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Brake Testing in the Slovak Republic

Service Brake Efficiency of Vehicles with GVW Exceeding 3,5 t

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Service brake efficiency testing in the Annex II of the Directive 2009/40/EC as amended by the Directive 2010/48/EU

1.2.2. Efficiency

Test with a static brake testing machine or, if one cannot be used for technical reasons, by a road test using a recording decelerometer. Vehicles or a trailer with a maximum permissible mass exceeding 3 500 kg

Does not give at least the minimum figure as follows

Vehicles registered first time after entry into force of this Directive:

Test with a static brake testing machine or, if one cannot be used for technical reasons, by a road test using a recording decelerometer. Vehicles or a trailer with a maximum permissible mass exceeding 3 500 kg has to be inspected following the standards given by ISO 21069 or equivalent methods.

Road tests should be carried out under dry conditions on a flat, straight road.

- Category L3e: 50 %
- Category L4e: 46 %
- Category L5e, L7e: 44 %
- Categories L (rear wheel brake):
- all categories: 25 %

Direct evaluation method

Calculation of the braking rate corresponding with the fully laden state of the vehicle and the highest achievable braking forces measured during the test on the roller brake tester (RBT).

Based on the “Laden Measurement Method” according to the ISO 21069.

$$Z = 10,2 \cdot \frac{\sum B_{vi}}{m_c} \quad (\%)$$

$\sum B_{vi}$ *sum of the highest achievable braking forces on all wheels of the vehicle (N)*

m_c *gross vehicle weight (kg)*

One-point extrapolation method

Prediction of the braking rate in the fully laden state of the vehicle, based on measurement of the highest achievable braking forces and the corresponding air pressure beneath the locking limit of the wheels.

$$Z = 10,2 \cdot \frac{\sum B_{v1} \cdot i_1 + \sum B_{v2} \cdot i_2 + \dots + \sum B_{vn} \cdot i_n}{m_c} \quad (\%)$$

$\sum B_{vi}$ sum of the braking forces on wheels of the axle i (N)

m_c gross vehicle weight (kg)

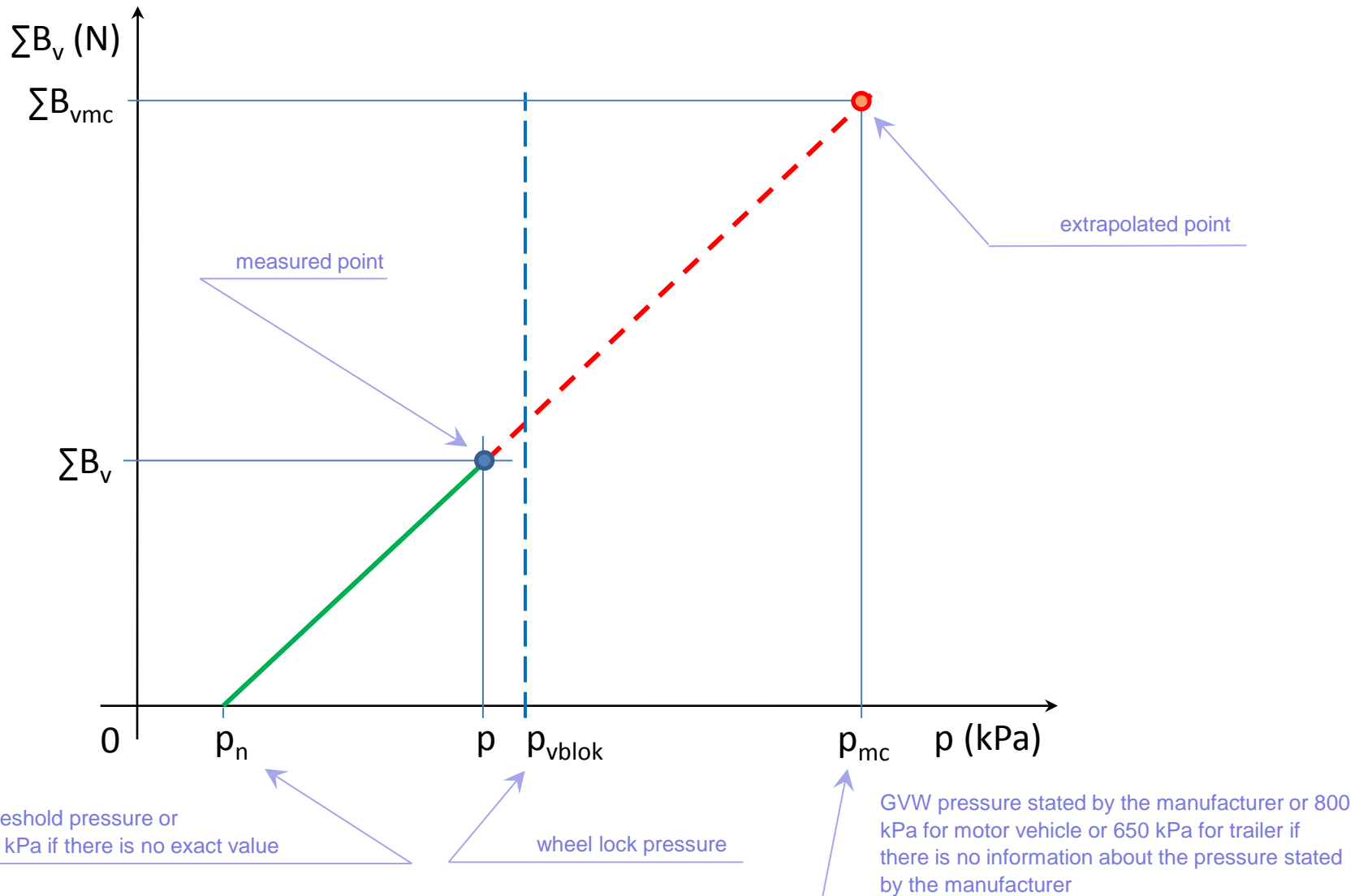
i_i extrapolation coefficient of the axle i : $i_i = \frac{P_{mci} - P_{ni}}{P_i - P_{ni}}$

P_{mci} fully laden vehicle state brake actuator pressure in the circuit of the axle i stated by the manufacturer (kPa); or 800 kPa for motor vehicle or 650 kPa for trailer if there is no information about the pressure stated by the manufacturer

P_{ni} threshold air pressure in the circuit of the axle i (kPa); or 40 kPa if there is no exact measured value

P_i brake actuator pressure in the circuit of the axle i corresponding with the highest achievable braking force measured on the RBT (kPa)

One-point extrapolation method



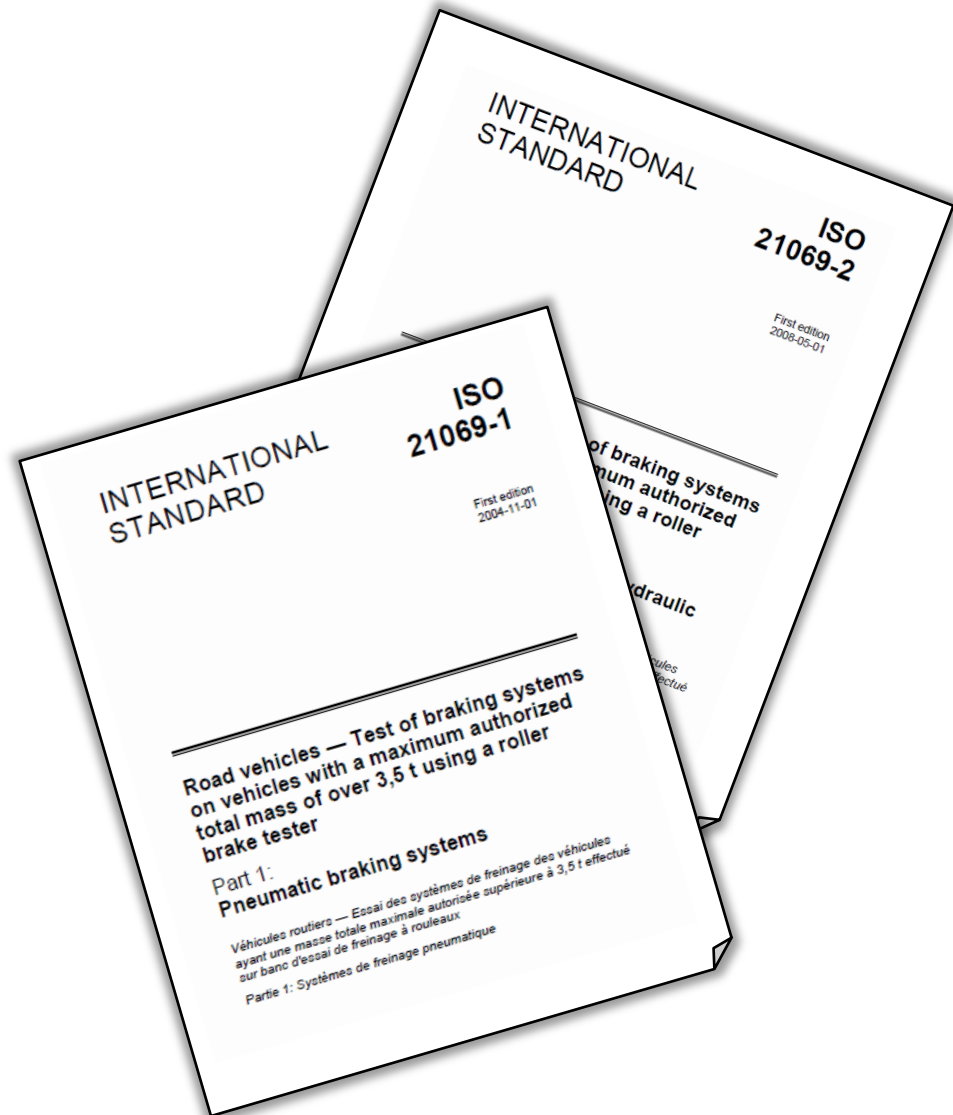
Extrapolation in ISO 21069

Extrapolation is mentioned in the ISO 21069 as an alternative to the measuring of the braking forces in the fully laden condition of the vehicle.

For a correct calculation, at least 30 % of the design brake actuator pressure should be achieved during the measuring of braking forces.

The extrapolation method has been used for service brake efficiency evaluation in the Slovak Republic for more than 30 years.

But without the obligation to reach the 30 % of the design brake actuator pressure.



Extrapolation: How to reach the 30 % of the design brake actuator pressure?

Considered solution:

To equip the RBTs in the PTI stations with load simulators

Problems:

- some vehicle manufacturers do not approve the use of a load simulator
- time demanding in comparison with “normal” brake testing
- impossible to use on some vehicles (buses ...)
- 2 inspectors necessary (usually only 1 inspector is performing the PTI)
- additional costs for PTI station owners – modification of RBT and pit, purchase of load simulator
- workplace safety concerns
- shortage of time – for the introduction of a new piece of PTI equipment as obligatory a transitional period of at least 1 year is necessary

Solution wasn't adopted

Extrapolation: How to reach the 30 % of the design brake actuator pressure?

Considered solution:

To introduce an obligation to present the vehicles over 3,5 t GVW for the PTI in a partly laden state (at least 40 % for trailers and 60 % for motor vehicles)

Problems:

- vehicle owners have to care for loading of their vehicle for PTI
- some vehicles can't be presented for the PTI in laden state (ADR vehicles, livestock transport vehicles, vehicles transporting dead animals, buses ...)
- additional costs for PTI station owners – excessive wear of the RBT rollers

Solution was adopted

Reference braking forces method

The measured braking force and corresponding brake actuator pressure are compared with the reference values stated by the vehicle manufacturer.

Reaching of the 30 % of the design brake actuator pressure is not necessary.

No braking rate calculation necessary.

Reference braking forces are currently available for the vehicles of following manufacturers:



Mercedes-Benz

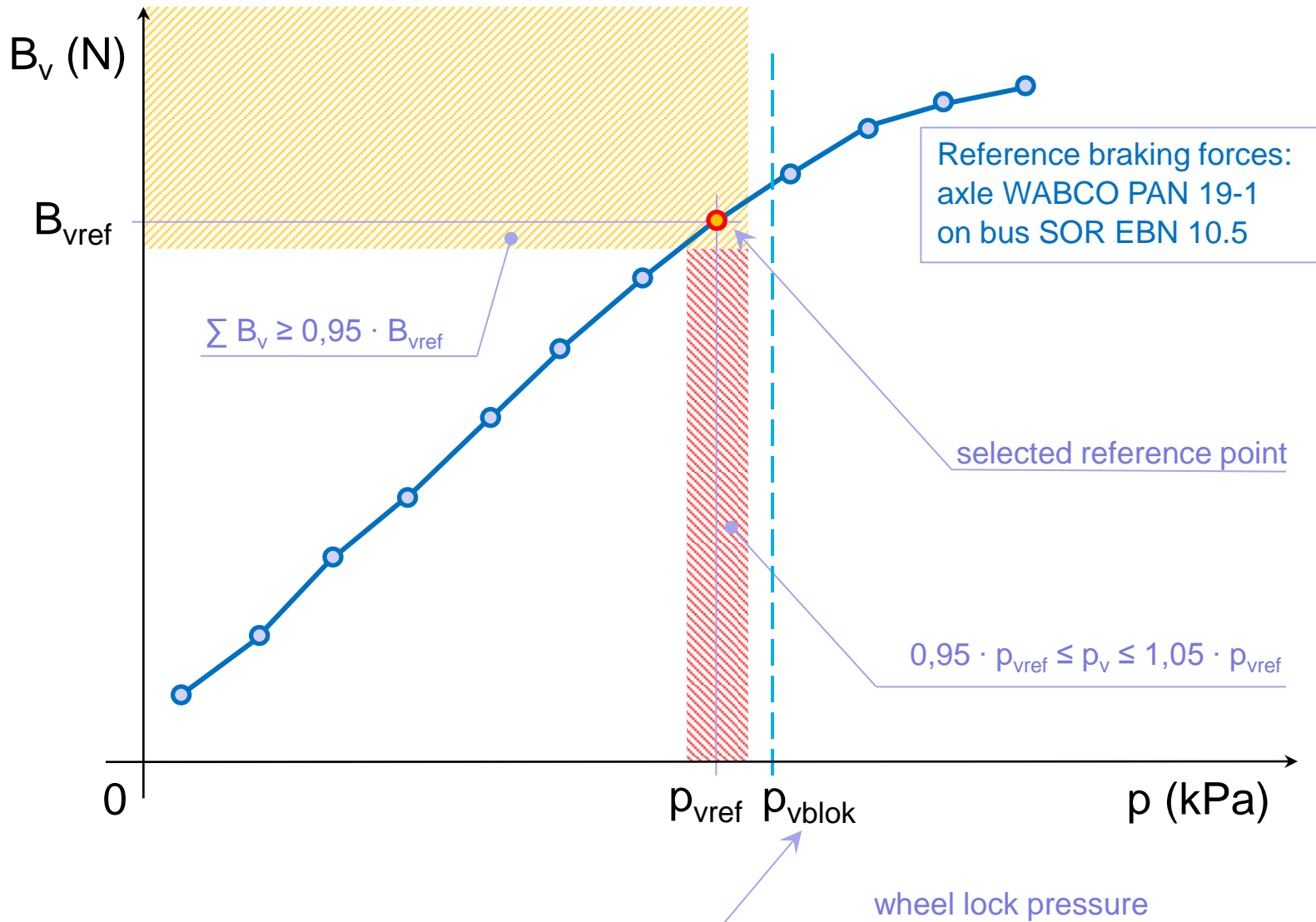


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Inspectors have access to the reference braking force values through the information system.

Reference braking forces method



Rough estimation method

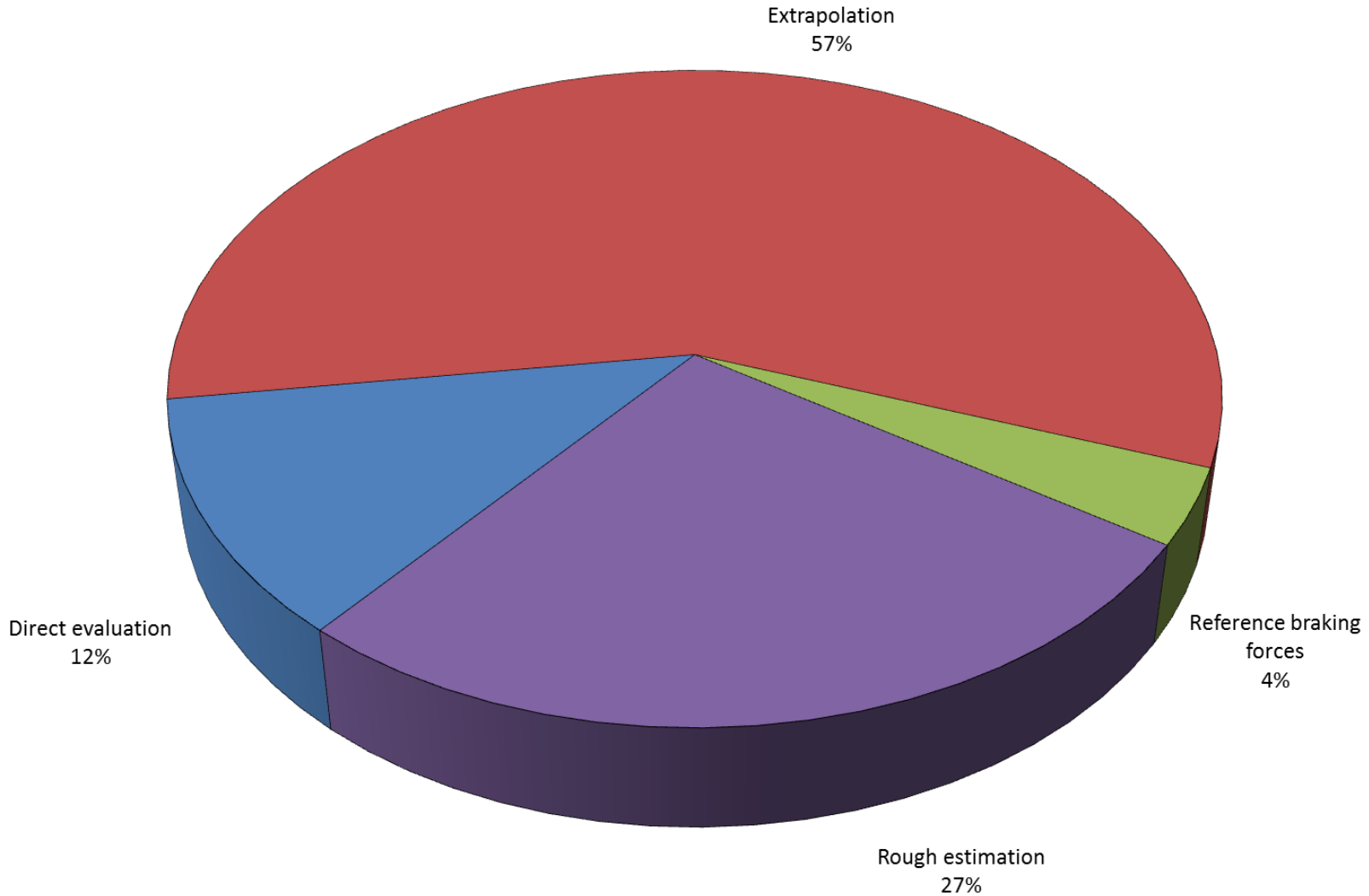


Allowed only if there are no test connections for pressure measurement on the inspected vehicle (or the test connections are not functioning) and no other method can be used.

The service brake efficiency is supposed sufficient if every wheel locks up during the test on RBT, a calculation isn't necessary.

This method was intended for older vehicles without test connections, but inspectors tend to misuse it.

Statistics: Methods used for service brake efficiency evaluation (March – July 2013)



The End



Thank you for your attention.