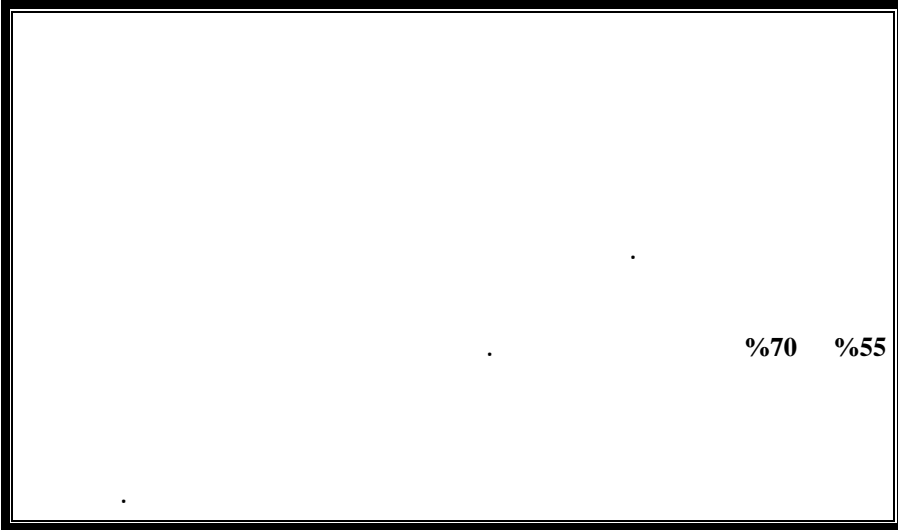


1



1

continuous welded railway CWR

Buckling

compressive longitudinal forces

Neutral temperature

%60 %40

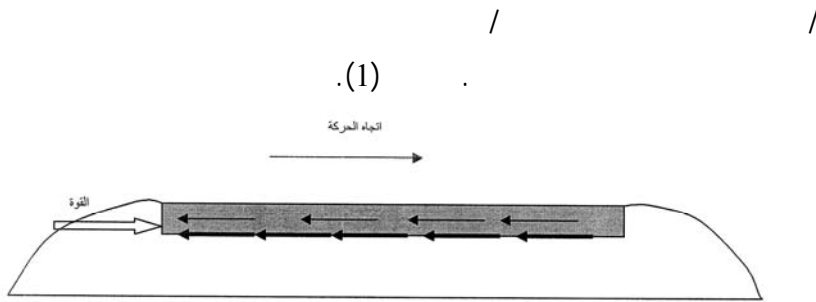
lateral resistance

CWR Stability

. 2020

lateral resistance (q)

-2



:1

:

.() -

.() -

.() -

. 50 40

." "

ΔR

Δl

:

-
-
-

$$F = \alpha \cdot E \cdot A \cdot \Delta T \quad (1)$$

$$\alpha = 11,5 \cdot 10^{-6} :$$

E

()

A

ΔT

Fo

$$F_o = \left(\alpha \cdot \Delta T - \frac{\Delta R}{R} \right) E \cdot A \quad (2)$$

$$q \geq \frac{F_o}{R} \quad (3)$$

[1]

:
:
:

(260 N/cm) 3438 lb/sleeper [2]

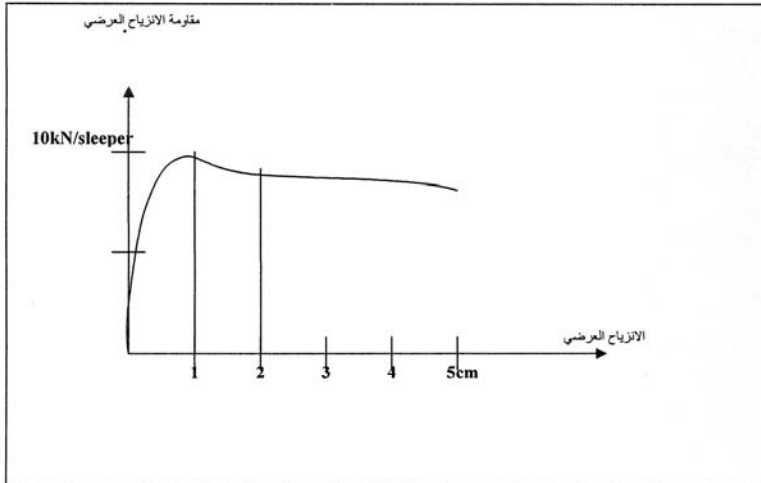
(150 N/cm)1869 lb/sleeper

(160 N/cm) 1938 lb/tie

UIC60 AREA 131 :

1664 1° و 3° 60

.kips 122 97



:2

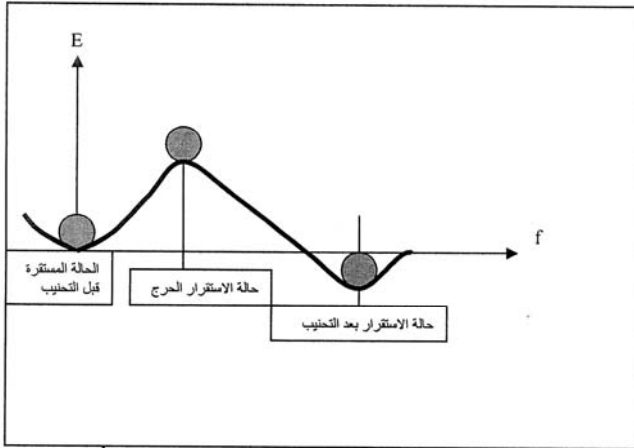
:

-3

f

$$\frac{\partial E}{\partial f} = 0 \oplus \frac{\partial^2 E}{\partial f^2} < 0 \quad (4)$$

$$\frac{\partial E}{\partial f} = 0 \oplus \frac{\partial^2 E}{\partial f^2} > 0 \quad (5)$$



:3

. [4] [3] 1959

:

%15 %10

-

-

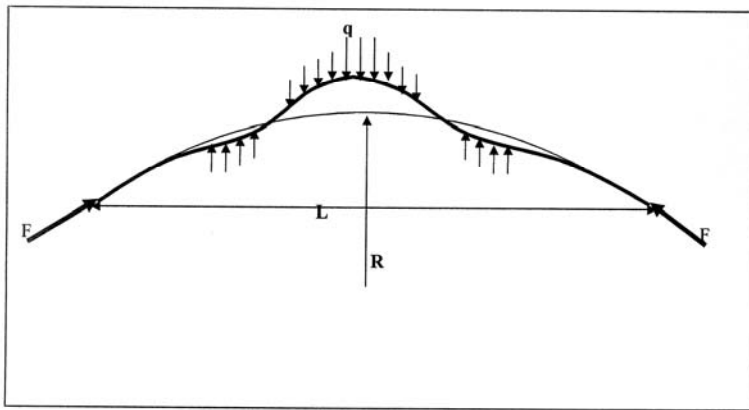
%30 %20

%70 %55

(2)

1

(4)



:4

$$F = (K_1 \cdot \frac{E.I}{L^2} + K_2 \cdot q_0 \cdot \frac{L^2}{fb} + K_3 \cdot \frac{q - q_0}{y_0} \cdot L^2 + K_4 \cdot \frac{M_0 \cdot L}{a \cdot fb}) \cdot \frac{fb}{fg} / (1 + K_5 \cdot \frac{L^2}{fg \cdot R}) \quad (6)$$

5 3

$$F = (K_1 \cdot \frac{E.I}{L^2} + K_2 \cdot q \cdot \frac{L^2}{fb} + K_4 \cdot \frac{Mo.L}{a.fb}) \cdot \frac{fb}{fg} / (1 + K_5 \cdot \frac{L^2}{fg.R}) \quad (7)$$

:

()

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$$\frac{dF}{dL} = 0$$

Lcr

Qbasic

1

25

5

F
E
I
L
q
qo
Yo
Mo
a
fg
fb
R
Ki

η

1,3

$$\eta = \frac{F_{cr}}{F_{max}} \geq 1.3 \quad (8)$$

[6]

:

2 76,86 :) UIC 60 -
 (Ix=3055 cm⁴, Iy=512,9 cm⁴ / 59,458

60 2,60 B70 -

4 Vossleh Pandroll -

4 4 4

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30 .() -

/ 250 35 / 160

. 50

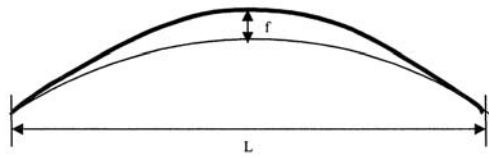
2 (5) -

5000 500 -

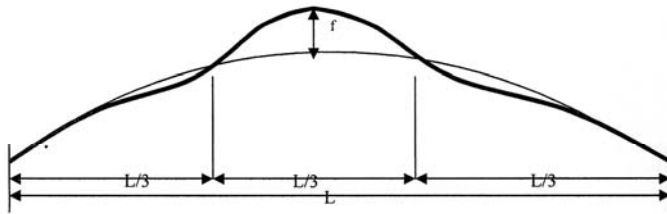
4 / 160 60 -

10

$\Delta T_{max} = 50$ -



التشوه في المنحنيات - نموذج 1



التشوه في المنحنيات - نموذج 2

[4]

:5

:

-4

$$20 \times (q) \quad 6 \times (R) \quad 6 \} \quad 2880$$

$$\{ 2880 = 2 \times (f) \quad 2 \times (L)$$

f=3 cm**1-1-4**

	q	60	80	100	120	140	160
R=500	Lcr(m)	9	8	8	7	7	7
	Fcr(kN)	1753	2054	2326	2568	2790	3012
	η	0.95	1.11	1.26	1.39	1.51	1.63
	q	60	80	100	120	140	160
R=1000	Lcr(m)	8	8	7	7	7	6
	Fcr(kN)	2059	2373	2635	2884	3134	3336
	η	1.11	1.28	1.43	1.56	1.70	1.81
	q	60	80	100	120	140	160
R=1500	Lcr(m)	8	7	7	7	6	6
	Fcr(kN)	2171	2488	2748	3008	3248	3443
	η	1.18	1.35	1.49	1.63	1.76	1.87
	q	60	80	100	120	140	160
R=2000	Lcr(m)	8	7	7	7	6	6
	Fcr(kN)	2232	2543	2808	3074	3301	3499
	η	1.21	1.38	1.52	1.67	1.79	1.90
	q	60	80	100	120	140	160
R=2500	Lcr(m)	8	7	7	7	6	6
	Fcr(kN)	2270	2576	2846	3115	3333	3534
	η	1.23	1.40	1.54	1.69	1.81	1.92
	q	60	80	100	120	140	160
R=5000	Lcr(m)	8	7	7	6	6	6
	Fcr(kN)	2351	2647	2923	3196	3401	3605
	η	1.27	1.43	1.58	1.73	1.84	1.95

f=5 cm

2-1-4

R=500	q	60	80	100	120	140	160
	Lcr(m)	10	10	9	8	8	8
	Fcr(kN)	1528	1787	2012	2232	2415	2597
	η	0.83	0.97	1.09	1.21	1.31	1.40
R=1000	q	60	80	100	120	140	160
	Lcr(m)	10	9	8	8	8	7
	Fcr(kN)	1753	2011	2253	2454	2654	2850
	η	0.95	1.09	1.22	1.33	1.44	1.54
R=1500	q	60	80	100	120	140	160
	Lcr(m)	9	9	8	8	8	7
	Fcr(kN)	1838	2096	2330	2538	2745	2926
	η	0.99	1.14	1.26	1.38	1.49	1.59
R=2000	q	60	80	100	120	140	160
	Lcr(m)	9	9	8	8	8	7
	Fcr(kN)	1878	2142	2371	2582	2793	2965
	η	1.02	1.16	1.29	1.40	1.51	1.61
R=2500	q	60	80	100	120	140	160
	Lcr(m)	9	9	8	8	8	7
	Fcr(kN)	1903	2170	2396	2609	2822	2989
	η	1.03	1.18	1.30	1.41	1.53	1.62
R=5000	q	60	80	100	120	140	160
	Lcr(m)	9	9	8	8	7	7
	Fcr(kN)	1955	2229	2447	2665	2871	3039
	η	1.06	1.21	1.32	1.44	1.56	1.65

f=3 cm

1-2-4

q		60	80	100	120	140	160
R=500	Lcr(m)	19	18	17	16	15	15
	Fcr(kN)	1770	2047	2294	2518	2726	2924
	η	0.96	1.11	1.24	1.37	1.48	1.59
q		60	80	100	120	140	160
R=1000	Lcr(m)	18	17	16	15	14	14
	Fcr(kN)	2005	2285	2533	2758	2973	3163
	η	1.09	1.24	1.37	1.49	1.61	1.71
q		60	80	100	120	140	160
R=1500	Lcr(m)	18	16	15	15	14	14
	Fcr(kN)	2093	2371	2622	2844	3054	3249
	η	1.13	1.29	1.42	1.54	1.66	1.76
q		60	80	100	120	140	160
R=2000	Lcr(m)	17	16	15	15	14	14
	Fcr(kN)	2137	2414	2664	2889	3096	3294
	η	1.16	1.31	1.44	1.57	1.68	1.79
q		60	80	100	120	140	160
R=2500	Lcr(m)	17	16	15	15	14	14
	Fcr(kN)	2163	2440	2689	2917	3122	3322
	η	1.17	1.32	1.46	1.58	1.69	1.80
q		60	80	100	120	140	160
R=5000	Lcr(m)	17	16	15	14	14	14
	Fcr(kN)	2217	2494	2742	2973	3176	3379
	η	1.20	1.35	1.49	1.61	1.72	1.83

f=5 cm

2-2-4

q		60	80	100	120	140	160
R=500	Lcr(m)	23	21	20	19	18	17
	Fcr(kN)	1520	1757	1970	2162	2339	2505
	η	0.82	0.95	1.07	1.17	1.27	1.36
q		60	80	100	120	140	160
R=1000	Lcr(m)	21	20	19	18	17	17
	Fcr(kN)	1692	1931	2144	2336	2515	2684
	η	0.92	1.05	1.16	1.27	1.36	1.45
q		60	80	100	120	140	160
R=1500	Lcr(m)	21	19	18	18	17	16
	Fcr(kN)	1753	1994	2206	2400	2576	2746
	η	0.95	1.08	1.20	1.30	1.39	1.49
q		60	80	100	120	140	160
R=2000	Lcr(m)	21	19	19	17	17	16
	Fcr(kN)	1786	2024	2242	2432	2608	2776
	η	0.97	1.09	1.21	1.32	1.41	1.50
q		60	80	100	120	140	160
R=2500	Lcr(m)	21	19	18	17	17	16
	Fcr(kN)	1806	2043	2255	2450	2627	2794
	η	0.98	1.11	1.22	1.33	1.42	1.51
q		60	80	100	120	140	160
R=5000	Lcr(m)	20	19	18	17	17	16
	Fcr(kN)	1844	2081	2293	2487	2667	2832
	η	1.00	1.13	1.24	1.53	1.44	1.53

: 3-2-4

2-2-4

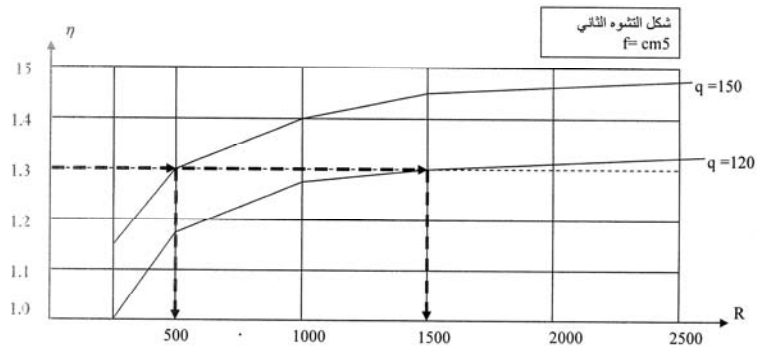
(7 6)

(6)

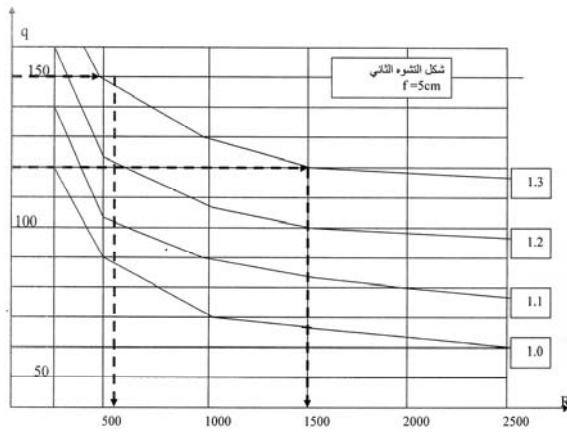
(7)

(6 و 7).

500م / 150
 1500م / 120



6: q



7:

: -5

/ 9 . -
120 / 7.5 / 150 -
/ (50) -
1500 150 500 -
.120 -
2500 -
.

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