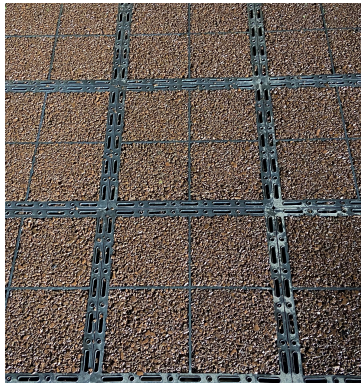


California Waste Tire Market Report: 2020

Contractor's Report Produced Under Contract
By Boisson Consulting

September 3, 2021



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Acknowledgments

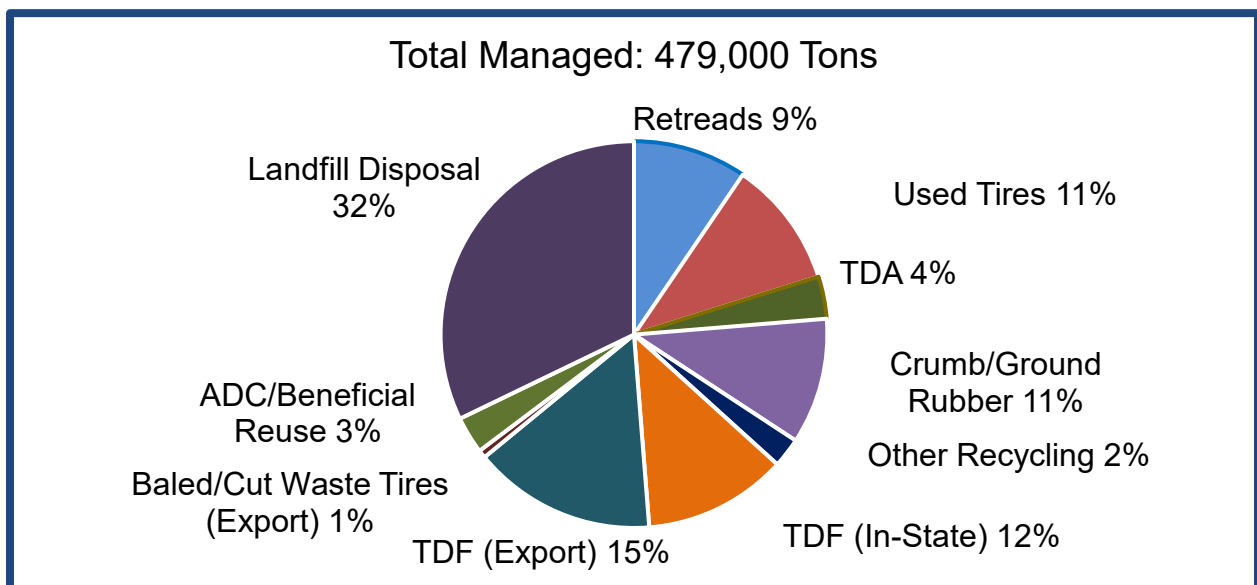
This report was prepared by Boisson Consulting in partnership with subcontractors DK Enterprises and RWR Strategies. We sincerely thank the many industry stakeholders who contributed their information, data, and insights as well as CalRecycle staff who coordinated access to department databases and clarified program policies and trends.

Executive Summary

This report describes California waste tire flows in 2020 and current trends as of Spring 2021, based on industry surveys, interviews, CalRecycle databases, and other sources. California’s well-developed waste tire management infrastructure serves the entire state. Most tire businesses were directly impacted by the COVID-19 pandemic with some suspending operations for a time. The statewide stay-at-home order issued in March 2020 triggered an abrupt drop in waste tire flows along with uncertainty and concern about future pandemic impacts. But as federal, state and local agency policies were circulated within weeks most waste tire management firms learned that, as essential businesses, they could continue operating. By the end of 2020, waste tire generation had rebounded, and company daily operations had settled into a new normal, with new personal protective equipment and social distancing protocols in place. Through Spring 2021, however, the pandemic-related impacts on employee retention, trucking, ocean shipping, and certain supply chains continued.

In 2020, an estimated 479,000 tons (47.9 million PTEs*) of California-generated waste tires were managed, eight percent less than in 2019. California waste tires flowed to nine different market segments as shown in Figure 1.

Figure 1
California Waste Tire Flows in 2020



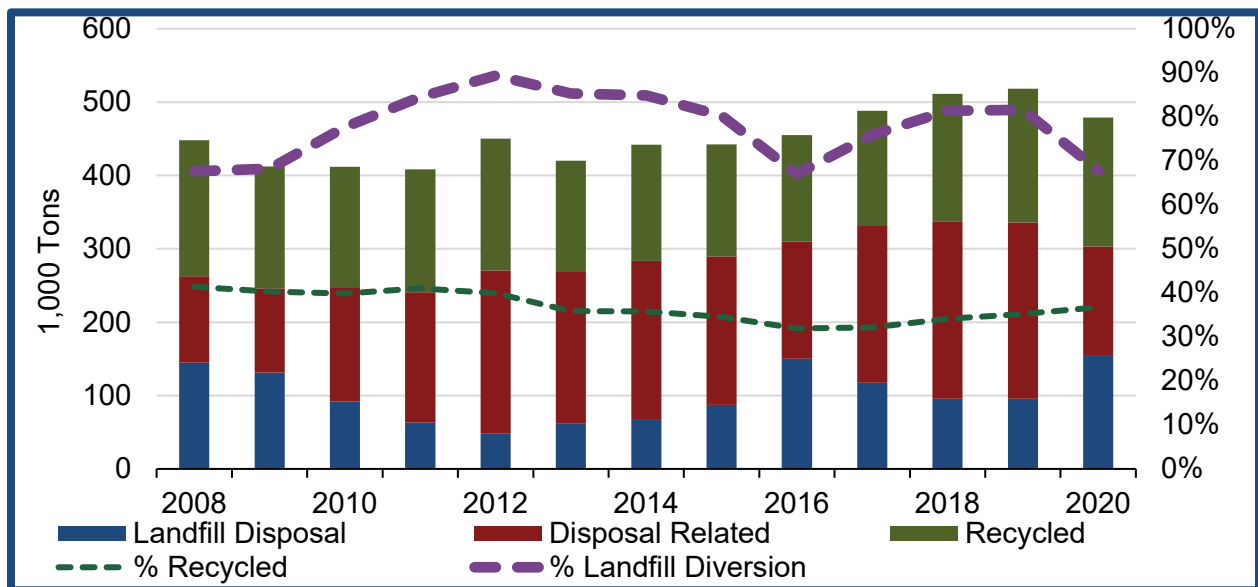
* PTE means Passenger Tire Equivalent, defined by CalRecycle (14 CCR § 17225.770) as 20 pounds. The PTE is a useful standardized reporting metric; but actual tire weights vary significantly by type, and passenger tires typically weigh more than 20 pounds.

See source data for Figure 1 in Appendix C.

This report uses a new reporting convention for crumb rubber and ground rubber that also impacts certain other categories. Previously in this report series the amount of waste tires in-bound to facilities that were used to produce crumb rubber and ground rubber was reported. In this report and going forward, crumb rubber and ground rubber flows will now be reported as the amount shipped outbound by production facilities, with residual byproducts (i.e., wire and fiber) reported within other categories depending on how they are managed. This refined approach provides a more detailed and complete accounting of waste tire flows and is consistent with CalRecycle's goal to create a circular economy within California. In this report, the authors have adjusted all prior annual findings accordingly. The net effect of this change is to reduce crumb rubber and ground rubber flows, increase "other recycling" flows (due to recycled residual wire), increase in-state TDF (due to a portion of fiber/fluff being used as fuel at a California cement kiln), and to increase disposal (due to a portion of residual materials that is disposed). For these reasons, compared to the reporting convention used in previous waste tire market reports, the revised approach used in this, and future reports will have somewhat lower recycling and diversion rates and somewhat higher disposal.

CalRecycle has informally adopted a 75 percent waste tire recycling goal, consistent with a statewide 75 percent recycling goal covering all waste materials mandated by AB 341 (Chesbro, Chapter 476, Statutes of 2011). As Figure 12 shows, the California waste tire recycling rate slowly increased in recent years, reaching 37 percent in 2020. The 2020 recycling rate increase was a result of an eight percent drop in the total amount of waste tires managed, as recycling tons fell from 182,400 tons (18.2 million PTEs) in 2019 to 175,900 tons (17.6 million PTEs) in 2020. Consistent with AB 341 and the reporting conventions used in CalRecycle's "State of Recycling" reports, recycling is defined here to include retreading and reuse, but excludes landfill alternative daily cover (ADC) and tire-derived fuel (TDF), which are considered "disposal related" activities. Driven by large drops in exported and in-state TDF shipments, 2020 disposal increased markedly to a 20-year high of 154,000 tons (15.4 million PTEs), 32 percent of all waste tires generated that year.

Figure 2
California Waste Tire Recycling, Disposal Related and Landfill Disposal Trends, 2008-2020¹



See source data for Figure 2 in Appendix C.

California state policies and programs provide support for waste tire recycling markets. Caltrans has used an average of 52.5 million pounds of crumb rubber in rubber asphalt applications since 2009. (A portion of this rubber may have come from out-of-state suppliers.) Average annual performance statistics calculated in this report show the significant support provided by CalRecycle’s grant programs for use of tire-derived materials (TDM) in different applications, including:

- The Rubberized Pavement Grant Program: 8.7 million pounds per year at an average grant expense of 45 cents per pound
- The Tire-Derived Product (TDP) Grant Program: 2.9 million pounds per year at an average grant expense of 29-31 cents per pound
- The Tire Incentive Program: 10.9 million pounds at an average grant expense of 11 cents per pound
- The Tire-Derived Aggregate (TDA) Grant Program: 10 million pounds per year at an average grant expense of two cents per pound.

Section Five of this report provides important details and assumptions regarding these findings. Additional state funding, research, testing, and technical assistance services as described in CalRecycle’s latest draft [Five Year Tire Plan](#), dated July 1, 2021, support these programs, and further help to expand markets.

In 2021, recycled tonnages may rise due to potential growth in retreading, paving, and the molded/other products segments. Depending on whether the total amount of waste

tires managed increases at a higher rate, this may result in a somewhat higher recycling rate in 2021. Disposal related uses (including TDF and ADC consistent with the AB 341 framework used for all waste materials in California) are expected to decline further due to lower in-state and export TDF shipments, which would likely lead to a rise in disposed tons. In the long run, significantly boosting recycling levels will require increased demand in stable and profitable recycling markets. Among existing markets, the paving, molded/other and civil engineering segments hold potential for high volume growth. Devulcanization markets could also hold potential, although the feasibility and market opportunity have yet to be demonstrated in California.

These opportunities must overcome a variety of constraints that vary by market segment, but include the need to:

- Drive increased demand
- Increase awareness of TDM and TDP performance characteristics
- Conduct testing
- Support the conversion of established manufacturing processes to TDM use

While progress has been made on these fronts, it has come slowly. Future diversification and expansion of California tire recycling is likely to remain incremental and not transformational.

1. Introduction

The Department of Resources Recycling and Recovery (CalRecycle) oversees management of waste and used tires in California as authorized by Senate Bill 876 (Escutia, Statutes of 2000, Chapter 838).[†] CalRecycle's long-term, informal goal is to achieve a 75 percent waste tire recycling rate consistent with requirements of AB 341 (Chesbro, Chapter 476, Statutes of 2011) that established a 75 percent statewide recycling rate goal for all materials by 2020.

This report estimates the 2020 California tire recycling rate and describes trends in the flow of California-generated waste tire and TDM to different market segments. This report also presents historical findings from prior reports going back to 2008. Boisson Consulting prepared the report in partnership with industry specialist DK Enterprises with research support from RWR Strategies. Boisson Consulting based findings in this report on detailed analysis of data and information provided by California waste tire management companies, CalRecycle staff and databases, and other sources.

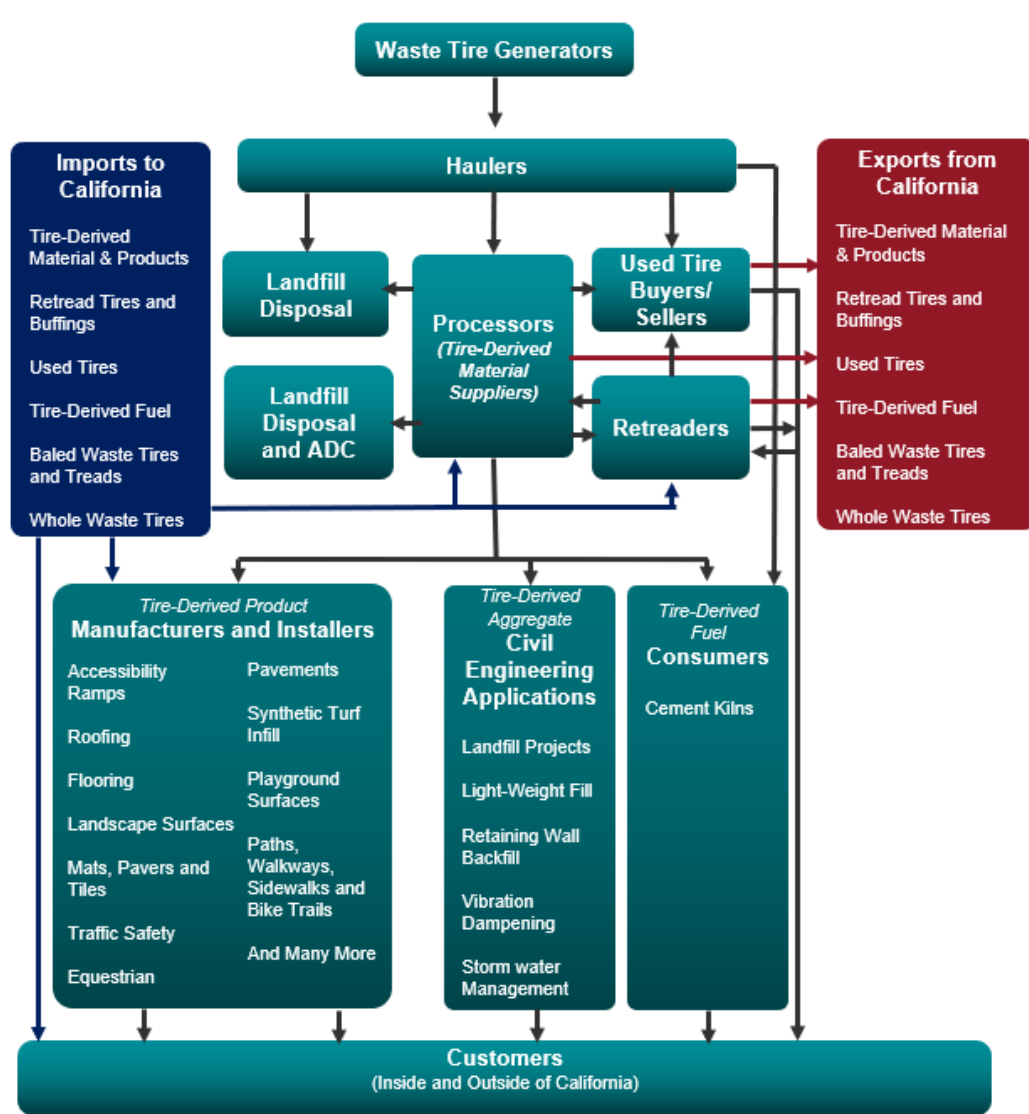
Following this introduction, Section 2 summarizes California waste tire management infrastructure. Section 3 summarizes some broad trends influencing waste tire market trends. Section 4 provides detailed findings by market segment. Section 5 describes key California state policies and programs supporting waste tire recycling markets. Section 6 provides some closing remarks on the outlook for waste tire recycling. Appendix A is a glossary of key terms and acronyms. Appendix B covers the report methodology, including some key changes in reporting conventions made in this year's report that triggered slight adjustments to some historic findings. Appendix C provides notes and source data for graphs and charts to make this report fully accessible to readers of all abilities in compliance with the American Disabilities Act, Government Code Sections 11546.7, 7405, and 11135, and Web Content Accessibility Guidelines 2.0. Information sources are provided in end notes at the very end of the report.

[†] Unlike some tire recycling studies, this report covers waste tires, used tires and retread tires. See definitions and regulatory references in Appendix A.

2. California Waste Tire Management Infrastructure

Figure 3 illustrates flows of California-generated waste tires and TDM. Table 1 lists the number of different types of facilities and companies serving the market. Waste tire collection and processing companies serve all areas of the state. CalRecycle’s [California Tire-Derived Product Catalog](#) provides detailed product information, maps, and directories with company contacts.

Figure 3
California Waste Tire Recycling Industry Flow Chart



See detailed description of Figure 3 in Appendix C.

Table 1**California Waste Tire Management Active Facilities Identified in 2020**

Category	Counts
Registered Waste Tire Haulers	> 13,000
Registered Waste Tire Generators	> 23,000
Number of 2020 Waste Tire Shipments (Each Documented with a Comprehensive Trip Log in CalRecycle's Waste Tire Manifest System)	> 539,000
Retreaders	40
Facilities with a Major Waste Tire Facility Permit (Specified onsite maximums range from 10,000 to 336,300 PTEs)	15
Facilities with a Minor Waste Tire Facility Permit (Allowing up to 4,999 PTEs onsite)	20
Processors Reporting Crumb Rubber or Ground Rubber Shipments	6
Processors Reporting TDA Shipments	3
Processors Reporting In-State TDF Shipments (Includes size-reduced TDF, whole tire TDF and residual fluff from crumb rubber production)	6
Processors Reporting Exported TDF (e.g., chips, shreds) and/or Baled and Cut Waste Tire Tread Shipments	5
Tire-Derived Product Manufacturers Listed in the California TDP Catalog	16
Tire-Derived Product Installers Listed in the California TDP Catalog	9
Companies that Own and Operate Rubber Asphalt Blender Units	13
California Cement Kilns Consuming TDF	4
Landfills Disposing Size-reduced Waste Tire Material On-Site (Two additional landfills in Nevada received California waste tires in 2020)	16

3. Broad Trends Influencing Markets

Following are some key trends that influenced California waste tire markets in 2020 and early 2021.

- **The Evolving COVID 19 Pandemic**
In early spring 2020, the world was shocked to learn of the emerging COVID-19 pandemic. As of late May 2021, California had seen 3.7 million COVID-19 infections and over 61,000 deaths. After a summer peak of over 11,000 new infections per day and a winter peak of over 60,000 new infections per day, as of Spring 2021 the state's rate of new infections was steadily declining as vaccination rates increased. However, concern over new virus variants and potential new spikes remains, and there is uncertainty over the future course of the pandemic and related impacts.
- **Initial State Shut Down Order Gives Way to Economic Growth**
On March 19, 2020, Governor Gavin Newsom issued a stay-at-home order to protect the health and well-being of all Californians to slow the spread of COVID-19. The order immediately halted a broad swath of non-essential economic activity and triggered widespread concern and uncertainty amid an immediate decline in economic activity. However, the trend shifted in spring 2021. According to one prominent group of economists, "A waning pandemic combined with fiscal relief means a strong year of growth in 2021—one of the strongest years of growth in the last 60 years—followed by sustained higher growth rates in 2022 and 2023."²
- **After an Initial Decline, California Waste Tire Management Companies Rebound as Essential Businesses Operate in the "New Normal"**
Shortly after the state's stay-at-home order was issued, waste tire flows dropped abruptly by as much as 40 percent. But as federal, state and local agency policies were circulated within weeks most waste tire management firms learned that, as essential businesses, they could continue operating, subject to new health and safety protocols such as mask wearing, social distancing, and provision of personal protective equipment. Many companies described adapting to "new normal" operations as waste tire volumes slowly and steadily rebounded, returning to previous levels by year's end in many cases. However, most companies reported some infections among staff and/or management. In some cases, this caused temporary shutdowns, with at least one facility permanently closing because of COVID-19 concerns. Over the course of the year most waste tire processing operations stabilized and consumer activity rebounded, resulting in 2020 waste tire volumes that were down by an estimated eight percent from 2019.
- **Government Support and Strong Infrastructure Funding**

From March 2020 through March 2021, several rounds of federal COVID-19 relief and stimulus injected over \$4 billion into the economy, including relief to unemployed individuals and small businesses.³ In addition, a variety of state programs are providing further support.⁴ Many California waste tire management companies received some level of support through these programs. Separately, in spring 2020, there was concern that new state and local transportation funding mechanisms based on a gas tax and bridge tools would decline significantly. However, the asphalt industry expects strong funding to be available in 2021.⁵

- **Continuing COVID-19 Related Disruptions in 2021**

- **Hiring and Employee Retention.** This was the most-cited concern among survey respondents. Many companies reported difficulty hiring and maintaining qualified, experienced employees due initially to health concerns but in 2021 due to attractive, supplementary unemployment payments and the rise in employment listings. This is a particular concern regarding drivers.
- **Shipping.** Many companies also cited increased shipping costs and the difficulty and unpredictability of booking shipments, especially East-West bound shipments, including trucking, rail, and especially at ports where drivers have often had to wait many hours to deliver their loads.
- **Export/Import.** By all accounts, international shipping was severely disrupted by COVID-19 and impacts only intensified in early 2021. Exporters of TDF from California ports report high unpredictability, challenges in securing containers, and successfully booking and executing shipments. Most critically, costs skyrocketed in 2020 and early 2021 to the point where some exporters said it was not economical to continue exports of size reduced TDF and baled waste tires.
- **Supply Chain.** The above disruptions were cited as causing a variety of shortages, including some key supplies needed by some waste tire management and recycling companies. Examples cited include urethane binder used in molded TDPs, lumber, and other materials used in construction, which can slow down projects specifying TDPs like roofing and flooring.

4. Trends by Market Segment

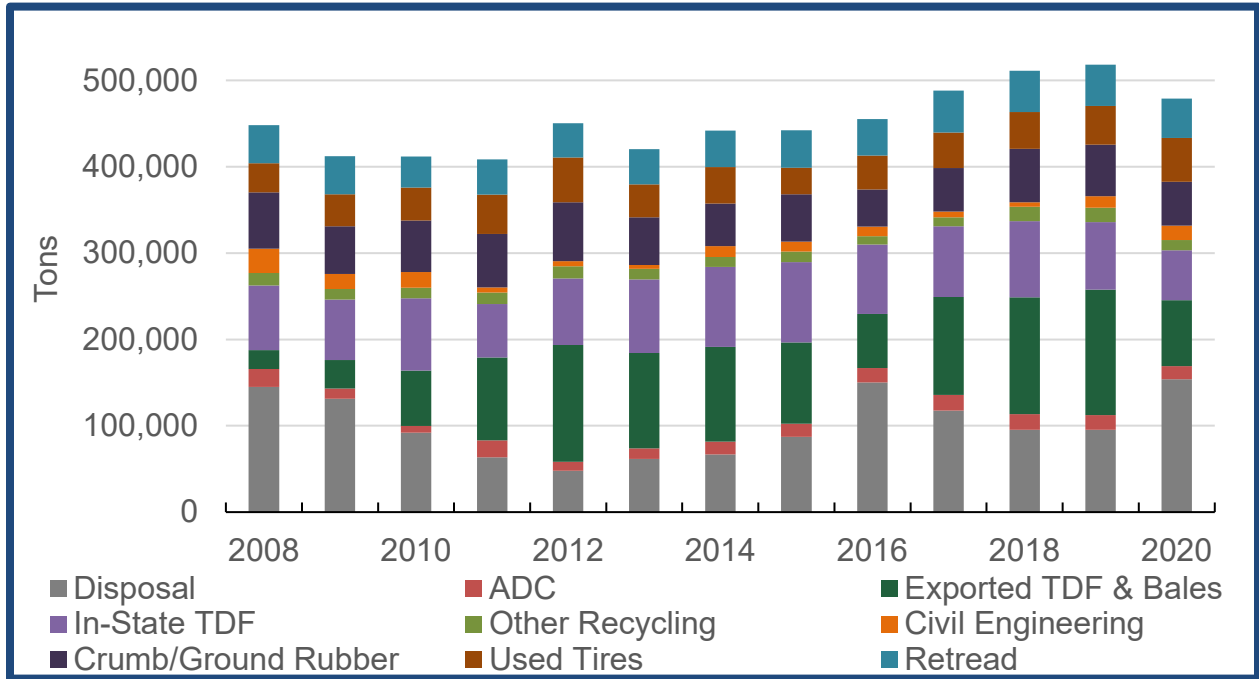
4.1 Historic Trends

Figure 4 shows the long-term trend in uses of California-generated waste tires and TDM, and Table 2 (on the next page) provides additional detail for the past three years. These findings are based solely on California-generated waste tires and exclude imports. Likewise, the flow estimates exclude buffings from retreader operations.

This report uses a new reporting convention for crumb rubber and ground rubber that also impacts certain other categories. The reporting convention previously used for the crumb rubber and ground rubber market segment in this report series was to report the amount of waste tires inbound to supplier facilities that were used to produce crumb rubber and ground rubber. In this report, and subsequent future reports, crumb rubber and ground rubber flows will now be reported as the amount shipped out from supplier facilities, with residual byproducts (i.e., wire and fiber) reported within other categories depending on how they are managed. This refined approach provides a more detailed and complete accounting of waste tire flows and is consistent with CalRecycle's goal to create a circular economy within California. In this report, the authors have adjusted all prior annual findings accordingly. The net effect of this change is to reduce crumb rubber and ground rubber flows, increase "other recycling" flows (due to recycled residual wire), increase in-state TDF (due to a portion of fiber/fluff being used as fuel at a California cement kiln), and to increase disposal (due to a portion of residual materials that is disposed). For these reasons, compared to the reporting convention used in previous waste tire market reports, the revised approach used in this, and future reports will have somewhat lower recycling and diversion rates and somewhat higher disposal.

The report methodology, including these changes, is described in more detail in Appendix B. The remainder of Section 4 describes trends in each market segment.

Figure 4
Historical Market Trends by Segment, 2008-2020⁶



See Figure 4 source data in Appendix C.

Table 2**Estimated End-Uses for California-Generated Waste Tires, 2018 - 2020⁷**

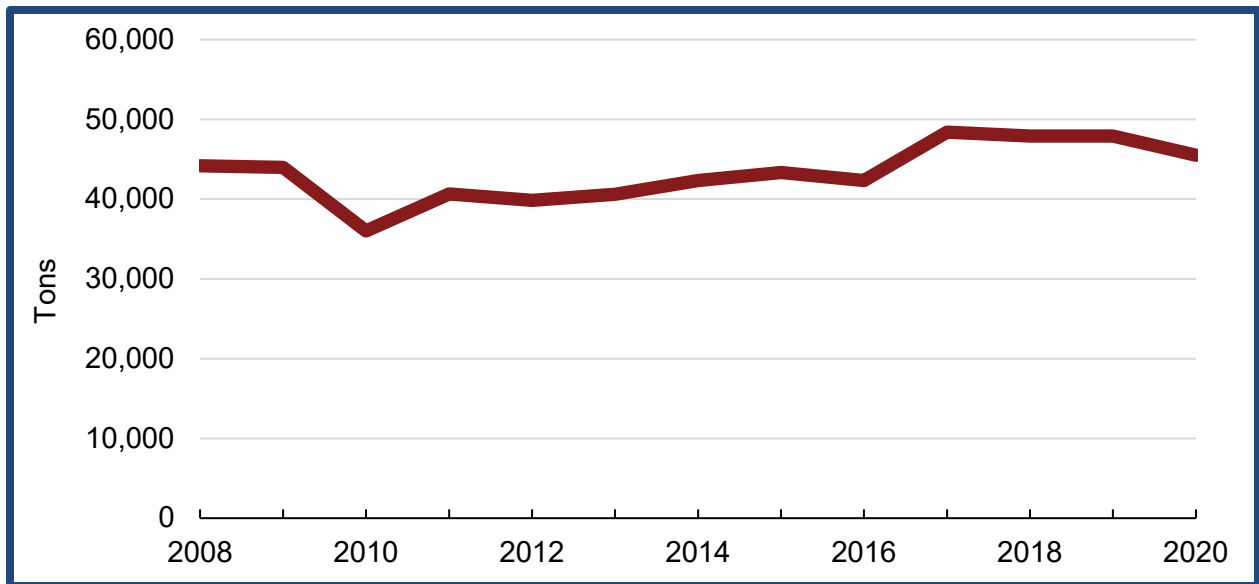
Category	2018 Tons	2018 M PTEs	2018 %Total	2019 Tons	2019 M PTEs	2019 %Total	2020 Tons	2020 M PTEs	2020 %Total	% Change 2019 - 2020
Retreads	47,900	4.8	9.4%	47,900	4.8	9.2%	45,500	4.6	9.5%	-5%
Used Tires	42,700	4.3	8.4%	44,800	4.5	8.6%	51,000	5.1	10.7%	14%
Crumb Rubber and Ground Rubber	61,700	6.2	12.1%	60,000	5.7	11.6%	50,500	5.1	10.5%	-16%
Tire-Derived Aggregate	5,100	0.5	1.0%	13,300	1.3	2.6%	16,900	1.7	3.5%	27%
Other Recycling	16,800	1.6	3.3%	16,400	1.6	3.2%	11,900	1.2	2.5%	-28%
Sub-Total, Recycled	174,300	18.7	34.1%	182,400	18.0	35.2%	175,900	17.6	36.7%	-4%
Tire-Derived Fuel (In- State)	88,400	9.1	17.3%	78,300	8.0	15.1%	57,600	5.8	12.0%	-26%
Tire-Derived Fuel (Export)	99,200	9.9	19.4%	114,400	11.4	22.1%	73,400	7.3	15.3%	-36%
Baled and Cut Waste Tires (Export)	36,000	3.6	7.0%	31,000	3.1	6.0%	3,200	0.3	0.7%	-90%
Landfill Alternative Daily Cover/ Beneficial Reuse	18,000	1.8	3.5%	16,800	1.7	3.2%	14,900	1.5	3.1%	-11%
Sub-Total, Disposal Related	241,600	33.4	47.3%	240,500	33.5	46.4%	149,100	14.9	31.1%	-38%
Landfill Disposal	95,400	9.1	18.7%	95,400	9.3	18.4%	154,000	15.4	32.2%	61%
Total Managed	511,300	50.7	100.0%	518,400	51.5	100.0%	479,000	47.9	100.0%	-8%
Whole Waste Tire Imports	26,900	2.7	5.3%	5,700	0.6	1.1%	26,800	2.7	5.6%	371%

4.2 Retreading

Figure 5 shows consistently strong estimated California retread volumes, even as rising demand for imported, low-cost, low-tier truck tires competing with California retreads has gradually eroded market share over many years. In 2020, COVID-19 related disruptions had mixed impacts. Based on interviews with California and national industry representatives, retreading declined overall by about five percent in 2020. In California, this decline represented 45,500 tons (4.6 million PTEs, or 9.5 percent of all waste tires managed). However, while some retreaders experienced significantly lower demand, some retreaders serving certain market niches saw higher volume sales (e.g., UPS trucks or school busses).

Retreaders are generally optimistic about strong growth in 2021. A strengthening economy means more trucking, notwithstanding a continuing shortage of drivers. The imposition of federal tariffs and duties is increasing the cost of imported new tires, which in turn is reducing demand for them. Many retreaders reportedly have high inventories and are well positioned for surging demand as high import/export costs and logistical challenges further reduce the availability of imported new tires. In 2021–2022, CalRecycle’s Retread Tire Services Contractor will conduct education and training to public agencies and commercial trucking fleets on using retread truck, bus, heavy equipment, and off-road tires and will evaluate the growth potential for certain market segments.

Figure 5
Estimated California-Generated Retread Tire Shipments, 2008–2020

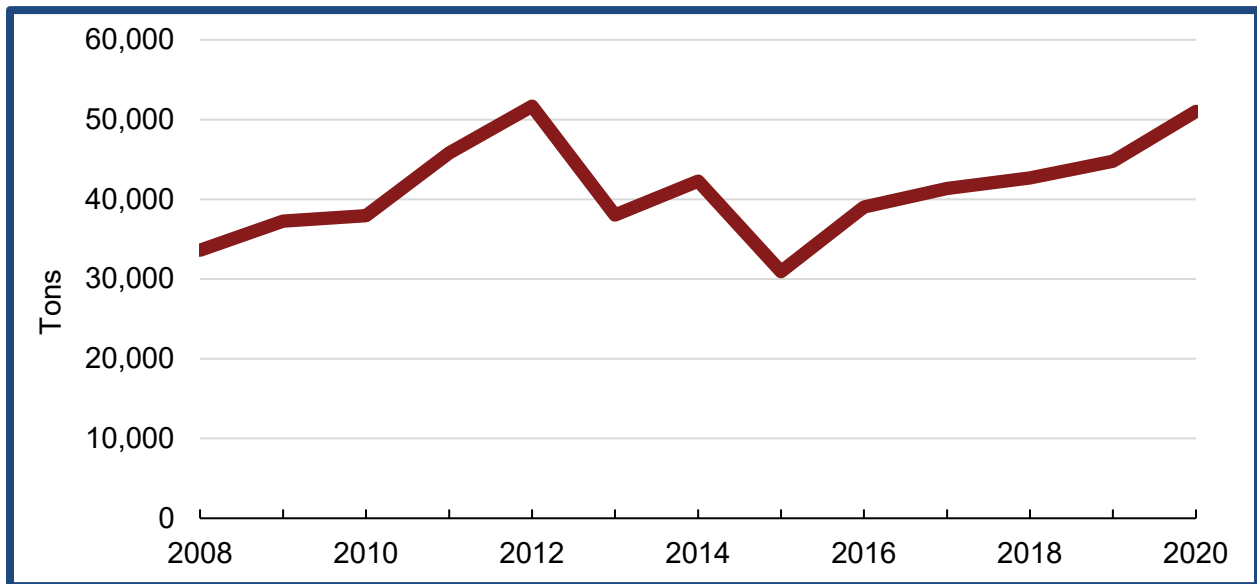


See Figure 5 Source Data in Appendix C.

4.3 Used Tires

As illustrated in Figure 6, estimated shipments of California-generated used tires increased by 14 percent in 2020 compared to 2019. An estimated 51,000 tons of used tires (5.1 million PTEs) were culled from California waste tires flows and sold for reuse in 2020 (11 percent of all waste tires managed). At least 13 percent of these used tires were exported, as indicated in survey responses, primarily but not exclusively to Mexico. Processors reported very strong demand and pricing for used tires and this historically strong segment is expected to continue at a particularly high level in 2021.

Figure 6
California-Generated Used Tire Shipments, 2008-2020



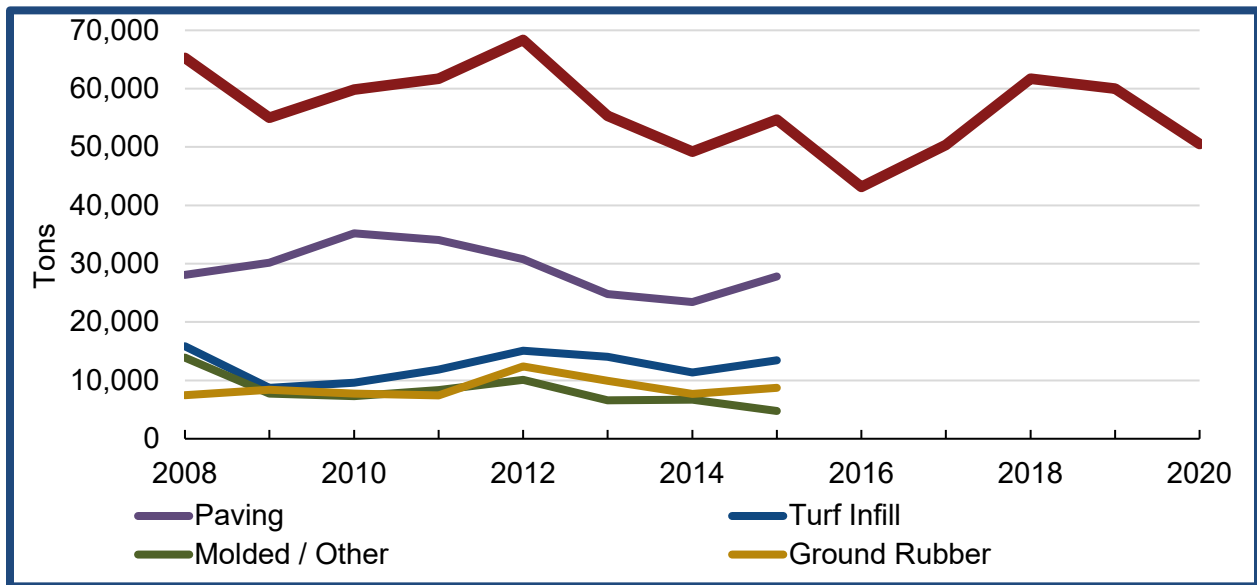
See Figure 6 Source Data in Appendix C.

4.4 Crumb Rubber and Ground Rubber

As illustrated in Figure 7 estimated shipments of California-generated crumb rubber (i.e., TDM equal to or less than ¼ inch in size) and ground rubber (i.e., TDM greater than ¼ inch up to 1 inch in size) declined by sixteen percent in 2020 compared to 2019, to 50,500 tons[‡] (5.1 million PTEs). This is 10.5 percent of all waste tires managed in California.

[‡] This report institutes a new reporting convention for crumb rubber and ground rubber that affects some other market segments. See Section 4.1 and Appendix B for details.

Figure 7
Shipments of California-Generated Crumb Rubber and Ground Rubber, 2008–2020⁸



See Figure 7 Source Data in Appendix C.

Below we describe trends in the flow of crumb rubber and ground rubber to different market segments. While flows of tire-derived materials are generally quantified in tons in this report, we refer to pounds below when discussing specific market segments, as is common in the industry.

- Paving.** California producers shipped 60-70 million pounds of crumb rubber for use in asphalt paving. The stay-at-home orders accelerated some paving projects due to lower traffic levels, but overall paving levels were reportedly down about five percent with some stakeholders saying new state roadwork funding was trickling in at a slow pace as Caltrans worked to prepare bid documents for fewer, but larger and more complex projects. With state and local transportation funding mechanisms generating strong revenues, and the prospect of additional federal and state infrastructure spending, many respondents were optimistic that paving levels would be strong for the next few years, with sustained use of rubber asphalt by local and state agencies at least at the level of recent years. Section 5 details trends in policies driving Caltrans' use of crumb rubber in state projects, and CalRecycle grant funding helping to drive rubber asphalt use by local government agencies.
- Turf Infill.** California producers shipped 8–12 million pounds of crumb rubber for use as infill in new and replacement synthetic turf athletic fields in 2020, about 20 percent less than in 2019. Construction of new and replacement synthetic turf athletic fields was reportedly on pace with 2019. However, while use of crumb

rubber infill nationally is reportedly well over 90 percent, in California it is far less due to public concerns about crumb rubber use, especially in Northern California. A CalRecycle-sponsored study on the safety of using crumb rubber is being prepared by the California Department of Environmental Health Hazard Assessment (OEHHA) has been underway since June 2015.⁹ Moreover, some synthetic turf builders reuse all or a portion of end-of-life (EOL) infill generated during the replacement of fields. This reduces to a degree the demand for new crumb rubber in these projects. EOL turf infill is often disposed or is sometimes shipped to horse arenas for use as footing material. After removal, synthetic turf grass is often rolled and stockpiled for potential resale. Reportedly, in some cases these rolls may contain some crumb rubber infill. EOL turf infill can also be used in the base layer under the turf system, but Boisson Consulting found no examples of this use in California. The pace of projects is reportedly quickening in 2021 and many expect crumb rubber shipments to increase, although some said that a slowdown in design and pre-bid project development due to COVID-19 could result in a slowdown in 2022.

- **Molded and Other Products.** California producers shipped 20–25 million pounds of crumb rubber to molded and other product manufacturers/installers in 2020, about 30 percent less than in 2019. Contributing to the decrease is that use of crumb rubber in this market segment was particularly high in 2019. In addition, some manufacturers may have accumulated relatively large inventories of crumb rubber feedstock prior to experiencing disruption during the COVID-19 pandemic. Based on survey responses this segment is expected to rebound in 2021 with increased crumb rubber use that could exceed the high level in 2019. CalRecycle’s Tire Incentive Program (TIP) and the Feedstock Conversion Services Contract have helped to increase flow to an increasingly diverse range of product manufacturers. This is covered in more detail in Section 5.5 below.
- **Ground Rubber Applications.** California producers shipped 4–7 million pounds of ground rubber in 2020, about 25 percent less than in 2020. Ground rubber specifications are used in pervious outdoor surfacing, mulch, ballistics, and playground applications, among others. While several California installers offer products in this category, shipments have declined in recent years, in part as CalRecycle TDP Grant funding (which historically supported playground surfacing, including loose fill material) has shifted to the TIP program. Still, given the low level of 2020, diversifying applications and a strong economy, growth is a possibility for 2021 and beyond.

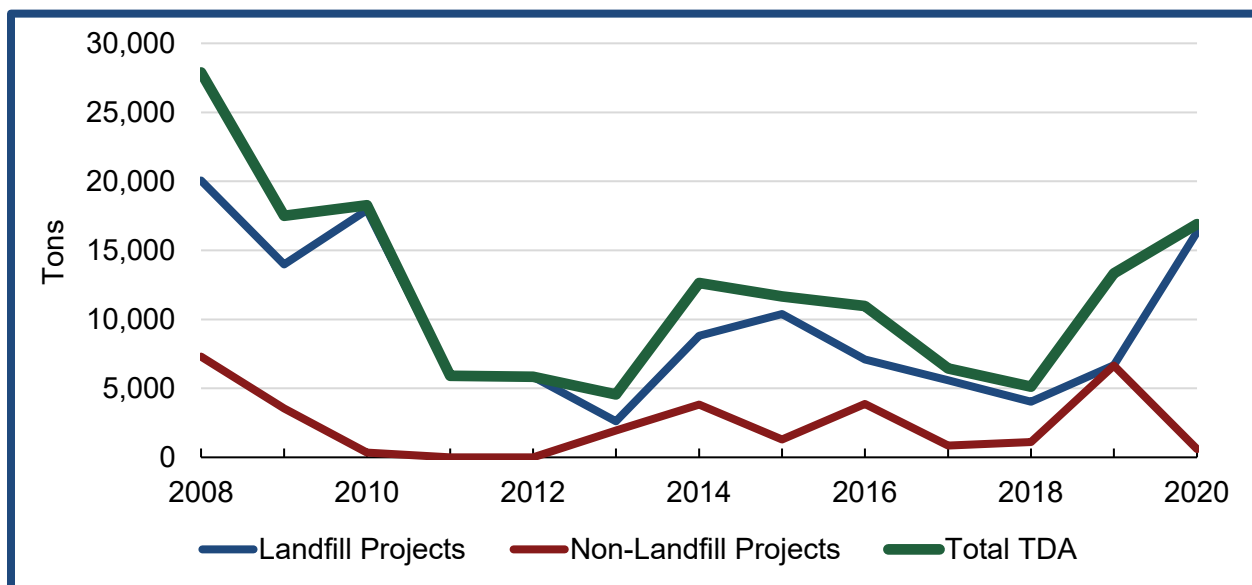
It is important to note that buffings from retreaders are excluded from these estimates and are not counted in recycling rates because the retreaded tires they originated from are already counted under retreads. Raw and screened buffings of various sizes are used in certain market sub-segments, especially pour-in-place playground surfacing, molded products, landscape mulch, and turf infill products. While not quantified in 2020, based on prior surveys and trends we estimate that well over 14 million pounds of

buffings were sold by California retreaders in 2020. Buffings continue to be in high demand.

4.5 Civil Engineering

Figure 7 shows how use of California-generated TDA in civil engineering projects has varied up and down in recent years. In 2020, TDA use was up 27 percent to 16,900 tons (1.7 million PTEs), four percent of all waste tires managed. Of this amount, four landfills received 16,300 tons (1.6 million PTEs) and the remaining 600 tons (600,000 PTEs) used to complete a landslide repair project. These projects received funding through CalRecycle’s TDA Grant program, which is described more fully in Section 5.6 below. TDA use in landfill related projects, primarily related to gas collection, has become relatively steady but is expected to decline somewhat in 2021. According to CalRecycle’s civil engineering technical assistance contractor, some potential new non-landfill projects have been identified the timing is unclear. In Fiscal Year 2020-21 no new grant applications were received. Non-landfill civil engineering projects that can use TDA include landslide repair, embankment/retaining wall backfill, and stormwater infiltration galleries.

Figure 8
California-Generated Tire-Derived Aggregate Shipped for Use in Civil Engineering Projects, 2008-2020



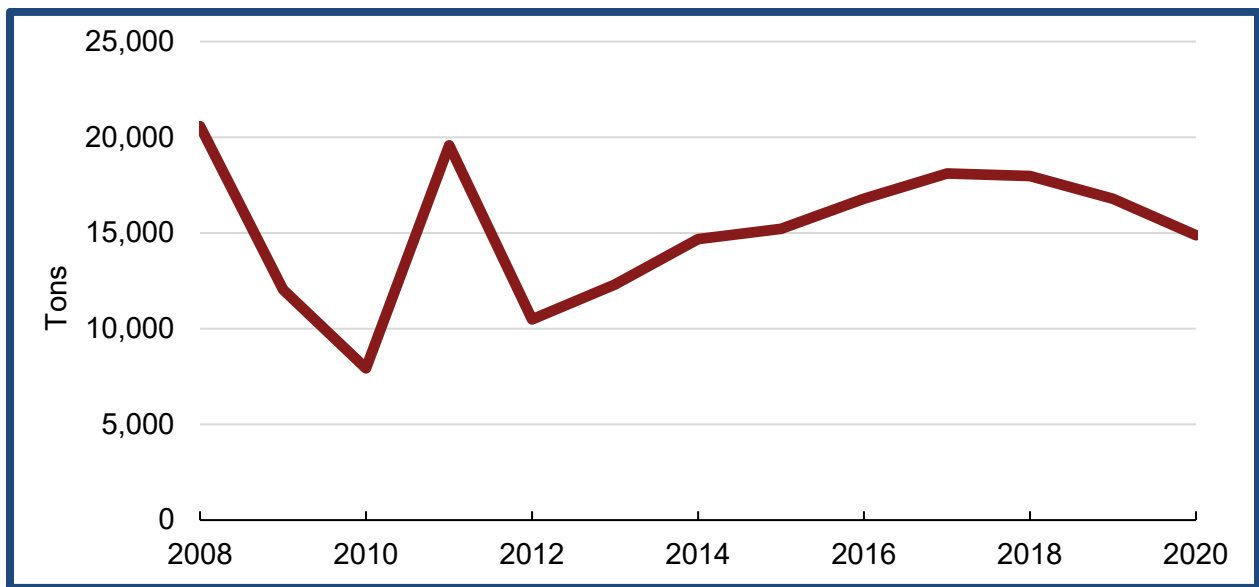
See Figure 8 source data in Appendix C.

4.6 Landfill Alternative Daily Cover / Beneficial Reuse

About 16,784 tons of tire shreds (1.7 million PTEs) were used as ADC at three landfills in 2019, seven percent less than 2018. Landfills are required to cover waste at the end of each operating day and typically use available soil; however, some landfills are

permitted to use a range of processed waste materials as ADC or other beneficial use applications. As Figure 8 shows, significant California waste tire amounts have been used as ADC for many years, although lower than in the early 2000s. One landfill using tire ADC in 2019 is now closed, so 2020 use is expected to decline.

Figure 9
California-Generated Tire-Derived Material Used as Landfill Alternative Daily Cover or in Beneficial Reuse Applications, 2008–2020



See Figure 9 source data in Appendix C.

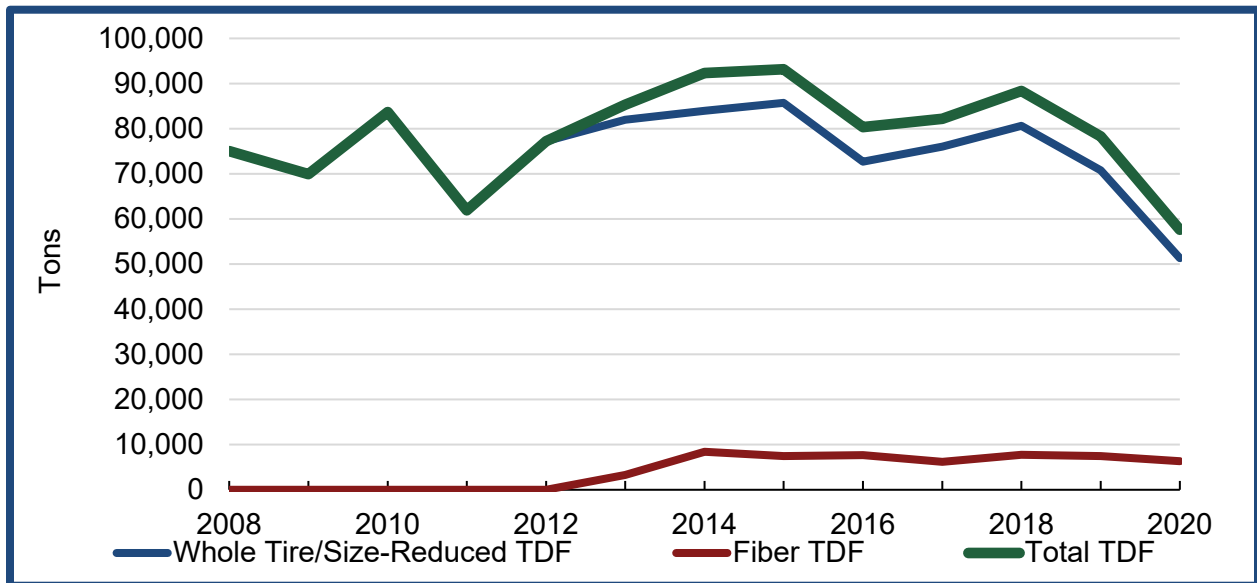
4.7 Tire-Derived Fuel (In-State)

While CalRecycle prioritizes non-fuel uses for waste tires, some California processors have long relied on the relatively profitable and stable, high in-state demand for TDF. Four California cement kilns continued to consume TDF in 2020 as they have for many years, but the year saw significant changes as well. As illustrated in Figure 10, shipments of California-generated TDF sent to cement kilns declined markedly in 2020 by 26 percent, to 57,600 tons (5.8 million PTEs), 12 percent of all waste tires managed. This amount includes 57,900 tons (5.8 million PTEs) of whole waste tires and size reduced TDF and 6,300 tons (600,000 PTEs) of tire fluff generated as residual by processors. An additional 3,500 tons of fluff and 9,200 tons (900,000 PTEs) of whole waste tires and size reduced TDF were also consumed by California cement kilns, were sourced, or derived from waste tires imported from out-of-state.

In 2020, one cement kiln that had previously used whole waste tires as TDF shifted to using size reduced. Another cement kiln said they expected their use of TDF in 2021 to decline by up to 60 percent. Demand and pricing for cement are currently very strong, and historically TDF use often falls under such circumstances. One cement kiln representative said their facility prefers to use petroleum coke, as it yields a more

consistent and efficient process. One cement kiln reportedly is increasing use of a bio-fuel source that is readily available and which offers greenhouse gas emission reduction advantages compared to TDF. It is unclear how long this reduced TDF consumption trend will last; however, shipments of TDF to in-state consumers are expected to drop again in 2021.

Figure 10
California Whole Waste Tires and TDF Consumed at California Cement Kilns, 2008-2020¹⁰



See Figure 10 source data in Appendix C.

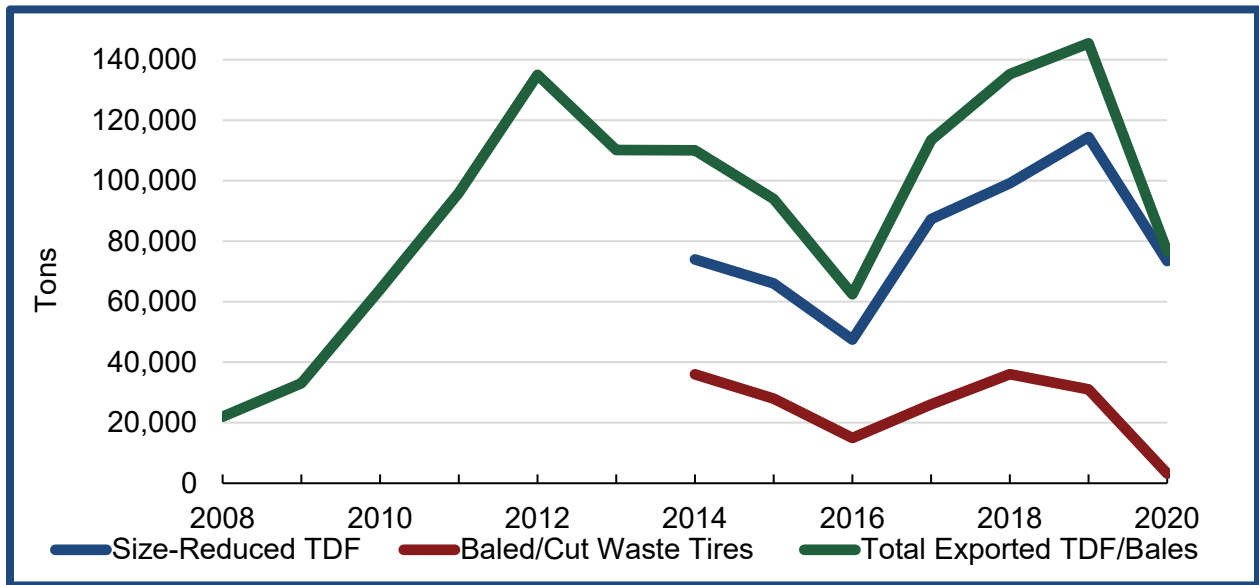
4.8 Tire-Derived Fuel (Export)

As Figure 11 shows, export of California-generated TDF (including size-reduced TDF and baled or cut waste tires) peaked in 2019 but declined markedly in 2020 by 47 percent to 76,600 tons (7.7 million PTEs). This is 16 percent of all waste tires managed. Export of size reduced TDF, primarily to Japan and Korea, dropped by 36 percent to 73,400 tons (7.3 million PTEs). An additional 5,900 tons (590,000 PTEs) of size reduced TDF was exported by California processors but was derived from imported whole waste tires. Export of baled and cut waste tires (e.g., bundled three-cut truck tires) to destinations including India and Pakistan, was down by 90 percent to 3,200 tons (300,000 PTEs). Exporters report the primary use is as fuel.

In Early 2020, India abruptly halted waste tire bale imports, while TDF shipments to the rest of Asia continued until around August. By late 2020 and into 2021, shipping costs and logistical challenges (for both trucking to ports and shipping overseas) had deteriorated to the point that most exporters found it no longer economical to continue the practice. This led to the rapid drop in exported TDF and bales and resulted in a rapid increase in landfill disposal of California-generated waste tires, as described

below. Reportedly, India is again importing waste tire bales, and some new TDF importing destination countries may open in 2021. However, economics are still a major concern and TDF export is expected to remain at a very low level in 2021.

Figure 11
California-Generated TDF and Baled and Cut Waste Tires, 2008-2020

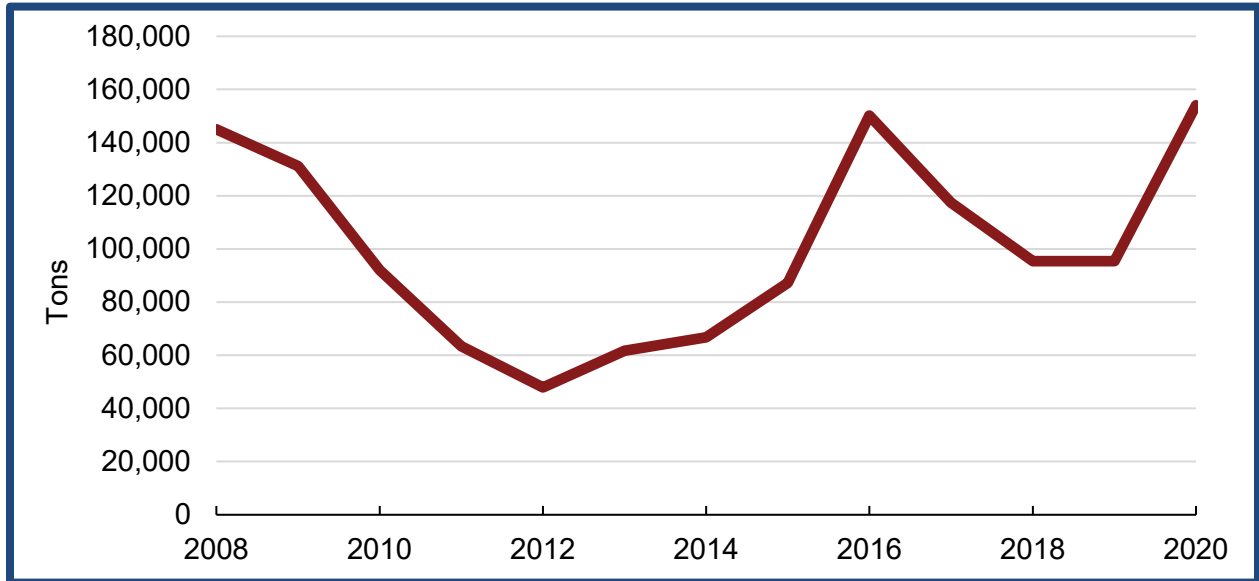


See Figure 11 source data in Appendix C.

4.9 Landfill Disposal

As shown in Figure 11, landfill disposal of California-generated waste tires increased markedly by 61 percent in 2020 to 154,000 tons (15.4 million PTEs), 32 percent of all waste tires managed. This surpassed two previous peaks in 2008 and 2016 and is the highest annual waste tire amount disposed since at least 2002. The main causes of the disposal spike were the disrupted export economics and logistical feasibility described in Section 4.8, which left companies that typically export with few options. An additional cause was a reduction in TDF demand at California cement kilns as discussed in Section 4.7. These factors caused TDF producers and exporters to redirect waste tire flows to landfills, including two landfills located in Nevada. Disposal is expected to remain very high in 2021 with further disruption expected in demand for TDF for cement kilns.

Figure 12
California-Generated Waste Tires Disposed in Landfills, 2008-2020¹¹



See Figure 12 source data in Appendix C.

4.10 Waste Tire Imports

In 2020, an estimated 26,100 tons (2.6 million PTEs) of whole waste tires were imported from out of state and flowed to multiple California processors. The study methodology excludes these imports from the California tire use estimates presented in Table 2 and throughout this report.

Table 3
Estimated Flows of Out-of-State Waste Tires Imported to California Processing Facilities (2020)

Category	Allocated Import Adjustments
Retreads	NA
Used Tires	5,200
Crumb Rubber and Ground Rubber	800
Tire-Derived Aggregate	800
Other Recycling	200
Total Recycled	7,000
Tire-Derived Fuel (In-State)	9,100
Tire-Derived Fuel (Export)	5,900
Baled and Cut Waste Tires (Export)	0
Landfill Alternative Daily Cover / Beneficial Reuse	0
Total Disposal Related	15,000
Landfill Disposal	4,800
Total Managed	26,800

5. California State Policies and Programs Supporting Markets

5.1 Overview

Table 4 summarizes findings on key California state policies and programs supporting tire recycling markets. Following the table, the remainder of this section describes each one in more detail. Note that, while flows of tire-derived materials are generally quantified in tons in this report, we refer to millions of pounds in this section as it mainly focuses on use of crumb rubber in specific market segment, and this is the common industry practice.

Table 4
Analysis of Select State Policies and Programs Supporting Waste Tire Market Development

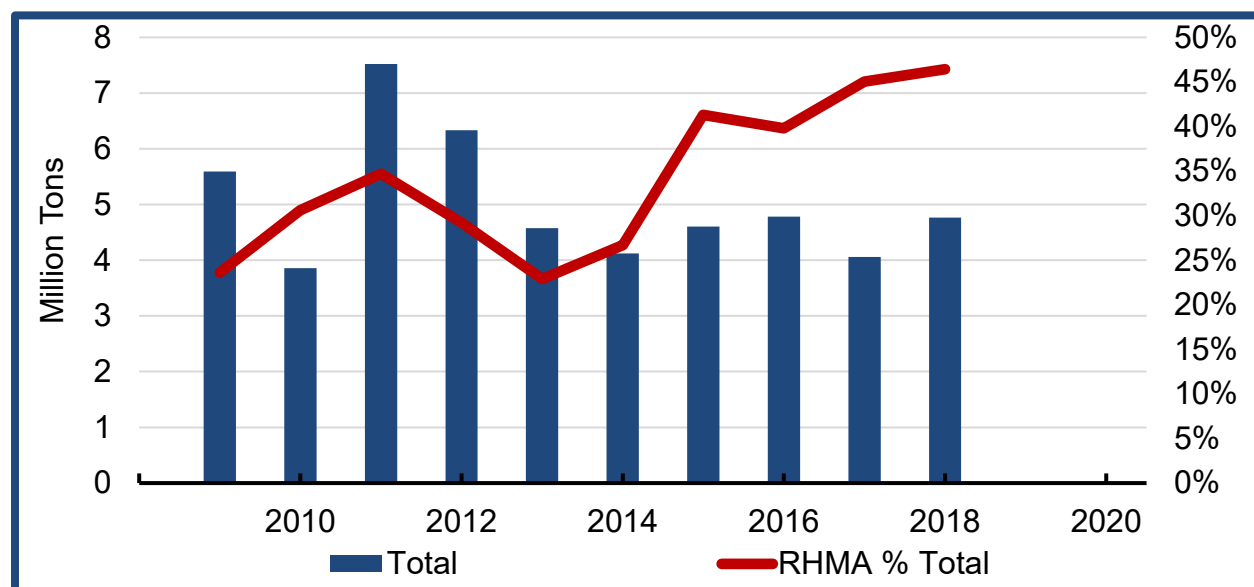
Policy or Program	Average Annual TDM Use (Million Pounds) Assumptions Detailed in Text Below	Average Grant Expenditures per Pound TDM Recycled
Caltrans Use of Rubberized Asphalt Paving Products (Mandated by PRC 42703)	52.5	NA
CalRecycle Rubberized Pavement Grant Program (7 Complete Years Ending in FY 2017/18)	8.7	\$0.45
CalRecycle Tire-Derived Product Grant Program (8 Complete Years Ending in FY 2012/13)	10.1	\$0.31
CalRecycle Tire-Derived Product Grant Program (4 Complete Years Ending in FY 2016/17)	2.9	\$0.29
CalRecycle Tire Incentive Program (6 Complete Years Ending in FY 2018/19)	10.9	\$0.11
CalRecycle Tire-Derived Aggregate Grant Program (7 Complete Years Ending in FY 2017/18)	10.1	\$0.02
CalRecycle RMDZ Loan Program (\$23.5 Million via 22 Loans to 11 Tire Firms since 1993)	NA	NA
State Agency Buy-Recycled Campaign (Average Purchases of Retreads \$740,000/year and TDPs \$2.4 Million/Year Over 4 Years Ending in FY 2018/19)	NA	NA
Additional State Programs and Activities	NA	NA

5.2 Caltrans Use of Rubberized Pavement Products

This section presents information compiled from Caltrans annual crumb rubber reports up to the most recent available report covering 2018.¹² California State law (PRC 42703) mandates that Caltrans use rubber asphalt in at least 35 percent of the total amount of asphalt placed. As illustrated in Figure 13, the agency has exceeded this rate every year since 2015. Caltrans contractors are not required to use California-generated crumb rubber. Caltrans has adopted policies to help ensure regular use of asphalt rubber, especially a Rubberized Hot Mix Asphalt (RHMA) Surface Pavement of Choice policy that requires an exemption letter if RHMA is not used in a wide range of circumstances.

Figure 13 also shows that Caltrans total asphalt placed has been relatively stable in recent years, averaging 4.5 million tons per year since 2013. This is down from an average of 5.8 million tons between 2009 and 2012. With a substantial boost in state transportation budgets due to the California Road and Repair Act (SB 1, Beall, Chapter 5, Statutes of 2017), an increase in overall paving, and a proportionate increase in crumb rubber use, is anticipated. However, some stakeholders said the pace of bids in 2021 is lower than hoped as Caltrans works to prepare more complex bids for fewer, but larger projects.

Figure 13
Caltrans Total Asphalt Placed and Percent Rubber Asphalt, 2009-2018¹³

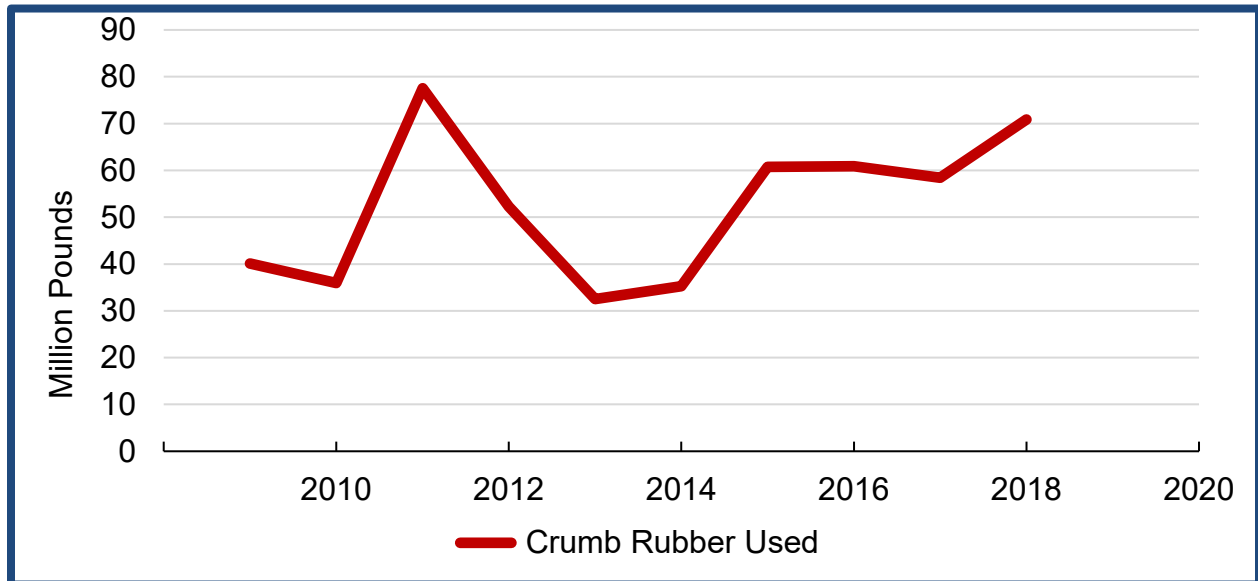


See Figure 13 source data in Appendix C.

Figure 14 shows Caltrans actual use of crumb rubber based on these reports, which hit 71 million pounds in 2018 but has averaged 52.5 million pounds over 10 years. The Waste Tire Market Report for 2018 estimated total demand for crumb rubber in asphalt

paving (in both state and local projects) was over 78 million pounds, suggesting average Caltrans use constitutes in the range of 67 percent of the total market.

Figure 14
Caltrans Use of Crumb Rubber in Paving Projects, 2009–2018¹⁴



See Figure 14 source data in Appendix C.

One way to document Caltrans crumb rubber use trends beyond their published annual reports is through analysis of bid documents.¹⁵ Because actual projects may vary significantly from bid projections or be canceled outright, and because it is not clear when projects may occur, estimates based on bids should be considered rough and subject to much uncertainty. With that caveat, analysis of Caltrans asphalt pavement bid documents for 2020 compared to 2019 indicates the total amount asphalt placed declined by 40 percent to 2.1 million tons, while the percentage of projects specifying RHMA was up from 39 percent to over 57 percent. Based on bid documents, we estimate Caltrans crumb rubber use was down by only about 11 percent, from 47 million pounds to 42 million pounds,¹⁶ well below the 10-year average of 53 million pounds.

Most all crumb rubber used in California paving projects is “field blend” also known as the “wet process.” With CalRecycle support, Caltrans has also explored use of additional crumb rubber through a variety of new policies under its *PG+X Initiative*, but Caltrans representatives report this is currently on hold. In 2021, some firms are seeking to advance use of new forms of terminal blend technologies to combine crumb rubber with asphalt at refineries, as previously used in California to a limited extent several years ago. Some firms are also advancing the possibility of using recycled plastics in asphalt paving. It is unclear to what extent these proposed uses may gain traction, or the potential impact they could have on asphalt rubber use.

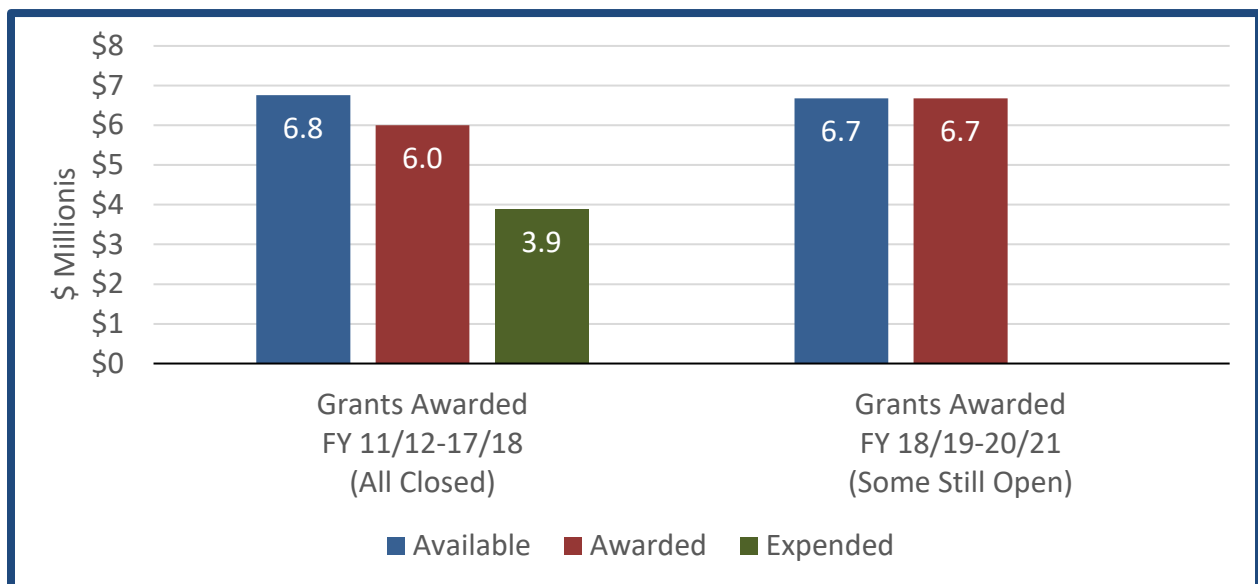
5.3 CalRecycle Rubberized Pavement Grant Program

CalRecycle's Rubberized Pavement Grant Program reimburses eligible local agencies for the net cost of two types of paving projects: RHMA and chip seals.¹⁷ Grants awarded in a given fiscal year may be expended over a three-year period, and full outcomes of the grants may not be documented until after they are complete and closed. Therefore, we analyzed average grant statistics separately for periods in which all grants are closed and more recent periods in which approved, grant-funded projects may still be ongoing.

Figure 15 presents average annual statistics on grant fund utilization for two periods. For grants approved in Fiscal Years (FY) 11/12-17/18, which are all now closed, an annual average of \$6.8 million was available, with \$6.0 million awarded and only \$3.9 million ultimately expended. For grants approved in FY 18/19-20/21 rubberized pavement grants were oversubscribed. An average of \$6.7 million was awarded each year, matching the available funds. Since these grants are still open, the actual expenditures are not known but would be expected to fall in the range of \$4 million based on past performance.

The grant utilization rate historically falls below the award amount because grant funds requested during the application process are estimates and grantees typically experience changes to their projects/products throughout the grant cycles. The most recent cycle of grants awarded in April 2021 totaled \$3.7 million, an allocation reduction made by CalRecycle in part due to anticipated budget reductions related to COVID-19.

Figure 15
CalRecycle Rubberized Pavement Grant Program, Average Annual Grant Fund Utilization¹⁸



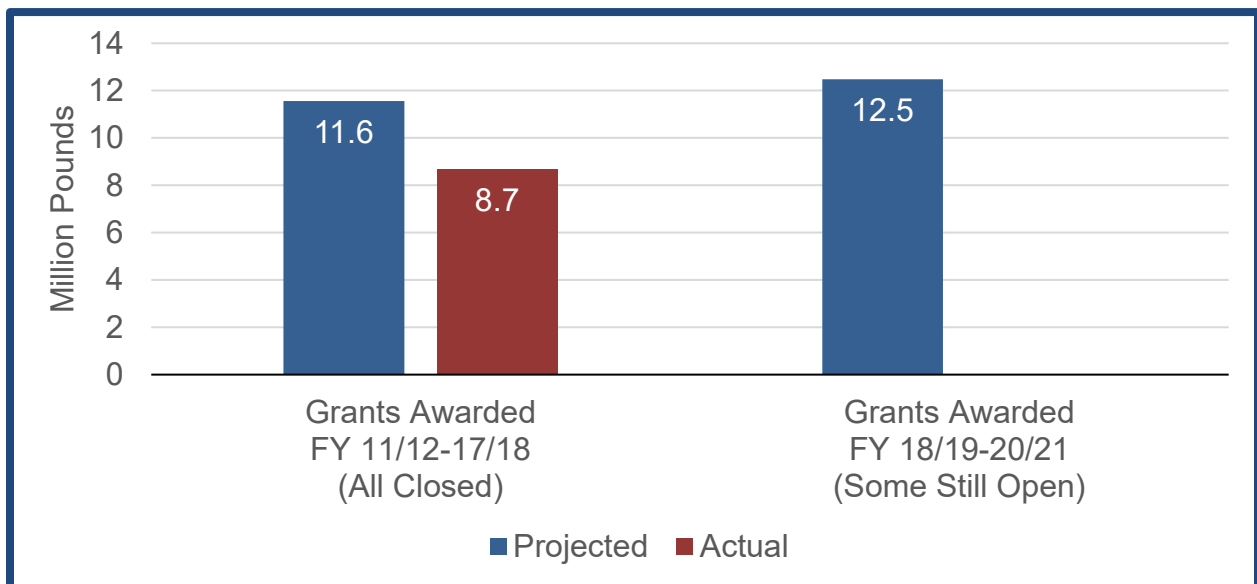
See Figure 15 source data in Appendix C.

Figure 16 analyzes the average annual amount of crumb rubber used in local asphalt paving projects supported by the Rubberized Pavement Grant Program. For grants approved in FY 11/12–17/18, applications forecast the use of 11.6 million pounds of crumb rubber. Grant recipients actually used 8.7 million pounds. Actual crumb rubber use is typically less than projected amounts due to grantees experiencing changes to their projects/products throughout the grant cycles.

For the still-open grants approved in FY 18/19–20/21, applications forecast use of 12.5 million pounds of crumb rubber, based on historical average grant fund utilization, Boisson Consulting estimates this could result in FY XX/XX grant recipients will expend about 75 percent of these approved grant funds may be expended to use about 9.4 million pounds of crumb rubber. For comparison, the 2019 Waste Tire Market Report estimated total demand for crumb rubber in local and state California paving projects was well over 75 million pounds.

The average grant expenditure per pound of crumb rubber used was 45 cents per pound. The Rubberized Pavement Grant Program is supported by CalRecycle Rubberized Asphalt Concrete Technical Support and Research contracts and a range of special research projects.

Figure 16
CalRecycle Rubberized Pavement Grant Program, Average Annual Crumb Rubber Use¹⁹



See Figure 16 source data in Appendix C.

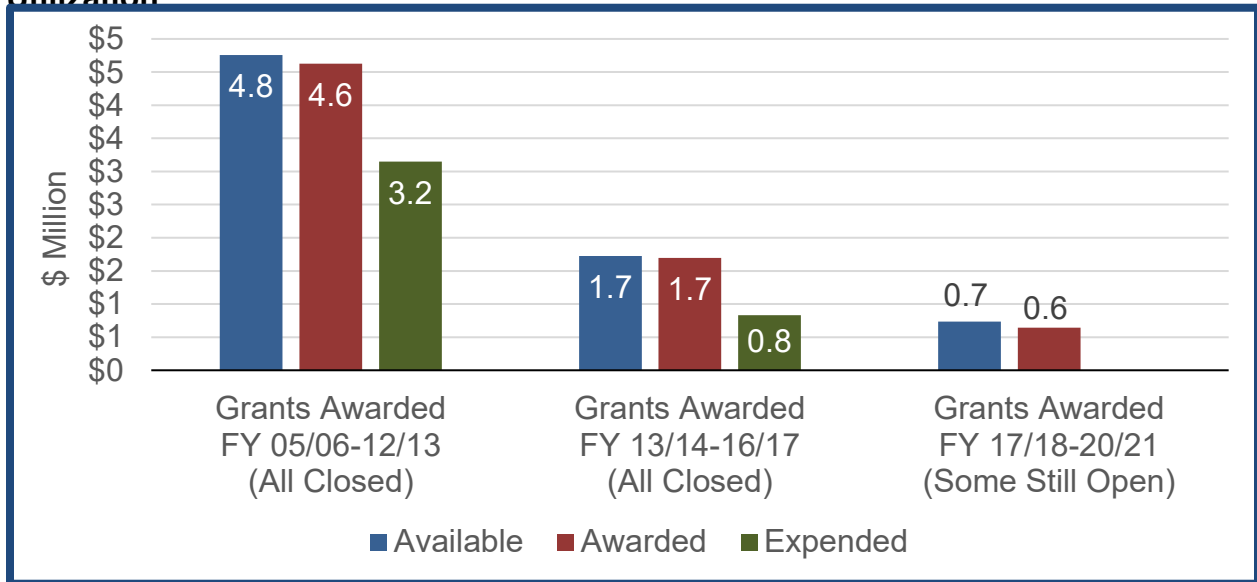
5.4 CalRecycle Tire-Derived Product Grant Program

Like rubberized pavement grants, the TDP Grant program reimburses eligible public entities that have been awarded a grant for the cost of approved TDP purchases and transportation.²⁰ The program covers a wide range of product types, although in the past a large portion of awards funded playgrounds and running tracks. In the current cycle, however, playgrounds and synthetic turf infill projects are not eligible pending the findings of an ongoing CalRecycle sponsored study by the Office of Environmental Health Hazard Assessment.

Figure 17 analyzes grant fund utilization for three groups of past TDP grants. For the now-closed grants approved in FY 05/06–12/13, CalRecycle allocated an annual average of \$4.8 million, and recipients expended a total average of \$3.2 million. For the now-closed grants approved in FY 2013/14–16/17, CalRecycle allocated an annual of \$1.7 million, and grant recipients expended an average of \$800,000. This period overlaps the first four years of the Tire Incentive Program (discussed below) and CalRecycle shifted a portion of allocated funds from TDP grants to TIP.

Finally, for the still-ongoing grants approved in FY 17/18-20/21, CalRecycle shifted additional funds from the TDP Grant Program to TIP, and for the first time offered TDP grant cycles only every other year, resulting in a much lower annual average program allocation of \$700,000. Based on past performance, Boisson Consulting estimates that 50–66 percent of available funds (\$350,000–460,000) will be expended. As with paving grants, the grant utilization rate historically falls below the award amount because grant funds requested during the application process are estimates and grantees typically experience changes to their projects/products throughout the grant cycles.

Figure 17
CalRecycle Tire-Derived Product Grant Program, Average Annual Grant Fund Utilization²¹



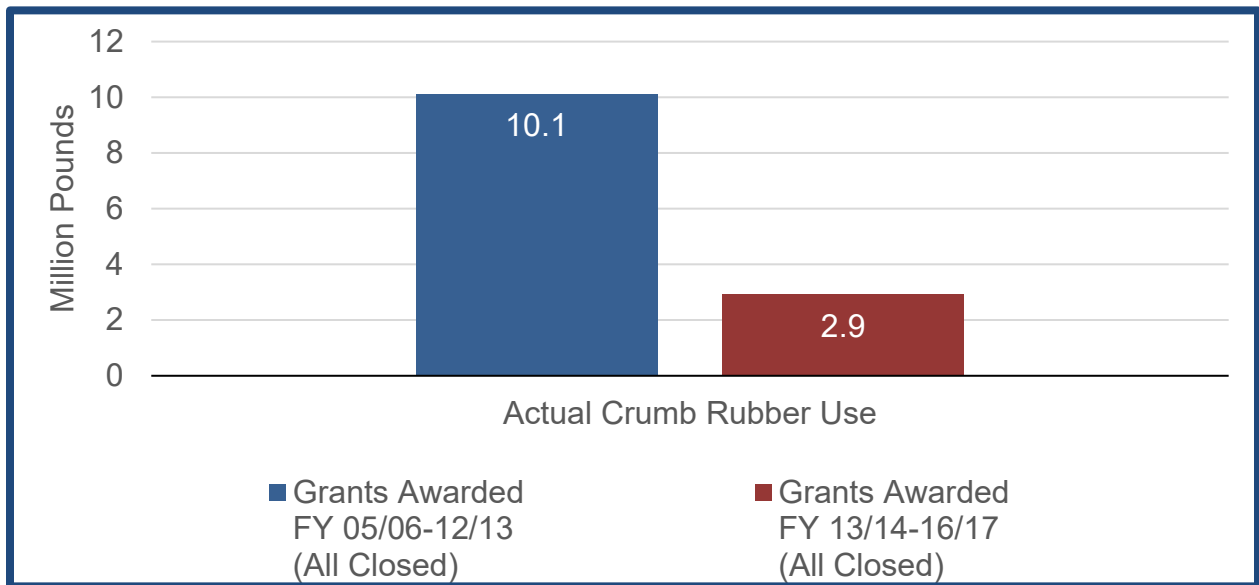
See Figure 10 source data in Appendix C.

Figure 18 shows the average annual crumb rubber use supported by TDP grants. For grants approved in FY 05/06–12/13, recipients used an annual average of 10.1 million pounds of crumb rubber, which is about 14 percent of total crumb and ground rubber shipments (72 million pounds) during this period. The average grant expenditure was 31 cents per pound.

For grants approved in FY 13/14-16/17 recipients used an annual average of 2.9 million pounds, which is about seven percent of crumb and ground rubber shipments (42 million pounds) during this period. The average grant expenditure was 29 cents per pound. This excludes paving. Data on projected rubber use in original applications were not available.

Applications were due on June 1 for the current FY 21/22 TDP grant cycle, which has an allocation of \$750,000, a significant drop in funding from earlier cycles. Based on historical trends, this forthcoming grant cycle may fund the use of 100,000–135,000 pounds of crumb rubber, which is a small fraction of total crumb rubber used in the state. The next grant cycle is scheduled for FY 23/24 with a tentative allocation of \$1 million.

Figure 18
CalRecycle Tire-Derived Product Grant Program, Average Annual Tire Rubber Use²²



See Figure 18 source data in Appendix C.

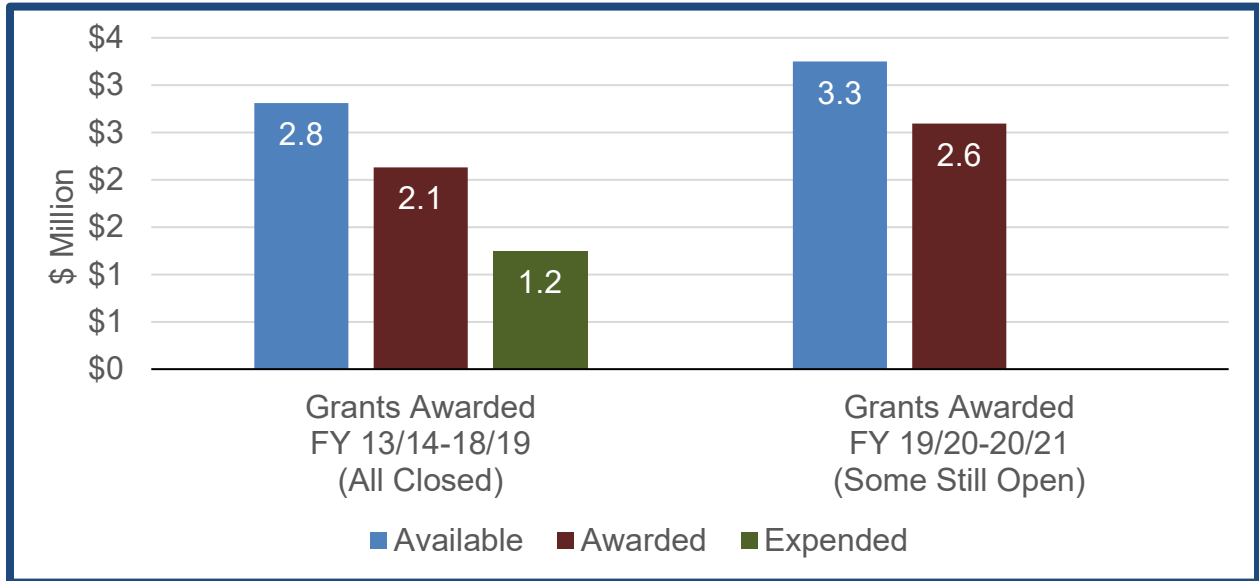
5.5 CalRecycle Tire Incentive Program

The tire incentive program started in FY 13/14. In contrast to other CalRecycle tire grant programs that reimburse a portion of the cost of purchasing TDPs, the TIP makes direct payments to TDP manufacturers based on pre-approved grants and the amount of crumb rubber used to make products that are sold into the market.²³ The current payment rates are 10 cents per pound for new and existing products, 40 cents per pound for feedstock conversion products or devulcanized rubber use, and 50 cents per pound for use of fine mesh crumb rubber 50 mesh or smaller.

We analyzed TIP grant market impacts in two groups. First, as shown in Figure 19, during Fiscal Years 13/14–18/19, CalRecycle allocated \$2.8 million for TIP grants, awarded \$2.1 million to applicants, and applicants expended \$1.2 million. Second, during FY 19/20-20/21, CalRecycle allocated \$3.3 million and awarded \$2.6 million. This grant cycle is still open.

Again, the grant utilization rate historically falls below the award amount because grant funds requested during the application process are estimates and grantees typically experience changes to their projects/products throughout the grant cycles.

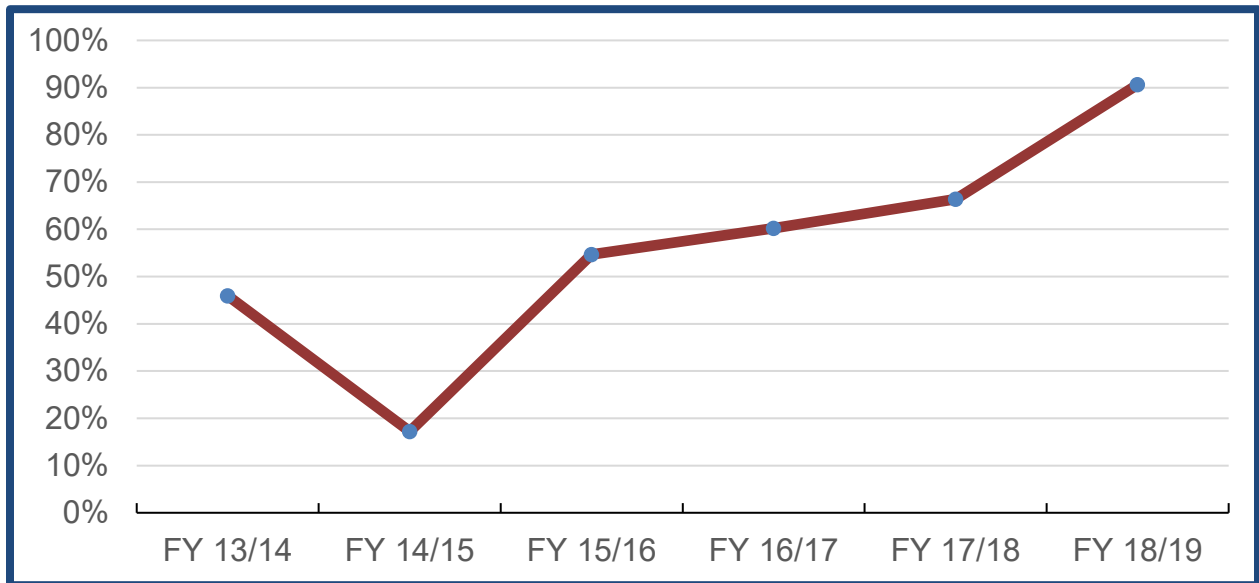
Figure 19
CalRecycle Tire Incentive Program, Average Annual Funding Utilization²⁴



See Figure 19 source data in Appendix C.

As Figure 20 shows, TIP fund utilization increased steadily to 91 percent in FY 18/19, in part due to fine-tuning of program rules to incentivize companies following through on prior grant and crumb rubber use commitments by giving them priority ranking in subsequent TIP grant cycles.

Figure 20
CalRecycle Tire Incentive Program, Annual Trend in Fund Utilization, FY2013-14
Through FY2018-19²⁵



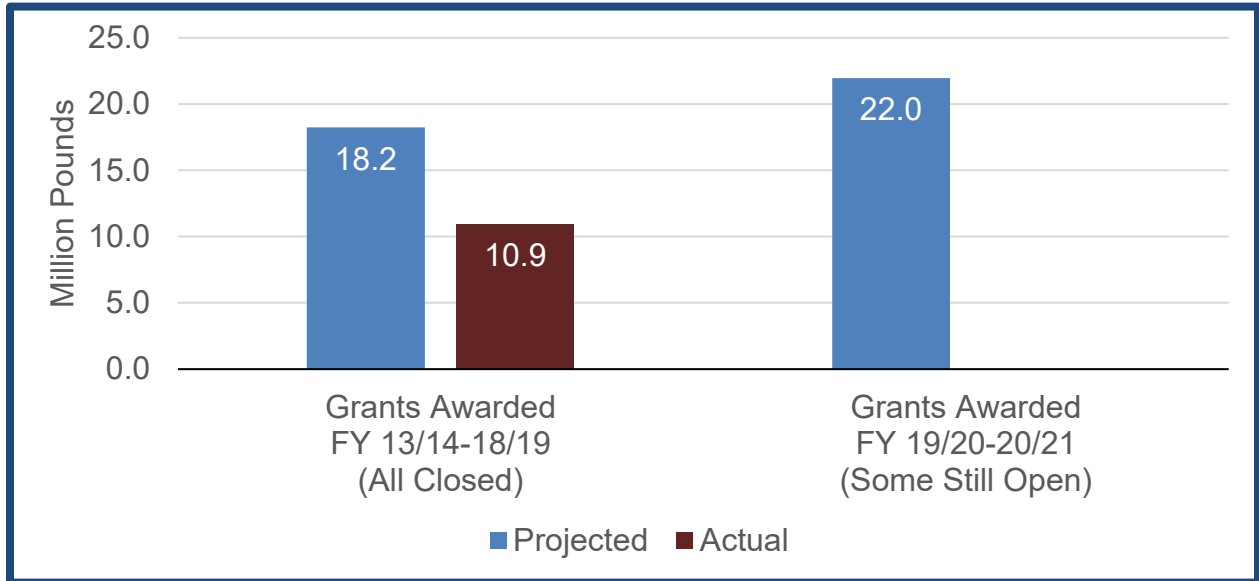
See Figure 20 source data in Appendix C.

Figure 21 shows the amount of crumb rubber use supported by the TIP Program. For FY 13/14-18/19, grant applications forecast an annual average use of 18.2 million pounds. Grant recipients actually used 10.9 million pounds, or 60 percent of the amount forecasted. This total use is about 31-44 percent of the 25-35 million pounds estimated to have been used in California in 2019. The average grant expenditure per pound was 11 cents per pound.

For Fiscal Years 19/20–20/21, grant applications forecast crumb rubber use to be 22 million pounds per year. If the 91 percent TIP fund utilization rate holds, actual average annual crumb rubber use from grant years could be in the range of 20 million pounds.

The next TIP grant cycle has an allocation of \$3.25 million and the application closed on July 29, 2021. The TIP Program is supported by CalRecycle’s Feedstock Conversion Technical Assistance and Testing Contract. Over two prior contracts, nine manufacturers received technical assistance and testing services (including over 450 certified lab tests) to advance 19 products, with most of these now participating in the TIP program.

Figure 21
CalRecycle Tire Incentive Program, Average Annual Crumb Rubber Use²⁶



See Figure 21 source data in Appendix C.

5.6 CalRecycle Tire-Derived Aggregate Grant Program

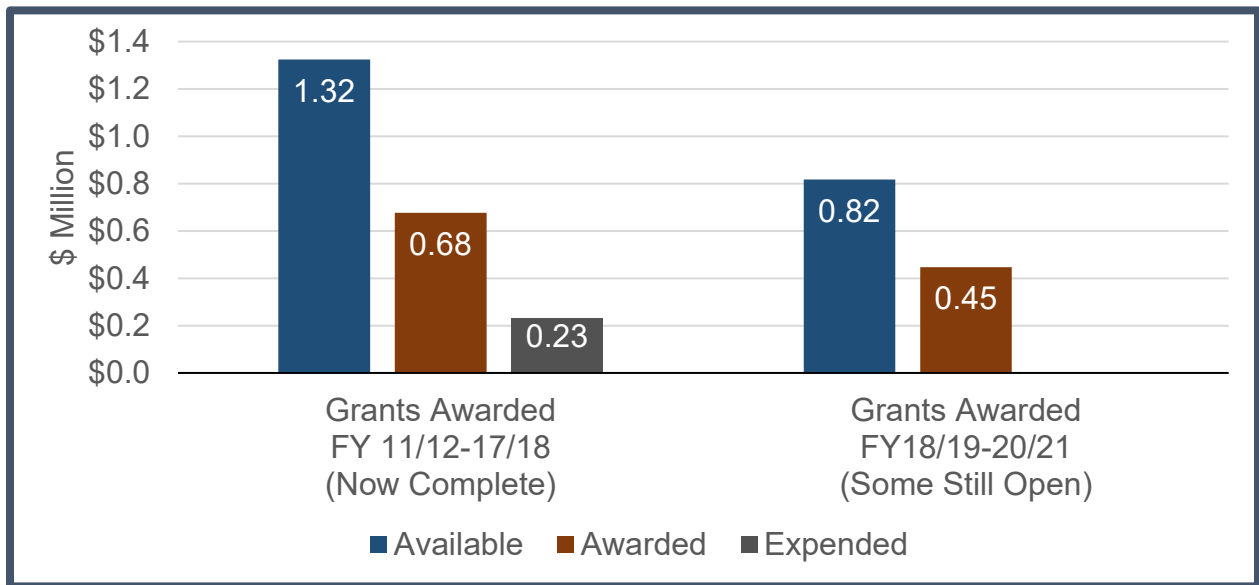
The CalRecycle TDA Grant Program supports use of TDA in a range of civil engineering projects involving landslide repair, stormwater filtration galleries, light rail sound dampening, landfill civil engineering projects, among others.²⁷ The program has seen abrupt spikes and dips as large projects start and finish, although landfill related civil engineering projects have become more consistent in recent years.

Figure 22 shows that grants awarded during FY 11/12–17/18 CalRecycle allocated on annual average \$1.32 million, awarded an average of \$0.68 million in awards, and grant recipients expended an average of \$230,000.

Even more than in other programs, the grant utilization rate for TDA grants historically falls below the award amount because grant funds requested during the application process are estimates and grantees typically experience changes to their projects/products throughout the grant cycles.

Fiscal Years 19/20–20/21 are not complete. CalRecycle allocated an annual average of \$820,000 and awarded \$450,000. CalRecycle received only one application in Fiscal Year 2020-21, but the applicant subsequently withdrew it.

Figure 22
CalRecycle Tire-Derived Aggregate Grant Program, Average Annual Grant Fund Utilization²⁸



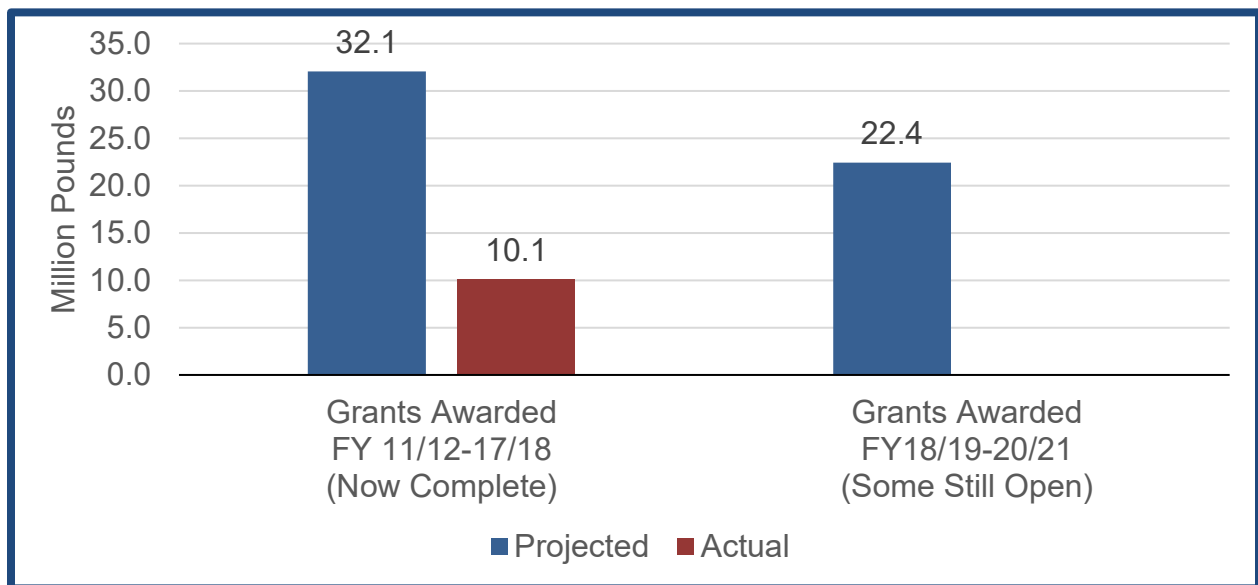
See Figure 22 source data in Appendix C.

Figure 23 shows the amount of TDA use supported by TDA Grants. For grants awarded during FY 11/12–17/18, applications forecast use of 16,000 tons of TDA, and grant recipients actually used just over 10 million pounds CalRecycle grants account for virtually 100 percent of the TDA civil engineering market. The average grant expenditure was 2.3 cents per pound.

For Fiscal Years 19/20–20/21, grant applications forecast the use of 22.4 million pounds. Based on previous performance, actual average annual TDA use for this period could be 7.5 million pounds.

CalRecycle expects to allocate \$750,000 for TDA grants issued in two cycles in June and December 2021. The CalRecycle Civil Engineering program is supported by Tire-Derived Aggregate Civil Engineering Technical Support and Research and the Technology Center and Laboratory Testing Services contracts.

Figure 23
CalRecycle Tire-Derived Aggregate Grant Program, Average Annual TDA Use²⁹



See Figure 23 source data in Appendix C.

5.7 CalRecycle Recycling Market Development Zone Loan Program

The CalRecycle Recycling Market Development Zone (RMDZ) Loan Program aims to stimulate the use of postconsumer waste materials and secondary waste materials generated in California as raw materials used as feedstock by private business, industry, and commerce. The loans are available to recycling processors and manufacturers located in 40 RMDZs designated throughout California.³⁰ Since 1993, CalRecycle has awarded 22 loans totaling \$23.5 million to 11 companies involved in waste tire processing and/or TDP manufacturing.

5.8 CAEATFA Sales and Use Tax Exclusion Program

The California Alternative Energy and Advanced Transportation Financing Authority (CAEATFA) administers the Sales and Use Tax Exclusion (STE) Program. The program excludes from sales and use taxes eligible and approved purchases of certain qualified property, such as equipment used in recycling processing and manufacture. Recycling manufacturers are specifically identified as an eligible category. A review of previously approved applications identified dozens of recycling related businesses that have benefited from the program. However, none were identified as companies involved in tire recycling.

5.9 State Agency Buy-Recycled Campaign

The State Agency Buy-Recycled Campaign (SABRC) is a joint effort between CalRecycle and the Department of General Services (DGS) to implement and promote

compliance with state laws requiring state agencies to purchase recycled-content products (RCP) and to track those purchases.³¹ The program requirements cover 11 product categories, including requirements that at least 50 percent of tire purchases be retreads, and 75 percent of certain product categories be TDPs. The TDP categories include, but are not limited to:

- Flooring
- Mats
- Wheelchair ramps
- Playground cover
- Parking bumpers
- Bullet traps
- Hoses
- Bumpers
- Truck bedliners
- Pads
- Walkways
- Tree ties
- Road surfacing
- Wheel chocks
- Rollers
- Traffic control products
- Mud flaps
- Artificial turf
- Rubber mulch
- Sports tracks
- Recreational flooring
- Stall mats
- Posts

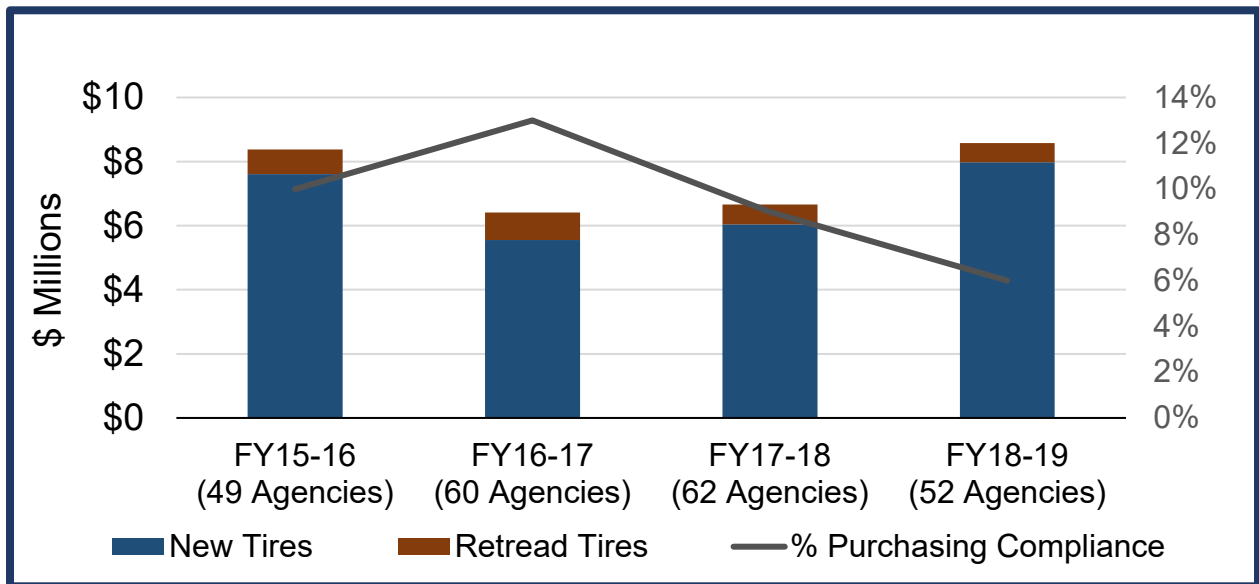
Each state agency submits a report to CalRecycle, who then compiles annual summaries based on reporting by individual agencies.

CalRecycle and DGS promote agency compliance in a variety of ways. There are no statutory enforcement penalties, but DGS considers compliance when reviewing agency purchasing authorities and may hold back certain exemptions from purchasing policies that agencies desire. DGS requires significantly non-compliant agencies to send CalRecycle a plan on how they will improve compliance. CalRecycle's director sends a letter to the director of significantly non-compliant agencies and offers CalRecycle assistance. CalRecycle regularly coordinates with DGS, is part of the DGS Performance and Environmental Standards Work Group and provides input to the state purchasing manual. CalRecycle also has a listserv for SABRC coordinators in each agency responsible for reporting.

Table 24 shows state agency annual purchasing of retread tires for FY 15/16-18/19 (the most recent data at the time of writing this report). Over this period, based on submitted agency reports compiled by CalRecycle, non-retread tire purchases averaged \$6.8 million per year and retread tire purchases averaged \$710,000 per year. This is an

overall average retread purchasing compliance rate of 9.4 percent over these four years, well below the 50 percent mandate. The legislature recently held the retread purchase mandate at 50 percent while increasing most other product category mandates to 75 percent. Through the CalRecycle Retread Tire Services Contract, the contractor will conduct education and promotional outreach to fleets aimed at expanding retread use. This includes collaborating with DGS to explore opportunities to expand state retread tire use, in addition to efforts targeted to local government and commercial fleets.

Figure 24
State Agency Buy-Recycled Campaign, Retread Tire Purchasing, FY 15/16–18/19³²

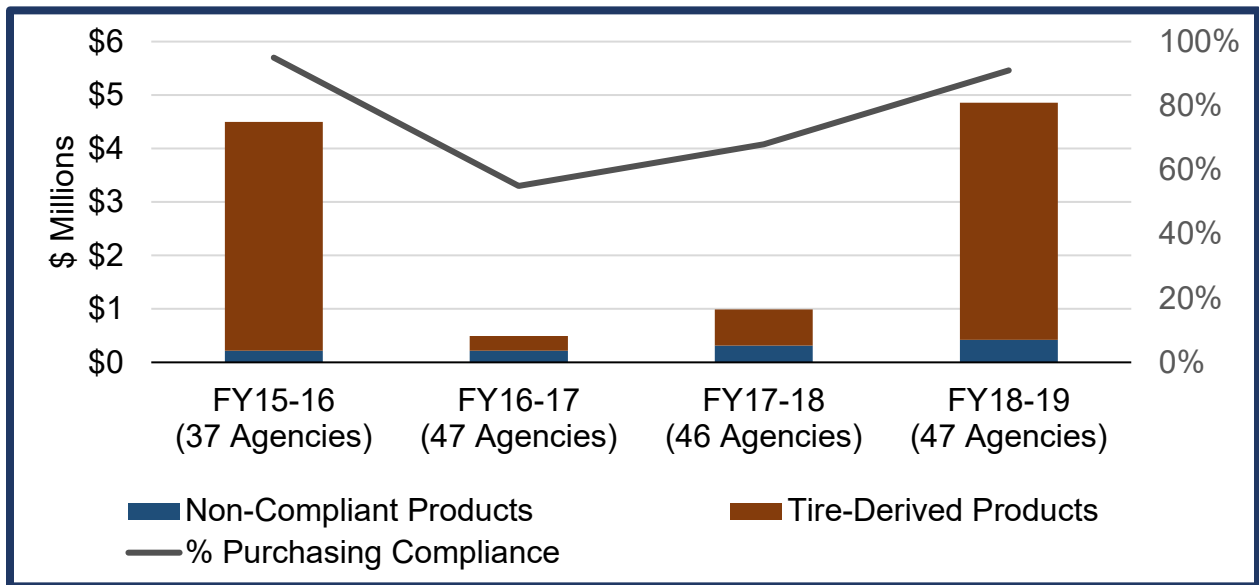


See Figure 24 source data in Appendix C.

Figure 25 shows state agency reported purchases of TDPs averaging \$2.42 million per year during FY 15/16-18/19 (the most recent year for which data are available). In the same period, non-compliant purchases of products in the same categories (listed above in this sub-section) averaged \$290,000 for average purchasing compliance of 89 percent over these four years, well above the required 75 percent level.

Figure 25 also illustrates how reported purchasing can vary significantly from year to year. Agencies are not required to provide details on the type of products purchased in their annual reports to CalRecycle, and in some cases abrupt changes occur.

Figure 25
State Agency Buy-Recycled Campaign, Tire-Derived Product Purchasing, FY
15/16–18/19³³



See Figure 25 source data in Appendix C.

5.10 Additional State Efforts

The Five-Year Plan for the Waste Tire Recycling Management Program guides CalRecycle’s efforts. Table 5 lists the Market Development and Research Budget as published in the most recent draft Five-Year Plan, dated July 1, 2021. The plan will be updated again in spring 2023.

Table 5
CalRecycle Average Annual Budget for Research and Market Development
Activities, FY 2021-22 Through FY 2025-26³⁴

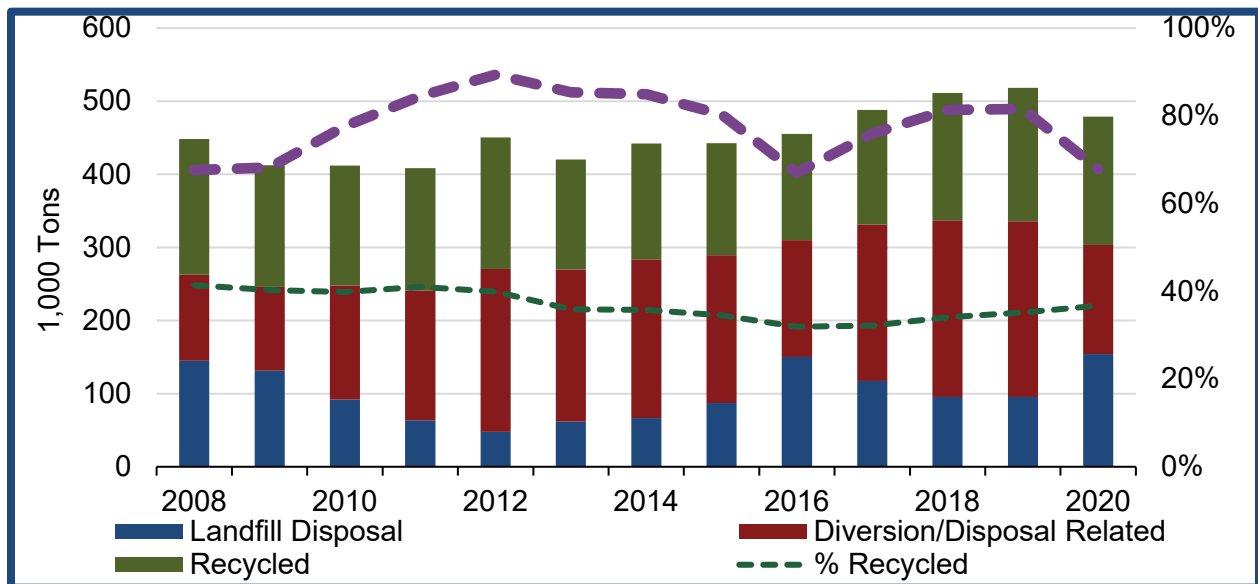
Program Area	Average Annual Budget
Tire-Derived Aggregate Civil Engineering Technical Support and Research; Technology Center and Laboratory Testing Services	\$740,000
Rubberized Asphalt Concrete Technical Support and Research	\$380,000
Caltrans Interagency Research	\$320,000
Waste Tire Technologies Research and Development	\$200,000
Feedstock Conversion Assistance and Material Testing	\$400,000
Tire-Derived Aggregate Grant Program	\$730,000
Rubberized Pavement Grant Program	\$3,820,738
Tire-Derived Products Grant Program	\$550,000
Tire Incentive Program	\$3,740,000
Tire Outreach and Market Analysis	\$319,400
Tire Events	\$100,000
Totals	\$11,300,138

6. Concluding Remarks: The Outlook for Increased Waste Tire Recycling

6.1 Historic Recycling, Disposal Related and Landfill Disposal Trend

California has a mandatory statewide 75 percent recycling rate goal by 2020 for all waste types per AB 341 (Chesbro, Chapter 476, Statutes of 2011). While not codified in statute, CalRecycle has also informally adopted a 75 percent recycling goal specifically for waste tires. Consistent with AB 341 and the reporting conventions CalRecycle uses in annual “State of Recycling” reports, recycling is defined here to include retreading and reuse, but excludes landfill alternative daily cover (ADC) and tire-derived fuel (TDF), which are considered “disposal related” activities. In 2019 (the latest year for which information is available), CalRecycle estimated the statewide recycling rate for all materials to be 37 percent, falling from 50 percent in 2014.³⁵ As shown in Figure 12, the California waste tire recycling rate steadily declined for several years before reaching a low point in 2016 of 32 percent, but has inched up slowly since then, reaching 37 percent in 2020, equal to the latest available all-materials recycling rate. (See Section 4.1 and Appendix B for a description of reporting convention changes in this report that resulted in slight adjustments to cited historic waste tire recycling rates.) The tons recycled has grown consistently since 2015 and hit a 10-year high in 2019 of 182,400 tons (18.2 million PTEs) before dropping in 2020 to 175,900 tons (17.6 million PTEs).

Figure 26
California Waste Tire Recycling, Disposal Related and Landfill Disposal Trend, 2008-2020³⁶



See Figure 26 source data in Appendix C.

6.2 Short-Term Outlook for Increased Tire Recycling

Table 6 summarizes the short-term outlook for each market segment in 2021, based on the trends identified earlier in this report. In short, recycling tonnages may rise due to potential growth in retreading and in paving and molded/other products made with crumb rubber. Depending on the extent to which the total amount of waste tires managed increases, this may result in a somewhat higher recycling rate in 2021. Tire-derived fuel, both in-state and exported (defined by CalRecycle as “disposal related” uses) is expected to decline further, which would likely lead to a rise in disposed tons.

6.3 Long-term Outlook for Increased Tire Recycling

Based on past trends, identified opportunities, and consideration of stakeholder perspectives, we conclude that California has strong potential for continued incremental diversification and growth in tire recycling. However, as analyzed in detail in previous Waste Tire Market Reports, achieving a 75 percent recycling rate for California waste tires would be extremely challenging, and should be viewed as a long-term aspirational goal.

Opportunities and barriers to increased tire recycling include:

- **Opportunity:** California can increase tire recycling through continued incremental expansion of demand for crumb rubber by established California manufacturers through feedstock conversion initiatives, with support from CalRecycle’s TIP program and Feedstock Conversion Technical Assistance and Testing and Services Contracts.
- **Barriers:** Success requires sustained financial and time commitments by manufacturers, motivated supply chain partners, the ability to secure customers with sustained demand, and the need to address technical and market barriers specific to each product and market segment. Some potential California markets, like the aeronautical and medical industries, may have specialized requirements that do not readily lend themselves to TDM feedstock use.
- **Opportunity:** California could seek to significantly expand existing markets for TDPs, such as civil engineering and asphalt paving that hold the potential for high-volume TDM use through expanded funding incentives, marketing efforts, and/or mandates.
- **Barriers:** California already has the largest rubber asphalt paving market in the U.S. New Caltrans policies and/or paving technologies could expand use but may risk offsetting current use in some cases. New mandates or greatly increased funding may be necessary to catalyze more consistent, increased local government asphalt rubber use. Additionally, rubber asphalt use in private paving projects is unproven and may

Table 6
The Short-Term 2021 Outlook for Diversion and Recycling

Category	2020 Tons	2020 M PTEs	2020 % Total	Outlook in 2021
Retreads	45,500	4.6	10%	Increase likely after a down year
Used Tires	51,000	5.1	11%	Steady at a high level as in 2020
Crumb Rubber and Ground Rubber	50,500	5.1	11%	Potential for growth, especially in the molded/other and paving segments
Tire-Derived Aggregate	16,900	1.7	4%	Decline unless new projects are identified and started in 2021
Other Recycling	11,900	1.2	3%	Flat, sustained by recycling of residual wire from processors
Total Recycling	175,900	17.6	37%	Potential tonnage increase, but the recycling rate may decline if the quantity of waste tires managed increases at a higher rate
TDF (In-State)	57,600	5.8	12%	Further decline based on cement kiln reported projections
TDF and Baled/Cut Waste Tires (Export)	73,400	7.3	15%	Possible further decline unless major change in export economics
Landfill ADC / Beneficial Reuse	14,900	1.5	3%	Steady use at two landfills
Total Disposal Related	149,100	14.9	31%	Modest decline due to downward in-state and export TDF trend
Landfill Disposal	154,000	15.4	32%	May rise further as disposal-related uses decline
Overall Diversion	325,000	32.5	68%	Decline likely unless recycling growth outstrips expected drop in disposal related uses
Waste Tires Managed	479,000	47.9	100%	Rebound after 2020 decline, high inventories may boost 2021 flows

not offer the same benefits as in road and highway projects. CalRecycle's long-standing civil engineering technical assistance and funding have yet to overcome resistance and lack of familiarity with TDA and its benefits.

- **Opportunity:** California could seek to establish production capacity for new types of TDPs not currently produced in California and develop new products and applications for TDM.
- **Barriers:** Producers must secure stable customers with strong, consistent demand and a willingness to pay an acceptable price for new TDPs. TDM producers must be willing and capable of supplying needed specifications. The competitiveness of markets may restrict entry for new producers of established products. Most "low hanging fruit" in terms of potential TDPs and applications may have already been explored and advanced to their maximum extent. New funding or incentives for research and development may be needed to generate manufacturer activity to evaluate and test potential new product types.
- **Opportunity:** California could seek to site a devulcanization facility capable of producing new types of needed TDM satisfying specifications that would attract manufacturer customers that may not be capable of using conventional crumb rubber feedstocks.
- **Barriers:** The feasibility and market opportunity of devulcanization in California has not yet been demonstrated.

An additional important barrier to all opportunities to expand tire recycling is the challenge of securing adequate quantities and types of waste tires, potentially shifting some flows away from existing high-volume segments like in-state and exported TDF that have historically been viewed as highly profitable and stable. Notwithstanding the current downturn in both these markets, the ability to secure such feedstock cannot be taken for granted and may come at a high cost or could lead to undesired industry disruption.

California has a strong, diverse existing waste tire management infrastructure that achieves recycling levels on par with other states and countries. Given its experience, its mandate to expand tire recycling, its consistent funding, and a history of innovative recycling legislation, CalRecycle is as well positioned as any state agency in the U.S. to advance tire recycling market development. However, success may continue to be incremental until more challenges and barriers are addressed.

Appendix A

Glossary of Key Terms and Acronyms

ADC: Alternative Daily Cover used at landfills instead of soil.

Buffings: Tire rubber produced as a by-product of the tire retreading process.

California-Generated: As used in this report, this term refers to waste tires generated in California and/or tire-derived materials or products made from waste tires generated in California, excluding any amounts derived from waste tires imported into California.

Caltrans: California Department of Transportation.

CARB: California Air Resources Board.

Comprehensive trip log (CTL): Paper or electronic forms used by haulers and waste tire facilities to document waste and used tire pickup or delivery transactions. Forms are submitted to CalRecycle and entered in the Waste Tire Manifest System database.

Crumb rubber: Tire-derived material equal to or less than ¼ inch in size, free of wire and fiber.

Diversion: In this report diversion means any use of waste tires other than landfill disposal, including use of alternative daily cover when allowed under facility permits.

Disposal Related: Consistent with its usage in CalRecycle’s annual “State of Recycling” reports, in this report disposal related refers to use of waste tires as alternative daily cover or as fuel, including exports where the assumed usage is as fuel.

End-of-Life (EOL): Refers to products that have reached the end of their useful life and are ready to be discarded and managed, whether through reuse, recycling, landfill disposal, or another means.

Feedstock conversion: The process whereby a manufacturer converts a portion of the raw materials (e.g., virgin rubber, EPDM, plastic, aggregate, or other raw material) used to make a product with recycled tire rubber.

Ground rubber: Tire-derived material greater than ¼ inch and up to 1 inch in size, sometimes referred to as nuggets depending on the specification and application.

OEHHA: California Office of Environmental Health Hazard Assessment.

Passenger tire equivalent (PTE): Defined as 20 pounds of tire rubber for the purpose of making consistent comparisons in this and other reports. (The actual weight of waste passenger tires may vary considerably.)

Recycling: In this report recycling refers to tire retreading, reuse, and production of new products or applications using tire-derived materials. Recycling excludes use of tire-derived materials as alternative daily cover or as fuel.

Retread tires: CalRecycle defines retreads as used tires (called “casings” in the retread industry) that have received a new tread. This extends the usable life of the tire casing.

Tire-derived aggregate (TDA): Tire-derived material used to replace conventional aggregates like rock in civil engineering applications.

Tire-derived fuel (TDF): Whole waste tires or tire-derived material consumed as fuel (referred to as size-reduced TDF in this report).

Tire-derived material (TDM): Tires processed to meet market specifications, for example, crumb rubber, ground rubber, tire-derived aggregate, and tire-derived fuel.

Tire-derived product (TDP): Product made entirely or in part from tire-derived material.

Tire Incentive Program (TIP): A CalRecycle program launched in June 2015 to promote feedstock conversion and the use of crumb rubber as feedstock by California manufacturers.

Used Tire: 30 PRC § 42806.5 defines "used tire" as a tire that: a) is no longer mounted on a vehicle but is still suitable for use as a vehicle tire; b) meets applicable requirements of the Vehicle Code and Title 13 of the California Code of Regulations; and c) meets specified storage requirements.

Waste Tire Manifest System (WTMS): Waste Tire Management System. A CalRecycle database containing information on waste tire management firms, permits, and submitted comprehensive trip log data.

Waste Tire: 30 Public Resources Code (PRC) § 42807 defines a "waste tire" as a tire that is not mounted on a vehicle and is no longer suitable for use as a vehicle tire due to wear, damage, or deviation from manufacturer original specifications.

Appendix B

Methodology

The main goal of the annual Waste Tire Market Report is to quantify the quantity of California-generated waste tires managed (including used tires and retread tires) and the market segments they ultimately flow to. This allows for calculation of a recycling rate and other performance related statistics. Conducting the analysis involves the following steps:

- Updating a master list of California facilities, including waste tire management companies, processors, TDP manufacturers and installers, asphalt rubber blender operators, brokers, retreaders, cement kilns, and landfills that dispose waste tires. Sources include CalRecycle databases, industry networking online searching.
- Compiling information on these facilities through surveys, CalRecycle databases, and online searches.
- Entering facility specific data into a customized flow model spreadsheet and systematically analyzing flows to and from processing facilities and to end-use market segments. This is an iterative process in which researchers identify issues and follow up with facilities to refine and validate the analysis. The process continues until researchers conclude the findings are as complete and accurate as possible, while avoiding double-counting.

In some cases where data are unavailable or contradictory, researchers make estimations based on the information available and perspectives offered by industry representatives.

Readers should keep the following in mind when interpreting and using findings:

- Findings reported in the main body of the report are rounded to the nearest 100 tons, reflecting a reasonable degree of uncertainty. However, the underlying source data used to generate charts, as presented in Appendix C, lists the exact numerical estimates generated through use of the customized flow model.
- The findings quantify California-generated waste tires and TDM/TDPs made from them. Imported waste tires and TDM/TDPs made from them are excluded from the California-generated findings, as are buffings from retread operations, since the rubber has already been “counted” as part of the retreading process.
- The findings do not represent estimates of California’s total market for TDM or TDPs.
- The waste tire market report series employs a consistent methodology that the authors strive to refine and improve over time. This includes very thorough data

gathering and validation through multiple sources where possible, as well as a rigorous and systematic data analysis. Because of this, despite the need to address data gaps and inconsistencies, the authors believe the findings provide reasonably accurate information that can be used to evaluate trends over time.

This report, for the first time, reflects a new reporting convention for crumb rubber and ground rubber that also impacts certain other categories. The authors have adjusted the historical flow estimates for consistency with this new reporting convention. Crumb rubber and ground rubber flows will now be reported as the amount shipped out from supplier facilities, with residual byproducts (i.e., wire and fiber) reported within other categories depending on how they are managed. This refined approach provides a more detailed and complete accounting of waste tire flows and is consistent with CalRecycle's goal to create a circular economy within California.

The reporting convention previously used in this report series was to report the amount of waste tires inbound to supplier facilities that were used to produce crumb rubber and ground rubber. For the first time, the authors have adjusted all prior annual findings accordingly. Data from previous studies informed the adjusted historical data. The net effect of this change is to reduce crumb rubber and ground rubber flows, increase "other recycling" flows (due to recycled residual wire), increase in-state TDF (due to a portion of fiber/fluff being used as fuel at a California cement kiln), and to increase disposal (due to a portion of residual materials that is disposed). For these reasons, compared to the reporting convention used in previous waste tire market reports, the revised approach used in this, and future reports will have somewhat lower recycling and diversion rates and somewhat higher disposal.

Another reporting convention change in this year's report is retitling of "baled waste tires and truck tread" exports as, "baled and cut waste tire" exports. These exported materials are primarily used as fuel according to exporters but are a distinct market from size reduced TDF. In some cases, exporters now bundle three-cut truck tires for export.

Appendix C

Accessibility Notes and Source Data

Following is the source data used for charts and figures in this report. Note that in the body of the report, findings are rounded to the nearest 100, reflecting a reasonable level of accuracy. However, in this appendix we present the exact estimates as generated in the waste tire flow model used by the study team.

Table C-1

Source Data for Figure 1 California Waste Tire Flows in 2020

Category	2020 Tons	2020 Percent
Retreads	45,529	9.5%
Used Tires	51,036	10.7%
Crumb/Ground Rubber	50,530	10.5%
Tire-Derived Aggregate	16,911	3.5%
Other Recycling	11,862	2.5%
Tire-Derived Fuel (In-State)	57,611	12.0%
Tire-Derived Fuel (Export)	73,412	15.3%
Exported Baled and Cut Waste Tires	3,200	0.7%
Alternative Daily Cover	14,876	3.1%
Landfill Disposal	154,050	32.2%
Total Managed	479,017	100.0%
Total Recycled	175,868	36.7%
Total Disposal Related	149,099	31.1%

Table C-2**Source Data for Figure 2 California Waste Tire Recycling, Disposal Related and Disposal Trends, 2008-2020**

Category	2008	2009	2010	2011	2012	2013	2014
Landfill Disposal	145,033	131,152	92,033	63,444	47,908	61,682	66,770
Disposal Related	117,600	114,968	155,603	177,500	222,695	207,754	217,043
Recycled	185,441	165,997	164,206	167,516	179,768	150,741	158,094
% Recycled	41.4%	40.3%	39.9%	41.0%	39.9%	35.9%	35.8%
% Landfill Diversion	67.6%	68.2%	77.7%	84.5%	89.4%	85.3%	84.9%

Category	2015	2016	2017	2018	2019	2020
Landfill Disposal	87,170	150,226	117,448	95,401	95,412	154,050
Disposal Related	202,382	159,654	213,707	241,597	240,503	149,099
Recycled	152,767	145,288	156,994	174,264	182,438	175,868
% Recycled	34.5%	31.9%	32.2%	34.1%	35.2%	36.7%
% Landfill Diversion	80.3%	67.0%	75.9%	81.3%	81.6%	67.8%

Historic flow data for certain categories in the table above may differ somewhat from previously published findings because they have been adjusted for consistency with a new reporting convention instituted for the first time in this report. See Appendix B for details.

Accessibility Notes for Figure 3, California Waste Tire Recycling Industry Flow Chart

This chart illustrates how California waste tires, tire-derived material (TDM), and tire-derived products (TDPs) flow between various entities. Haulers pick up waste tires from generators and may deliver them to either: a landfill for disposal; a processor (who may produce TDM); a used tire buyer or seller; or a TDF consumer (i.e., one of four California cement kilns). Processors may send tires or TDM to a landfill for disposal, use in civil engineering projects, or other beneficial reuses; a used tire buyer or seller; an exporter; a TDP manufacturer or installer; a TDF consumer; or a civil engineering project. Imports into and exports from California include: TDM and TDPs, retread tires and buffings, used tires, tire-derived fuel, baled and cut waste tires, and whole waste tires. Such imports may flow to California processors, TDP manufacturers and installers, TDF consumers, or directly to customers. Such exports may flow from California processors, TDP manufacturers, used tire buyer and sellers, and retreaders.

There are several categories of manufacturers and installers including:

- Accessibility ramps
- Roofing
- Flooring
- Landscape surfaces
- Mats, pavers, and tiles
- Traffic safety
- Equestrian applications
- Pavements
- Synthetic turf infill
- Playground surfaces
- Paths, walkways, and sidewalks
- And many more

Types of civil engineering applications include:

- Landfill projects
- Light-weight fill
- Retaining wall backfill
- Vibration dampening
- Storm water management

Finally, TDP manufacturers and installers, civil engineering project leads, and TDF consumers sell products directly to their customers, inside and outside of California.

Table C-3**Source Data for Figure 4 Historical Market Trends by Segment, 2008-2020**

Category	2008	2009	2010	2011	2012	2013	2014
Disposal	145,033	131,152	92,033	63,444	47,908	61,682	66,770
ADC	20,580	12,042	7,928	19,589	10,486	12,316	14,691
Exported TDF & Bales	22,000	33,000	64,000	96,000	135,000	110,144	110,000
In-State TDF	75,020	69,926	83,675	61,911	77,209	85,295	92,352
Other Recycling	14,460	12,221	12,121	13,427	14,059	12,166	11,643
Civil Engineering	27,890	17,510	18,274	5,915	5,844	4,557	12,632
Crumb/Ground Rubber	65,292	55,000	59,850	61,700	68,350	55,350	49,200
Used Tires	33,600	37,266	37,942	45,823	51,678	38,033	42,278
Retread	44,200	44,000	36,018	40,651	39,838	40,635	42,341
Total Managed	448,075	412,117	411,842	408,459	450,372	420,177	441,907

Category	2015	2016	2017	2018	2019	2020
Disposal	87,170	150,226	117,448	95,401	95,412	154,050
ADC	15,217	16,798	18,108	17,975	16,784	14,876
Exported TDF & Bales	94,000	62,476	113,405	135,236	145,412	76,612
In-State TDF	93,165	80,380	82,194	88,386	78,307	57,611
Other Recycling	12,114	9,790	10,433	16,791	16,442	11,862
Civil Engineering	11,668	10,961	6,431	5,127	13,330	16,911
Crumb/Ground Rubber	54,700	43,165	50,345	61,728	59,985	50,530
Used Tires	30,927	39,032	41,375	42,692	44,757	51,036
Retread	43,358	42,341	48,409	47,925	47,925	45,529
Total Managed	442,318	455,168	488,149	511,262	518,353	479,017

Historic flow data for certain categories in the table above may differ somewhat from previously published findings because they have been adjusted for consistency with a new reporting convention instituted for the first time in this report. See Appendix B for details.

Table C-4**Source Data for Figure 5 Estimated California-Generated Retread Tire Shipments, 2008-2020**

Category	2008	2009	2010	2011	2012	2013	2014
Retreads	44,200	44,000	36,018	40,651	39,838	40,635	42,341

Category	2015	2016	2017	2018	2019	2020
Retreads	43,358	42,341	48,409	47,925	47,925	45,529

Table C-5**Source Data for Figure 6 California-Generated Used Tire Shipments, 2008-2020**

Category	2008	2009	2010	2011	2012	2013	2014
Used Tires	33,600	37,266	37,942	45,823	51,678	38,033	42,278

Category	2015	2016	2017	2018	2019	2020
Used Tires	30,927	39,032	41,375	42,692	44,757	51,036

Table C-6**Source Data for Figure 7 Shipments of California-Generated Crumb Rubber and Ground Rubber, 2008-2020**

Category	2008	2009	2010	2011	2012	2013	2014
Paving	28,066	30,160	35,206	34,043	30,793	24,806	23,429
Turf Infill	15,852	8,723	9,605	11,871	15,089	14,034	11,355
Molded / Other	13,903	7,733	7,308	8,357	10,076	6,583	6,719
Ground Rubber	7,471	8,383	7,731	7,428	12,392	9,927	7,698
Total Crumb/Ground Rubber	65,292	55,000	59,850	61,700	68,350	55,350	49,200

Category	2015	2016	2017	2018	2019	2020
Paving	27,808	NA	NA	NA	NA	NA
Turf Infill	13,415	NA	NA	NA	NA	NA
Molded / Other	4,759	NA	NA	NA	NA	NA
Ground Rubber	8,718	NA	NA	NA	NA	NA
Total Crumb/Ground Rubber	54,700	43,165	50,345	61,728	59,985	50,530

Historic flow data for certain categories in the table above may differ somewhat from previously published findings because they have been adjusted for consistency with a new reporting convention instituted for the first time in this report. See Appendix B for details.

Table C-7

Source Data for Figure 8 California-Generated Tire-Derived Aggregate Shipped for Use in Civil Engineering Projects, 2008-2020

Category	2008	2009	2010	2011	2012	2013	2014
Landfill Projects	20,060	13,975	17,924	5,915	5,844	2,612	8,806
Non-Landfill Projects	7,300	3,535	350	0	0	1,945	3,826
Total TDA	27,890	17,510	18,274	5,915	5,844	4,557	12,632

Category	2015	2016	2017	2018	2019	2020
Landfill Projects	10,374	7,083	5,583	4,021	6,682	16,311
Non-Landfill Projects	1,294	3,878	853	1,106	6,648	600
Total TDA	11,668	10,961	6,431	5,127	13,330	16,911

Table C-8

Source Data for Figure 9 California-Generated Tire-Derived Material Used as Landfill Alternative Daily Cover or in Beneficial Reuse Applications, 2008-2020

Category	2008	2009	2010	2011	2012	2013	2014
ADC/Beneficial Reuse	20,580	12,042	7,928	19,589	10,486	12,316	14,691

Category	2015	2016	2017	2018	2019	2020
ADC/Beneficial Reuse	15,217	16,798	18,108	17,975	16,784	14,876

Table C-9**Source Data for Figure 10 California Whole Waste Tires and TDF Consumed at California Cement Kilns, 2008-2020**

Category	2008	2009	2010	2011	2012	2013	2014
Whole Tire/Size-Reduced TDF	75,020	69,926	83,675	61,911	77,209	81,982	83,934
Fiber TDF	0	0	0	0	0	3,313	8,418
Total TDF	75,020	69,926	83,675	61,911	77,209	85,295	92,352

Category	2015	2016	2017	2018	2019	2020
Whole Tire/Size-Reduced TDF	85,721	72,723	75,989	80,603	70,807	51,315
Fiber TDF	7,443	7,656	6,205	7,783	7,500	6,297
Total TDF	93,165	80,380	82,194	88,386	78,307	57,611

Historic flow data for certain categories in the table above may differ somewhat from previously published findings because they have been adjusted for consistency with a new reporting convention instituted for the first time in this report. See Appendix B.

Table C-10**Source Data for Figure 11 California-Generated TDF and Bales and Cut Waste Tires, 2008-2020**

Category	2008	2009	2010	2011	2012	2013	2014
Size-Reduced TDF	NA	NA	NA	NA	NA	NA	74,000
Baled and Cut Waste Tires	NA	NA	NA	NA	NA	NA	36,000
Total Exported TDF/Bales	22,000	33,000	64,000	96,000	135,000	110,144	110,000

Category	2015	2016	2017	2018	2019	2020
Size-Reduced TDF	66,000	47,476	87,317	99,197	114,427	73,412
Baled and Cut Waste Tires	28,000	15,000	26,089	36,039	30,985	3,200
Total Exported TDF/Bales	94,000	62,476	113,405	135,236	145,412	76,612

Table C-11**Source Data for Figure 12 California-Generated Waste Tires Disposed in Landfills, 2008-2020**

Category	2008	2009	2010	2011	2012	2013	2014
Landfill Disposal	145,033	131,152	92,033	63,444	47,908	61,682	66,770

Category	2015	2016	2017	2018	2019	2020
Landfill Disposal	87,170	150,226	117,448	95,401	95,412	154,050

Historic flow data for certain categories in the table above may differ somewhat from previously published findings because they have been adjusted for consistency with a new reporting convention instituted for the first time in this report. See Appendix B for details.

Table C-12**Source Data for Figure 13 Caltrans Total Asphalt Placed and Percent Rubber Asphalt, 2009-2018**

Year	Total Asphalt Placed (Tons)	RHMA % Total
2009	5,589,914	23.60%
2010	3,860,646	30.60%
2011	7,522,354	34.70%
2012	6,333,678	29.20%
2013	4,578,258	22.90%
2014	4,120,457	26.70%
2015	4,602,421	41.30%
2016	4,785,160	39.80%
2017	4,056,991	45.03%
2018	4,767,951	46.43%

Table C-13**Source Data for Figure 14 Caltrans Use of Crumb Rubber in Paving Projects, 2009-2018**

Year	Crumb Rubber Used (Million Pounds)
2009	40,103,331
2010	35,919,690
2011	77,543,629
2012	52,286,289
2013	32,514,454
2014	35,220,943
2015	60,775,793
2016	60,892,762
2017	58,456,877
2018	70,839,587

Table C-14**Source Data for Figure 15 CalRecycle Rubberized Pavement Grant Program, Average Annual Grant Fund Utilization (\$ Millions per Year)**

Group	Available	Awarded	Expended
Grants Awarded FY 11/12-17/18 (All Closed)	6.8	6.0	3.9
Grants Awarded FY 18/19-20/21 (Some Still Open)	6.7	6.7	NA

Table C-15**Source Data for Figure 16 CalRecycle Rubberized Pavement Grant Program, Average Annual Crumb Rubber Use (Million Pounds per Year)**

Group	Projected	Actual
Grants Awarded FY 11/12-17/18 (All Closed)	11.6	8.7
Grants Awarded FY 18/19-20/21 (Some Still Open)	12.5	NA

Table C-16**Source Data for Figure 17 CalRecycle Tire-Derived Product Grant Program, Average Annual Grant Fund Utilization (\$ Millions per Year)**

	Available	Awarded	Expended
Grants Awarded FY 05/06-12/13 (All Closed)	4.8	4.6	3.2
Grants Awarded FY 13/14-16/17 (All Closed)	1.7	1.7	0.8
Grants Awarded FY 17/18-20/21 (Some Still Open)	0.7	0.6	NA

Table C-17**Source Data for Figure 18 CalRecycle Tire-Derived Product Grant Program, Average Annual Tire Rubber Use**

Group	Actual Crumb Rubber Use (Million Pounds Per Year)
Grants Awarded FY 05/06-12/13 (All Closed)	10.1
Grants Awarded FY 13/14-16/17 (All Closed)	2.9
Grants Awarded FY 17/18-20/21 (Some Still Open)	NA

Table C-18**Source Data for Figure 19 CalRecycle Tire Incentive Program, Average Annual Funding Utilization (\$ Millions per Year)**

Group	Available	Awarded	Expended
Grants Awarded FY 13/14-18/19 (All Closed)	2.8	2.1	1.2
Grants Awarded FY 19/20-20/21 (Some Still Open)	3.3	2.6	

Table C-19

Source Data for Figure 20 CalRecycle Tire Incentive Program, Annual Trend in Fund Utilization, FY2013-14 Through FY2018-19

Fiscal Year	Expended %
FY 13/14	45.9%
FY 14/15	17.2%
FY 15/16	54.7%
FY 16/17	60.2%
FY 17/18	66.4%
FY 18/19	90.6%

Table C-20

Source Data for Figure 21 CalRecycle Tire Incentive Program, Average Annual Crumb Rubber Use (Million Pounds per Year)

Group	Projected	Actual
Grants Awarded FY 13/14-18/19 (All Closed)	18.2	10.9
Grants Awarded FY 19/20-20/21 (Some Still Open)	22.0	NA

Table C-21

Source Data for Figure 22 CalRecycle Tire-Derived Aggregate Grant Program, Average Annual Grant Fund Utilization (\$ Millions per Year)

Group	Available	Awarded	Expended
Grants Awarded FY 11/12-17/18 (Now Complete)	1.32	0.68	0.23
Grants Awarded FY18/19-20/21 (Some Still Open)	0.82	0.45	

Table C-22**Source Data for Figure 23 CalRecycle Tire-Derived Aggregate Grant Program, Average Annual TDA Use (Million Pounds per Year)**

Group	Projected	Actual
Grants Awarded FY 11/12-17/18 (Now Complete)	16,036	5,027
Grants Awarded FY18/19-20/21 (Some Still Open)	11,207	NA

Table C-23**Source Data for Figure 24 State Agency Buy-Recycled Campaign, Retread Tire Purchasing, FY2015-16 Through FY2018-19**

Category	FY15-16 (55 Agencies)	FY16-17 (68 Agencies)	FY17-18 (66 Agencies)	FY18-19 (52 Agencies)
New Tires	\$7,651,482	\$5,613,399	\$6,078,300	\$7,979,296
Retread Tires	\$860,827	\$863,994	\$621,439	\$597,126
% Purchasing Compliance	10%	13%	9%	6%
Total purchasing	\$8,512,309	\$6,477,393	\$6,699,739	\$8,576,422

Table C-24**Source Data for Figure 25 State Agency Buy-Recycled Campaign, Tire-Derived Product Purchasing, FY2015-16 Through FY2018-19**

Category	FY15-16 (39 Agencies)	FY16-17 (52 Agencies)	FY17-18 (51 Agencies)	FY18-19 (47 Agencies)
Non-Compliant Products	\$220,717	\$292,755	\$313,532	\$419,369
Tire-Derived Products	\$4,280,104	\$286,711	\$684,797	\$4,434,973
% Purchasing Compliance	95%	49%	68%	91%
Total Purchasing	\$4,500,821	\$579,466	\$998,329	\$4,854,342

Table C-25**Source Data for Figure 26 California Waste Tire Recycling, Disposal Related and Disposal Trends, 2008-2020**

Category	2008	2009	2010	2011	2012	2013	2014
Landfill Disposal	145,033	131,152	92,033	63,444	47,908	61,682	66,770
Disposal Related	117,600	114,968	155,603	177,500	222,695	207,754	217,043
Recycled	185,441	165,997	164,206	167,516	179,768	150,741	158,094
% Recycled	41.4%	40.3%	39.9%	41.0%	39.9%	35.9%	35.8%
% Landfill Diversion	67.6%	68.2%	77.7%	84.5%	89.4%	85.3%	84.9%

Category	2015	2016	2017	2018	2019	2020
Landfill Disposal	87,170	150,226	117,448	95,401	95,412	154,050
Disposal Related	202,382	159,654	213,707	241,597	240,503	149,099
Recycled	152,767	145,288	156,994	174,264	182,438	175,868
% Recycled	34.5%	31.9%	32.2%	34.1%	35.2%	36.7%
% Landfill Diversion	80.3%	67.0%	75.9%	81.3%	81.6%	67.8%

Historic flow data for certain categories in the table above may differ somewhat from previously published findings because they have been adjusted for consistency with a new reporting convention instituted for the first time in this report. See Appendix B for details.

End Notes

¹ Historic flow data for certain categories as presented in this report may differ somewhat from previously published findings because they have been adjusted for consistency with a new reporting convention instituted for the first time in this report. See Appendix B for details.

² [“California will recover from the pandemic faster than the U.S., forecast says.”](#) Los Angeles Times, March 10, 2021. Accessed online on May 20, 2021.

³ [“All of the COVID-19 stimulus bills, visualized.”](#) U.S.A. Today, March 11, 2021. Accessed online on May 20, 2021.

⁴ California All, COVID-19 [Get Financial Help Web Page](#) accessed on May 20, 2021.

⁵ [“Construction Spending Remains Robust in State Budget for 2021-22.”](#) California Asphalt Paving Association. California Asphalt Magazine, 2021 Forecast Issue. January 2021.

⁶ See end note 1.

⁷ See end note 1.

⁸ See end note **Error! Bookmark not defined..**

⁹ [Turf Infill Studies](#). California Department of Environmental Health Hazard Assessment.

¹⁰ See end note **Error! Bookmark not defined..**

¹¹ See end note **Error! Bookmark not defined..**

¹² California State Transportation Agency (Cal-STA). Annual Crumb Rubber report series, for years 2009-2018. Reports covering 2011 through 2016 are available online [here](#). The 2018 report is available [here](#).

¹³ See end note 15.

¹⁴ See end note 15.

¹⁵ Caltrans bid documents are published online on [Caltrans Bidding Connect](#).

¹⁶ Caltrans crumb rubber use is estimated based on an assumption that RHMA is comprised of 8 percent binder, which in turn contains on average 20 percent crumb rubber.

¹⁷ Information on the CalRecycle Rubberized Pavement Grant Program is available online [here](#).

¹⁸ Boisson Consulting analysis of grant program data provided by CalRecycle staff.

¹⁹ See end note 21.

²⁰ Information on the CalRecycle Tire-Derived Product Grant Program is available online [here](#).

²¹ See end note 21.

²² See end note 21.

²³ Information on the CalRecycle Tire Incentive Program is available online [here](#).

²⁴ See end note 21.

²⁵ See end note 21.

²⁶ See end note 21.

²⁷ Information on the CalRecycle Tire-Derived Aggregate Grant Program is available online [here](#).

²⁸ See end note 21.

²⁹ See end note 21.

³⁰ Information on RMDZ Loan Program is available [here](#) and a searchable database of past recipients is available [here](#). Information on RMDZ locations and contacts is available [here](#).

³¹ Information on the CalRecycle State Buy-Recycled Campaign (SABRC) is available online [here](#).

³² Boisson Consulting compilation and analysis of data from annual CalRecycle staff reports presenting results from the State Agency Buy-Recycled Campaign. The annual reports are available online [here](#).

³³ See end note 36.

³⁴ Draft Five-Year Plan For The Waste Tire Recycling Management Program (Eleventh Edition Covering Fiscal Years 2021-22 to 2025-26). July 1, 2021

³⁵ California Department of Resources Recycling and Recovery (CalRecycle). "State of Disposal and Recycling for Calendar Year 2019" Available online [here](#).

³⁶ See end note 1.