
MINNESOTA OFFICE OF THE LEGISLATIVE AUDITOR

State Building Maintenance

SUMMARY

Preservation of buildings owned by the State of Minnesota has become a topic of increasing concern within both the legislative and executive branches of government. Over the years, the state has made a significant investment in structures of many kinds: office complexes, college classroom facilities, storage sheds, monumental buildings, correctional facilities, and many other types of buildings. Altogether, state agencies, the University of Minnesota, and Minnesota State Colleges and Universities (MnSCU) are responsible for over 4,800 buildings with about 73 million square feet and a replacement value that exceeds \$7 billion. Policy makers are concerned about whether this investment is adequately protected and whether the state's buildings are adequately maintained.

In 1994, the Department of Administration estimated that the state had a deferred maintenance backlog of roughly \$1.5 billion. This represents a significant amount of deferred maintenance and raises important questions about the adequacy of state building maintenance and the suitability of the state's maintenance policies and procedures.

The evaluation addressed the following questions:

- **What is the condition of the state's buildings?**
- **Does the state have a deferred maintenance backlog? If so, how large is it?**
- **Does the state protect its building investments with adequate maintenance practices, including preventive maintenance?**

To answer these questions, we examined the Department of Administration's Facility Audit Survey data on the condition of state buildings, reviewed deferred maintenance projects identified by state agencies and higher education institutions, toured various buildings, interviewed facility management personnel, and reviewed the literature on building maintenance. We also surveyed physical plant directors and facilities managers about their maintenance practices.

Legislators were also interested in knowing whether state policies and practices add to the cost or time to construct new state buildings. Although we did not examine this issue in depth due to resource constraints, we did survey private consultant designers and construction contractors and employees from state agencies and higher education institutions to determine their perspective on this issue.

BUILDING CONDITION

Under the Department of Administration's Facility Audit Survey, state departments, colleges, and universities evaluated each of their buildings in terms of 98 building elements within 6 broad building components: building exteriors, roofs, mechanical systems, electrical systems, interiors, and sites. Most buildings were rated in 1994 or 1995. The survey asked maintenance staff to rate the physical condition and performance of each element as good, fair, or poor. In addition, the survey asked about building suitability, which differs from physical condition in that it considers whether the element meets the needs of the building's occupants. For example, a ventilation system that is in good working order but does not have adequate capacity to meet modern ventilation standards may be rated in good physical condition but poor for suitability.

Our analysis of the Facility Audit Survey data indicates that:

- **State agencies and higher education institutions rated most of their building components in good physical condition, although ratings for building suitability were generally lower.**

One-fifth of state buildings had at least one major component rated as "poor."

The percentage of buildings receiving "good" physical condition ratings ranged from 78 percent for electrical systems to 65 percent for roofs. The percentage with "poor" ratings ranged from 2 percent for electrical systems to 10 percent for roofs. State agencies and higher education campuses rated 42 percent of their buildings as "good" for all five primary building components although one building in five had at least one building component rated as "poor."¹

Suitability ratings were generally lower than physical condition ratings. For example, while state entities rated mechanical systems in "poor" physical condition for only 5 percent of buildings, they were more likely to rate suitability as "poor" for each of the major mechanical systems: cooling systems (22 percent), ventilation systems (21 percent), heating systems (14 percent), and plumbing systems (10 percent).

DEFERRED MAINTENANCE ESTIMATES

In 1994, the Department of Administration asserted that the state had a large "capital iceberg" of deferred maintenance of unknown size.² Its rough estimate of \$1.5 billion was obtained by (1) using studies from other states to estimate that the deferred maintenance for state agencies and state colleges and universities was about \$10 per square foot, or \$600 million, and (2) using the University of Minnesota's own estimate that its deferred maintenance was about \$923 million. The University's estimate was based on a theoretical model that considered the life expectancy, age, and replacement cost of major building components. To

¹ This analysis excluded the site component because site ratings were missing for many buildings.

² In this report, we use the term deferred maintenance in the same way that the Department of Administration uses the term "capital iceberg," that is, maintenance, repair, replacement, and renewal projects that are due but have not been completed.

State agencies, colleges, and universities used a variety of approaches to estimate deferred maintenance.

provide more concrete evidence of deferred maintenance, many state entities have identified specific building deficiencies and estimated the cost to correct them.

It is important to recognize that state departments, colleges, and universities used a variety of approaches to estimate their deferred maintenance. The principal difference involves the degree to which agencies included building improvements designed to bring building components up to modern standards. Some agencies defined deferred maintenance narrowly by including only physical defects that occurred because of physical deterioration. In contrast, the University of Minnesota took a broad view by also including the cost of upgrading buildings to meet modern standards, including modern heating, ventilation, and air conditioning standards, energy standards, fire and life safety standards, and accessibility standards. For example, the University included the cost of adding modern central air conditioning systems to buildings which lacked air conditioning or had only window air conditioners or small rooftop systems.

- **Overall, we confirmed that there is a substantial amount of deferred maintenance attributable to physical deterioration of state buildings, though there is considerable uncertainty over the exact amount.**

Statewide, the amount of deferred maintenance is not known with precision for several reasons. First, because definitions of deferred maintenance varied greatly among state entities, we could not simply add the estimates together. Instead, we had to make assumptions for some state entities to make estimates reasonably comparable. In addition, state agencies and higher education campuses vary in how thoroughly they have inspected their buildings and how they estimated the cost to correct the deficiencies.

Together, state agencies and MnSCU have identified roughly \$230 million in deferred maintenance, most of which is attributable to physical deterioration. While the University of Minnesota's deferred maintenance estimate is much higher (\$923 million), most of it involves the cost of upgrading buildings to meet modern standards rather than correcting physical deterioration. For example, comprehensive assessments of ten buildings scheduled to be renovated under the University's six-year capital plan indicate that 41 percent of the estimated cost is attributable to upgrading heating, ventilation, and air conditioning to modern standards and 30 percent is for correcting fire, life safety, asbestos, and accessibility deficiencies.

The fact that the University of Minnesota's buildings have the same average age as state agency buildings suggests that they may have roughly the same amount of physical deterioration as state agencies (on a square-footage basis). Allowing for a possibly large amount of unidentified deferred maintenance,

Some state buildings have a substantial amount of physical deterioration.

- **We estimate that the statewide level of deferred maintenance attributable to physical deterioration is between \$300 million and \$600 million.**

State agencies identified about \$140 million in deferred maintenance projects, most of which involve physical deterioration. For example, the Department of Corrections reported about \$46 million in deferred maintenance, the largest

amount of any state agency. About half of this amount is to replace or repair deteriorating windows and walls, particularly at Stillwater State Prison. For example, part of the catwalk on Stillwater's security wall has collapsed and other sections are not safe.

Other examples of physical deterioration are the veterans homes in Hastings and Minneapolis, both of which have extensive deterioration in their basic infrastructure, including tunnels and the steam and water distribution systems. An engineering analysis of the tunnels of the Minneapolis Veterans Home concluded that these deficiencies need to be addressed as soon as possible or risk major system failure and resident evacuation.

Based on the broader view of deferred maintenance, the best available evidence comes from comprehensive building assessments conducted by architectural and engineering consultants for 20 University of Minnesota buildings. Results from these assessments are generally consistent with the University's estimate that it would cost about \$923 million to upgrade all state-supported University buildings to modern standards.

Applying the same method to state agencies and MnSCU would certainly increase the deferred maintenance estimates, but it is difficult to estimate how much. For example, the cost of meeting modern standards is probably less for MnSCU because it has newer facilities and most of MnSCU's buildings already have modern heating, ventilation, and air conditioning systems in place. However, even if we assume that the cost of meeting modern standards for state agencies and MnSCU is only half as much as the University (on a square-footage basis), the statewide amount of deferred maintenance under the broad definition would be roughly \$2 billion.

MAINTENANCE PRACTICES

Preventive maintenance is important to avoid premature breakdowns.

The large amount of deferred maintenance for state facilities raises questions about the maintenance practices used by state agencies, colleges, and universities. We focused on the state's preventive maintenance practices. Preventive maintenance is widely recognized as being important to prevent premature breakdowns and to ensure that building systems operate efficiently.³ Preventive maintenance activities include regular inspections of mechanical systems, electrical systems, roofs, and building exteriors so that problems can be corrected before they cause a more serious problem such as a mechanical breakdown, a major roof leak, or structural damage.

Our survey of physical plant directors at state agency sites and college campuses revealed that:

- **Almost all physical plant directors said that they should be doing more preventive maintenance than they currently perform.**

³ Preventive maintenance includes planned actions taken to keep building components functioning as they were designed to perform. It occurs before a building component fails. In contrast, corrective maintenance occurs after a component fails.

Preventive maintenance practices vary widely among state entities.

In fact, 96 percent of survey respondents said they should be doing more, including over 40 percent who said they should be doing much more. Physical plant directors cited a variety of preventive maintenance tasks that they do not do enough of, including painting, checking electrical connections, wires, and motors, cleaning and monitoring mechanical equipment, and checking plumbing for leaks.

Key components of an effective preventive maintenance program include development of a formal program with written schedules, regular adherence to the schedules, and documentation of work actually performed.⁴ Our survey indicates that preventive maintenance programs at state facilities vary widely. Some have neither written nor unwritten schedules for any building component, while others have computerized programs that (1) contain customized schedules for each building component and each piece of equipment, (2) generate daily work orders for each maintenance employee, and (3) record all preventive and corrective work performed.

Overall, 73 percent of state agencies, colleges, and universities (weighted by square footage) said they had written preventive maintenance schedules for mechanical systems and 65 percent said they had written schedules for electrical systems. Only one-fourth to one-third of state entities said they had written schedules for roofs, building exteriors, and interiors. While an additional 12 to 22 percent had unwritten schedules for these components, about half had no schedule for roofs, exteriors, and interiors.

Schedules for mechanical systems are particularly important because heating, ventilation, and air conditioning systems are complex and require frequent checks and adjustments. But schedules for other components are also important. For example, regular roof inspections are important so that minor problems can be corrected before they shorten the life of the roof.

Problem areas include lack of schedules and documentation.

Most state entities that have schedules said that they follow them most of the time. The percentage of respondents with written schedules who said they regularly or frequently follow them ranged from 93 percent for mechanical systems to 71 percent for interiors.

While most state agencies and higher education institutions said that they document most of their preventive maintenance work, a substantial number do not regularly document their work. The percentage who do not regularly document preventive maintenance work ranged from 30 percent for mechanical systems to 46 percent for interiors.

Nearly all respondents reported inspecting belts, changing ventilation filters, and lubricating bearings at intervals that met minimum standards. However, performance of preventive maintenance for roofs and steam systems was mixed. For example, 27 percent of respondents said that they did not regularly inspect

4 David G. Cotts and Michael Lee, *The Facility Management Handbook* (New York: American Management Association, 1992), 203, 214-215.

their roofs, and only 8 percent met our consultants' recommended standard that roofs should be inspected by a qualified roof inspector at least twice a year.⁵ Moreover, most facilities with steam systems did not meet the standard that steam traps should be checked at least twice a year.

One way to manage the maintenance scheduling process is through the use of computerized maintenance programs. These software programs can generate prescheduled work orders and track completed preventive and corrective maintenance work. As of 1997, about 40 percent of state agencies, 34 percent of state colleges and universities, and the University of Minnesota's Twin Cities campus used computerized maintenance systems. We found:

- **Computerized maintenance systems are highly rated by those that use them, though there are start-up and ongoing costs.**

Almost all users rated computerized systems "very useful" or "moderately useful." In addition, agencies that used computerized maintenance systems were more likely than non-users to say that they increased the amount of preventive maintenance they performed compared with five years ago. Also, users of computerized programs were more likely to say that it is easier to complete corrective maintenance tasks now than five years ago and less likely to report large maintenance backlogs.

While these systems help state entities organize and schedule work, they are expensive to set up and require on-going clerical support to record and track work orders.

Many state entities need to strengthen their preventive maintenance programs.

In summary, preventive maintenance practices vary greatly among state agencies, colleges, and universities. We think that it is important that maintenance practices, particularly preventive maintenance, be improved. Many physical plant directors recognize that they need to strengthen their preventive maintenance practices, but said they do not have enough resources (staff and dollars) to establish an effective preventive maintenance program. We think that even if funding is inadequate, agencies should do a better job of preventive maintenance. In fact, some preventive maintenance practices pay for themselves very quickly. For example, one area that many agencies neglect is preventive maintenance of steam traps. Steam traps are designed to increase the efficiency of steam heating systems by letting condensate return to the boiler while trapping steam where it can most efficiently provide heat. Failing to repair or replace faulty steam traps generally will not be noticed by building occupants, but may reduce the efficiency of the heating system. The chief engineer at St. Peter Regional Treatment Center estimated that replacing a typical steam trap that was leaking steam would annually save three times the replacement cost of the steam trap.

⁵ We contracted with Cain Ouse Associates Inc. and Pope Associates Inc. to provide us with advice on engineering and architectural issues, and assistance in constructing several questionnaires.

POLICY CONSIDERATIONS

It is difficult to measure how much of the current backlog of deferred maintenance is due to poor or inefficient maintenance practices and how much to inadequate spending. Based on our survey of maintenance practices and our site visits, we think that inadequate maintenance practices are part of the deferred maintenance problem.

Maintenance programs could benefit from increased support by the Department of Administration and MnSCU.

We think that maintenance programs could benefit from greater oversight by central agencies and the Legislature. The state has a long term interest in preserving its building assets and should ensure that proper maintenance practices are used. The Department of Administration and MnSCU could provide additional technical assistance to state agencies, colleges, and universities and report back in future years on the status of maintenance practices. The Department of Administration has worked with several state agencies and community colleges to improve their maintenance practices. For example, it organized the Statewide Facilities Management Group, which includes facility management professionals from state agencies and MnSCU. Its objectives include developing facility management information systems, establishing common benchmarks and best practices, and sharing facility management information. We think that these are important objectives for the Department of Administration and other state entities to support. In addition, MnSCU could help set up a similar group for its colleges and universities.

We do not think that it would be wise for the Legislature to mandate specific preventive maintenance programs because the types of buildings and their requirements vary so much from facility to facility and specific practices and schedules are matters of professional judgment. Nor do we recommend creating additional bureaucracy to oversee state agencies and higher education institutions. But more legislative oversight hearings focused on maintenance practices would be appropriate and could prompt more executive branch action.

More legislative oversight could also help.

The Department of Administration could also, when appropriate, help state agencies set up computerized systems, building on the experience of existing users. MnSCU could perform a similar service for state colleges and universities. The Legislature may wish to help fund the start-up costs of these computerized systems, with the understanding that the ongoing operational costs would be the entities' responsibility. Costs for these systems vary. The Department of Human Services spent about \$5,500 per site several years ago for software for each regional treatment center; additional start-up costs included clerical staff time to input detailed specifications for preventive maintenance programs and additional computers. Ongoing support for the system requires clerical staff support, an annual license fee (\$550 to \$840 per site), and occasional computer upgrades.

We did not examine the efficiency of maintenance operations across the state, but we found that comparative information on maintenance staffing and spending is not readily available either in Minnesota or other states. Such information could provide useful benchmarks that might raise issues of efficiency (if staffing or spending is unusually high) or adequacy (if staffing or spending is unusually low).

The size and prevalence of deferred maintenance among Minnesota's state agencies and higher education institutions suggest that maintenance spending levels may also be a reason that Minnesota has a large amount of deferred maintenance. We found that:

- **State entities in Minnesota generally spent less on maintenance and repair than the middle of the range recommended by the Building Research Board of the National Research Council.**

These national standards are the judgments of a committee established by the Building Research Board, including public sector facility managers, professors of architecture, and engineers from the private sector, but are not based on systematic studies. As a result, these standards should be viewed as general benchmarks. In addition, maintenance operating spending levels by our sample of six state colleges and universities, the Department of Natural Resources, and the Department of Administration were below that of private sector office buildings. While these comparisons suggest that Minnesota's maintenance spending is low, they are not definitive.

In any case, recent executive and legislative initiatives have increased maintenance funding. Recently, the state has placed greater emphasis on asset preservation in the capital budget process by increasing funding of the Capital Asset Preservation and Replacement Account (CAPRA) and for Higher Education Asset Preservation and Renewal (HEAPR). Under CAPRA, the Department of Administration allocates funds for specific projects based on need. This helps ensure that funds are used on maintenance projects that have been externally reviewed. One concern with using this approach indefinitely is that it rewards agencies that let their buildings deteriorate by neglecting proper maintenance.

Overall, it makes sense to address the existing deferred maintenance problem with the capital budget process because of the magnitude of the problem. The capital budget process allows the Legislature to set priorities among large deferred maintenance projects and delegate decisions for smaller projects to the Department of Administration (under CAPRA) and MnSCU and the University of Minnesota (under HEAPR).

As a long term goal, however, we agree with the Capital Budget Reform Steering Committee's 1992 recommendation that capital financing should be reserved for "new construction, substantial adaptive remodeling, expansion, or improvements that are long term and not predictable or recurring."⁶ The operating budget is the appropriate place to fund routine and preventive maintenance and recurring repair and replacement projects such as roof and boiler replacements and masonry repair. These projects occur too frequently to be effectively managed by the Legislature and can be accomplished more efficiently if conducted as part of a well planned maintenance program.

The 1997 Legislature increased maintenance operating funding for several state agencies and MnSCU. The advantage of this approach is that it allows agencies to plan their maintenance program and use the funds for preventive maintenance

The operating budget should fund routine maintenance and recurring repair and replacement projects.

⁶ Capital Budget Reform Steering Committee, *Capital Budget Reform* (St. Paul, January 1992), 16.

instead of waiting for building components to fail. A potential disadvantage is that agencies are currently not required to spend a fixed amount of their appropriation on maintenance.

To help ensure that state entities spend as much on maintenance as intended by the Legislature, the Legislature could mandate that a certain level of funding be set aside for maintenance. The arguments in favor of spending set-asides are that (1) they would ensure that maintenance spending is addressed on a continuous basis, rather than waiting until problems mount, (2) there is no natural constituency for building maintenance as there is for state programs, and (3) the state is ultimately responsible for maintaining buildings and may have to make up for past maintenance omissions. An argument against spending set-asides is that state entities are in the best position to decide how to allocate funds between maintenance and programs.

Alternatively, the Legislature could require state entities simply to report their maintenance spending levels. This would be less intrusive than set-asides, though it would require active legislative oversight to be effective. A reasonable approach might be to require maintenance spending reports and follow up with set-asides if entities do not devote sufficient resources to maintenance.

To improve how maintenance funds are allocated to state entities, the Legislature may want to adopt a formula for funding building maintenance within the operating budget. A funding formula should reflect the variation in maintenance requirements among buildings due to factors such as square footage (or replacement cost), type of buildings, intensity of use, age of buildings, and whether the buildings have been renovated. The Legislature could direct the Department of Finance, in consultation with the Department of Administration, the University of Minnesota, and MnSCU, to recommend a specific formula for consideration during the 1999 legislative session.

The Facility Audit Survey was designed to help legislators broadly assess the condition of the state's buildings and to help set priorities for asset preservation funding. However, as it is currently structured and maintained, the survey is inadequate for this purpose. Interviews we conducted and results from our own building maintenance survey show that different agencies use different approaches to rate their buildings. Other than written instructions, the Department of Administration does not provide agency personnel with any formal training to ensure that ratings will be consistent across agencies. Also, it does not check the ratings to ensure the consistency of the data. The Department of Administration recognizes that the current system does not ensure consistent ratings but cites resource constraints as the reason it cannot check the ratings made by state agencies and higher education institutions.

In addition, the system is incomplete, containing ratings for only about 75 percent of the state's total square footage.⁷ The database contains very limited information about the age of building components and the estimated cost of needed building repairs. The Facility Audit data are also several years old. Given

The Legislature may want to adopt a formula to fund maintenance within the operating budget.

⁷ As of September 1997, the database was missing about half of the academic buildings (weighted by square footage) of the Minnesota State College and University system and about 80 percent of the buildings maintained by the Veterans Homes Board.

these problems, the Legislature cannot rely on the ratings alone to measure funding requirements of state agencies.

The Facility Audit Survey is a very detailed system, requiring staff to rate each of 98 elements in every building as poor, fair, or good. We think that keeping the level of detail found in the Facility Audit Survey is not necessary for policy purposes. It is more important to ensure that the data are reliable, current, and complete. In any case, we think that the Legislature should consider how it wants to use building condition data before deciding what type of data system should be maintained. Specifically,

- **If the Legislature intends to use building condition data to make funding decisions, we recommend that the Department of Administration should develop a less detailed but more uniform system for assessing the condition of the state's buildings.**

BUILDING CONSTRUCTION

State agencies, Minnesota state colleges and universities, and the University of Minnesota spend millions of state bonding dollars each year constructing new buildings. Legislators have expressed concerns about the cost and time required to construct state buildings, how state building costs compare to private sector costs, and what factors, if any, inflate state building costs.

We asked private consultant designers and construction contractors to compare the cost of constructing state buildings with that of similar private buildings. Over two-thirds reported that the costs for state buildings were higher. Contractors said that the number of meetings and reports, time to make decisions, and use of targeted vendors were factors that made the cost of state buildings “much higher” than comparable private buildings. State employees and private contractors also rated state decision-making delays and targeted vendor participation and selection as factors that might cause project budgets and timelines to increase from original projections.

State employees and private contractors identified predesign, prequalification of contractors and architects, and use of qualified project managers as factors that might help hold down project costs.⁸ Respondents volunteered both positive and negative comments about agencies and processes. The most positive comments identified use of a predesign phase to define the purpose, scope, cost, and schedule of the project. About 10 percent of all respondents volunteered comments critical of MnSCU's administrative procedures.

⁸ Predesign is a separate stage that specifies the purpose, scope, cost, and schedule of the complete project before the authorization of funds for construction. Prequalification of contractors is the advance determination that contractors and architects have the ability, including experience and other resources, to bid on a specific project. A qualified project manager is an independent manager or firm hired to guide a large project from development through completion.