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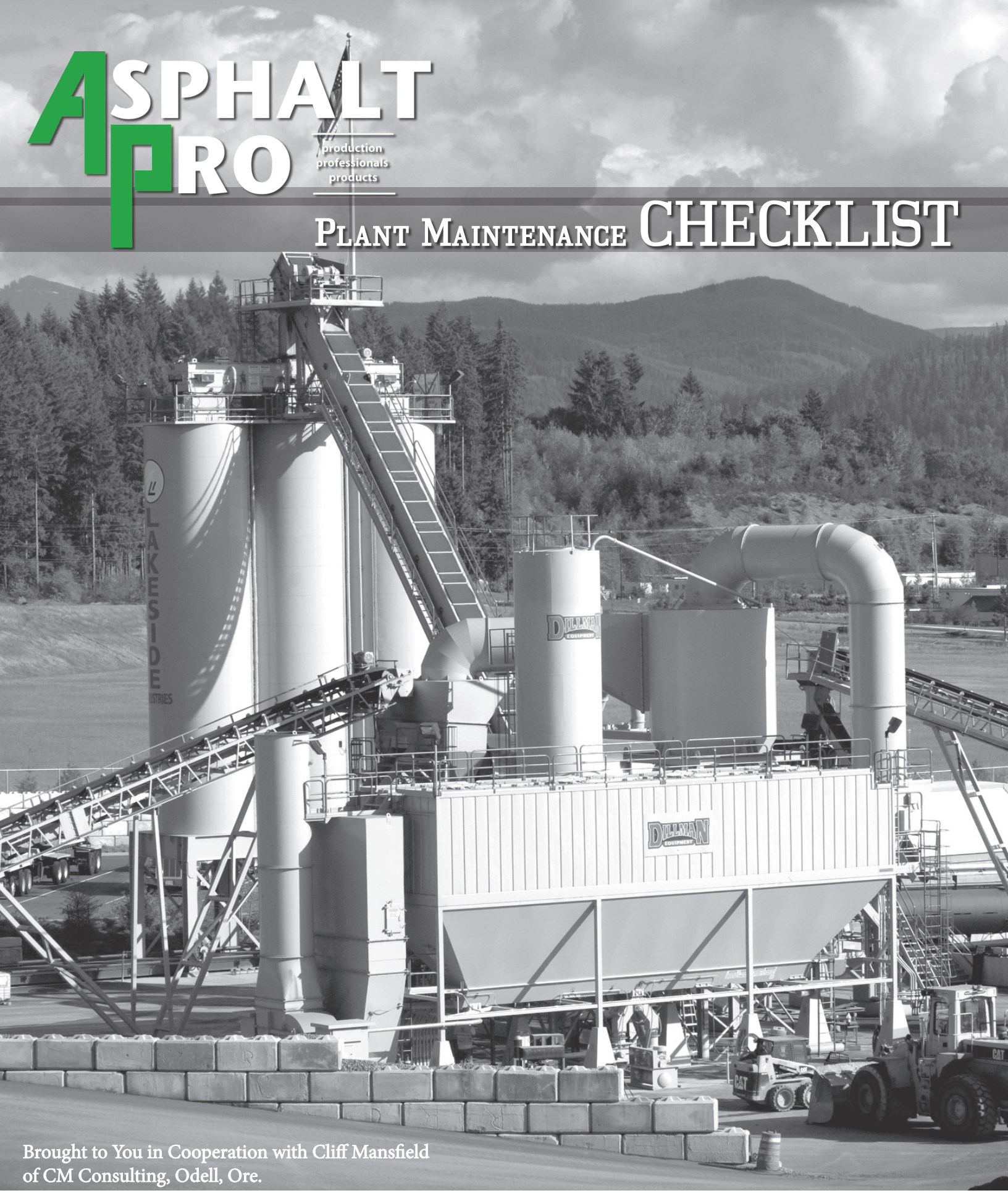
Plant Maintenance CHECKLIST



Brought to You in Cooperation with Cliff Mansfield of CM Consulting, Odell, Ore.

Plant Maintenance CHECKLIST

PART I: DRUM PLANTS

When the paving season draws to a close many owners' thoughts turn to a winter repair regimen for their asphalt plants. Most asphalt plant operators have a list of trouble spots they've accumulated during the season, but components are often overlooked when they've been trouble-free. A thorough plant review can go a long way toward assuring that no parts get neglected.

> "The **purpose** of this activity is to prepare a list of **observed problems** and form a plan to address them"

What follows is an inspection checklist, developed over 20 seasons of involvement with asphalt plants in various parts of North America. The first part will deal with drum mix plants and the components used therein. The second part will deal with batch plants and their parts. Please note that we've done our best to cover all manner of plant systems, but omissions are bound to happen. This article is intended as a guideline to minimize surprises in the next paving season.

The following inspections should be completed with pen and paper in hand. No repairs are made at this time. The purpose of this activity is to prepare a list of observed problems and form a plan to address them. A can of orange marking paint is handy to tag components slated for later repair.

Every component should be made safe per the Occupational Safety and Health Administration (OSHA) lockout, tagout regulations prior to inspection. On particularly dangerous units we'll include a reminder.

To begin, turn your attention to a general maintenance issue—oiling components. The ground man (or men) responsible for winter maintenance should examine all gearboxes and speed reducers for oil leaks and note them for repair if needed. It's a good idea to schedule each box for an oil change during the winter months. Collect properly marked samples from each box and give them to a reputable oil analysis company that will be able to detect any abnormalities. *Read AsphaltPro's "Replace Heat Transfer Fluid" for more how-to info. (October 2010)*

Complete a thorough greasing regimen prior to plant restart. For electric motors, follow the manufacturer's recommendations. Each year numerous motors fail because uninformed oilers pump them full of grease. Some motors vent excess grease internally, so once enough of the stuff is pumped in failure is bound to follow. Most motor manufacturers recommend a yearly greasing schedule consisting of one or maybe two pumps of the gun. Remember that self-oiling components need a refill; those reservoirs aren't self-sustaining.

Another item to remember about plant maintenance is cleanliness. When getting ready for your

PLANT MAINTENANCE CHECKLIST

RAP SYSTEM

On plants with this option the inspection procedure is, essentially, the same as for the cold feed system to the inlet to the drier. Follow those directions. Remember to schedule a thorough calibration sequence for your scale belt.

annual DOT inspection, remember that a clean plant may get inspected with a less critical eye than a plant that looks like it's run by Larry, Curly and Moe. A clean and "squared away" plant is also a safer environment to work in. Safety is a solid reason for performing good inspections, like the following.

COLD FEEDS

The feeders should be emptied of all aggregates for this inspection.

☐ 1. Check the bin walls in each feeder. Mark thin or damaged areas for repair. Note excessive scaling for removal as it interferes with consistent aggregate flow and can contribute to feeder stoppages. Also check the bin dividers. Mark for repair any damaged or missing components.

☐ 2. Check each bin's flow gate and the mechanism by which it is lowered and raised. They should move freely and lock into place with a minimum of fuss. Poorly maintained gates often lead to excessive downtime when it's necessary to make feeder adjustments and the operator discovers that nothing short of dynamite will move a bent or corroded gate. At the least, clean the gates and their guide rails and lubricate the operating mechanism.

☐ 3. Check the seal skirting around each feeder for excessive wear and note any needed repairs. Pay particular attention to what effect the skirting is having on the belt it seals. If deep ragged grooves exist where the seal contacts the belting it's possible that the larger aggregate sizes are binding under the skirting or its supporting metal and are being forced through the conveyor belt's cover. This is a highly undesirable condition and should be noted for correction.

☐ 4. Perform a detailed inspection of each individual feeder belt. Check for excessive wear, weather checking, and any brittle or damaged sections. Examine the area where the skirting rides. If the belt is worn into the cords in these areas it's time for a new belt. Also check the edges of the belting. Sometimes tracking problems can seriously damage the belt, requiring repair or replacement.

No matter what kind of belt lacing is used, you should examine it closely. Worn and broken components are a liability. If in doubt, mark them for replacement. Keep in mind that it's much easier to fix the belt under an empty feeder than one under a full feeder, especially when the trucks are stacking up and time is being lost with the paving crew idle.

☐ 5. Perform a systematic examination of each feeder belt's bearings. Use a bar and pry the head and tail shafts around. Mark for replacement any bearing that exhibits excessive movement. The same criteria apply to the troughing and support rollers. Mark any damaged components for repair.

☐ 6. Remove the guards and inspect each feeder's drive system. Chain drives suffer large amounts of wear in the hostile environment around the feeders. If your units use this method of propulsion

it's important that you inspect the chains for excessive wear and each sprocket for signs of damage. Look for a condition called "fish eyeing" or cupping on the load side of the teeth. Mark any abnormalities you find.

If your feeders are belt-driven you need to look for cracked or glazed belts, excessively worn sheaves and a loose condition that requires adjustment. For mechanical variable speed drives, remove the inspection covers and check the condition of the drive belt and sheaves.

☐ 7. Flow alarms should be tested for proper operation. These little guys can be life savers when you're making tight spec mixes or working on a pay-factor.

☐ 8. Inspect all bin vibrators or air-cannons for damage and test them for operation at this time. One way to do this, if they work off your flow alarms, is to disconnect the feeder drive chain (or belt), defeat the conveyor interlocks and turn the feeders on. If the system works the cannons or vibrators will come on. If they don't, mark them for repair.

☐ 9. On portable feeders, inspect the tires, brake components, springs and lights. Schedule a thorough examination of the brakes and lights with your mechanic at a later time. For now your goal is to note the obvious. **This applies to each unit on a portable plant** and won't be mentioned again.

☐ 10. Give any mechanical leveling or jacking devices special attention at this time. When these components work they can drastically reduce the amount of time needed to set up the feeders after a move. This also applies to the baghouse, the oil tanks and to any other unit using these features.

☐ 11. Inspect all wiring. Mark for replacement any lead that is doubtful. This is a safety issue and could possibly avert an injury. It's also a good idea to inspect all motor grounds for proper connection.

COLLECTING CONVEYOR

Inspection of this component is similar to the feeder belts. Check for excessive wear and damaged areas. Again, check the edges of the belting. Tracking problems are usually more pronounced on the collecting conveyor. Mark excessive damage for repair or replacement. As with the feeders, examine the belt lacing carefully. Worn and broken components are a liability. If in doubt, mark them for replacement. Keep in mind that a broken collecting conveyor belt can lead to prodigious piles of aggregate.

Examine the conveyor's bearings. Again, use a bar and pry the head and tail shafts around. Mark for replacement any bearing that exhibits excessive movement. Check the troughing and return rollers. Mark any damaged components for repair.

☐ 3. Remove the guard and inspect the conveyor's drive system. If you have chain drives,

examine each sprocket for "fish eyeing," marking any abnormalities you find. For belt drives you need to look for cracked or glazed belts, excessively worn sheaves and a loose condition that requires adjustment.

☐ 4. Check the condition of the belt wiper, noting any needed repairs.

Important: Reinstall all guards if there is any chance your plant might run before repairs are made.

LIME/CONCRETE SILO

The silo should be emptied for this inspection and all power locked out and tagged out.

☐ 1. Inspect the general area around the silo. Is there lime/concrete scattered about? If so, you need to find the leaks and mark them for repair. One area of concern is the small baghouse on top of the silo. (Not all units have this feature.) Inspect it for faulty bags, poor seals and smashed metal, which is common on upright silos where the baghouse is removed to facilitate transport.

☐ 2. Examine the silo's vane feeder closely. Look for accretions of solidified lime/concrete that can interfere with proper operation of safety gates and cause binding of the feeder. Check the drive system for signs of wear and mark for repair anything that raises doubts in your mind.

☐ 3. Inspect the air fluffing system. Look for frayed or damaged hoses, missing clamps, damaged or inoperative control solenoid, etc. Pay close attention to the air drier. Moist air blown into a concrete silo can lead to major headaches later.

LIME/CONCRETE AUGER

☐ 1. Inspect the lime/concrete auger. Look for worn flights or a thin bottom. Use a bar to pry bearings about and mark for replacement any found to be excessively loose.

☐ 2. Examine the drive system and note any abnormalities. Check for a build-up of lime/concrete in the drive motor's cooling fins. This condition often leads to premature motor failure. Mark for clean-up if needed.

☐ 3. Check the fit of the auger's covers. Mark for repair any that need attention.

☐ 4. Remember to examine ALL gearboxes and speed reducers for oil leaks and note them for repair if needed. It's a good idea to schedule each box for an oil change during the winter months. Collect properly marked samples from each box and give them to a reputable oil analysis company that will be able to detect any abnormalities and perhaps avert a surprise breakdown at a later date.

☐ 5. Consult the factory manual for your specific LIME/CONCRETE RATIO SYSTEM and follow its recommendations for inspection and periodic maintenance.

Plant Maintenance CHECKLIST

PUGMILL

Follow OSHA Lockout-Tagout regulations before inspecting this potentially lethal unit.

- [ ] 1. Remove the lids and examine the interior of the unit. Look for excessively worn shanks, tips and liners. Cracked or broken components should be slated for immediate replacement.
- [ ] 2. Examine the main shaft bearings. Again, use a bar to pry the shafts around. Mark for replacement any bearing you are in doubt about.
- [ ] 3. Inspect the drive assembly. With chains, look for "fish eyeing" and excessive wear. For belt drives, look for the same things as on the feeders. Give special attention to those units that use shaft couplers. Check for any signs of damage or movement. Again, when in doubt replace them. Failure of one of these devices on certain pugmills can throw the timing off, resulting in catastrophic damage to the machine.
- [ ] 4. Check the wiring for any condition that could render it unsafe. Mark anything that is substandard.
- [ ] 5. See the oiling comments above.

SCALPING SCREEN

- [ ] 1. Inspect the condition of the screen cloth. Look for the obvious: excessive wear; broken or missing wire; or wire cracking, especially around the edges where the mount bars are. It's a good idea to have a spare screen on hand regardless of the condition of the one on the machine.
- [ ] 2. Check the vibratory shaft bearings. Use a bar to pry these units around. Replace any which exhibit excessive movement or roughness.
- [ ] 3. Check all the support springs. Look for broken, missing or excessively worn components. One thing to keep in mind: spare springs, stored in your parts inventory, could well prevent downtime in the event of a spring failure on some future date.
- [ ] 4. Inspect the skirting between the screen and the conveyor it sits over. Leaks in this area can cause a build-up of aggregate, which interferes with the operation of the tail roll of that conveyor.
- [ ] 5. Check the drive system and wiring, looking for the same faults we've discussed on previous pieces of equipment.

SCALE BELT

The ratio computer is the brains and the scale conveyor is the heart of a drum mix asphalt plant. Under certain conditions, if it's transmitting inaccurate data to the ratio computer, this unit can break a company through out-of-spec penalties. Considering what's at stake, this unit deserves

an exacting and painstaking inspection. Because the price of failure is so high, the old adage "when in doubt, throw it out" applies to the components of this unit more than any other.

☐ 1. Begin by inspecting this unit the same way as you inspect conveyors we've previously discussed. Pay particular attention to any evidence of tracking problems such as ragged or frayed belt edges. The scale conveyor's frame sometimes offers testimony of tracking problems in the early stages. Look for shiny places on the frame around the head and tail roll areas, which would indicate belt rubbing. Tracking can, and does, affect the data output from the weigh bridge.

☐ 2. Check the speed sensor (usually on the tail roll). Is it loose or damaged in any way? If so, slate it for attention. Pay close attention to the unit's wiring. Is it damaged or brittle? If so, it should be replaced. It's a good idea to have a spare speed sensor with new wire on hand should the unit fail in the heat of battle.

☐ 3. Check the weigh bridge for any obvious damage. Malfunctioning rollers on this unit cause inaccurate readings. Additionally, examine the three rollers above and below the weigh bridge carefully. Mark for repair any that raise questions. It's also a good idea to schedule an examination of the ride height of the weigh bridge. Usually this is done with a string line. Consult your unit's operating manual for the proper procedure.

> "Make sure **all** maintenance personnel **follow** OSHA confined space entry protocol **at all times.**"

☐ 4. A visual inspection of the load cell usually reveals little other than physical damage. These components either work or they don't. For this reason I strongly recommended that a functioning spare be kept on hand.

☐ 5. Schedule a time for a full scale belt calibration test sequence. You should check for weighed load accuracy, linearity (accuracy through a wide range of weights) and repeatability. If the unit fails any of these tests you don't want to head into a paving season with it.

☐ 6. Oil as suggested above.

SLINGER CONVEYOR OR FEED CHUTE

Some plants use chutes; others use conveyors to feed the cold aggregates into the drier.

Thoroughly clean the chute before inspecting the floor and walls for abnormal wear. Record any needed repairs.

Due to the high operating speed of a slinger conveyor, especially a reversible one, it requires a more thorough inspection than a normal conveyor.

☐ 1. Check all bearings and rollers.

☐ 2. Because this unit typically runs under the burner, you need to check the belt for any signs of heat damage. If there is any doubt in your mind about this belt replace it. In the case of vulcanized belts this is a time-consuming process, not one you want to address in the middle of a large paving job. If yours is a laced belt and shows signs of damage, changing may take more time. It's a good idea to stock a pre-cut and laced spare.

☐ 3. Bearings at the burner end of the slinger conveyor operate in an extremely hostile environment. High heat combined with high speed ensure that these units are a frequent maintenance item. A few spare bearings could spell the difference between downtime and nightly maintenance. If you don't already use them, perhaps you should check into "hostile-duty" bearings designed and introduced in recent years for such applications.

☐ 4. Most slingers use training idlers. Examine them to verify proper operation. Mark for repair or replacement any that need it.

☐ 5. Oil as suggested above.

DRIER/MIXER

Whole articles have been written on the subject of drum maintenance, covering a wide variety of topics including flight design and internal air flow relating to veil patterns. This discussion deals with inspecting and scheduling repairs for the components that you already have. To that end, no mention will be made of the various configurations of flights that are available.

Of course you'd notice something this blatant during production. The problem is air system restrictions causing blow-back of combustion gases. Get out there and get it fixed. Photo courtesy of Cliff Mansfield.

We begin with the internal components of the unit. Because the inspection detailed in No.6 of the burner section is performed from inside the drier, perhaps it would be a good idea to read that section also before entering the drier. Make sure all maintenance personnel follow OSHA confined space entry protocol at all times.

The unit should be as clean as possible inside for this inspection. Before setting out on a manual cleaning mission, consider heating 20 or 30 tons of coarse aggregate to around 400 degrees. Sometimes this will clean a surprising amount of accumulated material out of a drum mixer, slat conveyor, batcher and storage silo.

Plant Maintenance CHECKLIST

☐ 1. Inspect each and every flight of a cooled drum for the following problems:

A. excessive wear
B. heat curling
C. impact bending
D. cracking or absence

Mark for replacement any flight that exhibits these problems. Obviously, any that are cracked can probably be welded, and those that are missing must be replaced.

☐ 2. Examine the mounts for each flight, noting and marking any cracked or broken components.

☐ 3. While you're in the drier, with your safety lanyard firmly attached, have an assistant cover what openings he can with plywood. Extinguish your light and look for sources of light that shouldn't exist. Pay particular attention to the knock-out box and its associated ductwork. These leaks reduce the amount of air available to the drying process, cause excessive burner fuel usage and, under certain conditions, leak dust into the atmosphere.

☐ 4. Check the rakes at the mixer discharge. Note any bent or missing rakes.

☐ 5. Inspect the discharge collar, looking for worn-out liners. Also examine the upper end of the discharge chute.

☐ 6. Look at the oil injection tube. Is it wearing badly on top? Are there any holes or cracks? Mark for repair anything that is wrong.

On a unit that exhibits wear on the top, which is caused by cascading mix abrading the pipe, consider installing a small trough on top of the injection pipe to catch a quantity of mix. On a 3-inch pipe, a 4-inch channel welded on with the upright sides of the U pointed skyward will quickly fill with hot mix. Because the mix is constantly being replaced as it wears away this operation will effectively end any future wear problems.

☐ 7. On plants with a recycle collar, examine the inlet chute and the kicker flights. Look for excessive wear, missing parts or product build-up.

The external inspection of the drier/mixer follows.

☐ 1. Examine the drier barrel end seals at the inlet and discharge collars. These often overlooked components can contribute significantly to fuel efficiency if they are in good condition. If your plant has a recycle collar you should examine its seals also at this time.

☐ 2. On plants with inlet chutes, check the air dam and see that it seals off the area over the incoming aggregate. If it's excessively worn, mark it for repair.

☐ 3. Examine the air dam in the discharge chute, noting any problems and marking them for repair.

☐ 4. Examine each trunnion for excessive wear or damage. To check the bearings it's a good idea to jack the drum up and use a bar to pry the units around. Proper trunnion adjustment is very important to over-all drier operation. It's difficult to maintain the proper settings with worn-out components so any loose bearings or abraded trunnions should be marked for immediate action.

☐ 5. On those units that use thrust bearings to control drier position, examine them to be sure they're in good shape. Excessive contact can indicate improperly adjusted trunnions. If this is the case, schedule some time to make the necessary adjustments per factory instructions.

Overlooked drum seals are a source of fugitive air. Burners get about 70 percent of their air from the main exhaust fan, making any leak significant. This leak at the drum seals reduces the amount of air available for combustion. If you didn't notice the reduction in efficiency during production, then be sure you mark this down as a spot to fix before you start up again. Photo courtesy of Cliff Mansfield.

☐ 6.Drive methods vary from plant to plant. For chain-driven units, inspect for the same things as any other chain drive. On friction-drive units, the condition of the trunnions is more important. To avoid slippage they must be smooth and flat. On both drive styles, check the condition of the gear boxes and any belts used.

☐ 7. On driers with a hydraulic jacking and leveling option begin by inspecting the power/pump unit. It should start easily and operate with a minimum of headaches. Hook the unit to each individual jacking station and check operation. On driers with screw jacks on the end of the set-up supports, check each one for proper operation.

☐ 8. Oil as suggested above. When moving and resetting the plant the previous devices can substantially reduce the amount of time the crane is on the job.

SLAT CONVEYOR

Slat conveyors can be unforgiving, lethal units if not treated with respect. Before beginning this inspection follow OSHA lockout, tagout regulations.

☐ 1. Inspect the condition of the floor, the flights and the chain. Obviously, the most important consideration here is whether or not they will operate trouble-free for the amount of tonnage you expect to run next season. This is a judgment call, but it's a good idea to remember how hard it is to dig 300-degree mix out of a stalled or broken slat conveyor.

☐ 2. Inspect the main drive sprockets at the top of the slat. If worn, can they be turned? If not, mark them for replacement. Don't take chances on these guys. If they're segmented sprockets then they're relatively inexpensive and easy to replace. If they're not, you don't want to tackle changing them in the middle of a paving contract.

☐ 3. Examine the reject gate. Look for excessive wear, misalignment or any other condition causing a poor seal.

- [ ] 4. Inspect the reject gate's air actuation system. Look for frayed or cracked air hoses, excessively worn air cylinders and pivots. Check the system's air solenoid and oiler. Do they work reliably? A thorough cleaning and tune-up would be a good start.
- [ ] 5. Oil as suggested above.

ASPHALT HOLDING SILO

The batcher is one of the most important pieces of equipment on an asphalt plant when it comes to battling mix segregation. As such it should be treated with a high degree of respect.

- [ ] 1. Inspect the batcher's sides and cone for thin spots. Mark them for plating.
- [ ] 2. Look closely at the gates and their pivots. Use a bar to pry the gates around. Are they loose? Have they been greased? Mark for repairs any abnormalities you find.
- [ ] 3. Meticulously examine the air actuation system. Failures here are the primary cause of batcher problems. Check the air cylinder(s) for excessive wear. Substandard air hoses should be slated for replacement. As with the reject chute controls, target the batcher's air solenoid and oiler for a thorough cleaning and tune-up. Kits for these items are inexpensive and easy to install. Stock a spare solenoid at least, and an oiler if possible.
- [ ] 4. If your batcher uses high-level indicators test them for proper operation. Refer to the factory manual for specific procedures. In general: If you have limit switches, activate them and have someone watch the appropriate warning light in the control room. If you have a torque stall type indicator, simply hold it from rotating and have someone check the light. Target for repair any system that fails to work.

The same inspection protocol is used for the holding silo as for the batcher.

- [ ] 1. Check the iron, especially in the cone area. Mark any thin areas for repair or replacement.
- [ ] 2. Examine the gate and all its actuating controls. Schedule the air solenoid and oiler for a cleaning and tune-up. As with the other gates, a spare solenoid should be on hand. Spare air hoses can be time savers here too.
- [ ] 3. Get on an aerial work platform (be sure to use an OSHA approved safety restraint belt) and have yourself hoisted up next to the gate. Check the pivot pins by prying the gates around with a bar. Schedule repairs for any found lacking. Look at the grease zerks and pins for grease needs.
- [ ] 4. Check the operation of the silo's high and low warning alarms. Use the same procedures as with the batcher.

PLANT MAINTENANCE CHECKLIST

BURNER, FUEL SYSTEM

Each burner manufacturer has written a maintenance manual for its specific product. Find that manual and study it. Following their recommendations might well avert a breakdown. In general and for older units:

- [ ] 1. Test and verify the operation of all safety systems.
- [ ] 2. Examine all fuel and propane lines. Schedule for replacement any that raise a question in your mind. Also look at the propane bottle for the igniter. Check for signs of leakage and damage.
- [ ] 3. Check the fuel pump and drive mechanism. Mark any frayed belts, worn couplers or leaking seals. Schedule the fuel filters for replacement, regardless of how long they've been in place.
- [ ] 4. Check the piping and valving from the supply tank. Verify that shut-offs do work. Don't take them for granted. Also take a minute and inspect the tank's filling apparatus. Note any leaks or unsafe practices.
- [ ] 5. If your fuel system uses a water separator, consult the manufacturer's literature on maintenance procedures. In general they should be drained and cleaned.
- [ ] 6. If you have a poured ignition port and combustion chamber check them for signs of damage. These units are often easiest to check from inside the drier/mixer. Because these items can fail all at once sometimes following relatively minor damage, it's best to schedule repairs on any area that raises questions in your mind.

EXHAUST FAN AND DUCTWORK

Inspection of ductwork is not for the claustrophobic. It can be a tight, confining area. Remember your OSHA confined space training here.

- [ ] 1. Inspect the ductwork from the outside first. Look for loose or misaligned joints and any physical damage that might lead to an air leak. On portable plants with a wet wash you should check the seals around where the venturii enters the knockout-box and the scrubber. The same holds true for the ductwork between a baghouse and the knockout-box.
- [ ] 2. Double-check to see that the exhaust fan is locked out and tagged out per OSHA regulations. Once you've done that, crawl inside the ductwork and inspect it for any signs of damage. Mark anything that raises questions. Now turn off your light. Look for any source of light that shouldn't exist. Obviously, these are leaks. Note any you find and mark them for repair.
- [ ] 3. Check for material build-up in the ductwork. Such accumulations often offer evidence of air flow deficiencies that should be analyzed and the root problem corrected to maximize plant efficiency and minimize fuel usage.

You'll find many styles of exhaust fans in use in contemporary plants. Because the focus of this discussion is catching problems, the following checklist is general in nature.

☐ 1. Examine the fan for any signs of excessive wear. On paddle fans pay close attention to the hub area where the fan blades attach. Look for cracks that could be precursors to a catastrophic failure.

☐ 2. On wet fans look for excessive scale build-up, which can lead to an out-of-balance condition.

After you clean the fan and find no flaws, schedule a vibration analysis. Fan balancing companies can come to your facility, balance your fan and electronically examine the bearings, leaving you with a clear picture of your unit's condition. I recommend that lower production facilities (under 100,000 tons per year) test their fans every other year. For higher production operations yearly is a good choice unless the fan is exhibiting chronic balance problems.

Wet fans presenting chronic balance problems due to a build-up of mud on the fan blades can sometimes be helped by the simple addition of a regulated water spray nozzle directed at the center of the fan on the inlet side. This washes away the accumulated mud and extends the life of a balancing job. Only add as much water as needed to keep the fan clean because the excess goes out the stack as muddy rain. Done properly, you shouldn't see any change in the stack.

☐ 3. Inspect the fan housing for worn and leaking areas. Mark any abnormalities.

☐ 4. Closely inspect the exhaust damper and its associated operating system, including the actuator. Mark for attention anything that raises questions in your mind.

☐ 5. Examine the fan motor, motor mount and belt guard. Mark anything that catches your eye.

☐ 6. Be sure the fan is locked out, and then remove the belt guard. Examine the belts and sheaves. Excessive wear here reduces fan efficiency and can lead to belt burn-up when starting. It's a good idea to carry spare belts for this unit because new ones this size aren't always readily available.

VENTURII WET WASH SYSTEMS

☐ 1. Begin by examining the entire system from the outside. Look for muddy areas, which indicate leaks. Mark these for attention.

☐ 2. Inspect the venturii actuator/servo-positioner. This item is critical to the operation of the venturii/scrubber system. If you have any doubts about it, schedule it for maintenance.

☐ 3. Remove the venturii's inspection door. (You'll have to crawl inside if your unit doesn't have one, so remember the OSHA confined space entry protocols.) Look for worn components, bent or warped venturii plates, and missing water nozzles. Schedule all nozzles for removal and cleaning. A spare set of nozzles is a good idea and also cheap insurance against the downtime incurred while the operator tries to clear obstinate nozzles in the heat of battle.

- [ ] 4. Inspect the water feed system. Check the hoses, connections and the y-filter. (You should have a y-filter removing the stuff that plugs nozzles.) Mark anything you think is substandard. The y-filter should be marked for a screen cleaning at a later date.
- [ ] 5. If you use a flow meter you should refer to its maintenance manual for advice on its upkeep.
- [ ] 6. Closely examine the water pump and its foot-valve. Schedule someone to remove the impeller housing on the pump and inspect the impeller for excessive wear. Failure of the pump can shut an operation down for an extended period of time under certain conditions. A faulty foot-valve leads to delayed start-ups and wasted time while the plant crew tries to prime a stubborn pump.
- [ ] 7. Remove the wet-scrubber's access door and climb inside. Is the unit muddy or relatively clean? Muddy scrubbers must be cleaned out. Excessive mud indicates that the scrubber is not working correctly. Analyze the situation and find out why. One cause could be low water volume. Another cause could be a partially plugged drain trough. Stubborn units often require the addition of a water nozzle in the head of the trough to wash particulates down and out into the settling ponds.
- [ ] 8. Examine the strike-off plate directly above the drain trough. Is it in good condition? If not, schedule it for attention.
- [ ] 9. Inspect the interior of the scrubber. Look for rusted out areas that could fail in the middle of a job. The supports for the fan inlet tube should be checked and marked if you have any doubt as to their structural integrity.
- [ ] 10. Often, people will install a screen over the tube leading to the fan inlet in a misguided attempt to catch large chunks of material before they are ingested by the fan. If your unit has such a screen, remove it. This screen causes the formation of water droplets and leads directly to muddy rain from the stack. Again, remove it. The chances of the fan ingesting a chunk of foreign material large enough to cause any damage are minimal at best. This is especially true of a well maintained wet scrubber.
- [ ] 11. If your exhaust stack uses a profiler to straighten the air flow and correct stack cyclonics (required by DEQs in most states) you should examine it and its supports at this time. Look for corrosion and rust which could lead to the profiler falling into the bottom of the stack.

BAGHOUSE

Refer to the manufacturer's maintenance manual for your specific unit prior to beginning this survey. The following checklist is general in nature. Before you begin, use a powder test to locate leaking bags.

- [ ] 1. Examine the baghouse from the outside. Note any signs of damage. Look for leaking covers on top, disconnected solenoids or by-passed sections. Make notes on any deficiencies.

PLANT MAINTENANCE CHECKLIST

PURE WATER

at sea level = 212°F (100°C)
at 984 feet = 210°F
at 2,000 feet = 208°F

SPARE PARTS

The following is a list of spare parts mentioned throughout this article that are good to have on hand. They're not prohibitively expensive to keep in the tool shed and they minimize downtime when you're in the thick of paving and production season.

scalping screen
screen cloth
scale belt speed sensor w/new wire
scale belt load cell
pre-cut and laced spare slinger
conveyor belt (if applicable)
drag chain sprockets
"hostile-duty" bearings
silo air hoses
air solenoids and oilers
exhaust fan belts
AC tachometer
control voltage fuses
fuses (of different sizes)
hot oil pump
Venturii wet wash water nozzles

☐ 2. Most units are fitted with their own air compressor. Refer to the compressor's manual for the yearly maintenance schedule. In general, this is another place where spares could mean the difference between a short break in production or days of downtime waiting for parts.

☐ 3. Inspect all air lines. Look for cracking, heat damage, weather damage or anything that raises doubts. Schedule your air driers for cleaning. Mark damaged ones for replacement. Examine the electronic controllers. If anything is by-passed or "jumpered," schedule repairs. Check the air solenoids for proper operation; schedule any that fail for repair or replacement. Lastly, look at all the air cylinders. Mark any that raise questions.

☐ 4. On reverse air units check the doors, seals, actuating cylinders and solenoids. This is a time-consuming job, but one that is necessary to insure the correct operation of these units.

☐ 5. Open the lids on top of the baghouse. Check the bag seals, cages and venturiis if so equipped.

☐ 6. Modern baghouses use either augers, drag chains or a combination of the two to get rid of 200s (fines or dust). On both units check the bearings and flights. On the drag chain you need to look at the chain and sprockets. You are looking for excessive wear of the sprockets. Schedule repairs for anything you find amiss.

☐ 7. Most baghouses use dust return systems to put the fines back into the drier. These can be air pumps or augers. Check these units for excessive wear and for proper operation.

☐ 8. On systems using air pumps, check the air box and the hoses used to pump the fines to the drier. ***See AsphaltPro's "Keep Baghouse Surges from Disrupting Mix Quality" for information on metering fines to augment quality control. (January 2012)***

☐ 9. Most baghouses use either a slam damper or a similar device to shut off air flow through the baghouse in the event of excessive heat. Check the operation of these safety

devices. Also check other safety devices such as temp monitors and pressure drop gauges for proper operation. Check out the upcoming "miscellaneous" section for information on calibrating thermometers.

☐ 10. If your exhaust stack uses a profiler to straighten the air flow and correct stack cyclonics (required by DEQs in most states) you should examine it and its supports. Look for corrosion and rust, which could lead to the profiler falling into the bottom of the stack.

HEAT TRANSFER OIL SYSTEM

Two types of heat transfer oil heating systems are in use on today's asphalt plants: electric and oil fired. Some units are stand-alone, others have most of their components built into the asphalt cement (AC) oil storage tanks. Please note that this examination should be done on a cold system.

General:

☐ 1. Examine your unit's overall condition. Has the control box been hit by one too many loaders, leaving the electrical components exposed to the elements? Does the unit still have insulation? Is the unit clean? These are safety issues and should be addressed accordingly.

☐ 2. Examine the hoses over the entire system. Are they brittle, cracked or leaking? Any that fit this description should be marked for replacement. Look at the oil pump. Is the seal leaking? Are the drive belts and guard in good condition?

☐ 3. Hot oil holding tanks have a low-level shut-down device. Check to see that yours works properly.

☐ 4. Test the control temperature sensor to verify accuracy.

☐ 5. Also test the overtemp protection thermometer.

☐ 6. Have the heat transfer fluid analyzed by a reputable company. It's also wise to change the oil every couple of years.

☐ 7. Inspect and test the auto start system. Does the time clock keep accurate time? Does the unit start and stop at the appointed hours?

Oil fired units:

☐ 1. Examine the fuel system. Check for leaking lines and seals. Schedule a fuel filter change.

☐ 2. Check the exhaust damper system for proper operation.

☐ 3. These units use several safeties similar to those found on your main burner, such as an ultraviolet "flame-eye," which is used to detect burner combustion. The unit also uses a step

timer to control things during the start-up/shut-down sequences. Refer to your operator's manual for specific procedures for testing yours.

Electric units:

Be aware of electrical shock hazards; disconnect the electricity before performing this examination. Check the wiring and connections. Schedule repairs on any that are loose or corroded. Do you have spare fuses handy? How about the small fuses used on the control circuits? These little guys are often hidden and the plant operator is unaware that they exist until one fails and production grinds to a halt. It's also a good idea to stock the contacts and a pull-in coil for the motor starter and for the heater relays.

ASPHALT OIL HOLDING AND DELIVERY SYSTEMS

Pump pallet:

- [ ] 1. Check the general condition of the asphalt pump. You want no leaks in the shaft seal, case gaskets or pipe connections.
- [ ] 2. On belt-driven units you should check the condition of the sheaves and belts. Make sure the guard is in place and in good condition.
- [ ] 3. On hydraulic units, schedule an oil and filter change. Also, examine the hoses, seals and the coupler between the pump and motor. If the unit is covered in grime, schedule a cleaning session paying particular attention to the oil cooler.
- [ ] 4. Pay close attention to the flow indicator or tachometer that provides a signal to the ratio computer to regulate oil percentage. Have a spare pick-up, drive belt or tachometer on hand.
- [ ] 5. Examine the flex lines from the tank to the pump and from the pump to the drum. Mark for replacement any that are frayed or kinked or that raise any questions in your mind.

AC oil holding tanks:

In general, you should examine the overall condition of the tanks. Make sure the insulation and covering skin are in good condition. Keep the tanks clean. Make sure you don't have accumulated oil beneath the tanks and perform the following steps.

- [ ] 1. As with the heat transfer oil system, you should schedule testing to determine the accuracy of the AC tank's temperature controls.
- [ ] 2. Check your tank vents to see that they are not plugged or obstructed.
- [ ] 3. Inspect the tanker off-loading pump and associated plumbing. Use the same protocols as for the pump pallet. Remember that oil haulers will start and stop pumps with their asphalt-covered gloves on. You want to clean your switch buttons to get that material off, and schedule a

toolbox talk with the truck drivers on how to carry and use clean gloves.

MISCELLANEOUS COMPONENTS

☐ 1. Air compressor: This unit should be scheduled for a complete service. Clean any associated air driers and lubricators at the same time. Examine all air lines, noting any problems.

☐ 2. Schedule a test session for all the thermometers on your plant.
One easy way to calibrate them is to boil water, immerse the sensor end and adjust the thermometer to read 212 degrees, the boiling point of water at sea-level. Adjust the temperature for the altitude of your plant; i.e. 208 at 1,000 feet. Another way is to find a thermometer you know is accurate, such as an infrared hand-held unit, and then set all the others to match it. ***Read AsphaltPro's "Achieve Best Lab Accuracy" for AMRL accreditation how-tos. (April/May 2012)***

On the heat transfer oil system and the AC tanks you can check the operation of the high-temp shut-downs by immersing the sensors in the boiling water and then slowly turning down the set-point controls until the unit shuts off. Record the setting and compare it with the boiling point of water at your altitude. Make the appropriate adjustments.

☐ 3. Portable AC plants usually rely on generators. Examine the radiator. Is it full of gunk? Schedule a thorough cleaning. Look at all the hoses and belts. Mark any that raise doubts. Schedule a complete service that includes testing and adjustment of the generator output. Do you have a stock of crucial spares such as control voltage fuses and possibly a regulator?

☐ 4. Examine the control van/room. Is it clean and neat or are there jumper wires sprouting from every panel and fuse box? Make sure all the motor starters work as designed and not through creative re-wiring. Schedule repairs as needed.

PART II: *BATCH PLANTS*

Here is the winter season inspection checklist for batch plants, with particular attention paid to the batch tower. Make sure you check all wiring and junction boxes for any condition that could render the workplace unsafe. Mark anything that is substandard.

Remember to follow Occupational Safety and Health Administration (OSHA) lockout, tagout regulations during these inspections. Also remember your general maintenance activities at this time.

Maintenance personnel should examine all gearboxes and speed reducers and note those that need repairs. It's a good idea to schedule each box for an oil change during the winter months. Collect properly marked samples from each box and give them to a reputable oil analysis company that will be able to detect any abnormalities.

As with the drum plant discussed in Part I, personnel should also complete a thorough greasing regimen prior to plant restart. For electric motors, follow the manufacturer's recommendations. Each year motors fail because uninformed service personnel pump them full of grease like they would a troughing roller. Some motors vent excess grease internally, so once enough of the stuff is pumped in failure is bound to follow. Remember that most motor manufacturers recommend a yearly greasing schedule that consists of one or two pumps of the gun. Read and follow their guidelines.

Also see to your housekeeping activities to keep the workplace safe. A clean place to work, statistically, has fewer accidents that one covered in grease and accumulated debris. Remember that state plant inspectors and officials from the DEQ will likely look more favorably upon a clean, neat facility than one with safety hazards and leaking parts.

HOT STONE ELEVATOR

Hot elevator chains operate in a very hostile environment. Heat, dust and stress all work together to promote wear. Unless we track that wear and address it at the appropriate time, things can come shuddering to a halt. When the bucket-line breaks, digging out the 300-degree rock, untangling the piled up chain and making the needed repairs is a time consuming chore. An inspection, using a critical eye, can go a long way toward dodging the proverbial bullet. Begin by removing all access and inspection doors.

- [ ] 1. Perform the external inspection first. Look for thin metal, dust leaks and obvious structural damage.
- [ ] 2. Remove the guard and inspect the hot stone elevator's drive system. Chain drives are common. If your unit uses this method of propulsion it is important that you inspect the

chain for excessive wear and both sprockets for any signs of damage. Look for a condition called "fish eyeing," or cupping on the load side of the teeth. Mark any abnormalities you find. If your unit is belt-driven, you need to look for cracked or glazed belts, excessively worn sheaves, and a loose condition that requires adjustment.

☐ 3. Examine the motor and gearbox for any abnormalities. Mark for attention anything that raises doubts.

This 5,000-pound batch plant is located in Washington State. Rust is a by-product of working in the Northwest, but vendors are always willing to quote a price to prep and paint with high-temperature paints suitable for the HMA plant. While the plant in this picture is in no danger yet of losing integrity or experiencing leaks, rust is something to watch on ductwork and temperature-sensitive joints where dust and heat need to stay inside. Photo courtesy of Cliff Mansfield.

☐ 4. Inspect both upper bearings. Use a bar to pry the shaft around. With the weight of the chain on the shaft, this operation will require considerable effort.

☐ 5. Look through the access door and examine the top sheave. On friction drives look for irregular wear patterns, breakage or looseness. For toothed sprockets look for excessive wear, fish eyeing and obvious damage.

☐ 6. Some elevators use idlers. It is essential that each one of these receives an exacting examination. Idler shafts have been known to break, and under certain conditions stall the elevator. On sprocket-driven units the bucket chains have broken as a result of the impact with the idler shaft. Look at each idler. Bent or grooved shafts and worn wheels must be scheduled for repairs.

☐ 7. Look at the tail shaft and traction wheel. Is the wheel egg shaped? Is it worn out or loose? Are the bearings in good condition? Do the adjusters work? How about the shaft's dust seals; are they working? Mark anything that needs attention.

☐ 8. Look at the individual chain links. If they are worn to the pins and the side bars abraded to knife edges, you don't want to head into a paving season with them.

When ordering hot stone elevator chain, get the best you can afford. I know of no other situation where the adage "You get what you pay for" applies as well as this.

☐ 9. Last, examine each and every bucket. Look for excessive wear, cracks or missing bolts. Any severely distorted bucket is a liability and should be replaced.

☐ 10. See the general maintenance discussion at the beginning of Part II.

SCREENS

The screens are very important to the operation of a batch plant. In my opinion, they are the only reason to own a batch plant as opposed to a drum. Any examination of this unit should be done with an eye toward efficiency.

Plant Maintenance CHECKLIST

☐ 1. Start with an external inspection. Look for missing parts, such as lid hold-downs, and for signs of dust leaks. Look at the skirting seals under the units. Are they there or long gone? Examine the top covers. Are they worn out where they rest on the frame or other lids? All these conditions should be addressed. Check to see that the screens move freely. If they don't, look for a buildup of aggregate under the drive end. Check the size of the material. If it's a useable size that normally goes into a hot bin the accumulation could point to leaks in the oversize discharge, exacerbated by screen flooding and carry-over.

Often, this condition can be addressed by repairing the leaks and reversing the screens so that they throw the material back toward the hot elevator. This makes the material stay on the screens a bit longer, giving it time to work through the screen cloth. This same approach can sometimes solve sampling problems, which are caused by carry-over at higher production rates.

It's not uncommon for a plant operator who has his machine calibrated and in spec at a certain tons-per-hour rate to find he is being forced to run his plant ever faster to meet production demands. As production rates increase, so does the carry-over rate. Under the right conditions the finished product can go out of spec, leading to hair pulling and a midnight recalibration session. If you've experienced this scenario, try reversing the screens. This should produce a more consistent mix through a wider range of feed rates.

☐ 2. Next, remove all the lids and side covers. It's a good idea to take a fire hose and clean the accumulated fines off the screen frames and springs. It makes it much easier to find damaged and cracked components. Caution: Remember to open all the gates below and provide a way for the water to escape from under the plant. Once the unit is clean you should inspect it for broken springs and cracks in the framework.

☐ 3. Closely inspect each screen cloth. Look for excessive wear and broken wire. Check the screen trays. Are they all tight? Is the screen cloth secure? It's good insurance to stock a complete change of screens. When stored in a custom built rack on the screen deck, they are ready for installation with a minimum of fuss. Don't forget to keep a supply of the appropriate bolts handy.

☐ 4. Examine the screen drive and eccentric. Follow the manufacturer's recommendations as to periodic maintenance. In general, you should look for damaged components, worn sheaves or belts, and broken motor mounts.

HOT HOLDING BINS

☐ 1. Inspect the inside of each bin. Look for thin metal, missing partitions and any structural damage. Check the overflow chutes and hats, if used, for leaks. Schedule maintenance on anything amiss. Look at the bin dividers. Do they go up close enough to the bottom of the screens to prevent cross-bin contamination?

☐ 2. Check the gates and their pivots/rails. Do they work freely? Are they excessively loose?

☐ 3. Examine the air cylinders. Check for leaks or loose rod and pivot bushings.

☐ 4. Schedule the air solenoids for kits and cleaning. The same for the air oilers.
Spare solenoids, air lines, a cylinder and an oiler might possibly shorten downtime in the event of a component failure.

AGGREGATE WEIGH HOPPER

You examine this unit in essentially the same manner as you would the hot bins with the exception of the weigh system.

☐ 1. Check the basic iron for thin spots.

☐ 2. Check the gate and its pivots/rails.

☐ 3. Check the air system. Again, schedule the solenoid and oiler for kits and cleaning.

Weigh system

☐ 1. Begin by cleaning all the knives/pivots. Use compressed air. Do not lubricate them once they are clean.

☐ 2. Inspect all knives and pivots. Look for loose, missing or misaligned components. If you find anything wrong contact a reputable company that specializes in scales. Have the scales repaired and calibrated.

It's best to schedule this activity for a time when all other repairs to related equipment have been completed. The addition or deletion of metal in the weigh hopper can drastically affect calibration.

ASPHALT OIL INJECTION SYSTEM

Generally, two types of oil injection systems are in use: Gravity feed and forced feed. The checklist for the weigh system and for the asphalt oil bucket is nearly the same for both systems. The gravity system has a clapper valve and some associated air controls. The forced feed system uses an injection pump, which we will address last.

Asphalt oil buckets

☐ 1. Examine the exterior of the unit. Is it covered in asphalt? If so, from where? Is it caused by overflows, which could be pointing to a problem with the scale read-out and its signal to the blending computer, or possibly from a sticky fill valve that occasionally fails to shut off when told to do so?

☐ 2. Check the heat transfer oil system for the bucket. Does it leak? Does it work? Check to see if the hot oil lines are binding the bucket, possibly resulting in inaccurate readings. If so, schedule repairs.

☐ 3. Examine the clapper valve on the gravity system. Does it fit properly and seal? Are the pins worn out? How about the air cylinder; is it worn out? Air lines in good shape? As with all the other solenoids and oilers, it's a good idea to schedule those on the oil injection system for a cleaning session and then install tune-up kits.

☐ 4. Check the spray bar where it enters the side of the pugmill. Is it free or does it bind? Under the right conditions a binding spray bar can lead to abnormally high oil contents. You should look for an accumulation of material between the bottom of the spray bar and the side of the pugmill. This material can restrict the downward movement of the oil bucket as it fills and cause the scales to read lighter than the amount actually in the bucket. Any build-up here should be scheduled for removal.

Oil bucket fill system

☐ 1. Check the overall condition of the valve. Is it leaking? How about its connections? Does the heat transfer oil system work? Does it leak?

☐ 2. Examine the air actuation system. Use the same criteria to evaluate it as we've used throughout this inspection.

Weigh system

This procedure is the same as the one for the aggregate weigh system detailed above. As with the aggregate scales, it's best to schedule this activity for a time when all other repairs to related equipment have been completed.

Oil injection pump

☐ 1. Check the pump and all its lines. Schedule any leaks for repairs.

☐ 2. Check the drive system. Some pumps use couplers and a direct drive motor; others use a belt drive while still others are driven by a chain off the pugmill itself. Whatever method yours uses examine it for the same flaws we've discussed on other units, such as fish eyeing, worn sheaves/belts and couplers.

☐ 3. On units that use a vacuum breaking valve to control emptying the weigh bucket you should check it and its operating system for any problems. For air operated systems start by checking the air cylinder. Is it worn out? Are the air lines in good shape? As with all the other solenoids and oilers, it's a good idea to schedule these for a cleaning session and then install tune-up kits.

PUGMILL

Follow OSHA lockout, tagout regulations before inspecting this potentially lethal unit.

☐ 1. Remove the inspection doors and examine the interior of the unit. Look for excessively worn shanks, tips and liners. Slate cracked or broken components for immediate replacement.

☐ 2. Check the asphalt injection spray bar. Are all the spray nozzles in place? *(See note 1 below.)* Is the bar worn thin on the top where the aggregate from the weigh hopper cascades over it? (See *note 2 below.)*

☐ 3. Examine the mainshaft bearings. Again, use a bar to pry the shafts around. Mark for replacement any bearing you are in doubt about.

☐ 4. Inspect the drive assembly. With chains, look for fish eyeing and excessive wear. For belt drives look for glazed or loose belts and worn sheaves. Special attention should be given to those units that use shaft couplers. Check for any signs of damage or movement. Again, when in doubt replace them. Failure of one of these devices on certain pugmills can throw the timing off, resulting in catastrophic damage to the machine.

Note 1: Several oil-related problems plaguing hot mix manufacturers can be traced back to the spray bar. Sluggish emptying of the weigh bucket can result in slowed production rates. This usually leads to the removal of some of the spray nozzles in an attempt to speed things up. This, in turn, leads to the second, potentially more damaging issue.

Spray nozzles control the distribution of oil in the mixer. If adjusted and sized properly, spray nozzles distribute the oil uniformly throughout the pugmill. If set-up incorrectly, or removed altogether, the nozzles can give a spray pattern that produces lean or rich spots in a particular batch of mix.

If the state's QC inspector gets mix from a lean spot and his results reflect a low oil content, the operator adjusts the oil upward to avoid going out of spec. If, on his next test, the QC inspector pulls the sample from a rich spot, the resulting jump in oil percentage could easily put a plant out of spec and into penalty territory. If the swing is bad enough it could result in a mandatory shut-down and plant recalibration.

Put quite simply, all of this could be due to an easily addressed oil distribution problem in the pugmill. Using a slat conveyor, batcher and holding silo usually eliminates this problem. However, for those plants that operate without a silo the problem can easily put you into an adversarial situation with the state DOT because all the data you have (tank stickings and quantities used over time) shows that you are, in fact, putting in the correct percentage of asphalt oil. Unfortunately, both you and the state would be right under these conditions. But the state has the final say, making it best to avoid the situation from the start.

Only remove or modify spray bar nozzles when you thoroughly understand what result that action will have. If you are experiencing distribution problems like those discussed earlier, analyze the issue. Once you see what's going on, don't be afraid to experiment. In general, you want to be sure that oil comes out the farthest end of the spray bar from the weigh bucket. If you must plug nozzles to get the oil to the far side, start with the one closest to the weigh bucket because it gets oil first and has it last.

Note 2: The addition of a trough on top of the oil spray bar to catch and hold a quantity of aggregate can go a long way toward eliminating wear on this item. Try a 6" x 1" x 1/8" channel iron. Have it welded to the top of the bar, the uprights pointing skyward.

Overall, inspection of the dratch or batch plant resembles that of the drum plant on a smaller, but not less observant, scale. Maintenance personnel have to stay on their toes and watch for leaks and wear any time of the year at any type of HMA plant. Take advantage of the slower winter months and scheduled downtime to make sure your operation is ready for a successful start-up this spring.