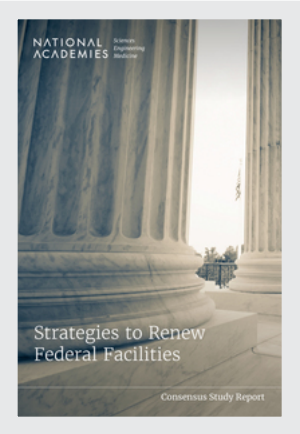

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Committee on a Strategy to Renew Federal Facilities

Board on Infrastructure and the Constructed Environment

Division on Engineering and Physical Sciences

Consensus Study Report

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This Consensus Study Report was reviewed in draft form by individuals chosen for their diverse perspectives and technical expertise. The purpose of this independent review is to provide candid and critical comments that will assist the National Academies of Sciences, Engineering, and Medicine in making each published report as sound as possible and to ensure that it meets the institutional standards for quality, objectivity, evidence, and responsiveness to the study charge. The review comments and draft manuscript remain confidential to protect the integrity of the deliberative process.

We thank the following individuals for their review of this report:

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Although the reviewers listed above provided many constructive comments and suggestions, they were not asked to endorse the conclusions or

recommendations of this report nor did they see the final draft before its release. The review of this report was overseen by Peter Marshall, Independent Consultant, and Chris D. Poland (NAE), Chris D. Poland Consulting Engineer. They were responsible for making certain that an independent examination of this report was carried out in accordance with the standards of the National Academies and that all review comments were carefully considered. Responsibility for the final content rests entirely with the authoring committee and the National Academies.

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Contents

Summary

The Committee on a Strategy to Renew Federal Facilities started its work by reviewing a substantial body of knowledge from the National Academies of Sciences, Engineering, and Medicine; federal oversight agencies; and industry associations that address the need to secure funding for the maintenance, repair, and renewal of aging federal buildings. The key issue is renewal: during meetings with senior agency officials, congressional staffers, and external experts from the public and private sectors, the committee realized that federal real property facility and financial managers believe they know *what* to do but are challenged on *how* to establish compelling strategies for facility renewal. To be successful, such strategies must inform senior officials and policy makers on how to make investments in federal facilities that improve an agency's overall mission performance. The committee recognized this is a chronic problem that has challenged federal facility managers since the Property and Administrative Services Act of 1949 became law.

This committee addresses this chronic problem in a new way, with strategies on how to make investments that continually renew federal facilities in response to evolving and dynamic mission needs. The report's five recommendations detail actions to fix age-old federal facility renewal challenges, built on the recognition that this is a facility asset management problem that requires a facility asset management solution. The recommendations introduce new facility asset management capabilities to develop strategies to ensure and assure that agencies will achieve their objectives and priorities efficiently and effectively.

STATEMENT OF TASK

The Federal Facilities Council (FFC)[1] formed this committee to identify broad-based, practical, and compelling strategies for securing continuing investment in the renewal of federal real properties and portfolios. Following its statement of task, the committee focused its work on the *how*—not the *what*—for adapting, repurposing, restoring, recapitalizing, and replacing real property assets. The committee considered multiple stakeholder perspectives, critical requirements, and expectations for providing long-term, cost-effective stewardship of the federal real property portfolio.

DEFINING RENEWAL

The committee's first task was to define renewal for the federal real property portfolio, distilling how ongoing, annual maintenance, repair, and operations costs relate systematically to long-term capital investment. Following advice from the FFC, the committee defines *renewal of a single asset* as "the extension of functionality beyond its expected service life." In this context, asset renewal includes renovation, replacement, and repurposing. This report extends this concept to "continual renewal" of an agency's real property portfolio that can be calculated as the sum of sustainment and renewal requirements for each asset in the real property portfolio over long investment horizons.

When implemented, continual renewal of a real property portfolio, which is referred to as "renewal" in this report, has to respond to changes in agency missions, operational requirements, and stakeholder preferences. In practice, given operating constraints, federal agencies typically focus on sustainment funding and sum of underfunded sustainment, which is also referred to as the "real property deferred maintenance backlog." The problem with this perspective is that it is a lagging performance indicator that does not fully account for an agency's real property renewal requirements. As a result, few agencies have systematically renewed their real property portfolios over time, which has resulted in poor facility performance, and, in turn, suboptimal mission achievement.

This ongoing problem led to the committee's view that a federal facility renewal strategy needs to be a policy, not simply a vision, that embraces a plan of action for an agency's real property portfolio, with actionable procedures and processes for achieving its mission objectives and obligations. The committee identifies constraints that are embedded in executive branch policies and statutes or that result from a lack of information. The purpose of federal facility renewal strategies is to ensure and assure that federal facilities are being used to achieve the agency's mission efficiently and effectively. The committee notes that

[1] The FFC is a cooperative association of more than two dozen federal agencies that operates under the Board on Infrastructure and the Constructed Environment in the Division on Engineering and Physical Sciences of the National Academies of Sciences, Engineering, and Medicine.

effective facility portfolio management should systematically integrate expenses for annual maintenance and repair with the capital investments periodically needed to renew federal facilities over the lifetime of the agency.

The committee's 25 findings and five recommendations are directed to the White House and federal agencies to implement a strategy for the renewal of federal facilities.

ESTABLISHING A FOUNDATION

The committee first turned to the international asset management standards, particularly the International Organization for Standardization's (ISO's) 55000 series, which it believes will improve federal agencies' facility asset management capabilities and, if used as a template, could help to enable efficient and effective federal facility renewal strategies.

The committee then turned to well-established concepts and common-sense principles that underpin strategic management system thinking: the federal government has an asset management problem that needs an asset management solution. This key concept is imperative to the committee's findings. Several key principles of asset management are precepts of the ISO 55000 series standards:

- *Facility portfolio management:* Federal facility renewal strategies must support an agency's whole facility portfolio covering whole life cycles and stakeholder requirements across whole agency mission sets.
- *Mission alignment:* Mission alignment of resource prioritization requires the use of verifiable, repeatable metrics to link the relative importance of individual facility assets to stakeholder needs and performance expectations.
- *Facility performance:* Knowledge of each facility asset's condition, functionality, availability, and utilization is required to understand a facility portfolio's true capabilities and performance.
- *Operational readiness:* Investment decisions must demonstrate the cause and effect between what stakeholders value in terms of operational readiness and facility asset performance measures across a range of investment horizons and resourcing strategies.

FACTORS IN DEVELOPING STRATEGIES FOR FEDERAL FACILITIES RENEWAL

The committee notes that facility renewal costs are complex and have been viewed as a set of largely unrelated restoration and modernization requirements while often ignoring regular maintenance interdependencies. The committee examined two approaches to estimating current and future renewal costs: the

Builder Sustainment Management System (Builder)[2] from the U.S. Army Corps of Engineers and the economic depreciation[3] model used by the Bureau of Economic Analysis (BEA) of the Department of Commerce. The Builder system is a condition assessment tool used across the lifetime of an asset; economic depreciation models are best used to assess the expected condition of a new asset as it ages.

The committee found the Builder system to be unsuitable for estimating renewal costs because of its limited scope and issues with its inspection and forecasting methods necessary to report anticipated annual maintenance and repair needs. However, the inventory data collected for use by Builder is valuable as an independent asset and would be useful if available for research purposes and for use by other models.

In contrast, the committee found the economic depreciation model to be consistent with the scope of renewal costs, and it benefits from a long history of academic research and application to policy. The committee encourages federal agencies to experiment with the depreciation model, modifying it to suit their particular facility portfolio.

The committee notes that the estimates of renewal costs using the depreciation model depend on building-specific measures of depreciation and service-life assumptions from BEA. These are aging data that are for the most part at least 20 years old. Revisions incorporating recent research and new sources would improve renewal cost estimates and also serve other types of economic analysis.

Because the cost of facilities renewal must be balanced with the benefits and risks to the agency mission based in its value, the concept of value and its role implementing federal facility renewal strategies is critical. Value generation, retention, and benefits always entail some levels of risk. From an enterprise risk management perspective, a strategic view of risk management seeks to add value and to focus executive management on execution risks in the following ways:

- Recognizing strategic risks as primarily compensated by their potential benefits to be retained and managed while avoiding or eliminating uncompensated risks,
- Integrating risk management within the agency's strategy for its robustness and effectiveness, and
- Establishing an early warning system linked to critical assumptions underlying the strategy.

[2] The Builder system is a web-based software application developed by the Engineering Research and Development Center's Construction Engineering Research Laboratory. It provides civil engineers, technicians, and managers information needed to decide when, where, and how to best maintain building infrastructure.

[3] Economic depreciation refers to how an asset (e.g., structures) declines in efficiency over time. It is contrasted with tax depreciation, which is whatever the tax authorities allow you to use when filing income taxes.

Value generation requires a multidimensional analysis that reflects input from appropriate stakeholders, considering agency values and mission needs. Furthermore, such analysis needs to attempt to measure the marginal increase in functionality achieving the agency's mission.

A federal facility renewal strategy must reconcile operating budgets with capital budgets. *Expenses* are costs with immediate effects and relatively short-term benefits. *Investments* are costs that provide long-term benefits or returns that often are greater than the investment. To distinguish expenses from investments, businesses and government agencies have both operating and capital budgets. But the federal budget process is a cash-based budget and does not differentiate operating expenses from capital or investment costs. The operating budget includes expenses of operating a business or program in the near term, and it matches expenses with expected revenues to ensure the business or program can pay its bills and generate the expected desired outcomes on time. The capital budget has a longer-term focus; it calculates the plant and equipment investments necessary to replace the current inventory of assets when they reach the end of their useable lives and grow (or reduce) the inventory of assets needed to support or grow the business. Businesses and governments often finance investments by borrowing. In a capital budget, projects compete for investments based on the long-term benefits they produce. Once a capital investment is approved, the operating budget typically funds the annual cost to repay the principal and debt service and to provide for the facilities' maintenance and repair. New strategies are needed to resolve this key issue that federal agency budgets have been facing since the Budget Control Act of 2011.

There is a compelling need for a persuasive message and effective communications with stakeholders, within and external to each agency, to renew real property assets for mission capability and service delivery. This need can be met by highlighting strategic communication principles for facility managers who wish to implement their asset management strategy and seek capital or other resources to renew real property assets for mission capability and service delivery. An agency's real property capital plan, which guides its facilities renewal strategy, can be a powerful communications tool in assuring stakeholders that asset management is proceeding in an efficient and effective manner. The committee argues that agencies should consolidate individual facility needs into a portfolio of like facilities and then consolidate these portfolio needs into a real property capital plan.

Such communication must occur throughout all agency policies and processes and reflect the following features:

- Engaging appropriate federal and, potentially, private-sector stakeholders;
- Targeting appropriate communication channels; and
- Being clear, complete, comprehensive, appropriately nuanced, fact-based, and rich with quality data.

RECOMMENDATIONS

Federal facility managers and budget officers need to articulate a compelling message to identify and fund facility renewal needs. Senior real property officials also need to instill a portfolio approach, including a rigorous adoption of an asset management system based on ISO 55000 principles and requirements to enable agencies to identify, prioritize, and ultimately incorporate their most urgent facility needs and funding requirements into the President's budget submission to Congress. Ensuring close collaboration between facility and budget management requires agencies to implement facility capital planning through their strategic planning processes, with senior leaders, to reconcile agency performance goals with available budgets and capabilities.

The committee suggests that agency strategies for renewing federal facilities incorporate four elements:

- Use an *asset management systems approach* to real property portfolio management that ensures and assures alignment with mission objectives and priorities; integrates annual operating costs with planned, periodic investment in (capital) construction and rehabilitation; and mandates its use in statutory, policy, and agency directives.
- Employ *capital planning and risk management tools* that meet science-based, professional standards for accuracy, rigor, transparency, and credibility, as well as *risk management methods* with common standards of integrity.
- Ensure *budgeting structures* with sufficient resources for implementing facility renewal strategies, including user charges for the full cost of operating, maintaining, renewing, and disposing of facilities; aggregating funds in revolving or working capital funds to prioritize investments across the portfolio and avoid funding "spikes"; establishing capital acquisition financing funds, such as a Federal Capital Revolving Fund, discussed in Chapter 6, to provide agencies with a source of capital they can repay over time; and privatizing or using public–private partnerships to devolve those public facilities and related services that are not inherently federal government responsibilities.
- Follow a *strategic communication strategy* that ensures and assures that stakeholders and decision makers understand the short- and long-term costs, benefits, and risks of federal facility renewal strategies and their relationships to achieving agency mission objectives.

To better enable a strategic approach for facility renewal, the committee offers the following five recommendations for an effective strategy. These recommendations are underpinned by 25 findings listed in the chapters. (Appendix H lists all of the findings and recommendations.)

RECOMMENDATION 1: Implement a Federal Facility Asset Management System

The Office of Management and Budget (OMB), in concert with the Federal Real Property Council, should update OMB Circulars A-11 and A-123 to improve guidance for implementing facility asset management systems by

- **Requiring federal agencies to use a comprehensive and principle-based facility asset management system, as defined by International Organization for Standardization 55000—Asset Management System standards, to implement federal facility renewal strategies;**
- **Clarifying how enterprise risk management and internal controls support implementation of federal facility renewal strategies by improving and clarifying policies contained in OMB Circulars A-11 and A-123;**
- **Clarifying agency senior real property officer's fiduciary responsibilities to ensure and assure that the agency is maintaining its facility portfolio efficiently and effectively, and that achievement of this responsibility is reported as part of the agency's OMB Circular A-136—Financial Reporting Requirements;**
- **Detailing how whole asset life-cycle costs, whole asset portfolios, and whole benefit analysis support resource-and-investment decision making; and**
- **Updating OMB Circular A-11, Section 83 (Object Classification) to remove fragmentation and many-to-many relationships that make it exceedingly difficult to generate and audit integrated real property performance–budget and management balance sheets.**

(See Findings 2-1, 2-2, 2-3, 2-4, 3-1, 3-3, 3-4, 3-5, 3-6, 3-7, 5-1, 5-2, and 6-1.)

RECOMMENDATION 2: Implement a Real Property Capital Plan

The Office of Management and Budget (OMB) should clarify its requirements for agencies' annual real property capital plans as detailed in OMB Circular A-11's Supplement—Capital Programming Guide and OMB Memorandum M-20-03, "Implementation of Agency-wide Real Property Capital Planning." Specific requirements needing clarification include

- **Ensuring the requirement for agencies to develop and publish a single, fully integrated real property capital plan as a component of the agency capital plan, as defined in the Capital Programming Guide;**

- **Verifying the relationship of real property capital plans in informing annual budget and investment decision making, including the successful inclusion of urgent and compelling facility renewal needs; and**
- **Publishing the role of the agency's real property capital plan by documenting and communicating the agency's strategy for reconciling agency objectives, budgets, and real property programs.**

Furthermore, agency senior real property officials should implement guidance in OMB M-20-03 for advancing the central role of their agency's real property capital plan, establishing a strategy for integrating and reconciling requirements, objectives, budget, and real property program execution.

(See Findings 2-4, 3-1, 3-2, 3-3, 3-4, 3-5, 3-6, 3-7, 6-1, 6-2, 6-3, and 6-8.)

RECOMMENDATION 3: Update the National Strategy for the Efficient Use of Real Property

The Office of Management and Budget (OMB) should clarify how the National Strategy for Efficient Use of Real Property and OMB Memorandum M-20-10 (Issuance of an Addendum to the National Strategy for the Efficient Use of Real Property) are used to guide their agency's asset management system implemented through real property capital plans. Specific requirements include the following:

- **Defining how agencies are to use the National Strategy to establish priorities and objectives for the efficient use of real property, to include addressing the Government Accountability Office's real property high-risk issues; and**
- **Establishing requirements that link performance reporting of budget execution for the real property capital plan to National Strategy objectives, as reviewed annually by the agency in the context of agency strategic plan reporting, such as through application of the Operational Readiness Principle.**

Furthermore, chief management officers and chief budget officers should ensure they coordinate their agency's response to OMB M-20-10 (Issuance of an Addendum to the National Strategy for the Efficient Use of Real Property) with their agency's response to OMB Memorandum M-20-03 (Implementation of Agency-wide Real Property Capital Planning).

(See Findings 2-2, 2-3, 2-4, 3-2, 3-3, 3-5, 3-6, 3-7, 4-4, 4-5, 5-1, 5-2, 6-5, 6-7, and 6-8.)

RECOMMENDATION 4: Improve Federal Facility Models, Data, and Measures

The Office of Management and Budget (OMB) should clarify guidance requiring agency senior real property officials to improve cost estimates of renewal requirements. Currently, there is no broadly accepted approach to estimating renewal costs, which diminishes the credibility of renewal decision making. After considering two of the methods available, the committee recommends the following:

- **Senior real property officials should adopt an economic depreciation approach for estimating renewal costs, tailorable to each agency's facility portfolio. As a starting point, the model could be simplified to a set of cost factors by facility type, analogous to the Department of Defense Facility Sustainment Model.**
- **Agencies should include existing dated depreciation rates and service lives in the economic depreciation approach review by using a schedule established for the revision of depreciation rate and service life data used in depreciation models, which is currently provided by the Department of Commerce's Bureau of Economic Analysis.**

Furthermore, the General Services Administration (GSA), in coordination with the Federal Real Property Council and under the direction of OMB, should create an independent database of component inventories for federal facilities, beginning with the extensive data collected for the Builder system, and make it available to qualified users and accessible by popular capital planning and facility management systems. The senior real property officials of all agencies would submit information to GSA for compiling, as directed by executive requirement.

(See Findings 3-5, 4-1, 4-2, 4-3, 4-4, 4-5, and 6-3.)

RECOMMENDATION 5: Implement Federal Facility Renewal Budgeting Strategies

Through implementation of facility asset management systems detailed in preceding recommendations, the Office of Management and Budget can ensure optimal use of federal facilities by having federal agencies guide budget development of federal facility renewal strategies by

- **Creating working capital funds or revolving funds to aggregate funding for capital investment into consolidated, agency-wide budget accounts, which could help smooth multiyear life-cycle spending and avoid large, disruptive year-to-year funding spikes;**

- **Installing user-pays models for all federal facilities that fund working capital required to sustainably operate, maintain, repair, and renew federal facilities;**
- **Allowing the General Services Administration to spend all the revenue collected in the Federal Buildings Fund for repairing, renewing, or replacing facilities managed by the Public Buildings Service;**
- **Encouraging agencies to identify noninherently governmental facilities and related services that are mirrored by a broad-based, active private market to be candidates for privatization, outsourcing, or public–private partnerships;**
- **Using the expedited disposal authorities created by the Federal Asset Sales and Transfer Act (FASTA), or seeking additional disposal authorities for properties not covered by FASTA, to dispose of unneeded and underutilized properties; and**
- **Using operating leases as an alternative to ownership when budget scoring rules show that the cost of owning is unlikely in the near-term budget outlook.**

(See Findings 3-1, 3-2, 3-4, 3-5, 3-6, 3-7, 4-4, 5-1, 6-1, 6-2, 6-3, 6-4, 6-5, 6-6, 6-7, and 6-8.)

The committee offers these recommendations as a starting point for a bold, new approach to managing facility assets. They introduce perspectives that will lead to transformational change, starting with how value is determined in a federal facility renewal strategy. This includes changing the basis of value from managing asset life-cycle activities supporting an agency's mission to managing mission value generated by facility assets. This approach fundamentally changes how supporting resource-and-investment decision making is viewed and will require changes to policy and practice. The greatest return on investment will come from initiatives that support implementation of disciplined facility asset management capabilities.

1

The Purpose of and Need for This Report

> Maybe we can show government how to operate better as a result of better architecture.
>
> —*Frank Lloyd Wright*

INTRODUCTION

The vast national federal facilities portfolio of land holdings, buildings, and structures speaks to belief that architecture influences an organization's productivity in achieving its mission. This wisdom can be applied to investment strategies for this architecture, or more broadly, to renewal strategies for federal facilities.

This report introduces a bold, new perspective on how federal agencies can use facility asset management to support mission achievement more efficiently and effectively. This perspective is implemented through clarification of an agency's fiduciary responsibility to manage its facility portfolio. This report presents a *how* for responding to this responsibility through disciplined asset management.

Asset management, as defined through the International Organization for Standardization (ISO) 55000 series, includes how risk, money, and performance are related in resource-and-investment decision making. ISO 55000 standards fully support federal facility operating requirements and provide a universal, systematic approach to improving performance while lowering cost and risk. When applied to federal facility management, the ISO 55000 standards would simplify how facilities are managed to maximize productivity in achieving agency mission objectives.

ORIGIN AND STATEMENT OF TASK

This report results from a request of the Federal Facilities Council (FFC) for further study of federal facilities, in order to build on a series of authoritative reports dating back to 1990 from the National Academies of Sciences, Engineering, and Medicine. The FFC is a cooperative association of more than 20 federal agencies with responsibility for the design, construction, operation, maintenance, and evaluation of federal facilities. Established in 1952, the FFC is an ongoing program activity of the Board on Infrastructure and the Constructed Environment in the Division on Engineering and Physical Sciences of the National Academies. Of interest to the FFC is how facility managers can secure the capital funds necessary to fulfill major facility renewal projects.

The FFC requested that this committee be formed to identify broad-based, practical, and compelling strategies for securing continuing investment in the renewal of federal real properties and portfolios. The following statement of task was provided to the committee:

> An ad hoc committee of experts will develop an implementation strategy for applying the business case for maintenance, renewal, and repurposing of federal facilities, not in support of a particular investment, but supporting a case for stewarding a portfolio. However, rather than identifying "what to do," this effort will focus on "how to do it" within the context of existing legislation and executive guidance.
>
> As part of its task, the committee may address the following questions:
>
> - What are the benefits of federal infrastructural renewal and repurposing? What are the key performance indicators (KPIs) for the benefits?
> - What are all the costs and what should be used to determine accurate full life cycle costs?
> - How can savings in life cycle costs justify near term investment in renewal?
> - What are the interdependencies of the various factors and how do they influence each other?
> - What are alternatives to renewal of federally owned infrastructure? What is the risk and cost of a no investment option?
> - What are the risks of having connected infrastructure of varying ages or stages of life cycle?
> - How should risks that deteriorating facilities, deteriorating building systems (e.g., mechanical, electrical), or components (e.g., roofs, foundations) pose to the achievement of a federal agency's mission or to other organizational outcomes (e.g., physical security, operating costs, worker recruitment and retention, healthcare costs) be measured and managed?
> - How can the practices for delivering and sustaining facilities that meet mission requirements be implemented in the most cost effective, energy efficient, safe, adaptable, and sustainable way?

The study will also recommend feedback strategies and practices for measuring the actual (as opposed to predicted) outcomes of maintenance and repair investments to aid in continuous improvement of investment strategies. The study will include in the business case options and strategies to present the renewal of facilities in the federal portfolio.

COMMITTEE'S APPROACH

This report does not focus on classical facility planning and management activities, which most agencies perform well. Instead, it presents a simple and complementary new asset management approach for a chronic asset management problem. This asset management approach is different from the classical facility management solution that seeks more money to fix an ever-increasing list of facility problems, sometimes referred to as a "deferred maintenance backlog." Instead, the report defines a new strategy on how to renew federal facilities that is dependent on a disciplined asset management system.

This approach will require a new approach the report calls "management system thinking," which views *inputs* as objectives, strategies, plans, standards, processes, and resources; views *outputs* as efficient and effective assets; and views *outcomes* as the agency benefits, capabilities, and value realized from the assets. Generally, outputs are defined in terms of asset performance, and outcomes are realized in terms of products, services, and assurances generated by the agency fulfilling its mission. This approach will also require federal agencies to develop new competencies in asset management. When combined, this approach and new competencies will change how risk is managed and how resource-and-investment decisions are made. The report's overarching objective is to share industry advancements in asset management system thinking that will influence new policies, practices, and behaviors critical to improving facility portfolios and, thus, agency mission achievement. The report's simple objective is to help each federal agency ensure and assure that every facility dollar spent supports and improves agency mission achievement effectively and efficiently.

The committee focused its work on the *how*—not the *what*—for adapting, repurposing, restoring, recapitalizing, and replacing real property assets. The individual facility assets (buildings and structures) are part of facility portfolios that are designed to support federal agency missions today and into the future. The committee considered multiple stakeholder perspectives, critical requirements, and expectations to provide long-term, cost-effective stewardship of the federal real property portfolio.

Within an ISO 55000–based asset management system, a facility portfolio is the generating source for value. Connecting the dots is the asset management system that coordinates management activities defined in terms of policies, doctrine, objectives, organizational structure, information technologies, and processes. Facility asset management is a means to fulfill an agency's fiduciary

responsibility to renew its facility portfolio efficiently and effectively. This relationship is shown in Figure 1-1.

This approach applies management system thinking to focus on how to make good resource-and-investment decisions. Management system thinking is used to implement an asset management system for generating an agency's facility renewal strategy. This strategy in turn coordinates resource-and-investment decisions related to managing facility assets. Finally, in managing the organization, the ultimate determinant of asset management success is a well-functioning facility portfolio that generates value in the form of mission support that helps an agency achieve its mission objectives efficiently and effectively. This approach elevates federal facility renewal strategies into an overarching policy that guides resource-and-investment decision making across the agency's whole facility portfolio, whole facility life cycles, and whole mission sets.

This report offers recommendations for requirements identification; fiscal risk management planning; practices for measuring the actual (as opposed to projected) outcomes of mission-driven investments; and strategies for communicating with critical stakeholder groups that support the renewal of federal facilities portfolios. The committee's recommendations promote a broad and disciplined view of asset management. This view covers the creation of various budget structures and analyses to better aggregate and allocate funding for capital investment, finance new investment, privatize or partner with the public–private sector for the provision of services to the public, dispose of unneeded and underutilized properties, and lease when ownership is not a realistic option given budget scoring rules and funding constraints. The committee also presents a recommendation for a new capital planning process for securing facility renewal funds. The

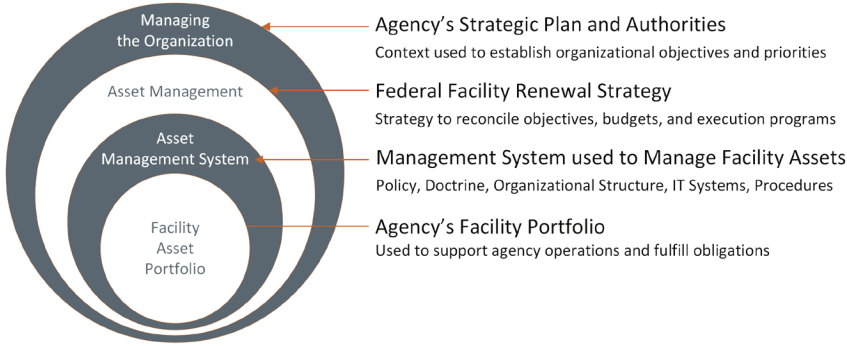

FIGURE 1-1 Relationship of key terms relating a facility asset management system to an asset management system based on ISO 55000.
SOURCE: © ISO. This material is reproduced from ISO 55000:2014 with permission of the American National Standards Institute (ANSI) on behalf of the International Organization for Standardization. All rights reserved.

committee believes that the strategies for renewal defined in this report will be useful for reshaping how federal agencies approach facility budget development and execution.

DEFINING RENEWAL

The committee's first task was to define renewal for the federal real property portfolio: specifically, how the costs of ongoing annual maintenance, repair, and operations relate systematically to long-term capital reinvestment, which is the renewal of the portfolio. Following advice from the FFC, the committee defines *facility renewal* as "sustaining an asset's current functionality and extending functionality beyond its expected service life through significant renovation, replacement, or repurposing." All assets eventually require reinvestment to adapt to changing times, missions, and operational requirements. Given fiscal constraints, federal agencies typically focus on sustainment funding to keep infrastructure running, rather than optimizing investments for continued mission achievement. This definition is extended through the concept of federal facility renewal strategies that systematically apply and integrate this approach for every asset to whole facility portfolios.

Few agencies have systematically renewed their real property portfolios over time. As a result, the real property portfolios of many federal agencies are in increasing need of major rehabilitations, retirement, or replacement. In 2020, the Federal Real Property Council (FRPC) estimated that the aggregate average age of the assets in the federally owned facility portfolio is 47 years (White House 2019). While older buildings can be marginally acceptable to meet a federal agency's needs in the present, their location and configuration may not meet future demands.

The committee's definition of a *federal facility renewal strategy* is a policy, not simply a vision, that embraces a plan of action for an agency's real property portfolio, with actionable procedures and processes for achieving its mission objectives and obligations. Executive branch policies and legislative statutes control the federal agencies' real property management resources for renewal. This report identifies constraints that are embedded in policies or statutes or that result from a lack of information. The purpose of federal facility renewal strategies is to ensure and assure that federal facilities are being used to achieve the agency's mission efficiently and effectively. This will be accomplished only when an agency's fiduciary responsibility to renew federal facilities is made clear in statute and policy. Achieving this vision will require changes to how policy is developed and how federal agencies make facility resource-and-investment decisions.

THE FEDERALLY OWNED BUILDING PORTFOLIO

The FRPC publishes a public list of the federal government's owned and leased facilities (OGP 2016). This list is aggregated into a series of data tables

included in the federal budget. The fiscal year (FY) 2016 data tables are the last year for which consolidated data for both defense and non-defense agencies are publicly available.

Table 1-1 is a snapshot of the federal government's real property portfolio located in the United States and U.S. territories as of September 2016. The building asset class includes offices, laboratories, hospitals, schools, museums, data centers, and warehouses; the structures class includes such assets as airfield pavements, harbors and ports, parking structures, and utility systems. Combined, these asset classes are also known as "facilities." One common way to describe the varied portfolio is by the cost of operating and leasing facilities. For FY2016, the federal agencies estimated a total annual operating cost of approximately $26 billion. This estimate represents only a portion of a facility portfolio's annual funding requirements. Annual operating costs include recurring maintenance and repair; utilities services; facility cleaning and/or janitorial services; grounds maintenance; landscaping; and snow and ice removal on roads, piers, and airfields of federally owned facilities. For those facilities leased by federal agencies, these annual operating costs include the lease annual rent to lessor and the lease annual operating and maintenance costs. Besides the cost of operations, as noted later in this chapter, federal investment costs are also required to renew federal facilities in order to meet current and future agency needs.

Most of the $26 billion in annual expenditures is executed by a single federal department, the Department of Defense, which operates more than 60 percent of the federal footprint—determined on a building square-foot basis. Not reported in the FY2016 federal facility open data set is the cost of investment in facilities—capital construction and rehabilitation or renewal—of the federal facility real property inventory. The federal government's plans for capital investments in facilities should be cost effective and coordinated with annual operating costs to meet existing or new mission needs most efficiently and effectively.

Table 1-2 shows the federal direct investment in capital construction and rehabilitation in support of each federal agency's building, structure, and physical infrastructure needs, with some exceptions, including the omission of investments for water resources projects (dams, locks, etc.). This information is a subset of the data presented in the FY2020 and FY2021 Analytical Perspectives of the U.S. Federal Budget (see White House 2019, 2020).

These budget authority data show that total construction and rehabilitation costs for federal facilities averaged $38 billion annually, a third of which was dedicated to defense and Department of Energy atomic energy facility renewal needs. Taken together, the estimated federal facility portfolio's operating costs and investments exceed $60 billion per year.

TABLE 1-1 Total Number of and Total Annual Operating Costs for Facilities in the United States and U.S. Territories in Fiscal Year (FY) 2016[a]

		FY2016			
		Owned	Leased	Otherwise Managed[b]	Total
Buildings	Total Number	232,419	19,404	15,304	267,127
	Total Square Feet	2,368,129,721	280,103,254	122,135,363	2,770,368,339
	Total Annual Operating Costs	$11,507,899,223	$7,284,160,244	$514,369,635	$19,306,429,102
Structures	Total Number	415,146	3,449	77,579	496,174
	Total Annual Operating Costs	$6,230,950,083	$59,135,377	$95,998,804	$6,386,084,265
Land[c]	Total Acres	19,602,337	1,328,020	21,413,159	42,343,516
	Total Annual Operating Costs	$124,878,776	$50,728,233	$180,546	$175,787,555
AOC[d]	Total Annual Operating Costs (Buildings, Structures, Land)	$17,863,728,082	$7,394,023,854	$610,548,985	$25,868,300,921

[a] All real property data from the Chief Financial Officers Act; agencies are required to submit data to the Federal Real Property Portfolio (FRPP). This table excludes real property data for the intelligence community and military family housing inventories. Current year data not publicly available.

[b] "Otherwise Managed" includes facilities that are state-government owned, foreign-government owned, museum trust, and withdrawn land.

[c] Does not include public-domain land.

[d] AOC = annual operating costs.

NOTE: This report focuses on FRPP data for assets in the United States and U.S. territories and does not reflect significant inventory reconciliation of real property data as a result of the Department of Defense's Financial Audit initiative.

SOURCE: Office of Government-Wide Policy, 2016, "FY 2016 Federal Real Property Profile (FRPP) Open Data Set," General Services Administration, https://www.gsa.gov/cdnstatic/FY_2016_Open_Data_Set.xlsx.

TABLE 1-2 Major Public Physical Direct Investment (Budget Authority)

	Budget Authority (millions of dollars)		
Direct Federal Programs	2018	2019	2020
Major Public Physical Investment			
Construction and Rehabilitation			
National Defense:			
Military Construction and Family Housing	10,256	11,339	16,472
Atomic Energy Defense Activities and Other	1,411	1,820	1,936
Subtotal, National Defense	**11,667**	**13,159**	**18,408**
Non-defense:			
International Affairs	1,885	1,373	1,090
General Science, Space, and Technology	2,006	1,965	2,011
Other Natural Resources and Environment	2,090	1,742	1,529
Energy	2,320	2,005	3,209
Postal Service	662	857	958
Transportation	200	791	590
Veterans Hospitals and Other Health Facilities	4,389	6,189	4,643
Administration of Justice	3,186	3,660	3,331
GSA[a] Real Property Activities	1,539	1,851	986
Other Construction	5,283	4,203	3,322
Subtotal, Non-defense	**23,560**	**24,636**	**21,669**
Total, Direct Federal Spending	**35,227**	**37,795**	**40,077**

[a] GSA = General Services Administration.
NOTE: Non-defense totals exclude budget authority information for water resource projects.
SOURCE: Office of Government-Wide Policy, 2016, "FY 2016 Federal Real Property Profile (FRPP) Open Data Set," General Services Administration, https://www.gsa.gov/cdnstatic/FY_2016_Open_Data_Set.xlsx.

ORGANIZATION OF THIS REPORT

This report is organized into seven key chapters. Chapter 2 sets the stage by reviewing federal statutes, management, and guidance issued by the Office of Management and Budget and salient audit reports by the Government Accountability Office. Chapter 3 further identifies leading industry and international standards for advancing asset management systems and principles and establishing clear agency fiduciary responsibilities to manage federal facilities efficiently and effectively. Chapter 4 describes the state of facility inventory and

asset management decision-support tools for assessing facility condition and estimating facility maintenance, repair, and major construction and rehabilitation needs. Chapter 5 addresses the subject of values, benefits, and risk management. Chapter 6 identifies innovative funding strategies that can be applied to support an agency's renewal strategy. Finally, Chapter 7 presents the committee's conclusions and recommendations. The report also includes seven appendixes that offer additional support and substantiation for the committee's recommendations.

2

The Operating Context for Federal Facility Renewal Strategies

> The purpose of federal facility renewal strategies is to ensure and assure that federal facilities are being used to achieve the agency's mission efficiently and effectively.
>
> —*Committee on a Strategy to Renew Federal Facilities*

INTRODUCTION

The nation's federal real property portfolio is critical infrastructure[1] that provides places and means for the federal government to operate and generate the products, services, security, and assurances that contribute to the nation's prosperity and values. This chapter identifies and clarifies the foundation for, limitations on, and opportunities to develop and implement federal facility renewal strategies designed to better achieve these objectives. It finds that federal facility renewal strategies are best implemented through asset management principles and frameworks, such as those detailed in the International Organization for Standardization (ISO) 55000 series on asset management. This is because these standards use the lens of agency performance and not asset life-cycle management as the basis for resource-and-investment decision making. When used, ISO 55000 asset

[1] For the purposes of this report, the nation's federal real property infrastructure includes public lands, buildings, and structures. A *building* is defined as a roofed and floored facility enclosed by exterior walls and consisting of one or more levels, which is suitable for single or multiple functions and protects human beings and their properties from direct harsh effects of weather, such as rain, wind, and sun. *Structures* are other real property assets not defined as buildings, including open storage facilities, roads, runways and taxiways, bridges, parking surfaces, and utility systems. This infrastructure is referred to in this report as *federal facilities*.

management standards provide a basis for defining fiduciary responsibility for facility management. Use of this standard also establishes a means to systematically improve agency mission achievement through more effective risk-based resource-and-investment decision making in support of federal facility portfolio management. In this report, this objective is synonymous with strategies for renewing federal facilities.

THE BASIS FOR FEDERAL FACILITY RENEWAL STRATEGIES

Federal facility renewal strategies are founded on the need to enable an efficient and effective federal government and are dedicated to making better resource-and-investment decisions regarding federal facilities to optimally enable federal government operations. This invites a new perspective, looking at federal facilities as an enabling asset and not as an overhead expense. Simply, the basis for federal facility renewal strategies is to generate value for the American people.

At the most basic level, creation of federal renewal strategies is an agency fiduciary responsibility carried out through facility asset management activity. In an ISO 55000 context, asset management is a disciplined approach that "does not focus on the asset itself, but on the value the asset can provide to the organization" (ISO 2014a, § 2.4.2a). This report applies this lens to focus on the role of federal facility renewal strategies in supporting federal agency operations today and into the future. The committee views federal facility renewal strategies as a management imperative, and it is, therefore, no surprise that their development and use are required by public laws and statutes.

FOUNDATIONS FOR FEDERAL FACILITY RENEWAL STRATEGIES

The modern beginnings of real property[2] management as a coordinated activity can be traced to the Federal Property and Administrative Services Act of 1949. The dawn of federal facility asset management begins with a report by the National Council on Public Works Improvement (1988), titled *Fragile Foundations—A Report on America's Public Works*. This report put into context the need for a national strategy of systematic investments to support America's productivity and quality of life.

On a parallel track in the late 1980s, ISO first published ISO 9001—Quality Management Systems (ISO 2015a). ISO based this standard on a wide range of efforts with a common interest in promoting quality in products and services.

[2] The term federal *real property* means public lands and improvements to public lands. A more comprehensive definition can be found in 26 CFR § 1.856-10, Definition of real property, https://www.law.cornell.edu/cfr/text/26/1.856-10. Accessed December 9, 2022.

Some references used to develop early versions of this standard go back to the 1950s. In the United States, similar forces were being mobilized to advance asset management capabilities, specifically the Chief Financial Officers Act of 1990. With this act, Congress commissioned a body of requirements mandating more effective management practices. In the ensuing years, additional laws, executive orders, Government Accountability Office (GAO) reports, and National Research Council reports,[3] advanced the intellectual development of asset management. These sources, along with many others, collectively supported the emergence of facility asset management. Notable international and national events occurring along this timeline to present day are shown in Figure 2-1.

The sources identified in Figure 2-1 demonstrate that across the world, asset-dependent organizations were pursuing similar advancements for generally the same reasons. For example, circumstances in the United Kingdom made facility asset management critically important. Around 1994, the United Kingdom was privatizing large portions of its public infrastructure to include rail, water, and wastewater. In the rail transportation sector, supporting contracts were 10 years in length, whereby a contracted entity was given authority to operate a rail line to generate revenue, but with an obligation to maintain the physical assets owned by the government. As activities played out, this strategy had a major flaw. The contracted operator's commitment to the long-term upkeep of the physical assets was not the same as the government's perpetual interests. As a result, the condition of the physical assets measurably decreased.

In response to this flaw, and to those of similar examples in other sectors, the British Standards Institute published Publicly Available Specification (PAS) 55—Specification for the Optimized Management of Physical Assets, first in 2004. The government's need to confer effective asset management requirements in contracts motivated this publication. For similar reasons, clarity of this objective was emerging in many physical asset–intensive industries across the world, with Australia and New Zealand being recognized leaders (e.g., the Financial Management Act in Australia in 1994). In parallel, ISO continued to advance development of standards on management systems based on ISO 9001—Quality Management Systems (ISO 2015a), the most prominent being ISO 14001—Environmental Management Systems (ISO 2015b). Today these ISO management system standards are part of a growing family of management system standards implemented in accordance with ISO/IEC (International Electrotechnical Commission) Directives, Parts 1 and 2.

Many more sources and stories relate to how facility asset management as a disciplined approach has matured. All have similar origins and motivations: how to make effective risk-based resource-and-investment decisions in order to manage assets for the good of the organization and its stakeholders. Success in using

[3] Prior to July 1, 2015, reports of the National Academies of Sciences, Engineering, and Medicine were authored by the National Research Council.

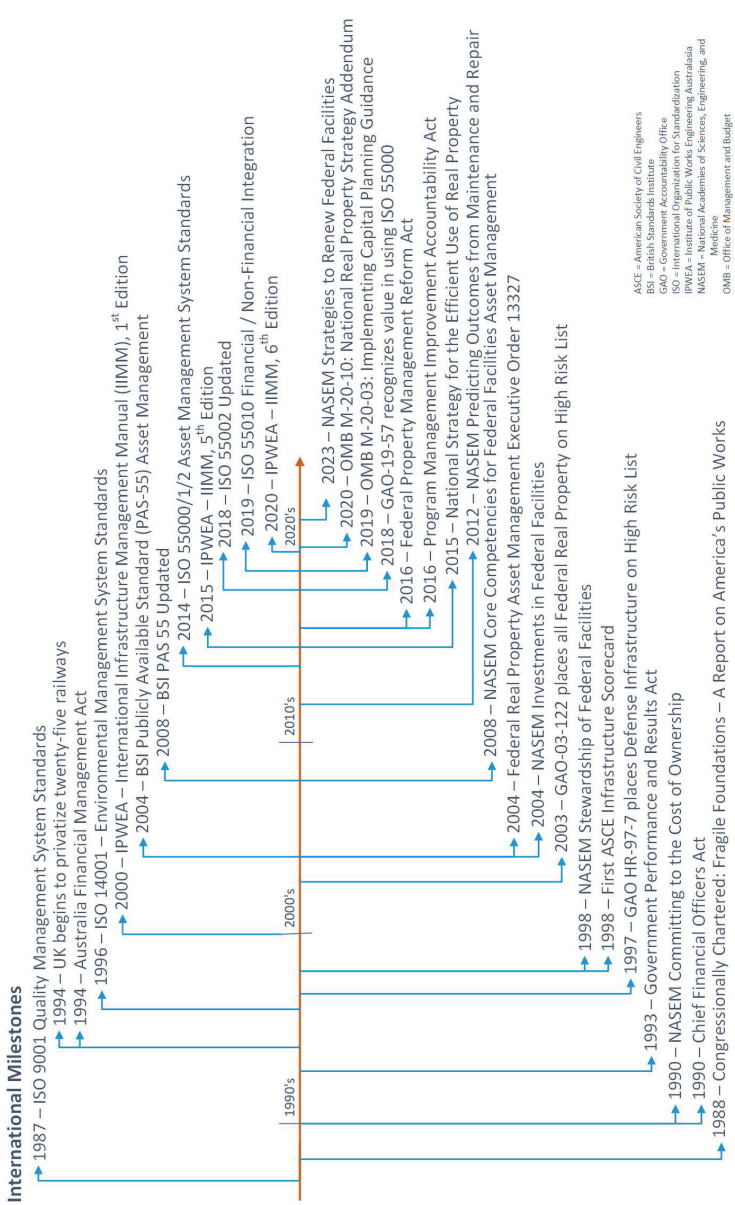

FIGURE 2-1 Significant milestones in the evolution of facility asset management in the U.S. federal sector.

PAS-55 in the United Kingdom generated demand for an international standard that led to the ISO 55000 series for asset management standards. The ISO Technical Committee (ISO/TC) 251—Asset Management manages these standards. The United States is a member of this committee authorized through the American National Standards Institute (ANSI) and sponsored by the American Society for Testing and Materials (ASTM) of the U.S. Technical Advisory Group (TAG) on Asset Management. Today, ISO/TC 251 leads international efforts advancing asset management system standards that underpin best practices for facility asset management around the globe.[4] This committee views the ISO 55000 asset management series as a foundation for improving an organization's facility asset management capabilities and therefore a solid foundation for developing and implementing federal facility renewal strategies. This committee also emphasizes experiences gained from the UK railway example above and its causal relationship to generating ISO 55000 as a good reason to consider using these standards to support U.S. government federal facility asset management.

OVERSIGHT OF THE FEDERAL REAL PROPERTY PORTFOLIO BY THE GOVERNMENT ACCOUNTABILITY OFFICE

Another foundational source contributing to the advancement of facility asset management is GAO and its many reports on or related to this subject. GAO is an independent, nonpartisan agency that works for Congress to examine how the federal government spends taxpayer dollars. GAO reports provide Congress and federal agencies with objective, reliable information to help the federal government save money and work more efficiently. The following sections highlight several foundational GAO reports influential to the committee's efforts to improve federal facility renewal strategies.

GAO's High-Risk Report Series

GAO commissioned its High-Risk report series in 1990.[5] This series has evolved into a biennial report released about the time of the start of each Congress. Its purpose is "to identify and help resolve serious weaknesses in areas that involve substantial requirements and provide critical services to the public."[6] Facility real property was first elevated as a high-risk area for the Department of Defense in 1997 (GAO 1997), and the whole federal government in 2003 (GAO 2003) and has remained there ever since. The most recent GAO High-Risk report,

[4] The ISO 55000 series is not limited to facility asset management. It covers both tangible and intangible assets. More information is available at https://committee.iso.org/home/tc251.

[5] See Government Accountability Office, "High-Risk List," https://www.gao.gov/highrisk/overview. Accessed December 9, 2022.

[6] Government Accountability Office, "High-Risk List."

Managing Federal Real Property (GAO 2019g), makes recommendations on 63 outstanding issues. Many of these are specific to facility asset management objectives. Although GAO does not identify facility asset management as a focus area, the committee views all its recommendations related to making better resource-and-investment decisions as a facility asset management recommendation. Though some progress has been made on one or more criteria since 2019, and ratings for a segment within facility asset management sufficiently improved so that the segment was removed, facility asset management remains on the 2021 GAO High-Risk report and the committee continues to be supportive of GAO's high-risk recommendations in this area (GAO 2021).

GAO Report on Facility Asset Management

In GAO-19-57, *Federal Real Property Asset Management—Agencies Could Benefit from Additional Information on Leading Practices*, GAO identified an asset management framework based on asset management literature, expert interviews, and ISO 55000 standards (GAO 2018f). This GAO report was influential to the committee's recommendations in the current report. The GAO report also includes key characteristics of an effective asset management framework (see Figure 2-2) that were formative in developing recommendations made in this report.

Also very influential was the report's conclusion:

> However, because existing federal asset management guidance does not fully reflect standards and the key characteristics, such as, directing agencies to develop a comprehensive approach to asset management that incorporates strategic planning, capital planning, and operations, federal agencies may not have the knowledge needed to maximize the value of their limited resources. In addition, because there is no central clearinghouse of information to support agencies' asset management efforts, as required by Executive Order 13327, agencies may not know how best to implement asset management activities, including using quality data to inform decisions and prioritize investments. (GAO 2018f, p. 37)

GAO's single recommendation in the report is as follows:

> The Director of OMB should take steps to improve existing information on federal asset management to reflect leading practices such as those described in ISO 55000 and the key characteristics we identified and make it readily available to federal agencies. These steps could include updating asset management guidance and developing a clearinghouse of information on asset management practices and successful agency experiences. (GAO 2018f, p. 37)

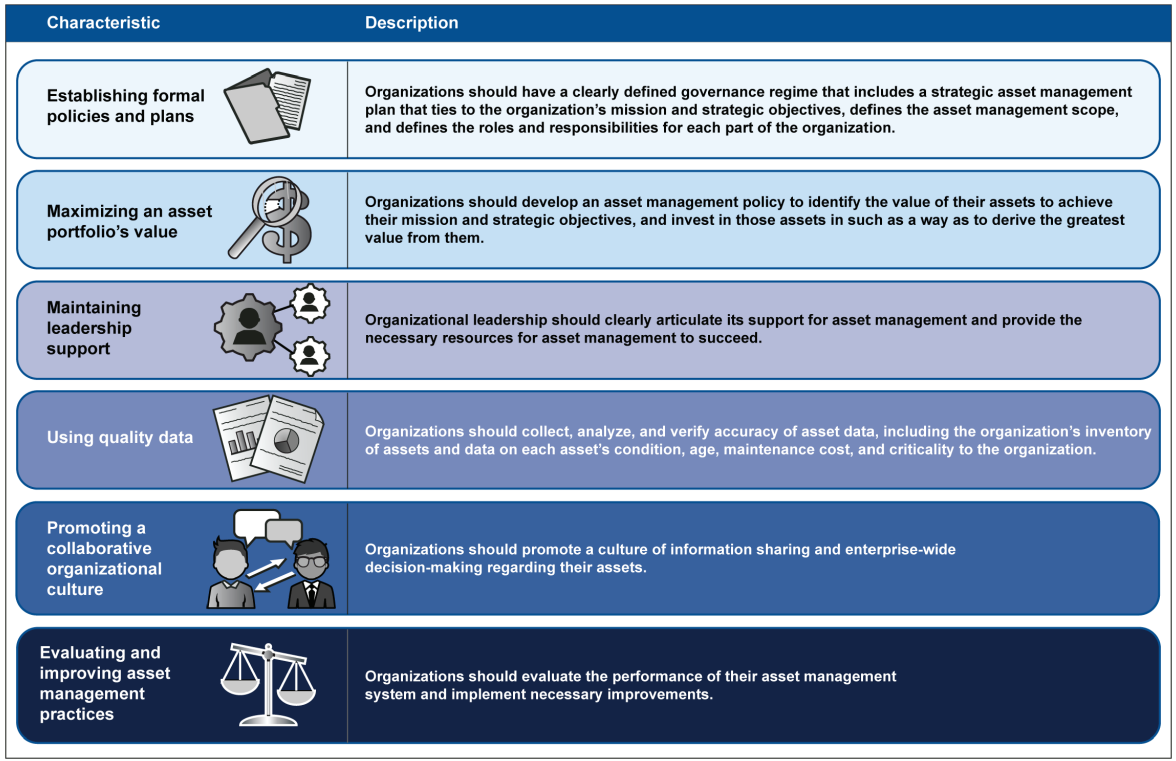

FIGURE 2-2 Key characteristics of an effective asset management framework.
SOURCE: Government Accountability Office, 2018, *Federal Real Property Asset Management: Agencies Could Benefit from Additional Information on Leading Practices*, GAO-19-57, Washington, DC, www.gao.gov/assets/gao-19-57.pdf.

GAO Report on Reliable Cost Estimates

All federal facility renewal strategies require reliable cost estimates, and GAO has advanced work value by adding methodologies in this area for years. Its most recent contribution is GAO-20-195G, *Costing Estimating and Assessment Guide—Best Practices for Developing and Managing Program Costs*. This guide states that developing reliable cost estimates is crucial for realistic program planning, budgeting, and management. GAO defines a cost estimate as the summation of individual cost elements using established methods and valid data to estimate the future costs of a program (GAO 2020a).

GAO-20-195G also describes cost-estimating processes and warns agencies about the risk of experiencing cost overruns, missed deadlines, and performance shortfalls if they do not use its leading practices (GAO 2020a). The committee agrees that development and use of cost-estimating guidelines, such as those detailed in the report (see Figure 2-3), are critical to any agency's facility asset management system, with one caveat: GAO-20-195G provides guidance related to developing reliable cost estimates for programs—not for facility asset portfolios. As detailed in Chapter 3, there is a distinction between the two. This point also highlights a bias the committee found in some OMB guidance that does not fully address facility asset management idiosyncrasies. Efficient facility asset management that improves overall facility portfolio performance requires strategies that integrate and coordinate many programs. These facility asset management strategy improvements must address both optimization of programs supporting facility operations and optimization of the value generated by facility portfolios. This is a subtle yet significant issue that agencies need to consider when applying guidance in GAO-20-195G to develop federal facility renewal strategies.

GAO Report on Analysis of Alternatives

Another area important for developing federal facility renewal strategies is the analysis of alternatives. A good example of how to approach this topic is GAO-16-853, *Joint Intelligence Analysis Complex: DOD Partially Used Best Practices for Analyzing Alternatives and Should Do So for Future Military Construction Decisions* (GAO 2016g). This report evaluated the decision process to move mission capabilities from one location to another. GAO has also identified 22 best practices on how to analyze alternatives (GAO 2017e). The GAO grouped their best practices into four characteristics, shown in Table 2-1. This committee found that these characteristics and criteria are an excellent starting point for an analysis of alternatives for developing federal facility renewal strategies.

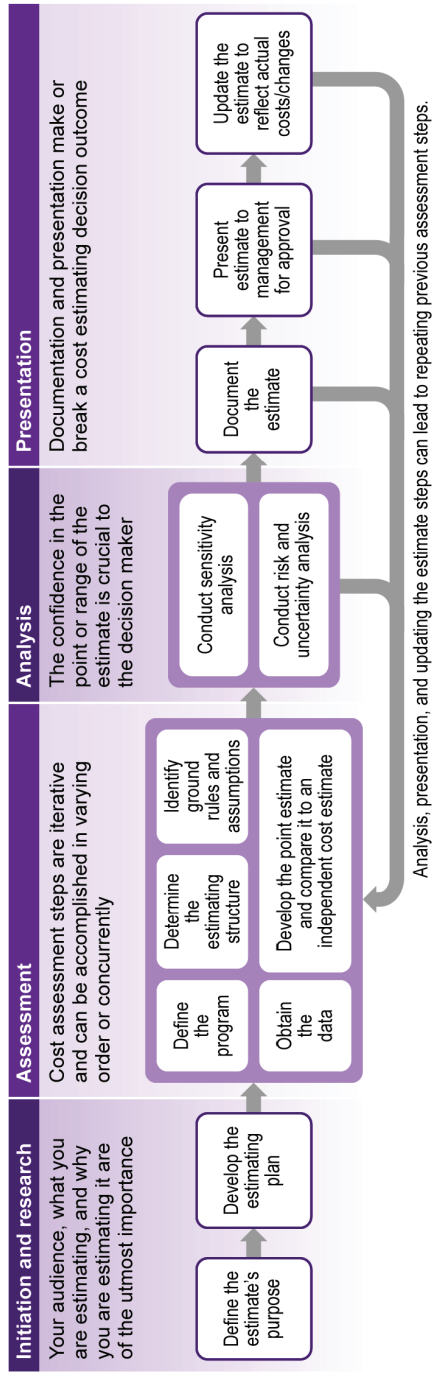

FIGURE 2-3 Cost-estimating process and guidelines.
SOURCE: Government Accountability Office, 2020, *Cost Estimating and Assessment Guide: Best Practices for Developing and Managing Program Costs*, GAO-20-195G, Washington, DC, www.gao.gov/assets/710/706933.pdf.

TABLE 2-1 Best Practices for Analysis of Alternatives (AOA)

Characteristics	AOA Best Practices
Well documented: The AOA process is thoroughly described, including all source data, clearly detailed methodologies, calculations and results, and selection criteria are explained.	12. Identify significant risks and mitigation strategies 14. Tie benefits/effectiveness to mission need 18. Document AOA process in a single document 19. Document assumptions and constraints
Comprehensive: The level of detail for the AOA process ensures no alternatives are omitted and that each alternative is examined thoroughly for the project's entire life cycle.	1. Define mission need 3. Develop AOA timeframe 8. Develop list of alternatives 11. Assess alternatives' viability 15. Develop life-cycle cost estimates (LCCEs)
Unbiased: The AOA process does not have a predisposition towards one alternative over another but is based on traceable and verified information.	2. Define functional requirements 4. Establish AOA team 6. Weight selection criteria 7. Develop AOA process plan 13. Determine and quantify benefits and effectiveness 20. Ensure AOA process is impartial 22. Compare alternatives
Credible: The AOA process discusses any limitations of the analysis resulting from the uncertainty surrounding the data to assumptions made for each alternative.	5. Define selection criteria 9. Describe alternatives 10. Include baseline alternative 16. Include a confidence interval or range for LCCEs 17. Perform sensitivity analysis 21. Perform independent review

SOURCE: Government Accountability Office, 2016, *Joint Intelligence Analysis Complex: DOD Partially Used Best Practices for Analyzing Alternatives and Should Do So for Future Construction Decisions*, GAO-16-853, Washington, DC, www.gao.gov/assets/690/689599.pdf.

GAO Report on Internal Management Controls

The last topic the committee chose to highlight is a GAO report on internal controls. OMB establishes internal control requirements in Circular A-123—Management Responsibility for Enterprise Risk Management and Internal Control, as implemented by OMB Memorandum M-16-17. This OMB source invokes the use of GAO-14-704G, *Standards for Internal Control in Federal Government* (also known as GAO's Green Book), as an "integrated governance structure" to "engage all agency management, beyond the traditional ownership of OMB Circular No. A-123 by the chief financial officer community" (OMB 2016). This was a significant expansion of OMB requirements relevant to the development and implementation of federal facility renewal strategies. OMB Circular A-123 establishes requirements for enterprise risk management, whereas GAO-14-704G focuses on guiding and structuring supporting internal controls, as highlighted in Figure 2-4.

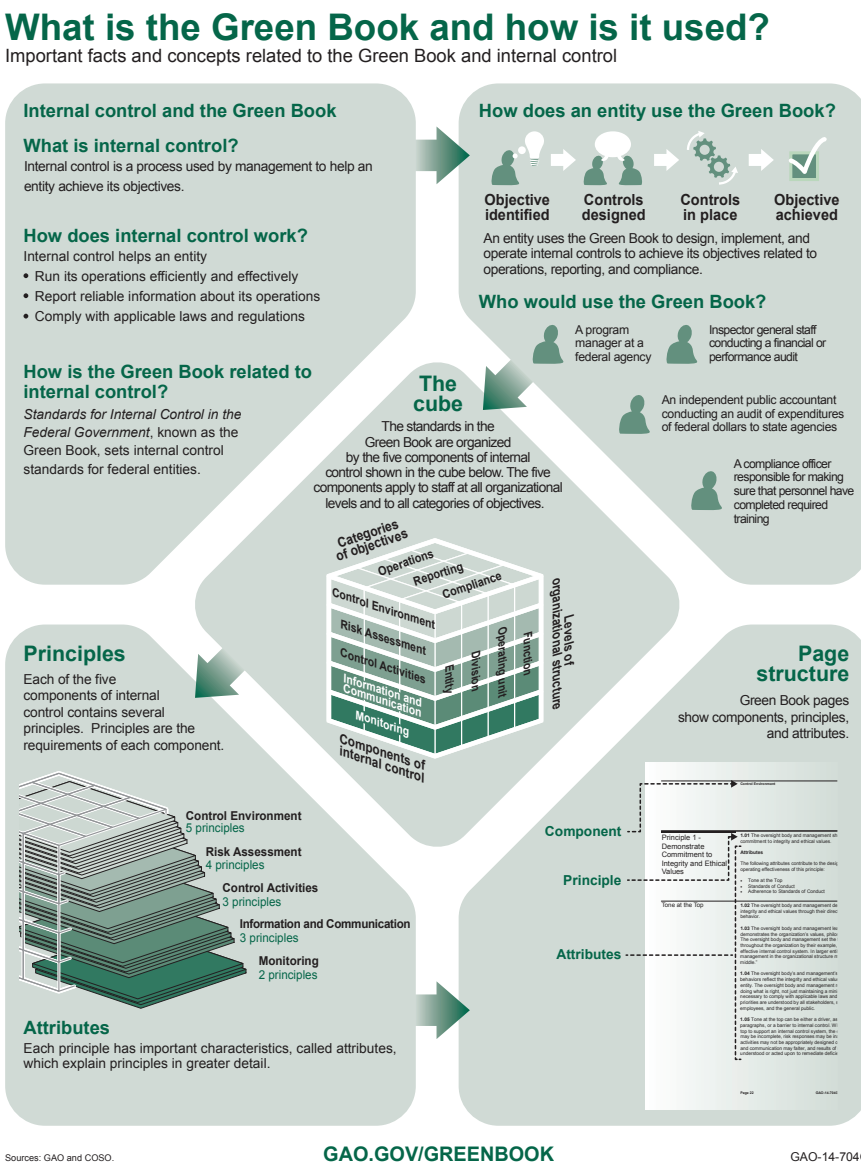

FIGURE 2-4 Guiding and structuring internal controls.
SOURCE: Government Accountability Office, 2014, *Standards for Internal Control in the Federal Government*, GAO-14-704G, Washington, DC, www.gao.gov/assets/gao-14-704g.pdf.

The balance of GAO-14-704G provides excellent guidance and principles on internal controls, but neither this source nor OMB Circular A-123 provides explicit instructions on how to implement them as part of a management system. The committee agrees with materials contained in these sources and goes one step further, as detailed in the report's first recommendation, recommending the use of ISO 55000 asset management standards to fill this gap in support of the development and implementation of federal facility renewal strategies.

Additional GAO Reports Related to Facility Asset Management

Appendix D of this report summarizes other GAO reports related to federal facility asset management issues and decision-making needs. These reports cover specific topics, including policy and process, strategies and plans, competency and training, and data and technologies. The committee considers the findings in the referenced GAO reports important to improving an agency's facility asset management system. These reports go beyond symptomatic issues to identify root causes that limit an agency's facility asset management system, thus generating more effective and impactful federal facility renewal strategies. Each report listed in the appendix provides insights to all agencies working to improve their facility asset management system. To leverage these insights, it is important for an agency to evaluate GAO's points and recommendations in the context of its facility asset management system, instead of discounting them based on perceived irrelevance.

THE OPERATING CONTEXT FOR FEDERAL FACILITY RENEWAL STRATEGIES

The preceding sections introduced the basis of and foundation for federal facility renewal strategies and established criteria and parameters for their operating context. This last section details prominent OMB policies used to establish the operating context for federal facility renewal strategies. This is a complex topic that could take volumes to explain. Below is a synopsis of a review, which is presented fully in Appendix E, intended to inform the reader of the needs and requirements for implementing federal facility renewal strategies.

The operating context for federal facility renewal strategies can be summarized as the governing body of laws, statutes, regulations, and executive orders that establish the policy used to generate agency strategies for facility asset management systems, which are communicated and managed through the agency's real property capital plan, focusing on the following four areas:

- Federal facility asset management authorities that set the foundation for developing and implementing federal facility renewal strategies,

- The current national strategy for federal facility asset management systems used to develop and implement federal facility renewal strategies,
- OMB policies as they relate to federal facility asset management and OMB's role in advancing federal facility renewal strategies, and
- The relationship between federal facility renewal strategies and an agency's real property capital plan.

A synopsis of each follows.

Federal Facility Asset Management Authorities

Federal asset management authorities are conferred through statutes, regulations, orders, and policy. There are too many to enumerate, and they all impact agencies' implementation of federal facility renewal strategies. Applying these authorities is made more complex by the fact that different agencies have different facility asset management authorities. Despite these differences, all generally agree on achieving the following objectives:

- Deliver and manage facilities necessary to achieve agency missions,
- Manage supporting resources in an efficient and effective manner,
- Comply with federal laws and regulations and the agency's priorities and values, and
- Use facilities to generate value for the nation and the American people.

The following three principal OMB policy areas are used to implement these authorities:

- OMB Circular A-11, Part 6 (Federal Performance Framework for Improving Program and Service Delivery), is founded on the Government Performance and Results Act of 1993. This part sets requirements and a rubric for establishing and reporting performance measures linked to an agency's strategic plan and budget that are applicable to the implementation of federal facility renewal strategies. Often these requirements are implemented through an agency's policy for planning, programming, budgeting, and execution.
- OMB Circular A-11, Supplement—Capital Programming Guide provides guidance governing how agencies are to plan for and manage capital assets, including their real property portfolios. Guidance is organized into three phases: planning and budget, acquisition, and management-in-use phases. Compliance with all is essential to implementing federal facility renewal strategies.

- OMB Circular A-123—Management's Responsibility for Enterprise Risk Management and Internal Control establishes requirements and provides guidance on how to implement effective risk management and internal controls governing the implementation of federal facility renewal strategies.

These OMB policies set the operating context for implementing federal facility renewal strategies, and individual agencies are expected to apply them to establish facility asset management systems. In turn, the facility asset management system is used to generate federal facility renewal strategies that are to be communicated and managed through the agency's real property capital plan as part of a continual improvement process.

National Strategy for the Efficient Use of Real Property

OMB commissioned the beginnings of a national strategy for federal facility asset management in OMB Memorandum M-12-12, "Promoting Efficient Spending to Support Agency Operations," also known as the "Freeze the Footprint" policy. This was later updated in OMB Management Procedures Memorandum 2015-01, known as the "Reduce the Footprint" policy, and subsequently with the release of the "National Strategy for the Efficient Use of Real Property" (National Strategy) (Executive Office of the President 2015). Most recently this strategy was renewed and updated in OMB M-20-10, "Issuance of an Addendum to the National Strategy for the Efficient Use of Real Property."

In its present form, ownership of the National Strategy has been assigned to the Federal Real Property Council (FRPC), acting under OMB direction in accordance with authorities established by the Federal Property Reform Act of 2016. This act codified the FRPC, which was first established under Executive Order 13327, "Federal Real Property Asset Management." OMB M-20-10 takes an honest look at the performance of the National Strategy since its inception and establishes an ambitious "Interim National Strategy Framework" supporting its continuance. This framework guides and seeks to:

- Perform a comprehensive assessment of current and future mission capability gaps in the portfolio and the capital required to eliminate them;
- Establish a common, government-wide business environment where agencies adopt common business processes and standards and share IT [information technology] and other tools and capabilities across government to promote better management practices and eliminate redundancy and prevent needless expenditure of resources; and
- Identify legislative reforms that provide agency leadership with the authority needed to prioritize mission support and cost efficiency (OMB 2020a, p. 7).

OMB M-20-10 goes on to establish expectations that it will take some time to develop a complete national policy statement. It also states OMB's intention to consider leading real property management practices from the private sector, state and local governments, and other national governments to develop this policy. What is made clear in this memorandum is that OMB, working through the FRPC, intends to make a serious push to advance this National Strategy over the next cycle of development (OMB 2020a).

Review of OMB Policy Supportive of Federal Facility Renewal Strategies

In order to identify opportunities to improve value generated by federal facility renewal strategies, OMB policy is reviewed in detail in Appendix E. A synopsis of this review is as follows:

- OMB Circular A-11, Part 6 (Federal Performance Framework for Improving Program and Service Delivery).[7] This part provides an excellent overarching performance management structure focused on reporting achievement of an agency's strategic plan objectives. However, it failed to make clear how this structure directly linked to budget development and how other plans defined in OMB Circular A-11 are to be integrated into the performance framework.
- OMB Circular A-11 Supplement—Capital Programming Guide (Guide). Criticism of this guide is focused on two specific issues:
  - — *Major system and IT asset acquisition bias.* The Guide is heavily biased toward these two asset types to the exclusion of facility assets, a bias demonstrated by its expansive attention given to supporting major system and IT acquisition project and program management activities. Acquisition of these types of assets is less complex and is governed by regulations measurably different from those that govern facility acquisitions. As a result, the Guide fails to address many idiosyncrasies related to facility management, such as master planning, nuanced applications of Circular A-94 (OMB 1992) (e.g., deciding between cost-benefit analysis and cost-effectiveness analysis, and leased-versus-owned investment decisions), and use of investment boards versus integrated project teams to make facility acquisition decisions. Because of this, the Guide does not provide clear guidance supportive of implementation of federal facility renewal strategy.
  - — *Facility portfolio perspective.* The Guide generally focuses decision making on individual assets or classes of assets. This perspective is common for management of major systems or IT capital assets

[7] This review is related to content contained in the August 2022 version of OMB Circular A-11.

but is ineffective for management of portfolios of facility assets. Specifically, facility portfolios include diverse assets, are commonly large, and are often geographically distributed—all have complex, competing requirements. This means facility portfolio resource-and-investment decision making is always an economic value proposition that is balancing trade-offs to optimize overall outcomes. At the facility portfolio level, decision making is never as easy as a cost-benefit or earned-value management analysis, and the Guide's scant guidance in this area significantly limits its value in supporting federal facility renewal strategies as defined in this report.

- OMB Circular A-123—Management's Responsibility for Enterprise Risk Management and Internal Control. While this circular is an excellent reference on the subject, it is too general and does satisfactorily cover how its guidance should be applied or implemented. Its stated purpose is to support implementation of OMB Circular A-11, and it provides a wealth of information on enterprise risk management and internal controls that apply to a whole range of objectives, including those beyond classic financial management activities led by the chief financial officer. The problem with this approach is that it is unclear when and to what extent this guidance applies to federal facilities renewal strategies or similar topics. Study of the guidance makes it clear that OMB Circular A-123 does apply to federal facility renewal strategy implementation, but there is little evidence that agencies are aware of this or understand how to apply the guidance provided.

Review of OMB Policy Supportive of Federal Facility Asset Management

The committee found one additional OMB policy area limiting to federal facility asset management, a topic broader than developing federal facility renewal strategies: OMB Circular A-11, Section 83 (Object Classification). As stated, "Object classes are categories in a classification system that presents obligations by the items or services purchased by the Federal Government" (OMB 2020b). While this convention is foundational to federal accounting structures, it also introduces a fundamental flaw detrimental to asset management and therefore to the implementation of federal facility renewal strategies.

OMB's definition of object classification focuses on the purchasing action and not on the asset. This convention is fully consistent with congressional oversight of executive branch expenditures, but also makes it exceedingly difficult to calculate or report expenditures consumed by individual assets or asset groups. This problem is related to the way federal contracts are let, which groups together work performed on many assets. Other problems are introduced when one type of

purchase (e.g., personnel compensation or fuel oil) is not traceable to individual assets or groups of assets given current accounting practices.

OMB's current object classifications, as implemented through agency financial accounting policies, do not support simple accounting practices to determine the amount of appropriated funds expended on specific assets or asset management activities managed through federal facility renewal strategies. As a result, it is exceedingly difficult to determine what money is spent on what facility asset. This makes it nearly impossible to compute total ownership costs and life-cycle costs for assets and asset groups, although doing so is fundamental to facility investment decision making.

This means federal real property asset managers are unable to evaluate basic resource-and-investment decision-making objectives, such as how performance is affected by a 5 percent reduction in maintenance budgets. Absent a correction to OMB's object classification convention, federal agencies will continue to be unable to produce requirements-based budgets supporting implementation of federal facility renewal strategies as detailed in this report. This topic is further addressed in Appendix F, through development of the accounting transparency principle and in Recommendation 1 (see Chapter 7).

Real Property Capital Plans

The last topic, also covered in Appendix E, is real property capital plans. OMB M-20-03, "Implementation of Agency-wide Real Property Capital Planning" requires agencies to demonstrate evidence of compliance with OMB Circular A-11 through implementation of their agency capital plan. Guidance detailing real property capital planning links back to the Capital Programming Guide and its description of an agency capital plan. In this report, the agency capital plan and OMB M-20-03's real property capital plan specification are understood to be the same thing. Specifically, it is understood that OMB policy through M-20-03 requires agencies, for the first time ever, to evaluate and report value to be generated from real property in their real property capital plan. OMB M-20-03 directs the FRPC to act as the authority for reviewing real property capital plans, determining their adequacy in managing agency facility portfolios, and supporting achievement of agency mission objectives.

CONCLUSION

This chapter builds from the problem statement established in Chapter 1 and details the basis and foundations for asset management to serve as the means to generate federal facility renewal strategies. Combined, these chapters make clear a progression of federal facility asset management advancements spanning more than a half century. They also illuminate the need and opportunities for improvements. Findings derived from this review are as follows:

Finding 2-1: Federal facility asset management should be defined as a fiduciary responsibility implemented as a disciplined approach through policy that promotes asset management system thinking, such as defined in the ISO 55000 Asset Management System standards series.

Finding 2-2: Current OMB policies provide substantial structure defining the operating context for federal facility renewal strategies but fail to support agency development of effective facility asset management systems needed to implement these strategies as defined. This includes the need for immediate attention improving OMB Circular A-11, Section 83 (Object Classification) to support federal facility asset management.

Finding 2-3: Work advancing a national strategy for federal real property is moving in a positive direction, but policy changes are needed to evolve it into a national strategy for federal facility asset management supportive of implementing federal facility renewal strategies as defined in this report.

Finding 2-4: Work supporting the emergence of real property capital plans is moving in a positive direction, but policy changes are also needed to promote its use for reconciling objectives, strategy, budget, and facility performance to support evidence-based decision making for agency mission achievement.

The next chapter will identify leading industry and international standards advancing asset management systems and principles, and introduce a series of principles needed to establish elements of facility renewal strategies.

3

Federal Facility Asset Management Systems

> Strategy without tactics is the slowest route to victory. Tactics without strategy is the noise before defeat.
>
> —*Sun Tzu*

INTRODUCTION

The preceding chapters frame this report's objectives and operating context for federal facility renewal strategies. This chapter builds on these by defining how a facility asset management system works. Neither the Office of Management and Budget (OMB) Circular A-11 nor A-123 defines what a facility asset management system looks like or how management functions are related. They only define behaviors or outcomes of what facility asset management systems do or accomplish.

Using the chapter's opening quote for context, facility asset management systems are used to organize the tactics for implementing federal facility renewal strategies. This is consistent with the standards in International Organization for Standardization (ISO) 55000, which when applied make federal facility real property capital plans the means for guiding and communicating tactical actions.[1]

To accomplish this, agencies must employ management system thinking and change their approach to facility resource-and-investment decision making. This level of change is required to incorporate federal facility asset management as a fiduciary responsibility. As defined in ISO 55000, a *management system* is a "set of interrelated or interacting elements of an organization to establish policy and

[1] Appendix C provides an expanded discussion of the material in this chapter.

objectives and processes to achieve those objectives" (ISO 2014c, § 3.4.2). This report applies this definition and expands it to encompass the concept of management system thinking activities, including change management, which are needed to implement facility asset management systems as the precursor to generating meaningful and impactful federal facility renewal strategies.

This chapter will cover these topics, provide examples of management system thinking, and introduce facility asset management principles that agencies can use to incorporate facility management systems into their overall management approach and implement facility renewal strategies.

MANAGEMENT SYSTEM THINKING

The way the U.S. federal government is managing its facility assets is not working. Or more directly, paraphrasing Albert Einstein, sometimes we cannot solve our problems with the same thinking we used when we created them. To solve this problem, we need management system thinking.

Management system thinking is used to operationalize asset management systems, standards for which are detailed in ISO 55001 (ISO 2014b), which can be used to evaluate compliance of an organization's asset management system. While doing so represents a step toward an organization gaining ISO 55001 certification, the committee does not recommend that agency facility operations be ISO 55001 certified. Instead, it strongly recommends that agencies gain knowledge of ISO 55001 asset management system requirements and use this knowledge to guide development of federal facility renewal strategies.

National Research Council[2] reports on federal facilities management include *Committing to the Cost of Ownership: Maintenance and Repair of Public Buildings* (NRC 1990); *Stewardship of Federal Facilities: A Proactive Strategy for Managing the Nation's Public Assets* (NRC 1998); *Investments in Federal Facilities: Asset Management Strategies for the 21st Century* (NRC 2004b); *Core Competencies for Federal Facilities Asset Management Through 2020* (NRC 2008); and *Predicting Outcomes of Investment in Maintenance and Repair of Federal Facilities* (NRC 2012b). These reports demonstrate that the problem of underinvesting in facilities, causing ever-increasing maintenance backlogs, has been recognized for decades and likely longer. Since it started producing the Infrastructure Report Card in 1998, the American Society of Civil Engineers has rated the U.S. infrastructure at an overall D or D-plus with one exception: in 2020 it rated U.S. infrastructure at a C-minus. Furthermore, the Government Accountability Office (GAO) placed Department of Defense facilities on their High-Risk list in 1997 (GAO 1997) and added the whole federal facilities portfolio to this list in 2003 (GAO 2003), where they have remained ever since. These respected,

[2] Prior to July 1, 2015, reports of the National Academies of Sciences, Engineering, and Medicine were authored by the National Research Council.

independent sources generally agree on the problem: Underfunding in facilities and infrastructure is bad and increases the risk to the organization's ability to achieve its mission objectives.

Could it be that the reason these problems have been unresolved for decades is that we are looking at the problem in the wrong way? This section explores this question and introduces new perspectives. Facility planners, architects, engineers, specialists, and managers understand how facilities operate and what is needed to sustain their operations. This report frames this objective around the concept of *renewal*, meaning that facilities, and more broadly facility portfolios, serve to keep the organization fresh and vigorous and able to achieve mission objectives continually. By logical extension, the facility portfolio's good repair, functional capabilities, and ready availability are critical to achieving this objective. This perspective has focused problem-solving on perfecting ways to deliver and maintain needed facilities, representing what this report calls *classical facility management thinking*.

Management system thinking, as introduced in this report, seeks to manage the value generated by facilities, changing the focus from managing assets to managing the value derived from them. To accomplish this, management system thinking focuses on leading indicators of performance, viewing *inputs* as objectives, strategies, plans, standards, processes, and resources. *Outputs* are viewed as efficient, effective facilities. *Outcomes* are the agency benefits, capabilities, and value realized from facilities. Generally, outputs are defined in terms of facility performance, and outcomes are defined in terms of products, services, and assurances generated by the agency fulfilling its mission.

The leading, authoritative source defining management systems that employ management system thinking is ISO. Over the past few decades, ISO has systematically evolved management system thinking across many management disciplines, published in more than 80 standards. Well-known ISO management system standards include ISO 9001—Quality Management (ISO 2015a) and ISO 14001—Environmental Management (ISO 2015b). Other management system standards cover information security management, occupational health and safety, facility management, human resource management, and innovation management.[3] Management system thinking provides the means to identify stakeholders, their needs, and how their needs are translated to policies, objectives, and processes designed to achieve these objectives. For the given problem set, the best management system standard series is ISO 55000—Asset Management. As defined by ISO, *asset management* does not focus on the asset, but on the value generated by the asset. This standard series covers the following four published standards:

- ISO 55000—Asset Management—Overview, Principles, and Terminology,
- ISO 55001—Asset Management—Management Systems—Requirements,

[3] For more information on ISO management systems, see https://www.iso.org/management-system-standards.html.

- ISO 55002—Asset Management—Management Systems—Guidelines for Application of ISO 55001, and
- ISO 55010—Asset Management—Guidance on the Alignment of Financial and Non-financial Functions in Asset Management.

These asset management standards are referred to collectively as "ISO 55000" throughout this report.[4] ISO Technical Committee 251 manages these standards and has produced an article titled "Managing Assets in the Context of Asset Management" (Dempsey 2017), which adeptly contrasts classical facility management thinking and management system thinking as presented in this report. A summary of this comparison and an excerpt from the article are provided in Table 3-1.

This article compares *managing assets*, a classical facility management thinking perspective, to *asset management*, a perspective that applies management system thinking. The basic point made in the article—and used with purpose in this report—is that both are critical to successful federal facilities management. The committee agrees with this premise but believes that management system thinking is the viewpoint needed to develop and implement impactful federal facility renewal strategies.

This distinction is important because most facility management strategies used by agencies today are dominated by classical facility management thinking—that is, figuring out how to better manage assets. Although this is an important perspective and always will be, this report focuses on how to generate value through better federal facility renewal strategies. The committee views this as an asset management problem in need of an asset management solution. This key concept is important for understanding the report's findings and recommendations. It also highlights a requirement for agencies to establish facility asset management systems to generate effective, impactful federal facility renewal strategies. Implementation of this perspective will be improved when federal policy recognizes federal facility asset management as the means to fulfill an agency's fiduciary responsibility to renew its facility portfolio efficiently and effectively.

Facility Asset Management System Definition

The purpose of federal facility renewal strategies is to ensure and assure that federal facilities are being used to achieve the agency's mission efficiently and effectively. Execution of this strategy requires tactics, such as how to perform planning, prioritize resources, and operate and maintain facilities. These tactics are organized through a disciplined facility asset management system—one of

[4] The exception to this is when referring to the ISO 55000 standard separately. When this is the case, it will be referred to as "ISO 55000, Asset Management—Overview, Principles, and Terminology."

TABLE 3-1 Classical Facility Management Versus Management System Thinking

When you listen, what are others <u>really</u> focused on?	
Managing Assets	Asset Management
Your **colleagues** are focused on: • Asset data, location, and condition assessment • Current KPIs[a] • Department budget	Your **colleagues** are focused on: • Information supported decisions (strategic context and related to customer needs) • Strategies to select and exploit assets over their life cycles to support business aims • Collaborations across departments to optimize resources allocated and activities
Your **stakeholders** are focused on: • Costs • Current performance • Response to failures/maintaining function	Your **stakeholders** are focused on: • Triple bottom line and value • Clarity of purpose of the organization • Focus on impact of activities on organization's objectives
Your **top management** is focused on: • Short term gain/loss • Departmental/individual performance • Savings, especially OPEX[b]	Your **top management** is focused on: • Long-term value for the organization • Developing competence and capability across workforce • Business risks understood and mitigated
Your **suppliers** are focused on: • Short-term contracts and performance • Service-level agreements are focused on contract specifications	Your **suppliers** are focused on: • Long-term contracts and/or partnering relationships in support of client value and objectives • Understanding client strategy and needs in 5-10 years

[a] KPI = key performance indicator.
[b] OPEX = operating expenditure.
SOURCE: © ISO. This material is reproduced from Asset Management First Edition ISO/TC WG4 (white paper) with permission of the American National Standards Institute (ANSI) on behalf of the International Organization for Standardization. All rights reserved.

many management considerations used by an agency. As a guide, ISO 55000 defines asset management key terms and relationships applicable to federal facility asset management, as shown in Figure 3-1.

Figure 3-1 establishes alignment between the agency's facility portfolio and mission objectives. Within an ISO 55000–based facility asset management system, the facility portfolio is the generating source for value. Connecting the dots is the asset management system, which coordinates management activities defined in terms of policies, doctrine, objectives, organizational structure, information technologies (IT), and processes.

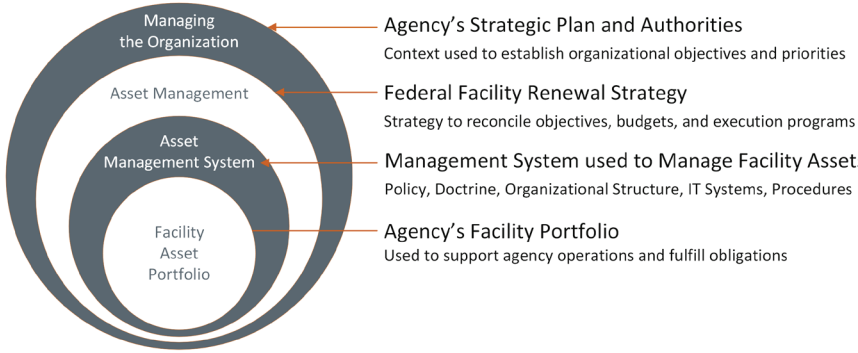

FIGURE 3-1 Relationship of key terms relating a facility asset management system to an asset management system, based on ISO 55000.
SOURCE: © ISO. This material is reproduced from ISO 55000:2014 with permission of the American National Standards Institute (ANSI) on behalf of the International Organization for Standardization. All rights reserved.

This approach applies management system thinking to focus on how to make good resource-and-investment decisions. Management system thinking is used to implement an asset management system, which in turn is used to generate the agency's facility renewal strategy. This strategy coordinates resource-and-investment decisions related to managing facility assets. Finally, in managing the organization, the ultimate determinant of asset management success is a well-functioning facility portfolio that generates value in the form of mission support that helps the agency achieve its mission objectives efficiently and effectively. In its fullness, as outlined in Chapter 1, this elevates federal facility renewal strategies into an overarching policy that guides resource-and-investment decision making across the agency's whole facility portfolio, whole facility life cycles, and whole mission sets—which is also the stated requirement of the agency capital plan defined in OMB Circular A-11 Supplement—Capital Programming Guide (OMB 2022b).

FACILITY ASSET MANAGEMENT SYSTEM FRAMEWORKS

Facility asset management systems are implemented through frameworks. This section introduces two frameworks helpful to agencies seeking to establish or improve their facility asset management capabilities. The first framework, shown in Figure 3-2, depicts how facility asset management aligns with OMB Circular A-11's Performance Management Framework.

As covered in this framework, OMB Circular A-11 requires agencies to establish a strategic plan. This plan typically involves several subordinate plans.

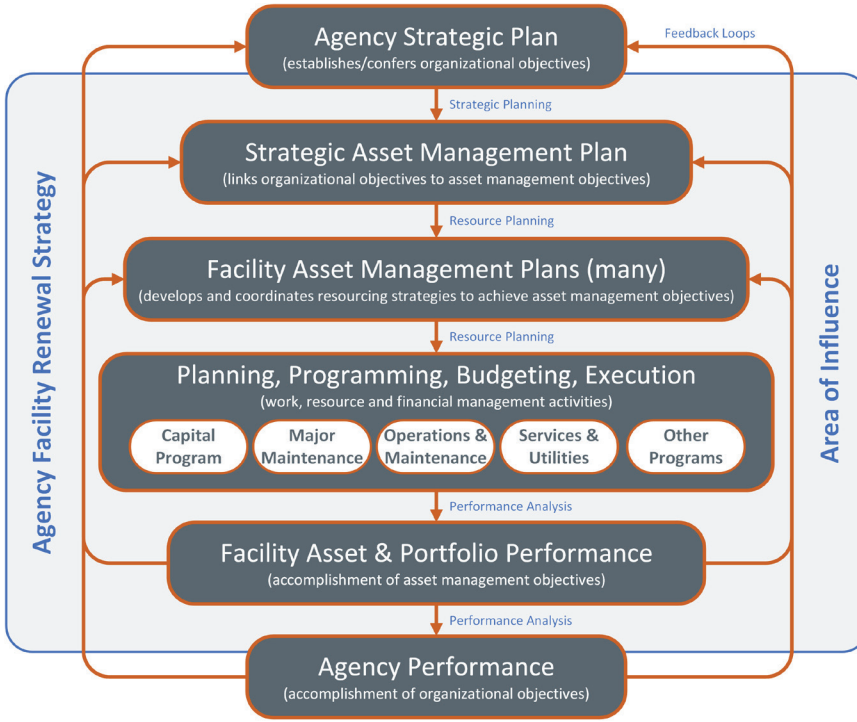

FIGURE 3-2 Facility asset management system framework.

While some of these plans will state specific facility needs and requirements, in most cases, this support is assumed or inferred, meaning the objective of effectively sustaining existing facilities to support agency mission operations may not be clearly stated—or often, not even mentioned—in high-level strategic plans.

As detailed in the previous chapter, the Capital Programming Guide, combined with OMB M-20-03, requires agencies to establish and implement a real property capital plan (OMB 2019). In ISO 55000 terms, this is called a *strategic asset management plan*, defined in the context of an organization's asset management system. This approach is consistent with federal policy governing a real property capital plan. In alignment, a real property capital plan translates strategic planning objectives into actionable facility asset management objectives. This is because strategic planning objectives do not often, or at all, specify facility asset or portfolio performance objectives; they are simply inferred. The purpose of these facility asset management objectives is to define how facility performance links to agency performance in a way that guides facility resource-and-investment decision making. In the context of this report, the real property capital plan is

the artifact and communication strategy that states the agency's facility renewal strategy.

Subordinate to the agency's real property capital plan are many other plans. Each focuses on different subset objectives—for example, installation master plans; capital investment plans; or environmental, energy, resiliency, and security program objectives. Other facility asset management plans may focus on specific management initiatives or be organized using the agency's organizational structure or geographical regions or relationships. Often these efforts are orchestrated through dedicated planning activities, such as master planning, focus studies and investigations, market surveys, and facility assessment programs. Collectively, subordinate facility asset management plans all seek to execute asset management objectives coordained by the real property capital plan. Also, consistent with the Capital Programming Guide requirements (OMB 2022a), the purpose of these plans is to inform resource-and-investment decision making, ultimately leading to development and execution of the agency's budget.

Resource-and-investment decision making is coordinated by agency planning, programming, budgeting, and execution (PPBE) policy. As covered in Chapter 2, OMB Circulars A-11 and A-123 contain detailed requirements all agencies must follow when executing appropriated funds. Activities at this level are generally focused on executing different funding streams aligned to the agency's authorities and appropriations, an activity involving many steps and procedures. Supporting methods for implementing federal facility renewal strategies are detailed in Chapters 4 and 5. At this point, it is sufficient to say that this involves management system thinking championed by executive leadership and often involves technology enablement and organizational change management. It is also important to note that PPBE policy only covers resource management tactics (e.g., developing budgets, allocating funds, prioritizing work) as opposed to asset management tactics (e.g., optimizing resource and mitigating risk to mission execution). Specific tactics are related but different in that resource management focuses on how to manage use of resources, while asset management focuses on the value generated by assets. Objectives to be achieved through PPBE activities are established in the real property capital plan and conferred through subordinate facility asset management plans.

It follows that the real property capital plan and subordinate facility asset management plans must also establish facility performance objectives. This is an ISO 55000 requirement implemented through enterprise risk management and internal controls detailed in OMB Circular A-123 (OMB 2016). A basic principle of asset management is that resource decisions should only be made in relation to achieving measurable performance objectives. Furthermore, it is prudent to report, verify, and validate achievement of facility asset management performance objectives through periodic assessment protocols organized by the asset management system. The most common forms of this are requirements-based

budgeting, planned-versus-actual performance analysis, performance–cost balance sheet analysis, and performance–cost forecasting.

The last part of this framework is agency performance. This step seeks to assure that agency strategic objectives are achieved. The best time to obtain this assurance is in cycle with the agency's PPBE process when establishing future budgets, which is consistent with the Capital Programming Guide (OMB 2022a). Simply put, this activity seeks to confirm that the current facility renewal strategy is meeting the agency's mission needs. If not, it also involves figuring out what needs to be done to make improvements that ultimately produce desired agency performance outcomes. This and the preceding performance step highlight another asset management principle: feedback loops must be clear and impactful to ongoing planning activities if the asset management system is to conform with ISO requirements.

As highlighted in the gray background in Figure 3-3, the agency facility renewal strategy area of influence ranges from the agency strategic plan to agency performance. It covers all aspects of agency facility resource-and-investment decision making. Its purpose is to guide facility decision making to best support agency mission achievement using tactics organized by the agency's facility asset management system.

The second framework helpful to implementing facility asset management systems is also shown in Figure 3-3. This framework depicts the anatomy of a facility asset management system.

A description of the facility management system anatomy follows. See also Appendix C, which applies this anatomy more specifically to strategies for communicating an agency's federal facility renewal strategy.

0 *Mission execution* is defined by the agency's operating context and prescribed through the agency's authorities, policies, and mission. This is Step 0 because it is considered outside of the scope of the facility asset management system. It is, however, influential in defining its purpose and operating parameters.

1 *Organizational objectives* are conferred through the agency's strategic plan and supporting strategic guidance. In accordance with OMB Circular A-11, these sources establish organizational performance objectives and priorities.

2 *Facility asset management objectives* are developed to ensure achievement of objectives established in the agency's strategic plan. Facility asset management objectives translate esoteric and aspirational strategic plan objectives into practicable facility management performance objectives that can be understood easily by facility users and managers. Examples include condition, functionality, utilization, and availability criteria and performance objectives. Facility asset management objectives must also be established using specific, measurable, attainable,

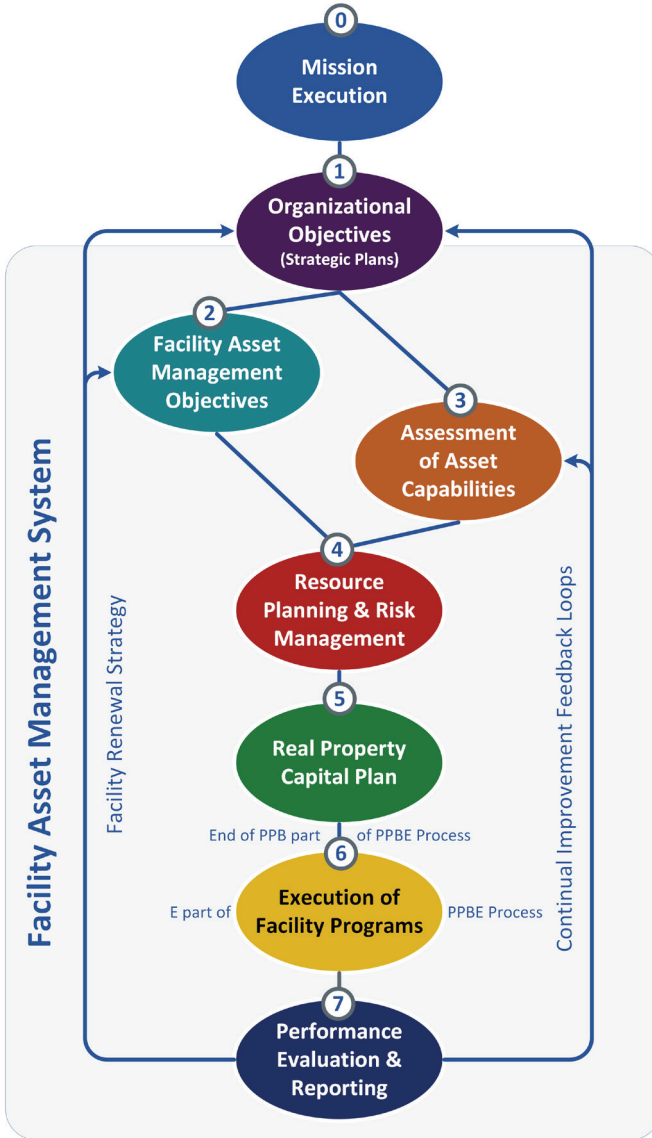

FIGURE 3-3 Facility asset management system anatomy.
SOURCE: Courtesy of J. Dempsey, founder, Asset Management Partnership, LLC.

relevant, time-bound (SMART) criteria and thresholds that double as performance baselines and reporting for planning and resource-and-investment decision making.

3 *Assessments of asset capabilities* report performance of the agency's facility assets and portfolio compared with facility asset management objectives. Information is typically obtained through facility assessments, inspections, analysis, and studies to include master planning, condition assessment, space studies, and application of data science techniques. A requirement is a gap found between an asset management objective and a facility's actual performance that requires work to mitigate or remove, ranging from performing a maintenance work order, executing a repair project, or building or acquiring a new building, to a major activity such as moving capabilities from one location to another or bringing on new capabilities in response to dynamic mission needs.

4 *Risk management and resource planning* is a gap assessment process and planning activity. It includes comparing facility asset management objectives with assessed facility asset and portfolio capabilities, and developing action plans to address resulting requirements. This planning sets the context for the facility asset management plan while considering resource and capability limitations as required by OMB Circulars A-11 and A-123.

5 *Real property capital plans* report on the culmination of previous steps and collectively state the agency's facility renewal strategy. Through incorporation, the agency's real property capital plan includes all subordinate facility asset management plans, becoming the focal point for integrating and reconciling resource-and-investment priorities. In the ISO 55000 context, this is the agency's facility strategic asset management plan. Work includes:

- Establishing facility asset management objectives linked to agency strategic objectives and priorities,
- Establishing and justifying budgets to achieve these objectives,
- Planning and prioritizing facility requirements responding to these objectives,
- Developing plans to execute prioritized requirements, and
- Establishing performance baselines to manage and continually improve work execution.

It is typically left to subordinate facility asset management plans to develop specific execution plans for specific facility programs and management areas. In this planning context, the agency real property capital plan represents the focal point of an agency's facility renewal strategy. It is through the real property capital plan that the agency plans budget

execution and performs the supporting enterprise risk management and internal controls dictated in OMB Circular A-123. It is also through these activities that many planning, programming, and budgeting actions detailed in the agency's PPBE process are completed.

6 *Execution of facility programs* seeks to achieve objectives conferred through facility asset management plans that are coordinated by the agency's real property capital plan. These activities also represent the execution portion of the agency's PPBE process and management of work in response to facility requirements. On the whole, supporting activities seek to execute established plans and manage change given dynamic working conditions and operating environments.

7 *Performance evaluation and reporting*—the last step in the facility asset management system anatomy—is both an ending and a beginning. It is an ending because it performs a final assessment on the performance of the agency's facility renewal strategy. This includes performance reporting on facility asset management objectives and their contribution to achieving broader objectives enumerated in the agency's strategic plans. It is also a beginning because it starts the next planning cycle. This is completed through feedback loops, principally in the form of planned-versus-actual comparisons, trend analysis, internal audits, and management reviews.

The committee deems this anatomy a critical missing link to guidance that should be covered in OMB Circulars A-11 and A-123, as detailed in Chapter 2. A final representation of the facility asset management system anatomy is mapping it to ISO 55001—Asset Management System Requirements, Standard Clauses, as shown in Table 3-2. ISO 55001 stands out for this purpose because it is the only one that defines requirements for asset management systems. Note that ISO 55001 asset management system requirements start at Clause 4 with the preceding clauses covering standard requirements for ISO standard use.

This mapping shows how the facility asset management system anatomy detailed above is covered in full by ISO 55001. This is important because, as detailed in Chapter 2 and further developed in Appendix C, neither OMB Circular A-11 nor A-123 defines what a facility asset management system looks like or how many management requirements are related. They only define behaviors or outcomes of what a facility asset management system would do or accomplish. As stated in these OMB policies, agencies are expected to apply requirements and guidance contained in each to develop facility asset management systems that best apply to their specific circumstances. This report recommends that ISO 55000 standards be used to fill this gap in guidance.

OMB's policy approach assumes agencies are equipped to understand and fully comply with its circulars and memorandums. As detailed in GAO-19-57, *Federal Facility Asset Management—Agencies Could Benefit from Additional*

TABLE 3-2 Facility Asset Management System Anatomy and ISO 55001 Clause Comparison

Relationship Between Facility Asset Management System Anatomy and Asset Management System Requirements	ISO 55001 Clauses						
	4 – Context of the Organization	5 – Leadership	6 – Planning	7 – Support	8 – Operation	9 – Performance Evaluation	10 – Improvement
0 – Mission Execution	■						
1 – Organizational Objectives	■	■	■	■		■	
2 – Facility Asset Management Objectives		■	■	■		■	
3 – Assessment of Asset Capabilities			■	■		■	
4 – Risk Management and Resource Planning			■	■		■	■
5 – Real Property Capital Plan			■	■		■	■
6 – Execution of Facility Programs				■	■	■	
7 – Performance Evaluation and Reporting	■	■		■		■	■

SOURCE: Sourced from data in International Organization for Standardization, 2014, *ISO 55001: Asset Management—Management Systems—Requirements*.

Information on Leading Practices, this is not the case (GAO 2018f). To remedy this, the committee agrees with recommendations made in this GAO report citing use of ISO 55000 asset management standards as an appropriate, available, and authorized source for agencies to use in developing and implementing facility asset management systems (GAO 2018f). This position is further supported by OMB Circular A-119—Federal Participation in the Development and Use of Voluntary Consensus Standards and in Conformity Assessment Activities, whose criteria meet the ISO 55000 asset management standards established in OMB Circular A-119.

In conclusion, two frameworks used to define facility asset management systems were presented in this section—the facility asset management system framework and the facility asset management system anatomy. Both support and implement requirements and objectives detailed in OMB Circulars A-11 and A-123, and ISO 55000. Both are presented as generic frameworks that represent, but do not dictate, how an agency would define its facility asset management system. These frameworks also inherently enable effective communications of an agency's renewal strategy. As will be detailed in the committee's recommendations, supported by the findings below, a disciplined facility asset management system that employs management system thinking is a prerequisite to implementing effective, impactful federal facility renewal strategies.

Finding 3-1: Development of federal facility renewal strategies requires the use of disciplined facility asset management systems employing "management system thinking." Management system thinking evaluates resource-and-investment decision making from the perspective of how facilities generate value for supporting agency mission achievement. This perspective is different from the way most agencies now evaluate facility resource-and-investment decision making, which is generally biased toward facility life-cycle management value propositions, referred to as "classical facility management thinking."

Finding 3-2: OMB policy, notably Circulars A-11 and A-123, does not provide sufficient guidance on how to implement and exercise facility asset management systems capable of generating federal facility renewal strategies detailed in this report. The ISO 55000—Asset Management System standards series is an appropriate, available, and authorized resource able to fulfill this need. Use of this standard also satisfies policy and objectives detailed in OMB Circular A-119.

Finding 3-3: Effective communications of federal facility renewal strategies are advantaged when they conform to clauses pertaining to facility asset management systems in ISO 55000.

PRACTICAL EXAMPLES AND EMPIRICAL EVIDENCE OF FACILITY ASSET MANAGEMENT SYSTEMS IN USE

To evaluate and better understand problems facing facility owners, the committee met with many public and private organizations to gain perspectives on how they have implemented facility asset management solutions. These organizations have applied frameworks described in the preceding section to manage the value generated by facilities rather than managing assets. A list of presenters to the committee is contained in Appendix B. The operating context, stakeholders, and missions of these organizations vary widely. Still, several common themes emerged that are supportive of asset management principles and requirements for implementing federal facility renewal strategies. This section shows that asset management is not a fad—it is being developed systematically, and in many ways organically, to improve facility performance supporting an organization's mission achievement. A summation of each theme follows.

Alignment with Organizational Objectives

Facility alignment with the organization's mission and needs was a paramount concern for all presenters. This alignment requires knowing who the key stakeholders are and knowing what they value. Each organization the committee

met with could clearly describe how stakeholder values were translated into organizational objectives and then in turn translated into facility asset management objectives. In doing so, they detailed deliberate steps to ensure that the appropriate stakeholders were engaged in this process. This is consistent with federal facility policy and supported as follows:

- OMB Circular A-11, Part 6 (Federal Performance Framework for Improving Program and Service Delivery) clarifies how the agency shall establish strategic goals according to their authorized mission and how these goals shall be developed to support operations and budget execution. Figure 3-4 provides an example from OMB Circular A-11 of how agency goals and objectives are structured to accomplish this. These requirements are further supplemented in OMB Circular A-123 by requiring that goal and objective development involve rigorous enterprise risk management and management controls. This level of disciplined attention would apply to federal facility asset management objectives enumerated by the agency facility renewal strategy.
- Both Army and Air Force representatives explained that the purpose of their agency's facility asset management activities was ultimately to achieve the U.S. National Defense Strategy (DoD 2018) and subordinate strategic plans and objectives. This includes responding to changes in the operating environment, which in the Department of Defense includes incorporating installation energy resiliency and protection from cyberattacks. This requires that they develop and incorporate supporting, actionable goals and objectives into their agency's facility renewal strategies.
- The chief financial officer (CFO) of the city government of the District of Columbia (2017) explained how the city's strategic plan establishes the context, parameters, goals, and objectives for financial planning to include renewal of the facilities and infrastructure it owns and operates. This plan includes developing strategies and plans for addressing deferred maintenance of its real property assets. In this context, focus on deferred maintenance was presented in the form of a business case that generated value in terms of both improved services and a better financial position for the city.
- Representatives from Howard and Marymount universities made clear that their efforts guiding facility renewal strategies must directly support their institution's educational mission and public image.
- The Air Force recently modernized its Mission Dependency Index (MDI) for installations worldwide. This activity measurably improved analysis linking facilities to mission execution. In this context, the MDI provides the logic bridge needed to ensure that facility resource-and-investment decisions align with the Air Force's dynamic mission needs; it is used to prioritize and program billions of dollars of work every year (USAF 2018).

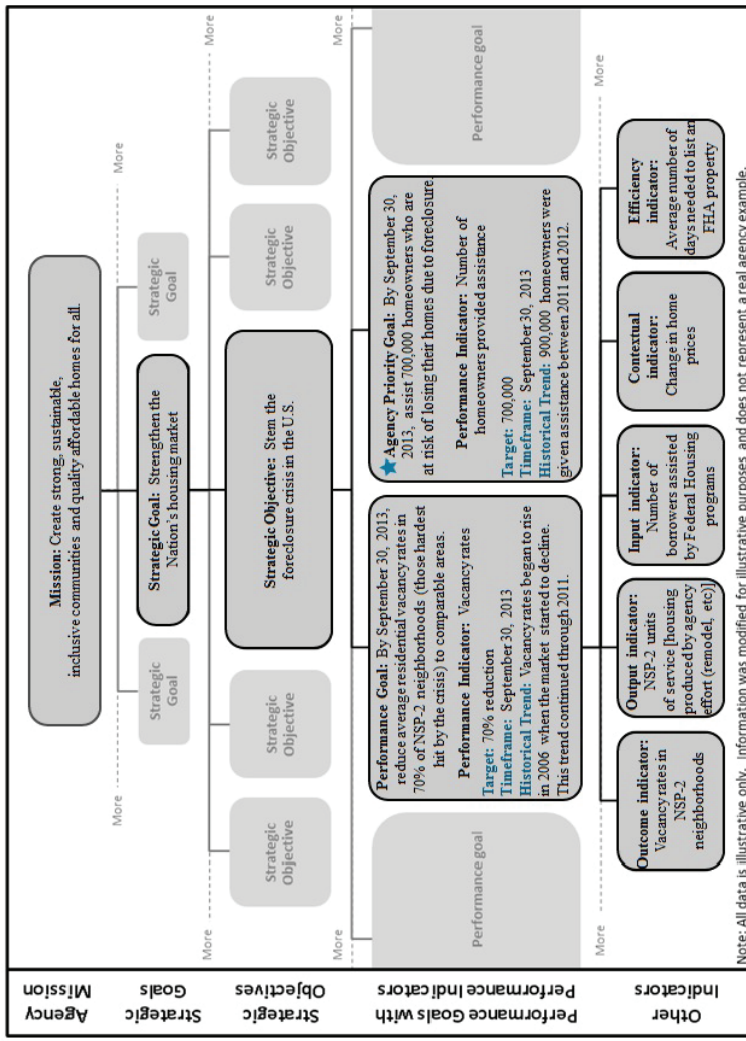

FIGURE 3-4 Example illustration of goal relationships.
SOURCE: Office of Management and Budget, 2020, Circular A-11—Preparation, Submission, and Execution of the Budget, Washington, DC, www.whitehouse.gov/wp-content/uploads/2018/06/a11.pdf.

Resource Management Integration

Asset management can be viewed as the means to translate potential energy (funding) into kinetic energy (work). Given that federal facility renewal strategies are ultimately an investment strategy seeking to generate a return on investment, it was no surprise that many organizations with which the committee met focused their asset management activities on financial decision making, or more broadly, resource management. Leading examples include the following:

- A representative from the Port Authority of New York and New Jersey (PANYNJ) detailed a broad vision using asset management to establish transparency and accountability, executing approximately $20 billion in mostly private investments in regional airports, including John F. Kennedy, LaGuardia, and Newark international airports. PANYNJ is using systematic asset management strategies to manage these capital investments and establish sustaining strategies for managing the capital assets delivered over their life cycle, including facility assets. This strategy aligns with the committee's framing of federal facility renewal strategies in this report.
- Lawrence Livermore National Laboratory (LLNL) has invested methodically in its facility asset management capabilities over the past 25 years. the MARS Cost Forecast System (now CostLab)[5] and the later integration of Builder, the U.S. Army Corps of Engineers' facility condition assessment tool, as well as the development of priorities and strategies using a mission dependency index like the one used by the Air Force and other agencies. LLNL targets a facility condition index (FCI) under 5 percent, where FCI is defined as the sum of maintenance requirements for a facility divided by present replacement value (PRV) of that facility. The outcome of this strategy has been that LLNL can maintain mechanical system life cycles economically and for much longer than design and manufacture estimates. In a broader analysis, LLNL found that for its mission, it could not tolerate an FCI greater than 9 percent on mission-critical buildings. LLNL also found that it needs maintenance funding greater than 2.5 percent of PRV to systematically reduce deferred maintenance backlogs.
- The District of Columbia's CFO detailed how their facility asset management strategy directly supported raising the district's bond rating from A to AAA, resulting in a 30 percent reduction in lending costs to serve its $26 billion infrastructure problem.[6] Elements of this success included having accurate inventories and work lists, effective stakeholder

[5] Developed by Whitestone Research, MARS was notably accurate with M&R cost forecasts found to be within 10 percent of actual cost over a 5-year period (2005-2009).

[6] Jeffrey S. DeWitt, chief financial officer, District of Columbia government, meeting with the committee on November 5, 2019.

communications, proactive management controls, and risk-based priorities that were linked to financial decision making. These are all fundamental and universal features of an effective facility asset management system.

Stakeholder Value Generation

In asset management, only one thing matters: value generation. As detailed throughout ISO 55000, stakeholders are the best judges on the value generated by facilities (ISO 2014a,b,c). The classical facility management thinking perspective discussed above links value to facility life-cycle management activities with the assumption that stakeholders agree with and understand this perspective. In management system thinking, however, the measure of value differs among stakeholder groups. By extension, this means that for a federal facility renewal strategy to be successful, it must be responsive to how different key stakeholder groups measure value.[7] Important points and reference examples supporting this objective include the following:

- OMB Circular A-11 requires federal agencies to develop budgets to achieve their authorized purpose. It also requires all federal managers to ensure that every dollar spent delivers value to the American people. Determining how federal facilities generate value for the American people requires complex asset management analysis. The performance management cycle detailed in this circular supports this analysis by requiring strategic plans to communicate agency mission, service, and stewardship objectives—inclusive of many different stakeholder group perspectives on value. These values, in turn, must likewise be represented in federal facility renewal strategies, given that they are designed to directly support agency mission and strategic plan objectives.
- On January 29, 2019, the Air Force commissioned its Infrastructure Investment Strategy (I2S), signed by the secretary of the Air Force and leading generals from every major command. This strategy clarifies the relationship between investments in installations and combat readiness—which the Air Force truly values. It further acknowledges that past strategies underfunded facilities, eroding the Air Force's power-projection capabilities. This strategy addresses these issues through a substantial, graduated increase in facility sustainment, restoration, and modernization (FSRM) funding. On budget, the amount of FSRM funding has increased more than 8 percent between fiscal years 2020 and 2026 to achieve the Air

[7] ISO 55002 has an excellent discussion on this topic in its annex titled "Consideration of 'Value' in Asset Management" (ISO 2014a).

Force's goal of 2.3 percent of PRV for a funding baseline.[8] Given the asset management value proposition presented in this strategy and supporting analysis, it was made clear that every investment in FSRM funding was also an investment in Air Force combat readiness.

- The New York Metropolitan Transit Authority (MTA) is the largest transportation agency in the United States, managing more than $1 trillion in capital assets, including passenger rail, bus, bridge, and tunnel infrastructure, and supporting an annual $1.4 trillion regional economy. A 2019 Ernst & Young analysis found that a $35 billion, 5-year capital investment in this infrastructure would generate more than $75 billion of statewide economic activity and create nearly 350,000 jobs throughout the state (MTA 2019). This study measured return on investment as the benefit from the capital assets, which formed the basis for investment business cases. MTA's capital program is further substantiated by earlier success based on asset management principles. For example, one asset management–based solution led to the "number of incidents that delay 50 or more trains dropped from 105 in January 2018 to 38 in August 2019. Over the same period, weekday on-time performance rose from 58% to 84%" (MTA 2019). All of these MTA business case examples were developed using its asset management system linked to what key stakeholders valued most.

It Is a Journey, Not a Destination

Finally, all presenters spoke of their facility asset management systems not only as a kit of parts, but as a continual improvement strategy used to implement the organization's policy. All discussed the need for better data, procedures, and IT systems, but framed it in terms of a need to advance communications, understanding, and learning. Having better data, procedures, and IT systems is not enough. Having the right data, procedures, and IT systems is important, but still not enough. Each organization with which the committee met spoke to their need for management system thinking to support critical self-evaluation and continual improvement.

OMB Memorandum M-20-10—Issuance of an Addendum to the National Strategy for the Efficient Use of Real Property underscores these ideas, stating that "further work is needed to develop a comprehensive and final strategy document" (OMB 2020a). This memo charts a direction involving research on policies and practices used by other organizations and outlines interim actions for the Federal Real Property Council to take. The memo also sets an investigative course on how to maximize the economic value generated by federal facilities for the American people. Simply put, OMB recognizes that implementation of better facility asset management capabilities is a journey and not a destination.

[8] Air Force Installation Mission Support Center correspondence, August 17, 2020.

In alignment with this report's recommendations, ISO 55000 standards provide a helpful roadmap for this journey.

FACILITY ASSET MANAGEMENT PRINCIPLES

This section completes the thought process contained in this chapter by presenting facility asset management principles. Principles and policy requirements are complementary, supporting facility asset management system implementation. While requirements are used to ensure that things are done right, principles are used to assure that the right things are done.

The following facility asset management principles, developed fully in Appendix F, establish concepts and practices foundational to management system thinking and facility asset management systems. Each principle serves a specific need for generating responsive and responsible federal facility renewal strategies. To do so, the committee proposes agencies use the following principles:

- *Data integrity.* Data used must be held to integrity standards determined by the facility asset management system's decision-making needs.
- *Whole life-cycle cost analysis.* Federal facility renewal strategies must cover whole life-cycle costs of the assets in their scope.
- *Portfolio management.* Federal facility renewal strategies must support the agency's whole facility portfolio, covering whole life-cycle and stakeholder requirements across whole mission sets.
- *Accounting transparency.* Federal facility accounting structures must support integrated and auditable analysis of financial and nonfinancial aspects to perform facility asset management activities supporting planned-versus-actual reconciliation of performance objectives.
- *Mission alignment.* Mission alignment of resource prioritization requires the use of validated and verifiable metrics to link the relative importance of individual facility assets to agency missions and stakeholder performance expectations.
- *Facility performance.* Knowledge of each facility asset's condition, functionality, availability, and utilization compared with agency-established standards is required to understand the capabilities and performance of facility assets and portfolios.
- *Decision-making alignment and accountability.* Facility asset management system decision making must integrate and reconcile objectives, resources, and performance management activities to promote stakeholder confidence in them.
- *Operational readiness.* The relationship between agency operational readiness and the levels of facility operational readiness delivered by federal facility renewal strategies must be balanced across a range of relevant investment horizons and resourcing strategies.

- *Performance–budget integration.* Investment decision-making frameworks must evaluate planned-versus-actual performance in a way that can simultaneously measure a performance gap (e.g., a requirement) and the means to remedy the gap related to budget development.
- *Balance sheet analysis.* Federal facility renewal strategies gain credibility based on their ability to reconcile a comprehensive and exhaustive set of facility requirements and capabilities against resources using a balance sheet analysis. In this context, a balance sheet involves a systematic reconciliation of needed and available capabilities enabled by facilities and their derivatives.
- *Facility asset management system maturity.* To ensure and assure that renewal strategies will lead to desired benefits, they must be supported by a facility asset management system that is periodically and rigorously assessed and reviewed using an objective maturity scale.

These facility asset management principles are intended to maximize the utility of facility asset management systems for generating federal facility renewal strategies. More information on facility asset management system principles can be found in ISO 55000—Asset Management Overview, Principles, and Terminology. This review leads to the following findings:

Finding 3-4: Facility asset management systems must be principle-based to ensure their alignment with value generation and desired benefits. Principles complement policy requirements. While requirements are used to ensure that things are done right, principles are used to assure that the right things are done.

Finding 3-5: Operational readiness should be used as the pinnacle principle for federal facility renewal strategy communications because it provides perspective by bringing together multiple criteria valued by stakeholders set within a resource-and-investment decision-making context.

Finding 3-6: Federal agencies can make use of the principles detailed in this report to evolve policies and implementation practices for strategic communication.

Finding 3-7: Federal agencies can communicate facility asset management objectives effectively through real property capital plans that define and maintain federal renewal strategies.

CONCLUSION

This chapter identified leading industry and international standards advancing asset management systems and principles and introduced a series of principles needed to generate federal facility renewal strategies. The next chapter describes the data and models for predicting renewal costs.

4

Improving Estimates of Renewal Costs

INTRODUCTION

Previous chapters introduced the concept of asset management planning and the foundation of statutes and regulations that govern the activity of the federal agencies' facility management activity. This chapter discusses the analytical tools and underlying data needed to estimate renewal requirements.

Accurately estimating renewal costs is the first step of justifying adequate funding, and the federal government depends on such estimates to guide its spending of billions of dollars annually for its facilities. For an individual structure, renewal costs are an essential input required for project development and economic analyses. For a facility portfolio, they are the basis for budget requests, strategic planning, investment decision making, and meeting federal reporting requirements.

Using what Wildavsky (1979) calls "analytical craftsmanship," estimates of renewal costs can be a powerful tool for advocacy.[1] Prepared poorly, such estimates can misalign with actual needs and lead to wasting chronically limited resources.

[1] "Craftsmen are judged by how they use their tools. Their handiwork is done individually but judged collectively. Are the data accurate, appropriate and manipulated according to prevailing standards? Is the evidence believable, coming from diverse sources, and tested for credibility? Are the arguments persuasive and balanced rather than one-sided? Does the analyst have a reputation for doing careful, accurate and, if called for, imaginative work? Do other analysts with different viewpoints, and other audiences who must be persuaded, find this analyst believable? Craftsmanship is persuasive performance" (Wildavsky 1979, p. 401).

EARLIER STUDIES

This report is the latest in a series produced by the National Academies[2] that has addressed estimating facility costs. In *Committing to the Cost of Ownership: Maintenance and Repair of Public Buildings* (NRC 1990), the authoring committee stated that routine annual maintenance and repair of a "substantial" building portfolio should range from 2 to 4 percent of aggregate replacement value. This range was sited again in *Stewardship of Federal Facilities: A Proactive Strategy for Managing the Nation's Public Assets* (NRC 1998) and the *Stewardship* committee also commented on the high cost of condition assessments and how their results become outdated quickly.

In *Intelligent Sustainment and Renewal of Department of Energy Facilities and Infrastructure* (NRC 2004a), the authoring committee recommended the Sustainment and Restoration & Modernization (S/RM) taxonomy shown in Table 4-1 and used the term *renewal* as interchangeable with *restoration* and *modernization*. Federal agencies were encouraged to consider using Department of Defense (DoD) models for estimating the two types of costs—the Facility Sustainment Model (FSM) and the Facility Restoration and Modernization (FRM) model.[3]

Key Performance Indicators for Federal Facilities Portfolios: Federal Facilities Council Technical Report Number 147 (NRC 2005a) noted that most performance metrics were financial; most commonly used to characterize facility condition was the facility cost index, the ratio of the cost of necessary repairs over the cost of replacement.

TABLE 4-1 Scope of Sustainment and Restoration and Modernization

Department of Defense Model	Cost Category
Facility sustainment	Preventive Maintenance, Minor Repair
	Unscheduled Maintenance
	Major Repair, Replacement
Facility Restoration and Modernization	Replacement due to Obsolescence
	Change in Use Modifications
	Policy-Mandated Retrofits
	Acts of War & Nature
	Repairs from Neglect
	Long-lived Components

SOURCE: Sourced from data in Whitestone Research, 2003, *Development of a Restoration & Modernization Requirements Process: Final Report*, Washington, DC.

[2] Prior to July 1, 2015, reports of the National Academies of Sciences, Engineering, and Medicine were authored by the National Research Council.

[3] See Janke and Lufkin (2005). The FSM is the only model still in regular use by DoD.

Also mentioned in the *Key Performance* report were the sustainment rate, the ratio of actual sustainment funding, and the predicted requirement based on the DoD sustainment model. The only nonfinancial condition measure noted was the building condition index (BCI), a weighted sum of costs of correcting inspection-based deficiencies, which were not used by any federal agency at the time of publishing.[4]

Predicting Outcomes of Investments in Maintenance and Repair of Federal Facilities (NRC 2012b) focused on ways to quantify investment outcomes, with an emphasis on risk. Recommendations regarding cost modeling included standardizing methods for data gathering, for decision support, and for outcome measures of investments in maintenance and repair. The 2012 committee advised federal agencies to use a knowledge-based approach for conditioning assessment and discussed the same approach for budgeting and risk analysis.

Having summarized comments on facility cost modeling in earlier National Academies' publications, the remainder of this chapter provides a typology of cost models and then reviews two specific models that might be used for estimating renewal requirements. The last section describes the pressing need for revised service-life[5] and depreciation rates, particularly for nonresidential structures.

THE EVOLUTION OF FACILITY COST MODELS

Methods for estimating repair and replacement costs have evolved with increasing computing capabilities and the growing demand for sophisticated planning tools. There are many different estimation models, varying in terms of scope, precision, and costs.[6] Table 4-2 compares the strengths, weaknesses, and applications of five common approaches.

- *Formula method*—A formula model is typically a single rate based on historical experience. Walter Kraft estimated annual maintenance and repair budgets for The University of Texas in the 1950s and 1960s by multiplying physical plant replacement value by a factor of 1.7 percent, with an additional 0.15 percent for air-conditioning (Gardner 1989). The formula method is good for a comprehensive, defensible summary of costs and requires little data. It is not applicable for specific buildings, particularly of different use types.
- *Delphi method*—The Delphi method is typically based on a simple rate or function defined by a committee of subject-matter experts. The most

[4] The BCI is a product of Builder, an assessment tool created by the U.S. Army Corps of Engineers (USACE) and discussed later in the chapter.

[5] The service life of an asset is the total period during which it remains in use, or ready to be used, in a productive process. During its service life an asset may have more than one owner (OECD 2001).

[6] In a study for the Air Force, Ottoman and colleagues (1999) identified 18 budget models "at our disposal in any fight with prospective budget cutters."

TABLE 4-2 Comparison of Five Cost-Estimating Methods

Method	Strength	Weakness	Application
Formula	• Simple • Stable over time • Objective • Inexpensive	• Misses oscillations in demand • Inflexible • Reflects historical errors	• Often extended to broad expense categories • Requires little data • Not applicable across institutions or for individual buildings
Delphi	• Simple • Stable over time • Authoritative • Inexpensive	• Subjective • Inflexible • Reflects actual experience, not necessarily ideal practice	• Either broad summary costs or specific subject • Limited to respective subject matter
Benchmark Survey	• Simple • Authoritative • Measured error	• Self-selecting sample • Inflexible • Reflects actual experience, not necessarily ideal practice • Costly to process	• Budget estimates for costs reflected in sample data • Limited to survey locations
Life Cycle	• Incorporates age • Objective • Proxy for costly inspections • Prescribed instead of actual costs	• Must know major system install dates and service lives • Tends to overestimate	• Usually limited to major repair and replacement costs
Simulation	• Multiple outputs • Very flexible • Objective	• Data intensive • Computationally complex • Limited transparency	• Potentially "cradle to grave" building costs • Dynamic staffing, resourcing, and risk analysis • Staffing, risk

common facility example is 2-4 percent of plant replacement value as an annual maintenance and repair guideline (NRC 1990). The authority of subject-matter experts is the greatest strength of the method, particularly when historical data are not available, but the scope of estimates is limited to the knowledge of the experts.

- *Benchmark survey*—A benchmark survey provides a rate or collection of rates defined by a survey of end users. Cost estimates based on survey results have the authority of experience, but sample size and the self-selecting nature of responses limit accuracy. Facility organizations conduct

annual cost-experience surveys for their respective constituencies—for example, the International Facility Management Association (public and private facilities), the Building Owners Management Association (office buildings), and APPA (educational facilities).

- *Life-cycle model*—The life-cycle model bases estimates on a schedule of major system replacements and their costs. Unlike earlier approaches, the life-cycle model incorporates the composition of the individual building and recognizes the oscillating nature of major costs as a building ages. In some applications, the assumption of a complete system (heating, ventilating, and air-conditioning; plumbing; exterior closure, etc.) replacement overstates actual costs of partial replacement and repair. There were many variants of the life-cycle model in the 1980s, with the Stanford model (Hutson and Biedenweg 1982) being the most well known. The Maintenance Resource Prediction Model (MRPM) was an innovative life-cycle model developed by the U.S. Army Corps of Engineers (USACE) that provided component-level cost estimates, although there is no evidence of widespread use (Neely et al. 1991). The Facility Sustainment Model (FSM) employed a commercial life-cycle model to estimate sustainment-cost factors (cost per square foot) for more than 400 categories of DoD facilities.[7] DoD publishes factors annually, and sustainment costs are a common reference point for actual expenditures. The scope of the FSM is shown in Table 4-1. The strengths of the FSM include its detail and objectivity. Unlike benchmark surveys, DoD based estimates from the FSM on published life cycles of individual components and represented "what should be spent" rather than summaries of actual expenditures.
- *Simulation models*—More of an exploratory environment than a single-purpose tool, a simulation model can provide detailed estimates of repair and replacement costs (individual building, components, labor, trade, etc.), staffing, and risk under a variety of utilization assumptions and funding levels. Desai (2012) offers a number of facility-related case studies. Simulation capabilities are available in at least one government-owned application and some commercial products.[8] Data storage and computational complexity require a dedicated application and trained users. Data acquisition and management costs are relatively high.

In a presentation to the committee, representatives from Lawrence Livermore National Laboratory (LLNL) described its use of simulations for successful

[7] The FSM was estimated with the MARS Forecast System, a commercial life-cycle cost product (Whitestone Research) that adopted concepts and initial data from the MRPM System, as did the maintenance and repair database annually published by R.S. Means.

[8] USACE's Builder tool has simulation capabilities, as does CostLab, a commercial simulation system developed by Whitestone Research.

advocacy,[9] summarized in Chapter 3. LLNL has an extensive history of cost modeling for the maintenance of nuclear weapons facilities that began with life-cycle modeling in the year 2000. Their modeling has progressed to an advanced simulation capability that calculates cost, risk, and LLNL staffing outcomes for alternative laboratory programs and funding assumptions. During this time, investment in infrastructure has grown from roughly $50 million to $200 million per year.

TWO APPROACHES TO ESTIMATING RENEWAL COSTS

Facility renewal is defined in Chapter 1 as extending an asset's functionality beyond its expected service life through significant renovation, replacement, or repurposing. This view is consistent with the DoD definition of recapitalization, as it "extends the service life of facilities or restores lost service life. It includes restoration and modernization of existing facilities, as well as replacement of existing facilities with new" (DoD 2016, § 080105). Given these similarities, the discussion in this section assumes the terms *renewal*, *recapitalization*, and *restoration and modernization* are equivalent, except where noted.

In concept, renewal restores or replaces an aging facility to achieve a contemporary level of mission-appropriate service and efficiency, and resets expected service life. In practice, renewal activities are sporadic and incomplete, seldom fully restoring the condition or value of a facility except in case of complete renovation or replacement. As noted in Chapter 1, few if any agencies have the consistent funding necessary to systematically renew their facility portfolio over time.

Estimating current renewal costs and predicting future costs is complex. Renewal consists of largely unrelated restoration and modernization requirements (shown in Table 4-1), and unlike for sustainment, there are no Delphic rules of thumb or predictable life cycles of maintenance and repair tasks. Simple subsystem replacement algorithms cannot incorporate the policy changes, technology retrofits, or random weather events that make up much of renewal requirements.

There is no widely accepted model for estimating the costs of renewal, but two approaches are reasonable candidates: the Builder system from USACE and the economic depreciation model used first by the Bureau of Economic Analysis (BEA), an agency of the Department of Commerce.

USING BUILDER TO ESTIMATE RENEWAL COSTS

Perhaps the most significant development in federal facility management in the last decade has been the rapid adoption of the Builder Sustainment Management System (Builder), an assessment and decision-support system for federal

[9] C. Shang, Y. Abed, and J. Farrell, 2019, "Science-Based Infrastructure Stewardship," presentation to the committee, November 11, 2019.

facilities.[10] Builder was developed in the 1990s, but adoption was fitful until its endorsement in 2012 by a National Research Council study (NRC 2012b) and the issuance of a directive in 2013 by the Office of the Secretary of Defense mandating its use across DoD (Frisinger 2013). According to USACE, by the end of 2020, Builder should have been used to inspect or import condition data for all DoD-owned or DoD-leased facilities—more than half of all federal facility assets. If fully implemented, Builder would create one of the largest real property databases of its type in the world.

The Builder system is, foremost, a building condition assessment tool. It provides a measure of the current physical condition of individual building components based on a fixed checklist of problems (distresses) and severity. A measure of overall building condition is based on the weighted combination of component condition.

The future condition of each component is predicted by a degradation curve that represents the relationship of the condition index and component age (see Figure 4-1). Key decision points or "sweet spots" provide a schedule of repairs and replacements that, combined with task costs, provide an estimate of future costs. The projections are presented as "satisfying requirements for long-term budgeting and sustainment, restoration & modernization planning" (Uzarski et al. 2018).

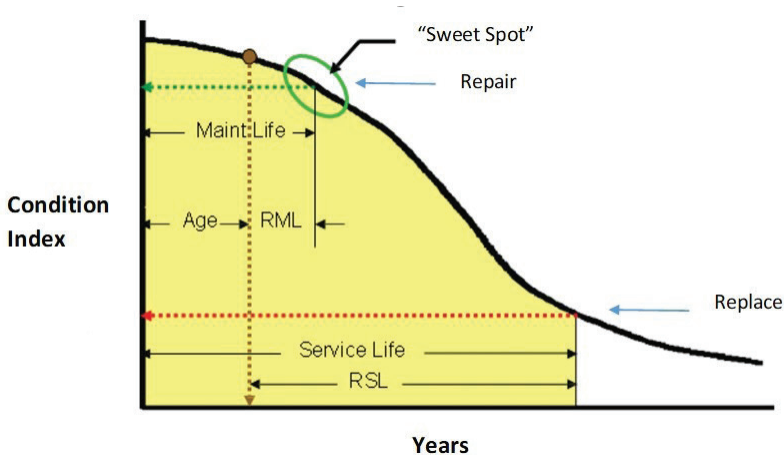

FIGURE 4-1 Condition degradation curve.
NOTE: RML = remaining maintenance life; RSL = remaining service life.
SOURCE: Adapted from figure courtesy of Dr. Uzarski, University of Illinois at Urbana-Champaign.

[10] For more information, see Sustainment Management System, https://www.sms.erdc.dren.mil.

Despite this capability, use of Builder as a cost prediction tool has been limited. One study found that among 11 federal agencies using Builder, none were using its forecasting and budget-related capabilities (Herrera et al. 2017). The study included early adopters—the U.S. Marine Corps (in 2008) and the U.S. Navy (in 2011) who presumably had time to implement the advanced capabilities if desired.

A second study (Lufkin 2020) of Builder focused on its cost-estimating capabilities. The study findings are highly critical of the system, raising questions about its ability to produce defensible results and meet the DoD mandate. Specific concerns included the following:

- The inspection process has not been validated according to common scientific standards. Overgeneralized inspection criteria (e.g., "broken," damaged," "deteriorated") invite inspector confusion and conflicting interpretation.
- Forecasts of future component condition and renewal costs are based on a "self-correcting" degradation curve that updates with every inspection. This less costly but unvalidated process replaced the definition of the curves by expert panels, a well-accepted approach used with earlier USACE systems.
- The optimum schedule of repairs and replacements is a product of "sweet spots" and "penalty costs" defined by the Builder user. This burdens the user with approximating unknowable decision factors and undermines the objectivity of predictions.
- Most critically, the scope of Builder inspections does not match the scope of renewal activities. Builder developers have stated explicitly that restoration and modernization data are not collected.[11]

The Independent Value of Component Inventory Data

To provide an estimate of building and component condition, Builder requires detailed component inventory data. Defined by inspection, or more likely by migration from an existing database, these data comprise the basic component information—description, location, size, quantity, and install date. These data are a valuable resource independent of Builder's analytical capabilities.

A typical building can have 50 to 75 components that could require repairs or replacement, while larger or more complex facilities might have hundreds of such components. Multiply this by hundreds of thousands of federal buildings,

[11] Committee interview with L. Marrano and M.N. Grussing, December 5, 2019.

and the aggregate component inventory is the largest database of its type—a unique resource for research, budgeting, and policy development.[12]

Finding 4-1: At this time, Builder is ill suited for estimating renewal costs. Its inspections do not collect restoration and modernization data, and its cost-forecast process has not been properly verified and validated.

Finding 4-2: The extensive component inventory created for use with Builder is, by itself, a valuable resource. After addressing privacy and security concerns, the inventory data could be made available to facility managers and qualified researchers. The data could also be used by other models capable of estimating renewal and other facility costs.

ESTIMATING RENEWAL COSTS WITH AN ECONOMIC DEPRECIATION MODEL

The structure value and productivity of a building diminishes with age (unlike land value, which tends not to depreciate and can vary with local economic conditions). The decline can be described as economic depreciation—the accumulation of wear and tear and obsolescence—that diminishes the services an asset provides and reduces its market value, even with regular maintenance and repair.

The causes of economic depreciation are roughly the same issues that lead to the need for facility renewal. The equivalence of the two concepts is found in tax policy, the regulation of public utilities, national accounting, and capital theory.[13] Given this equivalence, it is reasonable to assume that a method for estimating economic depreciation can also be used to estimate renewal costs.[14]

Recapitalization Rate

In the past, DoD relied on a simple form of depreciation for evaluating recapitalization funding. The recapitalization rate is the number of years required

[12] Builder will have been used to inspect 1.3 million square feet, or roughly one-third of the federal total, by 2020. Assuming the same proportion applies to buildings and an average of 75 components, there would be 8.9 million actual component records stored in Builder. In addition, the database could be reused as an input to other methods capable of forecasting sustainment and renewal costs.

[13] According to the U.S. Supreme Court, "Depreciation is the loss, not restored by current maintenance, which is due to all the factors causing the ultimate retirement of the property. These factors embrace wear and tear, decay, inadequacy and obsolescence" (*Lindheimer v. Illinois Bell Telephone Company*, 292 U.S. 151, 167 [1934]).

[14] It is important to note that economic depreciation does not include renewal costs such as change in use or policy-mandated retrofits that may improve the facility's mission-related activities, without changing its value or productivity or extending its service life. In this respect, depreciation-based estimates of renewal requirements are understated.

to replace all assets (or the average age at replacement) at a given funding rate. The recapitalization rate is calculated as R = PRV/restoration and modernization funding, where PRV is the plant replacement value, and R is the average service life at a given time.

Rearranging the calculation provides the economic depreciation rate and required funding. For example, in 2003, the weighted average service life of facilities in the DoD inventory was 67 years, and the PRV was $611 billion. Accordingly, the annual depreciation ($611 billion/67) would be an average $9.1 billion or 1.5 percent of PRV.

A problem with the recapitalization rate is that it assumes a constant value of depreciation (1.5 percent) over the facility service life. While a straight-line depreciation pattern for structures is common for tax purposes, it has no necessary connection with the way buildings actually age or how their productive capabilities (e.g., rent or conformance with established functional standards) decline.[15]

The Economic Depreciation Model

Despite its name, the economic depreciation model is really an investment guide. It informs the asset owner's ever-present choice to accept the current depreciated value or invest some amount that extends the asset's productive life and improves economic return. Depreciation measures the loss of productive capability over time that an asset delivers compared to when it was new. An estimate of this productive capability and its decline can be defined using the depreciation pattern. This approach can also be used to estimate the capital investment required to restore an asset's productive capability to a like-new condition.

In 1976, economists Hulten and Wycoff estimated depreciation rates for various structure types based on price data from a Department of the Treasury survey (Hulten and Wycoff 1980). They found a geometric pattern of depreciation, wherein the asset depreciates by a fixed percentage of its value over a given period, resulting in a final remaining productive capacity above zero, which represented well the decline of structure efficiency over time and estimated a set of depreciation rates that are still widely cited in practice.[16]

Estimates of renewal requirements using the straight-line depreciation pattern are much higher than those assuming geometric depreciation[17] with a 0.91

[15] See Gravelle (1999), for the history of taxation and the measure of economic depreciation.

[16] Professional building appraisers call the area under the depreciation curve the "percent good" (California State Board of Equalization 2012).

[17] Geometric depreciation is one of many types of economic depreciation. Other types of economic depreciation commonly used or referred to include straight-line depreciation, one-hoss shay depreciation, and hyperbolic depreciation, the latter with certain parameters.

declining balance, as shown in Figure 4-2, but lower than those with a 2.0 declining balance. The BEA uses a 32-year service life and a 0.91 declining balance rate for government nonresidential industrial structures.[18]

Balance rates are empirically derived rates used to calculate geometric depreciation rates by dividing the balance rate for each asset by the asset's assumed service life. For example, assume a double declining balance rate of 2. The service life of the asset is 10 years. The depreciation rate of the asset would be 2.0/10 = 20 percent. Another way to think of balance rates is as a multiplier of the comparable rate of depreciation that would be obtained for the first period of an asset's life using the straight-line method. If an asset has a 10-year life, the straight line depreciation per annum would be 10 percent. A balance rate of 2.0 is multiplied to this straight line rate: 2.0 × 10 percent = 20 percent depreciation rate. Under a 0.91 declining balance assumption, the average building of this type still retains 40 percent of its productive capability at age 32, the point at which all value is exhausted according to the straight-line pattern. Under a 2.0 declining balance assumption, the average government nonresidential industrial building of this type retains 13 percent of its productive capacity at the same age. The difference is reflected in the estimated renewal cost, meaning the annual renewal costs for government nonresidential industrial structures would be lowest with a geometric 0.91 declining balance rate and highest with a geometric 2.0 declining balance rate before age 26.

In the example provided the net result is 27 percent of the asset's productive capability, which equates to a range of capital investment required to renew the

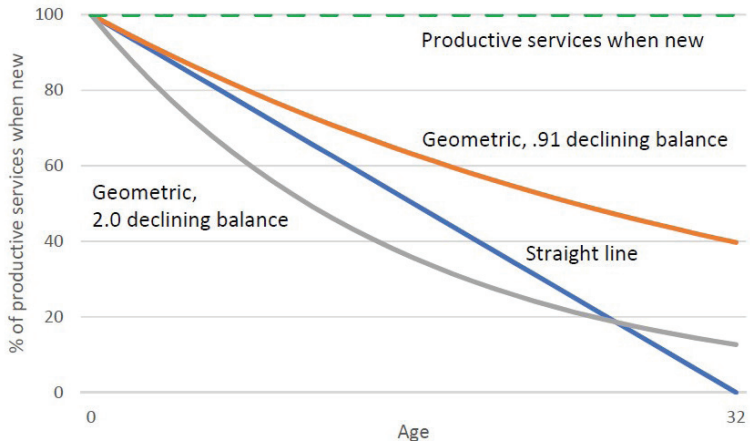

FIGURE 4-2 Alternative depreciation patterns for office buildings.

[18] See "BEA Depreciation Estimates," https://apps.bea.gov/national/pdf/BEA_depreciation_rates.pdf. Accessed November 2019.

asset to a desired level of capability. This leads to the observation that renewal cost is greater for structures with higher depreciation rates.[19]

The same magnitude of difference in estimates is found at the portfolio level. One study used geometric rates derived from Hulten and Wycoff to estimate an average annual restoration and modernization budget for all DoD real property in 2003. This estimate was $6 billion, or 1.1 percent of PRV—roughly 60 percent of the projection from the recapitalization rate—for the same year (Whitestone Research 2003).

The use of an economic depreciation model to estimate renewal costs is not new. In 2004, an NRC committee recommended use of the DoD recapitalization model to estimate renewal requirements for the Department of Energy (NRC 2004a). In 2005, the DoD model converted to the geometric depreciation rates favored by the BEA and expressed annual restoration and modernization costs as cost factors by the same facility categories as the Facility Sustainment Model (Lufkin et al. 2005).

An economic depreciation model is currently used by LLNL to estimate facility renewal (i.e., recapitalization) costs for National Nuclear Security Administration (NNSA) assets.[20]

Finding 4-3: Predicting federal investment requirements for facility renewal is difficult because they are noncyclical and consist of largely unrelated restoration and modernization costs. However, the geometric depreciation model addresses the same costs as those for restoration and modernization, making it a reasonable approach to estimating renewal requirements.

Finding 4-4: The DoD recapitalization metric was an estimation approach that was readily understood and easily applied by planners and facility management. The geometric depreciation model has greater technical credibility and can be just as convenient to use if renewal requirements are expressed as simple cost factors by facility category, similar to the DoD sustainment cost model.

[19] If there has been a 60 percent decline in the productive services that a structure can provide as determined by the depreciation rate, the cost of renewing the structure's productive services to the level provided when it was new may or may not be 60 percent of the cost of the structure when new even in the absence of inflation. Renewal costs depend upon restoration (repair and construction) costs, which do not depend on the depreciation rate, as these differ depending on the problem to be fixed.

[20] C. Shang, Y. Abed, and J. Farrell, 2019, "Science-Based Infrastructure Stewardship," presentation to the committee, November 11, 2019.

THE NEED FOR BETTER SERVICE-LIFE AND DEPRECIATION DATA

While an important input to an assortment of accounting and planning activities in the private sector, service-life estimates are also a principal requirement for cost modeling and budgeting for federal facilities. Yet there is no commonly accepted set of service lives for buildings or their components among federal agencies.

Building Service Lives

The difficulty starts with the definition. As Silva and colleagues (2016) and others have noted, there are at least three service lives for every building or component—the physical life during which the asset performs as specified, the functional life during which the asset best serves the institution purpose, and the economic life or "the period of time over which an investment is considered to be the least cost alternative for meeting a particular objective" (ASTM 1995). Each definition has a separate professional constituency—engineers, architects, energy specialists, economists—with sometimes conflicting priorities. Owners and operators replace equipment and entire buildings more often for changing use, aesthetics, or efficiency than for lack of physical durability.

There is no lack of potential sources for building service-life estimates. The U.S. Internal Revenue Service has provided service lives since 1918, although later versions changed with the evolution of tax policies. Regulated utilities report asset service lives at rate hearings and compile service-life data into an industry-wide summary, although it is confidential.[21] There are at least two international financial surveys (Japan and Canada) that report average asset service lives for tax purposes.[22] And at least three commercial publishers provide service-life estimates based on expert opinions and secondary sources. One of the most commonly used set of service lives comes from the BEA (Fraumeni 1997).[23] DoD considered all of these sources in a "best practices" survey in 2002 and did not find one comprehensive source for all facility categories (Whitestone Research 2002).

Regardless of their source, service-life assumptions can have a profound impact on cost estimates. For example, a revised set of service-life assumptions based on the 2002 survey led to a portfolio-wide average value of 34.7 years—almost half of the 67 years assumed in the previous DoD recapitalization

[21] This summary was compiled by the American Gas Association and the Edison Electric Institute at least through 2002.

[22] The National Wealth Survey conducted by the Japanese Ministry of Finance and the Capital and Repair Expenditures Survey by Statistics Canada.

[23] Current BEA service lives are available at https://apps.bea.gov/scb/account_articles/national/0797fr/table3.htm.

model. This would almost double the estimated restoration and modernization requirement.

There are a handful of methods used for defining the service life of building components. Perhaps the most common are point estimates provided by expert judgment, with manufacturers, service providers, and end users as sources. Replacement experience data are a growing resource with the ubiquity of maintenance management systems and extrapolation from condition-inspection tools for specific systems, such as Roofer and Paver, which have proven successful. Finally, simulations such as LLNL's risk calculation model can estimate the cost impacts of a range of component-level service-life assumptions.[24]

Depreciation Rates

Capital depreciation rates are primary inputs in estimating restoration and modernization rates using the economic depreciation model and, more broadly, for estimating the net value of national capital assets. The BEA maintains an aging set of rates for residential and nonresidential structures, which could be improved.

As Fraumeni (1997) explains, BEA depreciation rates consider the decline in productive capacity due to physical deterioration, normal obsolescence, or accidental damage. The depreciation rates for structures depend largely on estimates made by Hulten and Wykoff (1979, 1981a,b), mentioned in an earlier section.

The BEA grades the depreciation rates on their relation to the original Hulten and Wykoff findings. Type A rates are those for facility categories for which Hulten and Wykoff estimated age-price profiles. Type B rates are derived from research by others and Hulten and Wykoff judgment. Type C rates are not based on data, but are approximated using the average declining balance rate for all type A and B assets.

BEA has two broad categories of structures. Under the residential category, eight of the nine asset types have A-quality depreciation rates.[25] But for nonresidential structures (private and government), all but 1 of the 10 asset types have C-quality rates.[26]

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[24] C. Shang, Y. Abed, and J. Farrell, 2019, "Science-Based Infrastructure Stewardship," presentation to the committee, November 11, 2019.

[25] The two exceptions are for the subcategory's brokers' commissions and other ownership transfer costs and residential equipment.

[26] The exception is for highways. The BEA asset life for highways depends on later research by R. Beemiller, 1999, "Experimental Estimates of State and Local Government Highway Capital Stocks," Presentation at the annual meeting of the Southern Regional Science Association, Richmond, VA, April; B.M. Fraumeni, 1999, *Productive Highway Capital Stock Measures*, Washington, DC: Federal Highway Administration, Department of Transportation, https://www.fhwa.dot.gov/reports/phcsm/phcsm.pdf.

The depreciation rates published in 1997, based on the Hulten and Wykoff findings, better reflect the actual rates of depreciation of structures than did the straight-line depreciation rates that were previously assumed. But these were considered a work in progress, open to regular revision with new research. Except for minor adjustments, the depreciation rates for government residential and nonresidential structures, and their service-life assumptions, have not been revised since their initial publication.

> Finding 4-5: Capital depreciation rates are primary inputs for estimating restoration and modernization rates using the geometric depreciation model, and more broadly for estimating the net value of national capital assets. The BEA maintains an aging set of depreciation rates, patterns, and service lives for the residential and nonresidential structures categories. If revised, these data would improve renewal cost estimates, particularly for nonresidential structures.

CONCLUSION

This chapter discussed the recent history of facility cost models as tools for funding advocacy. For specifically estimating renewal costs, a well-known condition assessment tool, Builder, was found to be a poor fit. Alternatively, the committee found that a geometric depreciation model better matched the scope of renewal requirements. The committee also suggests that renewal estimates would benefit from updating two data series, depreciation rates and service lives, for specific facility types.

The next chapter will introduce the risk management framework needed to ensure that these requirements are weighted against all the other urgent and compelling needs of the federal agency to meet its mission, and will discuss its value and benefits.

5

Strategic Planning Process

INTRODUCTION

Successful asset management depends on a strong strategic plan that gets translated into strategic asset management plans, risk analyses, resource decisions, and operating plans. This chapter continues the narrative established in the preceding chapters, focusing on how a facility renewal strategy can generate value for federal agencies while managing risk. As introduced in Chapter 2, this is an essential purpose for federal facility renewal strategies in fulfillment of requirements contained in OMB Circulars A-11 and A-123. As a whole, this chapter can be viewed as a tutorial on the strategic planning process.

OMB Circular A-11 defines requirements to formulate and execute an agency's budget inclusive of real property to achieve its mission objectives and priorities. OMB Circular A-123 supports this policy by establishing requirements for internal controls to manage risk across the enterprise. This risk management includes real property resource-and-investment decision making. The OMB Circular A-11 Supplement—Capital Programming Guide goes on to establish requirements for agency facility renewal strategies to cover whole real property portfolios across whole facility asset life cycles in support of the agency's full set of mission objectives. Notably, the Capital Programming Guide requirements are not limited to capital planning or financial management—they apply broadly to managing the agency's real property capital assets.

These sources also establish the foundations for federal facility renewal strategy risk management. This chapter builds on this foundation, highlighting the important roles served by federal facility renewal strategies in generating value

and managing risk. The content in this chapter is supported by a more detailed explanation of risk management contained in Appendix G.

VALUE, BENEFITS, AND RISKS

Federal facilities and the activities they support have value and generate benefits for the American people. In the context of federal facility renewal strategies, value is measured in terms of the contributions that federal facilities make in helping an agency achieve its mission. Benefits are the desired societal outcomes made possible by federal facilities supporting agency operations. This point is emphasized in ISO 55000, Section 2.1 (Asset Management—General), with provisions as follows:

> Effective control and governance of assets by organizations is essential to realize value through managing risk and opportunity, in order to achieve the desired balance of cost, risk and performance.… Asset management translates the organization's objectives into asset-related decisions, plans, and activities using a risk-based approach. (ISO 2014c, § 2.1)

Value and benefit generation is always associated with some level of risk. On a fundamental level, this is the result of resource scarcity and an agency's desire to maximize benefits derived from limited resources and capabilities, including its real property portfolio. This perspective offers a basis for using a disciplined asset management system to systematically manage risk, as is clearly stated in ISO 55000:

> Asset management does not focus on the asset itself, but on the value that the asset can provide to the organization. The value (which can be tangible or intangible, financial or non-financial) will be determined by the organization and its stakeholders, in accordance with the organizational objectives. (ISO 2014c, § 2.4.2.a)

Therefore, federal facility renewal strategy risk management must focus on value generated by facilities, which includes the contribution to value generated by the people and capabilities using these facilities. In this context, value generation is defined in terms of agency mission objectives. As further developed in Appendix G, the correct perspective for this is anthropocentric, meaning for the benefit of humankind. This seems an obvious point, but understanding its significance in terms of developing federal facility renewal strategies cannot be overstated. Set within the U.S. federal government context, the benefit to humankind is organized around societal benefits, which are further refined through congressional authorizations and appropriations. As detailed in Chapter 2, OMB Circular A-11 channels this activity through the development and execution

of the agency's strategic plan and authorized budgets. The reconciled product generated by these two sources defines what is valued most and the objective of each agency's facility renewal strategy. The outcome is, through use of ISO 55000 standards and in accordance with guidance from OMB Circulars A-11 and A-123, agency facility requirements, budgets, and programs used to satisfy these requirements must be completely reconciled, and where this does not happen gaps must be defined and reported. These gaps in turn define liabilities and risks the agency cannot address because requirements are too great for the budget and for the agency's operational capabilities.

In practice, an agency's facility renewal strategy is an element of the agency's real property capital plan, which flows from the agency's strategic plan and by extension its capital plan. In accordance with the Capital Programming Guide, one of the strategy's primary purposes becomes informing resource-and-investment decision making through budget development, as follows:

> The Agency Capital Plan is the principal output of the Planning Phase. It is a dynamic plan that changes to reflect decisions about adding new assets and deleting old or even in-process asset acquisitions that are not meeting goals (i.e., the return on investment does not justify continued funding of the project). It should be the central document, or group of documents, that the agency uses for its capital asset planning. Agencies are encouraged to use a summary of the Agency Capital Plan for budget justifications to OMB, congressional authorizations of projects, and justifications for appropriations to the Congress. (OMB 2017)

The outflow of this logic in the agency facility renewal strategy is to guide development of the agency capital plan, referred to as the "real property capital plan" in this report. In accordance with the requirements detailed in OMB Circular A-123 and ISO 55000, this specifically includes managing risks associated with resource-and-investment decision making.

VALUE IN THE CONTEXT OF FEDERAL FACILITIES

Setting objectives for federal facility renewal strategy risk management requires the definition of value in the context of federal facilities. This section examines and qualifies value to assist risk management activities supporting the development and implementation of federal facility renewal strategies.

Risk management examines the potential loss of things that are valued. Examples include goods, property, assets, people, services, and trust. In terms of federal facilities, value includes determined physical, market, or replacement valuations, but more important is the value generated by a facility asset's functions and capabilities—that is, its contribution to the agency's ability to operate and achieve its mission objectives. It is this functional value that must be the focus of federal facility renewal strategies. Notably, this is the same value proposition

that was also used to acquire the facility asset in the first place. Simply, federal facility renewal strategies continually reevaluate this value proposition.

Supporting this value-generating perspective, risk management activities are performed using decision-analysis frameworks that offer choices or options to consider. Each choice must be set within an operating context and must define the work or resources required and the value or benefits to be generated. This is an asset management tenet: resourcing decisions shall only be made when linked to an outcome—that is, the measurable value or benefit to be generated (or conversely, that which will not be lost). What this means is that decision making limited to facility life-cycle management is insufficient to support development of federal facility renewal strategies. This is because the life-cycle management perspective—that is, the classical facility management thinking perspective detailed in Chapter 3—is not based on the return on investment a facility makes compared with mission achievement. This perspective is based on the agency's ability to deliver facility capabilities (i.e., an input to mission achievement) and not on the facility's contribution to overall agency performance (i.e., an outcome).

In practice, if the value generated by a facility investment choice is greater than the costs to generate this value, then it is considered a viable option. This can be computed as a ratio such as an internal rate of return. This type of risk-based management approach is also possible using the principle of operational readiness introduced in Chapter 3 and developed in Appendix F. These approaches employ value propositions that measure the contributions that facilities make toward agency mission achievement. By extension, risk management frameworks must be designed to evaluate these types of choices. This evaluation must also consider many risk-related factors and associated uncertainties—that is, the potential for achieving (or losing) the value or benefits sought.

In the context of federal facility renewal strategies, the objective of these frameworks is to inform resource-and-investment decision making. OMB Circular A-123 is clear on this point, stating: "agencies are required to manage risk in relation to achievement of reporting objectives" (OMB 2018). In coordination, OMB Circular A-11 establishes extensive reporting requirements related to federal facility management, as detailed in Chapter 2. The culmination of this is the agency capital plan defined in the Capital Programming Guide, and by extension the agency's real property capital plan suggested in OMB M-20-03, "Implementation of Agency-wide Real Property Capital Planning."

This progression of logic leads to focusing on value generation as the primary driver for facility portfolio renewal. In terms of federal facility renewal strategies, value is generated by delivering mission capabilities enabled by facilities when, where, and how it is needed. *When* and *where* needed involves two perspectives: (1) alignment with agency operating priorities and mission objectives, and (2) supporting both current and future needs. The *how* also involves two perspectives: (1) a choice's alignment with the agency's authorized missions, and (2) its alignment with the agency's values, which in many cases are embedded

in stewardship, environmental, energy, and socioeconomic goals and objectives often reinforced through statute. These are adapted into the agency strategic plan. The agency strategic plan focuses the strategic asset management plans through the setting of priorities and objectives each agency aims to achieve, the actions the agency will take, and how the agency will deal with challenges and risks. This whole discussion wraps back around to emphasizing the importance of harmonizing the agency's strategic plan and budget authorizations, and hence the purpose of OMB Circular A-11. It is through the agency strategy plan that objectives, emphasizing issues that the agency values, must be made clear. As detailed in emerging policy and clarified by recommendations made in this report, the agency's real property capital plan must be used to clarify what is valued and the extent to which it is valued. The ultimate determination of this last point is often the agency's budget—that is, if the authorized budget covers an expense, then it values the outcome and benefits derived from the activity more than those activities that were not funded.

As detailed throughout OMB Circular A-11 and OMB M-20-03 requirements, the real property capital plan, when recognized as a subset of the agency's strategic plan, must also be reconciled against the agency's authorized budget. This is a key performance role by the agency's facility asset management system used to govern facility program execution. Only at this point will the agency's value-generating activities and priorities be made clear and actionable. In this way, the agency's facility asset management system guides enterprise risk management activities to integrate, reconcile, and balance competing issues raised in the agency's strategic plan, budget, and facility programs, as shown in Figure 5-1.

As detailed in Chapters 2 and 3, the purpose of the facility asset management system is to organize this approach to determine what is truly valuable and to what extent it is valued. This sets the relationship used in supporting risk management frameworks detailed later. In this context, the agency's real property capital plan is the apex product of its facility asset management system, and the means used to establish and communicate supporting risk management activities.

RISK MANAGEMENT AND MISSION ALIGNMENT

A substantial body of work addresses how to best manage federal facility assets. The National Academies report preceding this one, *Predicting Outcomes of Investments in Maintenance and Repair of Federal Facilities* (NRC 2012b), was dedicated to this topic, and covered risk management and mission alignment in a section titled "Correlate the Effects of Failure with the Organization's Mission," which presents an effective practice for facility maintenance and repair investments. The current report expands on the materials presented in the previous report by clarifying how this relationship is defined and applied using several principles detailed in Chapter 3.

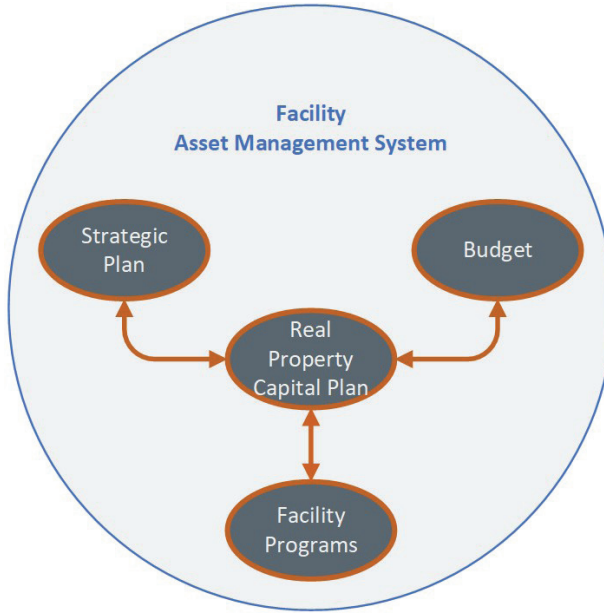

FIGURE 5-1 Facility asset management system triad.

To begin, the facility performance principle establishes facility performance areas including condition, functionality, availability, and utilization. These are collectively understood to report how well a facility, and by extension a facility portfolio, is performing. All are important risk management factors. In this group, in the context of this chapter, functionality stands out. At the individual facility level, measures of functionality focus on specific physical characteristics and capabilities. At the facility portfolio level, functionality measures focus on how a group of facilities can support mission-critical operations. Both perspectives are important to developing federal facility renewal strategies and are therefore critical inputs to the asset management system's risk management framework.

Once the *what* to do is defined, the next principle involved is the mission alignment principle. This introduces a perspective independent from the data and metrics generated by the facility performance principle. The mission alignment principle establishes the link between facilities and mission achievement. As detailed in Chapter 3, there are many methods to consider, and agencies should ensure that they are using the method best aligned with their decision-making needs. Otherwise, the products of their risk management activities will give the appearance of certainty when the opposite may be true. (See the discussion in Chapter 3 and Appendix F for more information on this topic.)

The operational readiness principle links the mission alignment and facility performance principles. It also establishes a context for systematic risk management—that is, the ability to qualify and quantify the flow of benefits and value. As developed in Appendix F, the operational readiness principle can be configured to serve a multitude of uses, is configurable using multi-attribute decision-analysis techniques, and has demonstrated its ability to be impactful in risk-based resource decision making, as made evident in the Army National Guard and Air Force examples detailed in this report.

Bringing this all together is the decision-making alignment principle. This principle is founded on ISO 55000 asset management system standards employed to develop and implement federal facility renewal strategies. This principle, as detailed in Chapter 3, fully aligns with OMB Circular A-11 and A-123 requirements and guidance, including the explicit application of enterprise risk management and internal control requirements detailed in both. In practice, as seen to be evolving in OMB policy, and covered in Recommendation 2 (see Chapter 7) in this report, the agency's real property capital plan should be generated by implementing this principle through the risk management framework established by the agency's facility asset management system. This will systematically ensure and assure that federal facility renewal strategy risk management activities fully align with agency mission objectives and priorities.

ECONOMIC MODELS FOR ANALYZING INVESTMENT OPTIONS

One additional element to cover before discussing risk management frameworks in greater detail is the use of economic models. The relationship between economic models and an agency's real property capital plan is established through interdependencies between OMB Circular A-11's Supplement—Capital Programming Guide and OMB Circular A-123's guidance on enterprise risk management. Specifically, the Capital Programming Guide requires agencies to manage facility assets using priorities and objectives aligned to support achievement of the agency's objectives (OMB 2022a). OMB Circular A-123 requires agencies to evaluate risk in its ability to achieve mission objectives (OMB 2016). Given that facility management involves the competition for scarce resources and economic models are designed to support decision making considering scarcity, it is obvious that economic models are useful for evaluating choices framed by real property capital plans.

Economic models are well documented in the literature, and an exhaustive review of them is beyond the scope of this report. That said, there are several standard economic analysis methods that apply to the development and implementation of federal facility renewal strategies. They include cost-benefit analysis, cost-effectiveness analysis, life-cycle cost analysis, savings-to-investment ratio, internal rate of return, decision trees, and sensitivity analysis using Monte

Carlo techniques. More information on these and related approaches is available in the *GAO Cost Estimating and Assessment Guide* (GAO 2009b).

OMB Circular A-94 should be used as the principal source for all federal facility renewal strategies. This source makes an important differentiation between two types of economic analyses relevant to developing federal facility renewal strategies. The first is a cost-benefit analysis (OMB 1992). This approach is used to evaluate changes to an agency's facility portfolio resulting from changes to an agency's authorities and related mission requirements. Examples of appropriate situations for cost-benefit analysis are given in Chapter 6. The more prevalent type of economic analysis used in federal facility renewal strategies is a cost-effectiveness analysis. This type of analysis is used to determine the option that best supports established mission requirements. See more on this topic in OMB Circular A-94 (OMB 1992).

ENTERPRISE RISK MANAGEMENT FRAMEWORKS

In accordance with OMB Circular A-123, implementation of federal facility renewal strategies requires the application of enterprise risk management. This reference explains what enterprise risk management is and establishes requirements for supporting internal controls, but it provides very little guidance on how to implement these requirements. This is where ISO 55000 asset management system standards apply. ISO 55000–based asset management systems are, by design, an enterprise risk management solution. Conforming facility asset management systems define and integrate how every supporting decision-making framework employs risk management. In this way, via application of ISO 55000 standards, all decision-making activities become risk based. The chain of events helpful to implementing an effective enterprise risk management solution for federal facility renewal strategies is as follows:

- The agency commissions policy to implement a facility asset management system.
- The scope of this asset management system is defined in terms of ISO 55001, Clause 4 (Context of the Organization). For example, the facility asset management system will cover the agency's complete real property inventory, inclusive of all of its supporting operations and life-cycle management activities employed to achieve authorized mission objectives.
- This policy will establish decision-making frameworks covering the scope of facility asset management system activities.
- Supporting decision-making activities will employ performance management and improvement requirements detailed in ISO 55001, Clauses 9 and 10, respectively.

Following these steps will result in the development of a robust enterprise risk management framework needed to implement effective agency facility renewal strategies. Use of ISO 55001 standards support this by defining requirements for an asset management system. It is important to note that ISO 55001 does not describe how to implement an asset management system; it only defines the characteristics of one. This is intentional in order to provide organizations the freedom to establish an asset management system best suited for their specific needs and circumstances.

Implementing an agency's facility asset management system includes developing risk management frameworks configured to perfect federal facility renewal strategies across the enterprise. Appendix F provides many examples, criteria, and foundations for risk management frameworks. The reality is that no single method or approach works in all cases. Generally, many frameworks can work, and some frameworks work better than others for different purposes. As detailed in Chapter 2, both OMB Circular A-123 and ISO 55000 standards recognize ISO 31000—Risk Management as a beneficial, authoritative source on the topic. ISO 55002—Guidelines for the Application of ISO 55001 also contains an excellent overview on how risk management is implemented through an asset management system. Independent of the authoritative source that an agency selects to establish its enterprise risk management solution, the following requirements should be applied to all risk management frameworks used to develop federal facility renewal strategies:

- Agencies are required to establish and document the risk management frameworks they are using to develop and implement federal facility renewal strategies. This should be made clear in the policies used to establish the agency's facility asset management system.
- Risk management frameworks must demonstrate compliance with OMB Circular A-11 and A-123 requirements.
- Established frameworks must be used and evidence of their use must be verified and validated. For example, refer to the requirements contained in GAO-14-704G—Standards for Internal Control in the Federal Government, Section 3 (Evaluation of an Effective Internal Control System), and ISO 55001—Asset Management System—Requirements, Clause 8 (Operations), Clause 9 (Performance Evaluation), and Clause 10 (Improvement).
- The risk management system must be anthropocentric—that is, focused on generating value for humankind, which in the context of federal facility renewal strategies is streamlined to mean achievement of the agency's authorized mission in alignment with budget authorities and as conferred through its strategic plan.

An excellent example of how one agency (Lawrence Livermore National Laboratory [LLNL]) accomplished these objectives, shared during the committee's discovery activities, is captured in the following quote:

> With $7B worth of assets in its portfolio—over half of which are in substandard condition—Lawrence Livermore put actuarial science, maintenance data, and modeling tools to work to evolve how we think about risk and then how we actually model risk and accept risk. (Shang et al. 2019)

The committee found this example representative of how a mature facility asset management system would implement a risk management framework. The reason for this is that LLNL used the context of mission and its facility asset inventory to frame its asset management system. It then developed decision-making frameworks using verified and validated data and models to evaluate the performance of its facility assets and the relationship of these facilities to the organization's overall performance. It continued through an involved process to educate and inform decision makers on how these systems manage risk to organizational performance through facility resource-and-investment decision making. As a result, over the course of many years, LLNL developed a sophisticated, yet simple to understand, common asset management model that executives and facility managers use to collectively manage risk and support mission achievement.

Finding 5-1: Federal policy is clear, notably in OMB Circulars A-11 and A-123: the purpose of federal facility renewal strategies is to systematically manage risk, with a focus on resource-and-investment decision making to ensure and assure that facilities best support achievement of agency mission objectives and priorities efficiently and effectively.

Finding 5-2: The risk management frameworks used must be systematic and documented, must comply with OMB Circular A-11 and A-123 requirements, and must be integral to federal facility renewal strategy development and implementation.

CONCLUSION

This chapter examined methods for identifying the value, benefits, and risks associated with the renewal of federal facilities. The next chapter identifies strategies that can be applied by agencies to improve funding for federal facility renewal.

6

Budgeting: Impactful Resource Decision Making

INTRODUCTION

Previous chapters introduced the use of a facility asset management system to improve planning by quantifying facility conditions, consistent with the value the facilities add to achieving the agency mission, as an element of portfolio management, life-cycle management, and risk management. This chapter provides a different yet complementary perspective, highlighting financial challenges faced by facility managers and their leadership as they create and implement a strategy for renewal of federal facilities.

One of the toughest challenges in managing a portfolio of real property assets is allocating the funding necessary to maintain, repair, renew, and dispose of facilities on a schedule that avoids system failure; renews facilities before they become obsolete; and takes advantage of newer, more efficient and effective methods and technologies. The operations, maintenance, repair, renewal, and disposal phases of an individual facility occur episodically and often require sizable amounts of funding compared with annual operating and maintenance costs. These large, infrequent investments create "spikes" in spending when compared with annually recurring expenses and are harder to budget for in relatively level or incremental budgets. To fund these investments, agencies may need to accumulate and hold reserve funds until they need the investment. Federal agencies often view funding for facility repair, renewal, and disposal as an expense that they can defer with little or no consequences, and thus treat it as a lower priority than funding the operations of a business or program.

This presents a specific and very important use case for federal facility renewal strategies: that is, how to develop budgeting strategies that can coordinate

major, large investment spikes with ongoing maintenance and repair, while also incentivizing agencies to opportunistically invest in newer, more efficient and effective methods and technologies. This introduces the need for an investment mindset when it comes to enterprise-level budgetary decisions. This chapter establishes a basis and understanding for how to view federal facility renewal strategies through this lens in a way directly applicable to current and evolving policy.

CAPITAL BUDGETS VERSUS OPERATING BUDGETS

One specific hurdle that a federal facility renewal strategy must overcome is reconciling operating budgets with capital budgets. Expenses and investments differ in that expenses are costs that are immediate and have relatively short-term benefits. Investments provide long-term benefits or returns that often are greater than the initial cost of the investment.

To distinguish expenses from investments, businesses and many countries, states, and local governments have both an operating budget and a capital budget. The operating budget includes the expenses of operating a business or a program in the near term, and matches expenses with expected revenues to ensure that the business or program can pay its bills and generate the expected income on time. The capital budget has a longer-term focus and calculates the investments necessary to the facility portfolio, as well as equipment to replace the current inventory of assets when they reach the end of their usable lives, and increase (or reduce) the inventory of assets needed to support or grow the business. In the broadest sense, this is the definition of *renewal*, as used in this report.

To bridge this divide, businesses and government often finance investments by borrowing. In a capital budget, investments compete based on the long-term benefits they produce. Once a capital investment is approved, the operating budget typically funds the annual cost of the repayment of principal and debt service and maintains and repairs the investment.

The amount of debt service relative to the operating budget constrains capital budgets. Rating agencies look at the portion of the operating budget associated with the debt service payments to determine an entity's creditworthiness. The lower the debt service as a percentage of the operating budget, the higher the creditworthiness and credit rating. The higher the credit rating, the lower the risk of default on the cost of borrowing.

The federal budget process is a cash-based budget and does not differentiate operating expenses from capital or investment costs. Under a cash-based budget, federal agencies budget all spending up front when they make commitments, regardless of when the agency will receive the benefits. This ensures that agencies consolidate all borrowing necessary to support government operations through the Department of the Treasury and guarantee debt repayment. While the federal government has a credit rating, its borrowing cost is the lowest of virtually any

entity in the United States because of the government's ability to pay off debt by either printing money or using its tax authority. As a result, the federal government does not have the constraint on borrowing that the private sector, states, and local governments have.

FEDERAL CAPITAL INVESTMENT

In the absence of a real constraint on borrowing, Congress and the President have used the federal budget process to attempt to control overall spending. Congress first enacted legislation in 1939 to establish debt limits. These limits do not authorize new spending, but finance existing legal obligations previously authorized by Congress and the President. Failing to increase these limits would cause the federal government to default on its legal obligations, which would have a catastrophic impact on the economy. As a result, Congress has always voted to raise the debt limit—more than 78 times since 1960.

Since the 1980s, Congress and the President, while raising the debt limit, have attempted to constrain new spending. Congress and the President have agreed to budget rules that limit or cap so-called discretionary spending. They have also limited increases in so-called mandatory spending by requiring that any new spending be paid for, or offset, with new revenues or other spending reductions, also known as "PAYGO" (pay as you go).

Despite these constraints, the federal budget continues to include significant investments intended to provide long-term benefits to the economy and the nation. Annually, the federal budget allocates more than $600 billion, or approximately 13 percent of the budget, to long-term investments. Roughly half of these investments are for major physical capital and half for research and development, education, and training. Of the major physical investments, more than 70 percent is for direct federal investment, and the remaining 30 percent is for grants to states and local governments. Of the direct federal investment, approximately $40 billion per year is invested by the government in construction and rehabilitation of the federal government's assets. Much of this is allocated to programs that manage large portfolios of assets (see Chapter 1).

Federal Budget Formulation Process Reforms

Despite volumes of guidance to the agencies on asset planning and management as described in Chapter 2, agencies still find it difficult to maintain accurate asset inventories or effective asset management systems. Without asset management systems as described in Chapter 3, agencies will continue to find it difficult to project the funding necessary to renew facility portfolios or quantify the benefits that will accrue from the investment (see Chapter 4).

In simple terms, a budget is an estimate of revenues and expenses over a specified future period, as defined in the balance sheet analysis principle stated

in Chapter 3. Budgeting consists of allocating resources to produce expected outcomes while balancing competing demands for limited funds. The goal of budgeting is to optimize the allocation of constrained resources to maximize the return while ensuring that it can provide required functions, which is facilitated through applying the operational readiness and performance–budget integration principles also found in Chapter 3.

Notwithstanding these investments, federal agencies remain challenged by the need to balance near-term budgetary funding constraints with the long-term capital investment requirements in the real property portfolio and adequately manage the risk this creates for the operating program budget. A successful budget allocates just enough resources every year to achieve all high-priority outcomes, but not more resources than needed. Conversely, the budget needs to look beyond the budget year to forecast future needs to ensure that it can meet them within likely future budget targets. Budgets need to anticipate the cost of replacing current assets and the funding investments needed to provide for future growth and anticipated changes. This trade-off between addressing current versus longer-term needs is challenging because it is natural to maximize immediate returns and defer future needs.

Facilities (real property) have long-term benefits but include long-term costs. Facilities have considerable up-front costs for constructing or acquiring new facilities and relatively low costs for operating and maintaining them each year thereafter. Periodically over the life of the asset, however, there will be additional costs to repair and replace facility components. The determination involves risk management as discussed in Chapter 5—failing to replace components when they reach the end of their service life will cost more over time than if completed when first required. A successful budget will recognize and anticipate these future costs and limit the facility portfolio's size to that which can be maintained, repaired, and replaced within budget limits. The budget may aggregate or reserve funding for repair and replacement in order to have the funds available when they are needed.

Budgeting for personnel includes not only the cost of annual salaries and benefits but also contributions to cover future costs such as retirement. For example, Section 32.3 of the Office of Management and Budget (OMB) Circular A-11 requires agencies to budget an additional 14 to 39 percent of an employee's salary, depending on the job classification and employing agency, for future retirement costs. Agencies do not have the discretion to not pay or defer retirement contributions, and neither does OMB or Congress.

Budgeting for facilities should not be different. Budgeting for facilities involves not only the initial cost of acquisition but also the operating and maintenance costs, and should include contributions to the future costs of repair and replacement. In budgeting for both people and facilities, failure to contribute to future costs today leaves an unfunded liability that may cost more in the future than the cost of reserving funds today. Agency management, agency budget staff,

OMB, congressional members, and staff all share responsibility for ensuring that there are adequate funds in the budget for addressing repair and replacement of facilities, or as defined in this report, for creating and implementing a strategy for renewal of federal facilities.

Agency Asset Management Systems and Data

Knowing the amount of resources to budget annually for facilities requires an asset management system that recognizes the entire portfolio of assets and plans the future cost of renewal to include repairing, replacing, and disposing of each asset. As discussed in Chapter 3, reliable principles and a robust asset management system will anticipate the future growth or decline of a program and schedule the needed investments to fit within a multiyear plan.

The data and analysis from the asset management system are a critical part of building the budget. Ideally, the system will forecast future funding needs to support the inventory and will capture the unfunded backlog of repair, replacement, and disposal costs. While this backlog of unfunded repair and replacement costs may be significant, documenting these costs and developing a plan to either invest in or dispose of underutilized assets is critical. If agencies leave these requirements undocumented, they will never be a priority to receive funding, as detailed in Chapter 4. Regardless of the funding level requested in the budget submission to OMB, the budget justification should include an exhibit that shows (1) the full cost of the backlog of unfunded capital projects, (2) the request, and (3) a future 5-year budget as part of a longer planning horizon to sustainably renew the agency's federal facility portfolio, inclusive of planned facility asset dispositions. Furthermore, agencies should address the strategy for reconciling these needs and mitigate risks through their real property capital plan as detailed in Recommendation 2.

OMB Budget Formulation Guidance

As discussed in Chapter 2, OMB has issued multiple guidance documents over the years that encourage agencies to improve asset management practices. OMB Circular A-11 is the primary guidance to agencies on how to formulate and execute budgets. Appendix J of the circular addresses "Principles of Budgeting for Asset Acquisitions," and Appendix K provides selected OMB "Guidance and Other References Regarding Capital Assets." Additionally Circular A-11's Supplement—Capital Programming Guide recommends the following:

> Agencies must have a disciplined capital programming process that addresses project prioritization between new assets and maintenance of existing assets, risk management and cost estimating to improve the accuracy of cost, schedule and performance provided to management, and the other difficult challenges

> proposed by asset management and acquisition. The purpose of the Capital Programming Guide, herein referred to as the Guide, is to provide professionals in the Federal Government guidance for a disciplined capital programming process, as well as techniques for planning and budgeting, acquisition, and management and disposition of capital assets. At the same time, agencies are provided flexibility in how they implement the key principles and concepts discussed. (OMB 2017, p. 1)

Regarding the budgeting process, the guidance recommends the following:

> The Budgeting step of the capital programming process occurs when OMB works with the agencies to devise a funding plan to allocate resources among various priorities. This process begins when the agency starts to incorporate budget concerns into its strategic and annual performance planning, including consultation with OMB staff and perhaps congressional staff. Budgeting is of greater urgency when the agency formally requests budget authority for the asset in its budget submission to OMB for the coming year. Although budgeting should be incorporated to account for all phases of an asset's life-cycle, the formal budget process really begins during this step of the Planning Phase once the agency requests OMB to include the funding for a program or project in the President's Budget. The Budgeting Step and the Planning and Budgeting Phase ends when the Congress appropriates funds for the acquisition and OMB apportions the funds to the agency. Agencies are encouraged to work with OMB through the entire Planning and Budgeting Phase to greater increase its likelihood of funding. This is where a long-term capital asset investment and utilization plan is useful. It greatly assists the decision makers at OMB see where this asset, among others, fits into the long-term goals of the agency. The plan, as described above, which includes condition analysis, annual performance, and asset inventory, would be familiar with the OMB RMO staff and clearly list out where the asset in question fits into the long-term plan. (OMB 2022a, pp. 21-22)

As noted in earlier chapters of this report, OMB has recently issued memorandums M-20-03 and M-20-10 that provide additional guidance to agencies on real property management. M-20-03 offers detailed guidance for agencies to implement the Capital Programming Guide. M-20-10 is an "Addendum to the National Strategy for the Efficient Use of Real Property." The memorandum outlines eight actions that agencies should take to improve real property management. Support for these memorandums is the focus of this report's second and third recommendations. Regarding budgeting, Action 4 of M-20-10 recommends improving the transparency of agency-level budget formulation and execution to allow for improved decision making by linking budget inputs to outputs and outcomes, and by integrating all phases of the budget process. This objective is highlighted in the asset management system principle performance–budget integration, detailed in Chapter 3 and Appendix F.

In many cases, agency management ignores or trades the need for capital investment in the real property portfolio for other operating expenses, and agencies do not request funding or provide any information on the unfunded capital needs to OMB or Congress. To strengthen transparency, OMB could require agencies to submit their capital asset plans—referred to in this report as real property capital plans, as it pertains to managing the agency's real property portfolio—and explain why they do not include needed funding in the agency's request for the budget year. This objective is highlighted in the asset management system principle of balance sheet analysis. Application of this principle would allow OMB to evaluate the rationale for not requesting needed funds. This oversight is not now occurring unless the agency requests funding.

> Finding 6-1: The committee observes that Circular A-11 does not require federal agencies to use a comprehensive asset management system, or require submittal of a coordinated operating and capital financial plan and explanation of why needed funding is or is not included in the agency's request for the budget year, as covered in the principles detailed in Chapter 3.

BUDGETARY STRUCTURES FOR INCREASING CAPITAL INVESTMENT AND TRANSPARENCY

Within the structure of the federal budget, the committee identifies several ways to help allocate funding to capital investment and protect it from being traded for operating expenses. These include (1) aggregating financing for capital assets, (2) charging users of facilities to pay for renewal costs, and (3) using the Federal Buildings Fund.

Aggregation of Financing for Capital Assets

Capital investments occur episodically, as opposed to every year, and can create spikes in spending relative to the budget levels of annually recurring operating costs. These spikes in spending, also referred to as "lumps," are a characteristic of capital investments that make them difficult to accommodate in budgets that are relatively constant. The Capital Programming Guide addresses "lumpiness" in Appendix G, titled "Principles of Budgeting for Capital Asset Acquisitions—Principles of Financing, Principle 4," as follows:

> Accommodation of Lumpiness or "Spikes" and Separate Capital Acquisition Accounts: To accommodate lumpiness or "spikes" in funding justified capital acquisitions, agencies, working with OMB, are encouraged to aggregate financing for capital asset acquisitions in one or several separate capital acquisition budget accounts within the agency, to the extent possible within the agency's total budget request. Aggregation of capital acquisitions in separate accounts may:

- Reduce spikes within an agency or bureau by providing roughly the same level of spending for acquisitions each year;
- Help to identify the source of spikes and to explain them. Capital acquisitions are more lumpy than operating expenses, and with a capital acquisition account it can be seen that an increase in operating expenses is not being hidden and attributed to one-time asset purchases;
- Reduce the pressure for capital spikes to crowd out operating expenses; and
- Improve justification and make proposals easier to evaluate, since capital acquisitions are generally analyzed in a different manner than operating expenses (e.g., capital acquisitions have a longer time horizon of benefits and life-cycle costs). (OMB 2017, p. 65)

Many agencies have separate construction or acquisition accounts that include the costs of acquisition and new construction. These accounts can also include funding for repairs and alterations. The larger the funds, the easier it is to absorb large, expensive projects. Aggregating all capital investments across an agency or department makes it easier to fund various major projects and avoid one-time spikes in funding. The Department of Defense (DoD) is an example where aggregating capital projects across the Army, Navy, and Air Force into the Military Construction Program allow DoD to fund large projects within overall, relatively stable annual funding levels.

Although this Military Construction Program, and similar types of funding used by non-DoD agencies, does provide a strategy for addressing the "lumpiness" problem highlighted earlier, it does not address agency needs satisfactorily to renew their facility portfolios systematically. This is because these capital funding sources are decoupled from other funding programs that support facility operations, maintenance, repair, and disposition. Applying International Organization for Standardization (ISO) 55000 standards in support of OMB Circular A-11 and A-123 policy and guidance would provide needed assurances that capital investment strategies are harmonized with agency facility operating strategies, as documented in agency real property capital plans submitted in justification of agency budgets. Furthermore, application of ISO 55000 would require agencies to document not only budget justification, but also risk mitigation strategies and plans for unfunded requirements.

Finding 6-2: The committee observed that few federal agencies aggregate capital investment into consolidated, agency-wide budget accounts, which could help smooth spending and avoid large spikes in funding from year to year.

Charging the Users of Facilities to Pay for the Cost of Renewing Real Property

Establishing processes that charge the users of real property the cost of operations, repair, and replacement is another approach to ensuring that agencies include these costs in the budget. Revolving or working capital funds allow agencies to collect and accumulate funds to pay the cost to repair and replace facilities as they age. Accumulating these payments in a fund allows property owners and managers to charge users the full facilities cost and allocate funds for major capital projects, reducing spikes in spending year to year. Facility users should include payments to the fund in their base budget and treat them like any current rents or other operating costs.

Federal Buildings Fund

One of the best examples of a user-pays model is the General Services Administration's (GSA's) Federal Buildings Fund (FBF). GSA, on behalf of the non-defense federal agencies, manages more than 9,000 buildings, encompassing 370 million rentable square feet of space that houses more than 1 million federal government employees. More than 60 percent of this space is leased from the private sector, and the remaining 40 percent is federally owned.

GSA's FBF is a quasi-revolving fund that was created in 1972 to help GSA manage its real property inventory. Federal agency tenants pay GSA rent to occupy space, and the rent is used to pay for (1) the lease costs of space in private buildings; (2) operations, maintenance, repairs, and alterations of government-owned space; and (3) the acquisition and construction of new space. GSA charges agency tenants in private, leased space the actual cost of the lease plus an administrative fee. For agency tenants in government-owned space, GSA charges rent based on the commercial equivalent of comparable space and services.

In a true revolving fund, GSA would control both the collection and the spending of the revenues in the fund. The FBF, however, is a quasi-revolving fund; while GSA collects the revenues from the rents paid by the tenant agencies, Congress controls spending of the revenues. Specifically, the 12 congressional appropriations subcommittees appropriate rent payments to the tenant agencies. The tenant agencies transfer rent to the Financial Services and General Government (FSGG) appropriations subcommittee. The FSGG subcommittee appropriates the rent revenue to GSA. When FSGG appropriates all the rent receipts, the receipts offset the spending and the committee is scored a net spending of zero.

From 1975 to 2011, Congress regularly appropriated all the rents collected in the FBF for space and services. In many years, Congress supplemented the FBF with additional appropriations primarily to fund new construction projects. Since 2011, except in 2016, Congress appropriated an average of $1 billion per year less than revenue collected, which is $9 billion less than the FBF collected, as of

this report's writing. Not appropriating this $9 billion to GSA has had a damaging impact on the government's owned inventory of buildings and has deprived the tenant agencies of paid-for services. GSA has had to delay needed repairs and renovations and deny construction of new facilities.

ACTIONS TO ADDRESS THE PROBLEM

The simplest approach to resolving the funding shortfall is for the Appropriations Committee to return to the pre-2011 practice of providing the FSGG subcommittee with a funding allocation—specifically, a 302(b) allocation—that allows the FBF to spend all the proceeds from rent payments for space and services. To help accomplish this, GSA and its tenants could educate members of Congress on investing in maintaining the federal building inventory and the increased costs of deferring maintenance. Strong congressional-member support for fully funding the FBF would go a long way in convincing appropriators to allow GSA to spend all the proceeds collected in the fund.

Alternatively, changes in legislation or how the Budget Committees, the Congressional Budget Office (CBO), and OMB score appropriations bills could be made to direct the appropriators to spend the proceeds in the FBF. Congress could enact legislation in an authorization bill, such as a budget agreement, to require the appropriators to spend all rent collections each year for FBF purposes authorized in law. Or, the 12 individual appropriations subcommittees could include language in their respective appropriations bills requiring the FSGG subcommittee to appropriate all rent payments paid by those subcommittees for authorized space and services or return the difference to the agencies. Another approach would be for the Budget Committees, CBO, and OMB to adopt a budget enforcement rule that would not give the appropriations committee the offsetting credit for any rent collected by GSA that is not appropriated to be spent for the authorized purposes of providing space and related services. These are all changes that could be made to return the FBF to its original purpose of ensuring that users pay for the cost of maintaining, repairing, and replacing the portfolio of real property assets.

Finding 6-3: The committee noted that the federal agencies struggle to find funds to meet the most urgent facility renewal needs. A remedy to this is only partially achieved by applying the Mission Dependency and Operational Readiness principles detailed in Chapter 3. More is required: Creating user-pays models for collecting the cost of operating, maintaining, renewing, and disposing of facilities could also help agencies collect funds needed for renewal. Furthermore, aggregating these funds into revolving or working capital funds is a proven means to help agencies prioritize needed capital investments and avoid funding spikes.

Finding 6-4: The committee also noted that, for the past decade, funds collected in GSA's Federal Buildings Fund have not been made fully available to repair and renew the portfolio of government-owned facilities. These funds could either be provided through appropriations or other measures to ensure they are invested in the portfolio.

CAPITAL ACQUISITION FUNDS

Another approach to budgeting for the costs of new facilities or funding major renovation is creating government-wide capital acquisition fund(s). These funds would provide borrowing authority to agencies that allow them to fund the up-front cost of a major project and repay the borrowing over years, avoiding the funding spike and flattening out the cost of the asset. An example of such a fund is the Federal Capital Revolving Fund (FCRF), which OMB has proposed in recent iterations of the President's Budget.

GSA is not alone in needing increased resources to address new construction and repair needs. Other landholding agencies, such as the Department of Veterans Affairs, Department of the Interior, Department of Homeland Security, and Department of Energy, have significant backlogs of deferred maintenance and inadequate budgetary resources to address them. For the past several budgets, OMB has included a proposal to address the funding shortage for large-cost construction and repair projects. OMB is proposing a new revolving fund that would make $10 billion available to non-defense agencies to borrow from to finance large-cost (more than $250 million) construction projects and repay the borrowing over 15 years. This would spread the cost and lessen the burden of having to fund the full cost of the projects in the first year. As agencies make repayments, those dollars would be available for borrowing for future projects.

The FCRF would be established on the mandatory side of the budget, and agencies could borrow from the fund by seeking discretionary appropriations to pay the first year of the repayment. If funded, the agencies would then be required to pay back the fund over 15 years. For example, if GSA wants to borrow $1.5 billion to fund the construction of a new headquarters for an agency, it could request $100 million to pay for the first-year repayment. If Congress appropriates $100 million, GSA could borrow $1.5 billion and repay it over 15 years.

Finding 6-5: The committee noted that creating government-wide capital acquisition fund(s) would help agencies finance the cost of major acquisitions or capital investments and spread the cost over time, making it easier to fund facility renewal in constrained annual budgets.

PRIVATIZATION

Privatization and public–private partnerships (PPPs) (which are discussed in the next section) are based on the doctrine that relatively few public functions outside the realm of national security are "inherently governmental," and that nearly all government-owned-and-operated facilities should be candidates for privatization or PPPs, under generally accepted principles of fairness and competitiveness. The burden of proof under this doctrine rests on each agency-occupier to justify why it should not privatize or partner with existing business functions and associated facilities that meet this basic private-market test to support the public interest. As covered in Chapter 2, this was the primary impetus for the creation of ISO 55000 standards. Specifically, ISO 55000 standards provide a framework for protecting the public's perpetual interests in built infrastructure while leveraging private industry efficiency and effectiveness in managing vast asset portfolios. Privatization is the process of transferring a public- or government-owned asset or service to private ownership and operations. In privatization, the private sector or other governmental entity can perform similar tasks in a competitive market at a lower cost. The key aspect of any privatization is that the federal government transfers the risks of ownership to the private sector, and there are no financial backstops or underwriting by the federal government.

A recent example of privatizing a federal asset is a proposal included in the 2021 President's Budget that would authorize the federal government to sell the Washington Aqueduct (USACE 2015). The Aqueduct is the wholesale water supply system for the District of Columbia; Arlington County, Virginia; City of Falls Church, Virginia; and a portion of Fairfax County, Virginia. There is no inherent federal responsibility to distribute drinking water in a community. Therefore, there is no need for the U.S. Army Corps of Engineers to operate and maintain this system. Privatization differs from PPPs in the degree of influence retained by the former owners on the assets once conveyed. The next section discusses these partnerships.

PUBLIC–PRIVATE PARTNERSHIPS

A PPP—a model for a public infrastructure project, such as a new telecommunications system, airport, or power plant—offers governments another approach to asset management that considers all key stakeholder needs, such as a public desiring that the federal government make efficient and effective use of its real property assets (Hanna 2022). PPPs are collaborations between private enterprises and public agencies that fuse private-sector resources and capabilities with public-sector purposes and authorities to plan, finance, build, deliver, and operate large, complex community facilities, projects, and services.

PPPs have been used by states, municipalities, and national governments to finance and manage public infrastructure and services. The public partner is

represented by the government at a local, state, and/or national level. The private partner can be a privately owned business, public corporation, or consortium of businesses with a specific area of expertise. PPP is a broad term that can be applied to anything from a simple, short-term management contract (with or without investment requirements) to a long-term contract that includes funding, planning, building, operation, maintenance, and divestiture (Hanna 2022).

PPP arrangements are useful for large projects that require highly skilled workers and a significant cash outlay to get started. They are also useful in countries that require the state to legally own any infrastructure that serves the public interest (Hanna 2022). They are defined by (1) long time horizons, from 30 years to a century or more; (2) comprehensive scope, encouraging cross-functional strategies and silo-busting structures; (3) large scales, to justify the heavy investments required for facilities, equipment, and staff, and to enlist interest from established, best-in-class market and industry leaders; (4) qualifications-based selection, based on the prospective partner's vision and capabilities, not the government's requirements and specifications; and (5) outcome-driven oversight, based on the partnership's actual accomplishments and results, not on personalities, politics, and procedural savvy.

Different models of PPP funding are characterized by which partner is responsible for owning and maintaining assets at different stages of the project. Examples of PPP models include the following, as articulated in *Public-Private Partnership (PPP)*:

- *Design-build (DB).* The private-sector partner designs and builds the infrastructure to meet the public-sector partner's specifications, often for a fixed price. The private-sector partner assumes all risk.
- *Operation and maintenance contract (O&M).* The private-sector partner, under contract, operates a publicly owned asset for a specific period of time. The public partner retains ownership of the assets.
- *Design-build-finance-operate (DBFO).* The private-sector partner designs, finances, and constructs a new infrastructure component and operates/maintains it under a long-term lease. The private-sector partner transfers the infrastructure component to the public-sector partner when the lease is up.
- *Build-own-operate (BOO).* The private-sector partner finances, builds, owns, and operates the infrastructure component in perpetuity. The public-sector partner's constraints are stated in the original agreement and through ongoing regulatory authority.
- *Build-own-operate-transfer (BOOT).* The private-sector partner is granted authorization to finance, design, build, and operate an infrastructure component (and to charge user fees) for a specific period of time, after which ownership is transferred back to the public-sector partner.

- *Buy-build-operate (BBO).* This publicly owned asset is legally transferred to a private-sector partner for a designated period of time.
- *Build-lease-operate-transfer (BLOT).* The private-sector partner designs, finances, and builds a facility on leased public land. The private-sector partner operates the facility for the duration of the land lease. When the lease expires, assets are transferred to the public-sector partner.
- *Operation license.* The private-sector partner is granted a license or other expression of legal permission to operate a public service, usually for a specified term. It is noted that this model is often used in information technology projects.
- *Finance only.* The private-sector partner, usually a financial services company, funds the infrastructure component and charges the public-sector partner interest for use of the funds (Hanna 2022).

These models are tools that can be implemented through an agency facility renewal strategy, although it can be challenging for federal agencies to understand the various models, compare their advantages and disadvantages, and determine how to reflect them in a budget. The Antideficiency Act of 1982 requires agencies to have enough budgetary resources to cover any commitments in the year in which agencies make the commitment. Determining how much to budget for a PPP ultimately depends on the level of commitment the agency is making in the transaction.

Circular A-11, Appendix B—Budgetary Treatment of Lease-Purchases and Leases of Capital Assets differentiates operating leases (the temporary use of an asset that is readily available in the private sector) from capital leases, lease-purchases, and construction or acquisitions. Operating leases require the agency to budget up front the first year's cost of a lease plus the potential cost to terminate the lease early. Capital leases, lease-purchases, and acquisitions commit the government to acquiring the asset and therefore require the full cost of the asset to be available at the outset of the lease.

If the PPP involves the financing and acquisition/construction of an asset that is ultimately transferred to the government, the PPP is a government entity, and OMB will score the full cost of the government's commitment as an acquisition. If a PPP (with the federal government as a partner) includes a leaseback to the government of space, the leaseback would be considered a capital lease. A capital lease would require the full cost of the lease to be budgeted up front.

Five of the models listed above (DB, DBFO, BOOT, BLOT, and Finance Only) are acquisitions as defined in the circular and would require the agency to budget for all costs of the transaction up front. The asset owner's interests—in this case, the federal government—are strengthened using a disciplined asset management system, as made clear in the Chapter 2 example discussing the UK government's railroad privatization. The federal government currently uses operating and maintenance contracts and operating licenses and, depending on their

terms, may limit the commitment by the government and not require full, up-front funding. It is unclear what the government's commitments would be under the BOO and BBO structures; therefore, it is not possible to determine the amount of funds needed at the contract's outset without further clarification. These structures most closely align with privatizing a government asset or service, which transfers the risk and cost to the private sector and does not require up-front funding.

An example of the use of PPPs in the federal government is the National Park Service and the U.S. Forest Service providing lodgings and visitor services in the national parks and forests. For more than 100 years, these national services have partnered with private firms to construct, operate, and maintain recreation facilities for public use. The key features of these PPPs include (1) the presence of a nonfederal revenue stream to pay for the costs associated with providing visitor services, (2) agreement with the federal government over the expenses and investments required to provide the services, (3) an expected internal return on investment, and (4) sufficient time to amortize the investment over the contract term. In addition, the military departments have divested many housing and utility-system assets to private ownership with success, albeit with lessons learned in the process.

Federal agencies can consider PPPs as an approach to operating and managing services to the public or providing grant funds to leverage other public and private resources. Still, agencies need to be careful to limit the federal government's commitment to only those resources available within the budget needed to cover the commitment.

Finding 6-6: The committee observed that while some federal agencies have unique congressional authority to enter into privatization and PPPs, others do not have that authority. Privatization and PPPs may offer more efficient or effective approaches to operating and managing services and facilities for public use.

DISPOSAL

When developing a real property capital plan, agencies need to right-size their asset portfolio by identifying assets that are unnecessary, are underutilized, or cannot be adequately maintained. When this is determined, agencies need to make plans to dispose of them. Agencies must proactively seek to renew their facility inventories in order to avoid asset portfolios that are too large or antiquated and cannot be properly maintained, repaired, or replaced with available resources. Recognizing and accounting for the financial commitment necessary to manage a portfolio is a function of federal facility renewal strategies.

The Federal Property and Administrative Services Act of 1949 (Property Act), as amended, governs the process of disposing of most federal real property unless an agency has independent disposal authority. Although DoD and the

U.S. Postal Service are 2 of the largest landholding agencies with independent disposal authorities, 4 other departments, 4 major independent agencies, and 11 departmental components have similar authorities. The Property Act prescribes a process for disposing of federal real property that begins when an agency determines it no longer needs a property. The agency will declare the property excess to its needs and turn it over to GSA for disposal. GSA will then offer the property to other federal agencies. If another federal agency has a need for the property, GSA transfers the property to that agency. The Property Act requires agencies acquiring excess property to pay the agency disposing of the property full fair market value. If funds are not available or there are extenuating circumstances, OMB may waive reimbursement.

If no agency indicates it needs the property, GSA declares the property government surplus and may sell the property to a state or local government or qualified nonprofit for the fair market value. Alternatively, GSA may transfer the property to the state or local government or nonprofit entity for up to a 100 percent discount, provided they use it for one or more legally enumerated public purposes. If the property is neither sold to a government or nonprofit nor transferred, it is sold to the public.

While selected agencies have the authority to manage and maintain real property, technically, they do not own the property. Generally speaking, all federal real property is "titled" to the U.S. government. Landholding agencies view the authority to possess real property as the equivalent of ownership and have cited the lack of incentives to dispose of excess real property. Agencies note a resource shortage for disposing of unneeded properties and a lack of reimbursement for the property's value once disposed. While agencies may be reimbursed if a property is transferred to another agency, if the property is declared surplus and sold the agency will not be reimbursed for its value. Except for agencies with delegated authority to retain disposal proceeds, those proceeds are deposited in the Treasury, and are not available to be spent, unless otherwise provided for by law.

Federal Assets Sale and Transfer Act of 2016

Recently, Congress enacted the Federal Assets Sale and Transfer Act of 2016 (FASTA), which authorizes an expedited process for identifying and disposing of non-defense[1] federal real property. FASTA authorized the creation of an oversight board, the Public Buildings Reform Board (Board). The Board identifies unneeded and underutilized properties that should be disposed of and reports these properties to OMB and Congress. Once OMB approves, agencies are required to declare the properties as excess and transfer them to GSA. The law

[1] DoD uses the Base Realignment and Closure processes to divest excess real property capacity, when requested by the administration and authorized by Congress. See DENIX, "Base Realignment and Closure," www.denix.osd.mil/brac/overview.

waives various authorities for GSA to transfer these properties to state and local governments and qualified nonprofits and directs GSA to sell these properties to the public. FASTA authorizes the Board to utilize proceeds from the sale of these properties to pay for costs associated with preparing the property for disposal and selling it. Moving forward, FASTA will also allow agencies to keep proceeds from future sales of surplus property.

> Finding 6-7: The committee believes that unneeded, underutilized properties exist, and that the non-defense agencies could take advantage of the expedited process provided by FASTA to dispose of these assets.

LEASING

For activities requiring physical space currently located on underutilized or inadequately maintained properties, agency facility renewal strategies should consider leasing as an alternative to ownership. While leasing is not a solution for housing many special-purpose activities, it offers an alternative that will ensure that agencies can provide a well-maintained, quality space. Since leasing includes all the costs of ownership, it can appear to be costlier than government ownership when compared with only the cost of acquisition and operations. When agencies need an asset in a specific location for a long-term period (30 years or more), government ownership is likely cheaper than leasing, but only if the government repairs and replaces the asset before it fails. However, the cost of failing to maintain the asset may cost more over time than leasing. Methodology supporting this determination is detailed in OMB Circular A-94 (OMB 1992).

Agencies should use leasing to house activities in spaces and locations where there is a competitive, private-sector market for the size and type of space being leased. As mentioned, OMB Circular A-11, Appendix B—Budgetary Treatment of Lease-Purchases and Leases of Capital Assets differentiates operating leases (the temporary use of an asset that is readily available in the private sector) from capital leases, lease-purchases, and construction or acquisitions. OMB Circular A-11 defines an operating lease as follows:

> Operating lease means a lease that meets all the criteria listed below. If the criteria are not met, the lease will be considered to be a capital lease or a lease-purchase, as appropriate. Multi-year service contracts (e.g., grounds maintenance) and multi-year purchase contracts for expendable commodities (e.g., cleaning products) are not considered to be operating leases.
>
> - Ownership of the asset remains with the lessor during the term of the lease and is not transferred to the Government at or shortly after the end of the lease term,

- The lease does not contain a bargain-price purchase option,
- The lease term does not exceed 75% of the estimated economic life of the asset,
- The present value of the minimum contractually required payments over the life of the lease does not exceed 90% of the fair market value of the asset at the beginning of the lease term,
- The asset is a general-purpose asset rather than being for a special purpose of the Government and is not built to the unique specification of the Government as lessee, and
- There is a private sector market for the asset (OMB 2022b, p. 7).

Agencies should not attempt to lease space they cannot acquire through an operating lease. Unless there is a private-sector market for an asset, the private sector will build-to-suit almost any space needed. However, the lessor will likely have to charge the government its full cost of ownership in the lease, which may cost more than the government's cost to build and own the asset itself.

Leasing affords the government flexibility to reduce, move, or change the location of an activity, flexibility that is not available in government-owned space. Lease costs for operating leases are spread throughout the lease and are easier to include in the budget than the up-front costs of significant capital investments. Many landholding agencies resist the use of leases because they may not perfectly meet the agencies' needs, or they may incur additional costs, such as transportation. With technology and the increased use of teleworking, however, location may not be as critical as it used to be. While leasing is not for every need, it offers an alternative to ownership when the budgetary resources are not enough to provide for the needed repair, replacement, and ultimate disposal of an owned asset.

> Finding 6-8: The committee observed that in some cases, using operating leases is an acceptable alternative to ownership when the up-front cost of owning cannot be supported in the near-term budget due to budget scoring rules or constraints.

The committee observed the challenges of prioritizing facility needs within the larger organization's budget needs. As the annual budget is finalized, agency senior leaders have a list of requirements, some of which will fall below the "cut line." One chief financial officer stated to the committee:

> They [senior agency leaders] are not going to listen to the engineers. They are not going to listen to the accountants. They're not. They listen to budget people. They listen to "Oh my gosh, we've neglected this, and there's this big number

> out there." [The facility renewal plan] tells us not only how much [money we need], it tells us which buildings we neglected.[2]

CONCLUSION

This chapter identified funding strategies that could be employed by federal agencies through facility renewal strategies for improving the amount of funding received for facility renewal. The next chapter will identify communication strategies necessary to ensure that these funding opportunities are realized.

[2] Jeffrey S. DeWitt, chief financial officer, District of Columbia Government, meeting with the committee on November 5, 2019.

7

Conclusions and Recommendations

INTRODUCTION

This chapter identifies the committee's conclusions, defines the key elements of a federal facilities renewal strategy, and establishes recommendations necessary to ensure that federal facilities sustain their critical missions—now and in the future. This report responds to the Federal Facilities Council's request that the National Academies of Sciences, Engineering, and Medicine form an ad hoc committee to describe the *how* and not the *what* for adapting, restoring, recapitalizing, and replacing assets sustainably, and addresses the key research questions raised by the Federal Facilities Council in the statement of task.

The committee conducted three public meetings and heard from 28 facility and budget experts from Congress, federal agencies, nonfederal governmental offices, and private-sector real estate officials to understand and synthesize the issues and constraints associated with planning, programming, and managing federal facility portfolios to support the missions of federal agencies. Appendix B lists the key experts and their organizations who presented information to the committee.

IMPETUS FOR TRANSFORMATIONAL CHANGE

The committee determined that implementation of successful federal facility renewal strategies must be approached as an asset management solution solving an asset management problem. Today's federal facility management operating environment is much like yesterday's operating environment: not enough money is being invested in federal facilities, which impacts agency mission execution

detrimentally. Insufficient funding is due to the government's need to respond to changing priorities. This is acknowledged and will happen, but failure of an agency to report the full extent and impact of unfunded facility requirements is a failure to fulfill its fiduciary responsibilities to Congress and the American people. In the words of one federal financial and facility expert who met with the committee,

> Agency senior leaders have a list of requirements, many of which are unmet, and they will continue to underfund those that are the least immediate in impact. Facilities fit there, until they don't. But even in a cost-strapped environment, you win the argument to rebuild a building you absolutely need now. You often lose the argument to reduce future costs or extend its useful life.[1]

Responding to this reality, the report details a bold, new approach based on management system thinking. This approach focuses problem solving not on managing assets, but on managing the value generated by assets. Although nuanced, this change in perspective will have a dramatic effect on agency facility management behaviors. Instead of focusing on facility asset life-cycle management activities, it focuses on how facilities support mission needs and stakeholder value. To be effective, new understandings, capabilities, and policies will have to be developed and implemented. Only through transformational change in implementing facility asset management systems will federal agencies gain the focus needed for improving facility resource-and-investment decision making, and ultimately for improving agency mission performance.

DEFINING THE ELEMENTS OF A FEDERAL FACILITIES RENEWAL STRATEGY

The committee began its work by defining *renewal* and establishing context for federal facility renewal strategies. In Chapter 1, the committee defined renewal as the extension of an asset's functionality beyond its expected service life through significant renovation, replacement, or repurposing. All assets eventually require reinvestment to adapt to changing times, missions, and operational requirements. Given operating constraints, federal agencies typically focus on sustainment funding for keeping the infrastructure running, rather than optimal investment strategies for their mission. Few agencies have systematically renewed their real property portfolios. As a result, the real property portfolios of many federal agencies are in increasing need of major rehabilitation, retirement, or replacement.

[1] Discussion between the committee chair and the Honorable John Conger, former Deputy Comptroller, Department of Defense, on August 3, 2020.

The committee believes a federal facilities renewal strategy is more than a vision. It is a policy embracing an action plan for an agency's real property portfolio. The report evolves this context into a facility asset management system approach that is implemented through the Office of Management and Budget (OMB) and agency policies adapted to their specific circumstances. Throughout, common asset management principles, objectives, and processes are used to guide risk-based, resource-and-investment decision making. The purpose of federal facility renewal strategies is stated as ensuring and assuring that federal facilities are being used to achieve the agency's mission efficiently and effectively.

Committee Statement of Task and Defining Elements for Facility Renewal Strategies

The committee's task was "to identify broad-based and practical strategies for federal facilities managers to continue investing in, and renewing, federal real property portfolios in alignment with their authorized purpose." The committee concluded its deliberations by defining the following key elements of any agency strategy on the renewal of federal facilities:

- An *asset management systems* approach is critical for real property portfolio management to ensure and assure alignment with mission objectives and priorities; to integrate annual operating costs with planned, periodic investment in (capital) construction and rehabilitation; and to mandate its use in statutory, policy, and agency directives.
- *Capital planning and risk management tools and methods* meet knowledge-based, professional standards for accuracy, rigor, transparency, and credibility. These tools and methods must effectively streamline understanding and link the cause and effect of facility performance with agency performance and vice versa.
- *Budgeting structures* plan for sufficient resources to implement facility renewal strategies, including user charges for the full cost of acquiring, operating, maintaining, and disposing of facilities; aggregating funds in revolving or working capital funds to prioritize investments across the portfolio and avoid funding "spikes"; establishing capital acquisition financing funds, such as the proposed Federal Capital Revolving Fund, to provide agencies with a source of capital they can repay over time; and privatization or use of public–private partnerships to devolve those public facilities and related services that are not inherently federal government responsibilities.
- *Strategic communication strategies* ensure and assure that stakeholders and decision makers understand the short- and long-term costs, benefits, and risks of federal facility renewal strategies and their relationships to achieving agency mission objectives.

RECOMMENDATIONS

The committee concludes its report by providing the following recommendations and listing relevant findings, which can be found in their corresponding chapters:

RECOMMENDATION 1: Implement a Federal Facility Asset Management System

The Office of Management and Budget (OMB), in concert with the Federal Real Property Council, should update OMB Circulars A-11 and A-123 to improve guidance for implementing facility asset management systems by

- **Requiring federal agencies to use a comprehensive and principle-based facility asset management system, as defined by International Organization for Standardization 55000—Asset Management System standards, to implement federal facility renewal strategies;**
- **Clarifying how enterprise risk management and internal controls support implementation of federal facility renewal strategies by improving and clarifying policies contained in OMB Circulars A-11 and A-123;**
- **Clarifying agency senior real property officer's fiduciary responsibilities to ensure and assure that the agency is maintaining its facility portfolio efficiently and effectively, and that achievement of this responsibility is reported as part of the agency's OMB Circular A-136—Financial Reporting Requirements;**
- **Detailing how whole asset life-cycle costs, whole asset portfolios, and whole benefit analysis support resource-and-investment decision making; and**
- **Updating OMB Circular A-11, Section 83 (Object Classification) to remove fragmentation and many-to-many relationships that make it exceedingly difficult to generate and audit integrated real property performance–budget and management balance sheets.**

(See Findings 2-1, 2-2, 2-3, 2-4, 3-1, 3-3, 3-4, 3-5, 3-6, 3-7, 5-1, 5-2, and 6-1.)

RECOMMENDATION 2: Implement a Real Property Capital Plan

The Office of Management and Budget (OMB) should clarify its requirements for agencies' annual real property capital plans as detailed in OMB Circular A-11's Supplement—Capital Programming Guide and OMB Memorandum M-20-03, "Implementation of Agency-wide Real

Property Capital Planning." Specific requirements needing clarification include

- **Ensuring the requirement for agencies to develop and publish a single, fully integrated real property capital plan as a component of the agency capital plan, as defined in the Capital Programming Guide;**
- **Verifying the relationship of real property capital plans in informing annual budget and investment decision making, including the successful inclusion of urgent and compelling facility renewal needs; and**
- **Publishing the role of the agency's real property capital plan by documenting and communicating the agency's strategy for reconciling agency objectives, budgets, and real property programs.**

Furthermore, agency senior real property officials should implement guidance in OMB M-20-03 for advancing the central role of their agency's real property capital plan, establishing a strategy for integrating and reconciling requirements, objectives, budget, and real property program execution.

(See Findings 2-4, 3-1, 3-2, 3-3, 3-4, 3-5, 3-6, 3-7, 6-1, 6-2, 6-3, and 6-8.)

RECOMMENDATION 3: Update the National Strategy for the Efficient Use of Real Property

The Office of Management and Budget (OMB) should clarify how the National Strategy for Efficient Use of Real Property and OMB Memorandum M-20-10 (Issuance of an Addendum to the National Strategy for the Efficient Use of Real Property) are used to guide their agency's asset management system implemented through real property capital plans. Specific requirements include the following:

- **Defining how agencies are to use the National Strategy to establish priorities and objectives for the efficient use of real property, to include addressing the Government Accountability Office's real property high-risk issues, and**
- **Establishing requirements that link performance reporting of budget execution for the real property capital plan to National Strategy objectives, as reviewed annually by the agency in the context of agency strategic plan reporting, such as through application of the Operational Readiness Principle.**

Furthermore, chief management officers and chief budget officers should ensure they coordinate their agency's response to OMB M-20-10 (Issuance of an Addendum to the National Strategy for the Efficient Use of Real Property) with their agency's response to OMB Memorandum

M-20-03 (Implementation of Agency-wide Real Property Capital Planning).

(See Findings 2-2, 2-3, 2-4, 3-2, 3-3, 3-5, 3-6, 3-7, 4-4, 4-5, 5-1, 5-2, 6-5, 6-7, and 6-8.)

RECOMMENDATION 4: Improve Federal Facility Models, Data, and Measures

The Office of Management and Budget (OMB) should clarify guidance requiring agency senior real property officials to improve cost estimates of renewal requirements. Currently, there is no broadly accepted approach to estimating renewal costs, which diminishes the credibility of renewal decision making. After considering two of the methods available, the committee recommends the following:

- **Senior real property officials should adopt an economic depreciation[2] approach for estimating renewal costs, tailorable to each agency's facility portfolio. As a starting point, the model could be simplified to a set of cost factors by facility type, analogous to the Department of Defense Facility Sustainment Model.**
- **Agencies should include existing dated depreciation rates and service lives in the economic depreciation approach review by using a schedule established for the revision of depreciation rate and service life data used in depreciation models, which is currently provided by the Department of Commerce's Bureau of Economic Analysis.**

Furthermore, the General Services Administration (GSA), in coordination with the Federal Real Property Council and under the direction of OMB, should create an independent database of component inventories for federal facilities, beginning with the extensive data collected for the Builder system, and make it available to qualified users and accessible by popular capital planning and facility management systems. The senior real property officials of all agencies would submit information to GSA for compiling, as directed by executive requirement.

(See Findings 3-5, 4-1, 4-2, 4-3, 4-4, 4-5, and 6-3.)

RECOMMENDATION 5: Implement Federal Facility Renewal Budgeting Strategies

[2] Economic depreciation refers to how an asset (structures, for example) declines in productivity over time. It is contrasted with tax depreciation, which is whatever the tax authorities allow you to use when filing income taxes.

Through implementation of facility asset management systems detailed in preceding recommendations, the Office of Management and Budget can ensure optimal use of federal facilities by having federal agencies guide budget development of federal facility renewal strategies by

- **Creating working capital funds or revolving funds to aggregate funding for capital investment into consolidated, agency-wide budget accounts, which could help smooth multiyear life-cycle spending and avoid large, disruptive year-to-year funding spikes;**
- **Installing user-pays models for all federal facilities that fund working capital required to sustainably operate, maintain, repair, and renew federal facilities;**
- **Allowing the General Services Administration to spend all the revenue collected in the Federal Buildings Fund for repairing, renewing, or replacing facilities managed by the Public Buildings Service;**
- **Encouraging agencies to identify noninherently governmental facilities and related services that are mirrored by a broad-based, active private market to be candidates for privatization, outsourcing, or public–private partnerships;**
- **Using the expedited disposal authorities created by the Federal Asset Sales and Transfer Act (FASTA), or seeking additional disposal authorities for properties not covered by FASTA, to dispose of unneeded and underutilized properties; and**
- **Using operating leases as an alternative to ownership when budget scoring rules show that the cost of owning is unlikely in the near-term budget outlook.**

(See Findings 3-1, 3-2, 3-4, 3-5, 3-6, 3-7, 4-4, 5-1, 6-1, 6-2, 6-3, 6-4, 6-5, 6-6, 6-7, and 6-8.)

A crosswalk of findings and recommendations is in Table 7-1, and Appendix H provides the consolidated list of findings and recommendations.

CONCLUSION

Robust, effective federal facility renewal strategies are possible when implemented using disciplined facility asset management systems; successful implementation of disciplined asset management systems is enhanced when using ISO 55000 standards. This asset management systems approach requires agencies to be more attentive to dynamic mission requirements and stakeholder expectations. To accomplish this, certain federal government policies need to be considered that limit or affect systematic, risk-based facility resource-and-investment decision making. This will require agencies to reassess their facility asset management

TABLE 7-1 Crosswalk of Findings and Recommendations

Findings	Federal Facility Asset Management System Implementation	Real Property Capital Plan	National Strategy for the Efficient Use of Real Property	Federal Facility Models, Data, and Measures	Federal Facility Renewal Budgeting Strategies
2-1	x				
2-2	x				
2-3	x				
2-4	x	x	x		
3-1	x	x			x
3-2		x			x
3-3	x	x	x		x
3-4	x	x			x
3-5	x	x	x	x	x
3-6	x	x	x		x
3-7	x	x	x		x
4-1				x	
4-2				x	
4-3				x	
4-4				x	x
4-5				x	
5-1	x				x
5-2	x				
6-1	x	x			x
6-2		x			x
6-3		x		x	x
6-4					x
6-5					x
6-6					x
6-7					x
6-8		x			x

capabilities that may result in the need for large-scale or targeted transformational change. The outcome of these efforts will help agencies better assure key stakeholders that facilities are being well managed, and are responsive to mission needs and performance expectations. The committee finishes its report highlighting the words of Air Force Secretary Heather Wilson when she declared the Air Force's commitment to its facilities renewal strategy:

> In the Air Force, we fight from our bases. The places we call home are also the platforms from which we project combat power. Hangers are not just structures; they are protectors of our assets. Runways are not just pavements; they are our starting lines. If our facilities fail, we fail. The Infrastructure Investment Strategy is how we succeed. (USAF 2019)

The committee believes that this focused message is how all federal facilities renewal strategies should be viewed and tailored to support each federal agency's mission.

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Appendixes

A

Biosketches of Committee Members

Michael A. Aimone, *Chair*, is the founder and chief data officer of Energy Management & Analytics, LLC. He specializes in facility energy activities in support to the Department of Defense (DoD), and defense communities. In his 50-year professional career, he served in various leadership positions in the private sector, academia, and DoD. While assigned to the Department of the Air Force, he served in numerous field and staff engineering assignments and concluded his 30-year active and reserve service as the Commander, 819th RED HORSE Squadron at Malmstrom Air Force Base, Montana. He most recently served simultaneously as the Acting Deputy Assistant Secretary of Defense (Operational Energy); executive director, DoD Siting Clearinghouse; and chief, Business Systems and Information within the Office of the Assistant Secretary of Defense (Energy, Installations, and Environment). As a member of the Senior Executive Service, he was responsible to the chief of staff of the Air Force for leadership, management, and integration of Air Force civil engineering, security forces, logistics readiness, and aircraft and missile maintenance. He previously served on a National Academies of Sciences, Engineering, and Medicine Committee on Predicting Outcomes of Investments in Maintenance and Repair for Federal Facilities. He holds a BS in electrical engineering from Michigan Technological University and an MS in electrical engineering from the University of Florida.

James "Jack" Dempsey, *Vice Chair*, is the founder of the Asset Management Partnership, LLC, that specializes in the advancement, development, and implementation of asset management and digital transformation solutions for asset owners and the asset management professionals that support them. Dempsey has over 30 years of experience as an asset manager for the built environment, his

first 20 years as an officer and civil engineer in the Coast Guard and then later as a director, advisor, and consultant at Definitive Logic, Jacobs, and CDM Smith. In this latter capacity he specialized in the development and implementation of technology-enabled asset management solutions for both public and private clients. Dempsey is also an active thought leader and board member on the national and international stages, serving as a member of the National Academies' Board on Infrastructure and the Constructed Environment and as a member and recent convenor of the International Organization for Standardization Technical Committee 251 for Asset Management representing the United States internationally through an American National Standards Institute–authorized, ASTM-sponsored Technical Advisory Group (US TAG). In addition, Dempsey remains active in the industry as a fellow with the Institute of Asset Management; a board member and senior fellow at the Asset Leadership Network; and as a licensed Professional Engineer.

Honorable Mahlon (Sandy) Apgar IV is a senior advisor at the Center for Strategic and International Studies, where he focuses on defense infrastructure, military housing and real estate, base closures, and public–private partnerships. Appointed by President Clinton and confirmed by the Senate, he served as the Assistant Secretary of the Army for Installations and Environment and led the clearance of a $7 billion maintenance backlog, the design and launch of the award-winning $20 billion program to privatize 86,000 military homes, and the restructuring of 70,000 historic military properties. He was a partner of McKinsey, Boston Consulting Group, where he established the infrastructure and real estate practice, and founder of his eponymous firm, where he served major U.S. and UK companies and advised on megaprojects in Europe, Japan, and the Middle East. He was awarded a U.S. patent for a corporate real estate portfolio evaluation and management system. He holds a BA in sociology from Dartmouth College and an MBA from the Harvard Business School.

Bilal M. Ayyub is a professor and the director of the Center for Technology and Systems Management at the A. James Clark School of Engineering at the University of Maryland, College Park, and was a visiting fellow at the National Security Analysis Department of the Applied Physics Laboratory in 2015-2016. He was a chair professor at Tongji University, Shanghai, China (2016-2018) and is currently the co-director of its International Joint Research Center for Resilient Infrastructure. He completed his PhD from the Georgia Institute of Technology, Atlanta, 1983. Ayyub's main research interests and work are in risk, resilience, sustainability, uncertainty, and decision analysis applied to civil, infrastructure, energy including renewables, defense, and maritime fields and climate-resilient infrastructure. Ayyub is a distinguished member of the American Society of Civil Engineers (ASCE) and an honorary member of the American Society of

Mechanical Engineers. He is also a fellow of the Society of Naval Architects and Marine Engineers, the Structural Engineering Institute, and the Society for Risk Analysis (2017-2018 treasurer), and a senior member of the Institute of Electrical and Electronics Engineers. Ayyub is the recipient of several awards, most recently the 2016 ASNE Solberg Award, 2018 ASCE Alfredo Ang Award, 2018 ENR Newsmaker award, 2019 ASCE President's Medal, and 2019 ASCE Le Val Lund Award. He completed his PhD in civil engineering from the Georgia Institute of Technology. He is currently a member of the National Academies' Board on Environmental Change and Society (2022-2025) and the National Academies' Roundtable on Macroeconomics and Climate-Related Risks and Opportunities.

Barbara M. Fraumeni is a special-term professor at the Central University of Finance and Economics in Beijing; a senior fellow at Hunan University in Changsha; a professor emerita of public policy at the Muskie School of Public Service, University of Southern Maine in Portland; and a research associate of the National Bureau of Economic Research in Cambridge. She is also a research fellow of the IZA Network, IZA Institute of Labor Economics, in Bonn. Fraumeni is an authority on human capital (World Bank, United Nations, and Organisation for Economic Co-operation and Development) and nonhuman capital, economic growth, productivity, and non-market accounts. She is a former program officer with the National Science Foundation and chief economist at the U.S. Bureau of Economic Analysis (BEA). While serving as the chief economist at the BEA, she was part of a team responsible for modifying the national accounts to treat research and development as an investment and assess its contribution to economic growth. Fraumeni attended Wellesley College, graduating in 1972 with a degree in economics and went on to earn a PhD in economics from Boston College.

David J. Haun is the president of Haun Consulting Inc., providing strategic advice and analytical support to public- and private-sector clients on federal government policy, program performance, and budgetary issues. He specializes in federal real property management and leasing with expertise in the federal budgetary treatment of leases and capital asset investments. Haun had a distinguished 35-year career in the federal government, with 33 years at the Office of Management and Budget (OMB). As the deputy associate director, he advised White House and OMB officials on policy, program performance, and budget issues for the Departments of Homeland Security, Transportation, and Justice and the General Services Administration (GSA). He is one of the original authors of OMB's scoring rules on the budgetary treatment of lease-purchases and leases (OMB Circular A-11, Appendix B) and reviewed countless GSA prospectuses for leases, construction, repair, and alterations. After retiring in 2015, he joined Grant Thornton as a director in its Public Sector practice and in 2018 founded Haun Consulting Inc.

Brian J. Lepore was a U.S. Government Accountability Office (GAO) analyst for nearly 32 years in Washington, DC, and Honolulu, Hawaii, including 12 years as a director of defense capabilities and management. At GAO he provided executive leadership of DoD infrastructure program audits, including reviews of military construction; base operations including facilities renewal; energy management; infrastructure privatization; mitigation of climate change impacts on military bases; cyber threats to utility systems; and base realignment and closure. Lepore has over 20 years of GAO experience working with Congress developing new audits, briefing members and staff on audit methodologies and findings, and as a director, testifying at 10 congressional hearings. Lepore represented GAO on numerous live and taped television and radio news and public affairs programs and presented at numerous conferences. He has taught GAO courses on managing congressional relations, DoD's structure, and performance auditing courses at GAO and one foreign national audit office, and has mentored GAO executive candidates and other staff. Lepore was detailed to the Senate Homeland Security and Governmental Affairs Committee to assist in the investigation into the government's response to Hurricane Katrina. Prior to GAO, he was a news and sports broadcaster at several commercial radio stations in Massachusetts. He holds an MPA from Suffolk University and a BA in arts in communications studies from the University of Massachusetts Amherst.

Peter S. Lufkin is currently managing partner with Pomar Lane, where he focuses on the development of real property cost and risk models. He previously was the founder and chief executive officer of Whitestone Research. Specializing in cost data products and consulting for capital planning, Whitestone was acquired by CBRE in 2013. His 25 years of experience includes development of the Department of Defense Facility Cost Models and the CostLab facility cost simulation system used by many large commercial property owners and government agencies. Lufkin also directed the development of the RISKSCAN capital prioritization tool and BRICKBITS, a residential cost website. He has authored over 90 technical reports and papers and has published in *Public Works Management & Policy*, *Military Engineer*, and *Facilities Manager*. He was also the publisher of the *Whitestone Facility Cost References* (North American and International editions) from 1995 to 2015. Lufkin did his undergraduate work at the University of California, Berkeley, and has a master's degree in politics and economics from the University of California, Santa Barbara.

David J. Nash is currently the president of Sustainable Biofuels Solutions, a waste-to-energy company with two technologies to convert carbon-based waste into either a high-BTU gas or drop-in fuels. He is also the president of Dave Nash and Associates, LLC, which is a company that provides consulting in construction programs and project management. He served the U.S. Navy as a commissioned civil engineer for 33 years before retiring as a Rear Admiral (upper half)

in 1998. He was a uniformed civil engineer responsible for construction and maintenance of Navy facilities around the world. Beginning in 2003, as a civilian on the federal payroll, he led the initial setup and management of an $18 billion reconstruction program in Iraq after hostilities ceased. He is a registered engineer in Michigan and Pennsylvania. He is a fellow in the American Society of Civil Engineers, a member of the National Academy of Construction, a member of the National Academy of Engineering, a fellow of the Society of American Military Engineers, and is involved with many other professional organizations. He has led several committees of the National Academies.

Janice L. Tuchman is the editor-in-chief and leads the editorial team creating content for the *Engineering News-Record* (ENR) enterprise—online, in print, and at live events. She is active in many construction organizations and has developed a broad network of industry sources who help keep ENR on top of the latest trends and innovations. In October 2020, Tuchman became vice chair of the Industry Leaders Council of the American Society of Civil Engineers, and she is a member of the National Academy of Construction (NAC) and the heavy industry honorary, The Moles. She is on the board of the nonprofit Bridges to Prosperity, which works to alleviate global poverty caused by rural isolation by building pedestrian bridges across raging rivers. She recently joined the board of advisors of the Center for Buildings, Infrastructure and Public Spaces at Columbia University and previously served two terms on the National Academies' Board on Infrastructure and the Constructed Environment. She is the recipient of the G.D. Crain Award for Distinguished Editorial Career, the Beaver's "Service & Supply" Award for outstanding achievement in heavy engineering construction, and the Carroll H. Dunn Award from the Construction Industry Institute for "outstanding contributions to improving the cost effectiveness of the United States construction industry." She was honored in 2019 with the Engineering and Construction Contracting Association Achievement Award and received the Ted C. Kennedy Award from NAC in October 2020. Tuchman earned her bachelor's and master's degrees in journalism from the University of Colorado Boulder.

B

Committee Interviews and Briefings

OPEN MEETING, JULY 23-24, 2019

Review of Findings and Recommendations from Pertinent National Academies Reports

- Get Moy, Vice Chair, *Predicting Outcomes of Maintenance and Repair of Federal Facilities*

Review of Findings on Federal Real Property Management, Government Accountability Office (GAO) High-Risk Reports

- Amelia Shachoy and Mike Armes, Physical Infrastructure, U.S. GAO
- Diana Maurer and Gina Hoffman, Defense Capabilities and Management, U.S. GAO

Legislative Perspective on Federal Real Property

- Jennifer Bastin, Professional Staff Member, Senate Appropriations Committee/Construction/VA Subcommittee

Roundtable Discussion with Federal Facilities Program Managers: Issues and Expectations

- Mike McAndrew, Department of Defense (DoD)
- Michael Karau, Department of Homeland Security

OPEN MEETING, SEPTEMBER 18-19, 2019

DoD Advanced Analytics—VTIME & SMS
- Lance Marrano, U.S. Army, Civil Engineering Research Center

Strategy for Federal Facilities Renewal—Air Force Senior Leader View
- Hon. John Henderson, Department of the Air Force
- Marc Vandeveer, Air Force Installations and Mission Support Agency

Strategy for Federal Facilities Renewal—General Services Administration Senior Leader View
- Dan Mathews, Commissioner, Public Buildings Service

NASA: Rethinking How They Make Facility Investment Decisions
- Kim Toufectis, National Aeronautics and Space Administration

Federal Real Property Council
- Victoria Collin, Office of Management and Budget

OPEN MEETING, NOVEMBER 5-6, 2019

Chief Financial Officer (CFO) Panel
- Hon. John Conger, Former DoD Deputy Controller
- Jeffrey DeWitt, Chief Financial Officer, District of Columbia
- Moderator: Ryen Tarbet, Chair of the USA Technical Advisory Group, ISO 55000—Asset Management

University-Sector Best Practices
- Al Diaz, CFO, Marymount University
- Derrek Niec-Williams, Executive Director, Campus Planning, Architecture & Development, Howard University
- Moderator: Yalda Saadat, University of Maryland

National Laboratory–Sector Best Practices
- Dr. Cliff Shang, Director of Strategic Infrastructure, Lawrence Livermore National Laboratory

Employing Data Analytics in Facility Renewal Decision Making
- Boudewijn Neijens, Chief Marketing Officer, Copperleaf Technologies, Inc.

Commercial Real Estate Sector Best Practices
- Tim Hutchens, Executive Vice President, CBRE Group, Inc.

Public, Nonfederal–Sector Best Practices

- Steve Berrang, Director of Capital Program Management, State of New York Metropolitan Transportation Authority
- Mildred Chua, Director & Program Executive, Enterprise Information & Asset Management, State of New York Metropolitan Transportation Authority
- Shawn Lenahan, Assistant Director, Office of the Chief Operating Officer, Port Authority of New York and New Jersey
- Paul Demit, Senior Vice President and Business Unit Director for Public–Private Partnerships and Infrastructure, Atkins Global
- Moderator: Justin Rice, Editor, *Engineering News-Record, Mid-Atlantic*

C

Communicating the Message Effectively

INTRODUCTION

Effective communications with stakeholders are critical to implementing federal facility renewal strategies. The best means to implement these strategies is through a facility asset management system, based on the International Organization for Standardization (ISO) 55000 standards. ISO 55000 goes to great length on how to identify and work with stakeholders using a strategic asset management plan (which the committee refers to as an agency's real property capital plan) and subordinate asset management plans. As detailed in this report, this invites a bolder, more direct way to communicate facility performance and budget needs to support agency mission achievement.

This appendix expands the concepts and discussion in Chapter 3 on facility asset management anatomy and its relationship to a facility asset management system to emphasize how these frameworks also provide a structure for communications. Figure C-1 and Table C-1, which illustrate these concepts, are repeated from Chapter 3 (see Figure 3-3 and Table 3-2) for easy reference. The appendix outlines an approach to promoting the benefits of a disciplined asset management system to agency policy makers, in order to improve the success of making the transformational changes described in this report.

FACILITY ASSET MANAGEMENT SYSTEM–BASED COMMUNICATIONS

When integrated, the facility asset management system anatomy and asset management system requirements establish a framework for communications.

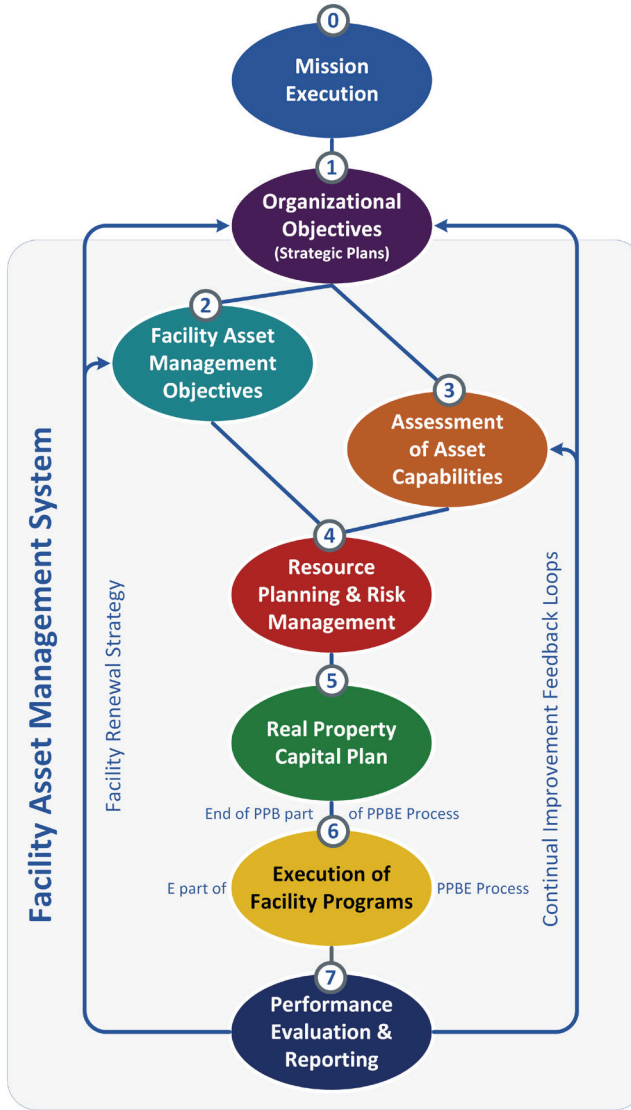

FIGURE C-1 Facility asset management system anatomy.
SOURCE: Courtesy of J. Dempsey, founder, Asset Management Partnership, LLC.

TABLE C-1 Facility Asset Management System Anatomy and ISO 55001 Clause Comparison

Relationship Between Facility Asset Management System Anatomy and Asset Management System Requirements	ISO 55001 Clauses						
	4 – Context of the Organization	5 – Leadership	6 – Planning	7 – Support	8 – Operation	9 – Performance Evaluation	10 – Improvement
0 – Mission Execution	■						
1 – Organizational Objectives	■	■	■	■		■	
2 – Facility Asset Management Objectives		■	■	■		■	
3 – Assessment of Asset Capabilities			■	■		■	
4 – Risk Management and Resource Planning			■	■		■	■
5 – Real Property Capital Plan			■	■		■	■
6 – Execution of Facility Programs				■	■	■	
7 – Performance Evaluation and Reporting	■	■		■		■	■

SOURCE: Data sourced from International Organization for Standardization, 2014, *ISO 55001: Asset Management—Management Systems—Requirements*.

While this framework was covered more generally in Chapter 3, here it is discussed from a communications lens.

Step 0: Mission Execution

Mission execution is defined by U.S. Code and informed through the President's Management Agenda and the Performance Management Framework, which are detailed in the Office of Management and Budget (OMB) Circular A-11, Section 200. This body of work defines agency authorities, priorities, and budgets, and its execution is governed by the revised Government Performance and Results Act of 1993. An agency must develop its federal facility renewal strategies in support of the agency's mission and demonstrate that it does so in its real property capital plan (ISO 2014b, Clauses 4 and 7.4). This approach is consistent with the data integrity principle introduced in Chapter 3, which states that data used (and communicated) must service the decision-making needs of the asset management system. This principle is used to assure stakeholders that facility asset management objectives—and, in turn, facility performance—align with their needs and expectations. This also ensures that the agency's real property capital plan upholds the agency's fiduciary responsibility to manage its facility

assets efficiently and effectively, and to report achievement of this responsibility through reporting requirements detailed in OMB Circular A-136—Financial Reporting Requirements, which, in part, respond to any outstanding Government Accountability Office (GAO) managing federal real property high-risk issues (GAO 2011c).

Step 1: Organizational Objectives

Organizational objectives development, in alignment with communications covered in Step 0, fulfills federal agency requirements to establish strategic plans (OMB Circular A-11). In turn, this makes use of existing agency strategic planning policy and processes to manage facility assets in support of resource-and-investment decision making. These management activities are well practiced, but a review of agency strategic plans finds that there is little (and often no) attention given to facility asset management activities. This is remarkable given that approximately 10 percent of most agency management and operations budgets is consumed by facility assets. Therefore, the committee recommends that OMB fix object classifications (Schedule O) contained in OMB Circular A-11, Section 83, to ensure that costs incurred by facility assets are fully accounted in accordance with the balance sheet analysis principle introduced in Chapter 3.

ISO 55001 calls out the importance of understanding organizational objectives and using them to guide facility asset management objective development. In all cases, organizational objectives define the purpose behind federal facility renewal strategies; therefore, their description and constant upkeep are essential to developing and maintaining effective, responsive real property capital plans. This is why, in a number of front-end clauses, ISO 55001 emphasizes that the role of an asset management system is to promote achievement of organizational objectives, in order to ensure that stakeholder needs and expectations are considered and communicated throughout the process.

Step 2: Facility Asset Management Objectives

Facility asset management objectives are a response to organizational objectives; this relationship provides a basis of communications to assure stakeholders that facility management activities align with mission needs and expectations. Communications of this type push facility asset managers beyond classical facility management thinking and into management system thinking. Specifically, facility managers must frame asset management objectives so that they are meaningful to three specific types of decision makers:

- Mission operators and facility users need to understand that the work defined by facility asset management objectives reflects their concerns and expectations in a way that invites critical feedback.

- Financial and program managers need to understand how performance risk is managed through resource-and-investment decision making (e.g., what is the impact or potential consequence if a budget decreases by 5 percent?).
- Facility managers need facility asset management objectives to define facility performance criteria that are relevant to facility planning and asset life-cycle management decision making.

To address these needs, as a building block of communication, is the performance–budget integration principle introduced in Chapter 3 and further developed in Appendix F (see Figure C-2).

Although it is relatively simple, the performance–budget integration framework can be adapted to a full range of facility asset performance requirements (e.g., stakeholder expectations) that are meaningful to facility managers in terms of acquisition, design/construction, maintenance, and operating standards. This framework can also be used to equate facility requirement cost analysis, supporting broader planning, programming, budgeting, and execution decision making relevant to financial and program managers. The framework shown is supported by OMB and numerous agency policies, but is rarely represented from an asset management perspective. Doing so is one way to advance communications using an ISO 55000–based facility asset management system.

Step 3: Assessment of Asset Capabilities

Step 3, assessment of asset capabilities, builds on communication activities detailed above. In this area of the framework, facility asset management objectives defined in Step 2 are used as a basis to communicate actual facility performance as a product of a facility assessment or study. This is an essential part of an ISO 55001 asset management system as defined in Clause 9 (Performance Evaluation) requirements and emphasized through many asset management principles introduced in Chapter 3.

There are two primary decision-making levels where this assessment is critical. The first is evaluating the performance of facility assets and portfolios in comparison with user-defined facility asset management objective performance criteria and thresholds. This provides a foundation for a gap analysis, which is performed in the next step. In Step 3, the focus is on reporting the facts on actual facility performance for areas that matter to the three stakeholder groups listed in Step 2 (mission operators and facility users, financial and program managers, and facility managers). Doing this correctly substantiates the Evidence-Based Policymaking Act (also known as the OPEN Government Data Act) of 2018 requirements, implemented through OMB Circular A-130—Managing Information as a Strategic Resource, which likewise affect development of federal facility renewal strategies. The second level critical to decision making entails establishing trust

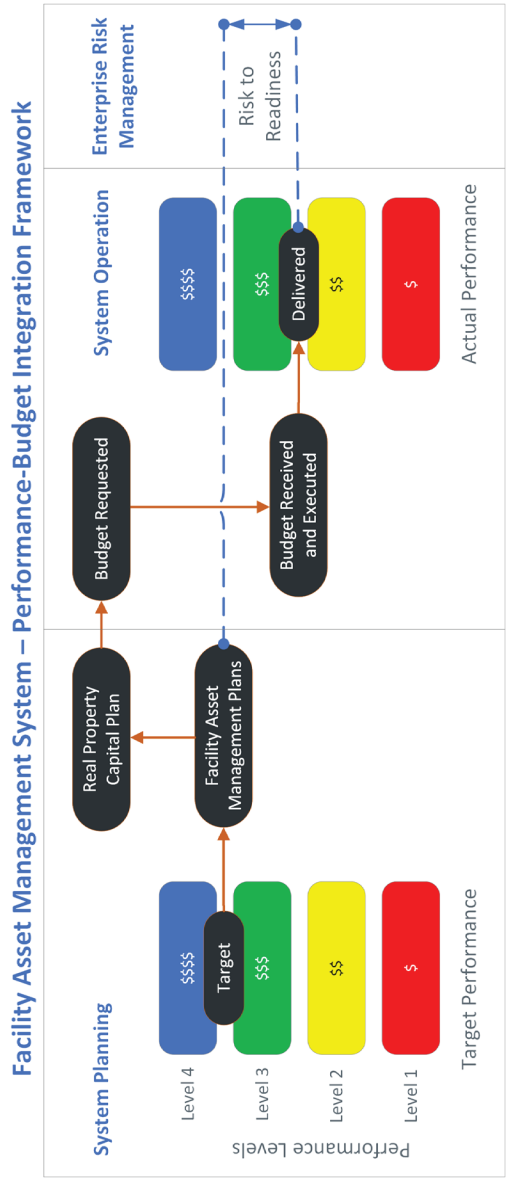

FIGURE C-2 Facility asset management system—Performance–budget integration framework.
SOURCE: Leitch and Dillinger, 2012, *Project Maintenance Management Development Guidelines*, U.S. Army Corps of Engineers.

in the resource-and-investment decisions being made. If the foundational information used in federal facility renewal strategies is suspect, confidence in any decision will likewise be suspect. This is why performing and reporting data validation and verification, as detailed in Chapter 4, is so important. This foundation includes accurate inventory, status, and performance reporting. This is also why so much energy has been spent on improving facility inventory data, which is only a first step of broader federal facility asset management strategy—not an end objective.

Also on the facility asset management system pipeline is status reporting, as exemplified by the proliferation of facility dashboards and decision-support technologies. Coupled to this motivator is facility performance reporting, summarized in the introduction to the facility performance principle in Chapter 3. This principle focuses attention on four performance attributes that are critical to evaluating the performance of all facility assets: condition, functionality, availability (a method for facility status reporting), and utilization. These methods, interrelationships, and decision-making interdependencies involve communications that, in accordance with ISO 55001, must be detailed and documented in the agency's facility asset management system (ISO 2014b).

Step 4: Risk Management and Resource Planning

Risk management and resource planning require tools and skills that are not typically the focus of a facility manager's professional growth trajectory. Given that facility managers are critical to facility asset management system operations, it then becomes incumbent on the system to introduce and augment these capability needs. These requirements are detailed in OMB Circulars A-11 and A-123, but—as highlighted in Chapter 2, and detailed in Appendix E and GAO-19-57, *Federal Real Property Asset Management: Agencies Could Benefit from Additional Information on Leading Practices*—OMB policy can do more to explain how to improve federal facility performance management. Supporting this is the operational readiness principle introduced in Chapter 3, which defines an apex method for supporting communications and provides a simple basis for communications, bringing together mission operators, financial and program managers, and facility managers in a common decision-making framework. Appendix E provides an example of this principle at work in the Army National Guard Readiness Center Transformation Master Plan. Likewise, this approach establishes a basis for enterprise risk management for whole facility portfolio management activities. This is the natural outcome of an ISO 55000–based facility asset management system and fully supports OMB Circular A-123 requirements and their role in implementing OMB Circular A-11 requirements for better management of government spending in alignment with value-generating objectives.

Step 5: Real Property Capital Plans

Real property capital plans are not just plans; they are communications platforms. More specifically, they are places where agencies can organize strategic communications with key stakeholders with interests in facility performance. To start, OMB Circular A-11's Capital Programming Guide requires the agency's capital plan, of which the real property capital plan is a subset, to be used to inform budget development. This is carried out through agency planning, programming, budgeting, and execution processes. In terms of communications and risk management, the real property capital plan provides a critical role in responding to changes in the operating environment. Specifically, the real property capital plan, through periodic updates, provides an iterative communications framework for balancing and reconciling risk in a manner understood by key stakeholder groups, as depicted in Figure C-3.

This framework recognizes that risk must be continually evaluated from three perspectives. Furthermore, the facility asset management system must detail how these communications are performed to ensure and assure clarity of effort and purpose. In alignment with federal policy, ISO 55000, and recommendations made in this report, the real property capital plan (per ISO 55000 the strategic asset management plan) is the apex means to bring clarity to these important decision-making and communication needs. ISO 55001 is focused on this area and the importance of its application in guiding facility asset management system development to implement effective and impactful federal facility renewal strategies.

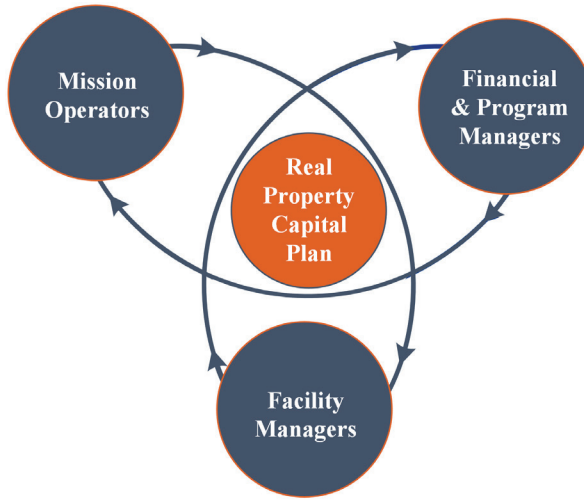

FIGURE C-3 Communication framework for balancing risk among stakeholders.

Step 6: Execution of Facility Programs

Execution of facility programs consumes a vast majority of the funding supporting facility operations, including acquisition, operations, maintenance and repair, real estate management, and services (utilities, communications, security). In the ISO 55000 construct, this activity is anticlimactic because it runs counter to the response-oriented, hero mentality prevalent in many facility operations. Performing this step effectively requires the setup of all the prior steps and substantial, systematic communications with key stakeholders. This is to ensure (via objective setting and performance evaluation feedback loops) and assure (via confidence and integrity building) that facilities are being managed well and achieving mission objectives in alignment with stakeholder expectations. Simply put, stakeholders that depend on a facility are the ultimate judge of how well that facility is being managed. Therefore, facility managers must continually ensure that their priorities align with organizational objectives and that their communications ensure that stakeholders understand this relationship and can participate in risk-based resource-and-investment decision making. It is important that stakeholders understand and accept the decisions and share the responsibility. As such, communicating in this area includes developing understanding, knowledge development, and performance reporting. All of these requirements are detailed in ISO 55001 as part of an effective facility asset management system.

Step 7: Performance Evaluation and Reporting

Performance evaluation and reporting are essential, often overlooked management activities for organizations beginning to implement disciplined facility asset management systems. While ISO 55001 includes many technical requirements supported by OMB Circular A-11 and A-123 requirements, it improves on these by clarifying how supporting management requirements must be coordinated to realize effective, impactful federal facility renewal strategies. This includes communications with agency executive leadership and superior decision makers in the executive branch and Congress. Supporting this, as detailed above, and as required in form through the performance management framework detailed in OMB Circular A-11, an agency's real property capital plan provides a focal point for these communications. OMB M-20-03, "Implementation of Agency-wide Real Property Capital Planning" and OMB M-20-10, "Issuance of an Addendum to the National Strategy for the Efficient Use of Real Property" also address these ideas. Also, as detailed in the discussion of this framework in Chapter 3, Step 7 represents both an end and a beginning. This step establishes a continual improvement process dictating how the facility asset management system must provide feedback regarding the asset management objectives detailed in Step 3, highlighting the fact that facility asset management objectives are the fulcrum for all performance evaluations, calling to mind the adage that "only

what is measured can be managed." Therefore, those developing a facility asset management system need to pay special attention to the selection of performance evaluations and the manner in which they are presented and communicated.

This section has detailed how an ISO 55000–based facility asset management system supports a wide range of communications needed to advance federal facility renewal strategies. OMB and most agency policies emphasize the importance of communications supporting effective facility management. The committee contends that current policy is helpful but insufficient for providing the breakthroughs required. That is why this report promotes the use of management system thinking to reframe risk, resource, and investment decision making, as well as stakeholder engagement. This bold, new approach will require substantial communications to develop this idea into working policies, as well as new and improved communications related to managing facility assets.

SUPPORTING AND JUSTIFYING FACILITY RENEWAL STRATEGIES THROUGH BUDGET DISCUSSIONS

This section extends the idea introduced in the last section on required communications to promote it as a policy that agencies can implement on their own. These aspects of communications generally get little attention from the classical facility management thinking perspective. This section develops an approach on how to communicate with and convince policy makers of the benefits derived from an ISO 55000–based facility asset management system, focusing specifically on how agencies can frame benefits in a way that clarifies risk and opportunities in making such a transformational change.

An agency's real property capital plan leads the way in communicating agency-wide plans and performance objectives in order to assure stakeholders that their needs and objectives are being addressed fully. Stakeholder engagement objectives are clearly stated in internal control requirements and guidance contained in OMB Circular A-123 and its supporting GAO-14-704G (the Green Book, GAO 2014e). Such communication needs to

- Occur throughout all agency processes;
- Engage any stakeholder who would benefit from better federal facility asset management;
- Develop influential communication method strategies that proactively leverage policy; and
- Be clear, complete, comprehensive, appropriately nuanced, fact based, and rich in quality data.

Effective communication is needed in almost every step of the facility asset management system framework, including (1) strategic planning; (2) budgeting; (3) program evaluation, including periodic reevaluation to identify any

programmatic changes that may be warranted; and (4) responding to requests for information from Congress and other external parties.

As the committee noted earlier, agency use of an asset management system is a critical component of effective facility portfolio management. An effectively developed and implemented federal facility renewal strategy should be thought of as a proactive communications strategy. The strategy can ensure efficient asset management because it harmonizes a decision-making framework, coordinating all stakeholder engagements, gathering high-quality and reliable data, supporting informed decision making, and including performance evaluation to inform improvement activities stemming from the evaluation.

The committee appreciates that many senior executives and other senior managers communicate among themselves and with stakeholders on a near-daily basis. At the same time, the committee notes that effective communication using leading practices can enhance the performance of agency officials at all levels and is helpful to establishing a cohesive overall message for federal facilities renewal (see OMB M-20-10, "Issuance of an Addendum to the National Strategy for the Efficient Use of Real Property"). Agencies can leverage the federal budgeting process to communicate progress, as detailed in Chapter 6.

At the highest decision-making levels, the federal budgeting process involves competing for resources among agencies and other components within federal departments. As noted in Chapter 3, federal agencies need to generate value supporting mission achievement. Given that resources are limited in normal, nonemergency situations, agencies have to find a balance between many different needs for funds, including funding federal facility renewal. Few federal agencies receive everything they request. Therefore, effective communication seeking resources should start with an honest appraisal of the value proposition supported by facilities. This should define the difference between *wants*—that is, resources that would be nice to have but are not essential for mission capability—and *needs*—that is, resources essential for mission execution. Effectively identifying mission needs and prioritizing them before seeking resources improves confidence in the request. In practice, this needs-versus-wants consideration is essential to implementing OMB's Circular A-11, Supplement—Capital Programming Guide. Doing so invokes several principles detailed in Chapter 3 and Appendix F, notably mission alignment, operational readiness, and performance–budget integration, while providing reasonable assurance to stakeholders, including Congress.

Agency program officials should then limit their request to only what they need; it is important to understand that their own agency, department, OMB, or Congress will not look favorably on requests that do not directly support mission achievement. This sometimes involves different audiences in the budgetary approval chain inside the department, at OMB, and among congressional appropriators and authorizers. These audiences may view the value of federal facilities beyond a narrow definition of agency mission execution to include

socioeconomic, environmental, energy, climate change, social responsibility, and national strategy objectives.

CONSISTENCY OF KEY COMMUNICATION PRINCIPLES

Effective communication relies on timeless principles of credibility, trust, and justification based on mission essential value. Implementing federal facility renewal strategies will be more persuasive when the case for renewal can be understood and trusted by key decision makers in their chain of command structure.

Credibility

Resource justifications using a disciplined asset management system applying principles outlined in Chapter 3 provide a rigor and framework that inspire confidence in budget decision makers. Full message transparency and an ongoing and frank dialogue with decision makers contribute to developing credibility. Organized messaging based on accurate and complete data, and robust internal audits and management reviews, as detailed in ISO 55001, Clause 9 (Performance Evaluation), are important for both developing an agency facility renewal strategy and establishing credibility for that strategy.

Trust

Successful federal facility renewal strategies must be responsive to how stakeholders measure value. These stakeholders include OMB officials, members of Congress and their staff, and senior agency decision makers. The relationships among facility and asset managers and these stakeholders may be limited to publication of the agency's real property capital plan and must be considered part of real property capital plan development. Basing real property capital plans on a robust facility asset management system that reinforces quality, consistency, and continual improvement builds trust through methodical fulfillment of expected results. Therefore, agency facility renewal strategies are advantaged when real property capital plans clearly support mission achievement and stakeholder expectations; therefore, clear communication requirements must be spelled out in the agency's facility asset management system.

EFFECTIVELY TARGETING COMMUNICATIONS WITH THE EXECUTIVE BRANCH

Facility managers and others along the budget approval chain should prepare facility renewal strategies in a manner that streamlines and simplifies budget development. Artful communications anticipate and respond to budget decision

making and demonstrate how risk is managed and value is generated. For instance, ISO 55000 promotes the view that asset management is about managing value and not about managing assets. In remarks to the committee, the Honorable John W. Henderson, assistant secretary of the Air Force for installations, environment, and energy explained:

> Air and Space Force installations are more critical than ever to current and future mission readiness, just as they were when General Hap Arnold stated, "Air Bases are a determining factor in the success of air operations. The two-legged stool of men and planes would topple over without this equally important third leg." Today, the Department of the Air Force has a backlog of facility maintenance and repair of over $33 billion across an asset replacement value of $280 billion. The only way forward to ensuring continued resilient mission support is to strategically invest in our facilities of the future at a rate at least 2.3 percent of our replacement value per year, proactively optimize maintenance management practices and expenditures, and divest unneeded infrastructure.[11]

Thus, requests for resources can be more effective if they include a convincing discussion of the contribution facilities make to mission capability. For example, the Air Force's Mission Dependency Index (MDI) links facilities to mission execution or mission capability for this purpose. Communications using tools such as MDI become more persuasive if they include a reasoned discussion of the consequences of doing nothing, or of how receiving insufficient resources will increase risk of mission failure. For example, in 2009, GAO reported that

> officials at McChord Air Force Base, Washington, stated that window repairs costing about $32,000 for the installation's steam plant had been deferred because sustainment funding was not available. The building's windows leak and allow water to flow onto the electrical panels of some equipment in the plant. The leaks have occasionally caused the panels to short out, resulting in temporary electricity outages to portions of the installation, potentially undermining operations. (GAO 2009a)

While the committee does not have evidence indicating whether the mission failure risk was communicated in the request for resources, the example highlights that such input can be compelling in requesting resources.

Communications need to include reliable and consistent data underpinning the request, which should increasingly build trust among the parties going forward. Federal departments can employ a process to target communications, using facility asset management objectives, to substantiate and justify budget requests. Effectively implementing such communications through real property capital plan development is a fundamental part of an ISO 55000–based facility asset management system.

[1] Honorable John W. Henderson, meeting with the committee, on September 17, 2019.

Similarly, agencies can also make effective connections by having a highly technical response ready for those who are likely to prefer or need a higher level of detail or greater technical specificity. Having responses appropriate to the needs of the decision makers can help officials who have approval, authorization, or appropriation responsibilities but may not have as much time as they might like for the review process. OMB Circular A-123 and GAO's Green Book offer some relevant key concepts that are completely compatible with ISO 55000. Specifically, management should use quality information to define facility asset management objectives. Management should then communicate the necessary quality information internally and externally using appropriate methods to specifically include real property capital plans, considering stakeholder needs, and including legal or regulatory requirements (GAO 2014e).

While federal agencies generally have planning, programming, budget, and execution processes, the committee notes that these policies generally focus on authorities and funding concerns but not on how to manage the value generated from facility assets, which is the exact purpose of ISO 55000 standards. This is another reason why selection and development of facility asset management objectives is so important. Specifically, these objectives should be developed to resonate with mission operators, financial and program managers, facility managers, and budgeting officials to ensure and assure that desired value-based objectives and benefits will be achieved. The art of pulling all of this together is the essence of federal facility renewal strategy development.

EFFECTIVELY TARGETING COMMUNICATIONS WITH THE LEGISLATIVE BRANCH

Communication between the executive and legislative branches can be challenging but need not be. Congress has a crucial role in determining what policies the federal government will pursue in the coming fiscal year through its appropriations and authorization processes. Agencies do well to view Congress as a partner seeking to enable mission achievement. In the same way that trust and credibility are built over time, communications with members of Congress or committee or member staff, such as allowed by agency policy and enabled through dissemination of real property capital plans, should also be considered when developing federal facility strategies. Specifically, development of real property capital plans should be attentive to both agency mission requirements and other requirements that may influence agency facility management. In this way, synergies may emerge that are helpful in improving agency mission achievement, supported by activities that also help achieve other authorized purposes.

Federal agencies can enhance their effectiveness by framing requests for resources to specific audiences involved in the budgeting process that may also have influence over agency budgets. At every step, agencies must comply with policies governing this type of communication. As contained in OMB

M-20-10—Issuance of an Addendum to the National Strategy for the Efficient Use of Real Property, federal agencies cannot secure capital unless appropriated by Congress (OMB 2020a). Moreover, the National Strategy itself notes the executive branch will need the support of its partners in Congress to identify additional flexibilities and resources to further relevant efforts and to recommend to Congress which properties should be disposed, consolidated, collocated, or reconfigured (Executive Office of the President 2015). Suggestions on what some of these could be are detailed in Chapter 6. Thus, federal agencies are invited to think creatively on how budget decision making can be used with strategic purpose to optimize agency mission achievement through coordination of other authorized objectives.

EFFECTIVELY TARGETING COMMUNICATIONS WITH THE PRIVATE SECTOR

Federal agencies may want to consider whether to engage private-sector stakeholders in communications related to infrastructure and real property assets—the agency's real property capital plan is one way to do this. A helpful first step is deciding what can be communicated. Second, the agency must identify its constituency and its interest in agency mission execution. Third, the agency must determine the allowable parameters of this type of communication. A caution here is that private-sector entities may have different interests and priorities than the public sector. Outreach may cause the private-sector entity to focus on the department or its programs in ways that the agency did not intend.

A federal agency that decides to reach out to the private sector has many options. For example, an agency could reach out to beneficiaries of service delivery programs (e.g., veterans through veterans' service organizations; nonprofit organizations that obtain ownership of lighthouses). As the committee notes in Chapter 2, OMB Circular A-123 is an excellent source of guidance related to enterprise risk management and internal controls, but like OMB Circular A-11, it does not provide a means to employ impactful facility renewal strategies. A key component of impactful renewal strategies is enhancing agency mission capability and service delivery. Private-sector outreach can produce informative input on the success of service delivery in some circumstances. Coordination with OMB would be critical to ensure that the executive branch department's communications are consistent with current policy priorities.

Communications with the private sector may be through any number of infrastructure-oriented associations, such as the

- American Society of Civil Engineers,
- American Society of Military Comptrollers,
- Asset Leadership Network,
- Association of Asset Management Professionals,

- Association of Defense Communities,
- Association of Government Accountants,
- Counselors of Real Estate,
- Federal Real Property Association,
- Institute of Asset Management,
- International Facility Management Association,
- National League of Cities,
- Society of American Military Engineers, and
- Urban Land Institute.

Many other organizations may also be interested in the specific mission or service to be accomplished in the facility for which the agency is seeking resources. Federal agencies choosing to reach out proactively may also want to present relevant messages at association meetings or conferences.

The news media provides another opportunity to reach out, although agencies should have a clear understanding of who they are trying to reach and have an associated strategy for achieving the connection. In all cases, this type of engagement must be in compliance with agency policy. For example, if the agency is seeking to reach the public in a given location related to enhancing mission capability or service delivery through a facilities renewal activity, the agency may want to target communications to local media in the target location. In a basic way, release of pending procurement and contract information is one value-adding reason to do so. This approach could also be effective when trying to reach the infrastructure-oriented associations identified above. At the same time, federal agencies need to understand that the media's independence means agencies could receive criticism by drawing attention to themselves. Examples of media outreach targets include news media, journals, and relevant business-to-business publications.

Last, agencies may also want to consider other means of engaging with the public. GAO's internal control standards specify that management obtain quality information from external parties, including the public. Initiatives stemming from the Digital Accountability and Transparency Act (DATA) of 2014 and Performance.gov are excellent, preapproved conduits. The committee also believes that agencies should consider developing a means of engaging with the public through established processes such as *Federal Register* notifications, when appropriate, and public meetings. In 2013, GAO reported on an Army initiative to hold "community listening sessions" as part of an initiative at that time on the selection of installations from which to inactivate 10 Brigade Combat Teams. The Army conducted the listening sessions to give communities surrounding 30 installations an opportunity to provide input to the Army's force structure reduction decisions. While Army officials described the listening sessions as an atypical part of the stationing process, officials also stated that they believed the

listening sessions were a valuable tool supporting the Army's overall Brigade Combat Team inactivation decision process and could serve as precedent for future stationing decisions (GAO 2013b). Such initiatives should be detailed in an agency's real property capital plan to give higher visibility when supporting agency facility renewal strategies.

Agencies should also consider whether a social media presence and campaign or relevant podcasts would be helpful if public engagement is appropriate and, if so, to proceed accordingly. If federal agencies pursue a social media presence, it would be prudent to develop policies and procedures for what to post, who can post, and where to post. Agencies may also need to coordinate with OMB. Additionally, agencies choosing to engage the public directly should evaluate periodically whether the engagement is having a positive effect and, if so, evaluate communication approaches as technology changes. Here, too, however, opening the door to social media presents the opportunity for anyone to publicly address the federal agency, so agencies should ensure that public affairs professionals are involved in decision making.

D

Doing Due Diligence: Government Accountability Office Reports on Renewal of Federal Facilities

Government Accountability Office (GAO) reports on renewal of federal facilities can be understood to be collectively promoting due diligence in managing federal facilities for mission capability or service delivery. GAO reports can help federal agencies do due diligence in managing infrastructure and real property assets, starting with a set of products offering guidance and leading practices. First, a GAO report titled *Federal Real Property Asset Management* identified an overall asset management framework based in part on International Organization for Standardization (ISO) 55000 standards, an international consensus standard on asset management; but also based on studies and articles on asset management practices and interviews with experts (GAO 2018f). GAO's report identified six key characteristics of an effective asset management framework that can help federal agencies effectively manage their assets and resources (see Table D-1).

GAO also reported that while the Office of Management and Budget (OMB) had issued guidance to inform federal agencies' real property management efforts, the existing guidance did not reflect an effective asset management framework because it did not fully align with the ISO 55000 standards and the key characteristics. For example, the guidance did not direct agencies to develop a comprehensive approach to asset management that incorporates strategic planning, capital planning and operations, maintaining leadership support, promoting a collaborative organizational culture, or evaluating and improving asset management practices. The OMB guidance did not reflect information on successful agency asset management practices, information that officials from three of the six agencies with which GAO spoke as part of this review said would be helpful to them. Consequently, GAO recommended that OMB improve existing information on federal asset management to reflect such leading practices as those described in

TABLE D-1 Key Characteristics of an Asset Management Framework[a]

Characteristic	Description
Establishing formal policies and plans	Define a governance regime and identify staff responsibilities.
Maximizing an asset portfolio's value	Develop a policy to identify the value of assets and to derive the greatest value.
Maintaining leadership support	Articulate leadership support and provide necessary resources.
Using quality data	Collect, analyze, and verify accuracy of asset data.
Promoting a collaborative organizational culture	Promote a culture of information sharing and enterprise-wide decision making.
Evaluating and improving asset management practices	Evaluate the performance of the asset management system and implement necessary improvements.

[a] GAO analysis of ISO 55000 standards, asset management literature, and comments from experts.
SOURCE: Government Accountability Office, 2018, *Federal Real Property Asset Management: Agencies Could Benefit from Additional Information on Leading Practices*, GAO-19-57, Washington, DC, www.gao.gov/assets/gao-19-57.pdf.

ISO 55000 and the key characteristics GAO identified and make it readily available to federal agencies. OMB had no comment on the recommendation.

Second, GAO has issued reports and other products offering leading practices and internal controls in government that are similarly helpful to agencies managing infrastructure and real property assets.

- GAO's Cost Guide can be used to develop reliable cost estimates (GAO 2020a),[1] stating that developing reliable cost estimates is crucial for realistic program planning, budgeting, and management. It also states that while some agency guidelines on cost estimating are thorough, other agency guidance is limited regarding processes, procedures, and practices for ensuring reliable cost estimates. The Cost Guide is intended to address this gap. GAO states that for the purposes of the guide, a cost estimate is the summation of individual cost elements, using established methods and valid data, to estimate the future costs of a program, based on what is known. The ability to generate reliable cost estimates is cited as a critical function, necessary to support OMB's capital programming process. Without this ability, agencies would be at risk of experiencing cost overruns, missed deadlines, and performance shortfalls. The Cost

[1] The March 2020 Guide updates a previous version of the Guide (GAO 2009b).

Guide outlines key steps in the cost-estimating process: the purpose, scope, and schedule of a cost estimate; a technical baseline description; a work breakdown structure; ground rules and assumptions; data collection; estimating methodologies; sensitivity and risk analysis; documenting and presenting results; and updating estimates with actual costs.

- GAO's guide for analyses of alternatives can be used for site selection for a major construction project.[2] GAO defines a high-quality, reliable analysis of alternatives process as well documented, comprehensive, unbiased, and credible.
- Finally, GAO has issued internal control standards for the federal government (GAO 2014e). GAO defines *internal control* as a process used by management to help an entity achieve its objectives. It further states that internal control helps an entity run its operations efficiently and effectively, report reliable information about its operations, and comply with applicable laws and regulations.

Taken together, these GAO products can be mutually reinforcing and help provide a comprehensive set of standards and practices that can help federal agencies manage their infrastructure and real property assets more efficiently and effectively.

GAO has also issued numerous reports since fiscal year (FY) 2009 on federal agency real property asset management practices. Some of these reports were addressed to a single cabinet department or agency (hereafter, agency) although the principle is often relevant government-wide and the findings in the reports help illustrate how other federal agencies should proceed. While the reports do not specifically reference ISO 55000 standards or the asset management framework, they do address the extent to which the agencies employ aspects of the key characteristics in real property asset management. These reports can be thought of as offering facilities renewal recommendations to federal agencies for the full life cycle of facilities and can be grouped into three categories. The first group of reports addressed topics that can be thought of as facilities acquisition for mission capability or service delivery. The second group addresses effective facilities management to maintain or otherwise enhance mission capability or service delivery. The third group addresses disposal of unneeded or otherwise obsolete facilities to free up resources for uses more productive than managing or maintaining facilities that are not contributing to mission capability or service delivery. In addition, GAO had both federal real property and defense support infrastructure on the agency's High-Risk list of federal programs subject to waste,

[2] GAO's guide for analyses of alternatives was previously included in a report on the planned acquisition of a certain military weapons system; see GAO (2015a).

fraud, abuse, or mismanagement, or in need of broad transformation at the time of this report (GAO 2019f).

SEVERAL APPROACHES TO FACILITIES ACQUISITION FOR ENHANCING MISSION CAPABILITY OR SERVICE DELIVERY

The GAO facilities acquisition reports issued since FY2009 have focused on effectively managing facilities acquisition through better planning, project management, and cost estimating; improved leasing practices; consideration of alternative financing; and security considerations. These reports lead collectively to the conclusion that federal agencies need to do due diligence in selecting the acquisition option and implementing the acquisition.

Better Project Planning

GAO's reports on better project planning have emphasized the need to better match the facilities to be acquired with the agencies' missions or service delivery needs. First, GAO reviewed the extent to which the Department of Veterans Affairs (VA) was effectively matching veterans' changing health care needs and expectations in health care facility planning (GAO 2019k). GAO found that VA's approach to examining demographic trends among current and likely future veterans populations risked poorly matching veterans' health care needs to the facilities essential to meeting those needs. For example, VA analyzes information about the needs of different veterans' groups and their demographic data to assess veterans' future needs for care. GAO reported, however, that VA was not systematically collecting data concerning whether demographic groups differ in their expectations for how they will receive care, such as whether some groups expect different levels of privacy. VA officials told GAO that VA gauges expectations by surveying veterans and talking to veterans' service organizations. However, GAO's review found the amount of information collected through these methods to be limited. In addition, GAO reported that most facility-planning officials had concerns with using estimated space needs derived from VA's strategic capital investment planning process, which converts estimated needs for veterans' health care into future space needs for the VA Medical Centers. Thus, GAO concluded that VA risked building space in VA facilities not well suited to likely future needs and thereby putting effective service delivery at risk. Consequently, GAO recommended that VA:

- Develop and implement a process to assess veterans' changing expectations and disseminate this information to VA medical centers;
- Instruct VA medical centers on how to meet VA's strategic goal of incorporating veterans' changing needs and expectations into facility planning;

- Provide additional instruction to the medical centers on how to incorporate veterans' health services into facility planning; and
- Systematically gather feedback from facility planners and address (as necessary) their concerns about the reliability of VA's strategic capital investment planning process, including providing additional information on how space estimates are derived when using the process (GAO 2019k).

In another review, GAO found that the General Services Administration (GSA) was missing opportunities to determine the extent to which its major construction projects meet federal agencies' mission needs (GAO 2019c). GAO reported that GSA tests installed in building systems to validate that the buildings' systems function as designed. However, because GSA relied on outdated guidance, the effectiveness of its activities may have been limited in assuring that buildings were operating optimally, according to GAO. Moreover, GSA also used post-occupancy evaluations to assess projects' performance and tenants' satisfaction. However, in the 5 years leading to issuance of the GAO report, GSA had not regularly conducted the evaluations and lacked a policy for selecting projects for evaluation and communicating evaluation findings. GAO concluded that GSA may have been missing opportunities to fully utilize the evaluations to gather tenants' feedback and inform the design and construction of future projects. As a result, GAO recommended that GSA identify and communicate when and how to conduct the post-occupancy evaluations and share lessons learned with future facilities project teams (GAO 2019c).

Finally, GAO has issued reports that reviewed the extent to which agencies used a high-quality process of analysis of alternatives in major construction projects or project site selection. For example, GAO reviewed the site selection process for a major intelligence agency construction project, the National Geospatial Intelligence Agency's West Campus project (GAO 2017e). GAO concluded that the process used to select St. Louis, Missouri, as the site for the new campus substantially met three of the four characteristics of a high-quality, reliable analysis of alternatives process. Similarly, GAO reviewed the extent to which the best practices had been used for another intelligence community project, this one in the United Kingdom (GAO 2016g). This latter intelligence community report provides a definition of each of the best practices, a description of the effect of having used the best practices, and a recommendation that the Department of Defense (DoD) determine for what other military construction projects the best practices should be used (GAO 2016g).

The recommendations in these reports are addressed to VA, GSA, or DoD. However, it is fair to conclude that the recommendations encompass the concept that all federal agencies do due diligence by developing and implementing means to match the type, nature, size, purpose, operational considerations, and location of facilities to be acquired to the mission capability or service delivery needs that are the purpose of the facilities' acquisition in the first place.

Better Cost Estimating

GAO's construction project cost-estimating and infrastructure recapitalization reviews have focused in part on the extent to which federal agencies have used leading practices to develop reliable cost estimates. GAO relied on its Cost Guide, discussed above, in reviewing the extent to which agency construction project cost estimates were developed using leading practices. First, GAO reviewed VA's new medical center construction project in Denver, Colorado, and concluded that the overall project would likely cost about $1 billion more than originally estimated. However, GAO also reported that the U.S. Army Corps of Engineers subsequently assumed responsibility for completing the project and the Corps' midstream cost estimate to complete the project met the leading practices in the Cost Guide (GAO 2017h, 2018h). Second, GAO reviewed three major DoD construction projects and concluded that the projects' cost estimates were unreliable. GAO explained that DoD's cost-estimating guidance did not fully incorporate all the steps needed for producing reliable cost estimates (GAO 2018b). Third, GAO reviewed military construction (and nonmilitary construction) cost estimates for the planned realignment of certain Marine Corps units from Okinawa, Japan, to Guam and concluded that, while they had improved since a 2013 report on the same topic, the latter cost estimates still did not meet the best practices for a reliable estimate (GAO 2013c, 2017f). Finally, GAO concluded that the Navy's cost estimates to recapitalize its shipyards were similarly unreliable because these estimates did not use leading practices (GAO 2019i).

GAO also reviewed the extent to which VA's minor construction and nonrecurring maintenance project cost estimates were reliable (GAO 2018i). GAO here too concluded that VA's cost estimating did not fully incorporate the steps in GAO's leading practices guide. As a result of not incorporating sufficient guidance on cost estimates for projects in the minor construction and nonrecurring maintenance programs, medical facilities staff would be unable to provide meaningful estimates of what it costs to maintain and improve medical facilities, according to GAO (2018i).

Alternative Acquisition Strategies: Leasing

GAO reports since FY2009 have also addressed facilities acquisition alternatives to using direct congressional appropriations for civilian or military construction. These strategies included leasing, rather than constructing and owning, the facilities; developing interagency processes for sharing facilities to better utilize existing facilities and avoid acquisition costs; and certain public–private partnerships (PPPs) in which publicly funded facilities are conveyed to private, for-profit enterprises to operate and maintain for the federal agency. But here, too, GAO found instances in which agency processes could better facilitate doing due diligence.

First, GAO reported that certain of GSA's facilities leasing practices can lead to higher costs to the government than would otherwise be likely (GAO 2019e). Specifically, GAO reported that GSA leases come with requirements not commonly used in the private sector, such as allowing for tenant substitution during the term of a lease and requiring the responsible lessor to pay for such services as utilities. These leases also involve lengthy negotiations—at times longer than a year—to finalize the lease. GAO continued that these unusual processes and long negotiation periods can lead to higher lessors' costs, which are then passed on to the government. GSA has sought input from stakeholders on practices that may be increasing costs and has attempted to make some adjustments and develop a model to make some leasing faster and more efficient. However, GAO also reported that GSA's practices may still be leading to high lessors' costs, thus prompting the lessors' to offer high bid prices; and further, that GSA has not fully evaluated the information it has obtained from stakeholders and consequently did not know if its reform efforts were working. GAO recommended that GSA expand its outreach to lessors and evaluate whether its model was in fact leading to desired reforms (GAO 2019e).

GAO also reviewed GSA's delegated leasing program in which the agency can delegate authority to other agencies to execute their own leases rather than relying on GSA (GAO 2019d). However, GAO reported that GSA does not know if agencies have the ability to manage their delegated leasing activities because it does not regularly assess their policies, procedures, or performance in meeting GSA's management goals, such as avoiding extensions. GSA officials told GAO that the agencies oversee their own delegated leases. Relatedly, GAO reported that GSA could not ensure that the leases agencies executed under the delegated authority meet program requirements and are within the authority granted because GSA lacked key procedures to do so. GAO found that GSA had only reviewed 1 percent of the post–lease award documents that agencies had submitted, and in some cases, agencies had not submitted required documentation at all. GSA officials said the agencies are responsible for submitting documents and meeting requirements. Nonetheless, GAO recommended that GSA assess agency procedures for managing delegated leasing, track agency performance, and develop a review process for post–lease award documents (GAO 2019d).

GAO Leasing Caution

GAO issued a report on leasing of space that offers a caution that GSA and other federal agencies need to be aware of, especially those engaged in highly sensitive activities such as handling of classified information (GAO 2017c). GAO found that GSA has at times leased space in buildings with foreign ownership for federal agencies that require higher levels of security based on mission criticality or facilities size. Specifically, GAO reported that 26 tenant agencies were occupying about 3.3 million square feet in foreign-owned buildings at an annual cost of

about $97 million and used the space, in some cases, for classified operations and to store law enforcement evidence and sensitive data. GAO determined that the high-security space is owned by companies based in such countries as Canada, China, Israel, Japan, and South Korea (GAO 2017c). Nine of 14 tenant agencies that GAO contacted indicated that they were not aware that the space they were occupying was in buildings that GAO identified as foreign owned. The other five agencies that knew about occupying foreign-owned space had taken actions to mitigate the risk or were not concerned.

GAO also reported that several federal officials who assess foreign investments in the United States, as well as selected real estate company representatives, stated that leasing space in foreign-owned buildings could present security risks such as espionage, unauthorized cyber and physical access to the facilities, and sabotage (GAO 2017c). For example, GAO reported that a Department of Homeland Security foreign investment official said that potential threat actors could coerce owners into collecting intelligence about the personnel and activities of the facilities when maintaining the property. The official said this situation could occur by direct observation or surreptitious placement of devices in sensitive spaces or on the telecommunications infrastructure of the facility (GAO 2017c).[3] Continuing, GAO reported that the Secret Service indicated that its counterintelligence branch determined that foreign ownership of a building it occupies could raise counterintelligence and security concerns. According to the Secret Service, the protection of its information, technology, personnel, and space could be in jeopardy if the space were compromised through any unannounced inspections, emergency repairs to the building or any component within, the use of foreign nationals to provide any type of service, and any unescorted access throughout the space by the facility owner or representatives. Other agencies raised similar concerns, according to GAO (2017c).

Since GSA's leasing policies did not include determining foreign ownership at the time of the GAO report, GSA was not in a position to notify the tenant agencies, thus permitting them to take mitigating action if warranted. As a result, GAO recommended that GSA determine whether the beneficial owner of high-security space that GSA leases is a foreign entity and, if so, share that information with the tenant agencies so they can adequately assess and mitigate any security risks (GAO 2017c).

[3] GAO similarly reported on potential threats from foreign ownership of land or businesses adjacent to or in near proximity to DoD test and training ranges, although these ranges generally do not constitute leased space. Here GAO reported that DoD had not conducted a risk assessment that included prioritizing ranges based on mission criticality, determining their vulnerabilities to foreign encroachment, and assessing the degree to which foreign encroachment could pose a threat to the mission of the ranges. According to GAO, these potential threats included ranges that would be the most valuable collection points for foreign adversaries trying to gather intelligence and which ranges house the most sensitive test and training activities. For more information, see GAO (2014d).

Alternative Acquisition Strategies: Facilities Sharing

Interagency sharing of otherwise unutilized or underutilized facilities can also provide a means for agencies to acquire space for mission capability or service delivery and provide certain financial benefits for the agency providing the space while the tenant agency can avoid some facilities acquisition costs. GAO reviewed a DoD program that permits military installations to share unutilized or underutilized space with other agencies (GAO 2015c), reporting that when a match can be made between an installation's available space and a potential tenant agency's needs, both parties can benefit. For example, installations can benefit through the avoidance of direct and indirect costs, such as the cost for utilities and maintenance incurred for unutilized or underutilized space. The non-DoD tenant agency can save costs on commercial leases because DoD charges for use of space by other federal entities on a cost-recovery basis only. Despite the potential benefits, GAO found that routine information sharing was not occurring between DoD and GSA concerning opportunities to move non-DoD agencies onto military installations. Specifically, GSA was not routinely contacting DoD installations to inquire whether space might be available. DoD, on the other hand, was not generally reaching out to GSA or agencies that may be interested in space. Thus, GSA may have been missing opportunities for their clients to reduce or avoid costs, while both GSA and DoD may have been missing opportunities to leverage resources and enhance utilization of federal real property. GAO recommended that DoD and GSA collaborate to enhance routine information sharing concerning non-DoD federal agencies seeking workspace that might be satisfied at military installations (GAO 2015c).

Alternative Acquisition Strategies: Public–Private Partnerships

PPPs offer another approach to facilities acquisition for mission capability or service delivery by leveraging private capital in lieu of appropriated funds. DoD has used these approaches extensively to provide military family housing or, at some installations, transient lodging. First, under the Military Housing Privatization Initiative, a private, for-profit housing developer has taken possession of and renovated or otherwise modernized existing on-installation military family housing and constructed new housing. Servicemembers in turn can use their basic allowance for housing to lease the on-installation housing from the developer or property manager.[4] It should be noted though that Congress has also permitted the military departments to invest limited amounts of appropriated funds in the developer or to make direct loans or loan guarantees if the purpose of the loans was to construct houses suitable for military families.

[4] In most cases, servicemembers may also choose to use their housing allowance to reside off installation instead of residing in the privatized, on-installation housing.

GAO reports cautioned, however, that some privatization projects with occupancy rates below 90 percent were challenged to generate enough revenue to fund construction, make debt payments, and set aside funds for recapitalization. Moreover, reductions in the housing allowance could reduce revenue for future sustainment. GAO reported that this could negatively affect the condition and attractiveness of privatized homes and make it harder to compete with other homes in the community (GAO 2009c, 2018g). Another caution here is that privatization may not fully insulate the federal agency if problems arise or agencies have not done due diligence. To illustrate, GAO testified at congressional hearings that reports of the presence in some privatized houses of lead-based paint and other hazards, such as mold and pest infestations, had raised questions about DoD's management and oversight of privatized housing (GAO 2019h, 2020b). GAO testified that

- The military departments had conducted some oversight of the physical condition of housing, but some efforts had been limited in scope;
- The military departments used performance metrics to monitor private partners, but the metrics did not provide meaningful information on the condition of housing;
- The military departments and private partners collected maintenance data on homes, but these data were not captured reliably or consistently; and
- DoD provided reports to Congress on the status of privatized housing, but some data in these reports are unreliable, leading to misleading results.

Furthermore, GAO testified that the military departments' oversight of the privatized housing was limited and that the military housing offices had not effectively communicated their role as a resource for servicemembers experiencing challenges.

Additionally, while the Army has privatized on-installation lodging, GAO reported cautions relevant to implementing privatization of other types of facilities (GAO 2010). First, GAO reported that a private developer had to delay the start of major renovations and new construction by 2 years because of several life-safety and critical system deficiencies at the facilities at the time of the report. The developer was repairing the deficiencies at its expense before these conveyed facilities could be used as collateral to obtain further financing to begin the planned renovations and new construction. Second, GAO reported that the economic downturn leading up to the time of the GAO report in 2010 hindered the private developer's ability to obtain financing for the lodging privatization project at favorable interest rates, which also delayed the project. In an earlier report on the DoD privatized housing program, GAO reported similarly that several factors related to turmoil in the financial markets at the time of the 2009 report had reduced available funds for project construction, resulting in more renovations relative to new construction and reduced amenities at some newly

awarded projects (GAO 2009c). First, GAO reported, higher interest rates in bond financing had increased the cost of some projects. Second, because of the diminished value of bond insurance, developers were having to set aside project funds to increase assurances the debt was repaid but that reduced available funds for construction. Third, financial turmoil had resulted in lower rates of return on invested funds (GAO 2009c).

In response, GAO issued more cautions: the condition of the facilities at the time of privatization can delay full implementation of the privatization concept in some circumstances. Moreover, because the DoD privatization programs rely on leveraged private capital, the programs may be more exposed to market conditions in the general economy than would otherwise be the case with the use of congressionally appropriated funding. This can require increased management and potentially renegotiation of the privatization deals to keep them financially viable (GAO 2009c). Finally, in another report, GAO concluded that the federal government's cost of borrowing is lower than in the private sector. When the private sector provides the project capital, the federal government later repays these higher private-sector borrowing costs in some way, according to GAO. However, GAO also stated that, in some cases, factors such as lower labor costs or fewer requirements could potentially help balance the higher cost of borrowing, making partner financing less expensive (GAO 2014a).

ENSURING FACILITIES AND OTHER INFRASTRUCTURE ARE IN GOOD WORKING ORDER AND RELATED FINANCIAL MANAGEMENT ISSUES

GAO's reports on ensuring existing facilities and other infrastructure are well suited to mission capability or service delivery needs have tended to focus on ensuring the facilities are and remain in good working order. These reports have focused in part on having reliable insight into the facilities themselves as a key step in managing the facilities, diligently maintaining existing facilities, and enhancing facilities' resiliency to potential threats, such as climate change impacts. GAO has also reported on opportunities to lease existing facilities or property to nongovernmental entities to realize revenue or in-kind consideration in another type of PPP.

Accurate and Current Facilities and Other Infrastructure Data Are Critical for Facilities Management

First, GAO has reported that federal agencies have not had reliable data on the facilities in their inventory, which undermines effective facilities management, although some improvements had been noted in the government-wide Federal Real Property Profile and in DoD's Real Property Assets Database. Still, GAO has federal real property on the High-Risk list in part because of data

reliability concerns (GAO, 2019f). In its High-Risk report, GAO recommended that OMB and GSA continue working with federal agencies to improve the reliability of their real property data through verification and validation efforts and encourage agencies to implement action plans to better assess, address, and track data quality. Data reliability concerns affecting federal agency facilities data are a long-standing issue based on the GAO reports. For example, GAO reported in 2012 that the Federal Real Property Council had not followed sound data collection practices in designing and maintaining the Federal Real Property Profile database, raising concern that the database was not a useful tool for describing the nature, use, and extent of excess and underutilized federal real property at the time of the GAO report. For example, GAO reported that the Council had not ensured that key data elements—including buildings' utilization, condition, annual operating costs, mission dependency, and value—were defined and reported consistently and accurately (GAO 2012b).

GAO similarly reported that DoD's Real Property Assets Database contained inaccurate data and lacked completeness, although certain data that GAO reviewed had improved in accuracy since FY2014 (GAO 2018c). GAO reported that accuracy of data elements and completeness of the database are important because DoD, other federal agencies, and Congress use this information to determine facility sustainment funding and to understand DoD's utilization of its real property as a means to identify potential excess property for disposal. This excess property could, in some circumstances, also be made available to other federal agencies through facilities sharing, as noted above. GAO found improvements in some facilities reporting such elements as whether the facilities had been reviewed within required timeframes and the facilities' operational status, but problems still existed in these and other elements, such as facilities utilization rates, and circumstances in which facilities that existed were not recorded in the database. GAO recommended that DoD monitor recording processes, develop and implement corrective actions for identified data discrepancies, and develop a strategy to address risks associated with data quality and information accessibility. Similarly, GAO reported that VA's ability to monitor its minor construction and nonrecurring maintenance programs is limited by a lack of accurate financial data and project information, such as reasons for changes in cost (GAO 2018i).

GAO also reported on data reliability concerns related to the extent to which federal buildings contained asbestos with an emphasis on the risks to federal office workers (GAO 2018a). GAO reported that GSA's policy says that the agency should have an asbestos survey in each building constructed prior to 1998 and should enter the results of that survey into a specified database. However, GAO found that these data were missing for 66 percent (289 of 436) of the office buildings under GSA's custody and control that were constructed before that date. GAO recommended that GSA update the database and provide funding to do so or develop an alternative plan to improve the data.

Keeping Facilities in Good Working Order

GAO has issued a number of reports on the extent to which departments and agencies are ensuring that their facilities and infrastructure are in good working order to ensure mission capability or effective service delivery. While these reports have also tended to focus on a single agency, they offer lessons learned associated with the principle of doing due diligence to ensure effective sustainment, which can be applied government-wide.

GAO's report on VA inspections of its medical facilities found deficiencies reflective of aging infrastructure (GAO 2018j). GAO reported that these buildings were, on average, 55 years old and that, in turn, the aging infrastructure was leading to workload and staffing challenges in addressing maintenance and repair needs.

GAO has also issued numerous reports on the extent to which DoD is adequately maintaining facilities to ensure mission capability. In one report, GAO stated that from FY2009 to FY2014 the military services annually spent about 80 percent of what was needed to meet estimated facility sustainment requirements, although DoD's goal was for the services to budget for 90 percent of sustainment needs (GAO 2016b). This GAO report, however, also pointed out that the military services' operation and maintenance budget requests did not meet even the 80 percent level in FY2014-FY2016. DoD officials told GAO that the services were granted permission to submit budget requests that did not meet the 90 percent budgeting goal, in order to fund other priorities. GAO also reported that for FY2014 the following were reported as being in poor or failing condition: 43 percent of the Navy's facilities, 37 percent of the Army's facilities, 34 percent of the Marine Corps' facilities, and 12 percent of the Air Force's facilities. The military services reported about $100 billion in deferred maintenance and repair at the time of the GAO report (GAO 2016b). GAO concluded that continuing not to meet the funding goal increases the risk of facility deterioration in the future.

Underfunding of facilities sustainment was in part the reason for including defense support infrastructure on GAO's High-Risk list until the 2011 update, at which point the services had been budgeting for sustainment at the 90 percent level. This prompted GAO to drop facilities sustainment as a continuing problem, explaining that DoD had adequately addressed the defense facilities sustainment budgeting deficiency as of FY2011 (GAO 2011e). As noted above, however, the services have reverted more recently to previous underfunding practices. Prior to the 2011 High-Risk update, GAO (2011c) had reported that defense officials acknowledged that underfunding facilities sustainment can undermine mission capability. For example, in one report, Navy and Air Force officials told GAO that inadequate facility sustainment funding had resulted in deteriorated facilities, reduced mission capabilities, and lower quality of life for installation personnel. Navy officials further stated that, in some instances, installation aircraft runways had been closed because sustainment funds were not available to perform

needed repairs. Finally, at that time, military service officials also told GAO that underfunding of sustainment requirements over many years would likely result in reduced service lives and more costly recapitalization requirements in the future (GAO 2009a).

GAO also issued a report identifying retained fees as an alternative funding source for facilities repair or maintenance (GAO 2014a). For example, instead of up-front funding, the National Park Service used retained recreation fees to fund high-priority projects linked to visitor need, according to GAO (2014a).

Addressing Climate Change Threats to Facilities

GAO has added to its High-Risk list the government's fiscal exposure to climate change, including risks to infrastructure due in part to the government's being a large property owner (GAO 2019f). The High-Risk report stated that the federal government owns and operates hundreds of thousands of facilities and manages millions of acres of land that could be affected by a changing climate and represent a significant federal fiscal exposure. For example, DoD owns and operates domestic and overseas infrastructure with an estimated plant replacement value of about $1 trillion. In September 2018, Hurricane Florence damaged Camp Lejeune and other Marine Corps facilities in North Carolina, with a preliminary Marine Corps repair estimate of $3.6 billion. One month later, Hurricane Michael devastated Tyndall Air Force Base in Florida, with a preliminary Air Force repair estimate of $3 billion and upwards of 5 years to complete the work (GAO 2019f).

GAO has issued numerous reports warning that federal facilities and infrastructure are at risk from extreme weather events. In one report GAO found that the federal government had incurred direct repair costs exceeding $320 billion due to extreme weather events over the decade preceding the report (GAO 2016a). Continuing, this report stated that selected standards-developing organizations generally have not used forward-looking climate information—such as projected rainfall rates—in design standards, building codes, and voluntary certifications, relying instead on historical observations. Furthermore, some organizations periodically updated climate information in standards, codes, and certifications, but others did not (GAO 2016a). GAO reported that, according to various reports, representatives of standards-developing organizations, and agency officials, federal agencies had initiated some actions and could take more to help standards-developing organizations address challenges. GAO recommended that the Department of Commerce initiate a government-wide effort to provide the best-available, forward-looking climate information to standards-developing organizations for their consideration in the development of design standards, building codes, and voluntary certifications.

Other GAO reports and testimony statements have suggested that enhancing resiliency to climate change impacts is necessary but has been limited. For

example, in a congressional hearing statement, GAO pointed out that one way to reduce federal fiscal exposure is to enhance resilience by reducing or eliminating long-term risk to people and property from natural hazards. For example, in September 2018, GAO reported that elevating homes and strengthened building codes in Texas and Florida prevented greater damages during the 2017 hurricane season (GAO 2019a).

GAO has also reviewed the extent to which DoD is addressing climate change impacts through enhancing resiliency of military installations. This body of work makes clear that DoD has made progress in addressing climate change impacts on the department's installations and infrastructure, although the progress was reported to be uneven. First, GAO returned to the theme of looking forward in planning for ways to enhance installation resiliency. GAO reported that DoD installations had not consistently assessed risks from extreme weather and climate change effects or consistently used projections to anticipate future climate conditions. For example, DoD's 2018 preliminary assessment of extreme weather and climate effects at installations was based on the installations' reported past experiences with extreme weather rather than an analysis of future vulnerabilities based on climate projections (GAO 2019b). Previously, GAO had reported that the expected impacts of weather effects associated with climate change pose operational and budgetary risks to overseas infrastructure but DoD did not consistently track the impacts' estimated costs. Operational risks were reported to include interruptions to training, testing, and missions; and budgetary risks were reported to include costs of repairing damages linked to these impacts. However, installations inconsistently tracked these costs because there was no requirement for such tracking (GAO 2017a). GAO also pointed out that DoD had not assessed the vulnerability to climate change of dozens of overseas sites because these sites had been exempted from a vulnerability assessment survey that DoD had carried out. Finally, this report identified that some progress had been made in integrating climate change adaptation into installations' plans and project designs although the integration had been limited. Earlier still, in its first report on DoD's climate change resiliency efforts, GAO reported that DoD had begun to assess installation vulnerability to climate change (GAO 2014b). In this first report, GAO had identified several operational impacts from climate change. In one example, GAO reported that restrictions had been placed on the use of live fire during military force training as a result of drought conditions to try and help prevent wildfires. In another example, GAO reported that the combination of thawing permafrost, decreasing sea ice, and rising sea levels on the Alaskan coast had led to an increase in coastal erosion at several Air Force radar early warning and communication installations. According to installation officials, this erosion had damaged roads, utility infrastructure, seawalls, and runways.

Finally, another GAO report focused on climate change impacts at federal facilities, such as National Aeronautics and Space Administration campuses, and at state highways, and local wastewater treatment systems (GAO 2013a). GAO's

report identified several federal efforts emerging at the time of the report to facilitate more informed adaptation decisions, and GAO also reported that these efforts could better support the needs of local infrastructure decision makers in the future, according to studies, local decision makers at the sites GAO visited, and other stakeholders. GAO also reported that a range of studies and local decision makers GAO interviewed cited the need for the federal government to improve local decision makers' access to the best available information to use in infrastructure planning. Accordingly, GAO recommended that the Executive Office of the President work with agencies to identify for local infrastructure decision makers the best available climate-related information for planning, and to update this information over time.

Generating Benefits from Unutilized or Underutilized Property

GAO issued two reports that assessed the benefits obtained when federal agencies provide long-term leases of their real property to public or private entities to use the property, known as an "enhanced use lease." In the more recent report, GAO reviewed the enhanced use lease programs at VA, the National Aeronautics and Space Administration (NASA), and the Departments of State and Agriculture (GAO 2012a). Among other things, GAO found that these agencies reported benefits including cash rent revenue although most were small amounts of cash. The agencies also reported receiving value through in-kind consideration such as priority placement for veterans in a municipal housing project in lieu of cash rent in one example of an enhanced use lease. Agencies also reported certain mission-related benefits such as the NASA's access to research and development of aerospace technologies.[5] GAO also reviewed DoD's use of enhanced use leases but concluded that the cash rent or in-kind consideration received had been less than expected from some leases although still positive in some cases (GAO 2011a).

Finally, both reports concluded that the net benefits received may not be fully understood or may be less than expected. GAO's report on the non-DoD agencies' leases concluded that the costs and benefits of these programs are not fully understood, given different agency practices in accounting for enhanced use lease costs. GAO continued, noting that lacking clear guidance and failing to incorporate all of the costs related to agencies' enhanced use lease programs could cause agencies to overstate the net benefits of these programs when reporting program performance or making decisions about future leases. In the report on the DoD program, GAO concluded at the time of the report that the costs as a percentage of consideration from the leases was 31 percent for the Army and

[5] The statutory authority for some of these agencies to continue agreeing to new enhanced use leases may have expired, although existing leases would remain in effect until the agreed-to termination date.

Navy but 135 percent for the Air Force. Specifically, GAO reported that the Air Force had spent about $10.4 million more to administer its enhanced used lease program than the amount of consideration received from its five leases during the period of the GAO study, FY2006-FY2010. GAO recommended that OMB work with the non-DoD agencies reviewed to ensure a more accurate accounting of the benefits received. In the DoD enhanced use leasing report, GAO recommended that DoD develop procedures to regularly monitor and analyze enhanced use lease program administration costs to help ensure that the costs are in line with program benefits.

THE DISPOSAL OF UNNEEDED FACILITIES TO FREE UP FUNDS FOR HIGHER-PRIORITY PURPOSES

GAO has stated that continuing to maintain unneeded facilities risks wasting resources due to ongoing maintenance costs as well as lost revenue from failing to sell surplus property (GAO 2017d). GAO has further stated that they added federal real property to the High-Risk list, in part due to long-standing challenges that federal agencies face in managing federally owned real property, including disposal of excess and underutilized property. GAO has also identified unreliable facilities data as contributing to difficulties disposing of unutilized or underutilized facilities. GAO's reports have highlighted the need to improve disposal procedures to promote disposal and offered suggestions on the reuse of facilities for another purpose, in a sense, another disposal process. Finally, GAO reports have suggested ways to better manage underutilized facilities to reduce operating costs and facilitate disposal.

Identify Benefits from Disposal

GAO's facilities disposal reports have pointed out that spending operations and maintenance funds on unutilized, underutilized, or otherwise unneeded facilities consumes funds that could be eliminated from the budget or used for higher-priority purposes (GAO 2014c). While certain of these reports were focused on a single agency, here too, the principle can be applied government-wide. GAO concluded that despite past and ongoing efforts, the federal government continues to maintain excess and underutilized property (GAO 2017d).

GAO has reported on the financial aspects of the disposal and retention of unutilized or underutilized property. First, GAO reported that 15 federal agencies have the statutory authority to dispose of facilities and retain the proceeds of the disposal, such as revenue realized from the facilities' sale. Specifically, GAO reported that five of these agencies used this authority to retain proceeds of about $557 million from all building sales, as of the time of the report. Of that total, the U.S. Postal Service disposals accounted for $446 million, GSA's accounted for $89 million, and the other three accounted for the remaining $22 million (GAO 2016c). It should be noted that GAO also reported that the federal agencies

reviewed in this report stated that disposal was primarily based on mission needs. Second, GAO has reported that retaining unutilized or underutilized property consumes funds that could be used for other purposes (GAO 2011b, 2019k).

GAO has reported that disposing of unneeded facilities can lead to cost savings since owning agencies no longer need to budget for the costs of operations and maintenance. One of the largest federal facilities disposal processes is DoD's base realignment and closure process, although this process is used by DoD only. GAO has reported that DoD has closed more than 100 major bases in the five rounds of base realignment and closure held since 1988, and net annual recurring savings from the most recent round in 2005 are estimated at $3.8 billion (GAO 2013d).

Identifying Challenges That Hamper Disposal

GAO's body of work also has identified five categories of challenges that can hamper disposal: (1) a lack of reliable data with which to measure the extent of the problem, (2) a complex disposal process, (3) costly environmental requirements, (4) competing stakeholder interests, and (5) limited accessibility of some federal properties (GAO 2016d). Challenges to disposal are a long-standing problem. GAO raised nearly the same concerns as early as FY2011 (GAO 2011d). On the topic of data reliability concerns, GAO's concerns referenced above as hampering effective facilities management also apply to identifying facilities that may be appropriate for disposal.

On the topic of complex disposal processes, GAO reported that conducting required environmental and historic reviews in a timely manner was among the challenges VA faced in its real property disposal process. Potentially compounding the problem was what GAO termed "VA's lack of clear procedures for property disposals" (2019j). Among other actions, GAO recommended that VA develop clear procedures for each of its disposal options to help facilities' managers plan, implement, and execute projects to dispose of vacant and unneeded properties. GAO also reported that the Department of Energy's procedures for disposal of excess real property appropriate for transfer for economic development purposes be identified and disposed of, but the procedures do not identify what entity is responsible for these tasks or when it should identify such properties (GAO 2015b). GAO recommended that the Department of Energy develop and document an approach for property transfer—including roles and responsibilities—consistent with the department's policy to identify and transfer properties for economic development purposes.

Similarly, DoD has encountered challenges in disposing of military installations and sections of such installations closed under the base realignment and closure process, according to a GAO report (GAO 2017g). Specifically, GAO reported that DoD identified as a key challenge coordinating with the large number of regulatory agencies involved in environmental cleanup issues at the

federal and state levels, and that certain states have more stringent cleanup requirements for some contaminants than specified at the federal level. In addition, GAO reported that the newly discovered presence of emerging contaminants was another challenge that had delayed the transfer of property and extended the timeline for cleanup in some locations, especially former airfields. GAO added that the most common emerging contaminants on DoD installations are perfluorinated compounds found in firefighting foam used nationwide by the military and commercial airports.[6] Finally, GAO had also reported that DoD identified other challenges to disposal, including accounting for the time and resources needed to manage consultation requirements for historic preservation, and contingent actions related to disposal in international settings (GAO 2011b).

Identifying a Variety of Ways to Dispose of Space

GAO has issued reports that identify ways to dispose of space through space consolidation and real property exchanges. First, GAO has reported that most of the 24 agencies with chief financial officers reported to OMB and GSA that they planned to consolidate their office and warehouse space and allocate fewer square feet per employee as key ways to achieve their space reduction targets (GAO 2018e). A second approach on which GAO reported consists of GSA exchanging titles to federally owned real property for other properties or construction services, known as "swap exchange," a form of public–private partnership (GAO 2016e). GAO reported nonetheless that GSA canceled the project and concluded in its February 18, 2016, memorandum on this decision that private-investor valuations for these two buildings fell short of the government's estimated value. GSA officials told GAO that they intend to improve the appraisal process for buildings involved in swap exchanges by (1) informing appraisers of the swap exchange's goals, objectives, and processes; (2) allowing appraisers to consider a range of values for uncertainties related to zoning and other economic assumptions; and (3) encouraging appraisers, when appropriate, to develop methodologies that take into consideration the size and complexity of proposed swap exchanges.

GAO also cautioned that these partnerships may not mitigate previously identified challenges to disposing of real property. For example, according to stakeholders interviewed by GAO, partnerships can provide a way for agencies to leverage existing assets to obtain needed improvements and facilities without procuring funding. As noted above, however, partnerships may not mitigate such challenges as the costs involved in accurately assessing the overall value and other challenges, such as environmental remediation costs associated with a property or balancing the interests of numerous stakeholders. In addition, GSA officials acknowledged the additional challenge that negotiating successful public–private partnerships requires unique expertise and organizational experience

[6] For more information on emerging contaminants at DoD installations, see GAO (2017b, 2018d).

with these partnerships and exchanges, which, at the time of the report, GSA lacked but was also believed to be gaining (GAO 2016f).

GAO FACILITIES RENEWAL REPORTS: DOING DUE DILIGENCE

GAO's reports since FY2009 on federal facilities renewal have identified progress made in some areas. At the same time, the reports have also highlighted the need for more federal focus on developing processes for effectively acquiring and maintaining federal facilities for mission capability and service delivery, and for disposing of underutilized or unutilized facilities. This disposal can free resources from operating and maintaining properties not contributing to mission capability or service delivery, thereby permitting the agencies to use the funds for higher-priority purposes. The body of recommendations contained in the GAO reports can be thought of as falling into the categories of acquisition, ensuring facilities remain in good working order, and disposal when no longer needed. It should be noted that many of the GAO recommendations are likely to have been implemented by the time of this report and thus the specific deficiencies GAO identified may no longer exist. At the same time, other agencies' managing infrastructure and real property can benefit from lessons learned and documented in the GAO reports. Finally, the large set of recommendations contained in these reports suggest policies and procedures that if implemented may help federal agencies to have reasonable assurance their facilities and associated resources are appropriate for mission or service delivery needs. In short, GAO's reports present ways of doing due diligence.

E

The Operating Context for Federal Facility Renewal Strategies

The operating context for federal facility renewal strategies can be summarized as follows: governing statutes and regulations set policy to establish agency facility asset management systems used to generate facility renewal strategies that are communicated and managed through the agency's real property capital plan. This appendix details this operating context and supports discussions described in Chapter 2. This appendix will

- Highlight federal facility asset management authorities that set the foundation for developing and implementing federal facility renewal strategies,
- Highlight the current national strategy for federal facility asset management systems used to develop and implement federal facility renewal strategies,
- Review the Office of Management and Budget (OMB) policies as they relate to federal facility asset management and its role in advancing federal facility renewal strategies, and
- Highlight the relationship between federal facility renewal strategies and an agency's real property capital plan.

EXECUTION OF FEDERAL FACILITY ASSET MANAGEMENT AUTHORITIES

Facility asset management authorities are established through the following:

- U.S. Code containing all permanent statutes, including those that establish general asset management authorities (e.g., disposal), and authorities for individual agencies
- Other federal laws, such as authorization and appropriations acts, that create temporary authorities regarding federal asset management
- Executive orders
- OMB circulars
- OMB memoranda
- Code of Federal Regulations
- Federal acquisition regulations
- Federal management regulations

This list shows the variety of sources that establish federal facility asset management authorities. Many of these sources, especially the U.S. Code, are tailored to specific agencies. Furthermore, individual agencies with different missions, cultures, and histories also contribute to variety in the way federal facility asset management authorities are executed. Despite these differences, federal facility asset management authorities generally agree to achieving the following objectives:

- Deliver and manage facilities necessary to achieve agency missions;
- Manage supporting resources in an efficient and effective manner;
- Comply with federal laws, regulations, priorities, and values; and
- Use facilities to generate value for the nation and the American people.

The sources listed above do not dictate how to achieve these objectives. It is therefore left to individual federal agencies to establish supporting policies, objectives, processes, and tools to manage their facility portfolios. This infers the existence of a facility asset management system while providing no way to evaluate its effectiveness, such as comparing it to an objective standard (e.g., International Organization for Standardization [ISO] 55001).

Guiding this report's activity are two apex sources: OMB Circular A-11, "Preparation, Submission and Execution of the Budget," and OMB Circular A-123, "Management's Responsibility for Enterprise Risk Management and Internal Control." Collectively, these circulars establish policy, requirements, expectations, and guidelines governing how agencies should develop and implement federal facility renewal strategies. Requirements governing these strategies are concentrated in four areas:

- OMB Circular A-11, Section 83 (Object Classification);
- OMB Circular A-11, Part 6 (The Federal Performance Framework for Improving Program and Service Delivery) [July 2020 version];
- OMB Circular A-11's Supplement—Capital Programming Guide; and

- OMB Circular A-123, "Management's Responsibility for Enterprise Risk Management and Internal Control."

The followings sections detail how requirements are presented in each of these areas.

OMB Circular A-11, Part 6 (The Federal Performance Framework for Improving Program and Service Delivery) [Pending Reissuance in Forthcoming Guidance]

OMB Circular A-11, Part 6, starts by stating that "federal managers have an important obligation to ensure that every dollar spent delivers results for the American people" (OMB 2022b). This source developed criteria and structure for a management system to evaluate performance in agency operations and budget execution. The basis for Part 6 is the Government Performance and Results Act (GPRA) of 1993 and the GPRA Modernization Act of 2010. As amended, these acts established the foundation for the Federal Performance Framework, which directly influences federal facility renewal strategy development and implementation.

This is a dynamic policy area. Notably, there have been many recent advancements to the Federal Performance Framework as follows:

- Enterprise Risk Management (2016),
- Program and Project Management (2018),
- Customer Experience (2018),
- Evaluation and Evidence-Building (2019),
- Sharing Quality Services (2019), and
- Category Management (2019).

This recent activity emphasizes the Federal Performance Framework as an important, emerging management capability. These advancements began to establish asset management system requirements affecting federal facility renewal strategies. Study of this framework concluded that federal facility renewal strategies must be integral to the agency's strategic plan and budget. To achieve this objective, agencies were guided to use the OMB Circular A-11's Performance Management Cycle, shown in Figure E-1.

Supporting guidance did not dictate how this is to be done, but provided basic structure most agencies used, often implemented through their financial planning, programming, budgeting, and execution policies. The performance management cycle depicted how agencies could set strategic goals and objectives within a continual improvement process, an approach that is immediately

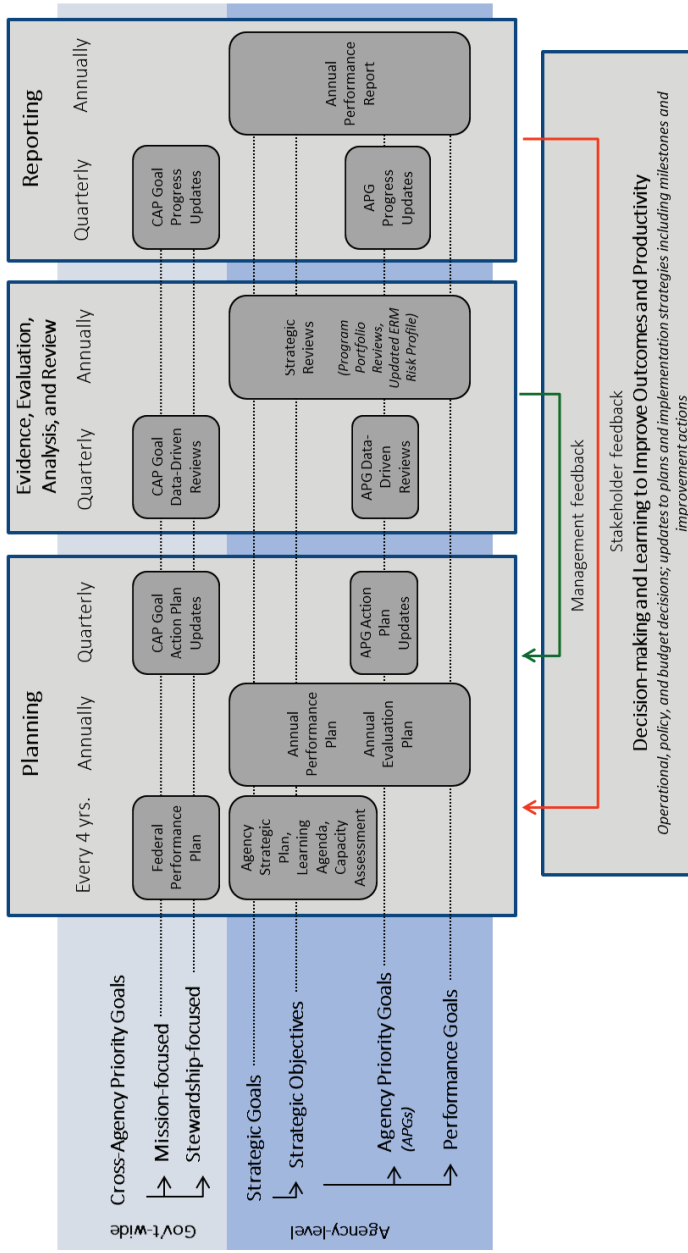

FIGURE E-1 Performance management cycle.
SOURCE: Office of Management and Budget, 2022, OMB Circular A-11.

applicable to federal facility renewal strategy development and implementation. Considerations for implementing this approach include the following:

- Agencies should establish policy to align their facility renewal strategies with their strategic planning, goals, priorities, and objectives;
- Consistent with OMB guidance, agencies must reconcile their federal facility renewal strategies with their budget authorities; and
- Agency strategies must serve as the basis for periodic performance analysis and reporting linked back to agency mission achievement.

This means federal facility renewal strategies cannot be merely aspirational. They must affect control over resource decision making and ensure that it links directly to agency mission objectives and priorities. Renewal strategies must therefore communicate actions responsive to requirements, dynamic changes, risk, and operating realities. In alignment with OMB Circular A-11, Part 6 requirements, agencies must create federal facility renewal strategies using objectives aligned with their strategic plans and, subsequently, periodically report performance in achieving these objectives.

OMB Circular A-11, Supplement—Capital Programming Guide

The second OMB Circular A-11 section directly influencing the development of federal facility renewal strategies is its Supplement—Capital Programming Guide. In the Guide, capital assets include land and structures that have an estimated use of more than 2 years, indicating complete agency federal facility portfolios. Facility asset costs covered under the Guide include "full life-cycle cost, including all direct and indirect costs for planning, procurement (purchase price and all other costs incurred to bring it to a form and location suitable for its intended use), operations and maintenance (including service contracts), and disposal, operations and maintenance" (OMB 2022a). The Capital Programming Guide sets its requirements as follows:

> Agencies must have a disciplined capital programming process that addresses project prioritization between new assets and maintenance of existing assets, risk management and cost estimating to improve the accuracy of cost, schedule and performance provided to management, and the other difficult challenges proposed by asset management and acquisition. (OMB 2022a, p. 1)

Rather than focusing mainly on capital decisions in financial terms, the Capital Programming Guide is focused on managing capital assets and covers all resourcing decisions across facility life cycles and whole facility portfolios. Its central purpose is to maximize the return on investment generated by federal capital assets. Through this lens, the guide directs agency efforts to establish "a single, integrated capital programming process to ensure that capital assets

successfully contribute to the achievement of agency strategic goals and objectives" (OMB 2022a).

The Capital Programming Guide allows agencies flexibility in applying the guidance. However, it clarifies that the approach used must include "a long-range planning and a disciplined, integrated budget process as the basis for managing a portfolio of capital assets to achieve performance goals with the lowest life-cycle costs and least risk" (OMB 2022b). To achieve these ends, the Capital Programming Guide recognizes three management phases, each covering specific supporting elements.

- Planning and budget phase
  - Strategic and program performance linkage
  - Enterprise architecture and integrated project teams
  - Functional requirements
  - Alternatives in capital asset analysis
  - Choosing the best capital asset
  - Developing the agency capital plan
  - Submitting the agency capital plan
- Acquisition phase
  - Validate planning decisions
  - Manage acquisition risks
  - Manage acquisition activities
  - Analyze acquisition activities
  - Acquisition acceptance
- Management in-use phase
  - Objectives during management in-use
  - Management in-use operational analysis
  - Management in-use process and outcome analysis
  - Asset disposition

Throughout, the Capital Programming Guide's purpose is to advance robust capital programming and management of all capital assets. This comes to a climax through guidance directing the development and implementation of agency capital plans. Given the focus of this study on federal facility renewal, agency capital plans, as defined in the Capital Programing Guide, are called real property capital plans in this report. Putting this into context, it is the agency's facility asset management system that guides development of the agency's facility renewal strategy that is implemented through the agency's real property capital plan.

This makes the Capital Programing Guide the central policy guiding development and implementation of federal facility renewal strategies. This point is so important the committee believes if this report is to improve federal facility asset management, and hence the development and implementation of federal facility

renewal strategies, it will have to result in advancements to capital programming capabilities and guidance contained in the Capital Programming Guide and the agency policies implementing it. Simply put, the only way to systematically improve development and implementation of federal facility renewal strategies is by making improvements to the Capital Programming Guide.

OMB Circular A-123, "Management's Responsibly for Enterprise Risk Management and Internal Control"

The last major source recognized in this report as having significant influence over the development and implementation of federal facility renewal strategies is OMB Circular A-123. This circular establishes requirements for managing risk using effective internal controls. These controls pertain to "all agency management, beyond the traditional ownership of OMB Circular No. A-123 by the chief financial officer community" (OMB 2016). What this means is that OMB Circular A-123 applies directly to the application of Capital Programing Guide requirements supporting the development and implementation of federal facility renewal strategies.

OMB Circular A-123 establishes risk management practices and internal controls for evaluating, operating, assessing, deficiency correcting, and reporting government performance. It refers to GAO's Green Book (*Standards for Internal Control in the Federal Government* [GAO-14-704G]), the GPRA Modernization Act (2010), the Federal Property Management Reform Act (2016), and ISO (e.g., ISO 31000, "Risk Management and ISO Management System Standards") as authoritative sources promoting the integration of internal controls as part of a systematic risk management process. This relates to the development and use of federal facility renewal strategies as follows:

- Use enterprise risk management to ensure mission achievement and
- Use internal controls to ensure that objectives, stakeholder needs, and priorities are achieved.

OMB Circular A-123 establishes enterprise risk management and internal control requirements that agencies must apply through their facility asset management systems to develop and implement federal facility renewal strategies.

NATIONAL STRATEGY FOR THE EFFICIENT USE OF REAL PROPERTY

The preceding discussion on authorities invites the question, What is the national strategy for federal facility asset management? This question sheds light on the reason behind the authorities and policies just detailed. It also invites the question, Should there be a national strategy for federal facility renewal

strategies? The first question will be answered in this appendix and the second question will be answer in the form of a report recommendation. Background and the answer to the first question follows.

On March 25, 2015, OMB released the Management Procedures Memorandum 2015-01," known as the "Reduce the Footprint" policy. This strategy expanded on successes generated by OMB Memorandum M-12-12, "Promoting Efficient Spending to Support Agency Operations," known as the "Freeze the Footprint" policy. OMB recognized the Reduce the Footprint policy as being the first of its kind, establishing "government-wide policy to use [real] property as efficiently as possible and to reduce agency portfolios through annual reduction targets" (Executive Office of the President 2015). This strategy was followed by the release of the "National Strategy for the Efficient Use of Real Property" (National Strategy) (Executive Office of the President 2015) and was updated on March 6, 2020, through the promulgation of OMB Memorandum M-20-10, "Issuance of an Addendum to the National Strategy for the Efficient Use of Real Property."

This National Strategy, when first released in 2015, initiated a 5-year effort designed to be an impetus to transform federal facility management generating value to the taxpayer. This National Strategy employed a three-step policy framework:

- "First, freeze growth in the real property portfolio,
- Second, measure the costs and utilization of individual real property assets to support their more efficient use, and
- Third, identify opportunities to reduce the size of the portfolio through asset disposal." (Executive Office of the President 2015)

It further established requirements that made federal agencies responsible "for fully implementing government-wide policy and instituting a planning process to identify, budget for, and implement efficiency opportunities" (Executive Office of the President 2015). OMB updated this strategy in OMB M-20-10. In this memorandum, OMB; "recognizes that further work is needed to develop a comprehensive and final Strategy document" (OMB 2020a). The purpose of this addendum is three-fold:

- "Extend the duration of the existing Strategy and to . . . more closely align it to the PMA [President's Management Agenda],
- Outline specific actions that can be implemented under the direction of the Federal Real Property Council (FRPC) to improve real property management and governance in the short term, and
- Outline the scope and content for a future publication of a more comprehensive national strategy for federal real property that not only takes into account the objectives outlined in this Addendum, but considers leading

> real property management practices from the private sector, state and local governments, and other national governments." (OMB 2020a)

This addendum was released just before the earlier National Strategy was about to lapse, and it recognized limitations in that document, including that it focused solely on reducing office and warehouse space and thus "did not address optimizing the Federal portfolio as a whole, across and within agencies, for mission effectiveness and cost efficiency" (OMB 2020a). OMB views this addendum only "as an interim step toward the issuance of a comprehensive real property National Strategy" (OMB 2020a).

The stated goal in OMB M-20-10 is to "optimize the federal real property portfolio to support agency mission needs, demonstrate stewardship of taxpayer resources, manage costs through implementation of robust capital and strategic planning, develop and use detailed budget and expenditure data, and prompt legislative reform" (OMB 2020a).

OMB M-20-10 further listed four high-level challenges to optimizing the federal government's real property:

- The first challenge is the significant constraints on available capital;
- Insufficient operating capital directly contributes to the second high-level challenge, management of the government's legacy portfolio;
- The third major challenge is management fragmentation of the real property portfolio into isolated, agency-based communities of practice; and
- The fourth challenge is lack of integration among real property budget formulation, execution, and accounting for costs and performance within agencies. (OMB 2020a)

It lists five historic issues that hinder the federal government from making significant progress toward an optimized facility portfolio, summarized as follows:

- *Issue 1: Leadership Engagement:* Sufficient leadership attention has not been provided to manage real property as a strategic asset because real property is often not appreciated as an important component of mission success.
- *Issue 2: Multiyear Capital Planning:* The Capital Programming Guide in OMB Circular A-11 requires that agencies "must have a disciplined capital planning process that addresses project prioritization between new assets and maintenance of existing assets," yet many agencies have either not implemented a rigorous multiyear capital planning process to allocate funding between the two, or they have not implemented capital planning at all.

- *Issue 3: Business Process and Data Standards and Shared IT Solutions:* The government's capability to manage its real property portfolio suffers from a lack of standard business processes, data standards, and shared IT solutions.
- *Issue 4: Alignment of Agency Internal Annual Budget Processes:* In many cases, the agencies' annual budget formulation process focuses on the cost of acquisition without adequate consideration given to out-year costs to operate, maintain, repair, and dispose the property.
- *Issue 5: Federal Disposal Process:* The current process under Title 40 of the U.S. Code for disposing of unneeded federal real property is burdensome and it does not provide incentives for federal managers to dispose of property or to maximize the disposal value to taxpayers. (OMB 2022a).

OMB M-20-10 then establishes the "Interim National Strategy Framework" for real property. This framework enables federal government managers to:

- Perform a comprehensive assessment of current and future mission capability gaps in the portfolio and the capital required to eliminate them;
- Establish a common, government-wide business environment where agencies adopt common business processes and standards and share IT and other tools and capabilities across government to promote better management practices and eliminate redundancy, and prevent needless expenditure of resources; and
- Identify legislative reforms that provide agency leadership with the authority needed to prioritize mission support and cost efficiency (OMB 2020a).

The Interim National Strategy then goes on to assign the Federal Real Property Council (FRPC), codified through the Federal Property Reform Act of 2016, the responsibility of leading efforts to advance framework objectives. This work is organized across three overarching strategy areas: capital planning, lifecycle execution, and root-cause analysis. The committee recognizes this evolving national strategy as the natural focal point for providing guidance supporting the development, implementation, and coordination of federal facility renewal strategies across all federal agencies.

So, in answer to the first question (What is the national strategy for federal facility asset management?), the national strategy should evolve from the Interim National Strategy commissioned by OMB M-20-10 and guided by the FRPC. The committee's only point of concern with this approach is to recognize and correct for the bias contained in current policies, as detailed in the next section, and align efforts behind a facility asset management perspective before trying to clarify and improve current policy guidance. This issue is covered in detail in Chapter 3, which contrasts the idea of managing assets and with that of asset management.

In addition, although this guidance is missing in OMB M-20-10, the committee assumes that the FRPC will also address what role real property capital plans, introduced in OMB M-20-03, will have in the national strategy. Now finally, the answer to the second question (Should there be a national strategy for federal facility renewal strategies?): The committee has answered this question in the form of Recommendation 3 (see Chapter 7), on updating the National Strategy for the Efficient Use of Real Property based on asset management system thinking.

REVIEW OF OMB POLICY SUPPORTIVE OF FEDERAL FACILITY RENEWAL STRATEGIES

This next section reviews OMB policies outlined earlier and identifies opportunities to improve federal facility renewal strategy implementation.

OMB Circular A-11, Part 6 (The Federal Performance Framework for Improving Program and Service Delivery)

OMB A-11, Part 6, highlights the importance of performance data in supporting decision making. Specifically, it is to ensure the achievement of agency mission objectives starting with cross-agency priority goals and strategic goals. The observed problem with OMB policy in this area is that it fails to make clear how this structure directly links to budget development and how other defined plans in OMB Circular A-11 (e.g., the agency capital plan detailed in the Capital Programming Guide) are to be integrated into the performance framework.

This criticism is based on the logic that agency capital plans (called "real property capital plans" in this report) are the product of the agency's facility renewal strategy. For instance, does OMB view agency capital plan development and management as being explicitly covered under Federal Performance Framework and OMB Circular A-123 requirements? If so, to what extent are or should agency capital plans be addressed through requirements contained in OMB Circular A-136, "Financial Reporting Requirements"? These are complex issues, but given that facilities represent the second or third largest cost center in most federal agency budgets, the emphasis on effective policy is merited. OMB policy should establish clear requirements for robust facility asset management systems used to generate federal facility renewal strategies communicated through real property capital plans.

OMB Circular A-11, Supplement—Capital Programming Guide

The Capital Programming Guide (the Guide) is developed to:

> Help establish a capital programming process within each component and across the organization. Effective capital programming uses long range planning and

> a disciplined, integrated budget process as the basis for managing a portfolio of capital assets to achieve performance goals with the lowest life-cycle costs and least risk. (OMB 2022a, p. 1)

The introduction to the Guide continues by stating:

> Agencies have flexibility in how they implement the key principles and concepts of the Guide. They are expected to comply with existing statutes and guidance (cited in the text where appropriate) for planning and funding new assets; achieving cost, schedule, and performance goals; and managing the operation of assets to achieve the asset's performance and life-cycle cost goals. However, the key principles and importance of thorough planning, risk management, full funding, portfolio analysis, performance-based acquisition management, accountability for achieving the established goals, and cost-effective lifecycle management will not change. In general, OMB will only consider recommending for funding in the President's Budget priority capital asset investments that comply with good capital programming principles. This Guide does not discuss the entire strategic planning process, only that portion that pertains to the contribution of capital assets. (OMB 2022a, p. 1)

The first quote is a helpful synopsis of the Guide, and overall, the Guide is excellent policy, except in the area of supporting implementation of federal facility renewal strategies, for three reasons: (1) guidance is biased toward major system and information technology (IT) acquisition, (2) the Guide does not adequately address facility portfolio management needs, and (3) the Guide does not provide a basis to evaluate facility asset management system capabilities needed to implement federal facility renewal strategies.

To frame the first criticism, the Guide provides specific guidance generalized across three types of capital assets: major systems, IT, and real property. Furthermore, the Guide emphasizes that its purpose is on programming, despite commenting that it covers the life cycle of these assets viewed from a portfolio perspective. The immediate problem with this is that programming related to major systems and IT assets focuses on acquisition decision making governed by federal acquisition regulations (FARs), Part 34—Major System Acquisition and Part 39—Acquisition of Information Technology. Requirements contained in these regulations are measurably different from how real property is acquired and managed. Real property is acquired through construction, purchase, or leases governed by FAR Part 36—Construction and Architect-Engineer Contracts and per U.S. Code Title 40—Public Buildings, Property, and Works. In the context established in the Guide, much of the generalized programming guidance does not apply to real property, which complicates its application and relevance to federal facility renewal strategy implementation.

The second criticism is related to the Guide not having a portfolio perspective supportive of the way real property is managed. The Guide emphasizes

acquisitions as one investment decision at a time, typically defined in terms of a project or a program, and highlights the importance of portfolio management, but only from the perspective of diversification akin to financial asset management and the need to maximize return to the taxpayer. This view of portfolio management focuses attention on prioritizing one asset acquisition alternative over another, as is common in major systems and IT acquisitions.

Agencies perform this type of analysis of alternatives when making major facility capital funding decisions. However, this perspective does not reflect how agencies manage facility portfolios. Specifically, agencies measure benefits derived from investments in individual facility assets across decades as part of a large, interdependent, and often geographically distributed asset portfolio. In facility asset management terms, agencies do not only evaluate the value proposition of one asset at a time, but also the contribution of each asset to the value generated by the facility portfolio in perpetuity. The Guide does not address this issue, and by its omission, makes developing federal facility renewal strategies difficult for agencies.

The last criticism is in part related to the second quote from the Guide's introduction provided above. Simply, the Guide provides a large volume of guidance that generally does not pertain to facility management, yet is considered clear and encompassing. As detailed in this report, implementation of federal facility renewal strategies is predicated on agencies having a fully functioning facility asset management system. The combination of these two points means agencies are not well guided on how to implement facility asset management systems needed to generate federal facility renewal strategies. The Guide should do this but does not. This point is underscored by GAO-19-57 stating that federal agencies do not have the knowledge needed to implement effective facility asset management systems. The committee believes that this issue can be remedied through implementation of the facility asset management system maturity principle introduced in Chapter 3 and further developed in Appendix F.

OMB Circular A-123, "Management's Responsibility for Enterprise Risk Management and Internal Control"

OMB Circular A-123 is an excellent source of guidance related to enterprise risk management and internal controls. Although the Capital Programming Guide does not thoroughly integrate this complex subject, such as through citation and application of OMB Circular A-123 references, Circulars A-11 and A-123 both make statements delegating responsibilities to agencies to establish policies, strategies, and processes for implementing suitable enterprise risk management and internal controls. These two circulars also frequently refer to management systems in terms of enterprise risk management systems, financial management systems, performance management systems, earned value management systems, acquisition management systems, and information management systems. They do not call out at any point the need for an asset management system.

As a result, the guidance on management system thinking is scattered, lacks clear organizing principles, and lacks important asset management system criteria needed to develop federal facility renewal strategies. As a result of this scattered management system thinking, implementation of A-123 guidance with implementation of A-11 requirements is not clear or helpful to developing federal facility renewal strategies. The committee believes that the best place to address this issue is within OMB Circular A-123. This could be remedied by improving OMB's use of management system structures and standards, such as those established by the ISO, including the ISO 55000 standards series. A similar observation is made in GAO-19-57, *Federal Real Property Asset Management, Agencies Could Benefit from Additional Information on Leading Practices* (GAO 2018f), as highlighted earlier and detailed in Chapter 2.

Rather than focusing on the many effective, well-working OMB policy elements, this review of OMB policies highlights gaps the committee recognized that are limiting implementation of federal facility renewal strategies. In practice, both must be understood to successfully generate federal facility renewal strategies. As observed by the committee, and as called out in OMB M-20-10, some agencies have done this well and others have not. The committee's belief is that all federal agencies would benefit from better OMB guidance, particularly related to the areas enumerated above.

REAL PROPERTY CAPITAL PLANS

The last area to highlight defining the operating context for federal facility renewal strategies is real property capital plans. This is the last topic covered because it is also the newest policy contribution related to implementation of federal facility renewal strategies released by OMB. The Capital Programming Guide "encourages" the use of an agency capital plan (i.e., an agency's real property capital plan). As detailed earlier, this plan is to cover management of the agency's facility portfolio. Furthermore, the use of the operative word *encourages*, when combined with detailed expectations in OMB Circular A-11, only implies the existence of real property capital plans.

Interestingly, it was not until OMB promulgated Memorandum M-20-03 on November 6, 2019, that agencies were required to submit a capital plan for real property. This memorandum requires that agencies compile and submit specific content to the FRPC annually to demonstrate their use of a robust capital planning process and evidence of a real property capital plan. OMB M-20-03 states that real property strategies should be a recognizable element in agency strategic plans, and these strategies should be reviewed annually as required by the Program Management Improvement Accountability Act. While the committee recognizes the promulgation of this memo as a large, positive advancement in developing real property capital plans, it believes that more needs to be done in this area, as detailed in Recommendation 2 (see Chapter 7).

F

Facility Asset Management Principles

This appendix further develops facility asset management principles introduced in Chapter 3. These principles serve as concepts and practices foundational to management system thinking and facility asset management systems.

DATA INTEGRITY PRINCIPLE

Data used must be held to integrity standards determined by the facility asset management system's decision-making needs.

Having accurate, relevant, and actionable data is a universal requirement to implementing federal facility renewal strategies. Many laws, regulations, and policies support this. This principle builds on this truth by providing additional stipulations. These stipulations are inherent to the agency's facility asset management system. This creates an integrity logic loop essential to supporting organizational learning and continual improvement. This logic loop is summarized as follows:

- Decision-making objectives are established by the facility asset management system.
- Decision-making capabilities are limited by data made available by the facility asset management system.
- To improve decision making, the facility asset management system must continually improve the data made available by it and for it.

This logic loop defines the data integrity principle. It also promotes scalable implementation of facility asset management systems. This means agencies

have freedom to start small or use a narrow scope to establish initial facility asset management system capabilities. As data improve, so too will the facility asset management system, which will work to both improve data and generate a demand for more and better data.

ISO 55001 contains detailed information requirements that can assist this process.[1] The International Organization for Standardization (ISO) 55001 requirements are not prescriptive; they are related to the asset management system scope set within a working decision-making framework. The takeaway of implementing this principle is that data integrity is entirely a function of an agency's facility asset management system definition, and this principle cannot be applied until after this system is defined.

WHOLE LIFE-CYCLE COST ANALYSIS PRINCIPLE

Federal facility renewal strategies must cover whole life-cycle costs of the assets in their scope.

Federal facility renewal strategies must have a whole life-cycle cost-analysis approach, as supported by generally accepted accounting principles and specific Office of Management and Budget (OMB) guidance. OMB guidance directs the use of GAO's cost-estimating guidance, updated in 2020, in GAO-20-195G, *Cost Estimating and Assessment Guide*, which, although framed in terms of program management activities, provides excellent guidance suitable for facility asset management. To complement these activities, the development of federal facility renewal strategies must consider an integrated investment perspective that includes the entire life-cycle cost of facility assets to address renewal of the agency's facility portfolio.

To achieve this, in complement to GAO-20-195G, agencies developing their federal facility renewal strategies can make use of ISO 15686—Buildings and Constructed Assets—Service Life Planning standards, especially Part 5 (Life Cycle Costing). This source covers life-cycle costing principles and settings, and decision-making variables for life-cycle cost and whole life cost analysis. Figure F-1 shows the relationship of whole life cost and life-cycle costs.

Figure F-2 expands on these relationships, defining life-cycle costings analyses from the perspectives of whole life, life-cycle costing for construction, and life-cycle costing in use. ISO 15686, Part 5, also recognizes different levels of life-cycle cost analysis, as shown in Figure F-3. This leads to a familiar observation on the influence on cost controls and costs incurred shown in Figure F-4, although this figure only represents a classic pattern of a single asset, rather than a view necessary for a whole portfolio of assets.

[1] See ISO (2014b, § 7.5—Information Requirements for more details).

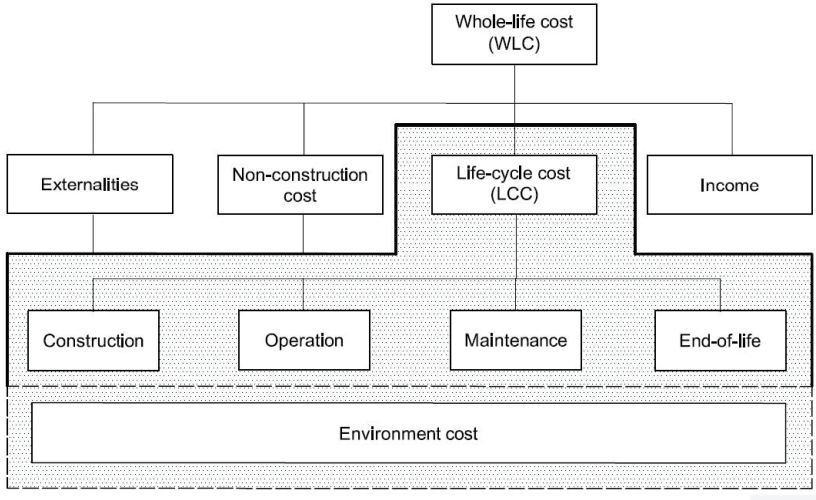

FIGURE F-1 Whole life and life-cycle cost elements.
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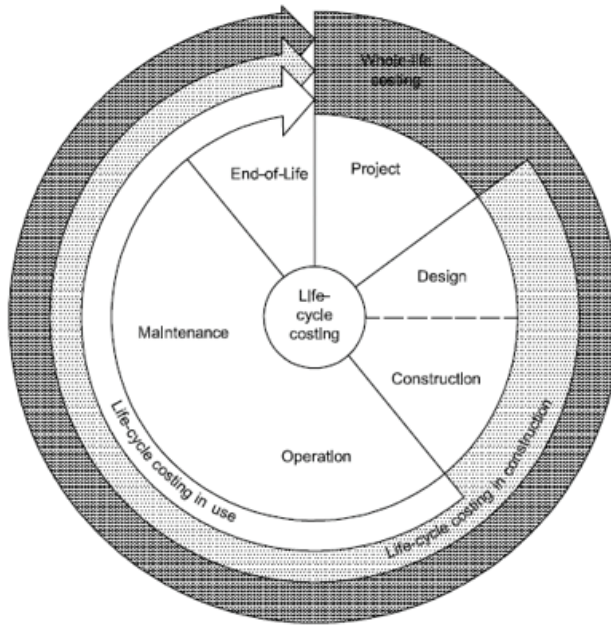

FIGURE F-2 Analysis of different stages of the life cycle.
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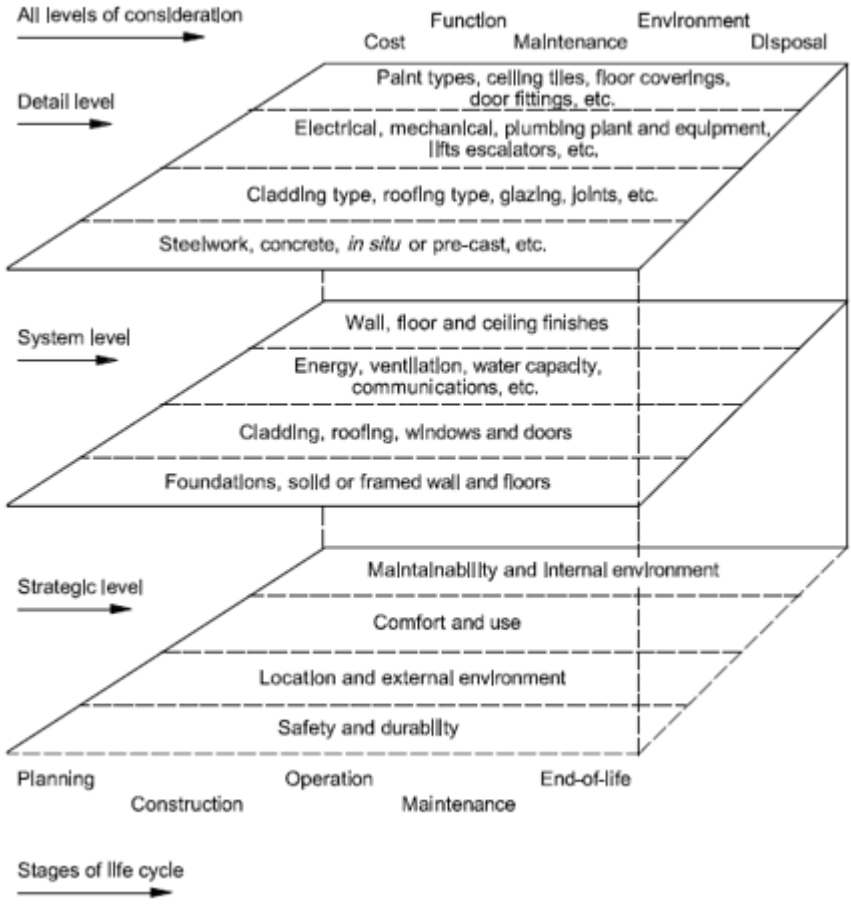


FIGURE F-3 Different levels of analysis at different stages of the life cycle.
SOURCE: © ISO. This material is reproduced from ISO 15686-5:2017 with permission of the American National Standards Institute (ANSI) on behalf of the International Organization for Standardization. All rights reserved.

The committee applauds the work presented in ISO 15686, Part 5, and sees it as a foundational source defining whole life cost analyses supporting the development of federal facility renewal strategies. In practice, this means cost analysis supporting federal facility renewal strategies must go beyond guidance outlined in OMB Circular A-11—Preparation, Submission and Execution of the Budget; OMB Circular A-94—Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs; and GAO-20-195G, *Cost Estimating and Assessment Guide*. Requirements in these sources generally address what ISO 15686, Part 5, defines as life-cycle costs relating to the acquisition of single-facility assets or real property programs with limited scope.

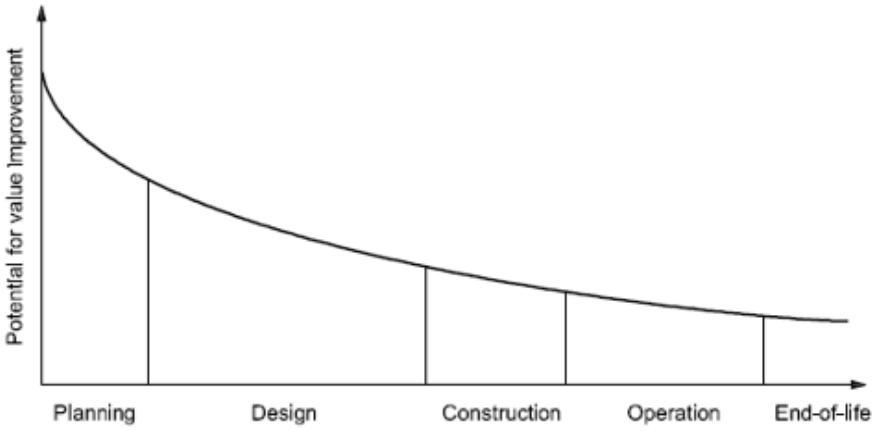


FIGURE F-4 Scope to influence life-cycle cost savings over time.
SOURCE: © ISO. This material is reproduced from ISO 15686-5:2017 with permission of the American National Standards Institute (ANSI) on behalf of the International Organization for Standardization. All rights reserved.

This will require advancing, or in some cases introducing, new approaches and federal guidelines. Current federal policy is insufficient for generating fully responsive federal facility renewal strategies because it does not apply a whole life perspective. Steps to address this could make use of ISO 15686—Buildings and Constructed Assets—Service Life Planning standards.

PORTFOLIO MANAGEMENT PRINCIPLE

Federal facility renewal strategies must support the agency's whole facility portfolio, covering whole life cycle and stakeholder requirements across whole mission sets.

Effective facility asset management systems do not just happen; they are engineered. OMB guidance requires federal agencies to proactively manage their whole facility portfolio. Supporting statements in OMB Circular A-11's Supplement—Capital Programming Guide (OMB 2022a) include the following:

> Capital assets should be compared against one another to create a prioritized portfolio of all major capital assets. Just as an individual invests in a diverse portfolio of securities, agencies invest in a diverse portfolio of capital assets (p. 19).

> In general, agencies should establish and manage portfolios of programs, projects, and other work in accordance with Federal policy and widely accepted standards. The coordinated management of the items in a portfolio

should enhance executive decision making and help ensure programs and projects contribute to an agency's ability to achieve strategic goals and objectives. The process includes the selection, prioritization and monitoring of programs and projects, but it does not include the management of the items in a portfolio. The management of individual items should be addressed in program/project management policy (p. 19).

Portfolio management theory and standards are readily available from commercial sources and academic literature. The theory is not repeated here. Agencies are encouraged to focus on the practical application of the principles as opposed to the development of portfolio management theory. Most likely, the practical application will involve the tailoring of the principles to an agency's unique circumstances (p. 19).

All of the items in a portfolio must support strategic plans, goals, objectives and priorities. The strategy and goals drive the selection and prioritization. The selection process should eliminate unnecessary and poorly planned projects. The selection and evaluation should result in a portfolio that is balanced so that the mix of items maximizes the agency's ability to achieve strategic goals (p. 19).

Annual reviews should include key performance indicators and ensure that the portfolio only contains items that support the mission. In addition to reviewing portfolio performance, each item should be reviewed individually to evaluate its contribution (p. 19).

The [Agency Capital Plan] should include an analysis of the portfolio of assets already owned by the agency and in procurement, the performance gap and capability necessary to bridge it, and justification for new acquisitions proposed for funding (p. 20).

The Agency Capital Plan can support an agency's related salaries and expenses associated with the staffing, operation, and maintenance of its capital asset portfolio (p. 21).

The agency should analyze their portfolio of capital assets, set goals and priorities for the optimization of the inventory, explain their use of performance indicators and analysis in decision making and develop a strategic timeline outlining improvement initiatives (p. 45).

A decision tree is just one of many diagnostic tools available to supplement agency portfolio analysis and provide additional information for decision making (p. 51).

> Under the concept of continuous monitoring, the disposition of an asset should be a proactive process that occurs at the portfolio level (p. 72).
>
> An examination of the existing portfolio of assets is encouraged in order to identify capital assets currently in use and in procurement that can help meet program objectives (p. 77).

To further develop implementation of a portfolio management approach, the Capital Programming Guide defines operative terms as follows:

> *Portfolio*. A set of programs, projects or other work grouped together to meet strategic goals and objectives.
>
> *Program*. An ongoing initiative composed of a group of projects and other work managed in a coordinated way to obtain benefits not obtained from managing them individually.
>
> *Project*. A temporary endeavor to create a unique product or service with a start date, a completion date and a defined scope. (OMB 2022a, p. 91)

It is important to note that the above portfolio definition is focused on a group of work activities and not on a group of assets. This observation supplements the review of OMB policy contained in Appendix E and findings contained in Chapter 2. It is the committee's opinion that defining a portfolio this way makes it difficult to implement facility asset management systems detailed in Chapter 3, which are needed for generating federal facility renewal strategies. This observation and supporting analysis led to the development of this principle.

ACCOUNTING TRANSPARENCY PRINCIPLE

Federal facility accounting structures must support integrated and auditable analysis of financial and nonfinancial aspects to perform facility asset management activities supporting planned-versus-actual reconciliation of performance objectives.

Underpinning facility asset management are accounting standards. This point is made clear in ISO 55010—Guidance on the Alignment of Financial and Non-Financial Functions in Asset Management. Implementation of this standard is helpful for establishing the facility asset management systems capabilities detailed in Chapter 3.

Federal requirements in this area are based on numerous laws that include accountability and transparency requirements governing expenditure of public

funds. Notable examples include the Chief Financial Officers Act of 1990, the Government Performance and Results Act of 1993, and the Federal Funding and Accountability Act of 2006. The following OMB circulars confer related requirements:

- Circular A-11—Preparation, Submission and Execution of the Budget
- Circular A-94—Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs
- Circular A-123—Management's Responsibility for Enterprise Risk Management and Internal Control
- Circular A-131—Value Engineering
- Circular A-134—Financial Accounting Principles and Standards
- Circular A-136—Financial Reporting Requirements

In terms of federal facility asset management, these requirements manifest in two general forms: inventory accounting and financial accounting.

Executive Order 13327—Federal Real Property Asset Management introduced centralized federal real property inventory reporting (White House, 2004), requiring federal agencies to report facility inventories, and requiring the General Services Administration's (GSA's) Office of Government-wide Policy (OGP) to publish updated information in the Federal Real Property Profile. GSA-OGP has done so annually since this time. In 2016, the Federal Assets Sale and Transfer Act and the Federal Property Reform Act required agencies to submit an annual report on excess and underutilized real property and make an annual assessment of each real property asset covering a range of specific criteria.

The second form is financial accounting. A foundational element to financial accounting that is supportive of federal facility renewal strategies is object class codes defined by OMB Circular A-11, Section 83 (Object Classification). Object class codes track the type of expenditure but do not adequately differentiate common cost centers used in day-to-day facility asset management. This is a fundamental reason why agencies cannot generate simple balance sheets comparing whole required and available facility portfolio requirements over a portfolio—or in simple terms, generate a requirements-based budget and compare it to the actual budget.

This problem is rooted primarily in the fact that some object class codes cover many types of facility expenditures, grouping facility expenditures with nonfacility expenditures. This creates many-to-many relationships and introduces sources of error. As a result, it is impossible to account for agency facility management activities using the OMB object class code convention.

Current federal accounting conventions do not support agencies performing planned-versus-actual comparisons between the appropriations budgeted for facility operations and the funding spent on their facilities. Overcoming this deficiency is essential to being able to generate effective, impactful federal

facility renewal strategies. The committee views this accounting function as a fundamental requirement for facility asset management, and this lack is a failure in current federal policy.

Introducing object class codes that align with common facility management functions would be a positive step forward. In a single action, updating the object class codes in Circular A-11 would correct a serious flaw in facility accounting across the federal government. This advancement would simplify basic facility management, acquisition, and procurement accounting. Clarifying accounting requirements will naturally improve data transparency and streamline auditing activities. Furthermore, this foundation will promote communications helping executive decision makers understand the interrelationship between budgetary decisions and facility performance, all advancing the value and impact of federal facility renewal strategies.

MISSION ALIGNMENT PRINCIPLE

Mission alignment of resource prioritization requires the use of validated and verifiable metrics to link the relative importance of individual facility assets to agency missions and stakeholder performance expectations.

OMB Circulars A-11 and A-123 are clear that federal expenditures must be directed toward achieving the agency's mission. These circulars further require use of internal controls to establish assurances this is happening. Facility asset management, by design, approaches resource decision making to achieve this purpose. It does this by evaluating the return on investment that each resourcing decision makes toward optimizing the agency's facility portfolio supporting operations and mission achievement. This work is the motivation behind ISO 55000 and its emphasis that asset management is not about the asset, but about the value generated by the asset.

To accomplish this in practical ways, agencies must use measures that confer a relationship between mission and facility assets. This objective is supported in ISO 55002 and its development of risk management, as follows:

> Risk management is essential in developing asset management objectives and plans, and ensuring decision making is in line with organizational objectives and stakeholder requirements. The guidelines given in ISO 31000 and IEC 31010 can be applied to defining and establishing a risk management approach that conforms to ISO 55001. (ISO 2014a, Appendix E)

Many agencies have accomplished this through the use of measures that report the relative importance of different facility assets from a mission execution perspective. The most widely practiced solution is the Mission Dependency Index (MDI), which is used by the Navy, Air Force, National Aeronautics and Space Administration, Army National Guard, and Coast Guard. Another is the

Asset Priority Index (API), used by the National Park Service. The OMB Capital Programming Guide cites both indices.

The Air Force uses the most capable and advanced MDI solution (USAF 2018). The committee considers it the most capable because it applies a simple operational readiness risk matrix based on probability and severity, supported by a set of data quality rules for reporting the relative importance of each facility asset. It calculates an MDI value for each distinct function at a location, as opposed to other methods that assign MDI scores to general facility types not based on the mission needs of a specific location.

The MDI uses the operational risk management ranking categories of probability and severity applied using terminology defining interpretability and replicability. Questions for each are asked on each key functional capability at a location to generate raw input using a common risk matrix (see example in Figure F-5). The Air Force then uses a set of rules to process inputs and calculates an MDI value for each asset, computing a relative measure of mission alignment. The MDI values provide a means to mission-weight different actions, such as prioritizing maintenance actions and projects, allowing the Air Force to align facility management activities with mission objectives.

The API offers an alternative method to the MDI. The API is static, based on multiple criteria related to the agency's mission that are stewardship related. This is supported in the API definition used in ASTM E2495-18—Standard Practice for Prioritizing Asset Resources in Acquisition, Utilization, and Disposition. In the case of the National Park Service, API criteria include resource preservation, visitor use, park support, and asset substitutability (see GAO-17-136, *National*

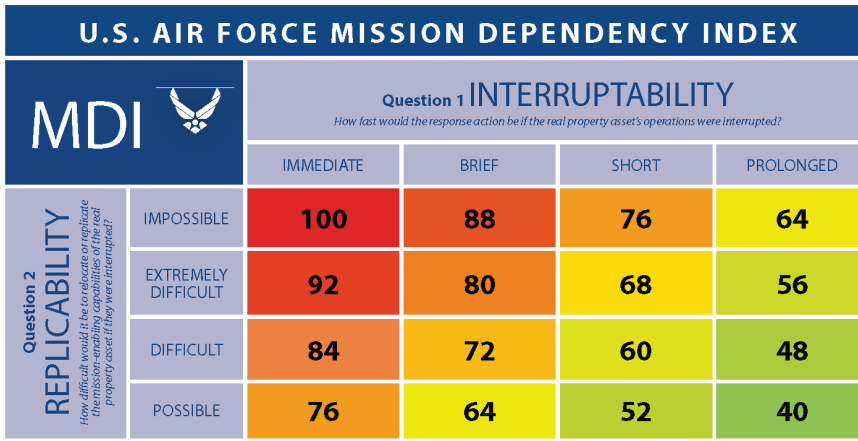


FIGURE F-5 Risk matrix.
SOURCE: R. Weniger, 2018, "Setting Priorities: Tactical MDI Aligns Facilities to Mission," *Air Force Civil Engineers* 26(1), Spring 2018, www.afcec.af.mil/Portals/17/documents/CE-Online/2018%20Spring%20CE%20mag.pdf.

Park Service—Process Exists for Prioritizing Asset Maintenance Decisions, But Evaluation Could Improvement Efforts). This method can be tailored to any agency's needs and priorities.

The decision to use an MDI- or an API-type approach comes down to the agency's mission. An MDI-type approach is best if an agency's mission requires agility in responding to a dynamic operating environment. An MDI works best in this case because it is sensitive to a full range of changing operating conditions responsive to the needs of a dynamic operating environment. On the other hand, if the agency's mission involves the delivery of products and services in a relatively unchanging operational environment, an API-type metric may be better. This is because the API-type method can consider a range of independent perspectives and uses a multicriteria decision analysis model to produce a relative ranking of facility assets. If the agency is response oriented, the MDI approach is better; if the agency is stewardship-oriented, the API approach is better. If resource decision making involves the need to respond to both operationally driven and stewardship objectives, the agency can define a mission alignment metric using inputs from both (see Figure F-6).

FACILITY PERFORMANCE PRINCIPLE

Knowledge of each facility asset's condition, functionality, availability, and utilization compared with agency-established standards is required to understand the capabilities and performance of facility assets and portfolios.

The Capital Programming Guide promotes four performance metrics for continuously monitoring real property assets: (1) operating and maintenance costs, (2) utilization, (3) condition, and (4) mission dependency (OMB 2020a, §

FIGURE F-6 Mission alignment index.
NOTE: This figure infers that there is a mathematical function jointing the Mission Dependency Index and Asset Priority Index into a new metric called a Mission Alignment Index, which would be used to support resource-and-investment decision making.

3.4.3). The committee agrees with these performance perspectives as a starting point and covers operating and maintenance cost evaluation in later principles and addresses mission dependency in the previous principle. Development of this principle focuses on reporting facility performance expanding on OMB's use of utilization and condition performance metrics.

In the committee's judgment, the following four perspectives constitute an exhaustive basis for determining and reporting the performance of a facility asset and facility portfolio:

- *Condition*—the physical performance of facility components and systems.
- *Functionality*—performance in terms of facility configuration other than condition.
- *Availability*—time a suitable facility is available to support an operating requirement (e.g., up-time).
- *Utilization*—the amount of time a suitable and available facility is used to support a requirement.

Other industry sources cover these metrics extensively, including the following National Academies publications:

- *Predicting Outcomes of Investments in Maintenance and Repair of Federal Facilities* (NRC 2012b)
- *Investments in Federal Facilities: Asset Management Strategies for the 21st Century* (NRC 2004b)
- *Intelligent Sustainment and Renewal of Department of Energy Facilities and Infrastructure* (NRC 2004a)

To produce a well-substantiated federal facility renewal strategy, facility performance assessments and metrics should:

- Be knowledge based—that is, constructed on specific engineering and use factors of the components, systems, and assets being evaluated (NRC 2012a)
- Use metrics that are validated and verified[22]
- Be based on clear, objective standards that enable accurate reporting of an asset's or asset portfolio's performance compared with a standard
- Be tailored to identify performance gaps that can be remedied by work actions defined in terms of scope, time, and level of effort to complete

Agencies must also organize facility assessment programs to provide actionable information suitable for documenting a comprehensive list of facility

[2] For more information on this topic, see NRC (2012a).

requirements. This documentation is different from practices where agencies only seek to identify enough work given budget, resource, or capability limitations. The latter approach fails to identify risks and opportunities related to broader resourcing and management strategies. This is why the committee prefers a comprehensive assessment approach to developing federal facility renewal strategies. The committee also notes that there are many methods to achieve a comprehensive analysis and some modeling methods can be just as accurate and less costly than labor-intensive on-site inspections. Example modeling methods include condition-based assessments and parametric cost models derived from actual consumption patterns.

If agencies do not define facility renewal strategies based on a comprehensive evaluation of the facilities portfolios' mission needs, stakeholder requirements, and whole life-cycle costs, they will be ignorant of many risks and causal relationships critical to optimizing resources supporting efficient and effective agency operations.

DECISION-MAKING ALIGNMENT AND ACCOUNTABILITY PRINCIPLE

Facility asset management system decision making must integrate and reconcile objectives, resources, and performance management activities to promote stakeholder confidence in them.

The preceding principles set a foundation for effective decision-making frameworks. This and succeeding principles focus on building confidence and trust in decision making. This is based on two objectives: alignment and accountability. First, decision making must be relevant and responsive to the agency's facility asset management system decision-making needs. Second, decision-making frameworks must reinforce accountability. When done together, decision making will promote stakeholder confidence and trust in the federal facility renewal strategies generated by the agency's facility asset management system.

The ISO 55001—Asset Management System—Requirements standard is designed to serve this purpose. The figure below presents a generic facility asset management system framework based on requirements contained in this standard configured to implement federal facility renewal strategies put in the context of federal policy.

This framework should be familiar to most agencies, with one distinction. Typically, it is presented in policy linking an agency's strategic plan to its planning, programming, budgeting, and execution (PPBE) cycle as required in OMB Circular A-11. Figure F-7 shows how agencies would employ facility asset management systems to achieve this objective. In this case, the real property capital plan, guided by the agency's facility renewal strategy, is developed to inform PPBE activities. OMB's Capital Programming Guide details its purpose in doing this:

> The Agency [Real Property] Capital Plan is the principal output of the Planning Phase. It is a dynamic plan that changes to reflect decisions about adding new assets and deleting old or even in-process asset acquisitions that are not meeting goals (i.e., the return on investment does not justify continued funding of the project). It should be the central document, or group of documents, that the agency uses for its capital asset planning. Agencies are encouraged to use a summary of the Agency [Real Property] Capital Plan for budget justifications to OMB, Congressional authorizations of projects, and justifications for appropriations to the Congress. (OMB 2022a)

The real property capital plan in OMB policy is synonymous with the strategic asset management plan used in ISO 55000 standards. Likewise, as depicted in the figure above, the real property capital plan translates organizational objectives into asset management objectives guided by the agency's facility renewal strategy.

Asset management objectives defined and further developed in subordinate asset management plans establish SMART (specific, measurable, actionable, relevant, and time-bound) facility asset management objectives. Examples include maintaining facilities at specific condition, configuration, and operating standards. This framework indicates the real property capital plan will organize many

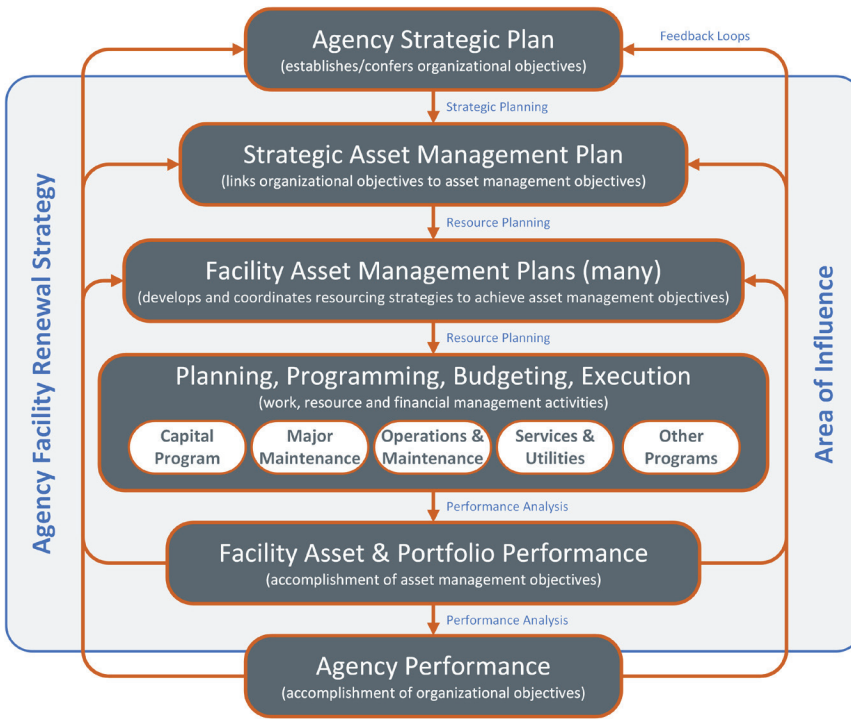


FIGURE F-7 Facility asset management system framework.

asset management plans depending on the size and complexity of the agency's facility portfolio and asset management system.

The next step in the framework, and the objective of every facility asset management system, is integration with the agency's PPBE process. The PPBE process is where the facility asset management system puts the facility renewal strategy into motion, guiding resource decision making compared with established performance objectives. The last aspect of this framework is configuring performance analysis as a feedback loop to improve next-cycle planning activities. When done correctly, each decision-making step clearly establishes its objective and its contribution to enterprise risk management, and defines the roles, responsibilities, and authorities of decision makers at every level. When this is accomplished, the decision-making alignment and accountability principle will be achieved.

OPERATIONAL READINESS PRINCIPLE

The relationship between agency operational readiness and the levels of facility operational readiness delivered by federal facility renewal strategies must be balanced across a range of relevant investment horizons and resourcing strategies.

Integrating and reconciling objectives, resources, and performance establish the need to focus decision making, which leads to the operational readiness principle. Operational readiness joins the mission alignment and facility performance principles. This joining provides a basis for evaluating the operational readiness of a facility asset or portfolio to include the perspective of occupants and stakeholders dependent on the products and services enabled by the facilities. ISO 55002 supports this by detailing use of multicriteria decision making as follows:

> A matrix of stakeholders and their influence, wants and needs, can be constructed to represent stakeholder value. This matrix can be quantified through multi-attribute decision making processes, or be reduced to a single number signifying stakeholder value. The multi-attribute decision making processes may include weighting methodologies, to enable prioritization of what are perceived to be more important factors. (ISO 2014a, Appendix 7)

OMB's Capital Programming Guide also details the need for decision models, combining these perspectives. Circular A-11 incorporates this approach in a discussion related to disposition decision making, in which it recognizes the utility of multicriteria decision-making models for other life-cycle management activities. The committee supports this approach. The Capital Programming Guide provides an example of this using a two-by-two scatterplot comparing how different assets score using mission alignment and facility performance (see Figure F-8).

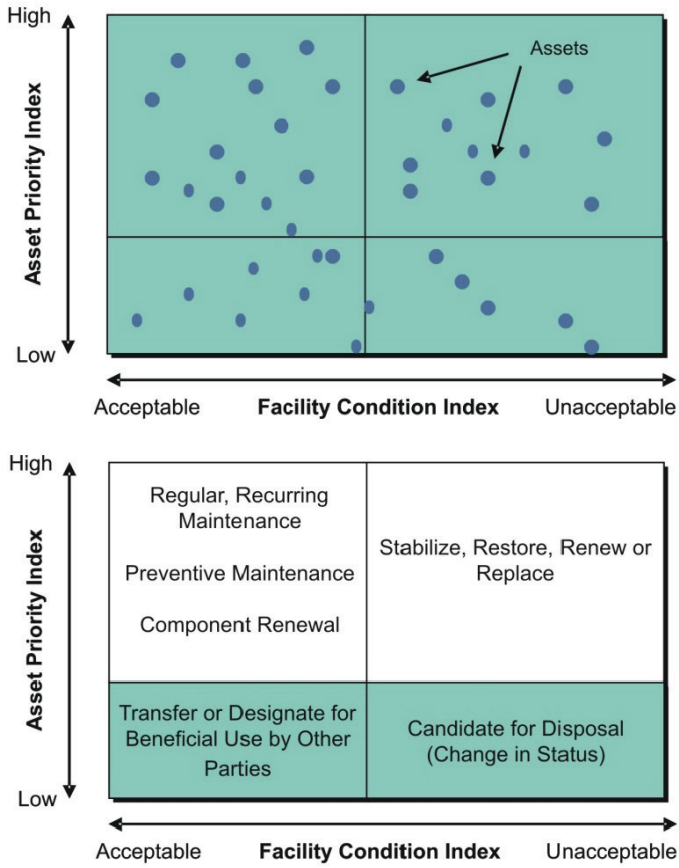


FIGURE F-8 Asset priority index versus facility condition index.
SOURCE: Office of Management and Budget, 2017, *Capital Programming Guide: 2017 Supplement to OMB Circular No. A-11*, Washington, DC, www.whitehouse.gov/wp-content/uploads/2021/01/capital_programming_guide.pdf.

Presenting the data in this way provides insight into the relative importance of an asset compared with other assets.

The committee supports ISO 55002 and OMB's guidance but urges agencies to employ a range of facility asset management decision-making objectives, and recommends evolving federal policy to make use of an Operational Readiness Index (ORI) as part of a method of communications supporting federal facility renewal strategy implementation. The ORI would be based on a multicriteria decision-making analysis, considering inputs shown in Figure F-9.

Figure F-10 provides a hierarchical relationship across three key performance indicator (KPI) levels; agencies could tailor the ORI calculation. The

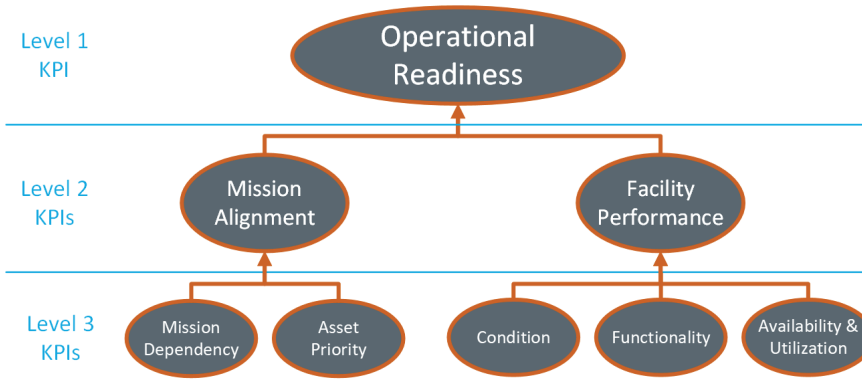


FIGURE F-9 Hierarchical relationship across key performance indicator levels.
NOTE: KPI = key performance indicator.

darkened ovals indicate different data used in ORI calculations configured for specific decision-making purposes:

A summary of the use cases presented in Figure F-10 follows:

- The first use case employs all ORI subordinate KPI inputs. This is useful when performing a **comprehensive analysis** evaluating the relationship between an asset portfolio's operational readiness and resource management plans and strategies across the enterprise.
- In the **mission critical maintenance analysis** use case, the ORI calculation uses mission dependency and the condition index. This is because these two KPIs are directly related to maintenance requirements supporting immediate operational needs. This use case is commonly applied to prioritize recurring major maintenance projects.
- The next use case supports a **long-term space analysis**, seeking to optimize space for a location or region over an extended period. In this use case, ORI is configured to be attentive to both mission dependency and asset priority criteria, joined with asset availability and utilization data.
- The last use case, **stewardship objective analysis** considers specific criteria reported using asset priority criteria and functionality data related to a stewardship objective. This ORI calculation is often used to develop strategies and prioritize actions related to environmental issues, energy goals, and regulatory requirements.

These use cases highlight ORI's versatility addressing a wide range of resource decision making objectives supporting federal facility renewal strategy development. This construct is also supportive of earlier discussions making use of facility asset performance metrics.

FIGURE F-10 Multicriteria decision making analysis.

The Army National Guard's Readiness Center Transformation Master Plan (RCTMP) successfully used operational readiness methods in 2014. Created in response to Congressional Directive 111-201, the Army National Guard used six specific criteria and performed an investment analysis for the 70 million–plus square feet of Readiness Centers scattered over 50 states, 3 territories, and the District of Columbia. Each Army National Guard entity generated a traditional master plan to create a priority list of military construction projects. The Army National Guard used these plans to develop a nationwide capital investment strategy using the national recommendation framework shown in Figure F-11.

ORI was the basis of the Army National Guard's investment strategy, and the two criteria used in its calculation were a Readiness Center stewardship analysis that included space utilization, facility condition, and mission functionality. The National Guard got this information from the Army's Installation Status Report system metrics. The mission dependency used the same method developed earlier. It evaluated the Army National Guard's mission dependency based on each Readiness Center and not on each facility asset. The National Guard then joined the resulting stewardship and mission dependency to identified target ORI ranges that optimally balanced costs and risks to achieve their mission objectives as shown in Figure F-12.

This methodology provided the basis for competing more than 2,000 individual military construction projects from Readiness Centers located around the nation. Traditional master plans generated by each state, territory, and the District of Columbia hardwired strategies for projects in each. The National Guard then

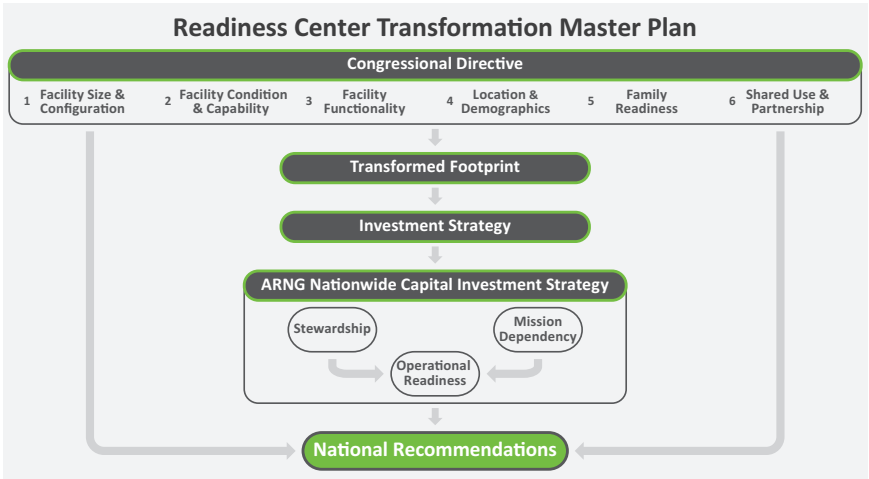


FIGURE F-11 Army National Guard (ARNG) nationwide capital investment strategy. SOURCE: U.S. Army National Guard, 2014, *Transformation Master Plan*, Final Report to Congress, Washington, DC.

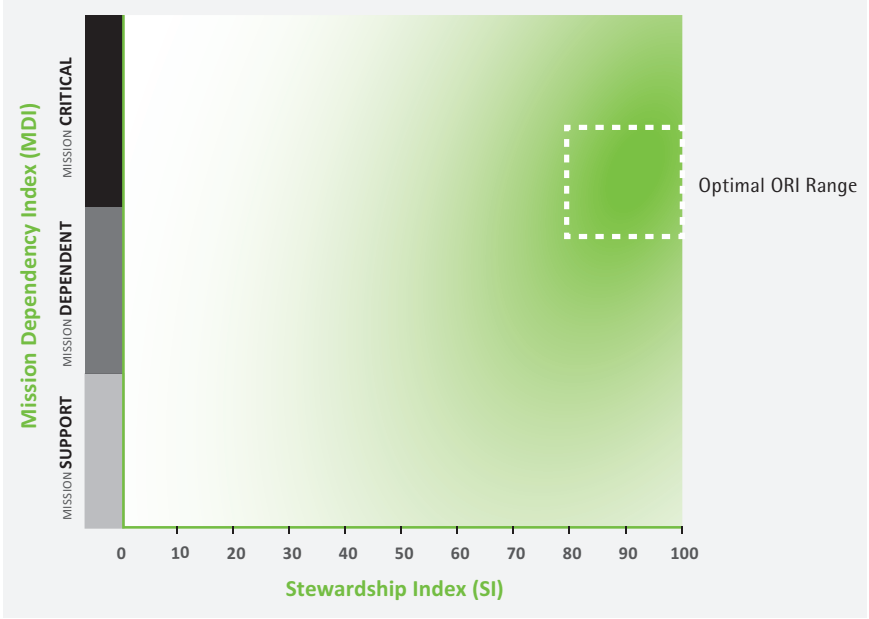


FIGURE F-12 Range of Optimal Operational Readiness Index (ORI).
SOURCE: U.S. Army National Guard, 2014, *Transformation Master Plan*, Final Report to Congress.

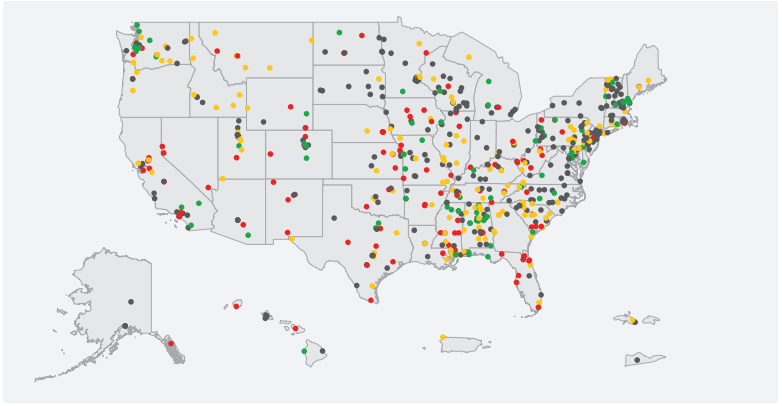
used the ORI methodology outlined above to complete actions across the whole portfolio. The outcome was a 15-year, ~$28 billion investment strategy that evaluated the interdependencies between military construction and Facility Sustainment, Restoration, and Modernization funding, showing the cause and effect of different investment strategies on Army National Guard operational readiness. Figures F-13 and F-14 show a depiction of this analysis.

The Army National Guard RCTMP is the first-known use of the ORI and this methodology. Six years later, the Army National Guard is still using the RCTMP as the basis for facility investments across the nation. The RCTMP, with the help of the ORI, provided executive decision makers and stakeholders with a clear and impactful way to understand the relationship between facility investments and the Army National Guard's Operational Readiness. The committee recognizes the RCTMP as a leading example of a detailed, defensible agency facility renewal strategy.

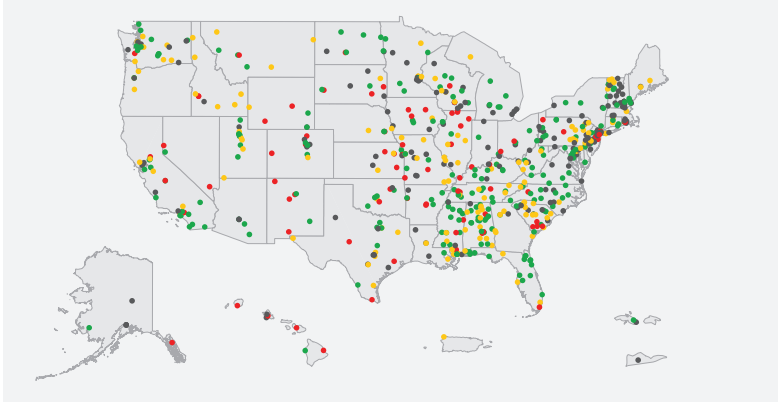
Making use of the Army National Guard RCTMP example, the Air Force developed an investment analysis model called the Installation Health Assessment, introduced in 2017. This model made use of Air Force facility mission dependency and condition index data. It used MDI scores for each facility for

the mission dependency input. For facility condition, it used simplified models that incorporated Sustainment Management System (SMS)/Builder data as a starting point.

The Air Force then developed parametric forecasting algorithms to model the effect of different investment levels on individual facilities rolled up to the whole portfolio. Like the Army National Guard RCTMP, this provided a simple way to demonstrate the cause and effects of different investment strategies on the Air Force's installation operational readiness, as shown in Figure F-15.

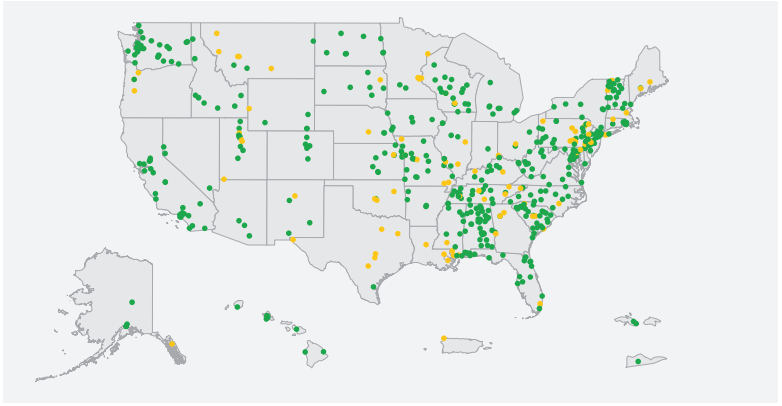


Scenario 1: Current Funding > ORI = 60

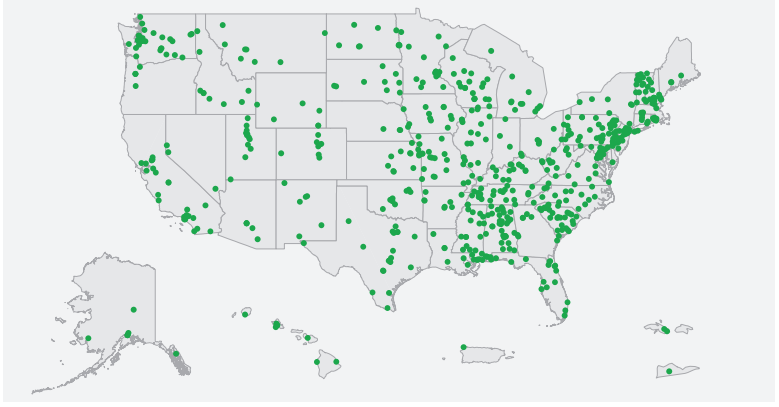


Scenario 2: Base Funding > ORI = 66

FIGURE F-13 Operational Readiness Index (ORI) comparison of tier 1 mission critical locations at year-15 across different funding scenarios.
SOURCE: U.S. Army National Guard, 2014, *Transformation Master Plan*, Final Report to Congress.



Scenario 3: Affordable Readiness > ORI = 75



Scenario 4: Getting to Green > ORI = 81

FIGURE F-13 Continued

This Installation Health Assessment method was essential to the Air Force generating support for its Installation Investment Strategy (I2S), released January 29, 2019. The I2S is a centerpiece to a broad strategy defined in the Civil Engineering Annex of the Air Force's Strategic Plan. The I2S establishes key objectives and performance criteria, supporting a measurable increase in Facility Sustainment, Restoration, and Modernization spending to be phased in over a 5-year investment horizon. Using the ORI to communicate the simple cause and effect between the Air Force's facility renewal strategy and the operational readiness of Air Force's mission capabilities drove an increase in facilities funding to

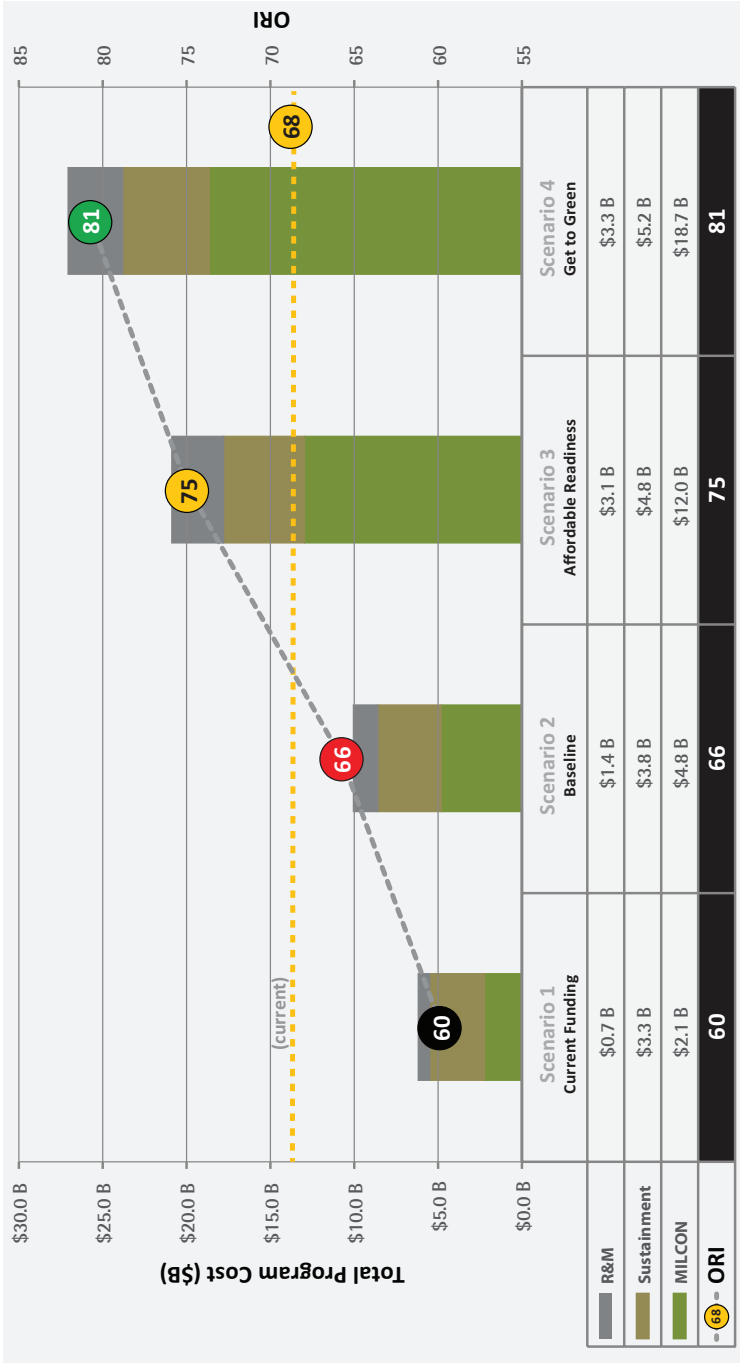


FIGURE F-14 ORI outcome comparison at year-15 across different funding scenarios.
NOTE: MILCON = military construction; ORI = Operational Readiness Index; R&M = restoration and modernization.
SOURCE: U.S. Army National Guard, 2014, *Transformation Master Plan*, Final Report to Congress.

achieve the Air Force's commitment to dedicate 2.3 percent of present retail value as the estimate for Facility Sustainment, Restoration, and Modernization funding.

The committee observes that the success of this Air Force strategy is based on three factors:

- It made use of high-quality, current, and accurate data reported on an individual facility-asset level. This includes inventory, condition, and mission dependency information.
- It made use of an intuitive analysis translating facility life-cycle needs into an operational readiness value proposition. This includes models based on SMS/Builder analysis joined with updated MDI data.
- It communicates findings of this investment analysis in a context important and understandable to operational commanders (i.e., operational readiness).

The Air Force Installation Health Assessment analysis in support of the I2S, like the ORI analysis in support of the Army National Guard's RCTMP, is a leading example of beginner federal facility renewal strategies. They both provided a defensible, verifiable statement of facility requirements set within a life-cycle cost model. Furthermore, this approach relates the cause and effect of different investment strategies on facility performance across whole portfolios and investment horizons.

Through the operational readiness principle described in this report, decision makers can link facility life-cycle analysis to the achievement of agency mission objectives. This requires a current, accurate MDI to capture risks from an operational perspective, joined with current, accurate facility performance metrics. The outcome using an operational readiness–based analysis forms a basis for federal facility renewal strategy discussions of complex factors across whole facility portfolios.

PERFORMANCE–BUDGET INTEGRATION PRINCIPLE

Investment decision-making frameworks must evaluate planned-versus-actual performance in a way that can simultaneously measure a performance gap (e.g., a requirement) and the means to remedy the gap related to budget development.

The preceding principles give evidence on how metrics can support risk-based facility asset management decision making. This principle expands on this and introduces how agencies can integrate these metrics with budget decision making when implementing federal facility renewal strategies. It also establishes capabilities responsive to the OMB M-20-10 requirement for the National Strategy on

the Efficient Use of Real Property to include "an assessment of how the federal government accounts for real property assets on the balance sheet" (OMB 2020a).

Figure F-15 depicts an enterprise risk management framework capable of linking asset performance and budget integration. This framework is applied through an iterative process supporting implementation of federal facility renewal strategies as follows:

- Facility asset management system–defined performance standards are used to set target performance levels. These standards need to establish performance levels that estimate the costs to deliver different levels of asset or asset portfolio performance.
- Facility asset management plans make use of many performance standards to establish strategies and plans for achieving performance objectives for assets and asset portfolios.
- Facility asset management plan performance objectives are linked to facility asset management objectives expressed in the agency's real property capital plan.
- The real property capital plan integrates performance objectives administered through many facility asset management plans to inform agency PPBE decision making. This links agency facility renewal management to budget development activities in accordance with guidance in the OMB Capital Programming Guide.
- Agency PPBE processes obtain budgets and allocate funds to achieve objectives organized through the agency's real property capital plan.
- Execution of the real property capital plan delivers solutions supporting the achievement of asset and asset portfolio objectives first established in the development of facility asset management plans, using facility asset management performance standards.
- Gaps between target and actual performance identified in assessments measure risk to readiness. The use of facility asset management standards simplifies measurement of performance gaps and development of the means to remedy gaps.

In this framework, target performance is linked to an observable facility performance standard. A simple example can be based on the U.S. Army Corps of Engineers' SMS, Paver. This system is used to report the physical condition of a pavement, such as an aircraft runway—for example, the condition of all runways should be maintained at a condition index greater than 86. Setting this target requires the organization to develop construction and maintenance standards for maintaining runways at this condition index value.

This is an iterative, complex activity, but when systematically implemented, a life-cycle cost profile can be generated applying this strategy for the assets being serviced. This strategy can then be translated into a requirements-based budget forecast covering multiple years. As represented in Figure F-16, if the

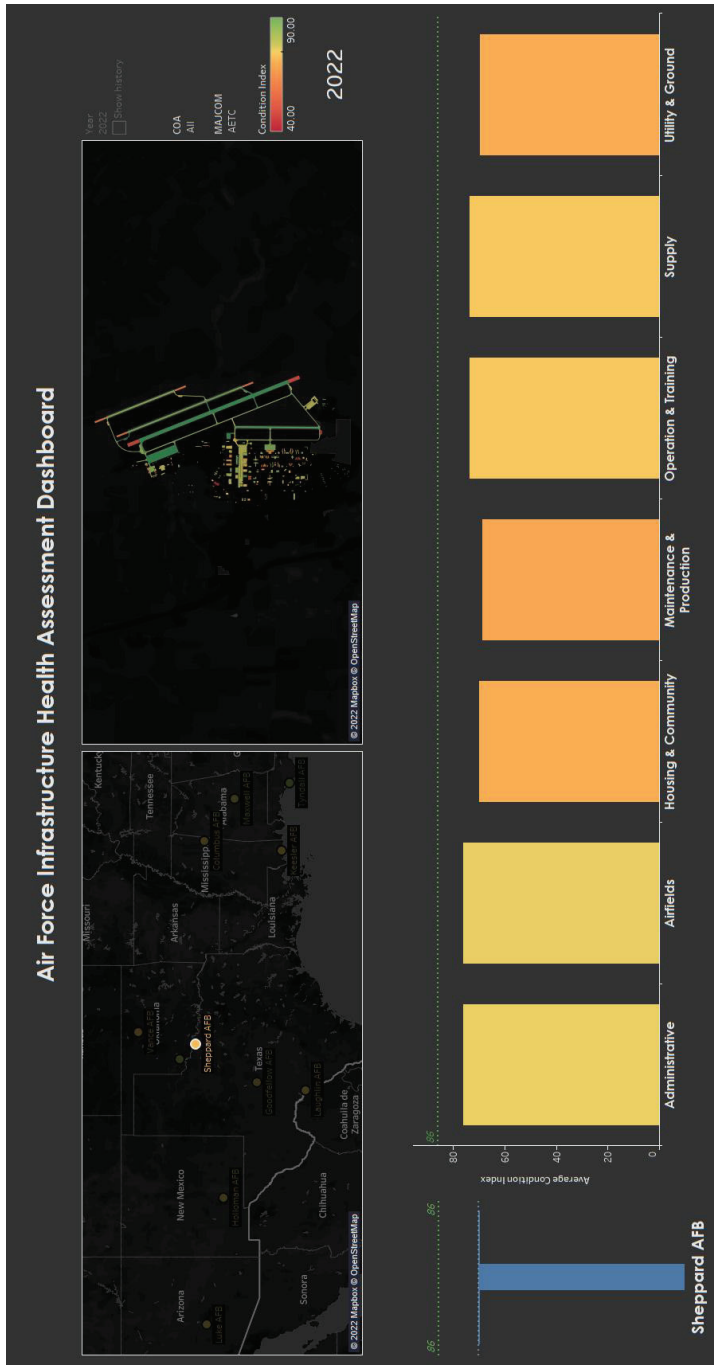


FIGURE F-15 Example representation of the Air Force Infrastructure Health Assessment Dashboard.
SOURCE: Courtesy of Air Force Installation and Mission Support Center Analytics.

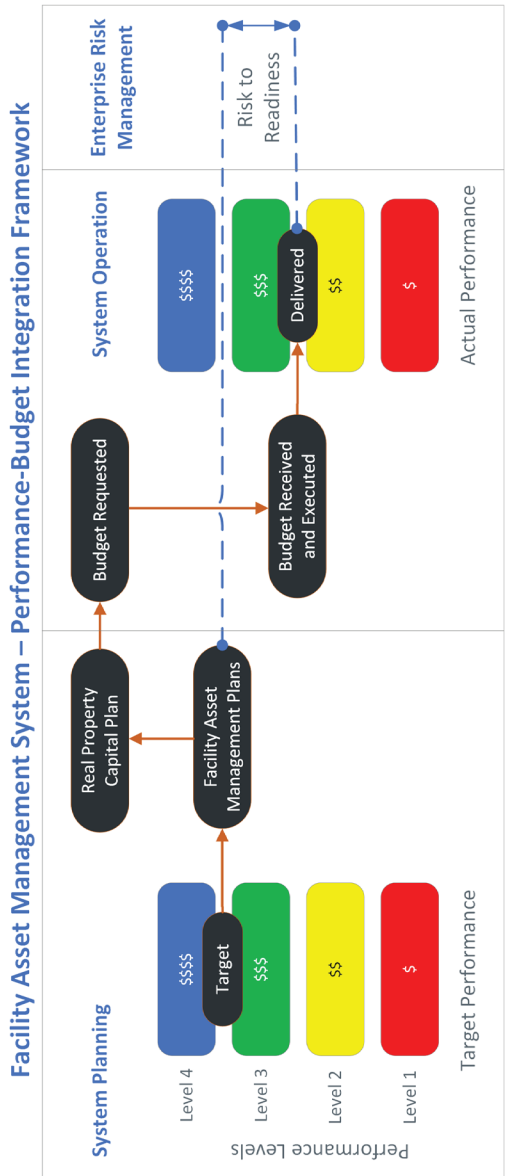


FIGURE F-16 Performance–budget integration framework.
SOURCE: U.S. Army Corps of Engineers, 2012, Project Maintenance Management Development Guidelines, Washington, DC.

budget process does not deliver funding at required levels, the maintenance strategy will not be accomplished, and actual performance would be lower than expected. The outcome of this logical analysis is the ability to explicitly link material performance criterion to physical assets and then monetize the means to achieve or sustain set performance targets. In turn, this simple model can be applied across a comprehensive set of performance standards that, when applied to facility portfolios, can provide a fact-based analysis for budget, resource, and investment decision making.

This framework is predicated on an agency's ability to develop relevant and responsive performance standards. A best practice is to start with measurement areas detailed in the facility performance principle. Agencies must then configure their facility asset management systems to determine optimal performance standard targets. Methods to do so include Monte Carlo, goal seeking, and performance-based analysis. Value generated employing this principle is improved when joined with the operational readiness principle because it raises the value proposition from asset life-cycle management to organizational performance.

On the scale of a federal facilities renewal strategy, this involves modulation of hundreds of standards and planning factors. This evaluation is represented conceptually on a strategic level in Figure F-17.

Figure F-17 introduces how agencies can view macro configuration of their facility asset management system. Configuring an asset management system

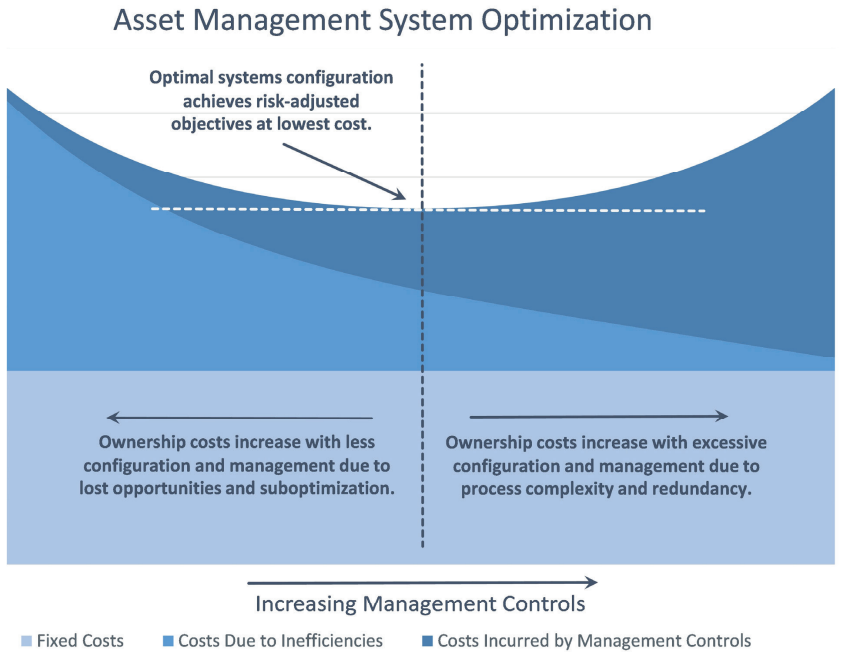


FIGURE F-17 Asset management system configuration.

involves balancing risks and costs to establish an optimal strategy for achieving targeted performance objectives. This is an iterative process, evaluating planned-versus-actual performance and tracing the setting of performance-standard levels through development of the agency's real property capital plan using the agency PPBE process to assess the outcomes of facility program execution. As detailed in Chapter 3, these are essential capabilities of facility asset management systems supportive of OMB policy and ISO 55000 standards.

BALANCE SHEET ANALYSIS PRINCIPLE

Federal facility renewal strategies gain credibility based on their ability to reconcile a comprehensive and exhaustive set of facility requirements and capabilities against resources using a balance sheet analysis.

This second-to-last principle completes the logic responding to the OMB M-20-10 requirement for strategies to include "an assessment of how the federal government accounts for real property assets on the balance sheet" (OMB 2020a). The committee views this not only as a good practice, but as a requirement for effective federal facility renewal strategies. To implement this principle, agencies must demonstrate that their facility renewal strategy is comprehensive and exhaustive.

Comprehensive involves assurance that the strategy covers the entire facility portfolio and the stakeholders' needs it supports. *Exhaustive* means assuring that the strategy addresses all important details. Obtaining these assurances must be inherent to facility asset management system function and the decision-making products it generates (e.g., comparing a requirements-based budget for a facility portfolio with the budget allocated to fulfill these requirements).

To demonstrate these assurances, agencies will need to produce facility portfolio balance sheets reconciling facility requirements and capabilities as part of their facility renewal strategies. Balance sheets list requirements to include desired performance levels to be delivered by federal facilities renewal strategies and the resourcing strategy supporting it. This balance sheet analysis must cover all facility programs coordinated by the real property capital plan and all associated performance objectives. Application of the operational readiness principle is designed to simplify this process by providing a relevant basis to formulate complex risk-based resource-and-investment decisions understood by many key stakeholder groups.

Furthermore, given OMB Circular A-11 and A-123 requirements, and as detailed in ISO 55000 standards, this analysis must be configured as a continual improvement process, evaluating performance as a trend analysis and using this analysis to forecast future performance. This provides a cause-and-effect analysis to evaluate how different requirements-and-maintenance funding strategies would affect performance outcomes. For example, if a certain sum of dollars is

required to maintain aircraft runways at a condition index of 86, and if this sum is not allocated for this purpose, it will then be possible to determine when, how, and why this condition performance target will not be achieved.

Trends must be based on evaluation of past performance and be used to develop forecasting models. Forecasting models must also account for influential factors and planning criteria. Confidence in forecasting models is increased through planned-versus-actual comparisons that could be augmented through data science. Demonstration of assurance can be achieved through balance sheet analysis reporting linked to performance metrics and resource-and-investment strategies that can be understood by key stakeholders.

FACILITY ASSET MANAGEMENT SYSTEM MATURITY PRINCIPLE

To ensure and assure that renewal strategies will lead to desired benefits, they must be supported by a facility asset management system that is periodically and rigorously assessed and reviewed using an objective maturity scale.

The last and one of the most frequently overlooked principles is the evaluation of facility asset management system maturity. OMB policy does not require it, except through assurance statements required in OMB Circular A-136—Financial Reporting Requirements, which are rarely applied to federal facility management. OMB Circular A-11 comes close to this requirement by requiring maturity models for data quality, agency strategic reviews, and customer experience. These are good uses of a maturity-based analysis, but none work for evaluating the maturity of a management system. More specifically, OMB Circulars A-11 and A-123 provide guidance on how to manage resources supporting capital assets, but do not provide guidance on how to evaluate an agency's competency to do so. Whereas ISO 55001 is the only authoritative source known to be able to do this. In fact, as stated in ISO 55001, doing so is an asset management system requirement: "the organization shall evaluate and report on: asset performance, asset management performance (including financial and non-financial performance), [and] the effectiveness of the asset management system" (ISO 2014b, § 9.1.d).

This is a confidence-building objective for asset management system products and foundational services and promotes continual improvement. Agencies that can demonstrate a fully functional facility asset management system are much more likely than those who cannot to generate effective federal facility renewal strategies. Doing so may be the fastest and most effective way to graduate federal real property management from the GAO High-Risk list.

It is for these reasons the committee recognizes the importance of facility asset management system maturity assessments. Leading knowledge-based asset management organizations around the world promote the use of asset management

maturity assessments. These organizations include the Asset Leadership Network,[3] The Institute of Asset Management,[4] the Asset Management Council,[5] the Institute of Public Works Engineering Australasia,[6] and the Global Forum for Maintenance and Asset Management.[7] They agree on using ISO 55001 as the basis for evaluating an organization's asset management system maturity. The general approach used by each involves a series of questions to score maturity across management domains, correlating to ISO 55001 subclauses, as detailed in Figure F-18. A typical summation of an assessment is shown in the spider-web diagram in Figure F-19.

In Figure F-19, the asset management maturity level is 2.20 for the organization being assessed. This is computed on a scale ranging from 0 to 4, with higher numbers indicating higher levels of asset management system maturity. This

FIGURE F-18 ISO 55001—Asset management system clauses.
SOURCE: Courtesy of J. Whittaker, global product owner, Engineering Services, JLL Work Dynamics.

[3] For more information, see Asset Leadership Network, https://www.assetleadership.net.

[4] For more information, see The Institute of Asset Management, https://theiam.org.

[5] For more information, see Asset Management Council, http://www.amcouncil.com.au.

[6] For more information, see Institute of Public Works Engineering Australasia, https://www.ipwea.org/home.

[7] For more information, see Global Forum on Maintenance & Asset Management, https://gfmam.org.

maturity score is computed as an average score across each ISO 55001 management domain. Using an objective, independent standard, such as ISO 55001, for asset management system assessments is essential because it supports the ability to evaluate a progression in maturity from one assessment cycle to another, as shown in Figure F-20.

Figure F-20 shows an organization's progression in asset management maturity over three evaluation cycles, measured from a baseline assessment. Using a consistent, objective standard to perform this assessment is essential for supporting third-party validation and organizational learning. The committee views this type of assessment as critical to agencies seeking to improve their facility asset management system capabilities, which is a means to improve their facility renewal strategies.

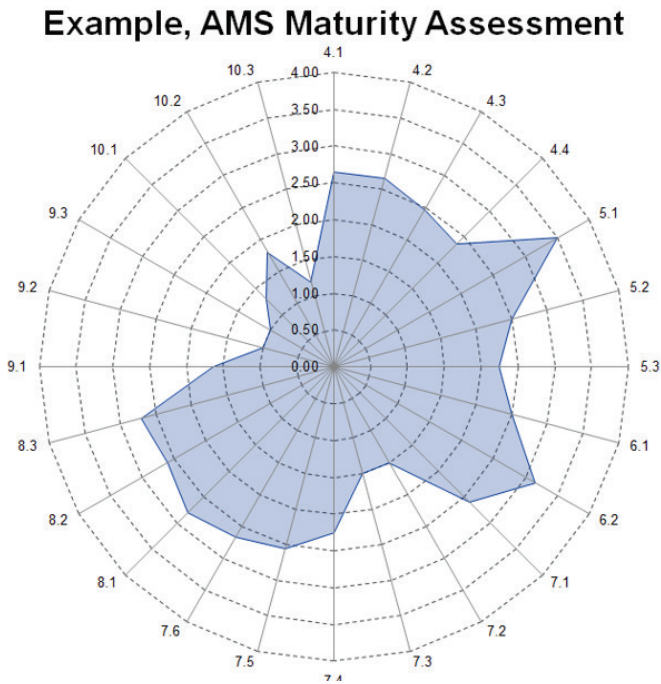


FIGURE F-19 ISO 55001 asset management system assessment report analysis, linked to ISO 55001 clause requirements.

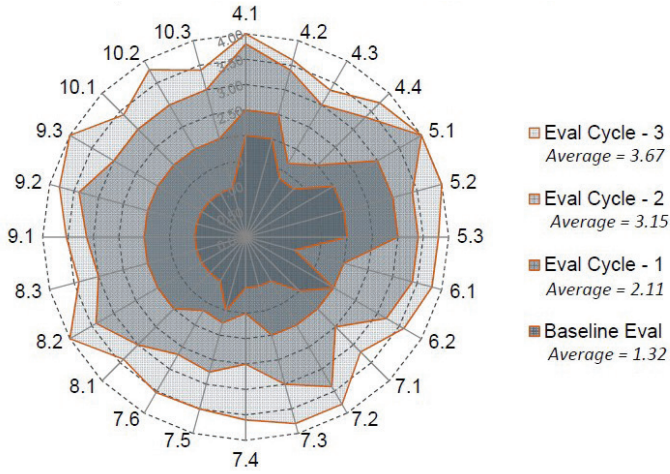


FIGURE F-20 Asset management maturity progression.

G

Value, Benefits, and Risks

Federal facilities have value and generate benefits to society. Value generation and retention, as well as benefits, are always associated with some levels of risk. From enterprise risk management perspectives, a strategic view of risk management seeks to add value and focuses executive management on execution risks by (1) recognizing there is a relationship between taking risks and receiving benefits, (2) implementing risk management through strategies, and (3) establishing metrics and methods for evaluating performance of the risk management strategy.

From asset management perspectives, the International Organization for Standardization (ISO) 55000 incorporates risk management throughout by focusing on measures of value. Ultimately, measures of value are based on the delivery of products and services enabled by facilities. These measures of value cascade from organizational objectives to asset management objectives, then to asset performance and back again, to ensure and assure that key stakeholders get the value needed from facilities. This established the value determined by an organization based on its objectives and stakeholders (1) aligning asset management objectives with the organizational objectives, (2) using a life-cycle management approach to realize value from assets, and (3) establishing decision-making processes that reflect stakeholder need and define value.

The method of revealed preferences, described at a high level in the next paragraph, provides a basis for comparing risks versus benefits and can be used to categorize different risk types. The underlying logic for this method and the relationship of interest is that decision makers do not take risks unless there is some benefit; otherwise, a rational decision maker will not undertake the risks, such as using future-proofing for federal facility renewal.

Benefits may be tangible or intangible, and measured in monetary or some other terms of worth, such as sustainability, pleasure, or symbolisms. Typically, different risk types can be segregated by voluntary versus involuntary actions or activities. The method of revealed preferences assumes that the society's risk acceptance is a natural product of an equilibrium generated from historical experiences (or data) and predicted (or projected) information on risks versus benefits, including associated biases, subjectivity, and perceptions. The method generates inferred approximate lines (i.e., approximate thresholds) representing the acceptance of different activities, segregated by the voluntary/involuntary action categories. These lines are the revealed preferences. Further analysis of such revealed preferences leads to estimating the proportionality relationship between risk and benefit, which, if monetized, is typically quantified at about 1 unit of risk for about 1,000 units of benefit in engineering-related systems (Ayyub 2014a) (see Figure G-1). A more complete discussion of the revealed preferences method is outside the scope of this paper and may be found in Ayyub (2014a). Other disciplines, such as the medical field, might target different or significantly smaller benefit-to-risk ratios in cases such as the use of hazardous drug therapies.

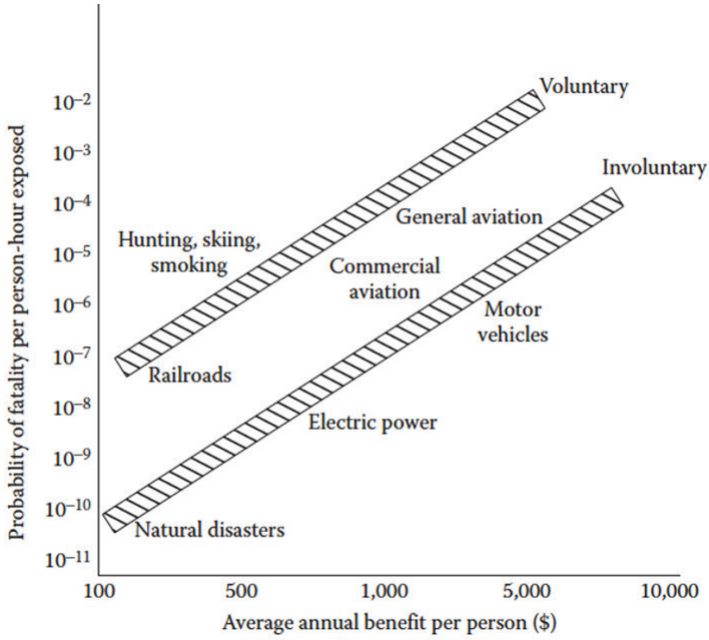


FIGURE G-1 Risks and benefits by the revealed preference method.
SOURCE: Copyright 2014 from *Risk Analysis in Engineering and Economics*, 2nd ed., by B. Ayyub. Reproduced with permission from Taylor and Francis Group, LLC, a division of Informa PLC.

In the context of federal facilities, benefits may include operational efficiency, sustainment, public satisfaction, and image, all feeding into mission fulfillment. On the other hand, the risks may include loss of productivity, decrease in system sustainment, or economic inefficiency. Maintaining an associated balance between benefits and risks requires spending resources on system enhancement or renewals such as in the case of federal facilities. The allocation of these resources at the portfolio levels of federal facilities is essential in any strategy adopted by agencies.

The risks associated with deteriorating facilities vary by type, system, existing condition, function, utilization, and their relationship to an agency's mission. Agencies can identify risks qualitatively, and some can be quantified, as illustrated in Chapter 3. Excess, underutilized, and obsolete facilities are a drain on the federal government's budget in costs. They are forgone opportunities to invest in the maintenance and repair of mission-supportive facilities and to reduce energy use, water use, and greenhouse gas emissions. It is prudent for agencies to consider such impacts in analytical studies (NRC 2012b).

VALUE TYPES IN THE CONTEXT OF FEDERAL FACILITIES

Decision makers use risk studies to examine the potential loss of things that we value, such as goods, property, assets, people, and services. Many decision-analysis frameworks require valuations in economic, monetary, or other terms. Approaching economic value broadly from philosophy, particularly from ethics, one can make distinctions among the following value types: (1) instrumental and intrinsic values, (2) anthropocentric (i.e., human-centric) and biocentric (or ecocentric) values, (3) existence value, and (4) utilitarian and deontological values (Callicott 2004; NRC 2005b). A primary basis for the development of a renewal strategy of federal facilities is economic valuation; however, it is necessary to introduce and discuss these distinctions. A federal agency with a facilities portfolio and a mission to sustain a set of ecosystems will be used as an example to discuss these distinctions, where an ecosystem is a biological community of interacting organisms and their physical environment.

The federal facility addressing these ecosystems draws on, as an example, the instrumental value of these systems that is derived from their role as a means toward an end other than itself—that is, its value is derived from its usefulness in contributing toward a mission. A human-centric value system considers humankind the central focus or final goal of the universe, with humans being the only thing with intrinsic value. In this system, humans derive the instrumental value of everything else from its usefulness in meeting their needs. A biocentric value system (i.e., non-human-centric), assigns intrinsic value to all individual living systems, including but not limited to humans. This system assumes that all living systems have value even if humans cannot determine their usefulness or can be

harmed by them. Other considerations include the existence value system and the deontological value system.

The treatment offered in this report recommends the general use of a valuation approach with the following characteristics (Ayyub 2014a), with exceptions as necessary:

- Human-centric based on utilitarian principles;
- Consideration of all instrumental values, including existence value;
- Utilitarian basis to permit the potential for substitutability among different sources of values that contribute to human welfare;
- Individual preferences or marginal willingness to trade one good or service for another that can be influenced by culture, income level, and information, making it time and context-specific; and
- Societal values as the aggregation of individual values through a system of governance representing society at large.

The approach defined by this list is consistent with current recommended practices from the National Academies of Sciences, Engineering, and Medicine (NRC 2005b). It does not capture non-human-centric values—for example, biocentric values and intrinsic values. In some decisions, including environmental policy and law, the federal government does include biocentric intrinsic values, such as in the Endangered Species Act of 1973.

VALUE AND BENEFITS OF RENEWAL

Value generation requires a multidimensional representation as a matrix of stakeholders and their influence, wants, and needs, quantified through multiattribute decision-making processes; or stakeholder value can be reduced to a single number. The multiattribute decision-making processes may include weighting methodologies to enable prioritization of dimensions, factors, or attributes (ISO 2014c).

Federal agencies can achieve beneficial outcomes of renewal through timely investments in federal facilities maintenance, repair, replacement, or repurposing (NRC 2012b). Those outcomes support mission achievement, compliance with regulations, improved condition, efficient operations, and stakeholder-driven preferences as introduced in Chapters 1 and 2. Agencies can measure all of these outcomes. Some outcomes, including reliability and physical condition, are suitable for predictive and projective pursuits. Agencies can estimate these outcomes before making, or choosing not to make, an investment. Deteriorating facilities and systems pose risks to the federal government, its agencies, workforce, and the public, including risks to the achievement of federal agencies' missions; risks to safe, healthy, and secure workplaces; risks to the government's fiscal soundness; risks to efficient and cost-effective operations; and risks to achieving public policy objectives. Table G-1 provides a summary of these beneficial outcomes related to investments in maintenance and repair.

TABLE G-1 Summary of Beneficial Outcomes Illustrated for Investments in Maintenance and Repair

Mission-Related Outcomes	Compliance-Related Outcomes	Condition-Related Outcomes	Efficient Operations	Stakeholder-Driven Outcomes
Improved reliability	Fewer accidents and injuries	Improved condition	Less reactive, unplanned maintenance and repair	Customer satisfaction
Improved productivity	Fewer building-related illnesses	Reduced backlog of deferred maintenance and repairs	Lower operating costs	Improved public image
Functionality	Fewer insurance claims, lawsuits, and regulatory violations		Lower life-cycle costs	
Efficient space utilization			Cost avoidance	
			Reduced energy use	
			Reduced water use	
			Reduced greenhouse gas emissions	

SOURCE: National Academies of Sciences, Engineering, and Medicine, 2012, *Predicting Outcomes of Investments in Maintenance and Repair of Federal Facilities*, Washington, DC: The National Academies Press, https://doi.org/10.17226/13280.

The value derived from assets varies over the life of the assets (see examples below) requiring the tracking of factors that influence value generation.

- During the investment or acquisition stage, assets are costs to the organization, but have value generated once in operation, with tension arising among asset acquisition, upkeep, repurposing, etc.
- Some assets can have a time delay before generation of value.
- At times, circumstances can lead private organizations to price outputs at a price point that ignores the original acquisition cost.
- Functional obsolescence due to changes in technology or changes in organizational objectives can mean that an asset will change its value to the organization.
- Consumer or stakeholder preferences may change over time (ISO 2014c).

ECONOMIC VALUATION

Economic valuation is defined as the worth of a good or service as determined by the markets. Economic valuation provides a basis for and is often used in decision analysis as discussed in Chapter 4. Economists initially dealt with this concept by estimating a good's value to an individual, then extending it broadly as it relates to markets for exchange between buyers and sellers for wealth maximization. Traditionally, the value of a good or service is linked to its price in an open and competitive market, determined primarily by the demand relative to supply. Therefore, goods, property, assets, safety, security of people, or services are treated as commodities. If there is no market to set the price of a commodity, then it has no economic value. Therefore, the value refers to the market worth of a commodity, which is determined by the equilibrium at which two commodities are exchanged. The limitation is in its inability to set a value of things that are not exchanged in markets.

The concept of economic valuation is rooted in the labor theory of value. The theory states that a good or service is related to the amount of discomfort or labor saved through the consumption or use of it. According to this theory, the exchange value is recognized without making it equivalent to an economic value—price and value are considered two different concepts. A value is determined based on the exchange price that does not necessarily represent its true economic value.

An economic measure of a good's value or a service's benefit is the maximum amount a person will pay for the good or service. The concept of willingness to pay (WTP) is central to economic valuation. An alternative measure is the willingness to accept (WTA), the amount a person will accept to forgo a good. One would expect WTP and WTA to produce similar amounts; however, WTA amounts are typically greater than WTP amounts, primarily because of income levels and affordability factors. These concepts offer bases for economic valuation of services necessary for market-driven enhancements of conditions of facilities. Chapter 3 introduces notions on condition-index or level-of-service analysis.

The economic concept of value, including exchange value, is well accepted. The concept of total economic value offers a broad basis to account for other considerations that do not have explicit or direct market value, as illustrated in Figure G-2.

CONSISTENCY IN RISK ANALYSIS AND MANAGEMENT

A strategy to renew federal facilities should be rooted in meeting missions of agencies, economic values, benefits, potential losses, cost effectiveness, and cost efficiency.

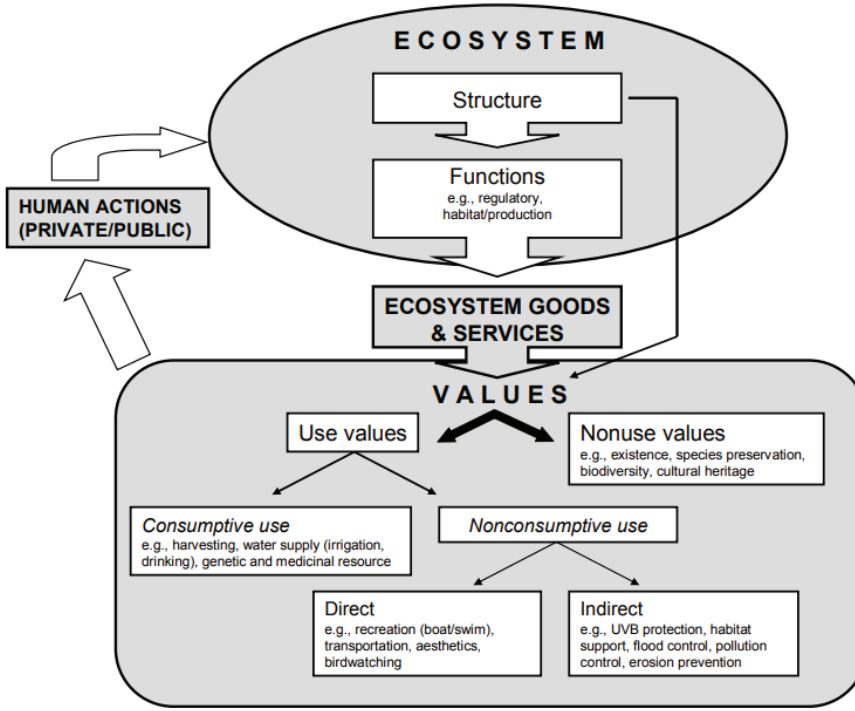


FIGURE G-2 Classification of total economic value for aquatic ecosystem services with examples.
SOURCE: National Research Council, 2005, *Valuing Ecosystem Services: Toward Better Environmental Decision-Making*, Washington, DC: The National Academies Press, https://doi.org/10.17226/11139.

Requirements for Risk Frameworks

Risk management entails resource allocation. The use of an economic framework, building on economic valuation and monetization of value and benefits, offers a basis for consistency and rationality in decision making. This section sets requirements for appropriate risk frameworks based on best practices.

As introduced in Chapter 2, OMB Circular A-123 defines an agency's responsibilities for enterprise risk management and internal control. It also guides federal managers to improve accountability and effectiveness of federal programs and mission-support operations by implementing enterprise risk management practices and establishing, maintaining, and assessing internal control effectiveness. The Circular emphasizes the need to integrate and coordinate risk management and effective internal control into existing business activities as an integral part of managing an agency.

Kaplan and Garrick (1981) captured the essence of risk assessment as applied to facilities and building system components in three questions posed originally for risk assessment of nuclear reactors (NRC 2012b):

- What can go wrong?
- What are the chances that something with serious consequences will go wrong?
- What are the consequences if something does go wrong?

Renewing federal facilities requires the development of a decision framework customized to meet the needs of a federal agency by meeting the following set of requirements to achieve consistency across agencies with resilience-related considerations (Ayyub 2014b), as discussed further in Chapter 3. A decision framework customized for a federal agency

- Builds on accepted definitions for uncertainty, risk, decision, and economic analysis;
- Considers the initial and desired future capabilities and capacities in terms of quantifiable performances;
- Treats capabilities, capacities, and performances as time variant with appropriate and justifiable projections and degradations within a planning horizon;
- Considers potential hazards and disturbances as sources of harm with occurrence rates and intensity treated probabilistically;
- Permits the characterization of performance in multidimensions with the associated things at risk, such as people, physical infrastructure, economy, key government services, social networks and systems, and environment;
- Accounts for systems changes over time, in some cases being improved, in other cases growing more fragile or aging;
- Accounts for full or partial recovery and times to recovery for enhancing functional and operational resilience;
- Accounts for potential enhancements to system performance after recovery from an adverse event or in response to other needs;
- Provides for the use of real options and associated economics in order to meet projected needs with deep uncertainty, such as hazards associated with a changing climate;
- Relates outcomes to other familiar notions such as reliability and risk;
- Incorporates uncertainty analysis probabilistically; and
- Requires input with meaningful units, is unit-consistent, and produces results with meaningful units.

ISO 55000 identifies the need to balance cost, risk, and performance in the generation of value with corresponding implications as follows:

- Cost usually needs to be controlled in order to generate value for the organization by maintaining financial viability. Time shifting of either costs or value generation can play a major role in managing financial viability; for example, some public service providers cross-subsidize services by using revenue from high-density population areas to help fund services to what would otherwise be unviable in sparsely populated areas.
- The likelihood or consequence of a threat is reduced, or the likelihood of or return from an opportunity to enhance value generation is increased.
- Performance is linked to success in generating value or meeting the asset management objectives (ISO 2014c).

Risk Analysis and Management Frameworks

Treatment of risk is a complex issue that must be considered in every decision-making activity. This is addressed in ISO 55000 and ISO 55001, which apply guidance from ISO 31000 supporting the implementation of asset management systems. Figure G-3 provides an example framework for risk analysis and management that meets the requirements outlined in the previous section.

In practice, formulaic risk methodologies are generally not robust enough for federal facility asset management systems covering whole portfolios. Therefore, it is best to approach implementation of risk management techniques through frameworks, principles, and processes, as represented in Figure G-3, and as detailed in the discussion on facility asset management principles in Appendix F.

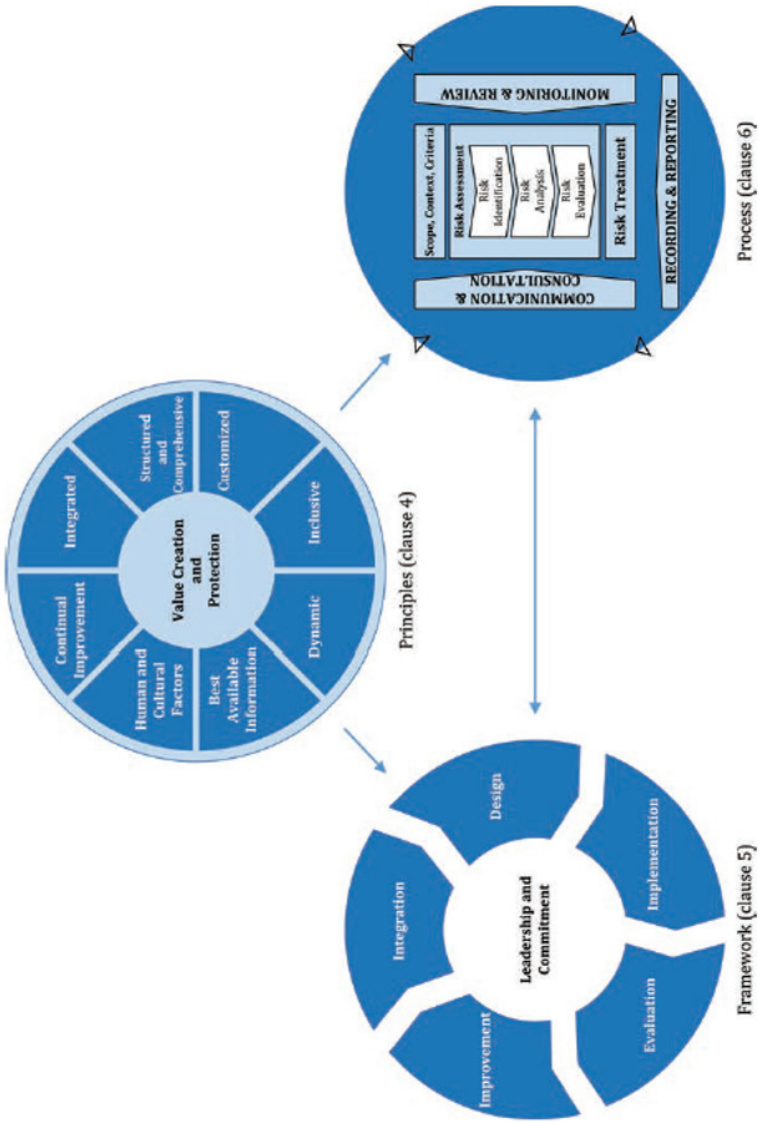


FIGURE G-3 Risk management guidelines.
SOURCE: © ISO. This material is reproduced from ISO 31000:2018 with permission from the American National Standards Institute (ANSI) on behalf of the International Organization for Standardization. All rights reserved.

H

Findings and Recommendations

This appendix provides a consolidated list of chapter findings and report recommendations and should be considered as a supporting document derived from the report simply as a convenience to the reader.

CHAPTER 2 FINDINGS

Finding 2-1: Federal facility asset management should be defined as a fiduciary responsibility implemented as a disciplined approach through policy that promotes asset management system thinking, such as defined in the ISO 55000—Asset Management System standards series.

Finding 2-2: Current OMB policies provide substantial structure defining the operating context for federal facility renewal strategies but fail to support agency development of effective facility asset management systems needed to implement these strategies as defined. This includes the need for immediate attention improving OMB Circular A-11, Section 83—(Object Classifications) to support federal facility asset management.

Finding 2-3: Work advancing a national strategy for federal real property is moving in a positive direction, but policy changes are needed to evolve it into a national strategy for federal facility asset management supportive of implementing federal facility renewal strategies as defined in this report.

Finding 2-4: Work supporting the emergence of real property capital plans is moving in a positive direction, but policy changes are also needed to promote its use for reconciling objectives, strategy, budget, and facility performance to support evidence-based decision making for agency mission achievement.

CHAPTER 3 FINDINGS

Finding 3-1: Development of federal facility renewal strategies requires the use of disciplined facility asset management systems employing "management system thinking." Management system thinking evaluates resource-and-investment decision making from the perspective of how facilities generate value supporting agency mission achievement. This perspective is different from the way most agencies now evaluate facility resource-and-investment decision making, which is generally biased toward facility life-cycle management value propositions, referred to as "classical facility management thinking."

Finding 3-2: OMB policy, notably OMB Circulars A-11 and A-123, do not provide sufficient guidance on how to implement and exercise facility asset management systems capable of generating federal facility renewal strategies detailed in this report. To mitigate this, ISO 55000—Asset Management System, standards series is an appropriate, available, and authorized resource able to fulfill this need. Use of this standard also satisfies policy and objectives detailed in OMB Circular A-119.

Finding 3-3: Effective communications of federal facility renewal strategies are advantaged when they conform to clauses pertaining to facility asset management systems in ISO 55000.

Finding 3-4: Facility asset management systems must be principle-based to ensure their alignment with value generation and desired benefits. Principles complement policy requirements. While requirements are used to ensure that things are done right, principles are used to assure that the right things are done.

Finding 3-5: Operational readiness should be used as the pinnacle principle for federal facility renewal strategy communications because it provides perspective by bringing together multiple criteria valued by stakeholders set within a resource-and-investment decision-making context.

Finding 3-6: Federal agencies can make use of the principles detailed in this report to evolve policies and implementation practices for strategic communication.

Finding 3-7: Federal agencies can communicate facility asset management objectives effectively through real property capital plans that define and maintain federal renewal strategies.

CHAPTER 4 FINDINGS

Finding 4-1: At this time, Builder is ill-suited for estimating renewal costs. Its inspections do not collect restoration and modernization data and its cost forecast process has not been properly verified and validated.

Finding 4-2: The extensive component inventory created for use with Builder is, by itself, a valuable resource. After addressing privacy and security concerns, the inventory data could be made available to facility managers and qualified researchers. The data could also be used by other models capable of estimating renewal and other facility costs.

Finding 4-3: Predicting federal investment requirements for facility renewal is difficult because they are noncyclical and consist of largely unrelated restoration and modernization costs. However, the geometric depreciation model addresses the same costs as those for restoration and modernization, making it a reasonable approach to estimating renewal requirements.

Finding 4-4: The DoD recapitalization metric was an estimation approach that was readily understood and easily applied by planners and facility management. The geometric depreciation model has greater technical credibility and can be just as convenient to use if renewal requirements are expressed as simple cost factors by facility category, similar to the DoD sustainment cost model.

Finding 4-5: Capital depreciation rates are primary inputs for estimating restoration and modernization rates using the geometric depreciation model, and more broadly for estimating the net value of national capital assets. The BEA maintains an aging set of deprecation rates, patterns, and service lives for the categories residential and nonresidential structures. If revised, these data would improve renewal cost estimates, particularly for nonresidential structures.

CHAPTER 5 FINDINGS

Finding 5-1: Federal policy is clear, notably OMB Circulars A-11 and A-123: the purpose of federal facility renewal strategies is to systematically manage risk, with a focus on resource-and-investment decision making to ensure and assure that facilities best support achievement of agency mission objectives and priorities efficiently and effectively.

Finding 5-2: The risk management frameworks used must be systematic and documented, must comply with OMB Circular A-11 and A-123 requirements, and must be integral to federal facility renewal strategy development and implementation.

CHAPTER 6 FINDINGS

Finding 6-1: The committee observes that Circular A-11 does not require the federal agencies to use a comprehensive asset management system, or require submittal of a coordinated operating and capital financial plan and explanation of why needed funding is or is not included in the agency's request for the budget year, as covered in the principles detailed in Chapter 3.

Finding 6-2: The committee observed that few federal agencies aggregate capital investment into consolidated, agency-wide budget accounts, which could help smooth spending and avoid large spikes in funding from year to year.

Finding 6-3: The committee noted that the federal agencies struggle to find funds to meet the most urgent facility renewal needs. A remedy to this is only partially achieved by applying the Mission Dependency and Operational Readiness principles detailed in Chapter 3. More is required. Creating user pays models for collecting the cost of operating, maintaining, renewing, and disposing of facilities could also help agencies collect funds needed for renewal. Furthermore, aggregating these funds into revolving or working capital funds is a proven means to help agencies prioritize needed capital investments and avoid funding spikes.

Finding 6-4: The committee also noted that, for the past decade, all funds collected in GSA's Federal Buildings Fund have not been made fully available to repair and renew the portfolio of government-owned facilities. These funds could either be provided through appropriations or other measures to ensure they are invested in the portfolio.

Finding 6-5: The committee noted that creating government-wide capital acquisition fund(s) would help agencies finance the cost of major acquisitions or capital investments and spread the cost over time, making it easier to fund facility renewal in constrained annual budgets.

Finding 6-6: The committee observed that while some federal agencies have unique congressional authority to enter into privatization and PPPs, others do not have the authority. Privatization and PPPs may offer more efficient or effective approaches to operating and managing services and facilities for public use.

Finding 6-7: The committee believes that unneeded, underutilized properties exist, and that the non-defense agencies could take advantage of the expedited process provided by FASTA to dispose of these assets.

Finding 6-8: The committee observed that in some cases, using operating leases is an acceptable alternative to ownership when the up-front cost of owning cannot be supported in the near-term budget due to budget scoring rules or constraints.

RECOMMENDATIONS

RECOMMENDATION 1: Implement a Federal Facility Asset Management System

The Office of Management and Budget (OMB), in concert with the Federal Real Property Council, should update OMB Circulars A-11 and A-123 to improve guidance for implementing facility asset management systems by

- **Requiring federal agencies to use a comprehensive and principle-based facility asset management system, as defined by International Organization for Standardization 55000—Asset Management System standards, to implement federal facility renewal strategies;**
- **Clarifying how enterprise risk management and internal controls support implementation of federal facility renewal strategies by improving and clarifying policies contained in OMB Circulars A-11 and A-123;**
- **Clarifying agency senior real property officer's fiduciary responsibilities to ensure and assure that the agency is maintaining its facility portfolio efficiently and effectively, and that achievement of this responsibility is reported as part of the agency's OMB Circular A-136—Financial Reporting Requirements;**
- **Detailing how whole asset life-cycle costs, whole asset portfolios, and whole benefit analysis support resource-and-investment decision making; and**
- **Updating OMB Circular A-11, Section 83 (Object Classification) to remove fragmentation and many-to-many relationships that make it exceedingly difficult to generate and audit integrated real property performance–budget and management balance sheets.**

(See Findings 2-1, 2-2, 2-3, 2-4, 3-1, 3-3, 3-4, 3-5, 3-6, 3-7, 5-1, 5-2, and 6-1.)

RECOMMENDATION 2: Implement a Real Property Capital Plan

The Office of Management and Budget (OMB) should clarify its requirements for agencies' annual real property capital plans as detailed in OMB Circular A-11's Supplement—Capital Programming Guide and OMB Memorandum M-20-03, "Implementation of Agency-wide Real Property Capital Planning." Specific requirements needing clarification include

- **Ensuring the requirement for agencies to develop and publish a single, fully integrated real property capital plan as a component of the agency capital plan, as defined in the Capital Programming Guide;**
- **Verifying the relationship of real property capital plans in informing annual budget and investment decision making, including the successful inclusion of urgent and compelling facility renewal needs; and**
- **Publishing the role of the agency's real property capital plan by documenting and communicating the agency's strategy for reconciling agency objectives, budgets, and real property programs.**

Furthermore, agency senior real property officials should implement guidance in OMB M-20-03 for advancing the central role of their agency's real property capital plan, establishing a strategy for integrating and reconciling requirements, objectives, budget, and real property program execution.

(See Findings 2-4, 3-1, 3-2, 3-3, 3-4, 3-5, 3-6, 3-7, 6-1, 6-2, 6-3, and 6-8.)

RECOMMENDATION 3: Update the National Strategy for the Efficient Use of Real Property

The Office of Management and Budget (OMB) should clarify how the National Strategy for Efficient Use of Real Property and OMB Memorandum M-20-10 (Issuance of an Addendum to the National Strategy for the Efficient Use of Real Property) are used to guide their agency's asset management system implemented through real property capital plans. Specific requirements include the following:

- **Defining how agencies are to use the National Strategy to establish priorities and objectives for the efficient use of real property, to include addressing the Government Accountability Office's real property high-risk issues; and**
- **Establishing requirements that link performance reporting of budget execution for the real property capital plan to National Strategy objectives, as reviewed annually by the agency in the context of agency strategic plan reporting, such as through application of the Operational Readiness Principle.**

Furthermore, chief management officers and chief budget officers should ensure they coordinate their agency's response to OMB M-20-10 (Issuance of an Addendum to the National Strategy for the Efficient Use of Real Property) with their agency's response to OMB Memorandum M-20-03 (Implementation of Agency-wide Real Property Capital Planning).

(See Findings 2-2, 2-3, 2-4, 3-2, 3-3, 3-5, 3-6, 3-7, 4-4, 4-5, 5-1, 5-2, 6-5, 6-7, and 6-8.)

RECOMMENDATION 4: Improve Federal Facility Models, Data, and Measures

The Office of Management and Budget (OMB) should clarify guidance requiring agency senior real property officials to improve cost estimates of renewal requirements. Currently, there is no broadly accepted approach to estimating renewal costs, which diminishes the credibility of renewal decision making. After considering two of the methods available, the committee recommends the following:

- **Senior real property officials should adopt an economic depreciation approach for estimating renewal costs, tailorable to each agency's facility portfolio. As a starting point, the model could be simplified to a set of cost factors by facility type, analogous to the Department of Defense Facility Sustainment Model.**
- **Agencies should include existing dated depreciation rates and service lives in the economic depreciation approach review by using a schedule established for the revision of depreciation rate and service life data used in depreciation models, which is currently provided by the Department of Commerce's Bureau of Economic Analysis.**

Furthermore, the General Services Administration (GSA), in coordination with the Federal Real Property Council and under the direction of OMB, should create an independent database of component inventories for federal facilities, beginning with the extensive data collected for the Builder system, and make it available to qualified users and accessible by popular capital planning and facility management systems. The senior real property officials of all agencies would submit information to GSA for compiling, as directed by executive requirement.

(See Findings 3-5, 4-1, 4-2, 4-3, 4-4, 4-5, and 6-3.)

RECOMMENDATION 5: Implement Federal Facility Renewal Budgeting Strategies

Through implementation of facility asset management systems detailed in preceding recommendations, the Office of Management and Budget can ensure optimal use of federal facilities by having federal agencies guide budget development of federal facility renewal strategies by

- **Creating working capital funds or revolving funds to aggregate funding for capital investment into consolidated, agency-wide budget accounts, which could help smooth multiyear life-cycle spending and avoid large, disruptive year-to-year funding spikes;**
- **Installing user-pays models for all federal facilities that fund working capital required to sustainably operate, maintain, repair, and renew federal facilities;**
- **Allowing the General Services Administration to spend all the revenue collected in the Federal Buildings Fund for repairing, renewing, or replacing facilities managed by the Public Buildings Service;**
- **Encouraging agencies to identify noninherently governmental facilities and related services that are mirrored by a broad-based, active private market to be candidates for privatization, outsourcing, or public–private partnerships;**
- **Using the expedited disposal authorities created by the Federal Asset Sales and Transfer Act (FASTA), or seeking additional disposal authorities for properties not covered by FASTA, to dispose of unneeded and underutilized properties; and**
- **Using operating leases as an alternative to ownership when budget scoring rules show that the cost of owning is unlikely in the near-term budget outlook.**

(See Findings 3-1, 3-2, 3-4, 3-5, 3-6, 3-7, 4-4, 5-1, 6-1, 6-2, 6-3, 6-4, 6-5, 6-6, 6-7, and 6-8.)