Total Cost of Ownership
Maintenance of Essential Data

Theodore J. Weidner, Ph.D., PE, RA, CEFP, DBIA,
Professor, Purdue University

Emily Herndon
Strategic Consulting, Woolpert
Agenda
Agenda

- Total Cost of Ownership fundamentals
- Source(s) of inputs
- Assumptions required
- Sensitivity of assumptions
- Overcoming sensitivities
- Maintaining relevance
- Research opportunities
TCO Fundamentals
Why Use Total Cost of Ownership

- Awareness of costs and commitments
- Planning for future costs
- Compare improvement/renewal costs
- Demonstrate ROI (return on investment)
- Track capital construction/renovation decisions
- Document capital construction value
Total Cost of Ownership

$$\text{TCO} = \sum C_a + \sum C_b + \sum C_c + \sum C_d + \sum C_e$$

Where:

- $C_a = \text{Initial Asset Costs (first cost, one-time)}$
- $C_b = \text{Cost of Operations and Maintenance (recurring)}$
- $C_c = \text{Cost of Utilities (recurring)}$
- $C_d = \text{Cost of Renewal (periodic)}$
- $C_e = \text{Cost at End-of-Useful/Functional Life (one-time)}$
Inputs
TCO Framework

End of Useful (Functional) Life (One Time)
- Sale/Adaptive Re-Use
- Re-sale Value/Salvage Value
- Removal
- Site Restoration/Remediation
- Deconstruction/Recycling

Initial Asset Costs (First Costs) (One Time)
- Planning and Programming
- Acquisition
- Design
- Construction/Site Development
- Lease or Rental
- Commissioning

Operations and Maintenance (O&M) (Recurring)
- Maintenance
- Operations
- Overhead and Administration

Renewal (Periodic)
- Replacement
- Programmatic Upgrades
- Improvements/Enhancements

Utilities (Recurring)
Initial Asset Costs – Planning and Programming, Acquisition, Design, Construction/Site Development, Commissioning
Inputs

$C_b$ Cost of Operations and Maintenance – Lease or Rental, Maintenance, Operations, Overhead & Administration

$C_c$ Cost of Utilities – Annual utility costs/expenditures

$C_d$ Cost of Renewal – Replacement, Programmatic Upgrades, Improvements/Enhancements
Inputs-end of life

$C_e$ Cost at End-of-Useful/Functional Life – Sale/Adaptive Reuse, Re-sale Value/Salvage Value, Removal, Site Restoration/Remediation, Deconstruction/Recycling
TCO process can begin anywhere

Planning stage – identify or manage a budget

Design stage – make value decisions

Post-acquisition – analyze commitments and make keep/remodel/dispose decisions

Financial – planning for future budgets and cost allocation
TCO Framework

Planning Starts here

Financial

Keep
Sell
Raze

End of Useful (Functional) Life (One Time)

Initial Asset Costs (First Costs) (One Time)

Operations and Maintenance (O&M) (Recurring)

Utilities (Recurring)

Asset Information Model

Renewal (Periodic)

Renew Remodel Decisions

Post-Occupancy Operating Phase

Energy Efficiency Upgrades
Operations & Maintenance (Facility Management)
First costs make up approximately 20% of the total cost of owning the asset. Operating the asset through disposition makes up the remaining 80%.
Facility Management

\[ TCO = \sum C_a + \sum C_b + \sum C_c + \sum C_d + \sum C_e \]

Operations and Maintenance (Facility Management)

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<thead>
<tr>
<th>OPERATIONS</th>
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<tbody>
<tr>
<td>• Monitoring Operations</td>
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<td>• Building Inspections</td>
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<td>• O&amp;M Inspections</td>
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<td>• Troubleshooting</td>
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<td>• Pest Management</td>
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<td>• Emergency Response</td>
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<th>MAINTENANCE</th>
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<td>• Preventative Maintenance</td>
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<td>• Corrective Maintenance</td>
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<tr>
<td>• Repair/Replacement</td>
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<td>• Emergency Maintenance</td>
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<td>• Building Inspections</td>
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<th>PORTFOLIO MANAGEMENT</th>
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<td>• Asset Visibility/Asset Inventory</td>
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<td>• Asset/Portfolio Condition</td>
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<td>• Capital Planning</td>
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<th>BUDGET &amp; PLANNING</th>
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<td>• Short- and Long-term Capital Investment planning</td>
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<td>• Resource Management</td>
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<td>• Risk Based Prioritization</td>
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<th>REGULATORY COMPLIANCE</th>
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<td>• Occupational Safety and Health</td>
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<td>• Fire and Life Safety</td>
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<td>• Environmental and Sustainability</td>
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<td>• FRPP Reporting</td>
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<th>ADMINISTRATION</th>
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<td>• Professional Development</td>
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<td>• Salaries</td>
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<td>• Contracts Management and Execution</td>
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Facility Management

\[ TCO = \sum C_a + \sum C_b + \sum C_c + \sum C_d + \sum C_e \]

Where does this number come from?
1. Initial TCO analysis at start of design project
2. From YOU!
Facility Management

How will this number be used?

1. Develop a target cost that shows progress towards efficiency?
2. Develop a cost that represents industry best practice?
3. Represent the actual cost of ownership today?
Facility Management

There’s no one “right” way to calculate costs

Things to consider:

• Agency/Organizations Strategic Plan
• Agency/Organizations Investment Strategy
• Strategic Asset Management Plan

WHY? Strategic Plans may have an influence on how you operate and maintain a facility.
Facility Management

Things to consider:
- Mission of your facility or facilities
- Expected level of performance

**WHY?** Mission criticality and EOP will affect your maintenance strategy
Facility Management

Things to consider:

- Condition of your asset portfolio
- Condition of your asset data
- Component renewal schedules
- PM/CM ratio
- Existing maintenance costs
- Deferred maintenance costs

**WHY?**
Your maintenance strategy at your facility ultimately make-up your maintenance cost.
Facility Management

Things to consider:

• Existing known costs
  • Utilities
  • Cleaning/Custodial
  • Groundskeeping
  • Waste Removal
  • Regulatory Compliance
  • Technology
  • Administration
  • Supplies
  • Training
  • Equipment Rental
  • Vehicles
  • Salaries & personnel
Tools and Resources

Computerized Maintenance Management System (CMMS)
Analytics dashboards/reporting
Energy management software
Utility bills
Contract values
Historical data

Program

NIST Building Life Cycle Cost (BLCC)
Final Thoughts

Calculating TCO across an enterprise or at a facility can be challenging but doesn’t have to be overwhelming.

With the right data, tools and processes in place, your organization can make data-driven decisions to calculate and manage TCO.
Research Opportunities
Research Opportunities

• Connections between each input
  • First Cost, Operation & Maintenance, Energy/Utilities, Renewal, End-of-Life

• Data needs
  • inputs and outputs

• Operating models
  • Reliability, Predictive, Preventive, Reactive, Run-to-Fail, Other

• Occupant (customer) driven results
• Effect of IoT
Discussion