

Tires

COMMODITY PROFILE

North Carolina Department of
Environment and Natural Resources
DIVISION OF POLLUTION PREVENTION AND
ENVIRONMENTAL ASSISTANCE

MARKETS ASSESSMENT 1998



OVERVIEW

Discarded, whole tires have been banned from disposal in landfills in North Carolina since March 1, 1990. An advanced disposal fee of two percent on the purchase of new tires provides funding to North Carolina counties to operate tire management programs. A portion of proceeds from the advanced disposal fee also goes into the Scrap Tire Disposal Account (STDA), administered by the Division of Waste Management (DWM). Due to a change in the law passed by the General Assembly in 1997, a portion of the STDA may be used to develop end use markets for processed tire materials. The DWM will lead a multi-departmental program through 2003 to distribute market development grants to worthy projects that consume tires generated in North Carolina. Two grant rounds have been completed to date, resulting in three grant project awards for uses of processed tires in molded products, as fuel, and in tire manufacturing.

SUPPLY

Generation

Thanks to strong state laws governing tire management, North Carolina has excellent data on the generation of discarded tires. The DWM documents the generation of discarded tires through its annual Scrap Tire Management Report.¹ Findings from the most recent report, covering fiscal year 1996-97 (July 1 through June 30), are presented in Figure 1.

In part because North Carolina prohibits counties from charging local tipping fees on tires (all local costs should be covered by distributions from the state advanced disposal fee), the state is a net importer of discarded tires from surrounding states. The DWM estimates that "normal" annual in-state generation of used tires is approximately 7.3 million tires. Thus, the 9.5 million tires includes about 2.2 million out-of state tires inadvertently managed through county programs.

Figure 1. Tires Managed in North Carolina, fiscal year 1993-94 through fiscal year 1996-97

Fiscal Year	Tires Managed
FY 1993-94	7.6 million
FY 1994-95	9.3 million
FY 1995-96	9.2 million
FY 1996-97	9.5 million

Figure 2. Estimate of Tire Generation (Supply) through 2002

	1996	1997	2002
In-state tires	7.3 million	7.54 million	7.89 million
Out-of-state tires (managed by NC county programs)	2.2 million	2.0 million	1.0 million*
Total tire supply	9.5 million	9.54 million	8.89 million

*Reflects successful efforts to stop out-of-state influx.

The DWM hired a designated staff person in fiscal year 1997-98 to work with counties to stop the influx of out-of-state tires. As this program grows, the amount of tires managed by local governments in North Carolina will likely decrease. Private processors of tires in the state will continue to receive some out-of-state tires directly, and that number may grow as North Carolina's tire recycling infrastructure strengthens. (See *Demand* section below.) Currently, tire processors located in North Carolina already manage about four million tires directly from out-of-state sources (in addition to 9.5 million tires managed largely through local programs).

The number of in-state generated tires managed will grow as North Carolina's population increases. A rule-of-thumb in estimating tire generation is one discarded tire generated per person per year, which can be used to project the in-state tire "supply" through 2002. The other variable in North Carolina's tire management effort is the number of out-of-state tires that will be managed by local government programs over the coming years. Figure 2 provides an estimate of tire generation (or available supply) through 2002.

Recovery

According to the fiscal year 1996-97 *Scrap Tire Management Report*, six companies managed the vast majority of generated scrap tires in North Carolina. These companies reported diverting approximately 4.7 million tires from disposal, or about 45 percent of what they received in fiscal year 1996-97. The report estimates the end uses to which the diverted tires were directed, as represented in Figure 3.

A majority of the remaining 55 percent of tires (about 5.8 million tires) that are not diverted from disposal in North

Carolina go to "monofills," or landfills allowed to take only one kind of material. The largest monofills are also controlled by a few of the six companies mentioned above. Conceivably, the tires disposed at these monofills represent a future potential supply that could be "mined" and returned to productive use. The cost and challenge of retrieving and processing the disposed tires will be quite formidable, however, and may not be feasible until high value-added markets are developed for processed tire material. Thus, the most likely available supply to meet any growing market demand will be the portion of annual generation of tires that are currently disposed.

Prices and Market Dynamics

Tires are currently a negatively priced commodity (i.e., processors charge a fee to receive and convert tires into usable products). Such products can range from very fine, metal-free "crumb" rubber for use in manufacturing rubber products to larger "chips" usable as fuel or as a substitute for aggregate. The cost charged at the gate by first line processors of tires in North Carolina was between \$55 to \$65 per ton in fiscal year 1996-97.² In effect then, the market price for whole tires is currently about -\$60 per ton.

The negative market value of tires reflects at least two factors: 1) the high cost and difficulty of collecting and processing tires, and 2) the immaturity of end use markets for processed tire materials. In future pricing, the first factor will remain relatively unaffected by market development efforts. The second factor, however, may begin to change substantially by 2002 as the State's market development grant program increases processed tire demand. It is unlikely that whole, discarded tires will have positive market value anytime soon (except in the retread market), but price

Figure 3. End Use Markets for Recycled Tires in North Carolina, fiscal year 1996-97

End Use Market	Approximate Numbers of Tires Recycled	Approximate Percentage of North Carolina Tires
Tire Reuse, Remanufacturing, and Retreading	473,000	5%
Tire-Derived Fuel	426,000	4%
Crumb Rubber	909,000	9%
Agricultural and Misc. Products	776,000	7%
Civil Engineering Applications	2,119,000	20%
Total	4,703,000	45%

trends should steadily improve over the next decade as competing end uses expand.

DEMAND

Market demand for tires in North Carolina should grow considerably as the result of the end-use grant program established by legislative action in 1997. With approximately \$5 million in grants available between 1998 and 2003, the state can be expected to reach its goal of sustainable market consumption of all discarded tires generated on an annual basis by 2005. It is possible as well that North Carolina's processing and end use infrastructure for tires will be healthy enough to consume a large supply of out-of-state tires.

The kinds of markets that can be expected to strengthen or develop include tire-derived fuel, crumb rubber based products, construction and civil engineering projects, and possibly old-tire-to-new-tire manufacturing. The Scrap Tire Management Council (SMTC) reports that there are now more than 110 new products that contain recycled tire rubber; SMTC estimates the fastest growing new markets for processed tires include playground cover, soil amendments, and flooring/matting.³ Details on these markets are provided below.

Reuse, Retreading, and Remanufacturing

This market category for tires includes both a long-standing outlet for discard tires³/₄ retreading³/₄ and a new, potentially large scale outlet³/₄ tire-to-tire manufacturing. Direct reuse of discarded tires has also been standard practice in the tire industry as tire dealers cull usable tires removed from cars and trucks for re-sale. It is assumed, however, that the direct reuse market is close to its maximum growth potential.

Retreading has been a particularly strong market for truck tires, but less so for automobile tires. The Tire Retread Information Bureau reports that 30.9 million retreaded tires were sold in North America in 1997, with 25 percent of

those tires sold for use on light trucks and 61 percent for medium and heavy trucks.⁴ For medium trucks, retreads constituted 58 percent of all tire replacements. The report also states that there are 1,440 retread plants in North America, many of which are small, independently owned businesses. The retreading industry points to potential cost savings and environmental benefits from using retreads, without sacrificing performance or safety. However, data presented on the World Wide Web home page of the International Tire and Rubber Association (ITRA) indicates that retread sales growth is slow.⁵ Extrapolating from this data, it would appear that unless there are large switchovers or expansions in fleet usage of retreads in North Carolina, this market will remain a small potential consumer of currently disposed tires.

A more promising potential market for discarded tires is "tire-to-tire" manufacturing, the target of a recent grant cycle conducted by the Division of Waste Management. DWM has awarded a \$380,002 contract to Continental General (Charlotte, North Carolina) to develop new processes and technologies to incorporate recycled tire materials into new tires. Technical challenges, including the apparent need to "de-vulcanize" recycled tire rubber, have prevented large-scale tire-to-tire recycling to date. The four-year Continental General project could result in end use demand for between two to 5.5 million PTE (passenger tire equivalents), or between 27,000 and 68,000 tons of processed tire material.

Tire-Derived Fuel

Tire-derived fuel (TDF) is by far the leading market for recovered tires nationally. The Recycling Research Institute estimates that 152 million tires, or 76 percent of all tires diverted from disposal in 1996, were burned for their energy content at cement kilns, pulp and paper mills, utility boilers, industrial boilers and dedicated TDF plants.⁶ Research by the Division of Pollution Prevention and Environmental Assistance (DPPEA) in the summer of 1997 indi-

cated that TDF markets have played a critical role in the states that are consistently diverting their annual generation of tires from disposal. Few other singular end uses can consume the same large volume of tires that TDF can within a single project or application.

A TDF project for a North Carolina-based paper mill was one of two originally awarded grants in the first tire market development grant round conducted by DWM in 1998. However, the project has experienced delays, in part related to air quality permitting issues. The North Carolina Division of Air Quality has indicated that permitting for TDF projects may be complicated and difficult.

Nevertheless, North Carolina has a number of potentially large-scale TDF users, some of which have already cleared at least a few of the regulatory barriers. DWM will maintain an interest in funding TDF projects, because the experience of other states is so compelling that TDF is a critical part of a comprehensive tire diversion infrastructure. It is likely, therefore, that a sizable project will develop between 1998 and 2002 for the consumption of TDF.

Crumb Rubber

The Scrap Tire Management Council estimates that 12.5 million scrap tires were processed into ground rubber in 1996.⁷ "Crumb" or finely ground rubber is used to make a variety of products from mats to flooring to rubber hoses. The American Society of Testing and Materials (ASTM) has recently developed scrap tire crumb rubber specifications, which should help the markets for crumb mature and expand.⁸

A significant potential market for crumb rubber is use as an additive to asphalt in road building. That practice has met with stiff resistance from road-builders in North Carolina, but appears to be expanding in use in states such as California, Texas, and Arizona.⁹ Although technical and other concerns may eventually be addressed, the reluctance of the Department of Transportation (DOT) and road-builders in North Carolina to use rubberized asphalt preclude that market as an immediately expandable outlet for tire processed material.

Other markets for crumb rubber hold more promise. Proposals received in the first tire market development grant round demonstrate a variety of possible applications, including use in making truck tire flaps, shoe soles, furniture parts, floor tiles, playground surfaces, athletic field soil additive, and decorative landscape blocks. The wide variety of proposed uses, the aggressive search for new crumb applications and markets, and the availability of state grant fund-

ing during the next five years make crumb rubber a high potential market growth area for North Carolina tires. The value-added nature of crumb markets should also enhance the economics of tire recycling in the state.

One of the proposals awarded funding in the first grant cycle will expand the consumption of crumb rubber by a manufacturer of solid rubber tires (such as those used on refuse carts). This project will result in added end use capacity for tires in North Carolina of 940 tons of high quality crumb, equivalent to 171,000 passenger tires.

The automotive industry could have a potentially large positive impact on crumb markets in such products as belts, hoses, and other car components. Ford Motor Company in particular has begun to ask its suppliers to deliver more products with recycled content. North Carolina has a number of rubber auto parts manufacturers that may also respond to state grant incentives to switch to recycled feedstock.

Agricultural and Miscellaneous Products

Processed tires are being used in a variety of agricultural applications, including matting for livestock operations. Other products have also been made from tires through punching, stamping, and other types of crude processing (as opposed to grinding into crumb). The Scrap Tire Management Council estimates that eight million tons of discarded tires were punched or stamped into new products in 1996.¹⁰

This market may enjoy moderate growth in North Carolina, in part as a result of grant funding for specific projects by DWM. Proposals received in the first end use grant round included projects to make tires into road barriers, rubber door mats, and segmented farm and industrial tires. Although none of these proposals were awarded funding, it appears that product development is active in this area and may result in expanded uses for North Carolina generated tires.

Civil Engineering Applications

Along with TDF, civil engineering applications offer another large outlet for tire "chips." As shown previously in Figure 3, civil engineering projects are by far the current leading market for tires in North Carolina. The Scrap Tire Management Council reports that 10,000,000 tires were used nationally in civil engineering applications in 1996.¹¹ A majority of these uses were initiated by state departments of transportation that apply tire chips as fill. The other major civil engineering use for tire chips has been as aggregate for septic drain fields.

Figure 4. Recycled Tire Materials Average Price History for Selected Sizes*

Material and Size	1994-95	1995-96	1996-97	1997-98
¼ inch crumb rubber	\$205	\$188	\$177.5	\$205.90
10 mesh crumb rubber	\$225	\$260	\$236.70	\$228.90
40 mesh crumb rubber	\$460	\$463	\$430	\$474
80 mesh crumb rubber	\$600	\$587	NA	\$546
1 inch minus TDF	\$28.20	\$36.60	\$24.70	\$23.25
Whole tire fuel	NA	-\$25	-\$55	-\$42.50
Civil Engineering Tire Chips/Shreds (3-4 inches)	NA	NA	NA	\$5.50

* All prices are for one ton of materials.

Tire fill fires in Oregon and Washington state in 1995 and 1996 put something of a damper on this use of tire chips, causing many states to re-examine this practice to make sure it was safe. The Federal Highway Administration (FHWA) investigated the fires and produced a set of interim guidelines for use of tires in embankment fills. NCDOT received approval from FHWA for its methods of constructing tire fills and has continued to apply them in projects around the state. The NC DOT Recycling and Solid Waste Management Report for fiscal year 1997 estimates that 619,530 tires were used in embankment fills that year, down from the DOT-set goal of using one million tires per year.¹² If NCDOT is able to meet or exceed its goal, it will help provide a consistent, large-scale outlet for tires in the state.

Tire chips have been used as an aggregate in septic drain fields in South Carolina for a number of years, and consumption for this use has expanded dramatically. Though not yet approved for use in North Carolina septic fields, a North Carolina-based maker of septic tire fill indicated in a tire end use grant proposal that it had already reached a production level of two million tires annually. If approval is given in North Carolina, this outlet could become even more significant for the state's tires.

Prices

The Scrap Tire and Rubber Users Directory, 1998 contains information on prices paid for processed tire materials, which is summarized in Figure 4. The table shows average prices paid in 1997-98 for a sampling of material sizes. For a more complete breakdown, see *The Scrap Tires and Rubber Users Directory*.¹³

As Figure 4 shows, prices are highest for smaller processed tire material. This advantage is counterbalanced by the extra expense and difficulty of processing tires to increasingly smaller and cleaner specifications. In general, prices for processed tire material have stayed fairly steady, fluctuating within a narrow range during the past four years.

Projected Demand

Figure 5 projects market consumption for discarded tires in North Carolina in 2002. Much of the market development will occur in response to grants given by the state of North Carolina. If these projections are reached, tires will probably have the highest recycling rate of any specific discarded material in North Carolina, approaching 100 percent of annual generation.

CONCLUSION

Market demand for tires in North Carolina should grow considerably as the result of the end-use grant program administered by DWM. With approximately \$5 million in grants available between 1998 and 2003, the state can be expected to reach its goal of sustainable market consumption of all discarded tires generated on an annual basis by 2005.

RECOMMENDATIONS

The following recommendations are based on the study of generation, recovery and markets for tires in North Carolina presented in this section.

- North Carolina state agencies and local governments should use their purchasing power to strengthen recycling markets for tires (for example, buying retread tires when possible and products made with processed tire materials).
- The state should work with the automotive industry to encourage use of recycled-content rubber products and to help specific manufacturers convert from virgin to recycled rubber as a product feedstock.
- The state should continue to establish sustainable, value-added markets for processed tire materials through its end-use grant program.

Figure 5. Projected End Use Markets for Recycled Tires in North Carolina, 1997 to 2002

End Use Market	Approximate Numbers of Tires Recycled, 1997 (percentage of total tires in parentheses)	Approximate Numbers of Tires Recycled, 2002, (percentage of total tires in parentheses)
Tire Reuse, Remanufacturing, and Retreading (including tire-to-tire manufacturing)	473,000 (5%)	1,520,300* (17%)
Tire-Derived Fuel	426,000 (4%)	2,000,000** (23%)
Crumb Rubber	909,000 (9%)	1,800,000** (20%)
Agricultural and Misc. Products	776,000 (7%)	899,600*** (10%)
Civil Engineering Applications	2,119,000 (20%)	2,456,500*** (28%)
TOTAL	4,703,000 (45%)	8,676,400 (98%)

* Assumes 10 percent growth in reuse/retreading markets and Continental General meeting half of its lower end projection of tires consumed in tire-to-tire manufacturing.

** Assumes effects of state grant-making targeted at these two categories.

*** Assumes three percent growth per year during five years.

¹ Division of Solid Waste Management, Solid Waste Section, *Scrap Tire Management Report, FY 1996-97*, October 1997.

² Ibid.

³ Scrap Tire Management Council web site: <http://www.rma.org./scrapfct.html>

⁴ The Tire Retread Information Bureau, "News Release About Tires," January 1998, p. 1.

⁵ International Tire and Rubber Association website: <http://www.itra.com/corporate/welcome.html>

⁶ Recycling Research Institute, *The Scrap Tire and Rubber Users Directory 1998*, Suffolk, CT, p. 66.

⁷ Scrap Tire Management Council web site: <http://www.rma.org./scrapfct.html>

⁸ Powell, Jerry, "Signs of Maturing Industry: The Recent Growth in Scrap Tire Recovery," *Resource Recycling*, March 1997, p 25.

⁹ The Rubber Pavements Association reported in its summer 1998 newsletter that the Arizona Department of Transportation will use 2.4 million tires in roads in construction year 1998.

¹⁰ Scrap Tire Management Council web site: <http://www.rma.org./scrapfct.html>

¹¹ Ibid.

¹² North Carolina Department of Transportation, *Recycling and Solid Waste Management Report, Fiscal Year 1997*, p. 1.

¹³ Recycling Research Institute, *The Scrap Tire and Rubber Users Directory 1998*, Suffolk, CT, p. 67.