

Streamlined Heavy-Duty Emissions Determination (SHED) Pilot Study



North Central Texas Council of Governments

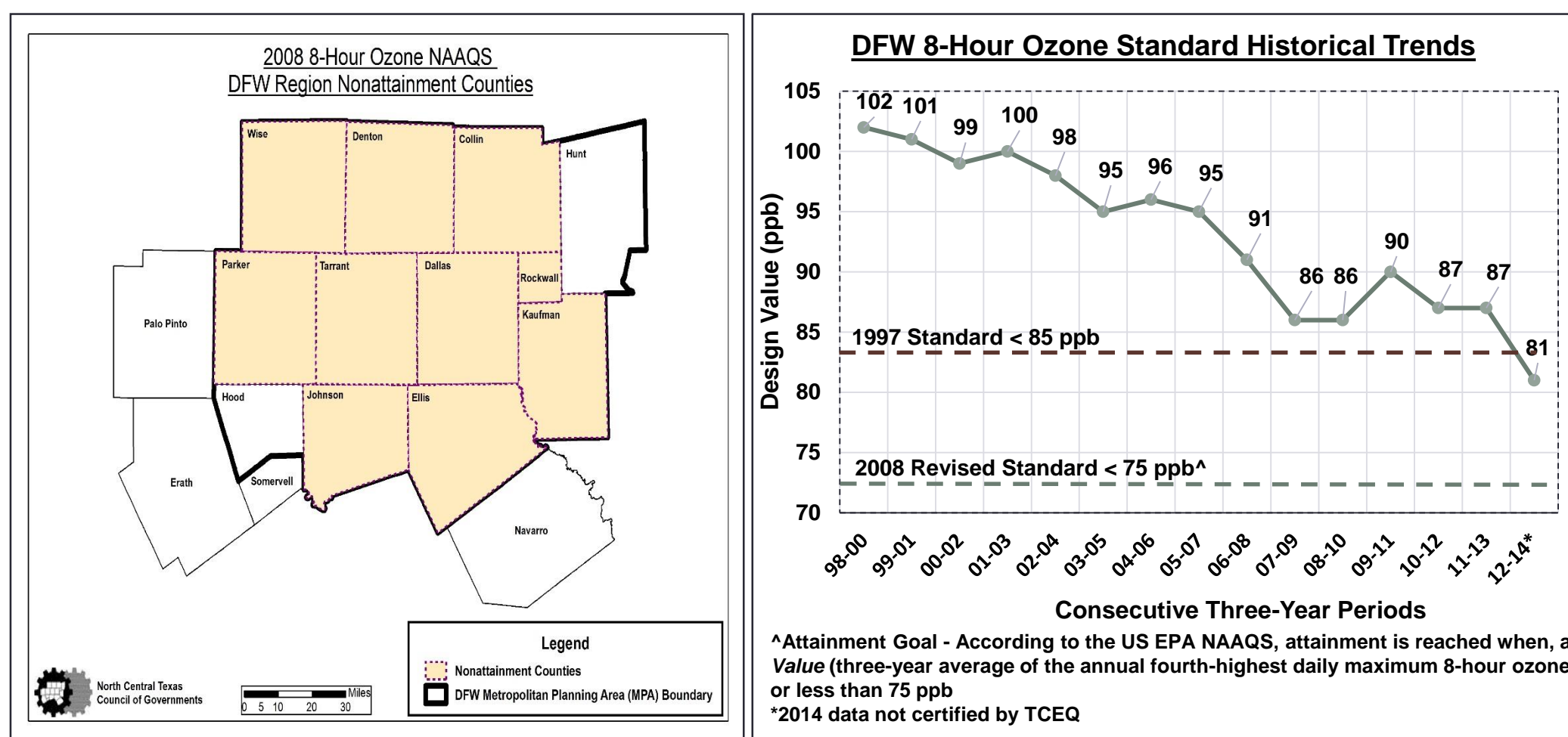
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AIR QUALITY (AQ) BACKGROUND

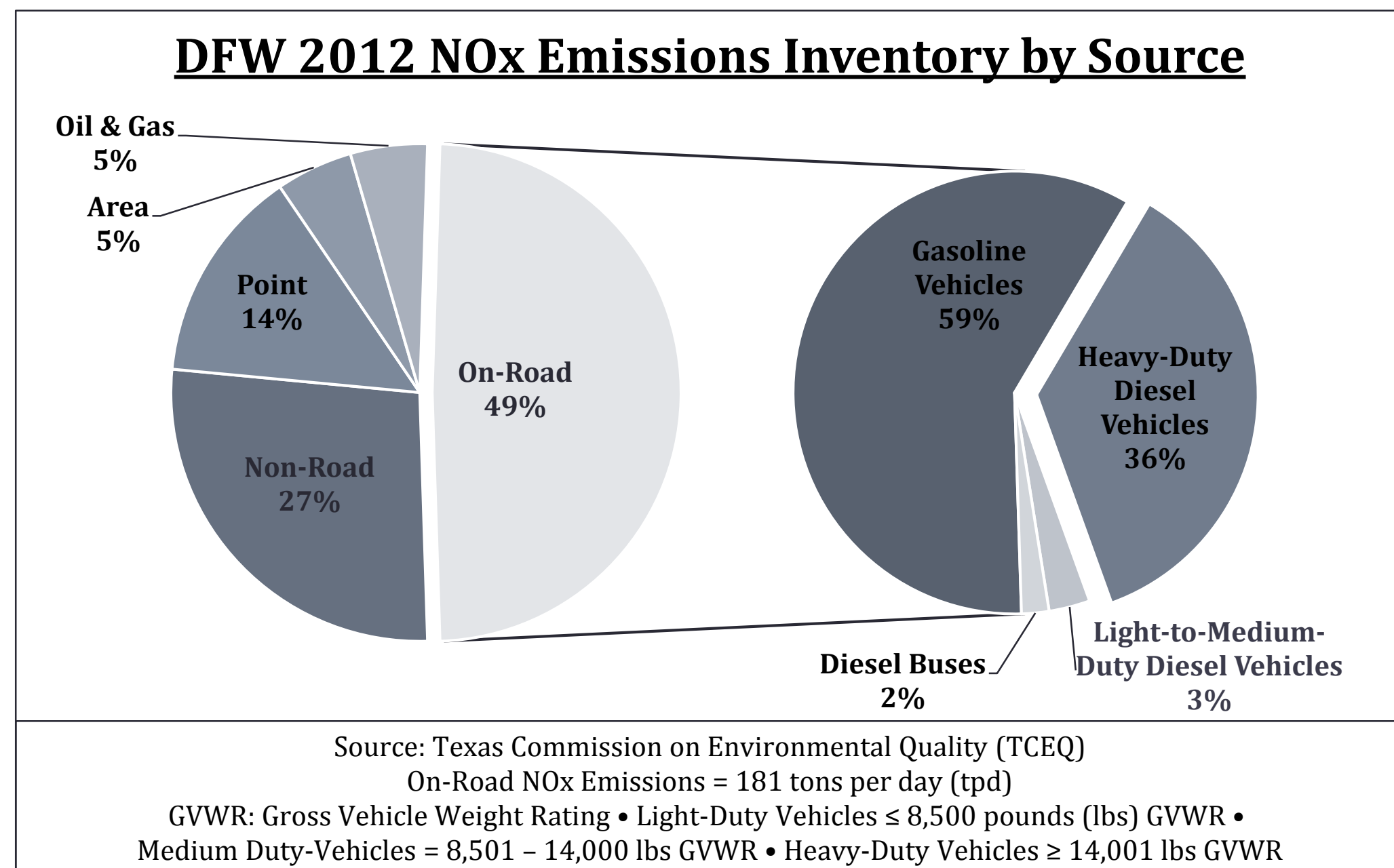
- Ground level ozone is created by chemical reactions between oxides of nitrogen (NOx) and volatile organic compounds (VOC) in the presence of sunlight
- Emissions from motor vehicle exhaust, gasoline vapors, industrial facilities and electric utilities, and chemical solvents are some of the major sources of NOx and VOC

DALLAS-FORT WORTH AQ CHALLENGE

- Ten counties within the Dallas-Fort Worth (DFW) metropolitan planning area (MPA) are designated by the Environmental Protection Agency (EPA) as moderately in nonattainment of the 2008 8-Hour National Ambient Air Quality Standards (NAAQS) for ground level ozone



- Heavy-duty diesel vehicles (HDDVs) account for approximately 36 percent of total on-road NOx emissions
- Texas currently does not have an Inspection/Maintenance (I/M) program for diesel vehicles



POLICY FOR POTENTIAL AQ IMPROVEMENTS

- Implementation of either an I/M and/or screening program for diesel vehicles, particularly for HDDVs

VIABLE METHODS FOR I/M PROGRAM

Testing	OBD Testing	Conventional remote sensing (RS) testing	Portable roadside (PR) Chassis Dynamometer Testing with PEMS	Water Brake (WB) Chassis Testing with PEMS	SHED
Estimated Testing Capacity (HDDVs/day)	~ 100	~ 200	~15	~15	~ 150
Measure Actual Tailpipe Emissions	No	Indirectly	Yes	Yes	Indirectly

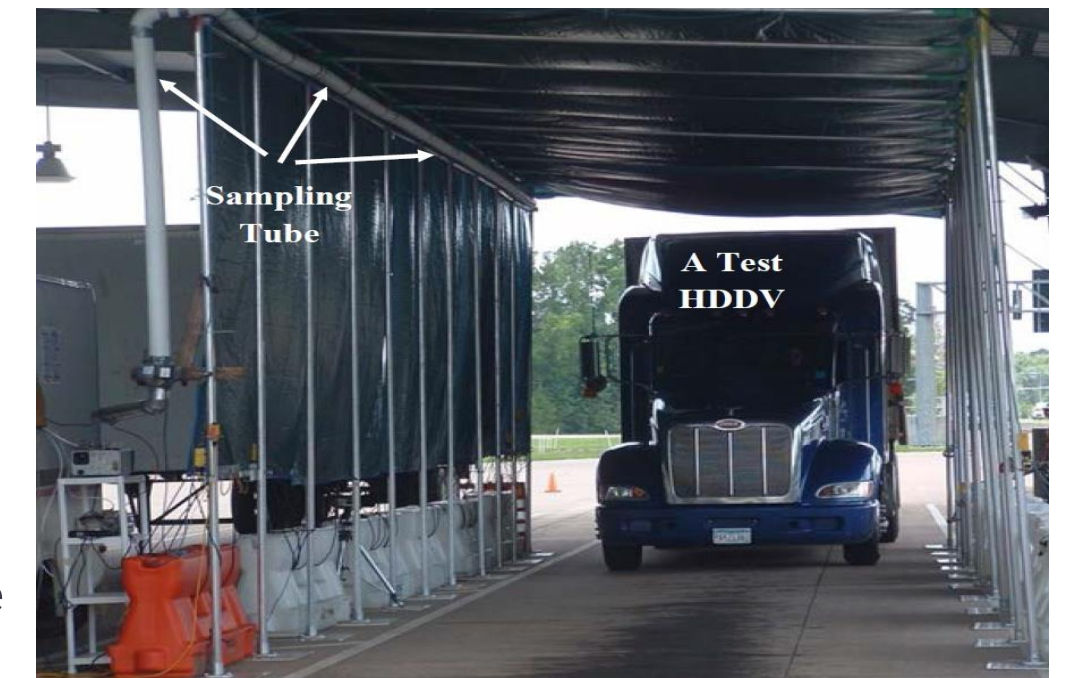
Source: Texas A&M Transportation Institute; OBD = On-board diagnostics

SHED

- A new vehicle emissions measurement methodology developed by researchers from Denver University (DU)
- Vehicle emissions are detected remotely and instantly reported similar to that of a conventional RS testing
- Measures vehicle emissions, on average, for up to six (6) seconds

SHED TESTING DESIGN

- HDDV drives through a tent-like structure that is 50 feet long, 12 feet wide, and 15 feet high at its apex
- Exhaust emissions accumulate under the roof of the tent
- An elevated perforated 50-foot sampling tube inside the tent, on the right side, collects the exhaust emitted
- A set of emissions analyzers measure the levels of pollutants that are collected



SHED PILOT STUDY SCOPE

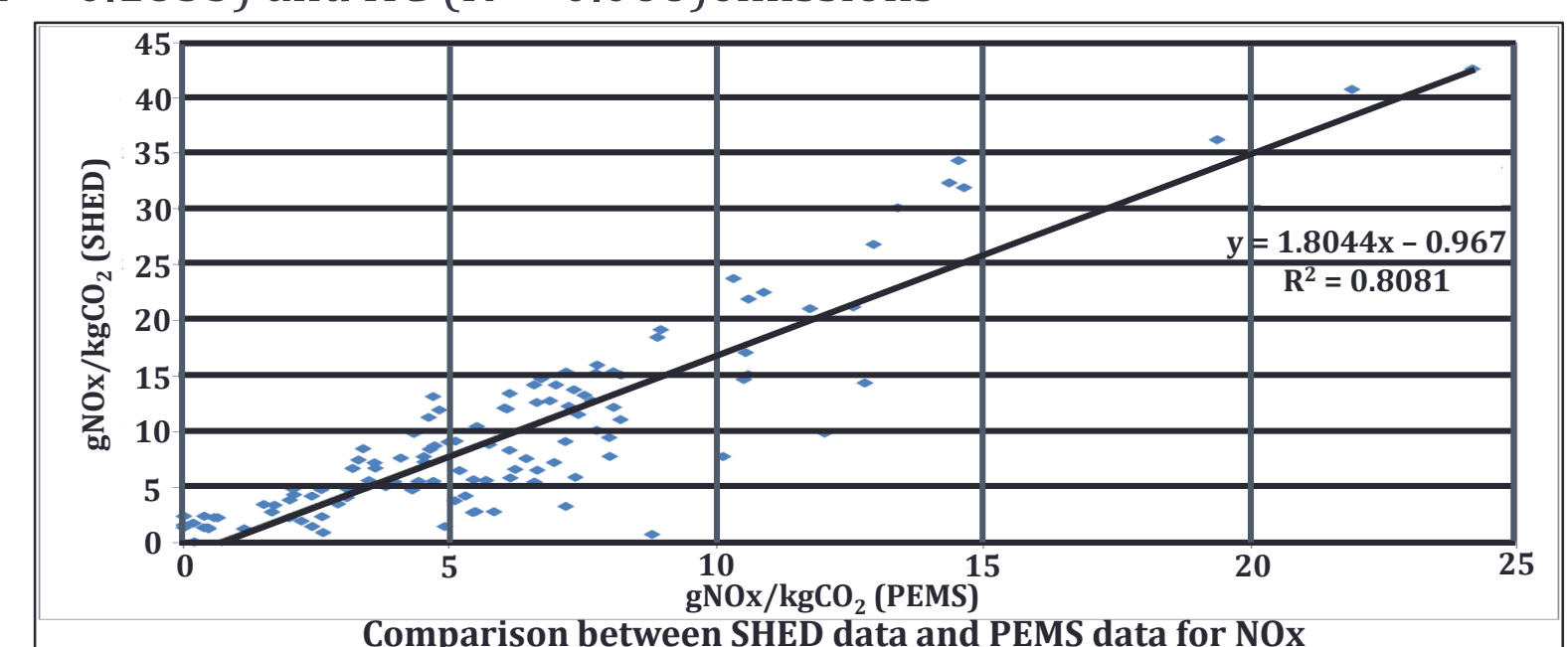
- Provide the North Central Texas Council of Government (NCTCOG) and the Texas Department of Transportation (TxDOT) with information relating to the potential implementation of an I/M or screening programs for HDDVs
- Compare and validate various emissions measurement methodologies
- Evaluate application of SHED testing for HDDV I/M or screening programs

SHED PILOT STUDY METHODOLOGY

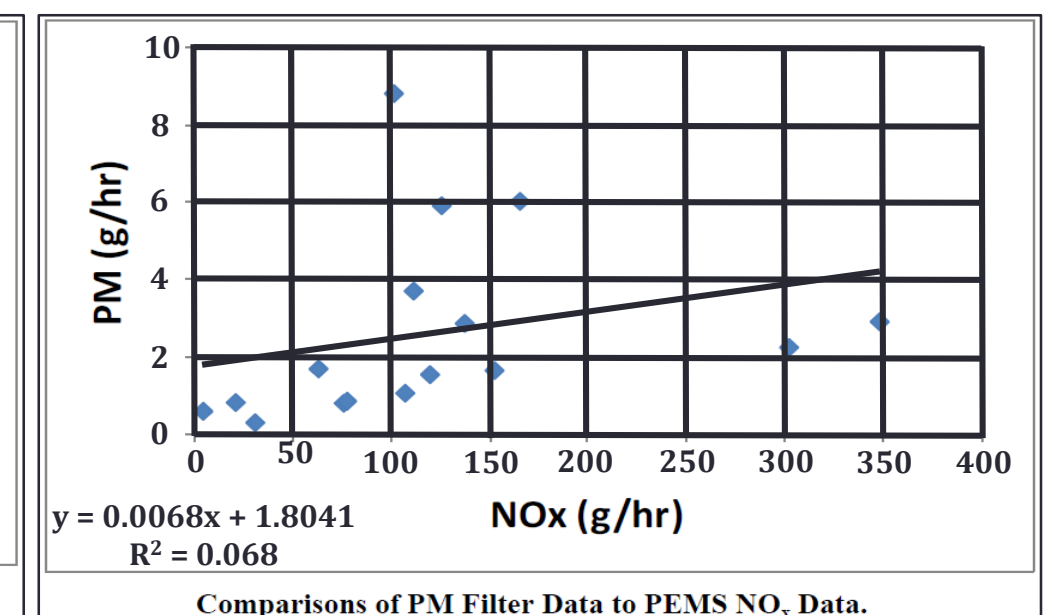
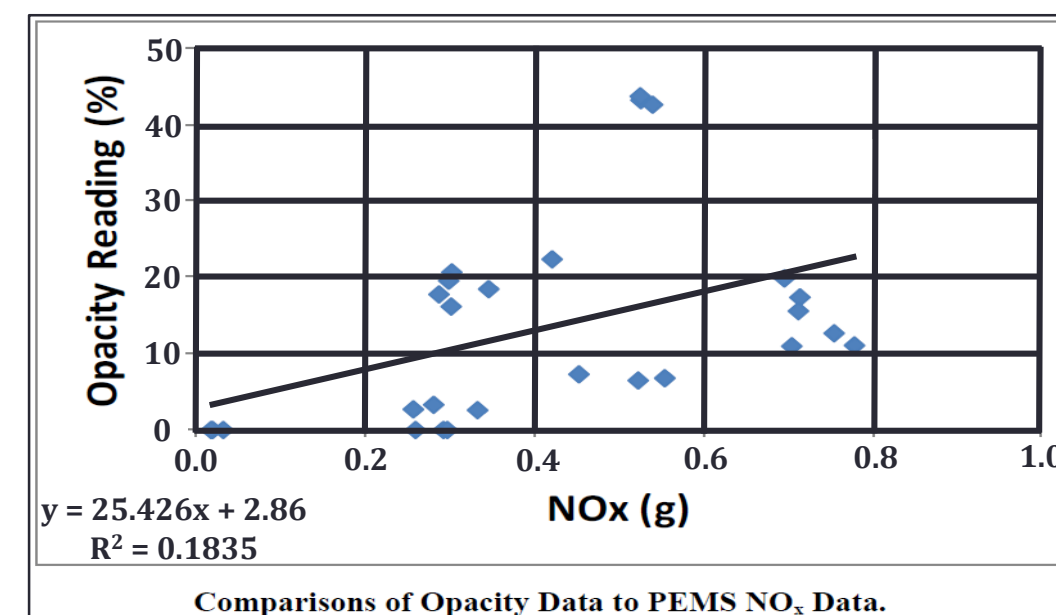
- Divert northbound HDDVs on Interstate Highway (IH) 45 to the New Waverly Weigh Station in New Waverly, Texas for two (2) weeks to assess where they are heading and to assess their levels of emissions using SHED testing
- Use ten (10) additional HDDVs to compare SHED testing results to results from PEMS, opacity testing, idling testing, and particulate matter (PM) filter sampling

SHED PILOT STUDY RESULTS

- Measured NOx emissions from SHED comparable to PEMS ($R^2 = 0.8081$), but not for CO ($R^2 = 0.1835$) and HC ($R^2 = 0.068$) emissions



- Measured NOx emissions from SHED more comparable to PEMS than from opacity testing and PM filter sampling



SHED Tested HDDVs	HDDVs Passing DFW Area	High-Emitting (HE) HDDVs (%)	NOx Emitted by HE HDDVs (%)	Potential NOx Reduction for DFW ¹
1,367	1,001	6.8%	19.2% of total NOx	8.7 tpd

¹Based on HE definition below and based on TCEQ report quantifying DFW regional emission using MOVES at 65.2 tpd of NOx per summer weekday. Reduction from 65.2 to 56.5 tpd if HE HDDVs produce NOx emissions as rest of the HDDVs observed.

HE = Emitting 35 g NOx/kg of CO₂; CO = Carbon Monoxide; CO₂ = Carbon Dioxide; HC = Hydrocarbons; g = grams; kg = kilogram; MOVES = Motor Vehicle Emission Simulator; PEMS = Portable Emissions Measurement System

- Measured emissions from SHED at different speeds were below the detection limits of the emissions analyzers due to air wakes and, thus, were invalid

NEXT STEPS

- Improve the general performance of SHED testing when compared against PEMS particularly for CO and HC emissions
- Modify the elevated perforated sampling tube to allow for testing of trucks with varying exhaust stack positions not just on the passenger side
- Augment the SHED sampling tent configurations in order to minimize air wakes and collect valid emissions data at different test speeds in addition to stop-and-go traffic