Off-the-road tires are much the same as on-road car and truck tires, they’re just larger—sometimes much, much larger. That’s both the opportunity and the challenge they present to tire recyclers, says Mary Sikora, publisher of *Scrap Tire News* (Leesburg, Va.). “These tires have a lot of valuable material: One large OTR tire equals many smaller tires.” For example, one 51-inch-diameter-rim OTR tire can yield up to 2,000 pounds of crumb rubber; an 8,000-pound OTR tire can have 800 pounds of steel. The largest ones can have up to six steel belts, four bead bundles, and up to 50 plies of rubber each, Sikora says. How large are they? The largest, typically used on mining and similar earth-moving vehicles, can reach 13 feet in diameter with tread widths up to 70 inches and weigh 8 tons, says Rob Stokes, president of Western Tire Recyclers (Tremonton, Utah). The material is...
basically the same as what’s in passenger and truck tires, says Gene Day, president of Hobbs Iron & Metal (Hobbs, N.M.) and a partner in State Rubber and Environmental Solutions (Denver City, Texas), which produces crumb rubber. “There’s just lots more of it.” Large OTR tires—9 feet in diameter and greater—have more virgin rubber in them, however, and could generate higher-quality crumb rubber, says Julie Prochello, president of Eagle International (Dakota Dunes, S.D.), a 23-year-old firm that manufactures tire cutting and recycling equipment.

Although all of this material might sound enticing, “adding mining tires to your current truck- and passenger-tire processing plant isn’t going to be as easy as you might think,” warns Greg Wright, sales director for Granutech-Saturn Systems Corp. (Grand Prairie, Texas). It can be “a recipe for disaster for processors with the wrong equipment.” Julie Prochello agrees that “you need to go in with your eyes open.” The rubber is thicker and more expensive to process than standard passenger and truck tires, says Dave Fleming, industrial sales specialist for SSI Shredding Systems (Wilsonville, Ore.). Given the amount of rubber in these tires that doesn’t have steel or nylon in it, however, the material could work well for ground cover and crumb markets, he says. Tire processors need to consider the sizes and types of OTR tires they’ll accept, whether they can cost-effectively secure a sufficient supply and adequate end markets, and what investments they might need to make in equipment and other infrastructure to process them.

**DEMAND AND SUPPLY**

To date, end markets for the largest tires have been difficult to establish or limited in size, Sikora says. With minimal, low-tech processing, companies turn some of them into items such as cattle feeders or water troughs. USA Tire Management Systems (Sioux City, Neb.), for example, collects about 100 to 140 earth-moving tires every few months from rock quarries, copper mines, and coal mines and turns them into cattle feeders and water cisterns, says Manager David Prochello, who’s also an on-site training manager for Eagle International and Julie Prochello’s husband. For about five years, Western Tire Recyclers has made cattle water tanks out of OTR tires, as well as rubber landscape and playground mulch that consists of larger pieces of rubber than traditional mulch. The company processes an average of about 3,500 tons of OTR tires a year, typically those with rim sizes of 57 or 63 inches, Stokes says. As with other markets, the demand for these products is tied to the economy, he says: When cattle prices go up, so does the demand for water tanks.

The supply picture also requires careful consideration, especially if you plan to build your business around OTRs, says Charlie Astafan, general manager of Columbus McKinnon Corp. (Sarasota, Fla.). “Where is that tire supply, and how are you going to get your hands on it? Are you going to have competition?” Other tire recyclers could be competitors or suppliers. “Sometimes processors will accept the tires, but they have no way of processing them,” Stokes says. “That’s one way we’ve gotten some of our business.”

The volume of U.S. OTR tires available for recycling each year remains a mystery, industry watchers say. “We don’t know exactly how many of them enter the scrap stream because no one really tracks it,” Sikora says. About 3 million OTRs are placed on vehicles or equipment in North America each year, she explains, but because they’re expensive, consumers retread and repair them to extend their lives as much as possible. Still, using OTR tire sales data, she estimates the United States generates thousands of tons of these scrap tires each year.

One factor that likely affects supply is the lack of a management system for these tires. Most of the interest in processing them comes from countries with legislation that dictates their processing, Fleming says. “Without legislation in place, I don’t feel that the business makes financial sense.” Whereas most states have mandatory tire takeback systems or fees to prevent the dumping or landfilling of on-road car and truck tires, that’s not the case for most OTRs. “Mining tires that can’t be retreaded or repaired have been traditionally left in vacant lots at the mining sites, and some are buried in abandoned mines,” Sikora says. Some mining companies are starting to realize that burying tires isn’t environmentally sustainable, however, Stokes says. They’re “trying to be proactive. They understand what’s going to happen if
things don’t change.” Some of these firms hire Western Tire Recyclers to recycle their tires and audit the facility to ensure it processes them in the manner it says it does.

The federal government is reviewing policies that allow burying or abandoning OTRs at mining sites, Sikora says. She expects the federal and state governments to eventually put an end to the practice, which would make more of the largest tires available to recyclers—and could awaken more interest in recycling them.

Pressure from environmental groups and government agencies on the mining community to recycle OTRs also could lead to increased disposal fees being charged for processing them, which could make them worth the additional investment they might require, says Mike Hinsey, international vice president of Granutech-Saturn Systems.

Adding to the difficulty of tracking the OTR tire market is the broad range of tires that can carry that label, Sikora says. Technically, she explains, it covers tires used on construction and scrap-handling vehicles such as wheel loaders, backhoes, trenchers, and forklifts; agricultural-vehicle tires; small tires from all-terrain vehicles and dirt bikes; and mining vehicle, aircraft, and racing tires. Some processors consider any tire not used on roadways an OTR tire; others use the term just for tires above a certain size or weight. “This diversity and range make it difficult to get good numbers on how many tires this represents in the recycling industry,” she says. Fleming typically categorizes the largest tires, such as those used on mining or earth-moving vehicles, as OTR tires; the rest he calls industrial tires, he says.

COLLECTING, TRANSPORTING, AND HANDLING
Regardless of what they call such tires, processors must determine what types and sizes they’ll accept. Although State Rubber and Environmental Solutions could accept tires of any size, it primarily processes agricultural-vehicle tires, Day says. “We’re in a large agricultural area, so that makes sense.” Four D Corp. (Duncan, Okla.) also focuses on tractor tires, says Max Daughtrey, co-owner and vice president of operations—ones that fit on the stock trailers the company’s haulers use. Daughtrey doesn’t accept tires wider than 20 inches—otherwise they won’t fit into the tire cutter, he says. “We don’t collect that many—maybe a couple of thousand a year.”

As Daughtrey notes, processors can collect smaller OTR tires with the same vehicles they use to transport passenger and truck tires. The largest tires are another matter. Very few processors tackle earth-moving tires, Sikora says. They “have to be looked at differently” because they’re difficult and expensive to load and transport, she says. “The supply is most likely going to be very geographically close because you can’t move them very far.” Often their height, width, and, sometimes, weight require using a special permit to transport them, Wright says. “The weight of a single tire won’t cause a permitting issue, but multiple tires would.”

Given the additional costs for transporting and handling these tires, some processors charge a per-ton or flat fee to take them, Sikora says. She’s heard of charges as little as $20 a tire and as much as $600 a ton. Mines used to pay USA Tire Management to take their tires, David Prochello says, but that changed after a tire shortage a few years ago. “We haven’t gotten back to the point where we can start charging.”
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he says. “The expense is all on me.”

Despite the cost, “we get the tires wherever we can,” he says. “We do cleanups around the country.” For example, the firm recently collected more than 4,000 mining tires over a six-month period from a cleanup project in Sioux Falls, S.D. He estimates it costs his company about $2,000 on average to move four earth-moving tires about 630 miles. He uses trucks with step-deck trailers, where the back 37 feet of the flatbed sit 16 inches lower than a normal flatbed, which makes it easier to stack smaller tires to get enough weight on the truck. About three of the largest tires—which weigh about 16,000 pounds each, stand 13 feet high, and have 70-inch tread widths and 57-inch-diameter rims—will fit on the bed of the truck at a time, he says. “If they’re worn out a little bit, I can get four [per trailer], but that’s tough.”

If the logistics challenges of transporting tires that size seem too daunting, tire processors can downsize the tires on site with a shear before bringing them to their facilities for further processing, Sikora says. David Prochello transports his tire-cutting equipment, including tire punchers and handlers, on a semi-tractor trailer to preprocess tires on site, he says. Although Prochello takes his leftover tire pieces to a licensed tire monofill in Kansas, he’s concerned that many of the processors who make water tanks on site don’t dispose of their tire scraps properly, he adds. “A lot of them will cut on site and then tell the customer [it] has to take care of the scraps.” Western Tire Recyclers, which receives tires from six Western states, only processes at its plant, Stokes says. The No. 1 reason is safety, followed by efficiency, he says. “We have more control, and we do not expose the mine to added liability by having our equipment and personnel at its site. Our goal is to make OTR tire recycling safe, sustainable, and convenient for the mine.”

Safety is a major concern when handling OTR tires, Astafan says. “Do not underestimate them.” They require specialized equipment not just for processing, but also for removing them from the truck and moving them around the yard. When moving them and trying to stack them, “stay away from them, and do whatever you can to not drop one,” David Prochello says. “It takes a lot to stop one of these tires once they start rolling.”

Best practices for handling large OTR tires include using two points of contact when picking them up with a tire handler, Granutech-Saturn Systems’ Wright says. At mine sites, the Mine Safety and Health Administration (Arlington, Va.) requires a tire handler that grips the outside of the tires, Prochello says, but he prefers grabbing the tires from the inside using heavy-duty, 6-foot forks on a rough-terrain Gehl forklift. “It’s easier for us and a lot more expedient,” especially when loading the tires into processing machines. Even after
downsizing the tires, processors need to use care when handling the segments, Julie Prochello says. “That tire wore out at about 10,000 pounds,” she points out. Even when cut into 8 or 16 segments, “those pie sections weigh a lot.”

Another concern is contamination, Astafan says. “Many of these tires have been stored at the mines in monofills. Some are above ground, and some have been buried. You need to think about what could be embedded in these tires—especially if you’re putting [them] into a shredder,” he explains. Stokes agrees, pointing out that rocks and other foreign objects such as pieces of steel sometimes become lodged in the tires. Because these objects are hard on equipment, workers watch for and remove them while vertically processing the tires into mulch with a machine that rotates a tire while shaving it, he adds.

**PROCESSING CONSIDERATIONS**

Although some primary tire shredders can handle whole OTRs up to 8 feet in diameter, most tire recyclers will want to downsize larger tires before feeding them into the shredder, says Granutech-Saturn Systems’ Hinsey. “When you’re considering tires 10 feet in diameter and above, you’re probably looking to prep them, which could mean cutting the bead bundles out ... splitting them in half, [and/or] cutting them into pie-shaped sections [before] putting them in a shredder.”

Julie Prochello recommends removing the bead bundles for less wear on the shredder. Also, “then you can recycle the high-carbon steel.” Steel bundles in the larger OTR tires can weigh as much as 490 pounds per tire, she says. Some of these bead bundles are more than 10 times the diameter of an automobile tire, Wright points out. Salvadorei (Rovereto, Italy) manufactures equipment to process OTRs, including debeaders, Hinsey says.

Debeaders are part of a three-step process Eagle International has...
designed over the past seven years, in conjunction with several shredder companies, to prepare giant OTRs for the shredder. “You need to get effective and efficient equipment to cut those tires into manageable pieces,” Julie Prochello says. “We researched every single aspect of downsizing giant tires.” First is bead removal: The company’s OTR bead remover cuts out the steel bead bundles encased in rubber. Alternatively, its OTR debeader—the firm’s newest machine—pulls the bundle out with minimal rubber attached, she says. Second, a punch cutter cuts the tires in half through the equator, like cutting a bagel. Finally, a machine cuts the pieces into wedges based on the size needed to fit the shredder. The three-step process can prep about 3.5 tires an hour, depending on the size of the tire and the number of segments per tire, Julie Prochello says.

Recyclers without specialized equipment either don’t remove the bead or use a mobile shear attachment on a material handler to do so. “In this case, the steel is not clean,” Fleming says. “They just do it to minimize the possibility of damage to secondary processing machinery they may have.” They also use the mobile shear to cut large OTR tires into pieces. To warrant such a purchase, however, “processors would want to have enough large OTR tires to shear tires almost every day,” Hinsey says—more than 10 tons an hour—because a shear costs nearly as much as a tire shredder. “And that’s just the shear attachment; that’s not the excavator it goes on.”

Tire processors that receive low volumes of large OTR tires might want to contract or partner with a nearby scrap facility that has a mobile shear, Hinsey says. He recommends waiting until there’s a day’s worth of shredding—“just check with your local officials to make sure storing the tires is permitted.” That’s what State Rubber and Environmental Solutions does. “We don’t have the volume to justify the cost of a bigger shredder or a dedicated shear,” Day says. Instead, the firm sets aside tires that won’t fit into the shredder whole, and when it has a sufficient amount, it transports to the tire plant the LaBounty Saber 3000 mobile shear used at Hobbs Iron & Metal, about 40 miles away.

Most processors shear the tires into 8-foot-long pieces, the longest you’d want to run through a primary tire shredder, Hinsey says. “In three
to five minutes, you could shear a 1-ton tire.” The more you shear it, “the less of a shredder you’re going to need,” Wright points out, but shearing is time-consuming. Each facility will want to calculate how much or how little shearing it needs for maximum efficiency with its shredder. Liberty Tire Recycling (Pittsburgh), which actively solicits OTRs, shears the tires into 3-foot sections, says Thomas Womble, vice president. OTRs constitute 2 percent of the firm’s volume of scrap tires company-wide, he notes.

Even after downsizing, shredding OTR tires might not be smooth sailing. “The pieces being fed to the shredder are awkward to work with,” Womble says. Daughtrey agrees. “It’s a little harder to get pieces of tires on a conveyor belt. They don’t lie flat.” Further, the cross-section of an OTR tire is thicker than a car or truck tire. The rubber of a mining tire can be more than 15 times thicker than an automobile tire, making the choice of a shredder extremely important, Wright says. It requires more processing power—a 300- to 600-hp shredder rather than a 200-hp one, Hinsey says. With tires under 8 feet in diameter, “you’re probably not taking the beading out,” he notes, which means “you’re going to need high power, high torque.” Many of the rubber plies are entwined with fiber strands, which also increases the processing difficulty, Sikora says.

That thicker rubber results in shred that’s more three-dimensional than car or truck tire shred, Fleming says. It can take four to six passes through multiple shredders before the pieces are ready to move downstream to granulators or grinders. Because it costs more to process, tire recyclers might find it’s not cost-effective to prepare this material for certain low-paying markets, such as cement kilns, Fleming says.

ON THE HORIZON
Manufacturers could build a shredder to process the largest OTR tires whole, but it would cost about $2 million, Fleming says. Other manufacturers agree that such equipment would not be economically feasible. A customer once asked Granutech-Saturn Systems to design a shredder that would process 14-foot-high mining tires, Hinsey says. “It would have had a slightly more than 14-foot-long cutting chamber, cutters that weigh 2 tons, 600,000 foot-pounds of torque, and weigh 175 tons,” with a 2,000-hp engine.
Its capacity would have been huge, Hinsey says. “It’s an investment comparable to putting in a whole crumb rubber plant—putting it well over $3 million.” The customer did not move forward with the purchase, he notes. His firm did build a shredder that could shred a 600-pound OTR in about 40 seconds, Hinsey says. “That’s 27 U.S. tons per hour of OTRs,” he points out—far more than any U.S. processor handles currently. The company built that machine, however, for a plant in Denmark that uses it to process appliances and electronic scrap. “We just tested OTRs in it when it was built,” he says. Though the number of processors who move forward with an equipment purchase remains low, Hinsey says that interest in the OTR tire market has picked up. Fleming agrees, estimating he gets about 100 calls a week about processing large OTR tires.

Perhaps there’s little demand for such high-end machines, but those who handle OTR tires say they’d welcome more and better equipment for downsizing and handling them. Western Tire Recyclers has used trial and error to modify existing equipment to serve its needs. Existing equipment is “very crude and not developed because the demand isn’t there,” Stokes says. “You basically have to invent the equipment as you go.” The equipment is “in a state of constant improvement,” he says, adding that it needs to be robust and able to do more than one task.

Day agrees that the lack of specialized equipment has “kept a lot of people from handling them. I think we’re going to have to continue to develop ways to handle and process OTRs.”

More equipment suppliers are entering the OTR recycling market, Sikora says. B&J Manufacturing (Glenwood, Ill.) has adapted a rasp blade that attaches to a buffing machine for use in making landscaping mulch, she notes. Eldan Recycling (Sanborn, N.Y.) has introduced a mining tire recycling system that combines heavy-duty cutting equipment with downstream size reduction. USA Tire Management Systems serves as a testing ground and provides research and development for Eagle International’s OTR tire processing equipment. This equipment is going to be expensive, David Prochello says, because it has to be durable. “These tires are built to be indestructible, and we’re building equipment to destroy them.”

Diana Mota is associate editor of Scrap.

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