

ICA 9: Vehicle Costing

ISE 453: Design of PLS Systems

Spring 2020

This ICA has an auto example on the front and one question on the back that you can submit.

UberX Rates for example 13 mile 16-22 minute trip (<https://www.uber.com/us/en/price-estimate/>):

- \$7.20 minimum fare
- \$2.20 booking fee
- 42 cents per minute wait time
- \$1.60 per mile

IRS: Beginning on Jan. 1, 2020, the standard mileage rates for the use of a car (or van, pickup, panel truck) will be:

- 57.5 cents per mile for business miles driven
- 17 cents per mile driven for medical or moving purposes
- 14 cents per mile driven in service of charitable organizations

Interest Rate		Annual	(Monthly)	(Mo x 12)	Source (accessed 2/5/2020)
Prime Rate		4.75%			http://www.forecasts.org/prime.htm
Increase over Prime		2.00%			
Nominal Interest Rate		6.75%			
Current Inflation Rate		2.44%			http://www.forecasts.org/inflation.htm
Real Interest Rate	(<i>i</i>)	4.31%	0.36%		
Car Loan					
Economic Life	(<i>N</i> , yr)	5	60		
Investment Cost	(<i>IV</i> , \$)	25,000	25,000		
Salvage Percentage		0%	0%		
Salvage Value	(<i>SV</i> , \$)	0	0		
Effective Investment Cost	(<i>IV</i> ^{eff} , \$)	25,000	25,000		
Cost Cap Recovery	(<i>K</i> , \$/yr)	5,665	464	5,567	
Lease					
Economic Life	(<i>N</i> , yr)	5	60		
Investment Cost	(<i>IV</i> , \$)	25,000	25,000		
Salvage Percentage		30%	30%		
Salvage Value	(<i>SV</i> , \$)	7,500	7,500		
Effective Investment Cost	(<i>IV</i> ^{eff} , \$)	18,927	18,952		
Cost Cap Recovery	(<i>K</i> , \$/yr)	4,289	352	4,220	
Costing					
Annual Mileage	(mi/yr)	12,000	1,000		
Fuel Efficiency	(mi/gal)	25.0	25.0		
Fuel Cost per Gallon	(\$/gal)	2.537	2.537		https://www.eia.gov/petroleum/gasdiesel/
Fuel Cost	(\$/mi)	0.10148	0.10148		
Annual Fuel Cost	(\$/yr)	1,218	101		
Tire, Repair, Insurance	(\$/yr)	1,200	100		
Operating Cost	(\$/yr)	2,418	201		
Operating Cost per Unit	(\$/mi)	0.20	0.20		
Annual Investment Cost	(\$/yr)	4,289	352		
Cost per Mile	(\$/mi)	0.36	0.35		
Total Annual Cost	(\$/yr)	6,706	553		
Cost per Mile	(\$/mi)	0.56	0.55		

Question. Estimate the *Cost per Mile* for a tractor-trailer using the following information:

Interest Rate		Annual	
Prime Rate		4.75%	
Increase over Prime		2.00%	
Nominal Interest Rate			
Current Inflation Rate		2.44%	
Real Interest Rate	(<i>i</i>)		
Lease			
Economic Life	(<i>N</i> , yr)	7.25	
Investment Cost	(<i>IV</i> , \$)	175,000	
Salvage Percentage		30%	
Salvage Value	(<i>SV</i> , \$)		
Effective Investment Cost	(<i>IV^{eff}</i> , \$)		
Cost Cap Recovery	(<i>K</i> , \$/yr)		
Costing			
Annual Mileage	(mi/yr)	103,945	
Fuel Efficiency	(mi/gal)	5.8	
Fuel Cost per Gallon	(\$/gal)	3.037	
Fuel Cost	(\$/mi)	0.52362069	
Annual Fuel Cost	(\$/yr)	54,428	
Tire, Repair, Insurance	(\$/yr)	77,044	
Driver Salary with Benefits	(\$/yr)	64,757	
Operating Cost	(\$/yr)	196,229	
Operating Cost per Unit	(\$/mi)	1.89	
Annual Investment Cost	(\$/yr)		
Cost per Mile	(\$/mi)		
Total Annual Cost	(\$/yr)		
Cost per Mile	(\$/mi)		
Target Costing			
TL Rev per loaded tr-mi	(\$/mi)	2.7303	Based on TL PPI for Dec 2019
Percent Empty Travel		0.15	
Percent Operating Profit		0.05	
TL Cost per mi	(\$/mi)	2.20	= RevPerLdMi * (1 - 0.15) * (1 - 0.05)

Solution

Interest Rate		Annual	Source (accessed 9/24/2018)
Prime Rate		4.75%	(http://www.forecasts.org/prime.htm)
Increase over Prime		2.00%	
Nominal Interest Rate		6.75%	
Current Inflation Rate		2.44%	(http://www.forecasts.org/inflation.htm)
Real Interest Rate	(<i>i</i>)	4.31%	
Lease			
Economic Life	(<i>N</i> , yr)	7.25	= 754,000/103,945, Avg mi until replace/Avg mi [1]
Investment Cost	(<i>IV</i> , \$)	175,000	[2]
Salvage Percentage		30%	
Salvage Value	(<i>SV</i> , \$)	52,500	
Effective Investment Cost	(<i>IV^{eff}</i> , \$)	136,343	
Cost Cap Recovery	(<i>K</i> , \$/yr)	22,286	
Costing			
Annual Mileage	(mi/yr)	103,945	[1]
Fuel Efficiency	(mi/gal)	5.8	p. 10 in [3]
Fuel Cost per Gallon	(\$/gal)	3.037	(https://www.eia.gov/petroleum/gasdiesel/)
Fuel Cost	(\$/mi)	0.52362069	
Annual Fuel Cost	(\$/yr)	54,428	
Tire, Repair, Insurance	(\$/yr)	77,044	\$0.34/mi in 1988 [3] * 103945 * (2.18/1) [4]
Driver Salary with Benefits	(\$/yr)	64,757	\$45,333 mean wage/(1 - 0.3) [5]
Operating Cost	(\$/yr)	196,229	
Operating Cost per Unit	(\$/mi)	1.89	
Annual Investment Cost	(\$/yr)	22,286	
Cost per Mile	(\$/mi)	0.21	
Total Annual Cost	(\$/yr)	218,515	
Cost per Mile	(\$/mi)	2.10	
Target Costing			
TL Rev per loaded tr-mi	(\$/mi)	2.7303	Based on TL PPI for Dec 2019
Percent Empty Travel		0.15	
Percent Operating Profit		0.05	
TL Cost per mi	(\$/mi)	2.20	= RevPerLdMi * (1 - 0.15) * (1 - 0.05)
[1] http://atri-online.org/wp-content/uploads/2017/10/ATRI-Operational-Costs-of-Trucking-2017-10-2017.pdf			
[2] https://www.fleetowner.com/blog/big-rigs-big-costs			
[3] https://people.engr.ncsu.edu/kay/ise453/idxsrc/TSWwp7.pdf			
[4] (2.18/1) infl. 1988 to 2018 (https://data.bls.gov/cgi-bin/cpicalc.pl)			
[5] https://www.bls.gov/oes/current/oes533032.htm			