Emergency Vehicle Inspection, Preparation, and Driving Techniques

INTRODUCTION

The intent of this portion of the manual is to provide the candidate with the information needed to safely and efficiently operate emergency apparatus. This section includes but is not limited to vehicle knowledge and inspection, general operation and safety features of the vehicle, and proper driving techniques in normal as well as emergency operations.

The candidate must be completely knowledgeable in all aspects of the vehicle they intend to operate. It is important the candidate is able to demonstrate safe driving habits and is fully knowledgeable of the safety features .inherent to the vehicle. The candidate shall be able to identify the various components of the vehicle and explain their use. The candidate will be able to identify any defects, make minor repairs, and understand when the vehicle is to be placed out of service due to safety reasons or major defects. In turn the candidate will be able to complete the necessary documentation required by the Department.

OBJECTIVES

Upon completing this module of the Driver Training Manual, the candidate will be able to correctly identify, maintain, evaluate, adjust, and operate an emergency vehicle. This will involve: being able to identify major components of an emergency vehicle and being able to prepare the vehicle for an emergency response. These operations will include - preventive maintenance, pre-response preparation, safety checks and adjustment. The candidate will know, understand, and successfully demonstrate safe and correct handling of the vehicle in routine, emergency, and dangerous driving situations.

VEHICLE INSPECTION AND DRIVING PREPARATION

Major Motor Vehicle Components

There are many motor vehicle components to be discussed when describing any motor vehicle and some are specifically associated with emergency vehicles. The following is a list of components covered in this section:

- Vehicle characteristics – height, weight, length, and width
- Motor / engine components
- Braking systems: drum, disc, air, ABS, and engine retarders
- Exhaust systems
- Driveline
- Steering system
- Electrical system
- Suspension
- Wheels and tires

VEHICLE CHARACTERISTICS

The characteristic of an emergency vehicle affects the impact on the physical forces of the vehicle. The **height, weight, length**, and **width** of the vehicle are those items that are going to affect to the action and reaction of the vehicle while it is in motion. These items limit the direction of travel of the vehicle due to weight limitations (bridges), height constraints (overpasses), and width restrictions (tunnels).

Height: It is important to know the *overall* height of the vehicle including all lights and other equipment mounted on the top of the vehicle. The operator should be able to recognize not only structural overhangs but also other potential problems, for example tree limbs, power and phone lines, and any other low hanging objects. It is also important to understand the vehicle height plays a roll in how the vehicle is going to handle in terms of braking and turning. The taller the vehicle is the higher the center of gravity. This is important when making turns. Because the center of gravity is higher, the potential for rollover is higher if the vehicle is exceeding a safe turning speed. This higher center of gravity changes the braking on the vehicle as well.

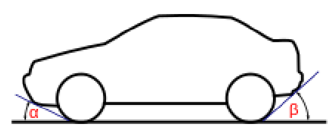
Weight: The gross vehicle weight rating (GVWR) is the maximum operating weight specified by the vehicle manufacturer including the vehicle itself, fluids, accessories, passengers, and cargo. The GVWR is vital to know because of posted weight limits on bridges, overpasses, roadways, and parking areas. All publicly maintained roads have a safety factor designed into the road bed or supporting structures, however privately maintained facilities are unpredictable.

Where a weight limit is posted on a public roadway it can be assumed that the actual designed weight limit is higher. Before entering an area with weight limit restrictions, consider the GVWR of your apparatus compared to the weight limit, the apparent condition of the roadway or bridge, and whether you will be simply passing across the surface or parking on it. When apparatus weight exceeds posted limits, consider another route. Knowledge of territory is key to avoiding these situations.

As with height, the weight of the vehicle influences vehicle handling. The weight of the vehicle has a direct impact on the braking system. The weight distribution between the front and rear axle must be appropriately distributed. The vehicle should have approximately 1/3 the weight over the front axle and 2/3 of the weight over the rear axle. Additionally the weight should be distributed evenly from side to side. Personnel, equipment, and accessories must be placed on the apparatus in a way that avoids overloading components of the vehicle. When weight is distributed correctly the braking, suspension, and steering systems will work as designed.

Another term to be familiar with is “curb weight”. The curb weight of a vehicle is the weight of the vehicle with all of the standard equipment and amenities, but without any passengers, cargo or any other separately loaded items in it. For fire apparatus, this is essentially the weight of the vehicle when it is brand new and leaving the manufacturing plant.

Length: The length of the vehicle is a primary factor in turning radius (wheel base contingent) and angle of approach and angle of departure. It is safe to assume that the longer the vehicle the larger the turning radius must be. The angle of approach and departure are important when moving across changes in grade. Angle of approach and departure are the angles made between the road surface and a line drawn from the point of ground contact and either the front or rear of the tire to any projection of the apparatus. This is important so that the front or rear bumpers or any object of the undercarriage of the vehicle does not come into contact with the road surface.



Angle of Approach and Departure

Width: The width of the vehicle comes into play when driving into diminished clearance environments. It is important that the width of the vehicle is the *overall* width that includes mirrors and any piece of equipment mounted to the exterior of the vehicle. Public roadways have lanes varying from 9 to 12 feet wide.

MOTOR/ENGINE COMPONENTS

There are two types of engines, gasoline and diesel. Their components are very similar in nature. The primary concern to the operator is the type of fuel used by the engine. Care should be taken to ensure the proper fuel is used. The following is a list of the basic components in the motor compartment of the vehicle.

Engine Block: The engine block is where the pistons perform the work to create the motion of the vehicle. The block becomes extremely hot during the operation of the vehicle. Oil and antifreeze pass through the block during its operation.

Radiator: The radiator contains the fluid used to keep the engine block from overheating. The cooling system is a closed system working under a vacuum. ** *NOTE* ** The fluid in this system becomes extremely hot and should not be handled until cooled.

Battery(s): The batteries are the storage area of the electrical system. They are used when starting the vehicle and maintain steady current to electrical components during the operation. Most ambulances have four 12-volt batteries wired in parallel; larger apparatus may have six or more. Older apparatus have a selector switch to opt for either or both batteries. The switch indicates which battery is being charged. Generally, the switch needs to be in the "both" position when starting and running the vehicle. Never turn off the battery switch while the engine is running. This will cause damage to the alternator and electrical system. If the batteries need to be charged, only charge one at a time, and not both, on the selector switch. Charging both could cause one battery to receive an excessive charge, causing the contents to boil, resulting in battery damage or destruction. ** *NOTE* ** The battery (s) contain acid which will harm you if you come in contact with it.

Power Steering Pump: The power steering pump pressurizes the fluid used to assist in steering the vehicle. The fluid in this system is stored in a reservoir and can be checked either while the engine is cold or hot. There are differentiating indicator marks on the dipstick for this purpose.

Brake Master Cylinder: The fluid for a hydraulic brake system is contained in the brake master cylinder. Most are translucent so the fluid level can be checked without removing the caps. It is important that no contaminants enter the brake system, therefore it is best not to remove the caps. If brake fluid is found low, consult with CMF prior to adding any fluid.

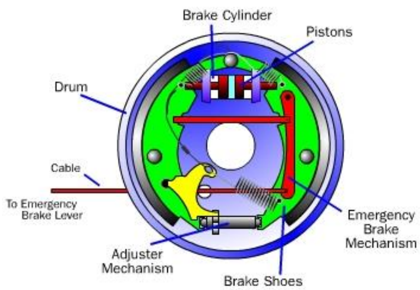
Fan/Accessory Belts: These belts are used to power various motor accessories, such as the cooling fan for the radiator, alternator, and air conditioning compressor.

BRAKING SYSTEMS

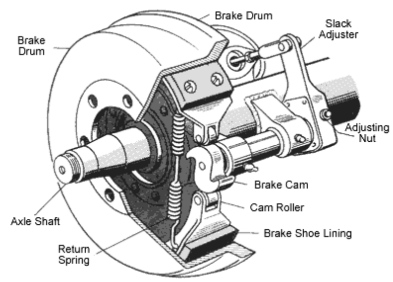
A vehicle's braking system converts inputs from the brake pedal or parking brake controls in the cab to the friction devices (brakes) located at each vehicle wheel.

Systems on MCFRS apparatus either use liquid or air to create the forces to engage the friction devices. Liquid systems are known as hydraulic.

There are generally two types of friction devices used to slow or stop vehicles, *drum* or *disc* brakes. *Drum* brakes contain two brake shoes that create friction when pushed outward against a surrounding drum. The drum is attached, and rotates with, the wheel. Pressure on the brake pedal causes fluid or air to actuate a cylinder at the wheel. The cylinder then moves the brake shoes outward against the brake drum to create friction. The friction of the shoe against the drum causes the wheel to slow or stop.

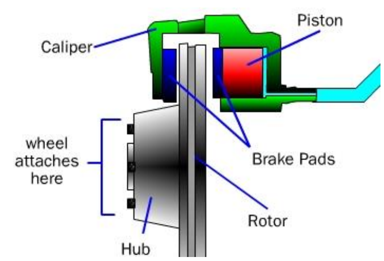


Hydraulic Drum Brake



Pneumatic Drum Brake

Disc brakes are comprised of brake pads and a caliper that squeeze the rotor to stop the vehicle. The rotor is a disc that is attached to the wheel axle. When the brake pedal is depressed, a piston in the caliper causes the caliper to squeeze together, bringing a pair of brake shoes into contact with the rotor. The friction of the opposing brake pads as they squeeze the rotor slows the rotor rotation and causes the wheel to slow and stop.



Disc Brake

Air brakes use compressed air to control the application of the brakes. An air brake system is comprised of three primary parts: service brake, parking brake, and emergency brake systems.

- The *service brake* system applies and releases the brakes when you depress the brake pedal during normal driving operations.
- The *parking brake* system applies and releases the parking brakes when you use the parking brake control.
- The *emergency brake* system uses parts of the service and the parking brake systems to stop the vehicle in the event of a brake system failure.

There are many individual components of the air brake systems. The following are some major parts of the system:

Air compressor – The air compressor pumps air into the air storage tanks. The compressor is connected to the engine through gears or a V-line belt. The compressor may be air or oil cooled.

Air Compressor Governor – The governor controls when the air compressor will pump air into the air storage tanks. When the air tank pressure rises to a preset level (around 125 psi) the governor stops the compressor. When the tank pressure falls below a preset level (around 100 psi) the governor allows the compressor to start pumping again.

Air Storage Tank – Air storage tanks are used to hold the compressed air. The number and the size of the tank(s) depend on the size of the vehicle and any auxiliary functions that draw air from the system. The tanks hold enough air for the service brakes to be used several times even if the compressor fails to automatically replenish the air. All air has a certain level of humidity which means that there is always water vapor in the atmosphere. Air is heated as it's compressed, and it cools as it travels through the discharge line to the air storage tank. This cooling results in condensation creating pools of water in the bottom of the air tanks. Oil from the compressor and any contaminants that made it through the compressor's air filter can also be in the water. This moisture can lead to blockages or malfunctions if the the water freezes. It can also lead to corrosion or reduce capacity in the storage tanks. Since the moisture tends to collect at the bottom of the air storage tanks each tank has a method of draining or bleeding the tank. Tanks can have either a stopcock valve that requires turning to open or a spring-loaded stopcock that is opened by pulling on a cable that is usually reachable without climbing under the vehicle. ***NOTE*** It is important to remember that once the tanks have been bled the system must be recharged prior to moving the vehicle.

Most fire service vehicles also have an automatic air dryer installed between the air compressor and storage tanks. Their purpose is to filter out water vapor, oil vapor, and other contaminants before they can reach the air tanks and valves. This helps prevent freeze-up during the winter and extends the life of air valves.

Safety Valve – A safety valve is installed in the first air tank the air compressor pumps air to. This valve protects the tank and the rest of the system from being over pressurized. This valve is usually set to release at 150 psi. ***NOTE*** If this safety valve releases air there is a problem that a mechanic should be notified immediately.

Brake Pedal – To apply the brakes you press down on the brake pedal. Pushing the pedal down harder applies more air pressure. Letting up on the brake pedal reduces the air pressure and releases the brakes. Releasing the brakes lets some of the compressed air to go out of the system, so the air pressure in the tanks is reduced. Pressing and releasing the pedal unnecessarily can let air out faster than the compressor can replace it. I f the pressure gets to low the brakes will not work.

Foundation Brakes – Foundation brakes are used at each wheel. The most common type is the S-cam drum brake. The following is the break down of the brake parts:

- **Brake drums, shoes, and linings** – Brake drums are located on each end of the vehicles axles. The wheels are bolted to the drums and the braking mechanism is inside the drum. To stop, the brake shoes and linings are pushed against the inside of the drum. This causes friction, which slows the vehicle (and creates heat). The heat a drum can take without damage depends on how hard and how long the brakes are used. Too much heat can make the brakes stop working.

- **S-cam Brakes** – When you push the brake pedal, air is let into each brake chamber. Air pressure pushes the rod out, moving the slack adjuster, thus twisting the brake camshaft. This turns the S-cam (named because of its S design). The S-cam forces the brake shoes away from one another and presses them against the inside of the brake drum. When you release the brake pedal, the S-cam rotates back and a spring pulls the brake shoes away from the drum, letting the wheels roll freely again.
- **Wedge Brakes** – In this type of brake, the brake chamber push rod pushes a wedge directly between the ends of the two break shoes. This shoves them apart and against the inside of the brake drum. Wedge brakes may have a single brake chamber, or two brake chambers, pushing wedges in at both ends of the brake shoes. Wedge type brakes may be self-adjusting or may require manual adjustment.
- **Disc Brakes –** In air-operated disc brakes, air pressure acts on a brake chamber and slack adjuster, like S-cam brakes. But instead of the S-cam, a "power screw" is used. The pressure of the brake chamber on the slack adjuster turns the power screw. The power screw clamps the disc or rotor between the brake lining pads of a caliper, similar to a large C-clamp.

Supply Pressure Gauge(s) – All air-brake vehicles have a pressure gauge connected to the air tank. If the vehicle has a dual air brake system, there will be a gauge for each half of the system. (Or a single gauge with two needles). These gauges let you know how much pressure is in the tanks.

Low Air Pressure Warning – A low pressure warning signal is required on all vehicles with air brakes. A warning signal you can see must come on before the air pressure in the air tanks falls below 60 psi. The warning is usually a red light and on some vehicles a warning buzzer sounds as well.

Stop Light Switch – Drivers behind you must be warned when you put your brakes on. The air brake system does this with an electric switch that works by air pressure. The switch turns on the brake lights when you are applying the brakes.

Spring Brakes – All vehicles must be equipped with emergency brakes and parking brakes. They must be held on by mechanical force (because air pressure may leak out). Spring brakes are used to meet these needs. When driving powerful springs are held back by air pressure. If the air pressure is removed, the springs put on the brakes. A parking brake control in the cab allows the driver to let the air out of the spring brakes. This lets the spring brakes on. A leak in the air brake system, which causes all the air to be lost, will also cause the springs to put on the brakes.

Parking Brake Controls – In most vehicles, you apply the parking brakes using a *diamond-shaped, yellow, pull-push control knob.* You pull the knob out to put the parking brakes on (spring brakes), and you push it in to release them. ***NOTE*** Never push the brake pedal down when the spring brakes are on. The combined forces of the springs and the air pressure could damage the brakes.

Apparatus equipped with air brakes use two methods for parking brakes. First is a driveline brake, which is an actual disc or drum that attaches to the drive shaft and is operated by cables or levers. The second type is a spring-activated brake atop a service brake chamber that automatically applies the brake when the air pressure drops below a preset pressure.

It is important to define what a *Dual Air Brake System* is. Most new vehicles use a dual air brake system for safety reasons. A dual air brake system has two separate air brake systems that use a single set of brake controls. Each system has its own tanks, hoses, and lines, etc. One system typically operates the regular brakes on the rear axle(s). The other system operates the regular brakes on the front axle. The first system is called the primary and the other called the secondary system.

Many vehicles are equipped with *Antilock Braking Systems (ABS)*. The purpose of the *ABS* is to permit the driver of the vehicle to stop the vehicle in the shortest possible distance while maintaining full control. By preventing the wheels from locking, *ABS* helps to improve control and stability. *ABS* allows steering during braking applications, and in most instances, reduces stopping distances, especially on wet, icy, or loose gravel surfaces. *ABS* use sensors at each of the wheels to send wheel speed information to a central computer. When the computer senses that a wheel is about to lock up, it automatically “pumps” the brakes on that wheel.

Due to the size and weight of today’s apparatus, secondary or auxiliary braking systems have been added to increase the braking capabilities of the vehicles. Essentially there at three (3) types of auxiliary braking systems:

- Engine Brake
- Automatic Transmission Retarder
- Driveline Retarder

The engine brake is known as a compression brake, or by the trade name “Jake Brake”. The brake mechanism uses the “compression” that the engine creates to slow the vehicle down. Essentially the system is allowing more new air into the cylinders of the engine causing it to work or bear down harder creating less horsepower and a force. The engine brake customarily comes with a selection switch allowing the driver to decide on the amount of work the braking system should do (2 cyl, 4 cyl, 6 cyl) or high or low. It should be noted that engine brakes on vehicles with automatic transmission are typically not effective below 20 miles per hour (mph) due to the low rpm’s of the engine while operating at low speeds. **NOTE** Most manufacturers recommend the engine brake be turned off or placed in a lower mode during inclement weather or slippery road conditions.

The *automatic transmission retarder* is attached to the transmission either on either end of the transmission. The input retarder operates on the input end and the output retarder, which is the most prevalent on fire service apparatus, is attached to the output end of the transmission. The retarder system is self-contained and consists of a vaned rotor, which rotates in a vaned cavity. The rotor is splined to and driven by the output shaft. An external accumulator holds transmission fluid until the retarder is activated. When activated, the fluid in the accumulator is pressurized and directed into the retarder cavity. The interaction of fluid with the rotating and stationary vanes causes the retarder rotor speed, and hence the output shaft, to decrease and slow the vehicle. ***NOTE*** Most manufacturers recommend the retarder be turned off during inclement weather or slippery road conditions.

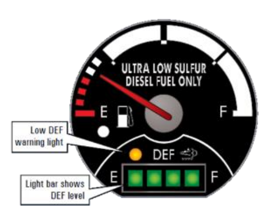
The *driveline retarder* can be divided into 2 types, hydraulic and electromagnetic. Both types are attached to the driveshaft between the transmission and the rear axle. The hydraulic type absorbs energy by pumping oil around the driveshaft slowing the vehicle down. The electromagnetic retarder sets up a magnetic field that grabs the driveline. The absorbed energy is transferred to the surrounding atmosphere as heat. ***NOTE*** Most manufacturers recommend the retarder be turned off during inclement weather or slippery road conditions.

EXHAUST SYSTEMS

Vehicle exhaust systems have grown increasingly complicated as emission control standards have increased. Since 2007 most diesel engines are equipped with "aftertreatment" systems integral to the exhaust system. For the apparatus operator, there are two primary areas of concern that impact vehicles equipped with these systems; the Diesel Exhaust Fluid (DEF) and the Diesel Particulate Filter (DPF). Both the DEF and DPF are included in the instrument panel light cluster to alert the driver to the system status.

DEF is a non-hazardous solution of 32.5% urea and 67.5% de-ionized water used in post-2009 diesel vehicles. DEF is sprayed into the exhaust stream of diesel vehicles to break down nitrogen oxide emissions into nitrogen and water. DEF is **not a fuel additive** and never comes into contact with diesel. It is stored in a separate tank, typically with a blue filler cap.

The DEF tank is separate from the diesel fuel tank and should be refilled only when it reaches half. There is no need to continuously top off the DEF tank. The DEF level indicator is generally located immediately adjacent to the diesel fuel level indicator on the dashboard. DO NOT allow the DEF tank to reach empty or the vehicle will automatically reduce power.



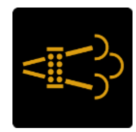
CMF stocks DEF in 2.5 gallon containers with filler tubes. DEF may also be found in bulk at certain fire stations. DEF may be requested as needed through normal supply procedures.

DEF crystallizes when stored for prolonged periods as the water evaporates. Do not use DEF that shows signs of crystallization and always completely use a container to avoid storing opened containers.

Use the filler tube supplied with the case to avoid spills or splashes. Spills can be safely washed down with water. DEF is not corrosive to human skin, however is corrosive to aluminum. Do not allow it to remain on the diamond tread.

The freezing point of DEF is 12°F, however vehicles are equipped to thaw the DEF and this should not restrict use of the vehicle.

Personal protective equipment is not necessary when handling DEF, however it will stain clothes.



The DPF indicator illuminates when sufficient particulate has accumulated in the system to require regeneration. Regeneration occurs in one of two modes; automatically when the vehicle is at highway speeds for in excess of 20 minutes or while parked. Parked regeneration is most likely the mode required simply due to the type of driving done by fire apparatus. Personnel must refer to the manufacturer's instructions for the breed of apparatus for specific instructions on conducting regeneration.

Beyond the emissions control features, the exhaust system is basic and is comprised of a muffler or mufflers, exhaust pipes, tail pipes, and or vertical stacks. It is important to note that a faulty exhaust system affects the performance of the motor and can emit poisonous fumes into the crew area causing serious illness.

DRIVELINE

The driveline consists of the transmission, front universal joint, driveshaft, rear universal joint, differential, and the rear axle. The transmission is a system of gears that allows change in the ratio of the number of engine revolutions to the number of wheel revolutions. The drive shaft connects to the rear of the transmission and is powered to turn the differential. The differential is a component of the rear axle that the rear wheels are attached to. The entire system works in unison to rotate the rear wheels.

Locking Differential

Vehicles may be equipped with a locking differential that is engaged by a switch on the dashboard. A locking differential temporarily divides torque from the driveline to be delivered equally to all wheels sharing an axle, regardless of their traction. The drive wheels will act like they are rotating on a common shaft. One wheel that finds good traction will keep the truck moving. Without a locking differential, the wheels without traction may continue to spin with little torque being sent to the wheels with traction.

- ✓ Never engage the differential lock above 25mph or while the wheels are spinning
- ✓ When engaged, steering radius will increase dramatically
- ✓ Disengage once the vehicle is freely moving—do not drive on dry pavement with the lock engaged or damage may occur to tires or axle components
- ✓ When tire chains are installed, do not attempt to turn the vehicle with the lock engaged.

<u>Inter-Axle Differential Lock (tandem axle chassis)</u>
The inter-axle differential in a tandem axle chassis provides for necessary differential action between the axles. This allows the wheels of either axle to revolve faster or slower than the wheels of the other axle in order to compensate for cornering, uneven road surfaces, and slightly different tire sizes. When encountering soft or slippery road conditions, the inter-axle differential can be locked out, eliminating any differential action between the axles.

- ✓ Engage the IAD lock only when stopped or moving at slow speed. NEVER lock the IAD lock with the rear wheels spinning.
- ✓ Disengage once the vehicle is freely moving—do not drive on dry pavement with the lock engaged.

There are two types of transmissions: standard and automatic. The standard or manual transmission uses a clutch assembly to shift the transmission gears depending on the RPMs of the motor and the desired speed requested. Computer modules control the automatic transmissions. The modules signal and influence the engines RPMs during transitional shifting.

STEERING SYSTEM

The steering wheel and column connect to steer the vehicle. They connect to a gear and linkage mechanism that changes the direction of the front wheels. In most vehicles this either “power assist” or “power steering” to ease the turning of the steering wheel. These are both hydraulic (fluid) driven systems.

ELECTRICAL SYSTEMS

The electrical system supplies power for primary and auxiliary functions. The primary functions of the electrical system include: power the generator and storage battery, generator/alternator, and voltage regulators; power distribution (via engine wiring); timing (distributor); and spark generation if equipped. Auxiliary functions include: inside/outside lighting (headlights; amber, red signaling or warning lights; turn signals; instrument panel lights; etc.); and horn, siren, and public address system.

SUSPENSION

This system is comprised of leaf springs, shock absorbers/coils, air rides, and wheels, and tires that enable the driver to handle the vehicle properly on rough terrain and sharp curves.

WHEELS AND TIRES

As mentioned before the wheels and tires are a part of the suspension system; however, it's important to define them a bit more. Both wheels and tires must have a weight rating which will accommodate the weight distributed through the axle and springs. The condition of the tires is based on inflation, tread design, and tread wear. All of these have a major impact on vehicle handling. Each tire has only about 40 square inches of contact with the road. It is imperative that both the inflation pressure and tread be in good condition to provide maximum safety. The minimum recommended tread depth for emergency vehicles is 4/32 inches for front tires and 2/32 inches for rear tires.

<u>Automatic Traction Control</u>
To aid the tires in maintaining traction, apparatus may be equipped with an automatic traction control function. This system monitors wheel speeds and automatically applies braking to a drive wheel that is spinning. In extreme situations, engine speed may also be decreased until traction is achieved leaving the driver unable to accelerate. If it is desirable to rock the vehicle when stuck and the automatic traction control is cutting the throttle, engage the "mud and snow" switch or other override control provided by the chassis manufacturer.

EMERGENCY VEHICLE PRE-RESPONSE PREVENTIVE INSPECTIONS

Emergency vehicles of all types should be inspected prior to and again within 24 hours after being used for an emergency response. Emergency vehicle accidents caused by the lack of maintenance or vehicle malfunction are preventable. Physical and visual inspections must be done on a routine basis. In the final analysis, no matter who performs the actual maintenance on the vehicle, it's the driver's responsibility to confirm the vehicle has been inspected prior to use. The driver *must* verify that the vehicle is in proper operating condition. The responsibility for the mechanical safety of the vehicle is that of the driver. *IF IT ISNT RIGHT, DON'T DRIVE IT*. The purpose of the pre-response preventive maintenance inspection is two fold – identify and correct unsafe conditions.

Inspection guidelines are broken down into nine (9) core areas to expedite the inspection process.

- Check prior maintenance records
- Conduct a vehicle overview
- Conduct an engine compartment check
- Conduct an interior cab check
- Conduct a vehicle walk around check
- Conduct a compartment and equipment check
- Conduct an undercarriage check
- Conduct a moving and driving test
- Complete inspection process

All inspections, maintenance, and repairs must be recorded by the Department. The records must include the date and description of all maintenance, repairs, and inspections performed. The following is a break down of the nine categories listed above:

Check PM Records - Each day the records of the previous days should be reviewed for defects and repairs.
Vehicle Overview – Conduct a vehicle overview including inspecting for body damage and cleanliness; and leveling of the vehicle (indicates suspension problems).
Engine Compartment – Conduct an engine compartment check with the engine off. You should check the following:

- Oil levels
- Coolant levels
- Power steering fluid level
- Transmission fluid level
- Air compression belts
- Hydraulic reservoir
- Brake fluid level
- Battery fluids both left and right
- Windshield washer fluid levels
- Belts and wiring harnesses
- Steering box not leaking
- Safety devices including hood latches and safety bars for tilt cabs

Interior Cab – Conduct an interior cab check by first properly preparing for the vehicle inspection:

- Engage the parking brake, chock the wheels, turn the batteries on, turn on the ignition master, place gears in neutral, and start the engine.
- Check the instrument/dash gauges for operating voltages, temperatures, pressures, and levels.
- Check the accelerator pedal padding, in place and not loose.
- Engage and disengage emergency air brake system.

- Conduct air/hydraulic brake test and listen for oblivious leaks, and/or blown diaphragms.
- Check steering wheel and column for centering, excessive play (greater than 10 degrees), and abnormal movement.
- Check electric/air horns for equal tone quality from each horn and blown diaphragm for moisture or oil on the windshield of the horn.
- Check electronic and mechanical sirens for excessive draw on ammeter and voltage fluctuations and electrical system problems.
- Check windshield wipers and washers as well as heating and defrosting systems.
- Transmission controls, such as the clutch catch or friction point, should be checked to ensure there is no hang up or binding and that it does not jump out of gear.
- Check radio equipment including fixed, portable, public address system, and cellular phone.
- Interior lighting systems in the cab and crew compartments should be checked to ensure they are working properly.
- Mechanisms for the seat adjustment, both mechanical and pneumatic, should be checked to ensure they are working properly.
- Check seatbelt (occupant restraints) systems.
- Check the interaxle differential locking systems, both dual and tandem axle.
- Check warning lights and buzzers systems, including oil, water, and transmission fluid level and temperature and open door compartment warning lights.
- Ensure outside mirrors, both manual and mechanical, can be adjusted and the wiring for the heating system is intact and operational.
- There should be the appropriate maps and accountability rings/systems on board.
- Internal communication devices and equipment (David Clark Systems) should be checked.
- Check the fast idle RPMs to ensure that it can maintain the electrical system.
- Check emergency lighting.

Vehicle Walk Around – Conduct a vehicle walk around and operate and/or check the following:

- Windshield and windows for any cracks that may necessitate taking the vehicle out of service.
- Check headlights, both low and high beams and four way flashers.
- Check the strobe lights and all the emergency vehicle-warning lights.
- Light bars, rotating lights, and/or oscillating lights should be checked.
- Check side markers and reflectors.
- Check turn signals.

- With assistance, check to make sure all the brake lights are operational.
- Check flood light systems.
- On the tires and wheels, check for oblivious gouges, slashes, cuts, bubbles, or any other damage. Make sure they are the proper size and are not mismatched. Look for indications of rust or peeling paint on non-aluminum rims. Check the condition of the lug nuts and wheel hubs. Check for any grease leaks. Inspect the rims for damage and missing weights. Make sure the tire pressure is correct and the valve stems are intact with caps. The depth of the tread should be 4/32" in the front and 2/32" in the rear.
- Check the auto chain systems for the rear wheel to make sure they function properly.
- The undercarriage should be checked for any oblivious fluid leaks in the engine area (note the color of the fluid leaking).

Compartment Check – Conduct the compartment and equipment check:

- Make sure the compartment latching mechanisms work properly.
- Compartment equipment must match the inventory and are in its proper place.
- Make sure the circuit breakers are working properly.
- Ensure there are sufficient warning devices such as cones, flares, and reflective triangles on board.
- Fire extinguisher is on board and fully charged.
- Check for appropriate documentation (accident reports, vehicle registration etc.)
- Crew equipment should include SCBA, hand lights, AED, EMS, as the basic, should be checked to ensure they are in working order.
- Ensure all other equipment is working properly.

Undercarriage – Conduct an undercarriage check:

- On the undercarriage bleed the moisture from the air tanks as required to check the color of the fluid being emitted – light gray sludge indicates a bad compressor: leaks from system ***NOTE*** Moisture should be bled from tanks frequently during inclement weather and temperature fluctuations. The brake lines should be checked for cracks, fraying, dry rot, pulling or distortion, or wear marks. ***NOTE*** Check slack adjusters for excessive movement, not more than 1 inch, and whether they are frozen in place. Do not attempt to make slack adjustments; trained personnel should conduct the adjustments.
- The driveline (engine to differential/rear axle) should be properly greased, make sure there is no excessive movement in the joints, and the dust covers are intact.
- Check the exhaust system for soot, black smoke, clamps and hangers, and any pitting on the underside.

- On the suspension system, mechanical or pneumatic, check the leaf springs for cracks and breaks, shackles and hangers, shock towers, and leaks and air leaks (shocks or bags).
- Make sure the automatic chain systems are securely attached and lined up properly.
- Look for oblivious damage, such as rust, loose parts, shiny spots, asymmetrical parts (out of alignment), any cracks in the frame rails, and shifting body mounts.
- The inner sides of wheels and tires/ sidewalls on the tires should be checked for excessive dusting, fluid leaks, bad seals, and cracked brake drums and shoes.
- The wiring harness should be checked fro frayed or cut wire.
- Check the fuel tank for oblivious leaks that straps and grounding pad are intact, fuel lines are ok, and the overflow is not kinked.
- Check for leaks of any fluids and if there is, their point of origin, either the transmission, rear end, or plugs, vents or right side or rear axle. Do not paint over any of these areas.

Brake Test/Air Brakes – For vehicles equipped with service air brake systems, conduct a DOT Brake Test. Reference the Practical Application Guide Sheet for Pre-Trip Air Brake Check. Note: this test is ONLY to be used on apparatus with air brakes. Some EMS Units are equipped with hydraulic brake systems.

Complete Inspection Process – Document the pre-response inspection and compare it to the previous report. Follow-up on discrepancies noted. If discrepancies are noted that influence on function, operational/directional ability, and/or safety, place the unit out-of-service and consult with the appropriate maintenance personnel before placing the unit back in service for responses.

ROUTINE MAINTENANCE ON EMERGENCY VEHICLES

Operator safety is dependant on the vehicle condition. Well-maintained vehicles have fewer malfunctions and are easier to control. The Department must identify the role of the emergency driver in the inspection and maintenance program. Routine maintenance of the vehicle is the responsibility of the driver. The Department should maintain checklists for these types of inspections and routine maintenance functions. Deficiencies should be repaired or reported in writing to the individual responsible for the maintenance. The role of the emergency driver as it pertains to preventive and routine maintenance is defined in NFPA Standard 1002, Fire Department Vehicle Driver/Operator Professional Standards. Applicable, with minor adjustments, to all emergency vehicles the standards states:

"… Prior to operating fire department vehicles the fire apparatus operator **shall** meet the job performance requirements as defined in …"

As this relates to the preventative maintenance function, it specifically states that the driver shall be able to "perform routine tests, inspections, and servicing functions on the specified systems and components and ... so that the operational status of the vehicle is verified."

The systems and components identified in NFPA 1002 are listed here. Items for consideration under each are identified as reference:

Batteries:

- Connections of the cables are clean and tight
- Battery box/compartment is clean and secure

Braking System:

- Air Brakes
    - Pressure prior to starting the engine (air) should be approximately 125 psi;
    - Build-up time, if appropriate (air), when the engine is operating at normal RPMs, the pressure should build from 85 psi to 100 psi within 45 seconds in dual air systems. In single air systems, pressure should build up from 50 to 90 psi within 3 minutes when operating at normal RPMs.
    - Moisture in system/drain air tanks, in tanks with manual bleed valves, turn the valve ¼ turn to drain air, moisture, and dirt from system. Return valve to closed position to build up air in system again
- Hydraulic Brakes
    - Proper fluid level in the master cylinder
    - No signs of leaks or damaged lines
- ABS verification (dash light)
- Braking Operation (during runs as well as at inspection time)
- Brake pedal (proper range of motion)

Coolant System:

- Correct level (generally approximately 2 inches below the top of the radiator, check with local requirements)
- Hose and/or connections wear/leaks

Electrical System:

- Ensure all lights and audio equipment is operational, if bulbs need to be replaced make sure the correct bulb size and style is used and replace faulty fuse in audio system if needed.
- Voltmeter should be reading between 12 and 14 volts

Fuel:

- If not above ¾ full, fill tank with proper type of fuel

Lubrication:

- Check for leaks on the floor of grease droppings
- Ensure there is not grease thrown in the engine compartment or body

Oil (Motor):

- Leaks on the floor under the vehicle
- Check levels using the dipstick in the engine compartment
  - Checked when the engine is cool or cold
  - Engine is warm or hot the oil is dispersed throughout the engine
  - Allow 20 to 30 minutes for oil to settle back into the oil pan after the motor is run
- The color and texture of the oil on the dipstick should be noted. If the oil is frothy (bubbly) or a color other than dark brown or black, there may be water or fuel infiltrating the oil that is indicative of a motor problem.

Tires:

- Condition (sidewalls, rims, tread)
- Correct inflation pressure, fill as needed to the rated pressure for that tire

Steering System:

- Ease of operation (power OK and no extra play)
- Correct fluid level, this may be checked while the engine is hot or cold and the fluid level should correspond to that on the dipstick

SAFETY CHECKS AND ADJUSTMENTS MADE BEFORE DRIVING

There are certain items that should be checked by the driver prior to moving the vehicle:

Occupant Restraint Systems – Restraints reduce the likelihood of serious injury or death in the event of an accident. The law requires that there be a restraint for all riders and that they be used any and all times the vehicle is in motion. The restraints keep the driver in position behind the wheel and in front of the controls during sharp turns, over excessive maneuvers, roll overs, and yaw skidding or spins.

Adjustable Head Restraints – Head restraints help prevent cervical spine and other in juries from hyperextension and hyperflexion; ie. forces resulting from rear end collisions. The proper adjustment for the head restraints is to have the center of the restraint at the center of the scull not at the base of the neck. If the restraint is to low, the neck could be broken if force of impact is great.

Seat Position – When the seat is properly adjusted, the brake and accelerator can be applied fully without fully extending the leg. The steering can be held with only a slight bend at the elbows. The seat should be fully locked into position. If the seat was to move during operation, it could cause the driver to lose control.

Mirrors –The side-view mirrors should be adjusted to view the edge of the vehicle and out to the adjoining lanes. Convex mirrors need to be adjusted to view the blind spots that the side-view mirrors do not cover. In large vehicles the convex mirrors are invaluable for managing lane position and expanding your view around the vehicle.

PRECAUTIONS BEFORE MOVING

The driver controls the movement of the vehicle; therefore the drive must verify when passengers are ready. Prior to moving the vehicle audible or visual communication is necessary with all crew members confirming that they are belted and ready. Prior to moving, ensure the bay door is fully opened and/or the wheel chock is stowed, all compartments and cab doors are closed, and there are no obstacles in the path of the vehicle. If you are dispatched to a call in the midst of training or daily checkout, it is especially important to ensure the crew, equipment, and apparatus are all ready for departure. Do not sacrifice a quick check of the apparatus for the sake of speed.

OPERATING AN EMERGENCY VEHICLE

Purpose of Emergency Vehicle Signaling Equipment

Lights and sirens (Emergency Vehicle Signaling Devices) are used to request the right of way from traffic, both vehicular and pedestrian. Warning and signaling equipment assist the responders with arriving at an incident expeditiously. Due regard ***MUST*** always be exercised, regardless of the perceived severity of the emergency.

Local Law (Maryland)

In order to request the right-of-way and enact the exemptions provided to emergency vehicles, Maryland law requires an emergency vehicle operator to use both audible and visual emergency warning devices while responding to an emergency. You may not be protected from consequences should you choose to run “silent” with only warning lights engaged. It is important to remember use of signaling equipment by the operator ***DOES NOT*** guarantee other drivers will yield or even see you, nor does it free the driver from the possibility of civil or criminal liability if a collision does occur.

To better understand the liability and responsibility of the driver, a few definitions will be discussed. They are as follows:

- **True Emergency** – is defined as a situation in which there is a high probability of death or serious injury to an individual or significant property loss.
- **Due Regard** – for the safety of others means that a reasonably careful person performing similar duties under similar circumstances would act in the same manner.
- **Negligence** – A legal deficiency or wrong that results whenever a person fails to exercise that degree of care that a prudent person would exercise under similar circumstances.

- **Gross Negligence** – Is the reckless disregard of the consequences of an act to another person. It occurs when a person's actions (or lack of) result in the failure to exercise even a slight degree of care.
- **Willful and Wanton** – Intentional or with careless indifference (considered the most serious for of negligence).
- **Vicarious Liability** – The legal liability placed on one person for the acts committed by another person.

Usually a court will judge the actions of an emergency vehicle driver based on two primary considerations:

1. Was the emergency vehicle responding to a **true emergency**?
2. Did the emergency vehicle driver exercise **due regard for the safety of others**?

If the answer to both questions is yes, the emergency driver has demonstrated a responsible and professional attitude through his/her subsequent action(s).

Using Emergency Vehicle Signaling Equipment

An emergency vehicle driver must use all signaling devices when responding. Remember that most emergency vehicles are taller than the average automobile on the road. As you approach another vehicle from behind there are fewer warning lights visible to that driver in their mirrors. Your unit can be so close that only a couple of lights on the grill of your unit are in position to gain their attention. This is another reason to leave a space cushion between you and the vehicles ahead.

Another good practice is to leave the cab windows cracked open to aid with hearing other responding apparatus, trains, and traffic.

BASIC EMERGENCY VEHICLE CONTROL TASKS

Steering, accelerating, and braking accomplish directional and speed control. A competent emergency vehicle driver understands, chooses, and applies each of the basic driving maneuvers in the right combination and intensity at the right moments to effectively and safely operate their apparatus.

Steering – Steering an emergency vehicle, whether driving non-emergency, responding to an emergency, or making an evasive maneuver, requires certain habits. These include:

- Use both hands on the steering wheel as much as possible. Obviously one hand is occasionally required to operate other vehicle functions, such as the windshield wipers, lights, and transmission.

- Maintain hands in the “9 and 3” or “10 and 2” position on the steering wheel for maximum control and turning without repositioning your grip.

Braking and Stopping – Effective braking is essential to the safe operation of an emergency vehicle. Braking must be applied in a timely fashion with the correct intensity to maintain control. Prior to anti-lock braking systems becoming nearly universal, vehicles with hydraulic brakes required firmly pumping the brake pedal during hard stops to avoid the locking of the wheels into a skid. Air brakes do not react well to repeated pumping of the pedal and instead required just enough firm and steady pressure to slow the vehicle without locking the wheels. This was referred to as “threshold” braking because the driver was seeking the threshold between braking and skidding.

Anti-lock braking systems (ABS) change the dynamic of applying pressure to the pedal on both hydraulic and air brake systems. The following guidance applies:

- Do not pump the brake pedal. This only creates confusion for the monitoring system that manages the ABS. Steady pressure to the pedal signals the system that you want to slow down and the system manages the foundation brakes to carry out that action.
- Even vehicles with ABS can skid. If the vehicle’s wheels lock, immediately release the brake pedal and steer with the skid. Reapply the brakes to attempt to establish traction.

In areas where there is a high probability of braking, i.e. passing through an intersection or traveling against traffic; the driver should “cover” the brake by hovering their foot over the brake pedal without applying pressure. This action will reduce the reaction time if braking is required.

The single most important aspect of braking safely is allowing enough space around your vehicle to identify the need to brake and then applying the brakes in a controlled manner. In heavy apparatus when you expand your look ahead distance sufficiently you can often slow and almost stop without even needing to engage the service brakes.

Backing – Backing collisions account for a large portion of preventable emergency vehicle incidents. Since speed is usually low, most backing incidents are relatively minor unless they involve a pedestrian. Regardless of severity, any collision makes the unit unavailable for service for a period of time varying from a an hour or two to days. It also results in consequences for the driver and potentially a bad public image for the MCFRS.

Backing apparatus safely is accomplished by adhering to some basic principles:

- Position to minimize the need for backing - If thought is given to the next move or destination for a vehicle, a simple adjustment in the approach can minimize or even eliminate the need for backing.
- Conduct an approach assessment – When approaching the place to back up the driver must complete a size-up of the entire area for obstacles that effect their planned path. This can only be done if the driver slows down so they

can view the area before pulling past to position for backing. Even when spotters are deployed there are times when the driver should dismount to see the area themselves before backing. Spotters do not absolve the driver of responsibility for avoiding a collision.

- Be predictable – The spotter(s) must know where the driver is going to properly assist. Drivers must communicate their planned path before the spotter(s) dismounts the apparatus. If confusion develops the apparatus must stop and a conversation needs to occur.
- Give audible notice – Most apparatus is equipped with a backup alarm of some type. When shifting the vehicle into reverse pause before backing to allow the alarm to engage and provide some warning to pedestrians around the vehicle. Recognize that high levels of ambient noise around the vehicle, such as an active fire scene, may disguise or overwhelm the sound of the backup alarm. Personnel can also become desensitized to the audible warning, so never assume the alarm is heard.
- Use a spotter – The first spotter should normally position at the driver side rear about 10 to 20 feet behind the tailboard. Additional spotters can be helpful in complex situations and should be positioned to watch the passenger side corners to supplement the primary spotter. Spotters need to allow themselves some space cushion to the apparatus and the ability to escape should be vehicle unexpectedly continue backing toward them. The driver and the spotter must make acknowledged eye contact. If the spotter disappears from sight, the driver must stop immediately or risk running over their co-worker. *IF* a spotter is unavailable, conduct a walk around the vehicle before backing.
- Drivers must remove their headset and roll down their window prior to backing – The sense of sound is needed to augment the visual information being gathered in the mirrors. Many collisions have occurred despite the presence of a spotter because the driver momentarily looked away from the spotter and failed to hear the spotter yelling to stop.
- Understand hand and audible signals – Ensure that the driver and spotter have the same understanding of what the signals mean. If confusion occurs the driver needs to stop and establish more clear communications. Spotters need to give clear guidance. The best spotter is often someone who is themselves an apparatus operator.
- Use mirrors – Drivers need to be well versed at using the mirrors. Hanging out the window or physically turning their body around in an attempt to see to the rear are not acceptable practices and should only be done in odd circumstances. Just like while driving forward, the driver needs to scan all mirrors and avoid fixating on just the driver side mirror.
- Beware of the front corners of the vehicle – When backing the front end of the vehicle can swing into blindspots and strike fixed objects that are not visible to the spotter. Landscaping rocks, low retaining walls, fire hydrants, and

protective bollards are all examples of objects than be out of view of the driver when backing. These types of obstacles need to be identified on the approach assessment.

- Maintain speed control – Backing should be done at an extremely slow speed. It is reckless and unnecessary to back vehicles more quickly than a spotter can casually walk.

Parking – Emergency vehicles are parked under a wide variety of conditions and time constraints. Nearly every emergency response will require the driver to decisively park the apparatus in a spot that is selected in a matter of seconds to best support operations. It requires skill and experience to do it fast and without mishap. Where experience is lacking, it must be replaced with a slower pace. New drivers need to learn to slow down upon approach to the scene. Some factors to take into account when positioning an emergency vehicle are as follows:

- Identify existing hazards on the scene and potential hazards as the incident escalates. Recognize overhead wires may fall, flammable liquids flow downhill, and flammable vapors may accumulate in low areas. Traffic is ALWAYS a hazard on every incident scene.
- Know policies that address positioning on the specific incident types, i.e. trench rescues, gas leaks, hazardous materials releases.
- Consider the location of your vehicle's exhaust outlet when responding to outdoor emergencies, such as vehicle crashes or medical emergencies. Avoid positioning your exhaust where it blows into the work area.
- Most emergency vehicles are not designed for off-road use. Before "beaching" an apparatus the driver needs to consider the terrain, the apparatus, the weather, and the legitimate incident needs.
- When operating an ambulance or arriving on a scene later in the incident sometimes it is best to park with consideration to future positioning or departure of the vehicle. There are times when it is important to not commit too deeply into a scene and limit positioning options. Listening to scene reports, knowing arrival order, and seeking guidance from the incident commander are all sources of information regarding positioning.

URBAN DRIVING SKILLS

Even in normal, non-emergency conditions, operating an emergency vehicle in urban areas requires a high degree of skill. Older communities with narrow streets to commercial areas with streets lined with midrise buildings to newer town center mixed use developments all share common hazards for fire apparatus. Bethesda, Rockville, Takoma Park, Silver Spring, the Kentlands, and numerous other areas of Montgomery County pose unique challenges for apparatus operators. Land values and a constantly increasing population inevitably lead to densely populated areas throughout the County as a transition from rural to urban occurs.

Emergency vehicles are typically larger and heavier than the traffic around them. Even command or staff "buggies" are loaded down with equipment not normally found in a typical passenger vehicle. Urban areas naturally develop limited sight distances and limited space cushions created by gridlocked traffic, narrow travel lanes, raised medians, street parking, and very short setbacks on buildings. These factors are further complicated by pedestrians, alleys, parking lots, landscaping trees, and crosswalks.

Speeds in excess of a posted limit are rarely justified. Excess speed should only be used if the road conditions permit it. Reasonable speed is one of the few factors under the direct control of the emergency vehicle operator that allows more time to react and more opportunity to control the vehicle if an evasive action is required.

Recognize that urban environments diminish the effectiveness of warning lights and sirens. An expected reaction to an approaching emergency vehicle is to pull to the side and slow down or stop. In an urban environment other traffic may not have any space to do this or may choose to do undesirable things. Some of the possibilities are: stopping in the middle of a lane, trying to race ahead of the responding vehicle, or beat the emergency vehicle through an intersection. In extreme cases, aggressive drivers may intentionally interfere with an emergency vehicle they perceive to be delaying their travel.

In other cases motorists may not react at all and just keep traveling. Modern vehicles have a great deal of sound deadening or insulation to increase occupant comfort. The volume of the radio or other entertainment systems, air conditioner noise, phone conversations, and/or poor driving habits of the driver can all be factors leading to a failure to yield to an emergency vehicle.

Emergency vehicle drivers must avoid the temptation to become aggressive when they encounter vehicles failing to yield. Overly aggressive or emotional reactions to civilian motorists will eventually lead to a collision. While seeming counterintuitive, backing off the siren, maintaining following distance, and giving the other driver a chance to think and react is often the best way to handle confused or oblivious motorists. Beware of startling an unsuspecting motorist. They could respond by slamming on their brakes or causing a collision with other vehicles. Vary the siren pitch and duration; use headlights, horn, siren, or spot light to get their attention. Be patient and keep signaling. Be very cautious about passing until you are sure the other driver sees you. If you attempt to pass an unaware driver there is a risk they'll identify you just as you are beside them and panic at a moment where you have no space cushion to react defensively.

Likewise avoid actions that could cause other drivers to enter intersections against the traffic light or crossing into oncoming traffic. In an effort to yield where medians and curbs leave no room another driver may move forward into cross traffic. Urban environments frequently make the use of opposing lanes a desirable option. Use of opposing lanes of traffic to pass other vehicles must be done with extreme caution as it multiplies the hazards to the emergency vehicle.

Apparatus drivers should learn the typical traffic patterns for their response area. Traffic blockages are common during the morning and evening commutes. Drivers may need to develop different routes for different times of day or days of the week. Construction zones or special events may further enhance the need to identify alternate routes.

When approaching gridlocked areas, slow down before reaching the blockage. This allow you time to identify the path of least resistance if one exists. Do not plow through the middle of stopped traffic when a right turn lane is wide open. The emergency vehicle driver can communicate their intention to other motorists through early lane positioning. Even where a lane is open as you approach, beware of motorists who panic and switch lanes unexpectedly. This can be especially true of right turn lanes or shoulders. Allow the traffic to make a path and avoid trapping your vehicle in a sea of surrounding traffic. Thinking in football terms – the best running backs sometimes let the play develop in front of them before they pick a path to run. If traffic is unable to move, moderate the use of your siren and/or horn as they may only increase confusion or anxiety. Patience will improve your safety and effectiveness.

NEGOTIATING INTERSECTIONS

Intersections are the most dangerous areas for emergency vehicles. Most people consider an intersection the meeting of two streets, however intersections come in many forms. An intersection is anywhere that other vehicles may cross your path, i.e. parking lot exits, alleys, driveways, trails, or railroad crossings.

There are two types of intersections: an *uncontrolled intersection* is any intersection that does not offer a control device (stop sign, yield sign, traffic signals, or railroad gates) in the direction of travel of the emergency vehicle. A *controlled intersection* is defined as any intersection that has a control device that regulates the flow of traffic, including stop signs and traffic signals.

Every intersection is a danger to the emergency vehicle operator until the cross traffic is confirmed to be controlled or absent. When approaching any intersection, consider the following:

- Scan the entire intersection for possible hazards (including vehicles turning right turn on red, pedestrians, vehicles not yielding). Observe conditions beyond the roadway.
- Slow down and cover the brake pedal with your foot.
- Change the siren cadence not less than 200 feet from the intersection.
- Do not assume warning devices are seen or heard unless the actions of other drivers is confirmed.
- Identify a primary path through the intersection as well as contingency paths if unexpected obstructions are encountered.

- Be prepared to stop. This means adjusting speed and covering the brake until the reaction of other drivers becomes obvious.
- Establish eye contact with other vehicle drivers.
- Utilize crew resource management when available. The officer and other crew members may assist in identifying the status of oncoming traffic, but this does not relieve the driver of the ultimate responsibility for avoiding a collision.
- When crossing intersections with multiple lanes of cross traffic proceed one lane of traffic at a time. Treat each lane of traffic as a separate intersection. Be very cautious of intersecting lanes that are not controlled by stopped traffic. Impatient motorists see the open lanes as an opportunity to race past the other stopped traffic.

Before exposing the apparatus to an intersection, the vehicle operator must make sure there is an adequate gap in traffic and/or traffic is yielding. The vehicle operator should at the very least:

1. <u>look left</u> – this traffic is usually the closest and immediate hazard
2. <u>look right</u> – once the left seems ready, check the next set of approaching lanes
3. <u>look left again</u> – ensure the nearest lanes remain safe to cross
4. <u>look straight across</u> – check that opposite traffic isn’t turning in front of you
5. <u>check the mirrors</u> – ensure impatient motorists have not pulled up beside you before making a turn

When making a right turn at an intersection from a stop it takes about six seconds to turn right and accelerate to a speed of 30 mph. This time increases with the size of the vehicle. Do not turn in front of other motorists assuming they see your apparatus. Other drivers must have time to react to your sudden appearance ahead of them.

An observation skill that needs to be developed by emergency vehicle drivers is reading the “body language” of other traffic. Some characteristics that can often be observed that help the emergency vehicle operator anticipate the actions of surrounding traffic are:

- Are the other cars changing speed?
- Does the driver appear to be scanning around them? Are they glancing at their mirrors?
- Are the turn signals or hazard flashers activated to try and signal a yielding action?
- Does the driver appear to be talking on a cell phone; either handheld or hands-free?

- Is the other vehicle showing any signs of yielding or changing their position; sometimes other drivers are simply indecisive?

Emergency vehicle operators can help other drivers by remaining predictable and signaling their intentions. Use all means of signaling – lights, sirens, turn signals, lane position, and eye contact or hand signals. As you approach stopped traffic, try to select your lane in advance and position the apparatus accordingly. Be decisive. Avoid weaving back and forth behind stopped traffic as this only increases the chance a civilian motorist will inadvertently switch lanes in front of your approach. Signal the emergency vehicles intent <u>at least</u> one block in advance of an urban intersection and five seconds in rural areas.

Intersections require drivers to constantly scan the roadway, the median, the shoulders, the cross streets, and the mirrors to identify obstacles. Be constantly aware of other responding apparatus, including police units. As you get closer to the incident scene the more likely you are to meet other units at an intersection. This situation can be especially confusing to motorists as they are now faced with yielding to vehicles from multiple directions. Do not forget to scan for bad road surfaces, bicyclists or pedestrians, animals, and diminished clearances (road signs overhanging the road, parked vehicle mirrors or accessories).

Ultimately, emergency vehicle operators must be prepared to some degree to stop at every intersection they encounter. Controlled intersections with stop or yield signals working against the travel route of the apparatus mandate the ability to stop in a controlled manner, however apparatus drivers must constantly search for conditions that could require yielding the right-of-way to avoid a collision.

TURNING VEHICLES AROUND

Any type of turnabout within open travel lanes exposes the apparatus to a collision. Be extremely cautious about passing through parking lots to turn around as they often have limited space, congested traffic lanes, and lots of pedestrians. Residential driveways can also be problematic as they are rarely constructed to hold the weight of heavy apparatus. Choosing a safe location to turnabout is important; choose an area with good visibility. You should have a clear view of the entire path of travel and all traffic lanes. Avoid hills, curves, and blind intersections where motorists may approach your apparatus with almost no warning.

Operators must become familiar with the turning radius of their apparatus to judge what type of turn around maneuver is appropriate or feasible. The types of turnabouts include the U-turn and the three-point turn.

- The *U-turn* is advantageous as it allows the apparatus to avoid backing. It requires a wide roadway and good visibility. Drivers must also remain aware of road signs or other unanticipated obstacles that hinder the turn. Beware of civilian vehicles entering blindspots when swinging wide for a U-turn; most drivers are not anticipating your maneuver. Look for other vehicles approaching from the driver side rear before you begin to turn.

- The *three-point turn* should only be used when the road is too narrow for a U-turn and other efficient options are not available. Three-point turns in open travel lanes need to be avoided as they tend to be done in a hurry and often a spotter is either not used or becomes exposed to uncontrolled traffic. Impatient or unaware motorists may strike the apparatus broadside or end up behind the apparatus during backing. The opportunity for a negative outcome is significant.

SAFE FOLLOWING DISTANCES

Emergency vehicles need a space cushion during travel to provide the operator time to react to conditions. A safe following distance allows the apparatus to stop or change lanes in a controlled manner without hitting the vehicle ahead should they stop or slow unexpectedly. Rear-end collisions are almost always avoidable when drivers pay attention and maintain good distances. If the proper distance is observed, left and right lateral evasive and other abrupt anti-collision maneuvering is minimized and unnecessary. Emergency vehicle operators must respect that their apparatus is considerably larger in dimension and weight than passenger vehicles. These differences create much larger forces working acting upon the vehicle and thus larger forces to stop the vehicle. The larger forces translate into longer stopping distances.

Drivers must recognize that a safe following distance accounts for their perception time, reaction time, and braking time/distance. Before any braking can occur, the driver must *perceive* a need to brake. This requires the driver to be alert and scanning ahead. *Reaction time* is the period between recognition of a hazard to the time brake application begins. Average drivers require about ¾ second. Air brake systems lengthen reaction time by ½ to 1 second due to lag within the system. The driver’s ability to perform under stress and the drivers experience are also factors that influence reaction time. Before the brakes even engage as much as 2 ½ seconds may elapse; which equates to nearly 150 feet of travel distance at 40mph.

Braking distance is the distance traveled from the first braking action until the vehicle comes to a full stop. Breaking distance varies nearly infinitely due to the factors involved. Vehicle speed, weight, mechanical condition, and tire condition are all factors. Road surfaces, weather, and the driver are also factors that affect braking distance.

An appropriate following distance will allow enough time to come to a full stop if the vehicle ahead of you comes to a sudden stop. One way to estimate a safe following distance for an emergency vehicle is the “four second rule”. The four second rule maintains a separation of at least four seconds between the emergency vehicle and the vehicle ahead up to speeds of 40mph. For each additional 10mph another 1 second is added to increase the separation. In adverse weather conditions, add another 1 second per 10mph.

The four second rule is simple to apply. When the vehicle traveling ahead passes a fixed object, begin counting the seconds. Stop counting when your vehicle passes that same fixed object. Compare this time to the recommended time established by the four second rule to reasonably approximate your safe following distance.

Policy and rules cannot replace sound judgment by the driver. Time and spacing requirements are effected by too many variables to be addressed by more than guidelines. Traffic density or volume, road surface conditions, hazards, roadway design, and speed limits influence the following and stopping distances. When conditions get bad, add more distance.

PASSING ANOTHER VEHCILE

Emergency vehicles are constantly overtaking other vehicles during a routine and emergency driving. In this section, the term “passing” references situations where the emergency vehicle must change lanes or make another maneuver to go around another vehicle. Some considerations to address before passing include:

- Is it necessary to pass?
- Is there a legitimate need to “get around” the vehicles ahead?
- Will vehicle traffic ahead yield in response to your audible/visual warning devices? Do the other drivers see you?
- Does your vehicle have enough residual power to accelerate effectively beyond a moving vehicle?

Roadway information is critical to successful passing. When gathering information to decide about passing, be certain to include the following in your assessment:

- Road signs: No Passing, Intersection Ahead, Pedestrian Crossing
- Pavement markings: Solid centerline, broken centerline
- Road configurations: hills, curves, intersecting roads, driveways

If “No Passing” is advised, the transportation engineers have identified features that could create an unacceptable level of risk for a collision. Often “no passing” areas are established as the result of prior collision history on that road. Never blindly pass a stopped car or line of cars without knowing why they are stopped. Fire department vehicles are not exempt from stopping for school buses loading or unloading passengers. In any situation avoiding mishaps is optimal. The following are some good tips to avoid mishaps when passing:

- Pass assertively. Do not hesitate as conditions change rapidly.
- Stay in the passing lane the shortest time possible.
- Constantly scan the roadway for unmarked, intersecting roadways.

- Mentally note the location of each vehicle you pass so you can identify in the mirror when you've cleared the final vehicle. Visualize their location in relation to the side of the apparatus.
- In non-emergency situations it is often better to decelerate and merge in behind other vehicles than to attempt to accelerate past.

EXPRESSWAY OPERATIONS

The term expressway includes interstates, freeways, turnpikes, or any other type of limited access multi-lane high speed roadway. Entering and exiting expressways require the operator to make quick and accurate decisions in rapid succession. Expressway traffic is often driving in excess of posted speeds and exposes emergency vehicles to traffic that is much more agile.

Entering and exiting expressways is generally accomplished via ramps with varying lengths of acceleration or deceleration lanes. These ramps can be some of the most difficult areas to navigate in larger vehicles as one group of vehicles is slowing down to exit while another set is accelerating to enter. When entering or exiting the expressway, you must monitor the road ahead while simultaneously checking your mirrors. Key points to remember while merging on an expressway:

- Use your mirrors to keep track of adjacent lanes.
- Always be prepared to stop suddenly.
- Look well in advance of your current position. Note vehicles that are approaching the merge area and identify gaps for your merge.
- Adhere to ramp speed limits. Beware of signage indicating roll-over hazards or sharp curves.

Beware that warning devices may startle other motorists as your apparatus approaches from a ramp. Other vehicles may stop suddenly or change lanes in panic. The curve of a ramp and presence of overpasses or sound walls makes visual and audible warning devices less effective. Expect to merge into the flow of traffic as normal, assess traffic flow, and then decide your best lane or approach. Remain predictable to other drivers and avoid weaving from one lane to another.

DRIVING AT HIGH SPEEDS

Driving at highway speeds or in excess of the posted speed limits presents significant hazards to emergency vehicles. Exceeding a posted speed limit is a privilege granted only during emergency response and should only be done with due regard for the safety of other motorists and the emergency apparatus. In all cases, consider the following:

- Posted speeds are based upon the roadway characteristics in good weather conditions.
- Gain and lose speed in straight lines, not in curves.
- Recognize when stopping distance exceeds sight distance. Sight distance is not under the driver's control, but stopping distance is controlled by speed.

- Driving at higher speeds increases the potential for heavy or excessive braking action that may lead to brake fade.
- Higher speeds result in higher momentum and shifts in the center of gravity for a large vehicle.

A moving vehicle naturally wants to stay in a straight line. As a vehicle enters a turn inertia results in centrifugal force that pushes the vehicle in a straight line rather than turning. This centrifugal force increase exponentially with speed. When the centrifugal force becomes too high, the vehicle will either slide or roll over. For every curve or turn, there is a maximum speed for traveling through the curve safely. The tighter the curve, the higher the potential is for centrifugal force, therefore the slower the vehicle must travel. Roadways are sometimes built with a slight side grade to the inside of the curve that aids in countering the centrifugal forces working against the vehicle. If the road is graded toward the outside of the curve this will work against the vehicle and require even slower speeds. In addition to the grade of the surface, the type and condition of the road surface plays an important role in maintaining sufficient traction in turns.

Due to land availability or restrictions, designers often lay out curves in a decreasing radius pattern. This is a design by which the turns start out with a relatively large radius (curve) that tightens as the vehicle passes through the curve. On decrease radius curves, the maximum entry speed is too fast for the later (tighter) portion of the curve. If the speed is too high for the tighter portion of the curve, physics will cause the vehicle to slide or roll over. Drivers must recognize when a ramp or curve is decreasing in radius.

To better define the safe mechanics of transitioning a curve, the following is a breakdown of a curve and proper techniques to pass through it.

Entry – Brake or decelerate to the proper entry speed *before* entering the curve. Enter the curve as far to the outside as possible. Entering on the outside of the curve effectively increases the radius of the track for the vehicle. The greater the radius, the faster the turn can be safely negotiated. Begin the turn as early as possible.

Transition – If the maximum safe speed to maintain control passing through a curve has been attained, the emergency vehicle operator experiences full control of the vehicle. The maximum “safe” speed is not the maximum “possible” speed that conditions will allow. When approaching maximum possible speeds, it will feel as though the suspension is straining. Do not apply aggressive breaking. Allow natural friction of the engine and compression to slow the vehicle down. If you are traveling at near maximum speed in a curve, a relatively small event (e.g. some sand or gravel on the road) can cause complete loss of control. Once in the curve, it is best to coast at speed to maintain maximum traction. Attempting to accelerate while in a turn can result in loss of steering control and traction at the rear wheels.

Exiting – Exiting curves requires the vehicle operator to keep the vehicle's speed steady. Maintain position on the inner surface of the curve. Gently accelerate out of the curve after the apex has been reached and the vehicle is on a straight path.

Stopping at higher speeds requires more stopping distance and is harder on the braking systems. Things to consider when braking at high speeds include:

- Braking creates friction that results in heat.
- Overheating in the brake system reduces braking effectiveness.
- Reduce the stress on brake systems by engaging auxiliary braking systems and downshifting the transmission.
- Drum brakes typically fade more quickly than disc brakes due to differences in heat dissipation capability.

UNUSUAL OR DANGEROUS DRIVING SITUATIONS

Driving In Adverse Conditions

Emergency vehicle operators cannot choose to avoid driving in weather conditions that would normally stop civilian drivers. Adverse conditions can be categorized as follows:

- Traction Implications
- Environmental Hazards
- Vision Implications

Emergency vehicle drivers must adjust their driving techniques for all adverse conditions as well as adjust the auxiliary braking systems that may be on their unit. The driver's primary responsibility is the safety of the passengers and arriving safely at the incident. Slow down and drive at a speed reasonable and appropriate for the conditions. Increase following distances and drive smoothly with any vehicle to avoid sudden and dramatic maneuvering.

Traction Implications – Traction can be adversely affected by a variety of conditions. Any materials or changes in the road surface will alter the friction between the road and the tires.

- Rain – In addition to oil buildup, water forms a layer that builds between the tires and the road surface. As little as $1/16^{th}$ of water can cause hydroplaning of a vehicle. Standing water may also impact steering, braking, and general vehicle operation.
- Chemicals – Road surfaces may have any number of chemicals, but the most common are oil, grease, and fuel. Chemicals can be particularly problematic early in the onset of wet weather before the rain washes away the residue.

- Snow and Ice – Snow, slush, and ice create variable road conditions resulting in reduced traction for vehicle tires. Certain roadway features such as bridges or shady areas may accumulate snow or ice prior to other parts of the travelway.
- Leaves – Leaves or other vegetation debris can create slippery conditions when allowed to accumulate on the road surface.

Whenever conditions have caused reduction in traction, the driver must reduce speed: and, steer, accelerate, or brake smoothly and evenly. The required stopping distances multiply depending on the condition of the road surface.

Environmental Hazards – Adverse handling could be caused by natural conditions such as high winds, vegetation, and the contour of the terrain. Road construction and design are examples of manmade conditions.

Vision Implications – Conditions that affect visibility include low-light driving, precipitation, vehicle construction, and the condition of the driver.

- Low-light Driving – Low-light conditions create various challenges: hidden hazards; increased difficulty in judging the speed of other vehicles, and distance; limited highway lighting; and glare from roadside lights. Even with these limitations and possibly impaired vision, a few simple rules can help the driver compensate.
- Dim dash and cab lights at night.
- Reduce speed.
- Keep headlights and windshield clean.
- Recognize the blind spots created by the vehicle characteristics.
- Look beyond the headlights.
- Keep eyes moving and scan continuously.
- Precipitation – Rain, fog, and snow reduce visibility. In addition, rain and fog increase glare both during the day and at night. During the day when the sun is out, the snow on the ground creates a considerable glare as well. Poor visibility conditions require the operator to:
    1. Drive slowly but keep moving.
    2. Turn headlights (low beams only) and wipers on.
    3. Use four way flashers if traveling 15 mph or more below the posted speed limit.
    4. Watch for cars ahead that are moving very slowly.
    5. Avoid decelerating suddenly.
    6. If you must pull off the road, use four way flashers and warning lights.
    7. Use the defroster or air conditioning to minimize fogging on the inside of the windows.

CONTINGENCY SITUATIONS – CAUSES AND PREVENTION

Contingency situations can arise at any time. A contingency situation is described as a possible future event, condition, or an unforeseen occurrence that may necessitate special measures. When they arise, normal traffic flow may be suddenly interrupted and the safety of all persons in the general area is diminished. Emergency vehicle operators must be familiar with contingency situations that occur most often, and to understand the actions that can be taken to minimize to reduce their impact. Five common contingency situations are:

1. *Vehicle malfunction or component failure* – Thorough pre-trip inspections are the key to reducing roadside emergencies. Inspect the vehicle at the beginning of every shift and note any deficiencies. Correct any deficiencies that are easily fixed in the station.
2. *Change or deterioration in the road* – The key to managing changing road conditions is to expand your look ahead distance to recognize approaching hazards. Remain alert, scan well ahead, and look for clues like construction signs or skid marks on the road. Operators must also remain aware of projects or existing conditions in their response district so they can anticipate poor conditions.
3. *Obstacle in the roadway* – Be prepared for an appearance of obstacles in the road (e.g. pedestrians, other vehicles, animals, etc.). In congested urban areas anticipate hazards appearing from side streets, alleys, parking garage exits, or between parked vehicles. Rural roads present more opportunities for animals or debris to enter the roadway.
4. *Weather change* – The DC Metro area presents widely varying and sometimes unpredictable weather conditions. Cold weather brings ice or snow. Summer storms bring the threat of hydroplaning and debris from high winds.
5. *Driver error, inattention, and inexperience* – Fatigue is a significant factor for drivers operating on shift work. Operators must determine for themselves when they are too tired, too sick, too stressed, or otherwise physically or psychologically unprepared to operate an emergency vehicle.

HANDLING CONTINGENCY SITUATIONS

Emergency vehicle operators must be prepared to encounter unusual situations or conditions. The nature of the vehicles combined with the environment offer endless variables that impact safe operations.

Evasive steering and skidding often occur when avoiding pedestrians, animals, vehicles, or other obstacles. These reactions usually occur because the driver either failed to recognize an impending hazard or the hazard appeared so suddenly that it was unavoidable. A driver in this situation needs to weigh the risk versus reward of their action. Is it worth risking loss of control of the vehicle to avoid a collision with a small animal?

The vehicle driver must constantly scan ahead and to the sides of their vehicle to identify escape routes in the event that braking is not going to avoid a collision. Beware that the crest of a hill, curves, and intersections limit your ability to identify escape routes and therefore reduce your options.

When braking will not avoid a collision, evasive steering may be employed to avoid or minimize the impact of a collision. Operators need to become accustomed to maintaining their hands at the 9 and 3 o’clock position on the steering wheel. This will allow the largest possible turn without moving the hands. The 10 and 2 o’clock positions are more comfortable, but the 9 and 3 o’clock position allows maximal directional control. Evasive steering occurs in two phases; to avoid a collision, turn the steering wheel sharply in the direction of the escape route and then counter steer as soon as the vehicle is clear of the obstacle. If a collision is unavoidable, choose an object with which to collide. When facing such a choice, the operator must rapidly decide which course and object(s) will result in the least severe collision. Head-on collisions are the most damaging collisions because the entire force of the striking vehicle is applied to the fixed object. A sideswiping or indirect collision allows the energy of the collision to dissipate over a long distance since the vehicle remains in motion. Impact absorbing objects are better to choose than large immobile items that will not “give”. Some examples of impact absorbing objects are parked cars, bushes and shrubs, guardrails, and small signs. Examples of nonimpact-absorbing objects include bridge abutments, retaining walls, buildings, large trees, and utility poles.

In addition to evasive steering, there are two other forms of maneuvering to avoid collisions – *emergency braking and evasive acceleration.*

- *Emergency braking* – The goal for emergency braking is to produce the shortest possible stopping distance without locking the wheels or losing control. The threshold braking method for accomplishing this is hard pressure to the brake pedal without locking the wheels. Modulate the pressure on the pedal. Apply steady pressure to the point of locking, and then release pressure slightly to get rolling traction. If the wheels lock, **release the brake pedal.** A vehicle with ABS does not require threshold braking because the computer will not allow the brakes to lock up; a steady pressure should be maintained on the pedal. Remember that a rapid stop could cause a rear-end collision; however, this is more preferable than hitting a pedestrian. Remember the action vs. outcome formula.
- *Evasive acceleration* – Evasive acceleration means a quick burst of speed. It can be used to avoid collision with side approaching or merging vehicles. When a vehicle is approaching from the side or merging, increasing speed can often avoid a side impact collision.

HANDLING SKIDS

While weather or road conditions may increase the possibility of skidding, skids are generally caused by one or a combination of these factors:

- Sudden change of speed or direction
- Change of speed or direction under conditions of poor traction
- Weight shift in the vehicle
- Poor tire condition
- Improper tire inflation
- Failure to identify a hazard through inattention
- Improper application of the brakes

To help regain control no matter what type of skid is occurring, ***STAY OFF THE BRAKE; STAY OFF THE ACCELERATOR; AND COUNTERSTEER!*** Steer in the direction that the vehicle rear end is skidding.

There are two key elements to effective countersteering:

1) the steering wheel does not have to be turned violently to correct a skid. This a common "panic" reaction, and further trouble arises because the rear tends to skid back and forth (fishtailing);

2) After the initial effort to countersteer, it may be necessary to immediately steer in the other direction to help recover.

Skids can be generalized into four categories:

- **Braking skids –** This skid occurs when sudden, hard brake pressure is applied causing one or more of the vehicles to lock. Regardless of how many wheels lock, some control of the vehicle will be lost. If all wheels lock evenly or if just the front wheels lock, the vehicle will continue in a straight line on its prior trajectory unless influenced by some other force (e.g. a dip in the road). If just the rear wheels lock, the vehicle will tend to spin around and end up facing the opposite direction. If a braking skid occurs:
    - Release the brakes immediately in an attempt to regain traction; this will return the ability to steer and attempt further braking.
    - If braking is still necessary, use less pressure to avoid the wheels locking again.
- **Power skid –** The power skid occurs due to sudden, hard acceleration. Since fire apparatus is typically rear-wheel driven, sudden acceleration can cause the rear wheels to lose traction. The back of the vehicle may skid to one side, trying to overtake the front end. The tendency for the rear end to slide will be greatest if the front wheels are turned. The vehicle may even spin all the way around. If a power skid occurs:
    - Release the accelerator.
    - Steer in the same direction as the rear end is skidding.
    - Counter steer to straighten the vehicle.

- **Cornering Skids** – Cornering skids (also called yaw skids) occur when speed is too great or traction is insufficient to keep the vehicle on the intended track around a curve. While the name "cornering" implies travel through an intersection, these skids can also occur on highway ramps or any area where the roadway changes direction. A vehicle naturally wants to follow a straight line and must be forced to follow the intended path around the curve through traction with the road surface. Much like a braking skid, a cornering skid may involve one or more wheels with the vehicle reacting accordingly. If a cornering skid occurs:
  - Release the accelerator.
  - Avoid the temptation to abruptly apply the brakes as this may further reduce traction; it is best to allow natural forces to slow the vehicle.
  - Light application of the brakes may be necessary, but needs to be done cautiously to avoid full loss of control
  - Countersteer as necessary to regain the desired trajectory.
- **Hydroplane Skids** – Hydroplane skids occur when the tire is moving too fast for the water on the road to escape into the tire tread and permit direct contact between the rubber and the road. A small wedge of water builds up in front of the tire and lifts it off the road surface. The water then effectively forms a barrier between the tire and the road surface. Hydroplaning can occur on minimally wet surfaces at speeds of 25 mph. Vehicle reaction during a hydroplane skid is hard to predict. As in all skids, there are varying degrees of brake and/or steering control. A hydroplane skid may not even be perceived by the driver unless the driver attempts to brake or steer. If a hydroplane skid occurs:
  - Release brake and/or accelerator.
  - Allow the vehicle to slow naturally. The vehicle will drop through the water barrier and regain contact with the road surface.

OTHER VEHICLE EMERGENCIES

There are a number of other emergencies that can occur while in transit. The following are some possible emergencies and ways to control them:

- **Rapid Tire Deflation** – Rapid tire deflation is most hazardous when it occurs on the steering axle. The vehicle can violently pull to the side of the blowout or deflated tire. The vehicle will pull to the side of the deflated tire because the flat tire grips the road with more rubber (and more friction) an acts as a pivot. As soon as deflation is detected, the driver should begin to slow the vehicle gradually while seeking a safe area to stop. Anticipate difficult steering and be prepared to make firm movements with the steering wheel. Avoid aggressive braking as they may further disrupt vehicle control.

- **Brake Failure (non-ABS hydraulic brakes)** – Brake failure in hydraulic brake systems generally results from neglect or deterioration of the system. For systems that are not ABS, pumping the brake pedal rapidly during a failure may build up enough pressure (fluid) in the system to provide minimal braking action. Leave any auxiliary braking systems engaged and down shift to allow the transmission to slow the vehicle. As a last resort once the vehicle has slowed, rub the tires against a curb for additional friction. For vehicles equipped with hydraulic service brakes, but an air parking brake another last resort is to apply the parking brake. Beware that applying the parking brake can lock up the wheels abruptly and cause the vehicle to skid.
- **Brake Failure (ABS hydraulic brakes)** – Anti-lock braking systems (ABS) have similar characteristics to non-ABS except they are controlled by a computer system. In the event of a computer failure in the ABS, they are designed to simply behave like a conventional braking system and will continue to stop the vehicle. If a mechanical failure occurs in an ABS equipped vehicle apply steady firm pressure to the brake pedal. Pumping the brakes on an ABS equipped vehicle may actually lengthen stopping distance. Leave any auxiliary braking systems engaged and down shift to allow the transmission to slow the vehicle. As a last resort once the vehicle has slowed, rub the tires against a curb for additional friction. For vehicles equipped with hydraulic service brakes, but an air parking brake another last resort is to apply the parking brake. Beware that applying the parking brake can lock up the wheels abruptly and cause the vehicle to skid.
- **Brake Failure (Air brakes) –** Failure of air brake systems can be the result of loss of air, contamination in the air system, or overheating of components. A catastrophic loss of air will result in the spring (parking) brake applying abruptly and potentially locking up the rear wheels. A partial system failure is more common and causes poor brake performance. Contamination of the air system may result in decreased performance of parts of the system if air lines become clogged or air capacity is reduced. Overheating of the brake pads or shoes occurs when the system is stressed by repeated heavy braking, such as an emergency response through traffic or in long downhill runs. Overheated brakes have a unique odor that most heavy apparatus operators recognize. Overheating results in brake “fade” and the vehicle will not slow down as efficiently because the friction applied by the pads or shoes is reduced. In severe cases braking ability is essentially lost and the pads or shoes can be permanently damaged. If an air brake system is experiencing a failure, use similar approaches as for an ABS equipped hydraulic brake vehicle. Do not pump air brake systems; this will only reduce the air supply. Leave any auxiliary braking systems engaged and down shift to allow the transmission to slow the vehicle. As a last resort once the vehicle has slowed, rub the tires against a curb for additional friction.

- **Transmission Malfunctions –** Complete transmission failures are rare unless the driver shifts between reverse and forward gears without allowing the vehicle to stop first. Most electronic transmissions have built-in features to prevent such damage. Vehicle operators need to recognize and address early indications of trouble in the transmission (e.g. slipping, thrusting etc.).
- **Steering Malfunctions / Failures –** The most common failure in a steering system involves the hydraulic power steering assist. A power steering failure occurs when the engine stalls, fluid in the system is low, or when the belt that drives the system flips or brakes. In a power steering failure the mechanical steering remains functional, however turning the steering wheel will require considerably more effort. Sudden mechanical failure of steering system components seldom occurs when proper pre-trip checks are conducted. If a failure occurs in the steering, slow the vehicle and stop as quickly and smoothly as possible.
- **Accelerator Sticks -** If the accelerator sticks, the driver should attempt to release the pedal by tapping on it with their foot. The next move is to pull the pedal up with their foot. Do not attempt to reach down and pull the pedal as this is likely to result in loss of control of the steering. If the pedal cannot be reset, shift the transmission to neutral and slow the vehicle to a stop. Avoid shutting the motor down until the vehicle is stopped as braking and steering will be more difficult.
- **Wheels off the Road –** Numerous roadways within the County do not have curb and gutter, therefore the pavement transitions to a soft shoulder of gravel or dirt. The shoulder may be immediately adjacent to the white line or the pavement may extend to offer a hard shoulder beyond the white line. Roadways with no hard shoulder pose a significant hazard to large vehicles. Many roll-over crashes involving fire apparatus are the result of over-correction after a set of wheels has dropped off the paved portion of the road and onto a soft shoulder. When the wheels have left the road, the vehicle will tend to pull toward the shoulder. The driver must hold the steering wheel firmly and avoid the temptation to countersteer in panic. The driver should release the accelerator and attempt to bring the wheels back onto the pavement through small steering inputs. These inputs would be similar to those used for a gradual lane change. A large steering input could cause the vehicle to lose control and enter a sideways skid.
- **Dashboard Warnings –** Apparatus operators must be familiar with the various warning lights and messaging screens associated with vehicle monitoring systems. In general, amber or solidly displayed dashboard warnings are advisory while red or flashing dashboard warnings require immediate action. Consult the manuals for your specific apparatus for detailed instructions. Operators should also know what normal operating ranges apply to the gauges and recognize when a vehicle is displaying abnormal “vital signs”.

PARKING PRECAUTIONS

Position of an emergency vehicle on an emergency incident is crucial. While apparatus is often positioned based upon function and assignment the operator must also consider traffic hazards. Utilize onboard cones and flares to enhance the work zone around the apparatus. Park the apparatus to serve as a barrier between oncoming traffic and dismounted personnel. EMS and smaller units should be protected by heavy apparatus whenever possible. When parking on a shoulder or a curb lane, even slightly angling the apparatus helps to keep the crew from opening their doors into open traffic lanes.

When apparatus is exposed to an open lane of traffic or while on an incident, all warning lights should be illuminated per standard procedures. When a unit is parked during a non-incident situation, drivers must exercise good judgement when selecting a parking spot and attempt to adhere to all applicable traffic laws. Apparatus operators need to avoid blocking travel lanes or reducing sight distances near intersections with their parked unit. Parking lots are typically very difficult for apparatus to navigate. If using parking lots, consider staying on the outer fringes of the traffic area to reduce exposure to confined areas and higher levels of vehicle traffic. Do not park in fire lanes or other areas that expose the apparatus to civilian vehicles backing out of parking spaces.

When positioning apparatus, some additional considerations must be taken into account:

- Reduced sight distances due to terrain, vegetation, buildings, vehicles, road configuration may require additional cones or other apparatus to position ahead of the scene.
- Control all avenues of approach around the apparatus. Recognize where intersections or driveways allow civilian vehicles to approach from multiple directions.
- Beware of blinding oncoming drivers with apparatus headlights or scene lights.
- Use a mix of traffic cones and flares as necessary to keep civilian vehicles out of the scene. Flares help illuminate adjacent cones at night, but also can serve as effective barriers during daylight hours.

Safety Reminder – When operating outside the protective shadow of a blocking unit you greatly increase your risk of being struck by a vehicle. **Never** turn your back on approaching traffic. Always face traffic when setting up and removing traffic control devices.