

Estimating Owning & Operating Costs



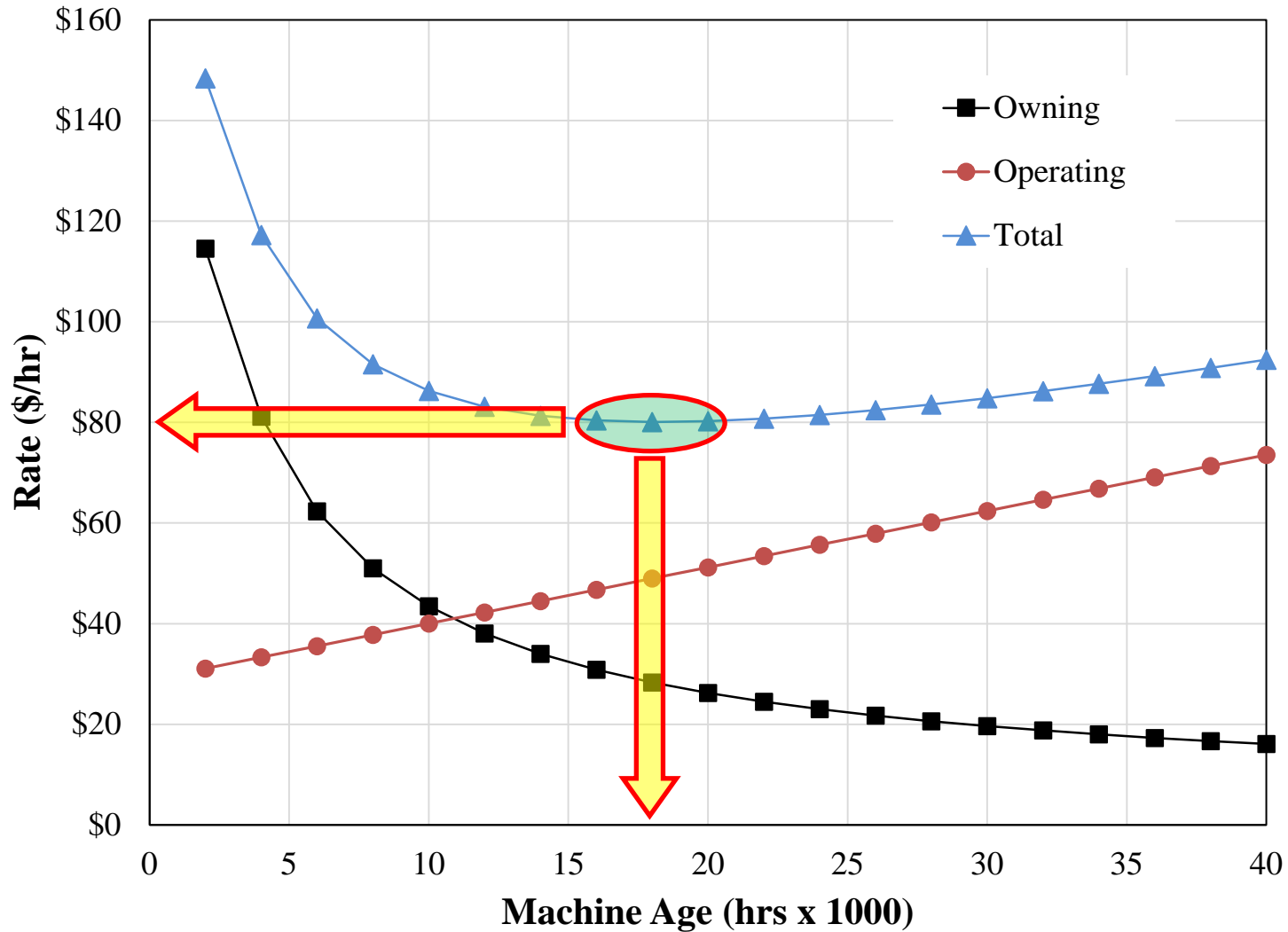
Estimating Equipment Costs

1. Equipment Costs
2. Annual Cost Model
3. Cumulative Cost Model
4. NCDOT Models

The take home...



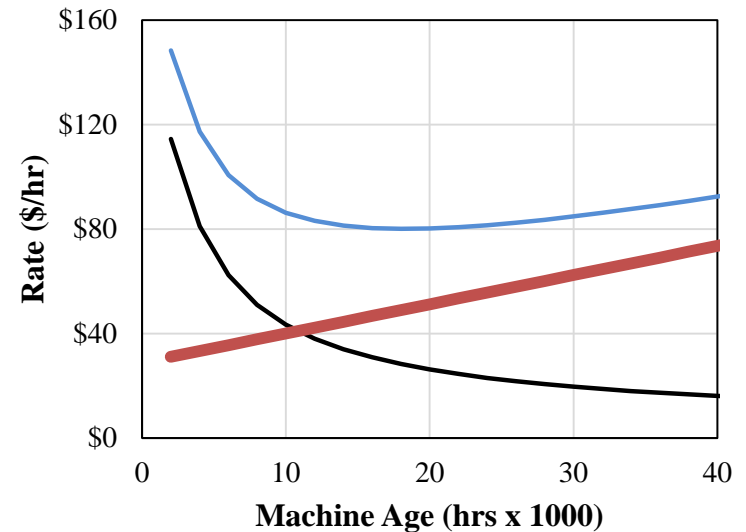
1. Equipment Costs



1. Equipment Costs

Operating Costs

- Rate (\$/hr) increases with age due to increasing frequency & magnitude of repairs
- Also a “fixed” rate component for fuel, PMs, and wear parts
- Timing and size of repairs are the real unknowns



2. Annual Cost Model

Owning Costs

- Sum of Years Digits to estimate machine value
- Depreciation term and ultimate value from:
 - Current NCDOT depreciation schedule
 - *Construction Equipment Ownership and Operating Expense Schedule by US Corps of Engineers*

Class 0201 – Truck, Pickup 5000 GVW

Term: 5 years

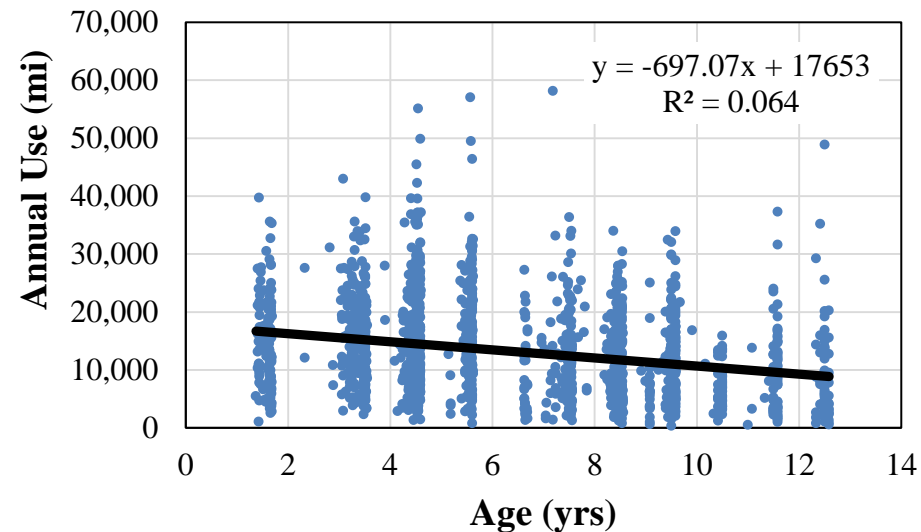
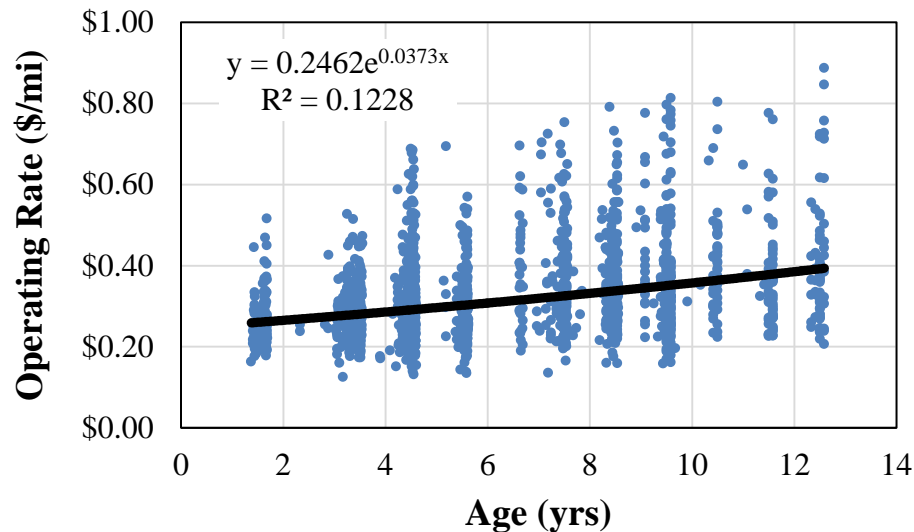
Salvage Value: 20% of purchase price



2. Annual Cost Model

Operating Costs

- Estimated cost and use in each year of life
- Snapshot of the fleet in a year (2011)



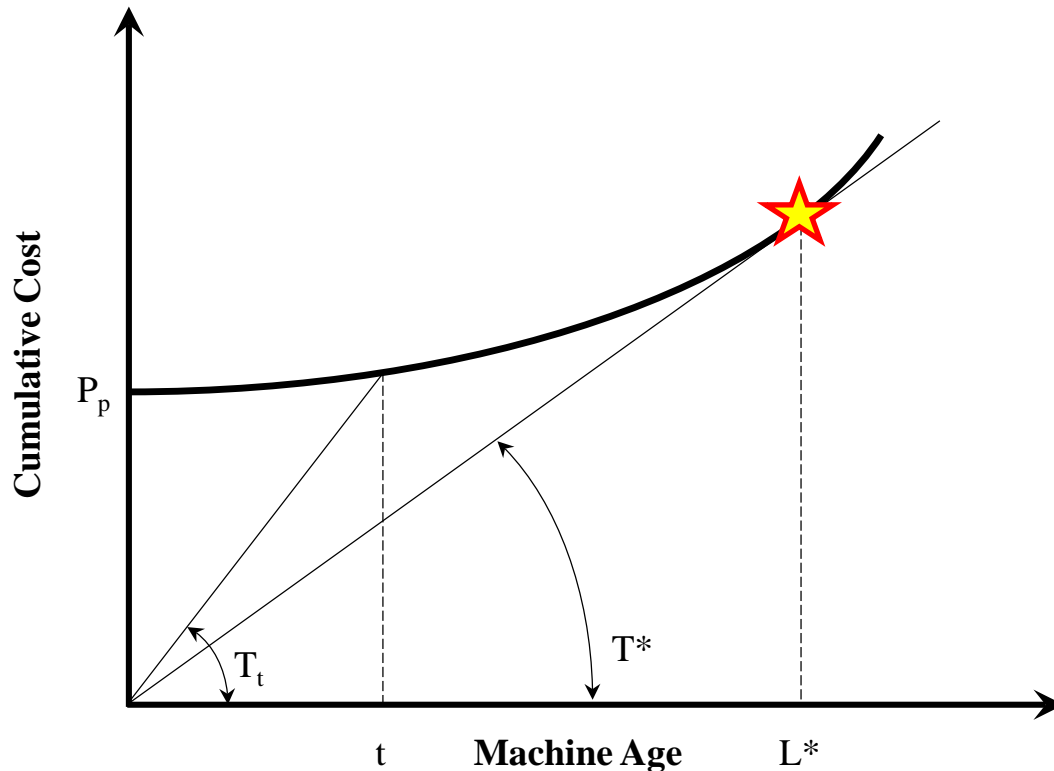
2. Annual Cost Model

Observations

1. Operating cost (\$/mi) highly variable
 - *Snapshot of a trend longer than 1 year*
 - *Investment periods – high cost and low use*
 - *Honeymoon periods – reaping benefits of previous investments*
2. Data included all possible variations
 - *All makes/models, applications, and operator skills*
 - *Some older machines no longer produced/purchased*
 - *May not accurately reflect expected future*



3. Cumulative Cost Model



- Track machine age in miles or hours, rather than years
- Tangent point defines economic life (lowest rate)
- Cost growth largely comes from increasing operating costs

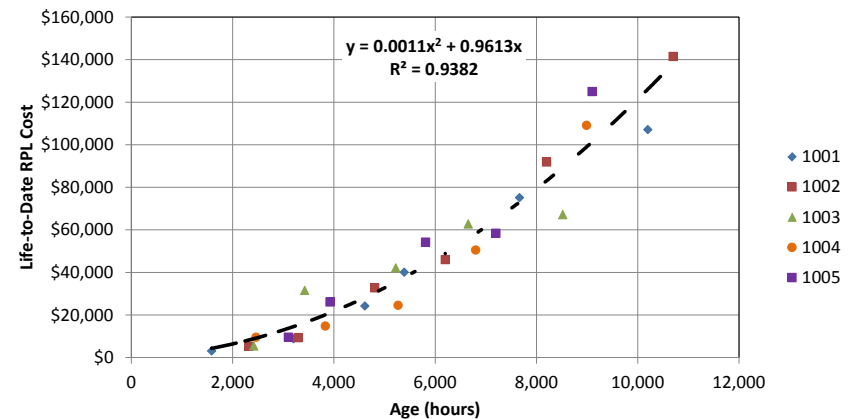


3. Cumulative Cost Model

Mitchell Curve

$$LTD \text{ Repair Cost} = A * Age^2 + B * Age$$

- For similar machines – type, size, and application
- Must have LTD cost and use (age) data
- Best to have:
 - Machines of varying ages
 - Some machines at or beyond economic life



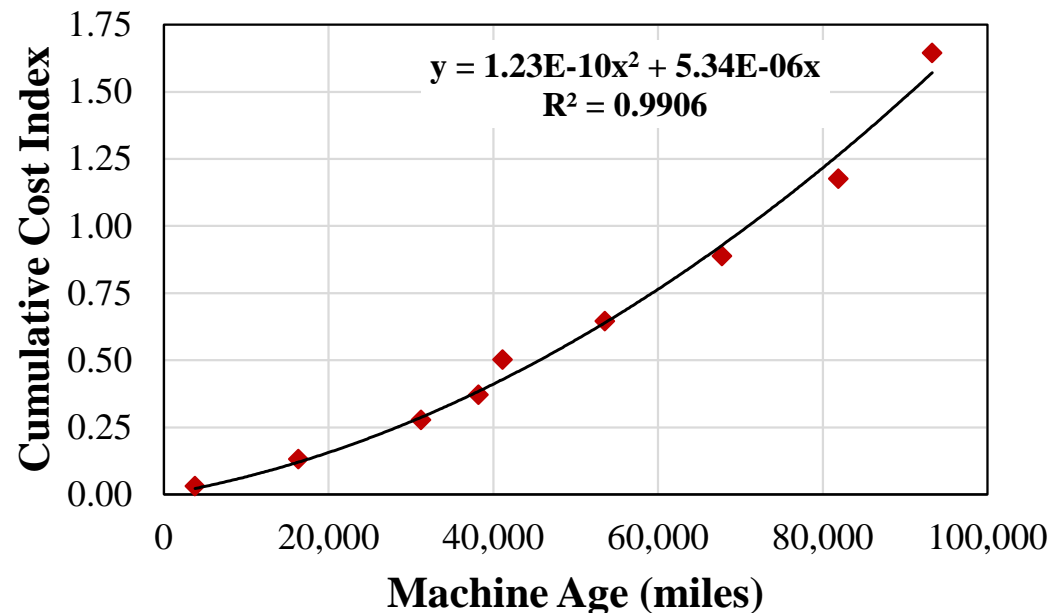
4. NCDOT Models

Equipment classes, model years 2003-08:

- 0201 Pickup trucks
- 0205 Dump trucks, 35k GVW
- 0314 Backhoes
- 0900 Motor graders

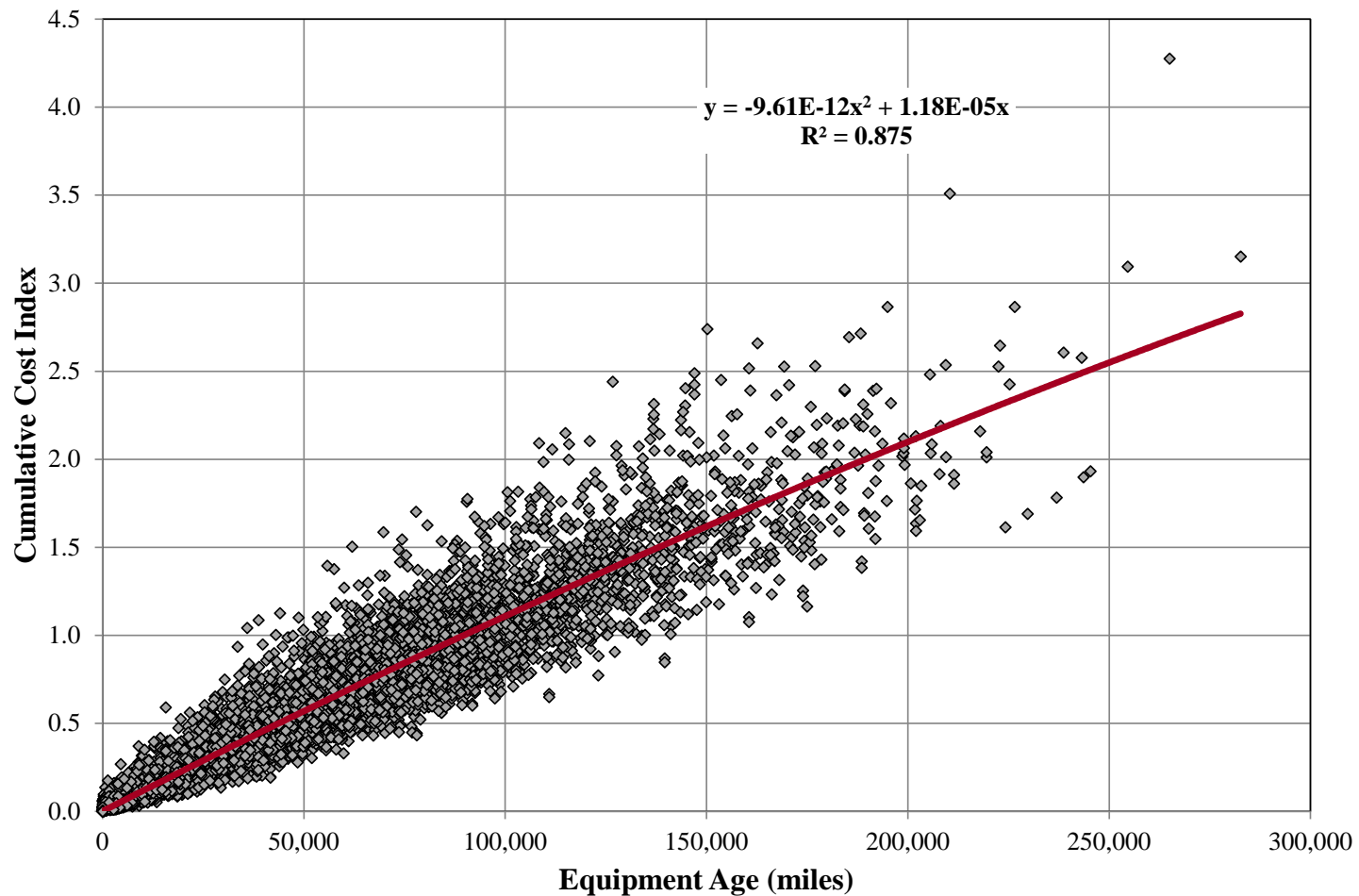
Cumulative Cost Index – Operating cost as a percentage of purchase price

$$CCI = \frac{\text{LTD Oper Cost [2012\$]}}{\text{Purchase Price [2012\$]}}$$



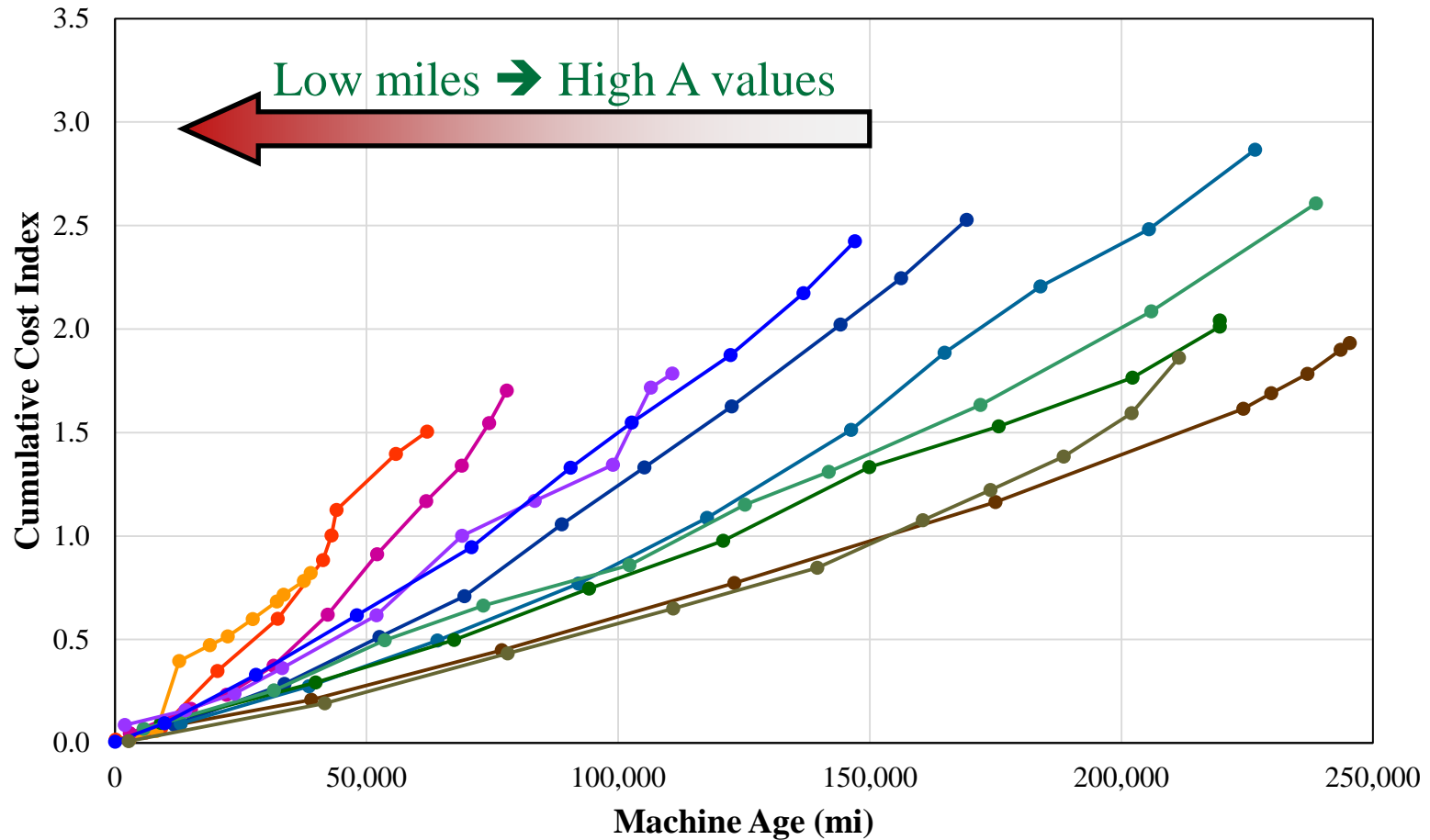
4. NCDOT Models

9,200 data points for 1,300 pickups (class 0201)



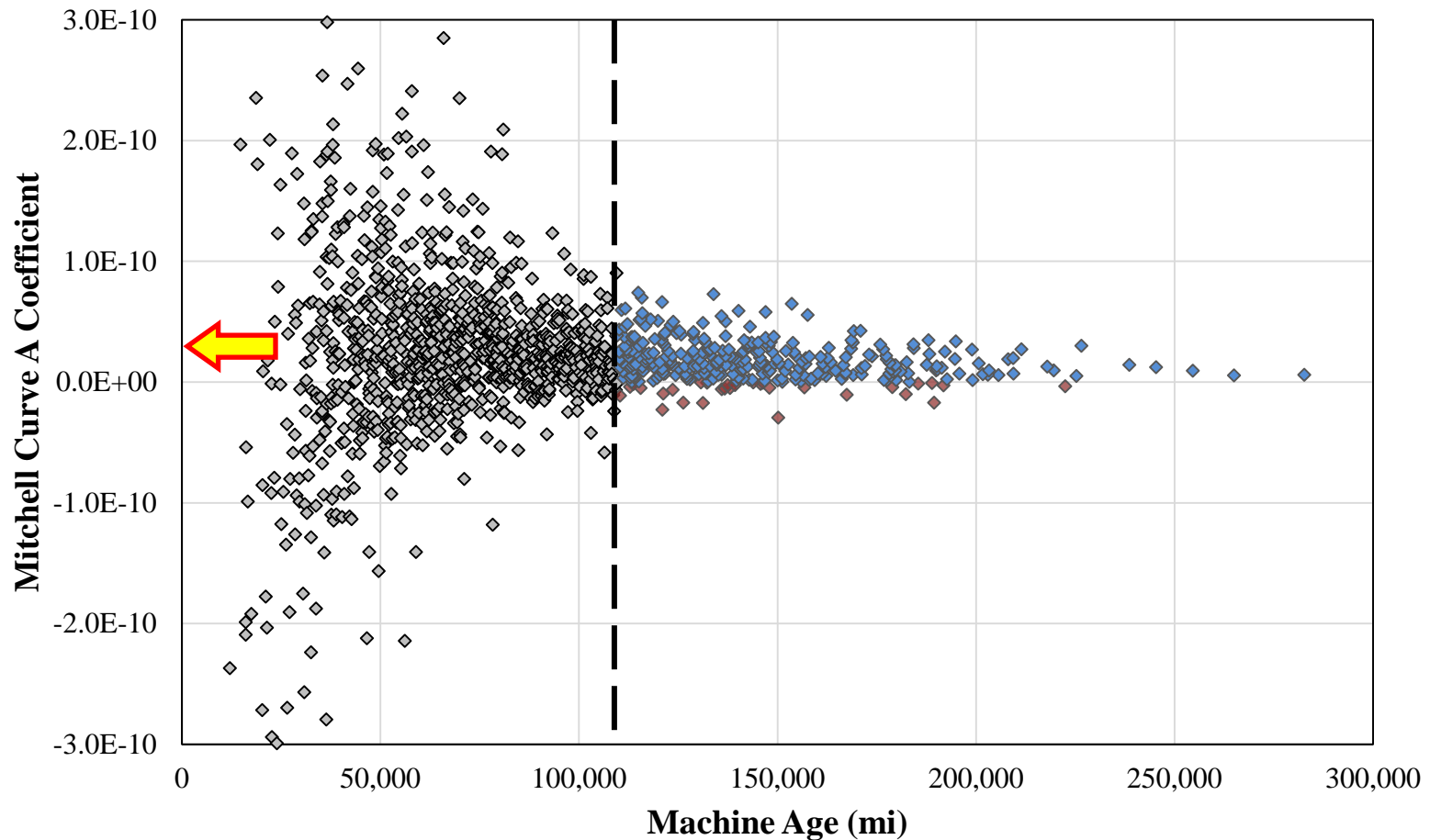
4. NCDOT Models

2003 Model Pickups

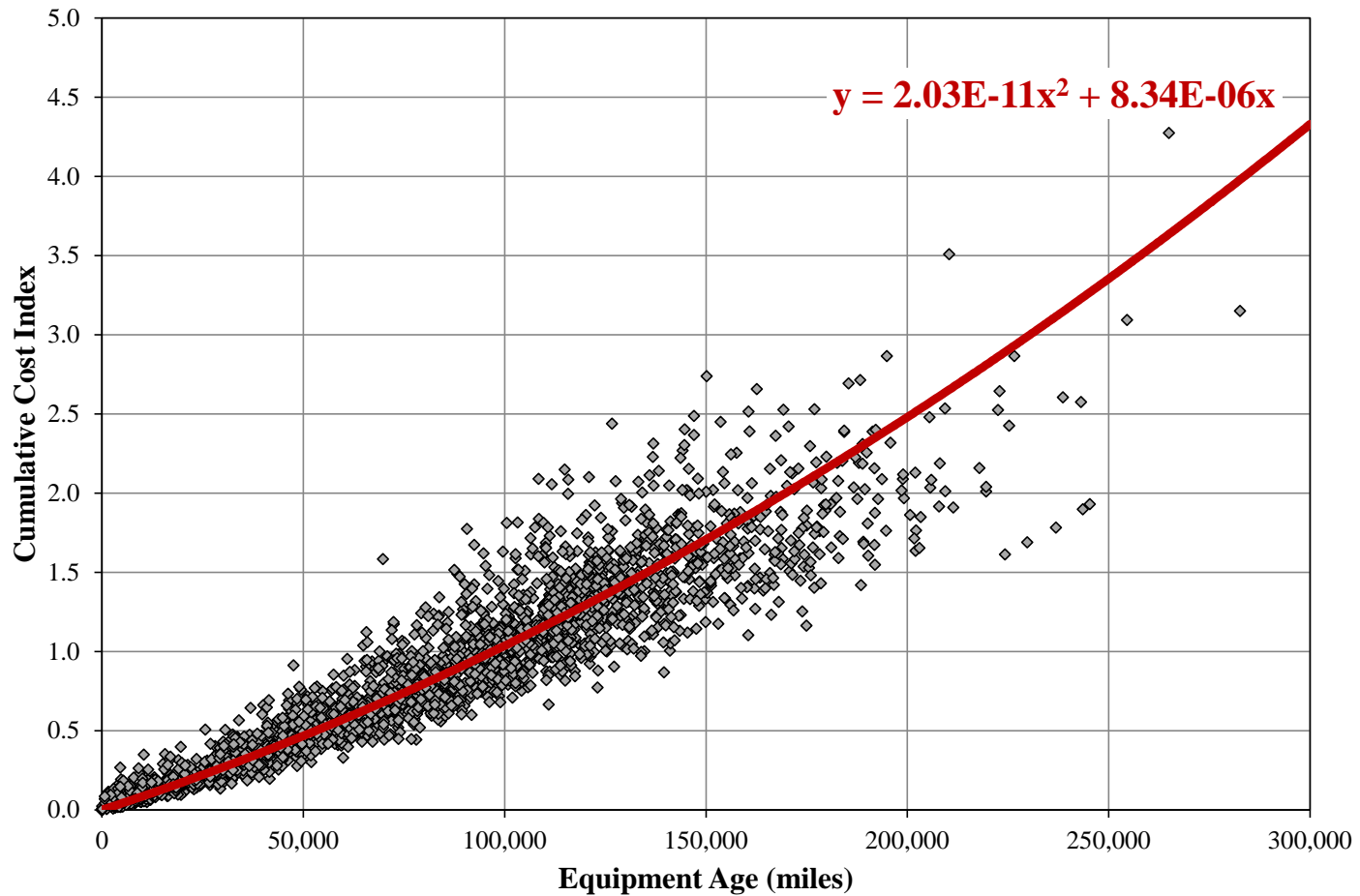


4. NCDOT Models

Average A value of top quartile machines by age



4. NCDOT Models



4. NCDOT Models

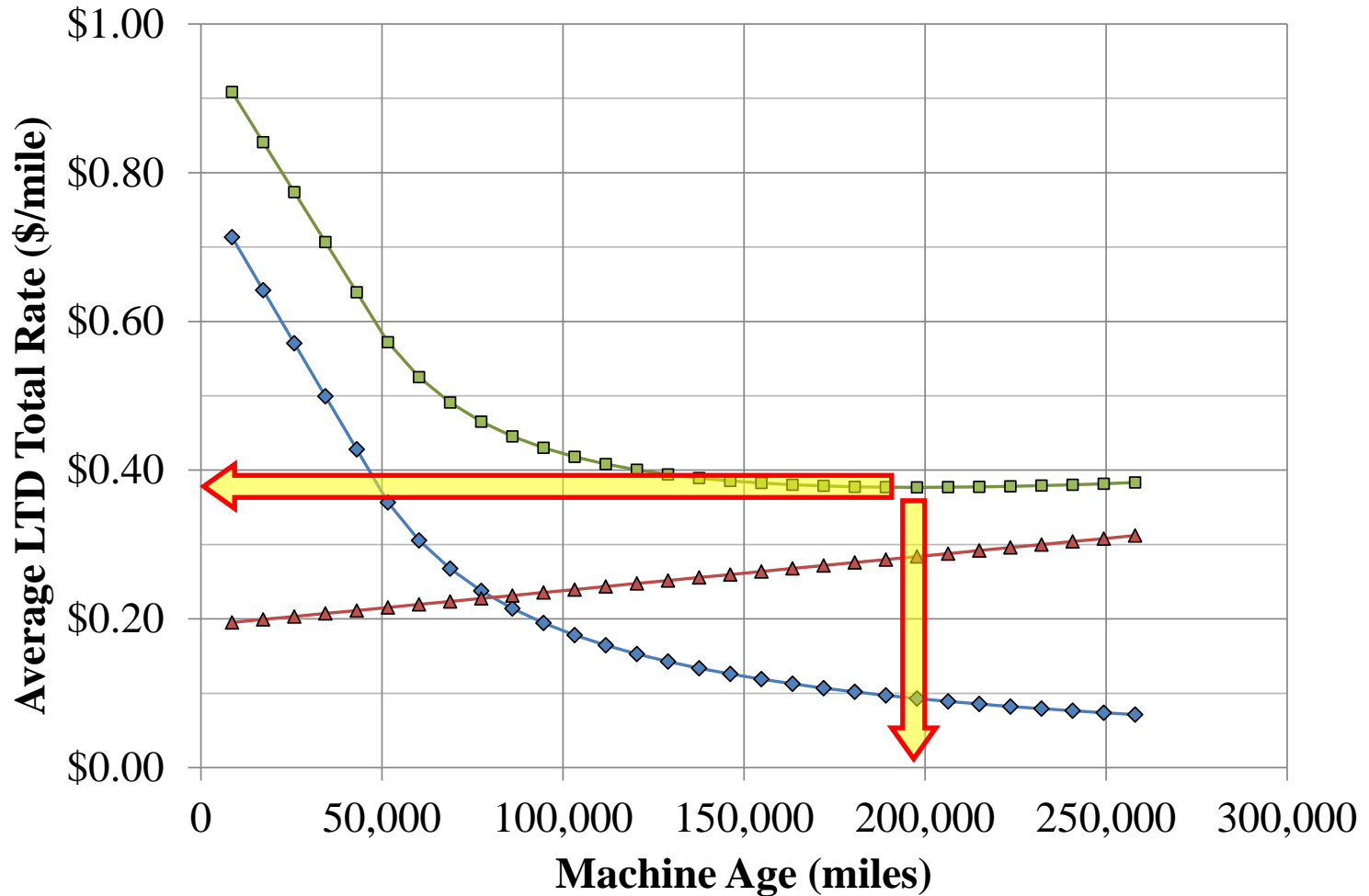
Class 0201 Pickup Trucks

Note: Based on 8,600 miles per year; \$23,000 purchase price; and 80 percent depreciation over 5 years

Year	Age (mi)	Annual Depreciation Charge	End of Year Machine Value	Life to Date Owning Rate (\$/mi)	Annual Operating Cost	Life to Date Operating Cost	Life to Date Operating Rate (\$/mi)	Life to Date Total Rate (\$/mi)
0			\$ 23,000					
1	8,600	\$ 6,133	\$ 16,867	\$ 0.71	\$ 1,679	\$ 1,679	\$ 0.20	\$ 0.91
2	17,200	\$ 4,907	\$ 11,960	\$ 0.64	\$ 1,748	\$ 3,427	\$ 0.20	\$ 0.84
3	25,800	\$ 3,680	\$ 8,280	\$ 0.57	\$ 1,817	\$ 5,245	\$ 0.20	\$ 0.77
4	34,400	\$ 2,453	\$ 5,827	\$ 0.50	\$ 1,887	\$ 7,131	\$ 0.21	\$ 0.71
5	43,000	\$ 1,227	\$ 4,600	\$ 0.43	\$ 1,956	\$ 9,087	\$ 0.21	\$ 0.64
6	51,600		\$ 4,600	\$ 0.36	\$ 2,025	\$ 11,113	\$ 0.22	\$ 0.57
7	60,200		\$ 4,600	\$ 0.31	\$ 2,095	\$ 13,207	\$ 0.22	\$ 0.53
8	68,800		\$ 4,600	\$ 0.27	\$ 2,164	\$ 15,371	\$ 0.22	\$ 0.49
9	77,400		\$ 4,600	\$ 0.24	\$ 2,233	\$ 17,605	\$ 0.23	\$ 0.47
10	86,000		\$ 4,600	\$ 0.21	\$ 2,303	\$ 19,907	\$ 0.23	\$ 0.45
11	94,600		\$ 4,600	\$ 0.19	\$ 2,372	\$ 22,279	\$ 0.24	\$ 0.43
12	103,200		\$ 4,600	\$ 0.18	\$ 2,441	\$ 24,720	\$ 0.24	\$ 0.42
13	111,800		\$ 4,600	\$ 0.16	\$ 2,510	\$ 27,231	\$ 0.24	\$ 0.41
14	120,400		\$ 4,600	\$ 0.15	\$ 2,580	\$ 29,810	\$ 0.25	\$ 0.40
15	129,000		\$ 4,600	\$ 0.14	\$ 2,649	\$ 32,459	\$ 0.25	\$ 0.39
16	137,600		\$ 4,600	\$ 0.13	\$ 2,718	\$ 35,178	\$ 0.26	\$ 0.39
17	146,200		\$ 4,600	\$ 0.13	\$ 2,788	\$ 37,965	\$ 0.26	\$ 0.39



4. NCDOT Models



4. NCDOT Models

Comparison of Results

Equipment Class	Annual Cost Models		Cumulative Cost Models	
	Econ. Life	Total Rate	Econ. Life	Total Rate
0201 Pickups	186,379 mi	\$ 0.42	197,800 mi	\$ 0.38
0205 35k GVW Dumps	113,525 mi	\$ 1.60	105,000 mi	\$ 1.32
0314 Backhoes	5,197 hrs	\$ 34.33	5,865 hrs	\$ 29.43
0900 Motor graders	6,568 hrs	\$ 52.20	6,020 hrs	\$ 52.27



Estimating Equipment Costs

1. Equipment Costs
2. Annual Cost Model
3. Cumulative Cost Model
4. NCDOT Models

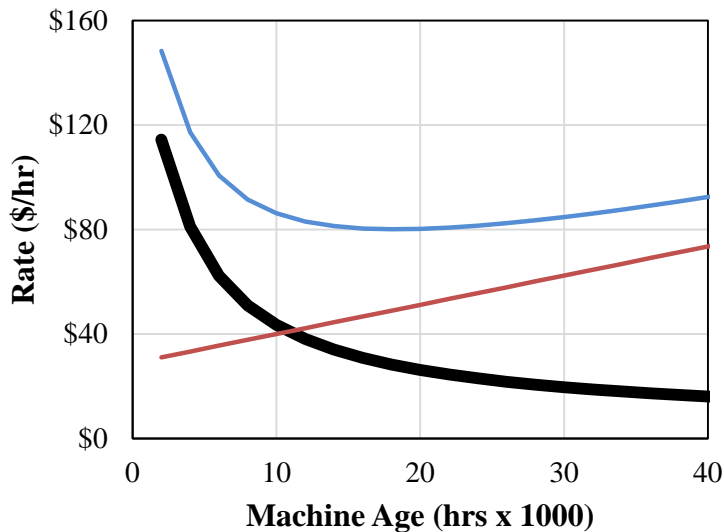
The take home...



1. Equipment Costs

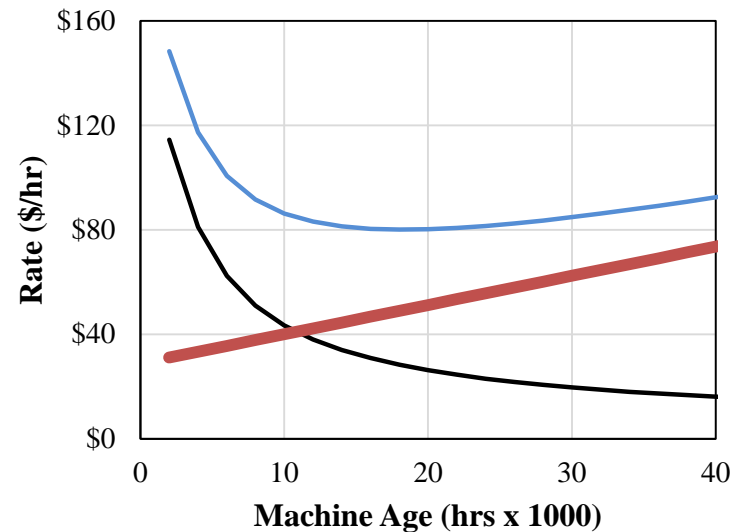
Owning Costs

Rate (\$/hr) decreases with age as hours are accumulated over which to spread the loss in value



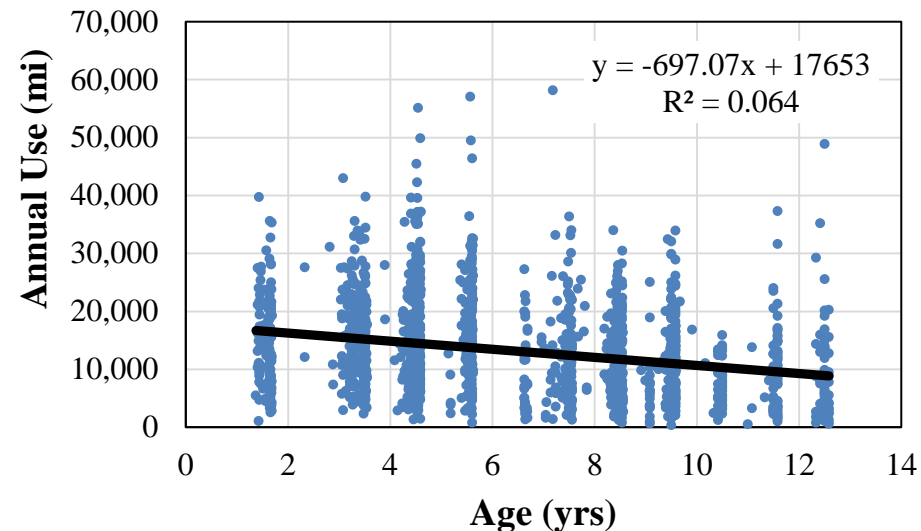
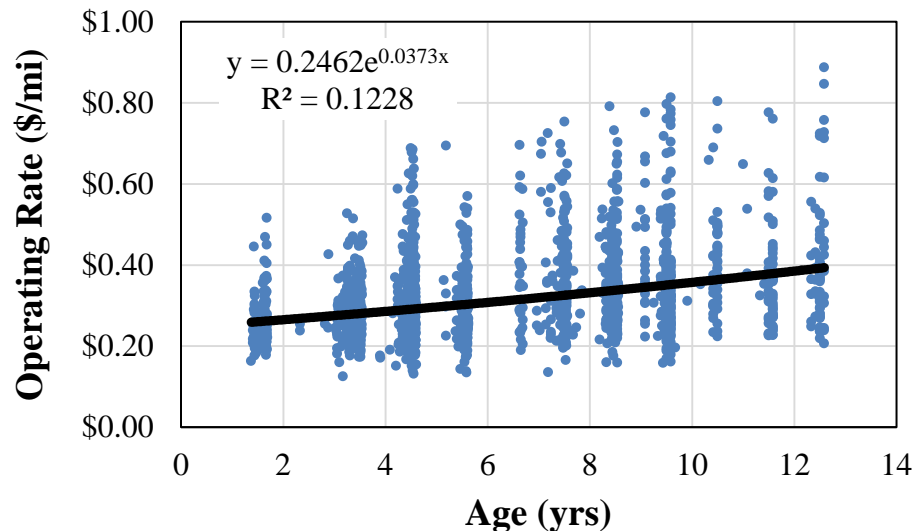
Operating Costs

Rate (\$/hr) increases with age due to increasing frequency & magnitude of repairs



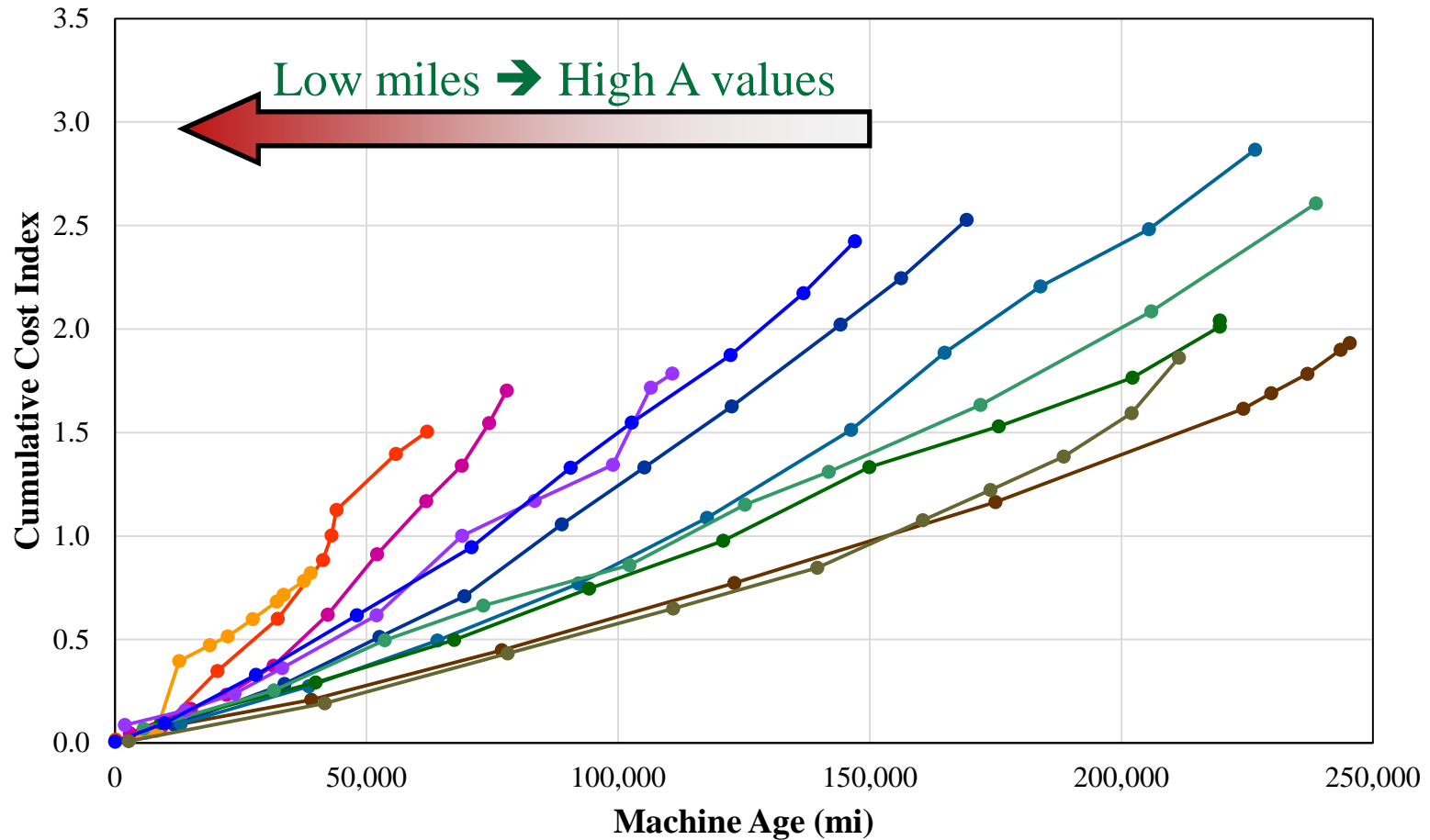
2. Annual Cost Model

- Estimated cost and use in each year of life
- Snapshot of the fleet in a year (2011)



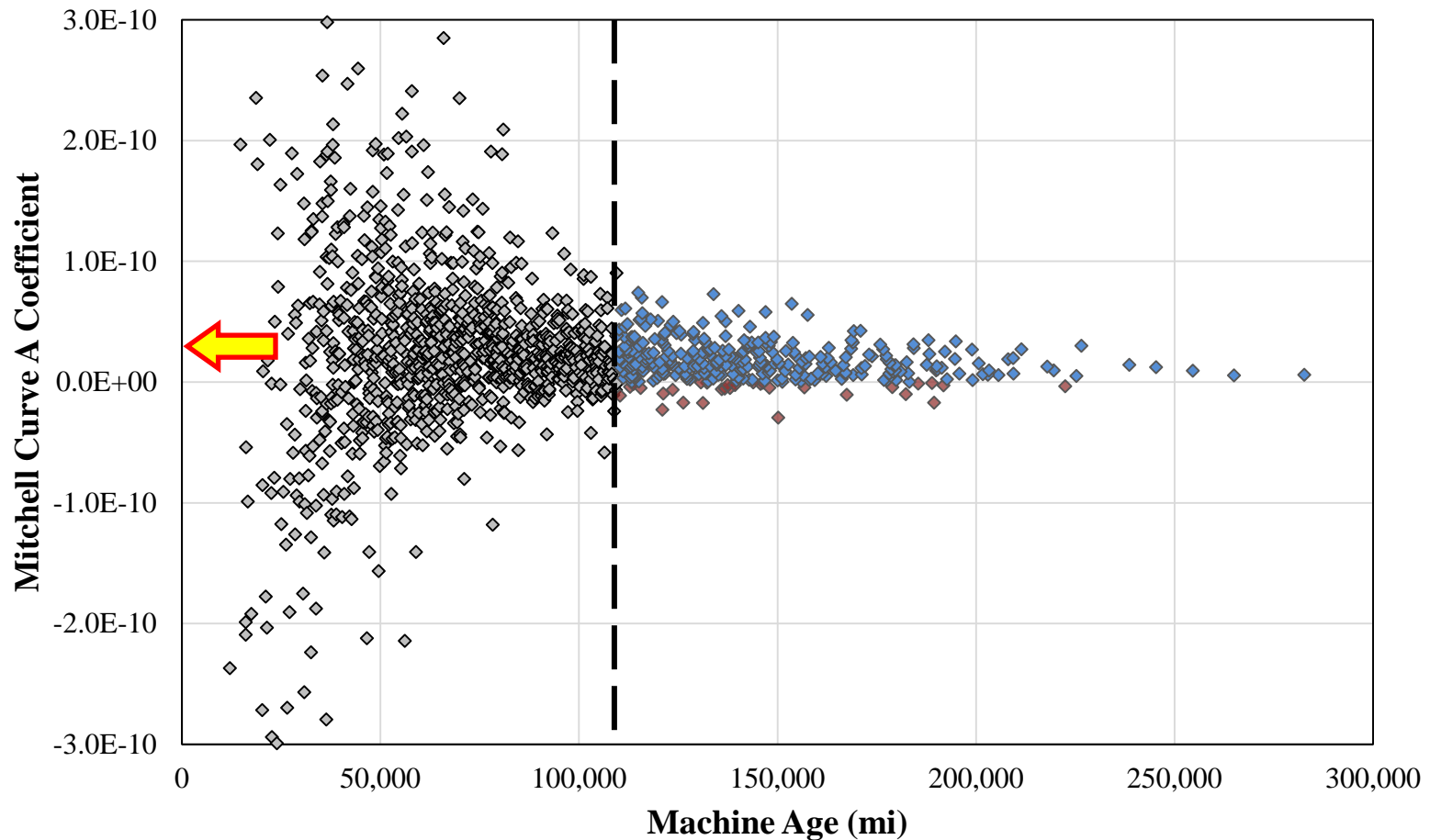
4. NCDOT Models

2003 Model Pickups

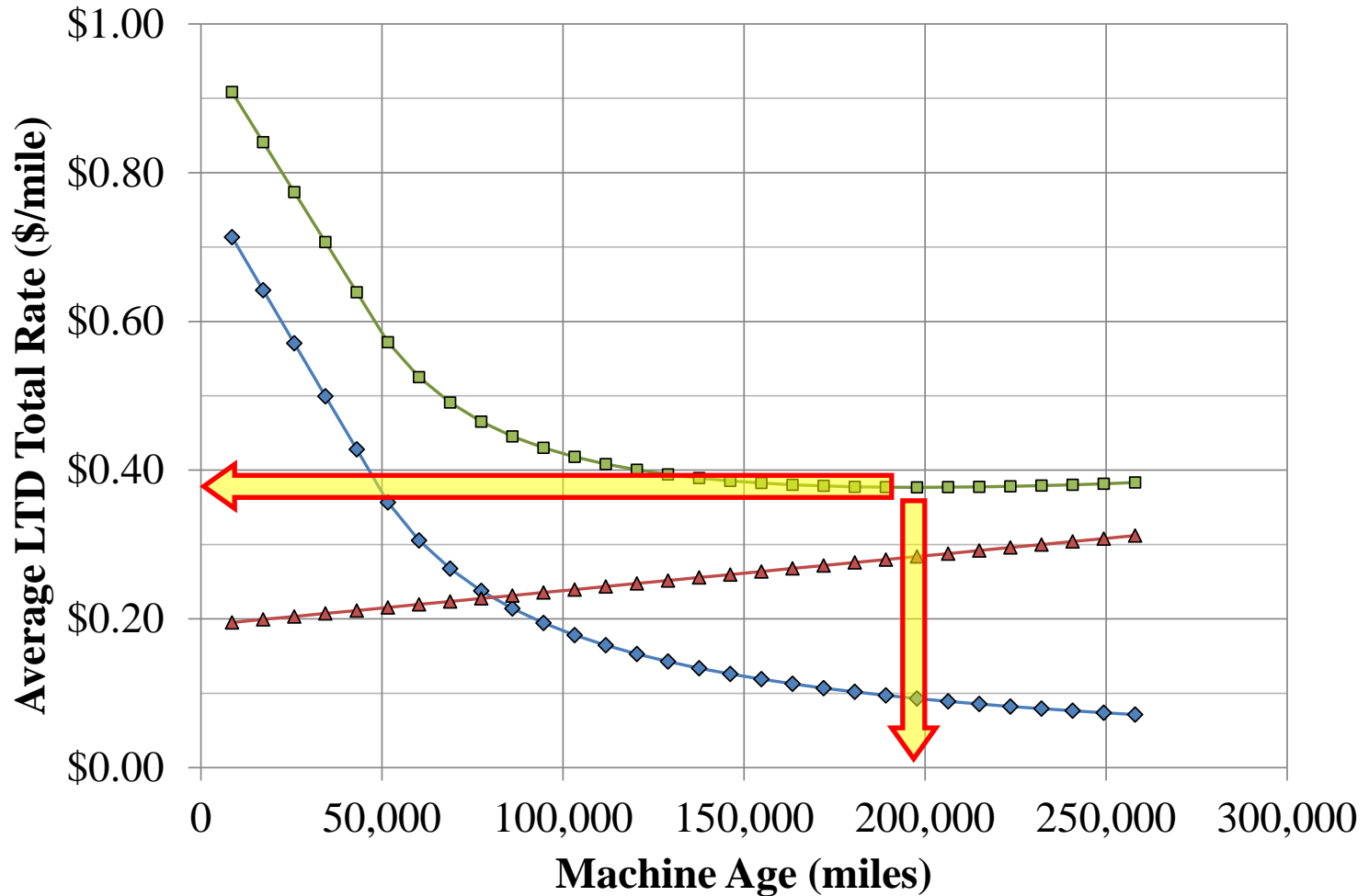


4. NCDOT Models

Average A value of top quartile machines by age



4. NCDOT Models



Estimating Owning & Operating Costs

