MSW MANAGEMENT | WASTE TRANSFER

Action and Reaction

New equipment and operational methods being used by recyclers and transfer stations

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Transfer station designed by SCS Engineers
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Transfer Station Operations and Equipment

Transfer stations are the connection nodes in a system of hauling routes. Like the branches of a tree or its root system, smaller hauling lines converge onto large hauling routes at these nodes which then load waste for the long haul to a large scale MRFZ or a regional landfill. In detail, their individual design layouts may vary somewhat depending on location, property limits and configuration, access to regional hauling routes, and local zoning laws. Their interior structure will be modified in accordance with its anticipated pass through capacity (the amount of waste entering and leaving the facility per work day). As such, the interior layout will affect floor space configurations, loading pit dimensions, access roads given over to truck queues, and whether the facility is open or enclosed.

The simplest layout includes a series of loading bays located adjacent to the tipping floor where the hauling trucks enter the facility and deposit their loads. These bays are set lower than the tipping floor surface in order to allow for a parked open top transfer trailer (usually with a 100 cubic yard volume capacity) to park and receive waste being pushed in from the top. The deposited waste piles are pushed into the open tops with wheeled bulldozers or wheeled front end loaders (tractor treads would typically do too much damage to a concrete surface of the tipping floor). There is nothing fancy about this operation: no compaction, no baling, no removal of valuable scrap. For facilities with low volume pass through capacities, this is an appropriate and cost-effective design.

Larger operations can manage higher pass-through rates with the help of operational systems that increase overall efficiency (defined in terms of pass-through rate per square foot of tipping floor space) by increasing the final density of the waste being handled. These include surge pits, compactors and balers.

More sophisticated equipment can produce higher density waste for long-haul transport. The most commonly used compaction mechanism is the hydraulic ram. This allows for direct compaction of waste into the back of the transfer trailer itself. The resultant high pressure requires that the transfer trailer frame must be upgraded to reinforced steel to withstand the impacts from the ram. This results in increased truck weight which does subtract somewhat from the vehicle's overall load capacity. Economic analyses would be performed to see if the operational savings resulting from the use of a hydraulic ram exceed the resultant increase in long haul transport costs.

The baler is a refinement on the compactor that is the best of both worlds: it produces high-density waste without the need for reinforced and heavier hauling trucks. Baler equipment compressed waste into large self-contained bales or bricks which are further secured by wrapping them in wire. These large bales can be loaded onto flatbed trucks (no need for specialized vehicles) with simple forklifts. Being stable objects, they can be stacked in place without the need for truck sidewall necessary to contain loosely dumped waste. The downside is the cost, which can be a significant upfront capital investment However, for larger transfer stations with high pass-through capacities, a baler may provide the perfect cost-effective solution.

Major design changes could be coming to transfer stations.
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Action—Changes in the Recycling Market

Moving back out to view the market as a whole, America has settled into what it thought was a long-term solution to its recycling needs—ship the material to China. Transfer station operations adjusted to or were modified to meet this market, with fewer materials going to landfills and more waste going to MRFs for sorting before shipping or even directly to docksides for the shipping of mixed material that would be later sorted in China. These good and stable (even growing) market conditions lasted until it received its first jolt in the Great Recession of 2008 which resulted in collapsing prices for recyclables that were on the road to recovery just when the Chinese initiated their first steps towards banning the import of waste in 2015.

Reaction—Changes in Transfer Station Equipment and Operations

At least until new overseas markets for recyclables are found, or when domestic markets are further expanded, transfer stations will have to adjust. The primary change will be increased wastestream volumes of materials that are no longer going directly to materials recovery facilities (MRFs) and instead will be directed to a landfill via a transfer station. These adjustments will be structural, operational, and technological in nature and may result in major overhauls at existing transfer stations along with major design change to new transfer stations being built.

First off, increased material deliveries would require increased floor space area or improvements in floor space operations. This would be a simple and direct solution to the problem. However, more waste does not necessarily mean more physical floor space, but it does require that existing floor space be utilized as efficiently as possible.

A picking station with access to an emergency pull cord
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Newer facilities are a different matter. These can be modified in the design stage in anticipation of increased wastestream volumes. Orientation and layout of a newly designed transfer station building can be accomplished with additional floor space added even within the unchanging limits of the site property lines. New facilities can squeeze out more productivity (and effectively increase the floor space) by designing traffic flows into, through, and out of the transfer station building in order to reduce the cycle times required for each truck delivery.

Though existing facilities may find it difficult to increase available floor space, adding new equipment remains a very feasible option for most facilities. A key piece of equipment is the compactor/baler. Compaction does more than its share since the material that was going to be shipped to recycling tend to be low density and lightweight. Its inclusion in the transfer station's wastestream will serve to reduce the waste's overall density. This is the last thing an operator wants since higher waste density equals more efficient and cost-effective waste handling operations.

Another option to achieve somewhat higher rates of waste compaction and onloading density would be the expanded use of mobile equipment operating within the transfer station. For example, the addition of a materials grappler with a tamper attachment can achieve respectable levels of density through the impact of the tamper on the material in the waste pit. The addition of another loader, or even an actual drum compactor, can allow for compaction operations to proceed concurrently with the movements of the front loader. Furthermore, size equals productivity. A larger loader that replaces a currently operating small loader could be a more cost-effective improvement than an additional loader.

Certain types of transfer stations already have a built-in advantage. These would be those that operate as multi-modal transport junctions. Typically, this is a facility that receives truckloads of waste but they transfer it to rail cars for long distance mass hauling. Rail haulers tend to have excess capacity compared to truck transport facilities, depending on the nature of the co-located railhead. As such, the increase in waste throughput may be handled often without significant changes to transfer station equipment or operational procedures, even if they receive waste that was previously being sent to another transfer station.

In any case, rail haul will always have an advantage over trucks when it comes to long distance hauling. However, there are issues associated with rail hauling of MSW (for example, odor issue from parked rail cars waiting to be moved). And with industry trends heading towards fewer but larger landfills receiving greater tonnages of waste per work day, planned transfer stations are moving towards multi-modal transport operations.

With overseas markets slashed, at least for now, there are always opportunities for serving local recycling markets. Assuming a transfer station has sufficient room to allow for their installation, it can be outfitted with recycling facilities that will produce valuable materials at least for local upscale markets. In short, this usually means scrap metal, both ferrous and non-ferrous. Ferrous metals (such as steel rebar from construction and demolition debris) are extracted from a wastestream by use of powerful electromagnets. Non-ferrous metals (such as aluminum cans) are recycled by means of eddy current generators that induce a current and associated magnetic field into the non-ferrous metal by means of rapidly rotating magnets. This induced field is repelled by the rotating magnets allowing the non-ferrous metal to literally jump off the sorting belt and into an adjacent storage bin. As always, with any capital improvement of this kind, the operator should perform a cost-benefit analysis comparing potential market sales with anticipated capital and operating costs.

More general recycling can be performed by the installation of sorting tables allowing for manual removal of plastics, cardboard, etc. Furthermore, the facility layout can be modified to include storage bunkers for diverse materials (cardboard, white goods, construction and demolition debris, etc.). Space and cost remain the biggest hurdles. It would make no sense to install these recycling facilities and reduce the operational area for offloading and onloading so that the overall result would be a decrease in overall throughput productivity.

Productivity and throughput rates are not the only considerations. Almost as important for overall operational efficiency is being a good neighbor. Most transfer stations (except for long-running legacy facilities) tend to be located away from residential areas. However, it is not uncommon for them to be sited in commercial districts and industrial zones. As such, increased transfer station operations can result in increased noise, traffic, odors, and longer operating hours. Little things can mean a lot to mitigate the stresses imposed on the transfer station's neighbors. For example, replacing a truck's back-up beeper with a light-based system can prevent unwanted noise. Expanding operations may require the installation of an expanded misting system to control odors and dust emissions.

One of the greatest transfer station nuisances happens offsite on the approach roads and streets carrying the incoming truck traffic. The additional truck traffic itself may be unavoidable, but a redesign of the external approaches and internal operating procedures can greatly reduce the length and duration of truck queues impacting local traffic. However, since changes to the facility layout may not be possible, operational efficiencies can be obtained through modifications of the trucks themselves. This includes higher tare weights (in effect increasing density before it even arrives) and RFID tags that allow for real-time tracking and location of truck movements. Even a better ticketing system can be a great help. A remote ticket printer can reduce entry wait times. A simple improvement in signage can go a long way in reducing offloading cycle times.

Lastly, there is the human element. Improved training of both station personnel and truck drivers to better handle increased waste loads will see significant improvements at modest costs. Best practice operations are not nearly as effective if the personnel involved are not properly trained to carry them out in an efficient and coordinated fashion. And while training can improve staff quality, it may also be necessary to increase staff quantity with the addition of more personnel dedicated to spotting and directing the incoming waste trucks. The shorter equipment operating cycle times that result should more than offset additional salary costs.

Modifications to transfer station design, operations, technology, and equipment are just a few of the ways that America will meet the challenge of the effective closure of China's recyclables market. Transfer stations and their operators will play a key role in this response, making it possible to transport materials to new markets with new methods. Will we meet this challenge? There is no doubt that we will; that is what America does best. We rise to challenges, whether it's Sputnik, OPEC oil embargoes, or Pearl Harbor; it is what we Americans do. Meeting these challenges resulted in Americans walking on the moon, becoming the world's largest oil producer and exporter, and winning the greatest war in history. We can do it again.

Major Suppliers of Transfer Station Equipment and Services

Cambridge Companies is a family-owned design-build construction firm with offices in Northwest Indiana and Scottsdale, AZ. We serve clients who desire a customized design-build solution. Cambridge's core services include design engineering, construction management, and services. Cambridge was founded in 1988 by Ray Eriks to develop premium commercial and industrial design-build projects, originally in the NW Indiana and NE Illinois areas but have since expanded a portion of our business to serve nationally. Cambridge creates unique design-build solutions for each of their clients by streamlining the process with increased project coordination, accountability, value-based project feedback system, and single-source project delivery. Cambridge has successfully completed transfer station projects in 15 states, both new facilities and upgraded transfer stations, including:

The removal and replacement of the surge pit and tipping floor separation wall; replace pit floor, tipping floor, and push wall; and completed miscellaneous building repairs for a facility in Alabama;

A newly built transfer station in Florida whose construction effort included careful planning and proper siting. The building, which is sized to accommodate future growth, is situated to allow for maximum queuing while orienting the building to prevent the views and odors from affecting the nearby roadway. The building is fully sprinkled to protect the investment, and the building uses an odor control system.

A rebuilt transfer station in Michigan which reused the existing foundation as possible and constructed the new facility on and around the remaining push walls and foundations. Along with the new building, scale house, and utilities, Cambridge also modified the pit to a standard lift and load operation to help ease operations.

SCS Engineers believes that transfer stations are the cornerstones of effective solid waste management and recycling and diversion programs. They have designed facilities that have ranged in size from 50 to over 5,000 tons per day and operate in a wide range of conditions. SCS provides engineering solutions for transfer station projects that address economic concerns, operational challenges, and permitting/regulatory issues. Their extensive landfill, solid waste, and organics management experience allow for a holistic approach that their clients receive the most cost-effective option possible. These solutions are based on client diversion goals, regional regulatory compliance issues, and traffic and public safety concerns. SCS maintains full architectural and engineering capabilities that have been developed specifically for the planning, design, and construction of transfer stations and similar waste management facilities, including waste collection studies, facility feasibility assessments, asset valuations, transfer station and long-haul transport evaluations, fleet management and vehicle acquisition planning, and waste conversion feasibility studies. SCS Engineers has been the design engineer of record for more than 100 design and construction projects involving solid waste facilities. Many of their transfer stations include waste processing, including conveyors, basic sorting, compacting/baling, and loading cranes. They go beyond just engineering a facility by assisting with public issues that need to be addressed in urban settings, neighborhoods, rural communities, and highly regulated states where water and air compliance are especially stringent.