Block Signaling on the Chicago & North Western.

The Chicago & North Western has lately established the block system on certain of its lines in Iowa, and the total mileage now worked by the space interval is 3,810.2. An officer of the company has sent us a map which shows the whole of the company's lines and indicates the different methods of operation on different sections of the road. The map is self-explanatory. The automatic signals are all on the lines near Chicago, where is to be found the heaviest movement of traffic. The length of lines shown as worked by the telegraph block system is 3,541.5 miles, but on nearly one-half of this (1,639.5 miles) many of the offices are closed during the night and trains are run by the time interval, the block system being used only during the daytime. The lines of which the block offices are closed during the night are: Fox River switch northward to Williams Bay and westward to Freeport; Madison westward to Lancaster and Galena; Fond du Lac to Marshfield and Wassau; Clintonville northeastward to Oconto; Powers northwest to Crystal Falls; Escanaba north to Ishpeming; Belle Plaine southward

to Stark; Jeweil Junction southward and westward; Eagle Grove northward and westward; Tracy northward and westward, and a few short sections elsewhere.

Permissive block signaling is allowed as between freight trains. where necessary. On the 1,986.8 miles of less important lines,

some of them having but few trains daily, the 10-minute time interval is used, and there is no block signaling.

The mileage signaled on each division is shown in the accompanying table.

SPACE INTERVAL AND TIME INTERVAL ON THE CHICAGO & NORTH WESTERN.

| Division.	Automatic. D. T.	Telegraph. D. & N.		Teleg. Days. D. T.	Teleg. Days. S. T.	10 Mins. S. T.	Total Miles.
		D. T.	S. T.				
Iowa	138.1	350.4	....	..	59.2	149.6	559.2
Galena	138.1	....	11	..	156.9	150.9	456.9
Wisconsin	124.6	53.5	163.6	..	....	5.3	346.8
Madison	6.0	96.7	225.7	..	136.6	39.5	504.5
North Wisconsin	....	5.5	145.6	..	129.6	51.1	331.8
Sioux City	....	....	75.9	..	253.2	72.4	401.5
North Iowa	....	....	29.4	..	211.3	115.0	355.7
I. & M.	....	....	....	..	58.6	268.7	327.3
Minnesota	....	....	221.2	..*	129.9	152.9	504.0
Dakota	....	....	....	8.8	124.8	188.2	436.7
Peninsula	....	8.7	106.2	..	262.5	547.1	809.6
Ashland	....	....	405.8	..	108.1	246.1	763.0
Total	268.7	514.6	1,387.4	8.8	1,630.7	1,986.8	5,797.0

LIVE STOCK MOVEMENT.

The Chicago & North Western's line from Omaha to Chicago has for many years been one of the principal carriers of live stock to the latter city, and the uniformly good time and prompt delivery made has reflected much credit on the officers of the road. The movement is always heaviest at the beginning of the week, and deliveries at Chicago on Monday average 700 cars.

On a recent occasion, from noon of Sunday until noon of Monday, the number of stock trains arriving in Chicago by this line was 26, and of ordinary freight trains two. Adding the through and local passenger trains, the total arrivals were 57. The number of cars of live stock was 730, and of other freight 62.

The main line from Clinton to Chicago, 138 miles, is equipped with Hall automatic block signals (enclosed disks). These signals for most of the way are set from 6,000 to 7,000 ft. apart, so that during a heavy movement like that here referred to, the road is used continuously for many hours to its full capacity. To make a graphic exhibit of this movement a photograph has been prepared, from data given in the train despatcher's sheet, which shows approximately the relative positions of 36 eastbound trains throughout their movements from Clinton
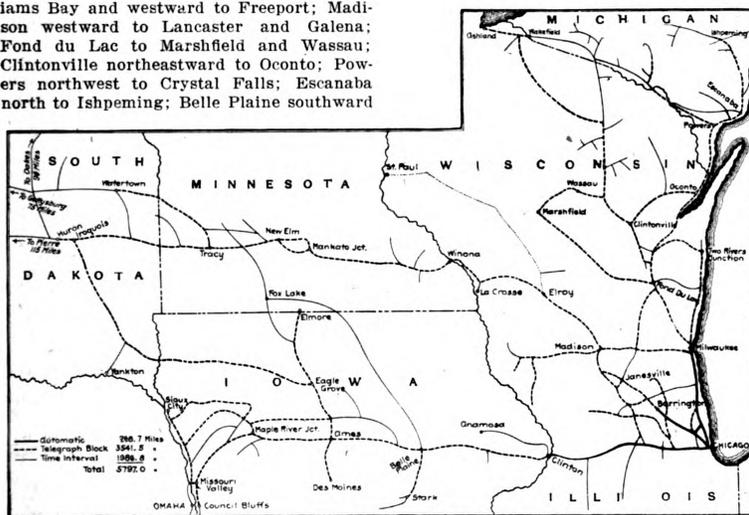
Block Signaling on the Chicago & North Western, June, 1904.
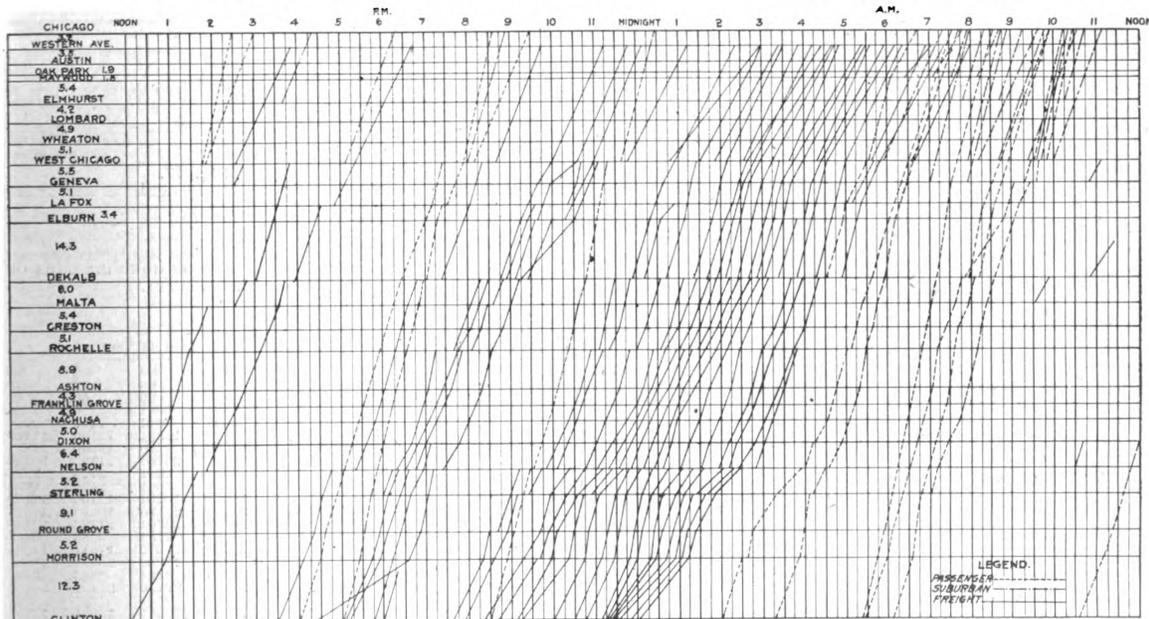
Chicago & North Western Railway—One Day's Train Movements, Clinton to Chicago.

to Chicago. A reproduction of this photograph is given herewith. This drawing does not represent the traffic on the day above mentioned, and it does not represent the precise position of the trains at all points of their respective journeys, as the lines are in their true positions only at those stations which are shown at the left of the drawing; but the intervals between each train and the one ahead of it and the one behind it are indicated with a considerable degree of accuracy. At the time this drawing was made, that portion of the line between Clinton and De Kalb was worked by manual block signals. Permissive signals were given where necessary to avoid serious delays to trains, but there were not so many of these as would appear from the drawing, for the reason that there were more block-signal stations than appear in the illustration; some were omitted in order to avoid confusing the lines in the drawing.

Steel Car Design.

V.

BY A. STUCKI.

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Box Cars with Load Carried by the Sides. Box cars with steel body framing can be designed so that the sides form a deep truss strong enough to carry all of the load, leaving the center sills to transmit only the end shocks and thus to become a backbone for the car. In the diagrams, Figs. 15 to 17, the usual forms of truss framing are shown, with the posts and braces arranged in the proper way for a car of the dimensions adopted as standard by the American Railway Association. The figures show the maximum forces, in pounds, in all of the members of the framing and were obtained by considering only those panels loaded, which, in each case, would give the maximum stress for the panel members. To cover the most severe cases and to allow for variations in the method of connecting the posts, braces and top and bottom members, the maximum allowable load for the 50-ton car was taken at 120,000 lbs. instead of the usual 110,000 lbs. and the weight of the body was assumed as 28,000 lbs. A theoretical height of panel of 100 in. was also assumed. On the diagrams, the heavy lines indicate compression and the light lines indicate tension. A low fiber stress should be chosen to allow for vibrations and vertical oscillation. The stresses in the top and bottom chords of the side trusses should not exceed 8,000 lbs.

The end pressure exerted by the load when abrupt changes in the speed of the car occur can be assumed as 10,000 lbs. at the top of the end framing and 20,000 lbs. at the bottom, for a 50-ton car and 80 per cent. and 60 per cent. of these values for the 80,000-lb. and 60,000-lb. cars, respectively. These forces, however, are usually taken up by members of the framing, which are not subjected to any great stress, and for this reason they have not been considered in calculating the stresses shown on the diagrams.

Since it is not possible to introduce diagonal braces in the door opening panels of the side trusses, an unsymmetrical load will create bending stresses in the top and bottom chords, the bending moment being

$$M = f \times \frac{\text{door opening in inches}}{4}$$

where f is the vertical component of the forces which would exist in the diagonal braces if they were introduced into the panel. The following are values of f for the three-capacity cars.

5,890 lbs. for 100,000 lb. cars with 2 intermediate doorposts.

5,119 lbs. for 100,000-lb. cars with 1 intermediate doorpost.

4,770 lbs. for 80,000-lb. cars with 2 intermediate doorposts.

4,147 lbs. for 80,000-lb. cars with 1 intermediate doorpost.

3,651 lbs. for 60,000-lb. cars with 2 intermediate doorposts.

3,175 lbs. for 60,000-lb. cars with 1 intermediate doorpost.

The bending moments in the top and bottom chords are shown on the diagrams and they are resisted by the continuous members, the deepest sections, of course, doing most of the work.

The posts and braces in addition to the direct tension and compression which they resist as members of the side truss, are subjected to cross-bending stresses induced by
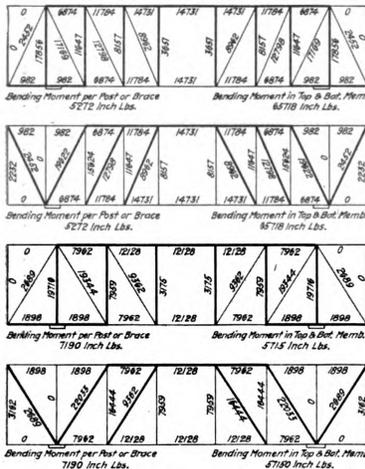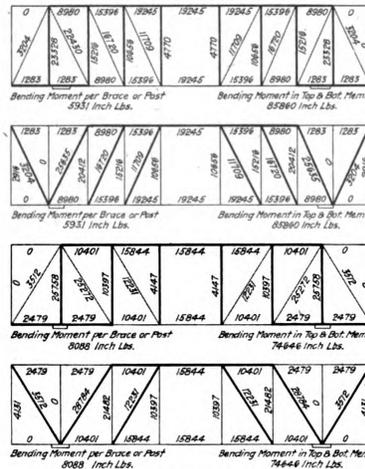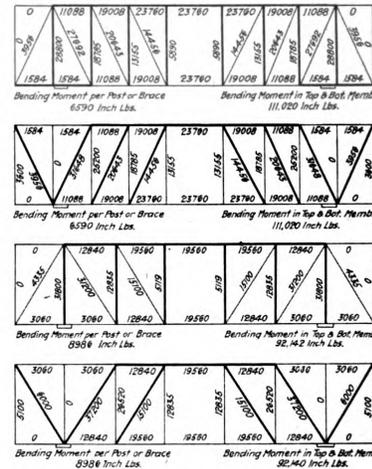

Fig. 15.   **Fig. 16.**   **Fig. 17.**

TABLE I.

FORCES IN STEEL SIDE TRUSS OF GONDOLA CARS OF 60,000 LBS. CAPACITY.
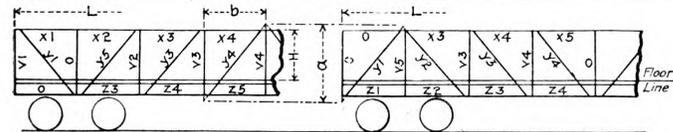
	L = 36 Feet.					L = 40 Feet.					L = 44 Feet.				
H=	3-0	3-6	4-0	4-6	5-0	3-0	3-6	4-0	4-6	5-0	3-0	3-6	4-0	4-6	5-0
A=	54	60	66	72	78	54	60	66	72	78	54	60	66	72	78
B=	54	54	54	54	54	60	60	60	60	60	66	66	66	66	66
X_1	2641	2300	2160	1981	1833	2935	2641	2392	2201	2031	3227	2904	2641	2420	2234
X_2	2641	2300	2160	1981	1833	2935	2641	2392	2201	2031	3227	2904	2641	2420	2234
X_3	13201	11880	10805	9900	9138	14688	13201	12000	11001	10155	16134	14521	13201	12100	11169
X_4	21120	19008	17280	15840	14622	23468	21120	19200	17600	16246	25812	23232	21120	19360	17871
X_5	23761	21384	19440	17821	16450	26416	23761	21612	19812	16525	29057	26151	23761	21793	20116
Z_1	2641	2300	2160	1981	1833	2935	2641	2392	2201	2031	3227	2904	2641	2420	2234
Z_2	2641	2300	2160	1981	1833	2935	2641	2392	2201	2031	3227	2904	2641	2420	2234
Z_3	13201	11880	10805	9900	9138	14668	13201	12000	11001	10155	16134	14521	13201	12100	11169
Z_4	21120	19008	17280	15840	14622	23468	21120	19200	17600	16246	25812	23232	21120	19360	17871
Z_5	23761	21384	19440	17821	16450	26416	23761	21612	19812	16525	29057	26151	23761	21793	20116
Y_1	3734	3568	3424	3309	3224	3920	3734	3568	3439	3330	4179	3930	3734	3583	3461
Y_2	18672	17519	17121	16542	16119	19644	18672	17839	17187	16647	20926	19644	18672	17911	17301
Y_3	11202	10702	10272	9925	9670	11786	11202	10702	10313	9988	12533	11986	11202	10747	10383
Y_4	3734	3568	3424	3309	3224	3930	3734	3568	3439	3330	4179	3930	3734	3583	3461
Y_5	22406	21087	20545	19851	19343	23574	22406	21407	20626	19977	25105	23574	22406	21494	20762
V_1	2641	2641	2641	2641	2641	2641	2641	2641	2641	2641	2641	2641	2641	2641	2641
V_2	13201	13201	13201	13201	13201	13201	13201	13201	13201	13201	13201	13201	13201	13201	13201
V_3	7919	7919	7919	7919	7919	7919	7919	7919	7919	7919	7919	7919	7919	7919	7919
V_4	5280	5280	5280	5280	5280	5280	5280	5280	5280	5280	5280	5280	5280	5280	5280
V_5	16000	16000	16000	16000	16000	16000	16000	16000	16000	16000	16000	16000	16000	16000	16000