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Assessment of Vehicle Mass Reduction Feasibility, Cost and Safety Effects for CAFE and GHG Rulemaking

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Jim Tamm
Chief, Fuel Economy Division

Topics

- 2017 and Beyond CAFE & GHG Rulemaking
- Mid-term Evaluation and NHTSA MYs 2022-2025 Full Rulemaking
- Assessment of Mass Reduction Feasibility and Cost for Rulemaking
- Assessment of Effects of Mass Reduction on Safety for Rulemaking

MY 2017+ CAFE & GHG Emission Rulemaking

- NHTSA and EPA joint federal rulemaking
  - NHTSA - Fuel Economy standards.
  - EPA – Greenhouse Gas Emission standards.
  - CARB – Accept EPA standards as compliance with California standards.
- Extensive technical, economic and environmental analyses.
- The standards are performance-based
  - Manufacturers will choose the technologies they will use for compliance.

Mid Term Evaluation

2017 2021 2022 2025

EPA Final unless changed by rulemaking

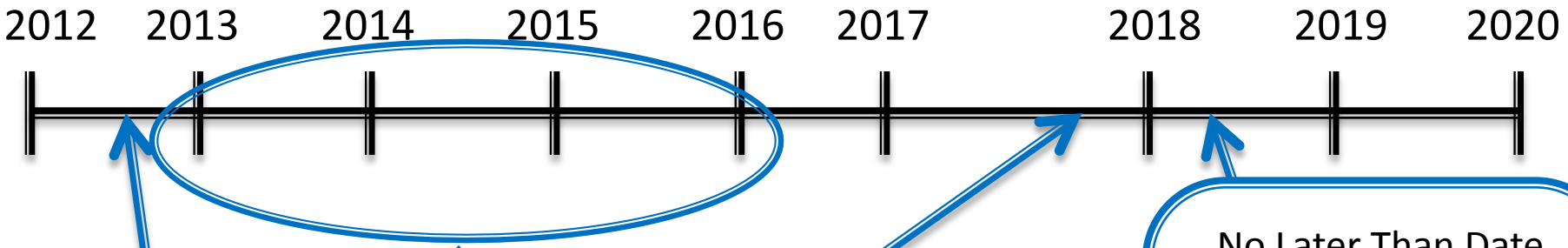
NHTSA www.nhtsa.gov 2017-2021 Final

2022-2025 Augural

NHTSA www.nhtsa.gov + EPA + California Air Resources Board

Joint Technical Assessment Report

"No Later Than" Timeline for 2022-2025 NHTSA Rulemaking and Midterm Evaluation



2017 and Beyond Final Rule

Key time frame to prepare underlying technical work for the Mid-Term Evaluation

No Later Than Date
Draft Technical Assessment Report
EPA/NHTSA/CARB

No Later Than Date

NHTSA and EPA coordinate on final action

Either
NHTSA Final Rule with EPA Decision not to reopen
OR
Joint EPA/NHTSA Rule

Fuel Economy Improving Technologies

Engine:

- Low friction lubricants
- Engine friction reduction
- Camshaft phasing control (VVT)
- Valve lift control (VVL)
- Cylinder deactivation
- Stoichiometric Gasoline Direct Injection
- Combustion restart
- Turbocharging and downsizing
- Cooled EGR
- Advanced Diesel

Transmission;

- 6-speed manual
- Improved automatic trans control
- High efficiency gears
- 6-, 7-, and 8-speed automatic
- 6- and 8-speed Dual clutch transmission
- Shift optimization

Electrification and Accessories:

- Electric power steering
- Improved accessories

Hybrid Technologies:

- 12v micro hybrid (start-stop)
- Belt mounted integrated starter generator
- Plug-in hybrid
- EV

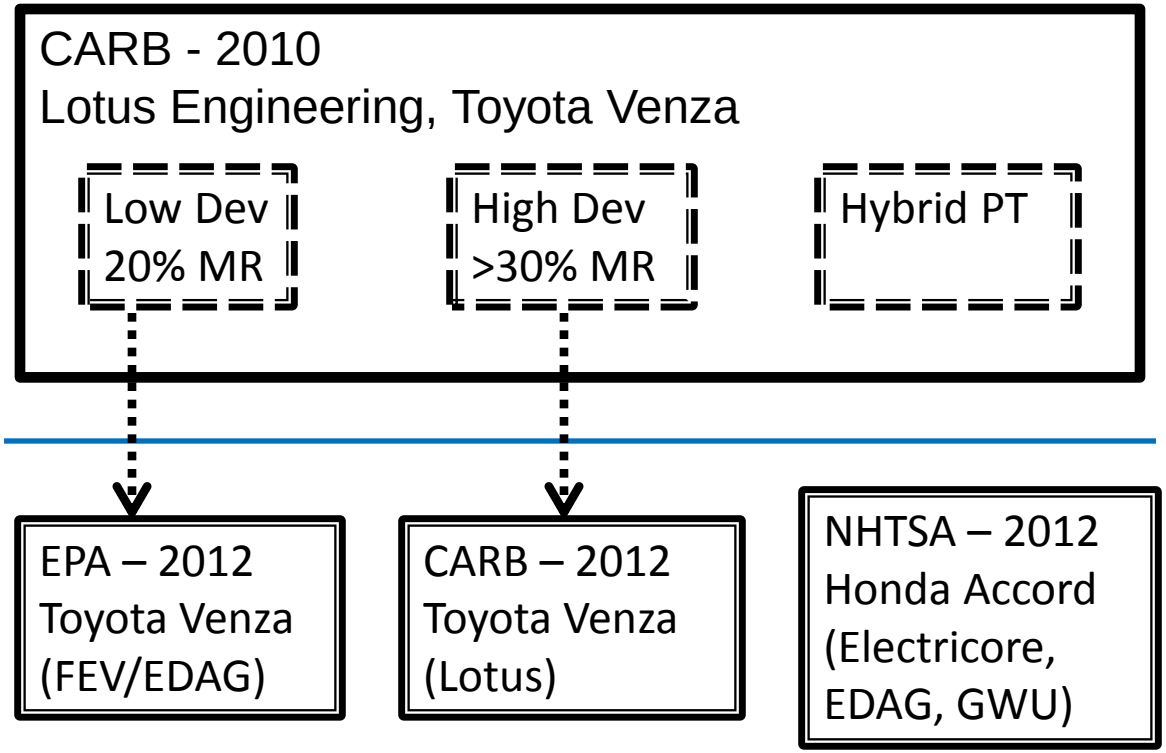
Vehicle Technologies:

MASS REDUCTION

- Aerodynamic drag reduction
- Low drag brakes
- Low rolling resistance tires
- Secondary axle disconnect

Engineering Studies for Mass Reduction Feasibility and Cost

Agency Holistic Vehicle Studies



Future Work:

EPA – 2011-2014
Light Duty Truck
(FEV/EDAG)

NHTSA Potential
Light Duty Truck

CARB: Lotus Engineering
Toyota Venza (Phase 1)
Glider only

EPA/ICCT: FEV & EDAG
Venza low development vehicle (Phase 2) –
Full vehicle

CARB/ICCT: Lotus Engineering
Venza high development vehicle (Phase 2) –
Body Structure and Closures

NHTSA: Electricore, EDAG & GWU
Honda Accord –
Full vehicle

EPA Truck study in progress

NHTSA potential truck study

Assessment of Effects of Mass Reduction on Societal Safety

Assessment of Societal Safety

- NHTSA has long considered the potential safety effects in determining maximum feasible CAFE standards
- If OEMs will reduce vehicle mass or build smaller vehicles in response to future CAFE standards, we want to anticipate:
  - Whether there will be safety implications
  - If so, what are those safety implications
- CAFE standards should be designed to encourage manufacturers to pursue a path toward compliance that is both safe and cost-effective.

Assessment of Societal Safety

NHTSA is assessing societal safety using two approaches:

- Backward Looking:
  - Statistical analysis of historical crash data
  - Study the effects of vehicle mass reduction and vehicle size on safety

- Forward Looking:
  - Engineering design and analysis approach
  - Crash simulation using CAE models
  - Use holistic light-weighted vehicle designs

Safety Assessment: Statistical Analysis of Historical Crash Data

NHTSA Statistical Analysis of Historical Crash Data

- Analyze historical crash data to assess the impact of vehicle mass and/or size changes on societal safety
- Why is statistical analysis of historical crash data useful to NHTSA's consideration of potential safety effects of CAFE standards?
  - It shows real-world trends in crash incidence and severity for smaller versus larger and lighter versus heavier vehicles – this information is not available elsewhere
  - It provides the agency with a substantial pool of data to analyze, which enables the agency to study various crash scenarios and exposures.
- However, there are some drawbacks to using historical crash data:
  - Data is historical – are we confident that it's representative of future trends?
  - Data are mixed from various crash scenarios/exposure. Sometimes there is not enough data to pinpoint the exact root cause.

NHTSA Statistical Analysis of Historical Crash Data

- Peer-Review of 20+ Studies
  - Independent review by UMTRI of the methodologies used in 20+ statistical studies
- Creation of Common Database
  - Purpose: Reduce discrepancies among various studies due to use of different input data
  - Contains fatality data from MY 2000-2007 vehicle crashes in CY 2002-2008
- Dr. Chuck Kahane's Updated Report
  - Uses the common database above
  - Responsive to comments from peer-reviews as well as from a NHTSA, DOE and EPA interagency team
  - Report published in August 2012

Mass Reduction Applied in MYs 2017+ Final Rule

- In MYs 2017+ final rule, the agencies used vehicle weight reduction levels that maintained safety for the analysis.

  The analysis shows a path that the industry could use to maintain overall fleet safety while meeting the new fuel economy standards.

- The following mass reduction levels were used in the analysis:
  - All vehicles must, of course, meet all applicable safety standards.
  - Relative to 2010 fleet levels

	Subcompact Car	Compact Car	Midsize Car	Large Car	MiniVan	Small Light Truck	Midsize Light Truck	Large Light Truck
Maximum Amount of Mass Reduction Allowed	0%	0%	3.5%	10%	20%	20%	20%	20%
Projected Industry Average Amount of Mass Reduction Applied in MY2025	0%	0%	3.5%	10%	15.3%	12.5%	10.2%	11.3%

Safety Assessment: Crash Simulation Modeling

NHTSA Safety Analysis Using Crash Simulation Modeling

- Sponsored by NHTSA
- Utilize finite element models of concept vehicles and on-road vehicles to evaluate safety of light-weighted vehicles
- Vehicle-to-vehicle and vehicle-to-object crashes
- Beyond crash conditions used for standards
  - Vehicle speed from 15mph – 40 mph;
  - Represents a broader array of crashes
  - Weighted by frequency of occurrence from the National Automotive Sampling System (NASS) database
- Interaction between light-weighted and non-light-weighted vehicles
- Evaluate potential countermeasures
  - Potentially different air-bag deployment timing for light-weighted vehicles
  - Adaptive occupant restraint systems

Next Steps

- Will be covered by other presenters later today and tomorrow.

THANK YOU!