

R-887

ANNUAL STUDDED TIRE SURVEY
WINTER 1972-1973

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MICHIGAN DEPARTMENT OF STATE HIGHWAYS

ANNUAL STUDED TIRE SURVEY
WINTER 1972-1973

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Research Laboratory Section
Testing and Research Division
Research Project 65 F-82
Research Report No. R-887

Michigan State Highway and Transportation Commission
E. V. Erickson, Chairman; Charles H. Hewitt,
Vice-Chairman, Carl V. Pellonpaa, Peter B. Fletcher
Lansing, October 1973

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Background

In 1969, Michigan contributed financially to a study being conducted by the Minnesota Department of Highways to determine the effect of studded tires on pavement surfaces. To effectively apply the information resulting from this study to Michigan pavements, two surveys were initiated. The first, initiated during the winter of 1969-1970, was designed to estimate the number of vehicles using tire studs in Michigan. The second, initiated in the spring of 1971, involved the measurement of pavement wear attributable to tire studs. Both surveys were carried out on a statewide basis and have been repeated yearly since their inception. This report will summarize the 1972-1973 surveys and make comparisons with past surveys.

Tire Stud Usage in Michigan

Field surveys for the fourth annual studded tire survey were performed by Research Laboratory personnel during the period from December 1972 through February 1973.

Only vehicles with Michigan license plates were included in the survey. State owned vehicles, buses, and trucks larger than a pickup or panel truck were not included since none of those vehicles are known to use studs. A predetermined number of vehicles are inspected in each county, usually in parking lots where large concentrations of vehicles are available. The sampling plan designed and used for this survey is explained in MDSHT Research Report No. R-766. This predetermined number is broken up into clusters of 25, 50, or 100. Each vehicle present is inspected in order of occurrence omitting only those previously mentioned, until the predetermined number has been sampled.

Figure 1 shows a map of the State indicating tire stud use by counties. An alphabetical listing of counties is given in Table 1 showing the number of vehicles surveyed, percent of vehicles using studded tires, and the location of these tires on the vehicle. Table 2 contains the same information combined into the nine Highway Districts. Table 3 relates studded tire use with type of vehicle. Table 4 lists the 83 counties in order of decreasing tire stud use. Table 5 gives a historical review of the four surveys conducted to date, while Table 6 gives statistical precision estimates for this year's survey.

The weighted statewide percentage of vehicles using studded tires decreased from 11.8 percent in 1971-1972 to 9.2 percent in 1972-1973. This use is down from a peak of 15.2 percent in 1970-1971 and can be attributed primarily to public reluctance to invest in studs due to questionable future legality of their use. Much publicity has been given to the intensive effort in the State Legislature to ban the use of studs in Michigan.

Tire Stud Wear on Michigan Pavements

This section summarizes the third annual survey of pavement wear attributable to the use of studded tires in Michigan. The field survey was conducted by Research Laboratory personnel during May 1973. The use of tire studs in Michigan is prohibited from May 1 through October 31.

In all, 75 locations were included in the survey as shown in Figures 2 and 3. Measurements were taken at each location and in all wheel tracks of the roadway. Tables 7 and 8 summarize the results of these measurements along with results of past surveys. The range of depths shown indicate the different depths found in separate wheel tracks. It should be mentioned that measurements taken on bituminous roadways combine stud wear with possible rutting from other causes. Although this may result in a measurement of depth greater than should be attributed to stud wear alone, there is no practical means of separating these two factors. Figures 4 through 11 show photographs of stud wear at several locations around the State.

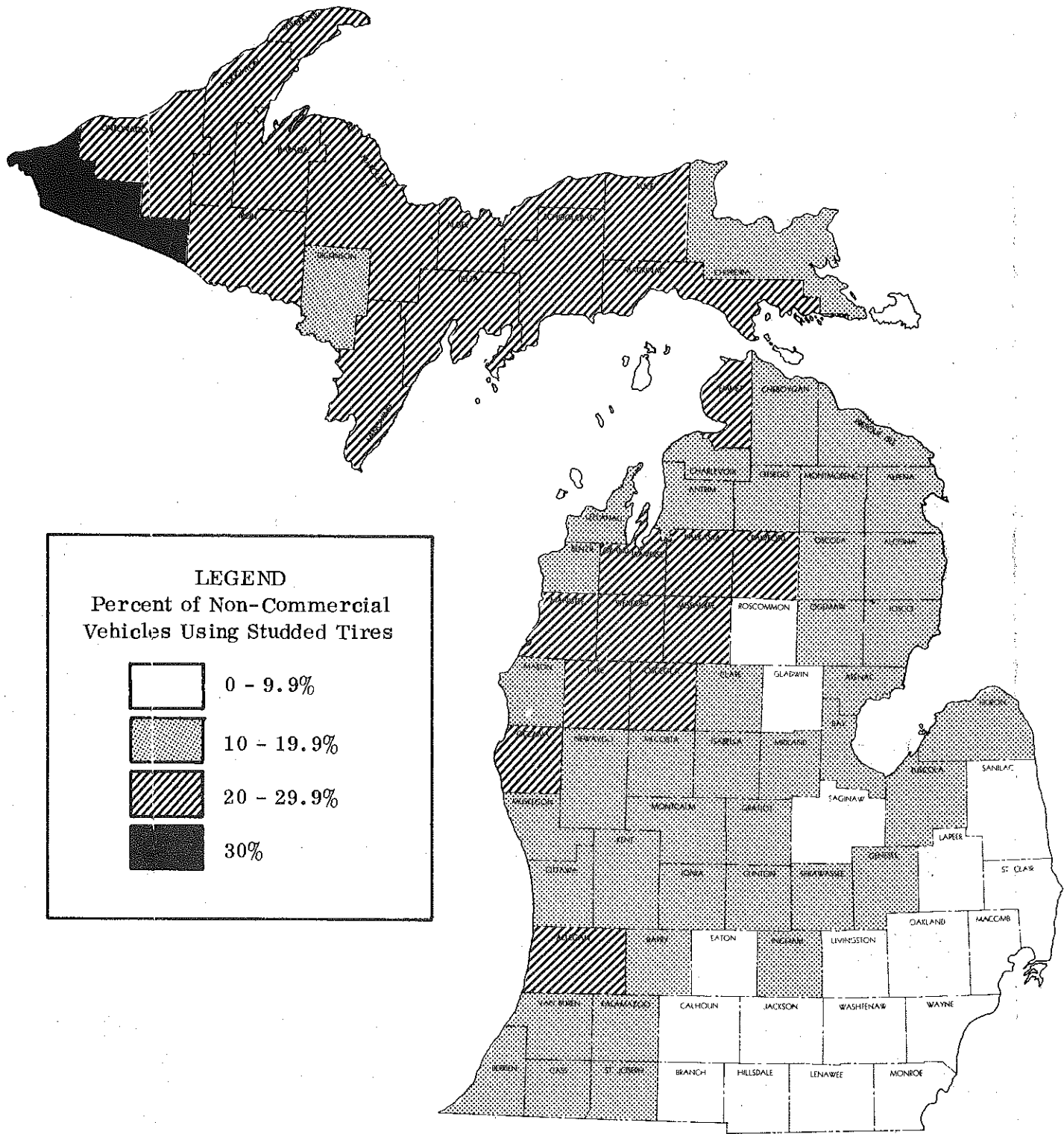


Figure 1. Studded tire usage in Michigan, winter 1972-73.

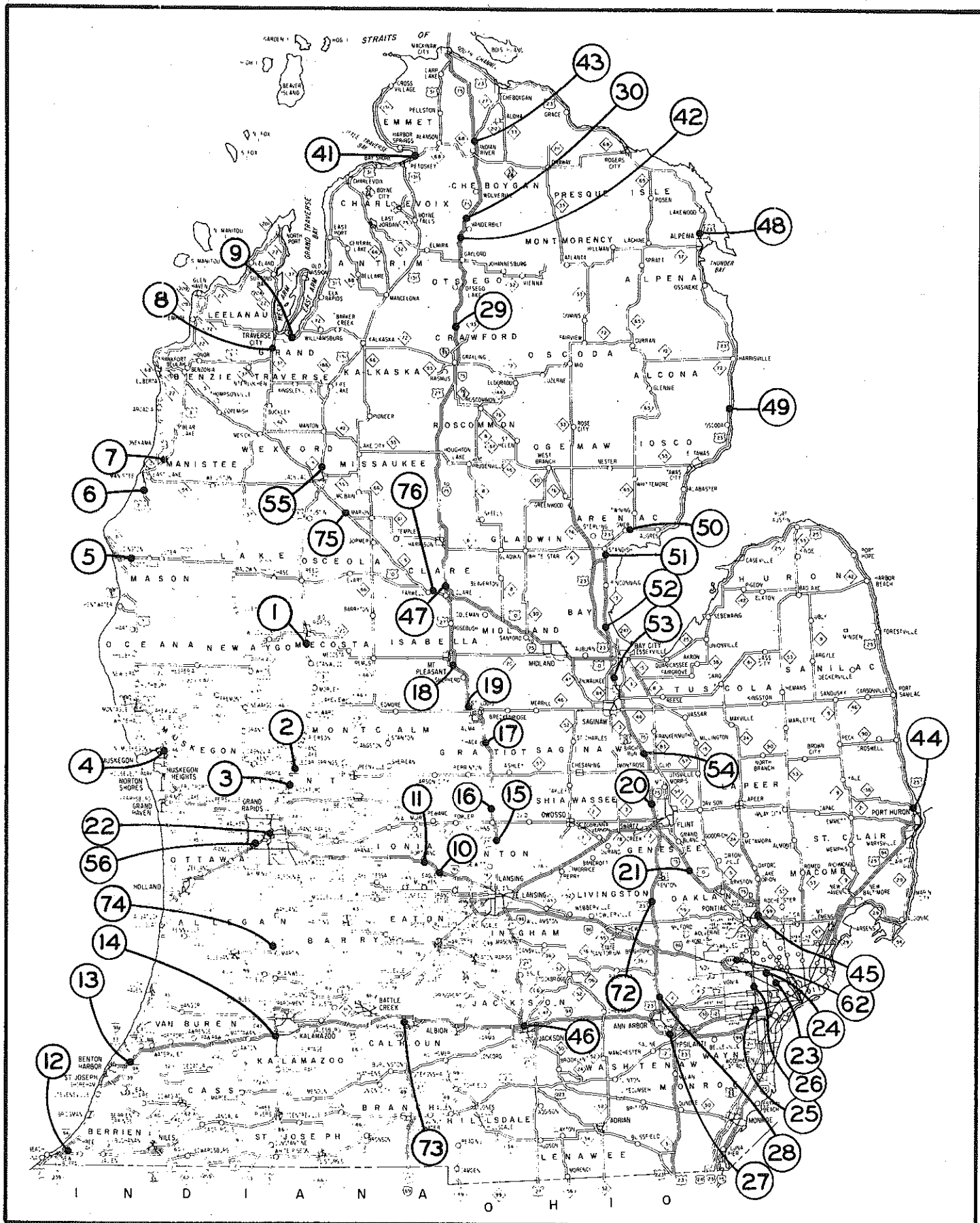


Figure 2. Tire stud wear survey locations.

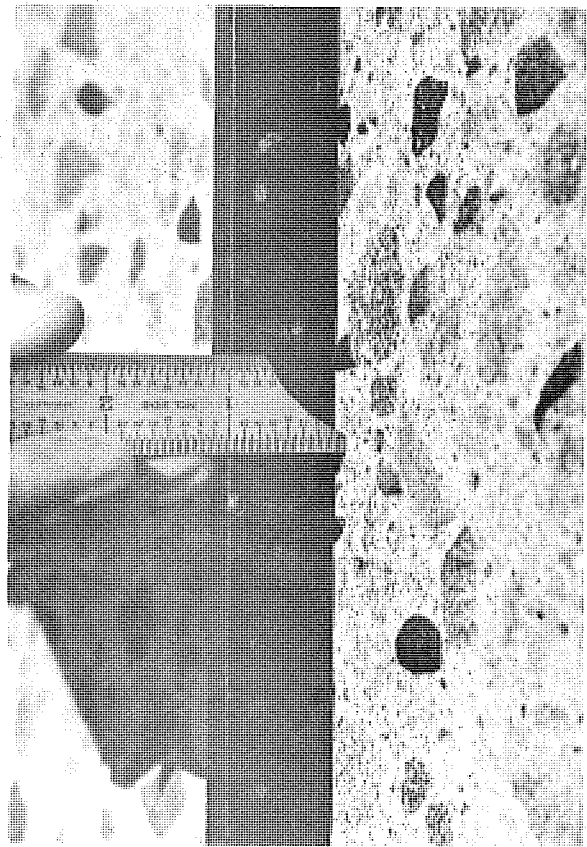
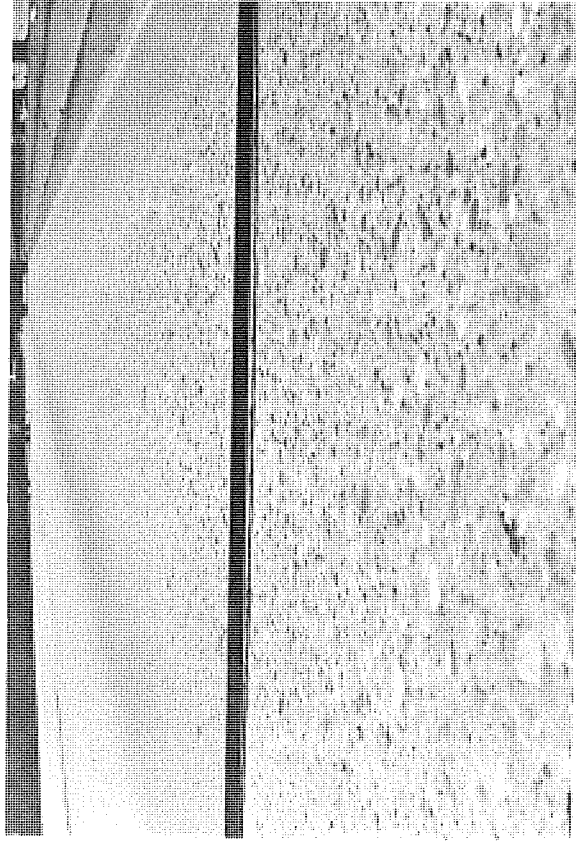


Figure 5. US 10 at Schaefer in Detroit, spring 1973.

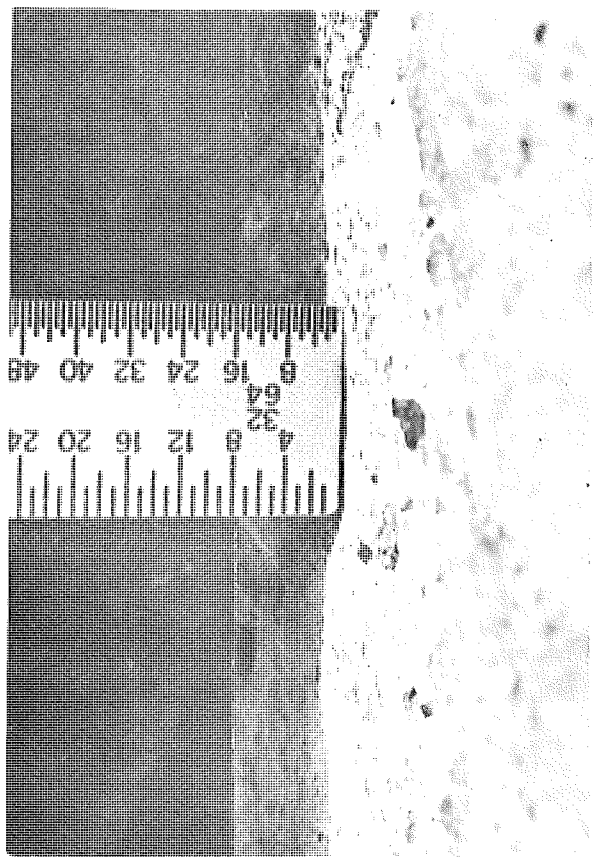
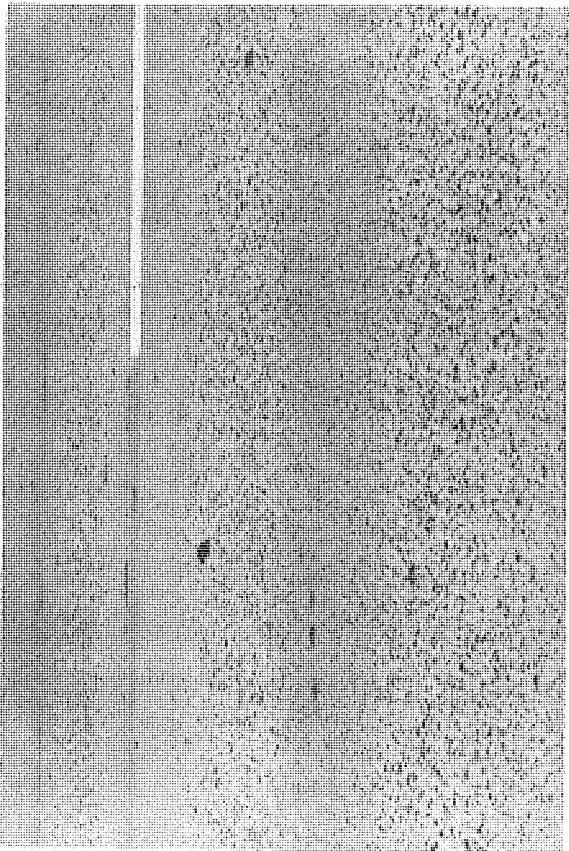


Figure 4. I 296 in Grand Rapids, spring 1973.

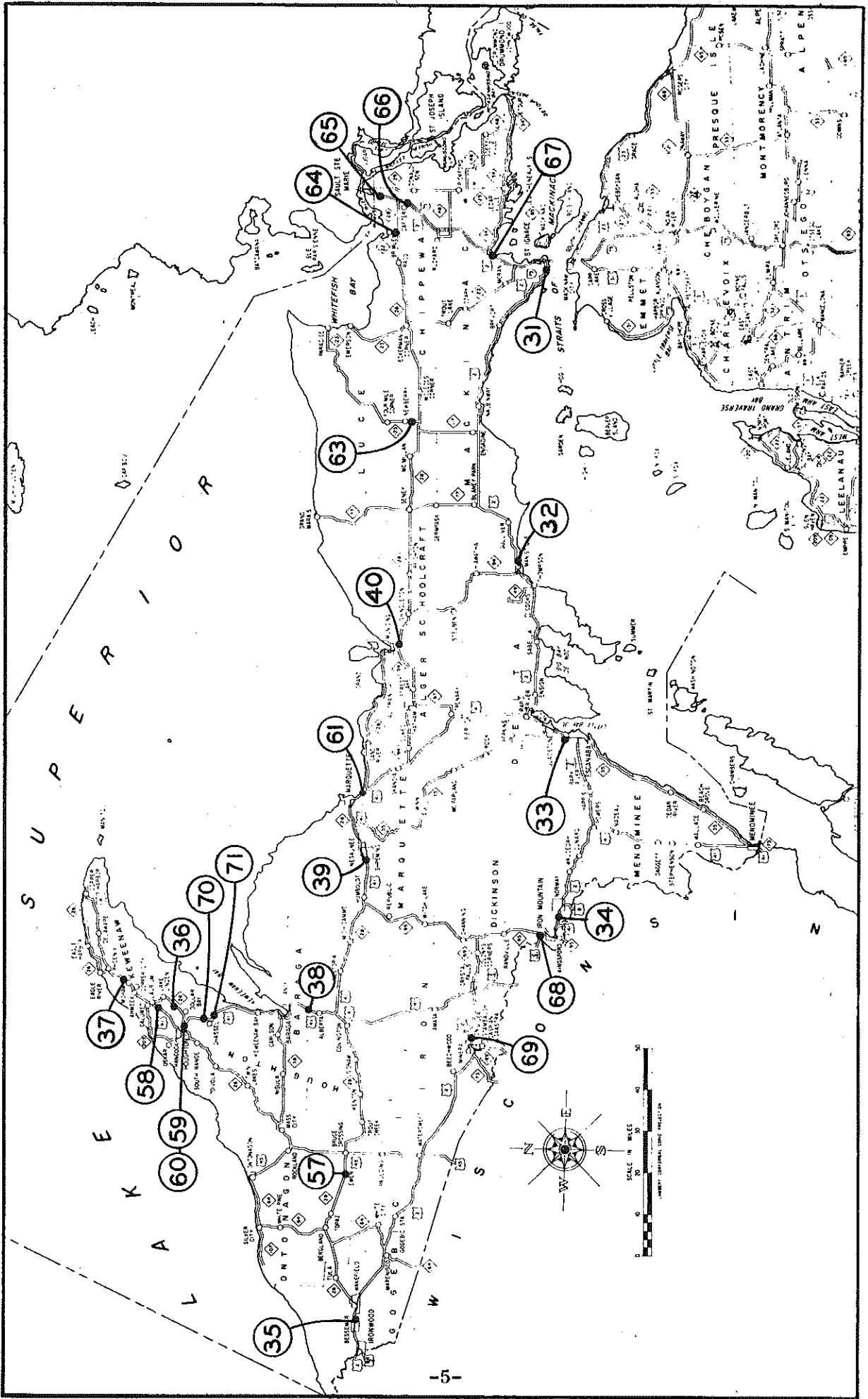


Figure 3. Tire stud wear survey locations.

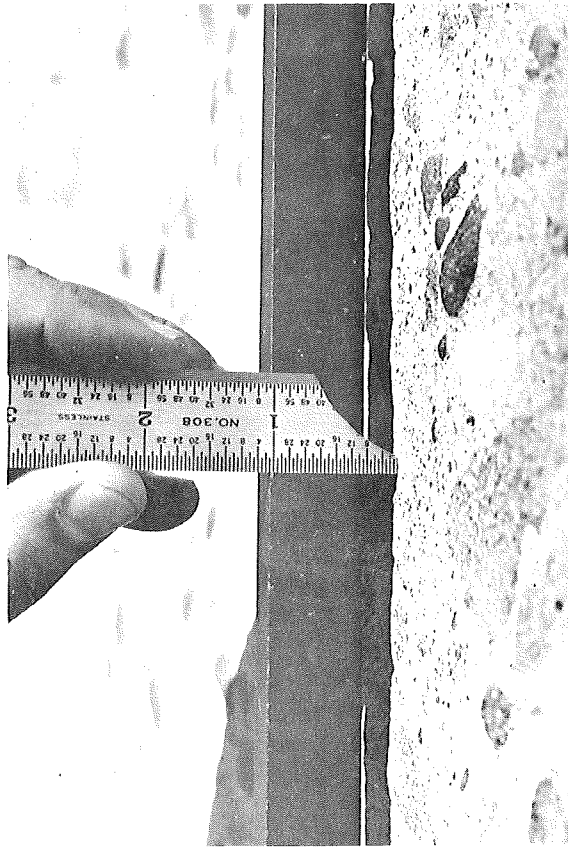
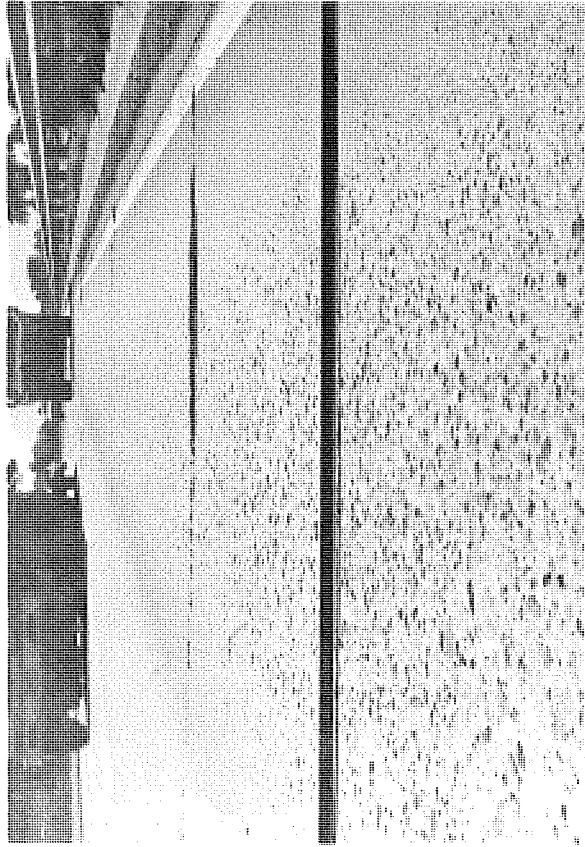


Figure 9. M 39 at Ford Rd in Detroit, spring 1973.

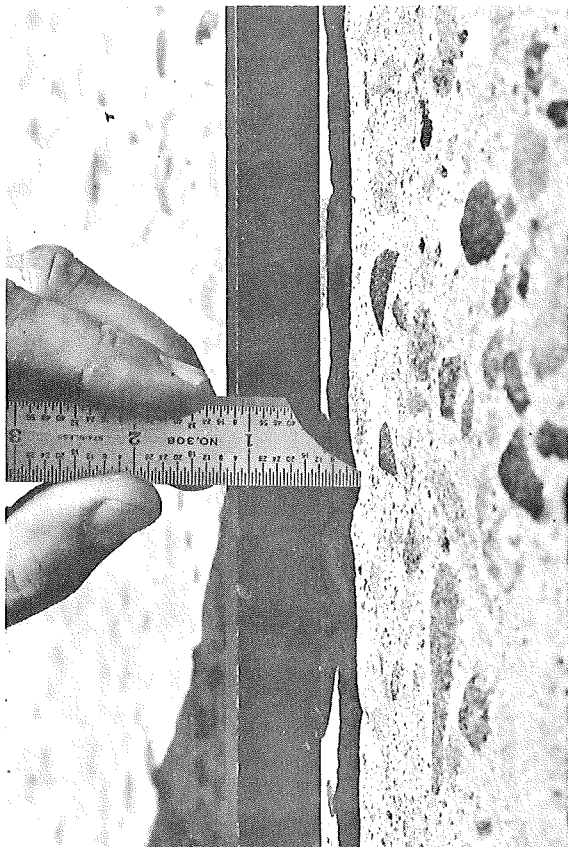
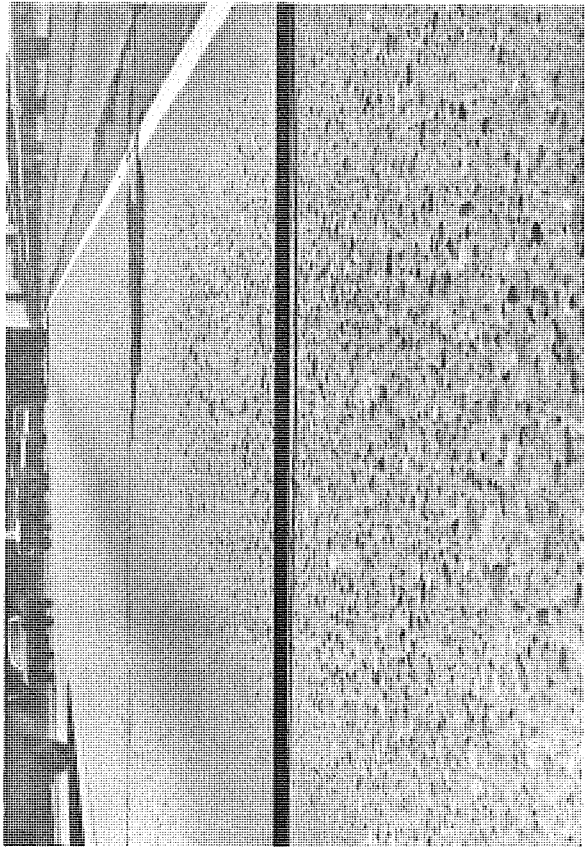


Figure 8. M 39 at Joy Rd in Detroit, spring 1973.

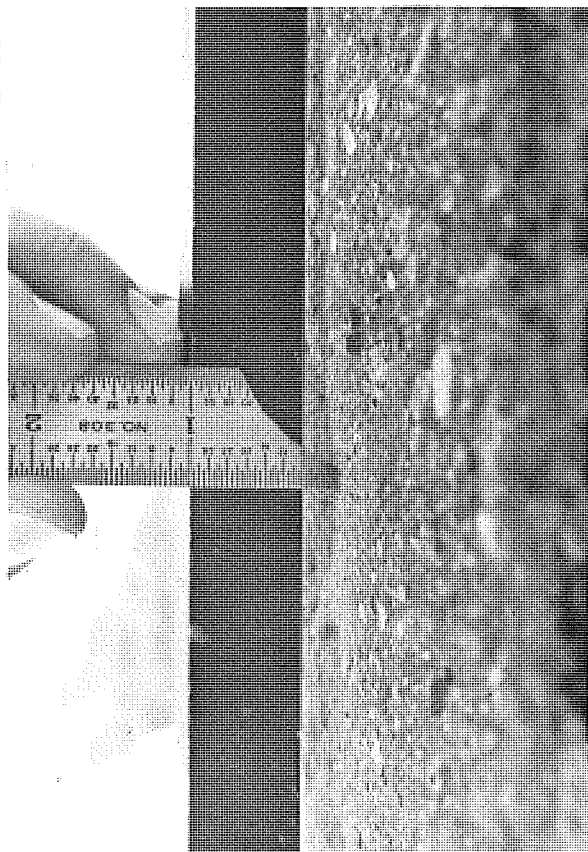
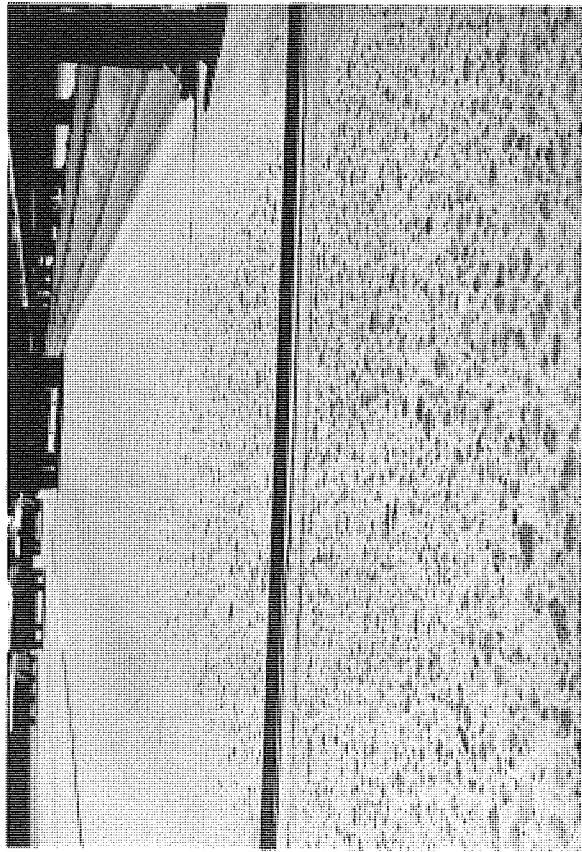


Figure 7. US 10 at Wyoming in Detroit, spring 1973.

Note: This location is on the precast patch placed May 27, 1971 upon removal of stud wear sample. The surface of the patch was straight when placed.

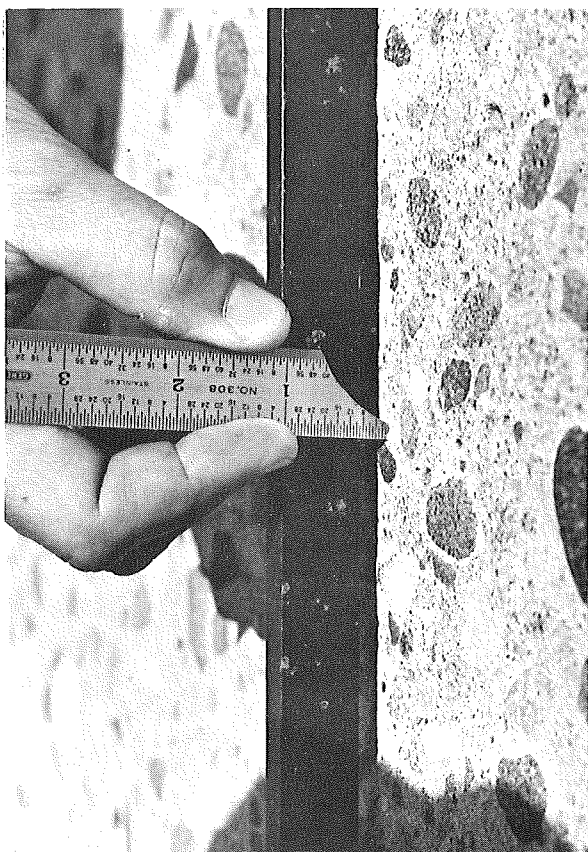
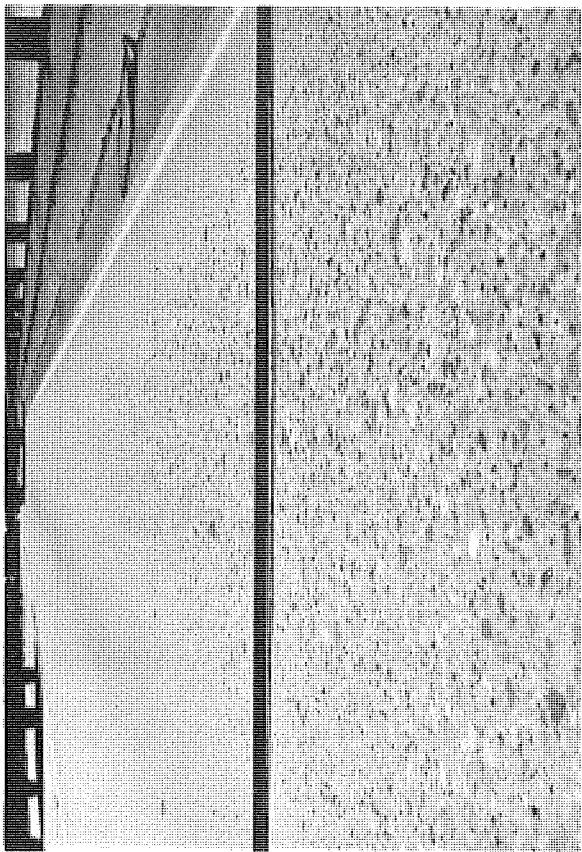


Figure 6. US 10 at 8 Mile Rd in Detroit, spring 1973.

TABLE 1
STUDED TIRE SURVEY BY COUNTIES, WINTER 1972-1973

County	No. of Vehicles	Percent of Vehicles			
		Without Studs	With Studs on Front Only	With Studs on Rear Only	With Studs on Front and Rear
Alcona	100	83.00	0	17.00	0
Alger	125	78.40	0	21.60	0
Allegan	400	79.00	0.25	20.50	0.25
Alpena	200	83.50	0	16.00	0.50
Antrim	100	83.00	0	17.00	0
Arenac	100	90.00	0	10.00	0
Baraga	100	71.00	0	28.00	1.00
Barry	200	83.00	0	16.50	0.50
Bay	200	85.86	0	14.00	0.14
Benzie	100	81.00	0	18.00	1.00
Berrien	1000	87.00	0	12.90	0.10
Branch	200	91.50	0	8.50	0
Calhoun	2000	91.05	0	8.95	0
Cass	300	89.00	0	11.00	0
Charlevoix	300	90.33	0	9.67	0
Cheboygan	300	84.00	0.33	15.33	0.33
Chippewa	200	85.00	0	15.00	0
Clare	100	86.00	0	14.00	0
Clinton	200	85.50	0	14.00	0.50
Crawford	100	77.00	0	22.00	1.00
Delta	200	74.50	0	25.50	0
Dickinson	100	81.00	0	19.00	0
Eaton	300	96.67	0	3.33	0
Emmet	100	71.00	0	27.00	2.00
Genesee	800	86.50	0	13.25	0.25
Gladwin	300	92.67	0	7.33	0
Gogebic	100	70.00	0	30.00	0
Grand Traverse	200	73.50	0.50	25.50	0.50
Gratiot	200	84.50	0	15.50	0
Hillsdale	200	92.50	0	7.50	0
Houghton	200	74.00	0	26.00	0
Huron	600	88.33	0	11.67	0
Ingham	1200	87.75	0.08	12.17	0
Ionia	600	89.67	0	10.33	0
Iosco	100	86.00	0	13.00	1.00
Iron	100	73.00	0	27.00	0
Isabella	600	86.17	0.17	13.66	0
Jackson	600	91.33	0.17	8.17	0.33
Kalamazoo	1100	83.64	0	16.27	0.09
Kalkaska	100	77.00	0	23.00	0
Kent	1500	88.60	0	11.40	0
Keweenaw	100	77.00	0	22.00	1.00



Figure 11. US 41 at south end of Houghton-Hancock Bridge, spring 1972.

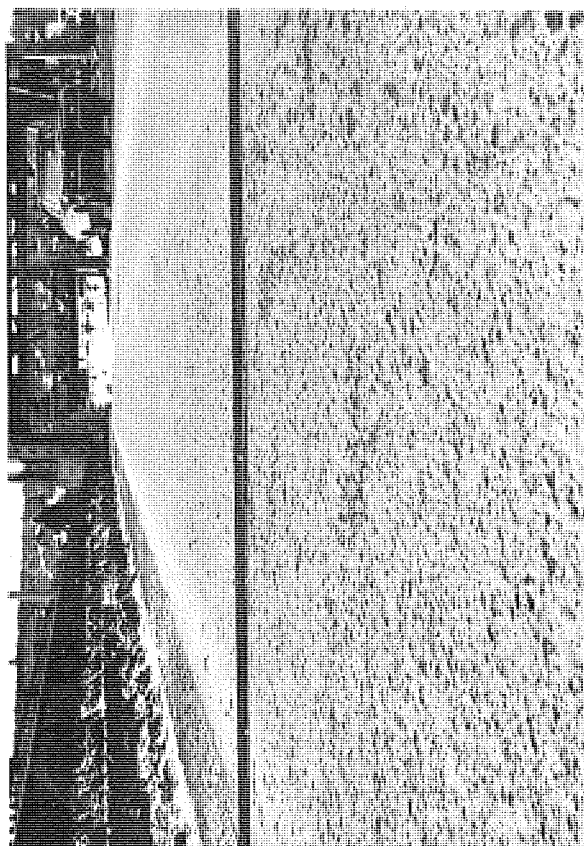


Figure 10. US 41 at north end of Houghton-Hancock Bridge, spring 1972.

TABLE 2
STUDED TIRE SURVEY BY DISTRICTS, WINTER 1972-1973

District	No. of Registered Vehicles	Percent of Vehicles			
		Without Studs	With Studs on Front Only	With Studs on Rear Only	With Studs on Front and Rear
1	93,263	74.97	0.00	24.88	0.15
2	46,513	78.75	0.09	21.16	0.00
3	108,663	79.70	0.11	19.97	0.22
4	86,930	82.66	0.03	16.76	0.55
5	501,521	86.14	0.02	13.46	0.11
6	563,971	88.47	0.02	11.36	0.15
7	418,416	86.55	0.02	13.32	0.11
8	515,377	91.77	0.05	8.10	0.08
M	<u>2,273,222</u>	<u>94.60</u>	<u>0.04</u>	<u>5.30</u>	<u>0.06</u>
Total	4,607,876	90.78	0.03	9.09	0.10

TABLE 3
STUDED TIRE SURVEY BY VEHICLE TYPES, WINTER 1972-1973

Vehicle		Percent of Vehicles			
Type	No. of Vehicles Surveyed	None	Front	Rear	Front and Rear
Passenger Car	29,912	87.52	0.03	12.35	0.10
Pickup & panel trucks	1,780	90.84	0.11	9.05	0.00
4 wheel drive	333	97.30	0.60	0.30	1.80

TABLE 1 (Cont.)
STUDED TIRE SURVEY BY COUNTIES, WINTER 1972-1973

County	No. of Vehicles	Percent of Vehicles			
		Without Studs	With Studs on Front Only	With Studs on Rear Only	With Studs on Front and Rear
Lake	100	80.00	0	19.00	1.00
Lapeer	200	93.00	0.50	6.00	0.50
Leelanau	300	83.67	0	16.33	0
Lenawee	500	93.20	0	6.80	0
Livingston	300	91.33	0	8.67	0
Luce	100	79.00	0	21.00	0
Mackinac	100	79.00	0	21.00	0
Macomb	1000	94.50	0	5.50	0
Manistee	100	73.00	0	27.00	0
Marquette	300	76.00	0	23.67	0.33
Mason	100	86.00	0	14.00	0
Mecosta	100	87.00	0	13.00	0
Menominee	100	74.00	0	26.00	0
Midland	400	90.50	0	9.50	0
Missaukee	100	78.00	0	22.00	0
Monroe	600	96.33	0	3.67	0
Montcalm	600	86.00	0	13.83	0.17
Montmorency	100	88.00	0	12.00	0
Muskegon	900	80.56	0	19.00	0.44
Newaygo	600	85.50	0	14.50	0
Oakland	1200	92.92	0.17	6.83	0.08
Oceana	100	80.00	0	20.00	0
Ogemaw	100	81.00	0	19.00	0
Ontonagon	100	74.00	0	26.00	0
Osceola	100	78.00	0	22.00	0
Oscoda	100	85.00	0	15.00	0
Otsego	100	82.00	0	18.00	0
Ottawa	700	86.72	0.14	13.00	0.14
Presque Isle	100	85.00	0	15.00	0
Roscommon	300	91.33	0	8.67	0
Saginaw	900	91.44	0	8.56	0
Sanilac	200	98.00	0	2.00	0
Schoolcraft	100	75.00	1.00	24.00	0
Shiawassee	300	86.67	0	13.33	0
St. Clair	700	95.00	0	4.86	0.14
St. Joseph	300	88.67	0	11.33	0
Tuscola	600	86.50	0	13.17	0.33
Van Buren	300	87.33	0	12.33	0.33
Washtenaw	1200	92.42	0	7.42	0.16
Wayne	1500	95.27	0	4.67	0.06
Wexford	300	78.67	0	21.00	0.33

TABLE 4
PERCENT OF VEHICLES USING STUDED TIRES BY COUNTIES

County	Percent	County	Percent	County	Percent
Gogebic	30.00	Otsego	18.00	Montmorency	12.00
Baraga	29.00	Alcona	17.00	Huron	11.67
Emmet	29.00	Antrim	17.00	Kent	11.40
Iron	27.00	Barry	17.00	St. Joseph	11.33
Manistee	27.00	Alpena	16.50	Cass	11.00
Grand Traverse	26.50	Kalamazoo	16.36	Ionia	10.33
Houghton	26.00	Leelanau	16.33	Arenac	10.00
Menominee	26.00	Cheboygan	16.00	Charlevoix	9.67
Ontonagon	26.00	Gratiot	15.50	Midland	9.50
Delta	25.50	Chippewa	15.00	Calhoun	8.95
Schoolcraft	25.00	Oscoda	15.00	Jackson	8.67
Marquette	24.00	Presque Isle	15.00	Livingston	8.67
Crawford	23.00	Clinton	14.50	Roscommon	8.67
Kalkaska	23.00	Newaygo	14.50	Saginaw	8.56
Keweenaw	23.00	Bay	14.14	Branch	8.50
Missaukee	22.00	Clare	14.00	Washtenaw	7.58
Osceola	22.00	Iosco	14.00	Hillsdale	7.50
Alger	21.60	Mason	14.00	Gladwin	7.33
Wexford	21.33	Montcalm	14.00	Oakland	7.08
Allegan	21.00	Isabella	13.83	Lapeer	7.00
Luce	21.00	Genesee	13.50	Lenawee	6.80
Mackinac	21.00	Tuscola	13.50	Macomb	5.50
Lake	20.00	Shiawassee	13.33	St. Clair	5.00
Oceana	20.00	Ottawa	13.29	Wayne	4.73
Muskegon	19.44	Berrien	13.00	Monroe	3.67
Benzie	19.00	Mecosta	13.00	Eaton	3.33
Dickinson	19.00	Van Buren	12.67	Sanilac	2.00
Ogemaw	19.00	Ingham	12.25		

TABLE 5
HISTORICAL REVIEW OF STUDED TIRE SURVEYS

County	1969-1970 Studded Tire Proportion	1970-1971 Studded Tire Proportion	1971-1972 Studded Tire Proportion	1972-1973 Studded Tire Proportion
Alcona	0.11	0.28	0.22	0.17
Alger	0.30	0.26	0.21	0.22
Allegan	0.17	0.27	0.21	0.21
Alpena	0.08	0.24	0.20	0.16
Antrim	0.25	0.32	0.21	0.17
Arenac	0.14	0.27	0.19	0.10
Baraga	0.30	0.31	0.26	0.29
Barry	0.23	0.36	0.18	0.17
Bay	0.08	0.16	0.20	0.14
Benzie	0.23	0.38	0.24	0.19
Berrien	0.12	0.21	0.13	0.13
Branch	0.08	0.12	0.08	0.08
Calhoun	0.10	0.12	0.10	0.09
Cass	0.13	0.24	0.26	0.11
Charlevoix	0.18	0.31	0.21	0.10
Cheboygan	0.23	0.36	0.28	0.16
Chippewa	0.16	0.28	0.22	0.15
Clare	0.20	0.21	0.19	0.14
Clinton	0.10	0.22	0.22	0.14
Crawford	0.25	0.35	0.20	0.23
Delta	0.20	0.32	0.29	0.26
Dickinson	0.24	0.49	0.34	0.19
Eaton	0.08	0.10	0.13	0.03
Emmet	0.33	0.40	0.23	0.29
Genesee	0.09	0.17	0.16	0.14
Gladwin	0.11	0.27	0.15	0.07
Gogebic	0.17	0.35	0.35	0.30
Grand Traverse	0.22	0.34	0.24	0.26
Graiot	0.16	0.15	0.20	0.16
Hillsdale	0.09	0.17	0.06	0.08
Houghton	0.42	0.46	0.30	0.26
Huron	0.18	0.32	0.26	0.12
Ingham	0.13	0.13	0.15	0.12
Ionia	0.18	0.21	0.16	0.10
Iosco	0.07	0.19	0.21	0.14
Iron	0.12	0.32	0.19	0.27
Isabella	0.16	0.17	0.24	0.14
Jackson	0.06	0.20	0.09	0.09
Kalamazoo	0.18	0.15	0.10	0.16
Kalkaska	0.22	0.27	0.22	0.23
Kent	0.18	0.21	0.17	0.11
Keweenaw	0.35	0.37	0.33	0.23
Lake	0.10	0.20	0.10	0.20
Lapeer	0.06	0.13	0.16	0.07

TABLE 6
SUMMARY OF 1972-1973 STUDDED TIRE SURVEY DATA

County	Vehicle Registration	Number of Clusters in County	Number of Clusters Sampled	Vehicles per Cluster	Number of Vehicles With Studs	Proportion With Studs	Standard Deviation	Precision of Estimated Proportion With Studs (95% Confidence)
Alcona	4,847	193.90	4	25	17	0.17	0.02	0.02
Alger	3,513	140.52	5	25	27	0.216	0.02	0.02
Allegan	33,302	666.03	8	50	84	0.21	0.02	0.01
Alpena	16,323	652.91	8	25	33	0.165	0.02	0.02
Antrim	6,204	248.15	4	25	17	0.17	0.02	0.02
Arenac	5,396	215.85	4	25	10	0.1	0.05	0.05
Baraga	3,804	152.15	4	25	29	0.29	0.04	0.04
Barry	16,476	659.04	8	25	34	0.17	0.03	0.02
Bay	59,418	1,188.35	14	50	99	0.1414	0.02	0.01
Benzie	4,936	197.44	4	25	19	0.19	0.06	0.06
Berrien	92,460	924.60	10	100	130	0.13	0.01	0.01
Branch	18,945	757.80	8	25	17	0.085	0.02	0.01
Calhoun	76,235	762.35	20	100	179	0.0895	0.01	0.01
Cass	22,760	910.38	12	25	33	0.11	0.03	0.01
Charlevoix	7,887	315.48	12	25	29	0.0967	0.02	0.01
Cheboygan	8,415	336.60	12	25	48	0.16	0.03	0.01
Chippewa	14,270	570.81	8	25	30	0.15	0.02	0.01
Clare	8,413	336.51	4	25	14	0.14	0.06	0.06
Clinton	19,447	777.87	8	25	29	0.145	0.03	0.02
Crawford	3,548	141.92	4	25	23	0.23	0.06	0.06
Delta	17,297	691.87	8	25	51	0.255	0.03	0.02
Dickinson	12,553	502.12	4	25	19	0.19	0.03	0.03
Eaton	35,175	1,407.00	12	25	10	0.0333	0.01	0.01
Emmet	10,663	426.53	4	25	29	0.29	0.06	0.06
Genesee	232,563	2,325.63	8	100	108	0.135	0.02	0.01
Gladwin	6,716	268.66	12	25	22	0.0733	0.02	0.01
Gogebic	9,441	377.65	4	25	30	0.3	0.03	0.03
Grand Traverse	24,654	986.15	8	25	53	0.265	0.03	0.02
Gratiot	19,725	789.01	8	25	31	0.155	0.02	0.02
Hillsdale	19,253	770.13	8	25	15	0.075	0.03	0.02
Houghton	14,369	574.74	8	25	52	0.26	0.04	0.03
Huron	18,163	726.54	24	25	70	0.1167	0.02	0.01
Ingham	138,264	1,382.64	12	100	147	0.1225	0.01	0.01
Ionia	21,523	860.93	24	25	62	0.1033	0.02	0.01
Iosco	11,731	469.25	4	25	14	0.14	0.05	0.05
Iron	6,992	279.68	4	25	27	0.27	0.08	0.08
Isabella	17,006	680.24	24	25	83	0.1383	0.01	0.01
Jackson	71,651	1,433.01	12	50	52	0.0867	0.01	0.01
Kalamazoo	103,015	1,030.15	11	100	180	0.1636	0.02	0.01
Kalkaska	2,906	116.25	4	25	23	0.23	0.04	0.04
Kent	224,817	2,248.17	15	100	171	0.114	0.01	0.01
Keweenaw	1,024	40.97	4	25	23	0.23	0.04	0.04

TABLE 5 (Cont.)
HISTORICAL REVIEW OF STUDED TIRE SURVEYS

County	1969-1970 Studded Tire Proportion	1970-1971 Studded Tire Proportion	1971-1972 Studded Tire Proportion	1972-1973 Studded Tire Proportion
Leelanau	0.17	0.38	0.28	0.16
Lenawee	0.05	0.14	0.09	0.07
Livingston	0.15	0.21	0.17	0.09
Luce	0.29	0.27	0.24	0.21
Mackinac	0.18	0.27	0.24	0.21
Macomb	0.09	0.08	0.08	0.06
Manistee	0.24	0.35	0.26	0.27
Marquette	0.40	0.42	0.30	0.24
Mason	0.19	0.33	0.22	0.14
Mecosta	0.16	0.25	0.22	0.13
Menominee	0.09	0.41	0.25	0.26
Midland	0.15	0.22	0.13	0.10
Missaukee	0.25	0.35	0.26	0.22
Monroe	0.06	0.14	0.06	0.04
Montcalm	0.12	0.32	0.28	0.14
Montmorency	0.10	0.16	0.12	0.12
Muskegon	0.18	0.25	0.17	0.19
Newaygo	0.26	0.26	0.26	0.14
Oakland	0.11	0.12	0.11	0.07
Oceana	0.25	0.36	0.24	0.20
Ogemaw	0.17	0.24	0.29	0.19
Ontonagon	0.12	0.35	0.33	0.26
Osceola	0.20	0.25	0.21	0.22
Oscoda	0.13	0.25	0.20	0.15
Otsego	0.18	0.44	0.24	0.18
Ottawa	0.19	0.25	0.18	0.13
Presque Isle	0.09	0.27	0.20	0.15
Roscommon	0.19	0.21	0.26	0.09
Saginaw	0.09	0.14	0.15	0.09
Sanilac	0.14	0.11	0.12	0.02
Schoolcraft	0.30	0.26	0.26	0.25
Shiawassee	0.13	0.14	0.17	0.13
St. Clair	0.08	0.10	0.07	0.05
St. Joseph	0.10	0.14	0.09	0.11
Tuscola	0.22	0.23	0.26	0.14
Van Buren	0.16	0.25	0.15	0.13
Washtenaw	0.10	0.12	0.11	0.08
Wayne	0.10	0.10	0.06	0.05
Wexford	0.24	0.34	0.22	0.21

Weighted 1969-70 Statewide Tire Stud Proportion = 0.1196

Weighted 1970-71 Statewide Tire Stud Proportion = 0.1524

Weighted 1971-72 Statewide Tire Stud Proportion = 0.1183

Weighted 1972-73 Statewide Tire Stud Proportion = 0.0922

TABLE 7
MEASUREMENT OF STUD WEAR ON MICHIGAN PAVEMENTS
Spring 1973

Map Reference No.	Location	Surface Type	Depth of Wear		
			1971	1972	1973
1	US 131 S of Big Rapids	Bit. over Conc.	3/16 - 1/4	1/4 - 5/16	1/4 - 5/16
2	US 131 S of Cedar Springs	Bit. over Conc.	3/8	3/8 - 7/16	3/8 - 7/16
3	Old US 131 at Rockford	Bit. over Conc.	1/8	1/8 - 3/16	1/8 - 3/16
4	US 31 at Muskegon	Concrete	0	1/16	1/16 - 1/8
5	US 10 & US 31 W of Scottville	Bit. over Conc.	1/4	1/4 - 5/16	1/4 - 3/8
6	US 31 S of Manistee	Concrete	1/16 - 3/32	1/8	1/8
7	US 31 N of Manistee	Bit. over Conc.	1/8	1/8 - 3/16	1/8 - 3/16
8	M 37 & US 31 S of Traverse City	Concrete	1/32	1/16	1/8
9	US 31 & M 72 in Traverse City	Concrete	1/16	1/16 - 1/8	1/16 - 1/8
10	I 96 E of Portland	Concrete	1/8	1/8 - 1/4	3/16 - 5/16
11	I 96 W of Portland	Concrete	1/16	1/8	1/8
12	I 94 S of Bridgeman	Bituminous	1/16	1/16 - 3/16	1/16 - 3/16
13	I 94 at St. Joseph	Concrete	1/32	1/16	1/16 - 1/8
14	I 94 at Kalamazoo	Concrete	3/32	1/8	1/8 - 3/16
15	US 27 S of St. Johns	Concrete	3/32	1/8	1/8
16	US 27 N of St. Johns	Concrete	1/16	1/16 - 1/8	1/16 - 1/8
17	US 27 at Ithaca	Concrete	1/16	1/16 - 3/32	1/16 - 1/8
18	US 27 at Mt. Pleasant	Concrete	1/16	1/16	1/16
19	US 27 at Alma	Concrete	1/16	1/16	1/16 - 1/8
20	I 75 N of Flint	Concrete	1/8	1/8	1/8 - 3/16
21	I 75 at Holly	Concrete	1/16	1/16 - 1/8	1/16 - 1/8
22	I 296 & US 131 in Grand Rapids	Concrete	3/32 - 1/4	3/16	1/8 - 5/16
23	US 10 at Wyoming	Concrete	7/32	9/32	11/32
23	US 10 at Schaefer	Concrete	7/32	5/16	3/8
24	US 10 at 8 Mile Rd	Concrete	1/8	7/32	9/32
25	M 39 at Ford Rd	Concrete	3/16	9/32	11/32
26	M 39 at Schoolcraft	Concrete	5/32	3/8	7/16
27	I 94 W of US 23	Concrete	1/16	1/16 - 1/8	1/8 - 1/4
28	US 23 N of Ann Arbor	Concrete	1/8	1/8 - 3/16	1/8 - 1/4
29	US 27 N of Grayling	Bituminous	1/8 - 1/4	1/8 - 1/4	1/8 - 1/4
30	I 75 N of Vanderbilt	Bituminous	1/8 - 3/16	1/8 - 3/16	1/8 - 3/16
31	US 2 W of St. Ignace	Bit. over Conc.	1/8 - 3/16	1/8 - 1/4	3/16 - 1/4
32	US 2 at Manistique	Bit. over Conc.	1/8	1/8 - 1/4	1/8 - 1/4
33	US 2 at Escanaba	Concrete	1/8	1/16 - 1/8	1/16 - 1/8
34	US 2 E of Iron Mountain	Bit. over Conc.	1/8	1/16 - 3/16	1/16 - 3/16
35	US 2 at Bessemer	Concrete	1/16	1/16	1/16
36	M 26 at Hubble	Bit. over Conc.	3/16	1/8 - 3/16	1/8 - 1/4
37	US 41 & M 26 at Mohawk	Bit. over Conc.	3/8 - 1/2	3/8 - 1/2	3/8 - 1/2
38	US 41 S of L'Anse	Concrete	1/16	1/16	1/16
39	US 41 at Negaunee	Concrete	1/8	1/16 - 3/16	1/8 - 3/16
40	M 28 E of Munising	Bituminous	1/8	3/16 - 5/16	3/16 - 5/16

TABLE 6 (Cont.)
SUMMARY OF 1972-1973 STUDDED TIRE SURVEY DATA

County	Vehicle Registration	Number of Clusters in County	Number of Clusters Sampled	Vehicles per Cluster	Number of Vehicles With Studs	Proportion With Studs	Standard Deviation	Precision of Estimated Proportion With Studs (95% Confidence)
Lake	2,816	112.62	4	25	20	0.2	0.02	0.02
Lapeer	23,196	927.83	8	25	14	0.07	0.02	0.01
Leelanau	5,200	208.02	12	25	49	0.1633	0.01	0.01
Lenawee	42,924	858.49	10	50	34	0.068	0.01	0.01
Livingston	28,979	1,159.15	12	25	26	0.0867	0.02	0.01
Luce	3,180	127.18	4	25	21	0.21	0.04	0.04
Mackinac	3,858	154.33	4	25	21	0.21	0.04	0.04
Macomb	350,305	3,503.05	10	100	55	0.055	0.01	0.01
Manistee	10,841	433.66	4	25	27	0.27	0.06	0.06
Marquette	28,023	1,120.94	12	25	72	0.24	0.03	0.01
Mason	12,510	500.42	4	25	14	0.14	0.03	0.03
Mecosta	12,152	486.08	4	25	13	0.13	0.04	0.04
Menominee	12,066	482.63	4	25	26	0.26	0.04	0.04
Midland	33,850	677.00	8	50	38	0.095	0.02	0.01
Missaukee	3,516	140.65	4	25	22	0.22	0.04	0.04
Monroe	60,137	1,202.74	12	50	22	0.0367	0.01	0.01
Montcalm	20,681	827.23	24	25	84	0.14	0.02	0.01
Montmorency	2,818	112.71	4	25	12	0.12	0.03	0.03
Muskegon	78,532	1,570.64	18	50	175	0.1944	0.01	0.01
Newaygo	14,593	583.71	24	25	87	0.145	0.02	0.01
Oakland	519,100	5,191.00	12	100	85	0.0708	0.01	0.01
Oceana	8,086	323.44	4	25	20	0.2	0.02	0.02
Ogemaw	6,546	261.84	4	25	19	0.19	0.03	0.03
Ontonagon	4,990	199.58	4	25	26	0.26	0.05	0.05
Osceola	7,789	311.55	4	25	22	0.22	0.06	0.06
Oscoda	2,588	103.53	4	25	15	0.15	0.02	0.02
Otsego	6,466	258.65	4	25	18	0.18	0.04	0.04
Ottawa	64,959	1,299.18	14	50	93	0.1329	0.01	0.01
Presque Isle	6,307	252.26	4	25	15	0.15	0.05	0.05
Roscommon	6,678	267.13	12	25	26	0.0867	0.01	0.01
Saginaw	113,524	1,135.24	9	100	77	0.0856	0.01	0.01
Sanilac	17,575	703.02	8	25	4	0.02	0.01	0.01
Schoolcraft	4,395	175.80	4	25	25	0.25	0.02	0.02
Shiawassee	30,872	1,234.87	12	25	40	0.1333	0.02	0.01
St. Clair	61,103	1,222.06	14	50	35	0.05	0.01	0.01
St. Joseph	26,090	1,043.60	12	25	34	0.1133	0.02	0.01
Tuscola	22,698	907.93	24	25	81	0.135	0.02	0.01
Van Buren	29,134	1,165.36	12	25	38	0.1267	0.02	0.01
Washtenaw	118,994	1,189.94	12	100	91	0.0758	0.01	0.01
Wayne	1,342,713	13,427.13	15	100	71	0.0473	0.01	0.01
Wexford	10,991	439.65	12	25	64	0.2133	0.04	0.02

TABLE 7 (Cont.)
MEASUREMENT OF STUD WEAR ON MICHIGAN PAVEMENTS

Map Reference No.	Location	Surface Type	Depth of Wear		
			1971	1972	1973
41	US 31 N of Petoskey	Bit. over Conc.	1/8	3/16 - 1/4	3/16 - 5/16
42	I 75 N of Vanderbilt (on Bit. patch)	Bituminous	3/16	1/4 - 5/16	1/4 - 5/16
43	I 75 N of Indian River	Bituminous	---	1/16 - 1/8	1/16 - 1/8
44	US 25 at Krafft Rd	Concrete	---	1/16	1/16
45	I 75 N of M 59	Concrete	---	1/16	3/16 - 1/4
46	I 94 W of M 106	Concrete	---	1/16	1/16 - 3/16
47	US 27 N of Clare	Concrete	---	1/16 - 1/8	1/16 - 1/8
48	US 23 N of Alpena	Bit. over Conc.	---	1/8	1/8
49	US 23 N of Oscoda	Bit. over Conc.	---	1/8	1/8
50	US 23 W of M 65	Bit. over Conc.	---	1/8 - 3/16	1/8 - 1/4
51	US 23 S of Standish	Bit. over Conc.	---	1/8 - 1/4	1/8 - 5/16
52	M 13 at Kawkawlin	Bit. over Conc.	---	1/8 - 3/16	1/8 - 3/16
53	I 75 at Zilwaukee	Bit. over Conc.	---	1/16 - 1/8	1/8 - 1/4
54	I 75 at Birch Run	Concrete	---	1/16 - 1/8	1/16 - 1/4
55	US 131 N of Cadillac	Bit. over Conc.	---	1/8	1/8 - 3/16
56	I 196 W of US 131	Concrete	---	3/16	3/16 - 1/4
57	M 28 at Ewen	Bituminous	---	1/8	1/8 - 3/16
58	US 41 S of Calumet	Concrete	---	1/16	1/16
59	US 41 in Hancock	Bit. over Conc.	---	1/8 - 1/4	1/4
60	US 41 at ends of Houghton-Hancock Bridge	Concrete	---	1/8 - 3/16	1/8 - 1/4
61	US 41 S of Marquette	Concrete	---	1/16 - 1/8	1/8 - 3/16
62	I 696 E of Novi	Concrete	---	7/32	7/32 - 9/32
63	M 123 S of Newberry	Bituminous	---	---	3/16 - 7/16
64	M 28 at Brimley	Concrete	---	---	1/32
65	I 75 S of Sault Ste. Marie	Concrete	---	---	1/32 - 1/16
66	I 75 S of M 28	Concrete	---	---	1/32
67	I 75 S of M 134	Concrete	---	---	1/32
68	US 2 W of Iron Mountain	Bit. over Conc.	---	---	1/8 - 3/16
69	US 2 E of Iron River	Concrete	---	---	1/32
70	US 41 N of Chassell	Bit. over Conc.	---	---	1/8 - 3/16
71	US 41 S of Chassell	Concrete	---	---	1/16 - 1/8
72	US 23 S of Fenton	Concrete	---	---	1/16 - 3/16
73	I 69 at Marshall	Concrete	---	---	1/16
74	US 131 at Martin	Concrete	---	---	1/16 - 1/8
75	M 115 S of Cadillac	Bit. over Conc.	---	---	1/8 - 3/16
76	US 10 W of Clare	Bit. over Conc.	---	---	1/4 - 3/8