



U.S. Department of Transportation  
**Office of the Secretary of Transportation**  
Bureau of Transportation Statistics

# Fleet Composition of Rail Tank Cars Carrying Flammable Liquids: 2020 Report



# ACKNOWLEDGEMENTS



U.S. Department  
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Special thanks to the Association of American Railroads and the Railway Supply Institute for providing invaluable assistance to the Bureau of Transportation Statistics, along with the necessary data and methods. In particular, we would like to acknowledge Robert Fronczyk and Rapik Saat.

Cover photo: Adobe Stock

## **Recommended citation**

U.S. Department of Transportation, Bureau of Transportation Statistics, *Fleet Composition of Rail Tank Cars Carrying Flammable Liquids: 2020 Report* (Washington, DC: 2020).  
<https://doi.org/10.21949/1519322>

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## Preface: Requirements of Section 7308 of the Fixing America's Surface Transportation Act (FAST)

Section 7308 of the Fixing America's Surface Transportation Act (FAST Act; P.L. 114-94; Dec. 4, 2015) requires the U.S. Department of Transportation (DOT) to collect and report data on rail tank cars transporting Class 3<sup>1</sup> flammable liquids (box A). The legislation aims to track progress in upgrading the rail tank car fleet to meet new safety requirements.

The legislation mandates that DOT provide an annual status report to Congress that presents the following information required in Section 7308(b):

- the total number of rail tank cars modified, or retrofitted, to meet the DOT-117R specification or equivalent;
- the total number of tank cars built to meet the DOT-117 specification or equivalent; and
- the total number of tank cars used, or likely to be used, to transport Class 3 flammable liquids that have not been modified.

The new safety standards, finalized in 2015, specify the characteristics of the tank car design that allow these cars to have the designation of DOT-117. These characteristics include a thicker tank wall with insulation, puncture protection, a full head shield, and top and bottom valve fitting protections.<sup>2</sup> The head shield is on both ends of the tank car and is a thicker wall to resist puncture in a derailment. The top and bottom valves are for filling and emptying the tank car and need to be protected against shearing off in a derailment and allowing a release of a flammable liquid.

This annual report addresses Section 7308(b) by summarizing the progress of tank car safety upgrades from 2013 through 2019 by tank car and flammable liquid type provided by the Association of American Railroads (AAR). See box B for more detail on the different types of tank cars referenced in this report.

<sup>1</sup> For the purposes of this report, flammable liquids refer to Class 3 flammable liquids.

<sup>2</sup> For more information and illustrations, see <https://tankcarresourcecenter.com/> (accessed August 24, 2020).

### Box A What is a Class 3 Flammable Liquid?

A *flammable liquid* (Class 3) is a liquid with a flash point of not more than 60 °C (140 °F) or any material in a liquid phase with a flash point at or above 37.8 °C (100 °F) that is intentionally heated and offered for transportation or transported at or above its flash point in a bulk packaging. This includes liquids such as refined petroleum products, crude oil, and ethanol. Class 3 flammable liquids are designated by four-digit United Nations (UN) numbers or North American (NA) numbers, used to identify hazardous materials worldwide and are required for the shipment of hazardous materials. In all, there are over 400 UN or NA numbers that fall within Class 3 flammable liquids.

*Flash point* is the minimum temperature at which a liquid gives off vapor within a test vessel in sufficient concentration to form an ignitable mixture with air near the surface of the liquid.

*Packing Groups* are the regulations that determine how a flammable liquid must be prepared for transport. Crude oil and ethanol are both packing group 1 and the approximately 400 liquids in the “other” category are a mix of packing group 1, 2, or 3. Packing group 1 liquids are the most dangerous and packing group 3 liquids are less dangerous. Packing group 3 liquids have a higher flash point than packing group 2, and they are both higher than packing group 1 liquids.

Source <https://www.gpo.gov/fdsys/pkg/CFR-2011-title49-vol2/pdf/CFR-2011-title49-vol2-part173.pdf>, accessed July 12, 2019.

Section 7308(c) requires the Bureau of Transportation Statistics (BTS) to “conduct a survey of tank car facilities modifying tank cars to the DOT–117R specification, or equivalent, or building new tank cars to the DOT–117 specification, or equivalent, to generate statistically valid estimates of the anticipated number of tank cars those facilities expect to modify to DOT–117R specification, or equivalent, or build to the DOT–117 specification, or equivalent.”

This report also includes the survey results from tank car shops on the projected number of new builds and retrofits for the current year, satisfying Section 7308(c). The prior annual reports can be found on the BTS website at: <http://www.bts.gov/tankcarreports>.

## Box B Tank Car Type Definitions

**DOT-111:** A non-pressurized tank car with a thinner shell (7/16 in.) than is now required for the DOT-117 tank cars (9/16 in.). These tank cars can carry both hazardous and non-hazardous liquids. These cars are not required to have head shields to protect the tank car from an adjacent car in an incident. The top fittings and valves are not protected and are vulnerable to being sheared off in an incident, leading to a release of contents. These tank cars also do not have a pressure relief device sized to protect against rupture in the event of a large fire. DOT-111s do have pressure relief valves that offer some protection in some fires.

**DOT-117 (TC-117 in Canada):** A non-pressurized tank car with a shell thickness of 9/16 of an inch and insulating material that provides thermal protection. Additionally, DOT-117s have a skin that holds the insulation and thermal protection in place and doubles as additional protection from punctures. The tank cars have protected top fittings, a fully protected head shield, and a bottom outlet valve with an enhanced handle designed to prevent the tank car from emptying its contents in an incident. All the enhancements are designed to protect the tank from being punctured and to prevent the valves from being disrupted. DOT-117R tank cars are cars that have been retrofitted to meet the 117 specifications.

**CPC-1232:** An industry-sponsored specification, intended to be safer than DOT-111 tank cars for carrying petroleum crude oil and ethanol. Cars ordered after October 2011 were required to meet this specification. These tank cars include a pressure relief valve, more extensive top fittings than on the DOT-111 rail tank cars, and a full height or half-height head shield. The shell of non-jacketed tank cars must be ½ inch thick, and for jacketed tank cars must be 7/16 inch thick.

**\*DOT-105:** A pressurized tank car that has more safety features than what is required on DOT-111 class non-pressurized tank cars.

**\*DOT-112:** A pressurized tank car that has additional safety features than what is required on DOT-111 class non-pressurized tank cars.

**\*DOT-114:** A pressurized tank car that has additional safety features than what is required on DOT-111 class non-pressurized tank cars. There are relatively few of these cars actively operating in the fleet carrying Class 3 flammable liquids.

**\*DOT-115:** A non-pressurized tank car similar to the DOT-111 but with an inner container surrounded by an

outer shell. The inner container may be split into multiple compartments. There are relatively few of these tank cars actively operating in the fleet carrying Class 3 flammable liquids.

**\*DOT-120:** A pressurized tank car that has additional safety features than what is required on non-pressurized tank cars. There are relatively few of these tank cars actively operating in the fleet carrying Class 3 flammable liquids.

**\*DOT-211:** A non-pressurized tank car similar to the DOT-111 rail tank cars. There are relatively few of these tank cars actively operating in the fleet carrying Class 3 flammable liquids.

\* Tank car types included in the “other” category for analysis purposes in this report.

- DOT-105, DOT-112, DOT-114, and DOT-120 rail tank cars that are grouped because they are pressurized and already meet a more intense set of regulations than the DOT-117 specification. These tank cars also carry other non-class 3 hazardous materials.

- DOT-115 and DOT-211 rail tank cars that are grouped because they do not typically carry crude oil or ethanol.

## Other Terms

**Jacketed vs. non-jacketed tank cars:** Jacketed tank cars have a layer of insulation and/or thermal protection between the tank shell and jacket that stabilizes the temperature of the liquid contained in the tank car and/or reduces the conductivity of heat from outside sources to the contents of the tank car.

**Single service vs. multiple service:** Rail tank cars may make one or more trips in a year. If they carry the same liquid for all of their trips, then they are a single service car. If a tank car is washed between trips and carries different liquids, then they are in multiple service for that year.

**Head shield:** Located at the ends of the tank car, the ½ inch thick steel shield provides extra protection in the event of an incident to prevent an adjacent car from puncturing the rail tank car.

**Top and Bottom fittings and valves:** Tank cars have valves on the top and bottom for the purposes of loading and unloading liquids. The top valve is surrounded by a steel structure to prevent damage to the top valve in a release. The bottom valve has specialized handles that prevent an unintended release.



## Fleet Composition of Rail Tank Cars carrying Class 3 Flammable Liquids

Key findings from this report include:

- DOT-111 rail tank cars have not carried crude oil since the 2018 deadline.
- 112,685 rail tank cars carried flammable liquids in 2019, which is nearly as high as the 2015 fleet of 113,045 rail tank cars.
- 48 percent of rail tank cars carrying Class 3 flammable liquids in 2019 met the new safety requirements (DOT-117s), up from 33 percent in 2018.
- 51 percent of new DOT-117 rail tank cars carried crude oil in 2019.
- Tank car shops certified to build or retrofit rail tank cars to the DOT-117 standards expect to build 3,588 tank cars and retrofit 4,350 tank cars in 2020.

## Background: Hazardous Materials Rule of 2015

Over the most recent decade, several high-profile incidents prompted the U.S. and Canadian governments to reexamine the safety standards that govern the transport of class 3 flammable liquids<sup>3</sup>. DOT's Pipeline and Hazardous Materials Safety Administration (PHMSA) and Federal Railroad Administration (FRA) issued a final rule on May 8, 2015, intending to make transporting flammable liquids safer. This rule, Hazardous Materials: Enhanced Tank Car Standards and Operational Controls for High-Hazard Flammable Trains (HM-251), included regulations to upgrade those cars operating in high-hazard flammable trains (HHFT).<sup>4</sup>

The FAST Act further included provisions to make the transport of hazardous materials safer by phasing out tank cars built to lower safety standards and then finally prohibiting those cars from transporting any

<sup>3</sup> For more information on the incidents, see <https://tankcarresourcecenter.com/tankcar101/> accessed August 25, 2020.

<sup>4</sup> A high-hazard flammable train (HHFT) is defined as a single train transporting 20 or more loaded tank cars of a Class 3 flammable liquid in a continuous block or a single train carrying 35 or more loaded tank cars of a Class 3 flammable liquid throughout the train.

Class 3 flammable liquids by 2029. Most notably, by 2025 petroleum crude oil must only be carried in DOT-117 or 117R rail tank cars. Cars that do not meet the new safety standards may be switched from carrying Class 3 flammable liquids to non-flammable liquids and continue to operate without modification or be retired. After the HM-251 rule was issued in May 2015, the FAST Act legislation revised the phase-out timeline in December 2015. In response to the FAST Act, PHMSA revised its rule so the phase-out dates in HM-251 matched the FAST Act via the HM-251C rule,<sup>5</sup> eliminating any confusion of when the phase-out is required to occur. The current dates can be seen in table 1.

## Current Fleet Composition (Section 7308(b))

### Data Sources

To provide a complete picture of the tank cars carrying Class 3 flammable liquids that meet the safety requirements, BTS uses data from the Association of American Railroads (AAR), which maintains two databases:

- UMLER®<sup>6</sup>: an inventory of individual tank cars (active or scheduled to be built) and their specifications, such as tank wall thickness or types of valves; and
- TRAIN II®<sup>7</sup>: a comprehensive listing of railcar movements.

These AAR databases consist of information on all rail tank cars in North America. Each car has a unique identification number used to identify the specifications of each car as well as to track commodities transported over the North American rail network. For the purposes of this report, only rail tank cars with shipments that are entirely within the United States or start or end in the United States are included in the numbers in this report.

<sup>5</sup> For the full text of the Hazardous Materials: FAST Act Requirements for Flammable Liquids and Rail Tank Cars (HM-251C), see: <https://www.federalregister.gov/documents/2016/08/15/2016-19406/hazardous-materials-fast-act-requirements-for-flammable-liquids-and-rail-tank-cars> accessed June 17, 2020.

<sup>6</sup> UMLER®: Universal Machine Language Equipment Register

<sup>7</sup> TRAIN II®: TeleRail Automated Information Network

**Table 1 FAST Act Phase Out Schedule for Rail Tank Cars Carrying Class 3 Flammable Liquids**

Flammable Liquid	Tank Car Type	Date for Phase-Out	Number of Cars Carrying Fluids	
			2018	2019
Petroleum crude oil	Non-jacketed DOT-111	January 1, 2018	0	0
	Jacketed DOT-111	March 1, 2018	29*	0
	Non-jacketed CPC-1232	April 1, 2020	1,979	208
	Jacketed CPC-1232	May 1, 2025	9,208	7,580
Ethanol	Non-jacketed DOT-111	May 1, 2023	12,146	8,480
	Jacketed DOT-111	May 1, 2023	102	109
	Non-jacketed CPC-1232	July 1, 2023	1,378	986
	Jacketed CPC-1232	May 1, 2023	164	142
Other Flammable Liquids, Packing Group I	Non-jacketed DOT-111	May 1, 2025	73	65
	Jacketed DOT-111	May 1, 2025	6	5
	Non-jacketed CPC-1232	May 1, 2025	25	25
	Jacketed CPC-1232	May 1, 2025	2	0
Other Flammable Liquids, Packing Group II/III	Non-jacketed DOT-111	May 1, 2029	12,740	13,027
	Jacketed DOT-111	May 1, 2029	4,263	4,290
	Non-jacketed CPC-1232	May 1, 2029	4,837	6,529
	Jacketed CPC-1232	May 1, 2029	3,098	3,128
Multiple Service Liquids	Non-jacketed DOT-111		6,185	4,023
	Jacketed DOT-111		174	149
	Non-jacketed CPC-1232		1,696	1,719
	Jacketed CPC-1232		2,257	873

\*Trips made by the 27 jacketed DOT-111 tank cars carrying crude oil were made in January and February 2018 only

**NOTE:** Due to some rail tank cars carrying different fluids in a year, they are classified as Multiple Service Liquids and do not have a phase-out date because there are multiple phase-out dates. For more information on packing groups, see Box A.

**SOURCE:** Final Rule, <https://www.phmsa.dot.gov/news/hm-251c-final-rule-pdf>, accessed July 12, 2019 and U.S. Department of Transportation, Bureau of Transportation Statistics. Special analysis based on data provided by the Association of American Railroads: UMLER® and TRAIN II® rail tank car and annualized rail tank car movements, 2013–2018, as of June 24, 2019.

The UMLER® file is a database, managed by Railinc Corp., a subsidiary corporation of the Association of American Railroads, that includes the railcars in use in North America, each identified by a unique number. UMLER® includes railcars in operation or soon to be in operation. It also includes the designated tank car specification with all the features of each tank car, such as the thickness of the tank wall and the types of valves on the top and bottom of the car. UMLER® also designates cars retrofitted to meet the DOT-117R specification.

The TRAIN II® database, also maintained by AAR, tracks the movements of railcars on the North American rail network. A movement is a trip made by any rail car, loaded or empty, from one location to another. TRAIN II® also provides information on each commodity a rail car carries for any movement. For tank cars that carry Class 3 flammable liquids (box A),

the specific type of flammable liquid (UN/ NA<sup>8</sup>) carried is tracked for each movement. Thus, any rail tank car that switches from carrying one type of flammable liquid to another will be counted twice within the database. For the purposes of this report, the counts are uniquely presented as single and multiple flammable liquid services.

Specifically, these databases were used to count the tank cars used in each of the years, from 2013 to 2019, by tank car type as well as type of flammable liquid carried. These data allowed for analysis of the changes in the composition of the fleet along with the overall fleet size and what is being carried by each car type. This analysis satisfies Section 7308(b) of the FAST Act.

<sup>8</sup> UN/NA codes are United Nations (UN) or North American (NA) codes identifying all hazardous materials. The UN and NA codes are the same but there are more NA codes than UN codes.



In 2019 the flammable liquid tank car fleet accounted for about 20 percent of all tank cars and included tank cars built to the following specifications (See box B for detailed descriptions):

- DOT-117;
- DOT-117R;
- Non-jacketed DOT-111;
- Jacketed DOT-111;
- Jacketed CPC-1232;
- Non-jacketed CPC-1232; and
- Other tank cars<sup>9</sup> including DOT-105, DOT-112, DOT-114, DOT-115, DOT-120, and DOT-211.

For the purposes of this analysis, tank cars were placed into one of four categories based on the flammable liquids they carry:

- petroleum crude oil;
- ethanol;
- other flammable liquids, such as refined petroleum products and chemicals; and
- multiple service—tank cars that carry various fluids in a year.

The “multiple service” category was added to include those tank cars that carried different types of flammable liquids each year. Rail tank cars that do not meet the more stringent criteria are being phased out of carrying Class 3 flammable liquids.

If an individual tank car made at least one trip carrying a specific Class 3 flammable liquid, then it is counted as a single tank car in this report, whereas if a tank car carried at least two different flammable liquids during one year, then it is counted under multiple service. This unit of analysis allows us to look at the changes in the composition of the fleet of rail tank cars that carry Class 3 flammable liquids from year to

year. This report contains those unique combinations of individual rail tank car by the four flammable liquid categories and seven tank car types. Because these counts could comprise one or many movements during a single year, the data in this report cannot be compared to the reports of tank car loadings and movements produced by AAR or other analyses.

The data in this report is different from the data reported in the past reports. Due to a refinement to the data methodology, it now includes tank cars that have traveled between Canada and the United States in any given year. While the numbers for the time period of 2013 to 2018 are different than in the previous reports, the overall patterns are unchanged. BTS will continue to monitor the composition of the rail fleet that carries flammable liquids within U.S. borders.

### ***Analysis Results***

Between 2013 and 2019, the number of rail tank cars carrying Class 3 flammable liquids has varied. There are numerous factors that determine whether a tank car will be used to transport Class 3 flammable liquids. Among these factors are:

- demand for each Class 3 flammable liquid, and
- pipeline capacity in North America for transporting crude oil as an alternative to using rail tank cars.

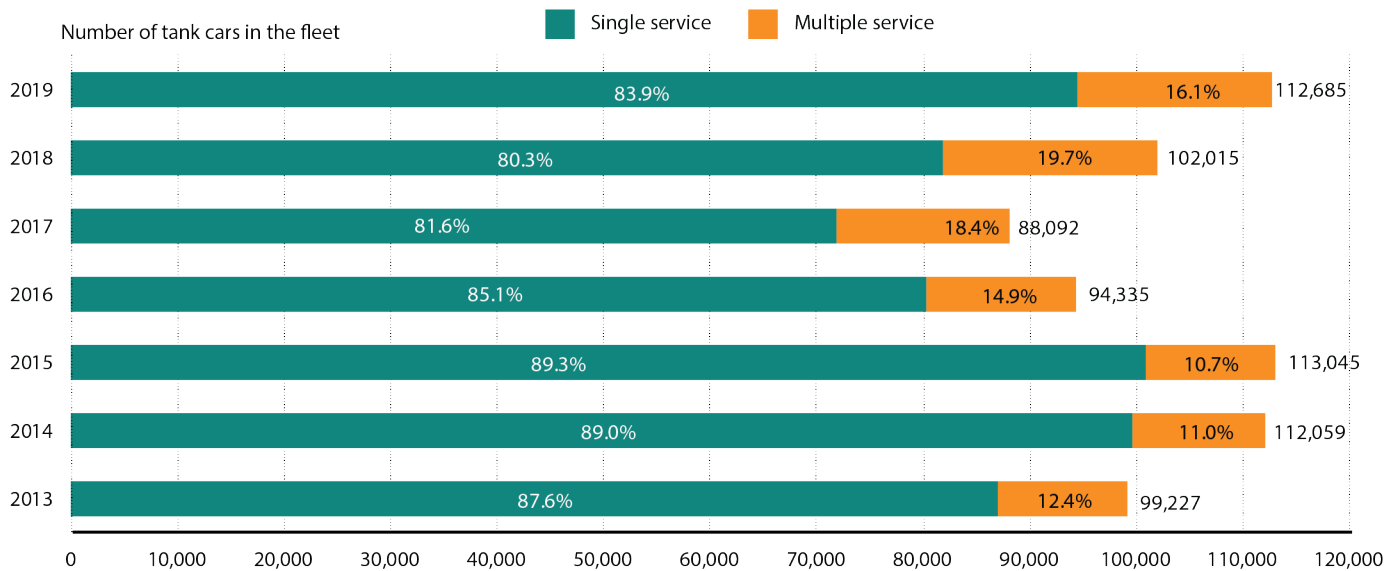
The size of the fleet is also affected by the number of tank cars that carry multiple flammable liquid types over the course of a year, which reduces the need for additional tank cars.

It is expected that by the end of the transition period, in 2029, all Class 3 flammable liquids will be carried in rail tank cars that meet or exceed the DOT-117 or DOT-117R specification. No new phase out deadlines occurred in 2019, and the previous deadlines from 2018 were met, thus no more DOT-111s are carrying crude oil.

As mentioned previously, the data in this report for the time period of 2013 to 2018 is different than those in the previous reports. To provide a more complete picture, the report now includes tank cars that have traveled between Canada and the United States in any given year. Therefore, the size of the fleet increased. As shown in figure 1, the total fleet of rail

<sup>9</sup> Other tank cars include DOT-105, DOT-112, DOT-114, and DOT-120 rail tank cars, which are pressurized and already exceed the DOT-117 specification, and DOT-115 and DOT-211 rail tank cars, which do not typically carry crude oil or ethanol, but may carry other flammable liquids.

**Figure 1 Rail Tank Cars by Percentage of Single and Multiple Flammable Liquid Service: 2013-2019**



**NOTE:** A change was made in how the single service and multiple service rail tank cars are counted between the 2018 and 2019 reports, causing the numbers to vary slightly, however, they are not substantively different.

**SOURCE:** U.S. Department of Transportation, Bureau of Transportation Statistics. Special analysis based on data provided by the Association of American Railroads: UMLER® and TRAIN II® rail tank car and annualized rail tank car movements, 2013–2019, as of June 9, 2020.

tank cars that actively carry Class 3 flammable liquids has fluctuated over the 2013 to 2019 period and findings include:

- 112,685 rail tank cars carried flammable liquids in 2019, which is nearly as high as the 2015 fleet of 113,045 rail tank cars.
- 84 percent of the 2019 fleet carried a single liquid throughout the year, representing the first increase in single liquid service since 2014.
- The number of tank cars carrying multiple fluids in a year increased by 64 percent between 2013 and 2018 before declining 10 percent to 18,167 in 2019

Over the 2013 to 2019 period, the mix of fluids carried by train also changed, in part due to increased pipeline capacity for petroleum products, as well as in increase in petroleum products produced in the U.S.<sup>10</sup> As seen in figure 2:

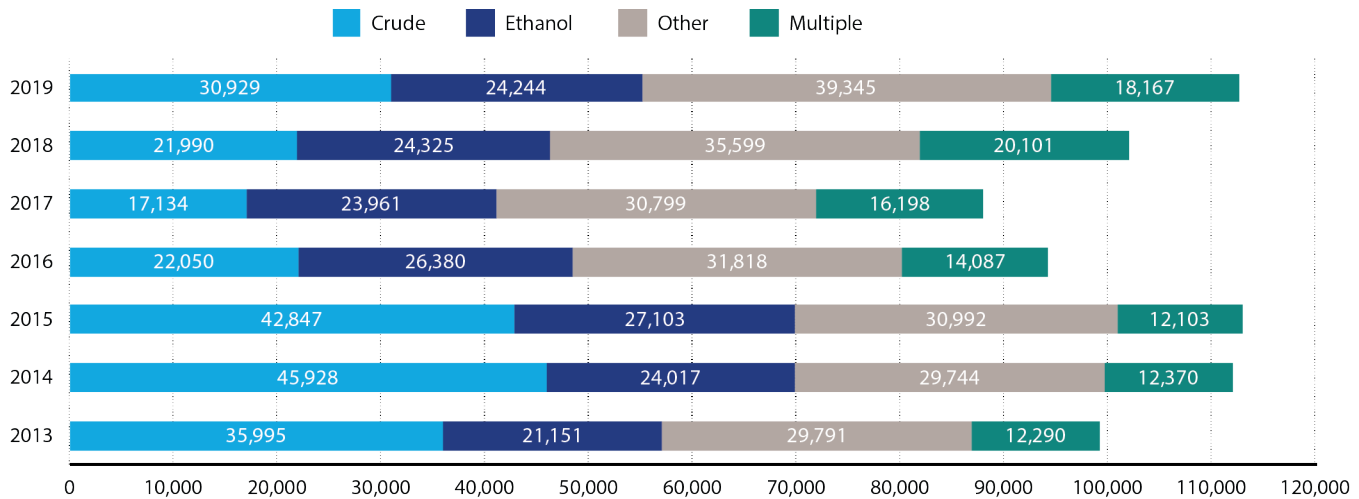
<sup>10</sup> This Energy Information Agency report, <https://www.eia.gov/todayinenergy/detail.php?id=39672> accessed on June 29, 2020, shows the increase in pipeline capacity by year, 2014–2018. It does not show any changes in the amount of crude oil carried by rail. Also, this EIA data, <https://www.eia.gov/petroleum/>, accessed on August 14, 2020, shows the increase in petroleum products in the U.S.

- Since 2015, the number of tank cars carrying crude oil decreased from 42,847 to 30,929, a 39 percent decrease.
- The number of tank cars carrying ethanol was 24,244 in 2019, a number consistent with the average of 24,454 over the 7-year period.
- The number of rail tank cars in the fleet of Class 3 flammable liquids carrying other fluids increased by 32 percent between 2013 and 2019.

From 2013 to 2019, the composition of the fleet also changed. Figures 3A and 3B show that:

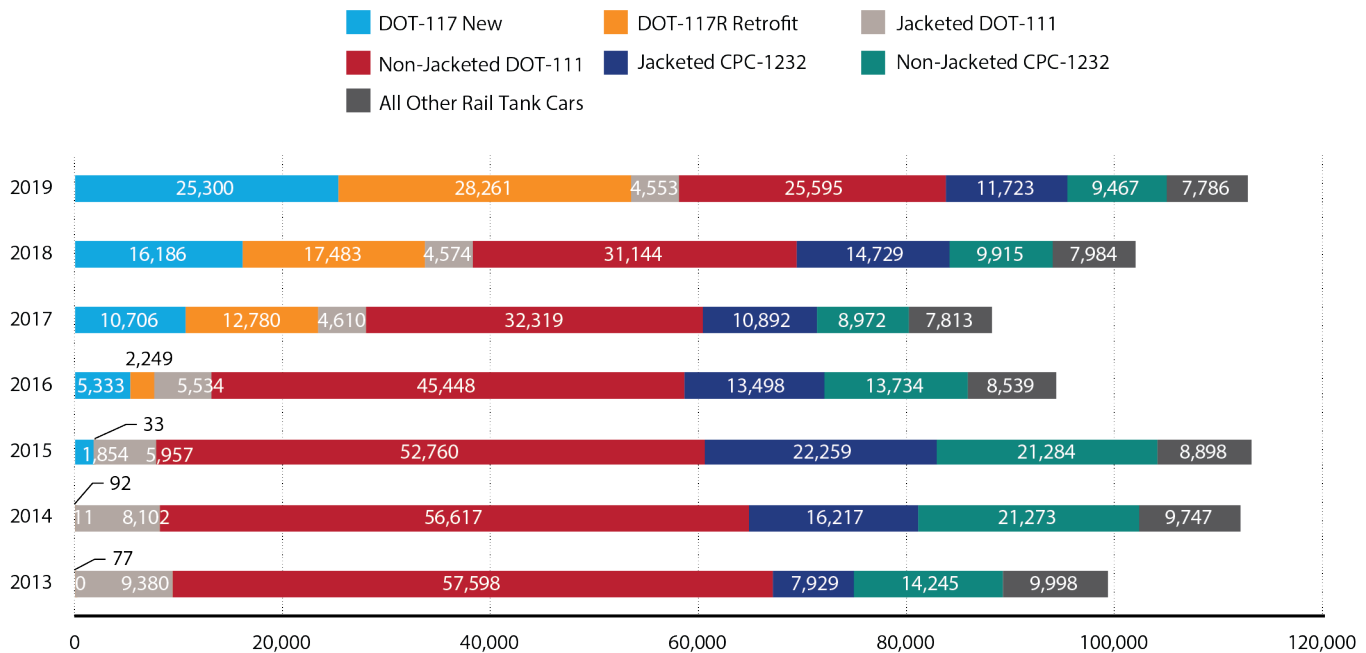
- The number of DOT-117s, both new and retrofitted, increased from zero in 2013 to 53,561 tank cars in 2019 (figure 3A), representing 48 percent of the fleet carrying Class 3 flammable liquids (figure 3B).
- For the first time since 2013, the non-jacketed DOT-111 rail tank cars are not the largest percentage of the fleet. Their numbers have been falling from 57,598 in 2013 to 25,595 in 2019.

**Figure 2 Number of Rail Tank Cars by Type of Class 3 Flammable Liquid Carried: 2013-2019**



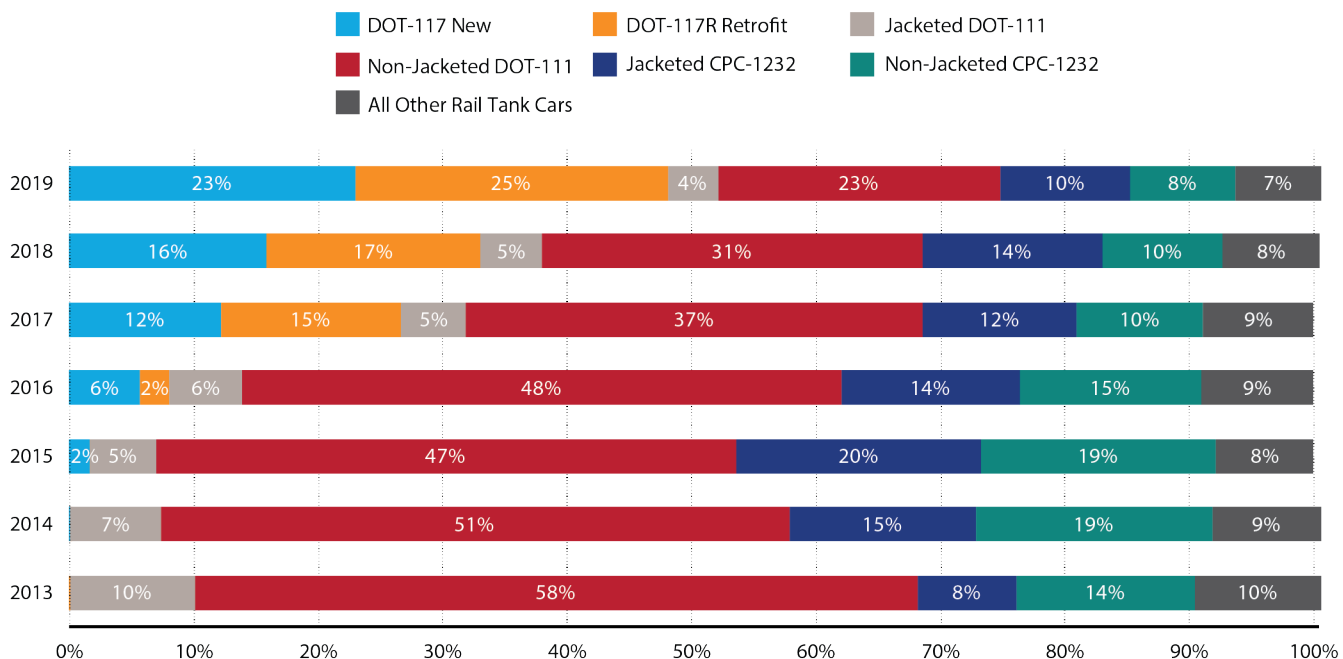
**SOURCE:** U.S. Department of Transportation, Bureau of Transportation Statistics. Special analysis based on data provided by the Association of American Railroads: UMLER® and TRAIN II® rail tank car and annualized rail tank car movements, 2013–2019, as of June 9, 2020.

**Figure 3A Fleet Composition of Rail Tank Cars Carrying Class 3 Flammable Liquids: 2013-2019 (by the numbers)**



**SOURCE:** U.S. Department of Transportation, Bureau of Transportation Statistics. Special analysis based on data provided by the Association of American Railroads: UMLER® and TRAIN II® rail tank car and annualized rail tank car movements, 2013–2019, as of June 9, 2020.

**Figure 3B Percent Fleet Composition of Rail Tank Cars Carrying Class 3 Flammable Liquids: 2013-2019**



**SOURCE:** U.S. Department of Transportation, Bureau of Transportation Statistics. Special analysis based on data provided by the Association of American Railroads: UMLER® and TRAIN II® rail tank car and annualized rail tank car movements, 2013–2019, as of June 9, 2020.

- Jacketed and non-jacketed DOT-111, non-jacketed CPC-1232, and all other rail tank cars<sup>11</sup> have been declining between 2013 and 2019, going from 92 percent of the fleet in 2013 to 42 percent of the fleet in 2019.

The fleet of rail tank cars carry many shipments throughout the year. A shipment is a single trip made by a single tank car from an origin to a destination. Any single tank car may carry one or many shipments in any given year. The total number of shipments, along with the mix of liquids needing transport at the same time, drives the fleet size for the year. Demand is based on the needs of the industries for Class 3 flammable liquid movements, primarily the crude oil and ethanol which are used for transportation, heating, and other essentials. Rail tank cars capable of carrying Class 3 flammable liquids are also capable of carrying other liquids. Figure 4 shows the number of shipments in each year, 2013 to 2019, by flammable liquid type.

<sup>11</sup> The grouping of Other Rail Tank Cars includes specifications of DOT-105, DOT-112, DOT-114, DOT-115, DOT-120, and DOT-211. Most of the tank cars (90 percent in 2019) in the Other Rail Tank Car category carrying any flammable liquids meet DOT-105, DOT-112, or DOT-120 specifications, which exceed the DOT-117 specification.

- Shipments in 2019 were up 12 percent from 2018.
- Between 2013 and 2019, fluctuation in the number of shipments is attributable to crude oil demand. The number of shipments for ethanol and other flammable liquids were relatively stable between 2013 and 2019. The number of shipments for crude oil varied from a high of 573,197 in 2014 to a low of 200,019 in 2017.

Because it will take time to fully upgrade the fleet of rail tank cars that carry flammable liquids, it is useful to look at the types of flammable liquids carried by the different types of rail tank cars. The remainder of the report summarizes the specific types of rail tank cars carrying Class 3 flammable liquids between 2015 and 2019.

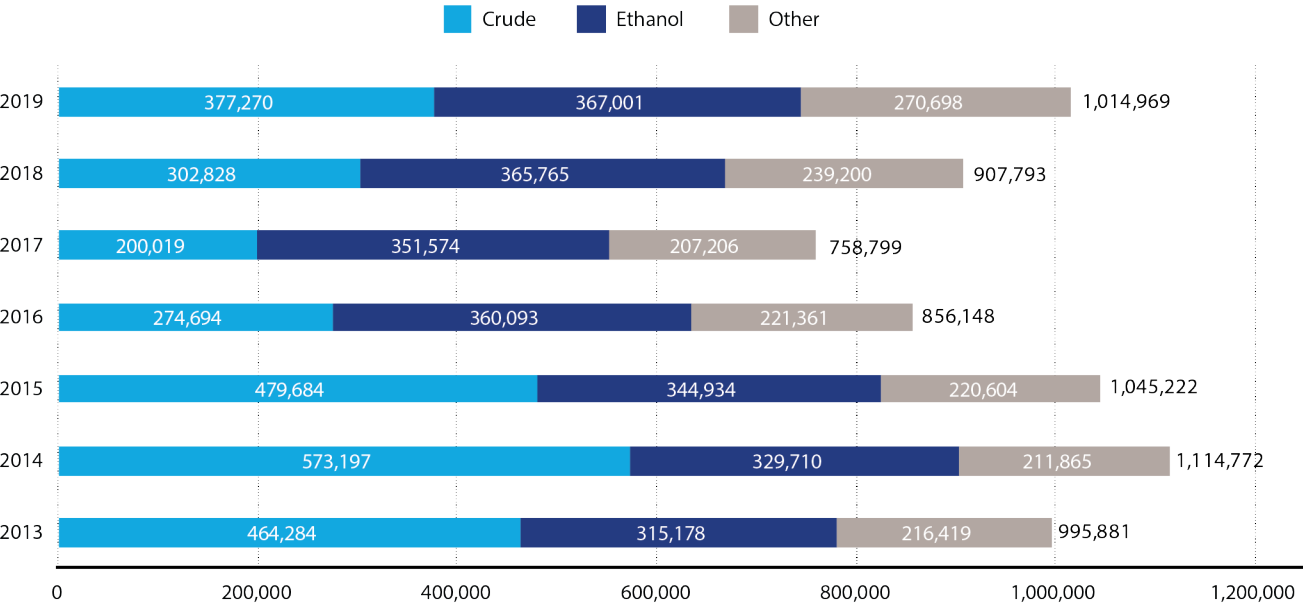
### **DOT-117 Rail Tank Cars**

DOT-117 rail tank cars, both new and retrofitted, are tank cars built to the technical and safety specifications finalized in 2015 federal regulations. All tank cars carrying Class 3 flammable liquids will be required at the end of the transition period in 2029 to meet or exceed the DOT-117 specification. In 2015, there were fewer than 2,000 of these new tank cars, and by 2019

over 53,000 were in use carrying Class 3 flammable liquids, as shown in figure 5. Key findings include:

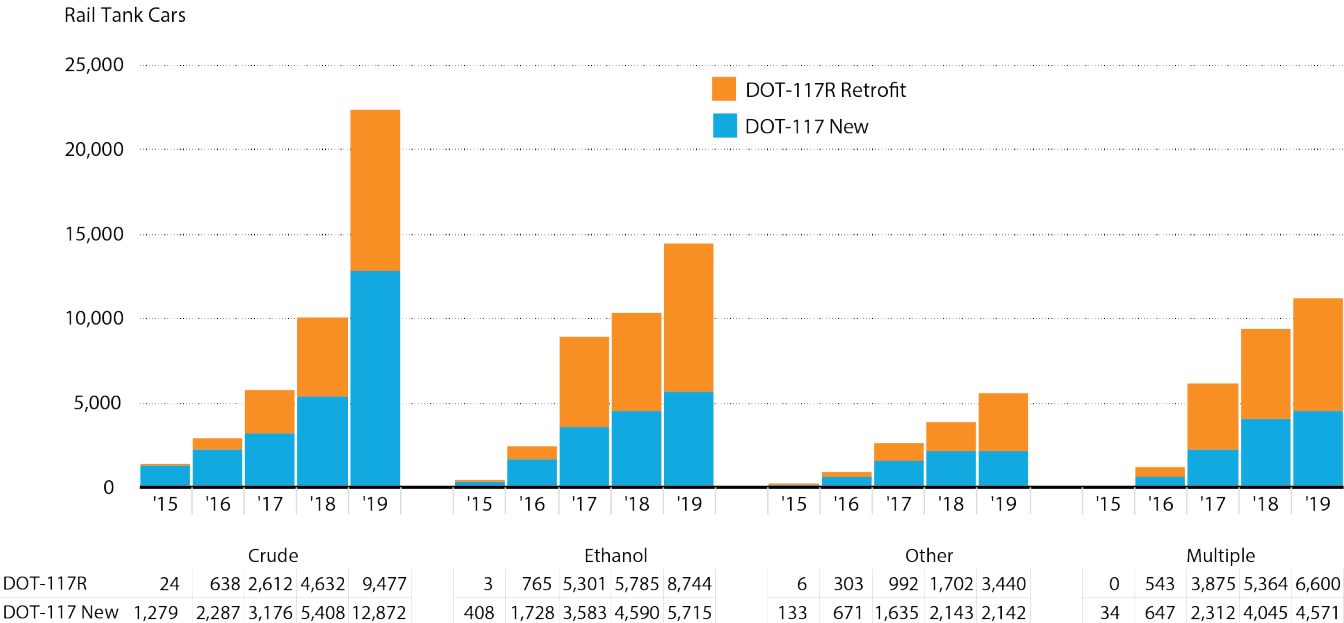
- DOT-117s, both new and retrofitted, carrying crude oil more than doubled their numbers between 2018 and 2019, going from 10,040 to 22,349.
- While new DOT-117 rail tank cars were being built, 28,261 existing rail tank cars were retrofitted to meet the DOT-117R requirements, comprising 25 percent of the 2019 fleet.
- The bulk of retrofits, over 10,000 of them, started actively carrying flammable liquids on the Nation’s rail system in 2019, with 65 percent of those cars carrying various types of ethanol and crude oil.

Figure 4 US Shipments of Class 3 Flammable Liquids by Year and Type: 2013-2019



SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics. Special analysis based on data provided by the Association of American Railroads: UMLER® and TRAIN II® rail tank car and annualized rail tank car movements, 2013–2019, as of June 9, 2020.

Figure 5 DOT-117 (both new and retrofit) Rail Tank Cars by Liquid Type: 2015-2019



SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics. Special analysis based on data provided by the Association of American Railroads: UMLER® and TRAIN II® rail tank car and annualized rail tank car movements, 2013–2019, as of June 9, 2020.

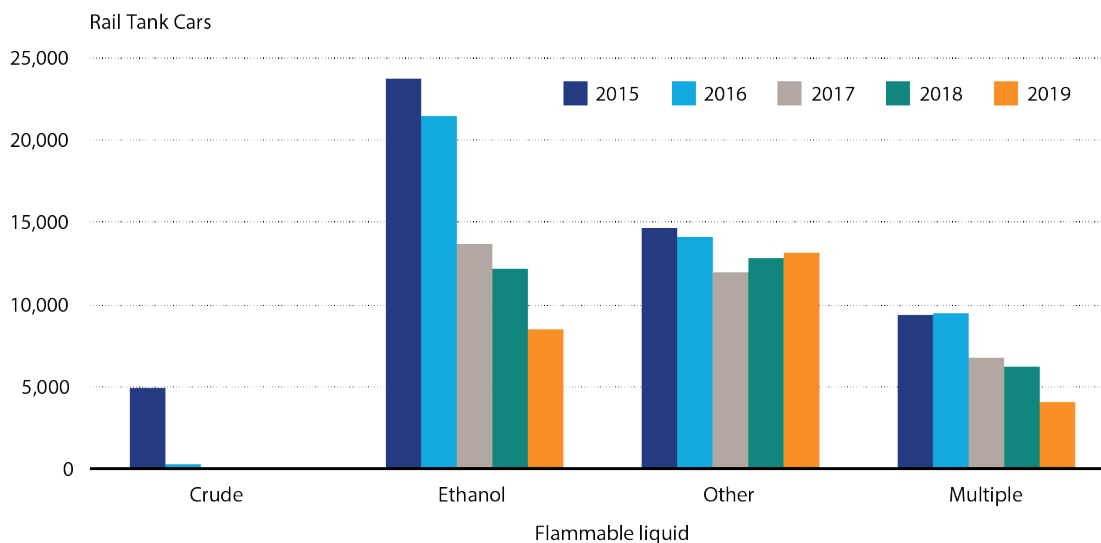


### DOT-111 Rail Tank Cars (Jacketed and Non-Jacketed): Meeting Key Deadlines

Mandated in HM-251 (table 1), non-jacketed DOT-111 rail tank cars are prohibited from carrying crude oil as of January 1, 2018. Jacketed DOT-111 rail tank cars are also prohibited from carrying crude oil as of March 1, 2018. Both deadlines were met. Prior to 2018, non-jacketed DOT-111 rail tank cars carrying crude oil had a significant presence in the fleet of rail tank cars that carry Class 3 flammable liquids as seen in figure 6. Figure 7 shows more detail for the jacketed DOT-111 rail tank cars. Key findings include:

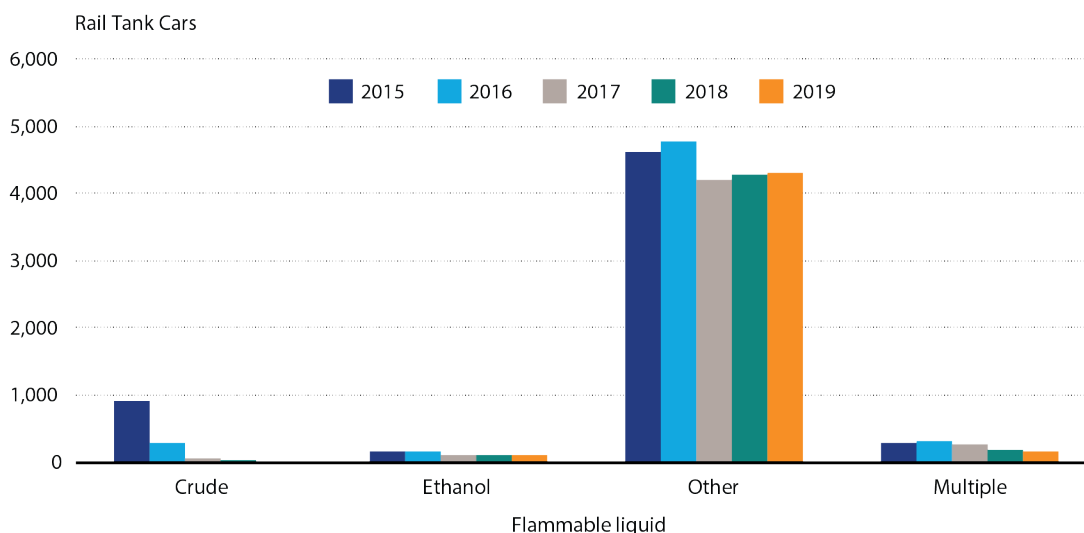
- 52 percent fewer non-jacketed DOT-111 rail tank cars carry flammable liquids in 2019 than in 2015, from 52,760 in 2015 to 25,595 in 2019.
- The number of non-jacketed DOT-111s carrying other flammable liquids held relatively steady between 2015 and 2019 (figure 3A).
- The March 2018 phase-out date meant that those tank cars carrying crude oil only made trips in January and February of 2018.

**Figure 6 Non-Jacketed DOT-111 Rail Tank Cars by Liquid Type: 2015-2019**



**SOURCE:** U.S. Department of Transportation, Bureau of Transportation Statistics. Special analysis based on data provided by the Association of American Railroads: UMLER® and TRAIN II® rail tank car and annualized rail tank car movements, 2013–2019, as of June 9, 2020.

**Figure 7 Jacketed DOT-111 Rail Tank Cars by Liquid Type for 2015-2019**



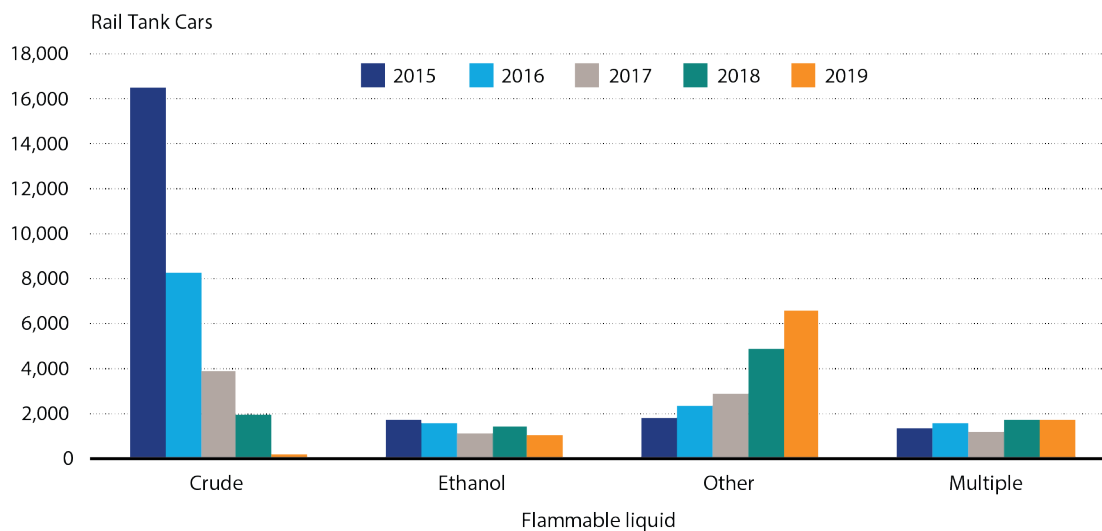
**SOURCE:** U.S. Department of Transportation, Bureau of Transportation Statistics. Special analysis based on data provided by the Association of American Railroads: UMLER® and TRAIN II® rail tank car and annualized rail tank car movements, 2013–2019, as of June 9, 2020.

### CPC-1232 Rail Tank Cars (Jacketed and Non-Jacketed)

The number of CPC-1232 tank cars decreased from 2015 to 2019. Figures 8 and 9 detail how many jacketed and non-jacketed CPC-1232 rail tank cars were used to transport Class 3 flammable liquids. Key findings include:

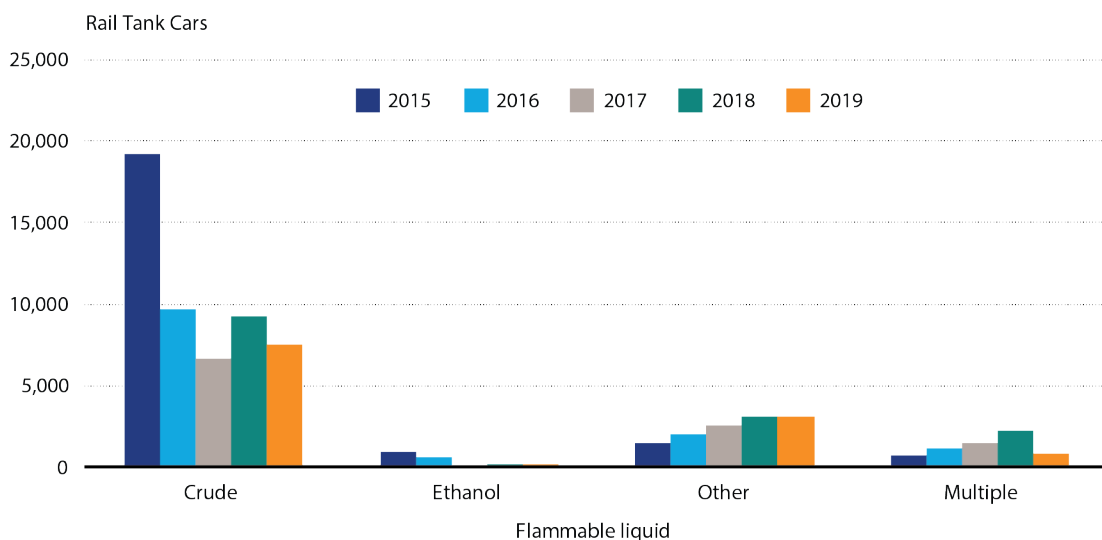
- The number of non-jacketed CPC-1232 rail tank cars has decreased by 56 percent between 2015 and 2019, from 21,284 in 2015 to 9,467 in 2019.
- The number of jacketed CPC-1232 rail tank cars has decreased by 47 percent between 2015 and 2019, from 22,259 in 2015 to 11,723 in 2019.
- Both non-jacketed and jacketed CPC-1232 rail tank cars carrying crude oil decreased (figures 8 and 9).
- Non-jacketed CPC-1232 rail tank cars carrying other flammable liquids or multiple liquids increased between 2015 and 2019 (figure 8), accounting for 87 percent in 2019.
- Jacketed CPC-1232 rail tank cars carrying other flammable liquids or multiple liquids have also increased between 2015 and 2019, accounting for 34 percent in 2019.

**Figure 8 Jacketed CPC 1232 Rail Tank Cars by Liquid Type for 2015-2019**



**SOURCE:** U.S. Department of Transportation, Bureau of Transportation Statistics. Special analysis based on data provided by the Association of American Railroads: UMLER® and TRAIN II® rail tank car and annualized rail tank car movements, 2013–2019, as of June 9, 2020.

**Figure 9 Non-Jacketed CPC 1232 Rail Tank Cars by Liquid Type for 2015-2019**



**SOURCE:** U.S. Department of Transportation, Bureau of Transportation Statistics. Special analysis based on data provided by the Association of American Railroads: UMLER® and TRAIN II® rail tank car and annualized rail tank car movements, 2013–2019, as of June 9, 2020.

## Other Rail Tank Car Types

Several other types of rail tank cars are capable of carrying Class 3 flammable liquids. However, their numbers are notably lower, representing just 7 percent of the fleet in 2019. Therefore, for analysis purposes, they are grouped together and include DOT-105, DOT-112, DOT-114, DOT-115, DOT-120, and DOT-211 rail tank cars. In 2019, 90 percent of the other rail tank cars were DOT-105, DOT-112, or DOT-120 cars which exceed the DOT-117 standard for carrying Class 3 flammable liquids. In 2019, the “Other” category comprised 7,786 rail tank cars. The ones used for transporting crude oil and ethanol numbered just 860, or 11 percent, in 2019. As seen in figure 10, there was a substantial increase in the number of cars carrying crude oil in 2019 compared to 2015, 792 v. 46, respectively.

## Anticipated Number of Rail Tank Cars Meeting New Safety Standard (Section 7308(c))

### Data Sources

Section 7308(c) requires DOT to estimate the anticipated number of DOT-117 and DOT-117R tank cars for each year through 2029 by collecting data from tank car shops that build or retrofit tank

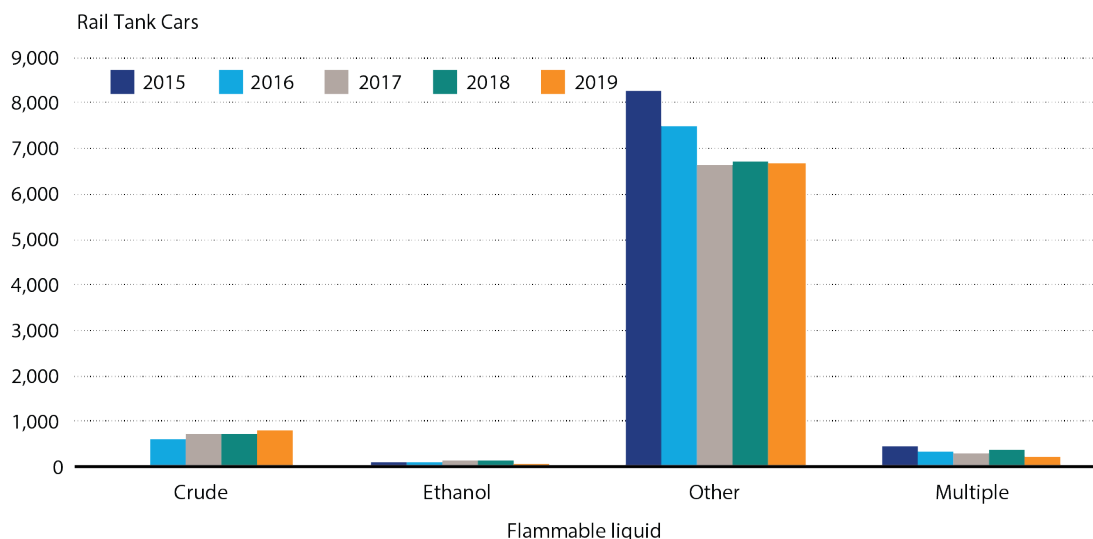
cars. This survey collects information from tank car retrofitting and manufacturing facilities on planned and projected numbers of tank cars to be retrofitted or manufactured in 2019. Any facility identified with the capacity to build new DOT-117 tank cars or modify tank cars to the DOT-117R specification, as described in Section 7308(c) of the FAST Act, was included in the voluntary survey. Because not all tank car shops or facilities are capable or certified to build or retrofit tank cars to the DOT-117 or DOT-117R specifications, the Association of American Railroads and the Railway Supply Institute<sup>12</sup> assisted BTS in identifying facilities with the capabilities and certifications to build or retrofit tank cars to the DOT-117 specification. The data collected from this annual survey effort is summarized in this report.

### Survey Results of Facilities:

Based on responses from U.S. owned and operated tank car shops, they expect to build 3,588 new rail tank cars in 2020 to meet the DOT-117 specification. Additionally, tank car shops plan to retrofit existing rail tank cars to meet the more rigorous DOT-117 safety standards. Table 2 shows that 4,350 rail tank cars are expected to be retrofitted from either DOT-111 or CPC-1232 standards to be DOT-117R tank cars.

<sup>12</sup> The Railway Supply Institute is a trade association representing rail tank car manufacturers and facilities performing repairs and maintenance.

**Figure 10 All Other Rail Tank Cars by Liquid Type for 2015-2019**



**SOURCE:** U.S. Department of Transportation, Bureau of Transportation Statistics. Special analysis based on data provided by the Association of American Railroads: UMLER® and TRAIN II® rail tank car and annualized rail tank car movements, 2013–2019, as of June 9, 2020.

**Table 2 Rail Tank Car Projections, 2020**

	Projected to be built in 2020
DOT-117	3,588
	Projected to be retrofit in 2020
Former DOT-111 or CPC-1232	4,350

**NOTE:** Based on the 2020 Annual Tank Car Facility Survey results from 149 facilities.

This data was collected in the summer of 2020, during the pandemic, and many businesses are facing uncertainty in the near future. Due to fluctuations in the business environment and market conditions, it is challenging for the facilities to predict the exact numbers of new tank cars that will be built, and existing rail tank cars retrofitted to meet the DOT-117 specification in 2020.

Also note, that the data collected from this survey will not match future counts of rail tank car movements in the Association of American Railroads data for the following reasons:

- Tank car movements account for all tank cars that carried a shipment, regardless of when they were built or retrofitted to meet a different specification.
- Newly built or retrofitted cars may enter into service at any point in the year and may not be used until the following year.
- Facilities that build or retrofit tank cars for the North American market outside the United States and not owned by an American company are not included in the survey.

## Summary

In 2019, 112,685 tank cars were used to transport Class 3 flammable liquids. This represents a rebound of 28 percent from the recent low point in 2017 when

88,092 tank cars carried at least one shipment of a flammable liquid. The 2017 data is reflective of lower crude prices and high crude reserves.<sup>13</sup> The tank car fleet has also changed in composition and in the types of flammable liquids transported. There has been growth in the number of DOT-117 and DOT-117R tank cars despite the changes in the size of the fleet carrying Class 3 flammable liquids between 2013 and 2019.

In 2015, when the FAST Act became law, DOT-117 rail tank cars, both new and retrofitted, made up just 2 percent of the fleet carrying Class 3 flammable liquids. In two years, DOT-117s grew to be over a quarter (27 percent) of the fleet carrying Class 3 flammable liquids. And by 2019, DOT-117s comprised nearly half of the fleet at 48 percent. Among the fleet of rail tank cars that meet the DOT-117 specification in 2019, 47 percent (25,300 tank cars) are new and 53 percent (28,261 tank cars) are retrofitted. Half of the new DOT-117 rail tank cars carried crude oil and 65 percent of retrofitted DOT-117 tank cars carried either crude oil or ethanol in 2019. Based on the tank car facilities who responded to the 2020 survey, they plan to build or modify 7,938 tank cars during 2020 to meet the new safety requirements.

Over the period of 2013 to 2019, the fleet of rail tank cars carrying shipments of Class 3 flammable liquids increased in 2015 (99,227 in 2013 to 113,045 in 2015), decreased to 88,092 in 2017, and rebounded to 112,685 in 2019 as demand increased. This is also seen in the number of shipments carried in those rail tank cars, particularly the change in the number of rail tank cars needed to carry crude oil as opposed to other flammable liquids. Regardless of the fleet size, DOT-117s will continue to become a significant part of the fleet, to meet the safety goal by 2029.

<sup>13</sup> For more information on crude oil prices and reserves, see [https://www.eia.gov/dnav/pet/pet\\_pri\\_spt\\_s1\\_d.htm](https://www.eia.gov/dnav/pet/pet_pri_spt_s1_d.htm) and <https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=WTTSTUS1&f=W> accessed July 14, 2020.

# Appendix A: Rail Tank Car Movement Data Supporting This Report

## Appendix A

DOT-117 New		2013	2014	2015	2016	2017	2018	2019
	Crude	0	11	1,279	2,287	3,176	5,408	12,872
	Ethanol	0	0	408	1,728	3,583	4,590	5,715
	Other Flammable Liquids	0	0	133	671	1,635	2,143	2,142
	Multiple Service of Flammable Liquids	0	0	34	647	2,312	4,045	4,571
	<b>Total</b>	<b>0</b>	<b>11</b>	<b>1,854</b>	<b>5,333</b>	<b>10,706</b>	<b>16,186</b>	<b>25,300</b>
DOT-117 Retrofit		2013	2014	2015	2016	2017	2018	2019
	Crude	60	73	24	638	2,612	4,632	9,477
	Ethanol	3	3	3	765	5,301	5,785	8,744
	Other Flammable Liquids	12	14	6	303	992	1,702	3,440
	Multiple Service of Flammable Liquids	2	2	0	543	3,875	5,364	6,600
	<b>Total</b>	<b>77</b>	<b>92</b>	<b>33</b>	<b>2,249</b>	<b>12,780</b>	<b>17,483</b>	<b>28,261</b>
Jacketed DOT-111		2013	2014	2015	2016	2017	2018	2019
	Crude	2,667	2,286	898	295	51	29	0
	Ethanol	143	147	152	149	103	102	109
	Other Flammable Liquids	5,870	5,151	4,627	4,785	4,202	4,269	4,295
	Multiple Service of Flammable Liquids	700	518	280	305	254	174	149
	<b>Total</b>	<b>9,380</b>	<b>8,102</b>	<b>5,957</b>	<b>5,534</b>	<b>4,610</b>	<b>4,574</b>	<b>4,553</b>
Non-Jacketed DOT-111		2013	2014	2015	2016	2017	2018	2019
	Crude	14,388	11,230	4,980	302	5	0	0
	Ethanol	20,494	22,163	23,762	21,477	13,643	12,146	8,480
	Other Flammable Liquids	13,575	13,864	14,697	14,153	11,914	12,813	13,092
	Multiple Service of Flammable Liquids	9,141	9,360	9,321	9,516	6,757	6,185	4,023
	<b>Total</b>	<b>57,598</b>	<b>56,617</b>	<b>52,760</b>	<b>45,448</b>	<b>32,319</b>	<b>31,144</b>	<b>25,595</b>
Jacketed CPC-1232		2013	2014	2015	2016	2017	2018	2019
	Crude	6,252	14,589	19,150	9,659	6,658	9,208	7,580
	Ethanol	0	336	957	586	123	164	142
	Other Flammable Liquids	988	701	1,436	2,063	2,596	3,100	3,128
	Multiple Service of Flammable Liquids	689	591	716	1,190	1,515	2,257	873
	<b>Total</b>	<b>7,929</b>	<b>16,217</b>	<b>22,259</b>	<b>13,498</b>	<b>10,892</b>	<b>14,729</b>	<b>11,723</b>
Non-Jacketed CPC-1232		2013	2014	2015	2016	2017	2018	2019
	Crude	12,266	17,534	16,470	8,258	3,899	1,979	208
	Ethanol	507	1,334	1,709	1,570	1,069	1,378	986
	Other Flammable Liquids	963	1,361	1,806	2,344	2,834	4,862	6,554
	Multiple Service of Flammable Liquids	509	1,044	1,299	1,562	1,170	1,696	1,719
	<b>Total</b>	<b>14,245</b>	<b>21,273</b>	<b>21,284</b>	<b>13,734</b>	<b>8,972</b>	<b>9,915</b>	<b>9,467</b>
All Other Rail Tank Cars		2013	2014	2015	2016	2017	2018	2019
	Crude	362	205	46	611	733	734	792
	Ethanol	4	34	112	105	139	160	68
	Other Flammable Liquids	8,383	8,653	8,287	7,499	6,626	6,710	6,694
	Multiple Service of Flammable Liquids	1,249	855	453	324	315	380	232
	<b>Total</b>	<b>9,998</b>	<b>9,747</b>	<b>8,898</b>	<b>8,539</b>	<b>7,813</b>	<b>7,984</b>	<b>7,786</b>
<b>Total Cars Used</b>		<b>99,227</b>	<b>112,059</b>	<b>113,045</b>	<b>94,335</b>	<b>88,092</b>	<b>102,015</b>	<b>112,685</b>

**NOTE:** All other rail tank cars includes DOT-105, DOT-112, DOT-114, DOT-115, DOT-120, and DOT-211.

**SOURCE:** U.S. Department of Transportation, Bureau of Transportation Statistics. Special analysis based on data provided by the Association of American Railroads: UMLER® and TRAIN II® rail tank car and annualized rail tank car movements, 2013–2018, as of June 9, 2020.



## Appendix B: Annual Tank Car Facility Survey Methodology

### Data Sources

Section 7308(c) requires DOT to estimate the anticipated number of DOT-117 and DOT-117R tank cars for each year through 2029 by collecting data from tank car shops that build or retrofit tank cars. This survey collects information from tank car retrofitting and manufacturing facilities on planned and projected numbers of tank cars to be retrofitted or manufactured in 2020. Any facility identified with the capacity to build new DOT-117 tank cars or modify tank cars to the DOT-117R specification, as described in Section 7308(c) of the FAST Act, was included in the voluntary survey. Because not all tank car shops or facilities are capable or certified to build or retrofit tank cars to the DOT-117 or DOT-117R specifications, the Association of American Railroads and the Railway Supply Institute<sup>14</sup> assisted BTS in identifying facilities with the capabilities and certifications to build or retrofit tank cars to the DOT-117 specification. The Association of American Railroads certifies the tank car shops to build and/or retrofit tank cars to the DOT-117 specification. The data collected from this effort is summarized in this report.

### Survey Method

The 2020 Annual Tank Car Facility Survey, conducted from May to August 2020, included U.S. owned or operated facilities, known as tank car shops, with the capability of retrofitting and/or manufacturing rail tank cars to the new safer standards. In total, 149 tank car shops were identified and requested to respond to this voluntary survey.

Tank car shops were contacted by phone and by letter to inform them of the data collection request and the purpose and use of the collected information. The letter assured confidentiality for their reported data and included the link and individual log-on credentials to the website for online data submission. Once logged into the electronic reporting tool, respondents were prompted to provide the number of tank cars they were expecting to build (DOT-117) in 2020 as well as the number of cars to be retrofitted (DOT-

117R) from a previous rail tank car specification type (e.g., DOT-111).<sup>15</sup> For more information on the specifications, see box B. A second mailing was sent to non-respondents and follow-up phone calls were also made to attempt to contact those who did not respond through the internet.

The information collected from the survey is protected by the Confidential Information Protection and Statistical Efficiency Act of 2002 (CIPSEA); therefore, only aggregate statistics are provided in this report to ensure the confidentiality of individual participants and responses.

The data collected from this survey will not match future counts of rail tank car movements in the Association of American Railroads data. Tank car movements account for all tank cars that carried a shipment, regardless of when they were built or retrofitted to meet a different specification. Newly built or retrofitted cars may enter into service at any point and may or may not be counted for that year. Furthermore, facilities outside the United States but in North America and not owned by an American company are not included in the survey.

Responses to this voluntary survey were obtained from 134 shops, or 90 percent. Due to non-response from 15 tank car shops, these projections of newly built DOT-117 rail tank cars and retrofits to the DOT-117R specifications underestimate the total projected numbers. It is difficult to discern the effects of nonresponses in this survey given the variation in business operations of tank car shops and the lack of auxiliary information to gauge that extent. The tank car shops included in this survey are varied in their capabilities as well as their industry reach geographically, across different modes of transport, and through supply chain control. Some of the shops are part of larger corporations and others are standalone entities. Of the 134 respondents, 83 percent of the respondents are part of corporations with more than three railcar shops. Of the shops, which are part of corporations with no more than three

<sup>14</sup> The Railway Supply Institute is a trade association representing rail tank car manufacturers and facilities performing repairs and maintenance.

<sup>15</sup> Per the FAST Act, Section 7308(c): The Secretary shall conduct a survey of tank car facilities modifying tank cars to the DOT- 117R specification, or equivalent, or building new tank cars to the DOT-117 specification, or equivalent, to generate statistically- valid estimates of the anticipated number of tank cars those facilities expect to modify to DOT-117R specification, or equivalent, or build to the DOT-117 specification, or equivalent.

railcar shop locations, 68 percent reported. Some tank car shops focus solely on repairs and retrofits with certifications from AAR to do that work, while others have the AAR certified capability to build brand new cars.