

NACAA Mobile Sources and Fuels Committee

Flex-fuel Vehicle F-Factor

September 22, 2020

Background

- ▶ Dual fuel vehicles are required to be tested on both fuels they use
- ▶ Flex-fuel Vehicles (FFVs) use both E85 and regular gasoline and must be tested on both to determine their GHG and CAFE compliance
- ▶ For Model Year (MY) 2016 and later, EPA regulations require the use of an “F-Factor”, which is used to weight the E85 and gasoline test results into a single value to be used in the manufacturer’s CO₂ fleet average for compliance
 - ▶ The F-Factor F is based on an assessment of the percentage of E85 expected to be consumed by an FFV over its life.
- ▶ Manufacturers can propose their own F-factor, or they can request that EPA establish the F-factor
- ▶ The F-factor is also used in CAFE starting in MY 2020
- ▶ In 2014, following an opportunity for public comment, EPA established a F-factor of 0.14 for MYs 2016-2018
- ▶ In 2019, in response to a request from the auto manufacturers, EPA extended the 0.14 value to cover MY2019

F-factor for Model Years 2020 and later

- ▶ On August 20th, EPA issued a letter to auto manufacturers carrying over the current 0.14 F-factor to model years (MYs) 2020 and later
 - ▶ EPA noted in the letter that for MYs 2021 and later, EPA intends to revisit the F-factor and request comment and data that may be used to inform EPA's assessment of a revised F-factor for those model years
 - ▶ The letter noted two key factors that EPA must consider further in updating the F-factor: (1) the significant updates to the EIA's Annual Energy Outlook (AEO) between AEO 2020 and the methodology used in previous years and (2) the significant impacts of COVID-19 on fuels markets
 - ▶ Link to EPA letter: https://iaspub.epa.gov/otaqpub/display_file.jsp?docid=50843&flag=1
- ▶ Concurrent with the manufacturer letter, EPA issued a Federal Register notice requesting comments and data for establishing a new F-factor for MYs 2021+
 - ▶ Link to FR Notice: <https://www.govinfo.gov/content/pkg/FR-2020-08-26/pdf/2020-18714.pdf>
 - ▶ A technical memorandum to the docket accompanied EPA's request for comment providing EPA's assessment of currently available data and possible methodological approaches for establishing a new F-factor (subsequent slides provide further detail)
 - ▶ Link to Technical Memo: <https://www.epa.gov/regulations-emissions-vehicles-and-engines/technical-memo-determining-weighting-factor-f-factor>
 - ▶ The 60-day comment period closes on October 26th (Docket No. EPA-HQ- OAR-2020-0104)

F-Factor Application in GHG and CAFE Programs

- ▶ For the GHG Program, the F-Factor is the percentage of E85 used over the life of a model year vehicle. It is used to weight a vehicle's CREE (Carbon Rated Exhaust Emissions)
- ▶ For the CAFE Program the fuel economy on E85 is divided by 0.15 and then weighted.

GHG Program

GHG emissions on E85 = 330 g/mi and on Gasoline = 350 g/mi
 $CREE = (0.14 \times 330) + (0.86 \times 350) = 347.2 \text{ g/mi}$

CAFE Program

The F-Factor is also used for CAFE with no cap starting in 2020 as follows:

$$MPG = (F/MPG_A + (1-F)/MPG_G) - 1$$

Where:

MPG_A is the mile per gallon on E85 divided by 0.15

MPG_G is the miles per gallon on Gasoline

So, if $F=0.14$,

MPG on E85 is 26.9 mpg, $MPGA = (26.9/0.15) = 244 \text{ mpg}$

$MPGG$ is 36.6 mpg

$$MPG = ((.14/244) + (1-.14)/36.6)^{-1} = 41.2 \text{ mpg}$$

Technical Memo

- ▶ “The agency recognizes that this is an opportunity to seek public comment on the available data sources and methodologies that could be used for a future F-Factor determination, and the purpose of this technical memorandum is to describe an approach, including the data sources and methodology, which EPA is considering using for Model Years 2021 and later.”
- ▶ The Technical Memo provides information regarding:
 - ▶ Definition and application of the F-Factor
 - ▶ Current F-Factor calculation methodology
 - ▶ Potential data sources for determining the F-Factor
 - ▶ Results using AEO 2019, AEO 2020 and stakeholders

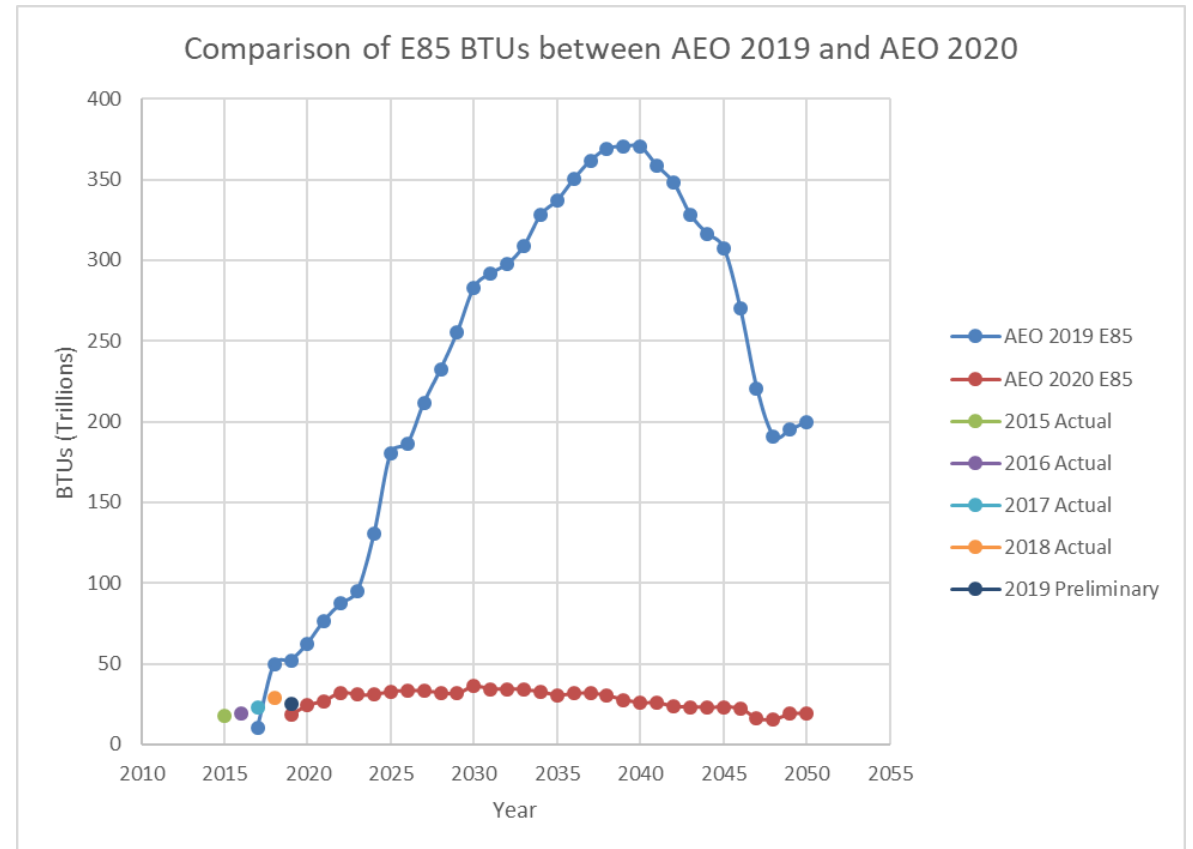
Technical Memo - Data Sources

- ▶ There are 3 primary data requirements for the determination of the F-Factor:
 - ▶ Future Fuel Consumption: EPA recommended the use of AEO in BTUs (Discussed on the next slide)
 - ▶ Vehicle Population: EPA recommended using EIA AEO Volumes for FFVs for initial values then using MOVES Survival Rate Tables for the population in future years (see Appendix)
 - ▶ Vehicle Miles Traveled (VMT): EPA recommended using a base mileage for Trucks of 18,000 miles then using the MOVES RMAR (Relative Mileage Accumulation Rate) table to calculate VMT for Cars and for future years (see Appendix)
- ▶ Details on the mathematical analysis can also be found in the Appendix

Technical Memo - AEO - Fuel

- ▶ As for previous editions, AEO 2020 projects E85 consumption volumes for each future year
- ▶ In comparison to AEO 2019, the projected E85 volumes in AEO 2020 are considerably lower due to
 - ▶ Greater competition between ethanol and biodiesel instead of assuming 15 bill gal ethanol
 - ▶ Increased renewable diesel capacity
 - ▶ Reduced projected sales of FFVs
 - ▶ Increased projected gasoline demand
 - ▶ Inclusion of potential future small refinery projections
 - ▶ POLYSIS / NEMS integration

- ▶ However, the AEO 2020 volumes are closer to actual historical volumes
- ▶ Note that Fuel Freedom Foundation took exception to EIA's E85 projections and provided its own analysis



Technical Memo - Results

Yearly Percentages

- ▶ The technical memo included "Yearly Percentages" which represent the fraction of fuel used by FFVs each year that is E85
 - ▶ $\text{E85 vol} / (\text{E85 vol} + \text{E10 vol})$ in calendar year X
- ▶ The Yearly Percentages are not F-Factors since they do not represent E85 used over the vehicle's life
- ▶ However, they provide a helpful homologue for assessing the accuracy of F-factors, particularly if there is little variability in Yearly Percentages over time
- ▶ Yearly Percentages can be based on historical estimates of E85 consumption or on future projections of E85 consumption (i.e. AEO)

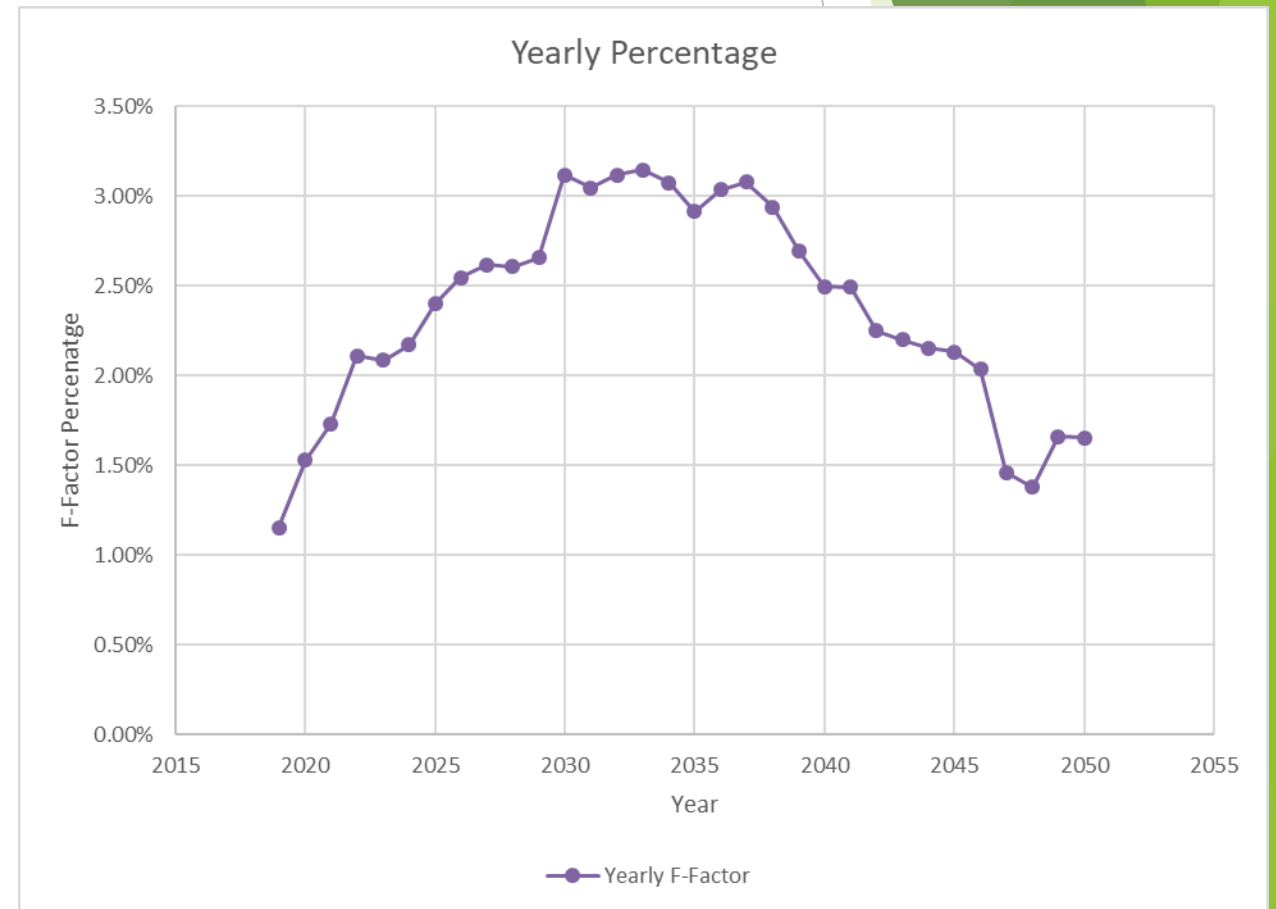
Technical Memo - Results

Yearly Percentages, cont.

Table 6 Yearly Percentage of Fuel used in FFVs which is E85

	Based on energy		Based on volume	
	Low	High	Low	High
2015	0.010	0.011	0.013	0.014
2016	0.011	0.012	0.014	0.015
2017	0.013	0.015	0.016	0.019
2018	0.014	0.019	0.017	0.024
2019	0.013	0.016	0.017	0.020

Figure 6: Yearly Percentage Calculated from AEO 2020



Technical Memo-Results

- ▶ F-Factors for MYs 2020-2025 using AEO 2019 and AEO 2020 for both EPA’s method and the methodology submitted by the Alliance.
 - ▶ The values presented here are a direct application of AEO 2020 into the Alliance methodology as calculated by EPA.
 - ▶ The Alliance methodology provides similar values to EPA’s since the Yearly Percentages for the model year’s lives are between 1 and 3 percent.
 - ▶ If AEO2020 values were used the F-Factor would be about 3 percent for 2020-2025.
- ▶ For comparison, the revised Fuel Freedom Foundation analysis yielded an F-Factor of 0.21.

Model Year	Using AEO 2019 Data			Using AEO 2020 Data		
	EPA 25 Year Life	Alliance 20 Year Life	Alliance 15 Year Life	EPA 25 Year Life	Alliance ^a 20 Year Life	Alliance ^a 15 Year Life
2019		16.53%	13.80%		2.55%	2.40%
2020	15.01%	17.91%	15.40%	2.39%	2.63%	2.53%
2021	16.56%	19.26%	17.05%	2.49%	2.68%	2.62%
2022	18.13%	20.56%	18.71%	2.58%	2.72%	2.71%
2023	19.70%	21.79%	20.38%	2.63%	2.72%	2.77%
2024	21.27%	22.98%	22.03%	2.68%	2.73%	2.83%
2025	22.64%	23.99%	23.50%	2.73%	2.73%	2.87%
2020-2025^b	18.84%	20.43%	18.70%	2.58%	2.68%	2.68%

- a. These columns were calculated using the Alliance methodology.
- b. The Alliance numbers are for 2019-2025 in this row, and the EPA numbers are for 2020-2025. The Alliance numbers would be larger if they were averaging 2020-2025.

Technical Memo-Requests for Comment Data

- ▶ “The agency recognizes that this is an opportunity to seek public comment on the available data sources and methodologies that could be used for a future F-Factor determination, and the purpose of this technical memorandum is to describe an approach, including the data sources and methodology, which EPA is considering using for Model Years 2021 and later.”
- ▶ “Due to uncertainty associated with the projection of E85 fuel consumption required to determine an appropriate F-Factor for MY 2020 and beyond, EPA is finalizing to carry-over the MY 2016-2019 F-Factor of 0.14 into MY 2020 and beyond. The agency recognizes that this is an opportunity to seek public comment on the available data sources and methodologies that could be used for a future F-Factor determination, and the purpose of this technical memorandum is to describe an approach, including the data sources and methodology, which EPA is considering using for Model Years 2021 and later.”
- ▶ EPA is determining this F-Factor for E85 in response to manufacturer requests and the Alliance submission. Note: 1) If no requests are made for an F-Factor for a model year it defaults to zero. 2) A manufacturer may always request an F-Factor of zero.
- ▶ “EPA also is soliciting comment on an alternative approach for future years using updated data that would be based on EIA’s Annual Energy Outlook (AEO) 2020 and the latest available MOVES model, MOVES 2014.”
- ▶ “EPA requests comment on analytical methods using historical data with and without projections to determine the F-Factor. EPA also requests comment on data sources and analytical methods that would enable projections of E85 use that account for future changes in E85 infrastructure.”
- ▶ The comment period closes on 10/26

Separate Action Related to FFVs: CAFE Regulatory Correction

- ▶ In the 2012 CAFE/GHG rule, EPA, with NHTSA's concurrence, established regulations under its authority to establish CAFE test procedures to use the F-factor in CAFE calculations starting in MY 2020
- ▶ While the agencies' intent was clear in the 2012 rule preamble, the EPA regulations contain an error that inadvertently caps the resulting credits from using the F-factor in CAFE at 0 mpg in MYs 2020 and later.
 - ▶ We are correcting this error in the regulations. There is no change in the policy.
- ▶ On August 31st, EPA issued two regulatory correction FR Notices, a Direct Final Rule and parallel Proposed Rule
 - ▶ The comment period for both notices closes on October 15th (Docket No. EPA-HQ-OAR-2020-0314)
 - ▶ If EPA does not receive adverse comments, the direct final rule will become effective on November 30th
 - ▶ If EPA receives adverse comments, EPA will issue a Federal Register notice withdrawing the Direct Final Rule and would proceed with a Final Rule based on the proposal and considering the comments it received
 - ▶ Link to Direct Final Rule: <https://www.govinfo.gov/content/pkg/FR-2020-08-31/pdf/2020-17217.pdf>
 - ▶ Link to parallel Proposed Rule: <https://www.govinfo.gov/content/pkg/FR-2020-08-31/pdf/2020-17214.pdf>

Appendix

Questions

Technical Memo-Method for Calculating an F-Factor

- ▶ The F-Factor is based on the EPA's assessment of the expected real-world use of the alternative fuel (E85) by FFV's. EPA's proposed F-Factor calculation methodology has three key data inputs:
 - ▶ 1. The projected amount of E85 and Gasoline consumption by FFVs in future calendar years
 - ▶ 2. Population of FFV's in a given model year
 - ▶ 3. Number of Vehicle Miles Traveled (VMT) for a given year of a model year's life of the vehicles age and knows of no reason or data to develop an alternative assumption.

▶ The equation for the model year F-Factor is as follows:

$$F_Factor = \frac{\sum_{i=0}^N (E85_i) * \frac{(VMT_i) * (Population_i)}{(\sum(VMT) * (Population))}}{\sum_{i=0}^N (EALL_i) * \frac{(VMT_i) * (Population_i)}{(\sum(VMT) * (Population))}}$$

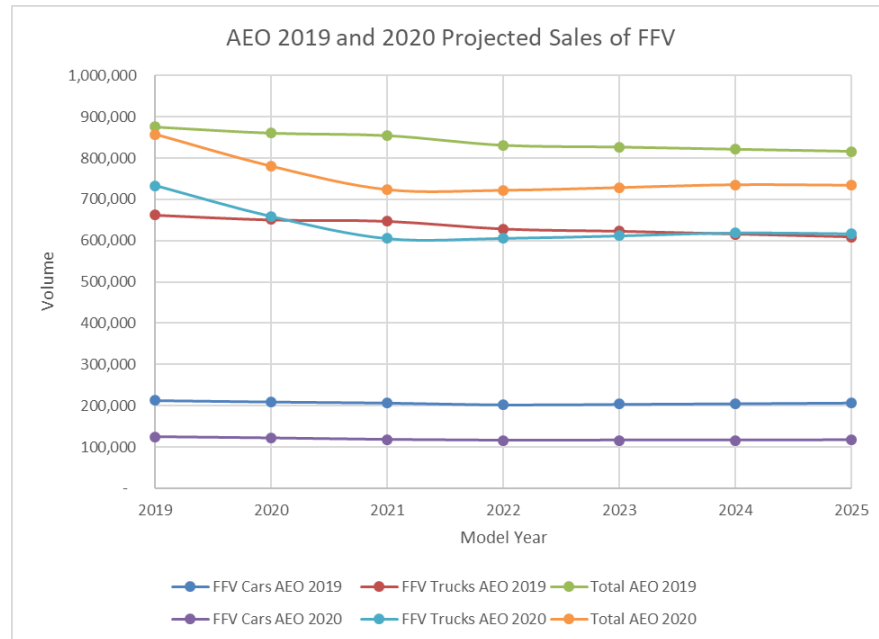
▶ Where

- ▶ • E85_i is the amount of E85 consumed in year i of the vehicle's life.
- ▶ • EALL_i is the amount of EALL (as described above) consumed in year i of the vehicle's life.
- ▶ • VMT_i is VMT for a vehicle in year i of the vehicle's life.
- ▶ • Population_i is the number of E85 capable vehicles in year i of the vehicle's life.
- ▶ • Population is the original E85 capable production volume.
- ▶ • $\sum(VMT)$ is the sum of the VMT over the vehicles life.
- ▶ • N is the number of years of vehicle life for the model year.
- ▶ To calculate the F-Factor for multiple model years it is necessary to add the sum as shown in the equation below.

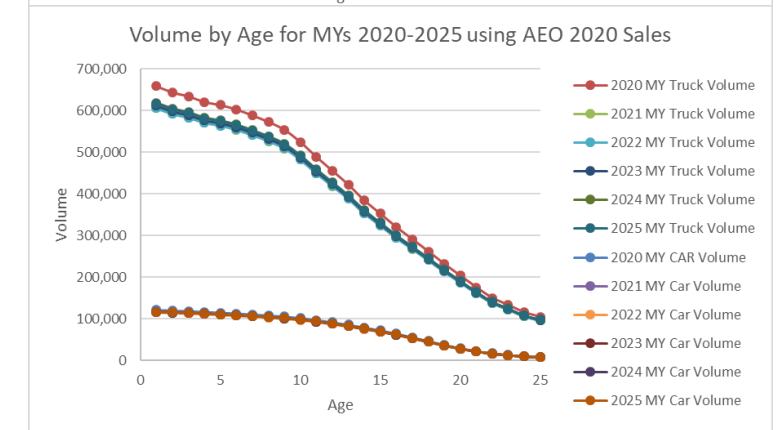
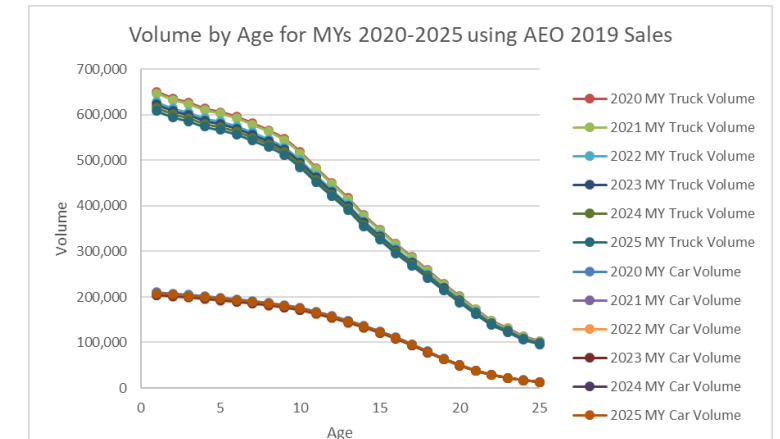
$$F_{Factor, Model Years X through Y} = \frac{\sum_X^Y \left(\sum_{i=0}^N (E85_i) * \frac{(VMT_i) * (Population_i)}{(\sum(VMT) * (Population))} \right)}{\sum_X^Y \left(\sum_{i=0}^N (EALL_i) * \frac{(VMT_i) * (Population_i)}{(\sum(VMT) * (Population))} \right)}$$

Technical Memo-AEO-Vehicles Volumes

- ▶ EPA used the MOVES Survival Rate Table along with AEO volumes for passenger cars and trucks to create a volume projection for each model year.



Survival Rate Table from MOVES 2014		
Vehicle Age	Proportion of Original Sales Surviving to Age:	
	Car	Truck
1	100.0%	100.0%
2	98.8%	97.8%
3	97.7%	96.3%
4	96.1%	94.3%
5	94.5%	93.1%
6	93.0%	91.5%
7	91.1%	89.3%
8	89.1%	87.0%
9	86.9%	84.1%
10	84.0%	79.6%
11	80.0%	74.2%
12	75.6%	69.2%
13	70.6%	64.1%
14	65.3%	58.3%
15	59.5%	53.5%
16	53.1%	48.6%
17	45.8%	44.2%
18	38.3%	39.8%
19	30.8%	35.2%
20	24.1%	30.9%
21	18.3%	26.7%
22	13.9%	22.8%
23	10.7%	20.2%
24	8.2%	17.5%
25	6.3%	15.8%



Technical Memo-Vehicles VMT

- ▶ In order to determine VMT over the life of the vehicles, EPA used the Relative Mileage Accumulation Rate (RMAR) values from MOVES 2014 to determine the mileage at each age for FFV cars and FFV trucks. The application of RMAR is done by multiplying RMAR values for car and trucks to the base mileage for trucks. Car mileage is a function of truck mileage using the RMAR. The table to the right shows the RMAR values and the results for applying those values to a base mileage of 18,000 miles for trucks.

RMAR Table with Base Mileage for Trucks Set to 18,000					
Age	RMAR Cars	RMAR Trucks	Base Mileage for Trucks	Car Mileage	Truck Mileage
1	0.885	1.000	18,000	15,925	18,000
2	0.868	0.981	18,000	15,623	17,662
3	0.850	0.960	18,000	15,296	17,280
4	0.830	0.937	18,000	14,947	16,862
5	0.810	0.912	18,000	14,579	16,412
6	0.788	0.885	18,000	14,193	15,934
7	0.766	0.857	18,000	13,792	15,431
8	0.743	0.828	18,000	13,379	14,909
9	0.720	0.799	18,000	12,956	14,373
10	0.696	0.768	18,000	12,526	13,828
11	0.672	0.738	18,000	12,090	13,275
12	0.647	0.707	18,000	11,653	12,722
13	0.623	0.676	18,000	11,215	12,173
14	0.599	0.646	18,000	10,780	11,633
15	0.575	0.617	18,000	10,350	11,106
16	0.552	0.589	18,000	9,927	10,595
17	0.529	0.562	18,000	9,514	10,107
18	0.506	0.536	18,000	9,114	9,644
19	0.485	0.512	18,000	8,728	9,214
20	0.464	0.490	18,000	8,358	8,820
21	0.445	0.470	18,000	8,009	8,465
22	0.427	0.453	18,000	7,683	8,156
23	0.410	0.439	18,000	7,381	7,895
24	0.395	0.427	18,000	7,106	7,690
25	0.381	0.419	18,000	6,861	7,542