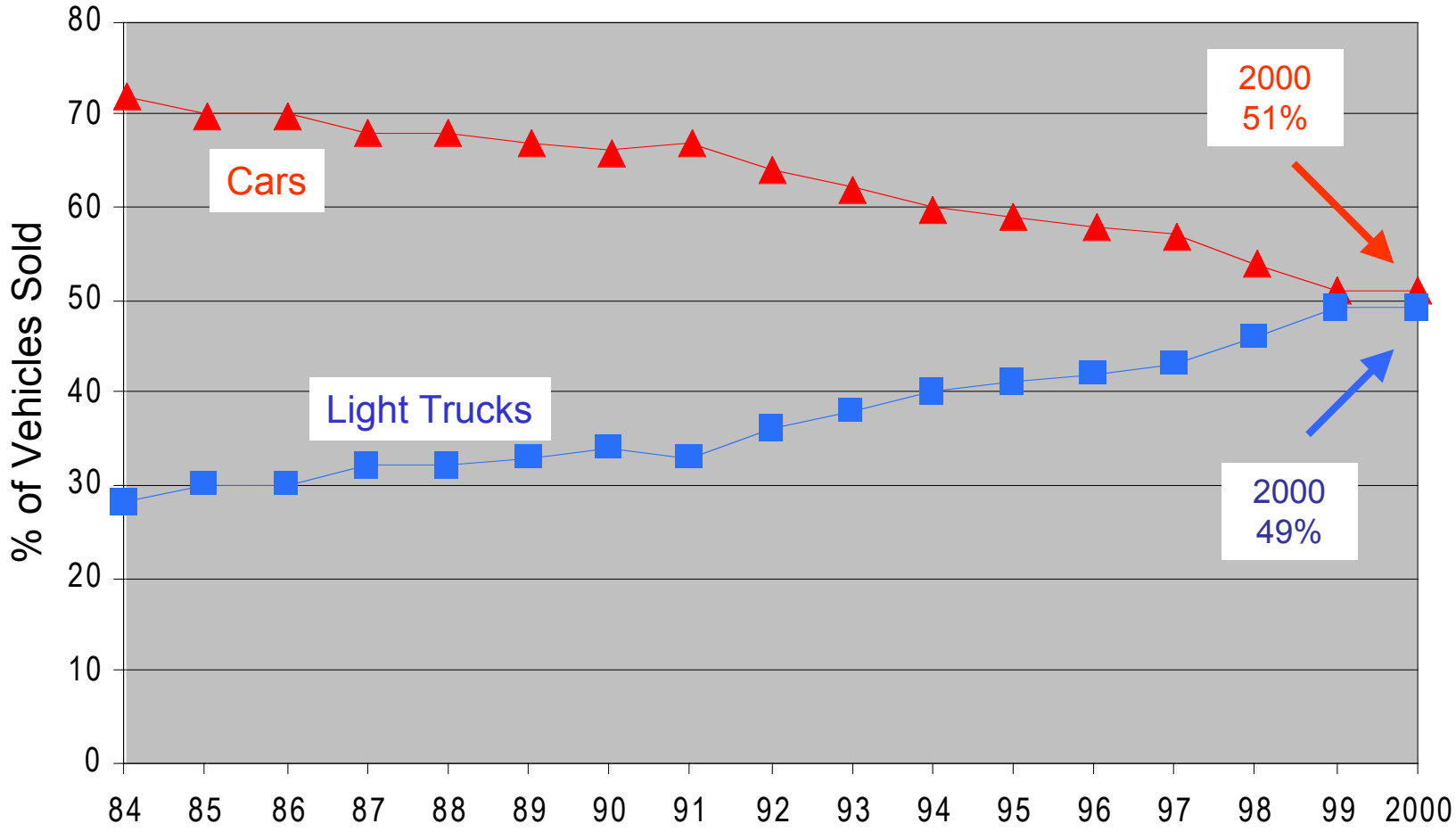
Cummins/DOE
Light Truck Diesel Engine
Progress Report

August 2001

Technical Program Overview

- Partnership, Cummins and U.S. Department of Energy
- Focus
  - Development of technologies that will result in a product in the near term
  - Emissions
    - ~ U.S. Tier 2 6000-8500 lb GVW
    - ~ NOx = 0.07 g/mi; PM = 0.01 g/mi
  - Fuel economy - 50 percent MPG improvement over 1997 gasoline powered vehicle it replaces
- Acknowledgment
  - Contractual funding from DOE
  - Vehicle and installation design assistance from Dodge Truck Engineering
  - Engine Development Team at Cummins

US Passenger
Car and Light Truck Market



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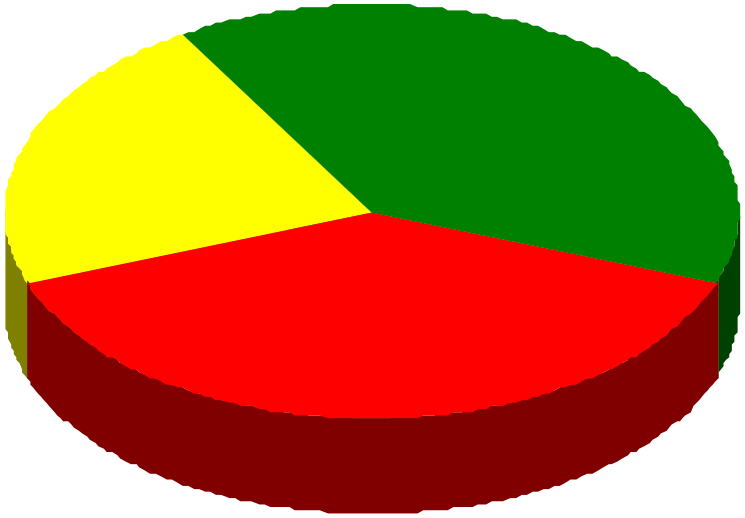
Light Truck Major Segments

8.4M Vehicles

Vans 22%

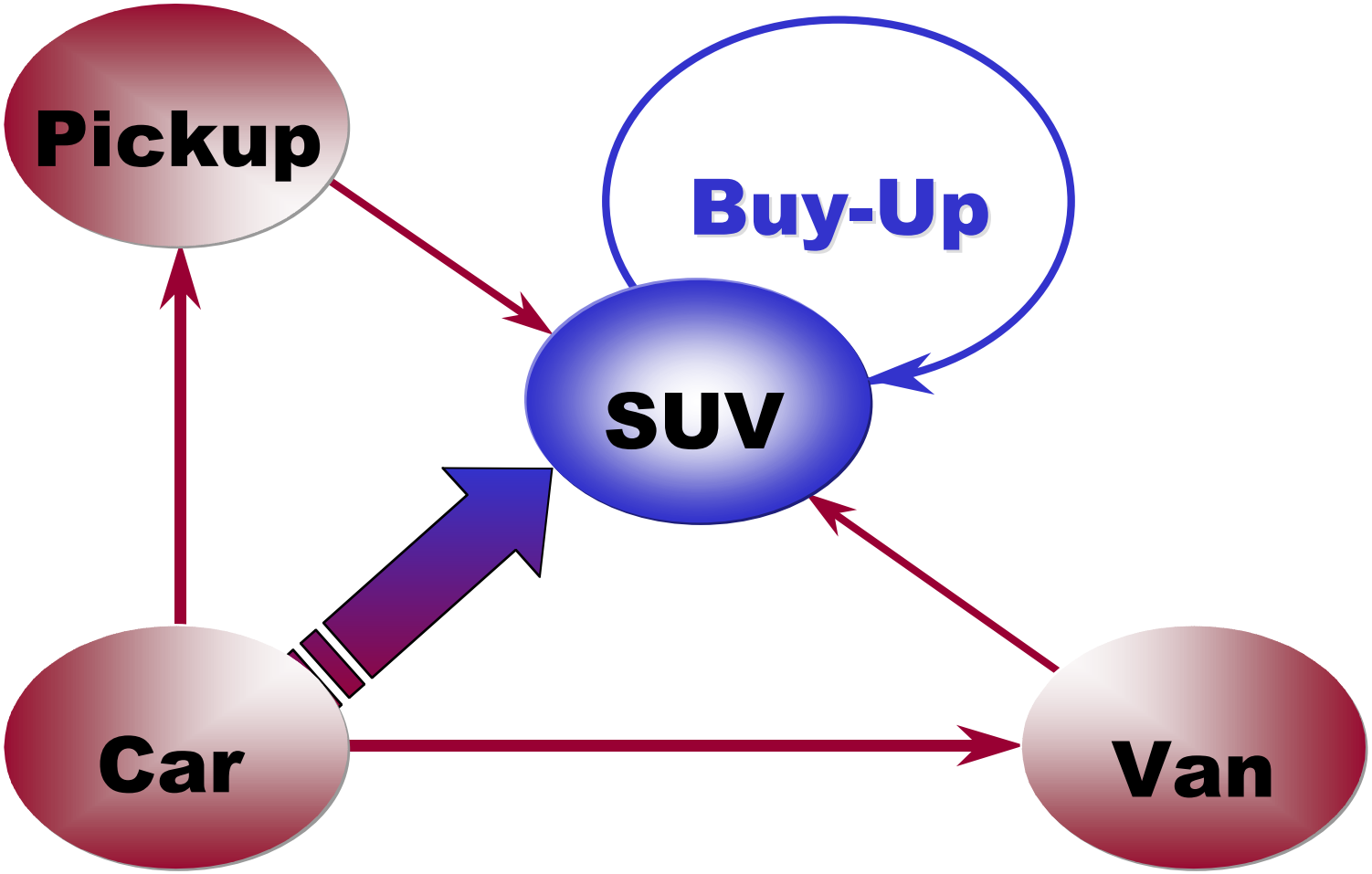


Sport Utility Vehicles 39%

Pickup Trucks 39%

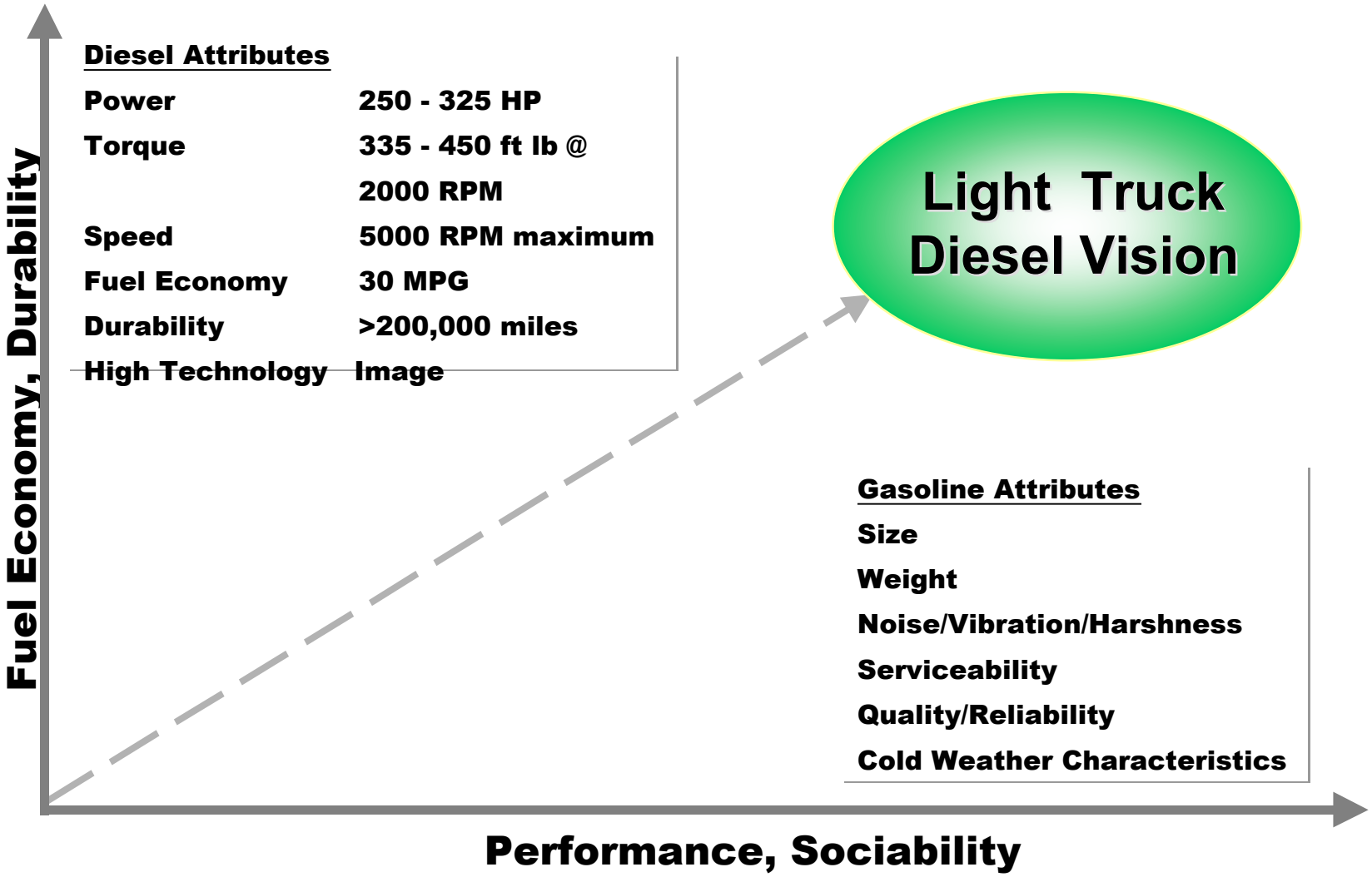
2000 Sales, "Automotive News"

Migration to SUVs



Internal Analysis

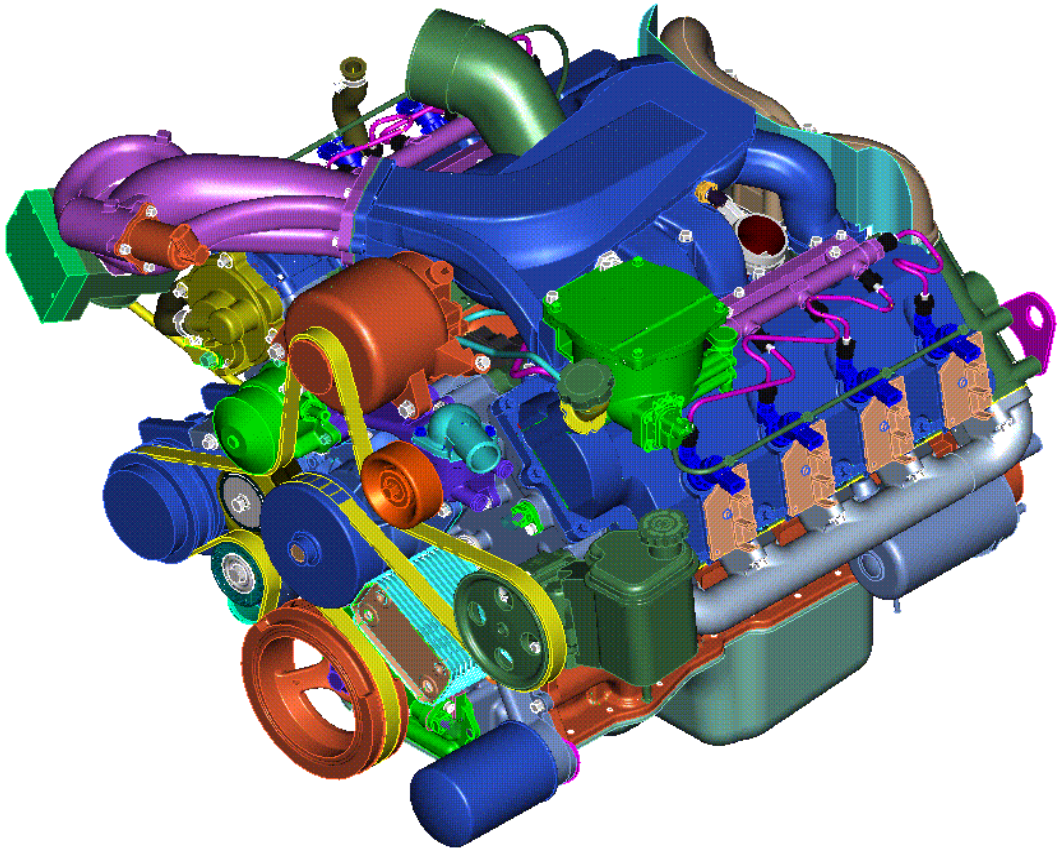
Engine Design Proposal



V Family Goals

Description	V6 Target Value	V8	Importance (10 High)
Customer Cost	Market Driven		10
Emissions	EPA Tier 2 & CA LEV II		9
Size (mm)	L641, W688, H755	L784, W688, H775	9
Noise	69 dBa Hood Open		8
Vibration	Equal to Gas		8
Fuel Economy	50% Better than Gas		8
Quality/Reliability	Equal to Gas		8
Rated Speed	4000 rpm (5000 maximum)		7
Useful Life	B10 > 325,000 km (200,000 mi)		7
Performance	Gasoline-Like		6
Displacement, l	4.2	5.6	6
Power	190 kW (250 HP)	240 kW (325 HP)	5
Torque Peak	Gasoline-Like Powertrain		5
	455 Nm (335 ft-lb)	600 Nm (440 ft-lb)	5
Warm-Up	75 C (167 F) Coolant in 10 min. @ -30 C (-22 F), road load		4
Serviceability	Equal to Gasoline		4
Cold Start	< 20 sec. @ -30 C (-22 F)		3
Weight, kg	275	320	3

Light Duty Automotive Engine - V8



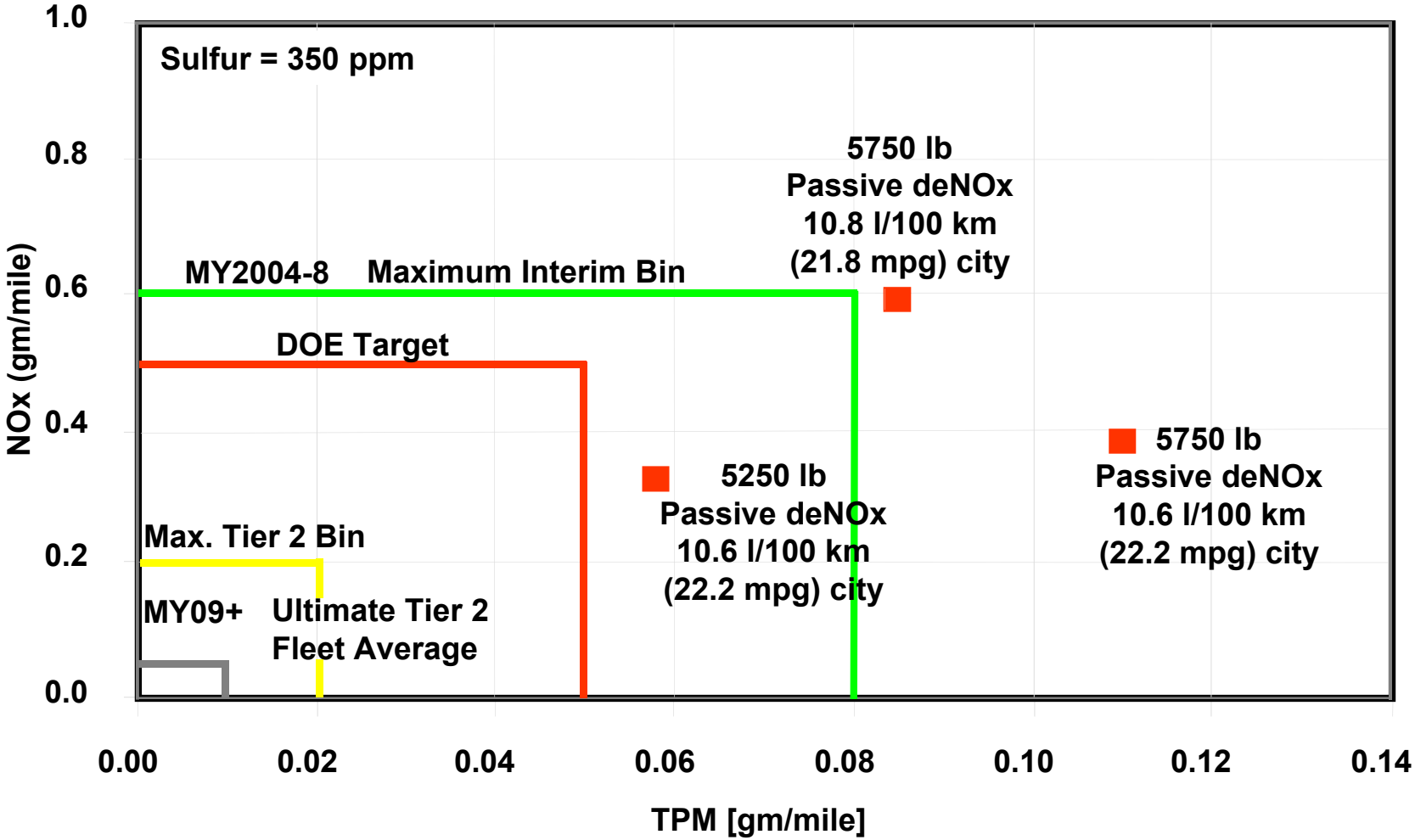
Light Truck Diesel

Subsystem Description

Subsystem	Description
Configuration	90° V
Displacement	4.2 L V6 5.6 L V8
Bore and Stroke	94 X 100 mm
Valvetrain and Drive	Single overhead cam, chain-driven
Valve System	Four valves per cylinder with hydraulic lash adjustment
Fuel System	High-pressure common rail (HPCR)
Control System	Full electronic
Emissions Control	Modulated-cooled EGR plus deNOx catalyst (Interim)
Aspiration	Wastegated turbocharged
Intercooling	Vehicle mounted air-to-air
Block	Cast iron, thin-walled
Head	High temperature alloy aluminum
NVH Control	Deep skirted block, with bedplate
Accessories	Common automotive V-8 gasoline
Accessory Drive	Single serpentine belt, self-adjusted

Demonstrated Emissions

Interim Results



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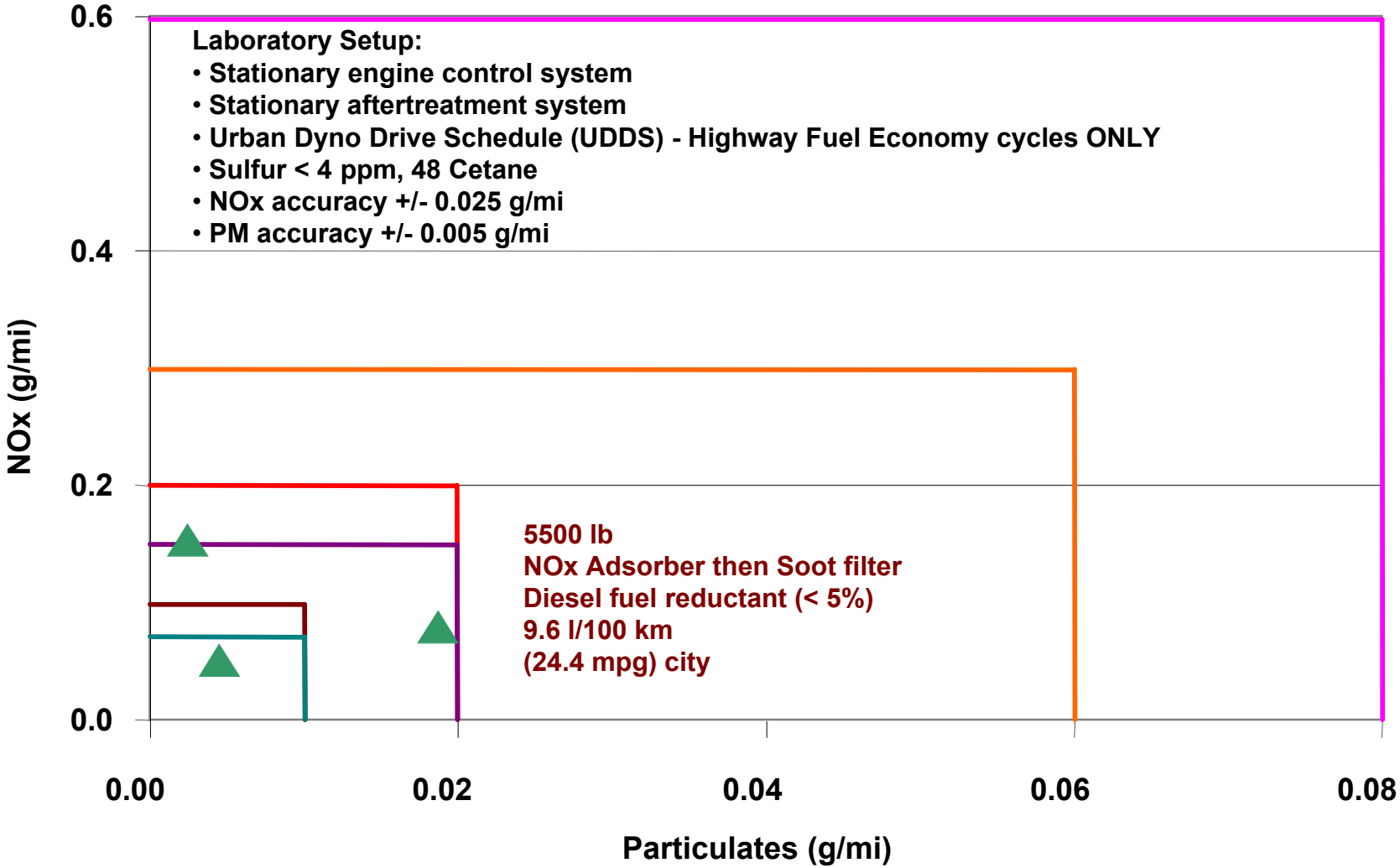
Demonstrated Emissions

Tier 2 Results



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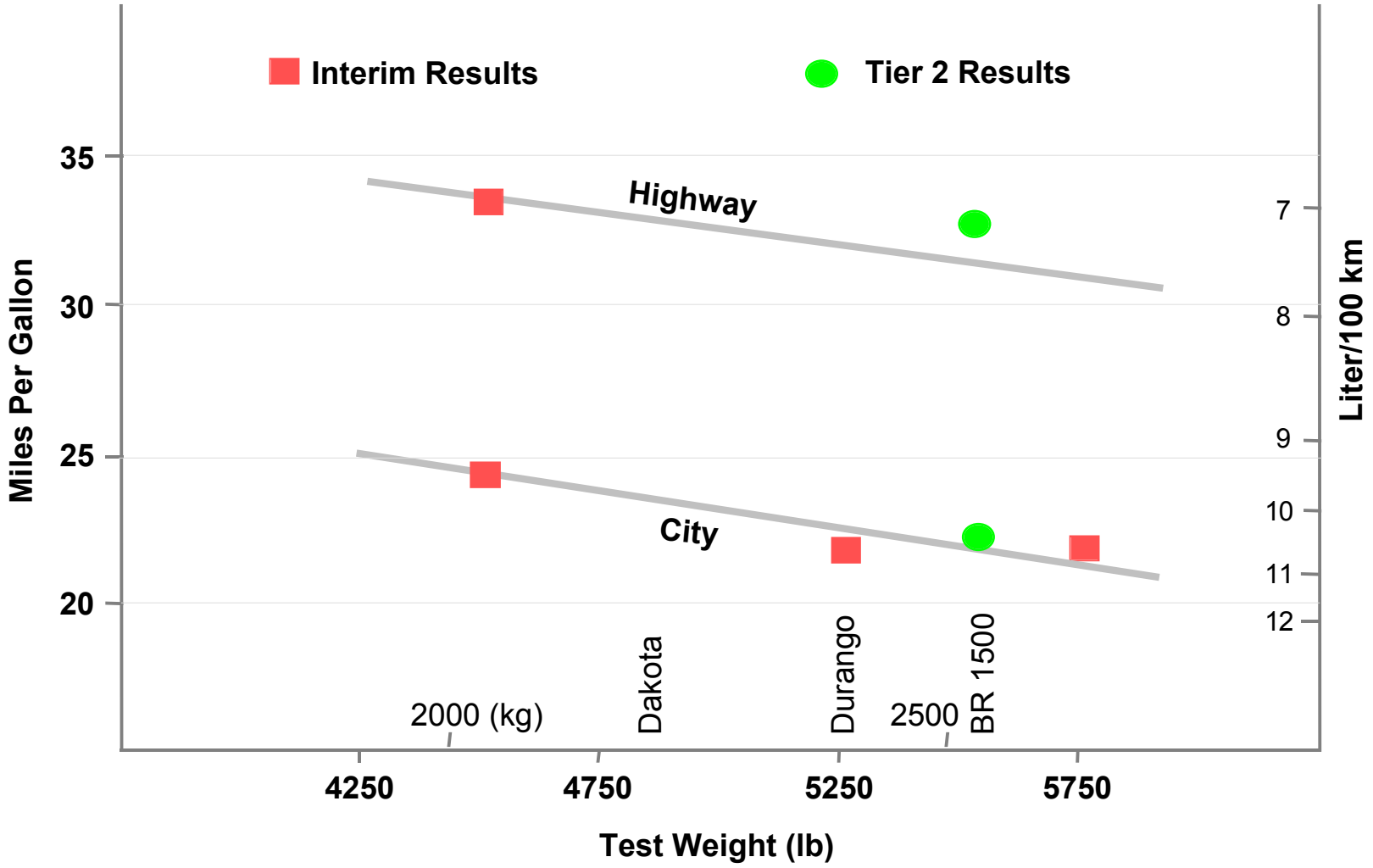
Demonstrated Fuel Economy



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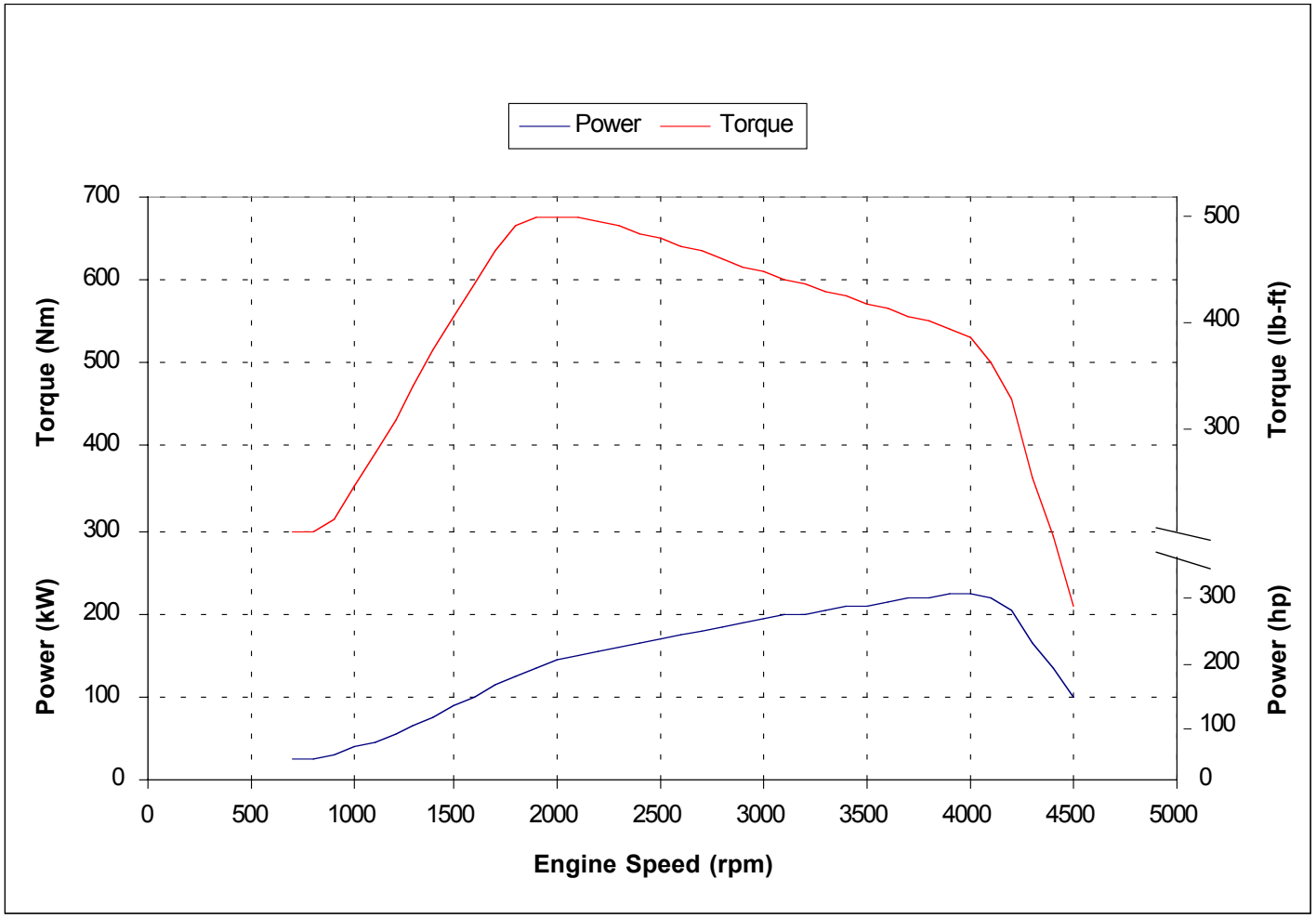
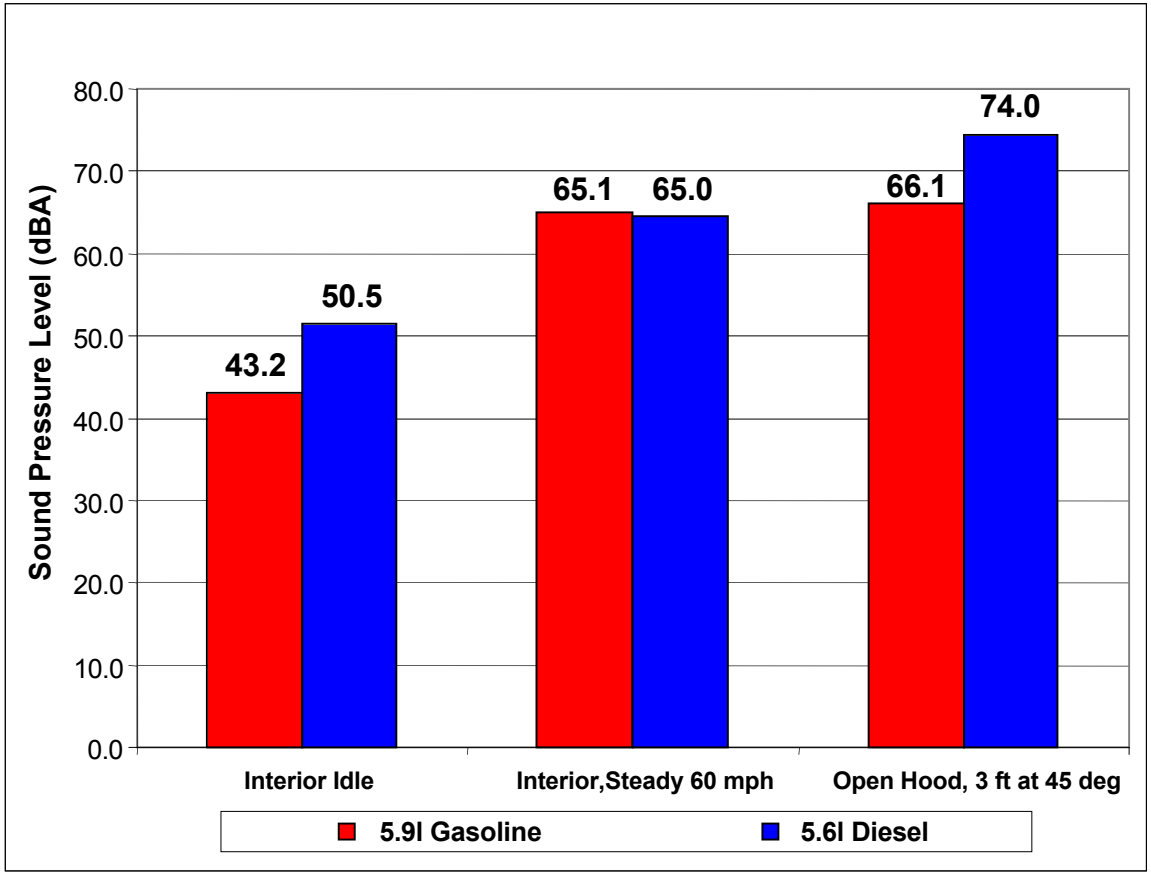
V8 Performance - Test Results



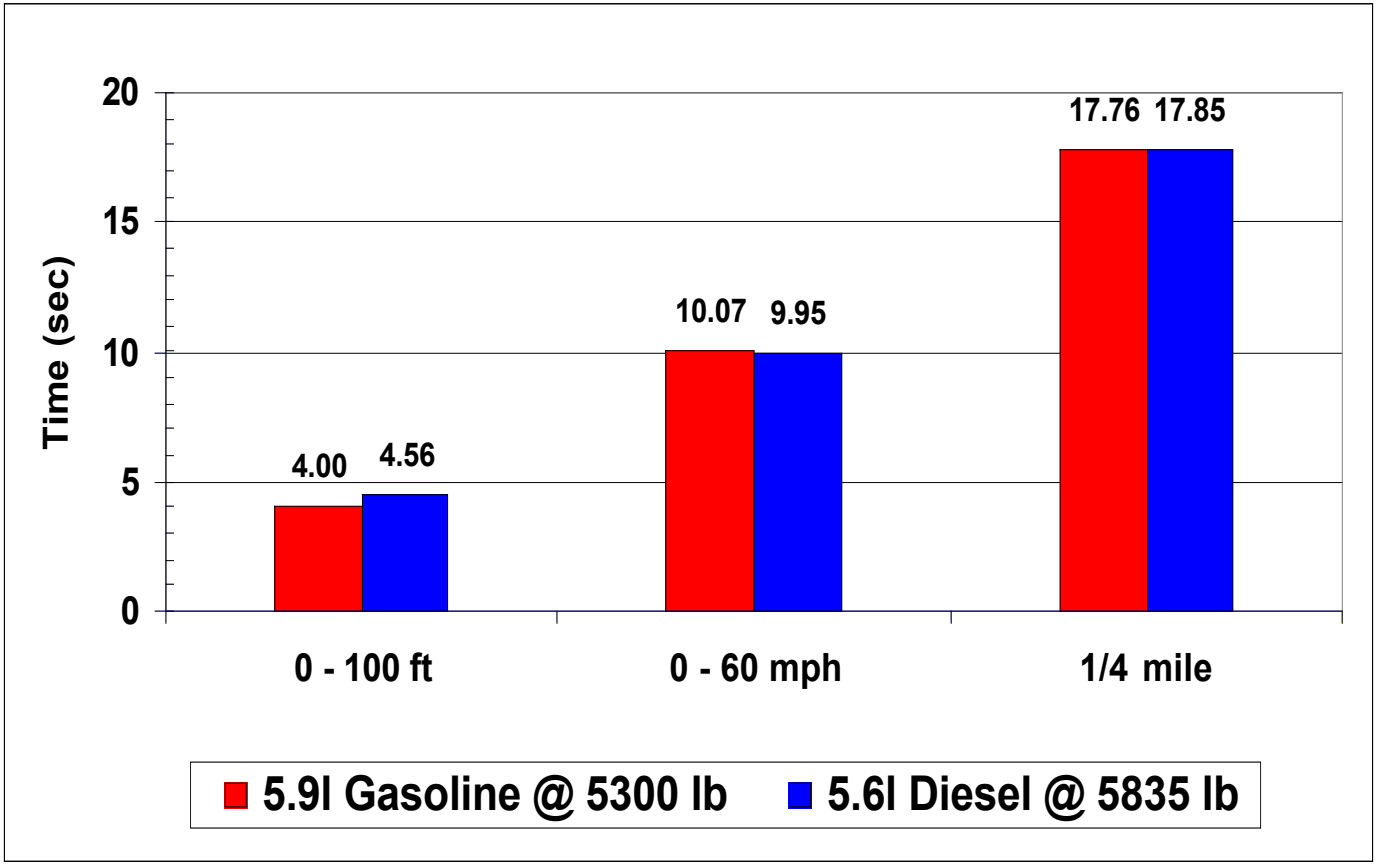
Noise Test Results

V8 in Ram 1500



Acceleration Test Results

V8 in Ram 1500



Conclusions

- Light Truck Diesel Family continues to show promise
- Fuel economy advantage is clear, approaching 60 percent
- Performance is gasoline-like
- Interim Tier 2 emissions, met using known technology
- Final Tier 2 emissions, demonstrated using advanced aftertreatment devices
- There is a path to market for the Light Truck Diesel