설계조건

적용기준/사용재료

콘크리트 압축강도 : f_{ck}= 30 N/mm²
철근 항복강도 : f_y = 400 N/mm²

부재 단면

보 폭 : b = 1800 mm
보 춤 : h = 1500 mm

처짐 설계 조건

보의 경간 : L =14.00 m
보의 지지조건 : Both Fix
재령 5년에서의 장기처짐 계산

사용 철근

내단부 : 상부철근:15/0-D25 하부철근:15/0-D25
중앙부 : 상부철근:15/0-D25 하부철근:15/0-D25
외단부 : 상부철근:15/0-D25 하부철근:15/0-D25
전단철근 치수 : D13
순피복 두께 : 40 mm

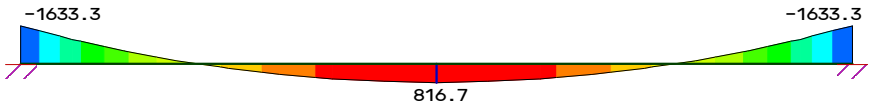
Loading Data

[Unit : kN, m]

Load Type	Load	A	B	:	C(l)	C(r)	M(o)	V(l)	V(r)
Dead Load 3:	100.00				1633.33	1633.33	2450.00	700.00	700.00
Live Load 3:	30.00				490.00	490.00	735.00	210.00	210.00

DEAD LOAD Moment

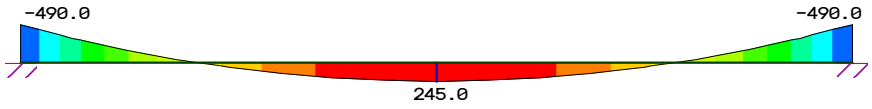
[Unit : kN·m]



Loc.	0	×	1/4	×	1/2	×	3/4	×	L
	-1633.3	-561.5	204.2	663.5	816.7	663.5	204.2	-561.5	-1633.3

LIVE LOAD Moment

[Unit : kN·m]



Loc.	0	×	1/4	×	1/2	×	3/4	×	L
	-490.0	-168.4	61.3	199.1	245.0	199.1	61.3	-168.4	-490.0

좌측부 유효단면2차모멘트 계산

설계 조건

d = 1435 mm, y_t = 750 mm
A_s = 7601 mm², A'_s = 7601 mm²

M_d = 1633.33 kN·m, M_l = 490.00 kN·m
M_{sus} = $[M_d + M_l \times 1.00]$ = 2123.33 kN·m

재료의 성질

E_c = 27537 N/mm², E_s = 200000 N/mm²
n = E_s/E_c = 7.2630
f_r = $0.63\sqrt{f_{ck}}$ = 3.45 N/mm²

단면2차모멘트

I_g = $bh^3/12$ = 50625000 cm⁴

균열단면2차모멘트

B = $b/(nA_s)$ = 0.033 mm
r = $(n-1)A'_s/(nA_s)$ = 0.862
kd = $[\sqrt{2dB(1+rd'/d)+(1+r)^2}-(1+r)]/B$ = 251 mm
I_{cr} = $b(kd)^3/3 + nA_s(d-kd)^2 + (n-1)A'_s(kd-d')^2$ = 8846160 cm⁴

유효단면2차모멘트

M_{cr} = $f_r I_g/y_t$ = 2329.19 kN·m
M_{cr}/M_d = 1.43 > 1.00
$(I_{Lt})_d$ = I_g = 50625000 cm⁴
M_{cr}/M_{sus} = 1.10 > 1.00
$(I_{Lt})_{sus}$ = I_g = 50625000 cm⁴
M_{cr}/M_{d+l} = 1.10 > 1.00
$(I_{Lt})_{d+l}$ = I_g = 50625000 cm⁴

중앙부 유효단면2차모멘트 계산

설계 조건

d = 1435 mm, y_t = 750 mm
A_s = 7601 mm², A'_s = 7601 mm²

M_d = 816.67 kN·m, M_l = 245.00 kN·m
M_{sus} = $[M_d + M_l \times 1.00]$ = 1061.67 kN·m

단면2차모멘트

I_g = $bh^3/12$ = 50625000 cm⁴

균열단면2차모멘트

B = $b/(nA_s)$ = 0.033 mm
r = $(n-1)A'_s/(nA_s)$ = 0.862
kd = $[\sqrt{2dB(1+rd'/d)+(1+r)^2}-(1+r)]/B$ = 251 mm
I_{cr} = $b(kd)^3/3 + nA_s(d-kd)^2 + (n-1)A'_s(kd-d')^2$ = 8846160 cm⁴

유효단면2차모멘트

M_{cr} = $f_r I_g / y_t$ = 2329.19 kN·m
M_{cr}/M_d = 2.85 > 1.00
$(I_{mid})_d$ = I_g = 50625000 cm⁴
M_{cr}/M_{sus} = 2.19 > 1.00
$(I_{mid})_{sus}$ = I_g = 50625000 cm⁴
M_{cr}/M_{d+l} = 2.19 > 1.00
$(I_{mid})_{d+l}$ = I_g = 50625000 cm⁴

우측부 유효단면2차모멘트 계산

설계 조건

d = 1435 mm, y_t = 750 mm
A_s = 7601 mm², A'_s = 7601 mm²

M_d = 1633.33 kN·m, M_l = 490.00 kN·m
M_{sus} = $[M_d + M_l \times 1.00]$ = 2123.33 kN·m

단면2차모멘트

I_g = $bh^3/12$ = 50625000 cm⁴

균열단면2차모멘트

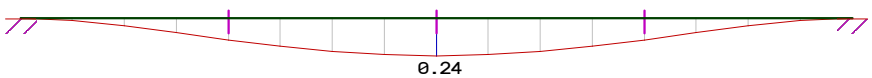
B = $b/(nA_s)$ = 0.033 mm
r = $(n-1)A'_s/(nA_s)$ = 0.862
kd = $[\sqrt{2dB(1+rd'/d)+(1+r)^2}-(1+r)]/B$ = 251 mm
I_{cr} = $b(kd)^3/3 + nA_s(d-kd)^2 + (n-1)A'_s(kd-d')^2$ = 8846160 cm⁴

유효단면2차모멘트

M_{cr} = $f_r I_g / y_t$ = 2329.19 kN·m
M_{cr}/M_d = 1.43 > 1.00
$(I_{Rt})_d$ = I_g = 50625000 cm⁴
M_{cr}/M_{sus} = 1.10 > 1.00
$(I_{Rt})_{sus}$ = I_g = 50625000 cm⁴
M_{cr}/M_{d+l} = 1.10 > 1.00
$(I_{Rt})_{d+l}$ = I_g = 50625000 cm⁴

Deflection : Instantenous

[Unit : mm]



Loc.	0	×	1/4	×	1/2	×	3/4	×	L
처짐량	0.00	0.05	0.14	0.22	0.24	0.22	0.14	0.05	0.00
처짐율	-	1/262558	1/98684	1/65062	1/57618	1/65062	1/98684	1/262558	-

처짐 허용값 : 38.89 mm (1/360)
최대 처짐 : 0.24 mm < 38.89 mm ---> O.K.

Deflection : Long-term

[Unit : mm]

Loc.	0	×	1/4	×	1/2	×	3/4	×	L
처짐량	0.00	0.52	1.37	2.08	2.35	2.08	1.37	0.52	0.00
처짐율	-	1/27161	1/10209	1/6731	1/5961	1/6731	1/10209	1/27161	-

처짐 허용값 : 29.17 mm (1/480)

최대 처짐 : 2.35 mm < 29.17 mm ---> O.K.