Ag Decision Maker

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Estimating Grain Transportation Costs

Marketing grain involves making decisions about when to sell, how to sell, and where to sell. With the increased availability of ethanol plants, feed mills, barge loading facilities, and grain processors, farmers have many choices for a selling location. Choosing among the options requires an accurate estimate of the cost of transporting the grain to each location.

Tractors and wagons have traditionally been used to move grain to nearby locations. Trucks are more often used for longer hauls. In recent years, semi-trailer trucks have become the most common means of transporting grain.

Grain transportation costs can be divided into two categories: **ownership** costs, which occur regardless of how much the truck or tractor is used, and **operating** costs, which vary directly with the number of miles driven.

Ownership Costs

Also called fixed costs, include depreciation, interest, insurance, and licenses.

Depreciation

Depreciation is a cost resulting from wear, obsolescence, and age. Age and accumulated miles of use are the most important factors in determining how fast a truck depreciates. Many farm trucks are purchased after having been used for over the road hauling, so they may have a high number of miles on the odometer.

Before an estimate of annual depreciation can be calculated, the initial purchase price, the number of years the truck will be owned, and a salvage value must be estimated. Salvage value is an estimate of the sale value of the machine at the end of its ownership period. It is the amount you can expect to receive as a trade-in allowance or an estimate of the used market value if you expect to sell it outright. Used vehicle websites or classified ads are good sources of information about used truck values.

For example, assume the purchase cost (used) of a semi-truck tractor was $45,000, and the estimated salvage value after 10 years is $20,000:

Total depreciation = purchase price - salvage value
= $45,000 - $20,000
= $25,000

Interest

If you borrow money to buy a truck, the lender will determine the interest rate to charge. But if you use your own capital, the rate to charge will depend on the opportunity cost for that capital elsewhere in your farm business. If only part of the money is borrowed, an average of the two rates should be used. For the example we will assume an average interest rate of five percent.

The joint costs of depreciation and interest can be calculated by using a **capital recovery factor**. Capital recovery is the number of dollars that would have to be set aside each year to just repay the value lost due to depreciation and to pay the interest cost.

Table 1 shows capital recovery factors for various combinations of interest rates and ownership periods. For the example, the capital recovery factor for 10 years and five percent is .130. The annual capital recovery cost is found by multiplying the capital recovery factor by the total depreciation over the ownership life, then adding the product of the interest rate and the salvage value to it.

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For the example values given:

Capital recovery	= (capital recovery factor x total depreciation)
	+ (salvage value x interest rate)
	= (.130 x $25,000) + ($20,000 x .05)
	= $3,250 + $1,000
	= $4,250 per year

For a semi-trailer truck the cost for the trailer can be estimated separately or combined with the truck. In the example, the trailer is assumed to have a purchase price of $25,000, an ownership life of 20 years, and a salvage value of $5,000. The capital recovery factor for five percent and 20 years is 0.08, so the annual capital recovery cost is:

Capital recovery	= .08 x ($25,000 – 5,000) + ($5,000 x .05)
	= $1,600 + $250
	= $1,850

Insurance and License
Costs for insuring and licensing a grain truck are usually much smaller than depreciation and interest, but they need to be considered, nevertheless. Insurance and license fees can be verified by farm records. In our example, they are estimated to be $350 and $500 per year, respectively, but they can vary widely.

Total Ownership Cost
The estimated costs of depreciation, interest, insurance, and license are added together to find the total ownership cost. For our example truck, this adds up to $6,950 per year.

Capital recovery, truck	= $4,250
Capital recovery, trailer	= $1,850
Insurance	= $ 350
License	= $ 500
Total ownership cost	= $6,950 per year

Operating Costs
Also called variable costs, include repairs, replacement of tires, fuel, lubrication, and operator labor.

Repairs and Maintenance
Repair costs occur because of routine maintenance, wear and tear, and accidents. The best data for estimating repair costs are the owner's own records of past repair expenses. *Ag Decision Maker File A3-16,* **Grain Harvesting Equipment and Labor in Iowa** (www.extension.iastate.edu/agdm/crops/html/a3-16.html), shows reported repair and maintenance costs for grain trucks from a recent Iowa survey. In our example, the owner estimates annual repair costs to be about $3,000 for the truck and $500 for the trailer.

Tires
Replacement of tires is a significant maintenance cost. The average number of tires purchased each year depends on the life of each tire, the number of miles driven, and the number of tires on each truck or trailer.

In our example, the semi-truck tractor has 10 tires with an expected life of 40,000 miles and a replacement cost of $400 each. If the truck is driven 8,000 miles per year, an average of two tires must be replaced each year, at a total cost of $800.

Tires replaced	= (8,000 miles / 40,000 miles per tire) x 10 tires = 2 tires
Cost of tires	= 2 tires x $400 per tire = $800 per year

Similarly, if the trailer has eight tires with an average life of 50,000 miles and a replacement cost of $250, the annual costs for trailer tires is:

Tires replaced	= (8,000 miles / 50,000 miles per tire) x 8 tires = 1.6 tires
Cost of tires	= 1.6 tires x $250 per tire = $320 per year

Fuel

Fuel costs can be estimated by dividing the total miles the truck is driven each year by the average fuel efficiency (in miles per gallon) to find the total gallons of fuel used, then multiplying by the average cost of fuel per gallon.

In the example, the truck is driven 8,000 miles per year and the average miles per gallon achieved is assumed to be 5.0, so 1,600 gallons of fuel are used annually. If the price of fuel is $2.65 per gallon, the annual expenditure is:

Fuel use	= 8,000 miles / 5 miles per gallon = 1,600 gallons
Fuel cost	= 1,600 gallons x $2.65 per gallon = $4,240 per year

Another 10 percent is added to the fuel cost for the cost of lubricants.

Lubricants cost = $4,240 x .10 = $424

Labor

The cost of labor can be the wages paid to the driver of the truck or the value of the operator's own labor. Hours of road time can be estimated by dividing the total miles the truck is driven each year by the average speed at which it is driven. Additional hours spent loading and unloading (including hours waiting in line) can be added. The total hours are multiplied by the assumed wage rate to estimate the total labor cost.

For our example, the truck is driven 8,000 miles per year at an average speed of 50 miles per hour.

Road time	= 8,000 miles / 50 miles/hour = 160 hours
Loads hauled	= 50,000 bushels hauled / 1,000 bu. per load = 50 loads per year
Loading time	= 50 loads x .5 hour/load = 25 hours
Unloading time	= 50 loads x 1.0 hour /load = 50 hours
Total labor time	= 160 + 25 + 50 = 235 hours
Total labor cost	= 235 hours x $15/hour = $3,525

Total Operating Cost

Repairs, fuel, lubricants and labor costs are added to calculate total operating cost. For the truck example, the total operating cost is:

Total operating cost	= $3,000 + $500 + $800 + $320 + $4,240 + $424 + $3,525 = $12,809

Total Cost

After all costs have been estimated, the total ownership cost per year can be added to the operating cost to calculate the total cost to own and operate the truck. Total cost for our example is:

Total ownership cost	= $ 6,950
Total operating cost	= $12,809
Total cost	= $19,759

Cost per Bushel or per Mile

Sometimes it is useful to calculate the total cost per mile driven or bushel hauled. In the example it was assumed that the truck was driven 8,000 miles per year, so the average total cost per mile would be:

Cost per mile	= $19,759 / 8,000 miles = $2.47 per mile

Remember, for hauling one load the round-trip miles should be used to calculate the total cost of the trip.

If 50,000 bushels of grain are hauled each year, the average cost per bushel hauled would be:

Cost per bushel	= $19,759 / 50,000 bushels = $.395 per bushel

When comparing the cost of hauling to alternative sites, only the operating costs need to be taken into account. The ownership costs will not change if more or fewer miles are driven. In the example, the operating cost per mile would be:

Operating cost per mile	= $12,809 / 8,000 miles = $1.60 per mile

If one potential grain selling location is 10 miles from the farm and another buyer is 75 miles away, the total operating costs for hauling to each one would be:

First location	= $1.60/mile x 10 miles x 2 = $32
Second location	= $1.60/mile x 75 miles x 2 = $240

The difference is equal to $208 per trip. If 1,000 bushels are hauled each trip, the price at the second location would have to be ($208 / 1,000 miles) = $.208 per bushel higher to make up for the greater hauling cost.

The worksheet at the end of this publication can be used to calculate the cost of transporting grain for your own situation. *Ag Decision Maker Decision Tool A3-29,* **Grain Truck or Wagon Transportation Calculator,** (www.extension.iastate.edu/agdm/crops/xls/a3-29graintransportation.xlsx) contains an electronic spreadsheet for estimating grain transportation costs using either a truck or a tractor and wagon combination. *Ag Decision Maker Decision Tool A2-32-A3-41,* **Grain Bid Comparison Tool**, (www.extension.iastate.edu/agdm/crops/xls/a2-32-a3-41grainbidpricecomparison.xlsx) allows you to easily compare grain bids at different locations, taking into account hauling costs as well as moisture discounts and drying charges.

Table 1. Capital recovery factors

Interest rate	2%	3%	4%	5%	6%	7%	8%	9%	10%
Years									
1	1.020	1.030	1.040	1.050	1.060	1.070	1.080	1.090	1.100
2	0.515	0.523	0.530	0.538	0.545	0.553	0.561	0.568	0.576
3	0.347	0.354	0.360	0.367	0.374	0.381	0.388	0.395	0.402
4	0.263	0.269	0.275	0.282	0.289	0.295	0.302	0.309	0.315
5	0.212	0.218	0.225	0.231	0.237	0.244	0.250	0.257	0.264
6	0.179	0.185	0.191	0.197	0.203	0.210	0.216	0.223	0.230
7	0.155	0.161	0.167	0.173	0.179	0.186	0.192	0.199	0.205
8	0.137	0.142	0.149	0.155	0.161	0.167	0.174	0.181	0.187
9	0.123	0.128	0.134	0.141	0.147	0.153	0.160	0.167	0.174
10	0.111	0.117	0.123	0.130	0.136	0.142	0.149	0.156	0.163
11	0.102	0.108	0.114	0.120	0.127	0.133	0.140	0.147	0.154
12	0.095	0.100	0.107	0.113	0.119	0.126	0.133	0.140	0.147
13	0.088	0.094	0.100	0.106	0.113	0.120	0.127	0.134	0.141
14	0.083	0.089	0.095	0.101	0.108	0.114	0.121	0.128	0.136
15	0.078	0.084	0.090	0.096	0.103	0.110	0.117	0.124	0.131
16	0.074	0.080	0.086	0.092	0.099	0.106	0.113	0.120	0.128
17	0.070	0.076	0.082	0.089	0.095	0.102	0.110	0.117	0.125
18	0.067	0.073	0.079	0.086	0.092	0.099	0.107	0.114	0.122
19	0.064	0.070	0.076	0.083	0.090	0.097	0.104	0.112	0.120
20	0.061	0.067	0.074	0.080	0.087	0.094	0.102	0.110	0.117

Worksheet for estimating grain transportation costs

Input Data	Semi Tractor	Trailer	Units
a. Purchase price	$ ______	$ ______	
b. Years truck will be owned	______	______	years
c. Expected salvage value at end of ownership	$ ______	$ ______	
d. Annual cost of repairs and maintenance	$ ______	$ ______	per year
e. Number of tires	______	______	tires
f. Replacement cost per tire	$ ______	______	per tire
g. Lifetime per tire	______	______	miles/tire
h. Miles truck driven per year	______		miles/year
i. Average hauling speed	______		miles/hour
j. Average miles driven per round trip	______		miles/trip
k. Bushels hauled per year with this truck	______		bushels/year
l. Bushels hauled per load	______		bushels/load
m. Loading time per load	______		hours
n. Unloading time per load	______		hours
o. Driver labor rate	$ ______		$/hour
p. Interest rate on investment	______ %		
q. Price of fuel	$ ______		$/gallon
r. Fuel efficiency	______		miles/gallon
s. Annual cost of truck license	$ ______		
t. Annual cost of truck insurance	$ ______		

Ownership Costs	Truck, $/year	Trailer, $/year	Combined
Capital recovery: capital recovery factor (from Table 1) [_____ × (a – c) + (c × p)]	______	______	______
Insurance and license: [s + t]	______	______	______
Total ownership cost	______	______	______
Operating Costs			
Repair and maintenance cost: [d]	______	______	______
Tires cost: [(h / g) × e × f]	______	______	______
Fuel and lubrication cost: [(h / r) × q × 1.1]	______	______	______
Labor cost: {(h / i) + [(m + n) × (k / l)]} × o	______	______	______
Total operating cost	______	______	______
Total Ownership plus Operating Costs	______	______	______

Worksheet for estimating grain transportation costs - example

Input Data	Semi Tractor	Trailer	Units
a. Purchase price	$45,000	$25,000	
b. Years truck will be owned	10	20	years
c. Expected salvage value at end of ownership	$20,000	$5,000	
d. Annual cost of repairs and maintenance	$3,000	$500	per year
e. Number of tires	10	8	tires
f. Replacement cost per tire	$400	$250	per tire
g. Lifetime per tire	40,000	50,000	miles/tire
h. Miles truck driven per year	8,000		miles/year
i. Average hauling speed	50		miles/hour
j. Average miles driven per round trip	60		miles/trip
k. Bushels hauled per year with this truck	50,000		bushels/year
l. Bushels hauled per load	1,000		bushels/load
m. Loading time per load	0.50		hours
n. Unloading time per load	1.00		hours
o. Driver labor rate	$15.00		$/hour
p. Interest rate on investment	5%		
q. Price of fuel	$2.65		$/gallon
r. Fuel efficiency	5.0		miles/gallon
s. Annual cost of truck license	$350		
t. Annual cost of truck insurance	$500		

Ownership Costs	Truck, $/year	Trailer, $/year	Combined
Capital recovery: capital recovery factor (from Table 1) [_____ × (a – c) + (c × p)]	$4,250	$1,850	$6,100
Insurance and license: s + t	850		850
Total ownership cost	**$5,100**	**$1,850**	**$6,950**
Operating Costs			
Repair and maintenance cost: [d]	$3,000	$500	$3,500
Tires cost: [(h / g) × e × f]	800	320	1,120
Fuel and lubrication cost: [(h / r) × q × 1.1]	4,664		4,664
Labor cost: {(h / i) + [(m + n) × (k / l)]} × o	3,525		3,525
Total operating cost	**$11,989**	**$820**	**$12,809**
Total Ownership plus Operating Costs	**$17,089**	**$2,670**	**$19,759**