

# An Introduction to OBDII Test Result Evaluation

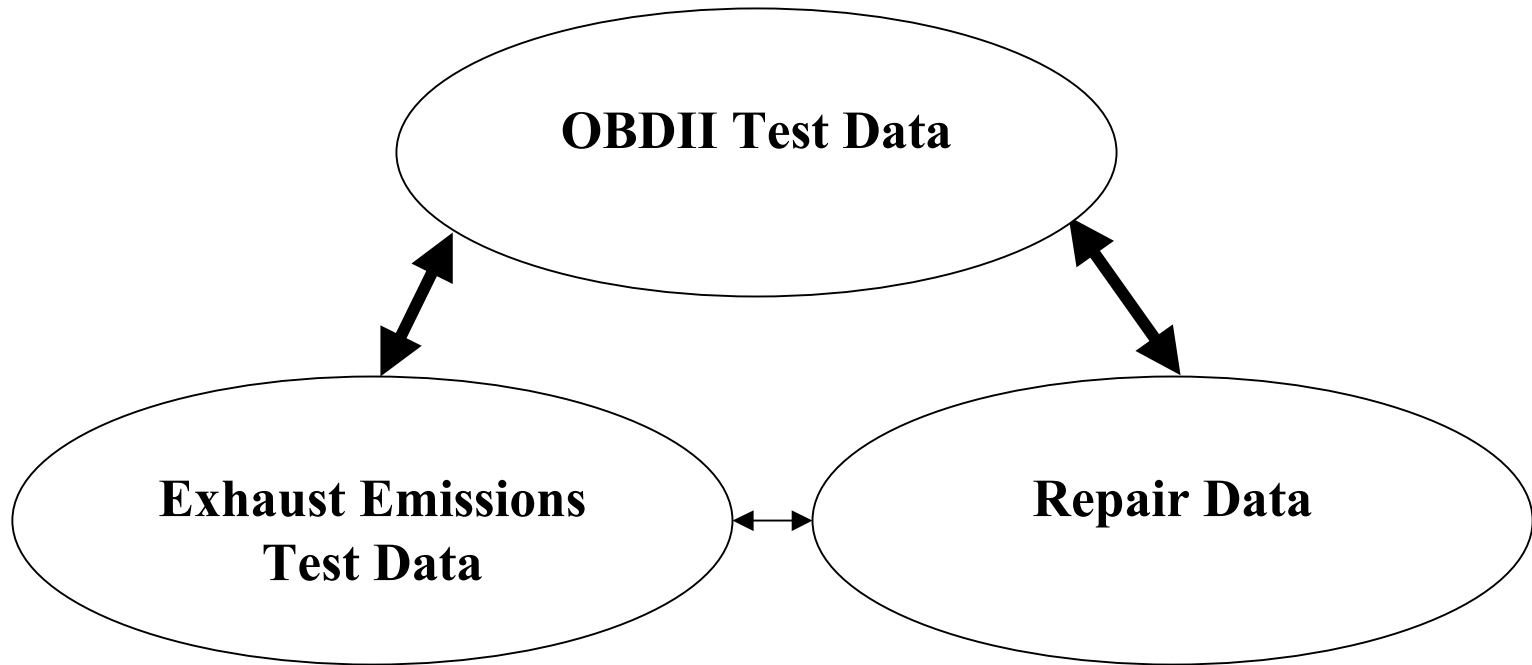
OBD2K2 Conference

May 24, 2002

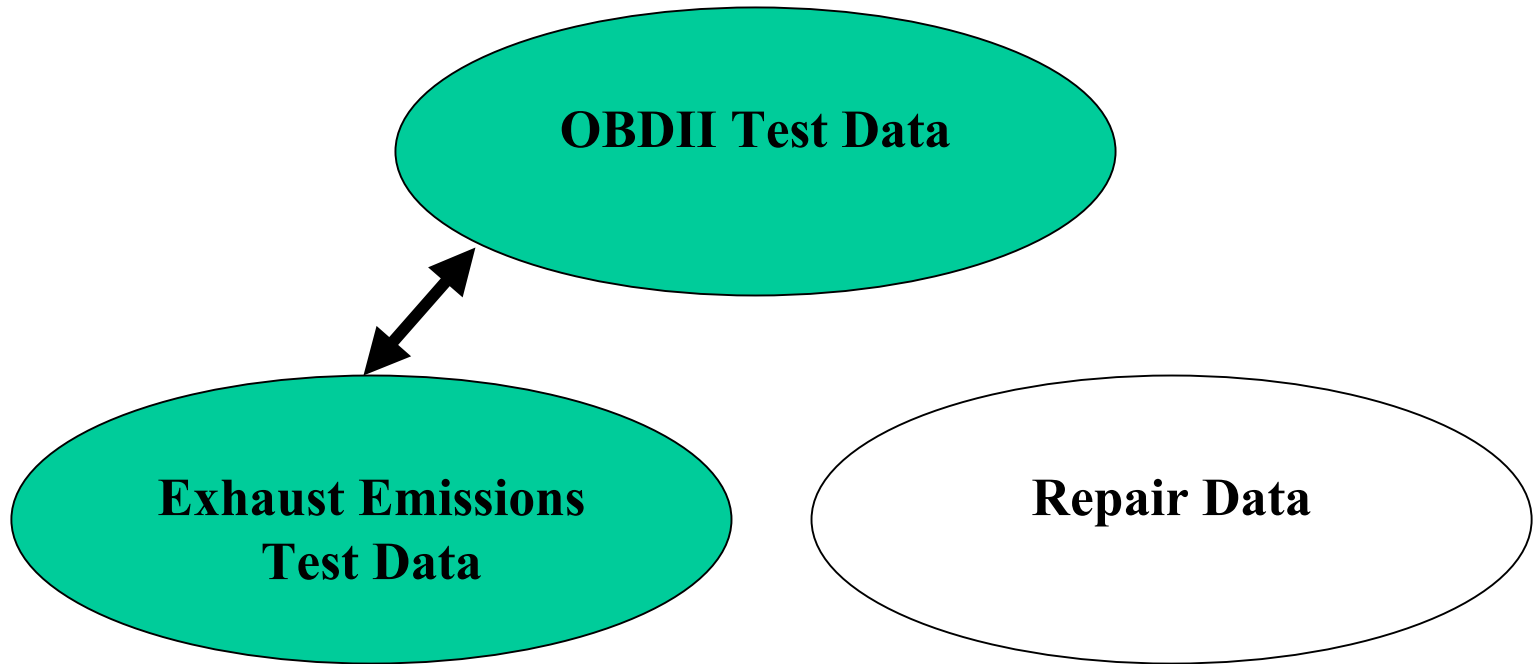
Michael Sabisch, ERG



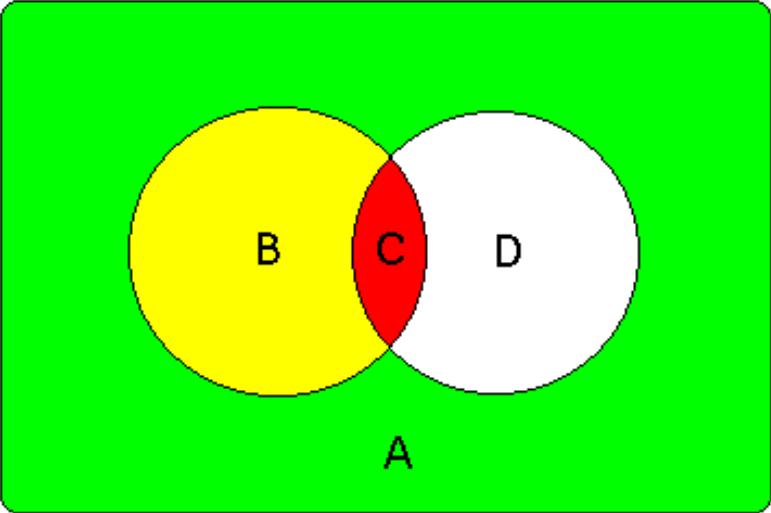
# Motivation for Analysis



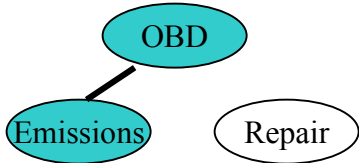
# OBDII / Exhaust

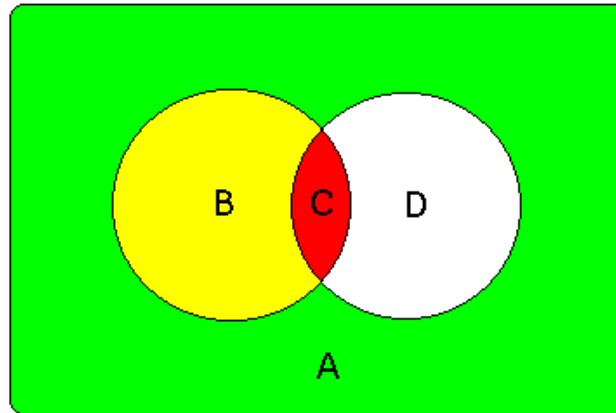


# OBD vs. Exhaust Test Outcomes

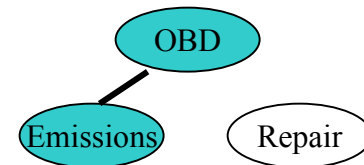


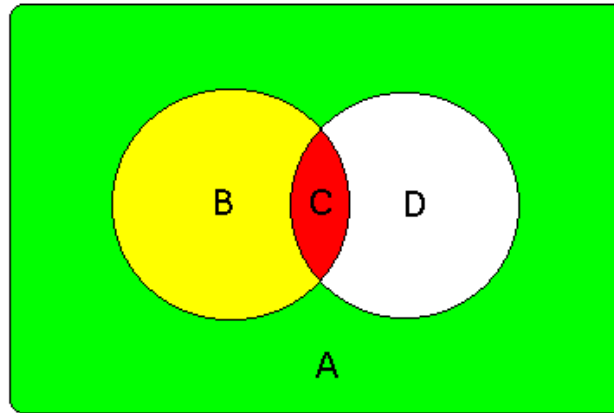
Region	OBDII	Exhaust
A	Pass	Pass
B	Fail	Pass
C	Fail	Fail
D	Pass	Fail



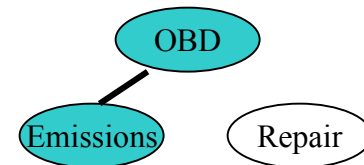


- Region B: OBDII Failure (MIL on) with Exhaust Emissions Pass
  - MIL commanded on, but emissions do not exceed I/M cutpoints
  - Component compensation
  - Exhaust emissions variability

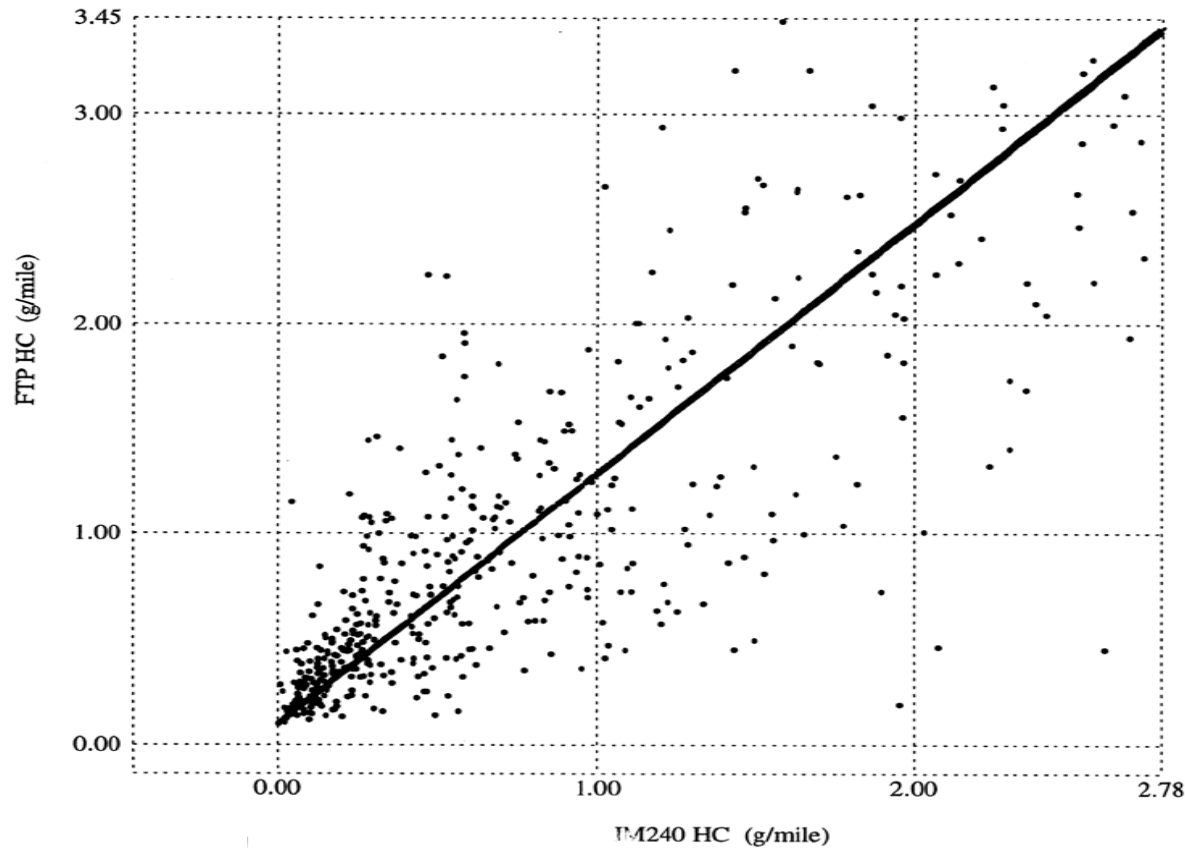




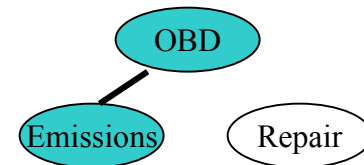
- Region D: OBDII Pass with Exhaust Emissions Failure
  - Potential OBDII system failure/fault
  - Exhaust emissions variability
    - vehicle to vehicle
    - test to test
  - For fleet, IM240 emissions  $\cong$  FTP emissions, but IM240 emissions  $\neq$  FTP emissions for individual vehicles



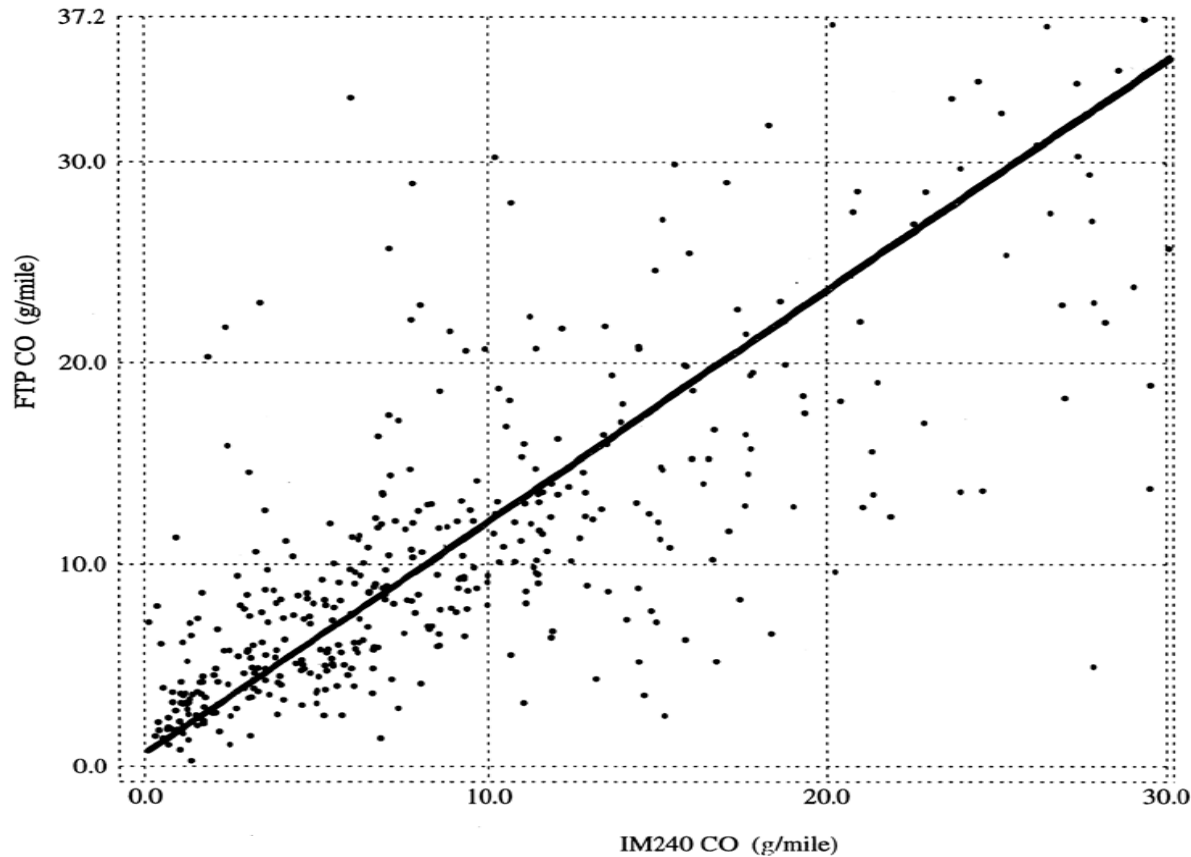
# IM240 vs FTP for HC



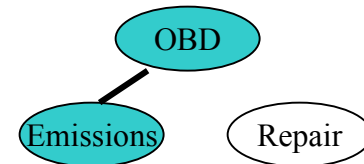
FTP HC Versus IM240 HC for EI Monte Data Set with Model Line in Vicinity of the Origin



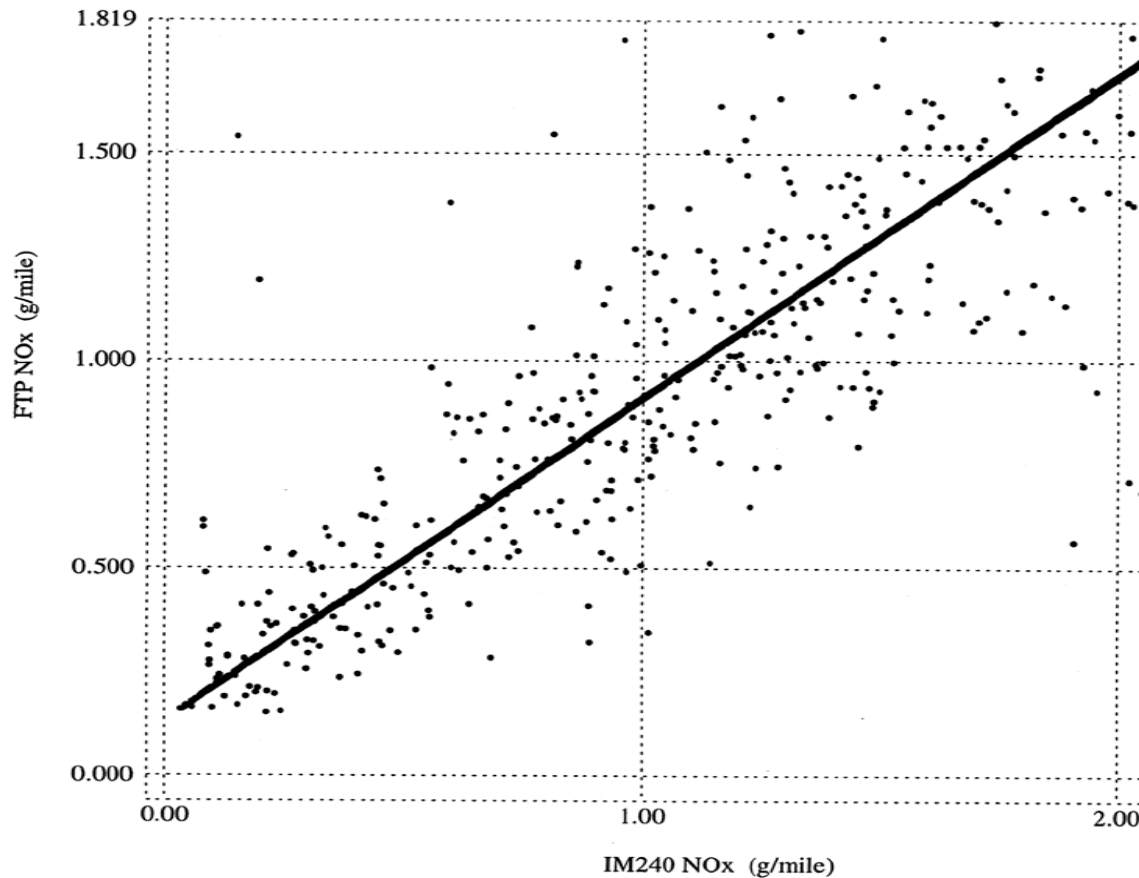
# IM240 vs FTP for CO



FTP CO Versus IM240 CO for El Monte Data Set with Model Line in Vicinity of the Origin



# IM240 vs FTP for NOx



FTP NOx Versus IM240 NOx for EI Monte Data Set with Model Line in Vicinity of the Origin

# Determining the Confidence Interval for the Mean

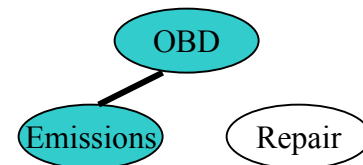
For 95% confidence,  $CI = \mu \pm \frac{1.96}{\sqrt{n}}(\sigma)$

Where:

$\mu$  = Sample Mean

$n$  = # of Sample Observations

$\sigma$  = Standard Deviation



# Calculation of Standard Deviation

- Continuous Data

$$\sigma = \sqrt{\frac{\sum (x - \mu)^2}{(n - 1)}}$$

$\sigma$  = Std. Deviation

$x$  = Single Observation

$\mu$  = Sample Mean

$n$  = # of Sample Obs.

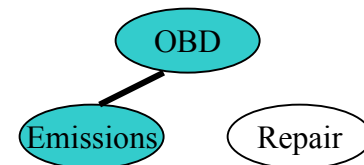
- Discrete Data

$$\sigma = \sqrt{\frac{p(1 - p)}{n}}$$

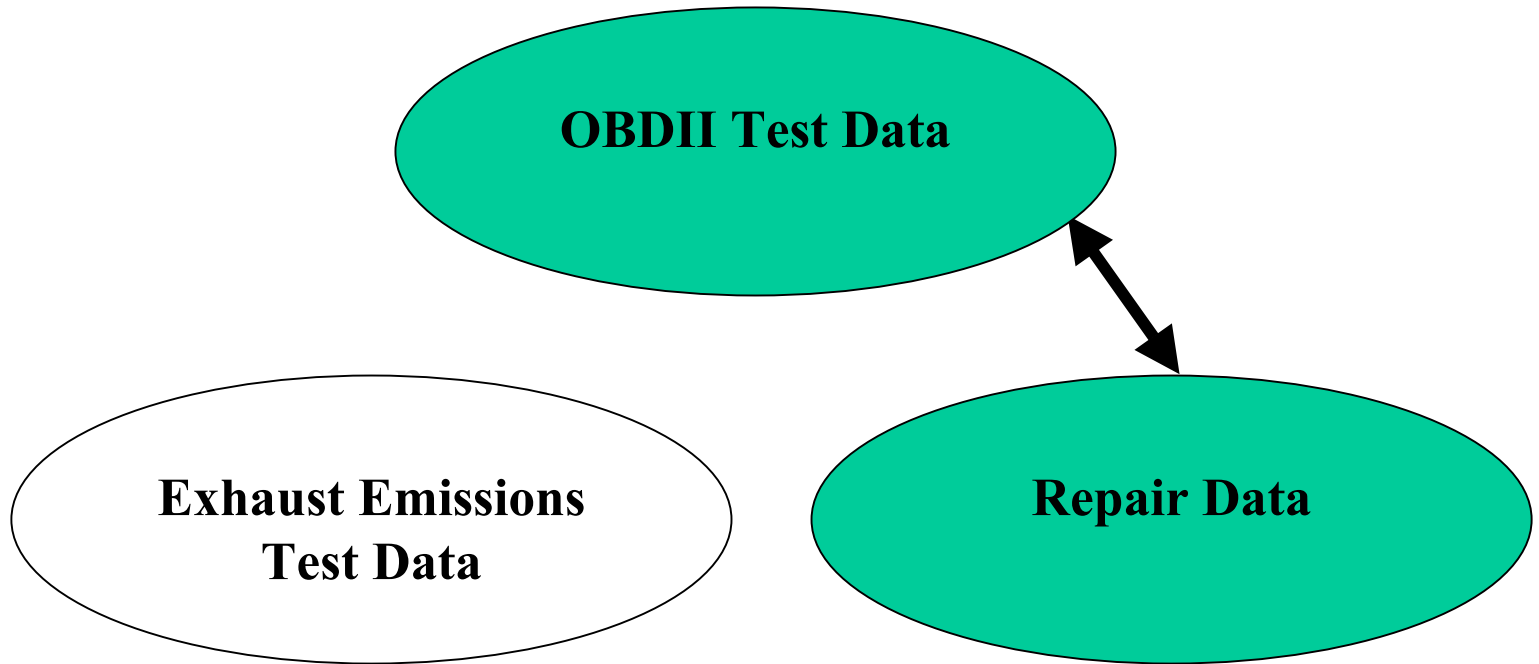
$\sigma$  = Std. Deviation

$p$  = Observed Event Proportion  
( $0 \leq p \leq 1$ )

$n$  = # of Sample Obs.



# OBDII / Repair



# OBD vs. Exhaust Test Cutpoints With Respect to Vehicle Fleet

