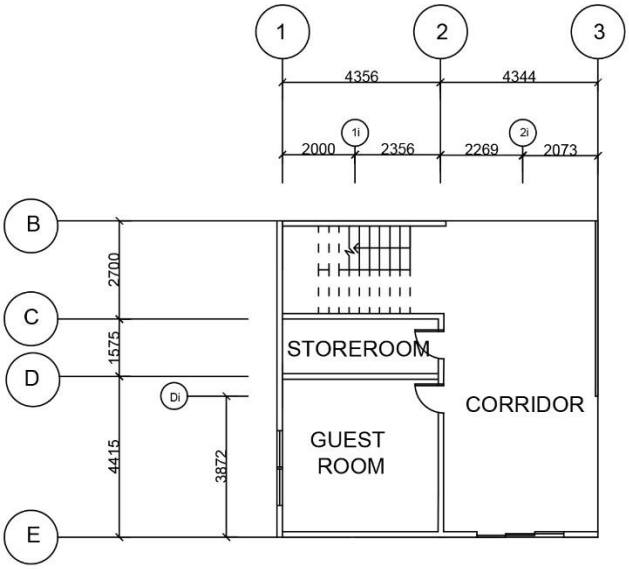
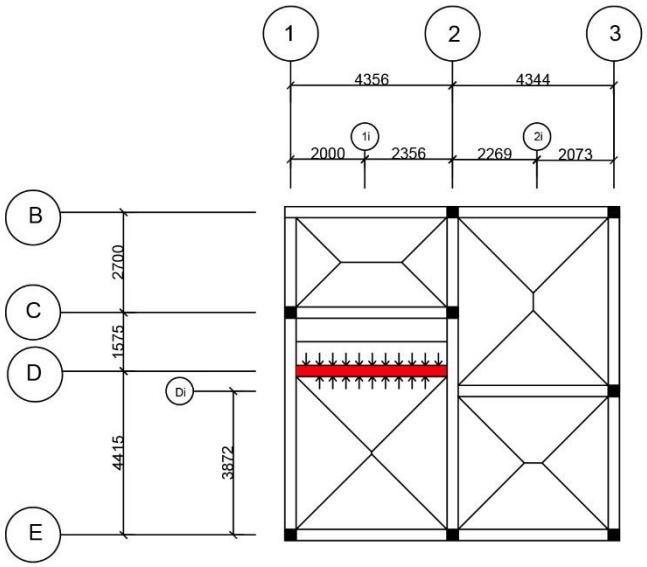
1. Ground Floor Beam (D/1-2) – Secondary beam

Slab C-D/ 1-2 = 4356/1575	Slab thickness = 0.15m
=2.766 (one way system)	Wall thickness = 0.15m
Slab D-E/ 1-2 = 4415/4356	Wall height = 3.2m
=1.01 (two way system)	Beam size = 0.15x0.3m (secondary beam)
	= 0.3x0.3m (primary beam)



GROUND FLOOR PLAN (ARCHITECTURAL)



GROUND FLOOR PLAN (STRUCTURAL)

Dead Load

1. Concrete beam self-weight
   = $(0.15x0.3)m^2$ x $24kN/m^3$
   = 1.08 kN/m

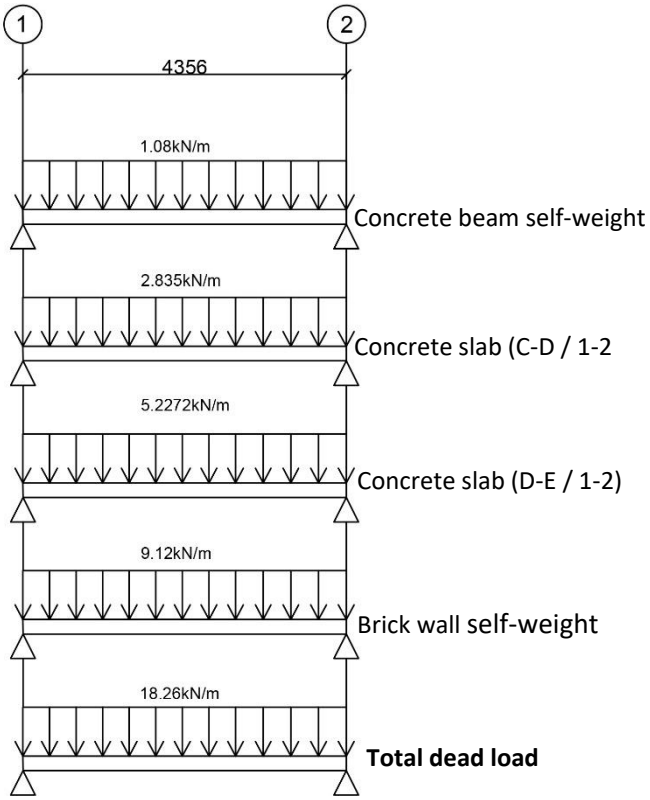
2. Concrete slab (C-D / 1-2) self-weight
   = 0.15m x $24kN/m^3$ x (1.575/2)m
   = 2.835 kN/m

3. Concrete slab (D-E / 1-2) self-weight
   = 0.15m x $24kN/m^3$ x (4.356/2)m x (2/3)
   = 5.2272 kN/m

4. Brick wall self-weight
   = $(0.15x 3.2)m^2$ x $19kN/m^3$
   =9.12kN/m

Total dead load = (1.08 + 2.835 + 5.2272 + 9.12) kN/m

= 18.26kN/m



Live Load

Live load UBBL: Storeroom 1.5kN/m^2

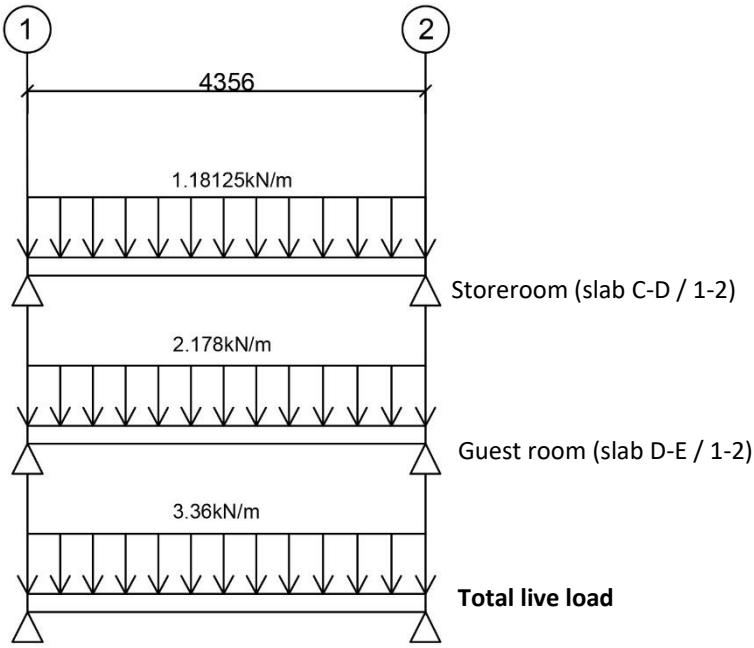
Guest room 1.5kN/m^2

1. Storeroom (slab C-D / 1-2)
   = 1.5kN/m^2 x (1.575/2)m
   = 1.18125 kN/m

2. Guest room (slab D-E / 1-2)
   = 1.5kN/m^2 x (4.356/2)m x (2/3)
   = 2.178 kN/m

Total live load = (1.18125 + 2.178) kN/m

= 3.36kN/m



Ultimate load

Ultimate dead load = 18.26kN/m x 1.4

=25.564kN/m

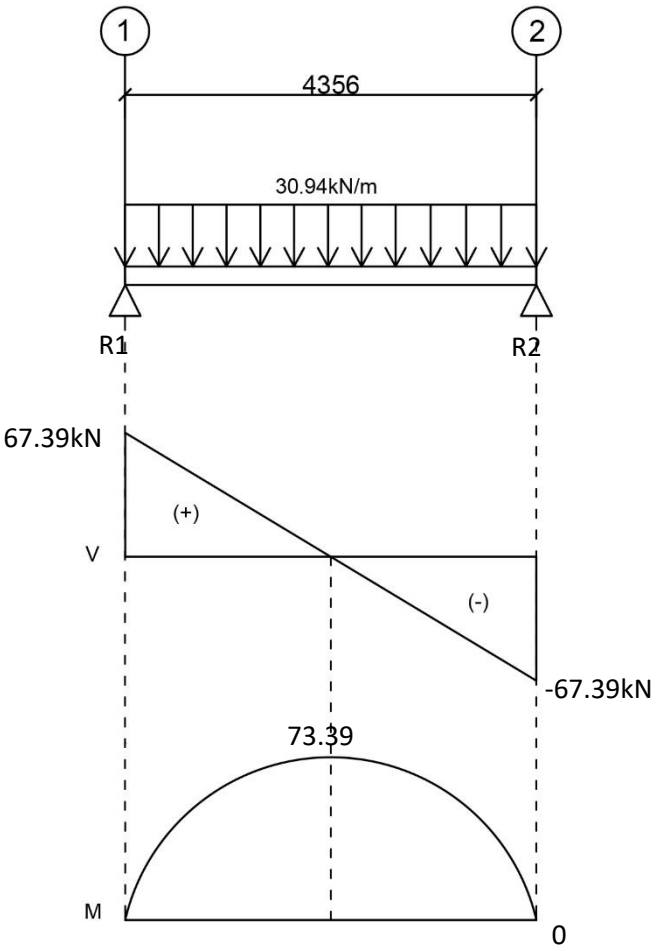
Ultimate live load = 3.36kN/m x 1.6

= 5.376kN/m

Total ultimate load = 25.564kN/m + 5.376kN/m

= 30.94kN/m

Ultimate load diagram



$\Sigma Fy = 0$

R1 = R2

= (30.94kN/m x 4.356m) /2

= 67.39kN (point load)

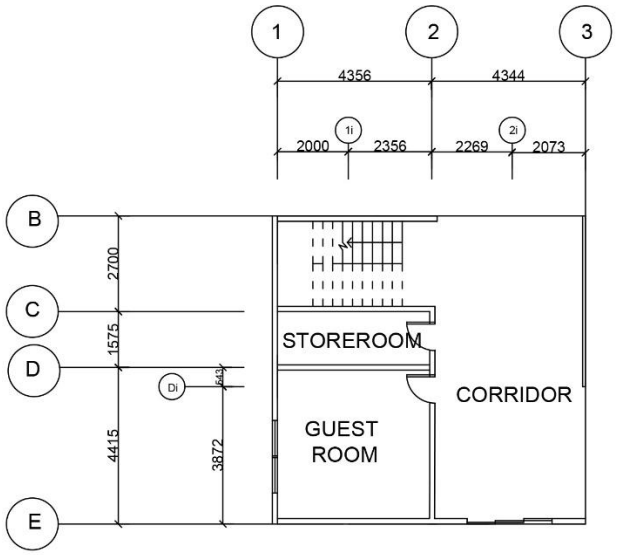
Positive area = Negative area

= ½ X 2.178 X 67.39

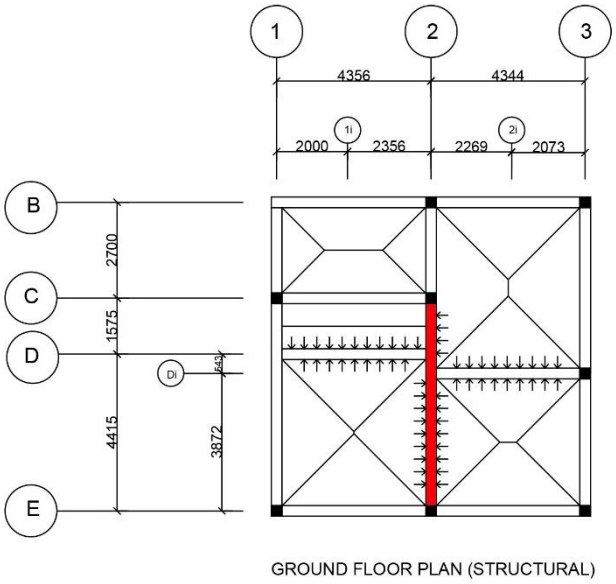
= 73.39

2. Ground Floor Beam (C-E/2) – Primary beam

Slab B-Di/ 2-3 = 4818/4344	Slab thickness = 0.15m
=1.109 (two way system)	Wall thickness = 0.15m
Slab Di-E/ 2-3 = 4344/3872	Wall height = 3.2m
=1.12 (two way system)	Beam size = 0.15x0.3m (secondary beam)
	= 0.3x0.3m (primary beam)



GROUND FLOOR PLAN (ARCHITECTURAL)



GROUND FLOOR PLAN (STRUCTURAL)

Beam (Di/2-3) – Secondary beam

Dead Load

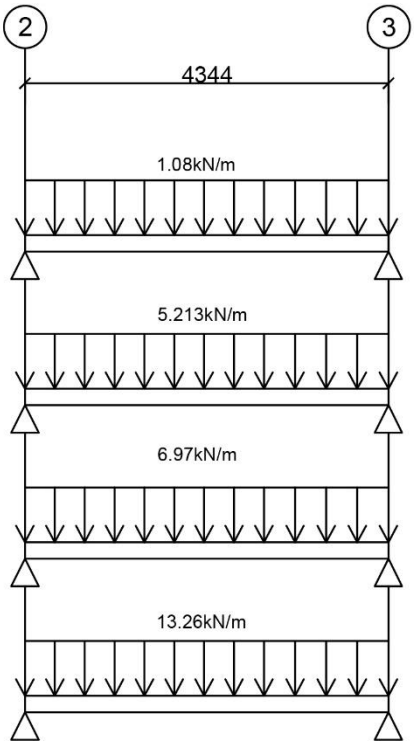
1. Concrete beam self-weight
   = (0.15x0.3)m^2 x 24kN/m^3
   = 1.08kN/m

2. Concrete slab (B-Di / 2-3)
   = 0.15m x 24kN/m^3 x (4.344/2)m x (2/3
   = 5.213kN/m

3. Concrete slab (Di-E / 2-3)
   = 0.15m x 24kN/m^3 x (3.872/2)m
   = 6.97kN/m

Total dead load = (1.08 + 5.213 + 6.97) kN/m

= 13.26kN/m



Concrete beam self-weight

Concrete slab (B-Di/2-3)

Concrete slab (Di-E/2-3)

Total dead load

Live Load

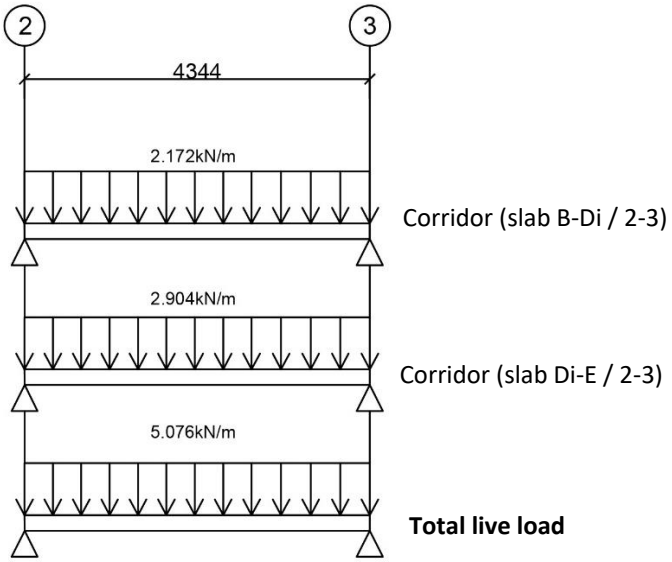
Live load UBBL: Corridor 1.5kN/m^2

1. Corridor (slab B-Di / 2-3)
   = 1.5kN/m^2 x (4.344/2)m x (2/3)
   = 2.172kN/m

2. Corridor (slab Di-E / 2-3)
   = 1.5kN/m^2 x (3.872/2)m
   = 2.904kN/m

Total live load = (2.172 + 2.904) kN/m

= 5.076kN/m



Ultimate load

Ultimate dead load = 13.26kN/m x 1.4

=18.564kN/m

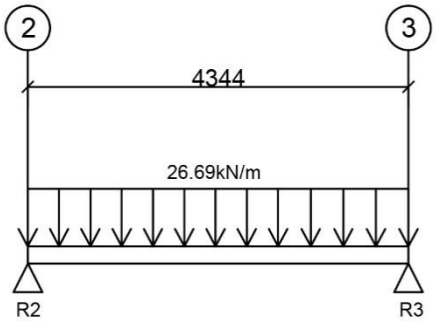
Ultimate live load = 5.076kN/m x 1.6

= 8.122kN/m

Total ultimate load = 18.564kN/m + 8.122kN/m

= 26.69kN/m

Ultimate load diagram



$\Sigma Fy = 0$

R2 = R3

= (26.69kN/m x 4.344m) /2

= 57.97kN (point load)

Beam (C-E/2) – Primary beam

Dead Load

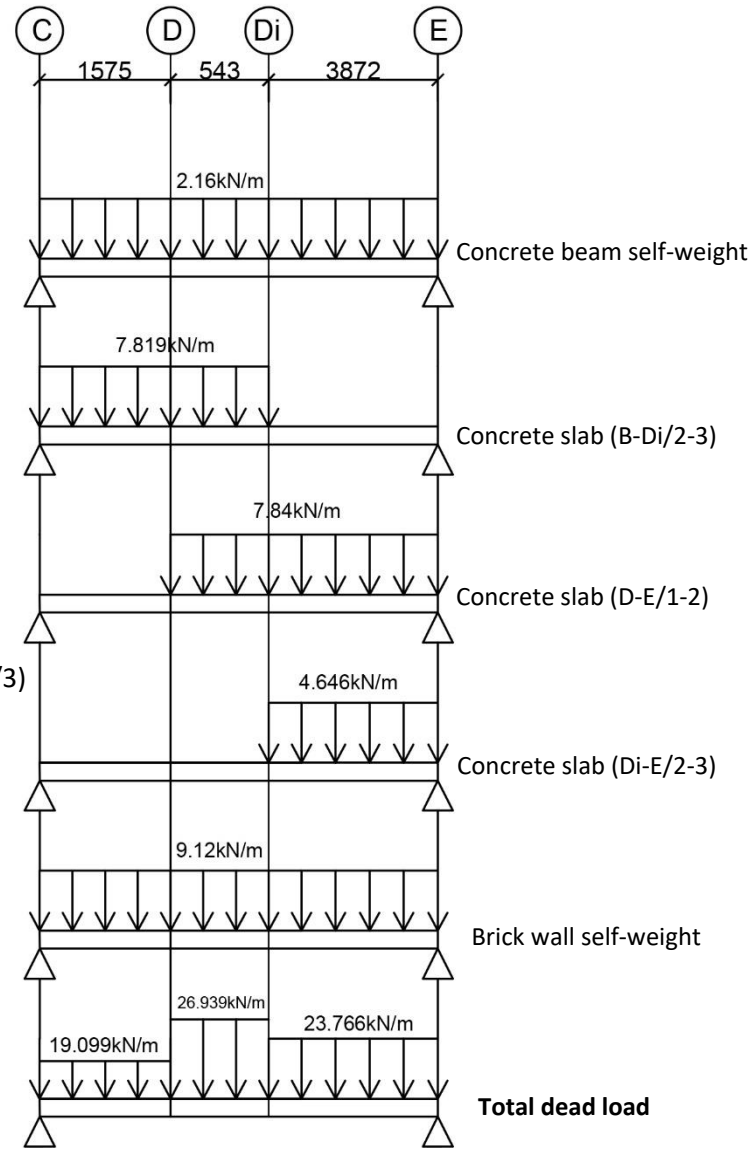
1. Concrete beam self-weight
   = (0.3x0.3)m^2 x 24kN/m^3
   = 2.16kN/m

2. Concrete slab (B-Di / 2-3)
   = 0.15m x 24kN/m^3 x (4.344/2)m
   = 7.819kN/m

3. Concrete slab (D-E / 1-2)
   = 0.15m x 24kN/m^3 x (4.356/2)m
   = 7.84kN/m

4. Concrete slab (Di-E / 2-3)
   = 0.15m x 24kN/m^3 x (3.872/2)m x (2/3)
   = 4.646kN/m

5. Brick wall self-weight
   = (0.15m x 3.2)m^2 x 19kN/m^3
   = 9.12kN/m



Total dead load

For C-D= (2.16+7.819+9.12)kN/m

= 19.099kN/m

For D-Di= (2.16+7.819+7.84+9.12)kN/m

= 26.939kN/m

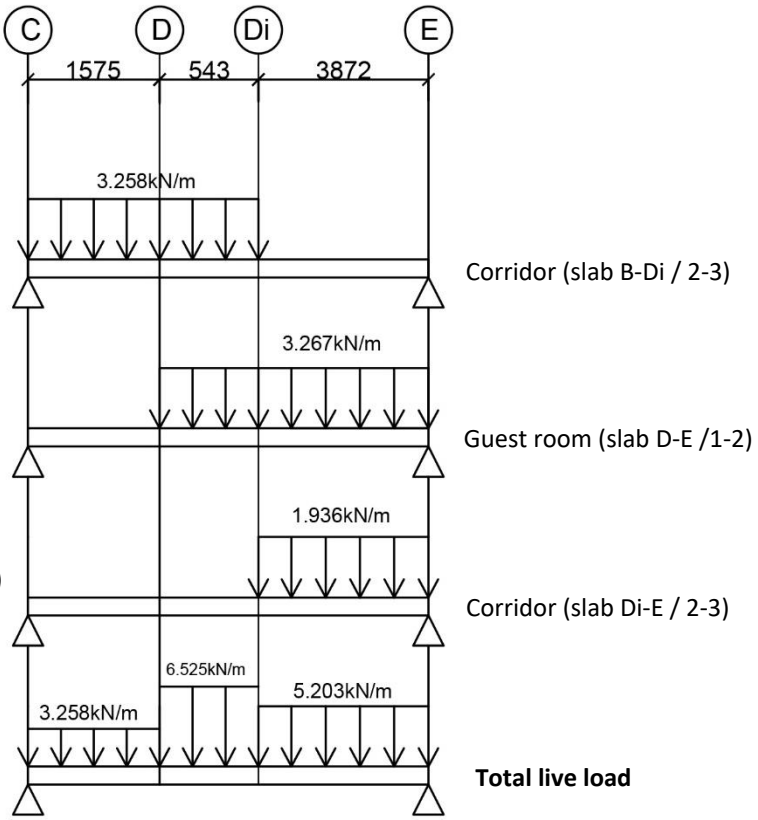
For Di-E= (2.16+7.84+4.646+9.12)kN/m

= 23.766kN/m

Live Load

Live load UBBL: Corridor 1.5kN/m^2

Guest Room 1.5kN/m^2



1. Corridor (slab B-Di / 2-3)
   = 1.5kN/m^2 x (4.344/2)m
   = 3.258kN/m

2. Guest Room (slab D-E/ 1-2)
   = 1.5kN/m^2 x (4.356/2)m
   = 3.267kN/m

3. Corridor (slab Di-E / 2-3)
   = 1.5kN/m^2 x (3.872/2)m x (2/3)
   = 1.936kN/m

Total live load

For C-D= 3.258 kN/m

For D-Di= (3.258+3.267)kN/m

= 6.525kN/m

For Di-E= (3.267+1.936)kN/m

= 5.203kN/m

Ultimate load

Ultimate dead load C-D = 19.099kN/m x 1.4 =26.739kN/m

Ultimate dead load D-Di = 26.939kN/m x 1.4 =37.71kN/m

Ultimate dead load Di-E = 23.766kN/m x 1.4 =33.27kN/m

Ultimate live load C-D = 3.258kN/m x 1.6 = 5.213kN/m

Ultimate live load D-Di = 6.525kN/m x 1.6 = 10.44kN/m

Ultimate live load Di-E = 5.203kN/m x 1.6 = 8.325kN/m

Total ultimate load

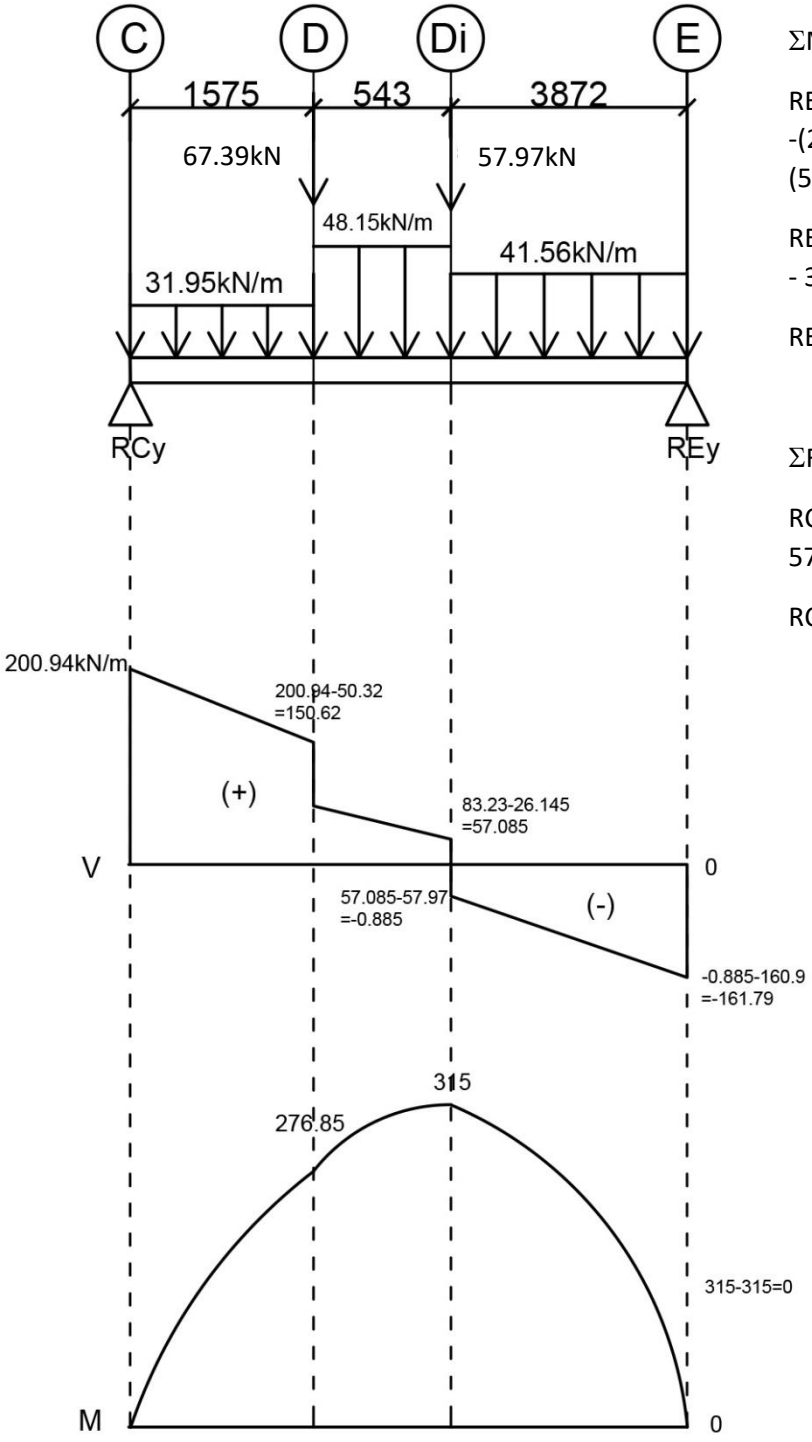
For C-D =26.739+5.213 = 31.95kN/m

For D-Di =37.71+10.44 = 48.15kN/m

For Di-E =33.27+8.325 = 41.56kN/m

Ultimate load diagram –Beam (D/1-2) already calculated, point load=67.39kN (refer to pg.3)

–Beam (Di/2-3) already calculated, point load=57.97kN (refer to pg.5)



$\Sigma Mc=0$

REy (5.99) - (160.9)(4.054) - (57.97)(2.118) -(26.145)(1.847) - (67.39)(1.575) - (50.32)(0.788)=0

REy (5.99) - 652.29 - 122.78 - 48.29 -106.14 - 39.65=0

REy = 161.79kN

$\Sigma Fy=0$

RCy + 161.79 – 50.32 – 67.39 – 26.145 – 57.97 – 160.9 =0

RCy = 200.94

Positive area = ½(200.94+150.62)(1.575)+

½(83.23+57.085)(0.543)

=276.85+38.096

=314.95

≈315

Negative area = ½(0.885+161.79)(3.872)

= 314.78

≈315

3. Ground Floor Beam (C-E/1) – Primary beam

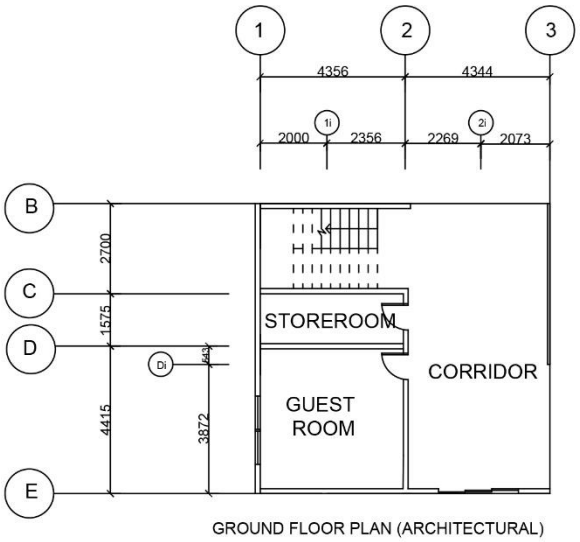
Slab thickness = 0.15m

Wall thickness = 0.15m

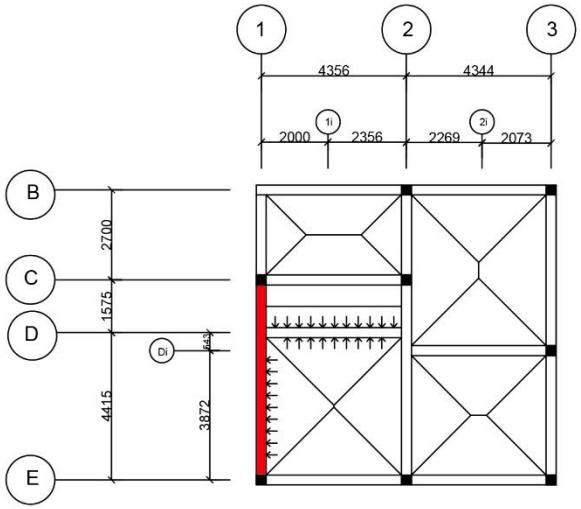
Wall height = 3.2m

Beam size = 0.15x0.3m (secondary beam)

= 0.3x0.3m (primary beam)



GROUND FLOOR PLAN (ARCHITECTURAL)



GROUND FLOOR PLAN (STRUCTURAL)

Dead Load

1. Concrete beam self-weight
   = (0.3x0.3)m^2 x 24kN/m^3
   = 2.16kN/m

2. Concrete slab (D-E / 1-2) self-weight
   = 0.15m x (4.356/2)m x 24kN/m^3
   = 7.84kN/m

3. Brick wall self-weight
   = (0.15x 3.2)m^2 x 19kN/m^3
   =9.12kN/m

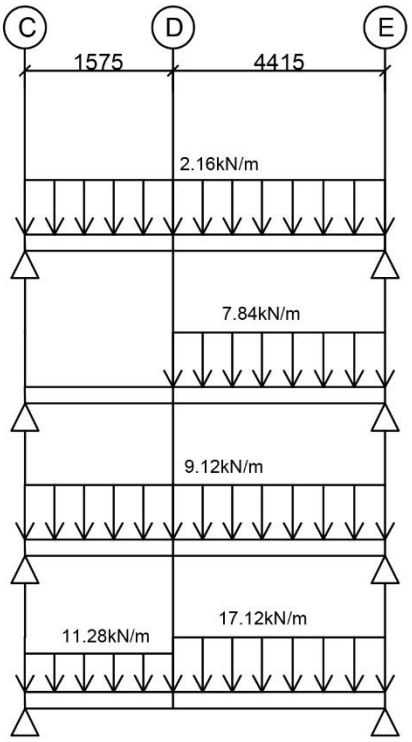
Total dead load

For C-D = (2.16 + 9.12)kN/m

= 11.28kN/m

For D-E = (2.16 + 7.84 + 9.12)kN/m

=17.12kN/m



Concrete beam self-weight

Concrete slab (D-E /1-2)

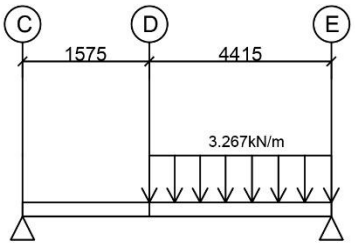
Brick wall self-weight

Total dead load

Live Load

1. Guest room (slab D-E/1-2)
   = 1.5kN/m^2 x (4.356/2)m
   = 3.267kN/m

Total live load for D-E = 3.267kN/m



Guest room (slab D-E/1-2)

Ultimate load

Ultimate dead load C-D = 11.28kN/m x 1.4

= 15.792kN/m

Ultimate dead load D-E = 17.12kN/m x 1.4

= 23.968kN/m

Ultimate live load D-E = 3.267kN/m x 1.6

= 5.227kN/m

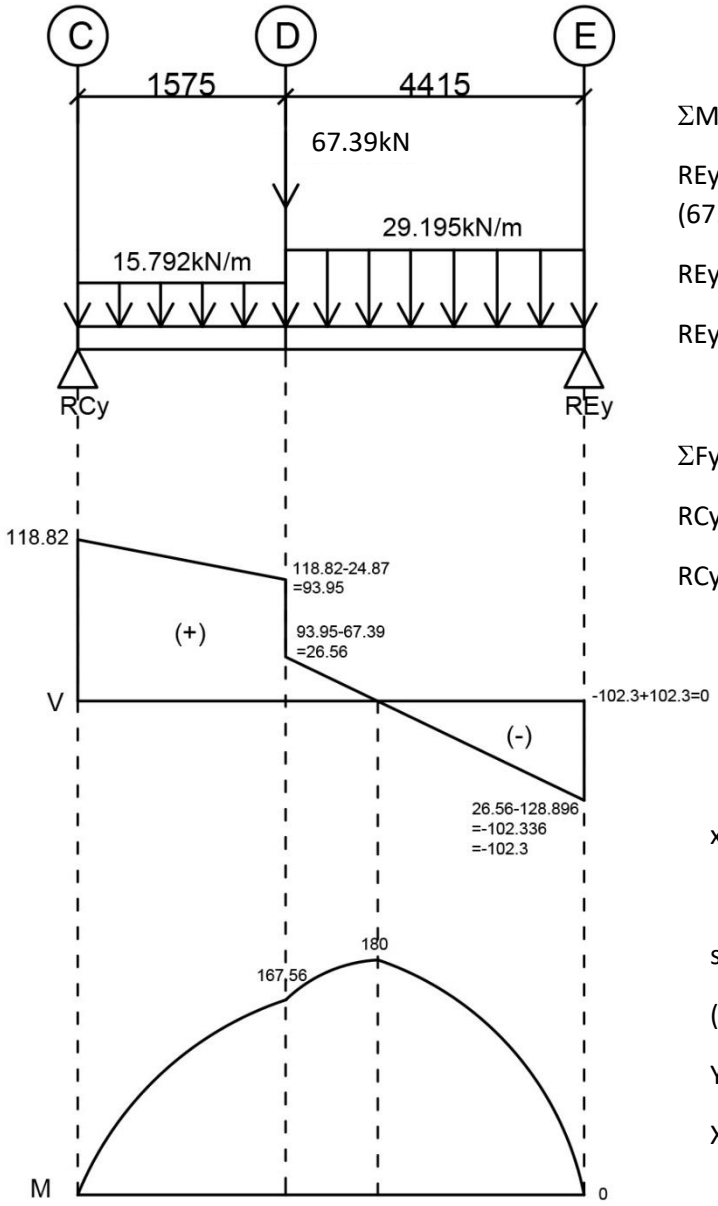
Total ultimate load

For C-D = 15.792kN/m

For D-E = 23.968 + 5.227

= 29.195kN/m

Ultimate load diagram –Beam (D/1-2) already calculated, point load=67.39kN (refer to pg.3)



$\Sigma Mc=0$

REy (5.99) - (128.896)(3.78) -
(67.39)(1.575) -(24.87)(0.788)=0

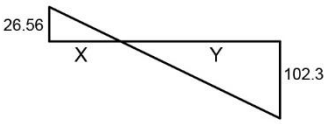
REy (5.99) – 487.23 – 106.14 – 19.6=0

REy = 102.332kN

$\Sigma Fy=0$

RCy + 102.332 – 24.87– 67.39 – 128.896=0

RCy = 118.82



x/y =26.56/102.3---(1)

x+y = 4.415---(2)

x = 4.415-y ---(3)

sub (3) into (1),

(4.415-y)102.3=26.56y

Y=3.5

X=0.915

Positive area = ½(118.82+93.95)(1.575)+

½(0.915x26.56)

=179.71

≈180

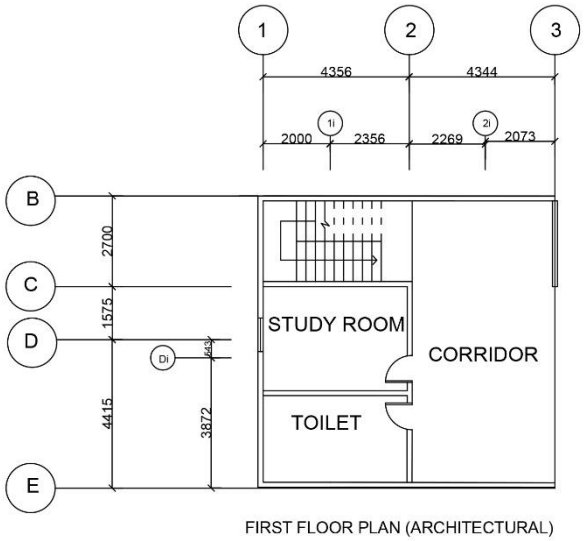
Negative area = ½(3.5 x 102.3)

= 179

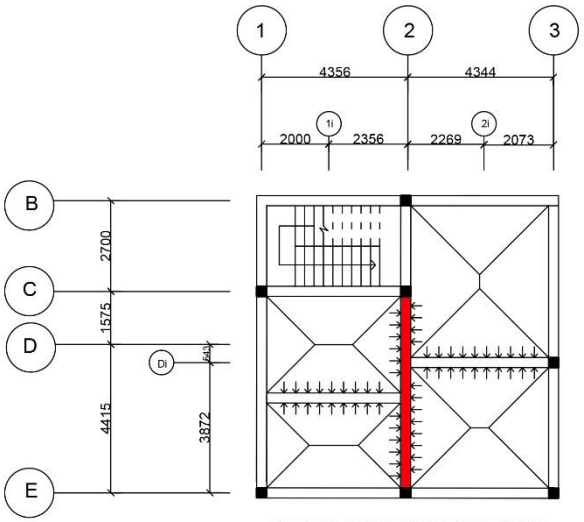
≈180

4. First Floor Beam (C-E/2) – Primary beam

Slab (C-Dii/1-2) = 4356/3167 = 1.37 (Two way system)	Slab thickness = 0.15m
Slab (Dii-E/1-2) = 4356/2821 = 1.5 (Two way system)	Wall thickness = 0.15m
Slab (B-Di/2-3) = 4818/4344 = 1.1 (Two way system)	Wall height = 3.2m
Slab (Di-E/2-3) = 4344/3872 = 1.1 (Two way system)	Beam size = 0.15x0.3m (secondary beam)
	= 0.3x0.3m (primary beam)



FIRST FLOOR PLAN (ARCHITECTURAL)



FIRST FLOOR PLAN (STRUCTURAL)

Beam (Dii/1-2) – Secondary beam

Dead Load

1. Concrete beam self-weight
   = (0.15 x 0.3)m^2 x 24kN/m^3
   = 1.08 kN/m

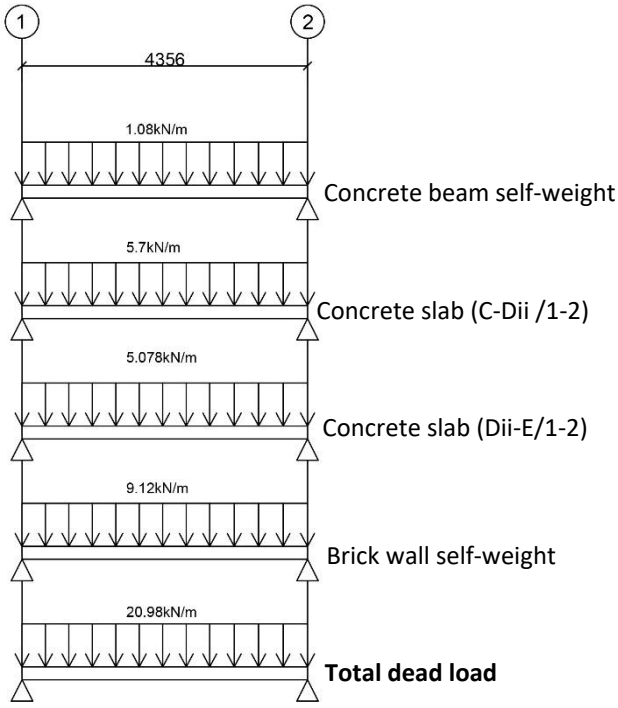
2. Concrete slab (C-Dii/1-2) self-weight
   = 0.15m x 24kN/m^3 x (3.167/2)m
   = 5.7kN/m

3. Concrete slab (Dii-E/1-2) self-weight
   = 0.15m x 24kN/m^3 x (2.821/2)m
   = 5.078kN/m

4. Brick wall self-weight
   = (0.15 x 3.2)m^2 x 19kN/m^3
   = 9.12 kN/m

Total dead load = (1.08 + 5.7 + 5.078 + 9.12)kN/m

= 20.98kN/m



Live Load

Live load UBBL: study room 1.5kN/m^2

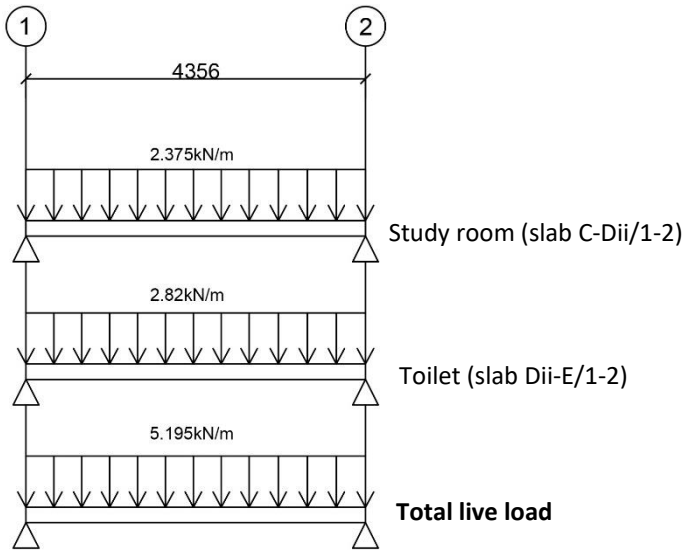
toilet 2.0kN/m^2

1. Study room (slab C-Dii/1-2)
   = 1.5kN/m^2 x (3.167/2)m
   = 2.375kN/m

2. Toilet (slab Dii-E/1-2)
   = 2.0kN/m^2 x (2.821/2)m
   = 2.82kN/m

Total live load = (2.375 + 2.82)kN/m

= 5.195kN/m



Ultimate load

Ultimate dead load 1-2 = 20.98kN/m x 1.4

= 29.372kN/m

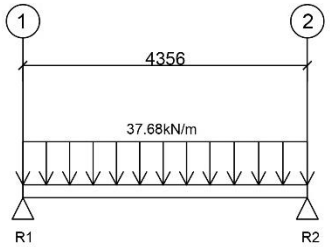
Ultimate live load 1-2 = 5.195kN/m x 1.6

= 8.312kN/m

Total ultimate load 1-2 = 29.372 + 8.312

= 37.68kN/m

Ultimate load diagram



$\Sigma Fy = 0$

R1 = R2

= (37.68kN/m x 4.356m) /2

= 82.07kN (point load)

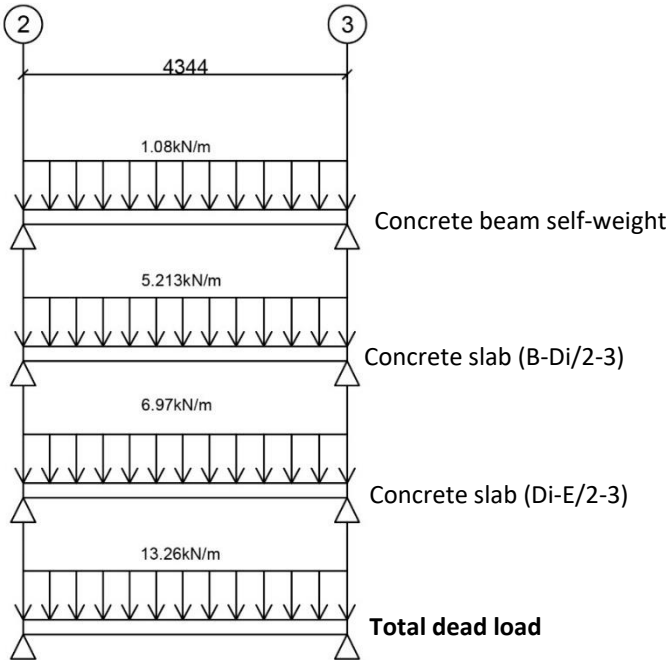
Beam (Di/2-3) – Secondary beam

Dead Load

1. Concrete beam self-weight
   = (0.15 x 0.3)m^2 x 24kN/m^3
   = 1.08 kN/m

2. Concrete slab (B-Di/2-3) self-weight
   = 0.15m x 24kN/m^3 x (4.344/2) x (2/3)
   = 5.213kN/m

3. Concrete slab (Di-E/2-3) self-weight
   = 0.15m x 24kN/m^3 x (3.872/2)
   = 6.97kN/m



Total dead load = 1.08 + 5.213 + 6.97

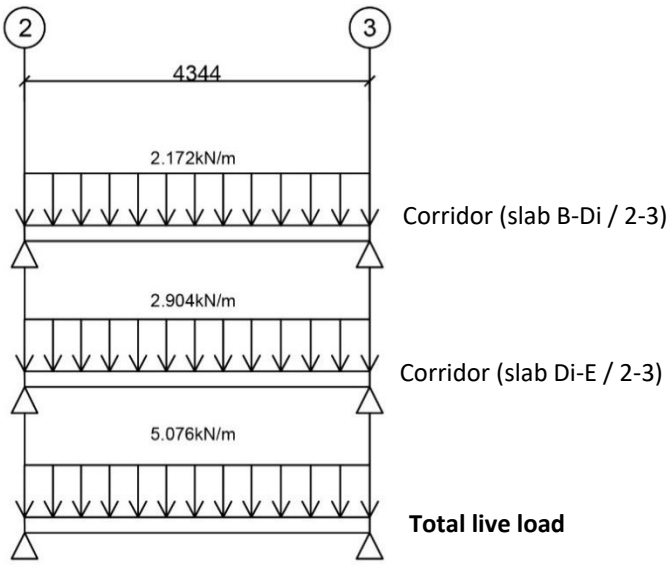
= 13.26kN/m

Live Load

Live load UBBL: Corridor 1.5kN/m^2

1. Corridor (slab B-Di / 2-3)
   = 1.5kN/m^2 x (4.344/2)m x (2/3)
   = 2.172kN/m

2. Corridor (slab Di-E / 2-3)
   = 1.5kN/m^2 x (3.872/2)m
   = 2.904kN/m



Total live load = (2.172 + 2.904) kN/m

= 5.076kN/m

Ultimate load

Ultimate dead load = 13.26kN/m x 1.4

=18.564kN/m

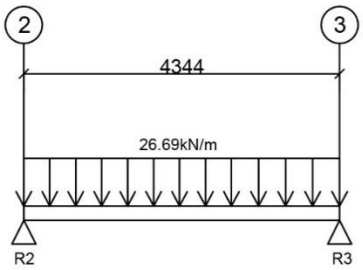
Ultimate live load = 5.076kN/m x 1.6

= 8.122kN/m

Total ultimate load = 18.564kN/m + 8.122kN/m

= 26.69kN/m

Ultimate load diagram



$\Sigma Fy = 0$

R2 = R3

= (26.69kN/m x 4.344m) /2

= 57.97kN (point load)

Beam (C-E/2) - Primary beam

Dead Load

1. Concrete beam self-weight
   = (0.3 x 0.3)m^2 x 24kN/m^3
   = 2.16 kN/m

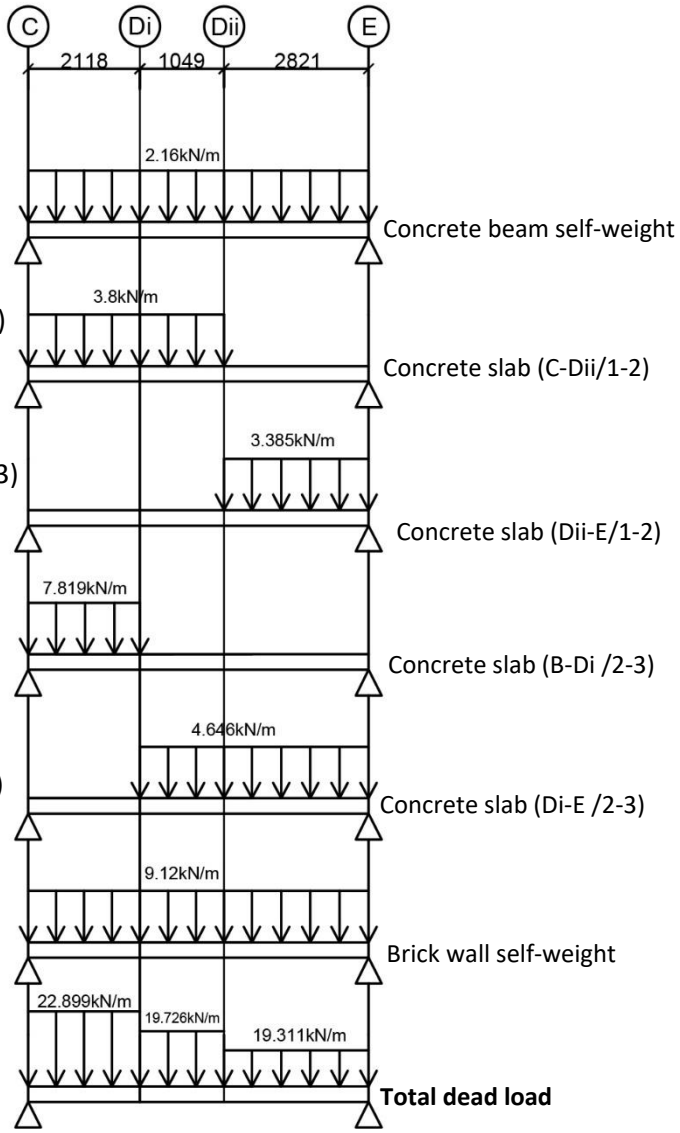
2. Concrete slab (C-Dii/1-2)
   = 0.15m x 24kN/m^3 x (3.167/2) x (2/3)
   = 3.8kN/m

3. Concrete slab (Dii-E/1-2)
   = 0.15m x 24kN/m^3 x (2.2821/2) x (2/3)
   = 3.385kN/m

4. Concrete slab (B-Di/2-3)
   = 0.15m x 24kN/m^3 x (4.344/2)
   = 7.819kN/m

5. Concrete slab (Di-E/2-3)
   = 0.15m x 24kN/m^3 x (3.872/2) x (2/3)
   = 4.646kN/m

6. Brick wall self-weight
   = (0.15 x 3.2)m^2 x 19kN/m^3
   = 9.12 kN/m



Total dead load

For C-Di = 2.16 + 3.8 + 7.819 + 9.12

= 22.899kN/m

For Di-Dii = 2.16 + 3.8 + 4.646 + 9.12

= 19.726kN/m

For Dii-E = 2.16 + 3.385 + 4.646 + 9.12

= 19.311kN/m

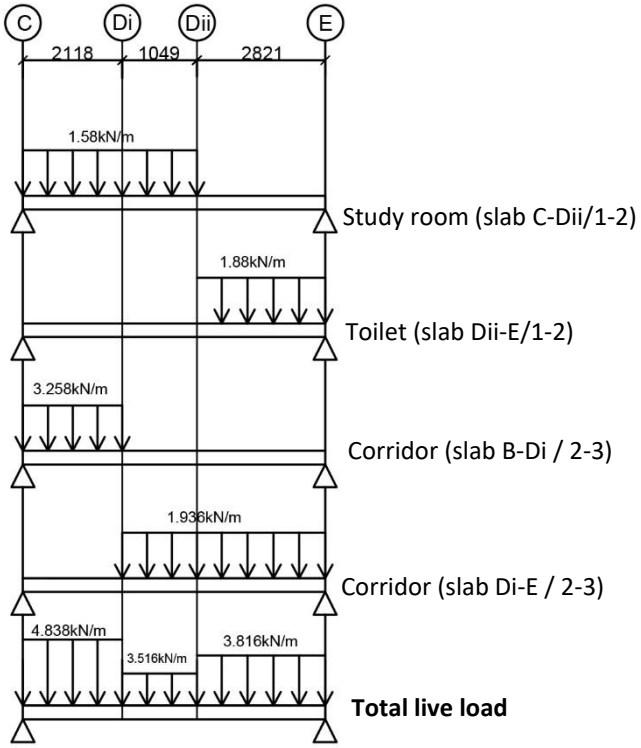
Live Load

1. Study room (slab C-Dii/1-2)
   = 1.5kN/m^2 x (3.167/2)m x (2/3)
   = 1.58kN/m

2. Toilet (slab Dii-E/1-2)
   = 2.0kN/m^2 x (2.821/2)m x (2/3)
   = 1.88kN/m

3. Corridor (slab B-Di/2-3)
   = 1.5kN/m^2 x (4.344/2)m
   = 3.258kN/m

4. Corridor (slab Di-E/2-3)
   = 1.5kN/m^2 x (3.872/2)m x (2/3)
   = 1.936kN/m



Total live load

FOR C-Di = 1.58 + 3.258 = 4.838kN/m

FOR D-Dii = 1.58 + 1.936 = 3.516kN/m

FOR Dii-E = 1.88 + 1.936 = 3.816kN/m

Ultimate load

Ultimate dead load for C-Di = 22.899kN/m x 1.4= 32.059kN/m

Ultimate dead load for Di-Dii = 19.726kN/m x 1.4= 27.616kN/m

Ultimate dead load for Dii-E = 19.311kN/m x 1.4= 27.035kN/m

Ultimate live load for C-Di = 4.838kN/m x 1.6 = 7.74kN/m

Ultimate live load for Di-Dii = 3.516kN/m x 1.6= 5.626kN/m

Ultimate live load for Dii-E = 3.816kN/m x 1.6= 6.106kN/m

Total Ultimate load

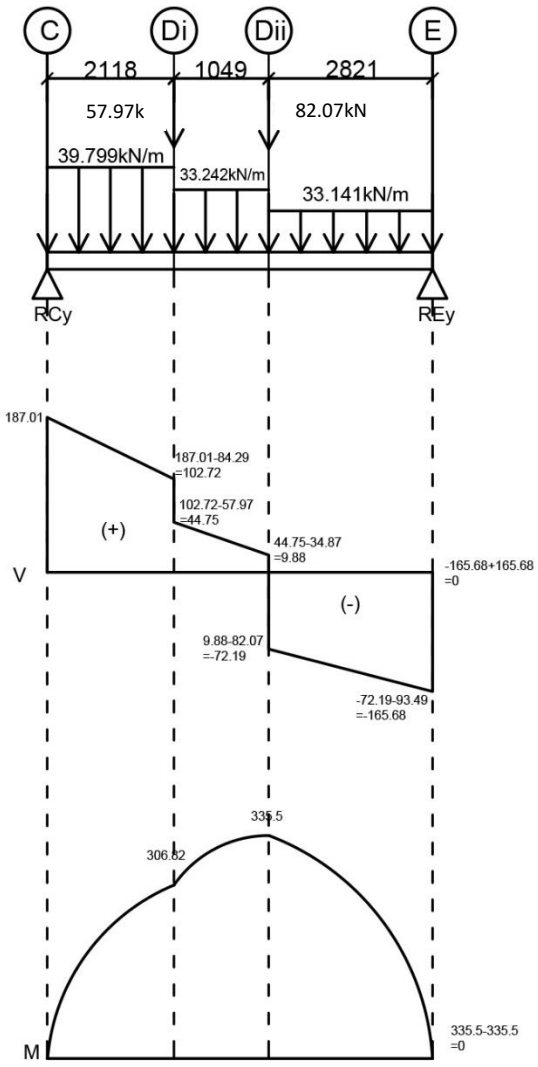
For C-Di = 32.059 + 7.74= 39.799kN/m

For Di-Dii = 27.616 + 5.626= 33.242kN/m

For Dii-E = 27.035 + 6.106= 33.141 kN/m

Ultimate load diagram –Beam (Dii/1-2) already calculated, point load=82.07kN (refer to pg.13)

–Beam (Di/2-3) already calculated, point load=57.97kN (refer to pg.15)



$\Sigma Mc=0$

REy (5.99) - (93.49)(4.578) - (82.07)(3.167) -(34.87)(2.643) - (57.97)(2.118) - (84.29)(1.059)=0

REy (5.99) – 427.997 – 259.92 – 92.16 - 122.78 – 89.26=0

REy = 165.68kN

$\Sigma Fy=0$

RCy + 165.68 – 93.49 – 82.07 – 34.87-57.97 – 84.29 =0

RCy = 187.01

Positive area = ½(187.01+102.72)(2.118)+

½(44.75+9.88)(1.049)

=335.49

≈335.5

Negative area = ½(72.19+165.68)(2.821)

= 335.5

5. First Floor Beam (C-E/1) – Primary beam

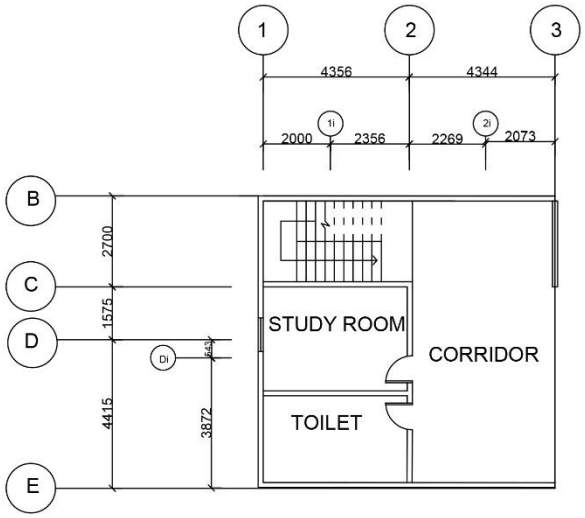
Slab thickness = 0.15m

Wall thickness = 0.15m

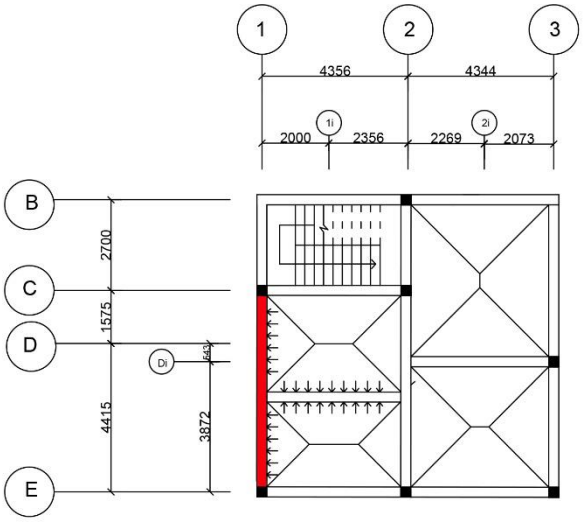
Wall height = 3.2m

Beam size = 0.15x0.3m (secondary beam)

= 0.3x0.3m (primary beam)



FIRST FLOOR PLAN (ARCHITECTURAL)



FIRST FLOOR PLAN (STRUCTURAL)

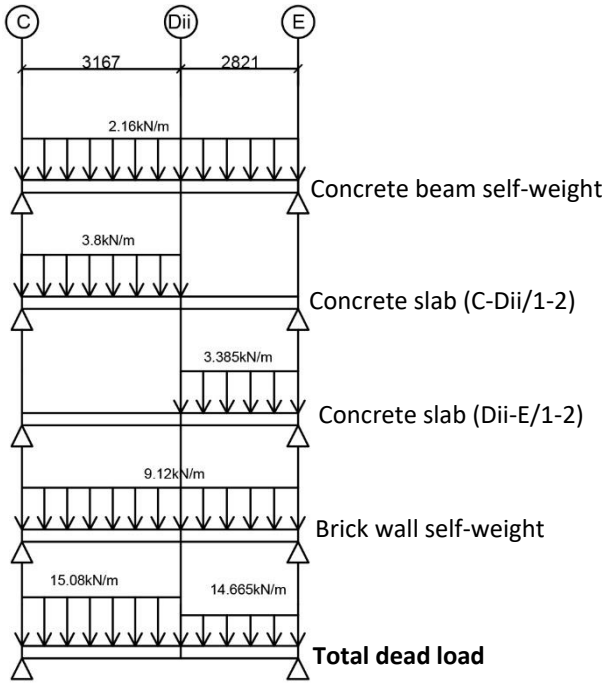
Dead Load

1. Concrete beam self-weight
   = $(0.3x0.3)m^2$ x $24kN/m^3$
   = 2.16kN/m

2. Concrete slab (C-Dii/1-2) self-weight
   = 0.15m x (3.167/2)m x $24kN/m^3$X (2/3)
   = 3.8kN/m

3. Concrete slab (Dii-E/1-2) self-weight
   = 0.15m x (2.821/2)m x $24kN/m^3$
   = 3.385kN/m

4. Brick wall self-weight
   = $(0.15x\ 3.2)m^2$ x $19kN/m^3$
   =9.12kN/m



Total dead load

For C-Dii = (2.16 + 3.8+9.12)kN/m = 15.08kN/m

For Dii-E = (2.16 + 3.385 + 9.12)kN/m=14.665kN/m

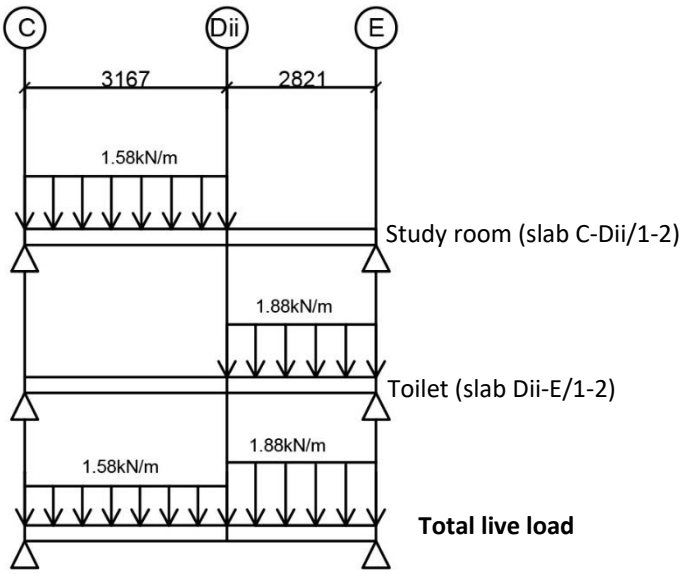
Live Load

Live load UBBL: Study room 1.5kN/m^2

Toilet 2.0kN/m^2

1. Study room (slab C-Dii/1-2)
   = 1.5kN/m^2 x (3.167/2)m x (2/3)
   = 1.58kN/m

2. Toilet (slab Dii-E/1-2)
   = 2.0kN/m^2 x (2.821/2)m x (2/3)
   = 1.88kN/m



Total live load for

For C-Dii = 1.58kN/m

For Dii-E = 1.88kN/m

Ultimate load

Ultimate dead load C-Dii = 15.08kN/m x 1.4

= 21.112kN/m

Ultimate dead load Dii-E = 14.665kN/m x 1.4

= 20.531kN/m

Ultimate live load C-Dii = 1.58kN/m x 1.6

= 2.528kN/m

Ultimate live load Dii-E = 1.88kN/m x 1.6

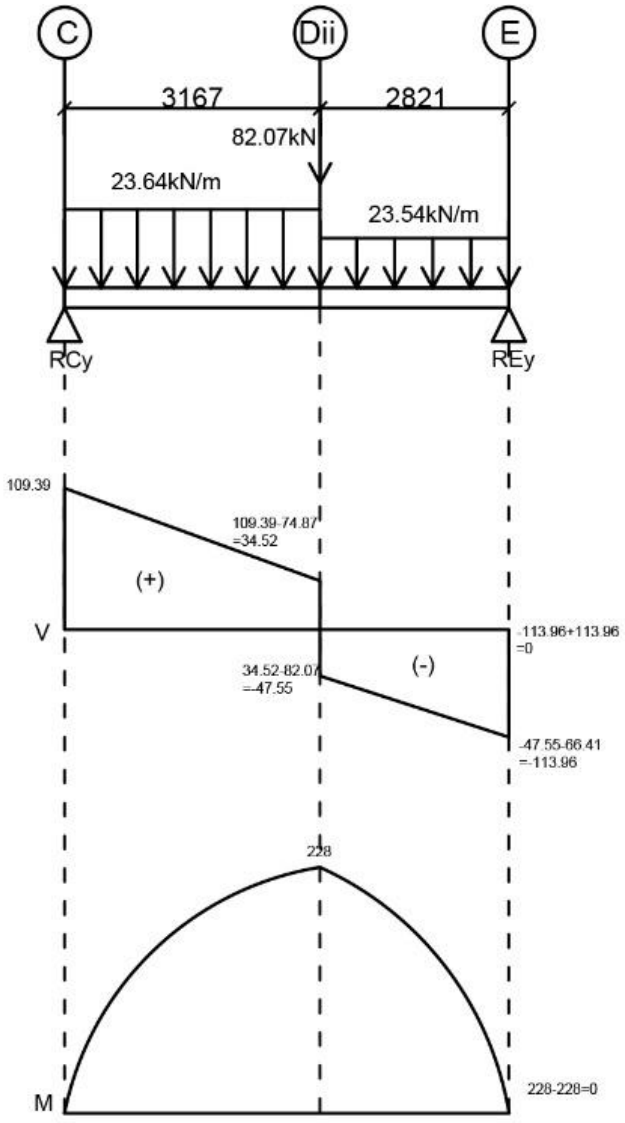
= 3.008kN/m

Total ultimate load

For C-Dii = (21.112+2.528)kN/m =23.64kN/m

For Dii-E = (20.531 + 3.008)kN/m =23.54kN/m

Ultimate load diagram –Beam (Dii/1-2) already calculated, point load=82.07kN (refer to pg.13)



$\Sigma Mc=0$

REy (5.99) - (66.41)(4.58) - (82.07)(3.167) - (74.87)(1.58)=0

REy (5.99) – 304.158 – 259.92– 118.29=0

REy = 113.96kN

$\Sigma Fy=0$

RCy + 113.96 – 74.87– 82.07 – 66.41=0

RCy = 109.39

Positive area = ½(109.39+34.52)(3.167)

=227.88

≈228

Negative area = ½(47.55+113.96)(2.821)

= 227.81

≈228

6. First Floor Beam (B-Di/3)- Secondary beam

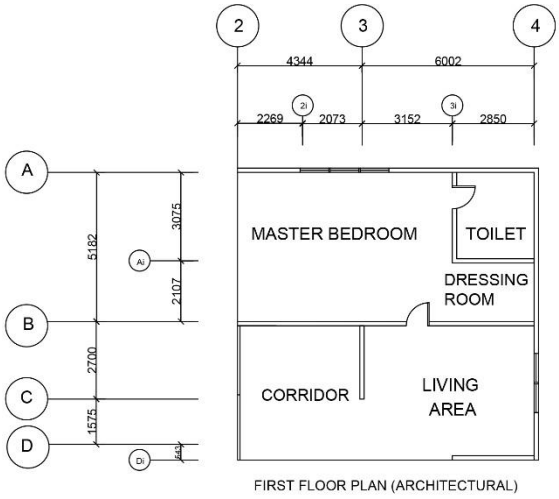
Slab thickness = 0.15m

Wall thickness = 0.15m

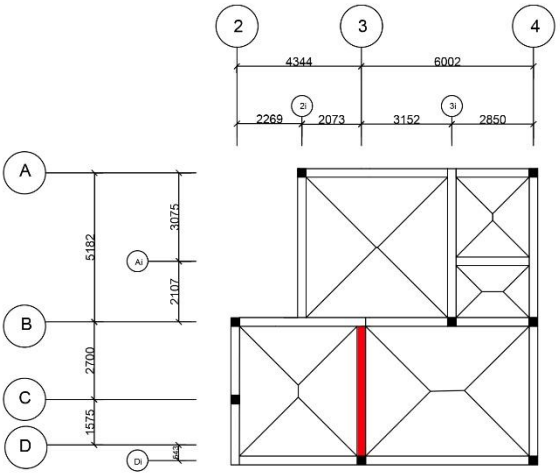
Wall height = 3.2m

Beam size = 0.15x0.3m (secondary beam)

= 0.3x0.3m (primary beam)



FIRST FLOOR PLAN (ARCHITECTURAL)



FIRST FLOOR PLAN (STRUCTURAL)

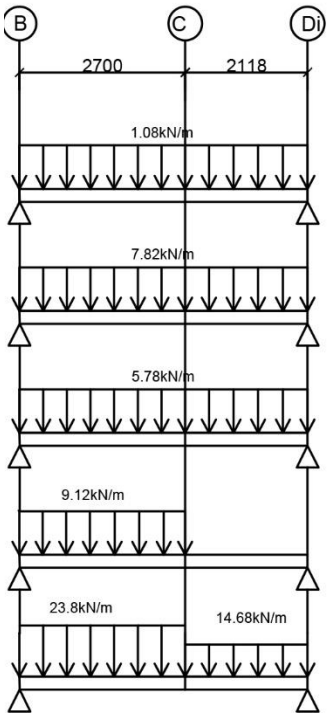
Dead Load

1. Concrete beam self-weight
   = $(0.3x0.15)m^2$ x $24kN/m^3$
   = 1.08 kN/m

2. Concrete slab (B-Di / 2-3)
   = 0.15m x $24kN/m^3$ x (4.344/2)m
   = 7.82 kN/m

3. Concrete slab (B-Di / 3-4)
   = 0.15m x $24kN/m^3$ x (4.818/2)m x (2/3)
   = 5.78 kN/m

4. Brick wall self-weight
   = $(0.15x\ 3.2)m^2$ x $19kN/m^3$
   =9.12kN/m



Total dead load

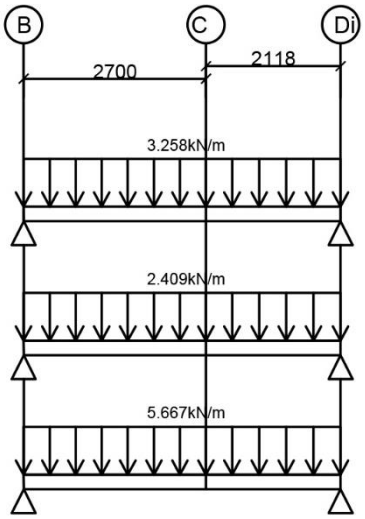
For B-C = 1.08+7.82+5.78+9.12 = 23.8kN/m

For C-Di = 1.08+7.82+5.78 = 14.68kN/m

Live Load

Live load UBBL: Corridor 1.5kN/m^2

Living area 1.5kN/m^2



1. Corridor (slab B-Di/2-3)
   = 1.5kN/m^2 x (4.344/2)m
   = 3.258kN/m

2. Living area (slab B-Di/3-4)
   = 1.5kN/m^2 x (4.818/2)m x (2/3)
   = 2.409kN/m

Total live load = 3.258+2.409

= 5.667 kN/m

Ultimate load

Ultimate dead load B-C = 23.8kN/m x 1.4

= 33.32kN/m

Ultimate dead load C-Di = 14.68kN/m x 1.4

= 20.552kN/m

Ultimate live load B-Di = 5.667kN/m x 1.6

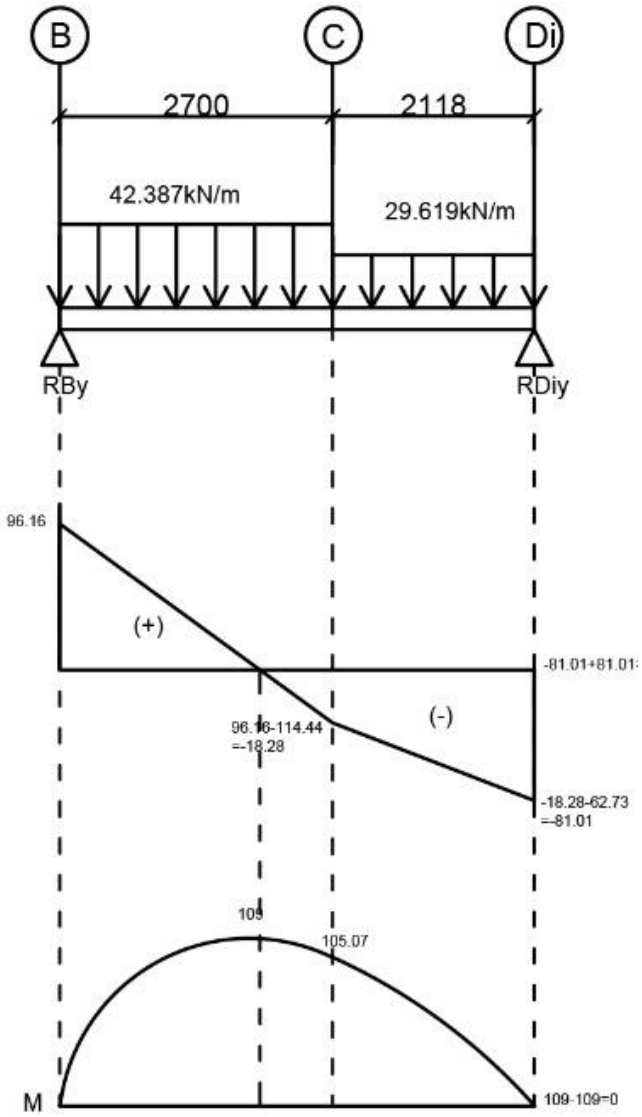
= 9.067kN/m

Total ultimate load

For B-C= (33.32+9.067)kN/m =42.387kN/m

For C-Di = (20.552+9.067)kN/m =29.619kN/m

Ultimate load diagram



$\Sigma MB=0$

RDiy (4.818) - (62.73)(3.759) - (114.44)(1.35)=0

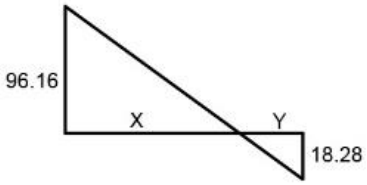
RDiy (4.818) – 235.8– 154.49=0

RDiy = 81.01kN

$\Sigma Fy=0$

RBy + 81.01-114.44-62.73=0

RBy = 96.16



x/y =96.16/18.28---(1)

x+y = 2.7---(2)

x = 2.7-y ---(3)

sub (3) into (1),

(2.7-y)(18.28)=96.16y

Y=0.43

X=2.27

Positive area = ½(2.27)(96.16)

=109.14

≈109

Negative area = ½(0.43)(18.28)+

½(18.28+81.01) (2.118)

= 3.93+105.15

=109