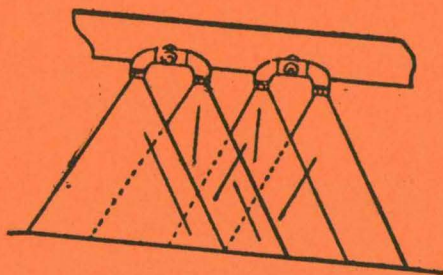


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INSPECTOR'S HANDBOOK

SURFACE TREATMENTS  
AND  
BITUMINOUS SEAL COATS



IOWA STATE HIGHWAY COMMISSION

AMES, IOWA

JULY 1971

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**SURFACE TREATMENTS  
AND  
BITUMINOUS SEAL COATS**

**Marvin Klein**

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Replaces Handbook Dated 1969**

## 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



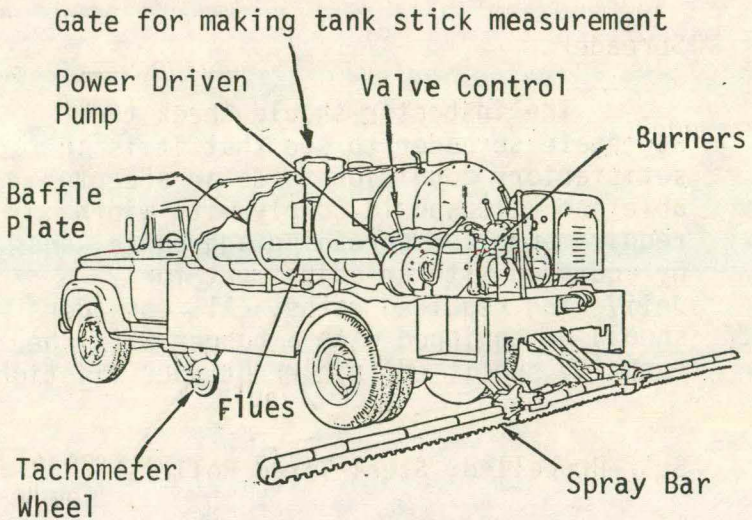


Figure 1 - Bitumen Distributor

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.

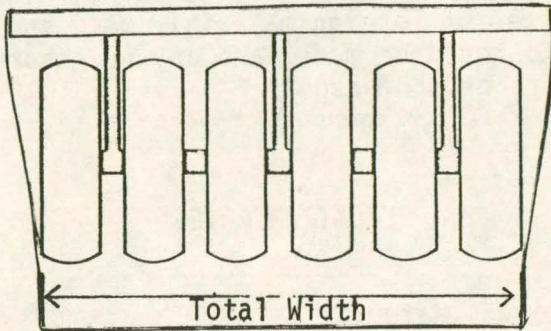


Figure 2 - Pneumatic-Tired Roller

#### 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: t = observed temperature in degrees Fahrenheit					
M = multiplier for correcting oil volumes to the basis of 60°F					
t	M	t	M	t	M
0	1.0241	50	1.0040	100	0.9842
1	1.0237	51	1.0036	101	0.9838
2	1.0233	52	1.0032	102	0.9834
3	1.0229	53	1.0028	103	0.9830
4	1.0225	54	1.0024	104	0.9826
5	1.0221	55	1.0020	105	0.9822
6	1.0217	56	1.0016	106	0.9818
7	1.0213	57	1.0012	107	0.9814
8	1.0209	58	1.0008	108	0.9810
9	1.0205	59	1.0004	109	0.9806
10	1.0201	60	1.0000	110	0.9803
11	1.0197	61	0.9996	111	0.9799
12	1.0193	62	0.9992	112	0.9795
13	1.0189	63	0.9988	113	0.9791
14	1.0185	64	0.9984	114	0.9787
15	1.0181	65	0.9980	115	0.9783
16	1.0177	66	0.9976	116	0.9779
17	1.0173	67	0.9972	117	0.9775
18	1.0168	68	0.9968	118	0.9771
19	1.0164	69	0.9964	119	0.9767
20	1.0160	70	0.9960	120	0.9763
21	1.0156	71	0.9956	121	0.9760
22	1.0152	72	0.9952	122	0.9756
23	1.0148	73	0.9948	123	0.9752
24	1.0144	74	0.9944	124	0.9748
25	1.0140	75	0.9940	125	0.9744
26	1.0136	76	0.9936	126	0.9740
27	1.0132	77	0.9932	127	0.9736
28	1.0128	78	0.9929	128	0.9732
29	1.0124	79	0.9925	129	0.9728
30	1.0120	80	0.9921	130	0.9725
31	1.0116	81	0.9917	131	0.9721
32	1.0112	82	0.9913	132	0.9717
33	1.0108	83	0.9909	133	0.9713
34	1.0104	84	0.9905	134	0.9709
35	1.0100	85	0.9901	135	0.9705
36	1.0096	86	0.9897	136	0.9701
37	1.0092	87	0.9893	137	0.9697
38	1.0088	88	0.9889	138	0.9693
39	1.0084	89	0.9885	139	0.9690
40	1.0080	90	0.9881	140	0.9686
41	1.0076	91	0.9877	141	0.9682
42	1.0072	92	0.9873	142	0.9678
43	1.0068	93	0.9869	143	0.9674
44	1.0064	94	0.9865	144	0.9670
45	1.0060	95	0.9861	145	0.9666
46	1.0056	96	0.9857	146	0.9662
47	1.0052	97	0.9854	147	0.9659
48	1.0048	98	0.9850	148	0.9655
49	1.0044	99	0.9846	149	0.9651
				150	0.9647
				151	0.9643
				152	0.9639
				153	0.9635
				154	0.9632
				155	0.9628
				156	0.9624
				157	0.9620
				158	0.9616
				159	0.9612
				160	0.9609
				161	0.9605
				162	0.9601
				163	0.9597
				164	0.9593
				165	0.9589
				166	0.9585
				167	0.9582
				168	0.9578
				169	0.9574
				170	0.9570
				171	0.9566
				172	0.9562
				173	0.9559
				174	0.9555
				175	0.9551
				176	0.9547
				177	0.9543
				178	0.9539
				179	0.9536
				180	0.9532
				181	0.9528
				182	0.9524
				183	0.9520
				184	0.9517
				185	0.9513
				186	0.9509
				187	0.9505
				188	0.9501
				189	0.9498
				190	0.9494
				191	0.9490
				192	0.9486
				193	0.9482
				194	0.9478
				195	0.9475
				196	0.9471
				197	0.9467
				198	0.9463
				199	0.9460
				200	0.9456
				201	0.9452
				202	0.9448
				203	0.9444
				204	0.9441
				205	0.9437
				206	0.9433
				207	0.9429
				208	0.9425
				209	0.9422
				210	0.9418
				211	0.9414
				212	0.9410
				213	0.9407
				214	0.9403
				215	0.9399
				216	0.9395
				217	0.9391
				218	0.9388
				219	0.9384
				220	0.9380
				221	0.9376
				222	0.9373
				223	0.9369
				224	0.9365
				225	0.9361
				226	0.9358
				227	0.9354
				228	0.9350
				229	0.9346
				230	0.9343
				231	0.9339
				232	0.9335
				233	0.9331
				234	0.9328
				235	0.9324
				236	0.9320
				237	0.9316
				238	0.9313
				239	0.9309
				240	0.9305
				241	0.9301
				242	0.9298
				243	0.9294
				244	0.9290
				245	0.9286
				246	0.9283
				247	0.9279
				248	0.9275
				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. WHERE, IOWA NO. F-1234	
TRUCK NO. <u>12</u>	DATE <u>6-20-1968</u>
SOLD TO _____	
PROJECT NO. <u>E-1-2(3)-20</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> <small>insp</small>
TRUCK DRIVER <u>George</u>	
RECEIVED <u>WFS</u>	<small>insp</small>

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  
4-73

IOWA STATE HIGHWAY COMMISSION

CONSTRUCTION QUANTITIES

FLEXIBLE PAVEMENTS

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

DISTRIBUTION:  
COPY 1 - Inspector  
COPY 2 - RCE  
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 low 60		
Start		6:00 A. M.			
Stop		5:00 P. M.			
Visitors today -		Res. Engr. Jackson A.M. Chief insp. Smith P.M.			
Daily Project Information					
Include all delays, shutdowns, type of work, area of work, progress, problems and solutions.					
Insp. Signature or initials					



Figure 7 - Diary

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

BITUMEN RECORD

Date	Time	Station		Lineal Feet	Width	Sq. Yds	Distributor		Gal. Used	Temp	Corr. Fact.	Gals. @ 60°	Rate	Insp.
		from	to				Start	Stop						
6-6-69	10:00 AM	11+00	21+00	1000	10	1111	960	630	330	230	.9343	308	.28	JFR

COVER AGGREGATE

Date	Station		Lineal Feet	Width	Sq. Ydc.	Pounds		Rate	Tons		Insp.	
	From	To				Reqd.	Used		Today	To Date		
6-6-69	11+00	21+00	1,000	10'	1111	27,775	28,000	1000	25.2	14.00	14.00	JFR
	NOTE: Required pounds figured @ 25 lbs. per					1. yd.						

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