BPW EBPMS

Electronic Brake Performance Monitoring System

Roger Thorpe - BPW Limited

11th June 2019

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Electronic Brake Performance Monitoring System (EBPMS)

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What is it?

EBPMS is a system to continually monitor the performance of the trailer brakes in real time and to provide a facility to acquire the data in the form of reports.

The system uses some of the data from the Electronic Braking System (EBS), and with data acquired from other systems is able to produce performance figures for the semi-trailer brakes. This type of system can be used as an alternative to roller brake testing.

The data can be transmitted via a telematics system, processed and made available to others.

BPW EBPMS System Overview.

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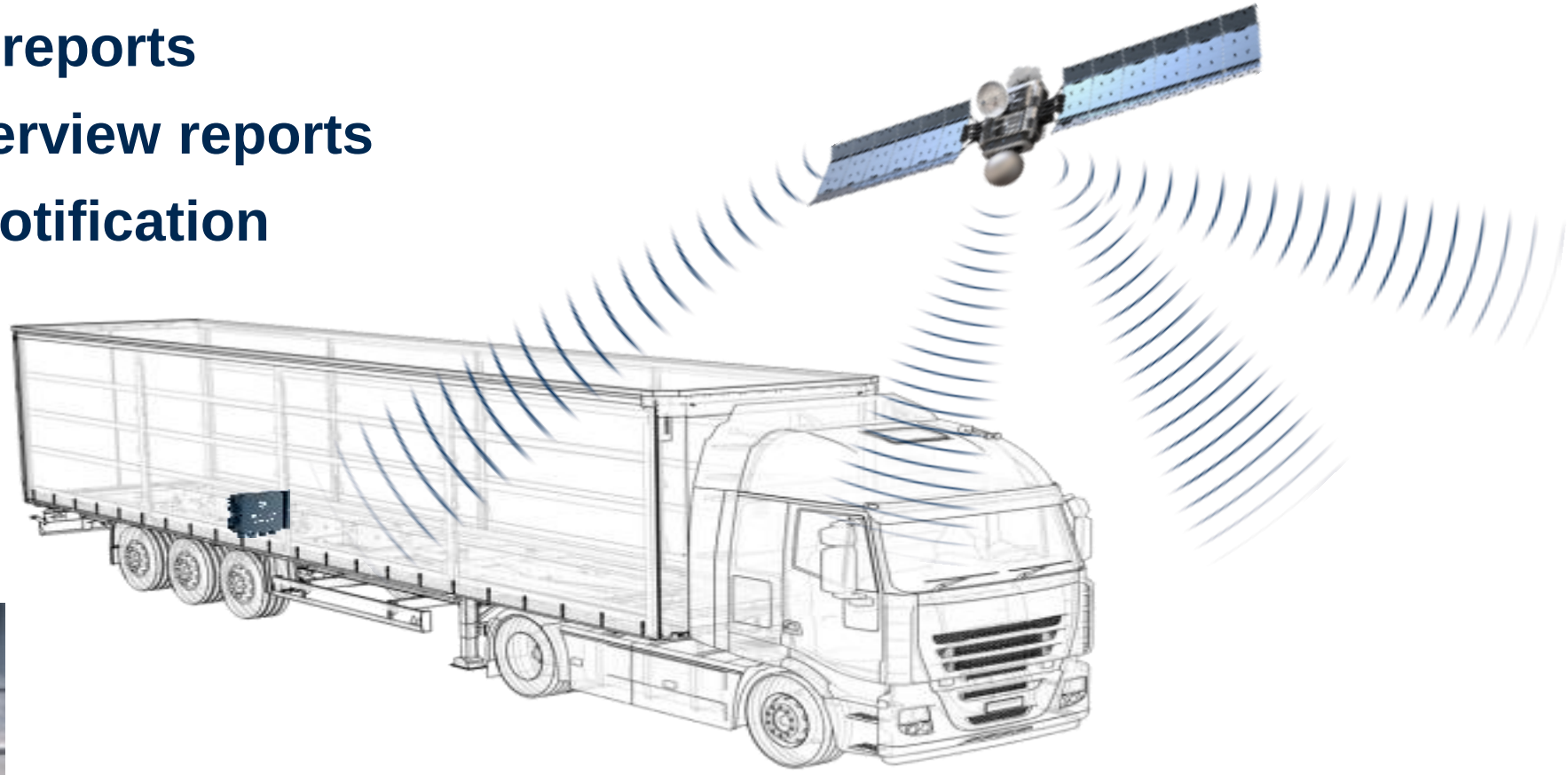
1. Individual trailer reports
2. Periodic fleet overview reports
3. EPBMS alarms notification



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How does it work?

EBPMS works by monitoring braking events and then comparing the result to the demand from the driver and tractor unit.

- The pressure on the Service coupling (or the equivalent electrical signal) tells us how much braking the driver/tractor unit is expecting.
- We can calculate from the speed and the distance travelled how much retardation is being achieved.
- This performance data is collected and stored and over time gives a measure of the trailer's braking performance.

EBPMS PROCESS CONTROL DIAGRAM

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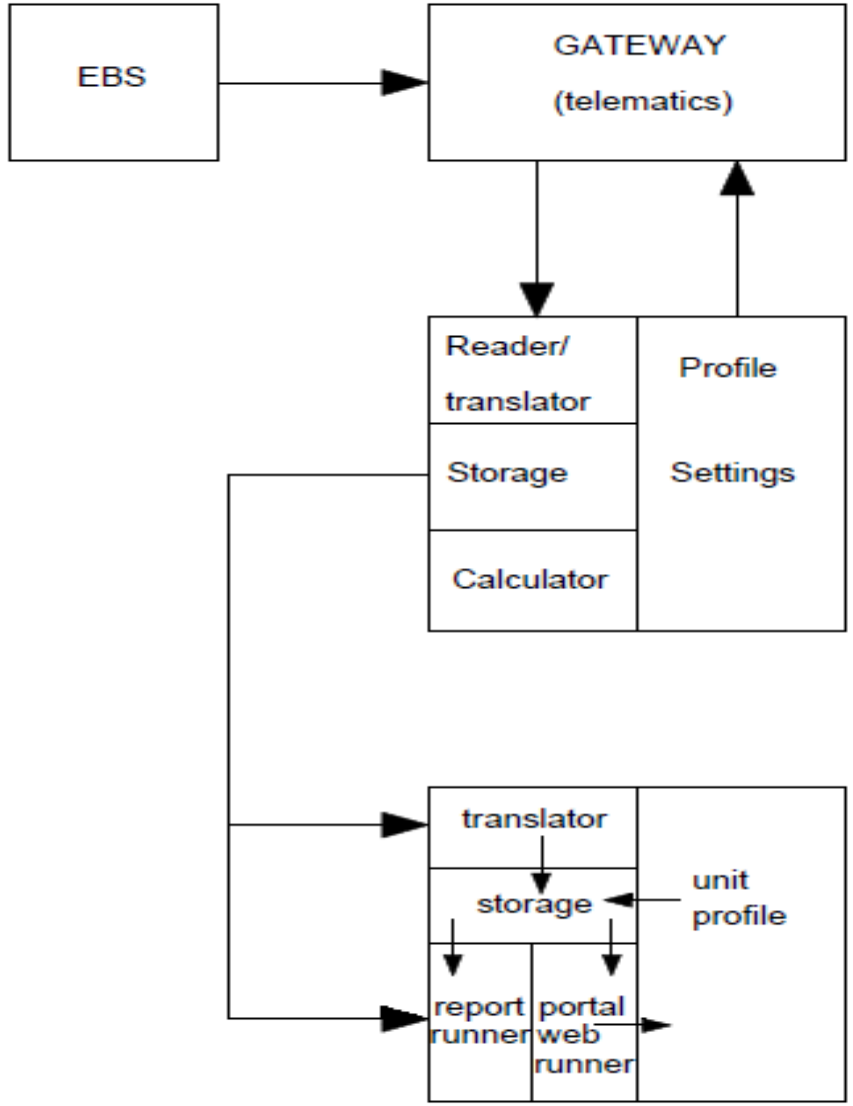
KNORR BREMSE

WABCO

Haldex



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What does it tell me?

The EBPMS system tells you how the braking system is performing against demand.

- The system is very good at monitoring braking events in real time and comparing those results to the demand from the driver/tractor.
- The longer the system is used for the more accurate the data becomes.
- The reports can produce data on a daily, weekly, monthly or annual basis.

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The system can report on exceptions via SMS or Email.

Reports show the data for individual trailers or collectively for the fleet.

Reporting

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EBPMS Report | PR8908 DD SINGLE

19.03.2019 00:00 - 25.03.2019 09:38

Brake Performance (Average)

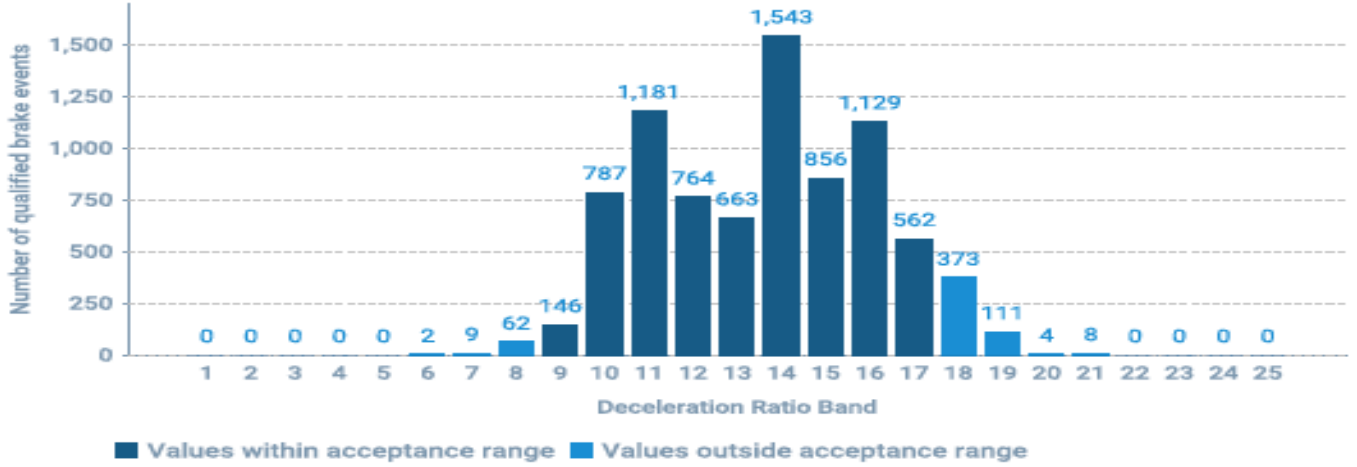
Brake Performance (Average)[1]	0.53 g
Brake Performance Lower Limit	0.45 g

[1]projection for brake pressure of 6.5 bar at full bogie load.

Overall result	PASSED

Brake Measurements (Recorded)

Days in report interval	7
Total number of brake events	8200
Brake events below acceptance range	73
Proportion of brake events below acceptance range	0.9 %
Brake events above acceptance range	496
Proportion of brake events above acceptance range	6.0 %



Reporting

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EBPMS Fleet Report

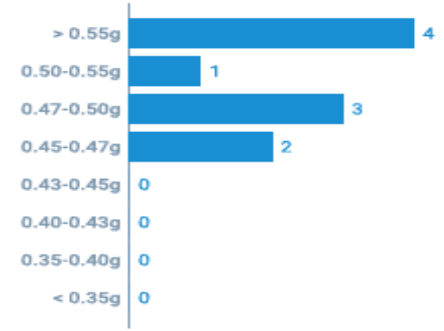
19.03.2019 00:00 - 25.03.2019 09:39

Overview

Days in report interval	7
Average fleet brake performance¹	0.54 g
Previous Interval - Average fleet brake performance¹	0.44 g
Brake Performance Lower Limit	0.45 g
Assets in report	13
Assets below lower limit	0
Proportion below lower limit	0 %
Average fleet brake performance below lower limit	
Previous Interval - Assets below lower limit	6
Previous Interval - Proportion below lower limit	38 %
Previous Interval - Average fleet brake performance below lower limit	0.39 g
Assets without rating	0
Proportion without rating	0 %

¹projection for brake pressure of 6.5 bar at full bogie load.

Summary:
No. of assets by brake performance range



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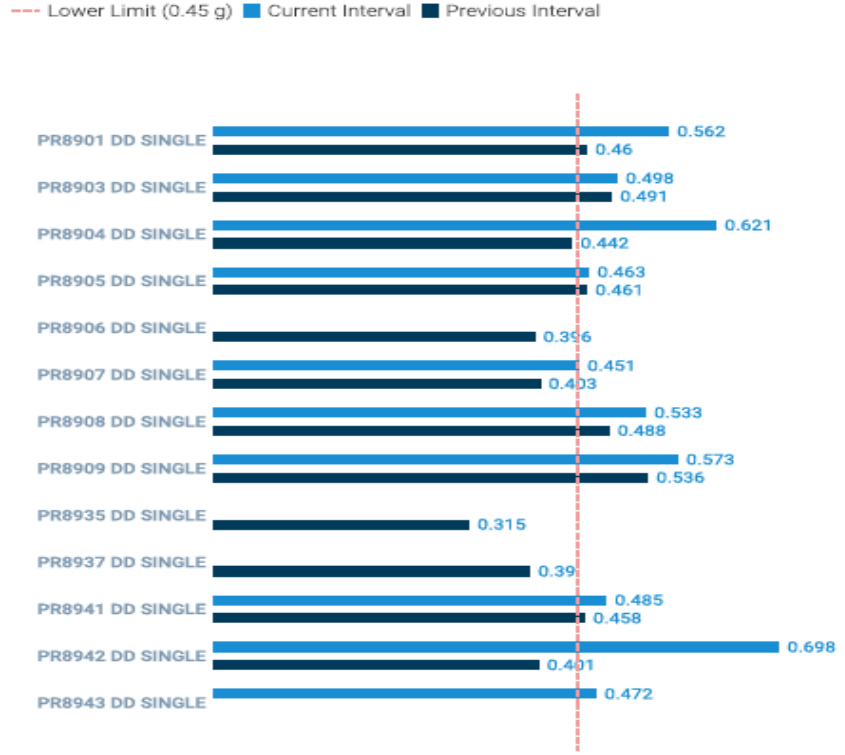
EBPMS Fleet Report

19.03.2019 00:00 - 25.03.2019 09:39

Fleet Brake Performance
Key: Previous Interval = equal to report interval duration, directly prior to report period



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Does anyone control how it works?

There are two documents published by DVSA which the industry has to work to and comply with:

- **Guide to Electronic Braking Performance Monitoring System(s)**
- **Electronic Braking Performance Monitoring System**

  Industry Standard Specification

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DVSA Industry Guide

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Key Information

- Manufacturers of EBPMS will need to demonstrate that their system adequately assesses and reports braking performance and must also conform to industry standard specification.
- The EBPMS shall be capable of reporting overall service braking performance.
- An EBPMS braking performance report must clearly identify the vehicle or trailer, the assessment date and also provide an overall result for the service braking performance since the last safety inspection.
- Braking performance evidence can be stored electronically or as a printout. All records should be retained in-line with the guide to maintaining roadworthiness.
- The operator needs to ensure appropriate action is taken to investigate, remedy and evidence any reported defects.
- EBPMS must meet minimum industry standard specification. The industry standard specification for trailer EBPMS can be found at the following Link.
- Ultimately it is the operators' responsibility to ensure that the EBPMS system is fit for their particular set of circumstances and used correctly.

DVSA Industry Standard Specification

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2.1 Provide a Braking Performance Value for a given time period; using Braking Event Data and a plurality of Braking Events

2.2 The Braking Performance Value shall be derived using valid statistical analysis techniques (such as Least Squares), the results shall:

a) Be reported with a statistical 95% Confidence Interval

b) Have a statistical Margin of Error of less than 3%

c) Utilise Braking Event Data in a manner that minimises the effect of Braking Events, which includes Braking Event Data that could have a negative influence on the validity of the Braking Performance Value.

d) Compensate for the effect of gravity on the Braking Event Data when a Braking Event occurs on an incline.

DVSA Industry Standard Specification

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2.3 The Braking Performance Value shall not:

a) Utilise inappropriate Braking Event Data, including but not limited to that generated during ABS cycling, or which includes inappropriate Demand Pressures or speeds or changes in speed.

b) Indicate a value where the Demand Pressure required to achieve said value cannot be supplied by the towing vehicle.

3.4 Verification of Function

The Information Document shall include results from practical tests which demonstrate that the EBPMS is capable of differentiating between different levels of braking performance on a single trailer.

DVSA Industry Standard Specification

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2.4.1 The Electronic Braking Performance Monitoring System shall include the following functionality:

a) To alert the vehicle operator by an appropriate means e.g. email, SMS etc, when a vehicle appears to be braking at a rate below its minimum prescribed in service braking performance.

b) To provide the vehicle operator with the ability to produce a Braking Performance Report.

c) To provide the vehicle operator with access to a system that allows historical Braking Performance Reports to be viewed for up to 36 months in the past and shall be verifiable as a true record.

d) The Braking Performance Report shall include supporting information indicating how the above requirements are fulfilled.

Dynamic Testing Track

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Compliance Document

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idem telematics cargofleet

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Document Name: EBPMSComplianceDVSAdoc Version: 3 **Issue Date: 18/04/19**

DVSA Electronic Brake Performance Monitoring System, (EBPMS), Industry Standard Specification **Compliance Document**

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General

Name of manufacturer: idem Telematics GmbH *(Supplied by BPW Limited in the UK)*
System name: cargofleet
Identification of unit(s): Gateway modem IMEI number
System variants: Gateway
Software version: GW.1.5.0ebpms-4 *(as at above Issue Date)*

Basic function / system philosophy:
The BPW idem "Gateway" EBPMS system monitors the brake performance of semi trailers and centre axle trailers during day to day operation. This continuous monitoring of the braking system allows the operator to produce performance reports at selected time intervals and, in particular, at the trailer's scheduled maintenance periods. Brake performance trends can be observed and any deterioration can be addressed during maintenance.

The "cargofleet" portal can generate either ad hoc reports for download or deliver scheduled auto-generated reports by e-mail. The report includes a brake performance value based upon the trailer's ECE R13 brake calculation and derived from the continuous sampling of the deceleration during each qualifying brake event and is expressed as a braking rate relative to the trailer's maximum rated axle loads at a given demand pressure. The brake performance value is presented as an average value of 'g' and is compared to the theoretical statutory minimum value specified for the category of vehicle.

Applications

a) **Vehicle types on which the Brake Performance Monitoring System may be Installed:**
All trailer pneumatically-operated braking systems with Electronic Braking System, (EBS), and utilising a 7-pin ISO7638 connector incorporating CAN data bus.

b) **Limitations in application or installation:**
1. During the hardware installation onto the trailer, the EBPMS is configured using data as shown on the manufacturer's Load Data and EBS Data plates. The brake performance values rely upon the accuracy of this information.
2. EBPMS system relies upon the tractor unit and trailer system being balanced.
3. EBPMS data will not be produced for trailers coupled with tractor units, which are not of a specification able to send CAN bus data.

Environmental Protection

Approvals / Certificates:
ECE10R-047670
CE
FCC
ROHS-compliant

DVSA Electronic Brake Performance Monitoring System, (EBPMS), Industry Standard Specification **Compliance Document**

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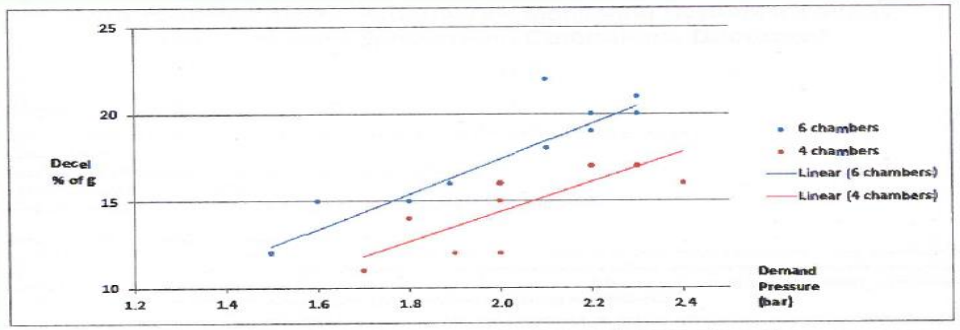
Verification of Function

Practical test results to demonstrate that the EBPMS is capable of differentiating between different levels of braking performance on a single trailer.



Deceleration comparisons with 6 brake chambers in operation vs 4 brake chambers in operation
Location: Bruntingthorpe
Date: 8th November 2018

Test Procedure EBPMS trailer

1. Load trailer with 2.5 tonne concrete blocks, six or seven directly over bogie and two over the kingpin to give approximate total bogie load of 20 tonnes and kingpin of 7 tonnes.
2. Carry out initial road run to get brakes to operating temperature.
3. Carry out Roller Brake Test, (RBT), and obtain read out.
4. Position trailer over pit and carry out inspection of EBPMS-spec Gateway installation.
5. Interrogate EBS and download mapping and Haldex Fleet Logger data.
6. Log on to cargofleet portal and download EBPMS latest brake report.
7. Travel to Bruntingthorpe Airfield and carry out controlled brake runs.
8. Carry out run to determine resistance value due to drag and rolling friction.
9. Carry out run to determine tractor engine retarder effect.
10. Carry out several runs with brake demands at between 2 and 3 bar.
11. Blank off brake chambers on one axle and carry out runs with brake demands at 2 to 3 bar.
12. Log on to cargofleet portal and download EBPMS latest brake report.

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Behind the scenes

The Industry Standard tells us that the data and reporting from an EBPMS system should enable us to compare that with the results from roller brake testing. There are major and significant differences when comparing this data:

- **RBT –** is a static (laden) test of the trailer only.
- **EBPMS –** is a measure of the braking performance of the combination.
- **Data Filtering –** to ensure that reliable data is recorded and used in reporting.
- **External Influences –** e.g. allowance for travelling up or down hills as one example

Influences on Deceleration - Combination

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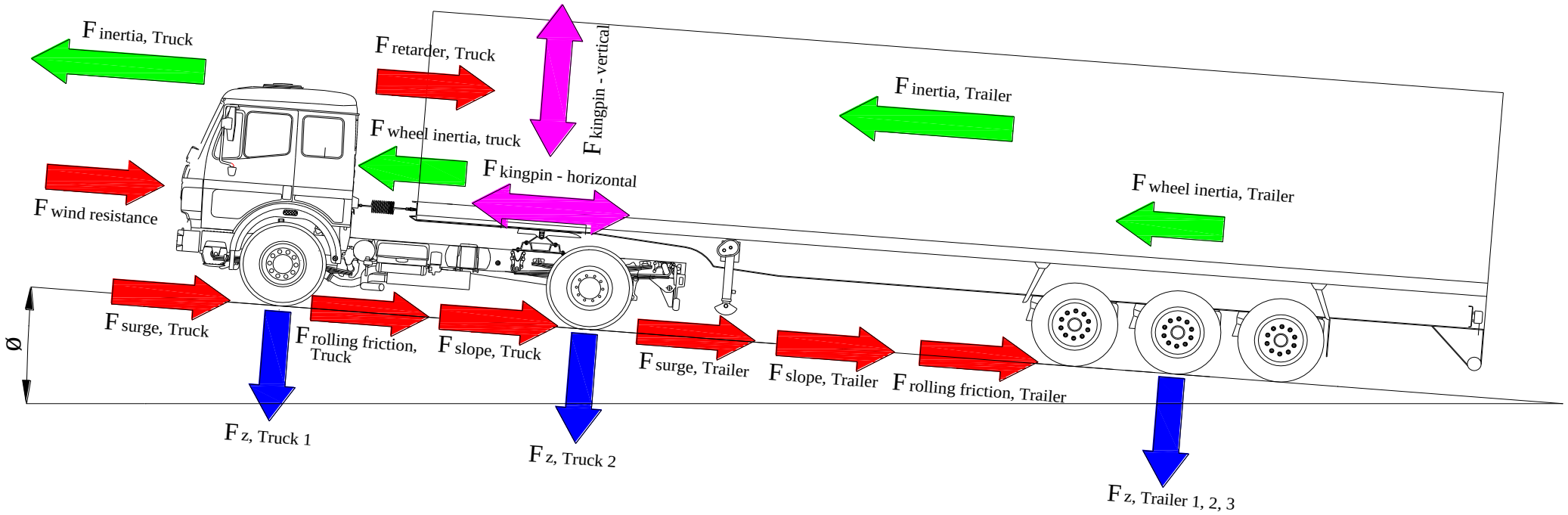

Dynamic Braking – Weight Transfer

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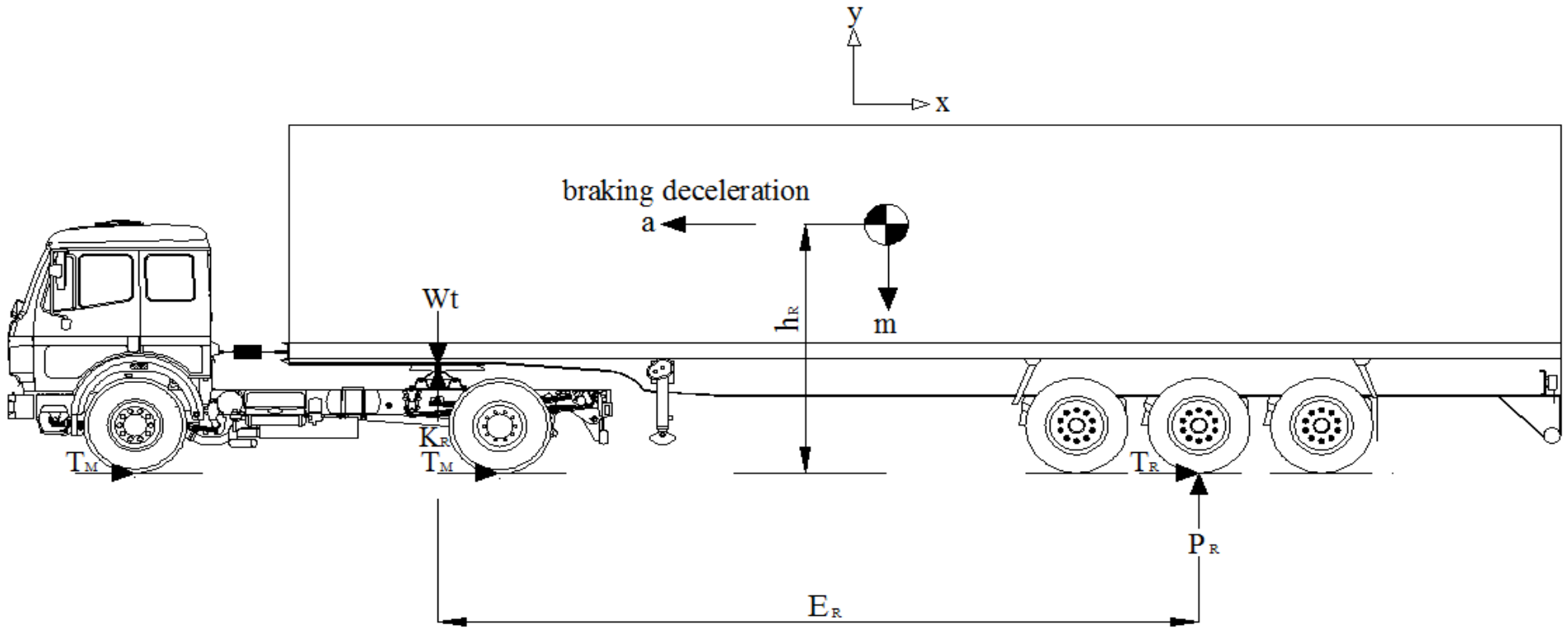

Weight transfer (W_t) = $m.a.(h_R/E_R)$

Driver Demand Pressure

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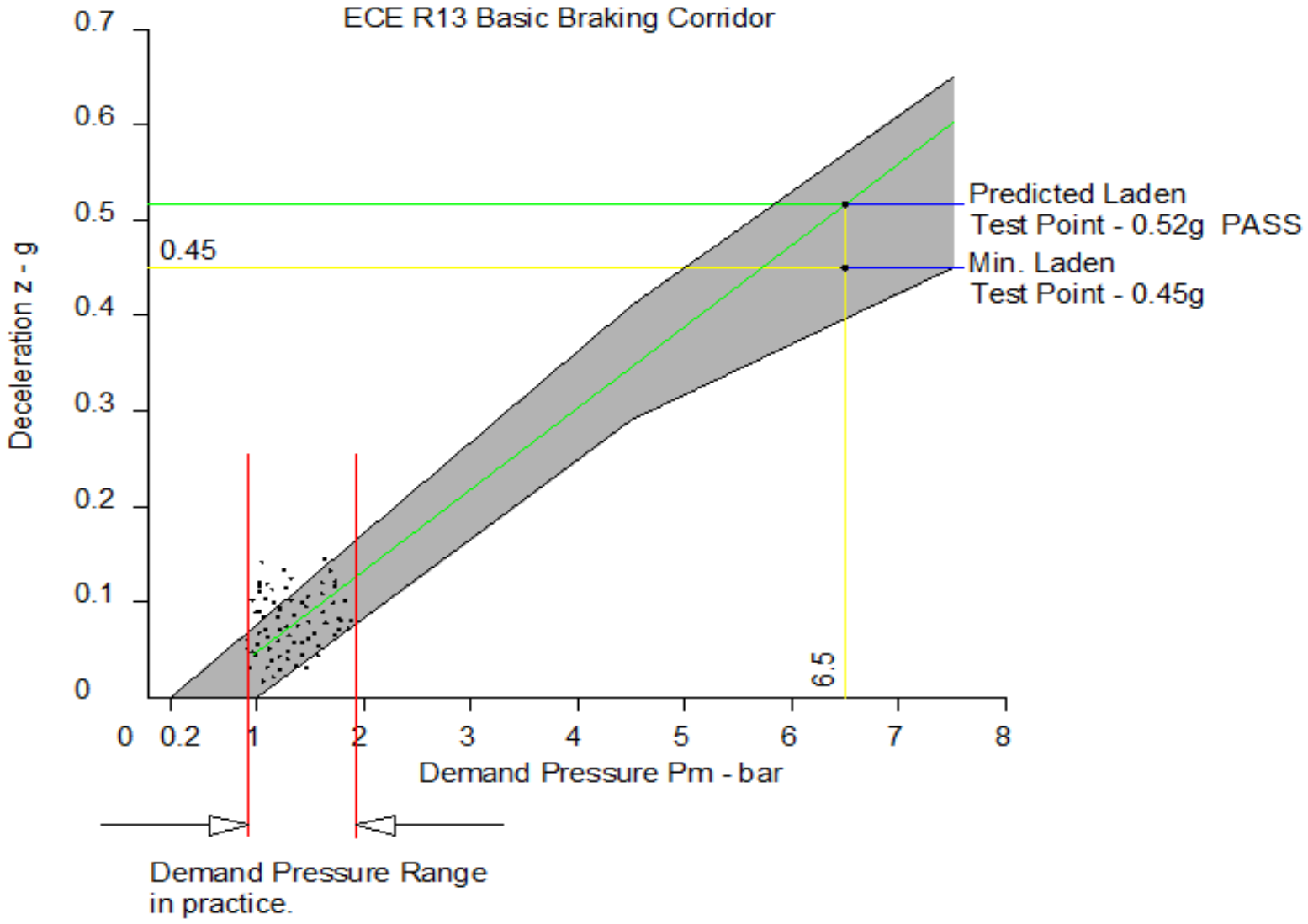

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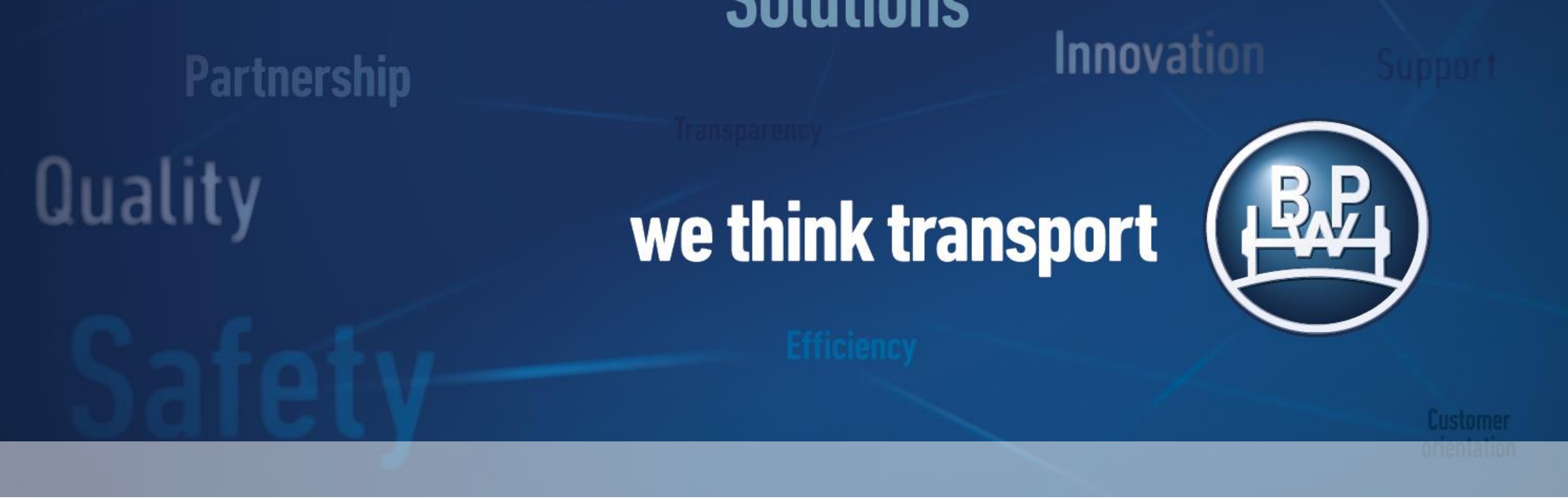
Things to consider:

- Don’t forget that the EBPMS report is for the tractor/trailer combination – remember this when trouble shooting.
- Don’t forget that the driver is an element in this system!
- Don’t forget that short or unusual trips may slew your data.



Thank you very much for your attention!

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