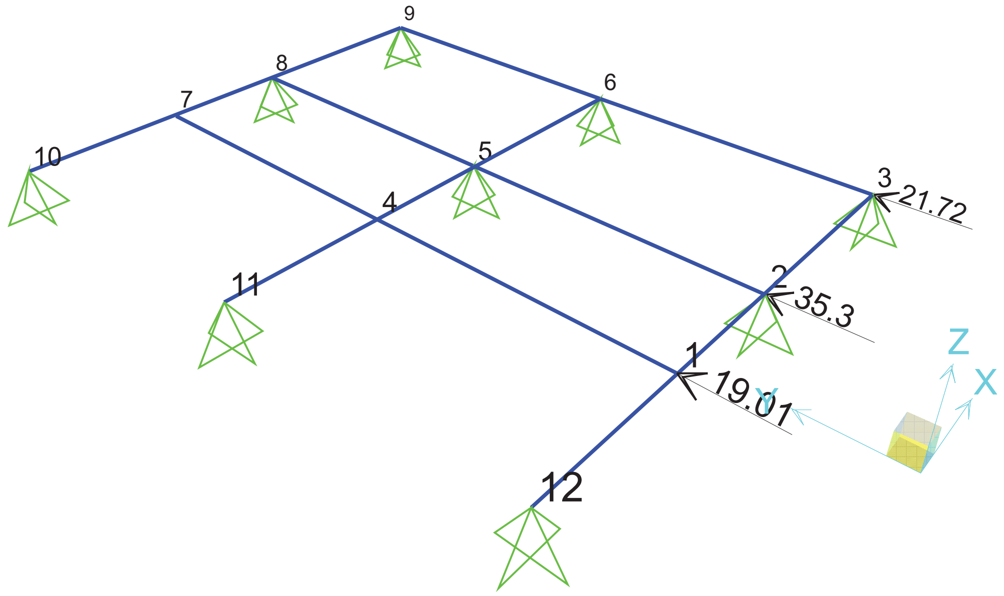
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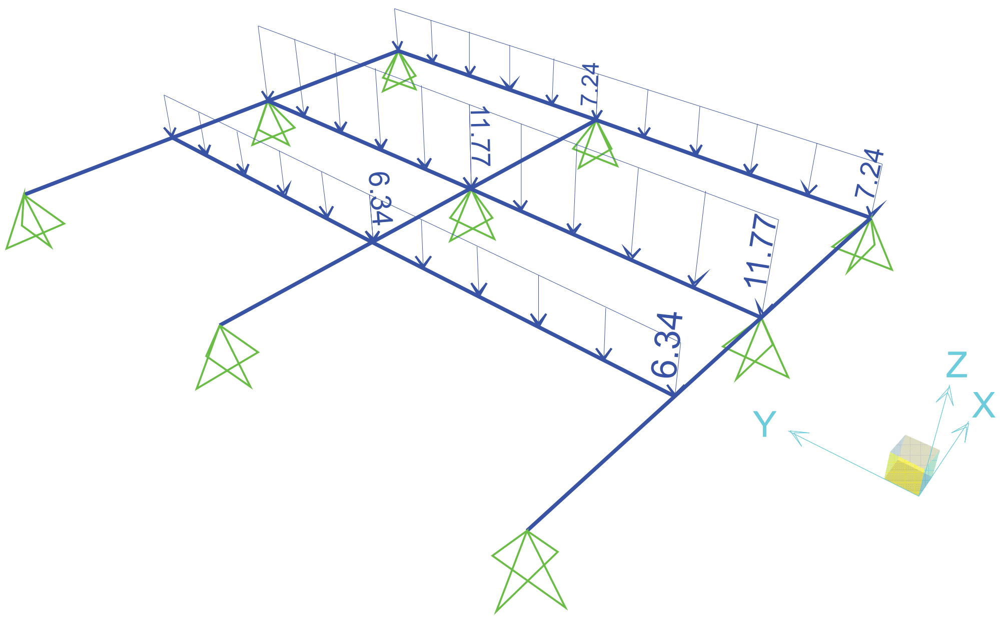
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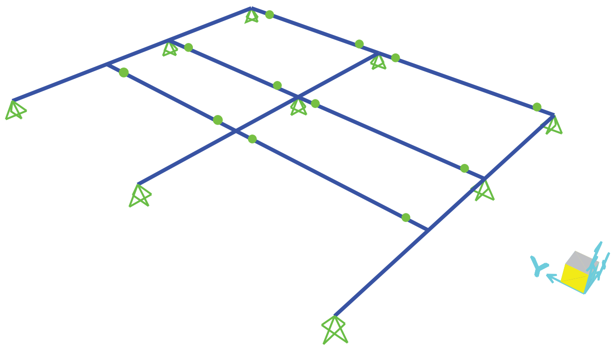

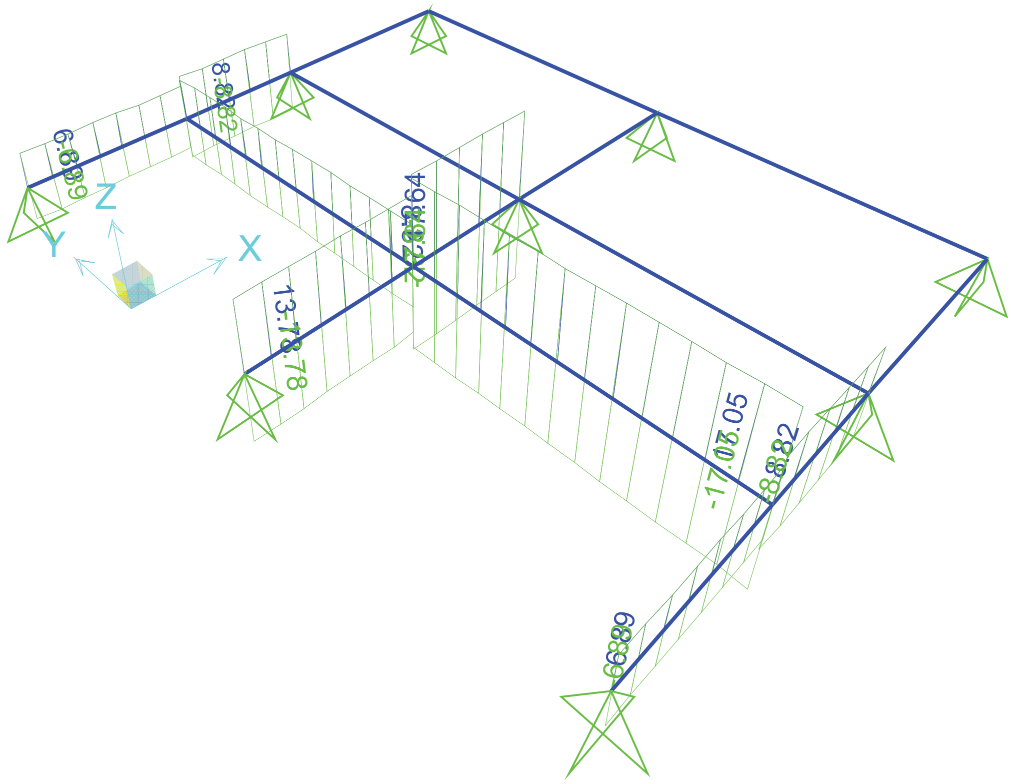
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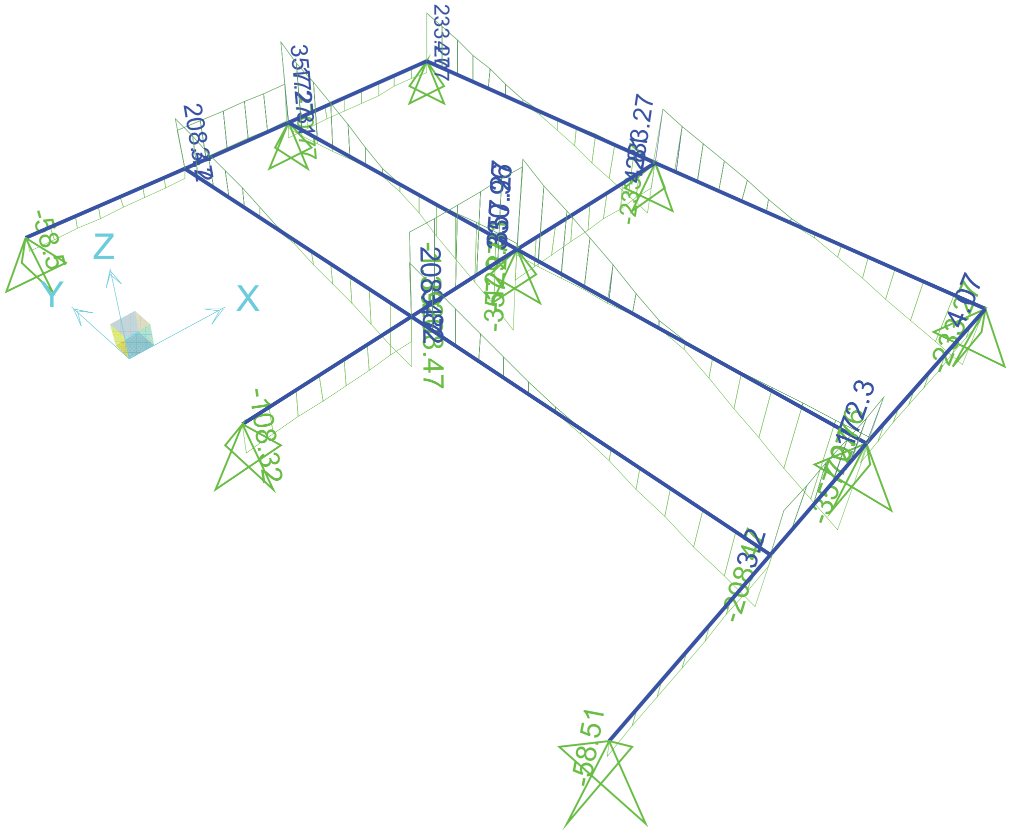
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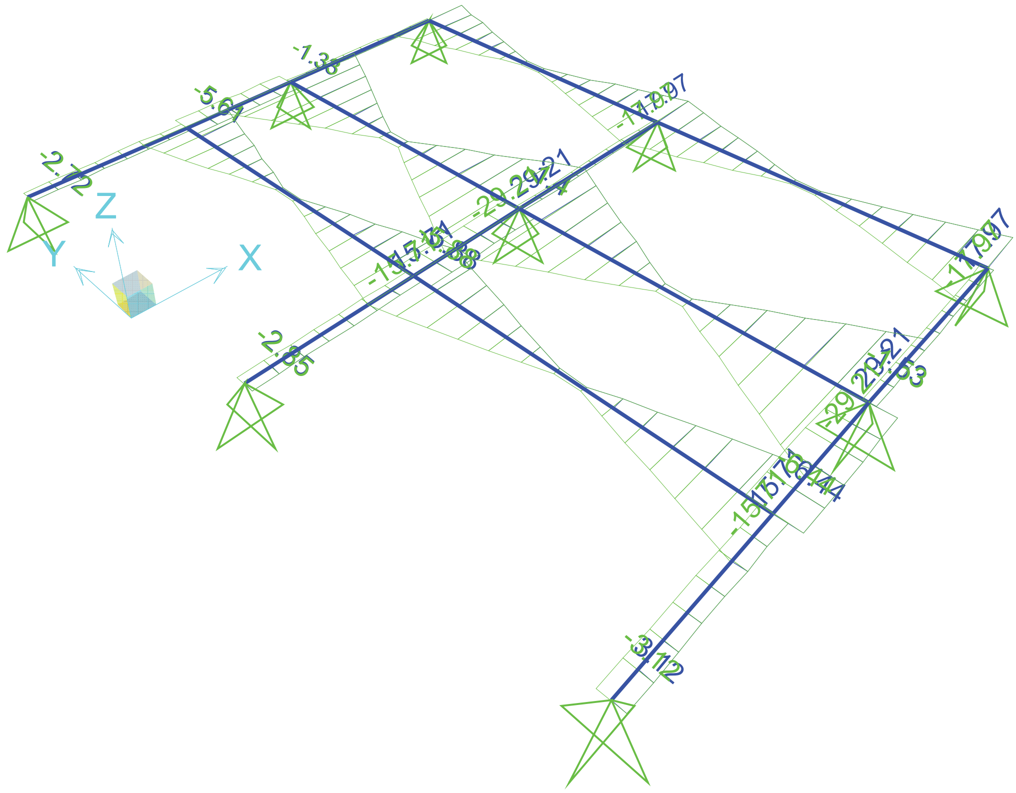
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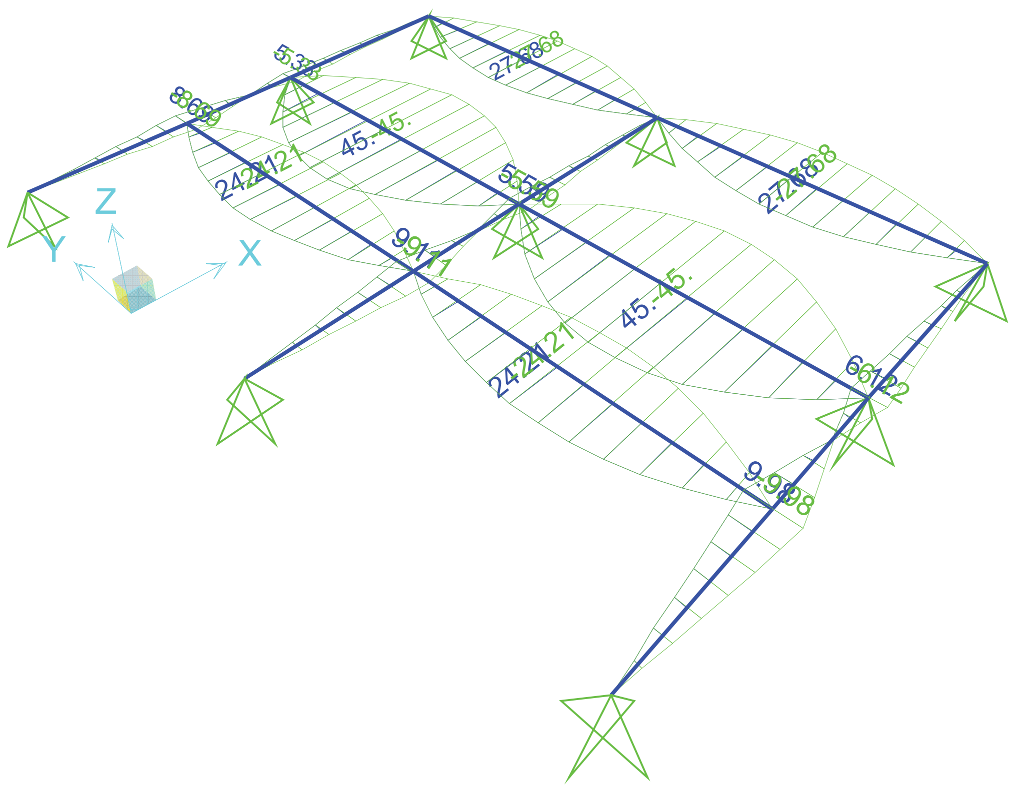
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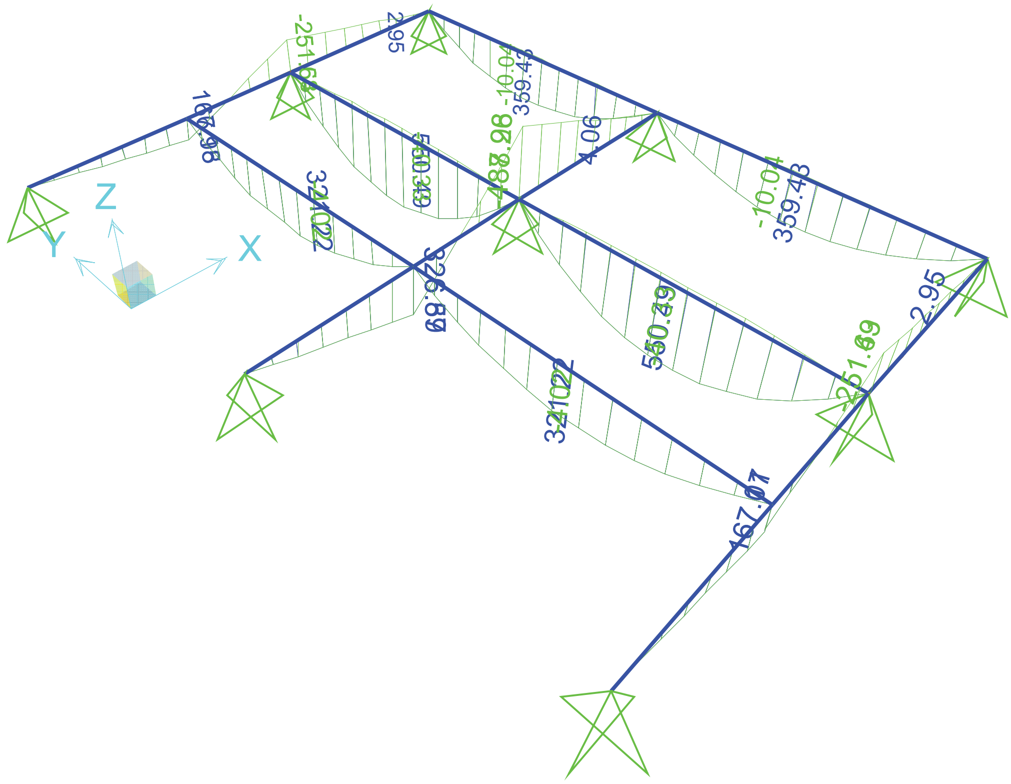
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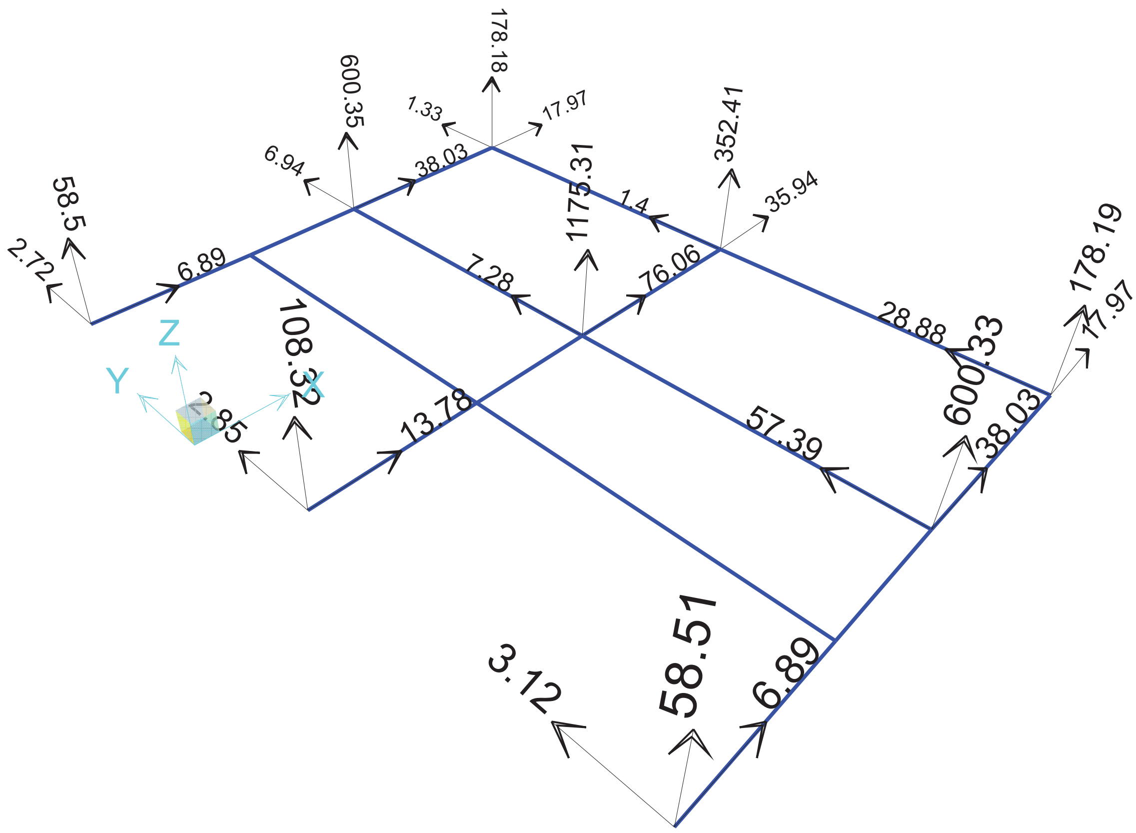
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TABLE: Element Forces - Frames-MB2

Frame	Station	OutputCase	CaseType	StepType	P	V2	V3	T	M2	M3	FrameElem	ElemStation
Text	m	Text	Text	Text	KN	KN	KN	KN-m	KN-m	KN-m	Text	m
4	0	ULS	Combination	Max	17.053	2.608	15.711	0.002	0	0	4-1	0
4	0.47692	ULS	Combination	Max	17.053	2.207	13.294	0.002	6.9165	91.7764	4-1	0.47692
4	0.95385	ULS	Combination	Max	17.053	1.806	10.877	0.002	12.6802	168.2567	4-1	0.95385
4	1.43077	ULS	Combination	Max	17.053	1.404	8.46	0.002	17.2912	229.441	4-1	1.43077
4	1.90769	ULS	Combination	Max	17.053	1.003	6.043	0.002	20.7494	275.3292	4-1	1.90769
4	2.38462	ULS	Combination	Max	17.053	0.602	3.626	0.002	23.0549	305.9213	4-1	2.38462
4	2.86154	ULS	Combination	Max	17.053	0.201	1.209	0.002	24.2076	321.2174	4-1	2.86154
4	3.33846	ULS	Combination	Max	17.053	16.036	1.209	0.002	24.2076	321.2174	4-1	3.33846
4	3.81538	ULS	Combination	Max	17.053	48.109	3.626	0.002	23.0549	305.9213	4-1	3.81538
4	4.29231	ULS	Combination	Max	17.053	80.181	6.043	0.002	20.7494	275.3292	4-1	4.29231
4	4.76923	ULS	Combination	Max	17.053	112.253	8.46	0.002	17.2912	229.441	4-1	4.76923
4	5.24615	ULS	Combination	Max	17.053	144.326	10.877	0.002	12.6802	168.2567	4-1	5.24615
4	5.72308	ULS	Combination	Max	17.053	176.398	13.294	0.002	6.9165	91.7764	4-1	5.72308
4	6.2	ULS	Combination	Max	17.053	208.471	15.711	0.002	4.44E-14	8.266E-14	4-1	6.2
4	0	ULS	Combination	Min	-17.053	-208.471	-15.711	-0.1615	0	0	4-1	0
4	0.47692	ULS	Combination	Min	-17.053	-176.398	-13.294	-0.1615	-6.9165	-1.1482	4-1	0.47692
4	0.95385	ULS	Combination	Min	-17.053	-144.326	-10.877	-0.1615	-12.6802	-2.1049	4-1	0.95385
4	1.43077	ULS	Combination	Min	-17.053	-112.253	-8.46	-0.1615	-17.2912	-2.8704	4-1	1.43077
4	1.90769	ULS	Combination	Min	-17.053	-80.181	-6.043	-0.1615	-20.7494	-3.4445	4-1	1.90769
4	2.38462	ULS	Combination	Min	-17.053	-48.109	-3.626	-0.1615	-23.0549	-3.8272	4-1	2.38462
4	2.86154	ULS	Combination	Min	-17.053	-16.036	-1.209	-0.1615	-24.2076	-4.0185	4-1	2.86154
4	3.33846	ULS	Combination	Min	-17.053	-0.201	-1.209	-0.1615	-24.2076	-4.0185	4-1	3.33846
4	3.81538	ULS	Combination	Min	-17.053	-0.602	-3.626	-0.1615	-23.0549	-3.8272	4-1	3.81538
4	4.29231	ULS	Combination	Min	-17.053	-1.003	-6.043	-0.1615	-20.7494	-3.4445	4-1	4.29231
4	4.76923	ULS	Combination	Min	-17.053	-1.404	-8.46	-0.1615	-17.2912	-2.8704	4-1	4.76923
4	5.24615	ULS	Combination	Min	-17.053	-1.806	-10.877	-0.1615	-12.6802	-2.1049	4-1	5.24615
4	5.72308	ULS	Combination	Min	-17.053	-2.207	-13.294	-0.1615	-6.9165	-1.1482	4-1	5.72308
4	6.2	ULS	Combination	Min	-17.053	-2.608	-15.711	-0.1615	-4.44E-14	-1.153E-13	4-1	6.2
5	0	ULS	Combination	Max	8.324	2.608	15.711	0.1614	0	0	5-1	0
5	0.47692	ULS	Combination	Max	8.324	2.207	13.294	0.1614	6.9165	91.7764	5-1	0.47692
5	0.95385	ULS	Combination	Max	8.324	1.806	10.877	0.1614	12.6802	168.2567	5-1	0.95385
5	1.43077	ULS	Combination	Max	8.324	1.404	8.46	0.1614	17.2912	229.441	5-1	1.43077
5	1.90769	ULS	Combination	Max	8.324	1.003	6.043	0.1614	20.7494	275.3292	5-1	1.90769
5	2.38462	ULS	Combination	Max	8.324	0.602	3.626	0.1614	23.0549	305.9213	5-1	2.38462
5	2.86154	ULS	Combination	Max	8.324	0.201	1.209	0.1614	24.2076	321.2174	5-1	2.86154
5	3.33846	ULS	Combination	Max	8.324	16.036	1.209	0.1614	24.2076	321.2174	5-1	3.33846
5	3.81538	ULS	Combination	Max	8.324	48.109	3.626	0.1614	23.0549	305.9213	5-1	3.81538
5	4.29231	ULS	Combination	Max	8.324	80.181	6.043	0.1614	20.7494	275.3292	5-1	4.29231
5	4.76923	ULS	Combination	Max	8.324	112.253	8.46	0.1614	17.2912	229.441	5-1	4.76923
5	5.24615	ULS	Combination	Max	8.324	144.326	10.877	0.1614	12.6802	168.2567	5-1	5.24615
5	5.72308	ULS	Combination	Max	8.324	176.398	13.294	0.1614	6.9165	91.7764	5-1	5.72308
5	6.2	ULS	Combination	Max	8.324	208.471	15.711	0.1614	4.44E-14	8.266E-14	5-1	6.2
5	0	ULS	Combination	Min	-8.324	-208.471	-15.711	-0.002	0	0	5-1	0
5	0.47692	ULS	Combination	Min	-8.324	-176.398	-13.294	-0.002	-6.9165	-1.1482	5-1	0.47692
5	0.95385	ULS	Combination	Min	-8.324	-144.326	-10.877	-0.002	-12.6802	-2.1049	5-1	0.95385
5	1.43077	ULS	Combination	Min	-8.324	-112.253	-8.46	-0.002	-17.2912	-2.8704	5-1	1.43077
5	1.90769	ULS	Combination	Min	-8.324	-80.181	-6.043	-0.002	-20.7494	-3.4445	5-1	1.90769
5	2.38462	ULS	Combination	Min	-8.324	-48.109	-3.626	-0.002	-23.0549	-3.8272	5-1	2.38462
5	2.86154	ULS	Combination	Min	-8.324	-16.036	-1.209	-0.002	-24.2076	-4.0185	5-1	2.86154
5	3.33846	ULS	Combination	Min	-8.324	-0.201	-1.209	-0.002	-24.2076	-4.0185	5-1	3.33846
5	3.81538	ULS	Combination	Min	-8.324	-0.602	-3.626	-0.002	-23.0549	-3.8272	5-1	3.81538
5	4.29231	ULS	Combination	Min	-8.324	-1.003	-6.043	-0.002	-20.7494	-3.4445	5-1	4.29231
5	4.76923	ULS	Combination	Min	-8.324	-1.404	-8.46	-0.002	-17.2912	-2.8704	5-1	4.76923
5	5.24615	ULS	Combination	Min	-8.324	-1.806	-10.877	-0.002	-12.6802	-2.1049	5-1	5.24615
5	5.72308	ULS	Combination	Min	-8.324	-2.207	-13.294	-0.002	-6.9165	-1.1482	5-1	5.72308
5	6.2	ULS	Combination	Min	-8.324	-2.608	-15.711	-0.002	-4.44E-14	-1.153E-13	5-1	6.2
6	0	ULS	Combination	Max	0	26.174	29.208	0.0018	0	0	6-1	0
6	0.47692	ULS	Combination	Max	0	22.147	24.715	0.0018	12.8585	157.2836	6-1	0.47692
6	0.95385	ULS	Combination	Max	0	18.121	20.221	0.0018	23.574	288.3533	6-1	0.95385
6	1.43077	ULS	Combination	Max	0	14.094	15.727	0.0018	32.1463	393.2091	6-1	1.43077
6	1.90769	ULS	Combination	Max	0	10.067	11.234	0.0018	38.5756	471.8509	6-1	1.90769
6	2.38462	ULS	Combination	Max	0	6.04	6.74	0.0018	42.8617	524.2787	6-1	2.38462
6	2.86154	ULS	Combination	Max	0	2.013	2.247	0.0018	45.0048	550.4927	6-1	2.86154
6	3.33846	ULS	Combination	Max	0	27.482	2.247	0.0018	45.0048	550.4927	6-1	3.33846
6	3.81538	ULS	Combination	Max	0	82.447	6.74	0.0018	42.8617	524.2787	6-1	3.81538
6	4.29231	ULS	Combination	Max	0	137.412	11.234	0.0018	38.5756	471.8509	6-1	4.29231
6	4.76923	ULS	Combination	Max	0	192.376	15.727	0.0018	32.1463	393.2091	6-1	4.76923
6	5.24615	ULS	Combination	Max	0	247.341	20.221	0.0018	23.574	288.3533	6-1	5.24615
6	5.72308	ULS	Combination	Max	0	302.306	24.715	0.0018	12.8585	157.2836	6-1	5.72308
6	6.2	ULS	Combination	Max	0	357.271	29.208	0.0018	2.508E-14	3.732E-13	6-1	6.2
6	0	ULS	Combination	Min	0	-357.271	-29.208	-0.1409	0	0	6-1	0
6	0.47692	ULS	Combination	Min	0	-302.306	-24.715	-0.1409	-12.8585	-11.5229	6-1	0.47692
6	0.95385	ULS	Combination	Min	0	-247.341	-20.221	-0.1409	-23.574	-21.1252	6-1	0.95385
6	1.43077	ULS	Combination	Min	0	-192.376	-15.727	-0.1409	-32.1463	-28.8071	6-1	1.43077
6	1.90769	ULS	Combination	Min	0	-137.412	-11.234	-0.1409	-38.5756	-34.5686	6-1	1.90769
6	2.38462	ULS	Combination	Min	0	-82.447	-6.74	-0.1409	-42.8617	-38.4095	6-1	2.38462
6	2.86154	ULS	Combination	Min	0	-27.482	-2.247	-0.1409	-45.0048	-40.33	6-1	2.86154
6	3.33846	ULS	Combination	Min	0	-2.013	-2.247	-0.1409	-45.0048	-40.33	6-1	3.33846
6	3.81538	ULS	Combination	Min	0	-6.04	-6.74	-0.1409	-42.8617	-38.4095	6-1	3.81538
6	4.29231	ULS	Combination	Min	0	-10.067	-11.234	-0.1409	-38.5756	-34.5686	6-1	4.29231
6	4.76923	ULS	Combination	Min	0	-14.094	-15.727	-0.1409	-32.1463	-28.8071	6-1	4.76923
6	5.24615	ULS	Combination	Min	0	-18.121	-20.221	-0.1409	-23.574	-21.1252	6-1	5.24615
6	5.72308	ULS	Combination	Min	0	-22.147	-24.715	-0.1409	-12.8585	-11.5229	6-1	5.72308
6	6.2	ULS	Combination	Min	0	-26.174	-29.208	-0.1409	-2.508E-14	2.443E-14	6-1	6.2
7	0	ULS	Combination	Max	0	26.174	29.208	0.1409	0	0	7-1	0
7	0.47692	ULS	Combination	Max	0	22.147	24.715	0.1409	12.8585	157.2836	7-1	0.47692
7	0.95385	ULS	Combination	Max	0	18.121	20.221	0.1409	23.574	288.3533	7-1	0.95385
7	1.43077	ULS	Combination	Max	0	14.094	15.727	0.1409	32.1463	393.2091	7-1	1.43077
7	1.90769	ULS	Combination	Max	0	10.067	11.234	0.1409	38.5756	471.8509	7-1	1.90769
7	2.38462	ULS	Combination	Max	0	6.04	6.74	0.1409	42.8617	524.2787	7-1	2.38462
7	2.86154	ULS	Combination	Max	0	2.013	2.247	0.1409	45.0048	550.4927	7-1	2.86154
7	3.33846	ULS	Combination	Max	0	27.482	2.247	0.1409	45.0048	550.4927	7-1	3.33846

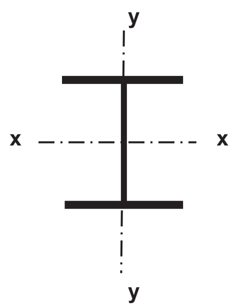
7	3.81538	ULS	Combination	Max	0	82.447	6.74	0.1409	42.8617	524.2787	7-1	3.81538
7	4.29231	ULS	Combination	Max	0	137.412	11.234	0.1409	38.5756	471.8509	7-1	4.29231
7	4.76923	ULS	Combination	Max	0	192.376	15.727	0.1409	32.1463	393.2091	7-1	4.76923
7	5.24615	ULS	Combination	Max	0	247.341	20.221	0.1409	23.574	288.3533	7-1	5.24615
7	5.72308	ULS	Combination	Max	0	302.306	24.715	0.1409	12.8585	157.2836	7-1	5.72308
7	6.2	ULS	Combination	Max	0	357.271	29.208	0.1409	2.508E-14	3.732E-13	7-1	6.2
7	0	ULS	Combination	Min	0	-357.271	-29.208	-0.0018	0	0	7-1	0
7	0.47692	ULS	Combination	Min	0	-302.306	-24.715	-0.0018	-12.8585	-11.5229	7-1	0.47692
7	0.95385	ULS	Combination	Min	0	-247.341	-20.221	-0.0018	-23.574	-21.1252	7-1	0.95385
7	1.43077	ULS	Combination	Min	0	-192.376	-15.727	-0.0018	-32.1463	-28.8071	7-1	1.43077
7	1.90769	ULS	Combination	Min	0	-137.412	-11.234	-0.0018	-38.5756	-34.5686	7-1	1.90769
7	2.38462	ULS	Combination	Min	0	-82.447	-6.74	-0.0018	-42.8617	-38.4095	7-1	2.38462
7	2.86154	ULS	Combination	Min	0	-27.482	-2.247	-0.0018	-45.0048	-40.33	7-1	2.86154
7	3.33846	ULS	Combination	Min	0	-2.013	-2.247	-0.0018	-45.0048	-40.33	7-1	3.33846
7	3.81538	ULS	Combination	Min	0	-6.04	-6.74	-0.0018	-42.8617	-38.4095	7-1	3.81538
7	4.29231	ULS	Combination	Min	0	-10.067	-11.234	-0.0018	-38.5756	-34.5686	7-1	4.29231
7	4.76923	ULS	Combination	Min	0	-14.094	-15.727	-0.0018	-32.1463	-28.8071	7-1	4.76923
7	5.24615	ULS	Combination	Min	0	-18.121	-20.221	-0.0018	-23.574	-21.1252	7-1	5.24615
7	5.72308	ULS	Combination	Min	0	-22.147	-24.715	-0.0018	-12.8585	-11.5229	7-1	5.72308
7	6.2	ULS	Combination	Min	0	-26.174	-29.208	-0.0018	-2.508E-14	2.443E-14	7-1	6.2
8	0	ULS	Combination	Max	0	6.514	17.968	0.0004965	0	0	8-1	0
8	0.47692	ULS	Combination	Max	0	5.512	15.203	0.0004965	7.91	102.6943	8-1	0.47692
8	0.95385	ULS	Combination	Max	0	4.51	12.439	0.0004965	14.5017	188.2728	8-1	0.95385
8	1.43077	ULS	Combination	Max	0	3.508	9.675	0.0004965	19.775	256.7357	8-1	1.43077
8	1.90769	ULS	Combination	Max	0	2.505	6.911	0.0004965	23.73	308.0828	8-1	1.90769
8	2.38462	ULS	Combination	Max	0	1.503	4.146	0.0004965	26.3667	342.3142	8-1	2.38462
8	2.86154	ULS	Combination	Max	0	0.501	1.382	0.0004965	27.685	359.43	8-1	2.86154
8	3.33846	ULS	Combination	Max	0	17.944	1.382	0.0004965	27.685	359.43	8-1	3.33846
8	3.81538	ULS	Combination	Max	0	53.832	4.146	0.0004965	26.3667	342.3142	8-1	3.81538
8	4.29231	ULS	Combination	Max	0	89.719	6.911	0.0004965	23.73	308.0828	8-1	4.29231
8	4.76923	ULS	Combination	Max	0	125.607	9.675	0.0004965	19.775	256.7357	8-1	4.76923
8	5.24615	ULS	Combination	Max	0	161.495	12.439	0.0004965	14.5017	188.2728	8-1	5.24615
8	5.72308	ULS	Combination	Max	0	197.383	15.203	0.0004965	7.91	102.6943	8-1	5.72308
8	6.2	ULS	Combination	Max	0	233.271	17.968	0.0004965	3.202E-14	2.979E-13	8-1	6.2
8	0	ULS	Combination	Min	0	-233.271	-17.968	-0.0397	0	0	8-1	0
8	0.47692	ULS	Combination	Min	0	-197.383	-15.203	-0.0397	-7.91	-2.8677	8-1	0.47692
8	0.95385	ULS	Combination	Min	0	-161.495	-12.439	-0.0397	-14.5017	-5.2575	8-1	0.95385
8	1.43077	ULS	Combination	Min	0	-125.607	-9.675	-0.0397	-19.775	-7.1693	8-1	1.43077
8	1.90769	ULS	Combination	Min	0	-89.719	-6.911	-0.0397	-23.73	-8.6031	8-1	1.90769
8	2.38462	ULS	Combination	Min	0	-53.832	-4.146	-0.0397	-26.3667	-9.5591	8-1	2.38462
8	2.86154	ULS	Combination	Min	0	-17.944	-1.382	-0.0397	-27.685	-10.037	8-1	2.86154
8	3.33846	ULS	Combination	Min	0	-0.501	-1.382	-0.0397	-27.685	-10.037	8-1	3.33846
8	3.81538	ULS	Combination	Min	0	-1.503	-4.146	-0.0397	-26.3667	-9.5591	8-1	3.81538
8	4.29231	ULS	Combination	Min	0	-2.505	-6.911	-0.0397	-23.73	-8.6031	8-1	4.29231
8	4.76923	ULS	Combination	Min	0	-3.508	-9.675	-0.0397	-19.775	-7.1693	8-1	4.76923
8	5.24615	ULS	Combination	Min	0	-4.51	-12.439	-0.0397	-14.5017	-5.2575	8-1	5.24615
8	5.72308	ULS	Combination	Min	0	-5.512	-15.203	-0.0397	-7.91	-2.8677	8-1	5.72308
8	6.2	ULS	Combination	Min	0	-6.514	-17.968	-0.0397	-3.202E-14	-5.074E-14	8-1	6.2
9	0	ULS	Combination	Max	0	6.514	17.968	0.0397	0	0	9-1	0
9	0.47692	ULS	Combination	Max	0	5.512	15.203	0.0397	7.91	102.6943	9-1	0.47692
9	0.95385	ULS	Combination	Max	0	4.51	12.439	0.0397	14.5017	188.2728	9-1	0.95385
9	1.43077	ULS	Combination	Max	0	3.508	9.675	0.0397	19.775	256.7357	9-1	1.43077
9	1.90769	ULS	Combination	Max	0	2.505	6.911	0.0397	23.73	308.0828	9-1	1.90769
9	2.38462	ULS	Combination	Max	0	1.503	4.146	0.0397	26.3667	342.3142	9-1	2.38462
9	2.86154	ULS	Combination	Max	0	0.501	1.382	0.0397	27.685	359.43	9-1	2.86154
9	3.33846	ULS	Combination	Max	0	17.944	1.382	0.0397	27.685	359.43	9-1	3.33846
9	3.81538	ULS	Combination	Max	0	53.832	4.146	0.0397	26.3667	342.3142	9-1	3.81538
9	4.29231	ULS	Combination	Max	0	89.719	6.911	0.0397	23.73	308.0828	9-1	4.29231
9	4.76923	ULS	Combination	Max	0	125.607	9.675	0.0397	19.775	256.7357	9-1	4.76923
9	5.24615	ULS	Combination	Max	0	161.495	12.439	0.0397	14.5017	188.2728	9-1	5.24615
9	5.72308	ULS	Combination	Max	0	197.383	15.203	0.0397	7.91	102.6943	9-1	5.72308
9	6.2	ULS	Combination	Max	0	233.271	17.968	0.0397	3.202E-14	2.979E-13	9-1	6.2
9	0	ULS	Combination	Min	0	-233.271	-17.968	-0.0004963	0	0	9-1	0
9	0.47692	ULS	Combination	Min	0	-197.383	-15.203	-0.0004963	-7.91	-2.8677	9-1	0.47692
9	0.95385	ULS	Combination	Min	0	-161.495	-12.439	-0.0004963	-14.5017	-5.2575	9-1	0.95385
9	1.43077	ULS	Combination	Min	0	-125.607	-9.675	-0.0004963	-19.775	-7.1693	9-1	1.43077
9	1.90769	ULS	Combination	Min	0	-89.719	-6.911	-0.0004963	-23.73	-8.6031	9-1	1.90769
9	2.38462	ULS	Combination	Min	0	-53.832	-4.146	-0.0004963	-26.3667	-9.5591	9-1	2.38462
9	2.86154	ULS	Combination	Min	0	-17.944	-1.382	-0.0004963	-27.685	-10.037	9-1	2.86154
9	3.33846	ULS	Combination	Min	0	-0.501	-1.382	-0.0004963	-27.685	-10.037	9-1	3.33846
9	3.81538	ULS	Combination	Min	0	-1.503	-4.146	-0.0004963	-26.3667	-9.5591	9-1	3.81538
9	4.29231	ULS	Combination	Min	0	-2.505	-6.911	-0.0004963	-23.73	-8.6031	9-1	4.29231
9	4.76923	ULS	Combination	Min	0	-3.508	-9.675	-0.0004963	-19.775	-7.1693	9-1	4.76923
9	5.24615	ULS	Combination	Min	0	-4.51	-12.439	-0.0004963	-14.5017	-5.2575	9-1	5.24615
9	5.72308	ULS	Combination	Min	0	-5.512	-15.203	-0.0004963	-7.91	-2.8677	9-1	5.72308
9	6.2	ULS	Combination	Min	0	-6.514	-17.968	-0.0004963	-3.202E-14	-5.074E-14	9-1	6.2

SUMMARY		P	V2	V3	T	M2	M3
	MAX	17.053	357.271	29.208	0.1614	45.0048	550.4927
	MIN	-17.053	-357.271	-29.208	-0.1615	-45.0048	-40.33

Calculation Sheet	Job No.	Sheet No.	Rev.
	Member / Location:		
Job Tilte :	Drg. Ref.:		
	Made By: BY Date: May-24 Check By:		

DESIGN CODE

Code of Practice for the Structural Use of Steel 2011



MEMBER SPECIFICATION

Member Mark: MB2

Steel grade	=	BS S355	(in accordance with BS EN standards)
Section	=	UC 305x305x158	(H-section)
Type	=	hot-rolled steel section	

MATERIAL/SECTIONAL PROPERTIES

Modulus of elasticity	E	=	205000 MPa			
Mass	m	=	158.1 kg/m			
Area	A	=	201 cm^2			
Dimensions	D	=	327.1 mm	d	=	246.7 mm
	B	=	311.2 mm	b	=	155.6 mm
	T	=	25 mm	t	=	15.8 mm
Moment of inertia	Ix	=	38750 cm^4	Iy	=	12570 cm^4
Radius of gyration	rx	=	13.9 cm	ry	=	7.9 cm
Elastic modulus	Zx	=	2369 cm^3	Zy	=	808 cm^3
Plastic modulus	Sx	=	2680 cm^3	Sy	=	1230 cm^3
Design strength	py	=	**345** MPa			

SECTION CLASSIFICATION

Parameter	e	=	SQRT(275 / py)	=	0.8928
Stress ratio	r1	=	Nc / (d * t * py)	=	0.0127
	r2	=	Nc / (A * py)	=	0.0025
Dimension ratio	b/T	=	6.2 <= 8 e	=	7.1
	d/t	=	15.6 <= 80 e / (1+r1)	=	70.5

Flange: Class 1
Web: Class 1
Overall: Class 1

DESIGN FORCES AND MOMENTS

Nc (kN)	Nt (kN)	Vx (kN)	Vy (kN)	Mx (kNm)	My (kNm)
17.06	17.06	29.21	357.27	550.49	45.01

(Page Refer)

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SHEAR CAPACITY CHECK

Shear area	Avy	= t * D	=	5168 mm^2			
Shear capacity	Vcy	= py * Avy / SQRT(3)	=	1029.4 kN	>=	Vy = 357.27 kN	OK
Shear load check	Vy	<= 0.6 * Vcy	=	617.66 kN		(Low shear load)	35%
Shear area	Avx	= 0.9 * (2 * B * T)	=	14004 mm^2			
Shear capacity	Vcx	= py * Avx / SQRT(3)	=	2789.4 kN	>=	Vx = 29.21 kN	OK
Shear load check	Vx	<= 0.6 * Vcx	=	1673.6 kN		(Low shear load)	1%

MOMENT CAPACITY CHECK

Moment capacity	Mcx	= py * Sx	=	924.6 kNm	>=	Mx = 550.49 kNm	OK
		(*1.2 * py * Zx*	=	*980.77* kNm)			60%
Moment capacity	Mcy	= 1.2 * py * Zy	=	334.51 kNm	>=	My = 45.01 kNm	OK
		(*py * Sy*	=	*424.35* kNm)			13%

BIAXIAL MOMENTS: LOCAL CAPACITY CHECK

$$\frac{Mx}{Mcx} + \frac{My}{Mcy} = \frac{550.49}{924.6} + \frac{45.01}{334.51} = 0.73 <= 1$$

OK
73%

TENSION CAPACITY CHECK

Tension capacity	Pt	= A * py	=	6934.5 kN	>=	Nt = 17.06 kN	OK
							0%

Calculation Sheet	Job No.	Sheet No.	Rev.
	Member / Location:		
Job Tilte :	Drg. Ref.:		
	Made By: BY	Date: May-24	Check By:

COMPRESSION CAPACITY CHECK

Effective length	LEx	= 6.200 m	LEy	= 6.200 m		
Slenderness	λx	= LEx / rx	λy	= LEy / ry		
		= 44.604		= 78.481		
From Table 8.7, use buckling curve		[b]		[c]		
Robertson constant	α	= 3.5	α	= 5.5		
	pEx	= $(\pi^2 * E) / \lambda x^2$	pEy	= $(\pi^2 * E) / \lambda y^2$		
		= 1017		= 328		
Limiting slenderness	λo	= $0.2 * SQRT(\pi^2 * E / py)$				
		= 15.316				
Perry factor	η	= $\alpha * (\lambda x - \lambda 0) / 1000$	η	= $\alpha * (\lambda y - \lambda 0) / 1000$		
		= 0.103		= 0.347		
	ϕ_C	= $[py + (\eta + 1) * pEx] / 2$	ϕ_C	= $[py + (\eta + 1) * pEy] / 2$		
		= 733		= 394		
Compressive buckling strength	pcx	= pEx * py / $[\phi_C + SQRT(\phi_C^2 - pEx * py)]$	pcy	= pEy * py / $[\phi_C + SQRT(\phi_C^2 - pEy * py)]$		
		= 301.14 MPa		= 189.47 MPa		
Compression resistance	Pc	= A * pcy = 3808.3 kN	>=	Nc = 17.06 kN	OK	0%

LATERAL-TORSIONAL BUCKLING CHECK

Effective length	LEy	= 6.200 m		
Slenderness	l	= LEy / ry	= 78.481	
Dist. betw. flange shear centers	hs	= D - T	= 302.1 mm	
Web depth	hw	= D - 2 * T	= 277.1 mm	
Torsional constant	J	= $(2 * T^3 * B + t^3 * hw) / 3$	= 360.6 cm^4	
Torsional index	x	= 0.566 * hs * SQRT(A / J)	= 12.766	
	g	= 1 - Iy / Ix	= 0.6756	
Buckling parameter	u	= $(4 * Sx^2 * \gamma)/(A^2 * hs^2)]^{0.25}$	= 0.8518	
Slenderness factor	v	= $1 / [1+ 0.05 * (l / x)^2]^{0.25}$	= 0.767	
	βw	= 1 for Class 1/Class 2 sect.	= 1	
Equivalent slenderness	λ_{LT}	= $u * v * \lambda * SQRT(\beta w)$	= 51.273	
	pE	= $(\pi^2 * E) / \lambda_{LT}^2$	= 769.63	
Limiting equivalent slenderness	λ_{L0}	= $0.4 * SQRT(\pi^2 * E / py)$	= 30.632	
Perry coefficient	η_{LT}	= $(\lambda_{LT} - \lambda_{L0}) * 0.007$	= 0.1445	
	ϕ_{LT}	= $[py + (\eta_{LT} + 1) * pE] / 2$	= 612.92	
Bending buckling strength	pb	= $pE * py / [\phi_{LT} + SQRT(\phi_{LT}^2 - pE * py)]$	= 281.04 MPa	< py (345 MPa)
Buckling resistance moment	Mb	= pb * Sx = 753 kNm	>= Mx = 550.49 kNm	OK 73%

TENSION + MOMENT CHECK

$$\frac{Nt}{Pt} + \frac{Mx}{Mcx} + \frac{My}{Mcy} = \frac{17.06}{6935} + \frac{550.49}{925} + \frac{45.01}{335} = 0.73 \quad <= \quad 1$$

OK

$$\frac{Nt}{Pt} + \frac{Mx}{Mb} + \frac{My}{py*Zy} = \frac{17.06}{6935} + \frac{550.49}{753} + \frac{45.01}{279} = 0.89 \quad <= \quad 1$$

OK

COMPRESSION + MOMENT CHECK

$$\frac{Nc}{A * py} + \frac{Mx}{Mcx} + \frac{My}{Mcy} = \frac{17.06}{6935} + \frac{550.49}{925} + \frac{45.01}{335} = 0.73 \quad <= \quad 1$$

OK

$$\frac{Nc}{Pc} + \frac{Mx}{Mb} + \frac{My}{py*Zy} = \frac{17.06}{3808} + \frac{550.49}{753} + \frac{45.01}{279} = 0.90 \quad <= \quad 1$$

OK

S. T. Wong & Partners Ltd Consulting Engineers 黃成增顧問工程師有限公司	Project	Project No.
Section: connection design	Rev.	Page
Subject: MB2 TO MB1	Date	

REF.	CALCULATIONS	OUTPUT

Loading:

Axial Force: P	=	24.7	kN
Shear Force: V_x	=	357.27	kN
Shear Force: V_y	=	30	kN
Moment: M_x	=	0	kNm
Moment: M_y	=	0	kNm

----------------- 面域 ------------------

面积: 6656.00
周长: 1696.00
边界框: X: -115.90 -- 115.90
Y: -108.00 -- 108.00
质心: X: 0.00
Y: 0.00
惯性矩: X: 48065194.59
Y: 56687495.13
惯性积: XY: -0.03
旋转半径: X: 84.98
Y: 92.29

Try 8 mm F.W.

Weld Length:

= 850 mm

Second Moment: I_x

= 48065195 mm^4

Ymax = 108 mm^3

Xmax = 115 mm^3

Second Moment: I_y

= 56687495 mm^4

Elastic Modulus; Z_x

= 445048 mm^3

Elastic Modulus; Zy

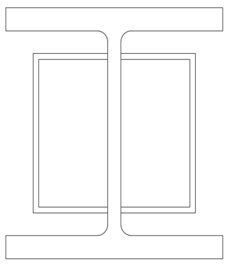
= 492935 mm^3

Resultant stress

$= \sqrt{[(V_x/L)^2+(V_y/L)^2+(P/L)^2]}/t + \sqrt{[(M_x/Z_y)^2+(M_y/Z_x)^2]}$

= 52.8495823 N/mm^2

< 0.7 x 250 = 175 N/mm^2 OK



Calc.	Checked	Remarks

Date:	14-May-24
Time:	10:30 AM

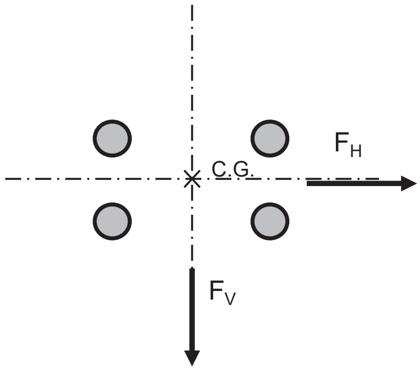
(HK2005)

Design Calculation for Bolt Connections

(Under Shear Only)

Project: Structural Study for the Existing Ferry Pier ToKwaWan (DeSpace)
Location: MB2 to MB1

FORCES on BOLT GROUP



Vertical Shear (Downwards)	F_v	=	357.3	
Horizontal Shear (Right)	F_H	=	30.0	
Shear Type (Single /Double Shear)		=	Single	
No. of Bolts		=	4	
Vertical Shear on Each Bolt		=	89.3	kN
Horizontal Shear on Each Bolt		=	7.5	kN
Maximum Shear on Bolts		=	89.6	kN

CAPACITY OF BOLTS

Bolt Diameter	d	=	M20	mm		
Plate/Web Thickness	t	=	10	mm		
End Distance	e	=	45	mm		
Type of Hole		=	Standard			
	k_{bs}	=	1.0			
Grade of Bolts		=	Gr 8.8			
Shear Strength of Bolts	p_s	=	375	N/mm^2		*(Table 9.5)*
Bearing Strength of Bolts	p_{bb}	=	1000	N/mm^2		*(Table 9.6)*
Grade of Plate		=	S355			
Bearing Strength of Plate	p_{bs}	=	550	N/mm^2		*… Clause 9.3.6.1.3*
Tensile Stress Area	A_s	=	245	mm^2		
Shear Capacity of Bolts	P_s	=	p_sA_s			*… Clause 9.3.6.1.1*
		=	**91.9**	**kN**	**>**	**89.6 kN**
Bearing Capacity of Bolt	P_{bb}	=	dtp_{bb}			*… Clause 9.3.6.1.2*
		=	200.0	kN	`	
Bearing Capacity of Connected Ply	P_{bs}	=	$k_{bs}dtp_{bs}$ or $0.5k_{bs}etp_{bs}$			*… Clause 9.3.6.1.3*
		=	110.0	kN		
Bearing Capacity of Bolts	P_b	**=**	**110.0**	**kN**	**>**	**89.6 kN**

OKAY!

lc	50	mm	
Us	275	N/mm^2	(For Grade S275)
Ub	450	N/mm^2	(For Grade 8.8)

P_{bs} = $1.5l_ct_pU_s$ or $2dt_pU_b$
= 180

TABLE: Element Forces - Frames-MB1

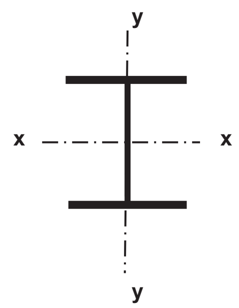
Frame	Station	OutputCase	CaseType	StepType	P	V2	V3	T	M2	M3	FrameElem	ElemStation
Text	m	Text	Text	Text	KN	KN	KN	KN-m	KN-m	KN-m	Text	m
1	0	ULS	Combination	Max	6.891	-5.759	2.716	9.313E-11	0	1.208E-14	1-1	0
1	0.45714	ULS	Combination	Max	6.891	-4.479	2.716	9.313E-11	1.2414	26.3352	1-1	0.45714
1	0.91429	ULS	Combination	Max	6.891	-3.199	2.716	9.313E-11	2.4829	51.8513	1-1	0.91429
1	1.37143	ULS	Combination	Max	6.891	-1.92	2.716	9.313E-11	3.7243	76.5483	1-1	1.37143
1	1.82857	ULS	Combination	Max	6.891	-0.64	2.716	9.313E-11	4.9657	100.4262	1-1	1.82857
1	2.28571	ULS	Combination	Max	6.891	0.64	2.716	9.313E-11	6.2072	123.4849	1-1	2.28571
1	2.74286	ULS	Combination	Max	6.891	1.92	2.716	9.313E-11	7.4486	145.7246	1-1	2.74286
1	3.2	ULS	Combination	Max	6.891	3.2	2.716	9.313E-11	8.6901	167.1451	1-1	3.2
1	3.2	ULS	Combination	Max	8.82	162.509	5.608	0.000008982	8.6901	166.9837	1-2	0
1	3.7	ULS	Combination	Max	8.82	164.469	5.608	0.000008982	5.8859	85.2393	1-2	0.5
1	4.2	ULS	Combination	Max	8.82	166.429	5.608	0.000008982	3.0818	2.9245	1-2	1
1	4.7	ULS	Combination	Max	8.82	168.388	5.608	0.000008982	0.2777	0.0592	1-2	1.5
1	5.2	ULS	Combination	Max	8.82	170.348	5.608	0.000008982	2.5264	-2.6865	1-2	2
1	5.7	ULS	Combination	Max	8.82	172.308	5.608	0.000008982	5.3305	-6.1321	1-2	2.5
1	5.7	ULS	Combination	Max	0	-7.132	1.333	-2.328E-11	5.3305	-6.1304	1-3	0
1	6.2	ULS	Combination	Max	0	-5.732	1.333	-2.328E-11	4.6642	-2.9144	1-3	0.5
1	6.7	ULS	Combination	Max	0	-4.332	1.333	-2.328E-11	3.9979	-0.3983	1-3	1
1	7.2	ULS	Combination	Max	0	-2.932	1.333	-2.328E-11	3.3316	1.4178	1-3	1.5
1	7.7	ULS	Combination	Max	0	-1.532	1.333	-2.328E-11	2.6652	2.534	1-3	2
1	8.2	ULS	Combination	Max	0	-0.133	1.333	-2.328E-11	1.9989	2.9502	1-3	2.5
1	8.7	ULS	Combination	Max	0	1.267	1.333	-2.328E-11	1.3326	2.6666	1-3	3
1	9.2	ULS	Combination	Max	0	2.667	1.333	-2.328E-11	0.6663	1.683	1-3	3.5
1	9.7	ULS	Combination	Max	0	4.067	1.333	-2.328E-11	1.164E-16	0.0397	1-3	4
1	0	ULS	Combination	Min	-6.891	-58.504	-2.716	-6.519E-10	0	-2.416E-13	1-1	0
1	0.45714	ULS	Combination	Min	-6.891	-56.712	-2.716	-6.519E-10	-1.2414	2.3402	1-1	0.45714
1	0.91429	ULS	Combination	Min	-6.891	-54.921	-2.716	-6.519E-10	-2.4829	4.0953	1-1	0.91429
1	1.37143	ULS	Combination	Min	-6.891	-53.129	-2.716	-6.519E-10	-3.7243	5.2653	1-1	1.37143
1	1.82857	ULS	Combination	Min	-6.891	-51.337	-2.716	-6.519E-10	-4.9657	5.8503	1-1	1.82857
1	2.28571	ULS	Combination	Min	-6.891	-49.545	-2.716	-6.519E-10	-6.2072	5.8502	1-1	2.28571
1	2.74286	ULS	Combination	Min	-6.891	-47.753	-2.716	-6.519E-10	-7.4486	5.265	1-1	2.74286
1	3.2	ULS	Combination	Min	-6.891	-45.962	-2.716	-6.519E-10	-8.6901	4.0947	1-1	3.2
1	3.2	ULS	Combination	Min	-8.82	0.592	-5.608	2.196E-07	-8.6901	4.0967	1-2	0
1	3.7	ULS	Combination	Min	-8.82	1.992	-5.608	2.196E-07	-5.8859	3.4508	1-2	0.5
1	4.2	ULS	Combination	Min	-8.82	3.392	-5.608	2.196E-07	-3.0818	1.9929	1-2	1
1	4.7	ULS	Combination	Min	-8.82	4.791	-5.608	2.196E-07	-0.2777	-81.1894	1-2	1.5
1	5.2	ULS	Combination	Min	-8.82	6.191	-5.608	2.196E-07	-2.5264	-165.8736	1-2	2
1	5.7	ULS	Combination	Min	-8.82	7.591	-5.608	2.196E-07	-5.3305	-251.5376	1-2	2.5
1	5.7	ULS	Combination	Min	0	-70.769	-1.333	-3.469E-09	-5.3305	-251.6785	1-3	0
1	6.2	ULS	Combination	Min	0	-68.809	-1.333	-3.469E-09	-4.6642	-216.7841	1-3	0.5
1	6.7	ULS	Combination	Min	0	-66.849	-1.333	-3.469E-09	-3.9979	-182.8696	1-3	1
1	7.2	ULS	Combination	Min	0	-64.889	-1.333	-3.469E-09	-3.3316	-149.935	1-3	1.5
1	7.7	ULS	Combination	Min	0	-62.93	-1.333	-3.469E-09	-2.6652	-117.9802	1-3	2
1	8.2	ULS	Combination	Min	0	-60.97	-1.333	-3.469E-09	-1.9989	-87.0054	1-3	2.5
1	8.7	ULS	Combination	Min	0	-59.01	-1.333	-3.469E-09	-1.3326	-57.0105	1-3	3
1	9.2	ULS	Combination	Min	0	-57.05	-1.333	-3.469E-09	-0.6663	-27.9955	1-3	3.5
1	9.7	ULS	Combination	Min	0	-55.09	-1.333	-3.469E-09	-1.164E-16	-0.0004963	1-3	4
2	0	ULS	Combination	Max	13.781	-5.136	2.848	3.26E-10	0	9.948E-15	2-1	0
2	0.45714	ULS	Combination	Max	13.781	-3.856	2.848	3.26E-10	1.3019	49.1099	2-1	0.45714
2	0.91429	ULS	Combination	Max	13.781	-2.576	2.848	3.26E-10	2.6039	97.4007	2-1	0.91429
2	1.37143	ULS	Combination	Max	13.781	-1.296	2.848	3.26E-10	3.9058	144.8724	2-1	1.37143
2	1.82857	ULS	Combination	Max	13.781	-0.016	2.848	3.26E-10	5.2078	191.5249	2-1	1.82857
2	2.28571	ULS	Combination	Max	13.781	1.263	2.848	3.26E-10	6.5097	237.3584	2-1	2.28571
2	2.74286	ULS	Combination	Max	13.781	2.543	2.848	3.26E-10	7.8116	282.3727	2-1	2.74286
2	3.2	ULS	Combination	Max	13.781	3.823	2.848	3.26E-10	9.1136	326.5679	2-1	3.2
2	3.2	ULS	Combination	Max	17.64	321.16	5.882	0.00001748	9.1136	326.8908	2-2	0
2	3.7	ULS	Combination	Max	17.64	323.12	5.882	0.00001748	6.1728	165.8208	2-2	0.5
2	4.2	ULS	Combination	Max	17.64	325.08	5.882	0.00001748	3.232	3.771	2-2	1
2	4.7	ULS	Combination	Max	17.64	327.039	5.882	0.00001748	0.2913	1.0361	2-2	1.5
2	5.2	ULS	Combination	Max	17.64	328.999	5.882	0.00001748	2.6495	-0.7171	2-2	2
2	5.7	ULS	Combination	Max	17.64	330.959	5.882	0.00001748	5.5903	-3.1703	2-2	2.5
2	5.7	ULS	Combination	Max	0	-6.393	1.398	5.122E-09	5.5903	-3.1738	2-3	0
2	6.2	ULS	Combination	Max	0	-4.993	1.398	5.122E-09	4.8915	-0.3273	2-3	0.5
2	6.7	ULS	Combination	Max	0	-3.593	1.398	5.122E-09	4.1927	1.8194	2-3	1
2	7.2	ULS	Combination	Max	0	-2.194	1.398	5.122E-09	3.4939	3.2662	2-3	1.5
2	7.7	ULS	Combination	Max	0	-0.794	1.398	5.122E-09	2.7951	4.013	2-3	2
2	8.2	ULS	Combination	Max	0	0.606	1.398	5.122E-09	2.0964	4.0599	2-3	2.5
2	8.7	ULS	Combination	Max	0	2.006	1.398	5.122E-09	1.3976	3.4068	2-3	3
2	9.2	ULS	Combination	Max	0	3.406	1.398	5.122E-09	0.6988	2.0539	2-3	3.5
2	9.7	ULS	Combination	Max	0	4.806	1.398	5.122E-09	1.114E-15	0.0009927	2-3	4
2	0	ULS	Combination	Min	-13.781	-108.324	-2.848	-3.26E-10	0	-9.948E-15	2-1	0
2	0.45714	ULS	Combination	Min	-13.781	-106.532	-2.848	-3.26E-10	-1.3019	2.0553	2-1	0.45714
2	0.91429	ULS	Combination	Min	-13.781	-104.74	-2.848	-3.26E-10	-2.6039	3.5255	2-1	0.91429
2	1.37143	ULS	Combination	Min	-13.781	-102.948	-2.848	-3.26E-10	-3.9058	4.4107	2-1	1.37143
2	1.82857	ULS	Combination	Min	-13.781	-101.157	-2.848	-3.26E-10	-5.2078	4.7107	2-1	1.82857
2	2.28571	ULS	Combination	Min	-13.781	-99.365	-2.848	-3.26E-10	-6.5097	4.4257	2-1	2.28571
2	2.74286	ULS	Combination	Min	-13.781	-97.573	-2.848	-3.26E-10	-7.8116	3.5556	2-1	2.74286
2	3.2	ULS	Combination	Min	-13.781	-95.781	-2.848	-3.26E-10	-9.1136	2.1004	2-1	3.2
2	3.2	ULS	Combination	Min	-17.64	-1.393	-5.882	1.128E-07	-9.1136	2.0964	2-2	0
2	3.7	ULS	Combination	Min	-17.64	0.006915	-5.882	1.128E-07	-6.1728	2.4429	2-2	0.5
2	4.2	ULS	Combination	Min	-17.64	1.407	-5.882	1.128E-07	-3.232	2.0895	2-2	1
2	4.7	ULS	Combination	Min	-17.64	2.807	-5.882	1.128E-07	-0.2913	-159.2588	2-2	1.5
2	5.2	ULS	Combination	Min	-17.64	4.206	-5.882	1.128E-07	-2.6495	-323.2684	2-2	2
2	5.7	ULS	Combination	Min	-17.64	5.606	-5.882	1.128E-07	-5.5903	-488.2579	2-2	2.5
2	5.7	ULS	Combination	Min	0	-129.813	-1.398	-1.863E-10	-5.5903	-487.9762	2-3	0
2	6.2	ULS	Combination	Min	0	-127.854	-1.398	-1.863E-10	-4.8915	-423.5595	2-3	0.5
2	6.7	ULS	Combination	Min	0	-125.894	-1.398	-1.863E-10	-4.1927	-360.1226	2-3	1
2	7.2	ULS	Combination	Min	0	-123.934	-1.398	-1.863E-10	-3.4939	-297.6657	2-3	1.5
2	7.7	ULS	Combination	Min	0	-121.974	-1.398	-1.863E-10	-2.7951	-236.1886	2-3	2
2	8.2	ULS	Combination	Min	0	-120.014	-1.398	-1.863E-10	-2.0964	-175.6914	2-3	2.5
2	8.7	ULS	Combination	Min	0	-118.055	-1.398	-1.863E-10	-1.3976	-116.1742	2-3	3
2	9.2	ULS	Combination	Min	0	-116.095	-1.398	-1.863E-10	-0.6988	-57.6368	2-3	3.5
2	9.7	ULS	Combination	Min	0	-114.135	-1.398	-1.863E-10	-1.114E-15	-0.0793	2-3	4

3	0	ULS	Combination	Max	6.891	-5.759	3.119	-2.328E-10	2.487E-15	1.279E-14	3-1	0
3	0.45714	ULS	Combination	Max	6.891	-4.479	3.119	-2.328E-10	1.4259	26.3389	3-1	0.45714
3	0.91429	ULS	Combination	Max	6.891	-3.199	3.119	-2.328E-10	2.8518	51.8587	3-1	0.91429
3	1.37143	ULS	Combination	Max	6.891	-1.919	3.119	-2.328E-10	4.2777	76.5594	3-1	1.37143
3	1.82857	ULS	Combination	Max	6.891	-0.64	3.119	-2.328E-10	5.7035	100.441	3-1	1.82857
3	2.28571	ULS	Combination	Max	6.891	0.64	3.119	-2.328E-10	7.1294	123.5035	3-1	2.28571
3	2.74286	ULS	Combination	Max	6.891	1.92	3.119	-2.328E-10	8.5553	145.7469	3-1	2.74286
3	3.2	ULS	Combination	Max	6.891	3.2	3.119	-2.328E-10	9.9812	167.1711	3-1	3.2
3	3.2	ULS	Combination	Max	8.82	162.501	6.441	0.000008981	9.9812	167.0097	3-2	0
3	3.7	ULS	Combination	Max	8.82	164.461	6.441	0.000008981	6.7605	85.2692	3-2	0.5
3	4.2	ULS	Combination	Max	8.82	166.421	6.441	0.000008981	3.5397	2.9259	3-2	1
3	4.7	ULS	Combination	Max	8.82	168.38	6.441	0.000008981	0.319	0.0589	3-2	1.5
3	5.2	ULS	Combination	Max	8.82	170.34	6.441	0.000008981	2.9017	-2.6869	3-2	2
3	5.7	ULS	Combination	Max	8.82	172.3	6.441	0.000008981	6.1225	-6.1325	3-2	2.5
3	5.7	ULS	Combination	Max	0	-7.132	1.531	-1.863E-10	6.1225	-6.1307	3-3	0
3	6.2	ULS	Combination	Max	0	-5.732	1.531	-1.863E-10	5.3572	-2.9147	3-3	0.5
3	6.7	ULS	Combination	Max	0	-4.332	1.531	-1.863E-10	4.5919	-0.3986	3-3	1
3	7.2	ULS	Combination	Max	0	-2.932	1.531	-1.863E-10	3.8266	1.4175	3-3	1.5
3	7.7	ULS	Combination	Max	0	-1.533	1.531	-1.863E-10	3.0612	2.5338	3-3	2
3	8.2	ULS	Combination	Max	0	-0.133	1.531	-1.863E-10	2.2959	2.9501	3-3	2.5
3	8.7	ULS	Combination	Max	0	1.267	1.531	-1.863E-10	1.5306	2.6665	3-3	3
3	9.2	ULS	Combination	Max	0	2.667	1.531	-1.863E-10	0.7653	1.683	3-3	3.5
3	9.7	ULS	Combination	Max	0	4.067	1.531	-1.863E-10	1.142E-15	0.0397	3-3	4
3	0	ULS	Combination	Min	-6.891	-58.512	-3.119	-3.26E-10	-2.487E-15	-5.969E-14	3-1	0
3	0.45714	ULS	Combination	Min	-6.891	-56.72	-3.119	-3.26E-10	-1.4259	2.3402	3-1	0.45714
3	0.91429	ULS	Combination	Min	-6.891	-54.929	-3.119	-3.26E-10	-2.8518	4.0952	3-1	0.91429
3	1.37143	ULS	Combination	Min	-6.891	-53.137	-3.119	-3.26E-10	-4.2777	5.2652	3-1	1.37143
3	1.82857	ULS	Combination	Min	-6.891	-51.345	-3.119	-3.26E-10	-5.7035	5.8502	3-1	1.82857
3	2.28571	ULS	Combination	Min	-6.891	-49.553	-3.119	-3.26E-10	-7.1294	5.85	3-1	2.28571
3	2.74286	ULS	Combination	Min	-6.891	-47.761	-3.119	-3.26E-10	-8.5553	5.2648	3-1	2.74286
3	3.2	ULS	Combination	Min	-6.891	-45.97	-3.119	-3.26E-10	-9.9812	4.0945	3-1	3.2
3	3.2	ULS	Combination	Min	-8.82	0.592	-6.441	2.194E-07	-9.9812	4.0965	3-2	0
3	3.7	ULS	Combination	Min	-8.82	1.992	-6.441	2.194E-07	-6.7605	3.4505	3-2	0.5
3	4.2	ULS	Combination	Min	-8.82	3.392	-6.441	2.194E-07	-3.5397	2.0015	3-2	1
3	4.7	ULS	Combination	Min	-8.82	4.792	-6.441	2.194E-07	-0.319	-81.1513	3-2	1.5
3	5.2	ULS	Combination	Min	-8.82	6.191	-6.441	2.194E-07	-2.9017	-165.8314	3-2	2
3	5.7	ULS	Combination	Min	-8.82	7.591	-6.441	2.194E-07	-6.1225	-251.4914	3-2	2.5
3	5.7	ULS	Combination	Min	0	-70.757	-1.531	-2.724E-09	-6.1225	-251.6323	3-3	0
3	6.2	ULS	Combination	Min	0	-68.797	-1.531	-2.724E-09	-5.3572	-216.7436	3-3	0.5
3	6.7	ULS	Combination	Min	0	-66.838	-1.531	-2.724E-09	-4.5919	-182.8349	3-3	1
3	7.2	ULS	Combination	Min	0	-64.878	-1.531	-2.724E-09	-3.8266	-149.9061	3-3	1.5
3	7.7	ULS	Combination	Min	0	-62.918	-1.531	-2.724E-09	-3.0612	-117.9571	3-3	2
3	8.2	ULS	Combination	Min	0	-60.958	-1.531	-2.724E-09	-2.2959	-86.9881	3-3	2.5
3	8.7	ULS	Combination	Min	0	-58.998	-1.531	-2.724E-09	-1.5306	-56.9989	3-3	3
3	9.2	ULS	Combination	Min	0	-57.039	-1.531	-2.724E-09	-0.7653	-27.9897	3-3	3.5
3	9.7	ULS	Combination	Min	0	-55.079	-1.531	-2.724E-09	-1.142E-15	-0.0004965	3-3	4

		P	V2	V3	T	M2	M3
SUMMARY	MAX	17.64	330.959	6.441	0.00001748	9.9812	326.8908
	MIN	-17.64	-129.813	-6.441	-3.469E-09	-9.9812	-488.2579

Calculation Sheet	Job No.	Sheet No.	Rev.
	Member / Location:		
Job Tilte :	Drg. Ref.:		
	Made By: BY	Date: May-24	Check By:

DESIGN CODE
Code of Practice for the Structural Use of Steel 2011



MEMBER SPECIFICATION **Member Mark: MB1**

Steel grade = BS S355 (in accordance with BS EN standards)
Section = UC 356x406x287 (H-section)
Type = hot-rolled steel section

MATERIAL/SECTIONAL PROPERTIES

Modulus of elasticity	E	=	205000 MPa				
Mass	m	=	287.1 kg/m				
Area	A	=	366 cm^2				
Dimensions	D	=	393.6 mm	d	=	290.2 mm	
	B	=	399 mm	b	=	199.5 mm	
	T	=	36.5 mm	t	=	22.6 mm	
Moment of inertia	Ix	=	99880 cm^4	Iy	=	38680 cm^4	
Radius of gyration	rx	=	16.5 cm	ry	=	10.3 cm	
Elastic modulus	Zx	=	5075 cm^3	Zy	=	1939 cm^3	
Plastic modulus	Sx	=	5812 cm^3	Sy	=	2949 cm^3	
Design strength	py	=	**345** MPa				

SECTION CLASSIFICATION

Parameter e = SQRT(275 / py) = 0.8928
Stress ratio r1 = Nc / (d * t * py) = 0.0078
r2 = Nc / (A * py) = 0.0014
Dimension ratio b/T = 5.5 <= 8 e = 7.1
d/t = 12.8 <= $\frac{80\ e}{1+r1}$ = 70.9

Flange: Class 1
Web: Class 1
Overall: Class 1

DESIGN FORCES AND MOMENTS

Nc (kN)	Nt (kN)	Vx (kN)	Vy (kN)	Mx (kNm)	My (kNm)
17.64	17.64	6.45	330.96	488.26	9.98

(Page Refer)

SHEAR CAPACITY CHECK

Shear area Avy = t * D = 8895 mm^2
Shear capacity Vcy = py * Avy / SQRT(3) = 1771.8 kN >= Vy = 330.96 kN **OK**
Shear load check Vy <= 0.6 * Vcy = 1063.1 kN (Low shear load) 19%

Shear area Avx = 0.9 * (2 * B * T) = 26214 mm^2
Shear capacity Vcx = py * Avx / SQRT(3) = 5221.5 kN >= Vx = 6.45 kN **OK**
Shear load check Vx <= 0.6 * Vcx = 3132.9 kN (Low shear load) 0%

MOMENT CAPACITY CHECK

Moment capacity Mcx = py * Sx = 2005.1 kNm >= Mx = 488.26 kNm **OK**
(*1.2 * py * Zx* = *2101.1* kNm) 24%

Moment capacity Mcy = 1.2 * py * Zy = 802.75 kNm >= My = 9.98 kNm **OK**
(*py * Sy* = *1017.4* kNm) 1%

BIAXIAL MOMENTS: LOCAL CAPACITY CHECK

$$\frac{Mx}{Mcx} + \frac{My}{Mcy} = \frac{488.26}{2005.1} + \frac{9.98}{802.75} = 0.26 <= 1$$

OK 26%

TENSION CAPACITY CHECK

Tension capacity Pt = A * py = 12627 kN >= Nt = 17.64 kN **OK**
0%

Calculation Sheet	Job No.	Sheet No.	Rev.
	Member / Location:		
Job Tilte :	Drg. Ref.:		
	Made By: BY	Date: May-24	Check By:

COMPRESSION CAPACITY CHECK

Effective length	LEx	=	9.700 m	LEy	=	9.700 m
Slenderness	λx	=	LEx / rx	λy	=	LEy / ry
		=	58.788		=	94.175
From Table 8.7, use buckling curve			[b]			[c]
Robertson constant	α	=	3.5	α	=	5.5
	pEx	=	$(\pi^2 * E) / \lambda x^2$	pEy	=	$(\pi^2 * E) / \lambda y^2$
		=	585		=	228
Limiting slenderness	λo	=	$0.2 * SQRT(\pi^2 * E / py)$			
		=	15.316			
Perry factor	η	=	$\alpha * (\lambda x - \lambda 0) / 1000$	η	=	$\alpha * (\lambda y - \lambda 0) / 1000$
		=	0.152		=	0.434
	ϕ_C	=	$[py + (\eta + 1) * pEx] / 2$	ϕ_C	=	$[py + (\eta + 1) * pEy] / 2$
		=	510		=	336
Compressive buckling strength	pcx	=	pEx * py / $[\phi_C + SQRT(\phi_C^2 - pEx * py)]$	pcy	=	pEy * py / $[\phi_C + SQRT(\phi_C^2 - pEy * py)]$
		=	269.18 MPa		=	151.06 MPa

Compression resistance	Pc	=	A * pcy	=	5528.8 kN	>=	Nc	=	17.64 kN	OK
										0%

LATERAL-TORSIONAL BUCKLING CHECK

Effective length	LEy	=	9.700 m		
Slenderness	l	=	LEy / ry	=	94.175
Dist. betw. flange shear centers	hs	=	D - T	=	357.1 mm
Web depth	hw	=	D - 2 * T	=	320.6 mm
Torsional constant	J	=	$(2 * T^3 * B + t^3 * hw) / 3$	=	1416.8 cm^4
Torsional index	x	=	0.566 * hs * SQRT(A / J)	=	10.273
	g	=	1 - Iy / Ix	=	0.6127
Buckling parameter	u	=	$(4 * Sx^2 * \gamma)/(A^2 * hs^2)]^{0.25}$	=	0.8344
Slenderness factor	v	=	$1 / [1+ 0.05 * (l / x)^2]^{0.25}$	=	0.6621
	βw	=	1 for Class 1/Class 2 sect.	=	1
Equivalent slenderness	λ_{LT}	=	$u * v * \lambda * SQRT(\beta w)$	=	52.03
	pE	=	$(\pi^2 * E) / \lambda_{LT}^2$	=	747.4
Limiting equivalent slenderness	λ_{L0}	=	$0.4 * SQRT(\pi^2 * E / py)$	=	30.632
Perry coefficient	η_{LT}	=	$(\lambda_{LT} - \lambda_{L0}) * 0.007$	=	0.1498
	ϕ_{LT}	=	$[py + (\eta_{LT} + 1) * pE] / 2$	=	602.17
Bending buckling strength	pb	=	$pE * py / [\phi_{LT} + SQRT(\phi_{LT}^2 - pE * py)]$	=	278.51 MPa < py (345 MPa)

Buckling resistance moment	Mb	=	pb * Sx	=	1619 kNm	>=	Mx	=	488.26 kNm	OK
										30%

TENSION + MOMENT CHECK

$$\frac{Nt}{Pt} + \frac{Mx}{Mcx} + \frac{My}{Mcy} = \frac{17.64}{12627} + \frac{488.26}{2005} + \frac{9.98}{803} = 0.26 \quad <= \quad 1$$

OK

$$\frac{Nt}{Pt} + \frac{Mx}{Mb} + \frac{My}{py*Zy} = \frac{17.64}{12627} + \frac{488.26}{1619} + \frac{9.98}{669} = 0.32 \quad <= \quad 1$$

OK

COMPRESSION + MOMENT CHECK

$$\frac{Nc}{A * py} + \frac{Mx}{Mcx} + \frac{My}{Mcy} = \frac{17.64}{12627} + \frac{488.26}{2005} + \frac{9.98}{803} = 0.26 \quad <= \quad 1$$

OK

$$\frac{Nc}{Pc} + \frac{Mx}{Mb} + \frac{My}{py*Zy} = \frac{17.64}{5529} + \frac{488.26}{1619} + \frac{9.98}{669} = 0.32 \quad <= \quad 1$$

OK

TABLE: Joint Reactions

Joint	OutputCase	CaseType	StepType	F1	F2	F3	M1	M2	M3
Text	Text	Text	Text	KN	KN	KN	KN-m	KN-m	KN-m
1	SLS	Combination	Max	3.698	1.94	42.777	0	0	0
1	SLS	Combination	Min	-3.698	-1.94	33.429	0	0	0
3	SLS	Combination	Max	20.358	4.958	440.877	0	0	0
3	SLS	Combination	Min	-20.358	-4.958	326.679	0	0	0
4	SLS	Combination	Max	9.61	0.952	130.811	0	0	0
4	SLS	Combination	Min	-9.61	-0.952	97.187	0	0	0
5	SLS	Combination	Max	7.396	2.034	79.355	0	0	0
5	SLS	Combination	Min	-7.396	-2.034	60.614	0	0	0
7	SLS	Combination	Max	40.716	5.199	863.607	0	0	0
7	SLS	Combination	Min	-40.716	-5.199	635.387	0	0	0
8	SLS	Combination	Max	19.22	0.998	258.811	0	0	0
8	SLS	Combination	Min	-19.22	-0.998	191.432	0	0	0
9	SLS	Combination	Max	3.698	2.228	42.782	0	0	0
9	SLS	Combination	Min	-3.698	-2.228	33.434	0	0	0
11	SLS	Combination	Max	20.358	40.994	440.863	0	0	0
11	SLS	Combination	Min	-20.358	-40.994	326.668	0	0	0
12	SLS	Combination	Max	9.61	20.627	130.819	0	0	0
12	SLS	Combination	Min	-9.61	-20.627	97.193	0	0	0
		SUMMARY		P	V2	V3	T	M2	M3
			MAX	40.716	40.994	863.607	0	0	0
			MIN	-40.716	-40.994	33.429	0	0	0

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Company:		Page:	1
Address:		Specifier:	
Phone I Fax:	|	E-Mail:	
Design:	1a	Date:	23/5/2024
Fastening point:			

Specifier's comments:

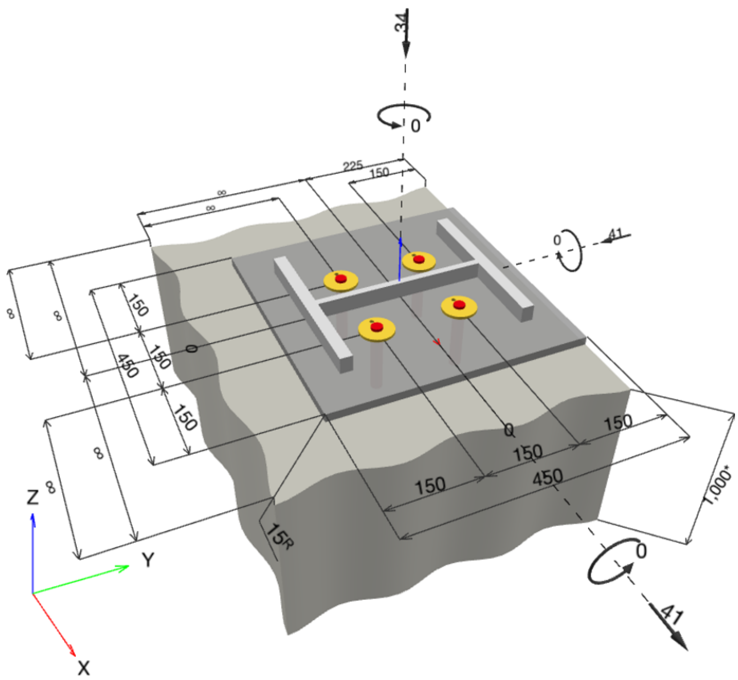
1 Input data

SAFESET

Anchor type and diameter:	**HIT-HY 200-R 100 years + HIT-Z-R M20**
Return period (service life in years):	100
Item number:	2018438 HIT-Z-R M20x215 (element) / 2045036 HIT-HY 200-R (adhesive)
Filling set or any suitable annular gap filling solution	
Effective embedment depth:	$h_{ef,opti}$ = 100.0 mm ($h_{ef,limit}$ = 220.0 mm)
Material:	A4
Evaluation Service Report:	ETA 12/0028
Issued I Valid:	11/4/2019 | -
Proof:	Based on design method EN 1992-4, Mechanical with a load factor 2 and global safety factor 3
Stand-off installation:	e_b = 0.0 mm (no stand-off); t = 15.0 mm
Anchor plate[R] :	l_x x l_y x t = 450.0 mm x 450.0 mm x 15.0 mm; (Recommended plate thickness: not calculated)
Profile:	IPB/HEB, IPB 340 / HE 340 B; (L x W x T x FT) = 340.0 mm x 300.0 mm x 12.0 mm x 21.5 mm
Base material:	cracked concrete, C40, $f_{c,cyl}$ = 31.90 N/mm^2; h =1,000.0 mm, Temp. short/long: 40/24 °C
Installation:	**hammer drilled hole, Installation condition: Dry**
Reinforcement:	no reinforcement or reinforcement spacing >= 150 mm (any Ø) or >= 100 mm (Ø <= 10 mm)
	no longitudinal edge reinforcement

R - The anchor calculation is based on a rigid anchor plate assumption.

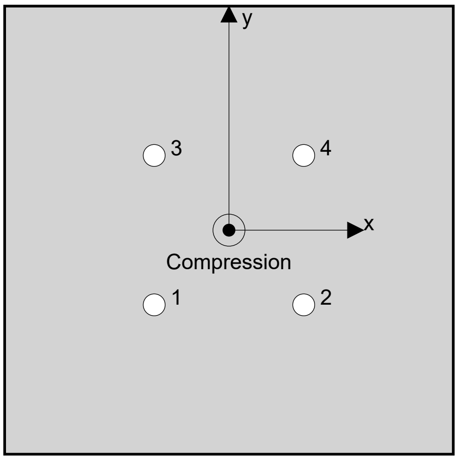
Geometry [mm] & Loading [kN, kNm]



1.1 Load combination

Case	Description	Forces [kN] / Moments [kNm]	Seismic	Fire	Max. Util. Anchor [%]
1	Combination 1	N = -34.000; V_x = 41.000; V_y = -41.000; M_x = 0.000; M_y = 0.000; M_z = 0.000;	no	no	76

2 Load case/Resulting anchor forces



Anchor reactions [kN]
Tension force: (+Tension, -Compression)

Anchor	Tension force	Shear force	Shear force x	Shear force y
1	0.000	14.496	10.250	-10.250
2	0.000	14.496	10.250	-10.250
3	0.000	14.496	10.250	-10.250
4	0.000	14.496	10.250	-10.250

max. concrete compressive strain: 0.01 [‰]
max. concrete compressive stress: 0.17 [N/mm^2]
resulting tension force in (x/y)=(-/-): 0.000 [kN]
resulting compression force in (x/y)=(0.0/0.0): 34.000 [kN]

Anchor forces are calculated based on the assumption of a rigid anchor plate.

3 Tension load ((Based on EN 1992-4, Section 7.2.1 FOS = 3))

	Load [kN]	Capacity [kN]	Utilization β_N [%]	Status
Steel Strength*	N/A	N/A	N/A	N/A
Concrete Breakout Failure**	N/A	N/A	N/A	N/A
Splitting failure**	N/A	N/A	N/A	N/A

* highest loaded anchor   **anchor group (anchors in tension)

4 Shear load ((Based on EN 1992-4, Section 7.2.2 FOS = 3))

	Load [kN]	Capacity [kN]	Utilization β_V [%]	Status
Steel Strength (without lever arm)*	14.496	29.333	50	OK
Steel failure (with lever arm)*	N/A	N/A	N/A	N/A
Pryout Strength**	57.983	83.500	70	OK
Concrete edge failure in direction y+**	20.500	27.241	76	OK

* highest loaded anchor **anchor group (relevant anchors)

4.1 Steel Strength (without lever arm)

$V_{Ed} \leq V_{Rd,s} = \frac{V_{Rk,s}}{\gamma_{M,s}}$ EN 1992-4, Table 7.2

$V_{Rk,s} = k_7 \cdot V^0_{Rk,s}$ EN 1992-4, Eq. (7.35)

$V^0_{Rk,s}$ [kN]	k_7	$V_{Rk,s}$ [kN]	$\gamma_{M,s}$	$V_{Rd,s}$ [kN]	V_{Ed} [kN]
88.000	1.000	88.000	3.000	29.333	14.496

4.2 Pryout Strength

$V_{Ed} \leq V_{Rd,cp} = \frac{V_{Rk,cp}}{\gamma_{M,c,p}}$ EN 1992-4, Table 7.2

$V_{Rk,cp} = k_8 \cdot N_{Rk,c}$ EN 1992-4, Eq. (7.39a)

$N_{Rk,c} = N^0_{Rk,c} \cdot \frac{A_{c,N}}{A^0_{c,N}} \cdot \psi_{s,N} \cdot \psi_{re,N} \cdot \psi_{ec1,N} \cdot \psi_{ec2,N} \cdot \psi_{M,N}$ EN 1992-4, Eq. (7.1)

$N^0_{Rk,c} = k_1 \cdot \sqrt{f_{ck}} \cdot h_{ef}^{1,5}$ EN 1992-4, Eq. (7.2)

$A^0_{c,N} = s_{cr,N} \cdot s_{cr,N}$ EN 1992-4, Eq. (7.3)

$\psi_{s,N} = 0.7 + 0.3 \cdot \frac{c}{c_{cr,N}} \leq 1.00$ EN 1992-4, Eq. (7.4)

$\psi_{ec1,N} = \frac{1}{1 + \left(\frac{2 \cdot e_{V,1}}{s_{cr,N}}\right)} \leq 1.00$ EN 1992-4, Eq. (7.6)

$\psi_{ec2,N} = \frac{1}{1 + \left(\frac{2 \cdot e_{V,2}}{s_{cr,N}}\right)} \leq 1.00$ EN 1992-4, Eq. (7.6)

$\psi_{M,N} = 1$ EN 1992-4, Eq. (7.7)

$A_{c,N}$ [mm^2]	$A^0_{c,N}$ [mm^2]	$c_{cr,N}$ [mm]	$s_{cr,N}$ [mm]	k_8	$f_{c,cyl}$ [N/mm^2]
202,500	90,000	150.0	300.0	2.560	31.90

$e_{c1,V}$ [mm]	$\psi_{ec1,N}$	$e_{c2,V}$ [mm]	$\psi_{ec2,N}$	$\psi_{s,N}$	$\psi_{re,N}$	$\psi_{M,N}$
0.0	1.000	0.0	1.000	1.000	1.000	1.000

k_1	$N^0_{Rk,c}$ [kN]	$\gamma_{M,c,p}$	$V_{Rd,cp}$ [kN]	V_{Ed} [kN]
7.700	43.490	3.000	83.500	57.983

Group anchor ID
1-4

4.3 Concrete edge failure in direction y+

$V_{Ed} \leq V_{Rd,c} = \frac{V_{Rk,c}}{\gamma_{M,c}}$	EN 1992-4, Table 7.2
$V_{Rk,c} = k_T \cdot V^0_{Rk,c} \cdot \frac{A_{c,V}}{A^0_{c,V}} \cdot \psi_{s,V} \cdot \psi_{h,V} \cdot \psi_{\alpha,V} \cdot \psi_{ec,V} \cdot \psi_{re,V}$	EN 1992-4, Eq. (7.40)
$V^0_{Rk,c} = k_9 \cdot d^{\alpha}_{nom} \cdot l^{\beta}_f \cdot \sqrt{f_{ck}} \cdot c_1^{1,5}$	EN 1992-4, Eq. (7.41)
$\alpha = 0.1 \cdot \left(\frac{l_f}{c_1}\right)^{0,5}$	EN 1992-4, Eq. (7.42)
$\beta = 0.1 \cdot \left(\frac{d_{nom}}{c_1}\right)^{0,2}$	EN 1992-4, Eq. (7.43)
$A^0_{c,V} = 4.5 \cdot c_1^2$	EN 1992-4, Eq. (7.44)
$\psi_{s,V} = 0.7 + 0.3 \cdot \frac{c_2}{1.5 \cdot c_1} \leq 1.00$	EN 1992-4, Eq. (7.45)
$\psi_{h,V} = \left(\frac{1.5 \cdot c_1}{h}\right)^{0,5} \geq 1.00$	EN 1992-4, Eq. (7.46)
$\psi_{ec,V} = \frac{1}{1 + \left(\frac{2 \cdot e_V}{3 \cdot c_1}\right)} \leq 1.00$	EN 1992-4, Eq. (7.47)
$\psi_{\alpha,V} = \sqrt{\frac{1}{(\cos \alpha_V)^2 + (0.5 \cdot \sin \alpha_V)^2}} \geq 1.00$	EN 1992-4, Eq. (7.48)

l_f [mm]	d_{nom} [mm]	k_9	α	β	$f_{c,cyl}$ [N/mm^2]
100.0	20.00	1.700	0.082	0.067	31.90

c_1 [mm]	$A_{c,V}$ [mm^2]	$A^0_{c,V}$ [mm^2]
150.0	135,000	101,250

$\psi_{s,V}$	$\psi_{h,V}$	α_V [°]	$\psi_{\alpha,V}$	$e_{c,V}$ [mm]	$\psi_{ec,V}$	$\psi_{re,V}$
1.000	1.000	90.00	2.000	0.0	1.000	1.000

$V^0_{Rk,c}$ [kN]	k_T	$\gamma_{M,c}$	$V_{Rd,c}$ [kN]	V_{Ed} [kN]
30.646	1.0	3.000	27.241	20.500

5 Displacements (highest loaded anchor)

Short term loading:

N_{Sk} =	0.000 [kN]	δ_N =	- [mm]
V_{Sk} =	10.738 [kN]	δ_V =	0.4295 [mm]
		δ_{NV} =	- [mm]

Long term loading:

N_{Sk} =	0.000 [kN]	δ_N =	- [mm]
V_{Sk} =	10.738 [kN]	δ_V =	0.6443 [mm]
		δ_{NV} =	- [mm]

Comments: Tension displacements are valid with half of the required installation torque moment for uncracked concrete! Shear displacements are valid without friction between the concrete and the anchor plate! The gap due to the drilled hole and clearance hole tolerances are not included in this calculation!

The acceptable anchor displacements depend on the fastened construction and must be defined by the designer!

6 Warnings

- The anchor design methods in PROFIS Engineering require rigid anchor plates per current regulations (AS 5216:2021, ETAG 001/Annex C, EOTA TR029 etc.). This means load re-distribution on the anchors due to elastic deformations of the anchor plate are not considered - the anchor plate is assumed to be sufficiently stiff, in order not to be deformed when subjected to the design loading. PROFIS Engineering calculates the minimum required anchor plate thickness with CBFEM to limit the stress of the anchor plate based on the assumptions explained above. The proof if the rigid anchor plate assumption is valid is not carried out by PROFIS Engineering. Input data and results must be checked for agreement with the existing conditions and for plausibility!
- Design is only valid if hole is filled to remove clearance, clearance as per EN 1992-4 Table 6.1
- Checking the transfer of loads into the base material is required in accordance with EN 1992-4, Annex A!
- The design is only valid if the clearance hole in the fixture is not larger than the value given in Table 6.1 of EN 1992-4! For larger diameters of the clearance hole see section 6.2.2 of EN 1992-4!
- The accessory list in this report is for the information of the user only. In any case, the instructions for use provided with the product have to be followed to ensure a proper installation.
- For the determination of the $\psi_{re,v}$ (concrete edge failure) the minimum concrete cover defined in the design settings is used as the concrete cover of the edge reinforcement.
- The characteristic bond resistances depend on the return period (service life in years): 100

Fastening meets the design criteria!

7 Installation data

Anchor plate, steel: EN S275; E = 205,000.00 N/mm^2; f_{yk} = 275.00 N/mm^2

Profile: IPB/HEB, IPB 340 / HE 340 B; (L x W x T x FT) = 340.0 mm x 300.0 mm x 12.0 mm x 21.5 mm

Hole diameter in the fixture (pre-setting) : d_f = 22.0 mm

Hole diameter in the fixture (through fastening) : d_f = 24.0 mm

Plate thickness (input): 15.0 mm

Recommended plate thickness: not calculated

Drilling method: Hammer drilled

Cleaning: No cleaning of the drilled hole is required

Anchor type and diameter: HIT-HY 200-R 100 years + HIT-Z-R M20

Item number: 2018438 HIT-Z-R M20x215 (element) / 2045036 HIT-HY 200-R (adhesive)

Maximum installation torque: 215 Nm

Hole diameter in the base material: 22.0 mm

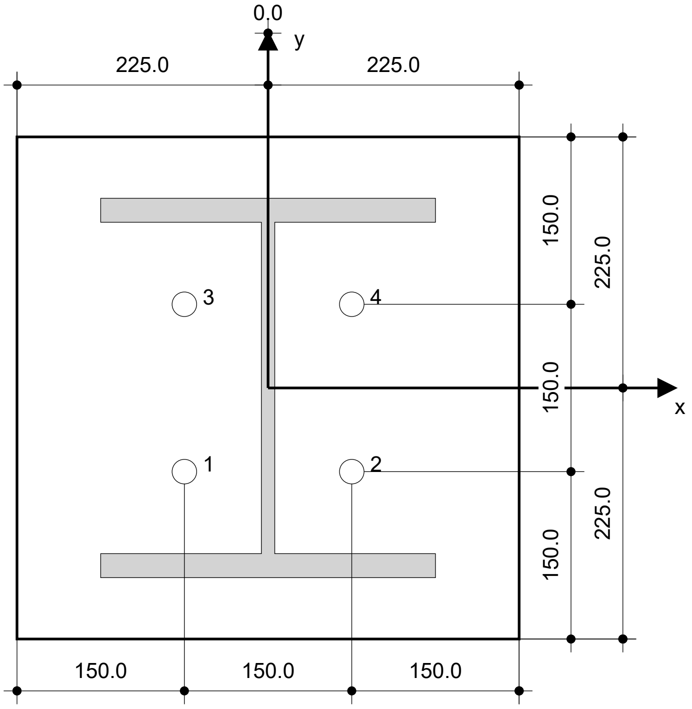
Hole depth in the base material: 156.0 mm

Minimum thickness of the base material: 200.0 mm

Hilti SAFEset HIT-Z non-cleaning bonded expansion anchor with HIT-HY 200 injection mortar with 100 mm embedment h_ef, M20, Stainless steel, Hammer drilled installation per ETA 12/0028, with annular gaps filled with Hilti Filling set or any suitable gap solutions

7.1 Recommended accessories

Drilling	Cleaning	Setting
• Suitable Rotary Hammer • Properly sized drill bit	• No accessory required	• Dispenser including cassette and mixer • Torque wrench



Coordinates Anchor [mm]

Anchor	x	y	c_{-x}	c_{+x}	c_{-y}	c_{+y}
1	-75.0	-75.0	-	-	-	300.0
2	75.0	-75.0	-	-	-	300.0
3	-75.0	75.0	-	-	-	150.0
4	75.0	75.0	-	-	-	150.0

8 Remarks; Your Cooperation Duties

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According To The Above Sap2000 Calculation Results:

MB1：

Mmax=488.26 kN・m

Vmax=330.96 kN

MB1 usable UC 356x406x287

MB2:

Mmax=550.49kN・m

Vmax=357.27kN

MB2 usable UC 305x305x158

The section, weld and bolt are verified and the scheme is feasible

The R/F layer meets the requirements of the retrofit function

3.0 Usage change Feasibility Calculation

According to record plan:

FLOOR	SDL(Ex.)		SDL(New)		LL (Ex.)（kPa）	LL(New)（kPa）	Loading Comparison
	Finishing (kPa)	Service (kPa)	Finishing (kPa)	Service (kPa)			
R/F	No data	No data	Remain unchanged	Remain unchanged	2 (Assume)	2	Usage of Roof floor remains unchanged and hence, no adverse effect to beam and slab. Additional water tank and pump will be supported by columns directly which will be checked in the next section.
UD/F	No data	No data	1.5	0.5	8	5	Existing Load = 8kPa > New Load = 7kPa
MD/F	No data	No data	1.5	0.5	8	5	Existing Load = 8kPa > New Load = 7kPa

In the proposed usage change from pier decks to exhibition hall , the new design load is less than the existing load at UD/F and MD/F. Therefore, the slabs and beams at UD/F and MD/F are capable for the proposed usage change.

For the roof floor, the existing beams and slabs will have no adverse effect as the usage will not change. However, the columns will subject to new loading due to new water tanks and pumps at roof floor, further checking required in the next section.

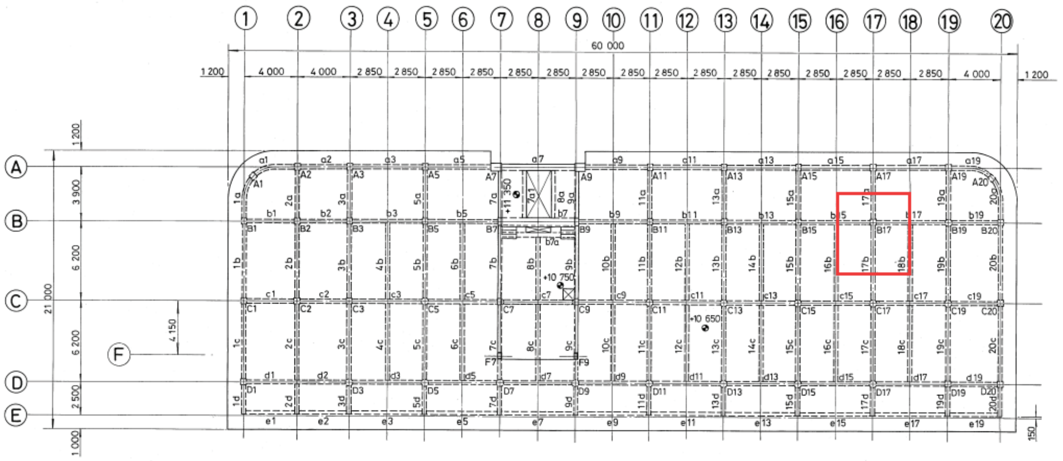
4.0 Column And Pile Feasibility Calculation

	Job Existing Checking		Job no.
Section: B17 Axial force-1		By:	Sheet no.
Subject: COLUMN		Date: May 11	

R/F Existing Building:
Density of concrete:24.5 KN/m³ Thickness of Slab max.to be 150mm.
Affected Area: (5.7/2 +5.7/2) * (3.9/2 +6.2/2)=28.79 m²
Reinforcement: 8T25
SDL: 3.0 KPa(Finishing) + 0.5 (Service) = 3.5 KPa (Assume, No Record)
LL: 2 KPa (Assume, Dormitory, No record)
DL:
Slab: s/w= 24.5 * 0.15(t)=3.7 KPa
Beam:

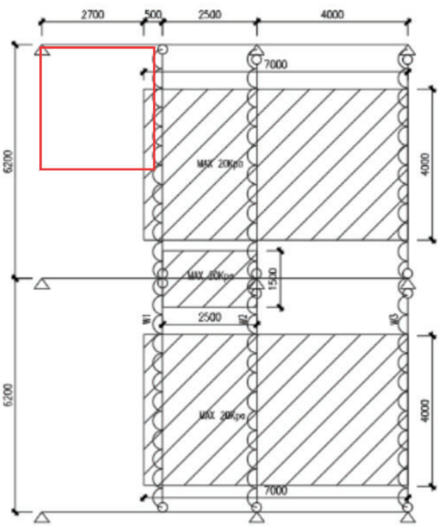
17a: s/w= 24.5 * 0.3 * 0.575 * 3.9/2(length of beam)=8.24 KN
17b: s/w= 24.5 * 0.3 * 0.575 * 6.2/2(length of beam)=13.1 KN
b15: s/w= 24.5 * 0.45 * 0.6 * 5.7/2(length of beam)=18.86 KN
b17: s/w= 24.5 * 0.45 * 0.6 * 5.7/2(length of beam)=18.86 KN
16b: s/w= 24.5 * 0.3 * 0.575 * 6.2/(2 * 2) (length of beam)=6.55 KN
18b: s/w= 24.5 * 0.3 * 0.575 * 6.2/(2 * 2) (length of beam)=6.55 KN

Column: s/w= 24.5 * 0.45 x0.45 * （10.65-7.3）m(Height of Column) = 16.62 KN
B17 R/F Axial force = (3.7 + 3.5) * 28.79 +8.24 + 13.1 + 18.86 + 18.86 + 6.55 + 6.55 + 16.62+ 2 * 28.79
= 353.65 KN



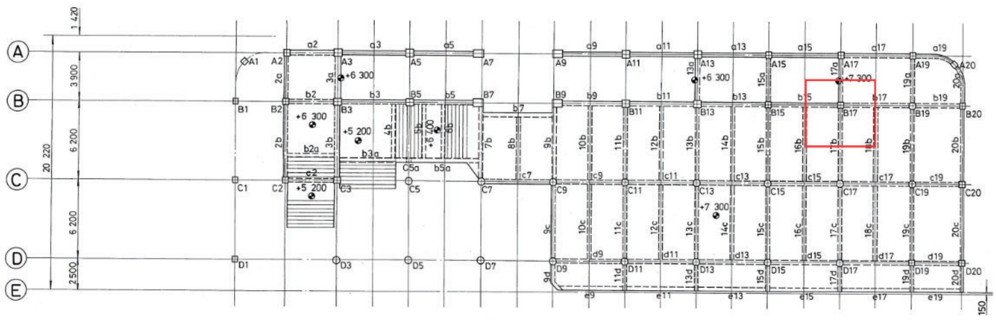
ROOF PLAN

Add water tank load:
MB1: UC 356x406x287kg/m; s/w=287 * 9.8/1000=2.9 kN/m
MB2: UC 305x305x158kg/m; s/w=158 * 9.8/1000=1.6 kN/m
Beam force:
MB1: 5.7/2 * 2.9 = 8.265 KN;
MB2: 6.2/2 * 1.6 = 5 KN
Slab : DD=2Kpa; DL=20Kpa;
A_{slab}=6.2/2 * 5.7/2 = 8.84 m²
A_{tank}= 4/2 * 3/2=3 m²;
s/w=2 * 8.84 + 20 * 3 =77.68KN
All New Axial Force = 77.68 + 8.265 + 5 = 90.945 KN = 91 KN.



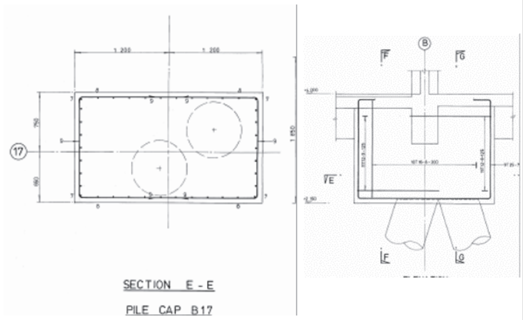
	Job Existing Checking		Job no.
Section: B17 Axial force-2		By:	Sheet no.
Subject: COLUMN		Date: May 11	

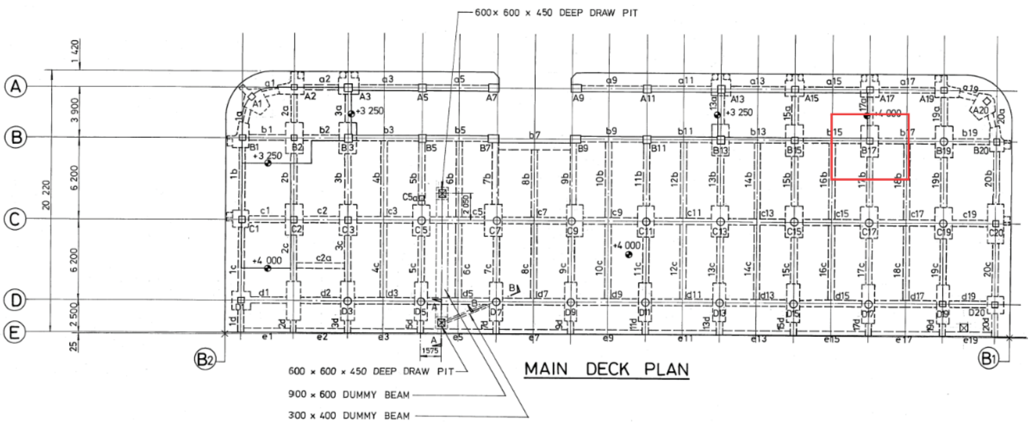
UD/F Existing Building:
Density of concrete:24.5 KN/m³ Thickness of Slab max. to be 175mm.
Affected Area: (5.7/2 +5.7/2) * (3.9/2 +6.2/2)=27.79 m²
Reinforcement: 8T25
SDL: 1.5 KPa(Finishing) + 0.5(Service)=2 KPa (Assume, No record)
LL: 5 KPa (Assume, Dormitory, No record)
DL:
Slab: 24.5 * 0.175(t)=4.3 KPa
Beam:
17a: s/w= 24.5 * 0.3 * 0.6 * 3.9/2(length of beam)=8.6 KN
17b: s/w= 24.5 * 0.3 * 0.6 * 6.2/2(length of beam)=13.671 KN
b15: s/w= 24.5 * 0.45 * 0.86 * 5.7/2(length of beam)=27 KN
b17: s/w= 24.5 * 0.45 * 0.625 * 5.7/2(length of beam)=19.64 KN
16b: s/w= 24.5 * 0.3 * 0.6 * 6.2/(2 * 2) (length of beam)=6.84 KN
18b: s/w= 24.5 * 0.3 * 0.6 * 6.2/(2 * 2) (length of beam)=6.84 KN
Column: s/w= 24.5 * 0.45 x0.45 * (7.3-4) (Height of Column) = 16.37 KN
B17 UD/F Axial force = (4.3 + 2) * 27.79 + 8.6 + 13.671 + 27 + 19.64 + 6.84 + 6.84 + 16.37+ 5 * 27.79
= 412.99 KN



UPPER DECK PLAN

MD/F Existing Building:
Density of concrete:24.5 KN/m³ Thickness of Slab max. to be 200mm.
Affected Area: (5.7/2 +5.7/2) * (3.9/2 +6.2/2)=27.79 m²
Reinforcement: 8T25
SDL: 1.5 KPa(Finishing) + 0.5 (Service) = 2 KPa (Assume, No record)
LL: 5 KPa (Assume, Dormitory, No record)
DL:
Slab: 24.5 * 0.2(t)=4.9 Kpa
Beam:
17a: 24.5 * 0.45 * 0.75 * 3.9/2(length of beam)=16.12 KN
17b: 24.5 * 0.45 * 0.75 * 6.2/2(length of beam)=25.63 KN
b15: 24.5 * 0.45 * 1.095 * 5.7/2(length of beam)=34.4 KN
b17: 24.5 * 0.45 * 0.775 * 5.7/2(length of beam)=24.35 KN
16b: 24.5 * 0.45 * 0.75 * 6.2/(2 * 2) (length of beam)=12.82 KN
18b: 24.5 * 0.45 * 0.75 * 6.2/(2 * 2) (length of beam)=12.82 KN
Footing: 24.5 * 2.4 x1.4 * 1.85m (Height of cap) = 152.3 KN
B17 MD/F Axial force = (4.9 + 2) * 27.79 + 16.12 + 25.63 + 34.4 + 24.35 + 12.82 + 12.82 + 152.3 + 5 * 27.79
= 609.141 KN





P_{B17}=353.65 + 412.99 + 609.141 +91=1466.781 = 1467 kN

	Job Existing Checking		Job no.
Section: B19 Axial force-1		By:	Sheet no.
Subject: COLUMN		Date: May 11	

R/F Existing Building:

Density of concrete:24.5 KN/m³ Thickness of Slab max.to be 150mm.

Affected Area: (5.7/2 +4.0/2) * (3.9/2 +6.2/2)=24.49 m²

Reinforcement: 8T25

SDL: 3.0 KPa(Finishing) + 0.5 (Service) = 3.5 KPa (Assume, No Record)

LL: 2 KPa (Assume, Dormitory, No record)

DL:

Slab: s/w= 24.5 * 0.15(t)=3.7 KPa

Beam:

19a: s/w= 24.5 * 0.3 * 0.575 * 3.9/2(length of beam)=8.24 KN

19b: s/w= 24.5 * 0.3 * 0.575 * 6.2/2(length of beam)=13.1 KN

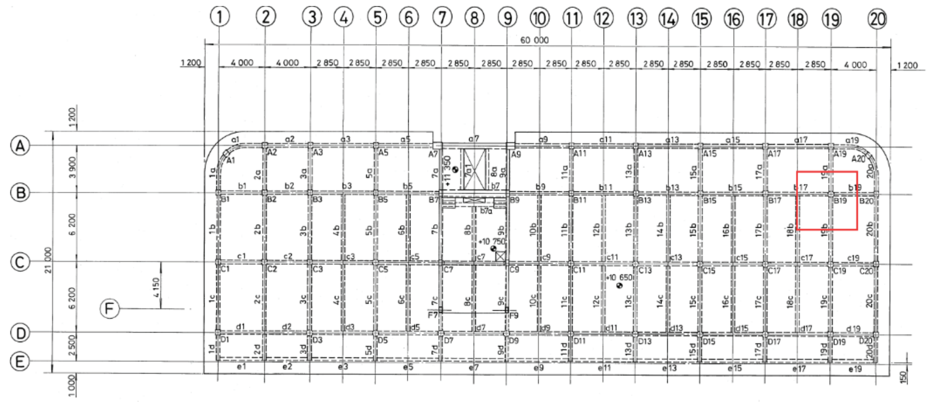
b17: s/w= 24.5 * 0.45 * 0.6 * 5.7/2(length of beam)=18.85 KN

b19: s/w= 24.5 * 0.45 * 0.6 * 4/2(length of beam)=13.23 KN

18b: s/w= 24.5 * 0.3 * 0.575 * 6.2/(2 * 2)(length of beam)=6.55 KN

Column: s/w= 24.5 * 3.14 x0.25 * 0.25 * 3.45m(Height of Column) = 16.59 KN

B19 R/F Axial force = (3.7 + 3.5) * 24.49 + 8.24 + 13.1 + 18.85 + 13.23 + 6.55 + 16.59 + 2 * 24.49
= 301.87 KN



ROOF PLAN

Add water tank load:

MB1: UC 356x406x287kg/m; s/w=287 * 9.8/1000=2.9 kN/m

MB2: UC 305x305x158kg/m; s/w=158 * 9.8/1000=1.6 kN/m

Beam force:

MB1:s/w= (5.7+4)/2 * 2.9= 14.1 KN;

MB2:s/w=2 * 6.2/2 * 1.6= 10 KN;

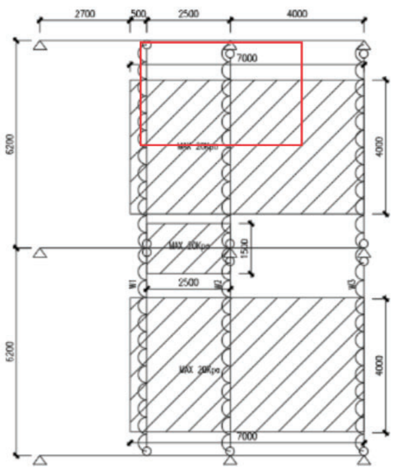
Slab: D=2kpa; DL=20kpa;

A_{slab}=6.2/2 * (5.7/2 + 4/2) = 15 m²;

A_{tank}=4/2 * (5.7/2 + 4/2) = 9.7 m²;

s/w=DD+DL:2 * 15 + 20 * 9.7 =224KN

All New Axial Force = 224 + 14.1 + 10.0 = 248.1 KN = 249 KN



	Job Existing Checking		Job no.
Section: B19 Axial force-2		By:	Sheet no.
Subject: COLUMN		Date: May 11	

UD/F Existing Building:

Density of concrete:24.5 KN/m³ Thickness of Slab max.to be 175mm.

Affected Area: (5.7/2 +4.0/2) * (3.9/2 +6.2/2)=24.49 m²

Reinforcement: 8T25

SDL: 1.5 KPa(Finishing) + 0.5(Service)=2 KPa (Assume, No record)

LL: 5 KPa (Assume, Dormitory, No record)

DL:

Slab: 24.5 * 0.175(t)=4.3 KPa

Beam:

19a: s/w=24.5 * 0.3 * 0.6 * 3.9/2(length of beam)=8.6 KN

19b: s/w=24.5 * 0.3 * 0.6 * 6.2/2(length of beam)=13.67 KN

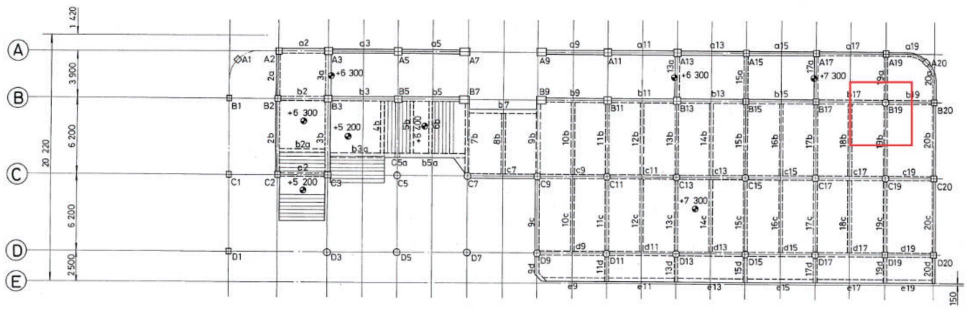
b17: s/w=24.5 * 0.45 * 0.625 * 5.7/2(length of beam)=19.64 KN

b19: s/w=24.5 * 0.45 * 0.625 * 4/2(length of beam)=13.78 KN

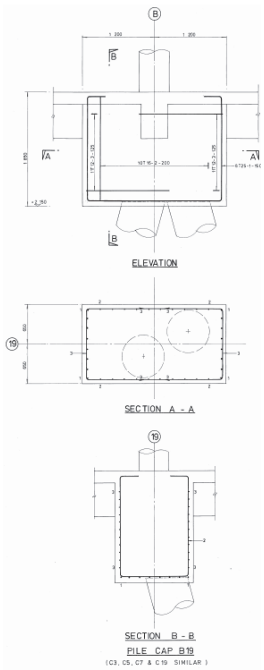
18b: s/w=24.5 * 0.3 * 0.6 * 6.2/(2 * 2)(length of beam)=6.84 KN

Column: s/w=24.5 * 3.14 * 0.25 * 0.25 * 3.3m(Height of Column) = 15.87 KN

B19 UD/F Axial force = (4.3 + 2) * 24.49 +8.6 + 13.67 + 19.64 + 13.78 + 6.84 + 15.87 + 5 * 24.49
= 355.14 KN



UPPER DECK PLAN



MD/F Existing Building:

Density of concrete:24.5 KN/m³ Thickness of Slab max.to be 200mm.

Affected Area: (5.7/2 +4.0/2) * (3.9/2 +6.2/2)= 24.49 m²

Reinforcement: 8T25

SDL: 1.5 KPa(Finishing) + 0.5 (Service) = 2 KPa (Assume, No record)

LL: 5 KPa (Assume, Dormitory, No record)

DL:

Slab: 24.5 * 0.2(t)=4.9 Kpa

Beam:

19a: s/w= 24.5 * 0.45 * 0.75 * 3.9/2(length of beam)=16.12 KN

19b: s/w= 24.5 * 0.45 * 0.75 * 6.2/2(length of beam)=25.63 KN

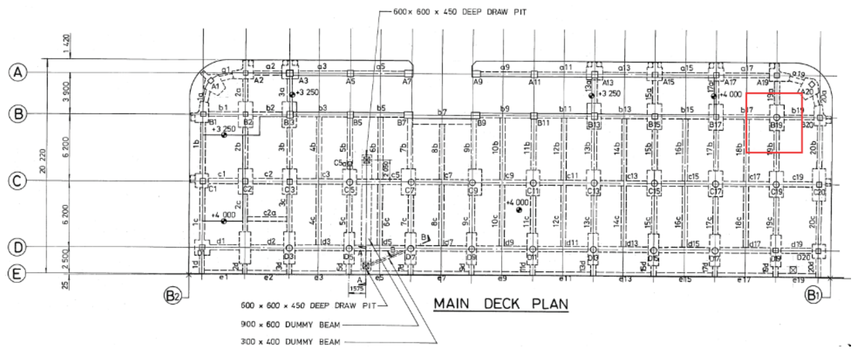
b17: s/w= 24.5 * 0.45 * 0.775 * 5.7/2(length of beam)=24.35 KN

b19: s/w= 24.5 * 0.45 * 0.775 * 4/2(length of beam)=17.09 KN

18b: s/w= 24.5 * 0.45 * 0.75 * 6.2/(2 * 2)(length of beam)=12.82 KN

Pile cap: s/w=24.5 * 2.4 * 1.3 * 1.85 m(Height of Column) = 141.414 KN

B19 MD/F Axial force = (4.9 + 2) * 24.49 + 16.12 + 25.63 + 24.35 + 17.09 + 12.82 + 141.414 + 5 * 24.49
= 528.855 KN

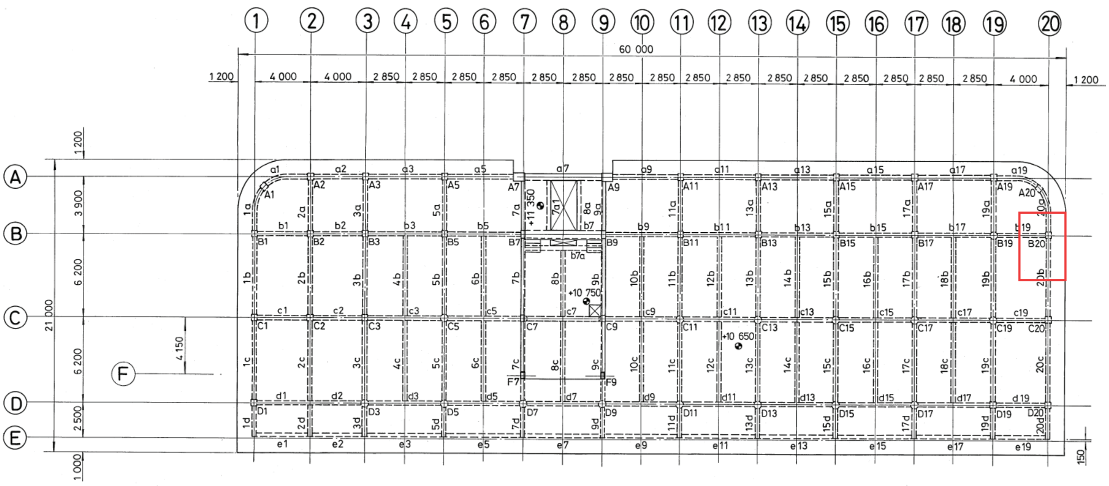


MAIN DECK PLAN

P_{B19}=301.87+355.14+528.855+249=1434.862=1435 kN

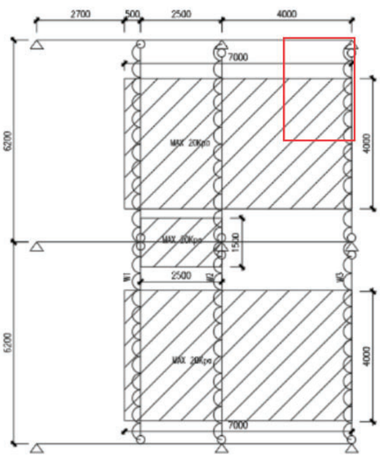
	Job Existing Checking	Job no.
Section: B20 Axial force-1	By:	Sheet no.
Subject: COLUMN	Date: May 11	

R/F Existing Building:
Density of concrete:24.5 KN/m³ Thickness of Slab max.to be 150mm.
Affected Area: (1.2 +4.0/2) * (3.9/2 +6.2/2)=16.16 m²
Reinforcement: 8T25
SDL: 3.0 KPa(Finishing) + 0.5 (Service) = 3.5 KPa (Assume, No Record)
LL: 2 KPa (Assume, Dormitory, No record)
DL:
Slab: s/w= 24.5 * 0.15(thk.)=3.7 KPa
Beam:
20a: s/w= 24.5 * 0.3 * 0.575 * 3.9/2(length of beam)=8.24 KN
20b: s/w= 24.5 * 0.3 * 0.575 * 6.2/2(length of beam)=13.1 KN
b19: s/w= 24.5 * 0.45 * 0.6 * 4/2(length of beam)=13.23 KN
Column: s/w= 24.5 * 0.45 * 0.45 * 3.45m(Height of Column) = 17.12 KN
B20 R/F Axial force =(3.7 + 3.5) * 16.16 + 8.24 + 13.1 + 13.23 + 17.12 + 2 * 16.16 = 200.36 KN



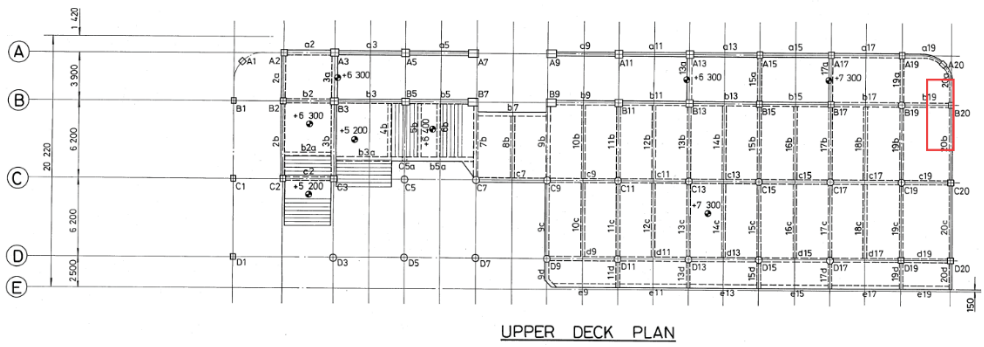
ROOF PLAN

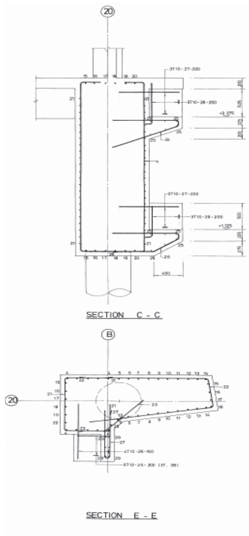
Add water tank load:
MB1: UC 356x406x287kg/m; s/w=287*9.8/1000=2.9 kN/m
MB2: UC 305x305x158kg/m; s/w=158*9.8/1000=1.6 kN/m
Beam force:
MB1: s/w= 4/2 * 2.9= 5.8 KN;
MB2: s/w= 6.2/2 * 1.6= 5.0 KN;
Slab: DD=2Kpa; DL=20Kpa;
A_{slab}=6.2/2 * 4/2 = 6.2 m^2
A_{tank}=4/2 * 4/2 = 4 m^2
s/w=: 2 * 6.2 + 30 * 4 = 132.4 KN
all new load P2: 132.4 + 5.8 + 5 = 143.2 KN = 144 KN.



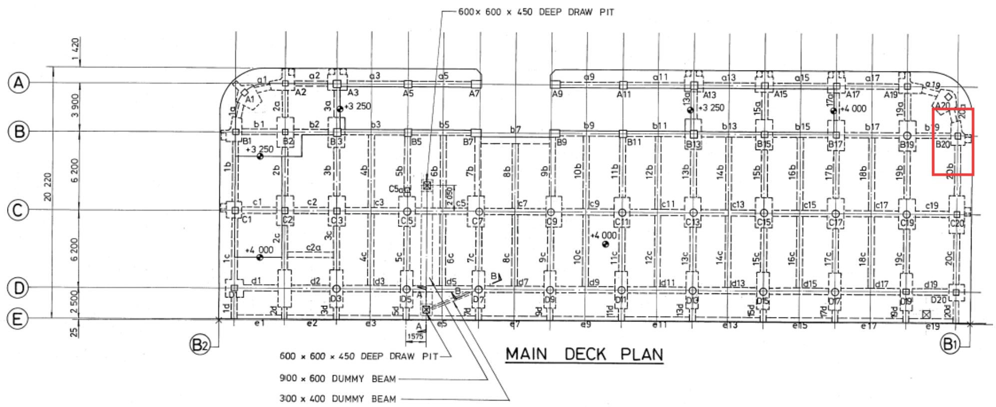
	Job Existing Checking		Job no.
Section:	B20 Axial force-2	By:	Sheet no.
Subject:	COLUMN	Date: May 11	

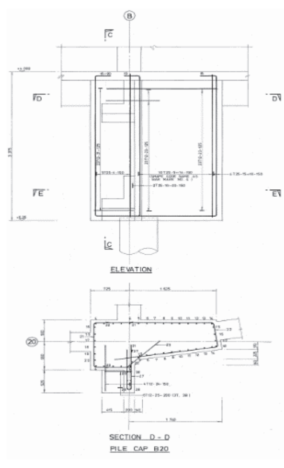
UD/F Existing Building:
Density of concrete:24.5 KN/m³ Thickness of Slab max. to be 175mm.
Affected Area: 4.0/2 * (3.9/2 +6.2/2)=10.1 m²
Reinforcement: 8T25
SDL: 1.5 KPa(Finishing) + 0.5(Service)=2 KPa (Assume, No record)
LL: 5 KPa (Assume, Dormitory, No record)
DL:
Slab: 24.5 * 0.175(t)=4.3 KPa
Beam:
20a: s/w= 24.5 * 0.3 * 0.55 * 3.9/2(length of beam)=7.88 KN
20b: s/w= 24.5 * 0.3 * 0.6 * 6.2/2(length of beam)=13.67 KN
b19: s/w= 24.5 * 0.45 * 0.625 * 4/2(length of beam)=13.78 KN
Column: 24.5 * 0.45 * 0.45 * 3.3m(Height of Column) = 16.37 KN
B20 UD/F Axial force = (4.3 + 2) * 10.1 + 7.88 + 13.67 + 13.78 + 16.37 + 5 * 10.1 = 165.83 KN





MD/F Existing Building:
Density of concrete:24.5 KN/m³ Thickness of Slab max. to be 200mm.
Affected Area: （4.0/2 + 1.2） * (3.9/2 +6.2/2)=16.16 m²
Reinforcement: 8T25
SDL: 1.5 KPa(Finishing) + 0.5 (Service) = 2 KPa (Assume, No record)
LL: 5 KPa (Assume, Dormitory, No record)
DL:
Slab: 24.5 * 0.2(t)=4.9 Kpa
Beam:
20a: s/w= 24.5 * 0.45 * 1 * 3.9/2(length of beam)=7.88 KN
20b: s/w= 24.5 * 0.45 * 0.75 * 6.2/2(length of beam)=25.63 KN
b19: s/w= 24.5 * 0.45 * 0.775 * 4/2(length of beam)=17.09 KN
Pile cap: s/w=24.5 x（2.22 * 3.375 m(Height of Column)+0.615 * (1.15+1) * 0.525）= 200.57 KN
B20 MD/F Axial force = (4.9 + 2) * 16.16 + 7.88 + 25.63 + 17.09 + 200.57 + 5 * 16.16 = 443.474 KN





P_{B20}=200.36 + 165.83 + 443.474 + 144 =953.664 kN

	Job	Job no.
	Existing Checking	
Section: C17 Axial force-1	By:	Sheet no.
Subject: COLUMN	Date: May 11	

R/F Existing Building:

Density of concrete:24.5 KN/m^3 Thickness of Slab max.to be 150mm.

Affected Area: (5.7/2 +5.7/2) * (6.2/2 +6.2/2)=35.34 m^2

Reinforcement: 8T25

SDL: 3.0 KPa(Finishing) + 0.5 (Service) = 3.5 KPa (Assume, No Record)

LL: 2 KPa (Assume, Dormitory, No record)

DL:

Slab: 24.5 * 0.15(t)=3.7 KPa

Beam:

17b: s/w= 24.5 * 0.3 * 0.575 * 6.2/2(length of beam)=13.1 KN

17c: s/w= 24.5 * 0.3 * 0.575 * 6.2/2(length of beam)=13.1 KN

c15: s/w= 24.5 * 0.45 * 0.75 * 5.7/2(length of beam)=23.57 KN

c17: s/w= 24.5 * 0.45 * 0.75 * 5.7/2(length of beam)=23.57 KN

16b: s/w= 24.5 * 0.3 * 0.575 * 6.2/(2 * 2)(length of beam)=6.55 KN

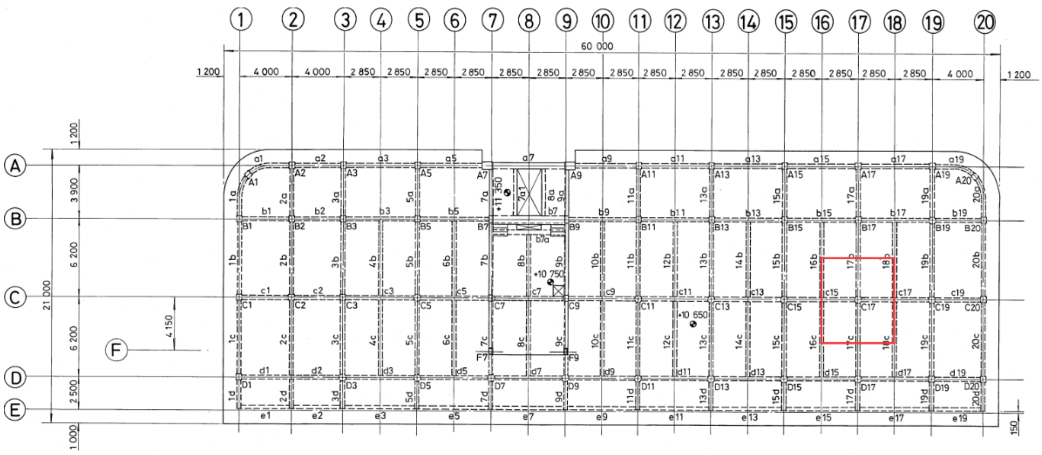
16c: s/w= 24.5 * 0.3 * 0.575 * 6.2/(2 * 2)(length of beam)=6.55 KN

18b: s/w= 24.5 * 0.3 * 0.575 * 6.2/(2 * 2)(length of beam)=6.55 KN

18c: s/w= 24.5 * 0.3 * 0.575 * 6.2/(2 * 2)(length of beam)=6.55 KN

Column: s/w= 24.5 * 0.45 x0.45 * 3.45m(Height of Column) = 17.12 KN

C17 R/F Axial force = (3.7 + 3.5) * 35.34 + 13.1 + 13.1 + 23.57 + 23.57 + 6.55 * 4 + 17.12 + 2 * 35.34
= 441.79 KN



ROOF PLAN

Add water tank load:

MB1: UC 356x406x287kg/m; s/w=287 * 9.8/1000=2.9 kN/m

MB2: UC 305x305x158kg/m; s/w=158 * 9.8/1000=1.6 kN/m

Beam force:

MB1: s/w=5.7/2 * 2.9= 8.3 KN;

MB2: s/w=2 * 6.2/2 * 1.6= 10 KN;

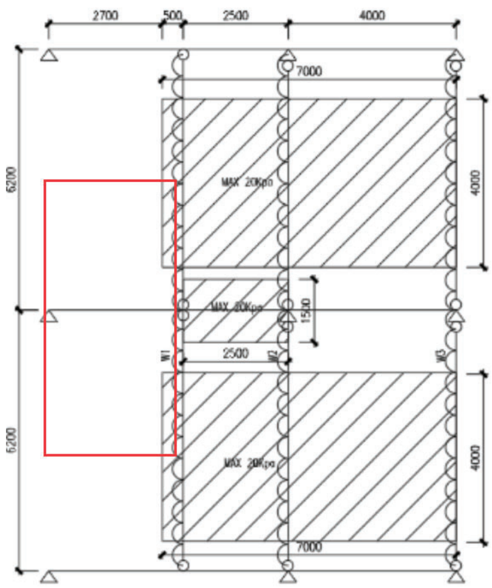
Slab: DD=2Kpa; DL=20Kpa;

A_{slab}=6.2 * 5.7/2 = 17.67 m^2;

A_{tank}=4 * 3/2 = 6.0 m^2;

s/w=DD+DL=2 * 17.67 + 20 * 6.0 =155.34KN

All New Axial Force = 155.34 + 8.3 + 10 = 173.64 KN = 174 KN.



	Job Existing Checking	Job no.
Section: C17 Axial force-2	By:	Sheet no.
Subject: COLUMN	Date: May 11	

UD/F Existing Building:

Density of concrete:24.5 KN/m³ Thickness of Slab max. to be 175mm.

Affected Area: (5.7/2 +5.7/2) * (6.2/2 +6.2/2)=35.34 m²

Reinforcement: 8T25

SDL: 1.5 KPa(Finishing) + 0.5(Service)=2 KPa (Assume, No record)

LL: 5 KPa (Assume, Dormitory, No record)

DL:

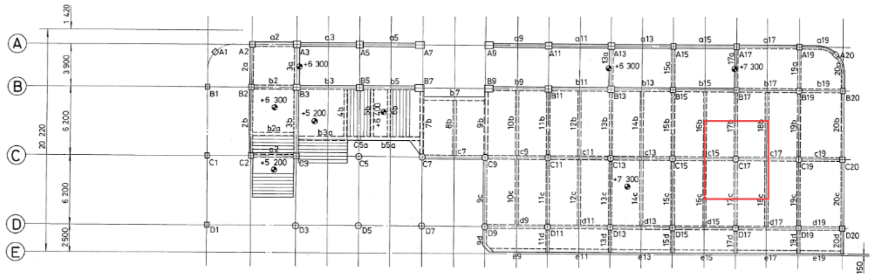
Slab: 24.5 * 0.175(t)=4.3 KPa

Beam:

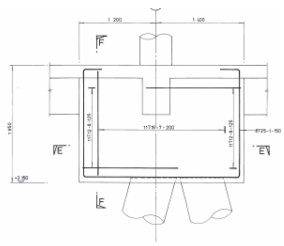
17b: s/w= 24.5 * 0.3 * 0.6 * 6.2/2(length of beam)=13.67 KN
17c: s/w= 24.5 * 0.3 * 0.6 * 6.2/2(length of beam)=13.67 KN
c15: s/w= 24.5 * 0.45 * 0.625 * 5.7/2(length of beam)=19.64 KN
c17: s/w= 24.5 * 0.45 * 0.625 * 5.7/2(length of beam)=19.64 KN
16b: s/w= 24.5 * 0.3 * 0.575 * 6.2/(2 * 2)(length of beam)=6.84 KN
16c: s/w= 24.5 * 0.3 * 0.575 * 6.2/(2 * 2)(length of beam)=6.84 KN
18b: s/w= 24.5 * 0.3 * 0.575 * 6.2/(2 * 2)(length of beam)=6.84 KN
18c: s/w= 24.5 * 0.3 * 0.575 * 6.2/(2 * 2)(length of beam)=6.84 KN

Column: s/w= 24.5 * 0.45 x0.45 * 3.3m(Height of Column) = 16.37 KN

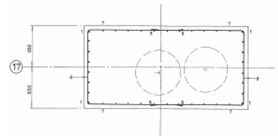
C17 UD/F Axial force = (4.3 + 2) * 35.34 + 13.1 + 13.1 + 19.64 + 19.64 + 6.84 * 4 + 16.37 + 5 x35.34
= 508.55 KN



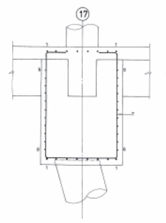
UPPER DECK PLAN



ELEVATION



SECTION E - E



SECTION F - F
PILE CAP C17

MD/F Existing Building:

Density of concrete:24.5 KN/m³ Thickness of Slab max. to be 200mm.

Affected Area: (5.7/2 +5.7/2) * (6.2/2 +6.2/2)=35.34 m²

Reinforcement: 8T25

SDL: 1.5 KPa(Finishing) + 0.5 (Service) = 2 KPa (Assume, No record)

LL: 5 KPa (Assume, Dormitory, No record)

DL:

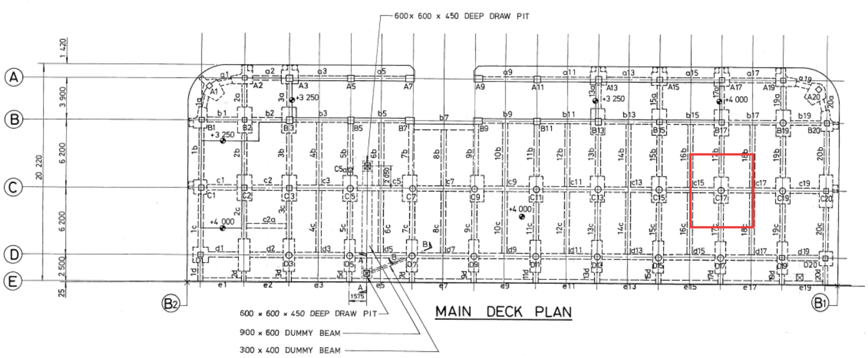
Slab: 24.5 * 0.2(t)=4.9 Kpa

Beam:

17b: s/w= 24.5 * 0.45 * 0.75 * 6.2/2(length of beam)=25.63 KN
17c: s/w= 24.5 * 0.45 * 0.75 * 6.2/2(length of beam)=25.63 KN
c15: s/w= 24.5 * 0.45 * 0.775 * 5.7/2(length of beam)=24.35 KN
c17: s/w= 24.5 * 0.45 * 0.775 * 5.7/2(length of beam)=24.35 KN
16b: s/w= 24.5 * 0.45 * 0.75 * 6.2/(2 * 2)(length of beam)=12.82 KN
16c: s/w= 24.5 * 0.45 * 0.75 * 6.2/(2 * 2)(length of beam)=12.82 KN
18b: s/w= 24.5 * 0.45 * 0.75 * 6.2/(2 * 2)(length of beam)=12.82 KN
18c: s/w= 24.5 * 0.45 * 0.75 * 6.2/(2 * 2)(length of beam)=12.82 KN

Pile cap: s/w=24.5 * 1.3 * 2.6 * 1.85m(Height of Column) = 153.2 KN

C17 MD/F Axial force = (4.9 + 2) * 35.34 + 25.63 * 2 + 24.35 * 2 + 12.82 * 4 + 153.2 + 5 x35.34
= 724.99 KN



MAIN DECK PLAN

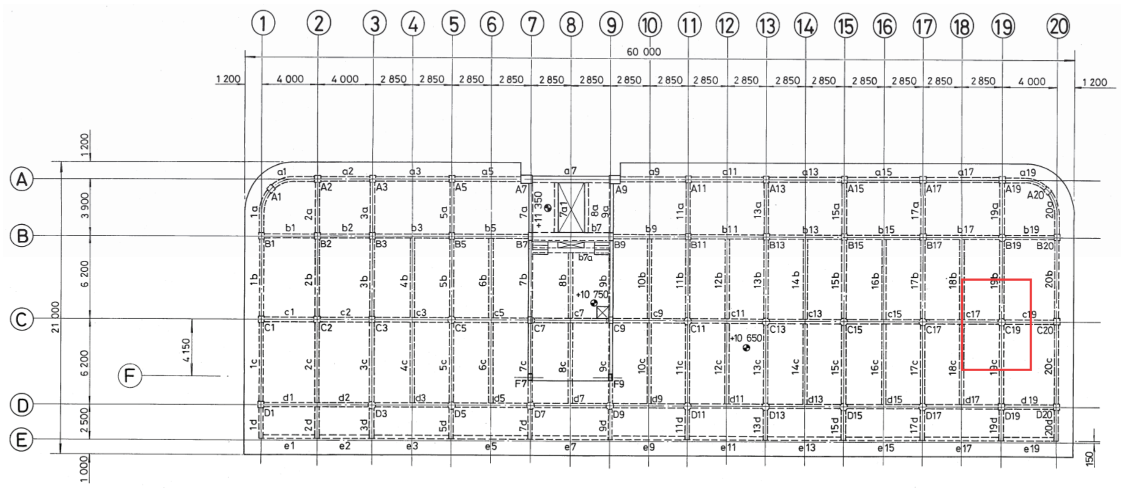
P_{C17}=441.79 + 508.55 + 724.99 + 174 =1940.327= 1849.33 = 1850 kN

	Job Existing Checking		Job no.
Section:	C19 Axial force-1	By:	Sheet no.
Subject:	COLUMN	Date: May 11	

R/F Existing Building:
Density of concrete:24.5 KN/m³ Thickness of Slab max.to be 150mm.
Affected Area: (5.7/2 +4.0/2) * (6.2/2 +6.2/2)=30.07 m²
Reinforcement: 8T25
SDL: 3.0 KPa(Finishing) + 0.5 (Service) = 3.5 KPa (Assume, No Record)
LL: 2 KPa (Assume, Dormitory, No record)
DL:
Slab: s/w= 24.5 * 0.15(t)=3.7 KPa
Beam:

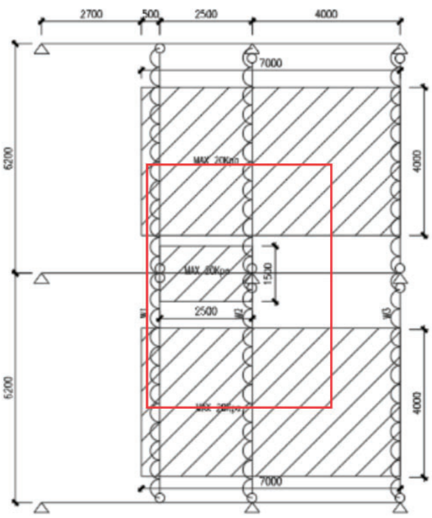
19b: s/w=24.5 * 0.3 * 0.575 * 6.2/2(length of beam)=13.1 KN
19c: s/w=24.5 * 0.3 * 0.575 * 6.2/2(length of beam)=13.1 KN
c17: s/w=24.5 * 0.45 * 0.75 * 5.7/2(length of beam)=23.57 KN
c19: s/w=24.5 * 0.45 * 0.75 * 4/2(length of beam)=16.54 KN
18b: s/w=24.5 * 0.3 * 0.575 * 6.2/(2 * 2)(length of beam)=6.55 KN
18c: s/w=24.5 * 0.3 * 0.575 * 6.2/(2 * 2) (length of beam)=6.55 KN

Column: s/w= 24.5 * 3.14 x0.25 * 0.25 * 3.45m(Height of Column) = 16.59 KN
C19 R/F Axial force =: (3.7 + 3.5) * 30.07 + 13.1 + 13.1 + 23.57 + 16.54 + 6.55 * 2 + 16.59 + 2 * 30.07
= 372.64 KN



ROOF PLAN

Add water tank load:
MB1: UC 356x406x287kg/m; s/w=287 * 9.8/1000=2.9 kN/m
MB2: UC 305x305x158kg/m; s/w=158 * 9.8/1000=1.6 kN/m
Beam force:
MB1: s/w= (5.7+4)/2 * 2.9= 14.1 KN;
MB2: s/w= 2 * 2 * 6.2/2 * 1.6= 20 KN;
Slab : DD=2Kpa; TANK1=10Kpa; TANK2=20Kpa;
A_{slab}=6.2/2 * 2 * (5.7/2 + 4/2) = 30.07 m²;
A_{tank1}=1.5 * 2.5 = 3.75 m² ;
A_{tank2}=4 * (5.7/2 + 4/2) = 19.4 m²
s/w=2 * 30.07 + 20 * 19.4 + 10 * 3.75 = 485.64KN
All New Axial Force =485.64 + 14.1 + 20 = 519.74 KN = 520 KN.



	Job Existing Checking		Job no.
	Section: C19 Axial force-2	By:	Sheet no.
	Subject: COLUMN	Date: May 11	

UD/F Existing Building:

Density of concrete:24.5 KN/m³ Thickness of Slab max.to be 175mm.

Affected Area: (5.7/2 +4.0/2) * (6.2/2 +6.2/2)=30.07 m²

Reinforcement: 8T25

SDL: 1.5 KPa(Finishing) + 0.5(Service)=2 KPa (Assume, No record)

LL: 5 KPa (Assume, Dormitory, No record)

DL:

Slab: 24.5 * 0.175(t)=4.3 KPa

Beam:

19b: s/w= 24.5 * 0.3 * 0.6 * 6.2/2(length of beam)=13.67 KN

19c: s/w= 24.5 * 0.3 * 0.6 * 6.2/2(length of beam)=13.67 KN

c17: s/w= 24.5 * 0.45 * 0.625 * 5.7/2(length of beam)=19.64 KN

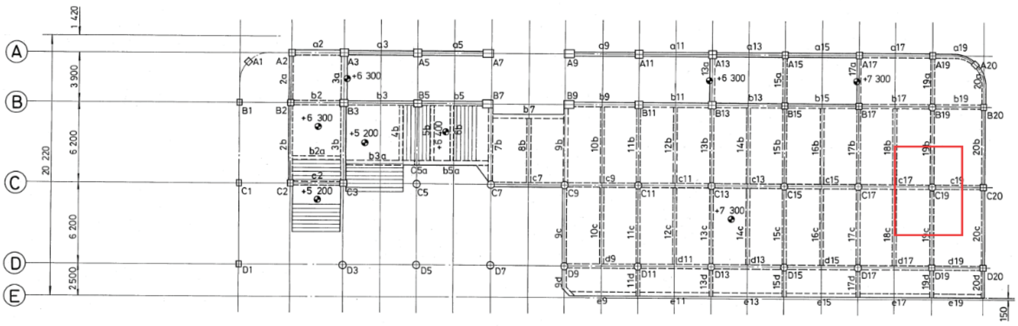
c19: s/w= 24.5 * 0.45 * 0.625 * 4/2(length of beam)=13.78 KN

18b: s/w= 24.5 * 0.3 * 0.6 * 6.2/(2 * 2)(length of beam)=6.84 KN

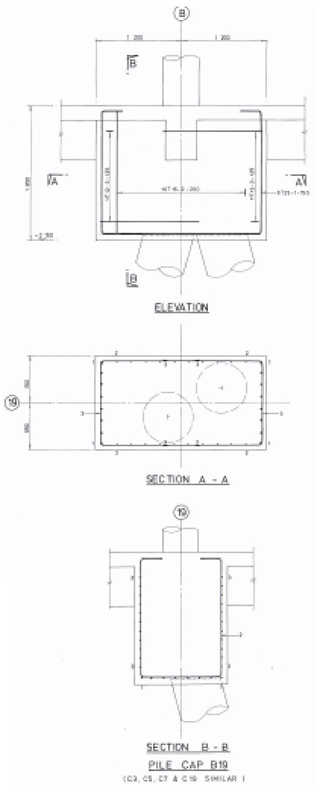
18c: s/w= 24.5 * 0.3 * 0.6 * 6.2/(2 * 2) (length of beam)=6.84 KN

Column: s/w= 24.5 * 3.14 x0.25 * 0.25 * 3.3m(Height of Column) = 15.87 KN

C19 UD/F Axial force = (4.3 + 2) * 30.07 + 13.67 + 13.67 + 19.64 + 13.78 + 6.84 * 2 + 15.87 + 5 * 30.07
= 430.1 KN



UPPER DECK PLAN



MD/F Existing Building:

Density of concrete:24.5 KN/m³ Thickness of Slab max.to be 200 mm.

Affected Area: (5.7/2 +4.0/2) * (6.2/2 +6.2/2)= 30.07 m²

Reinforcement: 8T25

SDL: 1.5 KPa(Finishing) + 0.5 (Service) = 2 KPa (Assume, No record)

LL: 5 KPa (Assume, Dormitory, No record)

DL:

Slab: 24.5 * 0.2(t)=4.9 Kpa

Beam:

19b: s/w= 24.5 * 0.45 * 0.75 * 6.2/2(length of beam)=25.63 KN

19c: s/w= 24.5 * 0.45 * 0.75 * 6.2/2(length of beam)=25.63 KN

c17: s/w= 24.5 * 0.45 * 0.775 * 5.7/2(length of beam)=24.35 KN

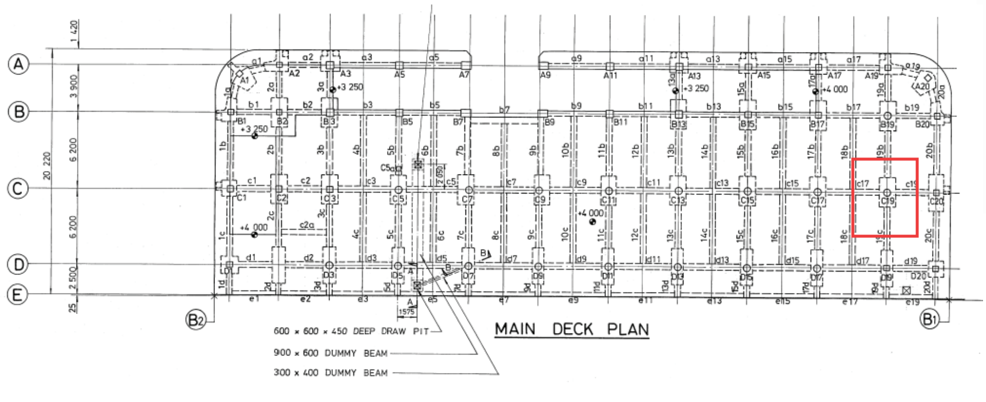
c19: s/w= 24.5 * 0.45 * 0.775 * 4/2(length of beam)=17.09 KN

18b: s/w= 24.5 * 0.45 * 0.75 * 6.2/(2 * 2)(length of beam)=12.82 KN

18c: s/w= 24.5 * 0.45 * 0.75 * 6.2/(2 * 2) (length of beam)=12.82 KN

Pile cap: s/w= 24.5 * 2.4 x1.3 * 1.85 (Height of cap) = 141.414 KN

C19 MD/F Axial force =(4.9 + 2) * 30.07 + 25.63 * 2 + 24.35 + 17.09 +
12.82 * 2 + 141.414 + 5 * 30.07 = 617.587KN



P_{C19}=372.64 + 430.1 + 617.587 + 520 =1940.327= 1941 kN

	Job Existing Checking		Job no.
Section:	C20 Axial force-1	By:	Sheet no.
Subject:	COLUMN	Date: May 11	

R/F Existing Building:

Density of concrete:24.5 KN/m^3 Thickness of Slab max.to be 150mm.

Affected Area: (1.2 +4.0/2) * (6.2/2 +6.2/2)=19.84 m^2

Reinforcement: 8T25

SDL: 3.0 KPa(Finishing) + 0.5 (Service) = 3.5 KPa (Assume, No Record)

LL: 2 KPa (Assume, Dormitory, No record)

DL:

Beam:

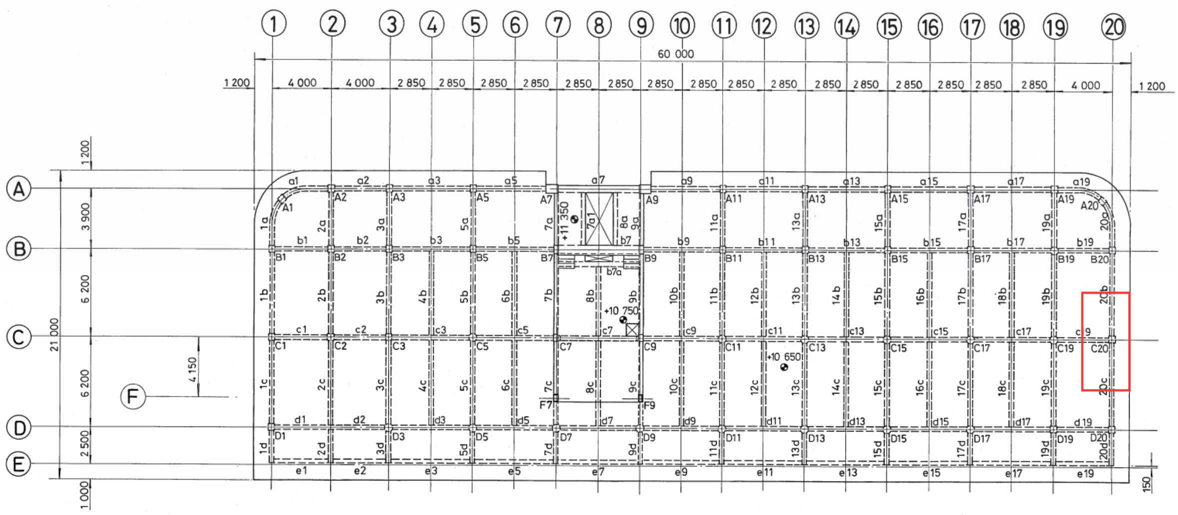
20b: 24.5 * 0.3 * 0.575 * 6.2/2(length of beam)=13.1 KN

20c: 24.5 * 0.3 * 0.575 * 6.2/2(length of beam)=13.1 KN

c19: 24.5 * 0.45 * 0.75 * 4/2(length of beam)=16.54 KN

Column: 24.5 * 0.45 * 0.45 * 3.45m(Height of Column) = 17.12 KN

C20 R/F Axial force = (3.7 + 3.5) * 19.84 + 13.1 + 13.1 + 16.54 + 17.12 + 2 * 19.84 = 242.39 KN



ROOF PLAN

Add water tank load:

MB1: UC 356x406x287kg/m; s/w=287 * 9.8/1000=2.9 kN/m

MB2: UC 305x305x158kg/m; s/w=158 * 9.8/1000=1.6 kN/m

Beam force:

MB1= 4/2 * 2.9= 5.8 KN;

MB2= 6.2 * 1.6= 10 KN;

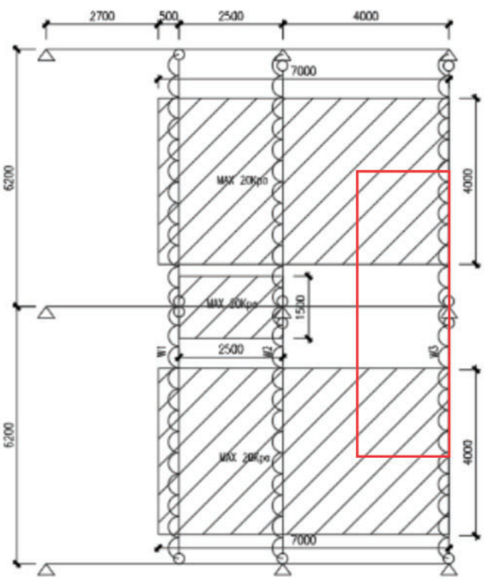
Slab: DD=2Kpa; DL=20Kpa;

A_{slab}=6.2 * 4/2 = 12.4 m^2;

A_{tank}=4 * 4/2 = 8 m^2;

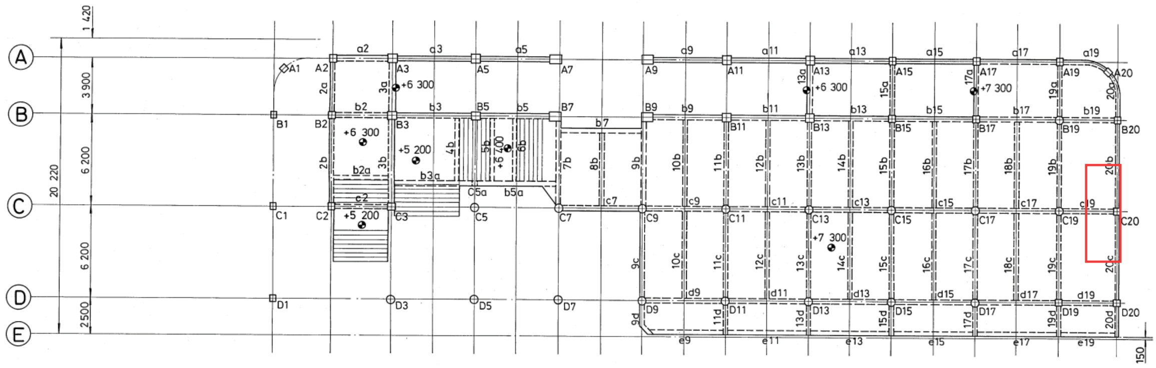
s/w=2 * 12.4 + 20 * 8 =184.8KN

All New Axial Force = 184.8 + 5.8 + 10 = 200.6 KN = 201 KN.



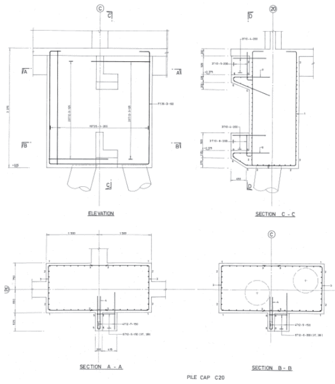
	Job Existing Checking		Job no.
Section:	C20 Axial force-2	By:	Sheet no.
Subject:	COLUMN	Date: May 11	

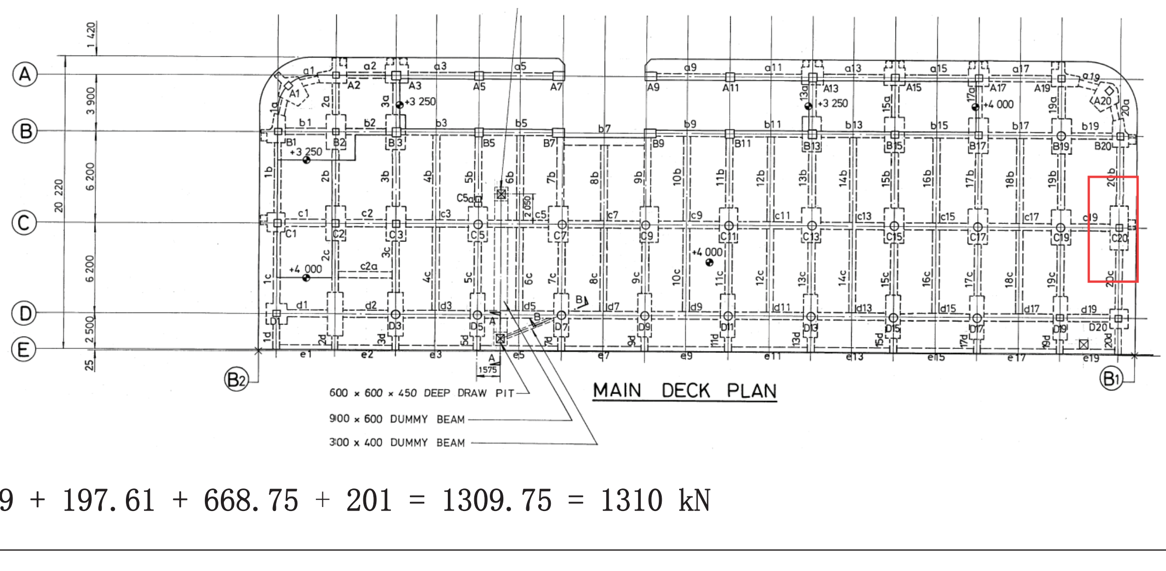
UD/F Existing Building:
Density of concrete:24.5 KN/m³ Thickness of Slab max. to be 175mm.
Affected Area: 4.0/2 * (6.2/2 +6.2/2)=12.4 m²
Reinforcement: 8T25
SDL: 1.5 KPa(Finishing) + 0.5(Service)=2 KPa (Assume, No record)
LL: 5 KPa (Assume, Dormitory, No record)
DL:
Slab: 24.5 * 0.175(t)=4.3 KPa
Beam:
20b: s/w=24.5 * 0.3 * 0.6 * 6.2/2(length of beam)=13.67 KN
20c: s/w=24.5 * 0.3 * 0.6 * 6.2/2(length of beam)=13.67 KN
c19: s/w=24.5 * 0.45 * 0.625 * 4/2(length of beam)=13.78 KN
Column: s/w=24.5 * 0.45 * 0.45 * 3.3m(Height of Column) = 16.37 KN
C20 UD/F Axial force = (4.3 + 2) * 12.4 +13.67 + 13.67 + 13.78 + 16.37 + 5 * 12.4 = 197.61 KN



UPPER DECK PLAN

MD/F Existing Building:
Density of concrete:24.5 KN/m³ Thickness of Slab max. to be 200mm.
Affected Area: (4.0/2 + 1.2) * (6.2/2 +6.2/2)=19.84 m²
Reinforcement: 8T25
SDL: 1.5 KPa(Finishing) + 0.5 (Service) = 2 KPa (Assume, No record)
LL: 5 KPa (Assume, Dormitory, No record)
DL:
Slab: 24.5 * 0.2(t)=4.9 Kpa
Beam:
20b: 24.5 * 0.45 * 0.75 * 6.2/2(length of beam)=25.63 KN
20c: 24.5 * 0.45 * 0.75 * 6.2/2(length of beam)=25.63 KN
c19: 24.5 * 0.45 * 0.775 * 4/2(length of beam)=17.09 KN
Pile cap: s/w=24.5 x (3 * 1.4 * 3.375m(Height of Column) + 0.525 * (1.15+1) * 0.615) = 364.3 KN
C20 MD/F Axial force = (4.9 + 2) * 19.84 +25.63 + 25.63 + 17.09 + 364.3 + 5 * 19.84 = 668.75 KN





MAIN DECK PLAN

P_{C20}=242.39 + 197.61 + 668.75 + 201 = 1309.75 = 1310 kN

	Job Existing Checking	Job no.
Section: D17 Axial force-1	By:	Sheet no.
Subject: COLUMN	Date: May 11	

R/F Existing Building:

Density of concrete:24.5 KN/m³ Thickness of Slab max.to be 150mm.

Affected Area: (5.7/2 +5.7/2) * (3.5 +6.2/2)=37.62 m²

Reinforcement: 8T25

SDL: 3.0 KPa(Finishing) + 0.5 (Service) = 3.5 KPa (Assume, No Record)

LL: 2 KPa (Assume, Dormitory, No record)

DL:

Slab: s/w= 24.5 * 0.15(t)=3.7 KPa

Beam:

17c: s/w= 24.5 * 0.3 * 0.575 * 6.2/2(length of beam)=13.1 KN

17d: s/w= 24.5 * 0.3 * 0.575 * 2.5(length of beam)=10.57 KN

d15: s/w= 24.5 * 0.45 * 0.6 * 5.7/2(length of beam)=18.85 KN

d17: s/w= 24.5 * 0.45 * 0.6 * 5.7/2(length of beam)=18.85 KN

16c: s/w= 24.5 * 0.3 * 0.575 * 6.2/(2 * 2)(length of beam)=6.55 KN

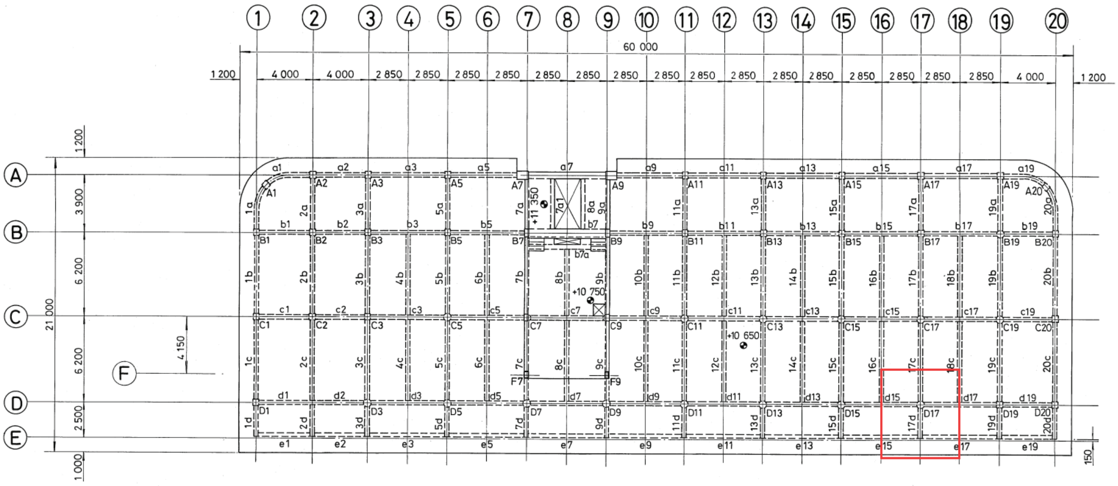
18c: s/w= 24.5 * 0.3 * 0.575 * 6.2/(2 * 2)(length of beam)=6.55 KN

e15: s/w= 24.5 * 0.3 * 0.45 * 5.7/2(length of beam)=9.43 KN

e17: s/w= 24.5 * 0.3 * 0.45 * 5.7/2(length of beam)=9.43 KN

Column: s/w= 24.5 * 3.14 * 0.25 * 0.25 * 3.45m(Height of Column) = 16.59 KN

D17 R/F Axial force = (3.7 + 3.5) * 37.62 + 13.1 + 10.57 + 18.85 * 2 + 6.55 * 2 + 9.43 * 2 + 16.59 + 2 * 37.62
 = 456.02 KN



ROOF PLAN

Add water tank lo

MB1: UC 356x406x287kg/m; s/w=287 * 9.8/1000=2.9 kN/m

MB2: UC 305x305x158kg/m; s/w=158 * 9.8/1000=1.6 kN/m

Beam force:

MB1: 5.7/2 * 2.9 = 8.265 KN;

MB2: 6.2/2 * 1.6 = 5 KN;

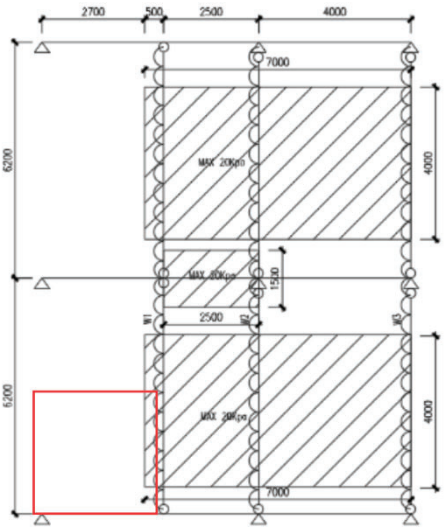
Slab: DD=2Kpa; DL=20Kpa;

A_{slab}=6.2/2 * 5.7/2 = 8.84 m²

A_{tank}= 4/2 * 3/2=3 m²;

s/w=2 * 8.84 + 20 * 3 =77.68KN

All New Axial Force =77.68 + 8.265 + 5 = 90.945 KN = 91 KN.



	Job Existing Checking		Job no.
Section: D17 Axial force-2		By:	Sheet no.
Subject: COLUMN		Date: May 11	

UD/F Existing Building:

Density of concrete:24.5 KN/m³ Thickness of Slab max.to be 175mm.

Affected Area: (5.7/2 +5.7/2) * (6.2/2 +2.5)=31.92 m²

Reinforcement: 8T25

SDL: 1.5 KPa(Finishing) + 0.5(Service)=2 KPa (Assume, No record)

LL: 5 KPa (Assume, Dormitory, No record)

DL:

Slab: 24.5 * 0.175(t)=4.3 KPa

Beam:

17c: s/w= 24.5 * 0.3 * 0.6 * 6.2/2(length of beam)=13.67 KN

17d: s/w= 24.5 * 0.3 * 0.6 * 2.5(length of beam)=11.03 KN

d15: s/w= 24.5 * 0.45 * 0.60 * 5.7/2(length of beam)=18.85 KN

d17: s/w= 24.5 * 0.45 * 0.60 * 5.7/2(length of beam)=18.85 KN

16c: s/w= 24.5 * 0.3 * 0.6 * 6.2/(2 * 2)(length of beam)=6.84 KN

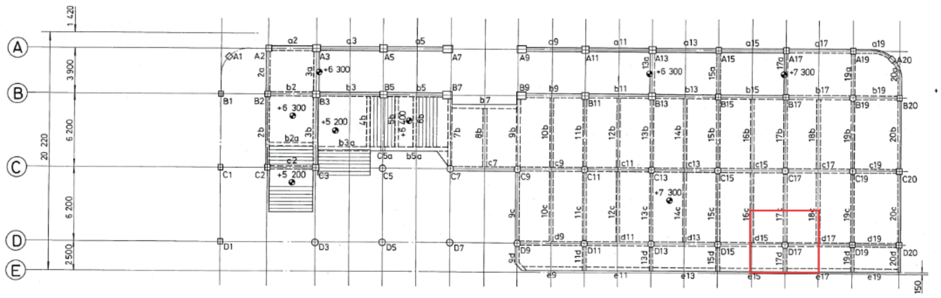
18c: s/w= 24.5 * 0.3 * 0.6 * 6.2/(2 * 2)(length of beam)=6.84 KN

e15: s/w= 24.5 * 0.3 * 0.55 * 5.7/2(length of beam)=11.52 KN

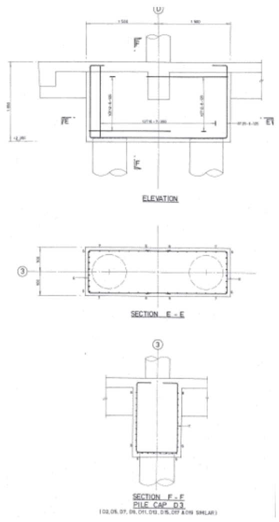
e17: s/w= 24.5 * 0.3 * 0.55 * 5.7/2(length of beam)=11.52 KN

Column: s/w= 24.5 * 3.14 * 0.25 * 0.25 * 3.3m(Height of Column) = 15.87 KN

D17 UD/F Axial force = (4.3 + 2) * 31.92 + 13.67 + 11.03 + 18.85 * 2 + 6.84 * 2 + 11.52 * 2 + 15.87 + 5 * 31.92
= 475.686 KN



UPPER DECK PLAN



MD/F Existing Building:

Density of concrete:24.5 KN/m³ Thickness of Slab max.to be 200mm.

Affected Area: (5.7/2 +5.7/2) * (6.2/2 +2.5)=31.92 m²

Reinforcement: 8T25

SDL: 1.5 KPa(Finishing) + 0.5 (Service) = 2 KPa (Assume, No record)

LL: 5 KPa (Assume, Dormitory, No record)

DL:

Slab: 24.5 * 0.2(t)=4.9 Kpa

Beam:

17c: s/w= 24.5 * 0.45 * 0.75 * 6.2/2(length of beam)=13.67 KN

17d: s/w= 24.5 * 0.45 * 0.75 * 2.5(length of beam)=20.67 KN

d15: s/w= 24.5 * 0.45 * 0.60 * 5.7/2(length of beam)=18.85 KN

d17: s/w= 24.5 * 0.45 * 0.60 * 5.7/2(length of beam)=18.85 KN

16c: s/w= 24.5 * 0.3 * 0.6 * 6.2/(2 * 2)(length of beam)=6.84 KN

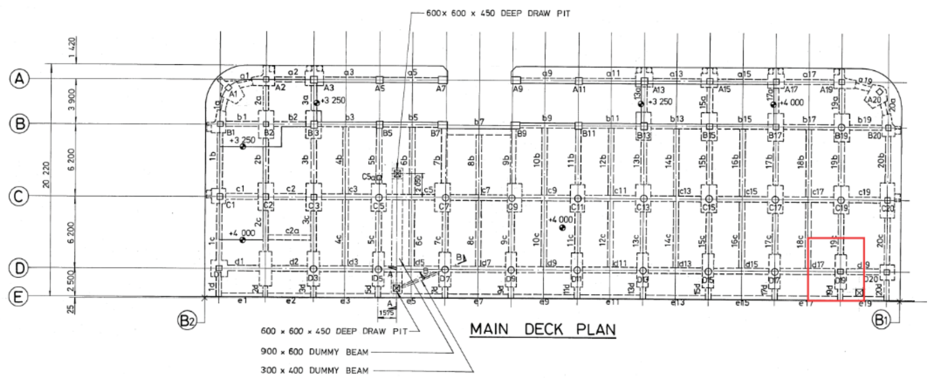
18c: s/w= 24.5 * 0.3 * 0.6 * 6.2/(2 * 2)(length of beam)=6.84 KN

e15: s/w= 24.5 * 0.3 * 0.55 * 5.7/2(length of beam)=11.52 KN

e17: s/w= 24.5 * 0.3 * 0.55 * 5.7/2(length of beam)=11.52 KN

Pile cap: s/w= 24.5 * 3 * 1 * 1.65m(Height of Column) = 121.275 KN

D17 MD/F Axial force =(4.9 + 2) * 31.92 + 13.67 + 20.67 + 18.85 * 2 + 6.84 * 2 + 11.52 * 2 + 121.275 + 5 * 31.92
= 609.883 KN

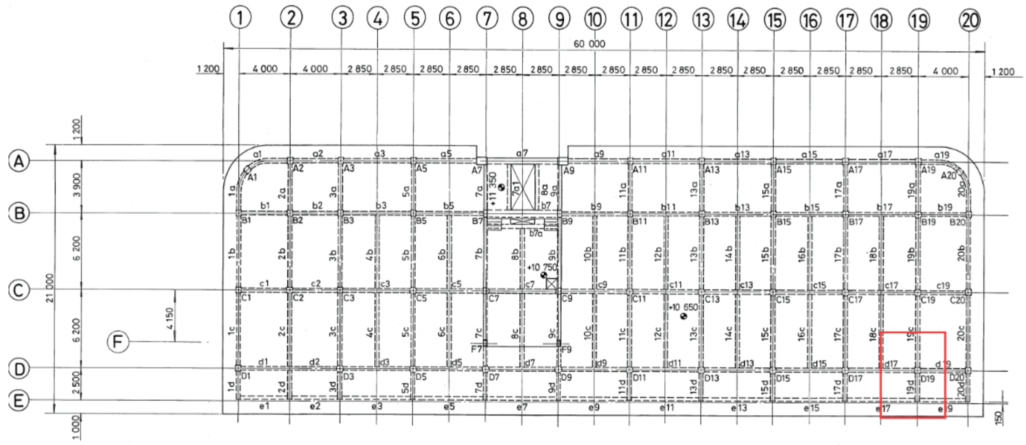


MAIN DECK PLAN

P_{D17}=456.02 + 475.686 + 609.883 + 91=1632.589 = 1633 kN

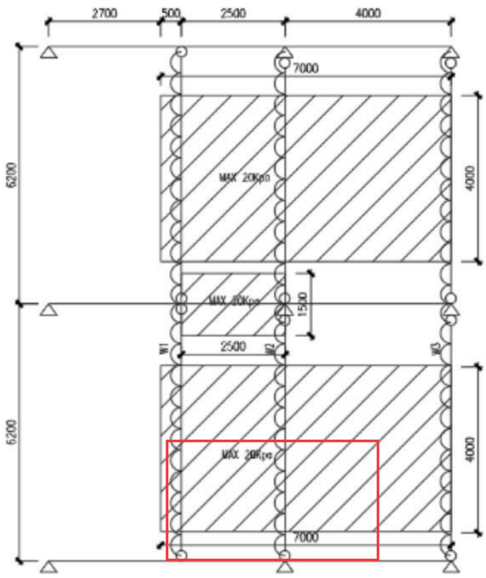
	Job Existing Checking		Job no.
Section: D19 Axial force-1		By:	Sheet no.
Subject: COLUMN		Date: May 11	

R/F Existing Building:
Density of concrete:24.5 KN/m³ Thickness of Slab max.to be 150mm.
Affected Area: (5.7/2 +4.0/2) * (3.5 +6.2/2)=32.01 m²
Reinforcement: 8T25
SDL: 3.0 KPa(Finishing) + 0.5 (Service) = 3.5 KPa (Assume, No Record)
LL: 2 KPa (Assume, Dormitory, No record)
DL:
Slab: s/w= 24.5 * 0.15(t)=3.7 KPa
Beam:
19c: s/w= 24.5 * 0.3 * 0.575 * 6.2/2(length of beam)=13.1 KN
19d: s/w= 24.5 * 0.3 * 0.575 * 2.5(length of beam)=10.57 KN
d17: s/w= 24.5 * 0.45 * 0.75 * 5.7/2(length of beam)=18.85 KN
d19: s/w= 24.5 * 0.45 * 0.75 * 4/2(length of beam)=18.85 KN
18c: s/w= 24.5 * 0.3 * 0.575 * 6.2/ (2 * 2) (length of beam)=6.55 KN
e17: s/w= 24.5 * 0.3 * 0.45 * 5.7/2(length of beam)=9.43 KN
e19: s/w= 24.5 * 0.3 * 0.45 * 4/2(length of beam)=6.62 KN
Column: s/w=24.5 * 0.45 * 0.45 * 3.45m(Height of Column) = 17.12 KN
D19 R/F Axial force = (3.7 + 3.5) * 32.01 +13.1 + 10.57 + 18.85 + 18.85 + 6.55 + 9.43 + 6.62 + 17.12 + 2 * 32.01 = 395.58 KN



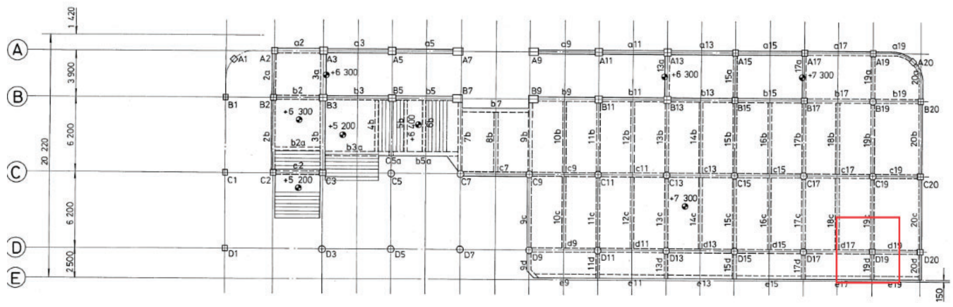
ROOF PLAN

Add water tank load:
MB1: UC 356x406x287kg/m; s/w=287 * 9.8/1000=2.9 kN/m
MB2: UC 305x305x158kg/m; s/w=158 * 9.8/1000=1.6 kN/m
Beam force:
MB1: s/w= (5.7+4)/2 * 2.9= 14.1 KN;
MB2: s/w= 2 * 6.2/2 * 1.6= 10.0 KN;
Slab: DD=2Kpa; DL=20Kpa;
A_{slab}=6.2/2 * (5.7/2 + 4/2) = 15 m²;
A_{tank}=4/2 * (5.7/2 + 4/2) = 9.7 m²;
s/w= 2 * 15 + 20 * 9.7 =224 KN
All New Axial Force = 224 + 14.1 + 10.0 = 248.1 KN = 249 KN.

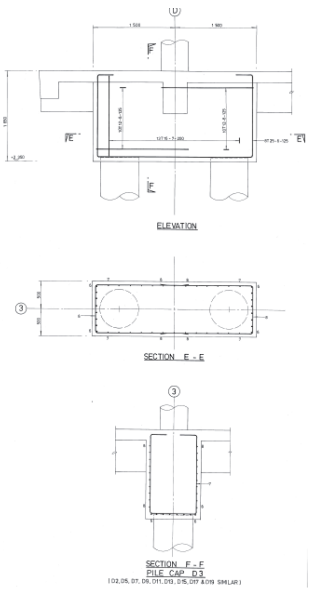


	Job Existing Checking		Job no.
Section: D19 Axial force-2		By:	Sheet no.
Subject: COLUMN		Date: May 11	

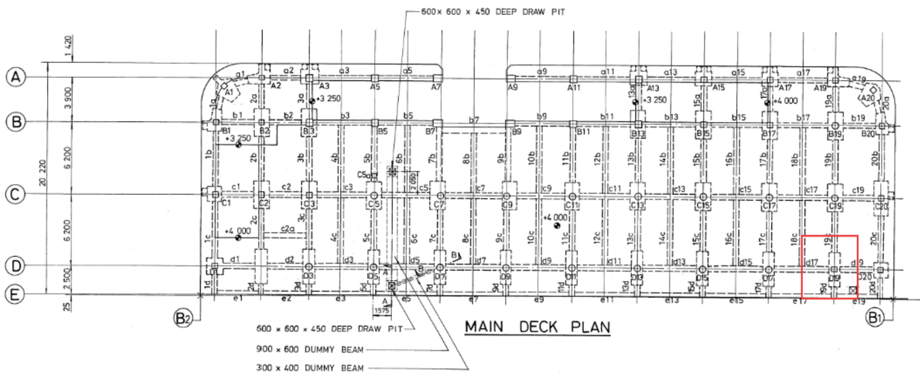
UD/F Existing Building:
Density of concrete:24.5 KN/m³ Thickness of Slab max.to be 175mm.
Affected Area: (5.7/2 +4.0/2) * (2.5 +6.2/2)=27.16 m²
Reinforcement: 8T25
SDL: 1.5 KPa(Finishing) + 0.5(Service)=2 KPa (Assume, No record)
LL: 5 KPa (Assume, Dormitory, No record)
DL:
Slab: 24.5 * 0.175(t)=4.3 KPa
Beam:
19c: s/w= 24.5 * 0.3 * 0.6 * 6.2/2(length of beam)=13.1 KN
19d: s/w= 24.5 * 0.3 * 0.6 * 2.5(length of beam)=10.57 KN
d17: s/w= 24.5 * 0.45 * 0.625 * 5.7/2(length of beam)=18.85 KN
d19: s/w= 24.5 * 0.45 * 0.625 * 4/2(length of beam)=18.85 KN
18c: s/w= 24.5 * 0.3 * 0.575 * 6.2/(2 * 2)(length of beam)=6.55 KN
e17: s/w= 24.5 * 0.3 * 0.55 * 5.7/2(length of beam)=11.52 KN
e19: s/w= 24.5 * 0.3 * 0.55 * 4/2(length of beam)=8.09 KN
Column: s/w= 24.5 * 0.45 * 0.45 * 3.3m(Height of Column) = 16.37 KN
D19 UD/F Axial force = (4.3 + 2) * 27.16 + 13.1 + 10.57 + 18.85 * 2 + 6.55 + 11.52 + 8.09 + 16.37 + 5 * 27.16 = 410.81 KN



UPPER DECK PLAN



MD/F Existing Building:
Density of concrete:24.5 KN/m³ Thickness of Slab max.to be 200mm.
Affected Area: (5.7/2 +4.0/2) * (2.5 +6.2/2) = 27.16 m²
Reinforcement: 8T25
SDL: 1.5 KPa(Finishing) + 0.5 (Service) = 2 KPa (Assume, No record)
LL: 5 KPa (Assume, Dormitory, No record)
DL:
Slab: 24.5 * 0.2(t)=4.9 Kpa
Beam:
19c: 24.5 * 0.45 * 0.75 * 6.2/2(length of beam)=25.63 KN
19d: 24.5 * 0.45 * 0.75 * 2.5(length of beam)=20.67 KN
d17: 24.5 * 0.45 * 0.775 * 5.7/2(length of beam)=24.35 KN
d19: 24.5 * 0.45 * 0.775 * 4/2(length of beam)=17.09 KN
18c: 24.5 * 0.45 * 0.75 * 6.2/(2 * 2)(length of beam)=12.82 KN
e17: 24.5 * 0.35 * 0.5 * 5.7/2(length of beam)=12.22 KN
e19: 24.5 * 0.35 * 0.5 * 4/2(length of beam)=8.58 KN
Pile cap: s/w=24.5 * 3 * 1 * 1.65m(Height of Column) = 121.275 KN
D19 MD/F Axial force = (4.9 + 2) * 27.16 + 25.63 + 20.67 + 24.35 + 17.09 + 12.82 + 12.22 + 8.58 + 121.275 + 5 * 27.16 = 565.839 KN



MAIN DECK PLAN

P_{D19}=395.58 + 410.81 + 565.839 + 249 = 1621.229 = 1622 kN

	Job Existing Checking	Job no.
Section: D20 Axial force-1	By:	Sheet no.
Subject: R/F	Date: May 11	

R/F Existing Building:

Density of concrete:24.5 KN/m³ Thickness of Slab max.to be 150mm.

Affected Area: (1.2 +4.0/2) * (3.5 +6.2/2)=21.12 m²

Reinforcement: 8T25

SDL: 3.0 KPa(Finishing) + 0.5 (Service) = 3.5 KPa (Assume, No Record)

LL: 2 KPa (Assume, Dormitory, No record)

DL:

Slab: s/w= 24.5 * 0.15(t)=3.7 KPa

Beam:

20c: s/w= 24.5 * 0.3 * 0.575 * 6.2/2(length of beam)=13.1 KN

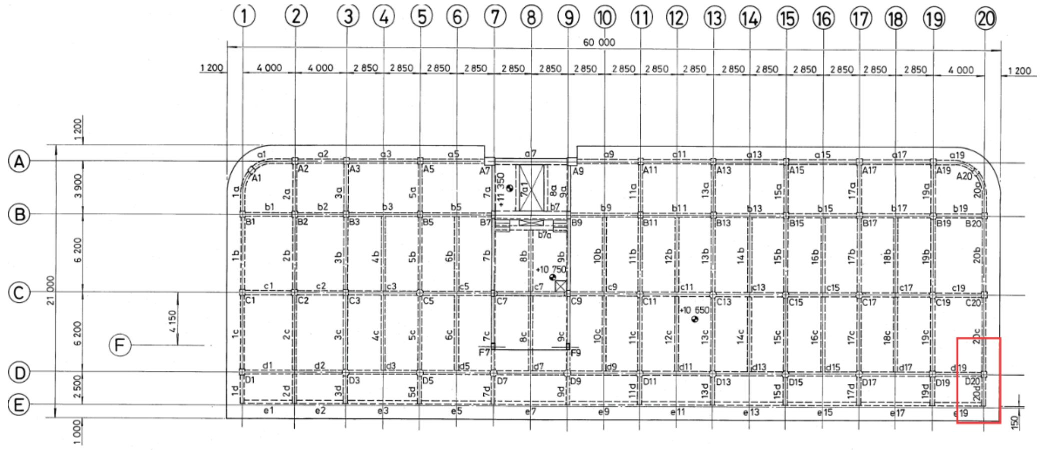
20d: s/w= 24.5 * 0.3 * 0.575 * 2.5(length of beam)=10.57 KN

d19: s/w= 24.5 * 0.45 * 0.6 * 4/2(length of beam)=13.23 KN

e19: s/w= 24.5 * 0.3 * 0.45 * 4/2(length of beam)=6.62 KN

Column: s/w= 24.5 * 0.45 * 0.45 * 3.45m(Height of Column) = 17.12 KN

D20 R/F Axial force = (3.7 + 3.5) * 21.12 + 13.1 + 10.57 + 13.23 + 6.62 + 17.12 + 2 * 21.12 = 254.94 KN



ROOF PLAN

Add water tank load:

MB1: UC 356x406x287kg/m; s/w=287 * 9.8/1000=2.9 kN/m

MB2: UC 305x305x158kg/m; s/w=158 * 9.8/1000=1.6 kN/m

Beam force:

MB1: s/w= 4/2 * 2.9= 5.8 KN;

MB2: s/w= 6.2/2 * 1.6= 5.0 KN;

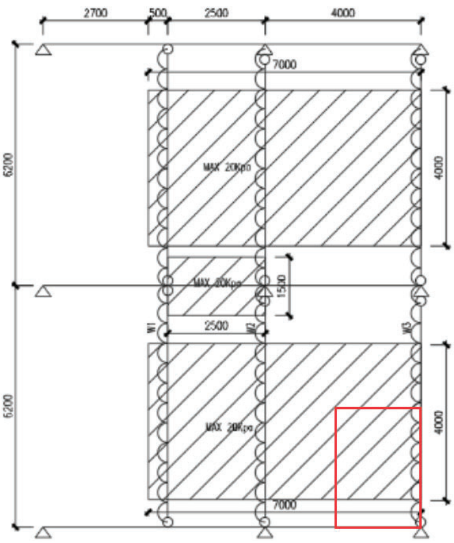
Slab: DD=2Kpa; DL=20Kpa;

A_{slab}=6.2/2 * 4/2 = 6.2 m^2

A_{tank}=4/2 * 4/2 = 4 m^2

s/w=2 * 6.2 + 30 * 4 = 132.4 KN

All New Axial Force = 132.4 + 5.8 + 5 = 143.2 KN = 144 KN.



	Job Existing Checking	Job no.
Section: D20	By:	Sheet no.
Subject: UD/F	Date: May 11	

UD/F Existing Building:

Density of concrete:24.5 KN/m^3 Thickness of Slab max.to be 175mm.

Affected Area: 4.0/2 * (2.5 +6.2/2)=11.2 m^2

Reinforcement: 8T25

SDL: 1.5 KPa(Finishing) + 0.5(Service)=2 KPa (Assume, No record)

LL: 5 KPa (Assume, Dormitory, No record)

DL:

Slab: 24.5 * 0.175(t)=4.3 KPa

Beam:

20c: s/w= 24.5 * 0.3 * 0.6 * 6.2/2(length of beam)=13.67 KN

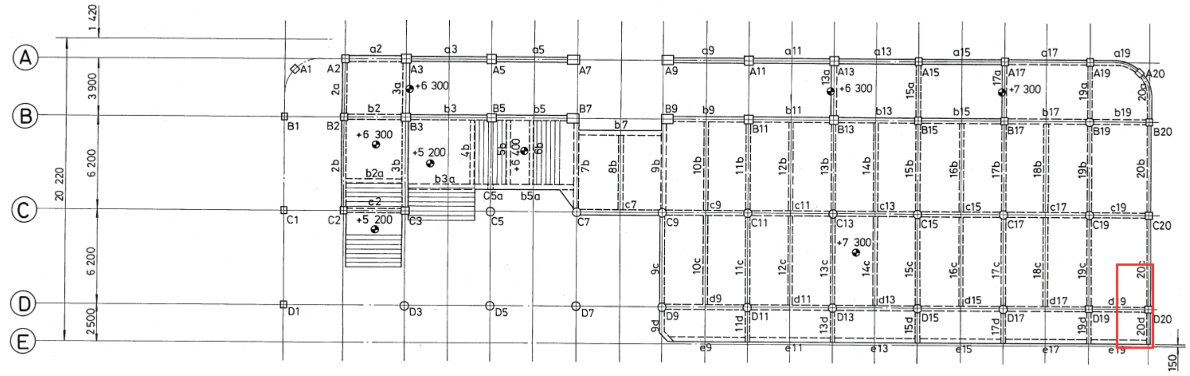
20d: s/w= 24.5 * 0.3 * 0.6 * 2.5(length of beam)=11.03 KN

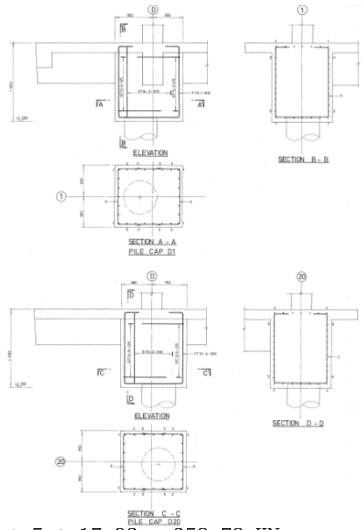
d19: s/w= 24.5 * 0.45 * 0.625 * 4/2(length of beam)=13.78 KN

e19: s/w= 24.5 * 0.3 * 0.55 * 4/2(length of beam)=8.09 KN

Column: s/w= 24.5 * 0.45 * 0.45 * 3.3m(Height of Column) = 16.37 KN

D20 UD/F Axial force = (4.3 + 2) * 11.2 + 13.67 + 11.03 + 13.78 + 8.09 + 16.37 + 5 * 11.2 = 188.38 KN





MD/F Existing Building:

Density of concrete:24.5 KN/m^3 Thickness of Slab max.to be 200mm.

Affected Area: （4.0/2+1.2） * (2.5 +6.2/2)=17.92 m^2

Reinforcement: 8T25

SDL: 1.5 KPa(Finishing) + 0.5 (Service) = 2 KPa (Assume, No record)

LL: 5 KPa (Assume, Dormitory, No record)

DL:

Slab: 24.5 * 0.2(t)=4.9 Kpa

Beam:

20c: s/w= 24.5 * 0.45 * 0.75 * 6.2/2(length of beam)=25.63 KN

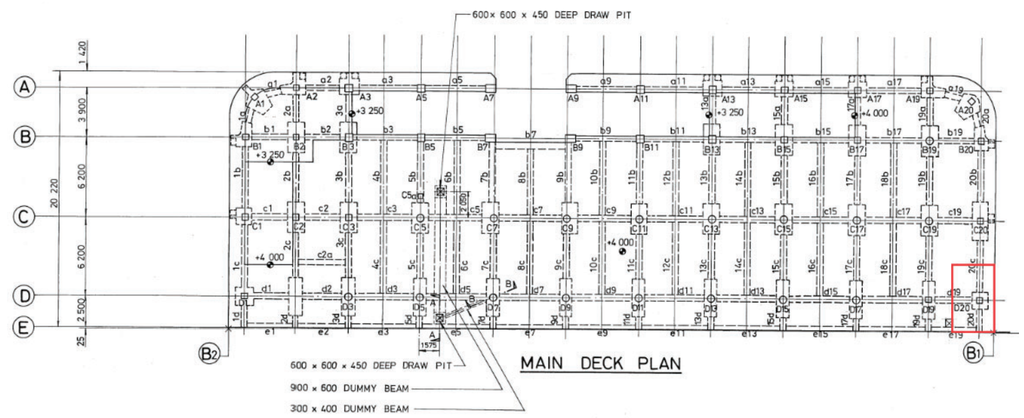
20d: s/w= 24.5 * 0.45 * 0.75 * 2.5(length of beam)=20.67 KN

d19: s/w= 24.5 * 0.45 * 0.775 * 4/2(length of beam)=17.09 KN

e19: s/w= 24.5 * 0.35 * 0.5 * 4/2(length of beam)=8.58 KN

Pile cap: s/w= 24.5 * 1.3 * 1.4 * 1.65m(Height of Column) = 73.57 KN

D20 MD/F Axial force = (4.9 + 2) * 17.92 + 25.63 + 20.67 + 17.09 + 8.58 + 73.57 + 5 * 17.92 = 358.78 KN



P_{D20}=254.94 + 188.38 + 358.78 + 144 = 946.1 = 947 kN

Summary of calculation results of bearing capacity of existing columns

Column Mark	Total load on each layer			Existing (kN)	New (kN)	New Total force (kN)	Capacity of (kN)	Whether the bearing capacity can meet the requirements	Safetyfactor =(capacity/New Total force)
	R/F (kN)	UD/F (kN)	MD/F (kN)						
B17	353.65	412.99	456.84	1223.48	91.00	1314.48	3387.00	1314.48 < 3387 OK	2.58
B19	301.87	355.14	387.44	1044.45	249.00	1293.45	3300.00	1293.45 < 3300 OK	2.55
B20	200.36	165.83	242.90	609.09	144.00	753.09	3387.00	753.09 < 3387 OK	4.50
C17	441.79	508.55	571.79	1522.13	174.00	1696.13	3300.00	1696.13 < 3300 OK	1.95
C19	372.64	430.10	476.17	1278.91	520.00	1798.91	3300.00	1798.91 < 3300 OK	1.83
C20	242.39	197.61	304.45	744.45	201.00	945.45	3387.00	945.45 < 3387 OK	3.58
D17	456.02	475.69	488.61	1420.31	91.00	1511.31	3300.00	1511.31 < 3300 OK	2.18
D19	395.58	410.81	444.56	1250.95	249.00	1499.95	3387.00	1499.95 < 3387 OK	2.26
D20	254.94	188.38	285.21	728.53	144.00	872.53	3387.00	872.53 < 3387 OK	3.88

Note:Capacity of Column = 0.35 • Fcu • Ac + 0.67 • Fy • As

（Size：d500mm）
N = 0.35 • Fcu • Ac + 0.67 • Fy • As
Fcu = 40 N/mm²
Ac = 3.14 x 250 x 250 = 196250 mm²
Fy = 210 N/mm² (highyield steel)
As (8T25)= 8 x 490.9 = 3927.2 mm²
N = 0.35 x 40 x 196250 + 0.67 x 210 x 3927.2
= 3300057.04 N = 3300 KN

（Size：450x450mm）
N = 0.35 • Fcu • Ac + 0.67 • Fy • As
Fcu = 40 N/mm²
Ac = 450 x 450 = 202500 mm²
Fy = 210 N/mm² (highyield steel)
As (8T25)= 8 x 490.9 = 3927.2 mm²
N = 0.35 x 40 x 202500 + 0.67 x 210 x 3927.2
= 3387557.04 N = 3387 KN

Summary of checking results of bearing capacity of pile foundation

Pile Mark	Weight of CAP (kN)	Total upper (kN)	Total axial force (kN)	Number of piles (bar)	Single pile axial force	Capacity of Single Piles(kN)	Whether the bearing capacity can meet the requirements	safety factor=(capacity/ Single pile axial force)
B17	152.30	1314.48	1467.00	2	733.5	1100.00	733.5<1100 OK	1.50
B19	141.41	1293.45	1435.00	2	717.5	1100.00	717.5<1100 OK	1.53
B20	200.57	753.09	954.00	1	954	1100.00	954<1100 OK	1.15
C17	153.20	1696.13	1850.00	2	925	1100.00	925<1100 OK	1.19
C19	141.41	1798.91	1941.00	2	970.5	1100.00	970.5<1100 OK	1.13
C20	364.30	945.45	1310.00	2	655	1100.00	655<1100 OK	1.68
D17	121.28	1511.31	1633.00	2	816.5	1100.00	816.5<1100 OK	1.35
D19	121.28	1499.95	1622.00	2	811	1100.00	811<1100 OK	1.36
D20	73.57	872.53	947.00	1	947	1100.00	947<1100 OK	1.16

Note:The bearing capacity of single pile is 110t （use1100kN）
（Among them, B20 and D20 are single piles, and the rest are double piles）

conclusion

Through the above calculation, the bearing capacity of all structural members meet the requirements of the transformation plan, and the checking calculation is passed

Appendix C
Drawings

Summary of calculation results of bearing capacity of existing columns

Column Mark	Total load on each layer			Existing (kN)	New (kN)	New Total force (kN)	Capacity of (kN)	Whether the bearing capacity can meet the requirements	Safetyfactor =(capacity/New Total force)
	R/F (kN)	UD/F (kN)	MD/F (kN)						
B17	353.65	412.99	456.84	1223.48	91.00	1314.48	3387.00	1314.48 < 3387 OK	2.58
B19	301.87	355.14	387.44	1044.45	249.00	1293.45	3300.00	1293.45 < 3300 OK	2.55
B20	200.36	165.83	242.90	609.09	144.00	753.09	3387.00	753.09 < 3387 OK	4.50
C17	441.79	508.55	571.79	1522.13	174.00	1696.13	3300.00	1696.13 < 3300 OK	1.95
C19	372.64	430.10	476.17	1278.91	520.00	1798.91	3300.00	1798.91 < 3300 OK	1.83
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D20	254.94	188.38	285.21	728.53	144.00	872.53	3387.00	872.53 < 3387 OK	3.88

Note:Capacity of Column = 0.35 • Fcu • Ac + 0.67 • Fy • As

(Size：d500mm)
N = 0.35 • Fcu • Ac + 0.67 • Fy • As
Fcu = 40 N/mm²
Ac = 3.14 x 250 x 250 = 196250 mm²
Fy = 210 N/mm² (highyield steel)
As (8T25)= 8 x 490.9 = 3927.2 mm²
N = 0.35 x 40 x 196250 + 0.67 x 210 x 3927.2
= 3300057.04 N = 3300 KN

(Size：450x450mm)
N = 0.35 • Fcu • Ac + 0.67 • Fy • As
Fcu = 40 N/mm²
Ac = 450 x 450 = 202500 mm²
Fy = 210 N/mm² (highyield steel)
As (8T25)= 8 x 490.9 = 3927.2 mm²
N = 0.35 x 40 x 202500 + 0.67 x 210 x 3927.2
= 3387557.04 N = 3387 KN

Summary of checking results of bearing capacity of pile foundation

Pile Mark	Weight of CAP (kN)	Total upper (kN)	Total axial force (kN)	Number of piles (bar)	Single pile axial force	Capacity of Single Piles(kN)	Whether the bearing capacity can meet the requirements	safety factor=(capacity/ Single pile axial force)
B17	152.30	1314.48	1467.00	2	733.5	1100.00	733.5<1100 OK	1.50
B19	141.41	1293.45	1435.00	2	717.5	1100.00	717.5<1100 OK	1.53
B20	200.57	753.09	954.00	1	954	1100.00	954<1100 OK	1.15
C17	153.20	1696.13	1850.00	2	925	1100.00	925<1100 OK	1.19
C19	141.41	1798.91	1941.00	2	970.5	1100.00	970.5<1100 OK	1.13
C20	364.30	945.45	1310.00	2	655	1100.00	655<1100 OK	1.68
D17	121.28	1511.31	1633.00	2	816.5	1100.00	816.5<1100 OK	1.35
D19	121.28	1499.95	1622.00	2	811	1100.00	811<1100 OK	1.36
D20	73.57	872.53	947.00	1	947	1100.00	947<1100 OK	1.16

Note:The bearing capacity of single pile is 110t （use1100kN）
（Among them, B20 and D20 are single piles, and the rest are double piles）

Conclusion

Through the above calculation, the bearing capacity of all structural members meet the requirements of the transformation plan, and the checking calculation is passed

Appendix C
Drawings

GENERAL NOTE

A. GENERAL NOTE

1. ALL EXISTING STRUCTURE DIMENSIONS SHOULD BE VERIFIED ON SITE, ALL LEVELS IN METRES REFERRED TO THE PRINCIPAL DATUM(mPD).
2. ALL LEVELS SHOWN IN DRAWINGS ARE INDICATIVE AND SHALL BE VERIFIED ON SITE.
3. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ARCHITECT DRAWINGS.
4. NEW STRUCTURAL STEELWORK AND EXISTING CONCRETE CHECKING ARE COMPLIED WITH:
   A/ C.O.P. FOR THE STRUCTURAL USE OF STEEL 2011 (2023 EDITION)
   B/ BUILDING (CONSTRUCTION) REGULATION
   C/ C.O.P. FOR DEAD AND IMPOSED LOADS 2011 (2021 EDITION)
   D/ C.O.P. ON WIND EFFECTS IN HONG KONG 2019
   E/ C.O.P. FOR FIRE SAFETY IN BUILDINGS 2011

B. DESIGN LOADING

1. LIVE LOAD FOR WATER TANK ON STEEL FRAME TO BE 20kPa (WATER HEIGHT=2.0m); WATER PUMP=10.0kPa (ASSUMED)
2. DESIGN WIND PRESSURE Qz=1.768kPa (HEIGHT = 13.65m) WITH WIND PRESSURE COEFFICIENT Cp=2.0, SHAPE FACTOR Ss=1.024, SOLIDITY RATIO = 1.0.
3. LIVE LOAD AT R/F = 0.75kPa (MAINTENANCE PLATFORM), AT G/F & 1/F (FORMER MD/F & UD/F) = 5kPa (EXHIBITION)

C. STRUCTURAL STEEL

1. ALL STRUCTURAL STEEL SECTIONS TO BE GRADE S355 (CLASS 1) TO BS EN 10025-1:2004 OR BS EN 10210-1:2006 WITH MINIMUM DESIGN STRENGTH OF 355MPa RESPECTIVELY.
2. ALL STEEL TO BE HOT DIP GALVANIZED (MIN. 85um) COMPLIED WITH BS EN ISO 1461:2009 UNLESS OTHERWISE STATED. AREAS OF GALVANIZED COATINGS DAMAGED BY WELDING OR CUTTING SHALL BE MADE GOOD WITH THE USE OF MINIMUM TWO COATS OF ZINC RICH TO BS 4652:1995.
3. ALL WELDING TO BE ELECTRODE GRADE 35 WITH STRENGTH OF 250MPa COMPLY TO BS EN ISO 2560:2009 AND BE EN ISO 15614 UNLESS OTHERWISE STATED.
4. ONLY CERTIFIED WELDERS SHALL BE EMPLOYED IN WELDING OF STEELWORKS. THEY SHALL BE TESTED TO BS EN 287:PART 1:2004. THE WELDER CERTIFICATE SHALL BE SUBMITTED AND APPROVED BY THE RSE BEFORE COMMENCEMENT OF WORKS.
5. CHIP OFF THE PLASTER FROM THE FACE OF EXISTING R.C. MEMBERS TO BE IN CONTACT WITH NEW STEEL MEMBERS BEFORE INSTALLATION.

MEMBER SCHEDULE

MARK	SECTION	GRADE
MB1	356x406x287 kg/m UC	S355
MB2	305x305x158 kg/m UC	S355
EM1	20mm THK. GMS PLATE	S355
S1	260X100X15mm THK. BUILT UP ANGLE	S355
-	15mm THK. GMS PLATE	S355

D. EXISTING STRUCTURE INFORMATION

1. ALL CONCRETE TO STRUCTURES TO BE OF GRADE 40/20.
2. ALL REINFORCEMENT TO COMPLY WITH BS 4449.
3. MINIMUM ANCHORAGE LENGTH FOR REINFORCEMENT OF HIGH YIELD TYPE 2 DEFORMED BARS TO BE 32 TIMES THE DIAMETER OF BAR UNLESS OTHERWISE SPECIFIED.
4. LIVE LOAD ON DECK LEVEL = 8.0 kPa
5. PERMISSIBLE LOAD ON PILE = 110 TONNES

E. ANCHOR BOLTS

1. WHERE SPECIFIED, CARRY OUT LOADING TEST OF ANCHOR BOLTS IN ACCORDANCE WITH BS 5080-1 AND BS 5080-2 AT A SAMPLING RATE OF AT LEAST 1% OF THE ANCHOR BOLTS OR 5 NUMBERS, WHICHEVEF IS MORE, OF EACH TYPE AND SIZE OF THE BOLTS INSTALLED.
2. EACH SAMPLE BOLT SHALL BE TESTED FOR TENSILE LOAD BY PULL-OUT TEST AND/OR SHEAR LOAD BY SHEAR LOAD TEST, AS APPROPRIATE, TO NOT LESS THAN 1.5 TIMERS THE RECOMMENDED WORKING LOAD OF THE BOLTS AND WITH A MINIMUM HOLDING TIME OF 60 MINS UNDER MAXIMUM TEST LOAD.
3. THE SAMPLE BOLT SHALL NOT SHOW ANY SIGNS OF SEPARATION, PLASTIC DEFORMATION OR DELETERIOUS EFFECT, AND SHALL HAVE AT LEAST 80% RECOVERY OF THE TOTAL DEFORMATION UPON REMOVAL OF THE TEST LOAD.
4. AN ACCREDITED LABORATORY SHALL BE EMPLOYED TO CARRY OUT THE TESTING OF ANCHOR BOLTS, AND PROVIDE ANY NECESSARY LABOUR AND ATTENDANCE.

ANCHOR BOLTS SCHEDULE (FOR CRACKED CONCRETE)

LOCATION	TYPE	# RECOMMENDED LOAD (kN)		* MIN. EMBEDMENT	MIN. EDGE DISTANCE	MIN. SPACING	TENSILE TEST LOAD	SHEAR TEST LOAD
EXISTING COLUMN	HIT-Z-R M20 W/ HIT-HY-200-R INJECTION ADHESIVE	TENSILE	29.0x1.26=36.54	100mm	100mm	100mm	36.54x1.5 =54.81kN	30.62x1.5 =45.93kN
		SHEAR	24.3x1.26=30.62					

* MEASURED FROM SOUND CONCRETE
# INFLUENCING FACTOR=$(40/25)^{1/2}$ =1.26

NUMBER / 編號	DATE / 日期	AMENDMENT / 修訂

REGISTERED STRUCTURAL ENGINEERS
STW S.T. WONG & PARTNERS LIMITED
STRUCTURAL ◆ GEOTECHNICAL ◆ ARCHITECTURAL ◆ PROJECT MANAGEMENT CONSULTANT
FLAT B, 8/F LEE MAY BUILDING
788-790 NATHAN ROAD,
MONGKOK, KOWLOON, HONG KONG
TELEPHONE : 2625 1776
FASCMILIE : 2467 9618
EMAIL : stwong@stwong.com.hk

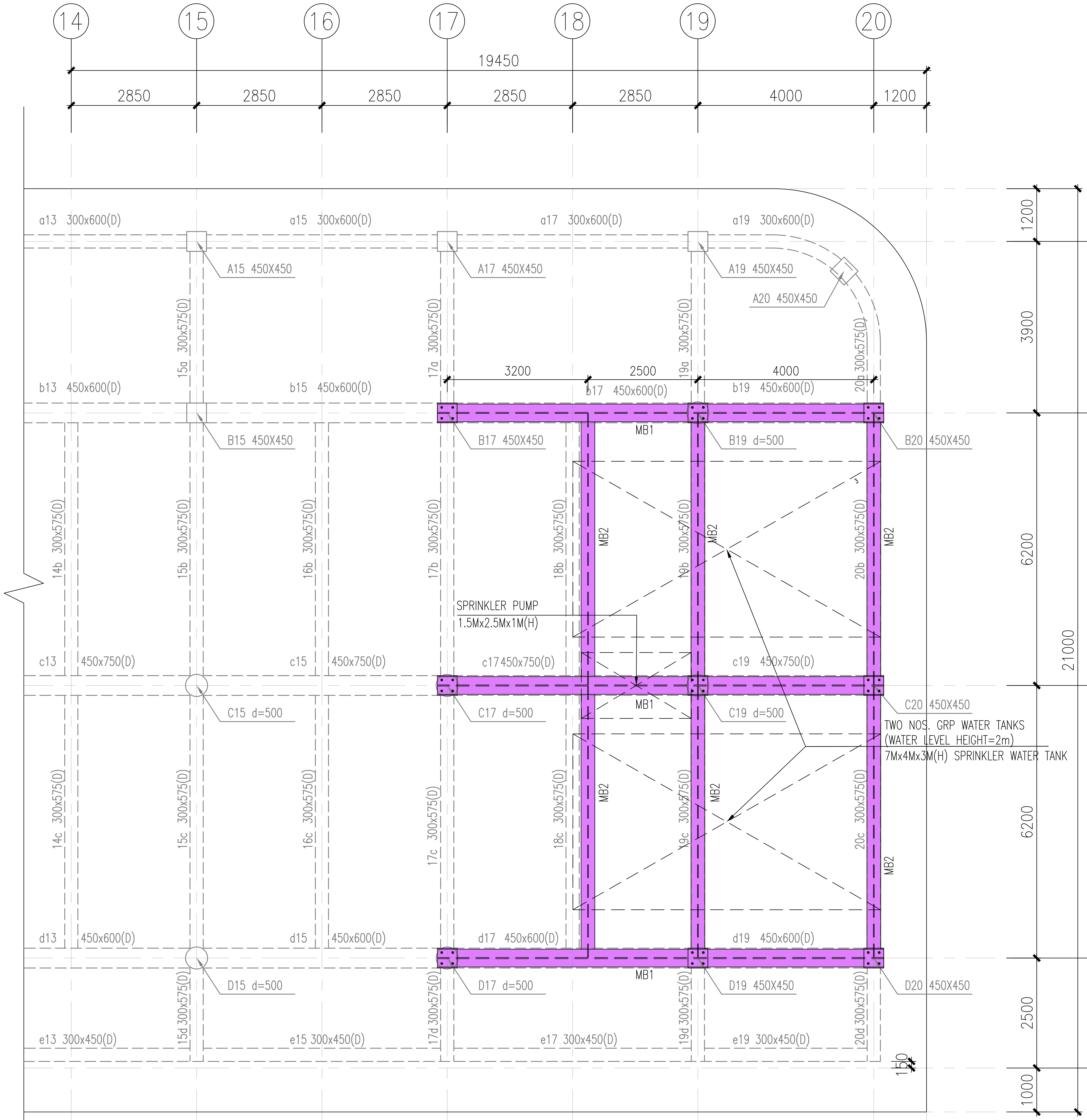
PROJECT / 工程項目
HUNG HOM BAY RECLAMATION PHASE II , HUNG HOM (NORTH) FERRY PIER , HONG KONG

DRAWING / 圖名
GENERAL NOTES

SCALE / 比例: AS SHOWN
JOB NUMBER / 工程編號:
DATE / 日期: 13/05/2024
DRAWING NUMBER / 圖號: AA-S-01

DESIGNED / 設計
CHECKED / 審核
APPROVED / 審定

- ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE NOTED
  除特別注明外，所有尺寸是以毫米制
- DO NOT SCALE DRAWING
  圖中以所有標注尺寸為准，不應量度
- ALL MEASUREMENTS SHOULD BE VERIFIED ON SITE
  最終尺寸須在現場核對準確



ROOF LAYOUT PLAN FOR WATER TANK FOOTING

1:100

NOTES: ALL SLABS TO BE 150 THICK EXCEPT OTHERWISE SHOWN

NOTES:
EXISTING LIVE LOAD (G/F & 1/F) = 8.0kPa
EXISTING LIVE LOAD (R/F) = 0.75kPa
DESIGN NEW LIVE LOAD (G/F & 1/F) = 5.0kPa
DESIGN NEW LIVE LOAD (R/F) = 0.75kPa

NUMBER / 編號	DATE / 日期	AMENDMENT / 修訂

REGISTERED STRUCTURAL ENGINEERS
STWJ S.T. WONG & PARTNERS LIMITED
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PROJECT / 工程項目

HUNG HOM BAY RECLAMATION PHASE II , HUNG HOM (NORTH) FERRY PIER , HONG KONG

DRAWING / 圖名

FOR WATER TANK FOOTING
ROOF LAYOUT PLAN

SCALE / 比例	JOB NUMBER / 工程編號
AS SHOWN	
DATE / 日期	DRAWING NUMBER / 圖號
13/05/2024	AA-S-02

DESIGNED / 設計	CHECKED / 審核	APPROVED / 審定

∘ ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE NOTED
除特別注明外，所有尺寸是以毫米制
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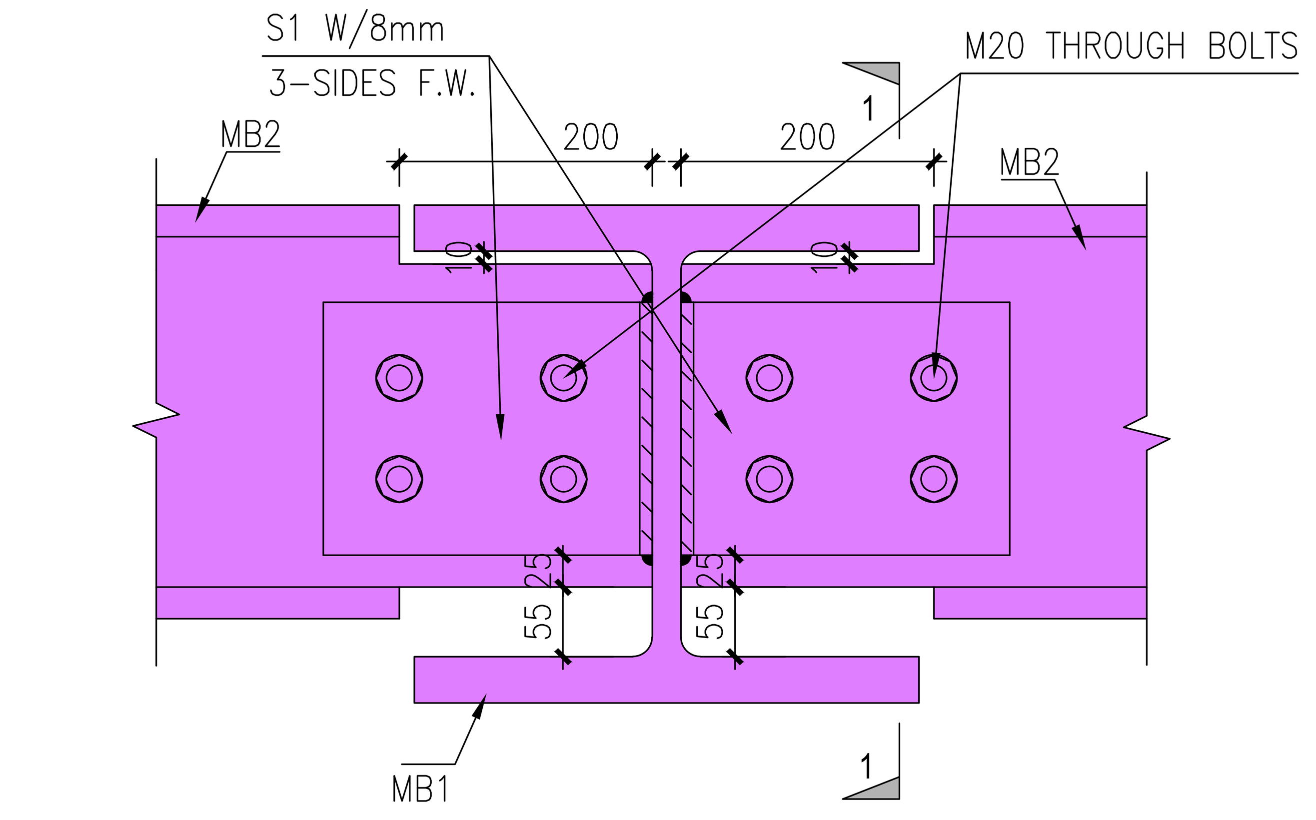
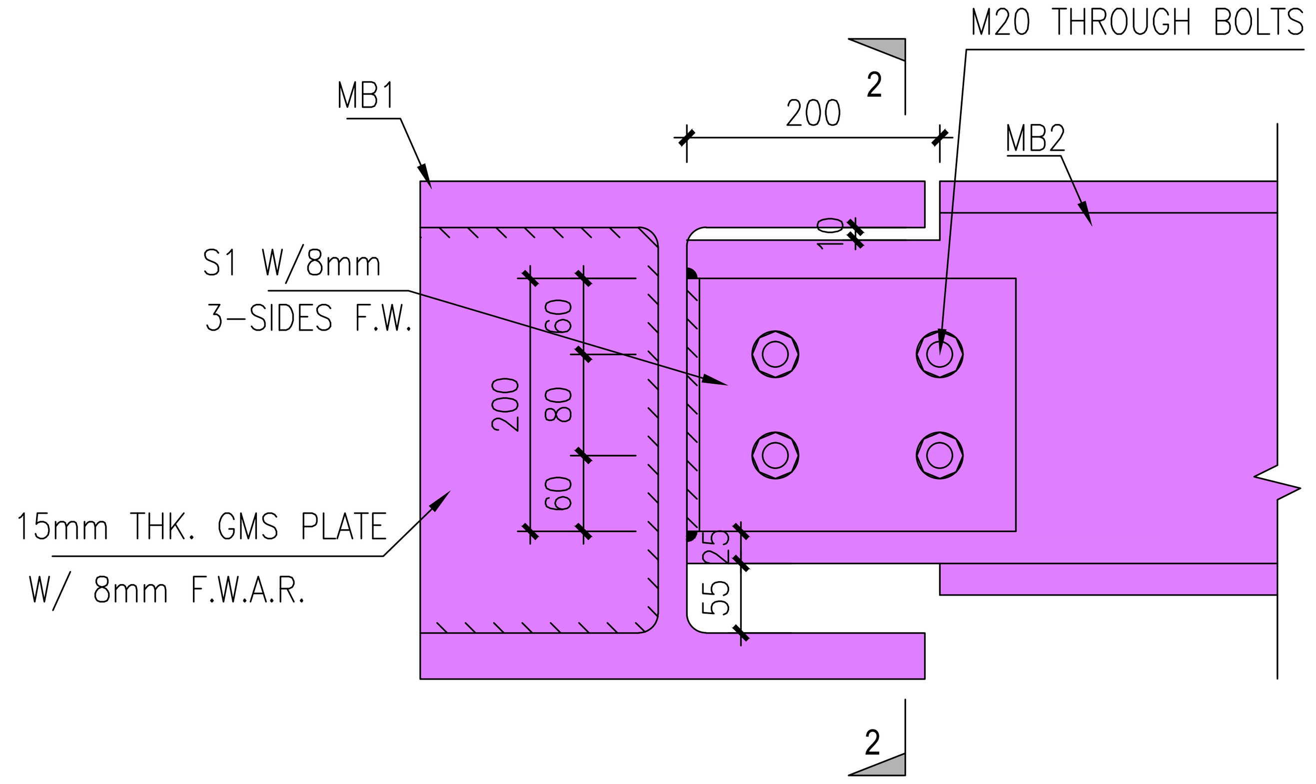
圖中以所有標注尺寸為准，不應量度
∘ ALL MEASUREMENTS SHOULD BE VERIFIED ON SITE
最終尺寸須在現場核對準確



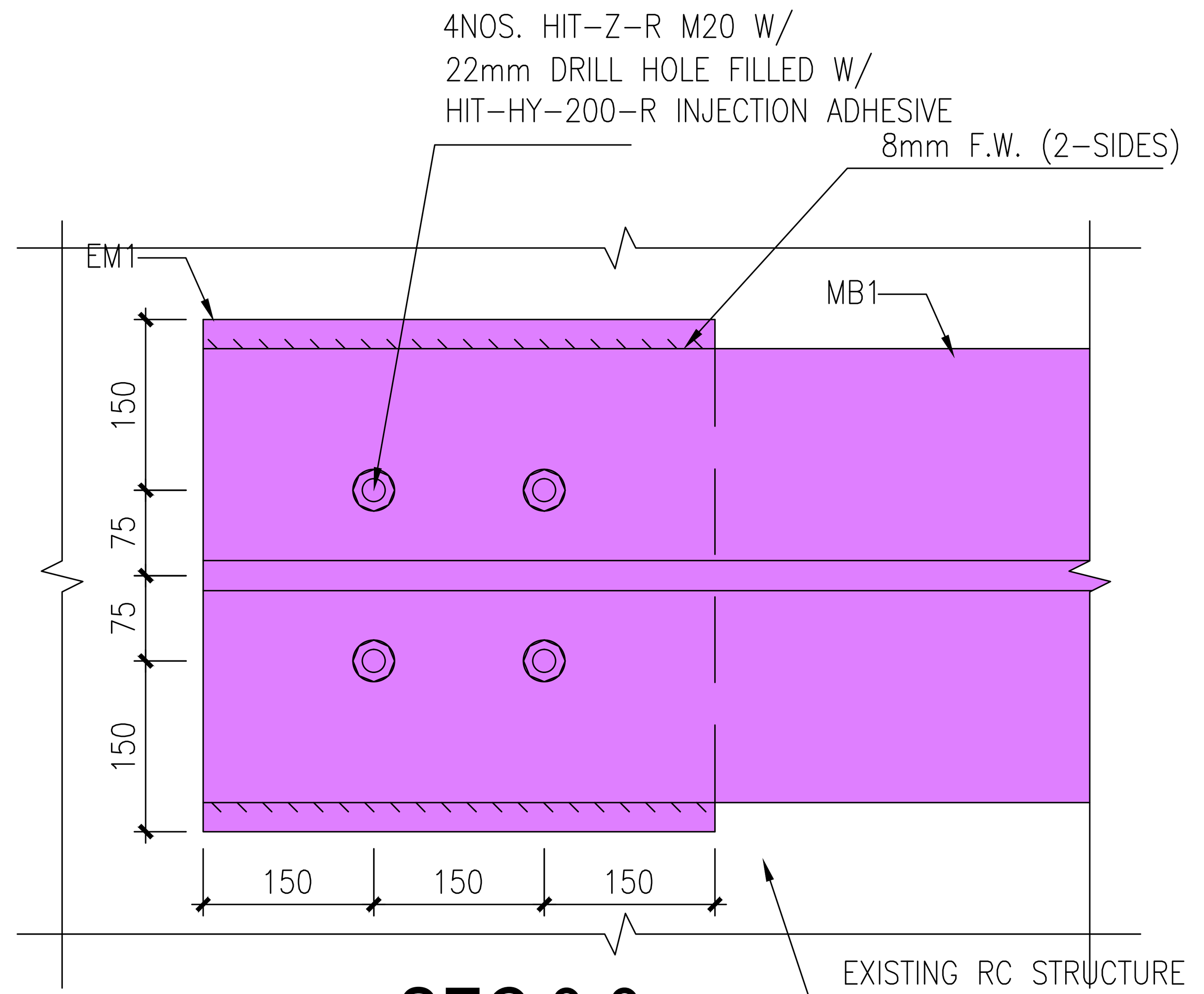
TYPY 1 : CONNECTION DETAIL BETWEEN MB2 & MB1

1:10



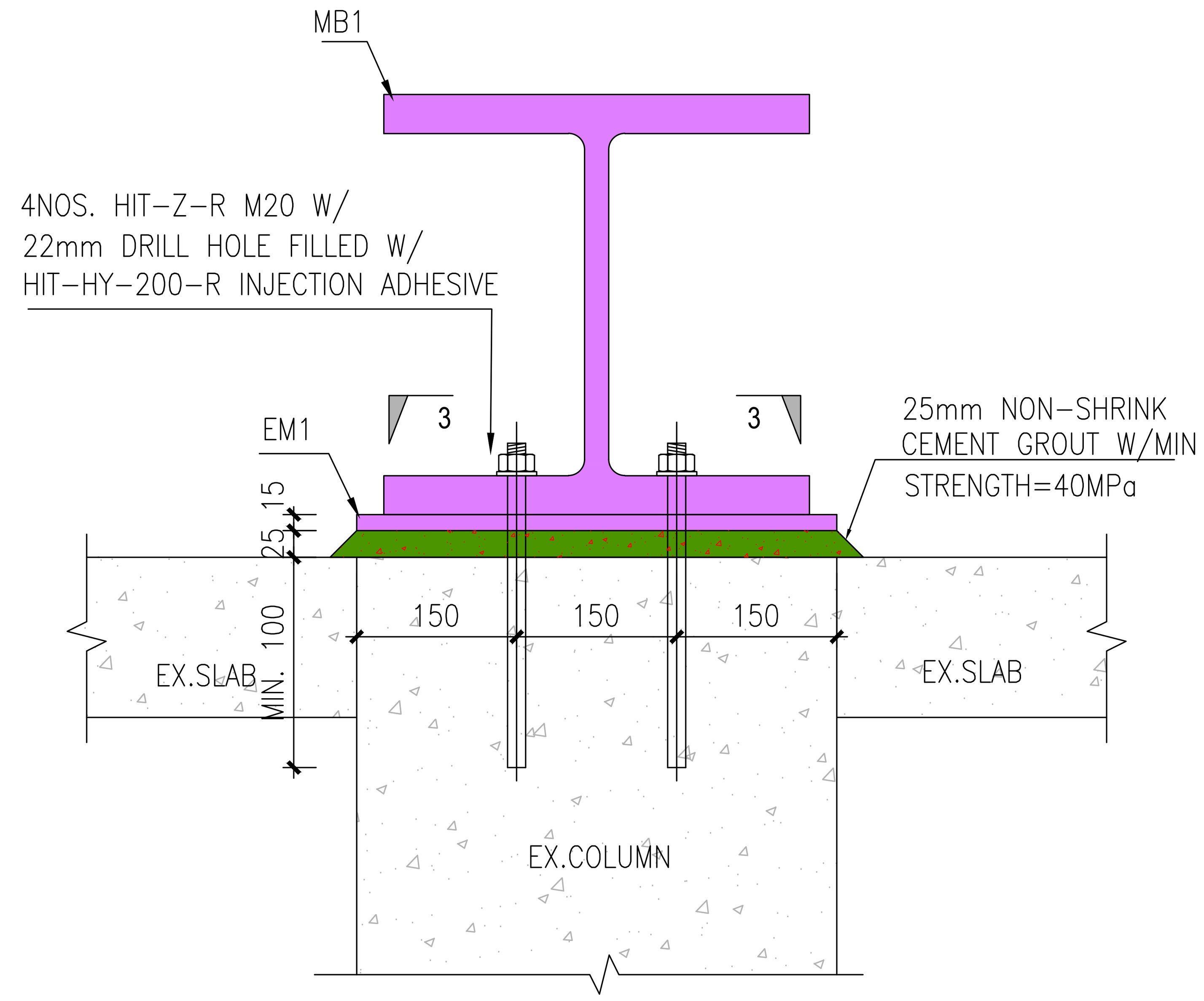
TYPY 2 : CONNECTION DETAIL BETWEEN MB2 & MB1

1:10



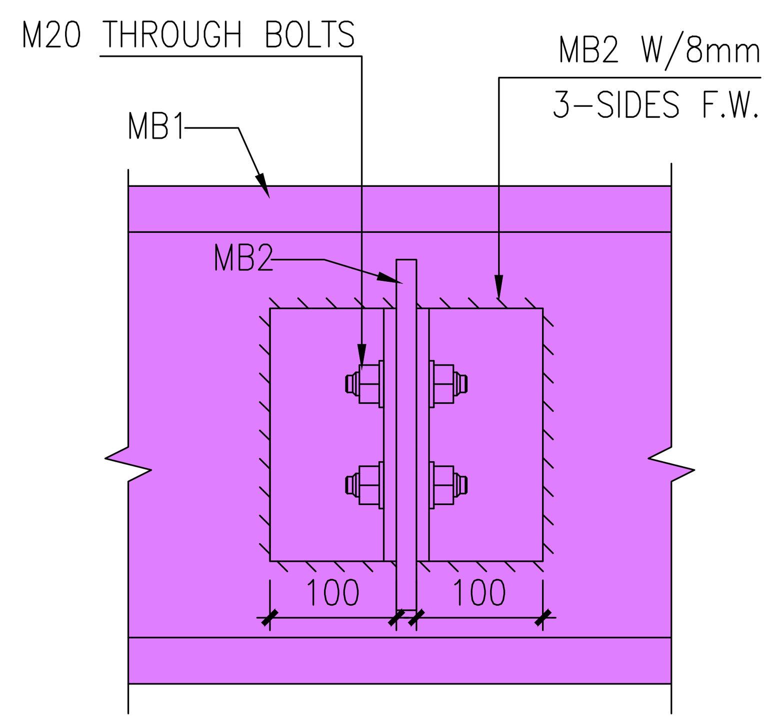
SEC.3-3

1:10



TYPICAL CONNECTION DETAIL BETWEEN MB1 & EX.COLUMN

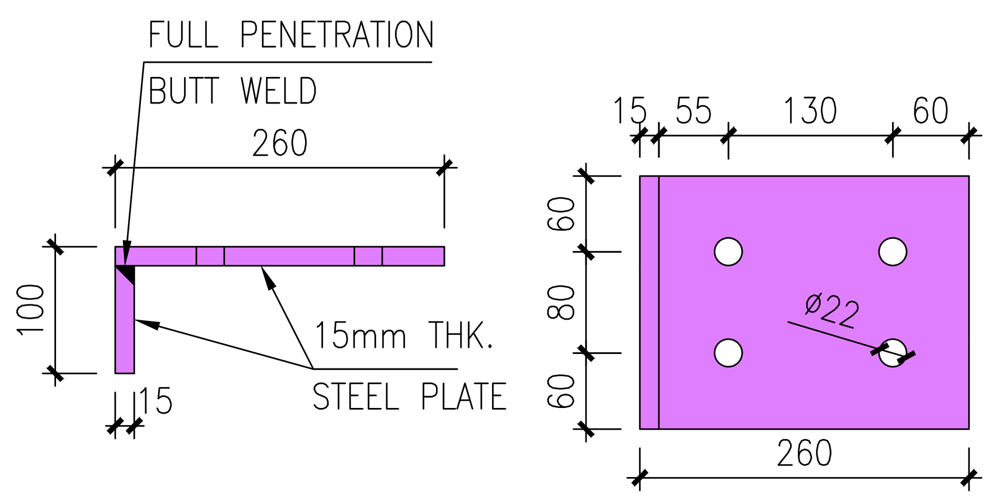
1:10



SEC.1-1

1:10

(SEC 2-2 SIMILAR)



TYPICAL DETAIL OF S1

1:10

CONCRETE

EXISTING MEMBER

NUMBER / 編號	DATE / 日期	AMENDMENT / 修訂

REGISTERED STRUCTURAL ENGINEERS

STW

S.T. WONG & PARTNERS LIMITED

STRUCTURAL ◆ GEOTECHNICAL ◆ ARCHITECTURAL ◆ PROJECT MANAGEMENT CONSULTANT

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PROJECT / 工程項目

HUNG HOM BAY RECLAMATION PHASE II , HUNG HOM (NORTH) FERRY PIER , HONG KONG

DRAWING / 圖名

DETAIL

SCALE / 比例	JOB NUMBER / 工程編號
AS SHOWN	
DATE / 日期	DRAWING NUMBER / 圖號
13/05/2024	AA-S-03

DESIGNED / 設計	CHECKED / 審核	APPROVED / 審定

- ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE NOTED
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- ALL MEASUREMENTS SHOULD BE VERIFIED ON SITE
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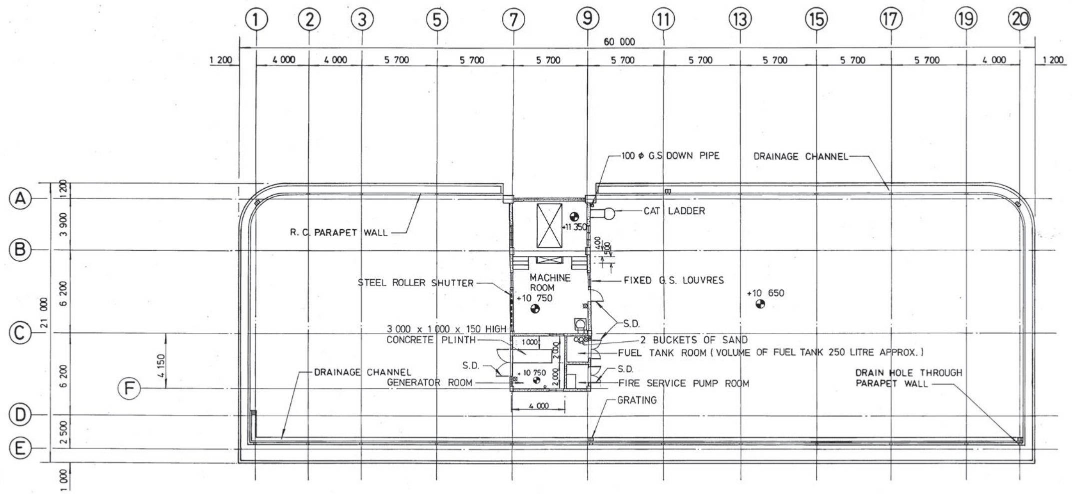
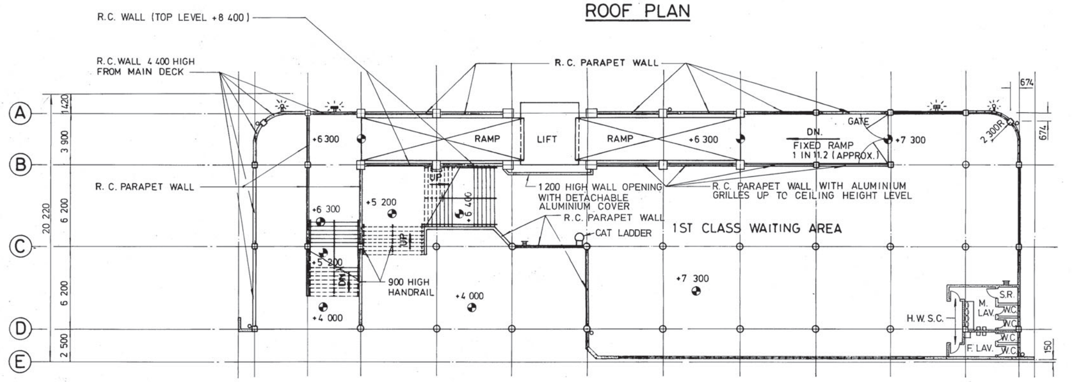
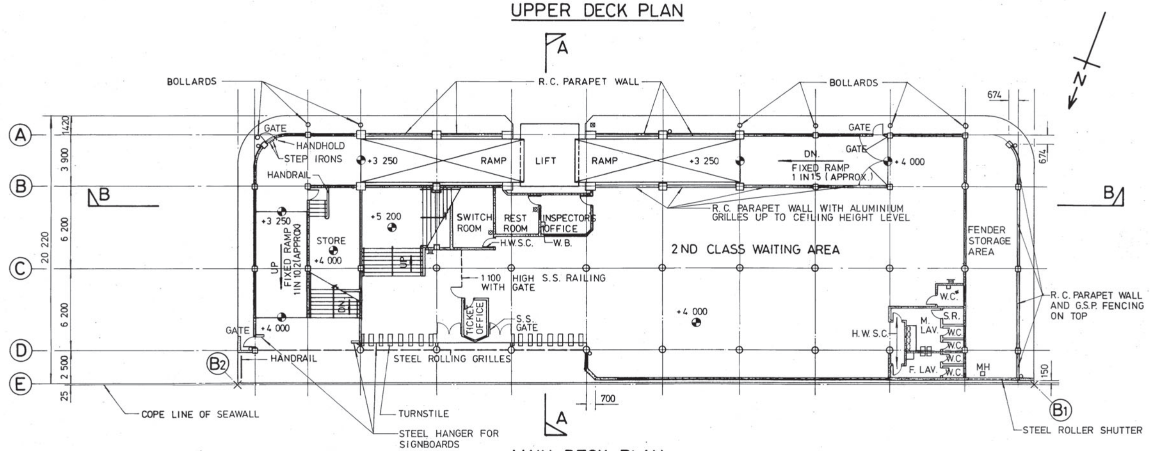
Appendix D
Record Plan



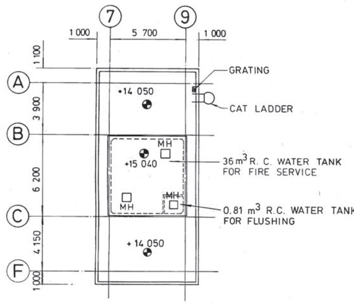
ROOF PLAN



UPPER DECK PLAN



MAIN DECK PLAN



UPPER ROOF PLAN

LEGEND :

	FULL HEIGHT 150 THICK R. C. WALL
------	25 x 15 DEEP GROOVE ON WALL
	NAVIGATION LIGHT
	FOG LIGHT
W. C.*	WATER CLOSET FOR DISABLED
G. S. P.	GALVANIZED STEEL PIPE
S. S.	STAINLESS STEEL
H. W. S. C.	HARD WOOD SELF CLOSING DOOR
MH	MANHOLE COVER
G. S.	GALVANIZED STEEL
S. R.	STORE ROOM
S. D.	STEEL DOOR
W. B.	WASH BASIN
	HOSE REEL
	40 φ BOAT DRAW OFF POINT (WITH LOCKABLE METAL BOX)
	1.5 kg BCF FIRE EXTINGUISHER
W. C.	WATER CLOSET
F. LAV.	FEMALE LAVATORY
M. LAV.	MALE LAVATORY

NOTES :

1. ALL DIMENSIONS IN MILLIMETRES.
2. ALL LEVELS TO BE STRUCTURAL LEVEL REFER TO CHART DATUM (C. D.) AND IN MILLIMETRES.
3. FENDERING SYSTEM NOT SHOWN.
4. ALL R. C. PARAPET WALL TO BE 150mm THICK AND 1 100mm HIGH UNLESS OTHERWISE STATED.

DATE OF COMMENCEMENT: 7/4/88
DATE OF COMPLETION: 20/7/90

PIER –

1. DESIGN VESSEL
   (a) DISPLACEMENT TONNAGE: 1000 TONNES
   (b) APPROACH SPEED PERPENDICULAR TO STRUCTURE = 0.3 m/s
   (c) BERTHING ENERGY = 28.34 KN-m
2. PERMISSIBLE LOAD ON PILE = 110 TONNES
3. LIVE LOAD ON MAIN DECK = 8 KN/m²

AS CONSTRUCTED

no.	date	description	initial
C	4.93	PREPARED: (I.O.W.) T. N. TSUI / CERTIFIED: (ENGINEER) M. C. LEE	
B	4-10-89	DETACHABLE ALUMINIUM COVER ADDED, GENERATOR ROOM WINDOW AND FIRE SERVICE PUMP ROOM DOOR AMENDED.	
A	26.5.89	FIRE SERVICE INLET AND HYDRANT DELETED; 9 LITRE FOAM FIRE EXTINGUISHER REPLACED BY 1.5 kg BCF FIRE EXTINGUISHER.	

REVISION

	name	date
surveyed		
designed	W. TSUI	17-7-87
drawn	Y. L. MA	28-9-87
traced	Y. L. MA	28-9-87
checked	W. TSUI	6-1-88
approved		12-1-88

contract no. CV / 87 / 08

file no. P. W.O. CV / 87 / 08

project no. 228 CL

contract

HUNG HOM BAY RECLAMATION PHASE II CONSTRUCTION OF FERRY PIERS AND SEAWALL STAGE I

drawing title

PIER B — GENERAL LAYOUT (SHEET 1 OF 2)

drawing no. P16031C

scale 1 : 200

office

PORT WORKS DIVISION
CIVIL ENGINEERING OFFICE

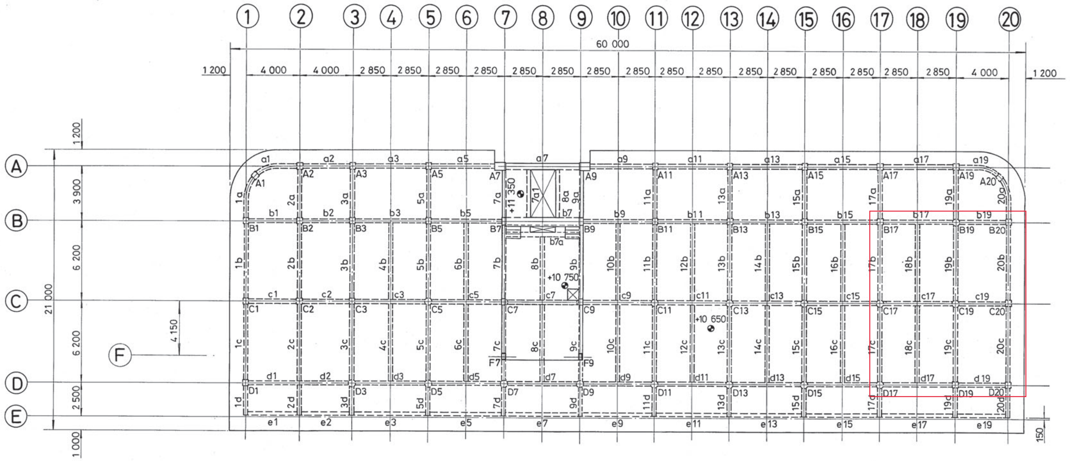
CIVIL ENGINEERING SERVICES DEPARTMENT
HONG KONG

pwd 123

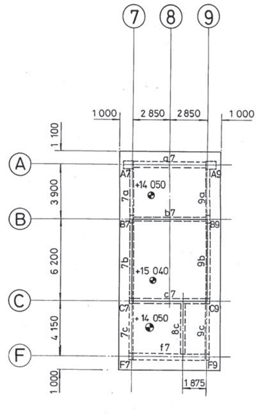
A1 841 x 594

NOTES:

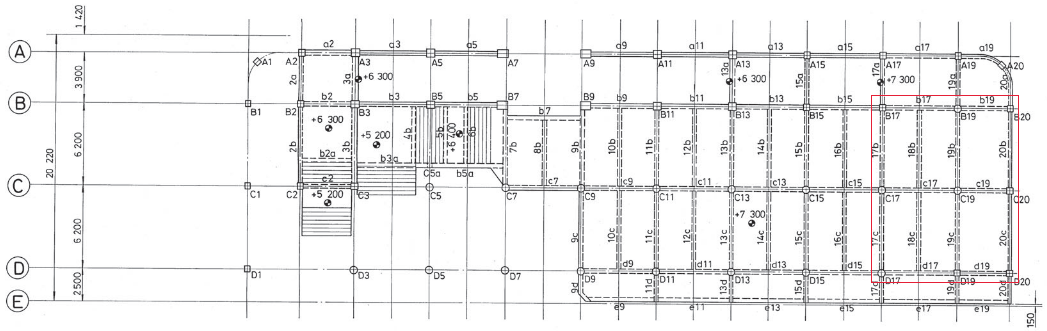
1. ALL DIMENSIONS IN MILLIMETRES.
2. ALL LEVELS TO BE STRUCTURAL LEVEL REFER TO CHART DATUM (C.D.) AND IN MILLIMETRES.
3. FOR R.C. DETAILS OF DUMMY BEAMS REFER TO DRAWING NOS. P15917B AND P15959A



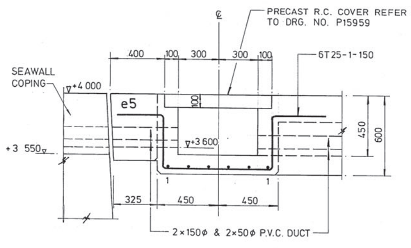
ROOF PLAN



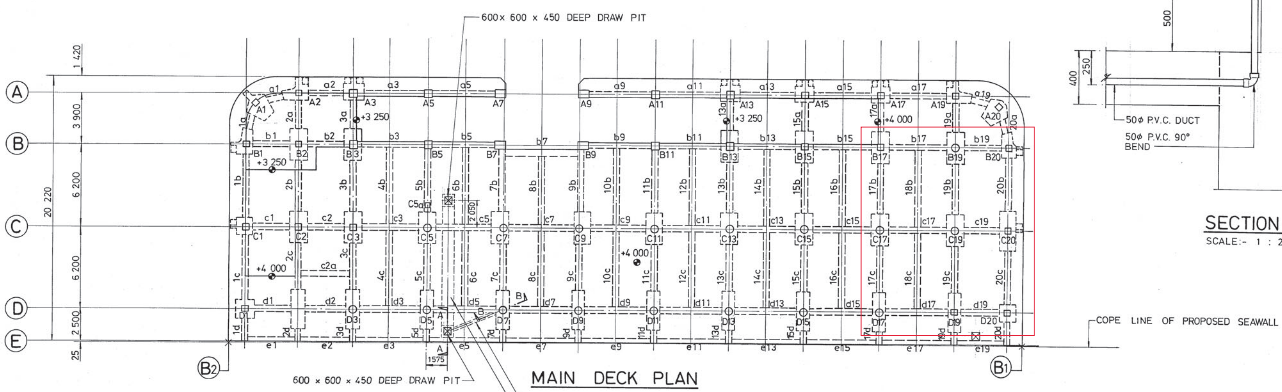
UPPER ROOF PLAN



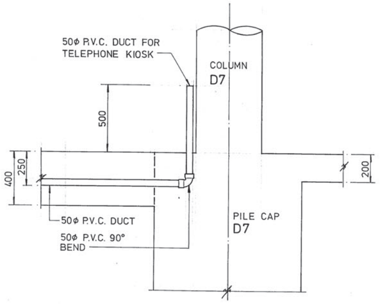
UPPER DECK PLAN



SECTION A-A
SCALE:- 1 : 20



MAIN DECK PLAN



SECTION B-B
SCALE:- 1 : 20

AS CONSTRUCTED

PREPARED: (I.O.W.) T. N. TSUI
CERTIFIED: (ENGINEER) M. C. LEE

no.	date	description	initial
B	4.93		
A	7-9-89	DUMMY BEAM WIDENED AND DRAW PIT SIZE INCREASED, SECTIONS A-A AND B-B ADDED	

REVISION

	name	date
surveyed		
designed	T. K. CHEUNG	17-9-87
drawn	C. Y. LAI	23-9-87
traced	C. Y. LAI	28-9-87
checked	W. TSUI	6-1-88
approved		13-1-88

contract no. C V / 87/ 08

file no. P.W.O. CV / 87 / 08

project no. 228 CL

contract

HUNG HOM BAY RECLAMATION PHASE II CONSTRUCTION OF FERRY PIERS AND SEAWALL STAGE I

drawing title

PIER B — FRAMING PLANS

drawing no. P16040B

scale 1 : 200 OR AS SHOWN

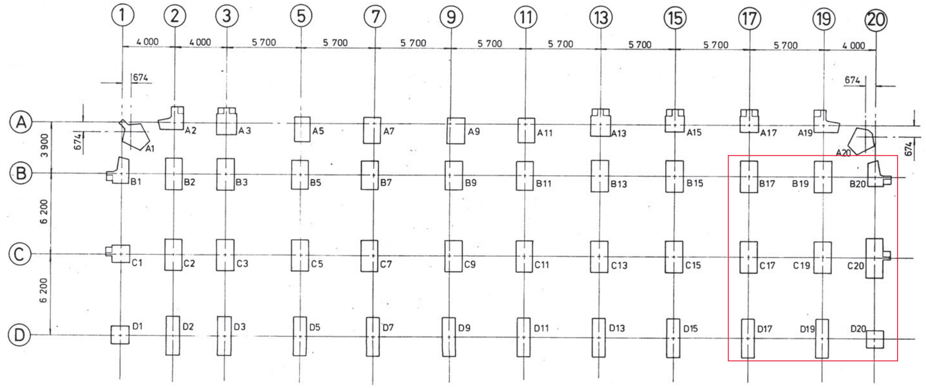
office

PORT WORKS DIVISION
CIVIL ENGINEERING OFFICE

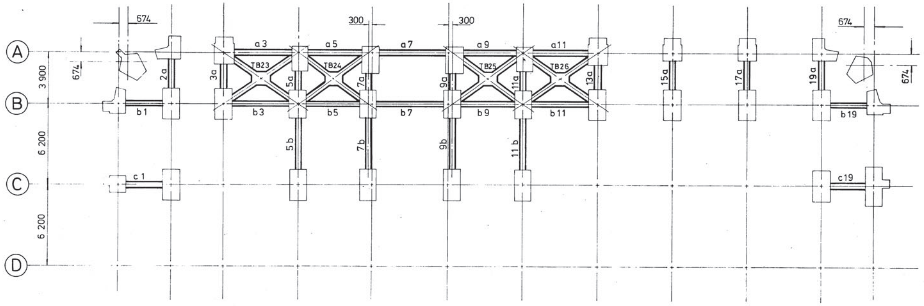
CIVIL ENGINEERING SERVICES DEPARTMENT HONG KONG

pwd 123

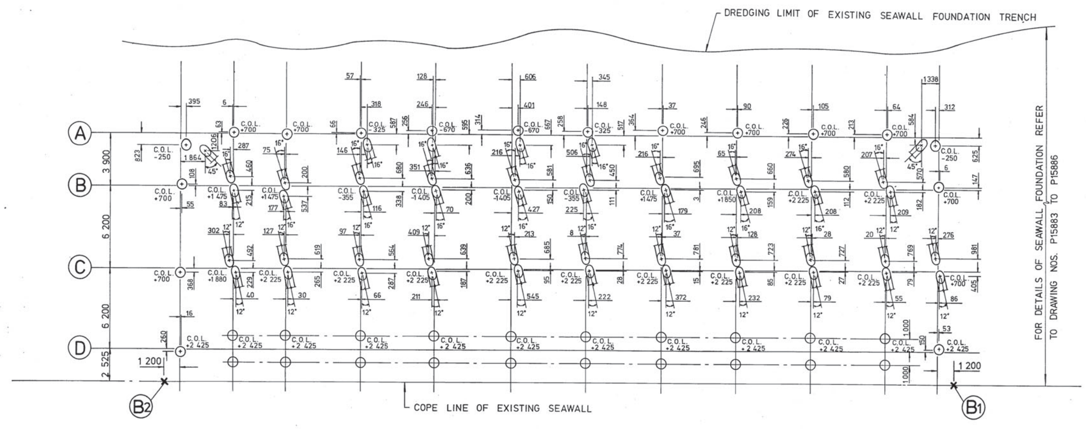
A1 841 x 594



PILE CAPS PLAN



PRECAST TIE BEAMS PLAN



PILING PLAN (C.O.L. = CUT OFF LEVEL)

PILE LOCATION	TOE LEVEL
A 1	-26 500
A 1 B	-33 067
A 2	-31 990
A 3	-33 500
A 5	-34 450
A 5 B	-37 097
A 7	-36 350
A 7 B	-33 429
A 9	-35 100
A 9 B	-34 297
A 11	-36 040
A 11 B	-33 587
A 13	-37 610
A 15	-36 285
A 17	-36 480
A 19	-36 375
A 20	-36 205
A 20 B	-33 447
B 1	-24 170
B 2 A	-33 267
B 2 C	-23 087
B 3 A	-34 472
B 3 C	-26 026
B 5 A	-34 087
B 5 C	-34 467
B 7 A	-35 991
B 7 C	-33 551
B 9 A	-33 247
B 9 C	-33 077
B 11 A	-36 777
B 11 C	-33 050
B 13 A	-36 792
B 13 C	-34 446
B 15 A	-36 837
B 15 C	-34 782
B 17 A	-34 357
B 17 C	-34 427
B 19 A	-33 737
B 19 C	-34 197
B 20	-35 870
C 1	-28 140
C 2 B	-26 906
C 2 D	-36 757

PILE LOCATION	TOE LEVEL
C 3 B	-30 296
C 3 D	-34 327
C 5 B	-34 372
C 5 D	-31 277
C 7 B	-33 697
C 7 D	-35 697
C 9 B	-36 847
C 9 D	-34 116
C 11 B	-32 747
C 11 D	-33 946
C 13 B	-36 497
C 13 D	-32 647
C 15 B	-37 160
C 15 D	-34 397
C 17 B	-36 531
C 17 D	-33 217
C 19 B	-37 107
C 19 D	-32 101
C 20 B	-36 577
C 20 D	-35 137
D 1	-27 710
D 2 C	-25 052
D 2 E	-31 432
D 3 C	-33 302
D 3 E	-33 287
D 5 C	-33 079
D 5 E	-35 930
D 7 C	-33 754
D 7 E	-34 037
D 9 C	-33 611
D 9 E	-33 330
D 11 C	-33 582
D 11 E	-33 401
D 13 C	-32 965
D 13 E	-32 737
D 15 C	-32 083
D 15 E	-35 143
D 17 C	-31 651
D 17 E	-29 962
D 19 C	-35 071
D 19 E	-35 028
D 20	-35 817

NOTES:

1. ALL DIMENSIONS IN MILLIMETRES.
2. ALL LEVELS REFER TO CHART DATUM (C.D.) AND IN MILLIMETRES.
3. ALL RAKING PILES SHALL BE INSTALLED AT A RAKE OF 1 (HORIZ) : 3 (VERT.)
4. ALL PILES ARE 700mm EXTERNAL DIAMETER, 12mm THICK, GRADE 50B STRUCTURAL STEEL TUBULAR HOLLOW SECTION COMPLYING WITH BS 4360.
5. MINIMUM CONCRETE COVER TO PILE AT PILE CAP TO BE 100mm.
6. FOR DETAILS OF STEEL TUBULAR PILES REFER TO DRAWING NO. P16171A.

AS CONSTRUCTED

no.	date	description	initial
A	4.93	PREPARED: (I.O.W.) T. N. TSUI; CERTIFIED: (ENGINEER) M. C. LEE	

REVISION

	name	date
surveyed		
designed	T. K. CHEUNG	17-9-87
drawn	C. L. CHIU	24-9-87
traced	C. L. CHIU	25-9-87
checked	W. TSUI	6-1-88
approved		13-1-88

contract no. CV / 87 / 08

file no. P.W.O. CV / 87 / 08

project no. 228 CL

contract

HUNG HOM BAY RECLAMATION PHASE II CONSTRUCTION OF FERRY PIERS AND SEAWALL STAGE I

drawing title

PIER B — PILE CAPS, PRECAST TIE BEAMS AND PILING PLANS

drawing no. P16041A

scale 1 : 200

office

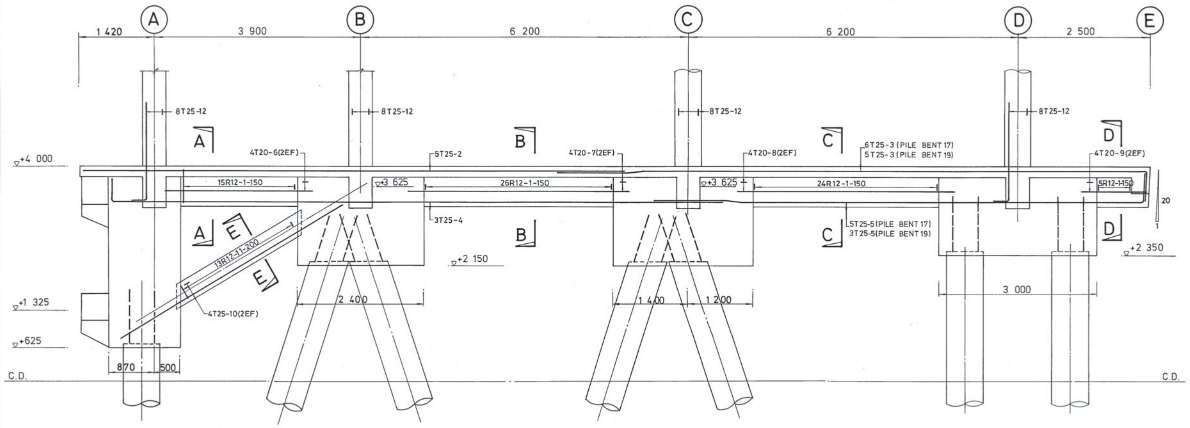
PORT WORKS DIVISION
CIVIL ENGINEERING OFFICE

CIVIL ENGINEERING SERVICES DEPARTMENT HONG KONG

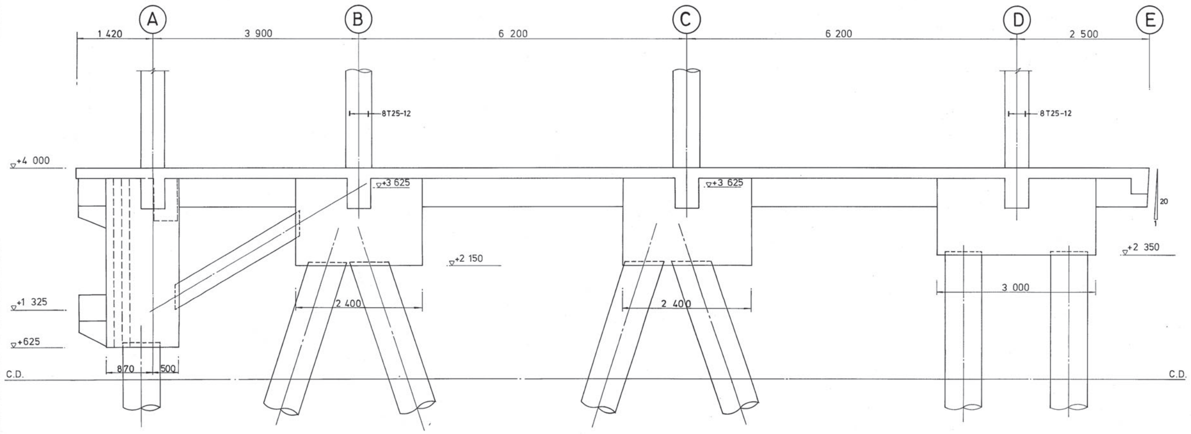
pwd 123

A1 841 x 594

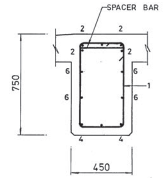
NOTES:
1. ALL DIMENSIONS IN MILLIMETRES.
2. ALL LEVELS REFER TO CHART DATUM (C.D.) AND IN MILLIMETRES.
3. FOR GENERAL NOTES REFER TO DRAWING NO. P16042A.



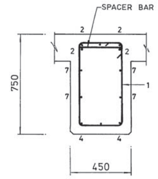
PILE BENT 17
SCALE 1 : 50



PILE BENT 19
(REINFORCEMENT ARRANGEMENT SIMILAR TO PILE BENT 17 OR AS SHOWN)
SCALE 1 : 50



SECTION A-A



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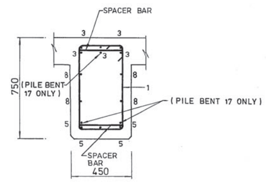
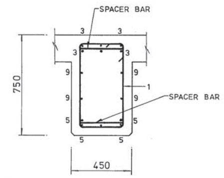
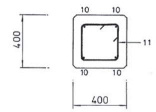


SECTION C-C



SECTION D-D



SECTION E-E

AS CONSTRUCTED

no.	date	description		initial
A	4.93	PREPARED: (I.O.W.)	T. N. TSUI	
		CERTIFIED: (ENGINEER)	M. C. LEE	

REVISION

	name	date
surveyed		
designed	T. K. CHEUNG	17 - 9 - 87
drawn	C. K. LI	11 - 12 - 87
traced	C. K. LI	11 - 12 - 87
checked	W. TSUI	6 - 1 - 88
approved		13 - 1 - 88

contract no. CV / 87 / 08

file no. P. W. O. CV / 87 / 08

project no. 228 CL

contract
HUNG HOM BAY RECLAMATION PHASE II CONSTRUCTION OF FERRY PIERS AND SEAWALL STAGE I

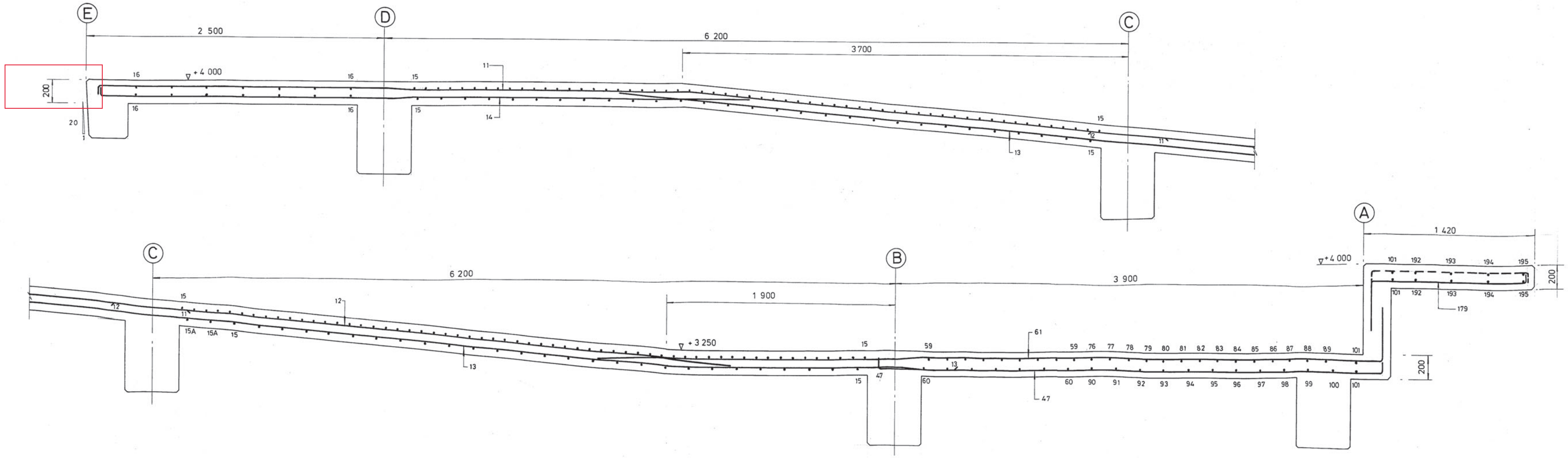
drawing title
PIER B — R. C. DETAILS OF PILE BENTS
(SHEET 5 OF 7)

drawing no. P16046A

scale 1 : 20 OR AS SHOWN

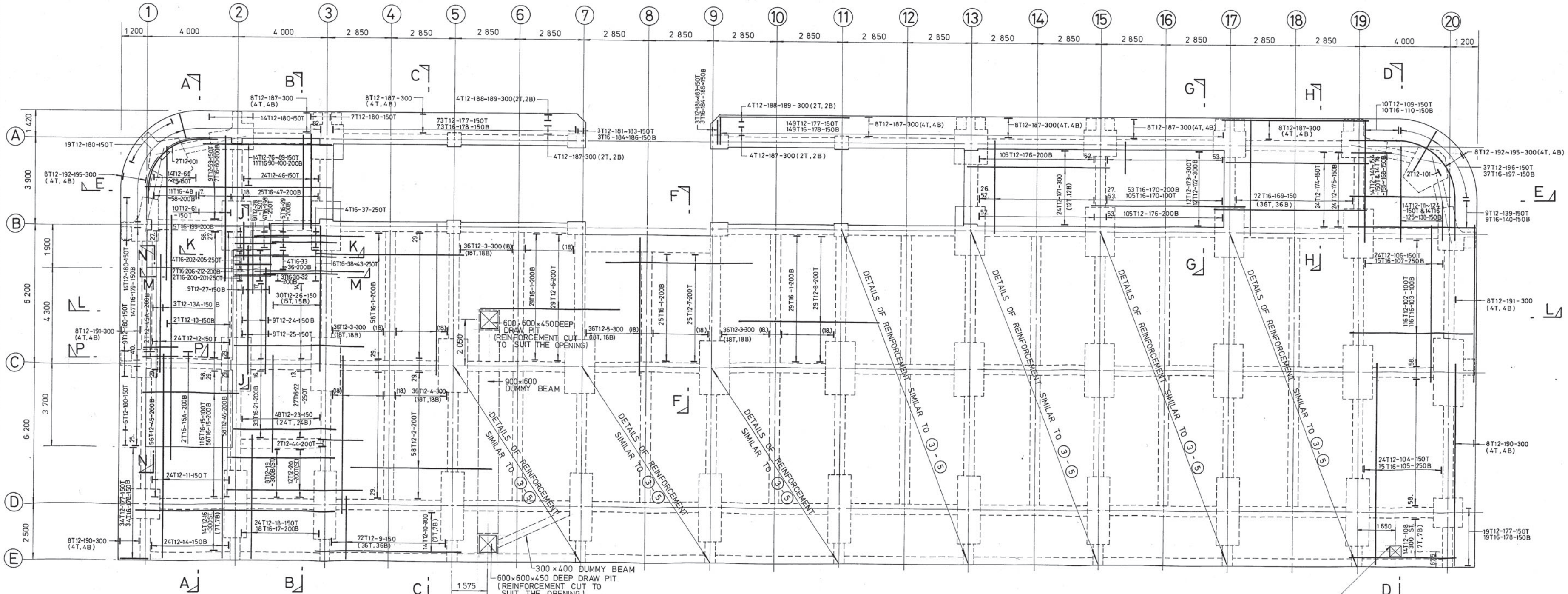
office
PORT WORKS DIVISION
CIVIL ENGINEERING OFFICE

CIVIL ENGINEERING DEPARTMENT HONG KONG



SECTION A - A

SCALE 1 : 20



PLAN

SCALE 1 : 100

NOTES:

1. ALL DIMENSIONS IN MILLIMETRES.
2. ALL LEVELS REFER TO CHART DATUM (C. D.) AND IN MILLIMETRES.
3. CONCRETE TO STRUCTURES TO BE OF GRADE 40 / 20.
4. ALL REINFORCEMENT TO COMPLY WITH B. S. 4449.
5. CONCRETE COVER TO REINFORCEMENT TO BE 40mm UNLESS OTHERWISE SPECIFIED.
6. MINIMUN LAP LENGTH FOR REINFORCEMENT OF HIGH YIELD TYPE 2 DEFORMED BARS TO BE 45 TIMES THE DIAMETER OF THE SMALLER LAPPED BAR UNLESS OTHERWISE SPECIFIED.
7. MINIMUM ANCHORAGE LENGTH FOR REINFORCEMENT OF HIGH YIELD TYPE 2 DEFORMED BARS TO BE 32 TIMES THE DIAMETER OF BAR UNLESS OTHERWISE SPECIFIED.
8. ALL EXTERNAL CONCRETE ARRISES TO BE 25 x 25mm CHAMFERED UNLESS OTHERWISE SPECIFIED.
9. FOR LAYOUT OF TERMINAL MANHOLE REFER TO DRAWING NO. P 16119A.
10. FOR R. C. DETAILS OF DRAW PITS, DUMMY BEAM AND DRAW PIT COVERS REFER TO DRAWING NOS. P 15917B, P15959A AND P16040B.
11. FOR TRIMMING BARS FOR DRAW PITS REFER TO DRG. NO. P15959A.
12. BAR MARK NOS. 13A, 15A AND 45A TO BE BENT FROM BAR MARK NOS. 13, 15 AND 45 RESPECTIVELY.

AS CONSTRUCTED

no.	date	description	initial
B	4.93	PREPARED: (I.O.W.) T. N. TSUI; CERTIFIED: (ENGINEER) M. C. LEE	
A	7-9-89	DUMMY BEAM WIDENED AND DRAW PIT SIZE INCREASED	

REVISION

	name	date
surveyed		
designed	T. K. CHEUNG	17 - 9 - 87
drawn	C. L. CHIU	3 - 11 - 87
traced	C. L. CHIU	3 - 11 - 87
checked	W. TSUI	6 - 1 - 88
approved		13 - 1 - 88

contract no. CV / 87 / 08

file no. P.W.O. CV / 87 / 08

project no. 228 CL

contract

HUNG HOM BAY RECLAMATION PHASE II CONSTRUCTION OF FERRY PIERS AND SEAWALL STAGE I

drawing title

PIER B — R. C. DETAILS OF MAIN DECK SLAB (SHEET 1 OF 5)

drawing no. P 16086 B

scale AS SHOWN

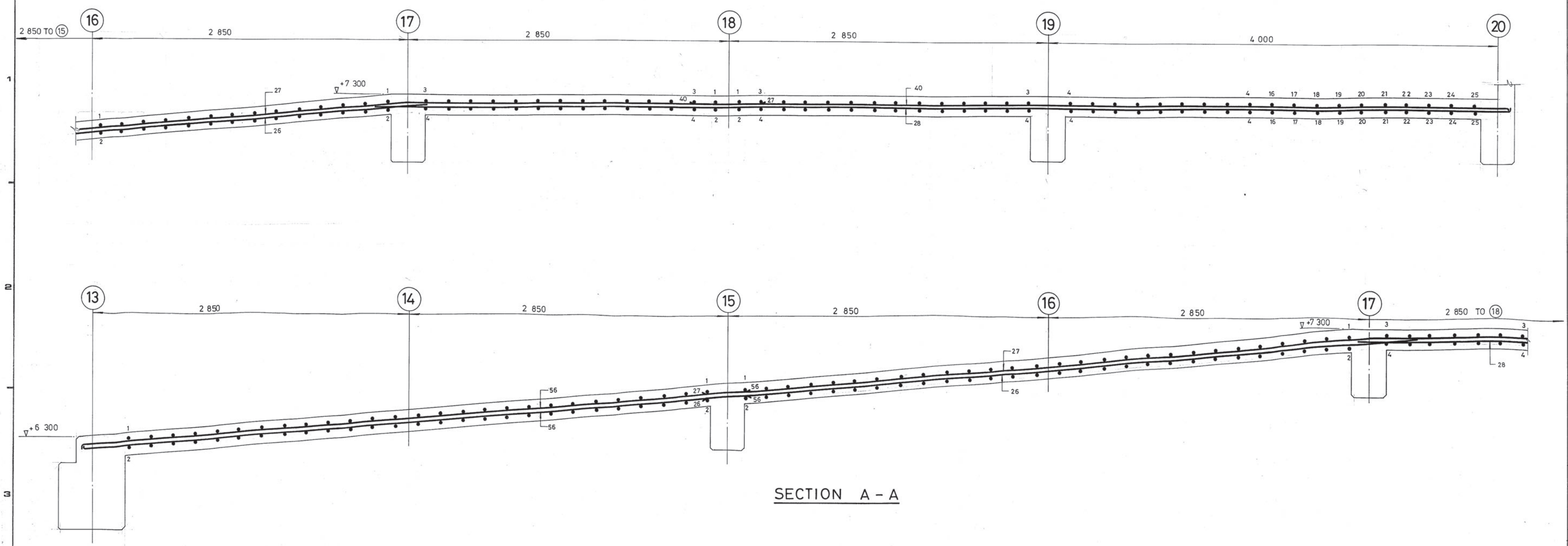
office

PORT WORKS DIVISION
CIVIL ENGINEERING OFFICE

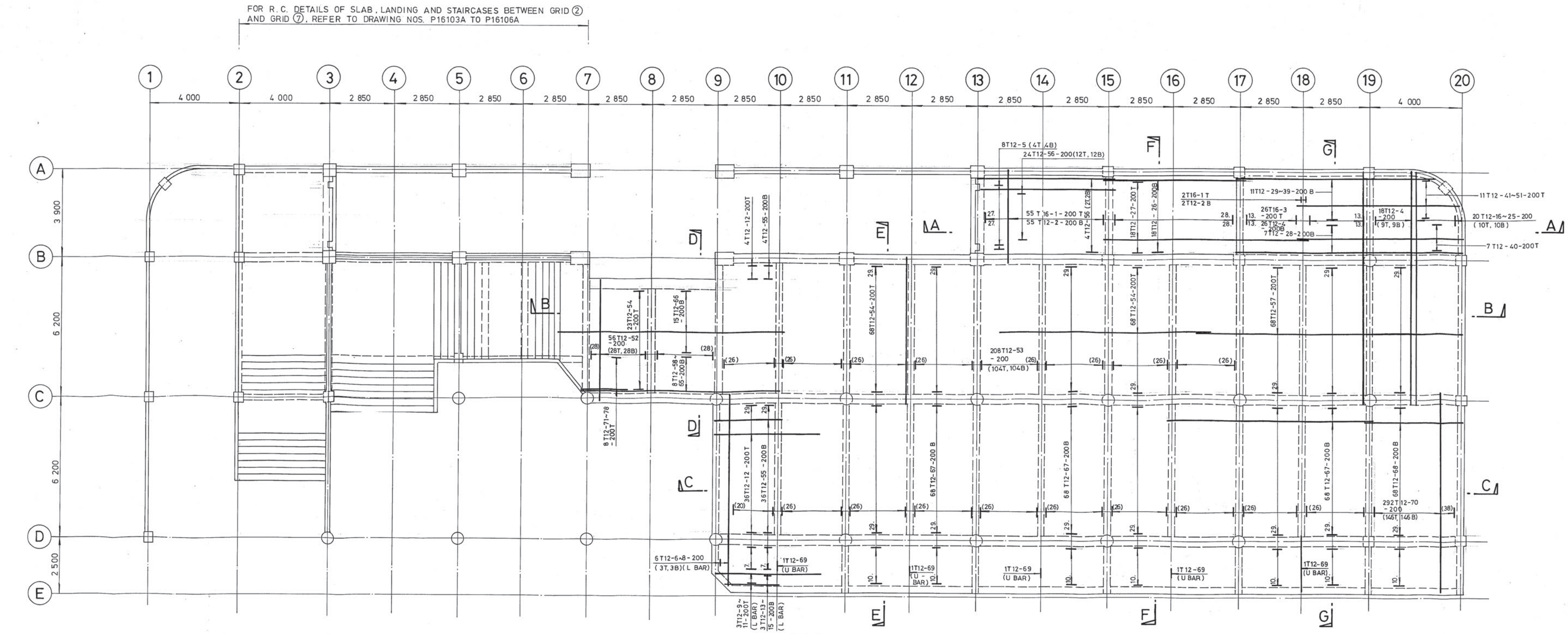
CIVIL ENGINEERING SERVICES DEPARTMENT
HONG KONG

pwd 123

A1 841 x 594



SECTION A - A



PLAN
SCALE:-1:100

NOTES:

1. ALL DIMENSIONS IN MILLIMETRES.
2. ALL LEVELS REFER TO CHART DATUM (C.D.) AND IN MILLIMETRES.
3. CONCRETE TO STRUCTURES TO BE OF GRADE 40/20.
4. ALL REINFORCEMENT TO COMPLY WITH B.S. 4449.
5. CONCRETE COVER TO REINFORCEMENT TO BE 40 mm.
6. MINIMUM LAP LENGTH FOR REINFORCEMENT OF HIGH YIELD TYPE 2 DEFORMED BARS TO BE 45 TIMES THE DIA. OF THE SMALLER LAPPED BAR UNLESS OTHERWISE SPECIFIED.
7. MINIMUM ANCHORAGE LENGTH FOR REINFORCEMENT OF HIGH YIELD TYPE 2 DEFORMED BARS TO BE 32 TIMES THE DIA. OF THE BAR UNLESS OTHERWISE SPECIFIED.
8. THICKNESS OF UPPER DECK SLAB TO BE 175 mm.
9. ALL EXTERNAL CONCRETE ARRISES TO BE 25 × 25 mm CHAMFERED UNLESS OTHERWISE SPECIFIED.

AS CONSTRUCTED

no.	date	description	initial
A	4.93	PREPARED: (I.O.W.) T. N. TSUI; CERTIFIED: (ENGINEER) M. C. LEE	

REVISION

	name	date
surveyed		
designed	T. K. CHEUNG	17-9-87
drawn	K. C. WONG	9-10-87
traced	K. C. WONG	13-10-87
checked	W. TSUI	6-1-88
approved		13-1-88

contract no. CV / 87 / 08
file no. P.W.O. CV / 87 /08
project no. 228 CL

contract
HUNG HOM BAY RECLAMATION PHASE II CONSTRUCTION OF FERRY PIERS AND SEAWALL STAGE I

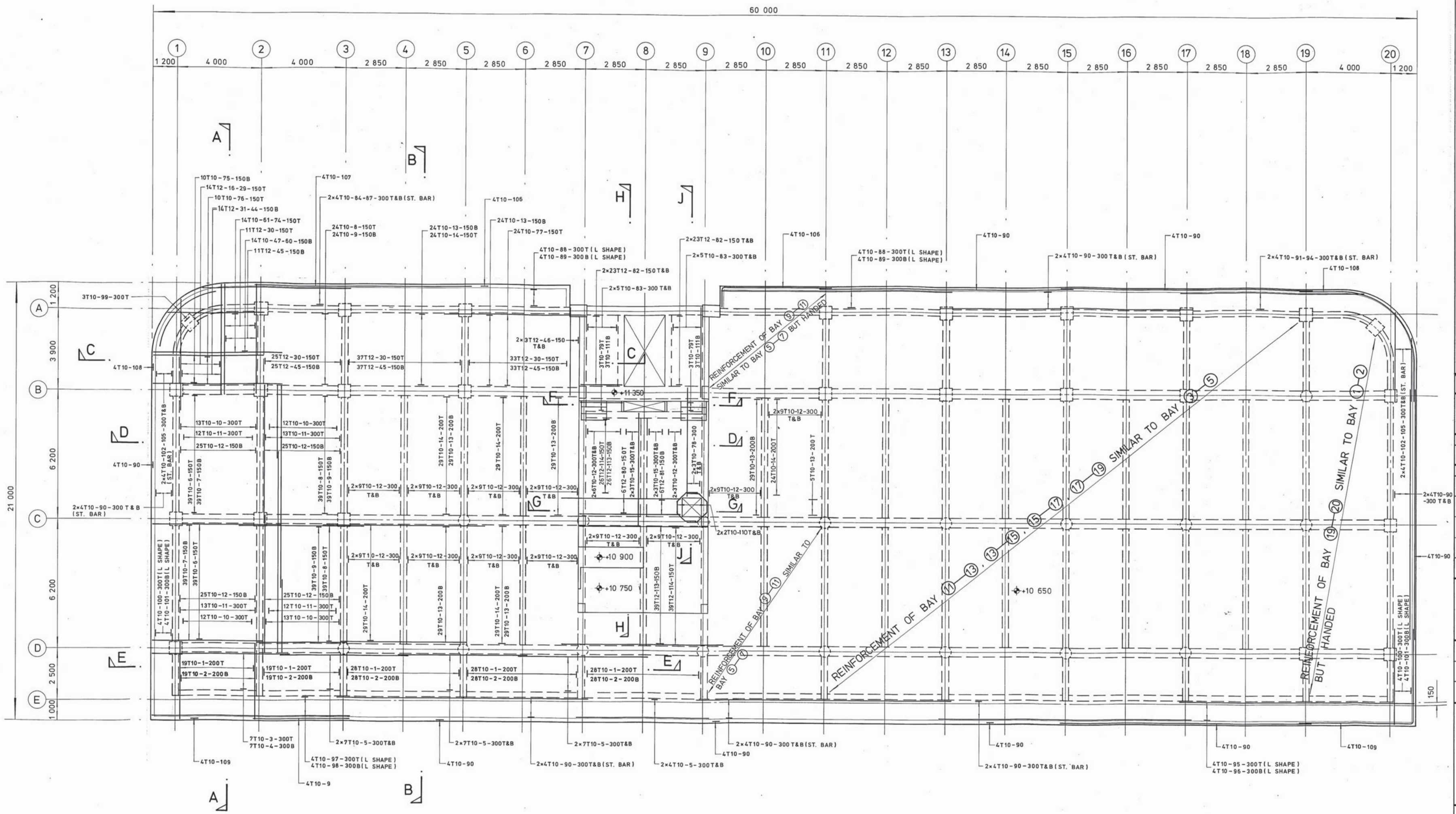
drawing title
PIER B — R. C. DETAILS OF UPPER DECK SLAB (SHEET 1 OF 3)

drawing no. P16090A

scale 1 : 20 OR AS SHOWN

office
PORT WORKS DIVISION
CIVIL ENGINEERING OFFICE

CIVIL ENGINEERING SERVICES DEPARTMENT
HONG KONG



ROOF SLAB
(THICKNESS OF SLAB = 150)

NOTES:

1. ALL DIMENSIONS IN MILLIMETRES.
2. ALL LEVELS REFER TO CHART DATUM (C.D.) AND IN MILLIMETRES.
3. CONCRETE TO STRUCTURES TO BE OF GRADE 40 / 20
4. ALL REINFORCEMENT TO COMPLY WITH B.S. 4449.
5. CONCRETE COVER TO REINFORCEMENT TO BE 40mm UNLESS OTHERWISE SPECIFIED.
6. MINIMUM LAP LENGTH FOR REINFORCEMENT OF HIGH YIELD TYPE 2 DEFORMED BARS TO BE 45 TIMES THE DIAMETER OF THE SMALLER LAPPED BAR UNLESS OTHERWISE SPECIFIED.
7. MINIMUM ANCHORAGE LENGTH FOR REINFORCEMENT OF HIGH YIELD TYPE 2 DEFORMED BARS TO BE 32 TIMES THE DIAMETER OF BAR UNLESS OTHERWISE SPECIFIED.
8. ALL EXTERNAL CONCRETE ARRISES TO BE 25×25mm CHAMFERED UNLESS OTHERWISE SPECIFIED.

AS CONSTRUCTED

no.	date	description	initial
A	4.93	PREPARED: (I.O.W.) T. N. TSUI; CERTIFIED: (ENGINEER) M. C. LEE	

REVISION

	name	date
surveyed		
designed	T. K. CHEUNG	17-9-87
drawn	Y. M. LEUNG	3-11-87
traced	Y. M. LEUNG	3-11-87
checked	W. TSUI	6-1-88
approved		14-1-88

contract no. CV/87/08

file no. P. W. O. CV/87/08

project no. 228CL

contract

HUNG HOM BAY RECLAMATION PHASE II CONSTRUCTION OF FERRY PIERS AND SEAWALL STAGE I

drawing title

PIER B — R. C. DETAILS OF MAIN ROOF SLAB (SHEET 1 OF 5)

drawing no. P 16093A

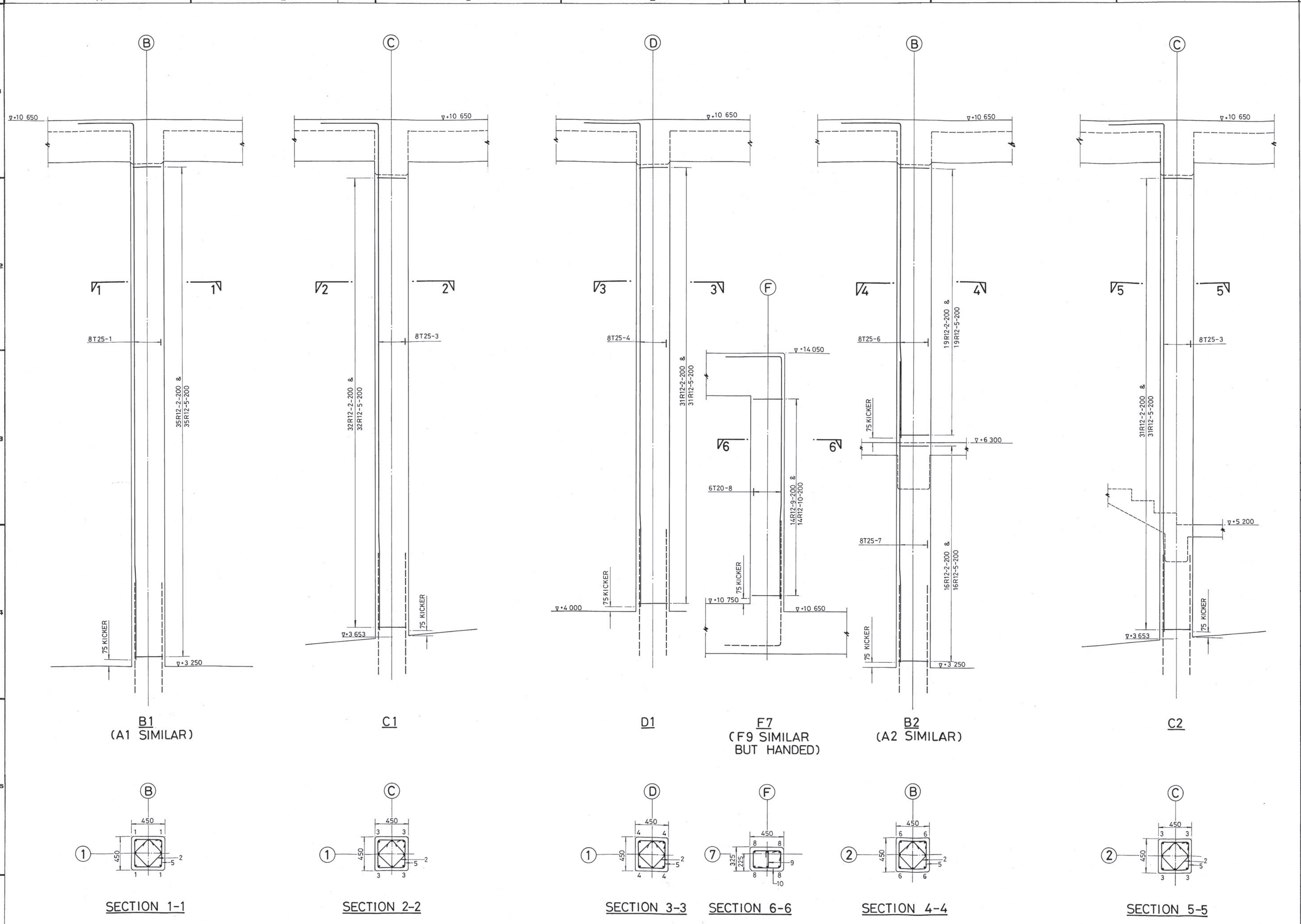
scale 1 : 100

office

PORT WORKS DIVISION
CIVIL ENGINEERING OFFICE

CIVIL ENGINEERING SERVICES DEPARTMENT HONG KONG

12.7



NOTES:

1. ALL DIMENSIONS IN MILLIMETRES.
2. ALL LEVELS REFER TO CHART DATUM (C.D.) AND IN MILLIMETRES.
3. CONCRETE TO STRUCTURES TO BE OF GRADE 40/20.
4. ALL REINFORCEMENT TO COMPLY WITH B.S. 4449.
5. CONCRETE COVER TO REINFORCEMENT TO BE 40mm.
6. MINIMUM LAP LENGTH FOR REINFORCEMENT OF HIGH YIELD TYPE 2 DEFORMED BARS TO BE 45 TIMES THE DIAMETER OF THE SMALLER LAPPED BAR UNLESS OTHERWISE SPECIFIED.
7. MINIMUM ANCHORAGE LENGTH FOR REINFORCEMENT OF HIGH YIELD TYPE 2 DEFORMED BARS TO BE 32 TIMES THE DIAMETER OF BAR UNLESS OTHERWISE SPECIFIED.
8. ALL EXTERNAL CONCRETE ARRISES TO BE 25 x 25mm CHAMFERED UNLESS OTHERWISE SPECIFIED.

AS CONSTRUCTED

no.	date	description	initial
A	493	PREPARED: (I.O.W.) T. N. TSUI; CERTIFIED: (ENGINEER) M. C. LEE	

REVISION

	name	date
surveyed		
designed	T. K. CHEUNG	17-9-87
drawn	C. Y. LAI	12-10-87
traced	C. Y. LAI	14-10-87
checked	W. TSUI	6-1-88
approved		13-1-88

contract no. CV / 87 / 08

file no. P.W.O. CV / 87 / 08

project no. 228 CL

contract

HUNG HOM BAY RECLAMATION PHASE II CONSTRUCTION OF FERRY PIERS AND SEAWALL STAGE I

drawing title

PIER B —
R. C. DETAILS OF COLUMNS
(SHEET 1 OF 4)

drawing no. P16099A

scale 1 : 25

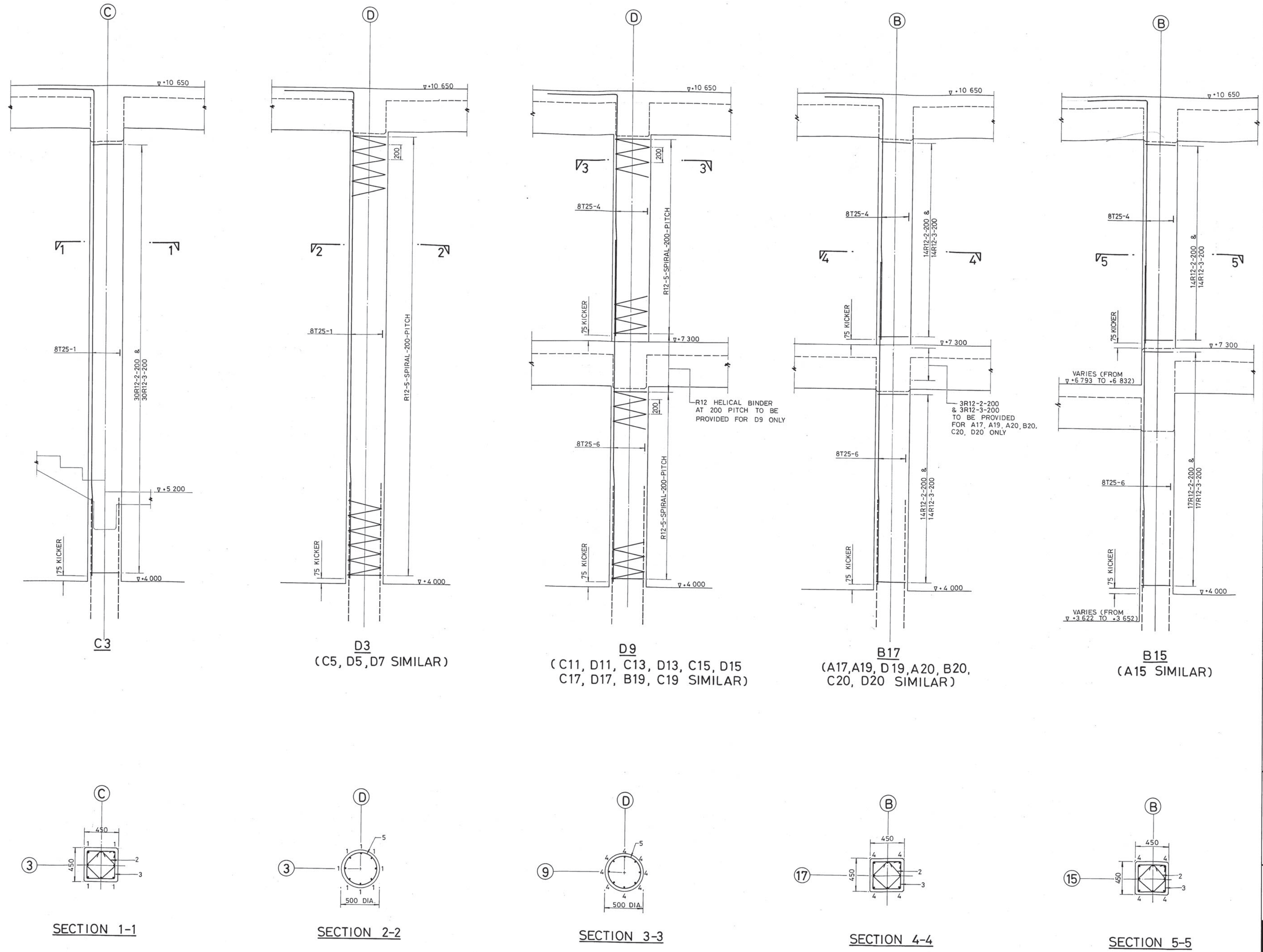
office

PORT WORKS DIVISION
CIVIL ENGINEERING OFFICE

CIVIL ENGINEERING SERVICES DEPARTMENT
HONG KONG

pwd 123

A1 841 x 594



NOTES:

1. ALL DIMENSIONS IN MILLIMETRES.
2. ALL LEVELS REFER TO CHART DATUM (C.D.) AND IN MILLIMETRES.
3. FOR GENERAL NOTES REFER TO DRAWING NO. P16099A.

AS CONSTRUCTED

no.	date	description	initial
A	4.93	PREPARED: (I.O.W.) T. N. TSUI; CERTIFIED: (ENGINEER) M. C. LEE	

REVISION

	name	date
surveyed		
designed	T. K. CHEUNG	17-9-87
drawn	C. Y. LAI	19-10-87
traced	C. Y. LAI	20-10-87
checked	W. TSUI	6-1-88
approved		13-1-88

contract no. CV / 87 / 08

file no. P. W. O. CV / 87 / 08

project no. 228 CL

contract

HUNG HOM BAY RECLAMATION PHASE II CONSTRUCTION OF FERRY PIERS AND SEAWALL STAGE I

drawing title

PIER B — R. C. DETAILS OF COLUMNS (SHEET 2 OF 4)

drawing no. P16100A

scale 1 : 25

office

PORT WORKS DIVISION
CIVIL ENGINEERING OFFICE

CIVIL ENGINEERING SERVICES DEPARTMENT
HONG KONG

pwd 123

A1 841 x 594

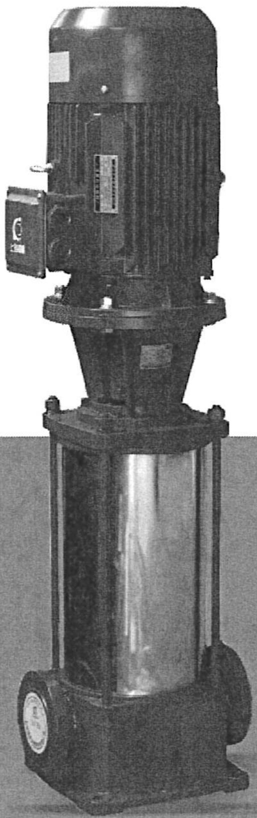
重要

操作人员在使用本产品前，请务必仔细查阅产品说明书，以确保操作安全。

IMPORTANT

Please ensure that these instructions are read and understood by machine operators before using the product.

请详阅手册内容并善加保存
Please read and save this mamual



使用说明书
Use Specification

GDL型立式多级离心泵

上海超盾机械制造集团有限公司
Shanghai Chaodun Machinery Manufacturing Group Co.,Ltd

About US
企业简介

上海超盾机械制造集团有限公司（原自高泵阀）公司始建于1992年，生产历史悠久，由于公司发展的需求于2019年组建成集团， 现位于上海浦东新区惠南镇双店路518号，总部占地面积6000平方米，建筑面积4000平方米，现有职工120人，工程技术人员20人，是一家专业生产泵类产品的公司，主要产品有单级泵系列、多级泵系列、排污泵系列、消防泵系列、化工泵系列、成套供水设备系列、水泵专用电气控制柜、变频控制柜等。

公司拥有国家B级水泵测试台，设有计算机控制中心，CAD/CAM计算机辅助设计和加工软件，有效地保证产品开发设计、生产制造、质量控制等工作的顺利进行。公司通过了ISO9001：2015质量管理体系认证，质量符合国家标准。产品广泛适用于石油、化工、冶金、电力、建筑、环保、制药、城市建设、污水处理、消防设施、集中采暖、农业排灌等领域，部分产品被南水北调、西气东输等国家重点工程和武汉钢铁集团、中国石化等大型企业所采用。

公司以市场为核心，靠质量万里行，在全国各大中型城市设有40多家销售服务公司或分支机构形成了一个系统性的销售服务网络，完全彻底的免除了用户的一切后顾之忧，使公司的产品一步步向新市场拓展，公司追求“精心、尽心、诚信、创新”的精神，本着“为客户创造价值，为员工创造机会，为社会创造效益”的宗旨，以建一流企业，创行业名牌，成为国内领先的泵类产品及供水解决方案的集成供应服务商为目标，超盾人真诚的与各界朋友开展广泛的合作，共同创造一个美好的未来。

Shanghai CHAODUN machinery group co., LTD. (Formerly ZIGAO Pump& valve) which was founded in 1992, has a long history. The company form a group in 2019 due to the demand for the development of the company, it located in No.518, Shuangdian road Huina town Shanghai Pudong new area. The headquarters covers an area of 6000 square meters, the building area is 4000 square meters, existing staff 120 people, 20 people engineers and technicians. CHAODUN is a professional production of pump products company, the main products include single-stage pump series, multistage pump series, sewage pump series, fire pump series, chemical pump series, complete water supply equipment series, special electrical control cabinet for water pump, frequency control cabinet and so on.

CHAODUN has the national B class water pump test bench, the computer control center, CAD/CAM computer aided design and processing software, It ensure product development and design, manufacturing, quality control work smoothly and effectively. CHAODUN has passed iso9001:2015 quality management system certificate, and the quality meets the national standards. The products are widely used in petroleum, chemical industry, metallurgy, electric power, construction, environmental protection, pharmaceutical, urban construction, sewage treatment, fire protection facilities, centralized heating, agricultural irrigation and drainage and other fields. Some products are used by national key projects such as south-to-north water diversion project, west-to-east gas transmission project and large enterprises such as Wuhan iron and steel group and Sinopec.

CHAODUN take the market as the core, rely on quality, has set up more than 40 large and medium-sized cities nationwide sales and service companies or branches which formed a systematic sales service network, ensure that customers have no worries, CHAODUN's products will meet the new market development step by step, CHAODUN pursues "carefully, diligent, integrity, innovation" the spirit, the spirit of "creating value for customers, creating opportunities for employees, create benefit for the society" the objective, to build first-class enterprise, create industry brand, become a leading domestic pump products and solution of water supply integrated supply services as the goal, Chaodun staff sincerely carry out extensive cooperation with friends from all walks of life to create a better future together.

目　　录

产品概述

GDL型多级离心泵是本单位在国内外优秀泵型之基础上结合用户的使用要求，并根据JB/Q6435.92标准设计制造的新一代产品。

该泵采用立式节段式外加不锈钢壳体结构，使得泵的进出口位于同一水平线上且口径相同，能像阀门一样安装于管路之中，它同时集中了多级泵之高压、立式泵之占地面积小及管道泵之安装方便的优点，同时由于采用了优秀的水力模型，所以还具有高效节能、运行平稳等优点，且轴封采用耐磨机械密封，无泄漏使用寿命长。

应用范围

GDL型多级离心泵主要适用于高压运行系统中冷热清水的循环和增压，高层建筑多台泵并联供水，消防、锅炉给水和冷却水系统及各种冲洗液的输送等。

工作条件

1、本型泵可输送清水或物理化学性质类似于清水的液体；

2、液体温度：-15℃~+80℃；

3、工作压力：最大工作压力<2.5MPa，即系统压力=入口压力+闭阀工作时的压力<2.5MPa；

4、周围环境的温度应低于40℃，相对湿度不超过95%；

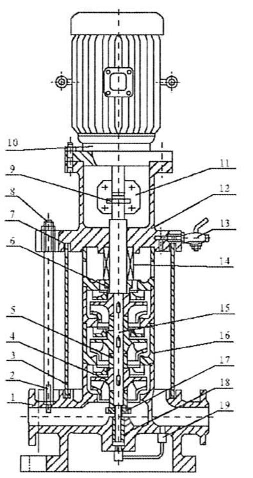
5、输送含腐蚀性介质及热液体时，请于订货时提出，以便采用特殊材质满足使用要求。

型号意义

50 GDL 12 - 15 × 5

- 5：级数为5级
- 15：额定单级扬程为15m
- 12：额定流量为12m^3/h
- GDL：GDL型立式多级管道离心泵
- 50：进出口公称直径为50mm

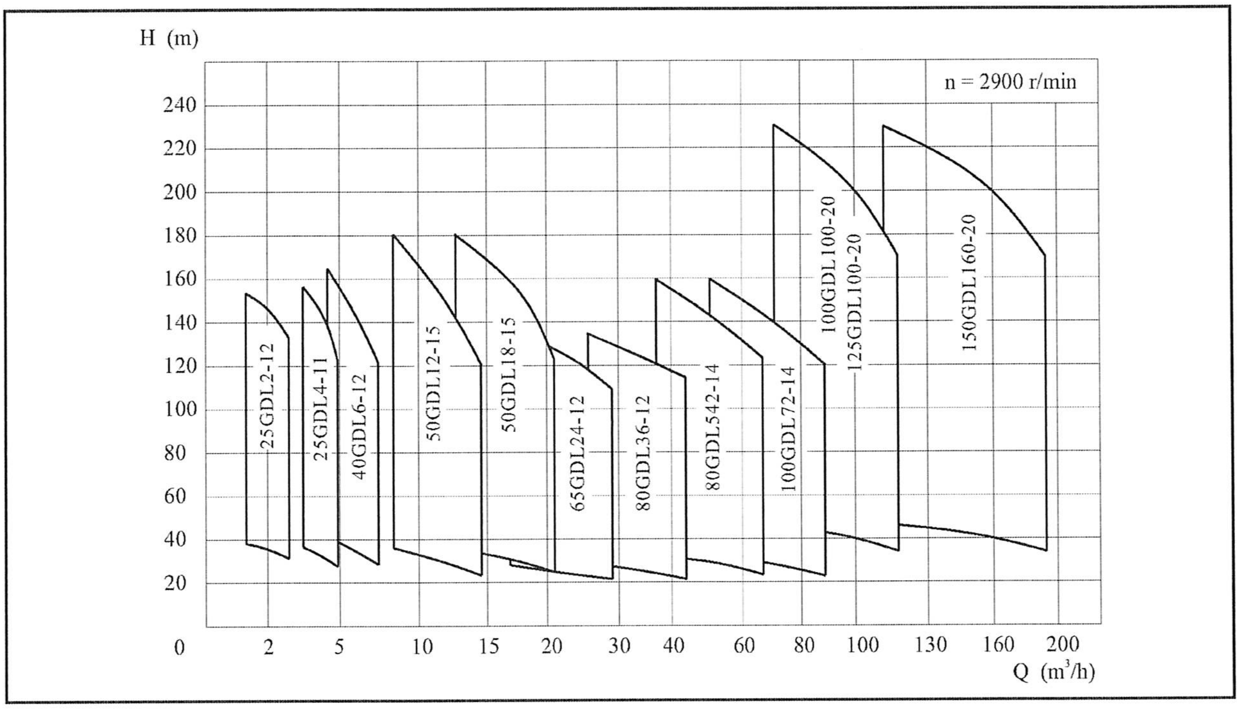
GDL型泵结构简图



GDL型
多级管道离心泵

1	泵体
2	拉紧螺栓
3	外筒
4	叶轮
5	叶轮挡套
6	轴套
7	密封垫
8	螺母
9	销
10	电机
11	联轴器
12	联接座
13	气嘴
14	机械密封
15	轴
16	中段
17	轴套螺母
18	轴瓦
19	回水管部件

GDL型泵型谱图



GDL型泵性能参数

型　号	流量 (m³/h)	流量 (L/s)	扬程 (m)	效率 (%)	转速 (r/min)	功率 轴功率(kw)	功率 电机功率(kw)	必需汽蚀余量 (NPSH)r(m)	高度 (mm)	重量 (kg)
25GDL2-12×3	1.4 2 2.4	0.39 0.56 0.67	38 36 33	23 30 32	2900	0.63 0.65 0.67	1.1	1.4 1.7 1.8	606	60
25GDL2-12×4	1.4 2 2.4	0.39 0.56 0.67	50 48 44	23 30 32	2900	0.83 0.87 0.90	1.1	1.4 1.7 1.8	646	64
25GDL2-12×5	1.4 2 2.4	0.39 0.56 0.67	63 60 55	23 30 32	2900	1.04 1.09 1.12	1.5	1.4 1.7 1.8	711	73
25GDL2-12×6	1.4 2 2.4	0.39 0.56 0.67	76 72 66	23 30 32	2900	1.26 1.30 1.35	1.5	1.4 1.7 1.8	751	76
25GDL2-12×7	1.4 2 2.4	0.39 0.56 0.67	88 84 77	23 30 32	2900	1.46 1.52 1.57	2.2	1.4 1.7 1.8	816	83
25GDL2-12×8	1.4 2 2.4	0.39 0.56 0.67	101 96 88	23 30 32	2900	1.63 1.74 1.80	2.2	1.4 1.7 1.8	856	87
25GDL2-12×9	1.4 2 2.4	0.39 0.56 0.67	114 108 99	23 30 32	2900	1.89 1.96 2.02	2.2	1.4 1.7 1.8	896	92
25GDL2-12×10	1.4 2 2.4	0.39 0.56 0.67	126 120 110	23 30 32	2900	2.01 2.17 2.24	3	1.4 1.7 1.8	981	105
25GDL2-12×11	1.4 2 2.4	0.39 0.56 0.67	139 132 121	23 30 32	2900	2.31 2.39 2.47	3	1.4 1.7 1.8	1021	109
25GDL2-12×12	1.4 2 2.4	0.39 0.56 0.67	152 144 132	23 30 32	2900	2.52 2.61 2.70	3	1.4 1.7 1.8	1061	113
25GDL2-12×13	1.4 2 2.4	0.39 0.56 0.67	164 156 144	23 30 32	2900	2.72 2.83 2.94	4	1.4 1.7 1.8	1221	127
25GDL2-12×14	1.4 2 2.4	0.39 0.56 0.67	176 168 156	23 30 32	2900	2.92 3.05 3.17	4	1.4 1.7 1.8	1261	130
25GDL2-12×15	1.4 2 2.4	0.39 0.56 0.67	188 180 168	23 30 32	2900	3.12 3.27 3.43	4	1.4 1.7 1.8	1301	135

GDL型泵性能参数

型号	流量 (m³/h)	流量 (L/s)	扬程 (m)	效率 (%)	转速 (r/min)	功率 轴功率(kw)	功率 电机功率(kw)	必需汽蚀余量 (NPSH)r(m)	高度 (mm)	重量 (kg)
25GDL4-11×3	2.8 4 4.8	0.78 1.11 1.33	36 33 28.5	32 40 41	2900	0.86 0.90 0.91	1.1	1.4 1.7 1.8	606	60
25GDL4-11×4	2.8 4 4.8	0.78 1.11 1.33	48 44 38	32 40 41	2900	1.14 1.20 1.21	1.5	1.4 1.7 1.8	671	70
25GDL4-11×5	2.8 4 4.8	0.78 1.11 1.33	60 55 47.5	32 40 41	2900	1.43 1.50 1.51	2.2	1.4 1.7 1.8	736	76
25GDL4-11×6	2.8 4 4.8	0.78 1.11 1.33	72 66 57	32 40 41	2900	1.72 1.80 1.82	2.2	1.4 1.7 1.8	776	79
25GDL4-11×7	2.8 4 4.8	0.78 1.11 1.33	84 77 66.5	32 40 41	2900	2.00 2.10 2.12	3	1.4 1.7 1.8	861	91
25GDL4-11×8	2.8 4 4.8	0.78 1.11 1.33	96 88 76	32 40 41	2900	2.29 2.40 2.42	3	1.4 1.7 1.8	901	95
25GDL4-11×9	2.8 4 4.8	0.78 1.11 1.33	108 99 85.5	32 40 41	2900	2.57 2.70 2.73	3	1.4 1.7 1.8	941	100
25GDL4-11×10	2.8 4 4.8	0.78 1.11 1.33	120 110 95	32 40 41	2900	2.86 3.00 3.03	4	1.4 1.7 1.8	1011	115
25GDL4-11×11	2.8 4 4.8	0.78 1.11 1.33	132 121 104.5	32 40 41	2900	3.14 3.30 3.33	4	1.4 1.7 1.8	1051	119
25GDL4-11×12	2.8 4 4.8	0.78 1.11 1.33	144 132 114	32 40 41	2900	3.43 3.60 3.64	4	1.4 1.7 1.8	1091	123
25GDL4-11×13	2.8 4 4.8	0.78 1.11 1.33	156 143 123.5	32 40 41	2900	3.72 3.90 3.94	4	1.4 1.7 1.8	1131	127
25GDL4-11×14	2.8 4 4.8	0.78 1.11 1.33	167 154 135	32 40 41	2900	3.98 4.19 4.30	5.5	1.4 1.7 1.8	1246	147
25GDL4-11×15	2.8 4 4.8	0.78 1.11 1.33	178 165 146	32 40 41	2900	4.24 4.49 4.65	5.5	1.4 1.7 1.8	1286	152
40GDL6-12×3	4.2 6 7.2	1.17 1.67 2.0	41 36 30.5	43 52 52	2900	1.09 1.13 1.15	1.5	1.4 1.7 1.8	657	71
40GDL6-12×4	4.2 6 7.2	1.17 1.67 2.0	54 48 40.6	43 52 52	2900	1.45 1.5 1.53	2.2	1.4 1.7 1.8	722	80
40GDL6-12×5	4.2 6 7.2	1.17 1.67 2.0	68 60 51	43 52 52	2900	1.81 1.88 1.92	2.2	1.4 1.7 1.8	762	85
40GDL6-12×6	4.2 6 7.2	1.17 1.67 2.0	82 72 61	43 52 52	2900	2.18 2.26 2.30	3	1.4 1.7 1.8	847	101
40GDL6-12×7	4.2 6 7.2	1.17 1.67 2.0	95 84 71	43 52 52	2900	2.54 2.64 2.69	3	1.4 1.7 1.8	887	107
40GDL6-12×8	4.2 6 7.2	1.17 1.67 2.0	109 96 81	43 52 52	2900	2.91 3.01 3.07	4	1.4 1.7 1.8	967	123
40GDL6-12×9	4.2 6 7.2	1.17 1.67 2.0	123 108 91	43 52 52	2900	2.27 3.39 3.45	4	1.4 1.7 1.8	1007	129
40GDL6-12×10	4.2 6 7.2	1.17 1.67 2.0	136 120 102	43 52 52	2900	3.63 3.77 3.84	4	1.4 1.7 1.8	1047	133
40GDL6-12×11	4.2 6 7.2	1.17 1.67 2.0	150 132 112	43 52 52	2900	4.0 4.15 4.22	5.5	1.4 1.7 1.8	1132	156
40GDL6-12×12	4.2 6 7.2	1.17 1.67 2.0	164 144 122	43 52 52	2900	4.36 4.52 4.60	5.5	1.4 1.7 1.8	1172	161
40GDL6-12×13	4.2 6 7.2	1.17 1.67 2.0	176 156 134	43 52 52	2900	4.68 4.90 5.05	7.5	1.4 1.7 1.8	1252	174
40GDL6-12×14	4.2 6 7.2	1.17 1.67 2.0	188 168 146	43 52 52	2900	5.00 5.28 5.51	7.5	1.4 1.7 1.8	1292	180
40GDL6-12×15	4.2 6 7.2	1.17 1.67 2.0	200 180 158	43 52 52	2900	5.32 5.66 5.96	7.5	1.4 1.7 1.8	1332	185
50GDL12-15×2	8.4 12 14.4	2.33 3.33 4.0	36 30 24	48 56 53	2900	1.72 1.75 1.85	2.2	1.4 1.8 1.8	766	75
50GDL12-15×3	8.4 12 14.4	2.33 3.33 4.0	54 45 36	48 56 53	2900	2.57 2.63 2.78	3	1.4 1.8 1.8	866	89
50GDL12-15×4	8.4 12 14.4	2.33 3.33 4.0	72 60 48	48 56 53	2900	3.43 3.5 3.70	4	1.4 1.8 1.8	1001	103

GDL型泵性能参数

型号	流量		扬程	效率	转速	功率		必需汽蚀余量	高度	重量
	(m^3/h)	(L/s)	(m)	(%)	(r/min)	轴功率(kw)	电机功率(kw)	(NPSH)r(m)	(mm)	(kg)
50GDL12-15×5	8.4 12 14.4	2.33 3.33 4.0	90 75 60	48 56 53	2900	4.2 4.27 4.63	5.5	1.4 1.8 1.8	1126	125
50GDL12-15×6	8.4 12 14.4	2.33 3.33 4.0	108 90 72	48 56 53	2900	5.15 5.25 5.55	5.5	1.4 1.8 1.8	1201	130
50GDL12-15×7	8.4 12 14.4	2.33 3.33 4.0	126 105 84	48 56 53	2900	6.0 6.12 6.48	7.5	1.4 1.8 1.8	1276	140
50GDL12-15×8	8.4 12 14.4	2.33 3.33 4.0	144 120 96	48 56 53	2900	6.86 7.0 7.40	7.5	1.4 1.8 1.8	1351	147
50GDL12-15×9	8.4 12 14.4	2.33 3.33 4.0	162 135 108	48 56 53	2900	7.72 7.87 8.33	11	1.4 1.8 1.8	1556	203
50GDL12-15×10	8.4 12 14.4	2.33 3.33 4.0	180 150 120	48 56 53	2900	8.58 8.75 9.25	11	1.4 1.8 1.8	1631	208
50GDL12-15×11	8.4 12 14.4	2.33 3.33 4.0	195 165 135	48 56 53	2900	9.29 9.63 9.99	15	1.4 1.8 1.8	1706	222
50GDL12-15×12	8.4 12 14.4	2.33 3.33 4.0	210 180 150	48 56 53	2900	10.00 10.50 11.10	15	1.4 1.8 1.8	1781	230
50GDL18-15×2	12.6 18 21.6	3.5 5 6	36 30 25	53 62 62	2900	2.33 2.37 2.37	3	1.4 1.8 1.8	791	83
50GDL18-15×3	12.6 18 21.6	3.5 5 6	54 45 37.5	53 62 62	2900	3.5 3.56 3.56	4	1.4 1.8 1.8	926	99
50GDL18-15×4	12.6 18 21.6	3.5 5 6	72 60 50	53 62 62	2900	4.66 4.75 4.75	5.5	1.4 1.8 1.8	1051	120
50GDL18-15×5	12.6 18 21.6	3.5 5 6	90 75 62.5	53 62 62	2900	5.83 5.93 5.93	7.5	1.4 1.8 1.8	1126	130
50GDL18-15×6	12.6 18 21.6	3.5 5 6	108 90 75	53 62 62	2900	7.0 7.12 7.12	7.5	1.4 1.8 1.8	1201	135
50GDL18-15×7	12.6 18 21.6	3.5 5 6	125 105 82.5	53 62 62	2900	8.16 8.30 8.31	11	1.4 1.8 1.8	1406	185
50GDL18-15×8	12.6 18 21.6	3.5 5 6	144 120 100	53 62 62	2900	9.32 9.49 9.49	11	1.4 1.8 1.8	1481	192
50GDL18-15×9	12.6 18 21.6	3.5 5 6	162 135 112.5	53 62 62	2900	10.49 10.68 10.68	15	1.4 1.8 1.8	1556	208
50GDL18-15×10	12.6 18 21.6	3.5 5 6	180 150 125	53 62 62	2900	11.66 11.87 11.87	15	1.4 1.8 1.8	1631	213
50GDL18-15×11	12.6 18 21.6	3.5 5 6	195 165 140	53 62 62	2900	12.60 13.00 13.30	15	1.4 1.8 1.8	1751	232
50GDL18-15×12	12.6 18 21.6	3.5 5 6	210 180 155	53 62 62	2900	13.60 14.20 14.70	15	1.4 1.8 1.8	1826	240
65GDL24-12×2	16.8 24 28.8	4.67 6.67 8	27 24 22	56 65 67	2900	2.21 2.41 2.57	3	2.9 3 3.1	821	98
65GDL24-12×3	16.8 24 28.8	4.67 6.67 8	40.5 36 33	56 65 67	2900	3.31 3.62 3.87	4	2.9 3 3.1	936	113
65GDL24-12×4	16.8 24 28.8	4.67 6.67 8	54 48 44	56 65 67	2900	4.41 4.83 5.15	5.5	2.9 3 3.1	1061	134
65GDL24-12×5	16.8 24 28.8	4.67 6.67 8	67.5 60 55	56 65 67	2900	5.52 6.03 6.44	7.5	2.9 3 3.1	1136	143
65GDL24-12×6	16.8 24 28.8	4.67 6.67 8	81 72 66	56 65 67	2900	6.62 7.24 7.73	7.5	2.9 3 3.1	1211	148
65GDL24-12×7	16.8 24 28.8	4.67 6.67 8	94.5 84 77	56 65 67	2900	7.72 8.45 9.01	11	2.9 3 3.1	1416	198

GDL型泵性能参数

型号	流量 (m³/h)	流量 (L/s)	扬程 (m)	效率 (%)	转速 (r/min)	功率 轴功率(kw)	功率 电机功率(kw)	必需汽蚀余量 (NPSH)r(m)	高度 (mm)	重量 (kg)
65GDL24-12×8	16.8 24 28.8	4.67 6.67 8	108 96 88	56 65 67	2900	8.83 9.65 10.3	11	2.9 3 3.1	1491	202
65GDL24-12×9	16.8 24 28.8	4.67 6.67 8	121.5 108 99	56 65 67	2900	9.93 10.85 11.59	15	2.9 3 3.1	1556	213
65GDL24-12×10	16.8 24 28.8	4.67 6.67 8	135 120 110	56 65 67	2900	11.0 12.06 12.88	15	2.9 3 3.1	1641	221
65GDL24-12×11	16.8 24 28.8	4.67 6.67 8	147 132 122	56 65 67	2900	12.00 13.30 14.30	15	2.9 3 3.1	1731	239
65GDL24-12×12	16.8 24 28.8	4.67 6.67 8	159 144 134	56 65 67	2900	13.00 14.50 15.70	15	2.9 3 3.1	1816	249
80GDL36-12×2	25.2 36 43.2	7 10 12	27 24 21	59 68 67	2900	3.14 3.46 3.68	4	3.5 4 4.2	917	163
80GDL36-12×3	25.2 36 43.2	7 10 12	40.5 36 31.5	59 68 67	2900	4.71 5.19 5.53	5.5	3.5 4 4.2	1052	195
80GDL36-12×4	25.2 36 43.2	7 10 12	54 48 42	59 68 67	2900	6.29 6.92 7.37	7.5	3.5 4 4.2	1137	210
80GDL36-12×5	25.2 36 43.2	7 10 12	67.5 60 52.5	59 68 67	2900	7.86 8.67 9.22	11	3.5 4 4.2	1352	245
80GDL36-12×6	25.2 36 43.2	7 10 12	81 72 63	59 68 67	2900	9.43 10.39 11.06	11	3.5 4 4.2	1437	220
80GDL36-12×7	25.2 36 43.2	7 10 12	94.5 84 73.5	59 68 67	2900	11.0 12.12 12.9	15	3.5 4 4.2	1522	265
80GDL36-12×8	25.2 36 43.2	7 10 12	108 96 84	59 68 67	2900	12.58 13.85 14.75	15	3.5 4 4.2	1607	275
80GDL36-12×9	25.2 36 43.2	7 10 12	121.5 108 94.5	59 68 67	2900	14.14 15.59 16.5	18.5	3.5 4 4.2	1737	295
80GDL36-12×10	25.2 36 43.2	7 10 12	135 120 115	59 68 67	2900	15.71 17.31 18.4	18.5	3.5 4 4.2	1822	310
80GDL36-12×11	25.2 36 43.2	7 10 12	145 132 126	59 68 67	2900	16.81 18.32 19.60	22	3.5 4 4.2	1911	355
80GDL36-12×12	25.2 36 43.2	7 10 12	160 144 134	59 68 67	2900	17.56 19.25 20.63	22	3.5 4 4.2	2026	365
80GDL54-14×2	37.8 54 64.8	10.5 15 18	32 28 25	62 70 73.5	2900	5.32 5.88 6.01	7.5	3.7 4 4.2	967	185
80GDL54-14×3	37.8 54 64.8	10.5 15 18	48 42 37.5	62 70 73.5	2900	7.97 8.82 9.01	11	3.7 4 4.2	1182	245
80GDL54-14×4	37.8 54 64.8	10.5 15 18	64 56 50	62 70 73.5	2900	10.13 11.76 12.01	15	3.7 4 4.2	1267	260
80GDL54-14×5	37.8 54 64.8	10.5 15 18	80 70 62.5	62 70 73.5	2900	13.3 14.7 15.0	18.5	3.7 4 4.2	1397	260
80GDL54-14×6	37.8 54 64.8	10.5 15 18	96 84 75	62 70 73.5	2900	15.9 17.64 18.0	18.5	3.7 4 4.2	1482	235
80GDL54-14×7	37.8 54 64.8	10.5 15 18	112 98 87.5	62 70 73.5	2900	18.6 20.58 21.0	22	3.7 4 4.2	1592	315
80GDL54-14×8	37.8 54 64.8	10.5 15 18	128 112 100	62 70 73.5	2900	21.3 23.54 24.0	30	3.7 4 4.2	1607	390
80GDL54-14×9	37.8 54 64.8	10.5 15 18	144 126 112.5	62 70 73.5	2900	23.9 26.49 27.0	30	3.7 4 4.2	1757	400
80GDL54-14×10	37.8 54 64.8	10.5 15 18	160 140 125	62 70 73.5	2900	26.6 29.43 30.0	37	3.7 4 4.2	1882	425
80GDL50-20×2	40 50 68.4	11.1 13.9 19	43.6 40 31.7	70 75 70	2900	6.78 7.26 8.44	11	3.1 3.8 5.3	1117	230

GDL型泵性能参数

型号	流量 (m³/h)	流量 (L/s)	扬程 (m)	效率 (%)	转速 (r/min)	功率 轴功率(kw)	功率 电机功率(kw)	必需汽蚀余量 (NPSH)r(m)	高度 (mm)	重量 (kg)
80GDL50-20×3	40 50 68.4	11.1 13.9 19	65.4 60 47.5	70 75 70	2900	10.18 10.89 12.65	15	3.1 3.8 5.3	1147	250
80GDL50-20×4	40 50 68.4	11.1 13.9 19	87.2 80 63.4	70 75 70	2900	13.57 14.52 16.87	18.5	3.1 3.8 5.3	1307	270
80GDL50-20×5	40 50 68.4	11.1 13.9 19	109 100 79.3	70 75 70	2900	16.96 18.16 21.09	22	3.1 3.8 5.3	1422	300
80GDL50-20×6	40 50 68.4	11.1 13.9 19	130 120 95	70 75 70	2900	20.35 21.78 25.31	30	3.1 3.8 5.3	1617	340
80GDL50-20×7	40 50 68.4	11.1 13.9 19	152 140 112	70 75 70	2900	23.75 25.42 29.80	30	3.1 3.8 5.3	1702	380
80GDL50-20×8	40 50 68.4	11.1 13.9 19	174 160 129	70 75 70	2900	27.14 29.05 34.27	37	3.1 3.8 5.3	1787	400
100GDL72-14×2	50.4 72 86.4	14 20 24	32 28 24	64 73 73	2900	6.87 7.53 7.74	11	4.2 4.5 4.7	1200	240
100GDL72-14×3	50.4 72 86.4	14 20 24	48 42 36	64 73 73	2900	10.3 11.29 11.61	15	4.2 4.5 4.7	1335	265
100GDL72-14×4	50.4 72 86.4	14 20 24	64 56 48	64 73 73	2900	13.7 15.05 15.48	18.5	4.2 4.5 4.7	1460	285
100GDL72-14×5	50.4 72 86.4	14 20 24	80 70 60	64 73 73	2900	17.17 18.81 19.35	22	4.2 4.5 4.7	1650	315
100GDL72-14×6	50.4 72 86.4	14 20 24	96 84 72	64 73 73	2900	20.6 22.57 23.22	30	4.2 4.5 4.7	1740	350
100GDL72-14×7	50.4 72 86.4	14 20 24	112 98 84	64 73 73	2900	24.03 26.34 27.09	30	4.2 4.5 4.7	1825	400
100GDL72-14×8	50.4 72 86.4	14 20 24	128 112 96	64 73 73	2900	27.4 30.1 30.96	37	4.2 4.5 4.7	1900	420
100GDL72-14×9	50.4 72 86.4	14 20 24	144 126 108	64 73 73	2900	30.9 33.9 34.83	37	4.2 4.5 4.7	1980	430
100GDL72-14×10	50.4 72 86.4	14 20 24	160 140 120	64 73 73	2900	34.3 37.6 38.7	45	4.2 4.5 4.7	2070	510
100GDL72-20×2	54 72 90	15 20 25	49.4 40 31.6	71 73 68	2900	10.3 10.9 11.4	15	3.1 3.5 3.8	1127	245
100GDL72-20×3	54 72 90	15 20 25	74 60 47	71 73 68	2900	15.40 16.37 17.08	18.5	3.1 3.5 3.8	1232	275
100GDL72-20×4	54 72 90	15 20 25	99 80 63	71 73 68	2900	20.60 21.80 22.80	30	3.1 3.5 3.8	1467	390
100GDL72-20×5	54 72 90	15 20 25	124 100 79	71 73 68	2900	25.70 27.30 28.50	30	3.1 3.5 3.8	1552	380
100GDL72-20×6	54 72 90	15 20 25	148 120 95	71 73 68	2900	30.80 32.70 34.20	37	3.1 3.5 3.8	1637	360
100GDL72-20×7	54 72 90	15 20 25	173 140 110	71 73 68	2900	36.00 39.00 40.70	45	3.1 3.5 3.8	1762	480
100GDL72-20×8	54 72 90	15 20 25	198 160 126	71 73 68	2900	41.20 43.71 45.60	55	3.1 3.5 3.8	1957	570
100GDL72-20×9	54 72 90	15 20 25	220 180 150	71 73 68	2900	52.92 61.25 64.08	75	3.1 3.5 3.8	2012	750

GDL型泵性能参数

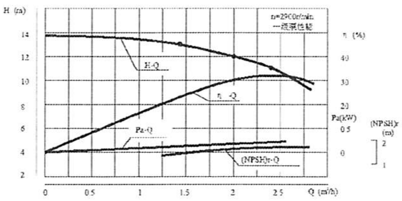
型号	流量		扬程	效率	转速	功率		必需汽蚀余量	高度	重量
	(m^3/h)	(L/s)	(m)	(%)	(r/min)	轴功率(kw)	电机功率(kw)	(NPSH)r(m)	(mm)	(kg)
100GDL100-20×2	70 100 120	19.4 27.7 33.3	46 40 34	65 74 73	2900	13.5 14.7 15.2	18.5	4.2 4.5 4.7	1345	248
100GDL100-20×3	70 100 120	19.4 27.7 33.3	69 60 51	65 74 73	2900	20.2 22.1 22.8	30	4.2 4.5 4.7	1598	360
100GDL100-20×4	70 100 120	19.4 27.7 33.3	92 80 68	65 74 73	2900	27.0 29.5 30.4	37	4.2 4.5 4.7	1715	390
100GDL100-20×5	70 100 120	19.4 27.7 33.3	115 100 85	65 74 73	2900	33.7 36.8 38.1	45	4.2 4.5 4.7	1959	470
100GDL100-20×6	70 100 120	19.4 27.7 33.3	138 120 102	65 74 73	2900	40.5 44.2 45.7	55	4.2 4.5 4.7	2106	540
100GDL100-20×7	70 100 120	19.4 27.7 33.3	161 140 119	65 74 73	2900	47.2 51.5 53.3	75	4.2 4.5 4.7	2291	680
100GDL100-20×8	70 100 120	19.4 27.7 33.3	181 160 136	65 74 73	2900	54.0 58.9 60.9	75	4.2 4.5 4.7	2408	730
100GDL100-20×9	70 100 120	19.4 27.7 33.3	207 180 153	65 74 73	2900	60.7 66.3 68.5	75	4.2 4.5 4.7	2575	740
100GDL100-20×10	70 100 120	19.4 27.7 33.3	230 200 170	65 74 73	2900	67.5 73.6 76.1	90	4.2 4.5 4.7	2692	790
125GDL100-20×2	70 100 120	19.4 27.7 33.3	46 40 34	65 74 73	2900	13.5 14.7 15.2	18.5	4.2 4.5 4.7	1185	265
125GDL100-20×3	70 100 120	19.4 27.7 33.3	69 60 51	65 74 73	2900	20.2 22.1 22.8	30	4.2 4.5 4.7	1315	390
125GDL100-20×4	70 100 120	19.4 27.7 33.3	92 80 68	65 74 73	2900	27.0 29.5 30.4	37	4.2 4.5 4.7	1410	410
125GDL100-20×5	70 100 120	19.4 27.7 33.3	115 100 85	65 74 73	2900	33.7 36.8 38.1	45	4.2 4.5 4.7	1585	470
125GDL100-20×6	70 100 120	19.4 27.7 33.3	138 120 102	65 74 73	2900	40.5 44.2 45.7	55	4.2 4.5 4.7	1865	520
125GDL100-20×7	70 100 120	19.4 27.7 33.3	161 140 119	65 74 73	2900	47.2 51.5 53.3	75	4.2 4.5 4.7	1960	740
125GDL100-20×8	70 100 120	19.4 27.7 33.3	181 160 136	65 74 73	2900	54.0 58.9 60.9	75	4.2 4.5 4.7	2055	750
125GDL100-20×9	70 100 120	19.4 27.7 33.3	207 180 153	65 74 73	2900	60.7 66.3 68.5	75	4.2 4.5 4.7	2225	760
125GDL100-20×10	70 100 120	19.4 27.7 33.3	230 200 170	65 74 73	2900	67.5 73.6 76.1	90	4.2 4.5 4.7	2370	810

GDL型泵性能参数

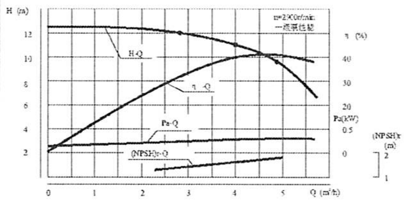
型 号	流量		扬程	效率	转速	功率		必需汽蚀余量	高度	重量
	(m^3/h)	(L/s)	(m)	(%)	(r/min)	轴功率(kw)	电机功率(kw)	(NPSH)r(m)	(mm)	(kg)
150GDL160-20×2	112 160 192	31.1 44.4 53.3	46 40 34	69 78 77	2900	20.3 22.3 23.1	30	4.4 4.5 4.7	1325	384
150GDL160-20×3	112 160 192	31.1 44.4 53.3	69 60 51	69 78 77	2900	30.5 33.5 34.6	37	4.4 4.5 4.7	1420	416
150GDL160-20×4	112 160 192	31.1 44.4 53.3	92 80 68	69 78 77	2900	40.6 44.7 46.2	55	4.4 4.5 4.7	1705	577
150GDL160-20×5	112 160 192	31.1 44.4 53.3	115 100 85	69 78 77	2900	50.9 55.9 57.8	75	4.4 4.5 4.7	1875	736
150GDL160-20×6	112 160 192	31.1 44.4 53.3	138 120 102	69 78 77	2900	61.0 67.1 69.3	75	4.4 4.5 4.7	1970	703
150GDL160-20×7	112 160 192	31.1 44.4 53.3	161 140 119	69 78 77	2900	71.2 78.3 80.9	90	4.4 4.5 4.7	2115	798
150GDL160-20×8	112 160 192	31.1 44.4 53.3	184 160 136	69 78 77	2900	75.1 80.4 84.6	90	4.4 4.5 4.7	2400	809
150GDL160-20×9	112 160 192	31.1 44.4 53.3	207 180 153	69 78 77	2900	91.6 100.6 104.0	110	4.4 4.5 4.7	2495	1180
150GDL160-20×10	112 160 192	31.1 44.4 53.3	230 200 170	69 78 77	2900	101.7 111.8 115.5	132	4.4 4.5 4.7	2670	1311
150GDL160-25×2	112 160 192	31.1 44.4 53.3	56 50 44	68 77 76	2900	25.10 28.30 30.30	37	5	1330	394
150GDL160-25×3	112 160 192	31.1 44.4 53.3	84 75 66	68 77 76	2900	37.70 42.40 45.40	55	5	1580	566
150GDL160-25×4	112 160 192	31.1 44.4 53.3	112 100 88	68 77 76	2900	50.20 56.60 60.50	75	5	1745	747
150GDL160-25×5	112 160 192	31.1 44.4 53.3	140 125 110	68 77 76	2900	62.80 70.70 75.70	90	5	1890	776
150GDL160-25×6	112 160 192	31.1 44.4 53.3	168 150 132	68 77 76	2900	75.40 84.90 89.20	90	5	1985	743
150GDL160-25×7	112 160 192	31.1 44.4 53.3	196 175 154	68 77 76	2900	87.90 99.00 106.00	110	5	2240	1158
150GDL160-25×8	112 160 192	31.1 44.4 53.3	224 200 176	68 77 76	2900	100.50 113.20 121.10	132	5	2455	1289

GDL型泵单级曲线图

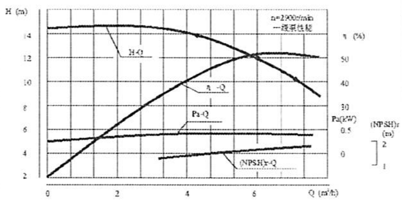
25GDL2-12×1



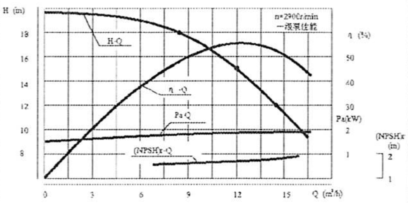
25GDL4-11×1



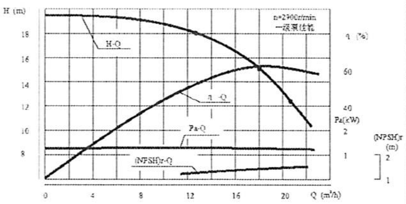
40GDL6-12×1



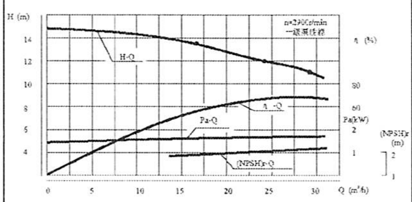
50GDL12-15×1



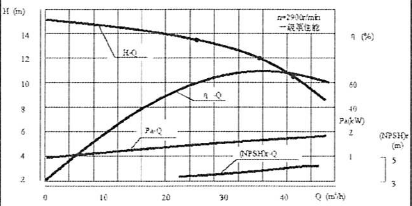
50GDL18-15×1



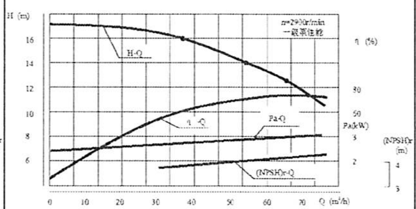
65GDL24-12×1



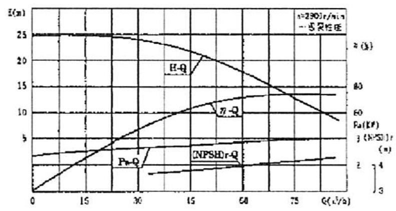
80GDL36-12×1



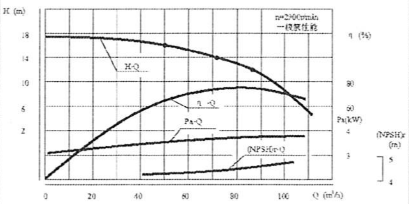
80GDL54-14×1



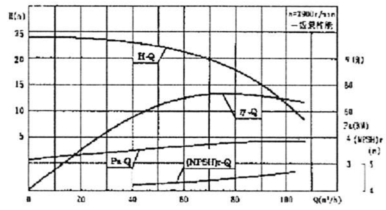
80GDL50-20×1



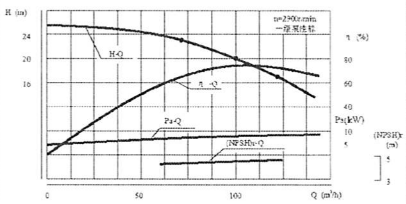
100GDL72-14×1



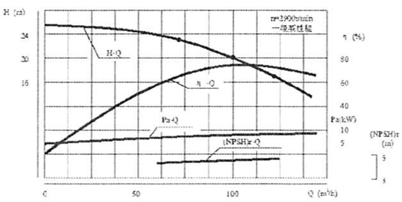
100GDL72-20×1



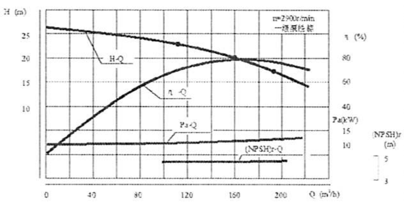
100GDL100-20×1



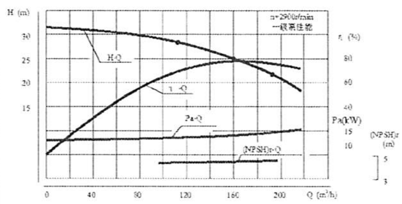
125GDL100-20×1



150GDL160-20×1

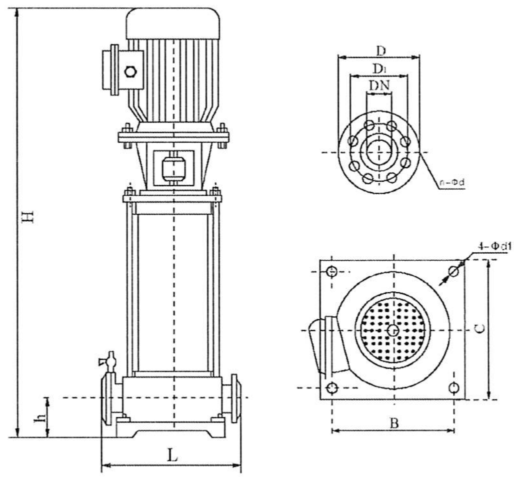


150GDL160-25×1



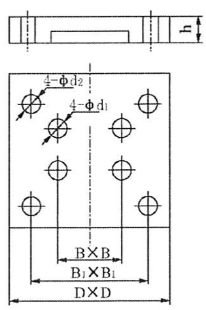
GDL型泵外形及安装图

型 号	h	L	B	C	4-φd1	进出口法兰			
						DN	D	D1	n-φd
25GDL	70	325	205	240	4-φ18	φ25	115	85	4~φ14
40GDL	90	340	215	255	4-φ18	φ40	150	110	4~φ18
50GDL	100	370	235	275	4-φ18	φ50	165	125	4~φ18
65GDL	115	380	235	275	4-φ18	φ65	185	145	4~φ18
80GDL	135	445	300	340	4-φ18	φ80	200	160	8~φ18
100GDL	145	455	300	340	4-φ18	φ100	220	180	8~φ18
125GDL	165	515	360	410	4-φ22	φ125	250	210	8~φ18
150GDL	185	515	360	410	4-φ22	φ150	285	240	8~φ22

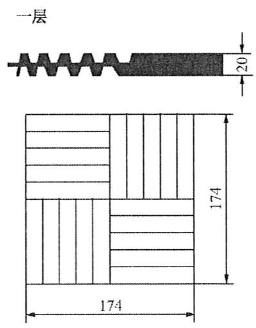


泵附件及其尺寸

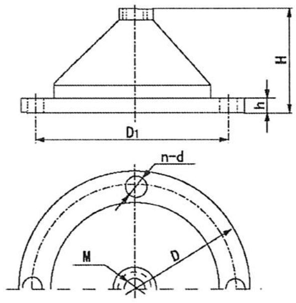
联接板



隔振垫



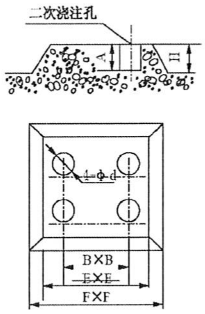
隔振器



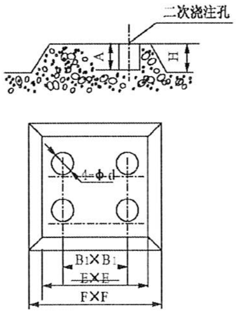
泵口径	联接板尺寸							隔振器尺寸						
	型号	D	h	B	B1	d1	d2	型号	M	D	D1	H	h	n-d
25	1#	500	55	205	440	18	22	JG2-2	M16	φ150	φ130	65	9	4-φ8.5
40	2#	500	55	215	440	18	22	JG2-2	M16	φ150	φ130	65	9	4-φ8.5
50	3#	600	55	235	540	18	22	JG2-2	M16	φ150	φ130	65	9	4-φ8.5
65	4#	600	55	235	540	18	22	JG2-2	M16	φ150	φ130	65	9	4-φ8.5
80	5#	700	55	300	640	18	22	JG3-2	M16	φ200	φ170	87	9	4-φ12.5
100	6#	700	55	300	640	18	22	JG3-2	M16	φ200	φ170	87	9	4-φ12.5
125	7#	800	55	360	740	22	22	JG4-2	M20	φ290	φ260	133	9	4-φ12.5
150	8#	800	55	360	740	22	22	JG4-2	M20	φ290	φ260	133	9	4-φ12.5

泵基础图及其联接尺寸

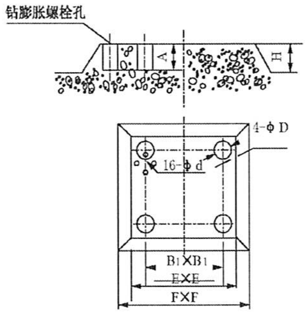
直接联接



配联接板、隔振垫



配联接板、隔振器



泵口径	直接安装基础尺寸						配联接板、隔振垫基础尺寸						配联接板、隔振器基础尺寸						
	H	A	B	E	F	d	H	A	B₁	E	F	d	H	A	B₁	E	F	D	d
25	200	150	205	500	550	80	200	150	440	750	800	60	200	60	440	750	800	130	8.5
40	200	150	215	500	550	80	200	150	440	750	800	60	200	60	440	750	800	130	8.5
50	250	200	235	550	600	80	250	200	540	850	900	60	250	60	540	850	900	130	8.5
65	250	200	235	550	600	80	250	200	540	850	900	60	250	60	540	850	900	130	8.5
80	300	250	300	600	650	100	300	250	640	950	1050	80	300	60	640	950	1050	170	12.5
100	300	250	300	600	650	100	300	250	640	950	1050	80	300	60	640	950	1050	170	12.5
125	300	250	360	650	700	100	300	250	740	1050	1150	80	300	80	740	1050	1150	260	12.5
150	300	250	360	650	700	100	300	250	740	1050	1150	80	300	80	740	1050	1150	260	12.5

安装说明

1、安装时管路重量不应承受在泵上，否则易损坏水泵；
2、泵与电机是整体结构，出厂时已由厂家校正，所以安装时无需调整，因此安装时十分方便；
3、安装时必须拧紧地脚螺栓，且每间隔一定时段应对泵进行检查防止其松动，以免水泵起动时发生剧烈振动而影响泵的性能；
4、安装水泵前应仔细检查泵流道内有无影响水泵运行的硬质物(如石块、铁砂等)，以免水泵运行时损坏过流部件；
5、为了维修方便和使用安全，在泵的进出口管路上安装一只调节阀及在泵进出口附近安装一只压力表，对于高扬程泵，为防止水锤，还应在出口闸阀前安装一只止回阀，以应付突然断电等失去动力事故，从而确保水泵在最佳工况下运行，增长水泵的使用寿命；
6、泵用于有吸程场合，应装有底阀，并且进口管路不应有过多弯道，同时不得有漏水、漏气现象，以免影响水泵的吸入性能；
7、为不使杂质进入泵内而堵塞流道影响性能，应在泵进口前面安装过滤器；
8、安装管路前转动水泵的转子部件，应无磨擦声或卡死现象，否则应将泵拆开检查原因。

起动与停车

起动前准备

1、用手拨转联轴器，叶轮应无卡磨现象，转动灵活；2、打开进口阀门，打开排气阀使液体充满整个泵腔，然后关闭排气嘴；3、如输送热液体时，起动前应预热，升温速度为50℃/h，泵的预热是用所输送液体不断循环来达到，以使各部位受热均匀；4、应先用手盘动泵几圈以使润滑水进入机械密封端面；5、点动电机，确定转向是否正确。

起动与运行

1、全开进口阀门，关闭吐出管路阀门；2、接通电源，当泵达到正常转速后再逐渐打开吐出管路上的阀门，并调节到所需工况；3、注意观察仪表读数，确保水泵在额定电流范围内运行并检查电机轴承处温度≤75℃，如果发现异常情况应及时处理。

停车

1、逐渐关闭吐出管路阀门，切断电源；2、关闭进口阀门；3、如环境温度低于0℃，应将泵内液体放尽，以免冻裂水泵；

泵的维护与保养

运行中的维护与保养

1、进水管路必须高度密封，不能漏水、漏气；
2、禁止泵在汽蚀状态下长期运行；
3、禁止泵在大流量工况运行时，电机超电流长期运行；
4、定时检查泵运行中的电机电流值，尽量使泵在设计工况范围内运行；
5、泵在运行中应有专人看管，以免发生意外；
6、泵每运行500小时应对轴承进行加油；
7、泵进行长期运行后，由于机械磨损，使机组噪声及振动增大时，应停车检查，必要时可更换易损零件及轴承，机组大修期一般为一年。

机械密封的维护与保养

1、机械密封润滑液应清洁无固体颗粒；2、严禁机械密封在干磨情况下工作；3、起动前应盘动泵(电机)几圈，以免突然起动造成机械密封断裂损坏。

易损件

滚动轴承

电机功率(kw)	轴承型号	电机功率(kw)	轴承型号
0.75	6204	18.5	6309
1.1	6204	22	6311
1.5	6205	30	6312
2.2	6205	37	6312
3	6206	45	6313
4	6206	55	6314
5.5	6308	75	6314
7.5	6308	90	6314
11	6309	110	6317
15	6309	132	6137

机械密封

泵型号	机械密封型号
25GDL	109-25
40GDL	109-25
50GDL	109-30
65GDL	109-30
80GDL	109-35
100GDL	109-35
125GDL	109-40
150GDL	109-40

故障原因及排除方法

故障现象	可能产生的原因	排除方法
1、水泵不出水	a、进出口阀门未打开，进出管路阻塞，叶轮流道阻塞 b、电机运行方向不对，电机缺相转速很慢 c、吸入管漏气 d、泵没灌满液体，泵腔内有空气 e、进口供水不足，吸程过高，底阀漏水 f、管路阻力过大，泵选型不当	a、检查，去除阻塞物 b、调整电机转向，紧固电机接线 c、拧紧各密封面，排除空气 d、打开泵上盖或打开排气阀，排尽空气 e、停机检查、调整(并网自来水管和带吸程使用易出现此现象) f、减少管路弯道，重新选泵
2、水泵流量不足	a、先按1、原因检查 b、管道、泵流道或叶轮部分阻塞,水垢沉积,阀门开度不足 c、电压偏低 d、叶轮磨损	a、先按1、排除 b、去除阻塞物，重新调整阀门开度 c、稳压 d、更换叶轮
3、功率过大	a、超过额定流量使用 b、吸程过高 c、泵轴承磨损	a、调节流量，关小出口阀门 b、降低 c、更换轴承
4、杂音振动	a、管路支撑不稳 b、液体混有气体 c、产生汽蚀 d、轴承损坏 e、电机超载运行	a、稳固管路 b、提高吸入压力，排气 c、降低真空度 d、更换轴承 e、调整按5.
5、电机发热	a、流量过大，超载运行 b、局部摩擦 c、电机轴承损坏 d、电压不足	a、关小出口阀门 b、检查排除 c、更换轴承 d、稳压
6、水泵漏水	a、机械密封磨损 b、泵体有砂孔或破裂 c、密封面不平整 d、安装螺栓松懈	a、更换 b、焊补或更换 c、修整 d、紧固

服务热线(Hotline)：

4000 778 809

上海超盾机械制造集团有限公司
Shanghai Chaodun Machinery Manufacturing Group Co.,Ltd

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传真：021－51686772
Http://www.cdungroup.com
E–mail:sales@cdunchina.com

手机网站

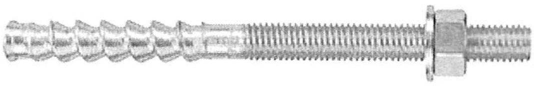
Hilti HIT-HY 200-R mortar for concrete

Ultimate performance hybrid mortar for heavy anchoring in concrete

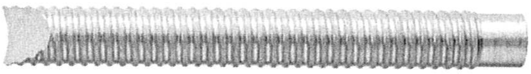
Injection mortar system

Hilti HIT- HY 200-R

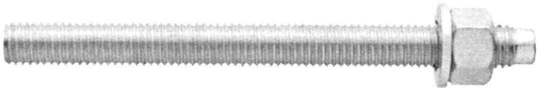
500 ml foil pack
(also available as
330 ml foil pack)



Anchor rods:
HIT-Z
HIT-Z-F
HIT-Z-R
(M8-M20)



Internally threaded
sleeves:
HIS-N
HIS-RN
(M8-M20)



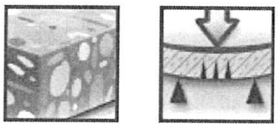
Anchor rods:
HIT-V
HIT-V-F
HIT-V-R
HIT-V-HCR

a) Please contact your Hilti representative for seismic resistance data

Benefits

- Maximum load performance in cracked concrete and non-cracked concrete
- Fire resistance performance approved and assessed as per Hong Kong's code requirements
- **SafeSet** technology: drilling and borehole cleaning in one step with Hilti hollow drill bit
- Small edge distance and anchor spacing possible
- ETA Approved for seismic performance category C1, C2 a)

Base material

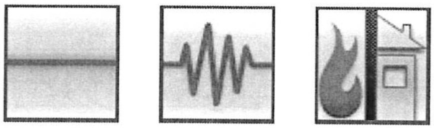


Uncracked concrete | Concrete (cracked)

Installation conditions

Hammer drilled holes | Diamond drilled holes c) | Hilti **SafeSet** technology | Variable embedment depth | Small edge distance and spacing

Load conditions



Static/ quasi-static | Seismic, ETA-C1, C2 a) | Fire resistance

Other information

European Technical Assessment | CE conformity | Corrosion resistance b) | High corrosion resistance b) | PROFIS Anchor design software

a) HIS-N internally threaded sleeves not approved for Seismic category C2.
b) High Corrosion resistant rods available only for HIT-V. Corrosion resistant rods available for HIT-V and HIS-N
c) Diamond drilling only covered for HIT-Z rods

Approvals / certificates

Description	Authority / Laboratory	No. / date of issue
European technical Assessment [a]	DIBt, Berlin	ETA-12/0084 / 2017-07-28 (HY200 R)
European technical Assessment [a]	DIBt, Berlin	ETA-12/0028 / 2017-05-30 (HY200 R)
Fire test report	IBMB, Brunswick	3501/676/13 / 2012-08-03

a) All data given in this section according to ETA-11/0493, issue 2017-07-28, ETA-12/0006, issue 2017-05-30, ETA-12/0084, issue 2017-07-28 and ETA-12/0028, issue 2017-05-30

Recommended general notes

* The below clauses based on Hilti product qualifications are for references only. Selection of clauses by the engineer shall be based on the specific application needs. Please contact Hilti's technical team for further details.

- Fast cure adhesive mortar for anchor fastenings in uncracked and cracked concrete
- HIT-Z application: Adhesive anchors system shall be bonded expansion anchor type to cracked and uncracked concrete.
- HIT-Z application: Anchor shall be approved for use in diamond cored holes.
- Anchor shall be approved for overhead installation.
- For overhead or deep embedment depth (>250mm) installation, specialized accessories shall be applied to ensure drill hole is fully grouted with no voids.
- Borehole drilled and cleaned in one step with Hilti hollow drill bit is recommended to reduce installation error.
- Anchors shall obtain the European Technical Assessment (ETA) report.
- The anchor bolt design shall be done either according to "ETAG001 Annex C Design Method" issued by EOTA or "Guides on design of post-installed anchor bolt systems in Hong Kong" issued by HKISC.
- Anchors shall be tested in accordance to either ETAG-001 Annex A or ACI 355.2 by accredited laboratories under HOKLAS Mutual Recognition Arrangement (MRA) Partners.
- Anchor to be approved by WRAS and NSF for use in contact with drinking water.

Static and quasi-static resistance (for a single anchor)

All data in this section applies to:

- Correct setting (See setting instruction)
- No edge distance and spacing influence
- *Steel* failure
- Minimum base material thickness
- One typical embedment depth, as specified in the table
- One anchor material, as specified in the tables
- Concrete C 20/25, $f_{ck,cube}$ = 25 N/mm²
- Temperature range I (min. base material temp. -40°C, max. long/short term base material temp.: +24°C/40°C)

For hammer drilled holes, hammer drilled holes with Hilti hollow drill bit:

Anchorage depth [a]

Anchor size			M8	M10	M12	M16	M20	M24	M27	M30
HIT-V										
Embedment depth	$h_{ef}=h_{nom,min}$	[mm]	80	90	110	125	170	210	240	270
Base material thickness		[mm]	110	120	140	161	134	266	300	340
HIS-N										
Embedment depth	$h_{ef}=h_{nom,min}$	[mm]	90	110	125	170	205	-	-	-
Base material thickness		[mm]	120	150	170	230	270	-	-	-
HIT-Z										
Effective anchorage depth [b]	$h_{ef}=l_{Helix}$	[mm]	50	60	60	96	100	-	-	-
Effective embedment depth [c]	$h_{ef}=h_{nom,min}$	[mm]	70	90	110	145	180	-	-	-
Base material thickness		[mm]	130	150	170	245	280	-	-	-

a) The allowed range of embedment depth is shown in the setting details
b) For combined pull-out and concrete cone failure
c) For concrete cone failure

Characteristic resistance

Anchor size			M8	M10	M12	M16	M20	M24	M27	M30
Non-cracked concrete										
Tension N_{Rk}	HIT-V 5.8	[kN]	*18,0*	*29,0*	*42,0*	70,6	111,9	153,7	187,8	224,0
	HIS-N 8.8		*25,0*	*46,0*	*67,0*	111,9	*116,0*	-	-	-
	HIT-Z a)		*24,0*	*38,0*	54,3	88,2	122,0	-	-	-
Shear V_{Rk}	HIT-V 5.8	[kN]	*9,0*	*15,0*	*21,0*	*39,0*	*61,0*	*88,0*	*115,0*	*140,0*
	HIS-N 8.8		*13,0*	*23,0*	*34,0*	*63,0*	*58,0*	-	-	-
	HIT-Z a)		*12,0*	*19,0*	*27,0*	*48,0*	*73,0*	-	-	-
Cracked concrete										
Tension N_{Rk}	HIT-V 5.8	[kN]	15,1	21,2	35,2	50,3	79,8	109,6	133,9	159,7
	HIS-N 8.8		24,7	39,9	50,3	79,8	105,7	-	-	-
	HIT-Z a)		21,1	30,7	41,5	62,9	86,9	-	-	-
Shear V_{Rk}	HIT-V 5.8	[kN]	*9,0*	*15,0*	*21,0*	*39,0*	*61,0*	*88,0*	*115,0*	*140,0*
	HIS-N 8.8		*13,0*	*23,0*	*34,0*	*63,0*	*58,0*	-	-	-
	HIT-Z a)		*12,0*	*19,0*	*27,0*	*48,0*	*73,0*	-	-	-

a) Hilti anchor rod HIT-Z-F: M16 and M20

Design resistance

Anchor size			M8	M10	M12	M16	M20	M24	M27	M30
Non-cracked concrete										
Tension N_{Rd}	HIT-V 5.8	[kN]	12,0	19,3	28,0	47,1	74,6	102,5	125,2	149,4
	HIS-N 8.8		16,7	30,7	44,7	74,6	77,3	-	-	-
	HIT-Z a)		16,0	25,3	36,2	58,8	81,3	-	-	-
Shear V_{Rd}	HIT-V 5.8	[kN]	7,2	12,0	16,8	31,2	48,8	70,4	92,0	112,0
	HIS-N 8.8		10,4	18,4	27,2	50,4	46,4	-	-	-
	HIT-Z a)		9,6	15,2	21,6	38,4	58,4	-	-	-
Cracked concrete										
Tension N_{Rd}	HIT-V 5.8	[kN]	10,1	14,1	23,5	33,5	53,2	73,0	89,2	106,5
	HIS-N 8.8		16,5	26,6	33,5	53,2	70,4	-	-	-
	HIT-Z a)		14,1	20,5	27,7	41,9	58,0	-	-	-
Shear V_{Rd}	HIT-V 5.8	[kN]	7,2	12,0	16,8	31,2	48,8	70,4	92,0	112,0
	HIS-N 8.8		10,4	18,4	27,2	50,4	46,4	-	-	-
	HIT-Z a)		9,6	15,2	21,6	38,4	58,4	-	-	-

a) Hilti anchor rod HIT-Z-F: M16 and M20

Recommended loads [b)]

Anchor size			M8	M10	M12	M16	M20	M24	M27	M30
Non-cracked concrete										
Tension N_{Rec}	HIT-V 5.8	[kN]	6,0	9,7	14,0	23,5	37,3	51,2	62,6	74,7
	HIS-N 8.8		8,3	15,3	22,3	37,3	38,7	-	-	-
	HIT-Z [a)]		8,0	12,7	18,1	29,4	40,7	-	-	-
Shear V_{Rec}	HIT-V 5.8	[kN]	3,0	5,0	7,0	13,0	20,3	29,3	38,3	46,7
	HIS-N 8.8		4,3	7,7	11,3	21,0	19,3	-	-	-
	HIT-Z [a)]		4,0	6,3	9,0	16,0	24,3	-	-	-
Cracked concrete										
Tension N_{Rec}	HIT-V 5.8	[kN]	5,0	7,1	11,7	16,8	26,6	36,5	44,6	53,2
	HIS-N 8.8		8,2	13,3	16,8	26,6	35,2	-	-	-
	HIT-Z [a)]		7,0	10,2	13,8	21,0	29,0	-	-	-
Shear V_{Rec}	HIT-V 5.8	[kN]	3,0	5,0	7,0	13,0	20,3	29,3	38,3	46,7
	HIS-N 8.8		4,3	7,7	11,3	21,0	19,3	-	-	-
	HIT-Z [a)]		4,0	6,3	9,0	16,0	24,3	-	-	-

a) Hilti anchor rod HIT-Z-F: M16 and M20
b) With overall partial safety factor for action $\gamma = 3.0$. The recommended loads vary according to the safety factor requirement from national regulations

Materials

Materials properties for HIT-V

Anchor size			M8	M10	M12	M16	M20	M24	M27	M30
Nominal tensile strength f_{uk}	HIT-V 5.8 (F)	[N/mm²]	500	500	500	500	500	500	500	500
	HIT-V 8.8 (F) AM 8.8 (HDG)		800	800	800	800	800	800	800	800
	HIT-V-R		700	700	700	700	700	700	500	500
	HIT-V-HCR		800	800	800	800	800	700	700	700
Yield strength f_{yk}	HIT-V 5.8 (F)	[N/mm²]	400	400	400	400	400	400	400	400
	HIT-V 8.8 (F) AM 8.8 (HDG)		640	640	640	640	640	640	640	640
	HIT-V-R		450	450	450	450	450	450	210	210
	HIT-V-HCR		640	640	640	640	640	400	400	400
Stressed cross-section A_s	HIT-V	[mm²]	36,6	58,0	84,3	157	245	353	459	561
Moment of resistance W	HIT-V	[mm³]	31,2	62,3	109	277	541	935	1387	1874

Anchor technology & design | Heavy / medium duty metal anchors | Plastic / light duty / other metal anchors | Chemical anchors

Mechanical properties for HIS-N

Anchor size			M8	M10	M12	M16	M20
Nominal tensile strength f_{uk}	HIS-N	[N/mm²]	490	490	460	460	460
	Screw 8.8		800	800	800	800	800
	HIS-RN		700	700	700	700	700
	Screw A4-70		700	700	700	700	700
Yield strength f_{yk}	HIS-N	[N/mm²]	410	410	375	375	375
	Screw 8.8		640	640	640	640	640
	HIS-RN		350	350	350	350	350
	Screw A4-70		450	450	450	450	450
Stressed cross-section A_s	HIS-(R)N	[mm²]	51,5	108,0	169,1	256,1	237,6
	Screw		36,6	58	84,3	157	245
Moment of resistance W	HIS-(R)N	[mm³]	145	430	840	1595	1543
	Screw		31,2	62,3	109	277	541

Mechanical properties for HIT-Z

Anchor size			M8	M10	M12	M16	M20
Nominal tensile strength f_{uk}	HIT-Z(-F) [a)]	[N/mm²]	650	650	650	610	595
	HIT-Z-R		650	650	650	610	595
Yield strength f_{yk}	HIT-Z(-F) [a)]	[N/mm²]	520	520	520	490	480
	HIT-Z-R		520	520	520	490	480
Stressed cross-section of thread A_s	HIT-Z(-F) [a)] HIT-Z-R	[mm²]	36,6	58,0	84,3	157	245
Moment of resistance W	HIT-Z(-F) [a)] HIT-Z-R	[mm³]	31,9	62,5	109,7	278	542

a) Hilti anchor rod HIT-Z-F: M16 and M20

Material quality for HIT-V

Part	Material
Zinc coated steel	
Threaded rod, HIT-V 5.8 (F)	Strength class 5.8; Elongation at fracture A5 > 8% ductile Electroplated zinc coated ≥ 5μm; (F) hot dip galvanized ≥ 45 μm
Threaded rod, HIT-V 8.8 (F)	Strength class 8.8; Elongation at fracture A5 > 12% ductile Electroplated zinc coated ≥ 5μm; (F) hot dip galvanized ≥ 45 μm
Hilti Meter rod, AM 8.8 (HDG)	Strength class 8.8; Elongation at fracture A5 > 12% ductile Electroplated zinc coated ≥ 5μm (HDG) hot dip galvanized ≥ 45 μm
Washer	Electroplated zinc coated ≥ 5 μm, hot dip galvanized ≥ 45 μm
Nut	Strength class of nut adapted to strength class of threaded rod. Electroplated zinc coated ≥ 5μm, hot dip galvanized ≥ 45 μm
Hilti Filling set (F)	Filling washer: Electroplated zinc coated ≥ 5 μm / (F) Hot dip galvanized ≥ 45 μm
	Spherical washer: Electroplated zinc coated ≥ 5 μm / (F) Hot dip galvanized ≥ 45 μm
	Lock nut: Electroplated zinc coated ≥ 5 μm / (F) Hot dip galvanized ≥ 45 μm
Stainless Steel	
Threaded rod, HIT-V-R	Strength class 70 for ≤ M24 and strength class 50 for > M24; Elongation at fracture A5 > 8% ductile Stainless steel 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362
Washer	Stainless steel 1.4401, 1.4404, 1.4578, 1.4571, 1.4439, 1.4362 EN 10088-1:2014
Nut	Stainless steel 1.4401, 1.4404, 1.4578, 1.4571, 1.4439, 1.4362 EN 10088-1:2014
High corrosion resistant steel	
Threaded rod, HIT-V-HCR	Strength class 80 for ≤ M20 and class 70 for > M20, Elongation at fracture A5 > 8% ductile High corrosion resistance steel 1.4529; 1.4565;
Washer	High corrosion resistant steel 1.4529, 1.4565 EN 10088-1:2014
Nut	High corrosion resistant steel 1.4529, 1.4565 EN 10088-1:2014

Material quality for HIS-N

Part		Material
HIS-N	Int. threaded sleeve	Electroplated zinc coated ≥ 5 μm
	Screw 8.8	Strength class 8.8, A5 > 8 % Ductile; Steel galvanized ≥ 5 μm
HIS-RN	Int. threaded sleeve	Stainless steel 1.4401,1.4571
	Screw 70	Strength class 70, A5 > 8 % Ductile; Stainless steel 1.4401; 1.4404, 1.4578; 1.4571; 1.4439; 1.4362

Material quality for HIT-Z

Part	Material
Threaded rod HIT-Z	Elongation at fracture > 8% ductile; Electroplated zinc coated ≥ 5 μm
Washer	Electroplated zinc coated ≥ 5 μm
Nut	Strength class of nut adapted to strength class of anchor rod. Electroplated zinc coated ≥ 5 μm
HIT-Z-F	Elongation at fracture > 8% ductile Multilayer coating, ZnNi-galvanized according to DIN 50979:2008-07
Washer	Multilayer coating, ZnNi-galvanized according to DIN 50979:2008-07
Nut	Multilayer coating, ZnNi-galvanized according to DIN 50979:2008-07
HIT-Z-R	Elongation at fracture > 8% ductile; Stainless steel 1.4401, 1.4404 EN 10088-1:2014
Washer	Stainless steel A4 according to EN 10088-1:2014
Nut	Strength class of nut adapted to strength class of anchor rod. Stainless steel 1.4401, 1.4404 EN 10088-1:2014

Setting information

In service temperature range

Hilti HIT-HY 200 R injection mortar with anchor rod HIT-V / HIS-(R)N may be applied in the temperature ranges given below. An elevated base material temperature leads to a reduction of the design bond resistance.

Temperature in the base material

Temperature range	Base material temperature	Max. long term base material temperature	Max. short term base material temperature
Temperature range I	-40 °C to +40 °C	+24 °C	+40 °C
Temperature range II	-40 °C to +80 °C	+50 °C	+80 °C
Temperature range III	-40 °C to +120 °C	+72 °C	+120 °C

Max short term base material temperature

Short-term elevated base material temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling.

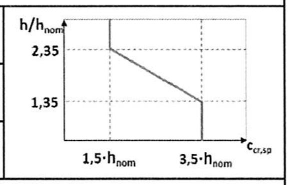
Max long term base material temperature

Long-term elevated base material temperatures are roughly constant over significant periods of time.

Curing and working time

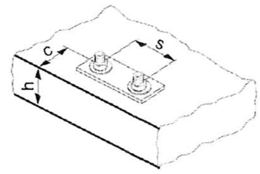
Temperature of the base material	HIT-HY 200-R	
	Maximum working time t_{work}	Minimum curing time t_{cure}
- 10°C > T_{BM} ≥ - 5°C	3 h	20 h
- 5°C > T_{BM} ≥ 0°C	2 h	8 h
0°C > T_{BM} ≥ 5°C	1 h	4 h
5°C > T_{BM} ≥ 10°C	40 min	2,5 h
10°C > T_{BM} ≥ 20°C	15 min	1,5 h
20°C > T_{BM} ≥ 30°C	9 min	1 h
30°C > T_{BM} ≥ 40°C	6 min	1 h

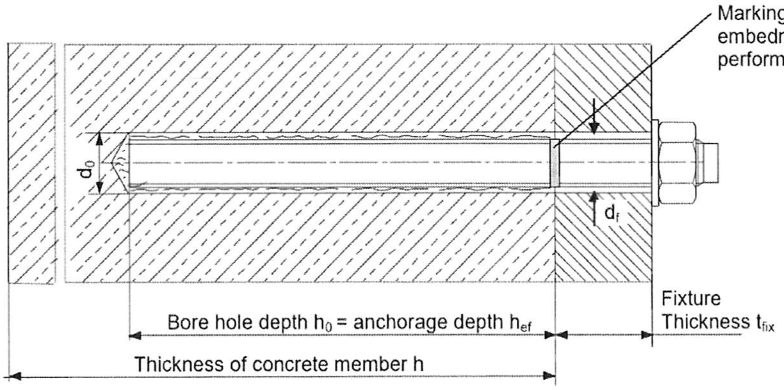
Setting details for HIT-V

Anchor size			M8	M10	M12	M16	M20	M24	M27	M30
Nominal diameter of drill bit	d_0	[mm]	10	12	14	18	22	28	30	35
Eff. embedment depth and drill hole depth [a)]	$h_{ef,min}$	[mm]	60	60	70	80	90	96	108	120
	$h_{ef,max}$	[mm]	160	200	240	320	400	480	540	600
Minimum base material thickness	h_{min}	[mm]	h_{ef} + 30 mm ≥100 mm			h_{ef} + 2 d_0				
Maximum diameter of clearance hole in the fixture	d_f	[mm]	9	12	14	18	22	26	30	33
Thickness of Hilti filling set	h_{fs}	[mm]	-	-	-	11	13	15	-	-
Effective fixture thickness with Hilti filling set	$t_{fix,eff}$	[mm]	$t_{fix,eff}$ - h_{fs}							
Max. torque moment [b)]	T_{max}	[Nm]	10	20	40	80	150	200	270	300
Minimum spacing	s_{min}	[mm]	40	50	60	75	90	115	120	140
Minimum edge distance	c_{min}	[mm]	40	45	45	50	55	60	75	80
Critical spacing for splitting failure	$s_{cr,sp}$	[mm]	2 $c_{cr,sp}$							
Critical edge distance for splitting failure [c)]	$c_{cr,sp}$	[mm]	**1,0 · hef**			for h / h_{ef} ≥ 2,00				
			4,6 h_{ef} – 1,8 h			for 2,00 > h / h_{ef} > 1,3				
			2,26 h_{ef}			for h / h_{ef} ≤ 1,3				
Critical spacing for concrete cone failure	$s_{cr,N}$	[mm]	2 $C_{cr,sp}$							
Critical edge distance for concrete cone failure [d)]	$c_{cr,N}$	[mm]	1,5 h_{ef}							

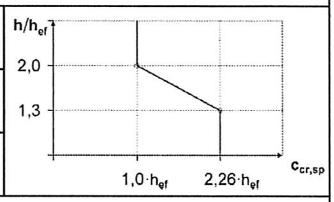
For spacing (edge distance) smaller than critical spacing (critical edge distance) the design loads have to be reduced.

a) $h_{ef,min} \le h_{ef} \le h_{ef,max}$ (h_{ef}: embedment depth)
b) Maximum recommended torque moment to avoid splitting failure during instalation with minimum spacing and edge distance
c) h: base material thickness (h ≥ h_{min})
d) The critical edge distance for concrete cone failure depends on the embedment depth h_{ef} and the design bond resistance. The simplified formula given in this table is on the save side



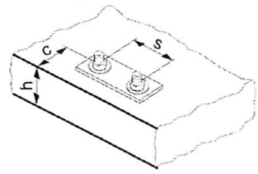


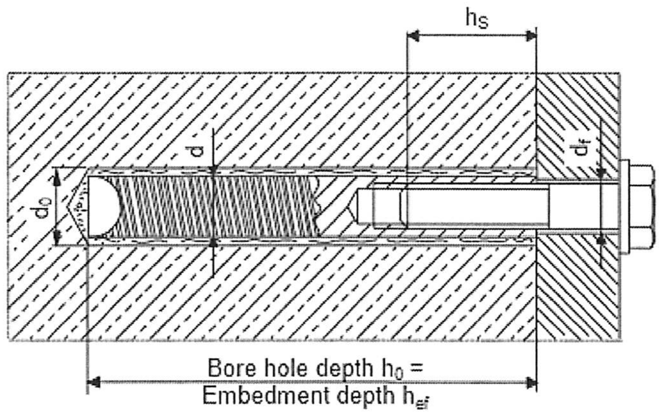
Setting details for HIS-N

Anchor size			M8	M10	M12	M16	M20
Nominal diameter of drill bit	d_0	[mm]	14	18	22	28	32
Diameter of element	d	[mm]	12,5	16,5	20,5	25,4	27,6
Effective anchorage and drill hole depth	h_{ef}	[mm]	90	110	125	170	205
Minimum base material thickness	h_{min}	[mm]	120	150	170	230	270
Diameter of clearance hole in the fixture	d_f	[mm]	9	12	14	18	22
Thread engagement length; min - max	h_s	[mm]	8-20	10-25	12-30	16-40	20-50
Minimum spacing	s_{min}	[Nm]	60	75	90	115	130
Minimum edge distance	c_{min}	[mm]	40	45	55	65	90
Critical spacing for splitting failure	$s_{cr,sp}$	[mm]	$2\ c_{cr,sp}$				
Critical edge distance for splitting failure [b]	$c_{cr,sp}$	[mm]	**1,0 · hef**	for $h / h_{ef} \geq 2{,}00$			
			$4{,}6\ h_{ef} - 1{,}8\ h$	for $2{,}00 > h / h_{ef} > 1{,}3$			
			$2{,}26\ h_{ef}$	for $h / h_{ef} \leq 1{,}3$			
Critical spacing for concrete cone failure	$s_{cr,N}$	[mm]	$2\ c_{cr,N}$				
Critical edge distance for concrete cone failure [c]	$c_{cr,N}$	[mm]	$1{,}5\ _{hef}$				
Max. torque moment [a]	T_{max}	[Nm]	10	20	40	80	150

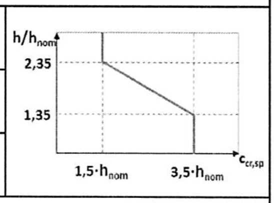
For spacing (edge distance) smaller than critical spacing (critical edge distance) the design loads have to be reduced.

a) Max. recommended torque moment to avoid splitting failure during Instalation with minimum spacing and edge distance
b) h: base material thickness ($h \geq h_{min}$)
c) The critical edge distance for concrete cone failure depends on the embedment depth h_{ef} and the design bond resistance. The simplified formula given in this table is on the save side



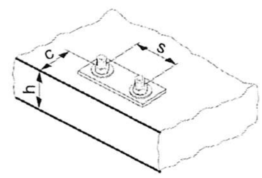


Settings details HIT-Z, HIT-Z-F and HIT-Z-R

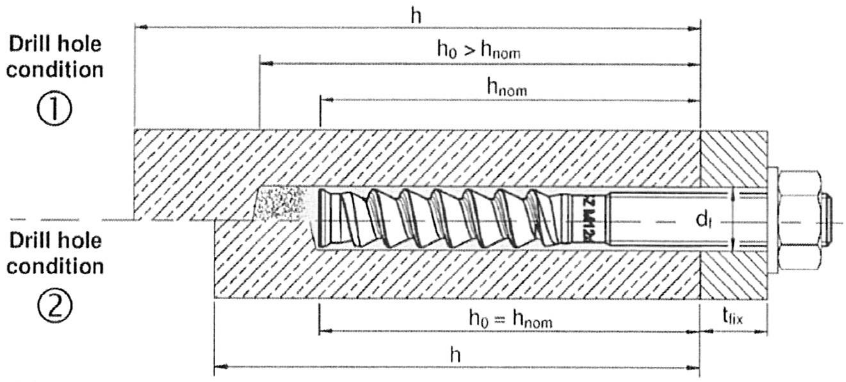
Anchor size			M8	M10	M12	M16	M20
Nominal diameter of drill bit	d_0	[mm]	10	12	14	18	22
Length of anchor	min l	[mm]	80	95	105	155	215
	max l	[mm]	120	160	196	420	450
Nominal embedment depth range [a)]	$h_{nom,min}$	[mm]	60	60	60	96	100
	$h_{nom,max}$	[mm]	100	120	144	192	220
Borehole condition 1 Min. base material thickness	h_{min}	[mm]	h_{nom} + 60 mm			h_{nom} + 100 mm	
Borehole condition 2 Min. base material thickness	h_{min}	[mm]	h_{nom} + 30 mm ≥100 mm			h_{nom} + 45 mm ≥45 mm	
Maximum depth of drill hole	h_0	[mm]	h – 30 mm			h – 2 d_0	
Pre-setting: Diameter of clearance hole in the fixture	d_f	[mm]	9	12	14	18	22
Through-setting: Diameter of clearance hole in the fixture	d_f	[mm]	11	14	16	20	24
Maximum fixture thickness	t_{fix}	[mm]	48	87	120	303	326
Maximum fixture thickness with seismic filling set	t_{fix}	[mm]	41	79	111	292	314
Installation torque moment [b)]	T_{inst}	[Nm]	10	25	40	80	150
Critical spacing for splitting failure	$s_{cr,sp}$	[mm]	2 $c_{cr,sp}$				
Critical edge distance for splitting failure [c)]	$c_{cr,sp}$	[mm]	**1,5 · h_{nom}**	for h / h_{nom} ≥ 2,35			
			6,2 h_{nom} - 2,0 h	for 2,35 > h / h_{nom} > 1,35			
			3,5 h_{nom}	for h / h_{nom} ≤ 1,35			
Critical spacing for concrete cone failure	$s_{cr,N}$	[mm]	2 $c_{cr,N}$				
Critical edge distance concrete cone failure [d)]	$c_{cr,N}$	[mm]	1,5 h_{nom}				

For spacing (edge distance) smaller than critical spacing (critical edge distance) the design loads have to be reduced.

a) $h_{nom,min} \leq h_{nom} \leq h_{nom,max}$ (h_{nom}: embedment depth)
b) Recommended torque moment to avoid splitting failure during instalation with minimum spacing and edge distance
c) h: base material thickness ($h \geq h_{min}$)
d) The critical edge distance for concrete cone failure depends on the embedment depth h_{ef} and the design bond resistance. The simplified formula given in this table is on the save side

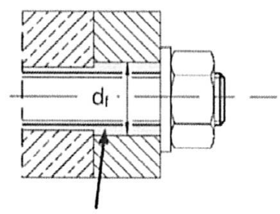


Pre-setting:
Install anchor before positioning fixture



Drill hole condition 1 → non-cleaned borehole
Drill hole condition 2 → drilling dust is completely removed

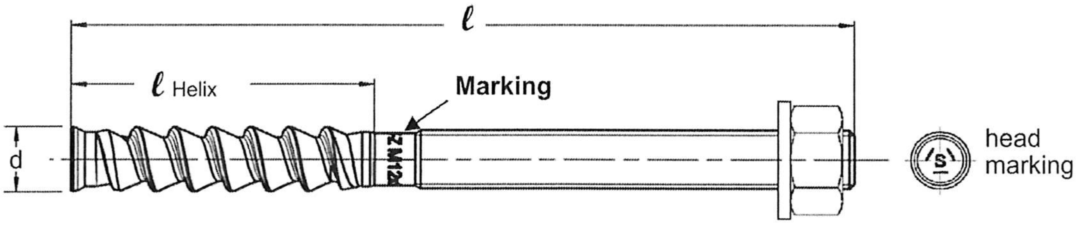
Through-setting:
Install anchor through positioned fixture



Annular gap filled with Hilti HIT-HY 200-A

Anchor dimension for HIT-Z

Anchor size			M8	M10	M12	M16	M20
Length of anchor	min ℓ	[mm]	80	95	105	155	215
	max ℓ	[mm]	120	160	196	420	450
Helix length	ℓ_{Helix}	[mm]	50	60	60	96	100



Minimum edge distance and spacing for HIT-Z

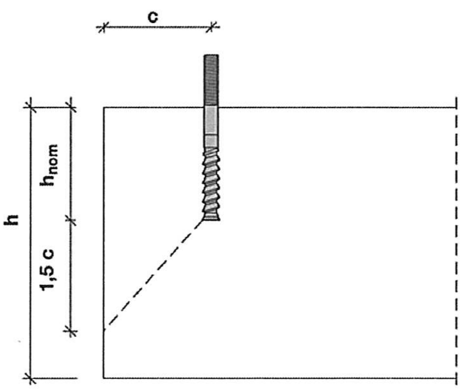
For the calculation of minimum spacing and minimum edge distance of anchors in combination with different embedment depth and thickness of concrete member the following equation shall be fulfilled: $A_{i,req} < A_{i,cal}$

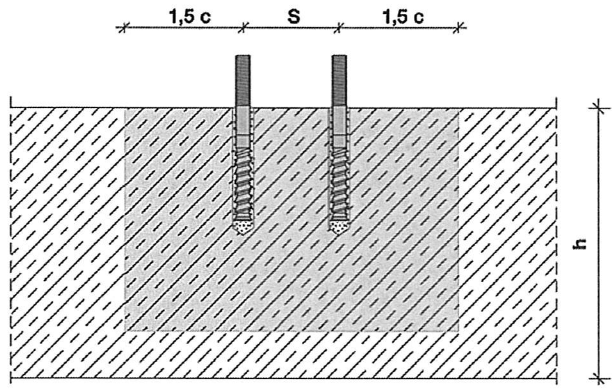
Required interaction area $A_{i,cal}$ for HIT-Z

Anchor size		M8	M10	M12	M16	M20
Cracked concrete	[mm²]	19200	40800	58800	94700	148000
Non-cracked concrete	[mm²]	22200	57400	80800	128000	198000

Effective area $A_{i,ef}$ of HIT-Z

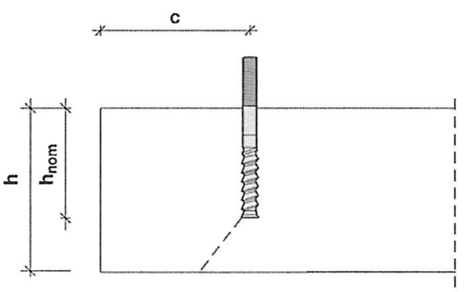
Member thickness $h \geq h_{nom} + 1{,}5 \cdot c$

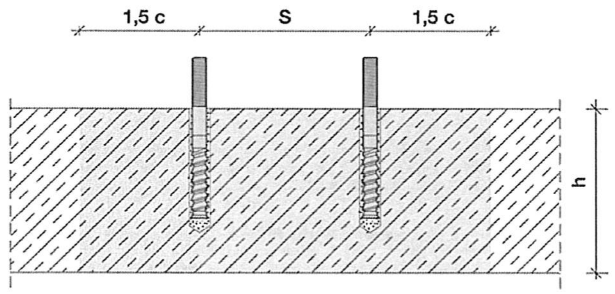




Single anchor and group of anchors with s > 3·c	[mm²]	$A_{i,cal} = (6 \cdot c) \cdot (h_{nom} + 1{,}5 \cdot c)$	with $c \geq 5 \cdot d$
Group of anchors with s ≤ 3·c	[mm²]	$A_{i,cal} = (3 \cdot c + s) \cdot (h_{nom} + 1{,}5 \cdot c)$	with $c \geq 5 \cdot d$ and $s \geq 5 \cdot d$

Member thickness $h \geq h_{nom} + 1{,}5 \cdot c$





Single anchor and group of anchors with s > 3·c	[mm²]	$A_{i,cal} = (6 \cdot c) \cdot h$	with $c \geq 5 \cdot d$
Group of anchors with s ≤ 3·c	[mm²]	$A_{i,cal} = (3 \cdot c + s) \cdot h$	with $c \geq 5 \cdot d$ and $s \geq 5 \cdot d$

Best case minimum edge distance and spacing with required member thickness and embedment depth

Anchor size			M8	M10	M12	M16	M20
Cracked concrete							
Member thickness	h ≥	[mm]	140	200	240	300	370
Embedment depth	h_{nom} ≥	[mm]	80	120	150	200	220
Minimum spacing	s_{min}	[mm]	40	50	60	80	100
Corresponding edge distance	c ≥	[mm]	40	55	65	80	100
Minimum edge distance	c_{min} =	[mm]	40	50	60	80	100
Corresponding spacing	s ≥	[mm]	40	60	65	80	100
Non-cracked concrete							
Member thickness	h ≥	[mm]	140	230	270	340	410
Embedment depth	h_{nom} ≥	[mm]	80	120	150	200	220
Minimum spacing	s_{min}	[mm]	40	50	60	80	100
Corresponding edge distance	c ≥	[mm]	40	70	80	100	130
Minimum edge distance	c_{min}	[mm]	40	50	60	80	100
Corresponding spacing	s ≥	[mm]	40	145	160	160	235

Best case minimum member thickness and embedment depth with required minimum edge distance and spacing (borehole condition 1)

Anchor size			M8	M10	M12	M16	M20
Cracked concrete							
Member thickness	h ≥	[mm]	120	120	120	196	200
Embedment depth	h_{nom} ≥	[mm]	60	60	60	96	100
Minimum spacing	s_{min}	[mm]	40	50	60	80	100
Corresponding edge distance	c ≥	[mm]	40	100	140	135	215
Minimum edge distance	c_{min} =	[mm]	40	60	90	80	125
Corresponding spacing	s ≥	[mm]	40	160	220	235	365
Non-cracked concrete							
Member thickness	h ≥	[mm]	120	120	120	196	200
Embedment depth	h_{nom} ≥	[mm]	60	60	60	96	100
Minimum spacing	s_{min}	[mm]	40	50	60	80	100
Corresponding edge distance	c ≥	[mm]	50	145	200	190	300
Minimum edge distance	c_{min}	[mm]	40	80	115	110	165
Corresponding spacing	s ≥	[mm]	65	240	330	310	495

Minimum edge distance and spacing – Explanation

Minimum edge and spacing geometrical requirements are determined by testing the installation conditions in which two anchors with a given spacing can be set close to an edge without forming a crack in the concrete due to tightening torque.

The HIT-Z boundary conditions for edge and spacing geometry can be found in the tables to the left. If the embedment depth and slab thickness are equal to or greater than the values in the table, then the edge and spacing values may be utilized.

Annex 2

No in-principle comment/ no comment from ASD and CEDD

Gmail Cheng Endy [redacted]

Re: [Structural Appraisal Report] Planning Application No. A/K9/287 - Portion of Upper Deck, Hung Hom (North) Ferry Pier, Hung Hom, Kowloon

wongchd@archsd.gov.hk <wongchd@archsd.gov.hk> 2024年5月24日 下午3:01
收件者：Cheng Endy [redacted]
副本：makyka@archsd.gov.hk

Dear Endy,

We spoke just now and please find our SE's response in below for your further handling. Thanks.

Your preceding email and the supplementary drawings and calculations from Mr James Lo of the RSE dated 23.5.2024 .

Please be advised that, on the basis of curtailed checking, our SE have no further comment on the maintenance aspect of the existing building structure under ArchSD's ambit arisen due to the latest Structural Appraisal Report endorsed by the Registered Structural Engineer (RSE), Wong Shing Tsang.

Please note that we only providing technical advice on the design submission of the captioned works. We do not assume to take up any supervision/ auditing role on the actual works done. The applicant is required to appoint a Registered Structural Engineer (RSE) to ensure that the design and supervision requirements set out under the Building Ordinance (and subsidiary regulations made thereunder and any amendments thereto), other relevant statutory requirements, standards/ specifications (e.g. ArchSD General Specification) and relevant codes of practice are complied with in the design and construction of the structural works. The appointed RSE shall also verify the actual site conditions against the design assumptions prior to construction, and shall certify that the completed works have been carried out in accordance with the design and are, in his opinion, structurally safe.

Regards,
Alex Wong
PSM/KC-S, ArchSD
2773 2601

From: "Cheng Endy" <endydespace@gmail.com>
To: Chi Hung WONG/ARCHSD/HKSARG@ARCHSD
Date: 23/05/2024 16:26
Subject: Fwd: [Structural Appraisal Report] Planning Application No. A/K9/287 - Portion of Upper Deck, Hung Hom (North) Ferry Pier, Hung Hom, Kowloon

---------- Forwarded message ---------
寄件者： **James Lo** [redacted]
Date: 2024年5月23日週四 下午4:23
Subject: Re: [Structural Appraisal Report] Planning Application No. A/K9/287 - Portion of Upper Deck, Hung Hom (North) Ferry Pier, Hung Hom, Kowloon
To: <makyka@archsd.gov.hk>
Cc: [redacted]

Dear Sir,

Please find the attached revised report and drawings for your reference according to the previous phone conversation.
The anchor bolts connection is revised to HIT-Z-R M20 with HIT-HY-200-R injection adhesive. Besides, the design loading of finishing and service is also stated in the introduction of the report.

_report.pdf

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Best Regards,
James Lo
S.T. Wong & Partners Limited
Tel: 2625-1776 Fax: 2467-9618
Address: Flat B, 8/F, Lee May Building, 788-790 Nathan Road, Kowloon[attachment "AA-S-02.pdf" deleted by Chi Hung WONG/ARCHSD/HKSARG] [attachment "AA-S-03.pdf" deleted by Chi Hung WONG/ARCHSD/HKSARG] [attachment "AA-S-01.pdf" deleted by Chi Hung WONG/ARCHSD/HKSARG]

Gmail Cheng Endy [redacted]

[Structural Appraisal Report] Planning Application No. A/K9/287 - Portion of Upper Deck, Hung Hom (North) Ferry Pier, Hung Hom, Kowloon

rwhso@cedd.gov.hk <rwhso@cedd.gov.hk> 2024年5月24日 上午11:49
收件者：Cheng Endy [redacted]
副本：[redacted]

Dear Endy,

We have no in-principle comment on the proposal, please find my advisory comments from marine engineering aspects:

- Our curtailed checking only focused on the basic principles of approach in the proposal and no attempt has been made to verify the accuracies in your submissions which should be subjected to your own in-house checking and scrutiny / the detailed examination on all aspects by the project office and the independent checking engineer.
- It is noted in your report that the structural integrity and stability of the column and pile of the existing pier will not be adversely affected by the proposed works in due course; and
- Please consult us again for any amendment in your design in the future and make sure that your design is in accordance with the latest Port Works Design Manual.

Thanks.

Best Regards,
Rosita So
E/D1
Port Works Division, CEDD
Office Tel: 2762 5531