Planning for Capital Reinvestment: Alternatives for Facilities Renewal Budgeting

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Abstract

Higher education is facing a crisis in widespread physical plant deterioration. A survey of colleges and universities sponsored by NACUBO, APPA and Sallie Mae identified $26 billion dollars in accumulated deferred maintenance and a growing backlog as a result of inadequate resources for capital reinvestment. How to adequately plan and budget for facilities renewal needs is a perennial problem for Higher education administrators. Just how much of an institution’s limited resources must, or should, be spent each year to responsibly maintain the physical plant and how do administrators effectively communicate that to trustees and legislators?

This paper describes and evaluates four alternatives to planning and budgeting for facilities capital reinvestment. The purpose is to help facilities directors, budget officers, and other senior decision makers understand the basic rationale of each alternative as well as the complexities, strengths, and drawbacks.

The four approaches to planning and budgeting for facilities renewal reviewed here are: (a) physical plant auditing; (b) depreciation based; (c) percentage of Current Replacement Value (CRV); and (d) facility sub-system modeling (also referred to as life-cycle modeling). Each of these methods offers distinct advantages and limitations in budgeting for and setting policies about deferred maintenance and facilities renewal. This paper evaluates the strengths and weaknesses of each approach against three essential criteria.

- Does the method provide convincing justification for funding facilities renewal?
- How accurate is the method?
- What is the cost and effort to implement and maintain the approach?

1. Introduction and Problem Statement

This paper examines the methodology of four different approaches to identifying the long-term needs and costs of physical plant renewal. The purpose of this review is to evaluate the effectiveness and cost of each method.

The four approaches examined are:

- a. Conducting a physical plant audit;
- b. Using plant depreciation as a model for renewal;
- c. Using a fixed percentage of the Current Replacement Value (CRV) to calculate annual renewal needs and;
- d. Creating a predictive model based on a facility subsystem (or life cycle) approach.
2. Definitions

The definitions used in this paper are drawn from Financial Planning Guidelines for Facility Renewal and Adaption, SCUP, 1989. This paper was a joint project of the Society for College and University Planning (SCUP), the National Association of College and University Business Officers (NACUBO), the Association of Physical Plant Administrators of Universities and Colleges (APPA) and Coopers and Lybrand. This project identified the need to recognize, plan, and budget for four distinctive aspects of facilities stewardship:

1. On-going maintenance;
2. Facilities renewal;
3. Deferred maintenance or catch-up;
4. Adaption.

While these four categories are linked (the definitions below discuss some of these links), they are also sufficiently distinct that the authors of the paper recommend treating them separately.

On-going Maintenance -- Routine upkeep such as lubrication of moving parts, checking electrical systems, patching roofs, and so forth. Failure to attend to these tasks speeds up deterioration of facilities and increases the likelihood of expensive emergency repairs. Normally on-going maintenance is funded by an institution’s operating budget.

Facilities Renewal -- A systematic approach to repairing or replacing major building subsystems such as roofs, HVAC, electrical, and plumbing systems, which have predictable life-cycles, to maintain and extend the life of the facility. This category is sometimes referred to as Planned Maintenance or Capital Repair. Normally funded by an institution’s capital budget.

Deferred Maintenance -- The accumulation of a backlog of pending physical plant improvements to correct the influence of age, use and normal wear and tear. Continued underfunding of on-going maintenance and facilities renewal increases the total backlog of deferred maintenance.

Adaption -- Alterations in physical plant to address changes in use, codes, or standards. Such changes include those required under the American Disabilities Act and those made to keep up with technology as well as facilities that become obsolete for program reasons.¹

¹Note: Other terms for adaption are code-driven obsolescence and functional - or program- obsolescence; they are separate in character. Code-driven are usually prescriptive; academic of program obsolescence refers to the inability of a facility to function well for its intended use. Funding may vary such that functional/program renovation is funded separately from a strict code upgrade, depending upon the scale of work needed. Often the two are combined and done at the same time on a building-wide basis.
While the four categories of facilities stewardship defined above are closely related, in higher education institutions, they are often administered and financed through different management processes and budgets. However, decisions about timing and scope of projects in each of these categories may have significant budget implications for the others. For example, inadequate funding of on-going maintenance will result in more deferred maintenance.

This increased cost is almost always greater than the cost would have been to adequately maintain the sub-system and the funding is less cost-effective than a simple repair would have been. Similarly, if facilities renewal projects are not performed as needed, the results are more crisis repairs and again, greater costs.

3. Criteria for Evaluating Alternative Approaches to Facilities Renewal Budgeting

In budgeting for and setting policies about deferred maintenance and facilities renewal, three key questions to answer are:

- How effective is the method in convincing key leaders of the importance of establishing adequate on-going funding for facilities renewal?
- How accurate is the method and information developed?
- What is the cost and effort to implement and maintain the approach?

The importance and implications of these questions are explored in the following paragraphs along with a set of criteria used in evaluating the four methodologies.

How Effective is the Method in Convincing Decision Makers?

Fiscal officers, policy makers, and governing bodies generally agree about the importance of preserving the value of an institution’s plant assets. They are not always convinced, however, of the magnitude of the overall problem of facilities renewal needs. Nor are they necessarily knowledgeable about the level of need in any given year. This is especially true at institutions with older physical plants, where a substantial portion of their facilities were constructed more than 40 years ago. The total magnitude identified can be so daunting as to discourage a rational allocation plan.

These decision-makers need approaches that:
- Facilitate understanding of deferred maintenance and facility renewal needs;
b. Are based on a solid analytic framework;
c. Are easy to understand and communicate; and
d. Are based on commonly-accepted standards.

**How Accurate is the Method in Identifying Current and Future Needs?**

An effective approach should include both an assessment of the current deferred maintenance and a forecast of future facilities renewal needs. It should also help forecast how well a building can be expected to perform over the next five to twenty years. How accurate is the facilities renewal methodology in meeting today s needs and in projecting future needs?

Thus, does the approach:

e. Identify where the immediate problems are?
f. Distinguish between deferred maintenance and current needs?
g. Predict future facilities renewal needs?
   i. account for the cyclical nature of renewal?
   ii. allow customization for an individual campus by taking into account age and type of facilities?
h. Identify, building by building, where future problems are likely to occur?

**What are the Costs and Effort Required?**

Institutions must always weigh the costs of gathering and maintaining information about deferred maintenance and renewal needs against spending the resources on the facilities themselves. Each methodology should be evaluated based on:

i. Cost and effort to implement.
j. Cost and effort to maintain.

**Other Criteria**

Information that supports more effective management of resources can save money by identifying when a subsystem will have to be replaced. For example, suppose a building needs an immediate electrical renovation. If, within the next five years, the building also will need a replacement of the mechanical system then it may be cost effective to renovate both sub-systems at the same time.

Similarly, if the building today is only marginally able to meet program needs (i.e., it is programmatically obsolete) it may be desirable to delay replacing a subsystem until a complete building and program review can be accomplished. Therefore:

k. Does the approach project the timing of replacement?
1. Does the approach assist with long-term capital planning for program obsolescence?

Finally, many institutions are interested in recognizing and disclosing the financial implications of aging facilities. Businesses and some private education institutions do this through accumulated depreciation. While recognition of depletion of assets is quite different from identifying deferred maintenance or facilities renewal needs, capturing this information can be useful for long-term capital planning.

m. Does the approach recognize the depletion of capital assets.

4. Alternative Approaches

4.a. A Physical Plant Audit

Physical plant audits are performed by a number of consulting and construction firms. Engineers and technicians perform building-by-building inspections to document the physical condition of a campus. The inspection survey can cover the entirety of the physical plant needs, including utility distribution systems and hardscape. Audit teams consisting of university personnel and members of the firm examine selected components and judge the level of physical deterioration. Typically, these inspections identify areas of deferred maintenance including:

- structures, foundations and substructures
- roofing and exterior walls
- heating, ventilation, and air conditioning systems (HVAC)
- plumbing, electrical systems
- safety systems
- ceiling systems
- floor coverings
- interior walls
- conveying systems

The typical product of these audits is a list of deferred maintenance needs by building and building components. In addition, most firms will help the campuses determine a set of relative priorities.

Strengths

The key strength of this approach is it provides a detailed and specific list of buildings and components in them that need maintenance. The approach is valuable to facilities managers because it clearly identifies those buildings and components with deferred
maintenance, the degree of deterioration, and it provides estimates of the cost to replace or repair. Priorities for repair may then be based on levels of degradation and safety hazards.

**Weaknesses**

There are two significant weaknesses to this approach. First, it can identify only today's total deferred maintenance needs. Consequently, it is not useful in projecting future facilities renewal needs. Nor is it useful in distinguishing current renewal needs vs. backlogged maintenance needs. [These deficiencies may be remedied by performing regular physical plant audits, however, many campuses find the cost to be prohibitive especially if the audit cannot focus on components whose timely replacement would result in overall cost savings.]

The second weakness of a facilities audit is that the high level of detail provided, while useful to facilities managers in determining work priorities, is, in consequence, a list of building components requiring attention. It is difficult to turn the audit into a long-term facilities renewal plan that can inform budget officers and legislators of the true state of need.

**Cost and Effort**

The cost of these audits typically varies from $0.07 to $0.15 per square foot, depending on the overall size of the audit and the level of detail requested. A physical plant audit of a system with seven million gross square feet of general and education space, will cost somewhere between $500,000 and $1,000,000. Staff time is also a factor. An institution's plant personnel are typically involved in the lengthy and detailed physical inspection of the buildings.

**4.b Plant Depreciation**

Calculating annual building depreciation can serve as the basis for determining a flow of funding for both facilities renewal and demolition/replacement. Allowances for depreciation are always calculated on the original cost of the asset and improvements. An institution may choose to use straight-line or an accelerated method of spreading the depreciation over the life of the asset. While institutions governed by the Government Accounting Standards Board (GASB) regulations are not required to record annual depreciation, many accounting, financial, and facilities managers believe such costs should be calculated and reported in annual financial reports to properly reflect the depletion of capital assets over an appropriate period.

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2 In industry, adjustments for salvage value or losses are recognized in the accounting records at the time of disposal of the asset. For higher education institutions the salvage value is typically assumed to be zero.
Applying depreciation as the basis for calculating facilities renewal costs requires a minimum of three steps:

1. Tracking the historical costs of each facility;
2. Determining an appropriate asset life and applying an accepted depreciation method (straight-line or accelerated); and
3. Actually funding the annual depreciation charge.

Depreciation is based upon historical costs of construction (and/or major rehabilitation); it is not an effective tool for estimating actual facilities renewal costs. It can be useful in establishing the basis for a regular stream of funding for capital projects. Institutions adopting this approach typically create a depreciation reserve and fund it annually through a charge to their current operating budget. The reserve then becomes one source of funding for capital or renewal projects.

Depreciation calculated on historical costs will not cover today’s costs of replacement or repairs. Therefore, the depreciation reserve must be supplemented by other sources of funding. One option is to adjust the annual depreciation charge to the operating budget by a formula to correct for the long-term impact of inflation. Ideally, annual depreciation would be adjusted to reasonably approximate the real costs of capital needs.

**Strengths**

The recent requirement by the Financial Accounting Standards Board (FASB) that all FASB governed not-for-profit institutions recognize and record the cost of depreciation on their balance sheets has focused attention on the depletion of capital assets in this sector. While government institutions are not within the FASB jurisdiction, operating instead under GASB regulations, many believe that it is imperative for Higher Education institutions to more accurately report their asset base by recognizing depreciation. If state and institutional leaders agree with this concept, it may be advantageous and relatively easy to get agreements to fund a depreciation reserve.

If depreciation accounting is already in place, there should be minimal effort required to calculate an annual depreciation charge and make transfers from the operating budget.

**Weaknesses**

The weaknesses associated with this approach are significant from several perspectives. First, the methodology provides neither estimates of deferred maintenance needs nor annual facility renewal needs. More important, this approach will not adequately fund
facilities renewal needs because it is based upon historical costs, unadjusted for inflation. It therefore has little relevance to future costs.

It is important to note that depreciation accounting was primarily established to measure profit and shelter income by permitting a business to annually expense a cost associated with the depletion of an asset without realizing a cash outflow. As such, the historical cost of the asset, not its replacement cost, forms the basis to determine the annual depreciation charge. Charles Horngren, professor of accounting at Stanford University, admonished his students and readers in each edition of his widely used textbook, *Cost Accounting, A Managerial Emphasis*, to be wary of the pitfalls of depreciation in creating capital budgeting decision models. Because depreciation intentionally uses historical costs --not predicted replacement costs -- it can seriously distort costs and cash flow analyses, particularly in inflationary times.

**Cost & Effort**

The cost of implementing and maintaining a plant depreciation model depends on what system is installed at the campus. If tracking applications already are in place, then it should not cost much more to keep depreciation records.

4.c *A Fixed Percentage of the Current Replacement Value*

Using a fixed percentage of the facilities current replacement value (CRV) is a recent approach to funding facilities renewal budgets. Total current replacement value of all facilities is calculated based upon current published construction costs. The institution then chooses a fixed percentage of the total CRV to determine how much should be allocated annually. In 1989 a report published by the Society for College and University Planning (SCUP) recommended 1.5% to 2.5% of CRV. Other studies recommend slightly lower ranges.

**Strengths**

One strength of this approach is that it is easy to understand how the calculation is made. One simply adds together the CRV of each facility and then multiplies by the fixed percentage.

Another strength is that this methodology, if it becomes policy, can be easily adjusted by simply asking the governing body for a different percentage.

Finally, the approach has an analogy to endowment management: Just as endowment managers need to constantly reinvest endowment returns in order to maintain the purchasing power of the endowment payout, so do physical plant officers need to reinvest in maintaining the value of the physical plant.
Weaknesses

There are four key weaknesses to this approach:

þ No commonly accepted standard defines 2.5%, 1.5% or any other percentage as the correct amount to budget for annual facilities renewal. Consequently, any number presented may appear to be arbitrary, and possibly irrelevant to the institution today. Using such percentages may stir debate and annual negotiations.

þ A fixed percentage approach also has little connection with the actual needs of a campus. Clearly, a very new campus should have very little in the way of either deferred maintenance or plant renewal needs. Alternatively, an older campus is likely to have higher-than-average renewal needs. Further, new capital construction programs tend to follow cycles (ten years of intense construction followed by fifteen years of minimal construction is common in higher education). This cyclical construction trend argues against the fixed percentage model.

þ The method cannot be used to accurately project deferred maintenance because it does not take into account the cyclical nature of facilities renewal. Instead, it is based upon average facility renewal requirements over a very long time.3

þ The method does not help physical plant administrators determine the magnitude of facilities renewal needs at any point in time. Thus, it must be used in conjunction with other methods that provide information on specific facilities renewal and deferred maintenance problems.

Cost and Effort

There is minimal cost to this methodology. Assuming a database that includes each facility and its square footage exists, then calculating CRV is simply a matter of estimating the cost per square foot of replacing the facility.

4.4 Creating a Predictive Model Based on a Facility Sub-system Approach

The sub-system approach to estimating future renewal and replacement requirements is a statistical method that predicts for each campus facility, when individual major sub-

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3 That is to say, ideally, one would like an approach that would predict the actual required facilities renewal funding requirement, so that in those years where funding did not occur as required, one could identify a major component of the deferred facilities renewal. The CRV approach does not predict actual need and actual funding, and so is not helpful in identifying the deferred need.
systems (e.g., electrical, HVAC, plumbing, roofing, etc.) are likely to fail and what the cost of replacement will be. This methodology uses facility type, gross square footage, construction and renovation dates, institutionally defined facility sub-systems, their life cycles, and cost of replacement to predict annual facilities renewal needs. Predicted renewal costs are aggregated by building and time period to project total renewal needs into the future.

A sub-system model is frequently tailored to an individual campus, but can also be designed to apply a consistent methodology across multiple campuses. Facility types and sub-systems are usually customized to accommodate institutional differences. Replacement costs and life cycle predictions are based on industry standards, but may be adjusted to reflect actual experience at the institution. A typical process for developing a predictive model is shown in the following figure.

**Figure 1**

1. Determine focus of Capital Renewal/Deferred Maintenance Study
2. Group facilities into common categories
3. Identify sub-systems for each facility category
4. Determine life cycle and renewal cost parameters for each sub-system

**Strengths**

The key strength of sub-system approach is that it is a simple to understand model based on sound theory and benchmarked against industry data.

- It is tailored to the individual campus by the use of actual campus facilities data.
- It accommodates the cyclical nature of facilities wear-out.
- The approach is benchmarked against industry standards for sub-system life cycles and replacement costs.
The model can be used to provide institutions with both annual facilities renewal needs and the backlog of deferred maintenance needs. Because the model is built using data from actual institution facilities, it can be used to provide a list of facilities and sub-systems where there are likely to be deferred maintenance and/or renewal needs.

The model can be used to accommodate planning for facility obsolescence and will recommend when specific buildings should be considered for either complete renovation or reconstruction.

The previously mentioned paper by SCUP, APPA, NACUBO and Coopers & Lybrand recommends this approach.

**Weaknesses**

While the model indicates which facility subsystems are likely to need replacement, it is not a physical plant audit per se, and thus does not provide the specific details on system components, which may have deteriorated at a rate different than expected.

The projected facilities needs and costs may vary significantly from one five-year period to another because the model captures the cyclical effects of construction booms. While this information provides a thorough understanding of actual costs, the relationship between renewal and accumulating deferred maintenance, and the total funding required, it is not as simple to budget for as the fixed percentage of CRV or depreciation methods.

**Cost & Effort**

The cost of implementing this model is approximately $0.01 - $0.02 per gross square foot. For an institution with seven million gross square feet, the cost would be approximately between $70,000 and $140,000. Once the model is implemented it can be updated annually with minimal effort.

**5. Summary**

All four methods surveyed in this paper have different strengths, weaknesses, and costs. Institutions may wish to chose one or more of the methods reviewed here depending upon the particular set of issues the institution is facing.

The advantage of a physical plant audit is that it provides details on exactly where facilities renewal and deferred maintenance projects are needed. Its disadvantages are the cost, the fact that it only provides a snapshot view of deferred maintenance today, and it provides little of the information needed to allocate funding over a period of time.
The key advantage of the *capital asset depreciation approach* is that it corresponds with the effort to recognize the depletion of physical plant assets in an institution’s financial statements. If policy makers and governing boards are cognizant of the financial issues of deteriorating facilities, it may be a straightforward step to secure approval for funding a capital reserve based on annual depreciation costs.

However, the disadvantage is that funding a reserve for current or future construction based upon depreciating historical construction costs will result in serious underfunding and may mislead decision makers into believing they have solved the problem. It also provides no guidance as to which facilities or sub-systems are in actual need of facilities renewal.

The benefit of the *percentage of CRV approach* is that it is inexpensive to implement, easy to calculate and has an analogy in endowment maintenance. Its disadvantages include an inability to recognize the cyclical nature of facilities renewal, inability to project deferred maintenance needs, and the lack of an industry-supported benchmark.

The benefits of the *sub-system model approach* are that it is based on sound theory, benchmarked against industry standards, and tailored to fit the institution. It accurately estimates the cyclical facilities renewal needs. It can be used to accurately calculate deferred maintenance in total and (to a lesser degree of accuracy), renewal and deferred maintenance needs by facility.

The disadvantages of the sub-system approach are that it is not a physical plant audit and it does not necessarily provide policy makers with information related to the cost of depleting physical plant assets.

A relative ranking of the four approaches is presented in Appendix A based upon our evaluation of how well they meet the following questions which were proposed in section two as the critical criteria.

* ¥ Does it provide convincing justification for funding for facilities renewal?*

* ¥ How accurate is the method?*

* ¥ What is the cost and effort to implement and maintain the approach?*

The ranking clearly demonstrates both the strengths and weaknesses each methodology.

In conclusion, a combination of the approaches may be the most effective strategy to meet an institution’s specific needs. Including facility depreciation in the annual financial report has the advantage of highlighting to policy makers and governing bodies the fact that institutions use up physical assets. Seeking agreement to fund a facilities reserve or provide an annual operating budget based upon either calculated depreciation or a fixed...
percentage of CRV may be a successful approach to generate an annual stream of revenue. A predictive sub-system model could be used, inexpensively, to provide estimates of actual facility renewal and deferred maintenance needs. The predictive sub-system model can also be used to identify facilities and sub-systems that need further focused facility audits.
Appendix A. Ranking the Four Budgeting Approaches

A score was developed for each of the four facilities renewal budget alternatives using the criteria described in section three and based upon their specific strengths and weaknesses. The scores are presented in the following table.

### Facilities renewal Budgeting Alternatives

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<th>Scores</th>
<th>Excellent at meeting criteria</th>
<th>3</th>
<th>Good at meeting criteria</th>
<th>2</th>
<th>Fair at meeting criteria</th>
<th>1</th>
<th>Sort of meets criteria</th>
<th>0</th>
<th>Does not meet criteria at all</th>
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<tbody>
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### Criteria

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<th>Policy</th>
<th>Support</th>
<th>Accuracy</th>
<th>Cost</th>
<th>Other</th>
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<tbody>
<tr>
<td>Audit</td>
<td>Depreciation</td>
<td>% of CRV</td>
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#### Policy

- A. Facilitate Understanding
- B. Conceptual Framework
- C. Ease of Approach
- D. Industry Standards

#### Support

- E. Identify Immediate Problems
- F. Diff. between DM and FR
- G. Predict Future Needs
- G.i. Cyclic
- G.ii. Allow Customization
- H. Identify fut. needs (by bidg)

#### Accuracy

- I. Cost and Effort to Implement
- J. Cost and Effort to Maintain

#### Cost

- K. Accommodate Obsolescence
- L. Long Term Cap Plans
- M. Recognize depl tn of Assets

#### Average

- Audits: 3.3
- Depreciation: 2.0
- % of CRV: 2.8
- Sub-system Model: 3.5

### Notes

- Average values calculated for each category to provide a comprehensive comparison of the four budgeting approaches.