

Section 5

ASPHALT PLANT EQUIPMENT AND REQUIREMENTS

5.1 BASIC OPERATION OF AN ASPHALT PLANT

Asphalt paving mixes made with asphalt binder are prepared at an asphalt mixing plant. Aggregates are blended, heated and dried, and mixed with asphalt binder to produce a hot asphalt paving mixture. The mixing plant may be small and simple or it may be large and complex, depending on the type and quantity of asphalt mixture being produced. The plant may be stationary (permanent) or portable.

5.2 TYPES OF ASPHALT PLANTS

Asphalt plants are basically of three general types:

- (1) **Batch plant**
- (2) **Drum mix plant**
- (3) **Continuous mix plant**

The specifications include specific equipment requirements for each type plant. However, the two most common types of asphalt plants are the batch plant and drum mix plants and will be discussed in detail in this manual. Continuous mix plants are not covered, since these are now very seldom used.

5.3 CERTIFICATION OF ASPHALT PLANTS

All plants used to produce hot mix asphalt for DOT projects are certified by the Division of Highways as meeting the requirements of the specifications. The initial inspection for plant certification will be made by the Pavement Construction Engineer or his representative upon request from the Contractor. A certificate of compliance, (Figure 5-1), including a copy of the certification checklist, will be issued to the plant owner and **shall be displayed** in the plant control room. This certification is effective from the date of issuance and is non-expiring, subject to continued compliance. Any plant which is significantly modified, relocated or which changes ownership must be recertified prior to use.

A list of all certified Asphalt Plants is available by contacting the Pavement Construction Section. Changes in certifications and the addition of new certifications will be updated in the system as they occur by the Pavement Construction Engineer. Updated listings will be furnished periodically to each Division QA Supervisor, or to anyone upon request.

At the beginning of each season, and any time deemed necessary by the Engineer, each plant site will be checked for compliance with the specifications. This check will be preformed by the QA supervisor or his representative and documented in writing in a daily log or diary. When QA Supervisors find anything out of compliance with the specifications, it should be documented in writing. The Contractor and the Pavement Construction Engineer shall be notified immediately.

This certification covers all plant equipment, including recycling equipment. This certification does not certify the Contractor's Quality Control Laboratory nor does it ensure the plant's mix quality. Field Lab tests performed during production is required to ensure mix quality. The plant certification also doesn't ensure accuracy of weighing devices. Refer to the appropriate section of this manual for specific requirements of weighing devices.



NORTH CAROLINA DEPARTMENT OF TRANSPORTATION



This asphalt plant has been inspected and certified as meeting the requirements of North Carolina Department of Transportation Standard Specifications for Roads and Structures Article 610-5, dated July, 2006 and other contract provisions currently in effect.

This Certification shall remain effective from the date of issuance until there is a change in ownership, location, or major modifications are made to the plant equipment, subject to continued compliance with the specifications.

Quality Paving Co., Inc.

Owner

Everywhere, N.C.

Site

AS-001

Plant Certification No.

CMI

Make

400 TPH

Rated Capacity

Drum

Type

12345

Serial No.

PTD-400

Model No

Yes

Certified for Recycled Mixes? (Y/N)

Wiley W Jones, III

Wiley W. Jones, III, P.E.

Pavement Construction Engineer

5.4 ASPHALT PLANT SPECIFICATION CHECKLIST

The following inspection checks are to be made and used frequently by both **QA** and **QC Technicians** at the asphalt plant. In addition to performing the following checklist, the Quality Assurance personnel should periodically perform an inspection of the QC operations. Frequent visits to the plant should be made.

ITEMS TO BE CHECKED:

GENERAL REQUIREMENTS FOR ALL PLANTS

1. Check to see if the plant is certified in accordance with the Standard Specifications?
If so, document for QA records on QA-4 or diary.
2. Check the stockpiles for:
 - (a) gradation
 - (b) uniformity
 - (c) segregation
 - (d) contamination
 - (e) ample space or bulkheads between stockpiles
 - (f) availability of materials as specified on job mix formula
3. Check cold feeders for:
 - (a) separate bin for each material size to be used
 - (b) a separate bin provided for mineral filler, if required
 - (c) bins loaded in a manner such that materials will not be mixed
 - (d) all gates in workable condition
 - (e) synchronized proportioning system when two or more bins used
 - (f) vibrators on bins where needed in workable order
 - (g) all cold feeders equipped with "no-flow" sensors and in good operating condition
 - (h) cold feeders calibrated in accordance with the job mix formula and documented
4. Check dryer for:
 - (a) capability of continuously agitating aggregate
 - (b) thermometric instrument in discharge chute functioning properly
 - (c) automatic burner control functioning
5. Check trucks for:
 - (a) the truck bodies are smooth and clean
 - (b) the body is washed down with an approved release agent and well drained before loading
 - (c) covers are being used on trucks and are of adequate size such that they will cover the load and prevent the entrance of moisture or rapid loss of temperature
 - (d) proper loading (three dumps at different locations within the bed of the truck)
 - (e) each truck body has a hole at least 3/8 inch (10mm) in diameter on each side of the body six inches (150mm) above the floor to facilitate the checking of temperature
6. Check to see if a satisfactory truck access (**sampling platform**) is provided
7. Check truck scales for:
 - (a) truck scales accurately calibrated and certified by Department of Agriculture in accordance with Article 106-7 of the Standard Specifications
 - (b) automatic weighing and recording equipment is operating properly, if used
 - (c) the Contractor's public weighmaster is properly licensed and current
 - (d) certified weight certificates are being issued in accordance with Article 106-7

8. Check Field Laboratory and Testing Equipment for:
 - (a) The laboratory is certified as meeting the requirements of Subarticle 609-5 (B) of the Standard Specifications
 - (b) All testing equipment is available and in good operating condition and properly calibrated
9. Have the proper field mix verification tests been performed in accordance with section 609-4 of the Standard Specifications and the most current edition of the HMA/QMS Manual on the mix type being produced?

BATCH PLANT OPERATIONS

10. Check hot bins and screens for:
 - (a) screens and screen deck are in satisfactory condition
 - (b) screening system is capable of removing oversize material
 - (c) hot bin sampling devices are operational
 - (d) hot bin overflow chutes are functional so as to prevent spillage into other bins
 - (e) gates close tightly to prevent leakage
 - (f) no holes exist in bin partitions
11. Mineral Filler, if needed, is introduced into the mix satisfactorily
12. Check weigh box or hopper for:
 - (a) capability of weighing each size aggregate automatically
 - (b) gates closing tightly to prevent spillage into mixer
 - (c) Form QC-2 (scale check) completed for aggregate scales and asphalt scales and **posted** at plant site, and a copy provided to the Division QA Supervisor
13. Check mixer for:
 - (a) no leaks occur in mixer box during mixing
 - (b) condition and clearance of mixer blades from fixed and moving parts adequate to assure complete mixing and coating of aggregate
 - (c) timing device set and locked at desired mixing time
 - (d) batches are being mixed at rated capacity of mixer
 - (e) required mixing time is being obtained after the asphalt starts being discharged into the pugmill
 - (f) the mix is of uniform appearance and temperature
14. Recycling Equipment, if applicable: (RAP/RAS)
 - (a) is plant equipped to automatically weigh and proportion the reclaimed material according to the job mix formula requirements?
 - (b) have weighing devices for reclaimed material been checked and calibrated to meet Specification tolerances?

DRYER-DRUM OPERATIONS

15. Check plant for:
 - (a) aggregate belt scales have been calibrated
 - (b) asphalt binder metering system has been calibrated
 - (c) aggregate moisture percentage has been determined and entered into control system

- (d) asphalt binder specific gravity data from mix design or most recent load ticket been entered correctly
 - (e) vibratory scalping screen is functional
 - (f) aggregate and asphalt binder feed rates are automatically interlocked
16. Check asphalt binder system for:
- (a) adequate circulation of asphalt binder and anti-strip additives
 - (b) silicone has been added for surface mixes
 - (c) anti-strip additive has been added in correct amounts at the terminal when required by the job mix formula or either in-line blending to be done at plant
 - (d) totalizer flow meter properly installed and operating properly (If anti-strip additive introduced at plant site).
 - (e) thermometer in binder feedline operating and temperature of asphalt binder is at mixing temperature
 - (f) no leaks in system occur in work area
 - (g) asphalt binder scales or meter are accurately calibrated
 - (h) form QC-2 (scale check) completed for aggregate weigh bridges, binder meters and anti-strip additive meters with a copy provided to the QA Supervisor
17. Check if automatic proportioning and mixing equipment is operating properly and being used to produce mix
18. Recycling equipment, if applicable:
- (a) is plant equipped to automatically weigh and proportion the reclaimed material according to the job mix formula requirements?
 - (b) have weighing devices for reclaimed material been checked and calibrated to meet Specification tolerances with form QC-2 completed and furnished to the QA Supervisor?

5.5 BATCH PLANT OPERATIONS AND COMPONENTS

Batch plants get their name from the fact that, during operation, they produce hot mix asphalt in batches, producing one batch at a time, one after the other. The size of a batch varies according to the capacity of the plant's pugmill (the mixing chamber where aggregate and binder are blended together). The Specifications require a minimum batch capacity of 3,000 lbs (1,360 kg). A typical batch capacity is about 6,000 lbs (2,720 kg); however, this may be as great as 12,000 lbs (5,440 kg)

Certain basic operations are common to all batch plants. They are:

- Aggregate storage and cold feeding.
- Aggregate drying and heating.
- Screening and storage of hot aggregates.
- Storage and heating of asphalt binder.
- Measuring and mixing of asphalt binder and aggregate.
- Loading of finished hot-mix.

Figure 5-2 illustrates the major components of a typical asphalt batch plant. Each component or group of related components is discussed in detail in sections that follow; however, an overview of the processes involved in plant operations will help the technician to understand the functions and relationships of the various plant components.

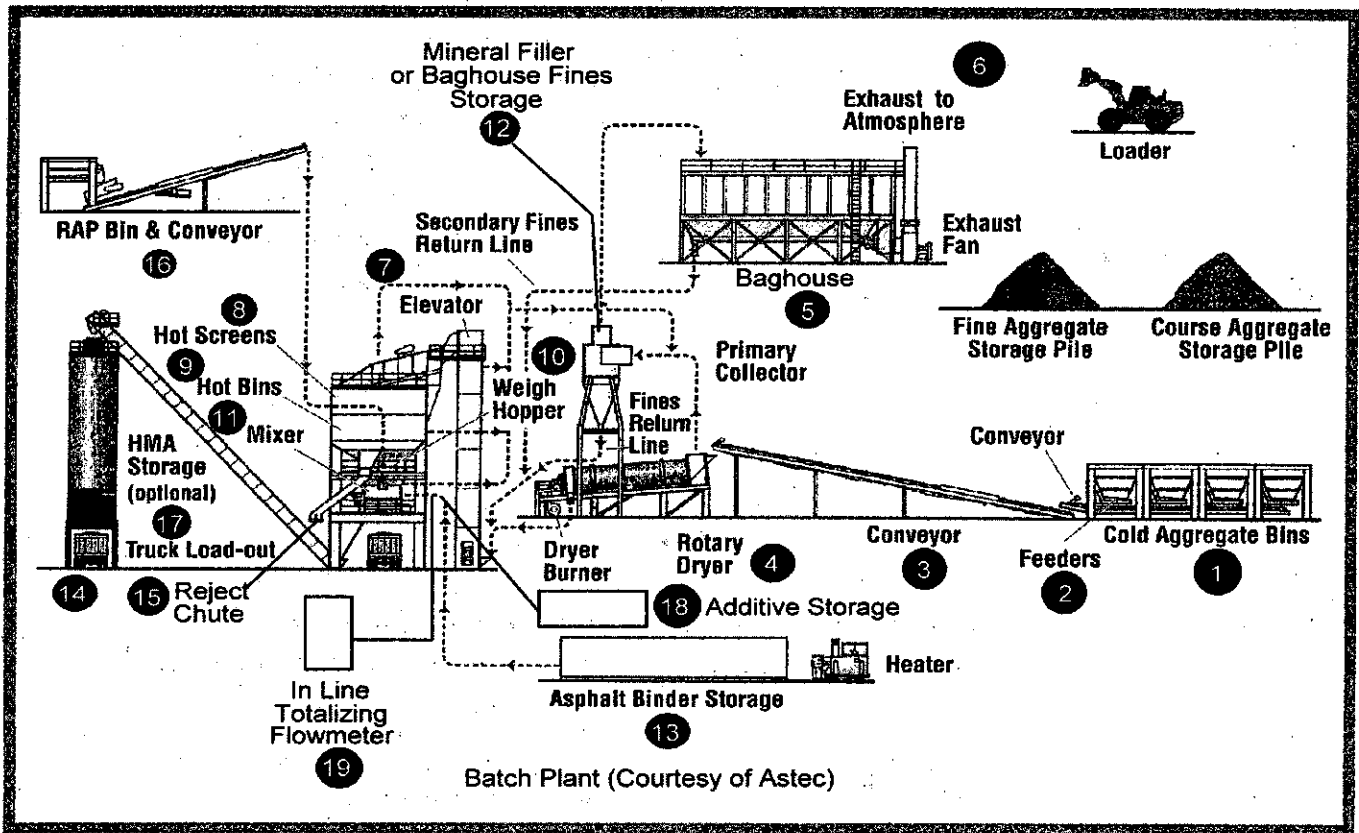


Figure 5-2
Major Batch Plant Components

Cold (unheated) aggregates stored in the **cold bins (1)** are proportioned by **cold-feed gates (2)** on to a **belt conveyor or bucket elevator (3)**, which delivers the aggregates to the **dryer (4)**, where they are dried and heated. The **baghouse (5)** removes undesirable amounts of dust from the dryer exhaust. Remaining exhaust gases are eliminated through the plant **exhaust stack (6)**. The dried and heated aggregates are delivered by **hot elevator (7)** to the **screening unit (8)** equipped with a scalping screen to remove any over sized material. This oversized material is deposited into a **reject chute (15)** for disposal. The material is then sized into different sized fractions and deposited into separate **hot bins (9)** for temporary storage. When needed, the heated aggregates are measured in controlled amounts into the **weigh box (10)**. The aggregates are then dumped into the **mixing chamber or pugmill (11)**, along with the proper amount of mineral filler, if needed, from **mineral filler or baghouse fines storage (12)**. If the plant is capable of producing recycled mixes then a **RAP Bin and conveyor (16)** is needed. Heated asphalt binder from the hot **asphalt binder storage tank (13)** is pumped into the **asphalt binder weigh bucket (14)** which weighs the asphalt binder prior to delivering it to the mixing chamber or pugmill where it is combined thoroughly with the aggregates, baghouse fines or mineral filler if used. From the mixing chamber asphalt hot-mix is deposited into waiting trucks or delivered into **storage silos or surge bins (17)**.

When anti-strip additives are introduced at the plant site an **additive storage tank (18)** is required with a **totalizing flowmeter (19)**, which is not capable of being reset, mounted in the additive feed line just prior to introduction into the binder feed line.

5.6 DRUM-MIX PLANT OPERATIONS AND COMPONENTS

Drum mixing is a relatively simple process of producing asphalt hot-mix. The mixing drum from which this type of plant gets its name is very similar in appearance to a batch plant dryer drum. The difference between drum-mix plants and batch plants is that, in the more conventional drum-mix plants the aggregate is not only dried and heated within the drum, but also mixed with the asphalt binder. However, there are some more recent model drum mix plants that introduce the asphalt binder outside the drum. The addition of a coater box, which is a pugmill type device, located at the discharge end of the drum allows the asphalt binder to be added into the coater box instead of into the drum. Still other "double barrel" type drum mix plants will add the asphalt binder between an inner and outer drum. The basic concept of all these types is the same though -- a continuous mixing process as compared to the mixing of batches at batch plants. There are no gradation screens, hot bins, or weigh hoppers in a drum-mix plant. Aggregate gradation is controlled at the cold feed and by the gradations of the individual aggregates being used.

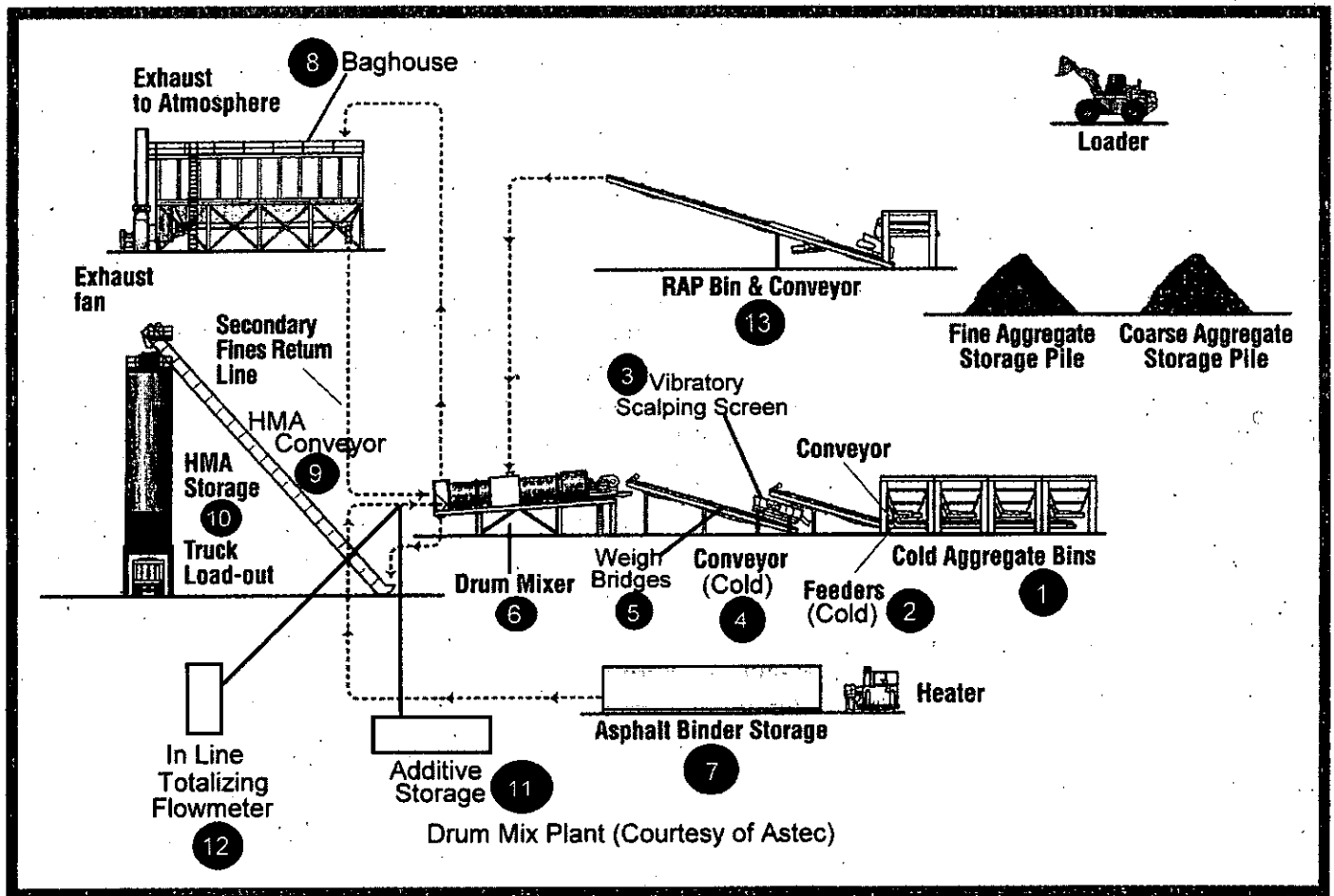


Figure 5-3
Basic Drum-Mix Plant

Drum mix plants vary in size and rated capacities from approximately 60 tons per hour up to several hundred tons per hour. Specifications require a minimum production capacity of 90 tons per hour for drum mix plants for certification purposes on all NCDOT construction contracts.

Referring to Figure 5-3, the following is a brief, general description of the sequence of processes involved in a typical drum-mix plant operation: Aggregates are deposited in the **cold feed bins (1)** from which they fed in exact proportions **cold feeders (2)** across a **vibratory scalping screen (3)** on to a **cold-feed conveyor (4)**. An automatic **aggregate weighing system or weigh bridges (5)** monitors the amount of aggregate flowing into the **drum mixer (6)**. The weighing system is interlocked with the controls on the asphalt binder storage pump which draws asphalt binder from a **storage tank (7)** and introduces it into either the drum, coater box, or between an inner and outer drum, where asphalt and aggregate are thoroughly blended by a mixing action. A dust collection system **baghouse (8)** captures excess dust escaping from the drum. From the drum, the hot-mix asphalt concrete is transported by **hot-mix conveyor (9)** to a **surge bin or silo (10)** from which it is loaded into trucks and hauled to the paving site. All plant operations are monitored and controlled from instruments in the control room.

5.7 INTRODUCTION OF ANTI-STRIP ADDITIVE AT BATCH PLANT OR DRUM PLANTS

When anti-strip additives are required in hot mix asphalt, the anti-strip may be either chemical or hydrated lime or combination of both. When a chemical additive is used, it shall be added to the asphalt binder prior to introduction to the aggregate. Any chemical additive or particular concentration of chemical additive found to be harmful to the asphalt material or which causes the performance grading of the original asphalt binder to be out of specifications for the grade required shall not be used.

When anti-strip additives are required the anti-strip shall be introduced and mixed into the asphalt binder at either the supplier's terminal or at the asphalt plant site. In-line blending equipment shall be used at either location.

When hydrated lime is used, it shall conform to the requirements of ASTM C 977. Hydrated lime shall be added at a rate of not less than 1.0 percent by weight of the total dry aggregate.

When chemical anti-strip additive is to be added at the asphalt plant in lieu of at the terminal, equip the plant with an in-line blending system capable of metering the additive within plus or minus 10 percent of the amount specified. Interlock the metering device with the asphalt binder control equipment in such a manner as to automatically vary the additive feed rate to maintain the required proportions and which will automatically indicate in the plant control room when flow is obstructed or stops. Inject the additive into the asphalt binder feed line prior to introduction into the aggregate. Equip the feed line with a blending device to thoroughly mix the additive with the asphalt binder prior to mixing with the aggregate. Provide a system capable of being calibrated, checked, and monitored for accuracy and quantity of the amount used.

Anti-strip additives are required in all NCDOT Superpave mixes. The quantity of anti-strip additive to be added will be based on the new or additional binder in the mix. Technicians should refer to the Job Mix Formula for the actual % of anti-strip additive for each mix type being produced.

The in-line blending system will be equipped with an in-line totalizing flow meter. The following are the guidelines for checking the totalizing flowmeters.

1. Totalizer Flowmeter is required if the chemical additive is introduced to the binder at the plant site.
2. Totalizer Flowmeter must be mounted in the additive feedline past the calibration bypass valve

3. Totalizer Flowmeters must not be capable of being reset. Meter readings will be the accumulated total flow of additive through the meter.
4. Totalizer Flowmeter is in addition to the calibration meter that is standard on additive systems.
5. Calibration Meters must be mounted in the additive feedline prior to the calibration bypass valve.
6. Additive storage tanks should be capable of being checked for quantity used. Checked either with a calibrated stick or a measuring gauge on the tank.
7. Additive storage tanks shall be equipped with a thermostatically controlled heating system capable of heating and maintaining the additive tank, contents and distribution system at the additive supplier's recommended temperature for the type of additive being used
8. Any metering system not fully meeting the above requirements may only be used with the approval of the Pavement Construction Engineer.

NOTE: QUALITY CONTROL PERSONNEL ARE REQUIRED TO READ THE FLOWMETER PRIOR TO PRODUCTION, DURING PRODUCTION AND AT THE END OF PRODUCTION AND RECORD THE READINGS ON FORMS QC-1 AND QC-3 AS PER INSTRUCTIONS IN SECTION 11 OF THIS MANUAL.

5.8 INTRODUCTION OF ANTI-STRIP ADDITIVE AT BINDER SUPPLIER'S TERMINAL

When the additive is introduced at the supplier's terminal, the additive shall be blended in-line for a minimum of 80% of the asphalt binder loading time. The asphalt binder delivery ticket shall show the rate, (or quantity), brand and grade of the additive. The Contractor shall furnish the name of the supplier, shipping point and grade of the anti-strip additive if blended at the plant site.

The blending system shall be capable of being calibrated, checked and monitored for accuracy, and amount used. A thermostatically controlled heating system capable of heating and maintaining the additive tank's contents and distribution system at the temperature recommended by the additive supplier for the type additive being used is required. The frequency of calibration of the additive system at the plant site will be the same as for the asphalt binder scales or asphalt binder meters, or as deemed necessary by the Engineer.

5.9 N.C. DEPARTMENT OF AGRICULTURE & CONSUMER SERVICES (NCDA & CS) SCALES CERTIFICATION

The NCDOT Standard Specifications require that scales used to weigh materials for payment shall be certified by the Standards Division of the Department of Agriculture & Consumer Services (NCDA & CS) in accordance with rules and regulations set forth by the NCDA & CS in accordance with the General Statutes of North Carolina. These requirements apply to scales used to weigh asphalt mixes for pay purposes. These procedures and regulations are outlined below. Note that the length of certification is generally one year. Satisfactory evidence of certification will be a NCDA & CS sticker placed on the weighing equipment.

NCDA & CS Rules, Regulations and Procedures

- 1) Contractors, Subcontractors, and suppliers who utilize scales to weigh materials for payment shall have the scales certified by the NCDA & CS in accordance with the rules and regulations set forth by that agency.
- 2) The NCDA & CS will certify, if appropriate, all existing scales during each calendar year. The effective period of this certification is through December 31 of the following year. For example, any scale certification issued during a calendar year will be effective through the end of the following calendar year.
- 3) The NCDA & CS will schedule and inspect all existing platform scales during their normal work schedule. The owners of existing platform scales do not need to schedule NCDA & CS for a scale check.
- 4) On platform scales that have not been certified previously or platform scales that have been relocated, the owners of the scales shall notify the Standards Division of NCDA & CS (919-733-3313) at least thirty days prior to commencement of any use. If the thirty day notification cannot be met, the owners of the scales may engage a scale company licensed by the NCDA & CS to test and certify the scales. The certification by the licensed scale company will be acceptable until the NCDA & CS inspects and certifies the platform scales.
- 5) On all other type scales utilized to weigh materials for pay purposes, such as batch plant scales or load cells on silos, the scales owner shall notify the NCDA & CS at least two weeks prior to the actual scales check. NCDA & CS prefers that these type scales be checked during the months of January thru March and will make every effort to check those during that time frame. This type of scale check will not be conducted by NCDA & CS personnel but must be monitored by them for certification. Either the Contractor or a certified scales company may perform this check, but in either case, it must be done under the supervision of NCDA & CS personnel in order for the scales to be certified.
- 6) No additional compensation or time extension will be allowed for use of a scale company.
- 7) All scales check should be conducted either prior to any use of new or relocated scales, or prior to the expiration of certification of existing scales.

Note: Section 6 of this manual continues in detail with asphalt plant equipment and procedures for both the batch and drum plants. It also outlines procedures and frequency for calibrating the following:

- 1) cold feed calibrations and different methods (batch and drum plants)
- 2) asphalt scales, weigh bridges and meter systems (Batch and drum plants)
- 3) computing percentages and weights for hot bins at a batch plant
- 4) aggregate scale and weigh bridge frequencies (batch and drum plants)
- 5) anti-strip additive meters system calibration (if anti-strip is introduced at plant site)