Equipment Replacement Decisions.

Session #W16

Wednesday, March 8.

9:30am – 10:30am.

Mike Vorster.
C.E.M.P.Central Inc.
www.cempcentral.com
Equipment Replacement Decisions.

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“Equipment replacement decisions present asset managers with on going challenges. The “sweet spot” model is one of several tools that can be used to rank units for replacement. Other metrics such as reliability, availability and utilization should also play a role in replacement decisions.”

- Define the replacement process.
- Understand metrics that can be used.
- Develop simple tools that can be used to assist.
Equipment Replacement Decisions.

1. Some definitions.
2. Understand the alternatives.
3. Cost based approaches.
4. Age based approaches.
5. Multi factor tools.

So... What I want you to take home

1. Some definitions.

1. Maintain.
   An action taken before failure to prevent failure.
2. Repair.
   An action taken after failure. Put it back to work without major expenditure.
3. Rebuild.
   Before or after failure. A significant investment in the future of the machine with the expectation of a long and improved future.
4. Replace.
   Retire the machine and bring in a new unit that is equivalent to or nearly equivalent to the existing unit.
5. Retire.
   Retire the machine, reshape the fleet and/or do something different.
1. Some definitions.

We will look at the REPLACEMENT decision.
Replace with Used.
   Rebuilt unit. (probably our own*)
   New**.

*This is the rebuild decision – very, very complex.
** The existing machine is the "defender" – the new machine is the "challenger"

Equipment Replacement Decisions.

1. Some definitions.
2. Understand the alternatives.
3. Cost based approaches.
4. Age based approaches.
5. Multi factor tools.

What I want you to take home
2. Understand the alternatives.

It is a four step process
1. Identify candidates for replacement.
2. Do the numbers.
   • Analyze repair, rebuild, replace – looking forward.
3. Identify and select chosen alternative.
4. Develop your plan.
   • Look at work load into the future.
   • Develop your acquisition/financing plan.

2. Understand the alternatives.

Identify candidates for replacement.
I will replace these six trucks because:
1. I have looked them over and think so.
2. They are getting too expensive.
3. There is a better challenger out there.
4. They are all older than 2005.
5. They have all got over 16,000 hours on them.
6. Lots of factors – cost, reliability, utilization – combine to indicate it is the right thing to do.
2. Understand the alternatives.

Identify candidates for replacement.

So, what do we need:

1. My eyes and ears and my judgement.

2. One or more decision criteria.  
   (cost, age, reliability, availability, utilization.)

3. A trigger value.  
   (what is a good value, what is a bad value.)

4. A progress rate. (burn rate)  
   (how fast do I progress towards my trigger value.)

2. Understand the alternatives.

Base your ranking and your decisions on:

1. Intuition and judgement.

2. Minimum cost for the defender or the challenger.

3. Age in either years of ownership or hours worked.

4. A combination of many factors including age, cost, reliability and utilization.

All are valid, all work but remember, we are talking about a lot of money and the majority of the left hand side of the balance sheet. You must be in a position to defend your position. “I think so” no longer cuts it.
Equipment Replacement Decisions.

1. Some definitions. ✓
2. Understand the alternatives. ✓
3. Cost based approaches.
4. Age based approaches.
5. Multi factor tools.

So... What I want you to take home

3. Cost based approaches.

Hourly owning cost goes down with age.
It depends on the rate at which residual market value decreases, annual utilization and the total number of hours LTD.

Hourly operating cost goes up with age.
It depends on the rate at which expenditure on repair parts and labor increases as the machine ages.

![Graph showing O&O Cost per hour LTD](image)
A Formal Definition of Economic Life

Many texts define economic life as

“That period that ends when the average hourly cost to date reaches a minimum.”

The terms used in the formal description are shown in the diagram on the left.

We use the term “sweet spot” to avoid the quantitative precision and narrowness of definition implied in the formal definition. We note that the concept of an economic ownership period is not captured in the formal definition.

As can be seen from the diagram on the right there is very little difference. Sweet spot is a broader, softer, more easily understood and accepted term.

Cost based approaches.

It is not an exact science

Each year that a machine spends in the orange or red zone is more expensive than all the prior years.
3. Cost based approaches.

5. The magnitude and timing calculation
### 3. Cost based approaches.

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>RMV%</th>
<th>O&amp;O Cost per hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>A8</td>
<td>Critical</td>
<td>100%</td>
<td>$200.00</td>
</tr>
<tr>
<td>A9</td>
<td>Critical</td>
<td>100%</td>
<td>$200.00</td>
</tr>
<tr>
<td>A6</td>
<td>Critical</td>
<td>100%</td>
<td>$200.00</td>
</tr>
</tbody>
</table>

### Ave cost per hour going forward

- Repair
- Rebuild
- Replace
3. Cost based approaches.

You can only do a defender challenger cost analysis if the two are essentially the same. If they are not, you have to include “revenue” and base your analysis on revenue minus cost.

---

**Equipment Replacement Decisions.**

1. Some definitions. ✓
2. Understand the alternatives. ✓
3. Cost based approaches. ✓
4. Age based approaches.
5. Multi factor tools.

So... What I want you to take home
4. Age based approaches.

Base your ranking and your decisions on:

1. Intuition and judgement.
2. Age in years of ownership.

Let's look at a group of trailers.

### Churn Chart – Age in years

<table>
<thead>
<tr>
<th>Unit ID</th>
<th>Equipment Identification</th>
<th>Year</th>
<th>Units</th>
<th>Age (years)</th>
<th>Trigger point</th>
<th>Burn rate</th>
<th>Good</th>
<th>Bad</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Dynapac CC524HF Roller RLR</td>
<td>2011</td>
<td>15</td>
<td>69</td>
<td>59</td>
<td>9</td>
<td>Green</td>
<td>Red</td>
</tr>
<tr>
<td>2</td>
<td>Dynapac CC522 Roller RLR</td>
<td>2006</td>
<td>15</td>
<td>79</td>
<td>59</td>
<td>9</td>
<td>Green</td>
<td>Red</td>
</tr>
<tr>
<td>3</td>
<td>Hamm HD12VV Roller RLR</td>
<td>2013</td>
<td>15</td>
<td>49</td>
<td>59</td>
<td>9</td>
<td>Green</td>
<td>Red</td>
</tr>
</tbody>
</table>

Candidates for replacement are likely to be here.
4. Age based approaches.

Base your ranking and your decisions on:

1. Intuition and judgement.
2. Age in hours worked.

Let's look at a group of pavers.

<table>
<thead>
<tr>
<th>Decision Criteria</th>
<th>Trigger Value</th>
<th>Rate Class aa bb d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age in hours</td>
<td>Varies</td>
<td>Use data</td>
</tr>
<tr>
<td></td>
<td></td>
<td>60% to 80% of TP</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt; 120% of TP</td>
</tr>
</tbody>
</table>

**Churn Chart – Age in hours.**

Candidates for replacement are likely to be here.
1. Some definitions. ✓
2. Understand the alternatives. ✓
3. Cost based approaches. ✓
4. Age based approaches. ✓
5. Multi factor tools.

So... What I want you to take home

5. Multi factor tools.

There is more to it than just cost and age.
Can you base your ranking and your decisions on several factors that can be combined into a single score.

<table>
<thead>
<tr>
<th>Rate Class</th>
<th>TT</th>
<th>OH</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decision Criteria</td>
<td>Good</td>
<td>Bad</td>
<td>Zero points</td>
</tr>
<tr>
<td>Year of Manufacture</td>
<td>2013</td>
<td>1994</td>
<td>15%</td>
</tr>
<tr>
<td>Miles travelled LTD</td>
<td>80,000</td>
<td>700,000</td>
<td>15%</td>
</tr>
<tr>
<td>Miles travelled, last 12 months</td>
<td>30000</td>
<td>10000</td>
<td>30%</td>
</tr>
<tr>
<td>Inspection score</td>
<td>8</td>
<td>3</td>
<td>10%</td>
</tr>
<tr>
<td>Labor cost per mile, last 12 months</td>
<td>$0.08</td>
<td>$0.30</td>
<td>15%</td>
</tr>
<tr>
<td>Parts cost per mile, last 12 months</td>
<td>$0.25</td>
<td>$0.40</td>
<td>15%</td>
</tr>
</tbody>
</table>

Ingredients must be in the pantry. What is "good"? What is "bad"? What "counts"?
5. Multi factor tools.

There is more to it than just cost and age.

Can you base your ranking and your decisions on several factors that can be combined into a single score.

<table>
<thead>
<tr>
<th>Decision Criteria</th>
<th>Good (10 points)</th>
<th>Bad (0 points)</th>
<th>Weighting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year of Manufacture</td>
<td>&gt; 2013</td>
<td>&lt;1994</td>
<td>15%</td>
</tr>
<tr>
<td>Miles travelled LTD</td>
<td>&lt; 80,000</td>
<td>&gt; 700,000</td>
<td>15%</td>
</tr>
<tr>
<td>Miles travelled, last 12 months</td>
<td>&gt; 30,000</td>
<td>&lt; 10,000</td>
<td>30%</td>
</tr>
<tr>
<td>Inspection score</td>
<td>&gt; 8</td>
<td>&lt; 3</td>
<td>10%</td>
</tr>
<tr>
<td>Labor cost per mile, last 12 months</td>
<td>&lt; $0.08</td>
<td>&gt; $0.3</td>
<td>15%</td>
</tr>
<tr>
<td>Parts cost per mile, last 12 months</td>
<td>&lt; $0.25</td>
<td>&gt; $0.4</td>
<td>15%</td>
</tr>
</tbody>
</table>

Ingredients must be in the pantry. What is “good”? What is “bad”? What “counts”?

Ranking for Replacement. May 2016
5. Multi factor tools.

There is more to it than just cost and age.

Can you base your ranking and your decisions on several factors that can be combined into a single score.

<table>
<thead>
<tr>
<th>Group</th>
<th>Tri-Axles</th>
<th>Analysis date</th>
<th>12/22/2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Good 10 points</td>
<td>Year of manufacture</td>
<td>Final Score</td>
</tr>
<tr>
<td>3</td>
<td>Bad 0 points</td>
<td>Labor</td>
<td>Parts</td>
</tr>
<tr>
<td>4</td>
<td>Weighting</td>
<td>15%</td>
<td>15%</td>
</tr>
<tr>
<td>5</td>
<td>BA Tri 28</td>
<td>2010</td>
<td>37,226</td>
</tr>
<tr>
<td>6</td>
<td>BA Tri 62</td>
<td>2015</td>
<td>37,226</td>
</tr>
<tr>
<td>7</td>
<td>BA Tri 54</td>
<td>2012</td>
<td>37,226</td>
</tr>
<tr>
<td>8</td>
<td>BA Tri 46</td>
<td>2015</td>
<td>37,226</td>
</tr>
<tr>
<td>9</td>
<td>BB Tri 22</td>
<td>2009</td>
<td>37,226</td>
</tr>
<tr>
<td>10</td>
<td>BB Tri 35</td>
<td>2013</td>
<td>37,226</td>
</tr>
<tr>
<td>11</td>
<td>BC Tri 27</td>
<td>2010</td>
<td>37,226</td>
</tr>
<tr>
<td>12</td>
<td>BC Tri 15</td>
<td>2007</td>
<td>37,226</td>
</tr>
<tr>
<td>13</td>
<td>BC Tri 19</td>
<td>2009</td>
<td>37,226</td>
</tr>
</tbody>
</table>

There is more to it than just cost and age.

Can you base your ranking and your decisions on several factors that can be combined into a single score.

<table>
<thead>
<tr>
<th>Decision Criteria</th>
<th>Good 10 points</th>
<th>Bad 0 points</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>&gt; 2013</td>
<td>&lt;1994</td>
<td>10%</td>
</tr>
<tr>
<td>Hours worked LTD</td>
<td>&lt; 4,000</td>
<td>&gt; 14,000</td>
<td>15%</td>
</tr>
<tr>
<td>Availability</td>
<td>&gt; 90%</td>
<td>&lt; 60%</td>
<td>15%</td>
</tr>
<tr>
<td>Own &amp; Opp Cost per hour, LTD</td>
<td>&lt; 1.1 x min LTD</td>
<td>&gt; 1.3 x min LTD</td>
<td>10%</td>
</tr>
</tbody>
</table>

Ingredients must be in the pantry. What is "good"? What is "bad"? What "counts"?
5. Multi factor tools.

There is more to it than just cost and age. Can you base your ranking and your decisions on several factors that can be combined into a single score.

**Candidates for replacement**

<table>
<thead>
<tr>
<th>Unit Number</th>
<th>Year of manufacture</th>
<th>Hours worked</th>
<th>Availability</th>
<th>R.E.D. Events per 1,000 hr</th>
<th>O&amp;O cost per hour</th>
<th>FINAL SCORE</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD 2 15/2</td>
<td>2010</td>
<td>2,658</td>
<td>96%</td>
<td>1</td>
<td>$67.00</td>
<td>10.0</td>
</tr>
<tr>
<td>HD 2 15/1</td>
<td>2010</td>
<td>1,980</td>
<td>95%</td>
<td>1</td>
<td>$59.00</td>
<td>9.8</td>
</tr>
<tr>
<td>HD 2 13/1</td>
<td>2015</td>
<td>1,523</td>
<td>95%</td>
<td>1</td>
<td>$58.00</td>
<td>9.6</td>
</tr>
<tr>
<td>HD 2 13/2</td>
<td>2012</td>
<td>700</td>
<td>75%</td>
<td>3</td>
<td>$60.00</td>
<td>5.4</td>
</tr>
<tr>
<td>HD 2 09/2</td>
<td>2009</td>
<td>8,000</td>
<td>96%</td>
<td>5</td>
<td>$111.00</td>
<td>2.9</td>
</tr>
<tr>
<td>HD 2 09/4</td>
<td>2009</td>
<td>14,000</td>
<td>56%</td>
<td>5</td>
<td>$125.00</td>
<td>6.0</td>
</tr>
<tr>
<td>HD 2 09/5</td>
<td>2009</td>
<td>8,500</td>
<td>88%</td>
<td>2</td>
<td>$125.00</td>
<td>6.0</td>
</tr>
<tr>
<td>HD 2 12/2</td>
<td>2012</td>
<td>4,989</td>
<td>65%</td>
<td>3</td>
<td>$111.00</td>
<td>4.7</td>
</tr>
<tr>
<td>HD 2 09/3</td>
<td>2009</td>
<td>12,124</td>
<td>66%</td>
<td>5</td>
<td>$165.00</td>
<td>2.9</td>
</tr>
<tr>
<td>HD 2 07/1</td>
<td>2007</td>
<td>15,634</td>
<td>60%</td>
<td>4</td>
<td>$125.00</td>
<td>1.8</td>
</tr>
<tr>
<td>HD 2 09/4</td>
<td>2009</td>
<td>17,236</td>
<td>49%</td>
<td>4</td>
<td>$111.00</td>
<td>3.3</td>
</tr>
</tbody>
</table>

**AB C DE F G H I J K**

**Group Tri Axles**

<table>
<thead>
<tr>
<th>Unit Number</th>
<th>Year of manufacture</th>
<th>Hours worked</th>
<th>Availability</th>
<th>R.E.D. Events per 1,000 hr</th>
<th>O&amp;O cost per hour</th>
<th>FINAL SCORE</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA Tri 28</td>
<td>2010</td>
<td>226,685</td>
<td>91%</td>
<td>1</td>
<td>$5,509</td>
<td>7.0</td>
</tr>
<tr>
<td>BA Tri 62</td>
<td>2015</td>
<td>37,226</td>
<td>60%</td>
<td>9</td>
<td>$6,541</td>
<td>10.0</td>
</tr>
<tr>
<td>BA Tri 54</td>
<td>2012</td>
<td>93,768</td>
<td>81%</td>
<td>6</td>
<td>$5,310</td>
<td>8.8</td>
</tr>
<tr>
<td>BC Tri 27</td>
<td>2010</td>
<td>114,820</td>
<td>91%</td>
<td>8</td>
<td>$5,790</td>
<td>6.9</td>
</tr>
<tr>
<td>BB Tri 22</td>
<td>2009</td>
<td>91,944</td>
<td>91%</td>
<td>6</td>
<td>$3,671</td>
<td>4.7</td>
</tr>
<tr>
<td>BC Tri 15</td>
<td>2007</td>
<td>627,808</td>
<td>75%</td>
<td>4</td>
<td>$5,732</td>
<td>2.1</td>
</tr>
<tr>
<td>BC Tri 19</td>
<td>2009</td>
<td>270,126</td>
<td>75%</td>
<td>3</td>
<td>$5,221</td>
<td>3.3</td>
</tr>
</tbody>
</table>

5. Multi factor tools.

There is more to it than just cost and age. Can you base your ranking and your decisions on several factors that can be combined into a single score.

**YES.**

We need to know our decision criteria.
We need to have the ingredients in the pantry.
We need to know what is “good” and what is “bad”.
We need to know what counts.

Intuition guides the process. The numbers lie where they fall.
1. Some definitions. ✔
2. Understand the alternatives. ✔
3. Cost based approaches. ✔
4. Age based approaches. ✔
5. Multi factor tools. ✔

So... What I want you to take home

1. Understand your options.
2. Job one is to identify and rank alternatives.
3. Include as much as you can in the scope of the analysis.
   - The ingredients must be in the pantry.
   - You must know what is good and what is bad
4. Intuition is good. Use it to set up the framework and then analyze the numbers and let them lie where they fall
5. Once the alternatives are ranked, do the numbers, develop a financing/acquisition strategy and act.
Equipment Replacement Decisions.

SESSION OUTLINE.

“Equipment replacement decisions present asset managers with on going challenges. The “sweet spot” model is one of several tools that can be used to rank units for replacement. Other metrics such as reliability, availability and utilization should also play a role in replacement decisions.”

- Define the replacement process.
- Understand metrics that can be used.
- Develop simple tools that can be used to assist.

1. Some definitions. ✓
2. Understand the alternatives. ✓
3. Cost based approaches. ✓
4. Age based approaches. ✓
5. Multi factor tools. ✓

So... What I want you to take home
Questions?

Please complete the session evaluation on the CONEXPO – CON/AGG Mobile App

Mike Vorster.
C.E.M.P.Central Inc.

www.cempcentral.com
We are too focused on cost when it comes to thinking about equipment replacement. It certainly is important to know what it will cost to own and operate a unit in the year ahead and to make wise replacement decisions when the old unit—the defender—is likely to cost more than the minimum lifecycle cost you can expect from a new unit—the challenger. The defender-versus-challenger replacement theory is well accepted in practice, and many companies use this approach to plan replacements and manage fleet average age.

But there is more to it than cost. Other metrics such as age and utilization are important, and we frequently face the problem of balancing many factors when we try to identify or, at the very least, rank units for replacement.

The American Public Works Association (APWA) proposes the use of a simple subjective points system to rank vehicles for replacement. The system asks users to award a certain number of points for factors such as age, miles travelled, reliability, cost and condition, based on their assessment of each factor. The points are totaled, and the unit with the highest score “needs immediate consideration” for replacement. It has been proven to work, but it is subjective.

The need to combine many factors when trying to identify units for replacement is a common problem. Building on the APWA system, let’s add a little technology and develop a spreadsheet that combines subjectivity and analysis to give us a practical tool we can use to help in replacement decisions for large equipment groups such as pickups and tri-axle trucks.

The nearby spreadsheet table serves as an example of how this might work with a grouping of tri-axle trucks.

Columns C, D, E, H, I and J show we are looking at six factors: year of manufacture; miles travelled, life to date; miles travelled in the past 12 months; a subjective inspection score; repair labor cost per mile; and repair parts cost per mile.

Factors other than cost influence our equipment-replacement decisions. We need to know how to include them.

The unit numbers and the required data need to be entered into the green cells. Then calculate cost per mile for labor and parts by dividing columns F and G by column E to obtain the values in columns I and J.

To set up the scoring system, award “points” to each unit under each of the six factors. Determine what value is “good” and worthy of 10 points and what value is “unacceptable” and not worthy of any points. Rows 3 and 4 indicate those ranges. For example, a year of manufacture of 2013 or later is worth 10 points, and a year of manufacture of 1994 or earlier is worth zero. The process of deciding what is “good” and “bad” takes some discipline. You need to quantify your expectations for each factor and decide where the boundaries lie. It is not easy, but it is necessary. It makes the process repeatable, and once you have set the boundaries, the process is defensible.

Units will not be at the boundaries; some will be above expectations, some below expectations, and some in between. The next step is to decide how to apportion points regardless of where units fall. If they fall above and below the boundary, values are easy: 10 points or zero points. If they fall in between boundary values, we apportion the points on a straight-line basis defined by the values in rows 3 and 4.

The graph on the left shows how it is done for year of manufacture: zero points for units older than 1994, a straight-line proportion of the points between 1994 and 2013, and 10 points for units newer than 2013. The graph on the right shows how it is done for labor cost per mile travelled during the last 12 months: 10 points for under $0.09 per mile, a straight-line proportion between $0.09 and $0.30 per mile, and zero if the cost is more than $0.30 per mile.

These six factors do not, or should not, count equally in determining the final score. A weighting factor applied to each of the six factors aids in calculating the final score. In row 5, 30 percent of the weighting goes to factors that measure age (15 percent for age in years, column C, and 15 percent
for age in miles, column D); 30 percent of the weight goes to utilization (miles in the last 12 months, column E); 30 percent of the weight goes to cost factors (cost per mile in the last 12 months for labor and parts, columns I and J); and 10 percent of the weight goes to the subjective inspection (column H).

With all the data in place, do the mathematics to determine the final score. It is a little technical but not complicated. The final score is the weighted total of the points calculated for each of the six factors considered.

Finally, use the analysis to help in your decisions. In this example, units in rows 9, 14 and 15 have low scores and are clearly candidates for replacement. Row 9 must go, the other two might depend on available capex budget. The unit in row 7 is better than the boundary values for all factors except labor cost per mile. It is a keeper, as are the units in rows 11, 8 and 6.

Tools like this enable us to move away from a fixation about cost. Other factors influence our decisions. We need to know how to include them.

This spreadsheet combines subjectivity and analysis into a practical tool to help in replacement decisions.

### Points Based on Year of Manufacture

![Graph](#)

**Points Based on Year of Manufacture**

- **Points**
  - 0
  - 2
  - 4
  - 6
  - 8
  - 10
  - 12

- **Year of manufacture**
  - 1990
  - 1995
  - 2000
  - 2005
  - 2010
  - 2015

Rankings that fall in between boundary values can be apportioned to correspond to points on a straight-line basis.

### Points Based on Labor Cost per Mile

![Graph](#)

**Points Based on Labor Cost per Mile**

- **Points**
  - 0
  - 2
  - 4
  - 6
  - 8
  - 10

- **Labor cost per mile, last 12 months**
  - $0.00
  - $0.10
  - $0.20
  - $0.30
  - $0.40
The Three Rs of Equipment Management

A tool for evaluating whether to repair, rebuild, or replace

Reading, writing, and arithmetic—if you get them right, you will be on your way to great things. The same is true for the repair/rebuild/replace decision. Get it right, and many of the requirements for success fall into place.

As with most sound bite titles, it is best to start with some definitions. “Repair” means the decision to keep a relatively old machine in the fleet and repair it for the foreseeable future without any major expenditure. You keep it and keep it running. “Rebuild” means to make a significant investment in the future of the machine by replacing major components and doing the work needed to extend life, lower future repair costs, and improve performance. You keep the old machine but invest the money needed to give it a longer future. “Replace” means to retire the machine and bring in a new equivalent or nearly equivalent. You dispose of the old and commit to a newer unit that will produce a lower lifecycle cost.

Good repair/rebuild/replace decisions follow a three-step process.

First, you need to identify candidates for replacement: the machines you believe require an explicit decision as to whether you should continue to run them and repair them, rebuild them now, or replace them in the next short while.

Second, you need to do the numbers. You make the estimates you need and analyze costs going forward for repairing, rebuilding, or replacing each of the identified candidates.

Third, you need to decide and act. Doing nothing to the identified candidates is not an option.

Identifying candidates for replacement and supporting your decision with hard facts and figures is not easy. We can no longer say, “This old dozer is at the end of its life, it is time for it to go.” We must plan and manage capital expenditure, and increasingly complex justifications are required to show that all alternatives have been quantified and carefully considered.

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Columns A, B, and C give the details for seven articulated dump trucks in the rate class used in our example. Column D gives the trigger point or the number of hours we expect the unit to work before it is likely to become a candidate for replacement. This will most likely be the number of hours of expected life that was used in the rate calculation, and it can be set using knowledge and experience or a detailed minimum lifecycle cost calculation. It can be simple or complex, but there is no way you can properly manage or cost a given rate class of equipment if you do not know, set, or assume an expected life and establish a trigger point for decision making. The spreadsheet shows that we expect 12,000 hours from HT6-21; 18,000 hours from HT6-26 on the basis that we performed a fairly substantial rebuild a short while ago; and 14,000 from the other newer-model 37-ton trucks.

Column E is the burn rate or the number of hours our data shows us the trucks are or are likely to work in a year. We see that we expect 1,500 hours per year for all the trucks except the three 37-ton units working extended shifts on a landfill project. Column F gives the current age, and columns G through K give the expected age at the end of the next five years. The calculations for columns G through K are not complex; HT6-21, for example, has worked 13,000 hours to date and has a burn rate of 1,500 hours per year. We can therefore assume that it would have worked 14,500 hours (13,000 + 1,500) in one years’ time and 17,500 hours (13,000 + 4,500) in three years’ time.

The visual impact comes from the standards set in the first two rows of the spreadsheet. Here we see that the cells in columns G through J will be green if the estimated hours worked falls between 60 percent and 80 percent of the trigger point, orange if the estimated hours worked falls between 80
percent and 120 percent of the trigger point, and red if the estimated hours worked is greater than 120 percent of the trigger point.

It is easy to see that HT6-21 is a present candidate for replacement and HT6-26 is not far from that point. Having been rebuilt once, HT6-26 is a clear candidate for replacement. HT6-32 and HT6-33 are not far behind, and we will have to start thinking about rebuilding or replacing them. HT6-37 and HT6-40 are young and will still see a lot of service.

The spreadsheet is simple, easy to understand, and a visual way to identify candidates for replacement and give insight into challenges that may lie ahead. Its simplicity is a bit of a disadvantage in that it relies on one parameter—age—to rank candidates. More complex tools such as the multi-parameter tool discussed in May 2016 are clearly better because they can be structured to include parameters such as availability, reliability, and utilization. But complex methods may be seen as “smoke and mirrors,” so it is often a good idea to use a simple tool that gets the job done. The given spreadsheet certainly works.

The next step, doing the numbers and analyzing options, can be complex. Remember that repair/rebuild/replace decisions are about the future. You are at a given point in time and are concerned with costs and hours worked going forward. Money spent and hours worked to date are behind you. You must look forward and optimize the future, not rework the past.

The run and repair decision is relatively easy. You know what it cost last year, you know it is at or beyond its sweet spot, and you know that the next year’s costs are likely to be the best costs in the future of the machine. The question is, are they the best costs that you could obtain if you were to rebuild it and keep it for a few more years? Are they the best costs you could obtain if you were to replace it and keep the new unit for its optimum life?

Many factors come into play, not the least of which are differences in the amount of capital required to implement each alternative and the time spans over which the alternatives are optimized. The nearby table gives the kind of results obtained and the factors that must be considered in a typical study. As you can see, you are definitely not comparing apples with apples and in many cases the intangibles and risks will rule the day.

Step three is decide and act. Understanding the alternatives and doing the numbers give you the framework for your decision. It is complex and may depend on your strategic plans, the work you have on the horizon, and your confidence in the future. You gather your data, do your analysis, look forward, and exercise your best judgment. Again, no right answers, just intelligent decisions.

For more on asset management, visit ConstructionEquipment.com/Institute.

Decisions on which machines are candidates for replacement can be supported with data such as this.