CONTINUOUSLY REINFORCED CONCRETE PAVEMENT: WELDED BAR MAT REINFORCEMENT

MICHIGAN HIGHWAY RESEARCH LABORATORY SECTION

MICHIGAN DEPARTMENT OF STATE HIGHWAYS

CONTINUOUSLY REINFORCED CONCRETE PAVEMENT: WELDED BAR MAT REINFORCEMENT

J. E. Simonsen

Research Laboratory Section
Testing and Research Division
Research Project 61 F-64(1)
Research Report No. R-703

State of Michigan
Department of State Highways
Lansing, June 1969

CONTINUOUSLY REINFORCED CONCRETE PAVEMENT:
WELDED BAR MAT REINFORCEMENT

This report has been prepared in answer to a request from D. E. Jones, Acting Division Engineer, Bureau of Public Roads to H. E. Stafseth, State Highway Director, dated March 19, 1969.

Four sections of I 75 in the Detroit area were selected for this study; three sections constructed with welded deformed bar mat reinforcing and one section with welded deformed wire mat reinforcing. The wire reinforced section was included in order to compare the performance of the two reinforcement types.

Project and construction information pertaining to each test section are summarized in Table 1. All sections consist of a 9-in. uniform concrete slab with a steel percentage of 0.7. Sections 1 and 2 consist of three 12-ft lanes in each roadway, whereas Sections 3 and 4 have four 12-ft lanes in each roadway.

To obtain quantitative data on crack spacing and surface crack width, eight sub-sections of the outside traffic lane, each 1000 ft long, were selected for measurements. Since it was necessary to close these areas to traffic while performing the measurements, the areas were selected such that interference with traffic would be minimum. The areas selected were void of end-of-pour joints and of exit or entrance ramps. The location of the sub-sections within each section were as follows:

Section No.	Sub-Section No.	Location (Station to Station)	Roadway
1	1	563-573	northbound
	2	645-655	northbound
	3	571-581	southbound
2	4	872-882	northbound
	5	933-943	northbound
	6	869-879	southbound
3	7	1125-1135	northbound
4	8	1158-1168	northbound

Transverse cracks in continuously reinforced concrete pavements are of an erratic nature. For example, some cracks in the traffic lane extend across the full lane width, some originate at either lane edge, and either terminate, join other cracks, or divide into two cracks before reaching the opposite edge, and some originate and end without reaching either lane edge. Therefore, in order to determine the crack spacing in this type of pavement it is necessary to define which type of crack is to be counted. In this study, any transverse crack greater than six feet in length (half-lane width) regardless of where it originated or ended was counted as a full lane-width crack.

In each sub-section, approximately ten percent of the cracks were randomly selected for surface crack width measurements. These measurements were taken with an optical scale microscope capable of measuring to 0.001 in. Since the actual crack width at the surface is affected by the degree of localized surface spalling at the crack, a one foot length of crack was selected near the pavement edge for each crack, and three surface crack width measurements were taken within this one foot length. The smallest measurement was selected as being the most representative of the actual slab separation near the surface and was used in plotting the crack-width frequency distributions. These values would then be smaller than the width of the crack at the surface which includes the spalling effect, and greater than the width of crack at the depth of the reinforcing steel.

Histograms of crack spacing and surface crack widths for the four sample sections are shown in Figures 1 through 4. With the exception of Section 2, (sub-sections 4, 5, and 6) the mean crack spacing and crack spacing distributions of the remaining two bar mat reinforced sections and the wire mesh reinforced section are essentially the same. The bar mat reinforced section 2 had a mean crack spacing of 4.1 ft as opposed to an average of 6.0 ft for the other three sections. Moreover, it can be seen from Figure 2 that the crack spacing distribution is significantly different than the other section, in that about 77 percent of the crack spacings are less than six feet and about 1 percent are greater than ten feet. Since crack development in a continuously reinforced concrete pavement is primarily a function of the temperature gradient and initial concrete curing conditions to which it is subjected, the greater number of cracks in the Section 2 sample, which was constructed in late summer, reflects the more severe temperature environment.

No significant differences can be attributed to any of the four sample sections with respect to surface crack widths. The average crack widths of these sections ranged from 0. 014 to 0. 017 in., with no crack widths exceeding 0. 040 in., and with about 55 to 72 percent of the crack widths being less than 0. 020 inches.

In addition, an inspection of the entire length of all four sections was made. No unusual crack spacing intervals were noted nor was there any evidence of excessive crack widths. It should be pointed out that in both Sections 1 and 2, there have been failures in the two outside lanes in various areas. These failures were the result of malfunction of equipment and related construction problems at the time of placement. In no case has there been any evidence that the pavement reinforcement contributed to any of these failures.

On the basis of the data presented, and the present condition and age of this pavement, there is no indication that the method of fabrication of the bar mat reinforcement has any effect on the pavement performance.

TABLE 1
PROJECTS AND CONSTRUCTION INFORMATION

Section Number	Project Number		Length, mi	Reinforcement Type	Mat Size		Construction Period	Approximate Age, yrs
	Federal	State			Length, ft	Width, ft		
1	I-75-1(66)38 I-75-1(70)40	BI 82191E-C17, 18 BI 82191G-C20, H-C21	4.039	Bar Mat	30	12	Oct-Nov '65	3.5
2	I-75-1(77)44	I 82194A-C12, B-C13, D-C14	1.733	Bar Mat	30	12	Aug-Sept '66	2.5
3	I-75-1(95)50	BI 82194J-C23	0.334	Bar Mat	30	12	Oct '66	2.5
4	I-75-1(86)49	BI 82194H-C24, I-C22	0.675	Wire Mat	30	4	Oct '66	2.5

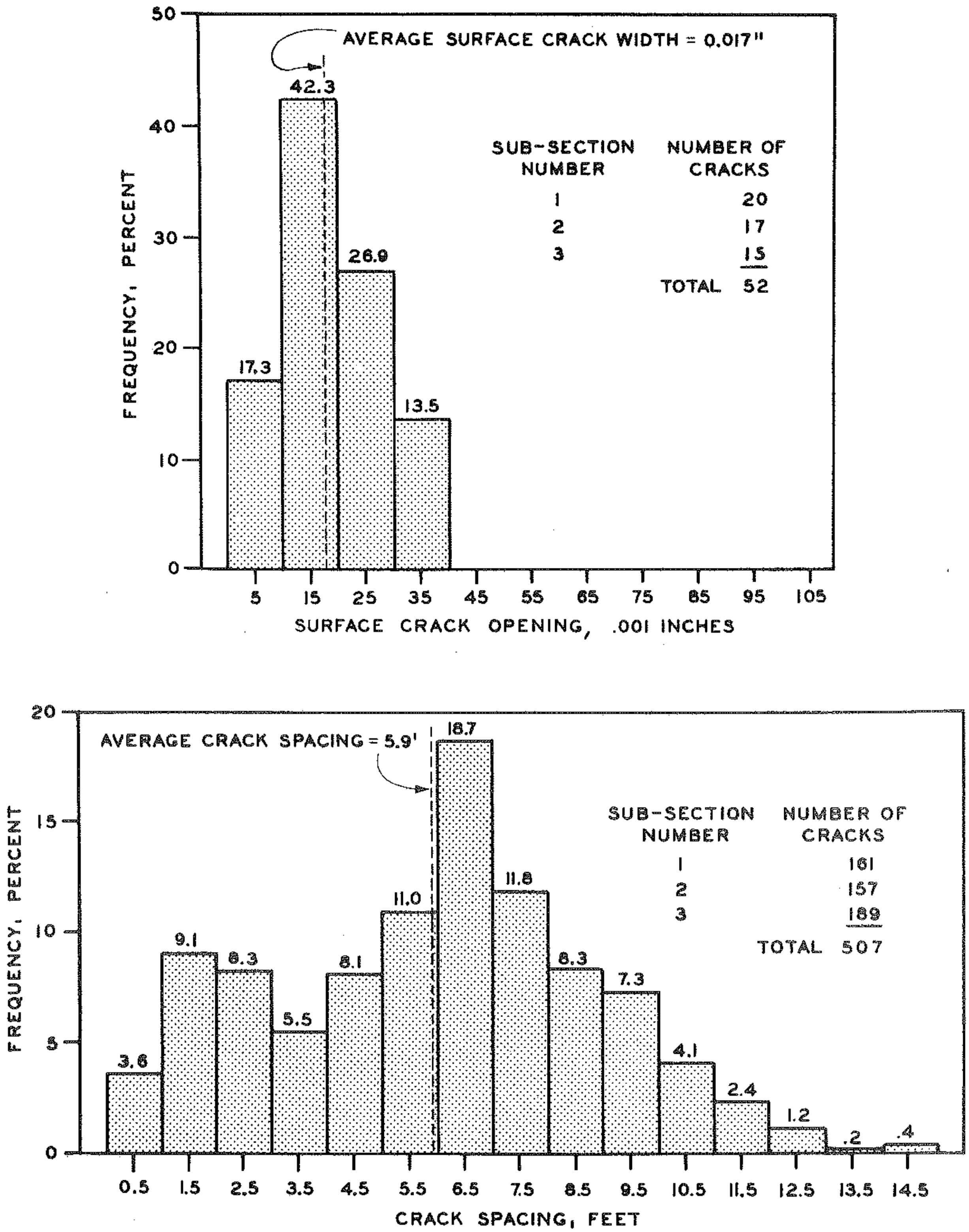

Figure 1. Frequency distribution of crack spacing and surface crack widths in 3-1/2 year old pavement (Bar Mat Reinforcement).

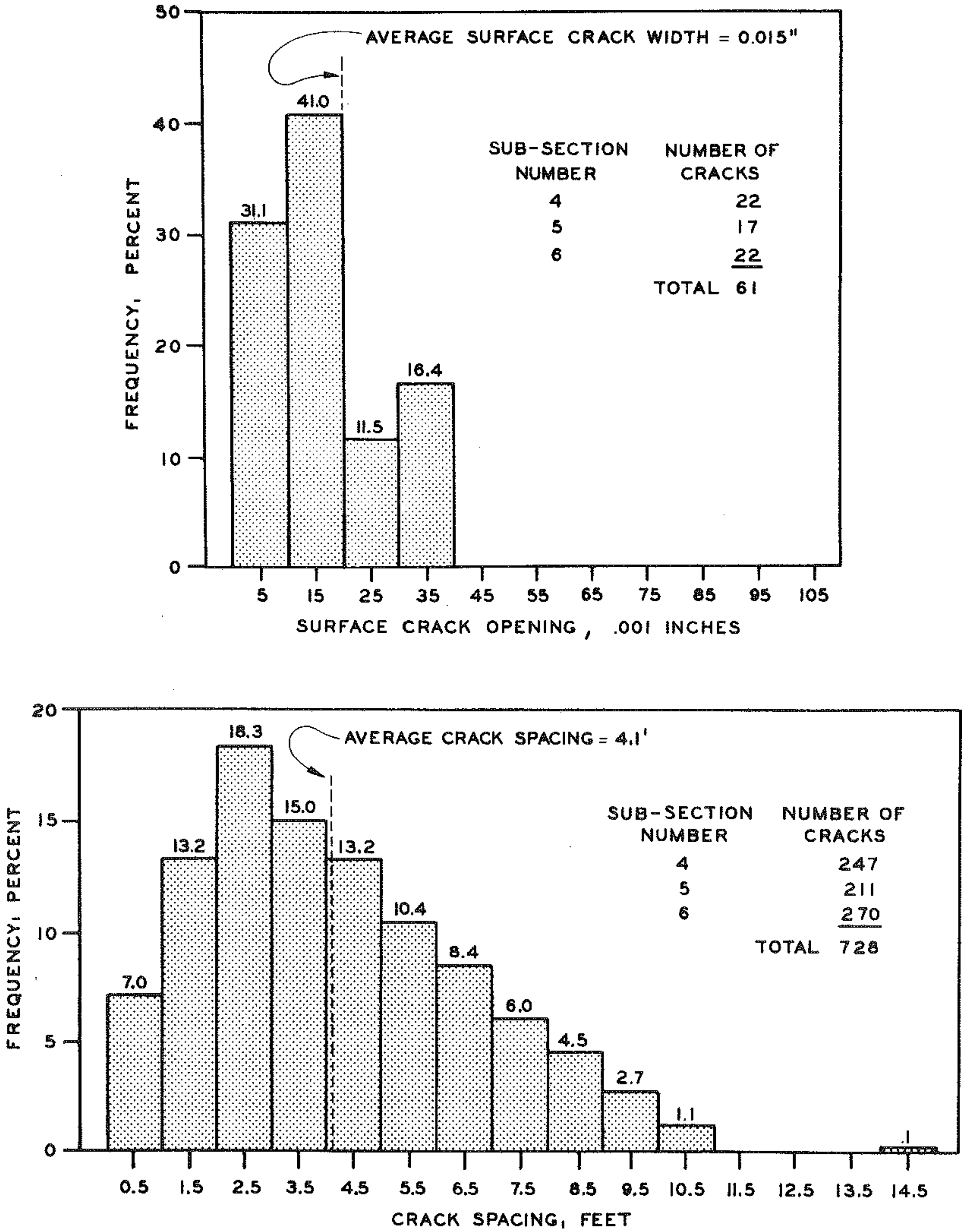

Figure 2. Frequency distribution of crack spacing and surface crack widths in 2-1/2 year old pavement (Bar Mat Reinforcement).

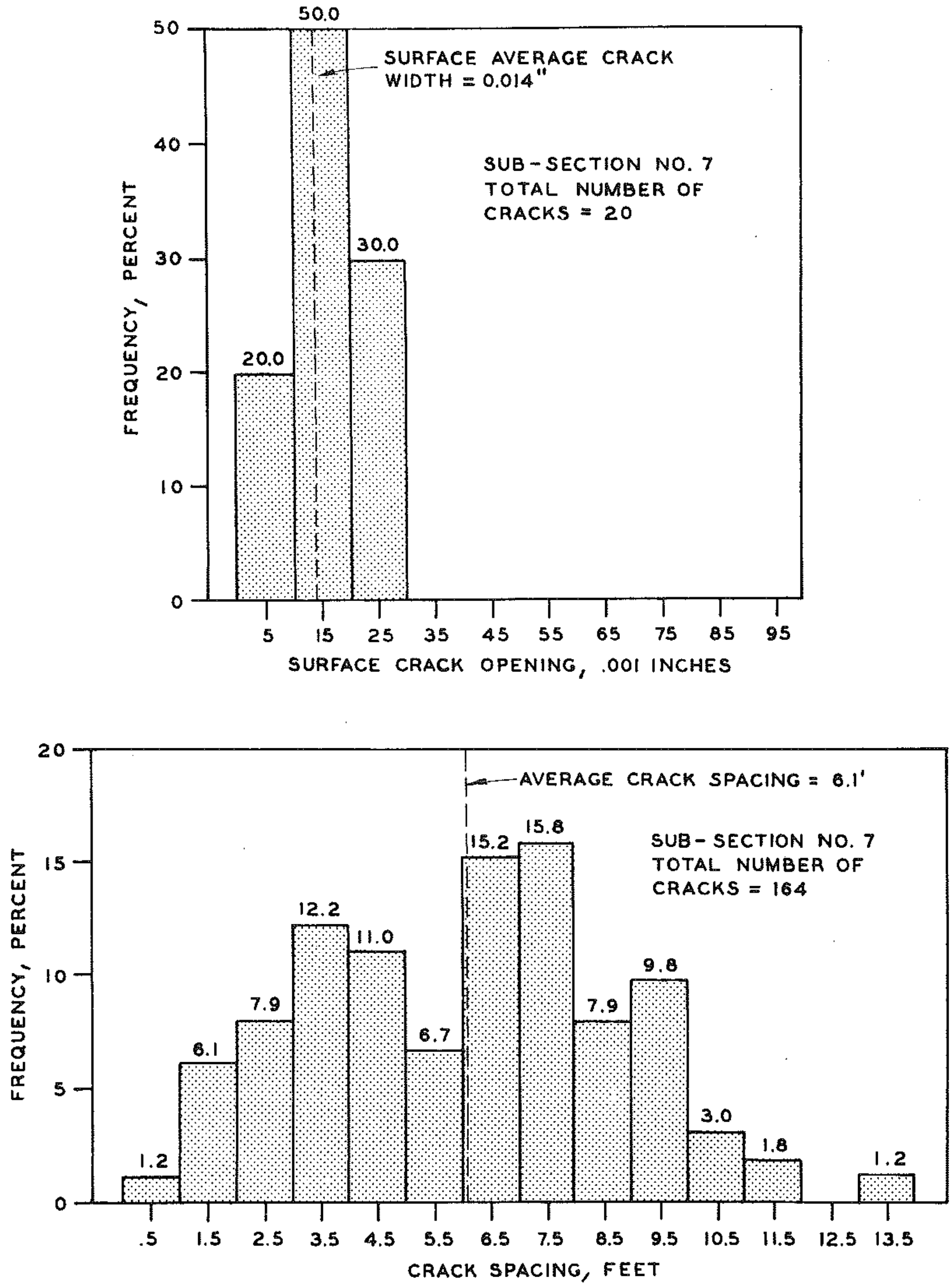

Figure 3. Frequency distribution of crack spacing and surface crack widths in 2-1/2 year old pavement (Bar Mat Reinforcement).

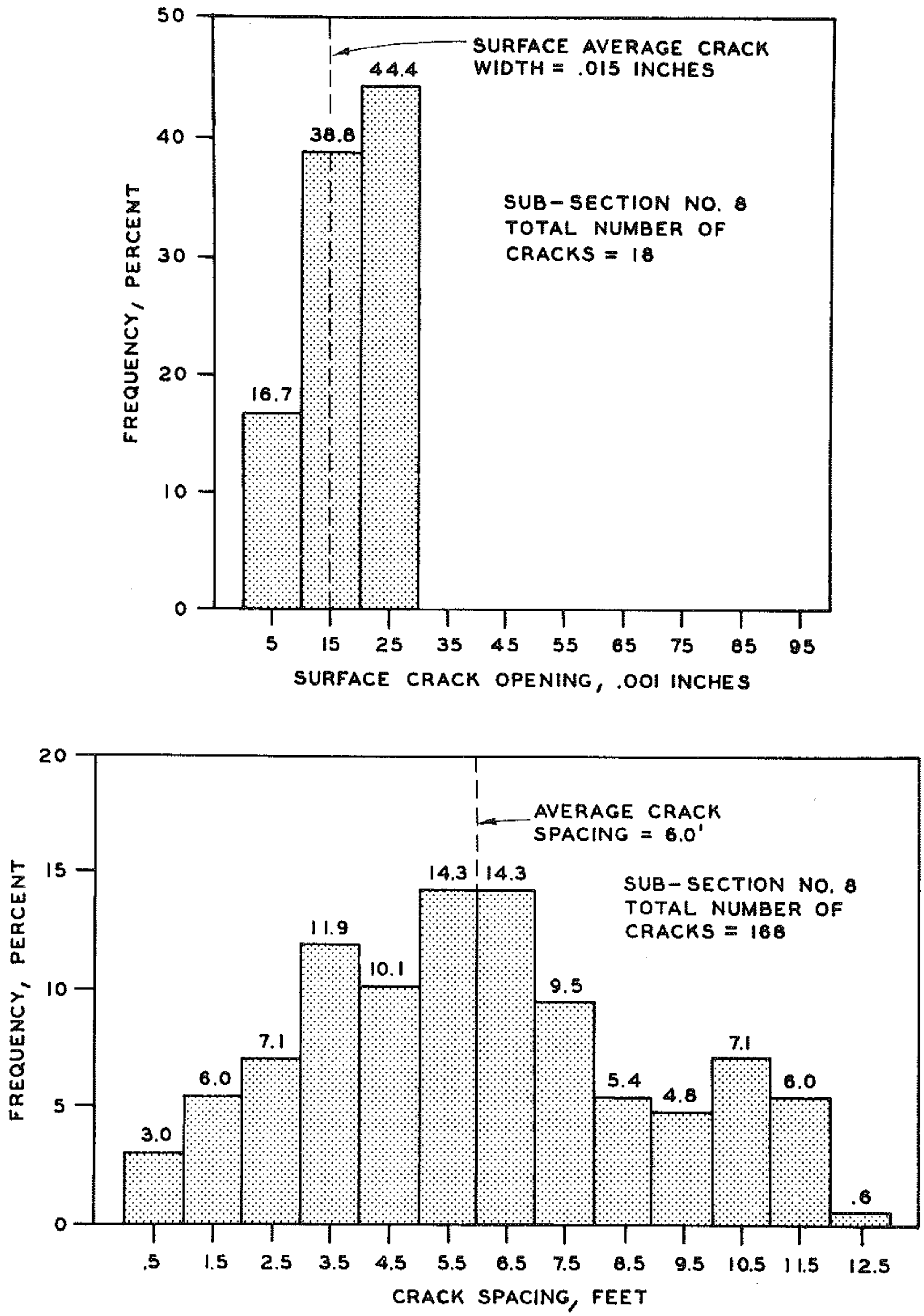

Figure 4. Frequency distribution of crack spacing and surface crack widths in 2-1/2 year old pavement (Wire Mat Reinforcement).