U.S. Department of Transportation
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Fleet Composition of Rail Tank Cars Carrying Flammable Liquids: 2019 Report

Acknowledgements

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Introduction

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 assemble and collect data on rail tank cars transporting Class 3[1] flammable liquids (box A). The objective of this legislation is to track progress in upgrading the rail tank car fleet to meet new safety requirements and to 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. This third annual report addresses Section 7308(b) by summarizing the progress of tank car safety upgrades from 2013 through 2018 by tank car and flammable liquid type. See box B for more detail on the different types of tank cars referenced in this report. 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 third report includes 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.

[1] For the purposes of this report, flammable liquids refers to Class 3 flammable liquids.

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.

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

Key findings from this report include:

- Meeting the January 1, 2018 deadline, non-jacketed DOT- 111s no longer carry crude oil.
- Meeting the March 1, 2018 deadline, jacketed DOT-111s no longer carry crude oil.
- In 2018 the overall size of the fleet increased for the first time since 2015, growing by 4 percent to 80,298 rail tank cars.
- Just over 34 percent of tank cars used to carry Class 3 flammable liquids in 2018 met the new safety requirements (DOT-117 and DOT-117R), an increase of nearly 76 percent from 20 percent compliance in 2017.
- Tank car shops certified to build or retrofit rail tank cars to the DOT-117 standards expect to build 6,700 tank cars and retrofit 8,410 tank cars in 2019.

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.

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 reduces the conductivity of heat from outside sources to the contents of the tank car.

* 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 together because they are pressurized and already meet a more intense set of regulations than the DOT-117 specification.
- DOT-115 and DOT-211 rail tank cars that are grouped together because they do not typically carry crude oil or ethanol.

SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics, 2019.

Background

DOT's Pipeline and Hazardous Materials Safety Administration (PHMSA) and Federal Railroad Administration (FRA) issued a final rule on May 8, 2015, with the intent of making the transportation of 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).[2] 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 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,[3] 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). AAR maintains two databases:

[2] 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.

[3] 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-forflammable-liquids-and-rail-tank-cars; accessed on Aug. 14, 2018.

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 2016	2018
Petroleum crude oil	Non-jacketed DOT-111	January 1, 2018	276	0
	Jacketed DOT-111	March 1, 2018	90	27*
	Non-jacketed CPC-1232	April 1, 2020	8,246	2,098
	Jacketed CPC-1232	May 1, 2025	5,164	3,690
Ethanol	Non-jacketed DOT-111	May 1, 2023	21,949	12,610
	Jacketed DOT-111	May 1, 2023	147	107
	Non-jacketed CPC-1232	July 1, 2023	1,633	1,451
	Jacketed CPC-1232	May 1, 2023	580	163
Other Flammable Liquids, Packing Group I	Non-jacketed DOT-111	May 1, 2025	108	67
	Jacketed DOT-111	May 1, 2025	5	8
	Non-jacketed CPC-1232	May 1, 2025	26	25
	Jacketed CPC-1232	May 1, 2025	0	1
Other Flammable Liquids, Packing Group II/III	Non-jacketed DOT-111	May 1, 2029	12,419	10,383
	Jacketed DOT-111	May 1, 2029	4,221	3,605
	Non-jacketed CPC-1232	May 1, 2029	1,376	2,882
	Jacketed CPC-1232	May 1, 2029	1,687	2,347
Multiple Service Liquids	Non-jacketed DOT-111		7,962	5,278
	Jacketed DOT-111		263	134
	Non-jacketed CPC-1232		1,220	809
	Jacketed CPC-1232		556	366

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.

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

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.

- UMLER®[4]: 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®[5]: 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.

The UMLER® file is a database, managed by Railinc Corp., a subsidiary corporation of AAR, 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[6]) 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 utilized in each of the years, from 2013 to 2018, by tank car type as well as type of flammable liquid being 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.

Methodology

In 2018 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[7] 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 either being phased out of carrying Class 3 flammable liquids or are switching to liquids that are less volatile or less likely to be in high-hazard flammable trains.

[4] UMLER®: Universal Machine Language Equipment Register

[5] TRAIN II®: TeleRail Automated Information Network

[6] 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.

[7] 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.

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. BTS has worked closely with AAR to ensure that the data used in this analysis are as accurate and thorough as possible. 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.

Analysis Results

Between 2013 and 2018, 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.

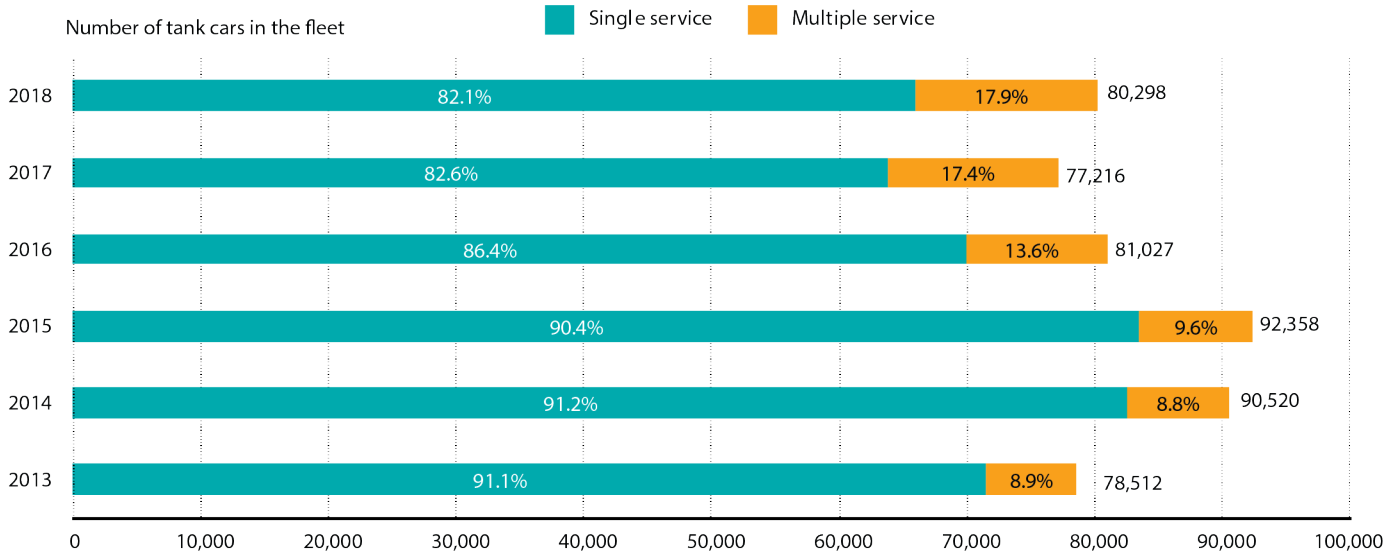
The number of tank cars in the fleet is also affected by those tank cars that carry multiple flammable liquid types over the course of a year, which reduces the need for additional tank cars.

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. The data show that in 2018 non-jacketed DOT-111s were no longer carrying crude oil, meeting the new safety requirement. Additionally, jacketed DOT-111s phased out carrying crude oil in the first 2 months of 2018, meeting the March 1, 2018 deadline.

As shown in figure 1, the total fleet of rail tank cars that actively carry Class 3 flammable liquids has fluctuated over the 2013 to 2018 time period:

- There were 78,512 rail tank cars in this service in 2013, rising to 92,358 by 2015.

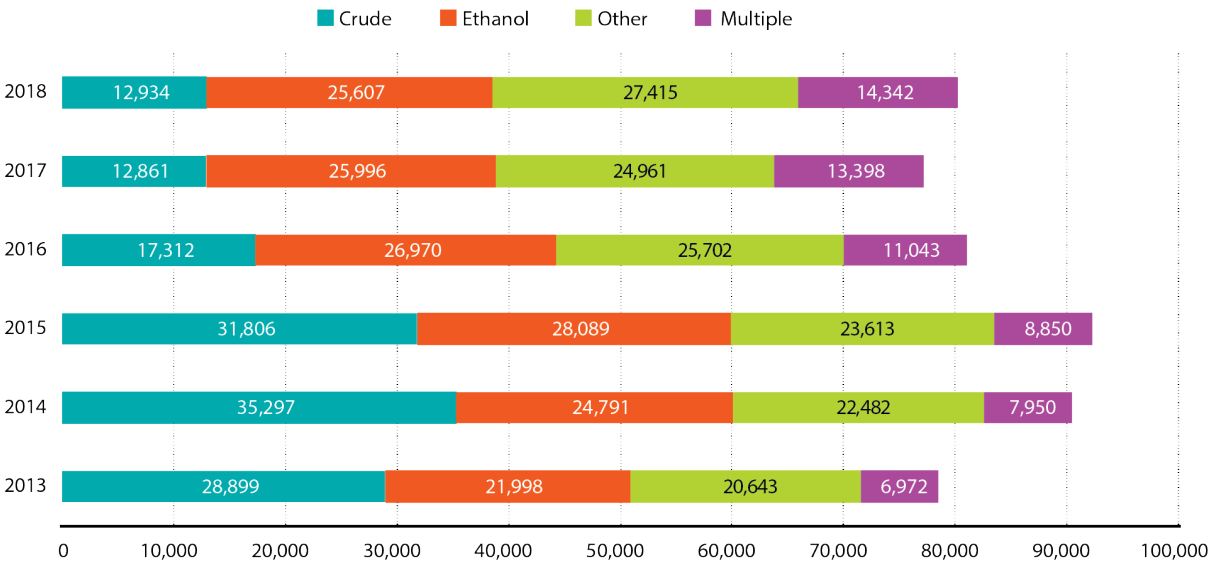
Figure 1 Rail Tank Cars by Percentage of Single and Multiple Flammable Liquid Service: 2013–2018



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.

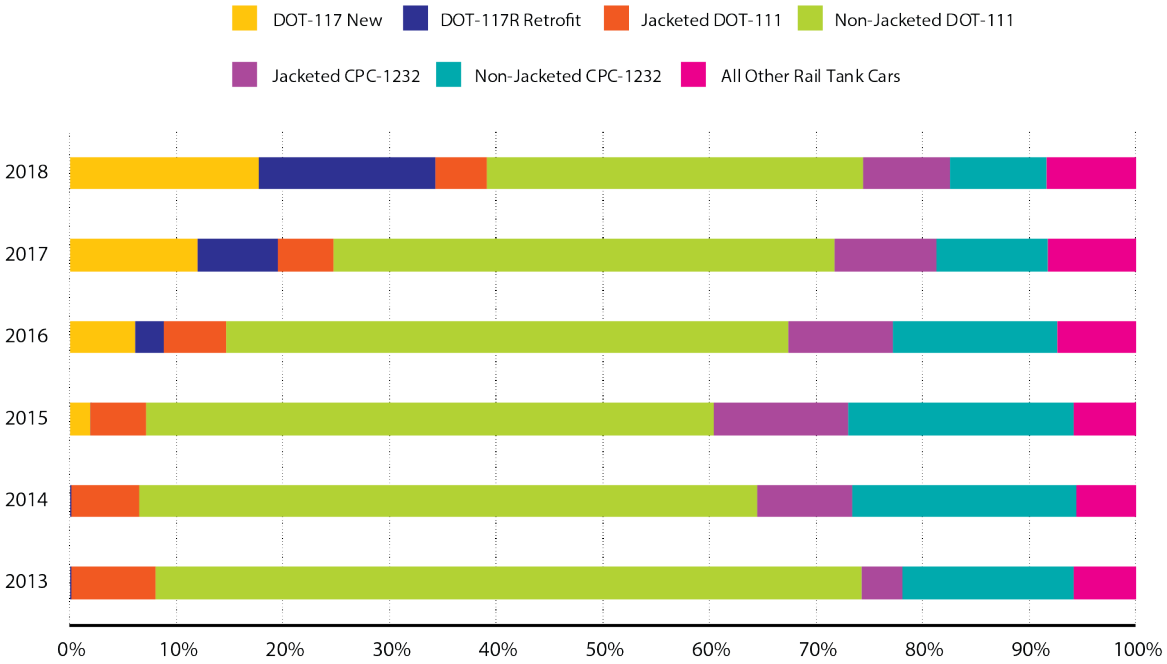
SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics. Special analysis based on data provided by the Association of American Railroads: UMLER® and TRAIN II® rail tank car and annualized rail tank car movements, 2013–2018, as of June 24, 2019.

Figure 2 Number of Rail Tank Cars by Type of Class 3 Flammable Liquid Carried: 2013–2018



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 24, 2019.

Figure 3 Fleet Composition of Rail Tank Cars Carrying Class 3 Flammable Liquids: 2013–2018



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 24, 2019.

- By 2017 the number had fallen to 77,216, before rebounding to 80,298 in 2018.
- Between 2017 and 2018, the number of rail cars carrying Class 3 flammable liquids increased by nearly 4 percent.[8]

Over the 2013 to 2018 period, the mix of fluids carried also changed, in part due to increased pipeline capacity for crude oil.[9] The national capacity increases ranged from 1 million to 2.5 million barrels per day between 2014 and 2018. As seen in figure 2:

- The number of rail tank cars carrying crude oil decreased by 63 percent, from nearly 29,000 tank cars to just under 13,000 tank cars.
- The number of tank cars carrying ethanol remained fairly consistent at 25,000–26,000 cars in the last 2 years.
- The number of rail tank cars in the fleet of Class 3 flammable liquids carrying other fluids increased by 33 percent.
- The number of tank cars carrying multiple fluids in a year more than doubled between 2013 and 2018.

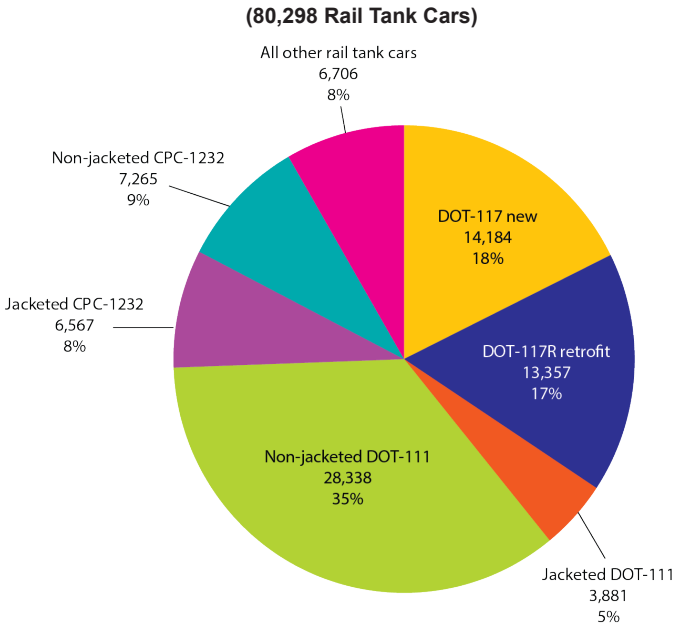
From 2013 to 2018, the composition of the fleet also changed. Figure 3 shows that:

- The number of DOT-117s, both new and retrofitted, increased from zero in 2013 to 7,181 tank cars in 2016, representing 9 percent of the fleet carrying Class 3 flammable liquids.
- By 2018 the count of all DOT-117s grew to 27,541, representing a 284 percent increase from 2016 and comprising 34 percent of the fleet of rail tank cars carrying Class 3 flammable liquids.
- Despite the increase in DOT-117s, the largest percentage of tank cars in this service remains the non-jacketed DOT-111 rail tank cars.

[8] 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.

[9] This report: https://energi.media/news/us-crude-oil-pipeline-capacity-shown-by-new-eia-database/ accessed on July 26, 2019 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.

Figure 4 Fleet of Rail Tank Cars Carrying Class 3 Flammable Liquids in 2018



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, 2013–2017, as of June 11, 2018.

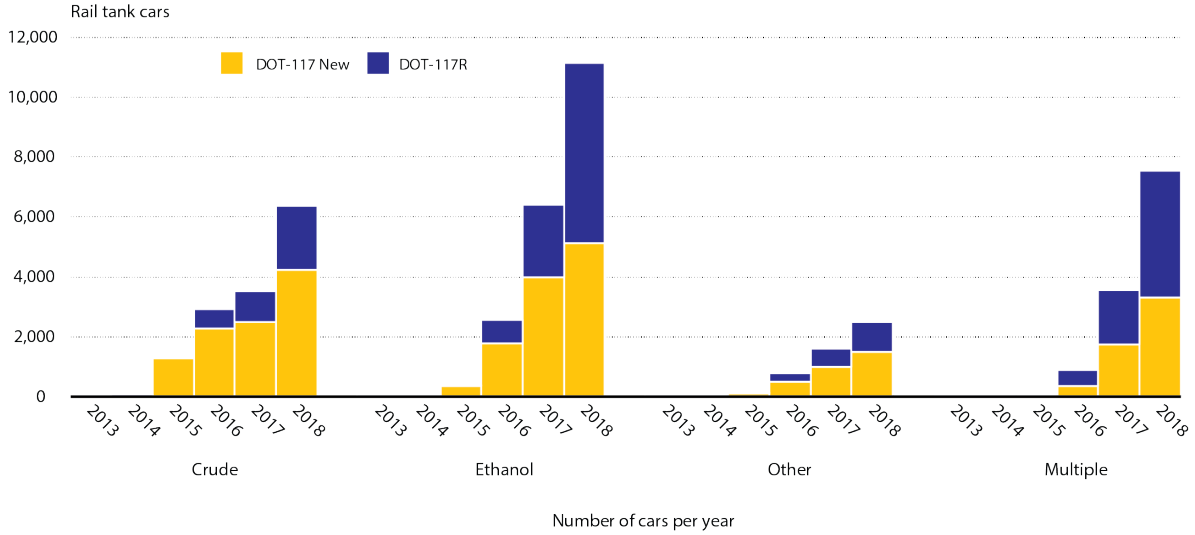
- However, the share of DOT-111s in the fleet dropped from 66 percent in 2013 to 35 percent in 2018, a decrease of 23,683 rail tank cars carrying ethanol and other flammable liquids that year.
- Compared with 2013, the number of jacketed CPC-1232 rail tank cars increased to 11,689 in 2015 before dropping to 6,567 tank cars in 2018.

The grouping of Other Rail Tank Cars, including specifications of DOT-105, DOT-112, DOT-114, DOT-115, DOT-120, and DOT-211, has shown a gradual increase from 4,519 rail tank cars in 2013 to 6,706 rail tank cars in 2018 (figure 4). Most of the tank cars 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. 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 variation in flammable liquids carried by the different types of rail tank cars between 2013 and 2018.

DOT-117 Rail Tank Cars

DOT-117 rail tank cars are tank cars built to the new technical and safety specifications that were finalized in

Figure 5 DOT-117 (both new and retrofit) Rail Tank Cars by Liquid Type: 2013–2018



	Crude						Ethanol							Other							Multiple						
	2013	2014	2015	2016	2017	2018	2013	2014	2015	2016	2017	2018		2013	2014	2015	2016	2017	2018		2013	2014	2015	2016	2017	2018	
DOT-117R	60	73	24	638	1,029	2,146	3	3	3	772	2,433	6,002		12	14	4	294	587	984		1	1	0	511	1,804	4,225	
DOT-117 New	0	11	1,279	2,287	2,484	4,239	0	0	375	1,793	3,975	5,115		0	0	103	505	1,007	1,500		0	0	19	381	1,745	3,330	

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 24, 2019.

2015. 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 2014, just 11 of these new tank cars were introduced, but by 2016 nearly 5,000 were in use carrying Class 3 flammable liquids as is shown in figure 5.

- As of 2018, 14,184 DOT-117 rail tank cars, or 18 percent of the fleet, were carrying Class 3 flammable liquids.
- These new tank cars were primarily used to carry crude oil and ethanol, accounting for 66 percent of the total DOT-117 fleet.
- While new DOT-117 rail tank cars were being built, 13,357 existing rail tank cars were retrofitted to meet the DOT-117R requirements, comprising 17 percent of the 2018 fleet.
- The bulk of retrofits, over 7,500 of them, started actively carrying flammable liquids on the Nation's rail system in 2018, with 61 percent of those cars carrying various types of ethanol and crude oil.

DOT-111 Rail Tank Cars

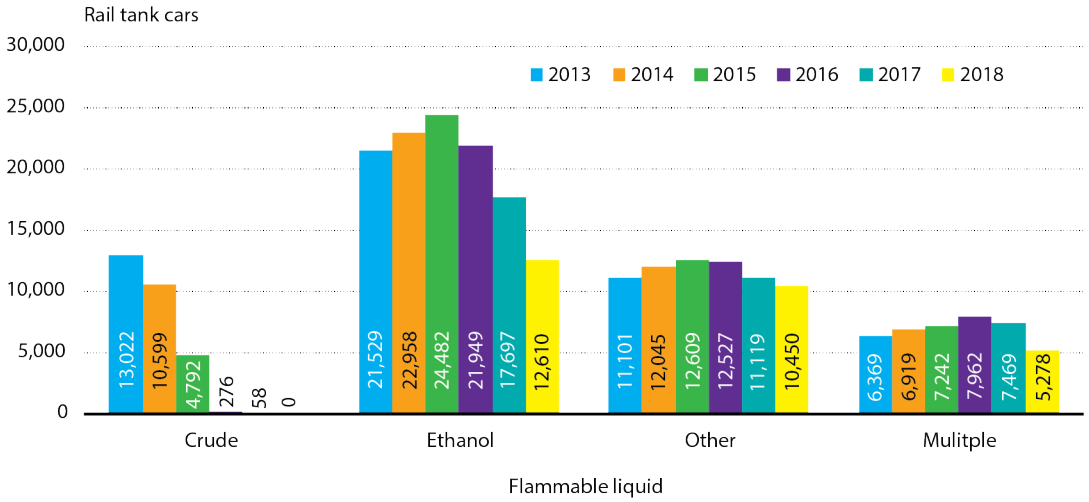
As of January 1, 2018, non-jacketed DOT-111 rail tank cars are prohibited from carrying crude oil as mandated in HM-251 (table 1). During 2018 no non-jacketed DOT-111s carried crude oil, meeting the goal of the legislation. Prior to 2018 non-jacketed DOT-111 rail tank cars had a significant presence in the fleet of rail tank cars that carry Class 3 flammable liquids as seen in figure 6.

- The number of these tank cars has been in decline, dropping from 52,521 in 2014 to 28,338 in 2018—a 46 percent decrease.
- The number of non-jacketed DOT-111s carrying ethanol declined from 24,482 cars in 2015 to 12,610 cars in 2018, a 48 percent drop.

Similar to the non-jacketed DOT-111s, jacketed DOT-111 tank cars are prohibited from carrying crude oil as of March 1, 2018,

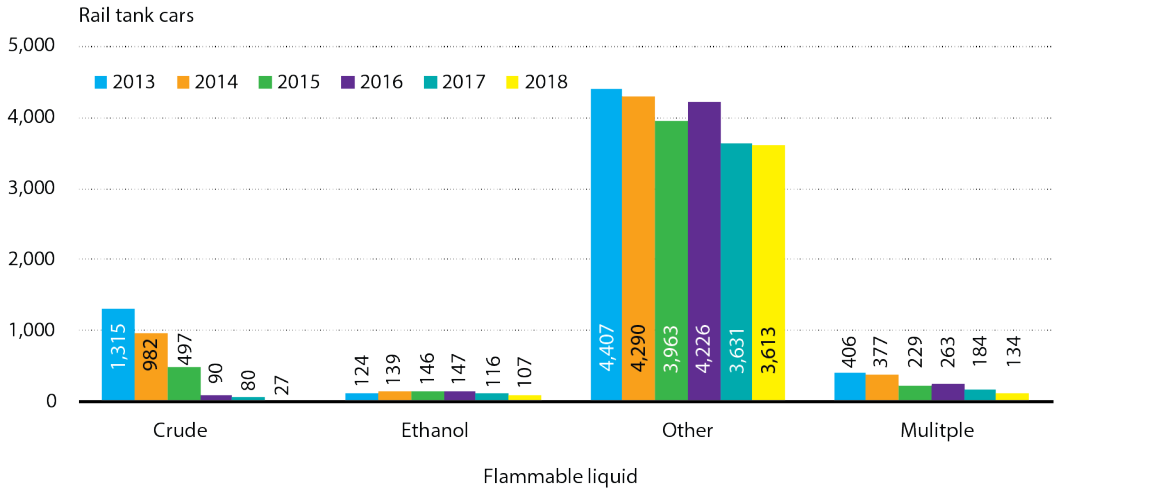
- The total number of jacketed DOT-111 rail tank cars declined between 2013 and 2018, representing nearly a 38 percent decrease as seen in figure 7. The remaining jacketed DOT-111s in the fleet are still carrying ethanol and other flammable liquids.
- Faced with the March 2018 phase-out date, those tank 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: 2013–2018



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 24, 2019.

Figure 7 Jacketed DOT-111 Rail Tank Cars by Liquid Type: 2013–2018



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 24, 2019.

CPC-1232 Rail Tank Cars

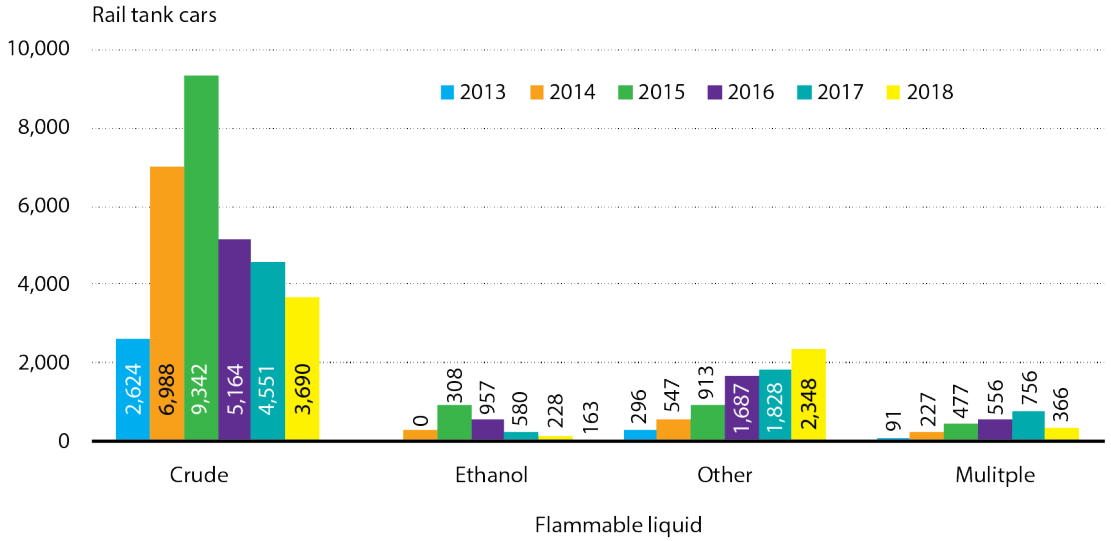
Figure 8 shows more detail on how many jacketed CPC-1232 rail tank cars were used to transport Class 3 flammable liquids.

- The number of these rail tank cars carrying flammable liquids increased significantly between 2013 and 2015, growing from 3,011 to 11,689 tank cars, a nearly 300 percent increase.
- However, by 2018 the number of these rail tank cars used dropped to 6,567, a 44 percent decrease from the peak in 2015, but still more than twice as many in 2018 as in 2013.

Of the liquids carried, crude oil follows the same pattern observed in the overall fleet, with a 256 percent increase from 2013 to 2015 in the number of cars used. This increase was followed by a drop in 2018 to a level of 3,690 jacketed CPC-1232 tank cars, which was still more than the number of these cars used in 2013 (2,624 tank cars). However, the increase in using jacketed CPC-1232 tank cars to carry other flammable liquids has been more consistent, in contrast to crude oil or ethanol, over the 2013 to 2018 period, ranging from 296 in 2013 to 2,348 in 2018.

The number of non-jacketed CPC-1232 rail tank cars carrying Class 3 flammable liquids increased from

Figure 8 Jacketed CPC 1232 Rail Tank Cars by Liquid Type: 2013–2018



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 24, 2019.

12,633 in 2013 to 19,586 in 2015, a rise of about 55 percent, before dropping to 7,265 cars in 2018. Non-jacketed CPC-1232 rail tank cars will be prohibited from carrying crude oil by April 1, 2020. However, for the individual flammable liquid types carried by non-jacketed CPC-1232 tank cars, the trend is more varied.

- While the number of non-jacketed CPC-1232 rail tank cars carrying crude oil rose from 2013 to 2014, that number started to drop in 2015.
- By 2018 there were 82 percent fewer tank cars carrying crude oil than in 2013 as seen in figure 9.
- From 2013 to 2018, transportation of other flammable liquids, not including ethanol or crude oil, in non-jacketed CPC-1232 rail tank cars increased 451 percent.

Other Rail Tank Car Types

While there are several other types of rail tank cars capable of carrying Class 3 flammable liquids, their numbers are notably lower, particularly for transporting crude oil and ethanol (893 combined in 2018). 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. As seen in figure 10, there was an increase to 734 cars carrying crude oil in 2018, compared to 113 in 2013. Between 2013 and 2018, there was a 31 percent increase in the number of these tank cars (to 5,613 rail tank cars) carrying other flammable liquids.

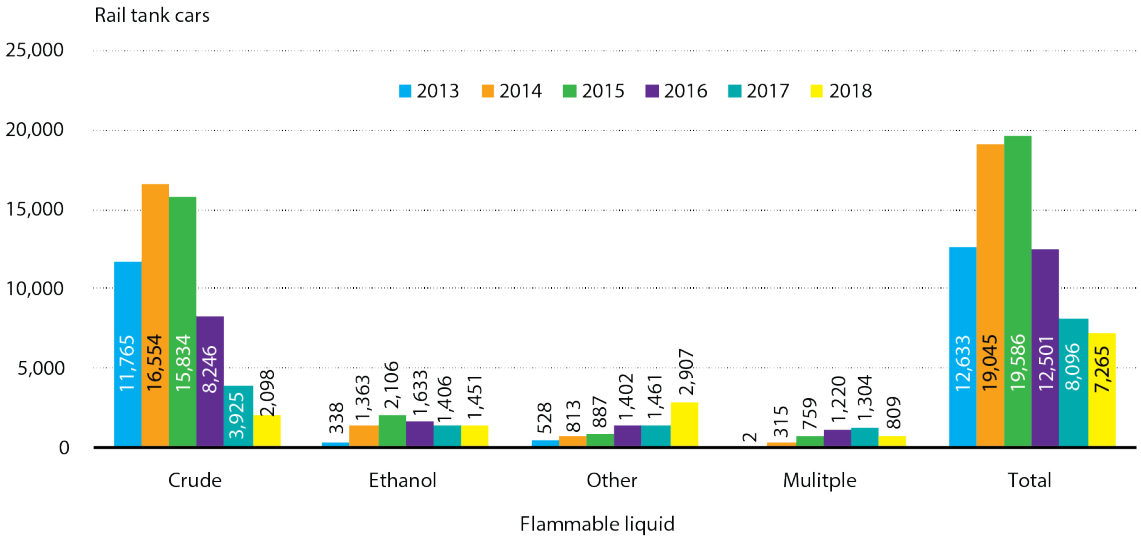
Anticipated Number of Rail Tank Cars Meeting New Safety Standard (Section 7308(c))

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, AAR and the Railway Supply Institute[10] 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.

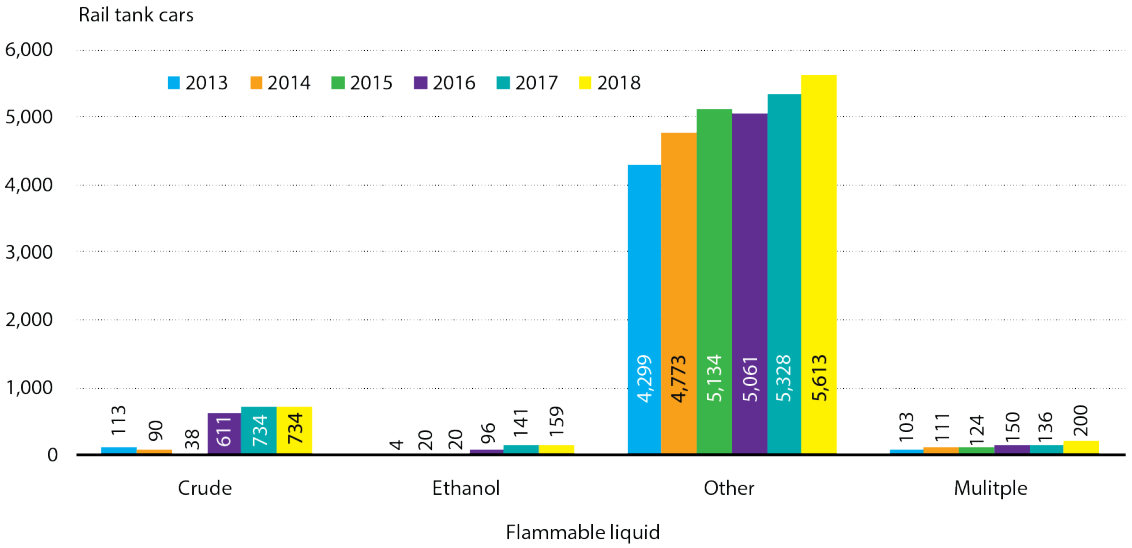
[10] The Railway Supply Institute is a trade association representing rail tank car manufacturers and facilities performing repairs and maintenance.

Figure 9 Non-Jacketed CPC 1232 Rail Tank Cars by Liquid Type: 2013–2018



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 24, 2019.

Figure 10 All Other Rail Tank Cars by Liquid Type: 2013–2018



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, 2013–2017, as of June 11, 2018.

Survey Results

The data collected from this survey will not match future counts of rail tank car movements in the AAR 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.

Based on responses from U.S. owned and operated tank car shops, they expect to build 6,700 new rail tank cars in 2019 to meet the DOT-117 specification or more rigorous standard. Additionally, tank car shops plan to retrofit existing rail tank cars to meet the more rigorous DOT-117 safety standards. Table 2 shows that 8,410 rail tank cars are expected to be retrofitted from either DOT-111 or CPC-1232 standards to be DOT-117R tank cars. 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 2019.

Table 2 Rail Tank Car Projections, 2019

	Build projections for 2019
DOT-117	6,700
	Retrofit projections for 2019
Former DOT-111 or CPC-1232	8,410

NOTE: Based on the *2019 Annual Tank Car Facility Survey* results from 102 facilities.

Summary

In 2018, 80,298 tank cars were used to transport Class 3 flammable liquids. This represents a slight rebound of 4 percent from the recent low point in 2017 when 77,216 tank cars carried at least one shipment of a flammable liquid. 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 117R tank cars despite the overall reduction in the fleet since 2015.

In 2018 the DOT-117 rail tank cars, both new and retrofitted, grew to 34 percent of the entire fleet used to carry Class 3 flammable liquids, a significant increase from just 2 percent in 2015. This is also a 76 percent increase over 2017 when the DOT-117 tank cars comprised nearly 20 percent of the fleet. Based on the 102 tank car facilities who responded to the 2019 survey, they plan to build or modify 15,110 tank cars during 2019 to meet the new safety requirements.

Among the fleet of rail tank cars that meet the DOT-117 specification in 2018, 52 percent (14,184 tank cars) are new and 48 percent (13,357 tank cars) are retrofitted. The DOT-117 and DOT-117R tank cars carry a variety of flammable liquids. During 2019, 89 percent of DOT-117s carried ethanol, crude, or a combination of fluids including ethanol or crude oil.

During 2018 there has been a reduction in Class 3 flammable liquids carried by DOT-111 tank cars, both jacketed and unjacketed. They are now carrying 40 percent of these liquids compared with 74 percent in 2013. While the DOT-111s are still the largest component of the fleet of rail tank cars carrying Class 3 flammable liquids, DOT-117 rail tank cars are the fastest growing portion of the fleet, reaching 34 percent in 2018.

Appendix A

DOT-117 new		2013	2014	2015	2016	2017	2018
	Crude	0	11	1,279	2,287	2,484	4,239
	Ethanol	0	0	375	1,793	3,975	5,115
	Other flammable liquids	0	0	103	505	1,007	1,500
	Multiple service of flammable liquids	0	0	19	381	1,745	3,330
	Total	**0**	**11**	**1,776**	**4,966**	**9,211**	**14,184**
DOT-117 retrofit		2013	2014	2015	2016	2017	2018
	Crude	60	73	24	638	1,029	2,146
	Ethanol	3	3	3	772	2,433	6,002
	Other flammable liquids	12	14	4	294	587	984
	Multiple service of flammable liquids	1	1	0	511	1,804	4,225
	Total	**76**	**91**	**31**	**2,215**	**5,853**	**13,357**
Jacketed DOT-111		2013	2014	2015	2016	2017	2018
	Crude	1,315	982	497	90	80	27
	Ethanol	124	139	146	147	116	107
	Other flammable liquids	4,407	4,290	3,963	4,226	3,631	3,613
	Multiple service of flammable liquids	406	377	229	263	184	134
	Total	**6,252**	**5,788**	**4,835**	**4,726**	**4,011**	**3,881**
Non-jacketed DOT-111		2013	2014	2015	2016	2017	2018
	Crude	13,022	10,599	4,792	276	58	0
	Ethanol	21,529	22,958	24,482	21,949	17,697	12,610
	Other flammable liquids	11,101	12,045	12,609	12,527	11,119	10,450
	Multiple service of flammable liquids	6,369	6,919	7,242	7,962	7,469	5,278
	Total	**52,021**	**52,521**	**49,125**	**42,714**	**36,343**	**28,338**
Jacketed CPC-1232		2013	2014	2015	2016	2017	2018
	Crude	2,624	6,988	9,342	5,164	4,551	3,690
	Ethanol	0	308	957	580	228	163
	Other flammable liquids	296	547	913	1,687	1,828	2,348
	Multiple service of flammable liquids	91	227	477	556	756	366
	Total	**3,011**	**8,070**	**11,689**	**7,987**	**7,363**	**6,567**
Non-jacketed CPC-1232		2013	2014	2015	2016	2017	2018
	Crude	11,765	16,554	15,834	8,246	3,925	2,098
	Ethanol	338	1,363	2,106	1,633	1,406	1,451
	Other flammable liquids	528	813	887	1,402	1,461	2,907
	Multiple service of flammable liquids	2	315	759	1,220	1,304	809
	Total	**12,633**	**19,045**	**19,586**	**12,501**	**8,096**	**7,265**
All other rail tank cars		2013	2014	2015	2016	2017	2018
	Crude	113	90	38	611	734	734
	Ethanol	4	20	20	96	141	159
	Other flammable liquids	4,299	4,773	5,134	5,061	5,328	5,613
	Multiple service of flammable liquids	103	111	124	150	136	200
	Total	**4,519**	**4,994**	**5,316**	**5,918**	**6,339**	**6,706**
Total cars used		78,512	90,520	92,358	81,027	77,216	80,298

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 24, 2019.

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 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, AAR and the Railway Supply Institute[1] 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 effort is summarized in this report.

Survey Method

The 2019 Annual Tank Car Facility Survey, conducted from July to September 2019, 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, 148 tank car shops were identified and requested to respond to this voluntary survey.

Each tank car shop was initially contacted by a letter to inform them of the data collection request and the purpose and use of the collected information. Furthermore, the letter provided assurance of confidentiality for their reported data. The letter 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 2019, as well as the number of cars to be retrofitted (DOT-117R) from a previous rail tank car specification type (e.g., DOT-111).[2] For more information on the specifications, see box B. Follow-up phone calls were also made, particularly to the larger corporations, 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 AAR 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 102 shops. Due to non-response from 46 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 extent of non-response bias 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 stand-alone entities. Of the 102 respondents, 91 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 railcar shop locations, 26 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.

[1] The Railway Supply Institute is a trade association representing rail tank car manufacturers and facilities performing repairs and maintenance.

[2] 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.