

SUMMARIES OF MICHIGAN PAVEMENT ROUGHNESS
1966 Test Program

Prepared for the Road Construction Division

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ABSTRACT: Test results for the sixteenth year of this long-term study of riding quality of newly constructed or opened Michigan pavements are tabulated, with full identification of projects; their lengths, routes, and locations; and contractors responsible for paving.

KEY WORDS: roughness, riding quality.

SUMMARIES OF MICHIGAN PAVEMENT ROUGHNESS 1966 Test Program*

This report summarizes 1966 roughness measurements of 217 lane miles of standard rigid pavement (two-lane pours), 54 lane miles of rigid pavement widening (one-lane pours) and, 58 lane miles of flexible pavement.

Since 1959, pavement roughness indices have been recorded by two measuring methods: 1) the Integrator method measuring accumulated inches per mile units of roughness, and 2) the more sophisticated electronic Level Indicator method measuring accumulated g's per mile units of roughness. The primary functions of the newer Level Indicator method have been to complement the Integrator method and to differentiate between identical Integrator ratings.

During the late summer and fall months of 1966, pavement roughness field testing was interrupted by repeated electronic problems with the Level Indicator measuring device. As a result, a decision was made to delete all Level Indicator values from the 1966 annual roughness summary in order to complete field testing of 1966 construction projects before seasonal weather conditions interfered with testing accuracy.

Rigid Pavement Construction (Two-Lane Pours)

Individual rigid pavement projects constructed as standard two-lane pours, and their roughness values as determined in the 1966 test program, 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. During the 16 years of roughness surveys, these Integrator values have ranged from a low (smooth) of 93 to a high (rough) of 282. For 1966 the range was from 123 to 168.

*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, and "lane mile" to length given in terms of individual vehicle lanes.

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) |
| "poor" | (175 or more) |

Table 2 shows that since 1951, with a total of 474 rigid pavement projects tested, 39, 50, and 11 percent of this total have been good, average, and poor, respectively. In the 1966 test year 16, 84, and 0 percent of the 25 projects measured were good, average, and poor, respectively. The weighted arithmetic mean for roughness of all projects tested during the 1966 test year was 143 accumulated in. per mi. This value represents a 2-percent increase in measured roughness for two-lane pours tested in 1966 over those tested in 1965. However, this increase is considered insignificant, especially when noting that none of the 1966 test year projects fall into the "poor" category of 175 or more accumulated in. per mi.

Rigid Pavement Construction (One-Lane Pours)

In addition to the usual surveys of roughness on newly constructed standard rigid pavements (two-lane pours), the 1966 measurements included 13 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 from that for standard rigid pavements. For this reason, widening projects are reported and tabulated separately from standard rigid construction. Table 4, which summarizes test data obtained during the nine years in which this type of construction has been under study, shows continued improvement in riding quality for widening-type construction. The influence of 1966 Construction Project I 63022A, C10, etc., with a roughness of 133 accumulated in. per mi on 20 lane miles (representing 37 percent of the total 54 lane miles tested during 1966) is the primary factor contributing to the lower average roughness index for this test year.

Flexible Pavement Construction

As in the case of rigid pavement widening, measurement of this type of pavement construction represents a supplement and extension of the

Research Laboratory's pavement roughness program, and is included in the annual reports as construction warrants. Normally, only flexible pavements of freeway quality are included in the surveys, although other bituminous projects may be measured when construction procedures or special roughness conditions make this desirable.

Three flexible pavement projects were surveyed in the 1966 test year. The accumulated inches per mile roughness values presented in Table 5 are averages of separate wheel track tests in all vehicle lanes.

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

| | Project | District | Length, mi | Type | Route and Project Location | Roughness (Integrator), in./mi | Paving Contractor |
|-------------------|---|----------|---------------|--------------------------------|--|--------------------------------------|--|
| 1965 CONSTRUCTION | I 82191H, C26* I 82191I, C27 I 82191J, C28 | 10 | 1.143 | 36 ft (dual) | I 75-Seaway Freeway north from 0.5 mi S of Goddard Rd. to S of US 25 | 137 | The Kutchins Co., Inc. ⁽¹⁾ |
| | SS 77052A, C3 | 9 | 4.070 | 24 ft | M 29 relocation N from 2550 ft S of S limits of Marysville to 250 ft S of Bunce Ave. | 138 | Anderson & Ruzzin, Inc. |
| | I 82191G, C20* I 82191H, C21 | 10 | 1.288 | 36 ft (dual) | I 75-Seaway Freeway N from S of Allen Rd. to 0.5 mi S of Goddard Rd. | 139 | Denton Construction Co. ⁽²⁾ |
| | F 33035B, C1 BI 33084A, C21 | 8 | 3.423 | 24 ft (dual) | US 127 relocation N from S of Holt Rd. to I 96-I 496 interchange | 141 | Sargent Construction Co. ^(3, 9) |
| | BI 82191E, C17* I 82191F, C18 | 10 | 1.67 | 36 ft (dual) | I 75-Seaway Freeway N from N of Pennsylvania Rd. to S of Allen Rd. | 154 | Denton Construction Co. ⁽²⁾ |
| | U 13121G, C6 | 7 | 0.658 | 24 ft (dual) | I 94BL E from near Capitol Ave. to "S" St. | 159 | Carl Goodwin & Sons, Inc. |
| | SS 22051A, C2 | 1 | 0.982 | 24 ft | US 8 relocation N from Menominee River to existing US 8 | 165 | Bacco Construction Co. |
| | U 63031A, C15 | 9 | 2.717 | 24 ft (NB) 48 ft (SB) | US 24 N from 1287 ft N of Eight Mile Rd. to S of I 696 | 168 | Cooke Contracting Co. |
| | U 77023D, C10* | 9 | 1.410 | 36 ft | M 21 (EB) E from 24th St. to Military St. | 168 | Eisenhour Construction Co., Inc. ⁽⁴⁾ |
| | Weighted Arithmetic Mean for 1965 Construction Tested During 1966 Test Year. | | | | | | 151 |
| 1966 CONSTRUCTION | F 77023A, C2 F 77023B, C15 | 9 | 5.197 | 24 ft (dual) | M 21 relocation E from existing M 21 to near 40th St. | 123 | Denton Construction Co. ⁽³⁾ |
| | F 59045A, C2 | 5 | 1.550 | 24 ft | M 46 E from 488 ft E of M 66, a distance of 1.550 mi | 125 | Denton Construction Co. ⁽⁵⁾ |
| | SS 25101C, C8 SS 73021C, C11 | 6 | 9.477 | 24 ft | M 57 E from 378 ft W of Stuart Rd. to 211 ft W of W limits of Montrose | 129 | Sargent Construction Co. ⁽⁹⁾ |
| | F 33035A, C6 | 8 | 3.309 | 24 ft (dual) | US 127 relocation N from existing US 127 near Mason to S of Holt Rd. | 130 | Sargent Construction Co. ^(3, 9) |
| | F 63043D, C21 | 9 | 4.502 | 24 ft (dual) | M 59 relocation E from Mott Rd. to Auburn Rd. | 131 | L. W. Edison Co. |
| | F 67015A, C1 | 3 | 7.57 | 24 ft | US 131 relocation N from 860 ft S of One Mile Rd. to 1717 ft N of Marion Rd. | 141 | Denton Construction Co. ⁽⁶⁾ |
| | I 12033A, C9 | 7 | 2.083 | 24 ft (dual) | I 69 N from N of Copeland Rd. to N of Maxon Rd. | 143 | Rieth-Riley Construction Co., Inc. ⁽⁷⁾ |
| | F 67015A, C2 F 83031A, C6 (part) | 3 | 5.00 | 24 ft | US 131 relocation N from 1717 ft N of Marion Rd. to 0.52 mi N of Osceola-Wexford County Line. | 145 | Denton Construction Co. ⁽⁸⁾ |
| | U 50051 E, C25* | 9 | 1.139 | 36 ft (SB) | US 25 relocation S from 1100 ft N of Patterson Ave. to Gratiot Ave. | 146 | Anderson & Ruzzin, Inc. |
| | F 32011A, C6 | 6 | 4.107 | 24 ft | M 25 N from N limits of Sebawaing to Unionville Rd. | 150 | Sargent Construction Co. ⁽⁹⁾ |

- (1) Subcontract from Louis Garavaglia Contractors, Inc.
(2) Subcontract from Roy Fruehauf, Inc.
(3) Subcontract from Holloway Construction Co.
(4) Subcontract from Sterling Garrett Contracting Co., Inc.
(5) Subcontract from C. E. Utterback Co.
(6) Subcontract from Ivan W. Schworm & Son, Inc.
(7) Subcontract from Rieth-Riley Construction Co., Inc.
(8) Subcontract from C. E. Utterback Co. & D. J. McQuestion & Sons, Inc.
(9) Sargent Construction Co. was incorporated 12-29-65 as "Sargent Contracting Co. & Sargent Machinery and Equipment Co."

*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, (integrator), in./mi | Paving Contractor |
|--|----------|---------------|------------------------------------|---|---------------------------------------|---|
| EBBF 09091A, C4 EBBF 73075A, C4 | 6 | 3.002 | 24 ft | M 47 (SB) S from 3044 ft N of Salzburg Rd. to 2268 ft S of Buck Rd. | 153 | Sargent Construction Co. ^(1, 5) |
| U 77023B, C9* | 9 | 1.280 | 24 ft (dual) 36 ft (dual) | M 21 relocation E from 400 ft W of 40th St. to 24th St. | 154 | Eisenhour Construction Co., Inc. ⁽²⁾ |
| I 63174A, C66 | 9 | 1.370 | 36 ft (dual) 48 ft (dual) | I 75 N from 100 ft S of Bernhard St. to 100 ft S of Manatee St. | 156 | Cooke Contracting Co. ⁽³⁾ |
| U 63052A, C18* | 9 | 1.459 | 36 ft (dual) | M 24-Square Lake Rd. E from Telegraph Rd. to Woodward Ave. | 160 | Cooke Contracting Co. |
| BI 82194E, C4* BI 82194F, C5 | 10 | 0.82 | 36 ft (dual) | I 75-Fisher Freeway N from S of Schaefer Rd. to Leonard Ave. | 161 | The Kutchins Co., Inc. ⁽⁴⁾ |
| U 38071A, C1 | 8 | 1.36 | 24 ft (dual) 60 ft | US 127BR relocation N from 200 ft N of Mansion St. to 300 ft N of E. Franklin St. | 167 | Eisenhour Construction Co., Inc. |
| Weighted Arithmetic Mean for 1966 Construction Tested During 1966 Test Year. | | | | | 140 | |
| WEIGHTED ARITHMETIC MEAN FOR 1966 ROUGHNESS TEST YEAR | | | | | 143 | |

1966 CONSTRUCTION (CONT.)

- (1) Subcontract from Johnson-Greene Co.
- (2) Subcontract from Sterling Garrett Contracting Co., Inc.
- (3) Subcontract from Greenfield Construction Co., Inc.
- (4) Subcontract from S. Weissman Excavating Co., Inc., & Walter Toebe & Co.
- (5) Sargent Construction Co. was incorporated 12-29-65 as "Sargent Contracting Co. & Sargent Machinery and Equipment Co."

*For additional data, see Table 3.

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

| Test Year | 1951 | 1952 | 1953 | 1954 | 1955 | 1956 | 1957 | 1958 | 1959 | 1960 | 1961 | 1962 | 1963-1964 | 1965 | 1966 | 1951-1966 |
|-------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|-----------|---------|---------|-----------|
| Total Projects | 17 | 25 | 40 | 17 | 22 | 21 | 33 | 34 | 45 | 35 | 37 | 36 | 35 | 52 | 25 | 474 |
| Percent Good 0-130 in./mi. | 47 | 4 | 17 | 29 | 36 | 19 | 61 | 74 | 51 | 83 | 38 | 25 | 40 | 21 | 16 | 39 |
| Percent Average 131-174 in./mi. | 29 | 68 | 68 | 42 | 64 | 62 | 36 | 26 | 42 | 14 | 49 | 61 | 51 | 60 | 84 | 50 |
| Percent Poor 175 or more in./mi. | 24 | 28 | 15 | 29 | 0 | 19 | 3 | 0 | 7 | 3 | 13 | 14 | 9 | 19 | 0 | 11 |
| Weighted Arithmetic Mean | 144 | 154 | 146 | 147 | 140 | 141 | 126 | 114 | 124 | 117 | 133 | 137 | 131 | 140 | 143 | 132 |
| Project Mileage* | 48,327 | 70,615 | 98,791 | 41,271 | 52,690 | 82,473 | 165,086 | 140,506 | 168,892 | 154,333 | 133,043 | 140,128 | 167,040 | 159,679 | 70,586 | 1,693,460 |
| Lane Mileage** | 109,318 | 173,900 | 250,082 | 110,838 | 145,723 | 241,866 | 520,200 | 487,352 | 660,744 | 558,866 | 477,087 | 511,668 | 606,852 | 572,206 | 216,644 | 5,643,346 |

* 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 (Integrator), in./mi | Paving Contractor |
|---|--|----------|---------------|-----------------|---|---|--|
| 1964 CONSTR. | SS 76012B, C2 | 6 | 1.263 | 12 ft | M 47 (shoulder side, both roadways) N from Owosso N city limits to N of Pasadena Ave. | 174 | Sargent Construction Co. ^(1, 7) |
| | | | | | | Weighted Arithmetic Mean for 1964 Construction Tested During 1966 Test Year. | 174 |
| 1965 CONSTRUCTION | BI 82191E, C17* I 82191F, C18 | 10 | 1.67 | 12 ft | I 75-Seaway Freeway (median side, both roadways) N from Pennsylvania Rd. to S of Allen Rd. | 145 | Denton Construction Co. ⁽²⁾ |
| | I 82191H, C26* I 82191I, C27 I 82191J, C28 | 10 | 1.143 | 12 ft | I 75-Seaway Freeway (median side, both roadways) N from 0.5 mi S of Goddard Rd. to S of US 25. | 153 | The Kutchins Co., Inc. ⁽³⁾ |
| | I 82191G, C20* I 82191H, C21 | 10 | 1.288 | 12 ft | I 75-Seaway Freeway (median side, both roadways) N from S of Allen Rd. to 0.5 mi S of Goddard Rd. | 159 | Denton Construction Co. ⁽²⁾ |
| | U 77023D, C10* | 9 | 1.410 | 12 ft | M 21 (EB) E from 24th St. to Military St. | 161 | Eisenhour Construction Co., Inc. ⁽⁴⁾ |
| | | | | | | Weighted Arithmetic Mean for 1965 Construction Tested During 1966 Test Year. | 153 |
| 1966 CONSTRUCTION | I 63022A, C10 I 47064A, C20 | 9, 8 | 10.266 | 12 ft | I 96 (median side, both roadways) W from 1025 ft W of Beck Rd. to 0.85 mi E of Kent Lake Rd. ; I 96 W from Oakland-Livingston Co. line to E of US 23 | 133 | L. W. Edison Co. |
| | I 63022A, C9 | 9 | 3.49 | 12 ft | I 96 (median side, both roadways) E from 1025 ft W of Beck Rd. to I 696. | 136 | L. W. Edison Co. |
| | BI 82194E, C4* BI 82194F, C5 | 10 | 0.82 | 12 ft | I 75-Fisher Freeway (median side, both roadways) N from S of Schaefer Rd. to Leonard Ave. | 157 | The Kutchins Co., Inc. ⁽⁶⁾ |
| | U 83032A, C6 | 3 | 1.09 | 12 ft | US 131 (shoulder side, both roadways) N from 13th St. to Boon Rd. | 157 | Hodgkiss & Douma, Inc. ⁽⁶⁾ |
| | U 50051E, C25* | 9 | 1.139 | 12 ft | US 25 relocation (SB) S from 1100 ft N of Patterson Ave. to Gratiot Ave. | 159 | Anderson & Ruzzin, Inc. |
| | U 63052A, C18* | 9 | 1.459 | 12 ft | M 24-Square Lake Rd. (median side, both roadways) E from Telegraph Rd. to Woodward Ave. | 161 | Cooke Contracting Co. |
| | BI 13033D, C10 I 13033E, C11 | 7 | 1.654 | 24 ft (dual) | I 194 N from Golden Ave. to Jackson St. E | 167 | Carl Goodwin & Sons, Inc. |
| | U 77023B, C9* | 9 | 0.56 | 12 ft | M 21 relocation (inside lane EB, outside lane WB) E from 32nd St. to 24th St. | 167 | Eisenhour Construction Co., Inc. ⁽⁴⁾ |
| | | | | | Weighted Arithmetic Mean for 1966 Construction Tested During 1966 Test Year. | 144 | |
| WEIGHTED ARITHMETIC MEAN FOR 1966 ROUGHNESS TEST YEAR | | | | | | 147 | |

- (1) Subcontract from Johnson-Greene Co., Saginaw Asphalt Paving Co., & Sand & Stone, Inc.
(2) Subcontract from Roy Fruehauf, Inc.
(3) Subcontract from Louis Garavaglia Contractors, Inc.
(4) Subcontract from Sterling Garrett Contracting Co., Inc.
(5) Subcontract from S. Weissman Excavating Co., Inc., & Walter Toebe & Co.
(6) Contract awarded to R. W. Meyer & Hodgkiss & Douma, Inc.
(7) Sargent Construction Co. was incorporated 12-29-65 as "Sargent Contracting Co. & Sargent Machinery and Equipment Co."

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

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

| Test Year | 1958 | 1959 | 1960 | 1961 | 1962 | 1963-1964 | 1965 | 1966 | 1958-1966 |
|---|--------|-------|--------|--------|--------|-----------|---------|--------|-----------|
| Total Projects | 3 | 2 | 5 | 10 | 4 | 14 | 30 | 13 | 81 |
| Percent <u>Good</u> 0-130 in./mi | 33.3 | 0 | 20 | 0 | 0 | 0 | 7 | 0 | 5 |
| Percent <u>Average</u> 131-174 in./mi | 33.3 | 50 | 60 | 70 | 75 | 64 | 63 | 100 | 69 |
| Percent <u>Poor</u> 175 or more in./mi | 33.3 | 50 | 20 | 30 | 25 | 36 | 30 | 0 | 26 |
| Weighted Arithmetic Mean | 122 | 194 | 138 | 162 | 169 | 163 | 156 | 147 | 156 |
| Project Mileage* | 5.403 | 3.092 | 13.925 | 17.704 | 10.006 | 27.093 | 61.360 | 27.252 | 165.835 |
| Lane Mileage** | 11.176 | 6.184 | 24.152 | 31.995 | 20.012 | 57.940 | 122.508 | 54.173 | 328.140 |

* 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 (Integrator), in./mi | Paving Contractor |
|---|----------|------------|-----------------|---|--------------------------------|------------------------------------|
| I 11014B, C9 I 11015A, C35 | 7 | 14.00 | 12 ft | I 94 (median side, both roadways) N from LaPorte Rd. to S limits of Bridgman | 96 | Rieth-Riley Construction Co., Inc. |
| I 11015B, C36 (part) | 7 | 7.25 | 12 ft | I 94 (median side, both roadways) N from S limits of Bridgman to S of Exit 23 | 100 | Rieth-Riley Construction Co., Inc. |
| 1965 CONSTR | | | | | | |
| Weighted Arithmetic Mean for 1965 Construction Tested During 1966 Test Year. 97 | | | | | | |
| F 83031A, C6 (part) | 3 | 3.78 | 24 ft (dual) | US 131 relocation N from 0.52 mi N of Osceola-Wexford Co. line to existing US 131 | 89 | The Hicks Co. (1) |
| 1966 CONSTR | | | | | | |
| Weighted Arithmetic Mean for 1966 Construction Tested During 1966 Test Year. 89 | | | | | | |
| WEIGHTED ARITHMETIC MEAN FOR 1966 ROUGHNESS TEST YEAR 95 | | | | | | |

(1) Subcontract from C. E. Utterback Co. & D. J. McQuestion & Sons, Inc.