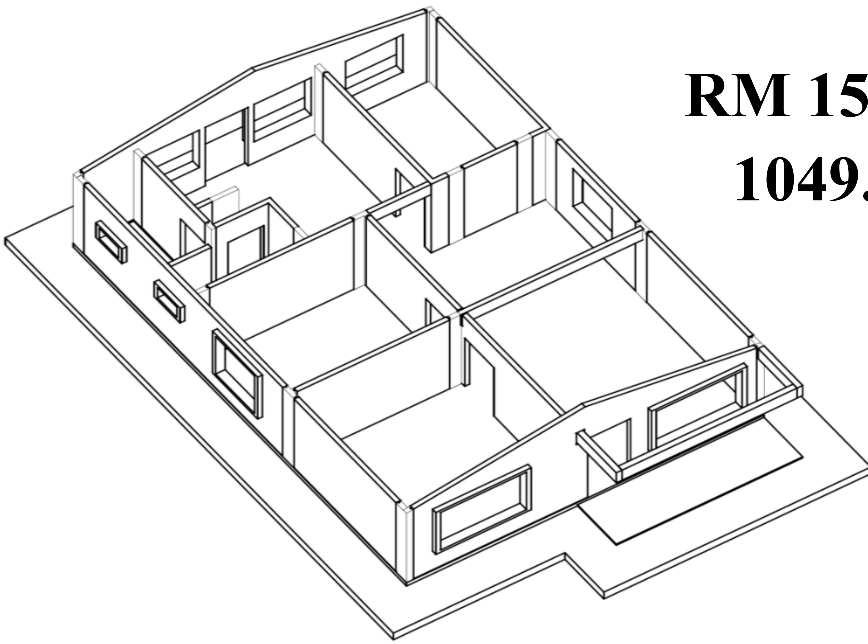
PERUMAHAN KEKAL MANGSA BANJIR (RKB)

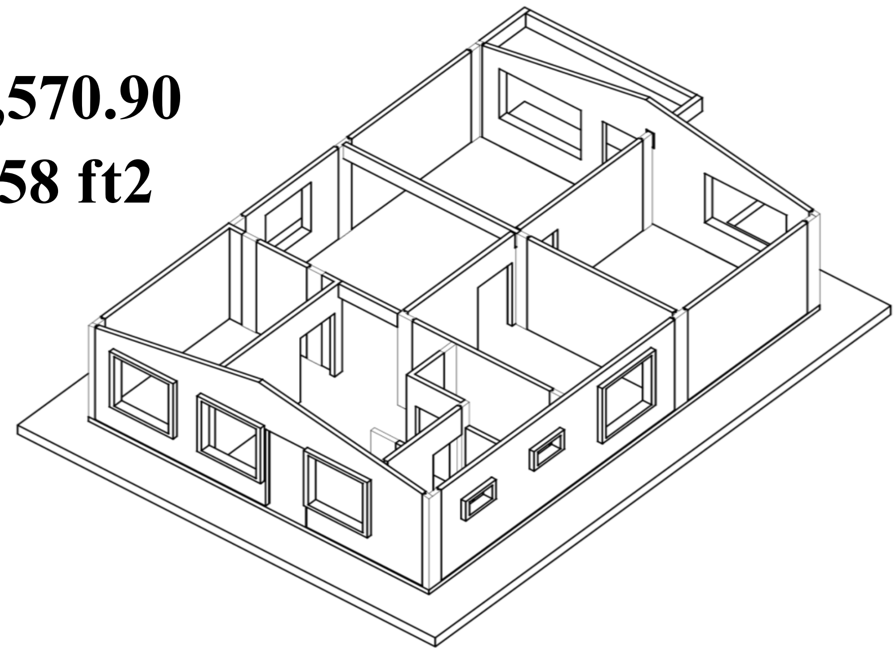
ONE OF THE WAYS TO IMPROVE THE OUTFLOW OF CURRENCY IS THE UTILIZATION OF INDUSTRIAL BUILDING SYSTEM (IBS)

Single Storey Bungalow



RM 15,570.90

1049.58 ft2



HC PRECAST SYSTEM

IBS Superstructure In Malaysia 3in1

Load Bearing Wall + Modular Shear Keys Wet Joint + Box System

- Speed, Quality & Environment

IBS IS A SYSTEM NOT A COMPONENTS

" significantly difference from traditional cast in-situ construction which relies heavily on customized site work "

We would like to highlight that we have not received any Soil Investigation information. As such, we have made several assumptions for the design of the said building's foundation. This design is based on the assumption that the soil bearing pressure is at least 50kN/m2.

- **The wall is designed to provide adequate fire resistance according to demand (with minimum 2hours as per BS8110)**
- **The system is designed and approved by PE and endorsed by independent checker**
- **Thickness of the wall can be customized according to requirement**
- **Our design and casting are following strictly to British Standard**

ONE OF THE WAYS TO IMPROVE THE OUTFLOW OF CURRENCY IS THE UTILIZATION OF INDUSTRIAL BUILDING SYSTEM (IBS)

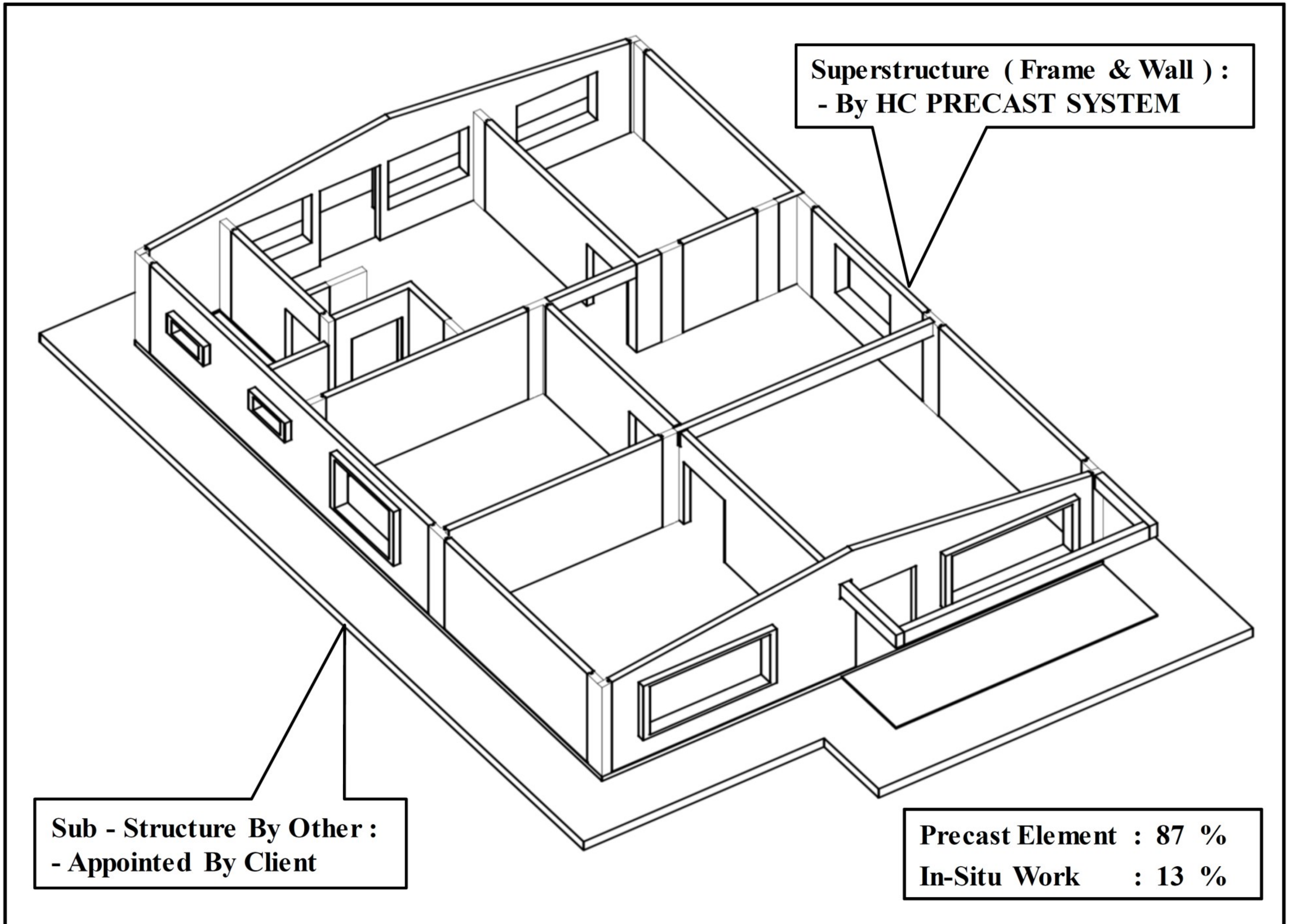
HC Precast System: Industrial Building System or Component?

Tiong, P.L.Y. and Teow, B.H.

What are the important elements required to complete a building to perform its function? Buildings, as we know require few basic structural components to form an integral system to contain its occupants to protect them from weather and external hazards. These components, as we know are beam, column, staircase and wall.

To speed up construction as well as decreasing dependant on heavy site works, the government are encouraging a relatively new-method of construction, termed as Industrialized Building System (IBS). However, what does IBS truly mean? Many precast manufacturers turn to use limited types of precast element in order to satisfy the minimum percentage of prefabricated materials in order to qualify for government projects. For example, by resorting to only precast beam and column (i.e. precast skeletal system), large amount of brick-wall assembling work is still required when the frame is in place. The same goes for concreting of staircase. Some may say, why don't we use precast wall together with precast frame? Okay, while this problem does not occur in countries like the U.S. or European, we have to accept the fact that the construction tolerance of local builders is a serious issue. The precast wall is unable to sit in place if the frame system beneath or above the wall does not form the exact angle as required.

Hence, in HC Precast System, we have come up with a complete precast building system where the level of site grouting work is kept to minimum. Only casting of connection between the precast elements is required. The complete system, consisting of precast beam, load-bearing wall, and staircase are able to provide the whole precast system rather than individual components. Besides that, our casting and lifting technology are able to produce wall panel with any types of openings, thus eliminating the need to rely on conventional brick-wall even for special architectural demands.


Superstructure (Frame & Wall) :
- By HC PRECAST SYSTEM
Sub - Structure By Other :
- Appointed By Client
Precast Element : 87 %
In-Situ Work : 13 %

RUMAH KEKAL MANGSA BANJIR - JENIS SEBUAH
(1049.58 Sqft) : RM 15,570.90
87% Precast Element at Factory
13% Wet work on Site (by system formwork)

Item	Description	Unit	Precast	In-situ
1)	Ground Floor			
a.	Panel	m^3	14.806	-
b.	Wet Joint	m^3	-	1.782
c.	Precast Beam	m^3	0.308	-
d.	Insitu Beam	m^3	-	0.405
	Sub Total	m^3	15.114	2.187
	Total	m^3	17.301	
	Rate / m^3	RM	900.00	
	Total Amount	RM	15,570.90	
	GFA	m^2	97.50	
	Rate / m^2 GFA	RM	159.70	
	Rate / ft^2 GFA	RM	14.83	
	Percentage	%	87.35	12.65

Scope of Works For Superstructure are as below:

Included :

1. Superstructure design calculation.
2. Supply & Install.
3. Setting out (panel)
4. TBM for each block & 4 + 2 Boundary point per unit must be provided.
5. Mobile crane.
6. Shop drawing for M&E location layout related to panel wall casting. (Subject to client / consultant confirmation)

Excluded :

1. Substructure design by others.
2. Skim coat.
3. Storage yard at project site : 50mm thick crusher-run base.
4. Access road at project site.
5. Temporary water & electricity supply.
6. Quarters for workers.
7. Security at site for our material & system formwork.
8. Contractor All Risks Insurance.

A) Lukisan

1) **Lukisan arkitek JKR ditukarkan kepada HC Precast System**
   Converting JKR architect drawing to HC Precast

Senarai Lukisan – 01 November 2015

Bil	Tajuk Lukisan	Nombor Lukisan
1	Pelan Aras Satu Dan Cadangan Pelan Tapak	JKR/HC/CA/11/01/PEL 15/008/RBB/P/01
2	Pelan Bumbung Dan Pelan Siling	JKR/HC/CA/11/01/PEL 15/008/RBB/P/02
3	Keratan A – A & Jadual Pintu Tingkap	JKR/HC/CA/11/01/PEL 15/008/RBB/K/01
4	Keratan B – B	JKR/HC/CA/11/01/PEL 15/008/RBB/K/02
5	Tampak Hadapan dan Belakang	JKR/HC/CA/11/01/PEL 15/008/RBB/T/01
6	Tampak Sisis Kanan	JKR/HC/CA/11/01/PEL 15/008/RBB/T/02
7	Tampak Sisi Kiri	JKR/HC/CA/11/01/PEL 15/008/RBB/T/03
8	Butiran Tandas & Bilik Mandi	JKR/HC/CA/11/01/PEL 15/008/RBB/B/01

2) **Lukisan 3D HC System dan pelan lantai – Vol : CD-2**
   HC System 3D drawing & layout

3) **Pelan Struktur**
   Structure layout

4) **Senarai arkitek panel HC Precast – Vol : CD-5**
   HC system architectural panel list

5) **Senarai struktur panel dinding dan rasuk – Vol : CD-6**
   Structural panel & beam list

6) **Lukisan M&E untuk pengesahan lokasi oleh klien**
   HC Precast M&E Shop drawing for client confirmation location

B) Structure design calculation – PE endorsement

C) Program Kerja '*Production, Delivery, Installation & Quality Control Sched*ule'

1) **Program kerja pengeluaran *(production)* bagi 73 unit**
2) **Program kerja bagi 43 unit**
3) **Program kerja bagi 30 unit**
4) **Program kerja bagi 2 unit rumah contoh RKB**

D) Video – 3D Model Rumah RKB

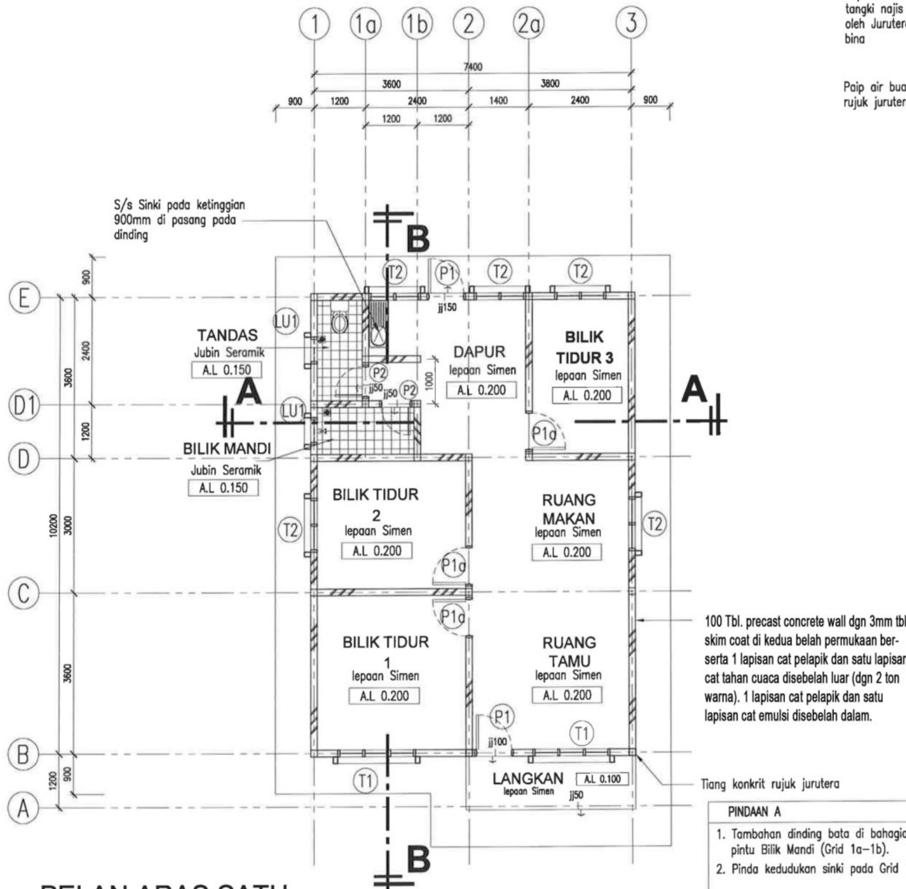
CADANGAN RUMAH KEKAL MANGSA BANJIR
- JENIS SEBUAH

SENARAI LUKISAN – 05 MAC 2015

BIL	TAJUK LUKISAN	NOMBOR LUKISAN
1.	PELAN ARAS SATU DAN CADANGAN PELAN TAPAK	JKR /HC/CA/11/01/PEL 15/008/RB1/P/01 (PINDAAN B)
2.	PELAN BUMBUNG DAN PELAN SILING	JKR /HC/CA/11/01/PEL 15/008/RB1/P/02 (PINDAAN B)
3.	KERATAN A – A & JADUAL PINTU TINGKAP	JKR /HC/CA/11/01/PEL 15/008/RB1/K/01 (PINDAAN B)
4.	KERATAN B –B	JKR /HC/CA/11/01/PEL 15/008/RB1/K/02 (PINDAAN B)
5.	TAMPAK HADAPAN & BELAKANG	JKR /HC/CA/11/01/PEL 15/008/RB1/T/01 (PINDAAN B)
6.	TAMPAK SISI KANAN	JKR /HC/CA/11/01/PEL 15/008/RB1/T/02 (PINDAAN B)
7.	TAMPAK SISI KIRI	JKR /HC/CA/11/01/PEL 15/008/RB1/T/03 (PINDAAN B)
8.	BUTIRAN TANDAS – PELAN LANTAI & KERATAN	JKR /HC/CA/11/01/PEL 15/008/RB1/B/01 (PINDAAN B)

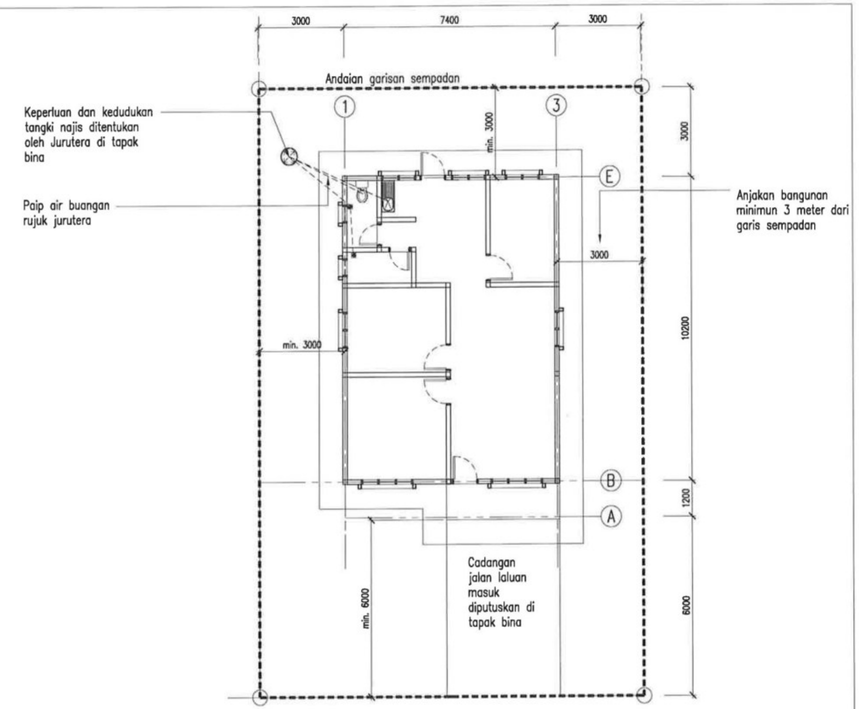
JKR

CAWANGAN ARKITEK
IBU PEJABAT JABATAN KERJA RAYA
MALAYSIA



PELAN ARAS SATU

SKALA 1 : 100



CADANGAN PELAN TAPAK

SKALA 1 : 150

NOTA

1. Saiz dan perletakan tiang sila rujuk butiran Jurutera
2. Semua Pintu dan Tingkap perlu dilengkapi dengan konkrit lintol rujuk butiran Jurutera

PINDAAN A	PINDAAN B
1. Tambahan dinding bata di bahagian depan pintu Bilik Mandi (Grid 1a–1b). 2. Pinda kedudukan sinki pada Grid 1b.	1. Pinda lokasi Pintu P1 dari kedudukan Grid 2a kepada Grid 2. 2. Pinda tingkap T1 (1 bil.) kpd. T2 (2 bil.) pada kedudukan Grid E. 3. Pinda ketebalan lepa simen dari 18mm kepada 16mm. 4. Siling di bahagian luar (roof eaves) dikeluarkan

KELUASAN RUANG UNIT

BIL	KETERANGAN	METER PERSEGI	KAKI PERSEGI
1.	RUANG TAMU	13.68	147.25
2.	RUANG MAKAN	11.40	127.71
3.	BILIK TIDUR TIDUR 1	12.96	139.50
4.	BILIK TIDUR TIDUR 2	10.80	116.25
5.	BILIK TIDUR TIDUR 3	8.64	93.00
6.	DAPUR	12.24	131.75
7.	BILIK MANDI	2.88	31.00
8.	TANDAS	2.88	31.00
	JUMLAH	75.48	812.48

JKR

CAWANGAN ARKITEK
IBU PEJABAT JABATAN KERJA RAYA MALAYSIA

PENGARAH CAWANGAN ARKITEK
Ar. SUTINA BT GHAZALLI

KETUA PENOLONG PENGARAH KANAN
Ar. HJH. MARIAH NOOR BT SUHUD

PENOLONG PENGARAH KANAN
MASSROL NIZZAM B. MD SALLEH

PENOLONG PENGARAH
NIK MUHAMMAD SYAHMAN NIK IBRAHIM

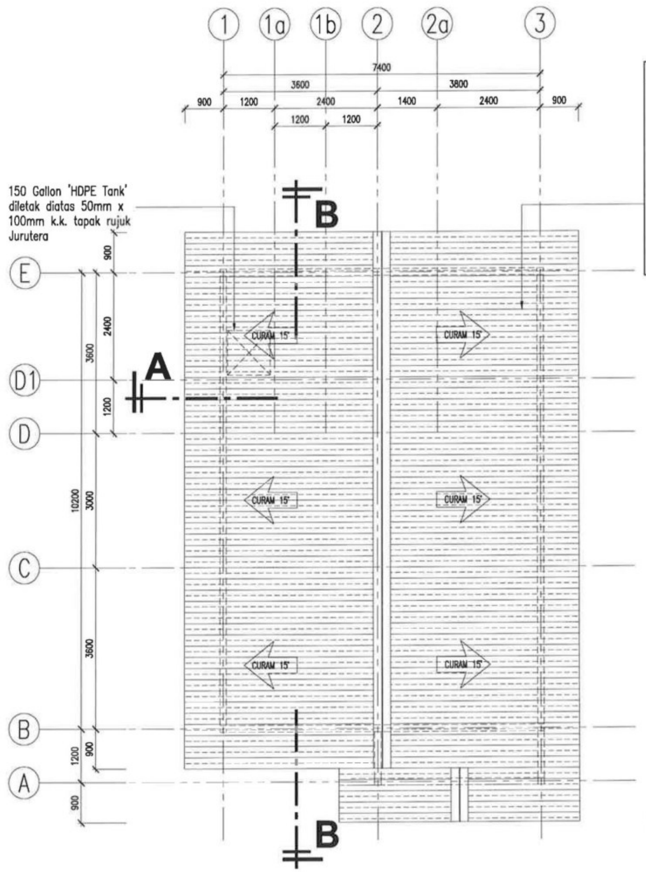
PROJEK
CADANGAN RUMAH KEKAL MANGSA BANJIR
- JENIS SEBUAH

TAJUK LUKISAN
- PELAN ARAS SATU
- CADANGAN PELAN TAPAK

NO. LUKISAN File Elektronik: .....
JKR /HC/CA/11/01/PEL 15/008/RB1/P/01

PINDAAN A B

DILUKIS	DISEMAK	SKALA	TARIKH
MFADZIL	NIK	1 : 100	05/03/2015

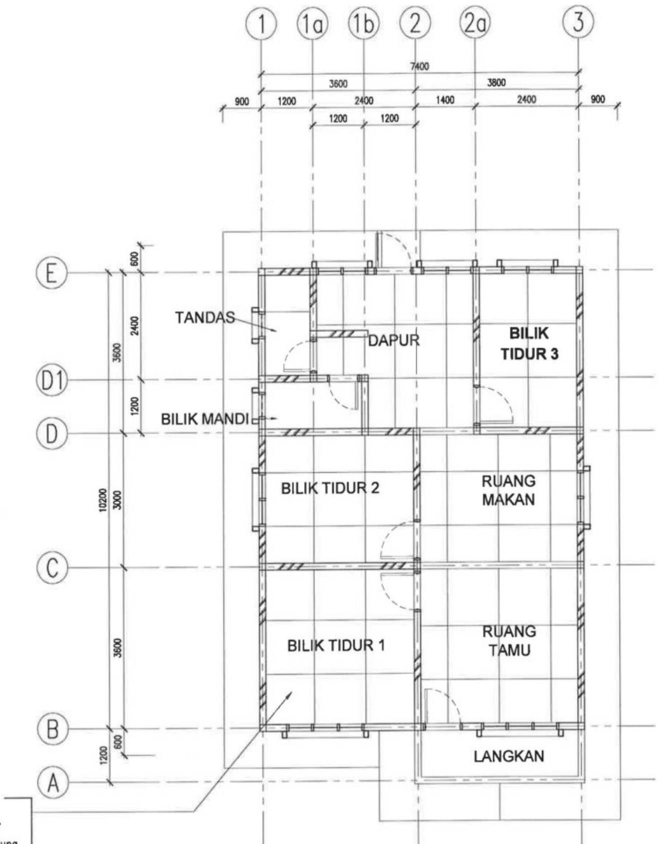


PEMBINAAN BUMBUNG

- 0.42mm BTM (0.48mm TCT) Bumbung keluli aloi zink-aluminium dilengkapi dgn aksessori 'ridge caping', apron mould, flashing mengikut spesifikasi pembekal yang diluluskan
- Sistem kekuda bumbung yang diluluskan oleh JKR
- 1 Lapisan penebat haba dua permukaan jenis alum. foil yang diluluskan oleh pihak JKR
- Kecerunan Bumbung adalah 15°
- 6mm Tbl. 'Simen Board tumpu kasau

PELAN BUMBUNG

SKALA 1 : 100



PEMBINAAN SILING

- 1200 X 1200 X 8mm tbl. 'Gypsum Board' yang dipasang tetap pada kerangka bumbung yang diluluskan Jurutera

PELAN SILING

SKALA 1 : 100

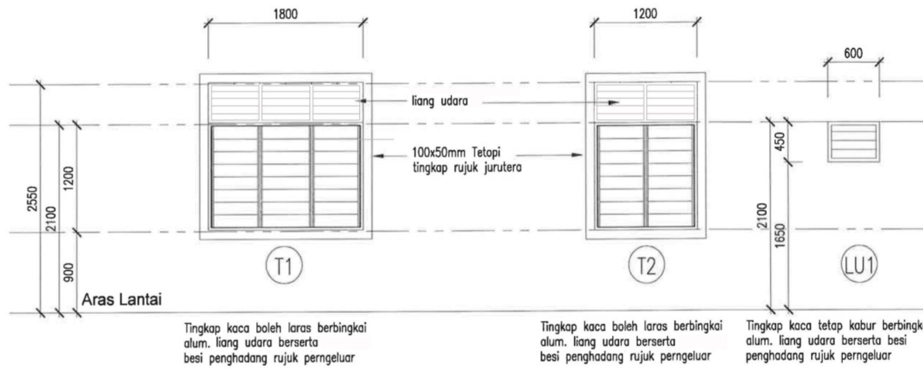
PINDAAN A	PINDAAN B
1. Tambahan dinding bata di bahagian depan pintu Bilik Mandi (Grid 1a–1b). 2. Pinda kedudukan sinki pada Grid 1b.	1. Pinda lokasi Pintu P1 dari kedudukan Grid 2a kepada Grid 2. 2. Pinda tingkap T1 (1 bil.) kpd. T2 (2 bil.) pada kedudukan Grid E. 3. Pinda ketebalan lepa simen dari 18mm kepada 16mm. 4. Siling di bahagian luar (roof eaves) dikeluarkan

JKR

CAWANGAN ARKITEK
IBU PEJABAT JABATAN KERJA RAYA MALAYSIA

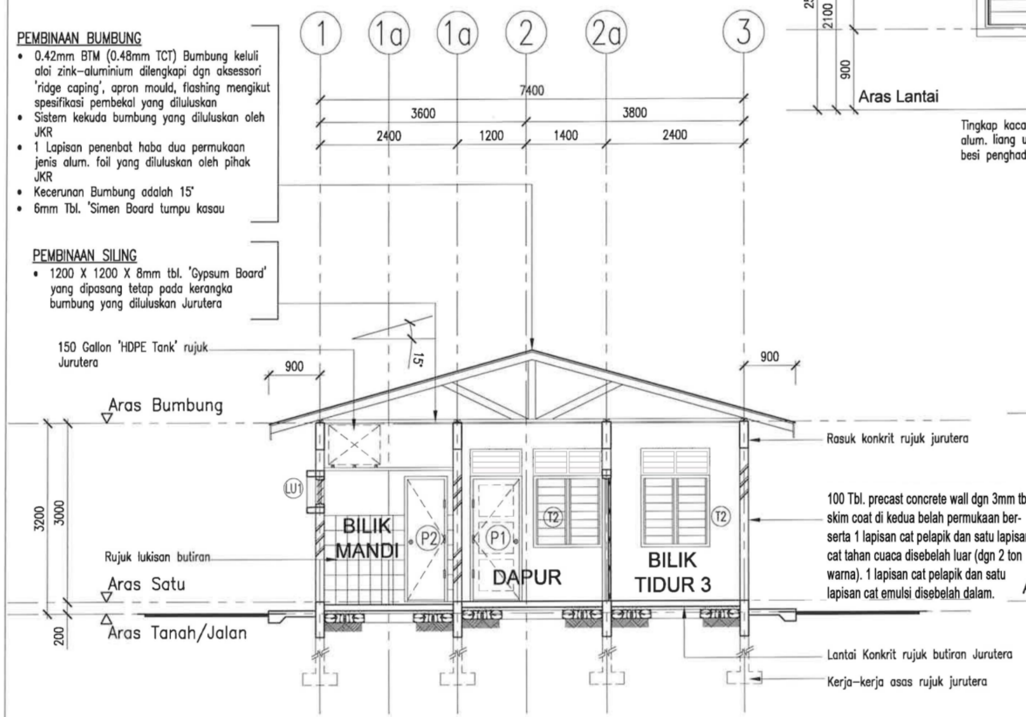
PENGARAH CAWANGAN ARKITEK	KETUA PENOLONG PENGARAH KANAN	PROJEK	TAJUK LUKISAN	NO. LUKISAN File Elektronik: .....
Ar. SUTINA BT GHAZALLI	Ar. HJH. MARIANI NOOR BT SUHUD	CADANGAN RUMAH KEKAL MANGSA BANJIR • JENIS SEBUAH	• PELAN BUMBUNG • PELAN SILING	JKR /HC/CA/11/01/PEL 15/008/RB1/P/02
PENOLONG PENGARAH KANAN	PENOLONG PENGARAH			PINDAAN: A, B
MASSROL NIZZAM B. MD SALLEH	NIK MUHAMMAD SYAHMAN NIK IBRAHIM			DILUKIS: MFADZIL; DISEMAK: NIK; SKALA: 1 : 100; TARIKH: 05/03/2015

PINDAAN A	PINDAAN B
1. Tambahan dinding bata di bahagian depan pintu Bilik Mandi (Grid 1a–1b). 2. Pinda kedudukan sinki pada Grid 1b.	1. Pinda lokasi Pintu P1 dari kedudukan Grid 2a kepada Grid 2. 2. Pinda tingkap T1 (1 bil.) kpd. T2 (2 bil.) pada kedudukan Grid E. 3. Pinda ketebalan lepa simen dari 18mm kepada 16mm. 4. Siling di bahagian luar (roof eaves) dikeluarkan



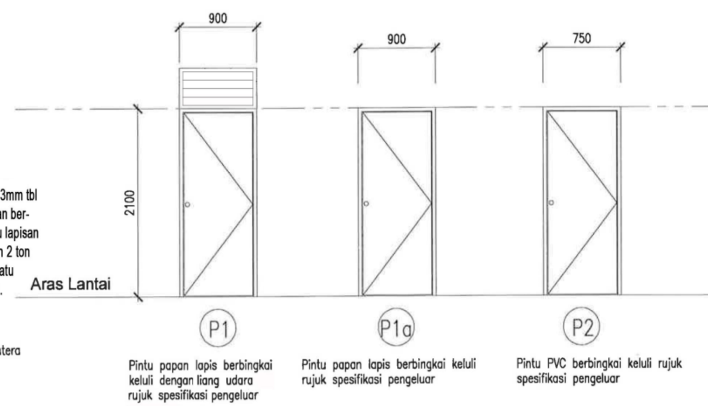
JADUAL TINGKAP

SKALA 1 : 50



KERATAN A-A

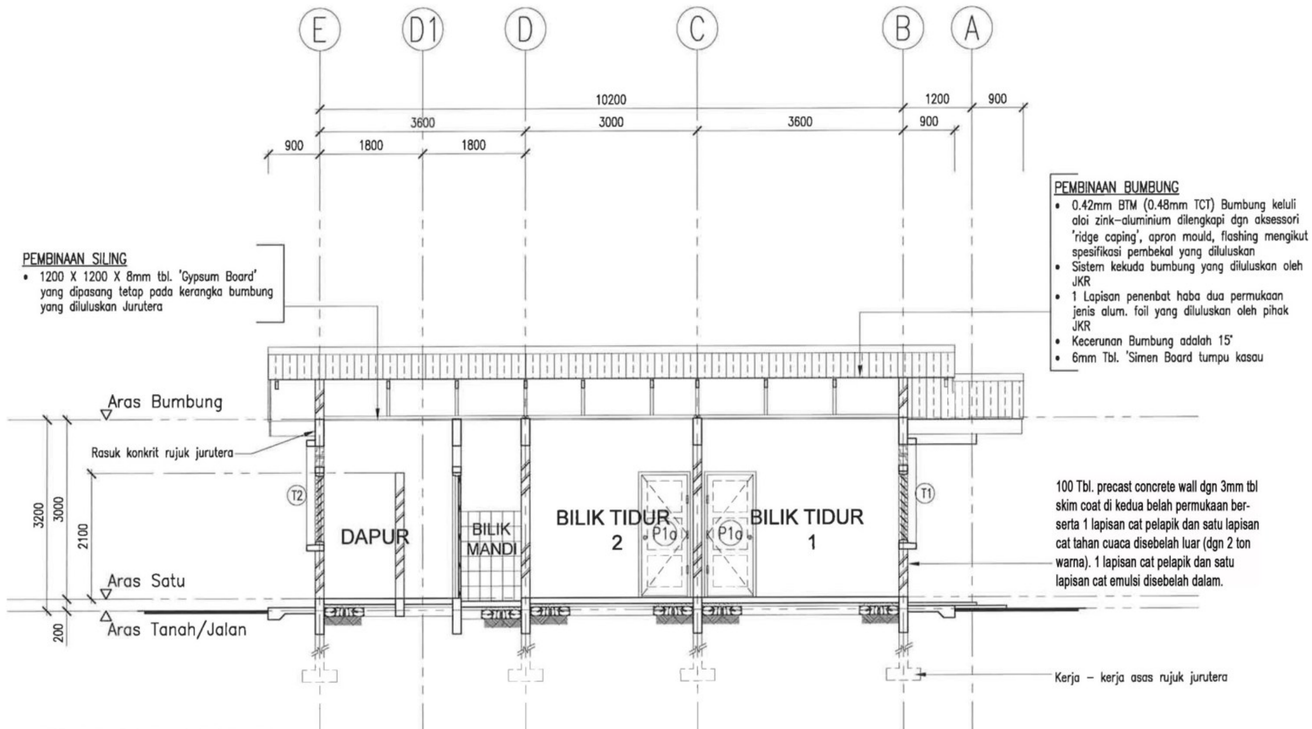
SKALA 1 : 75



JADUAL PINTU

SKALA 1 : 50

JKR CAWANGAN ARKITEK IBU PEJABAT JABATAN KERJA RAYA MALAYSIA	PENGARAH CAWANGAN ARKITEK Ar. SUTINA BT GHAZALLI PENOLONG PENGARAH KANAN MASSROL NIZZAM B. MD SALLEH	KETUA PENOLONG PENGARAH KANAN Ar. HJH. MARIANI NOOR BT SUHUD PENOLONG PENGARAH NIK MUHAMMAD SYAHMAN NIK IBRAHIM	PROJEK CADANGAN RUMAH KEKAL MANGSA BANJIR • JENIS SEBUAH	TAJUK LUKISAN • KERATAN A-A • JADUAL PINTU • JADUAL TINGKAP	NO. LUKISAN File Elektronik: ..... JKR /HC/CA/11/01/PEL 15/008/RB1/K/01 PINDAAN A B DILUKIS MFADZIL · DISEMAK NIK · SKALA 1 : 75 · TARIKH 05/03/2015



KERATAN B-B

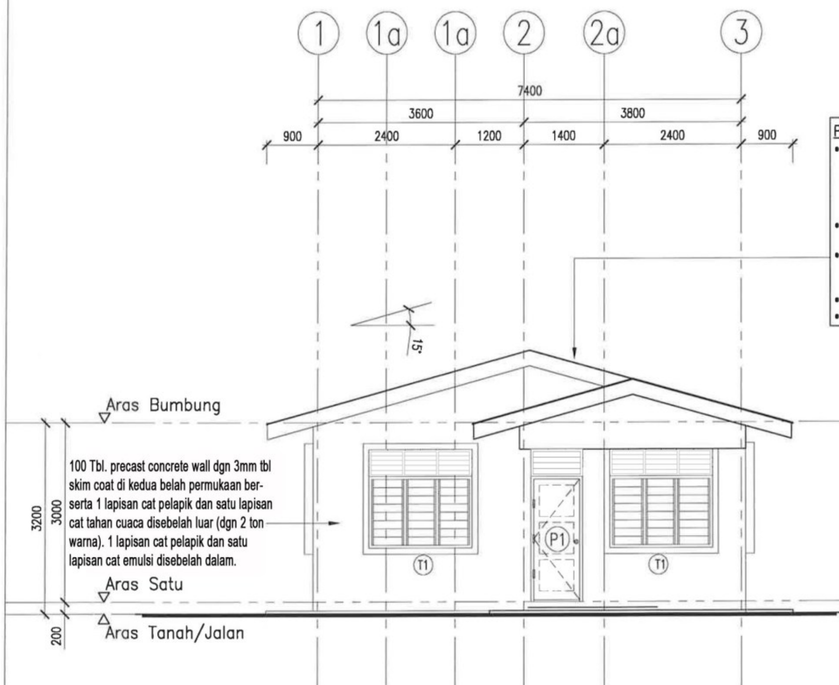
SKALA 1 : 75

PINDAAN A	PINDAAN B
1. Tambahan dinding bata di bahagian depan pintu Bilik Mandi (Grid 1a–1b). 2. Pinda kedudukan sinki pada Grid 1b.	1. Pinda lokasi Pintu P1 dari kedudukan Grid 2a kepada Grid 2. 2. Pinda tingkap T1 (1 bil.) kpd. T2 (2 bil.) pada kedudukan Grid E. 3. Pinda ketebalan lepa simen dari 18mm kepada 16mm. 4. Siling di bahagian luar (roof eaves) dikeluarkan

JKR

CAWANGAN ARKITEK
IBU PEJABAT JABATAN KERJA RAYA MALAYSIA

PENGARAH CAWANGAN ARKITEK	KETUA PENOLONG PENGARAH KANAN	PROJEK	TAJUK LUKISAN	NO. LUKISAN File Elektronik: .....
Ar. SUTINA BT GHAZALLI	Ar. HJH. MARIANI NOOR BT SUHUD	CADANGAN RUMAH KEKAL MANGSA BANJIR • JENIS SEBUAH	• KERATAN B-B	JKR /HC/CA/11/01/PEL 15/008/RB1/K/02
PENOLONG PENGARAH KANAN	PENOLONG PENGARAH			PINDAAN A B
MASSROL NIZZAM B. MD SALLEH	NIK MUHAMMAD SYAHMAN NIK IBRAHIM			DILUKIS MFADZIL / DISEMAK NIK / SKALA 1 : 75 / TARIKH 05/03/2015

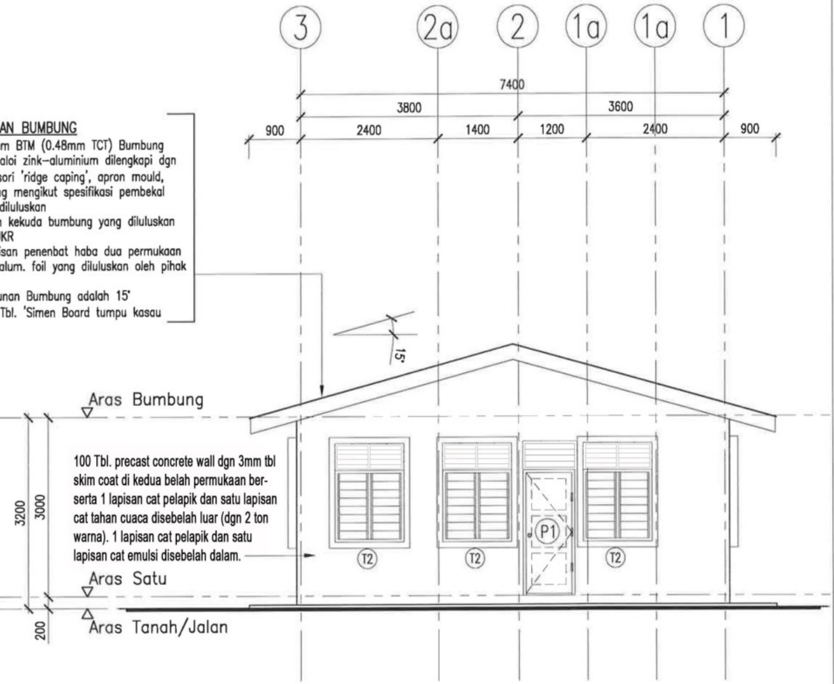


TAMPAK HADAPAN

SKALA 1 : 75

PEMBINAAN BUMBUNG

- 0.42mm BTM (0.48mm TCT) Bumbung keluli aloi zink–aluminium dilengkapi dgn aksessori 'ridge caping', apron mould, flashing mengikut spesifikasi pembekal yang diluluskan
- Sistem kekuda bumbung yang diluluskan oleh JKR
- 1 Lapisan penenbat haba dua permukaan jenis alum. foil yang diluluskan oleh pihak JKR
- Kecerunan Bumbung adalah 15°
- 6mm Tbl. 'Simen Board tumpu kasau



TAMPAK BELAKANG

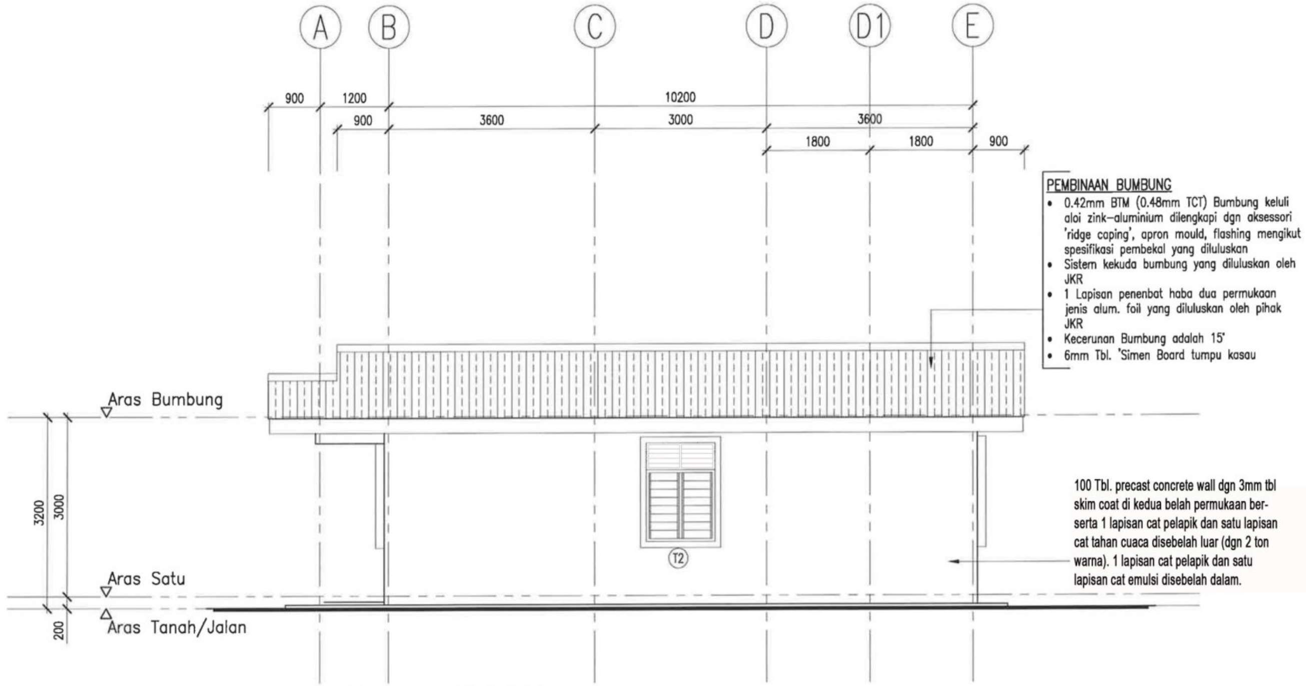
SKALA 1 : 75

PINDAAN A	PINDAAN B
1. Tambahan dinding bata di bahagian depan pintu Bilik Mandi (Grid 1a–1b). 2. Pinda kedudukan sinki pada Grid 1b.	1. Pinda lokasi Pintu P1 dari kedudukan Grid 2a kepada Grid 2. 2. Pinda tingkap T1 (1 bil.) kpd. T2 (2 bil.) pada kedudukan Grid E. 3. Pinda ketebalan lepa simen dari 18mm kepada 16mm. 4. Siling di bahagian luar (roof eaves) dikeluarkan

JKR

CAWANGAN ARKITEK
IBU PEJABAT JABATAN KERJA RAYA
MALAYSIA

PENGARAH CAWANGAN ARKITEK	KETUA PENOLONG PENGARAH KANAN	PROJEK	TAJUK LUKISAN	NO. LUKISAN File Elektronik: .....
Ar. SUTINA BT GHAZALLI	Ar. Hj. H. MARIANI NOOR BT SUHUD	CADANGAN RUMAH KEKAL MANGSA BANJIR • JENIS SEBUAH	• TAMPAK HADAPAN • TAMPAK BELAKANG	JKR /HC/CA/11/01/PEL 15/008/RB1/T/01
PENOLONG PENGARAH KANAN	PENOLONG PENGARAH			PINDAAN A B
MASSROL NIZZAM B. MD SALLEH	NIK MUHAMMAD SYAHMAN NIK IBRAHIM			DILUKIS MFADZIL · DISEMAK NIK · SKALA 1 : 75 · TARIKH 05/03/2015

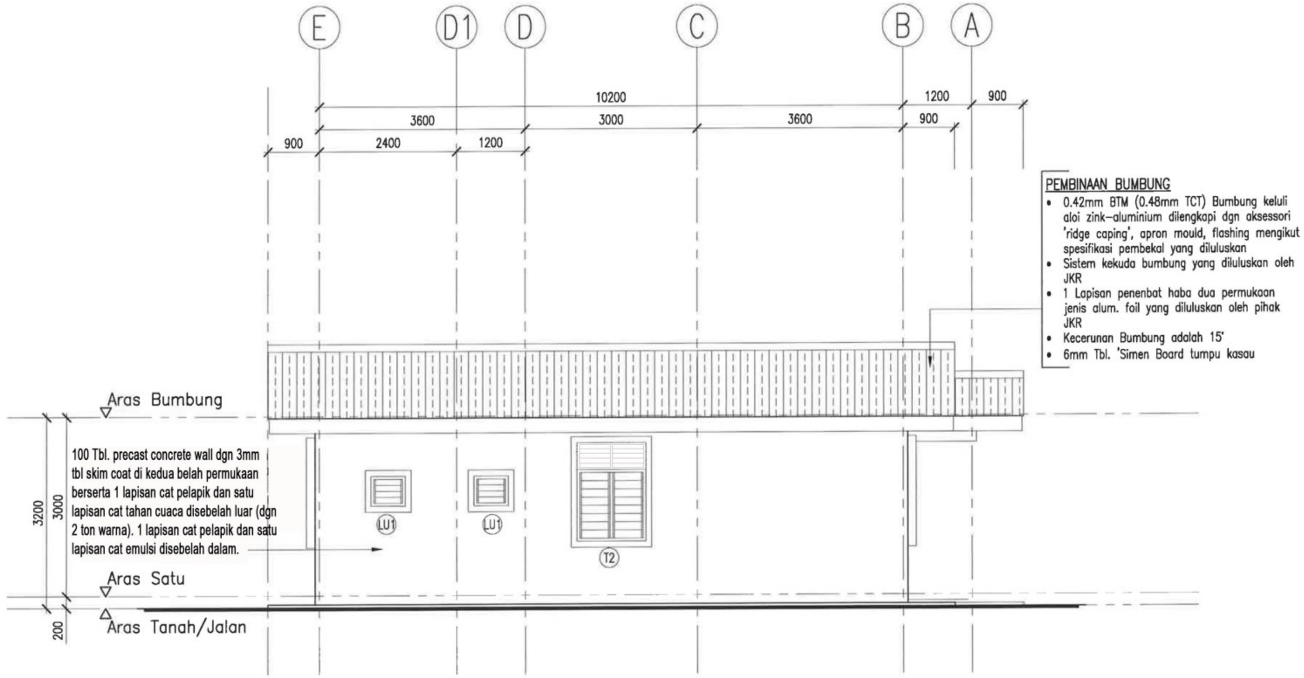


TAMPAK SISI KANAN

SKALA 1 : 75

PINDAAN A	PINDAAN B
1. Tambahan dinding bata di bahagian depan pintu Bilik Mandi (Grid 1a–1b). 2. Pinda kedudukan sinki pada Grid 1b.	1. Pinda lokasi Pintu P1 dari kedudukan Grid 2a kepada Grid 2. 2. Pinda tingkap T1 (1 bil.) kpd. T2 (2 bil.) pada kedudukan Grid E. 3. Pinda ketebalan lepa simen dari 18mm kepada 16mm. 4. Siling di bahagian luar (roof eaves) dikeluarkan

JKR CAWANGAN ARKITEK IBU PEJABAT JABATAN KERJA RAYA MALAYSIA	PENGARAH CAWANGAN ARKITEK Ar. SUTINA BT GHAZALLI	KETUA PENOLONG PENGARAH KANAN Ar. HJH. MARIANI NOOR BT SUHUD	PROJEK CADANGAN RUMAH KEKAL MANGSA BANJIR • JENIS SEBUAH	TAJUK LUKISAN • TAMPAK SISI KANAN	NO. LUKISAN File Elektronik: ..... JKR /HC/CA/11/01/PEL 15/008/RB1/T/02
	PENOLONG PENGARAH KANAN MASSROL NIZZAM B. MD SALLEH	PENOLONG PENGARAH NIK MUHAMMAD SYAHMAN NIK IBRAHIM			PINDAAN: A, B DILUKIS: MFADZIL; DISEMAK: NIK; SKALA: 1 : 75; TARIKH: 05/03/2015



TAMPAK SISI KIRI

SKALA 1 : 75

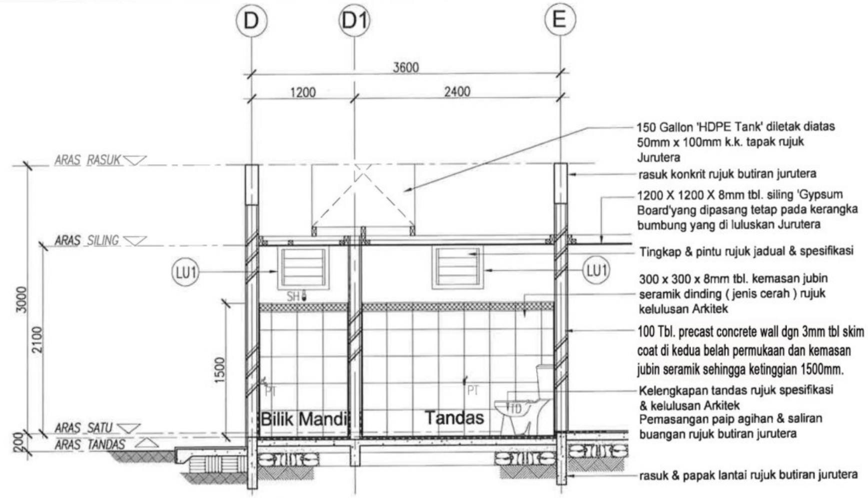
PINDAAN A	PINDAAN B
1. Tambahan dinding bata di bahagian depan pintu Bilik Mandi (Grid 1a–1b). 2. Pinda kedudukan sinki pada Grid 1b.	1. Pinda lokasi Pintu P1 dari kedudukan Grid 2a kepada Grid 2. 2. Pinda tingkap T1 (1 bil.) kpd. T2 (2 bil.) pada kedudukan Grid E. 3. Pinda ketebalan lepa simen dari 18mm kepada 16mm. 4. Siling di bahagian luar (roof eaves) dikeluarkan

JKR

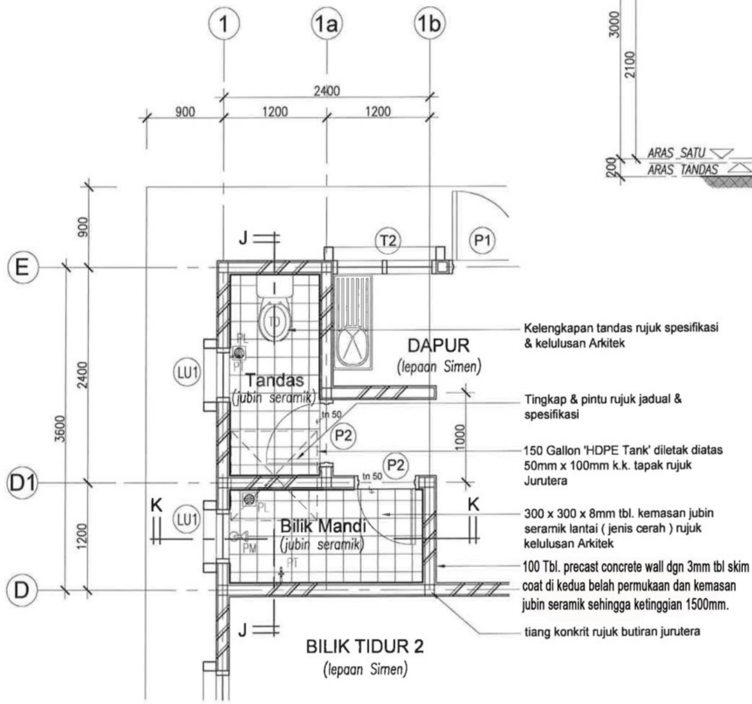
CAWANGAN ARKITEK
IBU PEJABAT JABATAN KERJA RAYA
MALAYSIA

PENGARAH CAWANGAN ARKITEK	KETUA PENOLONG PENGARAH KANAN	PROJEK	TAJUK LUKISAN	NO. LUKISAN File Elektronik: .....
Ar. SUTINA BT GHAZALLI	Ar. HJH. MARIANI NOOR BT SUHUD	CADANGAN RUMAH KEKAL MANGSA BANJIR • JENIS SEBUAH	• TAMPAK SISI KIRI	JKR /HC/CA/11/01/PEL 15/008/RB1/T/03
PENOLONG PENGARAH KANAN	PENOLONG PENGARAH			PINDAAN A B
MASSROL NIZZAM B. MD SALLEH	NIK MUHAMMAD SYAHMAN NIK IBRAHIM			DILUKIS MFADZIL / DISEMAK NIK / SKALA 1 : 75 / TARIKH 05/03/2015

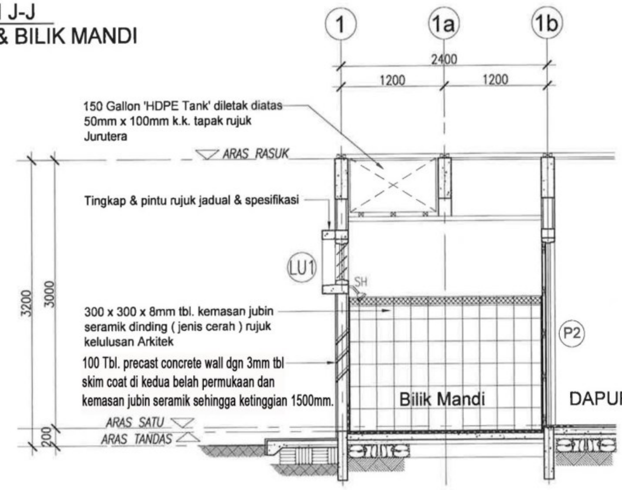
PINDAAN A	PINDAAN B
1. Tambahan dinding bata di bahagian depan pintu Bilik Mandi (Grid 1a–1b). 2. Pinda kedudukan sinki pada Grid 1b.	1. Pinda lokasi Pintu P1 dari kedudukan Grid 2a kepada Grid 2. 2. Pinda tingkap T1 (1 bil.) kpd. T2 (2 bil.) pada kedudukan Grid E. 3. Pinda ketebalan lepa simen dari 18mm kepada 16mm. 4. Siling di bahagian luar (roof eaves) dikeluarkan



KERATAN J-J
TANDAS & BILIK MANDI
SKALA 1 : 50



PELAN LANTAI
TANDAS & BILIK MANDI
SKALA 1 : 50



KERATAN K-K
TANDAS & BILIK MANDI
SKALA 1 : 50

CAWANGAN ARKITEK
IBU PEJABAT JABATAN KERJA RAYA MALAYSIA

PENGARAH CAWANGAN ARKITEK Ar. SUTINA BT GHAZALLI	KETUA PENOLONG PENGARAH KANAN Ar. HJH. MARIANI NOOR BT SUHUD	PROJEK CADANGAN RUMAH KEKAL MANGSA BANJIR • JENIS SEBUAH	TAJUK LUKISAN BUTIRAN TANDAS & BILIK MANDI
PENOLONG PENGARAH KANAN MASSROL NIZZAM B. MD SALLEH	PENOLONG PENGARAH NIK MUHAMMAD SYAHMAN NIK IBRAHIM		

NO. LUKISAN File Elektronik: .....
JKR /HC/CA/11/01/PEL 15/008/RB1/B/01

PINDAAN	A	B

DILUKIS	DISEMAK	SKALA	TARIKH
YAACOB	NIK	1 : 50	05/03/2015

CADANGAN RUMAH KEKAL MANGSA BANJIR SETINGKAT SEBANYAK 26 UNIT

Vol : CD-2

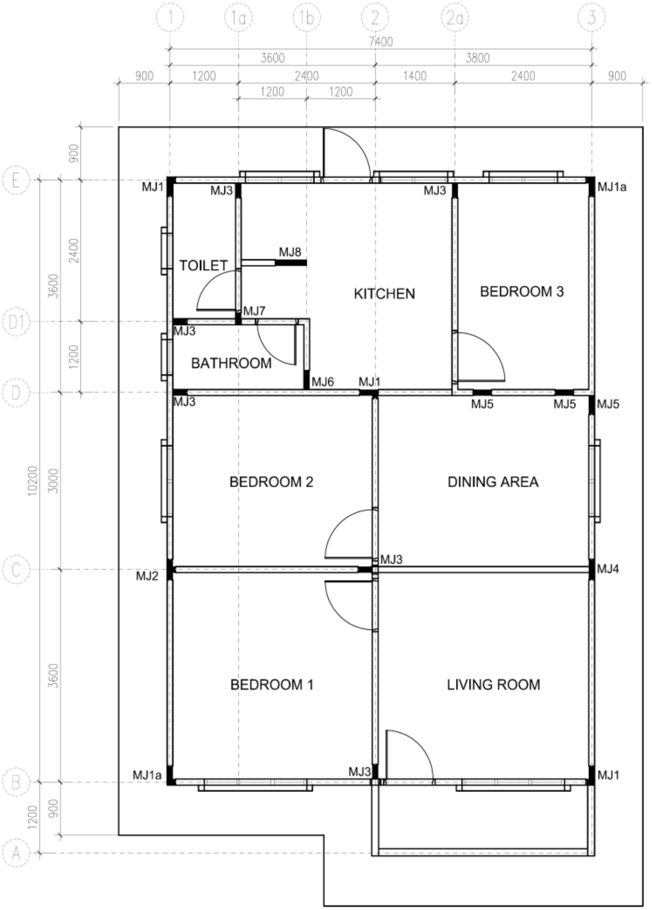
MUKIM KUALA NAL, KUALA KRAI, KELANTAN

UNTUK TETUAN:
JABATAN KERJA RAYA

JENIS SEBUAH BERKELOMPOK

3D DRAWI NG

SYSTEM PROVIDER
HC PRECAST SYSTEM SDN. BHD. (586697–M)
No.23, Jalan Seri Sarawak 20B/KS2, Taman Seri Andalas,
41200 Klang, Selangor D.E. Tel:03–3323 8995 Fax:03–3319 8994
e–mail:enquiry@hcprecast.com, Http:www.hcprecast.com



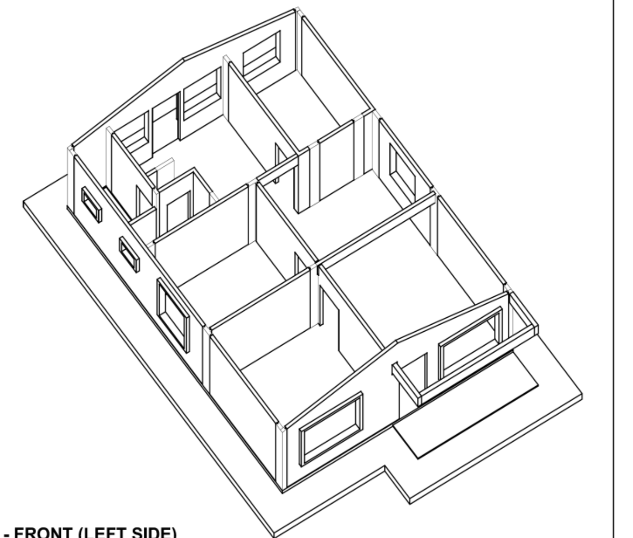
GROUND FLOOR COLUMN LAYOUT

SCALE 1:75

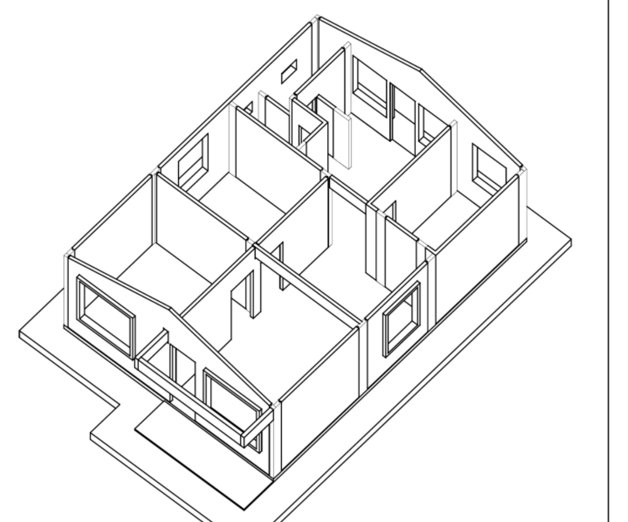
TOTAL VOLUME: 17.28m³
PRECAST ELEMENTS: 88%
WET WORKS ON SITE: 12%

MODIFIED JOINT - 1 UNIT

COLUMN	SHAPED	QUANTITY
MJ1	125 / 300	3
MJ1a	125 / 300	2
MJ2	125 / 300	1
MJ3	100 / 225	6
MJ4	100 / 300	1
MJ5	100 / 300	3
MJ6	100 / 325	1
MJ7	100 / 200	1
MJ8	100 / 550	1
	TOTAL	19



3D VIEW - FRONT (LEFT SIDE)



3D VIEW - FRONT (RIGHT SIDE)

SYSTEM PROVIDER

HC PRECAST SYSTEM SDN. BHD. (586697–M)
No.23, Jalan Seri Sarawak 20B/KS2, Taman Seri Andalas,
41200 Klang, Selangor D.E. Tel:03–3323 8995 Fax:03–3319 8994
e–mail:enquiry@hcprecast.com, Http:www.hcprecast.com

MANUFACTURER

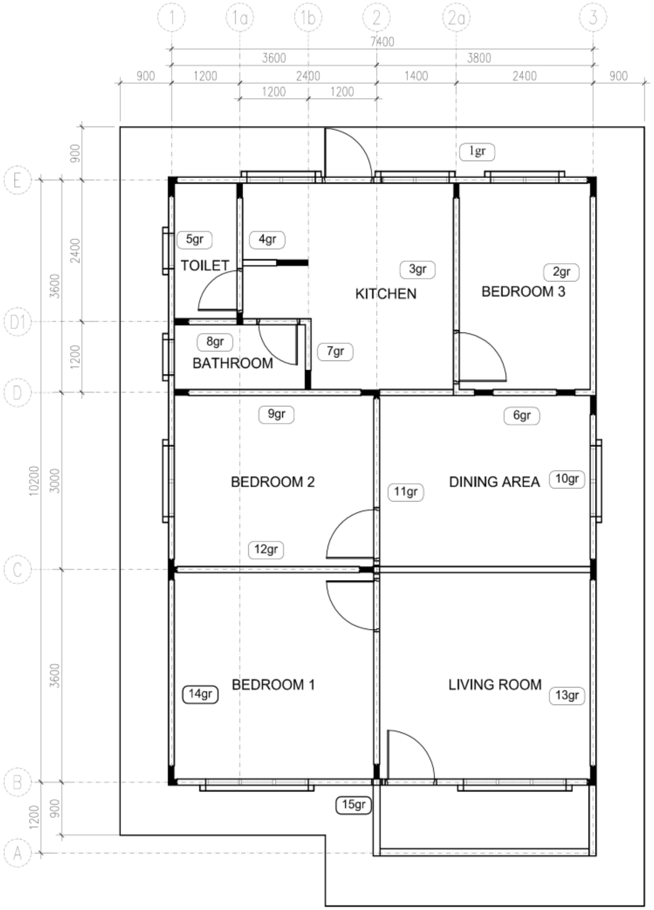
HC MANUFACTURING SDN. BHD. (585570–T)
No.23–1, Jalan Seri Sarawak 20B/KS2, Taman Seri Andalas,
41200 Klang, Selangor D.E.
Tel:03–3323 7999 Fax:03–3323 8993

DRAWN :	KC
DATE :	DEC 2015
CHECKED :	3993
EXAM'D :	3993
APPR'D :	3993
SCALE :	1:75

CADANGAN RUMAH KEKAL MANGSA BANJIR
- JENIS SEBUAH BERKELOMPOK

DRAWING TITLE :
ARCHITECTURAL DRAWING
GROUND FLOOR COLUMN LAYOUT
& 3D VIEWS

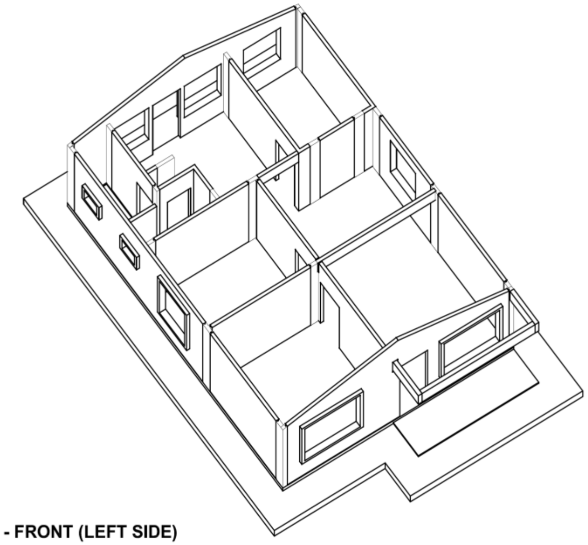
DRAWING NO : HC/JKR–CRKMB/JS/3D–01 REV : –
SYSTEM : – REV : –



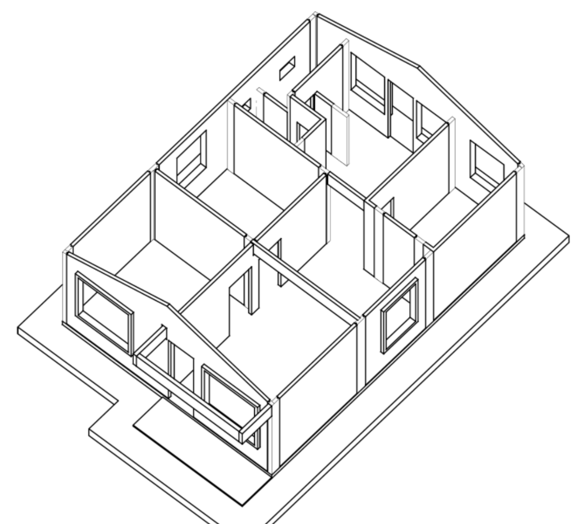
GROUND FLOOR PANEL LAYOUT

SCALE 1:75

TOTAL VOLUME: 17.28m³
PRECAST ELEMENTS: 88%
WET WORKS ON SITE: 12%

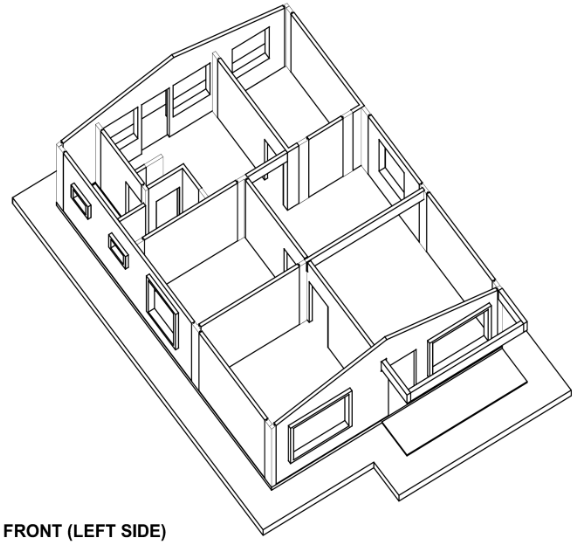


3D VIEW - FRONT (LEFT SIDE)

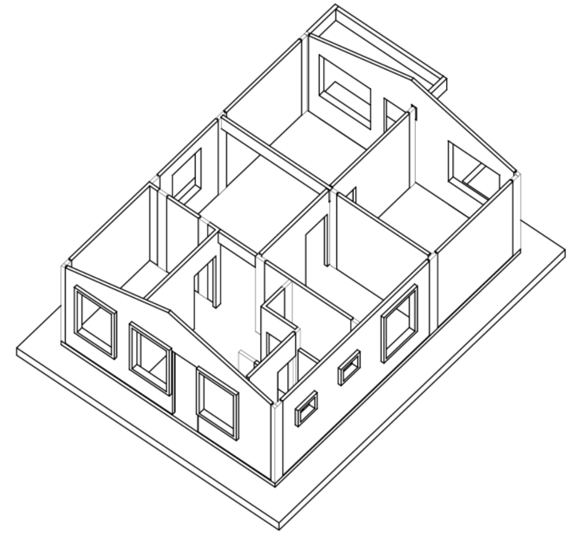


3D VIEW - FRONT (RIGHT SIDE)

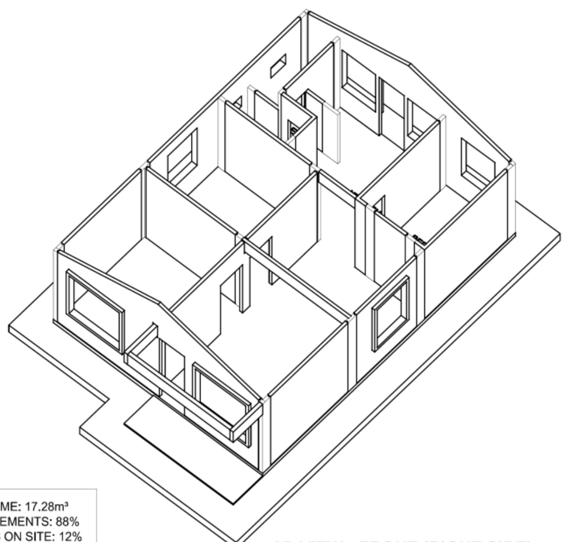
SYSTEM PROVIDER **HC PRECAST SYSTEM SDN. BHD.** (586697-M) No.23, Jalan Seri Sarawak 20B/KS2, Taman Seri Andalas, 41200 Klang, Selangor D.E. Tel:03-3323 8995 Fax:03-3319 8994 e-mail:enquiry@hcprecast.com, Http:www.hcprecast.com DETAILS SHOWN IN THIS DRAWING ARE PROPERTY OF HC PRECAST SYSTEM & PROTECTED BY PATENTS. ALL COPYRIGHT ARE RESERVED. (US 6,829,870 B2) & (MY-124213-A)	MANUFACTURER **HC MANUFACTURING SDN. BHD.** (585570-T) No.23-1, Jalan Seri Sarawak 20B/KS2, Taman Seri Andalas, 41200 Klang, Selangor D.E. Tel:03-3323 7999 Fax:03-3323 8993	DRAWN : KC DATE : DEC 2015 CHECKED : 3993 EXAM'D : 3993 APPR'D : 3993 SCALE : 1:75	CADANGAN RUMAH KEKAL MANGSA BANJIR - JENIS SEBUAH BERKELOMPOK	DRAWING TITLE : ARCHITECTURAL DRAWING GROUND FLOOR PANEL LAYOUT & 3D VIEWS DRAWING NO: HC/JKR-CRKMB/JS/3D-02 REV: - SYSTEM : - REV: -



3D VIEW - FRONT (LEFT SIDE)

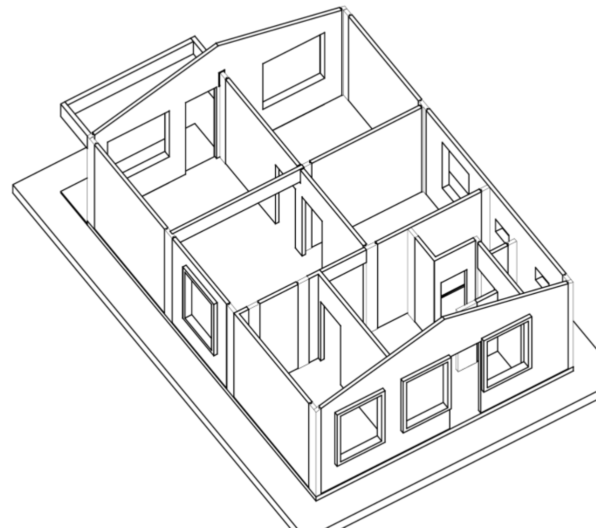


3D VIEW - BACK (LEFT SIDE)



TOTAL VOLUME: 17.28m³
PRECAST ELEMENTS: 88%
WET WORKS ON SITE: 12%

3D VIEW - FRONT (RIGHT SIDE)



3D VIEW - BACK (RIGHT SIDE)

SYSTEM PROVIDER

HC PRECAST SYSTEM SDN. BHD. (586697–M)

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e–mail:enquiry@hcprecast.com, Http:www.hcprecast.com

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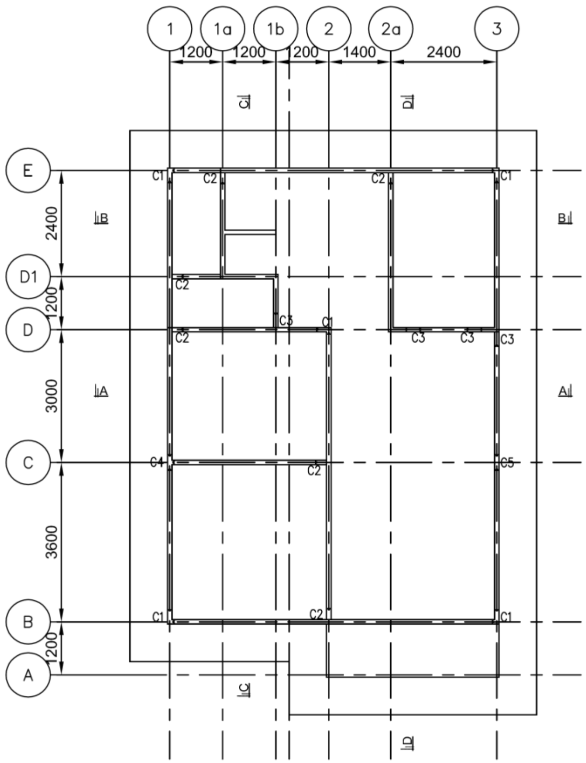
41200 Klang, Selangor D.E.
Tel:03–3323 7999 Fax:03–3323 8993

DRAWN :	KC
DATE :	DEC 2015
CHECKED :	3993
EXAM'D :	3993
APPR'D :	3993
SCALE :	1:75

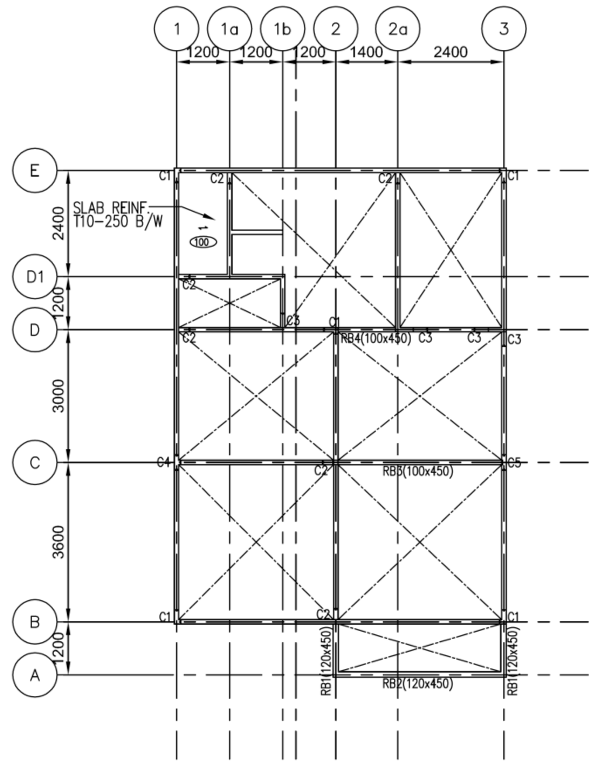
CADANGAN RUMAH KEKAL MANGSA BANJIR
- JENIS SEBUAH BERKELOMPOK

DRAWING TITLE : ARCHITECTURAL DRAWING 3D VIEWS	
DRAWING NO : HC/JKR-CRKMB/JS/3D-03	REV : –
SYSTEM : –	REV : –



FOUNDATION PLAN

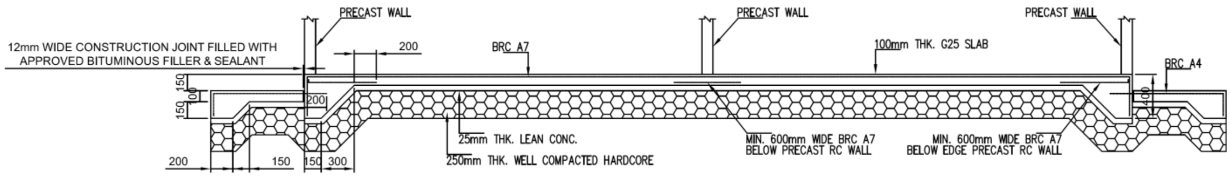
SCALE: 1:100



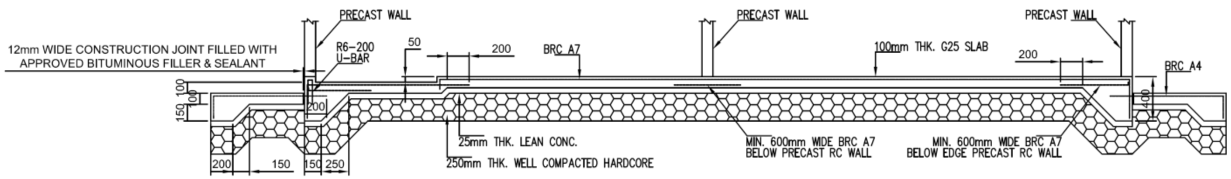
ROOF PLAN

SCALE: 1:100

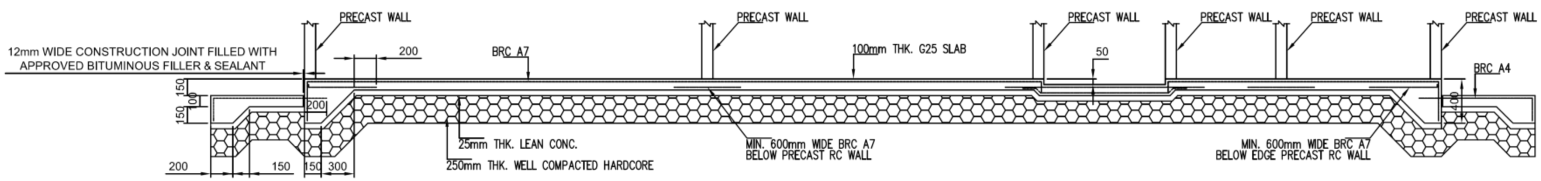
EPKM ENGINEERING SDN BHD (formerly known as PK Mak Consulting Engineer) B2-08, PJ INDUSTRIAL PARK, JALAN KEMAJUAN, SECTION 13, 46200 PETALING JAYA, SELANGOR DARUL EHSAN Tel :603-7931 8112 Fax :603-7931 8112 Email : pkmakcon@gmail.com	SYSTEM PROVIDER **HC PRECAST SYSTEM SDN. BHD.** (586697-M) No.23, Jalan Seri Sarawak 20B/KS2, Taman Seri Andalas, 41200 Klang, Selangor D.E. Tel: 03-3323 8995 Fax: 03-3319 8994 e-mail: enquiry@hcprecast.com, Http: www.hcprecast.com DETAILS SHOWN IN THIS DRAWING ARE PROPERTY OF HC PRECAST SYSTEM & PROTECTED BY PATENTS. ALL COPYRIGHT ARE RESERVED. (US 6,829,870 B2) & (MY-124213-A)	MANUFACTURER **HC MANUFACTURING SDN. BHD.** (585570-T) No.23-1, Jalan Seri Sarawak 20B/KS2, Taman Seri Andalas, 41200 Klang, Selangor D.E. Tel: 03-3323 7999 Fax: 03-3323 8993	DRAWN : DATE : CHECKED : EXAM'D : APPR'D : SCALE :	- DEC 2015 3993 3993 3993 1:100	CADANGAN RUMAH KEKAL MANGSA BANJIR - JENIS SEBUAH BERKELOMPOK	DRAWING TITLE : FOUNDATION & ROOF PLAN DRAWING NO : EPKM/JKR-CRKMB/JS/01 SYSTEM : -	REV : - REV : -



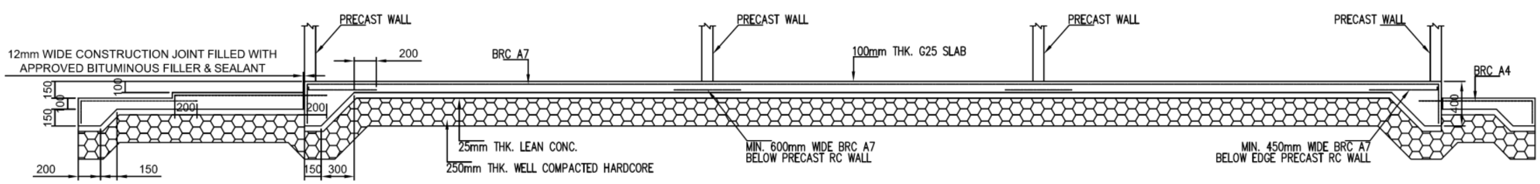
SECTION A–A
SCALE: 1:40



SECTION B–B
SCALE: 1:40



SECTION C–C
SCALE: 1:40



SECTION D–D
SCALE: 1:40

EPKM ENGINEERING SDN BHD
(formerly known as PK Mak Consulting Engineer)
B2-08, PJ INDUSTRIAL PARK,
JALAN KEMAJUAN, SECTION 13,
46200 PETALING JAYA,
SELANGOR DARUL EHSAN
Tel :603-7931 8112 Fax :603-7931 8112
Email : pkmakcon@gmail.com

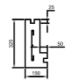
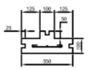
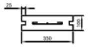
SYSTEM PROVIDER
HC PRECAST SYSTEM SDN. BHD. (586697–M)
No.23, Jalan Seri Sarawak 20B/KS2, Taman Seri Andalas, 41200 Klang, Selangor D.E. Tel: 03–3323 8995 Fax: 03–3319 8994
e–mail: enquiry@hcprecast.com, Http: www.hcprecast.com

MANUFACTURER
HC MANUFACTURING SDN. BHD. (585570–T)
No.23–1, Jalan Seri Sarawak 20B/KS2, Taman Seri Andalas, 41200 Klang, Selangor D.E.
Tel: 03–3323 7999 Fax: 03–3323 8993

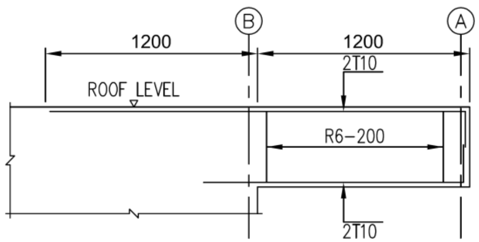
DRAWN :	–
DATE :	DEC 2015
CHECKED :	3993
EXAM'D :	3993
APPR'D :	3993
SCALE :	1:40

CADANGAN RUMAH KEKAL MANGSA BANJIR
- JENIS SEBUAH BERKELOMPOK

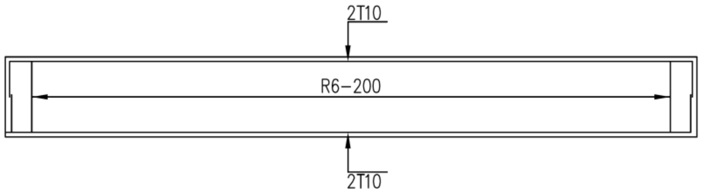
DRAWING TITLE : SECTIONS
DRAWING NO : EPKM/JKR-CRKMB/JS/02 REV : –
SYSTEM : – REV : –

COL. MARK / FLOOR		C1	C2	C3	C4	C5
GROUND FLOOR–ROOF						
	MAIN BAR	3T10	2T10	3T10	3T10	3T10
	OUTER TIES	R6 – 200	R6 – 200	R6 – 200	R6 – 200	R6 – 200
	INNER TIES	Nil.	Nil.	Nil.	Nil.	Nil.
	COL. SIZE	AS SHOWN	AS SHOWN	AS SHOWN	AS SHOWN	AS SHOWN

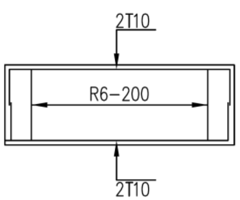
COLUMN REINFORCEMENT SCHEDULE



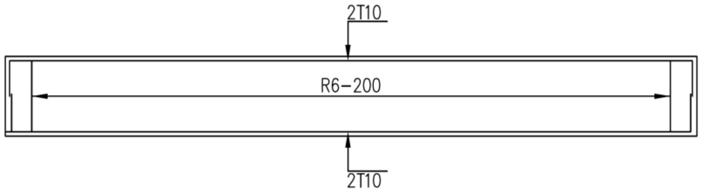
RB1 (120x450)
SCALE: 1:25



RB2 (120x450)
SCALE: 1:25



RB4 (100x450)
SCALE: 1:25



RB3 (100x450)
SCALE: 1:25

EPKM ENGINEERING SDN BHD
(formerly known as PK Mak Consulting Engineer)
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JALAN KEMAJUAN, SECTION 13,
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SELANGOR DARUL EHSAN
Tel :603-7931 8112 Fax :603-7931 8112
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41200 Klang, Selangor D.E.
Tel: 03–3323 7999 Fax: 03–3323 8993

DRAWN :	–
DATE :	DEC 2015
CHECKED :	3993
EXAM'D :	3993
APPR'D :	3993
SCALE :	1:25

CADANGAN RUMAH KEKAL MANGSA BANJIR
- JENIS SEBUAH BERKELOMPOK

DRAWING TITLE :
COLUMN REINFORCEMENT SCHEDULE
& ROOF BEAM DETAILS

DRAWING NO : EPKM/JKR-CRKMB/JS/03
REV : –
SYSTEM : –
REV : –

CADANGAN RUMAH KEKAL MANGSA BANJIR
SETINGKAT SEBANYAK 26 UNIT

Vol : CD-5

MUKIM KUALA NAL, KUALA KRAI, KELANTAN

UNTUK TETUAN:
JABATAN KERJA RAYA

JENIS SEBUAH BERKELOMPOK

ARCHITECTURAL PANEL LIST

SYSTEM PROVIDER
HC PRECAST SYSTEM SDN. BHD. (586697-M)
No.23, Jalan Seri Sarawak 20B/KS2, Taman Seri Andalas,
41200 Klang, Selangor D.E. Tel:03-3323 8995 Fax:03-3319 8994
e-mail:enquiry@hcprecast.com, Http:www.hcprecast.com

HC PRECAST SYSTEM

TITLE : CADANGAN RUMAL KEKAL MANGSA BANJIR
TYPE : JENIS SEBUAH BERKELOMPOK
CONCRETE: G30

SUMMARIZE OF PANEL NUMBER

Type	Qty of Panel	Nos of Unit	Volume per Unit (m^3)	Weight per Unit (tonnes)	Total Volume (m^3)	Total Weight (tonnes)
Jenis Sebuah	15	26	14.960	36.053	388.960	937.378
TOTAL	15	26	14.960	36.053	388.960	937.378

JENIS SEBUAH BERKELOMPOK

~ Panel Check List
~ Architectural Panel List

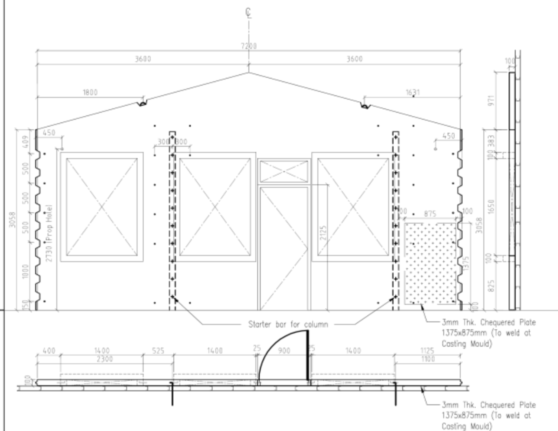
HC PRECAST SYSTEM

TITLE : CADANGAN RUMAL KEKAL MANGSA BANJIR
TYPE : JENIS SEBUAH BERKELOMPOK
CONCRETE : G30

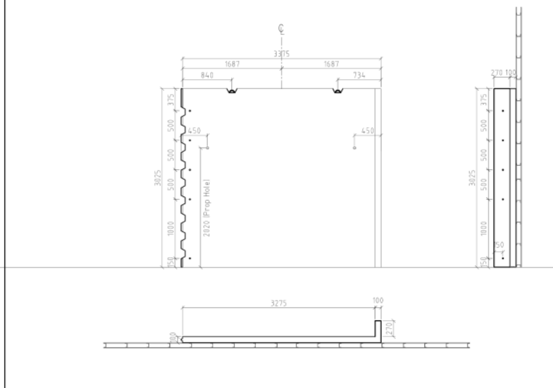
	POSITION	PANEL NAME	Chequered Plate	Beam Opening	Refer site PS mould	Panel Height	P & F	Middle P & F	Window	Door	Starter Bar		Power pt.		Wall Light point	6A Switch 1525(h)	TV Outlet 325(h)	Tel Outlet 325(h)	DB/Meter 2305(h)	Cold Water Pipe	Volume (m^3)	Weight (Tonnes)
											Side	Top	325(h)	1525(h)								
1	1gr	7200 (W2)(W2)(D1)(W2)	yes			3058	std		W2	D1	yes										1.916	4.618
2	2gr	3375				3025	std				yes										1.105	2.663
3	3gr	3350 (D2)				3025	std			D2	yes										0.906	2.183
4	4gr	1950 (D3)	yes			3025	std			D3	yes										0.561	1.352
5	5gr	6150 (W3) (W3) (W2)	yes			3025	std		W3 & W2		yes										1.724	4.155
6	6gr	1110				3025	std				yes										0.340	0.819
7	7gr	1200 (D3)				3025	std			D3	yes										0.438	1.056
8	8gr	850				2245	std				yes										0.193	0.465
9	9gr	3025	yes			3025	std				yes										0.920	2.217
10	10gr	2450 (W2)				3025	non-std 1		W2		yes										0.609	1.468
11	11gr	6200 (D2) (D2)		yes		3025	std			D2	yes										1.490	3.591
12	12gr	3200				3025	std				yes										0.973	2.345
13	13gr	3150				3025	std				yes										0.957	2.306
14	14gr	3150				3025	std				yes										0.957	2.306
15	15gr	7200 (W1) (D1) (W1)		yes		3058	std		W1	D1	yes										1.871	4.509
																					14.960	36.053

TOP VIEW

FRONT VIEW



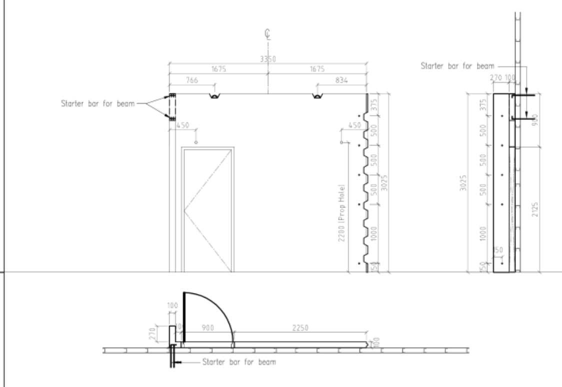
1gr	7200 (W2)(W2)(D1) (W2)	Lifting C-Channel	Thickness	Window Cornice	Prop Hole Height	P&F	TF	BP	M
		LC(Std:1)	100	3	2730	(std)	~	(std)	(std)



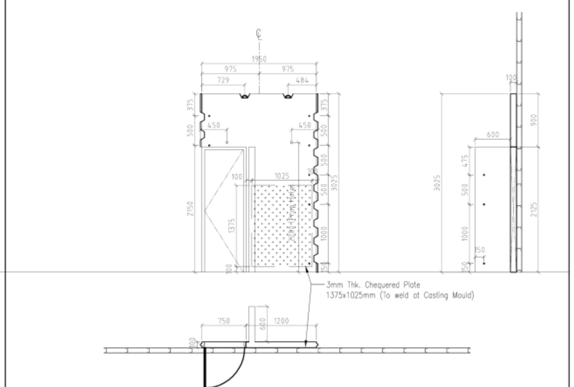
2gr	3375	Lifting C-Channel	Thickness	Window Cornice	Prop Hole Height	P&F	TF	BP	M
		LC(Std:1)	100	~	2020	(std)	~	(std)	(std)

TOP VIEW

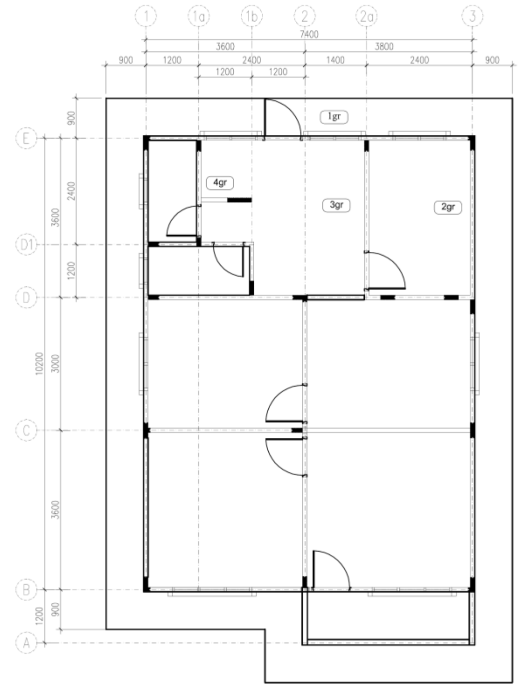
FRONT VIEW



3gr	3350 (D2)	Lifting C-Channel	Thickness	Window Cornice	Prop Hole Height	P&F	TF	BP	M
		LC(Std:1)	100	~	2200	(std)	~	(std)	(std)



4gr	1950 (D3)	Lifting C-Channel	Thickness	Window Cornice	Prop Hole Height	P&F	TF	BP	M
		LC(Std:1)	100	~	2200	(std)	~	(std)	(std)



GROUND FLOOR LAYOUT

SCALE 1:100

SYSTEM PROVIDER
HC PRECAST SYSTEM SDN. BHD. (586697-M)
No.23, Jalan Seri Sarawak 20B/KS2, Taman Seri Andalas, 41200 Klang, Selangor D.E. Tel:03-3323 8995 Fax:03-3319 8994
e-mail:enquiry@hcprecast.com, Http:www.hcprecast.com

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Tel:03-3323 7999 Fax:03-3323 8993

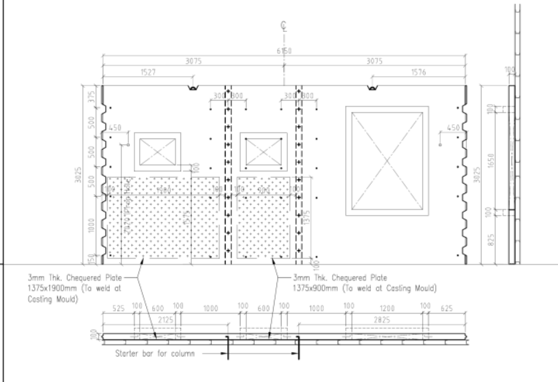
DRAWN :	KC
DATE :	DEC 2015
CHECKED :	3993
EXAM'D :	3993
APPR'D :	3993
SCALE :	1:75

CADANGAN RUMAH KEKAL MANGSA BANJIR - JENIS SEBUAH BERKELOMPOK

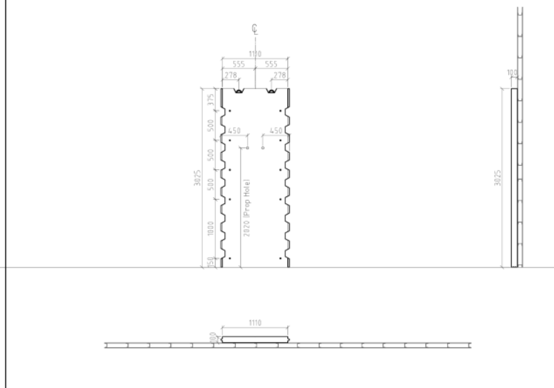
DRAWING TITLE : ARCHITECTURAL PANEL LIST

DRAWING NO. HC/JKR-CRKMB/JS/APL-01 REV : -

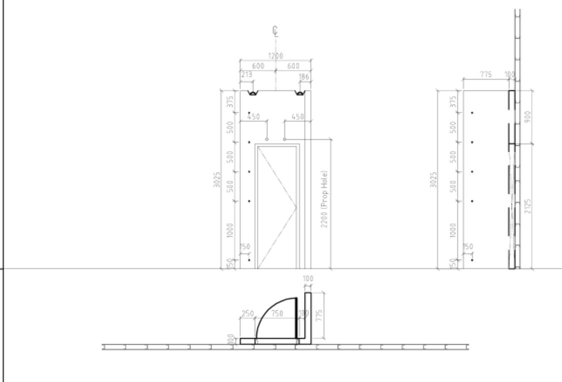
SYSTEM : - REV : -



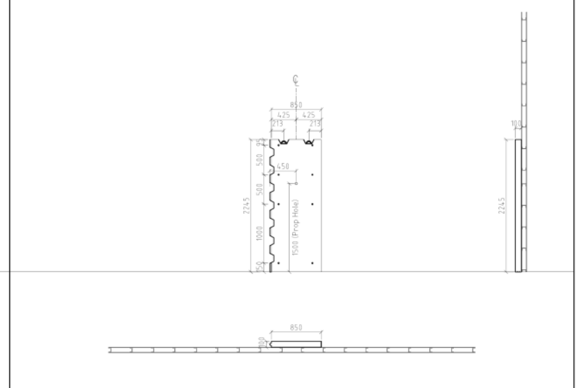
5gr	6150 (W3) (W3) (W2)	Lifting C-Channel	Thickness	Window Cornice	Prop Hole Height	P&F	TF	BP	M
		LC(Std:1)	100	3	2020	(std)	~	(std)	(std)



6gr	1110	Lifting C-Channel	Thickness	Window Cornice	Prop Hole Height	P&F	TF	BP	M
		LC(Std:1)	100	~	2020	(std)	~	(std)	(std)



7gr	1200 (D3)	Lifting C-Channel	Thickness	Window Cornice	Prop Hole Height	P&F	TF	BP	M
		LC(Std:1)	100	~	2200	(std)	~	(std)	(std)



8gr	850	Lifting C-Channel	Thickness	Window Cornice	Prop Hole Height	P&F	TF	BP	M
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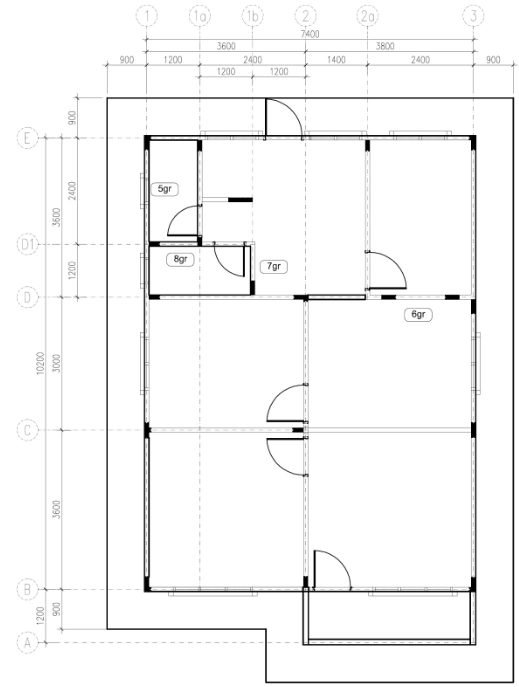

GROUND FLOOR LAYOUT

SCALE 1:100

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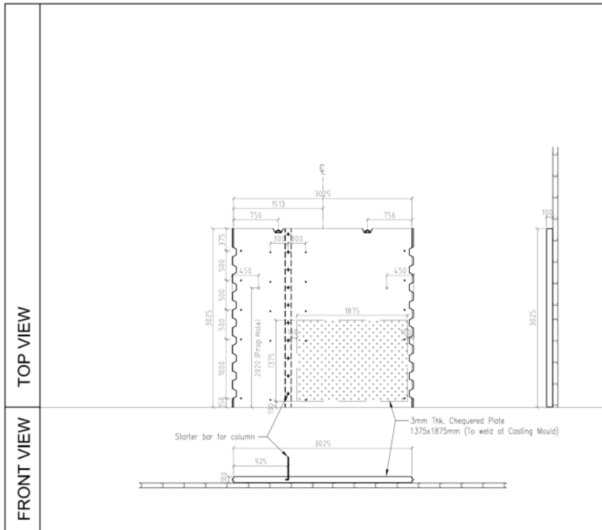
DRAWN :	KC
DATE :	DEC 2015
CHECKED :	3993
EXAM'D :	3993
APPR'D :	3993
SCALE :	1:75

CADANGAN RUMAH KEKAL MANGSA BANJIR - JENIS SEBUAH BERKELOMPOK

DRAWING TITLE : ARCHITECTURAL PANEL LIST

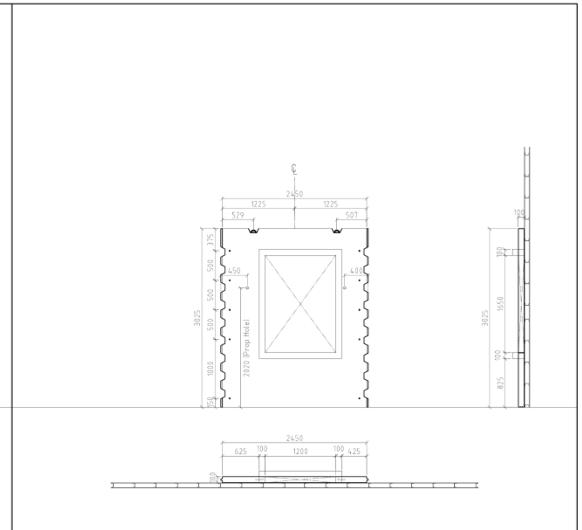
DRAWING NO. HC/JKR–CRKMB/JS/APL–02 REV : –

SYSTEM : – REV : –



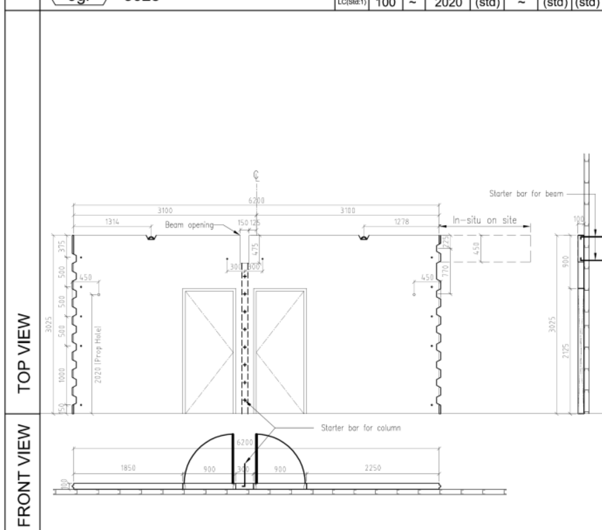
9gr 3025

Lifting C-Channel	Thickness	Window Cornice	Prop Hole Height	P&F	TF	BP	M
LC(Std:1)	100	~	2020	(std)	~	(std)	(std)



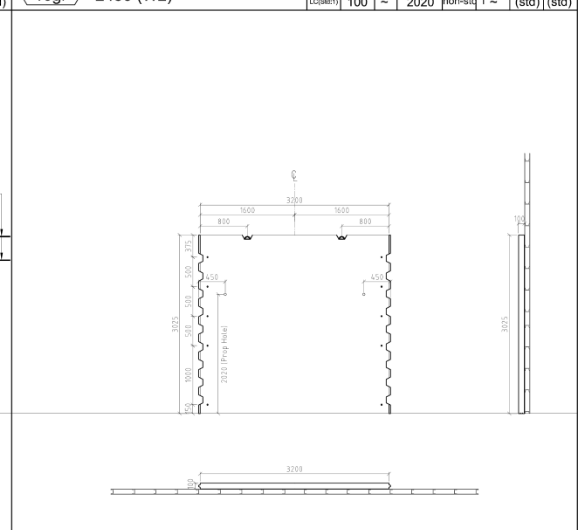
10gr 2450 (W2)

Lifting C-Channel	Thickness	Window Cornice	Prop Hole Height	P&F	TF	BP	M
LC(Std:1)	100	~	2020	non-std	1 ~	(std)	(std)



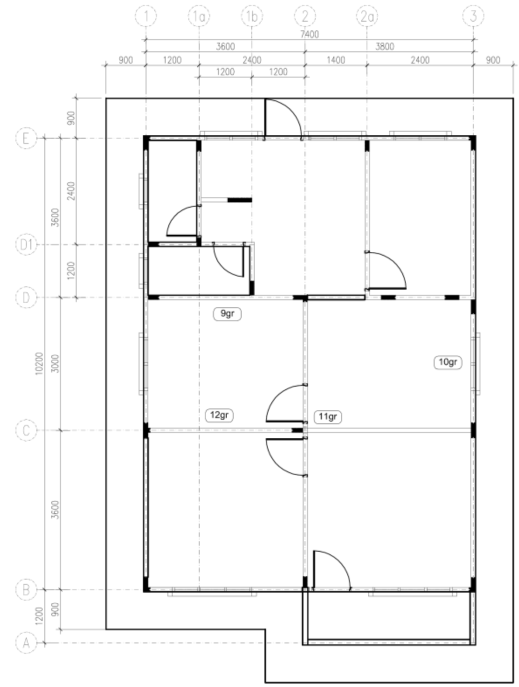
11gr 6200 (D2) (D2)

Lifting C-Channel	Thickness	Window Cornice	Prop Hole Height	P&F	TF	BP	M
LC(Std:1)	100	~	2020	(std)	~	(std)	(std)



12gr 3200

Lifting C-Channel	Thickness	Window Cornice	Prop Hole Height	P&F	TF	BP	M
LC(Std:1)	100	~	2020	(std)	~	(std)	(std)



GROUND FLOOR LAYOUT

SCALE 1:100

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No.23, Jalan Seri Sarawak 20B/KS2, Taman Seri Andalas,
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Tel:03-3323 7999 Fax:03-3323 8993

DRAWN :	KC
DATE :	DEC 2015
CHECKED :	3993
EXAM'D :	3993
APPR'D :	3993
SCALE :	1:75

CADANGAN RUMAH KEKAL MANGSA BANJIR
- JENIS SEBUAH BERKELOMPOK

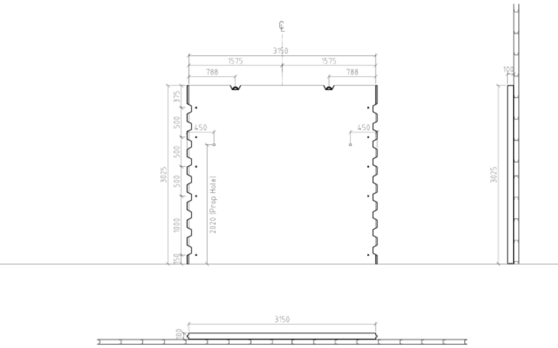
DRAWING TITLE : ARCHITECTURAL PANEL LIST

DRAWING NO HC/JKR-CRKMB/JS/APL-03 REV : -

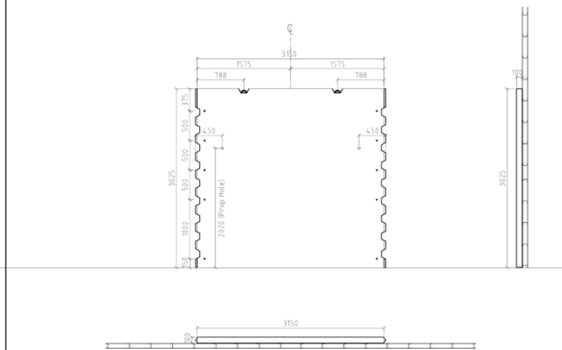
SYSTEM : - REV : -

TOP VIEW

FRONT VIEW



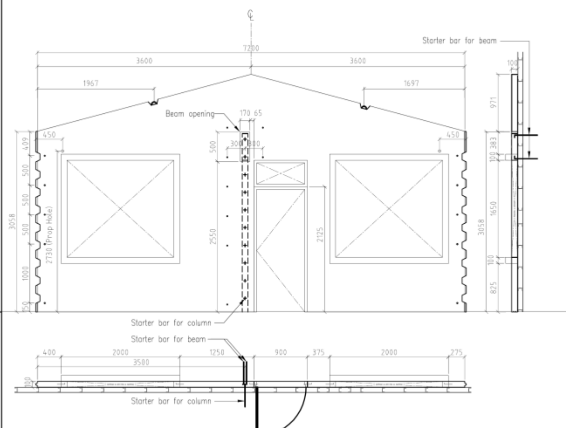
13gr	3150							
Lifting C-Channel	Thickness	Window Cornice	Prop Hole Height	P&F	TF	BP	M	
LC(Std:1)	100	~	2020	(std)	~	(std)	(std)	



14gr	3150							
Lifting C-Channel	Thickness	Window Cornice	Prop Hole Height	P&F	TF	BP	M	
LC(Std:1)	100	~	2020	(std)	~	(std)	(std)	

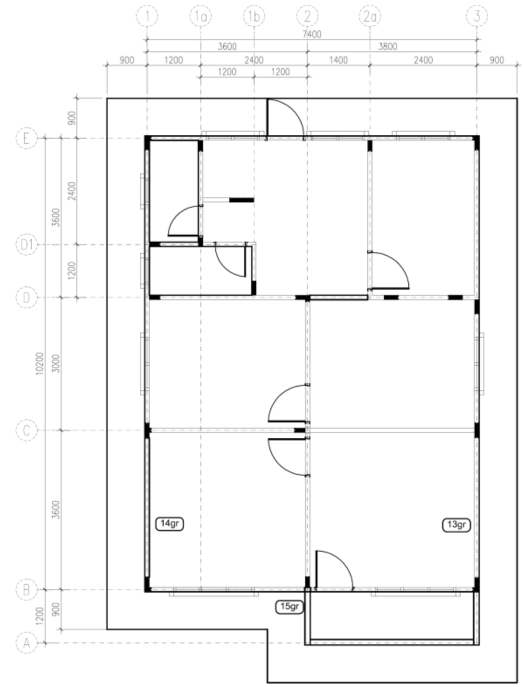
TOP VIEW

FRONT VIEW



15gr	7200 (W1) (D1) (W1)							
Lifting C-Channel	Thickness	Window Cornice	Prop Hole Height	P&F	TF	BP	M	
LC(Std:1)	100	~	2730	(std)	~	(std)	(std)	

Lifting C-Channel	Thickness	Window Cornice	Prop Hole Height	P&F	TF	BP	M



GROUND FLOOR LAYOUT

SCALE 1:100

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DRAWN :	KC
DATE :	DEC 2015
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EXAM'D :	3993
APPR'D :	3993
SCALE :	1:75

CADANGAN RUMAH KEKAL MANGSA BANJIR
- JENIS SEBUAH BERKELOMPOK

DRAWING TITLE : ARCHITECTURAL PANEL LIST

DRAWING NO HC/JKR-CRKMB/JS/APL-04 REV : -

SYSTEM : - REV : -

CADANGAN RUMAH KEKAL MANGSA BANJIR SETINGKAT SEBANYAK 26 UNIT

Vol : CD-6

MUKIM KUALA NAL, KUALA KRAI, KELANTAN

UNTUK TETUAN:
JABATAN KERJA RAYA

JENIS SEBUAH BERKELOMPOK

STRUCTURAL PANEL & BEAM LIST

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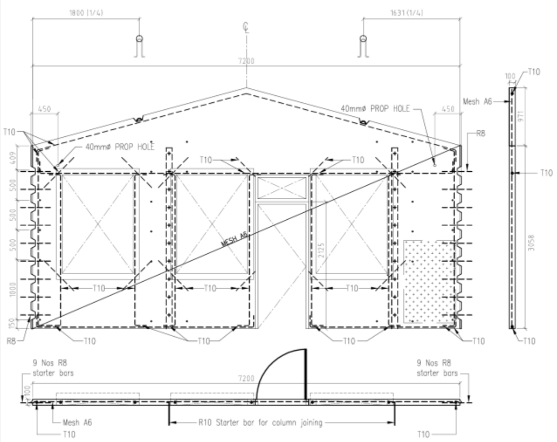
JENIS SEBUAH BERKELOMPOK

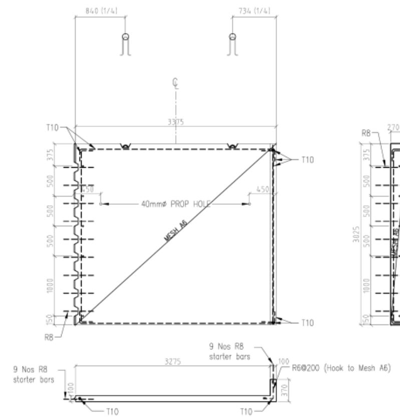
~ Structural Panel & Beam List

TOP VIEW

FRONT VIEW



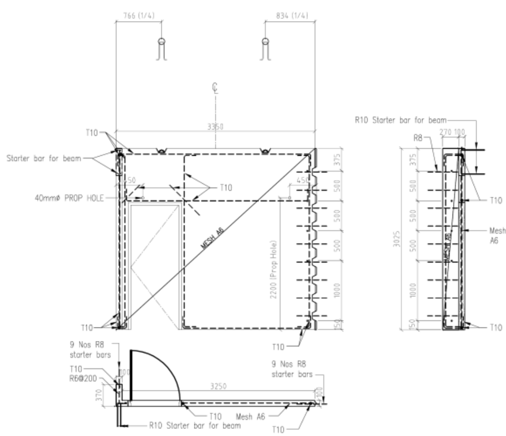
1gr 7200 (W2)(W2)(D1) (W2)



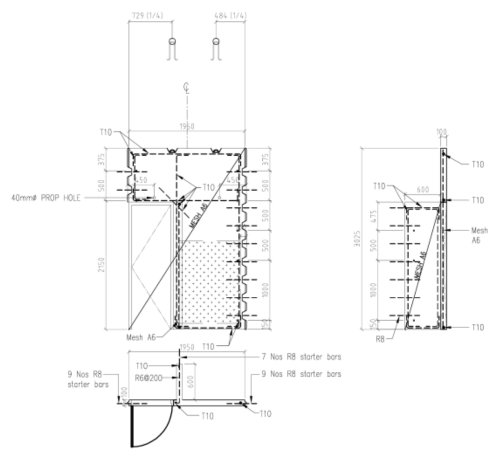
2gr 3375

TOP VIEW

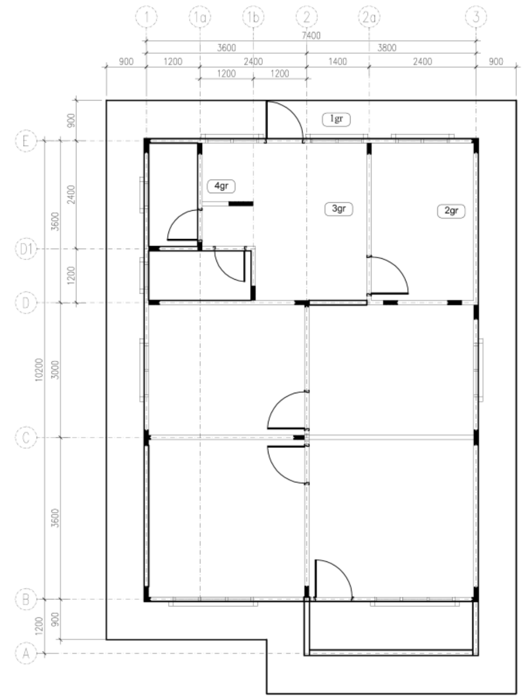
FRONT VIEW



3gr 3350 (D2)



4gr 1950 (D3)



GROUND FLOOR LAYOUT

SCALE 1:100

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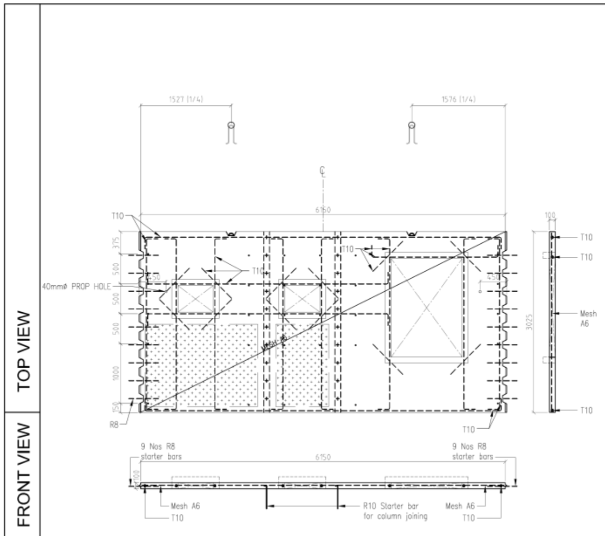
DRAWN :	KC
DATE :	DEC 2015
CHECKED :	3993
EXAM'D :	3993
APPR'D :	3993
SCALE :	1:75

CADANGAN RUMAH KEKAL MANGSA BANJIR - JENIS SEBUAH BERKELOMPOK

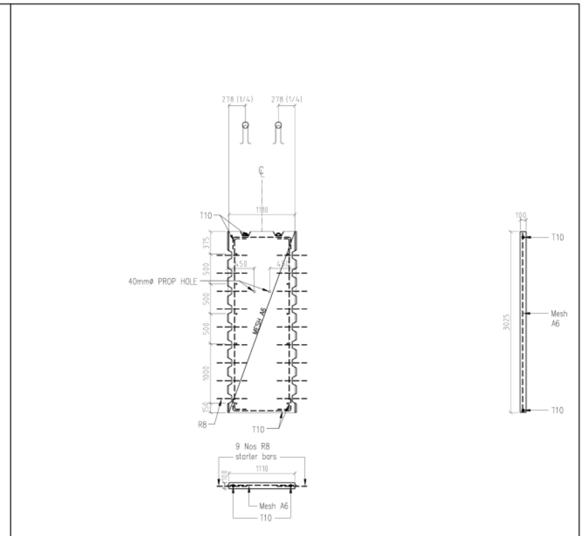
DRAWING TITLE : STRUCTURAL PANEL LIST

DRAWING NO HC/JKR-CRKMB/JS/SPL-01 REV : -

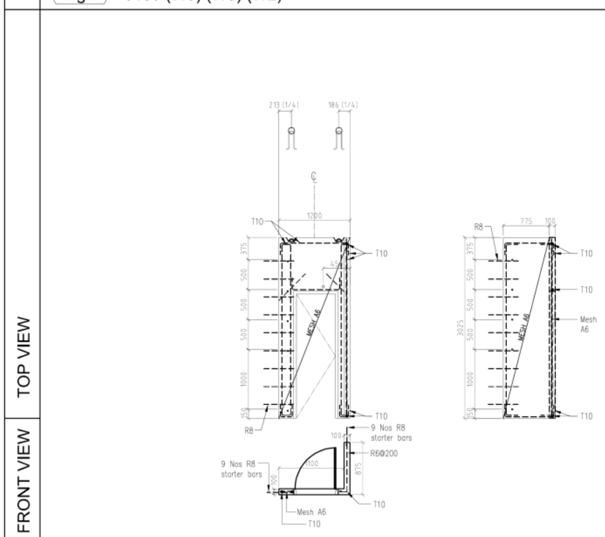
SYSTEM : - REV : -



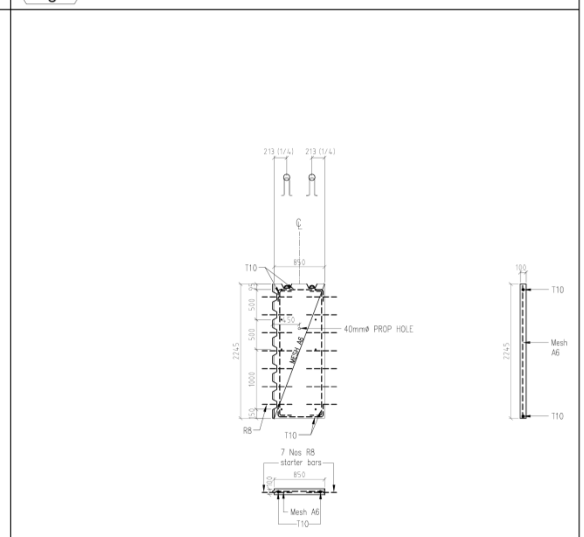
5gr 6150 (W3) (W3) (W2)



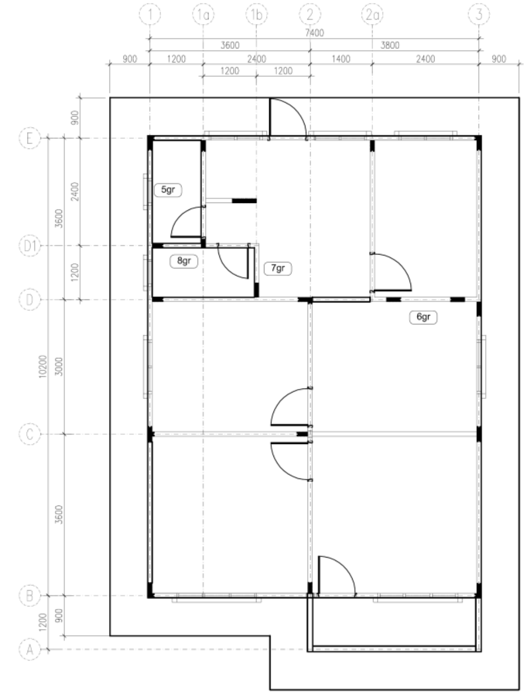
6gr 1110



7gr 1200 (D3)



8gr 850



GROUND FLOOR LAYOUT

SCALE 1:100

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DRAWN :	KC
DATE :	DEC 2015
CHECKED :	3993
EXAM'D :	3993
APPR'D :	3993
SCALE :	1:75

CADANGAN RUMAH KEKAL MANGSA BANJIR
- JENIS SEBUAH BERKELOMPOK

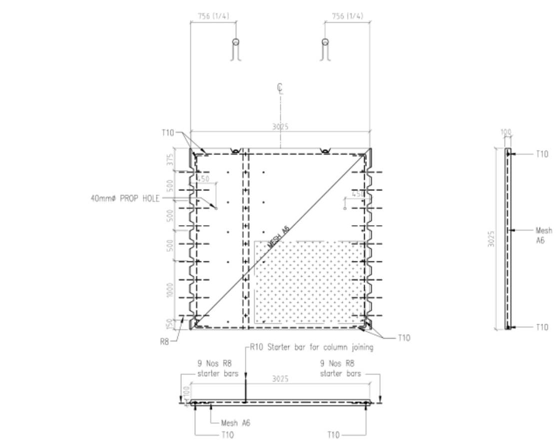
DRAWING TITLE :
STRUCTURAL PANEL LIST

DRAWING NO: HC/JKR-CRKMB/JS/SPL-02 | REV : -

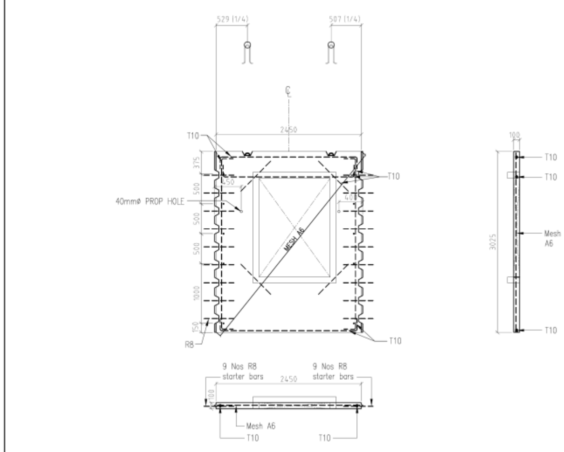
SYSTEM : - | REV : -

TOP VIEW

FRONT VIEW



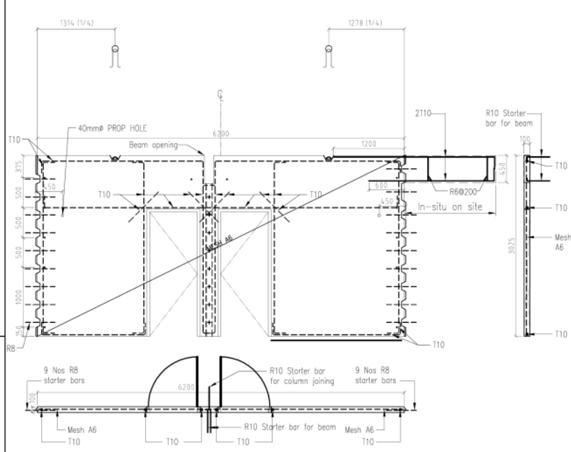
9gr 3025



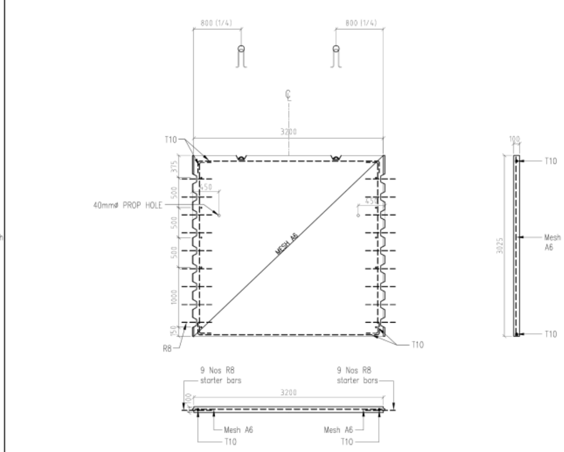
10gr 2450 (W2)

TOP VIEW

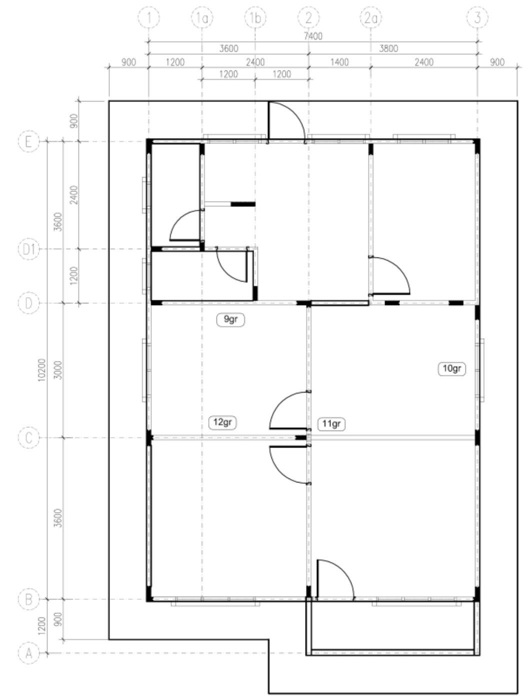
FRONT VIEW



11gr 6200 (D2) (D2)



12gr 3200



GROUND FLOOR LAYOUT

SCALE 1:100

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DRAWN :	KC
DATE :	DEC 2015
CHECKED :	3993
EXAM'D :	3993
APPR'D :	3993
SCALE :	1:75

CADANGAN RUMAH KEKAL MANGSA BANJIR
- JENIS SEBUAH BERKELOMPOK

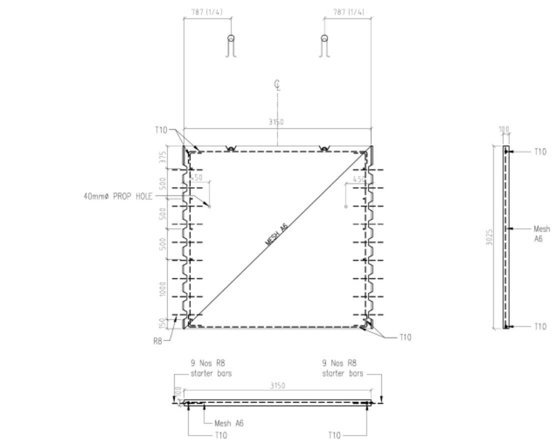
DRAWING TITLE : STRUCTURAL PANEL LIST

DRAWING NO HC/JKR-CRKMB/JS/SPL-03 REV : -

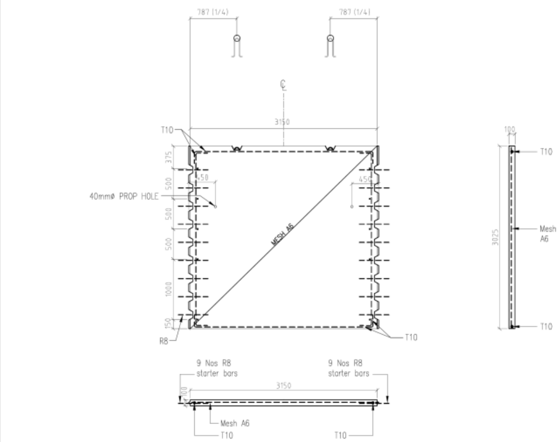
SYSTEM : – REV : -

TOP VIEW

FRONT VIEW



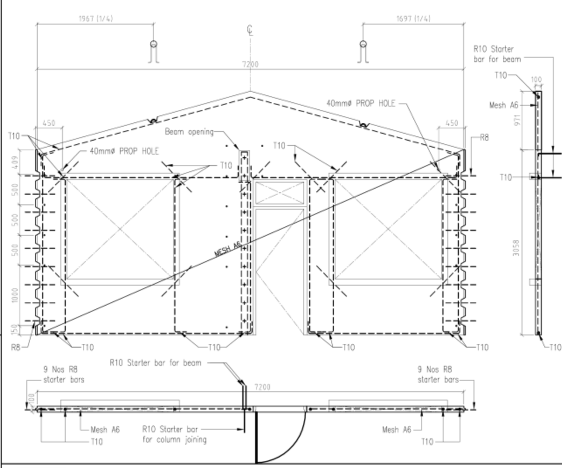
13gr 3150



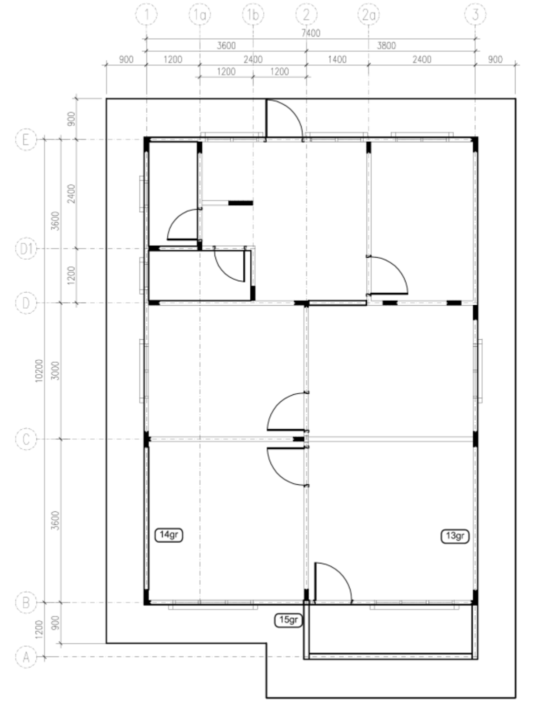
14gr 3150

TOP VIEW

FRONT VIEW



15gr 7200 (W1) (D1) (W1)



GROUND FLOOR LAYOUT

SCALE 1:100

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DRAWN :	KC
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EXAM'D :	3993
APPR'D :	3993
SCALE :	1:75

CADANGAN RUMAH KEKAL MANGSA BANJIR
- JENIS SEBUAH BERKELOMPOK

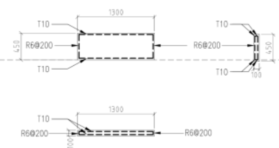
DRAWING TITLE :
STRUCTURAL PANEL LIST

DRAWING NO: HC/JKR-CRKMB/JS/SPL-04 REV : -

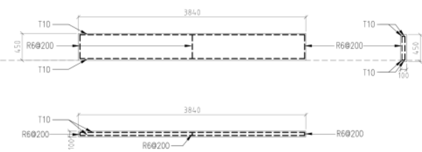
SYSTEM : - REV : -

TOP VIEW

FRONT VIEW



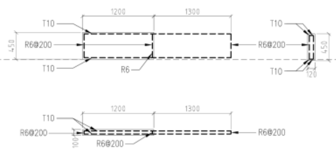
B1 1300 (IN-SITU)



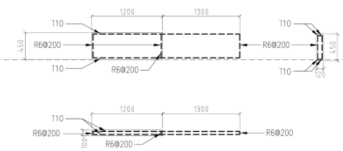
B2 3840 (PRECAST)

TOP VIEW

FRONT VIEW



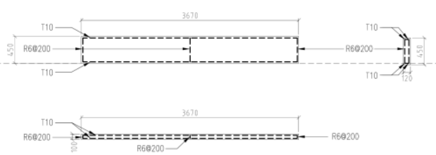
B3 1200 (IN-SITU)



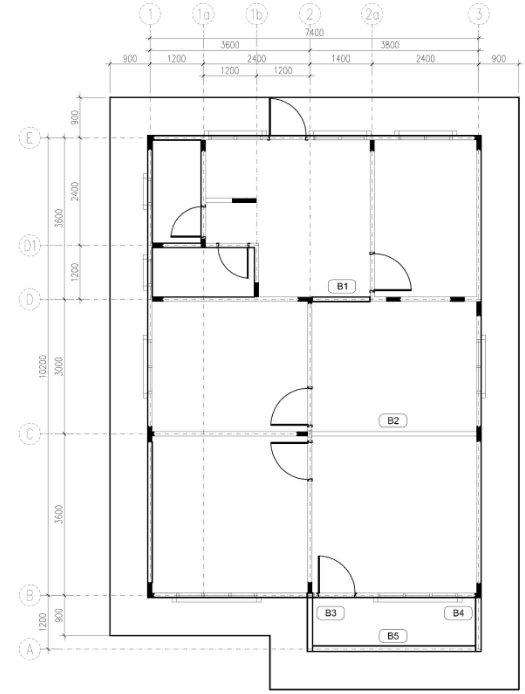
B4 1200 (IN-SITU)

TOP VIEW

FRONT VIEW



B5 3700 (IN-SITU)



GROUND FLOOR LAYOUT
SCALE 1:100

SYSTEM PROVIDER
HC PRECAST SYSTEM SDN. BHD. (586697–M)
No.23, Jalan Seri Sarawak 20B/KS2, Taman Seri Andalas,
41200 Klang, Selangor D.E. Tel:03–3323 8995 Fax:03–3319 8994
e–mail:enquiry@hcprecast.com, Http:www.hcprecast.com

MANUFACTURER
HC MANUFACTURING SDN. BHD. (585570–T)
No.23–1, Jalan Seri Sarawak 20B/KS2, Taman Seri Andalas,
41200 Klang, Selangor D.E.
Tel:03–3323 7999 Fax:03–3323 8993

DRAWN :	KC
DATE :	DEC 2015
CHECKED :	3993
EXAM'D :	3993
APPR'D :	3993
SCALE :	1:75

CADANGAN RUMAH KEKAL MANGSA BANJIR
- JENIS SEBUAH BERKELOMPOK

DRAWING TITLE :
STRUCTURAL BEAM LIST

DRAWING NO : HC/JKR-CRKMB/JS/BL-01 REV : -

SYSTEM : - REV : -

CADANGAN RUMAH KEKAL MANGSA BANJIR SETINGKAT SEBANYAK 73 UNIT

MUKIM KUALA NAL, KUALA KRAI, KELANTAN

UNTUK TETUAN:
JABATAN KERJA RAYA

JENIS SEBUAH BERKELOMPOK

M&E SHOP DRAWING
- POSITION OF BATHROOM & TOILET FITTINGS
- POSITION OF ELECTRIC POINT

SYSTEM PROVIDER
HC PRECAST SYSTEM SDN. BHD. (586697-M)
No.23, Jalan Seri Sarawak 20B/KS2, Taman Seri Andalas,
41200 Klang, Selangor D.E. Tel:03-3323 8995 Fax:03-3319 8994
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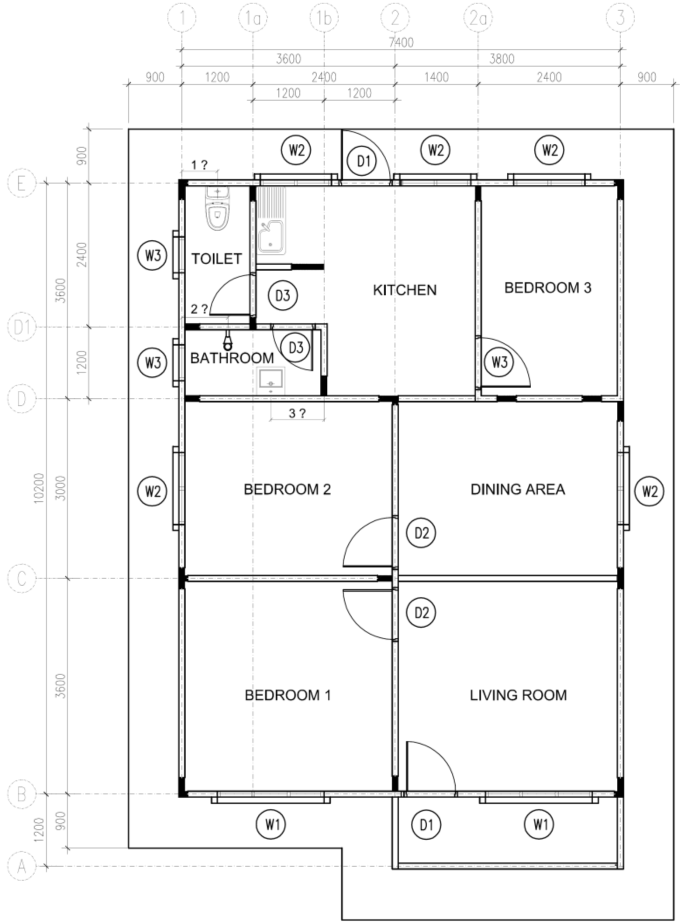

POSITION OF BATHROOM & TOILET FITTINGS

	Distance (mm)
1	
2	
3	

Notes:
1) Distance of fittings has been scaled from M&E Consultant drawing.
2) Height of fittings from schedule provided by M&E Consultant drawing.
3) M&E Consultant to fill in dimension not stated (?mm)

Confirmed by M&E Consultant

Signature :

Name :

Date :

Confirmed by Client

Signature :

Name :

Date :

SYSTEM PROVIDER

HC PRECAST SYSTEM SDN. BHD. (586697–M)

No.23, Jalan Seri Sarawak 20B/KS2, Taman Seri Andalas, 41200 Klang, Selangor D.E. Tel:03–3323 8995 Fax:03–3319 8994 e–mail:enquiry@hcprecast.com, Http:www.hcprecast.com

MANUFACTURER

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Tel:03–3323 7999 Fax:03–3323 8993

DRAWN :	KC
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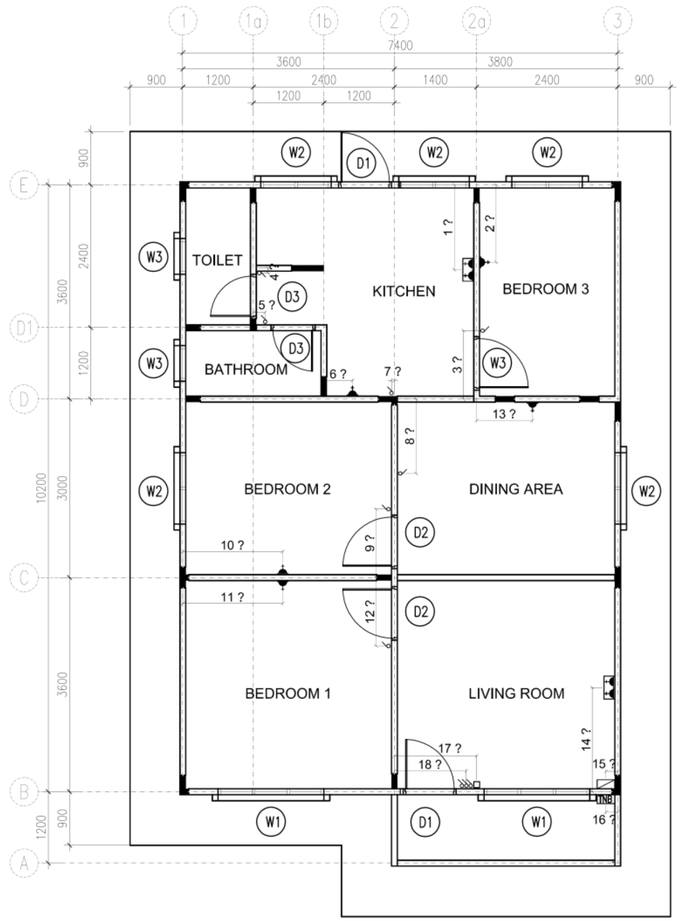
EXAM'D :	3993
APPR'D :	3993
SCALE :	1:75

CADANGAN RUMAH KEKAL MANGSA BANJIR
- JENIS SEBUAH BERKELOMPOK

DRAWING TITLE : BATHROOM & TOILET FITTINGS LAYOUT

DRAWING NO. HC/JKR–CRKMB/JS/BTFL–01 REV : –

SYSTEM : – REV : –



POSITION OF ELECTRICAL POINTS

	Distance of Point (mm)	Height of Point (mm)	Confirmation by M&E Consultant
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			

Notes:
1) Distance of Point has been scaled from M&E Consultant drawing.
2) Height of Point from schedule provided by M&E Consultant drawing.
3) M&E Consultant to fill in dimension not stated (?mm)

Confirmed by M&E Consultant

Signature :

Name :

Date :

SYSTEM PROVIDER
HC PRECAST SYSTEM SDN. BHD. (586697–M)
No.23, Jalan Seri Sarawak 20B/KS2, Taman Seri Andalas, 41200 Klang, Selangor D.E. Tel:03–3323 8995 Fax:03–3319 8994
e–mail:enquiry@hcprecast.com, Http:www.hcprecast.com

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HC MANUFACTURING SDN. BHD. (585570–T)
No.23–1, Jalan Seri Sarawak 20B/KS2, Taman Seri Andalas, 41200 Klang, Selangor D.E.
Tel:03–3323 7999 Fax:03–3323 8993

DRAWN :	KC
DATE :	DEC 2015
CHECKED :	3993
EXAM'D :	3993
APPR'D :	3993
SCALE :	1:75

CADANGAN RUMAH KEKAL MANGSA BANJIR
- JENIS SEBUAH BERKELOMPOK

DRAWING TITLE : ELECTRICAL LAYOUT

DRAWING NO : HC/JKR-CRKMB/JS/EL-01 REV : _

SYSTEM : – REV : _

CADANGAN RUMAH KEKAL MANGSA BANJIR - JENIS SEBUAH

STRUCTURE DESIGN CALCULATIONS

CLIENT	**JABATAN KERJA RAYA MALAYSIA**
	(PUBLIC WORKS DEPARTMENT MALAYSIA)
	CAWANGAN KERJA BANGUNAN 1
	(BUILDING WORKS BRANCH)
	IBU PEJABAT JKR MALAYSIA
	(P.W D. HEAD QUARTERS MALAYSIA)
	TINGKAT 13, 13A & 17, MENARA PJD
	No. 50, JALAN TUN RAZAK, 50400 KUALA LUMPUR
	Telefon : 03-2618 7002 (Pengarah Kanan)
	: 03-2618 7009 (KPPK BPKS)
	Faxsimilli: 03-4041 1925 (Pej. Pengarah Kanan)
	: 03-2618 7059 (BPKS)
STRUCTURE ENGINEER	**EPKM ENGINEERING SDN. BHD.**
	B2-08, PJ Industrial Park
	Jalan Kemajuan, Section 13
	46200 Petaling Jaya
	Selangor Darul Ehsan
	Tel/Fax: 03-7931 8112

JURUTERA PROFESIONAL
AWAM
IR. MAK PENG KEONG
4359
MALAYSIA

1) GENERAL

a) DESIGN DATA

<u>CODE USED</u>

STRUCTURAL CONCRETE	:	BS 8110
STRUCTURAL STEEL	:	BS 5950
LOADING	:	BS 6399

b) MATERIAL DATA

CONCRETE GRADE	:	30 N/mm^2
STEEL REINFORCEMENT	:	T = 460 N/mm^2
		R= 250 N/mm^2

c)

FOUNDATION USED	:	STRIP FOOTING
FOOTING	:	50 kN/m^2

2) DESIGN CONSIDERATIONS

a) PRECAST WALLS ARE DESIGNED AS LOAD BEARING WALLS

b) STRIP FOOTING WILL BE INTEGRATED WITH THE GROUND SLAB

c) MINIMUM SOIL BEARING PRESSURE OF 50Kn/m^2

Loadings

① Precast wall

DL: RC Wall = 24(0.1)3 = 7.2 kN/m
Skim Coat = 24(0.01)3 = 0.72 kN/m
= 7.92 kN/m

assume 5mm thick on both sides.

② Roof @ 1.8m spacing

DL : 3.66 kN
LL : 6.39 kN

from analysis (attached)

We use DL of 5kN and LL of 7.5 kN.

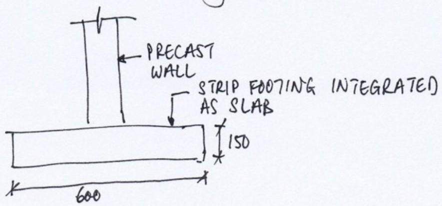
∴ Total ultimate loads;

$$ULT = 1.4(7.92 + 5.0) + 1.6(7.5)$$
$$= 30.088 \text{ kN}$$

max load on 1m strip of foundation.

Strip Footing Design

Assume a bearing width of 600 mm



Footing load = 24(0.6)0.15
= 2.16 kN/m

Total load (unfactored) = 7.92 + 5 + 7.5 + 2.16
= 22.58

$$\therefore \text{Soil bearing pressure} = \frac{22.58}{0.6} = 37.63 \text{ kN/m}^2$$

Shear Check

① Punching shear at face of wall

$$V = \frac{30.088 \times 10^3}{2(1000)(120)}$$

d = 150 − 25 − 5 = 120

$$= 0.125 \text{ N/mm}^2 < 0.8\sqrt{30} = 4.38 \sim \text{OK}.$$

② Shear at 1.5d

$$V = \frac{37.63(1.5)(600 - 460)}{2(1000)\,120}$$

$$= 0.03 \text{ N/mm}^2 - \text{Nominal}$$

Check on Precast Wall

Height = 3000 mm
Thickness = 100 mm

$$\frac{l_e}{w} = \frac{3000}{100} = 30 \leq 40 \sim \text{OK}$$ *braced*

Capacity of stocky braced walls. *3.9.4.15*

$$n_w \leq 0.3(h - 2e_x) f_{cu}$$

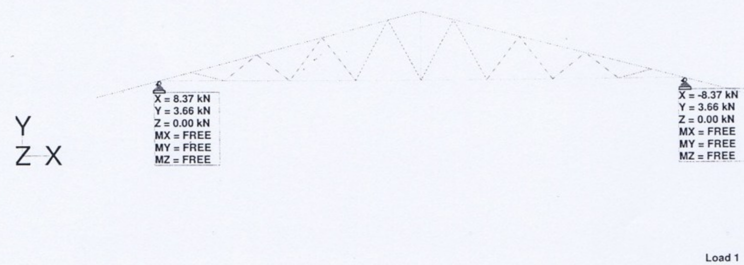
e_x considered as 0 as it is a single storey building

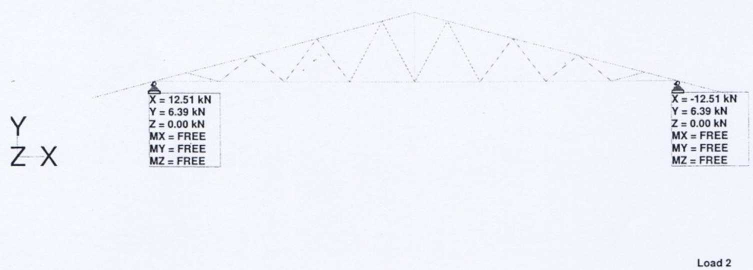
$$\therefore n_w \leq 0.3(100-0)30$$
$$\leq 900 \text{ kN/m} \ggg 30.088 \text{ kN} \sim \text{OK}.$$

Provide mesh A6 throughout and 7 10 at edges/openings for plain wall reinforcement.

ROOF DESIGN CALCULATIONS

Software licensed to	Job No		Sheet No 1	Rev
	Part			
Job Title Rumah Kekal Mangsa Banjir	Ref			
	By	Date 18-Dec-15	Chd	
Client JKR	File truss.std		Date/Time 18-Jan-2016 13:07	





Job Information

	Engineer	Checked	Approved
Name:			
Date:	18-Dec-15		

Structure Type	PLANE FRAME

Number of Nodes	21	Highest Node	27
Number of Elements	36	Highest Beam	42

Number of Basic Load Cases	3
Number of Combination Load Cases	4

Included in this printout are data for:

All	The Whole Structure

Included in this printout are results for load cases:

Type	L/C	Name
Primary	1	DL
Primary	2	LL
Primary	3	WL
Combination	5	DL+LL
Combination	6	GENERATED BRITISH BS 5950 1
Combination	7	GENERATED BRITISH BS 5950 2
Combination	8	GENERATED BRITISH BS 5950 3

Nodes

Node	X (m)	Y (m)	Z (m)
1	0.000	0.000	0.000
2	7.400	0.000	0.000
4	3.700	0.991	0.000
5	-0.869	-0.233	0.000
6	8.269	-0.233	0.000
7	3.700	0.000	0.000
8	0.925	0.000	0.000
9	1.850	0.000	0.000
10	2.775	0.000	0.000
11	3.237	0.867	0.000
13	2.313	0.619	0.000
14	1.850	0.495	0.000
15	1.388	0.372	0.000
17	0.463	0.124	0.000
18	4.625	0.000	0.000
19	5.550	0.000	0.000
20	6.475	0.000	0.000
21	4.162	0.867	0.000
23	5.088	0.619	0.000
25	6.012	0.372	0.000

Nodes Cont...

Node	X (m)	Y (m)	Z (m)
27	6.938	0.124	0.000

Beams

Beam	Node A	Node B	Length (m)	Property	β (degrees)
1	1	8	0.925	1	0
3	4	11	0.479	1	0
4	4	21	0.479	1	0
5	1	5	0.900	1	0
6	2	6	0.900	1	0
7	7	18	0.925	1	0
8	8	9	0.925	1	0
9	9	10	0.925	1	0
10	10	7	0.925	1	0
11	11	13	0.958	1	0
13	13	14	0.479	1	0
14	14	15	0.479	1	0
15	15	17	0.958	1	0
17	17	1	0.479	1	0
18	4	7	0.991	1	0
19	7	11	0.983	1	0
20	11	10	0.983	1	0
21	10	13	0.773	1	0
22	9	13	0.773	1	0
23	9	15	0.593	1	0
24	15	8	0.593	1	0
25	8	17	0.479	1	0
26	18	19	0.925	1	0
27	19	20	0.925	1	0
28	20	2	0.925	1	0
29	21	23	0.958	1	0
31	23	25	0.958	1	0
33	25	27	0.958	1	0
35	27	2	0.479	1	0
36	7	21	0.983	1	0
37	21	18	0.983	1	0
38	18	23	0.773	1	0
39	23	19	0.773	1	0
40	19	25	0.593	1	0
41	25	20	0.593	1	0
42	27	20	0.479	1	0

Section Properties

Prop	Section	Area (cm^2)	I_{yy} (cm^4)	I_{zz} (cm^4)	J (cm^4)	Material
1	CH76X38	8.530	10.700	74.100	1.106	STEEL

Materials

Mat	Name	E (kN/mm^2)	ν	Density (kg/m^3)	α (1/°K)
1	STEEL	205.000	0.300	7.83E+3	12E -6
2	STAINLESSSTEEL	197.930	0.300	7.83E+3	18E -6
3	ALUMINUM	68.948	0.330	2.71E+3	23E -6
4	CONCRETE	21.718	0.170	2.4E+3	10E -6

Supports

Node	X (kN/mm)	Y (kN/mm)	Z (kN/mm)	rX (kN·m/deg)	rY (kN·m/deg)	rZ (kN·m/deg)
1	Fixed	Fixed	Fixed	-	-	-
2	Fixed	Fixed	Fixed	-	-	-

Basic Load Cases

Number	Name
1	DL
2	LL
3	WL

Combination Load Cases

Comb.	Combination L/C Name	Primary	Primary L/C Name	Factor
5	DL+LL	1	DL	1.00
		2	LL	1.00
6	GENERATED BRITISH BS 5950 1	1	DL	1.40
		2	LL	1.60
7	GENERATED BRITISH BS 5950 2	1	DL	1.40
		3	WL	1.40
8	GENERATED BRITISH BS 5950 3	1	DL	1.20
		2	LL	1.20
		3	WL	1.20

Beam Loads : 1 DL

Beam	Type		Direction	Fa	Da (m)	Fb	Db	Ecc. (m)
1	UNI	kN/m	GY	-0.234	-	-	-	-
3	UNI	kN/m	GY	-0.396	-	-	-	-
4	UNI	kN/m	GY	-0.396	-	-	-	-
5	UNI	kN/m	GY	-0.396	-	-	-	-
6	UNI	kN/m	GY	-0.396	-	-	-	-
7	UNI	kN/m	GY	-0.234	-	-	-	-
8	UNI	kN/m	GY	-0.234	-	-	-	-
9	UNI	kN/m	GY	-0.234	-	-	-	-
10	UNI	kN/m	GY	-0.234	-	-	-	-
11	UNI	kN/m	GY	-0.396	-	-	-	-
13	UNI	kN/m	GY	-0.396	-	-	-	-
14	UNI	kN/m	GY	-0.396	-	-	-	-
15	UNI	kN/m	GY	-0.396	-	-	-	-
17	UNI	kN/m	GY	-0.396	-	-	-	-
26	UNI	kN/m	GY	-0.234	-	-	-	-
27	UNI	kN/m	GY	-0.234	-	-	-	-
28	UNI	kN/m	GY	-0.234	-	-	-	-
29	UNI	kN/m	GY	-0.396	-	-	-	-
31	UNI	kN/m	GY	-0.396	-	-	-	-
33	UNI	kN/m	GY	-0.396	-	-	-	-
35	UNI	kN/m	GY	-0.396	-	-	-	-

Selfweight : 1 DL

Direction	Factor
Y	-1.000

Beam Loads : 2 LL

Beam	Type		Direction	Fa	Da (m)	Fb	Db	Ecc. (m)
3	UNI	kN/m	GY	-1.350	-	-	-	-
4	UNI	kN/m	GY	-1.350	-	-	-	-
5	UNI	kN/m	GY	-1.350	-	-	-	-
6	UNI	kN/m	GY	-1.350	-	-	-	-
11	UNI	kN/m	GY	-1.350	-	-	-	-
13	UNI	kN/m	GY	-1.350	-	-	-	-
14	UNI	kN/m	GY	-1.350	-	-	-	-
15	UNI	kN/m	GY	-1.350	-	-	-	-
17	UNI	kN/m	GY	-1.350	-	-	-	-
29	UNI	kN/m	GY	-1.350	-	-	-	-
31	UNI	kN/m	GY	-1.350	-	-	-	-
33	UNI	kN/m	GY	-1.350	-	-	-	-
35	UNI	kN/m	GY	-1.350	-	-	-	-

Beam Loads : 3 WL

Beam	Type		Direction	Fa	Da (m)	Fb	Db	Ecc. (m)
1	UNI	kN/m	GY	1.276	-	-	-	-
5	UNI	kN/m	GY	1.276	-	-	-	-
6	UNI	kN/m	GY	1.276	-	-	-	-
7	UNI	kN/m	GY	1.276	-	-	-	-
8	UNI	kN/m	GY	1.276	-	-	-	-
9	UNI	kN/m	GY	1.276	-	-	-	-
10	UNI	kN/m	GY	1.276	-	-	-	-
26	UNI	kN/m	GY	1.276	-	-	-	-
27	UNI	kN/m	GY	1.276	-	-	-	-
28	UNI	kN/m	GY	1.276	-	-	-	-

Node Displacements

Node	L/C	X (mm)	Y (mm)	Z (mm)	Resultant (mm)	rX (rad)	rY (rad)	rZ (rad)
1	1:DL	0.000	0.000	0.000	0.000	0.00	0.00	-0.00
	2:LL	0.000	0.000	0.000	0.000	0.00	0.00	-0.00
	3:WL	0.000	0.000	0.000	0.000	0.00	0.00	0.00
	5:DL+LL	0.000	0.000	0.000	0.000	0.00	0.00	-0.00
	6:GENERATEI	0.000	0.000	0.000	0.000	0.00	0.00	-0.00
	7:GENERATEI	0.000	0.000	0.000	0.000	0.00	0.00	0.00
	8:GENERATEI	0.000	0.000	0.000	0.000	0.00	0.00	-0.00
2	1:DL	0.000	0.000	0.000	0.000	0.00	0.00	0.00
	2:LL	0.000	0.000	0.000	0.000	0.00	0.00	0.00
	3:WL	0.000	0.000	0.000	0.000	0.00	0.00	-0.00
	5:DL+LL	0.000	0.000	0.000	0.000	0.00	0.00	0.00
	6:GENERATEI	0.000	0.000	0.000	0.000	0.00	0.00	0.00
	7:GENERATEI	0.000	0.000	0.000	0.000	0.00	0.00	-0.00
	8:GENERATEI	0.000	0.000	0.000	0.000	0.00	0.00	0.00
4	1:DL	0.000	-0.732	0.000	0.732	0.00	0.00	-0.00
	2:LL	0.000	-1.076	0.000	1.076	0.00	0.00	0.00
	3:WL	-0.000	0.994	0.000	0.994	0.00	0.00	-0.00
	5:DL+LL	0.000	-1.808	0.000	1.808	0.00	0.00	0.00
	6:GENERATEI	0.000	-2.746	0.000	2.746	0.00	0.00	0.00
	7:GENERATEI	0.000	0.367	0.000	0.367	0.00	0.00	-0.00
	8:GENERATEI	0.000	-0.976	0.000	0.976	0.00	0.00	-0.00
5	1:DL	-0.068	0.252	0.000	0.261	0.00	0.00	-0.00
	2:LL	0.044	-0.168	0.000	0.174	0.00	0.00	0.00
	3:WL	-0.040	0.153	0.000	0.158	0.00	0.00	-0.00
	5:DL+LL	-0.024	0.084	0.000	0.087	0.00	0.00	0.00
	6:GENERATEI	-0.024	0.083	0.000	0.087	0.00	0.00	0.00
	7:GENERATEI	-0.151	0.566	0.000	0.586	0.00	0.00	-0.00
	8:GENERATEI	-0.076	0.283	0.000	0.293	0.00	0.00	-0.00
6	1:DL	0.068	0.252	0.000	0.261	0.00	0.00	0.00
	2:LL	-0.044	-0.168	0.000	0.174	0.00	0.00	-0.00
	3:WL	0.040	0.153	0.000	0.158	0.00	0.00	0.00
	5:DL+LL	0.024	0.084	0.000	0.087	0.00	0.00	-0.00
	6:GENERATEI	0.024	0.083	0.000	0.087	0.00	0.00	-0.00

Node Displacements Cont...

Node	L/C	X (mm)	Y (mm)	Z (mm)	Resultant (mm)	rX (rad)	rY (rad)	rZ (rad)
	7:GENERATEI	0.151	0.566	0.000	0.586	0.00	0.00	0.00
	8:GENERATEI	0.076	0.283	0.000	0.293	0.00	0.00	0.00
7	1:DL	0.000	-0.748	0.000	0.748	0.00	0.00	-0.00
	2:LL	0.000	-1.100	0.000	1.100	0.00	0.00	0.00
	3:WL	-0.000	1.018	0.000	1.018	0.00	0.00	-0.00
	5:DL+LL	0.000	-1.848	0.000	1.848	0.00	0.00	0.00
	6:GENERATEI	0.000	-2.807	0.000	2.807	0.00	0.00	0.00
	7:GENERATEI	-0.000	0.377	0.000	0.377	0.00	0.00	-0.00
	8:GENERATEI	0.000	-0.996	0.000	0.996	0.00	0.00	-0.00
8	1:DL	0.003	-0.506	0.000	0.506	0.00	0.00	-0.00
	2:LL	0.002	-0.730	0.000	0.730	0.00	0.00	-0.00
	3:WL	0.000	0.673	0.000	0.673	0.00	0.00	0.00
	5:DL+LL	0.005	-1.235	0.000	1.235	0.00	0.00	-0.00
	6:GENERATEI	0.008	-1.875	0.000	1.875	0.00	0.00	-0.00
	7:GENERATEI	0.005	0.234	0.000	0.234	0.00	0.00	0.00
	8:GENERATEI	0.007	-0.675	0.000	0.675	0.00	0.00	-0.00
9	1:DL	0.009	-0.686	0.000	0.686	0.00	0.00	-0.00
	2:LL	0.012	-1.005	0.000	1.005	0.00	0.00	-0.00
	3:WL	-0.008	0.929	0.000	0.929	0.00	0.00	0.00
	5:DL+LL	0.020	-1.691	0.000	1.691	0.00	0.00	-0.00
	6:GENERATEI	0.031	-2.568	0.000	2.568	0.00	0.00	-0.00
	7:GENERATEI	0.001	0.340	0.000	0.340	0.00	0.00	0.00
	8:GENERATEI	0.015	-0.914	0.000	0.914	0.00	0.00	-0.00
10	1:DL	0.008	-0.747	0.000	0.747	0.00	0.00	-0.00
	2:LL	0.012	-1.098	0.000	1.098	0.00	0.00	-0.00
	3:WL	-0.009	1.017	0.000	1.017	0.00	0.00	0.00
	5:DL+LL	0.020	-1.846	0.000	1.846	0.00	0.00	-0.00
	6:GENERATEI	0.030	-2.803	0.000	2.804	0.00	0.00	-0.00
	7:GENERATEI	-0.001	0.377	0.000	0.377	0.00	0.00	0.00
	8:GENERATEI	0.013	-0.994	0.000	0.994	0.00	0.00	-0.00
11	1:DL	0.022	-0.745	0.000	0.746	0.00	0.00	0.00
	2:LL	0.033	-1.097	0.000	1.097	0.00	0.00	0.00
	3:WL	-0.030	1.012	0.000	1.013	0.00	0.00	-0.00
	5:DL+LL	0.054	-1.842	0.000	1.843	0.00	0.00	0.00
	6:GENERATEI	0.083	-2.799	0.000	2.800	0.00	0.00	0.00
	7:GENERATEI	-0.011	0.374	0.000	0.374	0.00	0.00	0.00
	8:GENERATEI	0.030	-0.996	0.000	0.996	0.00	0.00	0.00
13	1:DL	0.058	-0.717	0.000	0.719	0.00	0.00	-0.00
	2:LL	0.087	-1.054	0.000	1.058	0.00	0.00	-0.00
	3:WL	-0.080	0.971	0.000	0.975	0.00	0.00	0.00
	5:DL+LL	0.145	-1.771	0.000	1.777	0.00	0.00	-0.00
	6:GENERATEI	0.221	-2.690	0.000	2.699	0.00	0.00	-0.00
	7:GENERATEI	-0.030	0.356	0.000	0.358	0.00	0.00	0.00
	8:GENERATEI	0.079	-0.960	0.000	0.963	0.00	0.00	-0.00
14	1:DL	0.073	-0.676	0.000	0.680	0.00	0.00	-0.00
	2:LL	0.111	-1.000	0.000	1.006	0.00	0.00	-0.00
	3:WL	-0.098	0.905	0.000	0.910	0.00	0.00	0.00
	5:DL+LL	0.185	-1.676	0.000	1.686	0.00	0.00	-0.00
	6:GENERATEI	0.281	-2.547	0.000	2.562	0.00	0.00	-0.00

Node Displacements Cont...

Node	L/C	X (mm)	Y (mm)	Z (mm)	Resultant (mm)	rX (rad)	rY (rad)	rZ (rad)
	7:GENERATEI	-0.035	0.320	0.000	0.322	0.00	0.00	0.00
	8:GENERATEI	0.104	-0.926	0.000	0.932	0.00	0.00	-0.00
15	1:DL	0.080	-0.601	0.000	0.607	0.00	0.00	-0.00
	2:LL	0.118	-0.879	0.000	0.887	0.00	0.00	-0.00
	3:WL	-0.108	0.806	0.000	0.813	0.00	0.00	0.00
	5:DL+LL	0.198	-1.481	0.000	1.494	0.00	0.00	-0.00
	6:GENERATEI	0.300	-2.249	0.000	2.269	0.00	0.00	-0.00
	7:GENERATEI	-0.040	0.287	0.000	0.289	0.00	0.00	0.00
	8:GENERATEI	0.108	-0.809	0.000	0.817	0.00	0.00	-0.00
17	1:DL	0.055	-0.306	0.000	0.311	0.00	0.00	-0.00
	2:LL	0.079	-0.438	0.000	0.445	0.00	0.00	-0.00
	3:WL	-0.071	0.386	0.000	0.393	0.00	0.00	0.00
	5:DL+LL	0.134	-0.744	0.000	0.756	0.00	0.00	-0.00
	6:GENERATEI	0.203	-1.129	0.000	1.147	0.00	0.00	-0.00
	7:GENERATEI	-0.022	0.113	0.000	0.115	0.00	0.00	0.00
	8:GENERATEI	0.076	-0.429	0.000	0.436	0.00	0.00	-0.00
18	1:DL	-0.008	-0.747	0.000	0.747	0.00	0.00	0.00
	2:LL	-0.012	-1.098	0.000	1.098	0.00	0.00	0.00
	3:WL	0.009	1.017	0.000	1.017	0.00	0.00	-0.00
	5:DL+LL	-0.020	-1.846	0.000	1.846	0.00	0.00	0.00
	6:GENERATEI	-0.030	-2.803	0.000	2.804	0.00	0.00	0.00
	7:GENERATEI	0.001	0.377	0.000	0.377	0.00	0.00	-0.00
	8:GENERATEI	-0.013	-0.994	0.000	0.994	0.00	0.00	0.00
19	1:DL	-0.009	-0.686	0.000	0.686	0.00	0.00	0.00
	2:LL	-0.012	-1.005	0.000	1.005	0.00	0.00	0.00
	3:WL	0.008	0.929	0.000	0.929	0.00	0.00	-0.00
	5:DL+LL	-0.020	-1.691	0.000	1.691	0.00	0.00	0.00
	6:GENERATEI	-0.031	-2.568	0.000	2.568	0.00	0.00	0.00
	7:GENERATEI	-0.001	0.340	0.000	0.340	0.00	0.00	-0.00
	8:GENERATEI	-0.015	-0.914	0.000	0.914	0.00	0.00	0.00
20	1:DL	-0.003	-0.506	0.000	0.506	0.00	0.00	0.00
	2:LL	-0.002	-0.730	0.000	0.730	0.00	0.00	0.00
	3:WL	-0.000	0.673	0.000	0.673	0.00	0.00	-0.00
	5:DL+LL	-0.005	-1.235	0.000	1.235	0.00	0.00	0.00
	6:GENERATEI	-0.008	-1.875	0.000	1.875	0.00	0.00	0.00
	7:GENERATEI	-0.005	0.234	0.000	0.234	0.00	0.00	-0.00
	8:GENERATEI	-0.007	-0.675	0.000	0.675	0.00	0.00	0.00
21	1:DL	-0.022	-0.745	0.000	0.746	0.00	0.00	-0.00
	2:LL	-0.033	-1.097	0.000	1.097	0.00	0.00	-0.00
	3:WL	0.030	1.012	0.000	1.013	0.00	0.00	0.00
	5:DL+LL	-0.054	-1.842	0.000	1.843	0.00	0.00	-0.00
	6:GENERATEI	-0.083	-2.799	0.000	2.800	0.00	0.00	-0.00
	7:GENERATEI	0.011	0.374	0.000	0.374	0.00	0.00	-0.00
	8:GENERATEI	-0.030	-0.996	0.000	0.996	0.00	0.00	-0.00
23	1:DL	-0.058	-0.717	0.000	0.719	0.00	0.00	0.00
	2:LL	-0.087	-1.054	0.000	1.058	0.00	0.00	0.00
	3:WL	0.080	0.971	0.000	0.975	0.00	0.00	-0.00
	5:DL+LL	-0.145	-1.771	0.000	1.777	0.00	0.00	0.00
	6:GENERATEI	-0.221	-2.690	0.000	2.699	0.00	0.00	0.00

Node Displacements Cont...

Node	L/C	X (mm)	Y (mm)	Z (mm)	Resultant (mm)	rX (rad)	rY (rad)	rZ (rad)
	7:GENERATED	0.030	0.356	0.000	0.358	0.00	0.00	-0.00
	8:GENERATED	-0.079	-0.960	0.000	0.963	0.00	0.00	0.00
25	1:DL	-0.080	-0.601	0.000	0.607	0.00	0.00	0.00
	2:LL	-0.118	-0.879	0.000	0.887	0.00	0.00	0.00
	3:WL	0.108	0.806	0.000	0.813	0.00	0.00	-0.00
	5:DL+LL	-0.198	-1.481	0.000	1.494	0.00	0.00	0.00
	6:GENERATED	-0.300	-2.249	0.000	2.269	0.00	0.00	0.00
	7:GENERATED	0.040	0.287	0.000	0.289	0.00	0.00	-0.00
	8:GENERATED	-0.108	-0.809	0.000	0.817	0.00	0.00	0.00
27	1:DL	-0.055	-0.306	0.000	0.311	0.00	0.00	0.00
	2:LL	-0.079	-0.433	0.000	0.445	0.00	0.00	0.00
	3:WL	0.071	0.386	0.000	0.393	0.00	0.00	-0.00
	5:DL+LL	-0.134	-0.744	0.000	0.756	0.00	0.00	0.00
	6:GENERATED	-0.203	-1.129	0.000	1.147	0.00	0.00	0.00
	7:GENERATED	0.022	0.113	0.000	0.115	0.00	0.00	-0.00
	8:GENERATED	-0.076	-0.429	0.000	0.436	0.00	0.00	0.00

Node Displacement Summary

	Node	L/C	X (mm)	Y (mm)	Z (mm)	Resultant (mm)	rX (rad)	rY (rad)	rZ (rad)
Max X	15	6:GENERATED	**0.300**	-2.249	0.000	2.269	0.00	0.00	-0.00
Min X	25	6:GENERATED	**-0.300**	-2.249	0.000	2.269	0.00	0.00	0.00
Max Y	7	3:WL	-0.000	**1.018**	0.000	1.018	0.00	0.00	-0.00
Min Y	7	6:GENERATED	0.000	**-2.807**	0.000	2.807	0.00	0.00	0.00
Max Z	1	1:DL	0.000	0.000	**0.000**	0.000	0.00	0.00	-0.00
Min Z	1	1:DL	0.000	0.000	**0.000**	0.000	0.00	0.00	-0.00
Max rX	1	1:DL	0.000	0.000	0.000	0.000	**0.00**	0.00	-0.00
Min rX	1	1:DL	0.000	0.000	0.000	0.000	**0.00**	0.00	-0.00
Max rY	1	1:DL	0.000	0.000	0.000	0.000	0.00	**0.00**	-0.00
Min rY	1	1:DL	0.000	0.000	0.000	0.000	0.00	**0.00**	-0.00
Max rZ	27	6:GENERATED	-0.203	-1.129	0.000	1.147	0.00	0.00	**0.00**
Min rZ	17	6:GENERATED	0.203	-1.129	0.000	1.147	0.00	0.00	**-0.00**
Max Rst	7	6:GENERATED	0.000	-2.807	0.000	**2.807**	0.00	0.00	0.00

Reactions

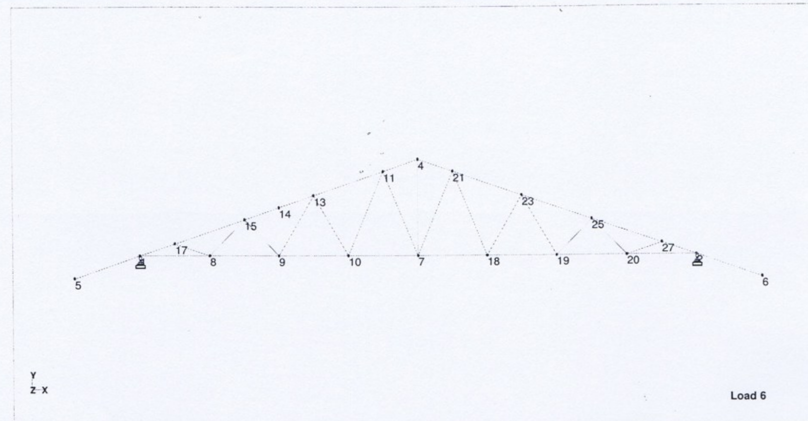
		Horizontal	Vertical	Horizontal	Moment		
Node	L/C	FX (kN)	FY (kN)	FZ (kN)	MX (kNm)	MY (kNm)	MZ (kNm)
1	1:DL	8.37	3.66	0.00	0.00	0.00	0.00
	2:LL	12.51	6.39	0.00	0.00	0.00	0.00
	3:WL	-10.99	-5.87	0.00	0.00	0.00	0.00
	5:DL+LL	20.88	10.05	0.00	0.00	0.00	0.00
	6:GENERATED	31.73	15.35	0.00	0.00	0.00	0.00
	7:GENERATED	-3.67	-3.09	0.00	0.00	0.00	0.00
	8:GENERATED	11.87	5.02	0.00	0.00	0.00	0.00
2	1:DL	-8.37	3.66	0.00	0.00	0.00	0.00
	2:LL	-12.51	6.39	0.00	0.00	0.00	0.00
	3:WL	10.99	-5.87	0.00	0.00	0.00	0.00
	5:DL+LL	-20.88	10.05	0.00	0.00	0.00	0.00
	6:GENERATED	-31.73	15.35	0.00	0.00	0.00	0.00
	7:GENERATED	3.67	-3.09	0.00	0.00	0.00	0.00
	8:GENERATED	-11.87	5.02	0.00	0.00	0.00	0.00

Reaction Summary

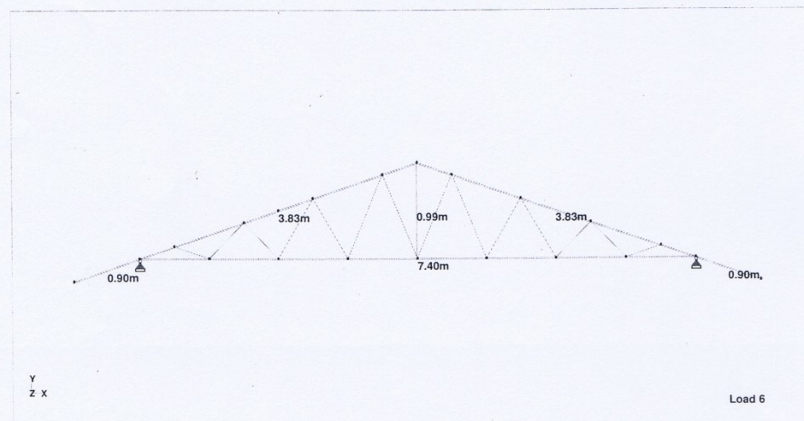
			Horizontal	Vertical	Horizontal	Moment		
	Node	L/C	FX (kN)	FY (kN)	FZ (kN)	MX (kNm)	MY (kNm)	MZ (kNm)
Max FX	1	6:GENERATED	**31.73**	15.35	0.00	0.00	0.00	0.00
Min FX	2	6:GENERATED	**-31.73**	15.35	0.00	0.00	0.00	0.00
Max FY	2	6:GENERATED	-31.73	**15.35**	0.00	0.00	0.00	0.00
Min FY	2	3:WL	10.99	**-5.87**	0.00	0.00	0.00	0.00
Max FZ	1	1:DL	8.37	3.66	**0.00**	0.00	0.00	0.00
Min FZ	1	1:DL	8.37	3.66	**0.00**	0.00	0.00	0.00
Max MX	1	1:DL	8.37	3.66	0.00	**0.00**	0.00	0.00
Min MX	1	1:DL	8.37	3.66	0.00	**0.00**	0.00	0.00
Max MY	1	1:DL	8.37	3.66	0.00	0.00	**0.00**	0.00
Min MY	1	1:DL	8.37	3.66	0.00	0.00	**0.00**	0.00
Max MZ	1	1:DL	8.37	3.66	0.00	0.00	0.00	**0.00**
Min MZ	1	1:DL	8.37	3.66	0.00	0.00	0.00	**0.00**

Utilization Ratio

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (cm^2)	Iz (cm^4)	Iy (cm^4)	Ix (cm^4)
1	CH76X38	CH76X38	0.064	1.000	0.064	BS-4.3.6	6	8.530	74.100	10.700	1.128
3	CH76X38	CH76X38	0.595	1.000	0.595	BS-4.8.3.3.1	6	8.530	74.100	10.700	1.128
4	CH76X38	CH76X38	0.595	1.000	0.595	BS-4.8.3.3.1	6	8.530	74.100	10.700	1.128
5	CH76X38	CH76X38	0.199	1.000	0.199	BS-4.3.6	6	8.530	74.100	10.700	1.128
6	CH76X38	CH76X38	0.199	1.000	0.199	BS-4.3.6	6	8.530	74.100	10.700	1.128
7	CH76X38	CH76X38	0.143	1.000	0.143	BS-4.8.3.3.1	6	8.530	74.100	10.700	1.128
8	CH76X38	CH76X38	0.073	1.000	0.073	BS-4.8.2.2	6	8.530	74.100	10.700	1.128
9	CH76X38	CH76X38	0.028	1.000	0.028	BS-4.8.3.3.1	7	8.530	74.100	10.700	1.128
10	CH76X38	CH76X38	0.143	1.000	0.143	BS-4.8.3.3.1	6	8.530	74.100	10.700	1.128
11	CH76X38	CH76X38	0.725	1.000	0.725	BS-4.8.3.3.1	6	8.530	74.100	10.700	1.128
13	CH76X38	CH76X38	0.837	1.000	0.837	BS-4.8.3.3.1	6	8.530	74.100	10.700	1.128
14	CH76X38	CH76X38	0.847	1.000	0.847	BS-4.8.3.3.1	6	8.530	74.100	10.700	1.128
15	CH76X38	CH76X38	0.915	1.000	0.915	BS-4.8.3.3.1	6	8.530	74.100	10.700	1.128
17	CH76X38	CH76X38	0.955	1.000	0.955	BS-4.8.3.3.1	6	8.530	74.100	10.700	1.128
18	CH76X38	CH76X38	0.096	1.000	0.096	BS-4.7 (C)	3	8.530	74.100	10.700	1.128
19	CH76X38	CH76X38	0.132	1.000	0.132	BS-4.7 (C)	6	8.530	74.100	10.700	1.128
20	CH76X38	CH76X38	0.057	1.000	0.057	BS-4.7 (C)	3	8.530	74.100	10.700	1.128
21	CH76X38	CH76X38	0.123	1.000	0.123	BS-4.7 (C)	6	8.530	74.100	10.700	1.128
22	CH76X38	CH76X38	0.045	1.000	0.045	BS-4.7 (C)	3	8.530	74.100	10.700	1.128
23	CH76X38	CH76X38	0.071	1.000	0.071	BS-4.7 (C)	6	8.530	74.100	10.700	1.128
24	CH76X38	CH76X38	0.041	1.000	0.041	BS-4.7 (C)	6	8.530	74.100	10.700	1.128
25	CH76X38	CH76X38	0.050	1.000	0.050	BS-4.7 (C)	7	8.530	74.100	10.700	1.128
26	CH76X38	CH76X38	0.028	1.000	0.028	BS-4.8.3.3.1	7	8.530	74.100	10.700	1.128
27	CH76X38	CH76X38	0.073	1.000	0.073	BS-4.8.2.2	6	8.530	74.100	10.700	1.128
28	CH76X38	CH76X38	0.064	1.000	0.064	BS-4.3.6	6	8.530	74.100	10.700	1.128
29	CH76X38	CH76X38	0.725	1.000	0.725	BS-4.8.3.3.1	6	8.530	74.100	10.700	1.128
31	CH76X38	CH76X38	0.847	1.000	0.847	BS-4.8.3.3.1	6	8.530	74.100	10.700	1.128
33	CH76X38	CH76X38	0.915	1.000	0.915	BS-4.8.3.3.1	6	8.530	74.100	10.700	1.128
35	CH76X38	CH76X38	0.955	1.000	0.955	BS-4.8.3.3.1	6	8.530	74.100	10.700	1.128
36	CH76X38	CH76X38	0.132	1.000	0.132	BS-4.7 (C)	6	8.530	74.100	10.700	1.128
37	CH76X38	CH76X38	0.057	1.000	0.057	BS-4.7 (C)	3	8.530	74.100	10.700	1.128
38	CH76X38	CH76X38	0.123	1.000	0.123	BS-4.7 (C)	6	8.530	74.100	10.700	1.128
39	CH76X38	CH76X38	0.045	1.000	0.045	BS-4.7 (C)	3	8.530	74.100	10.700	1.128
40	CH76X38	CH76X38	0.071	1.000	0.071	BS-4.7 (C)	6	8.530	74.100	10.700	1.128
41	CH76X38	CH76X38	0.041	1.000	0.041	BS-4.7 (C)	6	8.530	74.100	10.700	1.128
42	CH76X38	CH76X38	0.050	1.000	0.050	BS-4.7 (C)	7	8.530	74.100	10.700	1.128

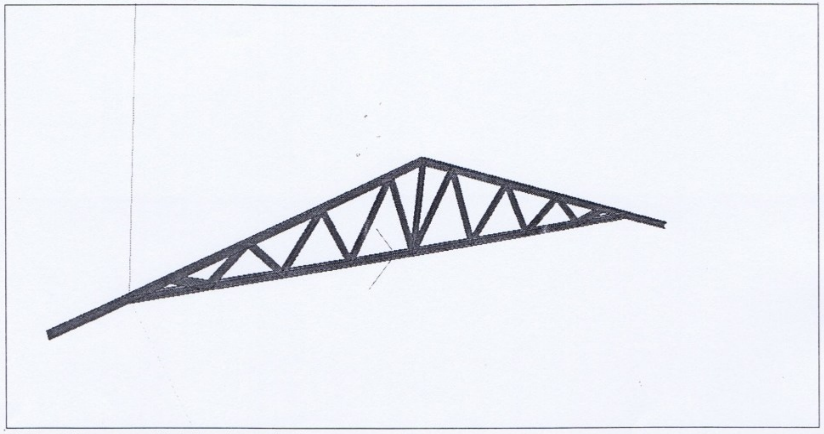


NODE NUMBER (Input data was modified after picture taken)



DIMENSION (Input data was modified after picture taken)

Software licensed to	Job No	Sheet No 12	Rev
	Part		
Job Title Rumah Kekal Mangsa Banjir	Ref		
	By	Date 18-Dec-15	Chd
Client JKR	File truss.std	Date/Time 18-Jan-2016 13:07	



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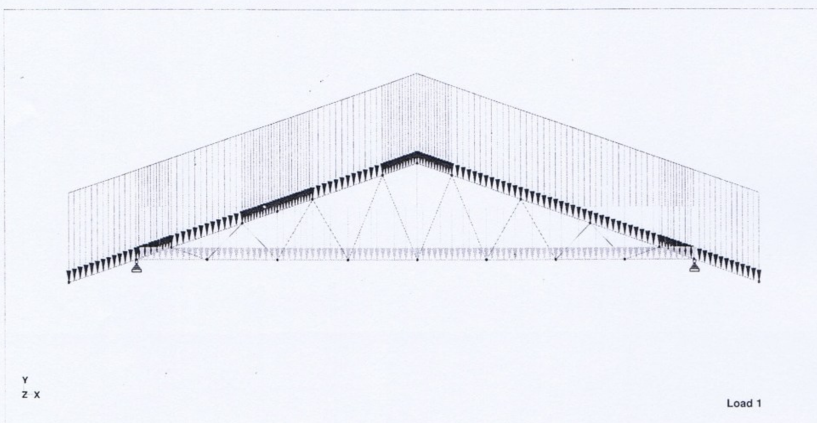
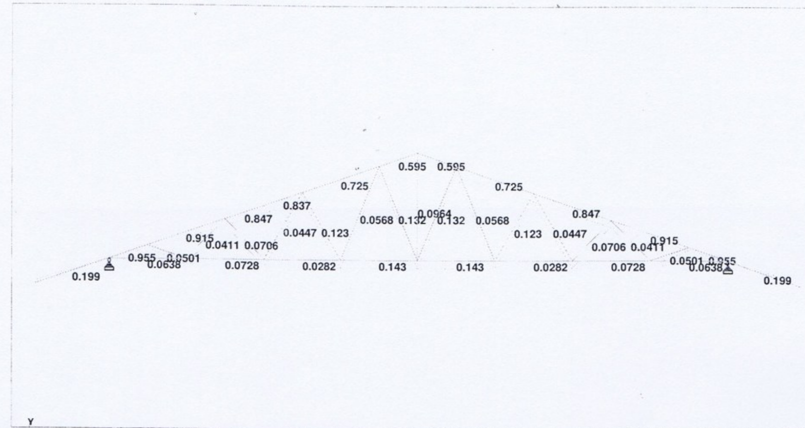


LOADING (Input data was modified after picture taken)

Software licensed to	Job No	Sheet No 13	Rev
	Part		
Job Title Rumah Kekal Mangsa Banjir	Ref		
	By	Date 18-Dec-15	Chd
Client JKR	File truss.std	Date/Time 18-Jan-2016 13:07	



STRESS RATIO (Input data was modified after picture taken)

SLAB DESIGN CALCULATIONS

SLAB DESIGN FULL REPORT

MATERIAL AND DESIGN DATA

Code of Practice	fcu (N/mm²)	Ec, (N/mm²)	fy (N/mm²)	γc	γs
BS8110 : 1985	30	24597	460	1.5	1.15

Cover (mm)	Conc. Unit Weight (kN/m³)	Steel Unit Weight (kg/m³)
25	24	7860

SLAB MARK: 1b - FS1

Slab Location : - D1/1 - D1/1A - E/1A - E/1
Slab Shape : Rectangular

FS1:1

Location : - D1/1 - D1/1A - E/1A - E/1
SubSlab Shape : Rectangular

Dimension: X = 1200 mm, Y = 2400 mm
Sub-Slab Thickness, h = 100 mm, Sub-Slab Drop = 0 mm

FEM Slab Analysis Result

Design Bending Moment from FEM Analysis (X) = 2.7 kNm/m
Design Bending Moment from FEM Analysis (Y) = 2.0 kNm/m
Unfactored Displacement from FEM Analysis = 12.57 mm

Design Calculation (Base on F.E.M. Analysis Result)

Bottom Bar Spanning in Direction(X) Parallel to Sub-Slab Local Axis
Bar Diameter, dia = 10 mm, Effective Depth, d = 100 - 25 - 10 / 2 = 70 mm

Average Concrete Stress above Neutral Axis, k1 = 0.40 × 30.0 = 12.12 N/mm²
Concrete Lever Arm Factor, k2 = 0.4518
Limiting Effective Depth Factor, cb = 0.50
Limiting Concrete Moment Capacity Factor, kk1 = cb × k1 × (1 - cb × k2)
= 0.50 × 12.12 × (1 - 0.50 × 0.4518) = 4.691N/mm²
k2 / k1 Factor, kkk = 0.037

Mu / bd² = 2.7 × 1000000 / (1000.0 × 70.0²) = 0.549 N/mm²
Singly Reinforced Design, limit Mu / bd² < kk1
Mu / bd² = 0.549 <= 4.691

Design as Singly Reinforced Rectangular Beam
Concrete Neutral Axis, x = 3.2 mm
Concrete Compression Force, Fc = k1 × b × x / 1000 = 12.12 × 1000 × 3.2 / 1000 = 39.22 kN

Steel Area Required, AsReq = Fc × 1000 / (fy / γs) = 39.22 × 1000 / (460 / 1.15) = **99 mm²**

Moment Capacity = Fc × (d - k2 × x) / 1000 = 39.22 × (70.0 - 0.4518 × 3.2) / 1000 = 2.7 kNm

Maximum Depth of Section = 100.0 mm
Minimum Tension Steel Area Required = 0.13% × 1000.0 × 100.0 = 130 mm²

Bottom Tension Steel Area Required = 130 mm²
Use 12T10-200 (c/c) - BB (393 mm² / m)
Steel Percentage Provided = 0.39 %
Note: Bar Spacing has been reduced further due to BS8110-1 clause 3.12.11.2.7

Bottom Bar Spanning in Direction(Y) Perpendicular to Sub-Slab Local Axis
Bar Diameter, dia = 10 mm, Bottom Bar Diameter, dia2 = 10 mm
Effective Depth, d = 100 - 25 - 10 - 10 / 2 = 60 mm

Average Concrete Stress above Neutral Axis, k1 = 0.40 × 30.0 = 12.12 N/mm²
Concrete Lever Arm Factor, k2 = 0.4518
Limiting Effective Depth Factor, cb = 0.50
Limiting Concrete Moment Capacity Factor, kk1 = cb × k1 × (1 - cb × k2)
= 0.50 × 12.12 × (1 - 0.50 × 0.4518) = 4.691N/mm²
k2 / k1 Factor, kkk = 0.037

Mu / bd² = 2.0 × 1000000 / (1000.0 × 60.0²) = 0.552 N/mm²
Singly Reinforced Design, limit Mu / bd² < kk1
Mu / bd² = 0.552 <= 4.691

Design as Singly Reinforced Rectangular Beam
Concrete Neutral Axis, x = 2.8 mm
Concrete Compression Force, Fc = k1 × b × x / 1000 = 12.12 × 1000 × 2.8 / 1000 = 33.80 kN

Steel Area Required, AsReq = Fc × 1000 / (fy / γs) = 33.80 × 1000 / (460 / 1.15) = **85 mm²**

Moment Capacity = Fc × (d - k2 × x) / 1000 = 33.80 × (60.0 - 0.4518 × 2.8) / 1000 = 2.0 kNm

Maximum Depth of Section = 100.0 mm
Minimum Tension Steel Area Required = 0.13% × 1000.0 × 100.0 = 130 mm²

Bottom Tension Steel Area Required = 130 mm²
Use 7T10-175 (c/c) - BT (449 mm² / m)
Steel Percentage Provided = 0.45 %
Note: Bar Spacing has been reduced further due to BS8110-1 clause 3.12.11.2.7

Deflection Check
Shorter span in X Direction (1200.0 mm)

Basic Span / Depth Ratio, Br = 20.0
Span Length, l = 1200.0 mm
Effective Depth, d = 70.0 mm
Actual Span / Depth Ratio, Ar = 17.1
Ultimate Design Moment, Mu = 2.7 kNm
Design Steel Strength, fy = 460.0 N/mm²
Area of Tension Steel Required, AsReq = 130 mm²
Area of Tension Steel Provided, AsProv = 393 mm²

- Checking for deflection is based on BS8110: 1985
- Table 3.10: Basic span / effective depth ratio for rectangular or flange beams
- Table 3.11: Modification factor for tension reinforcement

Design Service Stress in Tension Reinforcement, Equation 8
fs = {(5 × fy × AsReq) / (8 × AsProv)} × (1 / ßb)

= {(5 × 460.0 × 130) / (8 × 393)} × (1 / 1.00)
= 95.2 N/mm²

Modification Factor for Tension Reinforcement, Equation 7
MFt = 0.55 + {(477 - fs) / (120 × (0.9 + (M/bd²)))}
= 0.55 + {(477 - 95.2) / (120 × (0.9 + (2.7 × 1000000 / (1000 × 70.0²)))}
= 2.75 > 2.0
MFt taken as 2.0

Deflection Ratio = (Br × MFt) / Ar = (20.0 × 2.00) / 17.1 = **2.33**
Ratio >= 1.0 : Deflection Checked PASSED

SLAB DESIGN FULL REPORT (SUPPORT)

MATERIAL AND DESIGN DATA

Code of Practice	fcu (N/mm²)	Ec, (N/mm²)	fy (N/mm²)	γc	γs
BS8110 : 1985	30	24597	460	1.5	1.15

Cover (mm)	Conc. Unit Weight (kN/m³)	Steel Unit Weight (kg/m³)
25	24	7860

SLAB SUPPORT MARK: 1
RC Wall Mark = **D1/4-1B**

On Slab / Sub-Slab Mark: FS1:1
Thickness of Slab = **100 mm**
Design Bending Moment = **0.13 kNm**

Average Concrete Stress above Neutral Axis, k1 = 0.40 × 30.0 = 12.12 N/mm²
Concrete Lever Arm Factor, k2 = 0.4518
Limiting Effective Depth Factor, cb = 0.50
Limiting Concrete Moment Capacity Factor, kk1 = cb × k1 × (1 - cb × k2)
= 0.50 × 12.12 × (1 - 0.50 × 0.4518) = 4.691N/mm²
k2 / k1 Factor, kkk = 0.037

Mu / bd² = 0.1 × 1000000 / (1000.0 × 70.0²) = 0.027 N/mm²
Singly Reinforced Design, limit Mu / bd² < kk1
Mu / bd² = 0.027 <= 4.691

Design as Singly Reinforced Rectangular Beam
Concrete Neutral Axis, x = 0.2 mm
Concrete Compression Force, Fc = k1 × b × x / 1000 = 12.12 × 1000 × 0.2 / 1000 = 1.87 kN

Steel Area Required, AsReq = Fc × 1000 / (fy / γs) = 1.87 × 1000 / (460 / 1.15) = **5 mm²**

Moment Capacity = Fc × (d - k2 × x) / 1000 = 1.87 × (70.0 - 0.4518 × 0.2) / 1000 = 0.1 kNm

Maximum Depth of Section = 100.0 mm
Minimum Tension Steel Area Required = 0.13% × 1000.0 × 100.0 = 130 mm²

Top Tension Steel Area Required = 130 mm²
Use 5T10 - 200 mm (c/c) - TT (393 mm² / m)
Note: Bar Spacing has been reduced further due to BS8110-1 clause 3.12.11.2.7

SLAB SUPPORT MARK: 2
RC Wall Mark = **1A/D1A-D2**

On Slab / Sub-Slab Mark: FS1:1
Thickness of Slab = **100 mm**
Design Bending Moment = **0.12 kNm**

Average Concrete Stress above Neutral Axis, k1 = 0.40 × 30.0 = 12.12 N/mm²
Concrete Lever Arm Factor, k2 = 0.4518
Limiting Effective Depth Factor, cb = 0.50
Limiting Concrete Moment Capacity Factor, kk1 = cb × k1 × (1 - cb × k2)
= 0.50 × 12.12 × (1 - 0.50 × 0.4518) = 4.691N/mm²
k2 / k1 Factor, kkk = 0.037

Mu / bd² = 0.1 × 1000000 / (1000.0 × 70.0²) = 0.024 N/mm²
Singly Reinforced Design, limit Mu / bd² < kk1
Mu / bd² = 0.024 <= 4.691

Design as Singly Reinforced Rectangular Beam
Concrete Neutral Axis, x = 0.1 mm
Concrete Compression Force, Fc = k1 × b × x / 1000 = 12.12 × 1000 × 0.1 / 1000 = 1.70 kN

Steel Area Required, AsReq = Fc × 1000 / (fy / γs) = 1.70 × 1000 / (460 / 1.15) = **5 mm²**

Moment Capacity = Fc × (d - k2 × x) / 1000 = 1.70 × (70.0 - 0.4518 × 0.1) / 1000 = 0.1 kNm

Maximum Depth of Section = 100.0 mm
Minimum Tension Steel Area Required = 0.13% × 1000.0 × 100.0 = 130 mm²

Top Tension Steel Area Required = 130 mm²
Use 10T10 - 200 mm (c/c) - TT (393 mm² / m)
Note: Bar Spacing has been reduced further due to BS8110-1 clause 3.12.11.2.7

SLAB SUPPORT MARK: 3
RC Wall Mark = **E/1-3**

On Slab / Sub-Slab Mark: FS1:1
Thickness of Slab = **100 mm**
Design Bending Moment = **0.00 kNm**

Average Concrete Stress above Neutral Axis, k1 = 0.40 × 30.0 = 12.12 N/mm²
Concrete Lever Arm Factor, k2 = 0.4518
Limiting Effective Depth Factor, cb = 0.50
Limiting Concrete Moment Capacity Factor, kk1 = cb × k1 × (1 - cb × k2)
= 0.50 × 12.12 × (1 - 0.50 × 0.4518) = 4.691N/mm²
k2 / k1 Factor, kkk = 0.037

Mu / bd² = 0.0 × 1000000 / (1000.0 × 70.0²) = 0.000 N/mm²
Design to minimum steel percentage specified by code,

Maximum Depth of Section = 100.0 mm
Minimum Tension Steel Area Required = 0.13% × 1000.0 × 100.0 = 130 mm²

Top Tension Steel Area Required = 130 mm²

Use 6T10 - 200 mm (c/c) - TT (393 mm² / m)
Note: Bar Spacing has been reduced further due to BS8110-1 clause 3.12.11.2.7

SLAB SUPPORT MARK: 4
RC Wall Mark = **1/C1-D2**

On Slab / Sub-Slab Mark: FS1:1
Thickness of Slab = **100 mm**

Design Bending Moment = **0.00 kNm**

Average Concrete Stress above Neutral Axis, k1 = 0.40 × 30.0 = 12.12 N/mm²
Concrete Lever Arm Factor, k2 = 0.4518
Limiting Effective Depth Factor, cb = 0.50
Limiting Concrete Moment Capacity Factor, kk1 = cb × k1 × (1 - cb × k2)
= 0.50 × 12.12 × (1 - 0.50 × 0.4518) = 4.691N/mm²
k2 / k1 Factor, kkk = 0.037

Mu / bd² = 0.0 × 1000000 / (1000.0 × 70.0²) = 0.000 N/mm²
Design to minimum steel percentage specified by code,

Maximum Depth of Section = 100.0 mm
Minimum Tension Steel Area Required = 0.13% × 1000.0 × 100.0 = 130 mm²

Top Tension Steel Area Required = 130 mm²

Use 11T10 - 200 mm (c/c) - TT (393 mm² / m)
Note: Bar Spacing has been reduced further due to BS8110-1 clause 3.12.11.2.7

BEAM DESIGN CALCULATIONS

MATERIAL AND DESIGN DATA

Code of Practice	fcu (N/mm²)	Ec, (N/mm²)	fy (N/mm²)	fyv (N/mm²)	γc	γs
BS8110 : 1985	30	24597	460	250	1.5	1.15

Cover (mm)	Side Cover (mm)	Conc. Unit Weight (kN/m³)	Steel Unit Weight (kg/m³)
25	25	24	7860

Beam Design Detail Report

DETAIL CALCULATION FOR BEAM MARK : 1b1(120x500)

Beam Located along grid C/2-3
Number of Span within beam = 1
Number of Section defined by user = 1
Number of Supports = 3
Beam Cantilever End = Nil.

Section Dimension Data

Span	Section	Length (mm)	Width (mm)	Begin Depth (mm)	End Depth (mm)
1	1	3800	120	500	500

MATERIAL PROPERTIES

Maximum Concrete Strain, Ecc = 0.0035
Average Concrete Stress above Neutral Axis, k1 = 12.12 N/mm²
Concrete Lever Arm Factor, k2 = 0.4518
Limiting Effective Depth Factor, cb = 0.50
k2 / k1 Factor, kkk = 0.0373

Limiting Concrete Moment Capacity Factor, kk1
= cb × k1 × (1 - cb * k2)
= 0.50 × 12.12 × (1 - 0.50 × 0.4518)
= 4.6911 N/mm²

BEAM 1b1(120x500) SPAN NO. 1

FLEXURAL DESIGN CALCULATION

LOCATION : SPAN (2-D PLAN ANALYSIS RESULT)
Design Bending Moment = **3.6 kNm**
Width, b = 120.0 mm
Effective Depth, d = 460.0 mm
Mu / bd² = 3.6 × 1000000 / (120.0 × 460.0²) = 0.143 N/mm²
Singly Reinforced Design, limit Mu / bd² < kk1

Mu / bd² = 0.143 <= 4.691

Design as Singly Reinforced Rectangular Beam
Concrete Neutral Axis, x = 5.5 mm
Concrete Compression Force, Fc = k1 × b × x / 1000 = 12.12 × 120 × 5.5 / 1000 = 7.95 kN

Steel Area Required, AsReq = Fc × 1000 / (fy / γs) = 7.95 × 1000 / (460 / 1.15) = **20 mm²**

Moment Capacity = Fc × (d - k2 × x) / 1000 = 7.95 × (460.0 - 0.4518 × 5.5) / 1000 = 3.6 kNm

Maximum Depth of Section = 500.0 mm
Minimum Tension Steel Area Required = 0.13% × 120.0 × 500.0 = 79 mm²

Top Compression Steel Area Required = 79 mm²
Bottom Tension Steel Area Required = 79 mm²

Additional Tension Steel Required along beam span, Ast = Ft / (fyy × fy) = 0.0 × 10³ / (0.8696 × 460) = 0 mm²
Area of Longitudinal Bar Area Required by Top Reinforcement, AstTop = Ast / 4 = 0 mm²
Area of Longitudinal Bar Area Required by Bottom Reinforcement, AstBot = Ast = 0 mm²

Final Top Compression Steel Area Required (2D) = 79 mm²
Final Bottom Tension Steel Area Required (2D) = 79 mm²

LOCATION : SPAN (3-D ANALYSIS RESULT)
Design Bending Moment = **3.6 kNm**
Width, b = 120.0 mm
Effective Depth, d = 460.0 mm
Mu / bd² = 3.6 × 1000000 / (120.0 × 460.0²) = 0.143 N/mm²
Singly Reinforced Design, limit Mu / bd² < kk1
Mu / bd² = 0.143 <= 4.691

Design as Singly Reinforced Rectangular Beam
Concrete Neutral Axis, x = 5.5 mm
Concrete Compression Force, Fc = k1 × b × x / 1000 = 12.12 × 120 × 5.5 / 1000 = 7.95 kN

Steel Area Required, AsReq = Fc × 1000 / (fy / γs) = 7.95 × 1000 / (460 / 1.15) = **20 mm²**

Moment Capacity = Fc × (d - k2 × x) / 1000 = 7.95 × (460.0 - 0.4518 × 5.5) / 1000 = 3.6 kNm

Maximum Depth of Section = 500.0 mm
Minimum Tension Steel Area Required = 0.13% × 120.0 × 500.0 = 79 mm²

Top Compression Steel Area Required = 79 mm²
Bottom Tension Steel Area Required = 79 mm²

Additional Tension Steel Required along beam span, Ast = Ft / (fyy × fy) = 0.1 × 10³ / (0.8696 × 460) = 0 mm²
Area of Longitudinal Bar Area Required by Top Reinforcement, AstTop = Ast / 4 = 0 mm²
Area of Longitudinal Bar Area Required by Bottom Reinforcement, AstBot = Ast = 0 mm²

Final Top Compression Steel Area Required (3D) = 79 mm²
Final Bottom Tension Steel Area Required (3D) = 79 mm²

Top Reinforcement Provided = 2T10 (157 mm²)
Bottom Reinforcement Provided = 2T10 (157 mm²)

LOCATION : LEFT SUPPORT (2-D PLAN ANALYSIS RESULT)
Design Bending Moment = **0.0 kNm**
Width, b = 120.0 mm

Effective Depth, d = 460.0 mm
$Mu / bd^2 = 0.0 \times 1000000 / (120.0 \times 460.0^2) = 0.000$ N/mm²
Design to minimum steel percentage specified by code,

Maximum Depth of Section = 500.0 mm
Minimum Tension Steel Area Required = 0.13% × 120.0 × 500.0 = 79 mm²

Top Tension Steel Area Required = 79 mm²

LOCATION : LEFT SUPPORT (3-D ANALYSIS RESULT)
Design Bending Moment = **0.0 kNm**
Width, b = 120.0 mm
Effective Depth, d = 460.0 mm
$Mu / bd^2 = 0.0 \times 1000000 / (120.0 \times 460.0^2) = 0.000$ N/mm²
Design to minimum steel percentage specified by code,

Maximum Depth of Section = 500.0 mm
Minimum Tension Steel Area Required = 0.13% × 120.0 × 500.0 = 79 mm²

Top Tension Steel Area Required = 79 mm²

Additional Tension Steel Required along beam span, Ast = Ft / (fyy × fy) = $0.1 \times 10^3 / (0.8696 \times 460) = 0$ mm²
Area of Longitudinal Bar Area Required by Top Reinforcement, AstTop = Ast / 4 = 0 mm²
Area of Longitudinal Bar Area Required by Bottom Reinforcement, AstBot = Ast = 0 mm²

Final Top Tension Steel Area Required (3D) = 79 mm²
Final Bottom Compression Steel Area Required (3D) = 79 mm²

Top Reinforcement Provided = 2T10 (157 mm²)
Bottom Reinforcement Provided = 2T10 (157 mm²)

LOCATION : RIGHT SUPPORT (2-D PLAN ANALYSIS RESULT)
Design Bending Moment = **0.0 kNm**
Width, b = 120.0 mm
Effective Depth, d = 460.0 mm
$Mu / bd^2 = 0.0 \times 1000000 / (120.0 \times 460.0^2) = 0.000$ N/mm²
Design to minimum steel percentage specified by code,

Maximum Depth of Section = 500.0 mm
Minimum Tension Steel Area Required = 0.13% × 120.0 × 500.0 = 79 mm²

Top Tension Steel Area Required = 79 mm²

LOCATION : RIGHT SUPPORT (3-D ANALYSIS RESULT)
Design Bending Moment = **0.0 kNm**
Width, b = 120.0 mm
Effective Depth, d = 460.0 mm
$Mu / bd^2 = 0.0 \times 1000000 / (120.0 \times 460.0^2) = 0.000$ N/mm²
Design to minimum steel percentage specified by code,

Maximum Depth of Section = 500.0 mm
Minimum Tension Steel Area Required = 0.13% × 120.0 × 500.0 = 79 mm²

Top Tension Steel Area Required = 79 mm²

Additional Tension Steel Required along beam span, Ast = Ft / (fyy × fy) = $0.1 \times 10^3 / (0.8696 \times 460) = 0$ mm²
Area of Longitudinal Bar Area Required by Top Reinforcement, AstTop = Ast / 4 = 0 mm²
Area of Longitudinal Bar Area Required by Bottom Reinforcement, AstBot = Ast = 0 mm²

Final Top Tension Steel Area Required (3D) = 79 mm²
Final Bottom Compression Steel Area Required (3D) = 79 mm²

Top Reinforcement Provided = 2T10 (157 mm²)
Bottom Reinforcement Provided = 2T10 (157 mm²)

LOCATION : 1/4 SPAN (2-D PLAN ANALYSIS RESULT)
Design Bending Moment = **0.0 kNm**
Width, b = 120.0 mm
Effective Depth, d = 460.0 mm
$Mu / bd^2 = 0.0 \times 1000000 / (120.0 \times 460.0^2) = 0.000$ N/mm²
Design to minimum steel percentage specified by code,

Maximum Depth of Section = 500.0 mm
Minimum Tension Steel Area Required = 0.13% × 120.0 × 500.0 = 79 mm²

Top Tension Steel Area Required = 79 mm²

Additional Tension Steel Required along beam span, Ast = Ft / (fyy × fy) = $0.0 \times 10^3 / (0.8696 \times 460) = 0$ mm²
Area of Longitudinal Bar Area Required by Top Reinforcement, AstTop = Ast / 4 = 0 mm²
Area of Longitudinal Bar Area Required by Bottom Reinforcement, AstBot = Ast = 0 mm²

Final Top Tension Steel Area Required (2D) = 79 mm²
Final Bottom Compression Steel Area Required (2D) = 79 mm²

LOCATION : 1/4 SPAN (3-D ANALYSIS RESULT)
Design Bending Moment = **0.0 kNm**
Width, b = 120.0 mm
Effective Depth, d = 460.0 mm
$Mu / bd^2 = 0.0 \times 1000000 / (120.0 \times 460.0^2) = 0.000$ N/mm²
Design to minimum steel percentage specified by code,

Maximum Depth of Section = 500.0 mm
Minimum Tension Steel Area Required = 0.13% × 120.0 × 500.0 = 79 mm²

Top Tension Steel Area Required = 79 mm²

Additional Tension Steel Required along beam span, Ast = Ft / (fyy × fy) = $0.1 \times 10^3 / (0.8696 \times 460) = 0$ mm²
Area of Longitudinal Bar Area Required by Top Reinforcement, AstTop = Ast / 4 = 0 mm²
Area of Longitudinal Bar Area Required by Bottom Reinforcement, AstBot = Ast = 0 mm²

Final Top Tension Steel Area Required (3D) = 79 mm²
Final Bottom Compression Steel Area Required (3D) = 79 mm²

Top Reinforcement Provided = 2T10 (157 mm²)
Bottom Reinforcement Provided = 2T10 (157 mm²)

SHEAR & TORSION DESIGN CALCULATION

LOCATION : SECTION 1 LEFT SUPPORT
(B:0 mm E:950 mm from left grid of span)

Maximum Torsion within Zone, T = 0.0 kNm
Shear at Location of Maximum Torsion, V = 3.8 kN

Link Horizontal Dimension, h1 = b - 2 × Side Cover - DiaLink = 120 - 2 × 25 - 6 = 64 mm
Link Vertical Dimension, v1 = h - 2 × Cover - DiaLink = 500 - 2 × 25 - 6 = 444 mm
Dimension x1 = Min (h1, v1) = 64 mm, y1 = Max (h1, v1) = 444 mm

Section Dimension: Dmin = 120.0 mm, Dmax = 500.0 mm
Torsion Stress, vst = 2 × T × 10^6 / (Dmin² × (Dmax - Dmin / 3)) = 0.00 N/mm²
Effective depth, d = 460.0 mm
Shear Stress due to Loading, vss = V × 1000 / (b × d) = 3.8 × 1000 / (120.0 × 460.0) = 0.07 N/mm²

Part 2 : Clause 2.4.6 and Table 2.3
Maximum Combined Stress Allowed, vtu = Min (0.8 × √fcu, 5) = 4.38 N/mm²
Total Stress, vTot = vss + vst = 0.07 + 0.00 = 0.07 N/mm² ≤ vtu (4.38 N/mm²)
Checking for Combined Stress Allowed Pass

Part 2: Clause 2.4.5
Additional Checking While Small Cross Section (y1 < 550 mm)
Larger Link Dimension, y1 = 444.0 mm < 550 mm
vtu × y1 / 550 = 4.38 × 444.0 / 550 = 3.54 N/mm²
vst = 0.00 N/mm² ≤ 3.54 N/mm²
Checking for Torsion Stress Allowed Pass

Part 2 : Clause 2.4.6 Table 2.3
Torsion Strength contributed by concrete, vt,min = Min (0.067 × √fcu, 0.4) = 0.37 N/mm²
Torsion Stress, vst = 0.00 N/mm² < vt,min = 0.37 N/mm² -> ***No Torsion Reinforcement is needed***

Maximum Shear within Zone, V = 3.7 kN

Part 2 : Clause 2.4.5, 2.4.6 Table 2.3
Maximum Shear Stress Allowed, vtu = Min (0.8 × √30, 5) = 4.38 N/mm²
Shear Stress due to Loading, vss = V × 1000 / (b × d) = 3.7 × 1000 / (120.0 × 460.0) = 0.07 N/mm² ≤ vMax (4.38 N/mm²)
Checking for Maximum Shear Stress Allowed Pass

Minimum Design Shear Stress, vMin = 0.40 N/mm²

Maximum Tensile Force within element = 0.1 kN
Allowable Tensile Capacity of Concrete = 0.05 × fcu × Ac = 0.05 × 30 × (120 × 500) = 90.0 kN
Tension Steel Area Provided, Ast = 157 mm²
- Table 3.9: Values of vc, design concrete shear stress
Steel Percentage, 100 × As / (bv × d) = 0.28 % ≤ 3.0 %

Effective Depth Ratio, edr = 400 / d = 400 / 460.0 = 0.870 < 1
Effective Depth Ratio, 400 / d taken as 1

Minimum fcu, fcuMin = 25 N/mm², Concrete Grade Ratio, Min(fcu, 40) / fcuMin = 30 / 25 = 1.200
Concrete Shear Capacity, vc = 0.79 {100 As / (bv d)}⅓ (400 / d)¼ (fcu / 25)⅓ / γm
= 0.79 × {0.28}⅓ × 1.000 × (1.200)⅓ / 1.25 = 0.44 N/mm²

vss = 0.068 < vc + 0.4, Provides only minimum link
Design for minimum Shear Stress, vd = vmin = 0.40 N/mm²
Shear Link Area / Spacing Ratio, SAsv_Sv = (vd × b) / (fyy × fy) = (0.40 × 120) / (0.87 × 220) = 0.251 mm²/mm

ShearReinforcement Provided : R6-225

ShearLink Area / Spacing Ratio Provided = 0.251 mm²/mm > 0.251 mm²/mm

LOCATION : SECTION 1 MIDDLE ZONE
(B:950 mm E:2850 mm from left grid of span)

Maximum Torsion within Zone, T = 0.0 kNm
Shear at Location of Maximum Torsion, V = 1.9 kN

Link Horizontal Dimension, h1 = b - 2 × Side Cover - DiaLink = 120 - 2 × 25 - 6 = 64 mm
Link Vertical Dimension, v1 = h - 2 × Cover - DiaLink = 500 - 2 × 25 - 6 = 444 mm
Dimension x1 = Min (h1, v1) = 64 mm, y1 = Max (h1, v1) = 444 mm

Section Dimension: Dmin = 120.0 mm, Dmax = 500.0 mm
Torsion Stress, vst = 2 × T × 10^6 / (Dmin² × (Dmax - Dmin / 3)) = 0.00 N/mm²
Effective depth, d = 460.0 mm
Shear Stress due to Loading, vss = V × 1000 / (b × d) = 1.9 × 1000 / (120.0 × 460.0) = 0.03 N/mm²

Part 2 : Clause 2.4.6 and Table 2.3
Maximum Combined Stress Allowed, vtu = Min (0.8 × √fcu, 5) = 4.38 N/mm²
Total Stress, vTot = vss + vst = 0.03 + 0.00 = 0.03 N/mm² ≤ vtu (4.38 N/mm²)
Checking for Combined Stress Allowed Pass

Part 2: Clause 2.4.5
Additional Checking While Small Cross Section (y1 < 550 mm)
Larger Link Dimension, y1 = 444.0 mm < 550 mm
vtu × y1 / 550 = 4.38 × 444.0 / 550 = 3.54 N/mm²
vst = 0.00 N/mm² ≤ 3.54 N/mm²
Checking for Torsion Stress Allowed Pass

Part 2 : Clause 2.4.6 Table 2.3
Torsion Strength contributed by concrete, vt,min = Min (0.067 × √fcu, 0.4) = 0.37 N/mm²
Torsion Stress, vst = 0.00 N/mm² < vt,min = 0.37 N/mm² -> ***No Torsion Reinforcement is needed***

Maximum Shear within Zone, V = 1.9 kN

Part 2 : Clause 2.4.5, 2.4.6 Table 2.3
Maximum Shear Stress Allowed, vtu = Min (0.8 × √30, 5) = 4.38 N/mm²
Shear Stress due to Loading, vss = V × 1000 / (b × d) = 1.9 × 1000 / (120.0 × 460.0) = 0.03 N/mm² ≤ vMax (4.38 N/mm²)
Checking for Maximum Shear Stress Allowed Pass

Minimum Design Shear Stress, vMin = 0.40 N/mm²

Maximum Tensile Force within element = 0.1 kN
Allowable Tensile Capacity of Concrete = 0.05 × fcu × Ac = 0.05 × 30 × (120 × 500) = 90.0 kN
Tension Steel Area Provided, Ast = 157 mm²
- Table 3.9: Values of vc, design concrete shear stress
Steel Percentage, 100 × As / (bv × d) = 0.28 % ≤ 3.0 %

Effective Depth Ratio, edr = 400 / d = 400 / 460.0 = 0.870 < 1
Effective Depth Ratio, 400 / d taken as 1

Minimum fcu, fcuMin = 25 N/mm², Concrete Grade Ratio, Min(fcu, 40) / fcuMin = 30 / 25 = 1.200
Concrete Shear Capacity, vc = 0.79 {100 As / (bv d)}⅓ (400 / d)¼ (fcu / 25)⅓ / γm
= 0.79 × {0.28}⅓ × 1.000 × (1.200)⅓ / 1.25 = 0.44 N/mm²

vss = 0.035 < vc + 0.4, Provides only minimum link
Design for minimum Shear Stress, vd = vmin = 0.40 N/mm²

LOCATION : SECTION 1 LEFT SUPPORT
(B:0 mm E:950 mm from left grid of span)

Maximum Torsion within Zone, T = 0.0 kNm
Shear at Location of Maximum Torsion, V = 3.8 kN

Link Horizontal Dimension, h1 = b - 2 × Side Cover - DiaLink = 120 - 2 × 25 - 6 = 64 mm
Link Vertical Dimension, v1 = h - 2 × Cover - DiaLink = 500 - 2 × 25 - 6 = 444 mm
Dimension x1 = Min (h1, v1) = 64 mm, y1 = Max (h1, v1) = 444 mm

Section Dimension: Dmin = 120.0 mm, Dmax = 500.0 mm
Torsion Stress, vst = 2 × T × 10^6 / ($Dmin^2$ × (Dmax - Dmin / 3)) = 0.00 N/mm²
Effective depth, d = 460.0 mm
Shear Stress due to Loading, vss = V × 1000 / (b × d) = 3.8 × 1000 / (120.0 × 460.0) = 0.07 N/mm²

Part 2 : Clause 2.4.6 and Table 2.3
Maximum Combined Stress Allowed, vtu = Min (0.8 × √fcu, 5) = 4.38 N/mm²
Total Stress, vTot = vss + vst = 0.07 + 0.00 = 0.07 N/mm² ≤ vtu (4.38 N/mm²)
Checking for Combined Stress Allowed Pass

Part 2: Clause 2.4.5
Additional Checking While Small Cross Section (y1 < 550 mm)
Larger Link Dimension, y1 = 444.0 mm < 550 mm
vtu × y1 / 550 = 4.38 × 444.0 / 550 = 3.54 N/mm²
vst = 0.00 N/mm² ≤ 3.54 N/mm²
Checking for Torsion Stress Allowed Pass

Part 2 : Clause 2.4.6 Table 2.3
Torsion Strength contributed by concrete, vt,min = Min (0.067 × √fcu, 0.4) = 0.37 N/mm²
Torsion Stress, vst = 0.00 N/mm² < vt,min = 0.37 N/mm² -> ***No Torsion Reinforcement is needed***

Maximum Shear within Zone, V = 3.7 kN

Part 2 : Clause 2.4.5, 2.4.6 Table 2.3
Maximum Shear Stress Allowed, vtu = Min (0.8 × √30, 5) = 4.38 N/mm²
Shear Stress due to Loading, vss = V × 1000 / (b × d) = 3.7 × 1000 / (120.0 × 460.0) = 0.07 N/mm² ≤ vMax (4.38 N/mm²)
Checking for Maximum Shear Stress Allowed Pass

Minimum Design Shear Stress, vMin = 0.40 N/mm²

Maximum Tensile Force within element = 0.1 kN
Allowable Tensile Capacity of Concrete = 0.05 × fcu × Ac = 0.05 × 30 × (120 × 500) = 90.0 kN
Tension Steel Area Provided, Ast = 157 mm²
- Table 3.9: Values of vc, design concrete shear stress
Steel Percentage, 100 × As / (bv × d) = 0.28 % ≤ 3.0 %

Effective Depth Ratio, edr = 400 / d = 400 / 460.0 = 0.870 < 1
Effective Depth Ratio, 400 / d taken as 1

Minimum fcu, fcuMin = 25 N/mm², Concrete Grade Ratio, Min(fcu, 40) / fcuMin = 30 / 25 = 1.200
Concrete Shear Capacity, vc = 0.79 {100 As / (bv d)}⅓ (400 / d)¼ (fcu / 25)⅓ / γm
= 0.79 × {0.28}⅓ × 1.000 × (1.200)⅓ / 1.25 = 0.44 N/mm²

vss = 0.068 < vc + 0.4, Provides only minimum link
Design for minimum Shear Stress, vd = vmin = 0.40 N/mm²
Shear Link Area / Spacing Ratio, SAsv_Sv = (vd × b) / (fyy × fy) = (0.40 × 120) / (0.87 × 220) = 0.251 mm²/mm

ShearReinforcement Provided : R6-225

ShearLink Area / Spacing Ratio Provided = 0.251 mm²/mm > 0.251 mm²/mm

LOCATION : SECTION 1 MIDDLE ZONE
(B:950 mm E:2850 mm from left grid of span)

Maximum Torsion within Zone, T = 0.0 kNm
Shear at Location of Maximum Torsion, V = 1.9 kN

Link Horizontal Dimension, h1 = b - 2 × Side Cover - DiaLink = 120 - 2 × 25 - 6 = 64 mm
Link Vertical Dimension, v1 = h - 2 × Cover - DiaLink = 500 - 2 × 25 - 6 = 444 mm
Dimension x1 = Min (h1, v1) = 64 mm, y1 = Max (h1, v1) = 444 mm

Section Dimension: Dmin = 120.0 mm, Dmax = 500.0 mm
Torsion Stress, vst = 2 × T × 10^6 / ($Dmin^2$ × (Dmax - Dmin / 3)) = 0.00 N/mm²
Effective depth, d = 460.0 mm
Shear Stress due to Loading, vss = V × 1000 / (b × d) = 1.9 × 1000 / (120.0 × 460.0) = 0.03 N/mm²

Part 2 : Clause 2.4.6 and Table 2.3
Maximum Combined Stress Allowed, vtu = Min (0.8 × √fcu, 5) = 4.38 N/mm²
Total Stress, vTot = vss + vst = 0.03 + 0.00 = 0.03 N/mm² ≤ vtu (4.38 N/mm²)
Checking for Combined Stress Allowed Pass

Part 2: Clause 2.4.5
Additional Checking While Small Cross Section (y1 < 550 mm)
Larger Link Dimension, y1 = 444.0 mm < 550 mm
vtu × y1 / 550 = 4.38 × 444.0 / 550 = 3.54 N/mm²
vst = 0.00 N/mm² ≤ 3.54 N/mm²
Checking for Torsion Stress Allowed Pass

Part 2 : Clause 2.4.6 Table 2.3
Torsion Strength contributed by concrete, vt,min = Min (0.067 × √fcu, 0.4) = 0.37 N/mm²
Torsion Stress, vst = 0.00 N/mm² < vt,min = 0.37 N/mm² -> ***No Torsion Reinforcement is needed***

Maximum Shear within Zone, V = 1.9 kN

Part 2 : Clause 2.4.5, 2.4.6 Table 2.3
Maximum Shear Stress Allowed, vtu = Min (0.8 × √30, 5) = 4.38 N/mm²
Shear Stress due to Loading, vss = V × 1000 / (b × d) = 1.9 × 1000 / (120.0 × 460.0) = 0.03 N/mm² ≤ vMax (4.38 N/mm²)
Checking for Maximum Shear Stress Allowed Pass

Minimum Design Shear Stress, vMin = 0.40 N/mm²

Maximum Tensile Force within element = 0.1 kN
Allowable Tensile Capacity of Concrete = 0.05 × fcu × Ac = 0.05 × 30 × (120 × 500) = 90.0 kN
Tension Steel Area Provided, Ast = 157 mm²
- Table 3.9: Values of vc, design concrete shear stress
Steel Percentage, 100 × As / (bv × d) = 0.28 % ≤ 3.0 %

Effective Depth Ratio, edr = 400 / d = 400 / 460.0 = 0.870 < 1
Effective Depth Ratio, 400 / d taken as 1

Minimum fcu, fcuMin = 25 N/mm², Concrete Grade Ratio, Min(fcu, 40) / fcuMin = 30 / 25 = 1.200
Concrete Shear Capacity, vc = 0.79 {100 As / (bv d)}⅓ (400 / d)¼ (fcu / 25)⅓ / γm
= 0.79 × {0.28}⅓ × 1.000 × (1.200)⅓ / 1.25 = 0.44 N/mm²

vss = 0.035 < vc + 0.4, Provides only minimum link
Design for minimum Shear Stress, vd = vmin = 0.40 N/mm²

Shear Link Area / Spacing Ratio, SAsv_Sv = (vd × b) / (fyy × fy) = (0.40 × 120) / (0.87 × 220) = 0.251 mm^2/mm

ShearReinforcement Provided : R6-225
ShearLink Area / Spacing Ratio Provided = 0.251 mm^2/mm > 0.251 mm^2/mm

LOCATION : SECTION 1 RIGHT SUPPORT
(B:2850 mm E:3800 mm from left grid of span)

Maximum Torsion within Zone, T = 0.0 kNm
Shear at Location of Maximum Torsion, V = 3.8 kN

Link Horizontal Dimension, h1 = b - 2 × Side Cover - DiaLink = 120 - 2 × 25 - 6 = 64 mm
Link Vertical Dimension, v1 = h - 2 × Cover - DiaLink = 500 - 2 × 25 - 6 = 444 mm
Dimension x1 = Min (h1, v1) = 64 mm, y1 = Max (h1, v1) = 444 mm

Section Dimension: Dmin = 120.0 mm, Dmax = 500.0 mm
Torsion Stress, vst = 2 × T × 10^6 / ($Dmin^2$ × (Dmax - Dmin / 3)) = 0.00 N/mm^2
Effective depth, d = 460.0 mm
Shear Stress due to Loading, vss = V × 1000 / (b × d) = 3.8 × 1000 / (120.0 × 460.0) = 0.07 N/mm^2

Part 2 : Clause 2.4.6 and Table 2.3
Maximum Combined Stress Allowed, vtu = Min (0.8 × √fcu, 5) = 4.38 N/mm^2
Total Stress, vTot = vss + vst = 0.07 + 0.00 = 0.07 N/mm^2 ≤ vtu (4.38 N/mm^2)
Checking for Combined Stress Allowed Pass

Part 2: Clause 2.4.5
Additional Checking While Small Cross Section (y1 < 550 mm)
Larger Link Dimension, y1 = 444.0 mm < 550 mm
vtu × y1 / 550 = 4.38 × 444.0 / 550 = 3.54 N/mm^2
vst = 0.00 N/mm^2 ≤ 3.54 N/mm^2
Checking for Torsion Stress Allowed Pass

Part 2 : Clause 2.4.6 Table 2.3
Torsion Strength contributed by concrete, vt,min = Min (0.067 × √fcu, 0.4) = 0.37 N/mm^2
Torsion Stress, vst = 0.00 N/mm^2 < vt,min = 0.37 N/mm^2 -> *No Torsion Reinforcement is needed*

Maximum Shear within Zone, V = 3.7 kN

Part 2 : Clause 2.4.5, 2.4.6 Table 2.3
Maximum Shear Stress Allowed, vtu = Min (0.8 × √30, 5) = 4.38 N/mm^2
Shear Stress due to Loading, vss = V × 1000 / (b × d) = 3.7 × 1000 / (120.0 × 460.0) = 0.07 N/mm^2 ≤ vMax (4.38 N/mm^2)
Checking for Maximum Shear Stress Allowed Pass

Minimum Design Shear Stress, vMin = 0.40 N/mm^2

Maximum Tensile Force within element = 0.1 kN
Allowable Tensile Capacity of Concrete = 0.05 × fcu × Ac = 0.05 × 30 × (120 × 500) = 90.0 kN
Tension Steel Area Provided, Ast = 157 mm^2
- Table 3.9: Values of vc, design concrete shear stress
Steel Percentage, 100 × As / (bv × d) = 0.28 % ≤ 3.0 %

Effective Depth Ratio, edr = 400 / d = 400 / 460.0 = 0.870 < 1
Effective Depth Ratio, 400 / d taken as 1

Minimum fcu, fcuMin = 25 N/mm^2, Concrete Grade Ratio, Min(fcu, 40) / fcuMin = 30 / 25 = 1.200
Concrete Shear Capacity, vc = 0.79 {100 As / (bv d)}⅓ (400 / d)¼ (fcu / 25)⅓ / γm
= 0.79 × {0.28}⅓ × 1.000 × (1.200)⅓ / 1.25 = 0.44 N/mm^2

vss = 0.068 < vc + 0.4, Provides only minimum link
Design for minimum Shear Stress, vd = vmin = 0.40 N/mm^2
Shear Link Area / Spacing Ratio, SAsv_Sv = (vd × b) / (fyy × fy) = (0.40 × 120) / (0.87 × 220) = 0.251 mm^2/mm

ShearReinforcement Provided : R6-225
ShearLink Area / Spacing Ratio Provided = 0.251 mm^2/mm > 0.251 mm^2/mm

DEFLECTION CHECKING FOR SPAN

Basic Span / Depth Ratio, Br = 20.0
Span Length, l = 3800.0 mm
Effective Depth, d = 460.0 mm
Actual Span / Depth Ratio, Ar = 8.3
Ultimate Design Moment, Mu = 3.6 kNm
Design Steel Strength, fy = 460.0 N/mm^2
Area of Tension Steel Required, AsReq = 79 mm^2
Area of Tension Steel Provided, AsProv = 157 mm^2
Area of Compression Steel Provided, AsProv (Comp.) = 157 mm^2

- Checking for deflection is based on BS8110: 1985
- Table 3.10: Basic span / effective depth ratio for rectangular or flange beams
- Table 3.11: Modification factor for tension reinforcement
- Table 3.12: Modification factor for compression reinforcement

Design Service Stress in Tension Reinforcement, Equation 8
fs = {(5 × fy × AsReq) / (8 × AsProv)} × (1 / ßb)
= {(5 × 460.0 × 79) / (8 × 157)} × (1 / 1.00)
= 143.0 N/mm^2

Modification Factor for Tension Reinforcement, Equation 7
MFt = 0.55 + {(477 - fs) / (120 × (0.9 + (M/bd^2)))}
= 0.55 + {(477 - 143.0) / (120 × (0.9 + (3.6 × 1000000 / (120 × 460.0^2))))}
= 3.22 > 2.0
MFt taken as 2.0

New Modification Factor for Compression Reinforcement, Equation 9
MFc = 1 + {(100 × AsProv / (b × d)) / (3 + (100 × AsProv / (b × d)))}
= 1 + {(100 × 157 / (120.0 × 460.0)) / (3 + (100 × 157 / (120.0 × 460.0)))}
= 1.09 <= 1.5

New Deflection Ratio = (Br × MFt × MFc) / Ar = (20.0 × 2.00 × 1.09) / 8.3 = **5.26**
Ratio >= 1.0 : Deflection Checked PASSED

BEAM SUPPORT REACTION TABLE

Current Beam Grid Mark: C/2-3

Beam Support Reactions

Support No.	Grid Mark	Support Type	Support Reaction, kN	
			Dead Load	Live Load
1	2	Wall	2.7	0.0
2	2	Column	2.7	0.0
3	3	Column	2.7	0.0

DETAIL CALCULATION FOR BEAM MARK : 1b2(120x500)

Beam Located along grid 2/A-B
Number of Span within beam = 1
Number of Section defined by user = 1
Number of Supports = 2
Beam Cantilever End = Both

Section Dimension Data

Span	Section	Length (mm)	Width (mm)	Begin Depth (mm)	End Depth (mm)
1	1	1260	120	500	500

MATERIAL PROPERTIES

Maximum Concrete Strain, Ecc = 0.0035
Average Concrete Stress above Neutral Axis, k1 = 12.12 N/mm²
Concrete Lever Arm Factor, k2 = 0.4518
Limiting Effective Depth Factor, cb = 0.50
k2 / k1 Factor, kkk = 0.0373

Limiting Concrete Moment Capacity Factor, kk1
= cb × k1 × (1 - cb * k2)
= 0.50 × 12.12 × (1 - 0.50 × 0.4518)
= 4.6911 N/mm²

BEAM 1b2(120x500) SPAN NO. 1

FLEXURAL DESIGN CALCULATION

LOCATION : RIGHT SUPPORT (2-D PLAN ANALYSIS RESULT)
Design Bending Moment = **11.6 kNm**
Width, b = 120.0 mm
Effective Depth, d = 460.0 mm
Mu / bd² = 11.6 × 1000000 / (120.0 × 460.0²) = 0.459 N/mm²
Singly Reinforced Design, limit Mu / bd² < kk1
Mu / bd² = 0.459 <= 4.691

Design as Singly Reinforced Rectangular Beam
Concrete Neutral Axis, x = 17.7 mm
Concrete Compression Force, Fc = k1 × b × x / 1000 = 12.12 × 120 × 17.7 / 1000 = **25.77 kN**

Steel Area Required, AsReq = Fc × 1000 / (fy / γs) = 25.77 × 1000 / (460 / 1.15) = **65 mm²**

Moment Capacity = Fc × (d - k2 × x) / 1000 = 25.77 × (460.0 - 0.4518 × 17.7) / 1000 = **11.6 kNm**

Maximum Depth of Section = 500.0 mm
Minimum Tension Steel Area Required = 0.13% × 120.0 × 500.0 = 79 mm²

Top Tension Steel Area Required = 79 mm²
Bottom Compression Steel Area Required = 79 mm²

LOCATION : RIGHT SUPPORT (3-D ANALYSIS RESULT)
Design Bending Moment = **11.7 kNm**
Width, b = 120.0 mm
Effective Depth, d = 460.0 mm

Mu / bd² = 11.7 × 1000000 / (120.0 × 460.0²) = 0.459 N/mm²
Singly Reinforced Design, limit Mu / bd² < kk1
Mu / bd² = 0.459 <= 4.691

Design as Singly Reinforced Rectangular Beam
Concrete Neutral Axis, x = 17.7 mm
Concrete Compression Force, Fc = k1 × b × x / 1000 = 12.12 × 120 × 17.7 / 1000 = 25.78 kN

Steel Area Required, AsReq = Fc × 1000 / (fy / γs) = 25.78 × 1000 / (460 / 1.15) = **65 mm²**

Moment Capacity = Fc × (d - k2 × x) / 1000 = 25.78 × (460.0 - 0.4518 × 17.7) / 1000 = 11.7 kNm

Maximum Depth of Section = 500.0 mm
Minimum Tension Steel Area Required = 0.13% × 120.0 × 500.0 = 79 mm²

Top Tension Steel Area Required = 79 mm²
Bottom Compression Steel Area Required = 79 mm²

Top Reinforcement Provided = 2T10 (157 mm²)
Bottom Reinforcement Provided = 2T10 (157 mm²)

LOCATION : 1/4 SPAN (2-D PLAN ANALYSIS RESULT)
Design Bending Moment = **4.2 kNm**
Width, b = 120.0 mm
Effective Depth, d = 460.0 mm
Mu / bd² = 4.2 × 1000000 / (120.0 × 460.0²) = 0.167 N/mm²
Singly Reinforced Design, limit Mu / bd² < kk1
Mu / bd² = 0.167 <= 4.691

Design as Singly Reinforced Rectangular Beam
Concrete Neutral Axis, x = 6.4 mm
Concrete Compression Force, Fc = k1 × b × x / 1000 = 12.12 × 120 × 6.4 / 1000 = 9.27 kN

Steel Area Required, AsReq = Fc × 1000 / (fy / γs) = 9.27 × 1000 / (460 / 1.15) = **24 mm²**

Moment Capacity = Fc × (d - k2 × x) / 1000 = 9.27 × (460.0 - 0.4518 × 6.4) / 1000 = 4.2 kNm

Maximum Depth of Section = 500.0 mm
Minimum Tension Steel Area Required = 0.13% × 120.0 × 500.0 = 79 mm²

Top Tension Steel Area Required = 79 mm²
Bottom Compression Steel Area Required = 79 mm²

LOCATION : 1/4 SPAN (3-D ANALYSIS RESULT)
Design Bending Moment = **4.2 kNm**
Width, b = 120.0 mm
Effective Depth, d = 460.0 mm
Mu / bd² = 4.2 × 1000000 / (120.0 × 460.0²) = 0.167 N/mm²
Singly Reinforced Design, limit Mu / bd² < kk1
Mu / bd² = 0.167 <= 4.691

Design as Singly Reinforced Rectangular Beam
Concrete Neutral Axis, x = 6.4 mm
Concrete Compression Force, Fc = k1 × b × x / 1000 = 12.12 × 120 × 6.4 / 1000 = 9.27 kN

Steel Area Required, AsReq = Fc × 1000 / (fy / γs) = 9.27 × 1000 / (460 / 1.15) = **24 mm²**

Moment Capacity = Fc × (d - k2 × x) / 1000 = 9.27 × (460.0 - 0.4518 × 6.4) / 1000 = 4.2 kNm

Maximum Depth of Section = 500.0 mm
Minimum Tension Steel Area Required = 0.13% × 120.0 × 500.0 = 79 mm^2

Top Tension Steel Area Required = 79 mm^2
Bottom Compression Steel Area Required = 79 mm^2

Top Reinforcement Provided = 2T10 (157 mm^2)
Bottom Reinforcement Provided = 2T10 (157 mm^2)

SHEAR & TORSION DESIGN CALCULATION

LOCATION : SECTION 1 (B:-60 mm E:1200 mm from left grid of span)

Maximum Torsion within Zone, T = 0.0 kNm
Shear at Location of Maximum Torsion, V = 16.7 kN

Link Horizontal Dimension, h1 = b - 2 × Side Cover - DiaLink = 120 - 2 × 25 - 6 = 64 mm
Link Vertical Dimension, v1 = h - 2 × Cover - DiaLink = 500 - 2 × 25 - 6 = 444 mm
Dimension x1 = Min (h1, v1) = 64 mm, y1 = Max (h1, v1) = 444 mm

Section Dimension: Dmin = 120.0 mm, Dmax = 500.0 mm
Torsion Stress, vst = 2 × T × 10^6 / ($Dmin^2$ × (Dmax - Dmin / 3)) = 0.00 N/mm^2
Effective depth, d = 460.0 mm
Shear Stress due to Loading, vss = V × 1000 / (b × d) = 16.7 × 1000 / (120.0 × 460.0) = 0.30 N/mm^2

Part 2 : Clause 2.4.6 and Table 2.3
Maximum Combined Stress Allowed, vtu = Min (0.8 × √fcu, 5) = 4.38 N/mm^2
Total Stress, vTot = vss + vst = 0.30 + 0.00 = 0.31 N/mm^2 ≤ vtu (4.38 N/mm^2)
Checking for Combined Stress Allowed Pass

Part 2: Clause 2.4.5
Additional Checking While Small Cross Section (y1 < 550 mm)
Larger Link Dimension, y1 = 444.0 mm < 550 mm
vtu × y1 / 550 = 4.38 × 444.0 / 550 = 3.54 N/mm^2
vst = 0.00 N/mm^2 ≤ 3.54 N/mm^2
Checking for Torsion Stress Allowed Pass

Part 2 : Clause 2.4.6 Table 2.3
Torsion Strength contributed by concrete, vt,min = Min (0.067 × √fcu, 0.4) = 0.37 N/mm^2
Torsion Stress, vst = 0.00 N/mm^2 < vt,min = 0.37 N/mm^2 -> *No Torsion Reinforcement is needed*

Maximum Shear within Zone, V = 16.2 kN

Part 2 : Clause 2.4.5, 2.4.6 Table 2.3
Maximum Shear Stress Allowed, vtu = Min (0.8 × √30, 5) = 4.38 N/mm^2
Shear Stress due to Loading, vss = V × 1000 / (b × d) = 16.2 × 1000 / (120.0 × 460.0) = 0.29 N/mm^2 ≤ vMax (4.38 N/mm^2)
Checking for Maximum Shear Stress Allowed Pass

Minimum Design Shear Stress, vMin = 0.40 N/mm^2

Tension Steel Area Provided, Ast = 157 mm^2
- Table 3.9: Values of vc, design concrete shear stress
Steel Percentage, 100 × As / (bv × d) = 0.28 % ≤ 3.0 %

Effective Depth Ratio, edr = 400 / d = 400 / 460.0 = 0.870 < 1

Effective Depth Ratio, 400 / d taken as 1

Minimum fcu, fcuMin = 25 N/mm^2, Concrete Grade Ratio, Min(fcu, 40) / fcuMin = 30 / 25 = 1.200
Concrete Shear Capacity, vc = 0.79 {100 As / (bv d)}⅓ (400 / d)¼ (fcu / 25)⅓ / γm
= 0.79 × {0.28}⅓ × 1.000 × (1.200)⅓ / 1.25 = 0.44 N/mm^2

vss = 0.293 < vc + 0.4, Provides only minimum link
Design for minimum Shear Stress, vd = vmin = 0.40 N/mm^2
Shear Link Area / Spacing Ratio, SAsv_Sv = (vd × b) / (fyy × fy) = (0.40 × 120) / (0.87 × 220) = 0.251 mm^2/mm

ShearReinforcement Provided : R6-225
ShearLink Area / Spacing Ratio Provided = 0.251 mm^2/mm > 0.251 mm^2/mm

DEFLECTION CHECKING FOR SPAN

Basic Span / Depth Ratio, Br = 7.0
Span Length, l = 1260.0 mm
Effective Depth, d = 460.0 mm
Actual Span / Depth Ratio, Ar = 2.7
Ultimate Design Moment, Mu = 11.7 kNm
Design Steel Strength, fy = 460.0 N/mm^2
Area of Tension Steel Required, AsReq = 79 mm^2
Area of Tension Steel Provided, AsProv = 157 mm^2
Area of Compression Steel Provided, AsProv (Comp.) = 157 mm^2

- Checking for deflection is based on BS8110: 1985
- Table 3.10: Basic span / effective depth ratio for rectangular or flange beams
- Table 3.11: Modification factor for tension reinforcement
- Table 3.12: Modification factor for compression reinforcement

Design Service Stress in Tension Reinforcement, Equation 8
fs = {(5 × fy × AsReq) / (8 × AsProv)} × (1 / ßb)
= {(5 × 460.0 × 79) / (8 × 157)} × (1 / 1.00)
= 142.8 N/mm^2

Modification Factor for Tension Reinforcement, Equation 7
MFt = 0.55 + {(477 - fs) / (120 × (0.9 + (M/bd^2)))}
= 0.55 + {(477 - 142.8) / (120 × (0.9 + (11.7 × 1000000 / (120 × 460.0^2))))}
= 2.60 > 2.0
MFt taken as 2.0

New Modification Factor for Compression Reinforcement, Equation 9
MFc = 1 + {(100 × AsProv / (b × d)) / (3 + (100 × AsProv / (b × d)))}
= 1 + {(100 × 157 / (120.0 × 460.0)) / (3 + (100 × 157 / (120.0 × 460.0)))}
= 1.09 <= 1.5

New Deflection Ratio = (Br × MFt × MFc) / Ar = (7.0 × 2.00 × 1.09) / 2.7 = **5.55**
Ratio >= 1.0 : Deflection Checked PASSED

BEAM SUPPORT REACTION TABLE

Current Beam Grid Mark: 2/A-B

Beam Support Reactions

Support No.	Grid Mark	Support Type	Support Reaction, kN	
			Dead Load	Live Load
1	B	Wall	9.9	1.8

2	B	Column	9.9	1.8

DETAIL CALCULATION FOR BEAM MARK : 1b3(120x500)

Beam Located along grid A/2-3
Number of Span within beam = 1
Number of Section defined by user = 1
Number of Supports = 2
Beam Cantilever End = Nil.

Section Dimension Data

Span	Section	Length (mm)	Width (mm)	Begin Depth (mm)	End Depth (mm)
1	1	3800	120	500	500

MATERIAL PROPERTIES

Maximum Concrete Strain, Ecc = 0.0035
Average Concrete Stress above Neutral Axis, k1 = 12.12 N/mm²
Concrete Lever Arm Factor, k2 = 0.4518
Limiting Effective Depth Factor, cb = 0.50
k2 / k1 Factor, kkk = 0.0373

Limiting Concrete Moment Capacity Factor, kk1
= cb × k1 × (1 - cb * k2)
= 0.50 × 12.12 × (1 - 0.50 × 0.4518)
= 4.6911 N/mm²

BEAM 1b3(120x500) SPAN NO. 1

FLEXURAL DESIGN CALCULATION

LOCATION : SPAN (2-D PLAN ANALYSIS RESULT)
Design Bending Moment = **3.6 kNm**
Width, b = 120.0 mm
Effective Depth, d = 460.0 mm
Mu / bd² = 3.6 × 1000000 / (120.0 × 460.0²) = 0.143 N/mm²
Singly Reinforced Design, limit Mu / bd² < kk1
Mu / bd² = 0.143 <= 4.691

Design as Singly Reinforced Rectangular Beam
Concrete Neutral Axis, x = 5.5 mm
Concrete Compression Force, Fc = k1 × b × x / 1000 = 12.12 × 120 × 5.5 / 1000 = 7.95 kN

Steel Area Required, AsReq = Fc × 1000 / (fy / γs) = 7.95 × 1000 / (460 / 1.15) = **20 mm²**

Moment Capacity = Fc × (d - k2 × x) / 1000 = 7.95 × (460.0 - 0.4518 × 5.5) / 1000 = 3.6 kNm

Maximum Depth of Section = 500.0 mm
Minimum Tension Steel Area Required = 0.13% × 120.0 × 500.0 = 79 mm²

Top Compression Steel Area Required = 79 mm²
Bottom Tension Steel Area Required = 79 mm²

LOCATION : SPAN (3-D ANALYSIS RESULT)
Design Bending Moment = **3.6 kNm**
Width, b = 120.0 mm

Effective Depth, d = 460.0 mm
Mu / bd² = 3.6 × 1000000 / (120.0 × 460.0²) = 0.143 N/mm²
Singly Reinforced Design, limit Mu / bd² < kk1
Mu / bd² = 0.143 <= 4.691

Design as Singly Reinforced Rectangular Beam
Concrete Neutral Axis, x = 5.5 mm
Concrete Compression Force, Fc = k1 × b × x / 1000 = 12.12 × 120 × 5.5 / 1000 = 7.95 kN

Steel Area Required, AsReq = Fc × 1000 / (fy / γs) = 7.95 × 1000 / (460 / 1.15) = **20 mm²**

Moment Capacity = Fc × (d - k2 × x) / 1000 = 7.95 × (460.0 - 0.4518 × 5.5) / 1000 = 3.6 kNm

Maximum Depth of Section = 500.0 mm
Minimum Tension Steel Area Required = 0.13% × 120.0 × 500.0 = 79 mm²

Top Compression Steel Area Required = 79 mm²
Bottom Tension Steel Area Required = 79 mm²

Top Reinforcement Provided = 2T10 (157 mm²)
Bottom Reinforcement Provided = 2T10 (157 mm²)

LOCATION : LEFT SUPPORT (2-D PLAN ANALYSIS RESULT)
Design Bending Moment = **0.0 kNm**
Width, b = 120.0 mm
Effective Depth, d = 460.0 mm
Mu / bd² = 0.0 × 1000000 / (120.0 × 460.0²) = 0.000 N/mm²
Design to minimum steel percentage specified by code,

Maximum Depth of Section = 500.0 mm
Minimum Tension Steel Area Required = 0.13% × 120.0 × 500.0 = 79 mm²

Top Tension Steel Area Required = 79 mm²

LOCATION : LEFT SUPPORT (3-D ANALYSIS RESULT)
Design Bending Moment = **0.0 kNm**
Width, b = 120.0 mm
Effective Depth, d = 460.0 mm
Mu / bd² = 0.0 × 1000000 / (120.0 × 460.0²) = 0.000 N/mm²
Design to minimum steel percentage specified by code,

Maximum Depth of Section = 500.0 mm
Minimum Tension Steel Area Required = 0.13% × 120.0 × 500.0 = 79 mm²

Top Tension Steel Area Required = 79 mm²

Top Reinforcement Provided = 2T10 (157 mm²)
Bottom Reinforcement Provided = 2T10 (157 mm²)

LOCATION : RIGHT SUPPORT (2-D PLAN ANALYSIS RESULT)
Design Bending Moment = **0.0 kNm**
Width, b = 120.0 mm
Effective Depth, d = 460.0 mm
Mu / bd² = 0.0 × 1000000 / (120.0 × 460.0²) = 0.000 N/mm²
Design to minimum steel percentage specified by code,

Maximum Depth of Section = 500.0 mm
Minimum Tension Steel Area Required = 0.13% × 120.0 × 500.0 = 79 mm²

Top Tension Steel Area Required = 79 mm²

LOCATION : RIGHT SUPPORT (3-D ANALYSIS RESULT)
Design Bending Moment = **0.0 kNm**
Width, b = 120.0 mm
Effective Depth, d = 460.0 mm
$M_u / bd^2 = 0.0 \times 1000000 / (120.0 \times 460.0^2) = 0.000$ N/mm²
Design to minimum steel percentage specified by code,

Maximum Depth of Section = 500.0 mm
Minimum Tension Steel Area Required = 0.13% × 120.0 × 500.0 = 79 mm²

Top Tension Steel Area Required = 79 mm²

Top Reinforcement Provided = 2T10 (157 mm²)
Bottom Reinforcement Provided = 2T10 (157 mm²)

LOCATION : 1/4 SPAN (2-D PLAN ANALYSIS RESULT)
Design Bending Moment = **0.0 kNm**
Width, b = 120.0 mm
Effective Depth, d = 460.0 mm
$M_u / bd^2 = 0.0 \times 1000000 / (120.0 \times 460.0^2) = 0.000$ N/mm²
Design to minimum steel percentage specified by code,

Maximum Depth of Section = 500.0 mm
Minimum Tension Steel Area Required = 0.13% × 120.0 × 500.0 = 79 mm²

Top Tension Steel Area Required = 79 mm²

LOCATION : 1/4 SPAN (3-D ANALYSIS RESULT)
Design Bending Moment = **0.0 kNm**
Width, b = 120.0 mm
Effective Depth, d = 460.0 mm
$M_u / bd^2 = 0.0 \times 1000000 / (120.0 \times 460.0^2) = 0.000$ N/mm²
Design to minimum steel percentage specified by code,

Maximum Depth of Section = 500.0 mm
Minimum Tension Steel Area Required = 0.13% × 120.0 × 500.0 = 79 mm²

Top Tension Steel Area Required = 79 mm²

Top Reinforcement Provided = 2T10 (157 mm²)
Bottom Reinforcement Provided = 2T10 (157 mm²)

SHEAR & TORSION DESIGN CALCULATION

LOCATION : SECTION 1 LEFT SUPPORT
(B:0 mm E:950 mm from left grid of span)

Maximum Torsion within Zone, T = 0.0 kNm
Shear at Location of Maximum Torsion, V = 3.8 kN

Link Horizontal Dimension, h1 = b - 2 × Side Cover - DiaLink = 120 - 2 × 25 - 6 = 64 mm
Link Vertical Dimension, v1 = h - 2 × Cover - DiaLink = 500 - 2 × 25 - 6 = 444 mm
Dimension x1 = Min (h1, v1) = 64 mm, y1 = Max (h1, v1) = 444 mm

Section Dimension: Dmin = 120.0 mm, Dmax = 500.0 mm
Torsion Stress, $v_{st} = 2 \times T \times 10^6 / (D_{min}^2 \times (D_{max} - D_{min} / 3)) = 0.00$ N/mm²
Effective depth, d = 460.0 mm
Shear Stress due to Loading, $v_{ss} = V \times 1000 / (b \times d) = 3.8 \times 1000 / (120.0 \times 460.0) = 0.07$ N/mm²

Part 2 : Clause 2.4.6 and Table 2.3
Maximum Combined Stress Allowed, $v_{tu} = \text{Min}(0.8 \times \sqrt{f_{cu}}, 5) = 4.38$ N/mm²
Total Stress, $v_{Tot} = v_{ss} + v_{st} = 0.07 + 0.00 = 0.07$ N/mm² $\leq v_{tu}$ (4.38 N/mm²)
Checking for Combined Stress Allowed Pass

Part 2: Clause 2.4.5
Additional Checking While Small Cross Section (y1 < 550 mm)
Larger Link Dimension, y1 = 444.0 mm < 550 mm
$v_{tu} \times y1 / 550 = 4.38 \times 444.0 / 550 = 3.54$ N/mm²
$v_{st} = 0.00$ N/mm² ≤ 3.54 N/mm²
Checking for Torsion Stress Allowed Pass

Part 2 : Clause 2.4.6 Table 2.3
Torsion Strength contributed by concrete, $v_{t,min} = \text{Min}(0.067 \times \sqrt{f_{cu}}, 0.4) = 0.37$ N/mm²
Torsion Stress, $v_{st} = 0.00$ N/mm² $< v_{t,min} = 0.37$ N/mm² -> ***No Torsion Reinforcement is needed***

Maximum Shear within Zone, V = 3.7 kN

Part 2 : Clause 2.4.5, 2.4.6 Table 2.3
Maximum Shear Stress Allowed, $v_{tu} = \text{Min}(0.8 \times \sqrt{30}, 5) = 4.38$ N/mm²
Shear Stress due to Loading, $v_{ss} = V \times 1000 / (b \times d) = 3.7 \times 1000 / (120.0 \times 460.0) = 0.07$ N/mm² $\leq v_{Max}$ (4.38 N/mm²)
Checking for Maximum Shear Stress Allowed Pass

Minimum Design Shear Stress, vMin = 0.40 N/mm²

Tension Steel Area Provided, Ast = 157 mm²
- Table 3.9: Values of vc, design concrete shear stress
Steel Percentage, $100 \times A_s / (b_v \times d) = 0.28\% \leq 3.0\%$

Effective Depth Ratio, edr = 400 / d = 400 / 460.0 = 0.870 < 1
Effective Depth Ratio, 400 / d taken as 1

Minimum fcu, fcuMin = 25 N/mm², Concrete Grade Ratio, Min(fcu, 40) / fcuMin = 30 / 25 = 1.200
Concrete Shear Capacity, $v_c = 0.79 \{100 A_s / (b_v d)\}^{1/3} (400 / d)^{1/4} (f_{cu} / 25)^{1/3} / \gamma_m$
$= 0.79 \times \{0.28\}^{1/3} \times 1.000 \times (1.200)^{1/3} / 1.25 = 0.44$ N/mm²

$v_{ss} = 0.067 < v_c + 0.4$, Provides only minimum link
Design for minimum Shear Stress, $v_d = v_{min} = 0.40$ N/mm²
Shear Link Area / Spacing Ratio, $SA_{sv}\_S_v = (v_d \times b) / (f_{yy} \times f_y) = (0.40 \times 120) / (0.87 \times 220) = 0.251$ mm²/mm

ShearReinforcement Provided : R6-225
ShearLink Area / Spacing Ratio Provided = 0.251 mm²/mm > 0.251 mm²/mm

LOCATION : SECTION 1 MIDDLE ZONE

(B:950 mm E:2850 mm from left grid of span)

Maximum Torsion within Zone, T = 0.0 kNm
Shear at Location of Maximum Torsion, V = 1.9 kN

Link Horizontal Dimension, h1 = b - 2 × Side Cover - DiaLink = 120 - 2 × 25 - 6 = 64 mm
Link Vertical Dimension, v1 = h - 2 × Cover - DiaLink = 500 - 2 × 25 - 6 = 444 mm
Dimension x1 = Min (h1, v1) = 64 mm, y1 = Max (h1, v1) = 444 mm

Section Dimension: Dmin = 120.0 mm, Dmax = 500.0 mm
Torsion Stress, vst = $2 \times T \times 10^6 / (Dmin^2 \times (Dmax - Dmin / 3))$ = 0.00 N/mm^2
Effective depth, d = 460.0 mm
Shear Stress due to Loading, vss = V × 1000 / (b × d) = 1.9 × 1000 / (120.0 × 460.0) = 0.03 N/mm^2

Part 2 : Clause 2.4.6 and Table 2.3
Maximum Combined Stress Allowed, vtu = Min $(0.8 \times \sqrt{fcu}, 5)$ = 4.38 N/mm^2
Total Stress, vTot = vss + vst = 0.03 + 0.00 = 0.04 $N/mm^2 \leq$ vtu (4.38 N/mm^2)
Checking for Combined Stress Allowed Pass

Part 2: Clause 2.4.5
Additional Checking While Small Cross Section (y1 < 550 mm)
Larger Link Dimension, y1 = 444.0 mm < 550 mm
vtu × y1 / 550 = 4.38 × 444.0 / 550 = 3.54 N/mm^2
vst = 0.00 $N/mm^2 \leq$ 3.54 N/mm^2
Checking for Torsion Stress Allowed Pass

Part 2 : Clause 2.4.6 Table 2.3
Torsion Strength contributed by concrete, vt,min = Min $(0.067 \times \sqrt{fcu}, 0.4)$ = 0.37 N/mm^2
Torsion Stress, vst = 0.00 N/mm^2 < vt,min = 0.37 N/mm^2 -> ***No Torsion Reinforcement is needed***

Maximum Shear within Zone, V = 1.9 kN

Part 2 : Clause 2.4.5, 2.4.6 Table 2.3
Maximum Shear Stress Allowed, vtu = Min $(0.8 \times \sqrt{30}, 5)$ = 4.38 N/mm^2
Shear Stress due to Loading, vss = V × 1000 / (b × d) = 1.9 × 1000 / (120.0 × 460.0) = 0.03 $N/mm^2 \leq$ vMax (4.38 N/mm^2)
Checking for Maximum Shear Stress Allowed Pass

Minimum Design Shear Stress, vMin = 0.40 N/mm^2

Tension Steel Area Provided, Ast = 157 mm^2
- Table 3.9: Values of vc, design concrete shear stress
Steel Percentage, 100 × As / (bv × d) = 0.28 % ≤ 3.0 %

Effective Depth Ratio, edr = 400 / d = 400 / 460.0 = 0.870 < 1
Effective Depth Ratio, 400 / d taken as 1

Minimum fcu, fcuMin = 25 N/mm^2, Concrete Grade Ratio, Min(fcu, 40) / fcuMin = 30 / 25 = 1.200
Concrete Shear Capacity, vc = $0.79 \{100 As / (bv\, d)\}^{1/3} (400 / d)^{1/4} (fcu / 25)^{1/3} / \gamma m$
= $0.79 \times \{0.28\}^{1/3} \times 1.000 \times (1.200)^{1/3} / 1.25$ = 0.44 N/mm^2

vss = 0.035 < vc + 0.4, Provides only minimum link
Design for minimum Shear Stress, vd = vmin = 0.40 N/mm^2
Shear Link Area / Spacing Ratio, SAsv_Sv = (vd × b) / (fyy × fy) = (0.40 × 120) / (0.87 × 220) = 0.251 mm^2/mm

ShearReinforcement Provided : R6-225
ShearLink Area / Spacing Ratio Provided = 0.251 mm^2/mm > 0.251 mm^2/mm

LOCATION : SECTION 1 RIGHT SUPPORT
(B:2850 mm E:3800 mm from left grid of span)

Maximum Torsion within Zone, T = 0.0 kNm
Shear at Location of Maximum Torsion, V = 3.8 kN

Link Horizontal Dimension, h1 = b - 2 × Side Cover - DiaLink = 120 - 2 × 25 - 6 = 64 mm
Link Vertical Dimension, v1 = h - 2 × Cover - DiaLink = 500 - 2 × 25 - 6 = 444 mm
Dimension x1 = Min (h1, v1) = 64 mm, y1 = Max (h1, v1) = 444 mm

Section Dimension: Dmin = 120.0 mm, Dmax = 500.0 mm
Torsion Stress, vst = $2 \times T \times 10^6 / (Dmin^2 \times (Dmax - Dmin / 3))$ = 0.00 N/mm^2
Effective depth, d = 460.0 mm
Shear Stress due to Loading, vss = V × 1000 / (b × d) = 3.8 × 1000 / (120.0 × 460.0) = 0.07 N/mm^2

Part 2 : Clause 2.4.6 and Table 2.3
Maximum Combined Stress Allowed, vtu = Min $(0.8 \times \sqrt{fcu}, 5)$ = 4.38 N/mm^2
Total Stress, vTot = vss + vst = 0.07 + 0.00 = 0.07 $N/mm^2 \leq$ vtu (4.38 N/mm^2)
Checking for Combined Stress Allowed Pass

Part 2: Clause 2.4.5
Additional Checking While Small Cross Section (y1 < 550 mm)
Larger Link Dimension, y1 = 444.0 mm < 550 mm
vtu × y1 / 550 = 4.38 × 444.0 / 550 = 3.54 N/mm^2
vst = 0.00 $N/mm^2 \leq$ 3.54 N/mm^2
Checking for Torsion Stress Allowed Pass

Part 2 : Clause 2.4.6 Table 2.3
Torsion Strength contributed by concrete, vt,min = Min $(0.067 \times \sqrt{fcu}, 0.4)$ = 0.37 N/mm^2
Torsion Stress, vst = 0.00 N/mm^2 < vt,min = 0.37 N/mm^2 -> ***No Torsion Reinforcement is needed***

Maximum Shear within Zone, V = 3.7 kN

Part 2 : Clause 2.4.5, 2.4.6 Table 2.3
Maximum Shear Stress Allowed, vtu = Min $(0.8 \times \sqrt{30}, 5)$ = 4.38 N/mm^2
Shear Stress due to Loading, vss = V × 1000 / (b × d) = 3.7 × 1000 / (120.0 × 460.0) = 0.07 $N/mm^2 \leq$ vMax (4.38 N/mm^2)
Checking for Maximum Shear Stress Allowed Pass

Minimum Design Shear Stress, vMin = 0.40 N/mm^2

Tension Steel Area Provided, Ast = 157 mm^2
- Table 3.9: Values of vc, design concrete shear stress
Steel Percentage, 100 × As / (bv × d) = 0.28 % ≤ 3.0 %

Effective Depth Ratio, edr = 400 / d = 400 / 460.0 = 0.870 < 1
Effective Depth Ratio, 400 / d taken as 1

Minimum fcu, fcuMin = 25 N/mm^2, Concrete Grade Ratio, Min(fcu, 40) / fcuMin = 30 / 25 = 1.200
Concrete Shear Capacity, vc = $0.79 \{100 As / (bv\, d)\}^{1/3} (400 / d)^{1/4} (fcu / 25)^{1/3} / \gamma m$
= $0.79 \times \{0.28\}^{1/3} \times 1.000 \times (1.200)^{1/3} / 1.25$ = 0.44 N/mm^2

vss = 0.067 < vc + 0.4, Provides only minimum link
Design for minimum Shear Stress, vd = vmin = 0.40 N/mm^2
Shear Link Area / Spacing Ratio, SAsv_Sv = (vd × b) / (fyy × fy) = (0.40 × 120) / (0.87 × 220) = 0.251 mm^2/mm

ShearReinforcement Provided : R6-225
ShearLink Area / Spacing Ratio Provided = 0.251 mm^2/mm > 0.251 mm^2/mm

DEFLECTION CHECKING FOR SPAN

Basic Span / Depth Ratio, Br = 20.0
Span Length, l = 3800.0 mm
Effective Depth, d = 460.0 mm
Actual Span / Depth Ratio, Ar = 8.3
Ultimate Design Moment, Mu = 3.6 kNm
Design Steel Strength, fy = 460.0 N/mm²
Area of Tension Steel Required, AsReq = 79 mm²
Area of Tension Steel Provided, AsProv = 157 mm²
Area of Compression Steel Provided, AsProv (Comp.) = 157 mm²

- Checking for deflection is based on BS8110: 1985
- Table 3.10: Basic span / effective depth ratio for rectangular or flange beams
- Table 3.11: Modification factor for tension reinforcement
- Table 3.12: Modification factor for compression reinforcement

Design Service Stress in Tension Reinforcement, Equation 8

fs = {(5 × fy × AsReq) / (8 × AsProv)} × (1 / ßb)
= {(5 × 460.0 × 79) / (8 × 157)} × (1 / 1.00)
= 142.8 N/mm²

Modification Factor for Tension Reinforcement, Equation 7

MFt = 0.55 + {(477 - fs) / (120 × (0.9 + (M/bd²)))}
= 0.55 + {(477 - 142.8) / (120 × (0.9 + (3.6 × 1000000 / (120 × 460.0²))))}
= 3.22 > 2.0

MFt taken as 2.0

New Modification Factor for Compression Reinforcement, Equation 9

MFc = 1 + {(100 × AsProv / (b × d)) / (3 + (100 × AsProv / (b × d)))}
= 1 + {(100 × 157 / (120.0 × 460.0)) / (3 + (100 × 157 / (120.0 × 460.0)))}
= 1.09 <= 1.5

New Deflection Ratio = (Br × MFt × MFc) / Ar = (20.0 × 2.00 × 1.09) / 8.3 = **5.26**
Ratio >= 1.0 : Deflection Checked PASSED

BEAM SUPPORT REACTION TABLE

Current Beam Grid Mark: A/2-3

Beam Support Reactions

Support No.	Grid Mark	Support Type	Support Reaction, kN	
			Dead Load	Live Load
1	2	Beam	2.7	0.0
2	3	Beam	2.7	0.0

DETAIL CALCULATION FOR BEAM MARK : 1b4(120x500)

Beam Located along grid 3/A-B
Number of Span within beam = 1
Number of Section defined by user = 1
Number of Supports = 2
Beam Cantilever End = Both

Section Dimension Data

Span	Section	Length (mm)	Width (mm)	Begin Depth (mm)	End Depth (mm)
1	1	1260	120	500	500

MATERIAL PROPERTIES

Maximum Concrete Strain, Ecc = 0.0035
Average Concrete Stress above Neutral Axis, k1 = 12.12 N/mm²
Concrete Lever Arm Factor, k2 = 0.4518
Limiting Effective Depth Factor, cb = 0.50
k2 / k1 Factor, kkk = 0.0373

Limiting Concrete Moment Capacity Factor, kk1
= cb × k1 × (1 - cb * k2)
= 0.50 × 12.12 × (1 - 0.50 × 0.4518)
= 4.6911 N/mm²

BEAM 1b4(120x500) SPAN NO. 1

FLEXURAL DESIGN CALCULATION

LOCATION : RIGHT SUPPORT (2-D PLAN ANALYSIS RESULT)
Design Bending Moment = **11.6 kNm**
Width, b = 120.0 mm
Effective Depth, d = 460.0 mm
Mu / bd² = 11.6 × 1000000 / (120.0 × 460.0²) = 0.458 N/mm²
Singly Reinforced Design, limit Mu / bd² < kk1
Mu / bd² = 0.458 <= 4.691

Design as Singly Reinforced Rectangular Beam
Concrete Neutral Axis, x = 17.7 mm
Concrete Compression Force, Fc = k1 × b × x / 1000 = 12.12 × 120 × 17.7 / 1000 = 25.72 kN

Steel Area Required, AsReq = Fc × 1000 / (fy / γs) = 25.72 × 1000 / (460 / 1.15) = **65 mm²**

Moment Capacity = Fc × (d - k2 × x) / 1000 = 25.72 × (460.0 - 0.4518 × 17.7) / 1000 = 11.6 kNm

Maximum Depth of Section = 500.0 mm
Minimum Tension Steel Area Required = 0.13% × 120.0 × 500.0 = 79 mm²

Top Tension Steel Area Required = 79 mm²
Bottom Compression Steel Area Required = 79 mm²

LOCATION : RIGHT SUPPORT (3-D ANALYSIS RESULT)
Design Bending Moment = **11.6 kNm**
Width, b = 120.0 mm
Effective Depth, d = 460.0 mm
Mu / bd² = 11.6 × 1000000 / (120.0 × 460.0²) = 0.458 N/mm²
Singly Reinforced Design, limit Mu / bd² < kk1
Mu / bd² = 0.458 <= 4.691

Design as Singly Reinforced Rectangular Beam
Concrete Neutral Axis, x = 17.7 mm
Concrete Compression Force, Fc = k1 × b × x / 1000 = 12.12 × 120 × 17.7 / 1000 = 25.72 kN

Steel Area Required, AsReq = Fc × 1000 / (fy / γs) = 25.72 × 1000 / (460 / 1.15) = **65 mm²**

Moment Capacity = Fc × (d - k2 × x) / 1000 = 25.72 × (460.0 - 0.4518 × 17.7) / 1000 = **11.6 kNm**

Maximum Depth of Section = 500.0 mm
Minimum Tension Steel Area Required = 0.13% × 120.0 × 500.0 = 79 mm^2

Top Tension Steel Area Required = 79 mm^2
Bottom Compression Steel Area Required = 79 mm^2

Additional Tension Steel Required along beam span, Ast = Ft / (fyy × fy) = 0.0 × 10^3 / (0.8696 × 460) = 0 mm^2
Area of Longitudinal Bar Area Required by Top Reinforcement, AstTop = Ast / 4 = 0 mm^2
Area of Longitudinal Bar Area Required by Bottom Reinforcement, AstBot = Ast = 0 mm^2

Final Top Tension Steel Area Required (3D) = 79 mm^2
Final Bottom Compression Steel Area Required (3D) = 79 mm^2

Top Reinforcement Provided = 2T10 (157 mm^2***)***
Bottom Reinforcement Provided = 2T10 (157 mm^2***)***

LOCATION : 1/4 SPAN (2-D PLAN ANALYSIS RESULT)
Design Bending Moment = **4.2 kNm**
Width, b = 120.0 mm
Effective Depth, d = 460.0 mm
Mu / bd^2 = 4.2 × 1000000 / (120.0 × 460.0^2) = 0.166 N/mm^2
Singly Reinforced Design, limit Mu / bd^2 < kk1
Mu / bd^2 = 0.166 <= 4.691

<u>Design as Singly Reinforced Rectangular Beam</u>
Concrete Neutral Axis, x = 6.3 mm
Concrete Compression Force, Fc = k1 × b × x / 1000 = 12.12 × 120 × 6.3 / 1000 = 9.23 kN

Steel Area Required, AsReq = Fc × 1000 / (fy / γs) = 9.23 × 1000 / (460 / 1.15) = **24** mm^2

Moment Capacity = Fc × (d - k2 × x) / 1000 = 9.23 × (460.0 - 0.4518 × 6.3) / 1000 = 4.2 kNm

Maximum Depth of Section = 500.0 mm
Minimum Tension Steel Area Required = 0.13% × 120.0 × 500.0 = 79 mm^2

Top Tension Steel Area Required = 79 mm^2
Bottom Compression Steel Area Required = 79 mm^2

Additional Tension Steel Required along beam span, Ast = Ft / (fyy × fy) = 0.0 × 10^3 / (0.8696 × 460) = 0 mm^2
Area of Longitudinal Bar Area Required by Top Reinforcement, AstTop = Ast / 4 = 0 mm^2
Area of Longitudinal Bar Area Required by Bottom Reinforcement, AstBot = Ast = 0 mm^2

Final Top Tension Steel Area Required (2D) = 79 mm^2
Final Bottom Compression Steel Area Required (2D) = 79 mm^2

LOCATION : 1/4 SPAN (3-D ANALYSIS RESULT)
Design Bending Moment = **4.2 kNm**
Width, b = 120.0 mm
Effective Depth, d = 460.0 mm
Mu / bd^2 = 4.2 × 1000000 / (120.0 × 460.0^2) = 0.166 N/mm^2
Singly Reinforced Design, limit Mu / bd^2 < kk1
Mu / bd^2 = 0.166 <= 4.691

<u>Design as Singly Reinforced Rectangular Beam</u>
Concrete Neutral Axis, x = 6.3 mm

Concrete Compression Force, Fc = k1 × b × x / 1000 = 12.12 × 120 × 6.3 / 1000 = 9.22 kN

Steel Area Required, AsReq = Fc × 1000 / (fy / γs) = 9.22 × 1000 / (460 / 1.15) = **24** mm^2

Moment Capacity = Fc × (d - k2 × x) / 1000 = 9.22 × (460.0 - 0.4518 × 6.3) / 1000 = 4.2 kNm

Maximum Depth of Section = 500.0 mm
Minimum Tension Steel Area Required = 0.13% × 120.0 × 500.0 = 79 mm^2

Top Tension Steel Area Required = 79 mm^2
Bottom Compression Steel Area Required = 79 mm^2

Additional Tension Steel Required along beam span, Ast = Ft / (fyy × fy) = 0.0 × 10^3 / (0.8696 × 460) = 0 mm^2
Area of Longitudinal Bar Area Required by Top Reinforcement, AstTop = Ast / 4 = 0 mm^2
Area of Longitudinal Bar Area Required by Bottom Reinforcement, AstBot = Ast = 0 mm^2

Final Top Tension Steel Area Required (3D) = 79 mm^2
Final Bottom Compression Steel Area Required (3D) = 79 mm^2

Top Reinforcement Provided = 2T10 (157 mm^2***)***
Bottom Reinforcement Provided = 2T10 (157 mm^2***)***

SHEAR & TORSION DESIGN CALCULATION

LOCATION : SECTION 1 (B:-60 mm E:1200 mm from left grid of span)

Maximum Torsion within Zone, T = 0.0 kNm
Shear at Location of Maximum Torsion, V = 16.7 kN

Link Horizontal Dimension, h1 = b - 2 × Side Cover - DiaLink = 120 - 2 × 25 - 6 = 64 mm
Link Vertical Dimension, v1 = h - 2 × Cover - DiaLink = 500 - 2 × 25 - 6 = 444 mm
Dimension x1 = Min (h1, v1) = 64 mm, y1 = Max (h1, v1) = 444 mm

Section Dimension: Dmin = 120.0 mm, Dmax = 500.0 mm
Torsion Stress, vst = 2 × T × 10^6 / ($Dmin^2$ × (Dmax - Dmin / 3)) = 0.00 N/mm^2
Effective depth, d = 460.0 mm
Shear Stress due to Loading, vss = V × 1000 / (b × d) = 16.7 × 1000 / (120.0 × 460.0) = 0.30 N/mm^2

Part 2 : Clause 2.4.6 and Table 2.3
Maximum Combined Stress Allowed, vtu = Min (0.8 × $\sqrt{fcu}$, 5) = 4.38 N/mm^2
Total Stress, vTot = vss + vst = 0.30 + 0.00 = 0.30 N/mm^2 ≤ vtu (4.38 N/mm^2)
Checking for Combined Stress Allowed Pass

Part 2: Clause 2.4.5
Additional Checking While Small Cross Section (y1 < 550 mm)
Larger Link Dimension, y1 = 444.0 mm < 550 mm
vtu × y1 / 550 = 4.38 × 444.0 / 550 = 3.54 N/mm^2
vst = 0.00 N/mm^2 ≤ 3.54 N/mm^2
Checking for Torsion Stress Allowed Pass

Part 2 : Clause 2.4.6 Table 2.3
Torsion Strength contributed by concrete, vt,min = Min (0.067 × $\sqrt{fcu}$, 0.4) = 0.37 N/mm^2
Torsion Stress, vst = 0.00 N/mm^2 < vt,min = 0.37 N/mm^2 -> ***No Torsion Reinforcement is needed***

Maximum Shear within Zone, V = 16.2 kN

Part 2 : Clause 2.4.5, 2.4.6 Table 2.3
Maximum Shear Stress Allowed, vtu = Min $(0.8 \times \sqrt{30}, 5) = 4.38$ N/mm²
Shear Stress due to Loading, vss = $V \times 1000 / (b \times d) = 16.2 \times 1000 / (120.0 \times 460.0) = 0.29$ N/mm² $\leq$ vMax (4.38 N/mm²)
Checking for Maximum Shear Stress Allowed Pass

Minimum Design Shear Stress, vMin = 0.40 N/mm²

Maximum Tensile Force within element = 0.0 kN
Allowable Tensile Capacity of Concrete = $0.05 \times fcu \times Ac = 0.05 \times 30 \times (120 \times 500) = 90.0$ kN
Tension Steel Area Provided, Ast = 157 mm²
- Table 3.9: Values of vc, design concrete shear stress
Steel Percentage, $100 \times As / (bv \times d) = 0.28\ \% \leq 3.0\ \%$

Effective Depth Ratio, edr = $400 / d = 400 / 460.0 = 0.870 < 1$
Effective Depth Ratio, 400 / d taken as 1

Minimum fcu, fcuMin = 25 N/mm², Concrete Grade Ratio, Min(fcu, 40) / fcuMin = 30 / 25 = 1.200
Concrete Shear Capacity, vc $= 0.79 \{100\ As / (bv\ d)\}^{1/3} (400 / d)^{1/4} (fcu / 25)^{1/3} / \gamma m$
$= 0.79 \times \{0.28\}^{1/3} \times 1.000 \times (1.200)^{1/3} / 1.25 = 0.44$ N/mm²

vss = 0.293 < vc + 0.4, Provides only minimum link
Design for minimum Shear Stress, vd = vmin = 0.40 N/mm²
Shear Link Area / Spacing Ratio, SAsv_Sv = $(vd \times b) / (fyy \times fy) = (0.40 \times 120) / (0.87 \times 220) = 0.251$ mm²/mm

ShearReinforcement Provided : R6-225
ShearLink Area / Spacing Ratio Provided = 0.251 mm²/mm > 0.251 mm²/mm

DEFLECTION CHECKING FOR SPAN

Basic Span / Depth Ratio, Br = 7.0
Span Length, l = 1260.0 mm
Effective Depth, d = 460.0 mm
Actual Span / Depth Ratio, Ar = 2.7
Ultimate Design Moment, Mu = 11.6 kNm
Design Steel Strength, fy = 460.0 N/mm²
Area of Tension Steel Required, AsReq = 79 mm²
Area of Tension Steel Provided, AsProv = 157 mm²
Area of Compression Steel Provided, AsProv (Comp.) = 157 mm²

- Checking for deflection is based on BS8110: 1985
- Table 3.10: Basic span / effective depth ratio for rectangular or flange beams
- Table 3.11: Modification factor for tension reinforcement
- Table 3.12: Modification factor for compression reinforcement

Design Service Stress in Tension Reinforcement, Equation 8
$fs = \{(5 \times fy \times AsReq) / (8 \times AsProv)\} \times (1 / \beta b)$
$= \{(5 \times 460.0 \times 79) / (8 \times 157)\} \times (1 / 1.00)$
$= 142.8$ N/mm²

Modification Factor for Tension Reinforcement, Equation 7
$MFt = 0.55 + \{(477 - fs) / (120 \times (0.9 + (M/bd^2)))\}$
$= 0.55 + \{(477 - 142.8) / (120 \times (0.9 + (11.6 \times 1000000 / (120 \times 460.0^2))))\}$
$= 2.60 > 2.0$
MFt taken as 2.0

New Modification Factor for Compression Reinforcement, Equation 9
$MFc = 1 + \{(100 \times AsProv / (b \times d)) / (3 + (100 \times AsProv / (b \times d)))\}$
$= 1 + \{(100 \times 157 / (120.0 \times 460.0)) / (3 + (100 \times 157 / (120.0 \times 460.0)))\}$
$= 1.09 \leq 1.5$

New Deflection Ratio = $(Br \times MFt \times MFc) / Ar = (7.0 \times 2.00 \times 1.09) / 2.7 =$ **5.55**
Ratio >= 1.0 : Deflection Checked PASSED

BEAM SUPPORT REACTION TABLE

Current Beam Grid Mark: 3/A-B

Beam Support Reactions

Support No.	Grid Mark	Support Type	Support Reaction, kN	
			Dead Load	Live Load
1	B	Wall	9.9	1.8
2	B	Column	9.9	1.8

DETAIL CALCULATION FOR BEAM MARK : 1b5(120x500)

Beam Located along grid D/2-2A
Number of Span within beam = 1
Number of Section defined by user = 1
Number of Supports = 3
Beam Cantilever End = Nil.

Section Dimension Data

Span	Section	Length (mm)	Width (mm)	Begin Depth (mm)	End Depth (mm)
1	1	1400	120	500	500

MATERIAL PROPERTIES

Maximum Concrete Strain, Ecc = 0.0035
Average Concrete Stress above Neutral Axis, k1 = 12.12 N/mm²
Concrete Lever Arm Factor, k2 = 0.4518
Limiting Effective Depth Factor, cb = 0.50
k2 / k1 Factor, kkk = 0.0373

Limiting Concrete Moment Capacity Factor, kk1
$= cb \times k1 \times (1 - cb * k2)$
$= 0.50 \times 12.12 \times (1 - 0.50 \times 0.4518)$
$= 4.6911$ N/mm²

BEAM 1b5(120x500) SPAN NO. 1

FLEXURAL DESIGN CALCULATION

LOCATION : SPAN (2-D PLAN ANALYSIS RESULT)
Design Bending Moment = **0.5 kNm**
Width, b = 120.0 mm
Effective Depth, d = 460.0 mm
$Mu / bd^2 = 0.5 \times 1000000 / (120.0 \times 460.0^2) = 0.019$ N/mm²
Singly Reinforced Design, limit $Mu / bd^2 < kk1$
$Mu / bd^2 = 0.019 \leq 4.691$

Design as Singly Reinforced Rectangular Beam
Concrete Neutral Axis, x = 0.7 mm

Part 2 : Clause 2.4.5, 2.4.6 Table 2.3
Maximum Shear Stress Allowed, vtu = Min (0.8 × √30, 5) = 4.38 N/mm²
Shear Stress due to Loading, vss = V × 1000 / (b × d) = 16.2 × 1000 / (120.0 × 460.0) = 0.29 N/mm² ≤ vMax (4.38 N/mm²)
Checking for Maximum Shear Stress Allowed Pass

Minimum Design Shear Stress, vMin = 0.40 N/mm²

Maximum Tensile Force within element = 0.0 kN
Allowable Tensile Capacity of Concrete = 0.05 × fcu × Ac = 0.05 × 30 × (120 × 500) = 90.0 kN
Tension Steel Area Provided, Ast = 157 mm²
- Table 3.9: Values of vc, design concrete shear stress
Steel Percentage, 100 × As / (bv × d) = 0.28 % ≤ 3.0 %

Effective Depth Ratio, edr = 400 / d = 400 / 460.0 = 0.870 < 1
Effective Depth Ratio, 400 / d taken as 1

Minimum fcu, fcuMin = 25 N/mm², Concrete Grade Ratio, Min(fcu, 40) / fcuMin = 30 / 25 = 1.200
Concrete Shear Capacity, vc = 0.79 {100 As / (bv d)}⅓ (400 / d)¼ (fcu / 25)⅓ / γm
= 0.79 × {0.28}⅓ × 1.000 × (1.200)⅓ / 1.25 = 0.44 N/mm²

vss = 0.293 < vc + 0.4, Provides only minimum link
Design for minimum Shear Stress, vd = vmin = 0.40 N/mm²
Shear Link Area / Spacing Ratio, SAsv_Sv = (vd × b) / (fyy × fy) = (0.40 × 120) / (0.87 × 220) = 0.251 mm²/mm

ShearReinforcement Provided : R6-225
ShearLink Area / Spacing Ratio Provided = 0.251 mm²/mm > 0.251 mm²/mm

DEFLECTION CHECKING FOR SPAN

Basic Span / Depth Ratio, Br = 7.0
Span Length, l = 1260.0 mm
Effective Depth, d = 460.0 mm
Actual Span / Depth Ratio, Ar = 2.7
Ultimate Design Moment, Mu = 11.6 kNm
Design Steel Strength, fy = 460.0 N/mm²
Area of Tension Steel Required, AsReq = 79 mm²
Area of Tension Steel Provided, AsProv = 157 mm²
Area of Compression Steel Provided, AsProv (Comp.) = 157 mm²

- Checking for deflection is based on BS8110: 1985
- Table 3.10: Basic span / effective depth ratio for rectangular or flange beams
- Table 3.11: Modification factor for tension reinforcement
- Table 3.12: Modification factor for compression reinforcement

Design Service Stress in Tension Reinforcement, Equation 8
fs = {(5 × fy × AsReq) / (8 × AsProv)} × (1 / ßb)
= {(5 × 460.0 × 79) / (8 × 157)} × (1 / 1.00)
= 142.8 N/mm²

Modification Factor for Tension Reinforcement, Equation 7
MFt = 0.55 + {(477 - fs) / (120 × (0.9 + (M/bd²)))}
= 0.55 + {(477 - 142.8) / (120 × (0.9 + (11.6 × 1000000 / (120 × 460.0²))))}
= 2.60 > 2.0
MFt taken as 2.0

New Modification Factor for Compression Reinforcement, Equation 9
MFc = 1 + {(100 × AsProv / (b × d)) / (3 + (100 × AsProv / (b × d)))}
= 1 + {(100 × 157 / (120.0 × 460.0)) / (3 + (100 × 157 / (120.0 × 460.0)))}
= 1.09 <= 1.5

New Deflection Ratio = (Br × MFt × MFc) / Ar = (7.0 × 2.00 × 1.09) / 2.7 = **5.55**
Ratio >= 1.0 : Deflection Checked PASSED

BEAM SUPPORT REACTION TABLE

Current Beam Grid Mark: 3/A-B

Beam Support Reactions

Support No.	Grid Mark	Support Type	Support Reaction, kN	
			Dead Load	Live Load
1	B	Wall	9.9	1.8
2	B	Column	9.9	1.8

DETAIL CALCULATION FOR BEAM MARK : 1b5(120x500)

Beam Located along grid D/2-2A
Number of Span within beam = 1
Number of Section defined by user = 1
Number of Supports = 3
Beam Cantilever End = Nil.

Section Dimension Data

Span	Section	Length (mm)	Width (mm)	Begin Depth (mm)	End Depth (mm)
1	1	1400	120	500	500

MATERIAL PROPERTIES

Maximum Concrete Strain, Ecc = 0.0035
Average Concrete Stress above Neutral Axis, k1 = 12.12 N/mm²
Concrete Lever Arm Factor, k2 = 0.4518
Limiting Effective Depth Factor, cb = 0.50
k2 / k1 Factor, kkk = 0.0373

Limiting Concrete Moment Capacity Factor, kk1
= cb × k1 × (1 - cb * k2)
= 0.50 × 12.12 × (1 - 0.50 × 0.4518)
= 4.6911 N/mm²

BEAM 1b5(120x500) SPAN NO. 1

FLEXURAL DESIGN CALCULATION

LOCATION : SPAN (2-D PLAN ANALYSIS RESULT)
Design Bending Moment = **0.5 kNm**
Width, b = 120.0 mm
Effective Depth, d = 460.0 mm
Mu / bd² = 0.5 × 1000000 / (120.0 × 460.0²) = 0.019 N/mm²
Singly Reinforced Design, limit Mu / bd² < kk1
Mu / bd² = 0.019 <= 4.691

Design as Singly Reinforced Rectangular Beam
Concrete Neutral Axis, x = 0.7 mm

Concrete Compression Force, Fc = k1 × b × x / 1000 = 12.12 × 120 × 0.7 / 1000 = 1.07 kN

Steel Area Required, AsReq = Fc × 1000 / (fy / γs) = 1.07 × 1000 / (460 / 1.15) = **3 mm²**

Moment Capacity = Fc × (d - k2 × x) / 1000 = 1.07 × (460.0 - 0.4518 × 0.7) / 1000 = **0.5 kNm**

Maximum Depth of Section = 500.0 mm
Minimum Tension Steel Area Required = 0.13% × 120.0 × 500.0 = 79 mm²

Top Compression Steel Area Required = 79 mm²
Bottom Tension Steel Area Required = 79 mm²

LOCATION : SPAN (3-D ANALYSIS RESULT)
Design Bending Moment = **0.5 kNm**
Width, b = 120.0 mm
Effective Depth, d = 460.0 mm
Mu / bd² = 0.5 × 1000000 / (120.0 × 460.0²) = 0.019 N/mm²
Singly Reinforced Design, limit Mu / bd² < kk1
Mu / bd² = 0.019 <= 4.691

Design as Singly Reinforced Rectangular Beam
Concrete Neutral Axis, x = 0.7 mm
Concrete Compression Force, Fc = k1 × b × x / 1000 = 12.12 × 120 × 0.7 / 1000 = 1.07 kN

Steel Area Required, AsReq = Fc × 1000 / (fy / γs) = 1.07 × 1000 / (460 / 1.15) = **3 mm²**

Moment Capacity = Fc × (d - k2 × x) / 1000 = 1.07 × (460.0 - 0.4518 × 0.7) / 1000 = **0.5 kNm**

Maximum Depth of Section = 500.0 mm
Minimum Tension Steel Area Required = 0.13% × 120.0 × 500.0 = 79 mm²

Top Compression Steel Area Required = 79 mm²
Bottom Tension Steel Area Required = 79 mm²

Top Reinforcement Provided = 2T10 (157 mm²)
Bottom Reinforcement Provided = 2T10 (157 mm²)

LOCATION : LEFT SUPPORT (2-D PLAN ANALYSIS RESULT)
Design Bending Moment = **0.0 kNm**
Width, b = 120.0 mm
Effective Depth, d = 460.0 mm
Mu / bd² = 0.0 × 1000000 / (120.0 × 460.0²) = 0.000 N/mm²
Design to minimum steel percentage specified by code,

Maximum Depth of Section = 500.0 mm
Minimum Tension Steel Area Required = 0.13% × 120.0 × 500.0 = 79 mm²

Top Tension Steel Area Required = 79 mm²

LOCATION : LEFT SUPPORT (3-D ANALYSIS RESULT)
Design Bending Moment = **0.0 kNm**
Width, b = 120.0 mm
Effective Depth, d = 460.0 mm
Mu / bd² = 0.0 × 1000000 / (120.0 × 460.0²) = 0.000 N/mm²
Design to minimum steel percentage specified by code,

Maximum Depth of Section = 500.0 mm

Minimum Tension Steel Area Required = 0.13% × 120.0 × 500.0 = 79 mm²

Top Tension Steel Area Required = 79 mm²

Top Reinforcement Provided = 2T10 (157 mm²)
Bottom Reinforcement Provided = 2T10 (157 mm²)

LOCATION : RIGHT SUPPORT (2-D PLAN ANALYSIS RESULT)
Design Bending Moment = **0.0 kNm**
Width, b = 120.0 mm
Effective Depth, d = 460.0 mm
Mu / bd² = 0.0 × 1000000 / (120.0 × 460.0²) = 0.000 N/mm²
Design to minimum steel percentage specified by code,

Maximum Depth of Section = 500.0 mm
Minimum Tension Steel Area Required = 0.13% × 120.0 × 500.0 = 79 mm²

Top Tension Steel Area Required = 79 mm²

LOCATION : RIGHT SUPPORT (3-D ANALYSIS RESULT)
Design Bending Moment = **0.0 kNm**
Width, b = 120.0 mm
Effective Depth, d = 460.0 mm
Mu / bd² = 0.0 × 1000000 / (120.0 × 460.0²) = 0.000 N/mm²
Design to minimum steel percentage specified by code,

Maximum Depth of Section = 500.0 mm
Minimum Tension Steel Area Required = 0.13% × 120.0 × 500.0 = 79 mm²

Top Tension Steel Area Required = 79 mm²

Top Reinforcement Provided = 2T10 (157 mm²)
Bottom Reinforcement Provided = 2T10 (157 mm²)

LOCATION : 1/4 SPAN (2-D PLAN ANALYSIS RESULT)
Design Bending Moment = **0.0 kNm**
Width, b = 120.0 mm
Effective Depth, d = 460.0 mm
Mu / bd² = 0.0 × 1000000 / (120.0 × 460.0²) = 0.000 N/mm²
Design to minimum steel percentage specified by code,

Maximum Depth of Section = 500.0 mm
Minimum Tension Steel Area Required = 0.13% × 120.0 × 500.0 = 79 mm²

Top Tension Steel Area Required = 79 mm²

LOCATION : 1/4 SPAN (3-D ANALYSIS RESULT)
Design Bending Moment = **0.0 kNm**
Width, b = 120.0 mm
Effective Depth, d = 460.0 mm
Mu / bd² = 0.0 × 1000000 / (120.0 × 460.0²) = 0.000 N/mm²
Design to minimum steel percentage specified by code,

Maximum Depth of Section = 500.0 mm
Minimum Tension Steel Area Required = $0.13\% \times 120.0 \times 500.0 = 79\ mm^2$

Top Tension Steel Area Required = 79 mm²

Top Reinforcement Provided = 2T10 (157 mm²)
Bottom Reinforcement Provided = 2T10 (157 mm²)

SHEAR & TORSION DESIGN CALCULATION

LOCATION : SECTION 1 LEFT SUPPORT
(B:0 mm E:350 mm from left grid of span)

Maximum Torsion within Zone, T = 0.0 kNm
Shear at Location of Maximum Torsion, V = 1.4 kN

Link Horizontal Dimension, h1 = b - 2 × Side Cover - DiaLink = 120 - 2 × 25 - 6 = 64 mm
Link Vertical Dimension, v1 = h - 2 × Cover - DiaLink = 500 - 2 × 25 - 6 = 444 mm
Dimension x1 = Min (h1, v1) = 64 mm, y1 = Max (h1, v1) = 444 mm

Section Dimension: Dmin = 120.0 mm, Dmax = 500.0 mm
Torsion Stress, $vst = 2 \times T \times 10^6 / (Dmin^2 \times (Dmax - Dmin / 3)) = 0.00\ N/mm^2$
Effective depth, d = 460.0 mm
Shear Stress due to Loading, $vss = V \times 1000 / (b \times d) = 1.4 \times 1000 / (120.0 \times 460.0) = 0.03\ N/mm^2$

Part 2 : Clause 2.4.6 and Table 2.3
Maximum Combined Stress Allowed, $vtu = Min (0.8 \times \sqrt{fcu}, 5) = 4.38\ N/mm^2$
Total Stress, $vTot = vss + vst = 0.03 + 0.00 = 0.03\ N/mm^2 \leq vtu\ (4.38\ N/mm^2)$
Checking for Combined Stress Allowed Pass

Part 2: Clause 2.4.5
Additional Checking While Small Cross Section (y1 < 550 mm)
Larger Link Dimension, y1 = 444.0 mm < 550 mm
$vtu \times y1 / 550 = 4.38 \times 444.0 / 550 = 3.54\ N/mm^2$
$vst = 0.00\ N/mm^2 \leq 3.54\ N/mm^2$
Checking for Torsion Stress Allowed Pass

Part 2 : Clause 2.4.6 Table 2.3
Torsion Strength contributed by concrete, $vt,min = Min (0.067 \times \sqrt{fcu}, 0.4) = 0.37\ N/mm^2$
Torsion Stress, $vst = 0.00\ N/mm^2 < vt,min = 0.37\ N/mm^2$ -> *No Torsion Reinforcement is needed*

Maximum Shear within Zone, V = 1.3 kN

Part 2 : Clause 2.4.5, 2.4.6 Table 2.3
Maximum Shear Stress Allowed, $vtu = Min (0.8 \times \sqrt{30}, 5) = 4.38\ N/mm^2$
Shear Stress due to Loading, $vss = V \times 1000 / (b \times d) = 1.3 \times 1000 / (120.0 \times 460.0) = 0.02\ N/mm^2 \leq vMax\ (4.38\ N/mm^2)$
Checking for Maximum Shear Stress Allowed Pass

Minimum Design Shear Stress, $vMin = 0.40\ N/mm^2$

Tension Steel Area Provided, $Ast = 157\ mm^2$
- Table 3.9: Values of vc, design concrete shear stress
Steel Percentage, $100 \times As / (bv \times d) = 0.28\ \% \leq 3.0\ \%$

Effective Depth Ratio, $edr = 400 / d = 400 / 460.0 = 0.870 < 1$

Effective Depth Ratio, 400 / d taken as 1

Minimum fcu, fcuMin = 25 N/mm², Concrete Grade Ratio, Min(fcu, 40) / fcuMin = 30 / 25 = 1.200
Concrete Shear Capacity, $vc = 0.79\ \{100\ As / (bv\ d)\}^{1/3} (400 / d)^{1/4} (fcu / 25)^{1/3} / \gamma m$
$= 0.79 \times \{0.28\}^{1/3} \times 1.000 \times (1.200)^{1/3} / 1.25 = 0.44\ N/mm^2$

vss = 0.024 < vc + 0.4, Provides only minimum link
Design for minimum Shear Stress, $vd = vmin = 0.40\ N/mm^2$
Shear Link Area / Spacing Ratio, $SAsv\_Sv = (vd \times b) / (fyy \times fy) = (0.40 \times 120) / (0.87 \times 220) = 0.251\ mm^2/mm$

ShearReinforcement Provided : R6-225
ShearLink Area / Spacing Ratio Provided = 0.251 mm²/mm > 0.251 mm²/mm

LOCATION : SECTION 1 MIDDLE ZONE
(B:350 mm E:1050 mm from left grid of span)

Maximum Torsion within Zone, T = 0.0 kNm
Shear at Location of Maximum Torsion, V = 0.0 kN

Link Horizontal Dimension, h1 = b - 2 × Side Cover - DiaLink = 120 - 2 × 25 - 6 = 64 mm
Link Vertical Dimension, v1 = h - 2 × Cover - DiaLink = 500 - 2 × 25 - 6 = 444 mm
Dimension x1 = Min (h1, v1) = 64 mm, y1 = Max (h1, v1) = 444 mm

Section Dimension: Dmin = 120.0 mm, Dmax = 500.0 mm
Torsion Stress, $vst = 2 \times T \times 10^6 / (Dmin^2 \times (Dmax - Dmin / 3)) = 0.00\ N/mm^2$
Effective depth, d = 460.0 mm
Shear Stress due to Loading, $vss = V \times 1000 / (b \times d) = 0.0 \times 1000 / (120.0 \times 460.0) = 0.00\ N/mm^2$

Part 2 : Clause 2.4.6 and Table 2.3
Maximum Combined Stress Allowed, $vtu = Min (0.8 \times \sqrt{fcu}, 5) = 4.38\ N/mm^2$
Total Stress, $vTot = vss + vst = 0.00 + 0.00 = 0.00\ N/mm^2 \leq vtu\ (4.38\ N/mm^2)$
Checking for Combined Stress Allowed Pass

Part 2: Clause 2.4.5
Additional Checking While Small Cross Section (y1 < 550 mm)
Larger Link Dimension, y1 = 444.0 mm < 550 mm
$vtu \times y1 / 550 = 4.38 \times 444.0 / 550 = 3.54\ N/mm^2$
$vst = 0.00\ N/mm^2 \leq 3.54\ N/mm^2$
Checking for Torsion Stress Allowed Pass

Part 2 : Clause 2.4.6 Table 2.3
Torsion Strength contributed by concrete, $vt,min = Min (0.067 \times \sqrt{fcu}, 0.4) = 0.37\ N/mm^2$
Torsion Stress, $vst = 0.00\ N/mm^2 < vt,min = 0.37\ N/mm^2$ -> *No Torsion Reinforcement is needed*

Maximum Shear within Zone, V = 0.0 kN

Part 2 : Clause 2.4.5, 2.4.6 Table 2.3
Maximum Shear Stress Allowed, $vtu = Min (0.8 \times \sqrt{30}, 5) = 4.38\ N/mm^2$
Shear Stress due to Loading, $vss = V \times 1000 / (b \times d) = 0.0 \times 1000 / (120.0 \times 460.0) = 0.00\ N/mm^2 \leq vMax\ (4.38\ N/mm^2)$
Checking for Maximum Shear Stress Allowed Pass

Minimum Design Shear Stress, $vMin = 0.40\ N/mm^2$

Tension Steel Area Provided, $Ast = 157\ mm^2$
- Table 3.9: Values of vc, design concrete shear stress
Steel Percentage, $100 \times As / (bv \times d) = 0.28\ \% \leq 3.0\ \%$

Maximum Depth of Section = 500.0 mm
Minimum Tension Steel Area Required = 0.13% × 120.0 × 500.0 = 79 mm^2

Top Tension Steel Area Required = 79 mm^2

Top Reinforcement Provided = 2T10 (157 mm^2)
Bottom Reinforcement Provided = 2T10 (157 mm^2)

SHEAR & TORSION DESIGN CALCULATION

LOCATION : SECTION 1 LEFT SUPPORT
(B:0 mm E:350 mm from left grid of span)

Maximum Torsion within Zone, T = 0.0 kNm
Shear at Location of Maximum Torsion, V = 1.4 kN

Link Horizontal Dimension, h1 = b - 2 × Side Cover - DiaLink = 120 - 2 × 25 - 6 = 64 mm
Link Vertical Dimension, v1 = h - 2 × Cover - DiaLink = 500 - 2 × 25 - 6 = 444 mm
Dimension x1 = Min (h1, v1) = 64 mm, y1 = Max (h1, v1) = 444 mm

Section Dimension: Dmin = 120.0 mm, Dmax = 500.0 mm
Torsion Stress, vst = 2 × T × 10^6 / (Dmin^2 × (Dmax - Dmin / 3)) = 0.00 N/mm^2
Effective depth, d = 460.0 mm
Shear Stress due to Loading, vss = V × 1000 / (b × d) = 1.4 × 1000 / (120.0 × 460.0) = 0.03 N/mm^2

Part 2 : Clause 2.4.6 and Table 2.3
Maximum Combined Stress Allowed, vtu = Min (0.8 × √fcu, 5) = 4.38 N/mm^2
Total Stress, vTot = vss + vst = 0.03 + 0.00 = 0.03 N/mm^2 ≤ vtu (4.38 N/mm^2)
Checking for Combined Stress Allowed Pass

Part 2: Clause 2.4.5
Additional Checking While Small Cross Section (y1 < 550 mm)
Larger Link Dimension, y1 = 444.0 mm < 550 mm
vtu × y1 / 550 = 4.38 × 444.0 / 550 = 3.54 N/mm^2
vst = 0.00 N/mm^2 ≤ 3.54 N/mm^2
Checking for Torsion Stress Allowed Pass

Part 2 : Clause 2.4.6 Table 2.3
Torsion Strength contributed by concrete, vt,min = Min (0.067 × √fcu, 0.4) = 0.37 N/mm^2
Torsion Stress, vst = 0.00 N/mm^2 < vt,min = 0.37 N/mm^2 -> *No Torsion Reinforcement is needed*

Maximum Shear within Zone, V = 1.3 kN

Part 2 : Clause 2.4.5, 2.4.6 Table 2.3
Maximum Shear Stress Allowed, vtu = Min (0.8 × √30, 5) = 4.38 N/mm^2
Shear Stress due to Loading, vss = V × 1000 / (b × d) = 1.3 × 1000 / (120.0 × 460.0) = 0.02 N/mm^2 ≤ vMax (4.38 N/mm^2)
Checking for Maximum Shear Stress Allowed Pass

Minimum Design Shear Stress, vMin = 0.40 N/mm^2

Tension Steel Area Provided, Ast = 157 mm^2
- Table 3.9: Values of vc, design concrete shear stress
Steel Percentage, 100 × As / (bv × d) = 0.28 % ≤ 3.0 %

Effective Depth Ratio, edr = 400 / d = 400 / 460.0 = 0.870 < 1

Effective Depth Ratio, 400 / d taken as 1

Minimum fcu, fcuMin = 25 N/mm^2, Concrete Grade Ratio, Min(fcu, 40) / fcuMin = 30 / 25 = 1.200
Concrete Shear Capacity, vc = 0.79 {100 As / (bv d)}$^{1/3}$ (400 / d)$^{1/4}$ (fcu / 25)$^{1/3}$ / γm
= 0.79 × {0.28}$^{1/3}$ × 1.000 × (1.200)$^{1/3}$ / 1.25 = 0.44 N/mm^2

vss = 0.024 < vc + 0.4, Provides only minimum link
Design for minimum Shear Stress, vd = vmin = 0.40 N/mm^2
Shear Link Area / Spacing Ratio, SAsv_Sv = (vd × b) / (fyy × fy) = (0.40 × 120) / (0.87 × 220) = 0.251 mm^2/mm

ShearReinforcement Provided : R6-225
ShearLink Area / Spacing Ratio Provided = 0.251 mm^2/mm > 0.251 mm^2/mm

LOCATION : SECTION 1 MIDDLE ZONE
(B:350 mm E:1050 mm from left grid of span)

Maximum Torsion within Zone, T = 0.0 kNm
Shear at Location of Maximum Torsion, V = 0.0 kN

Link Horizontal Dimension, h1 = b - 2 × Side Cover - DiaLink = 120 - 2 × 25 - 6 = 64 mm
Link Vertical Dimension, v1 = h - 2 × Cover - DiaLink = 500 - 2 × 25 - 6 = 444 mm
Dimension x1 = Min (h1, v1) = 64 mm, y1 = Max (h1, v1) = 444 mm

Section Dimension: Dmin = 120.0 mm, Dmax = 500.0 mm
Torsion Stress, vst = 2 × T × 10^6 / (Dmin^2 × (Dmax - Dmin / 3)) = 0.00 N/mm^2
Effective depth, d = 460.0 mm
Shear Stress due to Loading, vss = V × 1000 / (b × d) = 0.0 × 1000 / (120.0 × 460.0) = 0.00 N/mm^2

Part 2 : Clause 2.4.6 and Table 2.3
Maximum Combined Stress Allowed, vtu = Min (0.8 × √fcu, 5) = 4.38 N/mm^2
Total Stress, vTot = vss + vst = 0.00 + 0.00 = 0.00 N/mm^2 ≤ vtu (4.38 N/mm^2)
Checking for Combined Stress Allowed Pass

Part 2: Clause 2.4.5
Additional Checking While Small Cross Section (y1 < 550 mm)
Larger Link Dimension, y1 = 444.0 mm < 550 mm
vtu × y1 / 550 = 4.38 × 444.0 / 550 = 3.54 N/mm^2
vst = 0.00 N/mm^2 ≤ 3.54 N/mm^2
Checking for Torsion Stress Allowed Pass

Part 2 : Clause 2.4.6 Table 2.3
Torsion Strength contributed by concrete, vt,min = Min (0.067 × √fcu, 0.4) = 0.37 N/mm^2
Torsion Stress, vst = 0.00 N/mm^2 < vt,min = 0.37 N/mm^2 -> *No Torsion Reinforcement is needed*

Maximum Shear within Zone, V = 0.0 kN

Part 2 : Clause 2.4.5, 2.4.6 Table 2.3
Maximum Shear Stress Allowed, vtu = Min (0.8 × √30, 5) = 4.38 N/mm^2
Shear Stress due to Loading, vss = V × 1000 / (b × d) = 0.0 × 1000 / (120.0 × 460.0) = 0.00 N/mm^2 ≤ vMax (4.38 N/mm^2)
Checking for Maximum Shear Stress Allowed Pass

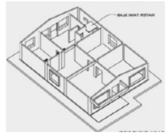
Minimum Design Shear Stress, vMin = 0.40 N/mm^2

Tension Steel Area Provided, Ast = 157 mm^2
- Table 3.9: Values of vc, design concrete shear stress
Steel Percentage, 100 × As / (bv × d) = 0.28 % ≤ 3.0 %

			Dead Load	Live Load
1	2	Wall	1.0	0.0
2	2	Column	1.0	0.0
3	2A	Wall	1.0	0.0

Project : PERUMAHAN KEKAL MANGSA BANJIR (RKB)

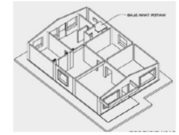
- Kuala Krai (Kelantan)
- 73 Units Sample House - Single Storey Bungalow



73 Units Sample House - Single Storey Bungalow

Work Programme for Industrialized Building System Sequence

Production, Delivery, Installation & Quality Control Schedule



Capacity

1 Bay = 170m x 4.5m x 2 Line = 3 units/day

2 Bay = 170m x 4.5m x 2 Line = 6 units/day

3 Bay = 170m x 4.5m x 2 Line = 9 units/day

Convertion :

3D System Drawing - 1 month

Mould Fabrication - 1 month

Precast Wall : 14.806 m3

In-situ column : 1.782 m3

Precast Beam : 0.308 m3

In-situ Beam : 0.405 m3

Total : 17.301 m3

Bill	Description	No. of workers /Team	No of Worker Required	Line
1	Installation Side Mould, Door Frame & Window Opening	5+0	10	L 1 / L 2
2	Installation Rebar	5+0	10	L 1 / L 2
3	Installation Plumbing Casing & M&E Concuit (by other - appoint JKR)	1+0 (by other)	2	L 1 / L 2
4	Casting Wall Panel	8+0	16	L 1 / L 2
			36	
Delivery (Transport)				

15/2/16

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
1 L 1															6		18		30			42		54		66			
1 L 2																12		24		36			48		60		72		
2 L 1																6		18		30			42		54		66		
2 L 2																	12		24			36		48		60			72
3 L 1																6		18		30			42		54		66		
3 L 2																	12		24			36		48		60			72
4 L 1																	6		18			30		42		54			66
4 L 2																		12		24			36		48		60		
Delivery (Transport)																											5		10

1/3/2016

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
1 L 1																															
1 L 2																															
2 L 1																															
2 L 2																															
3 L 1																															
3 L 2																															
4 L 1		73																													
4 L 2	72																														
Delivery (Transport)	15	20	25	30	35		40	45	50	55	60	65		70	72	73															

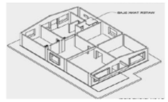
1/4/2016

	1	2	3	4	5	6	7	8	9	10
1 L 1										
1 L 2										
2 L 1										
2 L 2										
3 L 1										
3 L 2										
4 L 1										
4 L 2										
Delivery (Transport)										

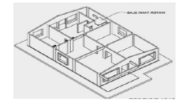
15 Days / Production

7 Days Curing

Project : PERUMAHAN KEKAL MANGSA BANJIR (RKB)
- Kuala Krai (Kelantan)
- 43 Units Sample House - Single Storey Bungalow



43 Units Sample House - Single Storey Bungalow
Work Programme for Industrialized Building System Sequence
Production, Delivery, Installation & Quality Control Schedule



Bill	Description	No. of workers /Team	No of Worker Required	CR
1	Survey Setting Out & Level Sim Plat Installed (2 Unit)	2+0	2	
2	Panel Wall Installation (GF) (2 Unit)	4+1	5	CR1
2.1	Wall Prop Required (GF) (QTY)	14x2x16 28nos/unit		
2.2	Dismantled Wall Prop (GF) 3 Days after column casting	2+0	Bill 2	
3	Filled Expendite Cement Mortar (GF) (2 Unit)	2+0	2	
4	Column Rebar Install (GF) (2 Unit)	5+0	5	
5	Column Mould, PC Beam & In-situ Beam Install (GF) (2 Unit)	5+0	5	CR2
5.1	Column Mould, In-situ Beam & Prop (GF) Required	19x1x10 19nos/unit		
5.2	Dsimantled Column Mould (GF) (2 Unit) 1 days after column casting Temporary Support to Beam 7 Days Curing	5+0	5	CR 2&3
5.3	Dismantled Temporary Support to Beam 7 days curing	2+0	Bill 5.2	
6	Column & Beam Casting (GF) (2 Unit)	5+0	5	CR3
			29	

Super Structure — 25 working days

15/2/16

Bill	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
Delivery (Transport)																											5		10
1																									2	4	6		8
2																													
2.1																													
2.2																													
3																													
4																													
5																													
5.1																													
5.2																													
5.3																													
6																													

1/3/2016

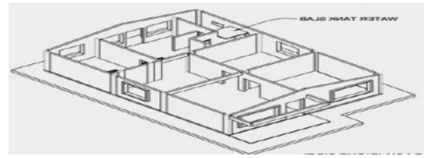
Bill	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Delivery (Transport)	15	20	25	30	35		40	45	50	55	60	65		70	72	73															
1	10	12	14	16	18		20	22	24	26	28	30		32	34	36	38	40	42		43										
2	2	4	6	8	10		12	14	16	18	20	22		24	26	28	30	32	34		36	38	40	42	43						
2.1	2	4	6	8	10		12	14	y	2	4	6		8	10	12	14	y	2		4	6	8	10	12						
2.2								2=18	4=20	6=22	8=24	10=26		12=28	14=30	16=32	18=34	20=36	22=38		24=40	26=42	28=43	30	32	34		36	38	40	42
3		2	4	6	8		10	12	14	16	18	20		22	24	26	28	30	32		34	36	38	40	42	43					
4		2	4	6	8		10	12	14	16	18	20		22	24	26	28	30	32		34	36	38	40	42	43					
5			2	4	6		8	10	12	14	16	18		20	22	24	26	28	30		32	34	36	38	40	42		43			
5.1			2	4	6		8	y1	2	4	6	8		y1	2	4	6	8	y1		2	4	6	8	y1	2		4			
5.2							2=10	4=12	6=14	8=16	10=18	12=20		14=22	16=24	18=26	20=28	22=30	24=32		26=34	28=36	30=38	32=40	34=42	36=43		38	40	42	43
5.3												2		4	6	8	10	12	14		16	18	20	22	24	26		28	30	32	34
6				2	4		6	8	10	12	14	16		18	20	22	24	26	28		30	32	34	36	38	40		42	43		

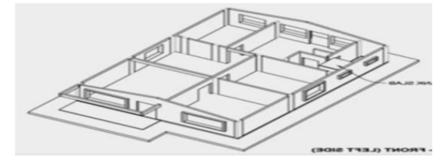
1/4/2016

Bill	1	2	3	4	5	6	7	8	9	10
Delivery (Transport)										
1										
2										
2.1										
2.2	43									
3										
4										
5										
5.1										
5.2										
5.3	36	38		40	42	43				
6										

Project : PERUMAHAN KEKAL MANGSA BANJIR (RKB)

- Kuala Krai (Kelantan)
- Accessories and Worker Team Required

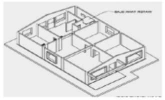




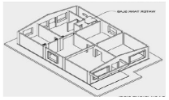
Bill	Description	Prop provided (unit)	Quantities (nos)	Drawing No
2.1	Ground floor wall prop	14 x 2 x 16 units	448	
5.1	Ground floor Column Mould	19 x 1 x 10 units	190	
5.1a	Ground floor In-situ Beam Mould	4 x 1 x 10 units	40	
5.1b	Ground floor Beam Supports (Scaffolding)	5 x 1 x 10 units	50	

Bill	Description	No. of Workers	Work done / Day
1	Wall Panel Installation	4+1 = 5	30 - 50 pcs panel
2	Fill in Expandite Concrete	2+0 = 2	30 - 50 pcs panel
3	Column Rebar Installation	5+0 = 5	40 - 60 nos column
4	Column Mould Installation	5+0 = 5	41 - 60 nos column
5	Column/Beam Casting	5+0 = 5	4 - 6 m3
6	Column Mould Dismantle	5+0 = 5	40 - 60 nos column
7	Precast Beam Installation	4+0 = 4	10 - 20 nos precast beam
8	Mobile Crance 25Ton Panel Installation		
9	Mobile Crance 20Ton Casting & Dismantled		

Project : PERUMAHAN KEKAL MANGSA BANJIR (RKB)
- Kuala Krai (Kelantan)
- 30 Units Sample House - Single Storey Bungalow



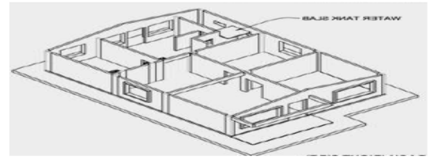
30 Units Sample House - Single Storey Bungalow
Work Programme for Industrialized Building System Sequence
Production, Delivery, Installation & Quality Control Schedule

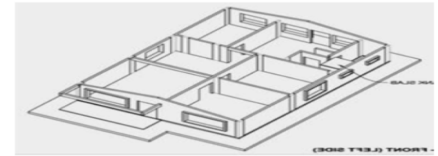


					15/2/16																									1/3/2016																															1/4/2016									
Delivery (Transport)																										5		10	15	20	25	30	35		40	45	50	55	60	65		70	72	73																													
					Super Structure																																																																									
Bill	Description	No. of workers /Team	No of Worker Required	CR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10
1	Survey Setting Out & Level Sim Plat Installed (2 Unit)	2+0	2																										2	4	6		8	10	12	14	16	18		20	22	24	26	28	30																														
2	Panel Wall Installation (GF) (2 Unit)	4+1	5	CR1																														2	4	6	8	10		12	14	16	18	20	22		24	26	28	30																								
2.1	Wall Prop Required (GF) (QTY)	14x2x16 28nos/unit																																2	4	6	8	10		12	14	y	2	4	6		8	10	12	14																								
2.2	Dismantled Wall Prop (GF) 3 Days after column casting	2+0	Bill 2																																						2=18	4=20	6=22	8=24	10=26		12=28	14=30	16	18	20	22		24	26	28	30																	
3	Filled Expendite Cement Mortar (GF) (2 Unit)	2+0	2																																2	4	6	8		10	12	14	16	18	20		22	24	26	28	30																							
4	Column Rebar Install (GF) (2 Unit)	5+0	5																																2	4	6	8		10	12	14	16	18	20		22	24	26	28	30																							
5	Column Mould, PC Beam & In-situ Beam Install (GF) (2 Unit)	5+0	5	CR2																																2	4	6		8	10	12	14	16	18		20	22	24	26	28	30																						
5.1	Column Mould, In-situ Beam & Prop (GF) Required	19x1x10 19nos/unit																																		2	4	6		8	y1	2	4	6	8		y1	2	4	6	8	y1																						
5.2	Dsimantled Column Mould (GF) (2 Unit) 1 days after column casting Temporary Support to Beam 7 Days Curing	5+0	5	CR 2&3																																				2=10	4=12	6=14	8=16	10=18	12=20		14=22	16=24	18=26	20=28	22=30	24		26	28	30																		
5.3	Dismantled Temporary Support to Beam 7 days curing	2+0	Bill 5.2																																										2		4	6	8	10	12	14		16	18	20	22	24	26		28	30												
6	Column & Beam Casting (GF) (2 Unit)	5+0	5	CR3																																	2	4		6	8	10	12	14	16		18	20	22	24	26	28		30																				
			29																															18 working days																																															

Project : PERUMAHAN KEKAL MANGSA BANJIR (RKB)

- Kuala Krai (Kelantan)
- Accessories and Worker Team Required





Bill	Description	Prop provided (unit)	Quantities (nos)	Drawing No
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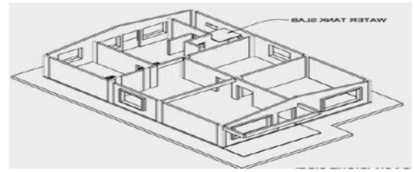
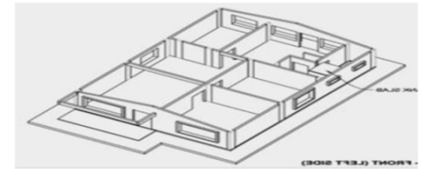
5.1	Ground floor Column Mould	19 x 1 x 10 units	190	
5.1a	Ground floor In-situ Beam Mould	4 x 1 x 10 units	40	
5.1b	Ground floor Beam Supports (Scaffolding)	5 x 1 x 10 units	50	

Bill	Description	No. of Workers	Work done / Day
1	Wall Panel Installation	4+1 = 5	30 - 50 pcs panel
2	Fill in Expandite Concrete	2+0 = 2	30 - 50 pcs panel
3	Column Rebar Installation	5+0 = 5	40 - 60 nos column
4	Column Mould Installation	5+0 = 5	41 - 60 nos column
5	Column/Beam Casting	5+0 = 5	4 - 6 m3
6	Column Mould Dismantle	5+0 = 5	40 - 60 nos column
7	Precast Beam Installation	4+0 = 4	10 - 20 nos precast beam
8	Mobile Crance 25Ton Panel Installation		
9	Mobile Crance 20Ton Casting & Dismantled		

Project : PERUMAHAN KEKAL MANGSA BANJIR (RKB)

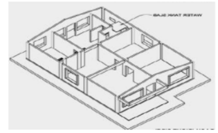
- Kuala Krai (Kelantan)
- Logistic Cost



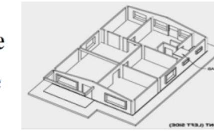


Item	Description	Super-structure (Frame & Wall) HC Precast System	Logistic		
			Kuala Krai	Kuala Lipis	Jerantut
	Super-structure (Frame & Wall) :				
	- Precast Element				
	- Wet Work on Site	15,570.90	4,534.20	3,022.80	3,023.80
	Total / unit	15,570.90	4,534.20	3,022.80	3,023.80
	Total GFA (m2)	97.50			
	Cost / m2 GFA	159.70			
	Cost / ft2 GFA	14.84			

Project : PERUMAHAN KEKAL MANGSA BANJIR (RKB)
- Kuala Krai (Kelantan)
- 2 Units Sample House - Single Storey Bungalow



2 Units Sample House - Single Storey Bungalow
Work Programme for Industrialized Building System Sequence
Production, Delivery, Installation & Quality Control Schedule



Capacity
1 Bay = 170m x 4.5m x 2 Line = 3 units/day
2 Bay = 170m x 4.5m x 2 Line = 6 units/day
3 Bay = 170m x 4.5m x 2 Line = 9 units/day

Convertion :
3D System Drawing - 1 month
Mould Fabrication - 1 month

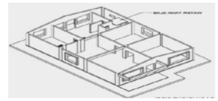
Precast Wall : 14.806 m3
In-situ column : 1.782 m3
Precast Beam : 0.308 m3
In-situ Beam : 0.405 m3
Total : 17.301 m3

Bill	Description	No. of workers /Team	No of Worker Required	Line	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
					15/2/16																													1/3/2016														
1	Installation Side Mould, Door Frame & Window Opening	5+0	5	L 1															2																													
				L 2																																												
2	Installation Rebar	5+0	5	L 1																2																												
				L 2																																												
3	Installation Plumbing Casing & M&E Concuit (by other - appoint JKR)	1+0 (by other)	1	L 1																2																												
				L 2																																												
4	Casting Wall Panel	8+0	8	L 1																	2																											
				L 2																																												
			18																																													
	Delivery (Transport)																														2																	

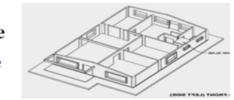
Production 3days

7 Days Curing

Project : PERUMAHAN KEKAL MANGSA BANJIR (RKB)
- Kuala Krai (Kelantan)
- 2 Units Sample House - Single Storey Bungalow



2 Units Sample House - Single Storey Bungalow
Work Programme for Industrialized Building System Sequence
Production, Delivery, Installation & Quality Control Schedule



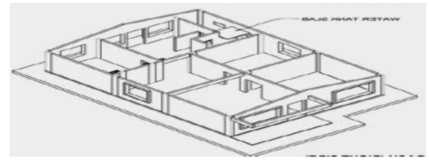
Super Structure

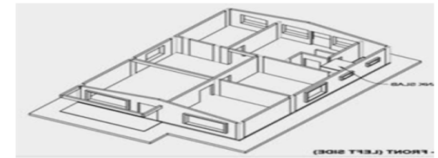
Bill	Description	No. of workers /Team	No of Worker Required	CR	15/2/16																													1/3/2016														
					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	Delivery (Transport)																														2																	
1	Survey Setting Out & Level Sim Plat Installed (2 Unit)	2+0	2																														2															
2	Panel Wall Installation (GF) (2 Unit)	4+1	5	CR 1																														2														
2.1	Wall Prop Required (GF) (QTY)	14x2x2 28nos/unit																																2														
2.2	Dismantled Wall Prop (GF) 3 Days after column casting	2+0	Bill 2																																						2=2							
3	Filled Expendite Cement Mortar (GF) (2 Unit)	2+0	Bill 2																																2													
4	Column Rebar Install (GF) (2 Unit)	5+0	Bill 2																																	2												
5	Column Mould, PC Beam & In-situ Beam Install (GF) (2 Unit)	5+0	Bill 2	CR 1																																	2											
5.1	Column Mould, In-situ Beam & Prop (GF) Required	19x1x2 19nos/unit																																			2											
5.2	Dsimantled Column Mould (GF) (2 Unit) 1 days after column casting Temporary Support to Beam 7 Days Curing	5+0	Bill 2	CR 1																																				2=2								
5.3	Dismantled Temporary Support to Beam 7 days curing	2+0	Bill 2																																											2			
6	Column & Beam Casting (GF) (2 Unit)	5+0	Bill 2	CR 1																																		2										
			5																															5 Days														

Project : PERUMAHAN KEKAL MANGSA BANJIR (RKB)

- Kuala Krai (Kelantan)

- Accessories and Worker Team Required





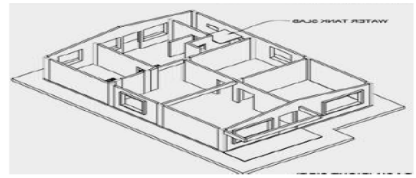
Bill	Description	Prop provided (unit)	Quantities (nos)	Drawing No
2.1	Ground floor wall prop	14 x 2 x 2 units	28	
5.1	Ground floor Column Mould	19 x 1 x 2 units	38	
5.1a	Ground floor In-situ Beam Mould	4 x 1 x 2 units	8	
5.1b	Ground floor Beam Supports (Scaffolding)	5 x 1 x 2 units	10	

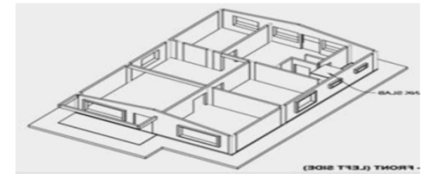
Bill	Description	No. of Workers	Work done / Day
1	Wall Panel Installation	4+1 = 5	30 - 50 pcs panel
2	Fill in Expandite Concrete	2+0 = 2	30 - 50 pcs panel
3	Column Rebar Installation	5+0 = 5	40 - 60 nos column
4	Column Mould Installation	5+0 = 5	41 - 60 nos column
5	Column/Beam Casting	5+0 = 5	4 - 6 m3
6	Column Mould Dismantle	5+0 = 5	40 - 60 nos column
7	Precast Beam Installation	4+0 = 4	10 - 20 nos precast beam
8	Mobile Crance 25Ton Panel Installation		
9	Mobile Crance 20Ton Casting & Dismantled		

Project : PERUMAHAN KEKAL MANGSA BANJIR (RKB)

- Kuala Krai (Kelantan)

- Logistic Cost





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DESIGNED BY YOU
PRODUCED BY
HC PRECAST SYSTEM

THANK YOU