Automotive Sheet
Who Will Win the Future?

SOUTHERN AUTOMOTIVE CONFERENCE
OCTOBER 2013

Automotive Potential

	2012	2025
Global Auto Build	77.8 M	100 – 120M
NA Auto Build	13.4 M	20 – 24 M
Average AL use in NA vehicle:	343 lbs.	550–650 lbs.
Total Auto AL NA Consumption	5 B lbs.	8 – 9 B lbs.
Total NA AL Sheet	.7 B lbs.	3 – 4 B lbs.

Notes:
- Some forecast 100 Global Build By 2016!
- 85%+ of new application aluminum growth will be wrought alloy

NA Automotive Situation

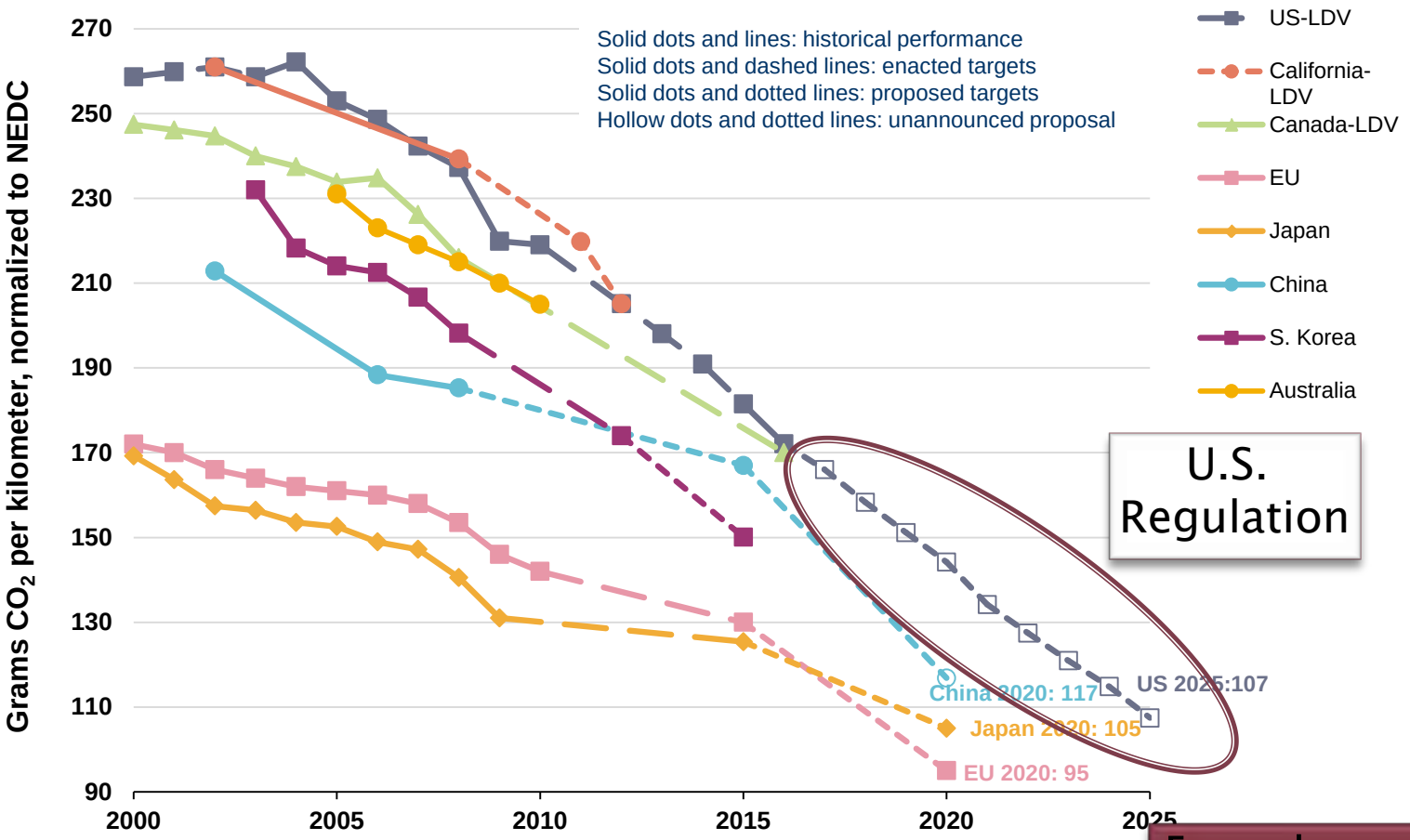
- Average Fleet 34.1 MPG By 2016
  Achievable
- Average Fleet 54.4 MGP By 2025
  Barriers

- The Challenge:

"Double MPG and cut CO2 emission by 50% by 2025 while maintaining safety, comfort, product mix, customer features, functionality, and HP to weight ratio to maintain performance."

Regulatory Impact on Materials

Global fleet CO_2 emissions performance and current or proposed standards adjusted for the NEDC test cycle

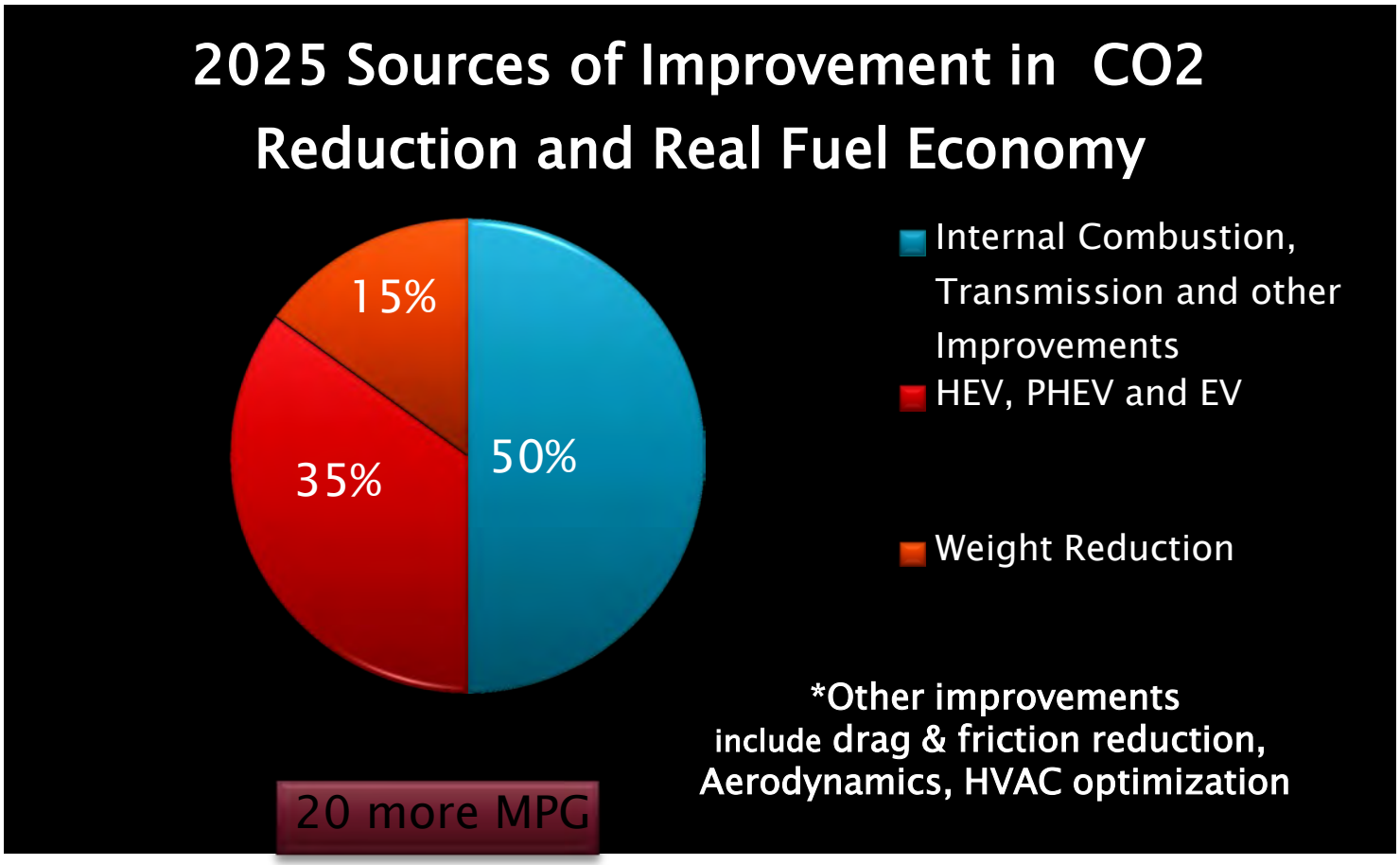


[1] China's target reflects gasoline fleet scenario. If including other fuel types, the target will be lower.
[2] US and Canada light-duty vehicles include light-commercial vehicles.

Europe has very aggressive targets for CO2 reduction

Weight savings is expected to provide 3 to 6 miles per gallon of fuel economy improvement by 2025. Aluminum directly or indirectly will provide much of this savings

Ducker Worldwide

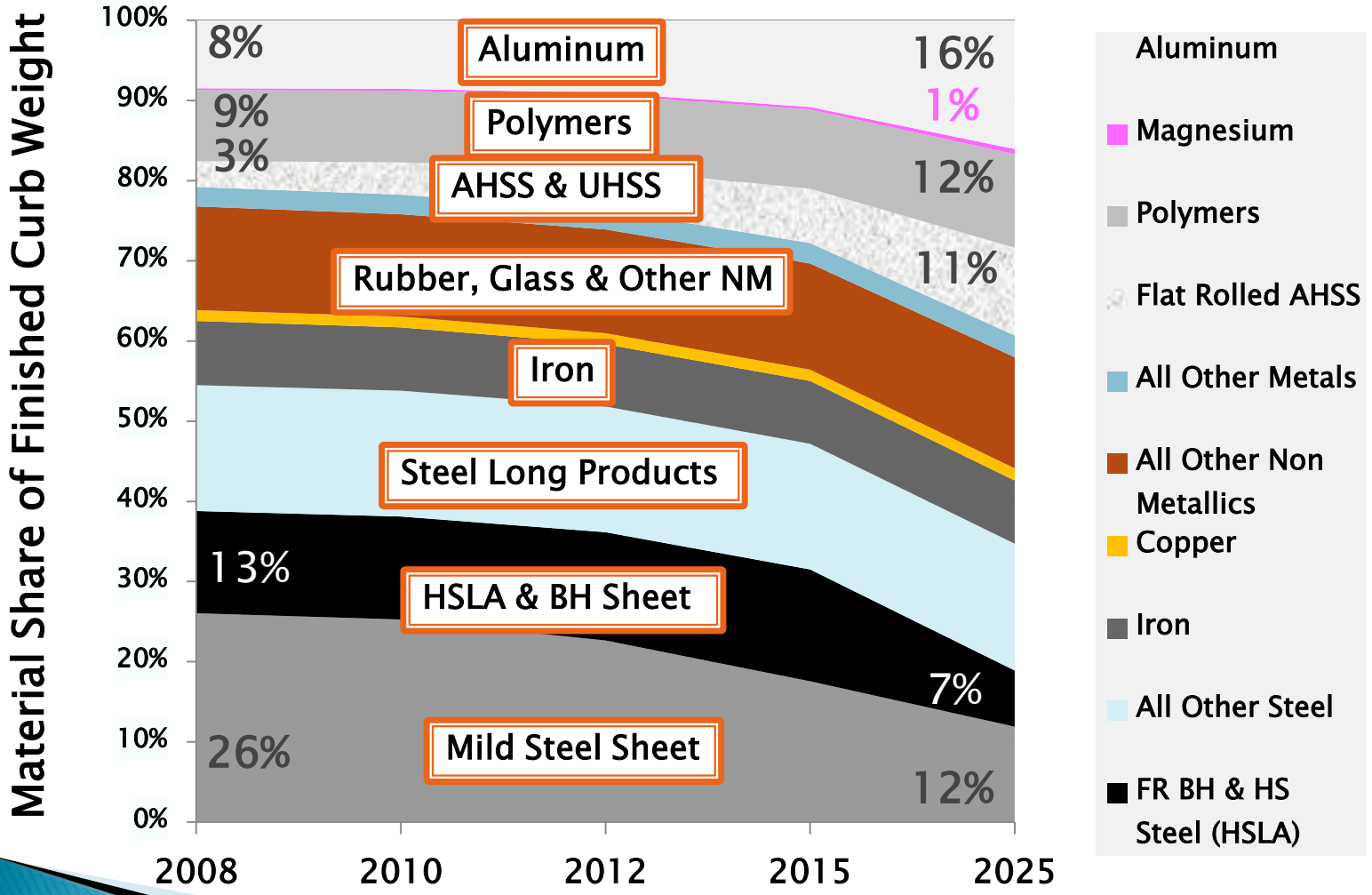


Automotive Strategies To Meet CAFE

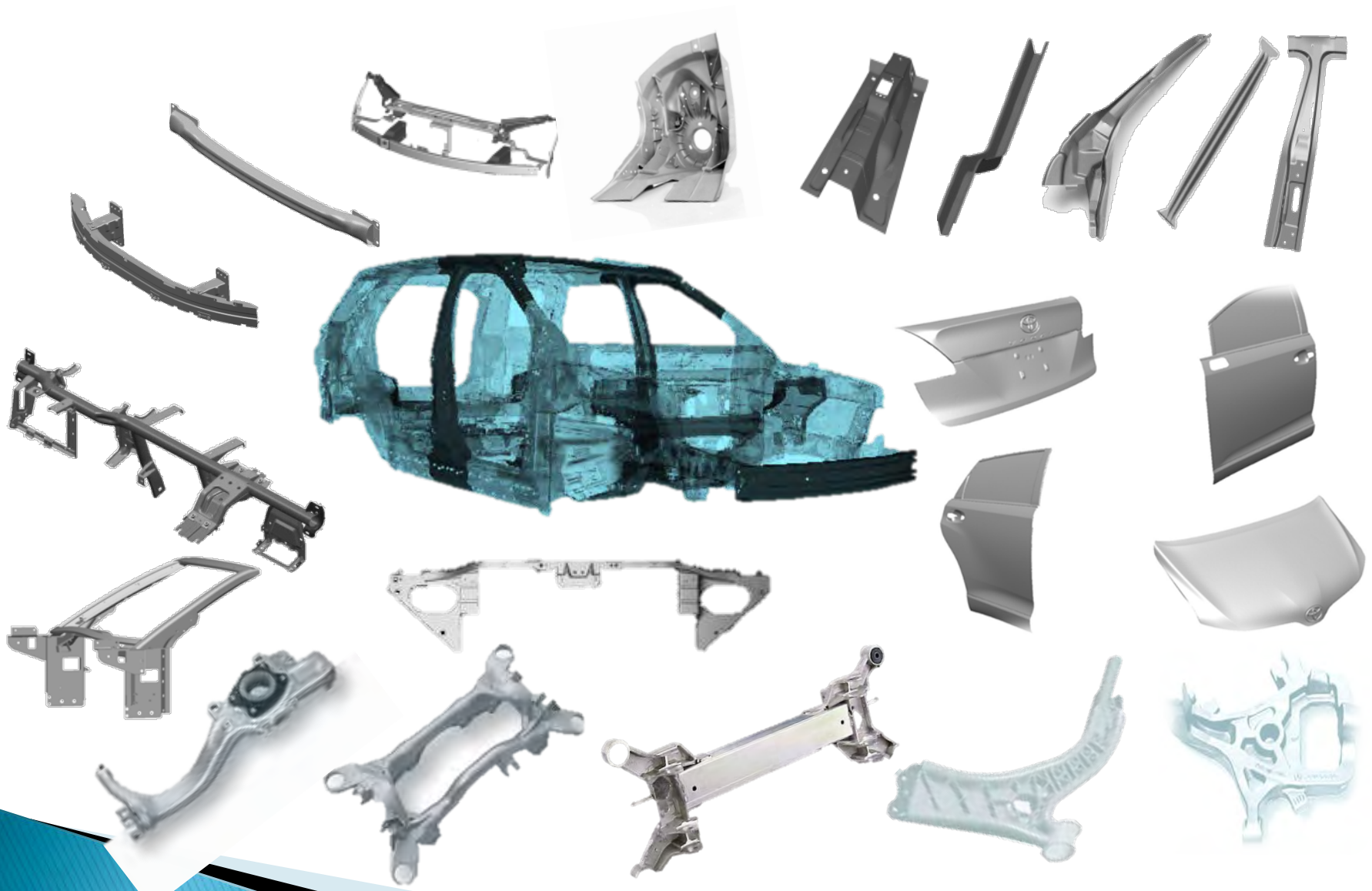
- Powertrain Enhancements
- HEV/EV
- Light Weight Materials:
  - Aluminum
  - AHSS (New Steels)
  - Composites, Polymers
  - Weight compounding
  - Magnesium

Future North American Aluminum Content

The mix of materials in NA light vehicles will shift to lower density and higher strength materials to save weight, reduce emissions and increase fuel economy Ducker Worldwide



Major Targets for Weight Savings



Potential Automotive Growth

- Hoods/Doors/Roofs/Deck Lids/Closures
- Bumpers
- Steering/Chassis/Suspension Components
- Increased Wheel Penetration
- Increased Powertrain Applications
- Frames with compounding value

Critical New Programs

- 2013 Range Rover
  - Aluminum Body 95%
  - 31.4 MPG Fuel Economy
  - 420 kg or 900 lbs. weight saved

- 2014 Ford F150
  - Aluminum Body
  - 1000 pounds of sheet
  - ?? MPG/20 %
  - 700 lbs. weight savings

"Huge Risk"

"Big Reward"

Additional Aluminum Programs

- 2014 Cadillac CTS Aluminum Doors
- Toyota/Lexus 2016 RX 350 aluminum hood and lift gate. First NA applications
- Jaguar announces aluminum frame n CX-17 use Frankfurt Auto Show Sept 2013
- BMW plan to integrate optimum mixture of materials with significant aluminum growth.

Issues With “New” Steel Usage

- Reduced gauge sheet requires reinforcement
- Higher Strength but less ductility requires hot forming
- Alloys result in change from traditional welding
- May require manufacturing press alteration or replacement
- Pricing requires market adjustable introducing price risk
- Modeling/Simulating performance of light weight materials
- Multiple material bonding/joining especially in a single joint
- Repair
- Recyclability

Issues With Aluminum Use

- Higher Unstable Cost
- Rolling and HT Capacity
- Sometimes requires warm forming, issue being resolved
- Welding/Riveting
- Customer Perception
  - Final consumer
  - Lack of Engineering Collaboration
- Roping/Forming Issues
- Repair

Bottom Line

"Steel will always be cheaper, aluminum will always be lighter"

Key Drivers For Aluminum Use

- Customer Acceptance/Perceived Value
  - Car Buyer
  - Design Engineers
- Cost/Supply Stability
  - New pricing structure? Supplier/Customer Commitment
- Aluminum Association
- Promote Safety Advantages
- CAFÉ Requirements/Fuel Cost
- **Closed Loop Recycle**
- Compounding Savings
- Technological Advancement
- Ensure Rolling/HT Capacity

Recycling Is Key to Success: "Sustainability"

- Current Aluminum Recycling
  - GM
  - Chrysler
  - Toyota
  - Honda
  - Alcoa
  - Novelis
  - Wise
  - Tri-Arrows
  - Many Others Are Committing

OEM Keys to Recycling Success

- **Recovery, Recovery, Recovery**
- All in conversion costs
- OEMs and generators assuring quality
- Process including capital and operations excellence
- Value tracking and recognition

Most Probable Outcome Over Next 10 Years

- Aluminum Evolution Not Revolution:
  - Significant penetration for Al and AHSS in large, premium and many mid-priced vehicles
  - Mild steel use will retain much of the high value small vehicle market especially Europe and Asia
  - Car manufacturers will closely balance material costs with weight savings with overriding factor being customer acceptance
  - Consumers will have more quality choices in all car classes

Thank You

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