"SPRINKLE TREATMENT OF ASPHALT PAVEMENTS"

IOWA'S EXPERIENCE IN 1977

BY CHARLES L. HUISMAN, P.E.

MATERIALS ENGINEER

IOWA D.O.T.

FOR

PRESENTATION AT

ASSOCIATION OF ASPHALT PAVING TECHNOLOGISTS

53RD ANNUAL TECHNICAL SESSIONS

SYMPOSIUM ON PAVEMENT REHABILITATION, MAINTENANCE & ECONOMICS

LAKE BUENA VISTA, FLORIDA

FEBRUARY 14, 1978

DEPARTMENT OF TRANSPORTATION

IOWA

Acknowledgements

The author would like to express his appreciation for the assistance provided by the various offices of the Iowa D.O.T. in the pursuit of this project, and expecially to Charles Potter and Joe Shay, Highway Engineer I's who were placed on Special Assignment to follow the activities of this project in the various areas of the state.

Additional thanks are extended to the E.D. Etnyre Co. of Oregon, Illinois and especially their Sales Manager, Mr. Warren Shetter, who through his diligence and efforts imported the Bristowes Mark V Chipping Spreader from London, England and made it available to the Iowa D.O.T. for the pursuit of this project in 1977.

Special thanks are extended to Ken Brown, of the Bristowes Machinery Ltd, Middlesex, England, who worked and lived on the Iowa projects during June and July, 1977. His total knowledge of the machine averted many operational problems. His experience with "Chipping" as the British call it, made success of some planned work that would have been failure without his advice.

Disclaimer

The interpretations of the Standard Specifications and Policies mentioned in the following paper and the opinions or conclusions are those of the author only and are not necessarily the official interpretations of the Iowa Department of Transportation.

"Sprinkle Treatment of Asphalt Pavements"

Iowa's Experience in 1977

By Charles L. Huisman, P.E.

Materials Engineer

Iowa D.O.T.

for

presentation at

Association of Asphalt Paving Technologists

53rd Annual Technical Sessions

Symposium on Pavement Rehabilitation, Maintenance & Economics

Lake Buena Vista, Florida

February 14, 1978

The Iowa Department of Transportation formerly the Iowa State Highway Commission, made its first attempts at sprinkle treatment of fresh asphalt concrete in 1974 on portions of old U.S. 30 near the Boone-Story County Line after having the procedure presented to us at the annual meeting of the Association of Asphalt Paving Technologists at Oklahoma City in February, 1971.

Increased emphasis on skid resistant non-polishing highway surfaces and the monitoring thereof precipitated an in-house "Skid Review Committee" in late 1972. Since that time, increased emphasis in mix design of asphalt mixes and aggregate selection of durable non-polishing materials has generated costly restructions on the use of local materials, even to the point of importing trap rock and/or quartzite from Minnesota, Wisconsin and South Dakota.

During the summer of 1975, with the cooperation of our Office of Maintenance, a dual spinner, tail-gate spreader was mounted on a standard departmental dump truck to attempt additional sprinkle treatment on a section of Iowa 7 west of Ft. Dodge. The dump truck equipment was marginally satisfactory since the lug tires of the truck left marks in the finished pavement and the uneven distribution of chips caused depressions in the surface and non-uniform surface texture. Results of increased surface skid texture and durability were well demonstrated.

During 1976, after pleading for a better spreading unit, a new, current order, dump truck was modified with an auxiliary transmission and a set of slick surfaced tires. The dual spinner spreader was mounted to again attempt surface sprinkle treatment. Precoated chips were ordered onto a test section of U.S. 30 about 15 miles west of Cedar Rapids, but because of lateness of the season and unseasonably cold fall weather, the project was delayed until 1977.

The work that Iowa has attempted in 1977 is rather extensive and I would like to regress and follow through with a slide presentation showing the chronological activities of our department in 1977 in the area of sprinkle treating surfaces for better skid textures.

***

#1 Logo

2

Over the years Iowa has had a rather extensive sealcoating program on the primary road system, wherein we use sealcoating to maintain the surfaces of older asphalt roadways and to protect the oxidized surface of newer asphalt pavements.

3

These slides show the typical sealcoating operations practiced in Iowa. We found this program quite successful on primary highways with less than 1,500 vehicles per day and have found that we can maintain skid coefficient numbers in the range of 50 quite consistently. Our biggest drawback in the use of sealcoats on the primary road system is the flying rocks after completion of the treatment which causes headlight and windshield damage and is considered quite objectionable by the traveling public of Iowa.

4

In the last 10 years we have also attempted to develop--design and placement procedures for slurry sealcoats on the slightly higher traffic primary roads hoping that we can seal the surfaces and still maintain skid numbers in the average range of 50.

5

This is a view of a typical slurry seal contract in Iowa on work that was placed in 1977.

6

In our slurry seal operations we place some 15 to 20 pounds of slurry mixture per square yard and use this on highways that have average daily traffic of less than 2,000 vehicles.

7

The finished texture of the mixtures appear quite serviceable however, in checking on the continuing skid numbers of these surfaces several years after placement, we find they usually deteriorate to numbers as low as 30 to 35.

8

Beginning in 1970 we developed a specification and procedure for hot asphalt sand surface course wherein the basic aggregates included a ¼" minus concrete sand with an ag-lime filler of from 5 to 15% and a binder bitumen using an AC-20 asphalt cement or-- a high float asphalt emulsion. We placed our first sections of this on a portion of Interstate 80 in west central Iowa in 1971. This section of highway averages 12,000 to 14,000 vehicles per day and has stood up very well under traffic, retaining surface skid numbers between 45 and 55 continuously since 1971.

9

We are presently using hot sand mix surface courses on sections of highway that have polished and developed low skid friction numbers, especially in the wheel tracks.

10

The photos you have just seen are of a hot sand mix surface course placed this season on a two lane section of primary highway just southwest of Des Moines with traffic of 5,000 to 8,000 vehicles per day. I'd like to call your attention to the surface texture of this hot sand mix surface course. We have realized that a mixture of this type has fairly good micro-texture, but is deficient in macro-texture and is the primary reason that we have embarked on an agressive investigative program into the merits of sprinkle treating hot asphaltic concrete surface courses.

11

In early June of 1977 we selected a project in east central Iowa on

Iowa 146 where we used this departmental dump truck and twin spinner tailgate spreader on a two lane asphaltic concrete resurfacing project to determine if we could successfully sprinkle treat a primary highway with this type of equipment and secure results that were satisfactory for surface skid numbers and with a low noise level so far as the travelling public is concerned. This shows the truck spreading a ½" minus limestone chip at a rate of 5 pounds per square yard.

12

This is a close up of that same spreader showing the minimal modifications that we made attempting to control the scatter of material only to the lane being resurfaced. Since most resurfacing in Iowa is done under traffic, we found that this method was quite objectionable since it did scatter random rocks into the other lane, strikeing the vehicles of oncoming traffic.

13

In this picture you can observe that the standard D.O.T. dump truck was modified with a set of slick tires both front and rear to eliminate any of the earlier problems we had with tire lug marks in the fresh asphaltic concrete.

14

On this slide you can see the distribution pattern of the chips on the mat and also the severe rutting in the fresh asphaltic concrete which although not objectionable in the finished surface, was still visible to the motorist. The uniformity across the section of the roadway is quite poor. The chips are spread quite heavily between the wheel paths and then thin out appreciably outside of the wheel paths.

15

This slide is a close up of the finished surface after rolling and traffic as seen in the prior slide. Note the unevenness of the surface texture and also the pocks in the surface where excess material was placed. We found that build-up of chips, that is, the finer diameter particles on top of each other only caused depressions in the surface and under traffic soon were whipped off and were of no benefit in the surface sprinkle treatment. This was our last attempt at using the broadcast twin spinner type spreader for sprinkle treatment on the primary road system and at this time which was about the middle of June, we were advised by the E.D. Etnyre Co. of Oregon, Illinois through their Sales manager, Mr. Warren Shetter, that they had on board ship a Bristowes Model Mark V Hydrostatic Chipping Spreader manufactured in Middlesex, England that was being shipped into the United States and would be made available to the Iowa D.O.T. through Etnyre's distributor James W. Bell Co., in Cedar Rapids.

16

In addition, we were advised that the Bristowes Co. was sending their assistant plant manager, Mr. Ken Brown, from their plant in England to spend two or three weeks with us in the development of procedures and usage of the Bristowes Mark V Spreader.

17

This is a picture of the loading of the Birstowes Spreader on the travel trailer which was included as part of the purchase package as the machine was uncrated at the James W. Bell Co. plant in Cedar Rapids, Iowa.

18

This photo shows the Bristowes Spreader as the first work was attempted in Fairfield, Iowa on Iowa Highway 1 in the middle part of June. The spreader is driven hydrostatically from the small diesel engine which powers the machine. The spreading hopper is suspended between sets of tandem wheels. This particular unit is 14' in clear width and spans the pass of the fresh asphaltic concrete. This extra width proved to be detrimental in subsequent projects,especially where narrow shoulders existed, or, where the shoulderslope was excessive, causing the spreader to scalp the freshly placed asphalt concrete.

19

The charging skip hopper which oscillates above the spreading hopper has a top dimension of 5 foot by 6 foot which made it quite difficult to charge with the standard large production loaders. In this particular operation, we charged the hopper in a sequence when one-way traffic was changing direction through the project.

20

This shows the freshly placed asphaltic concrete; the batch trucks in the foreground, followed by the paving machine and immediately behind it, the Bristowes Spreader which in this photo is spreading a 12 foot pass of ½" precoated limestone chips produced locally, followed by the breakdown roller immediately behind the Bristowes Spreader.

21

This is a close up of the distribution of the chips on this surface.

We found that any non-uniformity in this operation was due to the wide range in particle size. The more one size the aggregate, is the more uniform the rate of ditribution can be controlled.

22

This is a close up before rolling.

23

The same scene after compaction.

24

In this photo you see a close up of the surface of an uncompacted ½" dense graded asphaltic concrete mix as it is placed in Iowa.

25

This shows that same surface after it has been sprinkled treated with a ½" by No. 8 graded limestone aggregate, as we used on U.S. highway 20 east of Independence in the latter part of June.

26

This shows the same surface after compaction.

27

This is a photo across the surface of the U.S. highway 20 project. In the foreground, this lane was treated with the ½" by No. 8 limestone chips. The lane further away is the fresh asphaltic concrete without sprinkle treatment. This was shortly after a light rain, notice the glazed, slick appearance on the untreated lane and the good macro-texture in the near lane that was treated.

28

This is another view on the same project looking down the highway. The lane on your right, of course, was not treated. The lane on your left was. Notice the slight transverse corrugation pattern in the lane treated with chips. This was due in part to an older vibratory breakdown roller which did not have a high frequency vibrator and was operating at an excess travel speed and was the reason for this shaded pattern in the surface. I would report however, that this is fading under traffic and at no time has it left a rumble or vibration for vehicles travelling on the surface.

29

In a subsequent project, we placed a 3-½ mile section of a thin layer resurfacing, using 100 lbs. per square yard of a 3/8 inch maximum particle size, dense graded asphaltic concrete, in addition to scarifying the existing surface of the older asphaltic concrete to a depth of 3/4" with the Cutler Helio-planer as shown in this picture.

30

Here is a close up of the scarification that was provided to the old mat. One of the claims of the Cutler Co. is that this deep scarification of the old cracked pavement will greatly deter the reflection cracks in a new thin layer surface course.

31

This is a close up of the scarified old surface;

32

which was followed by placement of 100 lb. per square yard 3/8 inch mix asphaltic concrete immediately behind the scarifier and planer. This is the standard Cutler Heater-Paver as they use around the country.

33

This was followed by a sprinkle surface treatment of a 3/4" minus limestone aggregate as shown in this close up of the material in stockpile.

34

This material is a coarse aggregate grading with 100% passing the 3/4"sieve and a limit on the #4 of 0 to 5 and a limit on the #200 of no more than 1.5%. This is one of the better limestone aggregates that we have in Iowa and although it is subject to wear under traffic, it does not polish as do most of the limestones and dolomites found in Iowa.

35

This is a view of the finished surface texture after rolling.

36

D.O.T. Headquarters

Now if we can have the lights, I would like to give you a brief resume of the information gained from our experience to date.

******

First, in discussing the merits of the Bristowes Spreader, I would say that it is an exceptionally well engineered and manufactured unit and may be rugged enough for general contractor usage in the United States.

Specific advantages include:

1. The wheels on the spreader are spaced far enough apart so that the machine does not run on freshly laid asphalt.
2. The spreader meters a precise amount of chips per unit area.

3. When the machine must be halted, and there is much stop and go in this type of work, chips do not dribble out while it is stopped.

On this later model Bristowes Spreader a

4. fourth bonus is that the rotor rotates in a reverse direction rather than a forward direction as do most chip spreaders used in the United States. With this reverse direction, it lays the chips behind and since the speed of ejection matches the road speed of the vehicle, any tendency of chips to scatter and roll has been eliminated.

Regarding poor performance that we've had with the Bristowes Spreader we would enumerate as follows:

1. In most of the resurfacing work done in Iowa, placement is one lane at a time usually no wider than 12'; also in many cases the shoulders fall away quite rapidly at a slope that may exceed 6%. The Bristowes Spreader has low vertical clearnace across its span and with the 2' of shoulder overhang in the 14' width spreader, we had the unit high centering on the fresh asphaltic concrete many times which caused scarring of the fresh placed asphaltic concrete and poor distribution of the chips.
2. The Bristowes Spreader is designed to meter precisely a nearly one size aggregate chip, in fact, two fluted

drums are provided. One is sized for a 3/4" one size chip and a second one for a ½" one size chip. On all the work done in Iowa so far we have used the ½" fluted drum. We note that if a percentage of oversize material, that is, 3/4" plus is encountered in the chips provided that they have a tendency to pile up above the rotor if the gate is properly set for rate of application and cause some streaking or clogging, and conversely if the metering gate is open sufficiently to properly distribute the oversize chips, that excessive rates of application are encountered.

3. We find that the precoated chips must have all coated fines removed from the material. On the U.S. 20 project we found that in using a ½" precoated chip with a considerable percentage passing the #8 sieve with coated fines that this material had a tendency to compact on the flutes of the spreader drum to the point that eventually no metering could be provided. This caused very uneven ditribution to the point that the machine had to be stopped and the compacted asphaltic material chiseled out of the valleys of the flutes on the drum. This was very time consuming and caused a poor surface appearance. With late fall work and cold weather, this packing of fines in the drum flutes became a severe problem.

4. The small shuttle hopper, that is, the 5' x 6' hopper which cross feeds the spreader needs to be larger in order to accomodate a more conventional size loader.

In our activites we hauled the material to the roadway with Flow Boy trailer units, then dispensed it into the bucket of a loader and then into the shuttle hopper. We found the small, 1/2 to 3/4 cu. yd. Bobcat loader bucket was most satisfactory for this.

We have been investigating a belt conveyor attachment that is available for the flow boy trailer unit, hoping that the material can be dispensed directly from the hauling trucks to the spreader with this conveyor.

We found the most successful way to deliver the precoated chips to the spreader was by driving on the shoulder of the roadway being treated. In all future work if we have a section proposed that does not have a 10 foot or wider shoulder, for the truck to travel on, we will not try to schedule the sprinkle treatment spreader on that particular project.

With regard to the experience that we've had in the aggregates used and their distribution;

1. We have found that after much encouragement by Mr. Ken Brown of the Bristowes Co. that the more coarser, uniform size chips were the most satisfactory for sprinkle treatment. We have to date used quartzite, dolomite, limestone and expanded shale or "haydite" with good results. We intend to experiment further with crushed granite, trap rock and also crushed gravel which is locally available in Iowa.

2. On the surface sprinkle treatment work that has been completed to date, we have found little objectionable noise from the coarseness of the surface and the vehicles travelling thereon. There is no sensation of weaving or meandering by the vehicle from the coarse texture placed on the pavement surface.

3. We have found that no precise grade of or rate of asphalt application for precoating can be used for all aggregates involved. We found that for very hard, durable, finely grained limestone and quartzites, that as little as 1% is all the asphalt that is required for precoating. And conversely when we use the expanded shale light weight aggregate we had to precoat with as much as 2% of asphalt by weight. In all cases the asphalt used for precoating was the same material that was used in the original asphaltic concrete which was either 85 - 100 penetration asphalt cement or an AC-20 asphalt cement.

4. In all cases the precoating chips were precoated in a conventional hot mix asphalt plant either a drum or batch plant, and we found that temperatures in the 220° to 260° F. range worked more satisfactory than temperatures higher than that.

5. We also found that stockpiling the precoated chips in tall piles was detrimental since the chips did not have a chance to cool off sufficiently and also some rather severe caking was evident. On the advice of Mr. Brown from the Bristowes Co., if caking continued we wet down the stockpiled chips. We found that this was

quite beneficial in reconditioning the chips in the pile. At no time did we try to place any of the precoated chips hot. They were all placed at ambient temperatures.

6. On at least two occasions when the ambient temperatures were between 95° and 100° F we had caking of the precoated chips in the trucks hauling the material to the roadway. By wetting these chips down in the hauling truck with a water tank wagon, this problem was also eliminated.

7. Concerning whip off of the precoated and compacted chips after traffic was permitted on the fresh surface; the longer the roadway was closed to through traffic the less whip off occurred. Also the finer the chip, the more tendency for whip off was evident and the coarser the chip the less likelihood of whip off. Furthermore, the light weight expanded shale aggregate even though it was used in its coarser dimensions had more of a tendency to whip off than the more denser limestones and dolomites used. We also found that if a pneumatic roller was used in the compaction train of fresh asphaltic concrete, that pick up of the chips was more evident and detrimental than if smooth tired steel rollers were used both for breakdown, intermediate and finish rolling.

Finally, with uniform size chips, we can place them in precise rates of application. We have been able to consistently place the light weight haydite chips of the 3/4 by 3/8 inch grading in rates as low as 3½ to 5 lbs. per sq. yd. Our most successful rate of application of limestone, dolomite, and quartzite chips is at the rate of 7 to 7½ pounds per square yard and if any oversize, and by that I mean 3/4" plus particles are evident in the chips, rates of application will easily increase up to 10 lbs. per square yard.

A comment on cost of placing the sprinkle surface treatment on asphaltic concrete resurfacing projects. We are averaging approximately $2,500 per two lane mile or $0.18 per S.Y. for complete furnishing and placement of the precoated chips on the projects that we have completed in Iowa.

We have our first sets of skid numbers with 30 - 55 mph speed gradients on five projects completed to date. It is our standard procedure to operate our skid test trailers over new asphaltic concrete sections only after they have had at least 3 months of normal traffic following completion of the project. The skid numbers I have to date are as follows:

Table I

	40 mph	Speed Grad. 30-55 mph
Ia. 1 Van Buren		
Sprinkle (dolomite)	49	0.5
Control	42	0.6
U.S. 20 Buchanan		
Sprinkle (Limestone)	47	0.6
Control	42	0.6
U.S. 69 Polk		
Sprinkle (haydite)	48	0.2
Control	35	0.1
U.S. 18 Cerro Gordo		
Sprinkle (Quartzite)	54	0.3
No Control (P.C. Section)	29	0.5
U.S. 59 Pottawattamie		
Sprinkle (haydite)	52	0.1
No Control	--	---
Ia. 38 Cedar		
Sprinkle (Quartzite)	52	0.3
No Control	--	---

In conclusion I would like to report that our experience in Iowa has been satisfactory enough that we fully intend to include this as part of our standard procedures in resurfacing of 12 asphaltic concrete surface projects on the primary road system of Iowa in 1978; especially on those two lane highways that have traffic volumes in excess of 2,000 vehicles per day.

Further, one of the motivating reasons for Iowa experimenting in the area of sprinkle treatment of asphaltic concrete surfaces at this time is due to the experience we have had in the last two years in designing and placing high type asphaltic concrete mixes on our Interstate highway system. We have had to rule out many of the locally available dolomites and limestones, since they were lithographic or sublithographic and had characteristics of polishing under heavy traffic. A primary source of coarse, durable aggregate for surface courses has been quartzite that is available in South Dakota or Minnesota. We have had projects in Iowa where we have transported this material as far as 300 miles in order to incorporate it in a high type surface course mix. In a cost analysis of two Interstate resurfacing projects totalling 31 - 4 - lane miles placed in 1977; using only 30% of imported quartzite in the upper 1-1/2" thick by 24' wide surface course instead of locally available polishing limestone, added roughly <u>$480,000</u> to the cost of the surface layer.

By using the local limestones in the surface mix and "Sprinkling" with 7-1/2 lb. of Quartzite chip per S.Y. a project cost savings of approx. <u>$322,000</u> would have been experienced.

A net savings per 4 - lane mile of $10,400. We believe that by developing standard and comprehensive procedures, with the sprinkle treatment approach, that we can revert to our locally available aggregates for mixing and placing our asphaltic concrete overlays and then importing and using the high type quartzite, granites, or crushed gravels for the sprinkle treatments only.

Gentlemen, I appreciate the opportunity to discuss this subject with you. I have a few copies of a written paper which includes a "Supplemental Specification for Sprinkle Treatment for Asphaltic Concrete Surfaces", which we plan to use in our 1978 work. It's been a pleasure to present this information to you. If I can provide any additional information, please feel free to ask questions.

SUPPLEMENTAL SPECIFICATION
FOR
SPRINKLE TREATMENT OF ASPHALT CONCRETE SURFACES

.01 DESCRIPTION: Sprinkle Treatment shall consist of properly graded aggregate, precoated with asphalt cement and applied to the surface of hot mix asphalt concrete pavement as designated in these specifications and elsewhere in the contract documents.

.02 MATERIALS: The materials used in sprinkle treatments of asphalt concrete surfaces shall meet the following requirements.

A. Aggregate. The aggregate shall be composed of a Type III crushed gravel or a Type IV crushed stone as classified in Materials Instructional Memorandum T-203 or lightweight aggregate (expanded shales).

Crushed gravel shall be produced as a separate operation by crushing gravel to the extent that 100 percent will pass the 3/4 inch sieve; the aggregate shall be prescreened prior to crushing on a screen at least 1/4 inch larger. The prescreen size shall be adjusted to compensate for screening efficiency, material variability, and carryover.

All aggregate sources and production procedures shall be subject to approval of the engineer.

1. Freezing and Thawing Test. The freezing and thawing test loss when tested according to Laboratory Test Method 211, Method A, shall not exceed 10 percent.

2. Abrasion Loss. The percentage of wear as determined by AASHTO T-96, shall not exceed 40.

3. Size of Particles. When tested by means of laboratory sieves, the aggregate shall meet the following limits. The percentage passing the No. 200 sieve shall be determined by washing followed by dry sieving. Any mudballs present shall be completely broken up and dissolved.

Sieve Size	Percent Passing
3/4	100
3/8	20 - 55
No. 4	0 - 5
No. 200	1.5

B. Asphalt. The asphalt used to coat the aggregate shall be the grade used in the asphalt surface course.

C. Aggregate Coating. The aggregate shall have a uniform complete asphalt coating between 0.75 percent to 2.0 percent expressed as percent by weight of A.C. in the total mixture. Aggregates to be used for sprinkle treatment shall be submitted to the Central Laboratory for determination of the target percent for precoating.

.03 EQUIPMENT: The equipment used for spreading the precoated aggregate shall be a Bristowes Chip Spreader. An equivalent spreader may be approved by the engineer.

.04 PRECOATED AGGREGATE: The equipment and procedures for precoating shall comply with the applicable requirements of sections 2001.22 and 2303.04.

The aggregate shall be precoated at a temperature between 240°F. and 275°F. and shall have a uniform complete coating. The aggregate should be coated at the lowest temperature that insures complete coating. If coated aggregate is stockpiled it shall be stockpiled on a clean paved surface. Stockpiling methods which minimize segregation shall be used. Provisions should be made for manipulation or wetting of the coated aggregate if crusting of the aggregate occurs. The engineer may require the stockpile to be covered.

.05 CONSTRUCTION: The coated aggregate may be spread hot or cold. It shall be uniformly applied to the surface of the asphalt surface course as soon as possible after laydown and before initial rolling of the surface. The spreader shall span the lane to be spread. Provisions should be made for wetting the coated aggregate if crusting or unusual adherence of aggregate particles occurs.

The coated aggregate shall be applied to the surface at a target rate of 7-1/2 pounds per square yard when crushed stone or gravel is used and 5 pounds per square yard when lightweight aggregate is used. These target rates may be adjusted by the engineer to insure proper coverage of the surface area.

Rolling shall commence immediately after the coated aggregate is applied unless otherwise directed by the engineer. The initial rolling shall be done with a steel roller. Compaction shall be in accordance with the requirements for the type of surface course being laid. Pneumatic tired rollers, when used for intermediate compaction, shall not be used if tire pick up of sprinkle aggregate is encountered.

Any non uniform distribution of coated aggregate shall be corrected with lutes or brooms before initial rolling.

Traffic will not be permitted on the finished surface until the pavement has cooled to such a level that the coated aggregate will not pick up under the tires. Sprinkling the pavement surface with water may be required as directed by the engineer to promote cooling of the pavement prior to opening the roadway to traffic.

.06 LIMITATIONS: Sprinkle Treatment of Asphalt Concrete surfaces shall not be placed after October 1 except by authorization of the Construction Engineer.

.07 METHOD OF MEASUREMENT: The coated aggregate applied for sprinkle treatment will be measured in tons. The asphalt cement required for precoating shall be considered incidental and will not be measured for payment. Water, when required shall be considered incidental.

Measurement of the quantities will be performed in accordance with the applicable requirements of 2303.19A.

.08 BASIS OF PAYMENT: For the number of tons of coated aggregate measured as provided above, the contractor will be paid the contract price per ton. Coated aggregate in stockpile--25 percent of the contract price per ton for coated aggregate applied.

CANDIDATE PROJECTS FOR SPRINKLE TREATMENT

Project Number	Project Location	ADT	Mix Type	Surface Course Size	Thickness
FN-89-3(1)--21-85	Ia. 210, US 69 to Slater	1400-1700	B	1/2"	1-1/2"
FN-89-2(2)--21-08	Ia. 89 Woodward to Madrid	1130-1530	B	1/2"	1-1/2"
F-9-3(9)--20-30	E. Jct. 71 E. to Emmet Co. L.	2130-2410	A	1/2"	1-1/2"
F-71-9(9)--20-30	E. Jct. 9 W. 4.6 m. to Spirit Lake	2350	A	1/2"	1-1/2"
TQF-65-4(19)--29-50	Polk Co. L. to Ia. 117	3220	A	1/2"	1-1/2"
F-65-4(22)--20-77	Jasper Co. L. S.W. 2.4 m.	3150	A	1/2"	1-1/2"
FN-20-5(20)--21-12	US 20 Parkersburg to Grundy Co. L.	1950-2100	A	3/8"	1"
FN-20-8(17)--21-28	US 20, Ia. 38 to Ia. 136	2610-3800	A	1/2"	1-1/2"
F-9-9(18)--20-03	Churchtown E. to Lansing	1000-1360	B	1/2"	1-1/2"
FN-218-3(10)--21-92	US 218, F. Ia. 92 to Ia. 22	2140-2190	B	1/2"	1-1/2"
FN-1-3(1)--21-54	W. Jct. Ia. 1 to Brighton	1920-2460	B	1/2"	2"
FN-65-4(23)--21-50	US 65, from Ia. 330 No. to Colo	1250-1770	B	1/2"	2"