Superior Technical Bulletin

Long Distance Conveying – Long Term Savings
Conveyors VS Haul Trucks

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The Changing Industry

The landscape of the world continues to change in many different facets in the aggregate and mining industries. Aggregate reserves are becoming rare commodities in many areas, transportation issues are priorities because of rising costs and citizen concerns, and industry requirements for specialized products are all factors in the discussion surrounding this transformation. These factors continue to drive the need for change in the way that aggregates are transported, not only from the source of the aggregate and/or the production area, but also from the production site to the area of further processing or end-use.

The decision to get product from the aggregate reserve to the crusher or to the area of stockpiling by truck or by conveyor is made because of a number of inputs that are analyzed. Cost benefit, product quality, topography, and environmental issues are the areas that need to be analyzed in order to make the right decision when choosing conveyors or trucks to move product. Improvements in conveyor mobility, function, design, and flexibility, as well as escalating costs for operating haul trucks show the decision to use conveyors much more cost effective.

Cost Benefit

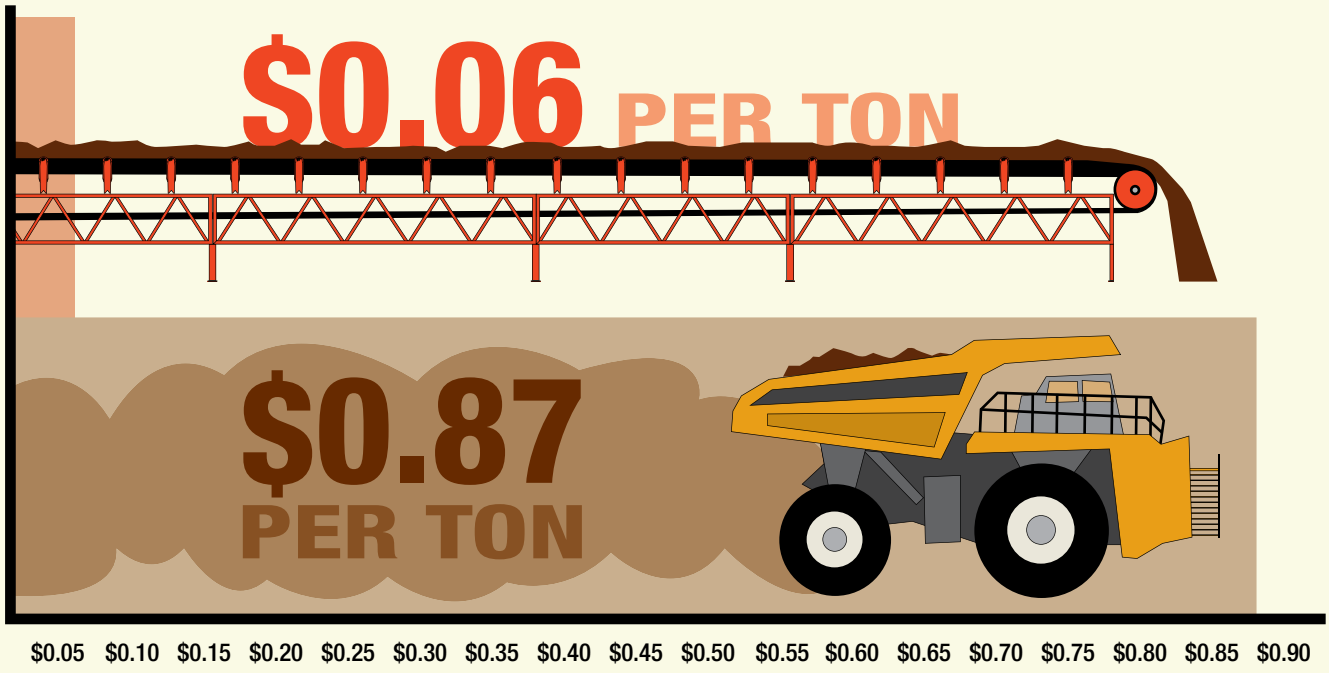
The main benefits of using conveyors, not only overland applications of short, medium or longer length, but radial stacking or telescoping conveyors for stockpiling where trucks have also been traditionally used, are decreased operating expense, (see Figure 1) limited inflationary effect, improved product quality, continuous flow, environmental friendliness, and the flexibility of design for conveyor systems.

Maintenance costs of conveyors are less as more downtime is required to keep trucks and loaders running efficiently. In addition, most conveyor replacement parts are available locally. Conveyor systems

Figure 1 - Operating Costs

Equipment	Model	Equipment Cost	Operating Cost/hour (labor, maintenance, and fuel)	Annual Cost	Cost/Ton
TeleStacker™ Conveyor	TSFD150	$200,000	$25.08	$62,700	$0.08
Articulated Truck	35 Ton	$455,000	$120.00	$142,500	$1.10
Mine Truck	50 Ton	$540,000	$81.00	$202,500	$0.84

Cost Comparison: Conveyor VS Haul Truck
- Transportation cost for 2,500 foot distance (630 TPH)



are also less labor intensive as trucks or loaders require one or sometimes two operators. Conveyors will also operate at maximum efficiency every hour of operation. This can decrease workforce and training requirements.

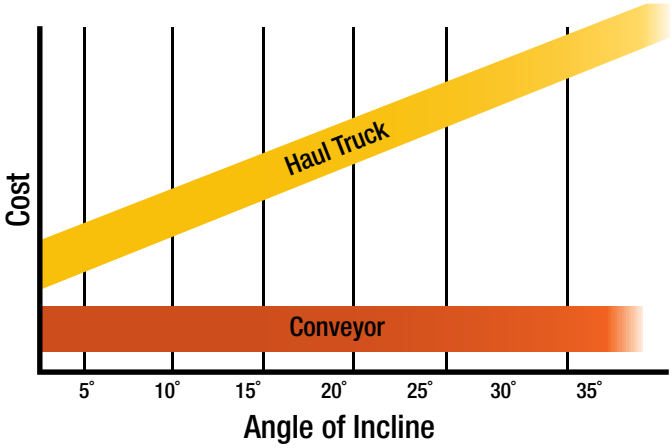
While the big advantage of the haul truck continues to be its flexibility, even bigger disadvantages are increased fuel prices, increased labor costs to operate, maintenance costs, and the shortage of parts such as tires, with lead times of over six months being reported.

Overland conveyors offer cost-effective material transport and a wide spectrum of capacities that can vary from a trickle of material all the way up to 30,000 tons per hour. Furthermore, with a lifespan of more than twenty years, the benefits of their high-capacity and low-cost operation are realized long after the initial truck fleet is retired. As an example, a Texas-based mining operation reports that their newly installed 2-mile-long conveyor eliminates more than 140,000 truck trips and 570,000 vehicle miles on an annual basis. Added to the fuel savings, this operation is significantly reducing costs associated with labor, workers' compensation costs, MSHA training, emissions, maintenance and engine depreciation.

The above costs, and cycle-time considerations when truck hauling in urban traffic congestion, were also factors in the recent Atlanta Airport project where a 5-mile-long overland conveyor was chosen as the method to transport 40 million cubic yards of fill material from several nearby quarries to the construction site of a fifth runway. This overland conveyor also allowed the proper blending of crushed rock and overburden material in desired percentages as it was fed onto the belt.

Limited inflationary effect is achieved because rising fuel and energy prices have little effect on the operating costs of conveyors, and are not sensitive to fuel shortages. Electricity costs are fairly stable compared to diesel prices and conveyors can be run at off peak energy times.

Figure 2 - Costs of Moving Material Up Angles



Improved product quality is seen because conveyors eliminate multiple handlings of material, which prevents compaction and contamination typically caused by trucks and/or loaders. Telescoping conveyors eliminate segregation and material degradation. Continuous flow is another advantage realized because conveyors are not affected by weather, can be fully automated and operated at the touch of a button. Aside from initial capital cost, operating expenses are the next major measured costs in aggregate operations. Initial comparative areas show that conveyor systems have high capacity and a low cost of operation, while depending on distance, the capital cost of a conveyor system can be higher than a haul truck. However, no matter what the distance, cost of operating a conveyor will be less. Long range costs show that conveyors have limited inflationary effect and a long life span of at least 20 years.

Topography

Current conveyor technology can take on inclines up to 35-degrees while truck efficiency is compromised in any inclined application (see Figure 2). There are also immovable issues such as the lay of the land. Haul trucks are not designed to tackle grades much above 6%. It is clear that more and more operations are limiting truck transport to the area between the working face and the pit crusher. That means that haul trucks are suitable mainly for level applications and truck efficiency is compromised in any inclined application.

Cost Savings Through Design Efficiencies

However, bigger isn't necessarily better. A common misconception is that oversized equipment lasts longer and requires less maintenance. Conveyors should be sized according to the expected load yet allowing for a small capacity increase. For example, going with a 36-in belt when you only need a 30-in belt will ultimately result in additional belt and idler rolling resistance, and less energy efficiency. Also, overland conveyors do not need to be five miles long over rugged, mountainous terrain to be considered as a legitimate option. Overland conveyor lengths as short as 500 feet are shown to have significant cost reductions over haul trucks. Payback of a system from 1,000 feet to 3,000 feet have been shown to be as short as 88 days to 182 days.

Electric motors consume 64 percent of the electricity produced in the United States, says a Northeast utilities provider whose report cites the example of a 100 HP AC induction motor that costs approximately $5,000, yet will use as much as $35,000 worth of electricity over its lifetime. With that said, it's clear that small improvements in efficiency can generate notable energy savings. As such, today's conveyor manufacturers normally install new premium efficiency motors on each unit they build. Since these motors perform most efficiently near their designed power rating, it's recommended to run at between 75 percent and near 100 percent of full load rating. If you're running at 50 percent of capacity or lower, the efficiency of the motor drops dramatically. Motor size should be matched to the horsepower requirements of the load.

Again, some producers will oversize a motor thinking that it will require less maintenance. But think again – the energy savings realized from a properly sized motor will outperform any maintenance savings derived from a larger model.

Monitoring and minimizing rolling resistance requires paying close attention to the quality of your belt and idlers. Manufacturers are now designing belts with special covers that help to counter rolling resistance. As to idlers, they may look similar but they vary in performance. Ask your conveyor manufacturer to recommend the right bearing and seal type for your application. Proper idler spacing is also important. Consult with the Conveyor Equipment Manufacturers Association (CEMA) or your conveyor manufacturer for idler spacing and rolling resistance formulas.

Systems must be designed and operated relative to the maximum material lump size. This is particularly applicable to material conveyed from the primary crusher. As the lump size increases, the potential capacity for a given belt width decreases. Some producers may skimp on belt width, while running at higher speeds or capacities. And while they may size their belt according to lump size, they may be running at a capacity that is not suitable to that lump size. A basic rule of thumb dictates that you should never run at an excess of 80 percent of volumetric capacity. Plus, when you're running material that is at maximum lump size, it's best to remain under 80 percent volumetric capacity to maintain standard edge distance and safe operation.

Safety and Maintenance

Obviously, safe conveyor maintenance does not allow for crawling under the unit to get to the other side. A ground line or overland conveyor must be designed with crossover points (for pedestrian and/or vehicles) at convenient intervals, so that producers

can safely, easily and efficiently complete maintenance tasks on both sides of the system.

Environmental Issues

But beyond costs-per-ton, there are other key drivers in an emerging overland conveying trend. Consider the ever-tightening environmental regulations. Individual mobile haulage units emit and stir pollution along the entire transfer path. As production sites expand and encroach upon suburban development, concerns arise over dust, noise and traffic. As such, quarry owners are often involved in decade-long negotiations over leasing and permitting. For instance, when faced with government and community opposition, a California-based aggregate operation proposed the use of overland conveyors over scrapers and trucks. They were armed with an environmental impact statement issued by the Bureau of Land Management. It reported that the use of overland conveyors over haul trucks would reduce estimated PM-10 (particulate matter larger than 10 microns) emissions by mobile haulage from 211 lbs. per day to as little as 5.1 lbs. per day (see Figure 3). Additionally, community concerns could be eased by the fact that an overland conveyor would offer quiet material transport, and when designed properly, could blend in with the environment.

Design Questions

A system needs to be based in reality, and according to your specific site parameters. What is the lay of the land? What is the percentage of incline? Will you need to cross roads or streams? What is the best way to route the conveyor? What is your power availability? What are your horsepower requirements? Answering these questions will provide a clearer picture of what conveyor system will not only work for you, but will make your operation an environmentally friendly neighbor, reduce safety issues for your associates, and save you mountains of money.

Figure 3 - Pounds of PM-10 Emissions per Year