Reviewing the State of Deferred Maintenance

by Harvey H. Kaiser

[Ed. Note: This article is developed from research in progress by the author on an APPA Center for Facilities Research (CFaR) project. The project on "Facilities Reinvestment" will examine the state-of-the-art in addressing capital renewal/deferred maintenance and result in a book with findings and a recommended planning process to gain support and funding for CRDM. In this article, Kaiser sets forth some basic principles that will form the framework for the research and the eventual recommendations.]

The Issues and Challenges

Higher education has historically underfunded maintenance of capital assets. Compounded by an asset portfolio of aging facility and infrastructure, inadequate funding for replacements of building systems and modernizations for current and new functions, and changing pedagogy, colleges and universities accumulate backlogs of capital expenditures, often at the risk of institutional financial equilibrium. Under these conditions, campus buildings and infrastructure are subject to potential critical failures and disruption to normal activities, threats to health and life safety, inadequacies to support intended programs, deterioration in campus appearance, and a reduction in capital asset value. Taken together, these circumstances are grouped in the general term "deferred maintenance."

Deferred maintenance issues are summarized as:

- Piecemeal approach to capital planning without linkages between strategic and operational planning;
- Chronic resource shortage;
- Inadequate management policies and practices, plus internal politics;
- Misunderstood and misapplied needs assessment methodologies and tools;
- Unrealistic financial planning; and
- Lack of performance measures.

Understanding the deferred maintenance liability requires documentation of the causal factors, and includes the impact of underfunding annual operating budgeting for maintenance and replacement of building and infrastructure at the end of a life cycle, and the gap between funding required for adequate capital asset maintenance and reinvestment. Although some public systems of higher education and individual institutions

Harvey Kaiser is president of Harvey H. Kaiser Associates, Inc., based in Syracuse, New York. He is the author of* The Facilities Audit: A Process for Improving Facilities Conditions, Mortgaging the Future: The Cost of Deferring Maintenance, *and the coauthor of* A Foundation to Uphold: A Study of Facilities Conditions at U.S. Colleges and Universities. *He can be reached at hhkaiser@att.net.

TABLE 1: BUILDING DATA ELEMENTS

Institutional identifier - FICE or IPEDS	Number of floors
Site identifier - institutional code	Estimated current replacement cost
Location or street address	Original building cost
Building identifier - local name	Cost of major renovation(s) - amount and date
Ownership status - owned, leased, etc.	Historic preservation status
Gross building area - gross square feet (GSF)	Type(s) of construction
Net assignable area - net square feet (NASF or ASF)	Disabled access
Year of construction - completion	Fixed equipment
Year of last major renovation	Building condition & functionality *(see Tables 6 & 7)*

have addressed these problems aggressively in recent years, many struggle with identifying their needs and presenting a persuasive and credible argument for financial support necessary to restore deteriorating and/or remedy unsafe conditions.

There are two major challenges in addressing deferred maintenance: 1) a consistent and commonly applied definition of deferred maintenance; and 2) a capital planning process identifying and integrating all campus capital needs. The basic definition of deferred maintenance is: *maintenance and repair deficiencies that are unfunded at the end of the fiscal year on a planned or unplanned basis and are deferred to a future budget cycle or postponed until funds are available.*

However, sometimes, estimates of campus "deferred maintenance" mistakenly includes major repairs and replacements for facilities more appropriately categorized as life cycle capital renewal, facilities modifications for change in use and upgrades to meet contemporary use standards, and regulatory requirements to meet environmental and life safety codes. Thus a "deferred maintenance backlog" is erroneously presented as the sum of several categories, in addition to the appropriate need to remedy existing physical conditions, by including annual life cycle renewal for facilities systems reaching the end of their useful life, and modernization/upgrade capital requirements.

A capital planning process, integrated into a long-range capital development plan by a strategic facilities planning process, comprehensively identifies capital requirements for all campus building and infrastructure based on needs assessments for *capacity* (enrollment, program), *condition and functionality* (immediate condition deficiencies and modernization/upgrades), and *regulatory needs* (environmental and life safety codes). An additional component of a capital program is a forecast for annual life cycle renewal needs, to form a comprehensive list of capital projects for prioritization and funding allocation strategies.

Data Elements

Data elements for analyses to address capital needs, including the deferred maintenance component, are based on methodology and tools for assessments of capacity, condition

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Are...

...we adequately tracking organizational occupancy and recovering indirect costs associated with funded research?

When...

...was the last PM performed on this equipment?

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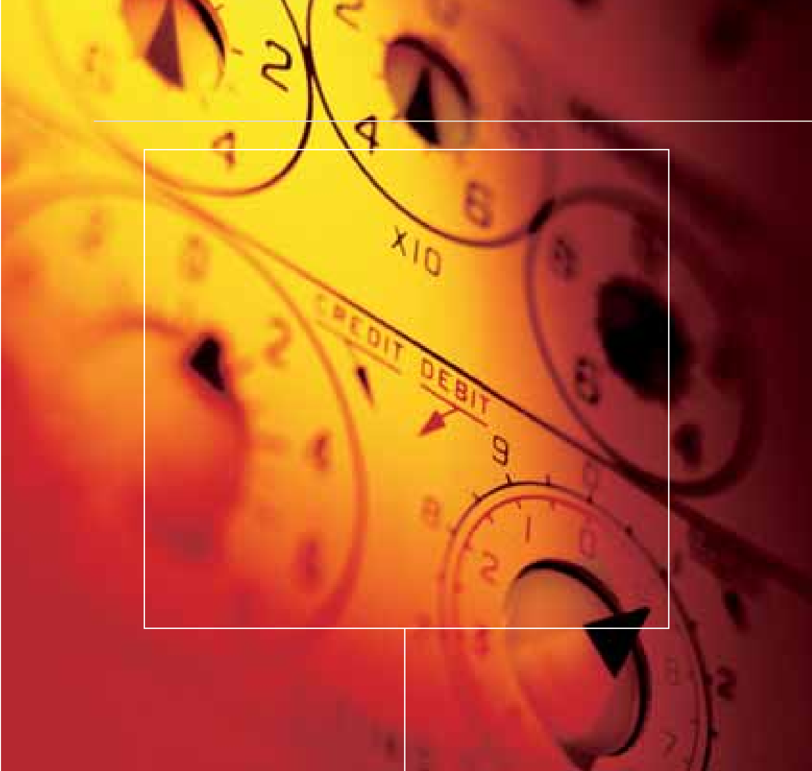

Where...

...is our inventory, and do we have the right materials on hand?

How...

...much are we spending on utilities each month?

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TABLE 2: ROOM DATA ELEMENTS

Institutional identifier - FICE or IPEDS	PEFIC Room Use Code - primary use, % use
Building identifier - local name	PEFIC Room Use Code - secondary use, % use
Unique space or room identifier - name, ID number	Assignable area - NASF or ASF
Organizational unit - name or code	Capacity - number of stations
CIP Discipline Code	Condition and functionality/suitability *(see Tables 6 & 7)*
Program Classification Structure	Disabled access

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and functionality, and forecasted life cycle renewal. A comprehensive facilities database includes data elements required for needs assessments at levels of building and room. Data is either numerical, narrative, or both.

Sample Methodologies

Methodologies and tools are applied for 1) a capacity analysis, 2) condition needs assessment, 3) functionality needs assessment, and 4) a life cycle renewal forecast.

Capacity Analysis

A capacity analysis uses space planning and utilization standards to predict how much space, expressed in assignable square feet (ASF), is required for each space type (PEFIC Room Use Code). Then, by comparison of the *required* amount of space with the actual amounts of space, the *capacity analysis* permits conclusions about *surplus* or *deficit* of space, by space type.

Condition Needs Assessment

The assessment of *physical condition* needs is a two-part exercise to determine the current observable deficiencies and a prediction of future needs based on life cycles of building systems and components. Current deficiencies are those that are defined as immediate or critical because of failure or those with a high potential in the next 12-24 months. Thus, needs can be identified as deferred maintenance backlog because of a failure to take remedial action within past or current budget cycles or critical because of an imminent need for funding remedial action.

TABLE 3: NON-FACILITIES DATA ELEMENTS

Division
College/School
Department
CIP Discipline Code
PEFIC Room Use Code
Classroom/Laboratory
- Section #
- # of students
- Course name
- Weekly schedule
- Contact hours
- Enrollment limit

Room assignment
Student Data
- Headcount
- Full time equivalents
- Affiliation—division, college/school, department

Employee Data - Classification (EE06)
- Headcount
- Full time equivalents
- Affiliation - division, college/school, department
- Classification - Admin., Faculty/Professional, Technical/Clerical, Graduate Assistants, Student Employees

Research Data
- Division name
- College/School
- Department
- CIP code
- Recent research expenditures - three-year average
- E & G current fund expenditures - three-year average

Library Data
- Library volumes - ACRL conversion method

TABLE 4: GENERAL CAMPUS AND UTILITIES INFRASTRUCTURE

Location
Capacity - design, performance
Condition/serviceability
Land use
Landscaping and open space
Transportation and circulation
Wayfinding
Disabled access
Utility Type:
- Electric power - normal and emergency
- HVAC
- Natural gas, compressed air, other specialized
- Data and telecommunications
- Water - city and campus
- Sanitary sewage
- Storm drainage

TABLE 5. SAMPLE SURPLUS/DEFICIT CALCULATION

Campus	FTEs (Student)	Actual ASF	Predicted ASF	Surplus (Deficit) ASF	% Variance from Predicted

There are alternative techniques for determining physical condition needs, with varying reliability and cost. Specific circumstances can dictate the selection of an appropriate methodology.

- *Qualitative Analysis*—a building walk-through is recorded as ratings (excellent, good, fair, poor, and unsatisfactory). The rating is converted as a ratio of the observed condition to an "excellent" condition and then multiplied by a current replacement value to determine the cost of a remedial action (lowest cost, moderate reliability).
- *Deficiency-Based Systems*—a comprehensive physical inspection performed on regular cycles, identifying observed deficiencies (condition and functionality) (highest cost, highest reliability);
- *Predictive modeling*—an assessment of facility-system level condition through its life cycle (lowest cost, moderate reliability); and
- *Engineered Management Systems*—an assessment of asset performance combining predictive life cycle modeling and a disciplined observation of current asset performance (moderate cost, highest reliability).

The deficiency-based approach (or facilities audit) is conducted as a comprehensive building-by-building inspection of spaces and operating systems on an average three-year cycle for all facilities. Various field methodologies are based on UNIFORMAT II (Uniformat II Elemental Classification for Building Specifications, Cost Estimating, and Cost Analysis, NISTIR 6389. Washington: Department of Commerce, National Institute of Standards and Technology, 1999). Actual inspections can be conducted using a spreadsheet template or computer data entry. Goals for the inspection are to

TABLE 6. CONDITION NEEDS ASSESSMENT DATA COLLECTION TEMPLATE

Inspection Data	System/Component Evaluation
- Facility Identifier - location, number, name	- Deficiency identifier - name, number
- UNIFORMAT II element category	- Deficiency description
- Inspector name	- Priority rating - level 1 (years 1-5), level 2 (years 5-10)
- Inspection date	- Estimated cost
- System/Component Condition Description	- Special Conditions

TABLE 7. FUNCTIONALITY NEEDS ASSESSMENT DATA COLLECTION TEMPLATE

Building Template	Room Template
1. Functional relationships	1. Functional adequacy
2. Architectural	2. Room/space finishes
3. HVAC	3. Climate control
4. Electrical service	4. Electrical service
5. Plumbing	5. Lighting
6. Lighting	6. Data and telecommunications
7. Data and telecommunications	7. Special services
8. Acoustics/sound and vibration control	8. Acoustics/sound and vibration control
9. Furnishings	9. Furniture and fixtures
10. Major equipment	10. Code compliance
11. Code compliance - accessibility, environmental, etc.	11. Accessibility
12. Historic preservation status	12. Safety and security
13. Safety and security	

identify routine maintenance items for annual operating budget expenditure and major repairs/replacements for two years (current year and next year capital budgets. Each major repair/replacement project should be estimated for current year and inflated costs to remedy deficiencies and prioritized for a five- to ten-year capital program.

Functionality Needs Assessment

Data is collected and evaluated for an estimate to correct functionality deficiencies using a template for buildings and rooms, the latter based on the specific functional assignment for a PEFIC Room Use Code.

Condition, functionality, and regulatory needs are combined into a Facilities Needs Index (FNI), a baseline metric for future performance evaluation and benchmark comparisons with other facilities and institutions. The FNI is expressed as

$$\text{FNI} = \frac{= \text{condition needs} + \text{functionality needs} + \text{regulatory needs } \textit{(times \%)}}{\text{current replacement value}}$$

[*Ed. Note:* See also Cain & Kinnaman, "The Needs Index: A New and Improved FCI," March/April 2004 *Facilities Manager.*]

Life Cycle Renewal Modeling

Life Cycle Renewal modeling utilizes factors of building systems or components estimated life along with current age and previous expenditures for improvements. Used as an independent analytical tool, the predictive (or life cycle model) provides a life cycle renewal forecast for systems with a 25-year life span (or longer). The predictive model forms the engineered management system approach which is used to identify building systems or components identified as close, at the end, or past the end of a life cycle for a facility-targeted, deficiency-based detailed assessment.

The predictive model also can be the basis of an annual renewal allowance in either an operating or capital budget. The allowance's purpose is to offset life cycle deterioration and serves to prevent an accumulation of capital repair/replacement backlog. **The allowance is in addition to a facilities operations**

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and maintenance annual operating budget. Data elements required for a life cycle renewal forecast, in addition to building data elements (Table 1), include an estimated theoretical life for facility systems and components.

Conclusion

Addressing deferred maintenance is a fundamental responsibility of the facilities management professional. Required is an understanding of the definitions and methodology to develop a credible and persuasive capital planning process. Integration into a long-range capital development case for funding and implementing a program to reduce deferred maintenance in order to offset future facilities deterioration and sustain functional facilities in support of institutional mission is also a requirement.