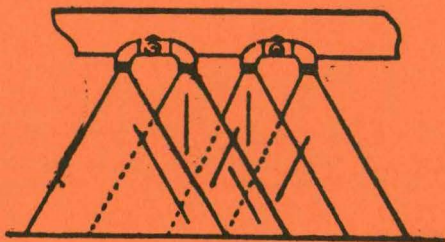


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INSPECTOR'S HANDBOOK

SURFACE TREATMENTS  
AND  
BITUMINOUS SEAL COATS



IOWA STATE HIGHWAY COMMISSION

AMES, IOWA

JULY 1971

REPRINTED July 1973

SURFACE TREATMENTS  
AND  
BITUMINOUS SEAL COATS

Marvin Klein

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## INTRODUCTION

This handbook is an inspector's aid. It was written by an inspector to bring together all of the most-often-needed information involved in his work.

Much care has been taken to detail each phase of construction, with particular attention to the requirements and limitations of specifications. All applicable specification interpretations in Instructions to Resident Engineers have been included.

The beginning inspector should look to the handbook as a reference for standards of good practice. The Standard Specifications and Special Provisions should not, however, be overlooked as the basic sources of information on requirements and restrictions concerning workmanship and materials.



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## SURFACE TREATMENTS AND BITUMINOUS SEAL COATS

Bituminous seal coats consist of one or more applications of binder bitumen applied over an existing wearing surface followed by embedding of cover aggregate in each layer of binder.

Bituminous surface treatments consist of one or more applications of binder bitumen applied over a newly-prepared base followed by embedding of cover aggregate in each layer of binder.

The only major difference between the two is that a bituminous seal coat is applied over an existing wearing surface (old road) while the bituminous surface treatment is applied over a newly-prepared base (new road).

## INSPECTION

### Plans, Proposals, and Specifications

Inspectors must be furnished a set of construction plans, proposals, and specifications. Plans indicate length, width, and depth of various components, and provide information about quantities and procedures. The title sheet designates the applicable standard specification book by date.

The inspector should familiarize himself with plans and specifications, checking contract items and quantities to verify their accuracy. The proposal--or contract--designates applicable special provisions and other supplemental specifications by number and date.

The resident or county engineer should issue copies of all documents to the chief inspector, grade inspector, plant inspector, and other key inspectors.

The individual inspector should have these copies with him in the field for ready reference.

### Preconstruction Details

Before any construction work is started, the resident or county engineer and/or designated inspectors should converse with the contractor to ensure that specifications, limitations, materials, and equipment are fully agreed upon.

The inspector should check and verify that the contractor has enough signs and barricades in place, or at least available when needed.

There should be enough checkers and inspectors to examine the various phases of construction without undue delay to the contractor.



## CHECKING BITUMINOUS DISTRIBUTORS

The following procedures are recommended for eliminating streaked surfaces and promoting uniform and accurate application rates of bitumen in constructing seal coats, armor coats, and surface treatments. Before any work is done, inspectors should check with the contractor to verify that:

- 1) the distributor is calibrated and identified by an IHC bin number.
- 2) the distributor nozzle size is that recommended by the manufacturer.
- 3) the angle of the nozzle slots with the spray bar is uniform for the full bar width, except for the end nozzles, where the slots may be  $90^{\circ}$  to the axis of the spray bar.
- 4) the height of the spray bar from the road surface is that recommended by the manufacturer.
- 5) some means is used to assure a reasonably constant height of the spray bar from full load to empty tank.
- 6) each bitumen-spreading unit is equipped with:
  - a) an accurate thermometer for indication of bitumen temperature in the distributor tank.
  - b) a tachometer operated by a wheel independent of the truck wheels.



- c) a calibrated measuring stick with an IHC number stamped on it by the Ames Laboratory and corresponding to the IHC bin number on the tank.
  - d) a quick-opening gate in the dome of the distributor tank.
  - e) quick cut-off valves at the nozzles.
- 7) the tachometer reading used is that given by the manufacturer's charts or instructions.
  - 8) the spray bar pressure or pump r.p.m. used is that recommended by the manufacturer.
  - 9) the contractor has the necessary manufacturer's charts and instructions.

When all of the above requirements have been satisfied, a short trial run should be made on the road to be treated (or another suitable surface). The uniformity of spray pattern should be determined by running the sprayer over a strip of building paper anchored to the road surface.

If the spray pattern from the trial run is unsatisfactory, spray bar height should be accordingly raised or lowered. Another trial run should then be made to check the effectiveness of the adjustments. Adjustments and trial runs should continue until a uniform spray pattern is attained.

## CHECKING SPREADERS AND ROLLERS

### Spreaders

The inspector should check the aggregate spreader to see that it is in satisfactory condition to do an acceptable job. It should comply with width requirements for spreading aggregate, and be equipped with an adjustment for delivering required rates. All spreaders should be equipped with a hopper with the capacity specified in current specifications.

### Self-Propelled, Steel-Tired Rollers

These rollers must be of the weight class specified in the specifications. The inspector measures the width of the roller in inches and multiplies this figure by the required pounds-per-inch width indicated in current specifications. The product is the required gross weight of each wheel of the roller. This weight must be verified by weighing on approved scales. In weighing the roller, both compaction and guide wheels should be at the same elevation; but, during weighing, only one wheel at a time should rest on the scales.

### Self-Propelled and Pull-Type Pneumatic-Tired Rollers

To determine the weight of this type of roller, the inspector first measures the width in inches of the widest axle, beginning with the outside tire and measuring



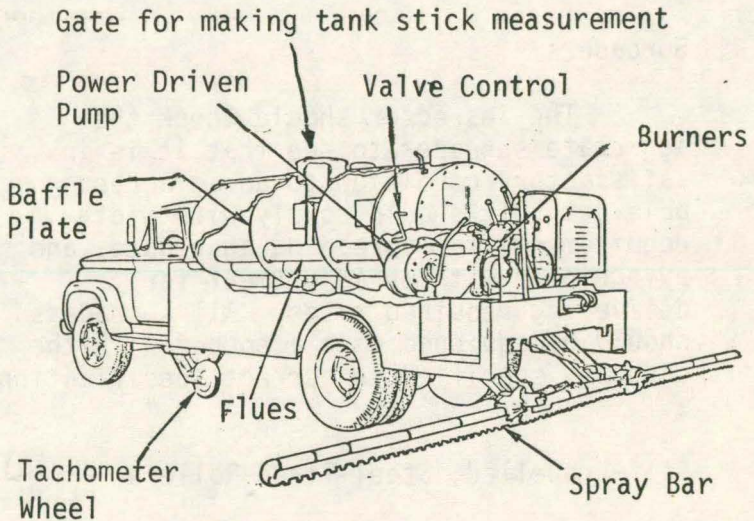


Figure 1 - Bitumen Distributor

the total distance to the outside tire of the opposite side. He multiplies this figure by the pounds-per-inch width required in current specifications. The product is the required gross weight of the roller. This weight should be verified by weighing on approved scales. Pneumatic--tired rollers must be operated with the tire inflation pressure required in the specifications.

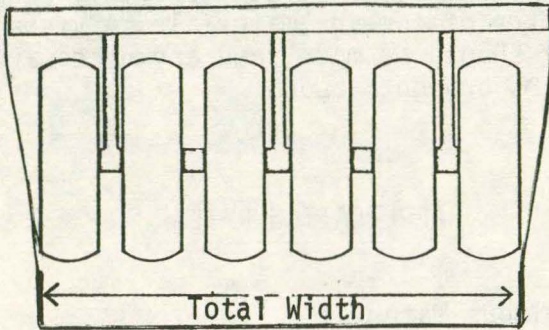


Figure 2 - Pneumatic-Tired Roller

#### HAND TOOLS AND POWER BROOMS

There are very few specifications for hand tools and power brooms. The contractor should supply enough hand brooms and shovels in good condition to do the job. Power brooms should be in good working order.

#### APPROVAL OF MATERIALS

The inspector should certify that all materials have been checked and approved by the Materials Department or by designated representatives thereof. He should have an approved report with lab number, and enter all report information in a field book.



## BASE PREPARATION

The base must be thoroughly cleaned and free of foreign material. A visual check should be made, and any necessary repairs brought about.

## APPLICATION RATES

### Bituminous Material

The rate of application is usually stated on the project plans. If it is not, the rate indicated in the specifications will govern.

### Aggregate Material

The rate of spreading cover aggregate is designated in the plans. It should be lowered if found necessary to eliminate an unusually large amount of unembedded particles.

## SPREADING OF BITUMEN AND AGGREGATE

### Bitumen

Before any bitumen is spread on the road, the inspector should determine the amount and temperature of the bitumen in the distributor. When the designated area of the road has been covered with bitumen,

the inspector should again determine the amount and temperature in the distributor. The bitumen quantity must be corrected to 60° F. volume, using a correction table. The data should be recorded in the field book. No bitumen should be spread unless the road surface temperature complies with current specifications and the roadbed is free of moisture.

If the bitumen has been heated above the temperature recommended by the specifications, the inspector should sample it and have it tested to determine if it was damaged. If damage has occurred and the bitumen has been used, a payment adjustment should be considered.

#### Base Surface Temperature

Liquid bitumens cannot be placed when a shaded portion on the road surface is cooler than the specified temperature. For uniformity, the following method of checking temperatures of shaded areas must be used on all projects:

- 1) Select a representative portion of the road surface to be covered with the liquid bitumen. If all the surface is subjected to direct sunlight, the test location should be in the sunlight. If portions of the road are shaded, the test location should be in the shade.



- 2) Lay the thermometer directly on the road surface in the test location. Shade the area temporarily while taking the temperature. The inspector should stand with his shadow covering the thermometer. The thermometer should remain in the test location for five minutes. Temperature tests should be made as often as necessary to certify that work is done according to specifications.

### Precautions

Uniform distribution of binder bitumen at transverse joints must be obtained by using paper at the start and at the end of each run.

Adjacent areas of bridge curbs, railings, etc., should be covered to prevent splattering with bitumen. Experienced and alert inspectors, careful drivers, and cautious distributor operators help eliminate poor longitudinal joints.

### Aggregate

At the time of spreading, aggregates should not contain more than the specified percentage of surface moisture based on dry weight. This percentage of moisture can be determined as follows:

- 1) A representative sample of the aggregate is selected.
- 2) The sample is weighed in its natural moisture condition.

**GROUP 1—SPECIFIC GRAVITY AT 60°F OF 0.850 TO 0.966**

**LEGEND: I** = observed temperature in degrees Fahrenheit  
**M** = multiplier for correcting oil volumes to the basis of 60°F

| I  | M      | I  | M      | I   | M      | I   | M      | I   | M      |
|----|--------|----|--------|-----|--------|-----|--------|-----|--------|
| 0  | 1.0241 | 50 | 1.0040 | 100 | 0.9842 | 150 | 0.9647 | 200 | 0.9456 |
| 1  | 1.0237 | 51 | 1.0036 | 101 | 0.9838 | 151 | 0.9643 | 201 | 0.9452 |
| 2  | 1.0233 | 52 | 1.0032 | 102 | 0.9834 | 152 | 0.9639 | 202 | 0.9448 |
| 3  | 1.0229 | 53 | 1.0028 | 103 | 0.9830 | 153 | 0.9635 | 203 | 0.9444 |
| 4  | 1.0225 | 54 | 1.0024 | 104 | 0.9826 | 154 | 0.9632 | 204 | 0.9441 |
| 5  | 1.0221 | 55 | 1.0020 | 105 | 0.9822 | 155 | 0.9628 | 205 | 0.9437 |
| 6  | 1.0217 | 56 | 1.0016 | 106 | 0.9818 | 156 | 0.9624 | 206 | 0.9433 |
| 7  | 1.0213 | 57 | 1.0012 | 107 | 0.9814 | 157 | 0.9620 | 207 | 0.9429 |
| 8  | 1.0209 | 58 | 1.0008 | 108 | 0.9810 | 158 | 0.9616 | 208 | 0.9425 |
| 9  | 1.0205 | 59 | 1.0004 | 109 | 0.9806 | 159 | 0.9612 | 209 | 0.9422 |
| 10 | 1.0201 | 60 | 1.0000 | 110 | 0.9803 | 160 | 0.9609 | 210 | 0.9418 |
| 11 | 1.0197 | 61 | 0.9996 | 111 | 0.9799 | 161 | 0.9605 | 211 | 0.9414 |
| 12 | 1.0193 | 62 | 0.9992 | 112 | 0.9795 | 162 | 0.9601 | 212 | 0.9410 |
| 13 | 1.0189 | 63 | 0.9988 | 113 | 0.9791 | 163 | 0.9597 | 213 | 0.9407 |
| 14 | 1.0185 | 64 | 0.9984 | 114 | 0.9787 | 164 | 0.9593 | 214 | 0.9403 |
| 15 | 1.0181 | 65 | 0.9980 | 115 | 0.9783 | 165 | 0.9589 | 215 | 0.9399 |
| 16 | 1.0177 | 66 | 0.9976 | 116 | 0.9779 | 166 | 0.9585 | 216 | 0.9395 |
| 17 | 1.0173 | 67 | 0.9972 | 117 | 0.9775 | 167 | 0.9582 | 217 | 0.9391 |
| 18 | 1.0168 | 68 | 0.9968 | 118 | 0.9771 | 168 | 0.9578 | 218 | 0.9388 |
| 19 | 1.0164 | 69 | 0.9964 | 119 | 0.9767 | 169 | 0.9574 | 219 | 0.9384 |
| 20 | 1.0160 | 70 | 0.9960 | 120 | 0.9763 | 170 | 0.9570 | 220 | 0.9380 |
| 21 | 1.0156 | 71 | 0.9956 | 121 | 0.9760 | 171 | 0.9566 | 221 | 0.9376 |
| 22 | 1.0152 | 72 | 0.9952 | 122 | 0.9756 | 172 | 0.9562 | 222 | 0.9373 |
| 23 | 1.0148 | 73 | 0.9948 | 123 | 0.9752 | 173 | 0.9559 | 223 | 0.9369 |
| 24 | 1.0144 | 74 | 0.9944 | 124 | 0.9748 | 174 | 0.9555 | 224 | 0.9365 |
| 25 | 1.0140 | 75 | 0.9940 | 125 | 0.9744 | 175 | 0.9551 | 225 | 0.9361 |
| 26 | 1.0136 | 76 | 0.9936 | 126 | 0.9740 | 176 | 0.9547 | 226 | 0.9358 |
| 27 | 1.0132 | 77 | 0.9932 | 127 | 0.9736 | 177 | 0.9543 | 227 | 0.9354 |
| 28 | 1.0128 | 78 | 0.9929 | 128 | 0.9732 | 178 | 0.9539 | 228 | 0.9350 |
| 29 | 1.0124 | 79 | 0.9925 | 129 | 0.9728 | 179 | 0.9536 | 229 | 0.9346 |
| 30 | 1.0120 | 80 | 0.9921 | 130 | 0.9725 | 180 | 0.9532 | 230 | 0.9343 |
| 31 | 1.0116 | 81 | 0.9917 | 131 | 0.9721 | 181 | 0.9528 | 231 | 0.9339 |
| 32 | 1.0112 | 82 | 0.9913 | 132 | 0.9717 | 182 | 0.9524 | 232 | 0.9335 |
| 33 | 1.0108 | 83 | 0.9909 | 133 | 0.9713 | 183 | 0.9520 | 233 | 0.9331 |
| 34 | 1.0104 | 84 | 0.9905 | 134 | 0.9709 | 184 | 0.9517 | 234 | 0.9328 |
| 35 | 1.0100 | 85 | 0.9901 | 135 | 0.9705 | 185 | 0.9513 | 235 | 0.9324 |
| 36 | 1.0096 | 86 | 0.9897 | 136 | 0.9701 | 186 | 0.9509 | 236 | 0.9320 |
| 37 | 1.0092 | 87 | 0.9893 | 137 | 0.9697 | 187 | 0.9505 | 237 | 0.9316 |
| 38 | 1.0088 | 88 | 0.9889 | 138 | 0.9693 | 188 | 0.9501 | 238 | 0.9313 |
| 39 | 1.0084 | 89 | 0.9885 | 139 | 0.9690 | 189 | 0.9498 | 239 | 0.9309 |
| 40 | 1.0080 | 90 | 0.9881 | 140 | 0.9686 | 190 | 0.9494 | 240 | 0.9305 |
| 41 | 1.0076 | 91 | 0.9877 | 141 | 0.9682 | 191 | 0.9490 | 241 | 0.9301 |
| 42 | 1.0072 | 92 | 0.9873 | 142 | 0.9678 | 192 | 0.9486 | 242 | 0.9298 |
| 43 | 1.0068 | 93 | 0.9869 | 143 | 0.9674 | 193 | 0.9482 | 243 | 0.9294 |
| 44 | 1.0064 | 94 | 0.9865 | 144 | 0.9670 | 194 | 0.9478 | 244 | 0.9290 |
| 45 | 1.0060 | 95 | 0.9861 | 145 | 0.9666 | 195 | 0.9475 | 245 | 0.9286 |
| 46 | 1.0056 | 96 | 0.9857 | 146 | 0.9662 | 196 | 0.9471 | 246 | 0.9283 |
| 47 | 1.0052 | 97 | 0.9854 | 147 | 0.9659 | 197 | 0.9467 | 247 | 0.9279 |
| 48 | 1.0048 | 98 | 0.9850 | 148 | 0.9655 | 198 | 0.9463 | 248 | 0.9275 |
| 49 | 1.0044 | 99 | 0.9846 | 149 | 0.9651 | 199 | 0.9460 | 249 | 0.9272 |

Figure 3 - Volume Correction  
for Asphaltic Materials



- 3) The sample is air dried until the particles are surface dry.
- 4) The sample is weighed again when in a surface dry condition.
- 5) The original sample weight less the air-dried weight gives the loss of moisture.
- 6) The loss of moisture divided by the air-dried weight multiplied by 100 gives the percentage of surface moisture.

### Precautions

Care should be exercised to prevent spillage and piling of aggregate. The truck weight ticket should show all necessary project information. Aggregates must be spread within the specified time, and the inspector must calculate the rate of application to insure spreading of the proper amount.

The scale inspector should:

- 1) have a copy of the spread chart.
- 2) put the correct spread for the corresponding net load on the scale ticket.
- 3) see that other project information, such as project number, county, material, and correct net weight, is on the scale ticket.
- 4) sign or initial all tickets leaving the scales with approved material.

The spread inspector should:

- 1) sign or initial each weight ticket as the truck is dumped.
- 2) check the spreading of material in the proper locations and amounts.
- 3) keep the original copy of all tickets for the project records and return other copies to the driver.
- 4) make sure that each ticket is for his project, and has been signed or initialed by the scale inspector.

|                                       |                                   |
|---------------------------------------|-----------------------------------|
| BEST CO.<br>WHERE, IOWA<br>NO. F-1234 |                                   |
| TRUCK NO. <u>12</u>                   | DATE <u>6-20-1968</u>             |
| SOLD TO _____                         | _____                             |
| PROJECT NO. <u>E-1-2(3)-22</u>        | COUNTY <u>Lee</u>                 |
| MATERIAL <u>Subbase Material</u>      | <u>spread 310 ft</u>              |
| GROSS <u>29,200</u>                   | LBS.                              |
| TARE <u>10,600</u>                    | LBS.                              |
| NET <u>18,600</u>                     | LBS.                              |
| WEIGHER <u>Lee</u>                    | CHECKER <u>JLR</u><br><u>1958</u> |
| TRUCK DRIVER <u>George</u>            | _____                             |
| RECEIVED <u>WFS</u>                   | <u>1958</u>                       |

Figure 4 - Scale Ticket



## ROLLING

Rolling must be done within the time limits specified. The number of passes must also conform to current specifications for the type of surface course being applied. The first passes are usually made with a pneumatic-tired roller, and the final passes by a steel-tired roller. If the aggregate is disarranged during rolling or maintenance operations (due to traffic, etc.,) to the extent that it is no longer uniformly distributed over the surface, a rotary broom should be used to return it to the part of the road being rolled. Rotary broom action should not be vigorous; it should float the loose material over the road.

## YIELD CHECKS

Yield checks should be made to assure that the proper amount of material is applied. They should be recorded in the field book.

Cover aggregate yield is figured by the inspector taking the weight from the scale tickets and dividing it by the square yards covered to get the actual rate of application.

## REPORTS AND RECORDS

## Required Reports

Form 193, Sample Identification, should accompany every sample sent to Ames Lab.

## Weekly Postcard

Not required for this type of work.

## Forms Optional For Local Use

Form 53, Construction Quantities Flexible Pavements is intended for use on all flexible base and asphalt base/surface projects--including interstate, primary and secondary. The report may be prepared by the inspector on each project as information for the resident construction engineer or the county engineer to use in the preparation of estimates. It is for field use only; copies should not be sent to Ames.



FORM 53  
4-71

IOWA STATE HIGHWAY COMMISSION

CONSTRUCTION QUANTITIES

FLEXIBLE PAVEMENTS

Report No. \_\_\_\_\_

DISTRIBUTION:  
Copy 1 - Inspector  
Copy 2 - BCE  
DO NOT SEND TO  
CENTRAL OFFICE  
Contractor \_\_\_\_\_

Project \_\_\_\_\_ County \_\_\_\_\_ Date \_\_\_\_\_

COVER AGGREGATE\*SUBBASE\*BASE\*STABILIZED SHOULDERS

|                |                 |         |      |                      |  |
|----------------|-----------------|---------|------|----------------------|--|
| Material       |                 |         |      |                      |  |
| From           |                 |         |      |                      |  |
| To             |                 |         |      |                      |  |
| Depth          |                 |         |      |                      |  |
| Width          |                 |         |      |                      |  |
| Lane           |                 |         |      |                      |  |
| Division       |                 |         |      |                      |  |
| Tons           |                 |         |      |                      |  |
|                | COVER AGGREGATE | SUBBASE | BASE | STABILIZED SHOULDERS |  |
| Previous Total |                 |         |      |                      |  |
| Day            |                 |         |      |                      |  |
| Total to Date  |                 |         |      |                      |  |

BITUMINOUS PRIMER\*BINDER\*FOG COAT

|                |        |        |          |  |  |
|----------------|--------|--------|----------|--|--|
| Use            |        |        |          |  |  |
| Place          |        |        |          |  |  |
| Material       |        |        |          |  |  |
| From           |        |        |          |  |  |
| To             |        |        |          |  |  |
| Lane           |        |        |          |  |  |
| Division       |        |        |          |  |  |
| Gallons        |        |        |          |  |  |
|                | PRIMER | BINDER | FOG COAT |  |  |
| Previous Total |        |        |          |  |  |
| Day            |        |        |          |  |  |
| Total to Date  |        |        |          |  |  |

ASPHALT CONCRETE

|                |        |         |          |             |  |
|----------------|--------|---------|----------|-------------|--|
| Use            |        |         |          |             |  |
| From           |        |         |          |             |  |
| To             |        |         |          |             |  |
| Lane           |        |         |          |             |  |
| Division       |        |         |          |             |  |
| Tons           |        |         |          |             |  |
|                | BINDER | SURFACE | SHOULDER | CUT SAMPLES |  |
| Previous Total |        |         |          |             |  |
| Day            |        |         |          |             |  |
| Total to Date  |        |         |          |             |  |

REMARKS \_\_\_\_\_

TOTALS CHECK \_\_\_\_\_

Contractor \_\_\_\_\_

Inspector \_\_\_\_\_

Figure 5 - Form 53

Figure 6 - Diary

|   |   |             |                   |  |  |
|---|---|-------------|-------------------|--|--|
| 6-5-69  | Monday  | cloudy-cool | high 70<br>low 60 |  |  |
| Start   | 6:00 A. M.  |             |                   |  |  |
| Stop  | 5:00 P. M.  |             |                   |  |  |
| Visitors  | today - Res. Engr. Jackson A.M.<br>Chief insp. Smith P.M. |             |                   |  |  |
| Daily Project Information   |   |             |                   |  |  |
| Include all delays, shutdowns, type of work,<br>area of work, progress, problems and solutions. |   |             |                   |  |  |
| Insp. Signature or initials   |   |             |                   |  |  |





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