U.S. Department of Transportation
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Fleet Composition of Rail Tank Cars Carrying Flammable Liquids: 2023 Report

Bureau of Transportation Statistics

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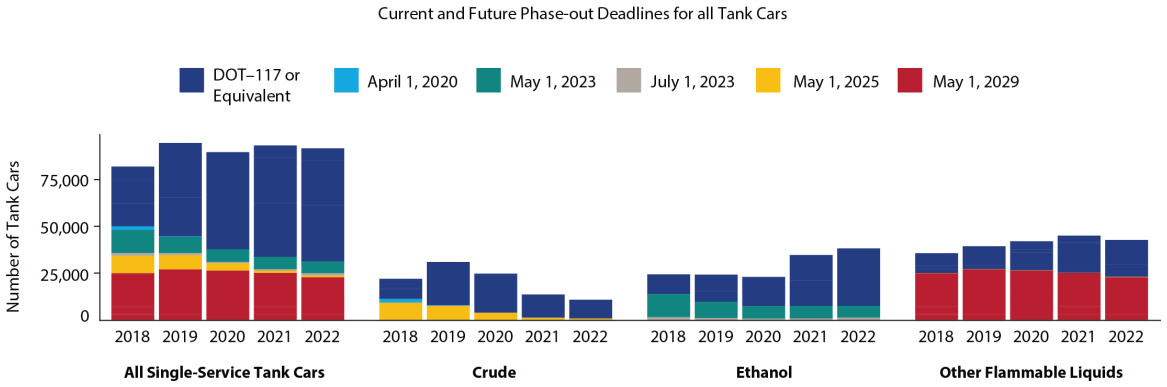


NOTE: Cars listed in this report as Others are considered to be in compliance with the FAST Act as they meet a stricter set of regulations. See Box B.

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, 2013-2022, accessed June, 2023

Key Points:

- All cars carrying crude oil met the phase out deadline
- All tank cars carrying ethanol need to meet 2023 phase-out deadlines. Census results show that this is an achievable milestone.
- All tank cars carrying Class 3 flammable liquids will need to meet DOT-117 or equivalent specifications by May 1, 2029

In accordance with the 2015 Fixing America's Surface Transportation (FAST) Act, the U.S. Department of Transportation's (USDOT) Bureau of Transportation Statistics (BTS) has released its Fleet Composition of Rail Tank Cars Carrying Class 3 Flammable Liquids: 2023 Report. This mandated annual report to Congress discusses progress made in upgrading to the DOT-117 standard that portion of the North American rail tank car fleet transporting Class 3 flammable liquids. This standard includes additional safety requirements and summarizes the types of rail tank cars carrying Class 3 flammable liquids. There is a rolling phase-out schedule of tank cars based on both tank car type and flammable liquid or liquids carried. All tank cars in service in 2022 that were subject to the FAST Act were compliant with the scheduled phase-out deadlines. There were no FAST Act phase-out deadlines required in 2022.

In 2022, 59 percent of all rail tank cars carrying Class 3 flammable liquids were built to the new DOT-117 specification or modified to meet the DOT-117R (retrofit) specification (figure 1).

BTS is also required to provide statistically sound estimates of tank car production in the coming year that will meet the DOT-117 specification. A census of rail tank car shops with the ability to produce new DOT-117 tank cars or retrofit existing tank cars to the DOT-117R specification was

recently conducted. It is expected that 4,349 new DOT-117 cars will be produced and 2,565 existing tank cars will be retrofitted to the DOT-117R specifications in 2023, introducing a total of 6,914 new DOT-117 or DOT-117R tank cars to the North American tank car fleet. The deadlines to meet DOT-117 specifications for most tank cars carrying ethanol, a Class 3 flammable liquid, were May 1, 2023 for DOT-111 tank cars and July 1, 2023 for non-jacketed CPC-1232 tank cars. There were 7,461 tank cars carrying ethanol that did not meet the DOT-117 or DOT-117R standards in 2022 that must meet the safety specifications by May or July 2023 to continue transporting ethanol. The results of our census found that there were 8,739 tank cars built or retrofitted over the course of 2022, as well as 6,914 projected new or retrofitted tank cars in 2023, making the 2023 deadline for tank cars carrying ethanol to meet the new standards an achievable milestone.

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

Section 7308 of the Fixing America's Surface Transportation Act (FAST Act; P.L. 114-94; Dec. 4, 2015) requires USDOT to collect and report data on rail tank cars transporting Class 3[1] flammable liquids (box A). This legislation aims to track progress in upgrading the portion of the rail tank car fleet transporting Class 3 flammable liquids to the new DOT-117 standard.

The new DOT-117 standards, finalized in 2015, specify the design characteristics of DOT-117 and DOT-117R tank cars. These characteristics include a thicker, insulated/thermally protected tank;[2] a full height head shield; and top and bottom valve fitting protections.[3] Thick-walled head shields are on both ends of the tank car to resist puncture in a derailment. The top and bottom valves, used to fill and empty the tank car, need to be protected from shearing off in a derailment to prevent release of flammable liquids.

The FAST Act mandates that USDOT 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.

Furthermore, the FAST Act mandates that USDOT provide projected numbers of new builds (i.e., DOT-117s) and retrofits (i.e., DOT-117Rs) by tank car shops for the current year that satisfy Section 7308(c). Section 7308(c) requires 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 annual report addresses Section 7308(b) by summarizing the progress of tank car safety upgrades, from 2013 through 2022, by tank car and flammable liquid type—as defined by the Association of American Railroads (AAR). See box B for more detail on the different types of tank cars referenced in this report.

Prior annual reports are on the BTS website: http://www.bts.gov/tankcarreports.

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 identified in the federal hazardous materials regulations and determine how a flammable liquid must be prepared for transport. Crude oil and ethanol are both packing group 1 and the 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 Aug 16, 2023.

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

[2] Existing tank cars retrofitted to the DOT-117R standard may continue in service with a 7/16 inch head and shell thickness.

[3] For more information and illustrations, see https://tankcarresourcecenter.com/ (accessed July 18, 2023).

Box B Tank Car Type Definitions

DOT-111: A non-pressurized tank car with a shell of7/16 in. These tank cars can carry both hazardous and non-hazardous liquids. These tank cars are not required to have head shields or top fittings protection. DOT-111s 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 full height 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 punctures and the valves from damage. DOT-117R tank cars are cars retrofitted to meet the 117 specifications except that they may continue in service with a shell of 7/16 of an inch.

CPC-1232: A voluntary, industry-sponsored specification for tank cars carrying petroleum crude oil and ethanol that include additional safety features as compared to DOT-111 tank cars. Cars ordered after October 2011 for the transport of crude oil or ethanol must meet this industry specification. CPC-1232 tank cars are equipped with 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 1/2 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 house 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 exceed 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 their trips, then they are a single service car. If a tank car is cleaned 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 1/2-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 a specialized handle that is intended to prevent an unintended release.

Fleet Composition of Rail Tank Cars carrying Class 3 Flammable Liquids

Key Findings

- There were 100,393 rail tank cars that carried Class 3 flammable liquids in 2022—a 2.8 percent reduction from 2021.
- Of those 100,393 rail tank cars, 10,787 carried only petroleum crude oil—a 20.5 percent reduction from 2021 to 2022 in the number of tank cars carrying crude only, reflecting a 27.6 percent drop in the volume of crude petroleum movements by rail in the same period.
- The share of crude carried by new or retrofitted DOT-117 cars increased from 85.6 to 90.0 percent from 2021 to 2022, with the balance primarily carried by Jacketed CPC 1232 cars (6.8 percent) that are due to be phased out from crude oil service by May 1, 2025.
- Tank car shops certified to build or retrofit rail tank cars to the DOT-117 standards expect to build 4,349 tank cars and retrofit 2,565 tank cars in 2023.
- There was a decrease in U.S. crude oil shipments (figure 5) and a reduction in rail tank cars carrying crude oil in 2022. Regardless of economic fluctuations and fleet size, DOT-117s have continued to become an increasingly significant proportion of the flammable liquid carrying fleet, which is expected to meet all FAST Act phase-out deadlines by May 1, 2029.

Background: Hazardous Materials Rule of 2015

Several high-profile incidents prompted the U.S. and Canadian governments to reexamine the safety standard that governs the transport of Class 3 flammable liquids.[4] USDOT'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 Class 3 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 cars transporting flammable liquids and operating in high-hazard flammable trains (HHFT).[5]

The FAST Act further included provisions to make the transport of hazardous materials safer by phasing out tank cars built to the DOT-111 standard from transporting Class 3 flammable liquids and then finally prohibiting those cars from transporting any Class 3 flammable liquid 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 switch to carrying commodities other than Class 3 flammable liquids or be retired. After the HM-251 rule was issued in May 2015, Congress passed the FAST Act legislation in December 2015, which further revised the phase-out timeline originally set in HM-251. 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,[6] eliminating any confusion as to when the phase-out must occur. The current dates are listed in table 1. The proportion of tank cars currently meeting the DOT-117 specification as well as the proportions that will be phased-out on a rolling basis are shown in figure 1. This figure shows the proportion of all tank cars which meet current phase-out guidelines (i.e., new DOT-117 tank cars or existing tank cars modified to the DOT-117R standard). Figure 1 shows there were 10,787 tank cars carrying petroleum crude oil in 2022. Out of these, there were 10,049 cars (including DOT-117s, retrofit DOT-117Rs, and cars classified as "Others"[7]) meeting phase-out dates outlined in the FAST Act. An additional 738 Jacketed CPC-1232 cars in use in 2022 are expected to be retrofitted or repurposed before the May 1, 2025 phase-out deadline.

[4] For more information on the incidents, see https://tankcarresourcecenter.com/tankcar101/ accessed July 18, 2023.

[5] 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.

[6] 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 July 18, 2023.

[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.

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

Fuel and Car Type	Date for Phase-Out	Number of Cars Carrying Flammable Liquids 2021	2022
Crude			
Non-Jacketed DOT-111	January 1, 2018	0	0
Jacketed DOT-111	March 1, 2018	0	0
Non-Jacketed CPC-1232	April 1, 2020	0	0
Jacketed CPC-1232	May 1, 2025	1,154	738
Ethanol			
Non-Jacketed DOT-111	May 1, 2023	6,531	6,122
Jacketed DOT-111	May 1, 2023	94	80
Non-Jacketed CPC-1232	July 1, 2023	776	1,210
Jacketed CPC-1232	May 1, 2023	72	49
Other Flammable Liquids Packing Group I			
Non-Jacketed DOT-111	May 1, 2025	34	96
Jacketed DOT-111	May 1, 2025	8	7
Non-Jacketed CPC-1232	May 1, 2025	51	106
Jacketed CPC-1232	May 1, 2025	3	0
Other Flammable Liquids Packing Group II/III			
Non-Jacketed DOT-111	May 1, 2029	11,444	10,301
Jacketed DOT-111	May 1, 2029	4,148	3,951
Non-Jacketed CPC-1232	May 1, 2029	6,290	5,346
Jacketed CPC-1232	May 1, 2029	3,143	3,159
Multiple Service Flammable Liquids			
Non-Jacketed DOT-111	-	1,407	1,392
Jacketed DOT-111	-	150	171
Non-Jacketed CPC-1232	-	2,259	1,309
Jacketed CPC-1232	-	503	567

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 August 15, 2023 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, 2013-2022, as of June 24, 2023.

Current Fleet Composition (Section 7308(b))

Data Sources

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

- UMLER®[8] : an inventory of individual tank cars (active or scheduled to be built) and their specifications, such as tank wall thickness, types of valves, etc.; and
- TRAIN II®[9] : a comprehensive listing of railcar movements.

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

The UMLER® file is a database, managed by Railinc Corp. (a subsidiary corporation of the Association of American Railroads), that includes freight railcars in

[8] UMLER®: Universal Machine Language Equipment Register

[9] TRAIN II®: TeleRail Automated Information Network

use in North America as well as locomotives and end of train devices, 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, the types of valves on the top and bottom of the car, etc. UMLER® also tracks whether a tank car is retrofitted to meet the DOT-117R specification.

The TRAIN II® database, also maintained by AAR, tracks the movement 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[10]) carried is tracked for each movement. Thus, any rail tank car that switches from carrying one type of flammable liquid to another is counted twice within the database. For the purposes of this report, the counts are listed as single and multiple flammable liquid services so that each car is counted only once.

Specifically, these databases were used to count the tank cars used in each year from 2013 to 2022 by tank car type as well as type of flammable liquid transported. This data allows for analysis of the changes in the composition of the fleet along with the overall fleet size and what is carried by each car type. This analysis satisfies Section 7308(b) of the FAST Act.

In 2022, the flammable liquid tank car fleet accounted for about 25 percent of all tank cars and included tank cars built to the following specifications (See box B for detailed descriptions):

- DOT-117
- DOT-117R
- Jacketed CPC-1232
- Non-jacketed CPC-1232
- Jacketed DOT-111
- Non-jacketed DOT-111
- Other tank cars[11] including DOT-105, DOT-112, DOT-114, DOT-115, DOT-120, and DOT-211

For the purposes of this analysis, tank cars are placed in 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
- Multiple service tank cars that carry various fluids in a year

The “multiple service” category was added to include those tank cars that carried more than one type of flammable liquids in the same year.

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 in one year, then it is counted under multiple service. This approach 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 cars by the four flammable liquid categories and seven tank car types. Because these counts could comprise of 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 2022, 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, such as:

- demand for each Class 3 flammable liquid, and

[10] 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.

[11] 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.

- North American pipeline capacity for transporting crude oil as an alternative to rail tank cars.

The size of the fleet of tank cars carrying Class 3 flammable liquids 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 phase-out 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 FAST Act phase-out deadlines were scheduled in 2022, and the industry continues to adhere to all phase-out deadlines that have already passed.

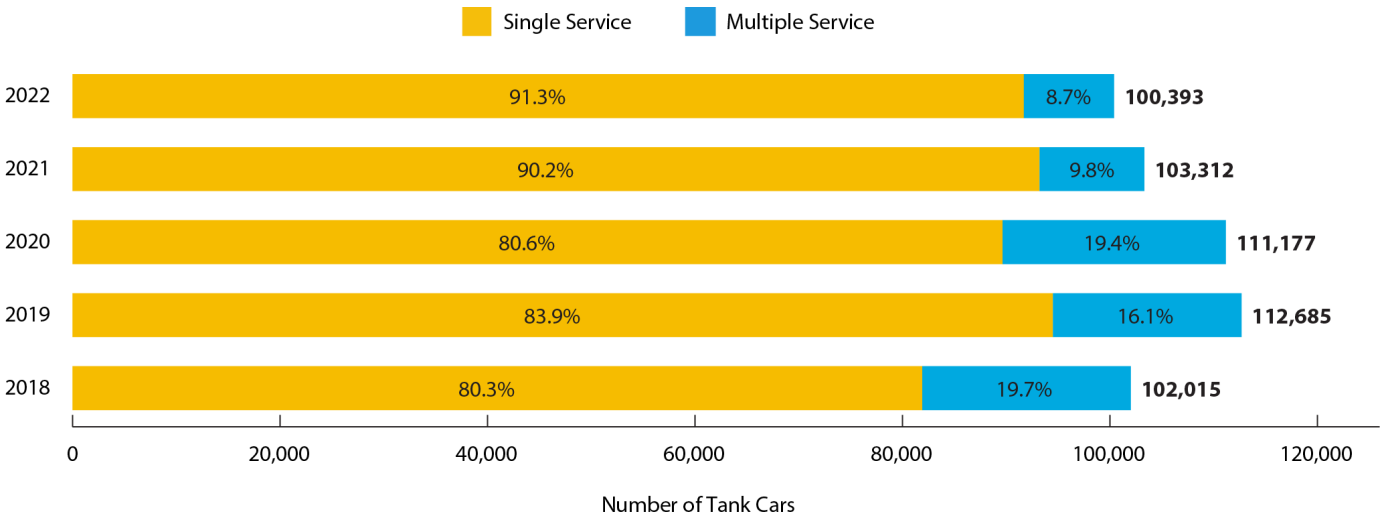
As shown in figure 2, the total fleet of rail tank cars that actively carry Class 3 flammable liquids has fluctuated over the 2018 to 2022 period and findings include the following:

- 100,393 tank cars carried flammable liquids in 2022. This decrease of 2.8 percent since 2021 is the third consecutive decrease in the population of tank cars carrying flammable liquid since 2018.
- The percentages of tank cars carrying multiple fluids was down to 8.7 percent in 2022 compared to 9.8 percent in 2021.
- The number of tank cars carrying multiple fluids in a year decreased to 8,688 in 2022 (figure 3), the lowest number of tank cars carrying multiple fluids in both number of cars and as a percentage of all tank cars carrying hazardous materials since data collection began in 2013.

Over the period from 2018 to 2022, the mix of fluids carried by train also changed, as seen in figure 3:

- The number of tank cars carrying crude oil decreased from 13,585 in 2021 to 10,787 in 2022, a 20.6 percent drop. This is a 65.1 percent decline from the high of 30,929 in 2019.
- While the number of tank cars decreased in all other categories, there was an increase in the number of single service tank cars carrying ethanol in 2022. The number of tank cars carrying ethanol has been relatively steady from 2013 to 2020, with an average of 24,264. In 2022, 38,197 tank cars carried ethanol, an increase of 10.3 percent

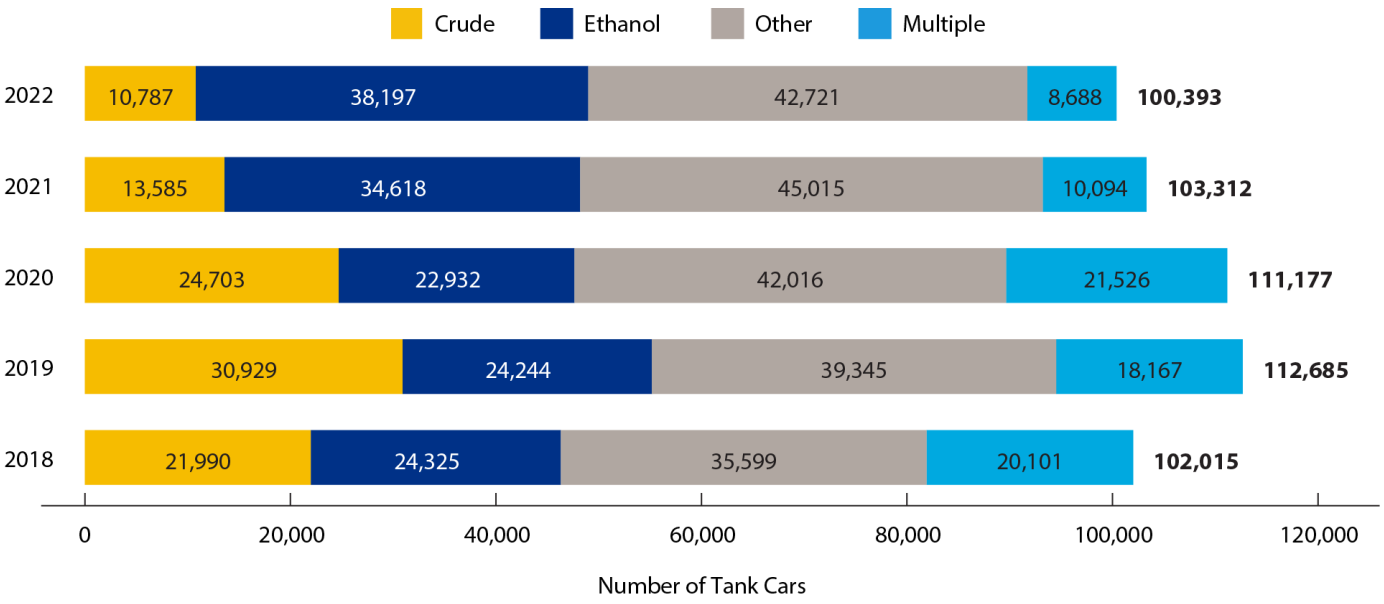
Figure 2 Rail Tank Cars by Percentage of Single and Multiple Flammable Liquid Service: 2018–2022



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, 2013–2022, accessed June, 2023

Figure 3 Rail Tank Cars by Type of Flammable Liquid Carried: 2018–2022



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, 2013–2022, accessed June, 2023

over the number in 2021 and an increase of 66.5 percent over the number in 2020.

- The number of cars in the fleet carrying other Class 3 flammable liquids has dropped by the highest amount since the beginning of this data collection, decreasing 5.1 percent compared to 2021.

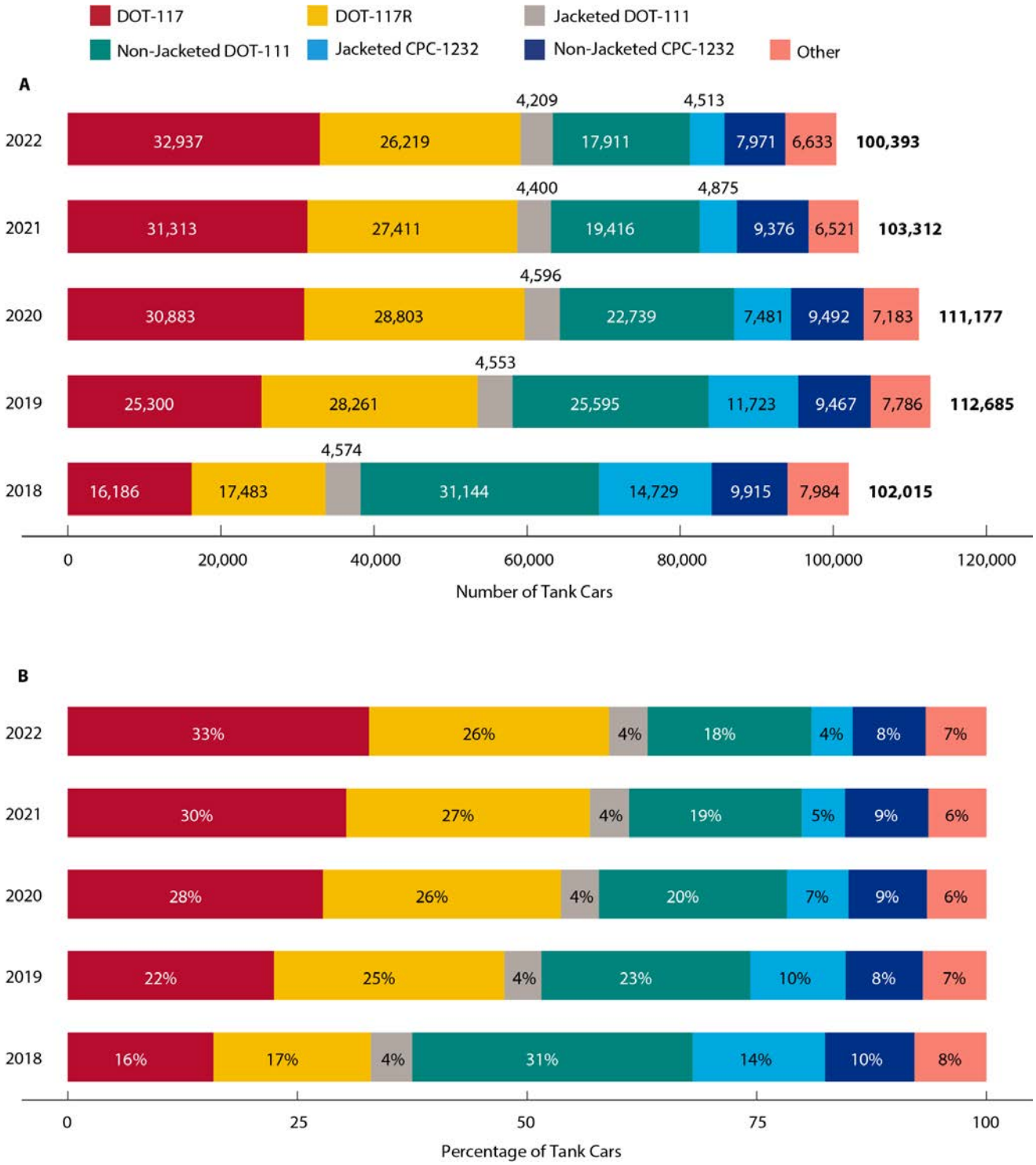
From 2017 to 2022, the composition of the fleet also changed. Figures 4a and 4b show the following:

- The percentage of tank cars meeting the DOT-117 standards continued to rise, from 57 percent in 2021 to 59 percent in 2022.
- The number of DOT-117s, including both DOT-117s and DOT-117Rs, increased from 33,669 in 2018 to 59,156 tank cars in 2022 (figure 4a)—59 percent of the fleet carrying Class 3 flammable liquids in 2022 (figure 4b).
- Jacketed and non-jacketed DOT-111, jacketed and non-jacketed CPC-1232, and other specification rail tank cars[12] declined between 2018 and 2022, from 67 percent of the fleet in 2018 to 41 percent in 2022.

The fleet of rail tank cars carry many shipments throughout the year. A shipment is defined as a carload movement that generates a waybill received from a rail customer, made by a single tank car from an origin to a destination. Any single tank car may carry one or many carloads in any given year. The total number of shipments, along with the mix of liquids needing transport, drives the active fleet size for the year. Demand is based on industry needs for Class 3 flammable liquid movements, primarily the crude oil and ethanol 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 5 shows the number of shipments in each year, 2018 to 2022, by flammable liquid type:

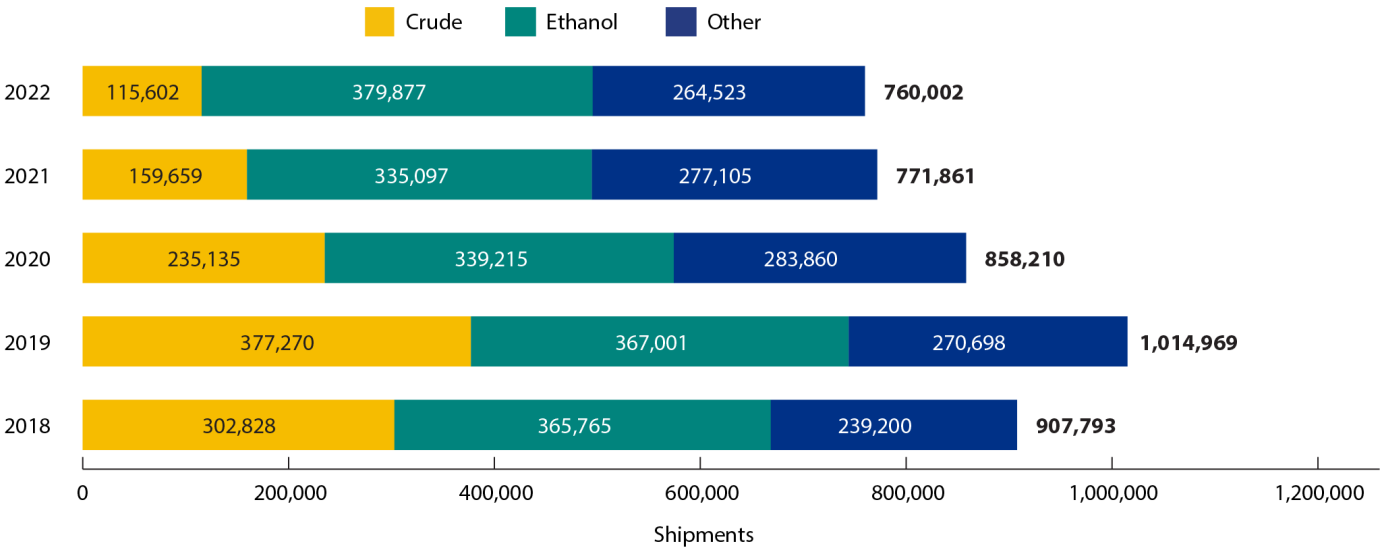
[12] The grouping of Other Rail Tank Cars includes specifications of DOT-105, DOT-112, DOT-114, DOT-115, DOT-120, and DOT-211. Most of the tank cars (90 percent in 2021) in the Other Rail Tank Car category carrying any flammable liquids meet DOT-105, DOT-112, or DOT-120 specifications, which exceed the DOT-117 specification. See Box A

Figure 4 Fleet Composition of Rail Tank Cars Carrying Class 3 Flammable Liquids: 2018–2022



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, 2013–2022, accessed June, 2023

Figure 5 U.S. Shipments of Class 3 Flammable Liquids by Year and Fuel Type: 2018–2022



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, 2013-2022, accessed June, 2023

- Overall shipments in 2022 were relatively stable. There was a 1.5 percent decline in the number of shipments compared to 2021.
- Crude oil shipments continued to decline in 2022, with a 27.6 percent reduction in shipments compared to 2021.
- Ethanol shipments were the highest since this data collection was begun, with 379,877 shipments—an increase of 13.4 percent over 2021 shipments.
- From 2017 to 2021, fluctuations in the volume of shipments are attributable to fluctuations in crude oil demand. The volume of shipments for crude oil varied from a high of 377,270 in 2019 to a low of 115,602 in 2022. The volume of shipments for ethanol and other flammable liquids were notably less variable between 2017 and 2022.

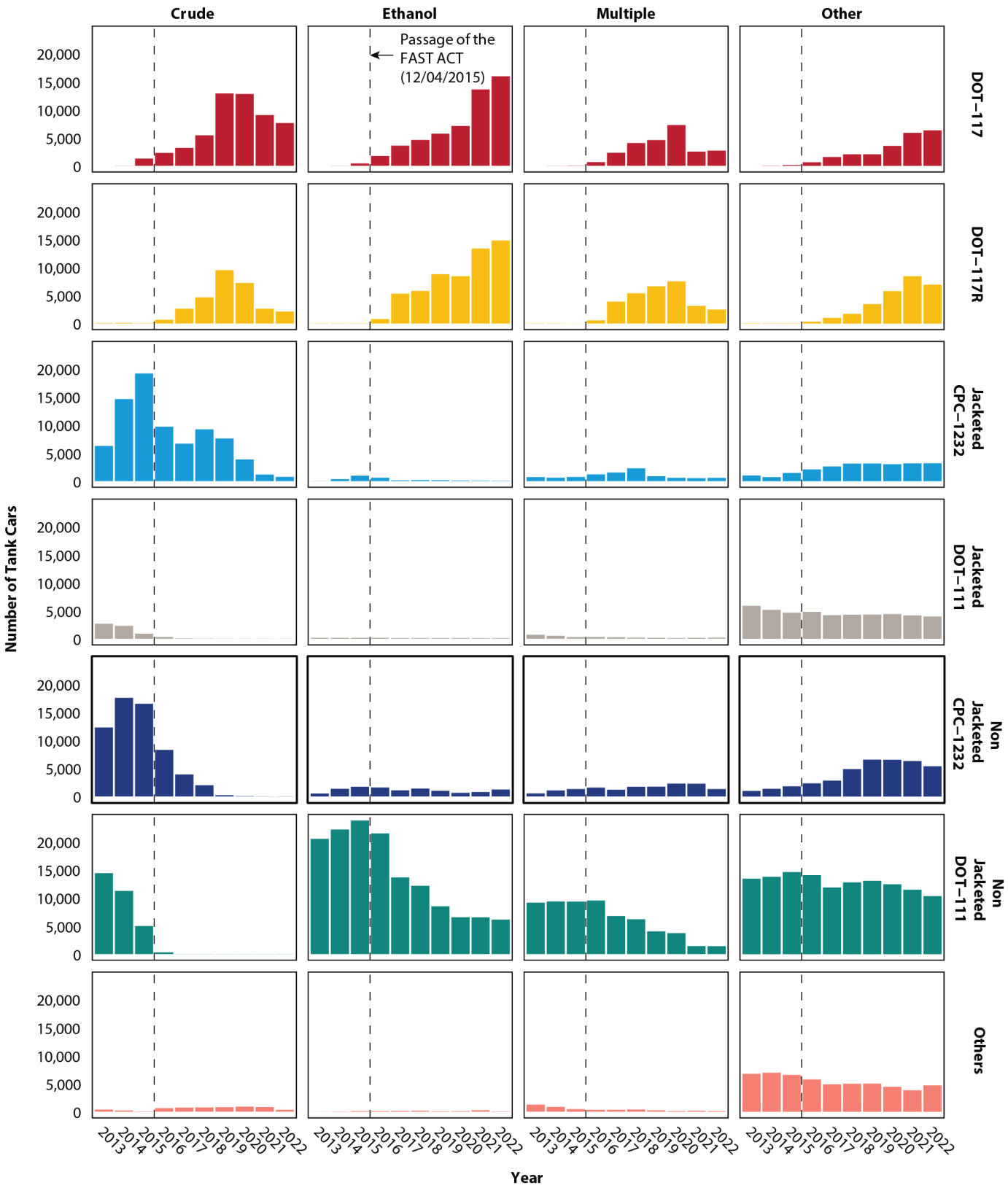
Due to the length of the full FAST Act phase-out schedule, it is useful to look at the types of flammable liquids carried by the various rail car types. The remainder of the report summarizes the specific types of rail tank cars carrying Class 3 flammable liquids between 2017 and 2022. Figure 6 shows a broader historical view of all the data from 2013 to the present report.

DOT-117 Rail Tank Cars

DOT-117 rail tank cars are new or retrofitted existing tank cars that meet the technical and safety specifications finalized in the 2015 federal regulations. All tank cars carrying Class 3 flammable liquids are required to meet or exceed the DOT-117 specification at the end of the phase-out period in 2029. In 2015, there were fewer than 2,000 of these DOT-117s or DOT-117Rs, but by 2022, 59,156 were in use carrying Class 3 flammable liquids, as shown in figure 7. Key findings include the following:

- DOT-117s, including DOT-117Rs, that carry flammable liquids besides crude oil increased 14.8 percent from 2021 to 2022, from 47,099 to 49,348.
- In 2022, there was a 27.6 percent reduction in the volume of crude oil shipments from 2021 (see figure 5) as well as a 16.4 percent reduction in the number of DOT-117 tank cars (both new and retrofitted) carrying crude oil.
- The percentage of new or retrofitted DOT-117 tank cars carrying crude among all DOT-117 tank cars in 2022 fell to 16.4 percent from 19.8 percent in 2021.

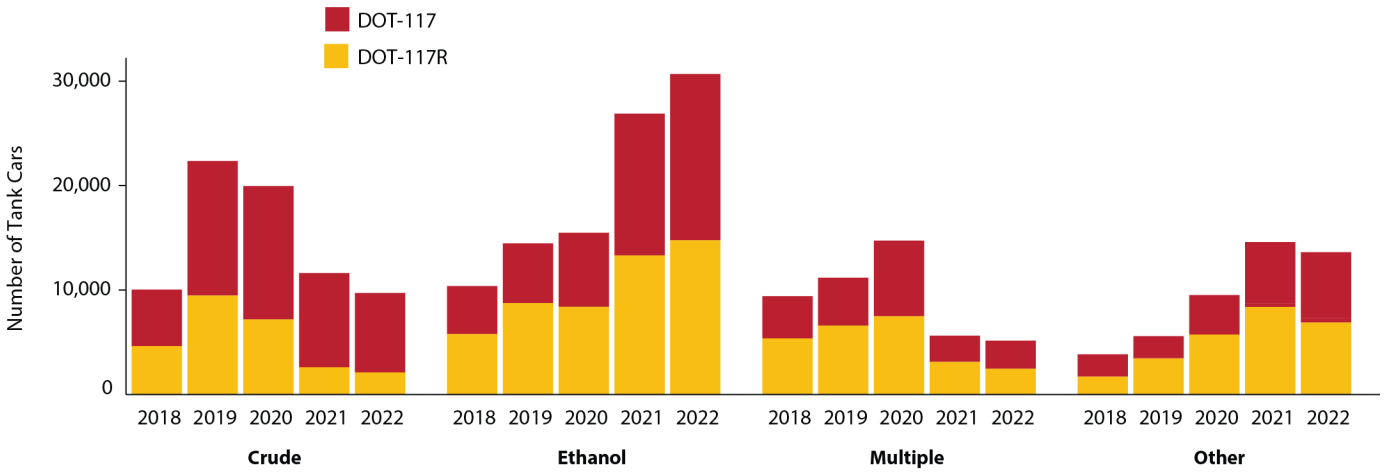
Figure 6 Trends in the Count of Rail Cars by Fuel Type and Type of Car: 2013–2022



NOTE: The dashed line indicates the passage of the FAST act on December 4, 2015

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, 2013–2022, accessed June, 2023

Figure 7 DOT-117 (both new and retrofit) Rail Tank Cars by Liquid Type: 2018–2022



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, 2013–2022, accessed June, 2023

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

The number of CPC-1232 tank cars decreased from 14,251 in 2021 to 12,484 in 2022. Figure 6 details how many jacketed and non-jacketed CPC-1232 rail tank cars were used to transport Class 3 flammable liquids. Key findings include the following:

The phase-out date for jacketed and non-jacketed CPC-1232 cars carrying ethanol is May and July of 2023 respectively. In 2022, 1,259 cars (10 percent of all CPC-1232 cars) carried ethanol.

There was a 36 percent decrease in jacketed and non-jacketed CPC-1232 cars carrying crude oil.

The majority (69 percent) of CPC-1232 cars are carrying flammable liquids other than crude oil and ethanol.

DOT-111 Rail Tank Cars (Jacketed and Non-Jacketed)

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. Figures 4 and 6 show more detail for the jacketed DOT-111 rail tank cars. Key findings include the following:

- The phase-out dates for DOT-111 tank cars carrying crude oil were in 2018. All 22,120 DOT-111 tank cars used to carry flammable liquids in 2022 were transporting a flammable liquid other than crude oil.
- There were 7 percent fewer DOT-111 tank cars, both jacketed and non-jacketed, in use in 2022 compared to 2021.
- The number of non-jacketed DOT-111s carrying other flammable liquids steadily declined between 2013 and 2022, from 19,445 to 14,252 (figure 6).

Other Rail Tank Car Types

Several other tank car types exceed the DOT-117 standard and can carry Class 3 flammable liquids. However, they are notably few, representing just 6 percent of the flammable liquid carrying fleet in 2022. 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

2022, 94 percent of these other rail tank cars were DOT-105, DOT-112, or DOT-120 cars. In 2022, the "other" category comprised 6,633 rail tank cars. As seen in figure 6, the majority of "other" tank cars transport flammable liquids other than crude oil or ethanol (92.6 percent).

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

Data Sources

Section 7308(c) requires USDOT 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 data collection program collects information from tank car retrofitting and manufacturing facilities on planned and projected numbers of tank cars to be retrofitted or manufactured in 2023. 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, is included in the voluntary data collection plan. 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[13] assisted BTS in identifying facilities with the capabilities and certifications to build or retrofit tank cars to the DOT-117 specification. In 2023, 121 tank car shops or facilities were identified for this data collection. The data collected from this annual program is summarized in the next sections.

Responses From Facilities:

Of the 121 shops identified to have the ability to build or retrofit tank cars to the DOT-117 specification, 96 (79 percent) responded. Based on these responses from U.S. owned and/or operated tank car shops, it is expected that 4,349 new rail tank cars will be built in 2023 to meet the DOT-117 specification. Additionally, these shops plan to retrofit 2,565 existing rail tank cars to meet the DOT-117R specification as seen in table 2.

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

Table 2 Rail Tank Car Projections, 2023

Car Type	Projected to be built in 2023
DOT-117	4,349
	Projected to be retrofit in 2023
Former DOT-111 or CPC-1232	2,565

NOTE: Based on the 2023 Annual Tank Car Facility Survey results from 121 facilities.

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 or retrofitted to meet the DOT-117 specification in 2023.

Also of note, the data collected from this data collection program will not match future counts of rail tank car movements in the AAR databases for the following reasons:

- Tank car movements account for all tank cars carrying Class 3 flammable liquids that carried a shipment, regardless of when they were built or retrofitted to meet a different specification.
- Newly built or retrofitted cars may enter 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 are not owned by an American company, are not included in the data collection.
- BTS did not receive responses from 25 tank car shops that have the ability to build new DOT-117 tank cars or retrofit existing cars to the DOT-117R standard. The projections listed here do not include tank cars that may be built or retrofitted by these 25 tank car shops, resulting in an underestimation of DOT-117 and DOT-117R tank cars for 2023.

Summary

In 2022, 100,393 tank cars transported Class 3 flammable liquids—a 2.8 percent reduction from 2021. Shipments of flammable liquids were down 1.5 percent overall, and crude shipments alone were down by 27.6 percent compared to 2021. In

2022, DOT-117s comprised over half of the Class 3 flammable liquid fleet at 59 percent. Among the fleet of rail tank cars that met the DOT-117 specification in 2021, 56 percent (32,937 tank cars) were new, and 44 percent (26,219 tank cars) were retrofitted. In 2022, 71 percent of DOT-117 rail tank cars carried either crude oil or ethanol, and 64 percent of DOT-117R tank cars carried either crude oil or ethanol. Based on responses to the data collection, 96 respondents plan to build or modify 6,914 tank cars during 2023 to meet the DOT-117 or DOT-117R specifications.

In 2022, there was a decrease in rail tank cars likely due to the reduction of crude oil shipments. While the total fleet size has decreased, the proportion of tank cars meeting the DOT-117 or DOT-117R specifications continues to increase. These tank cars comprise an increasingly significant proportion of the fleet transporting Class 3 flammable liquids as the industry strives to meet all phase-out deadlines in the FAST Act by 2029.

Appendix A: Rail Tank Car Movement Data Supporting this Report

DOT-117 New	Fuel Type	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
	Crude	0	11	1,279	2,287	3,176	5,408	12,872	12,773	9,021	7,610
	Ethanol	0	0	408	1,728	3,583	4,590	5,715	7,083	13,577	15,928
	Other Flammable Liquids	0	0	133	671	1,635	2,143	2,142	3,786	6,202	6,719
	Multiple Service Flammable Liquids	0	0	34	647	2,312	4,045	4,571	7,241	2,513	2,680
	Totals	**0**	**11**	**1,854**	**5,333**	**10,706**	**16,186**	**25,300**	**30,883**	**31,313**	**32,937**

DOT-117 Retrofit	Fuel Type	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
	Crude	60	73	24	638	2,612	4,632	9,477	7,186	2,604	2,108
	Ethanol	3	3	3	765	5,301	5,785	8,744	8,400	13,305	14,755
	Other Flammable Liquids	12	14	6	303	992	1,702	3,440	5,730	8,386	6,893
	Multiple Service Flammable Liquids	2	2	0	543	3,875	5,364	6,600	7,487	3,116	2,463
	Totals	**77**	**92**	**33**	**2,249**	**12,780**	**17,483**	**28,261**	**28,803**	**27,411**	**26,219**

Jacketed DOT-111	Fuel Type	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
	Crude	2,667	2,286	898	295	51	29	0	0	0	0
	Ethanol	143	147	152	149	103	102	109	102	94	80
	Other Flammable Liquids	5,870	5,151	4,627	4,785	4,202	4,269	4,295	4,381	4,156	3,958
	Multiple Service Flammable Liquids	700	518	280	305	254	174	149	113	150	171
	Totals	**9,380**	**8,102**	**5,957**	**5,534**	**4,610**	**4,574**	**4,553**	**4,596**	**4,400**	**4,209**

Non-Jacketed DOT-111	Fuel Type	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
	Crude	14,388	11,230	4980	302	5	0	0	0	0	0
	Ethanol	20,494	22,163	23,762	21,477	13,643	12,146	8,480	6,541	6,531	6,122
	Other Flammable Liquids	13,575	13,864	14,697	14,153	11,914	12,813	13,092	12,476	11,478	10,397
	Multiple Service Flammable Liquids	9,141	9,360	9,321	9,516	6,757	6,185	4,023	3,722	1,407	1,392
	Totals	**57,598**	**56,617**	**52,760**	**45,448**	**32,319**	**31,144**	**25,595**	**22,739**	**19,416**	**17,911**

Jacketed CPC-1232	Fuel Type	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
	Crude	6,252	14,589	19,150	9,659	6,658	9,208	7,580	3,832	1,154	738
	Ethanol	0	336	957	586	123	164	142	87	72	49
	Other Flammable Liquids	988	701	1,436	2,063	2,596	3,100	3,128	2,996	3,146	3,159
	Multiple Service Flammable Liquids	689	591	716	1,190	1,515	2,257	873	566	503	567
	Totals	**7,929**	**16,217**	**22,259**	**13,498**	**10,892**	**14,729**	**11,723**	**7,481**	**4,875**	**4,513**

Non-Jacketed CPC-1232	Fuel Type	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
	Crude	12,266	17,534	16,470	8,258	3,899	1,979	208	27	0	0
	Ethanol	507	1,334	1,709	1,570	1,069	1,378	986	626	776	1,210
	Other Flammable Liquids	963	1,361	1,806	2,344	2,834	4,862	6,554	6,559	6,341	5,450
	Multiple Service Flammable Liquids	509	1,044	1,299	1,562	1,170	1,696	1,719	2,280	2,259	1,309
	Totals	**14,245**	**21,273**	**21,284**	**13,734**	**8,972**	**9,915**	**9,467**	**9,492**	**9,376**	**7,971**

Others	Fuel Type	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
	Crude	362	205	46	611	733	734	792	885	806	331
	Ethanol	4	34	112	105	139	160	68	93	263	53
	Other Flammable Liquids	8,383	8,653	8,287	7,499	6,626	6,710	6,694	6,088	5,306	6,143
	Multiple Service Flammable Liquids	1,249	855	453	324	315	380	232	117	146	106
	Totals	**9,998**	**9,747**	**8,898**	**8,539**	**7,813**	**7,984**	**7,786**	**7,183**	**6,521**	**6,633**

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, 2013–2022, as of June 2023.

Appendix B: Annual Tank Car Facility Data Collection Methodology

Data Sources

Section 7308(c) requires USDOT 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 data collection program collects information from tank car retrofitting and manufacturing facilities on planned and projected numbers of tank cars retrofitted to the DOT-117R standard or manufactured to the DOT-117 standard in 2023. Any facility identified with the capacity to build new DOT-117 tank cars or modify existing tank cars to the DOT-117R specification, as described in Section 7308(c) of the FAST Act, was included in the voluntary data collection. 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[14] assisted BTS in identifying facilities with the capabilities and certifications to build or retrofit tank cars to the DOT-117 specification. The AAR 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.

Methodology

The 2023 Annual Tank Car Facility Data Collection, conducted from May to August 2023, 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 DOT-117 specification. In total, 121 tank car shops were identified and asked to respond to this voluntary questionnaire.

Tank car shops were contacted by U.S. mail. Follow up calls and emails were made to non-respondents. Respondents were asked to provide the number of DOT-117 tank cars they expect to build in 2023 as well as the number of tank cars to be retrofit to the DOT-117R specification from a previous rail tank car specification type (e.g., DOT-111).[15] For more information on the specifications, see box B. As in the past, all information is collected with the assurance of confidentiality of the reported information. The information collected from this program 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 program will not match future counts of rail tank car movements in the AAR databases. Tank car movements account for all tank cars that carried a Class 3 flammable liquid shipment, regardless of when they were built or retrofitted to meet a different specification. Newly built or retrofitted cars may enter 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 data collection.

Responses to this voluntary data collection were obtained from 96 out of 121 identified facilities, or 79 percent. Due to no response from 25 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 non-responses in this data collection 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 data collection are varied in their capabilities as well as their industry reach geographically, across different modes of transport, and through supply chain control. Some shops are part of larger corporations and others are standalone entities. Of the 121 facilities BTS surveyed, 79 percent of the respondents are part of corporations with two or more railcar shops. Of the 96 shops that are part of corporations with two or more locations, 83 percent reported. Of the 25 shops that are part of corporations with no more than one railcar locations,

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

[15] 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.

36 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.