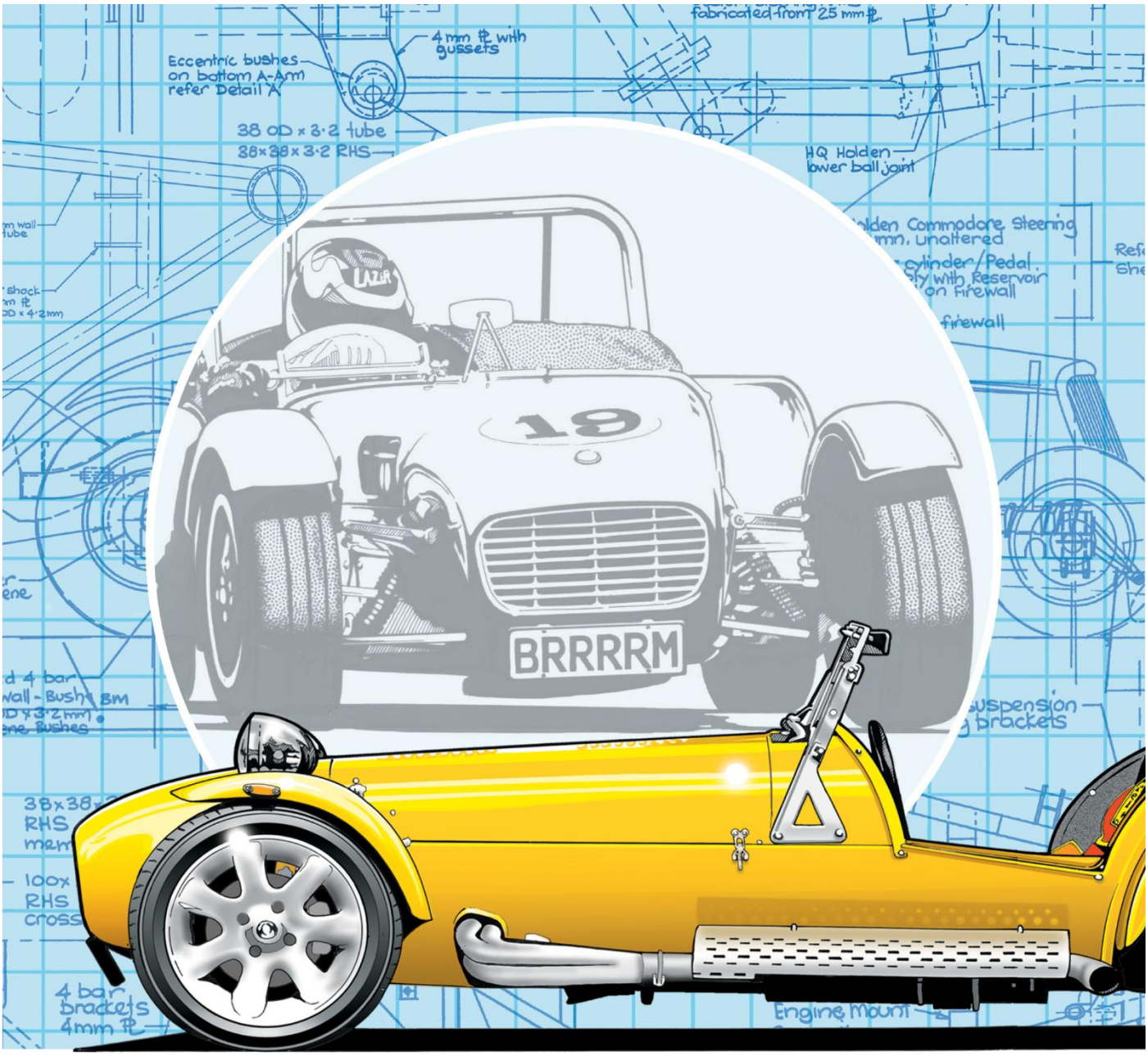
Low Volume Vehicle Technical Association (inc)

Helping New Zealanders Build & Modify Safe Vehicles

New Zealand Car Construction Manual

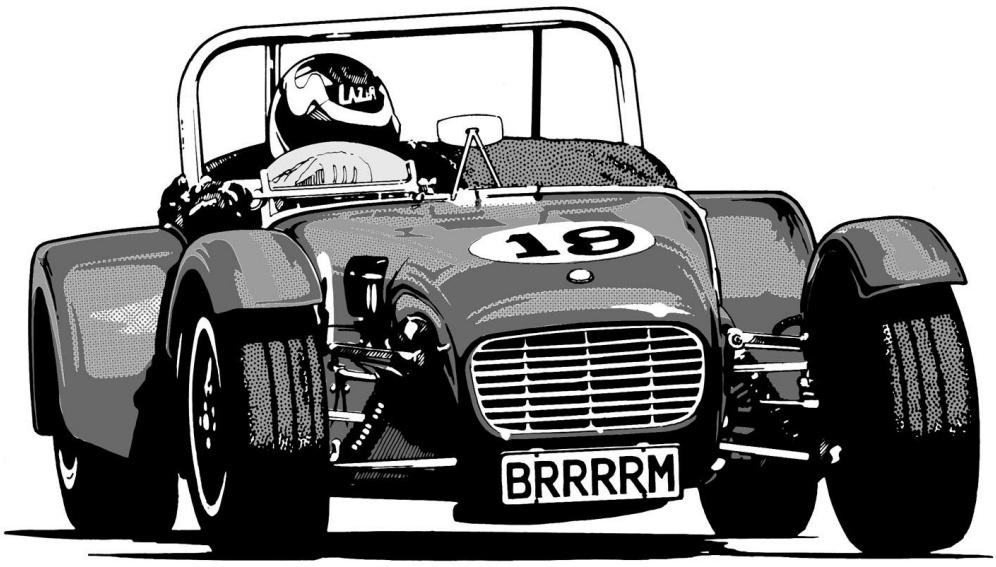
Chapter 19
Vehicle Operation

Version 3 | Effective from 1 December 2025



Low Volume Vehicle Technical Association (inc)

Chapter 19
Vehicle Operation



Tony Johnson illustration

Approval Record

Signed in accordance with clause 1.3(5) of the *Low Volume Vehicle Code* of the LVVTA	
On (date)..... on behalf of	
New Zealand Transport Agency	Low Volume Vehicle Technical Association .....

Amendment Record

Amendment details	Version #	Issue date	Effect date
• Original Issue	Version 1	January 2007	January 2007
• 1st Amendment	Version 2	November 2010	November 2010
• 2nd Amendment	Version 3	1 November 2025	1 December 2025

About Car Construction Manual Chapters

NZ Car Construction Manual Chapters (the chapters) provide the necessary detailed technical requirements, and helpful information, to enable a low volume vehicle to comply with the corresponding low volume vehicle standards (LVV standards). The chapters provide modifiers and constructors with the same information that an LVV Certifier will use when inspecting and LVV certifying a modified or scratch-built vehicle.

Author, Publisher, & Owner

This chapter is authored, published, and owned by the Low Volume Vehicle Technical Association Incorporated (LVVTA). LVVTA is an incorporated society established in 1992, that represents a group of specialist automotive organisations (in turn representing approximately 150,000 members) who are dedicated to ensuring that vehicles, when scratch-built or modified, meet the highest practicable safety standards.

The information in this chapter has stemmed from work undertaken by LVVTA founding member organisations that commenced in 1989 and has been progressively developed as an integral part of the New Zealand Government's land transport regulatory system, by agreement and in consultation with the New Zealand Transport Agency (NZTA).

As a result, the considerable experience in applied safety engineering built up by LVVTA and its specialist automotive member groups over the past several decades can be of benefit to members of the New Zealand public who also wish to build or modify motor vehicles.

LVVTA's contact details are:

- Phone: +(00) 64 4 238 4343
- E-mail: info@lvvta.org.nz
- Postal address: P. O. Box 50-600, Porirua 5240, Wellington, New Zealand
- Website: www.lvvta.org.nz

Availability & Current Version

This chapter is printed and distributed by LVVTA, and is available to the public free of charge from the LVVTA website; www.lvvta.org.nz

Note that printed copies of this chapter, like any other printed LVVTA documents, may have been superseded by an amended version and become out of date. Therefore, this and all other LVVTA documents should not be relied upon without first ensuring that the Version # (on the right-hand side of the header above) is the current version – please visit www.lvvta.org.nz/nzccm to check that this chapter is in fact the latest version.

Users' Feedback

This chapter is constantly undergoing an evolutionary development process in order to keep pace with changing trends and technology. To assist in this, LVVTA invites users of this chapter to engage in an ongoing consultation process with us by making submissions for any changes, additions, or clarifications which might improve the chapter, at any time.

Any submissions made via this rolling consultation process will be thoroughly considered, and incorporated, where appropriate, at the next available amendment opportunity.

Submissions should be made to submission@lvvta.org.nz, with the name of this chapter in the Subject line.

Supporting Information

This chapter may be supported by other documents (referred to as 'supporting information') on the same subject, which could be helpful to someone using this chapter. Supporting information, if available, can be found at www.lvvta.org.nz/nzccm and is all free of charge.

Legal Status & Copyright

This chapter supports *LVV Standard 35-00: Braking Systems* and *LVV Standard 195-00: Suspension Systems,* which are incorporated within the *Low Volume Vehicle Code* (*LVV Code*). The *LVV Code* is, in turn, incorporated by reference within *Land Transport Rule: Vehicle Standards Compliance 2002*.

Disclaimer

LVVTA has made all reasonable efforts to provide sound and correct advice, based on the historical knowledge and best practice experiences of all parties involved in the development and production of this chapter.

However, no responsibility or liability is accepted by LVVTA for any error or omission, or any loss suffered by any person relying directly or indirectly on this chapter. Any person who builds or modifies a motor vehicle accepts that there may be some associated risks, and does so in the full knowledge of this, and accepts full responsibility for their own actions.

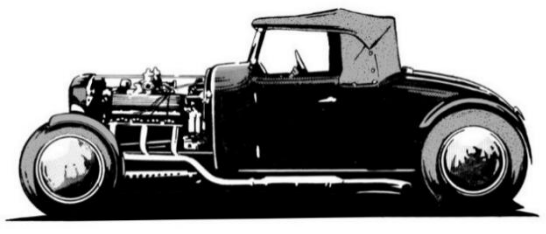
Credits

LVVTA acknowledges the following contributors for their assistance in the development of this chapter:

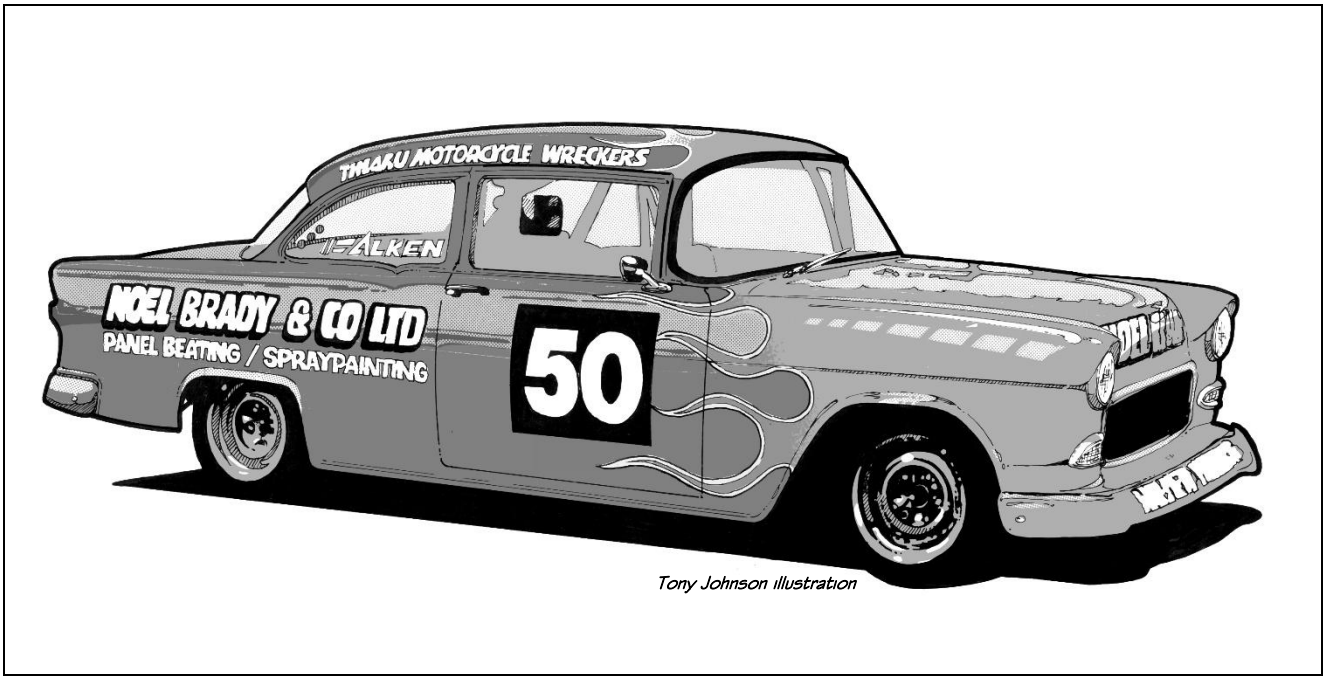
- Technical content: LVVTA Technical Advisory Committee, LVVTA technical staff
- Cover blueprint drawings: Graham Walls
- All car illustrations: Tony Johnson

Type Key (For full details of Type Key, refer to Chapter 2 – About this Manual)

Normal type:	Provisions of the NZ Car Construction Manual for all vehicles.
Italicised type:	Used when referencing external documents that are not part of this chapter.
Normal type in shaded box:	Special provisions of the NZ Car Construction Manual for vehicles built or modified before specified dates.
Script type:	Helpful hints, tips, explanations, clarifications, and interpretations.
Grey shaded text & grey vertical stroke in margin:	Latest amendments since previous version. Note that text which is high-lit in grey shows amendments that have been made since the document's previous version, and a grey vertical stroke to the left of the text denotes new or changed information which is important (rather than just a grammatical, formatting, or numbering change).



Chapter 19 Contents



Tony Johnson illustration

CHAPTER 19: VEHICLE OPERATION

Introduction

A general principle embedded within this chapter is that no-one should build a car that only the owner can drive, because it's a fact of life that others will drive it, even if only when you sell it. Therefore, the LVV Certifier must be satisfied during the road test that your car is stable, safe, and user-friendly enough that any competent driver capable of driving a 'normal' car, could get in it and drive it safely.

The LVV Certifier will ensure that the car has no bad habits, and is unlikely to inflict any nasty surprises on the driver.

Note that where components and systems within a modified production vehicle are not affected by modifications, the requirements in this chapter do not apply.

For conciseness, all references to 'vehicle' in this chapter mean a vehicle that, due to being modified or scratch-built, is legally classified as a low volume vehicle.

General Safety Requirements

19.0 Requirements applicable to all vehicles

19.0.1

A vehicle must:

(a) be designed and constructed using materials and components that are fit for their purpose; and

(b) be safe to be operated on the road.

19.0.1

These are the applicable general safety requirements from *2.3* of *Part 2* of the *LVV Code*, which makes it clear that, regardless of what technical requirements are or are not in place, every vehicle certified to the *LVV Code* must be fit for its purpose, and must be safe.

19.0.2

A steering system on a vehicle, and associated systems and components that could directly or indirectly affect the directional control of the vehicle, must provide the vehicle with safe, efficient, convenient and sensitive control.

19.0.3

A service brake must be able to be applied in a controlled and progressive manner.

19.0.4

If a vehicle is fitted with a warning system that is part of, or associated with, the use of a brake component or system, that warning system must function correctly.

19.0.5

When a vehicle's brake is applied:

(a) the vehicle or its controls must not vibrate to the extent that control of the vehicle is adversely affected; and

(b) the braking effort on each braked wheel of the vehicle must provide stable and efficient braking without adverse effect on the directional control of the vehicle.

19.0.2 – 19.0.5

These are the applicable general safety requirements from *Land Transport Rule 32003 Steering Systems 2001*, and *Land Transport Rule 32014/2002 Light Vehicle Brakes 2002* (all slightly amended for consolidation), which are required as part of this chapter, and are reproduced here in the interests of convenience.

Interior

19.1 Entry and exit

19.1.1

A vehicle must be designed and constructed in such a way that any able-bodied person within a normal range of height is able to quickly and easily enter and exit the vehicle.

19.1.2

A vehicle's door must be able to be opened mechanically from the inside of the vehicle.

19.1.1

In some cases, a vehicle may not be required to be fitted with conventional doors, if it meets an applicable exclusion in *CCM Chapter 13: Body Modification & Construction*. However, the means of entry and exit provided must not necessitate contortionist-like activity. If the design of a vehicle makes entry and exit difficult, an LVV Certifier may require, at their discretion, a demonstration that an occupant can exit the vehicle, from being seated and restrained with the door closed, to standing outside, within a maximum time of seven seconds.

19.2 Instrumentation and warning systems

19.2.1

A vehicle manufactured after 1 December 1951 must be fitted with a speedometer that:

(a) provides an accurate indication of the vehicle's speed; and

(b) for an analogue speedometer, has markings which permanently and clearly indicate the vehicle's speed to the driver; and

19.2.1(a)

See the Useful Information section for clarification on what an 'accurate indication' means.

19.2.1(b)

'Permanently' in this context does not include self-adhesive or 'Dymo'-type labels.

(c) is clearly visible to the driver whilst seated in a normal driving position.

19.2.2

A vehicle must be fitted with an operative warning light that can be easily seen by the driver, whilst seated in a normal driving position, to indicate to the driver the operation of, if fitted:

(a) the direction indicators; and

(b) any electronically controlled safety systems; and

(c) the high-beam lamps; and

(d) a manual traction-control or individual wheel brake system; and

(e) a roll-control or line-lock system.

19.2.3

A speedometer fitted to a vehicle must take its reading directly from the vehicle.

19.2.4

A vehicle must be fitted with a horn that can be heard under normal driving conditions from a distance of not less than 100 metres (328′).

19.3 Safety switching

19.3.1

A vehicle fitted with an automatic transmission must incorporate an operative inhibitor switch, so as to prevent the vehicle from being able to be started in any gear other than neutral or park.

19.3.2

A vehicle fitted with a nitrous oxide system must incorporate a fail-safe arming system to prevent unintentional activation of the system.

19.3.3

A proportioning valve which is adjustable from inside a vehicle must have the facility to be temporarily disabled or locked into a position of normal operation, to prevent unintended changes in front to rear brake balance occurring whilst the vehicle is being operated on public roads.

19.3.4

A roll-control or line-lock device fitted to a vehicle must:

(a) only be operable by a momentary switch that automatically disengages the device when the roll-control or line-lock device is released; and

19.2.1 & 19.2.2

This can be difficult to achieve sometimes, however any person within a normal height range should be able to see the speedometer and warning lights with a minimal amount of body or head movement.

19.2.2(b)

Such systems include the Anti-lock Braking System (ABS), Advanced Driver Assistance Systems (ADAS), and Supplementary Restraint Systems (SRS). The proper operation of these systems is normally confirmed by the brief illumination of the warning lamp once the engine has started, as the system performs a 'self-check'.

19.2.3

This means that a speedometer that uses a Global Positioning System (GPS) feed is not permitted.

See the Useful Information section for more information about GPS-based speedometers.

19.3.2

This means that a manual arming switch must be activated before the nitrous system's momentary switch can operate.

19.3.3

A motor-sport-type valve is acceptable provided the valve control lever or knob is removed, or protected by a hinged cover, for road use.

(b) have the facility to be temporarily enclosed or disabled to prevent use whilst the vehicle is being operated on public roads.

19.4 Ergonomics

19.4.1

All hand and foot controls within a vehicle must operate in such a way as to provide a natural and comfortable relationship with each other, and with the seating position of the driver.

A vehicle that was built before 1992 is not required to comply with 19.4.1, provided that the vehicle can be safely operated.

19.4.2

Safety-related controls within a vehicle must be able to be reached, and operated or adjusted, by a driver within an average range of height, whilst in the normal seated position, including the:

(a) driver's seatbelt; and

(b) rear-view mirror; and

(c) parking brake; and

(d) horn; and

(e) light controls; and

(f) windscreen wiping and washing controls; and

(g) indicators.

19.4.3

A seat in a vehicle that does not have adjustment in the fore and aft plane, must be positioned in such a way that:

(a) any driver within an average range of height can comfortably and safely operate the vehicle; and

(b) sufficient space is provided between any occupant and:

(i) the dashboard or other fixed interior fittings; and

(ii) where fitted, any Supplementary Restraint System (SRS) airbag.

19.4.4

A steering wheel in a vehicle must be positioned centrally in relation to the seat, and so as to provide a comfortable driving position.

A vehicle that was built before 1992 is not required to comply with 19.4.4, provided that the vehicle can be safely operated.

19.3.4

These are devices primarily designed for drag racing applications, to facilitate front brake-only application, to enable static burn-outs.

19.4.1

Advances in ergonomic design have meant that late-model production vehicles have similar critical dimensions between key components including the driver's seat, pedals, steering wheel, and gear lever, so no matter where in the world a vehicle is manufactured, these critical dimensions will be almost the same. Transposing these dimensions will enable a vehicle builder to achieve a safe and comfortable driving position.

19.4.4

The position of the steering wheel and driver's seat should not cause the driver to be positioned hard against the side of the vehicle.

19.5 Pedals and individual wheel brakes

19.5.1

Foot pedals in a vehicle must:

(a) be positioned where they could be reasonably expected; and

(b) have sufficient clear space around each pedal to enable all pedals to be safely accessed and operated; and

(c) provide smooth, progressive application; and

(d) with the driver seated in a normal driving position:

(i) be within easy reach; and

(ii) be able to be comfortably operated; and

(iii) operate freely and smoothly.

19.5.1(b)

A requirement of *CCM Chapter 8: Braking Systems* is that a vehicle must not have any obstruction between the brake pedal and the accelerator pedal, and a steering column is considered an obstruction. See *CCM Chapter 8: Braking Systems* for more information.

19.5.1(d)

The ideally positioned brake pedal can be operated with the ball of the foot with the heel positioned on the floor.

19.5.2

An accelerator pedal in a vehicle must be provided with sufficient return spring tension to ensure that the throttle closes quickly and firmly upon accelerator pedal release.

19.5.3

A manually controlled individual wheel brake system, if fitted to a vehicle, must incorporate operating levers that:

(a) are mounted in such a way that they do not obstruct normal operation of the vehicle; and

(b) return to a neutral position when released; and

(c) have the facility to be temporarily enclosed or disabled to prevent use whilst the vehicle is being operated on public roads.

19.5.3

A manually controlled individual wheel brake system is typically used in four-wheel drive competition events (sometimes referred to as 'fiddle brakes') and is designed to enable extremely tight maneuvering.

Road Testing Requirements

19.6 Scope and assessment

19.6.1

Section 5 of *LVV ORS Chapter 8: LVV Certification Inspection Process* must be referred to in order to establish:

(a) which vehicles do not require road-testing; and

(b) which vehicles require a 'normal function' road-test instead of meeting the requirements specified in this chapter; and

19.6

This CCM chapter relates to 'vehicle performance requirements', whereas *LVV ORS Chapter 8: LVV Certification Inspection Process* relates to an LVV Certifier's 'inspection requirements'.

See also Exclusions section.

(c) which vehicles must meet the applicable road-testing requirements specified in this chapter; and

(d) how an LVV Certifier must conduct road-testing competently and responsibly.

19.7 Chassis and drivetrain

19.7.1

The chassis or body structure in a vehicle must transmit to the driver a feeling of stiffness and rigidity during all types of vehicle operation, and over all types of road surfaces.

19.7.2

A vehicle must incorporate some form of differential action between the left and right wheels whilst cornering, except in the case of a vehicle that has been issued with a valid LVV Authority Card.

19.7.2

This means that unless the vehicle has a valid *LVV Authority Card*, it must not incorporate a spool, mini-spool, or permanently locked differential gears.

19.7.3

The tyres fitted to a vehicle must not exhibit any significant signs of scuffing, feathering, uneven wear, or abnormal wear.

19.8 Suspension

19.8.1

A vehicle must be fitted with shock absorbers that are effective and in good condition.

19.8.1

One shock absorber cycle after rebound is considered to be acceptable.

19.8.2

A vehicle must maintain satisfactory stability during cornering, slalom-type turning, and during a combination of braking and turning, including over uneven road surfaces.

19.8.3

The suspension system in a vehicle must:

(a) exhibit no scraping, binding, or contact between the wheel and tyre assembly, and any part of the vehicle structure or body panels during normal vehicle operation; and

(b) provide the vehicle with a well-controlled ride on uneven surfaces.

19.8.4

A vehicle's suspension system must incorporate suitable travel, so as to provide sufficient clearance between all components, and enable safe operation of the vehicle.

19.8.5

A modified production vehicle with lowered suspension may be inspected and tested at the discretion of the LVV Certifier in a condition of simulated occupant weight and load, on the basis of 80 kg (176 lb) placed and secured in each seating position.

19.9 Air and hydraulic suspension

19.9.1

19.9.1

See CCM Chapter 6: Suspension Systems for more information on correct airbag or hydraulic suspension system operation.

An airbag or hydraulic suspension system in a vehicle must be designed and installed in such a way that, in the case of a system that can be adjusted whilst the vehicle is in motion:

(a) the vehicle automatically reverts back to its approved and specified ride-height when the speed of the vehicle exceeds 20 km/h (12 mph); and

(b) the ride height of any part of the vehicle is electronically prevented from being adjusted or changed when the vehicle is being driven over a speed of 20 km/h (12 mph).

19.10 Steering

19.10.1

The steering system in a modified production vehicle must perform in a manner which preserves not less than the quality of steering control that could be reasonably expected when the vehicle was manufactured.

19.10.2

The steering system in a scratch-built vehicle must perform in a manner that gives a quality of steering control not less than that which could be expected from a production vehicle using components and systems having similar technology, taking into account the vehicle's age, style, and intended purpose.

19.10.3

It is recognised that some manual-steer vehicles will have heavy steering at parking speeds.

19.10.3

The steering system in a vehicle must enable the driver to steer the vehicle at all normal vehicle operating speeds without applying excessive steering effort to the steering wheel.

19.10.4

'Normal road speeds' are up to and including 100 km/h.

19.10.4

While being driven at normal road speeds, over a range of smooth, rough, undulating, and uneven road surfaces, the steering system in a vehicle must provide to the driver good steering control, including:

19.10.4(b)

The vehicle should continue to steer straight ahead if the grip on the steering wheel is relaxed, without any tendency to 'pull' in either direction, other than allowing for road camber.

(a) progressive and positive feel; and

(b) sufficient directional stability throughout all normal speeds, and over varying road surfaces, so as to enable relaxed driving; and

(c) immediate and positive self-centering after steering inputs, during both accelerating and neutral throttle conditions; and

(d) immediate and easy controllability when encountering direction change as a result of road camber changes or surface irregularities.

19.10.5

While being driven at normal road speeds, over a range of smooth, rough, undulating, and uneven road surfaces, the steering system in a vehicle must not exhibit:

(a) any tendency to change direction upon suspension compression or extension; or

19.10.5(a)

This is the end result of 'bump-steer', and the LVV Certifier will be looking very hard for any signs of this dangerous characteristic.

(b) any tendency to change direction during light, medium, or hard braking; or

(c) any apparent excessive under-steer or over-steer tendencies during constant radius cornering, including when encountering mid-corner bump disturbances; or

(d) kick-back through the steering wheel during turn-in and turn-out; or

(e) any tendency to climb the road camber toward the opposing lane; or

19.10.5(e)

Some mild tendency toward following the direction of the road camber is acceptable.

(f) any excessive pitch movement; or

(g) any unpredictable steering tendencies or characteristics.

19.10.6

The steering system in a vehicle must incorporate a lock that enables the vehicle to achieve a turning circle of not more than a 25 metre (82') diameter.

Brake Performance Requirements

19.11 Scope and assessment

19.11.1

19.11.1

This CCM chapter relates to 'vehicle performance requirements', whereas *LVV ORS Chapter 8: LVV Certification Inspection Process* relates to an LVV Certifier's 'inspection requirements'.

See also Exclusions section.

Section 5 of *LVV ORS Chapter 8: LVV Certification Inspection Process* must be referred to in order to establish how an LVV Certifier conducts any applicable brake performance testing (which forms part of the road-testing requirements) competently and responsibly.

19.12 General service brake requirements

19.12.1

A vehicle must be fitted with a service brake system that:

For clarification, where a vehicle is required to undergo a road test, it is also required to undergo a brake test. However, a vehicle which does not require a road test will not require a brake test.

(a) operates on all road wheels; and

(b) maintains constant hydraulic line pressure while braking force is applied to the pedal; and

(c) enables:

(i) some braking effect to occur with a pedal force of no more than 6.6 kg (14.5 lb); and

(ii) maximum braking effect to be achieved with a pedal force of no more than 68 kg (150 lb).

19.13 Requirements applicable to all service brake testing

19.13.1

A vehicle which is required to undergo any brake performance test specified in this section must:

(a) be in good running order, so as to properly exhibit the vehicle's true performance potential; and

(b) be tested on a hard level road surface that is free of loose material, and incorporates minimal camber; and

(c) be tested without the deliberate aid of engine compression, or, where deactivation is possible, regenerative braking; and

(d) in the case of a 3-cycle or 5-cycle fade resistance test:

(i) be tested using sufficient acceleration between each stop, which is appropriate to the performance potential of the vehicle; and

(ii) be proven, as a result of the test process, to be capable of achieving an average deceleration of not less than 0.65g for each stop.

19.13.2

A vehicle which is required to undergo any brake performance test specified in this section must exhibit, throughout the duration of the test:

(a) stability during the braking with no tendency to weave or swerve from the chosen line; and

(b) during smooth progressive pressure on the brake pedal, correspondingly smooth increase in braking force at the wheels; and

(c) no excessive vibration felt through the brake pedal, steering wheel, or vehicle body; and

(d) no significant loss of adhesion, and no premature lock-up at either end of the vehicle; and

19.12.1(b)

Pedal pulsation from normal operation of the anti-lock braking system is acceptable.

19.12.1(c)(ii)

68 kg (150 lb) is approximately the amount of pedal pressure that a lightly built person could apply in an emergency.

19.13

These are the requirements for how brake performance testing must be carried out, and the braking performance characteristics a vehicle must meet.

19.13.1(a)

This is to prevent a vehicle being detuned or otherwise purposely handicapped in an effort to meet the brake testing requirements.

19.13.1(d)(i)

The requirement for a sufficient level of acceleration between brake stops is in recognition that a vehicle with greater acceleration potential will reach 100 km/h in a shorter time, leaving less time for the brakes to cool between each cycle and increasing the risk of brake fade due to heat build-up that accrues as a result of the reduced cool-down time.

19.13.1(d)(ii)

An average deceleration of 0.65g from 100 km/h to zero equates to a stopping time of 4.4 seconds, or a distance of 61 metres.

(e) correct function of the anti-lock braking system, where fitted; and

(f) no imbalance between the braking performance on the two sides of the vehicle; and

(g) no tendency to grab at any time throughout the test process.

19.14 Service brake testing for all vehicles

19.14.1

A vehicle must, in every case, prior to undergoing a single stop or cyclic fade-resistance brake performance test, be tested from 30 km/h (18 mph) to standstill to ensure that the braking system is functioning normally.

19.15 When cyclic brake performance testing is not required

19.15.1

A vehicle that is not required by 19.16 to undergo a cyclic fade-resistance brake performance test must undergo a single stop brake performance test from 80 km/h (50 mph) to standstill, in accordance with the requirements in 19.13, achieving an average deceleration of not less than 0.65g.

19.16 When cyclic brake performance testing is required

19.16.1

A modified production vehicle must undergo a 3-cycle fade-resistance brake performance test in accordance with the requirements specified in 19.13, if the vehicle either:

(a) has an increase in engine performance from the original vehicle manufacturer's specifications of between 50% and 100%; or

(b) has a custom braking system; or

(c) has an increase in tyre diameter from the original vehicle manufacturer's specifications of 10% or greater; or

(d) exhibits, during the single stop brake performance test, any braking performance issues which are of concern to the LVV Certifier; or

(e) has braking componentry which the LVV Certifier considers may not be of sufficient durability relative to the performance potential or mass of the vehicle.

19.16.2

A vehicle must undergo a 5-cycle fade-resistance brake performance test in accordance with the requirements specified in 19.13, if the either:

(a) is a scratch-built vehicle; or

19.14 – 19.16

These sections outline which vehicles are required to undergo a brake performance test, and which test is necessary. See also Diagram 19.1 Brake Testing Requirement Flowchart in the Useful Information section.

19.14.1

The 30 km/h stop is to identify any major braking function problems, such as premature lock-up or pulling in one direction, at a low speed, helping the 80 km/h or cyclic test to be conducted safely.

19.15.1

An average deceleration of 0.65g from 80 km/h to zero equates to a stopping time of 3.5 seconds, or a distance of 38.5 metres.

19.16.1(a)

This can be due either to modifications to the vehicle's OE engine, or an engine change.

19.16.1(b)

A braking system where the majority of components are from unrelated sources would be considered 'custom' – for example, a '55 Chevy with a CPP master cylinder, Ford rear drums and Wilwood front discs & calipers would have a 'custom' braking system.

19.16.1(e)

A 'durable' braking system is where the power, setup, and efficiency of the braking system is suitably matched to the characteristics of the vehicle.

(b) is a modified production vehicle which has attained an increase in engine performance from the original vehicle manufacturer's specifications of more than 100%; or

(c) exhibits, during the 3-cycle brake performance test, any:

(i) significant increase in brake fade between cycles; or

(ii) braking performance issues which are of concern to the LVV Certifier.

19.16.2(b)

This can be due either to modifications to the vehicle's OE engine, or an engine change.

19.16.2(c)

For clarification, this means that a 3-cycle fade resistance test can be extended into a 5-cycle fade resistance test if the LVV Certifier has any concerns with any aspect of the vehicle's braking performance during the 3-cycle test.

19.17 Cyclic brake performance testing requirements

19.17.1

A vehicle which is required by 19.16 to undergo a cyclic fade-resistance brake performance test must:

(a) while undergoing the test, meet the requirements of 19.13; and

(b) either:

(i) where a 5-cycle test is required, complete 5 consecutive cycles from 100 km/h (62 mph) to standstill, within a total time of 3 minutes from the start of the first cycle to the completion of the fifth cycle; or

(ii) where a 3-cycle test is required, complete 3 consecutive cycles from 100 km/h (60 mph) to standstill, within a total time of 2 minutes from the start of the first cycle to the completion of the third cycle.

19.18.1(b)

The test in (b) will not be appropriate for some vehicles (such as those fitted with a cardan-shaft parking brake), so the type of test should be selected based on the vehicle's type and equipment fitted.

19.18 Parking brake test requirements

19.18.1

The parking brake system fitted to a vehicle must be capable of either, as appropriate:

(a) holding the vehicle in a stationary position without any assistance from the service braking system or transmission on a gradient of one in five; or

(b) bringing the vehicle from a speed of 30 km/h (18 mph) to a stationary position within a distance of 18 metres (59').

Exclusions

Exclusions:

This chapter provides exclusions from certain specified requirements for vehicles incorporating particular mechanical modifications and construction features.

It is important to note that there are also some vehicles which do not have to meet any of the vehicle operation requirements within this chapter, and these are specified in *LVV ORS Chapter 8: LVV Certification Inspection Process*.

19.19 Exclusion from this chapter

19.19.1

A vehicle specified in *5.2* or *5.3* of *LVV ORS Chapter 8: LVV Certification Inspection Process* is not required to be LVV certified to this chapter.

19.20 Non-performance vehicle brake testing exclusion

19.20.1

Where the only modification made to a vehicle relating to its performance and operation is the fitment of wheels and tyres that fall within the limits of the *LVV Certification Threshold Schedule*, the vehicle:

(a) is not required to meet the brake testing requirements specified in this chapter; and

(b) must meet the road-testing requirements specified in this chapter.

19.20.1

This exclusion is intended to apply to a vehicle such as a van with seats added, but which can also include aftermarket wheels fitted that are under the LVV certification threshold. Without the seats added, this vehicle would not need LVV certification for the changed wheels, and would just be subject to a WoF/CoF inspection.

This is a relaxation from the requirement for brake-testing where there is low risk to vehicle safety, and to bring the inspection more into line with in-service inspection criteria.

An LVV Certifier may still elect to perform a one-off or 3-cycle brake test where there is reason to believe that risk may be introduced by not conducting the test that would normally be applicable.

Note that while this excludes a vehicle from brake performance testing, road testing requirements still apply.

19.21 Rod or cable braking system exclusion

19.21.1

A vehicle that is fitted with a rod or cable braking system is not required to comply with 19.14 to 19.17 provided that:

(a) the vehicle meets the applicable requirements for rod or cable braking systems specified in *CCM* or *MCM Chapter 8: Braking Systems*; and

(b) the vehicle can be safely stopped in a controlled manner within a distance of 7 m (23′) from a speed of 30 km/h (18 mph).

19.21.2

A vehicle that is fitted with a rod or cable braking system which has undergone modifications to improve its braking performance is not required to comply with 19.14 to 19.17, provided the vehicle meets or exceeds the requirements specified in 19.21.1.

19.22 Vintage or veteran vehicle braking system exclusion

19.22.1

A vehicle that is fitted with brakes that operate on two wheels is not required to comply with 19.14 to 19.17, provided that:

(a) the vehicle meets the applicable requirements for two-wheeled braking systems specified in *CCM Chapter 8: Braking Systems*; and

(b) the vehicle can be safely stopped in a controlled manner within:

  (i) for a vehicle manufactured after 31 December 1918, a distance of 9 m (29′) from a speed of 30 km/h (18 mph); or

  (ii) for a vehicle manufactured before 31 December 1918, a distance of 20 m (65′) from a speed of 30 km/h (18 mph).

19.22.2

A vehicle that is fitted with brakes that operate on two wheels which has undergone modifications to improve its braking performance is not required to comply with 19.14 to 19.17, provided that the vehicle meets or exceeds the requirements specified in 19.22.1.

19.23 Heavy vehicle exclusion

19.23.1

A heavy vehicle is not required to meet the requirements specified in 19.14 to 19.17, and must instead, unless another exclusion applies, undergo a single stop brake performance test which:

(a) is carried out:

(i) with the vehicle in both an unladen and heavily laden condition; and

(ii) from a speed of not less than 50 km/h (31 mph);

and

(b) meets the requirements specified in 19.13.1 and 19.13.2; and

(c) achieves a peak deceleration of not less than 0.45g without any wheel locking throughout the test.

19.23.1

These are the requirements for stopping tests from *2.3(3)* of the *Land Transport Rule 32015/2006 Heavy-vehicle Brakes 2006.* Heavy vehicles are vehicles of class NB, NC, MD3, MD4, ME.

19.23.1(c)

An average deceleration of 0.45g from 50 km/h to zero equates to a stopping time of 3.1 seconds, or a distance of 22 metres.

19.24 Disability vehicle exclusion

19.24.1

A braking system fitted to a vehicle with additional servo assistance to enable a person with disabilities to operate the brakes with decreased brake pedal pressure is not required to comply with 19.12.1(c), provided that a label is permanently attached to the vehicle which:

(a) warns vehicle users of the braking system's increased sensitivity; and

(b) is clearly visible to the driver when seated in a normal position.

19.25 Wet road exclusion

19.25.1

A vehicle which is required to achieve 0.65g as part of a brake performance test, may, where the testing process could be made unsafe by a wet or slippery road surface, be tested, at the discretion of the LVV Certifier, to 0.55g.

19.25.1

An average deceleration of 0.55g from 100 km/h to zero equates to a stopping time of 5.1 seconds, or a distance of 71 metres.

Useful Information

The road-test process is a subjective one, which relies heavily on the feel and skill of the LVV Certifier. Fortunately, most top-level scratch-built authorised LVV Certifiers have got a high level of feel and skill. This is because they've spent most of their lives building and modifying cars of their own, friends, and club-mates, and many of them have had some background in motor racing. An experienced LVV Certifier has driven more modified and scratch-built vehicles than most people have ever seen, so their seat-of-the-pants style of analysis is worth its weight in chrome.

Speedometers

An 'accurate indication of the vehicle's speed', as specified in 19.2.1(a), means that a speedometer must never indicate a speed lower than the actual speed, nor indicate a speed more than 10% greater than actual speed. For example, at a true 100 km/h (62 mph) the speedometer must indicate between 100 and 110 km/h (62 and 68 mph). This requirement is necessary in order to enable accurate service brake performance-testing.

It is standard practice for vehicle manufacturers to calibrate speedometers to 'over-read', in order to provide a margin of error, however speedometers (as originally fitted) will generally never 'under-read'.

A speedometer must take its reading directly from the vehicle, which is usually via a cable or an electronic speed sensor driven by the output shaft of the gearbox, or mounted to the wheel hub. A speedometer that operates from a GPS signal is not permitted, as this does not provide a continuous indication of speed when the GPS signal is lost, such as when driving in a tunnel or between tall buildings.

Bedding-in new brake pads

When new brake pads are fitted, which will be the case for nearly all new scratch-built vehicles, a bedding-in process will need to be applied in order to achieve optimum performance throughout the life of the pads.

Brake disc rotors should be surfaced correctly and be within the manufacturers specified wear limits, and for best results, brake pad manufacturers bedding-in instructions should be followed wherever possible.

Maximising braking efficiency

To maximise the likelihood of having your vehicle drive well, and therefore perform well during the road test for the LVV Certifier, consider doing the following:

- fitting top-quality high-performance brake pads (this can help massively with the brake-fade testing); and
- have a full wheel alignment carried out; and
- check that the tyres are correctly inflated; and

If there are no specific bedding-in instructions available from the brake pad supplier, a basic bedding-in process, as follows, will generally do:

- test brakes gently from 20 km/h (12 mph) and 30 km/h (18 mph) for function, and proceed if the brakes apply evenly, and feel good;
- in quick succession, make a minimum of 4 medium to hard applications of the brakes from between 50 km/h (31 mph) to 60 km/h (37 mph), each time almost to a stop, followed by two hard applications from 100 km/h (62 mph), avoiding lock-up (a bit of brake smoke and stink toward the end of this process is quite normal);
- continue to drive the vehicle at normal speeds making minimal use of the brakes for 4 to 5 minutes.

Converting speed and time/distance to deceleration force

The following conversion table shows the distance and time figures required to achieve different deceleration forces (measured in g), which an LVV Certifier will use as part of their brake tests. For example, a stop from 100 km/h to 0 km/h that takes 4.4 seconds, or 61 metres (200'), would achieve a deceleration force of 0.65g. This is the amount of deceleration a vehicle's braking system should achieve on a dry road, free of loose material, as part of the brake testing requirements specified in section 19.13.

Speed	Time in seconds (distance in metres)			
	0.65g	0.6g	0.55g	0.45g
100 km/h	4.4s (61 m)	4.7s (65 m)	5.1s (71 m)	6.3s (88 m)
90 km/h	3.9s (49 m)	4.2s (53 m)	4.6s (58 m)	5.6s (70 m)
80 km/h	3.5s (38.5 m)	3.8s (42 m)	4.1s (46 m)	5.0s (56 m)
70 km/h	3.0s (29.5 m)	3.3s (32 m)	3.6s (35 m)	4.4s (43 m)
60 km/h	2.6s (22.5 m)	2.8s (24 m)	3.1s (26 m)	3.8s (32 m)
50 km/h	2.2s (15 m)	2.4s (16 m)	2.6s (18 m)	3.15s (22 m)

Table 19.1 Speed and Time/Distance Deceleration Force Conversion Table

Brake testing requirement flowchart

Decreasing speed limits within metropolitan areas have meant that LVV Certifiers are travelling further and further to find a suitable place in which they can carry out brake testing on a vehicle, which places an increasing time and cost burden on both the LVV Certifier and the vehicle owner.

Requirements for cyclic brake testing have been re-thought as a result of this, and below is a simplified chart outlining the levels of brake performance testing required for certain modifications.

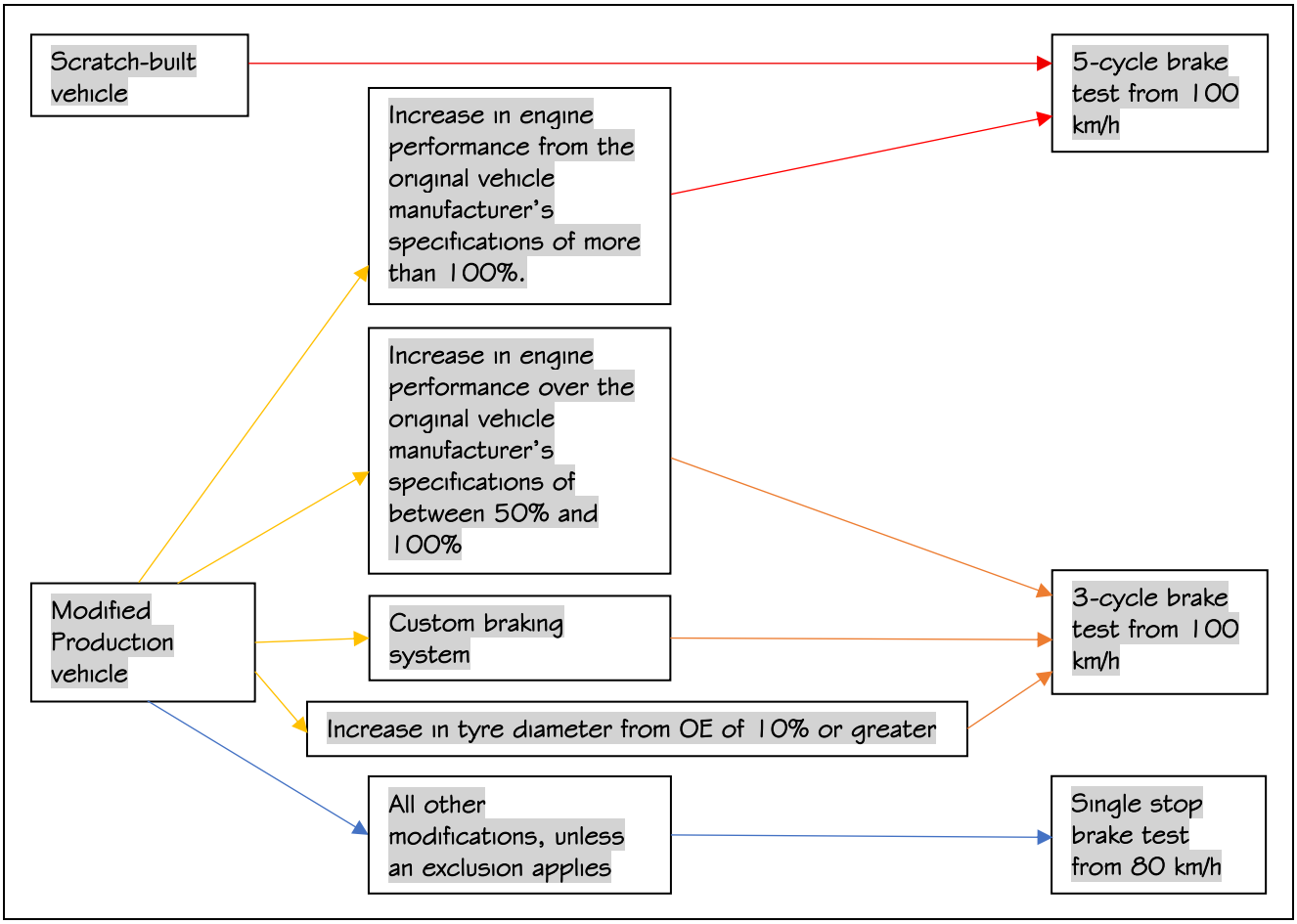


Diagram 19.1 Brake Testing Requirement Flowchart

Note that where a vehicle has, in the opinion of the LVV Certifier, braking componentry which may not be of sufficient durability relative to the performance potential or mass of the vehicle, or exhibits significant brake fade, the LVV Certifier must escalate the level of brake performance test required.

Terms & Definitions for Chapter 19

Accelerator pedal	see 'throttle'.
Applicable requirements	means any technical or operational requirement referred to in the *LVV Code* which an LVV must comply with in order to be approved for LVV certification.
Automatic transmission	means a type of gearbox, or transmission, which automatically varies the ratios between the input shaft and the output shaft to suit engine speeds automatically, without the driver having to physically select the gears.
AVI	(Authorised Vehicle Inspector) means a person who carries out WoF inspections on behalf of NZTA.
Brake fade	means the reduction of braking performance resulting from overheating of friction surfaces, due to prolonged or excessive use.
Bump steer	means the change in steering geometry of the steered wheels that can occur if one or more steering geometry principles are not correctly designed into the vehicle's steering system, as the steered suspension of the vehicle moves throughout its range of extension and compression.
CCM	(*NZ Car Construction Manual*) means LVVTA's detailed technical standards, incorporated by reference under the *LVV Code*, which must be met to enable an LVV to comply with applicable requirements. The *CCM* is referred to by the corresponding *LVV Standard*.
Certify	is, as defined in the *Land Transport Rule: Vehicle Standards Compliance 2002*, to verify that a vehicle complies with safety-related legal requirements prescribed by New Zealand land transport legislation.
Class	(also known as Type) in relation to a sound level meter, describes its accuracy as defined by the relevant international standards. The ANSI S1.4 and older IEC 60651 standards refer to the level of accuracy as 'Type', whereas the new standard IEC 61672 refers to the level of accuracy as 'Class'.
CoF	is an abbreviation for Certificate of Fitness.
Compliant	(also known as compliance) means a condition where evidence exists that an LVV complies with the applicable requirements specified in the *LVV Code*.
g	is an abbreviation for g-force, which is a unit of force equal to the force exerted by gravity, used to indicate the force to which a body is subjected, when accelerated or decelerated.
Gear lever	(also known as gear selector) means the device by which the different gear ratios in the gearbox are selected by the driver.
Heat shield	means a heat-resistant piece of material placed between a heat-generating component and a heat-sensitive component, to prevent or minimise heat transfer from one to the other.

Inspection	means the vehicle inspection process specified in section *2.4*, *2.5*, and *2.6* of the *LVV Code*, carried out by an LVV Certifier during the LVV certification of a low volume vehicle.
Km/h	is an abbreviation for kilometres per hour.
L-class	is an NZTA classification, which means, in very simple terms, a two-wheeled motorcycle or three-wheeled motor vehicle with a GVM of under 1000 kg.
Locked differential	means a differential (or 'diff') that drives both left and right-side axles simultaneously without the usual mechanical action designed into mass-produced vehicles which allows one wheel to rotate faster than the other whilst cornering, to provide smooth and comfortable turning.
LVV	(Low Volume Vehicle) means, in simple terms, LVVs which are modified or scratch-built in small numbers, and includes individually modified or scratch-built LVVs. The full definition of an LVV is contained in the *LVV Code*.
LVV Authority Card	(Low Volume Vehicle Authority Card) means an LVV certification document, issued under the delegated authority of LVVTA, specifying alternative safety related equipment required to be fitted to a vehicle for special purposes, as defined in *Annex 5* of the *LVV Code*.
LVV Certifier	(Low Volume Vehicle Certifier) means a person appointed by NZTA under the provisions of *Land Transport Rule: Vehicle Standards Compliance 2002*, to carry out low volume vehicle certification of modified and scratch-built LVVs, as specified by *Part 2* of the *LVV Code*.
LVV Certification	(Low Volume Vehicle Certification) means the process specified by the *LVV Code*, by which the design of an LVV is determined to comply with any applicable requirements, and, in recognition of which, an LVV EDP is affixed.
LVV Certify	(Low Volume Vehicle Certify) means the same as LVV certification.
LVV Code	(*Low Volume Vehicle Code* or the *Code*) means an LVVTA document which is incorporated by reference into the *Land Transport Rule: Vehicle Standards Compliance 2002*, and all applicable individual *Land Transport equipment rules*, that provides the legal framework to enable the LVV certification of modified and scratch-built LVVs in New Zealand.
LVV EDP	(Low Volume Vehicle Electronic Data Plate) is an RFID tag, in use from February 2021, fitted to an LVV upon completion of the LVV certification process, which when scanned by an NFC-capable device, displays details and photographs of the modifications and construction features on the LVV to which it is affixed.
LVV ORS	(*Low Volume Vehicle Operating Requirements Schedule*, *LVV Operating Requirements Schedule*, or *ORS*) means the document, incorporated by reference under the *LVV Code*, which provides LVVTA's operational processes and systems necessary to meet applicable requirements. The *LVV ORS* sets out the obligations and responsibilities of LVVTA, and the LVV Certifiers.
LVV Standards	(*Low Volume Vehicle Standards*) means LVVTA's technical standards, incorporated by reference under the *LVV Code*, that set out the legal requirements which vehicles that are modified and scratch-built vehicles in New Zealand must meet. Each *LVV Standard* refers to a corresponding *CCM chapter* or *MCM chapter* for detailed technical requirements.

LVVTA	(Low Volume Vehicle Technical Association) is an incorporated society comprised of specialist vehicle associations. Established in 1992, its objectives are to represent the interests of vehicle modifiers and builders in New Zealand, and to ensure high safety standards for modified and scratch-built LVVs. The LVVTA owns and administers the *LVV Code*.
Mass-produced (vehicle)	(also known as production vehicle, or high-volume vehicle) means a vehicle which is manufactured in quantities of more than 500 at any one location in any one year for the mass market.
MCM	(*NZ Motorcycle Construction Manual*) means LVVTA's detailed technical standards, incorporated by reference under the *LVV Code*, which must be met to enable a low volume motorcycle to comply with applicable requirements. The *MCM* is referred to by the corresponding *LVV Standard*.
Mph	is an abbreviation for miles per hour.
Modification	is defined in *Land Transport Rule: Vehicle Standards Compliance 2002* to change a vehicle from its original state by altering, substituting, adding or removing any structure, system, component or equipment, but does not include repair. 'Modified' and 'modification' have corresponding meanings.
Modified Production (LVV)	means, in simple terms, a vehicle which, while modified, maintains a sufficient percentage of body or chassis from one primary mass-produced vehicle that it can still be considered to be that vehicle. The full legal definition of a Modified Production LVV is complex and currently under review, and will be incorporated within the *LVV Code* once revised.
Motorcycle	means a vehicle of Table-A class LA, LB, LC, LD, and LE, as defined in *Land Transport Rule: Vehicle Standards Compliance 2002*.
NZTA	(New Zealand Transport Agency) is a Crown entity responsible for managing New Zealand's land transport system.
OE	is an abbreviation for 'original equipment', which, in this context, are the parts and equipment used in the assembly process of mass-produced vehicles.
Passenger compartment	means the part of a motor vehicle body that houses the passengers and driver.
Parking brake	means a braking system used to hold a vehicle in a stationary position, which is capable of remaining applied for an indefinite period without further attention.
RFID	(Radio Frequency Identification) is a technology which uses electromagnetic fields to automatically identify and track tags attached to objects. These tags link to electronically stored information, which can be accessed using RFID readers.
Scratch-built (LVV)	means, in simple terms, an LVV which has been individually constructed from unrelated components, or a mass-produced vehicle which has been modified to such an extent that it can no longer be considered to be a modified mass-produced vehicle. The full legal definition of a scratch-built LVV is currently under review, and will be incorporated within the *LVV Code* once revised.
Scratch-built Historic Replica (LVV)	means a sub-category of scratch-built low volume vehicle, as defined in *Chapter 2 - LVV Classifications* of the *LVV Operating Requirements Schedule*.
Scratch-built Reproduction (LVV)	means a sub-category of scratch-built low volume vehicle, as defined in *Chapter 2 - LVV Classifications* of the *LVV Operating Requirements Schedule*.

Service brake	means the primary braking system used to slow down and stop a vehicle.
Speedometer	means an instrument in a motor vehicle that continuously indicates to the driver the forward speed of the vehicle in either kilometres per hour or miles per hour.
Spool	see 'locked differential'.
Throttle	means the (usually foot-operated) device used by the driver for regulating engine power output.
VIN	(Vehicle Identification Number) means a 17-digit numbering system used world-wide as a primary means of individually identifying motor vehicles.
WoF	(Warrant of Fitness) means a safety inspection and approval process for in-service vehicles, issued by an NZTA-appointed AVI.