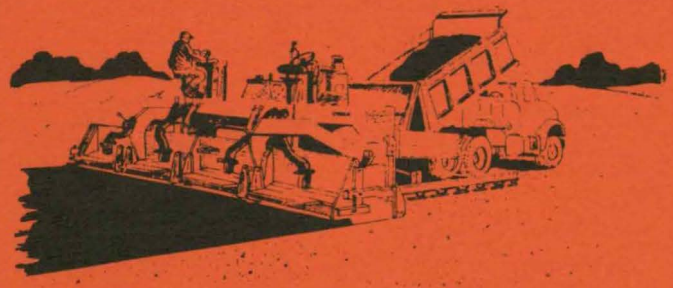
INSPECTOR'S HANDBOOK

RESURFACING
AND
ASPHALT CONCRETE PAVING



IOWA STATE HIGHWAY COMMISSION

AMES, IOWA

July 1973

INTRODUCTION

This handbook is an inspector's aid. It was written by an experienced 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 inspection, 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 correct practice. The Standard Specifications and Special Provisions should not, however, be overlooked as the basic requirements and restrictions concerning workmanship and materials.

CONTENTS

GENERAL Page 1

Plans, Proposals, and Specifications 2

Preconstruction Details 3

REPAIR AND PREPARATION OF OLD BASES FOR RESURFACING 3

Full Depth Patches 3

Cleaning and Removal 5

Surface Patches 6

Tacking and Sanding 7

LEVELING AND STRENGTHENING 8

WEDGE COURSES FOR THE SUPERELEVATION OF CURVES 9

INSPECTION OF FINISHING MACHINE 15

INSPECTION OF ROLLERS 16

Self-Propelled Vibratory Rollers 17

Self-Propelled, Smooth, Steel-Tired Rollers 18

Self-Propelled, Pneumatic-Tired Rollers 18

INSPECTION OF HAND TOOLS 20

SUBBASE AND SUBGRADE STABILITY 20

CONSTRUCTION OF THICK LAYERS 22

DRIVEWAYS AND INTERSECTING ROADS 23

YIELD 24

BASE SURFACE TEMPERATURE 25

LAYING WIDTHS 26

SPREAD RATES 31

CITY STREETS 33

Preliminary Layout 34

Construction 38

EDGE ALIGNMENT AND GUIDELINE STRINGS 42

LONGITUDINAL JOINTS 46

AUTOMATIC SCREED CONTROLS 48

OPERATION OF FINISHING MACHINES 53

CONTROL OF SURFACE TEARING 54

CONTROL OF SEGREGATION 56

RAKING AND HANDWORK 59

TRANSVERSE JOINTS 60

DENSITY SAMPLING AND CONTROL 62

MIXTURE SAMPLING 69

Frequency 69

Sampling Hot-Mix Asphalt Concrete for Lab Tests 70

INSPECTION FOR SATISFACTORY SMOOTHNESS 72

RECEIVING TICKETS 74

ADJUSTING FIXTURES 74

REPORTS AND RECORDS 75

Required Reports 75

Forms Optional for Local Use 75

PLANT INSPECTION 76

Plant Inspection in General 76

Inspecting the Mixing Time of Asphalt Plants 79

Scale Inspectors and Weight Tickets 79

Checking of Scales Used For Determining Pay Quantities 80

APPENDIX - SAMPLE DIARY PAGES 85

GENERAL

The inspection procedures in this handbook are directed mainly to construction where the asphalt concrete will be paid for by the ton. Most of the construction will be let on the tonnage basis. However, the specifications also provide for the alternate method of letting the construction contracts to be paid for by the square yard.

When payment is on the square yard basis, full-time inspectors will not be assigned to check the weighing for proportioning, or for weighing to keep track of tonnages. However, the plant inspectors shall periodically check the weighing procedures as one of their duties. Inspectors will not check the spread rates when payment is by the square yard.

The methods of testing described in this handbook are the same as the Instructional Memorandums that were issued by the Materials Department at the time the handbook was revised.

The frequency of samples and tests given in this handbook was taken from the Instructional Memorandum No. 204 that was in effect at the time of writing. The latest I. M. 204 should be checked carefully to insure that correct frequency of sampling and testing is being followed.

Plans, Proposals and Specifications

The plans indicate the length, width, and depth of the pavement components. They provide information about quantities and some of the procedures. The title sheet on the plans designates the applicable standard specifications book by date.

The proposal (or contract) designates the supplemental specifications and special provisions that are applicable by number and date.

Section XI of the Instructions to Resident Construction and County Engineers contains most of the official inspection policies that pertain to resurfacing and flexible pavements.

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

The plant inspectors should also be furnished the latest asphalt concrete plant inspection manual. These manuals can be obtained by writing or telephoning the Materials Engineer at the Ames office of the Iowa State Highway Commission.

The inspectors shall be familiar with the plans, specifications, and applicable official instructions and shall have copies with them in the field for ready reference.

The inspectors shall also check the contract items and quantities to verify their accuracy.

Preconstruction Details

Before any construction work is started, the resident or county engineers, together with the inspectors, shall converse with the contractors to ensure that the specifications, limitations, materials and equipment are fully understood and agreed upon.

The inspectors should check and verify that the contractors have enough signs and barricades in place (or available) when needed. The plans and signing specification will indicate the required signing arrangement.

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

REPAIR AND PREPARATION OF OLD BASES FOR RESURFACING

Full Depth Patches

When repairing old concrete pavements, a full depth patch should be used when the broken concrete shows evidence of traffic distortion or mud pumping.

This can usually be determined by observing the action of questionable sections under truck traffic.

When repairing old flexible pavements the surface should be checked for indication of serious break-up. The local maintenance foreman should also be consulted about areas that have required unusual maintenance repairing.

To facilitate traffic the specifications prohibit patching both sides of the pavement at the same time. Repairs that are needed for more than one-half the width of the pavement shall therefore be done on different days. A full-depth form shall therefore be used at the centerline for the first section on any concrete patch which extends on both sides of the centerline.

The edges of the excavations being patched in old bituminous pavements shall be cut to vertical lines.

Old reinforcing steel in concrete pavements shall be removed from the excavated area when asphalt concrete is used for patching.

The 1/8 inch vertical tolerance for the completed patches shall be enforced.

All patches shall be filled on the same day of removal.

Traffic is kept off full depth asphalt concrete patches until the mixture has cooled, at least to some

extent. Public Safety should govern, however, and barricades for asphalt patches are taken down before nightfall.

Cleaning and Removal

All vegetation, dirt, and other foreign material shall be removed from the old base. On old concrete bases, all material which can be loosened with pick-axes or air compressor tools shall be removed.

All flushed or fat bituminous material shall be removed from old concrete pavements. On old bituminous pavements, which have had considerable maintenance with cold-mix patches and seal coats, it frequently happens that a considerable portion of the old surface is flushed due to excess bitumen.

Experience has shown that complete removal of all such flushed material is undesirable and impractical. Therefore on old flexible pavements, only those cold-mix patches shall be removed that have sufficient depth to have distorted under normal traffic.

For cleaning old flexible pavements, the operation usually involves scraping selected locations with a short blade (3 to 4 foot) on a motor patrol. The locations shall be selected using distortion due to thick, fat bituminous patches as a basis -- not flushing. The inspector shall indicate

the locations and check the thoroughness of scraping while it is being done. To facilitate safe traffic movement, the contractor should backfill the resulting holes with hot mixture on the same day scraping takes place. Scraped material shall be picked up immediately, for it also can become a traffic hazard.

Work shall always be confined to one traffic lane. The adjacent lane shall be free of obstructions to public vehicles.

If the old pavement is concrete, the guideline string area shall be prepared by mowing the grass short along the pavement edge.

Surface Patches

Surface patches consist of hot mix asphalt concrete. They are used to replace undesirable material removed during cleaning and removal operations. If the depression caused by removal is less than one inch deep, a surface patch is not required.

The inspectors shall enforce conformance of surface patches to the vertical tolerance with relation to the surrounding pavement.

The edges of excavations for patching in old bituminous pavements shall be cut to vertical lines. The edges of excavations in old concrete pavements shall be cut to vertical lines as near as is reasonably possible.

All patches shall be filled on the same day of removal. Patching shall be completed before tack-coating is started in a given area.

Tacking and Sanding

Refer to the Base Surface Temperature section of this handbook for testing for temperature limitations before allowing tack to be sprayed.

When the old pavement has been patched and is ready to receive the tack coat, the surface should be inspected to ensure that the road is well swept and free from all dirt.

All tack coats (except in inaccessible areas) shall be applied with distributors. Inaccessible areas may be tacked with hand spray. Spray bar nozzles shall be small enough to permit a reasonable slow distributor speed -- less than 20 mph.

Before permitting a Bituminous Distributor to be used, the inspector shall check it according to the procedure described in the handbook for Surface Treatments and Bituminous Seal Coats.

A short section shall be selected for trial when organizing to place a tack coat. This section should be just long enough to give an accurate check of:

1) the rate of application of bitumen and sand.

3) Take elevations of the hubs and the inside edge of the base opposite each hub.

4) Plot a profile of the elevations of the inside edge of the base.

5) Draw a new profile for the inside edge of the base using the first profile for a guide, eliminating all distortions in the original profile.

6) Give the grade inspector a record of the distortions so he can have them leveled with asphalt concrete.

7) Using the new profile, calculate the fill needed at each hub to give the desired superelevation.

8) For 24-foot pavement, fill = new profile elevation of the inside edge of the base + (.5 ÷ 12) = (24 x superelevation feet-per-foot) - (elevation of the hub).

(.5 ÷ 12) is the 1/2 inch thickness at the inside edge expressed in terms of feet.

"Superelevation feet-per-foot" is the vertical-over-horizontal of the slope.

9) Mark fill (in feet) on the flat stake adjacent to the hub.

Full superelevation is usually not desired if a curve falls in a reduced speed zone. Sometimes plans show a reduction in the rate of superelevation; other times the reduction is overlooked. Check plans carefully. If the speed zone has been overlooked, reducing the rate of superelevation is usually necessary.

For badly distorted curves -- such as some flexible bases being resurfaced -- drive hubs offset from both inside and outside edges of the curve and use the centerline for a basis instead of the inside edge of the curve.

Have the contractor drive 3/4" x 1 1/2" stakes adjacent to the hubs and to the elevation indicated on the hubs. To correct any obvious errors in marking stakes, sight across them after they are driven. Make a table in the field book for each curve, patterning it after this sample:

Sta	Total Fill	Total Centerline Fill	Lay To	1st Lift	Remaining Fill	Lay To	2nd Lift	Remaining Fill	Lay To	3rd Lift

Using a level and a rule, measure (in inches) the total fill needed on the outside edge of the curve opposite the hubs. Record it under "total fill" in the table. To check the thickness necessary at centerline, hold a string line on the inside edge of the base and at the elevation of the top of the wedge at the outside edge of the base. Measure the necessary fill at the centerline, add 1/2 inch, and record it in the table under "total centerline fill". If the centerline fill is more than 3 inches, it shall be brought up with preceding courses. For safety reasons, each course shall not exceed 3 inches in depth; the final course should not require more than 3 inches fill at the center.

The additional 1/2 inch thickness at the centerline is placed so the longitudinal joint can be constructed and rolled with flat steel rollers. This gives a 1/2 inch crown to the superelevated section.

The "lay to" figure in the table is the theoretical remaining thickness between the top of the finished curve and the top of the wedge course being laid. By specification, the thickness of an individual layer of a wedge course for superelevating a curve shall not exceed 3 inches. The "lay to" is obtained by subtracting 3 inches from the largest number in the total fill (or remaining fill if it is any but the first course) column.

To get the actual thickness to be laid, subtract the "lay to" from each number in the total fill column. Record this under the first lift, second lift, etc.

A guideline string is used for each lift to ensure that all wedges are constructed in their proper location. The guideline string shall be moved for every succeeding lift of asphalt concrete. The edge of the screed of the laydown machine shall always be exactly one foot from the guideline string with a bevel side plate giving a 1:1 slope to the edge of the wedge.

The distance of the guideline string from the hubs is calculated by using this formula: guideline distance from hub = 3'12" - "lay to". The formula is derived in the following manner:

1) The top of the final wedge for the curve is directly over the outside edge of the base. Since the edge of the wedge has a 1:1 slope, the "lay to" figure numerically equals the distance from the edge of the base to the edge of the lift being constructed.

2) The hub is 5 feet from the edge of the base, and the guideline string is one foot from the edge of the screed.

3) Therefore, guideline distance from hub = 5 feet - "lay to" - 1'
= 3'12" - "lay to"

Before construction starts on the wedges -- but after the contractor has placed the 3/4" x 1 1/2" stakes -- the inspector measures the total fill, the total centerline fill, calculates the "lay to" for the first lift, calculates the thickness at each stake for the first lift, and records everything in his book. The following is a sample of field book records at this stage:

Sta	Total Fill	Total Centerline Fill	Lay To	1st Lift	Remaining Fill	Lay To	2nd Lift	Remaining Fill	Lay To	3rd Lift
30	0	0	6¼	0						
+25	1½	0	6¼	0						
+50	3¼	¼	6¼	0						
+75	7	2	6¼	¼						
31	9¼	2½	6¼	3						
+25	8¾	2¾	6¼	2½						
+50	9	2	6¼	2¾						
+75	8½	2	6¼	2¼						
32	8¼	2¼	6¼	2						
+25	9	1¾	6¼	2¾						
+50	8½	2¼	6¼	2¼						
+75	8½	2¼	6¼	2¼						

First lift guideline distance from hubs
= 3'12" - 6 1/4"
= 3'5 3/4"

The contractor sets the guideline string 3' 5 3/4" from the hubs and adjusts the finishing machine until the edge of the screed is one foot from the guideline string at station 30+50. The inspector marks the thickness to be laid on the base ahead of the finishing machine.

To lay succeeding lifts, the inspector measures remaining fill each time with a level and a rule, calculates the "lay to" thickness to be laid and the guideline distance from the hubs, and paving procedures are repeated.

INSPECTION OF FINISHING MACHINE

With the exception of the following checks, inspectors shall not assume responsibility for the condition of the finishing machine screed. Instead, they shall carefully observe the condition of the pavement while it is being constructed.

Inspectors should use the following procedures at frequent intervals during construction to check the screed surface for producing the shape of the pavement cross section, and to detect extremely worn screeds:

1) Check the screed surface for places worn through. Do not permit the use of a machine with a hole worn through the screed plate.

2) Check the screed extension installation with the required straight edge.

3) Check with a stringline and rule to see that the crown in the trailing edge of the screed is 1/4 inch. This may vary for unusual sections according to requirements.

4) Check with a stringline and rule to see that the crown in the leading edge of the screed is approximately 3/8 inch. The contractor should be asked to change this adjustment during construction to help produce a uniform surface texture. Less crown is put into the leading edge to eliminate tearing near the edges of the lane. More crown is put into the leading edge of the screed to eliminate tearing of the center portion of the lane.

INSPECTION OF ROLLERS

The specifications require rollers to comply with minimum standards. They also permit the contractor to use the weights and tire pressures during construction that he thinks are best, provided he obtains satisfactory end results.

The following inspection shall, therefore, be made before construction starts to insure that the equipment complies. However, the inspectors should not attempt to control the tire pressures or weights during construction except to be reasonably sure that the axle weights do not exceed the legal maximum of 18,000 pounds. For base construction, rollers having axle weights exceeding 18,000 pounds may sometimes be permitted. In such cases, the specifications should be checked carefully to insure that all the restrictions are enforced.

The inspector shall also make a record in his diary showing how and when the rollers have been inspected.

Self-Propelled Vibratory Rollers

Self-propelled vibratory rollers are permitted by the specifications. Not too much is known about the optimum dimensions or weights of these rollers. There is also considerable variance among the different brands concerning the amplitude and frequency of vibration. The specifications for vibratory rollers have therefore not included detailed requirements.

The inspection forces should be reasonably sure that they are in good repair.

There is no specified minimum diameter for the steel drum on vibratory rollers.

Self-Propelled, Smooth, Steel-Tired Rollers

Measure the diameter of the driving roll to insure its compliance with the specified minimum of 60 inches.

Self-Propelled, Pneumatic-Tired Rollers

Check the roller tire size as it is marked on the tire sidewalls for compliance with the specified minimum requirement.

The contractor must give the inspector reasonable verbal assurance that the roller is capable of exerting 80 psi ground contact pressure.

The following tables can be used to provide 80 psi ground contact pressures. They have been modified slightly from the standards of the Bituminous Equipment Manufacturers Bureau for the purpose of easy inspection.

Each combination of wheel load and tire inflation pressure should produce 80 psi ground contact pressure or slightly more:

Tire Size	Wheel Load Lbs.	Inflation Pressure psi	Ply Ratings
7.50 x 15	2000	120	All Ply
	2500	110	
	3000	100	
	3500	90	
	4000	85	
9.00 x 20	3000	--	Under 12 Ply
	4000	86	
	5000	79	
	6000	73	
	3000	115	Over 12 Ply
	4000	103	
	5000	94	
	6000	88	
10.00 x 20	4000	125	All Ply
	5000	114	
	6000	106	
11.00 x 20	3000	116	All Ply
	4000	99	
	5000	92	
	6000	87	
13.00 x 24	4000	100	18 Ply
	6000	90	
	4000	86	22 Ply
	6000	78	
	4000	78	26 Ply
	6000	72	

INSPECTION OF HAND TOOLS

Specifications have few restrictions on the hand tools used in asphalt concrete construction. The most important item is selection of rakes or lutes. These tools must be designed for use on asphalt construction. Garden rakes are too light to be useful and shall not be used. All hand tools shall be kept clean to ensure good workmanship.

SUBBASE AND SUBGRADE STABILITY

The specifications for natural subgrade and the various types of stabilized subbases require the contractor to immediately repair rutting or any other damage that occurs as a result of hauling operations. In enforcing these specifications the inspectors shall not permit layers of asphalt concrete to be spread over any subgrade or subbase that has become distorted.

Whenever rutting of the subbase or subgrade occurs, from the batch trucks, the other paving equipment, or from any other cause, in the asphalt concrete spreading area, to the extent that the thickness of the layer being spread does not conform to the designed dimension,

the inspectors shall immediately stop construction. Construction shall also not be permitted to start again until the distorted subgrade or subbase is reworked and smoothed to the correct elevation.

The contractors and inspectors are also encouraged to locate unstable areas, ahead of time, so that wet spots that will rut or distort under the equipment can be dried out before spreading of the asphalt pavement is started. This will avoid unanticipated and costly work shutdowns.

The recommended procedure for locating the wet or soft spots ahead of time, is by testing the finished subgrade or subbase with a loaded truck. When distortions are observed under the truck, the subbase and subgrade can be dried out and reworked.

The construction of the pavement should not be started again unless the testing gives a reasonable indication that distortions will not occur during construction of the overlying pavement.

When unusual or persistent problems are encountered with wet or unstable subgrades or subbases, the Ames Construction Department should be contacted.

CONSTRUCTION OF THICK LAYERS

The following shall be used as an inspection policy for thick layers.

When the specifications permit construction of thick layers, the contractors shall be permitted to select the thickness they think should be used.

The inspection forces shall then test the thick layer for density and observe its riding quality. If the density and riding quality are satisfactory, the work should be allowed to continue.

If the density results are not satisfactory, they should be controlled according to the specifications and this handbook's section on density control.

In determining whether the riding quality of a thick layer is satisfactory or not, consideration should be given to the fact that thick layers are inherently rougher riding than the thinner layers. Also consideration should be given to the location of the layer in the entire pavement. If it is not the top layer of the pavement, it will be reasonable to accept the roughness which is inherent to thick layers. The finishing machines will correct the roughness when subsequent layers are spread.

However, poor rideability which is caused by poor workmanship or incorrect machinery adjustment shall not be tolerated for any layer.

Asphalt treated bases will sometimes be designed with bituminous surface treatments as the wearing course. In those instances the top layer of the base is the top layer of the pavement. The specifications have not yet been changed to control this feature, but to insure satisfactory smoothness of those particular pavements, the inspection forces shall not permit the layer thicknesses to be planned and constructed so that the top layer exceeds 2 inches in thickness.

DRIVEWAYS AND INTERSECTING ROADS

The specifications do not require fillets of asphalt concrete to be constructed at driveways and intersecting roads unless the plans explicitly show them. Fillets can reasonably be eliminated from the plans when the design is being made if stabilized shoulders are to be constructed.

If fillets are required by the plans, care shall be taken by the inspector to insure their correct construction as follows:

Turn on and off the road with a car to determine the length of fillets for driveways and intersecting roads. Set stakes at the outer limits of the turn, and don't make the fillets too short.

Pay particular attention to insuring uniform profile elevation and true edge alignment of the fillets.

YIELD

Station markers should be placed at least every 500 feet to permit calculation of yield percentages.

Yield percentages are calculated by dividing the actual tonnage used by the tonnage which is estimated using the plan weight for that particular length, depth and width, and multiplying the quotient by 100. Yield percentages are used to indicate the comparative rate of application and are most usually calculated for each 1000 lineal feet constructed.

For the lower layer on resurfacing projects, the automatic controls should not be adjusted repeatedly based on tonnage yields taken at short intervals. The automatic controls should be allowed to correct for the irregularities in the underlying base without frequent adjustments.

Accordingly, the spread rate for individual truck loads will sometimes vary substantially from the plan rate because of the irregularities in the old base. However, over longer distances (one half mile or more), taking both sides of the pavement into account, the inspectors should select a general spread rate that compares as closely as possible with the plan quantities.

BASE SURFACE TEMPERATURE

Asphalt concrete is not permitted to be placed when a shaded portion on the road surface is cooler than the specified temperature. For uniformity, the following method of determining temperatures of shaded areas shall be used on all projects:

1) Select a representative portion of the road surface to be covered. 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 by letting your shadow cover the thermometer. It should remain in the test location for five minutes. Temperature tests should be made as often as necessary to be sure that the work complies with the specifications.

LAYING WIDTHS

The plans for asphalt concrete projects will show the overall dimensions of the finished pavement.

As an aid to the field forces, the following drawings have been made, for typical designs, showing the recommended dimensions for spreading the different lanes.

It is recommended that the dimensions shown be used when applicable. For other pavement thicknesses or widths which may not be adaptable to the drawings, similar drawings should be made by the inspection forces.

When spreading layers of Type A or B asphalt concrete that are 1 1/2" to 2" in thickness, a normal pavement will broaden 2 to 4 inches in width during rolling.

The drawings therefore indicate that the total spreading width before rolling is 3 inches less than the design width. An intended lap of one inch at the longitudinal joint is also recommended.

The finishing machine screed extensions are usually available in 6 inch increments. Also an excessive lap at the longitudinal joint shall not be permitted when constructing Type A or B asphalt concrete. It is furthermore considered undesirable to use a cut-off shoe when matching a longitudinal joint. To comply with these restrictions, the widths shown on the drawings should be the dimensions spread before compaction, and unless the broadening in width during rolling varies unusually from the expected 2 to 4 inches, no changes in spreading width should be required.

For asphalt treated bases, the requirements for surface roughness and appearance do not demand the foregoing refinements. For this construction, the contractor should be permitted to use a cut-off shoe when matching the longitudinal joints and to increase the lap at the longitudinal joints beyond one inch. These practices will permit construction of asphalt treated bases almost to the exact dimension shown on the plans.

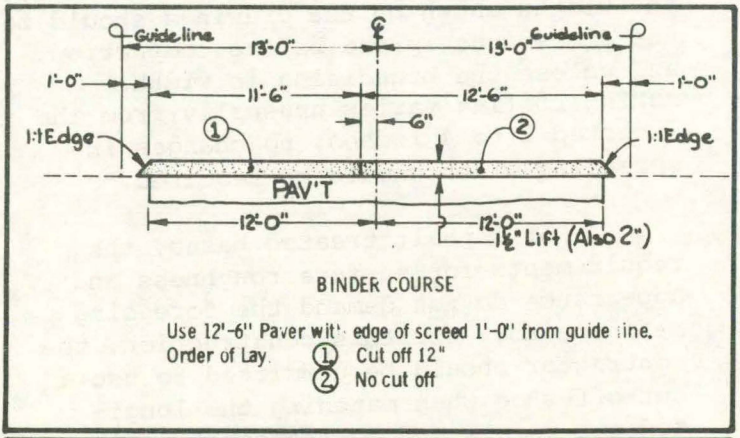
When using finishing machines that spread the pavement full width, the inspectors shall insure that the contractors adjust the spreading width so that they conform reasonably close to the dimensions described in the foregoing paragraphs.

When city streets or other multi-lane pavements are being surfaced, the laying widths shall be inspected according to the procedure described under CITY STREETS in this handbook.

Width checks should be made and recorded in a field book at least five times each day -- usually at the same location and time as field density tests.

RESURFACING 24' PAVEMENT

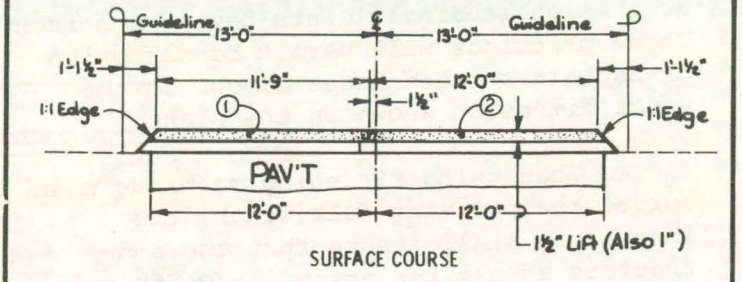
All widths are the dimensions to be laid before compaction. They should provide the design cross section after rolling.



BINDER COURSE

Use 12'-6" Paver with edge of screed 1'-0" from guide line.

Order of Lay: (1) Cut off 12"
(2) No cut off



SURFACE COURSE

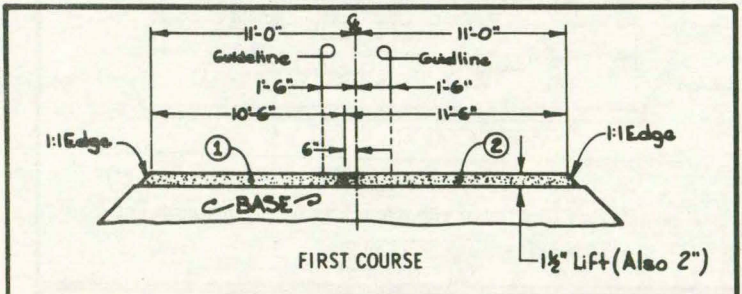
Use 12'-0" Paver with edge of screed 1'-1 1/2" from guide line.

Note:
(1) May be laid either side but must be laid first.

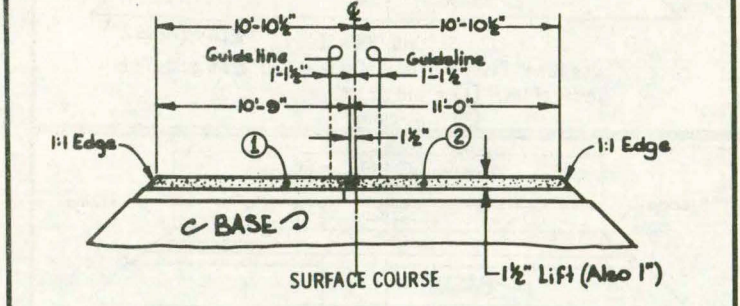
Order of Lay: (1) Cut off 3"
(2) No cut off

PAVING 22' PAVEMENT - 3" MAT - BEVELED EDGES

All widths shown are the dimensions to be laid before compaction. They should provide the required design cross section after rolling.



Use 11'-6" Paver with edge of screed 1'-0" from guide line.
Order of Lay: (1) Cut off 12"
(2) No cut off.



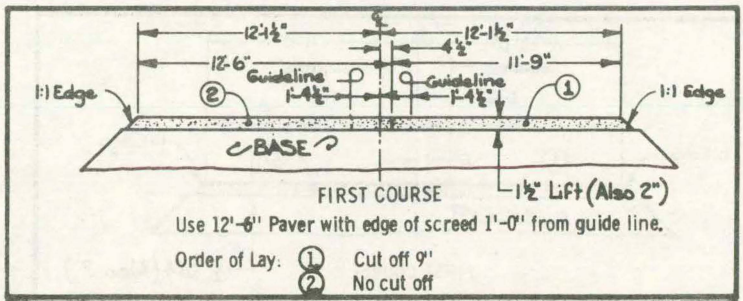
Use 11'-0" Paver with edge of screed 1'-0" from guide line

Note:
(1) May be laid either side but must be laid first.

Order of Lay: (1) Cut off 3"
(2) No cut off

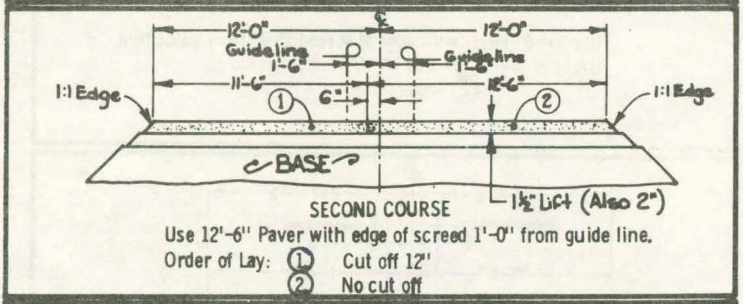
PAVING 24' PAV'T. - 4 1/2" MAT - BEVELED EDGES

All widths shown are the dimensions to be laid before compaction.
They should provide the required design cross section after rolling.



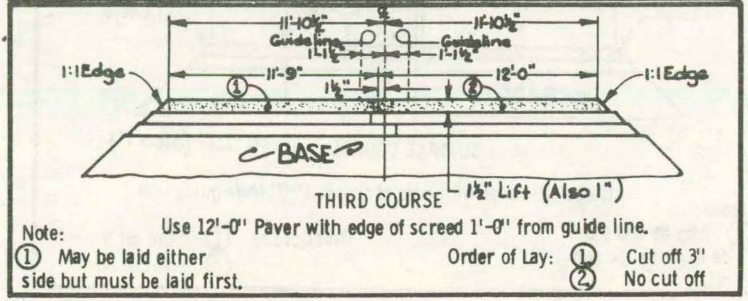
Use 12'-6" Paver with edge of screed 1'-0" from guide line.

Order of Lay: (1) Cut off 9"
(2) No cut off



Use 12'-6" Paver with edge of screed 1'-0" from guide line.

Order of Lay: (1) Cut off 12'
(2) No cut off



Use 12'-0" Paver with edge of screed 1'-0" from guide line.

Note:
(1) May be laid either side but must be laid first.

Order of Lay: (1) Cut off 3"
(2) No cut off

SPREAD RATES

For Class A subbases or other construction where payment is determined by surface measurement instead of by tonnage, the inspection forces shall not control the spread rates. When tonnage is the basis for payment, the following shall be the inspection procedure.

The inspection forces shall check the contract quantities to insure their accuracy.

In general, the spread rates for hot-mix construction shall be determined using contract tonnage as a basis. It is considered that the estimated weight used to calculate the contract quantities will provide sufficient quantities for construction of the design thickness for most mixtures used in the state.

Except when the term "average thickness" is shown adjacent to a particular layer on the plans, if the contract quantities are not sufficient to construct the thickness required on the plans, the district office shall be notified and the spread rate shall be increased as necessary to insure construction of the design thickness.

The term "average thickness" is normally shown for the lower layer on resurfacing projects.

Unusually thin and thick spots can be expected, especially if automatic screed controls are required.

For construction of layers showing the term "average thickness" on the plans, the spread rate shall not be increased to avoid construction of spots which are less than design thickness, provided that the contract quantities have been calculated correctly.

For the lower layer on resurfacing projects, the automatic controls should not be adjusted repeatedly based on tonnage yields taken at short intervals. The automatic controls should be allowed to correct for the irregularities in the underlying base without frequent adjustments. Accordingly, the spread rate for individual truckloads will sometimes vary substantially from the contract rate because of the irregularities in the old base. However, over longer distances (one half mile or more), taking both sides of the pavement into account, the inspectors should select a general spread rate that compares as closely as possible with the contract quantities.

For paved shoulders or other construction, where the dimensions are controlled by specified elevations, existing structures or by other unusual situations, the spread rates shall be adjusted as necessary to conform to those requirements or situations.

Layer depth should be checked and recorded in a field book at least five times each day. Depth checks are usually done at the same location and time as field density tests.

CITY STREETS

When a city street or other pavement involving more than two lanes for the finishing machine is surfaced with asphalt concrete, certain procedures and principles produce a finished product with a pleasing appearance and smooth riding qualities. Although the details involved in individual projects may vary, the correct approach is one that works toward the standard procedures described in this section.

In addition to the basic work (base repair, cleaning, and tacking), leveling shall be spread to correct lack of drainage, poor riding qualities, and to ensure that none of the longitudinal joints occur in an inverted crown (except in rare cases when drainage is not adjacent to the curb).

The correct construction of longitudinal joints is associated with straight lines and a uniform minimum lap of each lane over the adjacent lanes.

Preliminary Layout

1) Establish a working centerling by dividing the street at the end of each block.

2) Measure and record the distance from the working centerling to the face of the curb (if laying asphalt to the face of the curb is required) right and left at 100 foot intervals.

3) Offset the working centerline to stakes in the parking area or to painted X's on the sidewalk. Also cross-tie all fixtures to be covered with asphalt.

4) Plan the laying procedure using measurements from the working centerline to the face of the curb (right and left.) The planned procedure should be drawn up showing the width of each lane, the cutoff necessary from the entire machine width, and the guideline string offset from the established centerline.

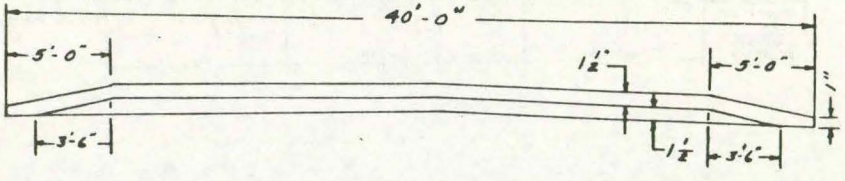
5) The guideline string for planning purposes, should be 1'0" from the edge of the screed. At least 3 inches should be allowed between each curb and edge of the screed for irregularities.

If possible, plan the laying procedures so that all street widths can be both binder and surface-coated with the same basic machine width. This eliminates installing and removing screed extensions during the construction. Use the cutoff shoe for varying the widths, but make the last lane the entire machine width with no cutoff used. Plan the width of lanes for different width streets so the inside lanes may be laid continuously. This eliminates many transverse joints and gives the job a better continuous appearance.

The following measurements are typical of two blocks of a city street to be resurfaced; they are the distances from the working centerline to the face of the curb, taken at 100 foot intervals:

Sta. 27 + 00	19'10"	19'10"
Sta. 26 + 00	19'11"	20' 4"
Sta. 25 + 00	20' 0"	20' 1"
Sta. 24 + 00	20' 0"	20' 0"
Sta. 23 + 00	20' 0"	20' 0"
Sta. 22 + 00	20' 1"	20' 1"
Sta. 21 + 00	20' 2"	19'11"
Sta. 20 + 00	20' 0"	20' 0"

It is reasonable to assume that the street was intended to be 40 feet wide, so a typical resurfacing design cross-section would be sketched as follows:

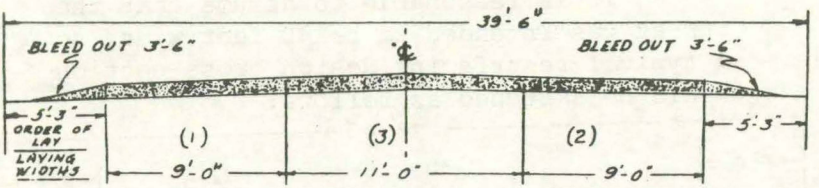


Sta 20 + 00 to Sta 27 + 00

The inspector shall adapt the designed cross section to the existing street measurements. He should plan lane widths which will ensure that the edge of the screed will not drag on the face of the curb. He shall make provisions that will insure straight longitudinal joints with a uniform lap of one inch of each lane over the adjacent lanes.

Because the narrowest dimension from the working centerline to the face of the curb controls the above factors, that dimension shall be used as the basis for construction. All wider dimensions are fill with asphalt along the curb by bleeding the mix from the outer edge of the finishing machine.

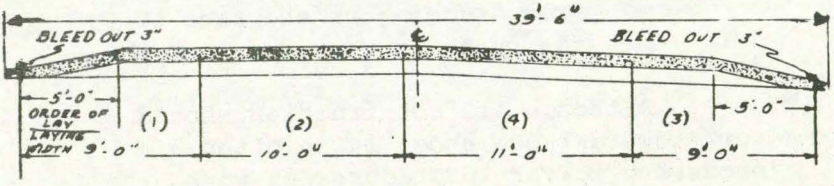
The typical street shown has a narrowest dimension of 19'10". Because screed width can usually be varied only in 3 inch increments, the dimension must be reduced to 19'9". For planning purposes, the street width becomes 39'6". The contractor may decide to use a screed width of 11'0". The following is a typical drawing of the laying procedure for an 11'0".



Binder Course. Use 11'0" screed.

ORDER OF LAY. (Guideline string 1'0" from screed edge)

(1) Guideline string 2'6" from centerline cutoff 2'0".
(2) Guideline string 2'6" from centerline cutoff 2'0".
(3) Guideline string 6'6" from centerline no cutoff.



Surface Course. Use 11'0" screed.

ORDER OF LAY (Guideline string 1'0" from screed edge)

(1) Guideline string 7'6" from centerline cutoff 2'0".
(2) Guideline string 1'6" from centerline cutoff 1'0".
(3) Guideline string 7'6" from centerline cutoff 2'0".
(4) Guideline string 1'6" from centerline no cutoff.

Construction

The inspector shall carefully lay out and thoroughly check the lane widths and guideline string offsets before construction commences. This eliminates errors which cause time loss to the contractor. The basic purposes of layout are:

1) to provide straight longitudinal joints with a uniform minimum lap of one lane over the adjacent lanes.
2) to keep the edge of the screed from dragging on the face of the curb.

Although all construction should work toward those ends, it is often necessary to vary procedures as work progresses. Lane widths shown on plans are widths before rolling. Lanes widen under rolling, and to take this into account, it will be necessary to reduce the width of at least one of the lanes after the first lane is placed and before the last one is placed. The lane with the adjusted width is normally the next-to-last lane placed; this is important if the closing lane (which must be the entire machine width without a cutoff shoe) is to be placed without an excessive, unsightly lap at the longitudinal joints. Because of widening under rolling, it is also necessary to vary the width between the guideline string and the edge of the screed to provide the desired joint lap.

A lap of one inch at the longitudinal joint is recommended. To eliminate confusion, the guideline string should be placed as shown on the planned procedure. On all but the first lane placed, the measurement between the edge of the screed and the guideline should be adjusted until the desired one-inch lap is obtained. On the first lane placed, the edge of the screed should be exactly one foot from the guideline string.

The guideline string is required by the specifications and it shall be used. The curb, gutterline, or edge of a previously constructed lane are not acceptable substitutes. They shall not be used in lieu of the guideline string.

The guideline string is the basis of construction and its correct use determines the amount of success attained. It shall be accurately set and maintained. The contractor shall appoint a capable full-time man each day to mark the working centerline from the offset line with crayon. He then sets the guideline string by measuring from the working centerline.

Hard steel nails are the only thing which can usually be driven between bricks or cracks in old pavement to hold the guideline string.

Edge alignment of each lane determines the trueness of longitudinal joints. For satisfactory joint construction and pleasing, straight line, the inspector shall require hand work wherever it is needed to straighten unevenly placed edges.

When resurfacing an old street, the shape of the finished pavement should be kept in mind. It is nearly impossible to make a longitudinal joint inversely crowned without leaving objectionable roller marks. It may be necessary to raise the inside edge of certain lanes more than the intended thickness to provide a slight crown at the joint.

When the street under construction makes a right angle turn, paving shall proceed through the intersection. The finishing machine will make a joint along the edge (which shall be sawed if allowed to cool) instead of turning the corner.

Thickness tapers are sometimes designed at the outer edges of asphalt concrete resurfacing which is adjacent to existing curbs to maintain gutter depth and still permit full resurfacing thickness as wide as possible.

It has been observed, over the years, that when the thickness tapers were constructed using the finishing machines, the surfaces adjacent to the curbs were usually smooth, free of distortions, and provided satisfactory drainage.

By comparison, the tapered surfaces which were constructed by hand methods or by using a wing plate attached to the finishing machine have many times resulted in gutter surfaces with minor distortions which detained the ready flow of water. Those distortions collected silt which caused the streets to be dusty during dry weather. Poor workmanship was not necessarily associated with the poor drainage.

The thickness tapered sections of surface layers shall be constructed with finishing machines whenever possible. The thickness tapers at the outer edges of the binder layers may be constructed by hand methods or a wing plate since they will be covered by the surface layers and will not affect the drainage.

Because of the peculiar dimensions and adjustments of the screed, it is not practical to use the finishing machine for constructing thickness tapers which are less than five feet in width.

In addition, for streets which are 24 feet or 26 feet wide, it is not practical to construct thickness tapers less than six feet in width with the finishing machine.

The Design Department is aware of the foregoing information, and when possible will design thickness tapers wide enough to be constructed with the finishing machine.

The inspection forces shall insure that finishing machines are used for constructing the tapers whenever the plans provide for sufficient width to do so.

EDGE ALIGNMENT AND GUIDELINE STRINGS

True edge alignment controls the correct lap at the longitudinal joint. If there is no lap, the joint will lack cohesion and raveling will occur. An excessive lap produces an objectionable wide scab of mixture on the surface next to the joint that has to be removed with hand tools to obtain an acceptable appearance. Excessive lap also tends to be associated with inadequate thickness at the joint which in turn results in inadequate compaction causing raveling.

An intended lap of one inch with a variance of one-half inch each way has been observed to produce correct longitudinal joint construction with minimum effort. If these close variances are to be maintained, each adjacent lane has to be constructed with true edge alignment.

One of the inspector's duties in obtaining true edge alignment is to make frequent measurements to insure that the guideline string has been correctly set and maintained. The nails used to secure the guideline string shall be at intervals close enough to eliminate chords on curves and other irregularities caused by wind, etc.

Guideline strings placed on all two-lane pavements except old concrete should be located by measuring from redhead nails which have been placed on the centerline by instrument parties. The spreading of the lower layer will cover the redheads. For succeeding layers, the guideline string should therefore be located by measuring from the exposed nails that were used to hold the string for the lower layers.

When resurfacing old concrete pavements that are only two lanes in width, the contractors have been permitted to locate the guideline strings on the shoulders along the outer edges.

This is done by measuring out from one of the pavement edges at intervals of approximately 500 feet, then tightening the string and using intermediate nails to secure the string. To insure that parallel alignment is used for the adjacent lane, the guideline string for that lane shall be located by measuring across the pavement from the nails used to secure the first line. To prepare a smooth location on the shoulder for the guideline string, the specifications require that the grass shall be closely mowed for a width of approximately 18 inches.

On curves for all surfaces, a sufficient number of nails shall be used to permit the finishing machine to follow the line exactly without producing objectionable chords on the curved edge alignment.

The finishing machine operator shall follow the guideline string exactly. If the machine goes off the line for any reason, it shall be adjusted back onto the line immediately. It is incorrect to smooth out the edge alignment by coming back onto the line gradually. This results in long stretches where incorrect lap at the longitudinal joint will occur.

Also when batch trucks bump the finishing machines off the line on curves, the movement is usually down the slope of the curve. If the machine is brought back on the line gradually, an objectionable, long, straight chord will result in what is supposed to be the curved edge alignment.

Irregular edge alignment due to any cause including adjustments of the finishing machine shall be corrected at once by hand tools. Sometimes the workmen are unable to make hand-work corrections in the edge alignment as rapidly as they occur. In such instances the inspector shall require the finishing machine to be stopped until the workmen catch up with making the corrections.

When constructing hand-worked areas such as driveway run-outs and bridge approach tapers, the edge alignment will usually become irregular during rolling because the small high and low spots in the hand-worked surface tend to extend in width unevenly. The edge alignment of hand-worked areas can be made true by first rolling the surface with a steel-tired roller and then immediately trimming the edge with hand tools while the mixture is still hot and workable.

When city streets or other multilane pavements are being surfaced, the guideline strings shall be inspected according to the procedure described under CITY STREETS in this handbook.

LONGITUDINAL JOINTS

To insure adequate compaction at the longitudinal joints, the inspectors shall require sufficient thickness to be spread to compensate completely for the reduction in the thickness that would normally occur during rolling. If there isn't enough thickness before rolling, the joint will usually be smooth in appearance, but it will lack cohesion because of inadequate compaction.

Better compaction can also be obtained along the joint if the edge of the lane being matched is vertical instead of sloping. However, asphalt highways are usually constructed under traffic that tends to round the exposed edge to a sloping shape. When this occurs (and it will usually occur) the inspector shall require the contractor to spray a tack coat along the sloping edge and the adjacent foot that will be covered when the mixture is spread.

Also, when an edge is left exposed for more than one day, tacking according to the foregoing shall be required.

Care shall be required to allow none of the tack coat to be sprayed on the surface of the lane being matched. Shields on the distributor spray bar, together with careful workmanship, will control this aspect.

If the overlap is maintained at approximately one inch and the thickness of the joint is correct, brooming or raking will not be necessary to obtain a smooth appearance. However, occasional corrections with hand tools are always necessary. When hand work is done, the inspectors shall not allow the excess material to be scattered out on the lane being constructed. Instead, it shall be picked up and wasted.

When automatic screed controls are used, the short joint matching shoe shall not be permitted except when spreading surface layers. When the lower layers are constructed, the specified 30-foot ski device shall be used for joint matching.

The short joint matching shoes produce joints with smoother appearances than the 30-foot ski devices. However, they do not contribute toward construction of a smoother riding full-width surface. The 30-foot ski device does.

Smooth longitudinal joints are very important for surface layers and the short joint matching shoes may be used when surface layers are spread.

Careful adherence to the inspection procedures described for edge alignment and guideline strings in this handbook will insure true edge alignment which is essential for the correct construction of longitudinal joints.

To insure correct construction of longitudinal joints when city streets or other multilane pavements are surfaced, the inspectors shall carefully enforce the surfacing procedures for CITY STREETS in this handbook.

AUTOMATIC SCREED CONTROLS

The specifications require automatic screed controls for most county, primary and interstate highway construction projects.

The machines with automatic controls which have been used in Iowa are made by the Iowa Manufacturing Company, the Barber-Greene Company, and the Blaw-Knox Company. The grade referencing ski devices for those machines are as follows:

The Iowa Manufacturing device consists of two sections of steel pipe laid end to end which are connected by two splice plates. By using four bolts in the splice plates the entire device can be made rigid. By using three bolts in the splice plates the device becomes hinged at the midpoint. A spring loaded taut wire is attached lengthwise to the device to indicate grade to the control sensor. The wire must be attached to the extreme ends of the device when it is hinged. When bolted rigid, the wire may be attached at the midpoints of each section.

The Barber-Greene device consists of a steel truss which may be operated by sliding along the base or it may be operated with wheels attached near each end. When the wheels are used, a taut string must be attached between the ends of the truss to indicate grade to the control sensor, because the truss tends to flex up and down when operated on wheels. When no wheels are used, the control sensor may rest directly on the truss.

The Blaw-Knox device consists of a beam supported on numerous ski-shaped feet attached in line along the beam. The feet are spring supported to permit free individual vertical movement. The control sensor rests directly on the beam.

For all layers requiring automatic controls except surface courses, the 30-foot long device must be used when matching longitudinal joints. A short shoe may be used for joint matching on all surface courses.

For resurfacing of old pavements, measurements shall be taken at representative locations to determine the average crown slope. If that average crown slope is satisfactory, the automatic controls should be set to produce that slope. All deviations in the old pavement from that slope will then result in thick or thin spots in the new surfacing.

A similar method shall be used on superelevated curves unless the plans indicate the use of wedge courses to produce a specified slope.

Occasionally long dips are encountered in the old pavement which are too long for the 30-foot ski to eliminate. Also some distortions in the old pavement are sometimes too deep for the automatic control's capacity to correct them completely.

In such cases, leveling courses should be constructed before placing the binder layer. It will sometimes be discovered after constructing the binder course that a leveling course should have been placed but was overlooked. In these instances, it is recommended that leveling courses should be constructed on top of the binder layer.

It is possible to adjust the distance between the ski device and the finishing machine. The contractor may be advised to select the most correct offset for the ski device which will avoid severe distortions such as channeled wheel paths, etc.

The inspector shall check to insure that a change in slope is dialed in the transitions between tangents and curves. At the same time the height of the sensor shall be adjusted to compensate for the change in the relative elevation of the ski device with relation to the elevation of the paving machine. When dialing slope changes, the numbers on the automatic control panels usually do not correspond exactly with the slopes being laid. A field calibration for correction is usually necessary. A slope board may be made with a 10-foot board, level and adjustable rod, to check the slope.

When malfunctions in the automatic controls occur, corrections shall be required immediately to the pavement which has been affected. The normal procedure is to stop the finishing machine, repair the automatic controls, shovel paths for the finishing machine tracks in the affected pavement, back the machine up to the properly paved portion and commence the paving operations at that point.

When malfunctions occur repeatedly, construction shall be stopped until steps have been taken to insure permanent repairs to the controls. The specifications allow the engineer to permit the completion of a day's work on manual controls when malfunctions occur. It is recommended that manual controls not be permitted unless the overall final riding quality is not affected by not using the automatic controls.

For the lower layer on resurfacing projects, the automatic controls should not be adjusted repeatedly based on tonnage yields taken at short intervals. The automatic controls should be allowed to correct for the irregularities in the underlying base without frequent adjustments. Accordingly the spread rate for individual truck loads will sometimes vary substantially from the plan rate because of the irregularities in the old base.

However, over longer distances (one half mile or more), taking both sides of the pavement into account, the inspectors should select a general spread rate that compares as closely as possible with the contract quantities.

OPERATION OF FINISHING MACHINES

The inspector shall require that the forward speed of a finishing machine be slowed until reasonably continuous operation is established. There should be no waiting between trucks unless breakdowns or other unavoidable stoppages occur.

Operation of the spreading screws which distribute the mixture in front of the screed affects the depth of the layer. Depth is slightly greater when they are operating. Consequently, a regular on/off operation of the spreading screws produces a slight rhythmic ripple in the pavement surface. The ripples can usually be noticed under lights at night or during a rainy day. They are directly associated with high roughometer readings.

To minimize rippling, the inspector shall require adjusting of the hopper gates downward until the screws are operating at least 80 percent of the time or more. This procedure is required only on binder and wearing courses (not bases.)

CONTROL OF SURFACE TEARING

When unsatisfactory screed results (tearing) are observed to continue for more than two or three hundred feet, construction shall be ordered to stop pending repairs or adjustments to the screed. If unsatisfactory screeding persists, the construction shall be ordered to stop until an authorized service repairman has repaired or adjusted the finishing machine.

Under no circumstances shall the work be permitted to continue beyond reasonable trial limits with poor screeding results occurring.

The contractor shall be required to make the necessary corrections with hand tools immediately to any pavement surface which has not been spread with satisfactory screeding results.

The contractor is responsible for making equipment and procedural adjustments to eliminate tearing. The inspector's assignment is to stop construction when tearing occurs. The following suggestions are listed for the contractor's consideration.

To eliminate tearing near the edges of the lane, less crown should be put into the leading edge of the screed. To eliminate tearing of the center portion of the lane, more crown should be put into the leading edge.

The use of silicone in the asphalt cement will sometimes eliminate surface tearing. If tearing persists, try the following:

> Dilute 2 ounces of a silicone-like DC-200 or SWS-101 in 2 gallons of kerosene or No. 1 diesel fuel. Then add this mixture to approximately a 10,000 gallon tank of asphalt. This is equivalent to about two parts per million content. Some contractors add this to the transport truck before it is pumped into storage tanks at the plant. This helps insure adequate mixing which, in turn, is associated with control of surface tearing.

Tearing has also been eliminated by increasing the mixing time.

If these suggestions do not solve the tearing, the construction should be stopped. Contact the district office and they are asked to call the central construction office. Do not permit the work to continue except on short trial sections until the problem has been solved.

CONTROL OF SEGREGATION

Segregation has caused serious cracking or raveling early in the life of some asphalt concrete pavements. To control it, the specifications have been written as follows: "The segregation shall be minimized to the extent that it cannot be visually observed in the rolled surface."

In order to insure uniform control of segregation when it occurs, the following procedures shall be enforced:

1. Insure that lack of mixing is not the cause. Lack of mixing gives a non-uniform condition and appearance that is similar to segregation.

(a) Check the mixing time according to the specifications. Do not permit construction to continue unless the mixing time conforms to the minimum specificied.

(b) The proper pugmill adjustment is essential to thorough mixing. If a segregation appearance persists, stop construction and do not permit it to start again until the pugmill has been checked and properly adjusted by an authorized service repairman.

2. When segregation persists, use a silicone-like DC-200 or SWS-101 in the asphalt cement according to the following proportion.

Dilute 2 ounces of silicone in 2 gallons of kerosene or No. 1 diesel fuel. Then add this mixture to a 10,000-gallon tank of asphalt.

This is equivalent to about two parts per million content. Some contractors add this to the transport truck before it is pumped into storage tanks at the plant.

Silicones will not prevent segregation itself. However, they will many times improve lack of mixing, especially if moisture in the mixture is causing the problem. This in turn will help control non-uniformity in appearance which sometimes looks similar to segregation.

3. Prevent coning in the truck during loading.

   (a) Do not permit the work to continue unless the pugmill hopper gate is properly repaired and has a quick opening and closing operation.

   (b) Require the truck to be moved between dumps from the pugmill.

4. Prevent segregation when unloading the trucks by requiring the truck boxes to be raised high enough to cause the mixture to slide out instead of flowing out of the truck.

5. Observe the effect of not cleaning the finishing machine hopper frequently. If an improvement is noticed, allow the corners to become filled with cooling mixture and then waste that material at the day's end.

RAKING AND HANDWORK

The contractor shall provide necessary hand tools and maintain them in good condition.

Specifications stipulate that kerosene, distillate, and fuel oil shall not be used aroung the finishing machine to clean tools. A pressure tank and burner have proven satisfactory for that purpose.

Another acceptable method is to equip each worker with a putty knife. Then he can keep his rake or shovel clean by scraping off the asphalt while it is still warm.

The inspector shall insure by visual inspection that all high and low spots are corrected whenever handwork is done. He shall insist that all coarse rock be removed from the handworked surface, and that all rake marks be smoothed with a lute or the back of a rake.

Handwork should be done with hot materials, clean tools, and techniques which prevent foot prints and other objectionable scars in the finished work.

TRANSVERSE JOINTS

The standard specifications require the use of a 10-foot straightedge for checking binder, surface and Type B base transverse joints for smoothness. The inspectors shall use the straightedge according to the following procedure.

Before the saw cut is made, the straightedge is used to determine where the full thickness of the layer ends and the tapered portion begins. The inspector shall require that the saw cut be located in the full thickness of the layer. All of the layer which extends beyond the saw cut, including the tapered portion, is then removed.

While the joint is being constructed and checked, the inspector shall require the finishing machine to be stopped approximately 30 to 50 feet from the joint and construction shall not be permitted to continue until the checking has been completed. The reason is to permit repaving of the joint, with the finishing machine, if the straightedge should indicate that a poor riding surface has been constructed.

The second check with the straightedge is made after the finishing machine has constructed the new layer, but before it has been compacted with the rollers. The straightedge is used to locate irregularities in the newly constructed layer and any irregularities which are found must be corrected by hand tools. When the straightedge indicates that there are no high or low spots, compaction should be permitted with the initial roller.

The third check with the straightedge is across the joint between the cold pavement and the hot mixture after it has been compacted with the initial roller. It is important to understand that this third check indicates whether the correct amount of material has been placed. For instance, if the freshly rolled layer is too high, it indicates that too much material has been placed. If the freshly rolled layer is too low, it indicates that not enough hot mixture has been placed.

For that reason high or low transverse joints are not usually corrected by additional rolling. Instead corrections should be made by cutting or filling the rolled surface while the mixture is still warm and can be manipulated. If there are unusually high or low areas after rolling, paths must be shoveled through the pavement for the finishing machine tracks. The finishing machine is then backed up to the joint and the paving operation commenced again.

The above procedure shall be repeated as necessary until the straightedge indicates that a good riding joint has been constructed. If repeated repaving operations cause the mixture to cool to the extent that its reuse becomes impractical, it should be shoveled aside and wasted.

When the straightedge indicates that a smooth riding joint has been constructed, the inspector should permit the finishing machine to proceed with the construction of the pavement.

The final procedure for insuring the proper construction of transverse joints is the checking for true edge alignment. The edge of the freshly rolled layer should be carefully trimmed by hand tools until it matches the alignment of the adjoining cold pavement.

DENSITY SAMPLING AND CONTROL

The specifications for asphalt concrete require each layer to be compacted to a quality index that is not less than a stipulated level. The quality index is calculated by using the formula included in the specifications. The formula is based on density percentages of samples taken from the pavement relative to densities obtained in the laboratory on the corresponding mixture.

The densities of the pavement are determined from samples cut by the contractor on the working day following construction.

The comparative laboratory density shall be determined for each day's construction from mixture samples taken as prescribed by the section on MIXTURE SAMPLING in this handbook. The inspection forces shall deliver each day's mixture samples to the district materials forces, who will perform the laboratory density tests. The materials forces will then communicate all of the tests results back to the inspection forces by telephone or by other prompt means, so that they may be used to calculate the comparative percentages. If more than one sample is used to determine laboratory densities for any day with the same mixture, an average of that day's laboratory densities shall be used.

In the event that a laboratory density is not available from the district materials office for a particular day's sample, the daily control shall be based on the laboratory density for the previous day's construction, using the same mixture.

The specifications, for most types of construction, stipulate the number of samples that shall be cut from a lot of construction. For surface courses that are designed one inch of less in thickness, each one-half day's construction is designated as a lot. For all other construction, each full day's construction is designated as a lot.

For tonnages per lot up to an amount designated in the specifications, five samples (no more or less) shall be taken.

The specifications also describe a statistical procedure for density sampling together with a formula and schedule for payment adjustments when non-compliance occurs. The inspection forces shall observe the following when using the statistical procedure.

The contractors are required to take the prescribed number of samples (five or seven), accompanied by the inspectors and at the locations selected by them. It will not be possible to determine the sample locations before spreading the mixture. Plastic or foil separators will therefore not be practical. This will sometimes involve difficulty in separating the sample from the underlying layer, especially when thin surfaces are involved. The contractors may have to remove full depth cores, take them to their shops, and saw off the samples. In hot summer weather it may be necessary to cool the cores in refrigerators before sawing them.

Each sample shall be inspected carefully before the inspectors test it. If damage is noticeable or if it is thinner than the specifications allow for density testing, it shall be discarded without testing and another taken to replace it.

If a test indicates that the density is less than the specified percentage, the sample shall be retested to insure its accuracy. However, after a sample is tested, resampling of individual locations shall not be done.

For resampling after the tests have been run, the entire lot shall be resampled (five or seven samples). In such cases, all of the tests of the original samples shall be disregarded. Instead, the tests of the last set of samples shall be considered as the controlling group.

When determining the sample locations within the areas designated by the specifications, a random system shall be employed. This may be accomplished by casting a die, by using a table of random numbers, or by drawing lots. If lots are used, each lot drawn shall be replaced each time before drawing again, to insure that the same relative location has a chance to be selected for each individual drawing.

The tests on density samples will give lower results if the samples are damaged during handling. The contractors and inspectors are therefore advised to use extreme care when taking cores, transporting and preparing them for testing.

Core bits should be kept sharp. Samples should not be pried loose from underlying layers. If a quick, hard knock won't break them loose, a core for the full depth should be removed and the sample sawed off with a masonry saw.

Samples should be transported on hard flat surfaces to avoid loss of density by distortion. If it is necessary to store the samples, it should be done in a cool place and on a hard flat surface.

If careful techniques are used and no samples are tested that have visible damage, the samples will give a reliable indication of the density of the pavement.

The specifications also require the contractors to take the density samples as promptly as practical. In enforcing this aspect of the specifications it will be considered reasonable for the inspectors to expect the contractors to obtain the samples not later than the working day following construction. If the contractors are unable to comply with this timing, the inspectors shall stop construction until they are able to do so.

The specifications permit rerolling when failing densities occur. Rerolling of sections with failing densities is normally initiated by the contractor. He is entitled to reroll a section have failing densities at least once. Rerolling should be started within the specified three working days limit, unless weather or other conditions prevent it. Rerolled sections shall also be sampled not later than the working day following the rerolling.

The foregoing is not intended to prohibit rerolling of any section more than once, provided that the resident construction or county engineer considers it reasonable for additional rerolling to be permitted.

No payment will be made for samples taken from the rerolled sections.

To eliminate the possibility of overlooking density failures, each lot failure shall be reported by the inspector to his engineer, and to the contractor, on the day that the tests are performed.

It is the contractors' responsibility to produce the minimum density by varying their procedures, etc., within the specification limitations. The inspection forces shall, therefore, not attempt to solve the density problems for the contractors. The contractors shall use their own initiative to control failing density results.

Although it is not the inspectors' duty to solve the contractors' density problems, the following is included to inform both the contractors and the inspection forces about some of the ways to improve compaction.

The first general procedure for increasing low densities is to insure that all the rollers are being used effectively.

Many times, increasing the weights of the rollers will be effective.

In addition to the above, the most common procedure for increasing low densities is more coverages with the pneumatic-tired rollers. This will usually necessitate using additional pneumatic-tired rollers.

A very important item for consideration includes checking to insure that the sampling and testing procedures are not in error.

Sometimes the pneumatic-tired rollers have been held back because of pickup on the tires. Although pickup is undesirable, it is not a specification violation and should not have priority over the minimum density requirement. Every known method should be used to prevent pickup, but sometimes it must be endured in order to compact the pavement while it is still hot to avoid failing densities.

To control pickup on the pneumatic roller tires, canvas or plywood covers around the wheels to prevent their cooling has been effective. Also using soap or detergent in the water that wets the tires (if water is used instead of rolling dry) will sometimes be helpful.

It is the responsibility of the district construction engineers on primary and interstate highway projects, and the district secondary engineers on secondary highway projects, to supervise, at the district level, the administration of the asphalt concrete density specifications. These engineers should take the necessary steps to insure that they are informed of density failures and should give personal attention to the more persistent or serious density problems.

If the normal remedial measures should fail to obtain the minimum density requirement, the district office should notify the central construction office immediately so that assistance can be given.

MIXTURE SAMPLING

Frequency

Not less than one sample of all mixtures per each 2,000 tons should be forwarded to the District Materials Office. If normal daily tonnages are less than 2,000 tons, it is also recommended that one sample of all mixtures be submitted each day. Densities will be determined on all samples submitted.

Sampling Hot-Mix Asphalt Concrete for Lab Tests

APPARATUS: template 8" wide, 8" long, 4" deep
scoop
putty knife
two-gallon cardboard box

SIZE OF SAMPLE: Approximately 45 to 50 pounds (larger samples permitted)

SAMPLING PROCEDURE: Lifts 3 inches or less in thickness

1. Sample shall always be taken behind laydown machine before the material receives any compaction.

2. Template shall be placed on the mat and forced straight down through the entire depth of the mat being laid. All material inside the template shall be scooped out and placed uniformly in the sample box. All the material which has stuck to both the inside and outside of the scoop shall be scraped off and added to the sample.

3. Samples shall be taken to represent a cross section of mat as follows:

   a. A minimum of 4 template samples shall be taken. One approximately 4 inches in from the outside edge of the mat, one approximately 12 inches right of the center of the screed, one approximately 12 inches left of center of the screed, and one approximately 4 inches in from the inside edge of the mat. If 6 template samples are needed to yield a 45-50 pound sample, an additional template sample shall be taken at each quarter point. If 8 or more template samples are needed to yield a 45-50 pound sample, 2 or more repetitions of 4 or 6 template samples may be required.

SAMPLING PROCEDURE: Lifts over 3 inches thick

1. Obtain sample in increments as outlined for lifts 3" or less in thickness. Template will not be required.

Precautions

1. Extreme care shall be taken to minimize segregation of coarse and fine particles while sample is being taken.

2. Extreme care shall be taken so as not to contaminate the sample with any foreign matter (fuel oil, dust, etc.).

INSPECTION FOR SATISFACTORY SMOOTHNESS

The specifications covering compaction of asphalt concrete are end result. They require the contractors to supervise all aspects of the rolling. They require the inspectors to use density tests to determine if the required compaction has been obtained and straightedge tests, together with visual observation, to determine if roller tire marks have been removed and the other requirements have been obtained.

The section of this handbook titled DENSITY SAMPLING AND CONTROL describes the inspection procedure for testing for density. To insure uniform practices, the following procedures shall be used by the inspectors when determining if satisfactory smoothness is being obtained.

The specifications describe the methods that shall be used to correct depressions and bumps that are outside the tolerance limits.

However, corrections for roller tire marks and other surface irregularities shall be made, if possible, before the mixture has cooled to ground temperature. A large percentage of the tire marks and other irregularities can be corrected by carefully manipulating the finish rollers, if such action is not delayed too long.

When the specifications require smoothness tests to be made for a particular layer, the correct inspection procedure is to assign a full-time inspector to operate the surface-checking straightedge immediately behind the finish rollers. Mixture buildup on the wheels of the surface checking straightedge should be regularly removed with a knife. The surface-checking straightedge should be placed where it will not be damaged when not in use.

The inspector operating the surface-checking straightedge shall take special care to continuously insure that all roller tire marks or roller wheel depressions are smoothed out during the finish rolling. He shall observe the longitudinal joints carefully to insure that they have been smoothly rolled as the specifications require.

If the surface is not being finished smoothly as the specifications require, the inspectors shall immediately stop construction until the contractor takes effective and satisfactory corrective action.

RECEIVING TICKETS

The paving inspector shall pick up and sign or initial each weight ticket representing a truck-load of hot mixture. The best procedure is to do each ticket as the truck unloads, if other duties permit. If inspection work elsewhere is necessary, a few tickets can accumulate.

Any waste occurring on the grade should be noted on the ticket and initialed by the grade foreman if possible. This information should also be given to the plant inspector to keep a record of waste for payment deduction; the contractor is not paid for wasted materials.

Tickets should have the contractor's name, county, project number, date, truck number, net weight, ticket number, and weighing inspectors initials. They should identify the type of material weighed.

ADJUSTING FIXTURES

The specifications require that manholes, water boxes, and other similar fixtures must be adjusted to the finished surface.

The adjustment shall be made before the final lift of asphalt concrete is placed but after all preceding lifts have been constructed adjacent to the fixture.

The fixtures are adjusted before the top layer is constructed to avoid the permanent bumps and blemishes which are associated with raising them afterwards.

REPORTS AND RECORDS

Required Reports

The paving inspector is not required to send any form reports to the central office. However, he is expected to advise the resident or county engineer of:

1) any test results (alignment, compaction, etc.) falling outside specifications.
2) corrective measures taken.
3) the reason for acceptance of materials and construction.

Forms Optional for Local Use

Form 52, Construction Quantities Asphalt Concrete Widening and Resurfacing, is prepared by the inspector on each project to provide information to the resident construction engineer for the preparation of estimates.

It is intended for resurfacing pavements both with or without widening. It is for field use only, and copies should not be sent to Ames. Copies should only be sent to the resident construction engineer and the District Office upon request.

Form 53, Construction Quantities Flexible Pavements, is intended for use on all flexible base and asphalt base or surface projects, both primary and secondary. It is prepared by the inspector on each project to provide information to the resident construction engineer (county engineer) for the preparation of estimates. It is for field use only, and copies should not be sent to Ames.

PLANT INSPECTION

Plant Inspection in General

Plant inspectors shall follow the inspection procedures described in the Asphalt Concrete Plant Inspection Manual that is issued by the Materials Department at Ames. The following shall also be followed.

The resident construction engineers and county engineers are responsible for the inspection at the asphalt plants. They are expected to recognize the importance of placing qualified personnel as plant inspectors.

They should assure themselves that the plant inspection personnel have been informed about their specific duties. This should include, but not be limited to, frequency of tests, information to be recorded, and samples to be submitted to the Ames and district laboratories.

The plant inspectors should be placed in charge of all the plant inspection. Their personal duties should include constant checks of the stockpile handling, equipment settings, mixture appearance, and supervision of the scale inspectors and assistant plant inspectors. The plant inspectors should be instructed to avoid spending prolonged periods in the laboratory trailer.

If at all possible, plant inspectors should be trained in the schools which are conducted by the Materials forces.

Assistant plant inspectors are usually assigned to perform the laboratory tests and other functions, to free the plant inspectors for the foregoing duties.

The district materials engineers will assist in training plant inspectors and will calibrate the plants. The are responsible for proportioning changes and will provide information to the county engineers and resident construction engineers accordingly.

The County or Highway Commission forces shall not take part in the management of the asphalt plants. The specifications require the contractors to be fully responsible for the compliance of the plants and the asphalt mixtures. Payment adjustments will normally be involved for noncompliance.

Highway Commission or county forces will perform calibrations, inspect the equipment and perform all of the tests required by the inspection policies. The inspectors shall also continuously determine as nearly as possible whether the plants are giving reliable performances.

If the plants become unreliable, the plant inspectors shall stop construction until corrective adjustments or repairs are made. If the performance continues to be unreliable, the inspectors shall stop construction while the contractors have a service repairman make the necessary repairs.

The service repairmen are paid for by the contractors and report to them. However, it is necessary for the service repairmen to visit with the plant inspectors before leaving the project and assure them that the plant has been repaired to a reliable condition. The inspectors may then permit construction to continue on a trial basis.

In no instance should the county or Highway Commission forces attempt to tell the contractor what repairs must be made.

Inspecting the Mixing Time of Asphalt Plants

The plant inspectors shall insure that the mixing time is inspected and enforced on continuous plants, as well as on batch plants.

The inspector's diary shall show when it is done and the calculations used. The inspection procedure is described in Materials IM 508 and should be followed carefully.

If the mixing time is found to be less than the specified minimum, the inspectors shall see that the contractor increases it to the specified amount. For working plants, it is done by decreasing of by increasing the pugmill contents.

The inspectors shall check the mixing time when work begins on the project and thereafter as they consider necessary to insure compliance.

Scale Inspectors and Weight Tickets

The scale inspectors shall be positioned near the contractor's scale operators so that they can closely observe the weighing.

The contractors shall write the scale tickets and present them individually to the scale inspectors for their signatures or initials before each truck leaves the plant.

The scale inspectors shall not write the scale tickets but shall initial or sign each one before the truck leaves the plant.

The procedure is required by Articles 2202.20 and 2303.19 of the 1972 Standard Specifications.

For some of the older batch plants where the controls are located on platforms on the plants, it will be necessary for the contractors to make special provision to provide reasonable space for the scale inspectors near the scale operators on the platforms. They will also have to arrange to have the tickets written and passed to the scale inspectors to be signed before each truck leaves the plant.

Checking of Scales Used for Determining Pay Quantities

State law and our specifications require that all products sold on a weight basis shall be weighed on scales calibrated and approved by the State Department of Agriculture.

Items such as crushed stone, base and subbase material and asphaltic concrete are contracted for by the ton and, therefore, require measurement on approved scales as mentioned above.

Because of the large number of temporary scale installations, it has been impossible for the Department of Agriculture to check all these scales without causing delays to the progress of the work.

To avoid delays and still comply with the spirit of the law, the following rules will be observed in connection with the use of portable truck scales:

1. The resident construction or county engineer will make sure the contractor, by letter, requests inspection by the State Department of Agriculture. The letter should indicate the location and type of scale, and the date when the scale will be ready for checking.

2. The resident construction or county engineer may permit the contractor to use the scale before calibration if he is satisfied with the scale installation and operation, and comparison of the scale with a currently certified scale proves the accuracy of the contractor's scale.

Such comparison should be with both a loaded and an empty truck, with a variation of not more than 100 pounds in either case.

3. Until the scale has been certified by the State Department of Agriculture, at least one loaded or unloaded truck comparison with a certified scale shall be made each operating day.

4. Scales used on projects involving more than 50,000 tons of material paid for by weight should be checked by a licensed commercial scale-servicing organization in the event the Department of Agriculture is unable to provide the service. While we will accept the results of a certified scale firm for operations, we should also check these results with a scale that has been certified by the Department of Agriculture. In this case a minimum comparison with one truck load each week should be made.

The following five numbered paragraphs apply to permanently installed scales as well as portable scales, whether calibrated and approved by the State Department of Agriculture or not.

5. Each scale shall be checked for sensitivity at least once each week of operation by carefully balancing the scale, then observing if movement of the equilibrium indicator is discernible upon application of a weight equal to two of the minimum graduations but not more than 20 pounds.

6. The working parts of scales (platform and beam linkage) shall operate freely to preserve this built-in accuracy and sensitivity. As a supplementary measure to No. 5 above, the following method of checking for free operation of the working parts should be used occasionally during the working day: with the scale balanced, place an additional weight (50 to 250 pounds) on the scales platform. An easily discernible movement of the scale pointer indicates satisfactory operation of the scale mechanism. Scale platforms should be kept clean to insure accuracy.

7. Each truck shall be tared daily. Taring of trucks should be on a random basis during the day's operation, using the previous day's tare weight until a new tare weight for the day is determined.

No truck may be used for hauling material paid for on a weight basis until tared.

8. All weight determinations (tare, gross load; comparative scale checks) involving pay quantities should be witnessed by the scale inspector or other representative of the resident or county engineer.

9. When using scales for determining pay quantities, the following records and documentation shall be kept for inclusion in the project files:

   a. Daily tare weights for each truck.
   b. Scale tickets for materials.
   c. Scale tickets for comparison checks.
   d. Documentation (in field book) of sensitivity checks. (No. 5 above)

All scale tickets shall be identified as to project and type of material and be initialed by both scale and grade inspectors.

APPENDIX

SAMPLE DIARY PAGES

For a complete listing of all of the recommended sample headings for the inspectors' diaries, refer to CONSTRUCTION RECORDS, dated March, 1973.

SAMPLE DIARY

1

6-2-68
THURSDAY

WARM
SHOWERS
80°

HOURS - 6:00 - 8:00 9:30 - 6:00
DELAYS - RAIN 8:00 - 9:30
WORK - PLACED BINDER ALL DAY

REMARKS - COMPLETE DAYS WORK SHOULD BE BRIEF. BUT COMPLETE SUCH AS TYPE OF WORK DONE, ANY EXTRA WORK DONE AND WHERE TO FIND INFORMATION ON THIS WORK. VISITORS TO PROJECT, AND THEIR COMMENTS, DISCUSSIONS WITH CONTRACTOR, AND ANYTHING THAT MIGHT SETTLE A DISPUTE AT A LATER TIME.

Figure 12 - Diary

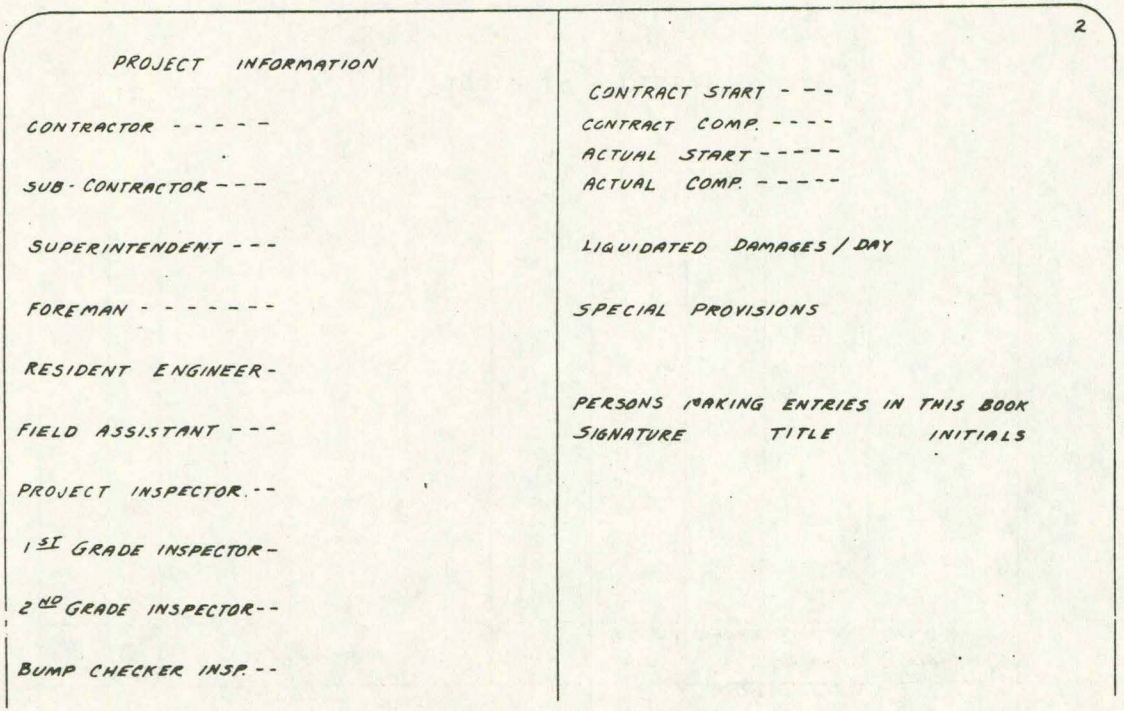


Figure 13 - Diary

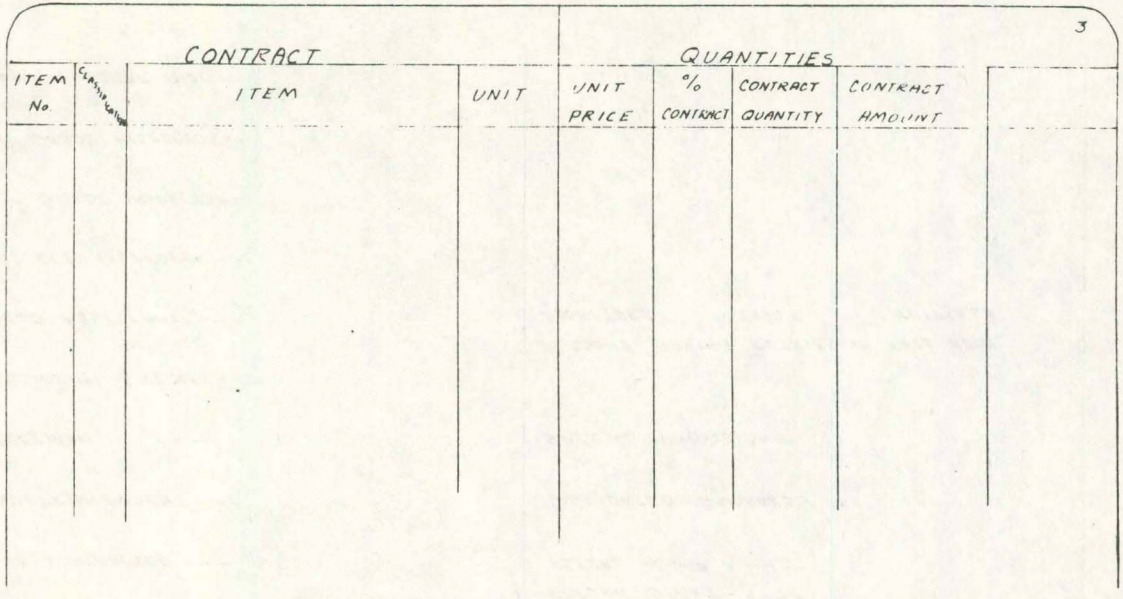


Figure 14 - Diary

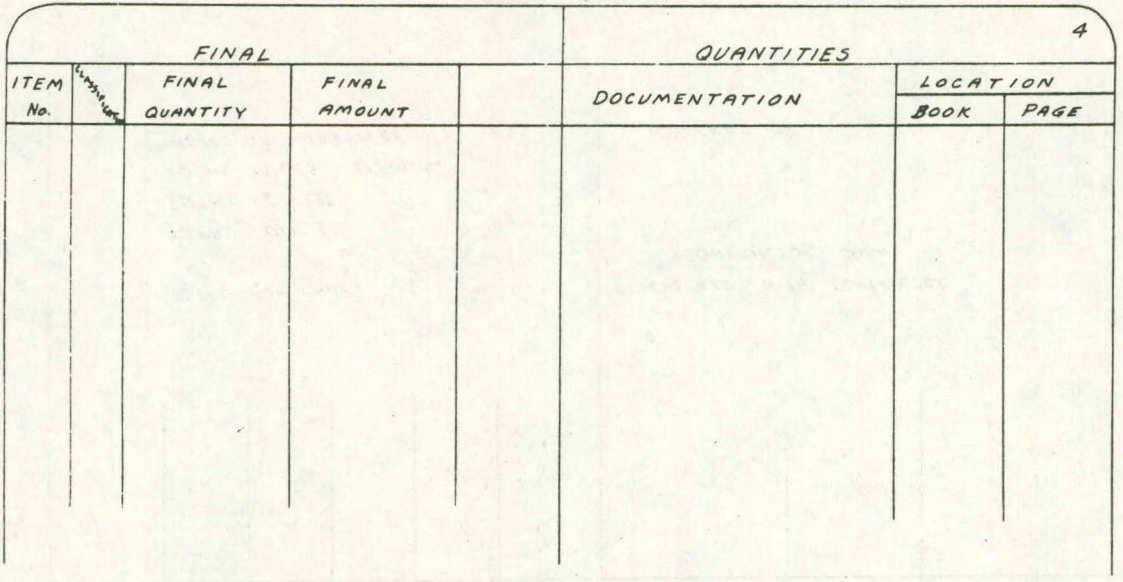


Figure 15 - Diary

CLEANING & PREPARATION OF OLD BASE

5

ART. PAGE

DATE	STATION		MEASURED		INSP. INITIALS	MEASURED BY	REMARKS	
	FROM	TO	LIN. FT.	MILES				

TOTAL FOR PAGE

TOTAL DIV. I

TOTAL DIV. II

TOTAL MILES ITEM No.

INSPECTOR SIGNATURE

CHECKED WITH CONTRACTOR

CONTRACTOR SIGN

CHECKED BY

Figure 16 - Diary

FULL DEPTH PATCHES ITEM 9 | ART. 6 PAGE

DATE PLACED	STA.	DIV. I & REF.	AVG. LENGTH	AVG. WIDTH	SQ FT.	SQ. YDS.	INIT.	TOTAL SQ. YDS.	DESCRIPTION OR SKETCH

TOTAL FOR PAGE

TOTAL DIV. I

TOTAL DIV. II

TOTAL ITEM 9 FOR PROJECT

INSPECTORS SIGNATURE

CHECKED WITH CONTRACTOR, _____ DATE

CHECKED BY _____

Figure 17 - Diary

7

ITEM 10 A.C. SURFACE PATCH ART. PAGE

DATE PLACED	DIV. I STATION FROM	DIV. I STATION TO	TICKET No.	LBS. WEIGHT	LBS. WASTE	LBS. USED	TONS USED	INSP. INITIALS	REMARKS

TOTAL FOR PAGE

TOTAL IN TONS

INSP. INITIALS

TOTAL DIV. I

TOTAL DIV. II

TOTAL ITEM 10 FOR PROJECT

CHECKED WITH CONTRACTOR. _____ DATE

CHECKED BY _____

Figure 18 - Diary

DIV. I

ITEM 11 PRIME OR TACK COAT BITUMEN

DATE	TIME	DISTRIBUTOR START	DISTRIBUTOR STOP	GALS.	TEMP.	CORR. FACTOR

TOTAL FOR PAGE

* TOTAL DIV. I
* TOTAL DIV. II
* TOTAL ITEM 11 FOR PROJECT
* NOTE - FINAL PAGE ONLY

B.

ART.

PAGE

GALS @ 60°	STATION START	STATION STOP	LIN. FT.	W_{IDTH}	SQ. YDS.	RATE	INSP. INITIALS

CHECKED WITH CONTRACTOR, _____

DATE

INSPECTORS SIGNATURE

CHECKED BY, _____

Figure 19 - Diary

ITEM 6 SAND COVER

DIV. I

ART PAGE 9

DATE	STATION FROM	STATION TO	LIN. FT.	WIDTH	SQ. YDS.	TICKET No.	LBS. WASTE	LBS. USED	RATE	INSP. INITIALS

TOTAL POUNDS FOR PAGE

TOTAL TONS FOR PAGE

NOTE: IF ONE TICKET IS USED IN MORE THAN ONE DIV. EXPLAIN ON BACK OF TICKET

TOTAL DIV. I

TOTAL DIV. II

TOTAL FOR PROJECT

TOTAL CHECKED WITH CONTRACTOR, _____ DATE

CHECKED BY _____

Figure 20 - Diary

10

ITEM 17 BASE ASPHALTIC TREATED DIV. I ART. PAGE

DATE	& REF	WIDTH	DEPTH	STATION FROM	STATION TO	LIN. FEET	TONS USED	TONS REQ'D	%	INSP. INITIALS	REMARKS
											ON INTERSTATE SHOW A.C. CONTENT AND LIFT No.

PAGE TOTAL

TOTAL DIV. I
TOTAL DIV. II
TOTAL ITEM 17 FOR PROJECT

INSPECTORS SIGNATURE

CHECKED WITH CONTRACTOR, _____
DATE

CHECKED BY, _____

Figure 21 - Diary

ITEM 20 TYPE 'A' LEVELING

11

ART. PAGE

DIV. I

DATE	STATION FROM	STATION TO	& REF.	WIDTH	AVG. DEPTH	LIN. FT.	PLAN TONS	ACTUAL TONS	%	INSP. INITIALS	REMARKS

TOTAL FOR PAGE

TOTAL DIV. I

TOTAL DIV. II

TOTAL ITEM *20 FOR PROJECT

INSPECTORS SIGNATURE

CHECKED WITH CONTRACTOR, _____

DATE

*NOTE - THESE HEADINGS MAY BE USED FOR STRENGTHENING

Figure 22 - Diary

12

TYPE "A" SURFACE ITEM 21 ART PAGE

DATE	℄ REF.	LIFT	WIDTH	DEPTH	STATION FROM	STATION TO	LIN. FT.	TONS USED	TONS REQ'D	TOTAL TO DATE	%	INSP. INITIALS	REMARKS

PAGE TOTAL

TOTAL DIV. I
TOTAL DIV. II
TOTAL ITEM 21 FOR PROJECT

INSPECTORS SIGNATURE

CHECKED WITH CONTRACTOR, _____
DATE

CHECKED BY, _____

*NOTE - THESE HEADINGS MAY BE USED FOR BINDER & WEDGE.

Figure 23 - Diary

13

ITEM 26 SHOULDERS GRANULAR SURFACING — ART. — PAGE

DIV. I

DATE	STATION FROM	STATION TO	& REF.	LIN. FT.	TONS USED	TONS REQ'D.	%	TOTAL TO DATE	INSP. INITIALS	REMARKS

PAGE TOTAL

TOTAL DIV. I

TOTAL DIV. II

TOTAL ITEM 26 FOR PROJECT

INSPECTORS SIGNATURE

CHECKED WITH CONTRACTOR, _____ DATE

CHECKED BY. _____

Figure 24 - Diary

15

% AIR VOIDS

DATE	STATION	% A.C.	COMB. SP.GR. AGG	SP. GR. A.C.	SP. GR. SLAB SAMPLE	% AIR % VOIDS	CHECKED BY	REMARKS

Figure 25 - Diary

DENSITY RECORD

16

DATE LAID	REF TO ℄	STATION	ORIGINAL DRY WT.	WT. IN H_2O	COURSE	DIFF.	FIELD DENS.			LAB. DENS.	% LAB. DENS.	THICK-NESS	INSP. INIT.

Figure 26 - Diary

17

CUT MAT SAMPLES

DATE LAID	DATE CUT	SIZE	COURSE	STATION	REF. TO ℄	CUT BY	RESULTS	REMARKS

MEASURED AS PER. ARTICLE
QUANTITIES IN FINAL BOOK

* NOTE: THIS PAGE NEEDED ONLY WHEN CONTRACTOR CUTS SAMPLES

Figure 27 - Diary

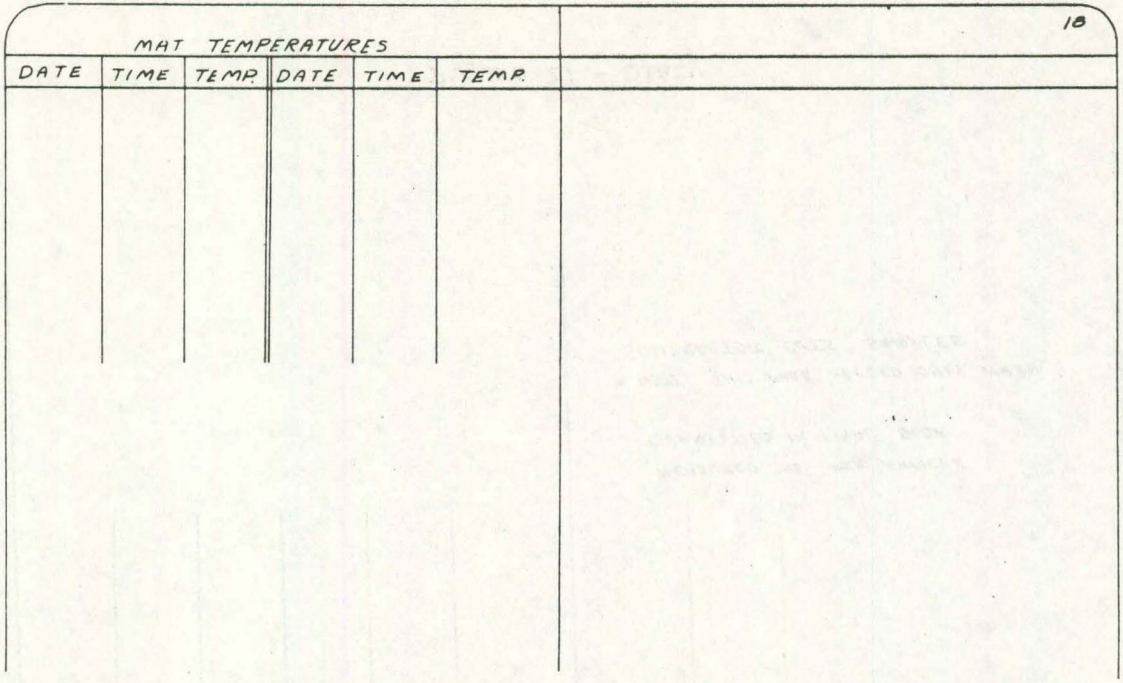


Figure 28 - Diary

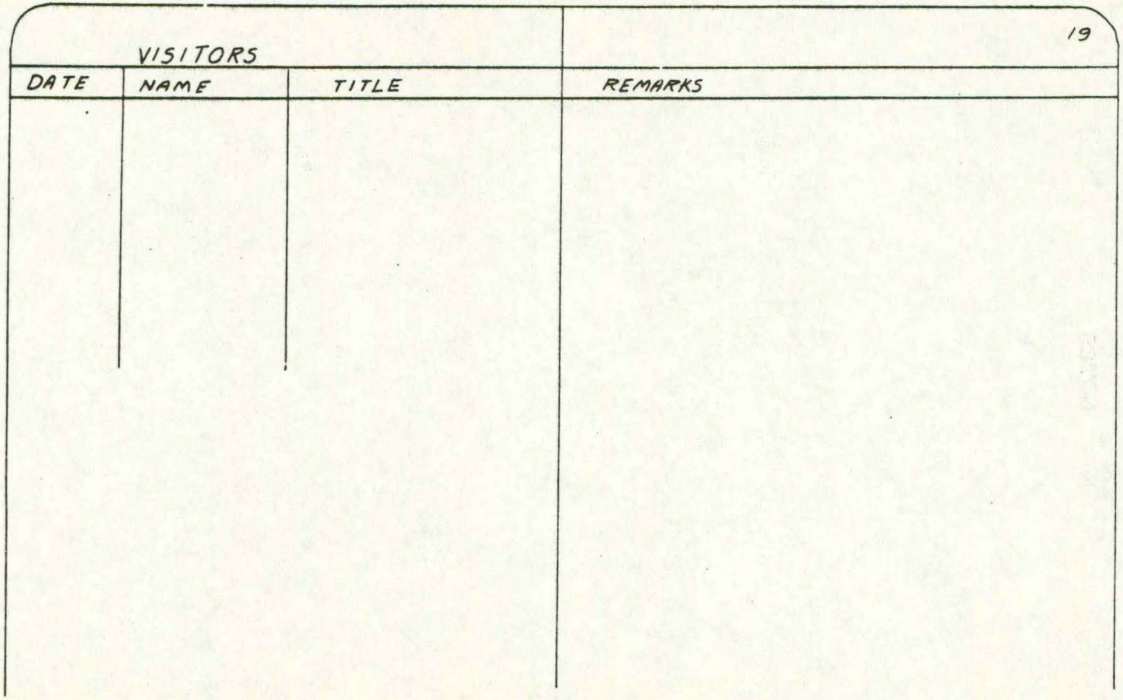


Figure 29 - Diary

NOTES