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13.0 Vehicles

Introduction
Drivers of vehicles are a major cause of work-related accidents and safety incidents in the mineral exploration industry. Usually they are due to driver error or negligence. Therefore, by improving driver skills, attitudes, defensive driving techniques, and by reducing driver fatigue, an exploration company can expect to reduce vehicle collisions and incidents. Carrying appropriate equipment and good maintenance practices also contribute to improved vehicle safety. Company employees who travel in countries where roads and driving conditions are particularly hazardous should avoid driving and instead use local staff drivers or professional drivers associated with their hotel.

When they differ, the instructions in the manufacturer's operator manual that accompany a vehicle or piece of equipment (e.g., winch or jack) take precedence over instructions in the Prospectors & Developers Association of Canada (PDAC) Health and Safety Guidelines.

13.1 Risks and Hazards

Risks include death, personal injury and damage to company property.

- Crashes may be caused by:
  - Driving too fast for road conditions
  - Lack of driver's training, poor driving skills
  - Fatigue, falling asleep while driving
  - Collisions with animals
  - Engine failure/breakdown or tire blowout
- Stranding may be caused by:
  - Running out of fuel
  - Engine breakdown
  - Flat tire – no spare(s)
- Damage to company property may be caused by:
  - Crashes
  - Not following safe operating procedures, lack of training
  - Poor maintenance
  - Vehicle fires

13.2 Responsibilities (Due Diligence) Regarding Vehicles

As presented in section 1.2 Due Diligence, companies should be able to demonstrate due diligence in regard to their employees' use of vehicles both driving to and from a field work site as well as while working in the field. Requirements to demonstrate this aspect of due diligence include but are not limited to the following measures.

Exploration Companies

- Develop written safe operating procedures (SOPs), site specific SOPs (as needed) and an emergency response plan (ERP) for the use of vehicles.
- Provide competent, trained supervisors; provide training and education for employees regarding SOPs, ERPs, regulations and work place hazards, terrain hazards related to driving
- Carry out inspections and maintenance of vehicles
- Monitor the use of vehicles and implement consequences when regulations and SOPs are not followed.
- Documentation: Keep records of all training, accidents, incidents and corrective actions, mitigation of hazards, inspections, maintenance, infractions etc., that apply to vehicles and their use.
- Provide required personal protective equipment (PPE).
- Carry adequate insurance.

Project Supervisors

- Implement company SOPs and those in the manufacturer's operator manuals of vehicles and accompanying equipment.
- Place warning decals on vehicles and associated equipment in the local language, when possible.
- Advise, instruct, and monitor employees and contractors regarding jurisdictional regulations, health and safety regulations, company SOPs, and potential hazards of using vehicles.

Operators

- Follow company SOPs and training regarding company vehicles.
- Be familiar with the warning decals on vehicles and associated equipment.
- Use PPE and safety equipment as directed.
- Report hazards, dangers, and defective vehicles and equipment to a supervisor.
- Be familiar with project ERP procedures regarding vehicles.

13.3 Safe Driving Guidelines for All Vehicles

1. Obey the rules of the road of the country, province, territory or state. Vehicles must carry vehicle registration and insurance documents.
2. Comply with the manufacturer's operating procedures located in the vehicle operator manual. Most manufacturers supply comprehensive operation and maintenance procedures.
3. Only properly licensed and trained employees should drive company vehicles. It is advisable for drivers to obtain an international driver's licence when it is necessary to drive in some countries.
4. Wear a seat belt at all times. Vehicles must be fitted with seat belts for each seat. The only exception to this rule – do not wear a seat belt when driving on frozen lakes or ice bridges.
5. Use vehicles that are appropriate for the job and conditions of the field area. Vehicles should be mechanically sound and carry sufficient equipment. Essential equipment should not be shared between vehicles.
6. Develop an emergency response plan (ERP). Include procedures that address breakdowns and overdue vehicles etc. In the event of a breakdown, it is usually best to stay with the vehicle. If it is necessary to go for help, leave a visible explanatory note with the vehicle in addition to any communication you may have with the camp or project. This may avert a full scale search.
7. Each project should establish a communication schedule with predetermined check-in times. Employees should adhere to the check-in schedule and inform their base camp of changes in plans.
8. Inform the person in charge of the planned route and the estimated time of arrival or return; record the information on a map. The person in charge of the tracking system should be familiar with the ERP and know what to do if a vehicle does not arrive or return as planned, or if it does not check in on schedule.
9. Respect the legal speed limit. Most crashes result from driving too fast for existing road conditions. Reduce speed if road conditions are unknown, if they deteriorate, or if visibility is reduced – no matter what the legal speed limit.
10. Obtain permission to cross private land. Leave gates as they are found.
11. Drive to protect the environment. Use existing roads and tracks. Minimize off-road driving especially in wet conditions, on stream banks and in fragile environments.
12. Avoid having passengers ride in the back of open vehicles unless they are properly restrained. Tray back trucks should be fitted with benches, seat belts and side bars if passengers are carried.
13. Do not drive a vehicle if you have consumed alcohol or if you have taken medication or drugs that might affect your ability to drive.
14. Do not drive when you are drowsy. Stop and take a break or nap, or have an alert passenger drive.
15. Where vehicles operate in the vicinity of heavy equipment or where visibility is routinely limited, vehicles should be equipped with a flashing light on top of the cab, and/or a whip with a flag and light at the tip, and/or with reflective tape**.**
16. Companies should consider establishing guidelines regarding the use of company owned or leased vehicles for recreational purposes.

13.4 Equipment Lists for Vehicles

The required and recommended equipment carried in vehicles should depend on (1) the time of year, (2) the terrain, (3) the degree of isolation, and (4) the distance to the field area or work site. Although the lists may seem extensive, note that a survival situation can develop near civilization depending on the weather. It is better to be safe than sorry. Use the lists to help determine which equipment is appropriate.

In addition, all vehicles should be equipped with stickers or laminated cards located in the glove box with the following information:

1. Contact telephone numbers for the camp, local office, manager, garage, police, etc.
2. Operating instructions for the vehicle radio or satellite phone, if present
3. A copy of the emergency response plan

Equipment for Field Vehicles

Items in bold should be considered essential.

- ☐ **First aid kit**
- ☐ **Communication: radio, mobile /cell phone, or satellite phone**
- ☐ **Maps, compass, GPS** (Global Positioning System) unit and **extra batteries**, as required
- ☐ **Vehicle operator manual** (store in glove box)
- ☐ **1 or 2 spare wheels with fully inflated tires, as required**
- ☐ **Jacks: axle jack for tire changes, plus Hi-Lift jack for field vehicles**
- ☐ **Lug wrench** (cross-type is best)
- ☐ **Tool kit**
- ☐ **Heavy duty jumper cables**
- ☐ **Tire pump and tire gauge**
- ☐ **Extra fluids: e.g., oil, coolant, transmission, brake, and windshield washer fluids**
- ☐ **Appropriate spare parts: e.g., fan or serpentine belt, hoses, filters, fuses, spark plugs**
- ☐ **Flares or reflective hazard signs for roadside safety**
- ☐ **Spare keys** (hidden on vehicle)
- ☐ **Drinking water** (quantity depending on region)
- ☐ **Fire extinguisher, Class ABC** (or locally certified) – mounted near driver and readily accessible
- ☐ **Shovel** (snow shovel in winter, spade in summer)
- ☐ Large flashlight and extra batteries
- ☐ Extra matches (waterproof)
- ☐ Survival kit suitable for region
- ☐ Axe or small saw
- ☐ 10 metres rope or straps to tie down cargo
- ☐ Duct tape
- ☐ Recovery strap or Kinetic Energy Recovery Rope (KERR) – tow chains or cables are more dangerous

- ☐ Maintenance log book (store in glove box)

Additional Equipment

Consider the following for specific work conditions or locations:

- ☐ Extra fuel in certified containers, as required
- ☐ Tire repair kit
- ☐ Spare bulbs for headlights and tail lights
- ☐ Hand operated winch (Note: Hi-Lift jacks can also be used for winching)
- ☐ Extra fire lighting equipment
- ☐ Extra drinking water
- ☐ First aid kit that includes latex or vinyl gloves and a face shield where AIDS is endemic
- ☐ Roll of paper towels
- ☐ Extra battery – mounted under the hood on opposite side of the exhaust manifold or a portable power system, depending on region

Additional Recommended Equipment in Cold Climates

- ☐ Windshield ice scraper and brush (winter)
- ☐ Tire chains for snow
- ☐ Extra mitts and wool hats
- ☐ Sleeping bags and/or blankets (1 per person)
- ☐ Space blankets (3 minimum to create shelter in vehicle)
- ☐ Gas line antifreeze
- ☐ Traction aids or sand bags
- ☐ Emergency candles, sterno cans
- ☐ Extra food (high calorie foods)
- ☐ Small stove and fuel

Additional recommended equipment in hot climates

- ☐ Large plastic bag for collecting water
- ☐ Transpiration bags
- ☐ White and clear plastic (for shelter, catching water)
- ☐ Space blankets (1 per person)
- ☐ Extra drinking water (minimum of 10 litres per day per person)
- ☐ Extra water for radiator
- ☐ Extra coolant
- ☐ Food (carbohydrates are recommended)
- ☐ Machete (tropics)

Addition equipment recommended for some tires and wheels, depending on country

- ☐ Tire repair kit and tire gauge
- ☐ Tire levers
- ☐ Wheel brace
- ☐ Rubber mallet

- Use good judgement and carry appropriate equipment for the field area. Take into consideration how remote the work site is, how quickly help will be available, the climate, and if you are travelling alone.
- Drivers are responsible for returning a vehicle with all equipment. Missing or damaged equipment should be replaced or repaired. Radios and their antennas should be maintained in good working order and returned intact with the vehicle.
- Keep tires, including the spares, at the correct pressure, which should be as recommended in the vehicle operator's manual, not what is stated as the maximum allowable pressure on the tire. This information may also be found mounted on the door frame or in the glove box. No vehicle should be fitted with a combination of radial and cross-ply tires, as this can adversely affect the handling of a vehicle. This can severely damage the axle assembly or transfer case on four-wheel drive vehicles (4x4s). Note: "All Season Radials" are a poor substitute for winter snow tires.

13.5 Vehicle Maintenance and Inspections

To make sure of their reliability and safety, company vehicles should undergo regular maintenance and inspections. Drivers should conduct a daily safety check on their vehicle to determine any need for repairs before departing on a trip. If a vehicle is obtained from a motor pool, be especially careful to inspect it. No vehicle should be driven if it is not in roadworthy condition as a mechanical breakdown may put your safety and/or life in jeopardy.

13.5.1 Vehicle Maintenance

Log Book

Each vehicle should contain a log book to record mileage (km) and routine servicing or repairs to the vehicle. Drivers should keep the log book up-to-date. Use the log book to note any mechanical problems as soon as they are identified, including tires, steering, lights, windshield wipers, communication equipment, the exhaust system etc. Report problems to a supervisor so that repairs can be completed as soon as possible. Do not use defective equipment.

General Maintenance

- Follow the schedule for maintenance and inspections prescribed in the manufacturer's operator manual. Increase the frequency for heavily used vehicles.
- Contain all lubricants and fluids when maintenance is carried out.
- Maintain records of inspections and maintenance performed on company vehicles.

13.5.2 Regular Vehicle Inspections

Carry out a thorough safety check on all field vehicles at the beginning of the field season.

Daily Check

Before a vehicle is driven for the first time each day, the driver should walk around it before entering and note:

- Do the tires look properly inflated? If in doubt check with a tire gauge. Are the tires free of cuts?
- Are the windshield wipers properly attached and in good condition? Clean the windshield as required.
- Check the exterior lights. Are the lenses undamaged and clear of dirt or snow?
- Check the oil, coolant, and windshield washer levels. The vehicle should be level.
- Check the vehicle for oil leaks, grass or brush caught in or under the vehicle.
- Check that the brake lights and turn signal lights all function.

Start the engine and check the following:

- Adjust the mirrors and the head rest. Clean the interior windshield glass if needed.
- Listen for unusual sounds as the engine starts. Check gauges (oil, temperature, voltage) to be sure the vehicle functions correctly.
- Check the fuel level.
- Test the brakes. Check the brake pedal travel.
- Check the steering wheel play, gear linkage and the accelerator.
- Check the warning lights. Warning lights should go out when the engine is running. Never take a vehicle into the field if a warning light indicates a problem. Have a mechanic or trained people correct the problem.
- A pre-operation check form should be filled out by the driver and filed with the supervisor. In Canada, the records should be kept for three years to comply with Workers Compensation Board legislation.

Periodic Inspection

Make this inspection in addition to the daily check. The frequency will vary with vehicle use. With normal usage, a weekly inspection may be enough. With heavy usage, this inspection routine may be necessary each day. Pay particular attention to brake lines, fuel lines and tires.

- Check the battery acid level if the vehicle has a non-sealed battery. Battery acid should be about 5 mm higher than the plates. If necessary, add distilled water. Never smoke or use an open flame for light while checking battery acid levels because a battery produces hydrogen gas that may explode. Use a flashlight if a light is required. At the beginning of the cold season, make certain the vehicle battery is in good condition. Have the battery load tested (by a mechanic, if necessary) as it is possible for a battery to indicate it is well charged yet still be unable to turn over a motor.
- Check battery connections. Make sure they are tight and corrosion free. Keep the terminals clean and lightly coated with petroleum jelly, which will reduce corrosion.
- Check the radiator coolant level when the engine is cold. If it is low, top up the coolant with the appropriate mixture of water, antifreeze or corrosion inhibitor.
- Check the brake fluid level. Top up with the same type of fluid. Before adding fluid, clean around the cap so no contaminants enter the reservoir.

- Check the fluid level in the hydraulic clutch reservoir (manual transmission) or the power steering fluid level (automatic transmission).
- Check the automatic transmission fluid level according to the manufacturer's instructions.
- Check all hoses and lines. Check all radiator hoses, fuel lines, brake lines and those associated with power steering for cracks or leaks. Connections should be tight and hoses free of kinks or swellings and with no wear marks that indicate rubbing or friction points.
- Check wires and electrical connections. Make sure they are firmly connected and do not rub against anything.
- Check the tire pressure, including the spares. Check for any tire damage. Only full size tires may be used as spares on field vehicles. Set the tire pressure according to the specifications in the manufacturer's operator manual. Tire valve caps should be present, as they keep out moisture and dirt, which might distort the valve and allow air to leak from tires. The following website contains excellent information about tires: http://www.nhtsa.dot.gov/cars/rules/TireSafety/ridesonit/brochure.html
- Check all necessary equipment. Make sure that the required tools, first aid and emergency kits are present and complete.

13.5.3 Contractor's Vehicles

If you are required to drive a contractor's vehicle, do not assume that it is in good working condition. Carry out a thorough roadworthiness test. Make certain that the brakes, steering, lights and other controls work properly. Perform the daily and periodic inspections on the vehicle to protect your own safety.

13.5.4 Rental or Leased Vehicles

- For a rental or leased vehicle, the driver's name and valid driver's license number is required to appear on the rental or lease agreement. Keep the agreement in the vehicle at all times. Carry your driver's license and insurance papers while operating the vehicle. Only persons listed on a rental agreement may drive a rental vehicle unless there are extenuating circumstances e.g., for the safety of individuals in the vehicle.
- Perform inspection procedures on rental or leased vehicles that are used for field work. Even when a vehicle is rented for a short time, check that the vehicle has an appropriate jack and full size spare tire if the vehicle will be taken on rough roads. Assemble the necessary equipment in leased vehicles before driving them to the field.
- Try to avoid driving in countries where the roads and driving are particularly hazardous. In some places, foreigners may be automatically implicated in any collision if they were driving. Therefore it is advisable to have local citizens do the driving. Where the company office employs professional staff drivers, arrange to use these drivers. Where no staff drivers exist, try to obtain a driver associated with a hotel with which you are familiar.
- In certain countries, employees renting vehicles while on company business should consider what insurance is included in the rental car rate and take out any additional insurance that is required to comply with local insurance laws. See that there is insurance to cover any damage to the hired vehicle and also damage to other property including third party vehicles. This is important to avoid delays or problems with local officials in the event of a collision.

13.6 Training

Exploration companies should see that their employees have the knowledge and skills to handle both 2-wheel and 4-wheel drive field vehicles if it is part of their job. Companies may consider a driving probation period for new employees. Team an inexperienced driver with an experienced driver rather than two inexperienced drivers together.

As a minimum, training should provide instruction in the safe operation, loading and handling of vehicles to meet the local conditions where they will be driven. Employees need to know the performance limits of the vehicle and its equipment and should demonstrate to a qualified supervisor that they are competent to drive company vehicles. To prevent crashes, employees should develop safe driving skills and attitudes and learn defensive driving techniques. Practice skills such as changing tires, using jacks and winches before they are needed in an emergency. Defensive driving courses are offered through the Canada Safety Council. Website: http://archive.safety-council.org/training/DDC/ddc.htm

If off-road driving is a significant part of field work, the following website gives the location of some training schools: http://www.oramagazine.com/pastIssues/0507-issue/050703t-finesse.html

13.6.1 Loading Guidelines

Learn how to load the vehicle correctly. If you are towing a trailer, load it according to the directions in section 13.7.5 Towing.

- Do not exceed the GVWR (Gross Vehicle Weight Rating). Refer to the vehicle's operator manual or the certification regulation plate mounted on the vehicle.
- Securely anchor all internal and external loads. Secure all items. Loose items may become airborne if you suddenly stop. Consider installing a cargo barrier between the passenger and cargo sections.
- Balance all loads both inside and outside the vehicle. Place heavier items forward near the cab (pickup trucks) and place lighter items toward the rear to avoid undue stress on the rear springs. The heaviest items should be loaded in front of the rear axle. Check frequently for spills and leakage when transporting liquids.
- Only light loads are permitted on roof racks. Make sure these are thoroughly secured and do not obscure the driver's vision.
- Transport propane tanks, fuel drums and gas bottles on the back of flatbed or pickup trucks. Always transport these items securely tied in an upright position. Do not transport them inside a hardtop vehicle.
- Avoid transporting passengers in the back of pickup or flatbed trucks.
- Follow Transport Canada regulations for the transportation of dangerous goods. Information is available at the following website: http://www.tc.gc.ca/tdg/who.htm

13.6.2 Vehicle Controls and Equipment

It is very important to refer to the operator's manual for any vehicle or related equipment (e.g., winch, jack, tow bar) when you use it the first time. Some equipment may require operating procedures that are not covered by (or vary from) this guide. The directions in this section should not supersede instructions given in a manufacturer's operator manual.

- Make sure you are familiar with the controls of the vehicle before driving it (headlights, windshield wipers, turn signal etc). Check the operator's manual.
- Do not drive while using a handheld mobile/cell phone or radio. Use a handheld telephone only while stopped. Pull over to the side of the road in a safe place.
- Know the capacity of the fuel tank and carry extra fuel, oil and water when driving in remote areas. Use the fuel in an auxiliary tank first (if fitted) followed by fuel from the main tank. Then, the gauge will indicate the final reserve. Switch fuel tanks before it is empty. Try never to run dry as contaminants (dirt, water) may be sucked into the carburetor or injectors.
- Do not engage the overdrive feature when driving off-road, in town traffic, on wet roads or on gravel, snow and ice.
- Know when it is appropriate to use the "cruise control" feature. Cruise control should not be used on twisty two-lane roadways, on snow-covered roads, in icy conditions, or in heavy traffic.

13.6.3 How to Change a Tire

Check the vehicle operator's manual for specific instructions about how to change a tire. Whenever possible, use an axle or frame jack (not a Hi-Lift jack) to change a tire. Because vehicles on jacks are very unstable, never allow passengers to remain inside or enter a vehicle once it is raised on a jack. If a Hi-Lift jack (bumper jack, Jack-All, kangaroo jack) is used, pay strict attention to safety (see section 13.6.4 below). The following are general instructions.

1. Change a tire only on a safe, level and firm surface – well off the road. If necessary, drive on a flat tire to find a safe location to change it.
2. Put on the four-way hazard flashers or set out warning flares, if needed.
3. Place the transmission in P (Park) for automatic transmissions or in gear for standard transmissions. Set the hand brake firmly before turning off the engine. Never start the engine of a jacked-up vehicle as the action may cause it to drop off the jack.
4. Remove all necessary tools, equipment and the spare tire from the vehicle prior to jacking. Do not enter the vehicle or the trunk once it is jacked-up as the motion might cause the vehicle to fall off the jack.
5. Chock ahead and behind the three remaining wheels with large rocks or pieces of wood. It is especially important to chock ahead and behind the wheel diagonally opposite the flat and both front wheels if the flat is on a rear tire. Place extra support under the vehicle, if possible. An extra spare tire works well.
6. Check the vehicle manual to locate the proper jacking points and for any suspension features that require deactivation before jacking (such as air suspensions). Use the jacking point nearest the tire being changed.
7. Follow the instructions for the type of jack available. Adjust the jack until it is firmly in place and the base is stable. Never place a jack on an icy, slippery or sloping surface.

Consider carrying a small steel plate or a heavy piece of wood for a base if you make frequent tire changes or if a Hi-Lift jack is the only type available. In muddy conditions, a strong wooden base may be essential for the jack to perform properly.

8. Loosen the wheel nuts slightly with the lug wrench before jacking, but leave them on so the wheel does not fall off. If they are very tight or rusted, you may have to step on the lug wrench to move them.
9. Jack the vehicle up the minimum height necessary to change the tire. Usually 5 cm (2 in) clearance under the flat is sufficient.
10. Remove the wheel nuts and then remove the wheel. Remember to remove the topmost wheel nuts last and replace them first so the tire does not fall onto you. Replace the flat with the spare. Do this gently so you don't cause the vehicle to fall off the jack.
11. Install the wheel nuts with the bevelled end inwards to tighten onto the rim.
12. Hand-tighten all the wheel nuts snugly before lowering the jack.
13. Lower the vehicle until the tire just touches the ground. Avoid rocking the vehicle.
14. With the lug wrench, tighten the wheel nuts fully. Use a criss-cross sequence (top-bottom-left-right) to obtain even tension.
15. Lower the vehicle and remove the jack. Tighten the wheel nuts again with the lug wrench. Place the flat in the spare wheel position. Replace all your equipment so it is available the next time it is required.
16. Check the wheel nuts again after travelling about 40 km (25 miles).

Note: Never crawl under a jacked-up vehicle for any reason unless it is also supported on blocks. Do not use concrete blocks as these may break.

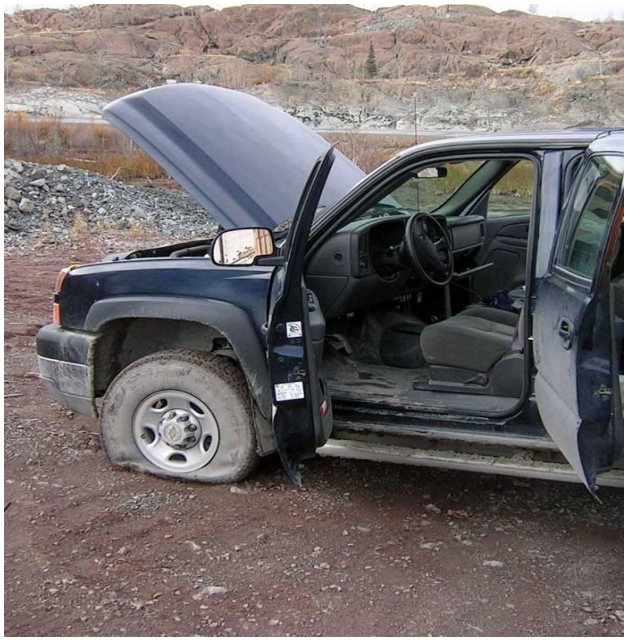

Figure 13.1 : Follow safe procedures when changing a flat tire. © Courtney Mitchell

13.6.4 How to Use a Hi-Lift Jack (Jack-All, Kangaroo Jack)

The Hi-Lift jack is a useful tool for off-road work, but also a potentially dangerous tool. It is advisable to use an axle jack for routine tire changes, depending on the weight of the vehicle. To increase safety when using a Hi-Lift jack, follow instructions that come with the jack and accessories, including those for lubrication and storage. If unavailable, instructions are available at the Hi-Lift website: http://www.hi-lift.com/media/pdfs/jack_instructions.pdf. A DVD (Digital Video Disc) is also available from the company that includes instructions for using a Hi-Lift jack and accessories. If none of these are unavailable, follow these guidelines:

- Vehicles may easily slip off a Hi-Lift jack. Never stand or work in an area where the vehicle might roll or slide if it slips off the jack.
- Hi-Lift jacks are difficult to use on vehicles that do not have steel step bumpers. Whenever possible, attach a Hi-Lift jack to the bumper, as the vehicle is less likely to slip off the jack. Note: Do not use a Hi-Lift jack on vehicles with a plastic bumper (it will break) or a rounded bumper, as the jack will not correctly fit onto this style of bumper. Hi-Lift supplies a "bumper lift" that can be attached to fit curved steel bumpers. Hi-Lift also supplies a "lift mate" accessory that can be attached to a wheel to lift it.
- Inspect the jack before use to see that it is complete and in good repair. It should be lubricated and free of dust and dirt to work correctly. Follow the instructions that accompany the jack.
- Place chocks before and after the tires to prevent the vehicle from rolling. Set the hand brake.
- Always use a firm base under a Hi-Lift jack (steel plate, wooden block, flat rock).
- If using a High-Lift jack for winching, follow the instructions with utmost care.
- Using a Hi-Lift jack as a chain tightener is very dangerous. If you use it for this purpose, follow the instructions with utmost care and keep your head well out of range of the handle.

WARNING: To raise or lower the vehicle, the reversing latch of the Hi-Lift jack must be in the appropriate UP or DOWN position. NEVER move the position of the reversing latch unless the jack handle is in the upright (vertical) position against the steel bar. If the jack handle is horizontal when the latch position is changed, the handle may quickly move up and down out of control. It may hit the operator and cause serious injury or even death.

Follow this sequence when raising a vehicle with a Hi-Lift jack.

1. Make sure the jack handle is in the upright position against the steel bar.
2. Lock the reversing latch in the UP position.
3. Make sure the lifting mechanism or "nose" fits firmly under the bumper or jacking point before starting to raise the vehicle.
4. Pump the handle up and down with both hands to raise the vehicle. Never use an extension on the handle. The vehicle will rise with each down stroke. Keep your head and body out of range of the jack handle.
5. Stop if there is any indication of instability with the jack or the vehicle.
6. Place the handle in the upright position as soon as the vehicle is raised high enough. Never leave the jack with the handle in a horizontal position.
7. Chock the vehicle before you proceed with changing a tire. Place supports under the vehicle before carrying out any work underneath it.

Follow this procedure when lowering a vehicle with a Hi-Lift jack.

1. Make sure the jack handle is in the upright position against the steel bar.
2. Lock the reversing latch in the DOWN position.
3. Carefully pump the handle up and down with both hands to lower the vehicle. The vehicle will lower with each up stroke. Keep your head and body out of the path of the handle in case the vehicle or the jack slips.

WARNING: Do not push a vehicle off a High-Lift jack. Pushing a vehicle off a Hi-Lift jack is extremely dangerous; the vehicle may not go where you intend it to go.

13.6.5 Starting a Vehicle with Booster Cables (Jump Start)

This procedure can be dangerous as batteries contain hydrogen gas and sulphuric acid that, if ignited, could explode and cause severe burns. Cold temperature increases the danger. Never smoke or allow open flames around batteries. Both the boosting battery and the dead battery must be the same voltage. A set of booster cables contains one cable with RED (positive) clamps and one cable with BLACK (negative) clamps. Work carefully to avoid electric shock. When connecting the booster cables to a battery terminal, be sure the clamps do not touch each other. If possible, work in an open area – not in a garage – and wear goggles or safety glasses.

- Remove rings and wristwatch from your hands and wrist to prevent unplanned contact with the battery terminals and booster cable leads.
- Place the vehicles close together but not touching each other.

These instructions apply to vehicles with batteries that are grounded (earthed) at the negative terminal. Follow this battery-cable connection sequence exactly. Failure to do so could result in personal injury or damage to batteries and the electrical systems of both vehicles.

1. Clamp one RED (positive) clamp onto the positive terminal of the good battery.
2. Clamp the other RED (positive) clamp onto the positive terminal of the “dead” battery.
3. Clamp one BLACK (negative) clamp onto the negative terminal of the good battery.
4. Clamp the remaining BLACK (negative) clamp to the engine block of the “dead” vehicle. This grounds the electrical circuit to help prevent short circuiting.
5. Start the engine of the vehicle with the good battery and rev the engine slightly.
6. Start the engine of the “dead” vehicle and let both vehicles idle for a few minutes.
7. Turn off the ignition of the vehicle with the good battery.
8. Remove the cables in exactly the reverse order – 4, 3, 2, 1.

13.6.6 Winches

There are various types of winches; some are power operated and are normally mounted on the front of a vehicle. Other winches are hand operated. Choose the winch that is appropriate for the vehicle, which depends on how and where it will be used. Learn how to operate the winch on the vehicle by reading the operator’s manual. Practice in a safe place – before you need it in an emergency. Most winches also have instruction decals attached directly on them. Do not remove any instruction or warning decals.

A ratchet type or “come-along” hand operated winch is very useful to pull a vehicle out of mud or a ditch. A come-along winch only has about 3 metres of cable so an additional strong recovery strap or cable is required. Do not use small hand winches with nylon cables for winching vehicles as the nylon stretches and will backlash very badly if the hook slips.

Additional recommendations for using a winch

- Assemble the necessary winch accessories required for safe operation. These include heavy leather gloves, hook strap (to keep fingers away from the fairlead opening), choker chain, tree saver straps, block and tackle, clevis or D shackles, and a correctly mounted tow hook. Maintain the equipment in good condition and inspect the cable periodically. Recovery straps or ropes are safer than chains or cables, but require a second vehicle for pulling. Inspect the winch and cable before use. Do not use kinked, frayed or damaged wire rope/cable. Replace it.
- Plan the pull. It may take two steps to extract a vehicle or remove an obstacle. Plan for safety.
- Never overload a winch. Refer to the winch operator’s manual for the winch lifting or pulling capacity and do not exceed it. Most winches have the rated capacity stamped on them. Know the cable capacity and make sure the winch and cable are capable of doing the job. Remember that the terrain and slope affect the pulling capacity of the winch.
- When using a winch to pull out a vehicle, attach the hook to the frame or a frame-mounted tow hook on that vehicle. Never attach it to the bumper or to any moving part of the vehicle (e.g., axle, shocks, springs and steering mechanisms). Do not connect a recovery strap with a winch hook to extend the length of a pull.
- Wear leather gloves to avoid cuts from frayed cables.
- Steel winch cables may snap or tear free during winching operations. No one should ever stand within range of a cable that might whip backwards. Try to visualize the possible paths of a snapping cable so that all spectators stand at least as far away as the snapping cable can fly. Stand clear before the cable is tightened. Use a remote control whenever possible.
- Raise the hood of any vehicle involved in winching to protect the windshield from a snapping cable. Drape a blanket, tarp, or even a jacket over the cable to help dampen any whipping action. Do not allow the drape to be wound into the winch.
- Never step over a winch cable that is under tension. Walk around.
- Keep the winching action straight – as close to 180° as possible – to maintain the capacity of the winch. Pull at a different angle only long enough to straighten the load. Use a slow, steady motion.
- Remember to leave enough cable on the winch spool (at least 5 turns). Perform the winching operation twice rather than risk detaching the cable from the winch spool. Make sure the cable will wind on properly and not develop kinks or knots. Rewind the cable onto the spool smoothly after the job is done.
- If the winch relies on power from the vehicle battery, do not deplete the battery to the point that the engine will not start once the job is finished.
- Turn the switch off if the winch motor stalls; check if the motor is hot – do not let it overheat.
- Always use genuine rather than non-standard “over-strength” shear pins. Carry extra shear pins and know how to replace them in the winch.

- Do not use your winch to tow another vehicle. A sudden shock load may exceed the capacity of the winch. Use a tow strap or chain.

Note: If you use a Tirfor winch, also known as a Griphoist winch, it is absolutely mandatory to use the genuine Tirfor cable with this type of winch, as regular cable is made of softer steel and can slip out of the Tirfor jaws.

13.6.7 Fuelling Procedures

- Use the correct fuel.
- Fuel at a designated fuel site whenever possible.
- Fuel only in an open well-ventilated area with the engine stopped.
- Do not smoke. Do not allow open flames or sparks in a fuelling area.
- Do not top up and overfill the tank. Close the tank cap securely when fuelling is completed.
- Clean up any fuel spills completely using spill kit materials as required. Dispose of contaminated materials in appropriately marked containers.
- Portable containers for fuel must be CSA (Canadian Standards Association) approved. When filling portable containers, always place them on the ground outside a pickup bed, enclosed vehicle or a trailer so the containers are properly grounded. Only fill the containers to 95% capacity, as fuel expands as it warms. Mark containers with a line to indicate “full”. If possible store fuel containers in a cool location out of direct sunlight.
- If a truck has a vinyl bed liner always place CSA approved gas cans and equipment with small motors (chainsaws, generators) on the ground to fuel them. Vinyl bed liners prevent the grounding (earthing) of the can or equipment. Static electricity builds up when the fuel flows through the hose into the can. A spark may cause vapours to ignite and explode when the nozzle is withdrawn. Do not fuel ATVs or snowmobiles being transported in a truck with a vinyl bed liner – fuel them when they are on the ground.

13.7 Handling and Driving Skills

13.7.1 Braking

Good braking skills are fundamental to safe driving. The following practices will increase safety and help avoid accidents. Anti-lock brakes (ABS) systems are common in vehicles. The following website provides an explanation of their purpose and function:
http://www.tc.gc.ca/roadsafety/tp/tp13082/abs1_e.htm

- If the vehicle has ABS (anti-lock brake system) brakes, use a steady, firm foot action when applying the brakes. Do not pump the brakes, especially in an emergency. The chattering or groaning noise you hear when firmly applying ABS brake is an automatic pulsing action, which indicates they are working correctly. While ABS brakes improve the vehicle control when braking on slippery surfaces, having ABS brakes will not shorten the distance required to stop the vehicle. It always takes longer to stop on slippery surfaces than on dry surfaces. The incorrect use of ABS brakes may contribute to the cause of a crash.

- Try to avoid heavy braking on a curve, which may cause a vehicle to skid and possibly roll over.
- Reduce speed and downshift to a lower gear when descending long or steep hills. Most vehicles with automatic transmission can be manually downshifted to reduce speed appropriately. Let the engine, rather than the brakes, do the work.
- If your vehicle stalls and you have power-assisted brakes, depress the brake pedal only once to stop. Do not pump your brakes as this will use up the vacuum reserve in the brake system.
- Do not brake suddenly if you have a flat tire while driving. Steer a straight course and reduce speed gradually. Choose a safe place to pull completely off the road and change the tire.
- Brake smoothly while driving straight ahead to avoid jackknifing when towing a trailer.

A vehicle's braking ability may be impaired if the brakes are wet. While most vehicles have disc brakes that are not always affected by water, drivers should be aware of the possible consequences of wet brakes. It may increase the distance required to stop or cause the vehicle may pull to one side. Test the brakes after crossing streams or driving through deep puddles. Test the brakes periodically when you drive on slushy or muddy roads (see section 13.8.3 Weather-Related Driving Tips).

To test the brakes, check that no traffic is nearby and do the following:

- Depress the brake pedal lightly to determine if the brakes respond normally. If they do not, they are probably wet.
- If the brakes are wet, continue to drive carefully for a short distance while applying light pressure on the brake pedal. This will heat the brakes and evaporate any moisture.
- If the brakes do not function properly after these measures, it is not safe to continue driving.

13.7.2 Parking

The following parking guidelines are designed to eliminate injuries and property damage caused by uncontrolled movement of unattended or improperly parked vehicles.

Parking light vehicles and four-wheel drive vehicles

- To reduce the risk of collisions, back into parking spaces or choose a parking space where you can exit by driving forward.
- Place the gearshift in P (Park) for vehicles with automatic transmissions. For manual transmissions, leave it in gear.
- Turn the engine off and engage the parking brake before leaving the vehicle.

When you park on a hill, turn the wheels so that if the brakes fail, the vehicle will coast off the road and away from traffic. Set the parking brake whenever you park a vehicle on a hill. Set the gearshift in P (Park) for automatic transmissions; set it in first or reverse gear for manual transmissions. Chock the wheels, if necessary.

- When you park heading downhill, turn the front wheels in the direction of the curb and allow the vehicle to move forward until the front of the wheel rests against the curb.
- When you park heading uphill, turn the front wheels in the direction of the street and allow the vehicle to reverse slightly until the back of the wheel rests against the curb.
- If you park on a hill with no curb, turn the front wheels toward where the curb would be.

When you park at a work site or remote location:

- Park in an identifiable and cleared area. Check for overhead dangers from falling trees or branches, rocks or snow. Avoid parking over dry flammable material.
- Park facing the exit direction so you are ready to drive away. A surprising amount of vehicle damage occurs at the end of a day's hard work. Also, it is easier to make a rapid exit in case of emergency.
- When parking pickups near a helicopter landing site, make sure that all lightweight materials in the bed of the pickup are weighted down and rubbish is removed to prevent the downdraft from sending them into the air. Designated parking areas for vehicles should be at least 50 metres from the landing site and away from the flight path.

13.7.3 Reversing

- Before reversing, check that there are no obstacles, pedestrians, or traffic in the intended path of movement. If there is any doubt, get out and check by walking around the vehicle before backing up.
- It is advisable to equip field vehicles with an audible back-up alarm.
- Mines Acts and regulations require an audible back-up alarm on vehicles at a mine site. Check that your vehicles meet the jurisdictional requirements.

13.7.4 Crossing Streams

Be cautious when driving across streams. Do not attempt a crossing unless it is absolutely necessary. Check both upstream and downstream for some distance to determine if there is a better place to cross. Remember, if in doubt – Do not cross.

- Get out of the vehicle and walk across to check the following: the entry and exit points, water depth, firmness of the stream bed, the presence of flowing current, and for hidden hazards. Check that there are no washouts (washaways) or potholes.
- If the water is too deep for a safe crossing (more than 0.5 metres or 20 inches), determine if the water level is rising, falling or stationary. Place a stick at the stream edge and observe the ebb and flow at that point. You can then estimate if a safe crossing will be possible within a reasonable length of time.
- Once you enter the water, try not to depress the clutch, as this may allow water into the transmission and affect the operation of the clutch.
- Drive slowly when you cross, as there may be hidden hazards. If necessary, use low range gears and drive with enough power to prevent water entering the exhaust pipe.
    - It is essential to prevent water from entering the engine air intake, as major damage can result if even a small amount of water is sucked into the engine. Vehicles can

stall if you drive too fast and the fan sprays water over the ignition system. Placing a sheet of plastic in front of the radiator will help prevent water from flowing through the radiator grill and being sprayed by the fan. This will also reduce the possibility of mud clogging up the radiator grill. Remember to remove the plastic afterwards or the engine will overheat. Do not remove the fan belt.

  - After entering the water, accelerate to create a reasonably small bow wave in front of the vehicle and then maintain this wave with a steady speed. If there is a fast-flowing current, cross at an angle against the flow from downstream to upstream to help maintain a bow wave.

- If the vehicle stalls, do not try to restart the engine if the tail pipe is under water, as this will suck water into the engine.
- Check if the brakes work properly afterwards (see section 13.7.1 Braking).
- Do not drive through flash floods or on flooded roads as the water may hide washouts. Avoid driving in dry stream beds, as they may undergo torrential flash flooding (refer to section 9.5 Floods).

13.7.5 Towing

Driver error, excessive speed, improper load management and improper equipment maintenance are the four main causes of vehicle-trailer accidents. If purchasing a vehicle that will be used to tow trailers (including boats, snowmobiles or ATVs), investigate if there is a “tow package” option for the vehicle, as it may increase the towing capacity and safety of the vehicle. The vehicle needs to have adequate power to safely haul the loaded trailer. Vehicles handle differently while towing a load so drivers should receive training in towing procedures and review a copy of appropriate operator’s manuals. Information regarding towing is available at the following website: http://www.nhtsa.gov/cars/problems/Equipment/towing/index.htm

Select the correct trailer and towing equipment for the job.

- Choose the correct trailer so the load is legal and it handles correctly. The Gross Combined Mass (GCM) of the trailer determines whether the trailer requires a braking system.
- The total weight of the trailer and cargo load should not exceed the vehicle’s weight restrictions. Overloading can cause tire failure, broken springs or shackles, or structural failure of both the trailer and towing vehicle. Overloaded trailers may overturn more easily. Refer to the vehicle’s operator manual or the vehicle certification regulation plate for the specified weight limit.
- One method to determine the appropriate capacity of a trailer for the job: Compute the weight of the load and add 33% to compensate for bad roads, extra equipment etc. The “load” equals the boat, ATV, snowmobile, fuel and/or field equipment etc., that will be transported.
- A trailer used for field work may require an extra heavy duty suspension system.
- Use a hitch that suits the size and weight of the vehicle and trailer. The vehicle’s operator manual will indicate the specifications. Make sure the ball hitch and socket are the same size by checking the size stamp on both parts. Consider installing a stabilizer bar if you will drive on very rough roads.
- If towing a boat, the trailer and boat should be compatible so the boat is correctly supported.

Trailer Inspection

Before loading any trailer, check for:

- Structural damage
- Condition of the trailer hitch
- Worn or damaged springs, shackles, signal lights, brakes and tires
- Leaking bearings or missing bearing covers (jack up the trailer, grasp the wheel and rock it to see if there is play and listen for a rumbling noise, which indicates worn bearings)
- Spare tire (fully inflated)
- Check that the signal lights are correctly placed and functioning. The following website indicates the required location of lights for trailers: http://www.tc.gc.ca/roadsafety/tp/tp13136/trailer_e.htm

Prepare and load the trailer correctly before departure.

- Use tires on a trailer with the highest load rating that will fit on the trailer, as this helps prevent blowouts. Check the tire pressure when the tires are cold.
- All trailers should be equipped with safety chains in case the hitch breaks. Make sure to attach the safety chains properly; safety chains should cross under the tongue and be secured to the vehicle. They should be long enough to permit proper turning, but no longer.
- Distribute the load in the trailer so that it is slightly heavier toward the front yet without excessive weight on the tongue. Check the trailer and vehicle operators' manuals regarding the correct tongue weight. Normally it is between 10% and 15% of the loaded trailer weight. The vehicle and trailer should be level when hitched – either with the trailer loaded or unloaded. There should be no appearance of "nose-up" or "nose-down". Proper load distribution helps reduce fishtailing and sway.
- Load the heaviest objects of the cargo as low as possible to maintain a low centre of gravity. Loads should be balanced across the trailer width. Secure the cargo thoroughly so that no shifting will occur. It is illegal to tow a trailer when the load is not properly secured.
- Any load that extends more than 1 metre behind the trailer should have a clearly visible white, red, orange or yellow fluorescent flag attached.
- Load snowmobiles with skis forward to avoid snowmobile windshield damage. Remove windshields if possible.
- The driver needs clear, unobstructed visibility when towing a trailer. Vehicles that tow loads should have rear view mirrors designed for extra visibility.
- Practice turning, stopping and backing up before actually towing the trailer on a trip. Practice in an area with no traffic and get the feel of it.
- Make sure the load has not shifted after arriving at the destination. Chock the wheels before uncoupling the trailer or unloading heavy items to make sure it does not roll.

Inspect the loaded trailer and vehicle before starting each trip.

- Complete an inspection of the vehicle, including all fluid levels, tire pressure and the brakes. Complete a full inspection of the trailer hitch, safety chains, wheels, tires, lights,

load distribution and load security. Check that trailer-vehicle connections are secure and all lights function properly. Check the tire pressure on both the vehicle and trailer. Test the vehicle brakes (and trailer brakes if present).

- After driving a short distance, stop and check the lights and connections again. Do a thorough vehicle and trailer check at appropriate intervals.

Towing Skills and Tips

Perform all starting, stopping and steering actions smoothly to avoid possible skids and jackknifes. This is especially important when driving on wet or slippery surfaces.

- Leave extra distance between your vehicle and the vehicle ahead. A good rule is to allow the vehicle ahead to pass a fixed point at least 5 seconds before you pass that same point ("5 second rule").
- Excessive speed is one of the major causes of towing accidents. Do not exceed the posted or recommended towing speed limit, and reduce your speed if the driving conditions deteriorate. If the vehicle-trailer combination fishtails and sways while underway, you are travelling too fast. Swaying increases with speed. Slow down when driving in poor weather, when road conditions are slippery or rough, and in heavy traffic.
- Passing other vehicles: Towing greatly affects the ability of a vehicle to accelerate, pull into traffic, change lanes, pass, and perform other manoeuvres. Allow plenty of room to accommodate the vehicle and trailer. Change lanes smoothly, overtake, and return to your lane without crowding other vehicles. Remember that a vehicle towing a trailer will accelerate less quickly.
- Stopping distance: Vehicles towing loads require extra distance to stop. Avoid sudden stops, which may cause the trailer to jackknife or the load to shift.
- Braking: Apply brakes gently and smoothly.
    - Brake gently *before* entering a turn. When turning, the extra weight of the trailer will continue pushing the vehicle ahead, especially on gravel or slippery roads. It is easy to lose control and jackknife. Also, entering a corner too fast may cause the trailer to pull the vehicle off the road causing a rollover.
    - Use a wider turning radius when turning a sharp corner (e.g., at intersections). The trailer wheels on the inside of the curve will track closer to the curb than those of the vehicle.
    - Do not use the brakes for extended periods as they may overheat; then you may experience brake failure. Downshift when descending long or steep hills and let the engine do the braking.
- Off-road towing requires extra caution. Very uneven ground may cause severe pitching at the hitch. It is easy to jackknife when towing a load down steep slippery slopes because braking and handling are more difficult. Slow down and use a lower gear.
- Cross-winds will cause trailers to sway. Swaying may also happen when large vehicles pass you. Prepare for cross-winds by holding the steering wheel firmly. Be ready to reduce speed by releasing your foot gradually from the accelerator. Do not brake suddenly and continue to steer straight ahead. Slow down.
- In hot weather or in mountainous areas, watch the temperature gauge for signs of overheating. Carry extra radiator coolant (see below: If the Engine Overheats in section 13.8.3).
- Downshift when climbing hills to maintain speed.

- Do not engage cruise control while towing a trailer.

Backing a Trailer

- Use extra caution when backing a vehicle-trailer combination. Get out of the vehicle and check for hazards before backing. If possible, have someone guide you to help avoid obstacles. Practice backing before getting underway.
- Technique tip: Hold the **BOTTOM** of the steering wheel with one hand and move your hand in the direction you wish the trailer to turn. Turn the wheel a little at a time. Go slowly.

To back a trailer to left

To back a trailer to right

Figure 13.2: Backing a trailer

Parking a Vehicle and Trailer

Always try to park on level ground rather than on a slope**.** Try to find a place to park where you can manoeuvre the trailer easily and position it for an easy departure. Chock the wheels of both the vehicle and the trailer.

If it is absolutely necessary to park on a slope, a helper should place chocks against the downhill side of the wheels of both the trailer and vehicle and then:

- For automatic transmissions: Apply the parking brake, then shift into PARK, and finally take your foot off the brake pedal. It is possible to damage the transmission if you place the vehicle in PARK before the other actions.
- For manual transmissions: Apply the parking brake and then turn off the motor in either first or in reverse gear.

When you drive away after parking on a slope:

1. For automatic transmission: Start the engine with your foot on the brake pedal. Shift into gear.
2. Release the parking brake and foot brake. Slowly move away from the wheel chocks. Have a helper pick up the chocks.

13.8 Defensive Driving Skills and Attitudes

Defensive driving is defined as "driving to prevent collisions in spite of the actions of others and the conditions around you". According to statistics, drivers can prevent 85% of vehicle collisions. The aim of defensive driver training is to develop driver attitudes and skills that will result in fewer vehicle accidents. Defensive drivers are able to recognize impending road hazards and emergencies. They know the best ways to handle them and react in time to prevent accidents. Employees should drive defensively at all times.

The Canada Safety Council website provides information about their defensive driving course: http://archive.safety-council.org/training/DDC/ddc.htm

13.8.1 General Defensive Driving Techniques

Eighty-five percent all collisions are preventable using defensive driving techniques.

- Adjust your speed to the driving conditions. Drive steadily and smoothly maintaining sufficient distance between your vehicle and the one ahead to allow you to stop should the other vehicle suddenly stop.
- Reduce speed when encountering adverse road conditions. These include heavy traffic, bad weather, poor light or visibility, and hazardous road surfaces (e.g., water, sand, oil, ice, snow, wet leaves, potholes, mud, ruts).
- Anticipate possible problems by scanning well ahead and behind the vehicle. If you identify a hazard, take preventative action. Don't have a "wait and see" attitude.
- Respect the "3 second rule" for safe following distance. Under normal conditions, allow the vehicle ahead of you to pass a fixed point 3 seconds before you pass that same point. This computes to one vehicle length for every 15 kph (10 mph). Increase this following distance when experiencing adverse conditions or when towing a trailer (use a "5 second rule").
- Be ready to yield the right-of-way to another vehicle to avoid a collision. An aggressive driving attitude often causes accidents.
- Drive with the daytime running lights or headlights on at all times where this is legal. Other drivers can see your vehicle more easily.
- Do not assume other vehicles will turn in accordance with their turn signals. Wait until they have commenced the turn before passing or pulling out in front of them.
- Do not run yellow lights. When leaving a stop light, wait a couple of seconds and look both ways after the light changes to allow "red light runners" through the intersection.
- Maintain an even temper. Do not drive when you are emotionally upset. Don't let another driver's bad driving cause you to lose your temper and do something stupid or have an accident. Road rage can be a serious problem.
- Know how to control skids.
- Be attentive. Keep your eyes moving so you don't develop a fixed stare.
- Wildlife: Be aware of the potential for collisions with wildlife or free range livestock, especially at dusk and dawn, although deer and moose may be encountered any time. Animals are attracted to road salt in the spring and are very active during rutting season. They may freeze in the headlights or bolt into the road at the last moment. Aim for the rear end of a large animal if a collision is imminent, as big animals rarely reverse their direction. Due to their dark colour, bison are very difficult to see at night. They favour

roads for warmth and salt while they forage along the shoulders. The following websites provide more information regarding wildlife and road safety.
http://archive.safety-council.org/info/traffic/roadkill.html
http://safety-council.org/safety-canada-online/issues/2007/10/4/public-safety-oh-deer-oh-moose-oh-my/

- Watch for trains at level crossings. Never race a train to an unguarded crossing or drive around lowered crossing gates. When a train has passed, wait a moment and look for another train when there are multiple tracks. If you routinely drive over train crossings, be informed about the hazards and read the information at the following website: http://www.ibc.ca/en/BeSmartBeSafe/Road_Safety/Train_Safety.asp
- Disengage the overdrive feature when descending steep hills to slow your speed. Downshift to a lower gear, if necessary. Let the engine rather than the brakes do the work.
- Proceed with extreme caution near the site of a crash. Other drivers looking at it may not be paying attention to their driving.

In addition to defensive driving techniques, the following strategies help reduce accidents.

- Avoid fatigue. Driver fatigue is a very serious but under-rated problem. Limit driving to no more than 9 hours a day, if possible. Take a break about every 2 hours. As you tire, eye movements slow down. You lose peripheral vision and do not process information as quickly. Therefore, you will not notice potential driving problems as quickly as when alert. Once you become aware of fatigue, it has already reached an acute stage. If you feel tired, stop and take a nap or ask someone else to drive. Information regarding this serious problem is available on these websites:

  http://www.fatigueimpairment.ca/documents/2008_02_14_Understanding_Driver_Fatigue_HSR.pdf
  https://www.cagc.ca/_files/practices/pdf/enform_fatigue_2006.pdf
  https://www.cagc.ca/_files/practices/pdf/gtsw_final_2007.pdf
  http://archive.safety-council.org/info/traffic/wake-up.html
  http://archive.safety-council.org/info/traffic/fatigue-06.html
- Plan routes and time of travel with road safety in mind – consider the road quality. If necessary, take into account any potential threat to personal safety (e.g., armed hold-ups, animals).
- Know how to reach your destination so it is not necessary to travel in convoy with another company vehicle or refer to a map while driving.
- Park the vehicle in a safe place when you stop by the side of the road. Park well off the road on a straight stretch away from curves, hills and intersections.
- Minimize night driving whenever possible. Avoid driving at night, in areas of known increased risk (wildlife, pedestrians, violence), and after a day's work or a long flight. If unavoidable, have two drivers in the vehicle or hire a driver.
- Don't push the weather. Snow – wait until roads are ploughed; fog – wait until it clears or travel at a speed that does not exceed your visibility with low beams on; rain – reduce speed; freezing rain – avoid travelling if at all possible; high winds – slow down or stop if the wind strength is causing damage.

13.8.2 Techniques for Unpaved Roads

Employees who are required to drive on poor quality unpaved roads should receive specific training to address the relevant hazards (e.g., terrain, climate and weather, remoteness). Although a 2-wheel drive truck may be adequate for some conditions, a 4-wheel drive vehicle is preferable if work involves considerable unpaved road or off-road travel. Know your driving capabilities and the limitations of your vehicle. In some situations, it may be safer to use an ATV or to walk. Driver attitude is an integral part of vehicle safety. Don't push your luck. It is better to walk than get stuck many kilometres from help.

Use the following techniques and information regarding variable quality unpaved roads.

- Drive according to the present road conditions – don't rely on "how it was the last time". Conditions on unpaved roads change rapidly due to weather (e.g., wind, rain, storms, floods, snowstorms and whiteouts).
- Gravel roads: Slow down and let the dust settle ahead of the vehicle for maximum visibility. This also reduces damage to the vehicle windshield from road gravel. Beware of soft shoulders on gravel roads.
- Driving in dust:
  - Drive with the headlights on and stay well back from other vehicles. Never attempt to pass a vehicle in a cloud of dust.
  - Slow down when being overtaken by another vehicle to avoid being blinded by dust. Reduce speed so that you can stop within the limits of your visibility.
  - Be prepared to avoid livestock or vehicles that may "suddenly appear".
- When driving on "washboard" gravel roads, the steering and braking abilities of the vehicle are diminished because the tires are only in contact with the crests of the washboard ripples. Slow down, as the vehicle may skid if you brake suddenly or take a corner too fast.
- Always assume you will encounter oncoming traffic – especially when cornering on narrow roads. Honk your horn when you cannot see around a corner or over the crest of a hill. Slow down and keep to your half of the road so there is a better chance to avoid a collision.
- Be careful when approaching old bridges and culverts in remote areas; they may be in poor condition or even be missing, especially on inactive logging roads. They are an even greater potential hazard at times of freshet and flood.

13.8.3 Weather-Related Safe Driving Techniques

Any time you drive, you may encounter unexpected circumstances. Always adjust your driving methods to meet local road and weather conditions. When necessary, prepare the vehicle to operate in harsh climates to help reduce risks.

Wet/Windy Weather Driving Tips

- Paved roads are most slippery at the start of a rainfall due to accumulated oil and grease. Light rains will not wash away road grease and oil. Only heavy rain lasting half an hour or more will do so.

- Slow down and be alert to potential problems on the road ahead. Do not follow another vehicle too closely and increase the spacing between vehicles as conditions worsen.
- Slow down when driving through heavy rain, standing water or slush. A wedge of water can build up and interfere with the tire-road contact of the vehicle at speeds as low as 50 km/h (30 mph). This “hydroplaning” results in a loss of steering and braking control; the effect is like driving on ice.
- If brakes become wet, dry them as described in section 13.7.1 Braking.
- Disengage overdrive and cruise control when roads are wet and/or slippery.

Warm or Hot Weather Driving Tips

- Use engine oil with a viscosity recommended by the vehicle’s operator manual for hot weather.
- Watch the temperature gauge in hot weather as the engine may overheat, especially if you are going uphill frequently. After a long hot drive, idle the engine for one minute before turning off the ignition.

If the Engine Overheats:

- Turn off the air conditioning and pull off the road in a safe place.
- Open the windows and turn on both the heater and fan to the maximum setting to help extract heat from the engine.
- If there are no signs of steam from the engine, lift the hood of the vehicle to help ventilate the engine compartment. Let the engine idle at a slightly higher than normal speed.
- Carefully check for leaks in the system and check for broken fan or pump belts. Turn off the engine immediately if you discover any broken belts, a broken fan, or leaking coolant.
- Never remove the radiator cap when the engine and radiator are hot.
- Never use cold water to cool a hot engine, as this may crack the engine block.
- Once the temperature returns to normal, check the belts and hoses for damage or looseness and leaks. After verifying they are in good condition, check the coolant levels and refill if necessary.

Cold Weather Preparation and Driving Tips

- The following measures make cold weather driving safer.
  - Make sure there is antifreeze (ethylene-glycol) at the correct concentration for the expected minimum temperature.
  - Check the condition of the battery and cables frequently so that ignition does not become a problem (see section 13.5.2 Regular Vehicle Inspections).
  - Use appropriate antifreeze solution in the windshield washer fluid and carry extra windshield washer fluid.
  - Use engine oil with a viscosity for cold weather as specified by the vehicle’s operator manual.
  - In very cold weather use a lighter weight lubricating oil in the drive train (differentials, standard transmission) if recommended in the vehicle’s operator manual.
  - Add fuel line antifreeze to the fuel tank.
  - Install and use a block heater and a battery warming blanket in vehicles that operate in very cold conditions.

- Completely clear the vehicle's hood, roof, windshield, side windows and all lights of snow and ice. Remove vapor, frost or ice from the inside of the vehicle's windows so you can see clearly. Use the defrost feature to diminish the condensation.
- Keep the fuel tank at least half full in case you become stranded.
- When driving in fog or blowing snow, set your headlights on **low** beam for less reflection and better visibility. Always be able to come to a full stop within the distance you can see.
- On snow-packed or icy roads, accelerate and brake gently to avoid skids.
- Do not use your parking brake in very cold weather as it may freeze while engaged.
- Do not let ice and snow accumulate under fenders, as the accumulation can cause steering difficulties.
- Remember that bridges and overpasses ice-up before ice forms on the rest of the road. Know where to expect black ice, which may look like shiny asphalt.
- Make sure vehicles are properly equipped with snow tires. Use tire chains in winter mountain conditions, as necessary.

Driving on Ice Roads

- Never drive on ice roads or bridges unless the ice thickness has been measured and verified to be safe for the weight of the vehicle. Refer to Chapter 21. Advanced Exploration Sites, Trenches and Access Routes.
- A period of warm temperatures can cause the ice thickness can diminish rapidly even if the temperature does not rise above freezing. It is imperative to measure the ice on a continuous basis to determine the load bearing capacity of the ice.
- Never wear seat belts while travelling on ice roads or bridges.
- Obey the speed limit. The allowable speed limit varies with the ice thickness and depth of water under the ice. Vehicles are required to travel at low speed, especially when approaching land so the deflection/pressure wave does not rupture the ice.
- It may be advisable to partially roll down the vehicle windows and keep ice rescue picks and a Res-Q-Me type window breaker immediately available. If a dangerous situation develops, drivers and passengers should wear the ice rescue picks.
- It is particularly important to establish strict check-in times with the project or camp and inform them of any changes to the schedule when travelling on winter ice roads.
- Do not park a vehicle on ice unless it has been established that the ice is thick enough. Ice must be thicker to support a stationary load than a moving load of equal weight.

Tips for Other Road Conditions

- Beware of slippery or muddy conditions, particularly during the rainy season. Strips of steel landing mats can provide traction if the vehicle gets bogged down. Carry a piece of heavy plywood to use as the base for a jack in case you need to jack up the wheels and place logs or rocks underneath them.
- Be cautious when driving through wet places on unpaved road areas. For flooded areas or large puddles, get out of the vehicle and walk through them. Check the firmness of the road bed, the water depth and look for ruts. Remember, never drive through floods.
- If working in desert areas, be prepared for sand. Carry a shovel and a strong steel bar for anchoring the winch in case there are no trees. You can also bury a spare tire or a wide fluted boat anchor to anchor the winch.
- Avoid driving or parking in dry stream beds if there is any possibility of flash flooding.

- Logging trucks and ore trucks have the right of way on private roads. Familiarize yourself with specific procedures and obey local rules. Expect them to take the inside of curves, even though it may be the wrong side of the road. Sound the horn and listen carefully. Whenever possible, use radio contact to track the location of these vehicles.
- Regularly clear away dry grass and vegetation from sump and exhaust guards. Do this daily or more often, as needed, depending on the locality.
- Avoid parking in tall dry grass to avoid the possibility of starting a grass fire from hot engine parts. Equip all field vehicles with spark arresters if there is a risk of a bush or grass fire.

Figure 13.3: The road is flooded and may be damaged. Test the quality of the road bed by walking across before driving through water. © Bill Mitchell

13.9 Four-Wheel Drive Vehicle Operation Guidelines

Four-wheel drive vehicles (4x4s) handle very differently from other vehicles. They can be significantly less safe than regular vehicles due to their design characteristics (high ground clearance and high centre of gravity). The high centre of gravity affects the stability of 4x4s and vehicle rollover is potentially a serious problem.

Learn to handle the controls and use the correct techniques for on-road and off-road driving. Most accidents or incidents that develop with 4x4s are due to (1) driver error, (2) misreading the road conditions or terrain or (3) not knowing the limitations of the vehicle.

13.9.1 General Driving Techniques

Review the section on the engagement and disengagement of 4-wheel drive in the manufacturer's operator manual for the specific vehicle. Some vehicles have automatic locking hubs while others require manual engagement of the hub locks. Some vehicles have all-wheel drive features. Failure to follow the instructions can be dangerous and cause expensive damage to the vehicle transmission.

- 4-wheel drive vehicles should not be driven on pavement at high speed with 4-wheel drive engaged. This may cause serious wear to the front transmission, tires and suspension. Unnecessary use of 4-wheel drive increases fuel consumption and driver fatigue. Check the vehicle's operator manual regarding the proper use of the 4-wheel drive system.
- Four-wheel drive vehicles offer increased surface traction but no increased breaking ability. 4x4 braking ability is the same as for other automobiles. In fact, braking distance may increase due to the extra vehicle weight.
- Avoid sharp turns and abrupt manoeuvres. These actions make 4x4s particularly vulnerable to loss of control and rollover.
- Slow down for better control when it is windy. Cross-winds adversely affect the stability of 4x4s, especially those with a cab on the back.
- Anticipate steering wheel kickback when driving over rough terrain. Keep your fingers and thumbs firmly placed on the outside of the steering wheel and your hands in the "ten-and-two" position. If the vehicle has an air bag in the centre of the steering wheel, it is safer to keep your hands in a "nine-and-three" position.

13.9.2 Off-Road Driving Guidelines

Good off-road driving entails smooth, even manoeuvres – not sensational performances. The best off-road drivers are not afraid to stop and try again with a slightly different strategy. Maintain a light touch on the gas pedal to achieve steady, smooth power.

- Know the limitations of the vehicle. The ease of some manoeuvres will depend on the length of the wheelbase and the vehicle's clearance.
- Know your own skill level and ability to handle the vehicle. Some terrain may be too difficult for the driver even though theoretically, the vehicle can do the job. Do not get the vehicle into a difficult situation requiring extraction because you are afraid to stop and try again.
- Know the vehicle's clearance limitations. Be aware of:
  - Ground clearance is the height of obstacles that can be cleared. The axle height is lower than the highest clearance.
  - Know the approach angle to avoid scraping the winch or front bumper.
  - Know the departure angle to avoid scraping the towing hitch or rear bumper.
  - Know the ramp angle to avoid hanging up the undercarriage or axle on ridges.
- Learn the appropriate techniques for the terrain where you must drive. Mud and sand require different methods than driving on firm or rocky surfaces.

- Inspect difficult terrain on foot to determine the height of rocks, depth of ruts or standing water, streams, unstable ground etc., and for other hazards that might strand or disable the vehicle.
- Use a passenger to act as a spotter or marshaller for the vehicle when you encounter difficult obstacles. The driver should follow directions and keep his or her eyes on the spotter who can see the hazards more clearly than the driver. To avoid confusion, only the spotter should relay instructions to the driver. If bystanders think they see a better solution they should inform the spotter, not the driver.

Slopes

- The ability to judge which gear to use for various conditions comes with training and experience.
- When driving off-road, drive straight up and down slopes. Do not spin the wheels on a hill as this may cause the vehicle to slip sideways and roll over.
    - Driving up a slope: Choose the right gear before you start and try not to change gears. It may be necessary to use low range and a low gear so you do not stall. It is better to crawl slowly up a slope than have to change gears part way up.
    - Driving down a slope: When coming down a steep or slippery slope, use low range and the lowest gear possible so that the engine does the braking.
- If you fail to make the crest of a hill, never try to turn around on the slope as you may roll over. Back down the slope and let the engine compression do as much braking as possible.
- Approach the top of a hill with caution. While you need enough momentum to reach the crest, you need to be able to stop safely at the top to determine the next move. If a hill is very steep, walk to the top to identify any hazards before driving up.
- Try not drive horizontally or at an angle across slopes, as the vehicle may tip and over turn. It is especially important not to traverse slippery slopes. Avoid ruts, bumps or rocks that increase the downhill tilt of the vehicle, which will increase the potential of tipping over.

Obstacles

- Drive across ditches at an angle so only one wheel at a time drops into the depression. Do not drive at excessive speeds or try to jump ditches with a vehicle.
- Steer toward a road's high spots. Let one wheel ride over large rocks to maintain maximum clearance. Try to straddle ruts.
- Mud, sand, and soft ground:
    - Drive slowly and steadily to avoid spinning the tires.
    - If the decision is made to deflate tires to drive on sand, do it correctly. Follow the directions in the operator's manual. Deflated tire pressure adversely affects the steering and handling of a vehicle. Reduce speed to avoid overheating the tires and avoid tire damage. Do not drive over rocks with deflated tires. Deflate the tires for only as long as necessary and then re-inflate them. Carry a good low pressure tire gauge and a compressor to re-inflate the tires. If no instructions are available, deflate by no more than 10 psi (pounds per square inch) for hard sand and 15 psi for soft sand.

  - If you become mired in mud, dig it out at the sides and in front of the wheels to release the suction. In some cases, it may be necessary to jack up the vehicle and place logs or rocks under the tires.
  - Wash off mud and sand at the end of the day to maintain the vehicle.
- Avoid spinning the wheels as this causes a loss of traction for the vehicle. Spinning the wheels will cause them to dig deeper into the ground (sand, mud, snow) and may make the vehicle slide sideways. When the wheels begin to spin, reverse out and try again choosing another route or using a bit more speed.
- Protect the environment: 4-wheel drive vehicles can cause significant environmental damage, depending on the local climate and vegetation.
  - In deserts, do not drive off established tracks, as severe erosion may result from the removal of "desert varnish" that holds the surface together.
  - Avoid becoming stuck in mud or sand, as spinning the wheels causes erosion.
  - Wherever possible, use existing roads or tracks, especially in fragile environments.

13.10 Resources

The Prospectors & Developers Association of Canada thanks the following for granting permission to include material from their publications:

Association for Mineral Exploration British Columbia (AME BC)

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