#ComingToGilbert

Water Meter Useful Life Analysis

Office Management and Budget

gilbertaz.gov
Using data analytic tools to:

• Calculate the average time to failure for water meters
• Calculate the probability of failure for a specified time
• Calculate the remaining life assuming reliability for a certain time.
• Determine the intersection between loss of revenue (due to unreliability) and depreciation of asset
• Conclude optimal time for water meter replacement
Methodology:

• Descriptive Statistical Analysis
• Weibull Statistical Analysis
• Straight Line Depreciation
• Break Even Analysis

Definitions:

Accuracy: Ability for a meter to exact readings at different rates of water flow.

Reliability: Probability an item (e.g. system or sub system) will perform its function with no failure for a stated mission time.

Accuracy of meter test determines failure threshold and reliability of the water meter system.
Mean Time To Failure

MTTF 18.263560 yr

Input
Failures/Suspensions
F/S 437/827

Calculate
Reliability
Prob. of Failure
Cond. Reliability
Cond. Prob. of Failure
Reliable Life
BX% Life
Mean Life
Mean Remaining Life
Failure Rate
Reliability Vs. Time

.75 SRII

Weibull Statistical Analysis

Meter Age (Years in Service)

Reliability

Data1
2P-Weibull
RRX SRM FM MED
F=43/5=827
Data Points
Reliability Line

Year (yr)

Carlos Lamkin
Town of Gilbert
11/18/2019
11:26:43 AM

Beta=6.636563, Eta=19.578992, Rho=0.545972
Reliability vs. Time

Kilogallons .75 SRII Weibull Statistical Analysis

Reliability vs. Water Usage (kgal)

Reliability
Data2
2P-Weibull
RRX SRI PM MED
F=437/5=872

Data Points
Reliability Line

Carlos Lamkin
Town of Gilbert
11/18/2019
11:21 PM

Beta=4.149273, Eta=3149.034186, Rho=0.981554
### Straight Line Depreciation

**Annual Depreciation Charge**

\[ ADE = \frac{C - R}{N} \]

- **C** = Cost of the asset
- **R** = Salvage Value of asset (0)
- **N** = Useful life in years (MTTF)

### Measuring loss revenue

Measuring loss revenue combines meter reliability with average accuracy readings for both passed and failed meters to measure slippage in revenue that results from declining accuracy and reliability.

<table>
<thead>
<tr>
<th>.75”</th>
<th>128</th>
</tr>
</thead>
<tbody>
<tr>
<td>1”</td>
<td>184</td>
</tr>
</tbody>
</table>

### Meter Costs

<table>
<thead>
<tr>
<th>Diameter</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>.75”</td>
<td>128</td>
</tr>
<tr>
<td>1”</td>
<td>184</td>
</tr>
</tbody>
</table>

### Meter Value .75 SRII Water Meters

![Cost of Asset](chart.png)
### Meter Value vs. Lost Water

<table>
<thead>
<tr>
<th>Average KG per Year</th>
<th>151.44</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Rate</td>
<td>$1.28</td>
</tr>
<tr>
<td>Revenue Assuming Full Reliability</td>
<td>$193.84</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Meter Reliability</th>
<th>100%</th>
<th>95%</th>
<th>90%</th>
<th>85%</th>
<th>80%</th>
<th>75%</th>
<th>70%</th>
<th>65%</th>
<th>60%</th>
<th>55%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenue</td>
<td>$193.84</td>
<td>$191.77</td>
<td>$190.85</td>
<td>$189.94</td>
<td>$189.02</td>
<td>$188.11</td>
<td>$187.20</td>
<td>$186.28</td>
<td>$185.37</td>
<td>$184.45</td>
</tr>
<tr>
<td>Lost Revenue</td>
<td>$0.00</td>
<td>$2.08</td>
<td>$2.99</td>
<td>$3.90</td>
<td>$4.82</td>
<td>$5.73</td>
<td>$6.65</td>
<td>$7.56</td>
<td>$8.47</td>
<td>$9.39</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age in Years</th>
<th>0.0</th>
<th>12.5</th>
<th>13.9</th>
<th>14.9</th>
<th>15.6</th>
<th>16.2</th>
<th>16.8</th>
<th>17.3</th>
<th>17.7</th>
<th>18.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remaining Meter Value</td>
<td>x</td>
<td>$40.30</td>
<td>$30.28</td>
<td>$23.62</td>
<td>$18.50</td>
<td>$14.23</td>
<td>$10.51</td>
<td>$7.08</td>
<td>$3.99</td>
<td>$0.98</td>
</tr>
</tbody>
</table>

| Breakeven Analysis Months | x | 19.4 | 10.1 | 6.0 | 3.8 | 2.5 | 1.6 | 0.9 | 0.5 | 0.1 |

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**.75 SRII Water Meter Trend Lines**

- **Lost Revenue**
- **Remaining Meter Value**

17.3 Years
Results All Meters

- **Average KG per Year**: 151.44
- **Water Rate**: $1.28
- **Revenue Assuming Full Reliability**: $193.84
- **Revenue**: $193.84, $191.77, $190.85, $189.94, $189.02, $188.11, $187.20, $186.28, $185.37, $184.45, $183.54
- **Lost Revenue**: $0.00, $2.08, $2.99, $3.90, $4.82, $5.73, $6.65, $7.56, $8.47, $9.39, $10.30
- **Remaining Months to Full Depreciation of Asset**
- **Break-even Analysis Months**

**.75 SRII Water Meter Trend Lines**

- **Lost Revenue**
- **Remaining Meter Value**

**2680 kgal**
The intercept is the point where the depreciation of the asset is equal to the lost revenue.

By measuring asset depreciation and revenue slippage due to system degradation we can obtain an optimal point for asset replacement. The following conclusions can be made.

• Across the whole system, optimal asset replacement can save on fixed costs.

• Changing the meter too early increases meter replacement costs.

• Changing the meter too late increases lost revenue from water sales.
THANK YOU

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