Performance Based Brake Testers. What are they and how are they used?

PBBT

- Official definition of a PBBT:

> "A PBBT (performance-based brake tester) is a device that can assess vehicle braking capability through quantitative measure of individual wheel brake forces or overall vehicle brake performance in a controlled test." (US 67 CFR 51770)

- Numerous brake performance testing tools and methods exist
- Several are illustrated in the following slides
- PBBT can measure brake forces WITHOUT RESTRICTION to:
  - Vehicle* or axle type (tractor, trailer, single-unit vehicle, steer, non-steer),
  - Brake type (disc vs. drum), or
  - Energy supply (air, hydraulic, electric, or lever & cable).

yno)

Fixed Facility Roller Dyno PBBT

Portable Roller Dyno PBBT

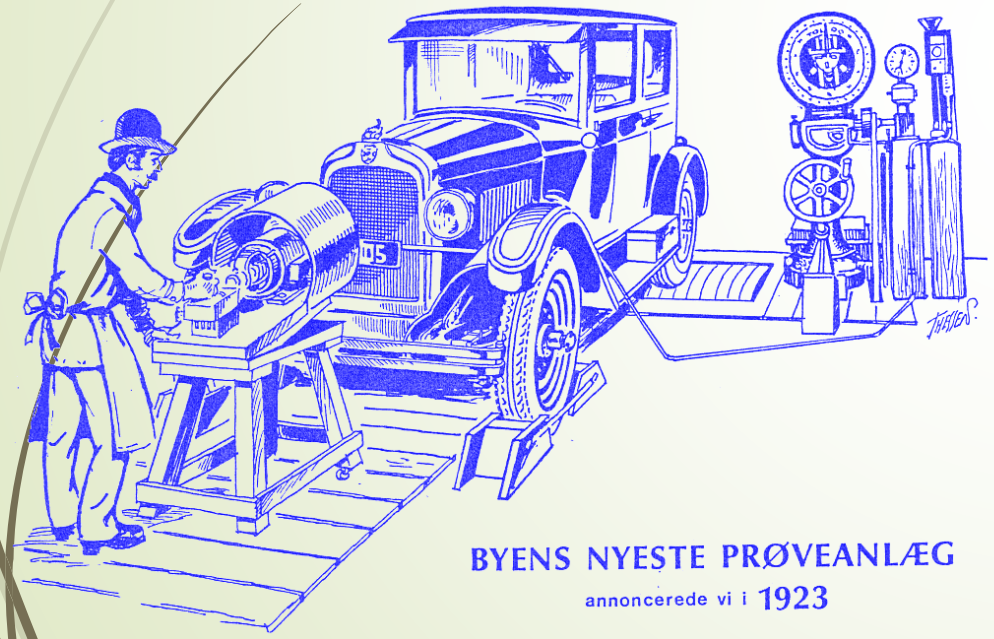
- Only roller dynamometer (roller-dyno) PBBT are approved and available for enforcement use in North America. **Therefore, for the purposes of this presentation we will use acronym *PBBT* synonymously with *roller dynamometer performance-based brake tester.***

Roller-Dyno PBBT

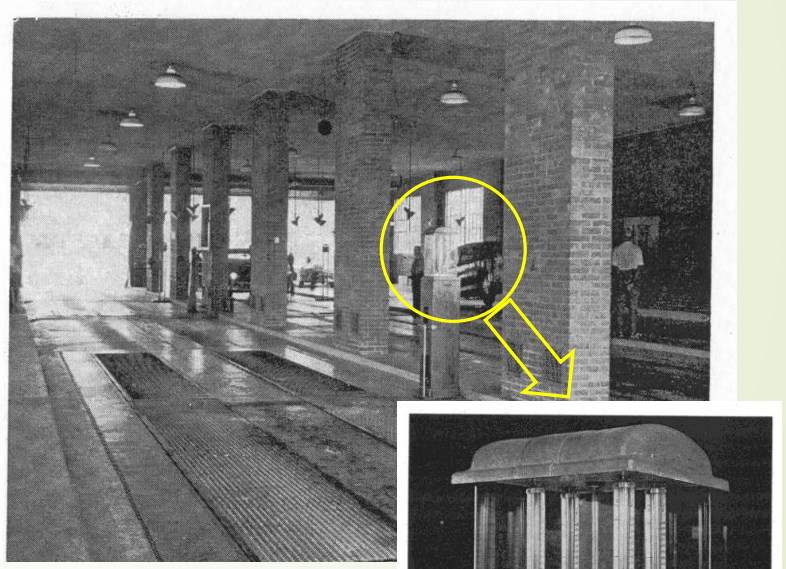
- A roller-dyno uses calibrated rollers that slowly rotate each wheel end as the driver gradually applies the brakes to a full application
- Each wheel end is tested independently
- The vehicle remains stationary as the rollers rotate the wheels throughout testing each axle.
  - There is minimal risk to the tires or the load during this type of test.
- Portable units are versatile tools for roadside enforcement.

PBBT History and Use Worldwide

- PBBTs have been in use to assess vehicle braking capability for more than 90 years. (Decelerometers for more than a century)
- Currently there are more than 150,000 PBBTs are in use worldwide



1923 – 1st Roller Dynamometer Patent



1950s
Flat plate tester used in Washington DC area.

What PBBTs Can and Cannot Do

A PBBT ONLY measures those things affecting either Brake Force or Weight, **not** visual defects

PBBTs **Can** Identify:

- Low friction between brake pad and drum/disc (poor quality pads or glazed brakes)
- Inadequate contact area between brake pad and drum/disc (i.e., non-conformal fit)
- Low force pressing brake pad against drum/disc (mechanical or air problem)

PBBTs **Cannot** "See":

- Actual Brake Stroke
- Lining Thickness
- Air Leaks
- Rear brake lamps or ABS dash icons that do not illuminate

Problems a Roller Brake Tester May Uncover

- Defective automatic slacks (under- and over-adjusted)
- Disconnected brakes
- Poor low-pressure balance between tractors and trailers (causing excessive wear and premature trailer or tractor wheel lockup)
- Very high crack pressures on steering axles (increases jackknife risk)
- Reversed bobtail proportioning systems (proportioning when trailer attached)
- Broken parking brake springs
- "Crossed" ABS wiring
- Pinched or blocked air lines (one vehicle had no front brakes)
- Sticking or frozen relay valves and QR valves
- Brakes adjusted "backwards" by mechanics
- Improperly ground shoes (low brake output)
- Leaking grease seals
- "Cammed over" S-cams

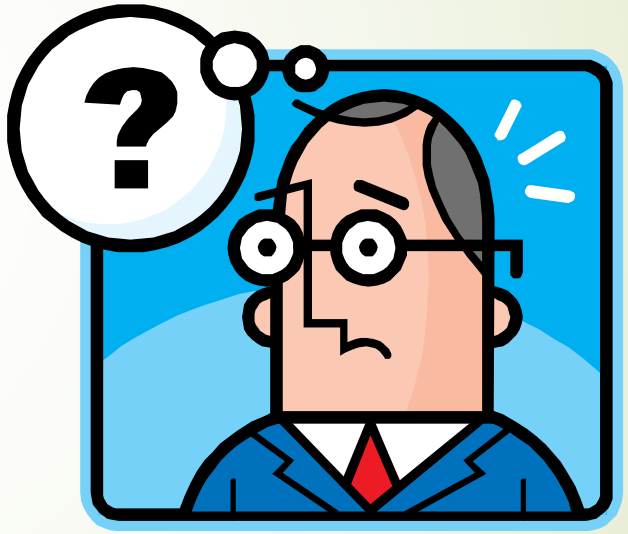
Why do we need these in Maine?

- Maine is seeing a large increase in CMVs with Electric braking systems
- Newer trucks have much more shielding on the braking components so it is more difficult to also inspect.
- We as both industry and enforcement can benefit from better brake analysis.
- Nationally truck crashes are increasing with CMV >26,000GVWR

Braking Force as Percentage of GVW[5]

What does that mean?

43.5%



[5] GVW in the context of a PBBT test is the sum of dynamic wheel loads measured during the test. This value is not necessarily equivalent to a static weigh for weight enforcement.

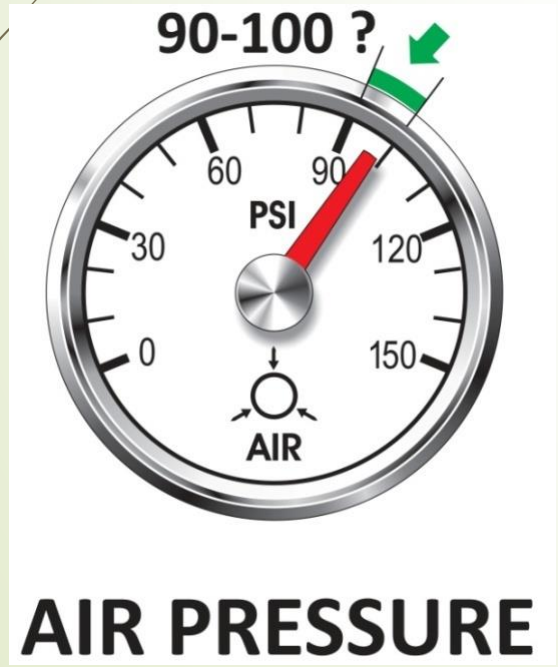
- The minimum PBBT pass/fail requirement is **43.5%** (for passenger and property carrying CMVs > 10,000 lbs).
- An overall ratio of total braking force over gross vehicle weight **at or above the listed requirement is a passing** PBBT result.
- A PBBT result **less than 43.5%** means **inadequate** braking performance.
- Individual brakes can be weak (or inoperative), but the **OOS** is based on **overall vehicle** braking performance

Explaining a PBBT Test To Drivers

- Greet the driver and explain the purpose of the test
  - The PBBT will slowly rotate the wheels and measure braking performance capability
  - The test is designed to not endanger the vehicle or the load
- Driver Expectations
  - There are only four basic things you need to communicate to a driver for a proper test.

Driver Expectations
1 - Have enough Air Pressure

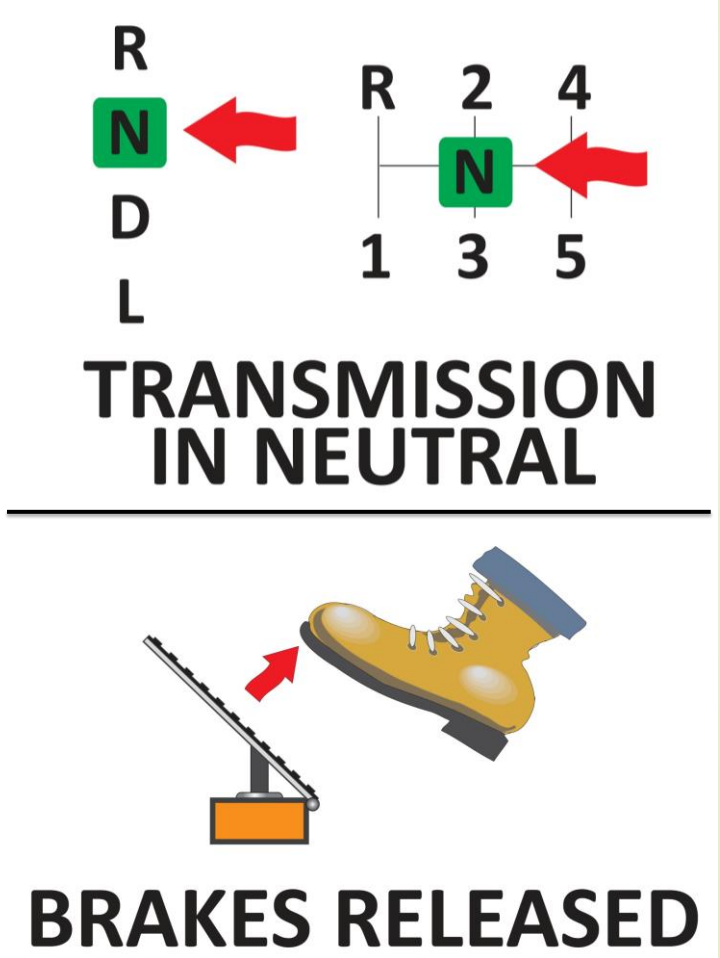
- Air pressure should be at least 90 psi for each axle tested
  - Ask the driver to alert you if the air pressure drops below 90 psi, and allow them to increase it
  - They are only hurting themselves if the air pressure is lower; low air pressure limits the maximum BF



- Advise the driver to hold the steering wheel firmly when testing the steer axle, and to steer if the vehicle starts to move sideways across the rollers.

Driver Expectations
2 - Relax for Rolling Resistance Measurement

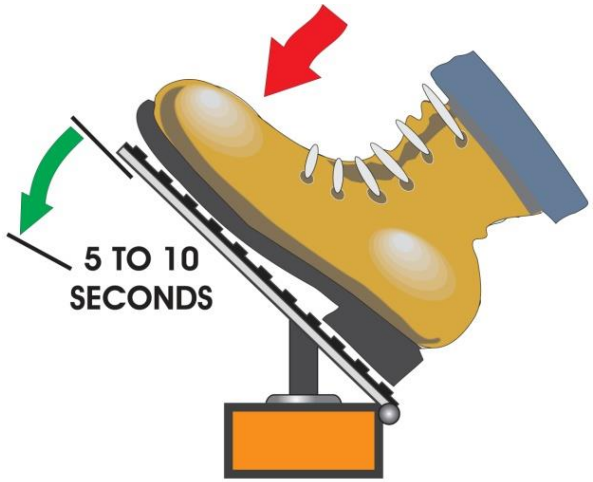
- During the rolling resistance measurement, for each axle…
  - The vehicle should be in neutral
  - The brakes should be off



Driver Expectations

3 - Apply the Brakes Slowly

- Brakes should be slowly and steadily applied over several seconds
- Have the driver slowly count to 10 during the brake application
- Do a chant: "One, two, three, four… all the way to the floor"



APPLY BRAKES SLOWLY

Driver Expectations

4 - Brakes Should End Up Fully Applied

- At the end of testing each axle, the brakes should be fully applied and firmly held. Not pressing firmly, increases chances of failing the test.
- Hold steady if no wheel lock-up.
- Tell the driver to release after test is completed.

PBBT Results Example

Location:	Terre Haute Scale
Vehicle ID:	WI 123-UFO
Inspector ID:	Doe - 407
Test #:	4376
Date:	1/16/23
Time:	4:13 PM

PASS or FAIL RESULT:
Overall Vehicle

51.2

Failure Limits (FMCSR § 393.52):

Passenger-Carrying Vehicles

- ☐ 65.2 – Vehicles w/seating capacity of 10 or less (w/driver), built on passenger car chassis
- ☐ 52.8 – Vehicles w/seating capacity more than 10 (w/driver), built on passenger or truck chassis with GVWR, 10,000 lbs.
- ☐ 43.5 – All other passenger-carrying vehicles (motorcoach)

Property-Carrying Vehicles

- ☐ 52.8 – Single unit vehicles less than 10,000 lbs. GVWR
- ☒ 43.5 – All other property-carrying vehicles and combinations of property-carrying vehicles

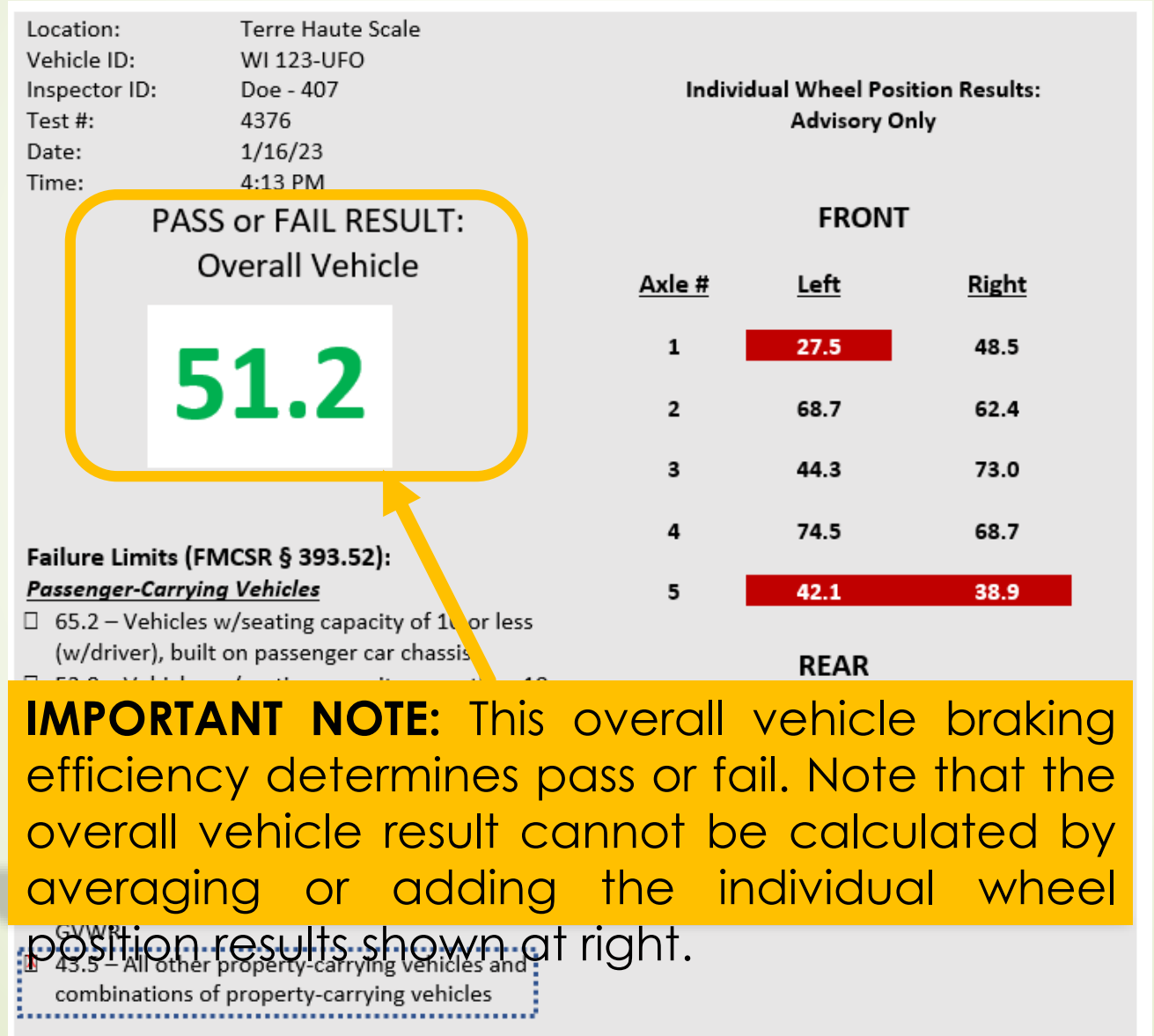
Individual Wheel Position Results:
Advisory Only

FRONT

Axle #	Left	Right
1	27.5	48.5
2	68.7	62.4
3	44.3	73.0
4	74.5	68.7
5	42.1	38.9

REAR

Interpreting PBBT Results



IMPORTANT NOTE: This overall vehicle braking efficiency determines pass or fail. Note that the overall vehicle result cannot be calculated by averaging or adding the individual wheel position results shown at right.

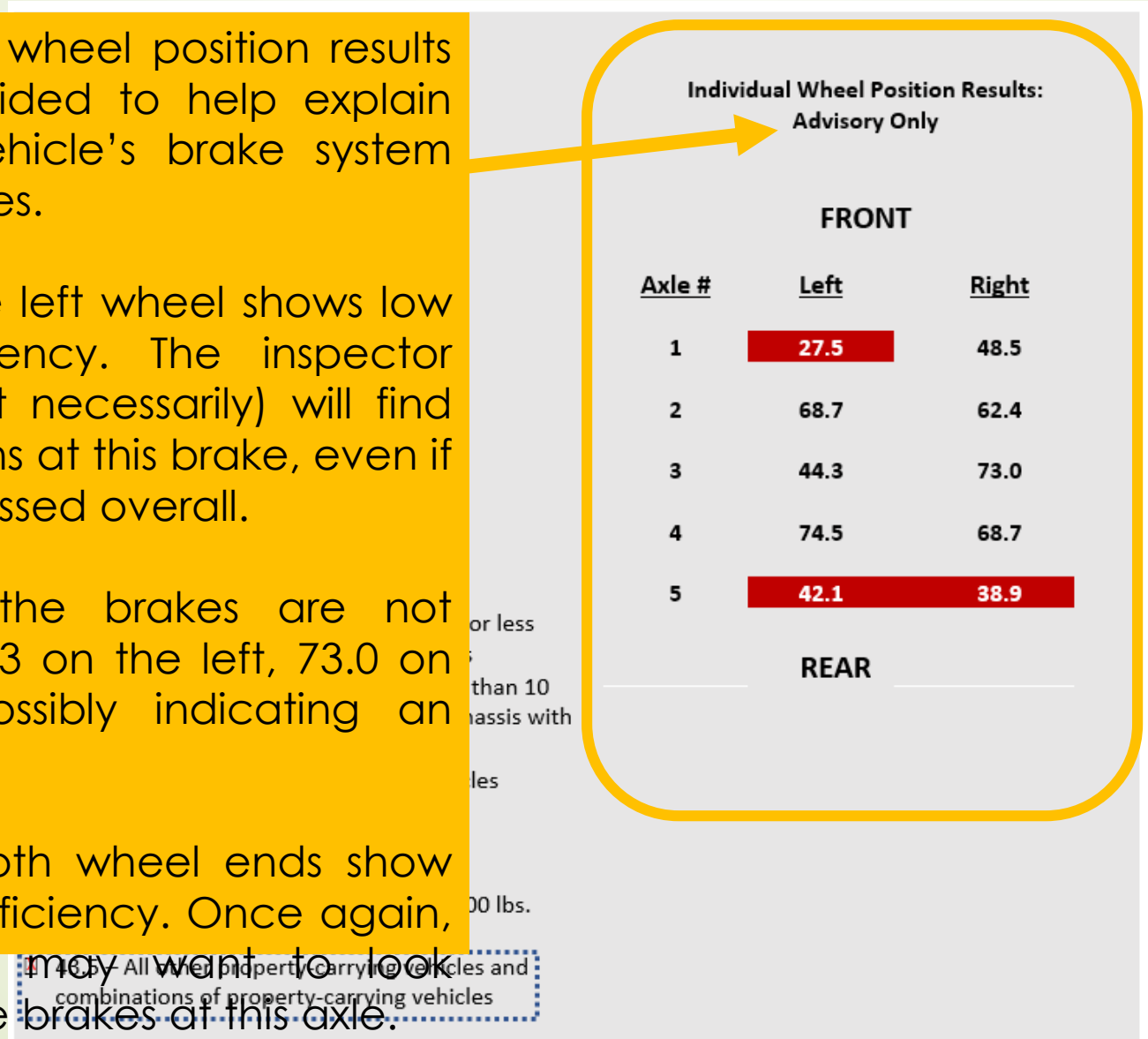
Interpreting PBBT Results

The individual wheel position results are only provided to help explain where the vehicle's brake system may have issues.

On Axle 1, the left wheel shows low braking efficiency. The inspector often (but not necessarily) will find visible violations at this brake, even if the vehicle passed overall.

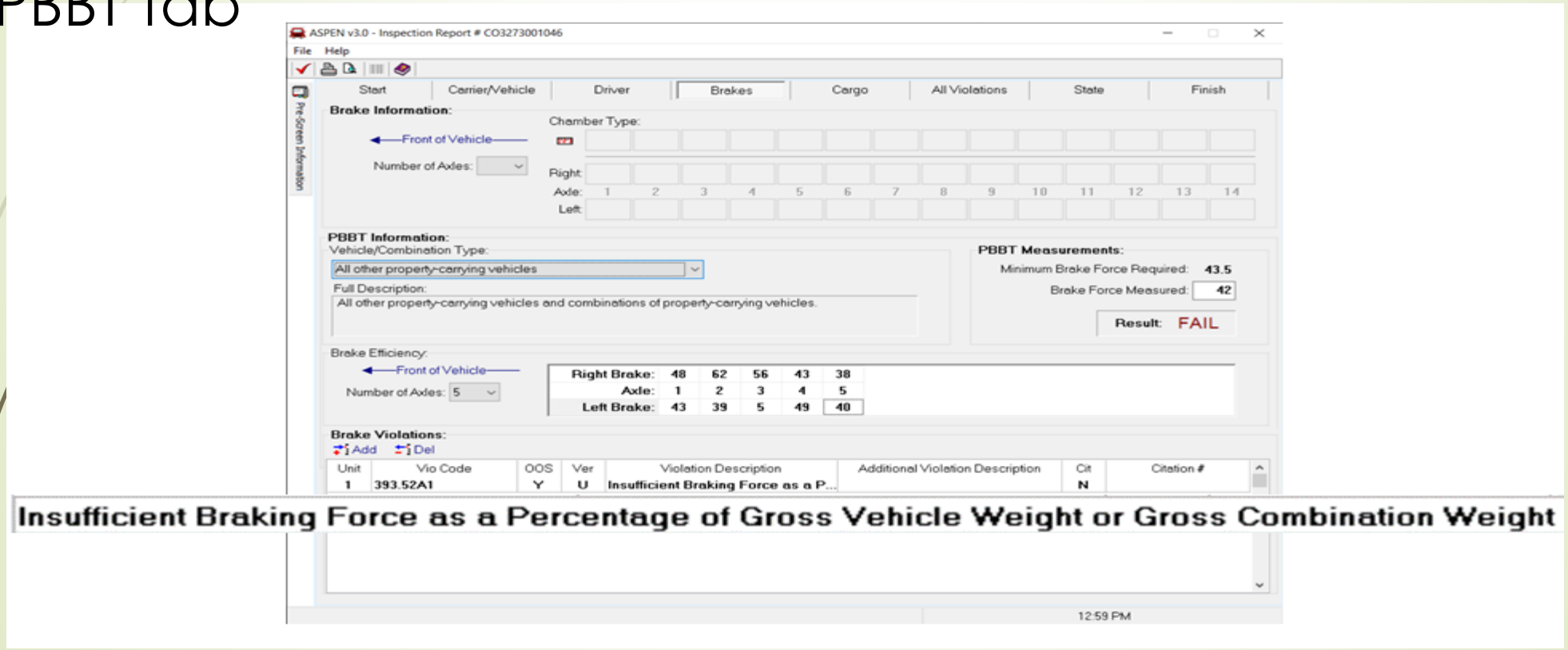
On Axle 3, the brakes are not balanced (44.3 on the left, 73.0 on the right), possibly indicating an issue.

On Axle 5, both wheel ends show low braking efficiency. Once again, the inspector may want to look carefully at the brakes at this axle.



Entering PBBT Information Into ASPEN

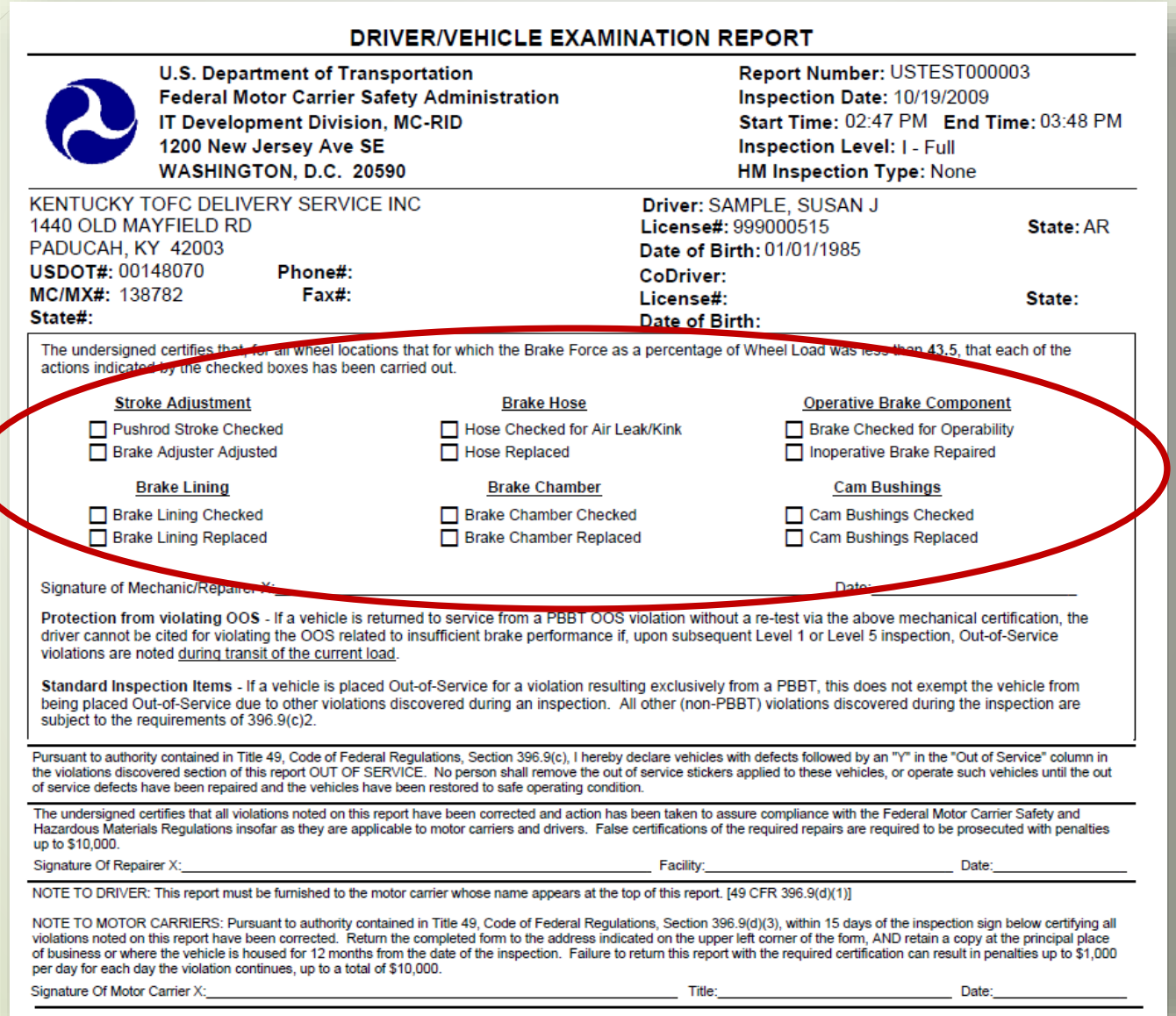
- A PBBT Violation appears automatically when a failing PBBT result is entered into the PBBT measurements on the PBBT tab



Conditions for Placing a Vehicle OOS Using a PBBT

1. The vehicle must have a PBBT result less than 43.5% (or appropriate value listed in **FMCSR 393.52**)
2. The PBBT must meet the PBBT Functional Specifications, as published in the U.S. Federal Register (65 FR 48799)
3. The PBBT must be in calibration at the time of the test
4. The inspector must be trained in the proper operation of the PBBT
5. The inspector must have followed the PBBT standard test procedure

Return to Service after Repair Mechanic/Repairer Checklist



DRIVER/VEHICLE EXAMINATION REPORT

U.S. Department of Transportation
Federal Motor Carrier Safety Administration
IT Development Division, MC-RID
1200 New Jersey Ave SE
WASHINGTON, D.C. 20590

Report Number: USTEST000003
Inspection Date: 10/19/2009
Start Time: 02:47 PM **End Time:** 03:48 PM
Inspection Level: I - Full
HM Inspection Type: None

KENTUCKY TOFC DELIVERY SERVICE INC
1440 OLD MAYFIELD RD
PADUCAH, KY 42003
USDOT#: 00148070 **Phone#:**
MC/MX#: 138782 **Fax#:**
State#:

Driver: SAMPLE, SUSAN J
License#: 999000515 **State:** AR
Date of Birth: 01/01/1985
CoDriver:
License#: **State:**
Date of Birth:

The undersigned certifies that, for all wheel locations that for which the Brake Force as a percentage of Wheel Load was less than 43.5, that each of the actions indicated by the checked boxes has been carried out.

Stroke Adjustment	Brake Hose	Operative Brake Component
☐ Pushrod Stroke Checked	☐ Hose Checked for Air Leak/Kink	☐ Brake Checked for Operability
☐ Brake Adjuster Adjusted	☐ Hose Replaced	☐ Inoperative Brake Repaired
Brake Lining	**Brake Chamber**	**Cam Bushings**
☐ Brake Lining Checked	☐ Brake Chamber Checked	☐ Cam Bushings Checked
☐ Brake Lining Replaced	☐ Brake Chamber Replaced	☐ Cam Bushings Replaced

Signature of Mechanic/Repairer X:_____ Date:_____

Protection from violating OOS - If a vehicle is returned to service from a PBBT OOS violation without a re-test via the above mechanical certification, the driver cannot be cited for violating the OOS related to insufficient brake performance if, upon subsequent Level 1 or Level 5 inspection, Out-of-Service violations are noted during transit of the current load.

Standard Inspection Items - If a vehicle is placed Out-of-Service for a violation resulting exclusively from a PBBT, this does not exempt the vehicle from being placed Out-of-Service due to other violations discovered during an inspection. All other (non-PBBT) violations discovered during the inspection are subject to the requirements of 396.9(c)2.

Pursuant to authority contained in Title 49, Code of Federal Regulations, Section 396.9(c), I hereby declare vehicles with defects followed by an "Y" in the "Out of Service" column in the violations discovered section of this report OUT OF SERVICE. No person shall remove the out of service stickers applied to these vehicles, or operate such vehicles until the out of service defects have been repaired and the vehicles have been restored to safe operating condition.

The undersigned certifies that all violations noted on this report have been corrected and action has been taken to assure compliance with the Federal Motor Carrier Safety and Hazardous Materials Regulations insofar as they are applicable to motor carriers and drivers. False certifications of the required repairs are required to be prosecuted with penalties up to $10,000.

Signature Of Repairer X:_____ Facility:_____ Date:_____

NOTE TO DRIVER: This report must be furnished to the motor carrier whose name appears at the top of this report. [49 CFR 396.9(d)(1)]

NOTE TO MOTOR CARRIERS: Pursuant to authority contained in Title 49, Code of Federal Regulations, Section 396.9(d)(3), within 15 days of the inspection sign below certifying all violations noted on this report have been corrected. Return the completed form to the address indicated on the upper left corner of the form, AND retain a copy at the principal place of business or where the vehicle is housed for 12 months from the date of the inspection. Failure to return this report with the required certification can result in penalties up to $1,000 per day for each day the violation continues, up to a total of $10,000.

Signature Of Motor Carrier X:_____ Title:_____ Date:_____

Video

Questions?

Presented by Stephen Hills