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USING THE TI-59 PROGRAMMABLE CALCULATOR TO ESTIMATE OPERATING COSTS AND HAULING RATES FOR BULK MILK ASSEMBLY

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INTRODUCTION AND PURPOSE

The New York State dairy industry is vitally dependent on an efficient and competitive transportation system for assembling and transporting milk from farms to processing plants. Much of the state's milk assembly operation is carried out by independent contract haulers who operate their own truck(s). The independent owner-operator has often proved the best as well as the lowest-cost option for accomplishing the hauling function. The use of a relatively large number of independent haulers over a wide range of route conditions does, however, create significant coordination needs for the participants. This publication is directed to assisting with one aspect of the coordination requirements: the determination of equitable hauling rates.

The rate paid to haulers for bulk milk assembly is, ideally, negotiated on a route-by-route basis. Typically, in practice the request for a rate change is initiated by a hauler and justified on the basis of an increase in labor, fuel or other costs. But since many cost increases affect all haulers, what began as a request for a rate change by an individual hauler often becomes a concurrent request by all haulers. If the handler agrees to a rate increase while lacking specific information about the effect of the cost increase on individual routes, the increase is often applied as a flat, across-the-board adjustment. Such uniform rate changes in assembly systems with highly divergent route conditions tend to favor some haulers over others. As a result some assembly routes can be substantially more profitable than others, while the system as a whole is neither efficient nor equitable for either the dairymen or the haulers. A detailed knowledge of assembly costs is essential for operating an efficient system.

At the same time, rapidly rising transportation costs have placed the small contract hauler at a competitive disadvantage to larger operators as the management function becomes more critical. The small operator, who drives and maintains the truck, has less time available for analyzing the business. A quick means of estimating changing route costs should prove an essential management tool during these inflationary times.

The purpose of this publication is to present a ready means of estimating the effect of a change in the cost of the one factor, like fuel, on overall operating costs. The resultant estimates are useful to both handlers and haulers. Handlers may use the estimates in planning for anticipated future cost changes. Haulers must keep track of costs to be sure that rates are sufficient to accumulate capital for timely replacement of the tank truck fleet. Together the estimates provide a common basis from which rate negotiations can be started.

The estimates are developed using economic engineering techniques by combining individual item costs, from fuel and tires to purchase price and maintenance, into uniform operating costs per unit of time and distance. These estimates may be broken out into fixed and variable cost components. To help with the calculations a TI-59 programmable calculator is used.[1/] With its assistance the effect of a fuel price increase on total per mile costs, to mention one example, can be determined within seconds.

The program is kept relatively short by omitting much of the detail and special considerations which are a part of day to day operations. Thus the

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[1/] The program is readily transferable to another programming language such as that used on the HP-97 calculator. Some knowledge of programming is necessary.

results should be viewed as estimates only. The estimates include operating costs only; other factors such as returns to management, and risk are not included. The appropriate payments for management and risk vary widely from firm to firm so that no rule-of-thumb figure can be established. Allowances for these factors and other items specific to particular routes must be established during negotiations.

Data requirements for the program are extensive. In some cases a considerable initial effort will be required to establish a system for collecting and updating the necessary information. If it is done properly this data collection procedure should lead to better record keeping and an improved understanding of the hauling system and the major factors influencing costs. If not, the estimates provided by the program will be inaccurate and misleading.

This report is organized as follows. The following section includes a description of the basic program, an example of its use and a methodology for collecting the necessary data. Section three entails an explanation of ways of adapting the basic model for different operating and cost conditions. A method for using the program output to calculate hauler payments and producer fees is described in the fourth section. Finally, the Appendix contains a printout of the TI-59 program.

Using the TI-59 Program

Steps for operating the program are detailed in Figure 1.

Definitions and Guidelines for Data Collection

The results of the program are, of course, only as good as the data which are entered by the user. A strict adherence to the definitions and collection guidelines listed below will help to assure that the program results are valid and compatible for cross-firm comparisons.

Figure 1: Operating Instructions for the TI-59 Program

Entering the Program from Magnetic Cards:

Turn Calculator off. Turn calculator on.
Press Key 1, insert side 1
2, insert side 2

DATA INPUT

Item[2]	Press Key	Example[3] Value	Press Key	Example Display	Your Value	Press Key	Your Display
Route Miles	A	40,000	A	40,000	____	A	____
CWT Capacity	B	344	B	344	____	B	____
Truck Cost ($)	STO 03	44,000	STO 03	44,000	____	STO 03	____
Truck Life (years)	STO 04	7	STO 04	7	____	STO 04	____
Interest Rate	STO 05	.12	STO 05	.12	____	STO 05	____
Truck Salvage Value	STO 06	7000	STO 06	7000	____	STO 06	____
Tank Cost ($)	STO 07	18000	STO 07	18000	____	STO 07	____
Tank Life (years)	STO 08	10	STO 08	10	____	STO 08	____
Tank Salvage Value	STO 09	2500	STO 09	2500	____	STO 09	____
Insurance	STO 10	1100	STO 10	1100	____	STO 10	____
Registration	STO 11	250	STO 11	250	____	STO 11	____
Highway Tax	STO 12	120	STO 12	120	____	STO 12	____
Miscellaneous Costs	STO 13	600	STO 13	600	____	STO 13	____
Driver Hourly Wage	STO 14	7.00	STO 14	7.00	____	STO 14	____
Relief Driver Wage	STO 15	2968	STO 15	2968	____	STO 15	____
Capacity Utilization	STO 16	.87	STO 16	.87	____	STO 16	____
Hours/Day - Driver	STO 17	8	STO 17	8	____	STO 17	____
MPG	STO 20	5	STO 20	5	____	STO 20	____
Fuel Costs ($/Gallon)	STO 21	.85	STO 21	.85	____	STO 21	____
Cost New Tire	STO 22	190	STO 22	190	____	STO 22	____
Cost Recapped Tire	STO 23	75	STO 23	75	____	STO 23	____
Number Tires	STO 24	10	STO 24	10	____	STO 24	____
Ton-Mile Tax Rate	STO 25	.017	STO 25	.017	____	STO 25	____
Annual Maintenance	STO 27	600	STO 27	600	____	STO 27	____
Repair Gradient	STO 28	800	STO 28	800	____	STO 28	____
Misc. Variable Costs	STO 29	---	STO 29	---	____	STO 29	____

OUTPUT

Press Key	Value Output	Example Display	Your Display
C	Total Annual Fixed Costs (TFC)[4]	34,500	____
R/S	TFC/Mile	.863	____
R/S	TFC/CWT	.316	____
R/S	Minute	.197	____
D	Total Annual Variable Costs (TVC)[5]	18,720	____
R/S	Total Annual Costs (TC)[6]	53,221	____
R/S	TC/CWT	.487	____
R/S	TC/Mile	1.33	____
R/S	TVC/CWT	.17	____
R/S	TVC/Mile	.468	____

[2] Definitions of these terms and suggested sources of information are included in the following section.

[3] Route characteristics are taken from a June 1978 survey in the New York State Order area. Hauling costs were collected from cooperating operators, but these numbers are intended to serve as an example only and do not necessarily reflect actual costs.

[4] Fixed Costs include the items stored in registers A and B and 3 through 7.

[5] Variable Costs are calculated from the data contained in registers 20 through 29.

[6] TC = TFC + TVC.

i) Route Miles - available directly from the hauler or through a special survey. These values may be verified by tracing the route. The annual total of daily garage-to-garage miles is used.

ii) Tank Capacity in CWT - available from the hauler or tank manufacturer.

iii) Truck Costs - trucks are available with an extremely large selection of optional equipment from engines, axles and transmissions, down to radios, air conditioners and seats. To standardize cost estimates the specifications of a serviceable truck, must be agreed upon by haulers and handlers. Examples of such specifications are listed in Figure 2. With these specifications, prices can be collected from cooperating new truck dealers. In most cases fleet prices will be assumed to apply.

Truck investment costs are frequently lumpy with a large initial investment (down payment), a stream of interest and repayment costs and finally a return in the form of the salvage value (trade-in or scrap value). In order to make nonuniform series of costs and returns comparable they are converted to an equivalent uniform annual series of payments.[8/] This series also takes account of the time value of money (present value) in recognizing that a dollar is worth more to us today than a year from now.

iv) Truck Life - the expected number of miles of service would be available from service managers. Dividing this figure by (i), the annual route miles, will give the expected life in years.

v) Interest Rate - the relevant interest rate for borrowed money may be collected from truck dealers and local bankers.[9/]

vi) Truck Salvage Value - this figure will perhaps be the most difficult to estimate accurately. Dealers can give a good indication of what a particular five year old truck is worth

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[8/] The Annual Equivalent Cost (AEC) formula used in the program is:

$$AEC = (B)\ \frac{i(1+i)^n}{(1+i)-1} - (V)\ \frac{i}{(1+i)^n-1}$$

B - present cost of investment
V - average value at end of nth year
i - interest rate on loan (see v. above)

Source: Gerald W. Smith, Engineering Economy: Analysis of Capital Expenditures. Iowa State University Press, Ames, 1968, p. 99.

[9/] The use of opportunity costs of capital is theoretically preferable but in practice may be difficult to determine.

today. This, however, will not necessarily indicate future salvage values since new truck prices have been rising rapidly in recent years, carrying used and junk truck prices up with them. The problem of estimating future salvage values is therefore one of projecting the rate of inflation for this equipment. Individual judgment must be used.

vii) Tank Cost and Life - available from the suppliers. Annual costs are calculated in the same manner as truck costs (see iii above).

viii) Tank Salvage Value - use current scrap metal values which have remained relatively constant over time.

ix) Insurance - annual rates for liability and cargo, available from insurance agents and brokers. A standardized policy should be used. Such a policy might include $300,000 - $500,000 liability, collision for the value of the truck with $200 - $500 deductible and cargo coverage in case of upset. Some states, like New York, mandate other coverage.

x) Registration Fees - annual fees available from the New York State Department of Motor Vehicles or comparable department in other states.

xi) Highway Tax (State and Federal) - listed in New York State Department of Taxation and Finance Highway Tax Law bulletin, October 1, 1974, or similar bulletins from other states, and in Federal tax codes. The tax should be calculated on an annual basis.

xii) Miscellaneous Fixed Costs - these costs should include annual garaging, bookkeeping, heat, office, and other expenses which are necessary to operate the milk hauling business. These items are likely to differ from operator to operator so that the actual costs should be used if available. If they are unavailable or if there are questions about the validity of the figures a rule-of-thumb allowance should be developed and used. In the longer term the establishment of a uniform accounting procedure is advisable. Other fixed costs which do not fit into the above categories may also be included here. See the following section for several examples.

xiii) Drivers' Wages - if a significant number of drivers are unionized, the rate stipulated in the contract may be used. Wages should include the value of all fringe benefits. If the drivers are not unionized or a significant number are independent owner-operators, then the prevailing local rate (including fringes) must be used. The relief driver wage is entered as an annual amount calculated by multipling the hourly rate by the total number of hours worked.

xiv) Capacity Utilization - calculated from average delivery weights recorded on weigh-bills, divided by tank capacity.

xv) Hours/Day for Driver - an eight-hour day may be assumed unless information from the haulers or contract specifications indicate that a different length of day should be used. A six-day week is also assumed and is stored as a constant in the program. The relief driver accounts for the 7th day.

xvi) Fuel Consuption MPG - available from operators or as estimates from truck dealers.

xvii) Fuel Cost ($/Gallon) - use average local pump prices.

xviii) Cost of New and Recapped Tires - use fleet prices collected from local dealers.

xix) Number of Tires - part of specifications under (iii) above.

xx) Ton-Mile Tax Rate - rates are listed in the New York State Department of Taxation and Finance Truck Mileage Tax and Fuel Use Tax bulletin, Regulations 21, April 1, 1970, or similar publications for other states. If fuel is bought outside the state of operation a fuel use tax must also be paid (not included in program).

xxi) Annual Periodic Maintenance - this figure includes oil, chassis lubrication, filters, plugs and points (if necessary). This cost is available from local service stations and can be calculated on an annual basis according to expected mileage and service intervals recommended by the manufacturer.

xxii) Repair Cost Gradient - with the specification list described in (iii) above an expected annual service schedule and cost of repairs can be developed with the assistance of local truck service managers. This cost schedule is then transformed into uniform annual gradient 10/ which in turn is converted to the present value. 11/

xxiii) Miscellaneous Variable Cost - to be used for items related to operating the truck but not included elsewhere. Examples include mileage based rental rates for the truck or tank.

10/ The formula used for converting the gradient g into a uniform annual cost R is:

$$R = \frac{g}{i} - \frac{ng}{i} \times \frac{i}{(1+i)^n - 1}$$

where: R - uniform annual gradient
g - gradient value
n - years
i - interest

11/ The uniform gradient R is calculated as a present annual value P by using:

$$P = R \times \frac{(1+i)^n - 1}{i\,(1+i)^n}$$

Source: E. Grant and W. G. Ireson, Principles of Engineering Economy, Ronald Press Co., N. Y., 1960, pp. 52 and 495.

Figure 2: Truck Specifications: Single Chassis

Specifications for a Single Chassis Truck
Suitable for a 4,000 Gallon, Farm Pickup Truck

Cab:	151" conventional	
Wheel base:	Approx. 218"	
Engine:	Detroit diesel - 671 N	Engine heater
	Low oil pressure warning	Vertical exhaust
	Spin-on oil filter	Luberfiner - 750
	Spin-on water filter	Farr air cleaner
	Plastic fan blade	Delco Remy H.D. alternator
	Jake brake	Ammeter
Clutch:	14" double disc	
Transmission:	Fuller R.T.O. 915	
Rear Axle:	Timken 38,000# 4:44 ratio	
Suspension:	Hendrickson spring & saddle mount. Extended leaf, 50" aluminum beam	
Front Axle:	Rockwell FL 901 - 18,000 lb., Shepard power steering	
Brakes:	S-Cam. Rear - 16 1/2" x 7 8" dia.	
	Front - 16 1/2" x 5"	
	Hand valve for all wheels	
	Front wheel limiting valve	
	Alcohol kit	
Tires:	Front - General high miler - 11:00 x 20	
	Rear - General D.C.L. 10:00 x 20	
Other Options:	Double frame or frame reinforcement	
	Dual 50 gal. step tanks	
	Stemco hubs	
	Tow hooks, front and rear	
	Bostrom Viking driver seat	
	Passenger seat	
	Air horn	
	Electric wiper motor	
	Radiator shutters	
	West Coast mirrors	

Source: Dennis R. Lifferth and Walter C. Wasserman, Milk Transportation and Processing: Analysis of Alternative Milk Marketing Systems USDA Farmers Cooperative Service, mimeograph, undated, p. 139.

Assumptions Incorporated in the Model

To keep the data inputs to a reasonable number it is convenient to incorporate some factors as constants within the program. These values entered into the program may not be appropriate for all users so that it is important to understand what assumptions are made in fixing the levels. The constants used are described below. The numbers in parentheses identify the step number from the appendix which are associated with the quoted value. If there is a need to make a change in these values, the procedure explained in the following section can be followed.

CONSTANTS:

Tire Use: a new good quality 10:00 x 20 tire is assumed to have a life of 55,000 miles and be recappable an average of once for a total carcass life of 80,000 miles (steps 180-84).

Regular Driver: The regular driver is assumed to work 312 days per year (steps 51-53).

Relief Driver: the relief driver wage is calculated based on 53 8 hour-days per year at a given rate per hour (stored as a variable).

Fixed Costs Per Minute: the fixed costs are allocated over an 8 hour-day (which works out to 480 minutes/day or 175,200 minutes per year) (steps 93-98).

ADAPTING THE MODEL FOR DIFFERENT CONDITIONS

The basic program applies to the simplest possible bulk hauling situation; the hauler follows one route per day using self-owned equipment. The program as written obviously does not apply to situations in which two or more routes are run per day, or if equipment is leased rather than owned. This section contains explanations for adapting the basic program for different conditions. The changes include straightforward modifications in the input data and increase in complexity up to permanent changes in the program itself. The following examples indicate how several kinds of changes

may be made. They should be used as guidelines for other uses of the program to meet specific user requirements.

Adjusting the Data for Different Conditions: Multiple Routes per Day

Assembly costs for a truck with two or three routes per day may be incorporated into the program as if it were one "super truck" making one trip. Multiple routes can generally be expected to reduce total costs per hundredweight. The cost savings come principally from spreading the fixed costs (primarily truck and tank costs) over a larger volume. Instructions for entering the figures for multiple routes are described below. If an item is not mentioned no change is necessary.

Data Input

- Route Miles: Add the total average daily miles (garage-plant-plant-garage) for the first, second and, if applicable, third routes and multiply by 365, enter figure on display and press A.
- CWT Capacity: Multiply the cwt capacity of the tank by the number of routes (loads), enter on display and press B.
- Hours/Day - Driver: Add average daily route hours for the first, second and, if applicable, third routes, enter value on display and press STO 17.
- Capacity Utilization: Add total cwt delivered for the first, second and applicable third routes, divide by the cwt capacity calculated as above, enter on display and press STO 16.
- Note: Maintenance and repair costs should be increased accordingly.

Example

A dual axle straight chassis truck with a capacity of 344 cwt covers two routes a day. On an average day the driver spends six hours covering 150 miles on the first route and delivering 317 cwt milk. The second route is shorter and faster covering 100 miles in 3½ hours but the delivery is only 281 cwt.

Calculations:

- Route Miles

  Total Miles = 150 + 100 = 250 x 365 = 91,250 miles

- CWT Capacity

  344 x 2 = 688 cwt

- Hours/Day - Driver

  6 + 3.5 = 9.5 hours

- Capacity Utilization

  317 cwt (1st load) + 281 cwt (2nd load) = 598 cwt total

  598/688 cwt capacity = .87 capacity utilization

Data Entry

Item	Enter Value	Press
Route Miles	91250	A
CWT Capacity	688	B
Capacity Util.	.87	STO 16
Hours/Day - Driver	9.5	STO 17

Incorporating Different Operating Characteristics: Leased Equipment

If equipment is leased rather than owned the lease rate may be included in register 13 or 29 or if the lease includes both fixed and variable aspects both may be used. (If all equipment is leased with a service contract an interest rate - register 05 - still must be entered for the program to operate.) A fixed rental rate should be entered in register 13. If the rate is established on a monthly basis it must be adjusted to reflect the actual annual fee.[12/]

12/ Some leases require a substantial payment at the beginning of the contract. If this payment is nonrefundable it should be entered in register 3 or 7 as equipment cost. Even if the payment is refunded at the expiration of the lease the compounded interest figure over the period can be substantial. This amount, too, should be entered as a cost.

Rates which vary according to distance or other factors should be included as a variable cost in register 29. Costs which are variable by the mile must be multiplied by total annual miles (register A). In some cases the tank payment is based on the volume of milk delivered. In this situation the rate must be multiplied by the capacity (register B) adjusted for capacity utilization (register 16). Instructions for inserting into the program new instructions for calculating variable costs per mile and similar changes are described in the following section.

Example

A hauler signs a seven-year lease for a bulk tank which includes a $1,500 nonrefundable payment plus one-half cent per hundredweight delivered.

Calculations:

- Volume delivered

CWT = Capacity x capacity utilization x days

= 344 x .87 x 365 = 109,237

This calculation must be made internally; see following section for instructions.

Data Entry

Item	Enter Value	Press
Initial Payment	$1,500	07
Tank Salvage Value	0	09
Tank Life	7	08
CWT Rate	.005	29

Changing a Constant Incorporated in the Program: Tire Life

The program calculated costs per tire mile based on tire life which is fixed for all users according to the following formula:

$$TC = \frac{CN + CR}{80,000}$$

where:

TC - total cost
CN - new cost
CR - retread cost

If radial tires, also once retreadable, are in service for a combined life of 110,000 miles it is necessary to change the 80,000 mile constant stored in the program (steps 180-84). This may be done in the following way (3 through 7 change the values of numbers previously stored; 8 creates a space not previously present for inserting a larger number):

	Press	Display	Object
1.	GTO 180	--	Locate part of program requiring change
2.	LRN	180 008	Put calculator in mode to make changes
3.	1	181 0	Insert new number
4.	1	182 0	Insert new number
5.	0	183 0	Insert new number
6.	0	184 0	Insert new number
7.	0	185 54	Insert new number
8.	2nd INS	185 0	Create space for larger number (all following steps are moved up one space)
9.	0	186 54	Have completed inserting 110,000 in place of 80,000
10.	LRN	--	Return to operating mode

If this change is to be permanent it may be stored on a magnetic card by following these steps:

Press 1 2nd WRT - insert card, turn over
Press 2 2nd WRT - insert card

If the display number is not flashing, the program was transferred properly.

Inserting Additional Instructions: CWT Rate

When the lease rate is based on the volume of milk delivered, it is necessary to include volume delivered as a variable in the program. The necessary instructions using the formula: RCL02 x RCL16 x 365 may be inserted following the rate variable (register 29) in the following fashion:

	Press	Display	Object
1.	GTO 208	--	Locate appropriate place in program
2.	LRN	208 95	Put in learn mode
3.	2nd INS	208 0	Clear space
4.	X	209 65	Insert multiplication instruction
5.	2nd INS	209 0	Clear space
6.	RCL	210 65	Multiply times capacity
7.	2nd INS	210 0	Multiply times capacity
8.	02	211 65	Multiply times capacity
9.	2nd INS	211 0	Multiply times capacity
10.	X	212 65	Multiply times capacity
11.	2nd INS	212 0	Multiply times capacity
12.	RCL	213 65	Multiply times capacity utilization
13.	2nd INS	213 0	Multiply times capacity utilization
14.	16	214 65	Multiply times capacity utilization
15.	2nd INS	214 0	Multiply times capacity utilization
16.	X	215 65	Adjust for year
17.	2nd INS	215 0	Adjust for year

	Press	Display	Object
18.	3	216 65	Adjust for year
19.	2nd INS	216 0	Adjust for year
20.	6	217 65	Adjust for year
21.	2nd INS	217 0	Adjust for year
22.	5	218 65	Adjust for year
23.	LRN	--	Exit learn mode

DETERMINING HAULING RATES FROM THE PROGRAM ESTIMATES

Hauling costs may be divided into three categories - on-farm, travel, and volume - based on where they are incurred. These categories take account of variable costs of travel (fuel, tires and maintenance) and the fixed costs of the tank, truck, insurance and the scheduled driver. Fixed costs are substantial, comprising approximately two-thirds of total assembly route costs, and must be allocated across a full day's activities on a cost per minute basis.

On-farm costs are fixed costs which include the time required to perform routine chores at each stop. These chores include hooking up, agitating the milk, sampling, and rinsing the farm tank. The driver's personal time for lunch and rest breaks is also included with the on-farm costs.

Travel or mileage costs include both fixed and variable cost segments. The variable costs are related to the miles traveled while the fixed costs include the proportionate share of the overhead costs for the time the truck is traveling. The final category, volume costs, involves pumping time at the farm and plant.

These three components of the hauler rate are summarized in Figure 3 below. For completeness, this figure also indicates how the producer rate may be calculated. Producers are assessed in a slightly different fashion

than the haulers are paid so that there is not a direct pass-through of each cost item, as shown in the Figure.

Figure 3: Cost Components Included in the Hauler Rate and Producer Payment

Hauler Rate	Route Costs	Producer Rate
Stop Payment	On-farm labor, excluding pumping time, plus share of fixed cost, plus waiting and personal time	Stop Charge
Mileage Payment	Transport (garage to first farm, last farm to plant and plant to garage) cost	Location Differential
	Assembly (first to last farm) costs plus share of fixed cost and labor	
Volume Payment	Plant pumping and wash plus farm pumping time	Volume Charge

Example of Determining Hauler Payments for a Representative Route

The representative route used in this example is based on a June 1978 survey of New York State Order assembly routes and has the following characteristics (the fractional route figure is an average of routes operated throughout the survey period):

Routes per day -	1.2
Effective tank capacity -	688 cwt
Number of stops -	9
Miles per year -	40,000
Hours per day -	8
Capacity utilization -	.51
Total assembly time -	228 min.
Less on-farm time -	135 min.
Driving time between stops -	93 min.
Plus transport time -	117 min.
Total driving time -	210 min.
Plant time -	90 min.

Unloading -	30 min.	
Washing -	30 min.	
Waiting -	30 min.	
Driver Personal time -		45 min.
Lunch -	30 min.	
Breaks -	15 min.	
Total route time -		480 min. (8 hours)

Applicable route costs from the program example in Figure 1 are:

Total annual fixed cost -	$34,500
Fixed cost per minute -	.197
Total annual variable cost -	$18,720
Variable cost per mile -	.468

A base hauling rate may then be calculated as follows:

Item	Includes	Amount	
Stop payment	On-farm labor, excluding pumping time, plus share of fixed costs, waiting and personal time	135 min. on-farm - 45 min. pumping 90 min. routine time 30 min. waiting at plant + 45 min. driver's personal time 165 min. x $.197 FC/min. $32.51	$32.51
Route mileage payment	Operating cost plus driving time	109 miles x $.468 VC/mile $51.01	
		210 min. x $.197 FC/min. $41.37	$92.38
Volume payment	Pumping and washing time	105 min. x $.197 FC/min $20.69	$20.69
		Total route cost/day	$145.58
		Total route cost/mile	1.34
		Total route cost/cwt.	.42

The calculated hauling cost of 42 cents per hundredweight must be used only as a base or guideline rate. There are numerous other factors that should be considered in arriving at an actual rate. The actual rate must include a return for hauler management and risk not included in the cost estimates as well as including differentials for specific route characteristics such as road conditions and grade. Thus each route or group of routes served by a hauler must be analyzed separately with the final rate determined through individual negotiations.

The procedure described above if properly implemented is a means of achieving a closer correlation between hauling rates and actual route costs. It should provide an incentive for both producers and haulers to improve efficiency in the milk assembly system and serve the long-run interests of all participants.

BULK MILK ASSEMBLY PROGRAM

LRN

000	76	LBL
001	11	A
002	42	STO
003	01	01
004	91	R/S
005	76	LBL
006	12	B
007	42	STO
008	02	02
009	91	R/S
010	76	LBL
011	13	C
012	43	RCL
013	03	03
014	65	×
015	71	SBR
016	89	'
017	75	-
018	43	RCL
019	06	06
020	65	×
021	71	SBR
022	33	X²
023	85	+
024	43	RCL
025	07	07
026	65	×
027	71	SBR
028	89	'
029	75	-
030	43	RCL
031	09	09
032	65	×
033	71	SBR
034	33	X²
035	85	+
036	43	RCL
037	10	10
038	85	+
039	43	RCL
040	11	11
041	85	+
042	43	RCL
043	12	12
044	85	+
045	43	RCL
046	13	13
047	85	+
048	43	RCL
049	14	14
050	65	×
051	03	3
052	01	1
053	02	2
054	65	×
055	43	RCL
056	17	17
057	85	+
058	43	RCL
059	15	15
060	95	=
061	42	STO
062	50	50
063	99	PRT
064	91	R/S
065	43	RCL
066	50	50
067	55	÷
068	43	RCL
069	01	01
070	95	=
071	99	PRT
072	91	R/S
073	43	RCL
074	50	50
075	55	÷
076	53	(
077	43	RCL
078	02	02
079	65	×
080	03	3
081	06	6
082	05	5
083	65	×
084	43	RCL
085	16	16
086	54	)
087	95	=
088	99	PRT
089	91	R/S
090	43	RCL
091	50	50
092	55	÷
093	01	1
094	07	7
095	05	5
096	02	2
097	00	0
098	00	0
099	95	=
100	99	PRT
101	91	R/S
102	76	LBL
103	89	'
104	53	(
105	53	(
106	43	RCL
107	05	05
108	65	×
109	71	SBR
110	34	√x
111	54	)
112	55	÷
113	53	(
114	43	RCL
115	49	∧9
116	75	-
117	01	1
118	54	)
119	54	)
120	92	INV SBR
121	76	LBL
122	33	X²
123	53	(
124	43	RCL
125	05	05
126	55	÷
127	53	(
128	43	RCL
129	49	∧9
130	75	-
131	01	1
132	54	)
133	54	)
134	92	INV SBR
135	76	LBL
136	34	√x
137	53	(
138	53	(
139	01	1
140	85	+
141	43	RCL
142	05	05
143	54	)
144	45	Y^x
145	43	RCL
146	04	04
147	54	)
148	42	STO
149	49	∧9
150	43	RCL
151	08	08
152	48	EXC
153	04	04
154	48	EXC
155	08	08
156	43	RCL
157	49	∧9
158	92	INV SBR

```
159  76 LBL
160  14   D
161  43 RCL
162  01   01
163  55   ÷
164  43 RCL
165  20   20
166  65   ×
167  43 RCL
168  21   21
169  85   +
170  53   (
171  53   (
172  53   (
173  43 RCL
174  22   22
175  85   +
176  43 RCL
177  23   23
178  54   )
179  55   ÷
180  08   8
181  00   0
182  00   0
183  00   0
184  00   0
185  54   )
186  65   ×
187  43 RCL
188  01   01
189  65   ×
190  43 RCL
191  24   24
192  54   )
193  85   +
194  43 RCL
195  25   25
196  65   ×
197  43 RCL
198  01   01
199  85   +
200  71 SBR
201  23 LNX
202  85   +
203  43 RCL
204  27   27
205  85   +
206  43 RCL
207  29   29
208  95   =
209  42 STO
210  51   51
```

```
211  99 PRT
212  91 R/S
213  43 RCL
214  50   50
215  85   +
216  43 RCL
217  51   51
218  95   =
219  42 STO
220  53   53
221  99 PRT
222  91 R/S
223  43 RCL
224  53   53
225  55   ÷
226  53   (
227  03   3
228  06   6
229  05   5
230  65   ×
231  43 RCL
232  02   02
233  65   ×
234  43 RCL
235  16   16
236  54   )
237  95   =
238  99 PRT
239  91 R/S
240  43 RCL
241  53   53
242  55   ÷
243  43 RCL
244  01   01
245  95   =
246  99 PRT
247  91 R/S
248  43 RCL
249  51   51
250  55   ÷
251  53   (
252  43 RCL
253  02   02
254  65   ×
255  03   3
256  06   6
257  05   5
258  65   ×
259  43 RCL
260  16   16
261  54   )
262  95   =
```

```
263  99 PRT
264  91 R/S
265  43 RCL
266  51   51
267  55   ÷
268  43 RCL
269  01   01
270  95   =
271  99 PRT
272  91 R/S
273  76 LBL
274  23 LNX
275  53   (
276  71 SBR
277  35 1/X
278  65   ×
279  53   (
280  43 RCL
281  52   52
282  75   -
283  01   1
284  54   )
285  55   ÷
286  53   (
287  43 RCL
288  52   52
289  65   ×
290  43 RCL
291  05   05
292  54   )
293  54   )
294  92 INV SBR
295  76 LBL
296  35 1/X
297  53   (
298  43 RCL
299  28   28
300  55   ÷
301  43 RCL
302  05   05
303  75   -
304  53   (
305  43 RCL
306  28   28
307  65   ×
308  43 RCL
309  04   04
310  55   ÷
311  43 RCL
312  05   05
313  54   )
314  65   ×
```

```
315   53   (
316   43  RCL
317   05   05
318   55   ÷
319   53   (
320   71  SBR
321   32  X↕T
322   75   -
323   01   1
324   54   )
325   54   )
326   54   )
327   92  INV SBR
328   76  LBL
329   32  X↕T
330   53   (
331   53   (
332   01   1
333   85   +
334   43  RCL
335   05   05
336   54   )
337   45  Y↑
338   43  RCL
339   04   04
340   54   )
341   42  STO
342   52   52
343   92  INV SBR
```