NRDC

October 26, 2018

Mr. James Tamm, Chief
Fuel Economy Division
Office of Rulemaking
National Highway Traffic Safety Administration
1200 New Jersey Avenue, S.E.
Washington, DC 20590

Re: Docket NHTSA-2018-0067 and
EPA–HQ–OAR–2018–0283

Dear Mr. Tamm,

Please find attached comments on the Notice of Proposed Rulemaking for The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021–2026 Passenger Cars and Light Trucks (herein "NPRM"). These comments are specifically focused on the assumptions in the NHTSA CAFE Volpe model and NPRM pertaining to mass reduction (or lightweighting) technologies.

As background, I have worked at the Natural Resources Defense Council (NRDC) as a Senior Scientist the past ten years on vehicle and fuel policies. Prior to this role, I worked as an engineer at the Office of Transportation & Air Quality at the U.S. Environmental Protect Agency. I have a Ph.D. in Materials Science & Engineering and a M.S. in Technology & Policy from the Massachusetts Institute of Technology.

Thank you for your consideration of these comments.

Simon Mui
Senior Scientist
NRDC

Summary

The following represents an analysis of the assumptions in the NHTSA CAFE Volpe model (NPRM version) pertaining to mass reduction (or lightweighting) technologies. A review of current industry data pertaining to lightweighting in current and planned technologies is presented first, followed by an analysis of the NHTSA CAFE Volpe model assumptions. The conclusions are that:

- Current industry data demonstrates that mass reduction technologies have been applied to larger vehicles compared to small vehicles.
- An analysis of the top ten compact vehicles in the U.S shows that an increase in mass – rather than reductions – has occurred in the segment while MY2011-2018 fuel economy and GHG emission standards were in place.
- Analysis by other reputable sources point to lightweighting continuing to occur largely in large vehicles through 2025 rather than small vehicles
- In the NPRM Volpe model, NHTSA has changed inputs to have small and large passenger cars lightweight more than even previously assumed, resulting in phantom fatalities. This change is a departure from the agencies' past Technical Assessment Report and not supported by the evidence.
- Mass reductions achieved through the substitution of advanced materials, with improved crash properties, have been ignored by NHTSA in the Volpe modeling leading to additional safety benefits that are ignored.
- Body-in-White Studies also point to the ability to improve crashworthiness or be neutral while lightweighting.
- Improved vehicle handling from mass reductions have been ignored.

The agencies' lightweighting (or "mass reduction") analysis faces several problemsAbsent correction of the Volpe CAFE model assumptions to reflect lightweighting occurring largely in large vehicles as opposed to small vehicles, and changes to the modeling to incorporate potential safety benefits from use of lightweighting materials and improved designs, the resulting fatality estimates from lightweighting remain flawed, in conflict with NHTSA and EPA's prior assessment in the 2016 TAR and 2012 rulemaking, and not supported by the data.

Current industry data demonstrates that mass reduction technologies have been applied to larger vehicles compared to small vehicles

Current data, shown below in Figure 1 and 2 and discussed further below, demonstrate that under current fuel economy and GHG emission standards, mass reduction technologies have largely been applied to larger vehicles as opposed to small vehicles, and that coming models are following this trend.[1] From an engineering standpoint, automakers will find more "bang-for-the-buck" from reducing excess weight from large, heavier vehicles than from smaller vehicles with less weight-saving opportunities. The real-world applications of mass-reduction technologies by automakers are not only improving fuel economy and GHG emissions across the fleet, but are also safety-beneficial by causing the fleet to be more homogeneous in weight rather than dispersed. The latter – reducing dispersion in vehicle weights – was shown by Anderson and Auffhammer (2014) to decrease accident fatalities.[2] NHTSA also appears to agree with this finding, stating:

> *"Results in the Draft TAR and the 2016 Puckett and Kindelberger report are consistent with results in the 2012 Kahane report; chiefly, societal effects of mass reduction are small, and mass reduction concentrated in larger vehicles is likely to have a beneficial effect on fatalities, while mass reduction concentrated in smaller vehicles is likely to have a detrimental effect on fatalities." [NPRM, p. 43109]*

The data shown in Figures 1 and 2 represents total mass reductions inclusive but not limited to use of aluminum and high-strength steel. The information was compiled from the following industry and agency sources:

- IHS Markit – providing market sales and registration data. Their services, with the acquisition of R.L. Polk & Company, also now includes information on curb weight of vehicle models.
- Edmunds Auto – auto sales by manufacturer and make
- NHTSA: Data on safety provided by 5-Star Rating Program for each vehicle model and model-year. Vehicle footprints (wheelbase times the average of the front and rear track widths) have been gathered by the U.S. Department of Energy.
- EPA: Fuel economy and CO2 performance of vehicles.

Figure 1 displays weight reductions in recent models (as well as planned weight reductions). The weight reductions are largely occurring in larger vehicles as opposed to small vehicles. As shown in Figure 2, mass reduction technologies are being applied to large vehicles like full-size pickups, SUVs, and minivans. Many of these models shown are among the highest-selling vehicles in the U.S. and will have a larger impact relative to low-volume vehicles. In addition, some high-selling vehicles like the compact Honda Civic and mid-size Toyota Camry have seen some very slight increases that would have a beneficial trend of making the fleet weight distribution even narrower. Figure 2 also shows that all of the vehicles, received a 5-star (highest) crash rating from NHTSA save for the Honda Odyssey (4.5 star).

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[1] *Automotive Aluminum Industry Statement on Today's EPA Determination on Emissions Regs*, August 2, 2018. Statement by Heidi Brock, Aluminum Association President and CEO. https://www.drivealuminum.org/news-releases/automotive-aluminum-industry-statement-on-todays-epa-determination-on-emissions-regs/ (viewed 10/12/2018).

[2] Anderson, Michael L and Maximilian Auffhammer (2014). "Pounds that Kill: The External Costs of Vehicle Weight." *The Review of Economic Studies*, **81** (2):535–571.

Figure 1: Exhibit demonstrating recent and planned weight reductions by vehicles are occurring in larger footprint vehicles rather than small (Source: Aluminum Association)

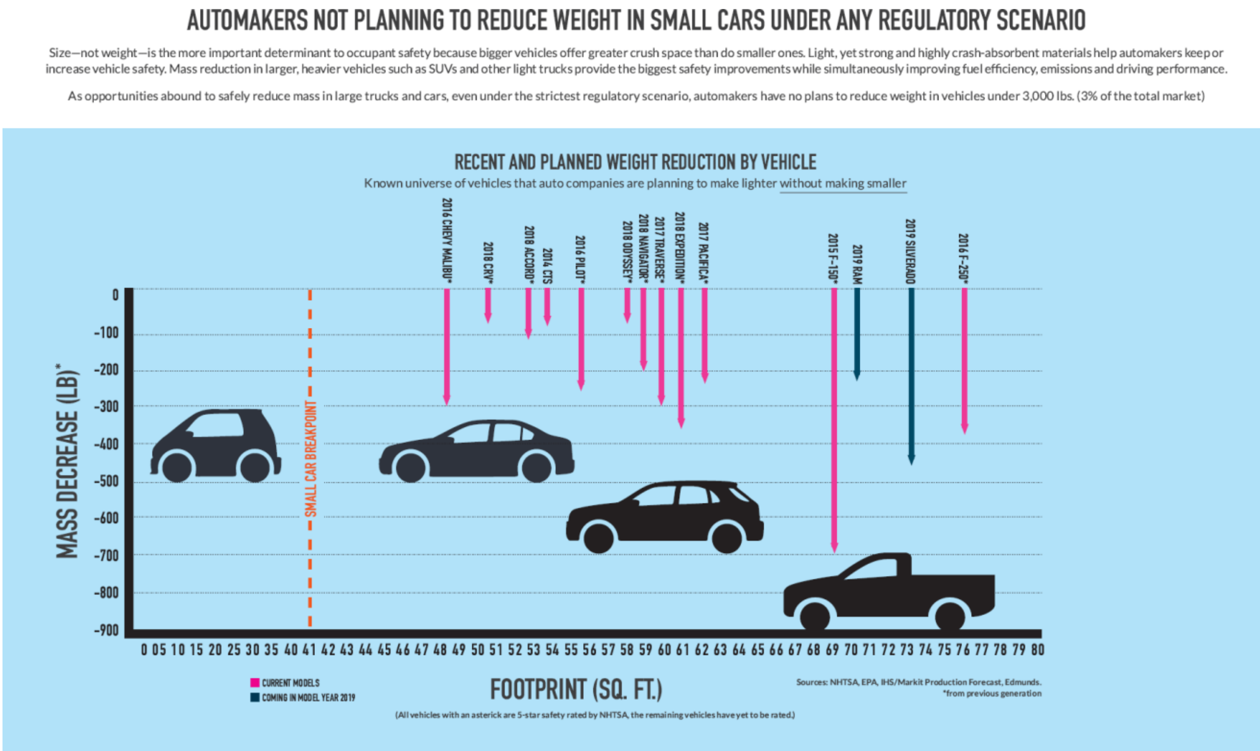
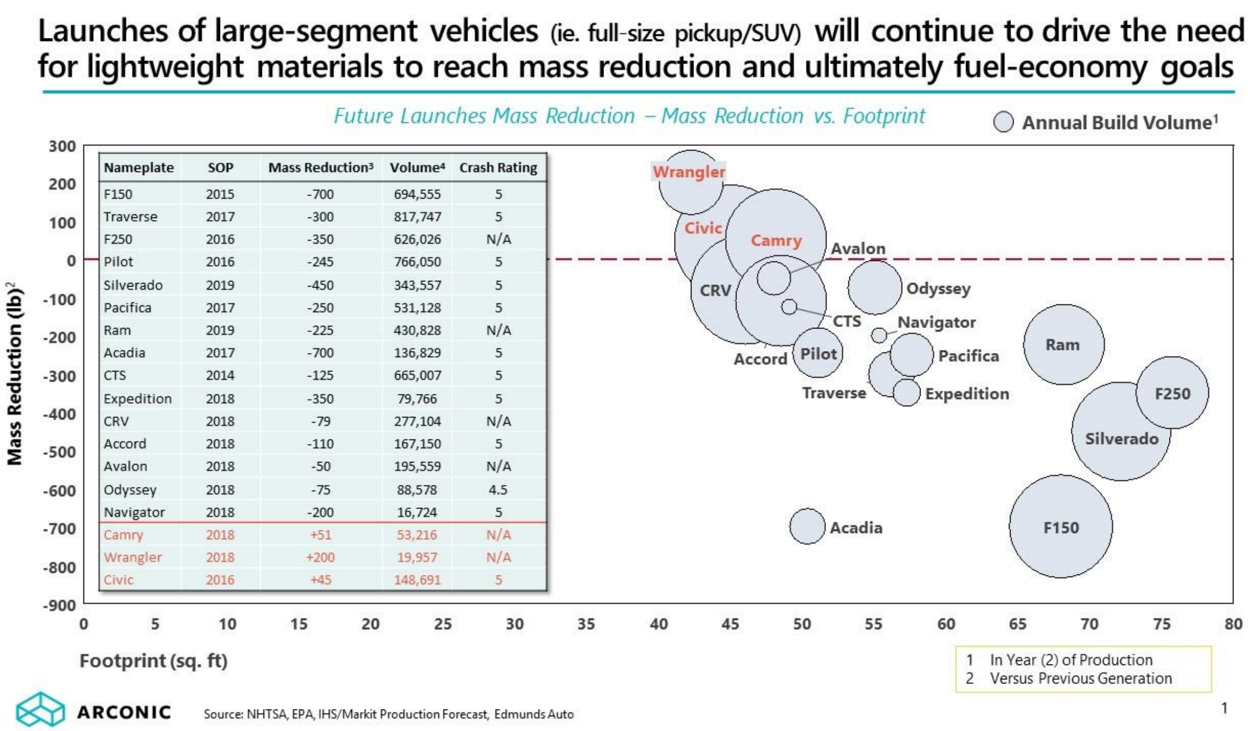


Figure 2: Exhibit demonstrating that weight reductions occurring in larger vehicles are among the highest-selling vehicles in the U.S. (Source: Aluminum Association)



An analysis of the top ten compact vehicles in the U.S shows that an increase in mass – rather than reduction – has occurred in the segment while MY2011-2018 fuel economy and GHG emission standards were in place.

An analysis of the changes in weight with each generation of vehicles among the top-ten selling compact vehicles currently in the U.S. is shown in Figure 3A and 3B.[3] These vehicle models represented 85% of the compact vehicle sales in the U.S. as of 2017, the last full year of data. The results overall show that automakers have largely increased the weight of their vehicles over time, by a sales-weighted average of about 125 pounds (lbs) overall between model years 2010 to 2018/2019.[4] This is the same time-period over which the MY2011-2016 and MY2017 and beyond standards have been implemented. Given that NHTSA and other studies' findings that a weight increase can have a beneficial effect at the smaller segments, the analysis suggests that the standards have likely been safety-beneficial or at least safety-neutral for the compact, small segments.

NHTSA has itself agreed that vehicle mass has continued to increase, but only discusses the trends over the MY 2004 to 2011 time-period.

> "*Vehicle mass continued an historical upward trend across the MYs in the newest databases. The average (VMT-weighted) masses of passenger cars and CUVs both increased by approximately 3% from MYs 2004 to 2011 (3,184 pounds to 3,289 pounds for passenger cars, and 3,821 pounds to 3,924 pounds for CUVs). Over the same period, the average mass of minivans increased by 6% (from 4,204 pounds to 4,462 pounds), and the average mass of LTVs increased by 10% (from 4,819 pounds to 5,311 pounds). Historical reasons for mass increases within vehicle classes include - manufacturers discontinuing lighter models; manufacturers re-designing models to be heavier and larger; and shifting consumer preferences with respect to cabin size and overall vehicle size." [PRIA, p. 1361]*

For the MY2011 through MY2017 period, we turn to EPA's latest *Light-Duty Vehicle CO_2 and Fuel Economy Trends*, which shows that on average the weight of passenger cars remained virtually unchanged going from 3569 lbs (MY2008) to 3570 lbs (MY2017, preliminary inertia weight). By comparison, trucks on average went from 4837 to 4703 lbs over the same time period, losing on average 134 lbs.[5]

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[3] Top ten based on CarMax 1Q2018 (https://www.carmax.com/articles/best-small-cars). Weight data was obtained for various product redesign model years from Edmunds.com. Where large variation existed for a specific model in a year, engine sizes were utilized to most closely compare between redesigned models. Total and individual model sales for the compact segment were obtained from carsalesbase.com.
[4] Calendar year 2017 was used for sales-weighting by model, the last full year of data available.
[5] EPA (2017), *Light-Duty Vehicle CO_2 and Fuel Economy Trends*, https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100TGDW.pdf (last viewed 10/18/2018)

Figure 3A: Changes in weight over time for the top-ten selling compact passenger cars in the U.S. (Top 1 through 5 shown)

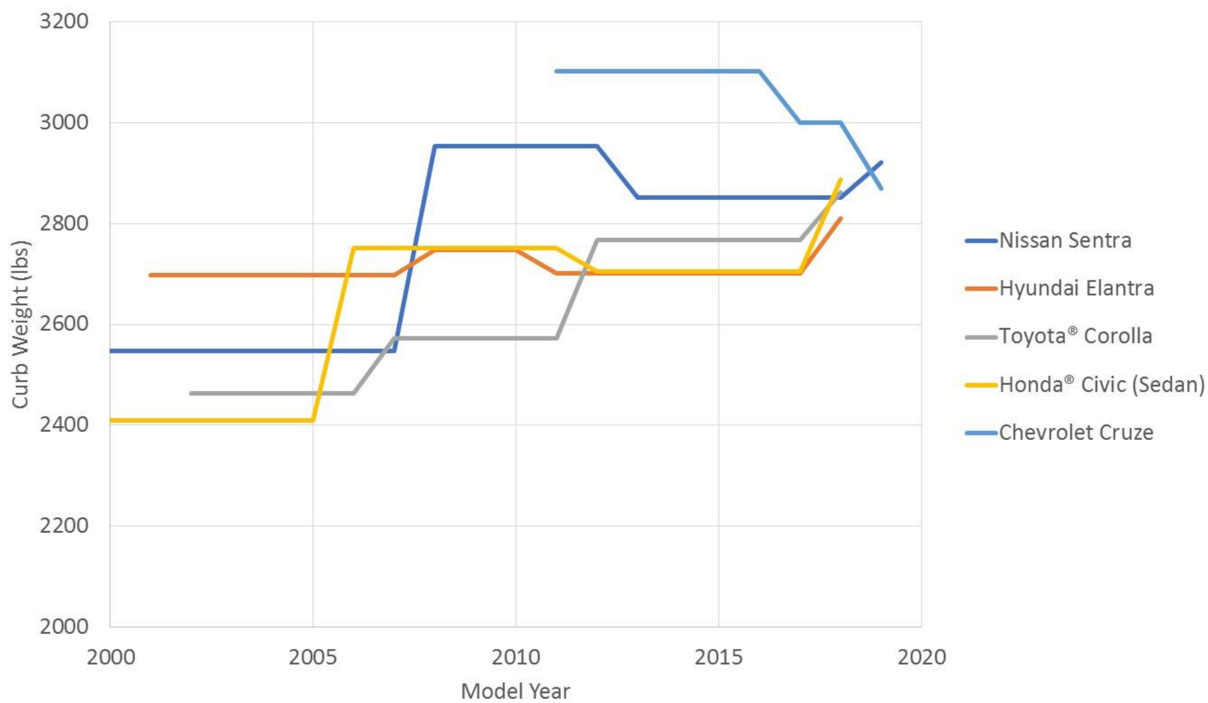
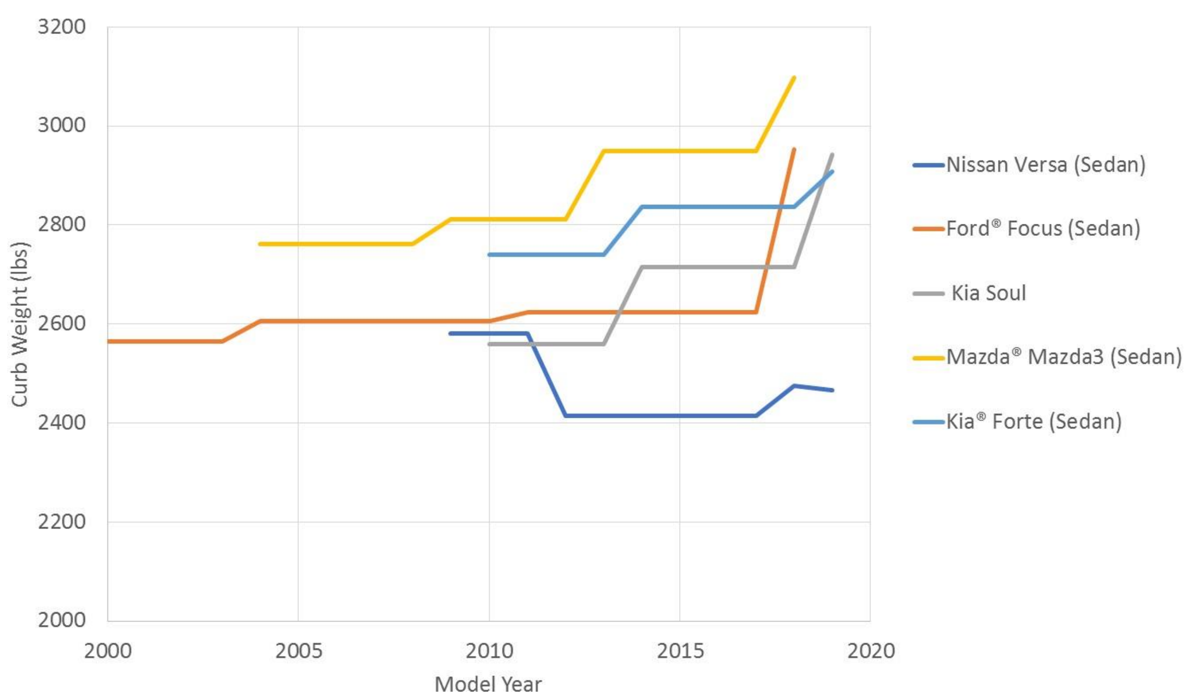


Figure 3B: Changes in weight over time for the top-ten selling compact passenger cars in the U.S. (Top 6 through 10 shown)



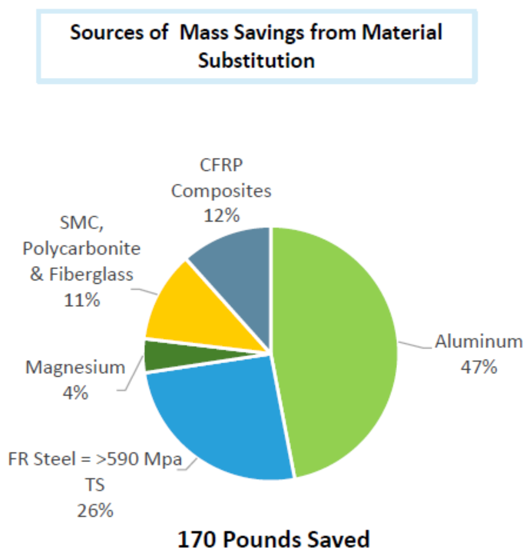
Analysis by other reputable sources point to lightweighting continuing to largely occur in large vehicles through 2025 rather than small vehicles.

Ducker Worldwide, which gathers input and data from automakers as well as their material suppliers, produces reports on trends in the use of lightweight materials. The latest publicly available report (2017) intended to "establish an independent view of what the technology paths in the TAR imply about weight savings by OEM, vehicle type, and even specific vehicles beyond 2020."[6]

Ducker (2017) states that "the regulation driven weight reduction goals vary by type of vehicle and by OEM. Less than 25% of the vehicles have to contribute 50% of the total savings. *Pickup trucks, large cars and SUVs, minivans and electric vehicles* will bear most of the burden."[7] [emphasis added]

Ducker's analysis forecasts that light trucks (pickups, SUVs, vans and multipurpose vehicles) will lose more weight relative to those passenger cars that do reduce weight. Based on these conclusions, one can logically deduce that the weight differential will narrow more than it otherwise would have, leading to a safety-benefit.

Figure 3: Sources of mass savings from Ducker Analysis for the 2025/2028 time period (170 pounds mass reduction).



[6] Ducker (July 2017), *Aluminum Content in North American Light Vehicles 2016 to 2028: Summary Report.* https://www.ducker.com/news-insights/unprecedented-growth-expected-automotive-aluminum-multi-material-vehicles-ascend-new (viewed 10/12/2018), p. 3

[7] Ibid.

IHS Markit, one of the largest consultancies collecting and providing auto industry data services, also conducts "Body in White" (BIW) Materials Forecasts.[8] Their service also finds that most of the substantive mass reductions will occur in full-size unibody vehicles, full-size light trucks, and sporty cars.

In fact, the Insurance Institute for Highway Safety (IIHS) stated that the institute was "*supportive of the fuel economy standards as implemented. The Obama-era changes to the rules, essentially using a sliding scale for fuel economy improvements by vehicle footprint, addressed safety concerns that IIHS raised in the past."*[9]

Despite the evidence and data, NHTSA has now changed inputs in the CAFE Volpe model to have small and large passenger cars lightweight more than even previously assumed, resulting in phantom fatalities. This change is a departure from the agencies' past Technical Assessment Report and is not supported by the evidence or new data.

NHTSA in its Volpe CAFE modeling of mass reductions applies a significant amount of percent mass reductions to the small or compact passenger car segment, as part of its new analysis of the Augural CAFE standards, or "No Change" scenario.[10] In Table 2 below, the mass reductions assumed for each vehicle category is shown for the 2018 NPRM CAFE Volpe model. This is contrasted against Table 3 below, which shows the mass reductions assumed for each vehicle category from the 2016 TAR conducted by NHTSA.[11] In Figure 4 below, the differences in NHTSA's assumptions for the 2016 TAR and 2018 NPRM are shown.

[8] https://cdn.ihs.com/www/pdf/AUT-BIW-Lightweighting-Infographic.pdf

[9] Russ Radar, IIHS spokesman, as reported by Bloomberg News, (February 16, 2018), *Safety gains from heavier cars may be cited to cut MPG rules, https://www.bloomberg.com/news/articles/2018-02-12/safety-of-heavier-cars-may-be-used-to-lower-u-s-fuel-efficiency*

[10] *NPRM, Tables VIII-16 and VIII-18, pp. 43396-43401.*

[11] The tables were produced by Meszler Engineering Services utilizing the NHTSA Volpe CAFE model (NPRM version as well as the TAR 2016 version). The 2032 values from the model are presented which allows – as the NPRM states – the Volpe modeling results to equilibrate and stabilize.

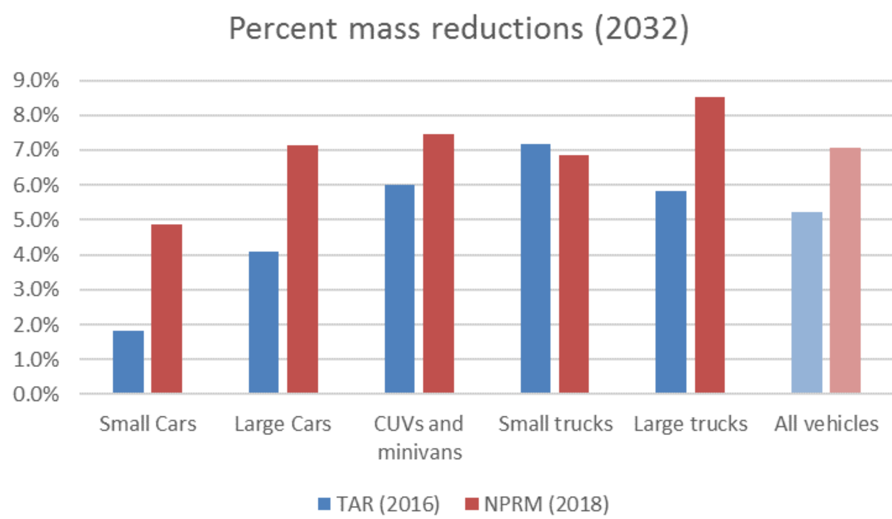
Table 2: 2018 NPRM CAFE Volpe assumptions and results on Augural CAFE Standards (2032 New Passenger Vehicle Fleet)

	Sales	Initial Vehicle Curbe Weight	Final Vehicle Curb Weight	Mass Reduction Assumed	
	(millions)	(lbs)	(lbs)	(lbs)	(%)
Small Cars	3.5	2871	2731	139	4.9%
Large Cars	4.0	3564	3310	255	7.1%
CUVs and minivans	6.2	3871	3582	288	7.4%
Small trucks	2.6	4477	4169	308	6.9%
Large trucks	1.7	5494	5026	468	8.5%
All vehicles	18.0	3854	3582	272	7.1%

Table 3: 2012 Rulemaking and 2016 TAR CAFE Volpe assumptions and results on Augural CAFE Standards (2032 New Passenger Vehicle Fleet)

Augural CAFE Standards (2032 New Passenger Vehicle Fleet)					
	Sales	Initial Vehicle Curb Weight	Final Vehicle Curb Weight	Mass Reduction Assumed	
	(millions)	(lbs)	(lbs)	(lbs)	(%)
Small Cars	3.1	2857	2805	52	1.8%
Large Cars	4.2	3639	3490	149	4.1%
CUVs and minivans	5.1	3965	3726	239	6.0%
Small trucks	2.5	4391	4075	316	7.2%
Large trucks	2.4	5889	5545	344	5.8%
All vehicles	17.4	4018	3809	209	5.2%

Figure 4: Comparison of percent mass reductions by vehicle classification between the 2016 TAR analysis and 2018 NPRM analysis.



The changes by NHTSA in its NPRM (2018) is unsupported and contrary to the evidence and data. The change is also a departure from the agencies own Technical Assessment Report (2016) as well as its 2012 rulemaking. In both cases EPA and NHTSA found that automakers could maintain safety and meet the standards. Indeed, in the 2012 Final Rulemaking, both NHTSA and EPA assumed that automakers would meet standards largely by limiting mass reductions for small cars and small SUVs while reducing mass by up to 20% for large trucks and SUVs as shown in Table 1.[12]

Table 4: Reproduced Table from EPA and NHTSA Joint Technical Support Document (2012)[13]

Table 3-127 Maximum Mass Reduction Amount Applied in CAFE Model

Absolute %	Subcompact and Subcompact Perf. PC	Compact and Compact Perf. PC	Midsize PC and Midsize Perf. PC	Large PC and Large Perf. PC	Minivan LT	Small, Midsize and Large LT
MR1*	0.0%	0.0%	1.5%	1.5%	1.5%	1.5%
MR2	0.0%	0.0%	3.5%	7.5%	7.5%	7.5%
MR3	0.0%	0.0%	0.0%	10.0%	10.0%	10.0%
MR4	0.0%	0.0%	0.0%	0.0%	15.0%	15.0%
MR5	0.0%	0.0%	0.0%	0.0%	20.0%	20.0%

As shown above, EPA and NHTSA's assessment in the 2012 rule and 2016 TAR has been directionally accurate thus far regarding mass reductions occurring in larger vehicles. If anything, the Agencies' 2012 rulemaking and 2016 TAR analysis was conservative in that it did not capture the weight increases in small vehicles that have been now observed.

NHTSA's NPRM (2018) modifications to the modeling parameters – adding more weight reductions to small and large passenger cars has the effect of creating phantom fatalities and flipping the lightweighting-safety effects. That is, NHTSA has flipped its light-weighting findings under the 2012 rulemaking and 2016 TAR for the Augural standards from being safety-neutral or beneficial to safety-harming under this NPRM. The only justification that NHTSA gives is a trivial, unsubstantiated statement:

> *"In light of the reality that vehicle manufacturers may choose the relatively cost-effective technology option of vehicle lightweighting for a wide array of vehicles and not just the largest and heaviest, it is now recognized that as the stringency of standards increases,*

[12] EPA and NHTSA note in its previous rulemaking "the agencies applied mass reduction of up to 20 percent relative to MY 2008 levels in this final rule compared to only 10 percent in the MYs 2012–2016 final rule." Federal Register, October 15, 2012; **77** (199), p. 62705.

[13] Table 3-127. EPA Technical Support Document, Final Rulemaking for 2017-2025 Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards. (last accessed 10/15/2018) https://nepis.epa.gov/Exe/ZyPDF.cgi/P100F1E5.PDF?Dockey=P100F1E5.PDF

so does the likelihood that higher stringency will increase on-road fatalities. As it turns out, there is no such thing as a free lunch." [NPRM, p. 42991]

No new analysis was provided of either past or future trends supporting this presumed "reality."

To demonstrate how these changes to NHTSA's prior modeling affect the fatality impacts, we reproduce Table II-45 from the current NPRM (2018) which shows the assumed revised percentages of fatality increase per 100-pound mass reduction. By increasing the light weighting for small and large cars, the agency has flipped the fatality results.

Table 5: Reproduction of NTHSA's table of fatality increases (%) per 100-pound mass reductions while holding footprint constant. (NPRM p. 278).

Table II-45 - Fatality Increase (%) per 100-Pound Mass Reduction While Holding Footprint Constant: MY 2004-2011, CY 2006-2012

	Point Estimate	95% Confidence Bounds
Cars < 3,197 pounds	1.20	-.35 to +2.75
Cars ≥ 3,197 pounds	0.42	-.67 to +1.50
CUVs and minivans	-0.25	-1.55 to +1.04
Truck-based LTVs < 4,947 pounds	0.31	- .51 to +1.13
Truck-based LTVs ≥ 4,947 pounds	-0.61	-1.46 to +.25

With respect to the 95% confidence bounds in Table 5, we note that NHTSA has stated that none of the coefficients shown are statistically significant, meaning fatality increases could be negative, zero, or positive and still within the range of confidence. Only two of the five coefficients are statistically significant above the 85% level.

"None of the estimated effects have 95-percent confidence bounds that exclude zero, and thus are not statistically significant at the 95-percent confidence level. Two estimated effects are statistically significant at the 85-percent level."[14]

Mass reductions achieved through the substitution of advanced materials, with improved crash properties, have been ignored by NHTSA in the Volpe modeling leading to additional safety benefits that are ignored.

We also note that the Volpe model – and thus the NPRM (2018) results and conclusions – are entirely devoid of any representation for *Improved crash-worthiness of materials and designs from lightweighting.* This is analogous to saying because NASCAR or Formula 1 racecars have become lighter over the years, they must have become less safe – entirely ignoring how the materials and design have improved crash-safety while lightweighting.

[14] NPRM at 43, 111.

As reflected in the TAR (2016), EPA and NHTSA also previously assumed that automakers could meet the standards without compromising safety through improved, more crashworthy and lightweight materials together with improved vehicle design. These material improvements are entirely left out of the CAFE Volpe model in its fatality calculation and analysis, significantly undercutting the safety improvements that have been occurring in the real-world. All of the vehicles shown in Figure 2 have achieved a 5-star crash-rating (with one 4.5 star). Automakers have themselves made statements, cited by NHTSA (2012) in its Final Regulatory Impact Analysis for 2017-2025 [p. 420]

Ford: "The use of advanced materials such as magnesium, aluminum and ultra high-strength boron steel offers automakers structural strength at a reduced weight to help improve fuel economy and meet safety and durability requirements."

Nissan: "We are working to reduce the thickness of steel sheet by enhancing the strength, expanding the use of aluminum and other lightweight materials, and reducing vehicle weight by rationalizing vehicle body structure."

In its modeling, NHTSA has failed to reflect the very conclusion experts made a decade ago in its own safety roadmap for new vehicle materials:

> *"To achieve lightweight architectures, without compromising on rigidity, automakers have been researching the replacement of steel with plastics, composites, foams, aluminum, and magnesium. Leading experts have argued that the use of advanced materials for reducing weight offers the easiest and least expensive way to achieve multiple benefits (reduce energy consumption and emissions at equal or better safety)." NHTSA (2007)*[15]

NHTSA-funded Body-in-White studies, together with other studies, point to the ability to improve crashworthiness or be safety-neutral while lightweighting

In a NHTSA supported study conducted by EDAG and Electricore, looking at a Honda Accord's Body-In-White system, the study found that:

> *"The new LWV [lightweight vehicle] 1.2 design was modeled and assessed for the performance of crashworthiness in seven crash safety tests. The new design achieved a "good," rating in all tests which are comparable to the safety rating of the MY2013*

[15] NHTSA (2007), A Safety Roadmap for Future Plastics and Composites Intensive Vehicles, https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/810863.pdf

Accord."[16] [The ratings used the Insurance Institute for Highway Safety scores which range from good, acceptable, marginal, or poor.]

The Aluminum Association also used the same NHTSA contractor (EDAG) in a follow-up study to evaluate a crossover utility vehicle using aluminum, using computational modeling simulations of light weighting and crash-worthiness for a Toyota Venza Body-in-White. The results showed that a 35-40% mass saving of the system could be achieved while obtaining higher torsion and bending stiffness, reduced intrusions and reduced dynamic crush – all beneficial from crashworthiness standpoint.[17] Figure 6 shows one example of lower intrusion into the vehicle dashboard upon a frontal crash while still reducing weight significantly.

The government agency in Canada, Transport Canada, supported a follow-up study to EPA's 2015 light-duty pickup truck analysis of a Chevy Silverado. The agency summarized its study of a vehicle that had applied lightweighting technologies resulting in a 19% weight reduction:

> *"Finally, the 'Task 5 Light-Weighted 4x4 CAE Model' (T5-LW Model) was developed by combining the light weight vehicle systems from the EPA Project with an updated Aluminum intensive cab, achieving the objective of also attaining a 'Good' structural rating in the IIHS Small Overlap Test. The T5-LW Model achieved equivalent or better performance in the other crash and NVH load cases compared to the T3-BL Model as required [the baseline Chevy Silverado on the market], and in most cases was actually comparable to the T4-GA Model."*[18]

Finally, the National Academies of Science (2015) report on fuel economy reported that:

> *"Crashworthiness is maintained or improved with all lightweighting designs (or the designs are modified to be safe)."*[19]

The evidence indicates that safety can be held neutral or even enhanced with use of currently available lightweight materials together with improved, careful vehicle design.

Improved vehicle handling from mass reductions has been ignored.

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[16] Update to Future Midsize Lightweight Vehicle Findings in Response to Manufacturer Review and IIHS Small-Overlap Testing. (February 2016), https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/812237_lightweightvehiclereport.pdf (last viewed 10/18/18).

[17] Venza Aluminum BIW Concept Study (April 2013), EDAG ENGINEERING GmbH. http://www.drivealuminum.org/wp-content/uploads/2017/05/Venza.FullStudy_2013MAY15.pdf (last viewed 10/18/2018).

[18] Transport Canada (2015), *Light-Duty Truck Weight Reduction Study with Crash Model, Feasibility and Cost Analysis* (September 24, 2015). https://www.tc.gc.ca/en/programs-policies/programs/ecotechnology-vehicles-program/etv-technical-papers/light-duty-truck-weight-reduction-study-crash-model-feasibility-cost-analysis.html (last viewed 10/25/18)

[19] Page 6-27, National Research Council. 2015. Cost, Effectiveness, and Deployment of Fuel Economy Technologies for Light-Duty Vehicles. Washington, DC: The National Academies Press. https://doi.org/10.17226/21744.

Finally, mass reductions, when coupled with improved design, can also improve vehicle handling including more responsive steering, improved acceleration and braking all of which can improve safety.

As the NAS (2015) stated::

> *"The other attributes (steering feel, driving responsiveness, acceleration, and stopping) can all be improved with lighter vehicles. As discussed earlier in this chapter, these attributes are important competitive differentiators that might favor lightweighting…"*[20]

These crucial factors have not been included in the Volpe modeling parameters or valued.

Conclusion

The agencies' lightweighting (or "mass reduction") analysis faces several problems. Absent correction of the Volpe CAFE model assumptions to reflect lightweighting occurring largely in large vehicles as opposed to small vehicles, and changes to the modeling to incorporate potential safety benefits from use of lightweighting materials and improved designs, the resulting fatality estimates from lightweighting remain flawed, in conflict with NHTSA and EPA's prior assessment in the 2016 TAR and 2012 rulemaking, and not supported by the data.

[20] Ibid.

Figure 5: Toyota Venza Body-in-White Study: Crashworthiness Results