Innovative Methods of Milk Transport: Double-Bottoms and TOFC

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Costs involved in double-bottoms (tandem trailers) and TOFC (trailer-on-flatcar; piggyback) were modeled and compared with conventional over-the-road transport of bulk milk from northern Vermont in single trailers. Both modes were found to be both cost-effective and fuel-sparing alternatives to conventional transport.

Since the study's completion, although not as a direct result of it, two shippers have adopted these innovations. One of them (using double-bottoms) has budgeted savings even larger than those claimed in our study.

Long-time increases in the costs of hauling bulk milk—notwithstanding recent declines in fuel prices—have prompted a search for economies in that phase of the milk marketing operation. Double-bottoms (tandem trailers) and trailer-on-flatcar (TOFC; piggyback) are the two innovations that were explored in this study. Each, within its respective limitations, was found to be practical. During late 1982, each has been adopted by a Northeastern milk shipper, evidently with satisfactory results.

The Setting

Between 1,000 and 1,200 trailer loads of bulk milk are shipped monthly from northern Vermont to markets in southern New England in the peak season of such shipments. An interest in potential savings in this operation—including resource savings in the event of national emergency—was the basis for a contract wherein the Vermont Department of Agriculture financed a study of the subject by the University of Vermont.

Conclusions

If permitted by highway regulations (which presently are restrictive), all of this milk would be suitable for double-bottoming for that part of its haul which is accomplished over the interstate highway system. This could be done at a saving which we estimate would typically amount to 6½¢ per 100 pounds of milk so handled. This is $65 per haul (100,000 pounds of milk) with a double-bottomed mileage of 150 miles in each direction. Other sources place the savings from double-bottoms at even higher levels.

The volume of milk in position to benefit from TOFC is onlly about 25% of that potentially benefiting from tandem trailers. However, TOFC has the very important advantage of being immediately available to northern Vermont shippers, whereas tandem trailers would require changes in federal and state laws. The fixed location of rail facilities imposes a rigidity upon TOFC service. Overnight TOFC service is presently available in Vermont from St. Albans, Vermont to Palmer and East Cambridge (near Boston), Massachusetts and New Haven, Connecticut. Under optimum conditions of volume and location of the receiving plant, TOFC savings could exceed $50 per trailer shipped (50,000 pounds milk) or 10¢ per 100 pounds.

Double-Bottoms

Legal Status

Milk is a bulky, perishable product requiring closely controlled handling conditions. To benefit milk shippers, most Northeastern highway regulations covering vehicle configurations, maximum lengths, and maximum weights of double-bottoms would have to be substantially changed. In fact, all of these re-

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Respectively, Visiting Economist (at the time this research was done), and Agricultural Economist at the University of Vermont.
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strictions would have to be liberalized. Action removing only one or two of these restraints would not be helpful to the dairy industry. At present, the New York Thruway and the Massachusetts Turnpike are the only Northeastern highways permitting double-bottoms at the weight and length limits that allow full-size tandem highway trailers.

At least one Eastern state permits turnpike tandems on specified routes (New York on the Northway) within the 65-foot length and 80,000-pound weight limits that govern single semi-trailers. This does not benefit milk shippers who can conveniently fill those limits with a single trailer.

The Budget Reconciliation Act, the last piece of legislation to clear the 97th Congress, directed eventual approval of double-bottoms on the interstate system but within the 80,000-pound weight limit. The same law ordered a study of the pros and cons of behavior configurations.

A sustained lobbying effort could probably bring about the necessary changes in federal laws and payments to states to gain approval of full-size double-bottom combinations on interstate highways. However, some impetus such as a worsening energy crisis would probably be needed to increase support for these changes. Opposition to such changes can be expected from competing carriers such as railroads, state highway administrators, and spokesmen for organized groups of private motorists.

Economic Factors

In South Dakota, double-bottoming of highway trailers (each 40–45 feet long with GVW's over 60,000 pounds) on interstates is well established. Fuel savings of 40% are reported by using one tandem vs. two singles. Savings in driver time approach 50% before adjustment for time spent deadheading and coupling-uncoupling the double units.

Only modest capital costs need to be committed before these operating savings can be realized. A dolly to connect the two trailers and the necessary adaptation of brake and electrical lines are estimated at $5,000. Reinforcement of the chassis of the lead trailer and installation of a pintle hook are $500.

Ideally, the tractor for a tandem should have a more powerful engine and more versatile transmission than ordinarily used for single-trailer operation: $10,000. More than offsetting the extra cost of a bigger tractor is the displacement of two ordinary tractors with one big one—($55,000 × 2) − $65,000 = $45,000.

Under the assumptions we used for the hauling of northern Vermont milk to markets in southern New England, the saving amounted to about $65 per trip or 6½¢ per 100 pounds of milk. This per trip saving was based on a round trip of 300 miles on interstates. If the distance hauled over interstates were greater, the savings would be more than proportionately larger because the fixed costs associated with deadheading and hookup would not be increased. Fuel and labor savings would change proportionately.

Reliable sources have already questioned these estimated savings as being too low, a gratifying argument to researchers who aspire to be innovative and yet conservative.

The first estimate of greater savings came to us from a South Dakota firm with extensive experience in double-bottoming in that state. The firm's base labor rate, paid on a per-mile basis, is 2½ to 3 times the equivalent per-hour rate prevalent in northern Vermont. Also, the average fuel cost per gallon was 25% higher than the then current costs in Vermont. South Dakota does permit tandems to travel on designated local streets and highways, reducing the deadheading and extra hookup operations that we assumed.

The second estimate of greater savings comes from the major milk marketing cooperative in New England, Agri-Mark. Since completion of our study, the cooperative began double-bottoming milk over the New York-Massachusetts toll roads between Canaan, New York, and metropolitan Boston—320 round-trip turnpike miles. Agri-Mark has estimated savings of 10 to 20¢ per 100 pounds.

Table 1 summarizes our comparison of the financial aspects of single-trailer vs. tandem trailer operation in bulk milk hauling on interstates, if such traffic were generally permitted.

TOFC

Availability and Rates

About 20 to 25% of the northern Vermont milk shipped to southern New England either originates within 20 miles of St. Albans or is produced at a location where highway alignments

Table 1. Financial Summary of Difference in Cost Items in Operation of Single and Tandem Semitraliers on Turnpike[a]

Item	Mode of operation: 2 Conventional units	Mode of operation: 1 Tandem	Difference in favor of tandem
	Dollars	Dollars	Dollars
Fuel @ $1 per gallon	120.00	80.00	40.00
Driver time @ $5 per hour, exclusive of fringes	75.00	53.50	21.50
Deadheading mileage, exclusive of fuel and driver time, @ $.40 per mile		16.00	(16.00)
Capital costs, converted to per-trip basis (net difference)			20.00
Net savings, per tandem trip, compared with two singles			65.50
Per cwt. milk, basis 500 cwt. per trailer (1,000 cwt. per double)			.0655

[a] Per-trip differences (unless otherwise stated) involving 300 turnpike miles per round trip and assuming 340 round trips per year.

make shipment through St. Albans a practical matter. In addition, considerable milk produced in northeastern New York is normally marked under Federal Milk Marketing Order No. 1 (New England) and could move along the interstate highway which passes through St. Albans.

The result is a volume that, if fully enrolled in piggyback, would permit application of the most favorable rate scale published by the Central Vermont Railway, supplier of the service. In mid-1982, rail charges for the service were as shown in Table 2. The per-mile equivalents of these rates (last column) are in every case significantly lower than the per-mile costs of approximately $1 per highway mile for over-the-road hauling. But there are additional costs beyond those stated in the rail tariffs.

Additional Costs

TOFC requires at least twice as many trailers as equivalent over-the-road haulage. Ideally, TOFC would be done with trailers especially reinforced to absort lateral shocks common on the rails but less frequent on the highways.

Table 2. Available Trailer-on-Flatcar Rail Services and Basic Rates, Vermont, Mid-1982

From St. Albans to:	Highway mileage one way	Published rate schedule per trailer on basis most advantageous to shipper[a]: Southbound (loaded)	Northbound (empty)	Total	Per round-trip highway mile equivalent	Revised rate, current as of May 1983, round-trip
	Miles	Dollars				
Palmer, Massachusetts	247	164	120	284	.57	
East Cambridge, Massachusetts (Boston)	254	230	186	416	.82	250
New Haven, Connecticut[b]	301				.69[c]	

[a] Lowest published rate as of May 1982 for trailers owned by highway carriers; not presently applicable to single trailer, but milk shippers could form a freight-forwarding co-op to qualify for the multiple rates on a space-reserved basis.
[b] Service to begin in June 1982. Exact rate not yet announced but expected to be about same total rail charge as to East Cambridge.
[c] Estimated equivalent.

Finally, the costs of drayage or local hauling at the destination must be included in the total TOFC costs.

Table 3 combines these additional costs with the basic rail tariff. The TOFC costs assume certain credits for spared tractor mileage and compares the total with over-the-road costs of an identical haul. On what is literally the bottom line of the table, a TOFC advantage of $52 per shipment is shown. This advantage can be realized, however, only with (1) steady use of the equipment to spread the high fixed costs and (2) a favorable location of the receiving plant relative to the unloading ramp to minimize drayage costs.

While our calculations as summarized in Table 3 show opportunity for TOFC benefits even with limited outside drayage costs, two Vermont co-ops have cut costs even further by using in-house drayage facilities.

In one case, the Richmond Cooperative Association, Inc. would dispatch a TOFC shipment to Palmer at the same time that an over-the-road shipment was en route to Webster, Massachusetts. The same trailer that drew the over-the-road load to Webster would accomplish the Palmer-Webster drayage, a matter of about 35 miles.

In the other case, the St. Albans Cooperative Creamery, Inc. arranged with its Massachusetts receiver, located 6 miles from the unloading ramp, to do the drayage with its own tractors. Drayage over such a distance is a minor direct cost when done in-house with available equipment but very costly when contracted out to an operator who includes overhead costs in his mileage charges.

The Richmond experience with piggyback occurred before our study was planned and terminated for reasons unrelated to rail use. The St. Albans Co-op experience—which continues—was begun after our study was completed. Like the earlier experience, continued use will depend not only on relative costs but also on milk production and sales factors outside the scope of our study.

The National Interest

One of the concerns of our study was the magnitude of possible savings in critical materials—fuel and rubber—via the innovative transport modes.

Double-bottoming, based on the South Dakota experience, results in a 40% fuel saving as compared with two single trailers. While a saving in tire use also occurs, it is less significant, occuring in approximately the following ratio:

Table 3. Summary of Costs, TOFC vs. Through-Truck Milk Hauling, Hypothetical Case, Enosburg Falls Area (St. Albans Loading Ramp) to Milk Receiver Within 30 Miles of Palmer Unloading Ramp[a]

Item	Principal costs which differ as between TOFC and through-truck			
			Difference	
	TOFC	Through-truck	In favor of TOFC	In favor of through-truck
	----------Dollars----------			
Fixed costs, annualized				
Related to capital investments (difference only)				10,227.50
Related to noncapital fixed costs	8,883.80	5,316.90		3,566.90
Total				13,894.40
Total fixed costs converted to daily basis (365 trips per year)				38
Direct costs, per trip	464	554	90	
Net difference, fixed and direct costs combined, per daily trip (365 per year)			52	

[a] Round trip basis, per daily trailerload of milk.

Unit	2 Singles	Double-bottoms
Tractor(s)	10 × 2 = 20	10 × 1 = 10
Trailers	8 × 2 = 16	8 × 2 = 16
Dolly	—	8 × 1 = 8
Total tires	36	34

The railroad use of diesel fuel is about 12 TOFC miles per gallon according to a summary of studies collated by the Canadian National Railway. This contrasts with a highway use of 5 miles per gallon found in a previous Vermont study. The current study gave no credit to TOFC for savings in tire wear because of hazards to sidewall life that occurs in ramp loading. This hazard is reduced and possibly eliminated in the newer methods of crane loading that some railroads are now introducing.

References

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