NHVR
National Heavy Vehicle Regulator

National Roller Brake Testing

Procedure

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1 Introduction

This procedure outlines the steps for conducting roller brake testing (RBT) and the requirements for the individual conducting the test to ensure the braking performance of vehicles is accurately assessed. This testing procedure, like all in-service brake tests, is not an absolute indicator of brake condition and performance. In-service brake tests are used to:

- verify that a vehicle's braking system is functioning
- provide information that highlights potential issues relating to non-compliances and/or system performance. Which can be used to determine if:
    - repairs or adjustments are required, and/or
    - specific brake components require inspection.

Although this procedure does not mandate fully loaded or simulated load testing, these conditions are encouraged when it is safe to do so, and the necessary facilities are available.

2 Purpose

The purpose of this document is to provide a single national standard for the equipment and test procedures used to conduct RBT of heavy vehicles.

3 Work procedure overview

This procedure must be used when conducting RBT for:

- compliance monitoring, or
- a regulated inspection of a heavy vehicle.

The individual conducting RBT for compliance monitoring and regulated inspections must:

- have relevant experience with RBT use, and
- meet the requirements outlined in Appendix D, or be under the supervision and instruction of a trained or experienced individual who does.

The roller brake tester used for compliance monitoring and regulated inspections must:

- meet the specification detailed in Appendix B, and
- be calibrated in accordance with the procedure detailed in Appendix C.

This procedure may be used when conducting RBT as part of routine maintenance to monitor brake performance.

Note:	When designing a maintenance regime an operator should consider the maintenance objectives and ensure the brake testing and inspection standards they adopt are consistent with their maintenance objectives. The use of a simplified and generalised test, such as the one outlined in this procedure, may not be thorough enough for the intended outcomes of a comprehensive maintenance management system.

4 Equipment Setup

4.1 Test location

RBT must be conducted on a flat and level surface, otherwise the vehicle must be properly restrained to prevent roll away. There should be sufficient length for the entire vehicle to maintain a stationary position with the brakes released. This applies to both the approach to and departure from the roller brake tester.

Note:	This does not exclude the use of portable roller brake testers with approach and departure ramps.

4.2 Setting up at the test location

The roller brake tester should be mounted flat and level within the manufacturer's tolerance, but it is recommended that the longitudinal and transverse grade should not be greater than ±1°. However, up to a grade of ±2° longitudinally and transversely is permitted provided wheel-chocks are used to hold the vehicle in place where the vehicle does not hold its position with the brakes released.

Prior to operation and before any vehicle is positioned for testing, the roller brake tester should be powered up and all its parameters checked using the manufacturer's self-checking facility or other protocol. Any fault code displayed during this self-check should be recorded and the roller brake tester must not be used until the fault identified is corrected.

SAFETY NOTE:

- The test location must be well ventilated so that the exhaust fumes do not pose a safety risk.
- Where there is a likelihood of the vehicle moving when the brakes are not applied, use wheel-chocks to hold the vehicle in place. Although the use of wheel-chocks can slightly altar readings, safety is most paramount.

4.3 Setting up for the test

At the start of each testing session, follow the roller brake tester manufacturer's start up instructions, which may include a calibration or self-check procedure.

For mobile roller brake testers, ensure the location allows vehicles to approach the equipment in a straight line and square to the roller brake tester.

Ensure that the rollers are clean (free of debris and not contaminated by lubricants).

Before positioning the vehicle on the rollers, ensure:

Step	Action
1.	the driver understands what is required of them throughout the test and how communication is to occur.
2.	the vehicle and testing areas are free of hazards such as sharp edges, loose objects that may fall during the test or slip and trip hazards.
3.	the tyres are inflated.
4.	If brake system requires air, it has had sufficient time to recharge and is free of leaks (air leaks and poor recharge time may affect the test results).
5.	the required brake system pressure is achieved (brake system pressure must be maintained above manufacturer's minimum operational pressure throughout each test).
6.	that any systems that may interfere with the test or test results are safely nullified (e.g. power divider, smart brakes, door interlock system and inter-axle differential locks are released, if applicable).
7.	that any relevant documentation and information is collected.

Note:

1. Correct air pressure during an axle under test is critical to the validity of the test results. The vehicle axle under test should not be below the manufacturer's air pressure operating range. This is typically for trailer axles greater than 400kPa (58 psi). Truck manufacturers generally show the air operating pressure range on the truck air gauge.
2. It may take three minutes (or more) after the truck reaches near-maximum working pressure before the rear most trailer axle group on a long combination has sufficient air pressure to test that axle group. Refer to section E3 on air pressure and supply for more information.
3. If brake performance decreases after successive tests, available stored air may have been diminished. If this happens, allow the air pressure to build to operational levels (as above) and retest. On long combinations, under test conditions the available air pressure may decrease more quickly. This decrease will occur as air is consumed across all active brake chambers each time the service brake is applied, and spring brakes are released.

5 Test procedure – Emergency and Park brake

5.1 Emergency brake

If the vehicle is fitted with a single circuit brake system (normally a vehicle built prior to 1980):

Step	Action
1.	Test the vehicle's emergency brake by applying it and then have the driver attempt to drive forward using a light throttle.
2.	Ensure that the emergency brake offers resistance to forward motion.
3.	Note the results and any concerns.

5.2 Park brake

Two methods of testing park brakes are available depending on how the park brake functions:

5.2.1 Systems that don't act directly at the wheels (e.g. transmission or tail shaft)

Step	Action
1.	Test the vehicle's park brake by applying it and then have the driver attempt to drive forward using a light throttle.
2.	Ensure that the park brake offers resistance to forward motion.
3.	Note the results and any concerns.

5.2.2 Systems that act directly at the wheels

Step	Action
1.	Test the vehicle's park brake by applying it and then starting the rollers. This would normally be performed when each axle is positioned for the service brake test.
2.	Where the roller brake tester manufacturer requires the rollers to be running before the park brake is applied, this is permitted provided the manufacturer's instructions and safety precautions are followed.
3.	Alternatively, to conserve air on long combinations and limit the risk of compromising the service brake test in time constrained testing, method in section 5.2.1 can be used. The method in 5.2.1 will provide an assurance of functionality but not for all vehicles in a combination.
4.	Each axle on which the park brake operates must achieve a reading of at least 15%g or the vehicle lifts out of the rollers.
5.	Note the results and any concerns.

6 Test procedure – Service brakes

6.1 Conducting the test

Step	Action
1.	Have the driver position the vehicle's first axle on the rollers and inspect to ensure the wheels are central and square on the rollers.
2.	For steer axles, ensure that the steering wheel is positioned and controlled to keep the wheels pointed straight ahead during the test procedure.
3.	Ensure the vehicle is in neutral and all brakes are released.
4.	Start the rollers and note the rolling resistance. **Note:** High rolling resistance is not a reason for rejection but can be indicative of incorrect brake adjustment and/or a mechanical defect. While high rolling resistance can increase fuel consumption, wear and maintenance, and may lead to breakdowns, brake fade and/or a brake fire, it can also be caused by normal factors within the braking system. For safety, check for any underlying issues to ensure optimum performance.
5.	Verify the brake system air pressure is close to the maximum operational range. Have the driver gradually apply the service brakes until wheel lock, slip or maximum braking effort is achieved. Ideally, there should be at least one wheel rotation and the test take 5 to 7 seconds. **Note:** 1. Correct air pressure at an axle under test is critical to the validity of the test results. The vehicle axle under test should not be below the manufacturer's air pressure operating range and generally for trailer axles greater than 400kPa (58 psi). Truck manufacturers generally show the air operating pressure range on the truck air gauge. 2. It may take three minutes (or more) after the truck has achieved close to the maximum working pressure before the rear most trailer axle group on a long combination has sufficient air pressure to test that axle group. Refer to section E3 Air pressure and supply for more information. 3. If brake performance decreases after successive tests, available stored air may have been diminished. If this occurs, allow the air pressure to build to operational levels (as above) and retest. On long combinations under test conditions, the available air pressure may decrease more quickly. This decrease will occur as air is consumed across all active brake chambers each time the service brake is applied and each time spring brakes are released. 4. **Brake Balance** - The roller brake tester records the maximum brake force for each wheel end and the axle. This reading indicates how well the vehicle brakes can stop within the required distance. The roller brake tester will also calculate the brake imbalance across axles. Poor brake balance indicates that at least one of the brakes is not operating correctly. Imbalance may affect the directional stability of a vehicle when braking. The roller brake tester may indicate that the test on an axle was invalid and prompt the RBT operator to make a decision whether to retest using the RBT operator decision trees in sections G1 and G2.
6.	Have the driver release the service brakes.
7.	If the park brake fitted, perform the park brake test as outlined in section 5.2.2.
8.	If the test is invalid and a retest is required, repeat section 6.1, steps 1-7 on the same axle. If not, move the vehicle forward to position the next axle on the rollers. Repeat steps 1-7 for each axle until all axles have been tested. **Note:** If retesting an axle follow the guidance in sections G1 and G2.
9.	Note the results and any concerns.

Step	Action
10.	A copy of the printed report of each test must be supplied to the driver. For more details on the information required see section 10, Reporting requirements and Appendix H.
11.	Irrespective of the result, a record should be accessible and easily retrievable for audit purposes. The roller brake tester must directly store test results electronically.

7 Test outcomes

The National Heavy Vehicle Inspection Manual (NHVIM) sets out the reasons for rejection that apply to RBT:

- There is more than 30% difference in the brake performance between the wheels on the same axle.
- The service braking decelerates the vehicle at less than the performance requirements specified in Table 1.
- The park brake when applied does not achieve at least a 15%g reading, or the vehicle does not lift out of the rollers.

Any of the above are reasons for rejection if present. When a reason for rejection is identified, a further inspection is recommended to identify the cause.

Table 1 Service brake performance table

Type of vehicle	Peak Deceleration	
	m/s^2	%g
GVM exceeding 4.5 tonnes	4.4	45

Note:
- On some vehicles the brake performance requirement might not be reached as the vehicle will be lifted out of the rollers or lock the wheels.
- The NHVIM also has an average deceleration for service brake performance; however, only peak deceleration is relevant to RBT.

8 Acceptance criteria, roadworthiness and defect notices

The following is deemed acceptable evidence of compliance with Section 87 (4) (a) of the *Heavy Vehicle (Vehicle Standards) National Regulation*:

- Where assessing an individual vehicle, the vehicle has achieved a brake performance result of at least 45%g using the dynamic test method.
- Where assessing a combination, each individual vehicle within the combination has achieved a brake performance result of at least 45%g using the dynamic test method. Testing must be performed on each individual unit (e.g. each vehicle with a number plate).
- Valid axle and wheel end test results have been used in the calculation of vehicle unit/s brake performance. Where the test cannot be self-validated by the roller brake tester, refer to the decision trees in the Appendix G for guidance.

Regardless of compliance with Section 87 (4) (a), a defect notice may be issued for the vehicle unit/s under Section 526 of the *Heavy Vehicle National Law* (HVNL). A defective heavy vehicle is defined in section 525 as:

defective heavy vehicle means a heavy vehicle that—

(a) contravenes the heavy vehicle standards; or

(b) has a part that—

(i) does not perform its intended function; or

(ii) has deteriorated to an extent that it cannot be reasonably relied on to perform its intended function.

For the purpose of this procedure a defect notice can be issued by an Authorised Officer under Section 526 if the vehicle fails to comply with the heavy vehicle standards. For example:

- The vehicle does not achieve 45%g using the dynamic test method calculated.
- A component or system has been found to be defective and will not perform its intended function.
- A part has deteriorated to an extent that it cannot be reasonably relied on to perform its intended function:
  - slip shut off was not achieved, and
  - achieved less than 30%g at its static weight and less than 45%g calculated using the dynamic weight on an axle.

9 Vehicle systems requiring additional attention and/or setup

To ensure accurate and repeatable RBT results, a number of advanced braking systems or components may require alternative or additional test procedures. These are outlined in Appendix A for vehicles with the following:

- Vehicles fitted with load sensing valves.
- Vehicles and trailers with an electronic braking system (EBS).

Note:	Alternative test methods described in Section 6 are only to be used when there are doubts about the tests validity. As the test results are calculated using dynamic weight measurement on the roller during testing, most are valid for compliance screening. Situations where an alternative method may be used are when: • a valid test cannot be performed on a vehicle with a highly reactive suspension • there is a high level of load shift off the axle being tested • the axle is lightly laden.

SAFETY NOTE:
When disabling or disconnecting vehicle systems is required, ensure these systems are reconnected and enabled after testing has been completed.

10 Reporting requirements

For each test conducted, results must be recorded and maintained by the tester for auditing purposes for a period required by the governing jurisdiction.

If there is a defect identified, a copy of the report must be supplied to the driver at the time of the test. This report must include identifying information about the test and the vehicle (i.e. location, date and time of test, make model, unit type e.g. trailer, prime mover, ridged truck etc. and registration and owner of the vehicle).

Results of measured values recorded will include:

For each axle position & brake type tested	maximum brake force (both left and right wheel end in kilonewtons (kN))
	brake imbalance between wheel ends (%)
	brake balance result (Pass/Fail)
	maximum brake force (kN)
	static weight (t) (where tonne = 1000kg)
	dynamic weight (t)
	static efficiency (%g)
	dynamic efficiency (%g)
	performance outcome Pass/Fail
	how the test was deemed to be successful – i.e. User stop, Time out or Slip

For overall unit performance for service brake	sum of axle brake force (kN)
	sum of axle dynamic weight (t)
	dynamic efficiency (%g)
	overall result (Pass/Fail)

For overall unit performance for park brake (if tested)	overall result (Pass/Fail)

Any additional comments or relevant information	Note as required

Appendix H provides an example of the recommended format of the report printout. It is important to note that as this is an example and variations in the layout may occur between different RBT manufacturers. Variations from this report layout are permitted provided all the information shown here is clearly presented.

Note:	The content of reports and tests carried out for maintenance or other purposes should not be limited by the content of this procedure.

11 Appendices

Appendix A Approved alternative and supplementary test procedures

A1 Supplementary testing methods

The National RBT procedure defines how in-service brake tests using roller brake testers are to be conducted. The procedure has been developed assuming vehicles will be tested at the mass presented, as this is the most practical loading approach for the situations where these tests are conducted.

Supplementary test methods are currently available, that include axle restraint and lifting bed, that allow a roller brake tester to artificially impose or simulate load, up to regulation mass. These methods are optional and may be used to test brakes through a greater brake force range.

Note:	These test methods are supplementary and not substitutes for the National RBT procedure.

A2 Vehicles fitted with load sensing valves

Where the RBT operator has concerns that the operation of load sensing valves is causing a vehicle or axle to fail the test, the RBT operator may use a load simulator if the roller brake tester is so equipped, so that the valve's operation does not impact the test. The operator must be skilled in the use of the load simulator function to use this option.

Alternatively, the valve linkage may be temporarily disconnected, or otherwise by-passed, immediately before the brake test, to allow the required braking force to be achieved. The RBT operator must ensure that the valve is restored to its proper working condition before the vehicle leaves the testing station. Failure to do so may affect the vehicle's performance and safety.

A procedure must be followed that specifically details the process that ensures the system is reconnected and enabled and the driver kept informed.

Deceleration test

If the vehicle cannot be roller brake tested, or for any other reason, a decelerometer may be used.

This will be dependent on-site restrictions and equipment available.

Appendix B Roller Brake tester specifications and settings

This procedure depends on the accuracy and consistency of the roller brake testers being used. To ensure accuracy and consistency, all roller brake testers must meet the following requirements:

- Be manufactured to comply with ISO 21069-1, AS/NZS 4613, or another standard accepted by the NHVR.
- Include vehicle weighing facilities (load cells).
- Be capable of automatically calculating the deceleration rate of individual wheels and axles.
- Be capable of calculating the deceleration rate of a vehicle unit including each vehicle in a vehicle combination.
- Report and record all brake test results as rates of deceleration, as a percentage of gravity (%g, where gravity is assumed as 9.81m/s2). This does not exclude the equipment reporting or recording other units of measure in addition to deceleration.
- Report and record peak force imbalance across an axle.
- Be capable of providing a written report of the results of a brake test. The report must clearly indicate test results as detailed in Section 10 and Appendix H.
- Must be capable of directly storing test results electronically from the roller brake tester.
- Must be capable of calculating results using both dynamic and static mass:
    - Must record the static mass and dynamic mass for all tests.
    - Must only use dynamic mass to determine and report the deceleration.
- Use only dynamic mass method for the purposes of any pass or fail indicator for service brake of the overall vehicle unit.
- Use both static and dynamic mass method for the purposes of any pass or fail indicator for service brake at the axle level.
- Use only static mass method for the purposes of a pass or fail indicator for park brake.
- On termination of a test, whether from lock up or manual intervention, both rollers must stop simultaneously.
- Must measure the Imbalance at the same time as the maximum brake force. The Imbalance at maximum brake force is to be recorded and calculated using the following formula:

$$\%\ \boldsymbol{Imbalance} = \frac{(\boldsymbol{BF_1} - \boldsymbol{BF_2})}{\boldsymbol{BF_1}} \times \mathbf{100}\%$$

Where:

- $\mathbf{BF_1}$ - Maximum brake forces achieved by the higher performing wheel end on an axle
- $\mathbf{BF_2}$ - Maximum brake forces achieved by the lower performing wheel end on axle

- Terminate the test when the roller brake tester detects a speed differential or 'slip' between the tyre and the roller of 27% ± 3%[1].
- Be independently checked for calibration at intervals not longer than 12 months (or 24 months for remote areas). The calibration and maintenance protocol is detailed in Section 9.
- Must have manufacturer's instructions for setup and operation, which is kept with the unit. The setup instruction must include a method for confirming operational accuracy of load cells and other components that may affect the accuracy and repeatability of results from the roller brake tester.
- Be programmed to deliver results as per the decision trees in Appendix F and Appendix G.
- Provide a user interface that allows correct operation, in accordance with that detailed in Appendix I.

[1] ISO 21069-1:2004(E) Road vehicles — Test of braking systems on vehicles with a maximum authorised total mass of over 3.5 t using a roller brake tester — Part 1: Pneumatic braking systems, 1.9 c

Appendix C Calibration procedure

The objective of this section is to minimise calibration uncertainty and ensure consistency and confidence in test result accuracy across the range of roller brake testers used.

The accuracy and repeatability of results depend on many factors, including the following:

a. Wear and condition of the roller brake tester
b. Calibration method
c. Tools used for calibration and their calibration
d. Skill level of the maintainers
e. Skill level of the roller brake tester operator
f. Design and characteristics of the roller brake tester
g. Measurement procedures
h. Method of calculating results
i. Vehicle to be tested, and how it is prepared.

Items a to d are addressed in this section.

Note:	This calibration procedure is to be used in conjunction with the manufacturer's calibration procedure and maintenance schedule. Where uncertainty exists between this procedure and the manufacturer's procedure, advice should be sought from the manufacturer on how to comply with this procedure either by calibration and/or maintenance.

C1 The wear and condition of the roller brake tester

The wear and general condition can have significant impact on the accuracy and repeatability of RBT results.

The manufacturer must give maintenance guidance in the form of a manual and/or service bulletins in the following areas:

- Roller wear and damage and the influence they can have on the coefficient of friction, the reduction in roller diameter and how these can affect the force measured by the roller brake tester
- Change in internal rotational resistance with wear and degradation of bearings can affect the force measured by the roller brake tester
- Important settings such as torque, preloads and lash adjustments that may impact the calibration and/or integrity of the roller brake tester.

C2 Calibration method

The roller brake tester must be considered a certified test instrument that is subject to calibration.

For a roller brake tester to be used for heavy vehicle in-service brake compliance, the manufacturer must give guidance in the following areas:

- Calibration of all sensors, including deceleration force transducers, load cells and 'slip' control
- Permissible resistance (e.g. torque) between the point of application of the parameter being measured and sensor
- Wear and tear on the rollers that may impact the accuracy of a test, such as roller friction and roller diameter
- Verification that all software or programs functioning correctly and ideally are the latest versions available from the manufacturer.

Calibration frequency

Calibration tolerance and calibration intervals that assure the recorded result (deceleration as calculated from weight and force) is within ±3% of the actual value with a 95% confidence level (the maximum recalibration interval is 12 months with one month leeway to allow for scheduling).

Note:	A case can be made for extending this calibration interval to 24 months in locations (e.g. remote areas with small populations) where test volumes are low and the manufacturer verifies that the roller brake tester will remain within the calibration limit with a 95% confidence level.

Calibration and maintenance records

Records must be kept for roller brake testers used for compliance detailing:

- the maintenance and calibration that has been performed
- the details of the person who conducted the calibration and maintenance.

C3 Tools used for calibration and their calibration

The RBT manufacturer must specify the tools to be used for calibration and the accuracy required of the tools. These tools must be maintained and calibrated in line with AS/NZS ISO 9001:2016 Quality management systems – Requirements following the manufacturer's instructions.

C4 Skill level of the maintainers

The maintainer's skill level is critical to the accuracy and safety of roller brake testers.

It is recognised that maintenance staff with a suitable trade qualification can perform effective maintenance. However, to calibrate roller brake testers and perform some critical maintenance, specialist knowledge and training will be required.

Roller brake tester manufacturers and suppliers must maintain a list of people qualified to calibrate and perform critical maintenance on the roller brake testers.

The list must include:

- critical maintenance which requires training
- the details of people that can perform critical work to and calibrate Roller brake testers
- details of specific critical maintenance and roller brake testers calibration the person can perform

To use roller brake testers for heavy vehicle in-service brake compliance, all critical maintenance and calibration must be performed by a person approved on the list.

Appendix D Roller brake tester operator requirements

Given the technical nature of a brake test and inspection, operators should have relevant experience and familiarity with roller brake testers or be under the supervision and instruction of an individual who is competent and confident in conducting the test.

The NHVR requires that those conducting brake tests and inspections meet the following criteria:

- Have sound knowledge of mechanical systems
- Have knowledge of heavy vehicle braking systems or be supervised and instructed by someone who does. This includes:
    - Identifying different braking systems, such as:
        - Cardan shaft parking brakes
        - Single circuit
        - Dual circuit
        - ADR 35 and ADR 38 brake systems
        - Spring brakes
        - Load sensing valves
        - ABS and/or EBS systems
    - Correctly identifying brake system non-compliance
    - Performing non-invasive visual braking inspections
- Have completed training on the operation of the roller brake tester being used. Training can be provided through:
    - Equipment manufacturer/supplier
    - Private training organisations, or
    - Within the organisation in which the individual works

Appendix E Test validation and control

This procedure is designed so that the roller brake tester alerts the RBT operator when a test result may be invalid. The information supports the procedure steps so that RBT operators can achieve the best test results within the limitations of the test.

This test procedure does not mandate axle restraint or defined loading requirements. Vehicles are tested as presented. This limits the extent to which brake performance can be tested. However, the roller brake tester provides detailed information, down to the wheel end level, offering diagnostic methods of ensuring brake performance that other test methods cannot.

The Australian road transport environment will also influence the test procedure, the results and how these results are interpreted. For example, the Australian heavy vehicle fleet that use suspensions that are reactive under RBT conditions, and long combinations that require time for brake pressures to regenerate and stabilise across the trailers. These issues are addressed in the relevant section.

E1 Setup on the rollers

Care must be taken when positioning the tyres of the axle under test on the rollers. An axle that is not parallel to the rollers may result in invalid test results for imbalance and may affect when the test is terminated because of slip.

E2 Applying the brake

To achieve good test results from roller brake testers, instantaneous static friction must be maintained between the tyre and roller with slowing building brake force to the point where the brake force delivered exceeds static friction limit or the brakes can deliver no more force. To achieve this, brake application must be slow and steadily increasing.

Instruction for the driver

The driver should apply the brakes as if slowing to a rolling stop up to a red light that may change to green. The driver is a distance from the red light so braking starts off light and slowly increases as if the distance to the light is closing.

Testing of lightly laden axles and laden axles that are exhibiting significant load shift will require a lighter touch and the brakes to be applied more slowly.

E3 Air pressure and supply

While the Australian heavy vehicle fleet typically includes longer combinations, with more trailers than other countries, it only occupies a small portion of the global market. This means that vehicles and their components are not always designed with Australian conditions in mind. The impact of this oversight is seen in the capacity of air systems for longer combinations where recharge times are extremely long once the supply is diminished. On long combinations under test conditions, the available air pressure may decrease more quickly as air is consumed across all active brake chambers each time the service brake is applied and spring brakes are released.

The vehicle axle under test should not be below the manufacturer's air pressure operating range and generally for trailer axles greater than 400kPa (58 psi). Truck manufacturers generally show the air operating pressure range on the truck air gauge. It may take considerable time after the truck has achieved close to the maximum working pressure before the rear most trailer axle group on a long combination has sufficient air pressure to test that axle group.

The following recharge times for air systems can be expected depending on the number of trailers:

Table 2 Recharge times for air systems

Number of trailers	Recharge times (minutes)
No trailers	1
1	1.5
2	2
3	3
4	4
5	5

If the performance is found to decrease, the further back along a combination the test is performed, these recharge times should be increased. However, excess recharge times may indicate a problem with the air system.

E4 Factors affecting brake force that can be measured

Axle weights (and slip shut off)

Accurate roller brake test results are dependent on friction between the vehicle's wheels and the brake rollers to prevent slippage and ensure accurate performance measurements. Weight transmitted to the brake rollers by the wheels increases friction and reduces premature slippage. When vehicles are lightly laden, only limited testing of brake capability can be performed. A lighter touch is also required on the brakes to ensure that valid brake results are obtained under these lightly laden conditions.

Lightly laden axles will reach slip shut off under light brake force. Slip shut off indicates the brakes have delivered more brake force than the roller brake testers programmed protection permits and friction between the roller and tyres is transitioning from static to dynamic. Slip shut off protects against the increase wear and damage caused by a skidding tyre.

Brakes that achieve slip shut off on a roller brake tester cannot be issued a defect notice for low brake performance.

Roller brake testers have been programmed to assess brake performance using the dynamic test method so false fails will be highly unlikely; however, the risk of the test overstating result is increased. Slow, steady brake application ensures a more reliable result.

Reactive suspensions

In the absence of axle restraint, reactive suspensions limit the ability of roller brake testers to measure maximum achievable brake force. Through field studies and statistical analysis, the dynamic mass on an axle under test has been shown to vary from 45% to 110%. At a dynamic mass 45-65% of the static mass presented, numerical compliance cannot be shown using the static mass calculation method, as slip shut off will occur. Using the dynamic mass value (weight measured during the test) numerical compliance can be shown. However, the dynamic test method will give a significantly higher result as more load is transferred off an axle.

For RBT operators that have facility for simulated load like axle restraint and axle lift, using these functions provides a more controlled and accurate evaluation of the brake's performance.

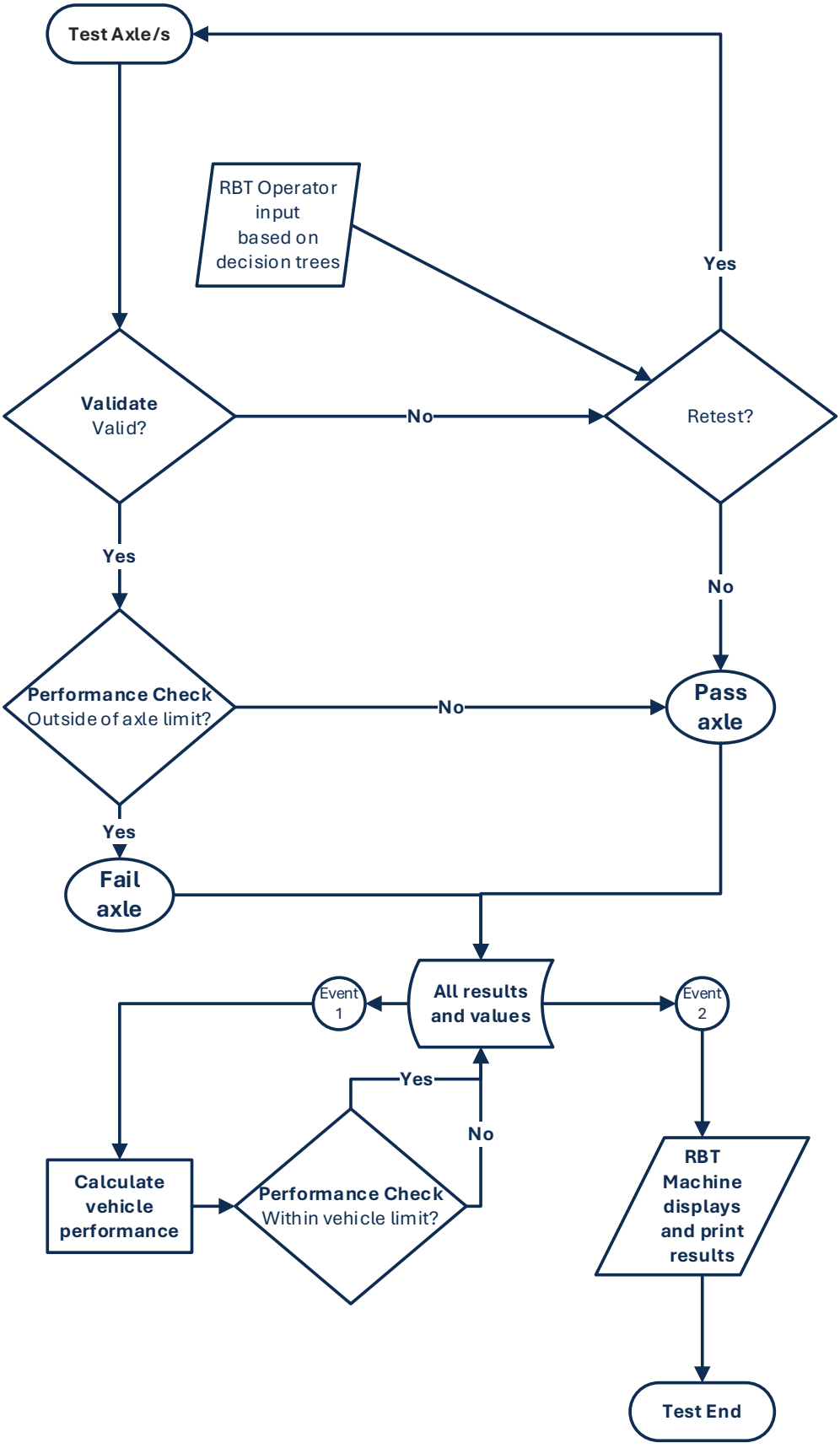
Where simulated load is not available, slowing down the brake application rate may improve the test quality and limit the level of load shift. This will become more difficult the more lightly laden the axle under test. This situation can be improved by testing with the vehicle partially laden.

Vehicle smart systems

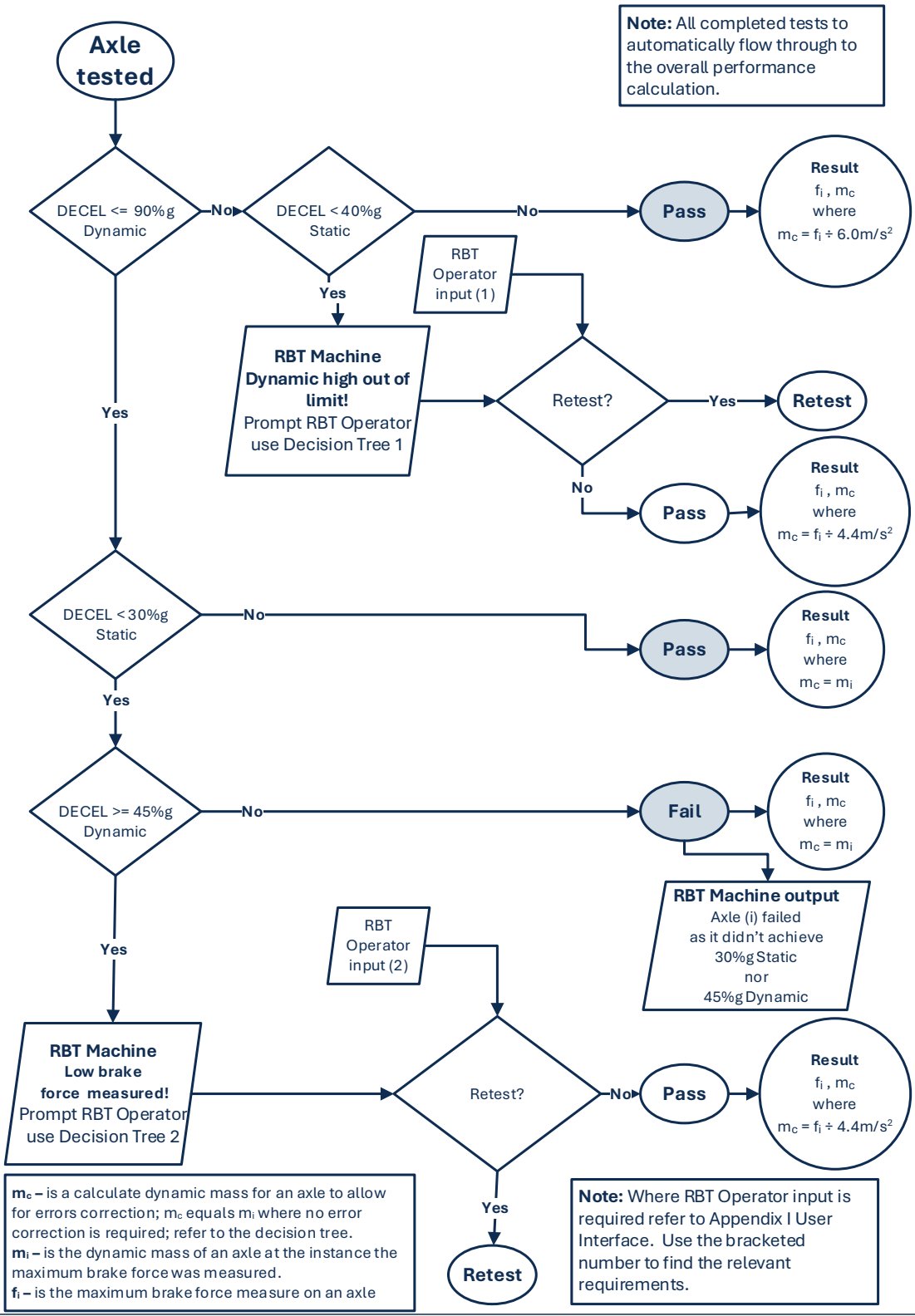
Vehicle smart systems generally will actively limit brake force based on the loading of an axle. Many of these systems will be inactive under the conditions encountered when using roller brake testers. Where low brake performance is being encountered and vehicle smart systems may be the cause, refer to section 9 and Appendix A for guidance on the procedure to be used.

Appendix F Roller brake tester decision trees

F1 Service brake test overview – Roller brake tester decision tree



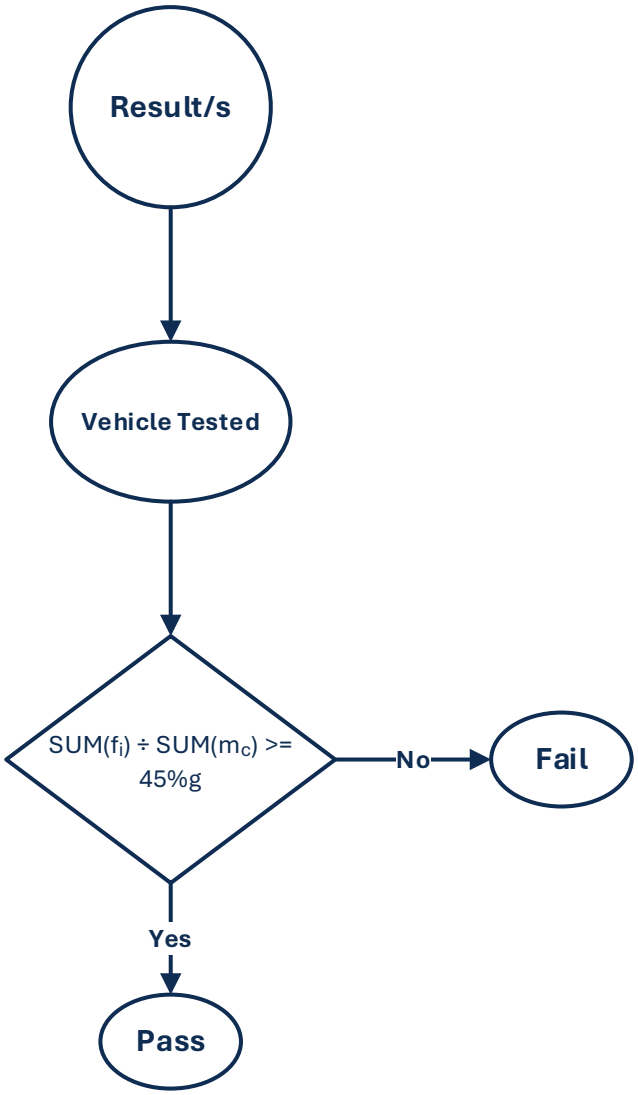
F2 Service brake test – Roller brake tester decision tree



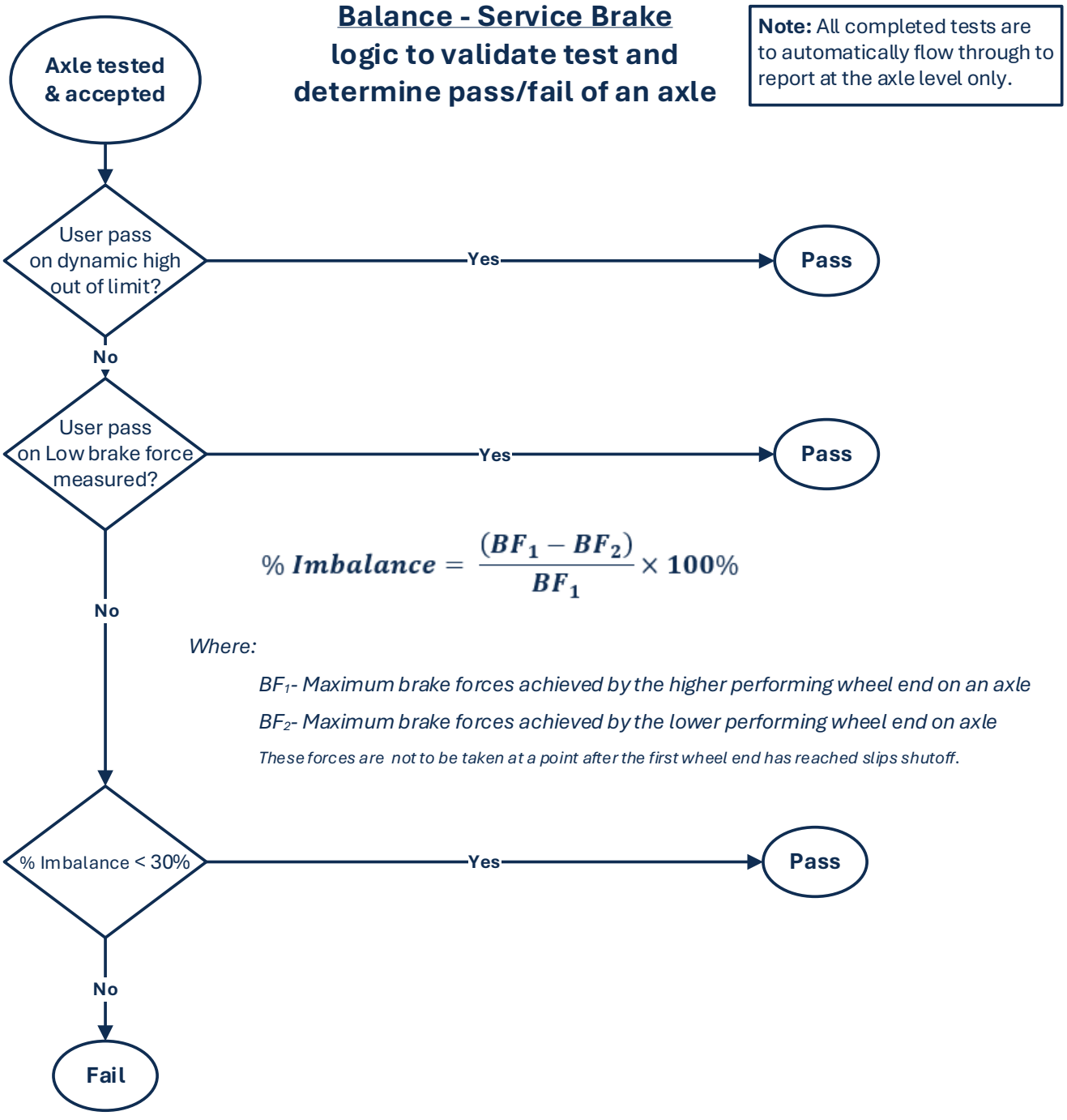
Note: Shaded areas highlight direct machine results, and unshaded areas show operator actions and results.

Refer to sections G1 and G2 for RBT operator input decision trees 1 and 2.

F3 Service brake test – Roller brake tester decision tree



F4 Brake balance service brake – Roller brake tester decision tree



$$\%\ Imbalance = \frac{(BF_1 - BF_2)}{BF_1} \times 100\%$$

Where:

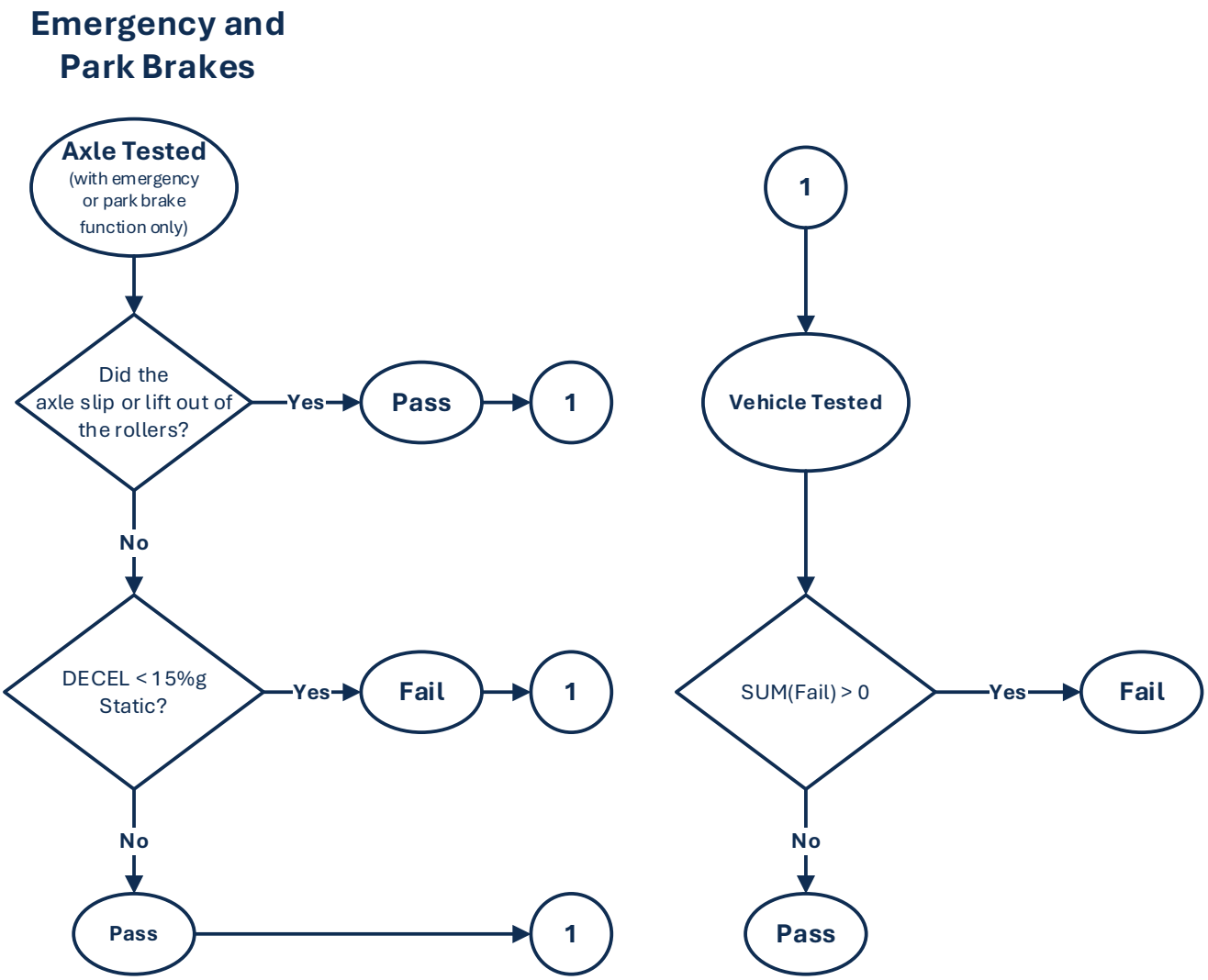
BF_1- Maximum brake forces achieved by the higher performing wheel end on an axle

BF_2- Maximum brake forces achieved by the lower performing wheel end on axle

These forces are not to be taken at a point after the first wheel end has reached slips shutoff.

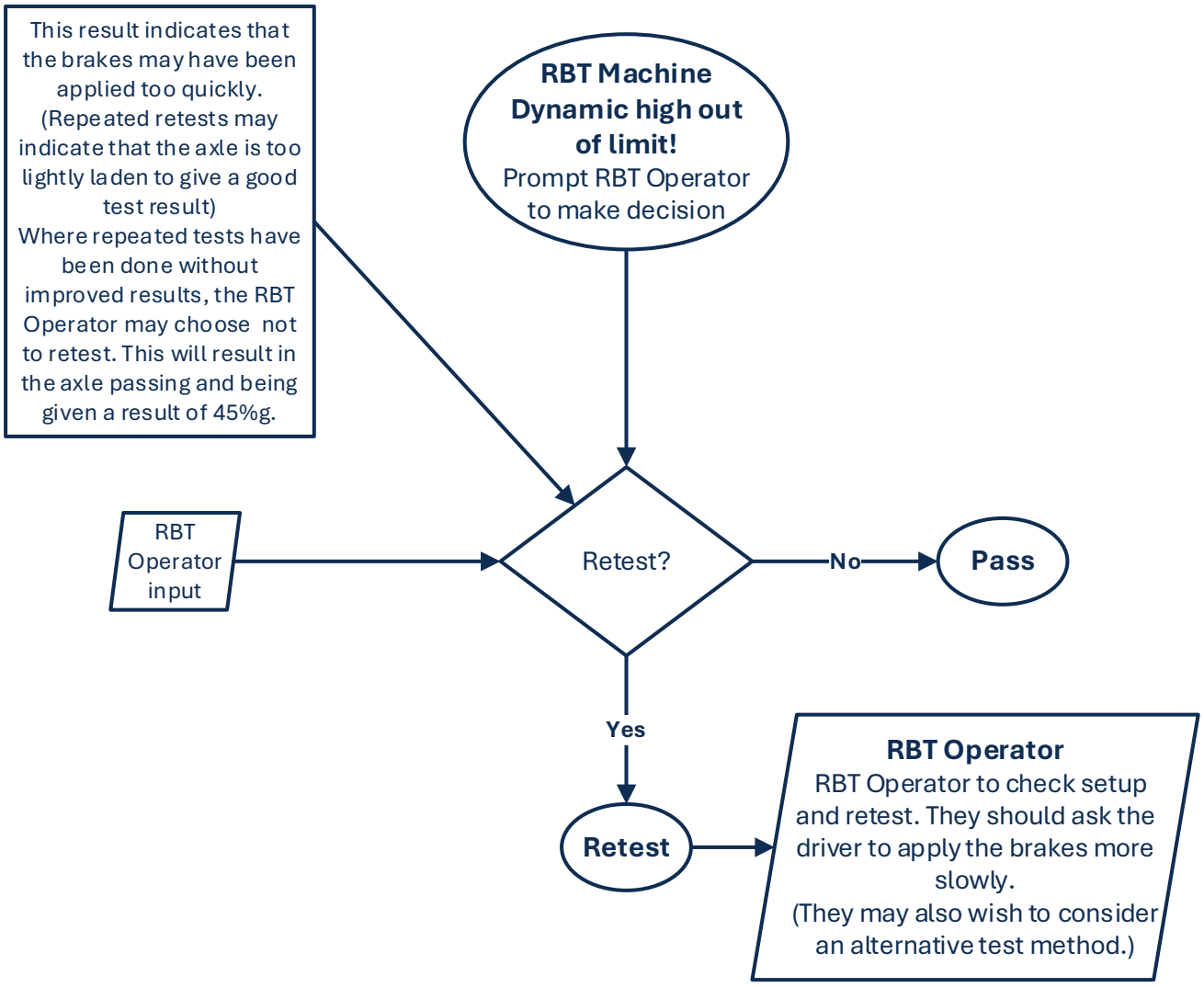
F5 Park brake test - Roller brake tester decision tree

Emergency and park brakes that act on the wheel ends are assessed at the axle level. If all axles that deliver an emergency and/or park brake functionally pass the below test, the vehicle is considered to have passed.

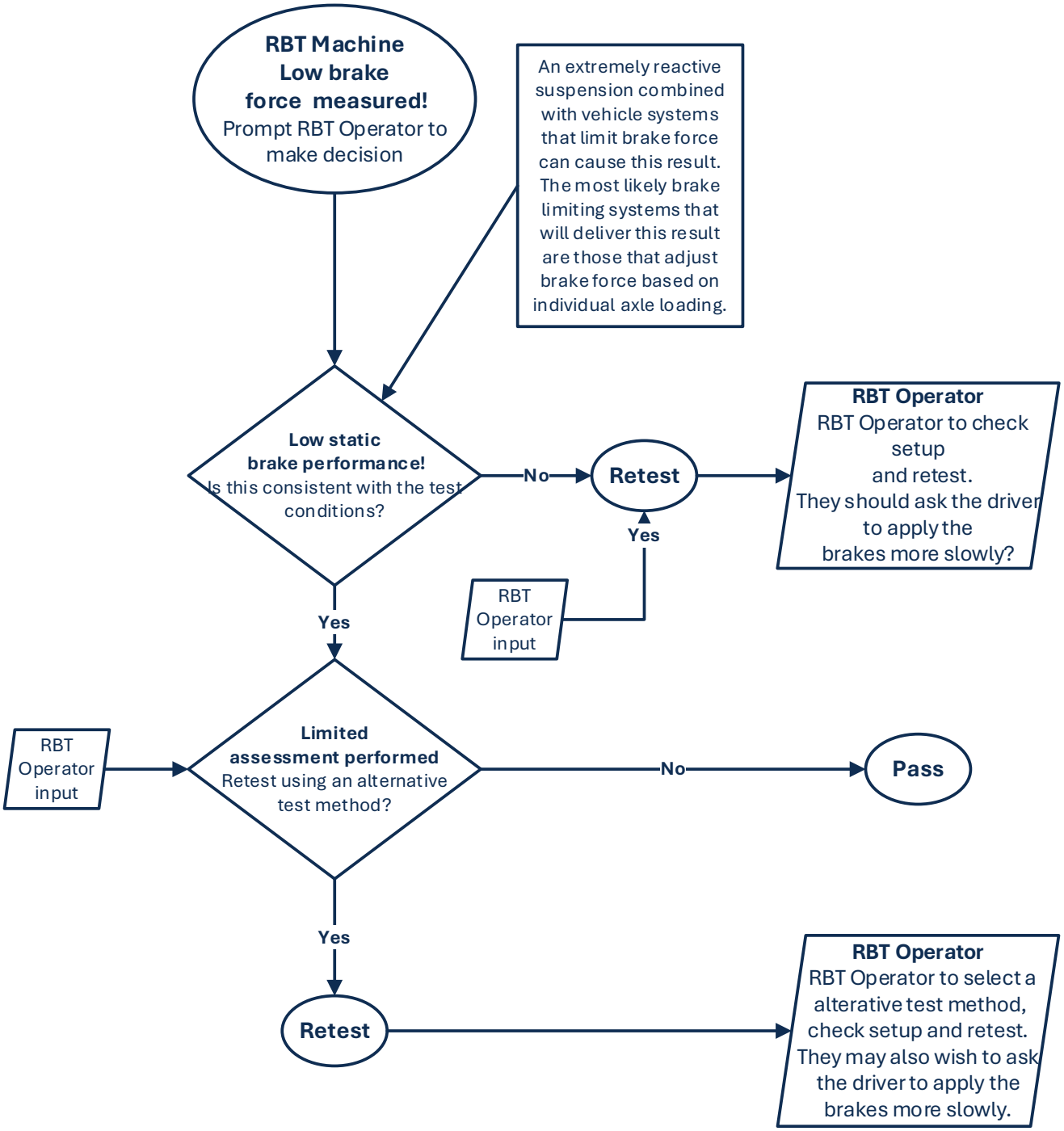


Appendix G RBT operator decision trees

G1 Service brake – User decision tree 1



G2 Service brake - User decision tree 2



Appendix H Vehicle brake testing results report printout

Customer and vehicle data					
Date:	Time:	Inspection Location:		Name/Co.:	
Next Calibration Date:		Make & Model:		Address:	
Brake Tester Type:		Unit Type:	Prime mover, trailer, ridged truck, bus etc.	Manufacturer:	
Brake Tester Serial No:		Mileage:		License pl no.:	
Inspector:		Number of Axles:		VIN:	

Axle position & Brake type	Max brake force (kN)		Imbalance (%)	Brake balance (Pass/Fail)	Weight (t)		Efficiency (%g)		Performance (Pass/Fail)	Test completed
	Left	Right			Sta.	Dyn.	Sta.	Dyn.		
Axle 1 SB:										
Axle 1 PB:										
Axle 2 SB:										
Axle 2 PB:										
Axle 3 SB:										
Axle 3 PB:										
Axle 4 SB:										
Axle 4 PB:										

Only display rows of axle position & brake type tested.

Pass or fail

(t) is for tonne – 1,000kg

Pass or fail

How the test was deemed successful – i.e. User stop, time out or slip.

Brakes on an individual axle that have a Static brake efficiency less than 30% and also a Dynamic brake efficiency less than 45% have failed to show that they can be relied on to perform their intended function in relation to the vehicle complying with a heavy vehicle standard. If this is observed the vehicle may be considered defective under part (b) of the definitions of a defective heavy vehicle in section 525 of the Heavy Vehicle National Law.

Unit overall performance	Brake force (kN)	Dynamic Weight (t)	Dynamic efficiency (%g)	Pass/Fail
Service Brake system (SB)				
Park Brake system (PB)				

Displayed Park systems only if tested.

Tester's Comments

Variations from this report layout are permitted provided all information shown here is clearly presented.
The content of reports and tests carried out for maintenance or other purposes should not be limited by the content of this procedure.

Appendix I User interface

The roller brake tester is required to interface with users in a way that allows them to:

- test to this procedure and print and save the results
- choose the brake systems to be tested while testing an axle and the order brake systems are to be tested in but normally in the order below:
    - Service brake
    - Park brake
- choose to retest any axle for any of the brake systems before the test is accepted
- respond to the special system validation prompts defined below in sections I1 and I2.

I1 Service brake high dynamic out of limit

Where a high dynamic out of limit as defined in appendix F2 is identified prompt the user to retest or accept the test.

This validation event shall prompt the user with the following message:

Dynamic above limit!

Accept or retest?

Retest XXXXXXX (step to be defined by the manufacture)

Accept XXXXXXX (step to be defined by the manufacture)

Retest is to initiate the roller brake tester to perform the normal retest process and the user is to maintain control over the start of retest.

Accept is to initiate the roller brake tester to perform the normal user defined next step in the process and the user is to maintain control over when the next step starts.

I2 Service brake low brake force measured

Where a low brake force measured as defined in appendix F2 is identified prompt the user to retest or accept the test.

This validation event shall prompt the user with the following message:

Static below limit!

Accept or retest?

Retest XXXXXXX (step to be defined by the manufacture)

Accept XXXXXXX (step to be defined by the manufacture)

Retest is to initiate the roller brake tester to perform the normal retest process and the user is to maintain control over the start of retest.

Accept is to initiate the roller brake tester to perform the normal user defined next step in the process and the user is to maintain control over when the next step starts.

12 Definitions

The following terms are specific to this work procedure:

Term	Definition
Roller Brake Testing (RBT)	The function of doing the test
Roller Brake Tester / RBT Machine	The unit or machine used to perform the test
Roller Brake Tester Operator	The individual carrying out the test

13 References

- Heavy Vehicle National Law Act 2012
- Heavy Vehicle Inspection Manual 2021
- AS/NZS 4613:2017 Automotive equipment - Brake force measuring instruments
- ISO 21069-1:2004 Road vehicles – Test of braking systems on vehicles with a maximum authorized total mass of over 3,5 t using a roller brake tester – Part 1: Pneumatic braking systems
- AS/NZS ISO 9001:2016 Quality management systems – Requirements