Determining Optimal Vehicle Replacement Cycles and Specifications for Higher Residual Values

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About the Instructor

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Manager, Mercury Associates Inc.

- More than 38 years’ experience
- Fleet management consultant
- Served as a Journey Technician at Utah Transit Authority, local and state government fleet manager (City of West Jordan, States’ of Utah and Georgia)
- Successfully transitioned from wrench tuner to manager of a $1.5 billion (annual capital and operating budget), 50,000-unit fleet
- Former Vice President of Fleet Operations at Republic Services, Coca-Cola over 43 states and Canada
- NCSFA Distinguished Service Award, 2009
- Honda Leadership Award, 2005
Session Learning Objectives

Learn how:

- Vehicle technology advancements are driving up life cycle costs by 25-30%.
- Utilizing a selective approach to specifications and developing empirical life cycles, fleet organizations can proactively reduce overall operating costs.
- Modeling costs associated with acquiring, operating and disposing of an individual vehicle class over various replacement cycles, and then determining which cycle results in lowest total cost of ownership.
- Specific strategies and specification techniques for creating optimal life cycle standards to reduce total cost of ownership over the life of a given vehicle asset class.
Determining Optimal Vehicle Replacement Cycles and Specifications for Higher Residual Values

All you need to know:

- Purchase “white” vehicles with moderately spec’d option packages
- Set and enforce policies and procedures for employees to care for vehicles
- Maintain vehicles in accordance with the OEM’s recommended maintenance and service interval guidelines
- Keep vehicles only during its optimally recommended life cycle
- De-logo, fix minor problems, and dispose vehicles in the fall or spring when residual values are at their peak
- Sell vehicles to your employee’s for the highest return
Some Spec’ing Questions to Consider

- What assets should be purchased?
- When should assets be purchased?
- What upfitter should be used?
- When should assets be sold?
- What are the market supply and demand factors?
- What asset color should be purchased?
- What asset options should be selected?
Growing Technological Complexity of Fleet Assets

- In the early 1980s, vehicles with embedded computers had upwards of 50,000 lines of software code; vehicles in 2016 generally have more than 100 million lines of code.
- Increasing demand for more and varied features.
- Items once considered options only available on luxury models eventually will be incorporated across model lines.
- The trend of ever expanding electronic functionality shows no sign of slowing down, continued progress in vehicle automation further accelerates the complexity and dependence on embedded controllers.
- For many fleet owner employees, their vehicle is far and away the most sophisticated electronic device they operate to perform their job functions and missions.
Why are Modern Vehicles Costs Higher?

**Driver support**
- Navigation
- Collision warning/avoidance
- Augmented vision

**System automation**
- Dynamic EV charging
- Computer control of engine, brakes, etc.

**Telematics**
- Remote control (locks, start)
- Remote diagnostics
- Remote repair (updates)

**Content and communication**
- Voice and data
- Information and entertainment
Technology and Regulations Driving Up Asset TCO

Examples of emissions complexity:

<table>
<thead>
<tr>
<th>System</th>
<th>Part Description</th>
<th>Pre-Emission</th>
<th>Post-Emission</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emissions/Exhaust</td>
<td>Muffler vs. Diesel Particulate Filter Assembly</td>
<td>$95</td>
<td>$4,719</td>
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<tr>
<td>After Treatment</td>
<td>Diesel Particulate Filter Only</td>
<td>-</td>
<td>$2,258</td>
</tr>
<tr>
<td></td>
<td>Turbo vs. Variable Geometry Turbo</td>
<td>$967</td>
<td>$3,294</td>
</tr>
<tr>
<td></td>
<td>EGR cooler vs. no EGR cooler</td>
<td>-</td>
<td>$1,096</td>
</tr>
<tr>
<td>Engine</td>
<td>Fuel Injector E6 vs. MP7</td>
<td>$106</td>
<td>$695</td>
</tr>
<tr>
<td></td>
<td>Cylinder Head E6 vs MP7</td>
<td>$1,779</td>
<td>$3,674</td>
</tr>
</tbody>
</table>

- Government emissions regulations and new engine technologies introduced between 2007 and 2010 continue to increase truck maintenance costs.
- On average, a post-2007 emissions asset costs 25% to maintain when it comes off warranty.
- Capital costs are up 30% since 2007 emissions regulations.
- Parts costs and total number of parts on vehicles needing to be replaced is expanding.
- Need to mitigate cost impact for training technicians on new technologies to higher cost 3rd party repair vendors and downtime.
Principles of Vehicle Fleet Replacement

1. Empirically validated vehicle replacement cycle guidelines (ORCA), using historical vehicle cost data minimizing total cost of ownership (TCO)
2. Long-term fleet replacement plan using recommended replacement cycles that predicts costs
3. Capital financing method that provides sufficient funds yearly to acquire replacement vehicles in accordance with the replacement plan
4. Budgeting process enabling fleet organizations to consistently secure the amount of funds needed to adhere to the replacement plan
# Optimal Replacement Cycle

EXAMPLE: 6-7 YEARS = Lowest TCO*

<table>
<thead>
<tr>
<th>Replacement Cycle (years)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
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<tbody>
<tr>
<td><strong>Year-End Odometer Reading</strong></td>
<td>12,272</td>
<td>24,544</td>
<td>36,816</td>
<td>49,088</td>
<td>61,360</td>
<td>73,632</td>
<td>85,904</td>
<td>98,176</td>
<td>110,448</td>
<td>122,720</td>
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<tr>
<td><strong>CAPITAL COST</strong></td>
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</tr>
<tr>
<td>Year-End Fair Market Value Percentage</td>
<td>78.90%</td>
<td>67.10%</td>
<td>57.00%</td>
<td>48.50%</td>
<td>41.20%</td>
<td>35.00%</td>
<td>29.80%</td>
<td>25.30%</td>
<td>21.50%</td>
<td>18.30%</td>
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<tr>
<td>Year-End Fair Market Value</td>
<td>$275,052</td>
<td>$233,795</td>
<td>$198,726</td>
<td>$168,918</td>
<td>$143,581</td>
<td>$122,044</td>
<td>$103,738</td>
<td>$88,178</td>
<td>$74,951</td>
<td>$63,709</td>
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<tr>
<td>Annual Capital Cost</td>
<td>$73,489</td>
<td>$41,257</td>
<td>$35,068</td>
<td>$29,808</td>
<td>$25,337</td>
<td>$21,537</td>
<td>$18,306</td>
<td>$15,560</td>
<td>$13,226</td>
<td>$11,242</td>
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<td><strong>OPERATING COSTS</strong></td>
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<tr>
<td>Annual M&amp;R Cost</td>
<td>$21,884</td>
<td>$24,910</td>
<td>$28,355</td>
<td>$32,276</td>
<td>$36,739</td>
<td>$41,820</td>
<td>$47,603</td>
<td>$54,186</td>
<td>$61,680</td>
<td>$70,209</td>
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<tr>
<td>Total Annual Operating Cost</td>
<td>$42,869</td>
<td>$46,743</td>
<td>$51,070</td>
<td>$55,909</td>
<td>$61,327</td>
<td>$67,401</td>
<td>$74,218</td>
<td>$81,876</td>
<td>$90,489</td>
<td>$100,182</td>
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<td>Avg Annual Operating Cost (2014)</td>
<td>$42,869</td>
<td>$44,125</td>
<td>$45,463</td>
<td>$46,888</td>
<td>$48,408</td>
<td>$50,030</td>
<td>$51,763</td>
<td>$53,614</td>
<td>$55,594</td>
<td>$57,713</td>
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<td><strong>TOTAL COST</strong></td>
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<tr>
<td>Annual Total Cost</td>
<td>$116,358</td>
<td>$88,000</td>
<td>$86,138</td>
<td>$85,717</td>
<td>$86,664</td>
<td>$88,938</td>
<td>$92,524</td>
<td>$97,437</td>
<td>$103,715</td>
<td>$111,425</td>
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<td>Cumulative Total Cost</td>
<td>$116,358</td>
<td>$204,358</td>
<td>$290,496</td>
<td>$376,214</td>
<td>$462,878</td>
<td>$551,816</td>
<td>$644,340</td>
<td>$741,777</td>
<td>$845,492</td>
<td>$956,917</td>
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<td>Equivalent Annual Cost</td>
<td>$116,358</td>
<td>$102,389</td>
<td>$97,131</td>
<td>$94,403</td>
<td>$92,945</td>
<td>$92,352</td>
<td>$92,352</td>
<td>$92,924</td>
<td>$93,986</td>
<td>$95,507</td>
</tr>
</tbody>
</table>

*Refuse Truck

Lowest TCO
Optimal Replacement Cycle
EXAMPLE: 7-8 YEARS = Lowest TCO*

<table>
<thead>
<tr>
<th>Replacement Cycle in Years:</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
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<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
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</thead>
<tbody>
<tr>
<td>Accumulated mileage at replacement</td>
<td>3,865</td>
<td>7,730</td>
<td>11,595</td>
<td>15,460</td>
<td>19,325</td>
<td>23,190</td>
<td>27,055</td>
<td>30,920</td>
<td>34,785</td>
<td>38,650</td>
<td>42,515</td>
<td>46,380</td>
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<tr>
<td><strong>CAPITAL COST</strong></td>
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<tr>
<td>Projected Residual Value</td>
<td>$71,187</td>
<td>$58,625</td>
<td>$50,250</td>
<td>$46,062</td>
<td>$41,875</td>
<td>$36,850</td>
<td>$34,337</td>
<td>$31,825</td>
<td>$29,312</td>
<td>$26,800</td>
<td>$24,287</td>
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<tr>
<td>Annual Depreciation</td>
<td>$12,562</td>
<td>$12,562</td>
<td>$8,375</td>
<td>$4,187</td>
<td>$4,187</td>
<td>$2,512</td>
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<td>$2,512</td>
<td>$2,512</td>
<td>$2,512</td>
<td>$2,512</td>
<td>$2,512</td>
</tr>
<tr>
<td>Total Annual Capital Cost</td>
<td>$12,562</td>
<td>$12,562</td>
<td>$8,375</td>
<td>$4,187</td>
<td>$4,187</td>
<td>$2,512</td>
<td>$2,512</td>
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<td>$2,512</td>
<td>$2,512</td>
<td>$2,512</td>
<td>$2,512</td>
</tr>
<tr>
<td><strong>OPERATING COST</strong></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Annual Maintenance and Repair Cost</td>
<td>$171</td>
<td>$551</td>
<td>$1,106</td>
<td>$1,828</td>
<td>$2,718</td>
<td>$3,778</td>
<td>$5,015</td>
<td>$6,434</td>
<td>$8,044</td>
<td>$9,853</td>
<td>$11,871</td>
<td>$14,109</td>
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<tr>
<td>Total Annual Operating Cost</td>
<td>$2,551</td>
<td>$3,027</td>
<td>$3,681</td>
<td>$4,507</td>
<td>$5,505</td>
<td>$6,678</td>
<td>$8,031</td>
<td>$9,572</td>
<td>$11,308</td>
<td>$13,249</td>
<td>$15,404</td>
<td>$17,784</td>
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<td><strong>TOTAL ASSET COST</strong></td>
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</tr>
<tr>
<td>Annual Total Cost</td>
<td>$15,113</td>
<td>$15,589</td>
<td>$12,056</td>
<td>$8,695</td>
<td>$9,692</td>
<td>$9,190</td>
<td>$10,544</td>
<td>$12,084</td>
<td>$13,821</td>
<td>$15,761</td>
<td>$17,916</td>
<td>$20,297</td>
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<td>NPV of Cumulative Annual Total Cost</td>
<td>$14,258</td>
<td>$28,132</td>
<td>$38,255</td>
<td>$45,142</td>
<td>$52,384</td>
<td>$58,863</td>
<td>$65,875</td>
<td>$73,457</td>
<td>$81,638</td>
<td>$90,439</td>
<td>$99,877</td>
<td>$109,964</td>
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<tr>
<td>Equivalent Annual Cost</td>
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<td>$14,702</td>
<td>$13,524</td>
<td>$12,144</td>
<td>$11,438</td>
<td>$10,866</td>
<td>$10,573</td>
<td>$10,464</td>
<td>$10,485</td>
<td>$10,602</td>
<td>$10,794</td>
<td>$11,047</td>
</tr>
</tbody>
</table>

*Dump Truck

Lowest TCO
Example: Optimal Life Cycles

Asset Types:

1. Tractors – Sleeper Cab, OTR = **4-5 Years**
2. Sweepers = **3-5 Years**
3. Refuse Trucks = **7-8 Years**
4. Straight Truck S/A – Day Cab, DSD = **6-7 Years**
5. Straight Truck T/A – Day Cab, DSD = **5-6 Years**
6. Trailers = **7-10 Years**
7. Sedans = **4-5 Years**
8. Pickup trucks = **6-7 Years**
9. SUVs = **5-6 Years**
10. Vans = **6-8 Years**

Resources: ATRI, Navistar, Penske, Industry articles, Mercury fleet manager experience, and client data.
Best Practices Ensuring Higher Residual Values

- Establish an annual specification committee comprised of company stakeholders with OEM participation
  - Research new innovation and options
  - Solicit vehicle operator’s feedback
- Evaluate the asset needs versus wants and use financial modeling to justify costly options
- Set optimal lifecycles based on empirical TCO data
- Sell vehicles when they reach their optimal life cycles
- Partner with a “Remarketing” company who understands the market and uses various selling channels to maximize values
- Use standard metrics to measure and track disposal and adjust for continuous improvement
Ensuring Higher Values - Remarketing Metrics

- Number of days from pick up to sale date
- Number of days to pick up from notification
- Total Days to sell / Compared to industry
- Salvage Value Relative to Published Wholesale Price (85-90%)
- Average sale price by year/type
- Percent of Sale price versus total fees (5-8%)
- Percent of sell price by sale method (auction, employee sale, scrap, etc.)
- Sale price by geography/type. (Regions)
- Sale price by make/model/color
- Sale price by time/year
- Percent return by type compared to industry guide (blue book, black book AMR)
- Sell price comparison proceeds in other markets. (Benchmark to other fleets)
Parting Thoughts:
Entropy - Second Law Of Thermodynamics

Definition: *Gradual decline into chaos or disorder*

- Assets are subject to the effects of entropy
- Assets must be maintained properly to avoid entropy
- Assets must be used continuously (not sit idle) to prevent entropy.
Parting Thoughts:

Asset Rule of “Always”

- Assets are *always* impacted by “Entropy”: The second law of thermodynamics
- Assets *always* depreciate (sit or not)
- Assets must *always* be tracked in a system
- Assets are *always* worth more today than tomorrow
- Assets *always* consume space (i.e., parking, etc.)
- Assets values *always* correspond to market timing (Purchase and resale)
- Asset residual values *always* depend on the specifications
For More Information

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