DIVISION 400 - PAVEMENTS

SECTION 401 -- PLANT MIX PAVEMENTS - GENERAL

Description

1.1 These specifications include general requirements that are applicable to all types of bituminous pavements of the plant mix type irrespective of gradation of aggregate, kind and amount of bituminous material, or pavement use. Deviations from these general requirements will be indicated in the specific requirements for each type.

1.2 These specifications provide for the use of reclaimed asphalt pavement material in certain specified mixtures.

1.3 This work shall consist of one or more courses of bituminous mixture constructed on the prepared foundation in accordance with these specifications and the specific requirements of the type under contract, and in reasonably close conformity with the lines, grades, thicknesses, and typical cross sections shown on the plan, within the tolerances specified, or established by the Engineer.

Materials

2.1 Aggregates shall be of uniform quality durable pebbles or fragments of rock, with or without sand or other inert finely divided mineral aggregate. All material shall be free from clay balls, organic matter, deleterious substances, and an excess of flat or elongated pieces as specified in AASHTO M 283 Section S6. Washing will not be required, except when aggregate plants do not produce clean material by the dry process method. In order to obtain uniformity as regards color and appearance of the pavement throughout the project, the aggregate for all the wearing course shall be obtained from the same material source. Sufficient material shall be on hand prior to starting daily operations to insure uninterrupted processing for the working day.

2.1.1 Coarse aggregate shall be crushed stone or crushed gravel and shall have a percentage of wear as determined by AASHTO T96 of not more than 45 percent unless otherwise specified by contract item. In each stockpile, not less than 50 percent by weight of the particles retained on the No. 4 sieve shall have at least one fractured face. Stockpiles consisting of a blend of crushed stone and crushed gravel will be permitted so long as the over-all consistency of the stockpile is reasonably maintained and the lesser portion of coarse aggregate material does not exceed ten percent of the total. This percentage shall be determined on the portion of the total sample that is retained on the No. 4 laboratory sieve, by weight.

2.1.1.1 Stockpiled coarse aggregate shall meet the requirements of Table 401-1.

Table 401-1 -- Percent Passing

Sieve Size	1-1/2 inch	3/4 inch	1/2 inch	3/8 inch
1-1/2 inch	100			
1-1/4 inch	90-100			
1 inch	50-85	100		
3/4 inch	10-50	90-100	100	
1/2		15-55	90-100	100
3/8			20-60	95-100
# 4				20-55
#10	0-5	0-5	0-10	0-10

2.1.2 Fine aggregate shall consist of sound durable particles of sand, crushed stone or a combination thereof. Fine aggregate shall be free from clay balls and injurious amounts of organic matter. Stone screening shall be produced from stone at least equal in quality to that specified for coarse aggregate. Fine aggregate may be 100 percent manufactured aggregate for base course and shall consist of at least 25 percent natural sand for wearing courses. If workability problems occur additional natural sand may be required. Fine aggregate stockpiles containing aggregate larger than 3/8 inches shall not be used.

2.1.3 Mineral filler shall conform to AASHTO M 17 Section 2.

2.1.4 Gradation. Coarse and fine aggregate shall each be of such gradation that when combined with other required aggregate fractions in proper proportion, the resultant mixture will meet the gradation required under the composition of mixture for the specific type under contract. (See Table 401-2). Not more than 10 percent of the fine aggregate blend shall pass the No. 200 sieve. Grading of mineral filler shall conform to the required grading of AASHTO M 17 except that 100 percent shall pass the No. 20 sieve, waiving the requirement for the No. 30 sieve.

2.2 Bituminous materials shall meet the requirements of AASHTO M 226 Table 2, as shown in 702, Table 702-1. The grade to be used shall be as ordered.

2.2.1 Approved sampling valves shall be installed in transport tank trucks to permit taking representative samples of the contents. The recommended location of the sampling valve is in the rear bulkhead of the tank, roughly 1/3 of the height above the bottom. The inlet pipe shall project into the contained liquid as shown in AASHTO T 40.

2.2.2 Asphalt cement furnished from Canada may be accepted based on the penetration grading. The grade shall be that approved by the Engineer.

2.3 Approval of materials. At least three working days in advance of the date of starting operations, representative samples of all materials proposed for use shall be submitted to the Engineer for test and for the preparation of trial mixes relating to the job mix formula. No material shall be used until it has been approved.

2.4 Composition of mixtures. The bituminous plant mix shall be composed of a mixture of aggregate, filler if required, and bituminous material. The several aggregate fractions shall be sized, uniformly graded, and combined in such proportions that the resulting mixture meets the grading requirements of the job mix formula.

2.4.1 Job mix. The general composition limits given in Table 401-2 indicates the master range of mixtures permissible under this specification. No work shall be started on a paving project until the Engineer approves a job mix formula appropriate to the raw materials and blends available to the specific project. The job mix formula shall lie within the master range indicated for the particular type of bituminous concrete. The job mix formula for each mixture shall establish a single percentage of aggregate passing each required sieve size, a single percentage of bituminous material to be added to the aggregate, and a single temperature at which the mixture is to be delivered at the point of discharge. This temperature is subject to change as ordered, depending upon the conditions of the day. Gradings which range from the maximum of one sieve to the minimum of the next will not be permitted. The job mix formula for each mixture shall be in effect until modified in writing by the Engineer. The Engineer may require the use of certain chemical additives.

2.4.1.1 After the job mix formula is established, all mixtures furnished for the project shall conform thereto, within the following ranges of tolerances:

Passing No. 4 and larger sieves	± 7 percent
Passing No. 10 to No. 80 sieves (inclusive)	± 4 percent
Passing No. 200 sieve	± 2 percent
Bitumen	± 0.4 percent
Temperature of mixture	± 20 degrees F

Wearing course mixtures made in the field laboratory with aggregates and asphalt cement combined in the proportions of the job mix formula shall yield a Marshall stability of not less than 750 pounds, a flow value between 8 and 16, and a void content of the compacted mixture between 2 and 6 percent. The Marshall values indicated shall be determined in accordance with AASHTO T 245.

2.4.1.2 Should a change in sources of material be made, a new job mix formula shall be established before the new material is used. When unsatisfactory results or other conditions make it necessary, the Engineer may establish a new job mix formula.

2.4.1.3 The quantity of asphalt cement is given in terms of percent by weight of the total mixture. The amount of asphalt required for a given mixture should be determined by appropriate laboratory testing or on the basis of past experience with similar mixtures, or by a combination of both.

2.5 Asphalt workability additive shall be a clear silicone liquid having a viscosity of approximately 1000 centipoises.

Table 401-2 -- Composition of Mixtures - Master Ranges [1]

	Base Course [2]									Wearing Courses								
	Type A: 1-1/4 in [4]			Type B: 3/4 in [4]			Type C: 1/2 in [4]			Type D: 3/4 in Single Course [4]			Type E: 1/2 in [4]			Type F: 3/8 in [4]		
	Percentage by Weight Passing - combined Aggregate																	
	Min	Desired	Max	Min	Desired	Max	Min	Desired	Max	Min	Desired	Max	Min	Desired	Max	Min	Desired	Max
1-1/4 in	95	100	100															
1 in	75	85	95															
3/4 in	62	72	84	95	100	100				95	100	100						
1/2 in	50	60	70	70	81	92	95	100	100	82	91	100	95	100	100			
3/8 in	42	50	60	60	71	80	65	75	85	68	79	90	85	90	95	95	100	100
No. 4	28	36	45	42	50	57	38	44	50	50	65	79	60	66	75	64	71	80
No. 10	18	23	27	289	32	38	28	32	36	36	51	67	38	46	50	44	50	55
No. 20	10	15	18	16	20	24	16	20	24				24	27	32	25	30	35
No. 40	5	10	13	9	13	17	9	13	17	17	30	44	14	19	23	15	20	25
No. 80	1	6	9	3	7	11	3	7	11	9	19	29	6	11	14	6	11	16
No. 200	0	2	4	0	3	4	0	3	4	3	5	8	2	3	6	2	4	6
Asphalt Cement: % of Mix[3]	3.8	4.3	4.8	4.8	5.3	6.0	5.0	5.4	5.8	5.5	6.0	6.5	6.0	6.4	7.0	6.3	6.5	7.0

(1) Gradings approaching the maximum amount permitted to pass the various sieves will result in pavement surfaces having comparatively fine texture, while gradings approaching the minimum amounts passing various sieves will result in surfaces with comparatively coarse textures.

(2) Alternate aggregate sizes are included to ensure that the coarse aggregate shall not be larger than one-half the thickness of the layer being placed.

(3) The asphalt content for the above mixture is based on the use of aggregate with a specific gravity of 2.65 to 2.70. The asphalt content will be adjusted when aggregate with a higher specific gravity is used.

(4) Reclaimed asphalt pavement (RAP) is permitted to be used in these courses.

2.6 Reclaimed Asphalt Pavement (RAP). Rap shall consist of asphalt pavement and shall be processed by crushing, cold milling or other approved sizing techniques approved by the Engineer to meet the required gradation specifications. The mixture of RAP, new aggregate and added asphalt cement shall meet the requirements specified in Table 401-2, Composition of Mixtures for aggregate gradation and asphalt cement content. The added asphalt cement may be AC 5, AC 10 or other asphalt cement grades as approved by the Engineer. The aggregate component of the RAP, shall meet the requirements of Section 401.2.1. The bitumen component of the RAP shall be asphalt cement and shall be free of significant contents of solvents, tars and other volatile organic compounds or contents of solvents, tars and other volatile organic compounds or foreign substances that will make the RAP unacceptable for recycling as determined by the Engineer. The blend percentage or RAP for a drum mixer shall not exceed 50 percent and for a batch plant shall not exceed 35 percent. RAP incorporated in wearing courses for both a drum mixer and a batch plant shall not exceed 15 percent. The Engineer will use one of the following procedures to approve the RAP quality.

(a) RAP obtained from a pavement, which was constructed with asphalt cement, and aggregates that meet the current requirements of Section 401.2.1, will be approved by the Engineer.

(b) If the source of the RAP or its quality is not known, the Contractor shall submit for approval to the Engineer at least 30 calendar days prior to the start of paving the following:

1. The designated use of the RAP and approximate proportions.
2. Representative samples and gradation and asphalt cement content test results of the RAP to be incorporated into the Recycled Mixture. Two samples shall be taken form each 1,000 tons or less of the stockpiled material.
3. Penetration, Kinematic Viscosity, and Visosity by Vacuum Capillary Viscometer test results of the recovered asphalt binder material. A minimum of one test for each 1,000 tons or less of the stockpiled material, certified by an independent laboratory.

2.7 Asphalt modifiers. Admixtures and additives may be approved by the Engineer.

Construction Requirements

3.1 Mixing Plants.

3.1.1 The site shall have ample storage space for the required separate bins, stalls, or stockpiles, to allow delivery of uncontaminated sized aggregates to the feeder. To prevent spillage from one pile or bin to the next, aggregate assigned to different stockpiles shall be separated by bulkheads or other satisfactory means, and buckets on equipment used to fill bins or stalls shall not be wider than the clear opening of the bin.

3.1.1.1 Course aggregates shall be furnished in at least two nominal sizes for mix types containing top size aggregates of one-half inch and above.

3.1.1.2 Stockpiles of coarse aggregate produced for use in drum mix plants having top size aggregates greater than three-fourths inch, shall be constructed in layers not to exceed four feet.

3.1.1.3 RAP shall be stockpiled on a free draining base separately from other aggregates. RAP from each pavement source shall be stockpiled with RAP materials having similar characteristics. RAP taken from Type A pavement courses shall be stockpiled separately. RAP shall be reclaimed from stockpiles without contamination by foreign materials.

3.1.1.4 RAP shall be fed into the plant by equipment specifically designed for recycling and shall be approved by the Engineer. In addition, all requirements pertaining to aggregates shall apply to RAP. Scalping screens, grizzlies or similar devices shall be installed on the RAP feed bin(s) to remove any debris or other foreign materials in excess of 4 inches. If a drum mix type plant is used, the RAP shall be fed into the drum so that it will not come in direct contact with the burner flame. Mixing of RAP with the new aggregate shall occur before the bituminous material introduction point. The final mix produced shall be visually free from any chunks of RAP

3.1.1.5 All blending of aggregates shall be accomplished through separate bins at the cold elevator feeders and not in stockpiles.

3.1.1.6 The plant shall be provided with a dust collector or collectors, designed to waste or return uniformly to the hot elevator, all or part of the material collected, as directed. All plants shall have adequate covers and housing as may be necessary to insure the proper collection of dust and the general cleanliness of the plant operation. The Contractor shall comply with all State and Federal environmental regulations.

3.1.1.7 Plants shall be approved prior to operations and shall be operated so as to assure an adequate supply of mixture to the project.

3.1.2 Storage of Bitumen.

3.1.2.1 Tanks for storage of bitumen shall be of minimum 10,000 gallon capacity and equipped for heating the material under effective and positive control at all times, to the temperature requirements set forth in the specifications for the paving mixture. Heating shall be accomplished by steam or oil coils, electricity, or other means such that no flame shall come in contact with the heating tank.

3.1.2.2 A complete system providing for continuous circulation of the bitumen between the storage tank and the proportioning units shall be employed. The discharge end of the circulating pipe shall be maintained below the surface of the bitumen in the storage tank to prevent discharging the hot bitumen into the open air.

3.1.2.3 The Contractor shall provide in the bitumen feed lines connecting the plant storage tanks to the bitumen weighting system or spray bar a sampling outlet consisting

of a valve installed in such a manner that samples may be withdrawn from the line slowly at any time during plant operation. The sampling outlet shall be installed between the pump and the return discharge line in such a location that it is readily accessible and free from obstruction. A drainage receptacle shall be provided for flushing the outlet prior to sampling.

3.1.3 Control of Bitumen.

3.1.3.1 Satisfactory means either by weighing or metering, shall be provided to obtain the proper amount of bituminous material in the mix within the tolerance specified. Means shall be provided for checking the quantity or rate of flow of bituminous material into the mixer as follows:

(a) Metering devices for bitumen shall indicate accurately to within 1.0 percent the amount of bitumen delivered. The section of the bitumen flow line between the charging valve and the spray bar shall be provided with a three-way valve and outlet whereby the quantity delivered by the meter may be checked by actual weight. The valve controlling the flow of bitumen to the mixer shall close tightly to prevent bitumen from leaking into the pug mill during the mixing cycle. The meter shall be constructed so that it may be locked at any dial setting to 0.1 gallon and will automatically reset to this reading after the addition of bitumen to each batch. The dial shall be in full view of the mixer operator. The size and spacing of the spray bar openings shall provide a uniform application of bitumen the full length of the mixer in a thin uniform sheet or in multiple sprays.

(b) If a bucket is used for weighing the bitumen, the bucket shall be of sufficient capacity to hold and weigh the amount required for a batch in a single weighing. The filling system and bucket shall be of such design, size, and shape that bitumen will not overflow, splash, or spill outside the confines of the bucket during filling and weighing, and it shall be so arranged as to deliver the bitumen in a thin uniform sheet or in multiple sprays over the full length of the mixer. The time required to add the bitumen shall be not more than 15 seconds.

(c) Bitumen scales shall conform to the requirements for aggregate scales as specified in 3.1.4.7. Beam type scales shall be equipped with a tare beam or adequate counter-balance for balancing the bucket and compensating periodically for the accumulation of bitumen on the bucket

3.1.3.2 Suitable means shall be provided, either by steam or oil jacketing or insulation, for maintaining the specified temperatures of the bitumen in the pipelines, meters, weigh buckets, spray bars, and other containers or flow line.

3.1.4 Batching Plants.

3.1.4.1 Feeders shall provide an accurate and positive means for uniform and continuous feeding of the mineral aggregate into the dryer. The feeder or feeders shall be capable of delivering the maximum number of aggregate sizes required in their proper proportion. They shall provide for adjustment of the cold feed and shall be capable of

being secured in any position. Feeders that surge or otherwise run intermittently will not be allowed.

3.1.4.2 Dryers shall continuously agitate the aggregate during the heating and drying process without leaving any visible unburned oily residue on the aggregate when it is discharged from the dryer. If unusually wet aggregate is being used, the input to the dryer shall be reduce to that amount which the dryer is capable of drying. Aggregates shall be free from coatings of dust after drying.

3.1.4.3 Plant screens shall be constructed and operated in such a manner that all aggregates will be uniformly separated into the sizes required for proportioning. They shall have sufficient capacity to furnish the necessary quantity of each aggregate size required for continuous operation. Screen cloth which has become broken or has worn sufficiently to affect the gradation shall be replaced.

3.1.4.4 Thermometric equipment shall be provided as follows:

(a) An armored thermometer of suitable range shall be fixed in the bitumen feed line at a suitable location near the discharge at the mixer unit.
(b) The plant shall be further equipped with an approved thermometer, pyrometer, or other approved thermometric instrument which shall continuously indicate the temperature of the heated aggregate at the discharge chute of the dryer.

3.1.4.5 Hot Bins shall consist of at least 4 separate aggregate compartments. One compartment shall be reserved for aggregate no larger than that passing a 5/32 inch square opening screen, and when required, one additional compartment shall be added for dry storage of mineral filler. Provision shall be made for accurate proportioning. When a compartment contains more than 15 percent undersized material, the compartment shall be drawn, and the cause of the contamination shall be corrected. Each compartment shall contain the following features:

(a) Sufficient volume to supply the mixer at full rated capacity.
(b) An overflow pipe that shall be of such size and at such a location as to prevent any backing up of material into other bins or into contact with the screen. Overflow apparatus shall be equipped with a telltale device that alerts the operator and the inspector when the overflow equipment is full.
(c) Adequate telltale devices to indicate the position of the aggregate in the bins at the lower quarter points.
(d) Gates which cut off quickly and completely, with no leakage.
(e) Adequate and convenient facilities including safe platforms for obtaining representative samples for each bin.

3.1.4.6 Weigh boxes shall be of sufficient size to hold the maximum required weight of aggregate for one batch without hand raking or running over. The weight box shall be supported on fulcrums and knife edges so constructed that they will remain in alignment or adjustment. All parts of the weigh box shall be free from contact with any supporting

rods, columns, or other equipment which will affect the proper functioning of the hopper or scale. Gates on both bins and weight hopper shall be constructed to prevent leakage when closed.

3.1.4.7 Aggregate scales for any weigh box or hopper shall be of standard make and design, accurate to 0.5 percent of the indicated load. The weight shall be indicated on a springless dial or digital display. Scales shall be substantially constructed and shall be installed in such a manner as to be free from vibration. The dial shall be of the compounding type and have a full set of pointers to indicate the job mix formula. All dials shall be located so as to be plainly visible to the operator at all times and shall be of such a size that the numerals can be read at a distance of 25 feet. When a digital display system is used, the display shall be in full view of the operator and the numerals shall be of such a size that they can be easily read by the inspector. If the digital display is so located that it is not easily accessible to the inspector, a duplicate display will be required for exclusive viewing by the inspector. The job mix formula target weights shall be part of the digital display continuously during plant operations. The digital scale weight indications shall be displayed adjacent (in juxtaposition) to each target weight for easy comparison to the job mix formula. It shall be the responsibility of the Contractor to arrange that all scales are tested and sealed according to provisions as shown in the National Bureau of Standards Handbook 44, at least on an annual basis. The work shall be accomplished by a competent commercial scale company prior to the start of the construction season. Scales shall be re-tested prior to use, after they have been moved. The Contractor shall have readily available at least ten standard 50 pound weights, for checking the scales during operations.

3.1.4.8 The batch mixer shall be of an approved pug mill type, hot oil or steam jacketed, or heated by other approved means and capable of producing uniform mixtures within the specified tolerances. The mixer shall have a batch capacity of not less than 2,000 pounds and be constructed so as to prevent leakage during the mixing cycle. The amount of material which may be mixed per batch shall not exceed the manufacturer's rated capacity. If the mixer will not mix properly at the rated capacity, or if its production does not coordinate with the other plant units, the Department reserves the right to reduce the size of the batch until the desired efficiency is obtained. The pug mill shall be equipped with a sufficient number of paddles operated at such speed as to produce a properly and uniformly mixed batch. if, in the course of mixing, two adjacent paddle tips become broken, immediate repair will be called for. If the paddle tips become broken at widely separated points, repair may be delayed until the end of the working day. The clearance of the tips from all fixed and moving parts shall not exceed 3/4 of an inch. Badly worn or defective tips shall not be used in mixing operations. The mixer shall be covered to prevent loss of fine material. The discharge gate shall be so designed that no uncoated material will be retained at the gate opening during the mixing operation. Leakage from the pug mill gate during operation will not be permitted.

3.1.4.9 Each plant shall be equipped with an accurate time lock to control the operations of a complete mixing cycle. A mixing cycle shall consist of two periods, the dry mixing period and the wet mixing period. The dry mixing period shall be the interval

of time between the opening of the aggregate weigh hopper gate and the start of the application of bitumen. The wet mixing period shall be the interval of time between the start of the application of bitumen and the opening of the mixer gate. The time lock shall be capable of being set at the intervals of five seconds or less throughout the mixing cycle and shall have a suitable case equipped with an approved lock. The setting of time intervals shall be performed in the presence and under the direction of the Engineer who may lock the case until such time as a change is to be made in timing periods. The time lock shall lock the bitumen bucket throughout the dry mixing period and shall lock the mixer gate throughout the dry and wet mixing period. Lights meeting the approval of the Engineer and visible from the ground, shall indicate when each portion of the mixing cycle is occurring.

3.1.4.10 The use of a fully automatic batching plant may be approved, provided the systems for automatic batching and proportioning of the various components of the bituminous mixtures meet the following requirements:

(a) The automatic proportioning controls shall include equipment for accurately proportioning batches of the various components of the mixture by weight in the specified sequence and for controlling and timing the mixing operation. Interlocks shall be provided which will delay, stop, or lock out the automatic batch cycling whenever the batched quantity of any component weight or the total batch is not within the specified weight tolerance, or when there is a malfunction in any portion of the control system. The automatic batching or proportioning controls shall be equipped with lights meeting the approval of the Engineer and visible from the ground and shall indicate when each portion of the mixing cycle is occurring.

(b) The automatic control for each batching scale system shall be equipped with a device for stopping the automatic cycle in the underweight check position and in the overweight check position for each material so that the tolerance setting may be checked.

(c) Each dial scale system shall be equipped with a removable dial puller which can be attached to the dial lever system so that the dial can be moved smoothly and slowly through its range to check the settings of the automatic control system. The plant operator shall perform this automatic control system checkout procedure periodically as requested by the Engineer.

(d) The weight batching controls shall meet the following tolerances for the various components weighed in each batch:

Component Weighed	Percentage of Total Batch Weight
Tare weight of aggregate weigh box	± 0.5
Tare weight of bitumen weigh box	± 0.1
Each aggregate component	± 1.5
Mineral filler	± 0.5
Asphalt	± 0.1

(e) The total weight of the batch shall not vary by more than +/- 2.0 percent of the designated batch weight.

(f) Recordation equipment shall be provided in all plants employing automatic proportioning. Each recorder shall include an automatic printer system. The printer shall produce, in digital form, a weight slip conforming to the requirement of 109.01 and 401.3.4.4.

(g) If at anytime the automatic proportioning or recording system becomes inoperative, the plant will be allowed to batch materials manually, but will be required to use the timing and time lock devices, for a period not to exceed two working days. Approval will be dependent upon the Contractor's furnishing an alternate satisfactory method of determining the total weight of material delivered to the project. Time extensions greater than two working days will require written permission.

3.1.4.11 The aggregate shall be dried and heated to a minimum temperature of 260 degrees F. The bitumen shall be heated to a temperature between 250 degrees F and 325 degrees F. Each size of hot aggregate, the mineral filler if required, and the bituminous cement shall be measured separately and accurately to the proportions in which they are to be mixed. The mixture shall be made by charging the mixer with the hot aggregate, coarse sizes first, unless otherwise directed, which shall be dry mixed for 5 to 15 seconds. The bitumen shall be added and the mixing shall continue until a uniform coating is obtained and all particles of the aggregate thoroughly coated. The total dry and wet cycle shall be not less than 35 seconds for base and binder mixtures and not less than 45 seconds for the wearing course. In no case shall the total mixing period exceed 75 seconds.

3.1.4.12 If the aggregate in the hot bins contains sufficient moisture to cause foaming in the mixture, such aggregate shall be removed from the bins and production rate shall be reduced so as not to exceed the capacity of the dryer. Material having once gone through the mixing plant shall not be returned to the stockpiles.

3.1.5 Drum Mix Plants.

3.1.5.1 The plant shall be specifically designed for the process and shall be capable of satisfactorily heating, drying, and uniformly mixing the bituminous material and aggregate in accordance with the job mix formula. The rate of flow through the drum shall be controlled in order that a homogeneous mixture is obtained with all particles uniformly coated. In no case shall the quantity of mix produced exceed the manufacturer's rated capacity. If the percent of moisture in the mixture exceeds 1.0 percent by weight, the right is reserved to decrease the rate of production. The plant shall be equipped with automatic burner controls.

3.1.5.2 The cold bins shall be divided in at least four compartments and shall be designed to prevent the overflow of material from one bin to another. When reclaimed pavement is used, an additional bin designed for this purpose will be required. Each cold bin shall be equipped with an orifice to feed the aggregate accurately and uniformly. The feeding orifice shall be adjustable and indicators shall be provided to show the gate opening. An automatic plant shutoff device shall be provided to operate when any aggregate bin becomes empty or the flow from any bin gate becomes restricted. A

vibrator or other suitable means may be required in order to insure a uniform flow of materials. The order of aggregate feed onto the composite cold feed belt shall be from coarse to fine. A scalping screen mounted independently of other proportioning or weighing equipment will be required.

3.1.5.3 The total cold aggregate feed shall be weighed continuously by an approved belt scale. The weighing system shall register within +/- 0.5 percent of the indicated load.

3.1.5.4 An automatic aggregate sampling device shall be provided which will divert representative samples of the full flow of aggregate from the total cold feed. The sampling device shall cut the full width and depth of the aggregate flow. The sampling point shall be after the aggregate has passed through the scalping screen and prior to entry into the drum.

3.1.5.5 Proportioning controls for aggregate and bitumen shall be located at the panel which also controls the mixture and the temperature. The panel shall be equipped with automatic controls that shall display, in digital form, the percentages of bitumen, mineral filler if required, and each aggregate in the job mix formula. The panel shall also be equipped to raise and lower the production rate without having to reset the individual controls for each change in production rate. The controls shall maintain an aggregate flow accuracy such that the total variation of all materials being drawn per interval of time shall not exceed an amount equal to 1.5 percent of the total weight of bituminous mixture per interval of time.

3.1.5.6 Provisions shall be made for introducing the moisture content of the total cold feed into the belt weighing system and correcting the wet aggregate weight to dry aggregate weight. The system shall be capable of adjusting the flow of bituminous material to compensate for any variation in the dry weight of the aggregate flow.

3.1.5.7 The dry weight of aggregate flow shall be displayed by automatic digital readout in intervals of weight and time.

3.1.5.8 When mineral filler is specified, a separate bin and feeder shall be provided with variable drive interlocked with the aggregate feeders. Mineral filler shall be introduce and uniformly dispersed into the mixture without loss to the dust collection system. A device shall be provided to indicate when the flow of filler into the delivery system stops or its specified volume is out of job mix tolerance. The rate of flow shall be accurate to within 0.5 percent by weight, of the total mix. Means shall be provided to readily divert the flow of mineral filler into a container for measurement.

3.1.5.9 The bitumen shall be introduce through a continuously registering cumulative indicating meter by a pump specifically designed for the plant. The meter shall be located in the asphalt line so that it will continuously register the asphalt discharge to the mixer and so that the discharge through the meter can be readily diverted into a suitable container for measurement by actual weight. The meter shall indicate accurately to within

1.0 percent the amount of bitumen being delivered. The accuracy of the pump and meter shall be verified at periodic intervals as designated by the Engineer.

3.1.5.10 Satisfactory means shall be provided to assure positive interlock between dry weight of aggregate flow and the flow of bituminous material through an approved meter.

3.1.5.11 The flow of bituminous material shall be displayed by automatic digital readouts in terms of volume or intervals of weight and time.

3.1.5.12 The plant shall have means of diverting mixes at start up and shut down or where mixing is not complete or uniform.

3.1.5.13 A surge or storage system complying with 3.3 shall be provided.

3.2 Mixing Temperature.

3.2.1 The Engineer may adjust the job-mix formula temperature within the limits of 260 degrees F and 350 degrees F according to the existing conditions. During hot weather, the temperature of the mixture when discharged, shall be as low as is consistent with proper mixing and placing. During cold weather, a temperature approaching the upper limit is desirable. Material with a temperature at discharge outside the job-mix formula tolerance may be rejected. In no case, will a mixture be accepted with a discharge temperature in excess of 375 degrees F.

3.3 Hot Storage System.

3.3.1 The hot storage system shall be capable of conveying the hot mix from the plant to insulated storage bins and storing the hot mix without appreciable loss in temperature, asphalt migration, segregation or oxidation.

3.3.2 The conveyor system may be a continuous type or skip bucket type. If the continuous type is used, it shall be enclosed to prevent a drop in mix temperature. If the skip bucket type is used, the bucket must be of sufficient capacity to transport an entire batch and mass dump in
to the bins.

3.3.3 The storage bins shall be designed in such a manner as to prevent segregation of the hot mix during discharge from the conveyor into the bins and shall be equipped with discharge gates that will not cause segregation of the hot mix while loading the mix onto the trucks. The storage bin heating system shall be capable of maintaining the mix temperature without localized heating (hot spots).

3.3.4 The bin shall be equipped with a light or indicator to show when the level of material reaches the top of the discharge cone. The bin shall not be emptied below the

top of the discharge cone until the use of the bin is completed each day. The material remaining in the discharge cone may be rejected if there is evidence of segregation.

3.3.5 Unless otherwise permitted, material placed in a surge bin or storage silo, must be used during the same working day. When such permission is given in an emergency, material remaining overnight, must be used within 24 hours of the time of mixing.

3.3.5.1 Extended storage silos designed for long term storage may receive prior approval for routine overnight storage provided that the mix is to be used on the following day. For this work, the Contractor must provide certified test results for each silo that the following acceptance criteria for mix quality are met. These test results and certifications must be obtained from an approved testing company and submitted to the Engineer. When an emergency arises such as an extended rainy period or equipment failure, the Engineer may grant additional storage time up to 72 hours provided that the bin has been certified for the extended period. When the extended period has been granted, the bin shall be sealed off from the entrance of air and shall not be opened for any reason until the project is ready for the entire contents of the bin. Violation of this provision will void the certificate and the contents of the bin will be rejected. The mixtures, after storage, shall meet the following criteria:

Test Property	Allowable Variation
1. Temperature	±20 degrees F from plant discharge temperature.
2. Asphalt Cement Recovered from Wearing Course Mixture	
a. Penetration at 77 degrees F	Loss not to exceed 50 percent of the penetration of the asphalt sampled from the plant prior to mixing at 290 degrees F.
b. Viscosity at 140 degrees F	Viscosity not to exceed four times the viscosity of the original asphalt sampled from the plant prior to mixing at 290 degrees F.

3.3.6 The storage time will be defined as the interval of time beginning with the introduction of the mixture into the bin to the time of the completion of discharge from the bin.

3.3.7 Approval for the use of storage bins may be withdrawn in the event there is an excessive amount of heat loss, segregation or oxidation of the hot mix due to the use of storage bins.

3.4 Weighing and Hauling.

3.4.1 Truck scales shall be provided for non-automated plants and storage without scales. These scales shall be tested and sealed according to provisions as shown in the

National Bureau of Standards Handbook 44 annually by a competent commercial scale company. Each truck shall be tared daily prior to the day's operations by a certified weigh master and shall be properly logged. The sealing of scales and provisions for random weighing of truck loads for all automated and non-automated plants shall be the responsibility of the Contractor. Portable scales shall be checked after moving and before being used.

3.4.2 The weight of each truckload of paving mixture as indicated by the truck scales, shall be within plus or minus 3 percent of the total weight of all batches in the load. Failure to maintain this standard of uniformity shall be sufficient cause for stopping plant operations until the cause of such disparity in weight is corrected.

3.4.2.1 The Contractor may provide an approved printer system which will print the weights of the material delivered. Such weights shall be evidenced by a weight slip for each load.

3.4.3 The Contractor may provide an approved automatic printer system which will print the weights of the material delivered, provided the system is used in conjunction with an approved automatic batching and mixing control system. Such weights shall be evidenced by a weight ticket for each load.

3.4.4 Weight slips shall include requirements as shown in 108.01 and the following. For batch plants with automatic proportioning equipment:

(a) Tare weight of aggregate weigh box.
(b) Tare weight of bitumen weigh box.
(c) Accumulative weights as batched for each aggregate (total of last aggregate will be aggregate total).
(d) Weight of bitumen.
(e) Accumulated total weight of batch.

3.4.5 Each weight slip will show a consecutive slip number and shall include accumulative total of material delivered for each day.

3.4.6 The mixture shall be transported from the paving plant to the project in trucks having tight, smooth metal beds previously cleaned of all foreign materials. Truck beds may be lined with a polyethylene type material designed and installed for hauling hot bituminous mixes. Each load shall be covered with canvas or other suitable material of sufficient size and thickness to retain heat and to protect it from weather conditions. The cover when new shall weigh a minimum of 18 oz/yd^2 and it shall be a tightly woven or solid material. The inside surfaces of vehicles may be lightly lubricated with a thin oil film or soap solution, but an excess of lubricant will not be permitted. When necessary, so that the mixture will be delivered on the project at the specified temperature, truck beds shall be insulated and covers shall be securely fastened. Equipment which leaks oil, diesel fuel, gasoline or any other substance detrimental to the pavement, will not be allowed on the project.

3.5 Placing.

3.5.1 Prior to placing of any mix, a Pre-paving conference shall be held to discuss and approve the paving schedule, source of mix, type and amount of equipment to be used, sequence of paving pattern, rate of mix supply, traffic control and general continuity of the operation. Special attention shall be made to the paving pattern sequence to minimize cold joints. The field supervisors of the above mentioned operations shall attend this meeting. All equipment used shall be approved on the project site prior to starting up each day.

3.5.1.1 The Contractor shall notify the Engineer at least three working days in advance of paving operations to allow sufficient time to schedule required site inspection and testing. All paving and compaction equipment shall be approved and on site prior to start up each day.

3.5.1.2 Crack sealing material to be covered by a 1" or less overlay shall cure a minimum of 45 days prior to the placement of bituminous pavement.

3.5.2 Weather Limitations. Mixtures shall be placed only when the underlying surface is dry, frost-free and the surface temperature is above 40 degrees F for courses greater than 1-1/4 inches in compacted depth and above 50 degrees F for courses less than 1-1/4 inches in compacted depth. The Engineer may permit, in case of sudden rain, the placing of mixture then in transit from the plant, if laid on a base, free from pools of water, provided motorist visibility is not impaired and all other specifications are met. No load shall be sent out so late in the day that spreading and compaction cannot be completed during daylight, unless night work is specified. If rapid surface cooling of the laid down mix is occurring due to wind, the Engineer may suspend operations for the day. Wearing courses shall not be scheduled for placement after October 1st of any year without written approval by the Engineer. If it is determined to be in the best interest of the City to schedule placement after October 1st, the above specified weather and surface conditions shall remain in effect.

3.5.2.1 In special instances, when the Engineer determines that it is in the best interest of the City, he may waive the requirements of 3.5.2.

3.5.2.2 Any material delivered to the spreader having a temperature lower than 250 degrees F, shall not be used.

3.5.3 At the beginning and end of the project or project section, the existing pavement shall be removed to a sufficient depth to allow the placing of the new pavement and construction of a transverse joint. The underlying course, shall be clean and free from foreign materials and loose bituminous patches and must present a dry, unyielding surface.

3.5.4 Sweeping. Existing pavement or previously laid courses shall be thoroughly dry and free from all dust, dirt and loose material. Sweeping with a power broom, supplemented by hand brooming, may be necessary.

3.5.5 Tack coat. Surfaces of any pavement course which have been exposed for a considerable length of time, when ordered, shall be covered by a tack coat of emulsified asphalt.

3.5.6 Drainage and utility structures within the limits of the pavement shall be set and raised in accordance with the provision of 604.3.4. Contact surfaces of the drainage and utility castings as ordered shall be painted with a thin coating of suitable bituminous material.

3.5.7 All courses shall be spread and finished to the required thickness by approved type, self-contained, self- propelled spreading and finishing machines (pavers). Pavers shall be provided with the adjustable, activated screed or strike-off assembly and shall be capable of spreading the mixtures with a finish that is smooth, true to the required cross-section, uniform in density and texture and free from hollows, tears, gouges, corrugations and other irregularities. Broadcasting behind the paver shall be held to a minimum. Pavers shall be capable of spreading and finishing courses of the required thicknesses and lane widths. Horizontally oscillating strike-off assemblies will not be approved. The Engineer may require the use of certain chemical additives to enhance workability.

3.5.7.1 The activated screed or strike-off assembly shall operate by cutting, crowding, vibrating or other practicable action without tearing, shoving or gouging the mixture. The activated portion of the screed shall extend the full width of the mixture being placed in the traveled way. Outside of the traveled way such as on shoulders, tapers, areas adjacent to curbs and at other locations as permitted, non-activated extensions to the screed will be allowed. The paver shall be equipped with a screed heater which shall be used when starting a cold machine and for maintaining a suitable screed temperature when needed.

3.5.7.2 The paver hopper gates shall be adjusted to pass the correct amount of mix to the spreading screws so that the screws will operate more or less continuously. The height of material shall be maintained at a constant level in front of the screed, to a point where approximately half of the auger shall be visible at all times.

3.5.7.3 Pavers shall be equipped with automatic screed controls with sensors for either or both sides of the paver:

1. 2-30' Ski type devices (Floating beams)
2. 2-Grade sensors
3. 2-Short skis (joint matchers)
4. Slope sensing control for transverse slope.

The sensors for either or both sides of the paver shall be capable of sensing grade from an outside reference line or from the surface using a ski type device and shall be capable of sensing transverse slope of the screed and providing automatic signals which operate the

screed to maintain the desired grad and transverse slope. Pavers shall not be used until the automatic controls have been checked and approved by the Engineer.

3.5.7.4 The use of automatic grade and slope controls shall be required on all pavers.

3.5.7.5 Whenever a breakdown or malfunction of the automatic controls occurs, the equipment may be operated manually or by other methods for the remainder of the normal working day on which the breakdown or malfunction occurred, provided this method of operation will produce results otherwise meeting specifications.

3.5.7.6 On projects or parts of projects where the Engineer deems that the use of automatic controls are impracticable, he may permit manual operation.

3.5.8 The forward speed of the paver shall be adjusted to the rate of the supply of materials so that the paver will be operated without having to make any but emergency stops. If the Engineer determines that the paving operations result in excessive stopping of the paver, he may suspend all paving operations until the Contractor makes arrangements to synchronize the rate of paving with the rate of delivery of materials.

3.5.9 When patching existing pavement, the material shall be placed on the prepared clean underlying surface at the locations designated and spread to produce a smooth and uniform patch. The patch material shall be thoroughly compacted and shall match the line and grade of the adjacent pavement.

3.5.10 Relatively small areas not accessible to the paver may be spread by hand, but extreme care shall be taken to create a surface texture similar to the machine work. Surface material shall be spread by lutes and not by rakes.

3.5.11 Unless otherwise authorized, the final wearing course shall not be placed until after guard rail posts have been set and general clean-up has been completed.

3.5.12 When hot bituminous bridge pavement is to be placed over barrier membrane, the placing temperature shall be as specified in 538.3.5. Unless otherwise permitted, the 1" base course shall be placed within five days after the membrane has been completed. A paver, mounted on rubber tracks or tires, shall be used to place the 1" base course unless this procedure is found to cause damage to the membrane. When such damage is found to be evident, the hand method may be allowed. The hand method may also be allowed if the Engineer determines that the use of a paver for this work is impractical. During warm weather, the above paving shall be done during the cool period of the day. A paver shall be used to place the wearing course.

3.5.13 Where pavement is placed adjacent to structural members such as expansion joints, the material in the top course shall be placed so that the compacted grade of the pavement is ¼ to ½ inches above the grade of the structural member.

3.6 Compaction.

3.6.1 Immediately after the bituminous mixture has been spread, struck off and the surface irregularities adjusted and it is in the proper condition, it shall be thoroughly and uniformly compacted by rolling. The initial rolling shall be done with a steel wheeled roller of either the static or vibratory type. If the initial rolling is done with a static roller, this operation shall be followed by the use of pneumatic tired roller and a 3-axle type steel wheel roller with center roll locked. If the initial rolling is done with a vibratory roller, the final rolling for this operation, shall be done with a static roller or a vibratory roller in the static mode. Rollers must be in good mechanical condition, free from excessive backlash, faulty steering mechanism or worn parts. The make and model number shall be properly marked on each roller.

3.6.2 Vibratory Rollers.

3.6.2.1 The Contractor may use dual vibratory steel drum rollers for all courses of hot bituminous pavement in excess of one inch of uncompacted depth. When dual vibratory steel drum rollers are used on uncompacted depths of one inch or less, or on previously compacted pavement, the roller shall be operated in the static mode. Only dual vibratory steel drum rollers appearing on the State of New Hampshire's approved Hot Bituminous Pavement Vibratory Compaction Equipment List, shall be permitted.

3.6.2.2 One dual vibratory steel drum roller shall be required for each paver for initial rolling. Asphalt pavers placing hot bituminous pavement, greater than sixteen feet in width, will require a second dual vibratory steel drum roller. An additional approved static steel wheel roller or rollers having a minimum weight of 8 tons, shall be required for finish or back rolling. If dual vibratory steel drum rollers are used for finish rolling, they shall be operated in a static mode.

3.6.2.3 Vibratory dual steel drum rollers shall be operated at uniform speeds not to exceed 2-1/2 MPH, 220 feet per minute. The minimum frequency for all dual vibratory steel drum rollers shall be 2200 V.P.M. If it can be demonstrated that a roller can accomplish a minimum of 10 impacts per liner foot at faster speeds, the Engineer may waive the maximum speed requirement. Roller overlaps shall be not more than 6 inches onto the previously compacted material.

3.6.3 Static Rollers.

3.6.3.1 All hot bituminous pavement courses may be initially rolled with an approved static steel wheeled roller, having a minimum weight of 8 tons. The roller shall overlap the previous roller pass by one half the width of the roll. If a static wheel roller is used for the initial rolling, a pneumatic tired roller shall be used for intermediate rolling and a three axle tandem roller shall be used for finish rolling.

3.6.3.2 Following the initial rolling, the courses shall be rolled with an approved pneumatic tired roller. This roller shall be self propelled and shall be equipped with smooth tires of equal size and diameter. The wheels shall be so spaced that one pass of a

2 axle roller, will accomplish one complete coverage. No overlap is required for pneumatic tired rollers. The wheels shall not wobble and they shall be equipped with pads which will keep the tires wet. The roller shall have an operating weight of not less than 2,000 pounds per wheel. All tires shall be maintained at a uniform pressure between 55 and 90 psi with 5 psi tolerance between tires. A suitable tire pressure gauge shall be readily available.

3.6.3.3 Following the intermediate rolling with a pneumatic tired roller, the courses shall be finish rolled with a three-axle tandem type roller having a locked center drum.

3.6.3.4 Static steel wheeled rollers shall move at a slow but uniform speed with the drive roll nearest the paver except on steep grades which may necessitate reversing this procedure. Rollers shall not operate at speeds in excess of 6 miles per hour, 528 feet per minute. When paving multiple lanes simultaneously, or when paving widths in excess of 16 feet, the Contractor shall furnish additional static steel wheeled and pneumatic-tired rollers as requested.

3.6.4 Control Strip.

3.6.4.1 When constructing the wearing course, a control strip shall be constructed at the beginning of the work for the purpose of establishing the correct rolling pattern that will achieve the required density. Each control strip shall be constructed to acceptable density and surface tolerances and shall remain in place to become portion of the completed roadway. Unacceptable control strips shall be corrected or removed and replaced at the Contractor's expense. A control strip shall be at least 100 linear feet in length and span the width of the freshly placed mat. The materials and the equipment used to construct the control strip, shall be the same as that to be used in the remainder of the course represented by the control strip.

3.6.4.2 Compaction of the control strip shall commence immediately after the course has been placed to the specified thickness. Compaction of the control strip shall continue until no discernable increase in density can be obtained by additional compactive effort. If the mean density following compaction is found to be less than 96 percent of the laboratory density or less than 92 percent of a maximum theoretical density for the material being used, the Engineer may order the construction of another control strip. The mean density shall be determined by averaging the results of 10 nuclear density tests taken at randomly selected sites within the test strip. A new control strip may be ordered by the Engineer or requested by the Contractor when a change in the material or job mix formula is made or if the Engineer has reason to believe that the material being placed, is not representative of the control strip.

3.6.4.3 A control strip will not be required if the total tonnage on the project is less than 500 tons.

3.6.5 Compaction Requirements.

3.6.5.1 Unless otherwise directed, rolling shall begin at the sides and proceed parallel to the road centerline, gradually progressing to the crown of the road. When paving in echelon or abutting a previously placed lane, the longitudinal joint shall be rolled first followed by the regular rolling procedure. On super-elevated curves, the rolling shall begin at the low side and progress to the high side by overlapping of passes parallel to the centerline. All turning of the roller shall be completed on a pavement which has had at least one roller pass. Base and binder courses shall be rolled until all roller marks are eliminated. The wearing course shall be rolled until all roller marks are eliminated and a minimum density of 95 percent of laboratory specimens prepared in accordance with AASHTO T 245 has been obtained.

3.6.5.2 Any displacement occurring as a result of reversing the direction of a roller or from other causes, shall be corrected at once by the use of lutes and addition of fresh mixture when required. Care shall be exercised in rolling not to displace the line and grade of the edges of the bituminous mixture.

3.6.5.3 To prevent adhesion of the mixture to the rollers, the wheels shall be kept properly moistened with water or water mixed with a very small quantities of detergent or other approved material. Excess liquid will not be permitted. All steel rollers shall be equipped with adjustable wheel scrapers.

3.6.5.4 Along forms, curbs, headers and similar structures and other places not accessible to a normal full- sized roller, sidewalk rollers weighing at least 2,000 pounds shall be used. Where rollers are impracticable, the mixture shall be thoroughly compacted with heated or lightly oiled tampers.

3.7 Joints.

3.7.1 The first lane placed shall be true to line and grade and shall be trimmed by hand to a stringline if necessary, to obtain a true longitudinal joint. Material not trimmed away shall be packed against the lane by means of lutes, leaving a uniform joint with a vertical or nearly vertical face. Outside joints in subsequent lanes shall be similarly trued as directed. Unless otherwise shown on the plans, the longitudinal wearing course joint shall be in the center of the pavement and joints of other courses, shall be offset approximately 6 inches.

3.7.2 The material being placed next to a previously placed lane shall be tightly crowded against the face of the abutting lane. The finishing machine shall be positioned so that in spreading, the material will overlap the edge of the first lane by 1 to 2 inches and shall be left sufficiently high to match the first laid lane after compaction. The overlapped material shall be crowded to the joint with a lute prior to rolling.

3.7.3 Placing of the course shall be as nearly continuous as possible keeping the number of transverse joints at a minimum while still being able to make a hot longitudinal joint.

3.7.4 If a bulkhead is not used to form the transverse joint, the previously laid material shall be cut back to the designed slope and grade of the course. The joint face shall be coated with approved bituminous material before the fresh mixture is placed against it. Extreme care shall be taken to insure that no unevenness occurs at the joint. If unsatisfactory riding qualities are obtained at the transverse joint in the wearing course, the joint shall be corrected by an approved method.

3.7.5 Contact surfaces of cold joints shall be painted with an approved bituminous material. This includes longitudinal, transverse and other joint faces that are ordered by the Engineer which are too cold for proper bonding.

3.8 Surface Tolerances.

3.8.1 The Contractor shall furnish and have available a 10 foot metal straightedge at the paver at all times during paving operations. All courses shall be tested with the straightedge laid parallel to the centerline and any variations from a true profile exceeding 3/16 of an inch, shall be satisfactorily eliminated. The finished surface of the pavement shall be uniform in appearance, free from irregularities in contour and shall present a smooth riding surface.

3.9 Replacement.

3.9.1 If any imperfect places are found in any course, the Contractor shall remove the unsatisfactory material and replace it with satisfactory material after coating the exposed edges with suitable bituminous material.

3.10 Application of Requirements.

3.10.1 Except as specifically noted, these construction requirements shall apply equally to all courses.

3.11 Finished Appearance.

3.11.1 Any bituminous material remaining on exposed surfaces of curbs, sidewalks or other masonry structures, shall be removed by sandblasting at the Contractor's expense.

Method of Measurement

4.1 Plant mix bituminous pavement will be measured by the ton to the nearest 0.1 of a ton, and in accordance with 108.01. Batch weights will be permitted as a method of measurement only when the provisions of 3.4.3 are met in which case, payment will be based on the cumulative weight of all the batches. The tonnage shall be the weight used in the accepted pavement and no deduction will be made for the weight of bituminous material or additives in the mixture.

4.1.1 Due to possible variations in the specific gravity of the aggregates and to possible field changes in areas to be paved, the tonnage used may vary from the proposal quantities and no adjustment in contract unit prices will be made because of such variation.

4.2 Bituminous concrete removed because of faulty workmanship or admixture of foreign materials, will not be included in the pay tonnage.

Basis of Payment

5.1 All work performed and measured as prescribed above will be paid for as provided in the respective sections for each type specified.

5.2 Tack coat material ordered under 3.5.5 will be subsidiary to the paving items.

5.3 Approved bituminous material ordered for the coating of contact surfaces and joints as specified will be subsidiary.

SECTION 403 -- HOT BITUMINOUS PAVEMENT

Description

1.1 This work shall consist of constructing one or more courses of bituminous pavement on a prepared base as shown or ordered. The methods may be classified as hand or machine.

1.1.1 Hand method shall include only the paving of raised islands, slopes, areas between rails at railroad crossings, existing sidewalks, drives, drive aprons control patch between granite curb and pavement, and paving of 50 tons or less added after the completion of paving operations.

1.1.2 Machine method shall include all paving not classified as hand method.

Materials

2.1 Materials and their use shall conform to the requirements of 401.2.

2.1.1 The required grading for base courses shall conform to 401, Table 2, Type B.

2.1.2 The required grading for wearing courses shall conform to 401, Table 2, Type F.

2.1.3 The required grading for single course pavement shall conform to 401, Table 2, single course, Type D.

Construction Requirements

3.1 Construction requirements shall be as prescribed in 401.3.

Method of Measurement

4.1 Hot bituminous pavement will be measured as prescribed in 401.4.

Basis of Payment

5.1 The accepted quantities of hot bituminous pavement will be paid for at the contract unit price per ton for the bituminous mixture, complete in place.

5.2 Single course pavement shall be paid under either machine or hand method as prescribed in 1.1.

Pay Items and Units:

403.11	Hot Bituminous Pavement, Machine Method	Ton

403.119	Hot Bituminous Pavement, Machine Method (Night)	Ton
403.12	Hot Bituminous Pavement, Hand Method	Ton
403.129	Hot Bituminous Pavement, Hand Method (Night)	Ton
403.21	Hot Bituminous Pavement, Aggregate 25 percent, Wear, Machine Method	Ton
403.22	Hot Bituminous Pavement, Aggregate 25 percent, Wear, Hand Method	Ton
403.51	Hot Bituminous Pavement, Aggregate 50 percent, Wear, Machine Method	Ton
403.52	Hot Bituminous Pavement, Aggregate 50 percent, Wear, Hand Method	Ton

SECTION 404 -- PAVEMENT RESTORATION

Description

1.1 This work shall consist of the permanent restoration of bituminous pavement and base materials removed to facilitate the construction of sewer, drainage and other underground facilities within the limits of existing roadways and easements.

1.2 This work shall also consist of the temporary restoration of bituminous pavement as designated on the plans or ordered.

Materials

2.1 Bituminous pavements shall conform to the requirements of Section 403. Base materials shall conform to the requirements of Section 304 Asphalt emulsion shall conform to RS-1 as specified in Section 702, Table 2.

Construction Requirements

3.1 The existing pavement shall be cut back from the top of the trench walls so that a minimum of 2 feet of new pavement will be placed over undisturbed material.

3.1.1 The pavement shall be cut to a neat line with a diamond saw or as approved by the Engineer.

3.1.2 Existing pavement and any temporary material shall be removed from within the limits of the final saw cuts.

3.2 Bituminous pavement shall be placed in accordance with the requirements of 401.3.

3.2.1 Bituminous pavement for permanent restoration shall be constructed to a depth equal of the thickness of the existing pavement (3 inches minimum). Where and overlay is proposed, bituminous pavement for permanent restoration shall be constructed to a depth equal to the total thickness of the existing pavement (4 inches minimum) with one inch of this thickness to be the wearing course.

3.2.1.1 The compacted base course shall be 1 inch less in thickness than the total thickness of the existing pavement (2 inches minimum).

3.2.1.2 The compacted wearing course shall be 1 inch in thickness.

3.2.1.3 The face of all joints shall be painted with asphalt emulsion immediately prior to placing the new pavement.

3.2.2 Bituminous pavement for temporary restoration shall be single course pavement, hand method, 1-1/2 inches in thickness and shall be constructed within the limits of the initial pavement cuts.

3.3 Aggregate base course materials shall be placed in accordance with the requirements of 304.3.

3.3.1 Base course materials shall consist of gravel and crushed gravel and shall be constructed for the full width of the trench to the undisturbed material.

3.3.1.1 The compacted depth of the gravel course shall be 12 inches.

3.3.1.2 The compacted depth of the crushed gravel course shall be 9 inches. When temporary pavement restoration is to be constructed, the compacted depth of the crushed gravel course shall be 10-1/2 inches.

3.3.1.3 In lieu of the 12 inch gravel course, a total depth of 18 inches of crushed gravel may be constructed, except that roadways typically having 9 inches of crushed gravel and 12 inches of gravel, must be restored in kind.

3.4 Pavement restoration shall be promptly completed and shall be maintained until the project has been accepted.

Method of Measurement

4.1 Unless otherwise shown on the plans or approved, the maximum allowable widths for computing pavement restoration for pipe construction shall be as follows:

For Trenches 0 to 10 Feet Deep:

—Pipe I.D.	Base Materials	Pavement
Up to 12 inches	6 feet	10 feet
12 inches-24 inches	7 feet	11 feet
Over 24 inches	8 feet	12 feet

For trenches over 10 feet deep, add 0.5 feet of width for each additional foot of depth.

4.2 Unless otherwise shown on the plans or approved, the maximum allowable diameters for computing pavement restoration for structures, shall be as follows:

For Excavations 0 to 10 Feet Deep:

—Structure I.D.	Base Materials	Pavement
4 feet	7 feet	11 feet
5 feet	8 feet	12 feet

6 feet	9.5 feet	13.5 feet
7 feet	10.5 feet	14.5 feet
8 feet	11.5 feet	15.5 feet

For excavations over 10 feet deep, add 1 foot to the diameter for each additional foot of depth.

4.3 Restored areas will be measured by the square yard of pavement to the nearest 0.1 of a square yard in accordance with 4.1 and 4.2.

Basis of Payment

5.1 The accepted quantities of pavement restoration will be paid for by the square yard.

Pay Items and Units:

404.1	Pavement Restoration	S.Y.

SECTION 410 -- BITUMINOUS SURFACE TREATMENT

Description

1.1 This work shall consist of preparing and applying one or more prime or seal coats of bituminous material to a gravel or stone course. This work shall also consist of a tack coat applied to a bituminous concrete surface or a portland cement concrete surface.

Materials

2.1 Bituminous material shall be the type and grade specified or ordered and shall conform to the requirements of AASHTO M 140 or M 208.

2.2 Blotter material shall be natural sand composed of hard, durable particles, free from loam showing uniform resistance to abrasion. Gradation shall conform to 520 Table 2.

Construction Requirements

3.1 Limitations. Bituminous material shall not be applied on a wet surface or when weather conditions would prevent the proper application and curing of the coat. The quantities, rate of application, temperatures and areas to be treated, shall be approved before application of bituminous material.

3.2 Equipment. Equipment required for this work shall be as follows:

(a) A distributor shall be so designed, equipped, maintained and operated such that bituminous material at even heat may be applied uniformly on variable widths of surface up to 24 feet, at readily determined and controlled rates from 0.02 to 2.0 gallons per square yard, with uniform pressure, and with an allowable variation from any specified rate not to exceed 0.02 gallons. Distributor equipment shall include a tachometer, pressure gages, accurate volume measuring devices or a calibrated tank, and a thermometer for measuring temperatures of tank contents. Distributors shall be equipped with a power unit for the pump and full circulation spray bars adjustable laterally and vertically. The spray bar shall contain spray nozzles providing a fan-shaped spray pattern adjusted so the vertical axis is perpendicular to the pavement surface. The spray pattern and spray bar height shall be adjusted to provide a uniform application of the tack coat without double coverage. The distributor shall be equipped with a mechanical device to adjust the spray height as material is discharged to keep a uniform height above the pavement for full coverage without overlapping. The distributor shall also be equipped with a hand-held spray attachment for applying the material to areas inaccessible to spray bars and to fill in irregular areas to provide full coverage. Approved sampling valves shall be installed in distributors and transport tank trucks to permit taking representative samples of the contents. The recommended location of the sampling valve is in the rear bulkhead of the tank, roughly one-third of the height above the bottom. The inlet pipe shall project into the contained liquid as shown in AASHTO T 40. At least one quart of

material shall be drained off through the sampling valve and discarded before the desired sample is taken. New sample containers will be furnished by the Engineer. To prevent the loss of solvents, containers shall be sealed with a tight fitting cover immediately after being filled.
(b) A rotary power broom for sweeping treated surface.
(c) A steel-wheeled roller.
(d) A self-propelled pneumatic-tired roller.
(e) A sand spreader capable of spreading blotter material in just sufficient quantity to prevent traffic pick- up of the applied bituminous material.
(f) A steel brush drag of an approved type.

3.3 Preparation of Surface to be Treated.

3.3.1 Prime Coat. The surface to be primed shall be shaped to the required grade and section, shall be free from all ruts, corrugations, segregated material or other irregularities and shall be uniformly compacted in accordance with 304.3.6.

3.3.1.1 Immediately before applying the prime coat, the surface shall be loosened slightly by dragging with a steel brush drag.

3.3.2 Tack Coat. The existing surface shall be patched and shall be free of irregularities to provide a reasonably smooth and uniform surface to receive the treatment. Unstable corrugated areas shall be removed and replaced with suitable patching materials. The edges of existing pavements which are to be adjacent to new pavement, shall be cleaned to permit the adhesion of bituminous materials.

3.4 Application of Bituminous Material.

3.4.1 Prime Coat. Bituminous material shall be applied to the width of the section to be primed by means of a pressure distributor in a uniform, continuous spread. When traffic is maintained not more than 1/2 of the width of the section shall be treated in one application. Care shall be taken that the application of bituminous material at junctions is not in excess of the specified amount. Excess material shall be squeegeed from the surface. Skipped areas or deficiencies shall be corrected.

3.4.1.1 When traffic is maintained, one-way traffic shall be permitted on the untreated portion of the roadbed. As soon as the bituminous material has been absorbed by the surface and will not pick up, traffic shall be transferred to the treated portion and the remaining width of the section shall be primed.

3.4.2 Tack Coat. Bituminous material shall be uniformly applied with an approved applicator. When ordered, a pressure distributor shall be used. The tack coat shall be applied to offer the least inconvenience to traffic and to permit one-way traffic without pickup or tracking of the bituminous material.

3.4.2.1 A tack coat shall be applied, prior to placement of pavement when the underlying pavement is weathered, has gon e through a winter, or is contaminated with any bond inhibiting material. The rate of application of emulsified asphalt shall be between 0.02 and 0.05 gal/sq. yd., as determined by the Engineer depending on the relative absorbence and texture of the pavement surface.

3.5 Application of Blotter Material. If after the application of the prime coat, the bituminous material fails to penetrate within the time specified and the roadway must be used by traffic, blotter material shall be spread in the amounts required to absorb excess bituminous material. Care shall be taken not to cover a 6 inch strip next to the centerline of the road until the untreated area has received the first application of bituminous material.

3.5.1 When the entire width of the surface has been treated with bituminous and blotter material, it shall be dragged with a steel brush drag. The surface shall be brushed only the amount necessary to distribute the blotter material uniformly.

3.5.2 When ordered, the entire treated surface shall be rolled until the materials are thoroughly bonded.

3.5.3 Sufficient extra blotter material shall be applied whenever necessary to prevent traffic and the roller from picking up the bituminous material.

3.5.4 Additional brush dragging may be required to keep the blotter material uniformly distributed until the bituminous material is thoroughly cured.

3.5.5 The primed surface shall be kept in repair. All holes ravels and deficient areas shall be patched and repaired with bituminous treated materials as approved.

3.5.6 When the bituminous material is thoroughly cured, blotter material remaining on the treated area shall be removed by sweeping with an approved power broom. This operation must be accomplished before subsequent application of any seal coat.

3.6 Seal Coat.

3.6.1 When directed, a seal coat shall be applied at the gallon rate per square yard specified on the plans or ordered, and by the same method as the prime coat.

3.6.2 Blotter material at the rate ordered shall be applied before the bitumen has set; the entire treated surface shall be dragged, rolled and maintained and the remaining blotter material shall be removed all by the same methods as specified for the prime coat.

3.7 Finished Appearance.

3.7.1 Any bituminous material splashed or sprayed onto exposed surfaces of curbs, sidewalks or other masonry structures shall be removed by sandblasting at the Contractor's expense.

Method of Measurement

4.1 Bituminous material will be measured by the ton or gallon, and in accordance with 109.01 Measurements by the ton will be made to the nearest 0.1 of a ton.

4.2 Blotter material furnished will be subsidiary.

Basis of Payment

5.1 The accepted quantities of bituminous surface treatment will be paid for at the contract price per ton or gallon for bituminous material complete in place.

5.2 Payment for patching existing pavements under 3.3.2 will be made at the contract unit price for 403. or 411.1 as ordered.

Pay items and units:

410.21	Emulsified Asphalt for Tack Coat	Ton
410.22	Emulsified Asphalt for Tack Coat	Pound
410.31	Asphalt Surface Treatment Including Blotter Material	Ton
410.41	Emulsified Surface Treatment Including Blotter Material	Ton

SECTION 411 -- PLANT MIX SURFACE TREATMENT

Description

1.1 This work shall consist of a leveling course when ordered and one or more courses of bituminous mixture constructed on an existing pavement.

Mixture

2.1 Materials and their use shall conform to the requirements of 401.2 as amended below:

2.1.1 Bituminous materials for mixtures shall be asphalt cement or asphalt emulsion as specified. Unless otherwise ordered, the grade shall be as specified below:

2.1.1.1 Asphalt cement shall be AC-10 and conform to the requirements of 702, Table 1.

2.1.1.2 Asphalt emulsion shall be HFMS-2 and conform to the requirements of 702, Table 2.

2.1.2 Unless otherwise directed the composition of the mixtures shall fall within the limits of the master ranges set forth in Table 401-1 or Table 401-2 as appropriate.

Table 401-1 - Composition of Mixture -- Master Ranges
Leveling Course

Sieve Size	Percentage by Weight Passing		
	Min.	Desired	Max.
3/8 in	95	100	100
No. 4	75	80	100
No. 10	55	60	65
No. 20	30	40	50
No. 40	14	20	26
No. 80	6	10	14
No. 200	2	4	6
Asphalt Cement: percentage of Total Mix	6.25	6.7	7.25

Table 401-2 - Composition of Mixture -- Master Ranges
Plant Mixed Surface Treatment

	Using Asphalt Cement						Using Emulsion		
	3/8 Inch Course			5/8 Inch Course			5/8 Inch Course		
Sieve Size	Percentage by Weight Passing								
	Min.	Desired	Max.	Min.	Desired	Max.	Min.	Desired	Max.
3/8 in	---	---	---	---	100	---	---	100	---
No. 4	---	100	---	85	92	100	85	92	100
No. 10	72	82	92	65	75	85	65	75	85
No. 20	43	54	65	40	50	60	38	49	60
No. 40	23	33	43	20	30	40	16	26	36
No. 80	9	14	21	8	12	20	4	8	12
No. 200	2	4	6	2	4	6	0	2	3
	Percentage of Total Mix								
	Min.	Desired	Max.	Min.	Desired	Max.	Min.	Desired	Max.
Asphalt Cement or	---	---	---	6.5	7.0	7.5	---	---	---
Asphalt Cutback	6.5	7.0	7.5	6.5	7.0	7.5	---	---	---
Asphalt Emulsion	---	---	---	---	---	---	8.0	9.0	10.0
(Bitumen by Extraction)	---	---	---	---	---	---	5.4	6.1	6.8

2.1.3 When permitted, asphalt cement may be substituted for asphalt emulsion.

2.1.4 Blotter materials shall be sand conforming to the requirements of Table 401-3.

Table 401-3 -- Blotter Material

Sieve Size	Percent by Weight Passing
No. 4	100
No. 10	70 - 92
No. 200	0 - 6

Construction Requirements

3.1 Mixing plants shall be as prescribed in 401.3.1 except that the second sentence of 401.3.1.4.5 will not apply for plants producing plant mix surface treatment. A 3/16 inch screen will be required in preparing the aggregate for the 3/8 inch course. However, the Engineer may waive this requirement when small quantities are involved.

3.2 Mixing and storage shall conform to 401.3.1.4.11, 401.3.2 and 401.3.3 with the following modifications.

3.2.1 The temperature of the asphalt emulsion shall be 120-160 degrees F. The temperature of the mixture in the truck shall be 210-230 degrees F.

3.2.2 If the aggregate contains sufficient moisture to cause foaming in the mixture, it shall be removed from the bins. The quantity of cold aggregate fed to the dryer shall be governed by the ability of the dryer to completely remove the moisture from the aggregate, as determined by the Engineer.

3.3 Weighing and hauling shall conform to 401.3.4.

3.4 Placing shall conform to 401.3.5 with the following modifications:

3.4.1 The existing pavement shall be thoroughly dry, and free from all dust, dirt, and loose material. Sweeping with a power broom supplemented by hand brooming may be required.

3.4.2 When ordered, the existing pavement shall be treated as prescribed in 410.3.3.

3.4.3 A leveling course of hot bituminous concrete may be ordered to prepare the pavement for the finish course.

3.4.4 Any material delivered to the spreader having a temperature lower than 200 degrees F for emulsion mixture or 250 degrees F for asphalt cement mixture shall not be used.

3.4.5 In those areas where the edges of the pavement are adjacent to paved or bituminous treated shoulders, the asphalt paving machine shall be equipped to produce a feathered edge, parallel to the direction of traffic, and a uniform longitudinal line shall be maintained at the outer edge of the applied pavement.

3.4.6 All bridges included within the limits of the work shall be treated curb to curb.

3.5 Compaction shall conform to 401.3.6 with the following modifications.

3.5.1 If necessary to prevent traffic pickup of the mixture, the surface of the work shall be given a light dusting of blotter material just prior to rolling with pneumatic-tired roller. The surface shall be maintained thereafter by occasional back sanding and rolling as directed.

3.5.2 When more than 125 tons of mixture is being placed per hour, and additional steel-wheeled roller will be required.

3.5.3 The use of a three-axle roller for final rolling will not be required.

3.5.4 Excess of blotter material remaining on the pavement and on paved shoulders shall be removed prior to acceptance of the project.

3.5.5 After rolling has been completed, the edges of the pavement shall be trimmed as directed to secure a uniform line.

3.6 Surface tolerances specified in 401.3.8 will not apply to plant mix surface treatment.

Method of Measurement

4.1 Plant mix surface treatment will be measured as prescribed in 401.4.

4.2 Blotter material used on plant mix surface treatment will be subsidiary.

Basis of Payment

5.1 The accepted quantities of leveling course and plant mix surface treatment will be paid for at the contract unit price per ton complete in place. Material ordered under 3.4.2 will be paid for under 410.

Pay Items and Units:

411.1	Hot Bituminous Concrete Leveling Course	Ton
411.19	Hot Bituminous Concrete Leveling Course (Night)	Ton
411.35	Plant Mix Surface Treatment (Emulsion), 5/8 inch	Ton
411.43	Plant Mix Surface Treatment (Asphalt Cement), 3/8 inch	Ton
411.44	Plant Mix Surface Treatment (Asphalt Cement), 1/2 inch	Ton
411.45	Plant Mix Surface Treatment (Asphalt Cement), 5/8 inch	Ton
411.46	Plant Mix Surface Treatment (Asphalt Cement), 3/4 inch	Ton

Table 411-2 - Composition of Mixture -- Master Ranges
Plant Mixed Surface Treatment

	Using Asphalt Cement						Using Emulsion		
	3/8 Inch Course			5/8 Inch Course			5/8 Inch Course		
Sieve Size	Percentage by Weight Passing								
	Min.	Desired	Max.	Min.	Desired	Max.	Min.	Desired	Max.
3/8 in	---	---	---	---	100	---	---	100	---
No. 4	---	100	---	85	92	100	85	92	100
No. 10	72	82	92	65	75	85	65	75	85
No. 20	43	54	65	40	50	60	38	49	60
No. 40	23	33	43	20	30	40	16	26	36
No. 80	9	14	21	8	12	20	4	8	12
No. 200	2	4	6	2	4	6	0	2	3
	Percentage of Total Mix								
	Min.	Desired	Max.	Min.	Desired	Max.	Min.	Desired	Max.
Asphalt Cement or	---	---	---	6.5	7.0	7.5	---	---	---
Asphalt Cutback	6.5	7.0	7.5	6.5	7.0	7.5	---	---	---
Asphalt Emulsion	---	---	---	---	---	---	8.0	9.0	10.0
(Bitumen by Extraction)	---	---	---	---	---	---	5.4	6.1	6.8

SECTION 413 --HOT-POURED CRACK SEALANT

Description

1.1 This work shall consist of furnishing labor, equipment and materials necessary for the performance of all operations including re-shaping, cleaning, filling and sealing of random cracks in bituminous concrete pavements, vegetation removed and sterilization of cracks where necessary at locations specified and/or as directed by the Engineer.

Materials

2.1 Crack sealer shall be an asphalt fiber-compound designed especially for improving strength and performance of the parent asphalt sealant.

a. Asphalt sealant shall be AC-10 or AC-20 with a penetration of 75-100.

b. Fiber reinforcing materials shall be short-length polypropolene or polyester fibers, having the following properties:

Length	10 mm
Denier	15 dpf
Color	natural
Crimp	none
Tenacity	4 g.p.d.

Asphalt fiber compound shall be mixed at a rate of 5-8% fiber weight to weight of asphalt cement. This compound having the same chemical base provides compatibility and exhibits excellent bond strengths. The fiber functions to re-distribute high stress and strain concentrations that are imposed on the sealant by thermal sources, traffic loading, etc....

Equipment

Equipment used in the performance of the work required by this section of the specification shall be subject to the Engineer and maintained in a satisfactory working condition at all times.

a. *Air Compressor:* Air compressors shall be portable and capable of furnishing not less than 100 cubic feet of air per minute and not less than 90 lbs per square inch pressure at the nozzle. The compressor shall be equipped with traps that will maintain the compressed air free of oil and water.

b. *Manually operated equipment.* Gas powered air broom or self-propelled sweeper designed especially for use in cleaning highway and airfield pavements, shall be used to remove debris, dirt and dust from cracks.

c. *Hand tools.* Shall consist of brooms, shovels, metal bars with chisel shaped ends and any other tools which may be satisfactorily used to accomplish this work.

d. *Melting Kettle:* The unit used to melt the joint sealing compound shall be double boiler, indirect fired type. The space between the inner and outer shells shall be filled with a suitable heat transfer oil o r substitute having a flash point of not less than 600 degrees F. the kettle shall be equipped with a satisfactory means of agitating the joint sealer at all times. This may be accomplished by continuous stirring with mechanically operated paddles and/or by a continuous circulating gear pump attached to the heating unit. The kettle must be equipped with thermostatic control calibrated between 200 degrees F. and 550 degrees F.

Preparation:

Debris Removal: All old materials and other debris removed from the cracks shall be removed from pavement surface immediately by means of power sweepers and hand brooms or air brooms.

Vegetation: When cracks show evidence of vegetation it shall be removed and sterilized by use of propane torch unit eliminating all vegetation, dirt, moisture and seeds.

General: No crack-sealing material shall be applied in wet cracks or where frost, snow or ice is present nor when ambient temperature is below 40 degrees F at night. Daytime temperatures must be in excess of 60 degrees F.

Preparation of Sealer: Joint sealing material shall be heated and applied at a temperature specified by the manufacturer and approved by the Engineer.

Measurement and Payment

Measurement for this bid unit shall be by the gallon and shall be the actual number of gallons of sealer applied to the pavement. Payment shall be set at the unit price provided the proposal and shall be complete payment for the entire item including furnishing, preparation and placing of materials, labor and equipment to be used on this project and all incidental items which may be required to complete the work in a satisfactory manner.

Pay item and unit:

1	Crack-sealing, Hot Reinforced Fiber, Complete-in-Place	Gallon

SECTION 417 -- COLD PLANING OF BITUMINOUS SURFACES

Description

1.1 This work shall consist of the removal of existing bituminous pavement by planing or milling type equipment to the depth and grade shown on the plans or ordered. Equipment

Equipment

2.1 Equipment used for planing of bituminous surfaces shall be a power operated rotary planing or milling machine capable of uniformly removing the existing bituminous surfaces.

Construction Requirements

3.1 The existing bituminous surface shall be removed by planing or milling machine capable of removing in one or more passes, bituminous material to the depth specified. The equipment shall be capable of accurately establishing profile grades by an automatic grade control system referencing from either the existing pavement or from an established independent grade line.

3.1.1 The equipment shall have an effective means for controlling dust.

3.2 Material removed during this operation, shall be transported and stockpiled for use as directed.

3.3 The Contractor shall supply sufficient lighting to ensure that night cold planning operations meet the requirements of 3.1 and allow for inspection.

Method Of Measurement

4.1 Cold planing of bituminous surfaces as shown on the plans or ordered will be measured by the square yard as determined by the actual surface measurements of the lengths and widths of the bituminous areas removed.

4.1.1 The nominal depth of material removed will be as shown on the plans.

Basis Of Payment

5.1 The accepted quantities of cold planing bituminous surfaces to the nominal depth specified, will be paid for at the contract unit price per square yard.

5.1.1 No separate payment will be made for any cost of project lighting or overtime necessary due to night operations.

Pay Item and Unit:

417.	Cold Planing of Bituminous Surfaces	Square Yard
417.19	Cold Planing of Bituminous Surfaces (Night)	Square Yard