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# CHARACTERISTICS OF MILK ASSEMBLY

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***Introduction***

Today's milk haulers complete the link between milk producers and milk processors by transporting raw milk in bulk tank trucks and tractor-trailer units from farms to processing facilities. From the producers' side, milk haulers often represent the only regular contact that they have with the organizations that market or buy their milk. In addition to transporting milk from farm to plant, haulers perform many important duties during milk assembly that add to the safety and, consequently, to the value of dairy products.

***Who Are Milk Haulers and Why/When Did They Evolve?***

By the early 1900s, milk production in the United States had become specialized to meet the needs of burgeoning population centers. Whereas dairy farmers from previous generations were obliged to transport their own milk to processing facilities or reload stations, the trend that developed encouraged dairy farmers to concentrate solely on milk production. One outcome of the specialization phase of dairy farming was the origin of milk haulers whose business was to relieve dairy farmers from the task of transporting raw milk to appropriate facilities.


This first milk truck equipped with a stainless steel tank was in use in 1927.

Before milk hauling businesses emerged, dairy farmers usually hauled a neighboring farm's milk in addition to his own to nearby reload plants or processing facilities in vehicles that served other farm purposes such as hauling grain, hay or straw. The earliest milk haulers operated stake-bodied trucks or flat bed, horse-drawn wagons to accommodate the 10 gallon milk cans when traveling to local reload stations or nearby manufacturing plants. These vehicles were versatile and allowed haulers to transport other goods such as ice, eggs, freight and even furniture. Milk can haulers became the nucleus of the system of one-truck bulk milk haulers common in the early 1960s as the industry changed from cans to bulk tanks. When reload plants began to close down, milk moved directly from farms to city milk plants, which required larger and more specialized trucks and drivers.

The advent and acceptance of the bulk tank as a more sanitary method for moving raw milk further contributed to the specialization of milk hauling. Diversified hauling businesses evolved into hauling operations that concentrated exclusively on milk in order to take full advantage of size efficiencies. As independent hauling businesses grew in size and number, handler-operated fleets also became more numerous and widespread.[1] Milk handlers attempted to maintain control over local milk supplies by investing in their own hauling equipment and drivers because the supply of milk was subject to competition from contract haulers who moved milk out of the area for other milk

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[1]A "handler" is any milk dealer who disposes of grade A milk products. Handlers include fluid milk processors who distribute milk to consumers and retailers as well as persons who sell milk to other dealers for fluid distribution. The term "handler" applies to proprietary operations and cooperative associations that handle milk for their members.

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processors. However, handlers found the cost of maintaining their fleets excessive, primarily because they could not match the labor cost of independent haulers. Fleet labor was subject to unionization which other hauling operations could avoid, thereby greatly reducing the hauling costs of contract haulers. Thus, lower costs and the exceptional work ethic of contract haulers made them a less expensive alternative to handler-operated fleet operations. By the late 1970s, most handlers chose to abandon their hauling fleets in favor of contracting the work out to proprietary milk haulers, a practice that persists today.

***What Are Hauling Routes and How Are They Determined?***

A route consists of a set of farms whose milk is picked up on a specified schedule then delivered to a designated location. In the Northeast, routes are generally not "owned" by the hauler, although in some parts of the country, milk routes are still considered an asset of the hauler's business. By virtue of the strong relationship between haulers and farmers, milk haulers who "own" their routes are able to influence all aspects of the route, including, in some instances, the delivery point. Producers exhibit a high degree of loyalty to their haulers and occasionally terminate their membership with a cooperative or rescind their contract with a proprietary handler if any attempt is made to alter the existing hauling routes.

Frequency of farm stops is determined by both the size of the bulk tank on the farm and health regulations, but the bulk tank ultimately has the larger impact of the two factors. Although health and sanitation standards specify that the bulk tank must be emptied and cleaned regularly, most farm bulk tanks are not large enough to hold more than two days of milk.[2] Furthermore, as dairy farms continue to decline in number and existing farms increase cow numbers without increasing the capacity of their bulk tank, many haulers are forced to empty the tanks daily, and, in some extreme cases, twice daily.[3] This raises the cost of hauling and has been a source of disagreement between producers and haulers when discussing hauling rates that equitably compensate haulers for the added work of everyday pickups.

Stability of designated locations for delivery ranges from very consistent to somewhat erratic. Some haulers routinely deliver to the same plant day after day; some deliver to 2, 3, or 4 different customers in a week. When milk production is not unusually high or low, changes to specified delivery points are uncommon, but a local surplus or shortage of milk can cause frequent and dramatic changes in time and distance to delivery points. During the fall months when milk production is at the lowest point of the year and consumption is seasonally high, special attention to the fluid milk plants near large cities may be warranted in order to maintain a constant supply of milk for fluid consumption. During the flush when milk production is at its highest point of the year and consumption of milk is falling, haulers may be requested to deliver their loads to a different location to balance the milk supply with the capabilities of the plants in the region. Clearly, in order to meet their agenda, milk cooperatives may request changes in delivery locations on a weekly or even daily basis.

***How Are Hauling Rates Determined?***

When contracting with a hauler for a route, milk cooperatives and proprietary handlers may contact several milk haulers to find the best available hauling rate. However, hauling rate is not the sole determinant of which business will be offered a route. A hauler's reputation and his relationship with producers are also important considerations in addition to a hauler's performance in timely deliveries, accurate milk weights and proper milk sampling techniques. Open bidding on routes is not a usual practice, but cooperatives and proprietary handlers can generate some degree of price competition by employing several haulers at one time. Hauling rates are determined through negotiations and are priced in terms of dollars per hundredweight of milk and thus will vary with route characteristics. Route mileage, number of farm stops, farm location and point of delivery are all considerations in developing a hauling rate, and these factors should be reflected in the agreed-upon hauling rate.

Throughout the Northeast, hauling rate negotiations for a particular route do not generally involve producers, but in other parts of the United States, it is not uncommon for producers to deal directly with haulers. In fact, in regions where milk production is not particularly large, cooperatives and proprietary handlers may not be directly involved in hauling negotiations, i.e., producers are responsible for hiring a hauler to pickup and deliver their milk. Despite differences regarding

[2]In New York, sanitary regulations specify that bulk tanks must be emptied and cleaned every 72 hours.

[3]Generally, when milk is picked up more than daily, it is from tanks that are already very large, probably tanker load sizes.

producer involvement in hauling negotiations, it is the producers who actually bear the cost of hauling. This may not always be obvious because of the complex systems involving deductions, hauling subsidies, pooling of revenues, and repayment procedures in different regions of the country. Written contracts between haulers and milk cooperatives or proprietary handlers are rare. Most contracts are verbal, and there are surprisingly few problems with negotiating the route details and hauling rate verbally.

***Milk Hauling Vehicle Types***

Three types of vehicles are used extensively for assembling raw milk and delivering it to a processing facility - double-axle truck, triple-axle truck (tri-axle), and tractors ("semis"). Double-axle trucks and tri-axles can be identified by their straight chassis and the number of rear axles; a double-axle has two rear axles, and a tri-axle has three rear axles. Generally, the greater the number of axles, the greater the amount of milk that can be hauled by the vehicle. Bulk tanks are fastened directly to the chassis of double-axle and tri-axles trucks. Tractors are basically power units, and their distinguishing characteristic is that they can be easily attached or detached from bulk tank trailers.

Early straight chassis trucks were designed to accommodate tanks with capacities of 200 to 250 cans (equivalent to 2,500 gallons) and did not need more than a single rear axle to safely haul a load of milk. By the late 1960s and early 1970s, most bulk farm pickup trucks had tank capacities of 400 cans or 4,000 gallons and required two rear axles to distribute evenly the weight of a full load of milk. Today, it is not unusual to find tank capacities that run as high as 7,200 gallons on farm pickup tractor-trailers.

***What Are a Hauler's Duties?***

A milk hauler is more than just a driver of a milk hauling vehicle, and while the job no longer requires the physical strength to lift 10 gallon cans, the list of responsibilities is nonetheless quite lengthy. The operator of the vehicle must simultaneously perform duties as a driver, a milk weigher and sampler, and a contact person for the organization that markets or buys the milk.

A typical routine for a milk hauler begins by driving to the area in which the farms are located. The order and time of day for farm stops may depend on farmer preferences, plant receiving schedules or a particular strategy adopted by the hauler which seeks to minimize driving distances or optimizes route efficiencies. At the farm, the hauler positions the vehicle near the bulk tank to transfer the milk, a task which may not be trivial depending on the configuration of the driveway and the size of the hauling vehicle. Upon entering the milk house, the hauler checks the temperature of the milk (milk should be below 40° F, and ideally, between 34° F and 36° F), reads the bulk tank measuring stick and records the volume, and starts the tank agitator before any milk can be removed. A sample can be taken after the milk has been agitated for a minimum of five minutes, and tanks that hold over 10,000 lbs. should be agitated for a minimum of ten minutes.[4] The samples will undergo a series of tests at the processing facilities' laboratory to determine the percentage of milk components (butterfat and protein), the somatic cell count per milliliter (SCC), the freezing point and bacterial content of the sample. More importantly, the sample is tested to determine if there are significant quantities of antibiotics present in the milk. Milk is rarely rejected for reduced levels of components or for elevated SCC, but a positive antibiotic test automatically leads to rejection of a load of milk. Clearly, proper sampling of each farmer's milk is extremely important, and haulers must be trained in correct sampling procedures.

Following sample collection, the milk is pumped over to the tank or tank-trailer via a transfer hose. After all of the milk is transferred, the hauler is responsible for washing down the floors of the milk house as well as rinsing the bulk tank. The farmer is generally responsible for cleaning the bulk tank, and with modern clean-in-place (CIP) systems available for bulk tanks, the cleaning and rinsing phase is accomplished by merely flipping a switch to activate the automatic CIP system.

[4]Some newer bulk tanks are equipped with agitators that can be set on a timer. This feature, however, does not eliminate the need for the hauler to agitate the tank immediately before taking samples of the milk.

The hauler's entire routine is repeated for each farm visited on the route, and after the last farm has been visited, the hauler generally delivers the load of milk to the designated plant.

In the past, some of the intermediate destinations were not plants but reload facilities. The milk was transferred (reloaded) to a different transport vehicle which may have been a straight chassis truck or tractor-trailer with a specialized transport tank or a railroad tanker car. Reload stations are rarely used today, although they are more common in some areas of the U.S., but some haulers may elect to use their fleet garages as a stopping point prior to departing on a long-distance haul. In these instances, trailers are often dropped off by a tractor used for assembly, and a second tractor is used to transport the trailer to the final destination. Haulers often separate their vehicles so that older vehicles assemble the load and the newer (and more reliable) vehicles transport the milk to a more distant delivery point. Where permissible, tank trailers may be hauled in tandem to further reduce delivery costs.

***Current Issues and Concerns in Milk Hauling***

The milk hauling industry is faced with many longstanding and significant challenges. Among the perennial difficulties encountered by milk haulers are governmental regulations covering driver hours and weight limits, issues of co-mingling milk and route overlap, everyday versus every other day pickups, retention of skilled drivers and extended waiting times at milk plants. Two other issues that involve haulers indirectly are stop charges and load shrinkage from farm to plant.

***Hours of Driver Service, Vehicle Weight Limits and Retaining Skilled Drivers***

"Hours of service" refers to the number of consecutive on-duty hours logged by a driver, and the problem faced by many haulers is maximizing the time logged by each driver without exceeding any of the Department of Transportation (DOT) regulations. Depending on the location of the assembly route and destination of the delivery, a single driver may be restricted to as few as ten consecutive hours of service, after which a mandatory off-duty period of eight consecutive hours must be taken. Haulers who transport milk over long distances are particularly affected by DOT regulations, and it is not unusual for a hauling operation to assign two drivers to a route — one driver to assemble the milk, and the second driver to transport the milk to its final destination. Vehicles equipped with sleeper cabs may also be used to comply with DOT regulations; sleeper cabs provide an adequate facility in which a driver can accumulate the eight hours of off-duty time required by DOT regulations.

Vehicle weight limits have become a complicating detail to many haulers only recently. A relaxation of gross vehicle weight limits and availability of overload permits have encouraged milk haulers to purchase tanks and trailers with large capacities. However, haulers with out-of-state deliveries may confront inconsistencies in weight limits while traveling on a single road. Maximum allowable road weights are set by each state, but neighboring states need not have similar limits on the same road. Gross vehicle weight violations can be costly and inconvenient; some haulers have experienced vehicle impoundment for violating weight limits.

Retaining experienced and skilled drivers is a never-ending struggle for hauling businesses. Because of the aforementioned characteristics of milk assembly, milk haulers have many driving and non-driving responsibilities and work long hours as well as most weekends. Typical wages for drivers are seldom attractive enough to entice them to remain with the same operation for more than a few years. Competition for drivers from other businesses that can afford to offer higher wages, shorter hours and fewer workdays per week effectively lure drivers away from the milk hauling industry. Given these circumstances, it is not surprising that many hauling businesses constantly contend with high driver turnover rates.

***Plant Waiting Times and Everyday Pickups***

Usually, the process of unloading and rinsing the tank at the plant requires about two hours, but during periods of high milk production, long waiting periods may add several hours to the task of delivering a load. Extreme waiting times occur during the flush season when the number of vehicles delivering milk to any particular plant greatly exceeds the capacity of the receiving bays or storage tanks. Some processors have attempted to relieve the congestion at the plants by constructing additional receiving bays and/or developing individual delivery schedules for haulers that deliver to the plant on a regular basis. Notwithstanding these efforts to facilitate milk deliveries, delays at the plant present several problems for haulers. First, time at the plant ties up the hauling equipment so that it cannot be used to pickup and transport milk. Secondly,

hauling businesses that pay their drivers by the hour are obliged to continue paying the driver during these idle periods. Haulers argue that their hauling rates do not include undue waiting periods at the plants, nor are their rates adjusted accordingly if extended waiting times are encountered. Consequently, some hauling operations have negotiated agreements with milk plants such that the plant pays the driver's wages if the driver is forced to remain on the premises for more than three hours.

Everyday pickups, like extended waiting times at the plants, impact hauling efficiencies. Any dairy farm that has expanded herd size without upgrading the bulk tank is a likely candidate for everyday pickups. From a hauler's perspective, the necessity of visiting a farm everyday places additional constraints on route scheduling, a condition that is exacerbated if neighboring farms do not require everyday pickups.

***Co-mingling Milk and Route Overlap***

Route overlap may be a symptom of inefficient route scheduling among a group of cooperatives and/or proprietary handlers resulting from the spatial disorganization of member farms. Unfortunately for milk haulers, farms located in the same vicinity may not belong to the same cooperative. As such, several milk haulers, each working for a different milk cooperative, may pass through the same area to pick up the milk from member farms. Co-mingling, one suggestion advanced to moderate route overlap, allows the hauler for one milk cooperative to pick-up all of the milk in an area, regardless of the membership of the farms. Credits for the milk transferred between the cooperatives are allocated based on the hauler's receipts from each farm. Such an arrangement requires a great deal of trust and cooperation between the two cooperatives, not only for exchanging milk credit, but also for addressing liability concerns in the event that a load of milk is rejected or an accident involving the hauler occurs. Despite the potential benefits, co-mingling is not widespread, probably the result of the complications confronted when trying to agree on the logistics of the alliance.

***Stop Charges and Load Shrinkage***

Stop charges represent an attempt by handlers to differentiate the costs associated with milk assembly. Hauling charges can be separated into two basic categories - fixed costs for the truck and driver and variable costs for truck operation. Fixed costs are borne by the hauler regardless of truck usage and include factors such as insurance, registration and depreciation. Furthermore, driver wages may be considered as a fixed cost when the driver is paid on a per day or per load basis. Variable costs cover all other costs of picking up and delivering milk. Expenses for fuel, tires, oil, maintenance and repairs are just some of the costs borne by a hauler that are reflected in a mileage or volume charge. The mileage (or volume) charge derives its name from the manner in which these costs are covered; producers are charged on a per mile or per hundredweight of milk basis.

The stop charge is the part of a hauling rate that addresses the fixed costs of owning and operatiang a truck. Each farm stop requires the hauler to perform a set of tasks that are independent of farm production, such as connecting and disconnecting the transfer hose, agitating the bulk tank, taking milk samples, weighing the milk and washing down the floors and bulk tank. These tasks require a significant amount of time, and consequently, there is an inherent cost to a hauler for merely stopping at each farm. A stop charge reflects the cost of these duties and should be approximately equal to the sum of all the fixed costs for the truck and driver divided by the number of farms typically visited when assembling a load. The mileage (or volume) charge considers all other costs of transporting a load of milk to a delivery point and accounts for the weight of the shipment, the distance from farm to plant and the time involved in pumping the milk on and off the truck.

The main objection to stop charges focuses on differential charges for farms with disparate production capacities. The levels of both the stop and volume charges determine the unit hauling cost to producers. For small producers, the stop charge has a much larger impact on the unit hauling cost. For this reason, stop charges have been a source of controversey between small and large producers when debating the structure of hauling fees.

Farm-to-plant shrinkage is the difference between what a hauler reports as the amount of milk picked up and the actual amount delivered to the plant. Most purchase agreements between milk cooperatives and milk plants address the issue of shrink by declaring an acceptable level of shrink that will be tolerated by the plant without penalty. For most agreements, the acceptable range of farm to plant shrink is between .25% and .50%. Shrink becomes an issue when it exceeds acceptable tolerances because it means that the plant is paying for air. Shrink may be attributed to improperly calibrated farm bulk tanks, incorrect readings of the farm

bulk tank dipstick, errors in converting inches on the dipstick to pounds or gallons of milk, errors in recording the amount of milk picked up, air in the milk from over-agitation and milk spillage during transfer.

***Pooled Hauling Costs, Hauling Subsidies, and Competitive Issues***

Another issue confronting both handlers, and haulers, is the problem of how to determine hauling charges to the producer. If farm pick-up volumes and delivery distances are uniform, and there is one, or very few alternative handlers, determining a hauling charge structure may not be a problem. The tendency in the past has been to simply divide all of the hauler payments by the total milk handled to calculate producer charges. Particularly in cooperatives, the 'pooling' of hauling costs has been a common practice.

When there are different farm sizes and/or different distances to delivery points, equity between producers may arise as an issue, particularly within cooperatives. When there are competing handlers in a milkshed, the hauling charge becomes a competitive issue, particularly in a tight milk supply situation. The pooling of hauling costs and/or inadequate reflection of actual individual farm hauling costs in an overall handler's hauling charge system has tended to result in the smaller, poorly-situated producers being subsidized by the larger, well-located producers that can be hauled at lower costs. In competitive conditions, it is these large producers who are the most sought after.

The hauler can be particularly vulnerable to competitive issues between handlers. If a handler loses a large farm to a competitor, the hauler typically is not in a position to do anything about it as it is generally the handler's, not the haulers, responsibility to contract with the producer. The loss of a large stop on a route can be very costly to the hauler as he will typically be unable to reduce capital equipment and other route costs by an equivalent amount. The coop or proprietary handler may be hard pressed to increase charges to remaining producers to offset this income loss to the hauler, as it may then generate further erosion of other well located large producers. Although difficult for any handler, cooperative handlers have an especially difficult time adjusting producer charges to actual hauling costs as a one farm-one vote democratic structure tends to give control to the typically higher number of smaller producers. The use of hauling subsidies to retain larger producers, rather than adjusting the rate structure (which increases the costs to smaller producers), can be expedient but can lead to reduced profits at the end of the year. For a proprietary handler, it may mean a higher cost, less competitive position. Both the handler and the hauler in this situation may end up in a weaker position. In parts of the Northeast and particularly in the Upper Midwest, the use of hauling subsidies is a common practice.

The components of a cost-based hauling charge system for determining producer charges includes the use of stop charges, location adjustment based on distance from milk processing locations, no or little producer control of selection of hauler and time of pickup, mandates or incentives to move smaller producers to every other day pick-ups, and/or volume brackets that reduce charges as volumes per pick-up increase. Even if these issues are tackled, competitive conditions between handlers can still lead to 'free hauling' offers to large producers. In such cases, a cost-based structure will provide producers and handlers with better information as to what the true cost of milk hauling is, so all parties can better evaluate these hauling offers in terms of what they really are: market premiums. A cost-based system also has longer term industry-wide benefits of promoting efficient production and assembly of milk.

***Conclusion***

Milk haulers have become a highly specialized and integral link in the dairy industry, and the importance of their duties cannot be overstated. Today's haulers must have a technical understanding of the dairy industry rather than the physical strength needed to lift 10 gallon cans required in days past. A hauler's familiarity with food safety regulations and sanitary standards as well as proficiency in weights and measures is crucial to the prosperity of the milk industry.

In the Northeast, milk hauling businesses have made dramatic changes in the structure of their fleet vehicles. Double-axle trucks, once the mainstay of the milk hauling industry, are being replaced by tractor-trailers. Milk plant closures and fewer dairy farms have led to longer distances between farms and plants, and the trend is regarded as a contributing factor in the conversion of tractor-trailers as the most popular milk hauling vehicle in the Northeast.

Milk haulers face many perennial issues that directly affect their businesses, and unfortunately, these problems have no immediate or clear solutions. Among the most significant concerns are governmental regulations covering driver hours and road weight limits, retaining skilled drivers, everyday farm pick-ups, extended plant waiting times, and the determination of equitable hauling rates for milk producers.

# APPENDIX

***Results of the 1992 Northeast Milk Hauling Study***

In 1992, a survey of milk haulers in New York and Pennsylvania was conducted to assess the structure of the Northeast milk hauling industry. Detailed information was collected on characteristics of the hauling businesses as well as the equipment operated.[5] One objective of the study was to assess changes in the structure of the milk hauling industry, and more specifically, changes in the hauling businesses themselves. Table 1 reveals that while double-axle trucks were the most popular type of vehicle in 1981, tractors are rapidly becoming the mainstay of the industry. Several reasons may explain milk haulers' efforts to move toward operations comprised primarily of tractors. First, dairy farms are becoming less numerous, and remaining farms are adding cows to increase herd size and boost milk production. The result is that haulers face larger milk pickups with greater distances between farms than a decade ago. Second, the number of milk processing facilities is declining and, consequently, haulers are forced to move milk over longer distances after completing longer milk assembly routes. Considering these changes in the dairy industry, tractor-trailers are better suited to perform milk hauling tasks than straight chassis vehicles, barring any restrictions on load size and farm accessibility.

Table 1. Percent of Milk Hauling Vehicles by Type

| Type of Vehicle | 1981 % Vehicles | 1992 % Vehicles |
|---|---|---|
| Tractor | 37 | 67 |
| Tandem | 55 | 24 |
| Tri-axle | 7 | 8 |
| Other | 1 | 1 |
| *Total* | *100* | *100* |

A second objective of the study was to obtain current cost data and review common efficiency measures. Table 2 reviews average values for various cost and efficiency categories related to milk hauling equipment. Values under the tank column are averages for both double-axle and tri-axle vehicles, and the averages under the trailer column apply to tanks that are matched with trailers. The efficiency measures, loads of milk, farm stops, pounds of milk, miles traveled, operating hours and ton-miles logged, are averages per day and relate to only the vehicle, not the tank or trailer.

Using Table 2 as a guide to equipment prices, a new double-axle truck with a new tank is estimated to cost about $95,000, and a new tractor-trailer rig is estimated to cost nearly $120,000. Tanks and trailers tend to be significantly older than the power units

Table 2. Milk Hauling Equipment Characteristics, Costs and Efficiency Measures

| | **Type of Equipment** | | | | |
|---|---|---|---|---|---|
| | Double-axle | Tri-axle | Tractor | Tank | Trailer |
| *Characteristics and Costs* | | | | | |
| Age of equipment, years | 6.9 | 5.6 | 5.4 | 11.5 | 8.9 |
| Cost of replacement, $ | 67,603 | 71,580 | 68,499 | 27,659 | 50,582 |
| Capacity of tank, gallons | 4,266 | 5,113 | 6,202 | 4,480 | 6,202 |
| *Efficiency Measures* | | | | | |
| Loads of milk per day | 1.5 | 1.4 | 1.1 | — | —- |
| Farms stops per day | 11.9 | 13.1 | 9.9 | — | —- |
| Pounds of milk per day | 50,929 | 55,402 | 52,779 | — | —- |
| Miles traveled per day | 153 | 138 | 288 | — | —- |
| Operating hours per day | 9.0 | 9.4 | 11.3 | — | —- |
| Ton-miles per day | 1024 | 998 | 3223 | — | —- |

[5]For more results on the Northeast Milk Hauling Study, refer to The Structure of the Milk Hauling Industry in New York and Pennsylvania by Erba, Pratt and Wasserman, A. E. Res. 93-13, Department of Agricultural, Resource and Managerial Economics, Cornell University.

themselves, a trend that is expected to continue as a result of the increasingly high replacement costs for tanks and trailers. Furthermore, the sentiment among many haulers is that refurbishing older tanks and trailers is more economically feasible than investing in new equipment. Although most haulers also try to retain vehicles for longer periods before offering them for resale, there is less of an opportunity to extend the life of trucks and tractors without extensive and costly overhauls.

Efficiency measures for the different types of vehicles do not conclusively demonstrate that trucks are more or less efficient than tractor-trailers, but they do support the conclusion that milk haulers tend to use trucks and tractor-trailers for different purposes. Trucks typically assemble milk on local routes from smaller farms and deliver to a local processing facility. Tractor-trailers, on the other hand, tend to concentrate on larger farms during milk assembly and cover more mileage in order to deliver the load. Table 2 indicates that, on average, straight chassis trucks make more farm stops per day and deliver more loads of milk per day than tractor-trailers. Tri-axle trucks haul the most pounds of milk per day, a consequence of utilizing larger capacity tanks than double-axle trucks and delivering an average of 1.4 loads of milk per day. Tractor-trailers log in the highest number of miles each day, and not coincidentally, the highest number of operating hours. Perhaps the most revealing entry in Table 2 as an indicator of the differences in vehicle uses is ton-miles logged per day. The term "ton-miles" demonstrates the amount of work performed by a vehicle and is calculated by converting a load of milk to a ton equivalent and multiplying the tonnage by the number of loaded miles covered in delivering the milk. Table 2 verifies that although tractor-trailers do not haul as much milk per day as tri-axles, tractors have a clear advantage in the amount of work performed. In fact, tractor-trailers average more than three times the work load than either type of truck.

The New York milk hauling industry is characterized by a large number of widely-dispersed, small to medium sized hauling businesses and a few large and centrally-located hauling businesses. Of the participating haulers, about 29% own a single milk hauling vehicle, but they account for only about 5% of the vehicles operated in the state. On the other hand, the five largest milk haulers in New York account for 30% of the vehicles in the study.

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