Facility Maintenance Modeling

Frank Kaleba, PE, Senior Engineer,
R&K Solutions, Roanoke/Alexandria VA

Van Dobson, PE, Associate VP,
Facilities Services and Campus Planning
Lehigh University
Learning Objectives

Describe the **challenge & goal** of modeling

Explain how to model and shortcuts

Describe how one university is making use of maintenance modeling
Impact of Performing Required MR & PM on Service Life

Performance Curve for an Inventory

Average Performance Curve for an Inventory

Adequate Performance

Inadequate Performance

Time

Design Life

Facility Maintenance Modeling
Influences on Maintenance Budgets

- Focused needs (e.g. IT versus production)
- Departmental preferences
- Constituencies (e.g. donors, customers, parents)
- Star Retention
- Availability of funds
- Return on Investment
- Operating expense (e.g. energy)
- Maximize service life
Problem

How do you get objective estimates of long term maintenance needs that are recognized by line and financial managers as consistent, auditable, and justify a facilities budget?
Methods

- Last year’s budget plus whatever inflation index you can get away with
- The surprise method – let it break and force an issue
- Benign neglect – most things will keep going – do what you can with what you have
- Predictive modeling
Maintenance Modeling

• Model the predicted maintenance requirement of your facilities
• Based upon “industry standard” – not your internal estimates
• Use this model to explain annual variations to avoid surprises and to plan for capital expenditures
• Provide regular updates
How Do You Model a Building?

• Commercial Sources
  – Whitestone Research “MARS”
    • Single user - $9,995
    • Cost data from R.S. Means
  – R.S. Means “CostWorks – Facility Maintenance & Repair” dataset
    • Single user - $428
Steps

• Inventory components requiring M&R and PM
  – e.g. roof, chiller, AHU, switchgear
• Enter components into software
• Develop annualized or annual costs from model
• Highlight significant cost events
Shortcuts

• Adapt existing model
  – Whitestone (models in “MARS” software)
  – Whole Building Design Guide (free)

WWW.WBDG.ORG
The Gateway to Up-To-Date Information on Integrated 'Whole Building' Design Techniques and Technologies

The goal of "Whole Building" Design is to create a successful high-performance building by applying an integrated design and team approach to the project during the planning and programming phases.

NEW & UPDATED PAGES

Performing Efficient and Effective Constructability Reviews
Resource Page - 12/23/2013

Continuing Education - 12/17/2013

Code-Plus Programs for Disaster Resistance
Resource Page - 12/16/2013

Green Principles for Residential Design
Resource Page - 12/04/2013

Historic Preservation including Apply the Preservation Process Successfully, Update Building Systems Appropriately, Accommodate Life Safety and Security Needs, and Comply with Accessibility Requirements
Design Objective - 12/02/2013

NEW CCB PUBLICATIONS

ARMY/COE Criteria - PWTB 200-1-133 Environmental Considerations for Selecting Cost-Effective Dust Control Technologies
Posted: 12/16/2013

ARMY/COE Criteria - PWTB 200-1-133 Evaluation of Erosion Control Blankets on Military Firing Ranges
Posted: 12/16/2013

DOD Criteria - ECB 2013-33 Application of Flood Risk Reduction Standard for Sand Rebuilding

PARTICIPATING AGENCIES

Select an agency below for more information on its building programs.

NEWS

Off-Site Construction Council to Hold First Official Meeting at Building Innovation 2014
Dec 23, 2013
View Details

46 Continuing Education Units Offered at Building Innovation 2014
Dec 18, 2013
View Details

Workshop Looks at Moving Data through the Healthcare Facilities Life Cycle
Dec 13, 2013
View Details

EVENTS

Building Innovation 2014
Jan 5, 2014
View Details

PERIODICALS

Facility Maintenance Modeling
UFC 3-701-01

**POPULAR LINKS**
- Unified Facilities Criteria
- Unified Facilities Guide Specifications (UFGS)
- Construction Waste Management Database
- Building Envelope Design Guide
- Federal Green Construction Guide for Specifiers
- Federal High Performance & Sustainable Buildings

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</table>
FAC 6100  General Administrative Building

SUC FY13: $ 3.29 SF

Source: Calculated using R.S. Means Cost Works with 3rd Qtr 2012

Model below:

Component List:

Chart: A chart showing relative annual sustainment requirements
<table>
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<tr>
<th>Description</th>
<th>Frequency</th>
<th>Qty</th>
<th>Unit</th>
<th>Total In-House</th>
<th>Design Life/ Frequency</th>
<th>Total Inc. OP</th>
<th>Adjusted Occurrences</th>
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<td>6,317.36</td>
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<td>Replace 5'-0&quot; x 7'-0&quot; aluminum storefront doors</td>
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<td>Door removal, by hand and visual inspection, metal</td>
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<td>5.10</td>
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<td>Metal roof flashing replacement, 2.5% of roof area</td>
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<td>102.57</td>
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<td>Replace metal stair railing, interior</td>
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<td>S.P.</td>
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<td>1.50</td>
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<td>22.50</td>
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<td>Replace vinyl tile flooring</td>
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<td>3.09</td>
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<td>46.35</td>
<td>46.35</td>
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<td>Replace 2'-0&quot; x 2'-0&quot; thinset ceramic tile floor</td>
<td>30</td>
<td>4.40</td>
<td>C.S.F.</td>
<td>13.20</td>
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**Facility Maintenance Modeling**

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**FAC 6100 Office**

**Sustainment by Year - Terminal Cost Applied**

- Cost: $125,000.00
- Year: 2012
- Unit: 6000 CFM
- Not in check 1" backflow preventer

**UFC**
Benefits/Results

Offices responsible for approving funds see this method as:

– objective,
– consistent,
– auditable,
– uniform methodology

Result is that budgets for facility M&R are more readily approved
Wider Application of the Modeling

Organizations with large number of facilities:
• School systems, colleges and universities
• State and local governments
• Banking and telecommunications
• Real Property Portfolio Management

For organizations with a small number of facilities, customized benchmarking models are worth investment
University Case Study
A little about Lehigh

- Located in Bethlehem, Pennsylvania
- Founded in 1865 by Asa Packer
- First class was 38 boys with zero tuition
- Today about 4800 undergrads & 2000 grad students
- 12,000 applicants for 1,200 first year seats
- 2300 acres
- 4.6 MGSF
- About 3,400 beds
- $1.5B plant replacement value
- Total supported population of 9-10,000 students, faculty, staff, and visitors
New Guy Asks…

Early 2012…

• New on the job, Van asks “How do we budget for new buildings?”

• Answer “We look at what we’ve spent in similar buildings.”

• Then he asks “What’s the full requirement, how much do we get, and how do we ask for more?”

• Answer “Not sure, let’s look at the budget, and we don’t really (they won’t give us anything anyway).”

• And then he asks “What’s our PRV?”

• Answer “Let’s call the controller’s office.”
What We Had

• Good building and space inventory
• Building-centric budget and execution information
• Eight year old facilities condition data
• Fair knowledge of workforce size (significant portion of PM and service work contracted to many vendors with little data collection)
• Partially fielded CMMS
• Knowledgeable and willing staff
• Senior administrators who appreciate deliberate, process-based analysis and planning
What We Did

- Applied APPA staffing model for custodial, grounds, and maintenance
- Restructured our budget, resource allocation, and cost accumulation processes around programs and utility commodities
- Applied the DoD Facilities Pricing Guide
  - Maintenance requirement
  - Plant Replacement Value
- Restarted our Facilities Condition Assessment Program
- Asked for more $$
- Refined and repeated the cycle
APPA Staffing Model

APPA Assessment Methodology:

• Calculate total square footage in four categories
• Apply staffing standards for each maintenance level
• Apply adjustments for campus size, age, facility variety, condition, and mission variety
• Compare to existing

And just for fun, subjectively assess level of service being experienced.
APPA Staffing Model

APPA Maintenance Levels:
1 – Showpiece Facility
2 – Comprehensive Stewardship*
3 – Managed Care
4 – Reactive Management
5 – Crisis Response

*Survey of CFOs at 2010 NACUBO national conference indicated that campus maintenance should provide “Comprehensive Stewardship.”
Facilities Pricing Guide

- Select a primary FAC for each building and structure (lots to choose from)
- Apply replacement cost, area cost, and soft cost factors to determine PRV
- Apply sustainment cost, area cost, and selective monumental building factors to calculate sustainment requirement
- Aggregate for Education & General, Housing, and Utilities & Infrastructure
- Compare to budgets
Gaining Acceptance

• **Briefing stakeholders**
  – My team and boss
  – Budget Office
  – President and Provost
  – Trustees

• **Include assessment in the FY14 and FY15 budgets**
  – General maintenance program funding level
  – New and renovated buildings

• **Use as the basis for projecting future maintenance requirements**
Outcomes

• Accepted as part of the budget process
• First module of the new Financial Analysis model being built around the Facilities Pricing Guide
• O&M projections associated with capital construction and renovation built likewise
• Budgets for six acquired buildings approved
• Despite no program growth in last 4-5 years,
  – FY14 maintenance budget up 4+%
  – FY15 slight maintenance increase possible
• Created a classroom improvement fund
Next Steps

• Complete Facilities Condition Assessment
• Craft facilities condition data and budget vs. model comparison into a convincing story
• Brief stakeholders
• Pursue rightsizing the maintenance budget

and on a similar note

• CMMS utilization
• Workforce shaping
• Electronic dispatch
• Project management
• APPA FPI
Prioritizing Needs Versus Desires

• Requirements
  – Rational
  – Reproducible (or auditable)
  – Reasonable (long range plan, near term priorities)
Questions?
Presenters

Frank Kaleba, PE, Master Code Professional
Senior Engineer
R&K Solutions
fkaleba@rkeng.com

Van Dobson, PE, Associate VP, Facilities Services and Campus Planning
Lehigh University
hvd211@Lehigh.EDU