The maximum bending moment and normal forces due to the live load in the various sections of the arches, are calculated by means of influence lines. The equations for the influence lines for the bending moment (M) and normal force (N) in the point m of the arches are:

$$M_m = M_{o,m} - X_a - X_b x - X_c y,$$
$$N_m = N_{o,m} + X_b \sin \phi - X_c \cos \phi;$$

$M_{o,m}$ and $N_{o,m}$ being the corresponding values in the auxiliary system, ϕ the angle between the x axis and the tangent at the point (Fig. 6), taken positive in the direction from the x axis to the y axis and the positive direction of the tangent taken toward the right. It will thus

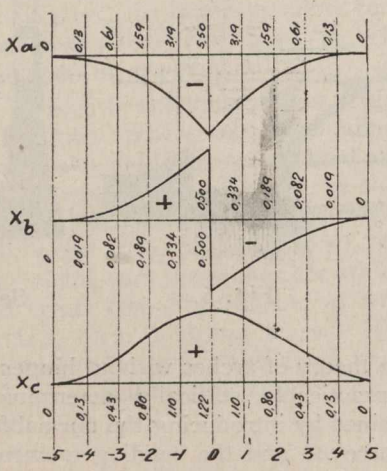

Fig. 7.

be seen that it is first necessary to find the influence lines for X_a, X_b and X_o, the equations of which, from the above given reduced equations, are:

$$X_a = \frac{\delta_{ma}}{\delta_{aa}}; \qquad X_b = \frac{\delta_{mb}}{\delta_{bb}}; \text{ and,} \qquad X_c = \frac{\delta_{mc}}{\delta_{cc}}.$$

wherein the different δ's are readily calculated by means of the so-called "v" forces. The influence lines for the quantities X are shown in Fig. 7, and the influence lines for the bending moments in Fig. 8.

A variation of the temperature of ± 40° F. was taken into consideration; the bending moments and normal forces produced by this change are:

$$M_t = - X_c y; \; N_t = - X_c \cos \phi,$$

X_a and X_b being = o, and $X_o = \dfrac{\epsilon E t l}{\delta_{cc}}$

in which ϵ is the elongation per unit length per 1° F., E the modulus of elasticity, t the variation of the temperature and l the span.

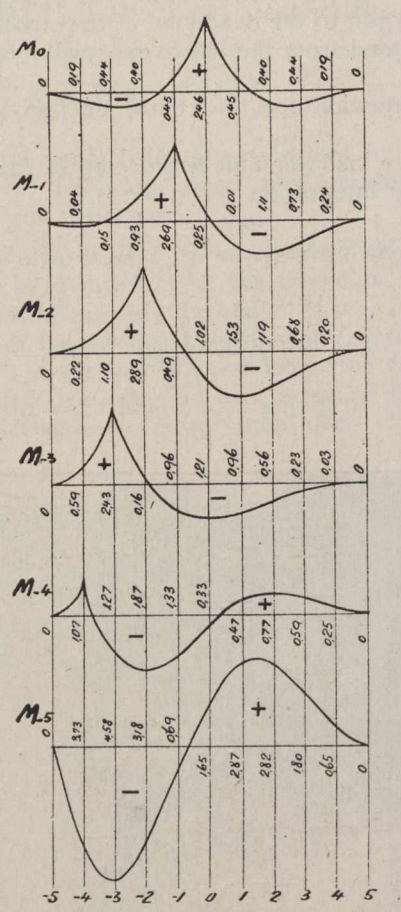

Fig. 8.

In Table I. is given the bending moments and normal forces due to the live load (M_p and N_p), to the dead load (M_g and N_g), and to the change of the temperature (M_t and N_t).

Table I.—Bending Moments (M) and Normal Forces (N).

Point.	o	1	2	3	4	5
Max. M_p	+ 34.8	+ 55.4	+ 61.7	+ 42.6	+ 40.4	+127.5 yard tons
N_p	+ 26.3	+ 33.9	+ 21.8	+ 12.7	+ 32.2	+ 42.5 tons
Min. M_p	— 30.0	— 38.7	— 59.0	— 52.2	— 63.0	—163.5 yard tons
N_p	+ 38.4	+ 30.1	+ 43.7	+ 62.3	+ 49.0	+ 40.6 tons
M_g	+ 32.3	+ 27.2	+ 12.0	— 14.7	— 52.8	—105.0 yard tons
N_g	+333.0	+337.0	+349.0	+369.0	+397.0	+435.0 tons
M_t	∓ 56.9	∓ 47.9	∓ 21.1	± 26.1	± 93.3	± 181.0 yard tons
N_t	± 21.0	± 20.8	± 20.1	± 19.0	± 17.8	± 16.3 tons
Max. M_{p+g}	+ 67.1	+ 82.6	+ 73.7	+ 27.9	— 12.4	+ 22.5 yard tons
N_{p+g}	+359.3	+370.9	+370.8	+381.7	+429.2	+477.5 tons
Min. M_{p+g}	+ 2.3	— 11.5	— 47.0	— 66.9	—115.8	—268.5 yard tons
N_{p+g}	+371.4	+367.1	+392.7	+431.3	+446.0	+475.6 tons
Max. M_{p+g+t}	+124.0	+130.5	+ 94.8	+ 54.0	+ 80.9	+203.5 yard tons
N_{p+g+t}	+338.3	+350.1	+350.7	+400.7	+447.0	+493.8 tons
Min. M_{p+g+t}	— 54.6	— 59.4	— 68.1	— 93.0	—209.1	—449.5 yard tons
N_{p+g+t}	+392.4	+387.9	+412.8	+412.3	+428.2	+459.7 tons