British Columbia Class 1 Mandatory Entry-Level Training Student Guide



ICBC

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Statement of Limitation

ICBC has prepared the *B.C. Class 1 MELT Student Guide* as the official study manual for students enrolled in a B.C. Class 1 MELT course at an ICBC-authorized driver training school or driver training institute. The B.C. Class 1 MELT course is intended as an entry-level training course for individuals applying for a B.C. Class 1 driver's licence with an air brake endorsement. As such, this guide focuses on entry-level skills foundational to operating semi-tractor trailer vehicles, and does not replace the need for professional level commercial driver training, or sector specific training and certification required under various provincial or federal laws.

ICBC does not make any representation or warranty that any individual who studies the *B.C. Class 1 MELT Student Guide* will be successful in obtaining a Class 1 driver's licence or any associated endorsements. ICBC is not responsible for any consequences that may result from the use of the *B.C. Class 1 MELT Student Guide*. Use of this guide by an authorized driver training school or driver training institute for the B.C. Class 1 MELT course, in addition to other training and study materials approved for use by ICBC, is permitted.

This guide references acts and regulations that govern driving and the design and construction of semi-tractor trailer vehicles, and air brake-equipped vehicles in B.C. This guide reflects the law in B.C. as set out in these acts and regulations as of April 15, 2021. These references are written in plain language for ease of understanding. In the event of a difference between the material included in the *B.C. Class 1 MELT Student Guide* and any of these acts or regulations, the acts or regulations shall apply.

The illustrations and explanations of various types of vehicles, vehicle components and air brake systems are provided for instructional purposes, and are not to be interpreted in any way as superseding vehicle, vehicle component, or air brake system specifications as may be required by law. ICBC recognizes that the information contained in this guide with respect to various vehicle and equipment standards are intended to provide a basic guideline for proper vehicle and equipment operation and do not replace or supersede specific manufacturer requirements unique to various vehicle makes and models, or equipment components.

table of contents

1 — Overview of the trucking industry 1
What you'll learn 1
The trucking industry in Canada today 1
Facts about truck safety 2
Costs of crashes and incidents 4
Canada's deadliest crashes involving a commercial vehicle 4
Class 1 driver's licence requirements 6
Training requirements 6
Medical requirements 6
Driver's licence classes in B.C. 7
What's it like to be a truck driver? 9
Equipment options 9
Career options 9
The transport industry 12
Prevention of human trafficking 13
Employer expectations and requirements 14
What are employers looking for in a new driver? 15
Applying for a job in trucking 18
Sample resume 19

2 — Health and safety 21
What you'll learn 21
Health challenges and issues affecting drivers 21
Stress 23
Signs of stress 24
Ways to reduce stress 25
Time management techniques 26
Falls 27
Your rights and responsibilities 28

Healthy eating, healthy living 29
Tips for healthy eating 29
Exercise 30
Ergonomics 31
Tobacco use and vaping 33
Hazardous substance exposure 34
Fatigue 35
Warning signs of driver fatigue 36
Microsleep 36
Sleep debt 36
Obstructive sleep apnea (OSA) 37
Dressing for protection 37
Distracted driving 38
Impaired driving 41
Workplace conflict and violence 48
Road rage 49
Aggression management 50

3 — Workplace communication 53
What you'll learn 53
Interpersonal communication 53
Your verbal message 54
Barriers to communication 56
Listening well 58
Answering questions 59
Defusing anger 59
Using the language of the profession 60
Acronyms 60
Technical terms 61
Providing customer satisfaction 64
Using communication technology 65
Cell phone etiquette 66
Voicemail tips 66
Using email 67
Communicating via satellite systems 68

4 — Vehicle components and systems 71
What you'll learn 71
Introduction 72
Tractor body styles 73
Cab design 73
Accessories outside the tractor cab 74
Frame assemblies 75
Suspension system 76
Steering system 82
Drivetrain 83
Electronic control module (ECM) 89
Speed limiters 89
Fuel system 90
Air intake and exhaust systems 91
After treatment systems 93
Engine lubricating system 96
Engine cooling system 99
Electrical system 102
Light switches 104
Cruise control 106
Speedometer and tachometer 107
Brake system 108
Air brake vs hydraulic brake systems 108
Primary (1) and secondary (2) air pressure gauges 109
Auxiliary brakes or engine retarders 109
Wheel assemblies 110
Tires 112
Coupling systems 116
Technology innovations 118
Electric heavy trucks 118
Driver-assist systems and self-driving vehicles 119
Detection technologies 119
Blind spot monitoring and warning 120
Side view cameras 120
Forward collision warning systems 120

Roll stability systems 121
Electronic stability control (ESC) 121
Anti-lock brake systems (ABS) 122
Truck/tractor ABS symbol 122
Trailer ABS symbol 123
Automatic traction control 123
Tracking systems and telematics 124
Remote diagnostic systems 125

5 — Driving Techniques 127
What you'll learn 127
Setting up to drive 128
Entering and exiting the cab 128
Seat adjustment 129
Engine start and warm up 129
Hand position 131
Seatbelts 132
Airbags and head restraints 134
Mirror adjustment 134
Using wheel chocks 136
Basic control of your vehicle 137
Moving off 137
Braking 137
Speed management 138
Shifting gears 143
Vehicle components to monitor while you drive 150
Tractor bobtailing 151
Entering and exiting traffic 152
Entering traffic or merging 152
Exiting a major roadway 153
Weave zones 153
Zipper merge 154
Lane positioning and passing 154
Lane changes 155
Passing 156

Steering and turning 159
Off-tracking 160
Left and right turns 162
Negotiating Intersections 166
Traffic circles and roundabouts 167
Crossing intersections 169
Curves 170
Mountain driving and grades 172
Uphill grades 172
Downhill grades 174
Railroad crossings 180

6 — Fuel-efficient driving 185
What you'll learn 185
Your driving habits 185
Tips to reduce fuel consumption 186
Choosing a fuel-efficient vehicle 190
Tire choice 191
Accessories 192
Fuelling a commercial vehicle 192

7 — Signs, signals and road markings 195
What you'll learn 195
Signs 195
Regulatory signs 196
School, playground and crosswalk signs 199
Designated road signs 199
Lane use signs 199
Turn control signs 201
Parking signs 201
Reserved lane signs 201
Warning signs 202
Object markers 204
Construction signs 205
Information and destination signs 206
Railway signs 206

Signals 207
Lane control signals 207
Traffic lights 207
Solid red light 208
Solid yellow light 208
Solid green light 209
Road markings 209
Yellow lines 209
White lines 209
Reserved lane markings 210

8 — Defensive and cooperative driving 211
What you'll learn 211
Defensive and cooperative driving 211
Driving conditions 212
Zones of awareness 212
See-think-do: a hazard detection system 213
Developing good visual habits 213
Engaging your other senses 216
Communicating 216
Driving conflicts and conditions 218
Sharing the road 218
Driver condition and ability 222
Other drivers 224
Visibility issues 227
Driving on slippery surfaces 230
Crosswinds 232
Driving in extreme heat 232
Roadway design and surface issues 232
Traffic conditions 236
Vehicle conditions 236
Crash avoidance 237
Crashes with the vehicle ahead 237
Crashes with the vehicle behind 238
Crash with an oncoming vehicle 238

Intersection or angle crash 240
Crashes caused by another vehicle passing you 240
Crashes caused by you passing another vehicle 241
Sideswipe crash 241
Crash with an overhead object 242
Incident with roadway clearance 242

9 — Handling emergencies 243
What you'll learn 243
General emergency steps 244
Emergency supplies 244
Emergency situations 248
Vehicle gets stuck 248
Towing 248
Personal medical distress 249
Using anti-lock braking systems (ABS) 249
Stopping with threshold braking 250
Skid avoidance and possible recovery 250
Jackknifing and trailer swing 251
Tire failure 253
Flooded roadway 254
Emergency action 254
Gravel shoulder recovery 256
Loss of brakes 257
Runaway lanes 258
Loss of visibility 261
Fire 262
Crashes and incidents 263
Emergency contact information 263
Legal reporting requirements 264
Crash/incident and near miss reports 264
Help from bystanders 265
Minor crashes 266
Major crashes 266
Loss of load and spills 267

10 — Off-road tasks and manoeuvres 269
What you'll learn 269
Backing basics 269
General tips for backing 271
Four backing manoeuvres 274
1. Straight backing 274
2. 90-degree alley-dock 274
3. Offset backing 278
4. Parallel parking 279
Sliding the fifth wheel 280
Sliding a trailer axle 284
Coupling and uncoupling a tractor-trailer 287
Coupling a tractor-trailer 287
Uncoupling a tractor-trailer 292
Coupling and uncoupling pintle hitch attachments 294
Double trailer combination types 296
Tire chains 299
Chain configurations 300
Chain requirements 301
How to install chains 302
Chain repairs 305

11 — Documents and regulatory requirements 307
What you'll learn 307
The National Safety Code 308
Motor Vehicle Act (MVA) and regulations 309
Traffic laws 309
Consequences of traffic convictions 310
Overview of commercial vehicle laws 312
Commercial Transport Regulations 312
Motor Vehicle Act Regulations 312
Safety certificate 313
Hours of service 314
Vehicle inspection and maintenance 314
Bills of lading and condition of carriage 315

Notice and orders 315
Documentation requirements 320
Vehicle licence, registration and insurance 321
Commercial Vehicle Inspection Program (CVIP) 322
International Registration Plan (IRP) 322
International Fuel Tax Agreement (IFTA) 323
Daily trip inspection report 323
Shipping documents 324
Information on the bill of lading 327
Transporting dangerous goods 330
Hazard classes and divisions 331
Identification of dangerous goods 332
Maximum vehicle weights 334
Vehicle dimensions and special permits 334

12 — Trip planning 341
What you'll learn 341
Trip planning overview 342
Trip planning steps 342
Trip documents 343
Confirm pickup and delivery times 344
Planning routes 344
Types of roadways 345
Road restrictions 347
Seasonal strength loss program 347
Ports of entry 348
Roadside safety inspections 349
Travel delays, road and weather information 350
Estimating travel time 351
Estimating fuel expenses 352
Estimating personal expenses 353

13 — Air brakes 355
Section one — Single unit 355
What you'll learn 355
Why do we have air brakes? 355
What's compressed air? 355
Basic air brake components 356
Force multipliers 357
Air brake chamber components 357
Leverage and air pressure 358
Air brake chamber — air pressure applied 358
Foundation brakes: S-cam type 359
Brake adjustment 360
Compressor 361
Governor 362
Reservoirs 362
Foot valve 363
How air brakes work 364
Dual air brake systems 365
Components of a dual air brake system 366
Parking brakes 368
Spring parking brakes 368
Driver alert — compounding of brakes 371
Spring parking brakes in dual air brake systems 371
Types of foundation brakes 373
Wedge brakes 373
Air disc brakes 374
Long stroke and regular stroke brake chambers 375
Air-over-hydraulic brakes 375
Other air brake system components 377
Air dryers 377
Alcohol evaporators and alcohol injectors 378
Automatic drain valves 378
Front wheel limiting systems 378
Automatic front wheel limiting systems 378
Manual front wheel limiting systems 379
Pressure-protection valves 379
Application pressure gauges 380

Anti-lock braking systems 380
Section two — Tractor-trailer air brake systems 381
What you'll learn 381
Tractor-trailer air brake systems 381
Tractor protection system 382
Trailer air supply valve 383
Hand valve 383
Two-way check valve 384
Trailer with spring parking brakes — charging 384
Trailer with spring parking brakes — service brake application 385
Trailer with spring parking brakes — dynamited 386
Bobtail tractors 386
Dual air tractor-trailer system — foot valve 387
Dual air tractor-trailer system — foot valve applied 387
Dual air tractor-trailer system — primary air system failure 388
Dual air tractor-trailer system — trailer breakaway 389
Trailer ABS air brake systems 390

14 — Vehicle inspection and maintenance 391
What you'll learn 391
National Safety Code (NSC) standards 391
Canadian inspection requirements 393
B.C. Commercial Vehicle Inspection Program (CVIP) 394
Inspection overview 395
Vehicle inspections by the driver 395
Compliance enforcement 396
Inspection stations 399
Vehicle defects — National Safety Code Standard 13 402
Driver responsibilities 406
En route inspections 407
Post-trip inspections 408
Pre-hill inspections 409
Vehicle inspection reports 410
Driver's vehicle inspection report form 411
Items to be checked in your pre-trip inspection 411
Walk-up/approach 413

Under-hood checks 413
Interior inspection 417
Engine start-up 418
Exterior inspection — driver side 422
Rear of the vehicle 427
Exterior — passenger side 428
Cargo and general appearance 428
Air brake trip inspection 429
Step 1: Under the hood 429
Step 2: Governor operation 430
Step 3: Tractor protection system 431
Step 4: Air system leaks 431
Step 5: Low air pressure warning devices 431
Step 6: Brake response test 432
Winter preparedness 432

15 — Hours of service (HOS) 435
What you'll learn 435
On-duty time 436
Off-duty time 436
Daily limits 437
Work shift 438
Daily hours (cycles) 438
Cycle Switching 439
Deferring off-duty time 440
Sleeper berth time 440
Single driver 441
Team drivers 442
Personal use exemption 443
Log books 443
Sample log book 445
Electronic logging devices 446
Tampering 447
Hours of service penalties 447
Out-of-service declarations 447
Drivers operating within 160 km of home terminal 448

Ferries....448
Driving north of the 60th parallel....449
Driving into the United States....450
Emergencies and adverse conditions....451
Carrier monitoring of driver hours of service....451

16 — Cargo securement....453
What you'll learn....453
Cargo securement standards....453
Personal safety....456
Cargo documentation....457
Cargo inspection....457
Loading cargo....459
Loading considerations....459
Cargo loading equipment....461
Inspect cargo carrying space....465
Inspect packing....466
Weight distribution....466
Securement system....472
Securement devices....477
Friction mats....478
Tie downs....478
Strapping....481
Chains....483
Securing freight in vans....486
Front-end structure on commercial vehicles....489
Specific commodities securement....490
Cargo needing special attention....494
Covering cargo....496
Cargo theft....497
Tips to prevent cargo theft....498
Cargo securement terms....499

1 Overview of the trucking industry

This unit will introduce you to the trucking industry, what it's like to be a professional truck driver and issues in trucking safety. You'll learn about Class 1 licensing requirements, different types of trucking jobs, and be able to think about what type of driving you might be most suitable for.

What you'll learn

This unit will help you learn to:

- Explain why truck drivers have a significant impact on the Canadian economy.
- Identify types of commercial vehicles that require a Class 1 driver's licence to operate.
- Understand the roles and responsibilities of professional drivers.
- Understand the requirements and steps needed to obtain and maintain a Class 1 driver's licence.
- Determine what type of commercial driving job you may be most suited for.
- Describe how to recognize when human trafficking may be occurring and how to report it.
- Identify employment requirements.

The trucking industry in Canada today

The trucking industry in Canada involves hauling goods locally, regionally and internationally. Approximately 90 percent of all consumer products and foodstuff movement between Canada and the United States are shipped by trucks (Canadian Trucking Alliance, 2017).

There are approximately 300,000 professional truck drivers in Canada. Professional truck drivers are nearly one percent of the national population and more than 1.5 percent of the nation's labour force. By keeping the national economy moving, trucking helps to keep millions of people working and is considered an essential service.

https://www.statista.com/statistics/449859/trucking-industry-revenue-canada/
Canadian Industry Statistics (2016)

Truck driving is a big responsibility

Driving a commercial motor vehicle is a big responsibility requiring special skills and knowledge. British Columbia roads present unique challenges for drivers, such as mountain passes and unpredictable weather. Heavy commercial vehicles, such as dump trucks and tractor-trailer units, represent only three percent of vehicles on B.C. roads, but they're involved in 19 percent of fatal crashes, according to B.C.'s Auditor General. A comprehensive training program and on-the-job training will give you the skills and knowledge you need to do the job safely.

https://www.bcauditor.com/sites/default/files/publications/reports/OAGBC_CVS_Report.pdf



Facts about truck safety

It's important to understand the benefits of becoming a safe driver to avoid crashes and reduce their severity. There are numerous contributing factors in truck crashes. Vehicle defects, such as faulty brakes, overloads, improperly secured loads, driving too fast for conditions, and driver fatigue are some key factors in truck-related crashes. Understanding vehicle weight and stopping distance for big trucks is important to reduce crashes.

A fully loaded transport truck travelling at 65 km/h (40 mph) takes 36 percent longer to brake and stop than a passenger car travelling at the same speed.

The biggest contributing factor to crashes by far is driver error — sometimes the trucker — but often other drivers. For this reason, truck drivers must drive in a way that accommodates for the mistakes of others by being one step ahead of everyone else on the road.

What important information do the following government statistics reveal?

- Nearly 2,000 Canadians are killed each year and another 10,000 seriously injured in crashes involving a heavy truck. Even on a per-distance-travelled basis, large trucks have a fatality rate double the rate for all other vehicles.
- Between 2015 and 2019, there were on average 15000 crashes involving a heavy vehicle that resulted in 3400 injured victims and 57 fatalities, annually.
- In an average year in B.C., large trucks are involved in less than one percent of all crashes, but they're involved in nearly 20 percent of fatal crashes.
- Studies across North America show that in crashes between cars and large trucks, the occupants of the passenger vehicle are at least four times more likely to be killed than the driver of the truck.
- Studies show that in fatal car-truck crashes, 2/3 or more of the incidents are found to be the fault of the passenger vehicle.
- Crashes are more likely to be caused by the actions or inactions of the drivers involved (both truck and passenger vehicle drivers), as opposed to other factors, such as weather, road conditions, and vehicle performance.

The table below shows WorkSafeBC's data from 2012 to 2016 listing the top 10 motor vehicle incident types for drivers employed in general trucking. The incident type with the highest number of WorkSafeBC claims during this period was "jackknifed or overturned" without involving a collision with another vehicle. What do you think the key contributing factors to the number one-ranked crash might have been?

Top 10 incident types in general trucking by number of claims (2012 – 2016)

Rank	Accident type	Claims
1	Jackknifed or overturned, no collision	365
2	Ran off highway, no collision	95
3	Vehicles moving in same direction	76
4	Moving and standing vehicle/equipment	76
5	Vehicle struck stationary object, roadside	72
6	Head-on collision	54
7	Highway collision	31
8	Intersection	27
9	Non-collision accident	24
10	Vehicle struck stationary object, on road	23
	All others	150

Costs of crashes and incidents

There are many visible and hidden costs associated with a commercial truck crash or incident. These costs can take a tremendous toll on drivers, companies and, sometimes, the environment.

Some of the costs could include:

- Cargo damage
- Vehicle damage
- Injury costs
- Medical costs
- Loss of revenue
- Administrative costs
- Recovery, towing and storage costs
- Loss of customers
- Lost sales
- Meetings missed
- Lost wages
- Cost to hire or train replacement workers
- Time
- Loss of personal property
- Vehicle replacement
- Equipment downtime
- Accelerated depreciation of equipment
- Collision/incident reporting
- Fines and punitive damages
- Collision/incident investigation and legal proceedings
- Insurance premium costs
- Poor public relations and publicity
- Increased public relations costs
- Government agency costs — police, fire, ambulance

Canada's deadliest crashes involving a commercial vehicle

Below is a list of some of Canada's deadliest crashes over the last four decades involving commercial vehicles. Think about what factors may have contributed to these crashes.

- Aug. 4, 1978 — Eastman, Que. — 41 dead

  People from Quebec's Asbestos region were travelling in a bus when, according to one passenger, the brakes failed and the driver was unable to make a turn. It went into Lac d'Argent, floating for as long as five minutes before it sank, according to United Press International (UPI).

- May 28, 1980 — Webb, Sask. — 22 dead

  A car crashed into a bus carrying Canadian Pacific Railway workers, putting it on its side before a tanker truck hit it, the Regina Leader Post reported.

- Dec. 30, 1986 — Swift Current Broncos — four dead

  Four members of the Swift Current Broncos died after their team bus slid off the highway as they began a road trip.

- Mar. 9, 1988 — north of Prince George, B.C. — six dead

  Six members of the Bethel Christian School basketball team in Dawson Creek were killed as the van they were travelling in crashed into a truck en route to a tournament in Lillooet.

- Oct. 8, 1989 — Cormier Village, N.B. — 12 dead

  Members of a family had reunited for a Thanksgiving hay ride in New Brunswick's Cormier Village. A logging truck hit their wagon killing 12 people, including five children and injuring 45 others, United Press International (UPI) reported.

- Oct. 27, 1989 — Kamloops, B.C. — five dead and 14 injured

  At noon, a 38,100 kg (84,000 lb) truck pulling a load of steel beams crashed into a line of cars stopped at a red light.

- July 9, 1990 — Horseshoe Bay, B.C. — two dead and four injured

  A runaway dump truck carrying hot asphalt slammed into a passenger van waiting for the ferry. The truck did stop at the brake check before the terminal, but the driver proceeded down the hill with his brakes not functioning correctly, reported the Prince George Citizen.

- Oct. 13, 1997 — Les Eboulements, Que. — 44 dead

  To this day, it's Canada's deadliest crash. A bus was carrying 47 elderly people when it went down a hill, the brakes failed and it went into a ravine, killing 44 passengers, La Presse reported.

- Nov. 11, 2004 — West Vancouver, B.C. — two dead and four injured

  A logging truck rounded a curve in the road and lost its load, with the logs landing on five cars that were travelling in the opposite direction.

- Jan. 12, 2008 — Bathurst, N.B. — eight dead

  A van that carried members of the Bathurst High School basketball team collided with a semi-truck, killing seven teens and their coach's wife.

- Feb. 5, 2012 — Hampstead, Ont. — 11 dead

  This incident saw a flatbed truck hit a passenger van that was carrying migrant workers, The National Post reported. The crash pushed the van 75 metres and 11 were killed in the crash.

- April 16, 2018 — Near Armley, Sask. — 16 dead

  Sixteen people were killed and 13 injured in the Humboldt Broncos bus crash. A northbound coach bus carrying high school kids was hit by a westbound semi-trailer truck that had run a stop sign.

Class 1 driver's licence requirements

Drivers must obtain a Class 1 learner's licence before beginning the Class 1 Mandatory Entry-Level Training (MELT) course. For information on obtaining your learner's licence, see the ICBC Driving Commercial Vehicles guide or visit ICBC.com.

Training requirements

The B.C. Class 1 MELT course is only available from ICBC-approved driver training schools, authorized to deliver the training. Class 1 driver's licence applicants must successfully complete all course hours and assessments to be issued a Class 1 MELT Declaration of Completion before they are eligible to attempt a Class 1 road test.

Medical requirements

Commercial drivers need to be in good physical condition. A medical report is required to upgrade a driver's licence to Class 1, 2, 3 or 4. All drivers are screened for vision, hearing, physical and medical conditions.

You'll be given a Driver's Medical Examination Report (DMER) form to be completed by your doctor or a nurse practitioner. Both of these medical professionals can complete a DMER and send the report to RoadSafetyBC, which will determine if you're medically fit to hold a commercial driver's licence. If you meet the driver medical fitness requirements to hold a B.C. Class 1 driver's licence, issuance of your driver's licence will be accepted as proof of your fitness to drive.

Licensed commercial drivers must also complete the examination report:

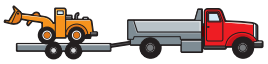
- every five years for Drivers 18–45 years of age, to be completed at ages 25, 30, 35, 40, and 45;
- every three years for Drivers 46–65 years of age, to be completed at ages 48, 51, 54, 57, 60, and 63; and
- every year for Drivers 66 years of age or older.

There are some medical conditions that can result in someone being deemed medically unfit to drive. These may include: heart disease, brain tumours, hearing or vision problems, certain musculoskeletal conditions, sleep disorders and kidney disease.

If you have questions regarding your medical fitness, contact RoadSafetyBC.

Those with a Class 1 driver's licence are permitted to operate other vehicle types for which a Class 2, 3, 4 or 5 driver's licence is normally required. The following chart provides more information:

Class	Vehicle type	Minimum age
Class 1 	• Semi-trailer trucks and all other motor vehicles or combinations of vehicles except motorcycles.	19
Class 2 	• Buses, including school buses, special activity buses and special vehicles. • Trailers or towed vehicles may not exceed 4,600 kg — may exceed 4,600 kg only if bus and trailers do not have air brakes. • Any motor vehicle or combination of vehicles in Class 4.	19
Class 3 	• Trucks with more than two axles, such as dump trucks and large tow trucks, but not including a bus that is being used to transport passengers. • Trailers or towed vehicles may not exceed 4,600 kg — may exceed 4,600 kg only if truck and trailers do not have air brakes. • A tow car towing a vehicle of any weight. • A mobile truck crane. • Any motor vehicle or combination of vehicles in Class 5.	18
Class 4 (unrestricted) 	• Buses with a maximum seating capacity of 25 persons (including the driver), including school buses, special activity buses and special vehicles used to transport people with disabilities. • Taxis, limousines and ride-hailing vehicles. • Ambulances. • Any motor vehicle or combination of vehicles in Class 5.	19

Class	Vehicle type	Minimum age
Class 4 (restricted) 	• Taxis, limousines and ride-hailing vehicles (up to 10 persons including the driver). • Ambulances. • Special vehicles with a seating capacity of not more than 10 persons (including the driver) used to transport people with disabilities. • Any motor vehicle or combination of vehicles in Class 5.	19
Class 5 or 7* 	• Two-axle vehicles including cars, vans, trucks and tow trucks. • Trailers or towed vehicles may not exceed 4,600 kg. • Motorhomes (including those with more than two axles). • Limited-speed motorcycles and all-terrain vehicles (ATVs). • Passenger vehicles used as school buses with seating capacity of not more than 10 persons (including the driver). • Construction and utility vehicles. • Three-wheeled vehicles — does not include three-wheeled motorcycles (trikes) or motorcycle/sidecar combinations. • Does not include Class 4 vehicles or motorcycles.	16
Class 4 or 5 with heavy trailer endorsement (code 20) 	• Trailers or towed vehicles exceeding 4,600 kg provided neither the truck nor trailer has air brakes. • Any motor vehicle or combination of vehicles in Class 5.	18
Class 4 or 5 with house trailer endorsement (code 07 – formerly code 51) 	• Recreational (house) trailers exceeding 4,600 kg provided neither the truck nor trailer has air brakes. • Any motor vehicle or combination of vehicles in Class 5.	18

What's it like to be a truck driver?

Truck drivers generally work very long hours, typically from 60 to 70 hours per week, and have to keep track of their time. They must get the cargo to its final destination on time, check the manifest sheet, make sure the load matches and often either load or unload the truck. Some truck drivers make deliveries on local routes, while others drive long distances all across North America.

Driving a tractor-trailer is different from driving a smaller vehicle. You have to know what to do when going up or down a steep grade, so the brakes won't overheat and know how to keep a load from shifting on a curve. The truck weighs 20 to 30 times more than a car and is typically 21 to 25 metres (70 to 85 feet) long.

Equipment options

As a professional driver, you may be called upon to drive a variety of vehicles:

- **Tractors** — used to pull trailers. Today's tractors have computerized engines for increasingly cleaner emissions. Cabs for long-haul drivers have many of the amenities of home.
- **Trailers** — the kind of trailer and the number of axles used on a particular trip usually depend upon the cargo being hauled. Semi-trailers with axles only at the rear of the trailer are the most common. Some of the semis you might drive include box vans, tankers, flatbeds, logging trucks, car carriers and refrigerated units.
- **Straight trucks** — a straight truck has a front steering axle and one or more rear driving axles and may have specialized equipment to handle cargo (power tailgate or Hiab).
- **Truck/tractor** — is a straight truck that can carry a load, as well as pull a trailer, such as dump or fuel trucks.

Career options

As a trained professional driver, you can seek work with a trucking company, invest in your own vehicle and become an owner-operator, or work through an agency as a leased driver. Within these categories, there are still more options to consider as you plan your new career.

Drivers can be classified into several subgroups:

1. **Short-haul/regional drivers** — These drivers typically leave their home terminal and either deliver goods to a distance within a half-day's drive or may be gone overnight. The routes may be set and fairly routine. About 75 percent of today's drivers fall into this category.

2. **Long-haul drivers** — These drivers are typically dispatched to destinations hundreds or thousands of kilometres away from home. They may travel on international routes across North America. Much of the trade between Canada and the United States is carried out by moving goods in trucks. Drivers must be familiar with the procedures required for border crossing, and since they are on their own much of the time, they must be good at organizing themselves and planning their routes. These drivers spend a considerable amount of time away from home.
3. **Local pick-up and delivery drivers** — These drivers generally work in a localized area picking up and delivering numerous small shipments, combining them into one truck or trailer. They must be strategic in planning the loading and delivery of these items to ensure that they work efficiently. This type of work will typically involve more backing, interacting with customers and time in traffic.
4. **Owner-operators** — These drivers are small business owners who either find their own loads or contract their trucks and their driving services to trucking companies or distributors. They may do short or long hauls or local pick-ups and deliveries. They must have sound business skills, as well as driving skills.
5. **Team driving** — As a team driver, you'll take turns driving with someone else. You'll take time off resting in the sleeper when you're not driving. The purpose of the team driver arrangement is to keep the truck and its cargo moving to its destination for as many hours in a day as possible. Team drivers normally run long-haul routes.

Myths and misconceptions about trucking

Many people have negative, preconceived notions of truck drivers and/or truck driving jobs as a profession. Here is a list of some of myths and their myth busters:

1. **Myth:** *The trucking industry isn't that important to the Canadian economy.*

   Myth buster: Approximately 90 percent of all consumer products and foodstuff movement between Canada and the United States are shipped by trucks (Canadian Trucking). There are more than 300,000 professional truck drivers in Canada. The trucking industry is the number one transporter of goods in the world and has significant importance to the national economy.

2. **Myth:** *Drivers have to work day and night to earn a decent income.*

   Myth buster: Canadian drivers earn good wages, often significantly more than the national average. Driving long-haul trips and being away from home all the time is not the norm. Fewer than five percent of Canadian truck drivers have to be away from home for more than two days at a time.

3. **Myth:** *Trucking is low tech.*

   Myth buster: The trucking industry is constantly applying new technology to improve its competitive edge. Laptop computers and onboard satellite systems are now common in cabs and drivers are skilled users of this advanced equipment.

4. **Myth:** *The trucking industry is a man's world.*

   Myth buster: In the Canadian trucking industry, a rapidly growing proportion of women and gender-diverse people work as transport drivers, dispatchers, sales representatives and managers of trucking companies. There are more than 9,000 women in the trucking industry in Canada today and that number is growing. Operating as a professional truck driver requires managing deadlines, upkeep of detailed daily logs, and knowledge of safe cargo transport, depending on the load type.

5. **Myth:** *All truck drivers do is sit.*

   Myth buster: Truck driving is actually a very demanding job. Besides having to stay focused for long periods of time, plus managing to drive huge semi-trucks, truckers also do a variety of tasks when they aren't driving. They may also be responsible for loading and unloading their cargo.

6. **Myth:** *Truck driving offers very little job security.*

   Myth buster: Not true, there's a huge demand for drivers. As the North American population expands, the need for the movement of goods to supply the growing population is expanding with it. The trucking industry is one of the critical sectors within the Canadian economy that does offer career-long job security.

7. **Myth:** *Truck drivers are lonely.*

   Myth buster: Just because truck drivers spend the majority of their time in the truck, doesn't mean they're lonely. In fact, many truck drivers are very sociable. They know the truck stop employees, the employees of the restaurants they frequent, the dispatchers, other truckers and so on. They're constantly meeting new people and working with others.

8. **Myth:** *Trucking is unsafe*.

   Myth buster: The transportation industry is highly regulated for safety and prepares truck drivers for the road. Canadian standards for equipment safety and driver skill are among the highest in the world.

9. **Myth:** *Truck driving is easy work.*

   Myth buster: Truck drivers spend many hours on the road maneuvering through bad weather, perilous road conditions and traffic congestion. Driving a truck requires a huge amount of training and education, plus focus, motivation, concentration, patience and discipline. Operating as a professional truck driver requires managing deadlines, upkeep of detailed daily logs, and knowledge of safe cargo transport, depending on the load type.

10. **Myth:** *Trucks emitting diesel smoke are major contributors to the degradation of our environment.*

    Myth buster: Trucking continues to impact the environment, but improvements made possible by new technologies have dramatically reduced the size and scope of that impact over the last two decades, even as consumer demand has dramatically driven up the tonnage of shipped goods. The North American Council for Freight Efficiency recently calculated that it takes 70 big trucks fresh off the showroom floor to emit as many pollutants in one year as just one truck did in 2002.

The transport industry

The transport industry is made up of numerous occupations, each with its own unique set of experience and training requirements. Occupations in greatest demand in the B.C. transport sector are Class 1 drivers and truck/trailer mechanics. Most jobs (60 percent) are with firms that conduct short-haul trips.

In a 2019 report, Trucking HR Canada* reported that:

- Employment of truck drivers has increased from 237,000 to 318,000 since 1998, and over the past decade the industry has added more than 26,000 jobs.
- The truck transportation industry has the highest job vacancy rate among all Canadian industries, averaging 6.6 percent in 2018, or more than double the Canadian average of 3.2 percent.
- Vacancies for truck drivers have more than doubled since 2016 with some 22,000 vacant positions in 2018.
- Unemployment among truck drivers has fallen from 6.6 percent to 3.8 percent between 2016 and 2018.
- There has been steady upward pressure on wages and other compensation for drivers over the past few years.

Truck driver salary

Class 1 truck driver salaries in Canada range from about $55,000 to $95,000. Pay is higher in certain areas and for certain types of jobs. Do your research and remember, you'll likely be working as many as 60 or up to 70 hours per week (Neuvoo, 2020).

The face of the Canadian truck driver

- 97 percent of transport truck drivers are male.
- Only 9.5 percent of truck drivers in Canada are younger than 30 years old, compared to 23.8 percent of the entire Canadian labour force.
- Only 27.8 percent of truck drivers are younger than 40, compared to 45.1 percent of the entire Canadian labour force.
- 32 percent of truck drivers are 55 years or older. Only 21 percent of the entire Canadian labour force is that age.
- 6.6 percent of truck drivers are already 65 years or older. Only 4.4 percent of all Canadians of that age are still working.

Finding employment in the industry

The high vacancy rate, combined with employment growth, low unemployment and an upward surge in wages provides greater demand for professionally trained truckers than the supply available.

Approximately 7 percent of transport truck drivers are 65 or older, which means they could retire and leave the industry soon, creating additional industry employment opportunities for well-trained drivers.

**Trucking HR Canada. (2019). LMI Interim Report. Ottawa: Trucking HR Canada*

Prevention of human trafficking

Every year, trucks and the transportation system are used for illegal activities, including human trafficking. Worldwide, there are around 40 million victims of human trafficking, according to the International Labor Organization. Human trafficking is a $150 billion illegal enterprise, second only to drug smuggling.

Traffickers prey upon their victims' vulnerabilities, such as their youth, condition of poverty, migration status or dreams of love and opportunity, while profiting off their exploitation. The victims, who are mostly women and children, are deprived of their normal lives and coerced to provide their labour or sexual services. Exploitation often involves intimidation, force, sexual assault and threats of further physical violence to themselves and their families.

According to Truckers against Trafficking — an organization dedicated to reducing human trafficking — there are six red flags to look for:

- Anyone who has a lack of knowledge of their whereabouts and isn't in control of ID/passport.
- Anyone who has restricted or controlled communication (not allowed to speak for themself or unable to come and go unrestricted and so on).
- Anyone mentioning a quota or having a pimp/daddy.
- Anyone with signs of branding or tattooing of a trafficker's name (often on the neck).
- A van, RV or vehicle with multiple women in an area mostly frequented by men and/or dropping women off and picking them up 15-20 minutes later.
- Signs of bruising or other physical trauma.

Be vigilant and be aware of the signs of robbery and trafficking, particularly at truck stops, motels, rest areas and city streets where this type of activity generally occurs. If you believe there's an illegal act in progress, call 911.

For questions about what you may or may not be witnessing, you can anonymously call the human trafficking hotline:

- Canada – 1-833-900-1010
- USA – 1-888-373-7888

For more information visit the Truckers Against Trafficking website at https://truckersagainsttrafficking.org/

Employer expectations and requirements

Drivers are a carrier's most important asset. A good driver enriches the company's value whereas a poor driver can become a serious liability. All carriers want to employ drivers who will drive safely and add value and esteem to the company's operation. Regardless of a driver's level of training and work experience as a tractor-trailer driver, a driver with a clean driving record is far more likely to find (and keep) employment than a truck driver with a record of traffic and criminal violations.

Prospective employers are looking for more than the licence classes and endorsements a driver has. They might also ask you to provide:

- A completed employment application form
- Your driver's abstract — a public (P) record of your basic driving history in the last five years (dated within 30 days)

- Your National Safety Code (NSC) abstract — a record of your basic driving history and any commercial vehicle-related convictions in the last five years (dated within 30 days)
- Medical information
- A criminal record check (dated within a specified period of time)
- Records of your previous work experience and training that are relevant to your job
- Consent to participate in periodic drug screening

Some of these requirements may be required on a periodic basis and failure to provide any of these may affect the status of your job. Your ongoing driving history and medical condition can affect your ability to maintain your commercial driver's licence.

Once you're hired, you'll be required to participate in the employer's own training programs as employers are required to provide additional training to their drivers. Training may be specific to the operation of specialized equipment/features on a vehicle or within the workplace, transportation of specific cargo (for example, dangerous goods), occupation health and safety rules, company policies (such as dress codes, code of conduct and ethics, disciplinary policies, substance abuse policies and so on), duties and scope of your position, condition of employment and so on. Your success as a professional truck driver goes far beyond just your driving skills — your interpersonal skills are also important.

Employers also expect that you, as a professional driver, have basic knowledge and understanding of the laws and other compliance requirements that govern the operation of commercial vehicles. You'll often have to rely on your knowledge of these requirements. These laws and regulations will be discussed in detail during this course.

What are employers looking for in a new driver?

Today's employers are looking for drivers who can demonstrate safe driving skills, a good attitude and the ability to communicate effectively with customers, dispatchers and supervisors. Employers will assess your commitment to working safely and look for the ability to make sound decisions about how to handle your paperwork, equipment and cargo.

Professional behaviour is most often characterized by the following attributes:

- Responsibility and accountability
- Communication skills
- Integrity and honesty
- Commitment to learning
- Competence in performing work
- Loyalty to the company/employer
- A commitment to maintaining confidentiality
- Good work habits — punctuality, meeting obligations
- Respectfulness and courtesy to fellow employees and customers
- A commitment to follow rules and policies

The National Occupational Standard for Professional Drivers (NOS) identifies some specific attributes expected in the trucking industry — promoting a positive image of the driving profession, pursuing learning activities, demonstrating integrity, being dedicated and committed, managing money, coping with change, maintaining a good sense of humour, being empathetic, dealing effectively with different people and taking initiative.

In practice, what does professionalism look like in the workplace?

1. **Driving skills.** Understanding vehicle operation allows drivers to operate the unit smoothly and efficiently. A professional driver is competent behind the wheel and can adapt his or her driving skills to a variety of road conditions and driving situations to avoid incidents and crashes.
2. **Adherence to laws and regulations.** A professional driver keeps current with changes to rules and regulations, such as those governing hours of service and follows them in day-to-day work.
3. **Preparedness.** A professional driver is ready to handle the unexpected — modify a trip plan due to a road closure or respond to a request from the dispatcher. Professional drivers carry the necessary paperwork, tools and personal hygiene items that will help them through unforeseen situations.
4. **Productivity.** Finding ways to meet both company and personal goals for productivity and profit demonstrates a professional's abilities. This means being organized, planning routes effectively and using safe and legal ways to make up for lost time.

5. **Truck maintenance.** A clean vehicle, like clean and appropriate clothing, conveys a professional image. A professional driver washes the outside of the truck on a regular basis and carries the cleaning supplies required to keep the cab clean and tidy. Papers are neatly organized in a file holder or clipboard. Routine maintenance helps to prevent costly breakdowns and delays due to mechanical issues.
6. **Relationships.** In dealings with employers, dispatchers, supervisors and customers, professional drivers maintain good relationships by having a sense of humour and listening carefully. A professional deals with everyone in a fair and ethical way, avoiding favouritism, sexism and racism.
7. **Voice.** People don't respond just to what you say but also to how you say it. Professional drivers maintain good relationships with co-workers and customers by speaking calmly and pleasantly, even when in a stressful or difficult situation.
8. **Dress.** In social situations, you can dress to reflect your personality. While working, professional drivers should dress in clothes that create a good impression of themselves and their company. Always having the correct safety gear available to meet industry and customer requirements.
9. **Actions.** Actions speak louder than words — so make sure your actions say the right thing. For example, professional drivers follow the procedures demanded by the shipper/receiver even if they seem overly bureaucratic. They know company policies and if they wish to make changes to them, do so through appropriate channels.
10. **Helping others.** Professional drivers demonstrate empathy (the ability to understand what someone else is feeling) by providing roadside assistance, helping out fellow drivers and being patient with co-workers and customers who have their own workplace stresses to deal with.
11. **Taking the initiative.** Every company, large or small, benefits from employees who take initiative — that is, individuals who take the lead in finding or implementing new ideas and opportunities. Professional drivers take initiative when they find more efficient ways to do things, draw attention to new opportunities for the company to make money, suggest ways to save money, or propose ways to make improvements to safety.

As a new professional driver, if you demonstrate these traits in your day-to-day work, you'll join the ranks of drivers who are making the public aware of the professionalism required for success in this business.

Applying for a job in trucking

To apply for a job in the trucking industry, you must provide a copy of your NSC commercial driver's abstract and a resume and be prepared to participate in an interview and on road driving evaluation.

Driver's abstract

Driver's abstracts are provided free of charge from ICBC. There are a few ways to obtain it.

- By phone: Call 1-888-715-7775 or 1-800-663-3051 and be sure to have your driver's licence ready when you call.
- Online: Go to icbc.com and find "get your records online". You can request a regular driver's abstract or NSC (commercial) driver's abstract to be emailed to you or your employer.
- By mail: Send a letter with your full name, date of birth and signature to: ICBC Licensing Support Services, Box 3750, 910 Government Street, Victoria, B.C., V8W 3Y5.

How to write a resume

A sample resume has been provided on the next page. For more information on writing resumes, visit the Skilled Immigrant InfoCentre (SIIC) at https://www.vpl.ca/

Provincial government ***WorkBC*** offices can help you prepare a resume and provide job search techniques. Go to WorkBC.ca for information.

Sample resume

Name

123 Street
City, B.C.
123-456-7890 | name@mail.com

Summary

Truck driver adept at navigation and efficient, on-time deliveries. Personable and energetic. Dependable and committed to getting each job done quickly, efficiently and safely.

Work Experience	
June 2010 – Present Abbotsford, B.C.	Long-Haul Truck Driver | Joe's Transport Ltd • Maintain consistent communication between customers and warehouse. • Follow all company procedures, traffic laws, and safety regulations. • Assist with training three new drivers brought onto the company.
2007 – 2010 Abbotsford, B.C.	Bulk Chemical Truck Driver | Canada Chemicals • Transported chemicals throughout Canada, including hazardous materials. • Positioned various lifting devices to load bulk materials into the truck. • Ensured load-related documentation was complete and accurate.
2004 – 2007 Abbotsford, B.C.	Oilfield Truck Driver | Wings Transport • Received extensive training in the handling of various sizes of trucks. • Updated daily work log and kept accurate records of deliveries and pick-ups. • Reported all delays, accidents, and other transportation situations to other vehicles at the oilfield.
Education 2002 – 2004 Abbotsford, B.C. Brown's Truck Driver Training Institute Class 1, Class 3 Licences Air Brake Certification	Additional Skills & Interests • Capable of managing all types of physical demands. • Thorough and accurate in all tasks and responsibilities. • Attentive to any instructions given. • Excellent driving and maneuvering skills in all types of weather conditions.

2 Health and safety

This unit is designed to provide you with some insights into the mental and physical demands of the job as a professional truck driver. A big part of truck driver safety has less to do with the vehicle and more to do with the driver. This unit shows you the importance of adopting a healthy lifestyle, protecting yourself, maintaining good health and ensuring your safety so you can be rested, alert and focused behind the wheel.

What you'll learn

This unit will help you learn to:

- Be "fit for work," maintain a healthy lifestyle and balance personal and work life.
- Manage fatigue and stress.
- Understand worker obligations, rights and responsibilities, and employment health and safety requirements.
- Identify common workplace hazards.
- Avoid impaired or distracted driving.
- Participate in a workplace in which everyone feels secure and free of unnecessary conflict.

Health challenges and issues affecting drivers

Truck drivers play a vital role in Canada's economy, but they also work in conditions that present unique health and safety challenges — 75 percent or more of their day is spent driving and about 10 percent of their day is spent conducting vehicle inspections.

Driving professionally requires you to:

- Climb in and out of your tractor cab and in or on to your trailer
- Sit for long hours
- Be able to react quickly
- See details of objects that are close and recognize objects that are far away
- Determine the distance between objects
- Hear sounds and recognize the difference between them
- See objects in very low light

- Notice objects or movements that are off to the side (peripheral vision)
- Communicate effectively
- Stay alert to manoeuvre the truck while loading, transporting and unloading cargo

A few of the most commonly performed actions requiring physical strength include:

- Pushing and pulling: Up/down and two handed
- Lifting and lowering: Weight up to 24 kg (53 lb)
- Carrying: Weight up to 24 kg (53 lb) between 1.5 m (5 ft) and 6 m (20 ft)
- Occasionally walking, climbing, crouching/squatting, neck movements, reaching, elbow movements and wrist movements

Why might life on the road make it difficult to stay healthy?

A research project between the University of Northern British Columbia, University of Saskatchewan, University of Waterloo, Transport Canada, Safety Driven, the Trucking Safety Council of B.C. and WorkSafeBC was performed to better understand factors that impact drivers' health, safety and wellness.

Research confirmed that a truck driver's job involves:

- Irregular, long hours
- Exposure to prolonged seated vibration
- Unhealthy dietary patterns
- Physical inactivity

Pilot results from the research project show truck drivers in B.C. and Canada face risk factors related to:

- Stress
- High blood pressure
- Diabetes
- Whole body vibration (WBV)
- Ergonomics
- Falls
- Poor diet
- Lack of exercise
- Sleep apnea
- Tobacco use
- Fatigue
- Distraction
- Drugs and/or alcohol use
- Exposure
- Chemical hazards
- Physical demands
- Workplace violence
- Safety on the road

Key statistics

The table below shows WorkSafeBC data from 2012 to 2016 listing the top 10 workplace incident causes for drivers employed in general trucking. Based on the number of claims, overexertion was the number one cause of incidents among drivers. Raising and lowering landing gear, securing loads as well as moving heavy boxes are examples of tasks that may cause overexertion injuries.

Top 10 causes of incidents for drivers in general trucking by number of WorkSafeBC claims (2012–2016)

Rank	Accident type	Claims
1	Overexertion	1153
2	Motor vehicle incidents (MVIs)	972
3	Fall from elevation	862
4	Slips and trips (fall on same level)	562
5	Struck by	411
6	Other bodily motion	134
7	Struck against	127
8	Involuntary motion	110
9	Caught in	109
10	Exposure to noise	47

Stress

Professional drivers face stressors that are unique to life on the road. It takes a conscious effort and deliberate planning to maintain good health and live a well-balanced life. The stress that professional drivers face comes from many sources. They work extremely long days and are required to meet tight schedules and stay alert for many hours per day.

Other stress factors might include:

- Long working hours
- Night work
- Spending extended periods on the road away from friends and family
- Pressure to stay on schedule even when road conditions are bad or when they are fatigued
- Delivering or picking up loads can be unpredictable (long waits for example)
- Being treated disrespectfully by shipping and receiving personnel

- Road and/or weather conditions
- Difficulty communicating with and maintaining family relationships

You are probably experiencing stress if you answer yes to more than one of the following questions:

- *Are you often tense or unable to relax during down times?*
- *Do minor frustrations cause you to become really angry?*
- *Do you worry to the point that sometimes you can't sleep?*
- *Are you under pressure?*
- *Do you feel tired and experience persistent unexplained pain?*

Stress can lead to depression and fatigue which are both dangerous conditions for the professional driver. Learn to recognize the signs of stress in your own life. When you realize that it's interfering with your ability to perform well at work and to live fully away from work, be sure to seek help. Talk to family and friends and seek the advice of a doctor.

Signs of stress

Your body may tell you that you're suffering stress if you experience:

- Fatigue
- Grinding of teeth
- Chest pain
- Twitches
- Blackouts
- Muscle tremors
- Nausea
- Rapid heart rate
- Dizziness
- Headache
- Vomiting
- Profuse sweating
- Difficulty breathing
- Diarrhea

Your emotions may signal that you're suffering stress if you experience:

- Anxiety
- Fear
- Anger
- Uncertainty
- Severe panic
- Depression
- Irritability
- Guilt
- Denial
- Negative thoughts

Your actions may tell you that you're suffering stress if you experience:

- Withdrawal
- Anti-social acts
- Emotional outbursts
- Inability to rest
- Substance abuse
- Change in activity
- Pacing
- Suspicion

Ways to reduce stress

Take care of your body

There are many ways to reduce or manage the amount of stress in your life and to prevent some of the symptoms listed. The first is to keep your body healthy. Sitting for long periods of time puts stress on your body and the inactivity can make you susceptible to stress. Your body produces extra glucose and adrenaline when you're stressed and if you don't burn them up through physical activity, you may experience some of the physical signs of stress. When stopped to do your en route inspections, take the opportunity to stretch and do some light exercise like jumping jacks to help keep you alert. Try to get 30 minutes of physical activity at least three times a week and make sure you eat well. Doing so will reduce the sensations of stress and help you to sleep better.

Take care of your emotions

One of the biggest challenges drivers face is balancing home and work. To do this effectively, you need to be organized and make balance in your life a priority. Plan specific times when you're at home to spend with family and friends. Make a list of all of the chores you have to get done at home and make a realistic schedule for completing them.

Maintain a good attitude by focusing on the positives. One way to do this is by spending your leisure time on hobbies, getting exercise and other activities to distract you from worries. Another technique is to look forward and focus on the present rather than worrying about issues or mistakes in the past. Confide in a trusted friend or a professional when needed. Generally, keeping things bottled up inside increases the stress you experience. Find someone you can share your feelings with. Ask for help when you feel overwhelmed, or better yet, before you get overwhelmed.

Use relaxation techniques like breathing exercises and meditation when you feel tense.

Keep your mind off of worries and reduce the sense of isolation by humanizing your trip — keep the radio on, communicate with other drivers, listen to audiobooks and podcasts or learn a new language when you're on the road — as long as it doesn't distract you from your driving.

Time management techniques

One of the most significant causes of stress is the pressure you feel when you can't meet deadlines, or when you can't accomplish everything you need to get done in a specific timeframe either at work or at home. Using time management techniques is important — they can help you manage multiple priorities. It takes effort to really apply these techniques; but using them will pay off in the end.

1. **Set goals and establish priorities.** When do you really need to have something completed? Identify the things that are necessary or essential, like stopping for fuel. Then determine the level of importance of the other tasks you have to accomplish. Which will help you to get the furthest and help you to achieve a goal? Do the important ones first and the less important ones later. Also consider your personal priorities: Is getting enough sleep your top priority now? If so, factor it into your prioritizing.
2. **Remember the 80–20 rule.** Time management studies have shown that 80 percent of our rewards (accomplishments, earnings and successes) come from 20 percent of our effort. Make sure that you're giving your attention to the 20 percent of the tasks that are truly going to pay off in productivity.
3. **Break tasks down into steps.** Some tasks may seem overwhelming at first but if you break them down into steps and just focus on completing one step at a time, you'll be surprised at how easily you accomplish the whole thing. Apply this principle to things like trip planning: There is the whole trip to plan, but there is also the daily trip or the specific stop on a given run that you can plan on its own.
4. **Eliminate clutter.** Keeping your things organized and knowing where to find tools, personal items and important papers will save time that might be wasted while looking for things.
5. **Fill waiting times with productivity.** If you find yourself waiting at a border crossing or other barrier, use the time to calculate expenses, catch up on your reading, sleep, walk, clean your truck or complete other important tasks. This will help reduce frustration and stress as well as pass the time.
6. **Use a schedule.** Keeping track of all your tasks can be a drain on your mental energy. By using planning tools such as a to do list, a calendar or an app to schedule your activities, you'll do better work and stay focused.
7. **Observe your behaviour.** Where does your free time go? Who or what do you give the most time to? Keep track for a couple of weeks — you may be surprised at where your time goes. You can begin to prioritize and schedule more effectively when you're aware of your own habits.

Implementing strategies to manage your time can help to reduce frustration and give you greater peace of mind. You can eliminate some of the guilt you feel about things you haven't completed yet when you know that you've done the important things and you have a plan for dealing with the less important ones. Often taking control of your time allows you to experience a higher energy level because you are worrying less.

Falls

According to WorkSafeBC, falls from height are the third leading cause of truck driver injuries, following overexertion and motor vehicle incidents.

Most falls occur when the driver:

- Exits or enters the cab (37 percent)
- Conducts vehicle inspections, maintenance and repairs (18 percent)
- Unloads cargo (14 percent)

Drivers most often fall from the cab steps, followed by falls from freight trailers and flatbed decks. Always wear suitable safety footwear with good support and slip-resistant soles and always use three points of contact when climbing into or out of the truck. This means three of your four limbs remain in contact with the vehicle at all times. Sideways movement should be avoided since it creates an imbalance of weight distribution.



Your rights and responsibilities

At a workplace, everyone has varying levels of responsibility for workplace health and safety. You should know and understand your responsibilities and those of others. As a worker, you have three key rights.

Your rights:

- The right to know about hazards in the workplace.
- The right to participate in health and safety activities in the workplace.
- The right to refuse unsafe work.*

*By law, employers are prohibited from penalizing workers for raising a health and safety issue. You can learn more about the actions workers can take if they feel this has occurred at WorkSafeBC.com.

Your responsibilities

As a worker, you play an important role in making sure you and your fellow workers stay healthy and safe on the job. As a worker, you must:

- Be alert to hazards. Report them immediately to your supervisor or employer.
- Follow safe work procedures and act safely in the workplace at all times.
- Properly use the protective clothing, devices and equipment provided.
- Cooperate with joint occupational health and safety committees, worker health and safety representatives, WorkSafeBC prevention officers, and anybody with health and safety duties.
- Get treatment quickly should an injury happen on the job, and tell the healthcare provider that the injury is work-related.
- Follow the treatment advice of healthcare providers.
- Return to work safely after an injury by modifying your duties and not immediately starting with your full, regular responsibilities.
- Never work under the influence of alcohol, drugs or any other substance, or if you're overly tired.

Healthy eating, healthy living

Professional drivers are often away from home for several weeks at a time without the luxury of fresh groceries and a full kitchen — it can be difficult to prepare healthy meals. Many drivers are tempted to stop at a diner, truck stop or fast food restaurant because it's quick and convenient. However, many of these meal options provide large portions that are often higher in calories, fat and sodium. Overeating or eating a less balanced diet can contribute to being overweight and to general fatigue.

Obesity can lead to a number of chronic diseases (like diabetes, stroke and heart disease). Avoid the risk of these diseases by developing or maintaining good eating habits. Start by reducing the size of your food portions. Eat smaller meals regularly — having just one or two larger meals a day is not healthy and actually promotes weight gain. Eating many small meals a day provides your body with a steady fuel supply. Avoid high calorie foods and eat your biggest meal earlier in the day.

Calorie counting

An average woman needs to eat about 2,000 calories per day to maintain weight, and 1,500 calories to lose one pound of weight per week. An average man needs 2,500 calories to maintain weight and 2,000 to lose one pound of weight per week. However, this depends on numerous factors like age, height, current weight, activity levels, metabolic health and several others. Use a calorie counter for a few days, to see how many calories, carbs, protein, fat, fibre, vitamins and minerals you're eating. There are many apps available to help you track calorie consumption.

Tips for healthy eating

Eat breakfast and smaller meals

According to Canada's food guide, eating breakfast and smaller, more frequent meals increases your blood sugar which gives you energy throughout the day.

Snack on healthy foods

- Hummus and veggies
- Hard boiled eggs
- Dried fruit
- Nuts and seeds
- Jerky
- Cheese (not processed)
- Dark chocolate
- Yogurt
- Whole-grain crackers
- Lightly salted popcorn
- Energy bars
- Whole fruit

Eat more salads and leafy greens

Adding leafy greens to your diet two times per day will increase your focus on the road. Leafy greens are a good source of vitamin K which prevents certain age-related conditions. They also help lower cholesterol and preserve your vision. Try to cover at least half your plate with vegetables when stopping for meals.

Drink a lot of water

Not drinking enough water can affect a driver's alertness. You should drink at least two litres (64 ounces) of water per day to ensure your body is functioning to its full potential.

Limit caffeine

Caffeine may help drivers stay awake, but consuming too much caffeine isn't good for anyone. A regular cup of coffee contains about 100 mg. According to Health Canada, adults shouldn't consume more than 400 mg of caffeine per day.

Caffeine can:

- Cause anxiety and tremors
- Increase aggressiveness
- Delay the onset of fatigue
- Decrease the pain perception threshold, which increases the risk of injury
- Promote dehydration
- Cause gastric problems
- Promote heart problems
- Cause poor sleep

Avoid sugary drinks like juice, pop and energy drinks

Energy drinks supply mental and physical stimulation for a short period of time. They contain caffeine, taurine (an amino acid that acts as a cardiac stimulant) and vitamins. An energy drink can contain 50 to 505 mg of caffeine. Energy drinks can cause the same problems as caffeine.

For more information about eating right visit Canada's food guide at https://food-guide.canada.ca/en.

Exercise

Many drivers say they're too busy to exercise. However, simple exercises can easily be performed for 20–30 minutes every day. There are many benefits of regular exercise — exercise and getting or staying fit helps both your mind and body and helps combat weight gain and certain conditions and diseases like heart disease and high blood pressure. Before engaging in any physical exercise, be sure to consult your doctor or physician.

Exercises you can do around your truck:

- Walking 20 times around your truck and trailer equals one kilometer.
- Park farther away from the truck stop when stopping to eat.
- If you're interested in more of a strength-training approach to fitness, push-ups, squats and lunges can be performed without the need for equipment.
- There are many different programs and apps available to teach and track exercise.

Exercises while driving:

- Try abdominal crunches. Squeeze your abs and hold for the length of a song — or at least two minutes and repeat this at every red light.
- Do shoulder shrugs. This is a great relief of tension that can build up around your neck. Lift your shoulders up to your ears, and hold them there for a few seconds, then slowly release. Do this 15 times in a row whenever you feel tension building in that area of your body.

There are many tips and videos available online to help with keeping fit and exercising while on the road, many specific to professional drivers. Take a look for more ideas and find something that works best for you.

Log your physical activity

Log your physical exercise for one week. This can be done simply with pen and paper, or by using one of the many fitness apps available. Once you've determined your starting point, aim to increase your active minutes each week.

Ergonomics

Ergonomics is the science of designing systems to optimize human performance. Ergonomics relating to vehicle design can include things like visibility from the vehicle, design and placement of controls and displays and vehicle noise and vibration. Ergonomics are factored into most vehicle designs today.

Discomfort, foot cramps, stiff neck, sore shoulders and lower back pain are frequent complaints reported by drivers. These symptoms are a result of poor posture, stress, tension and staying in one position for an extended period.

Poor posture can result from personal driving habits, or from an improperly adjusted or fitted seat. The shape of the seat may put pressure on selected parts of the legs, back and buttocks. This contact can lead to pain or discomfort at pressure points and may affect blood flow to the legs and feet.



Some tips to prevent discomfort when sitting for long periods include:

- Empty your back pockets before you drive so your back isn't tilted to one side.
- Don't slump in your seat.
- Use a lumbar support, cushion or rolled towel to support your lower back.
- Change the seat position a few degrees every 20 or 30 minutes.
- Adjust your seat so you're sitting fairly upright. This puts less strain on your back.
- The steering wheel should be positioned so that you don't have to move your shoulders away from the seat to reach it.
- Adjust your seat so that your knees are at the same height or slightly lower than your hips
- Take breaks. Get out of the truck to stand, stretch and walk. This helps to circulate the blood in your legs and give a much needed rest to the muscles needed to sit. It only takes five minutes every hour.
- Stay fit. Maintaining strong abdominal muscles will support your back and reduce the likelihood of back pain.

Whole body vibration

Long-haul truck drivers are likely to be exposed to continuous whole body vibration (WBV) for prolonged periods of time. Laboratory studies have shown that exposure to WBV increases physical and mental fatigue. Seats with active suspension systems transmit significantly less vibration than standard air-suspension seats and can significantly decrease the pain and discomfort caused by WBV.

Tobacco use and vaping

Smoking doubles your risk of getting heart disease, increases your risk of getting lung cancer and can triple your risk of a stroke according to research from the University of Waterloo (Wawzonek, Peter Aaron. "In Danger? An Exploration of Canadian Truck Drivers' Health through the Canadian Community Health Survey." Waterloo, Ontario, Canada, 2015). It damages nearly every organ of your body. But the good news is that as soon as you stub out your last cigarette, your body will start healing itself.

Quitting can be especially hard for truckers who rely on the nicotine to stay awake and remain focused. Because of challenging work schedules, they also often lack the constant support network of family and friends. Regardless of the challenges, hundreds of truckers quit smoking every year.

Here are some tips on quitting according to SafetyDriven Trucking Safety Council of BC:

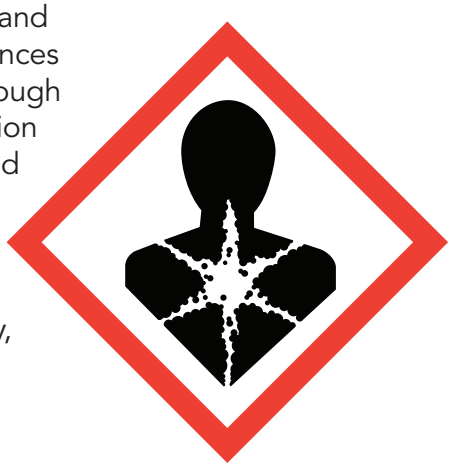
- Make a list of all the reasons why you want to quit.
- Replace cigarettes or vaping with healthy snacks. Fresh fruit, carrots, granola bars and nuts are healthy sources of nutrition that will help your body heal and keep your fingers busy doing something else.
- Avoid alcohol or other triggers. Alcohol and coffee are strong triggers for nicotine and can make the urge to smoke unbearable. Try hot tea and drink plenty of fresh water instead.
- Take it one day at a time and focus on your small victories.
- Treat yourself to something for all your hard work.
- Put away all the money you save in a jar. Each time you know you would have been buying a pack, put that money aside. As the money piles up, you'll realize how hard the habit was on your wallet.

Hazardous substance exposure

Aside from any required Dangerous Goods Training, all drivers need to be aware of hazardous chemicals they can encounter on a daily basis as part of the job. These can include things like fumes, battery acid and oil. Many companies require drivers to wear extra personal protective equipment whenever they're outside of the truck or performing certain tasks.

Workplace Hazardous Materials Information Systems

Employers are required to provide information and training to workers about any hazardous substances they will encounter. Information is provided through Hazard Symbols (SDS) and labels. The information sheets for each hazard include safe handling and storage, regulatory and usage information and what to do in an emergency.



As an example, this **health hazard** pictogram is used for the following classes: carcinogenicity, respiratory or skin sensitization, reproductive toxicity, specific target organ toxicity, germ cell mutagenicity, aspiration hazard.

Carbon monoxide

Carbon monoxide poisoning is an ever-present danger when you operate a motor vehicle. It can seep into a driving compartment and make you dizzy or drowsy. Too much of it will make you pass out, which will almost inevitably result in a crash if you're driving. It can kill you.

Carbon monoxide is especially dangerous because it's odourless, colourless, tasteless and difficult to detect. It's in the exhaust of every motor vehicle. Because it's so difficult to tell when it's present, always check your exhaust system to ensure that exhaust fumes aren't entering the driver's compartment of your vehicle.

Never run your engine in an enclosed area without proper venting. Don't follow any vehicle too closely, and maintain a safe distance between your vehicle and the one in front of you when you're stopped at traffic lights or stop signs. If you feel dizzy or drowsy while driving, pull over to the side of the road, get out and get plenty of fresh air. Chronic exposure to lower levels of carbon monoxide may also cause persistent headaches, depression, confusion, lightheadedness, memory loss, nausea, hearing disorders and vomiting.

Fatigue

Driver fatigue has been recognized as a critical problem for drivers and the trucking industry. The Federal Motor Carrier Safety Administration (FMCSA) estimates that 15 percent of large truck crashes involving death or serious injury are due to driver fatigue. In 2015, ABC News reported that lack of sleep may be responsible for 72,000 crashes a year, 30,000 injuries, and more than 700 deaths in North America.

Police statistics show that in a given year, at least 29 people were killed and 890 people were injured in B.C. as a result of fatigue-related motor vehicle crashes. Even more frightening, are the number of people who admit to falling asleep behind the wheel. A poll conducted by the Canadian Traffic Injury Research Foundation found that 20 percent of Canadians admitted to dozing off while driving.

Safe vehicle operation requires sustained vigilance, excellent judgment and quick reactions, particularly during heavy traffic or poor driving conditions. Driver fatigue impairs all of these abilities, endangering not only truck drivers, but also others who share the road with them.

In Canada, you can drive a commercial vehicle under the National Safety Code up to 13 hours a day, but it's recommended not to drive for more than two hours without stopping for a break.

When you're fatigued, your eyes move more slowly, it takes you longer to process information, you have moments when you are not paying attention and you may drift in and out of lanes on the road. Fatigued drivers have been shown to need more time to make a coordinated movement. Their hands are less steady and their ability to see (particularly in glare or flickering light) is significantly reduced. It takes them longer to brake and their steering is less accurate.

A common cause of fatigue among truck drivers is not getting enough sleep. Lack of sleep could be from medical problems such as sleep apnea, and it also can stem from employment conditions including:

- Long work hours
- Work-related stress
- Shift work or an irregular work schedule that forces drivers to sleep during the day, in opposition to the natural body rhythm of sleeping at night
- Sleeper berths that do not provide optimal sleeping conditions
- Fragmented sleep while awaiting notification of the availability of the next load

Warning signs of driver fatigue

Studies of typical human sleeping and alertness patterns (known as circadian rhythms) show that there are predictable low points at which drivers are most prone to falling asleep at the wheel — between 2 a.m. and 6 a.m. and at about 4 p.m. Knowing the risk is high at these times, you can take special steps to avoid drowsiness. Be sure to recognize the signs of your own fatigue.

Typical signs include:

- Yawning excessively
- Unintentionally varying your speed
- Inability to keep eyes focused and head up
- Having wandering, disconnected thoughts
- Driving the past few kilometres without remembering them
- Drifting between lanes, tailgating or missing traffic signs
- Noticing a vehicle in the rear-view mirror that seemed to appear out of nowhere

Microsleep

Microsleep is a temporary episode of sleep or drowsiness that can last from one to 30 seconds. It can manifest as droopy eyes, slow eyelid-closure and head nodding. They most often occur as a result of sleep deprivation but can also occur during monotonous tasks.

Microsleep becomes extremely dangerous in situations where constant alertness is needed, such as driving a vehicle or operating heavy machinery. People who experience microsleep are often unaware of it and shrug it off as having lost focus temporarily. By paying attention to your fatigue level, being honest with yourself and allowing yourself adequate rest or breaks you should be able to avoid microsleep.

Sleep debt

Sleep debt is the most common contributing factor of mental and physical fatigue. Sleep debt is the cumulative effect of not getting enough sleep. It's often ignored but can produce a decline in performance such as slower reaction times, failure to respond to changes and the inability to concentrate and make reasonable judgments.

Researchers say lack of sleep is connected to cardiovascular disease, hypertension and high blood pressure. It also compromises the immune system, contributes to obesity and severely impairs mental judgment. Lack of sleep can make dieting more difficult too: Studies show that when you're sleep deprived, your body actually boosts production of the hormone that makes you hungry.

Catching up sleep does not reverse sleep debt. A healthy lifestyle includes healthy sleep habits. Remember that sleep is just as important for your health as diet and exercise.

Obstructive sleep apnea (OSA)

Sleep apnea is a common cause of drowsy driving. It's a condition in which you repeatedly stop breathing or have shallow breaths while you sleep. When this happens, you may snore loudly or make choking noises as you try to breathe. Your brain and body become oxygen-deprived and you may wake up. This may happen a few times a night, or in more severe cases, hundreds of times during the night.

According to the American Academy of Sleep Medicine, drivers with sleep apnea are up to 2.5 times more likely to be involved in a motor vehicle crash, compared with a control group of other drivers. This risk was reduced by 70 percent among sleep apnea patients who used continuous positive airway pressure (CPAP) therapy.

Major risk factors for sleep apnea include obesity, high blood pressure, having a large neck circumference and daytime sleepiness. The diagnosis of sleep apnea usually is confirmed with an overnight sleep test. In many cases, testing can be performed in a patient's own home without the need to go to the hospital.

When drivers with sleep apnea are adequately treated, it reduces daytime sleepiness, and improves overall concentration and awareness. It also can reduce blood pressure and decrease a driver's overall risk of having a heart attack or stroke. Many employers are starting to offer routine sleep apnea screening for their employees to help reduce accident risk and improve overall worker health.

Dressing for protection

It's important to dress for protection and safety.



- Wear sturdy work boots or shoes instead of sandals.
- Always wear a bright and reflective safety vest or other clothing when outside the truck.
- Carry a hard hat and safety glasses for yards where wearing them is required.
- Wear gloves when working around, under or on the truck.
- Dress for the weather and the variance in conditions around the province.

The following chart shows temperatures across the province at various times of the year.

Region	Avg. max July/Aug	Avg. min Dec/Jan	Extreme max	Extreme min
Vancouver Island	22.5 C	- 0.6 C	36.1 C	- 18.8 C
Southwestern B.C.	22.9 C	0.4 C	35.6 C	- 18.3 C
Cariboo Chilcotin coast	22.2 C	- 11.6 C	36.4 C	- 42.5 C
High country	26.3 C	- 9.9 C	39.6 C	- 39.7 C
Okanagan Similkameen	26.5 C	- 8.4 C	36.0 C	- 36.3 C
Kootenay country	26.2 C	- 6.7 C	38.5 C	- 32.0 C
B.C. Rockies	24.7 C	- 12.3 C	37.5 C	- 42.2 C
North by Northwest	19.5 C	- 11.7 C	32.9 C	- 38.1 C
Peace River Alaska Highway	20.0 C	- 20.2 C	34.6 C	- 47.7 C

Distracted driving

There are three kinds of distraction:

1. **Visual:** Something that takes your eyes off the road like display screens in the cab, something moving at the roadside, billboards or scenery.
2. **Manual:** Something that results in your hands being off the wheel like eating or adjusting controls.
3. **Cognitive:** Something that takes your mind off what you are doing like talking to someone, listening to music or thinking about something.

Being alert and managing distractions is important in preventing crashes. When you focus too much on non-driving-related tasks, you may not see or notice real or potential threats, or you may react too late. Any driver whose attention lapses creates a real or potential hazard for those around them and could face fines, tickets or even criminal charges in the event of an incident.

Driver distraction is a major safety concern for drivers of all vehicle types. It's estimated that more than 9,500 drivers are using a hand-held device while driving at any given time in B.C., with 40 percent of those drivers texting behind the wheel.

According to 2016 data from Transport Canada's National Collision Database, distraction was a contributing factor in an estimated 21 percent of fatal crashes and 27 percent of serious injury crashes. These statistics are part of an upward trend of distracted driving-related crashes (up from 16 percent and 22 percent a decade earlier).

In B.C., an average of 78 people die in crashes involving distracted driving every year.

Fatal victims where distraction* was a contributing factor, by region and in B.C.

Region	2015	2016	2017	2018	2019	5-year average
Lower Mainland	30	31	25	25	14	25
Vancouver Island	8	9	11	6	12	10
Southern Interior	42	28	24	28	31	31
North Central	8	12	13	16	13	13
Unknown	1	0	0	0	0	1
British Columbia (total)	**89**	**80**	**73**	**75**	**70**	**78**

Source: B.C. Police Traffic Accident System (TAS)

* Distraction: Includes use of communication/video equipment, driver inattentive and driver internal/external distraction.

In approximately 41 percent of the commercial driver crashes that occurred between 2011 and 2015, driver inattention was the contributing factor, according to B.C. police-generated Traffic Accident System reports.

Distraction is a choice. It's up to you to know your own distraction vulnerabilities, triggers and temptations and set boundaries or create habits to manage these.

Keep your attention where it belongs: On the tasks and functions related to driving. If you decide to get take-out meals, ask yourself whether you can safely drive and eat while keeping your attention on the road and both hands on the wheel where they belong.

Cell phone use in B.C.

British Columbia, like many jurisdictions, has strict rules about when and how you can use electronic devices while driving:

- A driver must not hold, operate, communicate or watch the screen of a hand-held electronic communication device.
- A driver must not send or receive text messages or email on any type of electronic device.
- A driver must not hold, operate, communicate or watch the screen of a hand-held electronic computing device, one of the purposes of which is to process or compute data.

A person may use an electronic device in a hands-free telephone function while driving if:

- The electronic device, as well as any part or extension of it, is not held or operated by hand
- It is voice-activated or requires only one touch in order to initiate, accept or end a call
- If the device includes an earpiece, that earpiece can be worn in one ear only and must be placed in the ear prior to driving
- The electronic device is securely fixed to the vehicle or worn securely on the person's body, and is within easy reach of the driver's seat
- The device is installed in a manner that does not obstruct the driver's view of the front or sides of the motor vehicle or interfere with the safety or operating equipment of the motor vehicle

Fines for distracted driving

According to data from ICBC, between 2010 and 2016 police handed out more than 300,000 tickets for distracted driving.

In B.C., the fine for a distracted driving violation ticket is $368, along with 4 driver penalty points that will be applied to a driver's record. On a first infraction, these points will also result in a driver paying a further $252 ICBC Driver Penalty Point premium, for a total of $620 for a first infraction.

The distracted driving laws apply to all motor vehicles as defined in the *Motor Vehicle Act* and distractions are not limited to the use of cell phones, but include activities such as:

- Reading printed materials
- Writing or sketching
- Personal grooming (brushing teeth, putting on makeup or shaving)
- Using electronic devices such as laptop computers or cameras
- Entertainment displays and programming portable audio players

The use of two-way radios is permitted for commercial drivers provided the microphone is within easy reach of the driver, and is attached to the vehicle or worn on the body. GPS navigation units can also be displayed, but the unit must be affixed to the vehicle and programmed before you begin driving, or be voice activated. Commercial drivers are also permitted to have the following screen displayed:



Impaired driving

There's a good reason why truck drivers are scrutinized when it comes to drugs and alcohol. The stakes are high for truck drivers. There's more weight rolling down the road, potentially hazardous material in the trailer and far more hours spent behind the wheel.

There are penalties under B.C. law and under the *Criminal Code* of Canada. More immediate and severe penalties apply if you drive with a certain amount of alcohol or drugs in your system or you refuse to provide a bodily substance or breath sample. Penalties also become more severe for repeat offences.

Alcohol-affected and drug-affected driving are a leading cause of death on the roads. Police are trained to recognize the effects of alcohol and drugs on drivers. They have the discretion under B.C. law to serve driving prohibitions or driver's licence suspensions in order to remove alcohol-affected and drug-affected drivers from the road.

Note: You may be prohibited if a police officer considers your ability to drive to be affected by alcohol or drugs. You don't have to have a blood alcohol content (BAC) level equal to or exceeding 80 mg of alcohol per 100 mL of blood, or a blood drug content (BDC) equal to or exceeding two nanograms or more of THC per mL of blood.

Criminal Code penalties

If you're convicted of a *Criminal Code* offence for impaired driving due to alcohol or drugs, you could face some very serious penalties, including a lifetime driving prohibition and time in jail. The following chart provides a sample of some of the penalties you could face if you are convicted of an offence involving drugs or alcohol.

	Driving while impaired or Blood Alcohol Content (BAC) at or over .08, or refusal to provide sample			Impaired driving causing bodily harm	Impaired driving causing death
	1st Offence	2nd Offence	3rd Offence		
Prohibition from driving	1 – 3 years	2 – 10 years	3 years – lifetime	Up to 10 years	Up to lifetime
Fine	$1,000 and up	No maximum	No maximum	No maximum	No maximum
Jail	0 – 10 years	30 days – 10 years	120 days – 10 years	Up to 14 years	Up to life imprisonment

Note: the minimum fine for failing or refusing to provide a sample is $2000.

Other costs of impaired driving

Besides these penalties, there are other costs involved if you are caught driving while impaired:

Money — If you're convicted of impaired driving and you cause a crash, your insurance claim may be denied, including claims for damage that you might cause to your vehicle, or to other people or property. You could be responsible for paying these costs. As well, your insurance rates will increase and you'll receive a driver penalty bill.

Vehicle impoundment — If you receive an immediate roadside prohibition for having a BAC of 50 mg of alcohol per 100 mL of blood, police can immediately impound your vehicle for three, seven or 30 days, depending on whether it's your first, second or third infraction (in the last five years). If you register a BAC of 80 mg of alcohol per 100 mL of blood, police must impound your vehicle for 30 days, even for a first offence. The owner is then required to pay the vehicle towing and storage fees to get their vehicle back.

It's important for vehicle owners to understand that they are responsible for making sure that only licensed drivers use their vehicles. For example, if an employer allows a prohibited or unlicensed driver to use a company vehicle, the vehicle could be impounded.

Job — An impaired driving conviction could prevent you from obtaining or holding certain jobs.

Travel — An impaired driving conviction could create problems for you when travelling to certain countries, including the United States and Mexico.

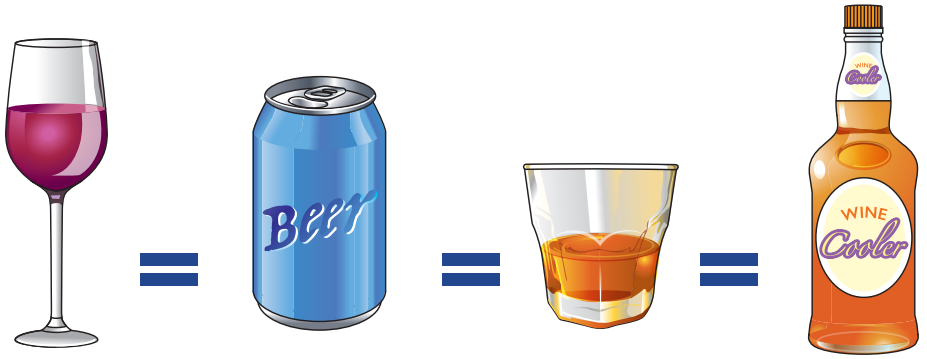
Effects of alcohol

Alcohol goes directly into the bloodstream and is carried to the brain. After passing through the brain, a small percentage is removed in urine, perspiration and by breathing, while the rest is carried to the liver. Typically, the liver can only process 10 mL (1/3 ounce) of alcohol per hour, which is considerably less than the alcohol in a standard drink. This is a fixed rate, so only time, not black coffee or a cold shower, will sober you up.

All of the following drinks contain the same amount of alcohol:

- 1 bottle (12 oz.) of regular alcohol content beer (5 percent)
- 150 mL (5 oz.) table wine
- 90 mL (3 oz.) fortified wine (port or sherry)
- 30 – 45 mL (1 – 1/2 oz.) hard liquor (rye, rum or vodka for example)

Alcohol equivalence



1 glass of wine 5 oz. of table wine 12% alcohol by volume	1 can or bottle of beer 12 oz. of beer 4.5% alcohol by voluume	1 shot glass with distilled spirits 1.5 oz. whisky/ other hard liquor 40% alcohol by volume or 80 proof	1 bottle of wine cooler 12 oz. of wine cooler 5% alcohol by volume
5x0.12=0.6 oz.	12x0.045=0.54 oz.	1.5x0.4=0.6 oz.	12x0.05=0.6 oz.

Alcohol and your ability to drive

Alcohol in any amount will affect your ability to drive. Alcohol depresses the central nervous system which slows down brain activity. Judgment, motor skills, vision and short-term memory are also impaired by the consumption of alcohol. Many employers in Canada forbid employees from driving within 12 hours of consuming any alcohol.

It's important to understand blood alcohol content (BAC) and its impact on driving at various levels. As the concentration of alcohol in the bloodstream increases, the body loses more and more of the functions required to drive safely.

BAC	Typical effects	Predictable effects on driving
.02%	• Some loss of judgment • Relaxation • Slight body warmth • Altered mood	• Decline in visual functions (rapid tracking of a moving target) • Decline in ability to perform two tasks at the same time (divided attention)
.05%	• Exaggerated behaviour • May have loss of small muscle control (such as focusing eyes) • Impaired judgment • Usually good feeling • Lowered alertness • Release of inhibition	• Reduced coordination • Reduced ability to track moving objects • Difficulty steering • Reduced response to emergency driving situations
.08%	• Muscle coordination becomes poor (such as balance, speech, vision, reaction time and hearing) • Harder to detect danger • Judgment, self-control, reasoning and memory are impaired	• Reduced concentration • Short-term memory loss • Reduced ability to control speed • Reduced information processing capability (such as signal detection and visual search) • Impaired perception
.10%	• Clear deterioration of reaction time and control • Slurred speech, poor coordination and slowed thinking	• Reduced ability to maintain lane position and brake appropriately
.15%	• Far less muscle control than normal • Vomiting may occur	• Substantial impairment of vehicle control, attention to driving tasks and visual and auditory information processing
.16%	Extreme crash risk	

This guide is based on averages and is not for legal use. Information is from the Centre for Disease Control and Prevention.

The increased likelihood of a crash begins long before drivers feel drunk or are severely impaired.

Increased likelihood of a crash	.05% – .09% BAC	.10% – .14% BAC	.15% or higher BAC
	11x	48x	380x

The parts of the brain affected when consuming alcohol and other substances are the same brain functions drivers rely on to make decisions while driving. Drugs and alcohol also affect the same brain functions required to make rational, safe decisions about refraining from driving after drinking or taking drugs.

When you stop driving for the night, it can be tempting to have a few drinks or take drugs. Instead, try watching movies, getting some exercise or reading a book; anything that takes your mind off becoming impaired will help. Look for healthy and safe alternatives.

Finally, never keep drugs, beer, wine or liquor in your cab. The temptation can be too great for some when it's nearby. Transporting a narcotic in a commercial vehicle can also cause problems. For example, a truck driver who purchases marijuana — even legally — can be ticketed for transporting even an unopened package in their commercial motor vehicle. Consequences can be even more serious if crossing into the United States. Transporting alcohol other than as cargo is also prohibited in the U.S.

Commonly used drugs

Commonly used drugs include alcohol, cocaine, club drugs, heroin, inhalants, LSD, cannabis, methamphetamine, ecstasy, nicotine, PCP, prescription drugs and steroids.

Drugs should never be mixed with alcohol because of the possible synergistic effects (chemical reaction between two or more drugs that may produce a reaction greater than either drug alone). These effects not only reduce the driver's ability to operate a vehicle but could cause serious health problems or even death. The key factor to remember is that any change a drug produces may also cause a lessening of driving ability.

Drugs and alcohol impair:

- Judgment
- Concentration
- Comprehension
- Perception
- Coordination
- Inhibitions
- Memory
- Vision
- Hearing
- Speech
- Mood
- Reaction time
- Tracking
- Body functions

Cannabis

After alcohol, cannabis is the drug most often used by drivers involved in crashes. Because more research data is available on cannabis than other drugs, specific information is provided for how this drug can affect driving.

Effects include:

- Loss of tracking ability: The ability to maintain the vehicle in a given line.
- Distance judgment: Following too closely can cause problems.
- Vigilance: Not remaining attentive to driving can cause a driver to follow too closely or drift into another lane.
- Divided attention: Driving is a task which requires constant but changing attention to traffic, roadway and weather conditions, passengers, gauges and so on.

Mixing alcohol and drugs: a synergistic effect

If a person already has another drug (including a prescription drug) in their system, the impairing effect on the brain is far greater than the impairing effect of the alcohol and the impairing effect of the other drugs combined; it is not a simple adding together of impairment, but rather a multiplier effect! This has an unpredictable effect on driving and can be deadly.

Drug testing

Many employers implement and enforce a drug and alcohol policy, including random drug and alcohol testing of their employees. Employers can also require a driver to submit to an alcohol or drug test if they have reason to be concerned.

Many transport drivers are already required to do drug and alcohol testing because they drive into the United States. Within the U.S., all transport drivers are required to be a part of a drug and alcohol testing program and those Canadian drivers who go into the U.S. must also follow these regulations. In Canada, testing done under the American regulations is referred to as Department of Transport (DOT) testing.

Did you know that drivers can test positive even when a narcotic seems to be no longer effective in their system? Cannabis for example, stays in the bloodstream and will test positive even three weeks post-use.

Workplace conflict and violence

Truck drivers may be at risk for workplace harassment or violence because of the environment they work in, but everyone has a right to work in an environment where racism, harassment, sexism and bullying do not exist. In fact, regulations require employers and workers to provide a workplace where everyone feels secure and free of unnecessary conflict.

Bullying and harassment include any inappropriate conduct or comment towards a worker that the person knew, or should have known, would cause that worker to be humiliated or intimidated. This can include verbal aggression, vandalizing, spreading malicious rumours, personal attacks, threatening gestures or harmful initiation practices.

Cyber-bullying is another form of bullying and harassment. It can include sending harassing emails, instant messages or text messages, or posting humiliating or intimidating information on social media or websites to or about an individual.

Bullying can come from many sources including other drivers, supervisors and employers, or from external sources such as customers, members of the public or drivers from other organizations.

The ugly threat of workplace violence also can't be ignored. When assessing the potential for violence while on the job, be extra vigilant if your work includes any of the following:

- Driving or parking in or near high crime areas
- Driving or parking in isolated or remote areas
- Driving or parking at night



Tips for staying safe

- If you're running a new route, ask dispatch and senior drivers for advice on where to fuel, eat and park along the route.
- If you'll be sleeping in your truck, plan your stops as much as possible as part of your trip plan.
- Choose safe areas to park such as truck stops and rest areas and ensure they are well lit.
- Check ahead with your customer as you may be able to safely park at their site overnight to unload in the morning.
- If your load delivers to a part of a city noted for a high crime rate, stay elsewhere and drive to the location just in time for your unloading appointment.
- Highway scales are a good place to park. In B.C., all scales have free internet service so you can check road conditions and more on DriveBC.
- Trust your instincts. If it doesn't feel safe, then it likely isn't.

Road rage

As motorists, we have almost all found ourselves in unpleasant situations involving abusive gestures or language from another driver who takes issue with how we drive. Anxiety and frustration can quickly provoke an aggressive or careless driver, who tailgates, speeds or fails to yield.

Road rage is an act of violence that all drivers need to be aware of and try to avoid. Most road rage incidents start off as a simple encounter between two drivers. An initial encounter can soon escalate and lead to more aggressive and dangerous behaviour. Anyone who drives for work needs to control aggressive driving behaviour and also needs to know how to prevent incidents of road rage against them.

Here are some tips to limit driving frustration and the potential for aggressive acts:

- Leave yourself enough time to get to your destination.
- Plan your route in advance. Some of the most erratic and inconsiderate driving occurs when motorists are lost.
- Avoid the temptation to speed which puts stress on you and the drivers around you.
- Drive in a courteous and considerate manner.
- Give an apologetic wave if you make a mistake.
- Don't take traffic problems personally.

- Avoid eye contact with an aggressive driver.
- Don't make obscene gestures, which can escalate the incident.
- Don't tailgate.
- Use your horn sparingly (even a polite honk can be misinterpreted).
- Don't block the passing lane (some drivers may think you're passive-aggressively holding them back).
- Create a relaxing and comfortable environment in your truck that will help you stay calm.
- Practice deep breathing and muscle relaxation techniques.
- Report aggressive drivers to the police.
- If you are being physically threatened, stay in the truck and secure the doors and call the police. Use your horn and lights to attract attention.
- Don't overreact to every mistake made by other drivers on the roadway. Everyone makes mistakes. Downplay the event and it will fade away.
- Remember: We all need to go home at the end of the day.

Aggression management

Aggression management is emotion and reaction management. Like any skill, it comes easier to some individuals than others. What other people do is not something you can control, but your response and behaviour is. There are a number of anger-management strategies like counting to three and taking a deep breath. You'll have to decide what works best for you based on the situation. Your conduct reflects not just on you but on your colleagues, and the company you work for.

A negative emotional state may result in lowering your ability to focus and detract your attention. This makes you less prepared to cope well with the task of driving. A useful method of dealing with emotional situations as they arise is to use the Stop, Drop and Process technique (SDP).

This is a method that can help you better manage your emotions when things get difficult. You can practice it if you feel like your emotions are out of control and no longer feel calm and collected. It's especially important to use SDP if you're worried that you may act in a way you will regret. With repeated practice, SDP can become a healthy habit for dealing with emotionally challenging situations in all areas of life, not just driving.

STOP: Stop and think before you act

If you're in a situation where your emotions are building to a point where you may have trouble maintaining control, stop! Sometimes, when we're in a highly emotional state, we act automatically, without considering the consequences or the best way to approach the situation. Learn how to identify the signs that you may be getting to this point:

- Take note of the physical feelings and thoughts that are associated with this emotional state, such as rapid breathing and tension in the jaw, neck or face.
- When these sensations or thoughts arise, this is a cue to stop and become conscious of your emotions and consider your response more carefully. Then you are ready to start working on the next steps.

DROP: Reduce the intensity of your emotions

When we're in an extremely emotional state, it becomes very difficult to think clearly and rationally. When the mind's response is triggered, we want to act quickly to resolve the situation or run away from it, and neither response is likely to be appropriate or effective for dealing with the situation. Before you begin to think through a situation, you need to calm down and reduce the emotional intensity:

- Engage in a repetitive action like counting or deep breaths. Any repetitive action can help you focus and calm your attention.
- Think of something that triggers a positive feeling.
- Breathe deeply. Concentrate on your abdomen and breathe in through your nose while counting to five, hold it briefly and breathe out for a five count, focusing on the feelings of the air and tension leaving your body. Repeat for a few minutes.

Now you're ready to more rationally consider the situation and your response.

PROCESS: Think about it

Begin with identifying the emotions you're feeling. To manage them, you must first be able to accurately identify them. Are you angry? Overwhelmed? Afraid? Ashamed? Frustrated? Annoyed? Uncomfortable? Helpless? Overconfident?

Identify the source of these feelings: Why are you feeling the way you are? What underlying issue may need to be addressed?

Finally, decide the best way to proceed. Once you work through the Stop, Drop and Process steps, you will be better prepared to find a healthy and effective way to deal with the challenges you face on the road. You'll be glad that you stopped yourself from acting impulsively.

3 Workplace communication

The ability to communicate clearly and interact effectively with customers, suppliers, co-workers, enforcement officials and the public is an important part of being a professional truck driver. Effective communication begins with recognizing the barriers to good communication and using strategies to overcome them. Drivers use a variety of electronic tools to communicate and this unit provides a brief introduction to them.

What you'll learn

This unit will help you learn to:

- Demonstrate clear and appropriate communication skills
- Explain how communication includes tone of voice, context, gestures and body language
- Practice sensitivity to cultural, ethnic and gender diversity
- Explain how to defuse situations that could cause anger, hostility or danger
- Provide good customer service
- Use communication technology appropriately

Interpersonal communication

Interpersonal communication is the process that we use to communicate our ideas, thoughts and feelings to others. It's not just about what's actually said and the language used, but also how it's said, and the non-verbal messages sent through tone of voice, facial expressions, gestures and body language.

Interpersonal communication can be accomplished directly (face-to-face) and indirectly (email, phone, voicemail, text). Successful interpersonal communication requires that both the message sender and the message receiver interpret and understand the message in the same way.

Communication is all about delivery. When you communicate, you can't always be sure your message was understood or if you're correctly understanding the sender's message. Generally, workplace communication is best when it meets the six Cs criteria. This means that the communication is:

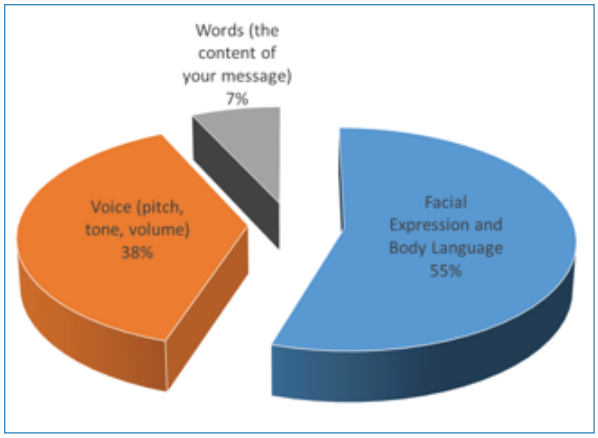
- **Complete**. You provide all necessary information and details.
- **Concise**. Say what you need to say to share your message, but be as brief as possible.

- **Clear**. Your message is concrete and specific, rather than broad and vague. Nothing is ambiguous or open to numerous interpretations.
- **Coherent**. Irrelevant details are omitted and the points are presented in a logical order.
- **Correct**. The information you present is accurate: names, dates, times, places, details and so on are right. If you're typing, you've used the spell checker to eliminate errors. Read a written message out loud to yourself to make sure it sounds right.
- **Courteous**. Relationships with customers and co-workers are important if business is to run smoothly. Keep the tone polite and professional.

Your verbal message

How can you package and deliver a message and feel confident that the other person will pay attention? You need to match the message to the needs of the person receiving it.

Confusion can result from the verbal part of your message — the words you actually say — and by how you say it. In a study, it was shown that the emotional and non-verbal content of a message is as much as 93 percent of the message where the words themselves communicate only seven percent.



Credits: Earning your wheels

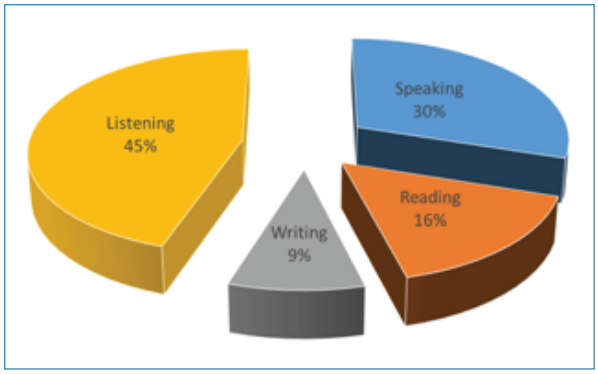
If your verbal message doesn't match the non-verbal message, people generally believe the non-verbal one. Some elements of non-verbal communication are obvious — your tone of voice or deliberate gestures — but there's more to it than that. Refer to the chart on the next page to see how complex it can be.

Face and eye expression	Your face communicates emotions such as happiness, disgust or surprise. Your eyes provide cues about your thinking process, check on the listener's response, and convey your feelings and attitudes.
Body movements and gestures	Your stance and gestures can convey information about your status (are you in charge?) in relation to the other person. Your body movements also send messages about how intense you are and about whether you're angry, happy, anxious or neutral. When you're the speaker, you must also read the listener's body language to determine how much attention they're giving the message.
Voice quality	The sound of your voice communicates a great many things — how you feel about the issue and whether you're confident about what you're saying. Your voice has a positive or negative impact on the listener depending on your pitch (high or low), volume (loud or soft), pace (fast or slow) and quality (correct enunciation).
Clothes and objects	How you look is part of the non-verbal message you send. Your clothes convey information about your status, your mood and your attitude.
Cultural context	This includes all the culturally learned behaviours and rules that affect interactions. If you come from a culture where it's considered rude to make long, direct eye contact, you will likely — out of politeness — avoid eye contact. If the other person comes from a culture where long, direct eye contact signals trustworthiness, then there could be a cultural basis for misunderstanding. Similarly, if you come from a culture where personal space is to be respected, you might — out of politeness — keep your distance. If the other person comes from a culture where close contact signals trustworthiness, there again is a cultural basis for misunderstanding.
Environment	The physical space you're in when communicating with someone can also influence the message. Furniture, location, noise level, temperature, season and time of day are all examples of factors related to the environment. A conversation in an office will be environmentally different from one in the work yard.

Listening

In your workplace, you're required to be on the receiving end of communication. You need to block out external and internal noise and sometimes compensate for the sender's lack of communication skills. Listening can be just as much of a challenge as speaking effectively.

We spend a great deal of time listening. One workplace study found that most workers listen more than they read, write or speak — suggesting that it's the most important of the communication skills. This chart shows that we spend 45 percent of our communication time listening.



Credits: Earning your wheels

The sender/receiver model also applies to other kinds of communication — written messages, phone messages and so on.

Barriers to communication

Effective communication ensures that business can be completed efficiently. Poor communication can lead to costly errors, delays and interpersonal conflict. To be sure that you're communicating effectively, it's helpful to understand some of the common barriers to clear communication and to identify ways to overcome them.

External barriers

Some barriers created by the situation in which you're communicating can include:

- Static on a phone or satellite connection
- Loud noises in the environment
- Communication equipment failure
- Poor quality print on documents
- Illegible handwriting

Vocabulary/language use barriers

In some situations, the words themselves can cause problems while communicating, leading to misinterpretation and misunderstanding. You may use a specialized vocabulary common to drivers or others in the trucking industry, but they won't have meaning to people in other professions. Before you started this course, did you know that "bobtailing" means driving a tractor without a trailer attached? Or that "four-wheeler" is a term for a car on the road with you? Slang or other technical terms you'll learn in this course are unfamiliar to many people.

Situational barriers

The most important rule of communication is to think about how and what you want to say so that the message gets through clearly. Take into consideration what you know about the person or group you wish to communicate to.

Age

Think about how a teenager talks versus an older person. While they both have a common language, they also use some vocabulary that the other might not understand. When you're talking or writing to someone, think about their age and whether they would be comfortable with the terms you're using, paying particular attention to slang.

Gendered language

Your job as a professional driver will have you interacting with people of varying generations, social circles, identities, ethnicities and experiences. Gender-inclusive language means speaking and writing in a way that doesn't discriminate against a specific sex or gender identity and that doesn't perpetuate gender stereotypes. Making your daily language gender inclusive and free of bias will ensure that you won't offend the people you communicate with.

Remember that many people can be offended, not just by jokes that put down one gender or the other, but also by terms that can be used to misgender someone, including being addressed as either male or female (he, she, sir, lady, Mrs., Ms., Mr., Miss, girl, boy, guys, gals, fellows and so on). The gender-neutral "they" is now acceptable in writing and speaking rather than he or she.

Creating gender-neutral conversation can be challenging, but noticing the habits within your conversation and how they're prolonging harmful stereotypes can be an eye opening and transformative experience.

Physical appearance

We may not like the idea that we judge, and are judged, by our dress and appearance, but numerous studies have shown that this is often the case. We may misunderstand someone because of strong non-verbal messages sent by appearances or risk that someone may not pay attention to our message if they judge us not worth listening to.

Cultural attitudes

Our way of seeing things tends to differ between cultures and can lead to interference when we communicate with people from other cultures.

We can miscommunicate through gestures that are harmless in our culture, but offensive in another. We can stand too close or too far away. We can break etiquette rules about who speaks first. Similarly, when someone from a culture different from ours inadvertently breaks one of our rules, we may be offended when no offence was intended.

Listening well

Listening well is key to good communication.

Helpful tips to be a better listener:

- Don’t interrupt when someone is talking
- Eliminate distractions or ignore the ones you can’t avoid
- Move to a quiet place
- Recognize and tune out personal prejudices
- Focus on the speaker's problems rather than your own
- Use your tone of voice and body language to reinforce the message that you’re listening
- Be open to hearing a person before assessing what they have to say
- Focus on the substance of the message rather than on the speaker or style
- If the speaker has an accent different from your own, it can be helpful to look at their mouth when they’re talking

You can apply many of these strategies when receiving a written message as well. You need to compensate for spelling, punctuation or grammar mistakes, or long-winded sentences and focus on the substance of the message.

Answering questions

Responding to questions with clear, complete, and correct information is important.

Below are a few tips to help answer questions effectively:

1. Pause. In most cases, you don't have to answer immediately. Think about what you've been asked and be sure that you were listening well.
2. Make sure you understand the question. Put it in your own words. For example, if you're asked, *"Can I have lunch here?"* You might say, *"Are you looking for a restaurant?"* The reply will let you provide the right kind of response.
3. Think about giving one point at a time. If you provide too much information, the listener might have trouble following you.
4. Answer only what was asked.
5. Use simple, plain language.
6. Use precise language. Instead of saying, *"The compressor is bad"* you could say, *"The compressor isn't maintaining a consistent pressure."*
7. Check that the answer was thorough enough by asking, *"Does that answer your question? Do you need clarification or more information?"*

Defusing anger

Below are some tips to use when communicating with difficult customers, co-workers or when in other situations involving conflict:

How to defuse anger	
Listen	Don't interrupt: Let them finish what they need to say.
Sympathize	A person making a complaint is generally looking for respect and attention. Sympathize with their position, if possible.
Determine the reason for the anger	Who's to blame? Are you or your company at fault in any way? Try to obtain precise information so that you can decide on your response or pass the information on to someone else.
Apologize	If you or your company has made a mistake or caused the problem, say so.

Take action, if you can	If there is an obvious, practical step you can take, do so.
Tell the customer your name	In the case of a customer issue, give your name so that the customer can follow up later. This is a way to build a relationship and make a commitment to customer satisfaction.
Call for help, if needed	If you can't calm the customer down, connect them with someone up the chain in your company. If you feel threatened, call the police.
Follow up with the customer	A person with a strong commitment to customer service calls back later to make sure the problem has been resolved. Alternately, ensure the proper person within your company follows up.

Using the language of the profession

One sign of a professional in any field is the ability to use the language of the business with ease. To convey that you're a professional driver, you need to learn to use the terms accurately and to use them in the right context. Keep in mind who you're speaking to and decide whether that person is in the industry before you start using trucking-specific terminology.

You can't learn all the language of the profession in this course, but you will get a flavour for the kinds of terms you'll eventually use easily and readily.

Acronyms

Most professions deal with a number of organizations and they tend to have long names, which people shorten in conversation. Here are some examples of organizations that are involved in the trucking industry, which are often referred to simply by their initials:

BCTA – British Columbia Trucking Association

CTA – Canadian Trucking Alliance

ICBC – Insurance Corporation of British Columbia

TSCBC – Trucking Safety Council of British Columbia

NTAC – National Truckers Alliance of Canada

CVSE – Commercial Vehicle Safety Enforcement

You need frequent exposure to acronyms before you can begin to understand them. There are a few you can figure out if you have enough context. For example, based on what you've seen above, you could probably figure out that CVSA is the Commercial Vehicle Safety Alliance. Professional drivers work with numerous organizations and agencies. Once you've been working in the industry for a period of time, these sentences might make sense to you:

> *"I heard the CBSA was reviewing AMPS and FAST."*
>
> *"Did you hear that the CRA has changed the daily meal allowance limit?"*
>
> *"I'm looking forward to our discussion of the Canadian TDG Act and HOS regulations."*

These may be a bit obscure to you right now, but once you're more familiar, remember that when speaking with someone outside the profession, they might not understand when you use those acronyms.

What were those sentences about? Here's the translation:

> *"I heard that the Canada Border Services Agency was reviewing the Administrative Monetary Penalty System (a penalty system that is designed to ensure compliance with customs regulations) and the Free and Secure Trade border crossing process (a special program to speed border crossing for frequent travellers)."*
>
> *"Did you hear that the Canada Revenue Agency (the income tax department) has changed the daily meal allowance limit?"*
>
> *"I'm looking forward to our discussion of the Canadian Transportation of Dangerous Goods Act and hours of service regulations."*

When you hear a new and unfamiliar acronym, just ask the speaker what it means. Eventually you'll become familiar with frequently used terms.

Technical terms

Throughout this course, you'll learn new technical terms that relate to the components of a truck, different loads, regulations and driving techniques. You need to learn many of these terms to communicate effectively with co-workers, dispatchers, maintenance technicians and the various officials you'll interact with. Your comfort using these terms is evidence of your knowledge of the profession. Look up unfamiliar terms in the appendix or a dictionary and when speaking with others in your industry, don't hesitate to ask them what the term means.

An example would be "fifth wheel." This is a device used on most tractor-trailer units to attach the truck and trailer to each other. This attachment was first designed back in the 1850s to be used on four-wheel, horse-drawn carriages and wagons to allow the front axle to pivot.

Customer service

Providing good customer service results in improved business opportunities for you and your company and demonstrates professionalism that customers and your employer expect. A professional driver understands the principles of customer service, handles difficult situations calmly and leaves a good impression of themselves and their company.

Customers generally expect to deal with professional drivers — those who are prompt, courteous, polite, helpful and easygoing. Companies set up rules and procedures to improve and keep business and to help drivers achieve that level of professionalism that customers are looking for.

One of the most important components of providing customer service is to follow company policies for cargo and freight documentation, for dealing with freight problems and customer complaints.

When you arrive at a customer's loading dock, you're a representation of your company. They don't know how things happen back at the office, exactly what you are or aren't responsible for, or what you personally can or cannot do for them. All of that is your business, not theirs. They expect you to understand how the system works and to answer their questions, solve their problems or put them in touch with just the right person.

Thinking about these three basic questions will help you provide good customer service:

1. What do customers want from you and from your company?
2. How do the support areas (back at the office) work to serve the customers you see face-to-face and how should you work with them to ensure good service?
3. What are the details — the small things that make a difference to the customers you see?

For business customers, service has three components:

1. **Formal commitments.** Through contracts, letters and published policies, your company makes service commitments to its customers who expect them to be honoured. When possible, you should know what these promises are so that you can handle complaints.
2. **Common expectations.** Based on their experiences with other carriers or in other business relationships, customers develop expectations about how your service should be provided. You may not even know what these expectations are, but if you don't meet them you might disappoint the customer. Discussing them with a customer will help you to determine whether you can meet these expectations.

3. **Personal commitments.** These are the promises that you make yourself such as, *"I'll call dispatch to see where that second truck is now."* These are the ones that you're in charge of and where you can make a difference to your company's customer service. These interactions help build your company's reputation for good or bad customer service.

Customers make judgements based on how you interact with them. One of the ways that you can deliver good service is to think before you respond and use a polite and courteous approach when handling a problem situation.

Phrases that maintain good customer relations	Phrases that lead to poor customer relations
How can I help solve this problem? Thank you. I don't have the answer, but I'll get the information. Thank you for bringing that to our attention. We appreciate you telling us. I'm concerned about your complaint.	We never make special arrangements. That's just not how we do it. What else did you expect? It's not my job. Just calm down.

In general, customers evaluate the service they receive by looking at these factors:

Efficiency Customers look for quick, correct service. The right goods, the right information, the right paperwork, the right bill, delivered on time to the right place and so on.

Confidence When customers ask you for something, they expect you to be able to provide it whether it's information, service or assistance. They'll have a good impression of you if you give a response with confidence and authority. If you seem unsure, you might create a bad impression.

Helpfulness This trait is usually considered to be a bonus. You can be helpful if you point out to a customer how they could get better service or work more effectively with your company. Or, you can be helpful if you provide information or a service that the customer didn't know they wanted.

Personal interest	If you see the same customers over and over again, you may develop a relationship with them. Customers generally respond well to the company representative who shows an interest in them, their business needs and their concerns. If there's a problem to solve, they look for the individual who takes a personal interest in getting it solved.
Reliability	Customers like to know that they can depend on you so they look for consistency in your service. They look for companies that are committed to responding to customers' inquiries and service requests.

Providing customer satisfaction

Customers can be frustrated and angry when delays or errors occur. As the only person customers may see face to face, you'll often be the person they voice their complaints to. It's easier to handle these situations if you have a few guidelines for customer service.

Who are your customers?

As a professional driver, you'll meet customers when you make deliveries or pick up a load. You must practice good customer service skills when you interact with anyone you meet at a customer's site. This includes people at every level from the dock workers and dock supervisors to the company manager. In each interaction, you leave an impression of your company.

You must also be aware that you have "customers" inside your own company, too. As a driver, you have to work with and provide service on behalf of dispatchers, operations managers, billing administrators and others. If you're an owner-operator, then the company to which you contract yourself becomes your customer. It's sometimes easy to forget that our co-workers are customers who deserve to be treated with the same respect as outsiders. You're maintaining the reputation and image of professional drivers by providing them with good service. If doing their own jobs well depends on your work being done professionally, then they're your customers.

What do customers want?

You can provide better customer service if you know what your customers are looking for. The following chart identifies some expectations a customer would have and some tips on how to meet those expectations.

Customers want…	What you can do:
to be treated as you'd treat a guest	• Be polite, even when they're not • Smile • Use the customer's name • Look professional • Follow up on actions you say you'll take • Find answers they need • Keep their information confidential
to have your attention	• Be consistent in your service and your manner • Do the little bit extra to meet their needs • Solve problems, even if you aren't responsible for them • Admit when you've made a mistake or caused a problem
to be served by a system that works for them, not against them	• Find creative workarounds if your computer or paper system won't let you do what they need you to do • Be as flexible as you can while maintaining your own professional standards • Take their concerns about "the system" back to your supervisor
to be spared embarrassment	• Listen when they have complaints • Be sensitive if they've made a mistake • Keep your criticism of them, your employer or "the system" to yourself
to be treated with dignity	• Don't stereotype customers • Don't show bias towards customers

Using communication technology

There are some communication guidelines that are specific to each of the communication tools used in trucking. This section looks at some of the most common communication technologies you'll encounter and the proper etiquette to follow when using them:

- Cell phones and voicemail
- Computers and e-mail
- Satellite tracking and communications systems

Cell phone etiquette

With cell phone technology, people can communicate almost anywhere. Just because you can, doesn't mean you should. Here are some do's and don'ts for using cell phones to communicate effectively and courteously.

Don't

- Subject other people around you in a confined space (small room, elevator) to your conversation. Wait until you can be in a quiet, private location.
- Set your cell phone ringer and tone to a loud, annoying tune.
- Dial while driving. Use voice-activated dialling or pull over to make that call.
- Take a personal call when you're discussing something with a customer.
- Have emotional conversations in public.

Do

- Pull over to make your calls, when possible.
- Maintain a 3 m zone around yourself while talking on a cell phone.
- Keep calls brief and to the point.
- Tell the person at the other end where you are or what you're doing, so they can anticipate distractions or problems while talking to you.
- If you're on speakerphone and you're not alone, inform the caller that others are present.

Voicemail tips

Voicemail systems can increase efficiency in today's workplace, but only if they're used effectively. A message that just says, "It's me, call me back" doesn't help to exchange or request information.

Here are some tips for leaving voicemail messages:

- Identify yourself, speaking slowly and clearly and give your name and company.
- Leave your telephone number, even if you think the other party already has it. They may have misplaced it and leaving your number makes it easier to call you back quickly.
- Make your message clear, concise and complete. Leave all the details the listener will need to call you back with the information you need.

- Speak slowly so that the listener doesn't have to replay the message. Be clear about when you need a response, especially if the information is needed to stick to your timelines.
- Say when they should call you back, remembering differences in time zones.

Using email

Here are a few tips to help you manage your email:

- Read your email on a regular basis.
- Delete any unnecessary messages after you read them. You can save the ones you'll need to refer to again, but many can be deleted.
- Remember email messages are not necessarily private. Don’t write anything that you wish to remain confidential.
- If you receive a message addressed to a group, it’s sometimes better to reply to one person from the group rather than “reply all” and send the message to the whole group.
- Keep it neat and use spell check.

Email etiquette

To communicate effectively through email, consider these guidelines:

- Be concise and to the point.
- Long documents should be sent as attachments, which can be printed out if required.
- Check spelling and grammar to keep a professional image.
- Answer emails as quickly as you can. Most people expect emails to speed up business, not slow it down.
- Don't attach big and unnecessary files; send only what the receiver needs.
- Don't overuse the "high priority" flagging options.
- DON'T USE ALL CAPITALS. IT SEEMS TO THE READER AS IF YOU’RE SHOUTING.
- Read your message before you send it, checking for missing words and confusing language.
- Use a subject line that’s meaningful to the receiver. This can help them identify what the message will be about so they can decide on its importance.
- Don't send material that’s not business-related (jokes or videos for example) without getting permission first.

Communicating via satellite systems

Much of a driver's communication takes place using specialized communication tools, which brings their own challenges to communicating effectively.

Many carriers today use a satellite or cell-based system for electronic communication between drivers, dispatchers and clients. These systems combine satellite communications links, landlines in some cases and on-board computers in cabs and trailers to manage fleet efficiency. Depending on the size of the fleet and the nature of the work the company does, they may use a very complex system or a simpler one that does fewer tasks. Most systems are modular and individual carriers can choose which modules they wish to use.

Driver communication

For the driver, the introduction of these systems means that some of your record keeping is electronic rather than paper based. When these systems are installed, they also increase the ease and frequency of two-way communication between the driver and dispatch, as well as with other people.

Most systems:

- Allow two-way voice communication between drivers and dispatchers.
- Provide voice and email communication between other users of the system.
- Let drivers access company information such as payroll data, customer details and can even provide driving directions and maps.
- Include an electronic log book function.

Devices

In your truck, you can expect to use a small device with a keyboard and display screen to do a variety of tasks. The device may also include a microphone and speaker because it may be used for both data and voice communication. This is your on-board computer. It communicates through a Global Positioning System (GPS) and may have a cell phone component as well. Back at the office, company staff can see the information your unit sends on their regular desktop computers and they may also have a voice and speaker system that works with your system.



The features available to the driver vary depending on which product your employer uses, but your on-board computer will allow you to do some or all of these things:

- Complete your log book electronically, with some entries made automatically
- Perform routine calculations (for example, fuel tax and mileage)
- Record border crossings
- Monitor your hours of service
- Help with navigation and route planning through the GPS functionality
- Record details on an electronic work order
- Send company and possibly personal email

While the technology that operates these systems is sophisticated, using the technology is not complicated. The driver enters standard information, basically filling in the blanks and the equipment does the rest. Most of the units have a standard keyboard, the same as on a computer, and some systems use the same Windows interface that you find on some desktop computers, making it easy to learn how to operate them. Some of the newer units are simply tablets with a variety of apps loaded on them.

4 Vehicle components and systems

The purpose of this unit is to familiarize you with the systems of a commercial vehicle and how they function and work together.

What you'll learn

This unit will help you learn to:

- Describe the general components and basic function of a typical commercial vehicle engine compartment and fluid systems.
- Describe the general layout and function of major body, frame and external vehicle components and systems.
- Explain the difference between single, tandem, tridem and other multi-axle configurations.
- Describe the basic types, features and function of tires and wheels.
- Describe the physical features and operation of common types of suspension systems.
- Describe the physical features and basic operation of drum and disc brake systems.
- Describe how stability control systems operate and affect vehicle operation.
- Describe different types of trailer coupling devices.
- Explain various instrument panel displays.
- Operate various switches and controls.
- Be aware of technological advances in commercial vehicles.
- Locate and operate all typical primary and secondary controls, gauges, switches and instruments.
- Explain the instrument panel indicators that display important vehicle operating information, warnings and safety system statuses.

Introduction

An important step in becoming a professional driver is learning the components of your vehicle. Being able to identify and understand the function of components such as the drivetrain, suspension and wheel assemblies allows you to monitor their correct operation and condition, as well as identify and report any defects.

Tractor engine systems that support engine function are essential. They include air intake, exhaust, lubrication and the cooling system. Identifying each component and its role will help you understand the total system. This allows for more accurate inspections and assists with troubleshooting when there are problems with performance.

Many of these systems are monitored by the driver with warning lights, symbols and gauges. These inform the driver that a system or component needs attention or is outside its safe operating range. Any time a warning light is illuminated, it typically indicates a problem with the system. Gauges, symbols, lights and colors may differ slightly between manufacturers. Refer to the owner's manual before driving.

Some components are controlled using switches. These control important functions, so it's essential to know where they are, when to use them and if they're in the correct operating position.

Different manufacturers of trucks will have different types, styles and configurations of switches. The switches will be identified by either names or symbols. They could be rocker, toggle, button or another style. For these reasons, it's very important that you become familiar with all of the controls of the vehicle you're driving, and refer to the owner's manual if necessary.





Tractor body styles

In your work you'll encounter a variety of tractor body styles. The differences and similarities between tractor body styles are most obvious when you look at the body components outside the cab.

Cab design

Next to the axle arrangement (tandem axle and tri-axle for example), the body and cab designs of a tractor are its most recognizable features. Most tractor bodies fall into the conventional cab category. Other cab types are typically used in specialized applications or are older.



Conventional cabs

The placement of the driver and engine access in conventional cabs is just like the average car, with the engine located ahead of the driver. Hood fasteners secure the hood to prevent accidental opening.





Low Cab Forward (LCF)/ Cab over engine (COE)

These designs have the cab placed over the engine. Access to the engine is gained by tilting the cab forward. The tilting cab of an LCF/COE tractor is extremely heavy, so hydraulically operated pumps that raise the cab are common. A safety brace prevents accidental lowering of the cab and protects personnel under the raised cab. In the closed position, safety latches prevent unintentional tilting of the cab. Securing and stowing all objects prior to lifting is important to prevent damage to belongings and the cab's windshield. Engine oil and water levels may be checked without tilting the cab.



Sleeper berths

A sleeper berth is an area behind the seats where the driver can sleep. It may be found in both conventional cabs and LCF/COE designs. A sleeper berth is important in long haul units. The most common use is for a single driver to take advantage of the sleeper cab rather than using costly hotels or motels for overnight stops. When team driving, one driver will sleep while the other drives. Some sleepers are now equipped with TVs, microwaves, refrigerators, coffee makers and generators, to allow drivers to live comfortably and economically while on the road.

Accessories outside the tractor cab

There are a variety of other components that are found on commercial vehicles. If you're driving a tractor-trailer with a specific application, you may find added accessories such as auxiliary power supplies, hydraulic pumps, auxiliary heaters and engine heaters.

Mirrors

Mirrors are essential as they provide information about the space behind and around the sides of the vehicle. Without mirrors, a driver is unaware of the traffic around the vehicle.

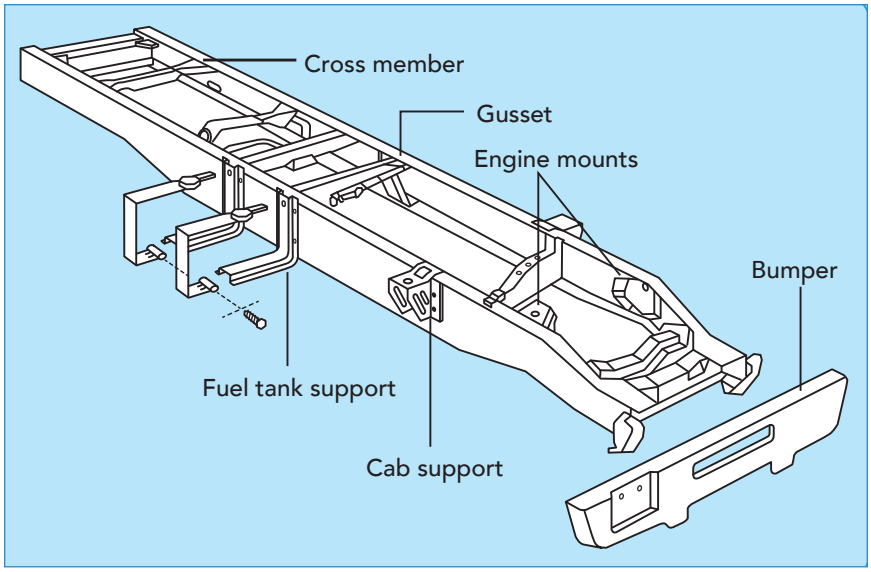
There are two types of mirrors on tractors:

1. **Convex mirrors:** The convex mirror bulges outwards and shows a larger field of view than can be obtained from a flat mirror of the same size. When aimed properly, these mirrors allow you to see most spots around your vehicle. They can be independently mounted or attached as part of the main mirror assembly.
2. **Flat mirrors:** Flat mirrors can give you a truer image of what's happening around and behind the tractor. Factors that affect visibility include the condition of the mirror, its cleanliness and its alignment.



Frame assemblies

The frame is the backbone of the tractor and trailer. The entire drivetrain, and all other components of the vehicle are attached either directly or indirectly to the tractor or trailer frame rails. These frame assemblies are rigid enough to maintain their shape as well as drivetrain and suspension alignment while being flexible enough to absorb the twisting and stresses of normal operation of the vehicle.



Frame rails — The two side rails that run the entire length of the vehicle are the frame rails. These are made of special steel or aluminum for tractors and trailers, and they're sized to support the rated loads that the tractor and trailer are designed to carry. Some specialized vehicles require reinforced frames and in some cases double frames. Frame rails should only be welded or drilled by qualified technicians.

Cross members — Cross members connect the two frame rails together and provide support and strengthen the frame. They cross the frame rails to form a ladder shape. They're sometimes made of aluminum to save weight.

Gussets — Gussets are brackets that attach the cross members to the frame rails. These hold the cross members at a 90-degree angle to the frame rails to maintain frame alignment.

Engine mounts —These are bolted to the frame rails and allow the engine to be attached to the frame through rubberized anti-vibration pads.

Suspension hangers — Suspension hangers are attachments to the frame. They connect the suspension to the frame rails.

Cab supports — The cab supports attach the truck cab to the frame.

Fuel tank supports — The fuel tank is attached to the fuel tank supports.

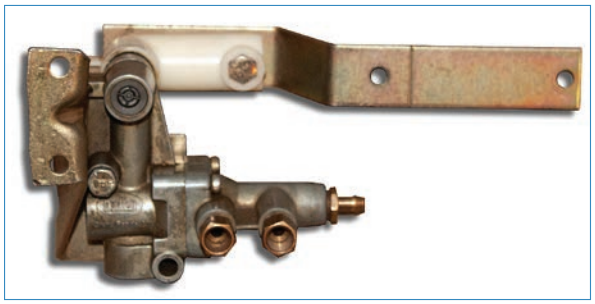
Exhaust mounts — Exhaust mounts are an attachment to the frame that securely hold the exhaust system in place and isolate it from vibration. The exhaust system includes a system that treats the exhaust before it leaves the vehicle. The exhaust pipe or stack of the vehicle may be vertical or horizontal.

Additional attachments — Options like tow hooks are available as attachments to the frame. When attached to the frame, tow hooks place the strain of a tow directly on the frame rather than on another component such as the bumper. A fifth wheel and/or a pintle hook will also be attached to the frame rails on a tractor to allow it to support and draw a trailer.

Suspension system

The suspension system connects the axles, wheels and tires to the vehicle. It must support the weight of the vehicle and its payload, cushion the vehicle from the road shock and transmit full braking and steering effort to the chassis or frame of the vehicle.

Air suspension — The air suspension system (most common in newer trucks and trailers) uses airbags (air springs) filled with compressed air. As the axle moves up, the air is compressed to absorb shock. The airbags are filled with air from the engine-driven air compressor. The ride height control valve maintains the airbag height by adjusting the air pressure in the bag as the vehicle's load is increased or decreased. If your air suspension fails to inflate properly it's usually due to a problem with the ride height control valve. The driver uses an air pressure dump valve to deflate the suspension while coupling or uncoupling the tractor and trailer. Torque rods control sideways, forward and backward movement of the axle. Torque refers to an engine's rotational force, measured in pounds feet (lb-ft), and is often referred to as "twisting force."



Levelling valve

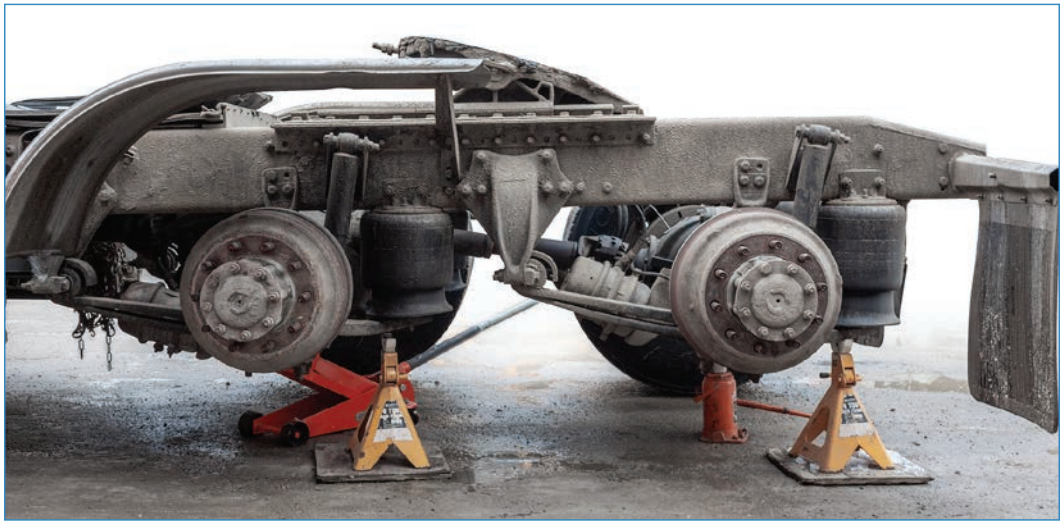
Air suspension dump switch — Used to dump the air out of the rear suspension of the tractor when coupling and uncoupling a trailer. This will help to avoid placing added stress on components, and to avoid scraping all of the grease off of the fifth wheel plate.





The type of switch may vary from truck to truck, but they perform the same function. The air suspension should always be in the SUSP, UP, or RUN position unless you're coupling or uncoupling a trailer.

Wait for the airbags to inflate before driving away. Driving with the airbags deflated will cause damage to the tractor driveline components such as the driveshaft, constant velocity (CV) joints, the differential, axle shafts and universal joints (U joints).



Air suspension system

Weight/axle/suspension load pressure gauge — Measures the air pressure in your drive axle airbags. This number can be used to check the weight on your axles. You need to be parked on level ground with your air system up to pressure for it to be accurate. There may be a trailer gauge mounted on the trailer near the axles.The name and type of gauge may vary between vehicles, but they perform the same function.





Refer to the maximum allowable weights for the jurisdiction you're driving in to ensure your trailer isn't overweight.

Maximum allowable weights will differ based on vehicle configuration, type of road and jurisdiction.

Leaf spring suspension — Leaf springs can be used in both tractor and trailer suspension systems. They're constructed to support the maximum loaded weight of the vehicle chassis while permitting a flexing action that dampens the vertical movement of the wheel assemblies as they travel along the road surface.

The stack leaf system is composed of a series of narrow metal leaves, bolted together in stacks. These stacks are secured to the axle at their centre by U-bolts and their ends are secured to the frame by front bracket and rear shackles. The torque rod or trailing arm prevents the spring assembly from being distorted by axle torque. The leaf springs in the stack are all the same thickness but vary in length. They become progressively shorter down the height of the stack. Stress absorbed by the flexing of the stack is therefore distributed more evenly.

In the tapered leaf suspension, the ends of each leaf are tapered. The leaves in the tapered leaf system are all the same length. Each spring shares the stress of the load. This system is most common on front axles.



Leaf spring

Walking beams — Walking beams are found on some tractors and trailers under a leaf spring or rubber block suspension. The assembly distributes weight evenly between the two axles, improving traction and enabling a smoother ride on rough roads.

Shock absorbers — Shock absorbers are used in the suspension system to control the rebounding effect of the springs and prevent side sway. Hydraulic shock absorbers are usually telescopic and operate on the principle of passing fluid through an orifice from one chamber to another to dampen the spring's motion.

Axles — The axle is a shaft on which two or more wheels revolve. It connects the wheel to the rest of the vehicle and also supports the weight of the vehicle. Tractor axles, along with trailer axles, serve as connection points for brakes. Tractors have a front axle and one or more rear axles.

Front and rear drive axle temperature gauges — Measures the temperature of the lubricant in the front and rear drive axles. Temperatures vary with the type of load, driving conditions and type of lubricant. Normal operating temperatures can range between 26 C and 104 C (80 F to 220 F) depending on the type of manufacturer. Refer to the owner's manual for normal temperatures for your vehicle.





It's normal for the front axle to read higher than the rear axle. High temperature readings indicate you should check the axle lubrication.

Driving with very hot temperatures in your drive axles can cause serious damage to axle bearings and seals.

When the truck is under a load such as climbing steep grades, it's not unusual for the temperatures to exceed the normal operating range as long as the temperature returns to normal when the load decreases.

Live axles — Live axles, also known as drive axles, transfer engine torque to the vehicle's drive wheels, and are directly connected to the vehicle's drivetrain. These are usually the rear axles (single, tandem or tridem) but may also be the steer axles in certain specialized vehicles used by power companies or for extreme off-road hauling situations at some remote mines, for example.

Dead axles — The wheels on a dead axle don't drive the vehicle, but the axle serves as additional support for the chassis. This type of axle is found on the trailer and the front axle of the tractor. As dead axles don't require internal drive gears, they can be shaped for a specific application. There are different types including straight, drop centre, I-beam, tube and box. These axles can also be fixed in a permanent location or be attached to an air lift system that allows them to be used only when required. Here are a couple of examples of dead axles:



Sample Dead-Axle

Sliding axles — Sliding axles, or bogies, are adjustable axles found on a trailer only. It's possible to slide them forward or backward to change the weight distribution and the wheelbase of the trailer.



Sliding Axle

Steering axles — Located at the front of the tractor, these axles are used for steering. Some vehicles may be equipped with twin steering axles.

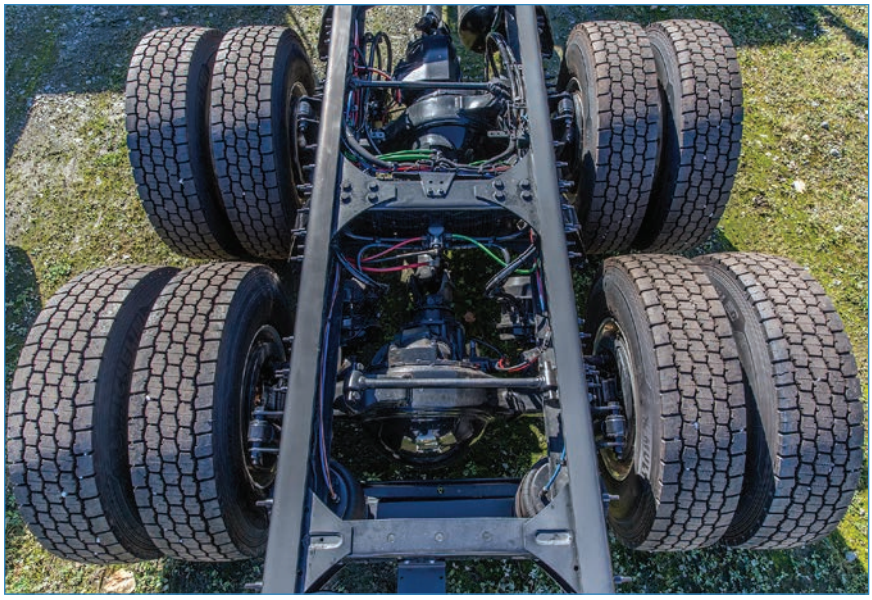


Sample Dead-Axle

Drive axle configurations

The rear drive system on the tractor can be configured as a single, tandem or triple axle (also known as tridem).

Tandem driver — Both axles are live. The forward axle has an input and an output drive shaft.



Tri-drives — Three axles systems or tri-drives distribute power to three live axles to provide additional traction.



Steering system

The steering system provides the driver with a means of controlling the vehicle direction. It's made up of the following components:

Steering wheel — Most steering wheels include a tilt and telescopic feature.

Steering shaft — The steering shaft is a long shaft enclosed in the steering column. It connects the steering wheel to the steering gear box. All shafts incorporate universal joints to compensate for angles as cabs flex and move at different rates than the truck frame. Some universal joints are sealed and some require greasing as part of the vehicle's maintenance.

Steering knuckle — The steering knuckle is the pivot point of the steering system, which allows the wheels to turn (also referred to as the hub).

Steering gear and power steering pump — The steering gear converts the turning motion of the steering shaft to forward/backward movement of the pitman arm to move the wheels. The power steering pump is driven by the engine and makes it easier to turn the wheels. Avoid dry steering as it's hard on the components and tires.

Pitman arm — Connected to the steering gear sector shaft, the pitman arm moves forward and backward as the steering wheel is rotated right or left.

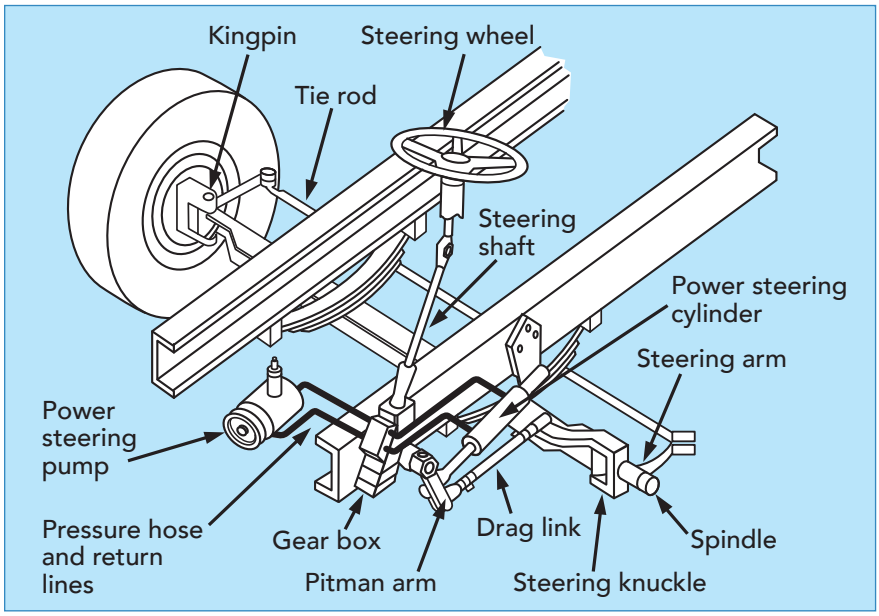
Drag link — The drag link is connected at one end of the pitman arm and to the upper steering arm at the other end. Movement of the drag link causes the left wheel to turn in the direction of the steering wheel movement.

Upper steering arm — Connected to the left steering knuckle only, the upper steering arm connects the drag link to the steering knuckle.

Lower steering arm — The lower steering arm is an angled arm that's connected to the lower half of each steering knuckle. It provides a means of connecting both wheels to the tie rod.

Tie rod assembly — The tie rod assembly consists of two tie rod ends, and each one is connected to the lower steering arms. The tie rod ends are joined together by a connecting tube that ties both steering knuckles together and transmits movement of the left wheel to the right wheel. This rod is adjustable to provide for proper wheel toe alignment.

Kingpins — The kingpins attach the steering knuckle to the front axle and permit the front wheels to swivel in response to the turning steering wheel. The spindle attaches the wheel to the steering knuckle.



Steering system components

Drivetrain

A power drivetrain is made up of six essential parts.

Engine — The engine takes energy in the fuel and converts it into mechanical motion that's capable of performing work. The torque or twisting force produced is capable of turning the transmission and moving the truck and load. There are different sizes and types of engines to suit the size of vehicle and the loads that they carry. The most common type of engine found in highway trucks is the diesel engine, due to its high torque output capabilities and longevity. Electric motors are also available.

Transmissions — The function of a transmission whether manual, automated manual or automatic is to provide a number of gear ratios to allow for different amounts of engine torque multiplication. This enables the tractor to pull the trailer from a stop to highway cruising speed. Transmissions also must provide a reverse gear to allow the driver to back up, and a neutral position to allow the engine to operate when the vehicle is stopped. Transmissions are bolted to the rear of the engine and receive torque from the engine's crankshaft through the clutch or torque converter.

Transmission temperature gauge — This gauge should be monitored to ensure the transmission doesn't overheat. The normal operating range for most transmissions is 82 C to 120 C (180 F to 250 F). If the transmission overheats, have it checked by a mechanic.



Manual transmissions (non-synchronized) — A manual transmission contains sets of various gears that produce different gear ratios. A typical manual transmission for a tractor-trailer has nine to 18 different gear ratios to allow the driver to select the appropriate gear ratio for the load and the terrain. The driver selects the various ratios by moving a gearshift. Most heavy truck transmissions consist of two sections, a front or main gearbox section and an auxiliary section. The main box contains the gears that are selected by moving the gearshift, and the auxiliary section provides ratios that are selected by operating additional buttons on the gearshift. The auxiliary section can provide low and high ranges as well as direct and overdrive ratios (deep reduction ratios are also available on some models).

Due to the loads and internal stresses inside the transmission, the proper type and level of transmission lubricant is required to prevent overheating. Many tractors have transmission temperature gauges in the instrument cluster to allow the driver to monitor the temperature during operation.

Clutch — Manual transmissions require the use of a clutch to connect and disconnect engine power from the transmission. This break in power transfer from the engine is required for initial gear engagement and when up or downshifting. A flywheel that's bolted to the rear of the engine's crankshaft drives the clutch. The clutch consists of one or two friction discs that are located between the flywheel and a clutch pressure plate assembly that provides the clamping force that applies the force against the clutch disc(s). The clutch is disengaged by a release bearing, which is operated by the clutch pedal through the use of mechanical linkage or hydraulic pressure. All of these clutch components are located inside a housing on the front of the transmission called the clutch housing. Be sure to check the level of your hydraulic fluid as part of your pre-trip inspection. The reservoir for the hydraulic clutch is attached to the firewall of your engine compartment.



Hydraulic fluid reservoir

Automated manual transmissions (AMTs) — It's important to understand that AMTs are not automatic. While many are a two-pedal operation (using only an accelerator and a brake pedal, along with a shift stalk to select drive, neutral, manual, low or reverse) and offer a similar driving experience to automatic transmissions, AMTs basically function internally the same as manuals with the clutch engaging automatically via centrifugal force. AMTs are generally lighter and cheaper than automatics, which means you can maximize your payload by having less total vehicle weight.

AMTs produce ideal shifts under all of the various driving conditions at the correct times. This reduces wear on the internal transmission components and provides increased fuel economy. The transmission uses an onboard computer, sensors and shift motors to complete the shifts. The transmission manufacturers offer different models that provide varying ranges of automation depending on the owner's preference. The fully automated models don't require the use of a driver-controlled clutch, so only a throttle and brake pedal are present in the cab.

AMTs have many benefits compared to true manuals in terms of safety, driver fatigue, maintenance and fuel economy. When driving AMTs, drivers are able to be safer by maintaining their undivided focus on the road and lessen the physical and mental fatigue that comes with continual manual clutch/gear stick shifting situations. Due to these factors, AMTs are often the preferred transmissions for on-highway applications. The driver still influences the performance of the transmission based on the position of the throttle pedal when accelerating from a stop as an example. The driver also needs to place the transmission in the manual mode and select the correct gear to safely descend steep grades. There are some unique features of these transmissions and drivers should receive training for their specific brand/model.

Drive shaft — Drive shafts carry the power from the transmission to the rear axles and between the axles. They are tubular in shape and vary in length to suit the distance from the transmission to the axle. Due to their speed of rotation and length, drive shafts must be balanced, aligned or phased and installed at the correct angle to prevent torsional vibration.

Centre support bearings — If the distance between the transmission and the first differential is too long, a centre support bearing will be installed. This bearing allows for the use of two shorter drive shafts. Using two short shafts prevents whipping from occurring from an imbalance in a longer, heavier drive.







Drive shafts

Slip joints — The drive shaft on all vehicles has a slip joint. The transmission is bolted rigidly to the engine while the axle is supported by the suspension. As the axle moves up and down to compensate for irregularities in the road surface, the distance between the transmission output shaft and the differential input shaft changes so the length of the drive shaft needs to be able to increase or decrease as needed.

A slip joint consists of internal splines that fit over external splines on one end of the drive shaft. These splines allow the two shafts to rotate while permitting the two shafts to move lengthwise. The overall length of the drive shaft can increase or decrease as necessary.

Universal joints — The universal joint is a coupling that transmits torque (twisting force) from one drive shaft component to another. Universal joints allow the transmission of torque through a slight angle. This means that the shaft can move up and down with the movement of the suspension or motor mounts during operation.

Final drive assemblies — Tractors are equipped with one, two or three final drive assemblies. These assemblies are responsible for taking the rotating drive torque from the drive shaft and turning it 90 degrees to drive the axle shafts.

This also provides a final gear reduction to allow the engine and transmission to operate under less stress. The assembly consists of an axle housing, carrier, drive gears, differential case and gearing and the axle shafts. When more than one drive is used, the forward drive has an additional component called a power divider to allow drive torque to be distributed to both front and rear drives. In the case of a tridem, the two forward axles would have power dividers.

Rear axle differential — If a vehicle were to travel in a straight line all the time, a differential wouldn't be required. Both wheels would travel the same distance and speed. However, when a vehicle turns a corner or rounds a curve, the outer wheel must travel further and faster than the inner wheel. Axle shaft gearing inside the differential allows one wheel to go faster than another during cornering or when travelling on uneven terrain.

Final drive housing (drive axle assembly) — The drive axle housing is a sturdy steel housing to which all of the final drive components are bolted. It's also the lower mounting point for the suspension.

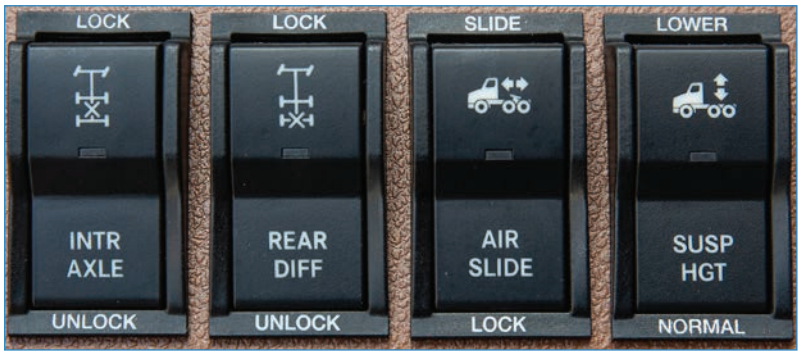


The drive housing holds all of the components in correct alignment while also providing a reservoir for the axle lubricant. On the top of the housing is a vent to prevent any pressure buildup from the lubricant that expands as it heats during operation. This vent must be checked routinely to ensure that its top cover is unobstructed and able to vent correctly. Axle seals prevent the lubricant from leaking out. Temperature sensors are mounted in most housings to detect the lubricant temperature and send a signal to the drive axle temperature gauge(s) found in the tractor's instrument cluster.

Inter-axle differential or power divider (first differential) — The inter-axle differential found on multiple drive axles takes the drive shaft torque and shares it between the driving axles. Since it's a differential, it will allow one axle to turn faster than the others. This may be necessary because of slight variations in tire sizes and operation on rough roads.

In conditions where traction is poor (slippery roads, mud, snow and ice for example) the driver can lock in the power divider. This prevents differential action between the axles and forces equal drive to both final drives. The power divider can be locked and unlocked while the tractor is moving, but it must not be locked if any wheel slip is present. To do this, however, the driver must break torque by releasing the accelerator to smoothly complete the transitions.

Note: The power divider should only be selected when extra traction is required.



Differential (Diff) lock — Also called "main differential lock" or "driver controlled differential lock" (DCDL). This locks both sets of dual wheels on the same axle to ensure they both spin together at the same speed. It should be used when operating on slippery or uneven surfaces.

Not every truck will be equipped with a differential lock. This feature comes as an option for the forward drive axle, the rear drive axle or both. If a truck is equipped with both, there will be a separate switch to operate each one as pictured.











Move the switch to the lock position to lock the wheels together.

Move the switch to the unlock position to allow each set of wheels to spin independently. It may take a few kilometres before the axle lock disengages.

The differential lock should only be used at low speeds such as 40 km/h or slower. Some manufacturers have designed the switch to automatically disengage if the transmission is shifted from fourth to fifth gear.

Switch to the lock position when the wheels are all turning at the same speed or stopped to avoid damage.

You may experience oversteer while driving with your differentials locked especially if you have more than one locked. If conditions are that slippery, you should consider using tire chains instead of having all your axles locked.

Note: Never use DCDLs while driving downhill as this could make steering difficult.

Electronic control module (ECM)

Modern diesel engines have sensors throughout their inner workings that are constantly sending messages regarding various engine performance characteristics to the computer or electronic control module (ECM) mounted on the engine. Electronic controls are designed to make driving easier and safer, help maximize fuel economy and instantly identify faults in the engine's operation.

Speed limiters

In North America a number of jurisdictions have introduced legislation to reduce energy costs, vehicle emissions and crash risks by limiting the maximum operating speed of large trucks on freeways and highways. However, British Columbia does not require speed limiters to be installed on heavy trucks.

Ontario and Quebec both have legislation mandating speed limiters. This means heavy commercial vehicles must have speed limiters installed, limiting them to a maximum of 105 km/h.

Reducing the speed of a vehicle results in lower fuel consumption, helps reduce greenhouse gas emissions and saves money on fuel. The risk of collision is also reduced when driving at lower speeds. Speed-related, at-fault crashes involving large commercial vehicles fell by 73 percent after mandatory speed limiter legislation took effect in Ontario (Ontario Ministry of Transportation Report, 2018).

Fuel system

The fuel system sends fuel to the engine. In newer models, fuel management is handled by a computerized element of the system.



Low fuel warning light — Displays when the fuel level is low

Fuel tanks — Most large trucks have two fuel tanks; one strapped to each side of the frame. They come in a variety of sizes. Fuel tanks are vented to maintain equal pressure on the inside and outside.

Fuel tanks serve both as a supply reservoir for the fuel pump to draw from and as a destination for fuel returned from the engine. Many engine designs oversupply the injection system so that the excess fuel serves as coolant. Returned to the tanks, the fuel radiates heat out through the tank walls.

To prevent fuel contamination when refueling, make sure that the areas around the tank caps are cleaned of dirt and debris. Fuel levels in the tanks should be maintained as high as possible to permit settling of water and sediment in the tanks. Maintaining full tanks when the vehicle is parked overnight also prevents airborne moisture from condensing in the tanks.



Fuel gauge — Measures the approximate level/amount of fuel in your fuel tank(s). This gauge should be checked regularly to ensure there's plenty of fuel to reach your destination. If you notice that the needle is stuck in one position for too long, this can indicate an issue with the gauge, the sensor in the tank(s), or the fuel is not leveling out between the two tanks. The next time you stop the vehicle, remove the cap(s), and ensure you still have enough fuel to reach your destination.

If it's a leveling problem, one tank may still be full while the tank where fuel is being drawn from is almost empty.

Fuel filters — This component keeps contaminants out of the fuel system by cleaning the fuel as it flows from the tank through the fuel lines into the fuel injector. Water separators or fuel dryers remove water droplets emulsified in the fuel supply. Several models of filters include separators in the primary filter elements.



Fuel filter gauge — Indicates the condition of the fuel filter. Monitors for a dirty fuel filter or one that might be gelling up on a cold day. Usually consists of two sections: White zone and red zone.

If the needle stays in the red zone it can indicate a clog in the fuel filter. A clogged fuel filter should be changed to maximize engine performance.

Air intake and exhaust systems

Air intake and exhaust systems ensure that fresh air is constantly supplied into, and burned gases expelled from, the engine to enhance smooth running of the tractor-trailer. A diesel internal combustion engine is not only powered by fuel but a mixture of fuel and air. This system supplies the air that causes combustion in the cylinder. It's composed of an air cleaner, turbocharger, charge air cooler and intake manifold.

Air cleaner — Clean air flows into the turbocharger through the charge air cooler (CAC) and into the intake manifold. Valves regulate the flow of air into the cylinders. It's important to check the air cleaner's restriction gauge regularly so you know when to change the filters. Dirty filters will impact the power of the engine and your fuel economy.



Air cleaner restriction gauge

Turbocharger — This is a turbine-driven forced induction device that increases an internal combustion engine's efficiency and power output by pressurizing the intake air. As the exhaust gases leave the engine they go through the turbo charger's hot side, spinning the turbine that's connected to the matching turbine on the cold or intake side of the turbo. This is "free" power provided by pressurizing the intake air going into the engine which allows the computer to inject more fuel and still have it burn cleanly. The additional fuel allows for a bigger explosion in the cylinder thus producing more power to move your truck down the road.

The turbine shaft and bearings, rotating at high speed, require a constant supply of oil lubrication to reduce friction and dissipate heat. For this reason, engines with turbochargers must be allowed additional time to warm up before being placed under load, and time to cool down at idle speed before being shut down.

Manifold pressure/turbo boost gauge — Indicates the power the engine is putting out by showing the amount of turbo boost in pounds per square inch (p.s.i). The name and look of this gauge may vary from truck to truck, but they perform the same function. A driver can drastically improve fuel efficiency by monitoring and attempting to keep the pressure low when accelerating.





The amount of p.s.i indicated on the gauge will vary depending on the load placed on the engine. If the pressure goes down when the engine is under a load, there may be something wrong with the engine and it should be checked by a mechanic.

Charge air cooler — This assists in cooling the intake air received from the turbocharger to a lower temperature level. The cooler air is also denser, so more air can be squeezed into the cylinder. This means more fuel can be added and results in more horsepower.

Pyrometer — The pyrometer, found on some instrument panels, measures the temperature of the exhaust gases. It's important that the temperature doesn't get too high (over 538 C/1,000 F). Most tractor units are equipped with an electronic control module (ECM) which manages the exhaust temperature for you. The pyrometer is a very important gauge on older trucks that don't have ECMs. If the temperature of the exhaust gases gets too high, the engine can become damaged.



If excessive exhaust temperatures occur, give the engine a chance to cool by gearing down to raise the engine RPM. If the other gauges are also outside of their normal ranges, the problem might be more serious. Stop and find the cause of the problem. Refer to your owner's manual for normal operating temperatures.

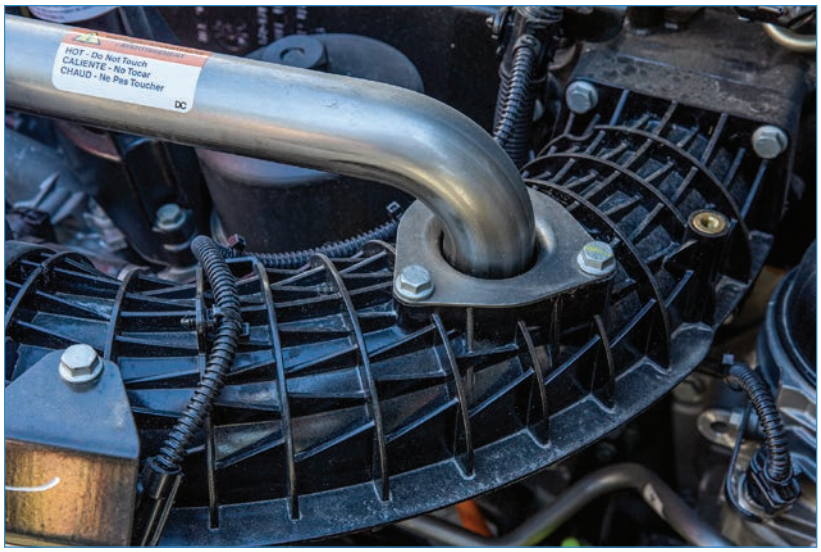
Exhaust — This system removes burned gases and fumes from the engine cylinder. After combustion has taken place, the exhaust valves open and the burned gases are discharged. These gases go out of the cylinder through the exhaust ports to the exhaust manifold, then on to the turbocharger. Most engines manufactured after 2004 recirculate a percentage of exhaust gases

back into the engine through an exhaust gas recirculation (EGR) cooler and the intake manifold as part of their pollution control system. The rest of the gases proceed to the after treatment system and, subsequently, to the exhaust pipe or stack. An exhaust pipe is mounted horizontally, while an exhaust stack is mounted vertically. Most exhaust stacks have curved ends to prevent rain from entering.

Aftertreatment systems

Pollution control regulations have been evolving since 1998, with significant changes in 2004, 2007 and 2010.

2004 (2005 model year trucks) — Exhaust gas recirculation was added to most diesel engines. This resulted in a metered amount of the exhaust gases being routed back to the intake side of the engine through an EGR cooler. After coming out of the EGR cooler the gases are routed back into the intake side of the engine.



2007 (2008 model year trucks) — Diesel particulate filters are added to the exhaust after treatment systems. Most systems have two filters. As they become plugged, the vehicle will start a regeneration procedure (also called regen) to clean them out. If the vehicle is operating at speeds consistently above 60 km/h, the regen will occur without you noticing, but it will use some extra fuel to burn off the accumulated ash. If your vehicle is not travelling above 60 km/h consistently then a light on your dash will indicate that a parked regen is required. A parked regen may take up to 45 minutes to complete and you should park in an area with no combustibles nearby. The exhaust system will get very hot and the truck will run on high idle with the fan on so it will be noisy. If the driver ignores the regen light it will eventually start

to flash. If you continue to ignore it, the ECM will derate the engine (where the computer reduces engine power to protect the engine and limits road speed) to a point where you'll have to stop and perform the parked regen. There are two warning lights related to this system:

Diesel particulate filter (DPF) regeneration lamp



Illuminates yellow when the diesel particulate filter requires a regeneration (regen) or when the regeneration operation is active. If the light is flashing you have a limited amount of time to stop and perform a parked regen before an engine derate occurs.

HEST light — warning of high exhaust system temperature



This warning light illuminates when the exhaust gas temperature and exhaust components become extremely hot, usually during and right after a regen. Eventually the DPF will reach their capacity. They'll need to be replaced and the ash counter in your ECM will need to be reset. Check with your engine manufacturer for new or remanufactured filters. Filters will typically last between 400,000 km to 500,000 km (248,548 mi to 310,685 mi) before needing replacement. This will vary with how much time your vehicle spends idling versus running up to temperature on the highway.

2010 (2011 model year trucks) — The next level of exhaust after treatment included the addition of selective catalytic reduction (SCR) catalyst and diesel exhaust fluid (DEF) into the trucks' exhaust systems. DEF is stored in a separate tank and is injected into the exhaust stream after the DPF and works to further clean the exhaust. DEF is used at a rate of 2 to 3 per cent of diesel fuel burned and the tank needs to be filled about every third time you buy diesel depending on its size. The DEF gauge is normally found on the bottom of the fuel gauge and has four bars to indicate how full the tank is. Some trucks have a separate gauge. If you allow the vehicle to run out of DEF the ECM will derate the engine to the point where you will have to park and get the tank refilled. Once the gauge is down to one green light you should be looking for a place to refill it. DEF is available in bulk at most card locks and in 9 litre jugs in many auto supply stores and truck stops.

Fuel gauge with DEF gauge built in





DEF storage tank on a tractor



DEF dispenser at a card lock





The malfunction indicator lamp (MIL) indicates problems specifically with the after treatment system. It's yellow in colour and shaped like the outline of an engine, similar to the check engine light. Trucks with MILs will usually have the word "check" added to the inside of the check engine light so you can tell the difference. Typically, you can continue to drive with your MIL on and report it to maintenance at the end of your trip.

If you see the MIL and check engine light on at the same time, you may experience an engine derate — where the computer reduces engine power to protect the engine and limits road speed. This situation needs to be reported to your support team as soon as possible. Ensure you're in a safe place (preferably at a repair shop) before you shut off your engine in this situation as depending on the problem you may be limited to a speed of 8 km/h upon restart until the issue is repaired.

The check engine light indicates a problem with the engine. The vehicle can still be safely driven, but should be serviced to correct the problem.

Engine lubricating system

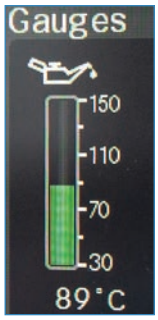
This is a system that assists with the distribution of oil to various parts of the engine. The presence of oil in the engine enables the moving parts to slide smoothly instead of rubbing together, thereby reducing friction between the surfaces of the engine parts. A well-lubricated engine will increase engine efficiency and extend the life of the engine's parts. Oil changes should be a part of regular maintenance as recommended by manufacturers.

The oil capacity of a typical tractor engine is 40 to 50 litres (10.5 to 13.2 gal). The oil level is checked using a dipstick (be careful not to over tighten dipsticks). The space between the high and low marking on the dipstick represents 4 to 6 litres (1 to 1.5 gal) of oil. Only add oil if the level nears the low mark on the dipstick. It's important not to overfill the engine with oil.

Oil is circulated through the lubrication system under pressure to ensure constant flow. Air pressure is built up within the system by the action of the crankshaft and other engine components. This could cause leakage if the system is not properly vented. A road draft tube extending from the top of the engine vents the crankcase.

Oil temperature varies with the terrain, load and condition of the engine. The driver must determine the normal operating temperature range for each power unit, keeping a watch on the gauge for variations.

Engine oil temperature gauge





Viscosity (thickness) of oil is much higher at lower temperatures, and oil subjected to heat that's too high can lose its lubrication properties which results in loss of lubrication of the engine components.

After starting a cold engine, you should wait for the engine oil temperature to rise before moving the vehicle to allow for proper lubrication and reduce engine damage. This is especially important in colder temperatures.

If you can't wait for the engine oil temperature to rise before driving, then it's important to slowly accelerate after each shift and not overwork the engine until the temperature reaches its normal operating range.

Normal operating temperature will differ among different types of engines. Refer to the engine manual for normal ranges.

If oil temperature rises above the normal operating temperature, you should reduce the load being placed on the engine or transmission to help reduce the temperature, and then determine the cause and have it repaired to avoid engine damage.

High temperatures can indicate a failing oil pump, a shortage of oil or a blockage.

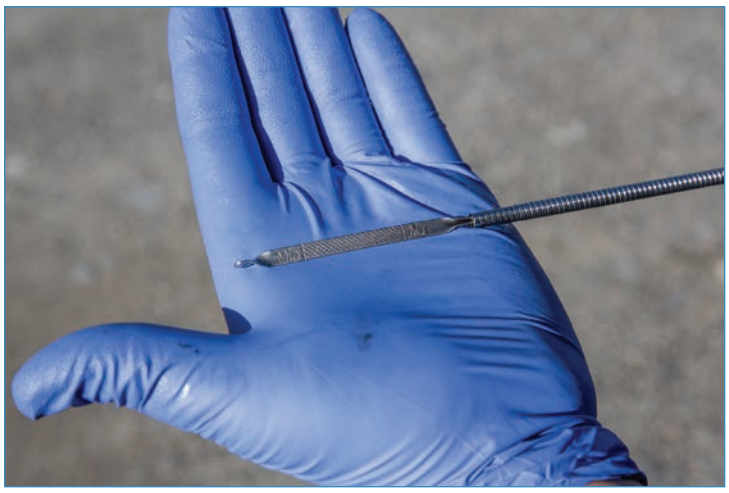
Typically the maximum oil temperature is 120°C (250°F).



Engine oil pressure gauge and warning light — Under normal operating conditions, oil pressure will register on the oil pressure gauge immediately after the engine is started. Oil pressure will gradually rise to normal operating levels and remain stable. Normal pressure will vary depending on the engine. Typically, newer engines operate at lower oil pressure than older ones. Watch for variations and fluctuations in oil pressure. A sudden drop in oil pressure may indicate a failure of the lubrication system. Shut down the engine immediately.

The light may illuminate as the tractor-trailer is being started, but should go off right after the engine starts. If it remains on, the vehicle should be inspected. Low pressure means there either isn't enough oil in the system or the oil pump isn't circulating enough oil to keep the critical bearing and friction surfaces lubricated.

Oil dipstick — This is used to indicate the level of oil in the engine. The dipstick is marked in increments from low/add to full.



Oil pan — The oil pan acts as a reservoir to hold a quantity of oil for lubricating purposes. It allows returned oil to cool and large contaminant particles to settle out of the oil.

Oil pump — The oil pump draws the oil from the oil pan and forces it under pressure through the oil filter and on to the oil galleries where it's distributed to and lubricates all moving parts.

Oil filter — Contaminated particles are removed from the oil by the oil filter. If the filter becomes plugged the oil will bypass the filter and go directly to the engine.

Oil cooler — Engines incorporate an oil cooler. Here, coolant from the cooling system circulates around pipes containing circulating engine oil. This cools the oil when it is hot, and warms the oil when it's cooler than the engine coolant temperature.

Oil galleries and lines — These are passages within the engine block construction and in some cases, external lines that direct oil to its required locations.

Oil pressure sending unit — This unit is a small device threaded into the engine block main oil gallery. It drives the oil pressure gauge up or down depending on the oil pressure in the galleries. There's a separate sensor which sends a signal to the ECM.

Engine cooling system

Heat is generated in the vehicle engine and may destroy the engine if not controlled. The cooling system assists in keeping the temperature of the engine consistent.

Coolant — Coolant is the fluid that circulates through the engine block and cylinder head and keeps the engine cool. The coolant flows through a channel called a water jacket, picking up heat as it goes. The channel then takes the coolant to the radiator for cooling. The coolant returns to the engine to repeat the cycle. The coolant is also used to heat the cab through a heater core.

Coolant pump — The coolant pump circulates the coolant from the radiator through the engine's coolant jackets when the engine is running. It's driven by the engine crankshaft.

Water manifold/jackets — Coolant from the radiator travels through these passages within the engine block and cylinder head to absorb heat created through friction and combustion.

Thermostat — The thermostat regulates the flow of coolant through the engine block. When engine temperature is too low, the thermostat blocks coolant flow. When the engine reaches operating temperature, the thermostat opens to permit coolant to circulate. Modern diesel engines operate at higher temperatures than older models. This design ensures the cleanest combustion of the diesel fuel possible to minimize pollution.

Water temperature gauge — This gauge should be monitored regularly to avoid engine damage. After starting a cold engine, you should wait for the water temperature to rise before moving the vehicle. Normal operating temperature is generally between 85°C and 96°C (185°F to 205°F). Refer to the engine manual for specifics for your engine. Engine fans will turn on at approximately 96°C (205°F). Some tractors will run beyond 104°C (220°F) before the engine overheat light comes on.



Overheating can happen when there are low coolant levels, a sudden loss of coolant or severe operating conditions such as climbing a steep grade.

If overheating occurs from climbing a steep grade you can usually continue driving, but select a lower gear to take the stress off the engine and allow it to cool down. Shut off your air conditioning as well to lessen the load on the engine. The overheating may also be caused by your engine fan failing to engage. In this case you'll need to turn the fan on manually.

If the engine overheats and the engine coolant temperature warning light illuminates:

- Stop the vehicle but leave the engine running unless a low water warning device indicates a loss of coolant.
- With the transmission in neutral, check to ensure that the oil pressure gauge is within normal range. Increase the engine speed to between 1,100 to 1,200 RPM maximum. Return the idle speed to normal after two to three minutes. If the warning light doesn't go off or the temperature gauge doesn't begin to drop, turn the engine off.
- If the overheating came from severe operating conditions, the temperature should have cooled by this time. If it has not cooled, stop the engine and let it cool before checking to see if the coolant is low.

Note: Never open the radiator cap on a hot engine.

Radiator — The radiator is a large heat exchanger (reservoir to store coolant) that cools large quantities of coolant that gets circulated to and from the engine block. The radiator is sealed by a pressure cap, which allows excess liquid to be vented into an overflow tank. The cap should be removed only when the engine is cold.

Fan — For the radiator to maintain a constant coolant temperature, airflow is required to draw off excess heat. The fan draws air through the radiator to cool the coolant, and a shroud around the fan directs the airflow. Fans are temperature controlled, engaging automatically when the coolant temperature gets too high and shutting off again when it has cooled to an acceptable level. Most trucks have a manual override switch on the dash to turn the fan on in case the temperature sensor fails to do so. A typical fan on a newer tractor will use up to 75 horsepower when operating.

Engine fan override — This switch allows you to control the engine fan manually or automatically. When the switch is on, the fan will run regardless of engine temperature.



When the switch is off, the fan will automatically start when the coolant/water temperature reaches approximately 96°C (205°F), and stop once the temperature has dropped to the normal operating range.

Don't operate the engine fan in the manual "on" position for extended periods of time. It's designed for intermittent operation only.

It may be used in conjunction with your engine brake to help hold your vehicle back while going down long, steep grades.

Fan belts — Fan belts transmit the turning motion of the crankshaft to the water pump, fan and other accessories such as the alternator and air conditioning compressor. Proper tension of belts is important for effective operation of the cooling system because belts that are too loose or too tight can cause damage to the fan, hub and water pump bearings. Most newer trucks use serpentine belts which are self-tensioning. It's an important part of your pre-trip inspection to check the condition of your belts.

Coolant filters — Coolant filters are small canisters that filter impurities (sludge, scale and foreign material) from the coolant. They're routinely changed when the tractor is serviced. A supplemental additive in the cooling filter assists in neutralizing the coolant to prevent harmful etching and erosion of engine components. This prolongs the life of the cooling system and engine components.

Cab heater — Like the radiator, the cab heater works as a heat exchanger. It has a heater fan which blows air through a heater core. This heats the cab of the tractor. There's an air filter in this system to keep dust out of your cab. If your fan isn't putting out enough airflow, the filter could be plugged. The filters are usually located on the firewall of the cab on the passenger side. Check the owner's manual for the location of yours. In wet or moist conditions, especially in the winter, it may be difficult to keep your windshield defogged when airflow is restricted due to a plugged cab filter.

Block and auxiliary heaters (optional) — Block heaters are electrically powered devices (120 V) that are used before the vehicle is started to warm the engine coolant in cold weather conditions. The auxiliary heater is a fuel-fired heater that uses the vehicle's own battery for starting and a gun type burner to produce heat. The water pump in the auxiliary heater circulates the engine coolant. This keeps the cab and engine block warm. This makes it easier to start the engine. Most modern diesel engines will start without a problem down to -10°C (14°F). For colder temperatures, use a heater.

Winter front cover (optional) — In areas of Canada where the temperature gets very low (below -20°C or -4°F) a winter front cover may be needed to help maintain the engine operating temperature. They limit the flow of air through the radiator. On after cooled engines, a front cover must not cover the entire opening as a sufficient air flow through the aftercooler must be maintained.

Electrical system

The electrical system is complex and needed to start your engine, maintain the batteries and run your lights, instruments and gauges.

The electrical system consists of the following components:

Batteries — Most trucks will have three or four batteries on board. Batteries are 12 volts and their stored power is needed to start the engine. Once the engine is running it gets its power from the alternator. Batteries are mounted securely in the vehicle and should be visually checked as part of your pre-trip inspection if they're easily accessible.



The battery light indicates a battery charging problem.

Battery shutoff switch — Disconnects power to most of the vehicle systems so the batteries don't discharge if the vehicle is parked for several days. The switch is normally located beside the driver seat. It must be in the on position for the engine to start.



Battery shutoff switch

Starting system — The starter is an electrical motor with a drive used to turn the engine crankshaft. When the ignition is turned to the start position or the starter button is pressed, current from the battery flows to the starter motor. A solenoid on the starter is activated and moves the drive pinion gear into mesh with the teeth on the ring gear of the flywheel or torque converter. This spins the flywheel allowing the engine to start. The ignition or start button is then released and the drive pinion moves back out of mesh with the ring gear.





Some older trucks will have a separate ignition switch and then a push button to start the engine. Most late model trucks have the same style ignition/start/accessory key switch as most cars and light trucks today.



Stop engine — Illuminates red with an audible alarm tone when a major engine system problem exists. This is considered an emergency situation and you should stop the vehicle as soon as possible and turn the engine off. The vehicle must be serviced and the problem corrected before starting up again to avoid further damage to the engine.



Wait to start engine — Illuminates yellow when the intake air heater (grid heater) needs to warm the intake air, or glow plugs need to warm the cylinder, before starting the engine.



Ammeter — This is the gauge on the instrument panel used to indicate the amount of charge or discharge the battery is receiving from the alternator. With the engine running, the normal position of the needle is in the centre or slightly on the charge side. High rates of charge or discharge usually indicate a problem.



Voltmeter — Indicates voltage in the electrical system. When you first turn the vehicle's ignition on it will show you the stored voltage of the batteries. Once the engine is running, the charging voltage is displayed and should be around 12.75 to 14.0 volts. If the gauge is reading higher than this it could indicate an over charge situation that could boil your batteries. If it's reading lower than this you could have a charge system problem and the vehicle may be running on battery power only. Check your ammeter (if equipped) to see if the system is charging or not.

Voltage regulator — This is mounted inside the alternator. It controls the amount of electricity produced by the alternator so that the electrical components aren't damaged and the battery isn't overcharged.

Wiring — Wires carry the electricity produced by the alternator. Wiring must be of sufficient size to carry the current. Any weak spot (loose connections, partially broken or corroded wire) will reduce the ability of the wire to carry electricity. Wiring is grouped in a wiring harness that provides protection and support for the individual wires.

Light switches



Headlights — Used to turn headlights on and off. When the headlights are on, the dash lights, front park lights, side marker lights and tail lights are also illuminated. Turning on the headlights will turn the daytime running lights off.

Push switch up to turn lights on and push down to turn lights off.

Some headlight switches have three positions: up for all lights on, middle for all lights off and down for marker lights only.



ID and clearance lights — These are the amber lights on the top, exterior of the truck cab and top, front and sides of the trailer, as well as the red lights at the rear of the truck and trailer. Some trucks have these lights included with the main headlight switch.

Push switch up to turn lights on and push down to turn lights off.

Marker interrupter/ID and clearance lights flash — Generally used at night to thank other drivers who assisted you in passing them. It can be a switch on the dash or a button on the end of the headlight dimmer lever located on the steering column. Some trucks have this button on the steering wheel.

It only works when the lights are on.





Dash switch: Push switch down to momentarily turn off all marker and clearance lights. Release the switch to turn the lights on.

Lever button: Push button in towards the steering wheel to momentarily turn off all marker and clearance lights.

Release button to turn the lights on.

Both types can be flashed multiple times to thank drivers by alternately pushing and releasing the switch or button.



Panel light dimmer — Used to vary the brightness of the instrument panel lights. Dimming the panel lights at night can help increase visibility of the road ahead, and decrease eye strain.

When the headlight switch is on, rotate the thumb wheel up to brighten the panel lights and rotate down to dim the panel lights.



Hazard lights/four-way emergency flasher — To be used when the vehicle is disabled, parked under emergency conditions or any time you have to stop on the side of the road, day or night. They warn other motorists that you're stopped so they can easily avoid you. Also commonly used when backing up and to warn motorists that you're traveling up or downhill slowly (usually at 40 km/h or slower). All turn signals on both the truck and trailer will flash simultaneously.

The flasher will work when the ignition switch is in the on or off position. Push switch up to turn lights on and push down to turn lights off. May be used in conjunction with emergency flares/reflectors.



Fog lights/driving lights — To be used in foggy or blizzard-like conditions to assist with visibility. Provincial, territorial and state requirements vary as to when high beams and fog lights can and cannot be used together. Make sure you know the law where you're traveling.

Push switch up to turn lights on and push down to turn lights off.

Most switches are wired so the fog lights will only operate with the low beam headlights or running lights and that the driving lights will only operate when your high beams are on.



Work light/utility lights — Most truck tractors come equipped with lights mounted to the side of the cab or bunk. Use these lights at night when backing up, coupling and uncoupling, chaining up or doing circle check inspections. This switch will either be located on the dash or a toggle switch will be installed on the inside of the cab wall behind the driver's seat.

Push switch up to turn lights on and push down to turn lights off. Remember to turn these lights off when you're done using them.

Cruise control

Advantages of cruise control include: Improving driver comfort, maintaining a consistent speed and improving fuel economy. Only use cruise control when conditions are ideal.



Cruise control on/off — This master switch turns the cruise control on or off. When conditions are less than ideal, turn the cruise control off to maintain better control of the vehicle and increase your reaction time. Don't use cruise control when operating on road surfaces with poor traction or in heavy traffic.

Cruise control must be turned off when descending steep grades.



Cruise control set/resume — When the master switch is on, this switch is used to set the desired speed and to resume the set speed when the cruise control has been interrupted. When the master switch is on and the parking brake is applied, it's used to set a high idle speed while the truck is parked with the engine running.

Cruise control:

- Push switch up to set desired speed and release.
- Push switch down to resume a previously set speed and release.
- Some trucks are programmed to automatically resume the set cruise speed after making a gear shift.

When cruise control is in use, the switch may be used to increase or decrease the desired speed.

Setting idle speed:

- Use the accelerator to bring the idle up to the desired RPM, then push the switch up to set.
- Push the switch down to resume idle speed.

Some trucks will have the idle speed preset. In this case, simply push the switch up or down to set depending on the manufacturer.

Speedometer and tachometer

Two key gauges you will be checking regularly are the speedometer (including the message centre) and the tachometer.

Speedometer and message centre — The speedometer indicates vehicle speed and the message centre is usually an electronic area at the bottom of the speedometer or somewhere on the instrument panel in front of the driver.

It displays the following information:

- Odometer: records the distance travelled in kilometres or miles. The far right hand number represents tenths of a kilometre or mile. Like the speedometer, every vehicle is required to have a properly functioning odometer.
- Trip meter
- Hour meter
- Warning and diagnostic messages



If the speedometer is indicating speeds that are slower or faster than what they should be, have the vehicle checked by a mechanic to correct the problem.

Malfunctioning cruise control could indicate a problem with the speed sensor.

If the message centre displays a warning or diagnostic message, and it's accompanied by a red stop engine light, pull over to determine the cause immediately. Contact your dispatcher to discuss and follow company policy. Refer to the owner's manual or contact a repair shop that specializes in the vehicle you're driving.

Tachometer — Measures engine speed in revolutions per minute (RPM) and allows the driver to operate the vehicle efficiently by matching speed and gear selection to the operating range of the engine. It may also contain an hour meter that measures the total time of engine operation.



If the engine speed gets too high, select a higher gear to lower the RPMs. If the engine speed drops too low, select a lower gear to raise the RPMs.

To avoid engine damage, don't let the engine exceed maximum governed RPM. Refer to your engine's manual for RPM recommendations.

Brake system

The brake system for commercial vehicles is designed to safely decelerate large masses in short distances. The brake systems are subject to high demands regarding safety, durability and wear.

As with many other vehicle components, brake systems for commercial vehicles are being constantly developed for better performance.

Park brake — Illuminates red when the parking brake is applied.



Air brake vs hydraulic brake systems

Air brake systems use compressed air for braking action; hydraulic brake systems use hydraulic brake fluid. Some hydraulic systems may also be vacuum assisted. Hydraulic brake systems are more often used in cars and light trucks than in tractor-trailer units.

Hydraulic brake system — Hydraulic brakes apply instantly. Brake fluid is held in a reservoir and brake lines so the system is constantly full. Brake fluid cannot be compressed as opposed to the air brake system.

Air brakes — This is a system that uses pressure from compressed air to increase braking force. Heavy vehicles require a more complex and powerful braking system than ordinary vehicles and air brakes are used as a way to gather the power of compressed air to control momentum, braking both the tractor wheels and the wheel of the trailers. An air compressor takes in air from the atmosphere and compresses (pressurizes) it and pumps it into storage tanks. The size of the air tanks depends on the air volume required for the airlines and chambers. With air brakes, there's a slight delay in brake activation as the air travels through the system. For more detailed information on the air brakes, see the air brakes unit.

Air application gauge — Measures the amount of air pressure being applied to the brakes from either the foot valve or hand valve. Use this gauge to ensure you're making a minimum of a **100 p.s.i.** brake application when performing a leak test.



Primary (1) and secondary (2) air pressure gauges

Ensure the air pressure gauges register maximum pressure on both gauges before moving the vehicle. Monitoring the gauges while driving will give you an early warning of any air leaks in the system.

Primary (left image) — measures primary reservoir air pressure for the truck's rear drive axle brakes.

Secondary (right image) — measures secondary reservoir air pressure for the truck's front steering axle brakes.





Other option: Single dual air pressure gauge with two different coloured needles indicating primary and secondary air system.

Auxiliary brakes or engine retarders

The engine retarder or engine brake helps to slow the truck down. It's useful when descending steep grades or slowing down to come to a stop. It helps to limit the amount of actual braking required, which keeps your brakes from heating up.



Engine brake on/off — Used to turn the engine brake on or off. It's illegal to use engine brakes within some urban areas and most request that you avoid using them. Watch for signs indicating this as you enter cities and towns.

With the switch turned on, you must release both the clutch (if equipped) and throttle pedal for the engine brake to activate. There's approximately 1.5 millimetres (1/16 inch) of free play in the throttle pedal. When you take that up, the engine brake will shut off but no fuel will be delivered to the engine.

Ensure you have adequate traction between the drive tires and the road surface before activating the engine brake or you could create a dangerous jackknife situation. There are four types of auxiliary brakes (engine brake, exhaust brake, hydraulic retarder and electric retarder). More information can be found in the air brakes unit.



This symbol illuminates green when the engine brake master switch is turned on.



Engine brake mode selector — Selects the progressive braking function that controls the amount of engine holdback. Most trucks are equipped with three modes: low, medium and high. Some trucks only use a single switch. In this case, the up position activates the high setting, the middle position is off and the down position activates the low setting.

Most switches are designed to be used this way:

- Push up to select the high mode which will give the most braking power.
- Set switch to the middle for medium braking power.
- Push switch down for low braking power.

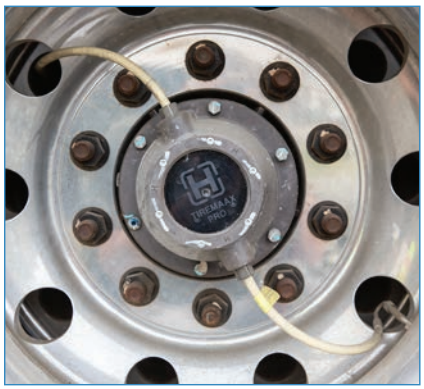
Wheel assemblies

The wheels of the tractor and trailer are mounted to axle hubs. They distribute the weight of the vehicle to the tires and the road surface below.

Wheel bearings — Wheel bearings are located at the ends of the axles. Bearings may be lubricated by grease or in an oil bath. The hubcap on the wheel end may have a plastic window to allow daily inspection of the oil level. On drive axles, lubrication must be checked at the oil fill port on the final drive housing. Some wheel ends are filled with grease instead of oil and some also support tire inflation systems as seen in the following pictures.







Rims — Tires are mounted on rims or wheels that are then installed on your truck or trailer. A one-piece rim is used for tubeless tires (radials) which are most common today.

Disc wheels — The one-piece wheel is known as a disc or budd wheel and is constructed of aluminum or steel.

There are two types of mounting systems for disc wheels: stud piloted and hub piloted.

Stud piloted — This mounting system uses the wheel studs of the vehicle as well as tapered nuts to center the rim on the wheel end and clamp it on. The wheel rim will have tapered or beveled holes to match the nuts and studs which are carrying the weight of the load.

When mounting dual wheels, there's an inner nut that attaches the inside wheel to the stud. This then becomes the stud for the outer wheel to mount to with an outer nut. Nuts and studs used in this mounting system will be right hand threaded for the passenger side of the vehicle and left hand threaded for the driver side of the vehicle. Be careful not to mix them up.





Hub piloted — This mounting system uses the centre or hub of the wheel to carry the weight and align it properly. The holes in these rims for the studs to go through are flat and the wheel nuts used come with a built-in flange washer, so the nut doesn't dig into the rim when you're tightening it up.

The hub on the wheel end of the truck or trailer has flanges to keep the wheel centred. Be sure to check for cracked or broken flanges when you're doing your pre-trip inspection. When mounting dual wheels with this system, slide the inner and the outer wheel onto the hub flange over the studs and use a single nut to clamp the two wheels onto the vehicle.

The hub piloted system has superior clamping force, uses fewer wheel nuts overall and all wheel nuts in this system are right hand threaded. The hub piloted system became industry standard when it was introduced in the early 1990s so you'll only see the stud piloted system on older vehicles.





Note: All wheel nuts, for all types of wheels, must be checked that they're tight and are torqued by a qualified installer. After installation it's required to get wheels retorqued usually within 150 km. Make sure you pay extra attention to any recently installed wheels during your vehicle inspections to ensure they're staying tight.

Tires

Tires provide traction, reduce vibration and absorb shock. It's important to have tires with good tread that are adequately inflated and are checked frequently for wear and tear.

Tubeless type tires — Tubeless type tires are mounted on single-piece rims. The tire itself holds the air. Air pressure causes the tire bead to seat against the rim. The valve stem mounts in the rim and is held in place by a nut. Tubeless rims have a recessed dropped centre that assists in mounting the tire. Tubeless type tires are safer to install than tube type tires.

Super single tires — One super singles tire replaces a set of dual tires. They provide lower rolling resistance, reduce weight and lower vehicle height. Canadian rules now allow super single tires to carry the same weight as dual tires. There are specific requirements for use of super single tires in B.C. that you should be aware of under section 7.25 of the Commercial Transport Regulations.

Advantages of radial tires — Although radial tires are more expensive than other tires, the tread on radials lasts from one and a half to three times longer than on bias and belted bias tires. More of the surface area of radial tires meets the road; therefore, radial tires have greater traction while creating 50 per cent less friction. The result is greater fuel economy and reduced tire wear, hence a lower cost per kilometre driven.

Matching tires — Mixing different tire types can create problems because of differences in traction and turning capabilities. Because of this, the tires on your vehicle should be of consistent size and construction and, if possible, the same brand. Never put tires of different sizes or construction on the same axle. Never combine the use of radial and bias tires on an axle.

Reconditioned tires

- **Full recap** — The remaining tread is completely shaved, and a new tread is bonded directly onto the old tire. In the full recap or full retread method, the edges of the new tread extend slightly down the sidewall of the old tire. You can choose from a variety of tread patterns when having your tires recapped depending if you want to use them on a trailer (rib pattern) or tractor drive axle (traction pattern).
- Recap tires are illegal for use on steering axles.

Load Ratings — Commercial tires may display information on the number of body plies in the tire construction. The construction of the tire determines the load rating which is printed on the tire sidewall. For example:

Tire Size	Ply/Load Rating	Max. Single Load	Max. Dual Load
295/75R22.5	14/G	6175 lb @110 p.s.i.	5675 lb @100 p.s.i.

Tire inflation — Having tires inflated to the proper pressure for the load you normally carry is essential to the effective operation of your vehicle. Tires should be inspected thoroughly and often. For correct tire pressure, refer to the vehicle's owner manual or company policy.

When inflating tires, keep in mind:

- A visual check of tire shape is not an effective way to determine proper inflation.
- Suggested tire pressures are stated for cold tires. If tires have been driven and are heated, they will have a higher pressure. If tires show less than proper pressure after they've been heated from use, they should be inflated to the correct tire pressure. They should then be rechecked the next time they're cold.
- Note the maximum pressure for the load that you'll be carrying; make sure not to exceed the rim or wheel rating.
- Replace the valve stem caps to maintain a tight air seal and prevent dirt and moisture from entering.

- If you've mounted new tires, check their pressure after 24 hours to get an accurate reading.
- During regular operation of your vehicle, you can expect tire pressure increases of 10 to 15 p.s.i. (pounds per square inch). Greater increases may suggest under inflation, overloading, excessive speed, incorrect tire size or any combination of these. As soon as you realize that one of these factors may be present and creating abnormal heat, stop and correct it.

Effects of underinflation

Underinflation is detrimental to the life of a tire in several ways:

- The tire tread wears down more quickly.
- The temperature can increase within the tire and cause the tread to separate from the body or belt ply.
- Over deflection can occur. As the soft tire travels over the road, the centre of the tread deflects upwards weakening the body cords. If this continues, the body cord construction deteriorates resulting in a sudden release of air (a blowout).

Dual wheels — If operating dual wheels with one of the tires underinflated or flat, the internal and external functions acting upon the tire can lead to heat build-up and the destruction of the tire (tire shredding). An equally disastrous alternative is that the other (good) tire could fail through overwork. This could be extremely dangerous for both the driver and other road users.

Radial tires — Radial tires may appear soft while actually maintaining their proper pressure. However, you should make sure that the pressure doesn't go too low. There will be serious consequences if excessive heat is generated and the tires fail. In an emergency situation, you'll have difficulty controlling your vehicle if the tires are underinflated.

Effects of tire overinflation

Overinflation, like underinflation, isn't good for the tire in several ways:

- The centre of the tread will wear out quickly and the tire won't provide optimal traction.
- Over rigidity of the tire makes it more susceptible to damage from objects on the road surface. This means it's easier for the tire to be cut, snagged or punctured.
- The tire's ability to absorb shock is decreased. Body breaks can occur, stressing the rim and causing it to fail.

It's important to remember that you can't increase the recommended maximum load capacity of your vehicle by increasing tire pressure.

Tire tread life — It's difficult to determine the exact tread life of tires because there are so many varying conditions under which tires and vehicles operate. Tread life depends on tire quality, usage and positioning:

- **Tires on front axles** — Front axle tires should be checked regularly and changed when required. This is recommended because the front tires are relied upon for steering. If they fail there would be serious consequences. If they're still in good condition, they can be used on a rear axle or trailer where the risk is lower.
- **Tires on tandem drive axles** — On tandem drive axles, average tire tread life is noticeably longer than on single drive axles. This is because the drive traction is distributed over both axles and not concentrated on one axle.
- **Driving habits and style** — As a driver, you can greatly increase the life of your tire treads by taking care to shift smoothly and by driving responsibly. Tread life can be cut in half if you drive exceedingly fast or brake sharply.

Routine monitoring and maintenance — Pay close attention to the condition of the tires and drive systems. Check for damage such as bulging or sidewall cuts and ensure the proper functioning and alignment of the suspension system and axles. Always check that the tires are properly inflated and matched for the vehicle load.

Proper matching of dual tires — Tires in dual assembly should be matched with regards to design and dimensional tolerances. If two tires of differing diameters are positioned together, the larger tire will begin to overheat and bulge out at the sides because it takes on more of the load. The smaller tire will wear irregularly because of its improper road contact and may result in tread separation. If the larger tire bulges too far, it will begin to touch or "kiss" the other tire. This increases the friction and heat between the two and could result in a blowout in one or both of the tires.

Did you know?



Gators are a result of some tire blowouts. This can happen when the tires are driven underinflated or damaged due to striking an object. As a result of the sudden explosion of a tire casing there will sometimes be pieces of the tire or "gators" strewn across the road behind you. This creates a hazard for other road users as they may have to take evasive action to avoid them. If you blow a tire be sure to check your vehicle for any additional damage from the blowout and clear the debris from the highway if safe to do so. Find a safe place to pull over and call your dispatcher to get a tire repair service truck sent to help you.

Coupling systems

The coupling system connects the tractor to a trailer. There are two main types: Semi-trailer connected to a tractor with a fifth wheel and kingpin, or pintle-hitch with a hook and eye to connect a trailer to the rear of a truck/tractor or to the back of another trailer. Proper coupling of the trailer is one of the major responsibilities you have as a professional truck driver.

The following details are provided as an overview only. See the unit on in-yard manoeuvres for details on how to couple and uncouple a trailer.

Fifth wheel — The fifth wheel is a coupling device that's mounted on the vehicle chassis. It consists of a skid plate, associated mounting brackets and a latching mechanism that couples or connects to a kingpin located on the trailer or other vehicle component. Its purpose is supporting and towing a semi-trailer. Many fifth wheels can slide to a different position if you need to redistribute weight or allow for swing clearances between the tractor and trailer.



Fifth wheel slide lock — Used to slide the fifth wheel to various positions in order to adjust weight distribution between the steering axle and the drive axles, as well as to accommodate a trailer with a deep kingpin setting, for example.





Generally once the fifth wheel has been set you don't have to move it again. Never operate the vehicle with the switch in the unlock position. Always ensure the switch is in the lock position and the pins are locked in place before driving the vehicle. Otherwise, the trailer could come unhitched from the tractor.

Don't move the fifth wheel while the tractor-trailer is in motion. Move the switch to the unlock position to release the pins that hold the fifth wheel in place. Once the fifth wheel is moved to the position that you want, move the switch to the lock position. Always visually confirm the fifth wheel has relocked.

Fifth wheel slide unlocked — Illuminates red with an audible warning tone to remind the driver that the fifth wheel slide is unlocked.



Trailer kingpin — This is a minimum 5 cm (2 in) strengthened steel pin that fits and locks into the jaws of the fifth wheel to couple the tractor to the trailer.



Trailer kingpin

Pintle hitch — A pintle hitch is a type of tow hitch that uses a ring-to-hook configuration for a more secure mount that's ideal for rougher terrain. This type of coupler is a mechanism that's bolted or welded onto the end of a trailer tongue. It fits securely over — and pivots on — the tow vehicle hook.



Pintle hitch

Roll coupling hitch — This is a low-lash coupling that provides the same function as a universal joint. It allows motion around the yaw axis (turning corners) and pitch axis (driving over bumps) and prevents twisting unless the hitch is equipped with optional selective roll-coupling.

Landing gear — This provides stationary support for the front of a semi-trailer when it's not coupled to a tractor.



Landing gear

Technology innovations

Technology innovations play a huge part in pushing the trucking industry forward and keeping efficiencies for customers and carriers at the forefront. New products are entering the marketplace monthly so the following list is likely already out of date. Subscribe to and read online trucking publications to stay informed about the latest improvements in the trucking industry.

Electric heavy trucks

A lot of manufacturers now have electric heavy-duty trucks that are ready to replace the diesel and gasoline-powered models of today. While pure battery-powered technology is available (mostly in smaller delivery trucks), most of the heavy vehicle industry is focused on hydrogen fuel cell powertrains. These provide significant weight and space saving advantages over electric technology for heavy-duty trucks. They also allow for greater range of operation for longer hauls.

The advantages of electric trucks include a quieter environment and less pollution. Further, many cities have noise restrictions during evening hours. Because electric trucks are so much quieter, they can perform tasks overnight that diesel-powered trucks are barred from doing. More trucks on the road at night means less congestion on the roads during the day.

Electric motors also hit peak torque almost instantly, allowing them to accelerate up to two times faster than a stock diesel tractor. New electric trucks have better aerodynamics, using energy only when needed with no idling, and use regenerative braking — a process that uses the vehicle's motor as a generator to convert much of the kinetic energy lost when decelerating back into stored energy in the vehicle's battery.

Driver-assist systems and self-driving vehicles

Several companies have begun developing self-driving truck technology. This innovation reduces, and in some cases eliminates, active driver steering. It requires a well-marked highway so onboard cameras can read road lines and position the vehicle. Among other technologies, self-driving trucks use:

- Radar-based adaptive cruise control (ACC) which automatically accelerates and decelerates, maintaining safe distances.
- Lane departure warning system (LDWS) that uses cameras to detect lane edges and striping to alert drivers when the vehicle is drifting.

Detection technologies

Detection technologies alert drivers when a bicycle, pedestrian or slow-moving or stationary obstacle has been detected when driving at low speeds, generally around 40 km/h. Some systems can only detect bicyclists, pedestrians or obstacles when they’re traveling directly in front of the vehicle and when moving in the same direction. Typically the sensors are radar-based. Warnings can come in the form of sounds, visuals, vibrations or a quick brake pulse, or a mix of warnings. The beeps become faster as the vehicle moves closer to the obstacle. A crash is imminent when the beeps become continuous. For some versions of obstacle detection, it will apply the vehicle brake automatically.

Blind spot monitoring and warning

Blind spot monitoring and warning technology warns the driver of other vehicles driving in their blind spots. The warning can be a displayed symbol, a sound or a vibration. The system may provide an additional warning if a driver uses their turn signal when there are other vehicles in the adjacent lane.

The warnings provided by the blind spot monitor can be helpful to the driver when making a lane change, but the driver should still always check their mirrors and perform a shoulder check.

Blind spot monitors are intended to provide an additional monitoring resource to mirrors and shoulder checks. Drivers should not become complacent and dependent on blind spot monitors alone for changing lanes.

Side view cameras

Some newer vehicles are equipped with side view cameras that give the driver an expanded view of the lane beside the vehicle when they use the turn signal or when they activate the feature manually. This feature shares similar uses to blind spot monitors.

The feature shows the driver a video view of what's next to or coming up alongside the vehicle. They may be used in conjunction with or in place of traditional mirrors. The driver can use the turn signal or activate the feature through a button usually located on the turn signal lever. If the driver wants to use this feature while backing up, it may only turn on if they're at low speeds.

Forward collision warning systems

Forward collision warning systems alert drivers of an impending collision with a slower moving or stationary vehicle or object ahead so a driver can brake in time to avoid a collision. Sensors located in the front of the vehicle are able to detect how close you are to other vehicles ahead. These typically are camera or radar-based. Warnings can come in the form of sounds, visuals, vibrations or a quick brake pulse, or a mix of warnings. The forward collision warning system scans the traffic ahead 20 times per second up to 150 m (492 ft) in front of the driver and then warns the driver to brake if a hazard is in their path.

Roll stability systems (RSS)

Roll stability control reduces the risk of a vehicle rollover in extreme cornering or evasive manoeuvres, especially for vehicles with a high centre of gravity that are more susceptible to rollover. Roll stability control monitors the vehicle and identifies dangerous driving conditions that could lead to rollovers. The system then triggers electronic stability control (ESC) to intervene, control the speed and restore stability. Stability control systems only address rollover situations; they don't prevent tip-overs where a vehicle slides into a curb and falls on its side, or where a vehicle tip-over is caused by terrain such as a soft shoulder. ESC systems may be installed on the tractor or the trailer or both.

An extension of roll stability control, the curve control system helps prevent the loss of control of a vehicle on a curve. The system senses when you're entering a curve too quickly, and automatically slows the vehicle speed by reducing engine power and applying brakes. Roll stability systems help protect against loss of control crashes by automatically reducing engine torque and engaging the engine retarder, while applying drive axle and trailer brakes. The activation takes place before the driver is aware of the need.

One key limitation is that the vehicle may simply be going too fast or traction levels may be too low to stay within the rollover threshold. Also, anything that causes weight to shift unpredictably in the vehicle, such as an improperly secured load or uneven road surfaces can make the system less effective.

Rollover and loss-of-control crashes involving heavy vehicles are serious safety issues. It's estimated there are on average about 660 truck rollover incidents in Canada every year. While this represents less than five percent of all truck crashes, when a rollover does occur the resulting impact can be costly in terms of injuries to both motorists and truck drivers, as well as traffic tie-ups and lost productivity and efficiency.

ESC — Electronic stability control



In August 2017, the National Highway Traffic Safety Administration in the USA and Transport Canada mandated that ESCs were to be installed on all three-axle truck tractors manufactured after that date. The rule was expanded to cover all tractors as well as buses by August 1, 2019. This is an upgrade to existing roll stability systems.

Since the RSS and ESC systems have been installed on trucks, there's been an increase in skid marks from tires going into certain curves on B.C. highways. In general, this is caused by drivers who push their safety margins when driving which causes the RSS or ESC systems to activate. This primarily happens with

empty vehicles and drivers who are pushing the limits causing their vehicle to sway or lean into curves thus causing an activation of the system. When brakes are automatically applied on an empty trailer it will skid quite easily. If you find your driving style is activating these systems then perhaps you should slow down more before entering turns and curves.

This system will be installed on many of the vehicles you drive but will hopefully never activate if you are driving within the abilities (speed, available traction) of your vehicle.

Anti-lock brake systems (ABS)

Anti-lock brake systems are mandatory in Canada on all trucks and buses over 4,536 kg (10,000 lb) manufactured since April 1, 2000 and on all commercial trailers equipped with air brakes.

The system monitors wheel speed and adjusts air or hydraulic pressure in the brake chambers to prevent wheel lockup under severe braking. Continuous wheel speed sensing information is transmitted to an electronic control unit (ECU) that processes the information for brake pressure application, allowing the system to accomplish its task.

The ABS allows the driver to steer while applying continuous brake application. ABS doesn't allow you to drive faster or stop sooner. In fact, on some surfaces such as gravel, the braking distance with ABS may be longer. ABS may also help you prevent jackknifing.

Truck/tractor ABS symbol



The symbol illuminates yellow when the ignition switch is first turned on and will remain on until the system self-test has been completed successfully. Sometimes you need to drive the vehicle above 4 km/h before it can complete its self-check. If the light doesn't illuminate at all or stays on for more than three seconds and doesn't shut off, contact a repair shop.

The truck/tractor ABS symbol illuminates during normal operating conditions to indicate a problem with the ABS system.

Trailer ABS symbol



The trailer ABS symbol illuminates yellow for a bulb check when the ignition switch is first turned on whether or not a trailer is connected to the vehicle. If the light does not illuminate at all, have the problem checked.

- With no trailer connected or a trailer not equipped with ABS, the light will go off after one second.
- If an ABS-equipped trailer is connected properly, the light will remain illuminated for a few more seconds while the trailer ABS is tested. If no problems are detected, the light will go off.

If problems are detected, the light will remain on, and the driver should have the problem corrected before the vehicle is driven with that trailer attached.

The symbol illuminates during normal operating conditions to indicate a problem with the trailer ABS.

Note: Tractors/trucks and trailers built on or after March 1, 2001 must be equipped with an in-cab trailer ABS warning light. Trailers built prior to March 1, 2001 are designed to verify ABS status via the required external yellow warning light mounted on the trailer.

Automatic traction control

Automatic traction control (ATC) is an optional addition to an ABS. It uses the pulsating signal from the speed sensors to detect loss of drive wheel traction on slippery road surfaces.

Using the same wheel sensors used by ABS, ATC can sense if a wheel has lost traction and is spinning instead of helping to accelerate the vehicle. If a drive wheel begins to spin, the traction control system will apply that brake, transferring power to the opposite side. In extremely slippery conditions, the traction control system will reduce engine power, allowing the wheels to regain traction.



Most vehicles equipped with ATC will have an information decal on the dashboard and a dash-mounted indicator that will light up if wheel spin occurs. ATC is always active. If you find yourself in especially slippery conditions you can turn the ATC switch on which will allow for additional wheel spin before derating the engine which may be desirable in some situations.

When on, a wheel spin control warning light will illuminate when drive wheel spin is detected and power will be reduced until the wheel stops spinning.

Tracking systems and telematics

The introduction of these sophisticated electronic tracking systems has helped carriers become more efficient and have better data to base business decisions on. For example, they can use the information available to decide whether a given load would be profitable to them or not. They can monitor the location of the vehicle and re-route a driver to an unscheduled stop on the fly thanks to real-time two-way communication.

When the systems are shared with customers, they can also improve customer satisfaction. A customer may have access to tracking information that indicates when they can expect a shipment to arrive, helping them to plan and reducing calls to dispatchers.

Some of the available applications also save time and reduce record keeping for drivers by automatically recording log book data and completing a number of forms.

The communication components of electronic fleet management systems are usually part of a broader system that may do all or some of the following, depending upon which modules your employer has purchased:

- Track the location and status of loads, trailers and cabs using Global Positioning System (GPS) technology
- Record when a trailer is connected and disconnected
- Provide information about the performance of a vehicle (braking and idling information, oil pressure, coolant temperature, and so on)
- Container tracking
- Verify the delivery of a load
- Let customers check where a load is at any given time
- Monitor the operation of reefers (temperature, failure of cooling system, for example) and notify dispatch of any problem
- Monitor partial loads and allow the office to identify new loads a driver could add en route
- Automate some billing processes
- Speed up some customs processes
- Usage-based insurance (in some jurisdictions)

Remote diagnostic systems

Most engine manufacturers offer remote engine, after-treatment and automated transmission diagnostic systems. When a MIL, check engine or stop engine light illuminates, an email is sent to the authorized representative of that vehicle describing the problem and possible solutions. If the vehicle is in cell range the message is sent immediately and will indicate if it's a "service now" or "service later" event. Typically, these programs come with a free subscription when you purchase a new vehicle but will be required to be renewed to maintain the service.

5 Driving techniques

Operating a tractor-trailer is very different from operating your personal vehicle. Everything about operating a tractor-trailer requires a new set of knowledge and skills. You'll need to pay much greater attention to how you manage your vehicle efficiently using the various systems available to you. Your secret to success will come with planning your next move well in advance, so you have the required time to execute the task successfully. Plan your work and work your plan. This unit will address basic driving techniques and correct tractor-trailer operations.

What you'll learn

This unit will help you learn to:

- Demonstrate and explain the importance of proper start up and warm up procedures
- Enter and exit the cab and cargo area safely
- Adjust the driver's seat and seatbelt to the correct position for comfort, safety and control
- Set up mirrors to minimize the vehicle's blind spots
- Monitor the engine, instrument panel and warning lights
- Avoid unnecessary idling
- Take care when crossing railway tracks
- Use effective observation skills
- Communicate effectively with other road users
- Manage space and speed
- Operate vehicle controls smoothly
- Pay attention to traffic, the vehicle, driving conditions and other road users
- Drive safely through curves
- Drive safely on uphill and downhill grades, including mountain driving
- Change lanes safely on both urban streets and higher speed roads
- Cross and turn at intersections safely
- Enter and exit a highway/freeway safely
- Make efficient and courteous use of passing lanes
- Use auxiliary brakes legally and effectively
- Use cruise control safely and appropriately
- Maintain vehicle speeds appropriate for conditions and legal requirements

Setting up to drive

Your first responsibility is to ensure that everything is in order regarding the vehicle and yourself before driving. It's important to be fully alert and not impaired by anything that may affect your ability. Whenever approaching your truck, do an overall visual inspection, noting damage, fluid leaks and general appearance, stance and surrounding area.

Entering and exiting the cab

To prevent fall and injury, it's important to maintain a three-point contact when entering and exiting the cab. This means that three of your four limbs remain in contact with the vehicle at all times.

These are some additional do's and don'ts to keep in mind when exiting and entering trucks.

Do:

- Wear shoes with appropriate support and traction.
- Check steps and handles for grease, mud and ice. Keep steps clean to eliminate slipping and injury.
- Enter and exit facing the cab.
- Climb up and down slowly.
- Mount and dismount only when equipment is stopped.
- Look for obstacles on the ground before exiting the vehicle.
- Break three-point contact only when you reach the ground, cab or platform.
- Take extra care in wet, snowy or icy weather.
- Avoid wearing loose or torn clothing that can catch on equipment.
- Before leaving the driver's seat or exiting the cab, ensure the vehicle is secured in neutral with the parking brake on.

Don't:

- Jump off a truck. Doing so exerts 12 times your body weight on your joints when you land.
- Climb down with something in your free hand. Put it on the vehicle floor and reach up for it when you get down on the ground.
- Move side-to-side as this can affect your balance.
- Use tires or wheel hubs as a stepping surface.
- Use the door frame or door edge as a handhold.



Seat adjustment

Correct seat adjustment is critical for vehicle control and driver comfort.

- Adjust the height so that your feet can rest flat on the floor. There shouldn't be any pressure on the underside of your leg.
- Adjust the forward placement of the seat so that your left foot can push the clutch pedal to the floor without having to stretch.
- The back of the seat should be straight up, then leaned back slightly and locked into the first setting that allows for some bend in your elbow when your hand is on the steering wheel. Ensure the seat is holding you up.
- Alter the lumbar adjustment to allow for lower back support, if equipped. If the seat provides no lower back support, use a small cushion.
- Adjust the tilt and telescopic steering wheel assembly, if equipped, to provide for a comfortable hand position and a good view of the dash.

Engine start and warm up

- Read the manufacturer's guide for proper start-up procedures.
- Turn the Battery Master Switch on (if applicable).
- For automated transmission vehicles, just turn the key.

- For manual transmission vehicles, ensure that the parking brake is applied, the vehicle is in neutral and the clutch is depressed.
- Turn the key to the ON position. Allow needles to sweep and warning lights to cycle on then off.
- If the unit is equipped with glow plugs, turn the key part way and wait for the light to go out before starting the engine.
- Start the engine, confirm the oil pressure and ensure no warning lights are on and gauges are reading correctly.
- If the engine doesn't start, only crank for a maximum of 30 seconds then wait two minutes to try again.
- Once the engine is running, proceed with the interior and exterior portion of the pre-trip inspection. See the *Vehicle Inspection* unit for detailed pre-trip inspection information.
- Engine warm up prepares the engine to do its job by circulating oil, lubricating parts and building pressure to proper levels. Idle to warm up the engine. Avoid excessive idling as it wastes fuel and can result in unnecessary wear and tear on the engine.
- Some components (the transmission, axles and other parts of the drivetrain) will not warm up with the tractor sitting still. Even if you left the engine on fast idle for an hour, the gauges would show little or no charge from start up. Start out gently to allow the oil in other components to warm up and circulate as you begin to drive especially in cold weather.

Observe gauges

When the key is turned to the ON position, the warning indicators should illuminate. Make sure they're all working.



The following are gauges you must watch after starting the engine, ordered by importance:

1. Observe the oil pressure gauge. If it slowly rises, the lubrication system is working. If it doesn't climb within three to five seconds, turn the engine off. Repeat again. If the oil pressure doesn't rise, you'll have to troubleshoot or call maintenance.
2. Observe the air pressure gauge or gauges. Like the oil pressure gauge, they should slowly rise. If not, check that all reservoir valves have been closed. Remember that air pressure must build from 50–90 p.s.i. in less than three minutes at fast engine idle speed. The air pressure warning device must stay on until pressure reaches 60 p.s.i. or greater.
3. The ammeter gauge should confirm normal charging rates. The voltmeter should read 12.5–14 volts.
4. Check the tachometer and make certain it's operating.
5. Fuel gauges should show proper fuel levels.
6. Check the air filter restriction gauge. It should remain within the green area or at 0 p.s.i.

Engine shut down

Set the parking brakes. If the vehicle has just come in and the engine has worked hard, let it idle until the water temperature is below 200 degrees and the pyrometer (if equipped) is below 300 degrees. Then, turn off the engine to save fuel, reduce wear on the engine and reduce noise levels.

Hand position

To maintain the greatest control while driving, keep both hands on the steering wheel. If you think of the steering wheel as a clock, hands are best placed anywhere from nine and three o'clock to 10 and two o'clock. You want a bend in your elbows and relaxed shoulders.

In the city and on rough roads, hold the steering wheel firmly to keep it from being pulled out of your grip. This can happen if the wheels hit something hard or drop into a pothole. Keep your thumbs outside the spokes of the steering wheel. If the steering wheel spins and your thumbs are inside, injury will result.

On the open highway, relax your grip. Small adjustments are all that are required to keep the tractor on the road. Adjust your grip to suit the speed of your vehicle and the conditions of the road.



Seatbelts

There's no question — seatbelts save lives. Transport Canada estimates that wearing seatbelts has saved an estimated 2,400 lives and prevented 55,000 injuries in the past 10 years. Wearing your seatbelt is also the law.

During a crash, seatbelt systems reduce the risk of occupants striking the interior of the vehicle, colliding with other passengers or being ejected. If you're belted in, you're much less likely to become injured or knocked out in a crash. If a 68 kg (150 lb) adult is in a 50 km/h head-on crash and not wearing a seatbelt, the adult could collide with other occupants, strike the inside of the vehicle or get thrown from the car with the same force as the weight of a 3,175 kg (3.5 ton) truck. An unrestrained 11 kg (25 lb) child will be thrown forward with the same force as the weight of a 544 kg (1,200 lb) baby elephant.

Staying conscious gives you a better chance of getting out of your vehicle quickly if it catches fire or lands in water. Even during normal driving conditions, a seatbelt can help you maintain better control on rough roads or during crash-avoidance manoeuvres.

Many people think they can protect themselves in a crash. You can't hold yourself back during a crash no matter how strong you are. Thousands of kilograms of force work against unbelted persons during the rapid deceleration that takes place during a crash.

Adjust your seatbelt correctly by:

- Placing the lap belt low over the pelvis, not over the soft stomach area, ensuring that it's snug.
- Ensuring the shoulder strap is snug across the chest.
- Never placing the shoulder strap under the arm or behind the back removing all slack.



Some shoulder belts can be adjusted for height on the door post to better fit the height of the driver.



- Use the seatbelt slack adjuster (if equipped) so the belt isn't tight across your chest all shift long.



Airbags and head restraints

If your vehicle is equipped with driver and passenger airbags, you must still wear your seatbelt. Airbags can seriously injure unbelted occupants. You must allow at least 25 cm (10 in) between your breastbone and the airbag unit in the steering wheel. This distance will minimize the risk of injury if the bag deploys.

If your vehicle has head restraints, it's important that you adjust them to fit correctly. This will reduce the risk of neck and back injuries during a rear-end crash. By simply making sure the top of the head restraint is at least as high as the top of your head and it's less than 10 cm (4 in) from the back of your head, you can help prevent neck injuries.

Mirror adjustment

Correct mirror adjustments are essential for the safe operation of a commercial vehicle. After adjusting the seat, adjust the left and right mirrors for optimum vision.

Mirrors should allow you to better view your blind spots and danger zone.

- There are blind spots immediately below and behind each mirror, directly in front of the vehicle and directly in back of the rear bumper.
- The danger zone is an area around the tractor-trailer where pedestrians and other objects are at the most immediate risk. The *no-zone* refers to the blind spot areas around large commercial vehicles or the areas where cars are so close to the tractor-trailer that the driver's ability to stop or manoeuvre safely is restricted.

Review the types of mirrors and how to set them up.

Flat mirrors

These mirrors are mounted on the left and right at the front of the windshield. They're used to monitor traffic and check clearance on the sides and to the rear of the vehicle.

Ensure that the left mirror is properly adjusted so you can see:

- Sixty metres or four vehicle lengths behind the vehicle
- The top of the trailer
- The inside edge, which should pick up the left side of the trailer
- The rear trailer tires touching the ground

Ensure that the right mirror is properly adjusted so you can see:

- The inside edge, which should pick up the right side of the trailer
- The horizon line 3/4 of the way up the mirror

Convex mirrors

These mirrors are located below the outside flat mirrors. They're used to monitor the left and right sides at a wide angle. They provide a view of traffic and clearance at the lower sides of the vehicle.

These mirrors present a view of people and objects that doesn't accurately reflect their size, distance and position from the vehicle — objects will appear smaller and farther away than they actually are. You should position the mirrors to see:

- A small portion of the entire side of the vehicle up to the mirror mounts
- Where the rear truck tires touch the ground
- At least one traffic lane on either side of the vehicle

Inside rearview mirror

Adjust the inside mirror to see through the rearview window of the vehicle, if applicable.

Using wheel chocks

Wheel chocks are used to block the wheels and should be used in addition to the parking brake to ensure the vehicle remains in position when the driver isn't in control at the steering wheel. The bottom surface is sometimes coated in rubber to enhance grip with the ground.

When using a wheel chock, follow these guidelines:

- Always ensure the chock is centred and squared with the tire. Position it snugly against the tire with about 2.5 cm (1 in) of the chock extending from the edge of the tire.
- Always use wheel chocks in pairs.
- On a downhill grade, position the chocks in front of the drive wheels.
- On an uphill grade, position the chocks behind the drive wheels.
- On a level grade, position the chocks on the front and back of a drive wheel.

Here are some conditions that must also be considered when using wheel chocks:

- Smaller tires require smaller chocks, while larger tires require larger chocks.
- Heavier vehicles require larger chocks than lighter vehicles.
- Chocks need to be positioned in different ways depending on if the ground is level or not.
- Ensure that the chock configuration is correct based on surface grade.
- Radial tires may wrap around the wheel chock, which reduces the chock's effectiveness. To combat this, vehicles with radial tires should be chocked with larger wheel chocks.
- Improperly inflated tires can lead to chocking failures.
- Condition of the ground, whether it's firm, soft, wet, dry, icy or frozen, is a key determination in the type of chock to use. For frozen or icy terrain, choose a chock with a cleated bottom. For severely wet or muddy terrain, multiple chocks may be necessary to ensure safe chocking.

Basic control of your vehicle

Moving off

To prevent roll back when you start out with a manual transmission vehicle, engage the clutch to the friction point then release your right foot off the brake and smoothly engage the clutch. The engine shouldn't stall as the computer will feed fuel to allow it to maintain its idle speed. If the vehicle stalls, you may be starting in too high of a gear or engaging the clutch too quickly. Starting up in a vehicle with an automated transmission is very similar to a car, but you may have an automatic hill start system that will take a second to release before the truck will move.

Accelerate smoothly and gradually to the next shift point of your transmission. Accelerate gradually when traction is poor, as in rain or snow. If you use too much power, the drive wheels may spin and you could lose traction. If the drive wheels begin to spin, ease up on the accelerator to see if you can regain traction. If the vehicle won't move, you may need to chain up.

Braking

When applying the brakes, press down on the pedal using an even pressure and then ease off the pedal as the vehicle slows down. Just before the stop, ease up to avoid a sudden jerk or rebound. Then, apply pressure to the brake pedal again to hold the vehicle while it's stopped.

Don't pump (alternately applying and then releasing) the air brakes as this will result in a loss of air pressure. It's better to make one steady application of the brakes. Braking systems are designed to stop or slow a vehicle down for a downshift. They were never intended to hold a vehicle back when descending mountains and hills. It's critical to select the right gear and use auxiliary braking systems (road conditions permitting) to control the speed of your vehicle going down hills. Keeping your foundation brakes cold in case an emergency stop is needed is important. You can descend a hill thousands of times too slow, but only once too fast!

Before going down a hill, do an en route inspection to confirm your brakes are still in adjustment, your air system is operating correctly along with lights, tire and cargo is secured. Before starting down the hill, test your trailer service brakes with the trailer hand valve to prove they're working and double check that your fifth wheel is locked.

Remember that the brakes, tires and suspension of a combination vehicle work best when the vehicle is legally loaded and the load is properly distributed among axles. When the cargo area is empty and there's no ABS, the vehicle's wheels may bounce and lock up. This can make braking more difficult and increase your stopping distance. In this situation, you'll need to increase your following distance and possibly travel at slower speeds.

Speed management

Heavy commercial vehicles take more time and more distance to slow and stop than smaller vehicles. More braking force is needed to overcome their weight and forward motion.

Proper speed management means operating at the appropriate speed for all road conditions. That includes taking into account the condition of the road, visibility and traffic speed and flow.

Stopping time and distance

Total stopping time is the distance your vehicle will travel from the moment you:

- **See** a hazard.
- **Think** and decide to stop.
- **Do** place your foot on the brake pedal until you stop.

This can be broken down into perception, reaction, brake lag time and braking time and distance.

1. Perception time is how long it takes a person to realize they need to stop (**see** and **think**). Average perception time is about 3/4 of a second. Perception time can increase if a person isn't paying attention, impaired or not feeling well physically or mentally. Perception distance is how far a vehicle travels during this time.
2. Driver reaction time is the time it takes between deciding to stop and actually applying the brakes (**do**). Normal driver reaction time is about 3/4 of a second. Reaction time will be slower if the driver is tired or has been drinking alcohol or using drugs. Reaction distance is how far a vehicle travels during this time.
    - Covering the brake (resting your foot on the brake pedal) when anything starts to change will save you time.
3. Lag time is the amount of time it takes for the air brake system to respond after the driver has applied pressure on the brake pedal. Air brakes do not respond immediately because it takes time for the compressed air to flow through the system and apply the brakes which takes about 4/10 of a second. Lag time distance is how far a vehicle travels during this time.
    - Lightly applying the brakes in anticipation of needing them will save you time.

4. Braking time is the time it takes for the vehicle to come to a complete stop after the brakes have been applied. Braking time depends on:
    - The force with which the brakes are applied.
    - The condition of the brake linings and drums or brake pads and rotors.
    - The traction of the tires on the road surface. Traction is the friction between the road surface and the tire contact patch. The amount of traction a vehicle has depends on several factors: the condition of the road, how much tire contact there is with the road surface, vehicle weight and tire condition and inflation.
    - The vehicle weight and speed.

    Braking distance is how far a vehicle travels during this time.

Another factor involved in stopping distances is the slope or grade of the road. A vehicle travelling downhill will need a longer stopping distance than a vehicle travelling at the same speed on a level surface because of the effect of gravity. A vehicle travelling up a hill will stop in a shorter distance than a vehicle travelling the same speed on a level surface, again because of the effect of the grade.

Following distance

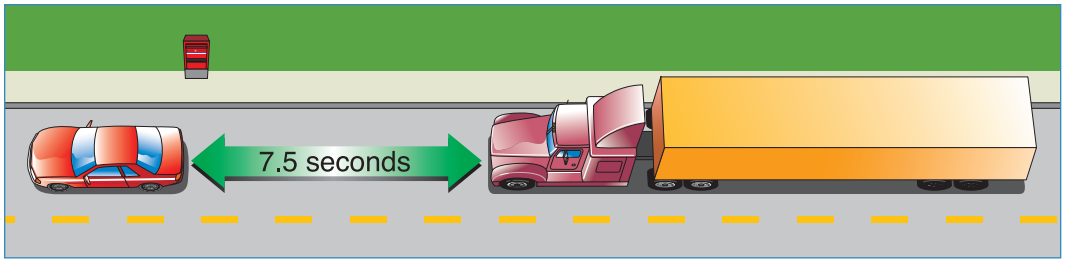
It's very important to allow enough distance when following other vehicles. Drivers of buses, trucks and other large heavy vehicles should never be less than one second for every 3 m (10 ft) of overall vehicle length and a minimum of five seconds behind the vehicle ahead under ideal driving conditions. When conditions are less than ideal, increase the number of seconds and adjust your following distance.

To measure following distance, watch the vehicle ahead of you as the back bumper passes a stationary object (such as a power pole) and count to yourself:

- One thousand and one
- One thousand and two
- One thousand and three
- One thousand and four
- One thousand and five

When your front bumper reaches the object, stop counting. This will give you the number of seconds between you and the vehicle you're following. If you pass the same object before you finish counting, you're following too close. Slow down a bit and increase your following distance.

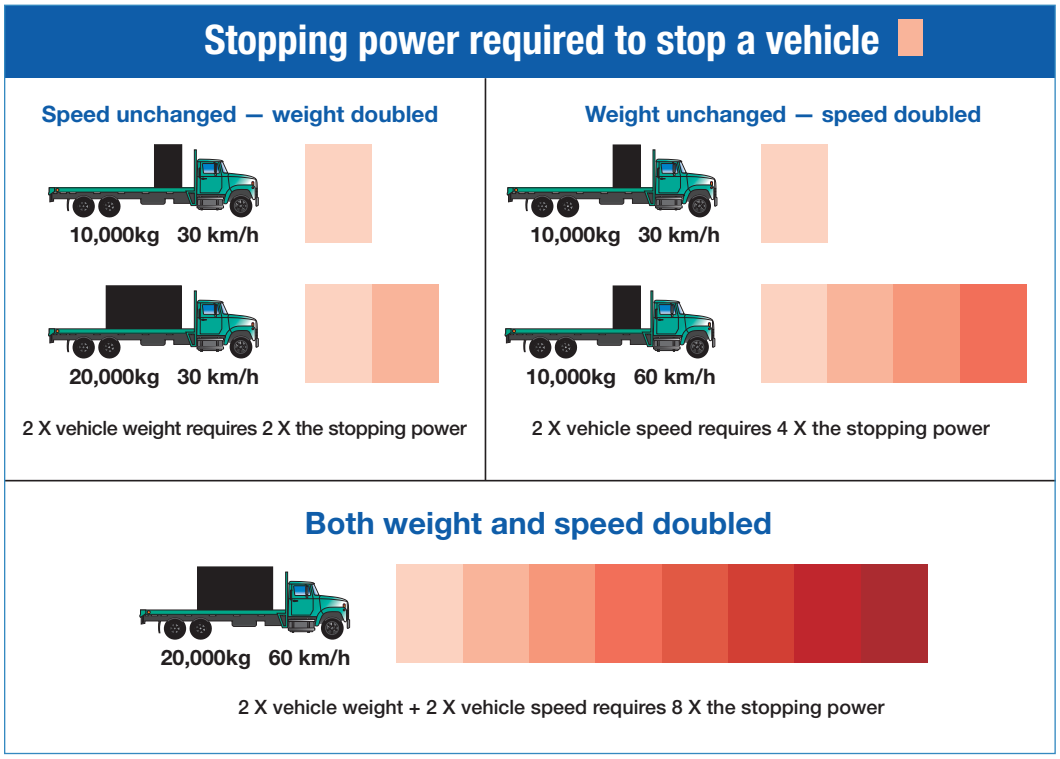
Repeat the count process until you're at least five seconds behind the vehicle ahead and farther if your vehicle is more than 15 m long, as in the image below:



Speed and weight facts

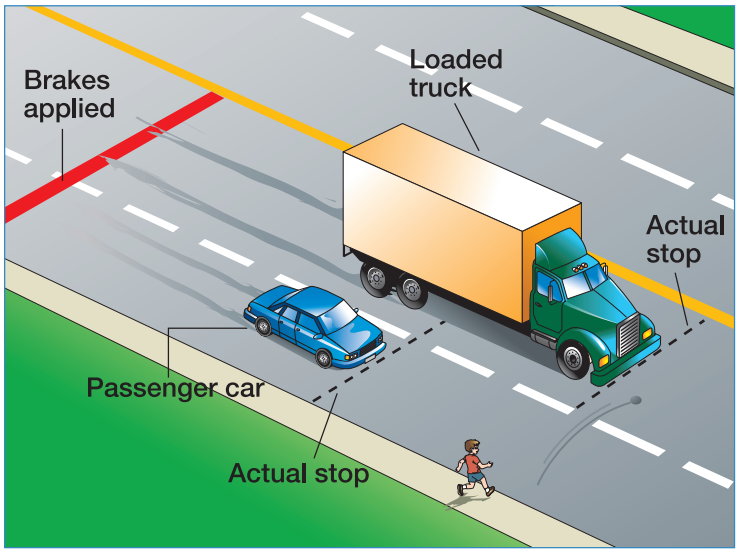
Speed and weight affect the stopping power required to stop any vehicle and how far it will travel before it stops. You need more stopping power whenever the speed you're travelling and/or the weight of your vehicle increases:

- 2 X vehicle speed requires 4 X the stopping power
- 2 X vehicle weight requires 2 X the stopping power
- 2 X vehicle speed and 2 X vehicle weight requires 8 X the stopping power



A typical compact car weighs about 1,000 kg (2,200 lb). The truck in the illustration below may weigh 25,000 kg (55,000 lb) when fully loaded — over 25 times heavier than a car — and heavy tractor-trailer combinations can weigh up to 63,500 kg (140,000 lb).

There's only so much stopping power available and the faster the vehicle is travelling, the more power it needs to stop. This is why it's so important to drive at a safe speed, at a safe following distance and within the vehicle's stopping capability.



Consequences of speeding

Speed limits are based, in part, on the principles of good speed management. They take into account several issues including sight distance limitation, road conditions and traffic volume. There are many reasons why you shouldn't speed.

- The greater the speed the vehicle is traveling when a crash occurs, the greater the chance of fatalities.
- A driver's ability to steer safely around curves or objects in the roadways can be reduced by speeding. Tractor-trailer rollover crashes happen when the driver of the truck doesn't adjust their speed to navigate curves and the slope of the road, such as on and off ramps.
- Speeding can result in fines (from $138–$483), three points on your driving record and can ultimately end up prohibiting you from driving.
- Higher speeds can affect maintenance costs. Tires and brakes wear out faster at higher speeds.
- The power and fuel required to increase speed multiplies substantially at higher speeds.

Driving faster than the flow

Driving faster than the traffic flow can create a variety of problems for you:

- You won't be able to maintain a safe following distance, which means you will be unable to stop quickly and safely.
- You increase your chance of making a wrong decision.
- Driving faster than the traffic around you requires more lane changes. Each lane change represents a problem that requires quick decision-making. The more decisions you make, the greater the chance you'll make a wrong one.
- You'll tire more quickly. Driving faster than the traffic flow creates tension and causes mental and physical fatigue.

Maintaining a steady speed, within legal limits, at a safe following distance will help give you the time needed to react in an emergency situation. Driving at a steady speed also saves money and helps the environment by reducing the amount of fuel your vehicle burns.

Driving slower than the flow

If you drive slower than the traffic flow, you increase your chance of a crash with vehicles travelling behind or beside you. Other drivers will become impatient and follow too closely or try to overtake your vehicle. After passing, they may cut in leaving you with little or no room for a quick stop. Large vehicles tend to accelerate and travel more slowly than small vehicles. When you're unable to keep up with the traffic flow, you must travel in the right lane.

Using cruise control

Using cruise control on big trucks can help maintain a consistent and appropriate speed, saving fuel, and allowing for a less stressful, more relaxed trip. It allows the driver to concentrate more on what's going on around the truck and other aspects of driving. Here are some tips:

- Set the cruise control at or just slightly under the speed limit. This will help ensure you have ample space in front of your vehicle.
- Only use the cruise control on completely dry road conditions.
- If road conditions or weather change for the worse, turn off the cruise control using the cruise control switch, not by tapping the brake pedal.

Slow and steady speed can help you avoid incidents and save you and your company a lot of money and time in the long run.

Shifting gears

In the past, the majority of tractors on the road were equipped with manual transmissions. Now, automatic or automated transmission-equipped trucks are becoming more prominent.

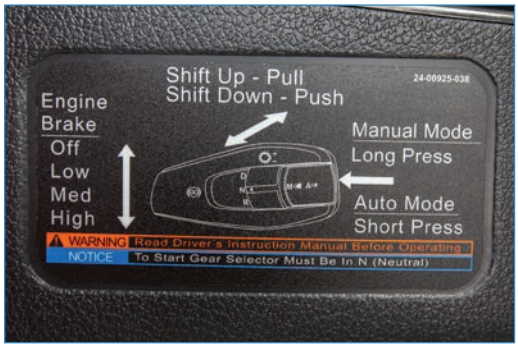
Type of transmissions



Here is an overview of the different types:

- **Manual shift (non-synchronized) transmissions** — Full driver control of clutching and gear selection. A high degree of skill is required to judge and execute proper shifting. Familiarize yourself with the gear pattern by checking the chart on the gear shift lever or the dash.
- **Automated manual transmissions** — Use an onboard computer, sensors and shifter motors to communicate with the engine and complete the shifts. Some models still have a clutch pedal which is only used to start and stop the vehicle moving. Fully automated models don't require the driver to use a clutch so only a throttle and brake pedal are present in the cab. The clutch is engaged centrifugally when the driver starts to accelerate. The benefits of these transmissions are that driver fatigue is reduced, drivers require less experience and there's less stress and wear on the driveline. It's important to get the driver handbook for the model of transmission you have and read it carefully to properly understand the available options, such as the hill start feature, that may be included in your vehicle. Manuals are available on the manufacturer's websites.





- **Fully automatic transmissions** — Typically found in vehicles that are used in urban environments, such as garbage trucks, fire trucks and municipal dump trucks. The transmission works the same as the one in your personal vehicle except it doesn't have a "Park " position. The transmission is left in neutral when the vehicle is parked, so the parking brake must be applied.



Getting the most out of your engine

You must learn how to select the appropriate gear to maintain control and ensure smooth operation of the vehicle.

Engines function best in the low to medium revolutions per minute (RPM) range, where they produce peak torque or power. Pushing for a higher RPM doesn't produce a proportionally higher amount of torque. For the sake of fuel efficiency and to reduce wear on the engine, the tractor should always be in the highest gear in which the engine can still maintain the desired speed. At cruising speeds, this is usually well below the engine-governed RPM and in the middle of the peak torque range.

Typical large displacement diesel engines today have a maximum operating RPM of 2,100 and idle in the 600–700 RPM range. As with most modern engines that are computer controlled (1990's onwards), you'll find your peak torque starts at 1,000–1,200 RPM and is a flat line to 1,500 RPM. Most engines have their peak horsepower (HP) rating at 1,800 RPM, but when you look at the HP curve, you reach 95 percent of your peak by 1,600 RPM. To get the most efficient operation of your engine, use the transmission instead of your brake pedal to keep the RPM lower to achieve maximum power and save fuel.

You must learn shifting techniques that can be applied to various driving scenarios. For example, when climbing a grade, select a gear ratio that will allow the engine to pull back to (or just below) peak torque as it crests the hill. Letting the engine pull back in RPM in this manner actually uses the peak torque potential designed in the engine. It also has the advantage of delivering near-maximum fuel economy.

By learning and practicing the correct procedures for shifting, accelerating and decelerating, a professional driver can save countless dollars on the wear and tear of an engine and clutch.

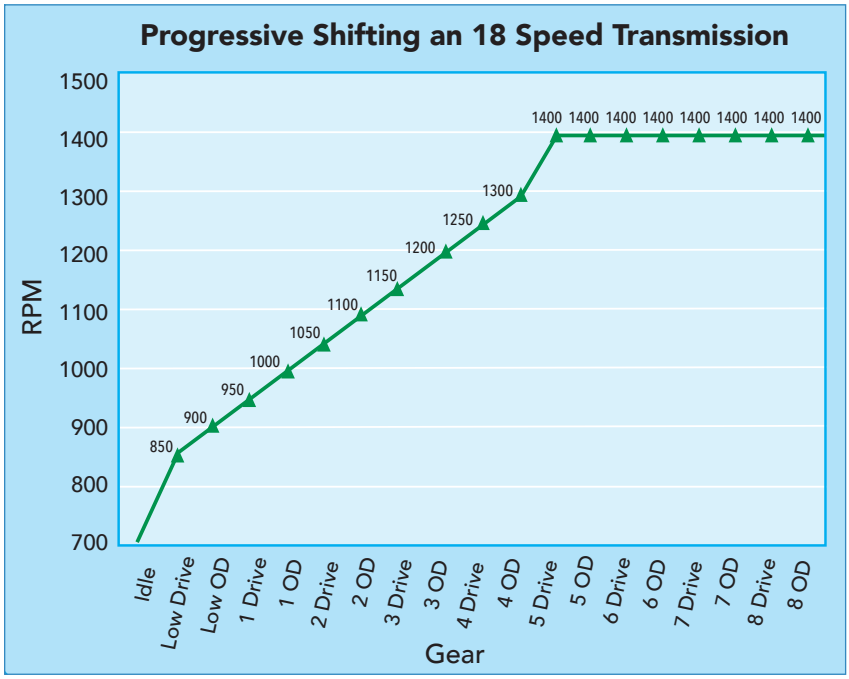
Smart tips for smooth shifts

- Always choose a starting gear that will provide sufficient reduction for the terrain and load.
- Anticipate and plan gear shifts in relation to changes in terrain and traffic.
- Use double clutching techniques whenever making shifts with the gear shift lever. Don't ride the clutch pedal.
- Shifting gears requires finesse not strength. Forcing the transmission into gear will damage it.
- Match road speed and RPM to gear ratios. Never downshift when RPM is too high; never upshift when RPM is too low.
- Avoid accelerating to maximum RPM for gear shifts.
- Use skip shifting when appropriate.
- Prolong the life of the tractor and trailer brakes by downshifting when slowing down and using auxiliary braking systems when appropriate.
- Save fuel by using a gear ratio that achieves maximum fuel economy for the cruising speed.
- Always be aware of the gear you're in, the maximum engine RPM and the safe top speed of the tractor and trailer.

Progressive shifting techniques

Progressive shifting is shifting to the next highest gear at the lowest possible RPM that will allow the tractor and trailer to continue accelerating. This makes the shifts easier, gets the most work out of the engine, increases fuel mileage and allows the tractor and trailer to reach highway speeds quicker.

The following chart shows a sample of the RPM requirements for progressive shifting techniques, which provide quicker acceleration, easier shifting and less wear on the engine.



Clutch and clutch brake operation

Proper use of a clutch is critical in shifting a non-synchronized transmission smoothly. The clutch pedal has five different positions:

1. **Free play** — the highest position where the pedal moves easily under the weight of your foot.
   - With a mechanical clutch, there should be 2 to 5 cm (0.75–2 in) of free play before you meet resistance. If there's less than this, the clutch needs to be adjusted.
   - Many newer trucks have hydraulically-actuated clutch pedals (reservoir on the fire wall of the engine compartment) with very little free play. Hydraulically-actuated clutch pedals are usually self-adjusting.
2. **Friction point** — the point where the clutch plates start to come together and begin to grab.
   - If you're holding the vehicle on a level road or slight grade with the foot brake, once you are at the friction point, you can simply release the foot brake and continue to smoothly release the clutch pedal. This should engage the clutch completely and get you moving.

Damage can occur to the clutch by overheating it during start up by:

- starting in a gear that's too high, creating excessive slippage of the clutch plates.
- adding unneeded RPM which creates additional torque that the clutch has to absorb.
- taking too long to go through the friction point.

Damage can also occur by going through the friction point too quickly. This creates stress on the springs inside the clutch and also stresses the tractor suspension, which loads up with energy and then unloads again, causing the tractor to hop.

3. **Shifting depth** — the clutch is disengaged beyond the friction point.
4. **Stopping depth** — the distance to push the clutch pedal in when bringing your vehicle to a stop.
   - Depress the clutch pedal past the friction point, but not all the way to the floor.
   - Leave the transmission in gear as you stop. This will stop all the gears inside the transmission from moving and allow you to easily select a start-up gear.
5. **Clutch brake** — pedal to the floor. After you start your engine and the transmission is in neutral, all of the gears on the input side of the transmission start to rotate while the gears on the output shaft side (connected to the drive axles) are stationary. To select a start-up gear, you need to stop the input shaft from rotating otherwise the gears will grind as you're attempting to engage them. This is done with the clutch brake.

   The vehicle must be stationary, held by either the parking brake or the foot brake because if it rolls while the clutch brake is engaged, you can easily damage the clutch brake.

   - Depress the clutch pedal all the way to the floor, holding it for three seconds to allow all the gears in the transmission to stop turning. If the clutch brake doesn't stop the gears from turning, it requires adjustment or replacement and needs to be checked by a technician.
   - Place the shifter into your start-up gear, usually low or first gear, depending on your load or if you're starting on a hill.
   - Attempt to put the transmission into gear. If it won't go in, then the gears will have stopped in a place where they can't engage properly. To remedy this, continue to hold the shifter against the gear that you want and simultaneously start to release the clutch pedal slowly. As you begin to release the clutch brake, the input shaft will begin to rotate slowly allowing the shifter to slide into gear.

Shifting non-synchronized transmissions

On non-synchronized transmissions, double-clutching makes shifting gears smoother because it allows you to co-ordinate the engine speed (input shaft) and the road speed (output shaft), aligning the gears for easier shifting. Follow this procedure for smoother shifts.

Upshifting by double-clutching:

- Take up the free play on a mechanical clutch, or put positive pressure on the clutch pedal for hydraulic clutches.
- Depress the clutch pedal just beyond the friction point and ease up on the accelerator simultaneously.
- Move the gearshift lever into neutral.
- Lift the clutch pedal to the point of free play — allowing the engine RPM to drop slightly.
- Again, depress the clutch pedal just beyond the friction point and shift to the next higher gear.
- Release the clutch pedal completely and accelerate at the same time.

Downshifting by double-clutching:

- Take up the free play/positive pressure.
- Depress clutch pedal just beyond the friction point.
- Move the gearshift lever into neutral.
- Lift the clutch pedal to the point where you still have the free play.
- Increase the engine RPM until it allows the next gear to synchronize with road speed (input shaft with output shaft).
- Depress the clutch pedal just beyond the friction point and move the gearshift lever to the next lower gear position while maintaining your engine RPM.
- Release the clutch pedal completely and continue accelerating or decelerating as needed..

Skip shifting

In some situations, a driver can skip some of the gear ratios. This would only be done if the road conditions and the load allow. Don't attempt skip shifting until you've mastered the basic shifting technique and are familiar with the vehicle you're operating.

Automatic/automated transmissions

Some vehicles have automatic or automated transmissions. You can select a "hold" or "manual" mode to get greater engine braking when going down grades. The lower ranges prevent the transmission from shifting up beyond the selected gear (unless the governor RPM is exceeded). It's very important to use this braking technique when going down grades.

Special conditions where you should downshift

- Before starting down a hill, slow down and shift down to a gear that lets you control the speed of your vehicle without using the brakes. Otherwise, the brakes can overheat and lose their braking power, potentially causing a runaway. When you are descending a hill or grade, make sure you're in a low enough gear to allow your engine brake to hold you back without the use of the service brake. This is usually the gear lower than what is required to climb a hill of the same grade you are descending.
- Before entering a curve, slow down to a safe speed and downshift to the right gear. This lets you use some power through the curve to pull the trailer and help the vehicle be more stable while turning. It also allows you to speed up as soon as you're out of the curve.
- It's important to understand that unlike a passenger vehicle, professional drivers use the vehicle's auxiliary braking system to slow down for downshifts, not the service brakes. Recognizing the need to reduce speed by looking well ahead when driving along and reading the warning signs, gives you the time needed to release the throttle pedal, activate the engine brake and allow the accumulated momentum to dissipate so you can downshift. Depending on how much speed reduction is required, you may need to make several downshifts to slow down enough. Heavily loaded tractor-trailer units need more time to accelerate and decelerate for turns, stops and on hills. You may delay traffic slightly to make these manoeuvres safely. Ensure you manage your vehicle properly and avoid rushing to attempt to not hold up traffic, which could just get you into an unsafe situation.

Vehicle components to monitor while you drive

In addition to pre-trip and post-trip inspections, using all of your senses to monitor your vehicle's behaviour while driving will help prevent dangerous and costly mechanical issues. The following are vehicle components to continually monitor as you drive.

Brakes

- The vehicle should not pull to the left or right when braking.
- Brakes should not grab, lock up or make excessive noise.
- Excessive pedal pressure required or unusual braking behaviour should also be noted.
- Monitor the gauge to ensure that adequate air pressure is maintained.

Transmission

- When the transmission is engaged in either the reverse or forward gears, the tractor-trailer should start out smoothly in response to depressing the accelerator and the transmission shouldn't produce any odd mechanical noises.
- Any mechanical difficulty in shifting gears should be noted.

Clutch

- The clutch should engage easily and smoothly without jerking, slipping excessively or "chattering".
- A properly adjusted (mechanical) clutch should have some free play (refer to manufacturer's recommendations) when the pedal is fully released. Hydraulically-actuated clutches have very little free play in the pedal which is normal.
- When changing gears, carefully control the speed of the engine so that the shift may be completed without jerking or excessive slippage.
- Erratic or careless shifting of gears wears out the clutch and reduces its service life.

Engine

- Be aware of any unusual engine noise, vibrations or lack of normal response.
- Increase speed slowly so that all parts may be properly lubricated. In colder weather, the tractor should idle for about 10 minutes to warm up before first starting out on your route.

Steering

- Does the tractor-trailer steer easily? Does it go precisely where you steer it?
- Does there appear to be excessive play or jerking?
- Is the power steering quiet?
- Does steering feel steady in turning and over bumps?

Suspension

- Is there excessive bounce or does the tractor-trailer bottom out when going over bumps or potholes?
- Is there a constant pull to the left or right when steering? If this occurs, it may be due to a suspension defect.
- Does it weave or sway excessively when turning corners or curves? If this occurs, it may be due to broken springs or faulty shock absorbers.

Tractor bobtailing

Bobtailing is operating a tractor without a trailer. Tractor drive axles are designed to carry weight and removing the trailer significantly reduces the traction of the drive axles. A brake application causes weight to transfer to the steering axle, further reducing drive axle traction. Strong engine power and braking, with very little traction, can cause a loss of vehicle stability.

Drivers should exercise caution even during safe road conditions.

Older tractors with bobtail proportioning valves reduce the application pressure to the rear brakes by as much as 75 percent to prevent skidding. In this situation, you'll need to apply additional force to the brake pedal to get the tractor to stop as you'll be using the front brakes only.

To safely operate a bobtail tractor:

- Avoid excessive acceleration and heavy brake applications.
- Reduce vehicle speed when road surfaces are slippery.
- Use auxiliary retarders at reduced settings.
- Leave an appropriate following distance from the vehicle ahead.

Exercise more caution when bobtailing in poor weather than you might with a loaded vehicle.

Entering and exiting traffic

Entering traffic or merging

Merging is done when two roadways join into one and the traffic on the main roadway must cooperate to allow enough space for vehicles to enter from the merging lane.

Merging is a shared responsibility between the vehicles joining the roadway and the vehicles already on the roadway. Avoid reducing your speed abruptly or stopping when merging. The merging lane is designed to allow you to bring your vehicle up to the speed of the traffic on the roadway onto which you're merging, while remaining within the speed limit. The drivers behind you are expecting you to continue moving ahead. If you slow or stop, your vehicle may be hit from behind. A loaded commercial vehicle won't likely be able to match speed with the traffic it's merging with as many acceleration lanes are fairly short.

Here are some tips on merging safely:

- Merging requires that you plan and time your approach to blend smoothly with traffic without stopping or abruptly reducing your speed.
- Check the traffic flow on the highway as soon as you can see the lane where you'll be merging.
- Choose your gap in the traffic and begin adjusting your speed, if required. Keep glancing at the gap you chose to ensure you're making the speed and timing adjustments necessary to safely merge without affecting traffic.
- Use your signal light as early as possible to warn other road users that you need space to move over.
- Accelerate to the speed of the traffic on the main road, if possible.
- Keep checking your mirrors (flat and convex) to view the gap and for vehicles following you.
- When it's safe and legal, move into the gap after you're past the solid white line of the acceleration lane. Adjust your speed to get your proper following distance.
- Ensure your signal light is turned off once you've completed the merge.

When entering traffic from the curb or loading zone, signal your intent with at least four flashes of your turn signal in advance, check mirrors and look directly out the windows to ensure the path is clear before starting to move. Stay in the lane nearest the curb until reaching appropriate speed. When entering traffic from an alley, side street, driveway or terminal, come to a stop before entering a sidewalk or cross street and proceed with extreme caution.

Exiting a major roadway

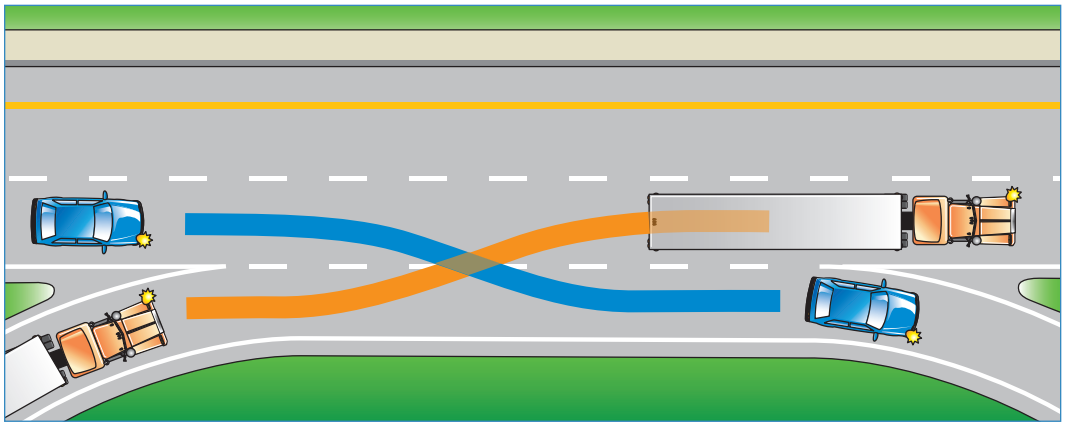
Tips on how to exit a major roadway or highway safely:

- Plan ahead. Be in the proper lane well before you reach your exit.
- Use your turn signal well in advance of the exit to alert the drivers behind you.
- Move into the deceleration lane as soon as space is available, if there is one.
- If possible, do most of the slowing in the deceleration lane. Some deceleration lanes are short; you may need to start reducing your speed while still on the highway.
- Verify your speed with your speedometer to ensure you're slow enough for any turns after exiting.
- When you have exited, ensure your signal light is turned off.
- If you miss your exit, don't stop. Continue to the next exit and make plans to return to your route. Don't stop and reverse on the highway, the emergency stopping lane or shoulder.

Weave zones

On some roadway interchanges, there are places where the highway entrance and exit use the same lane. The entrance and exit can be close together. These areas require caution and cooperation, because vehicles share the same lane to slow as they exit the highway while others are using it to increase speed to enter the highway. The area that these vehicles share is called a weave zone.

In weave zones, control your speed and the timing of your lane change to merge with other traffic. This requires skilful use of time and space. Use caution in these zones to ensure safe highway exiting and entering for all vehicles.

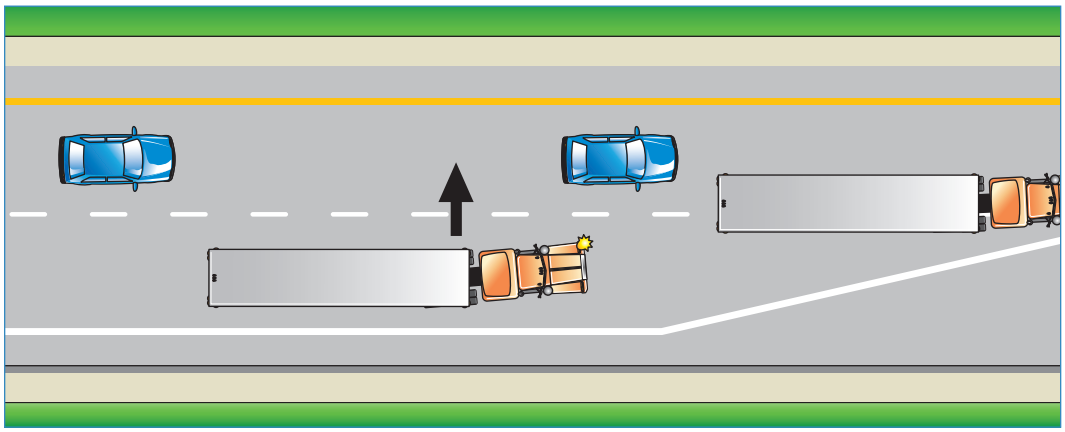


Zipper merge

When two lanes merge into one or when a lane is closed due to an obstruction, many drivers will take the first opportunity to change into the necessary lane. This is typical and requires care when traffic is congested. Making a sudden lane change can be dangerous when it's unexpected by other drivers. Making lane changes when vehicles are traveling at different rates of speed is also more difficult and risky. This can trigger reactions that lead to crashes and road rage.

The best way to merge when traffic is backing up and you need to move over is to stay in your current lane up to the point of the merge. Then take turns with other drivers to alternately allow a vehicle from each lane to proceed and smoothly ease into the remaining lane. This is called a zipper merge.

The advantage of a zipper merge technique is that the traffic speed in the adjacent lanes tends to be about the same. Lane changes can be made safer at the merge point rather than having drivers try to get into spaces that may not be large enough. A zipper merge requires drivers to cooperate and to provide space in front of their vehicle at the merge point.



Lane positioning and passing

Selecting the proper lane, positioning yourself within the centre of the lane and then making adjustments to your position to suit the current circumstances is a skill that requires a great deal of practice. As you continue to practice, you'll improve your ability to maintain adequate separation distance between your truck and other vehicles and pedestrians. On a multi-lane highway, it's recommended that trucks should position themselves in the right lane or the lane closest to the shoulder of the road. This will leave you an out, to the right, if you need one to avoid a crash.

Lane changes

Lane changing poses additional hazards — only change lanes when necessary. Always check for clearance by looking out of the windows and using both flat and convex mirrors to be sure that there are no vehicles beside or behind the truck.

Give special consideration for the speed vehicles are travelling behind you to ensure they won't overtake you once the lane change has begun. Always signal intent with at least four flashes of the turn signal before beginning the lane change. If the lane change involves passing another vehicle, when on a multiple lane highway, always maintain your minimum following distance. Once you're in the desired lane, cancel the turn signal after completion.

Traffic check — Monitor the surrounding traffic in front, beside and through the vehicle mirrors.

- Identify where and when the lane change should be made. The decision will be based on present conditions and anticipated conditions that will either make the lane change easier or more difficult. In dense traffic, motorists travelling beside a commercial vehicle will need time to adjust their positions in traffic in order to create adequate space for the larger vehicle to move into.
- Consider likely changes in the adjacent traffic and vehicles further away that may change position.
- Observe signs, pavement markings and any anticipated changes in the road markings.
- Check mirrors for vehicles traveling alongside, passing or approaching from the rear and any vehicle that may already be in — or may enter — a blind spot.

Signal — Signal to indicate your intention to change lanes. Signals must be initiated a reasonable amount of time before the lane change, depending on the conditions, but never provide less than four flashes of your turn signal in advance. Early use of turn signals can also help get other drivers to provide the necessary space.

Vehicle space — Maintain safe following distance within the current lane while preparing to make the lane change.

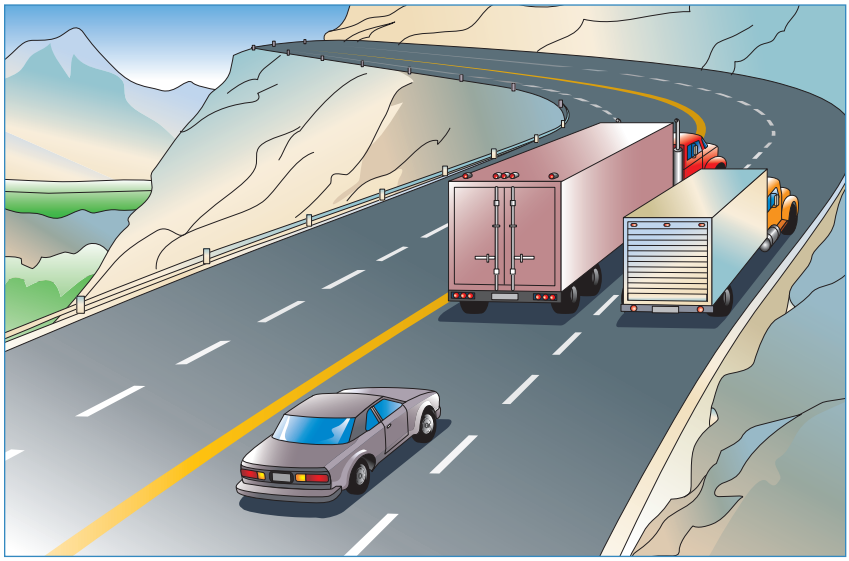
Move over — Make the lane change at a point of the roadway where road conditions and pavement markings indicate the lane change can be made. Lane changes should never be made in intersections, near pedestrian crossings, railway crossings and where solid lane markings indicate it's not permitted. Make a deliberate, smooth and steady lane change. Taking too much time allows the traffic patterns to change; hesitating may cause other motorists to change speed or position. Steer smoothly into the centre of the target lane, adjusting speed as necessary to establish safe distances from other vehicles. Avoid sudden movements of the steering wheel as this may result in your trailer whipping and possibly cause a roll over.

Cancel turn signals as soon as the vehicle is fully in the new lane position.

Resume driving — Adjust your speed and distance relative to other vehicles.

Passing

Drivers often become frustrated when a commercial vehicle holds them up as it passes another commercial vehicle that's driving at almost the same speed. If the passing truck occupies the fast lane when it isn't absolutely necessary, traffic may become congested.



Before passing a vehicle, check for forward clearance. There must be time and space for you to manoeuvre in the event of an emergency. Avoid overtaking a vehicle when you are to the right of it. Most drivers don't expect to be passed on the right and the noise of the vehicle may cause them to react by pulling quickly to the right and into your vehicle.

When you can see that there's sufficient passing distance in the left lane, follow these steps:

- Check the rearview mirrors and blind spots.
- Turn the left indicator lights on.
- Accelerate and move smoothly into the left lane.
- Overtake the vehicle and complete the pass as quickly as possible. Be especially cautious when in the blind spot where the driver is unable to see your vehicle.
- Check the right rearview mirror for clearance to make certain the vehicle is behind the trailer and allow at least a two-second gap before returning to the driving lane.
- Turn the right turn signal ON.
- Return smoothly to the right lane when safe to do so.
- Turn the right turn signal OFF.

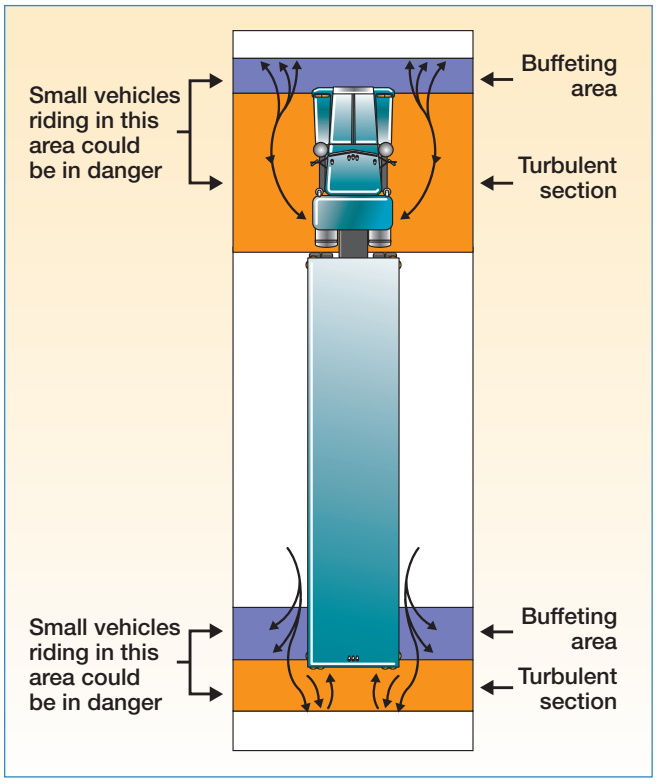
Use extra caution when passing under these conditions:

- The lead vehicle's vision to the rear is obstructed.
- There's the chance that the lead vehicle might pull out unexpectedly to pass.
- The driver of the lead vehicle appears inattentive or distracted.

Don't pass if the lead vehicle is doing any of the following:

- Signaling or otherwise indicating a left turn.
- Changing lanes and getting ready to pass another vehicle.
- Weaving and wandering near or across the centre line.
- Decelerating suddenly.
- Passing pedestrians, cyclists or animals.
- Being passed by another vehicle.

Passing or being passed by a heavy vehicle is very different from a passenger car. Large vehicles travelling at high speeds create air turbulence that can be hazardous to smaller vehicles. The larger your vehicle, the more wind turbulence. A car, bicycle or other road user travelling directly in front of a truck, alongside the cab, by the back area of the trailer or at the immediate rear of the trailer is in an area of air turbulence. For cyclists, the air turbulence from your vehicle can cause them to lose control.



Areas of turbulence are indicated in the diagram above.

Be alert for road users who drive in these areas. They may be forced off a narrow roadway or drawn into the side of your vehicle. If a smaller vehicle continues to drive in your area of turbulence, slow down until it's out.

Passing a stalled vehicle

When passing a stalled vehicle, treat it the same as passing a moving one. When approaching, look for any sign that the vehicle may move or discharge passengers. When possible, and as a courtesy, attempt to move over one lane to provide a safety cushion. Check clearance and determine if it's safe to change lanes, signal at least four flashes and change lanes. If changing lanes isn't possible, slow down and keep the brake covered, while carefully watching for any movement such as wheels turning out, lights coming on or exhaust coming out of the vehicle. After passing the danger, centre the vehicle back in the lane or pull back into the original lane.

Being passed

Part of our responsibility as professional drivers is to help other traffic to interact safely with us. It can be frustrating dealing with less knowledgeable drivers but it's important that everyone gets home safely at the end of the day. If you're being passed by another vehicle, it's important to keep track of their progress and the available space that they have to safely complete their manoeuvre.

If you're being passed on a multi-lane highway, there generally isn't too much to worry about.

If you're being passed on a regular highway in a passing lane that's going to end soon, then the situation will require more attention. When a passing lane is ending, there are warning signs on both sides of the highway showing the lane ending in 200 m (656 ft).



If the vehicle passing you is beside your trailer, they won't be able to see signs on the right side of the roadway. If there are large vehicles traveling in the opposite direction at the time, they may not see signs posted on the left side of the road and may be unaware that the passing lane is ending, for example.

Activate your left turn signal as you approach the "lane ends in 200 m" sign. It can serve as a warning to the vehicle passing you that they need to either complete their pass or back off and allow you to move over. You'll need to be prepared to adjust your speed to allow them to complete their pass safely, although it may be frustrating to lose some of your momentum, it's important to keep everyone safe.

If you're being passed on a two-lane roadway and a driver has crossed into the oncoming lane to pass you, it is again important to monitor the situation. Many drivers don't take your vehicle's length into consideration when calculating how long it's going to take them to safely pass you. Be prepared to reduce your speed to allow the passing vehicle to complete their manoeuvre. If they've miscalculated the required space, a head-on crash is possible with an oncoming vehicle. Your decision to change your speed needs to be carefully considered, because if the vehicle passing you decides to abort their passing manoeuvre when they see an oncoming vehicle and you slow down substantially, they may not be able to get back into your lane. If you're absolutely sure that the vehicle beside you is going to continue passing and there are vehicles approaching, then reduce your speed and, if safe to do so, move onto the paved shoulder of the road to allow more room.

Steering and turning

Operating a tractor-trailer is considerably different than driving a standard size automobile. It requires a lot more room to perform the same types of manoeuvres.

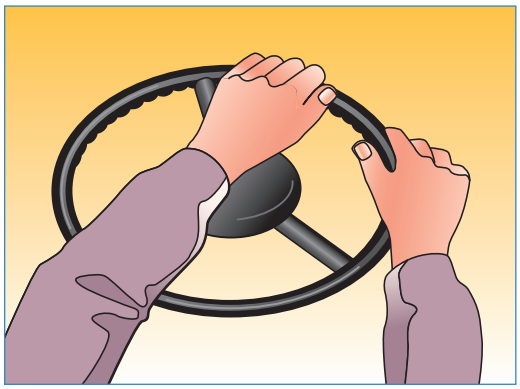
Before making a turn, make certain you signal check traffic to the front, sides and rear of the tractor-trailer by using the proper observation technique of left flat mirror/convex mirror/look ahead/and right flat mirror/convex mirror/look ahead and that you're in the correct lane for the turn. Plan ahead for the turn — you may need to borrow a portion of another lane in order to complete the turn. Reduce your speed and downshift to the proper gear at least a vehicle length before the turn.

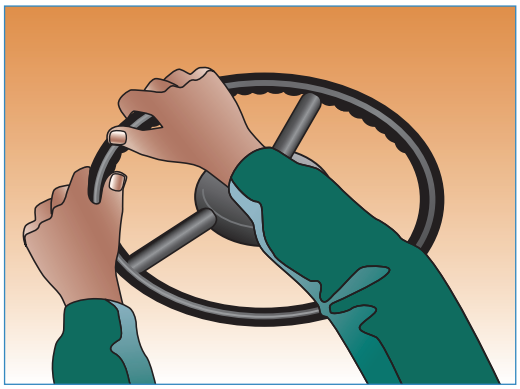
Use either the push-pull steering method or the hand-over-hand steering method.

The push-pull method — Each hand remains on its own side of the steering wheel with one hand pushing the wheel to the top where the other hand meets it and then pulls the wheel down.

The hand-over-hand method — One hand pushes the steering wheel up, across and down, while the other hand reaches up to the top of the wheel and pulls down. This action is repeated grasping the wheel at the top again.

Whichever method you use, the key is to ensure that the tractor-trailer is under control at all times.

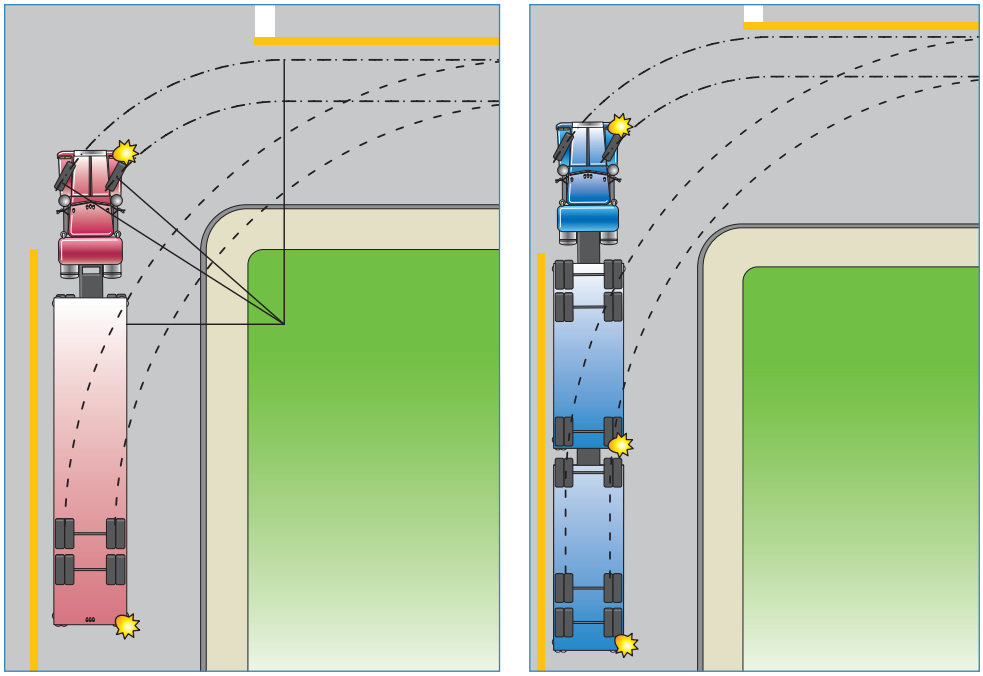




Off-tracking

Larger vehicles need additional room to manoeuvre and articulated vehicles, such as tractor-trailers, need even more space. One reason for this is the vehicle's dimensions. This is especially true when considering off-tracking. Off-tracking refers to the path of travel that wheels on the tractor and the trailer take, which differ in a turn. The rear wheels on a trailer take a different, shorter path than the front wheels on the tractor when the vehicle is turning or cornering. The greater the distance (wheelbase) between the front wheels and the rear wheels, the greater the amount of off-track. The off-track path of the rear wheels is a shorter radius than the path of the front wheels.

Vehicles that have a significant amount of off-track require drivers to adjust their turning arc. Failure to do so runs the risk of the rear wheels of the trailer running over curbs, running over the centre line, mounting sidewalks and striking fixed object hazards, such as power poles, light standards near the intersection and signposts.



Before making a turn, you must prepare for it by positioning the vehicle correctly. During this positioning, which may require entering adjacent lanes temporarily, you must check your immediate surroundings to ensure that you don't interfere with other vehicles and it's safe to do so.

There are two types of off-tracking:

- Low speed off-tracking is common when driving in a city. In low or moderate speed turns, the rear tires are pulled inward of the steering path. The longer the wheelbase of the vehicle or trailer or the tighter the turn, the more off-tracking that occurs.
- High-speed off-tracking is the effect of inertia. It's seen when a vehicle travels at higher speeds and the rear tires pull outward from the steering path during a turn. When you're driving a large vehicle, use a moderate speed when entering curves on open highways. Otherwise, you may encounter serious high-speed off-tracking that may result in a roll over.

Left and right turns

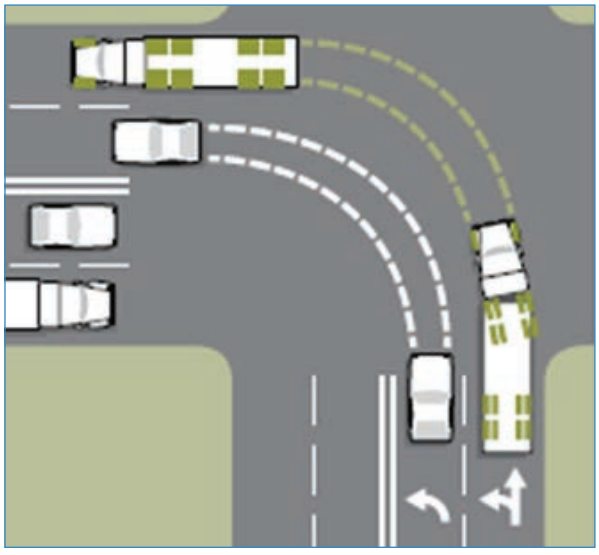
When planning to make a turn:

1. Mirror check and signal (approximately 30 m/100 ft from the turn in urban areas or approximately 100 m/330 ft in rural areas) to move into the proper position for the turn.
2. Reduce speed and downshift to the proper gear needed to execute the turn. The speed required should be achieved 20 m (65 ft) prior to the manoeuvre. You should slow the vehicle down to the necessary speed and then idle through the turn. This is especially important on wet, muddy, icy, snow-covered or gravel road surfaces as braking in a turn can lead to a jackknife situation.
3. Check for clear right-of-way by looking for potential conflict with other traffic, cyclists or pedestrians. Remember the off-tracking tendencies of the large vehicle. If you have to borrow space from other lanes, ensure it's safe to do so, otherwise stop and wait until it's safe to continue.
4. Be aware of other road users who may want to squeeze into an open space.
5. Check for traffic signals or signs that are directed at you and be aware of signs or signals applying to cross-traffic.
6. Execute the turn, checking both mirrors repeatedly through the turn and cancel the signal when complete.

Left turns

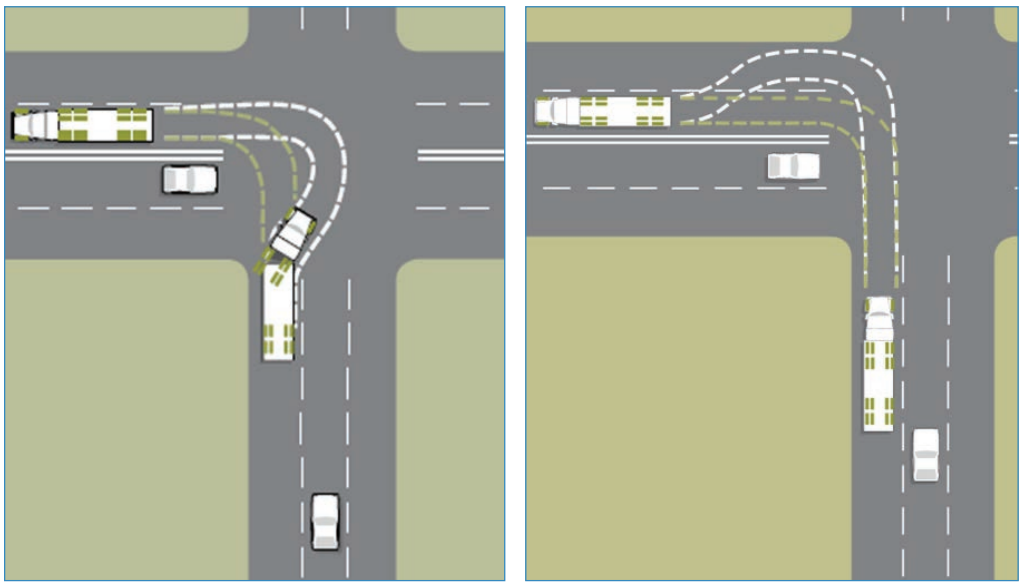
1. If not in the legal turning lane, mirror and shoulder check left, signal at least one-half block back and, when safe, enter the proper turning lane (in an urban area). This is the lane just to the right of the centre line or the left curb on one-way streets or as indicated by directional signs. Where two or more lanes are allowed to turn left, you should always position yourself in the outside (right) lane. This will give you the required space for your off-track and keep other vehicles that are turning visible in your left mirror, not on your blindside.
2. Reduce your speed one half-block back, if necessary.
3. Ensure that you shift into a proper gear for the turn if the turn can be done without stopping. (Lugging the engine should be avoided.)
4. From the proper lane, signal left at least one-third of a block from the intersection.

5. Scan the intersection for traffic control devices and comply as required.
6. Check left, centre, right and left again for traffic and pedestrians.
7. Travel straight into the intersection to within approximately 3 m (10 ft), or one lane's width, of the intended lane (except on one-way streets.)
8. Keep front wheels straight and yield to approaching traffic and/or pedestrians in the crosswalk to the left. Keeping the wheels pointed straight ahead will ensure that you won't be pushed into oncoming traffic if struck from behind.
9. Look well along the intended lane of travel, accelerate and begin the turn when safe to do so. Use the push-pull or hand-over-hand steering method. Remember to constantly check the left mirror. You should also check the right-hand mirror to ensure the nose swing of the trailer doesn't interfere with any obstacles, such as parked cars or poles and light standards.
10. Stay only as far to the right side as necessary to avoid the rear wheels running over obstacles or other vehicles. Amount of off-tracking must always be considered.
11. Start to recover steering by using the push-pull or hand-over-hand method and return into the proper lane.
12. Accelerate, cancel the turn signal and look well down your intended path of travel (at least 12 seconds or one block ahead.)



Left turns from a one-way to two-way

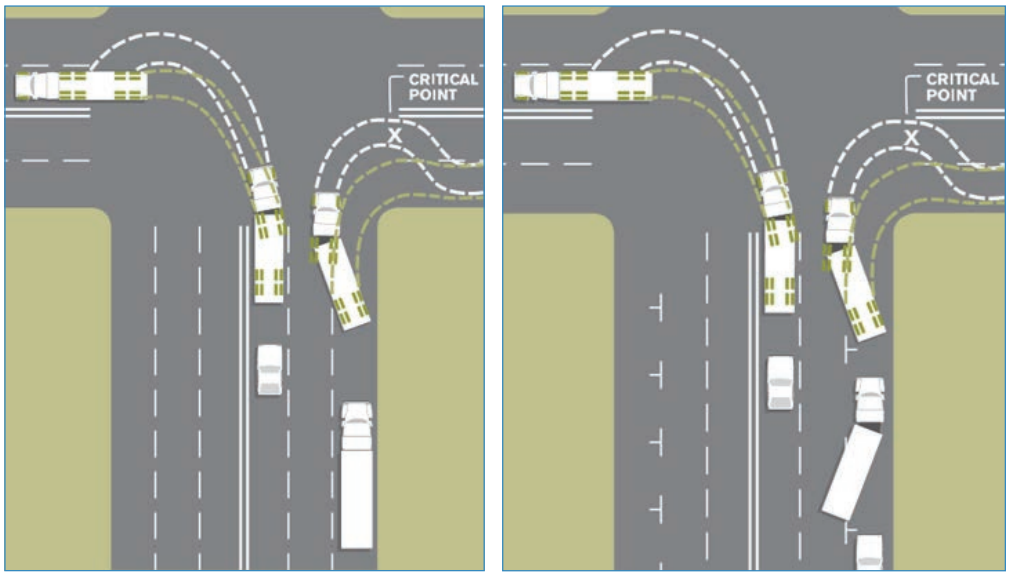
When turning left from a one-way street with no signs or lights indicating two or more turning lanes, the left turn should be made from the far left lane. An "S" turn could be used to block off any traffic that may attempt to pass on your left. Position your truck and trailer to the far right of the lane you are turning from and turning into. Continue checking trailer position throughout the turn.



Right turns

1. Take the right-most lane available. Be aware that for every turn of the steering wheel, the rear wheels will follow a shorter path than the front wheels. Allow for this low speed off-tracking on every turn.
2. Signal to the right.
3. Scan the intersection for traffic control devices and comply as required.
4. Check the left mirror for vehicles attempting to pass or that could otherwise interfere with the turning procedure.
5. Check the right mirror to ensure that smaller vehicles, motorcycles, cyclists or pedestrians aren't attempting to proceed in or around the right side of the tractor-trailer unit. Yield, if necessary.

6. Check if the intended lane of travel is free of obstructions, such as parked vehicles. If there's a parked vehicle within one block, then the left side of the vehicle is to be used as an extension of the curb.
7. Check left, centre, right for traffic and pedestrians. Check left again.
8. Proceed with the turning procedure using the push-pull or hand-over-hand steering method while constantly scanning the front and right side of the vehicle. (Watch for vehicles attempting to pass on the right.)
9. Be aware that you might need to go over the centre line of the street you're entering or into the second traffic lane.
10. Return to the curb lane immediately after the rear trailer wheels clear the curb.
11. Maintain a safe and controlled speed at all times.
12. Look well down the driving path, at least one block, continue recovering the steering wheel using the push-pull or hand-over-hand method.
13. Accelerate as necessary and ensure the turn signal has been cancelled.



Negotiating Intersections

Know — Expect the unexpected. Decide in advance what you need to know at intersections. Your indecision can confuse other drivers and cause a crash. Be prepared to yield at all times.

Show — Signal your intentions well in advance and be in the proper lane.

Slow — Slow down gradually. An intersection isn't a place for speed. Remember that at 25 km/h (15 mph), you cover more than 7 m (23 ft) per second and may travel 5 m (16 ft) just moving your foot from the accelerator to the brake.

Go — Proceed through the intersection without hesitation when safe. It's important to understand that uncontrolled side-streets, driveways and alleyways are also considered intersections. The distraction from pedestrians, cyclists and animals are additional hazards.

Best practices at all intersections:

- Never assume the other driver will yield to you when required. Approach each intersection with your foot off the accelerator and covering the brake.
- As you approach the intersection, look left, then right. Prior to going through the intersection, check left again, then right. If objects, like parts of your vehicle or your mirrors, block your vision, check carefully around them before you proceed.
- Proceed only when safe to do so, even if you have the right of way. You can't count on the other driver always obeying the rules.
- When changing lanes prior to turning at an intersection, ensure you drive the vehicle to the required lane at least 15 m (50 ft) before reaching the intersection.
- Never pass a vehicle that's stopped at an intersection until you're sure it's not stopped and waiting for a pedestrian to cross. Never assume a vehicle stopped at the intersection and signalling left is only waiting for oncoming traffic to clear. There may be a pedestrian crossing as well.
- It's illegal to pass a vehicle that has stopped to allow a pedestrian within a crosswalk (marked or unmarked) to cross the road.

Traffic circles and roundabouts

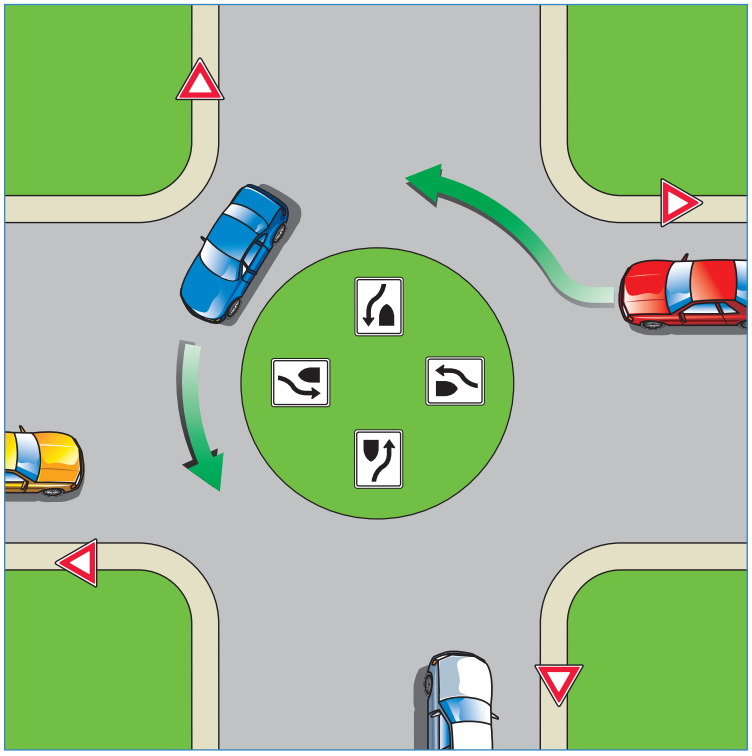
These are found in some areas to help ensure safe passage of traffic through an intersection without having to stop the flow of traffic. Roundabouts, while generally larger than traffic circles, work the same way:

- Slow down as you approach the circle.
- Yield to any traffic in the circle.
- If another vehicle arrives at the traffic circle at the same time as you do, yield to a vehicle on your right.
- Go around the traffic circle to the right (counter-clockwise).

Traffic circles

Traffic circles are designed for use in residential streets where trucks and buses don't usually travel. If you're driving a large truck or bus through a traffic circle, encroaching onto the median is okay to get through providing it's safe to do so.

Turn right to enter a traffic circle and turn right again to leave it. Yield to vehicles that are already in the traffic circle. If another vehicle arrives at the traffic circle at the same time as you do, yield to the vehicle on your right.



Roundabouts

Some roundabouts have more than one lane. Lane use signs and markings may be displayed at the approaches to indicate where you can go in each lane when you're in the roundabout.

Make sure you know where you want to go and are in the proper lane to get there before you enter.

Traffic circles and roundabouts often have a truck apron around the edge of the island in the middle. Large vehicles may need to drive over the apron in order to drive through the traffic circle or roundabout.

Slow down when approaching a roundabout and yield to traffic already in it. Take care when driving a large commercial vehicle. Due to your vehicle's off-track, you may need to take up more than one lane to get through the roundabout. Make sure there are no vehicles in the lane beside you.

When exiting, signal "right" in advance of your exit location.



In the example above, the red car has entered the roundabout from the south in the right lane after first yielding to vehicles in the roundabout. The driver may either turn right at the east exit or continue straight and take the north exit.

The blue car entered from the south in the left lane and merged into the left lane in the roundabout. Because the blue car entered from the left lane, the driver can't immediately turn right at the first exit (east), but can take either the north or west exit.

The tractor-trailer combination entered the roundabout from the east in the left lane and the driver is going to take the south exit. The trailer is partially in the right lane due to the length of the combination. The driver of the green car must yield to the tractor-trailer already in the roundabout.

Crossing intersections

Crossing intersections can be complicated. You need to watch for traffic approaching from the left and right and look out for oncoming traffic that may be turning. This can be very demanding, particularly if the road that you're crossing is busy and the traffic is travelling quickly.

From a stationary (stand-still) position, it takes at least 12 seconds to cross a typical intersection on a two-way road in a tractor-trailer. This means that you need at least a 15-second gap between your commercial vehicle and vehicles approaching in order to cross safely. You'll also need to allow for a much larger gap as the speed zone you're entering increases to allow you to cross the intersection safely and not cause the cross-traffic to brake or swerve to avoid your vehicle.

You may need less time to cross the intersection if your vehicle is already moving. This may be the case when you're approaching an intersection and can proceed across without stopping. However, you must still take care. It's difficult to judge your speed and that of other traffic from the left and right. If in doubt, stop and only cross the intersection when you're sure the gap is big enough.

You'll need to build your gap selection skills so you know what a safe gap looks like when you're crossing an intersection.

In urban areas, following the steps below will help you travel safely through intersections.

1. Depending on visibility, take your foot off the accelerator and cover the brake if needed.
2. Check mirrors and be aware of traffic following you. Prior to entering the intersection, check left then right for traffic indicators and controls, pedestrians and other vehicles. Make certain no vehicle approaching is about to turn left in front of you. If clear, check to the left and right once more and proceed through the intersection when safe.
3. Scan the area to determine the point-of-no-return. This is the point at which you'll no longer be able to stop if the lights turn amber. There's no exact point, but there's an area or range a short distance before the intersection where the driver must decide if it's possible to stop safely before the crosswalk or intersection when the lights turn amber. Deciding factors include: speed of the vehicle, road conditions, traffic volume to the front, rear and side and visibility. The point-of-no-return requires good judgment and experience when making the decision to stop or proceed.

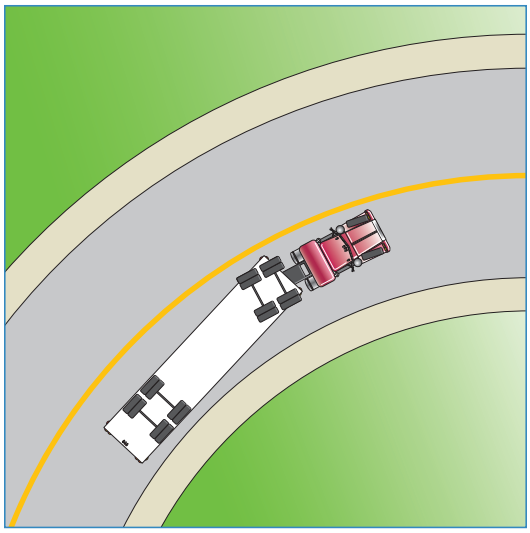
4. Between intersections, watch for traffic changing lanes or entering your lane from alleys or driveways.
5. Once past the intersection check mirrors again for any change in traffic patterns behind you. If you plan to turn at the next intersection, position yourself so you're ready to turn. Look for pedestrians that may be crossing ahead.

When approaching any intersection, if your visibility is obstructed for any reason, you may be required to stop before proceeding.

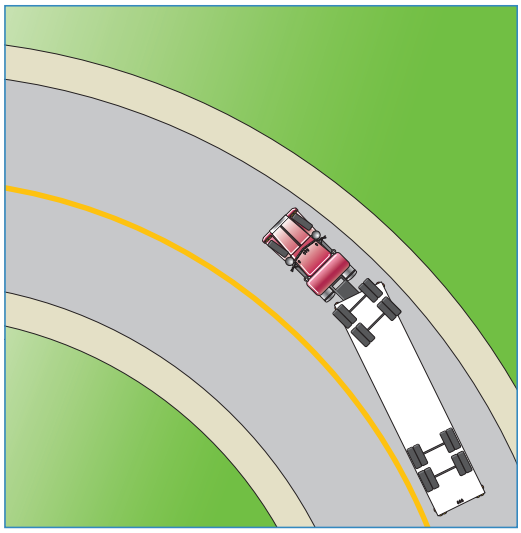
Curves

When large vehicles enter a curve, the rear wheels don't follow the same path as the front, because they don't pivot, so they'll off track closer to the curb or the center line depending on the direction you are traveling in the curve, as shown in the diagram below. To mitigate this off-tracking, you must lead your turning arc of the front wheels according to how sharp the curve is and the vehicle's off-track. Mirrors can also be used to help you monitor off-tracking.

What's the best way to negotiate a curve?



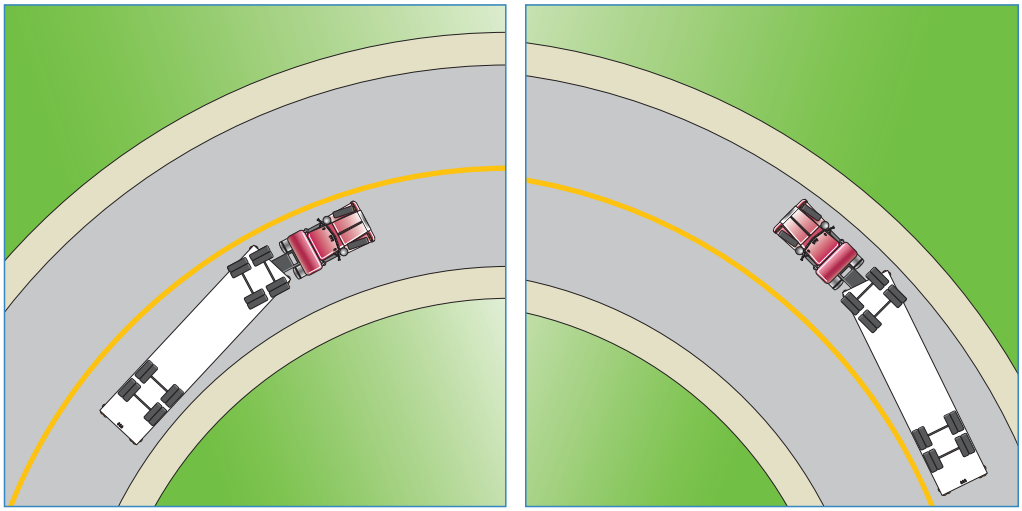
Position of a tractor and semi-trailer's wheels when turning to the right.



Position of a tractor and semi-trailer's wheels when turning to the left.

When approaching a curve, estimate a safe speed of travel (if not posted on a sign) from the degree of curvature and banking.

- On right curves, keep the front of the vehicle closer to the centre of the road so the trailer wheels don't roll over the curb or drop off the pavement on the right, while watching the right mirror for the position of the rear of your vehicle.
- On left curves, keep the front of the vehicle closer to the outside of the curve (right side of road), so the trailer wheels don't cut into the other lane of traffic on the left, while watching the left mirror.



- Hugging the outside of a curve increases the risk of hitting a soft shoulder when it's a left curve. Hugging the inside increases the risk of putting your mirrors into the path of oncoming vehicles. Manage the space you have and pay attention to tail swing and off-tracking.
- Slow down shortly before the curve and then gently apply power to the wheels after entering the curve. When you apply power to the wheels, you introduce a force in a different direction from the inertia (this force acts on your wheels by trying to keep it going in a straight line when negotiating a curve). The result is greater control.



Mountain driving and grades

When driving in the mountains or on hills, gravity plays a major role on how your vehicle behaves. Controlling your vehicle becomes much more challenging and you need to adapt your decision-making to suit the prevailing situation. When traveling uphill, your vehicle will slow down and you'll require lower gears to continue your ascent. Every time you take the transmission out of gear to make a downshift, the truck will slow further changing how the shift needs to be completed. When travelling downhill, it's important to select the correct gear before you start your descent so that you can travel safely to the bottom of the hill without the use of service brakes. Ensuring all your vehicle systems are in top condition before beginning your trip is more important when travelling in the mountains.

Uphill grades

The force of gravity causes all vehicles to slow down on upgrades, making it difficult to maintain a constant speed. The steepness of the grade, as well as the weight of the load on the vehicle, all play a part in which gear you'll need to travel up a hill. The steeper the grade and the heavier the load, the lower the gear you'll need. Remember, different trucks will have different engine ratings and transmissions, as well as different axle ratios, so some will go up a hill faster than others with the same load.

Stay to the right and use your four-way flashers to warn vehicles if you're travelling substantially below the posted speed limit. When your engine RPM starts to fall and shifting becomes necessary, select a lower gear that will keep you pulling in your peak torque range. Keep an eye on the operating temperatures of your coolant and the oil in your engine, transmission and differentials, if equipped with gauges. If their readings get too high, you'll need to drop to a lower gear, so you can reduce the load on the vehicle's drivetrain allowing them to cool down. This is especially important on a hot summer day. Never pass a vehicle on an upgrade unless you're travelling substantially faster than them and it can be completed safely.

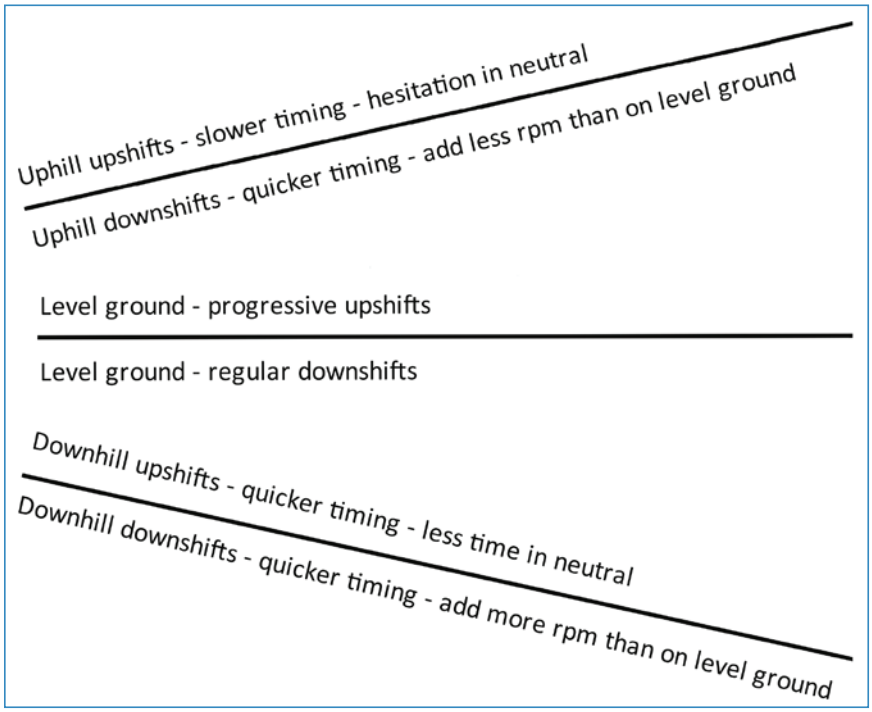
Uphill shifting — You'll have to change the timing of your shift to complete them smoothly. When you upshift, you'll have to pause longer in neutral because the vehicle (output shaft) slows during the shift and the pause will give the input shaft a chance to slow down enough to match the output shaft. If the grade is too steep, the deceleration rate of the vehicle could be too great to allow you to complete the upshift, so you'll need to stay in that gear until the grade lessens. Avoid clashing the gears, as this will cause damage to the transmission. All shifts should be smooth to prolong the life of the transmission and the driveline components.

When you downshift while climbing a hill, you'll have to change gears more quickly than usual, because the vehicle slows while the transmission is in neutral. There's less RPM differential between gears when compared to level ground shifts. It takes practice to master this skill as the RPM differential will vary depending on the percentage of grade, weight of the vehicle, how long you stay in neutral and which gears you're shifting between. If you miss this shift, you should be prepared to immediately recover the next lower gear. Continue to downshift until you reach a gear in which you can maintain the RPM in the torque range. Whether you're shifting up or down on a grade, you'll have greater success if you plan your shifts ahead of time.

Driving uphill in adverse conditions — When driving uphill in adverse conditions, traction between the tires and the road surface may be reduced. Your ability to keep moving will depend on the condition of your tires and the condition of the road surface.

You may need to install your tire chains in order to climb the hill. If possible, do this prior to starting up the grade. Waiting until you spin out to install your chains can put you in a dangerous position, possibly blocking traffic while you do the installation. If you do have to start up from a stop on the grade after installing your chains, it's recommended that you stay in the gear that you started out in until the grade lessens — attempting to shift will likely result in damage to the chains. Actuate the inter-axle differential lock and, if equipped, your driver controlled differential lock(s). Operating the engine at higher than normal RPM will reduce torque to the drive wheels which will help to prevent spin out.

Shifting on a grade



Downhill grades

Almost all brake failures and downhill runaway crashes are caused by overdriving the ability of the brakes to deal with heat. In other words, poor speed control and driver error. You'll need a consistent strategy to plan your descent.

Remember: There are mandatory brake check areas before significant grades on many of B.C.'s highways. You must pull over, stop and check that your brakes are properly adjusted and that the overall air brake system is in good condition before you descend the grade. Failure to do so is an offence and may result in a fine.



Select gear before beginning descent — Choosing the correct gear to use when driving down a long, steep grade requires experience and familiarity with your equipment and load. If you're unsure, start down the hill in a lower gear than you think you need as it's easier to upshift than downshift on a steep hill. Once you have driven for some time, you'll be able to determine more quickly which gear will hold you back to safely descend a given grade. When you have chosen the right gear, the engine won't race. Never shift into neutral and coast — this is very dangerous and illegal.

Save your service brakes for an emergency — Note that your service brakes are designed to stop you, not to hold you back while descending grades. Control your speed primarily through gear selection not by applying the brakes. Choose a gear that will allow you to descend without any use of the service brakes, so you have the service braking function ready in the event of an emergency.

If you descend a grade in too high a gear and need to use your brakes, they'll start to heat up. The heat will continue to build up with excessive hard braking until it exceeds the capability of the brake components to absorb and dissipate the heat. As brake drums heat up, they expand away from the brake linings. Too much heat can result in brake fade, brake damage and even worse, brake failure that could cause a serious crash. Brake components or tires may actually catch fire.

Whether in town or on a highway, you'll need to descend hills slower than other traffic in order to be safe and maintain control of your vehicle. Turn on your four-way flashers to warn traffic approaching from behind.

Engine brakes or retarders — Engine brakes or retarders help slow a vehicle down and are used to hold back a vehicle as it descends a hill. There are four basic types of retarders: exhaust, engine, hydraulic and electric with the engine brake being most common.



To activate the retarder, there is an on/off switch and a switch to vary the amount of holdback. If the switch is turned on and you release the pressure on the throttle pedal and clutch, the retarding device will activate.

How powerful the holdback is depends on the displacement of the engine in your truck. Larger displacement engines generally have more holdback than smaller ones, so some vehicles can descend a grade more quickly than another with the same load.

Traction also plays an important role in how effective the engine brake is as all of the holdback is generated between the drive tires and road surface. If there isn't enough traction, the drive axles could lock up and skid which could result in a jackknife. If you needed tire chains to climb the other side of the mountain, leave them on while descending the grade as well.

Note: Never use your driver-controlled differential locks (DCDL) to descend a grade as it could result in the loss of steering control. When unlocking your DCDL, it may take several kilometres before they actually unlock. Be sure they're unlocked (indicator light is out) before you start down a hill.

Engine brakes are most efficient at a high RPM (2,000–2,100), but check your owner's manual to see what RPM is appropriate for your truck. All modern trucks are manufactured to meet safety standards, including noise levels. A well-engineered truck with an engine retarder and a properly maintained muffler system shouldn't be noisy.



Many municipalities post signs restricting drivers from using engine retarders/engine brakes. Be sure to watch for and obey these signs.

Gear selection — It takes a lot of experience to know what gear to use when you start down a hill. The gear required is determined by how steep the hill is, how heavy your load is and how much holdback your engine brake generates. Generally, the gear you select to descend the hill is usually the same one you would need to climb it. Downshifting when going downhill takes a lot of skill and practice because the risk of missing a shift and losing control is very real. The best practice is to downshift before you start downhill so you're already in the correct gear. If you're not sure which is the correct gear, then use a lower gear to start out as it's easier to upshift than downshift on a grade.

Use the engine retarder — Ensure your retarder is set on high and monitor your tachometer, while checking what RPM your engine is holding back at. If you're holding back between 1,700 and 2,100 RPM, then you're in the correct gear and can just keep monitoring the gauges and the traffic around you.

If the RPM starts to climb past 2,100, you're in too high a gear and damage to the engine can result if you allow the RPM to keep climbing. At this point, you'll need to downshift.

Downshifting — If you find yourself in too high of a gear and need to downshift, begin by slowing the vehicle down substantially (to 1000 RPM or less) and once you're ready, shift the same way you would on level ground, but increase your RPM more than you would for a regular shift.

How much extra RPM you need will depend on how steep the grade is, the vehicle weight, how long you stay in neutral (the less time the better), and which gears you're shifting between — the lower the gear, the bigger the RPM differential. These shifts need to be carefully planned, precise, and smooth. Always remember, if you miss a shift to immediately recover the next highest gear to maintain control of your vehicle. To become an expert at shifting on grades requires a lot of practice.

If you haven't been trained how to make a downshift when going downhill, then make one brake application and bring your vehicle to a stop, select the lower gear, and continue down the hill safely.

Upshifting — If your vehicle is holding back at 1,600 RPM or less on the steepest part of the hill, then you could go down the hill one gear higher. If you've been trained how to make an upshift on a steep hill, then proceed with that. If you haven't, then stay in the gear you've selected and enjoy the ride safely to the bottom.

When you upshift when going downhill, the vehicle will accelerate as you take the transmission out of gear (output shaft speeds up), so the input shaft doesn't have to slow down as much for you to complete the shift smoothly. This means the shift needs to be quicker with less of a pause in neutral. How much quicker will depend on how steep the grade is, the vehicle weight, and what gears you're shifting between. If you're too slow with the shift it may not go into gear, and you'll need to recover the next highest gear to regain control of the vehicle. Never use your service brakes while the transmission is in neutral as you could lose control if the vehicle begins to skid.

Automated transmissions on downgrades

If you're driving an automatic or automated transmission, you'll need to use the "hold" or "manual" mode and select the gear you want to descend the hill in just like you would with a manual transmission. The decision-making process is the same as with a manual transmission even to the point of braking down to 1,000 RPM or less before you attempt a downshift. Remember: arriving safely at the bottom of the hill is the goal even if it takes a few minutes longer.

Plan your descent

Inspect your vehicle — Before you descend a long, steep grade, conduct an en route inspection, checking your vehicle for proper brake adjustment in particular, but also ensuring that your load is secure and that your vehicle is in good working order.

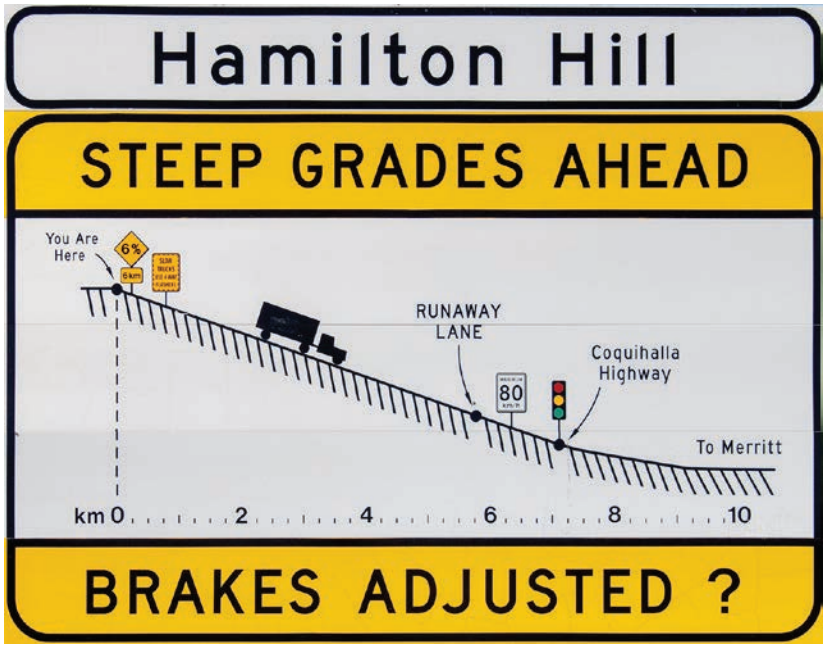
- Perform a hand valve tug test to ensure trailer service brakes are working.
- Check that the compressor is maintaining full reservoir pressure.
- Make sure slack adjustment is correct.
- Verify that glad hands and all air lines are secure with no audible air leaks.
- Check that brake drums are cool.

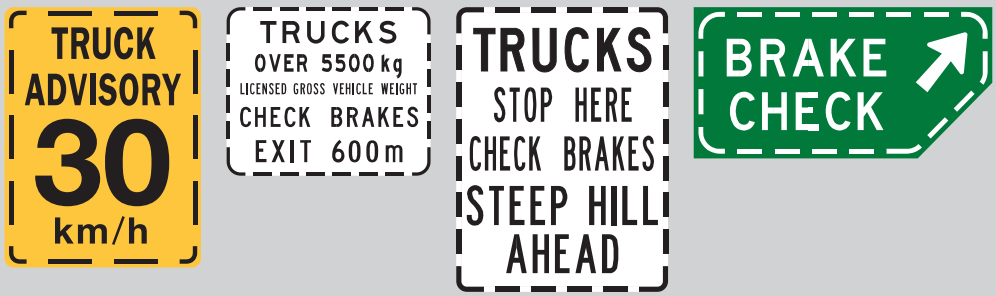
Plan ahead — Pre-plan your descent. Be sure to note any signage related to the slope you're about to drive down. Take into account the following factors:

- How steep and long is the grade?
- Are there switchbacks or tight turns?
- Are there runaway lanes?
- What are the road conditions?
- What's the weight of your load?

- How much auxiliary holdback power do you have available through, for example, engine brakes or retarders?
- What are your skills and training in downshifting on a downgrade?
- If the road conditions require it (for example, icy, snowy, wet) and it's legal to do so in the jurisdiction you're in, apply chains to your tires before descending. If the conditions are extreme, you may choose to stay at the top of the hill until they improve.

Information displayed on highway signs can help you plan your descent. This includes information about the severity of the grade, the recommended speed to negotiate sharp curves, and upcoming runaway lanes. In B.C., signs providing information for heavy truck operators may be displayed with or without dashed borders. In either case, you must comply with them.





These signs, showing special instructions for commercial vehicles, may be placed before a downhill grade. The one in the top left corner shows the speed suggested for descending the grade. The other signs direct you to check your brakes.

Runaway lanes — Runaway lanes are usually found in locations where other drivers have had problems. There are various types including incline ramps, gravel beds, restraint systems and water barrels. Whatever the design, a runaway lane will stop most runaways without major damage. If you lose control of your vehicle during a descent, use the runaway lane. Don't hesitate, the situation will not improve. *See the* ***Handling emergencies*** *chapter for more information.*







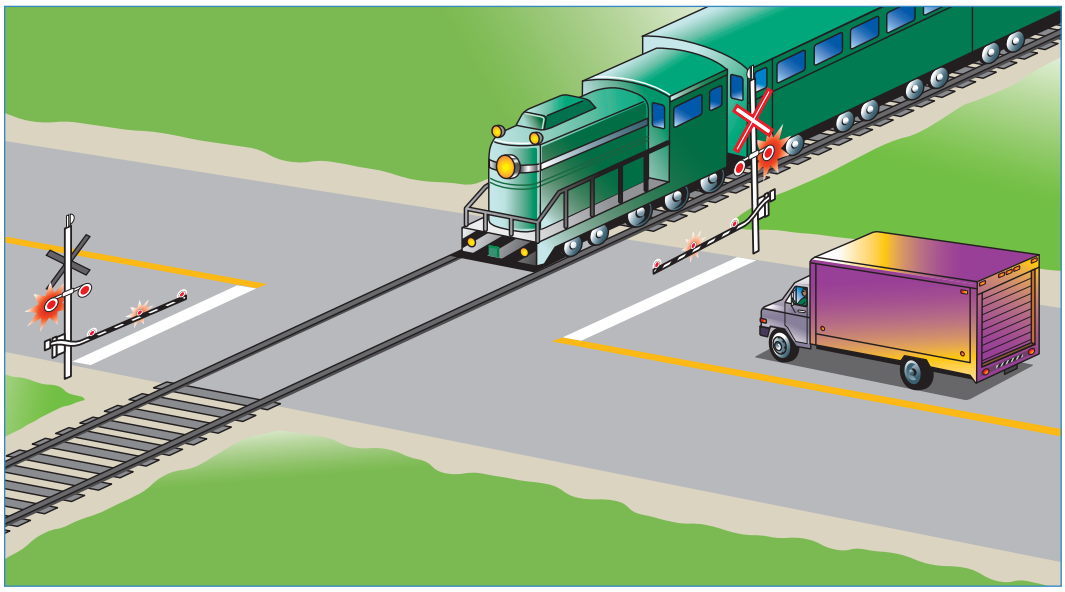


Railroad crossings

Take great care when the road intersects with railway tracks. As trains are long and heavy, they can take more than a kilometre to come to a complete stop. Never allow traffic conditions to trap you in a position where you have to stop on the tracks. Be sure you can get all the way across the tracks before you start across. When approaching crossings with multiple sets of tracks, look in both directions for each set.

Crossing railway tracks can be especially hazardous for drivers of large vehicles because of the following:

- Longer vehicles need to travel further and will need more time to clear a crossing.
- Heavier vehicles take more time and need more room to stop before a crossing.
- Larger vehicles are more likely to derail a train if there's a crash.



Controlled crossing — A controlled crossing is one with a flag person, stop sign, crossing gate or an electric or mechanical signalling device. All vehicles are required to stop at controlled railway crossings if signalled to do so.

Regardless of whether the railway crossing is controlled or not, always check for trains. Just because the crossing is controlled, it doesn't mean that the lights and gates will work. Power outages and extreme weather conditions can cause them to malfunction. Developing a habit of checking every railway crossing could save your life.

Uncontrolled crossing — Some vehicles are required by law to stop at all uncontrolled railway crossings. These vehicles are:

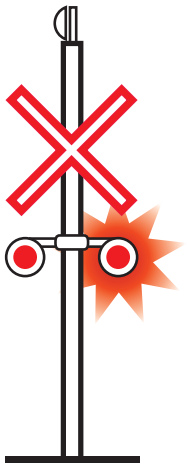
- School buses or buses carrying passengers for compensation
- Vehicles carrying explosives or poisonous/flammable substances as a cargo or part of their cargo
- Vehicles designated for carrying flammable liquids or gas, whether the vehicle is loaded or empty



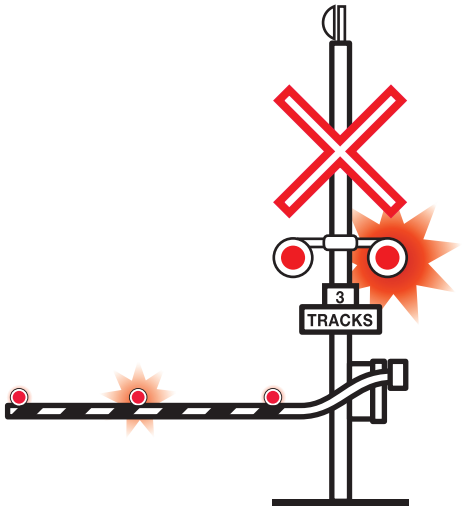
Railway crossing ahead — be prepared to stop



Railway crossing on side road ahead — be prepared to stop



Railway crossing — stop, then proceed when it is safe



Railway crossing — stay stopped until the gate is fully raised

Railroad crossing procedure

- Slow down, shift to a lower gear if you have a manual transmission and test your brakes.
- If you were required to stop at the tracks, shift only before or after crossing the tracks.
- Obey the traffic signs, signals, gates and flag person.
- Check for traffic behind you.
- Listen for warning bells and whistles. Turn off, or down, distracting fans, heaters and radios. Opening the window helps you hear.
- Stop behind any gates or stop lines — no closer than 5 m (about 16 ft) and no further than 15 m (about 49 ft) from the nearest rail.
- When stopped, put your vehicle in neutral and use your emergency or service brake and wait for the train to pass.

Note: Never stop with any part of your vehicle on or over the tracks.



Note: Never drive a vehicle through, around or under a crossing gate or barrier at a railway crossing while the gate or barrier is closed or is being opened or closed.

- Before resuming travel, make sure there's enough room on the other side of the track for the whole unit to clear, including the vehicle's overhang. Be aware that a train will be a metre (about 3 ft) wider than the rails on both sides.
- Proceed without shifting while your vehicle is on the tracks.
- Check the crossing signals one more time before proceeding.
- If the crossing lights begin to flash after starting, keep going. It's safer to continue than to back up.
- If there's more than one track, there may be more than one train. Don't assume the train you see is the only one.



- Don't attempt to cross the tracks unless you can see far enough in both directions to be sure that no train is approaching. Be especially careful at crossings without gates, flashing lights or bells. Even if there are active warning signals and they don't indicate that a train is approaching, you should still look and listen to be sure it's safe to proceed.
- Watch for no stopping zones near the tracks.

Vehicle stalled or stuck on the tracks — If your vehicle stalls or gets stuck on a crossing, get out of the vehicle immediately. If a train is coming, move away from the track in the direction of the approaching train. This will reduce the chances of being struck by flying debris if the train hits the vehicle as the momentum of the train striking the vehicle will sweep the debris forward. Contact the railway company if its emergency number is posted or call 911.

Rural crossings

Be cautious when approaching an uncontrolled rural railway crossing at night. A train may be crossing in front of you. The presence of a train may appear like a black, dark object against the background of a dark road. Many railway crashes involve a vehicle driving into the side of the train.

Pay extra attention when you cross railway tracks in rural areas because:

- Approach grades may be steeper.
- Snow banks may be higher.
- Brush and trees may be more common.

- There tend to be fewer automated warning systems.
- The grade crossing may be rough or uneven.

Common driver errors at crossings

- Due to its size, it's easy to misjudge the speed and distance of an approaching train.
- Never try to beat a train to the crossing. Many vehicles have been hit by the train or have run into the side of it when trying to get across the tracks ahead of the visibly approaching train.
- Familiarity breeds complacency. Always remember the saying, "anytime is train time." When approaching a familiar crossing that normally never has a train on it, the driver should still be alert for a train since their schedules can change from day to day.
- You should reduce speed and be especially observant if weather conditions or sight observations limit visibility of the rail.
- Some tracks may have curves and be hidden behind trees or hills which would make a train approaching at high-speed difficult to see and react to ahead of time.
- Always use extreme caution and take your time. Be 100 percent sure it's safe before crossing any railway track whether signalized or not.

6 Fuel-efficient driving

This unit focuses on fuel-efficient driving techniques for large commercial vehicles. In an increasingly environmentally conscious world with steadily rising fuel prices, it's critical that new professional drivers understand this topic. Learning these techniques can save thousands of dollars per year and reduce greenhouse gas emissions.

What you'll learn

This unit will help you learn to:

- Explain the economic and environmental importance of fuel-efficient driving.
- Describe fuel-efficient driving techniques to drive smart and save money.
- Describe vehicle maintenance practices that help conserve fuel.
- Describe commercial vehicle components and features that help make a vehicle more fuel efficient.
- Safely fuel a tractor-trailer.

Your driving habits

Your driving habits affect how much fuel you use, how often you need to refuel and vehicle maintenance costs.

Nearly 36 percent of all greenhouse gas emissions in B.C. are produced by the road transportation sector. Heavy-duty vehicles account for 19 percent of this total. Good safe driving habits can reduce fuel consumption by as much as 40 percent, save thousands of dollars a year in fuel and maintenance costs and reduce emissions.

It may surprise you to learn that:

- The cost of fuel has become the single largest expense for operating a heavy-duty truck — more than operator salaries, maintenance costs or the purchase price of the truck.

Tips to reduce fuel consumption

Practicing good driving habits can reduce the amount of fuel you burn. By looking ahead, keeping good space margins and anticipating road hazards, you can avoid sudden stops and changes in speeds. These and other smart driving habits also save on fuel and maintenance costs.

Here are some tips:

Preventive maintenance

Preventive maintenance plays a huge role in the health and efficiency of your vehicle. When your truck is serviced properly, you can run more efficiently and avoid unexpected downtime. Small problems should be fixed before they become bigger and more expensive.

In addition to regularly scheduled maintenance, you should also:

- Ensure your tires are inflated according to the manufacturer's recommendations. Driving a vehicle with tires under-inflated by eight p.s.i. (56 kPa) can increase fuel consumption by up to four percent. It can also reduce the life of your tires by more than 10,000 kilometres.
- Before you hit the road, make sure you've done a pre-trip inspection. Not only is it the law, it can also help you avoid unwelcome breakdowns during your travels.
- Ensure all fluid levels are correct. Under filling and over filling can both damage your vehicle.
- Monitor your restriction indicator for signs of the air filter becoming plugged or contaminated.





- Continually monitor your vehicle's condition during the trip:
  - Check the gauges on your instrument panel frequently. Conduct en route inspections, including tires and cargo, at least every three hours or 240 km.
  - Check for air leaks. They affect the use and effectiveness of the vehicle's air brakes. They also make the air compressor keep running longer and this reduces fuel efficiency.
- Do a post-trip inspection to spot problems that could delay you next time.

Starting and warmup

Fuel efficiency starts when you turn your engine on. Proper warmup helps lubricate components and seals, which reduces wear and leakage. Starting your truck properly can save money on fuel. Keep the following in mind:

- When starting your vehicle make sure you use zero throttle and are in a gear that doesn't need any throttle when starting out.
- Don't pump the throttle of a fuel-injected engine as the amount of fuel required for starting is pre-measured. Similarly, don't pump the throttle when cranking with older mechanical engines — it wastes fuel and can damage cylinder walls.
- When warming up the engine, don't increase the engine speed. Five minutes of idling for a warmup is generally adequate and cooldown is provided when pulling in for parking.
- Ensure oil and air pressure are in their normal operating ranges during startup.
- Warm your vehicle up after the initial idle time by driving easily; don't try to get too much power out of the engine by pushing the throttle down hard.

Reduce speed

Reduce your average speed. Driving fast eats up fuel no matter what vehicle you drive. Keep to the speed limit and save on fuel! Vehicles are most fuel efficient when they're travelling between 50 and 90 km/h. Above this speed zone, vehicles use increasingly more fuel the faster they go. For example, at 120 km/h, a vehicle uses about 20 percent more fuel than at 100 km/h. On a 25 km trip, this spike in speed — and fuel consumption — would cut just two minutes from your travel time.

Maintain a steady speed. When your speed dips and bursts, you use more fuel and spend more money than you need to. Tests have shown that varying your speed up and down between 75 and 85 km/h every 18 seconds can increase your fuel use by 20 percent.

Accelerate gently. The harder you accelerate the more fuel you use. In the city, you can use less fuel by easing onto the accelerator pedal gently. To be as fuel-efficient as possible, take five seconds to accelerate your vehicle up to 20 km/h from a stop. Imagine an open cup of coffee on the dashboard. Don't spill it!

Did you know?

- At speeds over 90 km/h, each additional 10 km/h increases fuel consumption by approximately 10 percent.
- At $1.45/litre, the cost of fuel for a heavy-duty truck using 45 L/100 km and traveling 150,000 km per year is around $98,000.
- Improving fuel efficiency by just 10 percent would save $9,800 in fuel costs and reduce greenhouse gas emissions by about 14 tonnes per year.

Drive smoothly

- On manual transmissions, change gears smoothly. Shifting professionally will result in about 30 percent improvement in operating costs.
- Practice progressive gear shifting. Shifting to the next highest gear at the lowest possible revolutions per minute (RPM) that will keep the truck accelerating. In low range gears this can be 800 to 1000 RPM. Shifting progressively reduces equipment wear, decreases noise levels, makes it easier to shift and saves fuel.
- Run the engine in the highest gear to keep the RPM low.
- Use your retarder properly and turn it off when you don't need it — let the terrain work for you.
- Back off the accelerator when going over the top of a hill and let gravity and momentum do the work.
- Use cruise control where appropriate.
- Anticipate traffic lights and pace yourself to avoid stopping and starting where possible.

Reduce idling

Idling a truck engine burns up to four litres of fuel per hour at 900 RPM. Turn off the engine when the vehicle is stopped for any length of time. This will save fuel, reduce maintenance requirements, prolong engine life and prevent unnecessary emissions.

If a 10-truck fleet were to cut idling by an hour a day for 260 days, it would save approximately 10,400 litres of fuel ($15,080 at $1.45/litre). A 100-truck fleet would save $150,800 and a 500-truck fleet $754,000.

Consider this:

- Ten seconds of idling uses more fuel than restarting your engine.
- Engine oil life can be reduced by as much as 75 percent leading to more frequent and expensive oil changes.
- Engine wear is increased. One hour of idling is equivalent to 11 km of driving.

Two ways to manage idle time:

1. Knowing how long the engine should run before and after a trip for correct engine operation and prevention of unnecessary fuel use.
2. Use the vehicle's computer when available. Some modern engine monitoring systems automatically shut down the engine after a pre-set idling time.

Monitor the weather

Weather conditions affect fuel efficiency. Driving on snow-covered roads can increase fuel consumption by 15 to 20 percent and fuel economy can be significantly affected by heavy winds.

Here are a few ways to minimize the effects of weather:

- Avoid bad weather where possible by changing trip times or routes.
- Adjust speed to suit the conditions. For example, reduce speed when there's a strong headwind.
- Slow down and maintain safe following conditions in order to better anticipate other vehicles in front of you.
- Do not park your tractor-trailer on an icy grade — getting stuck wastes fuel and time.

Plan your route

Plan your route carefully. The most fuel-efficient route is often one that avoids heavy commuter traffic, busy city driving and hills. Flat routes are more fuel-efficient than mountainous routes. Highway driving is more fuel-efficient than driving on congested city streets.

Choosing to drive on a flat multi-lane highway improves fuel efficiency by:

- Four to 11 percent compared to a flat two-lane highway.
- As much as 18 percent compared to a mountainous highway.
- 25 to 35 percent compared to driving on suburban roads.

Choosing a fuel-efficient vehicle

Equipment and options can make a big difference in fuel consumption. Consider some of the following equipment options.

Choose the right truck

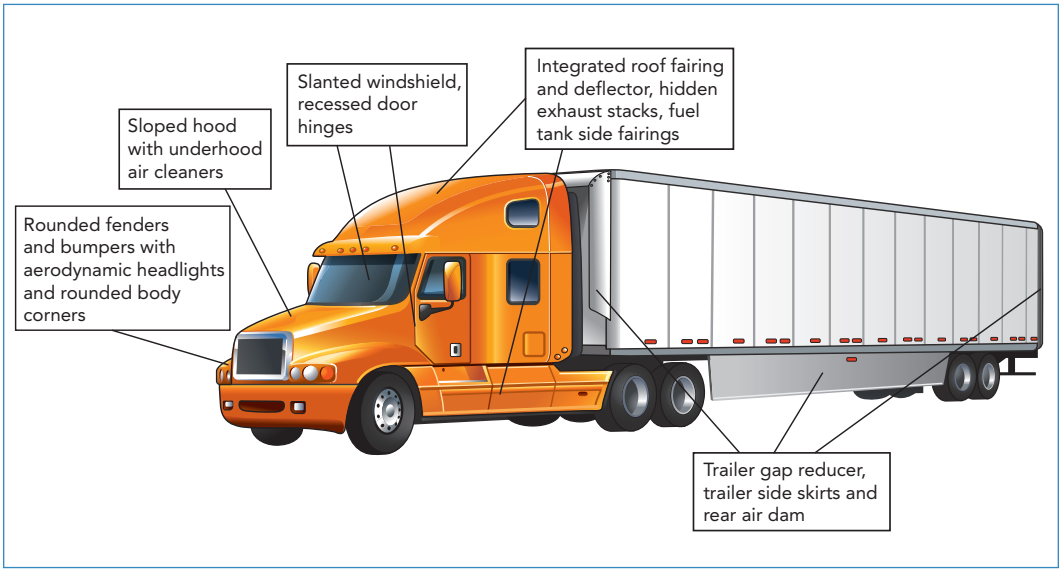
Choosing the right truck for the job with proper options and specifications can save on fuel and overall operating costs.

Using a truck designed for long-distance highway transportation for city transport costs more than using a truck designed and geared for city use.

If two trucks can each carry the same payload, purchasing the lighter one results in better fuel economy and reduced operating costs.

Look for aerodynamic features

At between 90 and 100 km/h, about 50 percent of the fuel consumed is used to overcome air resistance. Aerodynamic design features have a significant effect on how much fuel is consumed, particularly at highway speeds.



Some of the aerodynamic design features available on new trucks include:

- sloped hood with underhood air cleaners
- rounded bumpers
- rounded fenders with aerodynamic headlights and rounded body corners
- slanted and/or rounded windshield
- recessed door hinges and handles and low-profile side mirrors

- Integrated roof fairings and deflectors, fuel tank side fairings
- Hidden exhaust stacks, and
- Trailer gap reducers.

Trailer aerodynamic features include side skirts and rear trailer or boat tails, which can improve fuel economy by 15 to 20 percent. Many of these features can be added to older trucks and trailers. Aerodynamics should also be considered when loading flatbed trailers and flat deck trucks. Keeping the load low and covering it with a tarp will improve aerodynamics and help reduce fuel consumption. Ensure your tires are inflated according to the manufacturer's recommendations.

Tire choice

Tires with a rib tread design are more fuel efficient than tires with a lug tread design on drive and steering axles, however they don't provide as much traction in snow.

Aerodynamic drag is increased if any of the wheels on a tractor-trailer combination aren't properly aligned and tracking parallel to the direction of travel.

Also consider super single tires rather than dual tires on the drive axles. Super single tires provide low rolling resistance, are lighter and may lower your vehicle's height. Canadian rules now allow super single tires to carry the same weight as dual tires.



Lugged tire tread



Ribbed tire tread



Super single tire

Accessories

Use accessories designed to improve productivity and fuel efficiency:

- Oil pan heaters and block heaters help with cold starting and ensure the engine oil circulates better when the engine is started.
- Fuel heaters prevent fuel gelling in cold weather.
- Thermostatically controlled engine fans, winter grille covers, battery blankets and in-cab auxiliary heaters conserve engine heat in cold weather.

On-board computers that can monitor fuel consumption are available for new trucks and may be added to older trucks. They can help you drive in the most fuel-efficient way.

Fuelling a commercial vehicle

Your truck's fuel tanks are mounted to the frame and are low enough to allow you to fill them while standing beside the truck. Fuel is flammable and it must not be spilled or allowed to leak. Fuel dripping from your truck is a major safety defect. Fuel tank caps are vented to allow air to get into the tank as the fuel level drops, but must also keep fuel from splashing out. Fuel tank caps have seals to prevent leakage so always check for signs of fuel leaks. A missing fuel tank cap is a minor defect, but if fuel is splashing and dripping it's a major defect.

Keeping the fuel clean and keeping water out of the fuel are also very important. Dirty or contaminated fuel can cause serious engine damage. You should protect the fuel filler from dirt and water as you fuel up. Fill your tanks to the filler neck, but leave a little air space. Fuel will expand in warm weather.

Employers with dual tank trucks will have a safe work practice for fill ups, based on manufacturer specifications and those for the pump itself.

Always fuel with caution. The average flow rate of a commercial diesel pump is around 100 litres per minute and can go as high as 140. At a flow rate of 100 liters per minute, more than 1.5 litres per second will pour through the spout. That's a lot of fuel. Spills aren't only a serious hazard, they can lead to fines.

Fuelling tips

- Don't add fuel into the tank when the engine is running.
- Don't repeatedly enter and exit the vehicle while fuelling. Doing so can cause static build-up that can cause a static spark to occur when handling a fuel nozzle.
- Never overfill the fuel tank. Capacity is 95 percent of total volume to allow for expansion on warm days.
- In the event of a major or minor fuel spill, notify the attendant to get it cleaned up immediately using an approved absorbent material.

- Don't add fuel close to electrical sparks or open flame.
- Don't smoke while fuelling and be sure no one close by is smoking.
- Don't use a cell phone while fuelling.

Using propane

Only people with the proper certification or training can refuel a propane vehicle or container. However, if you are around a propane refueling station you should be aware of the following:

- Ensure there's nothing that could ignite within 3 m (10 ft) of the dispenser or container being filled
- Wear proper protective gloves and clothing, such as long sleeve shirts
- Engine and electrical accessories must be switched off
- Don't smoke and be sure no one close by is smoking
- Don't use a cell phone
- Do not allow your vehicle to be fueled while the engine is running, or a radio transmitter is on

Natural gas

A number of Canadian companies have fleets using natural gas as their fuel choice. Using natural gas has many benefits including:

- Reduced greenhouse gas emissions by 17 to 19 percent when compared to diesel.
- Fuel cost savings of 30 to 40 percent per kilometre.
- Quieter vehicles that create less noise in urban settings.
- Lower levels of air pollutants.

Summer fuel

Use the correct fuel for the season. Summer fuel can improve fuel economy by as much as three percent, but can cause engine problems in cold weather. Think about where you'll be driving. For example, if you delivered a load to California in the winter and refuelled to return to the B.C. Interior, that fuel may not be appropriate for B.C. winter temperatures.

Biodiesel

Consider using biodiesel fuel. Biodiesel is a diesel fuel substitute used in diesel engines made from renewable materials such as plant oils and animal fats, for example. It provides power similar to conventional diesel fuel, but contributes less carbon dioxide or sulfur to the atmosphere and is low in particulate emissions.

7 Signs, signals and road markings

This unit is a handy reference that gives examples of the most common signs, signals and road markings that keep traffic organized and flowing smoothly. Included are signs of particular interest to commercial vehicles.

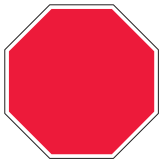
What you'll learn

This unit will help you learn to:

- Explain the meaning of the most common road signs and markings.
- Explain the associated traffic regulations that apply to commercial vehicles.
- Read road signs with particular messages that apply to commercial vehicles.

Signs

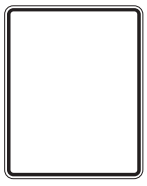
There are three ways to read signs: by their shape, colour and the messages printed on them. Understanding these three ways of classifying signs will help you figure out the meaning of other signs that are new to you.



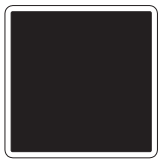
Stop



Yield the right-of-way



Shows driving regulations



Explains lane use



School zone signs are fluorescent yellow-green



Tells about motorist services



Shows a permitted action



Shows an action that is not permitted



Warns of hazards ahead



Warns of construction zones



Railway crossing



Shows distance and direction

Regulatory signs

The following signs communicate driving laws and regulations and it's an offence under B.C. law to disobey them. Drivers who don't follow the instructions on these signs may receive penalties.



Stop completely — continue only when safe



Give the right-of-way to other vehicles and crossing pedestrians



The maximum legal speed when the road is bare and dry and visibility is good



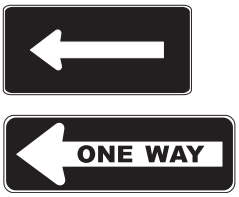
Indicates a lower speed limit ahead



Do not enter



Do not go this way — usually mounted on exit ramps



One way — gives direction of traffic on cross street



Winter tires or chains must be used when sign is displayed



Stay off this road during major disasters — road may be used only by emergency vehicles



Move into right lane if driving slower than regular traffic



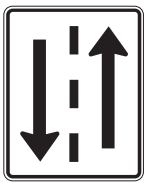
Keep right unless passing



Passing lane ahead



Do not pass



Two-way traffic — keep right unless passing



Keep right of the divider



No stopping between here and the next no-stopping sign



No stopping during posted times between here and the next sign



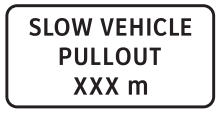
No bicycle riding beyond this point



No right turn on red light



Slow vehicles to use pullouts for the next stated distance



Slow vehicle pullout stated meters ahead



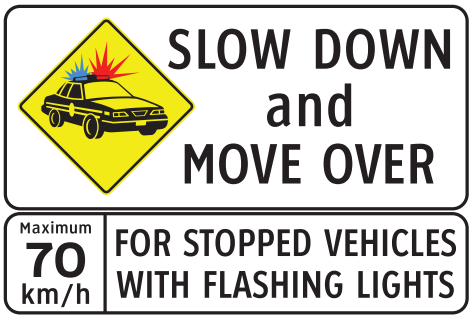
Slow vehicle pullout



Slow traffic delaying 5 vehicles must use pullout



Slow traffic delaying vehicles use pullouts



Slow down and move over when passing stopped vehicles with flashing lights. Travel no faster than 70 km/h in zones with posted speed limits of 80 km/h or more and no faster than 40 km/h if the speed limit is less than 80 km/h.



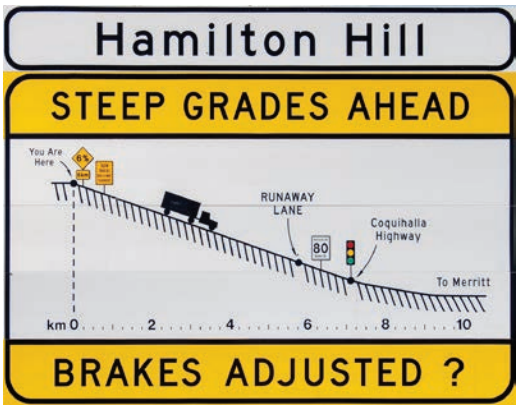
These highway signs direct you to pull into a weigh scale.

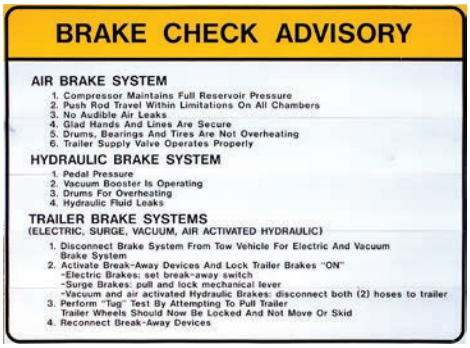


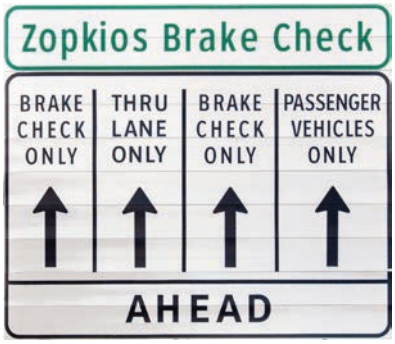
The sign on the left will flash when chains are mandatory.

These signs will be in advance of hills or grades.









Many municipalities post signs restricting drivers from using engine retarders/ engine brakes. Obey these signs.



School, playground and crosswalk signs

These signs illustrate the rules to follow in areas where you need to be extra cautious to ensure pedestrian safety.



Pedestrian activated crosswalk — prepare to stop if the light is flashing



Pedestrian crosswalk — yield to people crossing



School crosswalk — yield to pedestrians — if there is a crossing guard, follow directions



Playground nearby — be prepared to slow down



Playground zone — 30 km/h limit is in effect every day from dawn to dusk



School zone — reduce speed when children are present



School zone — 50 km/h limit is in effect from 8 a.m. to 5 p.m. on school days when children are on the roadway or shoulder



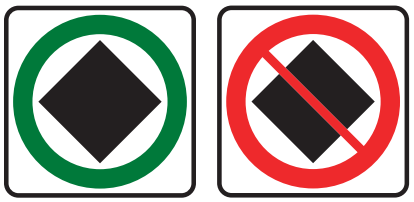
School zone — if the tab underneath only indicates the speed limit, that limit is in effect from 8 a.m. to 5 p.m. on school days



School zone — the tab underneath indicates the speed limit and the hours that it is in effect (in this case, the 30 km/h limit is in effect from 8 a.m. to 5 p.m. on school days)

Designated road signs

The sign on the left designates roads where vehicles transporting dangerous goods may travel. The one on the right designates roads where these vehicles are not allowed.



The signs below indicate truck routes:



Trucks permitted



Trucks not permitted



No trucks in this lane

Lane use signs

Signs showing which lanes may be used to turn or go straight are mounted above the lane or at the side of the lane before the intersection. If you're in a designated lane, you must follow the direction indicated by the arrows. You may not move into or out of a designated lane while you're in an intersection.



Turn left only



Continue straight only



Go through or turn left



Go through or turn right



Vehicles from both directions must turn left, no through traffic allowed



Vehicles in both these lanes must turn left

Turn control signs

Turn control signs are mounted directly above the intersection. Always follow the direction of the arrow.



Left turn only



Go straight only — no turns



Turn right or left only



No right turns during posted times

Parking signs

Parking signs let you know where and when you're allowed to park. You may receive fines or have your vehicle towed (or both) if you park illegally.



Time-limited parking during posted times



Do not park here



Parking is not allowed during posted times



Parking only for vehicles displaying the disabled parking sign and carrying a person with disabilities

Reserved lane signs

A white diamond painted on the road surface marks reserved lanes. Reserved lane signs are also placed over or beside lanes that are reserved for certain vehicles, such as buses or high-occupancy vehicles (HOVs). Other HOV signs may give additional information on who may use the HOV lane.



Only buses in this lane



Only buses and HOVs in this lane — may show how many people must be in the HOV



Curb lane of cross street ahead is a reserved lane

Warning signs

Most warning signs are yellow and either diamond-shaped, square or rectangle. They warn of possible hazards ahead.



Winding road ahead



Hidden side road ahead



Sharp curve ahead — slow to suggested speed



Curve ahead — slow down



Merging traffic ahead



Road merges with another road — added lane to the right ahead



Right lane ends ahead



Divided highway ends ahead — keep right



Two-way traffic ahead



Road narrows ahead



Narrow structure ahead — often a bridge



Bump or rough road ahead



Road may be slippery ahead



Steep hill ahead — slow down



Stop sign ahead



Roundabout ahead



Signal lights ahead



Signal lights ahead — prepare to stop when lights are flashing



Curve ahead — trucks and buses slow to suggested speed to avoid tipping over



Use your 4-way flashers to warn other drivers if you can't keep up with traffic. In some areas, these road signs are posted as a reminder.





These signs indicate the height of an overhead structure, such as a bridge or overpass. The diamond-shaped sign warns of low clearance ahead and the rectangle sign may be mounted on the structure. Make sure your commercial vehicle has clearance or else choose a different route.

The following two signs alert you to runaway lanes.



This sign is posted in advance of a runaway lane.



This sign is found at the entrance to a runaway lane.



Pedestrian crosswalk ahead



School crosswalk ahead — this sign is fluorescent yellow-green



School bus stop ahead



Cyclists may be on roadway



Fire truck entrance ahead



Truck crossing ahead



Recommended exit speed — drive slower in poor conditions



Pavement ends ahead



Hazard or danger ahead — turn right or left



Watch for deer ahead



Opening bridge ahead



Watch for rocks on the road ahead



Tunnel ahead



Remove sunglasses



Snow shed ahead



Use headlights ahead

Object markers

Pay special attention to object markers, which are mounted on obstructions.



Obstruction — keep right or left



Obstruction — keep right



Obstruction — keep left

Construction signs

These signs warn of construction and maintenance work. Pay attention to the warnings and obey the instructions on these signs. Obey traffic-control persons who may also be present, travel within the posted speed, stay well back from all equipment and pass only when it's safe. Traffic offences issued in construction zones may be double the usual cost.



Detour ahead



Soft shoulder ahead — stay off



Construction ahead



Traffic-control person ahead



Crew working — obey posted speed limit



Survey crew — obey posted speed limit



End of construction zone speed limit



Fine notice for speeding in a work zone



Blasting ahead — follow instructions on sign



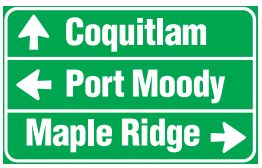
Follow the lighted arrow

Information and destination signs

The following signs provide information about destinations, route numbers and facilities.



Destination sign — distances are in kilometres



Directional sign



Trans-Canada Highway route marker



Primary highway marker sign



Hospital nearby



Gas available ahead



Accommodation ahead



Travel information ahead

Railway signs

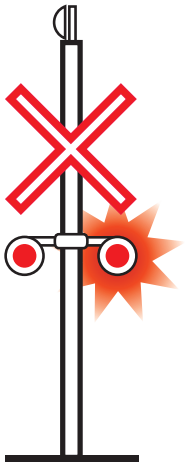
Public railway and highway crossings are indicated with signs or pavement markings and may also have mechanical or electrical warning devices for your protection. Watch for them and remember to always yield to trains.



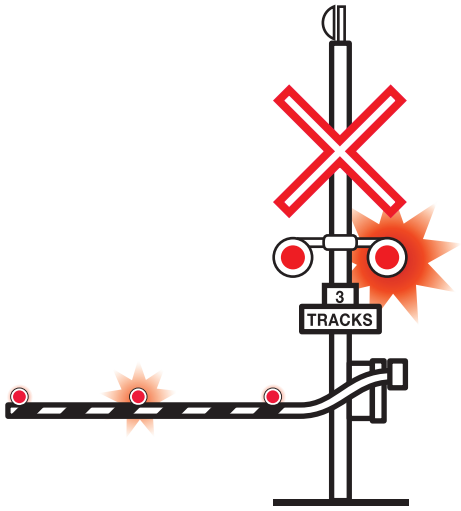
Railway crossing ahead — be prepared to stop



Railway crossing on side road ahead — be prepared to stop



Railway crossing — stop, then proceed when it is safe



Railway crossing — stay stopped until the gate is fully raised

Signals

Lighted signals are a way of controlling traffic flow.

Lane control signals

Lane control signals are placed over lanes to indicate which ones are open for driving.



Do not drive in this lane



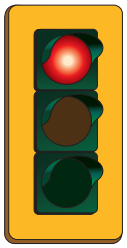
Move out of this lane and into a lane with a green arrow. If the lane control signals over all of the lanes are flashing yellow, slow down and proceed with caution



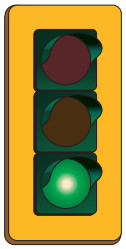
Drive in this lane

Traffic lights

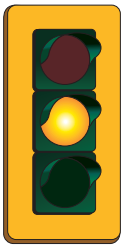
Traffic lights are used to help organize the flow of traffic at intersections or where roadways merge. The colour of the light determines which stream of traffic has the right of way. Generally, a red light means "stop," a yellow light means "caution" and a green light means "go." These signals can have slightly different meanings if they're flashing or if they're shaped as arrows rather than circles. In some places, green arrows may flash, but in others they might not.



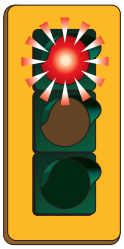
Steady red — stop — after coming to a full stop, you may turn right or turn left onto a one-way street unless a sign forbids it



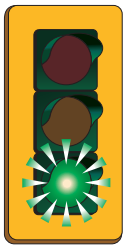
Steady green — continue if the intersection is clear



Steady yellow — slow down and stop before the intersection unless you can't safely stop in time



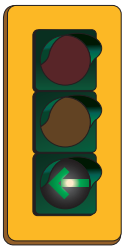
Flashing red — stop, then continue only when it is safe



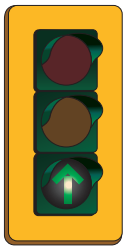
Flashing green — pedestrian-controlled light — go only if the intersection is clear



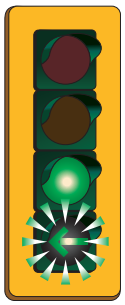
Flashing yellow — slow down and proceed with caution



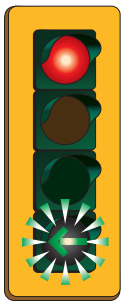
Green arrow — turn in the direction of the arrow



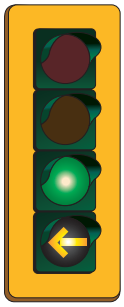
Green arrow — no turn permitted; go straight through only



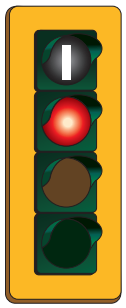
Flashing green arrow with a steady green light — may turn in the direction of the arrow or proceed



Flashing green arrow with a steady red light — left turn allowed; through traffic must stop for red light



Yellow arrow — advance left turn signal is about to change, slow down and stop before the intersection unless you can't safely stop in time



Transit priority signal — steady white rectangular light — only buses may go on this signal

Solid red light

When you face a traffic control signal displaying a solid red light, you must come to a complete stop before the stop line or crosswalk that's directly in front of your vehicle. If there's no stop line or crosswalk, stop before the intersection. In all cases, you must remain stopped at the red light until it turns green, unless safely turning right after stopping.

Unless a sign prohibits the turn, you may turn right at a red light after stopping completely before the stop line or crosswalk, if the turn can be made safely after yielding to other vehicles, cyclists and pedestrians.

Unless a sign prohibits the turn, the only left turn permitted at a red light is onto a one-way street. This turn is only permitted after your vehicle is brought to a complete stop before the stop line or crosswalk and if the turn can be made safely after yielding to other vehicles, cyclists and pedestrians.

Solid yellow light

When a green light changes to yellow, it indicates that the light will immediately change to red and drivers must prepare to stop or clear the intersection. When you're

approaching an intersection with a solid (not flashing) yellow traffic control light, you must come to a complete stop before the stop line or crosswalk, unless a point has been reached at the intersection where stopping can't be done safely. If there's no stop line or crosswalk, stop before the intersection. If you're already in the intersection and facing a yellow light, you must safely clear the intersection.

Solid green light

When you're facing a solid green traffic control light, you're permitted to travel through the intersection without stopping, unless required to yield to vehicles lawfully in the intersection when it turns green, to oncoming traffic when turning left, or to pedestrians in the crosswalk when turning right or left.

When you're approaching a green light, be aware that it may turn yellow. A good tip is to check the pedestrian walk light at the intersection. If it shows the WALK symbol, the light will stay green as you travel through the intersection. If it shows the DON'T WALK symbol, prepare to stop. If the traffic light does change, stop before the intersection if it can be done safely.

Road markings

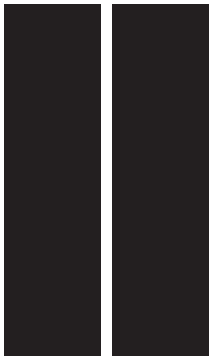
Road markings give you warnings or direction. They're painted on the roadway, curbs or other surfaces. It's illegal to drive over freshly painted, wet pavement markings.

Yellow lines

Yellow lines divide traffic moving in opposite directions. If there's a yellow line to your left, there will be traffic coming toward you on the other side of that yellow line.

White lines

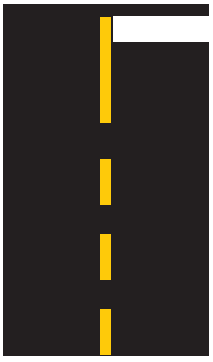
White lines are used to separate lanes of traffic moving in the same direction. They also mark crosswalks, stopping positions and the right shoulders of highways.



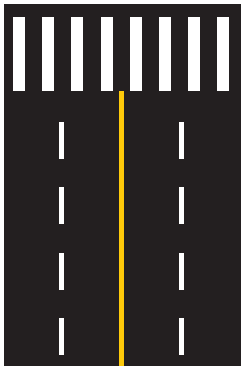
Solid line — do not change lanes



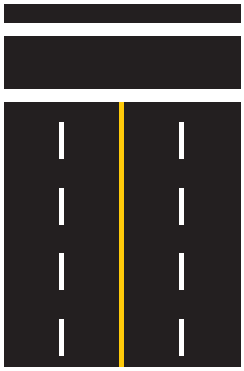
Broken line — lane changing is allowed when safe



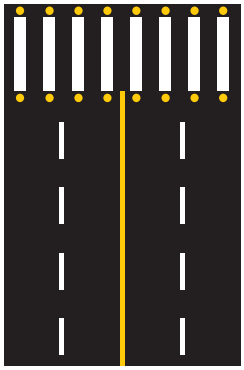
Stop line — stop before this line



Pedestrian crosswalk — stop for pedestrians in the crosswalk



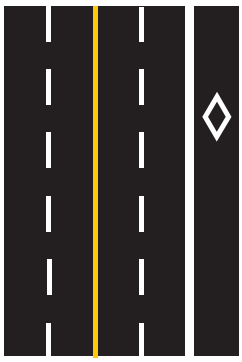
Pedestrian crosswalk — stop for pedestrians in the crosswalk



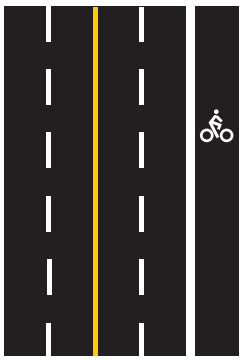
Pedestrian-activated crosswalk with illuminating lights in pavement — stop for pedestrians in the crosswalk

Reserved lane markings

These markings indicate lanes for HOVs, buses and bicycles. HOV lanes are marked with thick solid or broken lines and white diamond symbols.

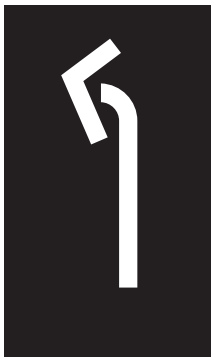


Reserved lane — additional signs or markings state which vehicles are allowed



Bicycle lane — for cyclists only — cyclists must travel in the same direction as the traffic beside them — the lane is marked with an outline of a bicycle and sometimes with a diamond

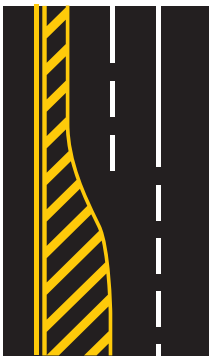
Other markings



Vehicles in this lane must turn left



Vehicles in this lane must go straight or turn left



Painted island — keep to the right and do not drive on or over

8 Defensive and cooperative driving

The purpose of this unit is to help new professional drivers learn about proactive and defensive driving and to help them learn to drive safely regardless of the driving conditions or the actions of others.

What you'll learn

This unit will help you learn to:

- Use defensive driving techniques
- Identify hazards and conflicts
- Communicate effectively with other road users
- Understand how driving conditions affect safety
- Appreciate how the size and weight of a tractor-trailer affects other road users
- Recognize common situations that lead to crashes
- Explain strategies to avoid crashes
- Understand that personal attitudes and defensive driving habits are key to preventing crashes
- Understand the challenges of driving in adverse conditions

Defensive and cooperative driving

There can be many contributing factors to crashes and incidents, but the biggest and most important one — and the one you have control over — is you. It's your skills, knowledge, habits, attitudes and physical and mental condition that often determine whether you're involved in a crash or if you've avoided one.

Defensive driving means driving safely despite the conditions around you and the actions of others. This means using strategies that minimize risk, like anticipating potential conflicts and taking action early to eliminate the hazard. Cooperative driving involves analyzing how you're affecting others rather than just how others are affecting you and driving in a way that assists the safe flow of traffic and use of the roadway.

Driving conditions

Driving conditions are categorized into six areas:

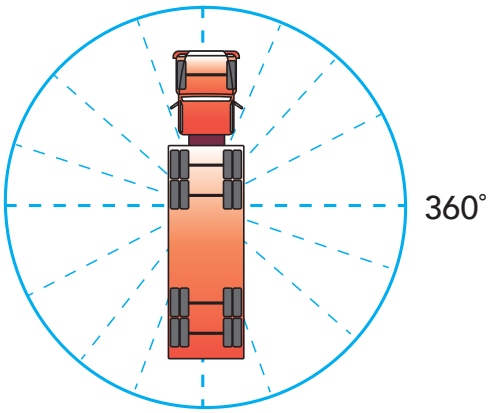
1. Driver — condition, ability, attitude
2. Road — conditions and type
3. Weather conditions
4. Traffic — volume, type of traffic and other drivers' behaviours
5. Light — daylight, darkness, glare
6. Vehicle — condition and capability

Pay attention to how these six conditions are impacting your current driving situation and adjust accordingly. Normally, your number one adjustment will be to slow down and increase your following distance, but in extreme cases it may mean parking your vehicle and waiting for conditions to improve.

A professional driver is patient and accommodates for the mistakes of others. Always take steps to avoid situations that might cause anger, hostility or danger. There isn't a load that's worth your life and everyone needs to get home at the end of the day.

Zone of awareness

Many drivers are content to limit their awareness to the things they can observe through the windshield, with an occasional glance in their mirrors. A proactive driver, however, realizes a hazard can come from any angle and that their zone of awareness must include a full 360-degree area around the vehicle as well as above and below.



While most hazards will appear from the front, rear or side of the vehicle, many drivers have lost control by not being aware of the road conditions under their truck. Similarly, drivers have lost the tops of their trucks or trailers in underpasses by not paying attention to hazards above the vehicle. Overhanging eaves, wires or tree limbs may also be a crash point if the driver is unaware.

The earlier a potential hazard is detected, the more time you have to avoid any problem that develops. Your zone of awareness should be as wide as possible for the circumstances. It contains clues to detect potential hazards and we can do this by engaging our senses: seeing, hearing, feeling and smelling.

See-think-do: a hazard detection system

Use your eyes to see and your mind to analyze what you see for potential dangers. A system that works well is **see-think-do**.

See:

- Scan and identify any real or potential hazards or conflicts

Think:

- Predict likely outcomes
- Decide which course of action will lead to the desired outcome

Do:

- Execute your decision and put your plan into action
- Scan mirrors, the road ahead and behind, paying attention to blind spots
- There is a "danger zone" approximately three metres (10 feet) around the tractor-trailer where pedestrians or other vehicles may be present and you don't notice

Developing good visual habits

Continuously scanning your surroundings on and off the road leads to good visual habits. As well as looking ahead, you should be scanning to the sides and behind your vehicle. Watch road signs and check your vehicle's instruments. Your eyes should be continually moving from far to near, as well as left to right.

To do this well, you must avoid distractions while driving, such as using the phone and radio, or eating. Being visually distracted by events like traffic incidents and cargo securement issues can not only cause you to miss key visual information but is also dangerous.

There are two interesting facts related to vision that you should be aware of:

- Speed — As your speed increases, there's a corresponding reduction in your peripheral vision. At highway speeds, this range of vision is reduced so the effect becomes somewhat like driving through a tunnel where you still see straight ahead but your peripheral vision is limited.
- Steering — We tend to steer toward whatever we look at. Not looking far enough ahead or looking off to the side of the road can cause us to wander or go wide in a curve. For this reason, keep your eyes moving and focused on where you want to go.

Here's how to use your eyes:

Eyes up — Look up as far as you can see. The further you can see, the more time you'll have to react to real or potential hazards. This would be about 20 seconds ahead at highway speeds and about 12 seconds ahead at lower speeds in town.

Sweep — Move your eyes left and right to identify hazards on and off the road. This can be especially important at marked/unmarked intersections, crosswalks, or areas with wildlife activity.

Fill in the gaps

- Drop your eyes from the "eyes up" position to about 12 seconds ahead of you at higher speeds and about six seconds ahead at urban speeds. Note that at different speeds, this will affect the amount of distance, but the seconds for you to reach where you're looking will remain the same. This is your *reference-down* point. You're looking for road signs, as well as potential, developing and immediate hazards or situations.
- Then, fill in the space between your *reference-down* point (six or 12 seconds ahead) to the front of your vehicle. Here's where you look for road signs, road surface, debris, potholes and anything that may cause you to adjust your position on the road.

Mirrors — By checking your flat and convex mirrors every five to eight seconds, you're making sure you're aware of your surroundings and escape routes. Use your mirrors to check:

- Space immediately behind and beside the vehicle
- Vehicles approaching from behind
- Cargo securement and covering
- Condition of your vehicle (engine exhaust, tires and other components)

It's especially important to check mirrors on both sides before turning, changing lanes or changing directions. Getting used to using your convex mirror is a challenge for many drivers, but it's a critical skill to master as these mirrors help to fill in the blind spots that you used to cover off with a shoulder check when driving a car. Make certain no vehicle has come between the trailer and the curb. While turning, check the mirrors continuously to look for vehicles sneaking up beside you.

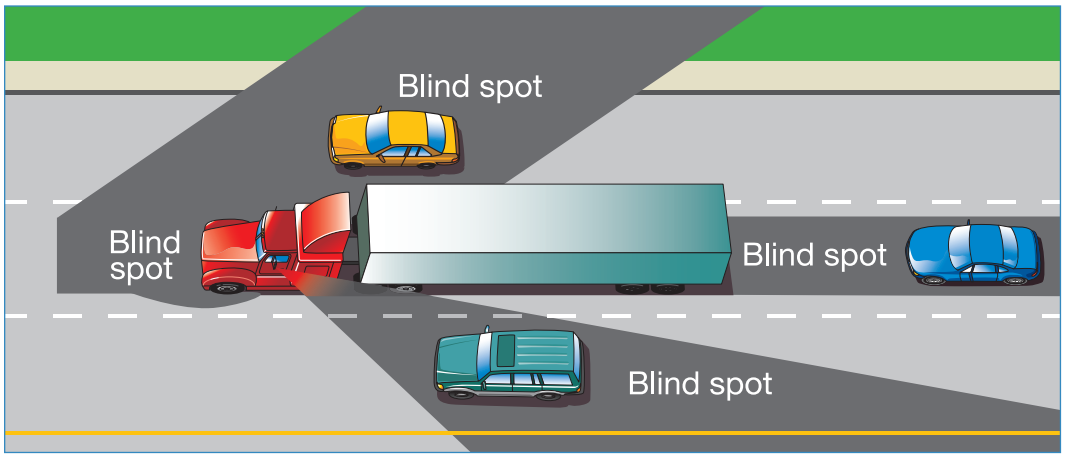
Good visual habits:

- At night when meeting oncoming vehicles with bright headlights or headlights on "high beam", shift your gaze well ahead and to the right edge of the road
- Keep your vehicle windows clean inside and out to reduce glare
- Maintain an unobstructed view

- Vegetation, buildings, trees, parked vehicles or any roadside obstruction that obscures vision should be treated as a hazard potentially requiring you to stop, if necessary, giving you time to study the situation before proceeding
- Be aware that other vehicles in the adjacent lane may obscure your vision
- Pay attention to traffic ahead possibly stopping for any number of reasons, including a left turn or a pedestrian
- Don't focus too much attention on gauges that can wait until you're stopped or on a straight stretch of road. If you need to make a few short glances at the same gauge, ensure you're not taking your focus and attention off the road for too long

Blind spots

A "blind spot" is an area alongside your vehicle that you can't see when using any of your mirrors. It's important to check blind spots to ensure you keep track of all the potential hazards around your vehicle, particularly if you're going to change lanes. Blind spots can be problematic for a regular sized vehicle, but the bigger the vehicle, the bigger the blind spot!



It should make you uncomfortable if you're driving in other drivers' blind spots. Virtually all vehicles have blind spots — even motorcycles. Yet, some drivers habitually change lanes without checking for other vehicles. It's a good idea to adjust your position relative to other traffic, so you stay out of another driver's blind spot whenever you can.

Eye health

Good vision and good visual habits are essential to safe and defensive driving. Vision can change so gradually that it's easy to be unaware of a vision problem until it's too late. Be sure to have regular eye examinations. If you wear corrective lenses, it's a good idea to take a spare pair with you when on the road.

Engaging your other senses

Hearing

Horns, train whistles, children playing and the sound of other vehicles are all examples of messages we receive through hearing and are indicators of potential hazards. Listening to the sound of your own vehicle can help you identify maintenance problems so you can get them fixed before they cause a breakdown. In the winter, driving with your window open slightly allows you to hear the sound of your tires on the road. A wet road is noisy, but an icy road is very quiet.

To gain the greatest advantage of your hearing, avoid playing the stereo or radio excessively loud and keep other in-vehicle noises at a low level.

Feeling

As we drive, our bodies are in contact with various parts of the vehicle: our hands on the steering wheel, our body in the seat and our feet on the pedals. As we learn what the vehicle feels like under normal conditions, it becomes easier to identify changes in the driving conditions as well as the overall condition of our truck. Pay attention to what may be causing the change in the ride or behaviour of the truck.

Smelling

Smell may offer an early indication of a possible problem with your vehicle, such as the smell of hot oil, rubber or antifreeze. Early detection of a problem allows you more time to find a safe location to park and have the problem dealt with.

Communicating

Good communication will help other road users be aware of your presence and understand your intentions.

A few tips to help you do it well:

Eye contact — When you're making a tight turn or moving slowly into an intersection, check the road users around you and make sure they've seen your signal and are aware of your intentions. Eye contact is a good way to confirm others have seen you. You can acknowledge them with a wave of the hand or a nod.

When passing — Whenever you're about to pass a vehicle, pedestrian or cyclist, assume they don't see you. They could suddenly move in front of you.

Lane changes and turning — Put your turn signal on early especially if there are vehicles in the lane you need to move into. Signalling early allows other drivers time to adjust their speed and open up a spot for your vehicle to fit into. This technique is especially important before changing lanes. Change lanes slowly and smoothly. This gives a driver you didn't see a chance to honk their horn or avoid your vehicle.

Slowing Down — Warn drivers behind you when you need to slow down. Flashing the brake lights should warn following drivers. Use the four-way flashers for times when you're driving very slowly or stopped. Warn other drivers in any of the following situations:

- Trouble ahead — the size of your vehicle may make it hard for drivers following to see hazards ahead. If you see a hazard that will require slowing down, warn the drivers behind you by flashing your brake lights or using the four-ways.
- Turning — brake early and slow down gradually for tight turns.
- Stopping on the road — truck and bus drivers sometimes stop in the road to unload cargo or passengers or to stop at a railroad crossing. Warn following drivers by flashing your brake lights. Don't stop suddenly.
- Driving slowly — drivers often don't realize how fast they're catching up to a slow-moving vehicle until they're very close. If you must drive slowly, alert following drivers by turning on your flashers.

When it's hard to see — If you're having trouble seeing other vehicles, other drivers will have trouble seeing you. Turn on your headlights and clearance lights at these times.

When backing — Use your four-way flashers any time you're backing up. If your vehicle doesn't have a back-up alarm, sound the horn twice and again every vehicle length. Before backing we want to use GOAL: Get Out And Look, walk around your vehicle prior to backing up to ensure the way is clear.

When parked at the side of the road — When you pull off the road and stop, turn on the four-way emergency flashers. This is especially important at night. If you stop on a road or on the shoulder of any road, you must put out your warning devices 30 m in front and back.

Don't direct traffic — Some drivers try to help out others by signalling when it's safe to pass. You shouldn't do this because it could cause a crash.

Driving conflicts and conditions

One of the most important aspects of proactive and defensive driving is recognizing potential hazards before they become a real hazard. Early recognition and being aware of what you see allows you the time you need to avoid trouble. Hazards appear under a variety of driving conditions. Your ability to adjust to these conditions will increase your chances of avoiding a crash.

Sharing the road

Pedestrians



Always yield to pedestrians and allow them to finish crossing the street before you start moving forward. Don't crowd them in the crosswalk. Be especially alert to pedestrians stepping from between parked cars, persons getting out of parked cars and children who might dart into the street. Cover the brake and be prepared to stop in all of the above situations. Prior to turning, observe whether there are any pedestrians present on the curb or on the roadway that you may need to consider. Halfway through any turn at an intersection, continually check blind spots, off-track and tail swing areas for pedestrians.

- When pedestrians indicate their intention to cross the street, you must stop your vehicle before the crosswalk and allow them to cross.
- When a pedestrian has entered a marked or unmarked crosswalk, you must yield the right-of-way.
- When stopping for a pedestrian at a crosswalk, stop far enough back (about two to three car lengths) so that traffic in another lane will be able to see the pedestrian and have time to stop.
- Never pass another vehicle when you're approaching a crosswalk. There's always a chance that the other vehicle is slowing or stopping for a pedestrian.
- Not all crosswalks are marked, but the rules of pedestrian safety should be followed at all intersections.
- Be considerate of visually-impaired pedestrians. Some may have a white cane or guide dog.
- At night, don't overdrive your headlights. You should be able to stop your vehicle within the distance you can clearly see.
- When it's dark, be alert for pedestrians. If they're wearing dark clothing, they can be difficult to see from a distance.

- Distracted people are hazards. Watch for where they're looking. If they're looking elsewhere, they can't see you, but be alert even when they're looking at you. Remember, you must exercise care to avoid hitting a pedestrian.
- Pedestrians talking to one another or on their phone may not be paying close attention to the traffic.

Cyclists



Due to their size, bicycles can easily be hidden in your vehicle's blind spots and are even quite difficult to spot in a convex mirror. They're far too often only seen at the last moment. Extra caution needs to be taken around bicycles.

There are large blind spots both behind and to the side of large vehicles. The "right turn squeeze" could occur if a motorcycle or cyclist is positioned between a large vehicle that's turning right and the curb. In this position, the driver of the large vehicle may not see the cyclist.

Cyclists should ride as close as practical to the right curb. However, they may need to ride further out when avoiding drainage grates, potholes, debris or slippery surfaces.

- Be aware of the roadway conditions that may affect a cyclist.
- When passing a cyclist, change lanes like you would for other vehicles.
- When preparing to turn right, watch for cyclists who may ride alongside your vehicle. Remember to check your blind spots to the right.
- Before moving away from the curb, check for cyclists who may be riding past your vehicle.
- Don't follow too closely behind cyclists. They don't have brake lights to warn you when they're stopping.
- Be alert for children on bicycles. They may lack the necessary knowledge and skills for safe cycling around traffic and may not be aware of all the dangers. Children on oversized bicycles are at risk of losing control.

Motorcycles and smaller vehicles

- Smaller vehicles may become impatient when driving behind a truck. When being passed, slow down to allow the vehicle to move safely and quickly ahead of you.
- Use extra care with motorcycles. They can be more difficult to spot and in the event of a crash, riders are more likely to be injured because they're less protected.

- Sometimes a motorcycle's turn signals can be hard to see. Watch the rider for clues. If the rider does a shoulder check, they may be intending to change lanes or turn.
- When turning left, watch for oncoming motorcycles. They can be hard to see, especially in heavy traffic, at night or at dusk. It can be difficult to judge the speed of the motorcycle.
- Be aware that motorcycle riders will often move within their lane to avoid road hazards like potholes and to maintain a space cushion from other vehicles.
- The "right turn squeeze" could occur if a motorcycle or cyclist is positioned between a large vehicle that's turning right and the curb. In this position, the driver of the large vehicle may not see the cyclist or motorcyclist.

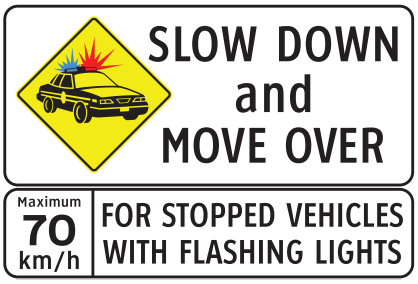
Work zones

According to Work Zone Safety Alliance BC, roadside work is a dangerous job. Between 2011 and 2020, there were a total of 12 roadside worker deaths and 207 injuries as a result of being hit by a motor vehicle.

Roadside worksites involve hundreds of activities. Some of the occupations at risk include construction workers, tow truck operators, road maintenance crews, telecommunications and utility workers, municipal workers and first responders who work alongside or on roads, in close proximity to traffic. Drivers should be prepared to move over and increase the space between their vehicle and the work zone, if it's safe to do so.



Flashing amber, red or blue lights — Drivers should be prepared to reduce speed when driving near an official vehicle with flashing amber, red or blue lights.



- If the posted speed limit is 80 km/h or more (50 miles per hour) drivers must slow to 70 km/h (43 mph).
- If the posted speed is less than 80 km/h (50 mph), drivers must slow to 40 km/h (25 mph).
- In both situations, drivers must move over and increase their space between their vehicle and the official vehicle with flashing lights, if it's safe to do so.

Roadside workers — Roadside workers are depending on drivers to keep control of their vehicle in a construction zone. Here's what they want you to do:

Slow down

- Plan your route and allow extra travel time.
- Expect the unexpected and don't tailgate.
- Stay within posted speed limits and pay attention.
- Allow extra space between your vehicle and the one in front of you.

Keep your eyes (and ears) on the road

- Never use a cell phone or text while driving.
- Follow sign and flag directions.
- Get to know the work zone signs.

Show respect for roadside workers

- Make eye contact.
- Keep your cool and be patient.
- Slow down even if you don't see anyone working. Hazards such as traffic shifts or lane reductions may appear suddenly.

Wildlife and livestock

Due to crashes caused by wildlife and livestock on roadways, several people are killed and hundreds of motorists are injured each year. According to provincial data, over 24,000 animals are killed each year as a result of being hit by a vehicle, resulting in significant cost to the province for highway clean-up.



Approximately, 80 percent of wildlife vehicle crashes involve deer. Moose, elk, bears, coyotes and other wildlife make up the remaining 20 percent. Crashes with smaller wildlife are extremely common, but usually go unreported. Because of their size, moose crashes are often the most serious.

Wild animals tend to be more active from dusk to dawn and they often move in groups. If you see one, there may be more. Be especially careful where creeks intersect roads, where forage is available at roadside, where there's a water source nearby and on long, wide straight stretches of road. During the winter, animals may wander onto the roads to lick salt off the ground. Open range cattle often forage near the roadside where grass grows and won't hesitate to suddenly walk across the road.





To reduce the chance of a crash with animals:

- Reduce your speed, look well ahead and use caution in areas with wildlife or open range cattle warning signs
- Watch the sides of the road and ditches for animals
- Watch for animal eyes reflecting from your headlights at night
- Honk or flash your headlights to help chase animals away or divert them from crossing the road
- Brake hard if you encounter an animal, but don't swerve to avoid it
- Leave a wide margin when you drive around an animal (frightened animals may run in any direction)
- Be especially cautious when passing a horse and its rider



For more information on wild animal crashes, visit wildlifecollisions.ca.

Driver condition and ability

Driving requires both mental and physical sharpness. You should always ensure you're fit for driving and not suffering from any impairments, including fatigue or distraction. Poorly trained drivers who may not be aware of the importance of good driver condition, pose a higher risk to themselves and others. Be mindful of your skill level and always seek to improve.

Your mental and physical condition can affect the quality of your work. In terms of driving errors, these can be divided into two broad categories: recognition errors and decision errors.

Recognition errors include:

- Distraction — psychological, environmental, situational
- General inattention
- Inattentional blindness
- Improper visual search patterns — fixation

Decision errors include:

- Speed choice
- Risk taking
- Disregarding traffic control devices and laws

Both of these error types can potentially arise from your diminished mental or physical condition. Recognition errors arise typically from some situation which you're not fully conscious of or may not take seriously. Decision errors arise when you, whether consciously or unconsciously, dismiss factors or cues you should be attentive to.

Some forms of errors, such as texting and driving, have elements of both categories. Texting and driving is a conscious decision which results in a distracted state that the driver doesn't acknowledge. It's also illegal in B.C. and many other parts of Canada and the U.S.

Recognition errors

There are many circumstances that can create the type of stress that diminishes a driver's capacity to operate a vehicle. These may be on-going personal concerns related to money or family issues or immediate issues related to the task at hand, such as time pressures or distractions from factors inside or outside the vehicle.

Any of these may create a state of mind that can take your attention from the primary task of driving. This can lead to a higher likelihood of infractions and crashes.

Decision errors

Decision errors may arise from inattention to cues and factors in the environment or from a conscious choice to disregard these things. Failing to stop at a stop sign or red light could result from being preoccupied and not noticing the control device — or noticing it and choosing to disobey it.

In unconscious decision errors, crucial information may be missed such as the presence of a small animal or child in the road or a vehicle in the vicinity not behaving as expected. Time concerns frequently create unconscious stresses in the mind of a driver which could lead to poor decision making, such as speeding or clearing intersections too late.

Rules of defensive driving are based upon the principle of making driving, which is inherently a dangerous activity, as safe as possible given the circumstances. Decision errors violate the rules of safe driving and, in both cases, increase the potential for crashes.

Keep your attention where it belongs — on the tasks and functions related to driving. If you decide to get take-out meals, it's unlikely you can safely drive a semi-truck and trailer and eat while keeping your attention on the road and both hands on the wheel where they belong.

Other drivers

In order to protect yourself and others, you must know when other drivers may do something hazardous. Watch driver body movements for clues. For example, drivers look in the direction they're going to turn. You may sometimes get a clue from a driver's head and body movements that they may be going to make a turn, even though the turn signals aren't on. Drivers making over-the-shoulder checks may be going to change lanes. These clues are most easily seen in motorcyclists and cyclists. Watch other road users and try to tell whether they might do something hazardous. Some clues to these types of hazards are discussed in this section.

Blocked vision. People who can't see others are a very dangerous hazard. Be alert for drivers whose vision is blocked. Vans, loaded SUVs and cars with the rear window blocked are examples. Rental trucks should be watched carefully. Their drivers are often not used to the limited vision they have to the sides and rear of the truck or the vehicle's size. In winter, vehicles with frosted, ice-covered or snow-covered windows are hazards. Vehicles may be partly hidden by blind intersections or alleys. If you only can see the rear or front end of a vehicle but not the driver, then they can't see you. Be alert because they may back out or enter into your lane. Always be prepared to stop.

Delivery trucks. Packages or vehicle doors often block the driver's vision. Drivers of step vans, postal vehicles, and local delivery vehicles often are in a hurry and may suddenly step out of their vehicle or drive their vehicle into the traffic lane.

Parked vehicles. Parked vehicles may be hazards, especially when people open doors to get out of them or if they suddenly start up and pull out. Driving beside parked vehicles is potentially hazardous because your vision is partially obstructed. Hazards often appear when there's little time or space for evasive action.

Key sources of hazards are:

1. The space between parked vehicles through which pedestrians and animals may suddenly appear and dart into the street
2. Parked vehicles, which may suddenly pull out into your path without warning
3. Occupants of parked vehicles who open their doors without looking first. Positioning your vehicle at least 1.5 metres (five feet) out from a parked vehicle will place it beyond the arc of a door should it suddenly be opened. Watch for movement inside the vehicle or movement of it that indicates people are inside.
4. A stopped bus and passengers that may cross in front of or behind it — they often can't see you

Usually there are clues a parked vehicle is planning to re-enter a traffic lane:

- Exhaust fumes will indicate the engine is running and that vehicle is possibly ready to go.
- Back-up and brake lights may indicate that a parked vehicle is preparing to enter traffic.
- Front wheels pointing toward traffic may indicate the vehicle is ready to leave the space or manoeuvring in preparation to leave.
- A person behind the steering wheel may indicate a readiness to leave a parking space.

Other commercial vehicles in trouble

When in rural areas, especially if you see another commercial vehicle pulled over and clearly having trouble, consider pulling over to assist if it is safe to do so and you feel personally safe and comfortable to extend help.

Tailgaters. Tailgating is following another vehicle too close to be able to stop in time if they suddenly stop. Drivers of large vehicles must rely on outside mirrors for rear vision, and so cannot see tailgaters who sit in the vehicle's blind spots. It's not always possible to prevent a rear-end crash caused by tailgaters, but if stops are gradual the impact may be much less. If you notice someone tailgating you, remain calm and increase the space between you and the vehicle in front if required.

It's good practice to allow tailgaters to pass. Watch for these drivers by checking your rearview mirror frequently. The easiest thing to do if you have someone tailgating is to pull over and let them pass.

Disabled vehicles. Drivers changing a tire or fixing an engine likely aren't paying attention to the dangers of the roadway and may be careless. Jacked-up wheels or raised hoods are clues that the vehicle may be disabled.

Crashes and incidents. Crashes are particularly hazardous. People involved in the crash may not look for traffic and may dart across the road without looking. Passing drivers tend to slow down or stop suddenly to look at the incident, causing a chain reaction crash.

Confused drivers and tourists. Confused drivers often change direction suddenly or stop without warning. Confusion is common near highway interchanges and major intersections. Tourists unfamiliar with the area can be very hazardous, so watch for rooftop luggage and/or out-of-province licence plates. Unexpected actions (stopping in the middle of a block, changing lanes for no apparent reason, backup lights suddenly going on) are clues of confusion. Hesitation is another clue, including driving very slowly, using brakes often or stopping in the middle of an intersection. You may also see drivers, including taxis, who are looking at street signs, maps, GPS and house numbers.

Slow moving vehicles. Seeing slow moving vehicles early can prevent a crash. Some vehicles are slow by design, such as: mopeds, farm machinery, construction machinery and tractors. Some of these will have the "slow moving vehicle" symbol to warn you. This is a red triangle with an orange centre.



Drivers signalling a turn. Drivers signalling a turn may slow more than expected or stop. If they're making a tight turn into an alley or driveway, they may go very slowly. If pedestrians or other vehicles block them, they may have to stop on the roadway. Vehicles turning left may have to stop for oncoming vehicles.

Drivers in a hurry. Drivers may feel your commercial vehicle is preventing them from getting where they want to go on time. Such drivers may pass you without a safe gap in the oncoming traffic, cutting too close in front of you. Drivers entering the road may pull in front of you in order to avoid being stuck behind you and causing you to brake. Be aware of this and watch for drivers who are in a hurry — let them go ahead.

Impaired or distracted drivers. Drivers who are sleepy, on drugs, sick, using their cellphone or have had too much to drink are all hazards. Some clues of impaired or distracted drivers include:

- Weaving across the road or drifting from one side to another
- Leaving the road (dropping right wheels onto the shoulder or bumping across a curb in a turn)
- Stopping at the wrong time (stopping at a green light or waiting for too long after a stop)
- Open window in cold weather
- Speeding up or slowing down suddenly or driving too fast or too slow

Visibility issues

Driving at night

In British Columbia, you're legally required to turn your headlights on 30 minutes after sunset and remain on until 30 minutes before sunrise or whenever visibility is poor. When you're driving at night or at any time when you can't see clearly 150 m (500 ft), you must turn your headlights on. Daytime running lights are not bright enough to be used at night. They're too dim and the taillights and instrument panel lights won't be on.

- Use your low-beam headlights if there's oncoming traffic.
- Be sure that your headlights are properly aimed, so they don't bother or interfere with other drivers.
- Keep your headlights clean.
- Don't overdrive your headlights at night (unable to stop or respond to a hazard illuminated by your headlights). The average low beam headlights are only capable of illuminating the highway ahead at a distance of approximately 100 m (328 ft).

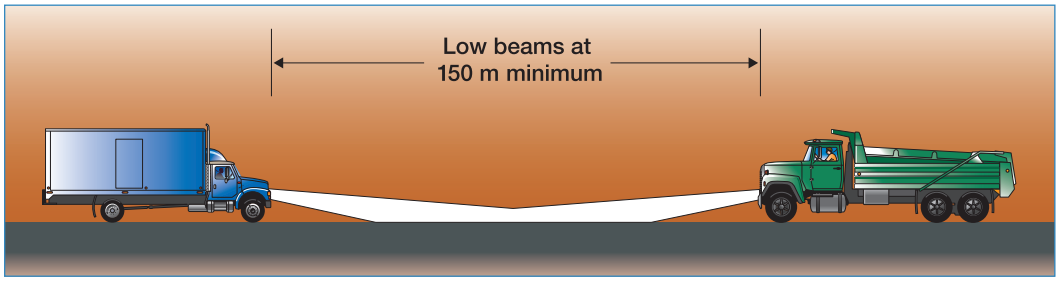
Glare

Glare from the sun, reflections and the lights of other vehicles can affect your vision in the day or at night. If glare makes it difficult to see the road, reduce your speed. Ensure your vehicle's windows are properly cleaned inside and outside to improve visibility. Sunglasses and a clean windshield are essential for a professional driver when dealing with sun glare or glare from the snow on a bright winter day. Avoid looking directly at oncoming headlights, so they don't impair your vision. Look slightly down and to the right edge of your driving lane until the vehicle passes you.



Headlight glare from oncoming and following vehicles can be a problem for every driver on the highway, so be sure to dim your headlights when encountering an oncoming vehicle. If your headlights make it hard for an oncoming driver to see, then you and your rig are also in danger. The human eye takes about seven seconds to recover from headlight glare. That means at 80 km/h (50 mph) a vehicle would travel 156 m (512 ft) in those seven seconds.

To help you see at night, keep your cab as dark as possible. Adjust your instrument panel lights to a low level.



These two vehicles are approaching each other at night in opposite directions with their lights on low beam.

Smoke and fog



Fog can occur at any time and can be extremely dangerous. It's often unexpected and visibility can deteriorate rapidly. You should watch for foggy conditions and be ready to reduce your speed. Don't assume that the fog will thin out after you enter it.

If visibility becomes so poor that it's no longer safe to continue driving, slow down and move your vehicle well off the side of the road to a safe location. Turn on your hazard lights and don't attempt to drive until conditions improve.

If you must drive, consider the following:

- Obey all fog-related warning signs.
- Slow down before you enter fog.
- Use low beam headlights and fog lights for best visibility even in daytime, as high beams will reflect the light back to you, creating glare. Be alert for other drivers who may have forgotten to turn on their lights.
- Turn on your four-way flashers. This will give vehicles approaching you from behind a quicker opportunity to notice your vehicle.
- Watch for vehicles on the side of the roadway. Seeing tail lights or headlights in front of you may not be a true indication of where the road is ahead of you. The vehicle may not be on the road at all.
- Use roadside highway reflectors and the white fog line as guides to determine how the road may curve ahead of you.
- Listen for traffic you can't see.
- Avoid passing other vehicles.
- Don't stop along the edge of the road, unless absolutely necessary.

Driving on slippery surfaces

Drive slowly and smoothly on slippery roads. If it's very slippery, you shouldn't drive at all. Start off driving gently and slowly, get the feel of the road and don't hurry. Check for ice on the road, especially on bridges and overpasses. A lack of spray from other vehicles could indicate that ice has formed on the road. Also, check your mirrors and wiper blades for ice. If they have ice, the road most likely will, too.

Steering control is lost when front tires skid on slippery surfaces. Make turns as gently as possible. Don't brake any harder than necessary and don't use the engine brake or retarder as they can cause the driving wheels to skid on slippery surfaces.

Adjust speed to conditions. Don't pass slower vehicles unless necessary. Go slowly and watch far enough ahead to keep a steady speed and avoid having to slow down or speed up. Take curves at slower speeds and don't brake while in curves. Be aware that as the temperature rises to the point where ice begins to melt, you should slow down even more as the road may become more slippery.

Adjust space to conditions. Don't drive alongside other vehicles and keep a longer following distance. When you see a traffic jam ahead, slow down or stop to wait for it to clear. Try hard to anticipate stops early and slow down gradually. Watch for snowplows, salt and sand trucks and give them plenty of room.

Water on the road

A wet road is a slippery road. It can take twice as long for a vehicle to stop on wet pavement as it does to stop on dry pavement. When the pavement is wet, slow down and increase your following distance. Be especially observant of painted areas, railroad tracks, steel bridges, oil spills and muddy surfaces. A road may be especially slippery just after it has started to rain as oil residue will sit on the surface until it's washed off.

Visibility is a concern when driving in the rain. Make sure your windshield wipers, washer and defroster are functioning properly. Drive with low beams on — high beams will reflect the light back to you creating glare — and reduce your speed.

Hydroplaning — Hydroplaning occurs when a vehicle drives through large amounts of water on the roadway and a cushion of water builds up under the tires. The result is a loss of traction and control. Hydroplaning is rare for loaded vehicles travelling under 100 km/h (62 mph) because of the weight on the tires. When bobtailing or hauling an empty trailer, drivers should be aware that their vehicle has less traction than a loaded vehicle and is subject to hydroplaning at lower speeds. The trailer could be floating behind you especially in slushy conditions when it's empty. If this happens, don't brake. Release pressure on the accelerator to allow the vehicle to slow. Look and steer where you want the front of the vehicle to go.

Flooding — Pools of water may hide a deep pothole that could cause damage to the wheel components and vehicle suspension.



Driving through large amounts of water at high speeds will soak the wheel components and when water enters the brake drums, braking efficiency is reduced. If driving through deep water is unavoidable, slow down and lightly apply the brakes.

Test the brakes if you've been driving in extremely wet conditions or if you've driven through a large amount of water. Place slight pressure on the brake pedal (dragging) until the brake pads and drums have had a chance to dry.

Snow and ice

Like driving on wet pavement, traction and braking ability are greatly reduced on ice and snow. When driving on packed snow, reduce vehicle speed by half. Slow to a crawl if driving on an icy road.

Be aware that ice and snow are most treacherous around the freezing point, zero degrees Celsius. Traction varies tremendously with temperature changes. Icy roads will look just the same at -2 or -22 C, but will be far more slippery at the warmer temperature. Ice melts slowly and freezes more rapidly, so be especially aware of shaded spots. Bridges and overpasses are other places that ice may build up. Many drivers relate their experiences of black ice as spots of thin, transparent ice that appear black because the pavement can be seen through them.

To stop on icy roads, use extremely light pressure on the brakes. This will help prevent the wheels from locking up. A slowly revolving wheel on an icy surface will be more effective than a locked wheel skidding on an icy surface. Vehicles equipped with anti-lock brake systems (ABS) may not have wheel lockup, but the road surface has a limited amount of traction and even with ABS, a truck can skid and jackknife.

Requirement to clear snow and ice — Snow and ice on vehicles are dangerous as they can obstruct your view if they're on your windshield. If they're on your roof, they can slide off and completely cover your windshield. When loose snow blows off commercial trucks and trailers, there's often a temporary loss of visibility for other vehicles on the highway. When the accumulated snow melts and freezes, thick chunks of ice may form and if these pieces dislodge when the vehicle is in motion, they can create hazards for other road users.

Before coupling, remove all snow and ice. In below freezing temperatures, the jaws of the coupling device may not lock if the grease is frozen. Double check the locking mechanism and make sure the fifth wheel is lubricated with a winter-grade lubricant.

Snow and ice build-up also increase fuel consumption due to the additional weight and can also damage your trucks and trailers.

Remove snow from the tractor-trailer before beginning a trip and at regular intervals if the snow continues to fall. Regularly clear the lights of snow and ice. Keep everything clean, so you can be seen.

Crosswinds

A crosswind is a strong wind blowing in a direction not parallel to your direction of travel. Unexpected crosswinds can result in a loss of control. Expect these conditions in flat, open areas or in locations where trees have been cleared. Heavy tractor-trailer vehicles traveling at high speeds are more prone to rollover in strong crosswinds. Crosswinds can be especially dangerous when the road is slippery and when hauling an empty trailer.



Driving in extreme heat

Driving in extreme heat can cause additional stress on you and your vehicle. Carry extra water and make sure you stay well hydrated. When conducting pre-trip and en route inspections in hot weather, pay extra attention to the following vehicle components:

- Tire condition and pressure. Low tire pressure will cause tires to overheat faster, causing a blow out.
- Engine oil and coolant. Low engine oil or low coolant will not be able to keep the engine cool in extreme heat. Overheated engines can seize.
- Engine belts and hoses. Heat causes belts and hoses to deteriorate over time. Ensure yours aren't getting worn out when driving in extreme heat.

Roadway design and surface issues

Pavement drop off

Sometimes the pavement drops off sharply near the edge of the road. Driving too near the edge can tilt your vehicle toward the side of the road, which can cause the top of your vehicle to hit objects, such as signs or tree limbs. Also, it can be hard to steer as you cross the drop off, going off the road or coming back on.

Objects and debris



Things that have fallen on the road can be hazards. They can damage tires, wheel rims, electrical and brake lines. They can get caught between dual tires and cause severe damage. Some obstacles that appear to be harmless can be very dangerous. For example, cardboard boxes may be empty, but they may also contain some solid or heavy material capable of causing damage. The same is true of paper and cloth sacks. It's important to remain alert for objects of all sorts, so you can see them early enough to avoid them without making sudden, unsafe moves. Watch for fallen rocks in mountainous areas.

Road design



Off ramps — Highway exits can be particularly dangerous for commercial vehicles. Off ramps and on ramps often have speed limit signs posted. Remember, these speeds may be safe for automobiles, but may not be safe for larger vehicles or heavily loaded vehicles. Exits that go downhill and turn at the same time can be especially dangerous. The downgrade makes it difficult to reduce speed. Braking and turning at the same time can be a dangerous practice. Make sure you're going slowly enough before you get on the curved part of an off ramp or on ramp.

Road crown — At the centre of most roads is a crown. It's designed to be higher than the outside edges to allow water to run off the road surface rather than pool and remain near the centre. The crown on some roads is abnormally high, which can cause the front end of the tractor to dip when entering a left hand turn.



Curves — The curves of modern highways are usually sloped (banked) to compensate for the outward movement (inertia) of the vehicle in a turn. On improperly designed roads, the degree of bank may be inadequate or could slope in the wrong direction (off camber). This could allow the vehicle to skid out of the turn and off the road.

Narrow bridges and underpasses



When approaching a narrow bridge or narrow underpass, turn on your hazard lights, slow down and yield to oncoming traffic. Before entering an underpass, check all posted clearance signs and ensure there will be proper clearance for you to safely travel under. When it's safe to proceed, cross the bridge or go under the narrow underpass. Turn hazard lights off when the tractor-trailer unit is across the bridge or through the narrow underpass. It is very important to be aware of the height and width of the commercial vehicle you are driving to ensure you can safely clear the top of underpasses when traveling below them, and when traveling along narrow roadways and bridges.

Gravel roads and poor surfaces



On roads with surface issues such as frost heave, broken pavement or potholes, allow more time for your trip. Increase your following distance, reduce your speed and maintain your space cushion.

Driving on gravel roads requires different skills than driving on paved roads. A vehicle tends to wander on a gravel road. Grasp the wheel firmly and compensate as necessary. Take care not to turn the steering wheel too abruptly as control may be lost.

Reduce speed and increase following distance to 12 seconds in order to maintain visibility from dust clouds created by vehicles ahead and to avoid rock chips from striking and damaging the truck. Slowing down also prevents churning up large amounts of loose gravel, which could become a hazard for other drivers.

Traction is also reduced when driving on loose surfaces. To get a sense of how your vehicle will handle on a gravel road, accelerate slowly and gradually increase your speed. If the vehicle loses traction or starts to slip, slow down.

Gravel roads are usually narrow and intersections and curves aren't always marked. Portions of the road may have a washboard surface caused by heavy vehicles driving too fast and braking too late. Gravel may be loose and deep which can make it difficult to steer around curves. In wet conditions, the road may be slippery in areas where there's less gravel and more mud. The surface may be particularly soft and loose along the shoulder.

Getting stuck — When mixed with moisture, the dust and dirt on the surface of gravel roads can become very slippery. Heavy rainfalls may make the ground extremely muddy and cause the vehicle to become stuck. If safe, step out of the cab to check the ground where the road condition is unknown. If the vehicle is stuck and the drive wheels are deeply submerged in mud or the vehicle is leaning to one side, seek assistance to recover the vehicle. Further attempts to drive the vehicle may sink it further or cause damage.

Visibility on gravel roads — A vehicle travelling on a dry gravel road produces a considerable cloud of dust. Stay well behind dust clouds on gravel roads. You never know if you'll meet slow moving farm implements or road maintenance equipment in the middle. Adjust your road speed before meeting oncoming traffic and turn your headlights on.

It's more difficult to see railroad crossings, intersections and farm approaches when travelling on gravel roads. Sight distances are shorter, there are more curves, more hills, more intersections and no shoulders. The road you're travelling on may come to an abrupt end at a T-intersection.

Passing on gravel roads — Take extra care when passing on gravel roads. This manoeuvre should only be done when absolutely necessary. Several factors can increase risks of passing:

- Narrower road.
- Soft shoulders.
- Reduced visibility from dust and debris from vehicles ahead.

Vehicles passing in the other direction may kick up gravel and dust. When oncoming vehicles approach, slow down and move the truck as far to the right as it's safe to do so. Once the vehicle has passed, gradually re-centre the truck and regain the appropriate speed. Remember — never pass another vehicle near the crest of a hill or when your vision is obstructed.

Back on the pavement — When you transition back to paved roads after driving on gravel, pull over and clean off loose debris/rocks and retighten cinches and belts. Check for rocks between tires. These projectiles can cause a lot of damage to other vehicles when they become loose.

Traffic conditions



Traffic conditions refer to the other vehicles on the road, their general flow, distribution and speeds. You should be aware of the actions of other drivers and their vehicles and plan ahead to ensure that they aren't placing themselves at risk of a crash.

Traffic conditions are created by the number of vehicles and pedestrians using that same road or street and by how well the road has been engineered to accommodate the amount of traffic present at a given time. More vehicles mean more conflict in traffic and more chance of a crash. Traffic conditions are influenced by the time of day, day of the week, holiday periods and by the nature of the environment, such as a shopping centre, sports arena, factory or school.

Vehicle conditions

Vehicle conditions such as wear, tear and pre-existing damage, can lead to equipment failure and crashes. Ensure that major defects are addressed prior to operating the vehicle on a public roadway.

By completing the required vehicle pre-trip inspections and vehicle checks throughout your shift, you'll be able to better identify minor issues before they require major fixes.

Frequent driving on gravel roads can take a toll on a vehicle. Dust and other particles collect in the air filter and radiator, reducing airflow into the engine and causing it to overheat. Particles will also stick to vehicle components that require grease to function. Excessive build-up of particles can increase friction between two moving parts and cause them to overheat or wear down more easily. Ensure air filters are checked and changed frequently.

A vehicle that is not kept in good mechanical condition can pose an extreme road safety hazard to yourself and other road users, and may result in your commercial vehicle being taken out of service by provincial commercial vehicle safety enforcement officers. As the driver, you are responsible to make sure your vehicle meets basic pre-trip inspection requirements and if there is a problem, you need to report it to your employer for repair, or arrange for the repair by a qualified mechanic if you are an owner/operator.

Crash avoidance

There are only six positions that another vehicle can take in relation to yours prior to a crash. They are:

1. Vehicle ahead — travelling in the same direction
2. Vehicle behind — travelling in the same direction
3. Oncoming vehicle
4. Vehicle approaching an intersection or at an angle
5. Another vehicle passing you
6. You passing another vehicle

By studying these six positions, recognizing the situations and hazards and managing space and speed, you can avoid being in most two-vehicle crashes. The following section will study those types of crashes as well as crashes with an overhead obstruction, the mystery crash and run-off-the road crashes.

Crashes with the vehicle ahead

Why do crashes with the vehicle ahead occur? There could be a variety of reasons. However, they generally all boil down to following too close. When required to stop, you must always be able to stop before running into the vehicle ahead. When driving a larger, heavier vehicle, it will take longer for you to stop than for the driver in front of you.

In order to defend against this type of crash, stay alert and always keep a safe following distance. Following distance in a commercial vehicle should be a minimum of five seconds in ideal conditions. Larger, loaded combination units should leave at least one second of following distance for every 3 m (10 ft) of overall vehicle length.

There are times when your following distance should be increased, such as when you're following:

- Oversize vehicles that obscure your vision
- Dangerous goods carriers
- Vehicles that stop frequently, such as delivery vans and school buses
- Motorcycles
- Vehicles being driven erratically
- Emergency vehicles

Also, increase your following distance when travelling in poor road conditions and under conditions that reduce visibility such as fog, rain, snow and smoke. Also, leave more space in areas where traffic intersects, merges or converges.

Few drivers are fully aware of the total stopping distance or time needed to bring a vehicle to a stop. It can be frustrating to leave a safe space in front of you and have automobiles constantly taking up that space. This will happen regularly and you need to be patient and recognize that it's your duty to be careful with your large vehicle. You will need to re-adjust your speed and space margin if a vehicle moves into the buffer space you created for your commercial vehicle.

Crash with the vehicle behind

Tailgaters can create hazardous situations for you. Be aware of any vehicle following you too close and allow or encourage them to pass, if possible. If you're already driving at the maximum posted speed limit, slow down a little to see if the tailgater will pass. If the tailgater stays behind you, increase your following distance from the vehicle ahead to give yourself more time to react should you have to stop suddenly. Keep yourself as visible as possible by keeping your lights clean and using your four-way flashers when travelling a lot slower than others.

Crash with an oncoming vehicle

One of the first rules of the road we learn is that you're to drive on the right side of the road in North America. There are times, such as passing another vehicle, when it's permissible to venture to the left side, but in specific instances only. If everyone carefully followed this rule of staying to the right, head-on crashes might be less frequent.

Circumstances do arise in which you or an oncoming vehicle will cross the centre line and you may suddenly find yourself in the path of an oncoming vehicle. Some of these circumstances are driver caused, but some aren't. Being aware of the reasons why a driver would venture into the wrong lane makes it more likely that you'll be able to anticipate and avoid a potential head-on crash.

Other than when passing another vehicle, there are four reasons a driver could be on the wrong side of the road:

1. A problem in their lane. Trouble in a driver's own lane, such as a construction barrier, animal, pedestrian or bicycle may cause a driver to swerve left in order to avoid the problem.
2. Faulty driving manoeuvres. Through an error in judgment, a driver may enter your lane. For example, making a wide right turn (which may be necessary for larger vehicles) or misjudging the distance required to pass a vehicle. If you drive a vehicle with an extended wheelbase, you may need to take additional space to complete the turn on the street you're entering.

3. Inertia effect on curves. Inertia acts on your vehicle by trying to keep it going in a straight line when negotiating a curve. If the driver on the inside of the curve is going too fast, loses traction or otherwise misjudges the curve, inertia will push their vehicle across the centre line and a sideswipe or head-on crash could result.
4. Loss of control. Drivers can lose control of their vehicles for many reasons, including:
    - The right wheel drops off the pavement edge and the driver overcompensates in making the recovery
    - A loss of visibility or centre line is obscured or worn away
    - Falling asleep at the wheel, drug or alcohol impairment
    - Tire blowout, skidding on a slippery surface
    - Poor road conditions, potholes, snow or slush
    - Poor judgment

Here's what you can do to avoid a head-on crash:

- **Read the road ahead** — Be aware of oncoming traffic and try to anticipate what problems the oncoming driver may encounter causing their vehicle to cross the centre line and enter your lane.
- **Ride to the right** — Don't crowd the centre line. If there are two lanes available to you going in the same direction, use the right lane as a matter of preference.
- **Reduce speed** — When you see a threat developing with an oncoming vehicle, reduce your speed immediately while moving right, if possible. This means slow down right away and if necessary, sound your horn and flash your lights. By quickly slowing down, you give them extra time to get back into the proper lane and avoid a crash.
- **Ride right off the road** — If you've followed the first three steps and the vehicle still keeps moving in your direction, you have only one out left — to ride off the road to the right. This option will, in almost all cases, be better than a head-on crash. If a crash is unavoidable, try to hit the object or vehicle at an angle rather than head-on to lessen the impact. Never try to out-guess the other driver by pulling to the left. If you're going into the ditch or field, it's better to steer into it to avoid a rollover.

Intersection or angle crash

About half of all two-vehicle crashes occur at intersections. This is largely due to the traffic conflict that exists at intersections, both vehicular and pedestrian. Be prepared for the unexpected.

Intersection hazards include:

- Stale green light — green lights that have been visible for a block or two may change suddenly to yellow. Also, watch for pedestrian signals that have changed to 'wait' as an indication of a green light about to change to yellow.
- Vehicles stuck behind left turners may become impatient and without warning or signal, swing over into the right lane to get by.
- Vehicles that are waiting at a green light or crosswalk may be waiting for other vehicles or pedestrians to clear — never pass these vehicles without slowing enough to check that the way is clear.
- Drivers making turns may signal and move into the intersection and then stop unexpectedly even when no traffic or pedestrians are blocking their path.
- Drivers who misjudge your speed and turn in front of you.

Crashes caused by another vehicle passing you

As a professional truck driver, you'll quickly become aware that most drivers would rather drive in front of you than behind you. Some of those drivers will take unnecessary risks such as:

- Tailgating — staying too close behind your vehicle and darting out to make a pass with limited visibility
- Following the leader — a series of vehicles passing you at the same time, even though the second and subsequent vehicles have extremely limited visibility
- Passing you on the right
- Racing to merge at the last second at the end of a merge ramp or where two lanes merge into one can result in the following crash types: side-swipes, being cut-off, or being run off the road

As a defensive driver, you can do a lot to reduce the risk of a crash by making it easier for other vehicles to pass:

- Maintain your lane position, either in the centre of the lane or slightly to the right, to allow the passing vehicles extra clearance and vision.
- Maintain or reduce your speed.

- Watch for vehicles merging in front of you with limited space.
- If you need to pull over, turn on your four-way flashers, get as far off the road as safely possible, and put out warning devices, as needed.
- When pulling back onto the road, wait for sufficient space. Leave on the four-ways until you're up to speed.

Crashes caused by you passing another vehicle

Think about passing before you do it. Every time you find yourself in a position to pass, ask yourself:

- Is it safe and legal?
- What will I gain by passing?
- Is it worth the risk?
- Is the pass necessary?
- Will I have to exceed the speed limit?

By asking yourself these questions, you may find that in most cases you don't have to pass after all. Passing also increases fuel consumption significantly. There's nothing wrong with passing another vehicle, so long as it's done where and when it's safe to do so. Remember — never feel pressured to exceed the speed limit and make an unsafe lane change simply because there is an aggressive driver tailgating you.

Sideswipe crash

A sideswipe typically occurs during a lane change while vehicles are passing or between vehicles going in opposite directions and colliding close to the centre line.

Avoiding getting hit by another vehicle in a sideswipe requires you to manage your lane position, carefully execute lane changes and to watch other drivers. You must also monitor your blind spots and pay attention to how you position your vehicle beside others. Sideswipe prevention involves getting your mirrors properly set up, having adequate convex mirrors and keeping your mirrors clean.

Crash with an overhead object

You need to make a conscious effort to ensure there's enough clearance overhead at all times. A major cause of damage is hitting overhead objects, so watch out for low-hanging wires, signs and so on. It's important for you to know the height of the truck you're driving. Ensure you check out the height of the overhead objects before driving under them. Exit the vehicle, as needed, to check clearances and identify potential obstructions.



While the height of bridges or overpasses is often posted, clearance may be reduced when the road is repaved or there's snowpack.

Incident with roadway clearance

Being aware of clearance under your vehicle is very important when crossing railway tracks and when entering or exiting sites with uneven surfaces. Trailers can get stuck (hung up) on the raised roadway area.

9 Handling emergencies

No matter how safely you operate your tractor-trailer, there's always a chance for a crash or incident as long as there are variables that you have no control over, such as weather, wildlife and other drivers. Even the best driver may be involved in a crash at some point in their driving career. When the unexpected happens, you need to safely and legally deal with the situation in a calm and responsible manner.

This unit will explain the professional driver's responsibilities at the scene of a crash and in protecting equipment, cargo and human life. This includes what to do about your truck, how to protect yourself and others, how to prevent a fire or control a fire if one ignites and how to report a crash. This unit also provides information on dealing with a variety of emergency situations.

What you'll learn

This unit will help you learn to:

- Handle emergency incidents in a safe and professional manner.
- Explain the importance of following workplace practices, procedures and policies regarding crashes, close calls, injuries or other incidents including:
  - Engaging emergency support, such as towing, recovery and repair services
  - Speaking with police, media or the public
  - Obligations and limitations in administering first aid
- Describe typical incidents that must be reported to employers, police and other reporting agencies.
- Explain the need to carry emergency equipment and first aid supplies.
- Describe how and when to use emergency equipment, such as fire extinguishers, warning devices, spill kits and first aid supplies.
- Properly wear and use appropriate personal protective equipment.
- Use warning devices and other emergency equipment safely and in compliance with regulations.
- Explain what to do in emergency situations such as, vehicle malfunctions, fires, medical distress, and vehicle runaway due to brake failure.

General emergency steps

Whenever any commercial motor vehicle or trailer is disabled, stalled, broken down or in a crash, the driver should quickly, safely and calmly take the necessary actions to safeguard the vehicle and other motorists.

It's important to follow workplace practices, procedures and policies when engaging emergency support, such as towing, recovery and repair services and when speaking with police, media or the public. When you get hired on, be sure to ask your employer for their procedures and policies if they don't train you in them. Following required procedures will help keep you safe and help protect you from liability in the event something goes wrong.

General emergency steps:

1. Turn on your four-way flashers.
2. Ensure there's no danger to yourself. Don't immediately get out of your truck unless you're in imminent danger. Radio other commercial drivers to help prevent a chain reaction. Watch for chain reaction crashes and be careful where you stand and walk.
3. Wear appropriate personal protective clothing and equipment based on weather, visibility and what you're dealing with.
4. Deploy appropriate warning devices.
5. Locate emergency contact information.
6. Know and follow your workplace practices, procedures and policies when engaging support, such as towing, recovery and repair services or when speaking with police, media or the public.
7. Know what needs to be reported to your employer, police and any other reporting agencies.

Emergency supplies

Approved warning devices

Any vehicle is a hazard when it's parked on the side of a road. Large vehicles present more significant hazards. In most cases, drivers are required to put out approved warning devices when they park their commercial vehicles at the side of the road in an area that isn't designated for parking.



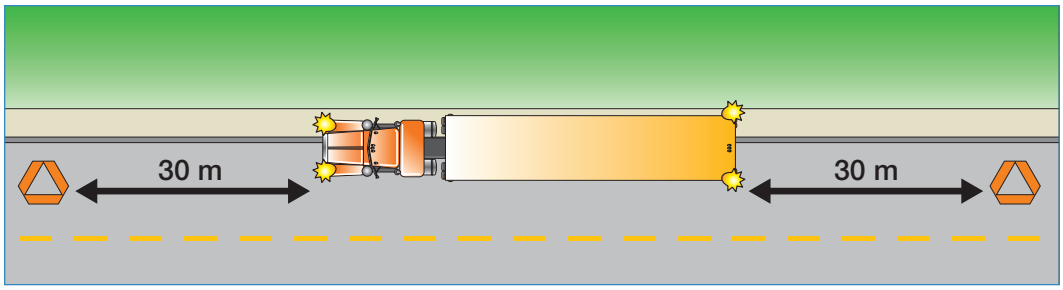
The following commercial vehicles must carry approved warning devices in the driver's compartment and must be easily accessible:

- All vehicles with a seating capacity of more than 10 passengers.
- All commercial vehicles with an overall width of more than 2.3 m (7.5 ft).
- All commercial vehicles with a load width of more than 2.3 m (7.5 ft).

When parked in the dark, the above commercial vehicles must have a minimum of two warning devices.

During daylight hours, the minimum for approved warning devices is:

- Two red flags that measure at least 30 by 30 cm (12 by 12 in), or
- Two warning devices that have been approved for daylight use, including flares, fuses and reflectors.



At night, you may use flares, fuses, reflectors and red lanterns.

If your vehicle becomes disabled:

- Move it as far off the travelled portion of the highway as possible.
- Place warning devices approximately 30 m (100 ft) ahead and 30 m (100 ft) behind the disabled vehicle.

Note: It's a good safety practice to place additional warning devices further than 30 m (100 ft) from your vehicle.

A breakdown can be dangerous at any time, but it's especially dangerous in adverse weather conditions. Exposure to wind and cold can cause frostbite and blowing and drifting snow can be disorienting. If your vehicle breaks down in adverse conditions, put on extra clothing, stay in the cab and stay warm.

First aid supplies

It is strongly advised that all commercial vehicles carry first aid kits that are easily accessible by the driver and that the driver be trained in basic first aid. Truck drivers are often in remote areas, including areas with no cell phone service, so it's important to be able to help yourself or someone else if there's an incident. It's also important for you to know and follow your workplace policies and

procedures regarding providing first aid to others. Know your limitations and obligations.

Fire extinguishers



Every vehicle registered as a commercial vehicle transporting fuel petroleum products and those registered as public service vehicles (except trailers) must be equipped with a fire extinguisher approved by Underwriters Laboratories (UL). The extinguisher must be kept charged with a valid expiry date. Extinguishers must be secured in a quick-release holder in view of and easily accessible to the driver.

There are two main categories of fire extinguishers: multi-purpose dry chemical extinguishers and carbon dioxide (CO2) extinguishers. The multi-purpose dry chemical extinguishers are easier and safer to use, but the CO2 extinguishers are more effective.

Multi-purpose dry chemical extinguishers are available in two classes. If its cylinder is marked BC, it can be used to put out grease, oil, gasoline and electrical fires. If its cylinder is marked ABC, it will also put out Class A fires, such as paper or cloth.

CO2 extinguishers are extremely effective but should never be used in an enclosed space. You could smother yourself if you use these in a confined space. You could also blister your skin.

How to use a fire extinguisher

- Remove from the bracket.
- Pull the safety pin by breaking the seal.
- Approach the fire from upwind, if possible.
- Hold the extinguisher in an upright position.
- Point the discharge apparatus (hose, horn, nozzle) at the base of the fire, approximately two to three metres (six to eight feet) away.
- Don’t allow the flames to come between you and an exit.
- Squeeze the handle.
- Continue to use until fire is out and extinguisher is fully discharged.
- Never turn your back on a fire as it may re-ignite.
- Ensure all discharged fire extinguishers are replaced with fully charged ones before the vehicle is used again.

Generally, extinguishers will be totally discharged in approximately eight to 10 seconds, so proper technique is extremely important! Even when the fire appears to be out, don't turn your back on it. Keep watch for flashback until the area has completely cooled.

Remember the word PASS:

P — Pull the pin

A — Aim low

S — Squeeze lever

S — Sweep from side to side

Personal protective equipment (PPE)

A carrier's safety plan will document PPE requirements and ensure that drivers receive training on requirements such as goggles, hard hats, steel toe boots, breathing apparatus and so on.

Drivers should carry extra warm clothing, hat, gloves, blankets, food, water and any required medication in case of being stranded for a long period of time due to weather or traffic delay. A driver should also carry an emergency contact list.

Other supplies

The following other supplies should be on hand:

- Ice scraper
- Snow brush
- Extra windshield washer fluid, antifreeze and oil
- Extra wiper blades
- Small shovel
- Sand or road salt
- Spare tire chains
- Flashlight and spare batteries
- Jumper cables
- Candles and matches
- Paper towels and bathroom tissue
- Antibacterial/antiviral wipes
- Disposable face coverings
- Bottled water

Emergency situations

Vehicle gets stuck

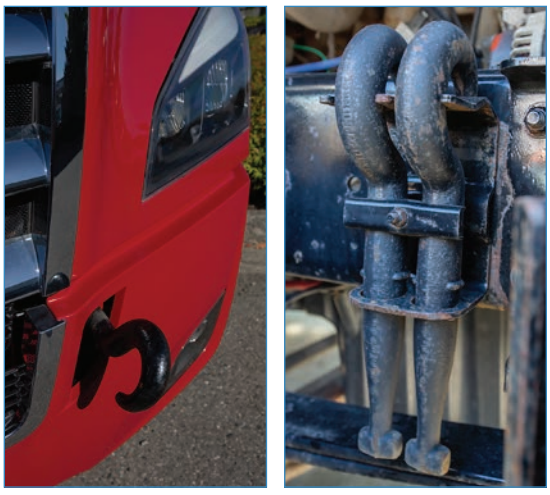
Ideally, by following the guidelines below, you shouldn't get stuck in the first place. The best way to prevent getting stuck is by avoiding soft shoulders, deep snow, muddy roads and icy/slippery surfaces.

If you do get stuck, stay calm and take the following steps:

1. Avoid spinning the drive wheels and rocking, this will dig the vehicle in deeper. Spinning wheels will warm any ice or snow under the tires, reducing traction even more.
2. Dig out from in front of the wheels. Install all of your tire chains on your drive axles. Scatter sand or gravel in the wheel path if you don't have chains.
3. When ready to try pulling out, start with the steering wheel facing straight ahead. Don't turn the wheel until the vehicle is moving.
4. Start in second or third gear, using very little power. This keeps the wheels from spinning and gives a smoother application of force.
5. Accelerate smoothly and gently. Ease off at the first sign of spinning or slipping. Allowing the wheels to continue spinning can cause you to dig in deeper and/or cause a spinout.

Towing

If the steps above fail to free your vehicle, you may need to call a tow truck. Remember, even if towing is necessary, you're still responsible for your vehicle and cargo. You need to stay in charge and supervise the operation. Talk to your dispatcher or supervisor before you call a tow company. Most major carriers have agreements with certain tow companies that give them better rates. Take pictures of your situation and send them to your employer so they can be sure to get the right size equipment dispatched to rescue you. While you're waiting, find your tow hooks (usually hanging on the side of the frame under the hood) and continue to dig yourself out. The shorter time the tow truck is on scene, the less it will cost.



Tow Hooks

Personal medical distress

If you have a sudden medical incident, do your best to stop and secure the vehicle and pull over if you can. Turn on your four-way flashers and get help however you're able to. Call for help on a two-way radio if you have one, dial 911, or push the help or accident button on your Electronic Logging Device (ELD) if there is one. Flash your lights, honk your air horn — anything to attract attention!

Using anti-lock braking systems (ABS)

Anti-lock brake systems (ABS) are mandatory in Canada on all trucks and buses over 4,536 kg (10,000 lb) manufactured since April 1, 2000 and on all commercial trailers equipped with air brakes.

The system monitors wheel speed and adjusts air or hydraulic pressure in the brake chambers to prevent wheel lockup under severe braking. Continuous wheel speed sensing information is transmitted to an Electronic Control Unit (ECU) that processes the information for brake pressure application, allowing the system to accomplish its task.

The ABS allows the driver to steer while applying continuous brake application, but it doesn't allow you to drive faster or stop sooner. In fact, on some surfaces such as gravel, the braking distance with ABS may be longer. ABS may also help you prevent jackknifing.

With good defensive driving skills, you'll hopefully never have to use emergency braking techniques. The unexpected and uncontrollable can happen, however, so you should practice these techniques periodically.

Refer to instructions in your vehicle's manual.

A few tips for emergency stopping with ABS:

- Apply firm, hard and continuous pressure to the brake pedal until the vehicle stops.
- Don't pump the brakes — this turns the system on and off and increases your stopping distance.
- Don't be alarmed by brake noise, pedal movement or shudder. This is normal. Keep applying firm pressure.
- Be extremely cautious when steering around obstacles. Remember that steering and handling characteristics will be affected by the size and load of the vehicle you're driving and by the trailer you may be towing. Always steer smoothly and never jerk the steering wheel.

IMPORTANT: When you operate combination vehicles, make sure you know which of the units have ABS. If the tractor and trailers don't all have ABS, apply the brakes as if you were operating a vehicle combination without ABS.

Stopping with threshold braking

Emergency braking with non-ABS brakes requires a sensitive touch on the brake pedal using a technique called "threshold braking." Don't "pump the brakes". Pumping the brakes with no "feel" for what the wheels and brakes are doing will only extend the stopping distance and reduce air pressure.

Threshold braking means applying brake pressure right up to the point of almost locking the wheels, then backing off just enough to prevent the skid. You'll constantly adjust pressure on the brake pedal throughout the stop to keep it at that point. If the brakes lock, immediately ease up and reapply. Once mastered, the technique will stop you faster than any other.

Skid avoidance and possible recovery

Skids are usually caused by too much acceleration, braking or steering. The best practice is not to get into a skid in the first place. Avoid dangerous skidding by anticipating low-traction conditions and braking, steering and accelerating smoothly.

Loss of traction may be caused by:

- Tire failure resulting from under inflation or sudden deflation from a blowout
- Worn out tires — tread depth too low
- Faulty brakes
- Excessive acceleration or speed on curves
- Rough or slippery surfaces
- Hydroplaning resulting from travelling too fast on a wet road
- The oily film that develops on the road after the first few minutes of rain
- Loose or deep gravel
- Snow and ice

Recognize adverse road conditions:

- Constantly monitor for road conditions that could cause a loss of traction.
- If road conditions are questionable, reduce your speed and drive smoothly.
- Take your foot off the accelerator and reduce speed gradually without braking suddenly.
- If conditions worsen, consider putting on your tire chains or find a safe place to park until conditions improve.
- If safe to do so, travel closer to the fog line as this is where you should find accumulated sand for extra traction in the winter.

Anticipating a skid:

- Notice reduced traction — your vehicle may feel loose on the road or you may sense it is skidding.
- Reduce speed gradually and use the threshold braking technique instead of a single, hard brake application. Remember-you can only apply threshold braking if you don't have ABS anywhere in your vehicle combination.
- Avoid sudden movement of vehicle controls. Keep everything smooth.

Reacting to a skid:

- Immediately release the brake if your wheels are locked up. It's impossible to control a skid when the wheels of your vehicle are locked.
- Ease off the accelerator and let the vehicle slow down.
- Disengage the clutch to get drive wheels rolling again. Look and steer in the direction of the skid. Use counter-steering techniques to avoid over steering.

Jackknifing and trailer swing

A jackknife is typically caused by a loss of traction at the tractor drive tires which can be caused by:

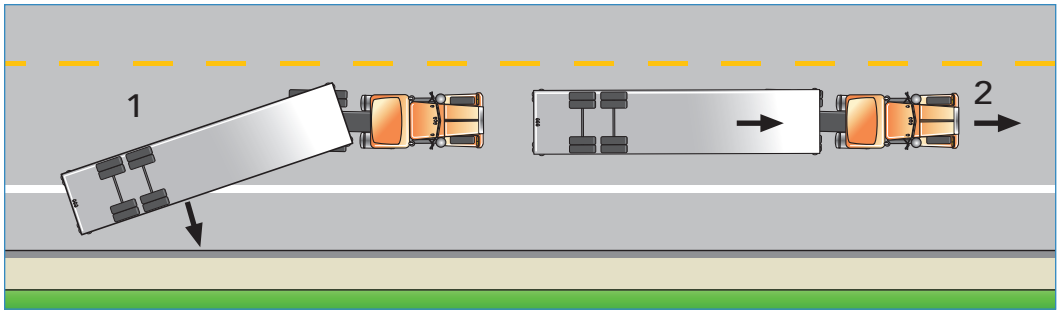
- Poor weight distribution in the trailer.
- Using the service brakes when there isn't enough traction due to a slippery surface or worn out tires.
- Activating the engine brake suddenly on slippery roads or at too high of a setting (this is a common cause).

The rear of the tractor will start to swing out as the drive tires accelerate due to a lack of traction. As the tractor begins to rotate, the weight of the trailer accelerates the rotation by pushing straight ahead.

Recovery from a jackknife situation requires quick action. As the angle between the tractor and trailer increases, the chances of recovery diminish. Once you pass a 15-degree angle, you're at the point of no return.

There are two distinct kinds of skidding involving a tractor trailer:

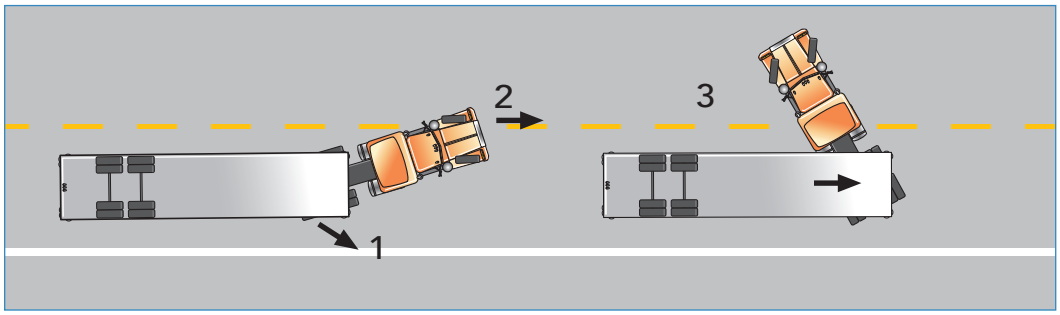
- A trailer swing-out in which the rear of the trailer swings out.
- A tractor jackknife in which the tractor rear end slides sideways and is pushed by the trailer.



Trailer swing
1 — the trailer skids while braking on a slippery surface
2 — the driver releases the brakes and drives forward, pulling the trailer back in line

Recovery from a potential jackknife depends on which type of skid you're experiencing. When the trailer skids, it will start to swing either left or right. When this happens, release the brakes and provide gentle acceleration to pull the trailer straight again. Steer smoothly and then let your vehicle slow down again. This can be especially challenging when descending steep mountain grades as increasing your speed down the hill isn't what you really want to do. In winter, look for areas of the road that will give you more traction (for example, accumulated sand) so you can slow down again but stay on your own side of the centreline. You'll only be able to maintain directional control of your vehicle if the wheels are turning.

Once you start down a hill, you're committed, so be sure you have enough traction. If conditions are poor, you can stay at the top of the hill until they improve. If you choose to continue, then installing tire chains on your drive axles along with a drag chain on one of your trailer axles may help your situation.



Jackknife
1 — the tractor begins to skid
2 — the driver steers into the skid, corrects it and drives on
3 — if the skid is not corrected, the trailer will push the tractor around until the cab hits the trailer

When the tractor skids at highway speeds, it typically results in a jackknife as the trailer you're pulling wants to travel straight ahead. Once the tractor begins to rotate, it pushes into a jackknife position very quickly. Many drivers who have experienced a high-speed jackknife describe it as happening so quickly that they didn't recognize what was happening until it was already over. Recovery from a high-speed jackknife is almost impossible, so prevention is the key.

If you're travelling slow enough and recognize the beginning of the rotation, you can accelerate and get the tractor straight again to prevent a jackknife.

To avoid a jackknife:

- Know the weight distribution of your cargo
- Remember that a light or empty vehicle will slide more easily
- Reduce your travelling speed
- Increase following distance
- Brake smoothly
- Avoid braking in curves
- Avoid swerving and braking at the same time
- Use the engine brakes on lower settings when roads are slippery and test the traction carefully
- Install traction devices if road conditions are questionable

Tire failure

If you're skilled in performing vehicle inspections, you'll have few problems with the tires of your tractor and trailer. There are, however, hazards of the road that can't be avoided. You may face an emergency if one of your tires has failed.

When a steer axle blowout occurs:

- Don't apply the brakes immediately
- Firmly grasp the steering wheel and steer your vehicle straight down the centre of your lane
- Accelerate until control of the vehicle is stabilized then allow the vehicle to slow gradually
- When you have the vehicle under control and speed is reduced, brake gently until the vehicle comes to a complete stop, preferably off the travelled portion of the road
- Turn on your four-way flashers

Typically, when a drive tire or trailer tire blows, it doesn't immediately impact vehicle control as it's generally in a dual-wheel configuration. You'll want to stop safely as soon as possible to prevent further damage to the vehicle or adjacent tire and then pull safely off the road, if possible. If you can't get off the road, you'll need to put out your warning triangles. Contact your supervisor with the pertinent information, such as tire size and wheel position, so they can arrange for a tire repairman to come out.

Flooded roadway

Water can reduce braking efficiency. Avoid driving through large amounts of water whenever possible. If you have to drive through flood water on the road, estimate the depth and whether you should drive through it at all. If you're going to drive through:

- Slow to a crawl as you approach the water
- Place a slight drag (a light constant pressure) on the brakes while you drive through. The drag will reduce the amount of water on the brakes
- After driving through the water, apply the brakes for a short distance to dry them out

Emergency action

The use of emergency action in a situation may reduce the likelihood or severity of a crash. Emergency action includes braking to slow your vehicle, as well as smooth steering to avoid an obstacle if it's safe to do so.

Prevention and a high level of awareness such as looking well ahead, slowing down and increasing your following distance in poor road conditions will reduce the need for emergency action. When you're confronted with an impending crash, it takes a calm approach to achieve the best result. Instinctively, we don't want to hit things, particularly if they're alive, but our emergency actions need to be calculated so we don't create a bigger problem.

Turning the steering wheel too aggressively in a tractor-trailer will create trailer whip and a likely roll over. Moving to another lane to avoid a crash is also risky — crossing the yellow centreline should be a last resort as you may put other motorists coming from the opposite direction at risk. First and foremost, you want to dissipate as much energy from your vehicle as possible so you need to brake and if your entire vehicle is equipped with ABS brakes then brake as hard as you can. Reducing speed is going to lessen any impact and if you need to steer, the vehicle will be under better control at the lower speed.

Wildlife — Animals crossing the road are a fact of life in B.C. and, sadly, result in many crashes. Drivers have lost their lives swerving to miss an animal which is a cost far too high. When faced with wildlife crossing the road, it's important to stay in your lane and reduce your speed as much as possible with hard braking.

Releasing the brake just before impact will allow the front of the vehicle to rise up. This may help in having the wildlife go under the vehicle rather than come up over the hood and possibility into the vehicle.

Oncoming vehicle in your lane — Hopefully you'll never experience a situation where another vehicle has crossed into your lane and there's an impending crash. These situations require clear thinking with the first step being to reduce your speed as much as possible to lessen the impact. The second step will be to smoothly steer to avoid the other vehicle completely or to lessen the impact. Steering to the shoulder is best to hopefully create a glancing blow versus a head-on crash. Try to avoid driving completely off the road.

Crossing the centreline to avoid a crash should be your last resort, since it puts drivers travelling in the opposite direction at risk. If the oncoming vehicle regains control, they'll instinctively return to their side of the road and hit you.

Emergency steering — Although a truck can be turned faster than it can be stopped, emergency steering can be very risky. If a crash is inevitable, emergency steering may reduce the severity, but done incorrectly it may worsen the situation. Steering must be completed smoothly to remain in control. Remember that if you're carrying a liquid bulk load, a product surge will be generated by any sudden manoeuvring.

To perform emergency steering:

- Reduce speed. If there's sufficient space, brake to a slower speed before reaching the obstacle; however, only brake while steering if you have ABS.
- Select an alternative path:
  - Hazard on a multi-lane roadway — check for a clear lane to move into
  - Hazard on two-lane roadway — check if oncoming lane is clear and check for obstacles on shoulder
  - Merging hazard — check for a clear lane to move into

Look where you want to go, not at the hazard.

- Perform emergency steering. Start steering as soon as the emergency is identified. Turn only enough to clear the obstacle. Don't put your vehicle into the path of oncoming traffic! Steering must be smooth and gradual.
- Perform counter steering. Smoothly steer back in the other direction when safe.

Crash unavoidable — Where a crash is unavoidable, it's best to avoid a head-on crash or hitting pedestrians. Colliding at an angle reduces the force of the impact. If you have a choice, it's far better to hit inanimate objects than people. Running off the road is sometimes the best option. Be calm and make a clear decision.

At a glance, you must assess your escape path for the following:

- Is the escape path free of hazardous obstacles?
- Are clearances sufficient for the vehicle?
- Will an off-road surface still permit steering control?
- Is the path going to remain clear or will it be occupied by someone or something else by the time you get there?

Remember, if you focus only on the obstruction, you'll be unable to assess your best escape path and likely steer towards the obstruction. **Look to where you want to go**, taking in the big picture. The size and weight of a larger vehicle limits its ability to swerve sharply to avoid an object or to leave the pavement with much control. Over steering is always a danger, especially when your wheels leave the pavement and are in soft ground. Steer firmly and as gradually as possible to clear the obstruction.

Gravel shoulder recovery

If the wheels of your tractor and/or trailer leave the roadway and begin to run on an unpaved shoulder, don't be in a hurry to get them back on the road. Swerving back onto the road at a higher speed may cause you to skid across to the other side or cause a rollover. To get back onto the road:

Reduce speed — Take your foot off the accelerator and gently apply the brakes.

If the shoulder is clear ahead

- If possible, keep one set of wheels on the pavement and steer straight until you stop
- Turn back onto the roadway when clear of traffic

If the shoulder ahead is blocked

- Confirm the distance you have and slow as much as possible
- Take your foot off the brake and turn the steering wheel carefully toward the roadway
- Don't brake while turning
- As soon as the front wheel rides up on the surface, turn in the direction of the roadway and regain control of the vehicle

Loss of brakes

There's a limit to the amount of heat that brakes can absorb and dissipate. The highest brake temperatures occur when braking from highway speeds while on long downgrades or from repeated use of the brakes without enough cooling time between applications. Almost all brake failures and downhill runaway crashes are caused by overdriving the ability of the brakes to deal with heat. In other words, **driver error**.

Drivers should always select a gear that will hold the vehicle back without the use of service brakes to descend hills. Keeping the service brakes cold so they're available in an emergency is key to travelling safely downhill. If while you're descending the grade your engine brake stops working, then simply stop. Select a lower gear (likely low or first) to continue on without the use of service brakes until you find a safe place to pull over. Don't continue down the hill until your engine brake is repaired. If you can't fix the problem yourself, you'll either need a mobile mechanic to come to you or you can uncouple from your trailer (ensure you're on solid ground) and bobtail to the nearest repair shop to get it fixed.

As a professional driver, you will inevitably hold up the flow of traffic from time to time. Due to the size and weight of your vehicle, it takes more time and space to manoeuvre safely in all situations. One of the biggest challenges some new truck drivers have is learning to think about driving differently compared to being in a car. You will need to adapt your driving to start your downshifts early prior to turns so you're in the correct gear when making a turn or tight manoeuvre. You'll also need to accept that often there will be a long line of traffic behind you when you are ascending and descending grades because you must drive your vehicle within its limits.

In other words, don't attempt to go down a hill faster just because you have traffic behind you. If there's a safe place to pull over, you may want to use that space to allow traffic to clear, but only if you can do it safely. Even at a lower descent speed, you need to be safe. It only takes a few minutes longer to get to the bottom of the hill. Always remember, you can descend a grade thousands of times too slowly, but only once too fast!

If your air system gets a major leak from a hose being knocked off a tank by a broken tire chain or a rock, your low air warning will activate by 60 p.s.i. and you need to immediately find a safe place to pull off the road. Once stopped, if you're not clear of the road, place your emergency triangles to warn other drivers. Call your supervisor and arrange for repairs before you proceed.

Runaway lanes

Runaway lanes enable vehicles that are having braking problems to safely stop. There are several types of runaway lanes in use that are connected to a steep downhill grade section of a main road and designed to accommodate large vehicles. The ramp allows a moving vehicle's kinetic energy to be dissipated gradually in a controlled and relatively harmless way, helping the driver to stop safely without a violent crash.

These two road signs alert you to runaway lanes.



This sign is posted in advance of a runaway lane.



This sign is found at the entrance to a runaway lane.



The runaway lane: a last resort



Runaway lanes are a final safety measure for when you lose your brakes. Use a runaway lane if applying the brakes has little or no effect on slowing the speed of your vehicle. If it feels like you have no brakes, don't chance it, take action.

It's extremely important to make the decision to use a runaway lane **before** your vehicle reaches an unmanageable descent speed. If you've lost your brakes and must use a runaway lane that goes up a steep grade, you need to be ready to secure your vehicle when it comes to a stop and before it begins to roll backwards down the grade again. If you've lost your service brakes due to overheating, your parking brake system also won't function to hold your vehicle on the grade. As your vehicle rolls to a stop at the top of the runaway lane, place the transmission in low gear and attempt to continue driving up the grade. This will likely cause your drive tires to spin and dig a small hole, and may even cause your engine to stall, which will hopefully be enough to hold the vehicle at the top of the runaway lane. Apply your park brakes once the brakes cool down as they will become effective again. Call your supervisor and let them know your situation. You'll likely need a tow truck to help you back down the hill. If your brakes have been overheated that badly, the entire unit will need to have a wheels-off brake inspection before being put back into service.

Examples of runaway lanes in B.C.

Runaway lanes come in various lengths and grades, with different materials and features designed to stop out-of-control vehicles. Here are two main types you can expect to see in B.C.

Gravity bed

This is the type of runaway lane that leads a truck up a slope. It uses a combination of gravity and in some cases a bed of gravel to slow the truck down and keep it from sliding backwards. You'll notice these runaway lanes on various B.C. mountain highways.

Arrester bed

The arrester beds are filled with washed/loose rocks that cause your vehicle to sink slightly into the bed which dissipates the energy and brings you to a stop. There's a service lane beside them for a tow truck and other support vehicles to park on while they're recovering a vehicle out of the arrester bed. When you're entering the arrester bed, ensure you put your vehicle completely into the bed. If you straddle the service lane with one side of your vehicle, it will create uneven deceleration and likely a jackknife situation.



Arrester bed with cable nets



This type of runaway lane relies on a cable netting system and a rock bed to slow down the truck on either a horizontal or descending grade. You'll need to be accurate with your entry as there are concrete walls on both sides of this

runaway lane to support the cables. This again highlights why it's important to use a runaway lane before you're going too fast. The cables are spring-loaded and aligned with the height of your front bumper. As you enter the runaway lane, you stretch out the spring-loaded cables which helps to dissipate the energy in your vehicle along with an arrestor bed. Once these devices have been used, special equipment needs to be brought in to re-tension the cables. This type of system is used in locations where there isn't enough distance to install a regular arrestor bed, such as at the Horseshoe Bay Ferry Terminal.

It's important for all drivers to watch for runaway lanes. Brake loss is more common in commercial transport trucks, but it can happen to any vehicle. If driving a regular route, remember where the runaway lanes are and never park your vehicle in or in front of a runaway lane.

Loss of visibility

Snow and ice can build up on the windows and mirrors of your vehicle making it difficult to see. Build up can also occur on lights and reflectors. This makes it more difficult for other drivers to see your vehicle. At night, your vision is also affected. It's necessary to clean the lights and reflectors more frequently, using a quality glass cleaner before your trip and every day if they're dirty. It's important to clean the inside of windows weekly as well to eliminate additional glare at night. If your defroster isn't clearing your windows properly, have your shop check the cabin air filter as it may be plugged. Turn your system to re-circulate to help with air flow in the short term.

Blowing snow can reduce visibility to zero. This makes driving at any speed unsafe. It's best in these situations to get off the road and wait it out. If the blowing snow is being caused by other vehicles, increase your following distance so the snow being blown by the vehicle ahead of you has time to settle so you can see. If the snow is being blown by vehicles passing in the other direction, reduce your speed when meeting them and direct your vision to the right edge of the road away from the snow cloud to maintain your road position. If you're not comfortable in these driving situations, then find a safe place to park until conditions improve.

What can you do in each situation?

Your headlights fail:

- Turn on high-beams and/or auxiliary driving lights
- Activate your four-way flashers
- Slow your vehicle quickly but safely. The idea is to reduce your speed before a slight steering error results in a crash
- Pull over as far as practical out of traffic and stop
- Place warning devices on the road as required by law

Mud, slush or snow splash on the windshield suddenly:

- Turn on wipers and washers
- Look outside windows and slow the vehicle down
- If the windshield wipers have failed or you have no washer fluid, activate the right turn signal and pull over as far as practical out of traffic and stop
- Activate four-way flashers. If your vehicle will remain stationary for more than a moment, put out warning devices on the road as required by law. Clear the snow from your lights and flashers

Fire

Commercial vehicle drivers should know how to prevent fires and have a basic knowledge of fire-fighting techniques. It's also essential to know what types of extinguisher or retardants to use on different types of fires.

Some common causes of truck fires:

- Running with a soft tire
- Overheated brakes, either from misuse or maladjustment. Check hub temperatures every time tires are checked during en route inspections
- Leaking fuel system, pump, filter, tanks or lines
- Unequal distribution of load, causing the trailer to lean and rub on tires
- Careless smoking habits. Lit cigarettes and cigars should always be disposed of in ashtrays, never thrown out windows. Never smoke while loading or unloading
- Carelessly placed flares, lamps or fuses used in an emergency
- Short circuits in the electrical system
- Occasionally, spontaneous combustion may occur in a van or trailer. Drivers must always know the nature of their cargo, so necessary fire-control precautions can be taken
- Stopping on dry grass during a drought. Heat from the truck can ignite the grass
- Failures or overheating of the truck's aftertreatment system — the device that cleans exhaust gases to meet emission regulations.

When a fire occurs:

1. Stop in a safe position away from buildings and other vehicles.
2. Call 911 and give your location and any critical information about your cargo.
3. Ensure your safety and the safety of others nearby.

4. If it's a combination unit, uncouple the unit when safely possible.
5. Based on the type of fire, take all possible steps to extinguish it.
6. If the fire might be due to a short-circuit, turn off the battery switch if equipped or remove battery cables, if possible.
7. If the cargo is of an explosive nature, stop traffic and warn people to stay back.
8. Call your supervisor.

Reporting forest fires

Within B.C., report grass, brush and forest fire sightings to:

- 1-800-663-5555
- Cell: *5555

Crashes and incidents

In Canada, when you've been involved in a crash, do something that causes a crash or witness a crash, you must stay at the scene and provide assistance and information. If you weren't involved in the crash, you should still stop and offer to help if the police or other help hasn't yet arrived. You'd want others to do the same for you.

You're protected by the *Good Samaritan Act* from liability for emergency aid provided to an ill, injured or unconscious person at the immediate scene of a crash or emergency, unless you're grossly negligent. Similar rules apply in most U.S. jurisdictions.

Emergency contact information

If an emergency incident has occurred, you don't want to be scrambling to look for emergency contact information. Keep a paper file in the truck and a copy on your phone for the following:

- Emergency services: police, fire and ambulance for the areas you travel (Not all areas in North America use 911 for emergencies)
- Forest fire reporting numbers
- Towing/recovery companies
- Your dispatcher
- Insurance companies

Legal reporting requirements

You must exchange the following information with the other driver, anyone who has been injured and anyone whose property has been damaged. You must also provide this information to a witness if requested.

- Your name and address
- The name and address of the registered owner of the vehicle
- The licence plate number
- Insurance information

You can report a claim to ICBC online or by phone, 24 hours a day, seven days a week.

Please provide the following when reporting a claim:

- The licence plate number of each vehicle involved
- Driver's licence number of each driver
- Insurance information for vehicles not insured by ICBC
- Police file number (if applicable and available)

Crash/incident and near miss reports

Follow your company's procedures when reporting any incidents or crashes. It's also important to report "near misses" — an event that didn't result in injury, illness or damage, but had the potential to do so. Only a fortunate break in the chain of events prevented an incident. Other terms for these events are "close call," "narrow escape," or "near hit."

History has shown repeatedly that most serious and catastrophic events were preceded by warnings or near miss incidents. Recognizing and reporting these can significantly improve worker safety and enhance an organization's safety culture.

A near miss could occur when driving or at other times such as loading/unloading, doing vehicle inspections or other workplace activities.

According to the National Safety Council, best practices in establishing a near miss reporting system include:

- A reporting culture that reinforces that every opportunity to identify and control hazards, reduce risk and prevent harmful incidents must be acted on.
- A reporting system that is non-punitive and, if desired by the person reporting, anonymous.

- Investigating near miss incidents to identify the root cause and the weaknesses in the system that resulted in the circumstances that led to the near miss.
- Using investigation results to improve safety systems, hazard control, risk reduction and lessons learned. All of these represent opportunity for training, feedback on performance and a commitment to continuous improvement.
- Near miss reporting is vitally important to help prevent serious, fatal and catastrophic incidents that are less frequent but far more harmful than other incidents.

Help from bystanders

A crash scene can be chaotic. In addition to those who are actually involved, there will likely also be bystanders curious to see what's happening. It's a hard situation to be in and remain cool and calm, however that's what's required. Most people at the scene of a crash would like to help, but often don't know what to do. If you take charge in a calm and assertive manner, they can help you bring the crash scene under control by performing the following tasks:

- Providing first aid to the limit of their ability
- Finding witnesses
- Directing and diverting traffic, if able to do so competently
- Helping to set out emergency warning devices to protect the scene
- Obtaining blankets, bandages, first aid kit, fire extinguisher and so on
- Contacting medical, police and fire department
- Comforting victims

To maximize your chances of gaining assistance, the following points are suggested for organizing others to help you:

- Remain calm. This will instill confidence and increase the chances people follow your instructions.
- Assign responsible individuals to help. Ask for their help to carry out specific tasks.
- Give clear and brief directions.
- Ask them to repeat the directions back to you to ensure they clearly understand what's required.
- When the task is complete, have them report back to you.

Minor crashes

In the event of a minor crash:

- Stop the vehicle and put on your safety vest before exiting the cab.
- Hit the accident button on your ELD.
- Under most conditions, don't move the vehicle until directed by a police officer. However, if there's a danger to other motorists, move the vehicle off the roadway, where possible. For example, don't leave the truck across both lanes of traffic on a blind curve.
- Warn other commercial drivers on the radio to prevent a chain reaction.
- Assess the scene. Check on the condition of everyone involved and check the vehicles to ensure that there's no danger of fire. Fire can occur when there's a fuel leak, if you see smoke emitting from vehicles involved or if the crash occurred near flammable material.
- Set out approved warning devices, if required.
- Summon assistance, as needed.
- Exchange information with others, as required by law.
- Avoid discussing who's at fault.
- Take photos of the scene from a distance and close up and/or make a diagram.
- Note the time and place of the crash, vehicle positions and any marks on the pavement.
- Report the particulars in accordance with the law and workplace policy and procedures.

Major crashes

In the event of a major collision, the severity of the crash will determine the order of the steps below:

- Call 911 for assistance (police, ambulance, fire department).
- Quickly assess the situation and evacuate, if necessary.
- Assign someone to protect the scene in order to prevent other motorists from becoming involved.
- Set out approved warning devices, if required.
- Treat the injured beginning with the most seriously injured first.

- Note the time and place of the crash, vehicle positions and any marks on the pavement.
- Take photos of the scene from a distance and close up. Focus on the vehicles, skid marks, damage to the vehicles and position of the vehicles. Don't take pictures of crash victims.
- Report the particulars in accordance with local policy and procedures.

Loss of load and spills

Any spill that threatens the environmental quality of water, land or air must be reported. Possible threats include gas leaks, oil, diesel or chemical spills and any other release of hazardous material to the environment. Call 911 for assistance in controlling the spill — a fire department has access to many resources very quickly.



When a spill occurs or there's the risk of one occurring, it must be reported immediately by calling 1-800-663-3456. This is known as the initial report or Dangerous Goods Incident Report (DGIR).

The initial report must be completed by the responsible person (spiller) if the quantity for the substance of the spill is equal to or greater than the quantity outlined in the schedule of the *Spill Reporting Regulation* in the *Environmental Management Act* available at www.bclaws.gov.bc.ca; or if the spill has, or might, impact a body of water.

For more information, search "Report a spill" at www2.gov.bc.ca.

For small spills, drivers should carry a spill kit. These are available in a variety of sizes and types.

10 Off-road tasks and manoeuvres

This unit will introduce some theory behind backing a tractor-trailer, coupling and uncoupling a trailer, sliding a fifth wheel, sliding tandem axles and installing tire chains on a tractor-trailer. All of these tasks will be practiced during your practical training.

What you'll learn

This unit will help you learn to:

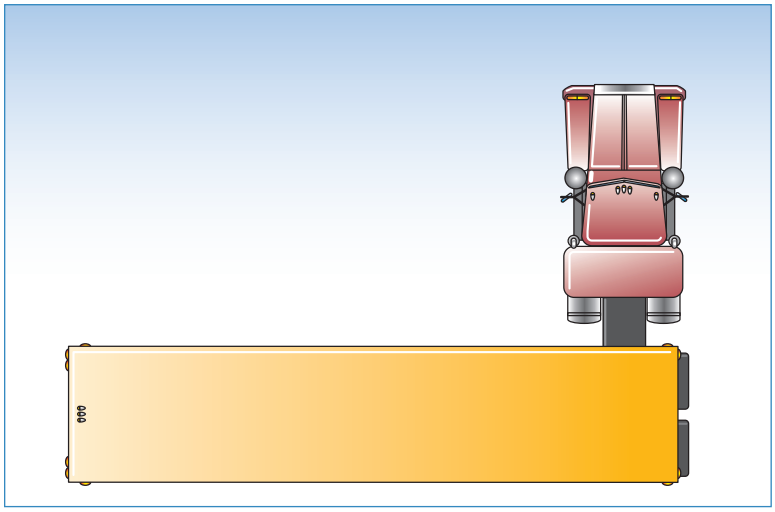
- Perform straight-line backing manoeuvres with a tractor-trailer unit.
- Perform offset backing manoeuvres with a tractor-trailer to the right and to the left.
- Perform alley-dock backing manoeuvres with a tractor-trailer to the right and to the left.
- Demonstrate how to couple and uncouple a tractor-trailer.
- Explain the safety precautions necessary with coupling, uncoupling and backing.
- Slide the fifth wheel and the trailer axles.
- Explain the importance of tire chains and when they're needed.
- Repair a broken chain.
- Install tire chains on a tractor-trailer.

Backing basics

Backing up a tractor-trailer can be challenging for new truck drivers or drivers in training. The best you can do is practice (a lot). You'll get more confident as you gain experience backing up and become more comfortable doing it. There isn't a truck driver anywhere that can perfectly back up every time. Take it slow and don't let anyone rush you. With practice, you'll begin to understand which way to turn and what the tractor-trailer will do.

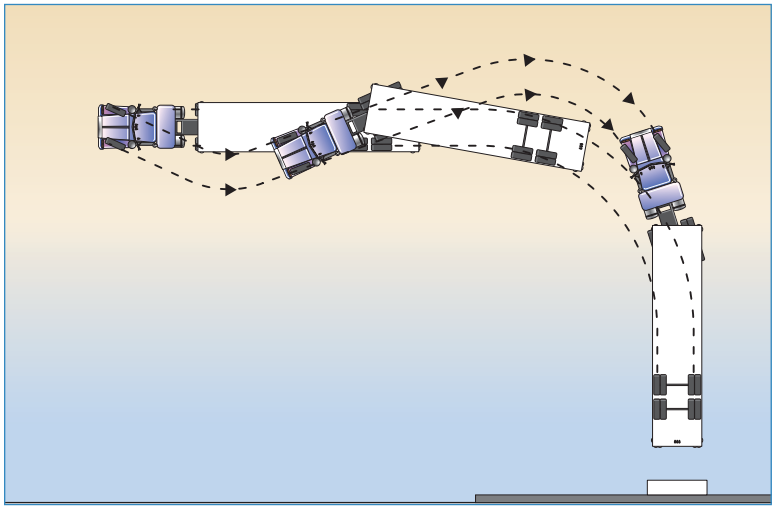
Backing up a single-unit vehicle is done in the same way as backing up a passenger vehicle; the top of the steering wheel moves in the direction your vehicle will go when backing up.

A tractor-trailer combination vehicle handles differently than a single-unit vehicle when backing because it has a pivot point where the trailer connects to the tractor. If you steer to the right, the rear wheels of the tractor move to the right. However, the trailer will pivot to the left. If you continue backing, the tractor and trailer will eventually meet at a sharp angle (90 degrees or more) called a jackknife. Turning a tractor while backing and causing the trailer to assume a jackknife position is called jacking.



Therefore, to prevent jacking, all of your steering actions need to be reversed. To move the back of the trailer to the left, steer right. To move the back of the trailer to the right, steer left.

As your trailer begins to turn, your tractor must begin to follow a path that matches the trailer's path. This is called chasing and, if not done, you risk jackknifing your vehicle. A tractor-trailer combination backing into a normal right-angle turn would follow an S-shaped curve.



General tips for backing

Backing any vehicle is risky and can be dangerous because you can't see everything behind your vehicle.

Start in the best position — Always start with a plan. Every backing manoeuvre starts with getting into a good position while travelling forward. A critical part of the setup is to get the back of the trailer as close to where you want it while going forward. The back of the trailer is the most difficult part to get into position, so always start with it as close to your target as possible. This position will depend on the type of backing to be done.

Adjust your mirrors — Make sure mirrors are adjusted for optimal viewing while backing.

Turn on your four-way flashers — Secure the vehicle and activate flashers.

Get out and look (GOAL) — Before backing, get out and walk around the vehicle. Check for obstructions and hazards. Check your clearance to the sides and overhead, as well as in and near the path your vehicle will take. Make note of any reference points that you'll need to see in the mirrors on either side of your vehicle as you back up. If things change, stop, get out and look again. **Remember:** always secure the vehicle by setting your tractor and trailer parking brakes whenever you get out and look.

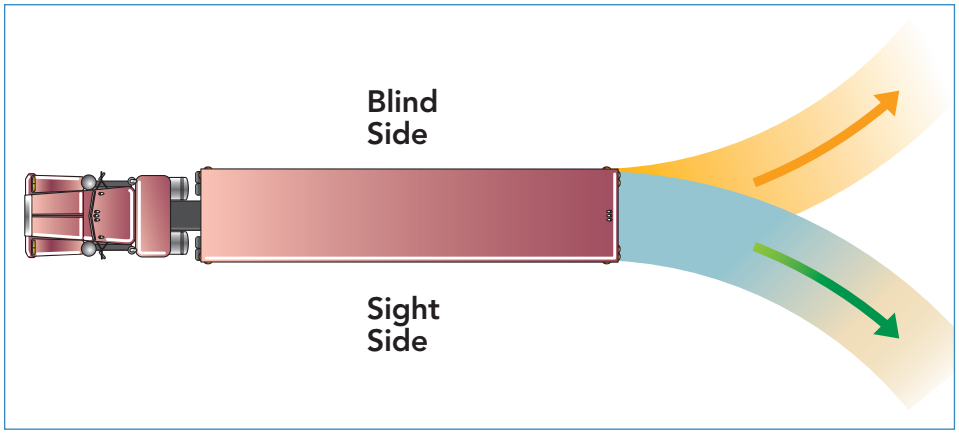
Silence your audio and roll down the window — This will give you a better view in the mirror and you can listen for any warnings when backing.

Sound horn — Sound the horn twice to start out and then twice for every vehicle length while backing.

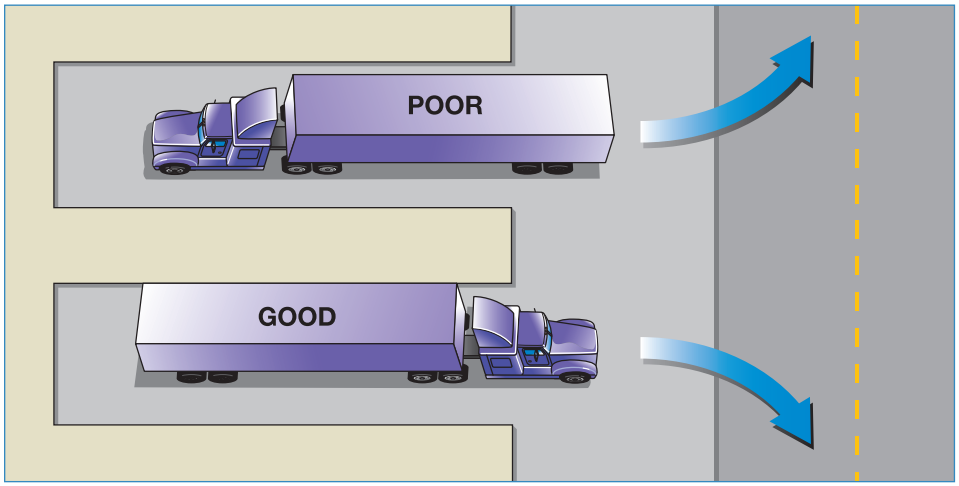
Use mirrors on both sides — Check the outside mirrors (flat and convex) on both sides frequently. Get out of the vehicle and check your path if you're unsure.

Back slowly — Always back as slowly as possible using the lowest reverse gear. That way you can easily correct any steering errors and stop quickly if necessary. It's easier to pull up and restart a backing manoeuvre than it is to try and correct it while reversing. Remember, when you turn the steering wheel to the right, the rear of the trailer goes left and when you turn the steering wheel to the left, the rear of the trailer goes to the right.

Back and turn toward the driver's side (Sight-side) — Set yourself up so you're backing to the sight-side, as it's much safer than blind-side backing. If you back and turn toward the sight-side, you can watch the rear of your trailer by looking out the side window when the angle between tractor and trailer gets too great to see it in your mirror. Use sight-side backing — even if it means going around the block to put your vehicle in this position — the added safety is worth it.

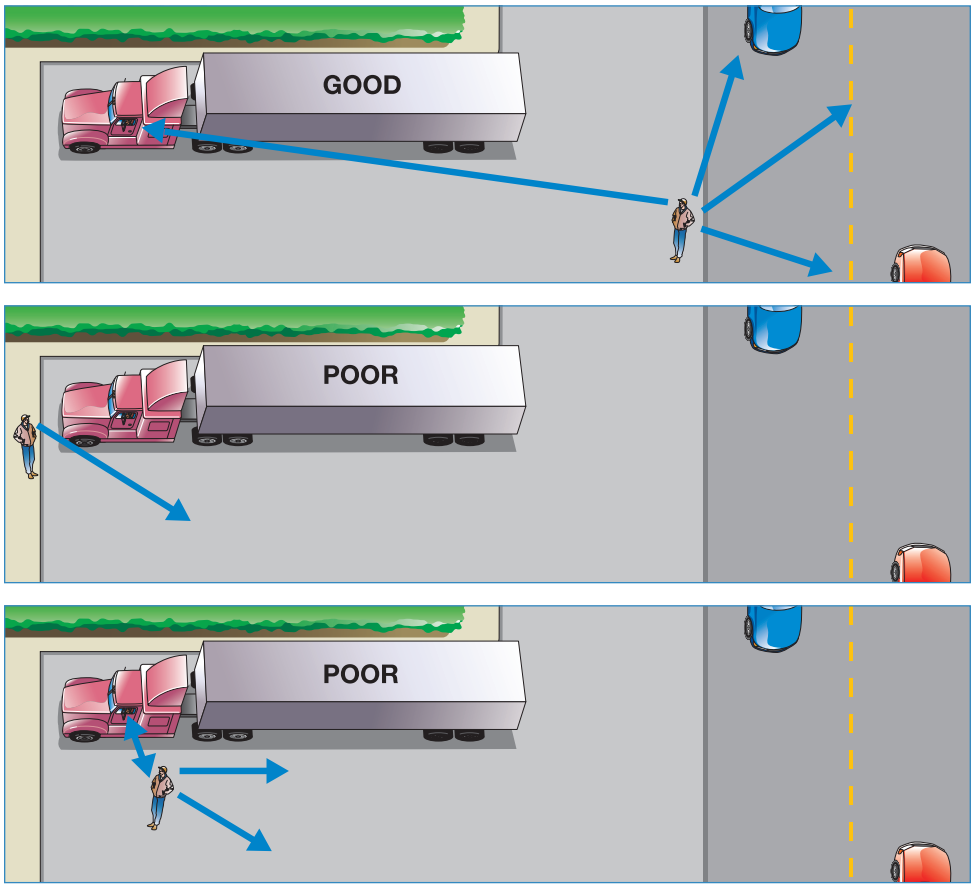


Back out of traffic — It's easier to back out of traffic than into traffic. In the following image, the driver in the vehicle at the top drove straight into the loading dock and will now have the difficult task of backing into traffic to get back onto the road. The driver in the vehicle at the bottom backed out of traffic into the loading dock and can now easily drive forward to get back onto the road.



Use a guide — Use a reliable guide whenever one is available. The guide should stand near the back of your vehicle where you can see them in the driver's side mirror and they can see behind your vehicle. If you can't see your guide, stop!

Placement of a guide



This image highlights hand signals typically used for backing.



Four backing manoeuvres

There are four different backing manoeuvres.

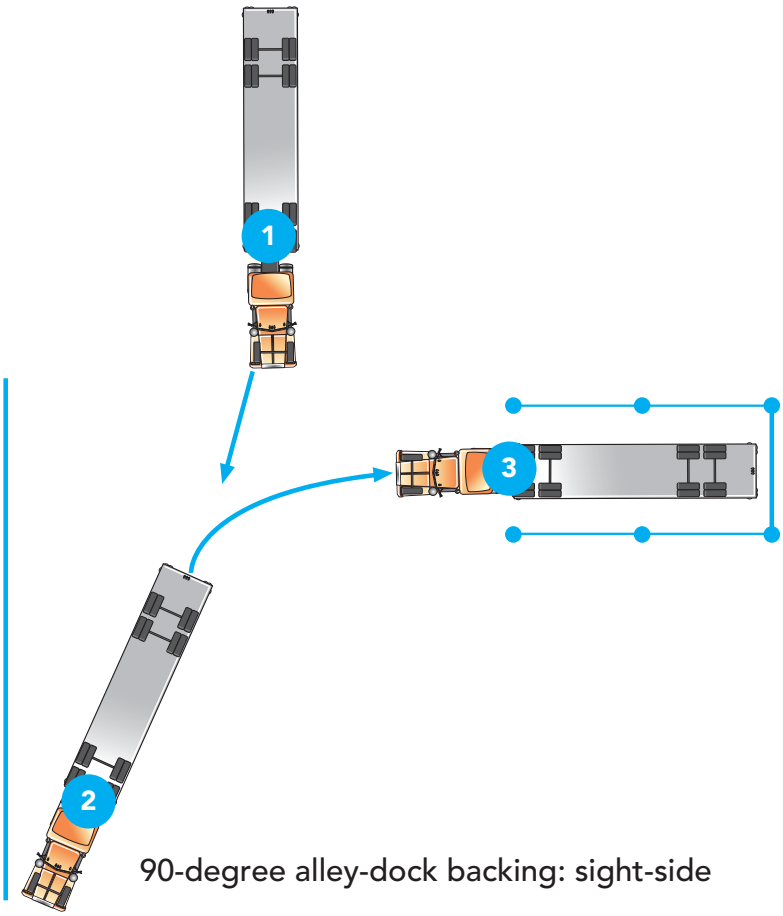
1. Straight back-up

Straight-line backing is the simplest manoeuvre to learn. It's fundamental in order to learn all other backing manoeuvres. While executing a straight-line backing manoeuvre, the vehicle should be positioned straight and shouldn't drift to either side.

- The earlier a drift is detected, the less steering input will be needed to correct the drift.
- If drifting can't be easily corrected, pull ahead, reset and start the manoeuvre over.
- It's easier to start over than to reposition the vehicle while backing. Selecting reference points behind the trailer will help you recognize if the vehicle is drifting.
- Ensure you're checking mirrors on both sides of the truck to help stay in a straight line and identify any hazards that may enter your path. Every time you check your flat mirror, you should also check your convex mirrors for hazards that are close to your tractor, such as curbs and concrete barriers.
- If someone or something enters your path, stop and, if necessary, get out and look again. Remember that before you exit the cab of the tractor each and every time, you must set the tractor and trailer parking brakes so the vehicle is secure.
- Remember to honk twice when you start your backing and then again for every vehicle length as you proceed backwards.
- If you're backing to a loading dock, remember to open the trailer doors before you reach the building.

2. 90-degree alley-dock

Alley-dock backing involves backing while turning into a space that is 90 degrees to the truck. It often occurs at loading docks when the driver must back in from off the street or between two vehicles. The manoeuvre combines sight-side (from the driver's side) backing and straight-line backing. It requires patience and extreme caution. Continually check your vehicle's clearance and watch for other vehicles, pedestrians or objects that may move into the path of the vehicle after the start of the manoeuvre.



90-degree alley-dock backing: sight-side

- Pull forward in a straight line near the entrance to the loading dock or parking space. Check your mirrors for obstructions. Pull up and stop with the tractor opposite the space you need the trailer to enter and ensure there are no obstacles (such as pallets or dock plates) that have been left in your way.

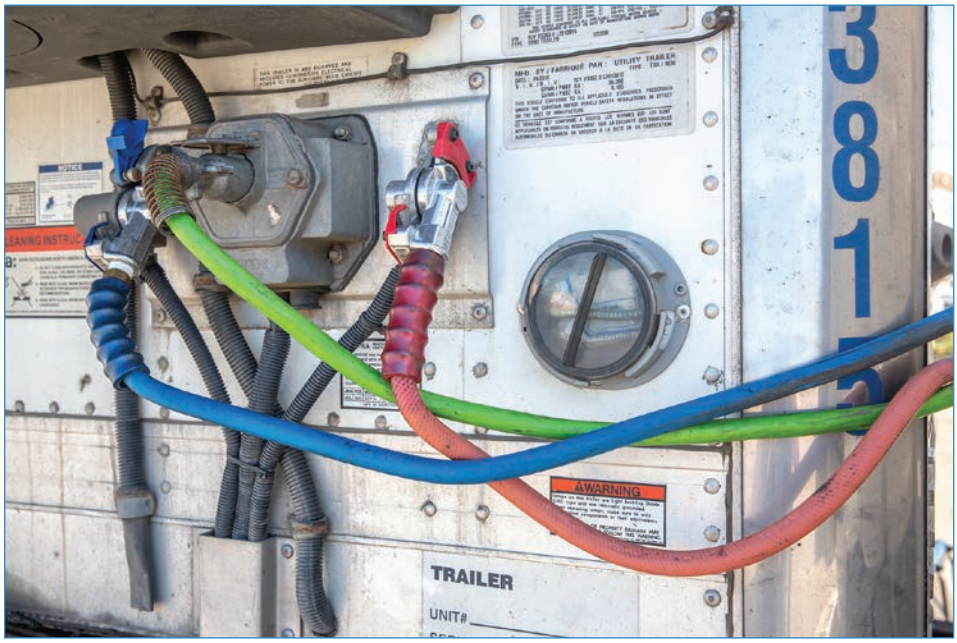


- Drive past the mouth of the space and proceed until the trailer landing gear (16-metre/53-foot trailer) is in line with the left side of the space, then turn hard to the right. How far you pull the trailer forward until you start to turn to the right will depend on the wheelbase of your trailer as well as how sharp your tractor turns. The wheelbase of a semi-trailer is the distance from the centre of the kingpin to the geometric centre of the axle group.
- Continue to move forward slowly. When the tractor is positioned at about 12 o'clock, turn to the left and continue to move slowly until the trailer is at a 45-degree angle. When you can see the dock or parking space in your left mirror, straighten your vehicle and stop. This sets up your trailer to head in the direction you need it to go.
- You'll now need to use a combination of jacking and chasing manoeuvres to back your trailer into the space as required. Keep in mind, you may need to get out and confirm your clearances on the right side of the trailer since you can't see them from the driver's seat. You may need to pull up and reset if you've jacked too far or not chased soon enough. You must also make sure to activate your 4-way flashers and sound the horn prior to backing.
- If space allows, once the back end of the trailer is partway into the space, pull ahead and reposition the unit to make it easier to complete the move. Turning the 90-degree dock into a straight-line back is safer as you can see down both sides of the trailer.
- Remember to open your trailer doors prior to finishing your docking unless you have a roll-up door. Always stand out of the way when opening the trailer doors in case the cargo has shifted, which could fall out on top of you. If your trailer has a seal on the door, you'll need to have the receiver remove it before you open it.

- Occasionally, if space is at a premium, you may have to finish with your tractor in a jackknife position so traffic can get past the front of your truck.



- Be sure to check that your air lines and light cord will stretch far enough prior to finishing the jackknife so you avoid damaging the lines.



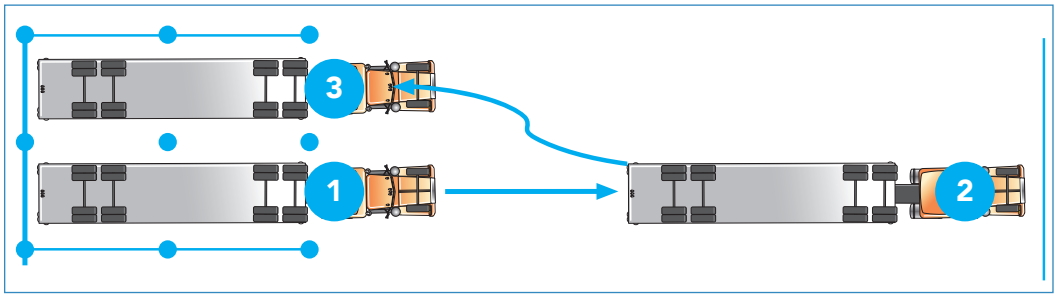
- Be aware that the tail frame of your tractor will likely stick out past the side of your trailer, so make sure there's enough clearance before you complete your move.



- Blind-side alley-dock parking should be avoided, if possible, as it's a high-risk manoeuvre. Circle around the block and come back to the dock from the opposite direction, so you're backing to your sight-side. If you have no choice but to blind-side back, use a guide. This course will teach you to blind-side alley-dock with the help of a guide.

3. Offset backing

Offset backing is used mostly when you need to realign yourself with your target. The need for this is generally due to not setting yourself up perfectly for a straight-line back or when you need to make a small correction.



If you need to realign, you can do that as you pull ahead as well as when you're backing. The biggest mistake new drivers often make when realigning is that they attempt to move their entire unit too far laterally at once for the amount of space they have. Realignment is done in the shortest distance with the use of an "S" manoeuvre.

If you need to move over 1 m (4 ft) to realign, it may take you two or three moves to complete that task depending on the space you have available. Using the "S" manoeuvre, you may be able to move your unit over 0.3 m (1 ft) as you pull up and then another 0.3 m (1 ft) as you do an offset back. You would then need to repeat the process to have moved over a metre (4 ft). If you have lots of pull up space, then you could complete this in one move.

Less experienced drivers sometimes get themselves into trouble because they attempt a bigger "S" manoeuvre than the space they have will allow them to complete.

There's no shame in pulling up to reposition. Be sure that every move you make improves your situation, whether it's moving forward or backward. Getting out and looking will keep your equipment and pedestrians safe and prevent incidents. There's never a valid reason to hit something when backing — it usually happens when drivers don't look or are unaware of their surroundings. Remember to always set your tractor parking brake before leaving the cab.

Sight-side offset backing — Sight-side backing is backing toward the left side of the vehicle. The driver can see the intended trailer path. Sight-side backing is preferred, as the driver has maximum visibility.

Blind-side offset backing — Blind-side backing is backing toward the right side of the vehicle. The driver has limited visibility and can only see in the truck's rear view mirrors. Blind-side backing is more dangerous than sight-side backing and should be avoided when possible. Stop often and get out of the tractor to check your position. Use a guide for this manoeuvre when possible.

4. Parallel parking

Parallel parking involves backing into a space along a curb or dock. You can also think about this as being a lane change while backing. It's similar to offset backing, except you're moving over the full width (3.7 m/12 ft) of a lane.

- Position your vehicle next to the other parked vehicles. Leave about 1 m (4 ft) between the vehicles.
- Pull forward in a straight line near the parking space.
- When the rear tandem axles of the trailer are about 3 m (10 ft) in front of the parking space, stop. Set the tractor and trailer parking brakes, exit the vehicle and do a visual check. Always check vehicle positioning.

- Get back into the vehicle and release the tractor and trailer parking brake, put your 4-way flashers on, and sound the horn twice. Then start backing slowly with the steering wheel turned to the left. The trailer should be entering the space at about a 15-degree angle.
- Turn the steering wheel sharply to the right and continue backing until the tractor and trailer are in a straight line. The middle of the vehicle should be in the parking space. Continue to back until the front of the trailer is even with the front of the parking space.
- Turn the steering wheel sharply to the right and keep backing until the trailer is parallel in the parking space.
- When the trailer is almost parallel to the packing space, turn the wheel all the way to the left and follow the trailer into the space. Any corrections can be made by pulling forward to straighten out the units.
- Remember that it's sometimes easier to restart the manoeuvre than it is to try and correct what's wrong.
- Ideally, you want to be within 30 cm (12 in) of the curb.

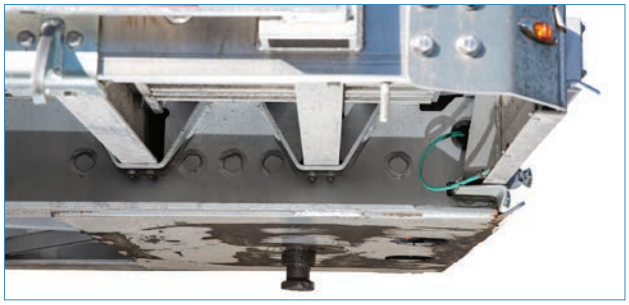
Sliding the fifth wheel

You'll recall that the fifth wheel coupler, often just referred to as the fifth wheel, is a skid plate mounted on the tractor chassis with a latching mechanism that couples or connects to the trailer kingpin. Most tractors have fifth wheels that can be slid forwards and backwards on a track. You may need to move your fifth wheel to accommodate different trailers or to ensure the correct weight distribution between the drive and steer axles of the tractor.

The majority of 16 m (53-ft) trailers today come with a 1 m (3 ft) pin setting — that means the kingpin located 1 m (3 ft) from the front of the trailer as in the image below:



Other trailers could have different pin settings from a shallow 46 cm (18 in) to some older trailers that are up to 1.8 m (6 ft) deep, as shown in the image below:



As part of your coupling, you'll need to check your trailer's kingpin setting as well as the location of trailer landing gear. Some pup trailers have landing gear that's close to the front of the trailer, which could interfere with the tail swing of your tractor. If the mud flaps on the rear of your tractor are removable, you may need to take them off to help with the swing clearance space on some landing gear. Ensure your fifth wheel position will prevent the trailer from striking the back of your cab, as well as the tractor tail frame from contacting the landing gear of the trailer.

Although all of the cargo is carried in the trailer, when you couple to the tractor weight is transferred to the tractor. The position of the fifth wheel plays an important role in tractor weight distribution and generally there's only one position that will give you the perfect weight distribution between drive and steer axles. Some tractors are dedicated to only one trailer so they may have a stationary fifth wheel, but most are equipped with one that's adjustable. If you slide the fifth wheel toward the nose of the tractor you will increase the weight on the steer axle and take weight off the drive axles. If you move the fifth wheel toward the rear of the tractor, you will increase the weight on the drive axles and decrease the weight on the steer axle.

You'll inspect your fifth wheel and attachments as part of your pre-trip inspection as well as anytime you're coupling to a trailer. There are several different styles of slide tracks in the industry and the newer tractors tend to have ones that are easier to slide as the fifth wheel sits on top of the rail. Before you attempt to slide your fifth wheel, ensure the track is free of dirt and sand as this will prevent the plate from moving. In some extreme cases, you may have to have the mechanism pressure washed to get it to move.



Fifth wheel track mechanism







Fifth-wheel plate

Steps for sliding the fifth wheel:

- Park the vehicle in a straight line on level, stable ground
- Apply the tractor and trailer brakes
- Exit the cab and lower the landing gear until it just touches the ground
- Note with a Holland ILS style slide, you may be able to move the fifth wheel without putting the trailer landing gear down
- Enter the cab and release the tractor brakes
- Set fifth wheel switch to "Unlock"
- Dump air from the tractor suspension, if applicable
- Wait for the suspension pressure gauge to read 0 p.s.i.
- Re-apply the tractor brake
- Exit the cab and visually check to see if the slide mechanism is unlocked
- The fifth wheel will be hanging from the trailer kingpin
- Ensure that the track isn't packed with debris
- Enter the cab and release the tractor parking brakes/engage the inter-axle differential lock
- Gently pull forward or backward as required to reposition the fifth wheel
- Damage to trailer landing gear could result from being too aggressive with your movements
- Once the fifth wheel is in the desired location, return its switch to the "Lock" position
- Perform a gentle tug test to ensure the fifth wheel is locked
- Refill the suspension, if applicable/disengage the inter-axle differential lock
- Apply the tractor parking brakes, exit the cab and check that the fifth wheel is locked
- Raise the landing gear and secure the handle

Sliding a trailer axle

Some trailers have sliding trailer rear axles which assist in transferring weight between the tractor and trailer to achieve proper distribution of weight. For example, when the trailer axles are adjusted toward the rear of the trailer, the amount of weight on the tractor will increase. However, when the trailer axles are adjusted forward, the weight will be shifted off the tractor and onto the trailer axles. If you're travelling between different jurisdictions, you may also have to slide your axles to meet trailer wheelbase regulations that are different from your home province or territory. Keep in mind that when you're finished sliding trailer axles (bogies) for weight distribution, the trailer wheelbase and rear overhang must still meet local legal requirements.

Steps for sliding a trailer axle:

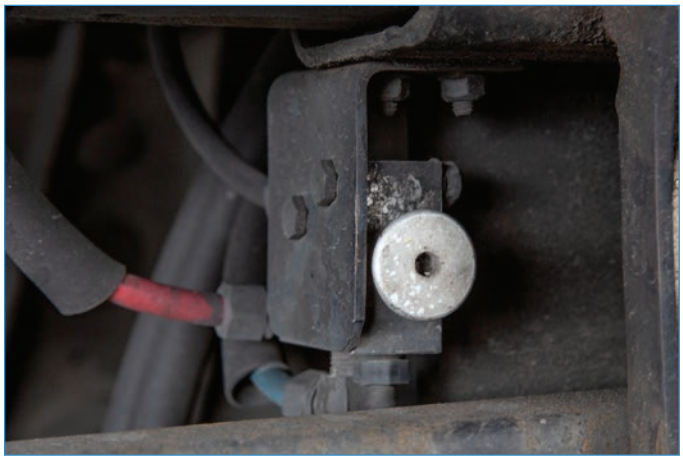
- Park vehicle in a straight line on level, stable ground
- Apply tractor and trailer brakes
- Deflate trailer air suspension, if equipped and it's a type that can be drained



- Pull and lock handle and latch it open or push the air-operated button to release the sliding axle locking pins



Sliding axle locking pin handle



Air-operated sliding axle release button

- Confirm all sliding axle locking pins are disengaged



Sliding axle and locking pin handle

- Enter the cab and release the tractor parking brakes only/engage the inter-axle differential lock
- Gently pull forward or backward as required (If the pins didn't unlock, you may have to rock the trailer first to unlock them)
- Once the trailer axles are in the required location, apply the tractor parking brakes and exit the cab
- Release the lock handle or pull out the release button to relock the slide pins
- Enter the cab and release the tractor parking brakes
- Move slowly until you hear/feel pins lock in/rock back and forth to ensure all pins are locked in
- Apply the tractor parking brakes and exit the cab
- Visually check all sliding axle pins are properly set — re-inflate the air suspension in the trailer



- Visually check for any air lines that are hanging down and secure, if required
- Enter the cab and disengage the inter-axle differential lock
- Perform a tug test to ensure all the sliding axle pins are securely locked
- Check your axle weights on the scale or measure the trailer wheelbase depending on the reason for sliding the axles

Coupling and uncoupling a tractor-trailer

Having the knowledge and skills to correctly connect and detach the trailer from the tractor is a major responsibility of every professional driver.

Coupling a tractor-trailer

1. Inspection of the yard prior to coupling

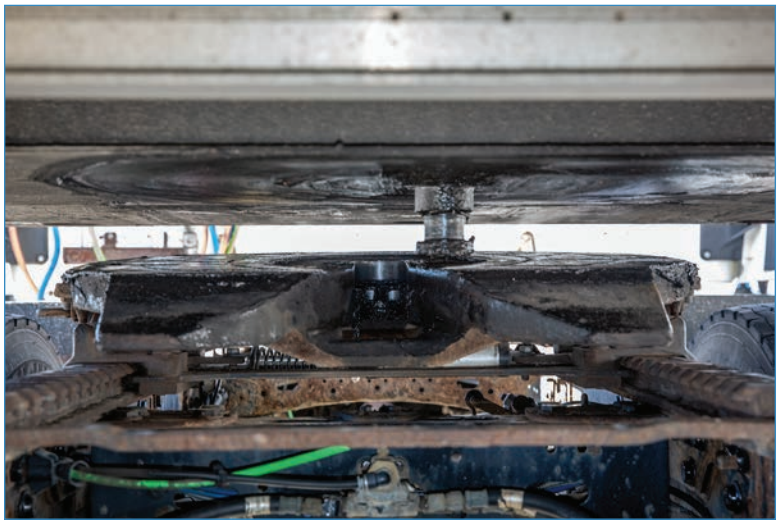
- Walk the area around the trailer and tractor before beginning the coupling procedure.
- Look for anything in the path that could obstruct the tractor and trailer. Make sure it's clear before beginning the first stages of alignment.

2. Align tractor and trailer

- Enter the tractor, release the tractor parking brakes.
- Turn on four-way flashers, engage your inter-axle lock if on uneven ground or in slippery conditions and sound the horn twice.
- Back the tractor at a walking pace. Position the tractor so the centre of the fifth wheel is in line with the trailer kingpin. Look in the mirrors or through the rear window (if equipped). As you get closer to the trailer, you'll need to rely on your convex mirrors.
- Stop just before the fifth wheel makes contact with the trailer apron.



- Know the width of the tractor compared to the trailer. Typically, trailers are 2.6 m (8.6 ft) wide and the outside edges of your drive axle tires are 2.4 m (8 ft) wide, so you need 7.6 cm (3 in) of trailer overhanging each side of your tires. Remember that the centre of the fifth wheel is always in the centre of the tractor frame and the kingpin is always in the centre of the front of the trailer.
- If you need to adjust to the trailer height, deflate the tractor air suspension. Set the tractor parking brake and get out to check the alignment of the fifth wheel with the kingpin. It's much easier to spot any extreme offset from the ground than it is from the tractor.



Trailer kingpin misaligned with fifth wheel centre



Trailer kingpin well-aligned with fifth wheel centre

3. Inspection of the tractor

- The fifth wheel is tilted back and the fifth wheel locking jaws are in the unlocked/open position.
- There's enough grease on the face of the fifth wheel plate.
- The fifth wheel slide is locked into place, free of damage and securely mounted.



- Air and electrical lines aren't damaged and are properly secured.

4. Inspect the trailer

- Check that the trailer spring brakes are applied, or if no spring brakes, that the wheels are chocked. You'll need to connect your air lines to the trailer, charge it with air and, if there are no spring brakes, use your hand valve to stop it from rolling as you couple.
- Check that axle slide pins are locked as shown in the image below:



- Check the condition of the trailer kingpin and apron, including the collar, and remove any kingpin locking devices. Check for excessive wear or cracks.

- Check the location of the kingpin and landing gear relative to the front of the trailer to ensure your tractor fifth wheel setting will work. Remove your mud flaps for extra clearance on the landing gear, if required.
- Check the height of the fifth wheel relative to the trailer apron. Ensure it will go underneath the trailer without touching and raise the trailer with the landing gear as required to accommodate.

5. Connect the trailer

- Re-enter the tractor and shift to reverse gear and release the tractor parking brakes.
- Reverse the tractor until the fifth wheel is fully under the front of the trailer, but still ahead of the kingpin. It can be helpful to note the location of the fifth wheel relative to your drive tires so you have an idea of how far to back up to get the fifth wheel under the trailer.
- Restore the tractor air suspension to its normal height.
- Apply the tractor parking brake, exit the cab and visually check that there's no air space between the face of the fifth wheel and the bottom of the trailer apron.
- Re-enter the tractor and shift to reverse gear and release the tractor parking brake.
- Watch the trailer in your mirrors as you back up slowly and smoothly to make the connection.
- Have your window open so you can hear the click; you should also feel the fifth wheel lock into place.
- Set the tractor parking brakes and exit the cab. Raise the landing gear until it's 5 cm (2 in) off the ground to ensure you won't damage it from any lateral movement as you lock into the fifth wheel.

6. Tug test

- Release the tractor parking brakes. Select low gear and attempt to move the tractor forward.
- The tug test must be firm enough to overcome the friction between the fifth wheel and the trailer's upper coupler plate. This should be done at least twice to verify the fifth wheel has locked around the kingpin.

7. Confirm fifth wheel is locked, raise the landing gear and connect air lines

- Set the tractor parking brakes and exit the cab. Visually check that the nut and washer (if equipped) are flush with the front of the fifth wheel, the release handle has retracted and is slack and there's no air space between the top of the fifth wheel and the trailer upper coupler plate.
- Go under the trailer, and using a flashlight, visually confirm the lock jaws are closed around the kingpin, or the lock bar is across the pin depending on the brand of fifth wheel.
- Fully raise the landing gear, then release slightly to prevent sticking during cold weather. Stow the landing gear handle into its retainer.
  - Never drive with the landing gear partway up.
- Inspect and connect air and electrical lines:
  - Lines are usually coloured red for supply and blue for service.
  - Check the seals and secure each air supply line to the appropriate trailer connection.
  - If the air lines are crossed, supply air will be sent to the service line instead of the trailer air tanks. This will not allow the release of the trailer parking brakes.
  - Check the condition of the trailer and tractor electrical connectors. Ensure the electrical cord is secured properly by the lock on the flap.

8. Supply air check

- Re-enter the vehicle and supply air to the trailer with the trailer supply valve.
- Re-charge the trailer air suspension (if applicable).
- Complete your pre-trip inspection.

Uncoupling a tractor-trailer

1. Location inspection

Ensure that the selected location and ground condition are level and strong enough to support the trailer landing gear, particularly if the trailer is loaded.

2. Position the tractor and trailer in a straight line.

3. Set the trailer parking brakes and ensure the tractor parking brakes are released.

4. Adjust suspension

- Dump the trailer suspension, if equipped with a manual air ride.



- Confirm that the suspension has deflated if equipped with an auto-dump.

5. Reverse gently to relieve kingpin pressure on fifth wheel locking jaws.

- Apply the tractor parking brakes and exit the cab.

6. Lower landing gear and block trailer wheels

- Block trailer wheels, if applicable, and place supports under the landing gear, if required.
- Lower the trailer landing gear until it touches the ground and ensure both legs touch at the same time.
- Crank until most of the trailer weight is on the dollies and not the tractor. This will be identified when airbag suspension begins to auto-deflate as weight is removed from the tractor.
- After the landing gear is lowered, place the crank handle into its travel position.

7. Remove connections

- Disconnect electrical connection and air lines.
- Hook glad hands to dead end couplers on the tractor.
- Stow electrical connection in the holder on the back of the tractor.



8. Unlock and disengage the fifth wheel

- Unlock the fifth wheel using a puller bar. If the lock mechanism is stuck, you may have to release the tractor brakes and gently back the tractor against the trailer kingpin to release the tension and then reapply the tractor park brakes. This should allow you to unlock it.
- Re-enter the cab and release the tractor parking brakes and drive the tractor ahead 15 to 25 cm (6 to 10 in) off of the pin. Apply the tractor parking brakes and lower the tractor air suspension. Set the tractor parking brakes and get out and ensure the weight of the trailer has been transferred to the trailer landing legs — there should be a large air space above the fifth wheel.

9. Confirm stability of trailer

Check again that the ground and the landing gear are supporting the trailer.

10. Clear trailer

- Re-enter the tractor, release the tractor parking brakes and slowly drive forward until the tractor is clear of the trailer.
- Re-inflate the tractor air suspension, if applicable.
- Re-install mud flaps, if they were removed.

Coupling and uncoupling pintle hitch attachments

The steps for coupling pintle hitch attachments are:

- Position the towing/power unit in line to receive the pintle eye.
- Stop the towing/power unit before contact is made with the pintle eye.
- Chock the trailer wheels, if not equipped with spring brakes.
- Ensure pintle hook is open to receive pintle eye.



- Ensure pintle hook and eye have no cracks and or signs of excessive wear.
- Ensure pintle eye is the proper height to lower onto the pintle hook, adjusting the drawbar height if necessary.
- Position towing/power unit so the pintle eye can be lowered onto the pintle hook.

- Snap pintle hook shut and ensure safety latch is locked.



- Properly attach safety cables/chains to the towing/power unit. Fasten safety pin, if applicable.
- Raise any drawbar support legs and connect air and electrical cords as required.
- Double check that the “no-slack” air ram is functional.



Steps for uncoupling pintle hitch attachments are:

- Park the towing/power unit and trailer in a straight line.
- Set the parking brakes of the towing/power unit and trailer.
- Chock the trailer wheels, if not equipped with spring brakes.
- Disconnect air lines, electrical line and other associated hoses, if applicable.
- Disconnect safety cables/chains from the towing/power unit.

- Disconnect the safety pin, if equipped.
- Release the pintle hook locking (safety latch) mechanism.
- Lower landing leg, if equipped; otherwise, block the drawbar when required.
- Move the towing/power unit ahead slowly until the pintle eye completely clears the pintle hook.
- Stop and visually check that the pintle eye is free of the pintle hook.

Double trailer combination types

When adding a second trailer to the rear of a lead trailer, an additional fifth wheel is needed. Sometimes we need a converter dolly (converts a semi-trailer to a full trailer) and sometimes the fifth wheel is a permanent extension of the lead trailer. There are three different types of double trailer combinations.

A-train

This converter dolly has an A-shaped drawbar that joins into a single pintle hitch point on the lead trailer. Due to its 'A' shape, it's often called an A-dolly. When two trailers are joined together using the A-dolly, the whole unit is called an A-train. These converters provide two points of articulation (joints that allow side-to-side or lateral movement). One of these points is at the pintle and the other is at the fifth wheel.



B-train

In a B-train, the fifth wheel is mounted to the frame of the lead trailer. Some B-train lead trailers have slide away dollies so they can be backed up to loading docks to be loaded or unloaded or have a power tailgate installed. When you don't need the fifth wheel, it slides underneath the back of the trailer out of the way. The lock pins for the slide away dollies are air operated and the trailer has a third glad hand on the front, which you supply with air to unlock the pins so you can slide the dollies in or out. Always confirm the lock pins for the slide away dollies are locked back in before driving away or coupling up your B trailer.



C-train

The C-train is like the A-train, in that it uses a separate converter dolly. The difference between the two is that the C-train has two drawbars (shaped like a "C ") and requires two pintle hitches on the back of the front trailer.

Two bars mean there's only one articulation point. The result is that the second trailer is more stable and moves less from side-to-side. To improve performance even more, some double drawbar converters have a self-steering axle.

When driving a C-train, check that the air pressure on the self-steering axle is within the manufacturer's standards. If the air pressure falls too low, the wheels will steer too much and the unit will become unstable. Lock your steer axle straight when running on highways particularly at high speeds and unlock it when you're in low-speed, tight-turning situations in a city or town.



Link-up arrangement

When linking two or more trailers to a towing unit, always hook the heaviest trailer directly to the tractor. The lightest trailer should be the furthest away from the towing unit. This rule applies no matter how long each trailer is. If the trailers are not joined according to weight, the unit will be unstable. The rear trailer will sway and control of the unit could be lost.

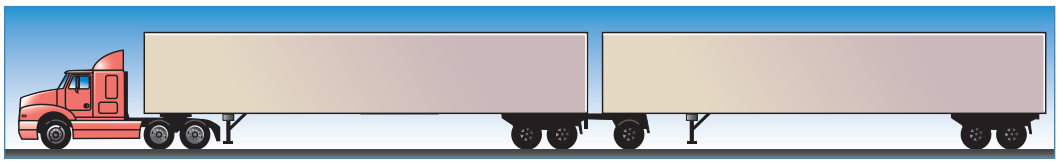
Examples of long combination vehicles (LCVs)

Carriers are required to obtain special operating permits from B.C.'s Commercial Vehicle Safety Enforcement (CVSE) branch before these vehicles may be operated on designated routes. Drivers of LCVs must have a minimum of 24 months or 150,000 km of experience driving articulated vehicles, and must meet additional training and other requirements before a Carrier may permit them to operate an LCV. They're not to be operated during adverse weather conditions.

Rocky mountain double (Max. 32 m/105 ft overall length)



Turnpike double (Max. 41 m/134 ft overall length)



Tire chains

Commercial drivers who travel outside the Greater Vancouver and Greater Victoria areas in the winter are required to carry chains, or other acceptable traction devices, and comply with all signage and regulations. While it is a requirement to carry chains at specific times and locations during the year, the best practice is to keep chains on board at all times. It is your responsibility to know how to install them.

Rapid changes in elevation and weather can make B.C. highway conditions unpredictable during winter months. Drivers may start a trip in sunshine but face stretches of slush, ice, heavy snowfall or compact snow along the way.

It's the responsibility for the driver of a vehicle to understand the conditions on the roads they travel and prepare their vehicle for those conditions. Drivers must obey winter tire and chain signs throughout the province from October 1 to April 30. For select highways not located through mountain passes and/or high snowfall areas, tire and chain requirements end March 31.

The B.C. Ministry of Transportation and Infrastructure will have signs posted: "Must carry tire chains, October 1 – April 30." Any vehicle found crossing that point without proper tires is subject to a fine. Professional drivers only need to carry, not install, chains at this point. However, when encountering a sign or flashing amber lights with a message that indicates vehicles over a certain posted gross vehicle weight must use chains, then the chains must be installed to meet the minimum government requirements in B.C.



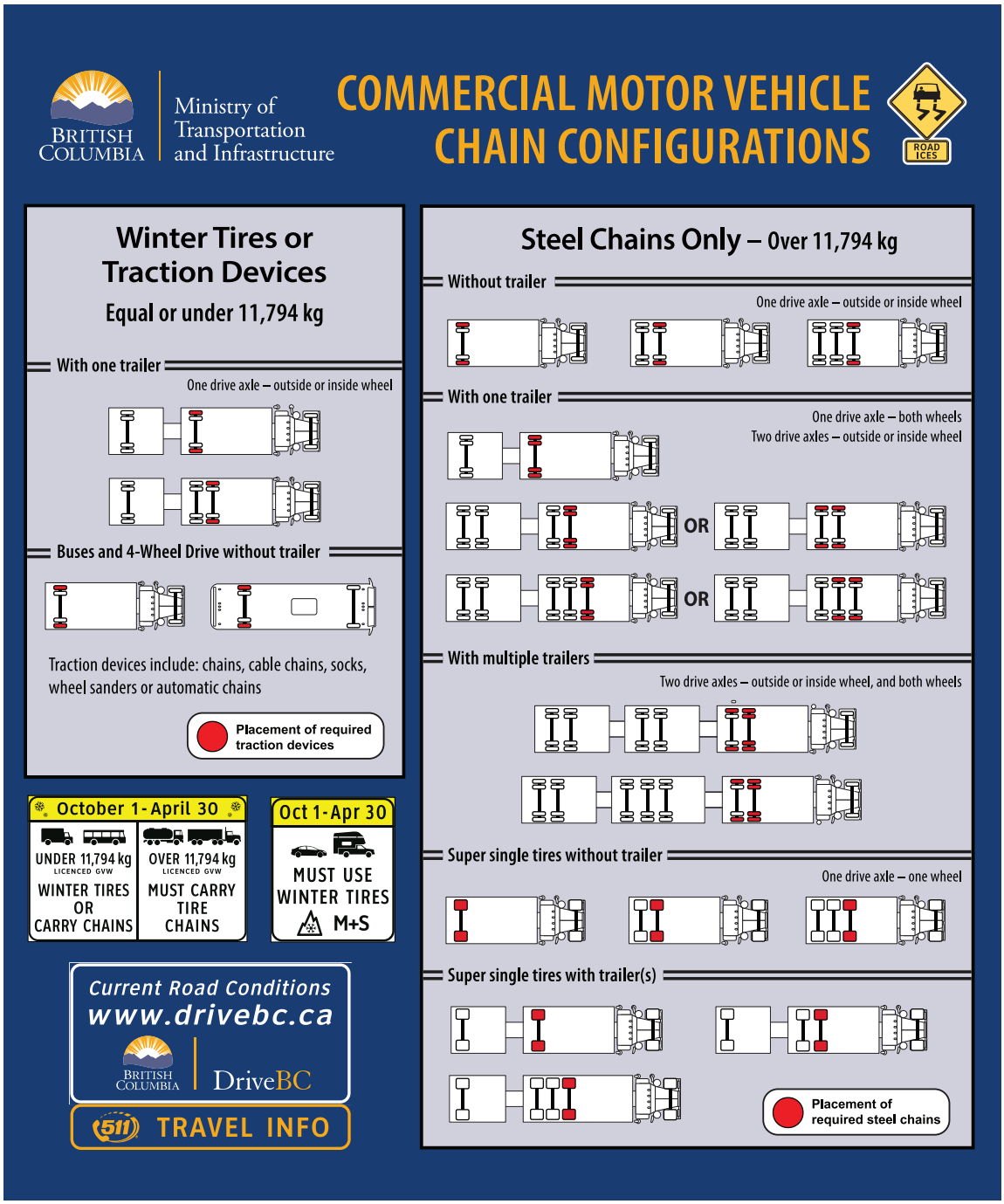


Commercial trucks weighing between 5,000 and 11,794 kg (11,000 and 26,000 lb) licensed gross vehicle weight (GVW) must carry chains or acceptable traction devices, unless the vehicle is equipped with winter-rated tires that have the three-peaked mountain and snowflake symbols or the M & S symbol.

Commercial vehicles that weigh 11,794 kg (26,000 lb) licensed GVW and greater, such as tractor-trailers, are required to carry steel chains on most major highways.

Chain configurations

Depending on the licensed GVW, vehicle type and configuration of commercial vehicle, the requirements vary for type, number and placement of chains or acceptable traction devices.



*Note: The chained tires highlighted are examples and can vary; however, they must be in the same grouping pictured.

Chain requirements

Chains required for vehicles 11,794 kg (26,000 lb) licensed GVW or greater:

Steel chains — It's a requirement that commercial vehicles with a licensed GVW of 11,794 kg (26,000 lb) or greater use steel-link chains. For larger vehicle configurations, they have been proven to provide superior traction and prevent lateral slippage.

Chain and traction device options for vehicles 5,000-11,794 kg (11,000-26,000 lb) licensed GVW

Cable chains — Cable-style chains are lighter and due to their lower profile, don't provide the same level of traction as steel-link chains.

Automatic tire chains — Automatic tire chains are activated and retracted from the safety of the driver's seat, eliminating the need for manual installation of chains.

Wheel sander — On demand, a wheel sander system delivers grit in front of the tire to increase traction.

Textile tire cover — Textile "socks" placed over tires improve traction. They work best on snow and ice and at low speeds. They degrade quickly when used on asphalt and at speeds higher than the manufacturer's specifications.

Tire chain drawbacks

While tire chains are useful and legally required in specific circumstances, they also have limitations and in some Canadian and US jurisdictions may not be legally permitted. Know the rules of the jurisdiction you travel in.

- Driving with chains reduces fuel efficiency and the allowable speed of the vehicle drops significantly to only 50 km/h.
- Tire chains can be very harmful to developed roads and should be kept off of any dry/barren surfaces.
- Chains must be secured tightly on the tire and periodically checked. Most owner's manuals recommend that you re-check the tightness of the tire chain from time-to-time, as they can loosen on their own while the vehicle is being driven.
- Use caution when operating with tire chains. If the tire chains come loose and slide off or break, they can cause damage to the tractor, as well as the trailer. They can even wrap around the axle, damaging it and severing air lines. However, if used properly, they can make the difference between you arriving safely and delivering your load on time, or not.

Common causes of tire chain failure:

- Driving too fast with chains.
- Driving on dry roads with chains for extended periods of time; this will rapidly wear the chains.
- Not securing the chains tightly enough.
- Accelerating too rapidly causing tire spin and stress on chains.
- Attempting to lift a loaded vehicle off on a hill without enough tire chains installed.

Stricter chain-up rules in B.C.

In the winter of 2018, unprepared commercial trucks caused 41 highway closures in B.C. because they were either poorly equipped or unequipped with chains. In some cases, this was due to the driver's inability to install the chains properly. Loss of traction in winter conditions leads to crashes and commercial vehicles spinning out on hills and blocking all lanes until they can be towed. New laws were introduced as a result.

Commercial vehicles are now restricted from using the left lane northbound on the Coquihalla between Box Canyon and Zopkios. This is to prevent multiple spin-outs from closing the highway. In the event of severe weather, Commercial Vehicle Safety and Enforcement (CVSE) and traffic control will be directing commercial drivers to chain up at the newly expanded Box Canyon chain-up area.

Carrying chains isn't helpful unless you know how to install them. Be sure you have the knowledge and ability to follow the new chain-up regulations. Your employer is required to ensure you're properly trained so ask for help if you're not confident in chaining up your truck.

See B.C. Ministry of Transportation and Infrastructure's YouTube video: "How to Put Tire Chains on a Commercial Vehicle".

How to install chains

Pre-season tire chain inspection

- Prior to your first trip out in October, inspect your tire chains for issues and install them on your tires for sizing.
- Replace any worn, cracked or broken components.
- Ensure your chains are racked/stowed correctly so they're easy to install when needed.
- Make sure your tire chain bungees are in good condition and your cam lock tools fit the tire chains you have.
- Replace or update supplies as needed, such as spare cross links, quick links and chain pliers.

- The middle of a snow storm on the side of a mountain isn't the time you want to be untangling your chains or discovering they're too short to fit your tires.
- Just because the bag the chains came in say they're the right size, this isn't always the case.

Prior to installing chains

- Ensure the vehicle is in a safe location away from traffic.
- Check that the vehicle is parked ideally, in a straight line on a stable and level surface.
- Apply both the tractor and trailer parking brakes.
- Use caution when walking around the vehicle, as the ground may be slippery from snow and ice.
- Wear gloves and high-visibility clothing and dress for the weather conditions.
- Gather your needed equipment: cam-lock tool, chains and bungees.
- Which axles to chain up and how many tire chains you should install will vary depending on your circumstances. In severe situations, you may need to also place a chain on the left rear trailer tire to help stabilize the trailer on the highway.
- If you feel road conditions would require a drag chain on your trailer, it may be safer to wait until road conditions improve to continue your journey.
- If you're pulling a single trailer and are lightly loaded, then installing tire chains over four tires should be adequate.
- If you're pulling multiple trailers or a heavily-loaded single trailer, you should install chains on all eight tires of your tractor's drive axles.
- If you've spun out on a hill and need to lift your load off of the hill, then all eight tires should be chained up to spread the load throughout your drive train and give you the best chance to get moving again.
- When lifting on a steep hill, use your lowest gear and start out as smoothly as possible. Stay in the same gear until the grade lessens enough to allow you to make a smooth up shift. If you attempt an up shift on too steep of a grade, the torque generated will likely break your chains and leave you stranded on the hill with a very expensive bill to replace your chains and possibly for a tow truck.
- Good quality tire chains are expensive ($300 plus per set of triples) and need to be used carefully. Destroying a couple of sets of chains can take all of the profit out of an entire week's work.

Installing chains

- Decide whether you'll be rolling forward or backward onto your chains and ensure there's enough room behind your trailer to back up, if that makes the most sense.
- Drape chains over the top of each tire with the tail chains just touching the ground on the side of the tire that you're going to drive towards.
- With triple chains, place them over the outside tire using the centre rail. Once positioned correctly, unfold the chain on to the inside tire as well.
- Release the tractor and trailer parking brakes and move the vehicle in the direction you determined to roll the chains onto the tires.
- Stop when the hooks are approximately half to three quarters of the way up the tire.
- Re-apply the parking brakes to secure the vehicle.
- Connect the side rails together using the hooks or boomers, depending on the style of chain you have.
- Single chains: do up the inside rail and then outside rail of the tire chain.
- Triple chains: do up the centre rail, then the inside rail and lastly the outside rail of tire chain.
- Tighten chains using the cam-locks, if equipped. If cam-locks are on both outer rails, then tighten the inside ones first.
- Make sure all the chain tails are secure so they don't beat against the trailer or tractor components as you're driving along.
- Installing bungee cords helps take any additional slack out of the chains, especially as they will loosen up as you drive.
- If you're installing chains just to get out of a parking spot and back onto bare roads, the chains don't need to be super tight, as you should only be driving at low speeds.
- If you'll be travelling very far on your chains, stop and retighten them after you've travelled a couple of kilometres. Find a safe place off of the highway to do this.

Note: The tighter the chains are installed, the less wear and tear will occur on the chains and tires.

Removing tire chains

- Remove your tire chains in the opposite order to how you installed them.
- Remove bungees, loosen cam-locks, release outside hook or boomer, inside hook or boomer and finally the centre hook.
- Lay the chains flat on the ground so you don't damage them as you drive off of them.
- Before you hang your chains up, inspect them for damage.
- If you have spare parts and chain pliers with you, repair the chains before hanging them up.
- If you can't repair them, always hang the damaged chains to the outside of the hangers so they're easy to access for repairs when you return to the yard.
- Triple chains should be picked up by the centre rail so they fold in on themselves to be hung up.
- Taking the time to hang your chains correctly makes installing them next time much faster.
- Double check that you've put all your tools and equipment away before continuing your journey.

Chain repairs

Changing cross links

- Spread the chain to be repaired out on a solid surface with the cross links face up.
- Gather enough cross links of the same type and length that need replacing.
- Lay the replacement cross link out flat beside the broken one and ensure there are no twists in it.
- Use your chain pliers to spread out the hooks on each end of the broken cross link.
- Remove the hooks from the side rails and replace them with the new cross link.
- Be sure to put the new crosslink in the same spot as the old one to keep your spacing correct on the chain.
- Use the opposite side of your chain pliers to squeeze the hook ends closed.
- Once all repairs are made, fold the chain over on itself (triple) and pick it up by the centre rail to hang back on the truck. With a single chain, just pick it up and hang on the truck.

Repairing side rails

- Generally, if your side rail breaks it's time for a new tire chain, but emergency repairs can be made to get you off of the road and back to civilization.
- Remove the chain from the tire and lay on a solid flat surface.
- Untangle the chain and ensure that there are no twists in the side rail.
- Use a quick link to repair the break in the side rail.
- If there are several breaks, you may need more than one quick link.
- If the rest of the tire chain is in good shape, you may be able to change the side rail out with one from another damaged chain once you’re back in the yard.
- Always hang the damaged chain to the outside of the rack so it can be easily removed for further repairs back at your terminal.

11 Documents and regulatory requirements

Canadian trucking regulations help govern transport across more than one million kilometres of highway that cover Canada. In order to ship items quickly and safely from coast to coast, it's important to understand the road transport laws and regulations that are in place and ensure you're abiding by those laws.

As a professional driver, you'll be expected to know and understand the laws and regulations that affect you and your employer, and that affect how you'll perform your day-to-day job. Canadian carriers operating in the cross-border movement of goods must adhere to both Canadian and American customs requirements and transport regulations.

The purpose of this unit is to introduce you to the various government laws, regulations and standards, including documentation, that govern the trucking industry. Workers are sometimes expected to rely heavily on their personal knowledge of these regulatory and compliance requirements.

What you'll learn

This unit will help you learn to:

- Explain the purpose, structure and basic content of regulations that apply to commercial vehicle operations
- Identify and describe the meaning of messages and symbols on cargo packaging and documents such as waybills, packing lists, delivery documents, instructions and workplace hazard information
- Describe the purpose, importance and proper condition of required vehicle-related documents
- Access information and reference tables related to vehicle weights and dimensions

Acronyms used in this unit

CCMTA	Canadian Council of Motor Transport Administrators
CDL	Commercial Driver's Licence
CVSA	Commercial Vehicle Safety Alliance
MVA	*Motor Vehicle Act*
NSC	National Safety Code
OOS	Out-of-service Order
SFC	Safety Fitness Certificate

The National Safety Code

Across Canada, road transportation is a provincial responsibility. Each province and territory in Canada uses the *National Safety Code* (NSC) standards as guides for drafting their own transportation safety requirements. The NSC is maintained by the Canadian Council of Motor Transport Administrators (CCMTA). The CCMTA coordinates all matters dealing with the administration, regulation and control of motor vehicle transportation and highway safety.

The goal of the NSC is to improve road safety and consistency of regulations across Canada and to help ensure that the transportation industry remains viable and sustainable.

Although the NSC standards aren't the law, they are considered best practices by Canadian federal, provincial and territorial governments. There are 16 standards overall, but the key standards you need to be aware of as a commercial driver are:

1. **Medical standards for drivers** — Outlines the medical requirements used to determine if a driver is medically fit to operate a vehicle.
2. **Carrier and driver profiles** — Assists in identifying the type of information that should be maintained on each carrier and commercial driver profile. These profiles help review carrier and driver safety performance.
3. **Short-term suspension** — Identifies the criteria that can be used by Peace Officers to place a driver "out-of-service" on a short term basis, which can include issues related to driver fatigue, alcohol or drug impairment, as well as hours of service violations.
4. **Hours of service** — Describes the number of hours a commercial driver can be on duty and operate a commercial vehicle.
5. **Cargo securement** — Describes the safest methods for securing loads to commercial vehicles to ensure that they don't shift, move or spill onto the roadway.
6. **Commercial vehicle maintenance and inspection** — Minimum standards for periodic inspection, maintenance and repair of commercial vehicles.
7. **CVSA on-road inspections** — Contains Commercial Vehicle Safety Alliance on-road inspection information and sets the minimum standards for roadside inspection in Canada, the United States and Mexico.
8. **Trip inspection** — Contains daily trip inspection requirements and ensures that any vehicles with problems or defects are immediately identified so that their operation may be prevented until all repairs have been made.
9. **Safety rating** — Establishes the safety rating framework to assess a carrier's safety performance.

10. **Facility audits** — Describes the auditing process used to determine a carrier's level of compliance with safety laws. It also indicates that carriers must maintain records at their principal place of business for review and assessment by an auditor.
11. **Commercial truck driver entry level training (Class 1)** — A standard designed to ensure that Class 1 commercial truck drivers are properly and consistently trained before they're licensed. In B.C., this is the Class 1 MELT course you are currently taking.

Safety code regulations in B.C. are found under various divisions of the Motor Vehicle Act Regulations (MVAR). Carriers in B.C. are required to establish, maintain and follow a written safety plan and preventative maintenance program to operate. All commercial drivers have a responsibility to follow the policies and procedures contained in their company's safety plan and preventative maintenance program and understand their responsibilities. The following motor vehicles are regulated under B.C.'s NSC Program:

- Commercial vehicles licensed with a gross vehicle weight of more than 5,000 kg (11,023 lb)
- A bus — commercial vehicles that have a seating capacity of 10 or more passengers plus the driver
- Vehicles operating under the *Passenger Transportation Act*

Motor Vehicle Act (MVA) and regulations

In B.C., the *Motor Vehicle Act* and its regulations govern the operation of motor vehicles on public roadways. This legislation sets out:

- procedures for obtaining a driver's licence and endorsements, and provisions for their renewal, expiry and suspension
- permitted uses for each type and class of vehicle, and uses of licence plates
- administration of driver penalty points for driving offences and resulting prohibitions from driving

Traffic laws

In B.C., traffic-related laws are set out in the MVA and its regulations. Other Canadian jurisdictions have their own versions of laws and individual municipalities in B.C. may also have their own bylaws. It's your responsibility to be aware of bylaws and the traffic laws in other jurisdictions before traveling in different municipalities and outside the province. Violating traffic laws may result in fines or other penalties.

***Criminal Code* of Canada** — The *Criminal Code* of Canada is federal legislation which sets out offences that apply across the country. Some of these include:

- Impaired driving:
  - regardless of blood alcohol content
  - with a blood alcohol concentration (BAC) that is at or over 80 mg of alcohol in 100 mL of blood
  - to any degree by alcohol or a drug, or by a combination of alcohol and a drug
  - driving with a blood drug concentration (BDC) at or over a prescribed level
  - driving with a BAC and BDC at or over prescribed levels.
- Leaving the scene of an accident
- Failure to provide a breath or blood sample
- Impaired driving causing bodily harm or death
- Dangerous driving causing bodily harm or death
- Driving while suspended, prohibited or otherwise disqualified

Convictions under the *Criminal Code* of Canada vary with the seriousness of the offence and whether it's your first, second or subsequent offence. Police have the authority to enforce the B.C. law, the *Criminal Code* of Canada and any municipal bylaws. It's illegal to refuse a lawful request from a police officer.

Consequences of traffic convictions

Traffic convictions and incidents added to your driving history will appear on your public abstract, as well as your NSC abstract. These may affect the status of your driver's licence as well as your ability to operate a truck or gain employment.

Consequences of receiving a traffic conviction may include one or a combination of the following:

- **Fines** — A direct fine for the violation. The dollar amount of the fine varies with the seriousness of the violation. Most offences are ticketed under provincial regulations but some may be ticketed under municipal bylaws.
- **Driver penalty points** — Some violations have driver penalty points points attached to them. These are recorded against your driving record when you're convicted of an offence. Each offence carries a different number of points. You're considered guilty of an offence if:
  - You pay the full fine amount, or part of the fine amount
  - 30 days have passed since the ticket was served on you, and you have not paid or disputed the ticket
  - You dispute the ticket and either attend court and are found guilty, or fail to appear in court

- **Driver penalty point (DPP) premium** — Each year ICBC looks at the total number of driver penalty points you received during a 12-month period called your "assessment period". Your assessment period may include driving offences committed during an earlier period for which convictions may have only recently been recorded on your driving record. If you collect more than three points on your driving record during the assessment period, you'll pay a DPP premium.
- **Driver risk premium (DRP)** — Each year ICBC also reviews your driving record for offences in the previous three years. You receive only one DRP invoice per year, but each driving offence may impact DRP billings for more than one year, depending on your driving record over the three-year period. The DRP, like DPP premium, is separate from Autoplan insurance premiums. They're billed even if you don't own or insure a vehicle, however, you will only be billed under one program each year, whichever results in the higher premium. You'll pay a DRP if you have at least:
  - One or more driving-related *Criminal Code* convictions
  - One or more 10 point MVA convictions
  - One or more excessive speeding convictions
  - Two or more roadside suspensions/prohibitions
  - Two or more convictions for using an electronic device while driving

This table shows the DRP amounts a person would have to pay for one or more of the following offences:

Number of Contraventions	*Criminal Code* of Canada or 10 Point MVA Conviction	Roadside suspensions/ prohibitions	Use of an electronic device while driving	Excessive speed
1	$1,303	$0	$0	$461
2	$5,414	$533	$533	$533
3	$11,750	$619	$619	$619
4	$20,966	$706	$706	$706
5	$34,560	$806	$806	$806
6	$34,560	$922	$922	$922
7	$34,560	$1,066	$1,066	$1,066
8	$34,560	$1,224	$1,224	$1,224
9	$34,560	$1,411	$1,411	$1,411
10	$34,560	$1,627	$1,627	$1,627

Note: The Driver Risk Premium for upwards of 10 Criminal Code convictions is $34,560, while the premium for roadside suspensions can reach a maximum of $28,800. The maximum premium for convictions for use of an electronic device while driving is also $28,800, while premiums for excessive speed are a maximum of $14,400.

- **Driver's licence suspension or prohibition** — Driving privileges can be suspended or prohibited for various reasons.
- **Jail time** — If you're found guilty of a driving-related offence, you may face time in jail.
- **Criminal record** — *Criminal Code* of Canada convictions may affect an individual's employment status and/or future employment opportunities. Employers may require their drivers or job applicants to disclose criminal record history in order to maintain their jobs or prior to them being hired.
- **Insurance cost** — Drivers with a history of traffic convictions and incidents may pay more for their personal vehicle insurance.
- **Travel restrictions** — Individuals with a criminal record may be refused entry into some countries.
- **Loss of employment** — Individuals may be required to disclose criminal convictions or traffic violations as a condition of their employment. Driving related convictions may result in work suspensions or termination.

Overview of commercial vehicle laws

This section provides an overview of some of the regulations that govern the operation of commercial vehicles, as well as requirements for commercial drivers. Breaches of regulations under Canada's *Motor Vehicle Transport Act* can result in fines of up to $5000 for an individual, and up to $25,000 for a carrier. These regulations apply to commercial vehicles operating across more than one Canadian jurisdiction. In addition to monetary fines, other penalties may apply. While operating in B.C., commercial drivers are subject to the MVAR and the Commercial Transport Regulations (CTR), which fall under the MVA and the *Commercial Transport Act* (CTA), respectively.

Commercial Transport Regulations

While the CTR covers various topics, you should become familiar with the requirements in Division 7, which regulate the size, weight and configuration of commercial vehicles operated in B.C. The CTR also provides requirements for pilot cars, oversize vehicles and requirements for reporting to weigh scales.

Motor Vehicle Act Regulations

The MVAR sets out requirements for classes of driver's licences, vehicle equipment standards, as well as hours of service and logbook requirements. These provincial regulations are aligned with standards in the National Safety Code, and are harmonized with regulatory requirements in other Canadian jurisdictions. As well as the previously mentioned topics, Division 7 of the MVAR covers vehicle equipment standards/requirements. Division 25 of the MVAR

addresses vehicle inspection and maintenance requirements. Division 37 of the MVAR covers safety code requirements, including safety certificates, hours of service, pre-trip inspections, facility audits, as well documentation requirements.

Safety certificate

To be insured in B.C., all commercial motor vehicles must have a valid NSC certificate number issued to the business for which the vehicle operates. These businesses are referred to as carriers, and include:

- a person who is the owner of a commercial motor vehicle,
- a person other than the owner, who manages the commercial motor vehicle, and who determines the use of the vehicle,
- the lessee of the commercial motor vehicle (where the lease term is one month or more), or
- a person who holds a licence under the *Passenger Transportation Act*, authorizing the commercial motor vehicle to be used as a passenger directed vehicle under a "transportation network service" authorization (e.g., Uber).

However, a person is not a carrier simply because they are the driver of the commercial motor vehicle. A carrier must also have an NSC safety certificate issued under Division 37 of the MVAR for their commercial motor vehicle. You will recall that in B.C., a commercial motor vehicle is defined as a:

- commercial motor vehicle with a licensed GVW of more than 5,000 kg (11,023 lb)
- a bus - commercial motor vehicles that have a seating capacity of 10 or more passengers, plus the driver
- vehicles operating under the *Passenger Transportation Act*

All provincial, territorial and U.S. jurisdictions have the authority and responsibility to regulate all carriers who operate within their borders. When a driver, driving a B.C. plated commercial motor vehicle, leaves B.C., they must follow the federal Commercial Vehicle Drivers Hours of Service Regulations and regulations enacted within the jurisdictions they visit. Similarly, when an out-of-province driver and vehicle enter B.C., they become subject to the laws of B.C.

You can find more information at the B.C. Ministry of Transportation and Infrastructure's Commercial Vehicle Safety and Enforcement website, under NSC Safety Certificate Applications: https://www.cvse.ca/.

Hours of service

Part 3 of the B.C. MVAR Division 37 limits the on-duty hours of drivers of certain commercial motor vehicle types. It also specifies the required number of off-duty hours between shifts. The regulation applies generally to buses and commercial motor vehicles with a gross vehicle weight (GVW) of 11,795 kg (26,000 lb) or more. It is important to know that there is some variation in hours of service requirements for specific industries, like forestry and the oilwell and natural gas industry. More information on hours of service requirements will be discussed in chapter 15 — Hours of service.

Vehicle inspection and maintenance

Division 25 of the MVAR sets out minimum vehicle inspection and maintenance standards in B.C. Carriers and registered vehicle owners are required to comply with these regulations, and maintain a record of all maintenance and repairs for each vehicle, as part of a preventative maintenance schedule. Under the provincial Commercial Vehicle Inspection Program (CVIP), licensed designated inspection facilities (DIFs) will inspect vehicles either once every 6 months or once a year, depending on the type and weight of the vehicle.

The following motor vehicles are required to comply with vehicle inspection standards:

- commercial motor vehicles, emergency vehicles, and farm logging vehicles with a licensed GVW over 8,200 kg
- commercial trailers or semi-trailers defined under the CTA
- private vehicles with a GVW of 3500 kg and less, registered outside of B.C.
- taxis, buses and limousines operating under the *Passenger Transportation Act*
- industrial machines (X-plated) with a licensed GVW over 17,300 kg
- school buses, and a bus with a seating capacity of 10 or more passengers, plus the driver
- farm vehicles with a licensed GVW over 17,300 kg
- vehicles issued a Notice and Order for inspection

The Commercial Vehicle Safety and Enforcement (CVSE) branch of the B.C. Ministry of Transportation and Infrastructure is responsible for maintaining the province's Vehicle Inspection Manual — which contains detailed inspection standards and requirements used by all licensed DIFs and by CVSE officers to ensure a vehicle meets safety standards.

Whether you work for a carrier or become an owner/operator, you are required to carry out a daily vehicle pre-trip inspection to keep yourself and others safe on the road, and to ensure the commercial vehicle you operate will meet inspection under the CVIP. More information will be covered in Chapter 14 — Vehicle inspection and maintenance.

Bills of lading and condition of carriage

A bill of lading is a document issued by a carrier to a shipper that covers the type, quality, and destination of the goods being carried. All bills of lading and shipping records must be issued in keeping with requirements under Part 7 of Division 37 of the MVAR. It sets out the specific information that must be included on bills of lading, and waybills for certain types of goods being transported, like livestock and household goods. The condition of carriage requirements are an agreement between a carrier and a shipper (customer) for the carriage of goods from Point A to Point B by the carrier against payment of freight by the customer.

More information on bills of lading and condition of carriage requirements are discussed further on in this chapter.

Notice and orders

A notice and order (N&O) is a provincial legal document informing the driver or registered owner of a vehicle that the vehicle or its operation doesn't meet the requirements of a specific act or regulation. Unlike a violation ticket, an N&O doesn't include a fine or driver penalty points. It may require that identified defects be remedied or repairs made, or require a driver to obtain or produce certain documents or certifications.

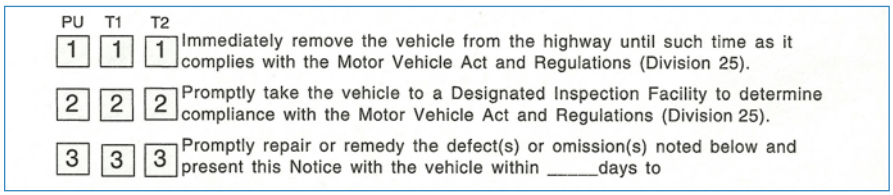
Once the corrective actions are completed, it's often required to report back to the issuing officer or agency, or that the vehicle undergoes a complete mechanical inspection at a designated inspection facility (DIF). If an order isn't complied with in the time indicated by the issuing officer, there's potential for the driver or registered owner to be issued a violation ticket. Further enforcement action can also result, up to and including, removing the vehicle from the road until defects are repaired and any required inspections are complete.

Any of the following enforcement officials can issue an N&O:

- Police officers
- Commercial Vehicle Safety and Enforcement (CVSE) officers
- Any Peace Officer authorized to enforce the *Motor Vehicle Act*, *Commercial Transport Act*, *Passenger Transportation Act* or *Transport of Dangerous Goods Acts*, and their regulations.

What to do if you receive an N&O

There are three levels of notice and order that can be issued. These are noted on the form as Box 1, 2 and 3. Each type or level can be applied to the power unit (PU), trailer 1 (T1) or trailer 2 (T2).



PU	T1	T2	
1	1	1	Immediately remove the vehicle from the highway until such time as it complies with the Motor Vehicle Act and Regulations (Division 25).
2	2	2	Promptly take the vehicle to a Designated Inspection Facility to determine compliance with the Motor Vehicle Act and Regulations (Division 25).
3	3	3	Promptly repair or remedy the defect(s) or omission(s) noted below and present this Notice with the vehicle within _____days to

Level 1 (box 1) means:

- The vehicle is immediately removed from the road and cannot be operated on highway until it passes a complete mechanical vehicle inspection at a DIF.
- The enforcement official may specify where the vehicle is to be towed to, for the purpose of inspection and testing.
- Tow costs are at the driver/registered owner expense.

Level 2 (box 2) means:

- The enforcement official has ordered the driver/registered owner to take their vehicle promptly to a DIF, have it repaired immediately and pass a complete mechanical vehicle inspection within 30 days.
- The vehicle is not out of service and may be driven from the location.
- A level 2 order provides a window of 30 days for vehicle repairs to be completed and to obtain a passed inspection at a DIF. It doesn't mean you can wait 30 days before having the vehicle inspected and repaired. The expectation is it must be done as promptly as possible within that window of time.
- If the level 2 N&O isn't satisfied within 30 days, the driver operating the vehicle on highway is subject to a fine of $598 and escalated enforcement, such as removing the vehicle from the road.

Level 3 (box 3) means:

- The enforcement officer has given the driver/registered owner specific direction to achieve compliance. This will typically specify vehicle component(s) on the N&O that must be fixed within the timeframe stated by the officer. This is also the section used to describe non-compliant driver behaviour and/or non-compliance to the acts/regulations, other than B.C law.

- This level of N&O doesn't require a vehicle inspection.
- The vehicle component(s) must be repaired and the driver/registered owner may be required to report back to the enforcement officer or a specific agency or location to confirm the vehicle meets the required safety standards. This same procedure may also apply to a non-compliance issue with any of the other applicable acts/regulations.
- This section may be used by the enforcement officer to indicate a warning to cease a non-compliant situation immediately.
- If an enforcement officer observes the vehicle operating contrary to the order, without the specified component(s) being repaired, the driver/registered owner may be subject to:
  - A fine of $598 for failing to comply with the order and any other violations under the act or regulations
  - Escalating enforcement, such as increasing the level (box) of the N&O

Do you have to have the vehicle inspected or repaired?

The registered owner may choose to not have the vehicle inspected or repaired, but wouldn't be able to operate the vehicle until the repairs have been made and the vehicle has been inspected, which may include passing a mechanical inspection at a DIF. Owners may choose to destroy or dispose of a vehicle instead of repairing.

The registered owner should inform any new owner of the vehicle if there is any outstanding level 1 (box 1) or level 2 (box 2) N&O upon the sale or transfer of the vehicle. If the vehicle hasn't satisfied the requirements of the order and passed a complete mechanical inspection by a DIF, this will cause an inability to obtain licencing and insurance from ICBC and may prevent the completion of the sale.

Is there a fine?

No. A notice and order isn't a violation ticket where a driver/registered owner receives a fine. If the N&O isn't complied with, the driver/registered owner may receive a fine for failing to comply with the order, or be subject to additional violations and fines under the applicable act/regulation that's being enforced.

Are points added to my driving record?

No. Points don't get added to the driver's/registered owner's licence if issued a notice and order.

Is a record kept of my notice and order?

- Yes. A level 1 (box 1) or level 2 (box 2) N&O is recorded on the Vehicle Information Database, maintained by ICBC.
- A level 3 (box 3) N&O may be maintained on a database within the enforcement officer's organization.

No violations are listed on the form. Why do I still have to have an inspection?

If the enforcement officer believes the vehicle doesn't comply and warrants a level 1 (box 1) or level 2 (box 2) N&O, the description of the defect or violation may not be indicated. Completion of this section or any notation in this section is discretionary.

Only brake defects are indicated. Why must I have a full inspection?

When issued a level 1 (box 1) or level 2 (box 2) N&O, a full mechanical vehicle inspection at a DIF is required. There may be more problems or suspected issues with the vehicle in addition to the indicated defect.

How many things actually have to be wrong with my vehicle before I get a notice and order?

- The issuance of a notice and order is determined by the enforcement officer based on the severity of the vehicle defects. It's not necessarily dependent on the amount or number of defects.
- It's at the discretion of the enforcement officer to determine if the vehicle condition or a component is unsafe or non-compliant.

BRITISH COLUMBIA **NOTICE AND ORDER** 2953675

☐ PVI ☐ CVI ☐ CVPE ☐ Police ☐ Peace Officer

The undersigned peace officer has reasonable and probable grounds to believe that the vehicle described below, driven by:

Driver Last Name		Given Names		
Driver Licence No.	Prov/State	Expiry Date	DOB (YYMMDD)	
Owner Last Name		Given Names		
Address	City	Prov/State	Postal/Zip Code	
Year	Make	NSC No.	Jur	
PU Reg.	Lic	Prov/State	Vin.	
T1 Reg.	Lic	Prov/State	Vin.	
T2 Reg.	Lic	Prov/State	Vin.	

on the ____ day of _____, 20 ____ at ____ hours on

Highway (if applicable) at or near Place/City/Town

does not comply with the Motor Vehicle, Commercial Transport, Transport of Dangerous Goods or Passenger Transportation Act and Regulations. The owner/operator is hereby given notice to:

PU	T1	T2	
1	1	1	Immediately remove the vehicle from the highway until such time as it complies with the Motor Vehicle Act and Regulations (Division 25).
2	2	2	Promptly take the vehicle to a Designated Inspection Facility to determine compliance with the Motor Vehicle Act and Regulations (Division 25).
3	3	3	Promptly repair or remedy the defect(s) or omission(s) noted below and present this Notice with the vehicle within _____days to

This is an Order issued by a Peace Officer under the Motor Vehicle Act Regulations that must be complied with. (See detailed instructions on reverse)

	Item		Description of Defect/Violation	
	Driver/Documents	1.		
	Brakes	2.		
	Coupling Devices	3.		
	Exhaust	4.		
	Body / Frame	5.		
	Fuel System	6.		
	Lights	7.		Office Use Only
	Load Security	8.		
	Steering	9.		
	Suspension	10.		
	Tires	11.		
	Wheels / Rims	12.		
	Wipers	13.		
	Other	14.		

PU CVIP Decal #	T1 CVIP Decal #	T2 CVIP Decal #

Peace Officer (Print)	Badge No.	Signature

Issuing Agency	Address / Postal Code

MV3073 (03/2012)

CVSE

Documentation requirements

The documentation that's required to be in the vehicle, or to be carried by the driver, can vary by the type or intended use of the vehicle and may differ between carriers. Document requirements can also vary by jurisdiction. When travelling across provincial or national borders, drivers must be aware of the documentation requirements in that jurisdiction.

You may be required to carry and produce the following documents:

Driver's documents:

- Driver's licence — A driver must be licenced for the class and type of vehicle they're operating. A Class 1 driver with an air brakes endorsement may operate semi-trailer trucks and all other motor vehicles or combinations of vehicles, except motorcycles, as set out in Division 30 of the MVAR.
- Your valid B.C. commercial driver's licence is your proof of medical certification.
- In some cases, a Code W may be placed as an identifier on a commercial driver's licence. It shows that the driver is prohibited from driving a commercial vehicle in the United States because of profound hearing impairment or epilepsy. The Code W appears as restriction 22 on the back of the driver's licence, along with a "W" placed on the front of the card at the bottom right hand corner. No medical conditions are displayed on the driver's licence and law enforcement do not have access to the reason the Code W exists.
- B.C. services card — The B.C. services card is issued to all B.C. residents enrolled in the provincial Medical Services Plan (MSP), and contains your personal health number (PHN). Drivers have the option of combining their B.C. services card with their driver's licence card, in most cases.
- Valid passport or FAST (free and secure trade) card for border crossings into the United States and Mexico. To apply online for a FAST card, visit the Trusted Traveler Programs (TTP) System operated by United Sates Customs and Border Protection, under the U.S. Department of Homeland Security.
- Log books — Under Division 37 of the MVAR, a driver is required to have in their possession a copy of their daily logs for the previous 14 days, the daily log for the current day, and any supporting documents or other relevant records that the driver received in the course of the current trip. See chapter 15 — Hours of service, for more information.

Vehicle and load documents:

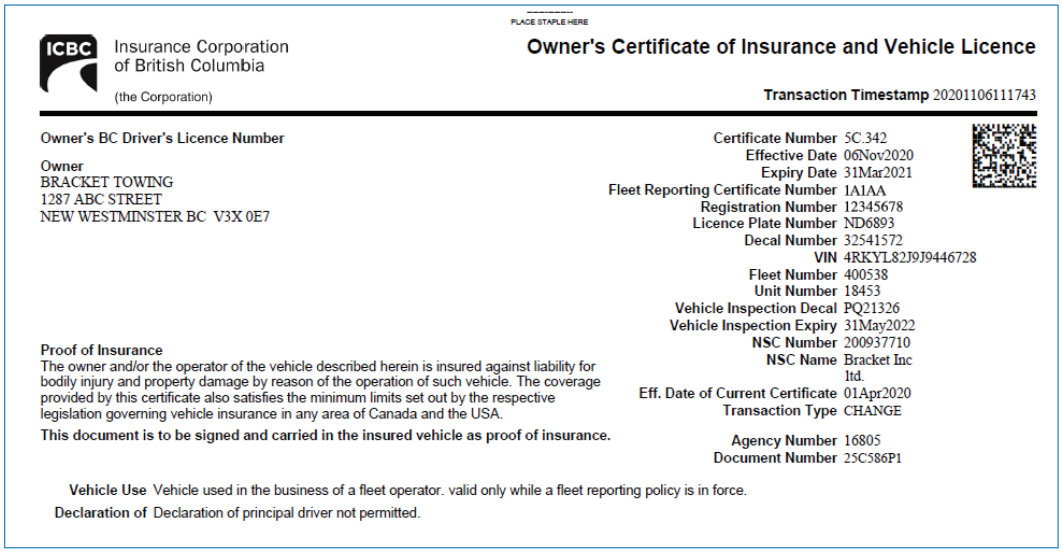
- Vehicle registration and insurance documents
- Lease/rental agreements
- Safety certificate
- Operating authority certificate

- Dangerous goods documentation (if applicable)
- Commercial Vehicle Inspection Program (CVIP) inspection certificate
- Permits that may be required by CVSE or other jurisdictional authority (if applicable)
- Trip inspection schedule and report
- Route/passenger information
- Shipping documentation

Vehicle licence, registration and insurance

Carriers must ensure that their vehicles are licensed, registered and insured for the appropriate vehicle type and use (or rate class), along with any other permits or certificates required for operation. Carriers must ensure their vehicles do not operate in excess of the weight they are licensed to carry. As well, if a carrier or owner/operator is paid to transport goods, they must carry cargo insurance.

As discussed earlier, B.C. carriers must have an NSC safety certificate before they may licence, register and insure a commercial motor vehicle. As a commercial driver, you should review the information on the owner's certificate of insurance and vehicle registration to ensure it matches the carrier's NSC safety certificate number, NSC number and NSC name.



PLACE STAPLE HERE

ICBC Insurance Corporation of British Columbia

(the Corporation)

Owner's Certificate of Insurance and Vehicle Licence

Transaction Timestamp 20201106111743

Owner's BC Driver's Licence Number

Owner
BRACKET TOWING
1287 ABC STREET
NEW WESTMINSTER BC V3X 0E7

Certificate Number	5C342
Effective Date	06Nov2020
Expiry Date	31Mar2021
Fleet Reporting Certificate Number	1A1AA
Registration Number	12345678
Licence Plate Number	ND6893
Decal Number	32541572
VIN	4RKYL82J9J9446728
Fleet Number	400538
Unit Number	18453
Vehicle Inspection Decal	PQ21326
Vehicle Inspection Expiry	31May2022
NSC Number	200937710
NSC Name	Bracket Inc ltd.
Eff. Date of Current Certificate	01Apr2020
Transaction Type	CHANGE
Agency Number	16805
Document Number	25C586P1

Proof of Insurance
The owner and/or the operator of the vehicle described herein is insured against liability for bodily injury and property damage by reason of the operation of such vehicle. The coverage provided by this certificate also satisfies the minimum limits set out by the respective legislation governing vehicle insurance in any area of Canada and the USA.

This document is to be signed and carried in the insured vehicle as proof of insurance.

Vehicle Use Vehicle used in the business of a fleet operator. valid only while a fleet reporting policy is in force.

Declaration of Declaration of principal driver not permitted.

Commercial Vehicle Inspection Program (CVIP)

The goal of the CVIP is to ensure all commercial motor vehicles, which includes trailers and specialized equipment, are subject to a systematic, regular preventative maintenance program. Regular preventative maintenance of equipment ensures small problems can be corrected before they result in crashes or incidents, major repairs, or a vehicle breakdown a long way from a service facility.

Vehicles that have met inspection requirements at a licensed provincial DIF will receive an inspection certificate of approval in the form of a CVIP decal, placed on the outside lower left hand or lower right hand of the vehicle's windshield, or other outside glazed surface to the right hand of the driver. In the case of a trailer, the CVIP decal is placed on the outside left or right, lower front corner of the trailer. As a commercial driver, you must confirm that both the truck-tractor and the trailer you are hauling have a valid CVIP inspection decal on each unit before you drive or park your vehicle on a highway or other roadway. It is illegal to operate the vehicle without a valid inspection certificate.

It's generally expected that the maintenance program will follow the recommendations of the vehicle manufacturer for maintenance and repair. The motor carrier must also ensure that each vehicle is repaired in the event of a recall notice being issued by Transport Canada. Proof of repairs and regular service must be kept in the vehicle's preventative maintenance file, while a copy of the DIF's inspection report must be carried in the vehicle.

Records of inspection, maintenance and repair must be kept for the last three years of ownership and six months after disposal of the vehicle.

International Registration Plan (IRP)

The International Registration Plan (IRP) is an agreement between the United States and Canada that allows for the sharing of commercial vehicle licensing (road use) fees. This plan was created to encourage the fullest possible use of the highway system between member provinces, territories and states. Federal carriers operating British Columbia-plated vehicles can apply through Prorate Services for vehicle registration in other provinces or states. The British Columbia government will issue a Cab Card for each vehicle the carrier operates.

The Cab Card will specify which member IRP locations a vehicle may operate in. An IRP registration doesn't:

- Exempt a carrier from paying motor fuel taxes in any province or state
- Exempt a carrier from obtaining an Operating Authority Certificate and/or a Safety Certificate
- Allow a carrier to operate outside of B.C. with a Provincial Operating Status
- Allow a carrier to exceed maximum height, length, width and axle limitations

For more information see the British Columbia IRP Manual available at ICBC.com.

International Fuel Tax Agreement (IFTA)

The International Fuel Tax Agreement (IFTA) is an agreement between the United States and Canada that allows federal carriers to operate in more than one location. This plan was created to make it easier for carriers to register, licence, report and pay taxes for motor fuels. A carrier licensed under IFTA is required to send quarterly fuel tax returns to its base jurisdiction where it's registered. IFTA reports help determine how much fuel tax is owed in each state or province based on the distance driven in each jurisdiction. If you've driven more distance in a jurisdiction than the amount of fuel you purchased, you will owe fuel tax to that state or province. If you purchased more fuel in a jurisdiction than the distance you drove then they will owe you a refund of fuel tax paid.

Fuel tax reporting is required from all intra-jurisdictional trucking firms that travel in B.C. An IFTA commercial vehicle is a motor vehicle used across jurisdictions or internationally for the commercial transportation of passengers or goods that:

- has two axles and a GVW or registered GVW over 11,800 kg (26,014 lb),
- has three or more axles regardless of weight, or
- is used in combination with a trailer where the weight of the combination is over 11,800 kg (26,014 lb).

Intra-jurisdictional trucking firms must apply for an IFTA licence to report and account for fuel tax payable and distances travelled in each jurisdiction in which they operate.

You must keep a careful record of your fuel receipts, log reports and trip reports.

Daily trip inspection report

Under Part 4 of MVAR Division 37 — Trip Inspection, a carrier must not allow a driver to operate a commercial motor vehicle without either the driver, or other authorized person, completing a daily pre-trip inspection and report of the vehicle. The inspection must occur daily, before the first trip of the day. If a trip lasts more than one day, a trip inspection must be done every day, no later than the first rest stop of the day.

In general, the following vehicles must carry out a daily pre-trip inspection: taxis, buses, commercial motor vehicles with a licensed GVW over 8,200 kg, vehicles licensed under the *Motor Carrier Act*, or a trailer/semi-trailer defined under the CTA, as well as vehicles owned or leased by a driver training school, and those under a licence or temporary operating permit under the *Passenger Transportation Act*.

An inspection schedule lists minor and major defects for each inspection item. Minor defects must be repaired before the next trip inspection. If a major defect is found, the commercial vehicle cannot be driven until the defect is repaired.

Completed by the driver, owner, carrier or the person authorized by the carrier or the owner, the daily vehicle trip inspection report is intended to serve as the communication tool between the driver, the carrier and the maintenance department.

It's an offence to drive, or permit a person to drive, a vehicle on a highway if any vehicle part (or equipment) is defective or inoperative. A defect found during an inspection could prevent problems later. If not addressed, defects can cause costly breakdowns or even worse, a crash. It's much less expensive to complete repairs during normal business hours than arrange for a service call on the road.

For detailed information on trip inspections and reports, see the *Vehicle Inspection* chapter.

Shipping documents

The documentation that accompanies shipments serves many purposes. Most importantly, it provides an accurate record of the cargo and in some cases it also serves as a contract for transport services. As a professional driver, you must be able to understand the terms and content of the shipping documents and your legal responsibilities.

If you don't understand how to properly prepare and handle the documentation of the freight you haul, you may:

- Be liable for civil or criminal penalties
- Damage your reputation as a professional driver
- Be fired from your job

In terms of dangerous goods, the shipping documents must be carried within the driver's reach. When the driver leaves the cab, the shipping documents should be left in an obvious place in the cab — either on the seat or in the pocket in the driver's door. The driver ensures information is complete and legible according to carrier policy and checks that load and paperwork match.

See *Motor Vehicle Act Regulations*, Division 37 — Safety Code, Part 7 — Required Documents.

Types of shipping/cargo documents:

- Bills of lading
- Waybills
- Dangerous goods shipping documents
- Weigh slips
- Delivery instructions

Bills of lading

A bill of lading is one of the most important documents in the shipping industry. The bill of lading is a legally binding document providing the driver and the carrier all the details needed to process the freight shipment and invoice it correctly.

The freight covered by a bill of lading must be in possession or control of the carrier at the time the bill of lading is issued. A bill of lading must cover only goods received from one shipper, picked up at one place and consigned to one consignee at one destination and delivered to one place. The number of pieces in the shipment as well as the correct freight classification for the goods being shipped are indicated. If there are discrepancies (for example, the description of the goods and/or the quantity on the bill of lading doesn't match the shipment delivered) you'll need to investigate.

There are three common types of bills of lading:

- Straight bill of lading — Freight delivered straight to the receiver.
- Order bill of lading — The order bill of lading is negotiable. It enables a shipper to collect for the shipment before the shipment reaches its destination.
- Multiple carrier bill of lading — Covers a shipment by more than one transportation company at a fixed rate for the entire service. More than one type of transport company may be used — for example, truck and rail.

A bill of lading must be completed and provided to the shipper when your freight is to be picked up. At least three copies of the bill of lading are issued: the original, the shipping order and the memorandum copy. The following information must be included:

- Name and address of the shipper
- Date of the shipment
- Originating point of shipment
- Name of originating carrier
- Names of connecting carriers, if any
- Name and address of the receiver of the goods
- Where the shipment is going (if different from address of receiver)
- Weight, description and particulars of the goods in shipment

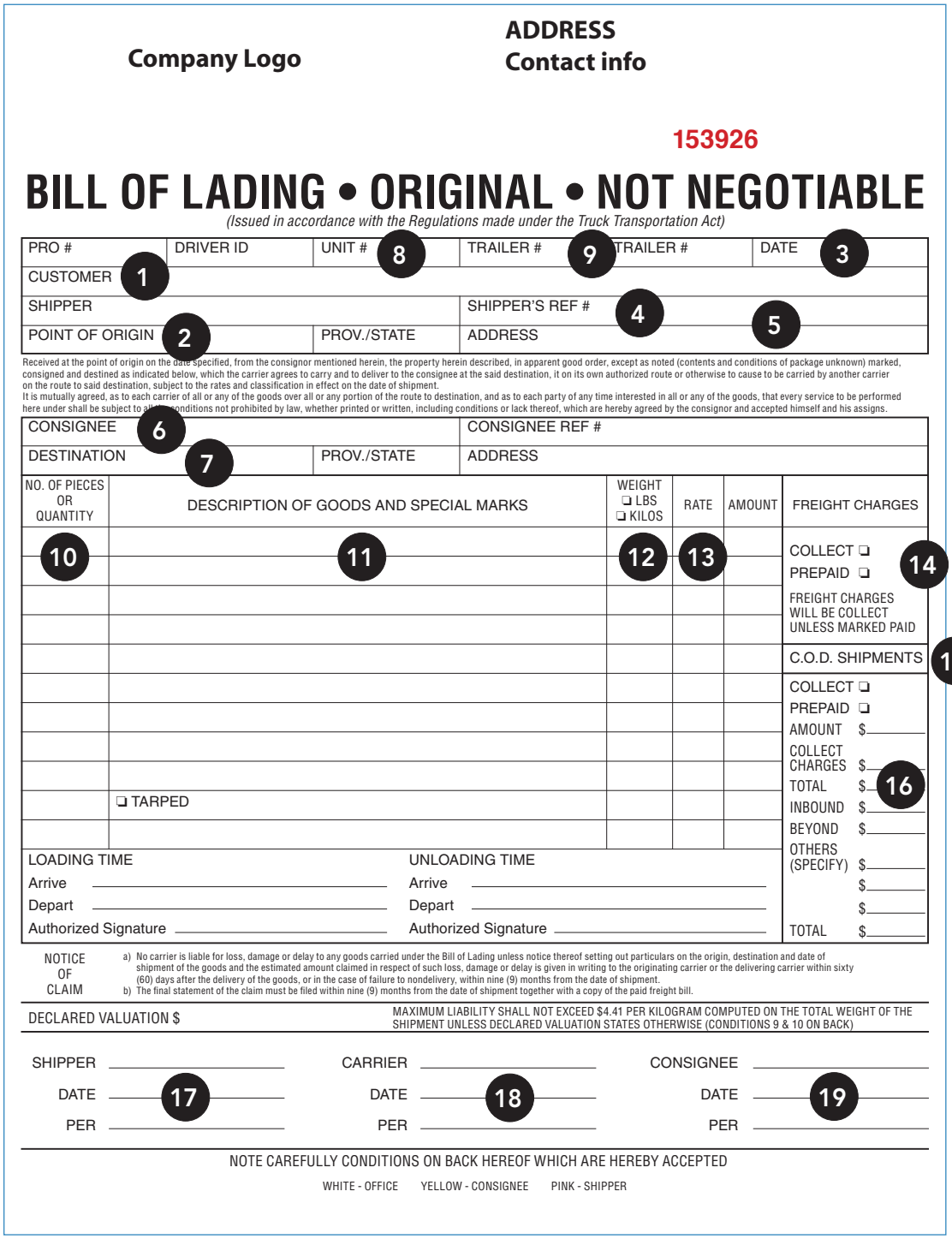
A bill of lading must also contain the following:

- Space to write whether the goods were received in apparent good order and condition
- Space to write the declared value of the shipment
- Space to tell whether transportation charges are prepaid or to be collected at delivery
- Space to note any special agreement between the consignor and the carrier
- A noticeable and clear statement of anything that limits a carrier's liability (For example, a term or condition of the carrier's applicable schedule of rates, an agreement with the consignor)
- A statement of notice of claim of the specified conditions of carriage

One of the most costly and obvious consequences of not using or filling out a bill of lading accurately is that you won't get your product to your desired recipient. As well, if the bill of lading indicates that the goods were loaded in good order and condition, but the consignee receives them at the destination in a damaged condition, the consignee will be entitled to make a claim for the damage against the bill of lading carrier. This means if the information isn't accurate, it will be difficult to get your full freight claim paid as you won't have the right information to recover the cost of damage; for example, if the bill of lading said there were 100 boxes but only 90 arrived, the consignee will be entitled to make a claim against the bill of lading carrier for the shortage. Incorrectly using a bill of lading can have severe consequences.

Information on the bill of lading

As a driver, it's your duty to make sure the information listed on the bill of lading is complete and any delivery instructions are followed. The forms themselves may vary in appearance and design, but the information fields are fairly standard.



Company Logo

ADDRESS
Contact info

153926

BILL OF LADING • ORIGINAL • NOT NEGOTIABLE

(Issued in accordance with the Regulations made under the Truck Transportation Act)

PRO #	DRIVER ID	UNIT # 8	TRAILER # 9	TRAILER #	DATE 3
CUSTOMER 1					
SHIPPER			SHIPPER'S REF # 4		5
POINT OF ORIGIN 2		PROV./STATE	ADDRESS		

Received at the point of origin on the date specified, from the consignor mentioned herein, the property herein described, in apparent good order, except as noted (contents and conditions of package unknown) marked, consigned and destined as indicated below, which the carrier agrees to carry and to deliver to the consignee at the said destination, it on its own authorized route or otherwise to cause to be carried by another carrier on the route to said destination, subject to the rates and classification in effect on the date of shipment.
It is mutually agreed, as to each carrier of all or any of the goods over all or any portion of the route to destination, and as to each party of any time interested in all or any of the goods, that every service to be performed here under shall be subject to all conditions not prohibited by law, whether printed or written, including conditions or lack thereof, which are hereby agreed by the consignor and accepted himself and his assigns.

CONSIGNEE 6		CONSIGNEE REF #
DESTINATION 7	PROV./STATE	ADDRESS

NO. OF PIECES OR QUANTITY	DESCRIPTION OF GOODS AND SPECIAL MARKS	WEIGHT ❑ LBS ❑ KILOS	RATE	AMOUNT	FREIGHT CHARGES
10	11	12	13		COLLECT ❑ PREPAID ❑ 14
					FREIGHT CHARGES WILL BE COLLECT UNLESS MARKED PAID
					C.O.D. SHIPMENTS 15
					COLLECT ❑ PREPAID ❑
					AMOUNT $
					COLLECT CHARGES $
					TOTAL $ 16
	❑ TARPED				INBOUND $
					BEYOND $
					OTHERS (SPECIFY) $
					$
					$
					TOTAL $

LOADING TIME	UNLOADING TIME
Arrive	Arrive
Depart	Depart
Authorized Signature	Authorized Signature

NOTICE OF CLAIM
a) No carrier is liable for loss, damage or delay to any goods carried under the Bill of Lading unless notice thereof setting out particulars on the origin, destination and date of shipment of the goods and the estimated amount claimed in respect of such loss, damage or delay is given in writing to the originating carrier or the delivering carrier within sixty (60) days after the delivery of the goods, or in the case of failure to nondelivery, within nine (9) months from the date of shipment.
b) The final statement of the claim must be filed within nine (9) months from the date of shipment together with a copy of the paid freight bill.

DECLARED VALUATION $

MAXIMUM LIABILITY SHALL NOT EXCEED $4.41 PER KILOGRAM COMPUTED ON THE TOTAL WEIGHT OF THE SHIPMENT UNLESS DECLARED VALUATION STATES OTHERWISE (CONDITIONS 9 & 10 ON BACK)

SHIPPER	CARRIER	CONSIGNEE
DATE 17	DATE 18	DATE 19
PER	PER	PER

NOTE CAREFULLY CONDITIONS ON BACK HEREOF WHICH ARE HEREBY ACCEPTED

WHITE - OFFICE YELLOW - CONSIGNEE PINK - SHIPPER

(Numbers refer to typical information fields referenced in the text below)

Fields on a bill of lading:

1. Shipper — Name and address
2. Point of origin
3. Date of shipment
4. Shipper's reference number
5. Carrier — Name and address
6. Consignee — Name and address
7. Destination — Address where the carrier will make delivery to the consignee
8. Unit number
9. Trailer numbers
10. Number of pieces
11. Description of goods
12. Weight
13. Rate
14. Freight charges prepaid or collect
15. C.O.D. shipment — Indication whether charges are prepaid or collect (cash on delivery)
16. Shipment declared value
17. Shipper's agent — Signature and date sent
18. Carrier's agent — Signature to take control of the shipment
19. Consignee's agent — Signature to acknowledge receipt of the shipment

Signing and dating the bill of lading — Signing and dating the bill of lading is extremely important. When you do this, you're accepting responsibility for the freight. You're signing as an agent of the company, and acknowledging that the company has accepted the terms of the contract. The bill of lading is not valid without signatures.

Count, inspect and determine that the freight is properly described before you sign the bill of lading. If you're not satisfied with the amount of the cargo or the condition of the cargo, **do not sign**. When in doubt, call your dispatcher or supervisor for instructions.

Checking the bill of lading — Mistakes in loading and unloading do occur, and the issue of theft is a problem for drivers. It's important to check that the freight you're transporting accurately matches the numbers and descriptions detailed in the bill of lading.

Waybills

Instead of carrying a bill of lading for the goods transported, the company may carry a waybill for the goods issued by the consignor or carrier. A waybill is identified by the numerical code or other means of identification set out on the bill of lading and sets forth at least the following:

- Particulars of the goods carried on the vehicle
- Name and mailing address of the consignor
- Point of origin of the shipment
- Name and mailing address of the consignee
- Destination of the shipment
- Names of connecting carriers, if any
- Whether the charges are prepaid or collect
- Date of the consignment

Miscellaneous documentation

A freight bill is a bill given by the carrier to the consignee for the freight, which contains a description of the freight, the name of the shipper, the point of origin of the shipment, its weight, and the amount of charges. A cargo manifest is a list of all of the goods that make up the freight you are carrying, generally for use by border customs or other officials.

In addition to the bill of lading, the freight bill and the cargo manifest, the driver may encounter several other documents associated with their shipments.

Packing slip — The packing slip is a list of the total parts that are packaged in a shipment. Upon receipt of a shipment, it's the consignee's responsibility to check the contents of the shipment against those indicated on the packing slip.

Delivery receipt — The delivery receipt is a paper signed by the consignee or an agent of the consignee. It's given to the driver when the consignee accepts the shipment. The driver keeps the delivery receipt as proof that the delivery was actually made.

Warehouse receipt — When the shipment goes to a warehouse, the driver may receive a warehouse receipt. The receipt is the driver's proof that the delivery was actually made at the warehouse.

Transporting dangerous goods

The transporting of dangerous goods in commercial or personal vehicles is subject to both federal and provincial laws and regulations. The federal dangerous goods program focuses on all modes of transportation, as well as movement between jurisdictions. The provincial program harmonizes provincial and federal requirements for transportation of dangerous goods on B.C. highways, including provincial ferry routes, under the *Transport of Dangerous Goods Act*.

This section provides a brief overview of dangerous goods documents and requirements for general information only and doesn't constitute dangerous goods training. Dangerous goods are also referred to as hazardous materials (hazmat). Dangerous goods can be solid, liquid or gaseous form, and can harm people, other living organisms, property or the environment.

Training required:

This course provides only a brief introduction to the topic of transportation of dangerous goods. As a new professional driver, it is your responsibility to be able to identify whether the cargo you are intending to haul may be considered a dangerous good based on the placard attached to your trailer, the bill of lading and labels on cargo. If you do not have a valid Transportation of Dangerous Goods (TDG) training certificate, you are not legally allowed to operate a vehicle carrying dangerous goods.

The law states that no one shall handle, offer for transport or transport dangerous goods unless they are trained, or they work in direct contact with someone who is trained.

Carriers are responsible to make sure their employees have the proper training to work safely with dangerous goods. This usually means a formal in-house training program to earn a TDG training certificate. The certificate is valid for three years and is not transferable; a new certificate is required each time a driver changes employment.

Hazard classes and divisions

Dangerous goods are divided into nine classes according to the type of danger they present. The following table is meant only to provide a sample of dangerous goods that pose a hazard and is not a complete list.

Hazard class definitions		
Class	**Class name**	**Example**
1	Explosives	Ammunition, dynamite, fireworks
2	Gases (flammable, non-flammable, toxic)	Propane, oxygen, helium
3	Flammable and combustible liquids	Gasoline fuel, acetone
4	Flammable solids	Sodium hydrosulphite, napthalene
5	Oxidizers and organic peroxides	Ammonium nitrate, dibenzoyl peroxide
6	Poisonous (Toxic) and infectious substances	Pesticides, arsenic
7	Radioactive	Uranium, plutonium
8	Corrosives	Hydrochloric acid, battery acid
9	Miscellaneous hazardous materials	Formaldehyde, asbestos
None	ORM-D (other regulated material-domestic)	Hair spray, charcoal
None	Combustible liquids	Fuel oils, lighter fluid

Identification of dangerous goods



Safety markings and documentation are used to inform people of how to properly handle dangerous goods. Placards are a clear way of telling people that a large container or transport unit contains dangerous goods. When a crash or spill occurs, these placards alert responders to the presence and nature of the dangerous goods. This allows them to take the correct actions.

- The consignor is responsible for providing the placards to the carrier before allowing a carrier to take possession of dangerous goods for transport in a large means of containment on the vehicle.
- It's a carrier's responsibility to make sure a vehicle has all the proper placards on it before it's loaded.
- Drivers must place the placards on each side and each end of the vehicle so anyone looking at the vehicle from any angle will be able to see the signs.
- The carrier must ensure that the placards remain displayed on the vehicle while the dangerous goods are in transport.

Labels are a clear way of telling people that a small container holds dangerous goods. There's a specific set of labels representing the different hazards defined by the federal Transportation of Dangerous Goods Regulations, which has been adopted by B.C. The labels may be displayed on any side of the outer surface of the container except for the side on which it's intended to rest or be stacked during transport. The label must also be placed on the shoulder of a cylinder.

In the event of an emergency

In the event of an emergency involving dangerous goods, call CANUTEC at **1-888-CAN-UTEC (226-8832)**, **613-996-6666** or ***666** on a cellular phone.

The following chart lists the dangerous good classes with their corresponding label and placard.

The following are examples of some of the dangerous goods placards that may appear on the sides and each end of the vehicle and its trailer:



Class 1
Explosives



Class 2.1
Flammable gas



Class 2.2
Compressed gas



Class 2.3
Toxic gas



Class 3
Flammable liquids



Class 4.1
Flammable solids



Class 4.2
Spontaneous combustion



Class 4.3
Dangerous when wet



Class 5
5.1 Oxidizing substances
5.2 Organic peroxides



Class 6.1
Toxic substances



Class 6.2
Infectious substances



Class 7
Radioactive



Class 8
Corrosive



Class 9
Miscellaneous products, substances or organisms



Mixed load

Maximum vehicle weights

Maximum weight standards have been established by jurisdictions to ensure public safety and to protect infrastructure. In B.C., the type of vehicle, the number of axles, the manufacturer's rating and the tire size can all impact the legal weight. You will need to become familiar with the maximum vehicle weights permitted based on the type and configuration of your vehicle, as well as its load. See Commercial Transport Regulations — Division 7.

Trailers with sliding axles are capable of changing the way the weight is distributed on the trailer. Sliding the trailer axle to shorten the trailer wheelbase, reduces off-tracking, but also reduces the maximum weight limit. Extending the wheelbase allows the weight capacity to reach the maximum allowed for axles. Never exceed the manufacturer's gross axle weight rating (GAWR). A carrier must be aware and comply with all weight restrictions that apply to their vehicles — these restrictions may vary between jurisdictions.

When travelling off of provincial or state highways you must be aware of your vehicle's gross weight in kilograms (and pounds for the United States), as cities, municipalities and U.S. counties may have different weight allowances and dedicated truck routes. If a bridge has a rated capacity of five tons, that's only 10,000 lb. If the rating is five tonnes, that's only 5,000 kg and your tractor-trailer when empty weighs more than either of those bridges can support. You're responsible for understanding and being able to calculate your weights. If you drive on a road, bridge over overpass and exceed the rated capacity, you'll be responsible for the cost of repair for any damage done. If you become lost, stop in a safe place and contact your dispatcher or safety department for help getting safely back on route before you cause damage.

A commercial vehicle must not be operated on a highway unless the owner of the registered vehicle has correctly decaled the sides of it. Drivers must be aware of weight restrictions that may apply to their vehicles.

Vehicle dimensions and special permits

The Commercial Transport Regulations set out the maximum dimensions for commercial vehicles and their loads. A driver must be aware of the actual size of their vehicle and load. If a vehicle or its load is too tall or too wide, it may not be able to travel on certain routes. Drivers need to be aware of the truck's dimensions to avoid conflicts.

The maximum overall length for a vehicle depends on if you are using a truck or truck tractor and what type of trailer you are using. For example, in B.C., a single vehicle cannot, without a permit, exceed 12.5 m (41'), while a logging truck and trailer with one articulation point cannot exceed 23 m (75' 6").

General information on the maximum overall length, including what items are not included when determining overall length, can be found in section 7.08 of the Commercial Transport Regulations.

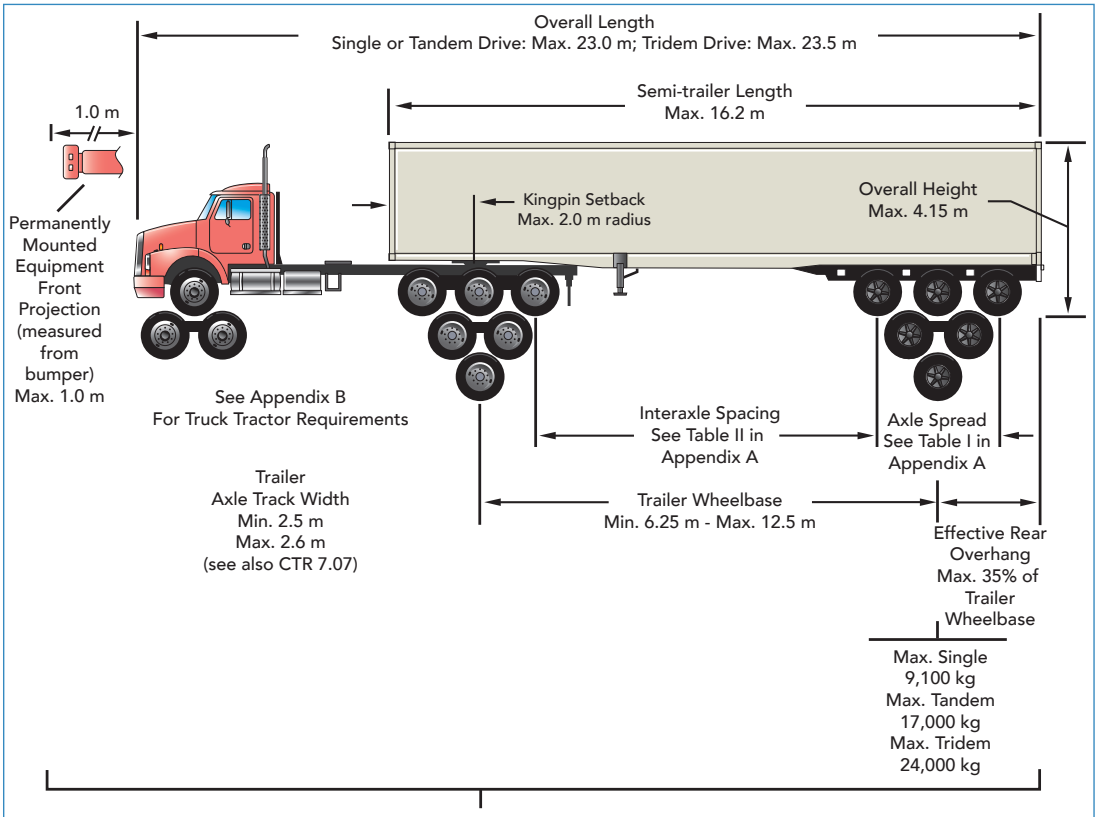
Load projection — the load cannot project more than:

- 1 m (3' 3") ahead of the front bumper
- 1.85 m (6' 8") behind the back of the vehicle
- 4.5 m (14' 9") behind the centre of the last axle

When making turns, be sure to leave enough room to avoid the rear of your tractor-trailer striking the vehicle in the lanes beside you. This is especially important if the trailer axles have been moved in order to transfer weight.

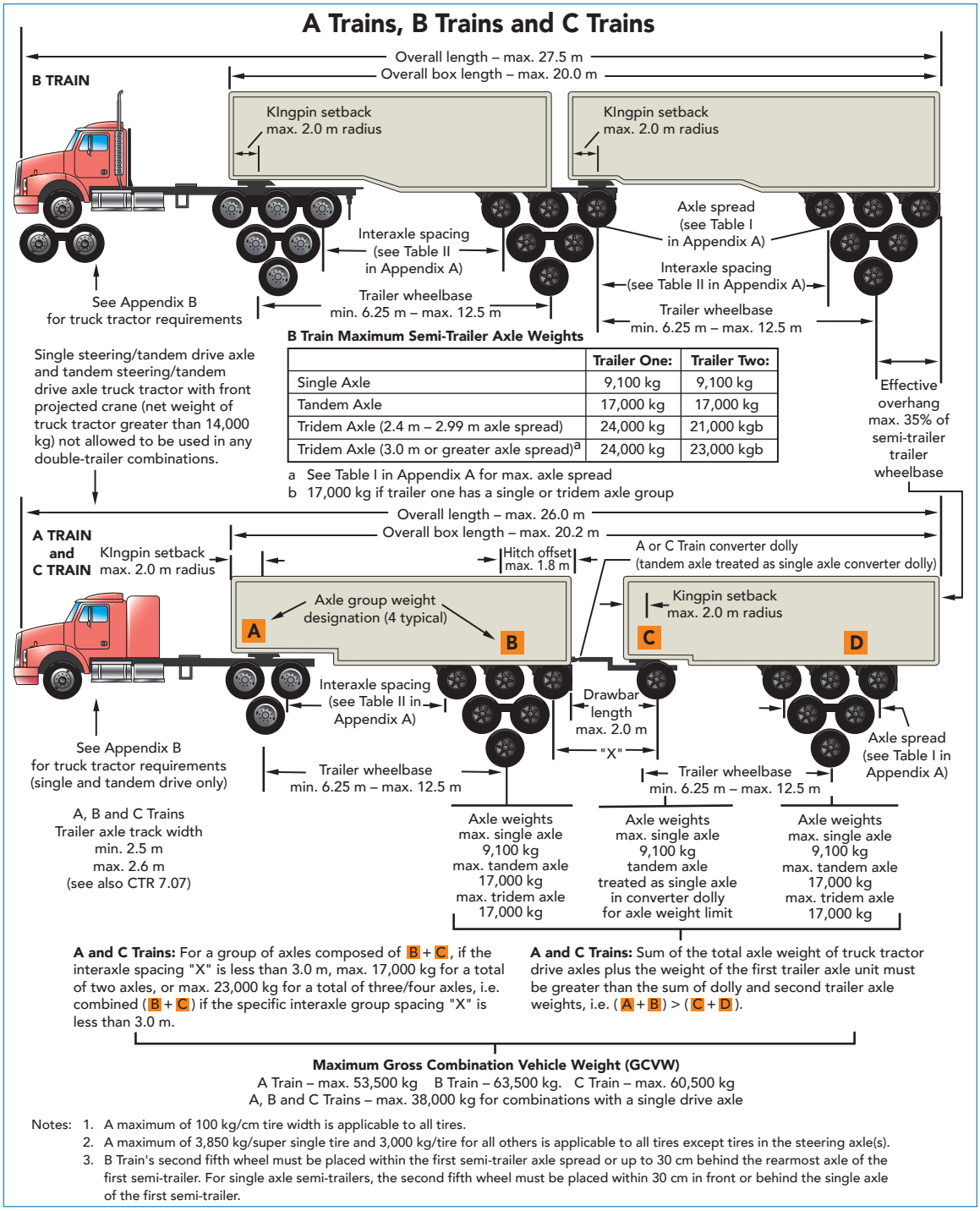
When leaving a curb, be sure that the rear of your tractor-trailer doesn't pivot onto the sidewalk, as this will be a danger to pedestrians and cyclists or may damage property such as power poles or sign posts.

The following two tables show the maximum weights and dimension of the most common commercial vehicle configurations. These diagrams may be found in Appendix D — Tractor Semi-Trailer Combination and Appendix G — A trains, B trains and C trains, of Division 7 of the Commercial Transport Regulations. Additional diagrams showing maximum weights and dimensions for other vehicle configurations, like trucks and pony trailers, full trailers, or pole trailers, can be also found in the Appendices of Division 7.



Maximum Gross Combination Vehicle Weight (GCVW) – 57,100 kg (Single Steer with Permanently Mounted Equipment)

Notes:
1. A maximum of 3,850 kg/Super Single tire and 3,000 kg/litre for all others is applicable to all tires except tires in the steering axle(s).
2. A maximum of 100 kg/cm of tire width applicable to all tires.
3. Tandem Steer/Tandem Drive Tractor Tare weights with front projected crane must be greater than 14,000 kg.
4. "Logging truck weight allowances" as indicated in the CTR Section 7.26 are allowed in addition to the axle and gross vehicle weights shown above.
5. "Logging truck weight allowances" as indicated in CTR 7.26 are not applicable to the tridem drive axle if the tridem-tridem interaxle spacing is less than 7.0 m.



Height — Maximum height: 4.15 m (13' 7")

Know the height of your tractor-trailer (and load) to be able to calculate if your vehicle is too tall to pass through underpasses, bridges or tunnels. It will also help you to watch for potential hazards of unmarked overhead obstructions such as: canopies, roof overhangs and other building protrusions, signs, utility lines, tree limbs, doorway entries and more. Signs may be posted on these structures to give their overhead clearances. Some areas may have check bars and warning devices installed to warn drivers.

Vehicle height regulation

7.05 (1) A person must not, without a permit, drive or operate a vehicle having a height in excess of 4.15 m.

(2) Despite subsection (1), if a vehicle is equipped at the top with a tarp system with roll-up tarp backstops consisting of short, non-retractable metal straps which extend upwards to secure the roll-up tarp, the overall height of the vehicle, including the backstops, must not exceed 4.3 m, and the overall height of the load must not exceed 4.15 m.

(3) Despite subsections (1) and (2), a person must not, without a permit, drive or operate a vehicle on a highway if the overall height of the vehicle is greater than the height limit indicated on a low clearance warning sign posted on the highway.

[en. B.C. Reg. 95/2006, s. 3.]

Width — Maximum legal width is 2.6 m (8' 6")

Know the width of your load and vehicle. There are allowances for your mirrors and other trailer attachments such as lights and ladders to exceed the 2.6 m width law. There's also an exception for loose hay or straw. Outside of these exceptions, you'll need to get a permit to haul an over width load.

Vehicle width regulation

7.06 A person must not, without a permit, drive or operate on a highway a vehicle having a total outside width in excess of 2.6 m, but not including the following as part of that width:

(a) loose hay, straw or fodder projecting over the sides of the vehicle to a total outside width not in excess of 3.1 m;

(b) one or more mirrors, fitted for the purpose of conforming to the requirements of the Motor Vehicle Act Regulations, which do not extend more than 30 cm on each side beyond the total width of vehicle and load otherwise permitted by this section;

(c) auxiliary equipment or devices that are not designed or used to carry cargo and do not extend more than 10 cm on each side beyond the total width of vehicle and load otherwise permitted by this section, including, but not limited to, anti-splash and spray devices, load securement devices, ladders, glad hands, air connectors, electrical connectors, hydraulic connectors, clearance lamps and dangerous goods placards;

(d) 445-mm-wide tires, fitted to the steering axles of a truck or truck tractor manufactured before January 1, 2005, that extend up to a maximum of 10 cm on either side of the vehicle beyond the maximum vehicle width of 2.6 m.

[en. B.C. Reg. 95/2006, s. 3; am. B.C. Reg. 128/2008, s. 1.]

Knowing your width is also important because external components such as side mirrors, anti-splash and spray devices, or clearance lights may be easily overlooked and damaged if the tractor-trailer is driven through a structure that's too narrow. In addition, load components extending beyond the frame of the vehicle must be considered.

Special permits

In B.C., CVSE monitors, controls and issues permits for the movement of all overweight or over-dimensional commercial vehicles traveling on provincial infrastructure. To enhance public safety, conditions are often applied to permits including things like adding extra signage to vehicles which have exceeded the weights and dimensions in regulations.

Permits may be required in multiple jurisdictions in order for a driver to travel in full compliance. For example, a vehicle that exceeds maximum weight or dimension limits may be allowed to operate if the carrier obtains a permit. It's the driver's responsibility to follow all conditions of their permit carefully, so be sure to read it carefully before proceeding. If you're unsure of the requirements get clarification from your carrier, the permit hotline or by calling your local scale. Some carriers who specialize in hauling over-dimensional loads will have term permits on some of their vehicles that are valid for an entire year. Larger loads may exceed the allowances of the term permit and may only be eligible for a single-trip permit. In some cases, extraordinary load approvals may be required.

Also consider what permits may be required if you are to travel in the United States or are transporting dangerous goods. Contact the appropriate department prior to departure. If a carrier is issued a permit, they must ensure that they and their drivers read and follow all applicable conditions. For information on the maximum dimensions for which a load may be permitted in B.C., see Chapter 4: Commodities Guidelines and Permit, of the B.C. Commercial Transport Procedures Manual, available at the CVSE website below.

Note: Permits can be obtained online at CVSE.ca or by calling the Provincial Permit Centre at 1-800-559-9688.

Over-dimension signs

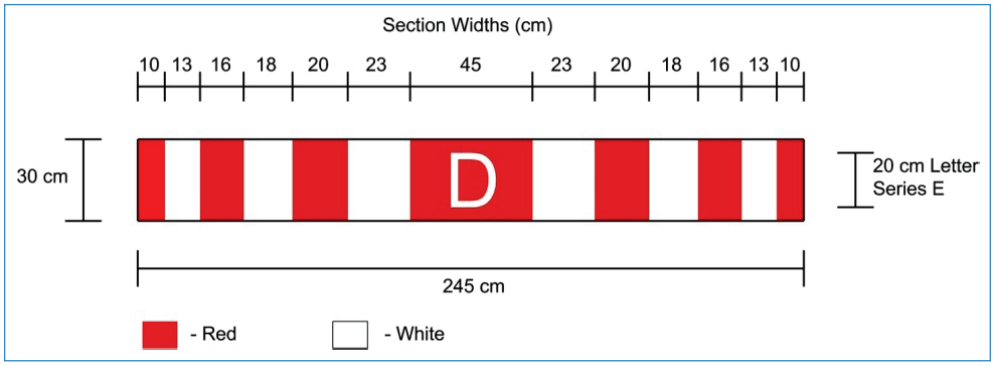
When a commercial vehicle is operated under the authority of an over-dimensional permit, they must meet all relevant safety requirements.



A vehicle that's required by regulation or permit conditions to be equipped with an oversize load/vehicle sign may use one of the following, as described in Division 8 of the CTR:

Large "D" sign

This sign may be used for over-dimensional vehicles that are long, wide or both long and wide.



- The sign or rigid area must be 2.45 m by 0.3 m
- The letter "D" must be white in colour and must be 20 centimetres high (Series E)
- The white portions of the sign or rigid area must be white in colour with a good reflective quality
- The red portions of the sign or rigid area must be red in colour and painted with the transparent red paint used for stop signs

Alternate sign for over-dimensional load



- The panel size must be 1.5 m by 0.3 m
- The lettering must be black on a yellow background
- The lettering "Wide Load" must be 20 cm high (Series C)
- For overlength loads, the words "Long Load" or "Oversize Load" must be 20 cm high
- The panel must have a 9.5 millimetre black border at the panel's edge

Pilot cars

Depending on what type of oversize load you're hauling and how wide or long the load is, you may require a pilot car escort. Pilot cars must meet very specific requirements for the type of vehicle as well as lighting and signage installed on them. Some loads require one pilot car, some require two and in extreme cases you may need three pilot cars or even a police escort. Requirements are listed in Division 8 of the CTR, along with the rules for where pilot cars should travel relative to the load they're escorting. Additional information on pilot car requirements can be found in Chapter 8: Miscellaneous Information, of the B.C. Commercial Transport Procedures Manual available at CVSE.ca.

Generally over-dimensional loads are hauled by drivers who have several years of commercial driving experience. The most important thing to remember is any time you're travelling under a permit you must always read the entire permit to properly understand what you're required to do. Permits will sometimes list designated routing, time of day you're allowed to travel and number of axles you're required to have under a load if it's overweight. Remember that provincial permits only apply to roads under provincial control and you may require an additional municipal permit if you have to travel off of the highway. When operating across national or provincial borders, you'll require permits for each jurisdiction you must travel through.

12 Trip planning

In this unit, you'll learn about everything that's involved in planning a safe and efficient trip. A carefully planned trip will help you reduce your fuel usage, reduce wear and maintenance on the vehicle and most importantly, keep you safe.

You'll learn about selecting the best route and rest stops, and things that may require a change to your plans. Finally, you'll learn about planning tools, such as maps and computer programs that will help you plan a successful trip.

What you'll learn

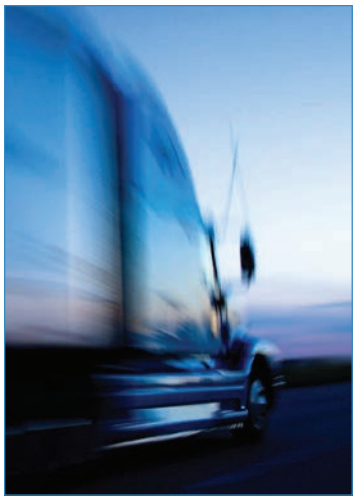
This unit will help you learn to:

- Identify personal safety gear, documents, permits and licenses required for your trip.
- Describe the need to carry emergency equipment and an emergency contact list.
- Plan ahead and anticipate problems.
- Explain the risk of travelling to an unfamiliar location without first confirming facilities and preferred routes.
- Identify some special requirements relating to a vehicle, load, routing or commodity.
- Identify sources of reliable information about weather and road conditions.
- Access sources of maps and electronic route information.
- Access sources of information about commercial vehicle routes, road construction, road closures, height clearances, weight restrictions, permit requirements and more.
- Prepare a route plan that considers vehicle size and weight.
- Calculate route and trip distances, including fuel and rest stops.
- Calculate fuel use, including converting between imperial and metric volumes and distances.
- Calculate trip durations to determine arrival times and plan departure times.
- Estimate expenses that might be incurred.

Trip planning overview

Things to consider when planning your trip:

- Travel distance
- Hours of service needed/available
- Departure and arrival times
- Pickup or dropoff appointment times
- Breaks — where you can rest, eat and so on
- Scale locations
- Traffic delays — rush hour, construction zones
- Vehicle dimensions
- Loading zones
- Fuel costs and other expenses
- Terrain — mountain vs. prairie, urban vs. rural
- Restricted routes
- Type of load
- Low or narrow clearances
- Weather conditions
- Border crossings
- Required documents — permits
- Emergency information and equipment



Trip planning steps

1. Ensure that documentation is current and correct
2. Plan the route considering restrictions, traffic and weather
3. Estimate travel time and plan for food and rest stops, considering hours of service requirements and where you may need to reset your hours
4. Estimate need for fuel and plan fuel stops on route
5. Estimate travel expenses
6. Confirm pick-up and delivery times

Trip documents

Next to driving, documentation is probably the largest task a driver deals with on a daily basis. Make sure you have all the necessary documentation and that it's accurate before you depart. Generally, documentation falls under three categories:

1. Driver
2. Cargo
3. Vehicle

Driver documentation

Driver's licence — You're required to have a valid driver's licence and must carry it when driving.

Log book/electronic log — The following must be available for inspection while you're on duty. For more information, see the *Hours of service* unit.

- A daily log that's updated to your last change in duty status
- Copies of your daily log for today and the previous 14 days.
- Any supporting documents you've been issued during your trip

Cargo documentation

Shipping documents must be in order before you begin your trip. This ensures the safe and accurate delivery of goods to the appropriate party. For more information, see the *Documents and regulatory requirements* and *Cargo securement chapters*.

Types of shipping documents include:

- Bills of lading
- Waybills
- Dangerous goods shipping documents
- Weigh slips
- Cargo packaging information
- Delivery instructions

Vehicle documentation

Paperwork related to the vehicle includes:

- Insurance documents, including vehicle licensing and registration
- International fuel tax agreement
- Required permits if your load is oversize
- Vehicle inspection report
- Trip report

Confirm pickup and delivery times

It's the driver's responsibility to confirm pickup and delivery times with shippers and receivers. It's especially important to make sure you have the correct time for your receiving appointments. Remember to account for different time zones when planning your arrival time. Find out if there are any delivery restrictions, such as non-acceptance on weekends or the need for an appointment that could cause costly stops or layovers.

Drivers must also keep in touch with their dispatcher on a regular basis throughout a trip. The dispatcher must be informed whenever a change to the planned route or a delay in the planned arrival time is required.

Planning routes

You may be given a designated route to follow, and you may even be given designated fuel stops, but ultimately it's the driver's responsibility to plan the trip. This is because the driver may discover a more efficient route than the dispatcher knows or the driver may be aware of changes that need to be made to designated routes. Drivers, therefore, need to be aware of the many types of roadways and highways, all of which can be located on a map or through GPS technology.

If you're going to use any type of GPS technology you must be sure to set your vehicle specifications in the settings. It's critical to use systems that will allow you to specify the height, length, width and weight of your vehicle. This prevents getting stuck somewhere that's designed for car traffic only. It's also a good idea to double check your route with a map book or other sources since navigation systems can make mistakes.



Types of roadways

Canadian and U.S. interstate highways — Provincial and U.S. interstate highways or freeways separate opposing traffic, have limited access and bypass small communities. Using these highways is more fuel efficient than using two lane highways. Even though these tend to be the safest types of highway for drivers, they can become busy if there's construction, bad weather, a major crash, or especially in urban areas, traffic congestion. Drivers should be prepared to take alternate routes if any of these problems occur on a highway. To avoid traffic congestion, drivers should plan to drive through congested city (urban) areas during non-rush hour traffic.

Some highways have truck only designated lanes. Watch for signs; often you won't know what routes are designated or restricted until you get to where you're going.





Toll roads — Toll roads require drivers to pay a fee to use them. An example of a toll road in Canada is the 407 Express Toll Route in Toronto, Ontario. In B.C., there are currently no toll highways or bridges. Many American cities have toll roads and bridges. Deciding whether the additional cost is worth incurring depends on several things:

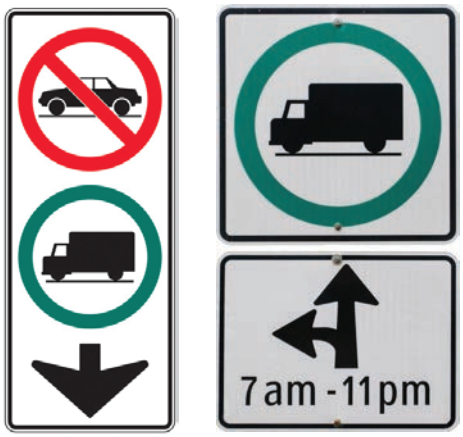
1. How much longer the trip will take if a non-toll road is used
2. Whether the terrain is easier to drive on the toll road
3. What the traffic and conditions are on the non-toll road
4. If using the toll road will allow the driver to avoid poor road conditions, busy areas and stop-and-go driving
5. If the toll road will avoid wear and tear on the truck's equipment
6. If driving the toll road will reduce fuel usage

After considering all these things, you may determine that a toll road route may be the most economical route to take.

Secondary routes — Secondary routes are major through routes. Even though these secondary routes have lower speed limits, are narrower, and are often more hazardous than highways, they may be good alternatives in case of delays on the multi-lane highways.

Other streets and highways — Other streets and highways must be used to reach loading or unloading points. Local streets aren't always designed for truck traffic, so you must avoid streets with low clearances and local truck restrictions. It's also wise to avoid streets with unsafe railroad crossings, poor road surfaces and sharp turns.

Local truck routes — Many cities and towns have designated truck routes; you need to know what these are in advance because they're not always marked well, and deviating from these routes could result in a fine or, much worse, an incident.



Posted bridges — Many bridges have special weight and height restrictions. If you cross a bridge while carrying more weight in your vehicle than what is permitted, it could result in fines, permit implications, and worse, bridge collapse.



Road restrictions

Roads are monitored and controlled by governments to ensure safety and minimize inconvenience to the traveling public and residents in urban centres. Using restricted routes can result in a fine but can also result in facing a hazardous condition or being unable to avoid an incident. It's the driver's job to find out which city (urban) routes cannot be used by trucks. Some restrictions may be for specific days of the week or times of the day. It's important to immediately recognize and respond to any unexpected situation where you find that your vehicle weight or height limit is greater than what's permitted on a particular roadway.

Find out the general weight and size restrictions of the regions you'll be travelling through. You'll need knowledge of the permits required, road restrictions and local bylaws regarding loading and unloading cargo. From time-to-time, roads are restricted because of construction, maintenance or seasonal conditions.



Commercial drivers who travel outside the Greater Vancouver and Greater Victoria areas in the winter are required to carry chains and comply with all signage and regulations. See Chapter 10 — Off-road tasks and manoeuvres, for more information on chains.

Seasonal strength loss program

During spring runoff, heavy vehicles travelling on B.C. highways can cause serious damage to some roadways, due to excess water under the road bed. To protect the roadway, the B.C. Ministry of Transportation and Infrastructure has in place a seasonal strength loss program. This program identifies and imposes load restrictions on roads or portions of roads that have been weakened by excess water in the road base. Once excess water has been removed from the road base, and the road has been determined to be structurally sound, load restrictions can be lifted.

Why are load restrictions needed?

In the spring, thawing of a road begins from the surface and moves downward. As the thaw progresses, the water may not efficiently drain out of the soil as the surrounding soil can remain frozen and impermeable. As the thawing continues, the soil then becomes temporarily saturated with water, which reduces the pavement structure's effective strength (bearing capacity) to carry traffic. If surplus water is present in the granular base material of a paved road, the majority of damage will occur in the asphalt layer. If the frost has extended down deep into the base layers of a road, damage may occur in the entire road structure.

All overload permits on restricted routes are invalid for the duration of these load restriction periods. Operators that violate a posted road restriction can be fined $345 under B.C.'s *Transportation Act*, section 79(1)(c) and can be made to reduce weights to posted restriction immediately on site or re-route depending on location and potential for road damage.



Load restriction notifications are available through email subscription on the Ministry of Transportation and Infrastructure website: www.th.gov.bc.ca/bchighways/loadrestrictions.

Ports of entry

Ports of entry are locations where a person may legally enter a country and include international airports, land border crossings, as with the U.S., and maritime ports, such as the Vancouver port. Cargo and vehicle inspections and weighing may take place at a port of entry. It is the responsibility of the carrier and the driver to ensure they have the required documents and clearance to transport goods across a port of entry.

The Canadian Border Services Agency (CBSA) manages and has enforcement responsibility over the flow of trade and travellers at Canadian borders. Carriers entering Canada by land must register with CBSA by obtaining a Carrier Code, which is used to identify the carrier in all CBSA programs, and to meet all other requirements for crossing the border.

Crossing the border into the United States

The U.S. Customs and Border Protection manages international travel and trade at U.S. borders. It is the responsibility of a Canadian carrier and driver to comply with the various driver, vehicle and cargo status requirements before transporting goods into the U.S. The following are some examples of the requirements that must be met before travelling across a U.S. port of entry:

Driver:

- Must be eligible to legally enter the United States
- Must be minimum 21 years of age to drive commercially in the United States
- Carry proof of citizenship — passport, free and secure trade (FAST) card and visa, if required
- Participate in a controlled substance testing program
- B.C. driver's licence must NOT have a "W" on it for as a result of a medical condition of profound hearing impairment or epilepsy.

Vehicle:

- Vehicle registration
- US Department of Transportation (DOT) number and operating authority
- US Border Crossing Permit or submit border crossing fee

Cargo:

- Pre-arrival notification under Automated Commercial Environment (ACE)
- Depending on the cargo type, other government department approval or pre-notification may be required. For example, the Federal Agriculture Agency for agriculture shipments.

Roadside safety inspections

Roadside safety inspections can be conducted at weigh stations, ports of entry, special safety inspection facilities or a suitably safe area. The driver must produce their driver's licence, driver's logs and cargo documentation. Cargo may be inspected even if sealed. Inspectors will provide a new seal and drivers should document both the old and new seal numbers. In the United States, you'll also require a medical certificate. Currently, your valid B.C. commercial driver's licence also acts as your medical certificate for travel to the United States.



Travel delays, road and weather information

Even though your trip is carefully planned, detours, emergencies and unexpected delays can happen any time. That's why at least one alternate route should also be planned. When things require you to change your route, you must contact your dispatcher immediately.

There are many ways to find out about your route and weather conditions before and during your trip:

- Talk to other truck drivers about restricted access.
- Use your cell phone or computer/GPS for route information and suggestions.
- Ask the shipper or receiver for the best local route to get to your destination.
- Listen to local radio for updates about traffic, incidents and weather. In the Vancouver area, AM 730 reports lower mainland B.C. traffic conditions 24 hours a day, including border crossing and ferry waits.
- In rural areas, signs will show a radio station to tune to for local road conditions, construction and so on.

Road reports

To check road conditions, go to DriveBC.ca or call 1-800-550-4997 (toll free).

Check the highway cameras several times to look for weather trends, incidents and construction. This is especially important in winter before heading into the mountains. Overhead electronic signage is not always up-to-date.
Get the DriveBC app for your phone or call *511 hands-free in B.C.

The DriveBC.ca website has helpful tools such as:

- Highway cameras
- Road restrictions
- Height clearance tool
- Major events
- Road construction
- Border delays

BCFerries.com provides ferry schedules and other travel information.

Weather reports

Environment Canada provides weather information by phone and online. For Vancouver, Howe Sound, Whistler and the Lower Fraser Valley:

- From Greater Vancouver: 604-664-9010
- For more information, talk directly to a forecaster: 1-900-565-5555 (charges apply)
- For local, national and international weather information: weather.gc.ca

Estimating travel time

The following formulas are often used to calculate distance, average speed and trip time:

Distance = speed multiplied by time: 80 km/h x 9 hours = 720 km

Average speed = distance divided by time: 720 km/9 hours = 80 km/h

Trip time = distance divided by average speed: 720 km/80 km/h = 9 hours

Drivers must also calculate how much time rest, meal and fuel stops will take when determining their arrival time. One way to calculate total trip time is to allow 2.5 hours for every 150 km you'll travel; experience has shown this to be reasonable for calculating driving time, meals, fuel and rest stops.

Example: distance 810 km/150 km = 5.4 x 2.5 hours =13.5 hours.

Drivers must also consider the following when calculating travel time:

- Stops, including weigh scale stops, ports of entry stops and possible roadside safety inspections
- Layovers
- Compliance with hours of service regulations
- Varying speed limits
- Load weights
- Route taken
- Ferry schedules
- Time of day
- Volume of traffic
- Personal endurance ability

Since crossing borders at ports of entry can cause delays, drivers must allow extra time for customs and immigration clearance. Drivers who cross borders regularly should apply for the FAST Express card that will allow them to:

- Use dedicated lanes in Canada and the United States as long as their carrier and the shipper are also FAST approved.
- Cross the border with faster customs and immigration processing.
- Transport eligible goods for approved carriers and importers.

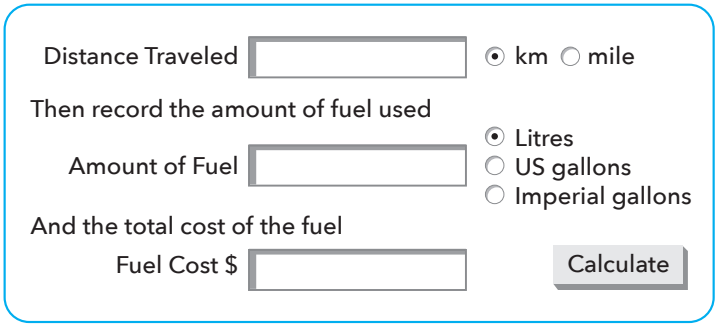
Estimating fuel expenses

Fuel consumption estimates are needed to plan fuel stops and to make sure drivers carry enough cash or have enough credit to cover their fuel expenses. Most employers will issue their drivers one or more card lock cards to purchase fuel for their trucks. Download the app for each of these fuel suppliers on your phone to help you plan your fuel stops.

When planning your trip, remember that fuel usage is based on highway driving time, city (urban) driving time and unexpected slowdowns. As discussed in Chapter six: Fuel-efficient driving, many factors can increase fuel usage, for example:

- Driving too fast
- Prolonged idling
- Operating at too high an RPM
- Stop and go driving
- Poor highway conditions
- Mountainous terrain
- Headwinds/tailwinds (reduce speed by 10 km/h when driving into strong headwinds).
- Condition of the vehicle: low tire pressure or defects in the engine or fuel line.

Fuel calculators are available online. When travelling between Canada and the United States, you'll need to convert imperial and metric quantities.



Estimating personal expenses

Drivers should consider personal needs when trip planning and keep receipts or other documentation to prove expenses. Each carrier will have their own policies and procedures for reimbursement. Be sure to know who is responsible for what expenses.

Drivers should consider:

- Meals
- Layover/lodging
- Fuel
- En route repairs
- Towing
- Tolls
- Permits
- Special fees

13 Air brakes

Section 1 — Single unit

What you'll learn

This section will help you learn to:

- ☐ Identify the components of an air brake system
- ☐ Explain how an S-cam foundation brake works
- ☐ Describe what happens when one or more air brake system components fail

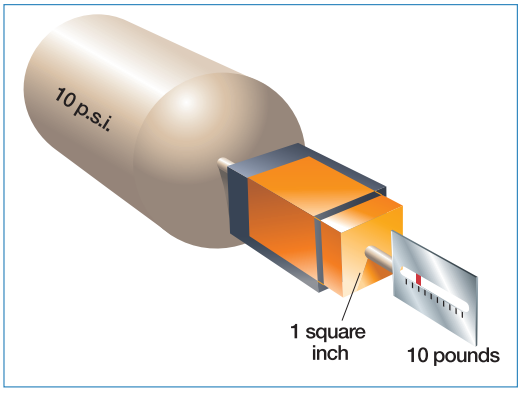
Why do we have air brakes?

Air brake systems:

- Use a much greater force to apply the brakes than hydraulic braking systems do, which is needed to cope with the heavy loads of commercial vehicles.
- Are more tolerant to small leaks, which in a hydraulic system could result in brake failure (an air brake system includes a compressor to generate more compressed air as needed).
- Are capable of stopping heavy vehicles safely.

What's compressed air?

Air can be compressed (squeezed) into a much smaller space than it would normally occupy. For example, the tires on a vehicle are filled with compressed air to support the weight of a vehicle.



Squeezing air into a smaller space increases the air's resistance, which creates pressure that can be converted into mechanical force to apply the brakes.

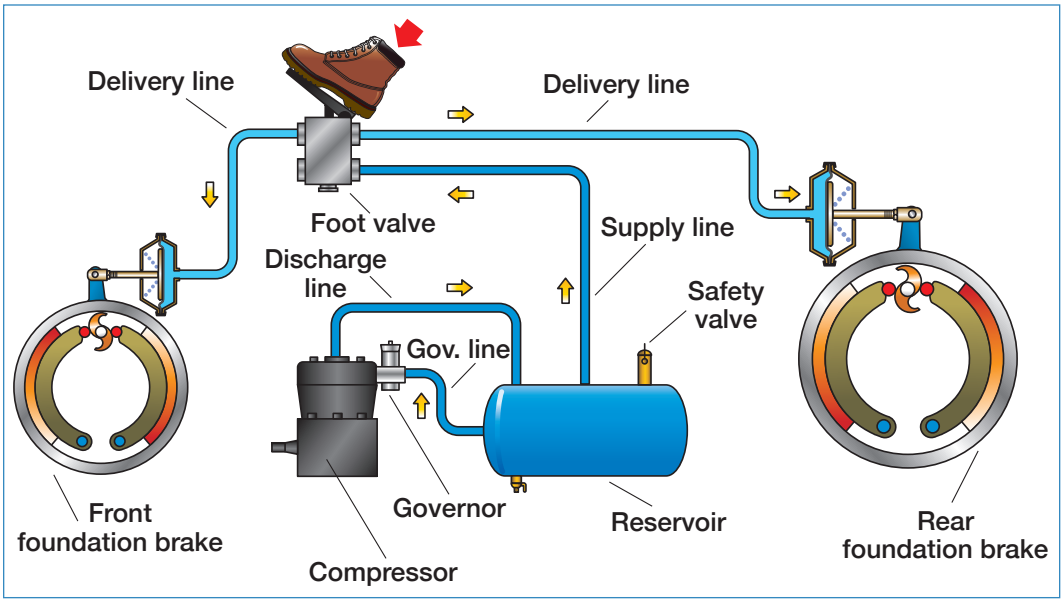
If a constant supply of compressed air were directed through a pipe that's one square inch (see previous diagram), and if a one square-inch plug were placed in the pipe, the compressed air would push against it. Holding a scale against the plug would register how much force the air was exerting against the plug.

Pressure is measured in pounds per square inch (p.s.i.) or kilopascals (kPa). One p.s.i. is equal to 6.89 kPa.

If the scale registered 10 p.s.i. (68.9 kPa), for example, then it could be said that the force was 10 lb on the one square-inch surface of the plug.

The more the air is compressed (that is, the greater the air pressure), the greater the force that would be exerted on the face of the plug.

Basic air brake components



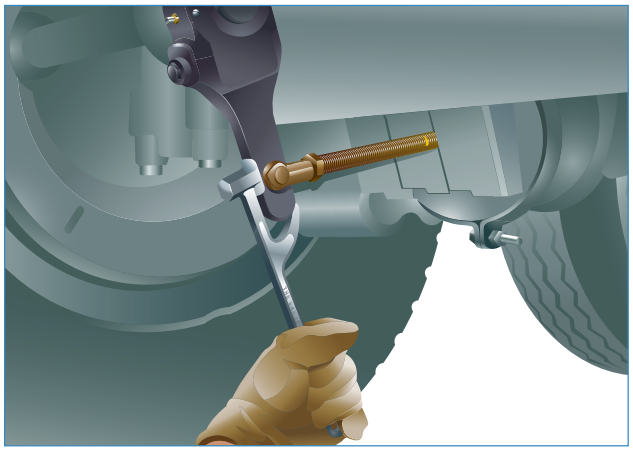
In this simplified diagram, air at full system pressure is indicated by the dark shading in the line connecting the supply reservoir to the foot valve. The driver is making a brake application. This can be seen by the light shading in the air lines connecting the foot valve to the air chambers. Arrows show the direction of air flow. The air chambers are pressurized and the brake linings (in red) have contacted the brake drums, slowing the vehicle.

This diagram, showing the brakes applied, highlights the components that are used to make the simplest possible air brake system:

- A compressor to pump air with a governor to control the compressor.
- Air lines to allow the pressurized air to flow between the air brake system components.
- A reservoir to store the compressed air.
- A brake pedal (usually called a foot valve) to apply the brakes by directing compressed air from the reservoir to the brakes.
- Foundation brakes, including brake chambers, slack adjusters, brake linings and drums or rotors, transfer the force generated by the compressed air through a mechanical linkage to apply the brakes.

Force multipliers

The force generated at the wheel to stop is a lot more than the force you apply when pushing down on the brake pedal.

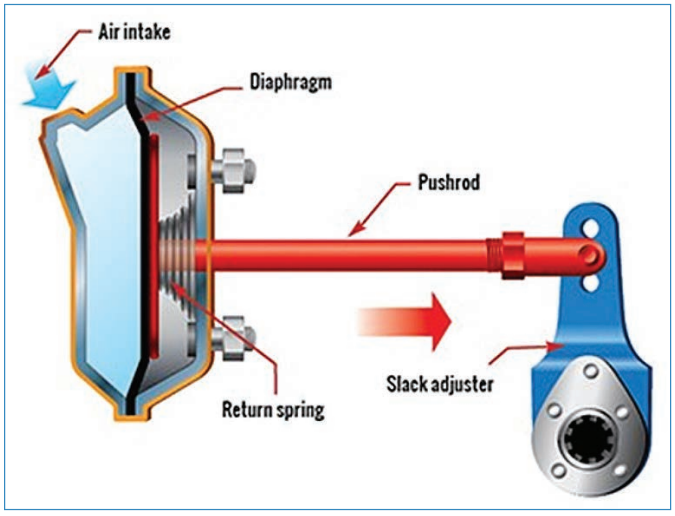


In the diagram, the driver is pulling on an air brake slack adjuster to measure if the brake is within adjustment tolerance.

The slack adjuster, besides adjusting for brake wear, acts as a lever. Leverage is a form of force multiplication.

Trucks and buses are much heavier than cars, so they need more mechanical advantage in order to safely and effectively stop the vehicle.

Air brake chamber components



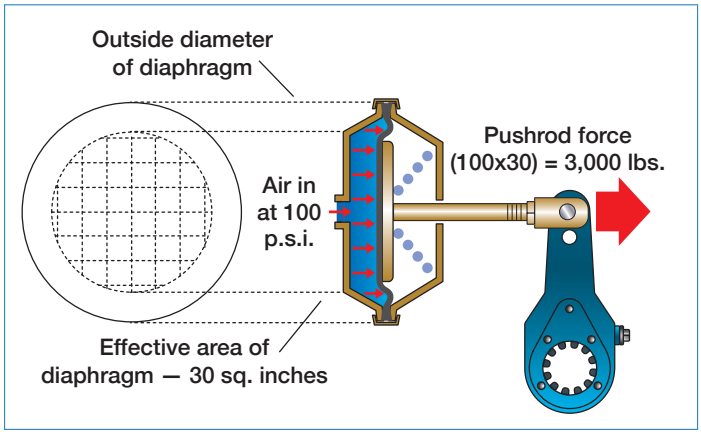
This diagram shows the most common device used to apply air brakes: the air brake chamber. It converts the force of compressed air into a strong mechanical force through the pushrod and slack adjuster.

The air brake chamber consists of a flexible diaphragm clamped between two steel housings. The diaphragm construction is similar to a tire sidewall consisting of a reinforced fabric core with a rubber coating. The other main parts are the pushrod and plate assembly and a return spring.

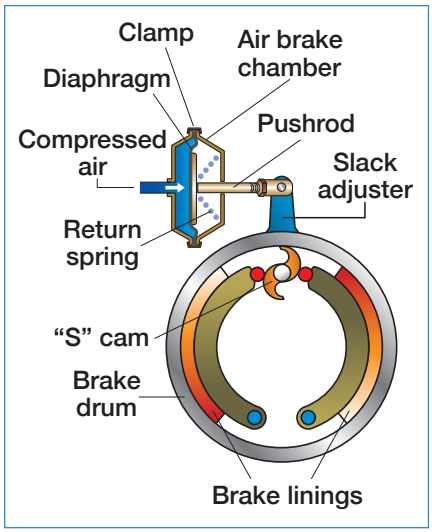
Leverage and air pressure

Air chambers are made in a number of sizes ranging from Type 9 (nine square inches of effective diaphragm area) to Type 36 (36 square inches of effective diaphragm area). The range of sizes allows for matching air chamber force with axle capacity so that no axle is under- or over-braked.

Air chambers are very powerful. A typical Type 30 chamber, if applied with air pressure at 100 p.s.i. (690 kPa), develops a pushrod force of 3000 lb (1,360 kg). This force is then applied to move the lever (the slack adjuster) to apply the brakes.



Air brake chamber — air pressure applied



This diagram shows how air under pressure comes in one side of the diaphragm causing it to inflate. As it inflates, it pushes against the pushrod, plate assembly and the return spring causing them to move. Note the position of the slack adjuster — it's now at about a 90-degree angle to the pushrod.

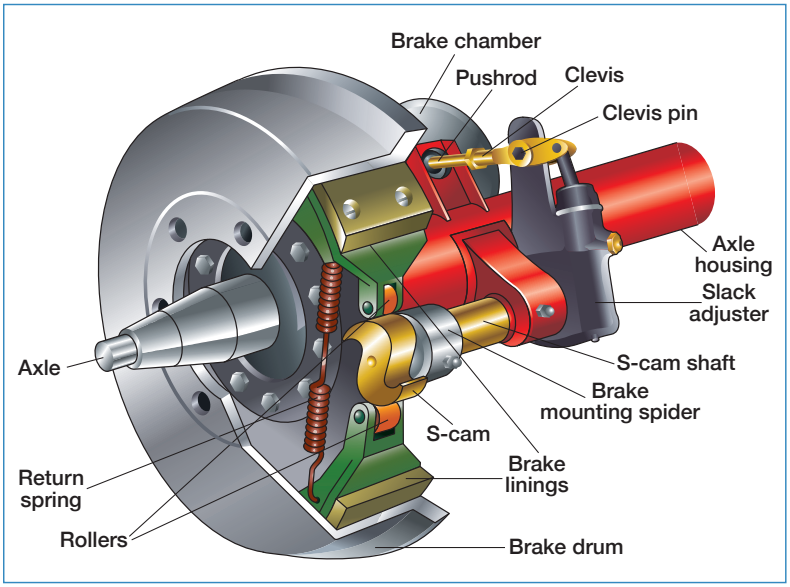
The amount of pushrod force is governed by the air pressure (in pounds per square inch) and the effective surface area of the diaphragm (in square inches). The pushrod force is exerted against the brake mechanism causing the brakes to apply.

The most common size air chamber used on a truck drive axle is a Type 30 clamp type chamber with 30 square inches of effective diaphragm area.

Even though air brake system pressures are 100 p.s.i. (690 kPa) and above, much lower air application pressure, usually less than 20 p.s.i. (138 kPa), is all that's required when making normal stops.

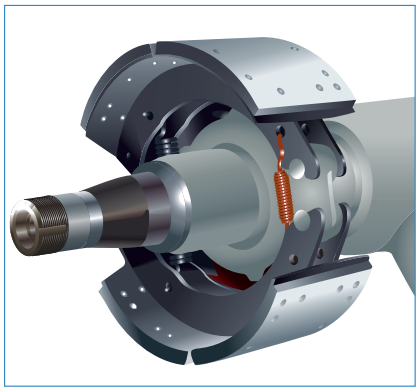
Foundation brakes: S-cam type

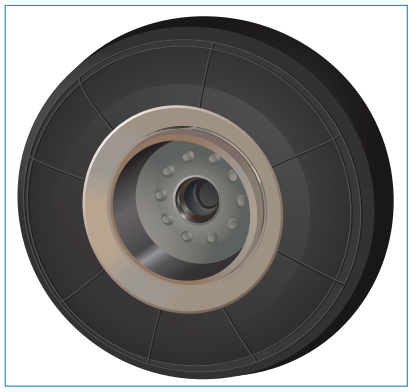
The brake assembly at each wheel is generally called the foundation brake. It consists of the brake parts around the wheel that are operated by the air brake system, including the brake chamber. The most popular type of foundation brake is the S-cam drum brake.



This diagram shows the main components used in the S-cam drum foundation brake. The air brake chamber pushrod is connected to a lever arm called a slack adjuster, which is attached to a camshaft with an S-shaped head called an S-cam. Air pressure applied to the chamber causes the pushrod to move forward causing the slack adjuster to rotate the S-cam. This causes the brake linings to press against the brake drum causing friction, which causes the wheel to decelerate stopping the vehicle.

The slack adjuster is also the way to adjust the brakes to compensate for brake lining and brake drum wear. Brake shoe return springs pull the brake linings away from the drum when the air pressure is released from the air chamber.





Brake adjustment

There are two methods of checking for correct adjustment of your brakes, but the measurements to indicate the need for brake adjustment are different. The applied stroke method is that used by roadside inspectors, and is also a method recommended by commercial fleet maintenance supervisors. Unless you have a device to apply and hold the service brakes on, this method requires two people — one to apply the brakes and one to measure travel.

The second method is the pry method of free stroke measurement (pry method), and requires you to use a brake tool (shown in the force multipliers section above) to measure brake chamber pushrod travel. New air brake chamber pushrods have markings (usually in red) to indicate when brake adjustment must be done immediately. If the pushrod travel becomes too excessive, the marking will show. Don't wait until the red marking is exposed before adjusting the brakes.

All commercial trucks and trailers with air brakes have been manufactured with automatic slack adjusters since 1996. While automatic slack adjusters adjust themselves during normal brake applications made in day-to-day driving, it is required that you still check the pushrod travel as part of your daily trip inspection. The acceptable measurement limit of pushrod travel depends on the size of the brake chamber. In general, for an automatic slack adjuster when using the pry method, there should be 19 mm (0.75 in) or less of free-play or pushrod travel. If an automatic slack adjuster strokes beyond the maximum allowed, it is usually an indication there are other brake problems that need to be repaired by a qualified mechanic. It is dangerous to manually adjust an automatic slack adjuster — they should only be adjusted or repaired by a qualified mechanic.

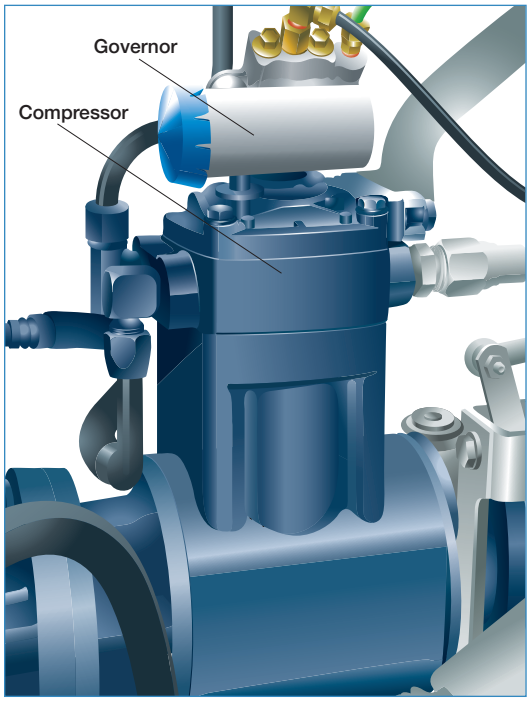
While most commercial trucks and trailers operating within the industry are equipped with automatic slack adjusters, there are still older vehicles in operation that are equipped with manual slack adjusters. Generally, the acceptable pushrod travel for a manual slack adjuster is 13 mm (0.5 in) to 19 mm (0.75 mm) when using the pry method. Unlike automatic slack adjusters, if the pushrod travel of a manual slack adjuster exceeds 20 mm using the pry method or 45 mm using the applied stroke method, you must adjust the brakes.

Brake adjustment is important and is more fully covered in the ICBC Driving Commercial Vehicles guide (MV2677) in Chapter 9 — Air brake adjustment.

Compressor

The first requirement of an air brake system is a way to compress air and store it in reservoirs (tanks) so that it's available for instant use.

The source of the compressed air is the compressor, which takes in air from the atmosphere and compresses (pressurizes) it. The compressed air is then pumped through an air line to a supply reservoir.



The compressor is usually mounted on the engine of an air brake-equipped vehicle — on most, it's mounted on the side of the engine and driven by gears. A belt, like a fan belt, drives some compressors on older and smaller vehicles. As long as the engine is running, the compressor will be running. The compressor must be able to build air pressure from 50 p.s.i. (350 kPa) to 90 p.s.i. (620 kPa) in under 3 minutes.

Governor

Although the compressor is capable of compressing air to over 500 p.s.i. (3,448 kPa), this is far higher than is needed to operate an air brake system. Most current air brake systems operate with a maximum pressure of 135 p.s.i. (931 kPa).

There needs to be a way to stop compressing air once a certain air pressure has been reached. And, if the air pressure in the tanks drops below a certain level (such as after a series of brake applications), there needs to be a way to start compressing air again.

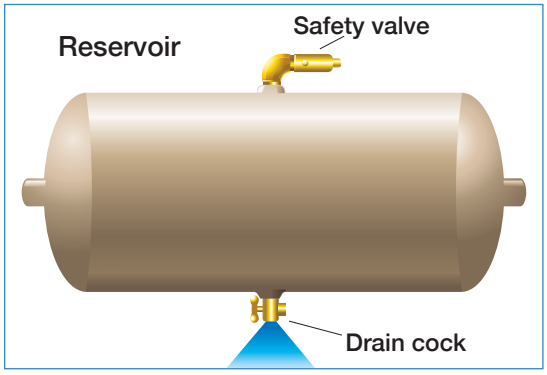
This is the job of the governor. When enough pressure has been built up, the governor causes the compressor to go into an "unloading" stage.

Governors are usually set to unload the compressor (stop the compressor from pumping air) when the air pressure reaches about 125 p.s.i. (862 kPa). Although the maximum pressure on different vehicles may vary between 105 p.s.i. and 135 p.s.i. (724 kPa and 931 kPa), the range between minimum and maximum pressure should be approximately 20 p.s.i. (138 kPa).

For example, if the maximum air pressure was 135 p.s.i. (931 kPa), the governor would put the compressor in the loading stage if air pressure in the reservoirs dropped to 115 p.s.i. (793 kPa). Applying the brakes several times would likely cause the air pressure to drop to this level. The governor must put the compressor in the loading stage if the air pressure drops below 80 p.s.i. (552 kPa).

Reservoirs

Tanks (known as reservoirs) are used to store the compressed air from the compressor.



A safety valve on the first reservoir protects the reservoirs from being over-pressurized and bursting if the governor fails to unload the compressor. The safety valve consists of a spring-loaded ball to allow reservoir air to exhaust into the atmosphere. The valve's pressure setting is determined by the force of the spring. Safety valves are normally set to vent the excess pressure at approximately 150 p.s.i. (1,034 kPa).

If the safety valve has to relieve the pressure, the governor needs service or repair. Only a qualified mechanic should do this.

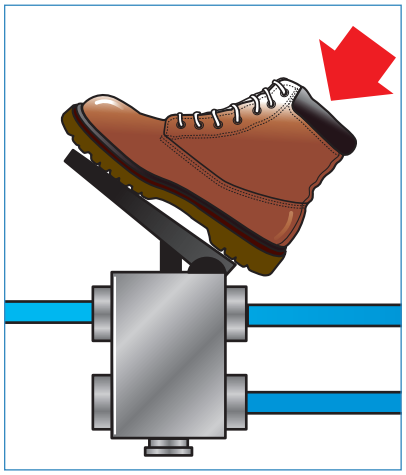
The air that's delivered from the compressor usually contains some water vapour that condenses into liquid. This is why the supply reservoir is often called the wet tank. Most compressors also pass a small amount of oil and carbon particles. The oil and any other contaminants mix with the water and make a grey sludge.

If allowed to accumulate, this sludge can enter other components of the braking system. Too much water in the system causes trouble with valves and other parts. In winter, water in the system may freeze causing malfunction of valves or brake chambers.

To prevent this sludge from contaminating the air valves in the system, drain valves (also known as drain cocks) are installed in all reservoirs. Draining the reservoirs can prevent this sludge buildup and most manufacturers recommend you drain them daily.

Foot valve

Pressing on the brake pedal (called the foot valve treadle) applies the air brakes, just like stepping on the brake pedal applies the brakes in a car.



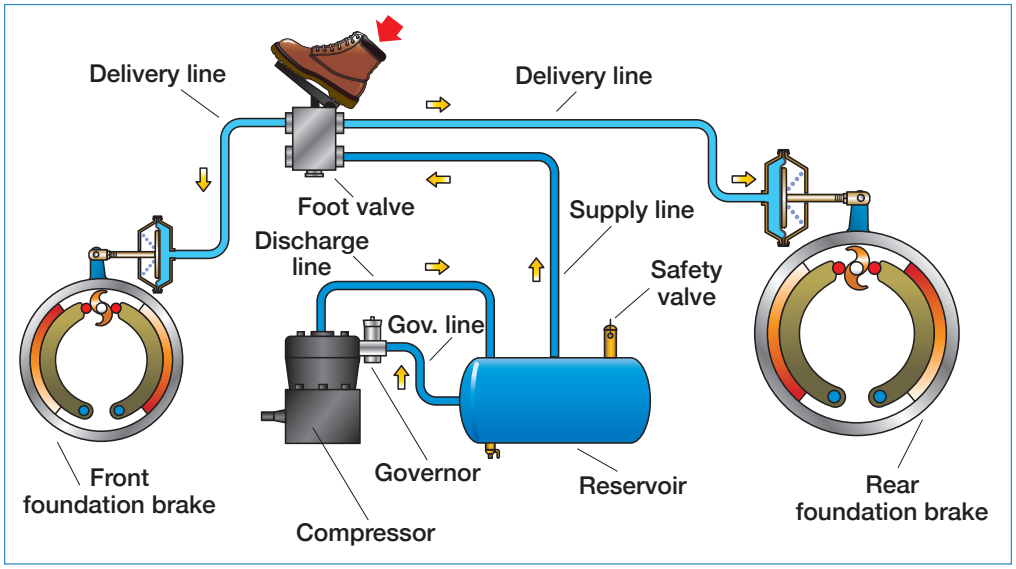
The treadle (pedal) of a foot valve has a springy feel that's quite different from the feel of a hydraulic brake pedal of a car. It's possible to push the pedal all the way to the floor which will give you your maximum brake application pressure. You're not creating the force with your foot, you're simply opening a valve that allows the stored compressed air to travel to the brakes. If the foot valve is held in one position, the air pressure delivered to the brake system will remain constant.

Releasing the foot valve allows the application air to be exhausted through the assembly's exhaust ports, releasing the brakes. It's important to remember that the maximum brake application you can make is limited to the amount of air pressure available in the reservoir. For example, if the reservoir air pressure is 80 p.s.i. (552 kPa), this is the maximum air pressure available for a brake application.

A unique feature of a foot control valve is the ability to maintain the application pressure that you've chosen, even if there are small leaks downstream from the foot valve. You need only to maintain the treadle position and the foot valve will momentarily open, replenish any air that has been lost and then close — all automatically.

How air brakes work

Brakes applied

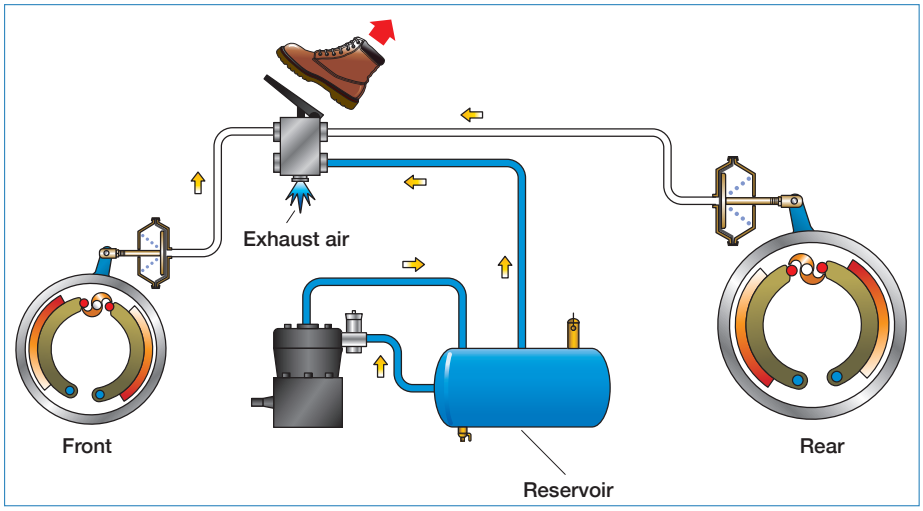


In this simplified diagram, air at full system pressure is indicated by the dark shading in the line connecting the supply reservoir to the foot valve.

The driver is applying the brakes, which is indicated by the light blue shading in the air lines connecting the foot valve to the air chambers with arrows that show the direction of air flow.

The air chambers are pressurized and the brake linings have contacted the brake drums, slowing the vehicle.

Brakes released



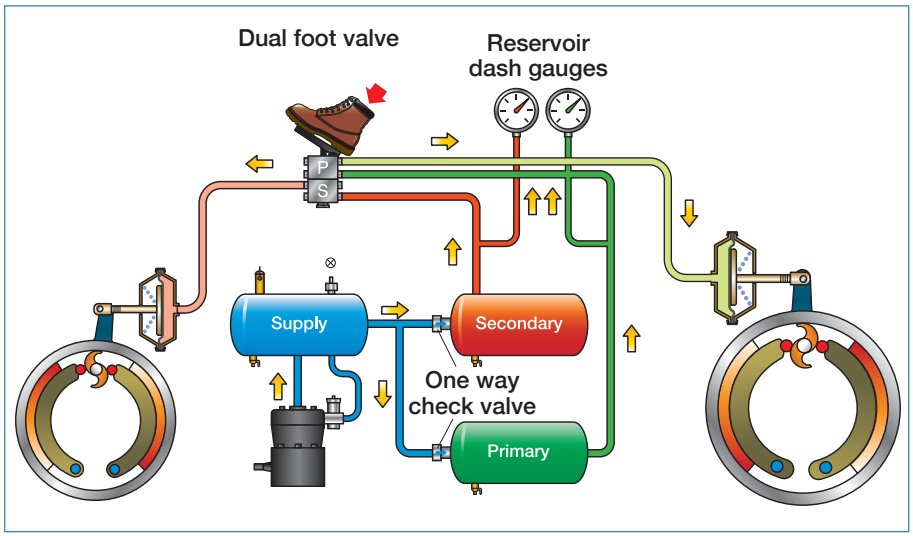
In this simplified diagram, the driver's foot is off the brake pedal allowing the brakes to release. This has caused an exhaust port in the bottom of the foot valve to open, so the air that was applied to the brake chambers can escape. Note the burst of exhaust air below the foot valve.

The return springs in the air chambers have returned the pushrod assembly to the released position and the slack adjusters and S-cams have rotated to their released position.

Brake shoe return springs (not shown) have also retracted the brake linings away from the brake drums.

Dual air brake systems

Dual air brake systems have been in use since the mid-1970s.



The device that made dual systems possible is the dual foot valve. It's actually two control valves operated by a single pedal. This allows the brake system to be divided into two completely independent sections. Each section has its own supply, delivery and exhaust ports.

The two sections of the dual foot valve are the primary and secondary. The primary section is located closest to the pedal and in many systems operates the drive axle brakes. The secondary usually operates the steering axle brakes.

When the driver applies the brakes, both sections of the dual foot valve are activated. Air from the primary tank is applied to the rear axle brakes and air from the secondary tank is applied to the front axle brakes.

Most dual systems use three reservoirs: a supply reservoir and two service reservoirs, one for each section of the dual system. Each service reservoir is filled through a one-way check valve and each has its own pressure gauges.

Even if the primary or secondary system totally fails, the driver is able to make a controlled stop using only the foot valve, although maximum braking power will be reduced.

There are other ways of splitting a dual air brake system. However it's divided, if one of the systems fails, the driver is still able to make a controlled stop.

Note the change in terminology for the reservoirs. The first reservoir (wet tank) is called the supply reservoir, while the two service reservoirs are called the primary and secondary to indicate the section of the dual foot valve that they supply.

Components of a dual air brake system

Supply, primary and secondary reservoirs

The compressed air from the compressor contains several contaminants including water vapour, oil mist and carbon particles. Most contaminants settle in the supply reservoir. Primary and secondary reservoirs have been added so that all the air brake components, with the exception of the governor valve, are supplied with cleaner air.

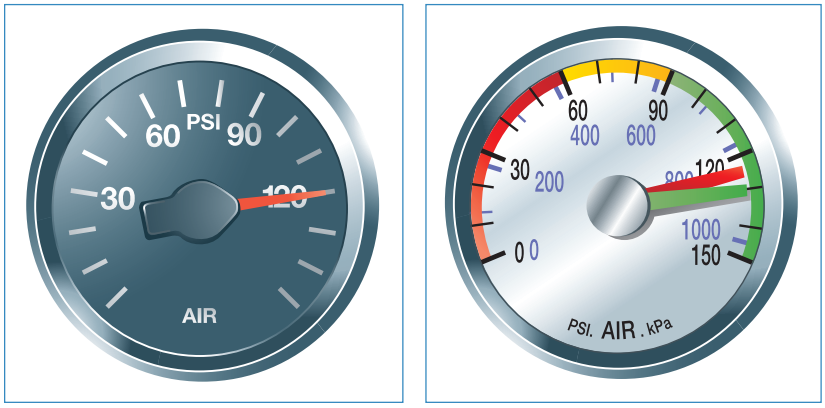
One-way check valve

One-way check valves allow air to flow from the supply reservoir to the primary and secondary reservoirs. As the name implies, a one-way check valve allows air to flow in one direction only.

This is so the air supply in the primary and secondary reservoirs is protected if there's a failure in the air compressor, compressor discharge line or supply reservoir.

Reservoir pressure gauges

All air brake-equipped vehicles have at least one gauge on the instrument panel to indicate the air pressure in the service reservoir system.



Rather than having two separate reservoir gauges, many vehicles have a single gauge with two needles, indicating the pressure in the primary and secondary reservoirs.

Many vehicles also have a gauge to indicate how much air pressure is being applied when the foot valve is depressed.

The reservoir pressure gauge is mounted in the dashboard so you can monitor the status of the air brake system while driving and during a pre-trip inspection.

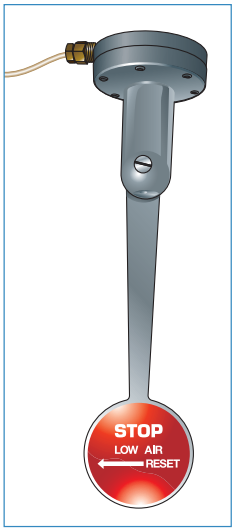
Low air warning device

All vehicles equipped with air brakes must have a warning device to indicate if the air pressure in the system drops to a dangerous level. This could occur if there's an air leak or if you apply the brakes repeatedly and have used up the air supply more rapidly than the compressor can replenish it.



The low air warning device should come on when air pressure drops below 60 p.s.i. (414 kPa).

A typical low air warning device is a warning light on the dashboard. There may also be a buzzer.



Some older vehicles are equipped with a low air warning device near the top of the windshield that drops into the driver's view when air pressure drops below approximately 60 p.s.i. (414 kPa). It's known as a wig-wag.

Some wig-wags automatically retract when air pressure rises above the warning level of 60 p.s.i. (414 kPa), while others need to be manually pushed up to the "out of view" position after the air pressure has risen above the warning level.

When a low air warning device activates, stop the vehicle and find the cause of the air loss. The air pressure remaining in the system (approximately 60 p.s.i./414 kPa) will be enough to stop the vehicle if you act promptly.

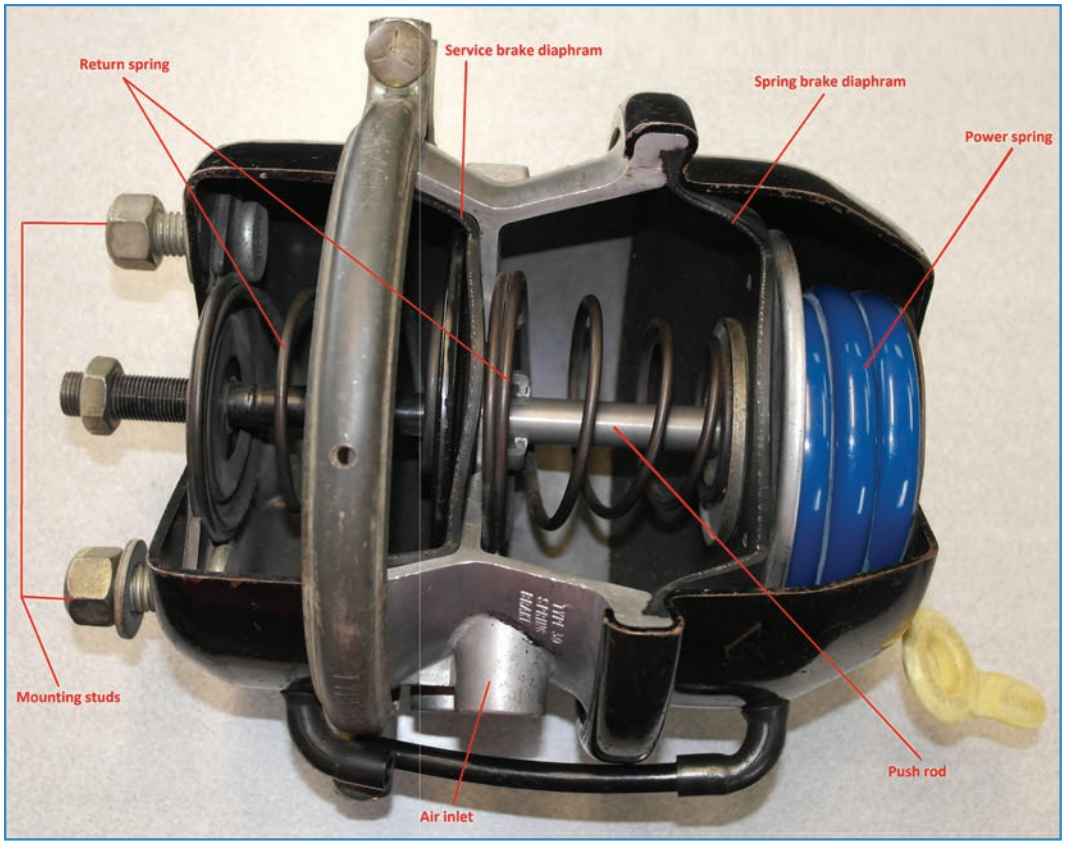
Parking brakes

While air pressure does an excellent job in helping to stop a vehicle by applying the foundation brakes, it's totally unreliable (and illegal) for use when parking. If you park a vehicle using only the air brakes, any leaks in the system or any failure in a hose, diaphragm or air valve would result in loss of air pressure and a possible rollaway crash.

Regulations for parking brakes require that the parking force must be maintained by mechanical means and be unaffected by loss of air pressure.

The most common type of parking brake in an air brake system is the spring parking brake. The second type is known as a safety actuator and is usually found only on some highway coaches and intercity buses.

Spring parking brakes



This diagram shows the main components of a typical combination spring and service brake chamber.

Spring parking brakes are mounted on the rear axles only — not on steering axles. The spring parking brake section is mounted behind the service brake chamber, which contains the normal pushrod, diaphragm and return spring. These brakes are applied and remain applied by mechanical spring pressure, not by air pressure.

The coil spring in most spring parking brake chambers can exert a force of between 1,500 and 2,000 lb. Keep away from a spring parking brake chamber that shows any sign of damage in the housing, such as cracks or dents. The spring in a spring parking brake chamber is under extreme pressure and could cause serious injury if tampered with. Spring parking brakes should only be serviced by a qualified mechanic.

Applying and releasing spring parking brakes

There are several ways to apply and release spring brakes.

- Normally, they're applied and released by using the parking brake control valve on the dashboard.
- If the air pressure in the system falls below approximately 60 p.s.i. (414 kPa), the spring brakes may begin to drag and at 20 p.s.i. to 45 p.s.i. (138 kPa to 310 kPa) may fully apply automatically.
- Caging the brakes: involves manually releasing an applied spring parking brake. If all air's lost and the vehicle has to be towed, spring parking brakes can be released by caging them. **For safety reasons, this should only be done by a qualified mechanic when making a repair or in an emergency.** Always ensure the wheels are blocked before spring parking brakes are caged — there will be no parking brake force at the wheel that is caged.

A **parking brake control valve** (usually a yellow button) is mounted on the dashboard. In most cases, pushing this valve in allows air pressure to flow to the spring parking brake chambers causing these spring parking brakes to release (a minimum 90 p.s.i./620 kPa is required). Essentially, air at reservoir pressure has been supplied to the spring parking brake causing the parking brake diaphragm to inflate, compressing the main spring.

Pulling the parking brake control valve out to the "park" position, exhausts the air pressure against the spring parking brake chamber causing these brakes to apply. Instructions are usually printed on the button.

While the push-pull parking brake control is the most common, some systems may use a switch instead. Usually, flipping it in one direction applies the spring parking brakes and flipping it in the other direction releases them.



Driver alert — compounding of brakes

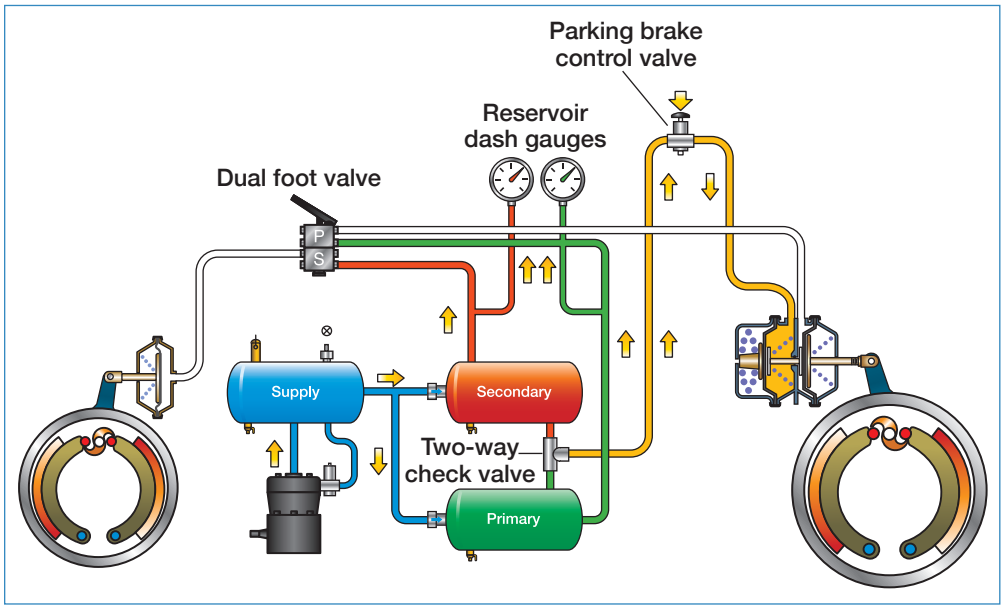
Always be sure that you have released the spring parking brakes before making heavy service brake applications, like during a pre-trip inspection.

When spring parking brakes are applied, there's up to 907 kg (2,000 lb) of force applied to all of the brake components. If a heavy service brake application is made, the force of the air application is added to the spring force. This could add a further 1,600 kg (3,000 lb) for a total of 2,268 kg (5,000 lb). This is known as compounding and can damage slack adjusters, S-cams, brake chamber mounting bolts, brake shoe rollers, shoes and brake drums.

Lighter brake applications of less than 30 p.s.i. to 40 p.s.i. (207 kPa to 276 kPa), to prevent a vehicle from rolling while the spring parking brakes are being released or applied, will not compound the brakes.

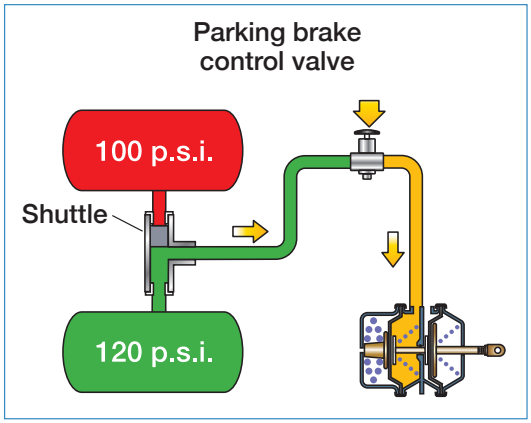
Spring parking brakes in dual air brake systems

This installation takes advantage of the primary and secondary reservoirs to supply the parking brake dash control with air from the tank that has the highest pressure.



This is accomplished by the use of a two-way check valve. The air that's delivered from the two-way check valve is called blended air.

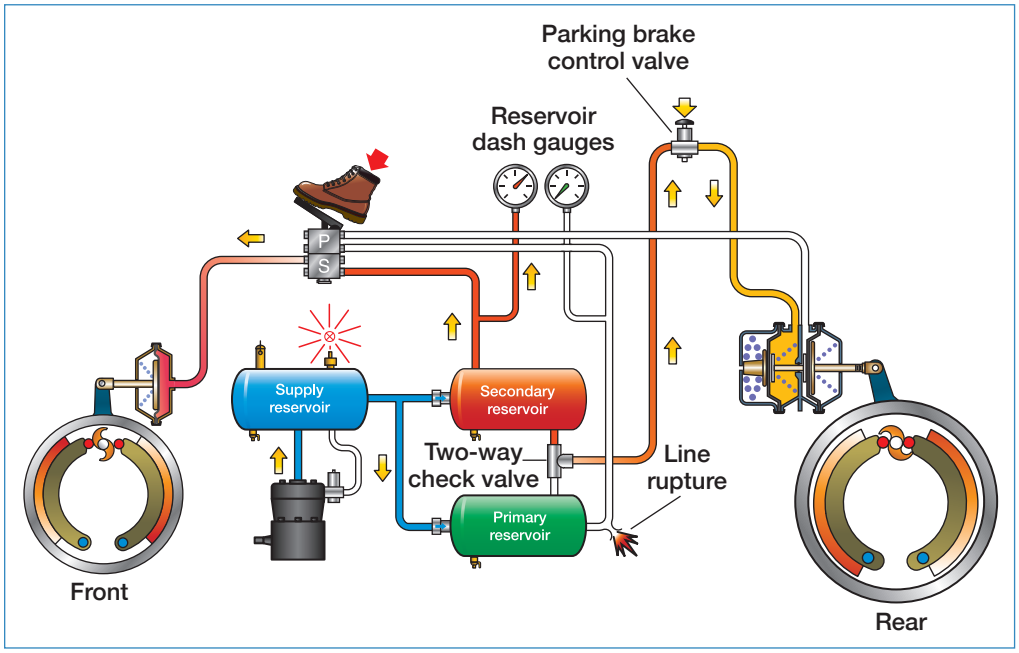
Blended air



The two-way check valve protects the primary circuit from the secondary circuit and allows the reservoir with the higher pressure to be supplied to the parking brake control.

This also ensures that the spring parking brakes will not automatically apply if there's a total loss of air pressure in either reservoir.

Dual air brake system — partial system failure



This diagram shows the benefit of the blended air supply for the parking brake system. There has been a loss of air from the primary reservoir. The two-way check valve shuttle has moved so that secondary reservoir pressure supplies the parking brake control valve.

The result is that the spring parking brakes don't apply automatically. The low air warning system has alerted the driver to the air loss, allowing them to make a controlled stop using the front axle brakes.

Some vehicles with dual air systems are equipped with an optional device called a spring brake modulator. This device senses a loss of pressure in the primary system, and when the driver applies the service brakes, causes air to be exhausted from the spring parking brakes in direct proportion to the brake application. By simply applying the foot valve normally, the driver controls the amount of spring force used to assist the front brakes to bring the vehicle to a controlled stop.

All vehicles must meet *Canadian Motor Vehicle Safety Standards* for emergency stopping, so regardless of how the dual system is arranged, the vehicle will have adequate braking force even with a partially failed air system.

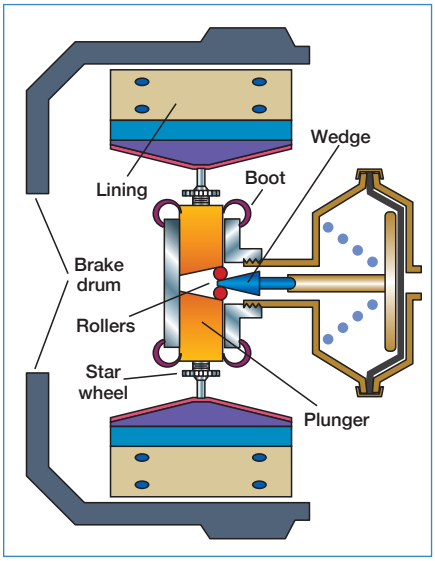
With all systems, after stopping, you can securely park the vehicle by manually applying the parking brake control valve.

Types of foundation brakes

The common types of foundation brakes found on air brake-equipped vehicles are:

- Wedge brakes
- Air disc brakes
- Long stroke and regular stroke air brakes
- Air-over-hydraulic brakes

Wedge brakes



This type of brake uses one or two small air chambers with wedge-shaped pushrods. Wedge brakes are usually found only on steering axles.

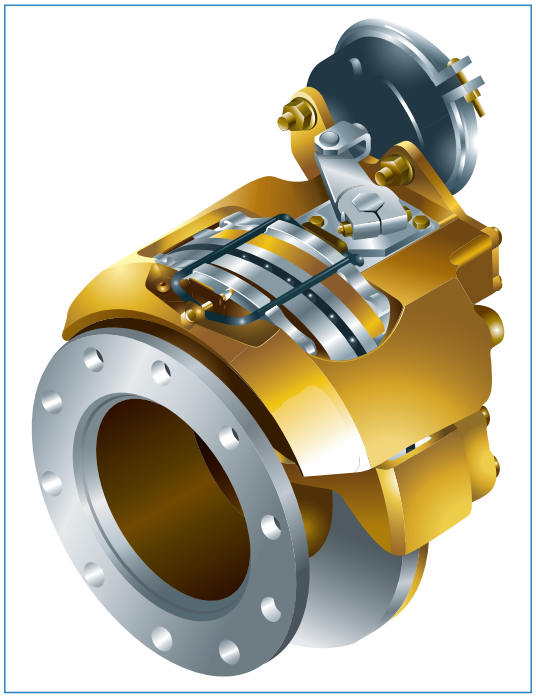
When the brakes are applied, air pressure in the brake chamber pushes the wedge part of the pushrod between two rollers, forcing the brake linings out to contact the brake drum.

Most wedge brakes have internal automatic adjusters. Checking proper adjustment requires that inspection hole covers in the backing plate be removed so that brake lining movement can be checked while the brakes are applied and released. If either linings move more than 1.5 mm (1/16 inch) or a total of 3 mm (1/8 inch) for both linings, the automatic adjusters have failed.

Unlike conventional S-cam braking systems, you can't easily check the wedge brake adjustment of a wedge brake.

Adjustment and repairs to wedge brakes should only be done by a qualified mechanic.

Air disc brakes



This type of brake uses a rotor, or disc, that's mounted to the wheel hub and rotates with the wheel. Two brake pads are located on either side of the rotor. When they're applied, the brake pads press against the rotor. This action is similar to that of a large "C" clamp.

There are a number of different linkages used between the air chamber and the operating mechanism. This illustration only shows one type, but the principle of the others is similar.

Most air disc brakes feature an internal automatic brake adjustment mechanism to adjust for brake pad wear.

Unlike conventional S-cam braking systems, you can't check the adjustment of an air disc brake.

Make sure adjustment and repairs to air disc brakes are only done by a qualified mechanic.

Long stroke and regular stroke brake chambers

Many new air brake systems are equipped with long stroke brake chambers. As the name implies, it has a longer pushrod stroke than the pushrod of a standard brake chamber.

Long stroke brake chambers can be identified by their square-shaped inlet ports and/or trapezoid-shaped name tag on a clamp bolt.

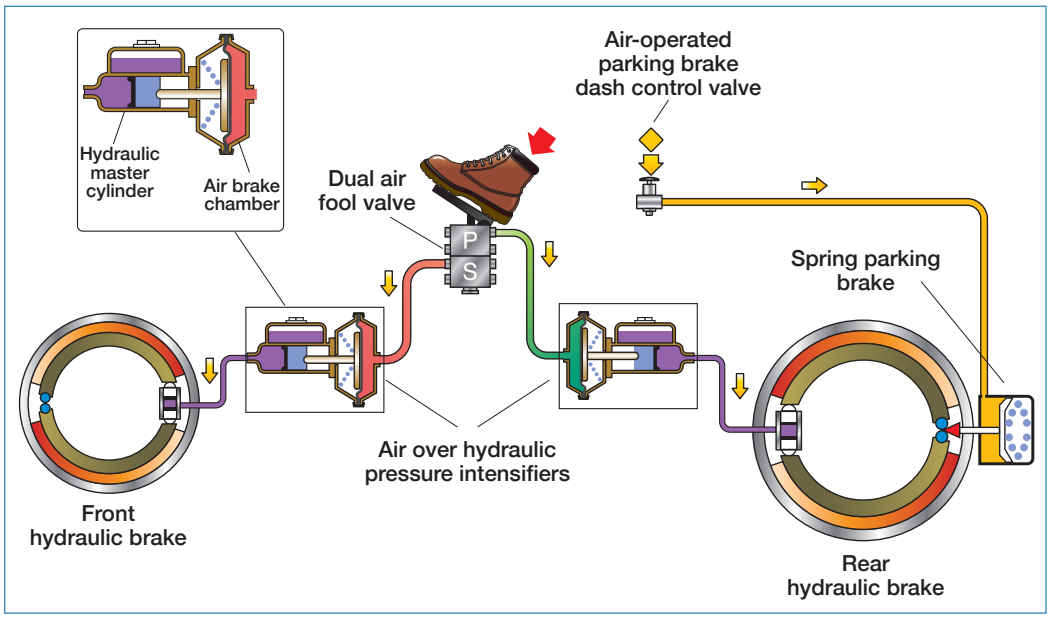


Air-over-hydraulic brakes

Air-over-hydraulic brakes are sometimes found on middleweight trucks and buses. This type of braking system combines the features of an air brake system and a hydraulic braking system.

Hydraulic foundation brakes offer several advantages on commercial vehicles of this size, including light weight, compact size and proven automatic adjusting mechanisms.

Most middleweight commercial vehicles were once powered by gasoline engines, which supplied a source of engine vacuum so that vacuum boosters for the hydraulic brakes could be used. The now-common diesel engine doesn't supply a usable vacuum, so a partial air brake system has been adopted.



As shown in the diagram above, an air-over-hydraulic braking system consists of a compressor, governor, air storage tanks, foot valve and two air-over-hydraulic pressure intensifiers. The system may also include spring parking brakes. Like a full air brake system, typical air-over-hydraulic braking systems use a standard air pressure of around 125 p.s.i. (862 kPa).

A standard dual air foot valve is also used. Pressing on the foot valve directs air pressure to the air-actuated side of the hydraulic pressure intensifiers causing the hydraulic-actuated side of the intensifiers to direct hydraulic pressure to the foundation brakes. In other words, air pressure actuates the braking action, but hydraulic pressure delivers the braking force to the foundation brakes to stop the vehicle.

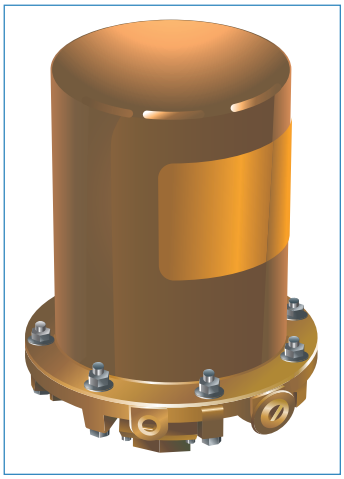
To provide a parking brake, many air-over-hydraulic braking systems have a parking brake chamber attached to the foundation brake.

The parking brake is controlled by the same dashboard-mounted parking brake control valve used on vehicles with full air brake systems. Applying the parking brake control valve on the dashboard applies the spring in the parking brake chamber, which forces a wedge between the brake shoes to apply the brakes. Releasing the parking brake control valve directs air pressure to the parking brake chamber to contract the wedge and spring.

Like a full air brake system, if there were a serious air leak in an air-over-hydraulic system, eventually the brakes would stop functioning properly. For this reason, you need to know and understand how the system works and check air pressure gauges frequently.

Other air brake system components

Air dryers



Air dryers are commonly installed in the compressor discharge line between the compressor and the first reservoir. They're designed to remove any water vapour, oil mist and carbon particles from the air before it's delivered to the supply reservoir.

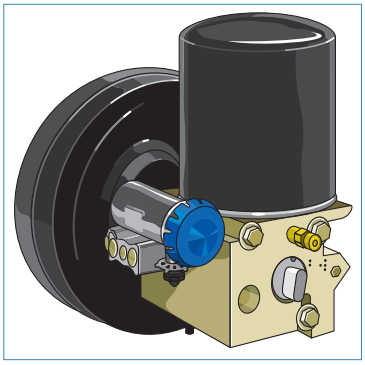
The warm, moist air from the compressor enters the dryer where a certain amount of the water vapour condenses on cool metallic surfaces. The air then passes through a filter that removes any oil and through another filter that removes the remaining water vapour. From there, the clean air passes through an internal one-way check valve and onto the supply reservoir.

When the system has come up to full pressure, a purge port in the bottom of the air dryer will open. The collected contaminants are ejected along with a sudden burst of air.

At the same time, a certain amount of clean air is allowed to flow back through the filters. This reverse flush effect cleans both filters in readiness for the next compression cycle. The purge port remains open until the compressor resumes pumping.

Some air dryers are equipped with an electric heating element to prevent freezing in cold weather.

Check the air dryer operation by periodically looking for water in the reservoirs. More than a few drops may indicate that the air dryer or compressor needs servicing.



There's also an integrated air dryer system, which combines the spin-on filter, dryer and governor into one unit. It also includes a purge reservoir that provides the air volume to purge all moisture and contaminants from the dryer cartridge each time the air compressor unloads. The former "wet" or "supply" reservoir isn't needed in this system. A unique feature is that air pressure builds in one service reservoir first and when pressure reaches approximately 100 p.s.i. (689 kPa), the other reservoir will begin to fill. Pressure in both service reservoirs and the air accessories circuit will then build to full pressure. Maximum pressure may be up to 135 p.s.i. (931 kPa).

Alcohol evaporators and alcohol injectors



Alcohol evaporators and alcohol injectors are optional devices that introduce a small amount of alcohol vapour into the air system. The alcohol vapour combines with any moisture that may be present. The alcohol acts as an anti-freeze, lowering the freezing point of any moisture that's collected in the air system.

These systems are designed to use pure methyl hydrate to provide the alcohol. Be sure to use only methyl hydrate specifically formulated for use in alcohol evaporators or alcohol injectors.

Automatic drain valves

Automatic drain valves, sometimes called spitter valves, are optional devices installed on some or all of the reservoirs on some air brake systems. They intermittently expel any contamination that's collected.

Most are self-contained and open briefly each time reservoir pressure lowers two or three p.s.i. (13.8 kPa or 20.7 kPa), but some are connected to the compressor governor and open briefly each time that the compressor cycles.

The manual drains should be opened periodically to check for the presence of water in reservoirs. If you find contaminants or more than a few drops of water, the compressor or air dryer may need servicing or the automatic drain valve may not be functioning correctly.

Front wheel limiting systems

Some vehicles may have an optional system to reduce the possibility of steering axle brake lockup and loss of steering control on slippery surfaces. There are two types of front wheel limiting systems:

- Automatic front wheel limiting systems
- Manual front wheel limiting systems

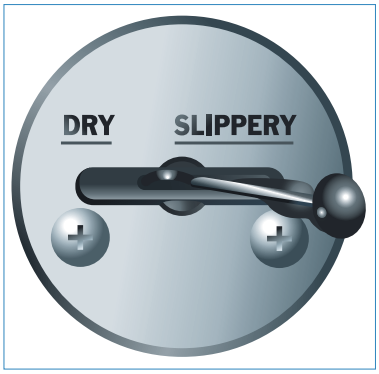
Automatic front wheel limiting systems

These consist of a limiting valve, sometimes called a ratio valve, mounted near the steering axle. There's no dashboard control.

At very low application pressures, no air pressure is delivered to the steering axle brakes. As application pressure exceeds the holdback point (five p.s.i. to 15 p.s.i./34.5 kPa to 103 kPa), limited application pressure is delivered to the steering axle brakes. At brake application pressures below 40 p.s.i. (276 kPa), the steering axle brake pressure is approximately 50 percent of drive axle pressure.

At application pressures above 40 p.s.i. (276 kPa), the percentage gradually rises until it reaches an application pressure that may be used during an emergency stop (60 p.s.i. to 70 p.s.i./414 kPa to 483 kPa) and steering axle and drive axle brakes receive equal pressure. A built-in quick release function helps to speed up the release of the steering axle brakes.

Manual front wheel limiting systems



These are no longer installed on new vehicles. They consist of a limiting quick-release valve mounted near the steering axle brakes and a dash-mounted control valve. The control valve may be a "flip" type switch, as shown, or a push-pull type.

With the control valve in the "dry" position, the steering axle brakes are applied with the same pressure as the drive axle brakes.

The "slippery" position limits the application pressure to the steering axle brakes to 50 percent of drive axle brake application.

Commercial vehicle safety standards allow reduced braking on steering axle brakes only when weather and road surface conditions make such operation essential for safety. Tests have shown that front wheel skids aren't as dangerous as the drive axles locking up.

The limiting quick-release valve also acts as a normal quick-release valve helping to speed up the release of the steering axle brakes.

Pressure-protection valves

Pressure-protection valves are often installed between the service brake reservoirs and any non-essential air-operated accessories, such as air seats, air horns, air windshield wipers, air suspensions, fifth wheel sliders and air shifts. Some air brake systems integrate the air dryer with the supply reservoir — these also use pressure-protection valves.

They're designed to cut off the air supply to these systems if a failed accessory causes the service reservoir pressure to drop below a preset pressure. This ensures that sufficient pressure is maintained in the service system so that a safe stop can be made.

Shutoff pressures vary between 60 p.s.i. and 90 p.s.i. (414 kPa and 620 kPa), depending on the manufacturer's specifications.

Application pressure gauges



Some vehicles are equipped with one or more optional gauges that indicate the actual pressure being delivered to the service brakes.

There may be a single gauge or separate gauges for tractor and trailer brake application.

Tractors may have a single gauge that indicates application pressure if either the foot valve or trailer hand control valve is applied.

Anti-lock braking systems

Anti-lock braking systems (ABS) are typically made up of three main sections: speed sensing, decision-making and brake releasing or modulation.

If the brakes are applied too hard for road conditions and a wheel lockup occurs, the Electronic Control Unit (ECU) senses the sudden drop in wheel speed and will signal valves to release air pressure from the brake chambers at the affected wheels.

As the brakes begin to release, the wheels will begin to turn and the ECU will allow the brakes to re-apply. If the lockup re-occurs, the apply-and-release cycle will repeat as often as necessary. Most systems are capable of cycling the brakes up to five times per second.

To achieve the shortest possible stopping distance on extremely slippery surfaces, you simply have to apply and maintain firm continuous pressure on the brake pedal. The ABS will rapidly apply and release the brakes as often as necessary. There may be some noise and vibration. ABS prevents the axle brakes from locking up allowing you to retain complete steering control.



Vehicles are equipped with a dash-mounted failure warning light that monitors the ABS. When the ignition switch is first turned on, the ABS performs a self-checking sequence. Depending on the system, the warning light may turn on, flash briefly, then stay lit until vehicle speed reaches seven kilometres an hour to 11 km/h or light briefly then turn off.

If the warning light doesn't go out or comes on during vehicle operation, it's telling you that there's been a failure in the ABS. Normal braking is still operational and only the anti-lock feature is disabled. The vehicle may be driven to a service depot for repairs.

Section two — Tractor-trailer air brake systems

What you'll learn

This section will help you learn to:

- ☐ Explain how trailer brakes are applied
- ☐ Safely park the trailer
- ☐ Connect the trailer to the tractor
- ☐ Understand the ABS for the trailer

Section one — Single unit covered an air brake system for a single unit vehicle such as a straight-truck or bus. Section two looks at components and systems needed to be able to pull air brake-equipped trailers.

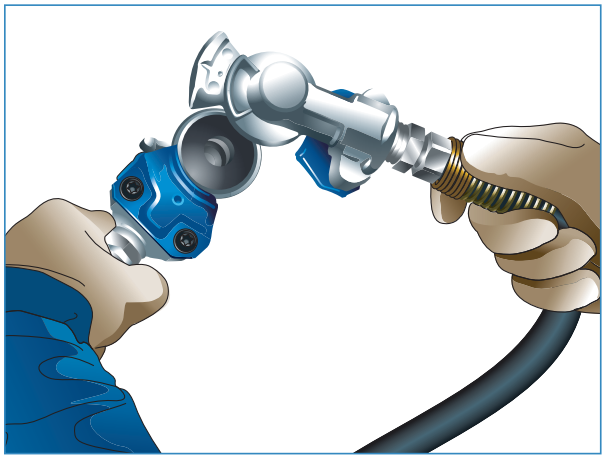
Tractor-trailer air brake systems

To create a tractor-trailer vehicle combination, we must first convert the truck to a tractor. This is completed by adding the following main components: a trailer supply valve on the dash (red button) and a tractor protection valve. The tractor protection valve will prevent total air loss in the event there's a separation of the trailer from the tractor.

We'll need to add two air lines from the tractor to the trailer, commonly referred to as the service line and the supply line. In some tractors, a hand valve that controls the trailer service brakes is added. Because tractors and trailers need to be disconnected and reconnected from time-to-time, the air lines are equipped with quick coupling devices called glad hands. Glad hands are often colour-coded — a blue line or blue colouring indicates the service line and a red line is used to indicate the supply line.

- The supply line (red) may also be called the emergency line.
- The service line (blue) may also be called the control line.

- Glad hands allow easy and quick connection between the tractor and trailer.
- Seals are used to ensure the glad hand connection doesn't leak air.





Tractor protection system

If the mechanical connection between the tractor and trailer fails, causing the trailer to separate from the tractor, the supply and service air lines will disconnect. Air pressure from the tractor system rushes out through the broken supply line and if the brake is applied, air pressure would rush out through the broken service line.

To prevent the tractor air from being depleted to an unsafe level, tractors are equipped with a tractor protection system.

A tractor protection system consists of a trailer air supply valve, located in the tractor dash, and a tractor protection valve, usually located behind the tractor cab. All of the supply and control air delivered to the trailer passes through the tractor protection valve.

If the trailer breaks away, the tractor protection system will automatically shut off air loss from the tractor, preserving enough pressure to make a safe stop.

Some tractor protection systems will shut off immediately in a breakaway, but some will allow tractor pressure to drop to as low as 20 p.s.i. (138 kPa) before shutting off.

Proper operation of the tractor protection system should be checked as part of the daily pre-trip inspection.

Trailer air supply valve

Once the air supply line is connected to the trailer, there needs to be a way of directing air pressure to the trailer.



For this, you use the dash-mounted trailer air supply valve, which senses air pressure in the supply line that carries air to the trailer system. Most trailer air supply valves are an octagon-shaped red button.

Hand valve

Applying the foot valve directs approximately the same application pressure to both the tractor and trailer brakes. For example, if you make a 20 p.s.i. (138 kPa) foot valve application, this application pressure will be applied to both the tractor and trailer brakes.

There are times when you want to apply only the trailer service brakes without applying the tractor brakes such as when coupling the tractor to a trailer.



For this you use the hand valve. When the trailer air brake system is fully connected to the tractor, the hand valve allows you to apply the trailer service brakes independently of the tractor.

Most hand valves are spring-loaded, just like the foot valve, so that when you release it, it will return to the released position (the hand valve is not used for parking the vehicle). Hand valves are commonly used to check brake lights as well as to tug test the trailer service brakes.

The hand valve should not be used in normal or emergency situations.

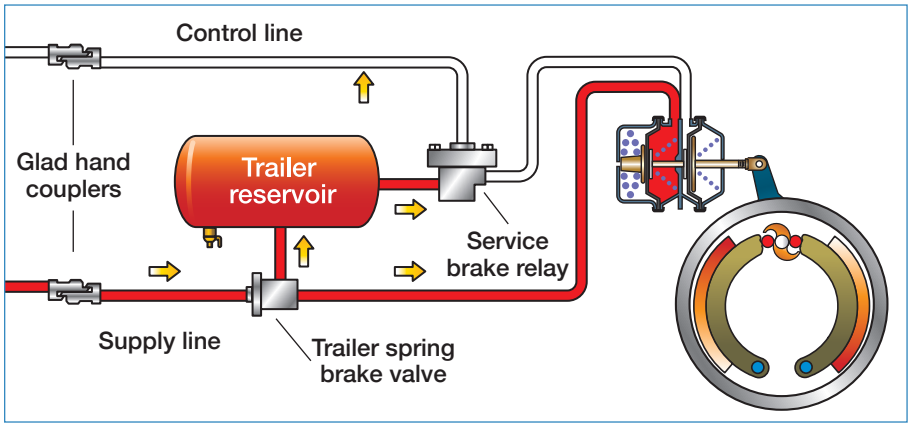
Two-way check valve

The two-way check valve allows you to apply the trailer brakes independently. This valve is identical in construction to the one used in spring parking brake installations, except that it allows the highest application pressure from the hand or foot valve to be directed to the trailer brakes.

Trailer with spring parking brakes — charging

There are two basic types of trailer air systems: those that use spring parking brakes and those that don't. Although most current trailers use spring parking brakes, some older trailers and converter dollies aren't equipped with them. In any case, all trailer systems must have an emergency stopping system that will fully apply the trailer brakes if the trailer separates from the tractor. Trailers that aren't equipped with spring parking brakes use a device called a relay emergency valve. If this valve senses the trailer has broken away from the tractor, it applies the trailer service brakes with full trailer reservoir pressure. This action is called dynamiting the trailer brakes. Trailers with spring parking brakes use the spring force to "dynamite" the trailer brakes if the trailer brakes away from the tractor.

This diagram shows a typical trailer system that uses spring parking brakes for parking and for emergency (breakaway) stopping.



The system shown uses one reservoir and two air valves, a relay valve for the service brakes and a trailer spring brake valve that fills the reservoir and controls the spring parking brakes.

Other systems may be equipped with one, two or three air valves and multiple reservoirs. Using more or fewer air valves or additional reservoirs doesn't alter the basic operation of the system.

The tractor is delivering air through the supply line to the trailer spring brake valve. The spring parking brake valve directs air to fill the reservoir(s) and release the spring parking brakes.

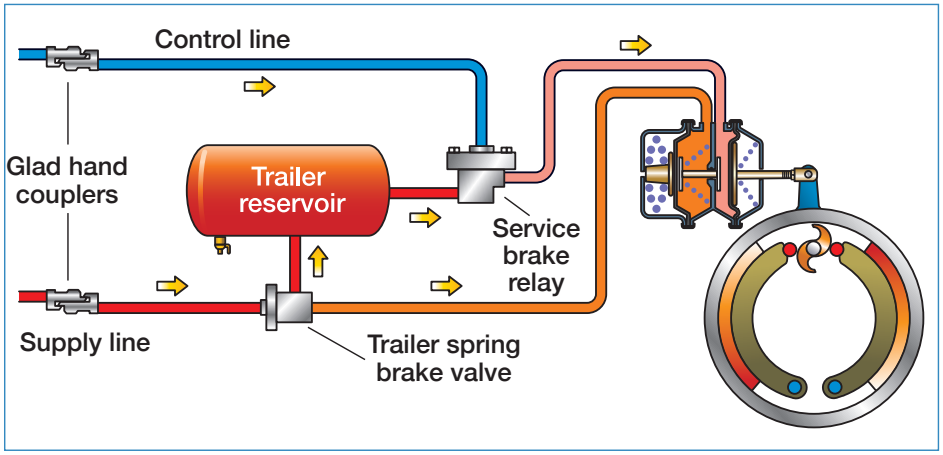
In the two types of systems:

- One fills the reservoir(s) before releasing the spring parking brakes.
- The other releases the spring parking brakes first, then fills the reservoir(s).

Always perform a tug test after coupling the tractor to the trailer. Follow the coupling procedures as shown in *Chapter 10: Off-road tasks and manoeuvres*.

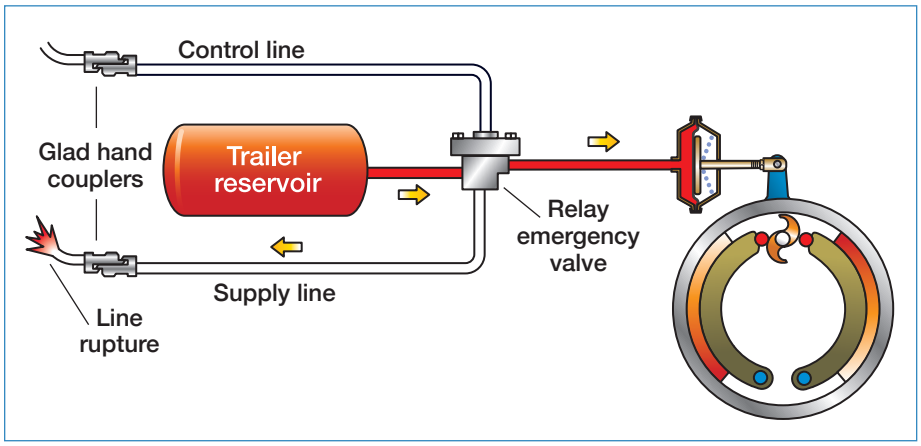
Trailer with spring parking brakes — service brake application

In this diagram, a control signal from the tractor has been sent through the control line to the trailer's relay valve. The relay valve has drawn air from the trailer reservoir and delivered it to the trailer service brake chambers at approximately the same pressure as the control signal.



Trailer with spring parking brakes — dynamited

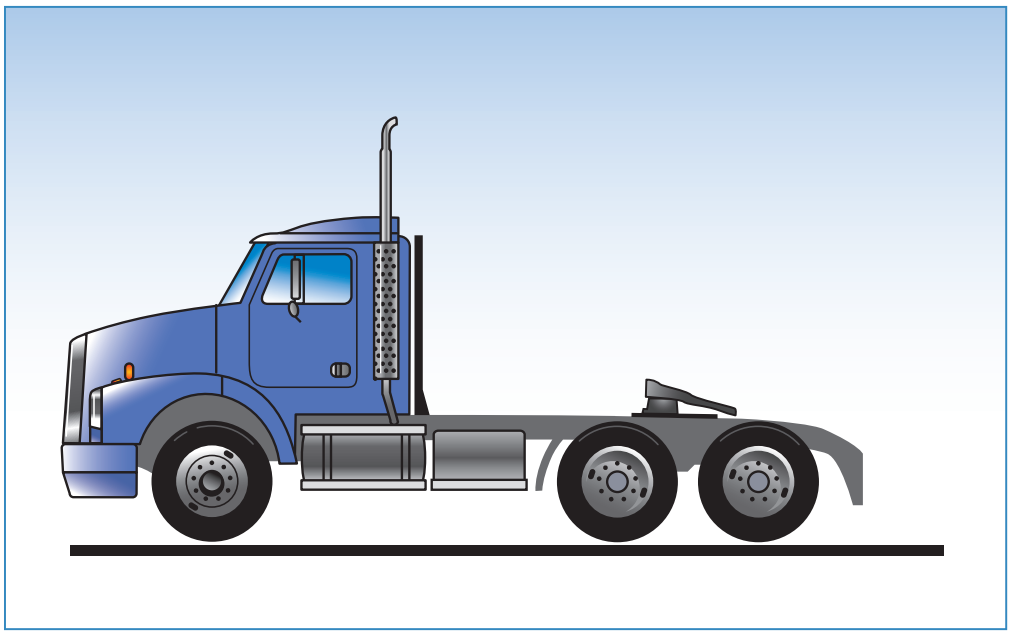
This diagram shows a broken supply line. The trailer spring brake valve has sensed the loss of pressure in the supply line and has exhausted the air pressure from the spring parking brake chambers causing the spring parking brakes to apply. Note the burst of air from the exhaust port of the trailer spring brake valve.



This is called dynamiting of the trailer brakes. The trailer brakes will also be dynamited each time the glad hands are disconnected or when the trailer supply valve that's located on the tractor dashboard is closed.

Bobtail tractors

Driving a tractor without a trailer attached is called bobtailing.



A bobtail tractor has very little weight over the rear drive axles, so it's very easy to lock up the rear brakes even with a light brake application.

To help prevent this unwanted lockup and to increase control, some older tractors not equipped with ABS use a bobtail proportioning system, which consists of two special valves: one that controls the steering axle brakes and another to control the drive axle brakes.

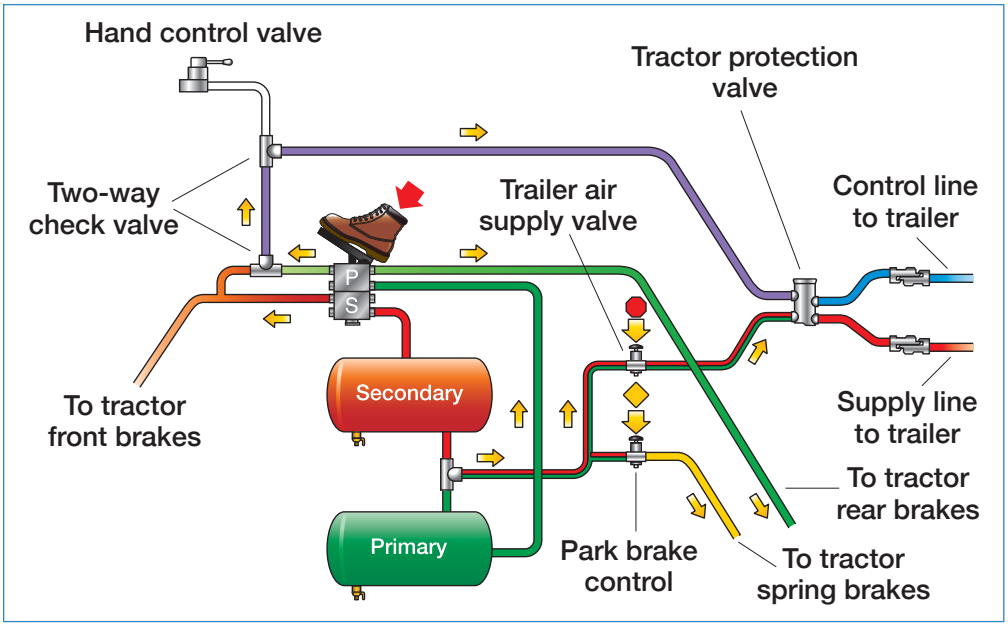
When the tractor is being driven with a trailer attached, the tractor brakes operate normally. However, when bobtailing, the braking pressure to the drive axle brakes is reduced by as much as 75 percent, preventing the rear brakes from locking. The steering axle brakes receive full application pressure.

A tractor with a bobtail proportioning system will stop in a shorter distance and control will be increased, especially on wet or slippery road surfaces.

Because the steering axle brakes are doing most of the braking, a higher than normal pedal pressure is required.

Dual air tractor-trailer system — foot valve

Dual air tractor-trailer system — foot valve applied



This diagram shows only the two service reservoirs, the dual foot valve and the components that are added to a tractor with a dual air system, so that it can safely tow a trailer with air brakes.

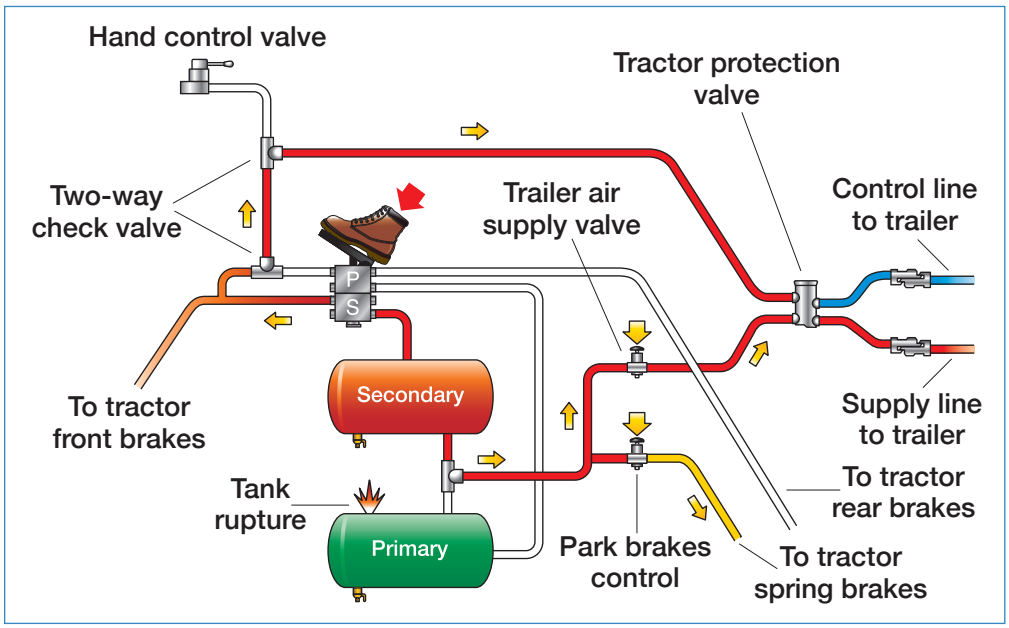
The components added are a trailer air supply valve, tractor protection valve, hand control valve and a pair of two-way check valves.

Two-way check valves are installed so that whichever brake is applied — foot valve or hand valve — a control signal will be sent to the trailer.

In this diagram, the driver is making a foot valve application. The tractor front and rear brakes are being applied and a control signal is being sent to the trailer through both of the two-way check valves.

Note that in most dual systems, the parking brake control valve (yellow button) is interlocked with the trailer supply valve (red button), so that applying the parking brake control valve causes all of the parking brakes on both the tractor and trailer to apply.

Dual air tractor-trailer system — primary air system failure



This diagram shows a tractor with a dual air system where there has been a failure in the primary air system on the tractor. The low air warning would have alerted the driver to the problem and a glance at the reservoir gauges would confirm that only one part of the dual air system had been lost.

The driver is making a foot valve application, causing the tractor front brakes to apply. Application air from the secondary foot valve is also passing through both of the two-way check valves to the trailer control line, signaling the trailer brakes to apply.

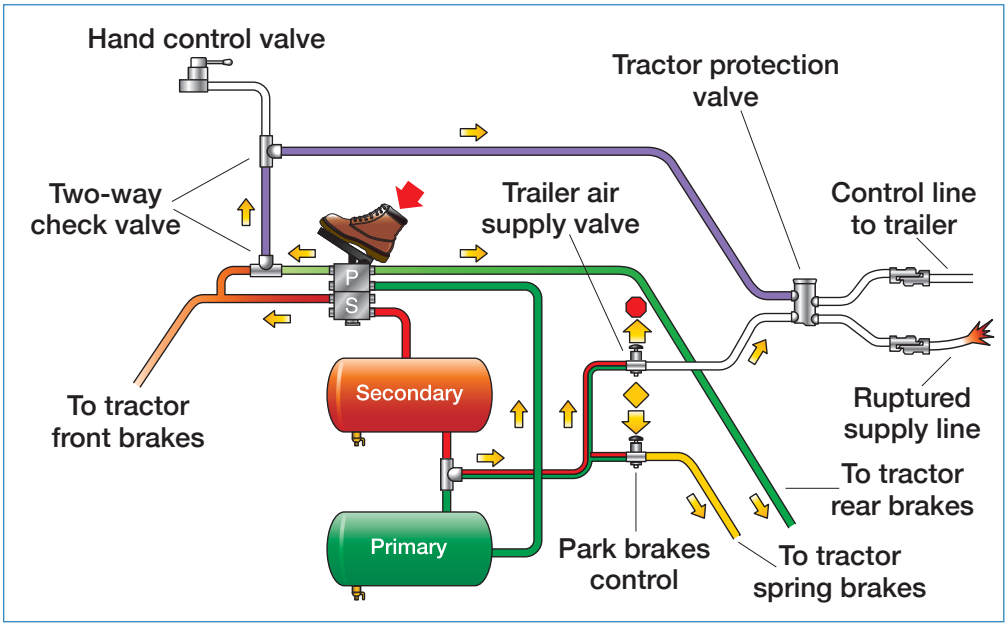
If the secondary system had failed, a foot valve application would apply the rear tractor brakes directing air through both of the two-way check valves to signal the trailer brakes to apply.

The same motor vehicle safety standards that require automatic shutoff of the air supply to the trailer — in the event that the pressure in the tractor air system is lowered to no less than between 20 p.s.i. and 45 p.s.i. (138 kPa and 310 kPa) — apply equally to tractors with dual air systems.

Because the trailer supply valve is now supplied with "blended air" from a two-way check valve, the automatic shutoff will not occur until the service reservoir with the highest pressure is lowered to between 20 p.s.i. and 45 p.s.i. (138 kPa and 310 kPa).

The automatic shutoff requirement should be checked as part of a pre-trip inspection. If it doesn't function properly, the vehicle must be placed out of service until it's repaired.

Dual air tractor-trailer system — trailer breakaway



This diagram shows how the tractor protection valve and trailer air supply valve act together to protect the tractor air supply from being depleted to an unsafe level if the trailer separates causing the connecting lines to rupture. The sudden loss of air through the broken trailer supply line has caused the trailer air supply valve to shut off automatically.

The driver is making a foot valve application causing the tractor service brakes to apply. The application pressure is also passing through both of the two-way check valves to the tractor protection valve.

Because there's no pressure in the supply line to the trailer, the tractor protection valve has closed the passage to the trailer control line. No application air can be wasted through that broken line.

If only the control line separates, nothing will happen until the trailer brakes are applied. When that happens, the tractor protection system will activate to protect the tractor air supply.

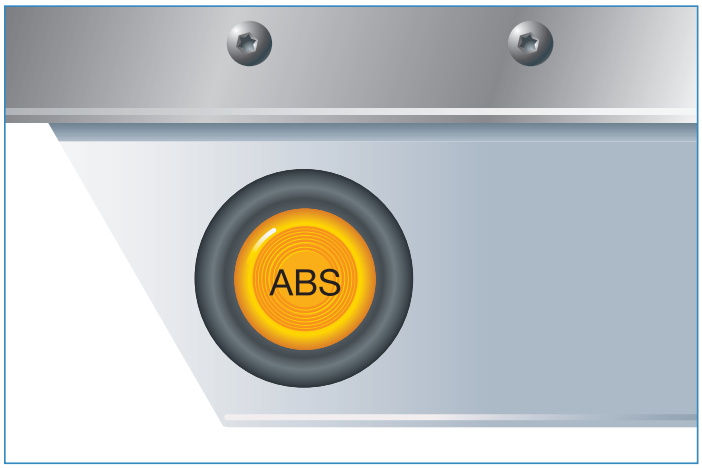
When a trailer isn't connected, the trailer air supply valve will be in the closed position. This allows the tractor to be driven bobtail so that no air will be lost through the disconnected glad hand couplers.

Trailer ABS air brake systems

Trailer ABS systems use similar components as those on trucks and tractors. The ECU may be powered from the stop lamp circuit or may have a dedicated power source through the electrical connector.

Trailers with ABS air brakes will also have an indicator visible in the tractor's mirror to indicate if the system's not functioning properly. This warning light may be mounted on the front left side of the trailer or on the rear left side of the trailer.

On some air brake systems, there may be a trailer ABS warning indicator on the dashboard of the tractor.



14 Vehicle inspection and maintenance

What you'll learn

In this unit, you'll learn how to inspect the tractor-trailer before, during and after a trip and how to fill out a vehicle inspection report.

This unit will help you learn to:

- Understand your role as a professional driver in ensuring no unsafe vehicles are on the road.
- Explain the importance of conducting pre-trip, en route and post-trip inspections.
- Describe a systematic sequence to use in a complete pre-trip inspection.
- Conduct an inspection using a checklist and pre-planned procedure.
- Complete an inspection report.
- Understand basic checks and service needed for the vehicle.
- Explain the requirement for a preventative maintenance program.
- Describe some basic maintenance procedures.

National Safety Code (NSC) standards

Canada's National Safety Code (NSC) sets out minimum standards of vehicle maintenance and inspection for drivers, mechanics and government vehicle inspectors to ensure safe vehicle and equipment operation on roads. These minimum standards (or best practices) have been adopted by Canadian provinces and territories through each jurisdiction's various regulations, and may differ from what is set out in the NSC. The following NSC standards have informed B.C.'s provincial vehicle and inspection maintenance requirements:

- **NSC Standard 11 — Maintenance and Periodic Inspection Standards:** Part A contains the recommended standards for a commercial vehicle maintenance program and the minimum criteria that should be evaluated in an audit of a carrier's operation. Part B contains the recommended schedule frequency for periodic motor vehicle inspections at an authorized facility and the standards to which the vehicle will be inspected. In B.C., these standards are set out under the Commercial Vehicle Inspection Program (CVIP) and carried out at Designated Inspection Facilities (DIF), under responsibility of the B.C. Commercial Vehicle Safety and Enforcement (CVSE) branch.
- **NSC Standard 12 — Commercial Vehicle Safety Alliance On-road Inspection**: The Commercial Vehicle Safety Alliance (CVSA) is a non-profit association made up of local, provincial, territorial, as well as U.S. state, and federal commercial motor vehicle safety officials and industry representatives.

CVSA developed the North American Standard Inspection Program as the roadside inspection process for inspecting commercial motor vehicles and drivers throughout North America. In B.C., it is CVSE that carries out these on-road inspections based on CVSA's inspection criteria.

– **NSC Standard 13 — Trip Inspection:** This standard sets out the daily vehicle trip inspection criteria a driver or other designated personnel must check to ensure early identification of vehicle problems and defects, and to prevent the operation of vehicles with conditions that are likely to contribute to a vehicle crash or breakdown. NSC Standard 13 — Part 2 contains a schedule of inspection items for trucks, tractors and trailers, referred to throughout this chapter and by industry as "Schedule 1." This is the minimum standard used by industry when conducting a daily vehicle trip inspection.

The following table shows the different requirements of each of the NSC standards, which have been implemented through B.C. regulations in the MVAR and by CVSE policy requirements for industry:

	NSC Standard 11, Part A Maintenance	NSC Standard 11, Part B CVIP	NSC Standard 12 CVSA	NSC Standard 13 Trip Inspections
Frequency	Regular (weekly, monthly, quarterly, semi-annually)	Annual/ bi-annual	Random	Daily
Inspection conducted by	Carrier mechanic	Designated Inspection Facilities (DIF)/ Preventative Maintenance Program (PMP) Facilities for large fleets	CVSE officers/ enforcement officers	Driver/ carrier service technician
Number of vehicle systems and parts inspected	Variable — depends on system implemented by carrier and trip inspection reports provided by driver	10 vehicle systems and 90 components with 1,100 inspection and rejection criteria	12 critical vehicle safety systems and driver paperwork items	23 critical vehicle safety systems
Compliance verification	On-road and audit of carrier facility	On-road and audit	On-road (weigh scales or vehicle stop)	On-road and during an audit

The daily pre-trip and post-trip inspections conducted by the professional driver are critical to the whole system of vehicle inspections shown in the table above. When you conduct trip inspections thoroughly and completely, the information provided to the carrier ensures small problems are identified and corrected as part of the maintenance process. In addition, diligence in conducting daily trip inspections ensures a vehicle is not placed out of service by an enforcement officer roadside, avoiding costly repairs away from the terminal and customer dissatisfaction over delays in product delivery. This also protects your earning ability as many driving jobs are paid per kilometre or a flat-rate trip fee. If your vehicle is broken down or out of service, you won't be able to earn any money. It is important to make sure that the vehicle you are operating is free from defects that might cause a vehicle breakdown or safety concerns for yourself and the general public.

Canadian inspection requirements

The Canadian rules are similar to U.S. *Federal Motor Carrier Safety Regulations* (FMCSR), Section 393, which covers parts and accessories for safe operation and Section 396, which describes the annual inspection requirements, as well as repair and maintenance requirements.

Generally, the Canadian trip inspection rules require professional drivers to complete more thorough daily trip inspections than are required in the U.S. There are no Canadian federal trip inspections, but most provinces have adopted the Canadian NSC standard. The Canadian trip inspection rules provide additional guidance on what must be inspected and how to conduct the daily trip inspection and record the results. CVSA on-road inspections performed by enforcement officers are identical in both countries.

In general terms, the Canadian rules are much more specific and complete in laying out the steps that must be taken by drivers and carriers to comply with preventative maintenance and inspection rules. For example, in the U.S., if a vehicle passes a CVSA on-road inspection, proof of this inspection can be used to comply with the U.S. annual inspection requirements. However, this practice isn't allowed in Canada, where the annual inspection is much more thorough — it includes 10 major vehicle systems and more than 90 parts and must be completed in a provincial Designated Inspection Facility (DIF) by government-certified technicians (mechanics).

While there's a reciprocity agreement in place between Canada and the U.S. on periodic (annual) inspection programs, Canadian drivers and carriers aren't required to inspect to U.S. part 396 rules. All Canadian registered vehicles must be inspected to the standards set out by each province and territory.

B.C. Commercial Vehicle Inspection Program (CVIP)

In B.C., commercial vehicles must meet provincial inspection requirements under the Commercial Vehicle Inspection Program (CVIP) set out under authority of Division 25 of the Motor Vehicle Act Regulations (MVAR), and managed by the B.C. CVSE branch. These B.C. requirements align with NSC Standard 11 — Maintenance and Periodic Inspections Standards. The goal of the CVIP is to ensure all commercial vehicles are subject to a systematic, regular preventative maintenance program. Regular preventative vehicle maintenance ensures small problems can be corrected before they result in crashes, major repairs, or a vehicle breakdown a long way from a service facility.

Inspections under B.C. CVIP requirements are completed every 6 or 12 months, based on vehicle type, at a designated inspection facility (DIF) or at Preventative Maintenance Program (PMP) facilities in the case of large fleets. Vehicles with a licensed GVW over 8,200 kg but less than 17,300 kg, as well as trailers and semi-trailers must be inspected every 12 months. Taxis, limousines, buses, dump and logging trailers, as well as vehicles with a licensed GVW over 17,300 kg, must be inspected every 6 months. It is generally the responsibility of the carrier to ensure that each vehicle in its fleet meets the CVIP inspection requirements and schedule. However, as a commercial driver you need to be aware that a vehicle inspector or enforcement officer may issue a Notice and Order to require a vehicle to have a CVIP inspection at any time. If a vehicle fails inspection, the necessary repairs must be done to bring the vehicle into compliance.

Vehicles that have met CVIP inspection requirements will receive an inspection report and certificate of approval in the form of a CVIP decal, placed on the outside lower left hand or lower right hand of the vehicle's windshield, or other outside glazed surface to the right hand of the driver. In the case of a trailer, the CVIP decal is placed on the outside left or right, lower front corner of the trailer. A vehicle with a valid B.C. CVIP decal meets the annual inspection requirements in other Canadian jurisdictions and the U.S.

As a commercial driver, you must confirm that both the truck-tractor and the trailer you are hauling have a valid CVIP inspection decal on each unit before you drive or park your vehicle on a highway or other roadway. A copy of the DIF's inspection report must also be carried in the vehicle. It's an offence to operate a commercial vehicle that has failed an annual inspection or with an expired CVIP inspection decal.



Inspection overview

Learning how to perform a good inspection is a very important step in becoming a professional driver. It requires that you can identify and recognize the operational status of each part and system on your rig as part of your daily routine, because the public expects its operation to be legal, safe and professional. Passing roadside inspections demonstrates a sincere respect for the rules and regulations of the transportation system. Meeting operational safety standards reduces the frequency of breakdowns and incidents.

The goals of inspection include:

- Taking a systematic approach to determine which system or parts are functioning properly, deteriorating or malfunctioning.
- Meeting the driver's legal responsibility to ensure that the vehicle and cargo are safe for the road.
- Providing a record that demonstrates the current operational state of a vehicle during roadside spot checks.
- Communicating maintenance issues to mechanics in a technically accurate form.

Vehicle inspections by the driver

Every commercial vehicle registered in B.C. with a licensed GVW of 5,000 kg (11,023 lb) or more must receive a daily trip inspection, but the following commercial vehicles also require a daily trip inspection report to be filled out by the driver or person authorized by the carrier: taxis, buses, commercial vehicles with a licensed GVW over 8,200 kg, vehicles licensed under the *Motor Carrier Act*, or a trailer/semi-trailer defined under the CTA, as well as vehicles owned or leased by a driver training school, and those under a temporary operating permit under the *Passenger Transportation Act*. As a commercial driver, you are responsible for the following three types of vehicle inspections:

1. Pre-trip inspection: A check of systems and parts done before each trip, including how the cargo is loaded and secured. These inspections must be recorded on the Driver's Vehicle Inspection Report (DVIR) listing any defects.
    - Has routine maintenance been performed?
    - Have previously noted mechanical problems been repaired?
    - Are all parts and systems operating in a safe fashion?
    - Is the cargo safely loaded and secured?
    - Is the rig ready to leave the yard?

2. En route inspection: A check of the truck, including controls and instruments while en route.
    - Are all controls and instruments still operating properly?
    - Are the tires at the proper inflation and in good condition?
    - Are all the lights still functioning correctly?
    - Are your brakes still in adjustment?
    - Do you have any air leaks?
    - Is the cargo still secure?
3. Post-trip inspection: A check at the end of the shift, trip or day. These inspections must be recorded on the DVIR listing any defects.
    - Are all parts and systems operating in a safe fashion?
    - What repairs must be performed before the next trip?

Compliance enforcement

Commercial vehicle safety and enforcement agencies in each province and territory are responsible for commercial vehicle compliance with provincial and federal acts and regulations that align with NSC Standard 12 — Commercial Vehicle Safety Alliance On-road Inspection. B.C. has adopted NSC Standard 12 for its roadside inspections of commercial vehicles, which are carried out by CVSE officers based on CVSA inspection criteria. All of the CVSE enforcement officers and some police officers are CVSA trained and certified to perform CVSA level 1 inspections (the most thorough). B.C.'s CVSE officers conduct more than 30,000 vehicle inspections each year, issuing violation tickets and removing unsafe vehicles from the provincial roadways on a daily basis.

All vehicles must be in safe operating condition at all times and must meet the minimum CVSA standards to receive a CVSA decal. If a vehicle meets the minimum standards, it will be given a decal. The decal is valid for the month in which it was issued, plus an additional 2 months. The colour of the decal indicates when the CVSA level 1 inspection was passed:

Green – January to March

Yellow – April to June

Orange – July to September

White – October to December

The results of these vehicle inspections, which may be conducted randomly at roadside or at weigh-scale inspection stations, are recorded on a "carrier's profile," and can affect the carrier's safety rating under B.C.'s NSC program. A

carrier's profile includes information on driver and carrier contraventions (guilty and pending), CVSA inspection results, carrier audits, crash information, driver and vehicle information, CVIP vehicle inspection history, Notice and Order history, primary type of business and jurisdiction, among other information.

The following are levels of CVSA inspection that CVSE officers may carry out roadside for Class 1 drivers of a tractor-trailer vehicle:

Level 1: Full inspection (vehicle & driver)

Level 2: Walk around inspection

Level 3: Driver only inspection

Level 4: Special inspection

Level 5: Vehicle only inspections

Level 6: Enhanced - Radioactive

Level 7: Other provincial





During any given time, CVSE may conduct a road safety commercial vehicle inspection sweep to check the condition of vehicles being operated on B.C. roads. Mechanical deficiencies, load security issues, bald tires, faulty brake and steering component conditions are some of the unacceptable issues they encounter.

On average, over the past 10 years in B.C., about 300 people per year have died in crashes, with almost 20 percent of them involving a heavy commercial vehicle.

The following are some examples of why a driver may be taken out of service after an inspection by a CVSE officer or other enforcement officer:

- Hours of service violation
- Being impaired by drugs, alcohol, fatigue or sickness
- Incorrect or no driver's licence/endorsements
- No Transportation of Dangerous Goods certificate when required

A vehicle may be placed out of service for the following:

- Unsafe vehicle
- Insecure or leaking cargo

Inspection stations

In addition to mobile patrol units, CVSE inspection stations exist at fixed locations throughout B.C. All commercial vehicles with a licensed GVW exceeding 5,500 kg are required to report to scales when they are open or when directed by an enforcement officer, including those being used for bobtailing.

Vehicles are checked at the scales to measure the dimensions of the vehicle, weigh all or part of the vehicle, or to allow enforcement officers to inspect any defects in the vehicle or the load carried, and for any other purpose under the *Commercial Transport Act* and its regulations. It may be necessary to re-arrange the load on the vehicle, or remove all or part of the load, to comply with vehicle weight, dimension and load requirements before you can continue operating. An enforcement officer may also inspect your vehicle and trailer brakes, as well as operate the vehicle for the purpose of testing the brakes. You must ensure you have all of the necessary vehicle, driver and cargo paperwork and documents in order when presenting at an inspection station or engaging with an enforcement officer.

What to do at a weigh scale

If you're driving a vehicle that's required to report to an inspection station, follow these procedures:

- Loaded vehicle — drive slowly across the scale lane watching the light board for direction.
- Empty vehicle — even if your vehicle is empty, you must cross the scale by law. However, some scale sites may have lane options for empty vehicles. Drive slowly and make eye contact with the scale master in case they want to wave you in.



The light board communicates what the scale master needs you to do:



- If the STOP light is activated, stop and wait for further instructions.
- If the BACK UP light is activated, slowly and safely back up keeping in mind that there may be other vehicles behind you.
- If the NEXT AXLE light stays on, roll slowly and smoothly across the scale deck and carry on your way.
- If the PARK light is activated, park in the lot and bring all vehicle and driver documents to the scale building.

Note: Procedures may vary by scale location.

Weigh2GoBC

Technology is boosting efficiency at inspection stations. In the past, all commercial vehicles carrying a load with a licenced GVW of more than 5,500 kg (12,125 lb) were required to stop at fixed scales (inspection stations) when they're open. Now, Weigh2GoBC technology allows commercial carriers to bypass Weigh2GoBC inspection stations. A vehicle with a registered transponder communicates with a weigh-in-motion-equipped station upon approach, and the vehicle is identified and checked for height, weight and safety credentials while travelling at highway speed. Based on NSC standards, data is collected on all commercial vehicles and determines a carrier's rating taking into account history, such as violation tickets, out-of-service records and at-fault crashes. The transponder in your truck will turn green if you're okay to bypass the scale or red which would require you to report as normal. You can find Weigh2GoBC at gov.bc.ca/gov/content/transportation/vehicle-safety-enforcement/services/weigh2gobc-join/weigh2gobc-inspection-stations.



Vehicle defects — National Safety Code Standard 13

NSC Standard 13 — Trip Inspection, sets out the daily vehicle trip inspection criteria a driver or other designated personnel must check to ensure early identification of vehicle problems and defects, and to prevent the operation of vehicles with conditions that are likely to contribute to a vehicle crash or breakdown. Part 2 of the standard contains a schedule of inspection items for trucks, tractors and trailers, referred to throughout this chapter and by industry as "Schedule 1." This is the minimum standard used by industry when conducting a daily vehicle trip inspection. The following chart lists the Schedule 1 minor and major defects:

Schedule 1 — Truck, tractor and trailer

Inspection item	Defect(s)	Major defect(s)
1. Air brake system	a — Audible air leak b — Slow air pressure build-up rate	c — Pushrod stroke of any brake exceeds the adjustment limit d — Air loss rate exceeds prescribed limit e — Inoperative towing vehicle (tractor) protection system f — Low air warning system fails or system is activated g — Inoperative service, parking or emergency brake
2. Cab	a — Occupant compartment door fails to open	b — Any cab or sleeper door fails to close securely
3. Cargo securement	a — Insecure or improper load covering (for example, wrong type or flapping in the wind)	b — Insecure cargo c — Absence, failure, malfunction or deterioration of required cargo securement device or load covering
4. Coupling devices	a — Coupler or mounting has loose or missing fastener	b — Coupler is insecure or movement exceeds prescribed limit c — Coupling or locking mechanism is damaged or fails to lock d — Defective, incorrect or missing safety chain/cable

5. Dangerous goods		a — Dangerous goods requirements not met
6. Driver controls	a — Accelerator pedal, clutch, gauges, audible and visual indicator or instruments fail to function properly	
7. Driver seat	a — Seat is damaged or fails to remain in set position	b — Seatbelt or tether belt is insecure, missing or malfunctions
8. Electric brake system	a — Loose or insecure wiring or electrical connection	b — Inoperative breakaway device c — Inoperative brake
9. Emergency equipment and safety devices	a — Emergency equipment is missing, damaged or defective	
10. Exhaust system	a — Exhaust leak	b — Leak that causes exhaust gas to enter the occupant compartment
11. Frame and cargo body	a — Damaged frame or cargo body	b — Visibly shifted, cracked, collapsing or sagging frame member(s)
12. Fuel system	a — Missing fuel tank cap	b — Insecure fuel tank c — Dripping fuel leak
13. General		a — Serious damage or deterioration that's noticeable and may affect the vehicle's safe operation
14. Glass and mirrors	a — Required mirror or window glass fails to provide the required view to the driver as a result of being cracked, broken, damaged or maladjusted b — Required mirror or glass has broken or damaged attachments onto vehicle body	

15. Heater/ defroster	a — Control or system failure	b — Defrost fails to provide unobstructed view through the windshield
16. Horn	a — Vehicle has no operative horn	
17. Hydraulic brake system	a — Brake fluid level is below indicated minimum level	b — Parking brake is inoperative c — Brake boost or power assist is inoperative d — Brake fluid leak e — Brake pedal fade or insufficient brake pedal reserve f — Activated (other than ABS) warning device g — Brake fluid reservoir is less than one-quarter full
18. Lamps and reflectors	a — Required lamp doesn't function as intended b — Required reflector is missing or partially missing	c — Failure of both low-beam headlamps d — Failure of both rearmost tail lamps *At all times:* e — Failure of a rearmost turn indicator lamp f — Failure of both rearmost brake lamps
19. Steering	a — Steering wheel lash (free-play) is greater than normal	b — Steering wheel is insecure or doesn't respond normally c — Steering wheel lash (free-play) exceeds required limit

20. Suspension system	a — Air leak in air suspension system b — Broken leaf spring c — Suspension fastener is loose, missing or broken	d — Damaged or deflated airbag e — Cracked or broken main spring leaf or more than one broken spring leaf in any spring assembly f — Part of spring leaf or suspension is missing, shifted out of place or in contact with another vehicle component g — Loose U-bolt, patched, cut, bruised, cracked to braid, mounted insecurely
21. Tires	a — Damage tread or sidewall of tire b — Tire leaking (if leak can be felt or heard, tire is to be treated as flat)	c — Flat tire d — Tire tread depth is less than wear limit e — Tire is in contact with another tire or any vehicle component other than mud flap f — Tire is marked "Not for highway use" g — Tire has exposed cords in the tread or outer sidewall area
22. Wheels, hubs and fasteners	a — Hub oil below minimum level (when fitted with sight glass) b — Leaking wheel seal	c — Wheel has loose, missing or ineffective fastener d — Damaged, cracked or broken wheel rim or attaching part e — Evidence of imminent wheel, hub or bearing failure
23. Windshield wiper/ washer	a — Control or system malfunction b — Wiper blade damage, missing or fails to adequately clear driver's field of vision	*When necessary for prevailing weather conditions:* c — Wiper or washer fails to adequately clear driver's field of vision in area swept by driver's side wiper

Driver responsibilities

You're not permitted to drive a truck or tow a trailer unless you or another person has conducted a trip inspection of the vehicle(s) within the previous 24 hours. In addition to drivers, others authorized by the carrier, such as maintenance or yard staff, are also permitted to conduct inspections and complete and sign reports. The requirement to complete daily pre-trip and post-trip inspections that align with the NSC 13 standard is intended to identify problems before they become critical.

B.C. regulations under MVAR Division 37 require that:

1. Before and after each trip, the driver or a person specified by the carrier, ensures that the commercial motor vehicle is in a safe operating condition. The inspection is performed daily before the first trip of the day.
2. If the trip lasts more than one day, the inspection is carried out on the second and every subsequent day of the trip no later than the first rest stop of the day.
3. A copy of the trip inspection is carried in the vehicle for the day in which it was done.

The person who conducts the inspection and signs the report is responsible under law for the inspection and information contained in the report. The driver may rely on such an inspection and must produce the daily inspection report to an officer if requested, unless the driver has reason to believe the inspection and report don't meet the requirements or the driver is aware or ought to be aware that the vehicle has a defect.

All information required to be in a report must be accurately completed in full. There are vehicle inspectors throughout the province who conduct commercial vehicle inspections. On the demand of an enforcement officer, a driver must produce the inspection schedule and trip inspection report.

En route inspections — In addition to the initial inspection, whether conducted by the driver or not, you're required to monitor the condition of the vehicle(s) for defects while and immediately record and report any defects found. Under NSC Standard 10 - Cargo Securement, the best practice is for a driver to inspect the vehicle's cargo and the cargo securement system used and make necessary adjustments before driving the vehicle, and within 80 km (50 mi) from the point where the cargo was loaded, and then every three hours or 240 km (149 mi). If you're hauling dangerous goods, the inspections are required every two hours or 160 km (99 mi).

Reporting defects — For the purposes of reporting defects to the carrier, an employee may be designated to receive reports. Any major or minor defects listed in the NSC 13 Schedule 1 must be reported immediately by the driver or inspection person to the carrier upon discovery of the defect. This may be done in person, by phone, via written report or by electronic means.

Driving with defects — You may continue to drive with a minor defect that's listed on an inspection schedule if you have immediately entered the defect on the daily inspection report and reported it to the carrier.

Under Part 1 — General Requirements of NSC Standard 13, no carrier shall permit a person and no person shall drive a commercial vehicle on a highway when a **major defect** that's listed on an inspection schedule is present on the vehicle.

En route inspections

Your pre-trip inspection will help ensure your vehicle is safe before you start your day's trip. As you drive, the condition of your vehicle may change. It's important to inspect your vehicle at regular intervals en route so you can identify any problems as soon as possible.

Before performing the en route inspection, keep the following in mind:

- Make sure the vehicle is completely off the road.
- Enter and park at a rest or check stop so that you don't have to back up.
- Avoid stopping at the bottom of a hill or on an uphill slope.
- The stop area should have an adequate acceleration lane to allow you to merge back onto the highway at an appropriate speed.

At a minimum, an en route inspection for your vehicle should include the following checks:

- All lights are clean and in working order.
- There are no air leaks.
- All the wheels are secure and tires are properly inflated and not hot.
- Wheel hubs aren't hot.
- There are no broken or loose items on the vehicle.
- The load/cargo is secure — nothing has shifted or can fall from the vehicle.
- Dangerous goods placards are clean and secure (if applicable).
- Coupling devices/glad hands and electrical cords are secure.
- The trailer locking mechanisms are secure and in good condition.
- The brakes are properly adjusted.
- There are no fluid leaks under the vehicle.
- Mirrors and windshield are clean.

Post-trip inspections

B.C.'s MVAR section 37.22 (6) requires a driver or a person authorized by the carrier to conduct a post-trip inspection of the commercial vehicle and to document any defects observed at the end of the final trip of the day or that may have occurred throughout the day. It is acceptable to note defects on either a written paper copy of a report or in an electronic format, so long as the carrier is made aware of any vehicle defects so repairs may be made. While a post-trip inspection is always required, there is no requirement in B.C. to do a written post-trip inspection report if no defects are identified during your inspection. This is consistent with NSC Standard 13 and other North American jurisdictions, including the U.S. Despite this, a carrier may still require a written post-trip inspection report be done to support overall vehicle maintenance of its fleet and for record-keeping purposes.

Postponing post-trip inspections can result in problems that are frustrating, time consuming, costly and unsafe. Though your carrier may require a more comprehensive inspection, at minimum, a post-trip inspection should include the following:

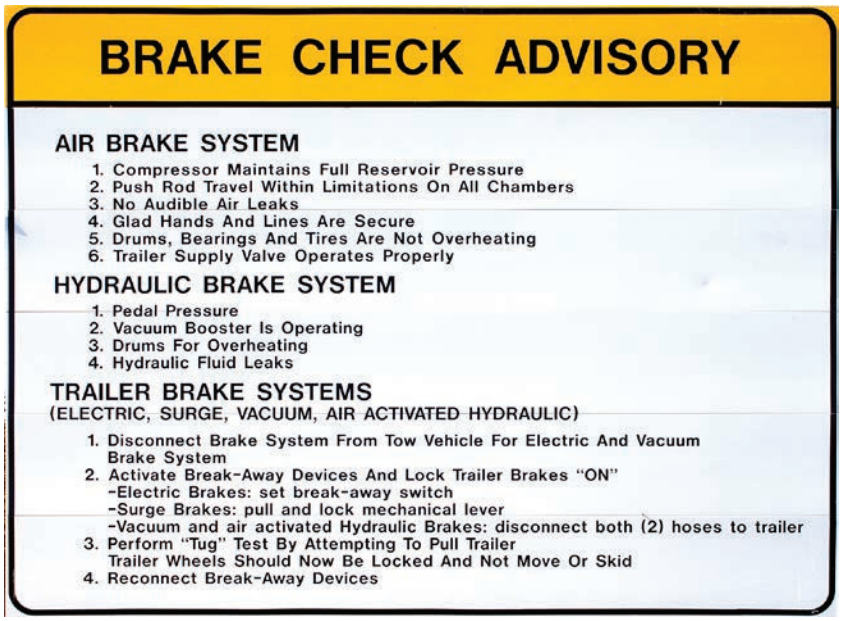
- Check your diesel exhaust fluid and fuel levels while finishing your day. Have a plan as to when you'll top them up. In the winter, keeping tanks full can help minimize condensation buildup.
- Park your vehicle and allow the engine to cool down on low idle if the water temperature is above 200 degrees Fahrenheit.
- Secure your tractor-trailer and turn all switches off (fans, AC and heaters). Shut down the vehicle.
- Complete a circle check of the truck's exterior looking at:
  - Body condition (no new damage)
  - Exterior lights (ensure they're functioning properly)
  - No leaks
  - Brakes adjusted
  - Hub oil levels
  - The condition of the wheels, tires and tire pressure
- Complete a check of the interior looking at:
  - Floor (clean, nothing left behind)
  - Controls (sanitize as required)
  - Seats (no new damage)
  - Windows (close and clean)
  - Seatbelts (set back in order)
  - Log book/post-trip inspection paperwork are completed

Note: Ensure trailer brakes cool before activating the park or spring brakes in winter to prevent moisture from freezing between the brake shoe and drum.

Pre-hill inspections

It's important to understand when and how to do pre-hill inspections. B.C. has many mountainous roads so you need to know how to perform these inspections properly and do them frequently.

In some areas of the province, signs are posted in advance of steep or long downhill grades. You must stop in the pullout area and inspect the vehicle's braking system before proceeding. Do a general en route inspection at the same time.



Depending on the vehicle you are operating, at minimum you must check the items listed on brake check advisory signs posted at pull-outs located at the top of steep grades. If you are operating a vehicle with an air brake system on the tractor and the trailer, for example, you must check that:

- The compressor maintains full reservoir pressure
- There are no audible air leaks and the trailer supply valve operates properly
- Glad hands and air lines are secure
- Brake drums and hubs are not overheated
- Pushrod travel is within limits on all chambers
- There are no fluid leaks

Note: You must check pushrod travel even if your vehicle is equipped with automatic slack adjusters.

Vehicle inspection reports

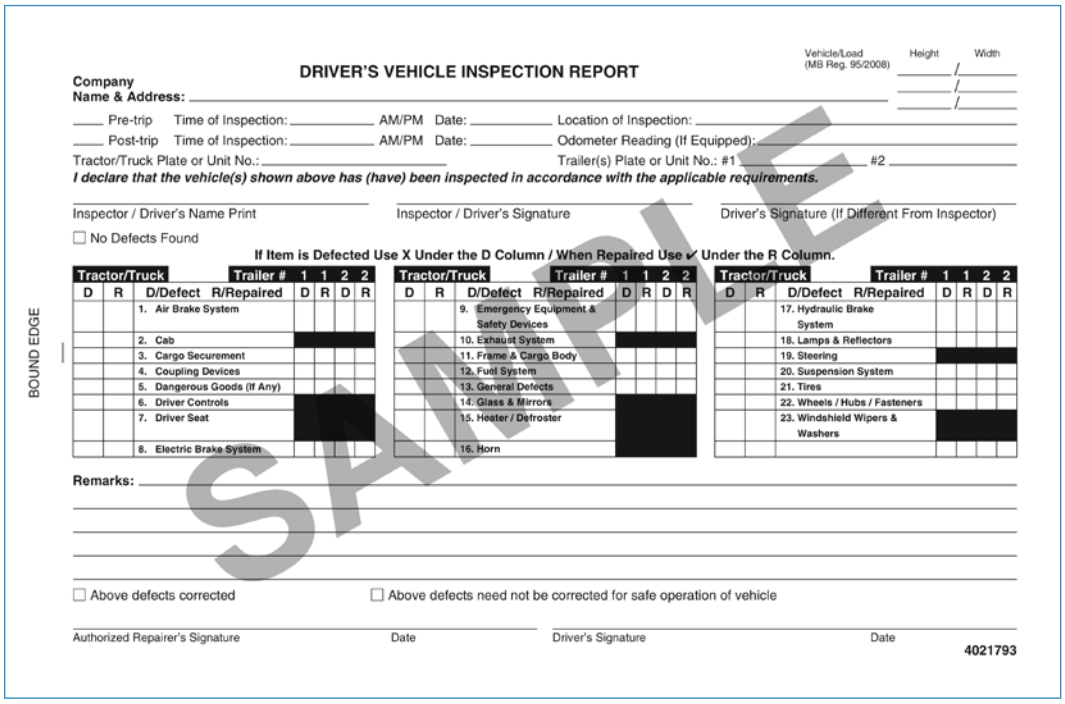
A trip inspection report is the document that confirms you have completed an inspection. The report is completed at the beginning and end of the day when driving is finished (pre-trip inspection and post-trip inspection). The report serves several purposes:

- Provides evidence that the required inspection has been completed.
- Shows when and where an inspection was conducted and who conducted it.
- Shows that the vehicle has no defects or is a record of defects found by the driver.
- A place for drivers to add any defects discovered during their work day.
- Provides a method for the driver to report defects to the carrier. Reports showing vehicle defects are retained as part of the vehicle maintenance and repair records.
- Some employers may have a separate form for you to complete to report defects to the maintenance department or request maintenance to be performed.

The format and layout of an inspection report is flexible, but the following information must be included on every report:

- Licence plate or unit number of the vehicle(s)
- Name of the motor carrier
- Date and time that the inspection was completed
- A declaration that the vehicle identified on the report has been inspected as required
- State any minor or major defects or that no defects were discovered
- The name and signature of the person who conducted the inspection
- The signature of the driver (if other than the person who conducted the inspection)
- The odometer reading

Driver's vehicle inspection report form



DRIVER'S VEHICLE INSPECTION REPORT

Vehicle/Load (MB Reg. 95/2008) Height / Width

Company Name & Address:

___ Pre-trip Time of Inspection: ___ AM/PM Date: ___ Location of Inspection:

___ Post-trip Time of Inspection: ___ AM/PM Date: ___ Odometer Reading (If Equipped):

Tractor/Truck Plate or Unit No.: Trailer(s) Plate or Unit No.: #1 #2

I declare that the vehicle(s) shown above has (have) been inspected in accordance with the applicable requirements.

Inspector / Driver's Name Print | Inspector / Driver's Signature | Driver's Signature (If Different From Inspector)

☐ No Defects Found

If Item is Defected Use X Under the D Column / When Repaired Use ✓ Under the R Column.

Tractor/Truck D	R	D/Defect R/Repaired	Trailer # 1 D	1 R	2 D	2 R
		1. Air Brake System				
		2. Cab				
		3. Cargo Securement				
		4. Coupling Devices				
		5. Dangerous Goods (If Any)				
		6. Driver Controls				
		7. Driver Seat				
		8. Electric Brake System				

Tractor/Truck D	R	D/Defect R/Repaired	Trailer # 1 D	1 R	2 D	2 R
		9. Emergency Equipment & Safety Devices				
		10. Exhaust System				
		11. Frame & Cargo Body				
		12. Fuel System				
		13. General Defects				
		14. Glass & Mirrors				
		15. Heater / Defroster				
		16. Horn				

Tractor/Truck D	R	D/Defect R/Repaired	Trailer # 1 D	1 R	2 D	2 R
		17. Hydraulic Brake System				
		18. Lamps & Reflectors				
		19. Steering				
		20. Suspension System				
		21. Tires				
		22. Wheels / Hubs / Fasteners				
		23. Windshield Wipers & Washers				

Remarks:

☐ Above defects corrected ☐ Above defects need not be corrected for safe operation of vehicle

Authorized Repairer's Signature Date Driver's Signature Date

4021793

BOUND EDGE

SAMPLE

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Items to be checked in your pre-trip inspection

A pre-trip inspection generally takes about 45 minutes.

Before beginning the inspection

Ensure you're wearing appropriate personal protective equipment such as gloves, high visibility (hi-vis) vest and boots. A hard hat and safety glasses may also be required.

Gather the following items:

- Clean rag to wipe off lenses and reflective tape
- Tire pressure gauge
- Pipe or tire hammer
- Flashlight
- Pen and inspection report booklet

You may also need some of these basic hand tools:

- Wrench to adjust brakes
- Pry bar to check slack adjustment such as a tie rod end puller



Before you begin a pre-trip inspection:

- Choose terrain that's level and park the vehicle safely away from traffic.
- Ensure that the engine has been shut off and the parking brakes have been applied.
- Remove the key to ensure the vehicle can't be moved while you're checking underneath.
- Chock the wheels and ensure the chocks will keep the vehicle from moving especially for vehicles equipped with air brakes that are to be released later. The minimum size for square blocks should be 15 by 15 centimetres (six by six inches).
- Check that all paperwork is in the truck and valid: vehicle registration, operating authority, insurance certificate, daily trip inspection report, NSC Schedule 1 trip inspection defect list, safety certificates, log books and the CVIP inspection certificate (decal).

A systematic approach — You may choose an inspection procedure that best suits the vehicle and its location. Whatever procedure is used, each regulated inspection item must be inspected and where a defect is discovered, the defect must be recorded on the report and reported to the carrier.

The tables in this section show a general method of making a systematic daily inspection of your vehicle, based on the NSC Schedule 1 trip inspection list of possible minor and major defects, provided earlier in this chapter.

Walk up/approach

When approaching the truck, assess the overall condition of the truck.

Component	Inspection points
Vehicle posture	Check vehicle 'posture' due to damaged suspension, flat tires or incorrect load placement. Major defect if, damaged or deflated airbag, cracked or broken main spring leaf or more than one broken spring leaf, part of spring leaf or suspension is missing, shifted out of place or in contact with another vehicle component, loose U-bolt patched cut, bruised cracked to braid mounted insecurely.
Leaks	Check for water and oil leaks under the vehicle.
Overall glass and body	Check for panel and glass damage.

Under-hood checks

Check for any cracks in the front of the hood before unlatching.

Unlatch and open up the engine compartment and check the following:

Component	Inspection points
Engine oil	Locate the engine oil dipstick, remove and wipe it clean. Then, insert the dipstick fully. Remove the dipstick once again and check the hi-low marking. Hold the dipstick level while checking. The oil will be black even if it was recently changed. White spots indicate coolant in the oil (notify maintenance). The oil level should be maintained between the full and add marks. Add oil only when the level approaches the low mark; don't overfill. Just because the level is below the full mark doesn't mean additional oil is required. When finished checking the oil, replace the dipstick and make certain the oil filler cap is snug (don't over-tighten). Never operate a vehicle when the oil level is below the add mark. Always carry additional oil in your vehicle.

Coolant system	Locate the filler tank and check the coolant level by looking at the coolant level sight gauge (if equipped). If necessary, add coolant up to the required level. Besides verifying the level of coolant, check for a concentration of grey, gummy film. This may indicate oil in the coolant (notify maintenance). Check the coolant hoses for tightness and signs of wear. Locate the water pump and check for leaks. Remember, the heater hoses are an important part of the cooling system. The cooling system in some tractors don't have a filler tank. In this situation, remove the radiator cap and use a hose to measure coolant level. It should be just above the radiator core. When finished, make certain the radiator cap has been properly tightened. Caution: Don't remove the pressure (radiator) cap on a hot engine. If the cap must be removed, allow the engine to cool for at least an hour. Then, remove the cap carefully and slowly. Carelessness will cause injury.
Power steering fluid	Check level with the dipstick supplied or by looking through the opaque reservoir on newer vehicles. Dip sticks will have a cold measurement on one side and hot measurements on the other, if the vehicle has been driven already. Top up with the recommended oil.
Fuel system	Know where the fuel lines run; check for leaks at the tank and lines. Locate the fuel filters and inspect for leaks and damages. Inspect the fuel transfer pump and lines for leaks. Major defect if there is an insecure fuel tank or dripping fuel leak.
Windshield washer fluid	Windshield washer fluid should be no less than three-quarters full. Check the windshield for damage and cleanliness. Wiper blades shouldn't be cracked or broken. Check the movement of the wipers (an air wiper will move, an electrical wiper won't). Carry extra fluid on board. Major defect when necessary for prevailing weather conditions: wiper or washer fails to adequately clear the driver's side field of vision in an area swept by the driver's side wiper.

Belts	Check all drive belts for tension, wear, cracks and fraying: fan, alternator and water pump. Belts should have no cracks or cuts. Check the belt deflection (tension) by pressing on the belt. Deflection should not exceed manufacturer's specifications. Generally, there should be 1.27 cm (0.5 in) of movement. Most newer trucks use serpentine belts which are self-tensioning. Tighten the loose belts. Replace cracked, worn or damaged belts (as per company policy). Check the belt pulleys to make certain they aren't loose, cracked or broken. Note: Never check the belts while the engine is running.
Hoses	Check all hoses for leaks, fraying or poor connections.
Fan blades	Fan blades must also be in good condition and not bent, cracked, missing blades or have loose mountings. Use caution. They can't be repaired and must be replaced. Even a small chip in a blade can put it out of balance and cause it to self-destruct from harmonic vibrations.
Electrical wiring and connections	Electrical connections should all appear tight and secure. No bare wiring. Broken or bare wires indicate trouble in the electrical system. Look for signs of chafing or wear. A loose or broken harness or missing ties may cause problems over time. Replace missing grommets. Insulation should be in good condition, not cracking or peeling.
Steering components	Check that the steering mechanism has no bent, broken or missing parts. Check the power steering pump and hose for leaks and adequate fluid level and ensure the steering mechanism has no wear or excessive play. Bolts, nuts, clamps shouldn't be missing or badly worn. Shake the steering arm, tie rod and drag the link at each wheel to ensure that they're not loose.
Transmission	Locate the transmission housing and check for leaks, especially around the seals. If there are signs of leakage, inform your supervisor. Weeping is okay but dripping should be reported.
Clutch	Clutch linkage and cable-operated clutches require pedal free play. Ensure that 1.27 cm to 5 cm (0.5 in to 2 in) of free-play is present. If it isn't, notify maintenance. If you have a hydraulic clutch, be sure to check for any leaks and verify the fluid level in the master cylinder reservoir mounted on the firewall under the hood.

Front wheels, brakes and suspension	Inspect the front wheels for wear or damage to the tires, rims and oil seal leaks. Check slack adjuster travel as per air brake inspection. With disc brakes, ensure the brake chamber will move (rock) slightly, which indicates the brake caliper isn't jammed on. Major defect if, wheel has loose missing or ineffective fasteners, damaged cracked or broken wheel rim or attaching part evidence of imminent wheel, hub or bearing failure. Flat tire, tire tread depth is less than wear limit, tire is in contact with another tire or any vehicle component other than mud-flap, tire is marked "not for highway use", tire has exposed cords in the tread or outside wall area.
Exhaust system	Look for carbon trails/black streaks at manifolds, turbocharger flanges and pipe connections. Carbon trails usually indicate a leak in the system. Inspect the EGR cooler and the exhaust brake (if equipped). Pipe hangers and clamps should be intact and secured. Any exhaust leak under the vehicle is an out-of-service defect. Major defect if, leak causes exhaust gas to enter the occupant compartment.
Air compressor, air lines and governor	Locate the compressor and check for leaks. Confirm that the mounting bolts are holding solidly and that there are no coolant or oil leaks and the governor is secure. Check air lines that are visible under the hood.
Air dryer integrated system (AD-IS)	Secured with no damage. Check for excessive amounts of oil at the discharge port.
Air intake system	Check the pipes, elbows and connections between the air cleaner and engine air intake. Check the air-to-air intercooler. Sometimes connections work free, so confirm that the clamps are tight. There should be no oil leaks on the turbocharger housing or line.
Final visual	Visually inspect the engine block for cracks or leaks. Check the frame and firewall for any damage. Check the hood and hinges for cracks and breaks. Finally, close and fasten the hood or cab.

Interior inspection

Enter the cab using three points of contact.

Component	Inspection points
Vehicle entry	Confirm that the driver's side steps, grab rail and door handles are clean and secure. The door mechanism should open easily and close securely.
Seat — adjustment	Adjust the driver's seat including the height, forward placement of the seat, back of the seat, lumbar adjustment (if equipped) and tilt and telescopic steering wheel assembly (if equipped).
Seats — condition	All seatbelts fasten and unfasten properly, have no rips or tears and are properly secured to the vehicle. Seat tether straps are in place and secure. Seats are securely fastened to the floor, in good condition and its settings function properly. Cushion or padding isn't missing, torn or badly worn. Confirm that the steering has no excessive play or slack. Major defect if, seatbelt or tether belt is insecure missing or malfunctions.
Mirror adjustment, cleanliness and condition	Confirm mirrors are adjusted correctly: • The large flat mirror allows a driver to keep an eye on traffic and on the sides of the trailer. • The smaller convex mirror allows a driver to keep an eye on traffic. alongside the tractor by filling in blind spots, if properly adjusted. Confirm that the mirrors are not cracked, missing, broken, damaged or obstructed.
Windows and windshield condition and cleanliness	Confirm that the windows open and close. Confirm windows aren't cracked or damaged and are clean to provide a clear view for the driver.
Cab doors	Confirm that the cab doors open properly and are securely closed. Check that the occupant compartment or any cab or sleeper door opens and closes properly. Doors must open and close from the inside. Major defect if, any cab or sleeper door fails to close securely.

Documentation	Tractor registration must be checked against plate number, sticker number, class and gross weight. Confirm that safety documentation matches the plate number and window stickers. Check that insurance certificates and ownership are current. Confirm that your log book, pre-trip inspection book and bill of lading are ready for your trip.
Cab floor	Driver's floor should be clean and free from damage and obstructions.
Safety equipment	These equipment items are required by law and must be present and easily accessible to the operator: • Approved warning devices are accessible and operational (such as emergency triangles and flares). • Fire extinguisher (required if carrying passengers or dangerous goods) is charged, secured and its pin is in place. • First aid kit is full, secure and accessible. • Tire chains as required from October to April. Optional items that might be required are wrenches, a jack with handle, fuses, spare lights and wheel chocks.

Engine start-up

Note: Idling should be kept to a minimum, depending on weather conditions.

Component	Inspection points
Engine start-up	Ensure transmission is in neutral prior to starting the engine. • Ensure the parking brake is applied. • Depress the clutch pedal to the floor and hold it there. • Turn the key to the on position, watch as gauges sweep and check all the warning lamps as they go through their test cycle. Start the engine. It's important to follow the manufacturer's start-up procedures, especially in cold weather. • Don't step on the accelerator pedal. • As soon as the engine starts, release the key or button. • Listen for unusual engine noises. • Immediately check the oil pressure gauge. If no oil pressure shows, stop the engine at once. You can damage the engine by running it with no oil pressure. Wait 30 seconds and retry.

Check gauges: Once the engine is running, ensure gauges are displaying correctly and no warning lights are on. All gauges must be functioning and giving normal readings, otherwise you shouldn't operate the truck. Immediately report any issues to your supervisor.

Component	Inspection points
Air pressure gauge	Indicates capacity to operate the brakes. Don't operate the truck until the air reaches the manufacturer's minimum specifications. Excessive loss of pressure overnight can indicate a leak in the air system. Major defect if low air warning system fails or the system is activated.
Oil pressure warning light	This light should be on as the truck is being started, but should go off right after the engine starts. If the warning light doesn't go off, this is a possible sign of low oil level (check the dipstick), bad oil pump, defective oil pressure sending unit, oil pressure gauge or warning light switch. If the warning light remains on, turn the engine off immediately.
Alternator warning light	If this light remains on after the engine is running, it may indicate a malfunction with the charging system. Frequently, a loose or slipping belt is the cause of a glowing or flickering alternator warning light. Don't operate if the light remains lit.
Ammeter/ voltmeter gauge (instead of alternator warning light)	If it continues to show a discharge after the engine is running, don't operate the vehicle. Talk to your maintenance department and get the charging system checked out.
Water temperature gauge and warning light	Shows the temperature of the coolant in the engine. If your truck has a gauge, it will show the operating temperature of the coolant. Typically, modern engines operate in the 200 to 220 degree Fahrenheit (93 to 104 degree Celsius) range. When the warning light goes on, you need to reduce the water temperature immediately. Generally, you'll need to take the load off of the engine by downshifting to a lower gear. If the high temperature is caused by a failure of the cooling fan or a leak in the cooling system, your only option may be to park safely and shut the engine off.

Fuel gauge	It should indicate a safe margin of fuel for the day's operation — preferably, you should operate out of the "top half" of the tank. Due to the large capacity of some fuel tanks, these gauges aren't always perfectly accurate. If in doubt, fill your tanks up. If you know what the fuel consumption of your truck is, you could use kilometres traveled to determine your next fill-up. Follow company procedures.

Check light indicators and other controls:

Component	Inspection points
Horn and backing alarm	Proper operation of both the air and electric horn and backing alarm (if applicable).
Heating and defrosting systems	Visible portions of the hoses and piping for the interior heaters routed within the occupant compartment must not be rubbed, cracked or leaking. Windshield defroster system must deliver heated air to the windshield and, where fitted, to the side windows to the left and right of the driver. System must switch between heater and defroster positions and the fan must blow sufficiently at each speed. Major defect if, deforester fails to provide unobstructed view through the windshield.
Light indicators	Confirm the following indicators are operational: • Hazard lights — four-way flashers • Signal lights, clearance lights, brake lights and headlights (high and low beams)
Steering slack	Check that there isn't excessive free-play in the steering wheel. Major defect if, steering wheel is insecure, or does not respond properly, steering wheel lash (free-play) exceeds required limit.
Windshield wipers and washers	Wiper and washer control are functioning properly. Wiper blades aren't damaged or missing. Wiper and washer must adequately clear the driver's field of vision. Major defect when necessary for prevailing weather conditions: wiper or washer fails to adequately clear the driver's side field of vision in an area swept by the driver's side wiper.
Communications equipment	Communications equipment works.

Check all pedal operations and brakes:

Component	Inspection points
Brake pedal	Brake pedal pad or anti-skid surface is secure and doesn't have excessive wear (where equipped). The brake releases immediately when pressure is released from the pedal.
Accelerator pedal	With engine idling, depress the pedal and release. There should be no binding or sticking. Accelerator pedal is secure and operates properly (no sticking or engine failing to return to idle).
Clutch pedal	Check for free-play and the amount of travel. Clutch brake engages when fully depressed. To check the clutch check, depress the clutch pedal and ensure that it's not sticking, vibrating, loose or making squeaking or grumbling noises.
Parking	When fully applied and not held by foot or hand force or air pressure, the parking brake must hold the vehicle stationary against the engine momentarily while the vehicle is operated in reverse gear and low forward gear at a light throttle setting. To check the park brake, place the truck in drive (or appropriate gear), release your foot off of the foot brake and tug test under load (recommended at idling speed). Major if, inoperative service, parking or parking emergency brake.
Service brake	When service brakes are applied by either foot or hand valve, it must stop the vehicle when it's operated in reverse gear and forward gear. When pre-trip is completed, perform a low speed brake application test to prove that the foot valve is functioning. Major if, inoperative service, parking or parking emergency brake.

Exterior inspection — driver side

Note: During the vehicle inspection, return to the driver's compartment as required to turn the lights on and off to check that they're working properly.

Component	Inspection points
Bumper, fender	Not missing. Securely mounted. Not broken, bent or corroded and no sharp edges.
Mirrors	Should be securely mounted. Clean to ensure proper visibility. Check for damage that affects the proper functioning of the mirror.
Windows	Cracks, discolouration, exposed sharp edges or missing parts. Cracks that extend more than 50 mm (2 in) into the area swept by the wipers or extend from one edge to another must be fixed. Chips in any area swept by the wipers must not be greater than 13 mm (0.5 in) in diameter. Cracks or chips must not go through both layers of laminated glass. Clean, clear and unobstructed to ensure proper visibility. Driver's window can be opened from the inside.
Doors	Must function and seal properly from both the inside and outside of the vehicle. Securely fastened to the vehicle and not damaged. Major defect if, any cab or sleeper door fails to close securely.
Inspection decals	Inspection decals are present, valid and in the proper location (if required for the specific vehicle).
Frame (body, chassis, sliding subframe, cross members)	Cracks, corrosion, structural damage, deformation, missing or loose fastener. Major defect if, visibly shifted , cracked, collapsing or sagging frame member(s).
Underbody	Structural damage, deformations, perforation or presence of openings not designed by the manufacturer.

Leaks	Carefully view the ground under the truck and on the inner walls of the tires for indications of fluid leaks or damage. Leaks could include engine oil, fuel, water, coolant, transmission fluid, power steering fluid clutch or axle fluids or grease. Major defect if, dripping fuel leak
Drive shafts/ U-joints/slip joints	Missing, loose or damaged parts. Too much free-play. Excessive wear. Universal joints must not show evidence of free-play.
Brakes	No cracks with a minimum brake lining thickness of 8 mm (5/16 in) Damage to drum or disc. Excessive wear on discs or inside the drum mustn't exceed the manufacturer's wear limit. Slack adjuster's free-play is within limits. Major defect if, pushrod stroke of any brake exceeds the adjustment limit.
Suspension	Excessive play for ball joints and control arm pivots. Front and rear springs, shackles, U-bolts, centre bolts, radius rods, control arms, torque arms, equalizers, sway bars, stabilizers and their supports and attachments must not be loose, bent, cracked, broken, disconnected, displaced, perforated by corrosion or missing. Leaf springs shouldn't have cracks or shifted leafs. Confirm lubrication of the suspension and components by inspecting grease points. Shock absorbers must not be loose, bent, disconnected, missing, damaged or show evidence of active fluid leakage. Airbags must not be damaged, leaking or deflated. Major defect if, damaged or deflated airbag, cracked or broken main spring leaf or more than one broken spring leaf, part of spring leaf or suspension is missing, shifted out of place or in contact with another vehicle component, loose bolt patched cut, bruised cracked to braid mounted insecurely.
Batteries	Securely mounted, must not be loose, missing or have hold downs missing and battery cover is on and secure. Check for corrosion or leaks. Battery cables are attached and secure.

Lights	All lights must operate properly: headlights, hazard lights, signal lights, clearance, marker and identification lights, taillights and brake lights. Components must not be damaged, discoloured, or missing in whole or in part. Lamps must not be covered or modified in a manner that reduces the effective area of the lens or the brightness of the light. Lamps must be the correct colour for their location. Major defect if, when lamps are required: failure of both low beam headlamps- failure of both rearmost tail lamps, At all times: failure of rearmost turn-indicator lamp, failure of both rearmost brake light.
Trailer electrical cord	Properly secured, not loose so as to contact moving parts and not rubbed through the insulation, peeled, cut or deteriorated. Check the contacts on both ends for corrosion.
Air lines	Properly secured, not dragging or rubbing, no leaks. Service and supply lines secure, properly connected to the trailer, not leaking.
Reflective tape	Must be properly affixed and not damaged where required. Clean if required to ensure your vehicle is visible.
Tires	Inspect the tires by thumping them. All tires should sound the same. If you have doubts about proper inflation, check with a tire pressure gauge. Drive axle tires have adequate tread depth (not less than 1.6 mm or 0.06 in), proper inflation and no bulges, sidewall separation, cuts or uneven wear. Dual tires aren't touching and nothing is trapped between them. If excessively worn (tread depth less than 1.6 mm or 0.06 in) or damaged tires, the driver must not drive until repaired or corrected. A flat tire is an out-of-service defect. Tire isn't in contact with any vehicle components. No missing valve stem caps and valve stems are straight and not damaged. Major defect if, flat tire, tire tread depth is less than wear limit, tire is in contact with another tire or any vehicle component other than mud-flap, tire is marked "not for highway use", tire has exposed cords in the tread or outside wall area.

Wheels and hubs	Wheel stud, bolt, clamp, nut and lug must not be loose, missing, damaged, broken or mismatched. Wheel assembly doesn't have any visible cracks and isn't bent in a way that affects the safe operation of the vehicle. Hub must not be cracked, bent, distorted, worn, missing or leaking. Axle assembly has no breaks, cracks, holes, broken seals or bends. Drive axle wheel rims have no cracks, missing pieces, bends or rust streaks (steel) or grey streaks (aluminum). Wheel fasteners are secure and not missing, broken or loose. A solid seal of dust between the nut and the wheel is a good indication that the nut is secure. Check for any wear (silvering) or gaps around the lug nut. If this is present, it indicates movement. Don't drive with a loose or damaged lug nut. Check for any foreign objects between the duals. Hub oil/wheel seal isn't leaking. Major defect if, wheel has loose missing or ineffective fasteners, damaged cracked or broken wheel rim or attaching part, evidence of imminent wheel, hub or bearing failure.
Sliding tandem and locking pins	The pins are locked and secure. No bends, cracks, breaks or weld separations in the cross members, torsion bars or flanges.
Mud guards/ flaps	Check for missing, perforated, patched or insecure components. No part of the exhaust system can be closer than 50 mm (2 in) to wiring, any part of a fuel or brake component or any combustible material that's not protected by a shield. No loose exhaust pipes or mufflers. The heat shield (if present) is secure. When the vehicle is running, look for visible exhaust and listen for excessive noise indicating a leak. Leaks should be reported immediately due to the danger of carbon monoxide gas entering the truck. Major defect if, leak that causes exhaust gases to enter the occupant compartment.
Fuel tank and lines	Fuel tank(s) securely mounted/attached. Fuel lines are present and secure and there are no leaks. Filler cap isn't missing and is secured. The fuel tank has no leaks and the air vent isn't plugged. Fuel system lines are secure, not hanging dangerously low and have no leaks. Major defect if, insecure fuel tank, dripping fuel leak.

Fifth wheel coupling device	Fifth wheel is secured to the vehicle frame. Jaw closure and locking mechanism is in good working order, not cracked or broken. Fifth wheel coupler bolt is secure, slider is locked and secure, plate shows no damage, cracks or weld separations, plate is flush to the apron (no daylight is visible between them). Saddle bushings must not be worn in excess of manufacturer's specifications. Fifth wheel locking jaws are closed, kingpin is enclosed. Kingpin and pintle hitch eye hook (if equipped) isn't worn, damaged, cracked or broken. Kingpin isn't loose, cracked, deformed or worn. Test for free-play in the fifth wheel slide mechanism and between the trailer kingpin and fifth wheel jaws. Hitches (if equipped), pintle hitch or ball hitch isn't worn and locking mechanism is closed. Pintle tensioner is functioning correctly. Chains/cables have no stress cracks or weld breaks and are secure. Electrical cord and air lines are properly attached and secure, not dragging or rubbing and no air leaks. Major defect if, coupler is insecure or movement exceeds prescribed limit, coupling or locking mechanism is damaged or fails to lock, defective, incorrect or missing safety chain/cable.
Landing gear	Raised, secure (in gear), no cracks, bends or missing parts. The handle must operate smoothly and easily and be properly stowed.
Frame and cargo body	Look for cracks, corrosion, structural damage, missing or loose fasteners. Look for visibly shifted, cracked, collapsing or sagging cross members. Major defect if, visibly shifted, cracked, collapsing or sagging frame member(s).

Rear of the vehicle

Component	Inspection points
Lights/signals	Right and left turn signals work, lenses are clean and not cracked. Hazard warning lights work, lenses are clean and not cracked. Brake lights work, lenses are clean and not cracked (whenever possible, have another person activate the brakes while you check for proper operation or use the trailer hand valve to check operation, if equipped). Clearance and marker lights work, lenses are clean and not cracked, reflectors and retro-reflective tape are clean. Backing and docking lights work, lenses are clean and not cracked. Major defect if, when lamps are required: failure of both low beam headlamps — failure of both rearmost tail lamps, At all times: failure of rearmost turn-indicator lamp, failure of both rearmost brake light.
Licence plate	Licence plate is clean, attached securely. Insurance decal is valid. Licence plate light is secure and works and the lens is clean.
Mud flaps	Mud flaps are secure, not torn and don't drag or rub on the tires.
Tailgate/cargo doors	Closed and properly secured. No structural damage or damage to hinges and latches. Open doors (if applicable) to check load is secure and the trailer is clean. Always stay to the side when opening doors in case the cargo has shifted and wants to push the door open or fall on top of you. Major defect if, serious damage or deterioration that is noticeable and may affect the vehicle safe operation, insecure cargo, absence, failure, malfunction or deterioration of required securement devices or load covering.

Rear impact guard/bumper	Locate the spare tire and spare tire rack (if equipped). Note the tire and rim type and size. They must match the other tires on the trailer unit. Check the carrier for cracks or damage. The spare tire tie down system must hold the tire securely. The tire must be properly inflated.
Spare tire and carrier	Locate the spare tire and spare tire rack (if equipped). Note the tire and rim type and size. They must match the other tires on the trailer unit. Check the carrier for cracks or damage. The spare tire tie down system must hold the tire securely. The tire must be properly inflated.

Exterior — passenger side

Continue inspecting the passenger side of the unit using the same procedures as on the driver's side of the truck-tractor and semi-trailer.

Cargo and general appearance

Component	Inspection points
Cargo and general appearance	Vehicle structure and other securement devices aren't damaged or weakened. Load security devices work, anchor points are secure, vehicle and load devices aren't damaged (if applicable). Major defect if, insecure cargo, absence, failure, malfunction or deterioration of required securement devices or load covering.
General outside appearance	Visually inspect for damage and vandalism. Serious damage or deterioration that's noticeable is a major defect. Body has no damage, broken or missing rivets, holes or weld separations. Brake chambers are secure, no signs of cracks, corrosion or holes and nothing obstructs the push rod travel. Major defect if, serious damage or deterioration that is noticeable and may affect the vehicle's safe operation.

Air brake trip inspection

An air brake trip inspection will be done as part of your daily vehicle pre-trip and post-trip inspections. The order you complete the steps in an air brake and vehicle trip inspection can vary, depending on the systematic approach you prefer once you get familiar with the requirements. The following information is a guide only. As with the vehicle pre-trip and post-trip inspections, any defects in the air brake system or brake components must be documented and reported so the necessary repairs can be done.

Before you begin:

- Park the truck and trailer on level, stable ground
- Set the parking brakes
- Block the wheels
- Drain the wet air tank (if equipped) or point out that vehicle has an air dryer integrated system (AD-IS). This would be located beside the governor. Vehicles equipped with AD-IS won't have a wet tank.
  - The air dryer would be located between the compressor and the first air tank. It cleans the air (moisture and contaminants) and prevents freezing. Filtration system filled with desiccant (like kitty litter).
  - The air dryer purges at maximum pressure — this you can hear. It can be located in a variety of locations on the truck. Draining the wet tank first checks that the one-way check valve works.
- Gather tools: pry bar, flashlight, timer and a pen

Step 1: Under the hood

With the engine off, check the security and condition of the following components:

- Compressor
- Compressor belt tension (if equipped)
- Air lines
- Governor
- Air dryer
- Steering axle foundation brake components

On the steering axle, manually check that the brakes are adjusted properly by checking the push rod travel or "free-play." It should be 13 mm to 19 mm (0.5 in to 0.75 in) and adjust manual slack adjusters to 13 mm (0.5 in), if equipped. If there's more than 19 mm (0.75 in) of free-play with an automatic slack adjuster, then an applied stroke check should be completed. The acceptable measurement will vary depending on the size of the brake chamber and the method you use to check the pushrod travel (applied stroke or pry method), but generally:

- Automatic slack adjusters — 19 mm (0.75 in) or less of free-play.
- Manual slack adjusters — 13 mm to 19 mm (0.5 in to 0.75 in) free-play. **Note:** 13 mm (0.5 in) is recommended.

Step 2: Governor operation

Pressure build-up

- Start the engine and run at 1000 RPM to 1200 RPM
- Check that pressure builds from 50 p.s.i. to 90 p.s.i. (345 kPa to 620 kPa) within three minutes [first air pressure gauge needle hits 50 p.s.i. (345 kPa), you start timing and when the last needle gets to 90 p.s.i. (620 kPa), stop timing].
- It would be a minor defect if pressure build-up time is greater than three minutes.

Governor cut-out pressure

- Allow the air to build up to maximum pressure.
- The governor must cause the compressor to stop pumping (governor cut-out) between 105 p.s.i. to 135 p.s.i. (724 kPa - 931 kPa).

Release all parking brakes. Observe governor cut-in pressure:

- Fan down the brakes (by pumping the brake pedal) until air pressure drops to about 20 p.s.i. to 25 p.s.i. (138 kPa to 172 kPa) less than cut-out pressure.
- Pause and check that air pressure begins to build (to confirm governor cut-in pressure). It should cut in at 20 p.s.i. (138 kPa) below the maximum, but in all cases, the governor must cause the compressor to cut in at a minimum of 80 p.s.i. (552 kPa).

Step 3: Tractor protection system

With the air pressure above 100 p.s.i. (690 kPa) and trailer brakes released, shut off engine and turn ignition key to the 'on' or 'run' position.

- Fan down the brakes until the tractor valve closes, which should occur when the highest reservoir pressure gauge reads between 45 p.s.i. and 20 p.s.i. (310 kPa – 138 kPa). Exit the truck and go to the back of the trailer to check that the trailer spring brakes have applied.
- Return to the front of the trailer and disconnect the supply and service air lines. There should be no air loss from either the tractor or trailer air lines.
- Enter the truck and apply the service brakes. There should be no air loss from the supply and service air lines.
- Reconnect the air lines.

Step 4: Air system leaks

Start the engine and let the air pressure build up to maximum pressure. Release all brakes, shut off engine and turn ignition key to the 'on' or 'run' position:

- Make and hold a full foot brake application.
- After the air pressure gauge(s) have stabilized, start timing for one minute.
- Watch the air pressure gauge(s) for any loss of air and listen for audible air leaks (window open).
- Maximum air loss must not exceed 4 p.s.i. (28 kPa) in one minute with a single trailer and 6 p.s.i. (41 kPa) per minute with multiple trailers.

Step 5: Low air pressure warning devices

With the air pressure above 60 p.s.i. (414 kPa), all brakes released, engine off and ignition in the 'on' or 'run' position:

- Fan down the brakes to lower the air pressure.
- Low air warning light must come on at a minimum of 60 p.s.i. (414 kPa).
- If equipped with an audible warning device, it must activate at the same time as the warning light.

Step 6: Brake response test

With the engine running and the air pressure built up to maximum pressure, apply the park brakes and remove the blocks from the wheels.

Perform the following four brake response tests:

Truck parking brake

- Truck park brake valve closed (yellow button out).
- Trailer supply valve open (red button in).
- Place transmission in a low forward gear and gently try to pull ahead to check that the truck spring brakes are holding.

Trailer parking brake

- Trailer supply valve closed (red button out).
- Truck park brake valve open (yellow button in).
- Place transmission in a low forward gear and gently try to pull ahead to check that the trailer spring brakes are holding.

Hand valve (spike), if equipped

- Truck park brake valve open (yellow button in).
- Trailer supply valve open (red button in).
- Place transmission in a low forward gear and move slowly ahead while applying the hand valve (spike) to check that the trailer service brakes are working. This will also serve to double check your fifth wheel is locked.

Foot brake

- Truck park brake valve open (yellow button in).
- Trailer supply valve open (red button in).
- Place transmission in a low forward gear and move slowly ahead and make a foot brake application to check that the service brakes are working.

Winter preparedness

Make sure your vehicle is ready before driving in winter weather. Conditions can change quickly in the winter and being prepared is key to successfully operating in snow, ice and extreme cold.

Winter preparedness should concentrate on parts of the vehicle that can be affected by extremely cold weather, snow and ice.

- You may find yourself in conditions where you can't drive without chains, even to get to a place of safety. Carry the right number of chains and extra cross-links. Make sure they fit your drive tires. Check the chains for broken hooks, worn or broken cross-links and bent or broken side chains. Learn how to put the chains on before you need to do it in snow and ice.
- Fill the top half of your fuel tank in the winter to minimize condensation and ensure you have enough fuel on board if you get stranded.
- Clean the cab, body and undercarriage weekly to remove road salt.
- Assure that all the glass and mirrors are kept clean.
- Make sure that the emergency kit includes road flares, fire extinguisher, reflective triangles, first aid kit, water, solar blanket, jumper cables and anything else you may need to survive through extreme weather overnight.
- Carry extra clothing and a thermal sleeping bag if you’re travelling through the mountains and particularly into Northern B.C.

15 Hours of service (HOS)

As a professional truck driver, you're responsible for the safety of one of the largest and heaviest vehicles travelling the highway. It's a job that requires you to be constantly alert and able to respond quickly to whatever comes your way.

It's extremely difficult to work safely when you're tired. That's why there are regulations that limit when and how long truck drivers are permitted to drive and work. These are informally referred to in the industry as hours of service regulations. They're similar to regulations intended to prevent fatigue in airline pilots. Fatigue slows reaction times, decreases awareness, increases aggressiveness and impairs judgement enough to cause a crash. For more information about fatigue, refer to the unit on health and safety.

National Safety Code standard 9 — Hours of Services sets out recommended hours of service criteria for Canadian provinces and territories. B.C. has adopted this standard and has set out hours of service in Part 3 of Division 37 — Hours of Service in the Motor Vehicle Act Regulations. If you work for a federally regulated carrier, you'll follow the federal regulations: *Commercial Vehicle Drivers Hours of Service Regulations*. The B.C. Ministry of Transportation and Infrastructure's Carrier Safety Guide, available at www.cvse.ca provides additional information on B.C. hours of service requirements.

What you'll learn

This unit will help you learn to:

- Understand the reasons behind the hours of service (HOS) regulations.
- Define and provide examples of driving time, off-duty time, and on-duty-not-driving time.
- Explain daily hour limits and cycles.
- Explain hour exemptions, such as personal use and adverse conditions.
- Provide examples of different HOS rules for north of 60 degrees latitude and driving in the United States.
- Explain different methods for recording HOS and what information should be included.
- Complete a daily HOS log.

On-duty time

On-duty time is when you begin to work or when a carrier requires you to be ready to start work. On-duty time ends when you stop work.

You're on duty whenever you drive or when you're:

- Inspecting, servicing, repairing, conditioning or starting a commercial vehicle.
- Travelling as one of two drivers when you're not resting in the sleeper berth.
- Participating in the loading or unloading of a commercial vehicle.
- Inspecting or checking the load.
- Waiting for the vehicle or load to be inspected.
- Waiting along the route because of a crash or other unanticipated event.
- Travelling as a passenger to a destination where you'll start driving — this qualifies as on-duty time when two conditions apply:
  - The carrier requests you make the trip.
  - You didn't have eight consecutive hours of off-duty time immediately before you began your driving time.
- Performing any other work as a carrier or while employed by a carrier.
- Waiting for a commercial vehicle to be serviced, loaded or unloaded when a carrier, who employs or otherwise engages you, asks you to do so.

During a ferry crossing, as long as the driver is not doing any work for any carrier, the time during the crossing can be recorded as off-duty since the driver is not in control of their vehicle.

Off-duty time

It's important that you get enough rest every day. Off-duty regulations are in place to protect you and everyone else who shares the road with you.

- Off-duty time includes any time you spend in a sleeper berth in a commercial vehicle.
- All drivers must take a minimum of 10 hours off duty every day.
- Off-duty time, other than the mandatory eight consecutive hours, may be distributed throughout the day in blocks of 30 minutes or more.

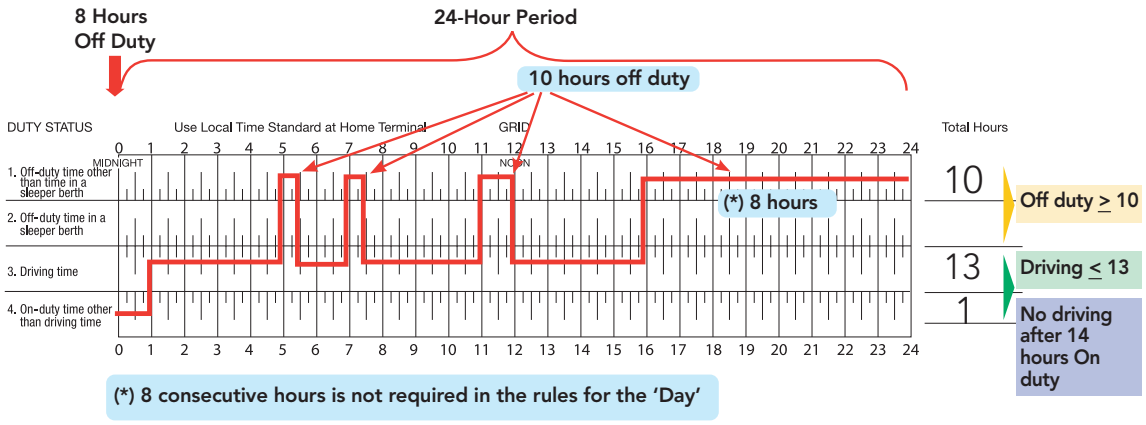
- The total amount of off-duty time that you take in a day must include at least two hours of off-duty time that doesn't form part of a period of eight consecutive hours of off-duty time.
- All drivers must have taken 24 consecutive hours off duty in the last 14 days.

Daily limits

A "day" is a 24-hour period that begins at the hour designated by the carrier for the duration of the driver's cycle. For example, one driver's day might start at midnight while another driver's day might start at 2:00 a.m. The driver needs to record the hour at which the day begins on their log book page (for example, midnight or 2:00 a.m.). Each day is independent and there are certain on-duty, off-duty and driving limits for each day:

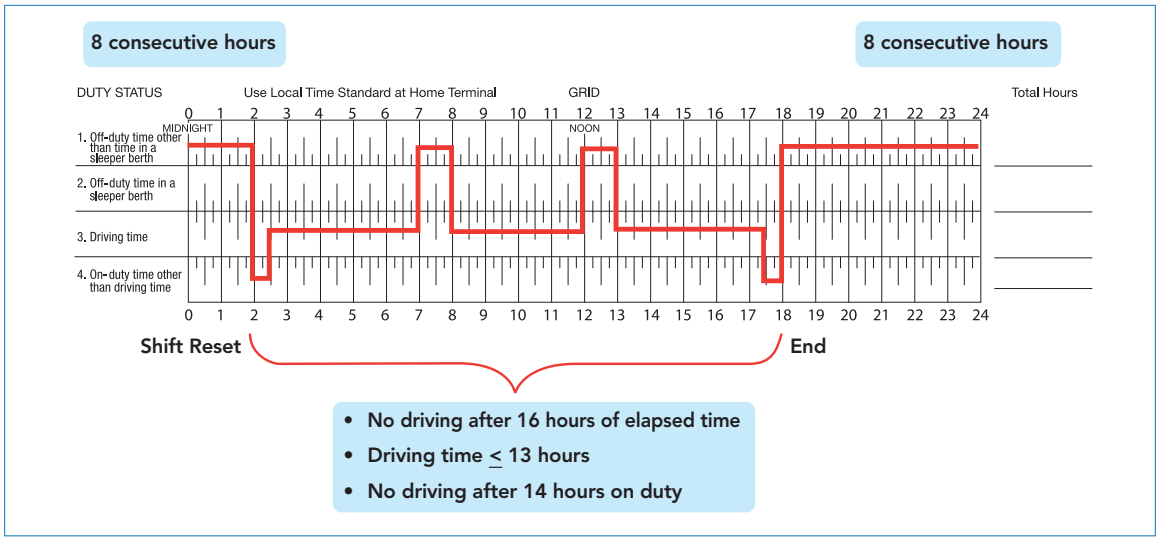
- A minimum of 10 hours of off-duty time must be taken every day.
- You're allowed to drive a maximum of 13 hours in a day.
- You're not allowed to drive after 14 hours **on duty** in a day.

Daily limits — a simple three-point check for compliance



Work shift

The "work-shift" is not a defined term in Division 37 of the MVAR but it's commonly referred to in industry. It can be helpful to think of the work-shift as a 16 hour window. A work shift is the elapsed time between two off-duty periods of at least eight consecutive hours. You're not permitted to drive after 16 hours of elapsed time (your work-shift) until you take at least eight consecutive hours of off-duty time. Every off-duty period consisting of eight consecutive hours or more resets the work shift.



Daily hours (cycles)

You must keep track of your time using one of two cycles. Each cycle has a maximum number of on-duty hours. You may choose one of two cycles:

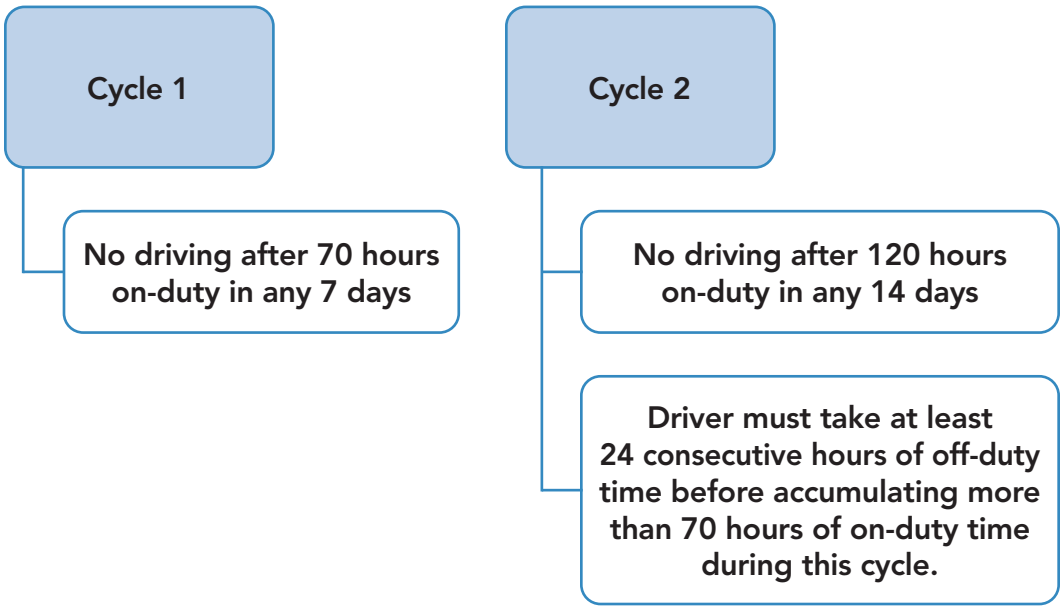
Cycle 1 — Drivers working on this cycle must not drive after completing 70 on-duty hours in seven days.

Cycle 2 — Drivers working on this cycle must not drive after completing 120 hours in 14 days and must take at least 24 consecutive hours off duty prior to accumulating 70 hours of on-duty time.

The start time of your day (24-hour period) remains the same throughout each cycle. You must reset a cycle to change the start time.

Did you know?

1. You can put in 14 hours of on-duty time without doing any driving at all.
2. You can reset a cycle at any time by taking:
   a. 36 consecutive hours off duty to reset cycle 1, or
   b. 72 consecutive hours off duty to reset cycle 2.



Cycle Switching

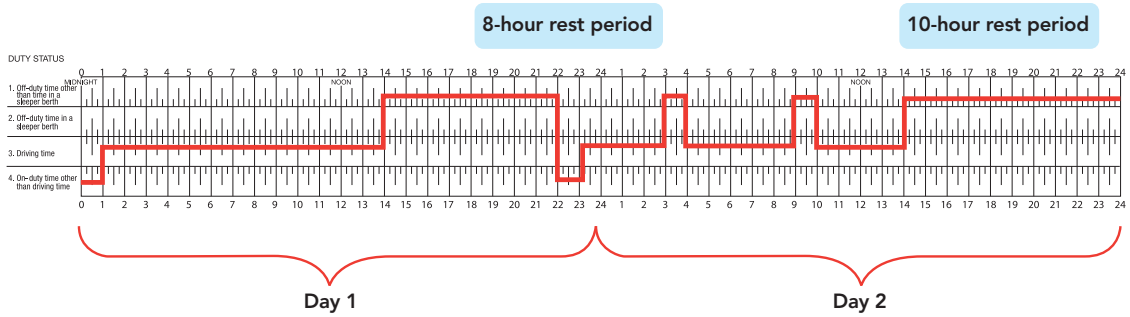
If a driver wants to switch from cycle 1 to cycle 2, they must take at least 36 consecutive hours of off-duty time before beginning to drive again. To switch from cycle 2 to cycle 1, the driver must take at least 72 consecutive hours of off-duty time before beginning to drive again. If a driver is using the logging truck or oil-well service vehicle hours, switching between cycle 1 and cycle 2 works differently.

Deferring off-duty time

You may reduce your off-duty requirement of 10 hours by up to two hours providing:

- The two hours aren't part of your eight consecutive off-duty hours.
- The total off-duty time taken in the two days is at least 20 hours.
- The two hours are added to the eight consecutive off-duty hours taken off the next day.
- The total driving time in the two days does not exceed 26 hours.
- You clearly indicate Day 1 and Day 2 on your log book and indicate in the log book remarks section that you are deferring off-duty time under MVAR 37.13.04.

Driver has 'deferred' two hours from Day 1 to Day 2



Notes:

1 The two hours 'deferred' from Day 1 are added to the eight-hour rest period on the following day (Day 2 — 1400–1600)

2 On Day 2 — Must still have the two 'Off-Duty' Hours that are not part of any mandatory eight-hour off-duty block (0300–0400) and (0900–1000).

Sleeper berth time

If a commercial vehicle has an approved sleeper berth, a driver can stop and rest whenever they're tired or during any extended period of waiting.

A driver must record any time spent resting in a sleeper berth as "off-duty time in a sleeper berth" on their daily log.

The same hours of service regulations for driving and on-duty time apply to drivers using sleeper berths.

A sleeper berth doesn't include the back seat of a bus or a reclining seat.

Single driver

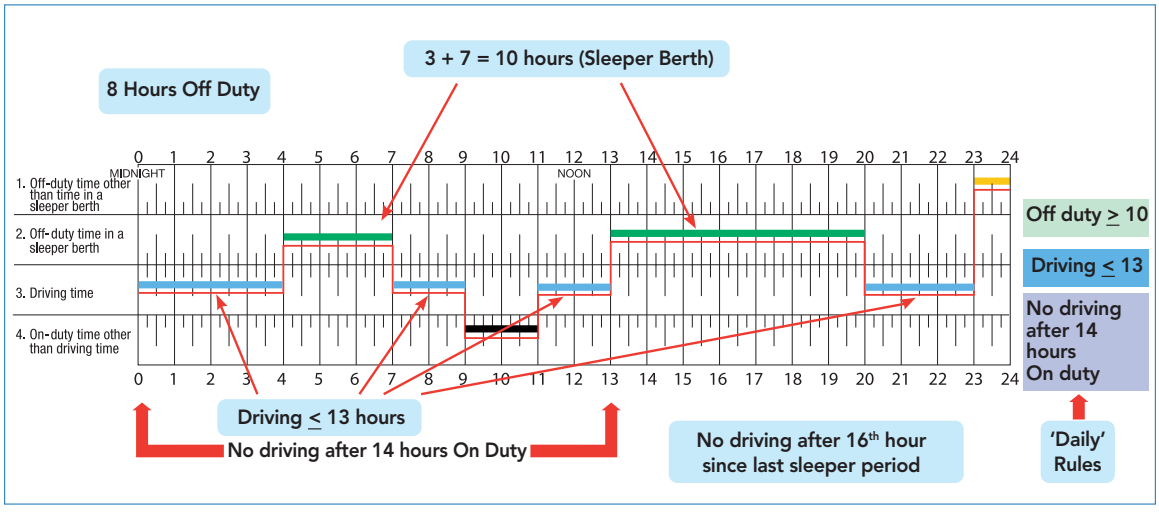
According to Division 37 of the MVAR, a driver can split the required 10 hours of daily off-duty time into two sleeper berth periods if:

- Neither period is less than two hours
- The total of the two sleeper periods is at least 10 hours
- The off-duty time is spent resting in the sleeper berth
- The total off-duty time in the day is at least 10 hours
- The total of the driving time in the periods immediately before and after each of the periods of off-duty time doesn't exceed 13 hours
- None of the daily off-duty time is deferred to the next day.
- The total of the on-duty time in the periods immediately before and after each of the two periods of off-duty time does not include any driving time after the 14th hour.
- The elapsed time before and after each sleeper period doesn't include any driving time after the 16th hour after the driver comes on duty.

The 16th hour is calculated by excluding any period spent in the sleeper berth that's two hours or more in duration and that, when added to a subsequent period in the sleeper berth, totals at least 10 hours and including:

- All on-duty time
- All off-duty time not spent in the sleeper berth
- All periods of fewer than two hours spent in the sleeper berth
- Any other period spent in the sleeper berth that doesn't qualify as counting towards meeting the requirements of the regulations

A log book example for a single driver using a sleeper berth is shown here.



Team drivers

Team drivers can split the required 10 hours of daily off-duty time into two sleeper berth periods if:

- Neither period is less than four hours and the total of the two sleeper periods is at least eight hours
- The off-duty time is spent resting in the sleeper berth
- None of the daily off-duty time is deferred to the next day
- The total driving time before and after each sleeper period doesn't exceed 13 hours
- The total of the on-duty time before and after each sleeper period doesn't include any driving time after the 14th hour
- The elapsed time before and after each sleeper period doesn't include any driving time after the 16th hour after the driver comes on duty

The 16th hour is calculated by excluding any period spent in the sleeper berth that's four hours or more in duration and that, when added to a subsequent period in the sleeper berth, totals at least eight hours and including:

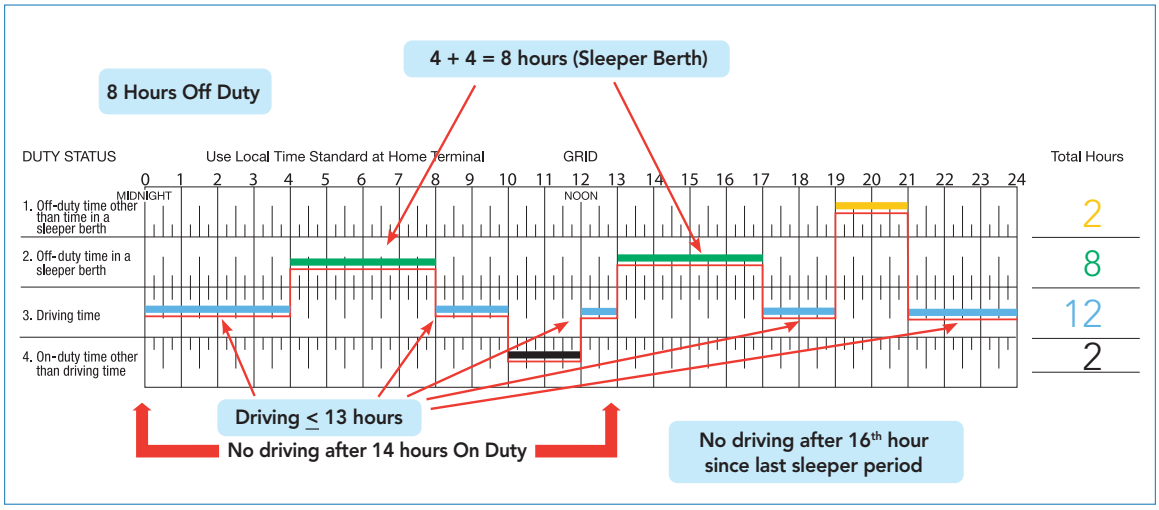
- All on-duty time
- All off-duty time not spent in the sleeper berth
- All periods of fewer than 4 hours spent in the sleeper berth
- Any other period spent in the sleeper berth that doesn't qualify as counting towards meeting the requirements of the regulations

Team drivers have the freedom to split the 10 hours of daily off-duty time in any way that the drivers want as long as each sleeper berth period is at least four hours and the total for two sleeper berth periods equals at least eight hours.

Team drivers must maintain their own daily logs and meet the daily and work shift limits on their own. When one driver is driving, the other must be resting in the sleeper berth for it to be counted as off-duty.

Only time actually spent in the sleeper berth counts towards the sleeper berth period. This means that any other off-duty time, such as sitting in the passenger seat, doesn't count towards the sleeper berth period.

A log book example for a team driver using a sleeper berth is shown here.



Personal use exemption

Driving a commercial vehicle for personal use isn't considered to be on-duty time if:

- The vehicle's unloaded
- The vehicle's not towing a trailer
- The vehicle's driven a maximum of 75 km a day for personal use
- The odometer readings are recorded at the beginning and end of personal use
- You're not subject to an out-of-service declaration

Log books

Drivers are required to maintain a complete, legible and accurate log in electronic or written format. The log must have the capability to record activities that occur 24 hours a day, seven days of the week. Your log book is recorded in the local time of your home terminal and is used to record your hours of on-duty, driving and off-duty time. Log book data must be completed on a graph grid so that each piece of required information may be recorded accurately. The grid is filled out in a way that ensures all of the driver's hours are accounted for in each of the four duty statuses, shown on the left side of the sample logbook above. Drivers may only have one log page per day even if they work for more than one carrier on that day.

Log books must contain:

- The date
- Start time, if different from midnight
- Name of driver in printed letters
- Driver's signature (at end of day)
- Name of the team driver, if applicable
- Odometer reading at the beginning and end of the day
- Total distance driven by the driver during the day
- Commercial vehicle licence plate number or vehicle unit number
- Cycle the driver is following
- Name of every carrier the driver worked with or for during the day
- Address of the home terminal and the principal place of business of each carrier the driver worked with or for during the day
- Total number of hours spent in each duty status — on-duty time, off-duty time, driving time and off-duty sleeper berth time — these totals must equal 24 hours
- Total amount of time spent in one location doing on-duty work other than driving (this must be shown as a continuous line on the log)
- Continuous line made by drawing through each time noted on the log page (the times noted must include every time the driver's duty status changed)
- Name of the municipality or location on a highway, including the name of the jurisdiction (province, territory or state), where each change in duty status took place
- Declaration in the "Remarks" section of deferral of off-duty time under MVAR 37.13.04, indicating Day 1 or Day 2
- Odometer reading at the beginning and end of personal use
- In the "Remarks" section, if applicable, note when the driving time is extended due to emergencies and adverse driving conditions.

Note: if you were not required to keep a daily log immediately before the beginning of the day, then you must record the number of off-duty time and on-duty time hours that you accumulated in the last 14 days in the "Remarks" section of the log book.

You must keep in your possession:

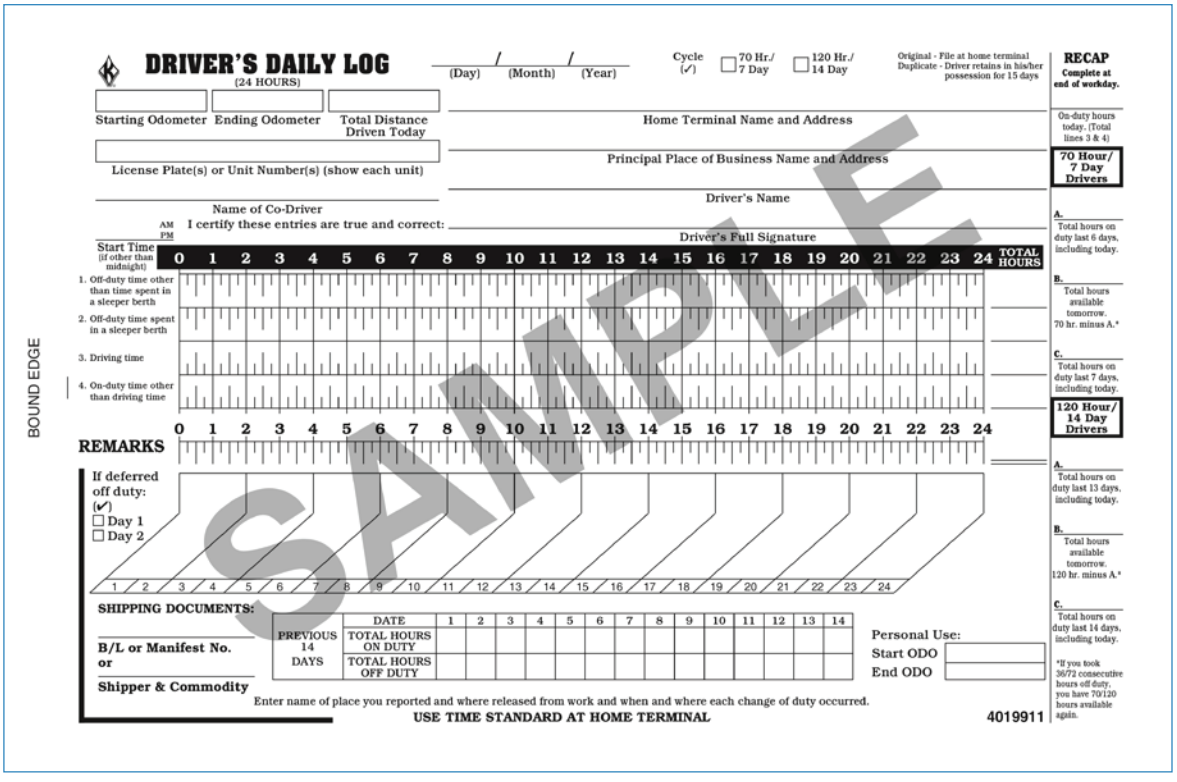
- A daily log for the current day that's updated to your last change in duty status
- Copies of your daily log for the previous 14 days
- Copies of your team driver's logs for the last 14 days if they're no longer riding with you
- Any supporting documents you've been issued during your trip

You must submit your original log book pages and all supporting documents to your home terminal (the carrier's place of business where you normally report for work) within 20 days of completing a daily log.

Officers, including police, commercial transport inspectors and motor vehicle inspectors, may ask to see your log book, which you must always present along with any supporting documents when asked. The documents may include:

- Bills of lading
- Shipping documents
- Fuel and accommodation receipts for expenses incurred along the route

Sample log book



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Electronic logging devices

In B.C., a driver operating within the province is permitted to use an Electronic Logging Device (ELD) instead of filling out a log book.

As of June 12, 2021, all commercial vehicles operated under federal requirements will require an ELD, whether in Canada or the U.S. ELDs will replace paper logs used to record hours of service in this case.

An ELD is hardware (a tablet) that connects directly to the engine control module (ECM) to automatically record driver compliance with hours of service requirements. It collects vehicle data including date, time, location information, distance driven and engine hours. It also generates alerts for vehicle movement with no logged in driver as "unassigned driving time".



This information is used to monitor the status of vehicles and drivers and is stored in a standard format that allows companies or enforcement officials to collect and review. The information contained in the device must be the same as the information that would've been recorded in paper format.

The ELD must be capable of displaying:

- The driving time and other on-duty time for each day that the device is used
- The total on-duty time remaining and the total on-duty time accumulated in the cycle being followed by the driver
- The changes in duty status and the time at which each change occurred for each day the device is used
- The times and dates on which the device has been disconnected and reconnected

When requested by an enforcement official, you must be able to immediately provide the information for the previous 14 days by producing it on a digital display screen of the electronic recording device, in handwritten form or on a printout.

This means that drivers must have blank daily log forms in the commercial vehicle. Any printed copy of the daily log that's generated from the information stored in the device must be signed on each page by the driver to confirm its accuracy.

Tampering

It's against the law to tamper with a daily log. Tampering may include any of the following activities:

- Driver keeps more than one daily log for any day.
- Driver records inaccurate information in a daily log, whether it's handwritten or produced using an electronic device.
- Anyone falsifies, mutilates or defaces a daily log or supporting documents.
- Anyone alters or tampers with original daily logs.

A carrier is responsible for ensuring their drivers do not falsify their logs, and must not request or require a driver to alter, falsify, delete or destroy daily log records or supporting documents.

Daily logs must be signed at the end of each day to confirm that all of the information recorded is accurate. If a log contains false information, an enforcement officer can still charge a driver with a violation even if the driver hasn't signed the daily log. They may also issue an out-of-service declaration for any of the violations listed above.

Hours of service penalties

B.C.'s MVAR section 37.37 lists out the various sections of the provincial hours of service regulations which are offences. Depending on the offence, you could receive a violation ticket fine of up to $598, or if convicted by a court you could face a fine of up to $2000 and/or jail time of up to six months.

For vehicles operating under federal requirements, the *Motor Vehicle Transport Act* section 18(1) provides that, anyone who contravenes or fails to comply with any provision of this Act or any regulation or order made under this Act is guilty of an offence punishable on summary conviction. Drivers who are convicted of an offence under this Act are liable to a fine not exceeding $5,000. Corporations who are convicted of an offence under this Act are liable to a fine not exceeding $25,000.

Out-of-service declarations

Enforcement officers can issue an out-of-service declaration to a driver for up to 72 hours, or more if the driver fails to take corrective action, if:

- the driver's faculties are impaired by fatigue, illness, or mental or physical infirmity to the point that is unsafe for the driver to drive
- driving would jeopardize or be likely to jeopardize the safety or health of the public, the driver or the employees of the carrier

- the driver fails to comply with requirements for driving time and off-duty time
- the driver is unable or refuses to produce their daily log book
- there is evidence that the driver has completed more than one daily log, or has falsified information in the daily log
- the driver has defaced or mutilated their daily log or supporting documents so that the enforcement officer cannot determine whether the driver has complied with driving time or off-duty requirements

If you drive while subject to an out-service declaration, you can receive a violation ticket of $598.

Drivers operating within 160 km of home terminal

A driver may be exempt from filling out daily logs if they operate a commercial vehicle within a radius of 160 km of the home terminal, and the driver returns to the home terminal each day to begin a minimum of 8 consecutive hours of off-duty time. The carrier must maintain accurate and legible records showing for each day:

- the driver's duty status and elected cycle
- the hour that each duty status begins and ends
- the total number of hours spent in each status, and
- the carrier must keep these records for a minimum of 6 months

Drivers must still follow all other hours of service rules and vehicle inspection requirements.

Ferries

During a ferry crossing in B.C., as long as the driver is not doing any work for any carrier, the time during the crossing can be recorded as off-duty if the crossing is fewer than 5 hours in length.

A driver travelling by a ferry crossing that takes more than five hours isn't required to take the mandatory eight consecutive hours of off-duty time if:

- The time spent resting in a sleeper berth while waiting at the terminal to board the ferry, in rest accommodations on the ferry and at a rest stop that's no more than 25 km from the point of disembarkation from the ferry combine to total a minimum of eight hours.
- The hours are recorded in the daily log as off-duty time spent in a sleeper berth.

- The driver retains, as a supporting document, the receipt for the crossing and rest accommodation fees. The supporting document must coincide with the daily log entries.

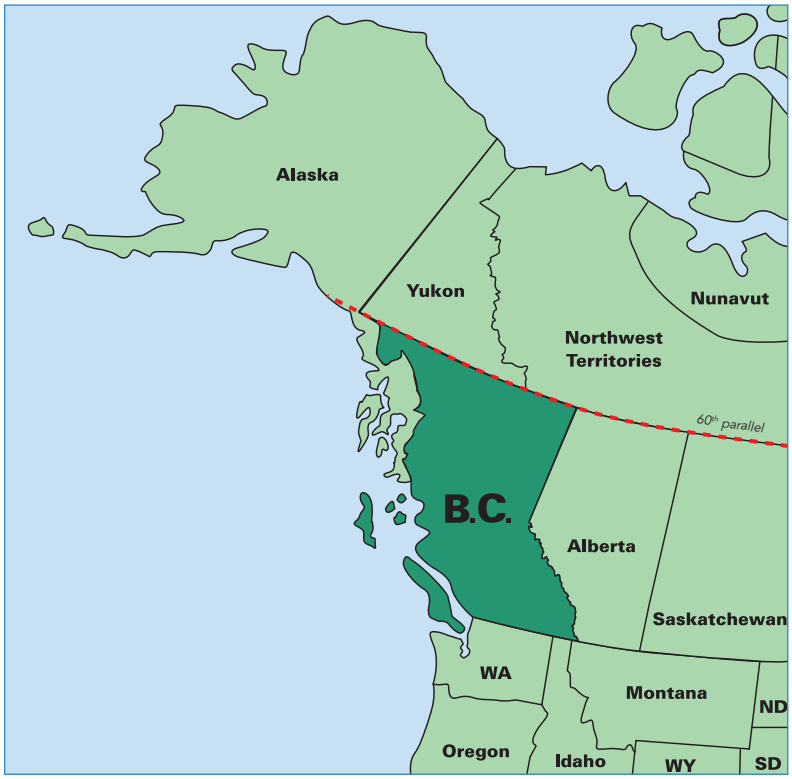
Driving north of the 60th parallel

If you operate commercial vehicles north of latitude 60, such as in the Yukon, Northwest Territories or Nunavut, some of the hours of service requirements are extended, and fall under federal requirements in the Commercial Vehicle Drivers Hours of Service Regulations. The longer hours are to accommodate short summers with longer days and ice roads in the winter. You'll need to pace yourself and not do too many of these longer days in a row.

- You may drive a maximum of 15 hours.
- You may not drive after 18 hours of on-duty time.
- You must take at least eight consecutive hours of off-duty time before starting the next work cycle.

Drivers may choose one of two cycles:

- Cycle 1 — 80 hours of on-duty time in 7 days.
- Cycle 2 — 120 hours of on-duty time in 14 days and after accumulating 80 hours of on-duty time, you must take 24 consecutive hours off-duty.



Driving into the United States

Although the rules in most jurisdictions are similar, there are some exceptions. Before entering another jurisdiction, be sure you know the local requirements. Driving into the U.S. is common for many Canadian drivers and they must obey all U.S. regulations while operating there.

The following table summarizes the HOS regulations for commercial truck drivers in the U.S. If you are a Canadian commercial truck driver travelling to or from the U.S., you must follow the U.S. HOS regulations while you are in that country. **Note:** U.S. HOS regulations for passenger carrying vehicles differ from what is below.

U.S. hours of service rules
11-hour driving limit May drive a maximum of 11 hours after 10 consecutive hours off duty.
14-hour limit May not drive beyond the 14th consecutive hour after coming on duty, following 10 consecutive hours off duty. Off-duty time does not extend the 14-hour period.
Rest breaks Drivers are required to take a minimum 30-minute off-duty or on-duty not driving period after eight cumulative hours of driving time. This doesn't apply to drivers using short-haul exceptions.
May work a maximum of: • 60 hours of on-duty time in seven days • 70 hours of on-duty time in eight days A driver may restart a seven or eight consecutive day period after taking 34 or more consecutive hours off duty.
Sleeper berth provision Drivers using the sleeper berth provision must take at least seven consecutive hours in the sleeper berth, plus a separate minimum two consecutive hours in the sleeper berth, off duty or any combination of the two. The two periods must add up to a minimum of 10 hours.

While the hours of service regulations are different in Canada and the U.S., the requirements for keeping a log book are similar. You're responsible for learning and complying with the laws of each jurisdiction you travel through.

More information on driving into the U.S. may be found at www.fmcsa.dot.gov.

Emergencies and adverse conditions

B.C. and Canadian federal regulations take into consideration situations where adverse conditions may inhibit drivers from adhering to driving time limits. Adverse driving conditions include snow, sleet, fog or other adverse weather or road conditions, including a highway covered with snow or ice, and unusual adverse road driving conditions. These adverse driving conditions must not have been known by a driver or dispatcher before the driver began driving.

A driver who encounters adverse driving conditions may extend the permitted 13 hours of driving time and reduce the two hours of daily off-duty time by the amount of time needed to complete the trip if:

- The driving, on-duty and elapsed time in the elected cycle are not extended more than 2 hours
- The driver still takes the required 8 consecutive hours of off-duty time
- The trip could have been completed under normal driving conditions without the reduction

Note: A driver who extends their driving, on-duty or elapsed time because of an emergency or adverse driving conditions must record the reason for doing so in the "Remarks" section of the daily log.

Carrier monitoring of driver hours of service

Carriers must ensure their drivers are following hours of service requirements. Carriers must:

- Evaluate all drivers to ensure they're complying with the regulations
- Record the date(s) in which any violation(s) occurred
- Record the date of issuance to the driver of a notice of non-compliance
- Record any actions taken with the driver

Monitoring activities involve the review of their driver's log books, supporting documents (such as fuel and lodging receipts) and any other relevant information. Carriers must document their findings to support any corrective or disciplinary action taken against a non-compliant driver.

It's recommended that carriers check their driver's logs as frequently as possible. Carriers should consider reviewing their driver's logs on a monthly basis, at a minimum.

The number of drivers and logs checked by a carrier every month may vary according to the size of the company. A small company may choose to monitor all drivers' logs every month, while a large company may choose only to monitor a portion of their drivers each month. Although a carrier has the option to monitor a percentage of their drivers each month, every driver should be checked at least once each year.

The objective of internal monitoring is to ensure all drivers are fully compliant every day — not just to document each driver's performance. It's recommended that carriers closely monitor new drivers or drivers with a history of non-compliance until they can demonstrate that they understand and are able to comply with the provincial and federal hours of service regulatory requirements.

16 Cargo securement

A professional commercial vehicle driver is responsible for the safe transporting of goods while they're in transit. In addition to sound driving skills, professional drivers must have basic skills on how to properly handle cargo. This unit will provide you with the knowledge to inspect, handle, load, secure and transport cargo in ways that keep it secure and prevent damage. Frequently used cargo securement terms are provided for your reference at the end of this unit.

What you'll learn

This unit will help you learn to:

- Comply with basic cargo securement regulations and practices
- Explain the importance of properly handling, loading and securing cargo
- Explain principles of cargo loading and weight distribution
- Ensure the cargo doesn't exceed vehicle weight capacity
- Describe methods of cargo securement
- Describe common cargo loading equipment
- Describe common devices used to secure a load
- Inspect cargo for proper securement
- Explain reasons for increased security measures within the transport industry
- Describe ways to increase the security of the rig and cargo
- Explain how to ensure personal safety when working with or around cargo

Cargo securement standards

In Canada, National Safety Code (NSC) Standard 10 — Cargo Securement, provides best practice guidelines for securing loads to commercial vehicles to ensure they don't shift, move or spill onto the roadway. British Columbia has adopted the NSC Standard 10 guidelines as a requirement under MVAR Division 35 — Cargo Securement. Drivers and carriers of vehicles transporting cargo on a highway, and vehicles exceeding a licensed GVW of 5,000 kg (11,023 lb) must ensure that cargo is transported safely and securely in accordance with NSC 10 and B.C. regulations. The NSC Standard 10 document, which contains detailed guidance and information on cargo securement requirements, can be found on the Canadian Council of Motor Transport Administrators (CCMTA) website at ccmta.ca.

Review these cargo securement requirements:

1. A carrier shall not permit a driver to operate a commercial vehicle where the cargo transported in or on the vehicle isn't contained, immobilized or secured in accordance with the NSC Standard as it relates to the particular type of commercial vehicle.
2. A driver shall not operate a commercial vehicle where the cargo transported in or on the vehicle isn't contained, immobilized, or secured in accordance with the NSC Standard as it relates to the particular type of commercial vehicle.
3. A driver or carrier must ensure that cargo transported by a commercial vehicle is contained, immobilized or secured so that it can't:
    a. Leak, spill, blow off, fall from, fall through or otherwise be dislodged from the vehicle
    b. Shift upon or within the vehicle to such an extent that the vehicle's stability or manoeuvrability is adversely affected
4. Drivers must regularly inspect the vehicle's cargo and cargo securement systems and make necessary adjustments before driving the vehicle and not more than 80 km (50 mi) from where the cargo was loaded.
5. Drivers must re-inspect cargo and the cargo securement system and make any necessary adjustments at specified intervals (whichever of the below occurs first):
    a. There's a change in duty status of the driver.
    b. The vehicle has been driven for three hours.
    c. The vehicle has been driven for 240 km (150 mi).
6. Inspection requirements immediately above don't apply if the cargo is sealed and the driver has been ordered not to open it to inspect it or if the cargo was loaded in a way that makes it, or portions of it, inaccessible.
7. If cargo isn't properly secured, the driver, carrier or shipper could face fines and penalties.
8. If an enforcement officer has reasonable and probable grounds to believe that a vehicle carrying cargo is unsafe for use on a highway because of the method of cargo securement, the officer may order the driver of the vehicle to stop and secure the cargo before proceeding.

The driver is responsible to inspect the cargo securement at the following points:

Driver action required	Pre-trip	Within first 80 km (50 mi)	When duty status of driver changes	At 3-hour intervals or every 240 km (150 mi), whichever is first
Inspect cargo and securing devices	✔	✔	✔	✔
Inform carrier if packaging isn't adequate	✔			
Adjust cargo and/or securing devices	As necessary	As necessary	As necessary	As necessary
Add additional securing devices	As necessary	As necessary	As necessary	As necessary

Withstand force — Each cargo securement system must be able to withstand a minimum amount of force in each direction.

- Forward force = 80 percent of cargo weight when braking while driving straight ahead.
- Rearward force = 50 percent of cargo weight when accelerating, shifting gears while climbing a hill or braking in reverse.
- Sideways force = 50 percent of cargo weight when turning, changing lanes or braking while turning.
- Upward force = 20 percent of cargo weight when travelling over bumps in the road or cresting a hill if the load is not fully contained within the structure of the vehicle.

Regulations are in place requiring that you must secure the following vehicle structures and equipment, if applicable:

- Doors
- Tarps
- Spare tires
- Tailgates/tailboards
- Cargo securing equipment
- Other equipment used in the vehicle's operation

Cargo isn't safely secured if it gets in your way or causes a distraction. The cargo or any other object must not interfere with the driver's ability to drive the vehicle safely (such as free movement of the driver's arm and leg). Cargo must be loaded onto a vehicle so that it doesn't:

- Cause a distraction due to loose or flapping securement devices
- Block vehicle entry or exit for the driver or passengers
- Obstruct the driver's view to the front, right or left sides
- Prevent easy access to emergency equipment
- Interfere with your control of the vehicle

Personal safety

Personal safety when working with cargo and when around cargo loading facilities must be top priority.

- Wear appropriate personal safety equipment, such as hi-visibility clothing, gloves, boots, safety glasses and hard hat (if required).
- Be careful when opening cargo doors as the load may have shifted during transit and may fall on you as you open the doors.
- Always secure the doors of the trailer in the open or closed position so they don't swing or get blown by the wind damaging other vehicles or injuring you or other bystanders.
- Watch for moving equipment on the ground and overhead.
- Always walk in the designated crosswalks or pedestrian walkways.
- Using hazard lights can help make others aware of moving vehicles.
- Don't walk close to the front of vehicles — the driver may not see you.
- Ensure you can hear parking brakes being applied before walking behind a vehicle or into a pinch point.

- Never take a shortcut and go underneath trailers.
- Make eye contact with others working in the area.
- Always agree on hand signals with other operators or guides.
- Stay out of the pinch points at all times.

Cargo documentation

Shipping documents for dangerous goods must be carried in a pocket on the driver's door or within the driver's reach. When the driver leaves the cab, the shipping documents must be left on the seat, in the pocket of the driver's door or in a location that's clearly visible to anyone entering through the driver's door.

The driver is responsible for ensuring that the cargo documentation is complete and legible according to carrier policy and that the cargo load and paperwork match. More detailed information on cargo documentation is covered in the chapter *Documents and Regulatory Requirements*.

Cargo inspection

While many drivers don't load or supervise cargo loading, they're responsible for verifying that the cargo they'll be transporting is properly secured and matches the documentation. Depending on what you're carrying, you'll also have to inspect your load for adequate:

- Blocking, bracing and dunnage (i.e., loose materials used to keep cargo in position)
- Tie downs to secure the load
- Covering of the load

If you're transporting a sealed or containerized load, you won't be able to inspect it for proper packaging. You must still ensure that it doesn't exceed the vehicle's weight capacity. If your load has a container seal, make sure that it's not broken before you accept the load. The seal shows that the container has been properly closed at origin. Since it can only be removed once, it ensures that the container remains unopened during the trip. This deters theft and minimizes the risk of an unauthorized person accessing the container to transport illegal cargo such as contraband and/or drugs. If a seal is broken, the shipment could be rejected when you deliver it.

If it has a customs seal, don't tamper with it. In the event of a fire or other emergency, have a witness (preferably a law enforcement officer) sign a statement describing the conditions under which the seal was removed.

Prior to moving the vehicle, conduct a cargo pre-trip inspection. Depending on the location of and accessibility to the cargo, the check should include:

- Walking around the vehicle to check for any leaks that may indicate that the cargo is damaged
- Ensuring that you know the weight of the cargo you intend to transport, which can be done by adding all weight outlined on the shipping document
- Ensuring that weight distribution is as low as possible to help keep the rig's centre of gravity low
- Ensuring that documentation matches the freight and the count matches the shipper's count
- Ensuring that there's no loose freight and that the cargo is properly secured by load securement devices
- Ensuring that heavy loads aren't loaded high in the trailer or positioned where they could fall on other cargo when transporting
- Ensuring that all parts necessary for hauling, containing and protecting the cargo are secured including tailgates, tailboards, doors, tarps and headboards
- Ensuring that the weight of the vehicle doesn't exceed weight limits for the route



Cargo that is not properly secured may result in:

- Loss of life
- Loss of goods
- Damage to the cargo
- Possible collision with other road users
- Injury to other road users
- Delays for other road users due to roads being closed
- Damage to the vehicle you're driving and/or other vehicles you're sharing the road with
- Fines or penalties
- The vehicle being placed out-of-service

Loading cargo

The rules of loading docks can vary from location to location. Be alert and ask questions when loading at an unfamiliar dock. Take notice of the dock area and any special procedures or traffic direction indicators.

When your vehicle is properly aligned to the dock and ready to load or unload, you must be ready to design a loading pattern. Careful planning is very important to protect the security of the load and prevent weight imbalances.

Ensure you're wearing appropriate personal protective equipment whenever working with cargo.

Loading considerations

It requires skill while loading in order to maximize the payload. It's important not to be overweight, but also important to haul the maximum load that your cargo space allows. This ensures success in a highly competitive hauling business. Truckers must learn to load the maximum allowable cargo by making economical use of all available space.

- Check container markings that refer to loading, such as *this end up* and *fragile*.
- Place heavy goods on the bottom.
- Place light and fragile goods on top.
- Block and brace any items that may shift in transit.

- Don’t mix incompatible cargo.
- To help prevent load shifts, use load locks or straps whenever they’re available as they help to stabilize cargo when you don’t have a full load.







Cargo loading equipment

Using proper loading equipment makes loading easier and prevents damage to cargo through mishandling. Proper equipment can also help prevent back injuries and other incidents during loading. You'll quickly become familiar with this equipment once you begin working in the industry. In many cases, a shipping and receiving dock worker will operate the equipment, but on occasion you may need to do the actual loading.



Forklifts (specialized instruction required)



Cranes (specialized instruction required)

Dock plates and boards, loading dock levellers and hydraulic lift tailgates

These are ways you can bridge the space between the loading area and the rear of the trailer:

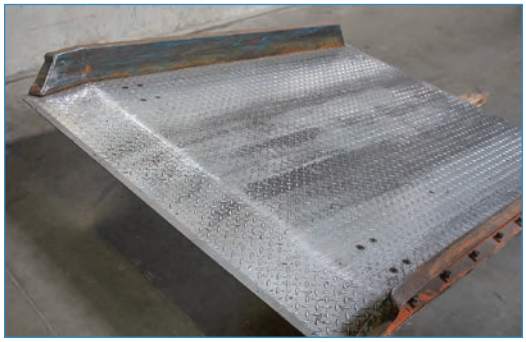
- Hydraulic lift tailgates are used on some trailers and many straight trucks to lower cargo to the ground or to lift it up from the ground.
- Walking ramps may be used in conjunction with a hand truck to load/unload smaller items from the back of a truck or trailer.





- Slanted dock plates on which forklifts are driven onto the rear of the truck are used when loading dock levellers aren't available.
- Dock boards are used between the rear of the truck and the dock for light loads usually carried on hand trucks.
- Make sure dock plates/boards are secure before travelling into the trailer. They should be level with the trailer and dock before you use them.






Hand truck

This is the most widely used type of cargo handling equipment. Hand trucks are used to load items, such as as household appliances, large cartons or several smaller cartons at one time. There are also special two-wheel trucks available to handle barrels and drums, known as drum trucks. Always use a specialized hand truck to load barrels or drums.

Take care when using hand trucks and don't overload them. Use a strap to hold the cargo if necessary.





Forklift operation

Regulations require that you receive specialized training and have demonstrated competency to operate a forklift. Make sure you're familiar with the operating instructions of any forklift that you operate.

Forklift operators should follow these general guidelines:

- Always wear your seatbelt.
- Always lift the load clear off the ground so that it can't catch or snag.
- Use good visual scanning techniques. Look in the direction of travel, check overhead and side clearances and if the load blocks your view, travel in reverse.
- Brake to a complete stop before reversing.
- Operate at a reasonable speed.
- Warn pedestrians and others with the horn.
- Drive smoothly, avoiding sharp turns or sudden jerks.
- Watch out for sideways swing during sharp turns that can occur because of the rear steering.
- Don't drive over small objects. This could bring the vehicle to a stop and cause the steering wheel to spin. Failing to avoid small objects in your path could result in serious injury.

- Carry the load properly. Keep the forks low from 10–15 cm (four to six in) off the ground and when travelling, cradle the load by tilting the mast back slightly.
- When travelling up or down a grade, the load must be facing uphill.
- If you're working with a forklift, make sure that your trailer is secure. Many loading docks have locks to achieve this purpose. If a dock doesn't have a lock, then you should chock the trailer wheels, put the tractor in gear and apply the parking brake while loading or unloading.

Drivers should learn to communicate effectively with forklift operators, follow the dock procedures and monitor their own safety and that of the forklift operator. Stay out of the pinch points and always agree on hand signals with the operator.

Inspect cargo carrying space

The first thing a driver should do is always inspect the cargo carrying space before the loading occurs.

Van trailers:

- Make sure there's no damage to the sides or roof which would allow water to leak on the cargo. Inspect the floor for holes or damage and ensure it's adequate to support the weight of the cargo.
- Check for potential cargo damaging conditions such as protruding nails, bolts, metal edges, holes or leaks. Workers loading a van trailer could be injured by some of these damaging situations.
- Sweep out the trailer if it wasn't done by the last person who used it.

Flatbed trailers:

- Make sure the deck and flooring are adequate, free from damage and strong enough for the cargo.
- Make sure any holes are patched.

Flatbed trailers with removable sides:

- Make sure all sideboards are in place and properly attached to stakes.
- Ensure stakes are properly seated to prevent cargo leakage onto the highway and to protect the cargo from getting wet.

Inspect packing

Inspect the packing before accepting a shipment. Things to watch out for include:

- Damaged cargo
- Cargo that will damage other cargo
- Wet or leaking cargo
- Improperly packed cargo

Improperly packaged or crated cargo can be damaged en route or cause damage to other cargo or the vehicle. Check containers carefully to make sure they meet the following criteria:

- Containers are adequate for the cargo (for example, items aren't too heavy).
- Containers are properly sealed so cargo can't break out in transit.
- Containers are packed tightly ensuring loose cargo doesn't cause damage en route and your load doesn't become unstable.

If the cargo is damaged in any way, follow your company's policy for actions to take. In some cases, a driver must refuse the cargo or note problems on the shipping papers to avoid liability.

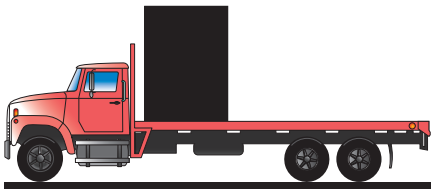
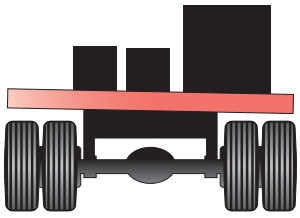
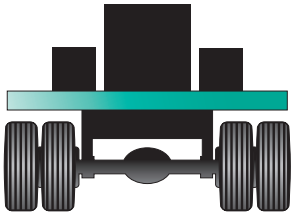
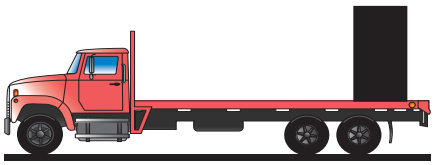
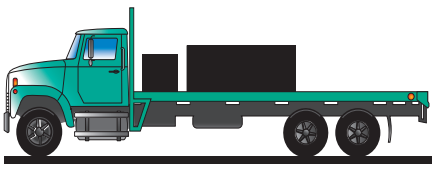
Weight distribution

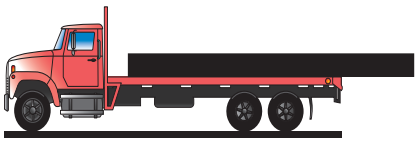
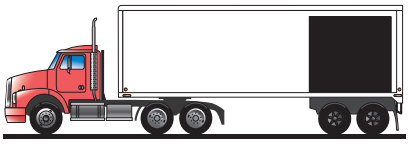
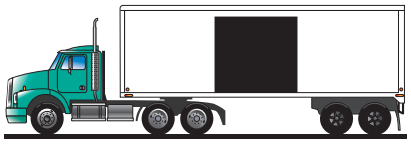
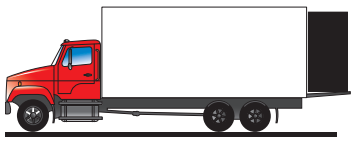
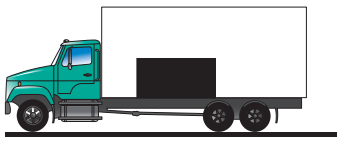
For proper handling of the truck, it's important that the cargo weight is correctly distributed. Apart from affecting vehicle handing, improper cargo weight distribution may also be illegal and cause you to get a ticket and be delayed while your truck is reloaded. When the weight of a tractor-trailer is balanced, it reduces the possibility of rollover.

It's your responsibility as a professional truck driver to ensure that each load is balanced and the weight is distributed evenly between the tractor's drive axles and the trailer's rear axles prior to transporting the cargo.

Trailer weight can be adjusted by sliding the rear axles of the trailer (if it's adjustable):

- When the axle is moved forward, more weight is shifted to the trailer axle and shifted off of the tractor.
- When the trailer axle is moved backward, more weight is shifted onto the tractor.

Wrong	Right
	
Don't place a very concentrated heavy load against the cab. This type of loading may permanently bend the frame. It'll also overload the front tires, which may make steering difficult and could cause a worn tire to blow out. This type of loading may also make your load dangerously top heavy.	Place a very concentrated heavy load near the rear, on its long side if possible. Most of the load should be partially over or just ahead of the rear axles to get proper tire loading. Make sure the load is securely blocked to prevent it from sliding forward. (More about this later in the chapter.)
	
Don't place a very heavy load on one side. This overloads the spring and the tires on the cargo side. The brakes may lock the wheels of the under-loaded side and could cause the tires to skid on wet surfaces. Loading in this unbalanced way may also cause flat spots on the tires.	Load your vehicle so that an equal amount of weight is placed on all rear tires. This will eliminate twisting and stress on the frame. It also prevents overloading the axle housing and wheel bearing.
	
Never load your vehicle this way. It may cause the frame to bend, will overload the rear tires and takes enough weight off the front tires to make steering almost impossible.	The correct place for the concentrated load is partially over or just ahead of the rear axles with the longest side on the floor. Make sure the load is securely blocked to prevent it from sliding forward. (More about this later in the chapter.)

Wrong	Right
	
On a rough road, a vehicle loaded this way may pivot on its rear wheels, taking the front wheels entirely off the road.	A tractor trailer combination is the correct vehicle to use for this type of service because a longer, heavy vehicle is needed to carry this long load. Always use the correct vehicle for the job. The risk of damage to the truck and tires, and even serious crashes, may be reduced.
	
This shows a heavy load with too much weight on the trailer's rear tires. The fifth wheel isn't supporting the load. The tractor's rear tires are likely to slip and wear away rubber. This vehicle will also be difficult to stop because the braking distribution will be uneven.	The load should be centred to properly distribute its weight over the tires. The average semi-trailer type truck has a central weight distribution point at approximately the middle of the trailer. Make sure the load is securely blocked to prevent it from sliding forward. (More about this later in the chapter.)
	
Never load items on the tailgate. It puts a severe strain on the equipment and can cause serious crashes.	This load should be placed partially over or just ahead of the rear axles with its longest side on the floor. Make sure the load is securely blocked to prevent it from sliding forward. (More about this later in the chapter.)



Don’t overload

Enforcement officers keep a close watch on highways for overloaded vehicles that violate regulations for maximum gross weight and individual axle weight. Provinces, territories and states have regulations governing the length, width and height of loads. The highway weight restrictions are designed to protect the road surface from excessive deterioration.

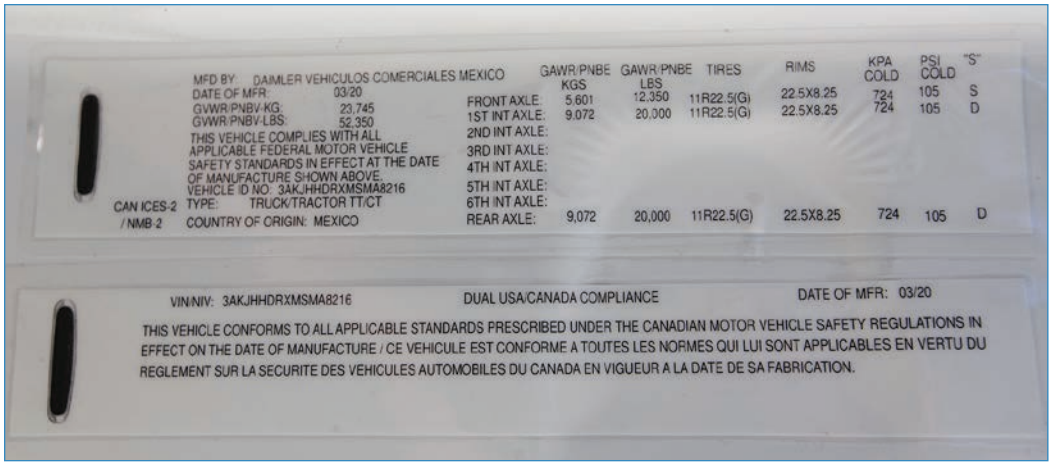
You must have a permit for any oversized or overloaded cargo and drivers caught violating load regulations are subject to heavy fines costing you both time and money. Each vehicle type has a maximum weight rating that’s designed to fit the vehicle's steering and braking systems. Overloading your rig creates unacceptable safety hazards.

Note: Overweight/oversize and other permits can be obtained online at CVSE.ca.

For more information on vehicle weights and dimensions, see chapter 11 — Documents and regulatory requirements.

Each manufacturer determines the maximum capacity limits for each vehicle by considering the combined values of the strongest weight bearing components (the axles) and the weaker components (vehicle body, frame, suspension and tires). When these factors have been rated, the manufacturer sets the vehicle's Gross Vehicle Weight Rating (GVWR) in accordance with the standards set by Transport Canada. Vehicle modifications may be illegal and may affect this rating.

The easiest way to figure out how much weight your vehicle is designed to carry is to subtract the net weight of the vehicle (found in your owner's manual, insurance papers or scale ticket) from the GVWR (found on the driver's door post). The remaining number is the maximum weight your vehicle can safely carry. This value includes the weight of passengers, fuel and cargo.



GVWR - Net weight of vehicle = Weight vehicle is designed to carry

Example:

23,600 kg - 9,500 kg = 14,100 kg

Therefore, the vehicle can carry 14,100 kg weight without being overloaded.

GAWR - Gross Axle Weight Rating = Maximum load weight that can be placed on the axle.

Note: The placement of the load on the tractor can't be concentrated in only one area. Each axle has a maximum weight rating and when crossing scales, the weight on each axle must not exceed the gross axle weight rating.

Example:

- Tractor front axle weight rating (GAWR) ... 5,450 kg
- Tractor intermediate axle weight rating (GAWR) ... 9,075 kg
- Tractor rear axle weight rating (GAWR) ... 9,075 kg
- Tractor total weight rating (GVWR) ... 23,600 kg

Aftermarket accessories or equipment will increase the net weight of the vehicle. The extra weight must be added to the net weight listed in your owner's manual. If you want to check the net weight of your vehicle, weigh your unloaded vehicle.

Overloads are both illegal and unsafe. A driver may not be responsible for the actual loading of a vehicle or trailer, but is responsible once behind the wheel. A driver must recognize and take action when an overload or poor weight distribution situation occurs.

Increasing a vehicle's GVWR is possible. However, modification to a vehicle's rating can only be done at facilities that are recognized by Transport Canada, since GVWR standards are set and enforced by Transport Canada.

The vehicle must also be licensed and insured for the proper gross vehicle weight which includes any trailers and their load when attached. If coverage isn't correct, insurance claims may be denied. You need to have the correct size tires installed as well to meet the legal axle loadings that are permitted by the jurisdiction in which you're operating. The legally allowable axle weights may be less than the GAWR of your vehicle.

Regulations aren't the only reason for monitoring your cargo. The way that cargo is secured will also affect the vehicle handling, safety and fuel efficiency of the vehicle combination. Overloading your tractor-trailer vehicle combination can cause:

- Problems with braking, handling, steering and speed control that may lead to crashes and increase your stopping distance
- A high centre of gravity — this may cause a vehicle to roll over
- Danger on curves or if you have to swerve to avoid a hazard
- Lost or damaged cargo or vehicle damage
- Danger to other drivers if they're hit by loose cargo objects
- Increased fuel consumption
- Legal and safety penalties
- Vehicles to be placed out of service if the vehicle components fail inspections due to load securement infractions
- Lost money and time if it's necessary to reload or shift the cargo to another vehicle
- Damage to road surfaces

In addition to following the regulations, consider the driving conditions when you're loading or securing cargo. You'll recall from Chapter 12 — Trip planning, that some B.C. roads may be restricted as part of the seasonal strength loss program that identifies and imposes load restrictions on roads or portions of roads that have been weakened by excess water in the road base. Remember that full loads may be too much for spring road restrictions. You also want to distribute the weight on the vehicle in a fashion that will provide for the best vehicle handling and traction. Keep in mind how your load will change if you have multiple drops.

Securement system

National Safety Code (NSC) Standard 10 — Cargo Securement and MVAR Division 35 use terms such as "immobilize", "contain" and "restrain" to define how cargo might be secured on or within a vehicle. These terms are simply describing different ways of making cargo secure.

Immobilize

This means not moving or incapable of being moved. Cargo that's immobile would be the most secure. Unfortunately, testing has shown that it's almost impossible to immobilize cargo so that absolutely no movement occurs. There will almost always be spaces between cargo, other cargo and restraining devices, so slight shifting will always occur.





Restrain

The most common way to secure cargo is to restrain it. Restraining cargo means to limit or hold back any movement in any direction, usually by the vehicle frame, body and tie-downs. Restrained cargo will still move to a certain extent, so it's not the same as immobilizing it. Even though it may be able to move, cargo will be secure when it's restrained in a way that it can't be lost from the vehicle.



Contain

Containing cargo may involve packaging, vehicle structures and body panels, other cargo and shipping containers of various types. Cargo that's contained is generally able to move freely inside a space or zone, but it can't leave that space. Contained cargo could move around inside the container. Therefore, the container itself must be able to withstand the cargo's movement, and in some cases, the cargo may need to be restrained or immobilized within the container.



Lateral forces on cargo

You must understand the lateral forces that develop while driving a vehicle, particularly when the vehicle is heavy and carrying cargo. Cargo tends to move laterally (sideways and forward or backward) from the forces of stopping, starting and manoeuvring around curves and turns. Just as important are how these forces develop and their effect on the vehicle and the cargo.

The cargo securement standard is designed to ensure that cargo remains secure despite the forces that will occur during normal driving. In fact, there's enough of a safety factor in these performance standards that most vehicles will never experience the maximum forces during driving. It's only in certain sudden emergency manoeuvres that forces will come close to reaching maximum values.

Improperly restrained cargo will slide when lateral force is high enough. Sliding cargo also causes the vehicle's centre of gravity to shift which increases the tendency to roll over. A vehicle travelling at a speed of 70 km/h (43 mph) on a ramp posted for 40 km/h (25 mph) can produce lateral force up to about 0.50 g (five times the normal weight).

The forces affecting your load during normal driving are lower than your securement method must withstand. Normal driving occasionally includes making emergency manoeuvres and your method of securing the cargo must withstand the forces that are created.

A cargo securement system combines the use of one or a combination of the following components:

1. **Vehicle structure** — including floors, walls, decks, tie-down anchor points, headboards, bulkheads, stakes, and posts. You must ensure that all these vehicle elements are in good working condition.
2. **Securing devices** — these are devices that are specifically designed and manufactured for cargo securement to a vehicle or a trailer:
    - Webbing
    - Chain
    - Wire rope
    - Manila rope
    - Synthetic rope
    - Steel strapping
    - Clamps and latches
    - Blocking
    - Front-end structure
    - Grab hooks
    - Binders
    - Shackles
    - Winches
    - Stake pockets
    - D-rings
    - Pocket
    - Webbing ratchet
    - Bracing
    - Friction mat

3. **Blocking and bracing equipment** — structure, device or article placed against or around cargo to prevent horizontal movement or tipping. To withstand splitting or crushing by the cargo, the materials used for blocking or bracing must be strong. When wood is used, it must be a hardwood that has been properly seasoned and is free from rot, knots and splits.





4. **Dunnage** — filler material used in the empty spaces between cargo. Dunnage keeps the cargo from shifting. Wood, cardboard, airbags, extra pallets, bubble wrap and plastic are types of material used as dunnage.



5. **Load locking bars** — used vertically or horizontally, these bars have rubber feet that are placed against the vehicle walls or ceiling and floor. The bars are placed snugly against the cargo and then tightened with a jacking device until they're tightly wedged in place against the cargo. Jack bars no longer have a weight rating for securing cargo and need to be supplemented with other securement devices as required to meet the regulations.





6. **Tarps** — if you carry freight in an open cargo area, you may need to use a tarp. Tarps prevent loose material like sand, peat moss, gravel, wood chips and salt from blowing or falling out of a vehicle. They can also be used to protect cargo from the weather. If you use a tarp, ensure that it fully covers your load and is secured at all securing points. While travelling, check your mirrors frequently to make sure the tarp hasn't become loose, causing a hazard for you and other road users. Loose tarps can also create a distraction for the driver.



Securement devices

According to Part 1, Division 2 of NSC Standard 10, General Performance Criteria, all vehicle structures, systems and parts used to secure cargo must:

- Be in proper working order and fit for the purpose for which they are used
- Be used on the correct type of cargo
- Not have knots, damage, cracks, cuts or weakened parts that may negatively affect on performance
- Be secured in a way that ensures they won't come unfastened while the vehicle operates on a highway
- Be able to withstand a specified amount of force in the forward (0.8 g deceleration), rearward (0.5 g deceleration), sideways (0.5 g acceleration) and downward directions.

Friction mats

Friction mats help to restrain cargo by increasing the level of friction between an article of cargo and the deck of the vehicle. A variety of friction mats are available made primarily from recycled rubber and composite material specifically designed to restrain cargo.

Friction mats are suitable for cargo that has a flat and relatively smooth bottom surface with a large enough area to rest on the mat itself. They're not useful for a heavy article that rests on legs or feet with a small contact area. For a friction mat to be effective, an article should be placed on it so that at least 50 percent of the bottom surface area rests directly on the mat. The friction mat must protrude beyond the cargo in the direction it's meant to restrain. Leaving a portion of the mat showing outside the footprint of the cargo in all directions will help you confirm it's there and correctly positioned.

Tie downs

When you carry freight on open vehicles, such as flat decks, tie downs are almost always required, but you may also need to use tie downs for certain freight in closed vehicles. You must understand their correct use and be familiar with the regulations that apply to them as the tie down method used depends on the vehicle and the cargo's shape, size, weight and stability.

You may use tie downs to produce only downward force, provide restraint in a single direction or provide restraint in several directions at the same time.

Cargo tie downs may be any of the following or they may be assemblies that include more than one of these elements:

- Chain
- Web straps or synthetic webbing
- Natural or synthetic rope
- Wire rope or cable
- Steel strapping

A tie down must be designed, constructed and maintained in a way that the driver can tighten it.

Tie downs must not be used for cargo securement if:

- The chain has cracked welds or links
- The chain has bent, twisted, stretched or collapsed links
- Chain links are weakened by gouges, nicks or pits
- The chain is incorrectly repaired

- Chain links are obviously worn or showing other evidence of loss of strength
- There are knots in any portion of chain, wire rope or webbing
- There are spread or disturbed grab hooks
- Nylon webbing has cuts, nicks or splits
- Wire cable has missing strands or wraps
- An anchor point is weakened or shows loss of strength due to cracks, breaks or distortion

Tie downs and other securement devices must be strong enough to properly secure a load. Manufacturers test these devices to determine how much force can be applied to them before they will break.

The "working load limit" (WLL) of a securement device refers to the maximum load that may be applied to that device during normal service. The "aggregate (combined) working load limit" is the sum of the working load limits of all devices that are used to secure an article on a vehicle.

To calculate aggregate (combined) working load limits:

- For tie downs that go from one anchor point to another on the vehicle, add the WLLs of each tie down to get the aggregate WLL of the load.
- For tie downs that go from one anchor point on the vehicle to an attachment point on the cargo itself, add together: 50 percent of the WLL of each end section of a tie down that's attached to the cargo.

The total working load limit of any cargo securement system must be at least half of the weight of the load being secured.

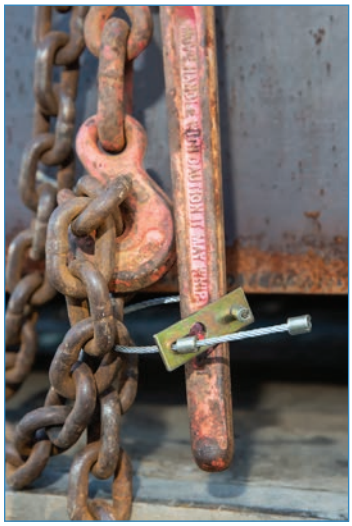
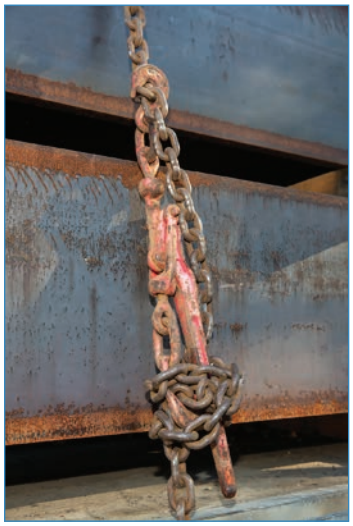
Current standards forbid the use of unmarked tie downs. Tie downs must be marked by the manufacturer with respect to their WLL. This ensures that all drivers use the proper equipment for securing a load.



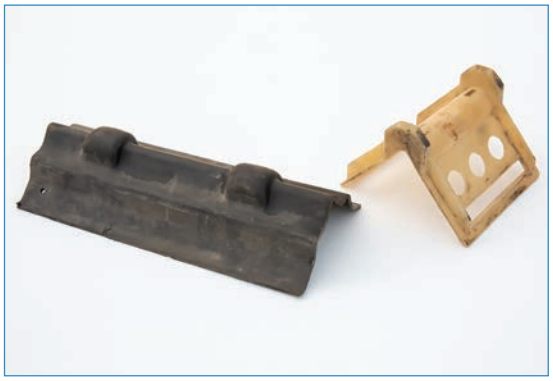


How to properly use a tie down

Ensure that each tie down is secured so that it doesn't come loose or unfastened and doesn't open or release while the vehicle is moving. This means you must be able to securely tighten a tie down before transporting cargo on a highway.


All tie downs and other parts of a cargo securement system must be located inside any rub rails whenever practical. Edge protection must also be used whenever a tie down would be subject to wear or cutting at the point where it touches an article of cargo. The edge protection must resist wear, cutting and crushing.

Some tie downs are passed over or through the cargo. When properly used, a downward force is created to increase the friction between the cargo and the vehicle's deck. The friction created restrains the cargo.

Note: Before a securement system is selected, you must ensure that it's appropriate for the cargo size, shape, strength and characteristics.

Strapping



When securing flatbed loads with strapping, make sure that the type of strapping used is strong enough to secure your load. The strapping must conform to load securement laws.

Apply sufficient tension to the strapping so that it's snug to the load. Winch, ratchet and wrench drive strap assemblies are among those used to tighten and lock web strapping securely to the load.

Nylon web strapping doesn't deteriorate due to moisture, but it can rot when exposed to long periods of sunlight, so it's always stored out of the light when it's not in use. Because it can be chafed or weakened by items with sharp edges, it's used in conjunction with edge protectors.

Winch type

- A J-hook or D-ring at the end of the strap is anchored to the vehicle after you've tossed the loose end of the strap over the load.
- Once all belts are thrown, you feed the loose end of the belt through a winch mounted on the side of the vehicle and tighten them up with a winch bar. Straps should be taut when securing cargo. Be careful not to damage your cargo by over tightening your securement devices.







Cargo, such as heavy loads of lumber, might be secured with this type of strapping. To use it, first pull the webbing to eliminate any slack. Then, use a winch bar to tighten it until proper tension is achieved. When it's time to unload, you'll need to use the winch bar again to release the tension.

Webbing is easier to use, cheaper than chains and can be used on a variety of load sizes and weights, but it's subject to chafing and isn't as durable as chain. It can't be used to secure machinery and certain other metal products because of the possibility of its being sliced by sharp edges and releasing the load.



Typical edge protectors that are used with nylon strapping include old rubber tire sections, old pieces of web strap or commercially available corners used on cargo edges. These edge protectors are also used to protect cargo from damage caused by chains.

Steel strapping is used to reinforce cartons and secure cargo to pallets, but it isn't strong enough to secure loads to a flatbed. Vibration has a tendency to tear steel strapping so when using it, ensure that it's protected from sharp edges and chafing.

It's better to use too many binders and straps than too few as your load must be secure. Be very careful when releasing straps, particularly when they're highly tensioned. Never stand on the load when releasing the straps.

There are other drawbacks to using steel strapping. Strapping must be joined properly and if it's at least 2.5 cm (1 in) wide, it must have two pairs of crimps for each join. End overlap joints must have two seals. Steel strapping will come loose easily if its crimps and seals aren't installed correctly.



Chains

Chain links are the strongest type of securement for flatbed loads. The working load limit of a chain is determined by its type, grade and size. Chains are available in a range of sizes and with different shapes of links (shorter links are stronger) and you must know how to select the proper chain for a given load.

Chains aren't suitable for some loads. For example, fragile cartons would be severely damaged by chains.



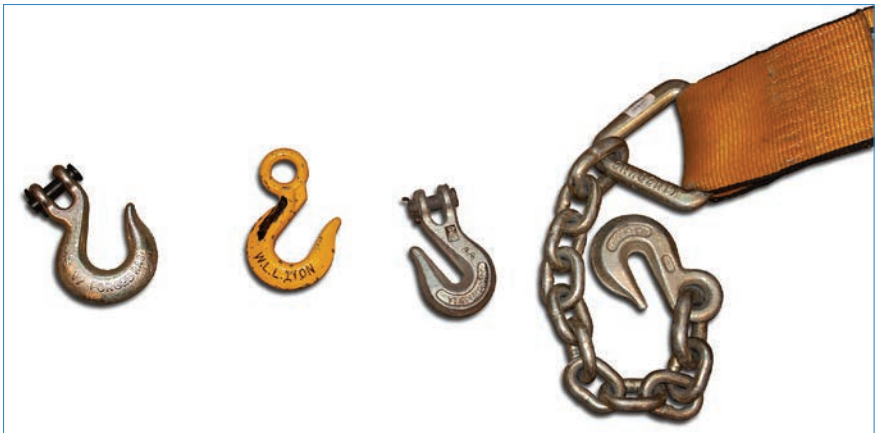
Chains have a Safe Working Load Limit (SWLL), which is established by the manufacturer and printed in the manufacturer's rating charts. Don't rely on the SWLL alone. Chains should be checked for deformation, twists, bends, cracks, wear or other flaws that could make them weaker than their rated SWLL.

For example, you wouldn't use this chain as it's broken.

Hooks

When a hook is used with a chain, it must have an SWLL which is no less than the SWLL of the chain. Check hooks for defects such as gouges, nicks, cuts or cracks.

Types of hooks include:



Clevis slip hook | Eye slip hook | Clevis grab hook | Triangular chain hook

Defective hooks or chains must not be used for tie downs. A defective hook should be tagged out of service and sent for recycling.

Always be careful when tightening or releasing load binders. Never stand on the load while releasing a load binder. Don't experiment with chain load binders until they've been demonstrated by your instructor or someone very familiar with their use.

Chain binders



Chain binders are used to tension the chain over the load and lock it in place. The chain binder handle is manipulated slowly, when it over-centers and tightens the chain, the handle is carefully secured in place to ensure the load won't be accidentally released in transit. The ratchet binder uses a ratcheting system to tension rather then a lever action. The ratchet binders are a safer tensioning tool.

The requirements for chaining down a load (for example, the number of tie downs required on a flatbed) are covered in Motor Vehicle Act Regulations Division 35 — Cargo Securement. The weakest link, whether it's the chain, hook or binder, will determine the allowable SWLL.

Chaining down an item

There are different methods you can use to chain down an item on a flatbed. Check your load to ensure that the most appropriate one has been used. If the item isn't secure, it could be lost in transit and cause an accident, a serious injury or even someone's death. Before you leave, determine how many chains you'll need and where they must be placed to ensure that the cargo can't move.

On a hard brake application or in a crash, an object that moves even slightly can pick up enough momentum to keep moving.

For example, to prevent a large item from moving to one side, you would attach the tie downs so that they pull the cargo towards the opposite side of a flatbed. To prevent an item from moving upwards, off the deck, you would attach tie downs to opposite sides of the cargo and pull down with them.











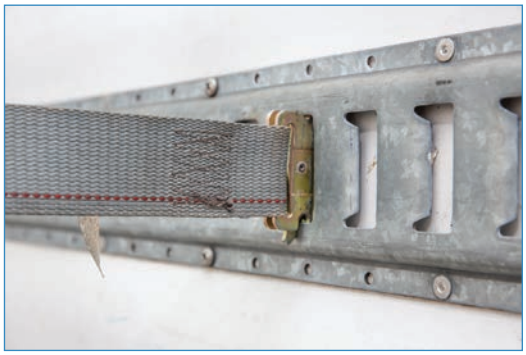
Combination winch bar

Securing freight in vans

This is accomplished in various ways.

- Most van trailers have either vertical or horizontal E-track rails built into the van trailer walls. Special attachments on each end of a locking bar can be clipped into position in the E-track rail to keep freight from moving.
- E-track straps may also be used to secure freight from moving inside van trailers.





- Dunnage can be used to block the load; sometimes dunnage is nailed to the floor.
- Special friction mats designed for awkwardly shaped cargo, such as rolls of paper, create resistance to horizontal movement and are rated for different loads.
- Rubber feet are placed against the truck walls and a jack is operated until the bar is wedged tightly in place. Jack bars no longer have a weight rating for securing cargo and need to be supplemented with other securement devices as required to meet the regulations.







Minimum number of tie downs

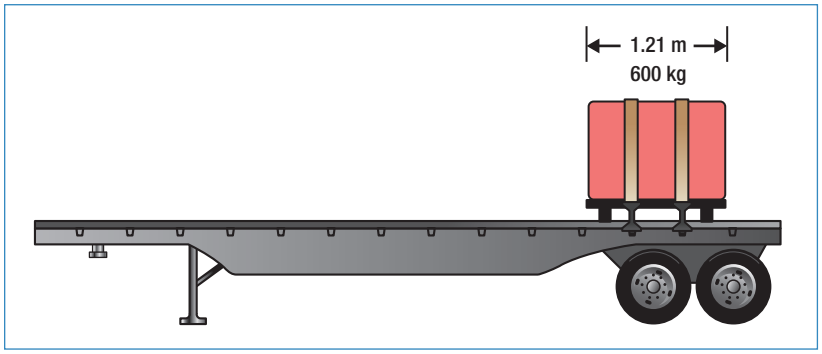
The following table shows the minimum number of tie downs required if an article of cargo on or in a vehicle isn't prevented from moving forward by a front end structure, tie down, other cargo or a device like the drop on a step deck trailer.

As a rough guide, use two tie downs for the first 3.04 m (10 ft) of a load and one tie down for every 3.04 m (10 ft) after that. Machinery or fabricated structural items that need special securement because of their size, design, shape or weight are exempted from these requirements.

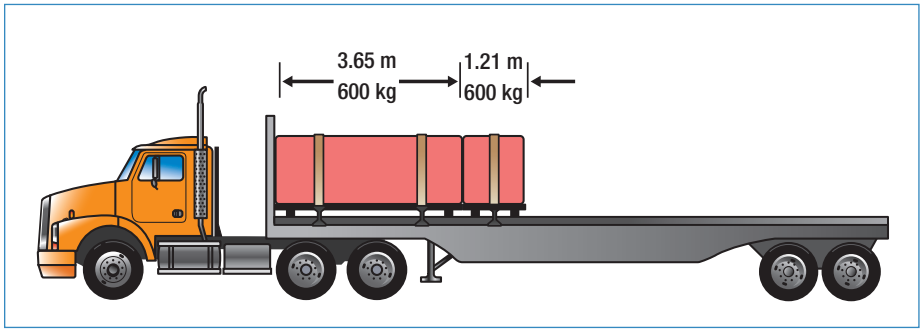
Article description	Minimum number of tie downs
1.52 m (5 ft) or shorter and 500 kg (1,100 lb) or lighter	1
1.52 m (5 ft) or shorter and over 500 kg (1,100 lb)	2
More than 1.52 m (5 ft) but 3.04 m (10 ft) or less	2
Longer than 3.04 m (10 ft)	2 + 1 tiedown for every additional 3.04 m (10 ft) or part of that thereof

When cargo is prevented from moving forward, the minimum number of tie downs required is one tie down for every 3.04 m (10 ft) of length.

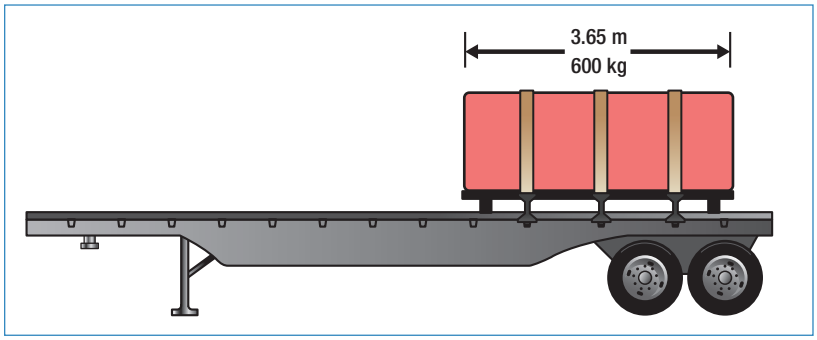
This article is 1.21 m (4 ft) long and weighs 600 kg (1,323 lb). The article isn't prevented from moving forward. Use two, equally-spaced tie downs.



Here, two articles are arranged on a flat deck. Since the first article is butted against a bulkhead or front end structure, use only two tie downs. Since the second article is butted against the first article, use only one tie down.



This article is 3.65 m (12 ft) long and weighs 600 kg (1,323 lb). Since the article isn't prevented from moving forward, use three, equally-spaced tie downs.



The total working load limit of any cargo securement system must be at least half of the weight of the load being secured.

Front-end structure on commercial vehicles

Some vehicles transport cargo that's in contact with the front-end structure of the vehicle. A "front-end" structure, according to NSC Standard 10, is a vertical barrier that's placed across the front of a deck that prevents cargo from moving forward. It's important to note that a cab shield is not a front-end structure or part of the cargo system. Front end structures must meet the following requirements:

Height and width

The height of the front end structure of a vehicle can't be shorter than:

a) The height at which it prevents cargo from moving forward

b) 1.22 m (48 in) above the deck

The width of the front-end structure of a vehicle can't be narrower than:

a) The width of the vehicle

b) The width at which it prevents cargo from moving forward

Strength

The front-end structure of a vehicle must be able to withstand a horizontal forward static load equal to 50 percent of the total weight of the cargo where:

a) The height of the front end structure is shorter than 1.83 m (6 ft)

b) The cargo is uniformly distributed over all of the front-end structure

The front-end structure of a vehicle must be able to withstand a horizontal forward static load equal to 40 percent of the total weight of the cargo where:

a) The height of the front end structure is 1.83 m (6 ft) or higher

b) The cargo is uniformly distributed over all of the front-end structure

Penetration resistance

The front-end structure of a vehicle must be able to resist penetration by an article of cargo that contacts it when the vehicle decelerates at a rate of 6.1 m (20 ft) per second per second. The front-end structure of the vehicle cannot have an opening or gap that is big enough to allow an article of cargo to pass through it.

Specific commodities securement

Depending on the industry you work in, you may haul various types of commodities that have unique load securement requirements under NSC Standard 10 — Cargo Securement and MVAR Division 35. Information found here is an overview only. You should receive training through your company on the specifics of loading and securing cargo you carry.

The following cargo require additional securement considerations:

- Logs
- Dressed lumber
- Metal coils
- Paper rolls
- Concrete pipe
- Intermodal containers
- Vehicles (small, large, crushed)
- Roll-on/roll-off or hook lift containers
- Boulders

Logs

There are many rules for the transportation of logs. A carrier must have a vehicle that was built specifically for hauling logs, but must also secure those logs according to the requirements in NSC Standard 10.



The rules for the transportation of logs apply to the transportation of almost all logs except:

- Loads of no more than four logs
- Firewood, stumps, log debris or logs that are transported in a vehicle or container that's enclosed on all sides and strong enough to contain them

In only the examples above, logs may be transported using the general cargo securement rules.

Dressed lumber

Dressed lumber is lumber that has been surfaced or planed smooth on four sides. Special rules for the securement of dressed lumber apply to:

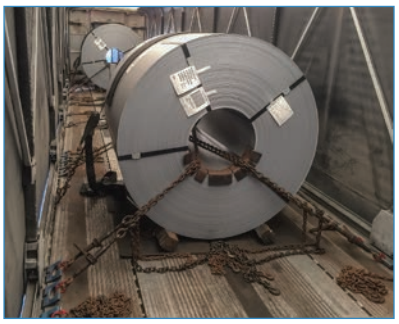
- Bundles of dressed lumber and packaged lumber
- Building products including plywood, gypsum board or other materials of similar shape



These items must be secured according to the requirements in NSC Standard 10.

Lumber or building products that aren't bundled or packaged must be treated as loose items and transported using the general cargo securement rules.

Metal coils



Special rules for the transportation of metal coils apply to a vehicle that's transporting one or more metal coils that, individually or grouped together, have a total weight of 2,268 kg (5,000 lb) or more. These coils must be secured according to the requirements in NSC Standard 10. Shipments of metal coils that weigh less than 2,268 kg (5,000 lb) may be secured using the general cargo securement rules.

Paper rolls



Special rules for the transportation of paper rolls apply to a vehicle that's transporting one or more paper rolls that, individually or grouped together, have a total weight of 2,268 kg (5,000 lb) or more. These rolls must be secured according to the requirements in the NSC Standard 10. Shipments of paper rolls that weigh less than 2,268 kg (5,000 lb) may be secured using the general cargo securement rules.

Concrete pipe



Special rules may apply to vehicles, flatbed trailers and lowboy trailers that are transporting concrete pipe. The pipe being transported must be secured according to the requirements in NSC Standard 10. Concrete pipe that's bundled tightly together into a single rigid piece with no tendency to roll and concrete pipe loaded into a sided container must be secured using the general cargo securement rules.

Intermodal container

Intermodal containers are freight containers that are designed to be transported in more than one way (for example, by road, rail or sea). These containers must either be transported on a chassis vehicle or must be secured on a different vehicle according to the requirements in NSC Standard 10. Cargo that's inside an intermodal container may be secured using the general cargo securement rules unless another commodity specific rule applies.



Vehicles

Special rules apply to the transportation of light vehicles, heavy vehicles and flattened or crushed light vehicles. These vehicles must be secured according to the requirements in NSC Standard 10. Light vehicles weigh 4,500 kg (9,921 lb) or less, while heavy vehicles weigh more than 4,500 kg (9,921 lb).



Roll-on/roll-off and hook lift containers

Special rules apply to the transportation of roll-on/roll-off containers and hook lift containers. Hook lift containers are primarily used to transport materials in the waste, recycling, construction, demolition and scrap industries. These containers are handled by specialized vehicles in which the container is loaded and unloaded onto a tilt frame body by a moveable hook arm. These containers must be secured according to the requirements in NSC Standard 10.



Large boulders

Special rules apply to the transportation of:

- Boulders on a flatbed vehicle
- Boulders in a vehicle that isn't designed to contain them
- A piece of natural, irregularly shaped rock that weighs more than 100 kg (220 lb) but less than 5,000 kg (11,023 lb)
- A piece of natural, irregularly shaped rock of any size that may be contained within a vehicle that's designed to carry it
- A piece of rock of any size that's artificially formed or cut into shape and has a stable base for securement



These boulders must be transported according to the requirements in NSC Standard 10. Some exemptions may apply to boulders that may be secured using the general securement rules.

For the complete requirements for these specific commodities, see NSC Standard 10. A carrier must secure each of these commodities according to the rules found in the standard. You should receive training by your employer on the specifics of loading and securing these items.

Cargo needing special attention

The following cargo types can shift or have a high centre of gravity. Be careful and slow down early in turns.

Dry bulk tanks and liquid tankers that transport food products, chemical products and building materials require special care, because they often have a high centre of gravity and the load can shift.





Hanging meat (suspended beef, pork and lamb) in a refrigerated truck can be a very unstable load with a high centre of gravity.

Livestock can move around in a trailer causing unsafe handling. With less than a full load, use false bulkheads to keep livestock bunched together. Even when bunched together, special care is necessary because livestock can lean on curves.

Over-length, over-width and/or overweight loads require special permits and may be limited to certain times and specific routes. Special equipment may be necessary, such as "wide load" signs, flashing lights, flags and so on. Such loads may require pilot vehicles bearing warning signs and/or flashing lights.

Dangerous goods constitute a special form of cargo. Drivers must receive dangerous goods training by the employer and qualify for a Transportation of Dangerous Goods Certificate before hauling dangerous goods. Transportation of dangerous goods training is not included in the B.C. Class 1 mandatory entry-level training course.

Dangerous goods are identified by:

- Classification
- Safety markings (placards)
- Documentation

Provincial and federal transportation of dangerous goods regulations must be strictly followed. Before drivers accept a shipment of dangerous goods, the shipper has several responsibilities when preparing the shipment. The shipper must be trained and certified to handle the goods and before offering dangerous goods for transport, the shipper must:

- Know the classification of the goods
- Label and mark packages or small containers
- Provide placards
- Complete a shipping document

Drivers must ensure that the shipper has done these things before the dangerous goods are loaded on their vehicle.

Covering cargo

There are two main reasons for covering cargo:

1. Spill protection (to protect the public).
2. Cargo protection (to protect the cargo).

Spill protection

Most laws require that sand, gravel, aggregate and small loads be covered. It's the driver's responsibility to know and comply with laws, ensure that the cover is secured properly and monitor the covering while driving. It's very important that drivers protect the public and meet all legal requirements of spill protection.

Cargo protection — tarps

Cargo can be ruined if it's not protected from the weather, so you must cover it to help prevent corrosion or other weather damage. When a tarp is required to protect cargo, it's your responsibility to ensure that it doesn't leak and is tied properly. A company will be liable for damaged cargo.

To ensure cargo isn't damaged, avoid sudden stops and starts and handle curves and on ramps carefully.

Tarps are typically used on flatbeds and open top trucks/trailers for hauling bulk commodities, such as gravel or wood chips. You must check the cargo covering for damages before using it. If a tarp is damaged, it must be patched by a professional.

To put a tarp on a flat deck load:

1. Slip the tarp on from front to back (if two tarps are used, install the rear tarp first)
2. Pull it back so the nose fits snugly, and centre it so it hangs evenly
3. Tie it securely with rubber straps or rope
4. Protect the cargo covering from any sharp edges of the cargo



Monitor the tarp for problems while driving. A flapping tarp is caused when a tarp has been improperly secured or a tarp grommet has ripped out. This will damage the tarp, expose the cargo and prevent you from seeing the rear end of the load. You must also be cautious of wind getting under the tarp and causing a ballooning effect.

Tarps used on open top trucks and trailers are typically opened and closed by mechanical means.

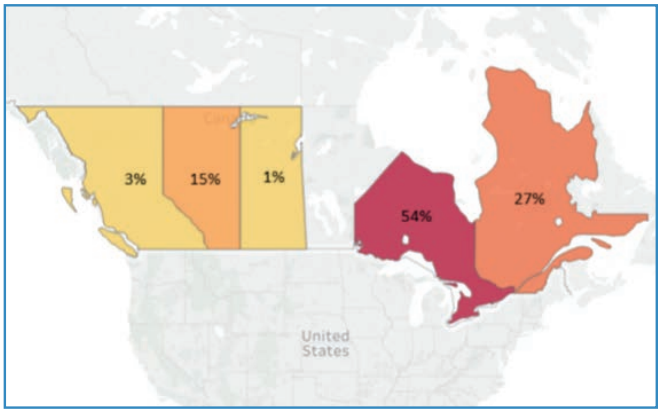


Cargo theft

Cargo security is an important part of a professional driver's job and every year, millions of dollars in cargo and equipment are stolen. According to the Insurance Bureau of Canada (IBC), there's estimated to be approximately $5 billion worth of cargo theft in Canada every year. Only a fraction of the stolen goods are ever recovered.

Where's cargo being stolen from? Cargo thieves operate across Canada, but these cargo theft rates rely on cases reported. With an increase in cases reported in recent years, numbers are becoming more aligned with the reality of cargo theft in each province.

The following map indicates the distribution of reported cargo theft in Canada. While cargo can be stolen across the nation, the highest concentration of reported cargo theft is in Ontario with 54 percent of reported thefts.



Tips to prevent cargo theft

To prevent arriving at your destination only to find that somewhere along the road you were robbed, here are six tips to deter cargo theft.

1. **Understand how cargo theft happens** — Cargo at rest is cargo at risk. Anytime you park your truck, your cargo is at risk. There are things you can do to protect cargo when you're stopped. The second factor to consider is to know what's most likely to be stolen. For example, goods such as pharmaceuticals, food and electronics have more value when resold. That means thieves are looking for these things. If someone asks you what you're hauling, it's none of their business. Instead, tell them it's something less desirable, such as bales of pulp, rolls of paper or empty bottles.
2. **Make sure your employer provides training and education** — Employers should provide you training for how to prevent cargo theft and ensure you know how to respond if you're a victim of stolen freight. There should be a security culture in your company and all employees should be aware of cargo theft and hijacking.
3. **Pay attention to your surroundings** — There are certain areas where you're more likely to be robbed than others. Some parts of the country have a higher rate of cargo theft than others, so knowing where those hot spots are is important. For example, busy roads with a lot of truck traffic are more targeted.
4. **Keep your freight moving** — Cargo will more likely be stolen when the truck is stopped rather than moving, but drivers do need to take breaks. Companies and drivers should work together to define time limits for how long a trailer can be stopped and unattended for different circumstances. Staying with your trailer when possible, even when stopped, can help prevent cargo theft. If you need to leave the truck unattended, be sure you're stopped in a well-lit area and try to back up against a wall or other obstacle that would make it difficult to open the trailer's doors.
5. **Do some research and plan** — Before you set out on your route, do some research on the areas you'll be traveling through. You can plan stops that are in safer areas and plan to drive straight through the areas with high rates of cargo theft. The more you know, the better decisions you'll be able to make.
6. **Use technology and other safety measures** — As pricing has become more reasonable, GPS tracking devices and security seals are becoming more common. These devices can be placed on the vehicle as well as the goods inside. When GPS devices are used, often you won't take a full loss and you may be able to work with law enforcement to recover some or all of the items stolen. It's also important to communicate with other drivers, company security or other personnel in the company when cargo will be left unattended for a period of time.

Cargo securement terms

Anchor point — Part of the structure, fitting or attachment on a vehicle and cargo to which a tie down is attached.

Banding — A strip of material that may be used to unitize articles and is tensioned and clamped or crimped back upon itself (Same as "strapping").

Binder — A device used to tension a chain tie down or combination of tie downs.

Blocking — A structure, device or another substantial article placed against or around an article to prevent horizontal movement of the article.

Bolster — A transverse load bearing structural component, particularly a part of a log bunk.

Bracing — A structure, device or another substantial article placed against an article to prevent it from tipping that may also prevent it from shifting.

Bulkhead — A vertical barrier across a vehicle to prevent forward movement of cargo.

Bunk — A horizontal bolster fitted with a stake at each end that supports and contains a stack of logs and is installed transversely.

Cab shield — A vertical barrier placed directly behind the cab of a tractor-trailer which is capable of protecting the driver in case cargo moves forward.

Chock — A tapered or wedge-shaped piece used to secure round articles against rolling.

Cleat — A short piece of material, usually wood, nailed to the deck to reinforce blocking.

Coil bunk — A device, used in conjunction with timbers, that keeps metal coils in place during transport.

Cradle — A device or structure that holds a circular article to prevent it from rolling.

Crown — The rounded profile of the top of a stack of logs, when viewed from the ends of the stack.

Deck — The floor of a vehicle onto which the cargo is loaded.

Dunnage — loose materials used to support, protect and keep cargo in position.

Flatbed vehicle — A vehicle with a deck but no permanent sides.

Frame vehicle — A vehicle with a skeletal structure fitted with one or more bunk units for transporting logs. A bunk unit consists of a front bunk and a rear bunk that together cradle logs. The bunks are welded, gusseted or otherwise firmly fastened to the vehicle's main beams and are an integral part of the vehicle.

Friction mat — A device placed between the deck of a vehicle and cargo or between articles of cargo, intended to provide greater friction than exists naturally between these surfaces.

Gross vehicle weight (GVW) — means the number of kilograms derived by adding the weights on all the axles of a commercial vehicle. It includes the net weight of a vehicle and the weight of its load. For commercial vehicles, the GVW for any given trip cannot exceed the licensed GVW.

Gross vehicle weight rating — means the value specified by the vehicle manufacturer as the loaded weight of a single vehicle.

Gross weight, all axles — means the sum of the individual axle weights of all the axles of a vehicle or combination of vehicles.

Gross weight, group of axles — means the sum of the gross axle weights of all the axles comprising the group of axles.

Gross weight, single axle — means the gross weight carried by a single axle and transmitted to the road by the wheels of that axle.

Headboard — A vertical barrier across the front of the deck of a vehicle to prevent forward movement of cargo.

Licensed gross vehicle weight (GVW) — means the GVW for which a vehicle is licensed. The maximum licensed GVW of a vehicle or combination of vehicles must not exceed 63,500 kg under B.C.'s Commercial Transport Regulations. The licensed GVW is not calculated for commercial trailers, as GVW of the commercial trailer is included in the licensed GVW calculation of the towing vehicle. In B.C., for commercial vehicles designed to carry a load, the licensed GVW is required to be a minimum 1.5 times the net vehicle weight.

Load capacity — The weight of cargo that a vehicle can carry when loaded to its allowable gross vehicle weight in a particular jurisdiction.

Load securement device — means a tie down, binder, lock, chain, cable, belt, rope, winch, cinch, hook or covering, or a door handle, door lock, door hinge or bunk cable guide required under Division 35 of the Motor Vehicle Act Regulations.

Net weight — means the weight of a vehicle that is empty except for the maximum capacity of fuel, oil and coolant necessary for its operation.

Pallet or Skid — A platform or tray on which cargo is placed so that it can be handled as an article.

Rail vehicle — A vehicle whose skeletal structure is fitted with stakes at the front and rear to contain logs loaded crosswise.

Rub rail — A rail along the side of a vehicle that protects the side of the vehicle from impact.

Shackle — A U-shaped metal coupling link closed by a bolt.

Shoring bar — A structural section placed transversely between the walls of a vehicle to prevent cargo from tipping or shifting.

Sided vehicle — A vehicle whose cargo compartment is enclosed on all four sides by walls of sufficient strength to contain cargo. The walls may include latched openings for loading and unloading and includes vans and dump bodies and a sided intermodal container carried by a vehicle.

Strapping — A strip of material that may be used to unitize articles and is tensioned and clamped or crimped back upon itself (same as “banding”).

Tare weight — also known as unladen weight, is the weight of a container when it's empty. Some jurisdictions and industry documents may use "tare" as the net weight of the vehicle, while referring to "net" as the weight of the load only. This guide reflects the usage of the term "net weight" of a vehicle as defined in Division 1 of the B.C. Motor Vehicle Act Regulations.

Tarp — A waterproof sheet used to cover and protect cargo and tied down with rope, webbing or elastic hooks.

Twist lock — A device designed to support and fasten one corner of an intermodal container to a container chassis vehicle.

Void filler — Material used to fill a void between articles of cargo and the structure of the vehicle that has sufficient strength to prevent movement of the articles of cargo. May be used interchangeably with the term "dunnage".

Wedge — A tapered piece of material, thick at one end and thin at the other.

Well — The depression formed between two cylindrical articles when they’re laid with their eyes horizontal and parallel against each other.

Winch — A device for tensioning a webbing or wire rope tiedown that’s fitted with means to lock the initial tension.

Working load limit (WLL) — The maximum load that may be applied to a component of a cargo securement system during normal service, usually assigned by the manufacturer of the component.