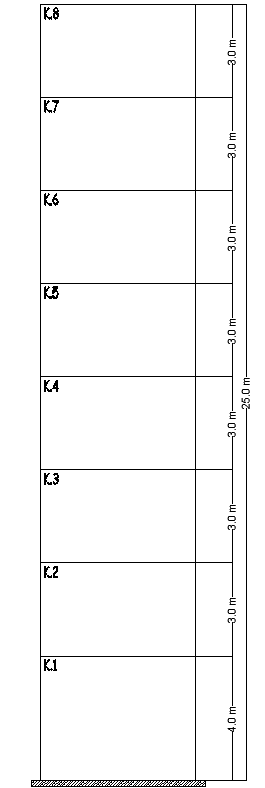
**BETONARME II-UYGULAMA**

**KİRİŞLİ RADYE TEMELLER**

**Veriler:**

Tüm katlarda: g=15.0 kN/m2

q=2.00 kN/m2

Kat Alanı = 256 m2

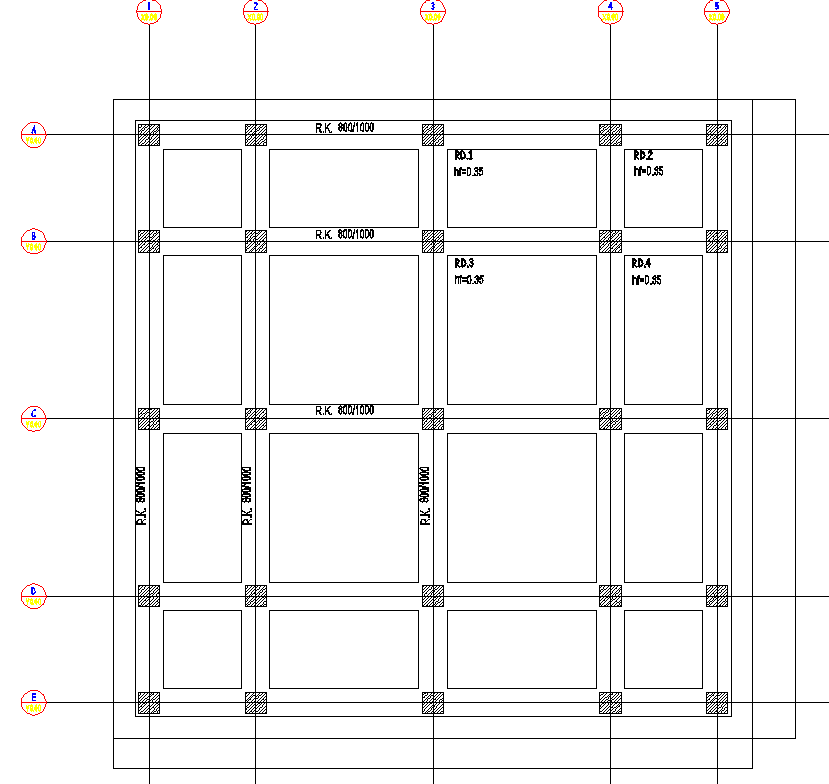
Ta=0.15 s, Tb=0.40 s, T=0.63 s

σzem=145 kN/m2 , A0=0.40

Malzeme :C20/S420

Yapı Fonksiyonu : Konut

Ra=R=8



**YÜKLER ve ZEMİN GERİLMELERİ :**

Depremli durum için m2 ağırlığı : g +nq = 15.0 + 0.3 x 2.0 = 15.6 kN/m2

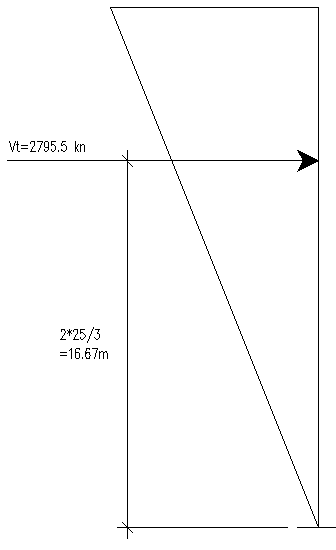
Bir katın ağırlığı : Wk= 256 x 15.6 = 3993.6 kN

Yapının toplam ağırlığı : ∑Wk = 8kat x 3993.6 = 31948.8 kN

Spektrum katsayısı : S = 2.5 x ( )0.8 = 2.5 x ( )0.8 = 1.74

Spektral ivme katsayısı : A = A0 x I x S = 0.40 x 1 x 1.74 = 0.70

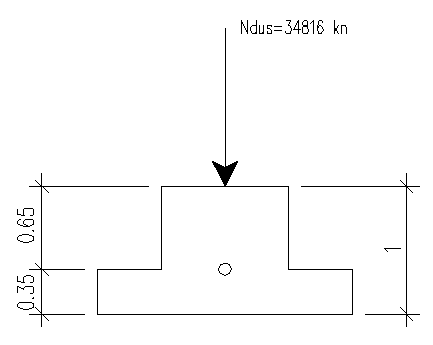
Toplam eşdeğer deprem yükü : Vt = = = 2795.5 kN

Mdep = 2795.5 x 16.67m =46601 kNm

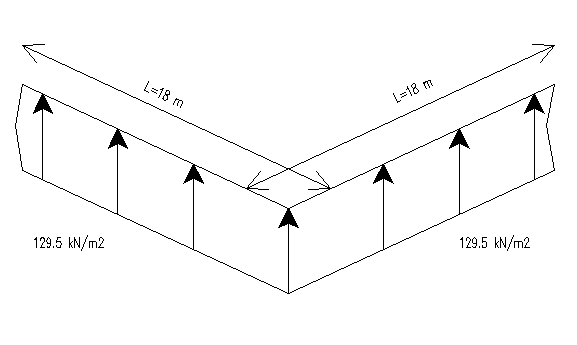
Ndüşey = (g + q) x Alan x Kat adedi = 17 x 256 x 8 = 34816 kN

Ndep = ∑Wk = 31948.8 kN

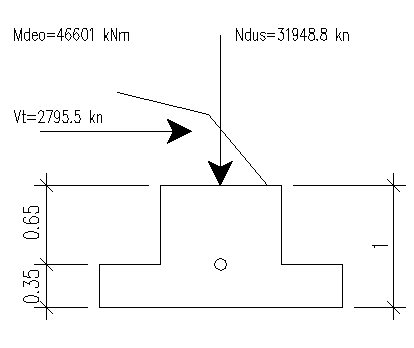
**Düşey yük durumu :**



σmax = + g’ = + 1 x 22 = 129.5 kN/m2 < σem = 145 kN/m2



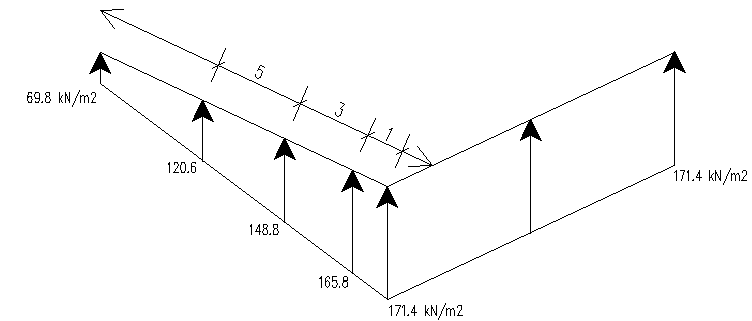
**Depremli durum :**

M0 = 46601 + 1 x 2795.5 = 49396.5 kNm

σ1,2 = + 1 x 22 = 98.6 50.8 + 22

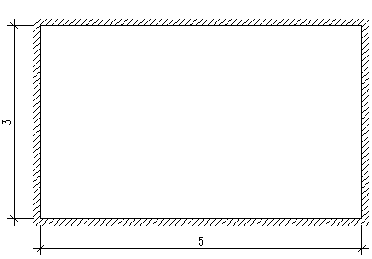
σ1 = 171.4 kN/m2 < 1.5 x σem = 217.5 kN/m2

σ2 = 69.8 kN/m2 > 0



**PLAKLARIN STATİK HESAPLARI :**

**RD1 Radye Plağı :**

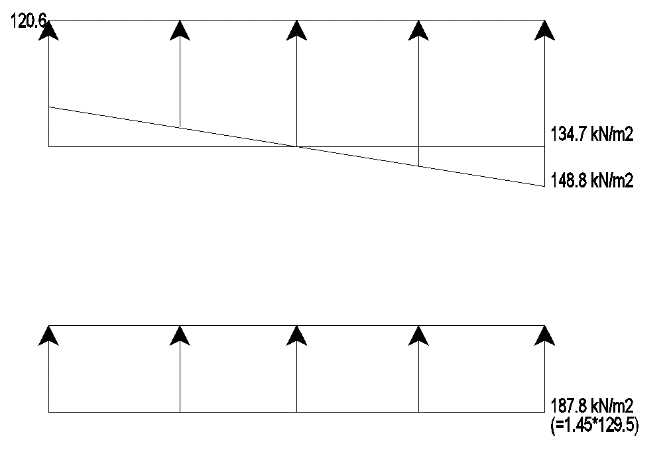
Plak altındaki yük dağılımı :

Depremli durum : p = 134.7 – 1 x 22 = 112.7 kN/m2

Düşey yük durumu : p=1.45 x 129.5 – 1.4 x 1 x 22

= 157.0 kN/m2

En elverişsiz yük durumu, düşey yük durumunda oluşmaktadır.

m = 5 / 3 =1.67

Kısa doğrultuda : αa  = 0.050 αm = 0.067

-Ma = 0.050 x 157 x 32 = 70.65 kNm /m

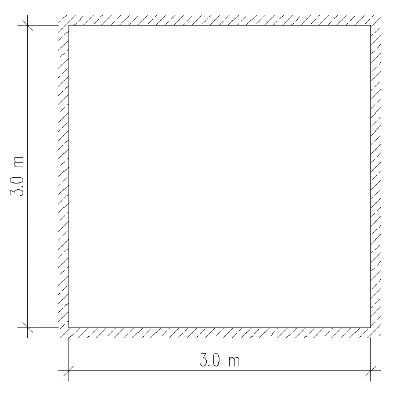
+Mm = 0.067 x 157 x 32 = 94.67 kNm/m

Uzun doğrultuda : αa  = 0.025 αm = 0.033

-Ma = 0.025 x 157 x 32 = 35.35 kNm /m

+Mm = 0.033 x 157 x 32 = 46.63 kNm/m

**RD2 radye plağı :**

Plak altındaki yük dağılımı , RD1’e benzer şekilde :

Depremli durum : p = (148.8 +165.8)/2 – 1 x 22 = 135.3 kN/m2

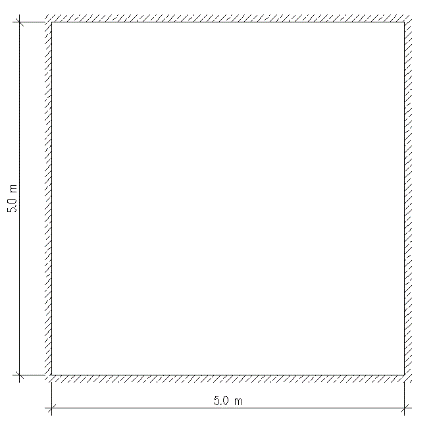
Düşey yük durumu : p=1.45 x 129.5 – 1.4 x 1 x 22 = 157.0 kN/m2

m = 3 / 3 =1

Her iki doğrultuda : αa  = 0.025 αm = 0.033

-Ma = 0.025 x 157 x 32 = 35.35 kNm /m

+Mm = 0.033 x 157 x 32 = 46.63 kNm/m

**RD3 radye plağı :**

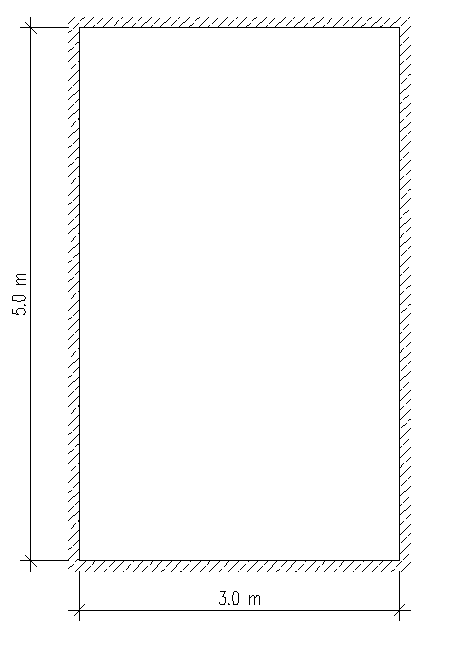
RD1 plağının benzeri gerilmeler mevcutdur.

p = 157 kN/m2 m = 3 / 3 =1

Her iki doğrultuda : αa  = 0.025 αm = 0.033

-Ma = 0.025 x 157 x 52 = 98.13 kNm /m

+Mm = 0.033 x 157 x 52 = 129.95 kNm/m

**RD4 radye plağı :**

RD2 plağının benzeri gerilmeler mevcutdur.

p = 157 kN/m2 m = 3 / 3 =1

Kısa doğrultuda : αa  = 0.050 αm = 0.067

-Ma = 0.050 x 157 x 32 = 70.65 kNm /m

+Mm = 0.067 x 157 x 32 = 94.67 kNm/m

Uzun doğrultuda : αa  = 0.025 αm = 0.033

-Ma = 0.025 x 157 x 32 = 35.35 kNm /m

+Mm = 0.033 x 157 x 32 = 46.63 kNm/m

**Mesnet momenti dengelemeleri :**

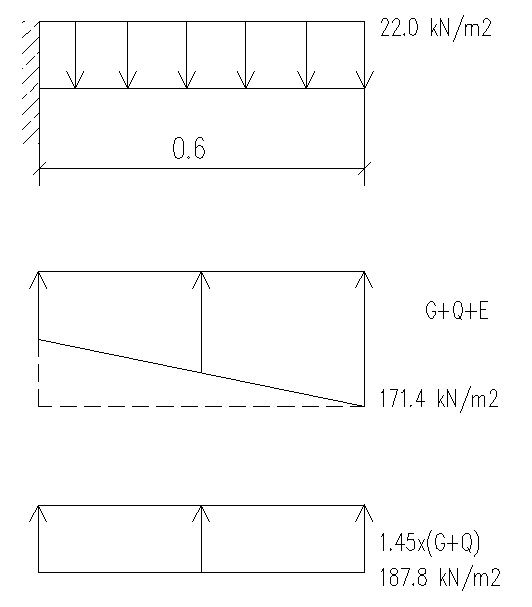
RD1 – RD2 → 46.63/46.63 = 1 Md = 46.63 kNm/m

RD1 – RD3 → 94.67/129.53 = 0.731 < 0.8 Md1=94.67+0.67x(129.53–94.67)x5/(3+5) =109.3 kNm/m

Md2 = 129.53 – 0.57 x (129.53 + 94.67) x 3 /(3+5) = 120.3 kNm/m → Md = 120.8 kNm/m

RD3 – RD4 → 94.67/129.53 = 0.731 < 0.8 → Md = 120.8 kNm/m

**AMPATMAN STATİK HESABI:**



Pdep = 171.4 – 1x 22 = 149.4 kN/m2

Pdüş = 187.8 – 1.4 x 1 x22 = 157.0 kN/m2 → Pdüş > Pdep → Pd = 157.0 kN/m2

Md = 157.0 x 0.62 / 2 = 28.3 kNm/m

**BETONARME HESAP :**

C20/S420 b= 1.0 m d1 = 0.35 – 0.05 = 0.3 m ; d2 = 0.3 – 0.015 = 0.285 m

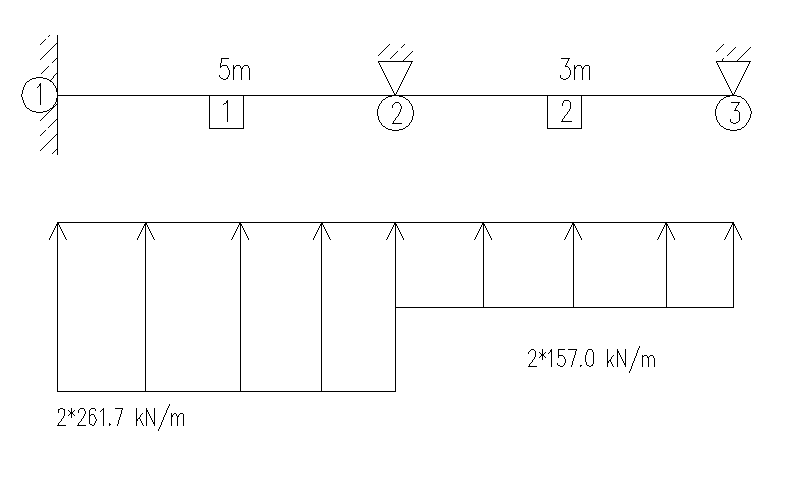
**Açıklıklarda Hesap :**

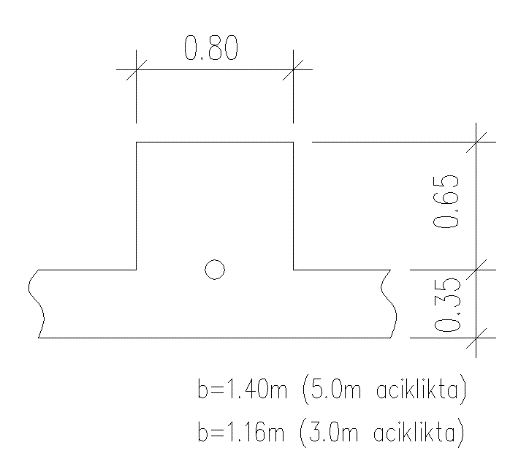
As,min = 0.0035 x 1000 x 290 = 1015 mm2

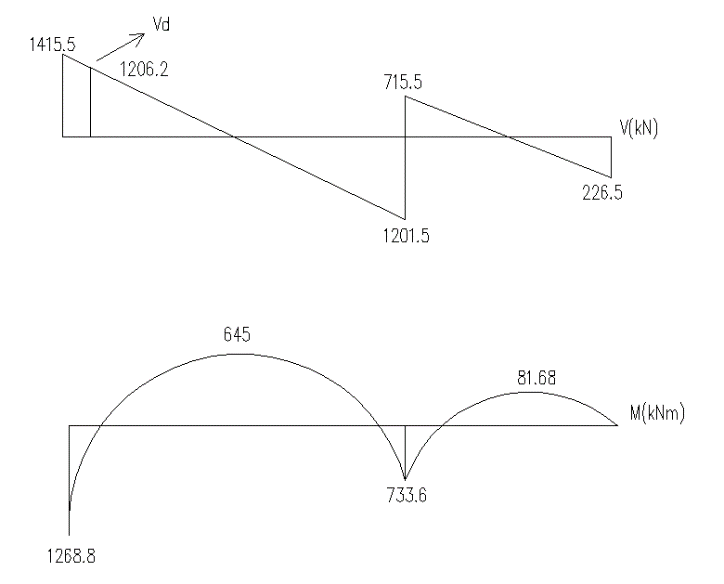
|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| plak | yön | d  (m) | Md  (kN.m/m) | K | Ks | As  (mm2/m) | Seçilen  (mm2/m) |
| RD1 | X  y | 0.285  0.300 | -35.35  -70.65 | 229.7x10-5  127.4x10-5 | 2.83  2.87 | 351  676 | Ø12/200↔ø12/400(d)+ø12/400(p)=565  Ø12/150↔ø12/300(d)+ø12/300(p)=754 |
| RD2 | X  y | 0.285  0.300 | -35.35  -35.35 | 229.7x10-5  254.6x10-5 | 2.83  2.83 | 351  333 | Ø12/200↔ø12/400(d)+ø12/400(p)=565  Ø12/200↔ø12/400(d)+ø12/400(p)=565 |
| RD3 | X  y | 0.300  0.285 | -98.13  -98.13 | 91.7x10-5  82.8x10-5 | 2.91  2.93 | 952  1002 | Ø12/100↔ø12/200(d)+ø12/200(p)=1134  Ø12/100↔ø12/200(d)+ø12/200(p)=1134 |
| RD4 | X  y | 0.300  0.285 | -70.65  -35.35 | 127.4x10-5  229.7x10-5 | 2.87  2.83 | 676  351 | Ø12/150↔ø12/300(d)+ø12/300(p)=754  Ø12/200↔ø12/400(d)+ø12/400(p)=565 |

**Mesnetlerde Hesap:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| kesit | yön | d  (m) | Md  (kN.m/m) | K | Ks | As  (mm2/m) | Mevcut  (mm2/m) | Ek |
| RD1-RD2 | x | 0.30 | +46.63 | 193x10-5 | 2.85 | 443 | Ø12/400+ø12/400 | - |
| RD1-RD3 | y | 0.30 | +120.8 | 75x10-5 | 2.95 | 1188 | Ø12/300+ø12/200 | Ø12/330=343 |
| RD2-RD4 | y | 0.30 | +46.63 | 193x10-5 | 2.85 | 443 | Ø12/400+ø12/400 | - |
| RD3-RD4 | x | 0.30 | +120.8 | 75x10-5 | 2.95 | 1188 | Ø12/300+ø12/200 | Ø12/330=343 |
| Ampatman | x;y | 0.30 | +28.3 | 318x10-5 | 2.82 | 266 | Ø12/300+ø12/400 | - |

**RADYE KİRİŞİ STATİK ve BETONARME HESABI :**





**Kirişlere Gelen Yükler:**

Kısa açıklık için: p x lx /3 den ;

1 nolu kirişe : 2 x[157.0 x 5/3] = 2x261.7 kN/m

2 nolu kirişe : 2 x[157.0 x 3/3] = 2x157.0 kN/m

**Eğilme hesabı :**

1.Açıklıkta betonarme hesabı :

Md = 645 kN.m ; b = 1.40 m ; d = 0.95 m

K = 195.9 x 10-5 ; Ks = 2.84 ; Kx = 0.099 ; x = 94 mm < hf

As = 1928 mm2 ;

As,min =0.8 x 1 x 800 x 950/365 =1666 mm2

Seçilen : 10 ø 16 = 2036 mm2 ; 5 ø 16 düz + 5 ø 16 pilye

As,g = 0.001 x 800 x 950 = 760 mm2 ; 4 ø 16 (=804 mm2)

**2.Açıklıkta betonarme hesabı :**

Md = 81.68 kN.m ; b = 1.16 m ; d = 0.95 m

K = 1281.7 x 10-5 ; Ks = 2.77 ; Kx = 0.038 ; x = 36 mm < hf

As = 238 mm2 ; As,min =1666 mm2

Seçilen : 9 ø 16 = 1810 mm2

1.mesnet betonarme hesabı : 2.mesnet betonarme hesabı :

Md = 1268.8kN.m b=0.8 m ;d=0.95 mv Md = 733.6kN.m b=0.8 m ;d=0.95 m

K=56.9 x10-5 ; ks =3.01 ; As =4020 mm2 K=98.4 x10-5 ; ks =2.90 ; As =2239 mm2

Mevcut : 4 ø 14(Montaj) + 2 x 5 ø 16(pilye) Mevcut : 4 ø 14(Montaj) + 5 ø 16(pilye)

=616+2011=2627 mm =616+1005=1621 mm2

Ek : 7 ø 16 = 1407 mm2 Ek : 7 ø 16 = 1407 mm2

**Kayma hesabı :**

Vd =1206.2 kN ; Vcr = 0.65 x 1000 x 0.80 x 0.95 = 494.0 kN Vcr < Vd hesap gereklidir.

Vmax =0.22 x 13 x 103 x 0.80 x 0.95 = 2174 kN Vmax > Vd kesit yeterlidir.

Etriyelerin tek başına kayma güvenliğini sağlaması için :

Vw s =x 950 x 365 ≥ Vd = 1206200 N → A0 / s ≥ 0.870 olmalıdır.

Etriyeler 4 kollu ø12 (=113 mm2) seçilirse s ≤ 129.9 mm bulunur. 2 ø12/125

Sonuçta etriyelerin aldığı kesme kuvveti :

Vw s = = 1253848 N > Vd =1206200 N

**DONATI KROKİSİ:**

