STANDARD SPECIFICATIONS

FOR

STATE ROAD AND BRIDGE CONSTRUCTION

EDITION 1990

KANSAS DEPARTMENT OF TRANSPORTATION

TOPEKA, KANSAS

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DIVISION 150

EQUIPMENT

SECTION 151

GENERAL

151.01 DEFINITIONS.

The Contractor shall provide all machinery and equipment, together with the necessary supplies for upkeep and maintenance, and also tools and apparatus necessary for the proper construction and acceptable completion of the work.

Equipment and tools shall meet with the approval of the Engineer as to design, capacity and mechanical condition and the equipment must be at the job site sufficiently ahead of the start of construction operations to be examined thoroughly and approved.

151.02 GENERAL EQUIPMENT REQUIREMENTS.

The Contractor shall at all times employ sufficient labor and equipment for prosecuting the several classes of work to full completion in the manner and time required by these Specifications.

All equipment which is proposed to be used on the work shall be of sufficient size and in such mechanical condition as to meet requirements of the work and to produce a satisfactory quality of work. Equipment used on any portion of the project shall be such that no injury to the roadway, adjacent property, or other highways will result from its use. All equipment shall be relatively free from oil, fuel, hydraulic fluid and anti-freeze leaks.

When the Contract specifies that the construction be performed by the use of certain equipment, such equipment shall be used unless others are authorized by the Engineer.

When the equipment to be used by the Contractor in accomplishing the construction are not prescribed in the Contract, the Contractor is free to use any equipment that will accomplish the Contract work in conformity with the requirements of the Contract.

If the Contractor desires to use a type of equipment other than that specified in the contract, then he may request authorization from the Engineer to do so. The request shall be in writing and shall include a full description of the equipment proposed for use and an explanation of the reasons for desiring to make the change. The Engineer, before considering or granting such request, may require that the Contractor

establish, at his own expense, satisfactory evidence that the proposed equipment will produce work equal in quality to that produced by the specified equipment. If approval is given, it will be on the condition that the Contractor will be fully responsible for producing construction work in conformity with Contract requirements. If, after trial use of the substituted equipment, the Engineer determines that the work proposed does not meet Contract requirements, the Contractor shall discontinue the use of the substitute equipment and shall complete the remaining construction with the normal and currently accepted equipment. The Contractor shall remove any deficient work and replace it with work of specified quality, or take such other corrective action as the Engineer may direct. No change will be made in basis of payment for the construction items involved nor in Contract time as a result of authorizing a change in equipment under these provisions.

151.03 COMPACTION EQUIPMENT.

(a) General.

When a numerical density is specified, the weight requirement for rollers will be waived providing that the compaction equipment used will compact the material to the density required.

When a numerical density is not specified, the weight requirement for rollers may be waived, at the discretion of the Engineer, providing that a particular roller has shown successful performance on previous Department projects.

The Contractor shall provide a suitable gauge for determining air pressure in the tires of pneumatic-tired rollers.

(b) Tamping or Sheepsfoot Rollers.

The compaction equipment for earthwork may be towed or self-propelled and shall include tamping rollers, grid rollers, segmented pad rollers, or other compaction equipment that can satisfactorily and uniformly obtain required compaction.

When Type "B" compaction is designated, the roller shall conform to the following requirements: Tamping or sheepsfoot rollers shall consist of metal rollers, drums, or shells surmounted by metal studs with tamping feet projecting not less than 6½ inches from the surface of the roller, drum, or shell. Tamping feet shall be spaced not less than six inches, nor more than twelve inches measured diagonally center to center; and the cross section area of each tamper foot, measured perpendicularly to the axis of the stud, shall not be less than

four nor more than twelve square inches. The weight of tamping rollers shall be such that when fully loaded, the load on each tamper foot shall be not less than 200 pounds per square inch of cross-sectional area. Other types of compacting equipment may be permitted by the Engineer for Type "B" compaction provided satisfactory performance is obtained. The performance shall be considered as satisfactory when the equivalent of 90 percent or more of standard compaction is being obtained. A rolling procedure, verified by density tests, shall be established for this equipment.

(c) Light Pneumatic-tired Rollers.

Light pneumatic-tired rollers shall be constructed so that they can be loaded to provide a gross weight of at least 225 pounds per inch of width of tire tread. The tires on the front and rear axle shall have wide smooth treads and shall be staggered to provide complete coverage of the entire area over which the roller travels. The tires shall be inflated to a pressure that has been approved by the Engineer and the pressure shall be reasonably uniform in all tires.

(d) Heavy Pull-type Pneumatic-tired Rollers.

Heavy pneumatic-tired rollers shall be single axle rollers and shall be constructed so that they can be loaded to provide a gross weight of not less than ten tons and not more then 50 tons. The pressure shall be reasonably uniform in all tires.

(e) Heavy Self-Propelled Pneumatic-tired Rollers.

Heavy self-propelled pneumatic-tired rollers shall be so constructed that they can be loaded to provide a gross weight of not less than eight tons and not more than 30 tons. The tires on the front and rear axles shall have wide smooth treads and shall be staggered to provide complete coverage of the entire area over which the roller travels. The tires shall be inflated to a pressure that has been approved by the Engineer and the pressure shall be reasonably uniform in all tires.

(f) Trench Rollers.

Trench rollers shall be of an approved type and shall weigh not less than 300 pounds per inch of width and shall be equipped with water tank and sprinkling device that shall be used for wetting the roll to prevent adherence of the placed material.

(g) Pull-type Steel Rollers.

Pull-type steel rollers shall have not less than 48 inches

effective width of roll and shall be designed and constructed so that the weight per lineal inch of roll can be varied from 200 to at least 300 pounds.

(h) Self-Propelled Steel Rollers.

(1) General.

The power mechanism for all self-propelled steel rollers shall be capable of propelling the roller smoothly and without jerking when starting, stopping, or reversing directions, free from backlash, loose link motion, faulty steering mechanism and worn king bolts. The steering mechanism shall have no lost motion, shall operate readily and permit the roller to be directed on the alignment desired. The faces of all rolls shall be smooth and free from defects which mar the finished road surface. Rollers shall be equipped with water tanks and sprinkling devices which shall be used for wetting the rolls to prevent adherence of the placed material.

Prior to achieving the required density, the traveling speed shall not exceed four M.P.H.

(2) Two-axle Tandem Steel Rollers.

In addition to the general requirements, two-axle tandem steel rollers shall be self-propelled and shall weigh not less than eight tons or more than twelve tons.

(3) Three-axle Tandem Steel Rollers.

In addition to the general requirements, three-axle tandem steel rollers shall be self-propelled and shall weigh not less than twelve tons.

Three-axle tandem rollers shall be so constructed that the rolls, when locked in position for all treads to be in one plane, are held with a rigidity which will satisfy the following test under full load: With the weight of the roller supported on the central roll, the tread of the central roll shall not be more than 1/8 inch above the plane tangent to the tread of the end roll. With the weight of the roller supported on the end rolls, the tread of the central roll shall not be more than 1/4 inch below the plane tangent to the treads of the end rolls.

(4) Three-wheeled Steel Rollers.

In addition to the general requirements, three-wheeled steel rollers shall weigh not less than eight tons or more than twelve tons.

(i) Vibrating Compactors.

Equipment using the principle of vibration as a tamping force shall be in good mechanical condition and shall be capable of transmitting forceful vibrations or impacts to the

various materials placed in construction. The equipment may be the roller or pad type or a combination of roller and pad type.

(j) Vibratory Rollers.

Vibratory rollers shall be of sufficient size and number to keep up with roadway production and provide the specified density. They shall be self-propelled and in good mechanical condition. Pneumatic tires, if used on the roller, will be of the smooth type. The roller shall be equipped with variable frequency adjustments, and shall be operated at the necessary frequency and amplitude to achieve the desired density without objectionable undulations, with minimal fracturing of aggregates and without material pickup or other surface defects.

Vibratory rollers for use on earthwork and aggregate bases shall meet speed and frequency ranges (vibrations per minute) shown in Table 1. Rollers should be operated at high amplitude unless otherwise directed and the roller speed and the vibrations per minute are to be coordinated so there is a minimum of 6 impacts per linear foot.

TABLE 1
AGGREGATE BASE AND EARTHWORK
Impacts per Linear Foot

ROLLER Speed M.P.H. (ft./min.)	(Vibrations per Minute) 1000	1200	1400	1600	1800	2000	2200	2400
1.0(88)	11.3	13.6	15.9	18.1	20.4	22.7	25.0	22.7
1.5(132)	7.6	9.1	10.6	12.1	13.6	15.2	16.7	18.2
2.0(176)	—	6.8	8.0	9.1	10.2	11.4	12.5	13.6
2.5(220)	—	—	6.4	7.3	8.2	9.1	10.0	10.9
3.0(264)	—	—	—	6.1	6.8	7.6	8.3	9.1
3.5(308)	—	—	—	—	5.8	6.5	7.1	7.8
4.0(352)	—	—	—	—	—	—	6.3	6.8
4.5(396)	—	—	—	—	—	—	—	6.1

Vibratory rollers for use on hot bituminous pavement shall be operated at the speed (MPH) and frequency range to provide a minimum of ten impacts per linear foot as shown in Table 2. Rollers shall be amplitude adjustable and operated at low amplitude unless otherwise directed. Vibratory rollers shall meet the following minimum requirements: 1800 Vibrations per minute (VPM) and static force on drums of 135 pounds per linear inch (PLI) of roller width.

Rollers shall be equipped with spray bars to prevent pickup of asphalt material. Vibrators shall shut off automatically

whenever the roller stops. On tender mixes, steep grades, and whenever directed, rollers shall be operated as a static roller until the mix is dense enough to permit vibratory compaction without displacement.

Vibratory rollers shall be equipped with an accurate and working gauge or gauges for measuring the frequency of each drum or have an accurate hand-held resonant reed tachometer available to the Engineer for each roller, before the Contractor will be allowed to use the roller on the Project. If, after starting the Project, the frequency gauge should quit working or the tachometer is damaged, the Engineer may permit the roller to operate to the close of the working day provided the compaction appears satisfactory.

The hand-held tachometer shall be one that has been approved by the Bureau of Materials and Research, Kansas Department of Transportation.

Each roller shall be equipped with full instruction on the procedures of making amplitude adjustments.

TABLE 2
ASPHALT PAVING
Impacts per Linear Foot

ROLLER Speed M.P.H. (ft./min.)	(Vibrations per Minute) 1800	2000	2200	2400	2600	2800	3000
1.0(88)	20.4	22.7	25.0	27.2	29.5	31.8	34.1
1.5(132)	13.6	15.2	16.7	18.2	19.7	21.2	22.7
2.0(176)	10.2	11.4	12.5	13.6	14.8	15.9	17.0
2.5(220)	—	—	10.0	10.9	11.8	12.7	13.6
3.0(264)	—	—	—	—	—	10.6	11.4
3.4(299)	—	—	—	—	—	—	10.0

Vibratory rollers, when used for finishing, shall be operated in the static mode on the last pass of the surface lift.

When the roller is in the static mode and prior to achieving required density, the traveling speed shall not exceed four M.P.H.

151.04 WATER HAULING EQUIPMENT.

(a) Controlled Water Distribution Equipment.

Equipment for the distribution of water shall consist of distributors or tanks equipped with spray bars and pumps to operate under pressure. The pumps shall be of sufficient capacity to provide uniform and adequate distribution. They shall be mounted on pneumatic-tired trucks or pneumatic-tired

trailers pulled by pneumatic-tired equipment. The minimum capacity of any tank shall be 1,000 gallons. The Contractor shall provide satisfactory means for the calibration of the tanks. The distributor equipment shall be constructed to permit accurate and uniform quantities of water per unit of surface area. The control valves shall be constructed to permit full closing and to prevent leakage. The water control valves shall be constructed to operate from the driver's seat or provisions made for an additional operator to operate the control valve while the equipment is traveling at the proper speed for distribution.

The requirement for pumps may be waived on force account projects, subgrade modification projects, lime treated and fly ash treated subgrades.

(b) Watering Equipment.

Water may be transported either in calibrated tanks or by means of a pipe-line system equipped with accurate and reliable meters placed as near the point of delivery as possible. Means shall be provided by the Contractor to check the accuracy of the meters or the calibration of the tanks. The capacity of the pump and pipe-line system or the calibrated tanks shall be such that they are capable of furnishing the required amount of water. The minimum capacity of any tank shall be 1,000 gallons.

151.05 HAULING EQUIPMENT.

Hauling equipment for aggregates shall consist of vehicles having dump bodies suitable for dumping materials in a windrow or in spreader boxes. The bodies shall be so constructed that their volume measurement can be accurately determined. They shall be so constructed and maintained to prevent loss of materials during hauling operations. The equipment shall be provided with dump controls that can be operated from the driver's seat.

Trucks used for hauling bituminous mixtures shall have tight, clean, smooth metal beds which have been thinly coated with a minimum amount of approved material to prevent the mixture from adhering to the beds. The coating material shall not contaminate or alter the characteristics of the mixture. The use of petroleum derivatives for coating the truck beds is prohibited. Truck beds shall be raised to remove excess coating material prior to hauling bituminous mix. When required by the Engineer each vehicle shall be equipped with

a canvass cover or other suitable material of such size as to protect the mixture from the weather. Any truck causing excessive segregation of material shall be removed from the project until such time the causes are corrected.

151.06 GENERAL WEIGHING EQUIPMENT.

The Contractor shall furnish, erect, maintain and operate acceptable beam-type scales or other approved weighing devices at locations approved by the Engineer. Competent scale operators shall be furnished to weigh and record all materials. In lieu of furnishing scales and scale operators, the Contractor may use public weighing facilities provided they have been tested, sealed, and certified by an acceptable certifying authority. All costs in connection with furnishing, installing, certifying, or testing and maintaining scales; for furnishing check weights and scale house; and other items specified in this subsection, including furnishing scale operators, shall be subsidiary to other pay items in the Contract.

Batch weights will not be acceptable for determination of pay quantities except when automatic weighing, cycling, and monitoring system is included as part of the batching equipment.

Platform scales shall be installed and maintained with the platform level and rigid bulkheads at each end. Weighing equipment for truck- hauled material shall be accurate to 0.5 percent throughout the range of use. The scale shall have a platform of adequate length to weigh the longest truck or truck-trailer combination which is used on the project, in one operation.

The approaches to the scale platform shall be maintained by the Contractor to the satisfaction of the Engineer.

Initial and periodic calibration of each weighing device shall be accurate within 0.25 percent throughout the range of use and the Contractor shall have the scales checked, adjusted, and certified by an approved testing firm or laboratory of the Kansas State Board of Agriculture or a qualified manufacturer's representative at (a) a maximum of six month intervals; (b) at each plant set up except for small units such as three sack mixers which are moved frequently, etc.; (c) when scales are repaired, and; (d) any other time deemed necessary by the Engineer. The seal of certification shall show the date of the inspection and the name of the organization making the inspection.

The operating tolerance shall be as specified for the type of work being performed.

The Contractor shall have available not less than 500 pounds of standard test weights for testing of all scales.

The Engineer may permit the use of weighing devices for a reasonable period prior to sealing, provided field testing indicates consistent compliance with the limits of accuracy specified herein.

In lieu of platform, plant and truck scales, the Contractor may provide an electronic system approved by the Engineer. The scale shall be equipped with an automatic printout system which will print the weights of the material being delivered. Information required on the tickets will be as determined by the Engineer. Such weights shall be evidenced by a weigh ticket for each load. The scales shall be calibrated meeting the accuracy requirements stipulated above.

The gross, tare, and net weights of each load shall be recorded and documented in a manner acceptable to the Engineer.

The documents shall contain all or part of the following information as applicable to the type of scales and recording system used:

- Project Number
- Date
- Truck Identification
- Time of Weighing
- Applicable Weights
- Scale Operator's Signature

The exact format will be as approved by the Engineer. The original record(s) and a written certification as to the accuracy of the weights shall be furnished the Engineer at the end of each shift or day as applicable. Alternate procedures may be approved by the Engineer.

The Engineer may, at random intervals, designate previously weighed vehicles to be reweighed to verify the weight of material.

151.07 MIXING PLANTS FOR STABILIZED BASE AND SHOULDERS.

(a) Central Mixing Plant.

The plant shall be equipped with a mechanical mixing device that will blend component aggregates and distribute the required moisture uniformly throughout the mix. The plant

shall be situated and designed for easy and accurate calibration.

(b) Traveling Mixing Plant.

The plant shall be so constructed and operated that it will mix the component materials and liquid in the proper proportions without damaging the subgrade. The plant shall be equipped for easy and accurate calibration.

151.08 CONCRETE BATCHING AND MIXING EQUIPMENT.

(a) General.

The batching plant shall include bins, weighing hoppers and scales for each size of aggregate. Bins with adequate separate compartments for each size of aggregate shall be provided in the batching plant. Each compartment shall be designed to discharge efficiently and freely into the weighing hopper or hoppers.

The scales for weighing aggregate, cement and/or fly ash shall be by visible means of checking weights or an electronic scale system approved by the Engineer. They shall be accurate within 0.5 percent throughout the range of use. When beam-type scales are used, provisions, such as an over-under indicator shall be made for indicating to the operator that the required load in the weighing hopper is being approached. A device on weighing beams shall indicate any critical position clearly. Poises shall be designed to be locked in any position and to prevent unauthorized change. The weigh beam and over-under indicator shall be in full view of the operator while charging the hopper, and he shall have convenient access to all controls.

When cement and/or fly ash are measured by weight, they shall be weighed on a scale separate from those used for other materials and in a hopper entirely free and independent of the hoppers used for weighing the aggregates.

The weighing hopper shall be properly sealed and vented to preclude dusting during operation and shall be constructed so as to eliminate accumulation of materials and to discharge completely.

(b) Central and On-site Mixers.

Each mixer shall have attached in a prominent place a manufacturer's plate showing the capacity of the drum in terms of volume of mixed concrete and the speed of rotation of the mixing drum or blades.

The mixer shall be capable of combining aggregate, cement and/or fly ash and water into a thoroughly mixed and uniform mass within the specified mixing period. The mixer shall be equipped with an approved timing device which will automatically lock the discharge lever when the drum has been charged and release it at the end of the mixing period. The device shall be equipped with a bell or other suitable warning device adjusted to give a visible or audible signal each time the lock is released.

In case of failure of the timing device, the Contractor will be permitted to operate while it is being repaired, provided he furnishes an approved time piece equipped with minute and second hands. If the timing device is not placed in good working order within 24 hours, further use of the mixer will be prohibited until repairs are made.

The mixers shall be cleaned at suitable intervals. The mixer, when loaded to the manufacturer's rated capacity without overload, shall be capable of combining the ingredients of the concrete within the specified time into a thoroughly mixed and uniform mass and of discharging the concrete with a satisfactory degree of uniformity. All mixers shall be examined periodically for changes in condition and will be accepted on their performance in furnishing well mixed, uniform concrete.

Mixers shall be equipped with a water-measuring device that can be adjusted to discharge the desired quantity of water into the mixer drum. The amount of water discharged shall be measured in pounds or gallons and shall be accurate within one percent of the amount required. When the desired amount of water has been discharged, the flow of water from the tank shall be automatically stopped.

In addition to the above requirements, all concrete mixers for producing air-entraining concrete shall be equipped with a semi-automatic measuring device for dispensing the air-entraining agent, or solution, into the batch. The discharge line from the dispenser shall be connected to the discharge line of the water measuring device in such a manner that the required amount of air-entraining agent will gradually discharge into the stream of mixing water. The entire amount of air-entraining agent shall be fully discharged before all of the mixing water has entered the drum of the mixer. The dispenser shall be a transparent container having a graduated scale showing the net contents. The dispenser shall be so arranged that the flow of air-entraining agent will automatically stop when the required amount has been delivered. The

dispenser shall be so constructed that it can be accurately calibrated at the various settings. A method shall be provided by which the discharge of the dispenser can be diverted from the stream of mixing water to a container for measurement. The dispenser shall be so designed and constructed that the quantity of admixture delivered to the mixer will not be effected by tilting the mixer in any direction.

The installation of the automatic water-measuring device and the semi-automatic air-entraining solution dispenser, together with the arrangement of the supply systems, discharge lines and warning or indicating devices on the mixer shall be tested and approved by the Engineer prior to use.

(c) Truck Mixers.

Unless each truck mixer used on the work is equipped with an automatic measuring device for dispensing the air-entraining solution into the batch, satisfactory central dispensing equipment shall be furnished as specified in subsection 151.08 (b).

The mixer, when loaded to the manufacturer's rated capacity without overload, shall be capable of combining the ingredients of the concrete within the specified number of revolutions into a thoroughly mixed and uniform mass and of discharging the concrete with a satisfactory degree of uniformity. The mixers shall be cleaned at suitable intervals. The pick-up and throw over blades in the drum, or drums, shall be repaired or replaced when they are worn to the point the mixer is no longer capable of producing well mixed, uniform concrete.

All mixers and agitators shall be examined periodically for changes in condition due to accumulation of hard concrete or mortar or to wear of blades. They shall be accepted on the basis of their ability to furnish well-mixed uniform concrete. Should there be a question on the performance, the Engineer may make slump tests from samples taken at approximately the beginning, the mid-point and end of a load. If the slump differs by more than plus or minus 1/2 inch when the average slump is three inches or less, or by more than plus or minus 1 inch when the average slump is greater than three inches, the mixer or agitator shall not be used until the condition is corrected.

The mixer shall be equipped with a water measuring device capable of accurately measuring the water to within one percent of the amount of mixing water required. In lieu of mounting this water measuring device on the mixer, it may be

located at the point of charging the mixer. It shall be located so as to provide ready access for determination of the amount of water used.

The drum or containers shall be of such size that the rating as a mixer (in volume of concrete) does not exceed 2/3 of the gross volume of the mixer, disregarding blades, or 80 percent of the gross volume when used as an agitator.

The mixer or agitator shall be provided with a plate showing the manufacturer's recommended operating speed for mixing and for agitating, except that the maximum speed of rotation for agitating shall be less than the minimum mixing speed when the mixer is used both for mixing and agitating.

The mixer or agitator shall be equipped with a counter in good working condition to indicate the number of revolutions of the drum or blades.

(d) Continuous Volumetric Mixers.

Approval of the use of a continuous volumetric mixer type operation will be subject to the following stipulations. The mixer shall:

(1) Be capable of carrying sufficient unmixed, dry bulk cement, fly ash, sand, coarse aggregate, admixtures and water to produce a minimum of six cubic yards of concrete.

(2) Contain separate compartments for each ingredient used in the mix.

(3) Produce thoroughly mixed uniform concrete meeting the consistency requirements stipulated in Section 402. The commencement of tests shall be delayed a minimum of 4 to 4 1/2 minutes after the sample has been discharged from the continuous mixer.

(4) Be capable of positive measurement of cement being introduced into the mix. A recording meter visible at all times shall indicate this quantity.

(5) Provide positive control of the flow of water and admixture into the mixing chamber. Water flow shall be indicated by a flow control valve and shall be readily adjustable to provide for minor variations in aggregate moisture.

(6) Have a water flow meter that will indicate to the nearest 0.10 gallon the number of gallons used.

(7) Be capable of being calibrated to automatically proportion and blend all components of indicated composition on a continuous or intermittent basis as required. The calibration shall be performed in accordance with the manufacturer's recommendations.

Permission to continue operation of the mixer may be re-

scinded upon failure to maintain acceptable production within the limits of the specifications.

(e) Non-Agitating Units.

Non-agitating units shall have interior surfaces that are smooth and water tight, with rounded corners and having gates or other means to control the concrete discharge. The interior shall be free from excessive accumulations of hardened concrete and other obstruction or deterioration that would interfere with the proper discharge of concrete.

(f) Small Quantity Concrete Mixers.

Small quantity concrete mixers shall be self-powered, in good mechanical condition and capable of producing in one mixing a minimum volume of concrete in which one sack of cement is required. This type of mixer may be used only when approved by the Engineer.

151.09 VIBRATORS.

(a) General.

The Contractor shall have available, the proper equipment for determining the frequency of the impulses of the vibrators.

(b) Vibrators for Structures.

Vibrators for vibrating concrete in structures shall be internal type vibrators. They shall operate at frequencies of vibration of not less than 8,000 cycles or impulses per minute under load. The amplitude of vibration shall be adequate to consolidate the concrete properly. The vibrating unit shall be such that it can easily enter the forms and be operated around the reinforcing bars.

Types of vibrators for use on forms or reinforcing steel will not be permitted.

The use of any vibrator shall be contingent upon its ability to vibrate and consolidate the concrete properly and the Engineer may require its adjustment, repair or removal at any time for nonperformance.

(c) Vibrators for Bridge Decks.

Consolidation of the concrete shall be accomplished by means of a mechanical device on which internal (spud or tube type) concrete vibrators of the same type and size are mounted. The vibrators shall be mounted so as to provide a maximum insertion spacing of 12 inch centers. This spacing may not be changed without the permission of the Engineer.

TABLE 3
VIBRATORS FOR BRIDGE DECKS

The vibrators shall meet the following requirements:	
Diameter of Head (inches)	1¾ to 2½
Frequency of Vibration (vib./min) (under load)	8,000 to 12,000
Average amplitude (inches)	0.025 to 0.05
Radius of Action (inches)	7.0 Minimum

The Contractor shall provide a copy of the manufacturers specifications for each type and brand of vibrators being used to verify compliance.

The vibrators shall be mounted on the mechanical device in such a manner that they will enter the concrete in a vertical position under the influence of their own weight and shall be provided with adequate flexibility to work themselves around the reinforcing steel.

The mechanical device may be mounted on the finishing machine or upon an independent framework capable of being propelled along the grade rails.

(d) Vibrators for Rigid Pavement.

(1) Consolidation shall be accomplished by the use of approved vibrators for the full width of concrete pavement. They may be either of the surface type (pan or screed) or the immersion type (tube or spud). They may be attached to the spreader or the finishing machine or may be mounted on a separate carriage. They must have the capability of vibrating the full depth of the concrete pavement without coming in contact with the joint, load transfer device, subgrade or side forms. The vibrators shall be operated only when the machine to which they are attached is moving.

TABLE 4
VIBRATORS FOR RIGID PAVEMENT

VIBRATOR ELEMENT FREQUENCIES (Under Load)

TYPE	FREQUENCY, MINIMUM CYCLES/MINUTE
Surface, Pan or Screed	3,500
Immersion Tube, Paving Machine Attached	5,000
Immersion Spud, Hand Operated	8,000
Immersion Spud, Gang Mounted	8,000

(2) Hand Operated Spud Type Internal Vibrators.

The vibrators shall be of the internal type and shall operate at a frequency of not less than 8,000 impulses per minute under load.

151.10 CONCRETE SAW.

The Contractor shall provide sawing equipment adequate in power to complete the sawing with water-cooled diamond edge, or abrasive wheel blades to the required dimensions and at the required rate. At least one stand-by saw and an adequate supply of blades shall be maintained at the site of work at all times during sawing operations.

151.11 LONGITUDINAL FINISHER.

The longitudinal finisher may be operated mechanically or by hand and shall be of a design having the capability of leaving the surface smooth, true to grade and required cross section.

The float shall be accurately adjusted and coordinated with the adjustments of the finishing screed so that a small roll of mortar is carried ahead of the float at all times.

151.12 FIXED FORM PAVING EQUIPMENT.

(a) Concrete Spreader.

A self-propelled concrete spreader equipped with a power-driven device for spreading the concrete uniformly across the subgrade transversely shall be required. The spreader shall have sufficient power and traction to spread and strike-off normal amounts of concrete on the subgrade without slipping on the forms.

The use of hand operated or tractor-drawn strike-off blades will be permitted only at locations where the dimensions or layout of the slab prevents the use of the self-propelled concrete spreader, or when "Hand Finishing" is authorized or permitted.

(b) Concrete Finishing Machines.

Finishing machines shall be self-propelled and capable of spreading and consolidating the concrete to conform to the required cross section shown on the Plans. The finisher may be mounted on the same carriage as the spreader.

The use of any finishing machine shall be contingent upon its ability to finish the pavement satisfactorily to the required section and degree of consolidation. The Engineer may, at any time, require the adjustment, repair, or replacement of the machine for mal-performance.

151.13 SLIP FORM PAVERS.

Slip form paving equipment shall, in one pass, have the capability to spread, consolidate, screed and float finish freshly placed concrete in a manner that a minimum of hand work will be required to produce a dense homogeneous pavement that is true to the specified cross section and profile. Units of the paving train shall have the capacity to vibrate and consolidate the fresh concrete thoroughly. The unit shall vibrate the concrete for the full width and depth of the pavement being placed. If, for any reason, it is necessary to stop the forward movement of the paver, the vibratory and tamping elements shall also be stopped immediately. Minimum vibrator element frequencies shall be as specified in Table 4. Vibrators shall be of the immersion or surface type. The vibrator unit or units may be mounted on or in combination with another unit of the paving train or on a separate carriage. The end result of vibration shall be the satisfactory completion of the specified density requirement.

Slip form pavers shall be equipped with traveling side forms of sufficient dimension, shape and strength to produce pavement of the specified cross section. The forms shall trail behind the paver for such a distance that no appreciable slumping of the concrete shall occur. The trail forms shall be constructed so the exposed edge of the pavement shall be finished with a radius no greater than 1/4 inch.

All slip form paving units shall be operated and contain all component parts in accordance with the manufacturers recommendations for the particular unit. When the paving train or any unit of the train has the need to operate on adjacent pavement, special care must be given to prevent damage to this pavement. The various pieces of equipment shall be provided with flangeless rubber tired wheels to avoid damage to the pavement. When tracked equipment is to run on adjacent pavement, pads or belting shall be used to prevent any damage to the existing pavement. The slip form paving equipment shall be guided by an approved reference system for placing the concrete at an established line and grade.

151.14 SUBGRADE PLANER.

(a) Fixed Form.

An approved type of subgrade planer that rides on the forms shall be used in forming the crown and shaping the subgrade or subbase to insure that the specified thickness is secured

when the pavement is finally finished. The planer shall have a continuous cutting edge. Scratch planers with spikes or teeth will not be permitted.

(b) Slip Form.

The surface of the subgrade or treated subbase shall be trimmed to required line and grade by means of equipment which is automatically controlled with regard to both line and grade.

The Engineer may waive the use of automatically controlled equipment on narrow widths or areas of irregular dimension where operations of the automated equipment is impractical.

For projects containing less than 20,000 square yards of subgrade, treated subbase or manipulation, the use of automatically controlled equipment is not required.

151.15 TEXTURING EQUIPMENT (CONCRETE PAVEMENT).

(a) Burlap Drag.

A drag consisting of a seamless strip of damp burlap, artificial turf or cotton fabric, which shall produce a uniform surface of gritty texture after dragging it longitudinally along the full width of pavement shall be used. Drags shall be maintained clean and free from encrusted mortar. Drags that cannot be cleaned shall be discarded and new drags substituted. Drags shall be used after the longitudinal finisher and prior to the transverse grooving.

(b) Transverse Grooving Equipment.

(1) The metal comb shall consist of a single line of tempered spring, rectangular steel tines, uniformly spaced at 3/4 inch centers and securely mounted in a suitable head. The tines shall be of a size and stiffness to produce grooves of specified dimension in the plastic concrete. The metal comb shall be attached to an approved mechanical device capable of transversing the entire pavement width in a single pass at a uniform speed. The device shall be operated so as to produce a relative uniform pattern of transverse grooves spaced at approximately 3/4 inch centers, 1/8 to 3/16 inch deep and 0.10 to 0.125 inch wide. The operation shall be performed at such a time as to minimize displacement of larger aggregate particles and before the surface permanently sets. Small or irregular areas may be grooved by hand methods.

(2) An alternate texturing method to the metal comb that would be acceptable is a mechanical fluted float that by

means of downward pressure places groove like configurations in the plastic concrete. The dimensions of the grooves shall be similar to those given for the metal comb. Details of such a device shall be submitted to the Engineer for approval prior to use.

151.16 CONCRETE CURING COMPOUND DISTRIBUTOR.

The curing compound distributor shall be capable of continually mixing and uniformly spreading liquid membrane-forming compounds at a minimum rate of one gallon per 150 square feet of surface. Nozzles shall be adjusted to treat the exposed edges of the slab at the same time and rate as the top surface regardless of whether or not further concrete placement will be made against the pavement edge.

151.17 EQUIPMENT FOR HEATING BITUMINOUS MATERIALS.

Equipment for heating bituminous materials shall be of adequate capacity to heat the material properly by circulating steam, hot gases or hot oil through coils of a tank or by circulating the bituminous material around a system of heated coils or pipes, or by circulating the bituminous material through a system of coils or pipes enclosed in a heated jacket or other approved means. The heating device shall be so constructed that it will prevent direct flame from striking the surface of the coils, pipes, or jacket through which the bituminous material is circulated. The heating device shall be operated in a manner that will not injure the bituminous material.

Railroad tank cars received on the work which have defective coils, or from which the coils have been removed, will be rejected by the Engineer unless satisfactory auxiliary means can be provided by the Contractor for the heating of the bituminous material without the introduction of moisture. The use of any equipment for the agitation of bituminous material to aid in heating will be prohibited if it injures or in any way changes the characteristics of the bituminous material or introduces free steam or moisture into the tank containing the bituminous material.

Railroad tank car connections for transferring bituminous material from tank cars to distributors, supply tanks, or storage tanks shall be so constructed that they cannot be used for any other purpose. The use of a tank car connection or

any other equipment by means of which free steam can be introduced directly into the bituminous material as a means of agitation or auxiliary heating shall be prohibited.

151.18 BITUMEN DISTRIBUTOR.

(a) Equipment for the distribution of bituminous materials shall be equipped with the following appliances or devices:

Tachometers
Pressure gauge
Adjustable length spray bars
Separate power unit and pump on distributing system or hydrostatic drive system
Heating coils and burner
Thermometer well and accurate thermometer
Measuring sticks
Quick opening gate in dome

All distributors and supply tanks shall be mounted on trucks or trailers equipped with pneumatic tires. The units shall be designed to insure that no rutting or other injury to the road surface will result. They will be sufficiently powered to maintain the desired speed of the equipment during operation.

The tachometer designating the speed of the truck shall be a separate operating unit attached to the truck and equipped with a large gauge approximately 5½ inches in diameter and graduated in units so that the speed of the truck can be determined within limits of approximately ten feet per minute or equivalent thereto. The gauge shall be located that it can be easily read at all times by both the driver of the distributor and the inspector.

The distributor shall be equipped with either a tachometer, calibrated to indicate revolutions per minute, attached to the pump shaft or a pressure gauge, calibrated to indicate pounds per square inch, or gallons per minute placed in the distributing system, by which the flow of bitumen may be regulated.

The spray bars shall be constructed to permit adjustment for length in increments of one foot for any length up to 16 feet, to permit vertical adjustment of all nozzles to the desired height above the road surface and conforming to the roadway crown, and to permit lateral shifting of the entire spray bar during operation. The spray bar and nozzles shall be constructed to prevent clogging of the nozzle and to provide positive and immediate cut-off when distribution of bituminous material ceases.

The power unit and pump distribution system shall have a capacity of not less than 250 gallons per minute, shall be equipped with a bypass into the supply tank and shall be capable of distributing a uniform and constant flow of bituminous material through all nozzles at a pressure between 30 and 50 pounds per square inch.

The entire distributor assembly shall be so constructed and operated to insure accurate distribution of bituminous material within 0.01 gallon per square yard for any quantity from 0.1 to one gallon per square yard.

(b) All distributors shall be calibrated and checked before being used on the work. The calibration of the tank and preparation of the certificate will be done by the District Materials Engineer in the district in which the distributor is first used.

A certificate of approval will be given the distributor operator by the District Materials Engineer, showing the record of the calibration and check. This certificate shall be kept in the distributor at all times and shall be available to the Field Engineer in charge on each project on which the distributor is used. This certificate may be revoked at any time due to unsatisfactory performance of the distributor and will be returned only when satisfactory repairs or adjustments have been made. Failure to present the certificate will necessitate a recheck and if deemed necessary a recalibration of the distributor before it can be used on a project. The Contractor shall furnish at his own expense all necessary equipment, materials, and assistance necessary for the calibration.

The operation of the distributor will be checked by the Field Engineer the first time it is used each subsequent year and when the operation is found to be satisfactory the distributor may be used and the certificate signed and dated by the Engineer making the check.

151.19 STORAGE OR SURGE BINS.

As a minimum when a storage or surge bin is used with any type of plant the following items shall be required: (a) the bin shall be designed, equipped and used in such manner so as to keep material essentially free of segregation; (b) the belt leading from the drum discharge to the bin shall be protected so as to prevent heat loss due to wind blowing on the material; (c) a "Gob-Hopper" or other type of device approved by the Engineer, to help prevent segregation of the mix as it falls into the bin or silo; (d) a Tel-Tale device located at the top of the tapered portion of the bottom of the bin to

indicate when the level of the bituminous mixture in the bin has been lowered to this point. In the case of special designed bins (such as full length tapered bins) the device shall be located at the point designated by the Engineer. The mixture shall not be lowered below this point except to clean out the bin when plant operations are being terminated at the end of the day and such other times as deemed necessary by the Engineer.

The Tel-Tale device shall be interconnected with the controls of the gate at the opening in the bottom of the bin in such manner that the gate will automatically close when the mixture in the bin has been lowered to the level of the Tel-Tale device, thus preventing material from being drawn from the bin below this level. Means of over-riding these controls may be provided solely for the purpose of cleaning out the bin at the termination of the plant's operation. The material in the bottom of the bin below the device may be used when the bin is cleaned out providing the material is deemed satisfactory by the Engineer. Hot bituminous mixtures shall not be kept in storage or surge bins longer than three hours without prior approval.

If the Engineer determines that segregation is occurring he may prohibit the use of storage or surge bins.

151.20 BITUMINOUS PAVER.

Bituminous pavers shall be self-contained, power-propelled units, provided with an automatically controlled activated screed or strike off assembly, heated if necessary, and capable of spreading and finishing courses of bituminous material in lane widths applicable to the specified section and thickness shown on the Plans. Pavers used for shoulders and similar construction shall be capable of spreading and finishing courses of bituminous material in widths shown on the Plans.

The paver shall be equipped with an approved automatic screed control system capable of grade reference and transverse slope control. The automatic controls shall include a system of sensor operated devices which sense and follow reference lines or surfaces on one or both sides of the paver as required. The screed shall be maintained at the proper elevation at each end by controlling the elevation of one end while automatically controlling the transverse slope, or by controlling the elevation of each end independently.

The screed or strike off assembly shall produce a finished

surface of the required evenness and texture without undue tearing, shoving or gouging the mixture.

The paver shall be equipped with a receiving hopper having sufficient capacity for a uniform spreading operation. The hopper shall be equipped with a distribution system to place the mixture uniformly in front of the screed. Pickup attachments used to feed the hopper shall not exert any vertical load on the paver and shall be capable of picking up and loading substantially all of the material from the surface.

The paver shall be capable of being operated, when laying mixtures, at forward speeds consistent with satisfactory laying of the mixture.

151.21 ASPHALT PLANTS.

(a) Traveling Mixing Plants.

Traveling mixing plants shall be so designed, constructed, and operated that they will adequately mix the aggregate, soil, or other material with the specified liquids in the proper proportions without damaging the subgrade or mixing surface or leaving any appreciable amount of unmixed material on the subgrade or mixing surface. Plants shall be mounted on pneumatic-tired wheels or smooth-tread crawler-type tracks of such width that the plant when loaded to capacity, will not rut or damage the subgrade or mixing surface. Plants equipped for drying aggregates or other materials shall be of such type that will not cause loss or segregation of any of the material to be mixed. The devices for proportioning the material and liquids to be mixed shall be of such type that they will measure accurately and constantly the specified amounts of each material while the machine is in motion.

All traveling mixing plants shall be equipped with sufficient valves and a by-pass in the bitumen line between the pump and spray bar to facilitate calibrating the output of the pump. They shall also be equipped with thermometers, thermometer wells, meters, and gauges to determine accurately the temperature and quantity of bituminous material being delivered to the windrow at all times. If ordered by the Engineer, canvass shields shall be installed on the feeder of the plant to prevent the loss of fine material.

Plants which depend on a uniform forward speed to meter the aggregate windrow shall be immediately preceded by an evener having sufficient capacity to insure a windrow with uniform end area.

Traveling mixing plants which mix the bituminous material

with the aggregate in place will be permitted if satisfactory pulverization and mixing is accomplished as determined by field tests.

(b) Stationary Mixing Plants.

Stationary mixing plants shall consist of measuring, proportioning and mixing equipment. They shall also include driers when aggregates are furnished that contain moisture in excess of the amounts permitted for mixing. The measuring and proportioning equipment shall consist of a system of hoppers and scales designed for proportioning and measuring by batch weights or of continuous flow equipment so designed and operated that the flow of materials can be accurately and continuously regulated and so arranged to permit easy and accurate checking of the rate of flow on a weight basis. For continuous flow mixing, the proportioning equipment may be at the stockpile site so that the individual aggregates may be blended prior to entering the drier.

Sufficient valves and a bypass shall be provided in the bitumen line between the pump and spray bar to facilitate calibration of the output of the pump.

The drier shall be capable of drying and heating the mineral aggregate to specified requirements.

The proportioning devices for the bituminous materials and aggregates shall be so synchronized that proper proportioning will be obtained at all times.

The design of the mixing chambers shall provide adjustment to permit a mixing period sufficient to produce a thorough and uniform mix. The approval of and continued use of a stationary plant shall be contingent upon its ability to proportion and mix satisfactorily the several materials in adequate quantity for the proper progress of the work.

(c) Hot Mix Plant.

All equipment shall meet the approval of the Engineer, be kept in good working condition, meet the requirements herein specified, and have sufficient capacity to adequately handle the proposed bituminous construction.

The type of plant used for the manufacture of bituminous mixture may be a drum mix plant, a batch plant or a continuous mix plant. All plants shall conform to the requirements under (1) Requirements for all Hot Mix Plants. In addition, drum mix plants shall conform to the requirements under (2) Requirements for Drum Mix Plants; batch mix plants shall conform to the requirements under (3) Requirements for Batch

Plants; and continuous mix plants shall conform to the requirements under (4) Requirements for Continuous Mix Plants.

Continued use of any of the hot mix plants will be on the condition that the Contractor will be fully responsible for producing material in conformity with the Contract requirements. When segregation occurs in the pavement such that the composition, quality, gradation, density and visual appearance are not uniformly attained and imperfections or other defective work occurs, normal plant operation shall be suspended until the problem is corrected.

(1) Requirements of All Hot Mix Plants.

(1.1) Uniformity. The plants shall be so designed, coordinated, and operated to produce a uniform mixture.

(1.2) The Engineer may require the locking or sealing of any automated proportioning equipment that may be manually manipulated.

(1.3) Heating and Storage Equipment for Bituminous Material. Storage tanks for bituminous material shall have sufficient capacity to provide for continuous operation. They shall be capable of uniformly heating and holding the bituminous material at the required temperature range without damaging or changing its characteristics. Direct flame against the tanks will not be permitted. The circulating system shall be so designed to assure proper and continuous circulation during the operating period. The Contractor shall furnish an accurate procedure for determining the amount of bituminous material in the tanks at any time. Calibration data shall be substantiated. The tanks shall be situated and constructed so the Engineer can safely and accurately measure the level of the material at anytime and they shall be set as nearly level as possible. The system shall include means of obtaining samples of bituminous material from the delivery line to the plant.

(1.4) Cold Feed Aggregate Bins. The plant shall have separate cold feed bins for each aggregate size used unless blending is permitted by methods approved by the Engineer. The capacities of the cold feed bins shall be sufficient to maintain a continuous flow of material. The bins shall be so constructed as to prevent any spilling or leakage from one bin to another. Each bin shall have a belt type feeder equipped with an adjustable gate or an adjustable drive, or both, which can be calibrated and controlled satisfactorily. If necessary, devices shall be provided to insure a uniform distribution of aggregate on the conveyor belt. Each bin shall be equipped with a device which will detect any reduction or interruption of aggregate flow and actuate a visual and/or

audible signal at a location or locations approved by the Engineer.

(1.5) Thermometric Equipment. The plant shall be equipped with a sufficient number of thermometric instruments to assure the temperature control of the aggregate and the bituminous material. The instruments shall be capable of recording temperature on a chart over each 24 hour period. Maximum chart gradation shall be 15 minutes and ten degrees F. A.M. and P.M. shall be designated. The units shall be installed separately from the plant in a readily accessible location.

The actuating unit for recording temperature of the bituminous material shall be located either in the storage tank or in the feed line between the pump and the discharge valve.

The actuating unit for recording aggregate temperature and/or bituminous mixture temperature shall be located as specified for each type plant.

The Engineer reserves the right to pass upon the efficiency of thermometric instruments. All temperature records shall be retained by the Engineer as part of the project records.

(1.6) Dust Collectors. The plant shall be equipped with an approved dust collector, bag house or other type of collector which will satisfactorily limit particulate emissions.

Collected fines will not be fed back into the mixture. The Contractor shall dispose of all waste material in a suitable manner.

The plant shall be sufficiently tight so as to prevent any substantial amounts of particulate leakage from the plant.

(1.7) Air Emission Permit. The Contractor shall not install an asphalt hot mix plant without furnishing a copy, to the K.D.O.T. Area Engineer, of an AIR EMISSION PERMIT, issued by the Kansas Department of Health and Environment (K.D.H.E.). It will be the Contractor's responsibility and expense to satisfy the K.D.H.E. requirements.

(1.8) Safety Requirements. Adequate and safe access shall be provided to sampling points and other locations where checking of plant operations is necessary. All gears, pulleys, chains, sprockets and other dangerous moving parts shall be thoroughly guarded and protected. Access to the top of truck bodies shall be provided by a platform or other suitable device to enable the Engineer to obtain samples and temperature data.

(2) Requirements for Drum Mix Plants.

(2.1) General. The plant shall be specifically designed for drum mixing and be capable of satisfactorily heating, drying and mixing the bituminous mixtures.

(2.2) Cold Aggregate Feed System. Positive weight measurement of the combined cold aggregates shall be by the use of belt scales. The amount of cold aggregate shall be continuously recorded on a non-set-back recorder. The belt scale shall have an accuracy within two percent by weight of the material being measured over any given period of time. The accuracy of the belt scales shall be certified at intervals as directed by the Engineer. The weight system shall be automatically coupled with the bitumen flow to maintain the required proportions.

(2.2.1) Safe, adequate and convenient facilities shall be provided for obtaining representative samples of the combined cold aggregate. The sampling device shall be capable of providing a sample of proper size from the full width of the combined aggregate flow while the plant is operating at regular production rate. The sample shall be large enough to be representative, but not so large that it cannot be carried safely by two people.

(2.2.2) Reclaimed Asphalt Pavement (RAP) Material Conveyor. If the plant is used for recycling, a dual weighing system will be required to control delivery of virgin aggregate and RAP material to the drum. The system shall be equipped with interlocking mechanisms in a manner which will assure positive and accurate delivery of virgin aggregates and RAP material in proper proportions at all times. Belt scales for the RAP material shall comply with the requirements specified in subsection 151.21 (c) (2.2).

(2.2.3) Moisture Compensation. The cold feed system shall include a moisture compensation device to correct for the moisture in the aggregate passing over the belt scales.

(2.2.4) Belt scales shall be protected from the effect of wind and weather.

(2.3) Bituminous Material Feed System. Bituminous material shall be supplied to the mixing drum through a continuously registering cumulative indicating meter by a pump specifically designed for drum mix plants. The meter shall be located in the bituminous material line so it will register the discharge to the drum. Provisions shall be provided to divert the flow into a container for calibration. The meter shall be supplied with a non-set-back register and shall have an accuracy within two percent by weight of the material measured in any

given period of time. The register shall record only that material delivered to the drum.

(2.4) Calibration of Feed Systems. The aggregate weighing system and the bituminous material metering system shall have provisions to enable easy calibration which will be subject to approval of the Engineer who may require a schematic diagram of the system prior to plant calibration.

(2.5) Mineral Filler Feed System. Fly ash and similar mineral fillers shall be introduced and uniformly dispersed into the drum mixer at the point of introduction of the asphalt without loss to the dust collector system. A non-set-back register shall record the quantity of such mineral filler discharged into the mixer. The delivery system shall be variable speed to interlock with the aggregate weigh belt so the total aggregate weight including the mineral filler is indicated to the asphalt proportioning system. A device shall be provided to indicate that mineral filler is being delivered uniformly to the drum. A device shall be provided to activate a visible or audible signal to the plant operator when the flow of mineral filler is reduced or interrupted. The delivery system shall have provisions to enable easy calibration, and shall be subject to the approval of the Engineer who may require a schematic diagram of the system prior to plant calibration.

(2.6) Mixing Drum. The drum shall be equipped with automatic burner controls to prevent damage to the aggregate or bituminous material. The discharge temperature of the mixture shall be within the range specified in Section 602 for the type of bituminous material being used. The activating unit for recording the bituminous mixture temperature shall be installed in the discharge chute of the drum mixer.

The rate of flow through the drum shall be such that the aggregate and bituminous material form a homogeneous mixture with all particles uniformly coated. In no case shall the quantity of mixture produced exceed the manufacturers rated capacity.

(2.7) Use of Storage Bins and Batchers. When used with a storage bin, these plants shall be designed and operated so the transfer of bituminous mixture from the drum to the storage bin will not cause segregation of the mixture and the batcher can be operated in accordance with subsection 603.03 (a) (4.5). If approved by the Engineer the batcher may dump the bituminous mixture directly into trucks.

(2.7.1) Requirements for Storage Bins and Batchers. All storage bins shall be provided with controls capable of main-

taining a specified minimum level or amount of bituminous mixture in the bin at all times during production.

If the amount of bituminous mixture in the bin can be determined by reading the output of load cells or other approved sensors, the minimum amount of material in tons shall be specified by the Engineer. Otherwise, the minimum level of bituminous mixture shall be the top of the tapered portion of the bin or at the point designated by the Engineer on special designed bins.

The Controls shall be set to close and lock the bin gate when the specified minimum amount or level is reached.

Override of the lock shall be permitted only to clean out the bin at the end of a production run.

Every storage bin shall be equipped with a batcher at the top, so located that the bituminous mixture is discharged vertically from the batcher into the center of the bin. Other equipment such as a rotating chute may be approved by the Engineer if the operation is satisfactory. Under no circumstances shall the storage bin be loaded directly from a belt or other conveyor. The belts carrying bituminous mixture shall be covered to prevent excess heat loss.

Control of batcher gates shall be such that the batcher will operate in accordance with subsection 603.03 (a) (4.5) throughout the output range of the plant.

(3) Requirements for Hot Mix Batch Plants.

(3.1) Drier. The plant shall include one or more driers which continuously agitate the aggregate during the heating and drying process. The driers shall be capable of drying and heating all aggregate to specified requirements.

(3.2) Aggregate Temperature. The actuating unit for recording the aggregate temperature shall be installed where the hot materials flow over it during the proportioning operation.

(3.3) Hot Aggregate Storage Unit. The configuration of the unit shall be such that the aggregate will not be segregated and it can be discharged into the weigh hopper in a manner which will not affect the accuracy of weighing.

(3.4) Weigh Box or Hopper. The equipment shall include a means for accurately weighing the aggregate in a weigh box or hopper suspended on scales and of ample size to hold a full batch with out running over. The gate shall close tightly so that no material is allowed to leak into the mixer while a batch is being weighed.

(3.5) Bituminous Control. The weigh bucket shall be a non-tilting type with a loose sheet metal cover. The length of the discharge opening or spray bar shall be not less than 3/4 the

length of the mixer and it shall discharge directly into the mixer. The bituminous material bucket, its discharge valve or valves and spray bar shall be adequately heated. The capacity of the bituminous material bucket shall be at least 15 percent in excess of the weight of bituminous material required in any batch. The plant shall have an adequately heated quick acting, non-drip, charging valve located directly over the bituminous material bucket.

The scale dial shall have a capacity of at least 15 percent in excess of the quantity of bituminous material used in a batch and be in full view of the mixer operator. The flow of bituminous material shall be automatically controlled so that it will begin when the dry mixing period is over and all of the bituminous material required for one batch will be discharged in not more than 15 seconds after the flow has started. If an approved metering device is used to control the amount of bituminous material the section of the bituminous line between the charging valve and the spray bar shall be provided with a valve and outlet for checking the meter.

(3.6) Scales. Scales may be of either the beam or springless dial type and shall be a standard make and design, accurate to 0.25 percent and operated within 0.5 percent of the maximum load that may be required.

Beam scales shall have a tell-tale dial that will start to function when the load being applied is within 100 pounds of that required.

Dial scales shall be springless, of a standard make. The dials shall be of the compounding type having full complements of index pointers. Pointers so placed as to give excessive parallax errors shall not be used. All dials shall be so located as to be plainly visible to the operator at all times.

Scales shall be inspected and sealed or certified in accordance with Section 151.06.

(3.7) Control of Mixing Time. The mixer shall be equipped with an accurate time lock to control the operations of a complete mixing cycle. It shall lock the weigh box gate after the charging of the mixer until the closing of the mixer gate at the completion of the cycle. It shall lock the bituminous material bucket throughout the dry mixing period and lock the mixer gate throughout the dry and wet mixing periods. The dry mixing period is defined as the interval of time between the opening of the weigh box gate and the start of introduction of bituminous material. The wet mixing period is the interval of time between the start of introduction of bituminous material and the opening of the mixer gate.

The setting of time intervals shall be performed in the presence of the Engineer who shall then lock the case covering the timing device until such time as a change is to be made in the timing device.

(3.8) Mixer. The batch mixer shall be an approved type capable of producing a uniform mixture.

If not enclosed, the mixer box shall be equipped with a dust hood to prevent loss of dust.

The clearance of blades from all fixed or moving parts shall not exceed one inch unless the maximum diameter of the aggregate in the mix exceeds 1¼ inches, in which case the clearance shall not exceed 1½ inches.

(3.9) Use of Storage Bins and Batchers. When used with a storage bin, these plants shall be designed and operated so the transfer of bituminous mixture from the mixer to the storage bin will not cause segregation of the mixture and the batcher can be operated in accordance with subsection 603.03 (a)(4.5).

(3.10) Requirements for Storage Bins and Batchers. Storage bins and batchers shall comply with the requirements specified in subsection 151.21 (c)(2.7.1).

(4) Special Requirements for Continuous Mix Plants.

(4.1) All continuous mix plants shall comply with the following requirements:

(4.1.1) Drier. The plant shall include one or more driers which continuously agitate the aggregate during the heating and drying process. The drier shall be capable of drying and heating the mineral aggregate to specified requirements.

(4.1.2) Mixer. The plant shall include a continuous mixer of an approved type, adequately heated and capable of producing a uniform mixture. It shall be equipped with a discharge hopper with dump gates which will permit rapid and complete discharge of the mixture. The paddles shall be adjustable for angular position on the shafts and reversible to retard the flow of the mix.

(4.1.3) Use of Storage Bins and Batchers. When used with a storage bin, these plants shall be designed and operated so the transfer of bituminous mixture from the mixer to the storage bin will not cause segregation of the mixture and the batcher can be operated in accordance with subsection 603.03 (a) (4.5).

(4.1.4) Requirements for Storage Bins and Batchers. Storage bins and batchers shall comply with the requirements specified in subsection 151.21 (c) (2.7.1).

(4.2) Continuous mix plants not using the hot aggregate

proportioning unit shall comply with the following requirements:

The plant shall meet all of the requirements of subsections 151.21 (c) (2.2), (2.2.1), (2.2.2), (2.2.3), (2.2.4), (2.3), (2.4) and (2.6).

(4.3) Continuous mix plants with aggregate proportioning units consisting of screens, bins and gates which grade, store and meter the heated aggregates shall comply with the following requirements:

(4.3.1) Aggregate Proportioning Unit. The unit shall include a feeder mounted under the aggregate compartment. The feeder shall have accurately controlled individual gates for volumetrically measuring each size aggregate drawn from the compartment. The feeding orifice shall be rectangular with one dimension adjustable by positive mechanical means provided with a lock. Graduated indicators with subdivisions of not more than 0.1 inch shall be provided for each gate to show the size of the opening. The aggregate apron shall be equipped with an accurate revolution counter.

(4.3.2) Calibration of Aggregate Feed. The plant shall include a means for calibrating gate openings by weighing test samples. An accurate platform scale with a minimum capacity of 500 pounds shall be provided.

(4.3.3) Control of Bituminous Material. The proportioning device for bituminous material shall be a positive displacement pump. The metering system shall include a pressure gauge to accurately indicate spray nozzle pressure. Discharge at the mixer shall be through a satisfactory spray nozzle arrangement.

(4.3.4) Synchronization of Aggregate Feed and Bituminous Material Feed. The aggregate feed and the bituminous feed shall be mechanically interlocked.

(4.3.5) Hot Aggregate Bins. Each bin shall be equipped with a device which will visibly or audibly indicate an insufficient supply of aggregate or which will shut down plant operations when aggregate supply reaches a level below requirements.

151.22 SELF-PROPELLED AGGREGATE SPREADER.

The aggregate spreader shall be self-propelled, of an approved design and shall be supported by at least four wheels equipped with pneumatic tires on two axles. The aggregate spreader shall be equipped with a means of applying the larger cover coat material to the surface ahead of the smaller cover coat material with positive controls so that the required amount of material will be deposited uniformly over the full width of the bituminous material.

151.23 SURFACE RECYCLE EQUIPMENT.

(a) Heater Scarifier.

Scarifying equipment shall consist of a self-contained unit or combination of self-contained units which are specifically designed to heat and scarify the upper portion of existing pavement. The machine or machines shall be self-propelled, capable of scarifying the bituminous surface to a depth of not less than 3/4 inch. The heating unit shall be adjustable in width with ports permitting fuel and forced air injection for proper combustion without excessive smoke. The scarifier mechanism shall be arranged to provide complete coverage.

(b) Distributor-Paver.

This will be a single unit which will uniformly distribute the rejuvenator at the stipulated rate onto the scarified material, and screed and finish the scarified material in a manner similar to a bituminous paver stipulated in Section 151.20.

(c) Heater-Scarifier-Paving Machine.

This will be a single unit which will meet the heater scarifier specifications listed above in subsection 151.23(a), mill and/or scarify to the specified depth, distribute the rejuvenator uniformly into the recycled material at the stipulated rate, and meet the bituminous paver specification listed in Section 151.20.

151.24 COLD RECYCLED BITUMINOUS PAVEMENT EQUIPMENT.

The Contractor shall furnish a self-propelled machine capable of cutting and removing the bituminous pavement, in one pass, to the depth shown on the Plans. The cutting machine shall have automatic controls capable of maintaining a uniform grade and cross slope. The existing asphalt pavement shall be pulverized to specified requirements without contamination from the subgrade material.

Provisions shall be made for continuous weight measurement of the pulverized pavement material, interlocked with the additive metering device in order that the desired additive content will be maintained. Positive means shall be provided for calibrating the weight measurement device and the additive metering device.

The additive shall be applied in a mixing chamber which is capable of mixing the pulverized pavement material and

additive to a homogeneous mixture. The additive pump will automatically shut off when delivery of pulverized material to the mixing chamber is stopped. The additive system shall maintain the binder amount within plus or minus 0.2 percent of the desired application rate of additive. The mixture shall be placed in a windrow in such a manner that segregation does not occur.

Placement of the recycled mixture shall be accomplished with a self-propelled bituminous paver meeting the requirements of Section 151.20 without segregation, to the line and grades designated. When a pick-up machine is used to feed the windrow into the paver hopper, it shall be capable of picking up the entire windrow down to the underlying materials.

The Contractor shall have the following self-propelled equipment available to establish the rolling procedure: steel, vibratory steel, pneumatic, and vibratory sheepsfoot. The vibratory steel roller may also be used as the steel roller.

151.25 ASPHALT-RUBBER CRACK SEALANT EQUIPMENT.

The machine used for pouring cracks shall be capable of mixing the asphalt and rubber in the specified proportions and at the specified temperatures into a homogeneous mixture. An agitating auger will be required in the machine to insure adequate mixing. The machine shall be equipped with a hand applicator tube.

151.26 EXTRACTION TESTING EQUIPMENT (HOT MIX PLANT).

The extraction apparatus shall consist of the following items:

(1) Extraction Assembly consisting of a 3000 gm capacity vacuum extractor complete with vacuum pump which is compatible with the extractor as recommended by the extractor manufacturer.

(2) Ultra-sonic bath with minimum inside dimensions of 11½" by 9½" by 6" high.

(3) Microwave Oven, 650 Watt Minimum, with the approximate inside dimension to be 14" × 14" × 9" minimum height. A florescent tube, F4T5/cw or a meter specifically designed for microwave leak detection shall be provided. The microwave oven timer shall provide for a minimum time setting of 15 minutes. This oven shall be vented by means of an exhaust

fan as described for a Type D Field Office and Laboratory as shown in Section 805.

(4) An enclosed cabinet shall be furnished which shall be of sufficient size to contain the extraction assembly, vacuum pump, and ultra-sonic bath. The cabinet shall be equipped with an exhaust fan of 300 c.f.m. vented to the exterior of the building. Electrical switches for controlling the exhaust fans shall be located on the exterior of the cabinet. The unit shall be vented as described for a Type D Field Office and Laboratory as shown in Section 805.

(5) The microwave oven shall be placed in a hood or similar enclosure with through-the-wall exhaust fan rated at 300 c.f.m. or greater.

(6) A solvent storage can of five gallon capacity with a tightly fitted closure and safety type, non-sparking spigot shall be provided for use within the laboratory. Any can exhibiting signs of leakage of liquids or fumes shall be removed from service and replaced.

The solvent to be used for extraction testing shall be as specified in Section 603.

151.27 SLURRY SEAL EQUIPMENT.

(a) Mixing Equipment.

The slurry mixing machine shall be a continuous flow mixing unit, truck mounted, capable of accurately delivering predetermined, properly proportioned amounts of aggregate, water and emulsified asphalt to an approved mixing unit and to discharge the thoroughly mixed product on a continuous flow basis. The machine shall have sufficient storage capacity for aggregate, emulsified asphalt, cement and water to maintain an adequate supply to the proportioning controls. The machine shall be operated continuously while loading to eliminate unnecessary construction joints.

The mixing machine shall be equipped with an approved fines feeder that shall provide a uniform, positive, accurately metered, predetermined amount of the specified mineral filler at the same time and location that the aggregate is fed.

The mixing machine shall be equipped with a water pressure system and nozzle type spray-bar to provide a water spray to the road surface immediately ahead of the slurry spreading equipment.

The aggregate feed to the mixer shall be equipped with a revolution counter or similar device so that the amount of aggregate used may be determined at any time.

The emulsion pump shall be of the positive displacement type and shall be equipped with a revolution counter or similar device so that the amount of emulsion used may be determined at any time.

The water pump for dispensing water to the mixer shall be equipped with a flow meter which will dispense the amount of water necessary to adjust for consistency. The pump shall be equipped with a minimum of two valves. One valve shall establish the required water flow. The other valve shall be a quick acting valve to start and stop the water flow.

The addition of any additive to the mixture or any component material shall require a metering device attached to the slurry machine. Such device shall have positive quick acting controls, shall be easily calibrated and shall maintain accurate and uniform flow.

The controls for proportioning each material to be added to the mix shall be calibrated and properly marked. They shall be accessible for ready calibration and so placed that the Engineer may determine the amount of each material used at any time.

(b) Spreading Equipment.

Attached to the slurry mixing machine shall be a mechanical type squeegee distributor equipped with flexible material in contact with the surface to prevent loss of slurry from the distributor box. The rear flexible seal shall act as a strike off and shall be adjustable in width. It shall be maintained so as to prevent loss of slurry on varying grades and crown by adjustments to assure uniform spread. A burlap drag may be required by the Engineer to obtain the desired texture. The box shall be equipped with lateral movement controls and shall be kept clean and free of any build up of asphalt and aggregate. The width of the distributor box shall be such that any longitudinal construction joint shall correctly delineate the existing traffic lanes. The box shall be equipped with a mechanical device capable of uniformly distributing the slurry in the box so as to maintain a uniform distribution in the box at all times.

151.28 MODIFIED SLURRY SEAL EQUIPMENT.

(a) Mixing Equipment.

The modified emulsion mixture shall be mixed and laid by a self- propelled mixing machine capable of accurately delivering and proportioning the aggregate, mineral filler,

water, additive(s) and emulsified asphalt to a revolving multi-blade dual mixer and discharging the thoroughly mixed product. The machine shall have sufficient storage capacity for aggregate, emulsified asphalt, mineral filler, water and additive to maintain an adequate supply to the proportioning controls. The machine shall be operated continuously while loading to eliminate unnecessary construction joints.

Individual volume or weight controls for proportioning each material to be added to the mix shall be provided. Each material control device shall be calibrated and properly marked. They shall be accessible for ready calibration and so placed that the Engineer may determine the amount of each material used at any time.

The mixing machine shall be equipped with a water pressure system and nozzle type spray bar to provide a water spray immediately ahead of and outside the spreader box as required.

(b) Spreading Equipment.

The paving mixture shall be spread uniformly by means of a mechanical type laydown box attached to the mixer, equipped with paddles to agitate and spread the materials through the box. These paddles shall be designed and operated so all the fresh mix will be agitated. This turbulence shall prevent the mixture from setting-up in the box or causing side buildup and lumps. Flexible seals, front and rear, shall be in contact with the road to prevent loss of mixture from the box. The box shall be equipped with lateral movement controls and shall be kept clean and free of build up of asphalt and aggregate. Rut-filling equipment will require adjustable steel strike-off plates. The rear flexible strike-off shall be adjustable. The spreader shall be operated to prevent the loss of the paving mixture when surfacing super elevated curves. The mixture shall be spread to fill cracks and minor surface irregularities and leave a uniform application of slurry on the surface. The spreader box and rear strike-off shall be so designed and operated that a uniform consistency is achieved to produce a free flow of material to the rear strike-off without causing skips, lumps or tears in the finished surface.

151.29 REBAR INSERTION EQUIPMENT.

(a) Drilling Equipment.

Drilling equipment shall be hydraulic driven and capable of operating in a clockwise direction. The drill shall be truck

or trailer mounted with adjustments in transverse and longitudinal directions. The drill shall be capable of operating at a pitch of 45 degrees with a power system to drive and raise the drill bit. Loose material shall be removed by drill shaft vacuum extraction during drilling.

(b) Epoxy Pump.

The pump system shall be certified, by the manufacturer, to deliver a proper mixture of specific material properties and a given resin to hardener ratio. The given ratio is supplied by the epoxy manufacturer.

The pump may be adaptable for variable mixture ratios. However, it must deliver the epoxy manufacturers specified mix ratio. The ratio of resin to hardener shall be maintained for the temperature range of 40 to 120 degrees F. and a pressure range of 20 to 100 P.S.I. The pump shall include the separate A to B supply hoses along with their respective backflow stop valves.

(c) Epoxy Mixer.

The epoxy mixer shall have adequate elements to thoroughly mix the resin and hardener components. The mixer shall be capable of operating within the same temperature and pressure range as the pump system. The mixer shall be constructed of semi-transparent materials in order to observe the mixing operation. The mixer should be easy to clean. Suitable mixers are available from the pump manufacturers.

(d) Injection Nozzle Assembly.

The injection nozzle shall be capable of temporarily locking into the one inch diameter hole in the concrete. The locking system shall be capable of holding a minimum sustained pressure of 100 P.S.I. without significant surface leakage. A design for a suitable assembly is available from the Kansas Department of Transportation, Bureau of Materials and Research.

151.30 PILE DRIVING EQUIPMENT.

(a) Hammers for Timber Piles.

Gravity hammers for driving timber piles shall weigh not less than 2,000 pounds and preferably not less than 3,500 pounds. The fall shall be so regulated as to avoid injury to the piles, and in no case shall exceed 15 feet. When a steam

or diesel hammer is used the total energy developed by the hammer shall be not less than 6,000 foot-pounds per blow.

(b) Hammers for Steel Piles, Steel Sheet Piles, and Shells for Cast-in-Place Concrete Piles.

Gravity hammers for driving steel piles, steel sheet, and shells for cast-in-place concrete piles shall weigh not less than 2,000 pounds and preferably not less than 3,500 pounds. In no case shall the gravity hammer weigh less than the pile being driven plus the weight of the driving cap. All gravity hammers shall be equipped with hammer guides to insure concentric impact on the drive head or pile cushion. The fall shall be so regulated as to avoid injury to the piles and in no case shall exceed 15 feet. Steam hammers or diesel hammers for driving steel piles, steel sheet piles, and shells for cast-in-place concrete piles shall be of such size that the rated gross energy of the hammer in foot- pounds shall be not less than 2½ times the weight of the pile in pounds and in no case shall the hammer develop less than 6,000 foot- pounds of energy per blow.

Contractor certified weights may be used for the weight of gravity hammers.

(c) Hammers for Prestressed Concrete Piles.

Unless otherwise provided, prestressed concrete piles shall be driven with a diesel, steam or air hammer which shall develop an energy per blow at each full stroke of the piston of not less than one foot- pound for each pound of weight driven. In no case shall the energy developed by the hammer be less than 6,000 foot-pounds per blow.

(d) Vibratory Hammers.

Vibratory hammers may be used only when specifically allowed by the Contract documents or in writing by the Engineer. Vibratory hammers, if permitted, should preferably be used in combination with pile load testing and retapping with an impact hammer. In addition, one of every ten piles driven with a vibratory hammer shall be retapped with an impact hammer of suitable energy to verify that acceptable load capacity was achieved.

(e) Additional Equipment.

In case the required penetration and/or bearing is not obtained by the use of a hammer complying with the above minimum requirements, the Contractor shall provide a ham-

mer of greater energy and/or when permitted resort to jetting or pre-drilling at his own expense. Use of the pile driving analyzer may be required when minimum requirements are not obtained or results are doubtful.

(f) Leads.

Pile-driving leads shall be constructed in such a manner to afford freedom of movement of the hammer, and they shall be held in position by guys or stiff braces to insure support to the pile during driving. Except where piles are driven through water, the leads shall be of sufficient length so that the use of a follower will not be necessary.

Inclined leads shall be used in driving battered piles. The driving of piles with followers shall be avoided if practicable and shall be used only with written permission of the Engineer. When followers are used, one pile from every group of ten or fraction thereof shall be a long pile driven without followers, and shall be used as a test pile to determine the average bearing power of the group.

(g) Hammer Cushion.

All impact pile driving equipment except gravity hammers shall be equipped with a suitable thickness of hammer cushion material to prevent damage to the hammer or pile and to insure uniform driving behavior. Hammer cushions shall be made of durable, manufactured material, which will retain uniform properties during driving. All wood, wire rope, and asbestos hammer cushions are specifically disallowed and shall not be used. A striking plate shall be placed on the hammer cushion to insure uniform compression of the cushion material. The hammer cushion shall be inspected in the presence of the Engineer when beginning pile driving at each structure or after each 100 hours of pile driving, whichever is less. The hammer cushion shall be replaced by the Contractor before driving is permitted to continue whenever there is a reduction of hammer cushion thickness exceeding 25 percent of the original thickness.

(h) Pile Driving Head.

Piles driven with impact hammers shall be fitted with an adequate driving head to distribute the hammer blow to the pile head. The driving head shall be axially aligned with the hammer and the pile. The driving head shall be guided by the leads and shall not be free- swinging. The driving head shall fit around the pile head in such a manner as to prevent

transfer of torsional force during driving while maintaining proper alignment of hammer and pile.

(i) Water Jets.

Jetting is to be used only with permission of the Engineer. When jets are used, the number of jets and the volume and pressure of water at the jet nozzle shall be sufficient to erode freely the material adjacent to the pile. The plant shall have sufficient capacity to deliver at all times at least 100 pounds per square inch pressure at 3/4 inch jet nozzles. At least five feet before the desired penetration is reached, the jets shall be withdrawn and the piles shall be driven with an approved hammer to secure the final penetration.

151.31 ROADSIDE IMPROVEMENT EQUIPMENT.

(a) Seeding Drill.

Drills used for roadside seeding and fertilizing shall be in good working order so that the rate of seed and fertilizer may be accurately controlled according to the rates shown on the Plans. Two or more separate seed compartments may be necessary for seeding certain projects. All of the seed compartments shall be capable of the accuracy needed to get the seeding rates shown for the various grasses and legumes listed on the Plans. The drill shall be a commercial grass-seed drill or a drill with grass-seed attachment as approved by the Engineer. The width of the drill shall be approved by the Engineer on the basis of the area to be seeded. The space of seed tubes, disks, and boots, shall be a maximum of eight inches. Drills shall be able to accurately control the depth of seeding and fertilizer placement. The depth of seeding and fertilizer shall not exceed 1/2 inch. Seed and fertilizer compartments shall be constructed with partitions to prevent the material from sliding to one side of the drill while operating on steep slopes.

(b) Hydraulic Slurry Seeding, Fertilization and Mulching.

All machines used for hydraulic seeding operations shall have continuous agitation of the slurry mixture during seeding operations. The machines shall have pressure to force seed and mulch material to the right-of-way line of most typical highway sections. The machine shall have tank capacity of not less than 750 gallons.

(c) Mulch Puncher.

Mulch punchers shall be constructed so that weight may be added or hydraulic force from the tractor may push the puncher into the ground. The discs used for punching purposes shall be notched and have a minimum diameter of 16 inches. The disks shall be flat or uncupped such as notched coulters commonly used on moldboard plows. Disks shall be placed a maximum of eight inches apart along the axle or shaft. Shaft or axle sections of disks shall be a maximum of eight feet in length.

(d) Cultipacker.

Cultipackers shall be constructed so that sections are a maximum of six feet in length. A maximum of three sections may be pulled behind a tractor or drill at any time.

(e) Root "Sprigger".

Spriggers shall be constructed so that the root planting mechanism is driven by the tractor's power take-off to assure a constant planting of roots on steep slopes. The machine shall be capable of planting roots in a continuous unbroken pattern. The Engineer shall check the machine on a slab or hard ground with the power take-off running to determine if enough roots are being fed through the machine.

(f) Emulsified Asphalt Mulch Distributor.

Machines for distributing emulsified asphalt for mulch cover shall be approved by the Engineer prior to use and shall be maintained in good operating condition.