load was finally increased to 60 tons, and this was left until July 14th. The total variation for May 14th to July 14th, when the test was closed, was .012 which was the apparent settlement. Below is the data on driving and the readings taken from June 8th to July 14th with a load of 60 tons.

Data on Driving.

Diameter of pile	16 in.
Length of pile	19 ft. 7 in.
Hammer weight	3300
Drop of hammer	8 ft.
Penetration in last 8 blows	1¾ in.
Number of blows	300.
Concrete mixture	1 : 2½ : 5
Date of driving	May 3rd, 1910.
Test started	May 13th, 1910.

Elevation Taken on Concrete Pile Test at Pacific Mill's New Plant, So. Lawrence—Load 60 Tons.

Date. 1910.	Elevation.		Date. 1910	Elevation	
June 8	3.619	(windy)	June 27	3.6112	
9	3.619		28	3.6197	
12	3.6189		29	3.6186	
13	3.6175		30	3.6135	(windy)
14	3.6163		July 1	3.6175	
15	3.6167		2	3.6180	
16	3.6152		5	3.6194	
17	3.615		6	3.6189	
18	3.6145		7	3.6165	pile
20	3.6154		8	3.6183	driver
21	3.6146		9	3.6206	working
22	3.6161		10	3.6207	nearby
23	3.6114		11	3.6205	(windy)
24	3.6188		12	3.6186	
25	3.6162		13	3.6214	
			14	3.6160	

RESULTS OF INVESTIGATION OF STRESSES IN LOCUST STREET BRIDGE AT DES MOINES, IOWA.*

By C. E. Goodin, C.E.

The Locust street bridge in Des Moines is a five-span reinforced concrete arch structure across the Des Moines river. It consists of a 72-foot, an 82-foot, a 92-foot, an 82-foot, and a 72-foot span in consecutive order.

On making a personal inspection of the bridge as it now stands it was found that there was a fine transverse crack on the under side of the arch ring near the crown in each of the 72-foot spans. We were unable to inspect the 82-foot and 92-foot spans.

To account for the cracks it was decided to investigate the stresses in the bridge.

In figuring the stresses the dead weight of the earth filling was assumed to be 100 pounds per cubic foot and of concrete 150 pounds per cubic foot. A live load of 150 pounds per square foot was used.

Temperature stresses were figured for a range of 40 degrees each way from the mean. A range of 40 degrees was taken because the results of actual measurements of the temperatures in a concrete arch, made in the vicinity of the college, indicated that the range was at least that much, and a little more in some cases.

* The Iowa Engineer.

Rib shortening stresses were also calculated. The maximum stresses were as follows:

72-FOOT SPANS

Point	Compression in Concrete	Tension in Steel
B3-R-1	1300 lbs. per sq. in.	54000 lbs. per sq. in.
B1-R-3	1150 lbs. per sq. in.	49000 lbs. per sq. in.
B1-R-6	500 lbs. per sq. in.	10000 lbs. per sq. in.
B1-R-Spr	315 lbs. per sq. in.	15500 lbs. per sq. in.

82-FOOT SPANS

Point	Compression in Concrete	Tension in Steel
B3-R-1	1250 lbs. per sq. in.	44000 lbs. per sq. in
B1-R-3	1100 lbs. per sq. in.	39500 lbs. per sq. in.
B1-R-6	550 lbs. per sq. in.	7500 lbs. per sq. in.
B1-R-Spr	335 lbs. per sq. in.	15000 lbs. per sq. in.

92-FOOT SPANS

Point	Compression in Concrete	Tension in Steel
B3-R-1	1390 lbs. per sq. in.	56000 lbs. per sq. in.
B1-R-3	1250 lbs. per sq. in.	49000 lbs. per sq. in.
B1-R-6	550 lbs. per sq. in.	9000 lbs. per sq. in.
B1-R-Spr	490 lbs. per sq. in.	32000 lbs. per sq. in.

B1 equals load on right half.
B2 equals full live load.
B3 equals live load ¼-¼ point.

R equals right. 1-3-6, etc., are points of application of loads, numbering from zero at the crown of the arch to No. 8, left and right. Spr. equals springing.

From the table of stresses it will be seen that, under the assumed loadings and temperature stresses, in the 72-foot spans the steel is stressed up to 54000 pounds per square inch, and the concrete up to 1300 pounds per square inch.

As the working stress in steel is usually taken as 16000 pounds per square inch and in concrete from 600 to 800 pounds per square in, according to the "elastic theory," the structure is much too light for the loading and temperature variation assumed.

As the cracks were found at the same points as the computed high stresses, the correctness of the range of temperature used and that of the "elastic theory" followed in the computation are evidently confirmed.

While there is much talk against the "elastic theory," mainly on the part of contractors who wish to build light bridges, it is generally found that when bridges are designed according to the theory they prove safe and substantial, when a sufficient range of temperature is used in the computations.

WATER POWER ON THE DANUBE.

Two great projects for employing water power for the generation of electric power are now under consideration in Hungary and Croatia. One, due to Albert Bass & Company, of Basel, is to use the Danube in its flow from Pressburg to Raab, a distance of about 40 miles in West Hungary. A navigable canal is to be dug for navigation and irrigation and three reservoirs are to be made, at Pressburg, Wieselburg and Raab, respectively, to supply 40,000 h.p. for driving dynamos. The total cost will be nearly two millions sterling. The other proposal is to utilize water power at Zeng on the Adriatic coast of Croatia. Here from 60,000 to 80,000 h.p. can be got to supply Fiume and the rest of the Austrian coast with light and power, and especially for railway traction. The cost of this larger undertaking would approach £4,000,000.