

SUMMARIES OF MICHIGAN PAVEMENT ROUGHNESS
1962 Test Program

Prepared for Road Construction Division

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Michigan State Highway Department
John C. Mackie, Commissioner
Lansing, October 1963

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1962 Test Program*

The greatest annual volume of trunkline mileage surveyed in the 12-year history of the Department's roughness program was covered in the 1962 tests. Approximately 916 lane miles were surveyed. The previous high volume of lane mileage, tested in 1961, was surpassed this year by 35 percent. The 1962 measurements included 512 lane miles of standard rigid pavement (two-lane pours), 380 lane miles of flexible pavement, and 24 lane miles of rigid pavement widening (one-lane pours).

All surveys were conducted in the usual manner with the MSHD Roughometer and two instrumental systems for recording the data. The Integrator (used since 1951) and the Acceleration Level Indicator (added in 1959 for supplementary and more extensive measurements) have now produced a 4-year correlation coefficient of 0.926, indicating continued agreement between the two recording systems. Simultaneous operation of both instruments provides an invaluable cross-check of results and a method of validating operations.

Rigid Pavement Construction (Two-Lane Pours)

Individual rigid pavement projects constructed as standard two-lane pours, and their roughness values as determined in the 1962 test program,

* Throughout this report, the terms "construction year" and "test year" are specifically used to distinguish between the period of construction operations, and the time when measurements were conducted by the Research Laboratory. Further, the term "project mileage" refers to length given by the Contract Division, "roadway mileage" refers to length of two-lane pavement, and "lane mile" to length in terms of individual vehicle lanes.

are listed in Table 1, grouped by year of construction, and ranked within these years according to accumulated inches per mile roughness by Integrator measurements; where two or more projects have the same Integrator count, they are ranked by Level Indicator count. During the 12 years of the roughness surveys, these Integrator values have ranged from a low (smooth) of 93 to a high (rough) of 282. This year the range was from 112 to 202.

On the basis of riding quality, the Laboratory classifies projects in three Integrator-count categories: "good" (0 to 130 accumulated in. per mi), "average" (131 to 174), and "poor" (175 or more). Table 2 shows that since 1951, with a total of 359 rigid pavement projects tested, 43, 46, and 11 percent of this total have been good, average, and poor, respectively. In the 1962 test year 28, 58, and 14 percent of the 36 projects measured were good, average, and poor respectively.

The weighted arithmetic mean for roughness of all projects tested this year increased 4 in. per mi over the mean for the preceding test year.

Rigid Pavement Construction (One-Lane Pours)

In addition to the usual surveys of roughness on newly constructed standard rigid pavements (two-lane pours), the 1962 measurements included four rigid pavement widening projects (one-lane pours), with the results shown in Table 3.

The testing and reporting procedures used for these projects are the same as those for standard rigid pavements. However, due to somewhat different construction procedures required in pours of one-lane width, the range of roughness values varies somewhat from that for standard rigid pavements. For this reason, widening projects are reported and tabulated separately from standard rigid construction. Table 4 summarizes test data obtained during the five years in which this type of construction has been under study.

Flexible Pavement Construction

Sixteen flexible pavement projects built to Interstate expressway standards were surveyed in 1962. The accumulated inches per mile figures presented in Table 5 are the result of measuring runs in separate wheel tracks both in the traffic and passing lanes.

As in the case of rigid pavement widening, this type of roughness measurement represents a supplement and extension of the Department's rigid pavement roughness program, and is being included in the annual reports as construction warrants. Normally, only flexible pavements of expressway quality are included in the surveys, although other bituminous projects may be measured when construction procedures or special roughness conditions make this desirable.

TABLE 1
ROUGHNESS DATA SUMMARY FOR RIGID PAVEMENT
(TWO-LANE POURS)

	Project	District	Length, mi	Type	Route and Project Location	Roughness		Paving Contractor
						Integrator, in./Mile	Level Indicator, g's/Mile	
1961 CONSTRUCTION	EBBF 18023, C1R	3	6.300	24 ft (Dual)	US 10 Relocation from Clare, southeast to the Isabella-Midland Co. line	112	585	Sargent Construction Co.
	EBBF 37032, C3R	5						
	EBBF 56044, C19R	6	3.634	24 ft (Dual)	US 10 Relocation from Sanford Lake, east and south to Stark Rd.	119	630	W. H. Knapp, Inc.
	EBBF 18033, C3RN	3	5.866	24 ft (Dual)	US 27 Relocation from grade separation south of Colonville Rd., north to 439 ft north of Hatton Rd.	122	660	Sargent Construction Co. (1)
	EBBF 56044, C16R	6	7.067	24 ft (Dual)	US 10 Relocation from west of M 18, southeast to Sanford Lake	123	656	Pierson Contracting Co.
	EBI 41025, C7RN	5	0.871	24 ft (Dual)	I 96 at the west side of the Grand River, east to Cheney Ave.	124	666	Pierson Contracting Co. (2)
	EBBF 25031, C11RN	6	8.998	24 ft	US 23 (northbound only) from 2.1 mi north of M 59, north to 1188 ft north of the Livingston-Genesee Co. line	138	736	L. A. Davidson
	EBBF 47014, C4RN	8						
	BF 11021, C6R	7	0.554	24 ft	M 60-US 12 from east city limit of New Buffalo, east to east of I 96 interchange	140	793	Titus Construction Co. (3)
	EBI 11015, C16RN*							
	EBBF 56045, C1R	6	6.420	24 ft (Dual)	US 10 Relocation from the Isabella-Midland Co. line, southeast to 2234 ft west of M 18	141	802	Cooke Contracting Co.
	EBBF 47013, C8RN	8	1.344	24 ft (Dual)	US 23 Relocation from C&O RR, north to north of I 96 interchange	142	711	L. A. Davidson
	EBI 47064, C10RN**							
	EBI 23152, C1RN	6	2.620	24 ft (Dual)	I 96 from 239.19 ft north of Eaton Hwy., south to south of M 43	144	709	Pierson Contracting Co. (4)
	EBI 47065, C3RN***	8	2.675	24 ft (Dual) & 36 ft (Dual)	I 96 from 2480 ft west of Grand River Ave., southeast to 780 ft west of Canterbury Rd.	148	805	L. A. Davidson
	EBI 47064, C10RN***							
	EBI 16091, C9RN*	4	1.618	24 ft (Dual)	I 75 from NYCRR, north to the M 27 interchange	150	801	Eisenhour Const. Co. (5)
	BI 73111, C5RN	6	1.644	24 ft	US 23 from 940 ft south of Janes Rd., north to M 81 interchange	154	842	Cooke Contracting Co.
	F 02041F, C1U	2	0.756	44 ft & 62 ft	M 28 from Hickory St, Munising, southeast to Cedar St.	180	1113	Bacco Construction Co.
BU 27021A, C1U	1	0.440	24 ft (Dual)	US 2 from the Michigan-Wisconsin State line, east in Ironwood	197	1064	Thornton Construction Co.	
F 13044, C1R	7	0.568	24 ft	I 94 BL from 0.535 mi east of the east limit of Marshall, northeast to I 94	201	966	Cross & White	
EBBF 22021, C4R	1	2.706	24 ft	US 2 from east limit of Iron Mountain, east to west limits of Norway	202	1100	Bacco Construction Co.	
EBBF 22022, C4R***								
Weighted Arithmetic Mean for 1961 Construction Tested in 1962						136	730	
1962 CONSTRUCTION	BI 17033D, C2RN	2	5.057	24 ft (Dual)	I 75 from 0.5 mi northeast of Kinross, northeast to old US 2	117	577	Pierson Contracting Co.
	BF 41033D, C7U, C8R	5	9.952	24 ft	M 37 Relocation from 0.5 mi north of Ballards, northwest to existing M 37 in Muskegon Co.	119	591	Pierson Contracting Co.
	BF 41033E, C9U, C10R							
	BF 61171A, C1U							
	EBI 47066, C1RN	8	7.860	24 ft (Dual)	I 96 from 0.175 mi east of the Livingston-Ingham Co. line, east to 0.134 mi northwest of Millet Rd.	126	734	Cooke Contracting Co.
	EBBF 81076B, C5RN	8	4.361	24 ft (Dual)	US 23 Relocation from 0.43 mi north of Willis Rd., north to north of US 12	129	651	Denton Construction Co. (6)
	BSS 39081B, C4R	7	1.259	48 ft	M 43 from 1417 ft west of 10th St., east to 12th St.	130	624	Carl Goodwin & Sons
	EBI 25131, C5RN	6	2.730	24 ft (Dual)	I 75 from US 23 intersection, southeast to Fenton Rd.	132	677	L. A. Davidson
	BI 17034D, C5UN	2	2.210	24 ft (Dual)	I 75 from south of 3 Mile Rd., north to 2000 ft south of Easterday Ave., Sault Ste. Marie	135	710	Hodgkiss & Douma, Inc. (7)
	BF 03111A, C11RN	7	5.991	24 ft (Dual)	US 131 Relocation from "E" Ave. (4.083 mi south of the Kalamazoo-Allegan Co. line), north to 500 ft south of M 83	138	642	Carl Goodwin & Sons
BF 39014D, C8RN								
RF 81074A, C1RN	8	3.630	24 ft (Dual)	US 23 Relocation from 146 ft south of Ellsworth Rd., north to 2242 ft north of Geddes Rd.	142	685	Denton Construction Co. (6)	

(1) Subcontract from Holloway Construction Co.
(2) Subcontract from Hall & Dexter Contractors
(3) Subcontract from Louis Garavaglia Contractors Inc.
(4) Subcontract from Canonic Construction Co.
(5) Subcontract from C. F. Replogle
(6) Subcontract from A. Lindberg & Sons
(7) Subcontract from S. J. Groves & Sons Co.
(8) Contract awarded to Chas. J. Rogers Inc., Cooke Contracting Co., and Jutton-Kelly Co.

* For additional data see Table 5.
** US 23 Relocation portion only.
*** For additional data see Table 3.

TABLE 1 (Cont.)
ROUGHNESS DATA SUMMARY FOR RIGID PAVEMENT
(TWO-LANE POURS)

Project	District	Length, mi	Type	Route and Project Location	Roughness		Paving Contractor
					Integrator, in./Mile	Level Indicator, g's/Mile	
EBI 25131, C3RN***	6	4.071	24 ft (Dual)	I 75 from the C&O RR, northwest to west of Fenton Rd.	142	798	Cooke Contracting Co.
EBI 25131, C1RN***	6	2.820	24 ft (Dual)	I 75 from Evans Rd., northeast to the C&O RR	142	821	Cooke Contracting Co. (6)
EBI 63173, C1RN***	9						
BF 47014, C6RN	8	8.346	24 ft (Dual)	US 23 Relocation from north of I 96 interchange, north to Dunham Rd.	144	714	L. W. Edison Co.
EBI 17034, C1UN	2	0.025	24 ft (Dual)	I 75 from 2000 ft south of Easterday Ave., Sault Ste. Marie, north to the International Bridge	144	742	Hodgkiss & Douma, Inc. (9)
EBBF 81076, C1UN	8	5.459	24 ft (Dual)	US 23 Relocation from north of the Wabash RR at the east limits of Milan, north to a point 0.43 mi north of Willis Rd.	146	698	Denton Construction Co. (6)
EBBF 81076, C3RN							
BF 39014B, C6RN	7	5.049	24 ft (Dual)	US 131 Relocation from 2300 ft south of M 43, north to "E" Ave.	150	695	Carl Goodwin & Sons
BF 81074D, C4RN	6	5.730	24 ft (Dual)	US 23 Relocation from north of Geddes Rd., north and west to existing US 23	152	714	Denton Construction Co. (10)
BF 81103A, C3RN							
EBI 19022, C4RN	5	4.763	24 ft (Dual)	I 96 from east of M 100, southeast to 271.09 ft north of the Clinton-Eaton Co. line	153	769	Denton Construction Co. (1)
F 73121B, C1	6	1.708	24 ft (Dual)	M 83-M 54 (Birch Run Rd.), from I 75 to M 83-M 54 junction	169	905	W. H. Knapp, Inc.
BU 21022B, C9R	2	2.486	24 ft (Dual)	US 2-US 41-M 35, from 0.217 mi south of the south city limit of Gladstone, northeast to US 2-US 41 junction	181	836	L. W. Brumm (11)
BU 21022D, C9U							
BU 21025A, C5U							
Weighted Arithmetic Mean for 1962 Construction Tested in 1962					139	701	
WEIGHTED ARITHMETIC MEAN FOR 1962 ROUGHNESS TEST YEAR					138	713	

- (1) Subcontract from Holloway Construction Co.
(6) Subcontract from A. Lindberg & Sons
(9) Subcontract from Alpine Construction Co.
(10) Subcontract from Miller Brothers Inc.
(11) Subcontract from Prokach Construction Co.

*** For additional data see Table 3.

TABLE 2
TWELVE-YEAR ROUGHNESS SUMMARY FOR RIGID PAVEMENT
(TWO-LANE POURS)

Test Year	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1951-1962
Total Projects	17	22	40	17	22	21	33	34	45	35	37	36	359
Percent <u>Good</u> 0-136 in./mi	41	5	18	29	36	19	61	74	53	83	38	28	43
Percent <u>Average</u> 131-174 in./mi	35	68	67	42	64	62	36	26	40	14	49	58	46
Percent <u>Poor</u> 175 or more in./mi	24	27	15	29	0	19	3	0	7	3	13	14	11
Weighted Arithmetic Mean	142	152	144	148	138	141	126	116	124	117	134	138	131
Project Mileage*	48,327	61,575	98,791	41,271	52,690	82,473	165,088	134,048	168,892	154,333	133,043	140,128	1,280,657
Lane Mileage**	100,614	163,340	233,727	91,622	140,574	230,399	558,781	461,520	645,962	554,350	494,012	511,668	4,176,479

* As given in Contract Division monthly "Report of Awards"
** Total mileage of 11- or 12-ft wide lanes

TABLE 3
ROUGHNESS DATA SUMMARY FOR RIGID PAVEMENT WIDENING
(ONE-LANE POURS)*

	Project	District	Length, mi	Type	Route and Project Location	Roughness		Paving Contractor	
						Integrator, In./Mile	Level Indicator, g's/Mile		
1961 CONSTRUCTION	EBI 47065, C3RN EBI 47064, C10RN**	8	1.340	12 ft	136 (median side, both roadways) from northwest of Spencer Rd., southeast approx. 7075 ft	168	949	L. A. Davidson	
	EBBF 22922, C4R	1	1.775	12 ft	US 2 (shoulder side, both roadways) from US 141, east to west limits of Norway	198	1082	Bacco Construction Co.	
	Weighted Arithmetic Mean for 1961 Construction Tested in 1962						185	1025	
1962 CONSTRUCTION	EBI 25131, C1RN EBI 63173, C1RN	6 9	2.820	12 ft	175 (median side, both roadways) from Evans Rd., northeast to the C&O RR	153	832	Cooke Contracting Co. (1)	
	EBI 25131, C3RN	6	4.071	12 ft	175 (median side, both roadways) from the C&O RR, northwest to west of Penton Rd.	167	891	Cooke Contracting Co.	
	Weighted Arithmetic Mean for 1962 Construction Tested in 1962						161	867	
	WEIGHTED ARITHMETIC MEAN FOR 1962 ROUGHNESS TEST YEAR						169	916	

(1) Contract awarded to Chas. J. Rogers, Cooke Contracting Co., and Jutton-Kelly Co.

* All construction is "third-lane" widening to projects reported in Table 1.
 ** 196 portion only.

TABLE 4
FIVE-YEAR ROUGHNESS SUMMARY
FOR RIGID PAVEMENT WIDENING
(ONE-LANE POURS)

Test Year	1958	1959	1960	1961	1962	1958-1962
Total Projects	3	2	5	10	4	24
Percent Good 0-139 in./mi	33.3	0	20	0	0	8
Percent Average 131-174 in./mi	33.3	50	60	70	75	63
Percent Poor 175 or more in./mi	33.3	50	20	30	25	29
Weighted Arithmetic Mean	130	194	140	161	169	155
Project Mileage*	6.403	3.082	13.925	17.704	10.006	51.130
Lane Mileage**	10.533	3.872	24.152	31.679	20.012	90.248

* As given in Contract Division monthly "Report of Awards"
 ** Total mileage of 11- or 12-ft wide lanes

TABLE 5
ROUGHNESS DATA SUMMARY FOR FLEXIBLE PAVEMENT

	Project	District	Length, mi	Type	Route and Project Location	Roughness		Paving Contractor	
						Integrator, In./Mile	Level Indicator, g's/Mile		
1961 CONSTRUCTION	EBBF 72014, C1RN	4	6.981	24 ft (Dual)	US 27 Relocation from 0.462 mile north of M 55, north to 0.412 mile north of Higgins Lake Rd.	92	390	Thornton Construction Co.	
	EBI 20014, C3RN EBBF 20016, C3RN	4	4.963	24 ft & 24 ft (Dual)	US 27 Relocation north from south of interchange with M 18-M 76; north from this interchange on I 75 to 2655 ft south of M 72	98	231	Lake & Howell Construction Co. (1)	
	EBBF 72014, C3RN*	4	4.220	24 ft	US 27 Relocation southbound from 2000 ft north of Higgins Lake Rd., north 4.22 mi	97	465	Thornton Construction Co.	
	EBF 16034, C1RN EBF 72013, C2RN	3	8.909	24 ft (Dual)	US 27 Relocation from 5.909 mi south of the Clare-Roscommon Co. line, north to 3.007 mi north of the Co. line	98	427	Mid-American Construction Inc. (2)	
	EBI 20015, C3RN	4	4.847	24 ft (Dual)	I 75 from north of County Rd. 612, north to the Otsego-Crawford Co. line	103	504	Thornton Construction Co., Inc. (3)	
	EBI 20014, C1RN EBI 20015, C4RN	4	6.076	24 ft (Dual)	I 75 from 2655 ft south of M 72 north to 2377 ft north of M 95	118	516	Saginaw Asphalt Paving Co. (4)	
	Weighted Arithmetic Mean for 1961 Construction Tested in 1962						100	419	
1962 CONSTRUCTION	EBI 69013, C3RN EBI 69013, C5RN	4	5.385	24 ft (Dual)	I 75 from 840 ft north of Charles Briak Rd., north to 2700 ft north of M 32	103	392	Spartan Asphalt Paving Co. (1)	
	EBI 16091, C9RN**	4	2.620	24 ft (Dual)	I 75 from south of M 68, north 2.620 mi to NYCRR	104	412	East Shore Asphalt Paving Co. (5)	
	EBBF 18034, C3RN	3	6.758	24 ft (Dual)	US 27 Relocation from 0.25 mi south of M 61, north 6.758 mi	106	464	Mid-American Construction Inc. 1961(2) Rieth-Riley Construction Co. Inc. 1962(4)	
	EBBF 18033, C5RN	3	4.150	24 ft (Dual)	US 27 Relocation from Hatton Rd., north to 0.25 mi south of M 61	109	468	Mid-American Construction Inc. 1961(2) Rieth-Riley Construction Co. Inc. 1962(2)	
	EBI 69014, C1UN EBI 69014, C3RN	4	8.718	24 ft (Dual)	I 75 from north limits of Gaylord, north to the north limits of Vanderbilt	110	416	Spartan Asphalt Paving Co. (1)	
	EBI 20015, C2RN	4	4.864	24 ft (Dual)	I 75 from 2377 ft north of M 93, north to north of County Rd. 612	111	383	Thornton Construction Co. Inc. (3) & (6)	
	EBI 11015, C16RN**	7	5.785	24 ft (Dual)	I 94 from 2100 ft south of US 12-M 86, northeast to 2947 ft southwest of Esay Rd.	118	587	Rieth-Riley Construction Co. Inc. (7)	
	EBI 69013, C1RN	4	7.665	24 ft (Dual)	I 75 from the Crawford-Otsego Co. line, north to 840 ft north of Charles Brink Rd.	121	445	Spartan Asphalt Paving Co. (1)	
	EBI 16092, C3RN EBI 16092, C5RN	4	7.942	24 ft (Dual)	I 75 from 0.75 mi north of Wolverine Rd., north to south of M 68	128	473	Spartan Asphalt Paving Co. (1)	
	EBBF 20016, C1RN EBBF 72014, C4RN	4	6.273	24 ft (Dual)	US 27 Relocation from 3500 ft south of Crawford-Roscommon Co. line, north to south of interchange with M 18-M 76	146	518	Thornton Construction Co., Inc.	
	EBBF 72014, C3RN*	4	4.220	24 ft	US 27 Relocation northbound from 2000 ft north of Higgins Lake Rd., north 4.22 mi	177	685	Thornton Construction Co., Inc. (6)	
	Weighted Arithmetic Mean for 1962 Construction Tested in 1962						121	472	
	WEIGHTED ARITHMETIC MEAN FOR 1962 ROUGHNESS TEST YEAR						114	454	

(1) Subcontract from Johnson-Groves Co.
(2) Subcontract from Gilliland Construction Co.
(3) Subcontract from Pierson Contracting Co.
(4) Subcontract from Holloway Construction Co.
(5) Subcontract from C. F. Ruple Co.
(6) Levelling course applied in 1961 and wearing course applied in 1962.
(7) Subcontract from Louis Garavaglia Contracting, Inc.

* Due to differences in construction methods, the northbound (1962) and southbound (1961) roadways are reported separately.
** Project part bituminous and part concrete; see Table 1.