S' = section modulus of composite section (used with appropriate subscript).
t = subscript denoting time or top of section.
w = distributed load.
y = midspan deflection.
Δ_{sh} = differential shrinkage strain.
ϵ_{creep} = creep strain of concrete.
ϵ_i = initial strain of concrete due to applied stress.
ϵ_{sh} = shrinkage strain of concrete.

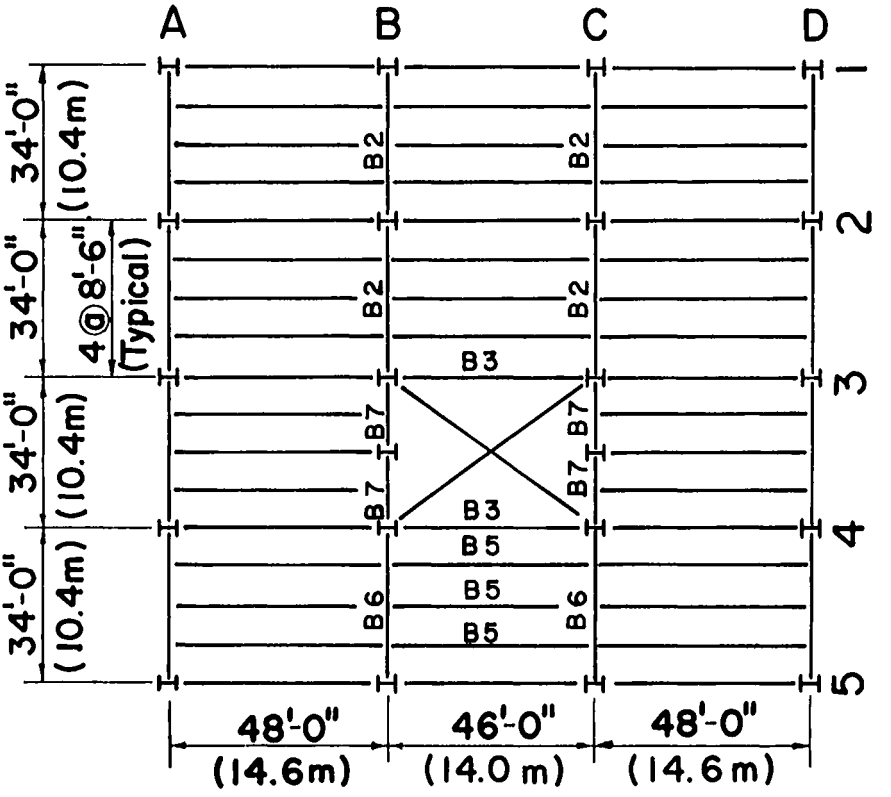

Fig. 8-1—Second floor framing plan

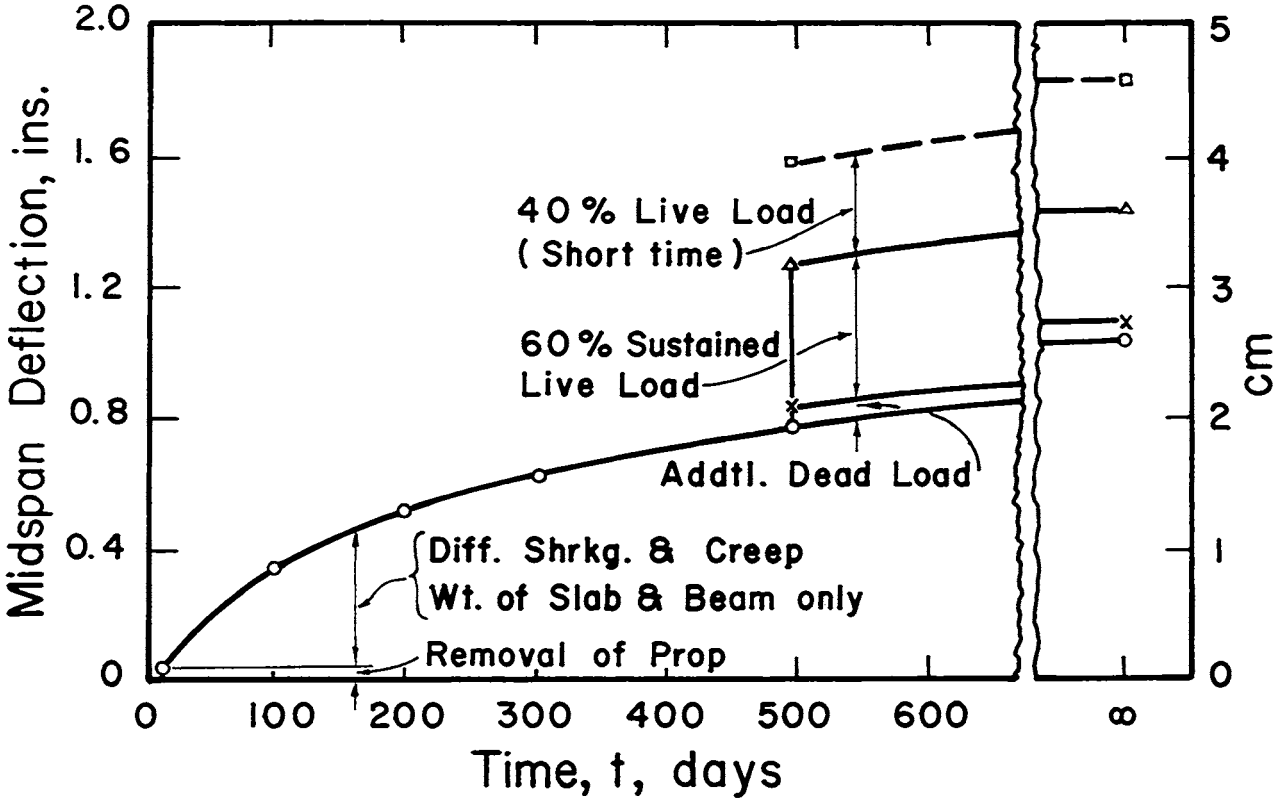

Fig. 8-2—Deflection of beam B 1

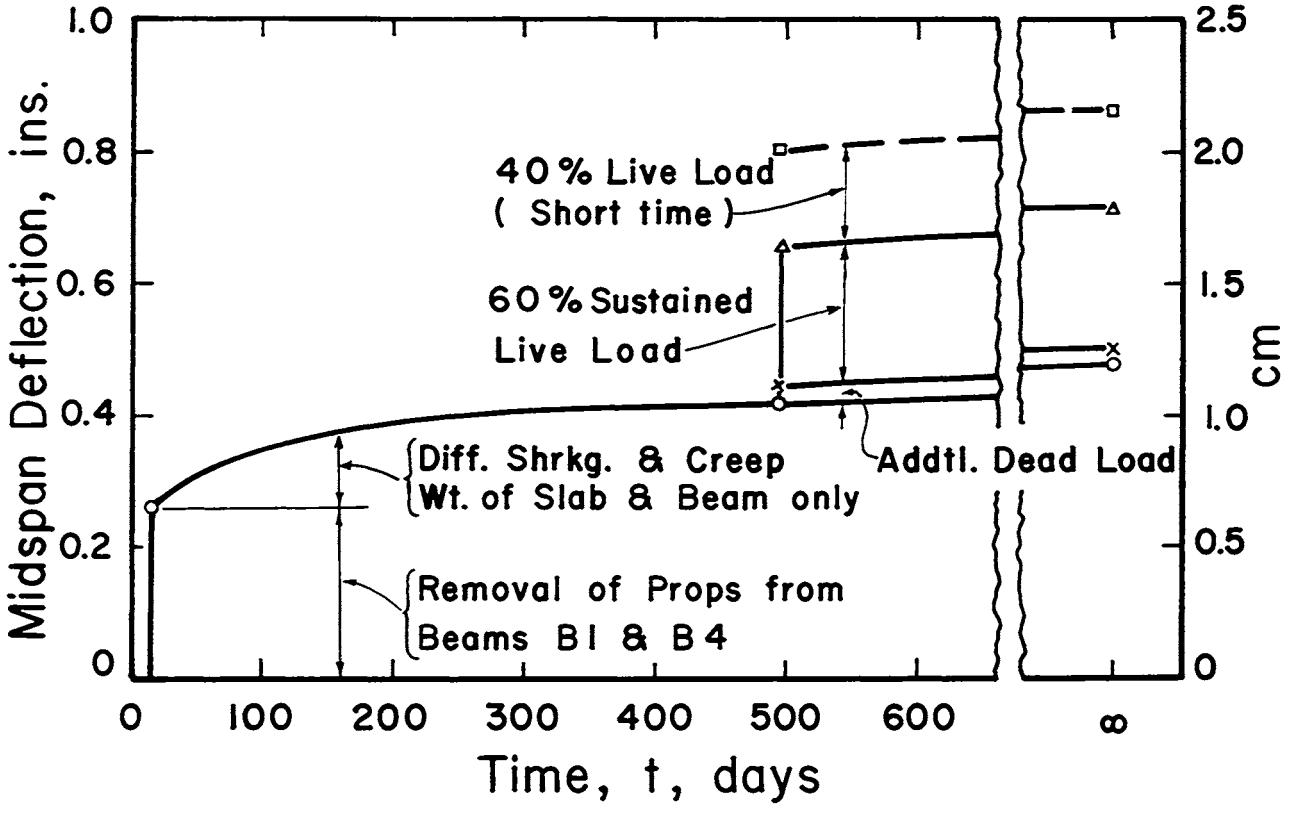

Fig. 8-3—Deflection of beam B 2

TABLE 8-1–TIME-DEPENDENT MATERIAL PROPERTIES OF CONCRETE

Property	Age, t, days		
	14	493	∞
f'_c, psi	1580	3340*	3470
E_c, 10^6 psi	2.29	3.33	3.40
ϵ_{sh}, 10^{-6} in./in.	116	618	707
C_t	-	2.0	2.5**

*Core tests
**Based on: Age of loading = 14 days, $f'_c \leqslant 4{,}000$ psi at loading,
Relative Humidity = 50 percent

TABLE 8-2–GEOMETRIC PROPERTIES AT MIDSPAN CROSS-SECTIONS

Beam	B1		B2	
standard section	21B44		27 WF 114	
cover plate	5 in. x ½ in. x 27-0 in.		12 in. x 1 in. x 18 ft-6 in.	
Steel section w/o slab				
I, in.^{4}	1077		5847	
S_b, in.^{3}	118		536	
S_t, in.^{3}	89.3		336	
Composite section				
At age, t, days	14	493	14	493
Effective flange width, in.	72	72	74	24*
Modular ratio, n	12.7	8.7	12.7	8.7
I', in.^{4}	2920	3200	11,668	9203
S'_b, in.^{3}	168	172	672	628
S'_t conc, in.^{3}	380	490	784	523
S'_t stl, in.^{3}	793	1263	1072	677

*Width between cracks parallel to top flange at t = 493 days.

TABLE 8-3a—BEAM B1: CENTER-LINE DEFLECTIONS AND STRESSES DUE TO LOADING CONDITIONS 1 TO 6

Loading cond.	Age, days	Deflection, in.	Stress, psi				Computation number
			Concrete		Steel		
			Top	Bot.	Top	Bot.	
1	0	-0.168	–	–	- 1,710	+ 1,290	(1)
2	0	+1.168	–	–	+14,800	- 11,200	(2)
3	0	-0.025	–	–	+ 3,770	- 2,850	(3)
4	14	-1.018	-647	-310	- 3,940	+18,600	(4)
1 to 4	14	-0.043	-647	-310	+12,920	+ 5,840	(5) = (1) + (2) + (3) + (4)
5	14 to 493	-0.519 (-0.544)	+ 44 (+ 13)	+157 (+189)	- 6,260 (- 6,580)	+ 1,400 (+ 1,560)	(6)
6	14 to 493	-0.217 (-0.230)	+ 19 (+ 6)	+ 66 (+ 80)	- 2,620 (- 2,750)	+ 590 (+ 650)	(7)
1 to 6	493	-0.779 (-0.817)	-584 (-638)	- 87 (- 41)	+ 4,040 (+ 3,590)	+ 7,830 (+ 8,050)	(8) = (5) + (6) + (7)

Note: 1. Deflections are relative to the ends of the beam. Positive deflections are upward; negative deflections are downward.
2. Positive stresses are tension; negative stresses are compression.
3. Values in parentheses ( ) are based on concrete properties at 493 days.
4. Factors for conversion to SI units:
Multiply in. by 2.54 to obtain cm.
Multiply psi by 0.0703 to obtain $kgf/cm.^2$

TABLE 3b–BEAM B1: ADDITIONAL AND CUMULATIVE CENTER-LINE DEFLECTIONS AND STRESSES DUE TO LOADING CONDITIONS 7 to 10

Loading cond.	Age, days	Deflection, ins.	Stress, psi				Computation number
			Concrete		Steel		
			Top	Bot.	Top	Bot.	
7 (a)	493	- 0.164	+ 14	+ 49	- 1990	+ 450	(9)
(b)	to ∞	- 0.085	+ 7	+ 25	- 1030	+ 230	(10)
1 to 7	∞	- 1.028	- 563	- 13	+1020	+ 8,510	(11) = (8) + (9) + (10)
8	493 to ∞	- 0.053	- 33	- 13	- 110	+ 830	(12)
1 to 8	∞	- 1.081	- 596	- 26	+ 910	+ 9,340	(13) = (11) + (12)
9	493	- 0.743	- 465	- 184	- 1580	+11,660	(14)
1 to 6 + 8 + 9	493	- 1.575	- 1082	- 284	+2350	+20,350	(15) = (8) + (12) + (14)
10 (a)	493	- 0.446	- 279	- 111	- 950	+ 7,000	(16)
(b)	to	- 0.008	-	-	- 100	+ 20	(17)
(c)	∞	- 0.297	- 186	- 73	- 630	+ 4,660	(18)
1 to 6 + 8 + 10 (a)	493	- 1.278	- 896	- 211	+2980	+15,660	(19) = (8) + (12) + (16)
1 to 8 + 10 (a) + 10 (b)	∞	- 1.535	- 875	- 137	- 140	+16,360	(20) = (13) + (16) + (17)
1 to 10	∞	- 1.832	- 1061	- 210	- 770	+21,020	(21) = (20) + (18) = (13) + (14) + (17)

Note: 1. See notes (1), (2) and (4) for Table 8-3a.
2. Loading conditions 7 (a) and (b) (Computation Nos. (9) and (10)) are due to differential shrinkage and creep respectively.
3. Creep due to additional dead load (Computation No. (12)) is negligible.
4. Loading condition 10 (a) (Comp. No. (16)) is short-time effect due to 60 percent of total live load.
Loading condition 10 (b) (Comp. No. (17)) is [illegible] due to 60 percent of total live load. Concrete stresses are negligible.
[illegible]ng condition 10 (c) (Comp. No. [illegible]d.

TABLE 8-4a–BEAM B2: CENTER-LINE DEFLECTIONS AND STRESSES DUE TO LOADING CONDITIONS 1 TO 6

Loading cond.	Age, days	Deflection, in.	Stress, psi				Computation number
			Concrete		Steel		
			Top	Bot.	Top	Bot.	
1	0	- 0.062	–	–	- 1,880	+1,180	(1)
2	0	+0.181	–	–	+ 5,560	- 3,490	(2)
3	0	- 0.164	–	–	- 5,020	+3,140	(3)
4	14	- 0.214	- 445	- 325	- 4,120	+6,590	(4)
1 to 4	14	- 0.259	- 445	- 325	- 5,460	+7,420	(5) = (1) + (2) + (3) + (4)
5	14 to 493	- 0.111	+448	+519	- 3,700	+ 650	(6)
6	14 to 493	- 0.049	+200	+232	- 1,660	+ 290	(7)
1 to 6	493	- 0.419	+203	+426	- 10,820	+8,360	(8) = (5) + (6) + (7)

Note: See Notes 1, 2, and 4 for Table 8-3(a).

TABLE 8-4b—BEAM B2: ADDITIONAL AND CUMULATIVE CENTER-LINE DEFLECTIONS AND STRESSES DUE TO LOADING CONDITIONS 7 TO 10

Loading cond.	Age, days	Deflection, in.	Stress, psi				Computation number
			Concrete		Steel		
			Top	Bot.	Top	Bot.	
7 (a)	493	-0.035	+ 142	+165	- 1,180	+ 210	(9)
(b)	to ∞	-0.020	+ 80	+ 92	- 650	+ 120	(10)
1 to 6	∞	-0.474	+ 425	+683	-12,650	+ 8,690	(11) = (8) + (9) + (10)
8	493 to ∞	-0.025	- 88	- 68	- 590	+ 640	(12)
1 to 8	∞	-0.499	+ 337	+615	-12,060	+ 9,330	(13) = (11) + (12)
9	493	-0.358	-1260	-975	- 8,490	+ 9,160	(14)
1 to 6 + 8 + 9	493	-0.802	-1145	-617	-19,900	+18,160	(15) = (8) + (12) + (14)
10 (a)	493	-0.215	- 756	-585	- 5,090	+ 5,500	(16)
(b)	to	-0.005	+ 23	+ 27	- 190	+ 30	(17)
(c)	∞	-0.143	- 504	-390	- 3,400	+ 3,660	(18)
1 to 6 + 8 + 10 (a)	493	-0.659	- 641	-227	-16,500	+14,500	(19) = (8) + (12) + (16)
1 to 8 + 10 (a) + 10 (b)	∞	-0.719	- 396	+ 57	-17,340	+14,860	(20) = (13) + (16) + (17)
1 to 10	∞	-0.862	- 900	-333	-20,740	+18,520	(21) = (20) + (18) = (13) + (14) + (17)

Note: 1. See Notes 1, 2, and 4 for Table 8-3(a).
2. Loading conditions 7 (a) and (b) (Comp. Nos. (9) and (10)) are due to differential shrinkage and creep respectively.
3. Creep due to additional dead load (Comp. No. (12)) is negligible.
4. Loading condition 10 (a) (Comp. No. (16)) is short-time effect due to 60 percent of total live load.
Loading condition 10 (b) (Comp. No. (17)) is creep due to 60 percent of total live load.
...ng condition 10 (c) (Comp. No ... d.

TABLE 8-A1—STRESSES AND DEFLECTIONS FOR LOADING CONDITIONS 1 TO 4: BEAM B 1

Loading condition			1	2	3	4	Resultant
Description			Wt. of beam, 44 lb/ft	Prop for 1 in. camber	Wt. of slab, 425 lb/ft prop in place	Prop removed at 14 days	1 + 2 + 3 + 4
Effective				Non-composite section		Composite	——
Stress, psi	Steel	Top	- 1,710	+ 14,800	+ 3,770	- 3,940	+ 12,920
		Bottom	+ 1,290	- 11,200	- 2,850	+ 18,600	+ 5,840
	Conc.	Top	-	-	-	- 647	- 647
		Bottom	-	-	-	- 310	- 319
Deflections, ins.			- 0.168	+ 1.168	- 0.025	- 1.018	- 0.043

Note: (1) See Table 8-2 for cross-sectional properties.
(2) Span length = 48 ft
(3) Positive deflections are upward; negative deflections are downward.
(4) Positive stresses are tension; negative stresses are compression.
(5) Factors for conversion to SI units:

Multiply ins. by 2.54 to obtain cms.
Multiply psi by 0.0703 to obtain kgf/cm^2.
Multiply lb/ft by 1.490 to obtain kgf/m.
Multiply lb by 0.454 to obtain kgf.