

Louisiana Highway Research

**HOT MIX
PAVEMENT
TEMPERATURES**



IN REPLY PLEASE REFER TO
FILE NO.

Louisiana
DEPARTMENT OF HIGHWAYS

P. O. BOX 4245, CAPITOL STATION
BATON ROUGE, LA. 70804

November 5, 1964

SERVICE TEMPERATURE STUDY
Research Project No. 61-3B
FAP No. HPR 1(2)

Materials Engineers
American Association of State
Highway Officials

Enclosed is a report entitled, SERVICE TEMPERATURE STUDY
FOR ASPHALTIC CONCRETE.

This report covers the investigation undertaken to determine
the maximum surface temperatures for hot mix pavements
obtained on Louisiana highways.

Any comments or suggestions concerning this report will be
invited.

Very truly yours,


L. W. Harrell
Testing & Research Engineer

VA:jk
Enclosure

cc: Mr. J. C. Breaux
Mr. R. E. Bollen, HRB
Mr. C. A. McKeogh
Mr. John M. Griffith



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BATON ROUGE, LA. 70804

November 5, 1964

SERVICE TEMPERATURE STUDY
Research Project No. 61-3B
FAP No. HPR 1(2)

Mr. Lyman G. Youngs
Division Engineer
Bureau of Public Roads
3444 Convention Street
Baton Rouge, Louisiana

Dear Mr. Youngs:

Enclosed are 104 copies of the final report for the captioned project entitled, SERVICE TEMPERATURE STUDY FOR ASPHALTIC CONCRETE.

We have made arrangements to distribute this report to the Material Engineers of the AASHO.

This report covers the investigation undertaken to determine the maximum surface temperatures for hot mix pavements obtained on Louisiana highways.

Very truly yours,


L. W. Harrell
Testing & Research Engineer

VA:jk

Enclosures

cc: Mr. E. J. James
Mr. T. W. Parish, Jr.
Mr. A. D. Jackson
Mr. Oren Baker
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Mr. C. W. Burns

All District Engineers
Mr. D. D. McDuff
All Project Engineers
All District Laboratory Engineers
Advisory Research Council
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**SERVICE TEMPERATURE STUDY
FOR
ASPHALTIC CONCRETE**

BY

PHILIP J. ARENA
Bituminous Research Engineer

Research Report No. 14

Research Project No. 61-3B
HPR 1(2)

Conducted by
LOUISIANA DEPARTMENT OF HIGHWAYS
Testing and Research Section
in Cooperation with
U. S. Department of Commerce
BUREAU OF PUBLIC ROADS

October, 1964

SYNOPSIS

The Service Temperature Study was undertaken to supplement a pilot study started in 1959 which indicated that service temperatures obtained on Louisiana highways are slightly higher than those used for testing purposes.

Temperature recorders were installed in the northern, central and southern parts of Louisiana for hot mix wearing and binder course lifts. Results showed that the wearing course in southern Louisiana (Baton Rouge area) exceeded the hot mix testing temperature of 140° F during the months of May, June, July, and August for 1961 and 1962. It was also observed that the wearing course was at or above 140° F 17 per cent of the time in July, 1962 with an average maximum peak, during the same month, of 150° F for 1961 and 1962. This percentage was based on the number of hours at which the wearing course was at or above 140° F divided by the total number of hours during the period of recording, which was generally seven days. The percentages of each period were then in turn averaged for each month.

The binder course lift in this same area showed a maximum monthly peak of 130° F also in July, 1962.

Temperature results for the central part of Louisiana, namely, the Alexandria area showed that the average maximum peak temperature was 144° F and occurred in the month of June, 1963. It should also be mentioned that during the months of July and August the hot mix testing temperature of 140° F was also exceeded with average maximum peak temperature of 141° F per each of these months. However, although the month of June, July, and August show average maximum peak temperature exceeding 140° F the percentage of time at or above 140° F was only 6 per cent for the month of June and 1 per cent for July and August. The binder course lift for this area showed an average maximum peak temperature of 123° F also in June, 1963 which was below the hot mix testing temperature.

Temperature results for the Shreveport area (north Louisiana) indicated that the wearing course had an average maximum peak temperature of 129° F in June, 1963 which is also below the hot mix testing temperature. The binder course showed an average maximum peak of 123° F also occurring in June, 1963.

It should be noted that the binder and wearing course lifts for all these locations maintained their maximum temperature generally from 4 to 5 hours per day. Overall results showed that the average maximum and minimum temperatures ranged from 40 to 150° F respectively for the wearing course lift and from 14 to 130° F for the binder course.

SERVICE TEMPERATURE STUDY

FOR

ASPHALTIC CONCRETE

INTRODUCTION

This study was initiated in 1961, to determine the maximum and minimum pavement temperature for binder and wearing courses of hot mix asphaltic concrete pavement. This was accomplished through the installation of "Three-Lead Weekly Honeywell Recording Thermometers" in the north, central and southern areas of the State, with the purpose of comparing these results with the hot mix testing temperature for Marshall Stability of 140° F and also determining the minimum temperature a pavement may be subjected to in Louisiana.

SCOPE

This study consisted of recording thermometers located in the Baton Rouge, Alexandria and Shreveport areas of Louisiana in which temperature recordings were taken continuously for binder and wearing course lifts, along with air temperatures over a given period of time. These temperatures were recorded on seven day recording charts which were considered as one period and changed weekly. However, some of the periods exceeded seven days.

PROCEDURE

Honeywell Temperature Recorders were installed in Baton Rouge, Alexandria and Shreveport in the parking lots on Louisiana Department of Highways property. Figure 1 shows a cross section of the installation. As can be seen each recorder contained three leads, one each for binder and wearing courses and one for air temperatures. The binder course lead was inserted approximately 2 inches from the surface of the pavement and the wearing course lead approximately 1/2 inches from the surface. Each of the binder and wearing course leads were 3/4 of an inch in diameter and 1 foot in length and were inserted 2 feet from the edge of the pavement. The lead for obtaining air temperatures

is a spiral type lead which was attached to the top of the temperature recorders.

Figure 2 shows the complete instrument used in this study including the three leads previously mentioned. As can be seen, the photograph contains a seven day recording chart with recordings for binder, wearing and air temperatures.

DISCUSSION OF RESULTS

The results of all measurements, tabulated for each period, are shown in Tables I, II, and III of the Appendix for each of the three locations previously mentioned. In order to simplify data presentation, the temperatures are given on a periodic basis.

For a clear understanding of the data it will be necessary to define the terminology used in the tables and discussion.

- (a) Minimum Period Temperature - the lowest recorded temperature for any one period (generally seven days).
- (b) Minimum Period Peak - is the lowest peak temperature for a given period.
- (c) Maximum Period Peak - is the highest peak temperature for a given period.
- (d) Average Daily Peak - is the average of all the maximum temperatures recorded each day for a given period.
- (e) Per Cent of Time at (90°, 120°, 140° F) or Above - is the total number of hours in a period compared to the number of hours at or above these temperatures on a percentage basis.
- (f) Average Maximum Period Air Temperature - is an average of the maximum temperatures for each day in one period. This data was obtained from the recording charts for the Alexandria and Shreveport areas, with the exception of the air temperature from the Baton Rouge area which was obtained from the weather bureau due to malfunctioning of the air temperature recorders shortly after installation.

For easy reference purposes, tables are included showing a summary of the monthly results for binder and wearing courses for each of the three locations. The monthly results given in these tables were obtained by averaging the

periods covered during a particular month. In some cases there is an overlapping of approximately 3 days into another month. Consequently the average of the monthly results may have two or three days included from the following month.

Table I shows the average monthly results for binder and wearing course lifts in the Baton Rouge area. As can be seen from the tables temperature recording began in May 1961, and continued through August 1962. Figure 3 shows the monthly maximum and minimum temperature relationships for the wearing course. As indicated by Curve A, the monthly average maximum period peak for wearing course exceeded 140° F in the months of May, June, July and August in the years 1961 and 1962, which were all above the established hot mix testing temperature of 140° F . It should also be noted that the month of July for both years showed the highest maximum temperature peaks at 150° F .

Curve B representing the monthly average daily peaks follow the same trend as Curve A with the exception that only during the months of May 1961, and July 1962, the testing temperature of 140° F was exceeded. However, it should be mentioned that temperatures recordings were available only for the final week of May 1961, which was the hottest part of the month and is probably the reason for the high average daily peak for that month.

Curve C shows the monthly average minimum period temperature with the lowest being 63° F in January 1962, and 67° F in December 1961. It can be seen from Curve D which represents the average maximum period air temperatures that during the months of May, June, July, and August in which maximum temperatures exceeded 140° F the air temperature ranged from 82 to 95° F .

Figure 4 illustrates the monthly maximum and minimum temperature relationship for binder course. Curve A shows a maximum peak of 130° F in 1962 as compared to 126° F in 1961. These, as in Figure 3, show the month of July as having the highest temperatures. As can be seen from Figures 3 and 4, the temperature of the wearing course is approximately 20 degrees higher than that of the binder course.

Figure 5 shows the monthly percentage of time at or above 120° and 140° F for the wearing course. As seen by Curve A, the wearing course lift exceeded 120° F 48 per cent of the time in July 1962, and 27 per cent of the time in July 1961. Curve B shows that the wearing course in July 1962, maintained a temperature of 140° F or above 17 per cent of the time during that month and 6 per cent of the time in July 1961.

AVERAGE MONTHLY RESULTS

TABLE I

BATON ROUGE AREA

WEARING COURSE

Month	Ave. Min. Period Temp.		Ave. Max. Period Peak		Ave. Daily Peaks		Percent Time Above						Ave. Max. Period Air Temp.	
	1961	1962	1961	1962	1961	1962	90°F.		120°F.		140°F.		1961	1962
January	-	63	-	102	-	91	-	13	-	0	-	0	-	60
February	-	72	-	113	-	101	-	26	-	0	-	0	-	74
March	-	73	-	120	-	109	-	40	-	0	-	0	-	69
April	-	81	-	131	-	117	-	64	-	6	-	0	-	77
May	98(1)	94	147(1)	143	143(1)	135	(2)	100	(2)	31	(2)	1.5	82	89
June	92	91	145	144	131	132	100	100	22	25	3.5	4	86	88
July	94	104	150	150	136	146	100	100	27	48	6	17	88	94
August	97	94	143	150	135	137	100	100	26	33	2.2	7	88	95
September	90	-	138	-	124	-	100	-	14	-	0	-	86	-
October	82	-	126	-	116	-	73	-	3	-	0	-	80	-
November	70	-	106	-	95	-	16	-	0	-	0	-	68	-
December	67	-	103	-	91	-	11	-	0	-	0	-	65	-

(1) These results are from one period only and not an average of the entire month.

(2) Per cent of time above 90°, 120° and 140°F were not tabulated for the month indicated due to malfunctioning of the recorder pen.

BINDER COURSE

January	-	45	-	80	-	71	-	0	-	0	-	0	-	60
February	-	54	-	89	-	81	-	1	-	0	-	0	-	74
March	-	57	-	95	-	89	-	4.5	-	0	-	0	-	69
April	-	65	-	105	-	97	-	27	-	0	-	0	-	77
May	76	79	123	121	117	117	61	70	2	3	-	-	82	89
June	80	81	123	122	113	112	62	63	5	0.5	-	-	86	88
July	83	91	126	130	118	126	75	100	6	20	-	-	88	94
August	84	83	123	125	118	119	75	76	4	8	-	-	88	95
September	76	-	116	-	108	-	45	-	0	-	-	-	86	-
October	68	-	102	-	100	-	31	-	0	-	-	-	80	-
November	54	-	86	-	77	-	7.2	-	0	-	-	-	68	-
December	50	-	80	-	73	-	0	-	0	-	-	-	65	-

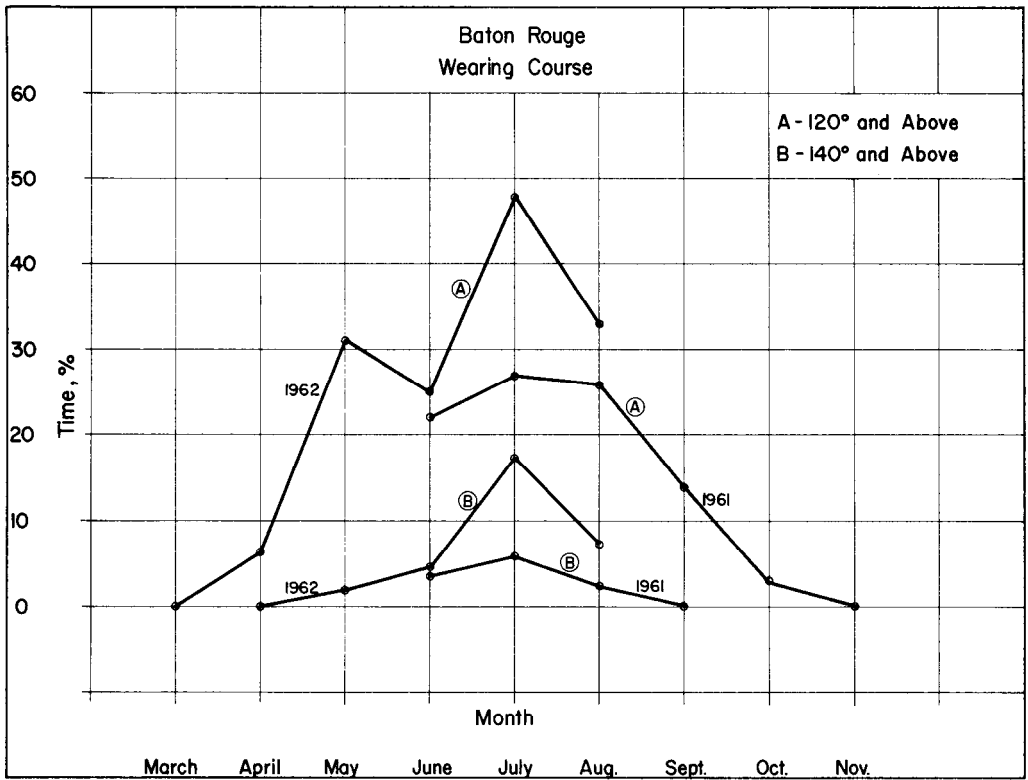


Figure 5 - Illustration of the Monthly Per Cent of Time Above 120°F and 140°F for the Wearing Course in the Baton Rouge Area.

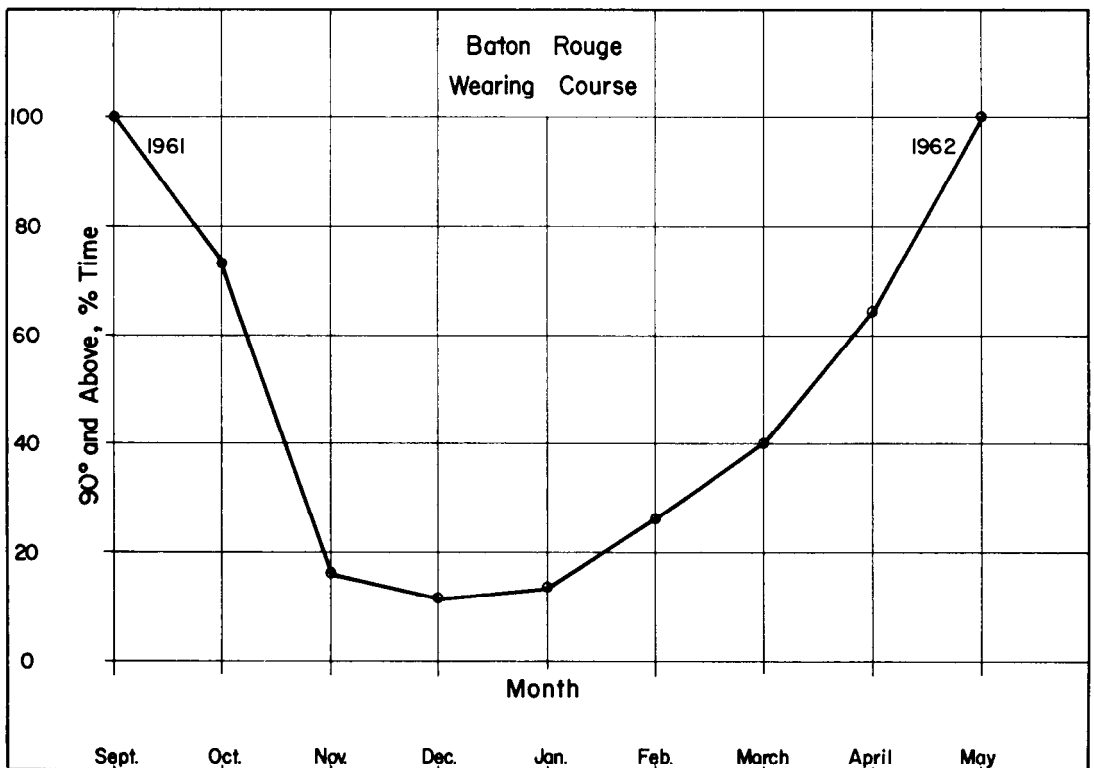


Figure 6 - Illustration of the Monthly Per Cent of Time Above 90°F for the Wearing Course in the Baton Rouge Area.

Figure 6 illustrates the monthly percentage of time above 90° F for the wearing course. As indicated by the curve the coldest months namely, November, December, and January showed the wearing course at 90° or above at least 11 per cent of the time. It should also be noted that the wearing course represented by Figure 6 never shows a full month below 90° F.

Figure 7 represents the percentage of time at or above 90° and 120° F for the binder course. Curve A indicates that in July 1962, the binder course was 90° F or above 100 per cent of the time and 75 per cent of the time for August and September 1961. Curve B shows the percentage of time at or above 120° F for the years 1961 and 1962, with July 1962, again showing the highest observed percentage of 20 per cent.

Table II gives the average monthly results for the binder and wearing course lifts in the Alexandria area. As can be seen from the table temperature recording for this area began August 1962, and continued through December 1963.

The maximum and minimum temperature recordings for the Alexandria area are illustrated in Figures 8 and 9. Figure 8 shows that the wearing course as in the Baton Rouge area exceeded the hot mix testing temperature of 140° F during the months of June, July, and August of 1963, with the maximum monthly temperature of 144° F occurring in the month of June. Curve B shows the same trend with the highest average daily temperature of 136° F also recorded in June 1963. Figure 9 which represents the binder course shows that Curve A has a monthly maximum temperature peak of 123° F in June 1963 which, as in the Baton Rouge area, is also approximately 20 degrees lower than the wearing course lift.

Figure 10 representing the wearing course shows the percentage of time at or above 120° and 140° F for temperature recordings taken in the Alexandria area. Curve A indicates that in June and August 1963 the wearing course lift was at 120° or above 28 per cent of the time during these months. Curve A for the year 1962 shows a very low percentage of 12 in the month of August due to the fact that the study began in the last two weeks of the month which were evidently the coolest. Although the hot mix testing temperature of 140° F was exceeded in June, July and August of 1963 the percentage of time at or above 140° F as indicated by Curve B was only 6 per cent for June and 1 per cent for July and August of this year 1963.

Figure 11 shows the percentage of time at or above 90° and 120° F for the binder course. Curve A shows a maximum percentage of 82 at or above 90° F for August 1963. Curve B which represents the percentage of time at or above 120° F shows a maximum percentage of 7 in the month of June 1963. Figure 12

AVERAGE MONTHLY RESULTS

TABLE II

ALEXANDRIA AREA

WEARING COURSE

Month	Ave. Min. Period Temp.		Ave. Max. Period Peak		Ave. Daily Peaks		Percent Time Above				Ave Max Period Air Temp				
	1962	1963	1962	1963	1962	1963	90°F	120°F	140°F	1962	1963	1962	1963		
August (1)	89	-	134	-	123	-	99	-	12	-	0	-	91	-	
September	87	-	133	-	126	-	92	-	17	-	0	-	87	-	
October	81	-	120	-	115	-	64	-	4	-	0	-	81	-	
November	64	-	98	-	90	-	12	-	0	-	0	-	63	-	
December	58	-	89	-	81	-	2	-	0	-	0	-	57	-	
January	-	50	-	82	-	70	-	0	-	0	-	0	-	49	-
February	-	51	-	92	-	86	-	3	-	0	-	0	-	57	-
March	-	64	-	114	-	104	-	26	-	0	-	0	-	72	-
April	-	76	-	126	-	118	-	65	-	9	-	0	-	79	-
May	-	86	-	135	-	130	-	90	-	24	-	0	-	86	-
June	-	91	-	144	-	136	-	100	-	28	-	6	-	92	-
July	-	91	-	141	-	132	-	98	-	23	-	1	-	91	-
August	-	93	-	141	-	135	-	100	-	28	-	1	-	92	-
September	-	87	-	131	-	123	-	85	-	13	-	0	-	87	-
October	-	77	-	116	-	114	-	57	-	0	-	0	-	85	-
November	-	61	-	97	-	90	-	9	-	0	-	0	-	67	-
December	-	50	-	80	-	73	-	0	-	0	-	0	-	48	-

BINDER COURSE

August (1)	80	-	113	-	106	-	55	-	0	-	0	-	80	-	
September	78	-	115	-	109	-	52	-	0	-	0	-	78	-	
October	70	-	101	-	97	-	24	-	0	-	0	-	70	-	
November	54	-	81	-	75	-	0	-	0	-	0	-	54	-	
December	45	-	73	-	66	-	0	-	0	-	0	-	45	-	
January	-	40	-	67	-	59	-	0	-	0	-	0	-	40	-
February	-	43	-	74	-	68	-	0	-	0	-	0	-	43	-
March	-	57	-	93	-	85	-	5	-	0	-	0	-	57	-
April	-	68	-	106	-	101	-	31	-	0	-	0	-	68	-
May	-	78	-	114	-	110	-	50	-	0	-	0	-	78	-
June	-	83	-	123	-	116	-	77	-	7	-	0	-	83	-
July	-	82	-	121	-	112	-	65	-	1	-	0	-	82	-
August	-	85	-	120	-	116	-	82	-	1	-	0	-	85	-
September	-	77	-	111	-	104	-	52	-	0	-	0	-	77	-
October	-	69	-	96	-	94	-	18	-	0	-	0	-	69	-
November	-	51	-	79	-	73	-	0	-	0	-	0	-	51	-
December	-	32	-	62	-	52	-	0	-	0	-	0	-	32	-

(1) Began on August 20.

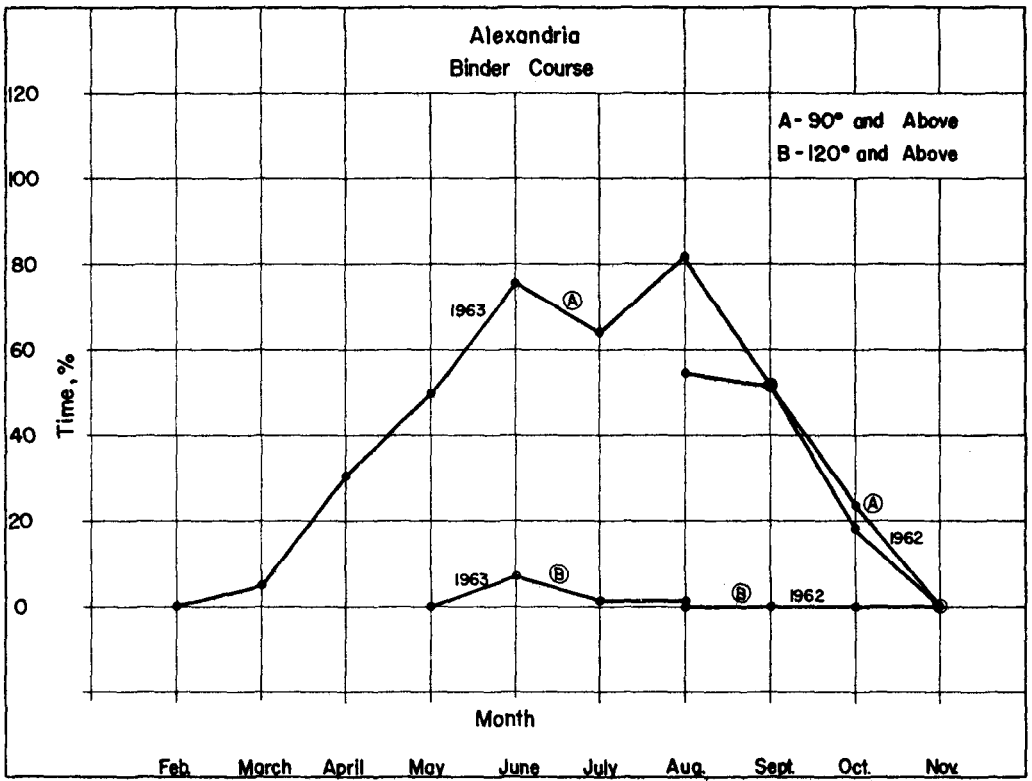


Figure 11 - Illustration of the Monthly Per Cent of Time Above 90°F and 120°F for the Binder Course in the Alexandria Area.

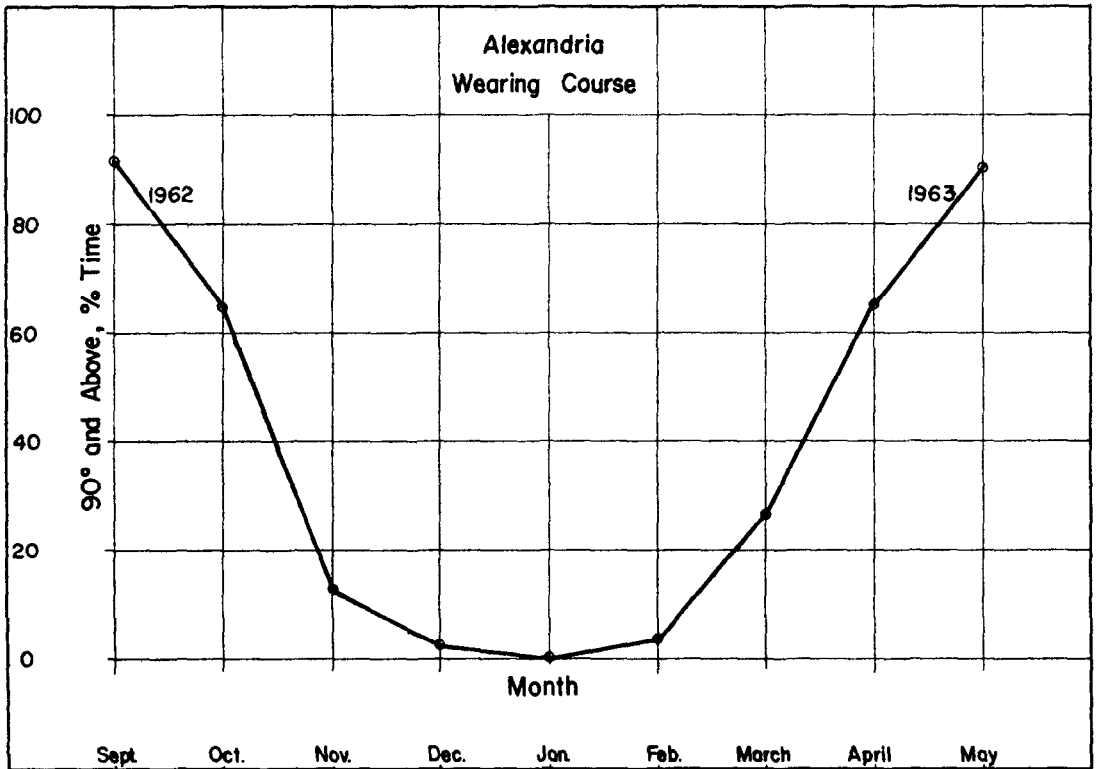


Figure 12 - Illustration of the Monthly Per Cent of Time Above 90°F for the Wearing Course in the Alexandria Area.

illustrates the percentage at or above 90° F for the wearing course during the winter months. As indicated by the curve the only month that did not reach 90° F was January 1963.

Average monthly results for the Shreveport area which is located in the northern part of the State is represented by Table III for wearing and binder courses. As seen by the table temperature recordings began in April 1963, through December of that same year. Figure 13 and 14 represent the average maximum and minimum monthly temperature for wearing and binder courses respectively. As shown in Figure 13 the monthly maximum temperature peak did not at any time surpass 140° F for that area. However, as in the other areas, namely Baton Rouge and Alexandria, the highest temperatures were in the months of June, July, and August in the Shreveport area with the maximum of 129° F in June. Figure 14 shows the average maximum period peak temperature for the binder course to be 123° F in June 1963. It is interesting to note that the average minimum period temperature indicated by Curve C shows that the binder course went as low as 14° F for the month of December. Curve A, Figure 15 indicates that the wearing course was 120° F and above 15 per cent of the time in the month of June and August. As can be seen by Curve B not at any time did the maximum temperature reach 140° F. In Figure 16 which shows the percentage of time at or above 90° and 120° F. for the binder course Curve A indicates that during the month of June the binder course maintained a temperature of 90° F or higher, 45 per cent of the time. Curve B shows that the binder course stayed at 120° F or above only 5 per cent of the time during the month of June. Figure 17 shows the percentage of time that the wearing course was at or above 90° F for the entire study in the Shreveport area. As indicated by the curve the wearing course got as high as 90° F for every month with the exception of December.

As based on the results mentioned in the preceding paragraphs for each of the locations, it is evident that the highest temperatures for both wearing and binder courses occurred in the southern part of the State, namely the Baton Rouge area and was followed by Alexandria (central) and Shreveport (north) respectively. However, these recordings for each area were not taken in the same year, but in a period of approximately three years. It is quite possible that had the recordings been taken simultaneously the results may have been equally as high for the Alexandria and Shreveport areas as the Baton Rouge area.

Figures 18 and 19 shows the maximum and minimum temperature range for binder and wearing courses as based on the three locations. Figure 18 shows that the maximum monthly peak temperature occurred in July and August at a temperature of 150° F for the wearing course. The minimum temperature occurred in December at 40° F.

AVERAGE MONTHLY RESULTS

TABLE III

SHREVEPORT AREA

WEARING COURSE

Month	Ave. Min. Period Temp. 1963	Ave. Max. Period Peak 1963	Ave. Daily Peaks 1963	90°F 1963	Percent Time Above 120°F 1963	140°F 1963	Ave. Max. Period Air Temp. 1963
April	63	115	103	29	0	0	80
May	70	119	112	65	0	0	88
June	90	129	122	95	15	0	99
July	89	126	119	92	11	0	98
August	89	128	123	95	15	0	96
September	85	119	111	70	6	0	87
October	76	108	103	44	0	0	85
November	55	84	77	1	0	0	65
December	41	65	57	0	0	0	47

BINDER COURSE

April	68	107	98	27	0	0
May	70	117	109	37	0	0
June	74	123	116	45	5	0
July	71	116	111	38	1	0
August	64	113	108	34	0	0
September	55	99	90	11	0	0
October	46	85	82	0	0	0
November	26	62	55	0	0	0
December	14	47	36	0	0	0

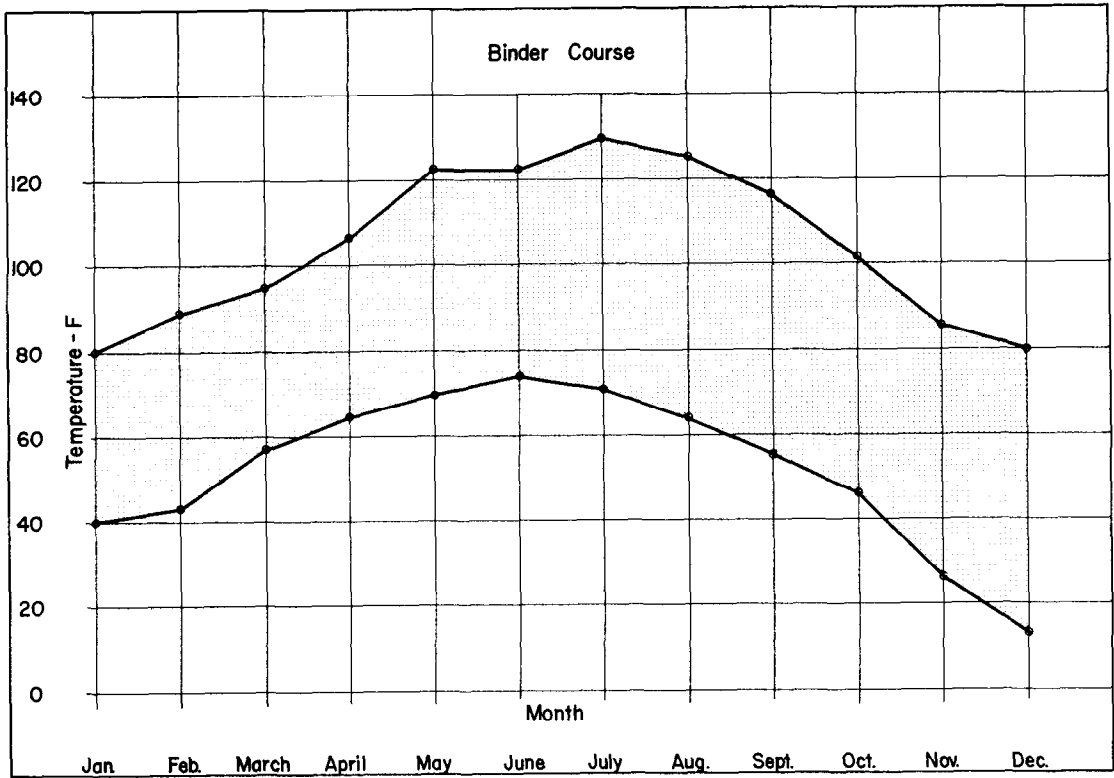


Figure 19 - Monthly Maximum and Minimum Temperature Ranges for the Binder Course.

Figure 19 shows the maximum and minimum temperature range for the binder course. As can be seen the maximum monthly peak temperature occurred in July at a temperature of 130°F. The minimum temperature for the binder course also occurred in December at a temperature of 14°F. It is established from these curves that the wearing course temperatures ranged from 40 to 150°F and the binder course from 14 to 130°F.

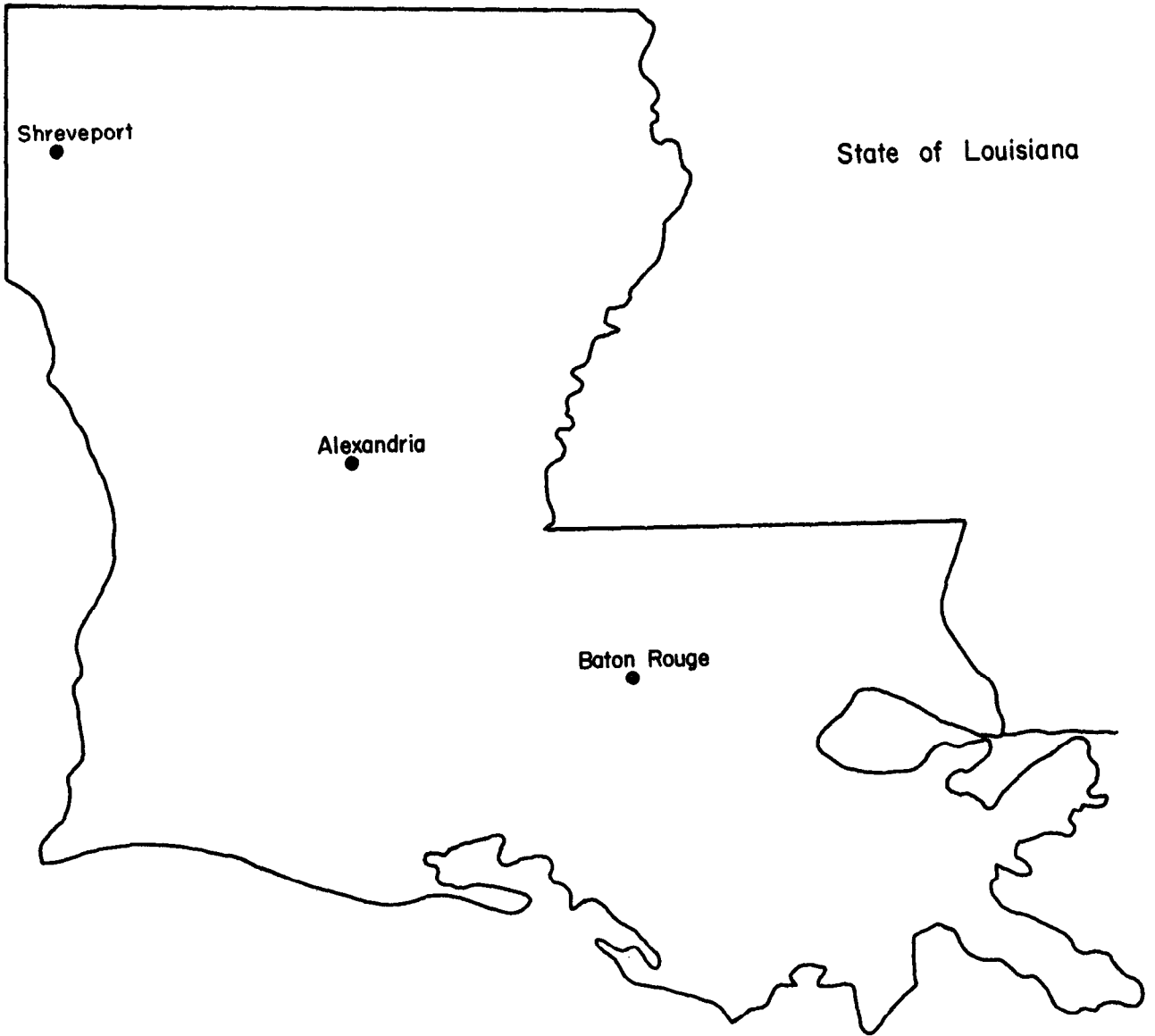
CONCLUSION

1. The wearing course exceeded the hot mix testing temperature of 140°F during the months of May, June, July, and August in the Baton Rouge area for 1961 and 1962, and in the Alexandria area during the months of June, July, and August of 1963.
2. The wearing course maintained a monthly average maximum peak temperature at or above 140°F 17 per cent of the time in July 1962 from the Baton Rouge area and 6 per cent of the time in June 1963 from the Alexandria area.
3. The maximum monthly peak temperature for the wearing course was 150°F and occurred in July 1961 and 1962 from the Baton Rouge area.
4. The maximum monthly peak temperature for the binder course was 130°F and occurred in July 1962.
5. The maximum temperature for wearing and binder courses generally lasted approximately 4 to 5 hours in a day.
6. The monthly temperatures ranged from a high of 150°F in July and August to a low of 40°F in December for the wearing course and 130°F in July to 14°F in December for the binder course.

RECOMMENDATIONS

1. Although the hot mix testing temperature of 140°F was exceeded at times during this study, the period was so short that it does not warrant a change. It is recommended that the testing temperature of 140°F not be changed.

APPENDIX



Map Showing the Locations of the Temperature Recorders

PERIOD TEMPERATURE MEASUREMENTS

TABLE I

Period	WEARING COURSE				BATON ROUGE AREA				BINDER COURSE							
	Min. Period Temp	Min. Period Peak	Max. Period Peak	Ave. Daily Peaks	Percent 90°F	Time 120°F	Above 140°C	Ave. Max. Period Air Temp.	Min. Period Temp	Min. Period Peak	Max. Period Peak	Ave. Daily Peaks	Percent 90°F	Time 120°F	Above	Ave. Max. Period Air Temp.
May 16-23, 1961	98	140	147	143	100	36	14	86	81	117	124	120	67	4		86
May 24-30	(1)	(1)	(1)	(1)	(1)	(1)	(1)	80	71	105	121	114	55	0		80
June 6-12	96	128	145	137	100	28	4	88	87	112	126	121	85	9		88
June 13-19	89	97	136	116	100	8	0	80	76	82	114	99	41	0		80
June 20-26	88	104	145	130	100	23	5	83	75	90	126	111	55	5		83
June 27-July 3	96	128	144	139	100	28	2	85	83	108	124	119	58	5		85
July 4-10	92	114	144	131	100	22	4	85	85	96	123	113	66	2		85
July 11-17	92	123	146	140	100	27	7	86	78	100	124	117	60	4		86
July 18-24	97	119	150	136	100	30	7	89	85	106	130	121	90	12		89
July 25-31	96	126	142	137	100	28	5	88	85	109	125	119	84	7		88
Aug. 1-7	99	130	143	140	100	36	7	88	87	114	124	122	92	9		88
Aug. 8-14	96	122	142	135	100	24	2	86	84	106	123	116	68	5		86
Aug. 15-21	96	134	143	137	100	26	1	86	84	115	123	119	75	4		86
Aug. 22-28	96	118	136	132	100	22	0	85	82	103	120	115	67	0		85
Aug. 29-Sept. 4	96	118	143	133	100	23	1	89	83	104	124	116	71	0		89
Sept. 5-11	90	96	138	114	100	5	0	85	80	82	120	101	33	0		85
Sept. 13-20	(1)	(1)	(1)	(1)	(1)	(1)	(1)	80	72	97	113	107	40	0		80
Sept. 21-27	97	115	134	130	100	22	0	88	82	110	118	115	62	0		88
Sept. 28-Oct. 4	82	118	132	127	100	14	0	82	68	100	114	108	44	0		82
Oct. 5-11	86	119	126	122	96	10	0	81	72	102	109	104	42	0		81
Oct. 12-18	(1)	(1)	(1)	(1)	(1)	(1)	(1)	-	(1)	(1)	(1)	(1)	(1)	(1)		-
Oct. 19-25	80	113	120	115	59	0	0	77	67	94	102	99	34	0		77
Oct. 26-Nov. 1	80	106	114	111	64	0	0	79	66	92	96	92	18	0		79
Nov. 2-8	72	82	106	96	16	0	0	66	56	66	89	75	0.5	0		66
Nov. 9-15	(1)	(1)	(1)	(1)	(1)	(1)	(1)	69	(1)	(1)	(1)	(1)	(1)	(1)		69
Nov. 16-26	71	84	104	97	19	0	0	66	55	67	86	80	0	0		66
Nov. 27-Dec. 3	67	82	98	93	14	0	0	66	51	68	82	77	0	0		66
Dec. 4-10	75	82	102	95	24	0	0	70	58	64	82	77	0	0		70
Dec. 11-17	65	77	100	87	10	0	0	62	48	58	77	69	0	0		62
Dec. 18-25	64	88	103	94	9	0	0	57	45	68	82	74	0	0		57
Dec. 26-Jan. 2	62	80	92	87	1	0	0	56	43	60	74	68	0	0		56
Jan. 3-17, 1962	51	68	92	82	3	0	0	51	34	46	73	62	0	0		51
Jan. 18-25	68	74	102	89	14	0	0	63	50	56	82	70	0	0		63
Jan. 26-Feb. 1	70	92	102	99	23	0	0	69	52	75	84	80	0	0		69
Feb. 2-8	69	90	100	95	18	0	0	65	50	72	79	74	0	0		65
Feb. 9-15	73	98	112	106	36	0	0	74	56	80	93	87	4	0		74
Feb. 16-22	78	87	110	101	31	0	0	71	60	70	90	82	0.5	0		71
Feb. 23-March 8	67	84	113	100	22	0	0	64	50	65	95	81	1	0		64
March 9-15	69	92	112	104	31	0	0	67	52	72	88	82	0	0		67
March 16-22	72	86	115	108	34	0	0	70	56	66	94	89	7	0		70
March 23-29	80	90	120	116	56	0	0	75	62	89	100	95	1	0		75
March 30-April 5	72	90	117	107	38	0	0	69	58	72	96	89	10	0		69
April 6-12	77	94	120	107	57	0	0	73	60	78	99	88	12	0		73
April 13-19	79	114	127	121	69	10	0	75	63	95	106	100	32	0		75
April 20-May 3	86	115	131	124	90	13	0	81	71	96	111	104	37	0		81
May 4-10	92	132	138	135	100	31	0	85	77	113	119	116	57	0		85
May 11-24	97	130	140	136	100	33	0.6	89	82	110	122	118	76	2		89
May 25-31	93	123	143	135	100	24	4	88	79	106	123	116	77	5		88
June 1-7	94	110	138	129	100	22	0	86	79	94	118	110	62	0		86
June 8-July 4	88	110	144	135	100	25	4	-	83	98	126	114	64	0.9		-
July 5-12	103	141	150	146	100	48	16	94	91	120	130	126	100	22		94
July 13-19	106	142	149	146	100	51	19	94	94	124	130	127	100	22		94
July 20-26	104	142	150	147	100	46	17	95	91	122	129	127	100	21		95
July 27-Aug. 9	101	136	150	143	100	43	12	95	89	116	132	125	100	16		95
Aug. 10-16	100	134	150	142	100	37	12	98	86	116	130	124	92	15		98
Aug. 17-23	100	135	144	141	100	35	5	95	82	117	125	122	90	9		95
Aug. 24-31	81	105	137	129	100	18	0	91	80	90	120	111	46	0		91

(1) Results are not reported for the period indicated due to malfunctioning of the recorder pen.

PERIOD TEMPERATURE MEASUREMENTS

TABLE II

ALEXANDRIA AREA

Period	WEARING COURSE				Percent 90°F	Time 120°F	Above 140°F	Ave. Max. Period Air Temp.	BINDER COURSE						
	Min. Period Temp	Min. Period Peak	Max. Period Peak	Ave. Daily Peaks					Min. Period Temp	Min. Period Peak	Max. Period Peak	Ave. Daily Peaks	Percent 90°F	Time 120°F	Above 140°F
Aug. 20-26, 1962	87	112	130	119	97	6	0	92	79	94	112	104	59	0	0
Aug. 27-Sept. 3	91	99	137	126	100	17	0	90	80	86	118	108	51	0	0
Sept. 4-10	88	104	136	123	96	10	0	89	78	90	115	104	37	0	0
Sept. 11-17	92	130	137	133	100	27	0	92	83	111	118	114	74	0	0
Sept. 18-24	84	122	132	128	90	22	0	83	77	108	118	115	57	0	0
Sept. 25-Oct. 1	84	106	128	121	81	10	0	83	74	92	110	103	41	0	0
Oct. 2-8	82	120	124	123	76	10	0	84	73	102	105	104	38	0	0
Oct. 9-15	87	110	124	119	89	4	0	87	75	93	104	100	34	0	0
Oct. 16-22	80	96	122	111	54	0	0	81	68	82	102	94	18	0	0
Oct. 23-29	73	104	111	107	35	0	0	73	64	86	94	89	5	0	0
Oct. 30-Nov. 5	65	75	103	93	19	0	0	65	54	66	87	80	0	0	0
Nov. 6-12	67	87	99	94	13	0	0	66	56	74	82	78	0	0	0
Nov. 13-20	61	66	97	89	12	0	0	62	55	63	81	73	0	0	0
Nov. 21-28	64	70	92	82	2	0	0	59	50	60	74	68	0	0	0
Nov. 29-Dec. 5	68	72	94	87	5	0	0	64	52	61	77	72	0	0	0
Dec. 6-13	52	70	85	80	0	0	0	52	41	57	70	65	0	0	0
Dec 14-26	54	62	88	77	0	0	0	56	41	52	72	62	0	0	0
Dec 26-Jan. 10, '63	46	61	92	76	0	0	0	--	44	51	72	61	0	0	0
Jan. 11-18	51	62	77	70	0	0	0	46	38	54	63	57	0	0	0
Jan. 19-28	48	62	72	60	0	0	0	45	34	45	60	53	0	0	0
Jan. 29-Feb. 4	54	61	87	74	0	0	0	55	43	50	71	63	0	0	0
Feb. 5-11	55	77	96	89	6	0	0	65	48	63	78	72	0	0	0
Feb. 12-19	47	62	88	83	0	0	0	50	39	52	70	65	0	0	0
Feb. 20-27	51	78	93	85	3	0	0	56	41	61	74	67	0	0	0
Feb. 28-March 7	57	73	106	95	12	0	0	64	52	72	84	76	0	0	0
March 8-14	65	84	114	103	21	0	0	77	56	70	94	84	5	0	0
March 15-22	67	98	113	107	33	0	0	75	59	78	94	86	4	0	0
March 23-29	67	106	121	111	38	0	0	73	59	87	98	93	10	0	0
March 30-April 8	67	78	123	111	46	6	0	74	58	66	102	92	23	0	0
April 9-16	77	118	127	123	64	14	0	81	70	97	106	103	37	0	0
April 17-24	82	100	126	116	76	9	0	80	74	86	107	100	26	0	0
April 25-May 2	78	115	129	120	74	6	0	81	71	95	110	101	36	0	0
May 3-10	85	127	134	129	87	25	0	85	78	105	112	108	48	0	0
May 11-17	88	127	137	134	96	31	0	87	81	113	116	115	51	0	0
May 18-24	81	109	130	124	78	13	0	84	72	92	110	104	37	0	0
May 25-June 5	89	122	140	131	99	26	0	87	81	102	118	112	62	0	0
June 6-12	95	138	144	140	100	36	6	93	88	117	123	120	93	8	0
June 13-19	90	107	146	137	100	30	11	93	81	94	126	118	80	14	0
June 20-29	89	128	142	130	100	17	0	89	80	98	120	110	58	0	0
June 30-July 8	88	116	138	131	100	19	0	92	79	99	118	111	61	0	0
July 9-15	92	110	140	131	100	20	0	89	83	95	120	109	59	0	0
July 16-22	97	133	143	139	100	34	4	93	88	114	122	119	97	5	0
July 23-29	88	104	142	127	92	17	0	88	78	89	122	107	43	0	0
July 30-Aug. 5	96	135	140	138	100	27	0	94	87	114	120	117	87	0	0
Aug. 6-12	96	136	142	138	100	32	2	94	89	116	122	118	99	2	0
Aug. 13-19	88	129	142	130	98	26	2	87	81	97	122	113	67	2	0
Aug. 20-26	92	132	138	135	100	26	0	94	83	111	116	114	73	0	0
Aug. 27-Sept. 3	93	131	141	134	100	26	0	94	85	108	119	114	85	0	0
Sept. 4-10	92	128	140	134	100	27	0	93	84	109	119	114	77	0	0
Sept. 11-18	86	92	133	116	100	9	0	84	74	80	114	98	41	0	0
Sept 19-25	86	119	121	117	78	4	0	83	76	86	104	100	38	0	0
Sept. 26-Oct 3	76	100	118	112	46	0	0	80	68	85	99	94	20	0	0

PERIOD TEMPERATURE MEASUREMENTS

TABLE II CONTINUED

ALEXANDRIA AREA

Period	WEARING COURSE							BINDER COURSE							
	Min. Period Temp	Min. Period Peak	Max. Period Peak	Ave. Daily Peaks	Percent 90°F	Time 120°F	Above 140°F	Ave. Period Air Temp.	Max. Period Temp	Min. Period Peak	Max. Period Peak	Ave. Daily Peaks	Percent 90°F	Time 120°F	Above 140°F
Oct. 4-10	82	109	119	117	86	0	0	88	73	92	99	98	28	0	0
Oct. 11-17	81	111	119	117	60	0	0	87	71	92	99	97	27	0	0
Oct. 18-24	78	111	114	112	44	0	0	85	69	91	94	92	13	0	0
Oct. 25-31	65	104	113	109	39	0	0	80	62	85	92	90	4	0	0
Nov. 1-7	66	94	105	98	22	0	0	71	54	76	85	80	0	0	0
Nov. 8-18	61	87	98	91	8	0	0	67	52	70	80	74	0	0	0
Nov. 19-26	59	86	96	90	6	0	0	68	50	66	79	73	0	0	0
Nov. 27-Dec. 3	56	62	88	81	0	0	0	63	45	59	72	63	0	0	0
Dec. 4-11	56	76	84	81	0	0	0	-	-	-	-	-	0	0	0
Dec. 12-18	48	60	75	69	0	0	0	44	36	46	66	52	0	0	0
Dec. 19-27	45	50	81	66	0	0	0	43	27	36	60	48	0	0	0
Dec. 28-Jan. 3	50	68	80	74	0	0	0	56	33	51	59	55	0	0	0

PERIOD TEMPERATURE MEASUREMENTS

TABLE III

SHREVEPORT AREA

Period	WEARING COURSE								BINDER COURSE						
	Min. Period Temp	Min. Period Peak	Max. Period Peak	Ave. Daily Peaks	Percent 90°F	Time 120°F	Above 140°F	Ave. Max. Period Air Temp.	Min. Period Temp	Min. Period Peak	Max. Period Peak	Ave. Daily Peaks	Percent 90°F	Time 120°F	Above 140°F
Mar. 27-Apr. 2 '63	68	103	117	112	40	0	0	87	64	98	107	103	38	0	0
Apr. 3-9	54	62	116	93	19	0	0	74	56	64	106	87	16	0	0
Apr. 10-16	68	100	116	112	42	0	0	83	72	96	108	105	40	0	0
Apr. 17-23	64	82	118	104	32	0	0	80	76	84	110	100	30	0	0
Apr. 24-31	63	82	108	92	14	0	0	75	70	84	104	93	11	0	0
May 1-7	60	94	116	108	43	0	0	85	70	90	112	105	33	0	0
May 8-14	74	98	121	115	68	0	0	90	82	100	118	112	42	0	0
May 15-23	70	90	118	109	75	0	0	84	60	82	118	106	32	0	0
May 24-30	81	109	120	114	75	0	0	91	66	104	119	111	39	0	0
May 31-June 6	87	116	125	121	97	9	0	96	71	112	120	117	50	1	0
June 7-13	96	125	131	129	100	28	0	101	79	120	126	123	59	13	0
June 14-20	87	98	132	117	85	8	0	-	73	88	126	110	37	4	0
June 21-July 2	88	110	126	122	97	13	0	100	71	101	120	114	35	0	0
July 3-9	90	120	128	123	100	17	0	97	70	104	120	115	41	0	0
July 10-16	89	107	120	113	95	0	0	95	70	94	107	100	27	0	0
July 17-24	94	122	130	127	100	21	0	102	74	112	122	119	46	3	0
July 25-Aug. 1	83	99	127	112	74	6	0	-	-	-	-	-	-	-	-
Aug. 2-8	94	121	126	124	100	17	0	99	71	107	114	112	38	0	0
Aug. 9-18	85	102	126	118	86	4	0	90	59	84	112	104	27	0	0
Aug. 19-28	89	120	132	127	100	23	0	99	62	103	114	109	37	0	0
Aug. 29-Sept. 4	92	113	128	123	100	16	0	95	62	92	108	103	26	0	0
Sept. 5-11	86	112	123	118	90	7	0	93	58	89	104	97	18	0	0
Sept. 12-19	79	82	110	95	27	0	0	76	51	55	92	71	0	0	0
Sept. 20-26	82	103	113	109	63	0	0	85	50	84	92	88	0	0	0
Sept. 27-Oct. 3	75	81	110	102	39	0	0	80	44	69	89	82	0	0	0
Oct. 4-10	82	110	112	111	65	0	0	95	51	88	90	89	0	0	0
Oct. 11-17	79	98	112	107	55	0	0	89	49	74	89	84	0	0	0
Oct. 18-24	76	96	104	101	39	0	0	85	47	74	81	79	0	0	0
Oct. 25-30	68	90	100	96	24	0	0	77	40	71	78	75	0	0	0
Oct. 31-Nov. 6	61	81	94	87	4	0	0	72	32	57	72	65	0	0	0
Nov. 7-14	55	77	88	83	0	0	0	64	27	44	62	59	0	0	0
Nov. 15-25	52	50	83	74	0	0	0	67	20	50	62	52	0	0	0
Nov. 26-Dec. 2	50	58	70	65	0	0	0	55	23	35	50	44	0	0	0
Dec. 3-12	46	49	71	63	0	0	0	51	20	25	51	41	0	0	0
Dec. 13-26	37	38	61	50	0	0	0	40	8	14	44	29	0	0	0
Dec. 27-Jan. 2 '64	40	55	64	57	0	0	0	49	13	33	46	39	0	0	0