

# FTA

FEDERAL TRANSIT ADMINISTRATION

## Lowering Maintenance Costs with Bus Testing October 10, 2019

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# Bus Testing Report Numbering

- PTI and LTI – Larson Transportation Institute at Penn State University – operator of the Altoona Bus Testing Center
- First two digits – year test started\*
- Second two digits – sequence within that year
- -P indicates a Partial Testing Report
- LTI-BT-R1234 – Full test of 34<sup>th</sup> bus to begin in 2012
- PTI-BT-R0123-P – Partial test of 23<sup>rd</sup> bus to begin in 2001

\* Buses that started testing in 2000 are numbered 20XX

# Partial Testing Reports

- A previously-tested bus model that is produced with major changes may be eligible for Partial Testing – only those tests that might be expected to produce significantly different data need to be repeated
- The remaining data is available from one or more full Bus Testing Reports on the related “baseline” model

# There is a lot of specific information on a bus model in a Bus Testing Report

- Bus characteristics
  - Photos
  - Installed equipment
  - Weights and dimensions
- Overall performance
- Descriptions, photos, and classifications of failures
  
- Bus Testing Reports can be used in many ways to reduce maintenance costs, including. . .

# Bus Model Selection

- Compare Bus Testing Reports for competing bus models
  - Score (since Pass/Fail)
  - Unscheduled maintenance hours (since Pass/Fail)
  - Number and types of failures
    - Safety hazards (Class 1) or road calls (Class 2)
    - Just a few failures of low-cost, discrete, and easily-replaced parts
    - Recurring minor (or major) problems – development issues vs. fundamental problems
    - Major structural/system failures
  - Accessibility for maintenance
- Validate manufacturer claims
  - EV driving range
- It's risky to acquire a bus model that has not yet been tested
  - Bus model could be unreliable or unsafe
  - Bus model might fail the test and remain ineligible for FTA funding

# Procurement Remedies

If testing identified one or more significant failure modes but the recipient feels they need to acquire that specific bus model anyway, they can try to negotiate with the manufacturer for:

- Extended warranty on the bus structure
- Extended warranty on specific parts or systems
- Liquidated damage clauses
- Buy-back provisions
- Termination for cause
- Lease instead of purchase

# Targeted Preventative Maintenance

- True story. Two transit agencies in the same geographic area acquired the same bus model.
- One TA had recurring shock mount failures.
- The other TA noted shock bushing failures in the Bus Testing Report and proactively replaced the rubber bushings as part of their PM program. They had no shock mount failures.

# Anticipating Spare Parts to Stock

- Bus Testing Reports reveal components that may fail or wear prematurely.
- Stocking these spare parts will significantly reduce downtime.
- Parts that have had repeated failures on certain bus models include:
  - Suspension airbags
  - Shock absorbers
  - Anti-sway bars



# Pass/Fail Protects Grantees from Problem Bus Models

- Pass/Fail went into effect in late 2016.
- Since then, more than one bus model has been withdrawn from testing because it was on-track to receive a FAIL rating.
- Some bus models tested prior to Pass/Fail would not have passed.

# Examples of Failures by Class

Failure Class	Examples
<p><b>Class 1 – Physical Safety Hazard</b> (Potential for serious injury or severe crash)</p>	<p>Brakes fail; steering fails; wheel falls off; fire.</p>
<p><b>Class 2 – Road Call</b> (Bus inoperable causing interruption in revenue service)</p>	<p>Engine won't run, transmission won't engage, blown suspension airbag, flat tire, major structural failure, rapid fluid loss, low/no air pressure.</p>
<p><b>Class 3 – Bus Change</b> (Bus is operational but must be removed from service until repaired)</p>	<p>Moderate fluid leaks, door failure, soft tire, ADA lift or ramp inop.</p>
<p><b>Class 4 – Degraded operation</b> (Degrades operation, may be repaired during next scheduled service interval)</p>	<p>Slight fluid leaks or seepage, trim loose, interior lights not working.</p>

## Failures observed in first 16 years of Bus Testing (303 Buses Tested – through 12/31/06)

Quantity and Class of Failures		Number of Failures	Average Failure Rate (failures/bus)
Class 1	Physical Safety Hazard	38	0.13
Class 2	Road Call	147	0.49
Class 3	Bus change	3,545	11.70
Class 4	Degraded operation	3,704	12.22
Total Number of Failures		7,434	24.53

# Failures observed to date

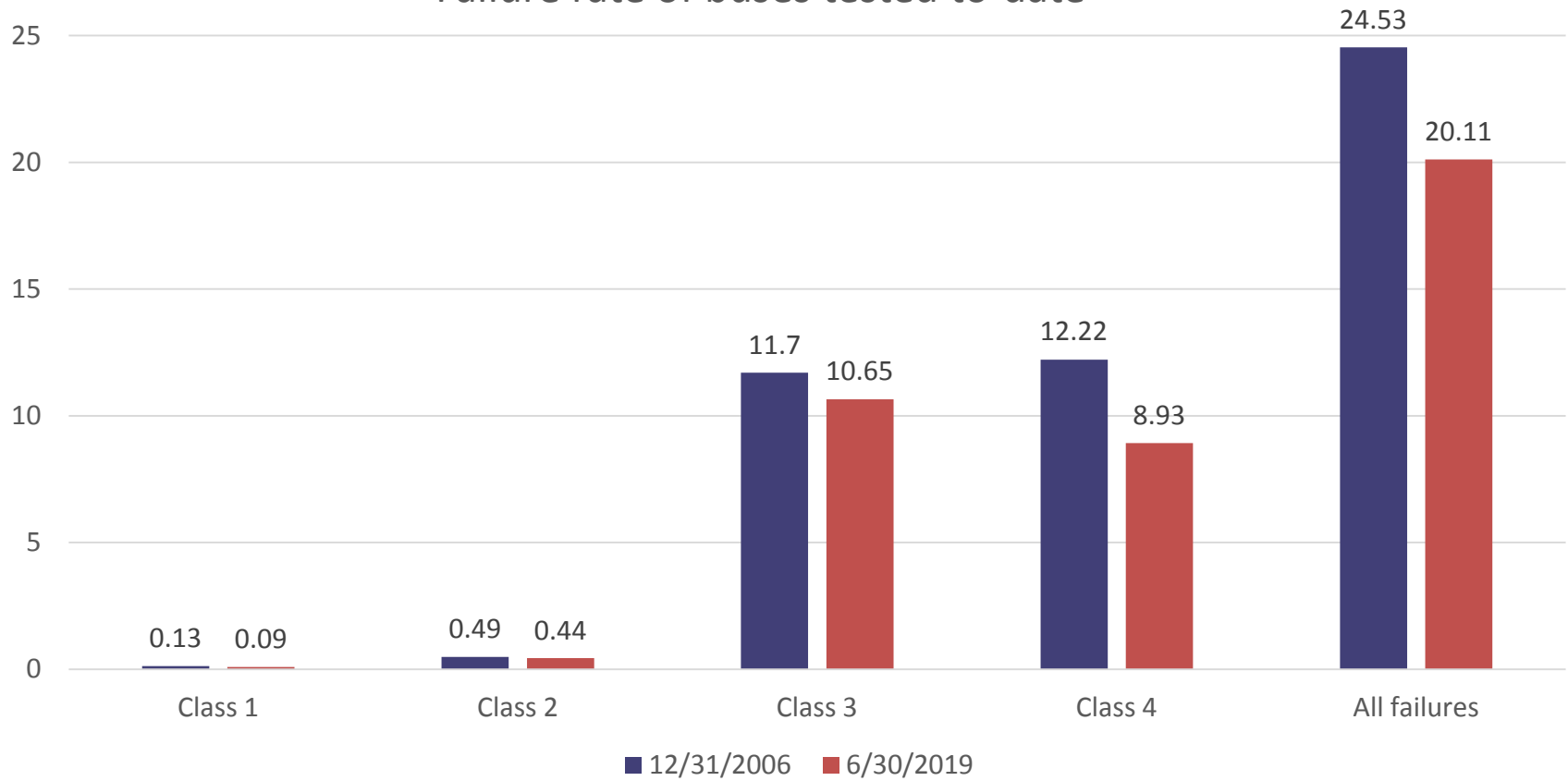
(486 Buses Tested – through 06/30/19)

Quantity and Class of Failures		Number of Failures	Average Failure Rate (failures/bus)
Class 1	Physical Safety Hazard	46	0.09
Class 2	Road Call	215	0.44
Class 3	Bus change	5,175	10.65
Class 4	Degraded operation	4,338	8.93
Total Number of Failures		9,774	20.11

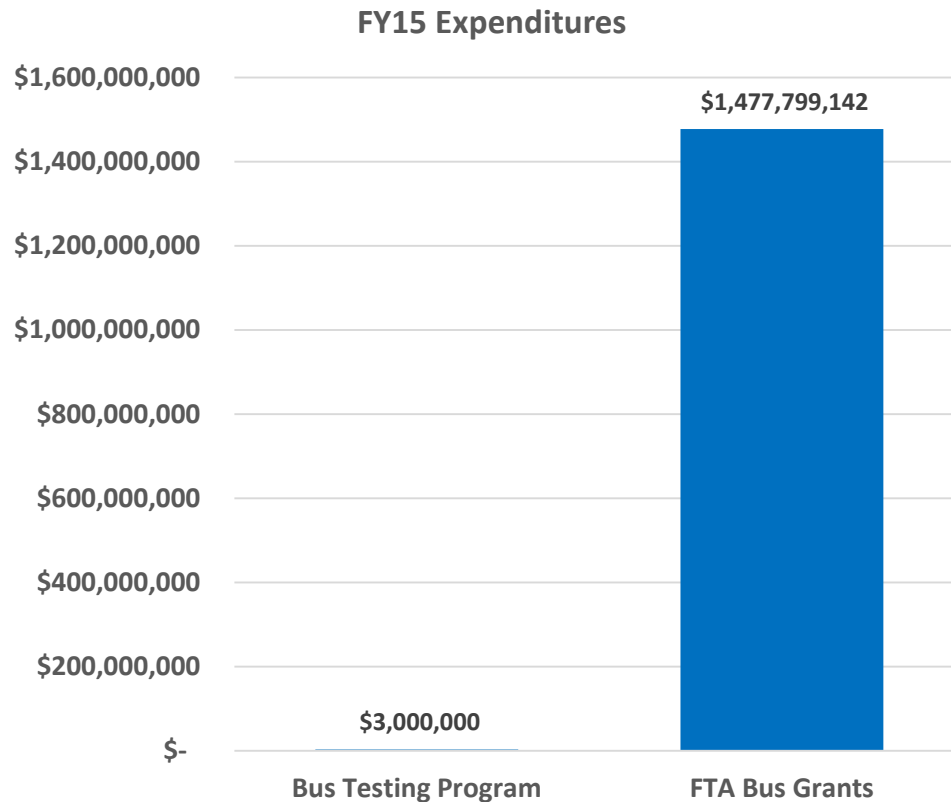
# Buses are getting more reliable

Difficult to prove, but intuition says Bus Testing “weeds out” marginal bus models and manufacturers, and “raises the bar” for those that remain

Failure rate of buses tested to-date



# The Bus Testing Program is Cost-Effective



# Bus Testing Report example

Visit [www.altoonabustest.org](http://www.altoonabustest.org) and review the most recently published full Bus Testing Report

- Executive Summary
  - Highlights of problem areas
  - Failure numbers and classification
  - Unscheduled maintenance hours
- Vehicle Data Form
- Maintainability
- Structural Durability
  - Failure details and individual repair times



Administrat