<u>รายการคำนวณโครงสร้าง</u>

โครงสร้างพื้นโรงงาน และฐานราก

โครงการปรับปรุงโรงงานจักรวาลเคมี

เจ้าของโครงการ : บริษัท จักรวาลเคมี จำกัด

สถานที่ก่อสร้าง : 545 นิคมอุตสาหกรรมบางปู ถนนสุขุมวิท สมุทรปราการ

<u>วิศวกรโครงสร้าง</u>

นายณัฐพล กิตติวัฒนาชัย สย.9722

วันที่ 10 มกราคม พ.ศ. 2556

รายการคำนวณโครงสร้าง งานปรับปรุงโรงงานจักรวาลเคมี

ข้อกำหนดที่ใช้ออกแบบ (Design Criteria)

1 หน่วยน้ำหนักที่กระทำกับโครงสร้าง

อ้างตามกฎกระทรวงมหาดไทย ฉบับที่ 6 พ.ศ. 2527 ซึ่งออกตาม ความใน พระราชบัญญัติควบคุมอาคาร พ.ศ. 2522 ส่วนอื่นใดที่ไม่ได้กำหนด ไว้จะอ้างอิง ตามมาตรฐานอาคารคอนกรีตเสริมเหล็ก ของวิศวกรรมสถานแห่งประเทศไทย ในพระบรมราชูปถัมภ์

2 น้ำหนักบรรทุกคงที่ (Dead Load)

คอนกรีตเสริมเหล็ก	=	2400	Kg/m^3
เหล็กรูปพรรณ	=	7850	Kg/m^3
ผนังก่ออิฐครึ่งแผ่น	=	180	Kg/m^2
ผนังก่ออิฐเต็มแผ่น	=	360	Kg/m2
นน.กระเบื้องปูพื้น	=	50	Kg/m2

2 น้ำหนักบรรทุกจร (Live Load)

โครงข้อแข็ง	=	100	Kg/m
พื้นรับรถบรรทุก 6 ล้อเล็ก	=	2000	Kg/m^2
พื้นรับเครื่องจักร	=	3000	Kg/m^2

3 น้ำหนักของเครื่องจักร

ตามน้ำหนักที่ระบุโดยผู้ผลิต

4 มาตรฐานที่ใช้ในการออกแบบ

มาตรฐาน ว.ส.ท. 1008-38 มาตรฐานสำหรับอาคารคอนกรีตเสริมเหล็ก โดยวิธีกำลัง
มาตรฐาน ว.ส.ท. 1007-40 มาตรฐานสำหรับอาคารเหล็กรูปพรรณ
American Concrete Institute (ACI 318-99)
American Institute of Steel Construction (AISC) - ASD 89

5 คุณสมบัติของวัสดุ

กำลังอัดประลัยของคอนกรีต ที่ 28 วัน	f'c	=	150	ksc
โมดูลัสยืดหยุ่นของคอนกรีต	Ec	=	185181	ksc
เหล็กข้ออ้อย : เหล็กชั้นคุณภาพ SD40 (มอก. 24-2527)				
กำลังครากต่ำสุด	fy	=	4000	ksc
เหล็กกลม : เหล็กชั้นคุณภาพ SR24 (มอก. 24-2527)				
กำลังครากต่ำสุด	fy	=	2400	ksc
โมดูลัสยืดหยุ่นของเหล็ก	Es	=	2040000	ksc
เหล็กรูปพรรณ เกรด SS400				
กำลังครากต่ำสุด	fy	=	2450	ksc
โมดูลัสยืดหยุ่นของเหล็ก	Es	=	2040000	ksc
ลวดเชื่อม E70	Fv	=	1470	ksc

6 ตัวคูณแรงและการรวมแรง

ตัวคุณแรงสำหรับน้ำหนักบรรทุกคงที่	=	1.7
ตัวคุณแรงสำหรับน้ำหนักบรรทุกคงที่	=	2

UL = 1.7 DL + 2.0 LL

ซึ่ง

UL หมายถึง น้ำหนักบรรทุกประลัย
DL หมายถึง น้ำหนักบรรทุกคงที่
LL หมายถึง น้ำหนักบรรทุกจร

7 เสาเข็ม

ให้เป็นเสาเข็มเจาะระบบแห้งขนาดศก. 400 มม. กำลังรับน้ำหนักไม่น้อยกว่า 25 ตันต่อต้น

ส่วนผสมคอนกรีต
(MIX DESIGN)

รายการคำนวณ ออกแบบอัตราส่วนผสมคอนกรีต

วิศวกร :

กำลังที่ต้องการ= 150 กก./ตร.ซม.
กำลังอัดที่ผลิต(กำลังอัดที่ต้องการ+ส่วนเผื่อ 60 กก/ตร.ซม.)= 240 กก./ตร.ซม.
ค่ายุบตัว=150 กก./ตร.ซม.
ขนาดหิน= หิน1

.....รายการคำนวณที่ยังไม่ได้ปรับสภาพความชื้นหินทราย.....

1. ปริมาณน้ำที่ใช้เมื่อไม่ใส่น้ำยาผสมคอนกรีต=180 ลิตร/ลบ.ม. คอนกรีต
2. W/C=.712
3. จาก1และ2 ได้น้ำหนักซีเมนต์=253 กก.
4. ปริมาตรซีเมนต์=น้ำหนักซีเมนต์/ถ.พ. ของซีเมนต์=80 ลิตร
5. เนื่องจากที่หินใช้ขนาด หิน1
จะได้ปริมาตรซีเมนต์+ทราย 380 ลิตร
ดังนั้นปริมาตรทราย=300 ลิตร
6.น้ำหนักทราย=(ปริมาตรทราย*ถ.พ.ทราย)=795 กก.
7.ปริมาตรหิน=(1000-ปริมาตรซีเมนต์-ปริมาตรทราย -ปริมาตรน้ำ)=440 ลิตร
8.น้ำหนักหิน=(ปริมาตรหิน*ถ.พ.หิน)=1188 กก.
9.ปริมาณน้ำยาที่ใช้=น้ำหนักซีเมนต์*ปริมาณที่ใช้=0 ลิตร

.....ส่วนผสมที่ยังไม่ได้ปรับความละเอียด ใน 1 ลบ.ม. .....

ซีเมนต์=253 กิโลกรัม
น้ำ=180 ลิตร
ทราย=795 กิโลกรัม
หิน=1188 กิโลกรัม
น้ำยาผสมคอนกรีต=0 ซีซี

.....ส่วนผสมที่ปรับความละเอียดแล้ว ใน 1 ลบ.ม. .....

ซีเมนต์=255 กิโลกรัม
น้ำ=180 ลิตร
ทราย=795 กิโลกรัม
หิน=1190 กิโลกรัม
น้ำยาผสมคอนกรีต=0 ซีซี

.....รายการคำนวณที่ปรับสภาพความชื้นหินทรายแล้ว ใน 1 ลบ.ม. .....

1.เนื่องจากกำหนดทรายมีความชื้น=5%
2.และทรายมีค่าการดูดซึม=0.7 %
3.ดังนั้นความชื้นผิว=(1)-(2)=4.3%
4.นั่นคือทราย 795
มีน้ำมากไป=34.185 กิโลกรัม
5.ดังนั้นจะต้องชั่งทรายเพิ่มขึ้น=829.185 กิโลกรัม
6.ฉนั้นจะต้องใส่น้ำในส่วนผสมทั้งสิ้น=145.815 ลิตร

******* ส่วนผสมที่ปรับสภาพความชื้นหินทรายแล้ว ใน 1 ลบ.ม.*******

ซีเมนต์=255 กิโลกรัม
น้ำ=145 ลิตร
ทราย=830 กิโลกรัม
หิน=1190 กิโลกรัม
น้ำยาผสมคอนกรีต=0 ซีซี

*** อัตราส่วนผสมต่อซีเมนต์ 1 ถุง ปรับสภาพหิน/ทรายแล้ว ***

ซีเมนต์ = ซีเมนต์ 1 ถุง (50 kg.)

น้ำ = 28.43 ลิตร ประมาณ1.1 ถัง

ทราย = .1 ลบ.ม.(คิว) ประมาณ5.3 บุ้งกี๋

หิน = .15 ลบ.ม.(คิว) ประมาณ7.9 บุ้งกี๋

น้ำยาผสมคอนกรีต = 0 ซีซี

หมายเหตุ

ส่วนผสมต่อซีเมนต์ 1 ถุง (50 kg.)จะได้ปริมาณคอนกรีต= .2 ลบ.ม.(คิว)

1 บุ้งกี๋มีปริมาตรโดยประมาณ 0.019 ลบ.ม.(คิว) และ ถังน้ำ 1 ใบมีปริมาตรโดยประมาณ 27 ลิตร

หากใช้บุ้งกี๋หรือถังน้ำ ใหญ่หรือเล็กกว่านี้ ควรตวงปริมาตรให้เท่านี้ (คิดหน่วย นน.ของหินและทราย =1600 กก./ลบ.ม.)

เสาเข็ม

(PILING)

	Job N°.	Section	Sheet N°.	Rev.
			1	1
	Engineer NPK.		Checked	
	Date 26.09.2012		Rev. Date	

Project : ปรับปรุง พื้นอาคาร โรงงาน จักรวาล เคมี

Part : กำลังรับน้ำหนักเสาเข็มเจาะ ขนาด 0.40 ม.

ขนาดเสาเข็มเจาะ = 400 mm

Factor of Safety = 3

Ultimate Skin Friction = 60 t/m

Ultimate Point Bearing = 60 t/m^2

Ultimate Friction Resistance

$= 60 \times \pi \times 0.4 = 75.4$ ton

Ultimate Bearing Resistance

$= 60 \times \pi \times 0.4^2/4 = 7.54$ ton.

Total Ultimate Pile Capacity = 82.94 ton.

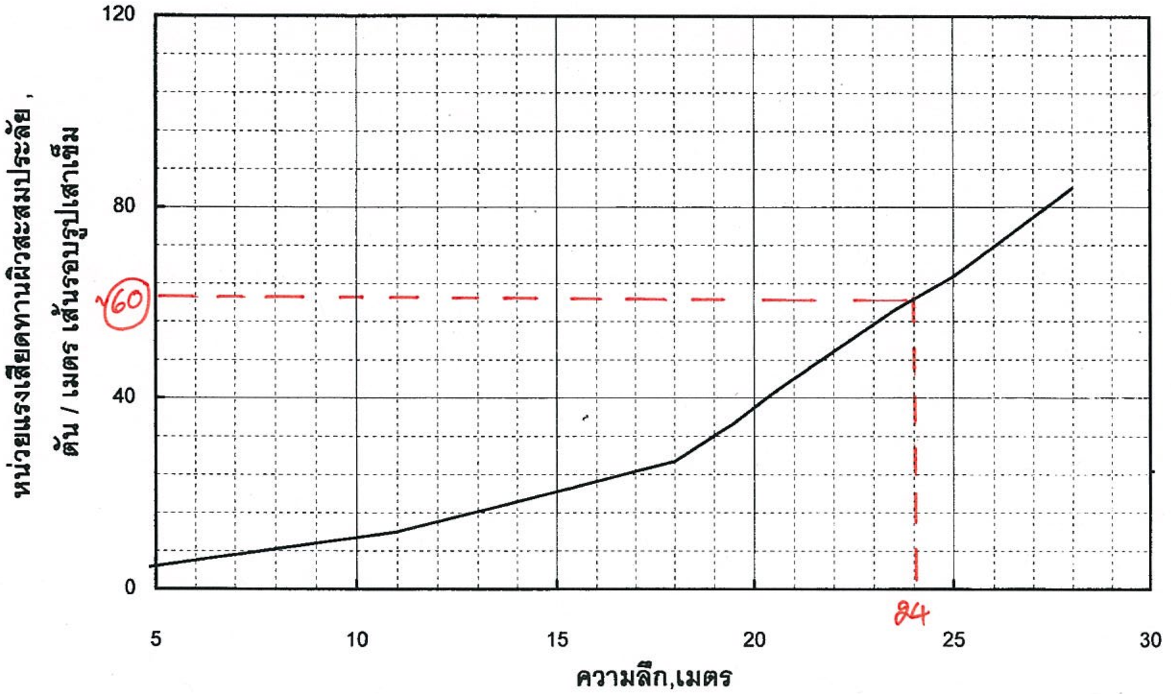
Pile weight = 6.94 ton

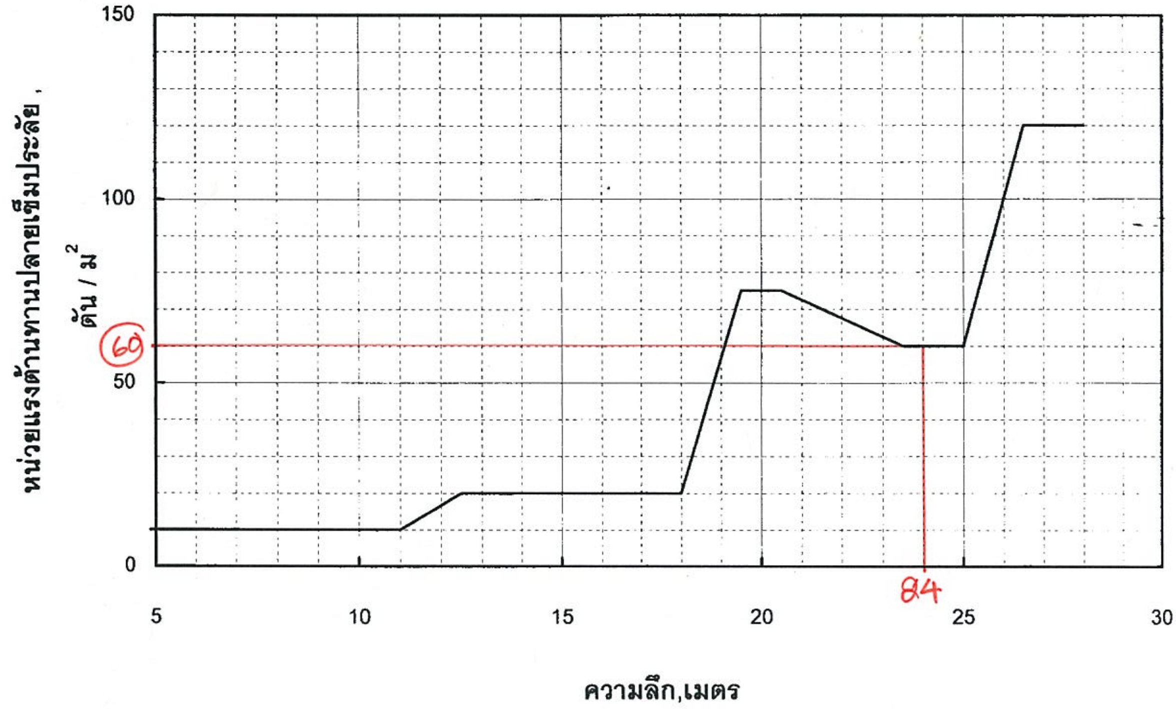
$$Q_{all} = \frac{(82.94 - 6.94)}{3} = 25.33 \text{ ton}$$

ดังนั้นใช้ กำลังรับ น้ำหนัก ปลอดภัย เสาเข็ม = 25 ตัน/ต้น

K:\00-WSP WORKS\DATA\calculate sheet.doc

คัดลอกจากรายงานการสำรวจดินบริเวณก่อสร้าง โรงงาน GCC





รูปที่ 4 แสดงหน่วยแรงเสียดทานผิวสะสมประลัย และหน่วยแรงต้านทานปลายเข็มประลัย พล็อตเทียบกับความลึก

นน.ลงฐานราก

(SUPPORT REACTION)

REACTION FOR PILE AND FOUNDATION

PHASE 1

Story	Point	Load case	FX Ton	FY Ton	FZ Ton	0.4 PILE DIA400 SAFE LOAD (TON)	Check Pile Capacity
FOUNDATION	1	ENVSER	-0.14	0.03	14.00	25	PASS
FOUNDATION	3	ENVSER	0.21	0.52	19.00	25	PASS
FOUNDATION	13	ENVSER	-0.22	-0.05	16.00	25	PASS
FOUNDATION	15	ENVSER	0.16	-0.20	16.00	25	PASS
FOUNDATION	75	ENVSER	2.24	-0.16	14.00	25	PASS
FOUNDATION	79	ENVSER	2.63	0.09	17.00	25	PASS
FOUNDATION	87	ENVSER	-1.03	-0.01	15.00	25	PASS
FOUNDATION	91	ENVSER	-0.71	-0.14	12.00	25	PASS
FOUNDATION	146	ENVSER	0.08	0.03	15.00	25	PASS
FOUNDATION	161	ENVSER	0.39	0.22	18.00	25	PASS
FOUNDATION	176	ENVSER	-0.14	0.24	19.00	25	PASS
FOUNDATION	191	ENVSER	0.02	0.17	18.00	25	PASS
FOUNDATION	561	ENVSER	-0.10	-0.02	16.00	25	PASS
FOUNDATION	562	ENVSER	0.01	0.02	17.00	25	PASS
FOUNDATION	563	ENVSER	0.29	-0.08	16.00	25	PASS
FOUNDATION	564	ENVSER	0.31	0.13	17.00	25	PASS
FOUNDATION	565	ENVSER	0.31	-0.06	17.00	25	PASS
FOUNDATION	566	ENVSER	0.29	0.16	16.00	25	PASS
FOUNDATION	567	ENVSER	-0.02	0.10	17.00	25	PASS
FOUNDATION	568	ENVSER	-0.10	0.12	16.00	25	PASS
FOUNDATION	572	ENVSER	0.04	0.05	16.00	25	PASS
FOUNDATION	573	ENVSER	0.06	0.03	16.00	25	PASS
FOUNDATION	574	ENVSER	0.13	0.03	17.00	25	PASS
FOUNDATION	575	ENVSER	0.17	-0.03	18.00	25	PASS
FOUNDATION	576	ENVSER	0.17	0.06	18.00	25	PASS
FOUNDATION	577	ENVSER	0.17	0.01	18.00	25	PASS
FOUNDATION	578	ENVSER	0.17	0.09	18.00	25	PASS
FOUNDATION	579	ENVSER	0.15	0.05	18.00	25	PASS
FOUNDATION	580	ENVSER	0.07	0.05	17.00	25	PASS
FOUNDATION	584	ENVSER	0.20	0.03	17.00	25	PASS
FOUNDATION	585	ENVSER	0.03	0.06	18.00	25	PASS
FOUNDATION	586	ENVSER	0.29	0.22	20.00	25	PASS
FOUNDATION	587	ENVSER	0.15	-0.03	20.00	25	PASS
FOUNDATION	588	ENVSER	0.23	0.23	20.00	25	PASS
FOUNDATION	589	ENVSER	0.17	-0.02	20.00	25	PASS
FOUNDATION	590	ENVSER	0.15	0.25	20.00	25	PASS

REACTION FOR PILE AND FOUNDATION

PHASE 1

Story	Point	Load case	FX Ton	FY Ton	FZ Ton	0.4 PILE DIA400 SAFE LOAD (TON)	Check Pile Capacity
FOUNDATION	591	ENVSER	0.37	-0.01	21.00	25	PASS
FOUNDATION	592	ENVSER	0.06	0.06	19.00	25	PASS
FOUNDATION	596	ENVSER	-0.17	0.02	18.00	25	PASS
FOUNDATION	597	ENVSER	-0.09	0.06	18.00	25	PASS
FOUNDATION	598	ENVSER	-0.16	0.24	20.00	25	PASS
FOUNDATION	599	ENVSER	-0.11	-0.02	20.00	25	PASS
FOUNDATION	600	ENVSER	-0.13	0.23	20.00	25	PASS
FOUNDATION	601	ENVSER	-0.12	-0.02	20.00	25	PASS
FOUNDATION	602	ENVSER	-0.11	0.26	20.00	25	PASS
FOUNDATION	603	ENVSER	-0.16	-0.02	21.00	25	PASS
FOUNDATION	604	ENVSER	-0.10	0.03	19.00	25	PASS
FOUNDATION	608	ENVSER	-0.02	-0.03	16.00	25	PASS
FOUNDATION	638	ENVSER	-1.15	0.01	15.00	25	PASS
FOUNDATION	639	ENVSER	-0.79	0.07	14.00	25	PASS
FOUNDATION	640	ENVSER	-1.39	-0.02	14.00	25	PASS
FOUNDATION	641	ENVSER	-0.95	0.14	14.00	25	PASS
FOUNDATION	642	ENVSER	-0.95	-0.05	14.00	25	PASS
FOUNDATION	643	ENVSER	-1.40	0.06	14.00	25	PASS
FOUNDATION	644	ENVSER	-0.78	-0.02	14.00	25	PASS
FOUNDATION	645	ENVSER	-1.01	0.04	14.00	25	PASS
FOUNDATION	659	ENVSER	2.40	0.02	16.00	25	PASS
FOUNDATION	660	ENVSER	3.02	0.10	16.00	25	PASS
FOUNDATION	661	ENVSER	5.06	-0.03	16.00	25	PASS
FOUNDATION	662	ENVSER	3.62	0.17	16.00	25	PASS
FOUNDATION	663	ENVSER	3.62	-0.08	16.00	25	PASS
FOUNDATION	664	ENVSER	5.05	0.08	16.00	25	PASS
FOUNDATION	665	ENVSER	2.96	-0.05	16.00	25	PASS
FOUNDATION	666	ENVSER	2.28	0.04	16.00	25	PASS
FOUNDATION	729	ENVSER	-0.09	0.05	16.00	25	PASS
FOUNDATION	730	ENVSER	-0.05	0.03	18.00	25	PASS
FOUNDATION	731	ENVSER	-0.08	0.02	18.00	25	PASS
FOUNDATION	732	ENVSER	-0.07	0.06	18.00	25	PASS
FOUNDATION	733	ENVSER	-0.09	0.08	18.00	25	PASS
FOUNDATION	734	ENVSER	-0.08	0.08	18.00	25	PASS
FOUNDATION	735	ENVSER	-0.04	0.09	19.00	25	PASS
FOUNDATION	736	ENVSER	-0.08	0.03	17.00	25	PASS

REACTION FOR PILE AND FOUNDATION

PHASE 1

Story	Point	Load case	FX Ton	FY Ton	FZ Ton	0.4 PILE DIA400 SAFE LOAD (TON)	Check Pile Capacity
FOUNDATION	752	ENVSER	-0.12	-0.05	15.00	25	PASS
FOUNDATION	753	ENVSER	-0.17	0.31	16.00	25	PASS
FOUNDATION	754	ENVSER	0.02	-0.26	18.00	25	PASS
FOUNDATION	755	ENVSER	-0.22	-0.03	17.00	25	PASS
FOUNDATION	756	ENVSER	-0.10	0.40	18.00	25	PASS
FOUNDATION	757	ENVSER	-0.31	-0.11	17.00	25	PASS
FOUNDATION	758	ENVSER	-0.32	0.24	16.00	25	PASS
FOUNDATION	759	ENVSER	-0.06	0.76	19.00	25	PASS
FOUNDATION	760	ENVSER	-0.06	0.01	18.00	25	PASS
FOUNDATION	761	ENVSER	-0.08	0.21	16.00	25	PASS

REACTION FOR PILE AND FOUNDATION

PHASE 2

Story	Point	Load case	FX Ton	FY Ton	FZ Ton	0.4 PILE DIA400 SAFE LOAD (TON)	Check Pile Capacity
FOUNDATION	1	ENVSER	-0.14	0.31	17.00	25	PASS
FOUNDATION	3	ENVSER	-0.02	0.61	20.00	25	PASS
FOUNDATION	13	ENVSER	-0.14	0.19	14.00	25	PASS
FOUNDATION	15	ENVSER	0.09	0.31	17.00	25	PASS
FOUNDATION	16	ENVSER	0.07	-0.15	12.00	25	PASS
FOUNDATION	18	ENVSER	-0.11	-0.29	15.00	25	PASS
FOUNDATION	69	ENVSER	-0.64	-0.10	17.00	25	PASS
FOUNDATION	70	ENVSER	0.82	0.04	14.00	25	PASS
FOUNDATION	72	ENVSER	-0.65	0.20	13.00	25	PASS
FOUNDATION	73	ENVSER	2.17	-0.15	18.00	25	PASS
FOUNDATION	75	ENVSER	2.50	0.45	18.00	25	PASS
FOUNDATION	79	ENVSER	2.45	0.31	14.00	25	PASS
FOUNDATION	80	ENVSER	1.00	-0.06	13.00	25	PASS
FOUNDATION	81	ENVSER	1.88	-0.30	15.00	25	PASS
FOUNDATION	82	ENVSER	-0.41	-0.38	11.00	25	PASS
FOUNDATION	84	ENVSER	0.56	-0.38	12.00	25	PASS
FOUNDATION	85	ENVSER	-0.52	-0.31	14.00	25	PASS
FOUNDATION	86	ENVSER	-0.29	-0.05	11.00	25	PASS
FOUNDATION	87	ENVSER	-0.71	0.28	12.00	25	PASS
FOUNDATION	91	ENVSER	-0.79	0.37	16.00	25	PASS
FOUNDATION	142	ENVSER	0.02	-0.12	13.00	25	PASS
FOUNDATION	143	ENVSER	0.27	-0.12	15.00	25	PASS
FOUNDATION	144	ENVSER	-0.22	-0.11	15.00	27	PASS
FOUNDATION	145	ENVSER	-0.03	-0.16	14.00	29	PASS
FOUNDATION	146	ENVSER	0.02	0.28	18.00	31	PASS
FOUNDATION	161	ENVSER	0.30	0.36	21.00	33	PASS
FOUNDATION	176	ENVSER	-0.26	0.36	21.00	35	PASS
FOUNDATION	191	ENVSER	-0.08	0.31	20.00	37	PASS
FOUNDATION	332	ENVSER	0.27	0.06	9.40	39	PASS
FOUNDATION	334	ENVSER	-0.25	0.21	11.00	41	PASS
FOUNDATION	335	ENVSER	4.09	0.25	13.00	43	PASS
FOUNDATION	336	ENVSER	-1.13	0.23	11.00	45	PASS
FOUNDATION	484	ENVSER	-0.17	-0.36	13.00	47	PASS
FOUNDATION	485	ENVSER	0.36	-0.36	13.00	49	PASS
FOUNDATION	486	ENVSER	-0.24	0.02	15.00	51	PASS
FOUNDATION	487	ENVSER	0.39	0.07	15.00	53	PASS

REACTION FOR PILE AND FOUNDATION

PHASE 2

Story	Point	Load case	FX Ton	FY Ton	FZ Ton	0.4 PILE DIA400 SAFE LOAD (TON)	Check Pile Capacity
FOUNDATION	488	ENVSER	-1.46	0.06	19.00	55	PASS
FOUNDATION	489	ENVSER	1.28	-0.01	16.00	57	PASS
FOUNDATION	491	ENVSER	-1.12	0.15	15.00	59	PASS
FOUNDATION	492	ENVSER	5.70	0.09	21.00	61	PASS
FOUNDATION	495	ENVSER	-0.23	-0.05	17.00	63	PASS
FOUNDATION	496	ENVSER	0.30	-0.03	17.00	65	PASS
FOUNDATION	497	ENVSER	-1.01	0.12	19.00	67	PASS
FOUNDATION	498	ENVSER	0.40	0.38	15.00	69	PASS
FOUNDATION	500	ENVSER	-0.61	0.33	15.00	71	PASS
FOUNDATION	501	ENVSER	5.11	0.07	20.00	73	PASS
FOUNDATION	504	ENVSER	-0.09	0.55	16.00	75	PASS
FOUNDATION	505	ENVSER	0.11	0.55	17.00	77	PASS
FOUNDATION	509	ENVSER	0.03	0.14	11.00	79	PASS
FOUNDATION	510	ENVSER	0.06	0.15	11.00	81	PASS
FOUNDATION	539	ENVSER	0.00	0.14	15.00	83	PASS
FOUNDATION	540	ENVSER	0.26	0.19	17.00	85	PASS
FOUNDATION	541	ENVSER	-0.22	0.19	17.00	87	PASS
FOUNDATION	542	ENVSER	-0.03	0.14	16.00	89	PASS
FOUNDATION	543	ENVSER	-0.14	-0.01	16.00	91	PASS
FOUNDATION	544	ENVSER	-0.06	0.01	17.00	93	PASS
FOUNDATION	545	ENVSER	0.30	-0.07	17.00	95	PASS
FOUNDATION	546	ENVSER	0.31	0.05	17.00	97	PASS
FOUNDATION	547	ENVSER	0.31	-0.02	17.00	99	PASS
FOUNDATION	548	ENVSER	0.30	0.11	16.00	101	PASS
FOUNDATION	549	ENVSER	-0.07	0.06	16.00	103	PASS
FOUNDATION	550	ENVSER	-0.14	0.00	16.00	105	PASS
FOUNDATION	552	ENVSER	0.03	0.01	17.00	107	PASS
FOUNDATION	553	ENVSER	0.07	0.02	18.00	109	PASS
FOUNDATION	554	ENVSER	0.13	-0.04	18.00	111	PASS
FOUNDATION	555	ENVSER	0.14	0.04	18.00	113	PASS
FOUNDATION	556	ENVSER	0.14	-0.02	17.00	115	PASS
FOUNDATION	557	ENVSER	0.12	0.07	17.00	117	PASS
FOUNDATION	558	ENVSER	0.08	0.00	18.00	119	PASS
FOUNDATION	559	ENVSER	0.01	-0.03	17.00	121	PASS
FOUNDATION	560	ENVSER	0.04	0.03	19.00	123	PASS
FOUNDATION	561	ENVSER	0.22	0.20	20.00	125	PASS

REACTION FOR PILE AND FOUNDATION

PHASE 2

Story	Point	Load case	FX Ton	FY Ton	FZ Ton	0.4 PILE DIA400 SAFE LOAD (TON)	Check Pile Capacity
FOUNDATION	562	ENVSER	0.10	-0.02	20.00	127	PASS
FOUNDATION	563	ENVSER	0.17	0.22	20.00	129	PASS
FOUNDATION	564	ENVSER	0.13	-0.03	19.00	131	PASS
FOUNDATION	565	ENVSER	0.08	0.23	20.00	133	PASS
FOUNDATION	566	ENVSER	0.30	-0.05	20.00	135	PASS
FOUNDATION	567	ENVSER	0.01	0.00	19.00	137	PASS
FOUNDATION	568	ENVSER	-0.15	0.01	19.00	139	PASS
FOUNDATION	569	ENVSER	-0.21	0.20	20.00	141	PASS
FOUNDATION	570	ENVSER	-0.18	-0.02	20.00	143	PASS
FOUNDATION	571	ENVSER	-0.21	0.22	20.00	145	PASS
FOUNDATION	572	ENVSER	-0.21	-0.04	20.00	147	PASS
FOUNDATION	573	ENVSER	-0.19	0.25	20.00	149	PASS
FOUNDATION	574	ENVSER	-0.23	-0.05	21.00	151	PASS
FOUNDATION	575	ENVSER	-0.14	-0.03	19.00	153	PASS
FOUNDATION	576	ENVSER	-0.12	-0.01	17.00	155	PASS
FOUNDATION	577	ENVSER	-0.09	0.01	18.00	157	PASS
FOUNDATION	578	ENVSER	-0.19	0.01	18.00	159	PASS
FOUNDATION	579	ENVSER	-0.16	0.06	18.00	161	PASS
FOUNDATION	580	ENVSER	-0.16	0.05	18.00	163	PASS
FOUNDATION	581	ENVSER	-0.17	0.08	18.00	165	PASS
FOUNDATION	582	ENVSER	-0.06	0.09	19.00	167	PASS
FOUNDATION	583	ENVSER	-0.08	-0.06	18.00	169	PASS
FOUNDATION	592	ENVSER	3.64	-0.01	16.00	171	PASS
FOUNDATION	593	ENVSER	2.79	0.06	16.00	173	PASS
FOUNDATION	594	ENVSER	5.16	-0.03	16.00	175	PASS
FOUNDATION	595	ENVSER	3.52	0.16	16.00	177	PASS
FOUNDATION	596	ENVSER	3.52	-0.08	16.00	179	PASS
FOUNDATION	597	ENVSER	5.16	0.08	16.00	181	PASS
FOUNDATION	598	ENVSER	2.80	-0.01	16.00	183	PASS
FOUNDATION	599	ENVSER	3.68	0.01	16.00	185	PASS
FOUNDATION	600	ENVSER	-1.04	-0.01	14.00	187	PASS
FOUNDATION	601	ENVSER	-0.79	0.06	14.00	189	PASS
FOUNDATION	602	ENVSER	-1.45	-0.02	14.00	191	PASS
FOUNDATION	603	ENVSER	-0.99	0.13	14.00	193	PASS
FOUNDATION	604	ENVSER	-1.00	-0.06	14.00	195	PASS
FOUNDATION	605	ENVSER	-1.46	0.04	14.00	197	PASS

REACTION FOR PILE AND FOUNDATION

PHASE 2

Story	Point	Load case	FX Ton	FY Ton	FZ Ton	0.4 PILE DIA400 SAFE LOAD (TON)	Check Pile Capacity
FOUNDATION	606	ENVSER	-0.79	-0.03	14.00	199	PASS
FOUNDATION	607	ENVSER	-1.06	-0.03	14.00	201	PASS
FOUNDATION	619	ENVSER	-0.38	-0.01	11.00	203	PASS
FOUNDATION	620	ENVSER	1.31	0.02	12.00	205	PASS
FOUNDATION	622	ENVSER	-0.05	0.20	12.00	207	PASS
FOUNDATION	624	ENVSER	-0.04	0.38	14.00	209	PASS
FOUNDATION	626	ENVSER	0.01	0.08	13.00	211	PASS
FOUNDATION	627	ENVSER	0.06	0.17	15.00	213	PASS
FOUNDATION	628	ENVSER	-0.15	0.17	15.00	215	PASS
FOUNDATION	629	ENVSER	-0.05	0.10	14.00	217	PASS
FOUNDATION	630	ENVSER	-1.70	0.01	11.00	219	PASS
FOUNDATION	631	ENVSER	0.57	0.02	12.00	221	PASS
FOUNDATION	632	ENVSER	0.01	0.03	12.00	223	PASS
FOUNDATION	633	ENVSER	0.03	0.02	14.00	225	PASS
FOUNDATION	634	ENVSER	-0.12	0.03	14.00	227	PASS
FOUNDATION	635	ENVSER	-0.05	0.05	13.00	229	PASS
FOUNDATION	636	ENVSER	-0.56	0.05	13.00	231	PASS
FOUNDATION	637	ENVSER	6.01	0.01	12.00	233	PASS
FOUNDATION	638	ENVSER	-0.05	-0.06	16.00	235	PASS
FOUNDATION	639	ENVSER	-0.15	0.28	17.00	237	PASS
FOUNDATION	640	ENVSER	0.04	-0.29	18.00	239	PASS
FOUNDATION	641	ENVSER	0.06	-0.07	17.00	241	PASS
FOUNDATION	642	ENVSER	-0.03	0.59	17.00	243	PASS
FOUNDATION	643	ENVSER	-0.34	-0.21	17.00	245	PASS
FOUNDATION	644	ENVSER	-0.12	0.28	16.00	247	PASS
FOUNDATION	645	ENVSER	0.01	1.01	19.00	249	PASS
FOUNDATION	646	ENVSER	-0.08	-0.19	18.00	251	PASS
FOUNDATION	647	ENVSER	-0.19	0.15	17.00	253	PASS

พื้นและฐานราก

(SLAB AND FOUNDATION)

	Job N°	Section	Sheet N°	Rev.
	Engineer Nuttapol K.		Checked	
	Date 06.01.2013		Rev. Date	

Project : GCC Renovation

Part : Punching Shear Check for Slab.

Slab thickness = 30 cm.

Pile diameter = 40 cm.

Pile Load (ULT) = 42. Ton. = V_u (25×1.7).

$d = 30 - 5 - 2 = 23$ cm.

$\phi V_n = \phi V_c = \phi v_c b_o d$

$= 0.85 (1.06 \sqrt{240}) (\pi \times (40+23)) (23)$

$= 63540.$ kg.

$= 63.5$ ton $> V_u$ (42.5 ton)

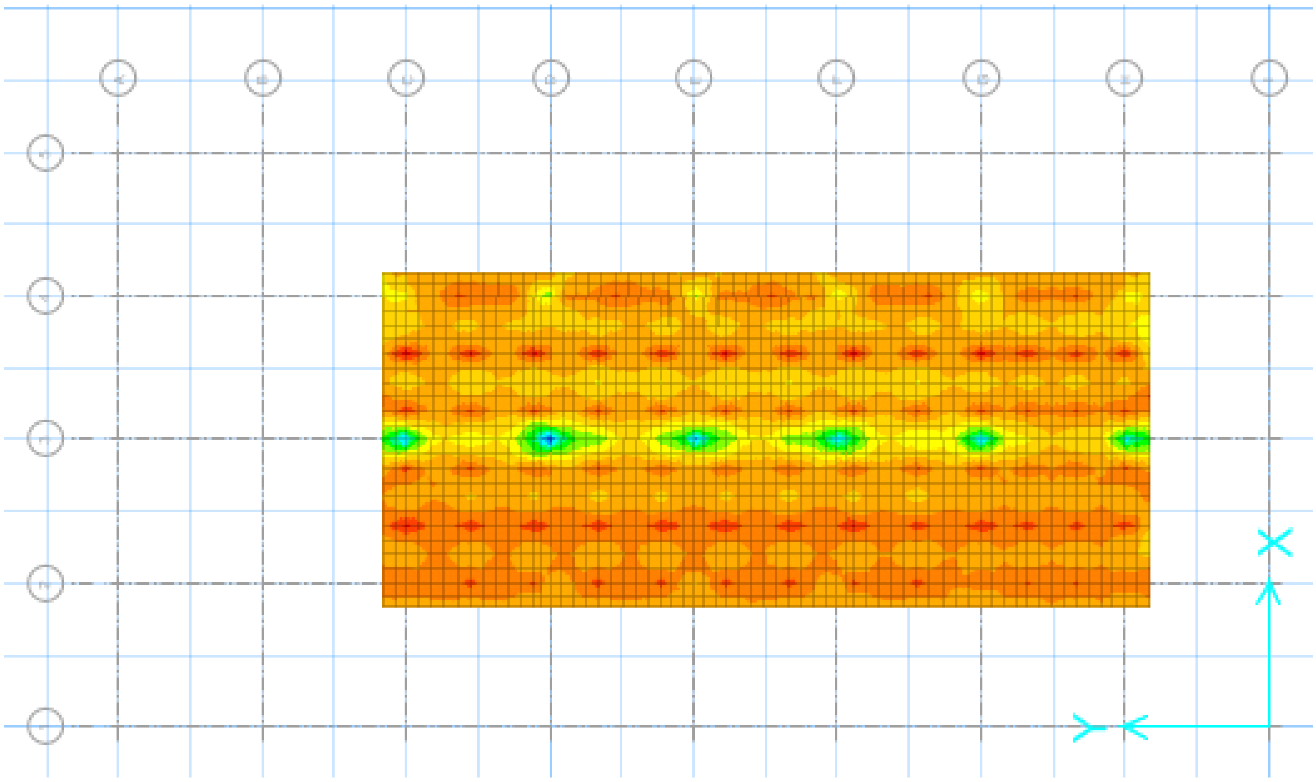
ไม่จำเป็นใช้เหล็กเสริม รับแรงเฉือนทะลุ

Slab thickness is enough

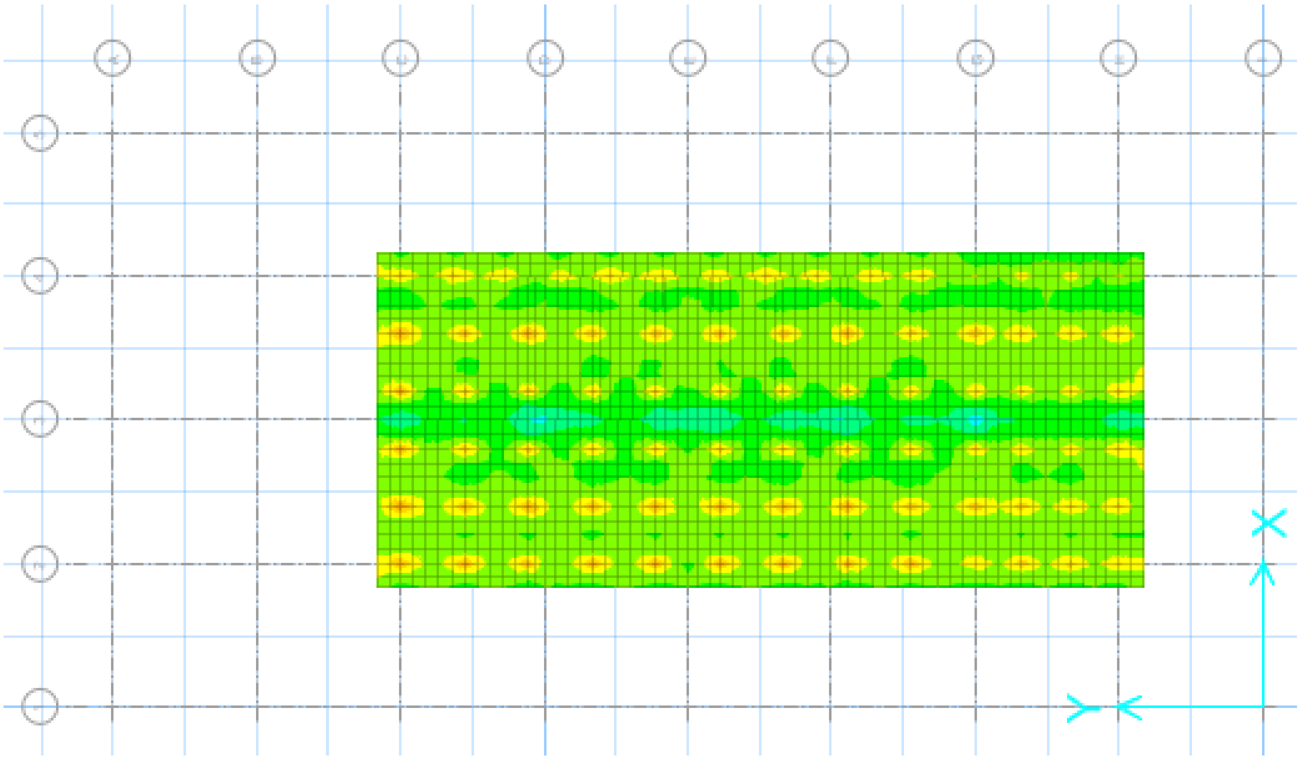
ANALYSIS RESULTS

Part A: FOOTING 600mm thickness

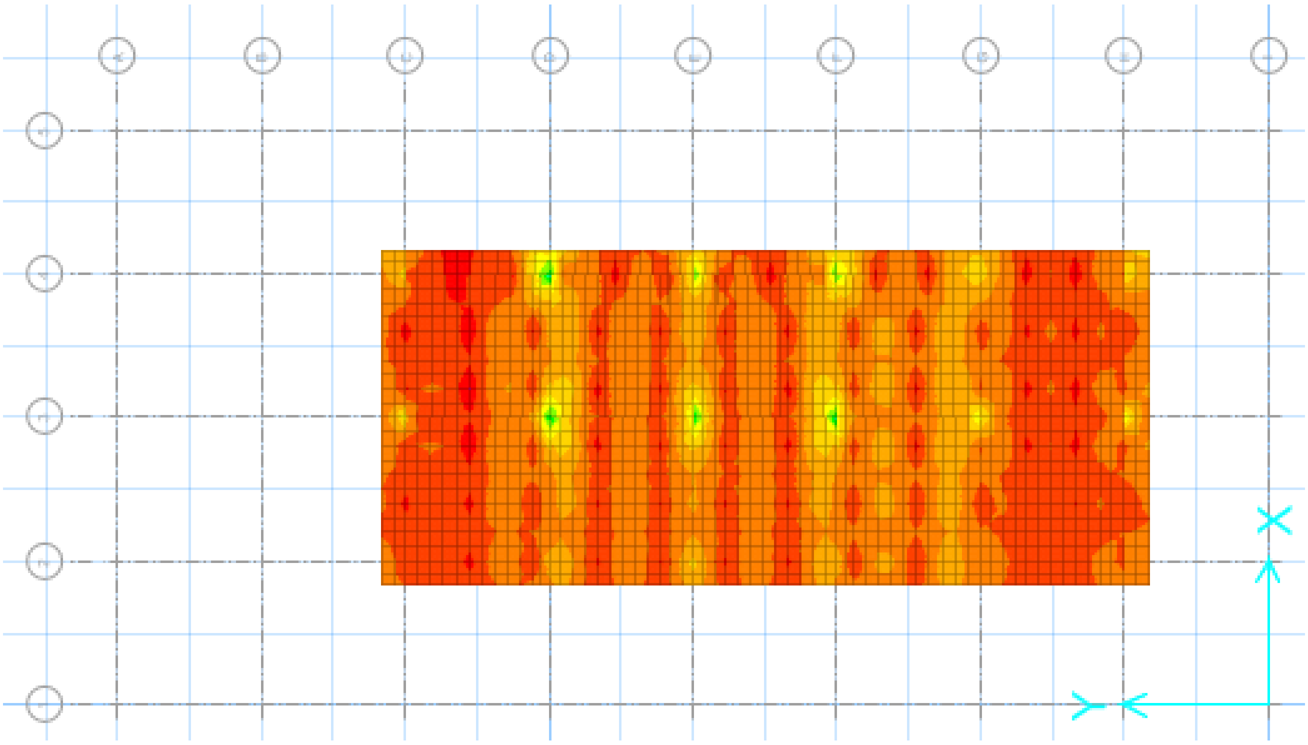
- Ultimate M11 – ENVULT (Max) : M+Max = 124 KN-M



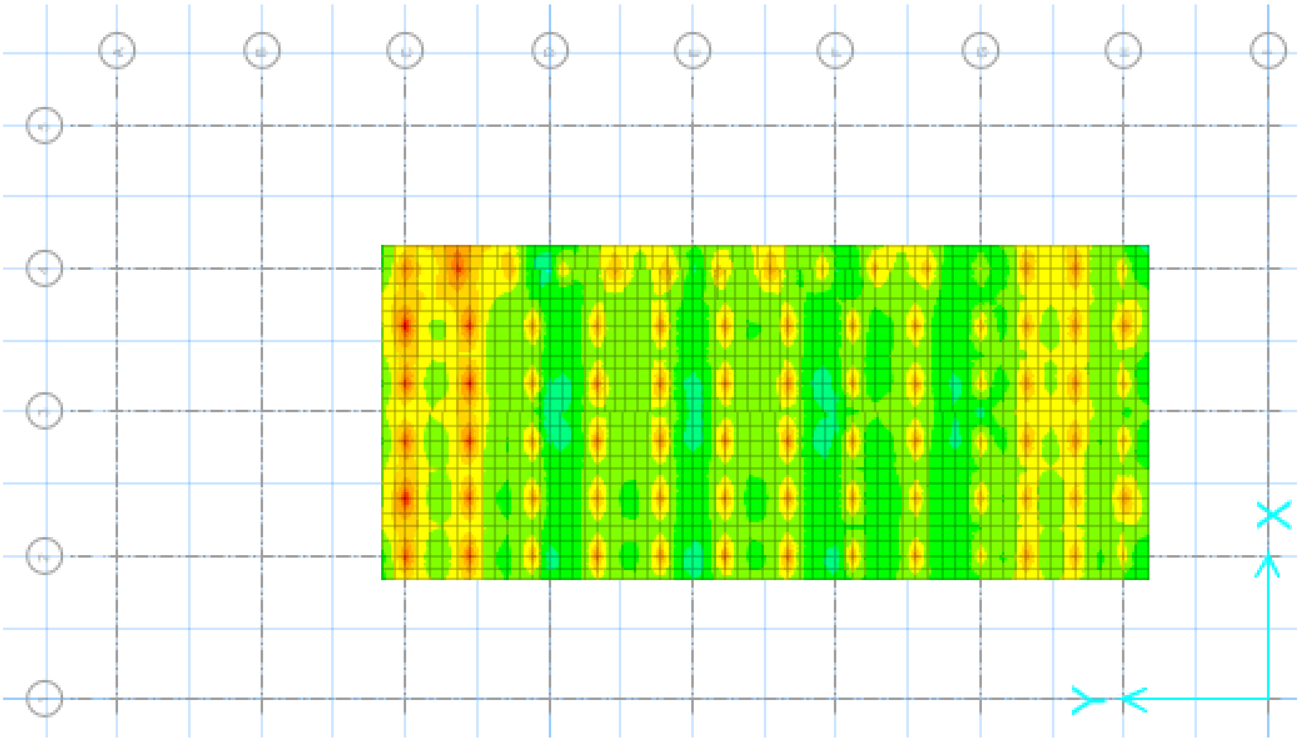
- Ultimate M11 – ENVULT (Min) : M-Max = --45 KN-M



- Ultimate M22 – ENVULT (Max) : M+Max = 122 KN-M

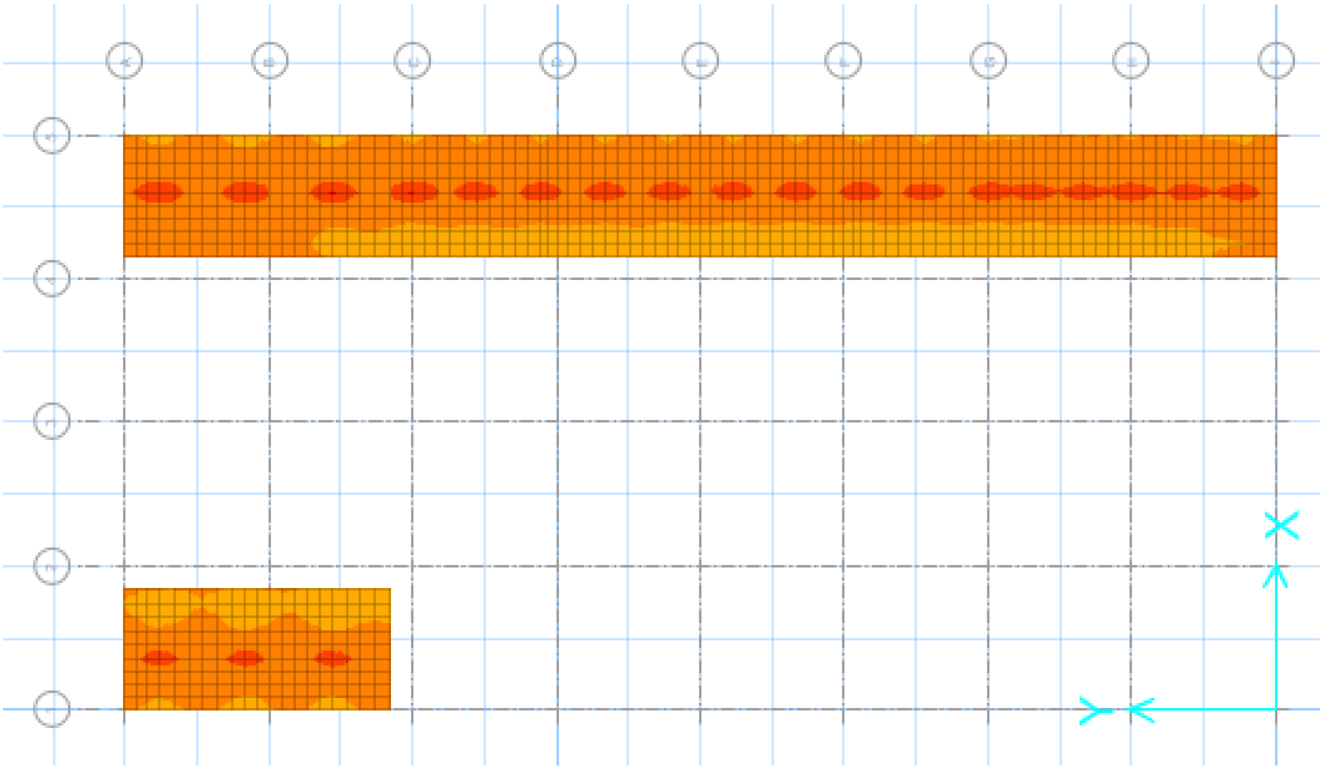


- Ultimate M22 – ENVULT (Min) : M-Max = -102 KN-M

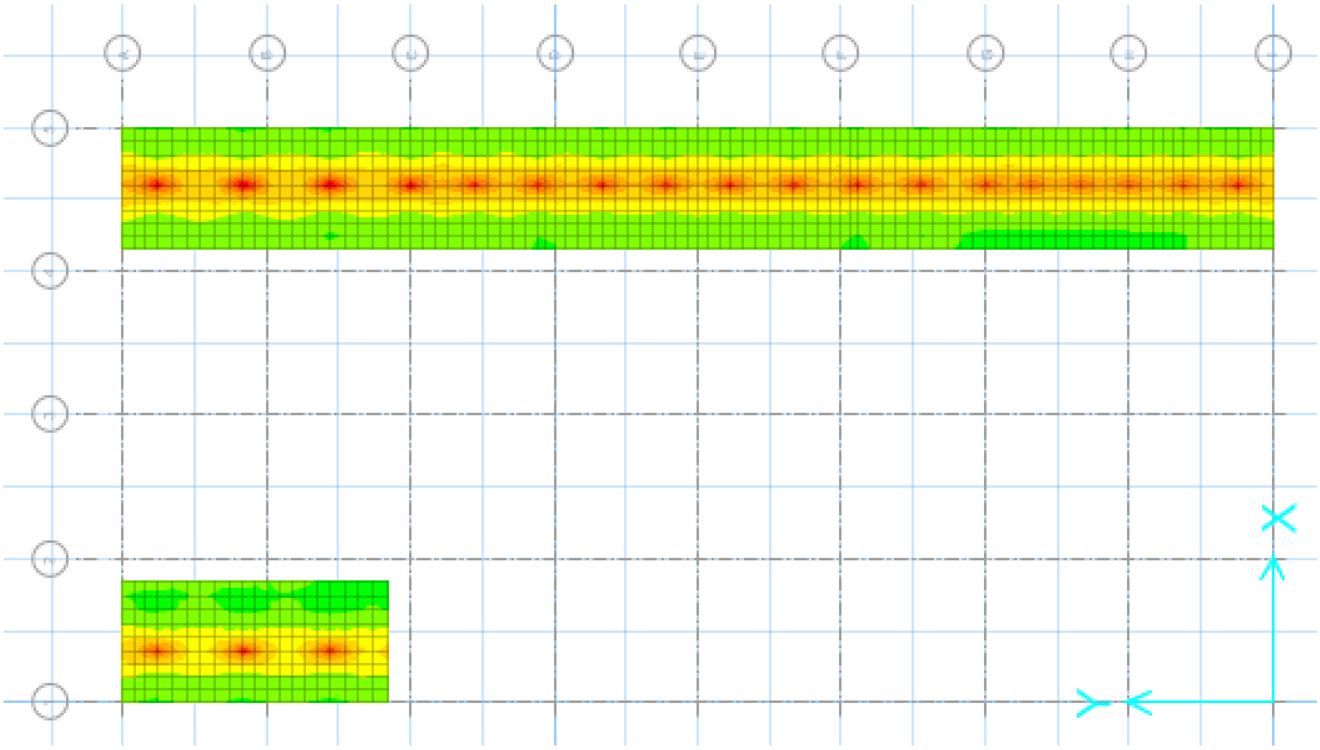


Part B: FOOTING 300mm thickness

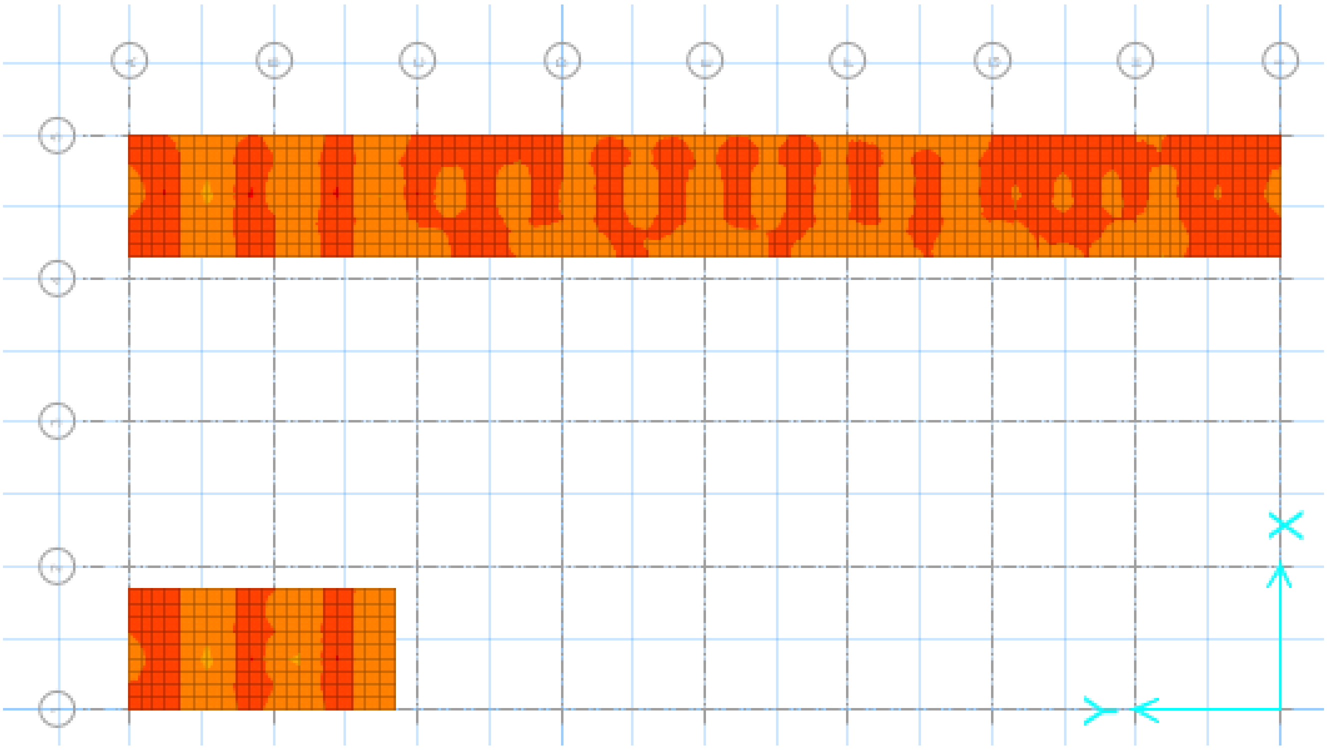
- Ultimate M11 – ENVULT (Max) : M+Max = 10 KN-M



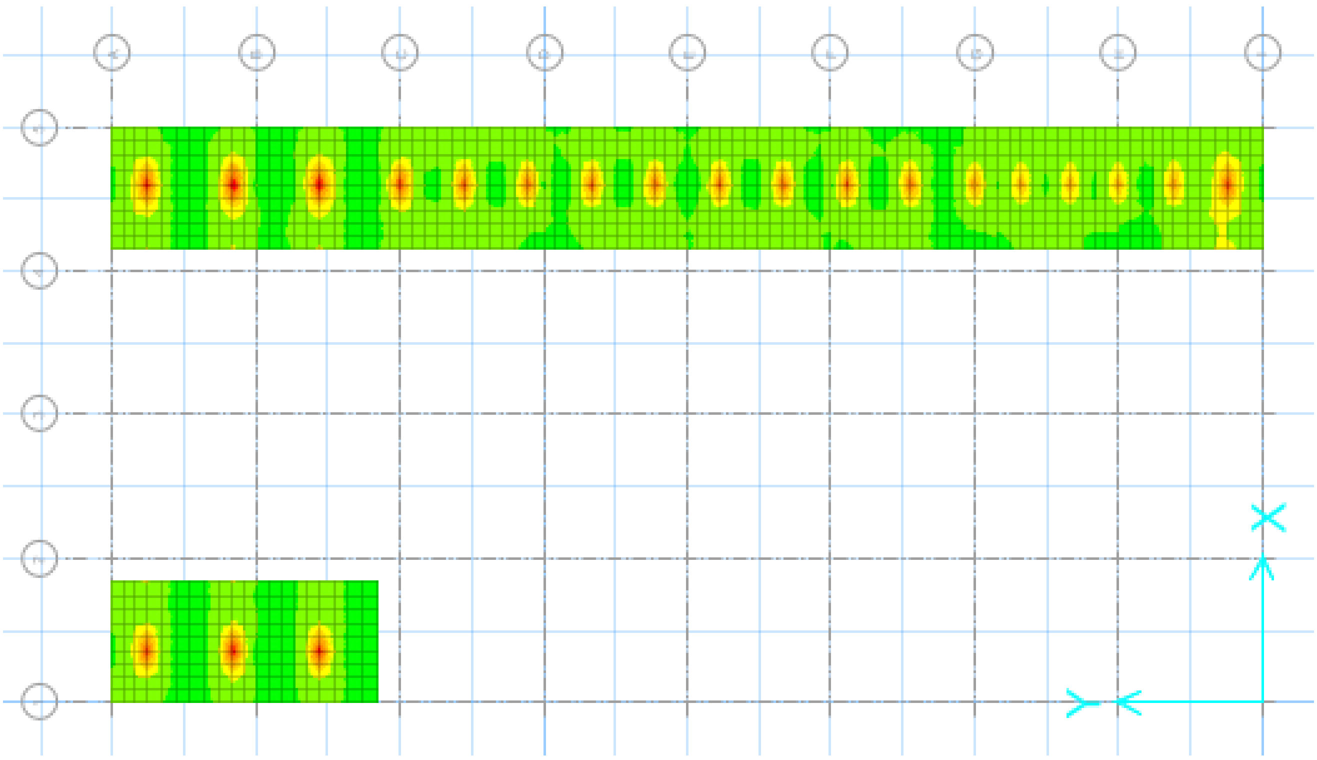
- Ultimate M11 – ENVULT (Min) : M-Max = -155.8 KN-M



- Ultimate M22 – ENVULT (Max) : M+Max = 20 KN-M

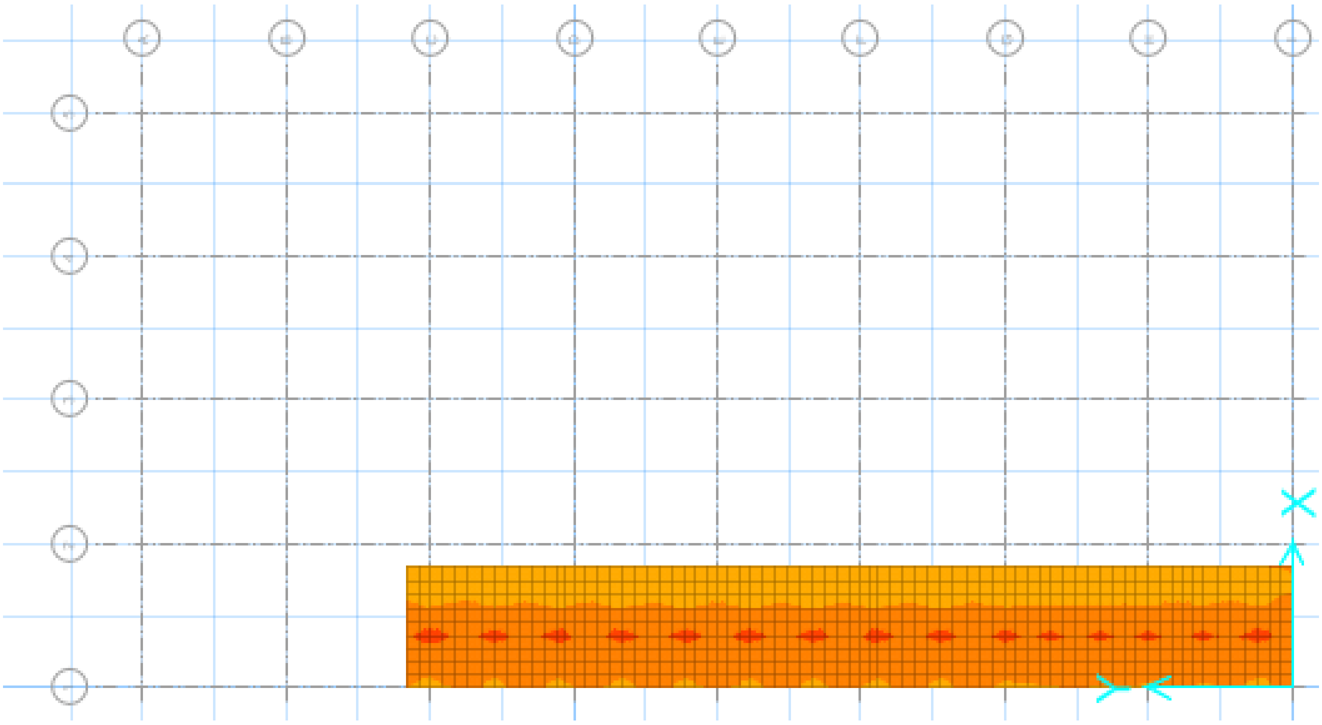


- Ultimate M22 – ENVULT (Min) : M-Max = -120 KN-M

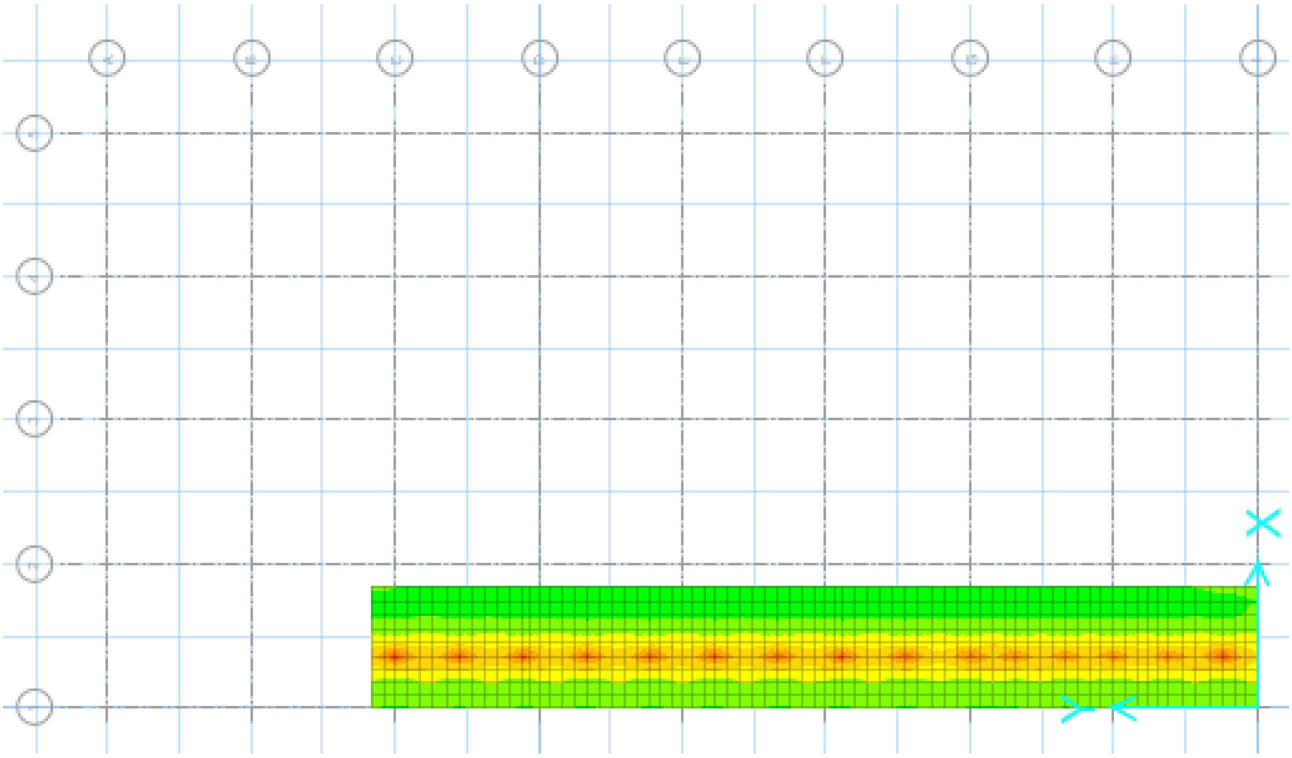


Part C: FOOTING 300mm thickness

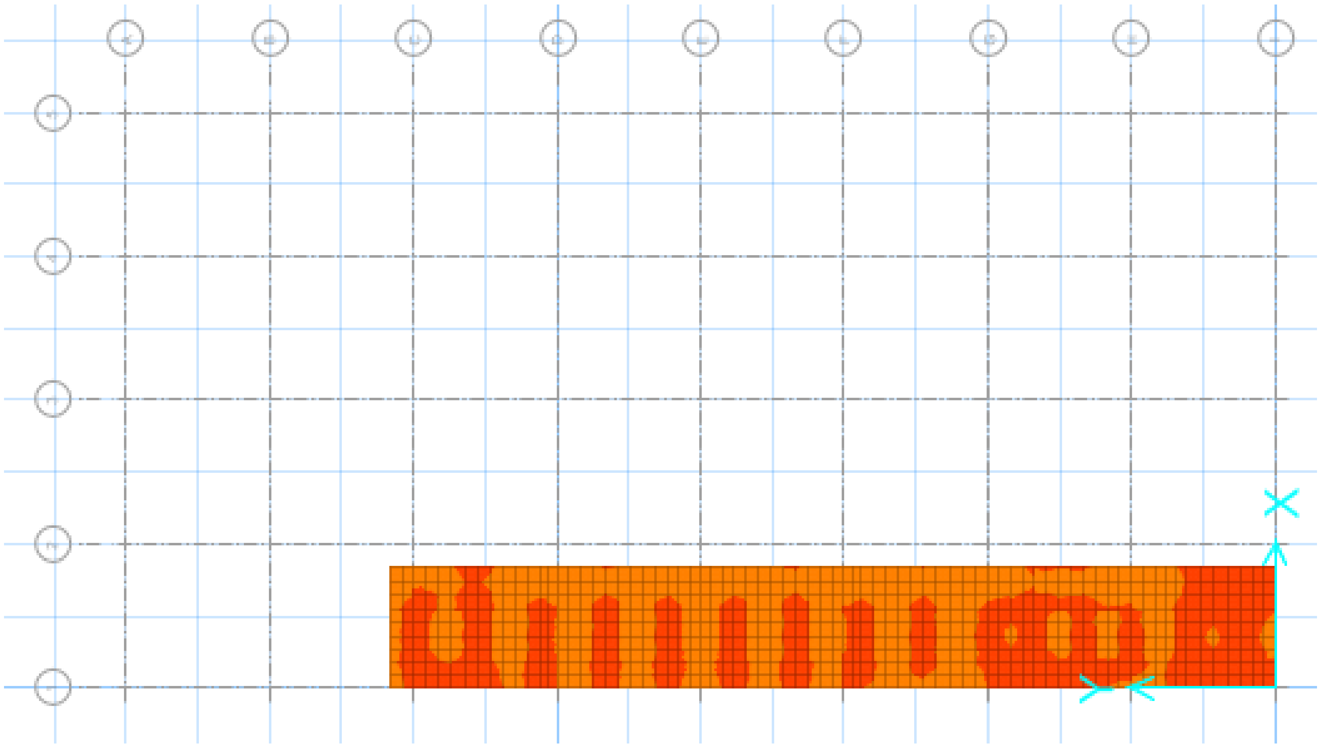
- Ultimate M11 – ENVULT (Max) : M+Max = 10 KN-M



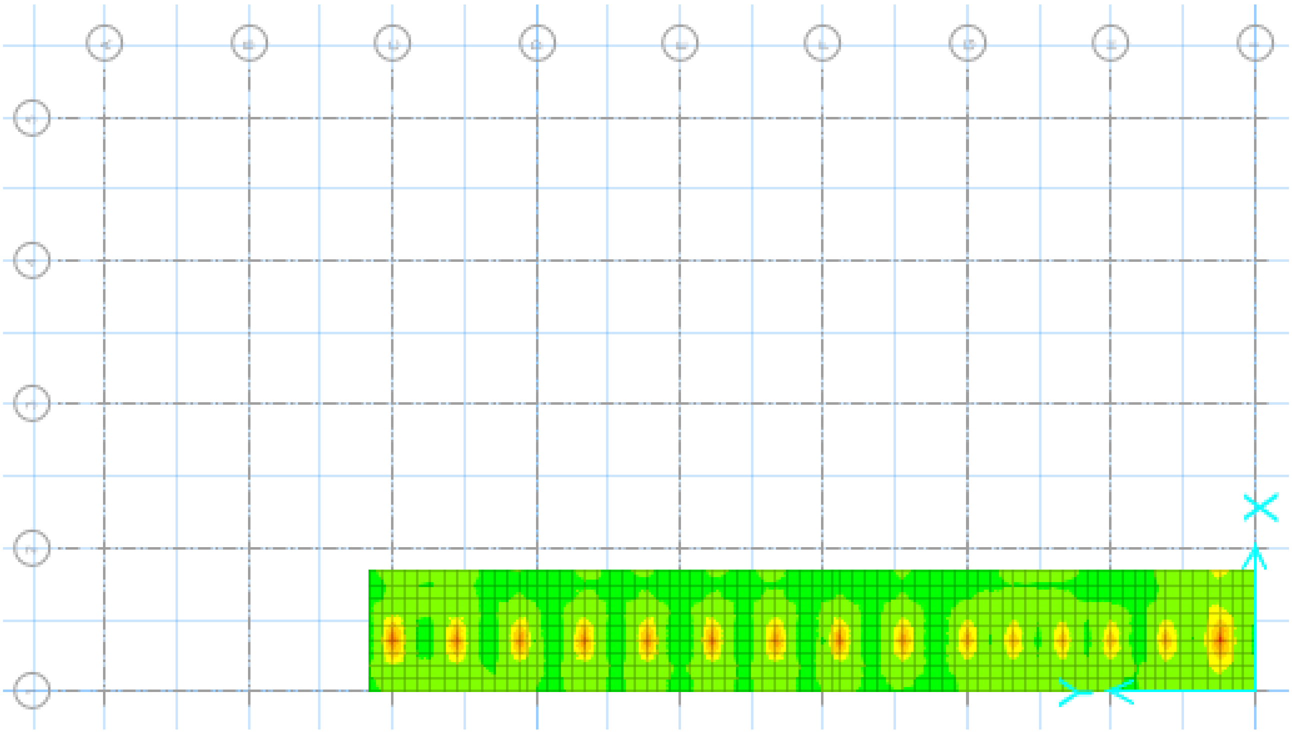
- Ultimate M11 – ENVULT (Min) : M-Max = -116 KN-M



- Ultimate M22 – ENVULT (Max) : M+Max = 10 KN-M

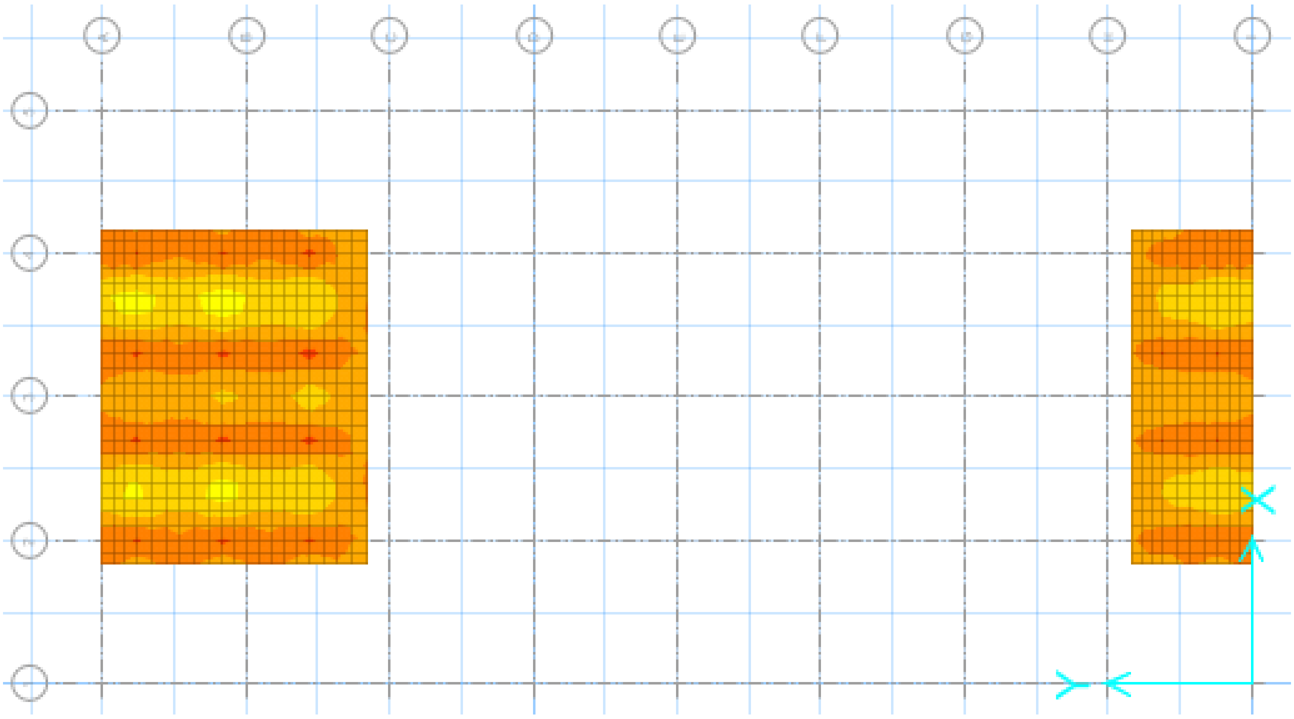


- Ultimate M22 – ENVULT (Min) : M-Max = -85 KN-M

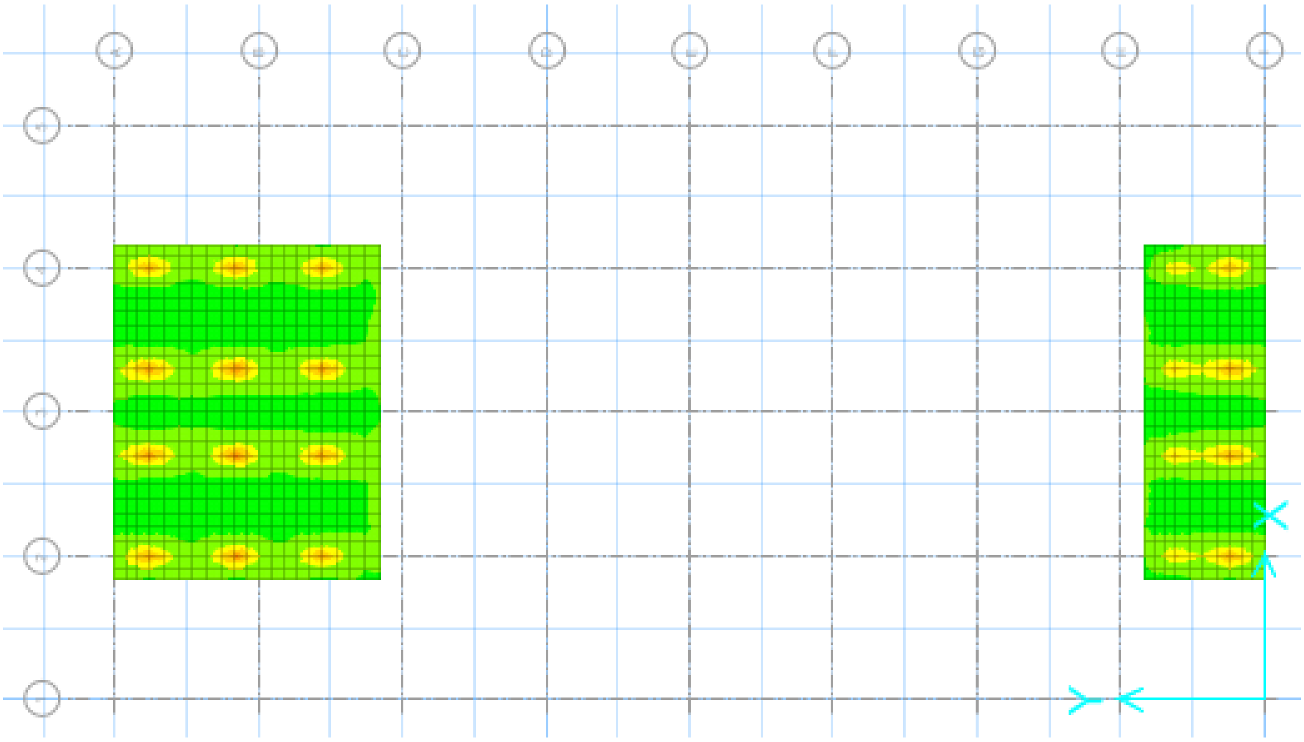


Part D: FOOTING 300mm thickness

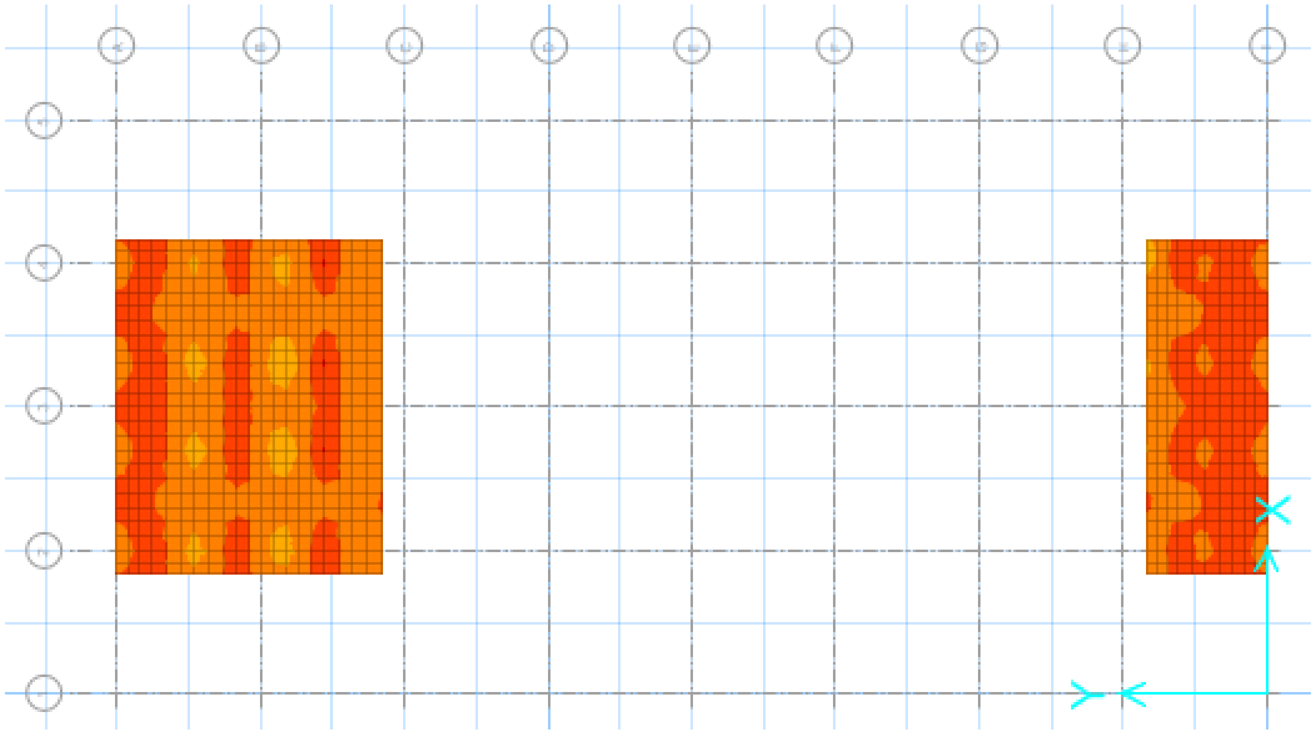
- Ultimate M11 – ENVULT (Max) : M+Max = 34 KN-M



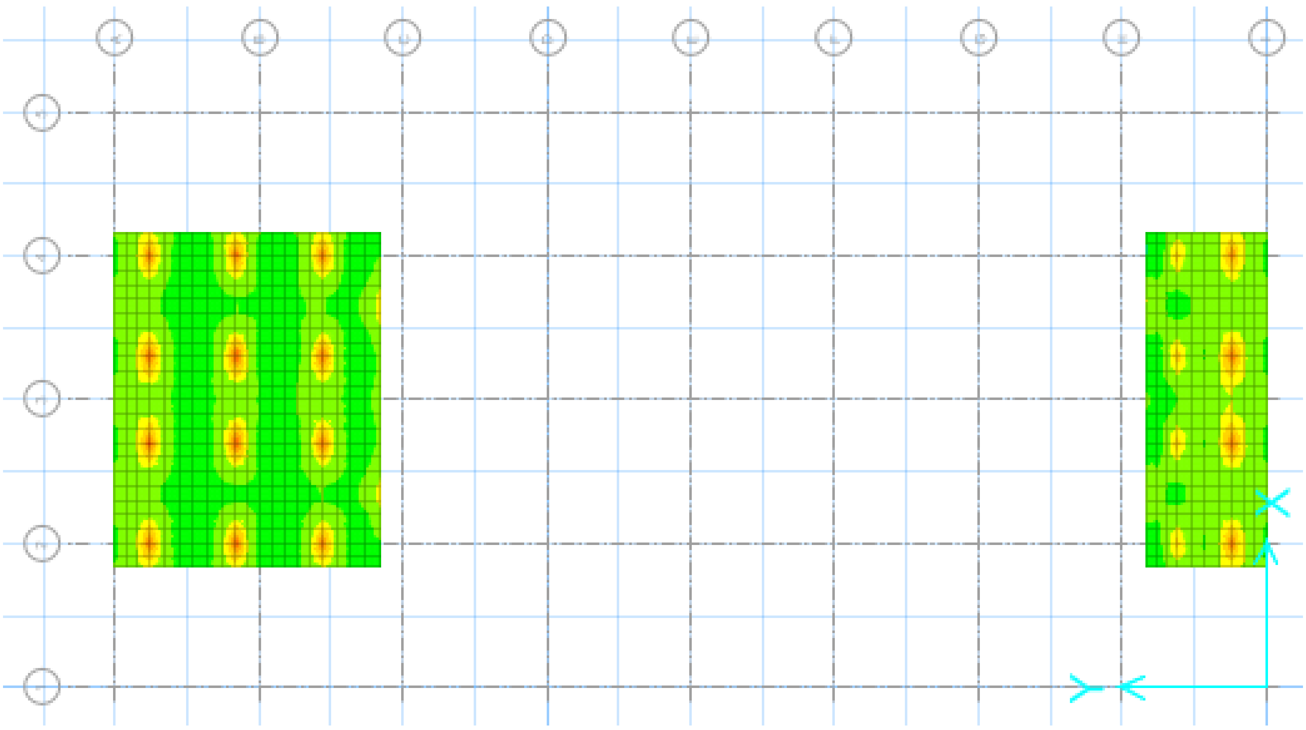
- Ultimate M11 – ENVULT (Min) : M-Max = -90 KN-M



- Ultimate M22 – ENVULT (Max) : M+Max = 26 KN-M



- Ultimate M22 – ENVULT (Min) : M-Max = -84 KN-M



Summary of Results:

Part A: 600mm thickness

Max. positive moment for design =	124	KN-m
Max. nagative moment for design =	-102	KN-m

Part B: 300mm thickness

Max. positive moment for design =	20	KN-m
Max. nagative moment for design =	-155.8	KN-m

Part C: 300mm thickness

Max. positive moment for design =	10	KN-m
Max. nagative moment for design =	-116	KN-m

Part D: 300mm thickness

Max. positive moment for design =	34	KN-m
Max. nagative moment for design =	-90	KN-m

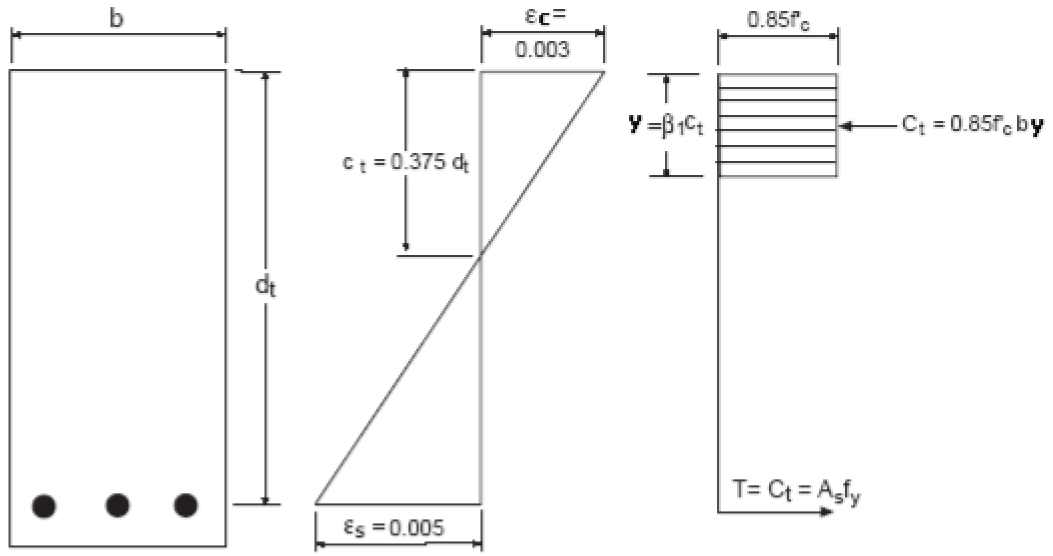
RCM ACI-Builder Reinforced Concrete Members ACI-Builder			
Project No :	001		
Project Name :	GCC RENOVATION		
Job Title:	SLAB 600mm - Bottom Reinforcement		
Calcs by : NK		Checked by :	NK
Sheet : of		Date :	11-01-2556

Design of Flexure According to ACI318-2005

CALCULATE EQUIVALENT MOMENT DUE TO PROVIDED AREA OF STEEL

Tension-Controlled Section

Sections are tension-controlled when the net tensile strain in the extreme tension steel is equal to or greater than 0.005 just as the concrete in compression reaches its assumed strain limit of 0.003.



Strains at Tension-Controlled Limit

Material Properties:

- . f'c = 24 MPa — Concrete compressive strength
- . fy = 400 MPa — Bending Reinforcement yield strength
- . Es = 200000 MPa — Reinf. modulus of elasticity
- . phi = 0.90 — Flexure strength reduction factor (Tension-controlled section)

Section Properties:

- . B = 1000.0 mm — Section breadth
- . H = 600.0 mm — Section height
- . a = 80.0 mm — Cover to tension rebar center
- . dc = 50.0 mm — Cover to compression rebar center

Provided Area of steel:

- . Main Mesh: T20 @ 250 = 1256.64 mm2
- . Total area of provided steel As(total)= 1256.64 mm2

Singly Reinforced Section properties:

- . ec = 0.003 — Concrete compressive strain
- . es = 0.005 — Reinf. tensile strain
- . dt = H - dc = 520.0 mm — Effective depth
- . Ct = [ec/(ec+es)]*dt = 0.375*dt = 195.00 mm — Neutral axis depth
- . 0.85 >= {beta = 0.85-0.05[(f'c-28)/7]} >= 0.65, then beta = 0.850 — Equivalent depth factor
- . Ymax = beta * Ct = 165.75 mm — Equivalent compressive block depth
- . Asmax(singly) = {[0.85*f'c*B*Ymax]/fy} = 8453.25 mm2 — Maximum area of steel for singly reinforced section
- . Mur(singly) = phi*{0.85*f'c*B*Ymax*[dt-(Ymax/2)]} = 1330.25 kNm — Maximum resistance moment for singly reinforced section

Section works as a Singly Reinforced Section because of:

Provided area of steel As(total) is lesser than the maximum area of steel for Singly Reinforced Section (Asmax)

As(total) = 1256.64 mm2 < Asmax = 8453.25 mm2

Check minimum area of steel for Slab section against Shrinkage & Temperature:

- . fy < 420 MPa then Asmin = 0.002*B*H/2 = 600.00 mm2 — To be placed on each face of slab
- . As(total) = 1256.64 mm2 > Asmin = 600.00 mm2 OK

Calculate equivalent moment

- . Y = {As(total)*fy / (0.85*f'c*B)} = 24.64 mm — Equivalent compressive block depth
- . Mu = {phi*0.85*f'c*B*Y*(d-Y/2)} = 229.67 kNm — Equivalent moment for provided area of steel

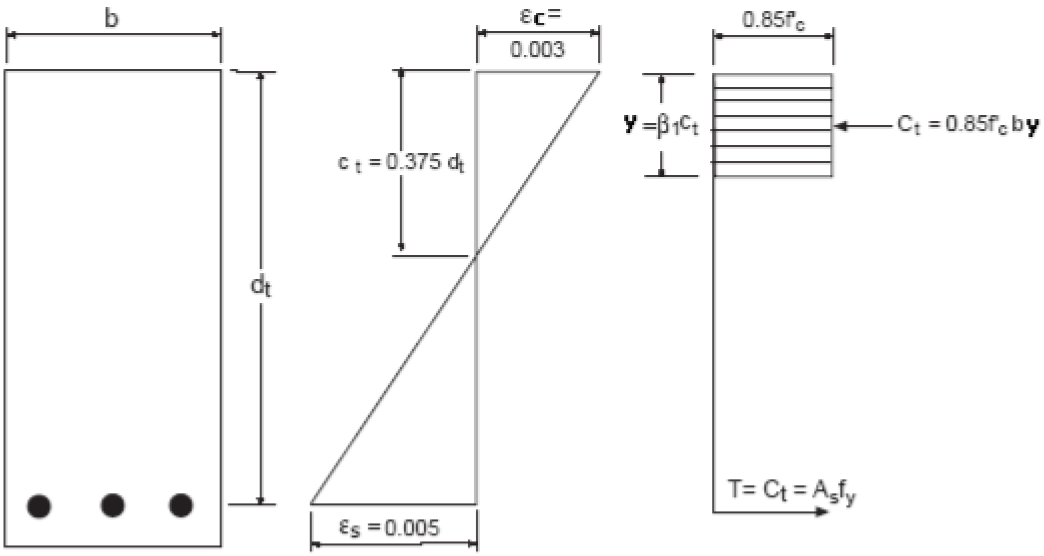
RCM ACI-Builder Reinforced Concrete Members ACI-Builder	Project No : 001	
	Project Name : GCC RENOVATION	
	Job Title: SLAB 300mm - Bottom Reinforcement	
	Calcs by : NK	Checked by : NK
	Sheet : of	Date : 11-01-2556

Design of Flexure According to ACI318-2005

CALCULATE EQUIVALENT MOMENT DUE TO PROVIDED AREA OF STEEL

Tension-Controlled Section

Sections are tension-controlled when the net tensile strain in the extreme tension steel is equal to or greater than 0.005 just as the concrete in compression reaches its assumed strain limit of 0.003.



Strains at Tension-Controlled Limit

Material Properties:

- . f'c = 24 MPa — Concrete compressive strength
- . fy = 400 MPa — Bending Reinforcement yield strength
- . Es = 200000 MPa — Reinf. modulus of elasticity
- . phi = 0.90 — Flexure strength reduction factor (Tension-controlled section)

Section Properties:

- . B = 1000.0 mm — Section breadth
- . H = 300.0 mm — Section height
- . a = 80.0 mm — Cover to tension rebar center
- . dc = 50.0 mm — Cover to compression rebar center

Provided Area of steel:

- . Main Mesh: T16 @ 250 = 804.25 mm2
- . Total area of provided steel As(total)= 804.25 mm2

Singly Reinforced Section properties:

- . ec = 0.003 — Concrete compressive strain
- . es = 0.005 — Reinf. tensile strain
- . dt = H - dc = 220.0 mm — Effective depth
- . Ct = [ec/(ec+es)]*dt = 0.375*dt = 82.50 mm — Neutral axis depth
- . 0.85 >= {beta = 0.85-0.05[(f'c-28)/7]} >= 0.65, then beta = 0.850 — Equivalent depth factor
- . Ymax = beta * Ct = 70.13 mm — Equivalent compressive block depth
- . Asmax(singly) = {[0.85*f'c*B*Ymax]/fy} = 3576.38 mm2 — Maximum area of steel for singly reinforced section
- . Mur(singly) = phi*{0.85*f'c*B*Ymax*[dt-(Ymax/2)]} = 238.11 kNm — Maximum resistance moment for singly reinforced section

Section works as a Singly Reinforced Section because of:

Provided area of steel As(total) is lesser than the maximum area of steel for Singly Reinforced Section (Asmax)

As(total) = 804.25 mm2 < Asmax = 3576.38 mm2

Check minimum area of steel for Slab section against Shrinkage & Temperature:

- . fy < 420 MPa then Asmin = 0.002*B*H/2 = 300.00 mm2 — To be placed on each face of slab
- . As(total) = 804.25 mm2 > Asmin = 300.00 mm2 OK

Calculate equivalent moment

- . Y = {As(total)*fy / (0.85*f'c*B)} = 15.77 mm — Equivalent compressive block depth
- . Mu = {phi*0.85*f'c*B*Y*(d-Y/2)} = 61.41 kNm — Equivalent moment for provided area of steel

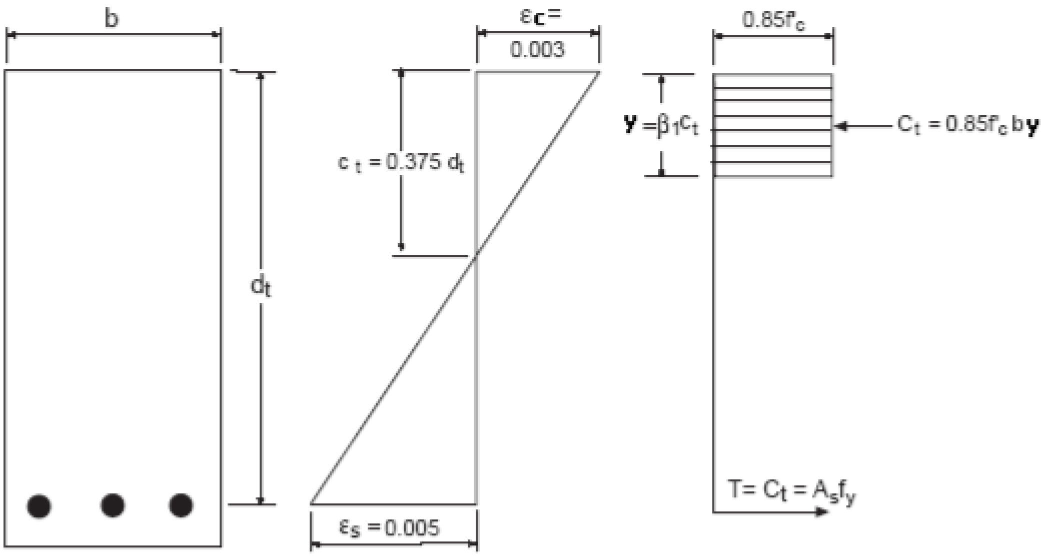
RCM ACI-Builder Reinforced Concrete Members ACI-Builder	Project No :	001		
	Project Name :	GCC RENOVATION		
	Job Title:	SLAB 300mm - Top Reinforcement Part B - Layer 1		
	Calcs by :	NK	Checked by :	NK
	Sheet :	of	Date :	11-01-2556

Design of Flexure According to ACI318-2005

CALCULATE EQUIVALENT MOMENT DUE TO PROVIDED AREA OF STEEL

Tension-Controlled Section

Sections are tension-controlled when the net tensile strain in the extreme tension steel is equal to or greater than 0.005 just as the concrete in compression reaches its assumed strain limit of 0.003.



Strains at Tension-Controlled Limit

Material Properties:

- . f'c = 24 MPa — Concrete compressive strength
- . fy = 400 MPa — Bending Reinforcement yield strength
- . Es = 200000 MPa — Reinf. modulus of elasticity
- . phi = 0.90 — Flexure strength reduction factor (Tension-controlled section)

Section Properties:

- . B = 1000.0 mm — Section breadth
- . H = 300.0 mm — Section height
- . a = 60.0 mm — Cover to tension rebar center
- . dc = 50.0 mm — Cover to compression rebar center

Provided Area of steel:

- . Main Mesh: T20 @ 250 = 1256.64 mm2
- . Extra Mesh: T20 @ 250 = 1256.64 mm2
- . Total area of provided steel As(total)= 2513.27 mm2

Singly Reinforced Section properties:

- . ec = 0.003 — Concrete compressive strain
- . es = 0.005 — Reinf. tensile strain
- . dt = H - dc = 240.0 mm — Effective depth
- . Ct = [ec/(ec+es)]*dt = 0.375*dt = 90.00 mm — Neutral axis depth
- . 0.85 >= {beta = 0.85-0.05[(f'c-28)/7]} >= 0.65, then beta = 0.850 — Equivalent depth factor
- . Ymax = beta * Ct = 76.50 mm — Equivalent compressive block depth
- . Asmax(singly) = {[0.85*f'c*B*Ymax]/fy} = 3901.50 mm2 — Maximum area of steel for singly reinforced section
- . Mur(singly) = phi*{0.85*f'c*B*Ymax*[dt-(Ymax/2)]} = 283.37 kNm — Maximum resistance moment for singly reinforced section

Section works as a Singly Reinforced Section because of:

Provided area of steel As(total) is lesser than the maximum area of steel for Singly Reinforced Section (Asmax)

As(total) = 2513.27 mm2 < Asmax = 3901.50 mm2

Check minimum area of steel for Slab section against Shrinkage & Temperature:

- . fy < 420 MPa then Asmin = 0.002*B*H/2 = 300.00 mm2 — To be placed on each face of slab
- . As(total) = 2513.27 mm2 > Asmin = 300.00 mm2 OK

Calculate equivalent moment

- . Y = {As(total)*fy / (0.85*f'c*B)} = 49.28 mm — Equivalent compressive block depth
- . Mu = {phi*0.85*f'c*B*Y*(d-Y/2)} = 194.85 kNm — Equivalent moment for provided area of steel

RCM ACI-Builder
Reinforced Concrete Members ACI-Builder

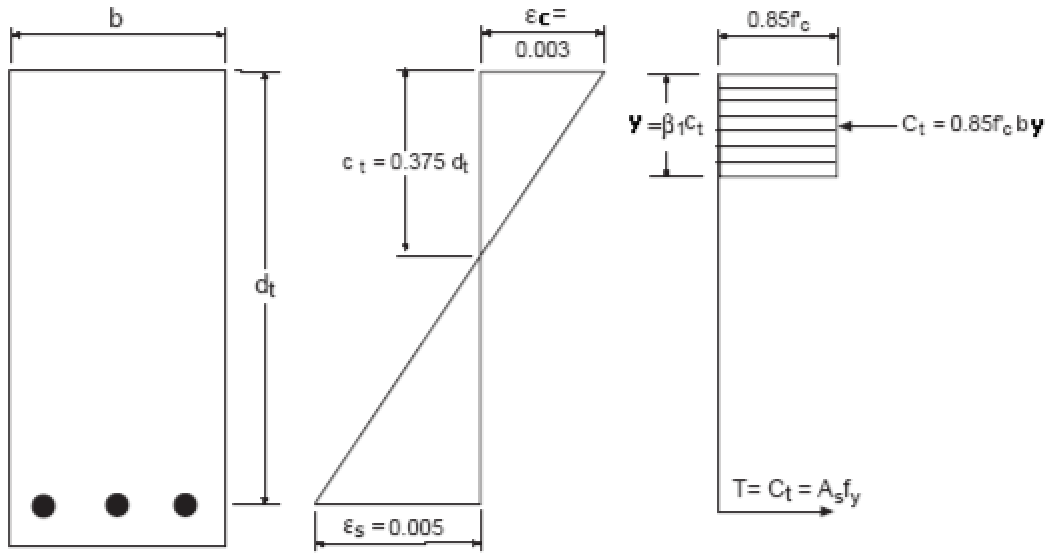
Project No :	001		
Project Name :	GCC RENOVATION		
Job Title:	SLAB 300mm - Top Reinforcement Part B - Layer 2		
Calcs by :	NK	**Checked by :**	NK
Sheet :	of	**Date :**	11-01-2556

Design of Flexure According to ACI318-2005

CALCULATE EQUIVALENT MOMENT DUE TO PROVIDED AREA OF STEEL

Tension-Controlled Section

Sections are tension-controlled when the net tensile strain in the extreme tension steel is equal to or greater than 0.005 just as the concrete in compression reaches its assumed strain limit of 0.003.



Strains at Tension-Controlled Limit

Material Properties:

- . f'c = 24 MPa — Concrete compressive strength
- . fy = 400 MPa — Bending Reinforcement yield strength
- . Es = 200000 MPa — Reinf. modulus of elasticity
- . phi = 0.90 — Flexure strength reduction factor (Tension-controlled section)

Section Properties:

- . B = 1000.0 mm — Section breadth
- . H = 300.0 mm — Section height
- . a = 60.0 mm — Cover to tension rebar center
- . dc = 50.0 mm — Cover to compression rebar center

Provided Area of steel:

. Main Mesh: T20 @ 250 = 1256.64 mm2

. Extra Mesh: T16 @ 250 = 804.25 mm2

. Total area of provided steel As(total)= 2060.88 mm2

Singly Reinforced Section properties:

. ec = 0.003	Concrete compressive strain
. es = 0.005	Reinf. tensile strain
. dt = H - dc = 240.0 mm	Effective depth
. Ct = [ec/(ec+es)]*dt = 0.375*dt = 90.00 mm	Neutral axis depth
. 0.85 >= {beta = 0.85-0.05[(f'c-28)/7]} >= 0.65, then beta = 0.850	Equivalent depth factor
. Ymax = beta * Ct = 76.50 mm	Equivalent compressive block depth
. Asmax(singly) = {[0.85*f'c*B*Ymax]/fy} = 3901.50 mm2	Maximum area of steel for singly reinforced section
. Mur(singly) = phi*{0.85*f'c*B*Ymax*[dt-(Ymax/2)]} = 283.37 kNm	Maximum resistance moment for singly reinforced section

Section works as a Singly Reinforced Section because of:

Provided area of steel As(total) is lesser than the maximum area of steel for Singly Reinforced Section (Asmax)
As(total) = 2060.88 mm2 < Asmax = 3901.50 mm2

Check minimum area of steel for Slab section against Shrinkage & Temperature:

. fy < 420 MPa then Asmin = 0.002*B*H/2 = 300.00 mm2 — To be placed on each face of slab
. As(total) = 2060.88 mm2 > Asmin = 300.00 mm2 OK

Calculate equivalent moment

. Y = {As(total)*fy / (0.85*f'c*B)} = 40.41 mm	Equivalent compressive block depth
. Mu = {phi*0.85*f'c*B*Y*(d-Y/2)} = 163.07 kNm	Equivalent moment for provided area of steel

RCM ACI-Builder
Reinforced Concrete Members ACI-Builder

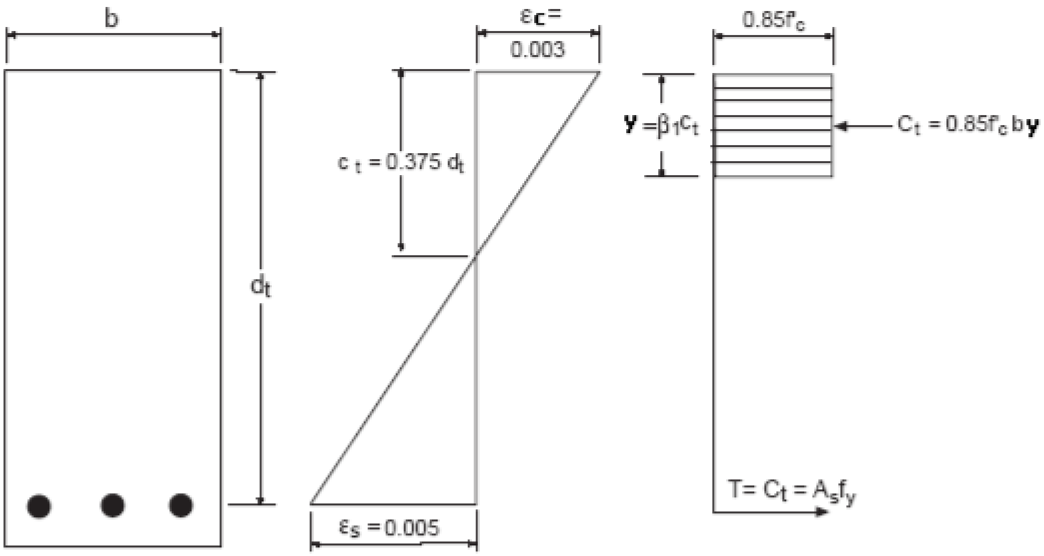
Project No :	001		
Project Name :	GCC RENOVATION		
Job Title:	SLAB 300mm - Top Reinforcement Part C - Layer 1		
Calcs by :	NK	Checked by :	NK
Sheet :	of	Date :	11-01-2556

Design of Flexure According to ACI318-2005

CALCULATE EQUIVALENT MOMENT DUE TO PROVIDED AREA OF STEEL

Tension-Controlled Section

Sections are tension-controlled when the net tensile strain in the extreme tension steel is equal to or greater than 0.005 just as the concrete in compression reaches its assumed strain limit of 0.003.



Strains at Tension-Controlled Limit

Material Properties:

. f'c = 24 MPa Concrete compressive strength
. fy = 400 MPa Bending Reinforcement yield strength
. Es = 200000 MPa Reinf. modulus of elasticity
. phi = 0.90 Flexure strength reduction factor (Tension-controlled section)

Section Properties:

. B = 1000.0 mm Section breadth
. H = 300.0 mm Section height
. a = 60.0 mm Cover to tension rebar center
. dc = 50.0 mm Cover to compression rebar center

Provided Area of steel:

. Main Mesh: T20 @ 250 = 1256.64 mm2
. Extra Mesh: T16 @ 250 = 804.25 mm2
. Total area of provided steel As(total)= 2060.88 mm2

Singly Reinforced Section properties:

. ec = 0.003 Concrete compressive strain
. es = 0.005 Reinf. tensile strain
. dt = H - dc = 240.0 mm Effective depth
. Ct = [ec/(ec+es)]*dt = 0.375*dt = 90.00 mm Neutral axis depth
. 0.85 >= {beta = 0.85-0.05[(f'c-28)/7]} >= 0.65, then beta = 0.850 Equivalent depth factor
. Ymax = beta * Ct = 76.50 mm Equivalent compressive block depth
. Asmax(singly) = {[0.85*f'c*B*Ymax]/fy} = 3901.50 mm2 Maximum area of steel for singly reinforced section
. Mur(singly) = phi*{0.85*f'c*B*Ymax*[dt-(Ymax/2)]} = 283.37 kNm Maximum resistance moment for singly reinforced section

Section works as a Singly Reinforced Section because of:

Provided area of steel As(total) is lesser than the maximum area of steel for Singly Reinforced Section (Asmax)
As(total) = 2060.88 mm2 < Asmax = 3901.50 mm2

Check minimum area of steel for Slab section against Shrinkage & Temperature:

. fy < 420 MPa then Asmin = 0.002*B*H/2 = 300.00 mm2 To be placed on each face of slab
. As(total) = 2060.88 mm2 > Asmin = 300.00 mm2 OK

Calculate equivalent moment

. Y = {As(total)*fy / (0.85*f'c*B)} = 40.41 mm Equivalent compressive block depth
. Mu = {phi*0.85*f'c*B*Y*(d-Y/2)} = 163.07 kNm Equivalent moment for provided area of steel

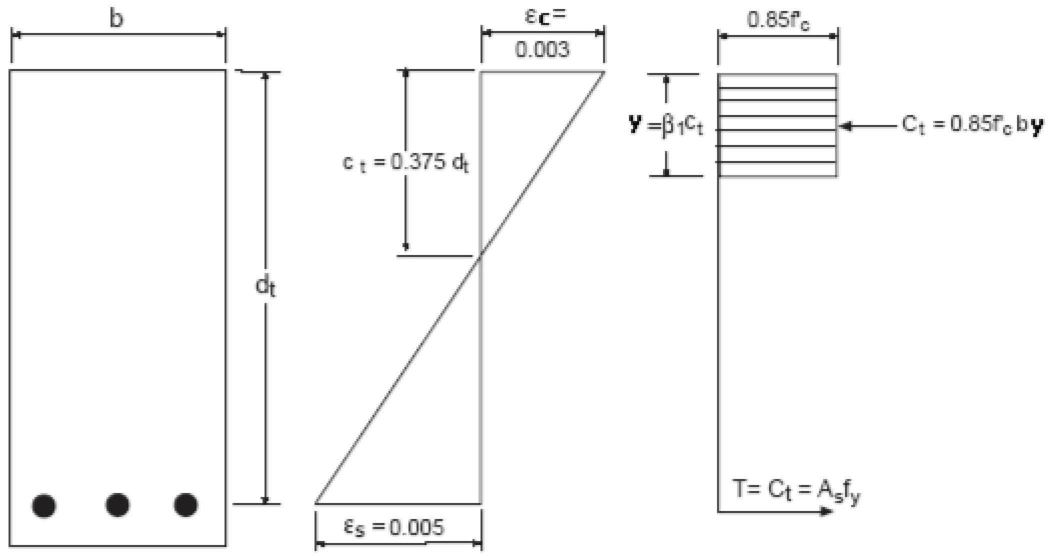
RCM ACI-Builder — Reinforced Concrete Members ACI-Builder			
Project No :	001		
Project Name :	GCC RENOVATION		
Job Title:	SLAB 300mm - Top Reinforcement Part C - Layer 2		
Calcs by :	NK	Checked by :	NK
Sheet :	of	Date :	11-01-2556

Design of Flexure According to ACI318-2005

CALCULATE EQUIVALENT MOMENT DUE TO PROVIDED AREA OF STEEL

Tension-Controlled Section

Sections are tension-controlled when the net tensile strain in the extreme tension steel is equal to or greater than 0.005 just as the concrete in compression reaches its assumed strain limit of 0.003.



Strains at Tension-Controlled Limit

Material Properties:

. f'c = 24 MPa Concrete compressive strength
. fy = 400 MPa Bending Reinforcement yield strength
. Es = 200000 MPa Reinf. modulus of elasticity
. phi = 0.90 Flexure strength reduction factor (Tension-controlled section)

Section Properties:

. B = 1000.0 mm Section breadth
. H = 300.0 mm Section height
. a = 60.0 mm Cover to tension rebar center
. dc = 50.0 mm Cover to compression rebar center

Provided Area of steel:

. Main Mesh: T20 @ 250 = 1256.64 mm2
. Extra Mesh: T12 @ 250 = 452.39 mm2
. Total area of provided steel As(total)= 1709.03 mm2

Singly Reinforced Section properties:

. ec = 0.003 — Concrete compressive strain
. es = 0.005 — Reinf. tensile strain
. dt = H - dc = 240.0 mm — Effective depth
. Ct = [ec/(ec+es)]*dt = 0.375*dt = 90.00 mm — Neutral axis depth
. 0.85 >= {beta = 0.85-0.05[(f'c-28)/7]} >= 0.65, then beta = 0.850 — Equivalent depth factor
. Ymax = beta * Ct = 76.50 mm — Equivalent compressive block depth
. Asmax(singly) = {[0.85*f'c*B*Ymax]/fy} = 3901.50 mm2 — Maximum area of steel for singly reinforced section
. Mur(singly) = phi*{0.85*f'c*B*Ymax*[dt-(Ymax/2)]} = 283.37 kNm — Maximum resistance moment for singly reinforced section

Section works as a Singly Reinforced Section because of:

Provided area of steel As(total) is lesser than the maximum area of steel for Singly Reinforced Section (Asmax)
As(total) = 1709.03 mm2 < Asmax = 3901.50 mm2

Check minimum area of steel for Slab section against Shrinkage & Temperature:

. fy < 420 MPa then Asmin = 0.002*B*H/2 = 300.00 mm2 — To be placed on each face of slab
. As(total) = 1709.03 mm2 > Asmin = 300.00 mm2 OK

Calculate equivalent moment

. Y = {As(total)*fy / (0.85*f'c*B)} = 33.51 mm — Equivalent compressive block depth
. Mu = {phi*0.85*f'c*B*Y*(d-Y/2)} = 137.35 kNm — Equivalent moment for provided area of steel

คาน
(BEAM)

	Job N°	Section	Sheet N°	Rev.
	Engineer Nuttapol K.		Checked	
	Date 01.02.2013		Rev. Date	

Project : GCC Factory

Part : B1 : 300x600mm

B1 : 300x500mm $\quad L = 6.5$ m.

$f'_c = 240$ ksc $\quad f_y = 4000$ ksc

$w_{DL} = (2400 \times 0.3 \times 1.225) + (2400 \times 0.3 \times 0.5) = 1242$ kg/m

$w_{SDL} = 120 \times 1.225 = 147$ kg/m

$w_{LL} = 2000 \times 1.225 = 2450$ kg/m

$w_u = 1944.6 + 4165 = 6109.6$ kg/m

$M_u = 32,266.325$ kg-m

$V_u = 19,856.2$ kg.

$R_u = (32266.325 \times 100) / (0.9 \times 30 \times 40.55^2) = 72.68$ kg/cm²

$\rho = 0.02366$

$A_s = \rho bd = 0.02366 \times 30 \times 40.55 = 28.78$ cm²

Use 6 DB25 $\quad A_s = 6 \times 4.91 = 29.46$ cm² $> A_s$ OK.

$V_u = 19,856.2$ kg

$V_c = 0.53\sqrt{240} \times 30 \times 40.55 = 9988.5$ kg

$V_{max} = 2.1\sqrt{f'c} \times 30 \times 40.55 = 39,576.5$ kg

$V_{s_{req}} = \frac{V_u}{\phi} - V_c = \frac{19856.2}{0.85} - 9988.5$

$= 13,371.74$ kg.

Use DB12@200 :

$V_s = \frac{A_s f_y d}{s} = \frac{2 \times 1.13 \times 4000 \times 40.55}{20}$

$= 18,328.6 > V_{s\,req.}$ OK.

	Job N°.	Section	Sheet N°.	Rev.
	Engineer Nuttapol K.		Checked	
	Date 01.02.2013		Rev. Date	

Project : GCC Factory

Part : B2: 200x500 mm

Size : 200x500 mm   L = 6.5 m.

$f'c = 240$ ksc $fy = 4000$ ksc.

$w = 0.55$ m.

$w_{dl} = (2400 \times 0.3 \times 0.55) + (2400 \times 0.2 \times 0.5) = 636$ kg/m.

$w_{SDL} = 120 \times 0.55 = 66$ kg/m

$w_{LL} = 2000 \times 0.55 = 1100$ kg/m

$w_U = 982.8 + 1870 = 2852.8$ kg/m.

$M_u = 15066.35$ kg-m

$V_u = 9,271.6$ kg.

$R_u = (15066.35 \times 100) / (0.9 \times 20 \times 40.55^2) = 50.91$ ksc

$\rho - 0.015$

$A_s = \rho bd = 0.015 \times 20 \times 40.55 = 12.1 cm^2$

Use 4DB20 $A_s = 4 \times 3.14 = 12.56 cm^2$.

$V_u = 9271.6$ kg.

$V_c = 0.53 \sqrt{240} \times 20 \times 40.55 = 6659$ kg

$V_{sreq} = \frac{V_u}{\phi} - V_c = \frac{9271.6}{0.85} - 6659 = 4249$ kg.

shear:

RB9@200

$V_s = \frac{2 \times 0.64 \times 2400 \times 40.55}{20} = 6228.48$ kg

$> V_{sreq}$. Ok.

ฝารางระบายน้ำ
(Trench Cover)

	Job N°	Section	Sheet N°	Rev.
	Engineer Nuttapol K.		Checked	
	Date 04.02.2556		Rev. Date	

Project : GCC Factory

Part : ฝา Trench ภายนอกอาคาร.

Span $L = 450$ mm $f'_c = 240$ ksc.

Width $w = 500$ mm $f_y = 4000$ ksc

thickness $t = 100$ mm

$w_{DL} = 2400 \times 0.45 \times 0.5 \times 0.1 = 54$ kg/nos.

Line Load :

$w_{DL} = 2400 \times 0.5 \times 0.1 = 120$ kg/m

$w_{SDL} = 120 \times 0.5 = 60$ kg/m

$w_{LL} = 2000 \times 0.5 = 1000$ kg/m.

$w_u = 1952$ kg/m.

$M_u = 49.41$ kg-m

$V_u = 439.2$ kg.

$R_u = (49.41 \times 100) / (0.9 \times 50 \times 6.9^2) = 2.31$ kg/cm^2

$\rho = 5.8 \times 10^{-4}$

$A_s = \rho b d = 5.8 \times 10^{-4} \times 50 \times 6.9 = 0.2$ cm^2

$A_{s\,min} = 0.0020 \times 50 \times 10 = 1$ cm^2.

$A_{s\,req} = 1$ cm^2.

Use 4DB12 $A_s = 4.52$ cm^2 ok.

Use RB9@ 150 mm > $A_{s\,min}$ OK.

$V_c = 0.53\sqrt{240} \times 50 \times 6.9 = 2832$ kg $> V_u$ OK.

	Job N°	Section	Sheet N°	Rev.
	Engineer Nuttapol K.		Checked	
	Date 04.02.2556		Rev. Date	

Project : GCC Factory

Part : ah Sump Pit.

Span $L = 900$ mm $f'_c = 240$ ksc.

Width $w = 400$ mm $f_y = 4000$ ksc

thickness $t = 100$ mm

$w_{DL} = 2400 \times 0.9 \times 40 \times 0.1 = 86.4$ kg / nos.

Line Loads

$w_{DL} = 2400 \times 0.4 \times 0.1 = 96$ kg/m

$w_{SDL} = 120 \times 0.4 = 48$ kg/m

$w_{LL} = 2000 \times 0.4 = 800$ kg/m

$w_u = 1.4 \times (96+48) + 1.7(800) = 1561.6$ kg/m

$M_u = 1561.6 \times 0.9^2/8 = 158.112$ kg-m

$V_u = 1561.6 \times 0.9/2 = 702.72$ kg.

$R_u = (158 \times 100)/(0.9 \times 40 \times 6.9^2) = 9.225$ kg/cm²

$\rho = 2.36 \times 10^{-3}$

$A_s = \rho bd = 2.36 \times 10^{-3} \times 40 \times 6.9 = 0.65$ cm²

$A_{s\,min} = 0.0020 \times 40 \times 10.0 = 0.8$ cm²

$A_{s\,req} = 0.8$ cm²

DB12 $A_s = 1.13$ cm²

use 3 DB12 Ok

use RB9 @ 200 mm. > Asmin Ok.

$V_c = 0.53\sqrt{f'_c}\,bd = 0.53\sqrt{240} \times 40 \times 6.9$

$= 2266$ kg > 703 kg Ok