

## BAB V

### PEMBAHASAN

#### 5.1 Hasil Analisa Hitungan

Dari hasil perhitungan analisa balok beton prategang komposit dengan perancah pasca tarik dengan tendon terekat dapat diperoleh kapasitas penampang beton terhadap kekuatan lentur. Kapasitas penampang akan diketahui secara pasti, sehingga akan membantu dalam perancangan. Hal ini dapat dijadikan referensi dalam merencanakan balok prategang komposit yang dapat menahan lenturan, gaya geser dan defleksi yang terjadi. Dengan demikian dalam perencanaan selanjutnya dapat menghasilkan suatu penampang balok prategang yang ekonomis.

Dalam analisis kapasitas penampang yang mampu menahan lenturan, geser dan lendutan dapat diketahui besarnya tegangan yang terjadi pada tahap-tahap tertentu, seperti tahap penarikan (transfer) dan tahap akhir (layan) sebelum balok menjadi komposit serta pada

saat balok telah komposit (layan). Kekuatan lentur suatu penampang balok prategang komposit tergantung pada beberapa parameter, seperti dimensi penampang jumlah tulangan prategang, karakteristik dan kekuatan bahan, penarikan tendon, kehilangan gaya prategang dan faktor modifikasi dari balok prategang komposit.

Untuk kehilangan gaya prategang total dalam analisis ini ditetapkan sebesar 20% yang bekerja sesaat setelah tranfer. Kehilangan gaya prategang tersebut disebabkan oleh gesekan, slip ankur dan deformasi elastis beton. Kehilangan gaya prategang total ini menyebabkan tereduksinya gaya prategang awal  $P_o$ , sehingga pada tahap akhir (layan) gaya prategang akan menjadi gaya prategang efektif  $P_e$ .

Untuk penampang balok prategang komposit adanya faktor modifikasi "n" dimaksudkan untuk menyamakan kekuatan bahan yang berbeda antara balok pracetak dan beton cor ditempat.

Pada dua keadaan, sebelum menjadi komposit dan setelah menjadi komposit penampang didesain ekonomis serta mampu menahan lentur, geser dan lendutan dengan menggunakan material beton yang berbeda, baja prategang yang berbeda dan ukuran panjang yang berbeda-beda.

## 5.2 Pembahasan

Beberapa perencanaan balok prategang komposit dengan panjang yang berbeda tetapi menggunakan material beton, baja prategang dan penutup beton yang sama akan menghasilkan suatu tampang yang bervariasi. Untuk lebih jelasnya dapat dilihat pada tabel dibawah ini.

**Tabel 5.1:** Hasil perhitungan untuk  $bw/b=0,3$ ;  $hf/h=0,1$  dan  $f'_{cp}=6000$  psi,  $f'_{cs}=3500$  psi

Notasi	$L = 115$ ft	$L = 98,5$ ft	$L = 86$ ft	$L = 66$ ft
h (in)	62,5000	52,5000	42,5000	32,5000
b (in)	27,5000	25,0000	22,0000	20,0000
bw (in)	8,2500	7,5000	6,6000	6,0000
hf (in)	6,2500	5,2500	4,2500	3,2500
Ic (in <sup>4</sup> )	359191,8945	193540,4297	90353,1406	36731,0938
Ac (in <sup>2</sup> )	756,2500	577,5000	411,4000	286,0000
r <sup>2</sup> (in <sup>2</sup> )	472,6563	333,5063	218,5563	127,8063
Ct (in)	31,2500	26,2500	21,2500	16,2500
Cb (in)	31,2500	26,2500	21,2500	16,2500
St (in <sup>3</sup> )	11494,1406	7372,9688	4251,9125	2260,3750
Sb (in <sup>3</sup> )	11494,1406	7372,9688	4251,9125	2260,3750
Lc (ft)	10,0000	10,0000	10,0000	10,0000
f'c (psi)	6000,0000	6000,0000	6000,0000	6000,0000
F'ci (psi)	5000,0000	5000,0000	5000,0000	5000,0000
Fci (psi)	3000,0000	3000,0000	3000,0000	3000,0000
Fti (psi)	212,1320	212,1320	212,1320	212,1320
Fts (psi)	464,7580	464,7580	464,7580	464,7580
Fcs (psi)	2700,0000	2700,0000	2700,0000	2700,0000
Wd (plf)	787,7604	601,5625	428,5417	297,9167
Md (lb-in)	1302266,4388	729563,7207	360189,2708	162215,6250
Fcent (psi)	-1393,9340	-1393,9340	-1393,9340	-1393,9340
P (lb)	1054162,5745	804996,8751	573464,4405	398665,1191
Pi (lb)	28900,0000	28900,0000	28900,0000	28900,0000
x (strand)	36,4762	27,8546	19,8431	13,7946
Po (lb)	1040400,0000	780300,0000	549100,0000	375700,0000
Pe (lb)	832320,0000	624240,0000	439280,0000	300560,0000
e (in)	21,5000	18,9250	15,5000	10,7500
ft (psi)	-779,7240	-525,9207	-339,7837	-379,3175
fb (psi)	-1971,7471	-2176,4170	-2329,6378	-2247,9552
ft (psi)	-895,6951	-658,2193	-475,1364	-475,6898
fb (psi)	-1305,4818	-1503,6509	-1660,4007	-1626,1284
f'cs (psi)	3500,0000	3500,0000	3500,0000	3500,0000

n	0,7638	0,7638	0,7071	0,7071
hs (in)	5,0000	5,0000	5,0000	5,0000
beff <sub>1</sub> (in)	88,2500	87,5000	86,6000	86,0000
beff <sub>2</sub> (in)	120,0000	120,0000	120,0000	120,0000
beff <sub>3</sub> (in)	345,0000	295,5000	246,0000	198,0000
bm (in)	67,4021	66,8292	61,2354	60,8112
As (in <sup>2</sup> )	337,0103	334,1461	306,1772	304,0559
y (in)	65,0000	55,0000	45,0000	35,0000
Acc (in <sup>2</sup> )	1093,2603	911,6461	717,5772	590,0559
Cbc (in)	41,6538	36,7878	31,3837	25,9119
Ctc (in)	25,8462	20,7122	16,1163	11,5881
Icc (in <sup>4</sup> )	625435,5565	369196,1934	190004,8172	89176,3657
r <sup>2</sup> (in <sup>2</sup> )	572,0830	404,9775	264,7866	151,1321
Stc (in <sup>3</sup> )	24198,3863	17825,0186	11789,6022	7695,4978
Sbc (in <sup>3</sup> )	15015,0785	10035,8452	6054,2525	3441,5246
W <sub>sd</sub> (kip/ft)	351,0523	348,0689	318,9346	316,7249
W <sub>csd</sub> (kips/ft)	123,5682	122,5180	112,2629	111,4851
W <sub>l</sub> (kips/ft)	561,6815	556,9080	510,2934	506,7578
M <sub>sd</sub> (lb-in)	580333,4131	422131,4362	268064,5490	172456,7148
M <sub>csd</sub> (lb-in)	204273,6473	148587,5639	94357,0056	60703,6599
M <sub>l</sub> (lb-in)	928529,7467	675407,5962	428901,5628	275929,6400
ft (psi)	-1745,2410	-1497,1255	-1280,5816	-1269,5410
fb (psi)	63,6514	-13,6399	-91,9367	148,9803
ftnc (psi)	-2471,8505	-2445,9029	-2444,4288	-2860,3217
fbnc (psi)	483,0505	524,5036	572,9184	1076,5560
Mu (lb-in)	54001481,6188	35623064,6716	20889453,7505	12271281,4502
Wu (plf)	2722,1919	2447,7528	2071,1336	1878,0657
Mn1(lb-in)	60001646,2431	39581182,9684	23210504,1672	13634757,1668
Ø (in <sup>2</sup> )	0,1530	0,1530	0,1530	0,1530
dp(in)	57,7500	50,1750	41,7500	32,0000
Aps (in <sup>2</sup> )	5,5080	4,1310	2,9070	1,9890
ρ	0,0014	0,0012	0,0011	0,0010
β	0,7500	0,7500	0,7500	0,7500
F <sub>py</sub> /F <sub>pu</sub>	0,8500	0,8500	0,8500	0,8500
Fps (psi)	260830,5384	262016,8118	263684,4108	264322,8605
c <sub>1</sub> (lb)	1718752,2966	1704145,3366	1821754,5557	1809132,6997
T (lb)	1436654,6053	1082391,4494	766530,5822	525738,1695
a (in)	4,1794	3,1758	2,1038	1,4530
Mn2(lb-in)	79964659,8970	52590283,0313	31196328,6767	16441669,5872
Vu (lb)	156526,0337	120551,8263	84916,4787	61976,1689
Vn1 (lb)	184148,2749	141825,6780	99901,7396	72913,1399
0,5dp (in)	2,4063	2,0906	1,7396	1,3333
0,4fpu (psi)	108000,0000	108000,0000	108000,0000	108000,0000
Vn2 (lb)	176442,0699	138815,4820	97782,3810	71440,1472
Vu0,5h(lb)	149975,7594	111052,3856	78225,9048	57152,1178
0,8h (in)	54,0000	46,0000	38,0000	30,0000
Mu 0,5dp (lb-in)	4425119,6382	2960153,3935	1735026,1238	971586,0020

(Vu.dp)/Mu	1,9573	1,8824	1,8824	1,8824
Vc(lb)	355649,0640	280908,1745	206717,5002	144038,3235
Vcmin(lb)	73809,3801	58298,0818	46108,3341	32127,7450
Vcmak(lb)	184523,4503	145745,2045	115270,8352	80319,3625
Vs(lb)	-8081,3804	-6929,7226	-17488,4541	-8879,2153
8lamda (lb)	295237,5205	233192,3273	184433,3362	128510,9801
Av1 (in <sup>2</sup> )	0,3407	0,2875	0,2364	0,1938
Av2 (in <sup>2</sup> )	0,1650	0,1500	0,1320	0,1200
Begel	#3-24	#3-24	#3-24	#3-24
Cc (lb)	1002605,5063	994084,7797	910877,2779	904566,3498
80b <sub>v</sub> l <sub>vh</sub> (lb)	128205,0000	1482200,0000	1672800,0000	1029600,0000
Avft(in2)	4,9000	3,3600	1,6650	1,2152
Avfm(in2)	1,3300	1,3010	1,4250	1,2500
S (in)	24	24	24	24
Dowel	#3-24	#3-24	#3-24	#3-24
kt (in)	13,7342	11,0085	16,4297	13,0420
kb (in)	22,1341	19,5526	31,2199	26,6084
e <sub>1</sub> (in)	29,7405	26,9709	15,0266	13,7602
e <sub>2</sub> (in)	18,8718	17,4761	7,1625	7,0597
e <sub>3</sub> (in)	13,7342	11,0085	16,4297	13,0420
e <sub>4</sub> (in)	46,2042	39,5492	47,0118	39,2369
e <sub>5</sub> (in)	40,1867	34,5501	43,0639	36,0798
e <sub>6</sub> (in)	22,1341	19,5526	31,2199	26,6084
e <sub>e</sub> (in)	4,2000	4,2000	4,3000	4,3000
Δ <sub>1</sub> (in)	26,6195	23,1726	19,5984	15,3704
Δ <sub>2</sub> (in)	22,9880	19,7877	16,3144	12,2689
Δ <sub>3</sub> (in)	3,6315	3,3849	3,2840	3,1015
L/240 (in)	5,7500	4,9250	4,1000	3,3000
Jumlah Stirrups	7#8	5#8	4#8	3#8
Daerah(in)	31,25	26,25	21,25	16,25
Pelat (in x in)	3,5 x 10	3,5 x 9	3,5 x 7	3,5 x 6
fb awal (psi)	5874,8860	5907,2191	4821,7196	4922,2526
fb akhir (psi)	4605,8968	4629,1005	3857,1429	3927,9220

**Tabel 5.2:** Hasil perhitungan untuk  $bw/b=0,3$ ;  $hf/h=0,2$  dan  $f'_{cp}=6000$  psi,  $f'_{cs}=3500$  psi

Notasi	L = 115 ft	L = 98,5 ft	L = 82 ft	L = 66 ft
h (in)	65,0000	55,0000	45,0000	35,0000
b (in)	15,0000	15,0000	15,0000	15,0000
bw (in)	4,5000	4,5000	4,5000	4,5000
hf (in)	13,0000	11,0000	9,0000	7,0000
Ic (in <sup>4</sup> )	291239,8125	176440,6875	96638,0625	45468,9375

Ac (in <sup>2</sup> )	565,5000	478,5000	391,5000	304,5000
r <sup>2</sup> (in <sup>2</sup> )	515,4500	369,0500	247,0500	149,4500
Ct (in)	32,5000	27,5000	22,5000	17,5000
Cb (in)	32,5000	27,5000	22,5000	17,5000
St (in <sup>3</sup> )	8961,2250	6416,0250	4295,0250	2598,2250
Sb (in <sup>3</sup> )	8961,2250	6416,0250	4295,0250	2598,2250
Lc (ft)	10,0000	10,0000	10,0000	10,0000
f'c (psi)	6000,0000	6000,0000	6000,0000	6000,0000
F'ci (psi)	5000,0000	5000,0000	5000,0000	5000,0000
Fci (psi)	3000,0000	3000,0000	3000,0000	3000,0000
Fti (psi)	212,1320	212,1320	212,1320	212,1320
Fts (psi)	464,7580	464,7580	464,7580	464,7580
Fcs (psi)	2700,0000	2700,0000	2700,0000	2700,0000
Wd (plf)	589,0625	498,4375	407,8125	317,1875
Md (lb-in)	973793,9453	604495,6543	342766,4063	172708,5938
Fcent (psi)	-1393,9340	-1393,9340	-1393,9340	-1393,9340
P (lb)	788269,6673	666997,4108	545725,1543	424452,8978
Pi (lb)	28900,0000	28900,0000	28900,0000	28900,0000
x (strand)	27,2758	23,0795	18,8832	14,6870
Po (lb)	780300,0000	664700,0000	520200,0000	404600,0000
Pe (lb)	624240,0000	531760,0000	416160,0000	323680,0000
e (in)	25,2500	19,7500	16,2500	12,0000
ft (psi)	-487,0677	-475,3667	-319,9207	-259,3209
fb (psi)	-2272,6140	-2302,8987	-2337,5506	-2398,1503
ft (psi)	-650,4562	-606,4130	-447,4697	-366,9890
fb (psi)	-1557,2892	-1616,1993	-1678,5074	-1758,9880
f'cs (psi)	3500,0000	3500,0000	3500,0000	3500,0000
N	0,7638	0,7638	0,7638	0,7638
hs (in)	5,0000	5,0000	5,0000	5,0000
Beff <sub>1</sub> (in)	84,5000	84,5000	84,5000	84,5000
Beff <sub>2</sub> (in)	120,0000	120,0000	120,0000	120,0000
Beff <sub>3</sub> (in)	345,0000	295,5000	246,0000	198,0000
bm (in)	64,5379	64,5379	64,5379	64,5379
As (in <sup>2</sup> )	322,6897	322,6897	322,6897	322,6897
y (in)	67,5000	57,5000	47,5000	37,5000
Acc (in <sup>2</sup> )	888,1897	801,1897	714,1897	627,1897
Cbc (in)	45,2159	39,5829	33,7957	27,7900
Ctc (in)	24,7841	20,4171	16,2043	12,2100
Icc (in <sup>4</sup> )	543591,7164	350562,9167	207866,5850	108807,4246
r <sup>2</sup> (in <sup>2</sup> )	612,0221	437,5529	291,0523	173,4841
Stc (in <sup>3</sup> )	21933,0909	17170,0600	12827,8325	8911,3510
Sbc (in <sup>3</sup> )	12022,1339	8856,4244	6150,6891	3915,3418
W <sub>sd</sub> (kip/ft)	336,1351	336,1351	336,1351	336,1351
W <sub>csd</sub> (kips/ft)	118,3174	118,3174	118,3174	118,3174
W <sub>l</sub> (kips/ft)	537,8140	537,8140	537,8140	537,8140
M <sub>sd</sub> (lb-in)	555673,3530	407658,3584	282521,5596	183025,5672
M <sub>csd</sub> (lb-in)	195593,4639	143493,1331	99445,7808	64423,8283
M <sub>l</sub> (lb-in)	889073,8085	652250,7644	452032,6872	292839,7361
ft (psi)	-1547,9169	-1447,4600	-1227,6482	-1094,5408

fb (psi)	80,0314	14,3489	-51,3726	-103,0740
Ftnc (psi)	-2586,3227	-2590,3520	-2501,9427	-2568,1510
Fbnc (psi)	639,2953	634,5443	651,6305	736,3577
Mu (lb-in)	47118126,4995	32720787,6418	21396993,7634	13032584,8346
Wu (plf)	2375,2049	2248,3299	2121,4549	1994,5799
Mn1(lb-in)	52353473,8884	36356430,7131	23774437,5148	14480649,8163
Ø (in <sup>2</sup> )	0,1530	0,1530	0,1530	0,1530
dp(in)	62,7500	52,2500	43,7500	34,5000
Aps (in <sup>2</sup> )	4,1310	3,5190	2,7540	2,1420
ρ	0,0010	0,0010	0,0010	0,0010
β	0,7500	0,7500	0,7500	0,7500
<sup>FPY</sup> / <sub>Fpu</sub>	0,8500	0,8500	0,8500	0,8500
Fps (psi)	263390,0014	263237,7243	263679,5823	263766,0937
c <sub>1</sub> (lb)	1645717,4965	1645717,4965	1645717,4965	1645717,4965
T (lb)	1088064,0960	926333,5519	726173,5697	564986,9727
a (in)	3,3057	2,8144	2,2063	1,7165
Mn2(lb-in)	66477591,4287	47097402,6456	30969032,6578	19007140,0546
Vu (lb)	136574,2797	110730,2458	86979,6494	65821,1355
Vn1 (lb)	160675,6232	130270,8774	102328,9993	77436,6300
0,5dp (in)	2,6146	2,1771	1,8229	1,4375
0,4fpu (psi)	108000,0000	108000,0000	108000,0000	108000,0000
Vn2 (lb)	157022,5814	127391,5825	100054,1550	75750,0368
Vu0,5h(lb)	125618,0651	101913,2660	80043,3240	60600,0294
0,8h (in)	56,0000	48,0000	40,0000	32,0000
Mu 0,5dp (lb-in)	4187595,9675	2828889,3279	1860381,9441	1110684,9141
(Vu.dp)/Mu	1,8824	1,8824	1,8824	1,8824
Vc(lb)	210786,1041	175515,1225	146962,4232	115890,3680
Vcmin(lb)	43745,3469	36425,4084	30499,7439	24051,2266
Vcmak(lb)	109363,3672	91063,5209	76249,3596	60128,0664
Vs(lb)	47659,2142	36328,0615	23804,7953	15621,9703
8lamda (lb)	174981,3876	145701,6335	121998,9754	96204,9063
S (in)	17,3796	18,9853	24,2598	29,1513
Begel	#3-17	#3-18	#3-24	#3-24
Cc (lb)	960001,8729	960001,8729	960001,8729	960001,8729
80b <sub>v</sub> l <sub>vn</sub> (lb)	3588000,0000	2600400,0000	1771200,0000	1108800,0000
350b <sub>v</sub> d <sub>p</sub> (lb)	1427562,5000	1005812,5000	689062,5000	422625,0000
Avft(in <sup>2</sup> )	16,0000	16,0000	16,0000	1,2906
Avfm(in <sup>2</sup> )	8,6250	7,3875	6,1500	4,9500
S (in)	18,9750	16,2525	13,5300	35,2000
Dowel	#3-17	#3-9	#3-12	#3-24
kt (in)	13,5355	11,0541	8,6121	6,2427
kb (in)	24,6942	21,4307	17,9614	14,2084
e <sub>1</sub> (in)	36,7169	29,7440	25,3200	20,1908
e <sub>2</sub> (in)	24,1538	19,5445	16,8370	13,5824
e <sub>3</sub> (in)	13,5355	11,0541	8,6121	6,2427
e <sub>4</sub> (in)	51,2233	42,2939	34,6796	26,6698
e <sub>5</sub> (in)	44,5910	37,0781	30,5000	23,5545

$e_6$ (in)	24,6942	21,4307	17,9614	14,2084
$e_e$ (in)	3,5000	3,5000	3,5000	3,5000
$\Delta_1$ (in)	25,9377	21,7409	16,6970	12,8863
$\Delta_2$ (in)	23,3263	19,2103	14,3822	10,6581
$\Delta_3$ (in)	2,6114	2,5306	2,3148	2,2282
L/240 (in)	5,7500	4,9250	4,1000	3,3000
Jumlah Stirrups	4#8	4#8	3#8	2#8
Daerah (in)	32,5	27,5	22,5	17,5
Pelat (in x in)	3,5 x 9	3,5 x 9	3,5 x 6	3,5 x 6
fb awal (psi)	4433,6377	4433,6377	4922,2527	4922,2527
fb akhir (psi)	3585,6858	3585,6858	3925,9220	3925,9220

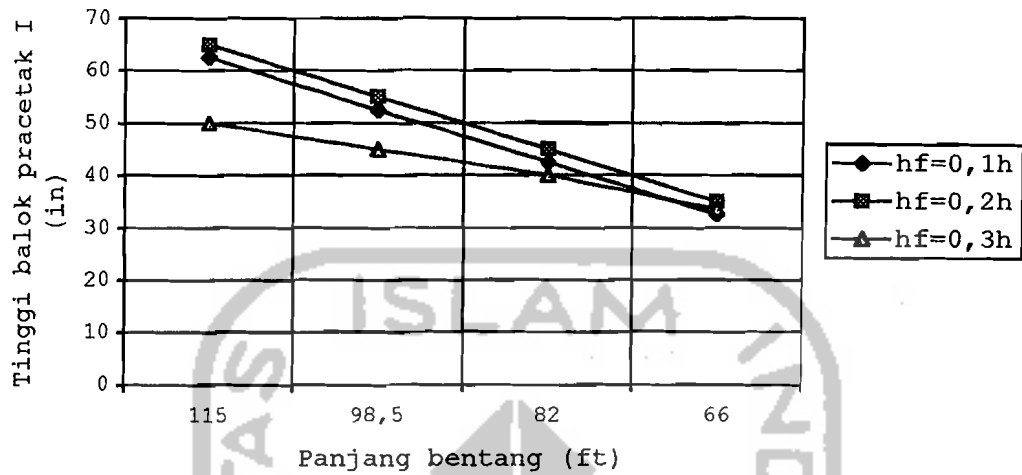
**Tabel 5.3:** Hasil perhitungan untuk  $bw/b=0,3$ ;  $hf/h=0,3$  dan  $f'_{cp}=6000$  psi,  $f'_{cs}=3500$  psi

Notasi	$L = 115$ ft	$L = 98,5$ ft	$L = 82$ ft	$L = 66$ ft
h (in)	50,0000	45,0000	40,0000	33,5000
b (in)	29,0000	21,0000	18,0000	15,0000
bw (in)	8,7000	6,3000	5,4000	4,5000
hf (in)	15,0000	13,5000	12,0000	10,0500
$I_c$ (in <sup>4</sup> )	288550,0000	152324,5500	91699,2000	44888,8778
$A_c$ (in <sup>2</sup> )	1044,0000	680,4000	518,4000	361,8000
$r^2$ (in <sup>2</sup> )	277,5000	224,7750	177,6000	124,5698
$C_t$ (in)	25,0000	22,5000	20,0000	16,7500
$C_b$ (in)	25,0000	22,5000	20,0000	16,7500
$S_t$ (in <sup>3</sup> )	11542,0000	6769,9800	4584,9600	2679,9330
$S_b$ (in <sup>3</sup> )	11542,0000	6769,9800	4584,9600	2679,9330
$L_c$ (ft)	10,0000	10,0000	10,0000	10,0000
$f'_c$ (psi)	6000,0000	6000,0000	6000,0000	6000,0000
$F'_{ci}$ (psi)	5000,0000	5000,0000	5000,0000	5000,0000
$F_{ci}$ (psi)	3000,0000	3000,0000	3000,0000	3000,0000
$F_{ti}$ (psi)	212,1320	212,1320	212,1320	212,1320
$F_{ts}$ (psi)	464,7580	464,7580	464,7580	464,7580
$F_{cs}$ (psi)	2700,0000	2700,0000	2700,0000	2700,0000
$W_d$ (plf)	1087,5000	708,7500	540,0000	376,8750
$M_d$ (lb-in)	1797773,4375	859558,7109	453870,0000	205208,4375
$F_{cent}$ (psi)	-1393,9340	-1393,9340	-1393,9340	-1393,9340
$P$ (lb)	1455267,0781	948432,6819	722615,3767	504325,3150
$P_i$ (lb)	28900,0000	28900,0000	28900,0000	28900,0000
x(strand)	50,3553	32,8177	25,0040	17,4507
$P_o$ (lb)	1445000,0000	924800,0000	722500,0000	491300,0000
$P_e$ (lb)	1156000,0000	739840,0000	578000,0000	393040,0000
e (in)	17,0000	15,5000	12,7500	8,0000
ft (psi)	-1133,4186	-773,9254	-580,4981	-816,0677
fb (psi)	-1634,7806	-1944,4755	-2206,9248	-1899,7974
ft (psi)	-1280,5571	-923,8592	-701,9770	-836,6275
fb (psi)	-934,0023	-1250,8615	-1527,9613	-1336,0646

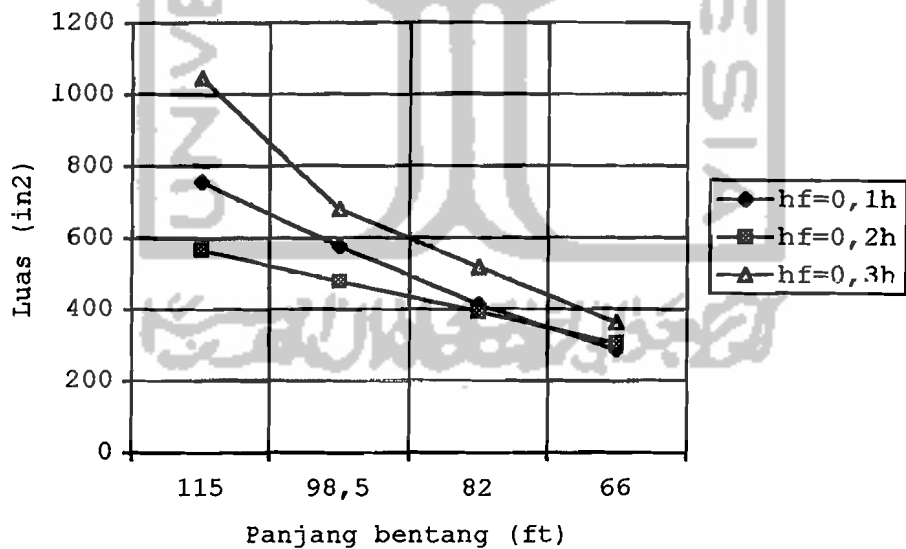


$f'_{cs}$ (psi)	3500,0000	3500,0000	3500,0000	3500,0000
N	0,7638	0,7638	0,7638	0,7638
hs (in)	5,0000	5,0000	5,0000	5,0000
$Beff_1$ (in)	88,7000	86,3000	85,4000	84,5000
$Beff_2$ (in)	120,0000	120,0000	120,0000	120,0000
$Beff_3$ (in)	345,0000	295,5000	246,0000	198,0000
bm (in)	67,7457	65,9127	65,2253	64,5379
As (in <sup>2</sup> )	338,7287	329,5636	326,1266	322,6897
y (in)	52,5000	47,5000	42,5000	36,0000
Acc (in <sup>2</sup> )	1382,7287	1009,9636	844,5266	684,4897
Cbc (in)	31,7367	30,6578	28,6887	25,8250
Ctc (in)	23,2633	19,3422	16,3113	12,6750
Icc (in <sup>4</sup> )	482666,5751	291775,4605	193723,7756	108765,6800
$r^2$ (in <sup>2</sup> )	349,0682	288,8970	229,3874	158,9004
Stc (in <sup>3</sup> )	20747,9912	15084,9224	11876,6700	8581,1511
Sbc (in <sup>3</sup> )	15208,4638	9517,1663	6752,6130	4211,6352
$W_{sd}$ (kip/ft)	352,8424	343,2954	339,7152	336,1351
$W_{csd}$ (kips/ft)	124,1983	120,8378	119,5776	118,3174
$W_l$ (kips/ft)	564,5456	549,2704	543,5422	537,8140
$M_{sd}$ (lb-in)	583292,6203	416342,2050	285530,6650	183025,5672
$M_{csd}$ (lb-in)	205315,2693	146549,7916	100504,9667	64423,8283
$M_l$ (lb-in)	933264,4593	666144,8635	456847,2365	292839,7361
ft (psi)	-2276,4351	-1901,5535	-1553,6125	-1592,1753
fb (psi)	424,6141	298,8059	-30,0827	203,3541
Ftnc (psi)	-2858,3283	-2844,3342	-2647,1967	-2970,8041
Fbnc (psi)	856,1960	927,6445	678,0764	1083,2010
$\mu$ (lb-in)	62489801,2643	37486527,1018	23430098,2369	13578582,2096
$W_u$ (plf)	3150,0845	2575,7961	2323,0318	2078,1424
$M_{nl}$ (lb-in)	69433112,5159	41651696,7798	26033442,4854	15087313,5663
$\emptyset$ (in <sup>2</sup> )	0,1530	0,1530	0,1530	0,1530
dp (in)	47,0000	43,0000	37,7500	29,7500
$A_{ps}$ (in <sup>2</sup> )	7,6500	4,8960	3,9780	2,6010
$\rho$	0,0024	0,0017	0,0016	0,0014
$\beta$	0,7500	0,7500	0,7500	0,7500
$f_{py}/f_{pu}$	0,8500	0,8500	0,8500	0,8500
$f_{ps}$ (psi)	254431,1489	258806,1685	259530,9672	261221,6421
$c_1$ (lb)	1727516,4726	1680774,2005	1663245,8485	1645717,4965
T (lb)	1946398,2888	1267115,0008	1032414,1875	679437,4912
a (in)	5,6335	3,7694	3,1036	2,0643
$M_{n2}$ (lb-in)	85998186,7586	52097788,9912	37371528,6854	19511997,8219
$V_u$ (lb)	181129,8587	126857,9597	95244,3018	68578,6980
$V_{n1}$ (lb)	213093,9515	149244,6585	112052,1197	80680,8212
$0,5dp$ (in)	1,9583	1,7917	1,5729	1,2396
$0,4f_{pu}$ (psi)	108000,0000	108000,0000	108000,0000	108000,0000
$V_{n2}$ (lb)	205836,4038	143815,2843	107753,3723	77650,1969
$V_{u0,5h}$ (lb)	164669,1231	115052,2274	86202,6978	62120,1575
$0,8h$ (in)	44,0000	40,0000	36,0000	30,8000
$\mu_{0,5dp}$ (lb-in)	348672,2436	223152,9356	146937,6818	83412,4088
$(V_u \cdot dp)/\mu$	0,1603	0,1712	0,1805	0,1768
Vc (lb)	305233,9547	202220,2943	152169,0919	99934,4477

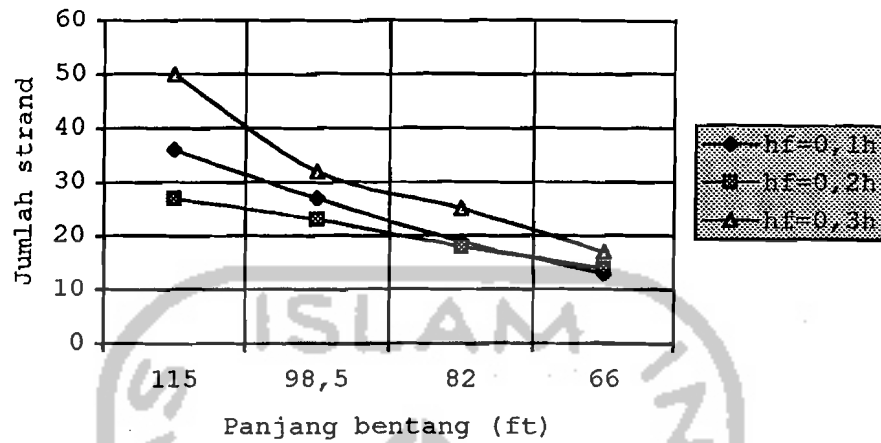
Vcmin (lb)	63346,5156	41967,6475	31580,3062	20739,8258
Vcmak (lb)	158366,2890	104919,1188	78950,7655	51849,5645
Vs (lb)	47470,1148	38896,1655	28802,6067	25800,6324
$\delta$ lamda (lb)	253386,0624	167870,5902	126321,2248	82959,3033
s (in <sup>2</sup> )	13,0693	14,5927	17,3005	15,2206
Begel	#3-12	#3-14	#3-13	#3-15
Cc (lb)	1007717,9424	980451,6170	970226,7449	960001,8729
80b <sub>v</sub> l <sub>vh</sub> (lb)	1600800,0000	992880,0000	708480,0000	475200,0000
350b <sub>v</sub> d <sub>p</sub> (lb)	477050,0000	316050,0000	237825,0000	156187,5000
Avft (in <sup>2</sup> )	16,7953	16,3409	16,1704	1,3447
Avfm (in <sup>2</sup> )	16,6750	10,3425	7,3800	4,9500
S (in)	9,0382	15,9135	13,3874	17,6000
Dowel	#3-8	#3-14	#3-13	#3-15
kt (in)	15,0051	14,9361	14,0631	12,5366
kb (in)	10,9989	9,4233	7,9957	6,1530
e <sub>1</sub> (in)	21,5310	18,9403	12,8591	10,2244
e <sub>2</sub> (in)	12,3970	10,4712	6,1285	4,5342
e <sub>3</sub> (in)	0,0000	0,0000	0,0000	0,0000
e <sub>4</sub> (in)	32,4775	27,8807	21,9457	17,2091
e <sub>5</sub> (in)	27,1078	23,2663	18,4582	14,4451
e <sub>6</sub> (in)	0,0000	0,0000	0,0000	0,0000
e <sub>e</sub> (in)	3,0000	3,5000	2,8000	2,8000
$\Delta_1$ (in)	30,7809	23,8282	17,6086	11,0040
$\Delta_2$ (in)	26,1126	19,5980	14,8489	8,8387
$\Delta_3$ (in)	4,6683	4,2302	2,7597	2,1653
L/240 (in)	5,7500	4,9250	4,1000	3,3000
Jumlah Stirrups	5#8	4#8	4#8	3#8
Daerah (in)	25,0	22,5	20,0	17,5
Pelat (in x in)	3,5 x 19	3,5 x 14	3,5 x 9	3,5 x 6
fb awal (psi)	4420,0500	4506,6844	4684,3203	4922,2527
fb akhir (psi)	3576,2374	3636,5492	3760,6990	3927,9220



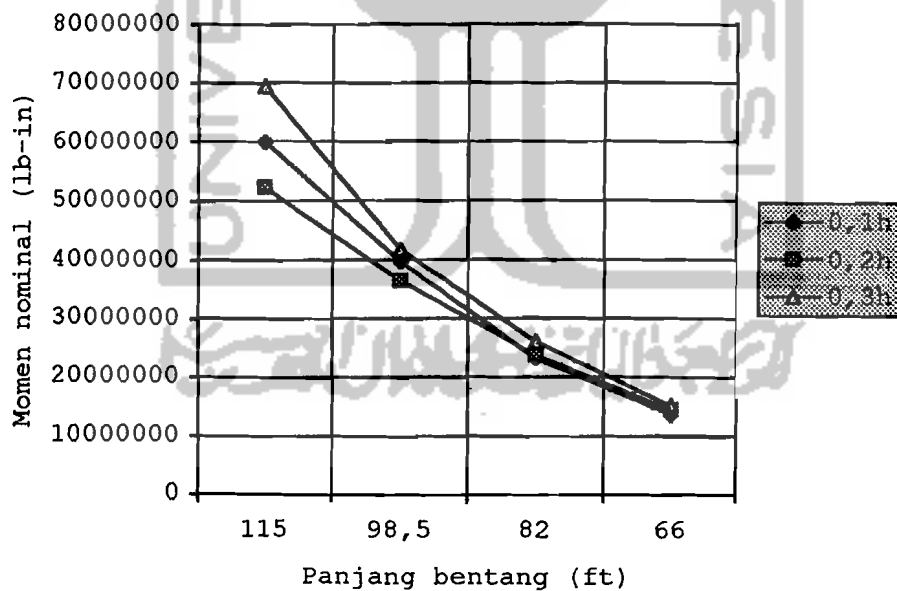
Grafik 5.1. Hubungan antara tinggi balok dan panjang bentang terhadap perbandingan  $h_f/h$ .



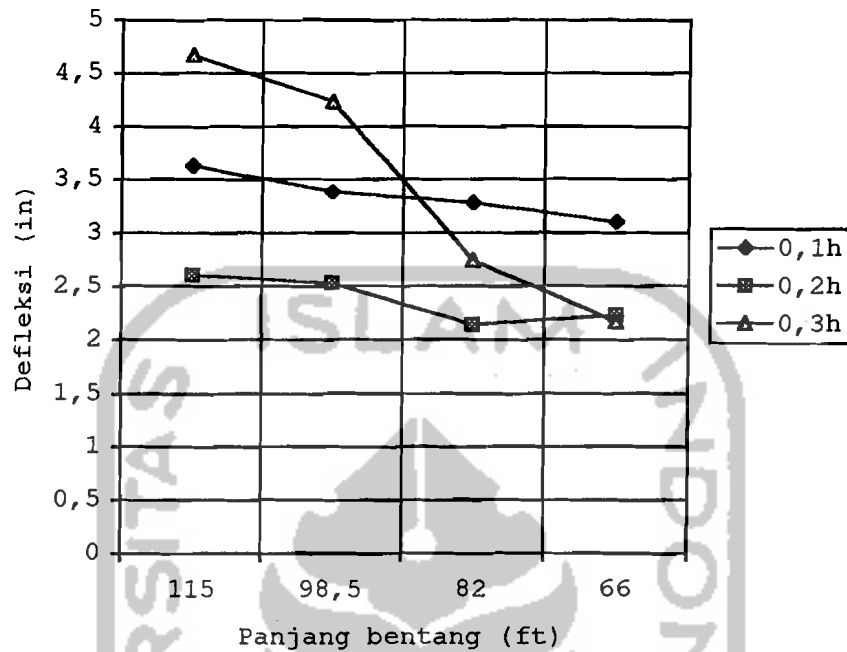
Grafik 5.2. Hubungan antara luas balok pracetak dan panjang bentang terhadap perbandingan  $h_f/h$ .



Grafik 5.3. Hubungan antara jumlah strand dan panjang bentang terhadap perbandingan  $hf/h$



Grafik 5.4. Hubungan antara momen nominal dan panjang bentang terhadap perbandingan  $hf/h$ .



Grafik 5.5. Hubungan antara defleksi dan panjang bentang terhadap perbandingan  $hf/h$ .

Dari analisa diatas dapat diketahui :

1. pada  $hf/h=0,2$  luas balok pracetak yang digunakan lebih kecil dari perbandingan  $hf/h$  yang lain,
2. jumlah strand yang digunakan pada  $hf/h=0,2$  relatif lebih sedikit dibanding dengan perbandingan  $hf/h$  yang lain,
3. momen nominal yang terjadi pada  $hf/h=0,2$  lebih kecil dari perbandingan  $hf/h$ , kecuali pada bentang

82 ft dan 66 ft lebih besar atau sama dengan  $h_f/h=0,1$ ,

4. defleksi yang terjadi perbandingan  $h_f/h=0,2$  lebih kecil dari perbandingan  $h_f/h$  yang lain, kecuali untuk bentang 66 ft , karena pada bentang tersebut momen inersia  $h_f/h=0,3$  semakin besar walaupun masih lebih kecil dari inersia  $h_f/h=0,2$
5. secara umum menggunakan tampang balok pracetak dengan perbandingan  $h_f/h=0,2$  lebih ekonomis dibandingkan menggunakan balok pracetak dengan perbandingan  $h_f/h=0,1$  atau  $h_f/h=0,3$  untuk panjang bentang lebih besar dari 82ft,
6. penggunaan balok komposit lebih ekonomis dibandingkan dengan menggunakan balok pracetak biasa pada bentang yang panjang, karena digunakannya dua macam kekuatan beton yang berbeda,
7. penggunaan struktur balok komposit dapat dijadikan salah satu alternatif dalam penggunaan struktur balok dengan bentang yang panjang.