National Ready Mixed Concrete Association
900 Spring Street
Silver Spring, MD 20910

(301) 587-1400
Fax (301) 585-4219
URL: www.nrmca.org
E-mail: trainingmgr@nrmca.org

These materials were developed for the purpose of training students for the National Ready Mixed Concrete Association's (NRMCA) Concrete Delivery Professional Certification Program. The information provided herein is offered in good faith and believed to be accurate and reliable, but is offered WITHOUT WARRANTY, EXPRESS OR IMPLIED, AS TO MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR ANY OTHER MATTER. NRMCA does not guarantee that users of any of the materials developed for the above-mentioned certification program will pass the NRMCA certification tests. Certification tests and the certification program will be administered in accordance with NRMCA guidelines. The only remedy the user shall have hereunder will be the return of the test application fee.

About the authorship:

These materials were developed by the National Ready Mixed Concrete Association's Operations and Equipment Maintenance and Education Activities Committees. For information on the committees see http://www.nrmca.org.

The primary writer for the materials was Paul M. Muck, Swift Mills Associates, LLC, Clarence, NY, e-mail: pmuck@pce.net.

Supported by

TMMB
TRUCK MIXER MANUFACTURERS BUREAU

Introduction

Successful delivery of ready mixed concrete requires that the CDP and the truck mixer perform as a complete unit. A properly functioning truck mixer is essential to the mixing and delivery process, and a well-trained CDP uses the truck mixer as a tool to get the correctly manufactured concrete product where the customer wants it. Like any tool, the truck mixer is only as good as the skill of the CDP operating it. But if the tool does not work correctly, the CDP will be very limited in their ability to deliver the product. Therefore, it is extremely important for the CDP to understand how a concrete mixer properly functions and what to do when it does not function properly.

As with all information in the CDP program, each individual producer may have specific procedures to follow in these knowledge areas. The CDP should always follow established company procedure if it conflicts with any information presented in this module. Producers can use the information presented to help structure or modify their own programs as well. In particular, the information in Chapter 2 on pre-trip inspection and the accompanying video can benefit most producers in performing this essential routine.

This module is not designed to be a review of the knowledge and skills that the CDP should have received through the Commercial Drivers License (CDL) program. A proper foundation of heavy truck operating knowledge and skills are necessary for the CDP to perform essential tasks, especially in vehicle maintenance and operations. If the CDP is deficient in CDL skills or needs refresher training, many local programs exist to help a commercially licensed driver.

The objectives of this module include:

- Providing the CDP with a working knowledge about truck mixer systems and their components;
- Presenting best practices for vehicle inspection and operation, especially in inclement weather conditions;
- Reviewing procedures that can help the CDP to deal with common malfunctions that may affect delivery.

To learn more about the information presented in this module, please see the list of references and recommended readings in the appendix. A glossary of terms can be found at the end of this module.

CHAPTER 1 – TRUCK AND MIXER COMPONENTS

Chapter objectives

After studying this chapter, the CDP candidate should be able to:

- List the basic components of these truck and mixer systems:
  - Engine systems
  - Steering, chassis and drive train
  - Axles, suspension, wheels and tires
  - Mixer system
- Identify key areas in these systems that can affect delivery.

Why know about the parts?

The CDP must have a good working knowledge of all components on the truck mixer for several reasons. First, the CDP must know where important components are located on the truck mixer in order to perform required pre-trip inspections. If problems are discovered, the CDP must be able to describe the names and functions of these components in order to relay the problem to a mechanic, or assist the mechanic in repairs. The CDP may on occasion need to troubleshoot problems with the truck or mixer on the jobsite, and must be able to describe the problem via radio. This will enable a mechanic to bring the appropriate repair parts.

Secondly, the CDP must take responsibility for the entire vehicle and know when the truck mixer is not functioning properly. The CDP is not only the vehicle operator, but also has the primary task of making sure the truck mixer is in good order and ready for service. A good working knowledge of the truck mixer components will allow problems to be diagnosed quickly, and avoid costly delays and downtime. Being responsible for the operation and performance of the truck mixer also requires the CDP to know whether or not a mechanical condition can create a safety problem. Even though mechanics are mainly responsible for repairs and maintenance on the truck, the CDP has the final decision as to whether or not the truck is safe to operate. This requires knowledge of truck mixer components and how they function.

Finally, the CDP must be aware of proper maintenance operations and schedules. If proper maintenance is not done, the vehicle may break down and cause delays or become unsafe to operate. The CDP acts as part of the vehicle maintenance quality control team by making sure that required preventative maintenance is done timely and properly.

Engine oil system

Most truck mixers are powered by diesel engines. Various manufacturers and sizes of engines require different oil change schedules, and the CDP must be aware of the oil change schedules for his or her vehicle. The primary function of oil in an engine is to lubricate moving parts and suspend dirt. Oil is circulated through the system by an engine-driven oil pump, and cools as it circulates. If the oil cooler itself fails, the oil can force itself into the coolant system and create damage.

Oil is supposed to get dirty, and filters are included on engines to trap dirt and debris as oil flows through the filter. Regular filter changes and oil replacement will help keep an engine running properly. Some companies conduct routine

Engine oil system *(continued)*

oil sampling to determine if there is premature wear in the engine by analyzing oil samples for contaminants, dirt, or metal particles.

At the beginning of every shift, the oil should be checked as part of the pre-trip inspection. The CDP must know the location of the oil dipstick, as well as the location in the engine where oil may be added if it is low. The CDP should monitor the amount of oil that is added for excessive use, because it indicates engine trouble. When looking at the oil on the dipstick, the CDP should note whether the oil is very dark, smells burnt, or look watery. If the oil is very dark or smells burned, there could be a problem with the engine. If there is water in the oil, it will turn to a milky, brown color. Both conditions should be written up for maintenance.

Fuel system

The engine system consists of fuel injectors, fuel pipes, a fuel pump, a fuel strainer, a fuel filter, and numerous connecting fuel lines. Fuel is first drawn from the fuel tank and travels through a fuel strainer. It catches large pieces of foreign material in the fuel system. A fuel pump then forces the fuel through the fuel filter, which removes most small foreign material. The fuel travels onto the fuel inlet manifold. Fuel pipes carry the fuel into the inlet side of the fuel injectors. Here the fuel is atomized through a very small spray tip openings into the combustion chamber. Surplus fuel returns from the injectors through fuel lines back into the fuel tank.

Figure 5-1: The CDP should not rely only on the fuel gauge within the cab. The fuel levels should be checked visually as well.

Fuel gauges in the cab allow the CDP to monitor fuel levels, but the CDP should not rely solely on these gauges to determine whether additional fuel is needed. These gauges can fail or be inaccurate, and running out of fuel can cause serious delays or problems. The CDP should periodically check the fuel levels (See Figure 5-1). Refueling intervals and procedures differ from company to company. The most common refueling procedure is for the CDP to top off the fuel tank at the end of his or her shift.

Fuel contamination can block the fuel lines or filters and cause the engine to starve for fuel, or stop running entirely. Water in the fuel will also create problems with engine operation. The CDP must always use caution when fueling the truck mixer to avoid getting dirt, water, or other contaminants into the fuel system. During extremely cold weather, diesel fuel can turn into a gel-like substance and not flow properly. Many producers use a blended fuel/kerosene mixture or a fuel additive to prevent this problem. Hot weather can also affect fuel performance. When fuel temperatures start to reach 100 degrees F or higher, the engine starts to lose horsepower and is less efficient. Keeping the fuel tank over half-full at all times will keep the fuel cooler and also prevent condensation and water from contaminating the fuel.

Cooling system

The engine cooling system circulates water and water additives through the engine to reduce temperatures caused by the friction of the engine operation. The additive is usually an anti-freeze that conditions the water and protects against engine damage from extreme hot or cold temperatures. Engine coolants are stored in and circulated through the radiator which helps lower the temperature of the coolant before it re-enters the engine. A fan driven by an engine belt pulls air through the radiator, and a thermostat helps regulate

Cooling system *(continued)*

engine temperatures. The flow of the coolant is controlled by the water pump, which is belt driven by the rotation of the crankshaft in the engine. A temperature gauge is mounted in the cab so that the CDP can monitor engine coolant temperature.

The CDP should check the coolant level at the beginning of each shift during the pre-trip inspection and add coolant as necessary (See Figure 5-2). Most producers have storage tanks that contain blended amounts of water and anti-freeze to add instead of pure water. Observe the color of the coolant. A rust colored coolant is an indication of metal impurities from the cooling system, and if this is found, the cooling system should be flushed and cleaned. The CDP should never open the radiator cap of a hot engine, because the coolant will be extremely hot and may cause severe burns.

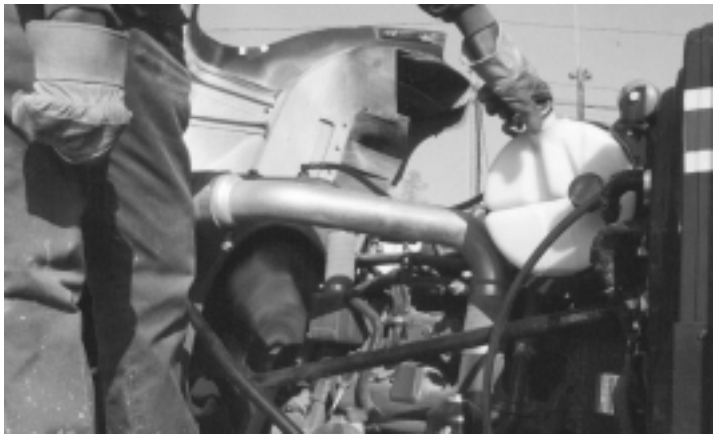

Figure 5-2: The CDP should check coolant levels during the pre-trip inspection. Never open the radiator cap when the engine is hot.

Air Intake system

A properly functioning air intake system is essential to truck mixer operation. Engines need clean air to mix with fuel in the combustion chamber. Compressed air is also used to operate many other systems on the vehicle including brakes, water tank pressure, transmission controls and air horns. Air is drawn into the engine air compressor through a filter system and pressurized. Some older engines have filter systems that use oil to help trap dirt and debris, but most modern engines use a plain paper filter. Air filters are designed to keep dirt and debris out of the engine. As little as one teaspoonful of dirt in an engine can cause serious damage. Clogged or improperly sealed air filters are hazardous to the full, useful life of an engine.

Construction equipment, such as a truck mixer that operates in a dusty or dirty environment, needs more frequent cleaning and changing of its air filter system. Filters that get clogged with dirt can also block airflow and starve the engine, thereby shutting it down. The CDP should monitor vacuum gauges for gradual drop in vacuum pressure as an indicator that the filter system might need maintenance.

Electrical system

The primary functions of the electrical system are to provide power for starting the vehicle and a power source for various electrical components on the truck mixer, including gauges and lights. Wiring can be a source of extensive downtime if not properly maintained. Acid and large amounts of water are used to clean truck mixers. They can cause damage to wiring and other electrical system components. Many batteries, alternators and starters have been ruined due to faulty or damaged wiring. Most vehicles today have 12-volt electrical systems, although there are some 6-volt systems still around.

The primary components of the electrical system are the battery, alternator, starter, solenoid, coil, and key switch. Many of these components are now being combined into solid-state electronic systems because they are much more reliable and require much less maintenance. Newer engines are equipped with electronic control modules; these modules, or ECM's, control virtually the entire engine from air intake, fuel flow, to monitoring the anti-lock brake system. Some more advanced ECM's are even capable of self-diagnostics.

Electrical system *(continued)*

Figure 5-3: The CDP should have a good working knowledge of the engine's electrical system.

The CDP should check the battery terminals and connections as part of the pre-trip inspection. The battery box should be secure and stable (See Figure 5-3).

Engine hoses

All fluids, except for engine oil, are transported through hoses. A leak or hose failure can cause major damage and/or unnecessary downtime of the vehicle. There are many different diameters, lengths and thicknesses of hoses. The primary material used for hoses is rubber, which can become dry and brittle with age. Wear points are also a common problem, as contact with hard surfaces will rub hoses and weaken or destroy them. This is usually a result of engine and vehicle vibration.

Hose-end clamps may also be loosened through vibration, especially squeeze-type clamps. All hoses, clamps and any potential wear points should be periodically checked by the CDP. Noticeably weakened, cracked or worn-out hoses should be written up by the CDP for immediate replacement.

Engine belts

Engine belts are used to power accessories attached to the engine. These all work off the rotation of the engine and their speed is varied through the use of various sizes of pulleys. All belts have an optimum tightness and should not be too tight or too loose. A belt that is too tight puts an excessive load on bearings and shortens the life of the belt. A belt that is too loose allows slippage and lowers the fan speed, causing excessive wear and low performance of the system it is powering. The CDP should check belts following the procedure outlined in the pre-trip inspection presented in Chapter 2 of this Module.

Power steering system

Steering systems vary on different types of equipment, but the basic system consists of a power steering unit, steering shaft, tie rods, draglinks, and steering arms. All of these components must be checked during the pre-trip inspection to ensure that the vehicle is safe for operation. The steering wheel should have no more than 2 inches of free play. The fluid level in the power steering system should also be checked during the inspection, as well as a visual inspection of the steering box or boxes for any sign of oil leaks.

Driveline system

The driveline consists of main and auxiliary transmissions, differentials, and all connecting drive shafts. The driveline system receives power from the engine, and allows the operator to use that power for maximum performance. Both transmissions and the differentials (rear ends) are sealed units connected by a series of universal joints ("u-joints") and drive shafts. These drive shafts are normally engineered to be the weak link in the total system, because they are the easiest and least expensive to replace. A shock from the transmission or differential should damage the drive shaft, not the sealed components. A warped drive shaft or worn u-joint can cause vibration that can cause serious damage to sealed components. The clutch assembly is also an important part of the driveline system. The clutch assembly is one of the most often adjusted parts of a truck, and may be replaced or rebuilt on a regular basis.

The CDP can monitor the condition of the driveline by noting any excessive vibration or noise coming from the system. The clutch adjustment is also checked during the pre-trip inspection.

Chassis

The chassis is basically the vehicle frame and bumpers. It has many lubrication points and is exposed daily to dirt, grease, water, cement or concrete. The CDP should keep the chassis as clean as possible, as part of his or her regular cleaning routine. This will help facilitate routine maintenance and repair.

Suspension

Suspensions vary by truck manufacturer but their purpose is the same. Virtually all road vehicles will have springs on the front and some are also equipped with shock absorbers. Most truck mixers have one or more leaves on the left front spring than on the right front. Rear suspension systems are normally either springs or semi-solid suspensions with rubber biscuits and walking beams. Some units will also be equipped with high lift axles, pushers or tag axles. Pusher axles are those in front of the rear driving axles. In either case, these extra axles are air operated. Proper functioning of the air bags is critical. Torque arms and sway bars are also used on vehicles to assist other suspension components to make sure that the unit is safe and easy to operate. These parts receive a great deal of use and wear. The CDP should check suspension components as part of the pre-trip inspection routine. Any defects found should place the vehicle immediately out of service.

Brakes

The brake system is one of the most important systems a CDP needs to monitor at all times (See Figure 5-4). The CDP's life and the lives of others depend on it. The brakes are activated by compressed air stored in the vehicle's air tanks from the air compressor. A series of lines carry air to valves, which open and close when the brake pedal in the cab is pressed. The valves allow air to flow into chambers and activate diaphragms, which engage the brakes. Brake systems must be adjusted on a regular basis to maintain safe operation of the truck mixer. Newer units are equipped with anti-lock braking systems, and the CDP operating a truck with ABS systems may feel that braking ability is reduced. In reality, ABS systems actually stop the unit in a far shorter distance. Pumping ABS systems should be avoided.

Figure 5-4: For safety purposes, the CDP must constantly monitor the brake system.

Tires and wheels

There are two different types of wheels. Their difference between them is mainly in their center construction: one is of a spoke design and the other is solid. Both types of wheels come in assorted sizes and individual company preference usually dictates the type and size.

Tires are more complicated. The national trend seems to be moving away from bias-ply to radial tires, although bias-ply tires are still used in large quantities. There are many different tire sizes and brands available. Matching tires by circumference tread depth and type (bias-ply, radial, original tread, recap) is one of the most important aspects of extending tire life. The second way to extend tire life is by maintaining appropriate tire pressure. For every one pound of under-inflation, tire life can be reduced by approximately one percent.

Tire costs are the second highest cost of running a truck mixer, with fuel being the most expensive. In the ready mixed concrete industry, more tires are ruined than worn out. Tire failure can cause delivery and schedule delays, unhappy customers, and even create a major safety hazard. A tire failing on a 30-ton vehicle traveling at 60 miles an hour can be fatal to the CDP and others in the vicinity. Most tire failures can be prevented through a good tire inspection program, and the CDP is an important part of that program.

Figure 5-5: Check the tire pressure frequently. Under-inflation will greatly reduce tire life.

As part of the pre-trip inspection, all tires must be checked (See Figure 5-5). Most producers simply require the CDP to use a hammer or metal device and "bump" the tires to check proper inflation. Others set up a tire program that requires the CDP to use a tire gauge to monitor tire pressures. This prevents under-inflation and prolongs tire life. Use of recapped tires also requires closer monitoring. Recapped tires can only be used on driving axles and not on steering axles. The CDP should always check recaps for tread separation of the casing. If the casing starts to separate, or any steel cords in the tire become visible, the tire should be immediately changed.

Tire sidewalls are weaker than the tread area and any cuts in the sidewall should be monitored closely. Objects, such as stones or debris in the tire tread, should be removed promptly. If they are not removed, they can become imbedded and create leaks. Observe the tire for bulges or blisters because they indicate a weakness in the tire. The tire should be replaced immediately if any of these defects are found.

Mixer system

The mixer systems include all parts and pieces installed by the mixer manufacturer. Hydraulics, water tanks, fenders and trailing axles (if equipped) are part of the mixer system. A concrete mixer is a complicated piece of equipment. There are a limited number of moving parts, but there are several self-contained systems operating at once. These include a water system operated with air pressure, a closed hydraulic system, an electrical system that is connected to the truck's electrical system, and a "manufacturing" system that takes raw materials and makes concrete from them.

Because of the constant and sometimes rapid movement of the mixer drum, the resultant friction and vibration can cause parts to wear quickly. All of these systems within the mixer system must operate properly or the entire unit will not function. Visual inspection of key areas in the mixer system by the CDP is very important.

Most concrete mixers have hydraulic direct-drive gearboxes, although some producers still operate units that use a chain drive. The direct drive has all driving gears sealed in a case and chain driven units have an external sprocket that turns a large chain attached to another sprocket on the drum.

The primary components of the mixing system are the drum and fins, charge hopper, discharge hopper, ring and bearings, pedestals, and chutes. Drums come in many different sizes, as well as different thickness of construction and fin styles. The drum is supported at the front by the front pedestal and is attached to either a hydraulic or chain drive. A steel ring is welded on the back portion of the drum and the ring rides on two rollers attached to the rear pedestal. The fins are welded to the inside of the drum and act as a screw mechanism for mixing and discharging concrete. When the truck is being loaded, raw materials pass through the charge hopper at the top of the rear pedestal and are funneled into the drum. When the drum rotates in a clockwise direction (looking from the rear of the truck) the fins pull the materials into the drum and blend them together. When the drum rotates counter-clockwise, the fins push the concrete to the back of the drum into the discharge hopper and chutes.

There are a variety of trailing axles that have been engineered to allow larger payload capacities on truck mixers. Newer trailing axles depend on the hydraulic pump for operation, unlike high-lift pusher and tag axles that normally operate from the air system. Proper operation of these trailing axles is very important, because some are involved in the actual loading and/or unloading of the mixer drum. The CDP should also be aware that vehicles equipped with a trailing liftable axle have a tendency to pull to the right when making a left turn because of the way the axles track on the roadway.

CHAPTER II – PRE-TRIP INSPECTION

Chapter objectives

After studying this chapter, the CDP candidate should be able to:

- Identify the proper steps in a pre-trip inspection for rear-discharge truck mixers.
- Identify additional or different steps in pre-trip inspection for front-discharge mixers and mixers with liftable axles.

Legal requirements for inspection

Federal Motor Carrier Safety Regulations require commercial vehicle drivers involved in interstate commerce to conduct an inspection of their trucks before beginning each trip. Many states have adopted the same rule for intra-state travel. Department of Transportation (DOT) regulations also require a post-trip truck inspection and must be completed by the vehicle operator at the end of each shift. Copies of these reports must be kept in the cab of the truck and by the maintenance supervisor. If a truck is involved in an accident, or investigated for any reason, DOT inspectors or law enforcement personnel may ask for these records to verify that mechanical problems have been reported and corrected per DOT guidelines.

In order to adequately comply with these inspection regulations, as well as to make sure the vehicle is ready for daily operations, the CDP should follow a routine procedure when inspecting the truck and mixer. The NRMCA and its Operations and Maintenance Committee have developed a 7-step procedure for the CDP to use, as well as a training video, which follows the procedure in this study guide. The CDP should review both the study guide and view this video to become completely familiar with this important procedure. A sample checklist for both rear-discharge and front-discharge mixers can be found in the appendix of this module.

There are seven steps to the pre-trip inspection procedure:

Step 1: Vehicle overview

Step 2: Check engine compartment

Step 3: Start engine and inspect inside cab

Step 4: Turn off engine and check lights

Step 5: Walk-around inspection

Step 6: Check signal lights

Step 7: Start engine and check brake system.

Additional mixer-specific functions covering liftable axles, all-wheel drive, and front discharge units have been added at the end of step 7.

Step 1: Vehicle Overview

The vehicle overview involves looking for signs of major defects and vehicle obstructions. Start the vehicle overview by looking for puddles on the ground beneath the truck or dripping fluids. Check that no tires are flat. If the truck is leaning to one side, this is often an indicator of a broken or damaged suspension. Look around the vehicle for any hazard, including objects in the truck's path. Make sure the exterior mixer drum rotation control is in neutral. Close all air system petcocks left open at the end of the previous shift to drain and flush impurities out of the system. Check the post-trip vehicle inspection report from the last shift the truck was driven. If defects were noted, make sure that these items have been repaired.

Step 2: Check Engine Compartment

Check that the parking brake is applied or that the wheels are chocked. Raise the hood or tip the cab on cab-over-engine models. , Check the fluid levels: the oil, power steering fluid and radiator coolant. Check the condition of all hoses: look for cracks, bulges and splits. Check the belts for tightness; there should be no more than ¾ of an inch of play in any direction at the center. Look for wear or cracks. Be sure to check the power steering belt, water pump belt, alternator belt and air compressor belt. Check all air lines and couplings for tightness and signs of fatigue. Check electrical wiring for cracks, and worn or burned spots.

Next, check the steering mechanism thoroughly. Look for bent, loose or broken parts in the tie rod, steering arm assembly and steering gear box. The play in the steering wheel will be checked in Step 3, so pay attention to the steering system components that affect it. Look for missing nuts, bolts, cotter keys or other parts. Check the power steering pump and hoses for leaks.

Check the front brakes while the hood is open. Look for cracked drums and shoes with oil or grease on them. Make certain the brake shoes are not missing, broken or worn dangerously thin. Brake chambers must be securely mounted, and should not be leaking, cracked, or dented. Make sure the hoses are not chafed or leaking. Check the adjustment of the brakes by pulling on the slack adjuster. If it moves more than about one inch, it probably needs adjustment. Check that the angle of the push rod and the adjuster arm is just over 90 degrees when the brakes are released. Close and secure the hood or cab.

Be thorough with the brake inspection. Not only does the CDP's safety depend on it, but also poorly adjusted or damaged brakes are cited by police officers in roadside checks of heavy trucks more than any other equipment problem!

Step 3: Start Engine and Inspect Inside Cab

Depress the clutch and put the transmission shifter in the neutral position. Automatic transmissions should be put park or neutral. The interior mixer drum control should be in neutral. This is especially important in cold weather.

Start the engine. Listen for unusual noises and check the gauges. The oil pressure gauge should show increasing or normal pressure and its warning light should turn off. The electrical gauge should show that the alternator is charging and its warning light should go off. The water temperature gauge should move from zero and increase gradually. If there is no gauge, the temperature warning light should go off. If there is an oil temperature gauge, it should also gradually rise to the normal operating range. The air pressure gauge should indicate steadily increasing pressure. Low-air warning lights and buzzers should be on until the pressure passes 60 psi. The compressor should cut off at about 125 psi. After air pressure builds, check the air horn.

Next, check the vehicle controls. The steering wheel should have less than ten degrees of play, or about two inches of free movement. More play in the wheel makes it hard to steer and frequently indicates damage to the steering control system. The clutch pedal should have one to two inches of free-play before tension of the pressure plate separating from the clutch throw-out bearing is felt. Depress the clutch and check that the transmission shifter moves smoothly. The accelerator pedal should be firm. If it is mushy or does not return to its original position, check the throttle return spring. Test the inter-axle differential lock switch, if the truck has one. The inter-axle lock dashboard light should come on.

Step 3: Start Engine and Inspect Inside Cab *(continued)*

Make sure the windshield wipers and washers work. Check that the heater and defroster work. The following light controls should be checked: headlights, high beam dimmer switch, turn signals, four-way hazard flashers, and any additional clearance or marker light switches. Check the mirrors and windshield. Make sure they are clean and not cracked. Appropriate vehicle inspection and tax stickers should be current and in place on the windshield. There should be no outdated stickers or obstructions. Adjust all the mirrors.

Make sure the vehicle has all the proper emergency equipment and that it is in good condition. An emergency signal kit is required by DOT for all vehicles over 10,000 GVW whether they travel more than 50 miles from their home base or not. At a minimum, the truck must have spare electrical fuses (unless the truck has circuit breakers), three red, reflective warning triangles; and a properly charged and rated fire extinguisher. A first-aid kit is also recommended. Check that the seat belt is securely mounted, and that it adjusts and latches correctly.

Step 4: Turn off Engine and Check Lights

The CDP should now turn off the engine and keep the key on his or her person. Turn on the headlights and the four-way hazard flashers. Get out of the cab and go to front of the vehicle. Check that both headlights are on and that both of the four-way flashers are working. Push the high beam dimmer switch and check that both high beams work. Turn off headlights and four-way hazard flashers. Next, turn on all parking, clearance, side-marker and identification lights. Turn on the right-turn signal.

Step 5: Walk-around Inspection

The purpose of the walk-around inspection is to focus attention on components on all sides of the vehicle, beginning at the left front of the truck. All lights, reflectors and glass should be cleaned as the CDP walks around the truck. During the walk-around inspection the windshield should be cleaned and the windshield wipers inspected. Wiper arms should have proper spring tension and the blades should be properly attached and in good condition. Start the walk-around inspection by cleaning the driver's door glass. Check that the door latch and the lock work properly. Next, check the condition of the left front wheel and rim. Look for missing, bent or broken studs, clamps and lugs. Look for rust around the lug nuts, often the first indicator that the nuts are loose. Check the wheel hub oil level and look for leaks. Look at the wheel and tire treads wear for signs of misalignment. Check the condition of the left front tire. Make sure it is properly inflated. Look for serious cuts, bulges or tread wear: Steering tires must have tread depth of at least 4/32 of an inch in the deepest groove. Check the valve stem condition and make sure that the cap is on. Next, check the left front wheel's suspension. Look for cracked, broken, or shifted leaf springs. Check the condition of spring hangers, shackles, and u-bolts.

Now, proceed to the front of the vehicle. Check for damage to the front axle. If the vehicle has a front mounted power take off unit (PTO), visually inspect the driveline and check that the hydraulic hoses and connections are not leaking, loose, or worn. Check the hydraulic oil tank for proper fluid level and leaks. For trucks equipped with rear PTOs, check these lines from the right side of the truck. Look over all lights. The parking, clearance and identification lights should be clean and operating. The right front turn signal light should be operating and clean.

Move around to the right front side of the truck. Check the wheel, tire, and suspension, as already done to the left front. Clean the right side window. For cab-over-engine models, check that the cab safety locks are engaged. Check the condition of all components visible from the front right side. Make sure nothing is leaking from the rear of the engine or transmission. The exhaust system should be secure and not be in contact with any wires, fuel or air lines. Check the frame and cross members for bends or cracks. Make sure that concrete chutes are properly secured and are in good condition.

At the right rear of the truck, again check the condition of the wheels and tires. All non-steering tires must have tread depth of at least 2/32 of an inch in the deepest groove. Make sure that paired tires are not rubbing against each other and that nothing is stuck between them. The spacer between the dual wheels should be centered, keeping the tires evenly spaced. Paired tires should be evenly matched for height as well. The tires must be the same type, meaning radials and bias ply tires should not be mixed on the same axle. Make sure the axle seal is not leaking.

Pay particular attention to the rear suspension. It takes a beating due to heavy loads and tough off-road conditions. Depending on the type of suspension, a variety of components need to be checked. Look for cracks in the brackets and mounting hardware. Inspect the condition of the walking beam and check the load cushions for distortion or damage. With leaf-spring suspensions, check the leaves for cracks, breaks and shifting as was done with the front suspension. Rear suspension problems are usually first noticed by the CDP experiencing serious handling problems. Make sure that the axle is not leaking gear oil. Next, check the condition of the brake drums, pads, or shoes. Make sure that none of the brake lines show any wear due to rubbing.

Check the lights and reflectors. Side-marker lights must be clean and operating. Side-marker reflectors must be in place and clean. At the rear of the vehicle, check the lights and reflectors. Tail, clearance, and identification lights must be clean and operating. Rear reflectors must be in place and clean. The right rear turn signal should be operating properly. Check that the license plate is in place, clean and secured. The mud flap must be in place, undamaged, properly fastened and not dragging on the ground or rubbing tires.

Make sure the chutes are in good working order. Check that the chute lock is functioning properly and is not loose. Unlock it and make sure the chute swings easily. Re-lock the chute and make sure the fold down chute lock is undamaged and latched.

At the left rear of the truck, check the wheels, tires, and suspension, as you did on the right side. Check the truck's water tank. Make sure it is securely mounted, that the flap seal is in good shape, and that the air and water lines are undamaged. Check that all drain valves are closed and make sure the sight gauge is in good condition.

Move on to check the fuel tank. It should be securely mounted, undamaged and free of leaks. Visually check that the tank is full. DO NOT DEPEND ON THE FUEL GAUGE! The fuel tank cap must have a rubber gasket and be tight. The battery box must be firmly mounted to the vehicle, with a secure cover. Make sure the battery is secured against movement. Batteries must not be cracked or leaking. Unless it is a maintenance-free battery, check that the fluid is at the proper level and that the cells caps are in-place and tightened. Battery connections should be tight and free of corrosion.

Step 6: Check the Signal Lights

The CDP should get in the cab and turn off any lights left on for step 5. Apply the brake pedal and have a co-worker check that both brake lights are working. Turn on the left-turn signal. Get back out of the cab and go to the front of the vehicle. The left front turn signal light should be clean and operating. Go to the back of the truck and check and clean the left rear turn signal light as well.

The back-up alarm should also be checked at this time, although this check is not included in the pre-trip inspection video. While checking the brake lights, the CDP should put the truck in reverse and make sure that either the driver or a co-worker can hear the back-up alarm.

Step 7: Start the Engine and Check Brake System

Get back in the cab of the truck and turn off any lights not needed for driving. Check for all the required vehicle papers and permits, and secure all loose articles in the cab. Start the engine and prepare for the air brake system test.

The brake check is a critical part of the pre-trip inspection and should be done with particular care. First, allow the air pressure to build up to 100 to 125 psi, at which point the air compressor should cut off. Next, fully depress the brake pedal and hold it down. After an initial pressure drop, the pressure should not decrease by more than 3 psi in one minute. Release the parking brake. Next, "fan" the brake continuously and make sure that the low-air warning device activates before the pressure drops below 60 psi. Continue fanning the brake to relieve the air pressure. At about 40 psi, the parking brake valve should pop out. If the truck is equipped with an engine braking system ("jake brake"), turn the switch on, then depress and release the accelerator. The CDP should hear the engine brakes engage. Turn the switch back off.

Now, test the service brake stopping action. Allow the air pressure to build again. Release the parking brake and drive forward at 3 to 5 miles per hour. Apply the brake pedal firmly. The vehicle should stop immediately. Be alert for pulling to one side, any unusual brake pedal "feel" or delayed stopping action.

Test the parking brake. With the vehicle fully stopped, apply the parking brakes only. Make sure it holds the vehicle when the truck is shifted into low gear and **gently** pull against the brake at idle speed.

Check Mixer Control and Mixer Rollers

The mixer unit should now be inspected. While this test is not part of any required DOT inspection, it is critical to making sure the truck mixer is ready for delivery. Set the parking brake and leave the engine running. Go to the rear of the truck and look around the mixer drum track to make sure that nothing will interfere with the movement of the drum and rollers. Gently put the mixer control into the charge position. Watch and listen for signs that the drum, rollers or roller bearings are damaged. If everything is okay after the first revolution, gradually increase the engine RPMs with the throttle control. Slow the drum back down and change the drum direction to discharge for one or two turns. If everything works as it is supposed to, the drum controls are in good condition. Put the throttle back to idle and in the drum control in neutral. Go back to the cab and make sure the interior drum controls work by following the same procedure.

The pre-trip inspection is now complete. If the CDP encounters any problems, they should be reported immediately. The CDP must have the mechanic's or maintenance supervisor's go-ahead before the truck is placed into service.

Liftable Axles

Many truck mixers are equipped with liftable axles to allow for heavier payloads in compliance with state weight laws. The following procedure shows how to inspect a trailing, load-span axle, popular in states with "bridge formula" weight laws.

At the end of Step 7 of the inspection, set the parking brake and leave the engine running. Whether the pressure gauge for the axle is in the cab of the truck or on the mixer body, make sure the pressure is at the minimum setting. It is possible to raise the drive tires off the ground when the axle is lowered, leaving the truck with no parking brakes! Re-enter the cab, lower the axle to the ground and make sure that the vehicle is stable. Go to the rear of the truck and check the axle assembly for damage. Examine the hydraulic cylinder, lines and connections for leaks. Look at the safety latch for concrete build-up or anything else that may prevent it from functioning properly.

Remember, an additional axle means an additional set of wheels, tires and brakes that need to be checked. Look these over carefully. Check the tires for uneven tread wear that may indicate the liftable axle is not tracking as it should. Make certain the brake lights, turn signals, and running lights on the "dolly" are operational. Go back to the cab and put the transmission in reverse. The folding axle should come all the way up. Listen for unusual noises from the pivot pins and bushings during the lowering and raising of the trailer arms. Go back to the rear of the truck and make certain the safety latch is properly engaged.

Front Discharge Truck Mixers

The seven-step procedure for front-discharge truck mixers is essentially the same as for rear-discharge mixers. Many of the components are located in a different position on the truck, so the order of the inspection is somewhat different.

Step 1: The Vehicle Overview is identical for both types of trucks.

Step 2: The engine compartment check includes several differences. On most front discharge models, the engine compartment is at the rear of the vehicle. Set the parking brake and then go to the rear of the truck. First, check the hydraulic fluid level and the tank and lines. Next, raise the engine cover. Check the oil and radiator coolant levels. The battery and battery box should also be checked during the engine compartment inspection, while the hood is up. This truck is equipped with an automatic transmission. The transmission fluid level is best checked when the engine is warm. Some companies have their CDP's do this at the end of the day, along with fueling and drain-down. There is no brake inspection via the engine compartment with front discharge mixers. Brakes are checked at the four corners of the vehicle during step 5, the walk-around inspection.

Step 3: With an automatic transmission, there is no clutch to check. After the engine start-up and gauge check, with the parking brake on, run the shift lever through the gears once to verify that it shifts smoothly. Leave the transmission in neutral, or park if available, during the remainder of Step 3. After completing the check of the light controls, check that chute lever control is working. Lower, raise and swing the chute in both directions. Listen for any unusual sounds and watch for hesitation or jerking movement.

Step 4: Checking the lights are done in the same manner.

Step 5: The walk-around inspection is somewhat different because of the position of equipment on the front discharge mixer. For example, the fuel

Front Discharge Truck Mixers *(continued)*

tank is on the right, the chutes are stored on the left and the water tank sits on the frame between the cab and drum. Since the steering mechanism is not in the engine compartment, it should be inspected from the front of the vehicle. The walk-around inspection still begins at the left front and goes forward and around the vehicle from there.

Step 6: checking the signal lights, and

Step 7: starting the engine and checking the brakes, are done in the same manner.

Special features

There are several features of a front discharge truck that require special attention. Many front discharge mixers are six-wheel drive. This means there is an additional front transfer case and front axle that should be inspected for oil leaks. It is easiest to check these from the vehicle's right side. The drive shaft to the front axle should also be inspected for signs of damage. If there is a problem with any part of the front drive assembly, the CDP will probably notice a strong vibration when the truck is moving.

Most front-discharge trucks are equipped with super singles rather than dual rear wheels. While this makes some aspects of the inspection easier, the condition and proper inflation of these tires is even more important than with duals. Some front-discharge mixers are equipped with a liftable pusher axle, usually located in front of the drive axles. As with the trailing load-span axle, the pusher has an additional set of wheels, tires, and brakes to inspect. Look for signs of leaks in the air bags: the pusher axle is pneumatically activated rather than hydraulic. Most pusher axles are steerable axles. That means it should be carefully inspected for broken parts and proper alignment. At the end of Step 7, the CDP should check that the pusher axle raises and lowers properly. Remember; always make certain that this axle is in the up position before backing the truck.

Another difference with front discharge units is that they have a mechanically controlled chute. From the front of the vehicle, check the chute's drive chain. There should not be any more than one-half inch of play in the middle of the chain, nor should it be too tight.

All-wheel drive trucks require an additional step to verify that the front axle drive assembly engages and disengages properly. With the engine running and the transmission in neutral, flip on the all-wheel drive switch on the dashboard. Move forward, then backward slightly. The CDP should feel and hear the front axle engage. Repeat the process in reverse to disengage the front drive axle.

How long should the inspection take?

It is important to complete the pre-trip inspection as quickly as possible, but just as important for the inspection to be done thoroughly. With practice, the CDP should be able to complete the inspection of a rear-discharge mixer within 10 minutes and a front-discharge mixer within 15 minutes. The procedure will obviously take longer if problems are found that the CDP has to either correct on his or her own, or with a mechanic's assistance. If problems are discovered and the vehicle will not be immediately available for service, the CDP should notify the dispatcher immediately with an estimated time that the vehicle would be unavailable.

If there are no problems discovered in the pre-trip inspection, the CDP should report in service and await assignment from the dispatcher.

CHAPTER III – STARTUP PROCEDURES AND JOBSITE OPERATIONS

Chapter objectives

After studying this chapter, the CDP candidate should be able to:

- Identify proper startup procedures and truck/mixer operation under normal conditions.
- Understand the effects of weather and temperature on start-up and operation of truck mixer.
- Describe proper techniques for entering and maneuvering on jobsites with truck mixer, and how to make the unloading process go as efficiently as possible.

Starting/operating under normal conditions

After the pre-trip inspection is complete and the truck mixer is ready for service, the CDP should contact the dispatcher for assignment. Hopefully the dispatcher has a full day planned and the CDP will be needed to load almost immediately.

Concrete producers have their own set of procedures to follow that affect the operation of the truck mixer. Here are a few operating tips:

- Make sure the drum keeps turning all the time while driving, even with an empty drum. If the drum is kept in neutral, the bouncing and vibrating of the drum can create flat spots on the rollers and can lead to excess wear. Keep the drum in agitating speed while empty.
- If the truck mixer is equipped with a full wheel lock differential, it should be engaged prior to entering a job site, where additional traction may be needed. If the differential is engaged when traction is lost, the benefit of locking the wheels may not be as effective or not effective at all. Make sure the truck stops moving before engaging or disengaging the differential.
- If the truck is equipped with any kind of liftable or pusher axle, they should be raised prior to entering the job site. Weight conditions or bridge formula restrictions no longer apply. They are designed for on-road conditions and may be damaged when used in an off-road jobsite. An exception may be made when entering or maneuvering on paved jobsites, unless the truck has a liftable axle that must be raised in order to unload.
- Do not "slip" the clutch while discharging into a moving slip-form machine. This creates premature and excess wear on the clutch mechanism. Keep the truck in the lowest gear possible, and keep the clutch either fully engaged or disengaged. Use the brake system to help keep pace with the machine. It is more cost-effective to replace brake shoes than clutch plates!
- Do not allow the customer to hang extension chutes onto the truck chutes unless they are fully supported and do not add any weight onto the truck chutes. Normal-weight concrete weighs approximately 150 pounds per cubic foot. Too much weight on the chutes can break mounting points off the rear of the truck.

Starting/operating under normal conditions *(continued)*

A word about engine idling: Excessive engine idling wastes fuel, harms the engine, and pollutes the environment. Many areas have regulations that prevent trucks from idling more than a specific period of time unless special conditions are met. In general, the truck mixer should idle more than 10-15 minutes unless it is carrying a load or unless the weather conditions are such that the truck engine has to be running to keep the truck warm or cold. Every minute of excess idling creates excess wear on the engine because of incomplete combustion. Deposits will form on exhaust valves and piston rings, which reduces efficiency and creates more frequent engine service.

Starting/operating in cold weather

Cold weather can make starting and operating the truck mixer very difficult, especially if the truck is parked outside. Cold weather operation can create a great deal of stress on the truck mixer because the fuel, oil, coolant, and battery are all affected. As a result, the CDP must be careful to use special techniques when starting and operating.

In the startup process, perform the normal pre-trip inspection. Remove any accumulations of ice and snow from the vehicle. Do **NOT** use water to defrost or remove snow and ice. The water will just freeze on the truck. Should a drum roller freeze and not turn when the mixer is engaged, do not use a torch to try and defrost it. Spray the roller with warm or hot water and re-grease the roller when it starts to turn. If all the water has not been drained from the water system the night before, it will likely freeze in the lines and keep the truck mixer out of service until it is thawed out with handheld torches or moved into a heated garage.

Ether is a common material used to start trucks in cold weather. Many times it is used to reduce wear on the battery when trying to crank a cold engine, because at 0^{o} a fully charged battery will only have 40% of its cranking power. Ether should be used sparingly because it can damage an engine or cause a fire if used improperly. The CDP should try to crank the engine six to eight times before using ether. If ether is necessary, get someone else to assist. If at all possible, external electrical connections from an AC cold start jumper cart saves wear on the engine and battery. Block heaters are often installed in trucks that routinely operate in cold weather to pre-heat the engine and make starting easier.

Starting/operating in hot weather

Hot weather operation presents a different set of challenges for the CDP. While starting the vehicle and completing the pre-inspection checklist follow normal procedures, hot weather can create a great deal of stress on the truck mixer and its systems.

The primary problem of operating in hot weather is keeping the truck mixer engine cool. Under normal conditions, only 33% of the heat generated by the engine is used as horsepower. The rest has to be carried away by the cooling system. As the air gets warmer, there is less heat transfer away from the engine. The cooling system has to work harder to keep the engine temperature constant. If the cooling system cannot keep up, the engine retains more heat. The oil can break down and not lubricate, and the engine can seize up as a result. Sixty to seventy percent of diesel engine failures are caused by problems with the cooling system.

Engines running at high temperatures can also suffer a problem called "implosion". Implosion occurs when an engine runs hot with higher fuel

temperatures. Premature detonation of the fuel/air mix occurs and damages the cylinder walls.

Starting/operating in hot weather *(continued)*

To operate properly in hot weather, the CDP should monitor the engine coolant/ temperature gauge closely. Minimize rapid acceleration after a period of idling and minimize engine lugging or strain. Monitor the cooling system for leaks.

Common malfunctions

Even the most well maintained truck mixer might encounter mechanical problems or breakdowns from time to time. Here are some of the most common ones and some suggestions on how to deal with them:

Hydraulic Failure – on occasion, a hydraulic hose bursts or a fitting loosens. The ability of the CDP to continue delivery depends on what the hose is connected to. If the hydraulic failure is from a hose or fitting that is critical, many CDPs have diagrams of hoses and fittings that they can compare to the broken one. This allows them to radio the maintenance staff with the information they need to bring the correct repair parts (See Figure 5-6).

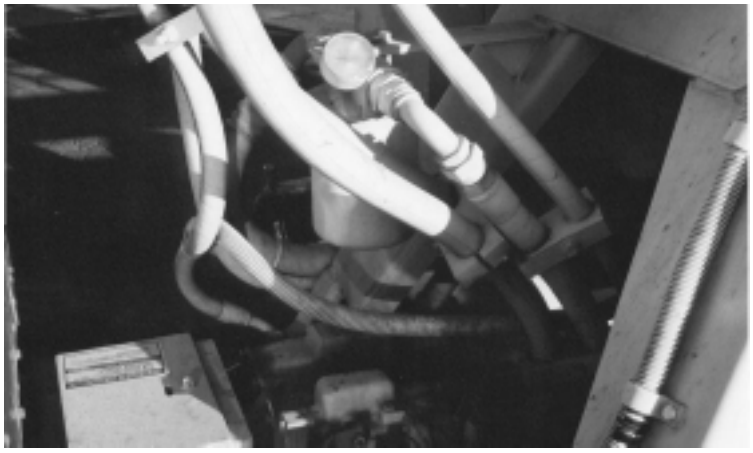

Figure 5-6: In case of hydraulic failure, the CDP must be able to identify the failed part and accurately radio that information back to the maintenance staff.

There are six main components to most common hydraulic system: main pump, filter, drum drive motor, oil cooler, hydraulic hoses, and oil reservoir tank. When a CDP encounters a hydraulic leak, he or she must be able to accurately describe the part that is leaking. If it is a hose, the CDP must be able to advise the mechanic which two parts the hose connects and the size of the hose in question. Further information, such as the ID number taken from the malfunctioning part, is important in order for the mechanic to be able to respond to a hydraulic breakdown in a timely fashion. The CDP should always keep their hands away from a hose or part spraying hydraulic fluid. The fluid is under high pressures and can result in bodily injury.

Flat Tires – If a flat tire occurs while driving, the CDP should calmly attempt to get the truck onto the shoulder of the road. Failure of a front tire is more serious and can create more of an immediate safety problem than a rear tire. Do not turn the steering wheel suddenly or sharply, but instead, guide the truck gradually onto the shoulder. Keep a firm grip on the wheel at all times. Do not apply the brakes heavily! Gradual pressure on the brakes will help slow down the truck. A panic stop with a blown tire can throw the truck mixer off balance and may lead to a rollover. Once the truck stops safely, advise dispatch of the situation and secure the vehicle with the proper warning devices.

Driveline Failure - The driveline consists of main and auxiliary transmissions, clutch assembly, differentials, and all connecting drive shafts. In general, driveline failures will inhibit or completely disable the trucks ability to move. The CDP must be able to identify driveline parts in case of a breakdown. In breakdown situations, the CDP should contact his supervisor via the radio and be able to accurately describe the problem he or she is encountering.

Common malfunctions *(continued)*

Engine Cooling System (Overheating) – If the cooling system is not adequate to keep the engine at proper operating temperatures, the CDP may have to stop the vehicle and open the hood to allow for more efficient engine cooling. In some cases, the truck water hose can be used to mist the area around the engine, particularly the radiator. Caution must be exercised if the CDP tries to add water or coolant to a hot coolant system. Taking the cap off the radiator when it is hot will result in the coolant "boiling" out, which will lead to more coolant loss. The CDP also runs the risk of being burned by the hot coolant. A determination to shut the engine down when loaded should always be made by a qualified mechanic. Immediate radio contact should be made to the dispatch office and/or maintenance shop if the engine is overheating.

Engine Failure - The CDP should be familiar with the engine system in order to diagnose problems. Should engine problems occur, open the hood and observe the engine compartment. The CDP should check for loose or disconnected wire, or broken belts. Check to ensure all water and vacuum hoses are attached. Check all fluid levels for possible automatic shutdown. In breakdown situations, the CDP should contact his supervisor via the radio and be able to accurately describe the problem he or she is encountering.

If the mechanical problem is severe enough that the delivery cannot take place, the CDP must deal with the concrete load appropriately. Assuming that the load will be replaced by another delivery to the customer, the CDP may have to add water and keep the load at a high enough slump to prevent it from setting up inside the drum. Many producers use sugar as an emergency retarder and keep a five-pound bag of sugar with every truck mixer. In the event the breakdown is severe and the drum can still be turned, the CDP can add the sugar and mix it into the load. This will prevent the load from setting up in the drum for several hours. Adding water or other products to the load should only be done with approval from dispatch or supervision.

No matter what breakdown situation occurs, it is imperative that the CDP understand the workings of the truck mixer in order to give an accurate assessment of the problem to the maintenance shop or dispatch office.

CHAPTER IV – POST-TRIP INSPECTION, CLEANING AND MAINTENANCE

Chapter objectives

After studying this chapter, the CDP candidate should be able to:

- Identify the steps in post-trip inspection and proper documentation.
- Describe the value of proper truck mixer cleaning and housekeeping practices.

Post-trip shutdown procedures

After the CDP completes delivery for the day, there are a number of tasks that he or she must complete before going home. This will ensure that the truck mixer is ready for service without delay for the following day.

- Fuel the truck mixer even though it might only require a few gallons. This prevents delay during startup the next morning, and a full tank is less likely to have condensation buildup. Be careful not to get the fuel nozzle or fuel cap dirty, which might lead to fuel contamination. Exercise caution when fueling to keep fuel spills or leaks to a minimum. Promptly clean up any spilled fuel.
- Make sure the drum is clean and that there is no water or slurry in the drum by driving to the appropriate waste discharge location at the plant and reversing the drum for several revolutions.
- Drain all water tanks and lines, especially in cold weather.
- Park the truck in the designated area. Before shutdown, idle the truck for a minute at 1000 rpm, then at a lower speed for a few more seconds. This allows the engine to properly cool down.
- Lower the booster axle or pusher axle if the truck is equipped with one.
- Open all air petcocks and drain all air tanks to remove any dirt or sludge accumulation.
- Check underneath truck for any leaks, hanging wires or other truck damage.
- Place the mixer controls in neutral.
- If the truck is parked on a steep grade, place chocks or other wheel blocks behind the wheels.
- Set the parking brake.

There may be additional procedures that each concrete producer requires at the end of each day. If the producer is using a wash water additive or concrete reclaiming chemical to recycle concrete or water, the CDP must use special care and attention in following the correct procedures.

Paperwork

Make sure that any required paperwork is completed in a neat, clean, and legible manner. Review all delivery tickets, note any problems or observations from the job and turn them in, along with any other required company paperwork. Complete the post-trip inspection report, as required by the company and DOT regulations. Make special note of any deficiencies or problems that require repair. These forms are usually in several parts. Leave one part with the truck for the next day and turn the other part into the shop. An example of a post-trip inspection report can be found in the appendix of this module.

If logbooks are required, the CDP should complete the logbook with a record of deliveries and hours as necessary. This information is also used to help determine compliance with DOT hours or service regulations.

Value of a clean truck

The value of a clean truck, both outside and inside, cannot be overemphasized. The truck mixer is a rolling billboard for the concrete producer and the CDP. The cleaner it is, the better it looks and the better the company looks. The CDP should also take pride in the appearance of the truck mixer and treat it as if it were his or her own vehicle. That pride in ownership is one of the things that separate the CDP from an average mixer driver (See Figure 5-7).

Figure 5-7: Keeping a clean vehicle instills pride of ownership for the CDP.

While some producers may allocate specific time for housekeeping and truck cleaning, most of the time it has to be done on rainy days or between loads. This can mean that a truck mixer can go long periods of time without thorough cleaning. The best way to keep a truck clean is to do it on a regular basis! The CDP should not wait for specific cleaning time, but consider this job as one that is done all the time. There are plenty of opportunities through the day to work on truck cleaning. Sitting on the job waiting to unload and at the plant waiting to load are two examples. Housekeeping can take a lot of different forms and there is always plenty to do.

- Keep the cab clean of trash, dirt and debris.
- Store items such as cleaning supplies, clipboards, maps and other small items in a specific place. A plastic milk crate is ideal and is easy to move from one truck to another.
- Keep the dashboard clean so that you can read the gauges.
- Continually wipe the mirrors, headlamps, turn signals and warning signals to keep them clean.
- If time and location permit, rotate the drum and spray it with water. Use a long-handled cleaning broom and move it slowly across the drum as it rotates. This helps keep dirt and cement from accumulating.
- Check around the vehicle for accumulation on the chutes, pedestals and fenders of dirt or concrete. These small accumulations can usually be easily removed with a small hammer.
- Check the tire treads for dirt or stones and remove them before they become embedded.

Remember that periodic and frequent cleaning prevents having to spend excessive time with acid and a chipping hammer later.

Using acid

When buildup of concrete or cement gets excessive, acids are sometimes used to clean the outside of the drum. Most companies that use acids for cleaning do not allow them to be used on the cabs of their trucks. Follow the company's approved safety precautions when using diluted acid or an acidic cleaning solution. Wear eye protection, long sleeves, an appropriate respirator and rubber gloves to prevent the acid from contacting skin or eyes. Should an accident occur, flush immediately with lots of clean water. The CDP should know where the eyewash fountain is located before any acids or chemical cleaning solutions are used. Read the manufacturer's *Material Safety Data Sheet (MSDS)* instructions for acids and other cleaning agents before you use them.

Using acid

The CDP should only use acid to clean the truck mixer when authorized to do so. The facility should have a designated pit or pad to park the truck mixer when using acid. Do not use acid anywhere else in the plant or yard and **do not** leave the yard with a container of acid on the truck. Acids must be disposed of properly and may be safely discharged into the plant's sedimentation or reclaiming machine if it is designed to do so.

Acid is extremely corrosive to metals. Acid spills on the structure of the truck should be washed off immediately and thoroughly. Do not apply acid to extensive portions of the truck mixer at once. Use acid in small areas, clean and wash off promptly (See Figure 5-8).

Figure 5-8: Cleaning should be performed on small areas of the truck using a diluted acid solution, then the area should be promptly rinsed.

Preventative maintenance

Where company policy and labor agreements permit, the CDP will increase their own value and their benefit to the producer by learning as much as possible about adjusting, repairing and replacing items on the truck mixer. Many CDPs are mechanically competent and often perform preventative maintenance work on their truck mixer with guidance from mechanics, or work alongside the mechanic. The CDP should take every opportunity to learn more about their truck by being thoroughly familiar with manuals on the truck, engine, and mixer system. Observing mechanics working on the truck and learning more about the vehicle can also yield valuable information for the CDP to use in the future.

A truck mixer is a complicated machine with many moving parts and systems. There is always something to repair, adjust or replace, even on a new vehicle. Mechanics are often busy with specific jobs and when company policy permits, the CDP can cut down on delays and downtime by performing many of these simple tasks. Not everyone may be comfortable or proficient at these tasks. The CDP should only attempt repairs or preventative maintenance that they are comfortable doing **and** have been approved by his or her supervisor.

APPENDIX FOR MODULE V

Appendix 1 – References and Recommended Materials

For more information on the subjects covered in this chapter, read or view the following:

- NRMCA Publication 160 – Maintenance Manual
- NRMCA Publication PPMM – Training Program for Preventative Maintenance
- NRMCA/Morse Brothers Mentor Driver Program tapes:
  - 2PRV001 – Clean Machine
  - 2PRV004 – Maximum Mileage
  - 2PRV005 – Maximum Traction
  - 2PRV009 – Responsible Management
  - 2PRV010 – Tire Care
  - 2PRV012 – Too Cold! Can't Start?
  - 2PRV013 – Booster Axle
  - 2PRV015 – Dipstick Detective
  - 2PRV016 – Hitting On All Cylinders
  - 2PRV017 – Thermal Shock
  - 2PRV019 – Implosion
  - 2PRV020 – Hydraucula

NRMCA Concrete Delivery Professional Vehicle Inspection Checklist

CCI A RAR DICAR RC MIR

Step #1: VIC VRVI

Step #: NIN CMPARMN

Step #: NIN AR AND CA INPCIN

Step #: ICC

Step #: AARND

Step #: INA ICC

Step #: RAM an PCIA IPMN CC

Appendix 3 – Sample Front Discharge Truck Mixer Pre-Trip Inspection Checklist

Appendix 4 – Sample Post-trip Inspection Report

GLOSSARY AND RELATED TERMS FOR ALL MODULES

Accelerator A chemical which, when added to concrete, shortens the time of set and increases the early stages of hardening and strength development.

Admixture A material other than water, aggregates or hydraulic cement used as an ingredient of concrete. Most commonly used admixtures are chemical solutions that are carefully metered into concrete batches to lend or enhance a specific property of the concrete.

Agent A general term for a material that may be used either as an addition to cement or an admixture in concrete, for example, air-entraining agent. Sometimes called an additive.

Aggregate Granular material such as sand, gravel, crushed stone or slag which, when blended with cement and water, makes concrete.

Air Content The volume of the air voids in concrete, expressed as a percentage of total volume of the concrete.

Air-Entraining Agent An admixture which causes microscopic air bubbles to be incorporated in the concrete during mixing. Usually to increase its workability and freeze/thaw resistance.

American Concrete Institute (ACI) An engineering organization responsible for writing and publishing codes and standards for concrete construction.

American Society for Testing and Materials (ASTM) An organization that writes and publishes test methods and standard specifications for a wide variety of materials.

Axle Load The portion of the gross weight of a vehicle transmitted to a roadway through the wheels supporting a given axle.

Bag of Cement A quantity of portland cement equivalent to a loose cubic foot of the bulk material; Equals 94 lb. in the United States. Also called Sack of Cement.

Barrel of Cement A quantity of portland cement equal to 4 bags or 376 lb.

Batch The materials in or the concrete produced from a single mixing cycle or load of concrete

Batch Plant The equipment required for batching and mixing concrete including bins, silos, hoppers, conveyors, weigh-batchers, etc.

Bleeding Movement of mixing water to the surface of freshly placed concrete caused by the settling of solid materials in the concrete.

Bonding Agent A coating applied to an existing surface to create a bond between it and a succeeding layer, for example, between a concrete subsurface and a terrazzo topping.

Broom Finish The surface texture obtained by stroking a broom over freshly placed concrete.

Buggy A wheeled hand or motor-driven cart, usually rubber tired, for transporting small quantities of concrete from hoppers or mixers to forms.

Bull Float A tool with a large, flat rectangular piece of aluminum, magnesium, or wood with a long handle. It is often used to smooth large areas of a slab immediately after the concrete is struck off with a screed.

Bush-Hammer Finish A decorative finish on concrete obtained by chipping off the surface mortar.

Cement See Hydraulic Cement and Portland Cement.

Cement Balls Tennis ball to volleyball-sized lumps of cement, sand and coarse aggregate that form in the truck drum during loading and mixing. Cement balls generally break free from the head of the drum and roll down the chute when concrete is discharged.

Cement Content Quantity of cement contained in a cubic yard of concrete, expressed as a weight. For example, 500 lb. per cu. yd.

Cement, Expansive A special cement, which causes concrete to expand slightly, rather than shrink, at an early age.

Cement, High-Early Strength Cement characterized by producing higher early strength in concrete than regular cement. Called Type III in the United States.

Central Mixed Concrete Concrete completely mixed in a stationary mixer and then transported to the jobsite.

Chute A rounded, sloping trough or tube for moving concrete from a higher to a lower point.

Compressive Strength The measured maximum resistance of a concrete specimen to compressive loading expressed in pound per square inch (psi). A typical 6 inch diameter concrete cylinder, equivalent to roughly 3000 to 6000 psi, will support a load of 40 to 80 tons.

Concrete A heavy, versatile building material made from combining coarse and fine aggregate, hydraulic cement and water.

Concrete, Lightweight Concrete made with lightweight aggregates, typically weighing 75 to 80% as much as normal weight concrete.

Concrete, Plain Concrete without any steel reinforcing bars.

Concrete Plant Manufacturers Bureau (CPMB) An organization of concrete plant manufacturers that publishes standards for concrete plants. Most concrete plants have a CPMB rating plate showing its maximum rated load size.

Concrete Pump A machine which conveys concrete to the point of placement via a pipeline and/or hose.

Concrete, Reinforced Concrete with steel reinforcing bars or mesh.

Confined Space A space that is: (1) difficult to enter or exit, (2) not designed for people to stay in, and (3) has certain hazards. A truck mixer drum is a confined space.

Construction Joint A joint where two adjacent placements of concrete meet. The joint may be keyed, bonded or reinforced.

Contraction Joint A formed, tooled or sawed groove in a concrete structure, floor slab, or pavement to regulate the location of cracks in the concrete.

Conveyor A continuous belt for moving materials.

Core Test A compression test on a concrete sample drilled from hardened concrete.

Corrosion Destruction, or deterioration of concrete reinforcement by chemical, electrochemical or electrolytic reaction. Often results in the rusting/deterioration of reinforcing steel and frequently cause by from deicing salt applied to the concrete or salts from seawater in a marine environment.

Coulomb Test A "Rapid Chloride Permeability" test of hardened concrete to measure the resistance of concrete to the penetration of chlorides (salt) that will can reinforcing steel to rust.

Crack A complete or incomplete separation of the concrete into two or more parts caused by breaking or fracturing.

Craze Cracks Fine, shallow, random cracks or fissures in a concrete surface.

Crazing The development of craze cracks, or the pattern of craze cracks in a concrete surface.

Cubic Meter Unit of measure in the metric system. Equal to 1.3 cubic yards. Written as m^3.

Cubic Yard Unit of measure of concrete volume in the United States. Written as cu. yd. or yd^3. Equal to 27 cubic feet.

Curing The maintenance of favorable moisture and temperature conditions for freshly placed concrete during its early stages so that the concrete can develop strength and other properties.

Cylinder, Concrete A strength test specimen. Molded by placing concrete in a plastic, metal, or cardboard mold which is usually two times its diameter in height. In the United States, 6" by 12" is the standard test cylinder size.

Darby A hand-held straightedge, 3 to 8 ft. long, used to smooth and level concrete in the early stage of finishing.

Drum Speed (rpm) The rate of rotation of the mixer drum when used for charging, mixing, agitating or discharging concrete. Maximum drum speeds must be shown on the mixer rating plate.

Drying Shrinkage Contraction cracks caused by moisture loss from hardened concrete sometimes resulting in cracks in the concrete occurring days, weeks, or months after placement.

Dusting The appearance of powdered material at the surface of hardened concrete.

Early Strength The strength of concrete as measured in the first three days or earlier after placement.

Efflorescence A deposit of salts (usually white compounds) formed on a hardened concrete surface.

Entrained Air Microscopic air bubbles intentionally incorporated in concrete (using an admixture) during mixing to improve freeze/thaw durability and workability.

Entrapped Air —Air voids in concrete which are not purposely entrained. Entrapped air voids are larger than entrained air bubbles and offer little protection from freeze/thaw cycles. They often result from incomplete vibration or compaction.

Expansion Joint A separation between pavement slabs on grade, or between adjoining parts of a structure that to allow room for the concrete to move or expand. Usually filled with a compressible material.

False Set Premature rapid stiffening of fresh concrete. False-setting concrete can usually be remixed without additional water to become workable again. See flash set.

Field-Cured Cylinder Test cylinders cured in the same way as the concrete in the forms to indicate when the forms may be removed, when construction may continue or when the structure may be put in service.

Final Set A degree of stiffening of concrete after initial set, such that it will support a weight to an established level. See initial set.

Finishing The process of leveling, smoothing, compacting, and otherwise treating the surface of fresh concrete.

Flash Set Premature rapid stiffening of fresh concrete. The concrete usually requires remixing with additional water to become workable again. See false set.

Flexural Strength The ability of concrete to withstand bending. Measured by breaking a test beam molded from the concrete.

Float A small, handheld tool, made of wood, aluminum or magnesium, used in finishing immediately after placement and strike off of a fresh concrete surface.

Fly Ash The fine ash resulting from burning coal in electric utility plants. Used as a mineral admixture or pozzolan in concrete. See pozzolan.

Groover A hand tool used to form grooves or joints in concrete slabs to control the location of cracks. Also called a jointing tool.

Gross Vehicle Weight The total weight of a vehicle, e.g., the empty weight of a vehicle plus the weight of the payload.

Grout Cement and water, with or without aggregates, mixed to be pourable. Used to fill cracks and voids in concrete or to prime concrete pumps.

Hairline Cracks Small, barely visible cracks in a concrete surface. See craze cracks.

Hardener A chemical applied to concrete floors to reduce wear and/or dusting.

Heavyweight Aggregate Aggregate of high density, such as iron or steel shot, used for making heavyweight concrete.

High-Strength Concrete Concrete with a 28-day design strength of 6000 psi or greater.

High-Range-Water-Reducing Admixture A water reducing admixture that markedly increases the slump of fresh concrete and great enhances its flowability. Also called a superplasticizer.

High-Early-Strength Concrete Concrete made with a special cement(s) or admixture(s) that reaches a specified strength at an earlier age than normal concrete.

Hydration The chemical reaction between hydraulic cement and water.

Hopper A funnel-shape box or tank from which or through which material can be discharged evenly.

Hydraulic Cement A cement that sets and hardens via a chemical reaction with water, such as portland cement.

Initial Set A degree of stiffening of concrete, less than final set, such that it will support a weight to an established level, e.g., the weight of a finisher standing on a concrete slab. See final set.

Joint A physical separation or break in cast-in-place concrete.

Lightweight Aggregates Aggregate of low density such as expanded clay or shale, slag, pumice, etc. Used for making lightweight concrete.

Lock Out Mechanically and/or electronically disabling a piece of equipment so that it cannot start or become energized. See, also, tag out.

Material Safety Data Sheet (MSDS) A document providing information on a product's potential safety or environmental hazards and precautionary measures for those who use the product.

Mineral Admixture A fine powdered material such as fly ash or slag cement which may be used to improve the workability, strength or durability characteristics of concrete. See pozzolan.

Mixer Capacity The volume of concrete permitted to be mixed or carried in a truck mixer.

Mortar A mixture consisting of cement, water and fine aggregate.

National Ready Mixed Concrete Association (NRMCA) The national trade association for ready mixed concrete producers, dedicated to lobbying, promoting research and training on behalf of the industry.

Paste The portion of concrete consisting of cement and water.

Peeling Thin flakes of mortar breaking away from a concrete surface. See scaling, spalling

Plastic Shrinkage Cracks Cracks which appear in fresh concrete soon after placing and finishing while the concrete is still plastic.

Preventive Maintenance (PM) Scheduled, periodic vehicle maintenance that follows a prescribed routine. Preventive maintenance includes inspecting, adjusting, testing, clamping, tightening, cleaning, draining, flushing, adding fluids and lubricants and replacing filters.

Portland Cement General, all-purpose, hydraulic cement. Manufactured by fusing several minerals together in a large kiln and grinding the resultant cement clinker into a fine powder. The active ingredient in concrete that causes it to set and gain strength.

Pozzolan Naturally occurring or man-made materials which chemically react in concrete to form compounds which have some cementing properties. Pozzolans such as fly ash and slag cement are sometimes referred to as mineral admixtures.

Rebound Hammer A non-destructive testing device used to quickly estimate the in-place compressive strength of hardened concrete.

Reinforcement Steel bars or wire mesh used in concrete to strengthen a structure.

Retarder An admixture which delays the setting time of concrete. Also called a set-retarder.

Sand Streaks A streak of exposed sand in a formed concrete surface, often due to inadequate mixing of the concrete

Scaling Flaking or peeling of the top surface of hardened concrete. See peeling, spalling.

Screed A tool, sometimes a long board, used for striking off the concrete surface.

Sedimentation Pit (or pond) A washout pit or series of pits, often with separate chambers or basins, designed to allow solids to settle out of concrete wash water. Sedimentation pits may be concrete lined structures or earthen ponds.

Segregation Separation of the coarse aggregate from the mortar portion of the concrete.

Shrink-Mixed Concrete Ready mixed concrete partially mixed in a plant mixer and then discharged into a truck mixer where its mixing is completed.

Silica Fume A very fine powdered material with particles about100 times smaller than portland cement particles. Used for making high strength, low permeability concrete.

Slag, ground A by-product of steel mills, ground to a fine powder and used as a pozzolan in concrete. Also known as Ground Granulated Blast-furnace slag. See pozzolan.

Slump A measure of the consistency of fresh concrete.

Slump Cone A cone shaped mold with an 8-inch base diameter, a 4-inch top diameter, and 12-inch height, used to test the slump of fresh concrete.

Slump Meter A gauge on the hydraulic system of the truck mixer which measures the approximate slump of the concrete in the revolving drum.

Slurry A mixture of water and cement.

Spalling Chipping, flaking or peeling of concrete fragments from a hardened concrete surface. See peeling, scaling.

GLOSSARY AND RELATED TERMS FOR ALL MODULES *(continued)*

Stamped Concrete Finish The surface texture obtained by using a stamp to imprint a design in the surface of a concrete slab during finishing.

Strength Generic term for concrete's ability to resist strain, stress, or breaking.

Superplasticizer A high-range-water-reducing admixture (see definition).

Tag Out Placing a tag or notice on a piece of equipment indicating that it is out of service. See locked out.

Topping A layer of concrete placed to form a floor surface over a concrete base.

Trowel A steel, flat, hand tool used in finishing to achieve a smooth, hard, dense surface on a concrete slab.

Trowel Finish A smooth finish obtained by using a steel hand trowel or power trowel on a concrete slab.

Truck Mixed Concrete Ready mixed concrete mixed in a truck mixer. Also called transit-mixed concrete.

Truck Mixer Manufacturer's Bureau (TMMB) Organization of truck mixer body manufacturers that writes and publishes standards for concrete truck mixers. Most truck mixers have a TMMB rating plate showing the maximum rated volume of the drum.

Unit Weight The weight of concrete per unit volume. Usually expressed in pounds per cubic foot (abbreviated as lb./cu. ft., e.g., 147.50 lb./cu.ft.

Water-Cement Ratio A ratio of the weight of water to the weight of cement, in concrete, expressed as a decimal, e.g., 0.45.

Water-Reducing Admixture A liquid admixture that increases the slump of fresh concrete without increasing the water content or maintains the slump with a reduced amount of water.