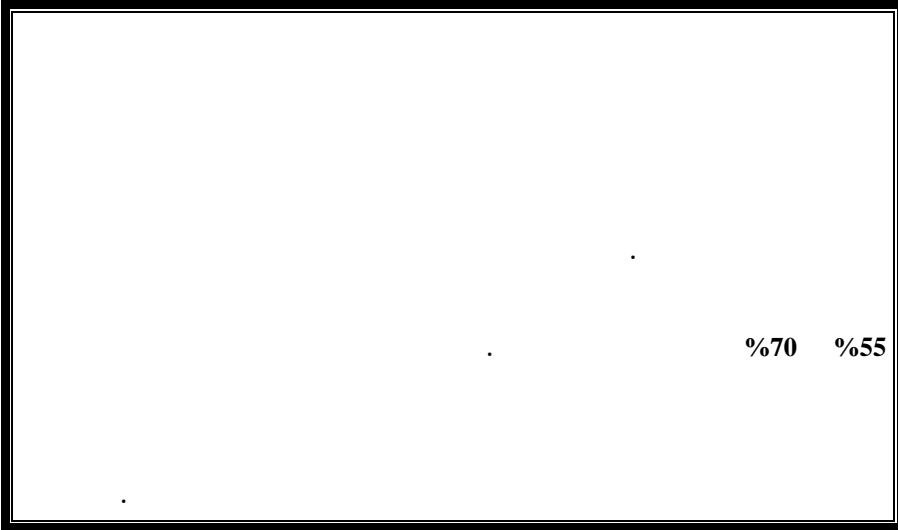


1



1

continuous welded railway CWR

Buckling

compressive longitudinal forces

Neutral temperature

%60    %40

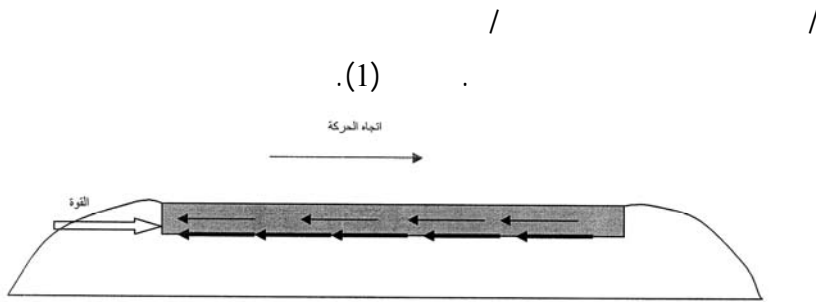
lateral resistance

CWR Stability

. 2020

lateral resistance (q)

-2



:1

:

.( ) -

.( ) -

.( ) -

. 50 40

." "

$\Delta R$

$\Delta l$

:

-  
-  
-

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

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

E

( )

A

$\Delta T$

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]

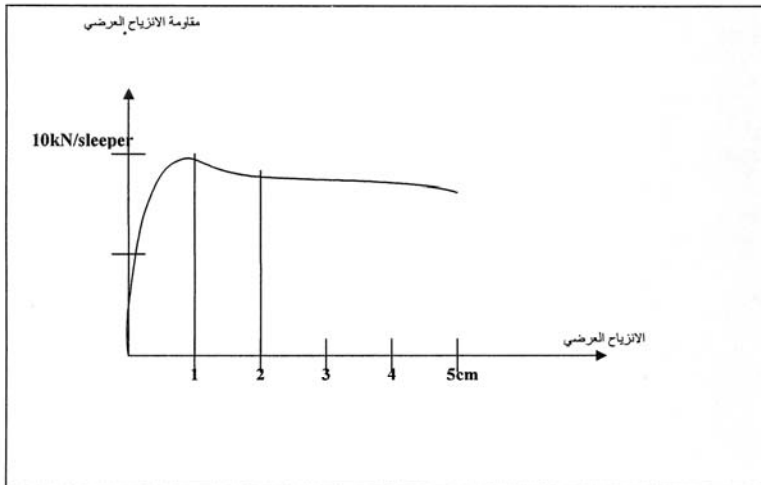
(150 N/cm)1869 lb/sleeper

(160 N/cm) 1938 lb/tie

UIC60 AREA 131 :

1664 1° و 3° 60

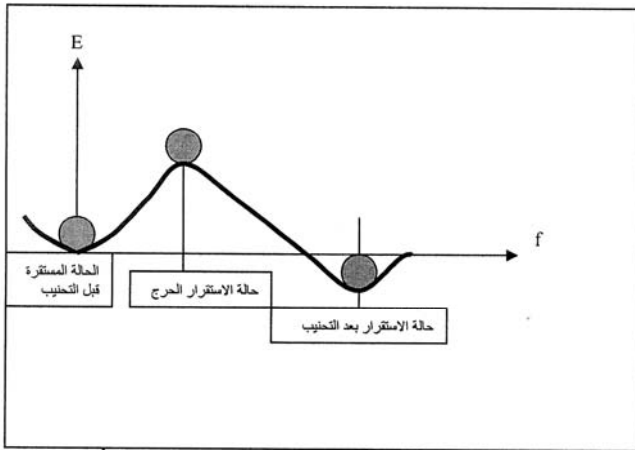
.kips 122 97



:2

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

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



:3

. [4] [3] 1959

%15    %10

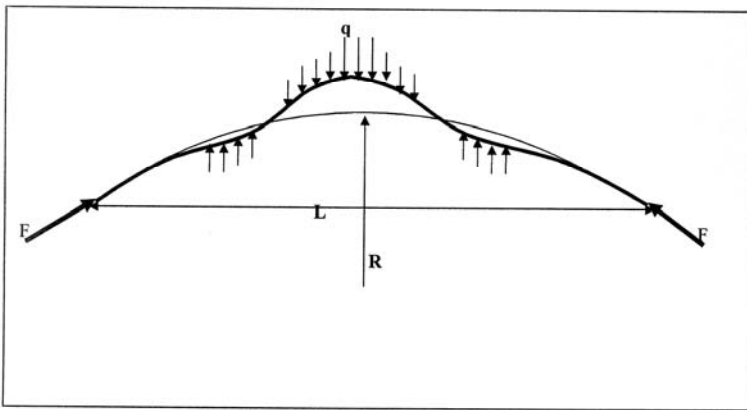
%30    %20

%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

---


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

:

( )

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

( )

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

Lcr

Qbasic

1

25

5



$\eta$

1,3

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

[6]

:

2 76,86 : ) UIC 60 -  
 (Ix=3055 cm<sup>4</sup>, Iy=512,9 cm<sup>4</sup> / 59,458

60 2,60 B70 -

4 Vossleh Pandroll -

4 4 4

.(

30 .( ) -

/ 250 35 / 160

. 50

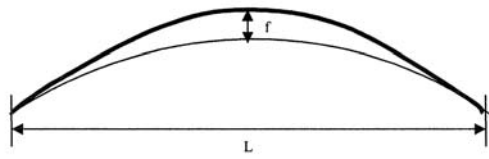
2 (5) -

5000 500 -

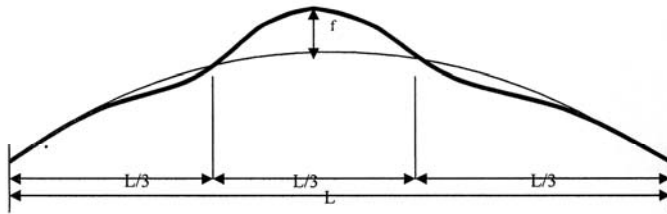
4 / 160 60 -

10

$\Delta T_{max} = 50$  -



التشوه في المنحنيات - نموذج 1



التشوه في المنحنيات - نموذج 2

[4]

:5

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-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**

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

**f=5 cm**

**2-1-4**

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

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
	$\eta$	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
	$\eta$	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
	$\eta$	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
	$\eta$	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
	$\eta$	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
	$\eta$	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
	$\eta$	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
	$\eta$	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
	$\eta$	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
	$\eta$	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
	$\eta$	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
	$\eta$	1.00	1.13	1.24	1.53	1.44	1.53

: 3-2-4

2-2-4

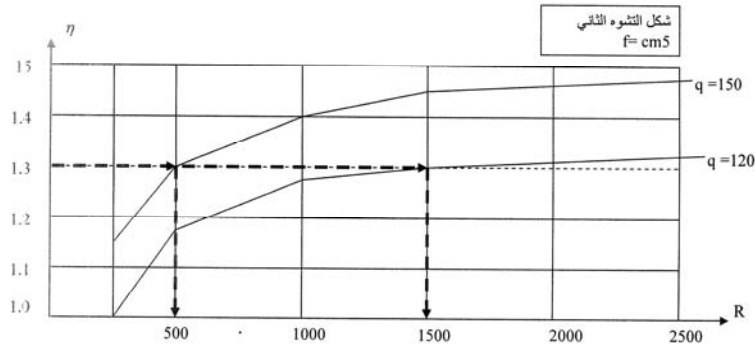
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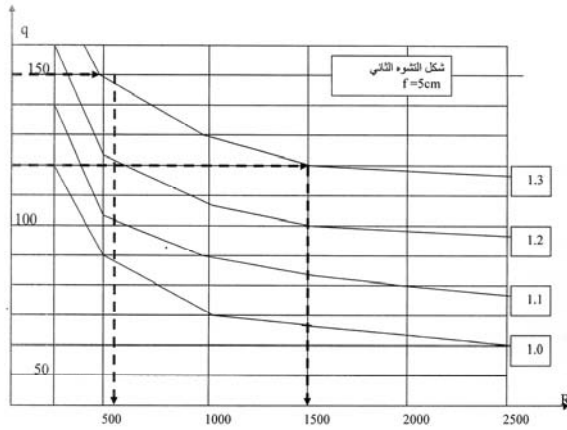
(7)

(6 و 7).

500م / 150  
 1500م / 120



6: q



7:

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: -5

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