FRICTIONAL PROPERTIES OF ASPHALT CONCRETE PAVEMENTS IN IOWA

Final Report for Project MLR 87-5

July 1987

Highway Division
Iowa Department of Transportation

PROJECT MLR 87-5

FRICTIONAL PROPERTIES OF ASPHALT CONCRETE PAVEMENTS IN IOWA

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Iowa Department of Transportation
Highway Division
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DISCLAIMER

The contents of this report reflect the views of the authors and do not necessarily reflect the official views of the Iowa Department of Transportation. This report does not constitute a standard, specification or regulation.

ABSTRACT

Friction testing of pavements has been a continuing effort by the Iowa Department of Transportation since 1969.

This report details results of tests of asphaltic concrete pavements on the primary and interstate road systems. Both sprinkle treated and non-sprinkle treated pavements placed between 1975 - 1985 are included. A total of 1785 miles representing 216 separate paving projects were examined.

The effect of fog sealing sprinkle treated pavements was studied by testing friction levels before and after the application of the fog seals.

Conclusions of the report are:

1. Current aggregate selection criteria for a.c. pavement surface courses provides adequate friction levels through 10 years and should remain effective through a 15 year design life.

2. Sprinkle treatment of pavements has, for the most part, provided macrotexture in the pavement surface as evidenced by smooth tire testing.

3. Fog sealing sprinkle treated pavements does not significantly alter the friction properties.

INTRODUCTION:

The Iowa Department of Transportation has recognized the importance of pavement frictional properties for over twenty years when, in 1965, funds were first appropriated for the construction of a friction testing system. Subsequent to 1965 several other friction testing systems have been purchased.

Routine testing began in 1969 and has continued to the present. Testing priorities are established based upon traffic volumes and frictional histories of the pavements. A very detailed review of pavements is made by the Pavement Friction Review Committee which was formed in 1972. The operation of this Committee is explained in detail in Policy 600.01 (Appendix A).

Several pavement design changes have been made for the purpose of providing better and longer lasting frictional properties for both p.c. concrete and a.c. concrete. Transverse texturing of p.c. concrete is now routine. The friction level of a.c. pavements has been improved by more careful aggregate selection in surface courses and through the use of sprinkle treatments on higher volume roads.

Several reports (1, 2, 3, 4, & 5) have been written regarding the evaluation and performance of a.c. pavements in regard to frictional properties.

PURPOSE AND SCOPE:

The purpose of this report is to provide current information regarding the frictional performance of a.c. pavements on the primary and interstate systems. The data presented will be that which has been accumulated from 1975 through 1985. Specific sources of the data are detailed in Appendix B.

The report will deal with pavements both with and without sprinkle treatments. There are some projects represented that contain recycled asphalt and no attempt to evaluate recycled pavement versus all virgin pavement has been made. Such an evaluation will be made in a later report.

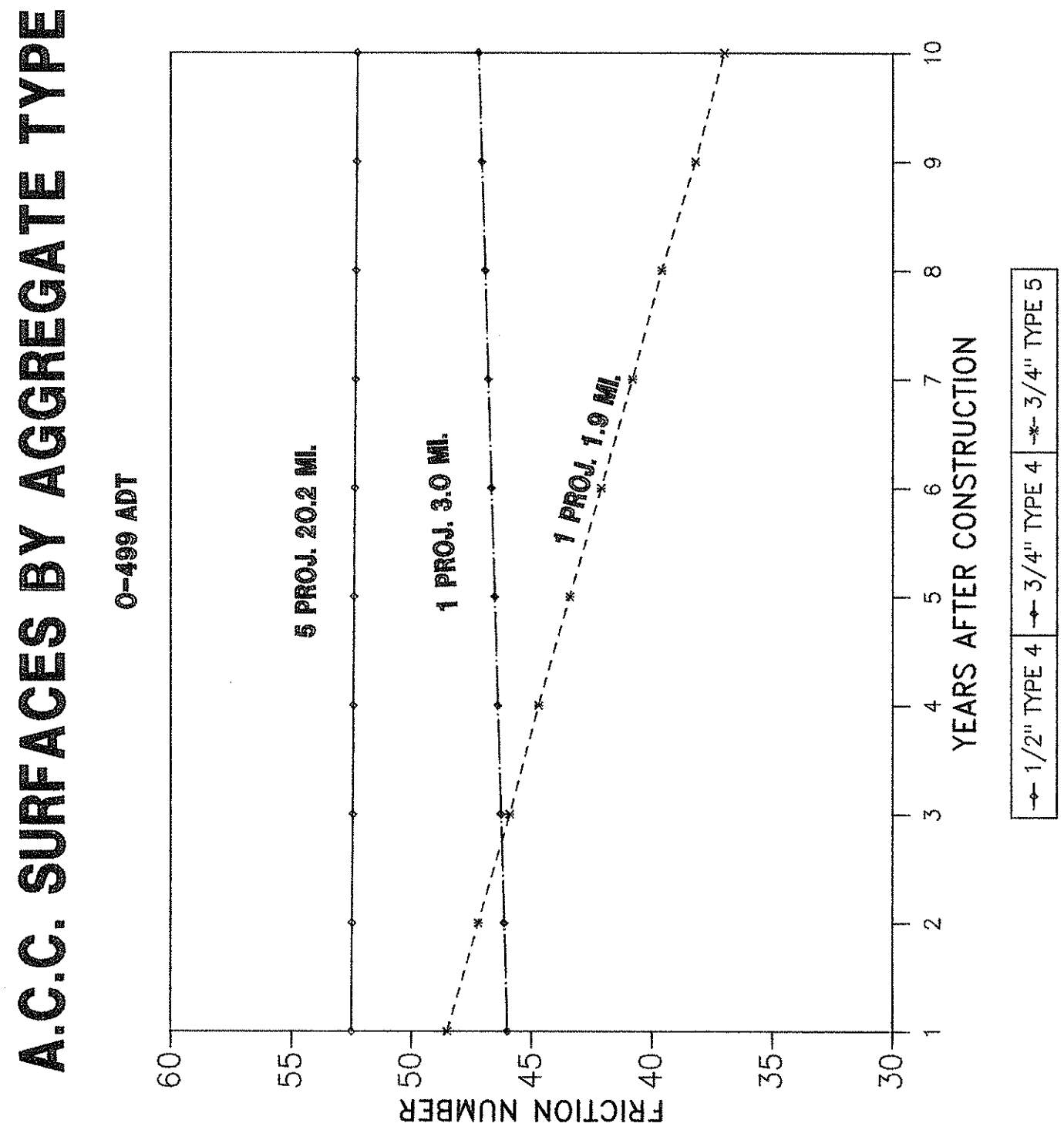
NON-SPRINKLE TREATED PAVEMENTS:

The Iowa Department of Transportation began a classification system in 1975 designed to rate coarse aggregates as to their frictional characteristics. Aggregates have been classified into five functional types with a Type 1 providing the highest friction level. A complete description of the classification system can be found in the Office of Materials Instructional Memorandum T-203. Appendix C provides detailed information of the complete classification system.

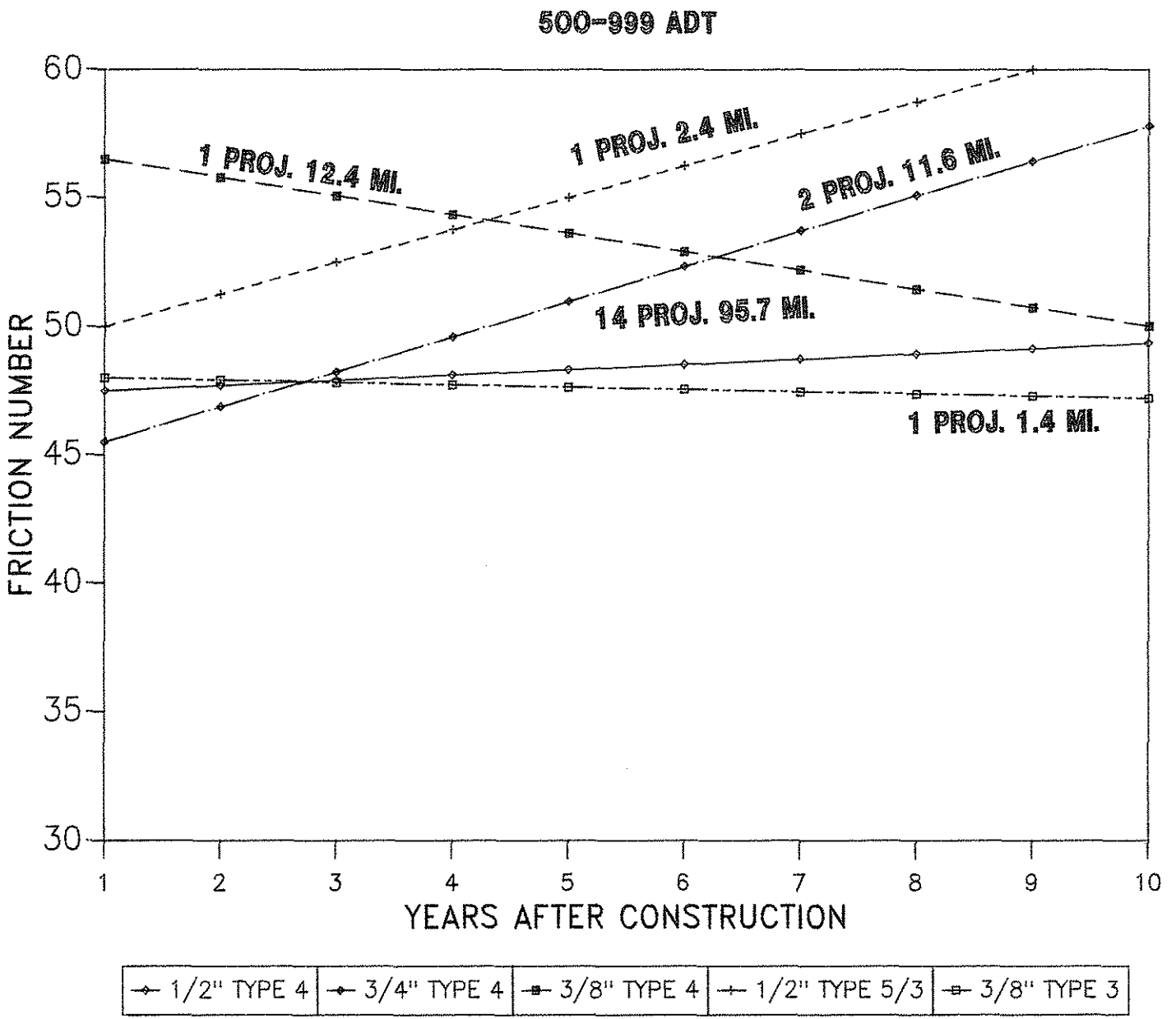
Figures 1-5 represent the friction levels over time at various levels of traffic. There are 104 projects and 692 miles of pavement represented. Various mix sizes and types are included with the Type B mixes used for the lower traffic roads and Type A used for the higher traffic volumes. Appendix D itemizes the current design criteria for mix types currently used.

As expected, there is a gradual loss of friction over time as the pavement polishes with traffic wear. In general the loss is quite limited and shows an acceptable level of friction through the 10 year period examined. All testing was conducted in accordance with ASTM-E274 using ASTM E 501 ribbed tires.

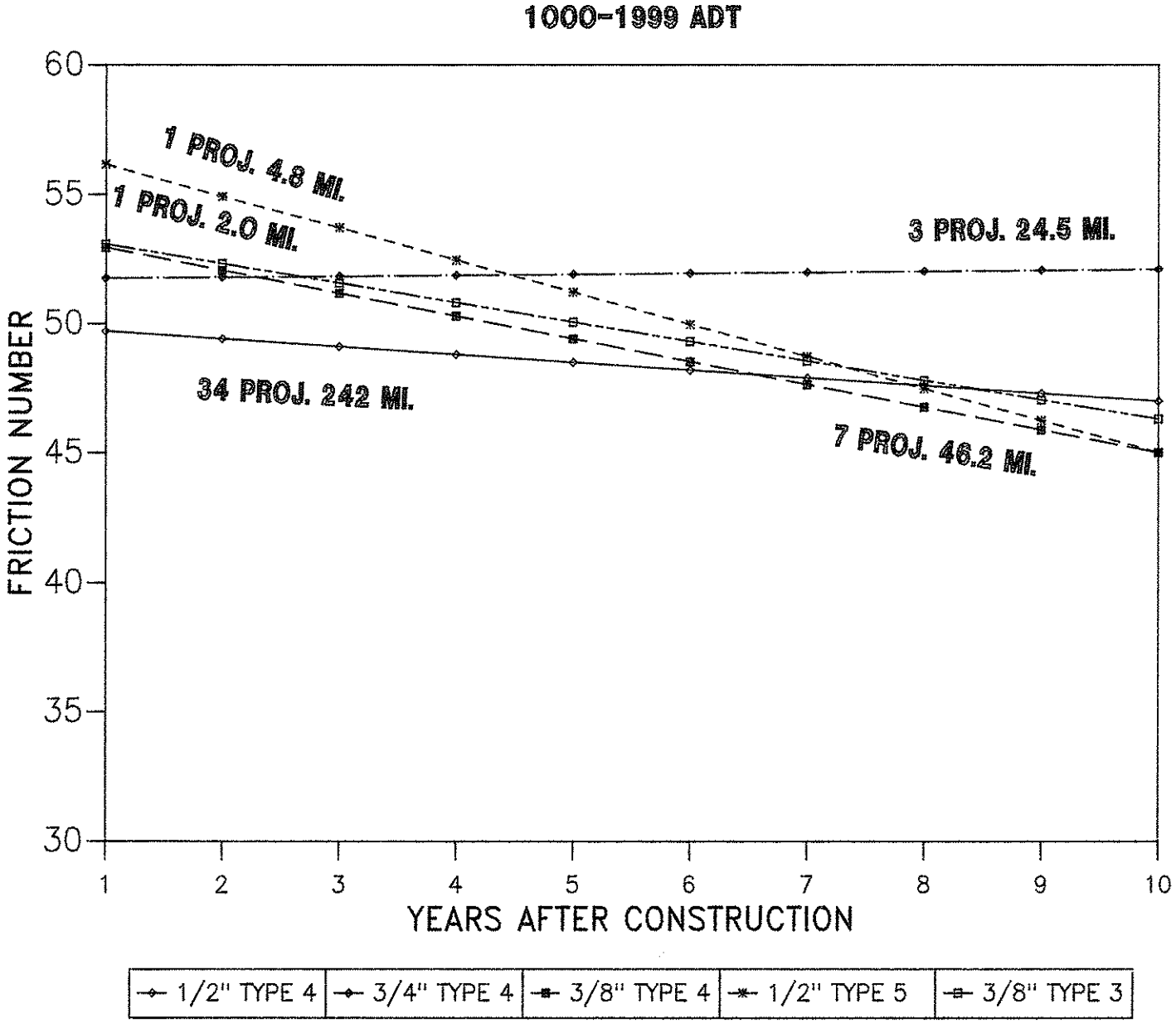
Figure 1


A.C.C. SURFACES BY AGGREGATE TYPE
0-499 ADT
5 PROJ. 20.2 MI.
1 PROJ. 3.0 MI.
1 PROJ. 1.9 MI.
FRICTION NUMBER
60
55
50
45
40
35
30
1
2
3
4
5
6
7
8
9
10
YEARS AFTER CONSTRUCTION
1/2" TYPE 4
3/4" TYPE 4
3/4" TYPE 5

A.C.C. SURFACES BY AGGREGATE TYPE



A.C.C. SURFACES BY AGGREGATE TYPE



A.C.C. SURFACES BY AGGREGATE TYPE

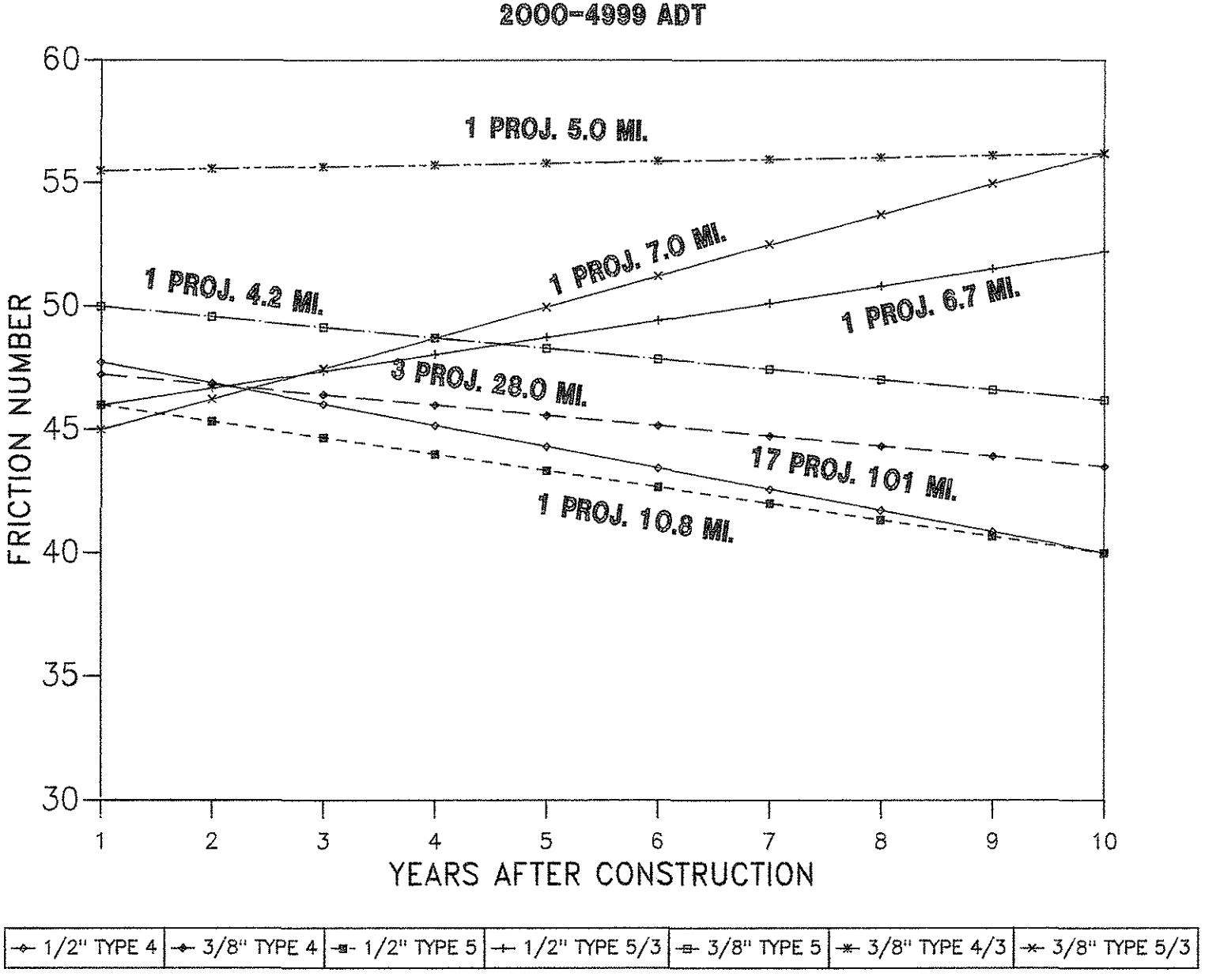
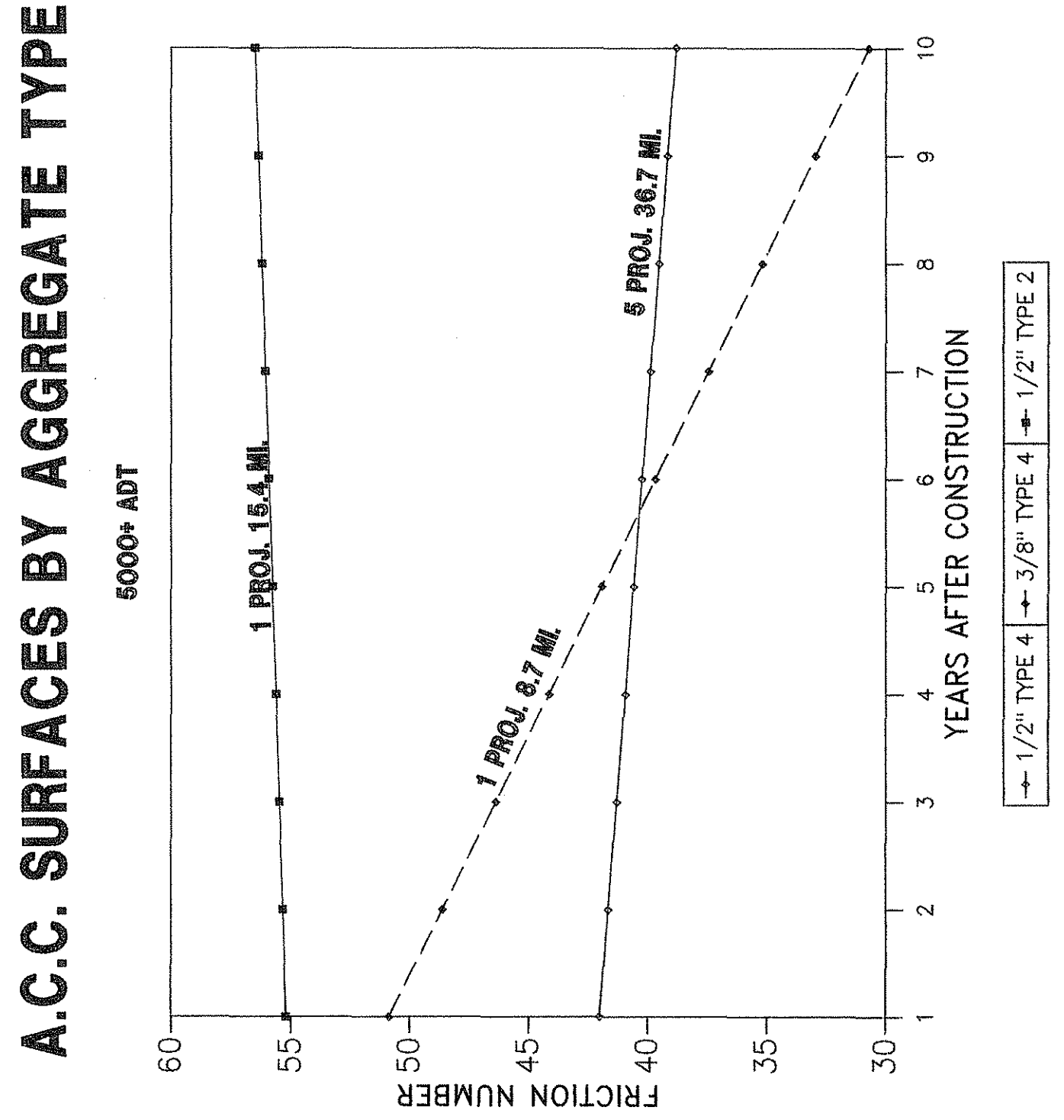


Figure 5


A.C.C. SURFACES BY AGGREGATE TYPE
5000+ ADT
1 PROJ. 15.4 MI.
1 PROJ. 8.7 MI.
5 PROJ. 36.7 MI.
FRICTION NUMBER
60
55
50
45
40
35
30
1
2
3
4
5
6
7
8
9
10
YEARS AFTER CONSTRUCTION
1/2" TYPE 4
3/8" TYPE 4
1/2" TYPE 2

SPRINKLE TREATED PAVEMENTS:

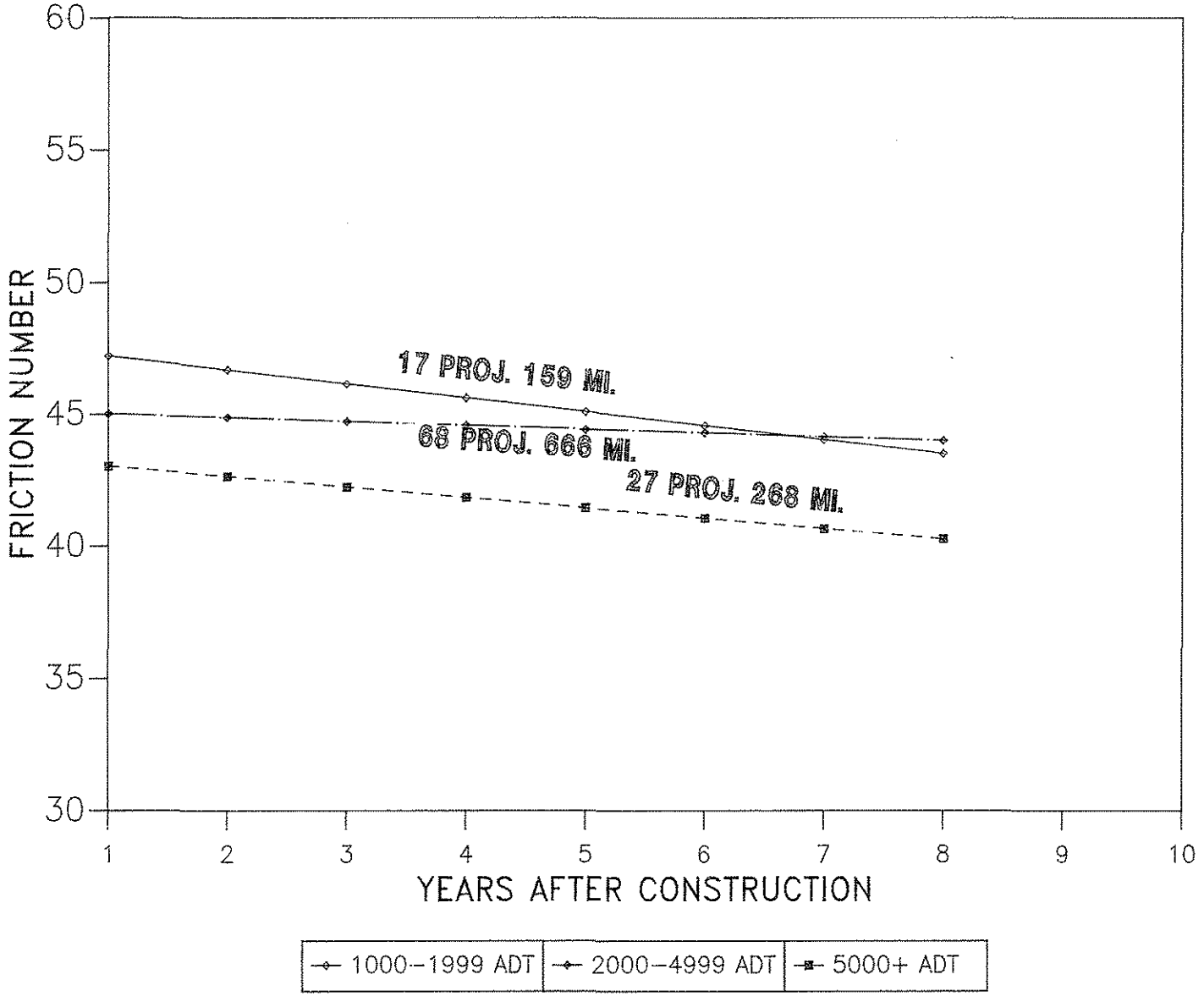
Sprinkle treatment consists of rolling pretreated, asphalt coated coarse aggregate into the surface course during the compaction process. Standard aggregate such as crushed gravel or crushed stone is applied at the rate of 7.5 lbs/sq. yd. When lightweight aggregate is used, it is applied at the rate of 5 lbs/sq. yd.

Iowa began using sprinkle treatment in 1977 and has placed the following mileages through 1985:

YEAR	MILEAGE
1977	46
1978	136
1979	90
1980	28
1981	116
1982	206
1983	220
1984	263
1985	225

Figure 6 representing 112 projects and 1093 miles, shows frictional levels at various ages for sprinkle treated pavements when tested with a ribbed tire. All pavements receiving sprinkle treatment have traffic volumes exceeding 1000

A.C.C. SURFACES WITH SPRINKLE TREATMENT



V.P.D. As was the case on regular (non-sprinkle treated) pavements, there is a gradual, but acceptable, loss of friction over time.

The purpose of providing sprinkle treatments is to increase pavement macrotexture, reduce vehicle tire spray during wet weather, and reduce headlight glare from wet pavements during nighttime or wet surface driving periods.

Iowa Highway Research Board Project HR-199

In 1978, an experimental project to evaluate sprinkle treatments was constructed on old US 30 in Story County. Details of this project were reported by Shelquist[3] and will not be covered here. Briefly, the project assessed various sprinkle aggregate types embedded in three different asphalt mixes (1/2", 3/8", and sand-asphalt).

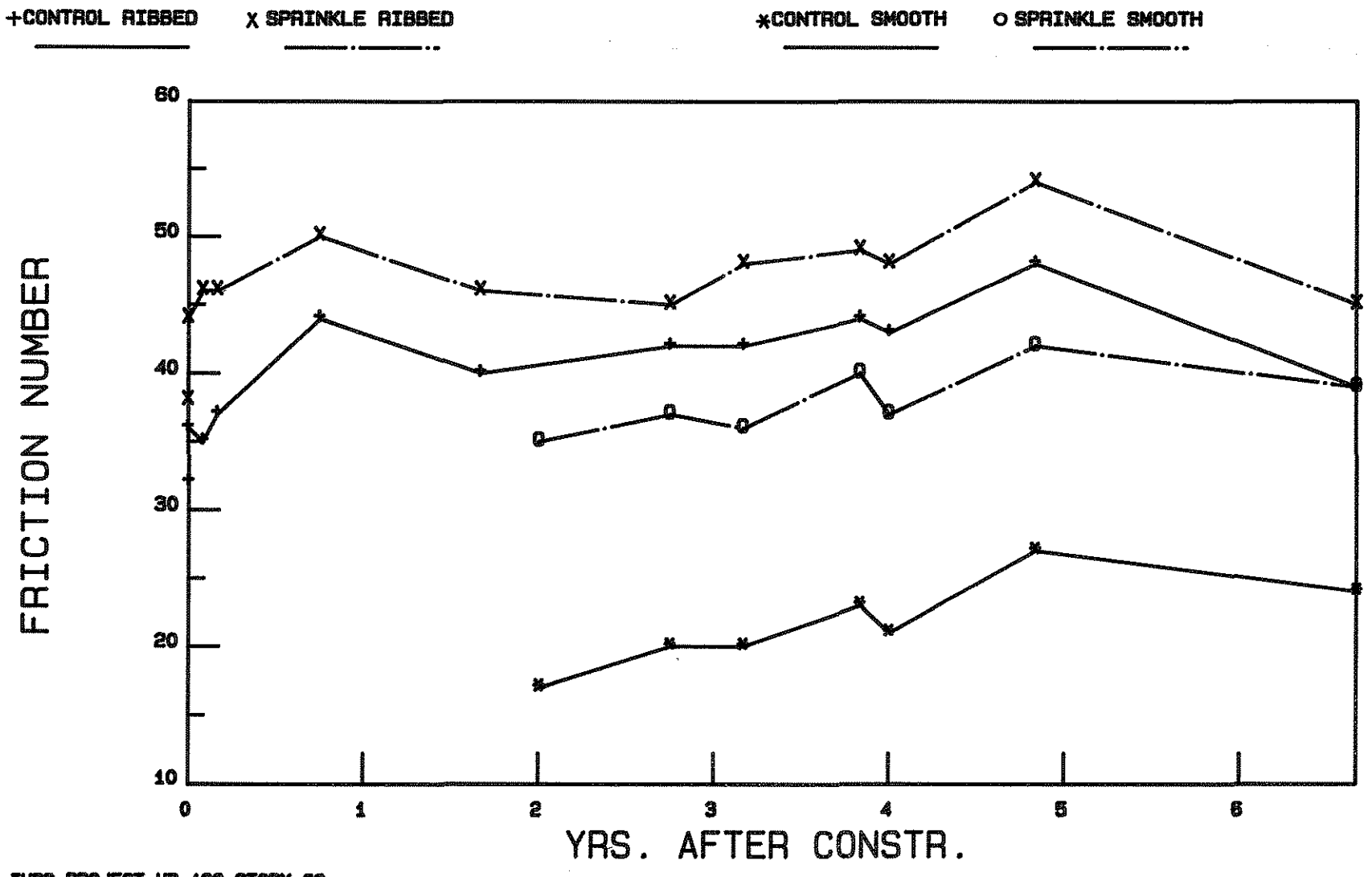
Figures 7 and 8 reflect the friction levels on this project for the 1/2" and 3/8" mixes respectively. Tests were conducted using both ASTM E 501 ribbed tire and ASTM E 524 smooth tires. The friction levels of sprinkle treated pavements were considerably greater than control (non-sprinkled) pavement when tested with the smooth tire. This is logical since the pavement, rather than the tire, provides drainage channels for water during this test.

FOG SEALS:

There is some concern that sprinkle treated pavement surfaces tend to "dry out" thereby necessitating a fog seal within a few years after construction. There is a question as to whether or not such fog sealing would significantly reduce the friction level of these pavements.

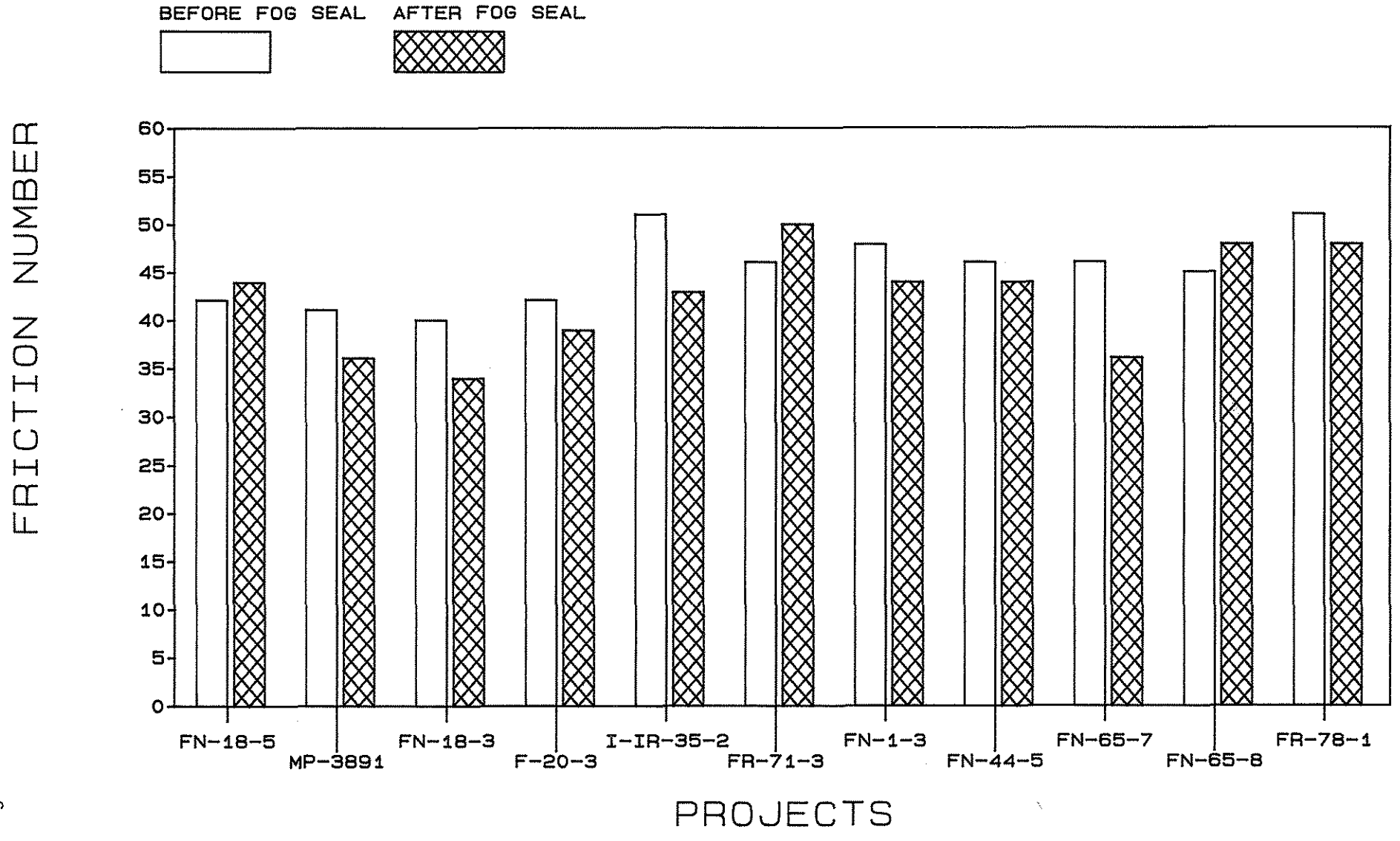
COMPARISON OF FRICTION NUMBER FOR SPRINKLE TREATED AND CONTROL SECTIONS

TYPE B 1/2IN MIX USING RIBBED AND SMOOTH TIRE



IHRB PROJECT HR-199 STORY CO.
AMIX12

FRICTION DATA FOR SPRINKLE TREATMENT SURFACES BEFORE AND AFTER FOG SEAL



AVERAGE FRICTION NO. BEFORE FOG SEAL=45
AVERAGE FRICTION NO. 1+ YEARS AFTER FOG SEAL=42

Figure 9 represents the friction levels of eleven projects that had received sprinkle treatments and subsequently were fog sealed. All testing of fog sealed pavements was done at least one year after the sealing was done. While there is some lessening of friction numbers (from 45 to 42) such a reduction is not meaningful.

ADDITIONAL STUDIES:

In some instances, when Type 2 or Type 3 coarse aggregate were used in asphalt surface courses, sprinkle treatment was not required. An effort was made to evaluate these pavements and compare them to sprinkle treated pavements. Tables 1-4 reflect friction levels on these pavements with and without sprinkle treatments.

TABLE 1

Type 3 Friction Quality
Gravel Sprinkle Aggregate Friction Test Results

Road #	Const. Year	MP	MP	Location	County	Agg Source	Eastbound Smooth	Eastbound Ribbed	Westbound Smooth	Westbound Ribbed
US 30	1978	82.85	92.91	Carroll to Greene Co.	Carroll	D.M. River Boone	*	34	30	36
US 59	1979	96.00	101.49	South of US 30 Jct.	Crawford	D.M. River Boone	Northbound 26	32	Southbound 26	31
US 18	1982	65.51	77.66	O'Brien Co. Line to Spencer	Clay	Hallett	Eastbound 37	42	Westbound 34	41

*Testing with smooth tire not done because of equipment breakdown.

TABLE 2

Type 3 Friction Quality
Gravel Coarse Aggregate With No Sprinkle Treatment

Road #	Const. Year	MP	MP	Location	County	Agg Source	Northbound Smooth	Northbound Ribbed	Southbound Smooth	Southbound Ribbed
IA 4	1978	117.89	126.70	US 18 to Emmet County	Palo Alto	Local Gravel	45	53	44	53
US 59	1974	146.02	152.26	Ida Co.Line near IA 31	Cherokee	Local Gravel	44	56	38	55
IA 175	1981	0.00	5.75	Missouri R. to I-29	Monona	Local Gravel	Eastbound 30	46	Westbound 30	48
IA 39	1978	0.71	4.30	US 59 north 4 miles	Crawford	Local Gravel	Northbound 26	44	Southbound 26	40

TABLE 3

Type 2 Friction Quality
Quartzite Sprinkle Aggregate Friction Test Results

Road #	Const. Year	MP	MP	Location	County	Agg Source	Eastbound Smooth	Eastbound Ribbed	Westbound Smooth	Westbound Ribbed
US 30	1982	57.00	65.00	East of Denison	Crawford	LG Everist Dell Rapids, SD	30	38	31	39
US 30	1983	0.00	9.22	Missouri R. to Missouri Valley	Harrison	LG Everist Dell Rapids, SD	37	38	38	38

TABLE 4

Type 2 Friction Quality
Quartzite Coarse Aggregate With No Sprinkle Treatment

Road #	Const. Year	MP	MP	Location	County	Agg Source	Northbound Smooth	Northbound Ribbed	Southbound Smooth	Southbound Ribbed
US 59	1985			South Jct. 30 to IA 39	Crawford	20% 5/8" Dell Rapids, SD	16	29	20	31
US 75	1985	119.40	126.79	Jct. 60 to near Maurice	Plymouth	LG Everist Dell Rapids, SD	19	43	18	42
*IA 60	1974	8.73	14.37	Plymouth Co. Sioux Line to Alton		3/8" mix Dell Rapids, SD	37	37	34	35

*Covered With Seal Coat August 1986

Comparison of these pavements is difficult since they are of different ages, traffic volumes, mix designs, etc. Even though definite conclusions cannot be drawn, the benefits of quartzite (Type 2) sprinkle treatment are apparent and much less noticeable on the gravel (Type 3) aggregate.

CURRENT AGGREGATE SELECTION

CRITERIA

Current aggregate selection criteria for a.c. pavements is as follows:

Interstate System

Sprinkle treatment aggregate of Type 2 or better is required. A Type 4 aggregate is specified for coarse aggregate in the surface course.

Primary System

1. Over 5000 VPD - A Type 3 or better sprinkle aggregate is specified. The coarse aggregate for the surface course is type 4D or better.

2. 2000 - 5000 VPD - A Type 4 or better sprinkle aggregate is specified. Type 5 or better is allowed for the coarse aggregate in the surface course. For areas where better aggregates are readily available, Type 4 is specified.

3. 1500 - 2000 VPD - Type 4D or better is acceptable without sprinkle treatment. If Type 5 is the only readily available aggregate, sprinkle treatment is specified.

4. Less than 1500 VPD - No requirements for aggregates are specified unless there are alignment problems that may make sprinkle treatment a worthwhile safety consideration.

CONCLUSIONS

Based upon the data collected to date the following conclusions are appropriate:

1. Current aggregate selection criteria for a.c. pavement surface courses provides adequate friction levels through 10 years and should remain effective through a 15 year design life.

2. Sprinkle treatment of pavements has, for the most part, provided macrotexture in the pavement surface as evidenced by smooth tire testing.

3. Fog sealing sprinkle treated pavements does not significantly alter the friction properties.

BIBLIOGRAPHY

1. "Development of the Aggregate Classification System for Asphaltic Concrete Pavements", B. H. Ortgies (Approx. 1978), Iowa Department of Transportation.

2. "A Review of the Frictional Classification of Iowa Aggregates", B.C. Brown, 1981, Iowa Department of Transportation.

3. "Sprinkle Treatment of Asphalt Surfaces", R. A. Shelquist, 1984, Iowa Department of Transportation.

4. "A Study of the Frictional Properties of New Asphaltic Concrete Pavements in Iowa", B. C. Brown, 1978, Iowa Department of Transportation.

5. "Skid Resistance of the Secondary Road System in Iowa", B. C. Brown, 1977, Iowa Department of Transportation.

APPENDICES

FORM 103050
7-75

Iowa Department of Transportation

POLICIES AND PROCEDURES MANUAL

SUBJECT	POLICY NO.
Pavement Friction Evaluation Program	600.01
RESPONSIBLE DIVISION(S), OFFICE(S)	RELATED POLICIES & PROCEDURES
Highway Division, Deputy Director-Operations	
EFFECTIVE / REVISION DATE: 11-20-72 / 10-25-85	APPROVAL(S):

I. **Affected Division(s), Office(s):** Highway Division--Offices of Materials, Maintenance, and Construction, and the district offices; Bureau of Transportation Safety.

II. **Policy Statement and Purpose:** It is the policy of the Highway Division to establish a program for conducting friction tests on the interstate and primary road systems, isolate sites with low friction wet weather characteristics, evaluate pavement materials, test construction processes, and determine the effectiveness of maintenance practices designated to increase the frictional coefficient of the pavement surface.

The purpose of this policy is to establish criteria to be used in the evaluation of the frictional characteristics of pavement surfaces and to take action to mitigate low frictional coefficient areas.

III. **Authority:** This policy is established by the authority of the Director of the Highway Division.

IV. **Definitions:**

A. The Pavement Friction Review Committee is an advisory body to the Deputy Director-Operations of the Highway Division and is responsible for uniform assessments of frictional data on a statewide basis and for resultant recommendations of remedial action.

The Committee shall be composed of representatives from the Offices of Maintenance, Materials and Construction, and the Bureau of Transportation Safety. The Committee shall establish its internal operating procedures and designate a chairperson. The representative from the Office of Maintenance shall serve as secretary.

B. Form 840002 - "Request for Field Review of Pavements"

C. Other data - Data such as but not limited to various tabulations, correspondence, drawings and photographs.

V. **Summary of Responsibilities:**

A. The Office of Materials shall be responsible for the establishment of testing priorities, the performance of tests, and test data compilation.

B. The Bureau of Transportation Safety shall be responsible for the preparation of Forms 840002 and the furnishing of supplemental data such as traffic volume and wet weather accident data.

C. The Office of Maintenance shall be responsible for the authorizing and ordering of interim warning signs, the preparation and distribution of the minutes of meetings, and the maintenance of friction review files.

D. The District Offices shall be responsible for the performance of field reviews, the submission of corrective action recommendations, and the implementation of corrective action as directed.

E. The Pavement Friction Review Committee shall be responsible for the:

1. Review of data for pavement sections with the following friction number averages:

   -Greater than 37 with individual numbers below 30

   -Equal to or less than 37

2. Review of district office recommendations.

3. Submission of recommendations for improvement action to the Deputy Director-Operations.

F. The Deputy Director-Operations of the Highway Division shall be responsible for the review of the recommendations submitted by the Pavement Friction Review Committee and for authorizing or recommending improvement actions to be taken.

VI. Procedures:

A. Field Testing Program

1. The Office of Materials shall establish a priority listing of pavement sections to be tested. This listing shall consider traffic volumes, time since last friction tests were performed, and friction values obtained in previous tests.

2. The Office of Materials shall conduct the tests and be responsible for the accuracy of the test data. Tests shall normally be conducted at the rate of two per mile in each direction, with a total of not less than five tests in each direction on each pavement section.

B. Test Data Evaluation

1. The Office of Materials shall provide the computer-printed test reports to the Bureau of Transportation Safety.

2. The Bureau of Transportation Safety shall prepare Form 840002 and other data for pavement sections as required by the following guidelines:

Friction Number Average (both directions of travel):	Action Required:
Greater than 37 and no individual number below 30	No Form 840002 required
Greater than 37 with individual numbers below 30	Prepare Form 840002 and other data
Equal to or less than 37	Prepare Form 840002 and other data

3. Traffic volume and wet weather accident data shall be provided on Form 840002 by the Bureau of Transportation Safety.

4. The Bureau of Transportation Safety shall forward the computer-printed test reports, Forms 840002 and other data to the Office of Maintenance.

5. The Office of Maintenance shall process the test reports, Forms 840002 and other data in accord with the following guidelines:

Friction Number Average (both directions of travel):	Action Required:
Greater than 37 and no individual number below 30	No action required

Greater than 37 with individual numbers below 30	To committee; does not go to district for initial review
Numbers 33 through 37 and no individual number below 30	To committee; does not go to district for initial review
Numbers 33 through 37 with individual numbers below 30	To district for initial review
Numbers 20 through 32	To district for initial review
Any section 19 or less	Order "Slippery When Wet" signs and instruct district on placement. Ser d Form 840002, test report and other data to district for initial review.

C. Field Review

1. The district office shall conduct a field review of all pavements requested. The geometry of the pavement and the types of traffic maneuvers at locations with less than desirable friction numbers shall be considered in making improvement recommendations.

2. The district office shall make recommendations concerning improvement action on Forms 840002 and return them to the Office of Maintenance.

3. Signs at locations other than those authorized by the Office of Maintenance may be requested by the district office.

D. Improvement Action

1. The Office of Maintenance shall assemble Forms 840002 and other data for review by the committee.

2. The committee shall review Forms 840002 and other data and recommend action.

3. The committee shall review all field recommendations and either concur with the district's recommendations or, if the committee does not concur, provide an alternate recommended action.

4. Following committee action, the secretary shall forward Forms 840002 and other data to the Deputy Director-Operations for review.

5. The secretary shall return to the districts those Forms 840002 for which improvement action is authorized or recommended by the Deputy Director-Operations.

6. The district office shall take the improvement action if it is within the capability of the district forces. Upon completion of the action, Form 840002 shall be returned to the Office of Maintenance showing the date the action was completed.

7. If surface restoration or resurfacing is the recommended action, the highway section involved shall be considered for programming during surface restoration or bituminous surfacing program development. District engineers shall consider these sections when preparing recommendations for projects, and staff engineers shall consider these sections as they evaluate the districts' recommendations and prepare the statewide resurfacing and surface restoration programs.

8. 'Slippery When Wet' signs should be removed after any contract surface restoration work. For work such as seal coating or slurry seals, the signs may be removed by the district office if visual inspection or friction testing indicates correction of the

problem. The district should document when the signs are removed and notify the Office of Maintenance. Should there be any question about the effectiveness of the improvement action, the signs should remain in place until the pavement section is retested.

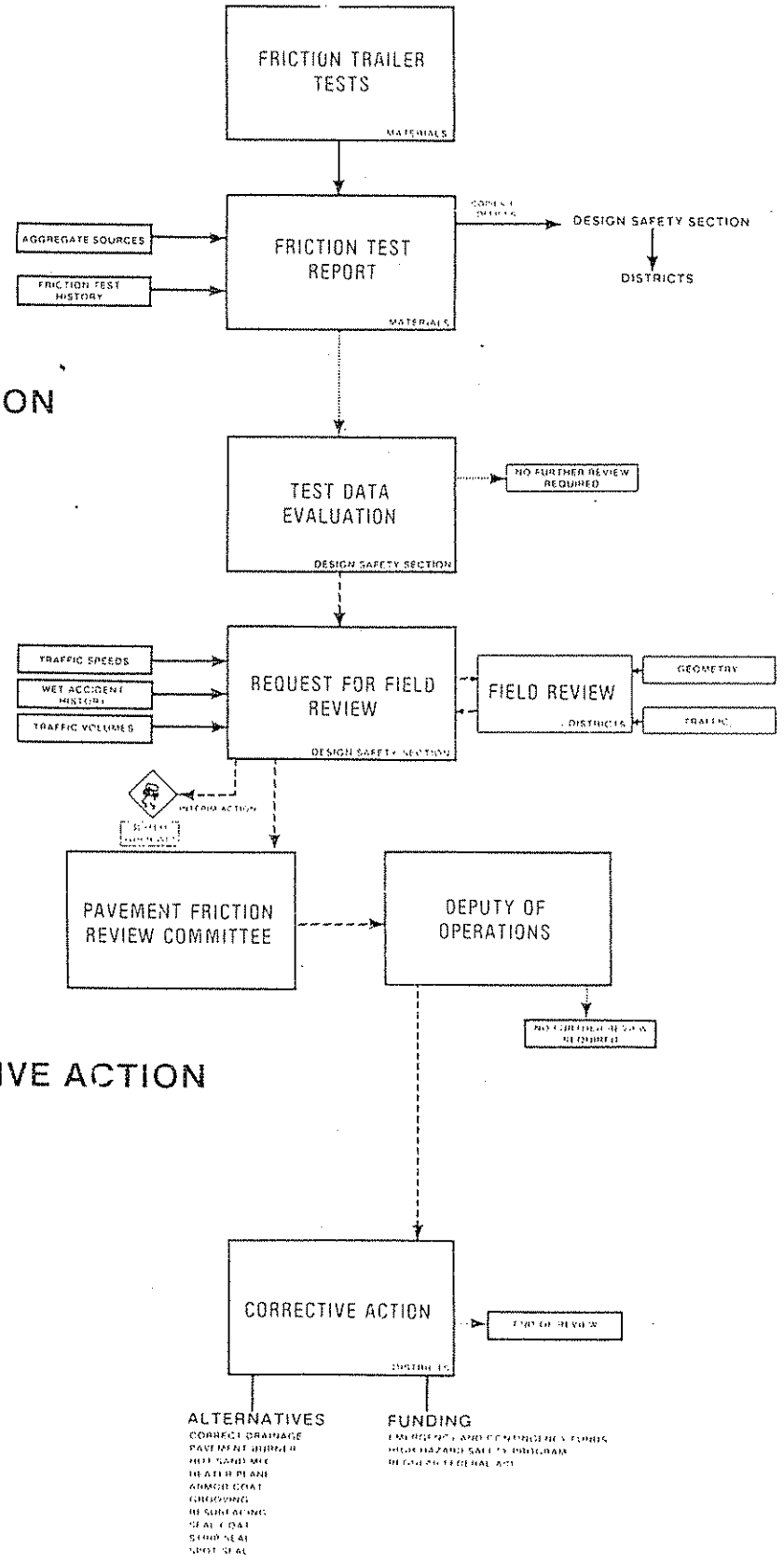
9. The Office of Maintenance shall transmit copies of completed Forms 840002 to the Bureau of Transportation Safety and the Office of Materials.

APPENDIX A

PAVEMENT FRICTION EVALUATION PROGRAM

TESTING

IOWA



FRICTION TESTS ON A.C.C. PAVEMENTS WITH SPRINKLE TREATMENT

PROJECT NO.	DISTRICT NUMBER	COUNTY NUMBER	DATE BUILT	BEGINING MILE POST	ENDING MILE POST	DATE TESTED	FRICTION NUMBER	COUNT CODE 1
FN-89-2(2)--21-08	1	8	1979	1.90	6.87			C
FR-17-1(11)-2G-77	1	8	1985	7.07	21.09			D
F-44-5(5)--20-25	1	25	1980	0.96	1.02	1985	52	D
FR-30-3(13)--2G-37	1	37	1983	117.14	119.03		44	D
MP-1446--69-38	1	38	1979	113.56	123.30	1983	46	D
FN-20-4(29)--21-40	1	40	1984	14.25	17.25	1985	47	C
EACF-65-6(42)--2K-42	1	42	1983	132.65	148.50	1985	46	C
FN-65-4(23)--21-50	1	50	1978	98.38	113.20	1983	48	C
FR-163-2(5)--2G-50	1	50	1982	29.43	40.17	1983	48	E
I-IG-80-5(34)178--04-50	1	50	1984	174.40	183.74	1985	56	E
FN-63-3(35)--21-62	1	62	1984	76.32	82.77			D
F-34-2(24)--20-69	1	69	1983	35.50	52.10	1984	44	C
MP-1319	1	77	1977	89.40	93.00	1984	33	C
F-FG-65-4(22)--20-77	1	77	1979	0.83	0.98	1984	42	D
FR-65-4(29)-2G-77	1	77	1981	0.83	0.98	1984	45	D
FN-5-4(14)--12-91	1	77	1983	90.39	91.54	1985	32	E
RF-146-3(1)--35-86	1	86	1977	30.45	31.45	1983	54	C
FR-30-6(42)--2G-86	1	86	1984	204.60	209.85	1985	42	D
MP-1667--69-D1	1	94	1981	124.00	137.60	1984	36	E
FN-9-9(18)--21-03	2	3	1979	289.16	295.39	1984	49	C
F-9-9(17)--20-03	2	3	1980	279.21	289.16	1984	49	D
FN-63-6(38)--21-07	2	7	1982	148.27	153.33	1984	42	C
FN-218-7(37)--21-07	2	7	1982	191.33	197.19	1985	41	E
IX-20-6(35)--3P-07	2	7	1984	233.13	234.79	1984	39	D
FN-3-6(21)--21-09	2	9	1979	222.59	228.41	1983	40	D
MP-2683--69-D2	2	9	1982	215.88	219.87	1983	44	D
F-63-7(20)--20-09	2	9	1983	179.41	232.36	1984	47	E
MP-218-2(204)--76-09	2	9	1984	205.93	206.81	1985	43	D
FR-218-8(14)--26-09	2	9	1984	206.81	218.46	1985	48	D
FN-20-5(20)--21-12	2	12	1983	202.69	211.21	1985	53	D
FN-3-5-(37)--21-12	2	12	1983	210.27	215.88	1985	40	D
FN-3-5(38)--21-12	2	12	1985	193.84	202.77			D
FN-18-5(27)--21-17	2	17	1977	176.32	181.19	1985	46	E
FN-65-8(16)--21-17	2	17	1977	198.78	203.77	1984	44	E
FN-65-8(17)--21-17	2	17	1978	179.59	194.70	1985	48	E
FR-18-7(31)--2G-19	2	19	1983	220.85	230.85	1984	50	D
F-18-7(36)--20-19	2	19	1984	238.08	243.51	1985	54	D
FN-18-1(37)--21-19	2	19	1985	232.35	233.42			D
FR-3-8(11)--2G-22	2	22	1982	268.44	277.88		46	D
FN-9-4(31)21-32	2	32	1984	0.87	87.50	1985	41	D
FR-3-7(14)--2G-33	2	33	1979	253.22	268.44	1983	48	D
FR-3-7(20)-2G-33	2	33	1984	241.42	251.79	1985	48	D
FN-18-6(14)--21-34	2	34	1979	193.83	205.39		48	D
FR-218-9(33)--2G-34	2	34	1980	222.14	231.14		50	D
FN-65-7(5)--21-35	2	35	1978	155.39	167.35	1985	36	D
FN-65-7(7)--21-35	2	35	1979	169.37	179.59	1984	42	D
FN-18-4(11)--21-41	2	41	1981	161.36	172.77	1981	29	D
EACF-3-3(22)21-46	2	46	1984	1.18	128.70	1985	52	D
FN-3-3(23)21-46	2	46	1984	1.31	142.30	1985	50	D
FN-169-8(24)--21-55	2	55	1982	191.15	214.65	1985	51	D
FN-65-9(5)--21-98	2	98	1978	203.77	221.20	1985	44	D
MP-2681--69-99	2	99	1982	165.78	178.90	1983	44	D
FR-24-1(6)--26-19	3	19	1985	1.10	8.19			D
F-20-3(36)--20-13	3	13	1981	84.00	95.20	1985	39	D

1. Count Code is traffic ADT
   - C = 1000-1999 ADT
   - D = 2000-4999 ADT
   - E = 5000+ ADT

FRICTION TESTS ON A.C.C. PAVEMENTS WITH SPRINKLE TREATMENT

PROJECT NO.	DISTRICT NUMBER	COUNTY NUMBER	DATE BUILT	BEGINING MILE POST	ENDING MILE POST	DATE TESTED	FRICTION NUMBER	COUNT CODE 1
MP-3891-69-14	3	14	1978	82.85	92.91	1984	36	E
F-18-2(39)--20-21	3	21	1982	65.51	77.66	1983	48	D
FN-71-8(10)--21-21	3	21	1984	207.92	217.23	1985	40	E
MP-3936-69-24	3	24	1979	96.00	101.49	1984	36	C
FR-30-2(42)--2G-24	3	24	1982	56.04	68.88	1983	45	D
FN-30-2(56)--21-24	3	24	1984	37.96	52.97	1985	43	D
FR-30-1(38)--26-43	3	43	1983	0.00	9.22	1984	41	D
FN-18-3(34)-21-74	3	74	1979	106.75	119.61	1985	34	D
FR-60-1(9)-26-75	3	75	1981	0.00	8.73	1985	45	D
F-60-2(9)-20-84	3	84	1982	16.34	31.06	1985	41	D
IR-80-2(91)86--12-01	4	1	1982	85.50	99.50	1985	45	E
FN-148-2(10)--21-02	4	2	1983	29.07	30.19	1984	42	D
FR-34-3(17)--2G-02	4	2	1983	52.10	63.70	1984	44	C
FR-71-3(26)--26-15	4	15	1981	42.90	59.40		50	D
F-34-1(49)--20-65	4	65	1983	19.80	35.50	1984	46	D
EACH-34-1(49)--2K-65	4	65	1983	19.87	35.68		46	D
FR-71-2(17)--2G-69	4	69	1981	30.13	41.73	1983	48	C
FR-34-2(22)--2G-69	4	69	1981	48.48	50.41	1984	44	D
EACH-34-2(24)--2K-69	4	69	1983	35.68	52.11	1984	44	D
MP-4531-69-D4	4	78	1977	39.32	49.34	1983	54	C
I-IR-35-2(157)33-14-20	5	20	1979	33.15	43.00	0	47	D
FR-63-1(21)--2G-26	5	26	1980	17.10	31.20			D
IR-35-1(44)00-12-27	5	27	1985	0.00	33.16			D
FN-2-5(13)--21-27	5	27	1985	9.79	23.90	3		D
FR-61-2(29)--2G-29	5	29	1984	44.04	59.72	1985	44	E
F-34-9(36)--20-44	5	44	1981	238.01	243.96	1985	34	E
F-218-2(17)--20-44	5	44	1981	38.45	48.30	1985	40	D
FN-218-2(28)--21-44	5	44	1984	48.35	57.09	1985	44	D
FN-163-2(5)--21-50	5	50	1982	28.45	40.30	1983	48	E
FN-1-2(11)--21-51	5	51	1977	17.10	23.75	1984	58	D
FN-34-8(11)--21-51	5	51	1979	196.90	222.80	1984	53	D
FN-34-8(18)--21-51	5	51	1984	202.68	212.71	1984	53	D
FN-1-3(1)--21-54	5	54	1978	37.00	43.55	1985	44	C
FR-78-1(6)--2G-54	5	54	1980	0.35	12.95	1985	48	C
F-63-3(30)--20-54	5	54	1982	45.60	61.20	1985	40	D
FN-61-1(34)--21-56	5	56	1981	29.15	30.60	1983	40	E
FN-61-1(33)--21-56	5	56	1981	3.87	9.90	1985	31	E
FN-61-1(38)--21-56	5	56	1982	0.10	3.87	1984	37	E
FR-61-3(24)--2G-58	5	58	1984	59.72	67.51	1985	44	D
FN-34-6(27)--21-59	5	59	1984	146.14	154.66	1985	44	D
FN-34-6(31)--21-59	5	59	1985	132.17	135.12			D
FR-14-2(15)--2G-59	5	59	1985	9.79	23.90			D
FR-163-4(2)--2G-62	5	62	1983	44.10	57.00	1984	46	D
FN-92-7(29)--21-62	5	62	1985	174.57	179.97			D
FN-163-3(8)--21-63	5	63	1982	42.90	44.13	1983	48	E
FN-5-3(7)--21-63	5	63	1983	66.55	71.20	1984	46	D
FN-5-3(8)--21-63	5	63	1983	72.05	75.30	1984	40	D
FN-5-3(9)--21-63	5	63	1984	45.10	60.40	1985	44	D
FR-14-3(23)--2G-63	5	63	1985	150.75	157.95			D
EACF-34-6(28)--2K-68	5	68	1983	158.90	167.60	1984	42	D
EACF-34-6(29)--2K-68	5	68	1983	170.75	176.85	1984	46	D
FN-70-1(7)--21-70	5	70	1985	19.63	25.83			D
FN-34-7(28)--21-90	5	90	1982	196.10	202.35	1984	44	D
FN-5-4(14)--21-91	5	91	1982	89.10	91.25	1984	39	E

1. Count Code is traffic ADT
   C = 1000-1999 ADT
   D = 2000-4999 ADT
   E = 5000+ ADT

FRICTION TESTS ON A.C.C. PAVEMENTS WITH SPRINKLE TREATMENT

PROJECT NO.	DISTRICT NUMBER	COUNTY NUMBER	DATE BUILT	BEGINING MILE POST	ENDING MILE POST	DATE TESTED	FRICTION NUMBER	COUNT CODE 1
FN-65-3(14)--21-91	5	91	1985	54.07	58.74			D
FN-5-4(19)--21-91	5	91	1985					D
FN-92-9(38)--2G-92	5	92	1984	234.85	239.70	1985	42	E
FN-218-3(15)--21-92	5	92	1984	57.09	67.28			D
FN-65-1(11)--21-93	5	93	1984	0.00	12.89			C
FN-14-1(16)--21-93	5	93	1984	1.24	9.79	1985	53	C
FR-65-1(12)--2G-93	5	93	1985	12.89	22.43			D
FN-218-6(20)--21-06	6	6	1979	148.60	166.40	1985	42	C
HES-150-2(2)--2H-06	6	6	1981	0.28	0.29	1985	44	E
F-20-7(10)--20-10	6	10	1977	4.00	12.40	1985	41	C
FN-38-2(11)--21-16	6	16	1977	26.04	34.06			D
FR-61-6(17)--26-23	6	23	1981	142.95	157.89	1985	38	E
FN-20-8(17)--21-28	6	28	1978	283.10	294.10	1985	43	D
FN-13-2(21)--21-28	6	28	1981	44.00	48.50	1984	48	E
BRF-F-13-2(22)--2P-28	6	28	1983	43.40	44.00	1984	48	E
FN-13-2(13)--20-28	6	28	1983	48.50	53.70	1984	50	D
FR-151-1(3)--26-48	6	48	1983	68.00	81.70	1984	44	D
FR-151-1(3)--2G-48	6	48	1983	68.20	81.70			D
FN-61-7(25)--21-49	6	49	1982	159.38	174.71	1983	45	E
FN-1-5(22)--21-52	6	52	1982	98.41	107.30	1985	38	D
FR-1-5(27)--26-52	6	52	1983	88.20	98.53	1984	36	D
F-15104(31)--20-53	6	53	1982	24.00	50.10	1983	37	E
FN-150-1(18)--21-57	6	57	1977	4.50	17.20	1984	38	D
FN-30-7(54)--21-57	6	57	1979	253.20	258.80	1984	38	D
F-67-1(54)--20-82	6	82	1983	22.45	24.42	1985	42	D
FN-1-4(23)-21-92	6	92	1983	69.10	71.20			D

1. Count Code is traffic ADT
   C = 1000-1999 ADT
   D = 2000-4999 ADT
   E = 5000+ ADT

FRICTION TESTS ON A.C.C. PAVEMENTS

PROJECT NO.	COUNTY NUMBER	DATE BUILT	LENGTH MILES	AGG. SIZE	AGG. FRIC. CODE 1	COUNT CODE 2	YEARS TEST 3	FRICTION NUMBER	COMMENT
FN25-3(6)	1	1977	10.4	0.500	4	C	1	42	
FN25-3(6)	1	1977	10.4	0.500	4	C	4	52	
FN25-3(6)	1	1977	10.4	0.500	4	C	8	33	
FN-1(10)	4	1975	6.7	0.375	7	D	5	50	TYPE 5 AGGREGATE WITH 20% TYPE 3
FN5-1(10)	4	1975	6.7	0.375	7	D	1	45	TYPE 5 AGGREGATE WITH 20% TYPE 3
MP5733-69	4	1977	5.0	0.375	6	D	1	57	TYPE 4 AGGREGATE WITH 20% TYPE 3
MP5733-69	4	1977	5.0	0.375	6	D	5	52	TYPE 4 AGGREGATE WITH 20% TYPE 3
MP5733-69	4	1977	5.0	0.375	6	D	8	58	TYPE 4 AGGREGATE WITH 20% TYPE 3
FN-101-1(12)	6	1979	14.2	0.500	4	C	1	44	
FN-101-1(12)	6	1979	14.2	0.500	4	C	4	40	
FN-101-1(12)	6	1979	14.2	0.500	4	C	6	44	
FN198-1(1)	6	1976	2.7	0.500	4	A	1	50	
FN198-1(1)	6	1976	2.7	0.500	4	A	5	49	
FN198-1(1)	6	1976	2.7	0.500	4	A	9	50	
FN30-6(30)	6	1976	3.0	0.500	4	D	4	48	
FN30-6(30)	6	1976	3.0	0.500	4	D	7	29	
FN30-6(30)	6	1976	3.0	0.500	4	D	8	40	
P-279-0(2)	6	1978	2.4	0.500	4	C	1	55	
P-279-0(2)	6	1978	2.4	0.500	4	C	5	47	
RF30-6(32)	6	1976	10.0	0.500	4	E	4	40	
RF30-6(32)	6	1976	10.0	0.500	4	E	6	36	
RF30-6(32)	6	1976	10.0	0.500	4	E	8	35	
RF30-6(32)	6	1976	10.0	0.500	4	E	9	29	
TQFS-200-0-(1)	6	1977	12.1	0.500	4	C	1	46	
TQFS-200-0-(1)	6	1977	12.1	0.500	4	C	5	42	
F-175-9(6)	7	1978	4.0	0.500	4	C	1	50	
F-175-9(6)	7	1978	4.0	0.500	4	C	4	50	SEAL COAT
F-175-9(6)	7	1978	4.0	0.500	4	C	5	47	
FN-58-1(16)	7	1979	1.6	0.500	4	D	1	52	
FN-58-1(16)	7	1979	1.6	0.500	4	D	4	41	
RF144-2(2)	8	1976	4.9	0.500	4	C	4	47	
RF144-2(2)	8	1976	4.9	0.500	4	C	7	44	
MP2245-69	9	1976	3.8	0.500	4	E	4	49	
MP2245-69	9	1976	3.8	0.500	4	E	7	42	
MP2245-69	9	1976	3.8	0.500	4	E	9	46	
FN-187-1(6)	10	1978	10.2	0.500	4	B	1	52	
FN-187-1(6)	10	1978	10.2	0.500	4	B	6	47	
RF150-5(11)	10	1976	11.3	0.500	4	D	4	46	
RF150-5(11)	10	1976	11.3	0.500	4	D	7	33	
RF150-5(11)	10	1976	11.3	0.500	4	D	8	36	
RF336-1(1)	10	1976	2.0	0.500	4	B	4	46	
MP3744	13	1976	11.0	0.375	4	D	4	44	
MP3744	13	1976	11.0	0.375	4	D	7	42	
MP3891	14	1978	10.1	0.375	4	D	1	44	
MP3891	14	1978	10.1	0.375	4	D	4	41	
MP3891	14	1978	10.1	0.375	4	D	6	36	
FN83-2-(8)	15	1975	9.4	0.500	4	C	1	48	
FN83-2-(8)	15	1975	9.4	0.500	4	C	1	50	
FN83-2-(8)	15	1975	9.4	0.500	4	C	7	45	
FN-38-2-(15)	16	1979	6.5	0.500	4	D	1	50	
FN-38-2-(15)	16	1979	6.5	0.500	4	D	1	47	
FN-38-2-(15)	16	1979	6.5	0.500	4	D	5	51	
FN38-2(11)	17	1977	7.3	0.500	4	D	2	55	
FN65-8(17)	17	1977	7.0	0.500	4	D	2	47	

1. Aggregate friction code is friction type.
   Code 2-5 = friction type 2-5
   Code 6 = 80% type 4 & 20% type 3
   Code 7 = 80% type 5 & 20% type 3

2. Count Code is traffic ADT.
   A = 0-499 ADT
   B = 500-999 ADT
   C = 1000-1999 ADT
   D = 2000-4999 ADT
   E = 5000+ ADT

3. Years test is number of years from construction to testing date.

FRICTION TESTS ON A.C.C. PAVEMENTS

PROJECT NO.	COUNTY NUMBER	DATE BUILT	LENGTH MILES	AGG. SIZE	AGG. FRIC. CODE 1	COUNT CODE 2	YEARS TEST 3	FRICTION NUMBER	COMMENT
MP2315	41	1977	4.2	0.375	5	D	8	47	
F175-7(12)	42	1977	7.7	0.500	4	B	1	47	
F175-7(12)	42	1977	7.7	0.500	4	B	5	50	
MP1295	42	1977	7.0	0.375	4	C	2	52	
MP1295	42	1977	7.0	0.375	4	C	6	49	
FN-20-2(13)	47	1979	3.9	0.500	4	D	4	44	
FN-20-2-(13)	47	1979	3.9	0.500	4	D	1	40	
FN62-1(4)	49	1975	1.4	0.375	3	B	1	47	
FN62-1(4)	49	1975	1.4	0.375	3	B	2	48	
FN225-1(1)	50	1975	4.8	0.500	5	C	1	44	
FN225-1(1)	50	1975	4.8	0.500	5	C	2	54	
FN225-1(1)	50	1975	4.8	0.500	5	C	6	52	
FN6-4(39(	50	1975	8.2	0.500	4	C	1	51	
FN6-4(39)	50	1975	8.2	0.500	4	C	1	46	
FN6-4(39)	50	1975	8.2	0.500	4	C	6	51	
TQF-117-1(9)	50	1978	11.0	0.500	4	C	1	43	
TQF-117-1(9)	50	1978	11.0	0.500	4	C	4	51	
TQF-117-1(9)	50	1978	11.0	0.500	4	C	7	47	
F22-3(3)	52	1977	3.0	0.500	4	C	1	51	
F22-3(3)	52	1977	3.0	0.500	4	C	4	45	
F22-3(3)	52	1977	3.0	0.500	4	C	7	44	
FN218-4(18)	52	1977	8.4	0.500	4	D	2	31	
FN218-4(18)	52	1977	8.4	0.500	4	D	3	30	
FN218-4(18)	52	1977	8.4	0.500	4	D	4	37	
FN218-4(18)	52	1977	8.4	0.500	4	D	6	24	
FN-1-6(4)	53	1976	3.5	0.500	4	D	4	46	
FN-1-6(4)	53	1976	3.5	0.500	4	D	7	39	
FN-1-6(4)	53	1976	3.5	0.500	4	D	9	36	
FN38-3(20)	53	1975	4.4	0.500	4	C	2	45	
FN38-3(20)	53	1975	4.4	0.500	4	C	3	50	
FN38-3(20)	53	1975	4.4	0.500	4	C	7	50	
FN-1-6(4)	54	1976	1.0	0.500	4	D	1	50	
FN63-3(17)	54	1976	1.0	0.500	4	D	2	50	
FN63-3(17)	54	1976	1.0	0.500	4	D	4	42	
RF143-1-(10)	54	1976	10.2	0.500	4	C	1	51	
RF143-1-(10)	54	1976	10.2	0.500	4	C	5	48	
RF143-1-(10)	54	1976	10.2	0.500	4	C	8	43	
FN-169-8(17)	55	1977	8.1	0.500	4	B	2	37	
FN-169-8(17)	55	1977	8.1	0.500	4	B	5	41	
FN103-1(3)	56	1977	7.6	0.500	4	C	1	55	
FN103-1(3)	56	1977	7.6	0.500	4	C	5	50	
MP5732	56	1977	8.1	0.375	4	E	2	49	
MP5732	56	1977	8.1	0.375	4	E	4	43	
MP5732	56	1977	8.1	0.375	4	E	6	40	
RF-16-4(3)	56	1976	13.6	0.500	4	B	1	49	
RF-16-4(3)	56	1976	13.6	0.500	4	B	5	54	SEAL COAT FRICTION 81
RF88-(2)	56	1976	7.5	0.500	4	C	1	49	COUNTY ROAD
FN-150-1(18)	57	1977	13.0	0.500	4	E	1	46	
FN-150-1(18)	57	1977	13.0	0.500	4	E	4	41	
FN-150-1(18)	57	1977	13.0	0.500	4	E	6	31	
FN-150-1(18)	57	1977	13.0	0.500	4	E	7	39	
RF970-2(2)	57	1976	5.3	0.500	4	E	1	44	
RF970-2(2)	57	1976	5.3	0.500	4	E	3	40	
RF970-2(2)	57	1976	5.3	0.500	4	E	5	38	

1. Aggregate friction code is friction type.
   Code 2-5 = friction type 2-5
   Code 6 = 80% type 4 & 20% type 3
   Code 7 = 80% type 5 & 20% type 3

2. Count Code is traffic ADT.
   A = 0-499 ADT
   B = 500-999 ADT
   C = 1000-1999 ADT
   D = 2000-4999 ADT
   E = 5000+ ADT

3. Years test is number of years from construction to testing date.

FRICTION TESTS ON A.C.C. PAVEMENTS

Appendx B

PROJECT NO.	COUNTY NUMBER	DATE BUILT	LENGTH MILES	AGG. SIZE	AGG. FRIC. CODE 1	COUNT CODE 2	YEARS TEST 3	FRICTION NUMBER	COMMENT
FN-25-1(7)	80	1976	7.0	0.500	4	B	7	40	
FN-20-2(13)	81	1979	9.0	0.500	4	C	1	40	
FN-20-2(13)	81	1979	9.0	0.500	4	C	4	43	
FN-65-5(12)	85	1978	12.3	0.500	4	C	1	50	
FN-65-5(12)	85	1978	12.3	0.500	4	C	5	43	
FN96-2(3)	86	1975	3.0	0.750	4	A	1	48	
FN96-2(3)	86	1976	3.0	0.750	4	A	2	47	
FN96-2(3)	86	1975	3.0	0.750	4	A	6	45	
FN-25-2(9)	88	1977	7.9	0.500	4	B	5	50	
FN-25-2-(9)	88	1977	7.9	0.500	4	B	1	52	
FN25-2-(1)	88	1976	5.4	0.500	4	B	1	49	
FN25-2-(1)	88	1976	5.4	0.500	4	B	5	52	
FN25-2-(1)	88	1976	5.4	0.500	4	B	9	54	
FN-1-1(7)	89	1977	11.8	0.500	4	C	1	52	
FN-1-1(7)	89	1977	11.8	0.500	4	C	5	52	
HHS23-1(2)	90	1975	12.7	0.500	4	C	5	46	
HHS23-1(2)	90	1975	12.7	0.500	4	C	9	52	
FN-156-1(1)	91	1978	2.7	0.500	4	B	1	49	
FN-156-1(1)	91	1978	2.7	0.500	4	B	5	45	
HHS-14-3(11)	92	1978	12.2	0.500	4	D	1	48	
FN-20-3(30)	94	1977	11.4	0.500	4	D	1	49	
FN-20-3(30)	94	1977	11.4	0.500	4	D	2	38	
FN-20-3(30)	94	1977	11.4	0.500	4	D	4	44	
FN-20-3(30)	94	1977	11.4	0.500	4	D	8	44	
P-144-9(5)	94	1978	4.0	0.500	4	B	1	54	
P-144-9-(5)	94	1978	4.0	0.500	4	B	5	53	
FN-69-9(13)	95	1978	8.7	0.500	4	C	1	53	
FN-69-9(13)	95	1978	8.7	0.500	4	C	2	49	
FN-69-9(13)	95	1978	8.7	0.500	4	C	6	51	
FN69-9(13)	95	1977	6.5	0.500	4	D	1	49	
FN69-9(13)	95	1977	6.5	0.500	4	D	2	44	
FN69-9(13)	95	1977	6.5	0.500	4	D	5	46	
FN69-9(13)	95	1977	6.5	0.500	4	D	8	48	
MP2244	98	1976	4.2	0.375	4	C	2	53	
MP2244	98	1976	4.2	0.375	4	C	3	48	
MP2244	98	1976	4.2	0.375	4	C	6	52	
FN-3-4(13)	99	1976	6.1	0.500	4	C	1	59	
FN-3-4(13)	99	1976	6.1	0.500	4	C	5	55	
FN-3-4(13)	99	1976	6.1	0.500	4	C	9	50	

1. Aggregate friction code is friction type.
   Code 2-5 = friction type 2-5
   Code 6 = 80% type 4 & 20% type 3
   Code 7 = 80% type 5 & 20% type 3

2. Count Code is traffic ADT.
   A = 0-499 ADT
   B = 500-999 ADT
   C = 1000-1999 ADT
   D = 2000-4999 ADT
   E = 5000+ ADT

3. Years test is number of years from construction to testing date.

FRICTION TESTS ON A.C.C. PAVEMENTS

PROJECT NO.	COUNTY NUMBER	DATE BUILT	LENGTH MILES	AGG. SIZE	AGG. FRIC. CODE 1	COUNT CODE 2	YEARS TEST 3	FRICTION NUMBER	COMMENT
FN25-3(6)	1	1977	10.4	0.500	4	C	1	42	
FN25-3(6)	1	1977	10.4	0.500	4	C	4	52	
FN25-3(6)	1	1977	10.4	0.500	4	C	8	33	
FN-1(10)	4	1975	6.7	0.375	7	D	5	50	TYPE 5 AGGREGATE WITH 20% TYPE 3
FN5-1(10)	4	1975	6.7	0.375	7	D	1	45	TYPE 5 AGGREGATE WITH 20% TYPE 3
MP5733-69	4	1977	5.0	0.375	6	D	1	57	TYPE 4 AGGREGATE WITH 20% TYPE
MP5733-69	4	1977	5.0	0.375	6	D	5	52	TYPE 4 AGGREGATE WITH 20% TYPE 3
MP5733-69	4	1977	5.0	0.375	6	D	8	58	TYPE 4 AGGREGATE WITH 20% TYPE 3
FN-101-1(12)	6	1979	14.2	0.500	4	C	1	44	
FN-101-1(12)	6	1979	14.2	0.500	4	C	4	40	
FN-101-1(12)	6	1979	14.2	0.500	4	C	6	44	
FN198-1(1)	6	1976	2.7	0.500	4	A	1	50	
FN198-1(1)	6	1976	2.7	0.500	4	A	5	49	
FN198-1(1)	6	1976	2.7	0.500	4	A	9	50	
FN30-6(30)	6	1976	3.0	0.500	4	D	4	48	
FN30-6(30)	6	1976	3.0	0.500	4	D	7	29	
FN30-6(30)	6	1976	3.0	0.500	4	D	8	40	
P-279-0(2)	6	1978	2.4	0.500	4	C	1	55	
P-279-0(2)	6	1978	2.4	0.500	4	C	5	47	
RF30-6(32)	6	1976	10.0	0.500	4	E	4	40	
RF30-6(32)	6	1976	10.0	0.500	4	E	6	36	
RF30-6(32)	6	1976	10.0	0.500	4	E	8	35	
RF30-6(32)	6	1976	10.0	0.500	4	E	9	29	
TQFS-200-0-(1)	6	1977	12.1	0.500	4	C	1	46	
TQFS-200-0-(1)	6	1977	12.1	0.500	4	C	5	42	
F-175-9(6)	7	1978	4.0	0.500	4	C	1	50	
F-175-9(6)	7	1978	4.0	0.500	4	C	4	50	SEAL COAT
F-175-9(6)	7	1978	4.0	0.500	4	C	5	47	
FN-58-1(16)	7	1979	1.6	0.500	4	D	1	52	
FN-58-1(16)	7	1979	1.6	0.500	4	D	4	41	
RF144-2(2)	8	1976	4.9	0.500	4	C	4	47	
RF144-2(2)	8	1976	4.9	0.500	4	C	7	44	
MP2245-69	9	1976	3.8	0.500	4	E	4	49	
MP2245-69	9	1976	3.8	0.500	4	E	7	42	
MP2245-69	9	1976	3.8	0.500	4	E	9	46	
FN-187-1(6)	10	1978	10.2	0.500	4	B	1	52	
FN-187-1(6)	10	1978	10.2	0.500	4	B	6	47	
RF150-5(11)	10	1976	11.3	0.500	4	D	4	46	
RF150-5(11)	10	1976	11.3	0.500	4	D	7	33	
RF150-5(11)	10	1976	11.3	0.500	4	D	8	36	
RF336-1(1)	10	1976	2.0	0.500	4	B	4	46	
MP3744	13	1976	11.0	0.375	4	D	4	44	
MP3744	13	1976	11.0	0.375	4	D	7	42	
MP3891	14	1978	10.1	0.375	4	D	1	44	
MP3891	14	1978	10.1	0.375	4	D	4	41	
MP3891	14	1978	10.1	0.375	4	D	6	36	
FN83-2-(8)	15	1975	9.4	0.500	4	C	1	48	
FN83-2-(8)	15	1975	9.4	0.500	4	C	1	50	
FN83-2-(8)	15	1975	9.4	0.500	4	C	7	45	
FN-38-2-(15)	16	1979	6.5	0.500	4	D	1	50	
FN-38-2-(15)	16	1979	6.5	0.500	4	D	1	47	
FN-38-2-(15)	16	1979	6.5	0.500	4	D	5	51	
FN38-2(11)	17	1977	7.3	0.500	4	D	2	55	
FN65-8(17)	17	1977	7.0	0.500	4	D	2	47	

1. Aggregate friction code is friction type.
   Code 2-5 = friction type 2-5
   Code 6 = 80% type 4 & 20% type 3
   Code 7 = 80% type 5 & 20% type 3

2. Count Code is traffic ADT.
   A = 0-499 ADT
   B = 500-999 ADT
   C = 1000-1999 ADT
   D = 2000-4999 ADT
   E = 5000+ ADT

3. Years test is number of years from construction to testing date.

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ASPHALTIC CONCRETE AGGREGATES

Aggregates for asphaltic construction have been classified into five main functional types in accordance with their frictional characteristics. Those aggregates with the potential to develop the greatest amount of friction under traffic conditions are classified as Type I with the potential for friction decreasing as the type number increases. One or more friction types may be specified for use in pavement surface courses. If a type is not specified in the contract documents, Type 5 or better will be acceptable.

When aggregates of friction Type 1 through Type 4 are specified for construction, a source approval including bed limitations, is required for each project. Tentative bed limitations are shown in this publication.

The frictional classification types are listed and defined in order of descending quality as follows.

Type 1 Aggregates which are generally a heterogeneous combination of minerals with coarse grained microstructure of very hard particles (generally, a Mohs hardness rage of 7 to 9) bonded together by a slightly softer matrix.

These aggregates are typified by those developed for and used by the grinding-wheel industry such as calcined bauxite (synthetic) and emery (natural). They normally are not available from Iowa sources. Due to the high cost, these aggregates would be specified only for extremely critical situations.

Type 2 Natural aggregates in this class are crushed quartzite and granites. The mineral grains in these materials generally have a Mohs hardness range of 5 to 7.

Synthetic aggregates in this class are some air-cooled steel furnace slags and others with similar characteristics.

Type 3 Natural aggregates in this class are crushed traprocks, and/or crushed gravels. The crushed gravels shall not contain more than 60 percent total carbonate. Synthetic aggregates in this class are the expanded shales with a Los Angeles abrasion loss less than 35 percent.

Type 4 Aggregates crushed from dolomitic or limestone ledges in which 80 percent of the grains are 30 microns or larger. The mineral grains in the approved ledges for this classification generally have a Mohs hardness range of 3 to 4. For natural gravels, the Type 5 carbonate (see below) particles, as a fraction of the total material, shall not exceed the noncarbonate particles by more than 20 percent.

Type 4D A subgroup of the Type 4 category comprised of those aggregates near but exceeding the 30 micron minimal grain size. Type 4D aggregates are not acceptable for use in sprinkle treatment.

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Type 5 Aggregates crushed from dolomitic or limestone ledges in which 20 percent of more of the grains are 30 microns or smaller. This classification also includes natural gravels where the number of lithographic and sublithographic carbonate particles, expressed as a fraction of the total material, exceeds the noncarbonate particles by more than 20 percent.

SOURCE LISTINGS - Explanation

The use of X's in the PCC or AC columns indicates use where no classification is required or, if required, has not been made.

Note - indicates top size limitation.

Bed numbers shown for PCC aggregate are those on the formal source approval letter. Beds shown for AC sources are those which have been used or have potential for use and are of the designated friction type.

Frictional Classification - as indicated on page 2
Asphaltic Concrete - Type A and B

Durability Class for Portland Cement Concrete
Coarse Aggregate Fine Aggregate

Source Code Number - Used to identify sources on test requests and for data storage.

Specific Gravity

CODE	OPERATOR	SOURCE NAME	LOCATION	SP GR	DUR PCC CA	DUR PCC FA	FRICT AC A	FRICT AC B	BEDS	
57	LINN DIST 6	---CRUSHED STONE---								
A57002	ALPHA CRUSHED STONE INC	BETENBENDER-COGGON	SW 03 T086 R06W	DWU	2		4	4	8 -10	
A57004	ALPHA CRUSHED STONE INC	PLOWER	SE 36 T086 R06W	2.62	3				9 -11	
							4	4	1 -10	
					1				1 - 9	
A57006	B L ANDERSON INC	ROBINS	NE 21 T084 R07W	2.57	3		4	4	3	*
A57008	ALPHA CRUSHED STONE INC	BOWSER-SPRINGVILLE	SW 29 T084 R05W	DWU	2		4	4	6 - 7	
A57012	B L ANDERSON INC	MORGAN CREEK	SE 22 T083 R08W				X	X		
A57016	B L ANDERSON INC	ALICE	NW 08 T085 R07W					4		
A57018	MARTIN MARIETTA	SOUTH CEDAR RAPIDS	NE 15 T082 R06W	2.65	3				2 - 9	@
							4	4	2 -14	
A57020	B L ANDERSON INC	LISBON	NW 24 T082 R05W	DWU	3B		4	4	1	

NOTES:
DWU - DETERMINE WHEN USED
B - APPROVED FOR BRIDGE DECK/OVERLAY/REPAIR
* - 1.25 INCH MAXIMUM TOP SIZE
@ - AASHTO 57 GRADATION MAXIMUM

RECOMMENDED BASE, BINDER AND SURFACE TYPES ①				
ADT	BASE ②	BINDER	SURFACE	THIN LIFT OPTION
< 2000	ATB-2202	B-2304	B-2304	Sand-2306
2000 ③ 5000	ATB-2202	B-2304	A-2303	Sand-2306
>5000 ④	ATB-2202	A-2303	A-2303	Sand-2306

① For projects involving less than 2000 tons, the same mix size and type should be used for both binder. . . . and surface courses.

② For ramps, secondary road surfaces, etc., Type B ACC base (2203) can be considered. Class 1 should be designated except that class II should be considered for all northwest counties when traffic is less than 2000 vehicles per day.

③ When traffic exceeds 2000 vehicles per day and speeds are in excess of 50 MPH, sprinkle treatment should be considered. (7½ lbs. per sq. yd. std. aggregate 5 lbs. per sq. yd. lt. wt. aggregate).

④ For Interstate and/or other high density traffic situations special aggregate or additives may be required. The Office of Materials should be consulted for specific recommendations.

TABLE 3-42H

THIN LIFT SURFACE COURSES (Tons Per Station, Full Width Pavement)			
Ⓓ	ASPHALT SAND SURFACE COURSE Design Weight Estimate @ 127 lbs. per Cu.ft.		TYPE 'A' OR 'B' ⅜" SURFACE COURSE Design Weight Estimate @ 140 lbs. per Cu. ft.
	A=¾"	A=1"	A=1"
22'	8.73	11.64	12.83
24'	9.52	12.70	14.00

TABLE 3-42J