

Standard Eight: Physical Resources

Description

As the state's largest public institution of higher education, UMass Amherst includes more than 10 million gross square feet of facility space on more than 1,400 acres. Campus facilities and equipment, as well as their planning, construction, operations and maintenance, are professionally managed and maintained by a well-qualified staff.

Real Property Assets

- **Ownership**

The ownership and ultimate responsibility for most of the real property at UMass Amherst rests with the Commonwealth of Massachusetts. Several buildings, including residence halls and some academic facilities, were constructed and are owned by the [University of Massachusetts Building Authority \(UMBA\)](#) a distinct, quasi-public entity established by the Massachusetts legislature to build facilities that could be financed using student fees and charges.

As a public institution, UMass Amherst is a "user agency" under *Massachusetts General Laws*; its real estate and facilities planning, design and construction are supervised by the commonwealth's Division of Capital Asset Management (DCAM). The campus also maintains liaison with the state Department of Public Safety, the Department of Environmental Protection and other agencies to ensure compliance with all current statutes, codes and regulations. The campus is responsible for day-to-day management of its state-owned property but cannot act independently.

- **Compliance**

All new construction and renovations on campus comply with the current Massachusetts State Building Code and all national codes. All construction designs are reviewed by the state Building Inspector, state Plumbing Inspector, town Fire Marshals and Electrical Inspectors.

In 2007, Governor Deval Patrick, with Executive Order No. 484, established new sustainability goals for state building projects. The order mandates that all new commonwealth-funded building projects meet or exceed certain guidelines articulated in the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) Plus program. In addition, the campus uses recognized standards for promoting sustainable design: All new campus construction has a goal of LEED Silver certification. The campus also participates in the [American College and University Presidents Climate Commitment](#).

For each construction project, the Facilities Planning Division assigns a Project Manager with substantial experience in project design and construction. The Project Manager provides oversight from inception to completion. Project Managers and Division procurement staff have completed the state's Certified Public Purchasing Official program on design and construction; all Project Managers are licensed professionals in architecture or engineering. Every project complies with [State Procurement and Construction Regulations](#).

- **Size**

Since its founding 145 years ago, UMass Amherst has grown to encompass 1,463 acres, 893 in the town of Amherst and 570 in the town of Hadley. Research field stations, located in nine other communities, account for additional 2,639 acres. UMass Amherst buildings comprise more than 10.9 million gross square feet, with 10.7 million gross square feet on the main campus and an additional 200,000 at the field stations. The main

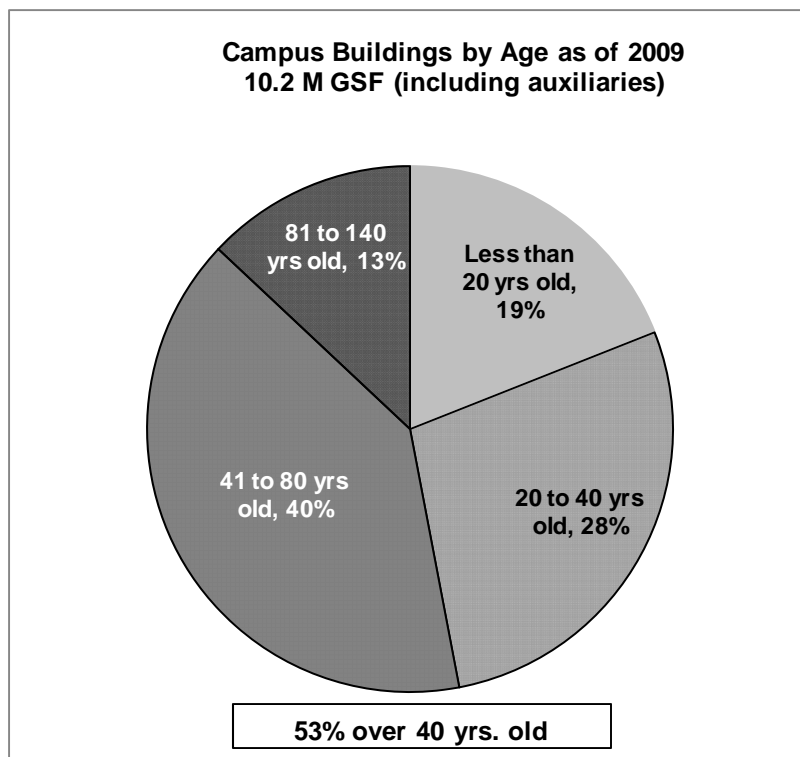
campus includes 23 miles of roadways, 50 miles of sidewalks, 250 acres of lawns, 258 acres of parking lots, 62 miles of electrical lines and 27 miles each of steam lines and water lines ([Summary of Acreage and Buildings as of December 31, 2008](#)).

Between 2000 and 2009, UMass Amherst added 1.18 million gross square feet of new buildings; 61,749 gross square feet of buildings have been removed because of deteriorating condition and to clear sites for new construction ([Structures Added at UMass Amherst Campus, 2000-2009](#) and [Structures Removed from the UMass Amherst Campus 2000-2009](#)).

- **Age**

As shown in Figure 8.1, more than 50 percent of campus facilities are more than 40 years old – the age when systemic corrective action is required to maintain structures at an acceptable level.

Figure 8.1



- **Types of Space**

Table 8.1 summarizes net usable space by categories defined by the U.S. Department of Health and Human Services in its *Facilities Inventory and Classification Manual*. Square footage is identified as gross, net, or net assignable square feet (NASF) based on *Manual* definitions. Using these clearly defined elements as a foundation, the campus's space utilization data may be readily compared with similar institutions across the country.

Table 8.1

	Space Utilization		
	Total NASF	% of Net SF	% of Assignable
Assignable Space			
Classrooms	234,081	3%	3%
Laboratories, Instructional	320,388	4%	5%
Laboratories, Research	570,795	6%	8%
Office	1,208,363	13%	18%
Libraries and Study	282,298	3%	4%
Special use	727,655	8%	11%
General use	505,719	5%	7%
Support	742,720	8%	11%
Health care	22,113	0%	0%
Residential	2,175,564	24%	32%
Alteration	15,559	0%	0%
Inactive	69,064	1%	1%
Total Assignable Space	6,874,319	75%	100%
Non-Assignable Space			
Custodial	37,195	0%	
Circulation	1,622,909	18%	
Utilities	560,514	6%	
Rest Rooms	125,166	1%	
Unfinished	1,984	0%	
Total Non-Assignable	2,347,767	25%	
Total Net SF	9,222,086	100%	
Instructional and Research	1,125,264		16%

During 2009-10, the campus will add approximately 157,500 net square feet, or nearly 192,000 gross square feet, of new building space to the campus inventory. New construction includes a regional transit center, a recreation building, a police station, and practice and equipment space for the UMass Marching Band. Construction of new research greenhouses, included in this square footage calculation, will increase the total instructional and research area to 1.125 million net square feet. A new Integrated Sciences Building, an addition and renovation to Skinner Hall for the School of Nursing, and a new Studio Arts Building are several projects that recently have been completed. The need for additional teaching laboratories is being addressed in the *Comprehensive Science and Engineering Facilities Plan*, which includes a second new science building, currently in design.

Space categorized as instructional and research makes up 16 percent of the total campus net assignable square footage, but instruction is not limited to those space types alone. Office space, including faculty offices, makes up about 18 percent (1.2 million NASF), and library and study space approximately 4 percent (282,298 NASF). The need for additional academic departmental office and support space is being addressed in the *Comprehensive Academic and Classroom Facilities Plan*.

- **Classroom Space:** The Undergraduate Registrar's Office manages assignment of the campus classroom inventory, consisting of general-purpose classrooms, seminar rooms and auditoria. This inventory of 234,081 NASF includes more than 300 rooms with more than 14,400 seats available at

any one time. Auditoria and large classrooms are the most heavily scheduled of these instructional spaces. The campus plans to add auditoria and large classrooms as part of new construction of academic buildings, as well as the upgrading and right-sizing of existing academic facilities. The *Comprehensive Academic and Classroom Facilities Plan*, currently under way, will evaluate and assess the size, character and distribution of existing classrooms on campus, and will develop a long-range plan to improve existing classrooms and to add new classrooms to meet long-term campus needs.

- ***Departmental Teaching Spaces:*** Teaching laboratories and individual study spaces are assigned to, and are managed by, the academic departments. This use category represents 320,388 NASF and more than 5,500 stations available at any one time. Existing spaces are equipped from both departmental and central campus funds. They are refurbished either during major renovations or as small rehabilitation projects.
- ***Research Laboratory and Support Spaces:*** Research laboratory space, totaling 570,795 NASF, also is assigned to, and is managed by, individual academic departments; it does not include offices for faculty, graduate students and technicians, or for shops and other general support. Recent new buildings with research space have been built for Chemistry, Electrical & Computer Engineering, and the Polymer Science & Engineering departments. Existing spaces are renovated and equipped using funds from research grants, research overhead, major renovation grants, and annual operating funds. The need for additional research laboratories and support space is addressed in the *Comprehensive Science and Engineering Facilities Plan*. As for the quality of research space, some departments, such as Polymer Science, enjoy state-of-the-art facilities, while other strong research departments, such as Entomology and Veterinary Science, struggle in space that is grossly outdated.
- ***Student Life Space:*** Many support-service units help sustain student life on campus. Athletics, Campus Activities, Dean of Students, Undergraduate Affairs, Auxiliary Services, and Enrollment Services all support an active community. Space for these administrative units totals about 777,000 NASF. Athletics facilities comprise roughly 233,000 NASF of this total, while the UMass Hotel at the Campus Center has 36,000 NASF.

UMass Amherst has a large inventory of residential space, including dormitories and apartments; it amounts to almost 32 percent of the total net assignable space, or 2.18 million NASF. Residential facilities on campus are generally in better condition than other facilities because of their access to capital funds through room charges. Current housing improvements focus on safety-related projects, such as providing full sprinkler facilities. A recently launched housing study will evaluate the condition of existing residential stock. It will help determine a realistic strategy for improvement of aging facilities, taking into account cost-effectiveness, scope and timing.

- ***Utilities Infrastructure and Energy:*** UMass Amherst has invested significant effort into improving the condition and reliability of its utilities infrastructure. Recent capital construction projects have included replacing an obsolete power plant with a state-of-the-art cogeneration facility. The new Central Heating Plant uses the best available control technology, making it the cleanest-burning gas and oil cogeneration plant in Massachusetts (See “Focus On: A Green Campus”). It can generate 14 megawatts of electrical power. That supplies the entire campus electric load for 70 percent of the calendar year. Its electric distribution system is more reliable than that of the local utility company.

The campus has replaced the two main electrical substations and much of the electrical distribution systems. It also has moved the campus-owned electric distribution system completely underground to protect it from weather-related failures. Several miles of deteriorated steam lines have been replaced throughout the campus. Distribution-replacement projects for steam, water and electricity began in summer 2009 and will continue in summer 2010 in the northeast and southwest corners of the

campus. In late October each year, an infrared flyover is conducted to determine the location of hot spots in steam lines, electrical connections and roof leakages.

In 2004, the campus issued a Request for Bids for energy service contractors to propose utilities cost-reduction projects that would cut the campus's costs and address some deferred maintenance. The campus developed a \$42 million performance contract with Johnson Controls Inc. of Springfield, a contract which guaranteed that the campus would reduce its utilities costs by \$6.5 million per year. The project covered the entire 10 million square feet of campus space and, once the work was completed, the campus reduced its steam use by 24 percent, electric use by 9 percent and water use by 43 percent. Given the success of this cost-reduction project, the Vice Chancellor for Administration and Finance implemented an in-house performance contracting program in which the Physical Plant Division may propose energy-reduction projects that have a payback of up to seven years in utilities savings.

- **Campus Landscape:** In 2007, UMass Amherst began a Campus Landscape Improvement Project (CLIP) that involved a complete review of the campus landscape standards, including landscape furniture, exterior lighting, planting materials and locations, pedestrian and vehicular traffic flow, and condition analyses of roadways, walkways, and turf and plants. This study led to the adoption and publication of CLIP standards and the identification and prioritization of landscaping improvement projects. One major CLIP proposal was the renovation of the Southwest Concourse, an open area that is part of the Southwest dormitory complex, which houses 5,500 students.

New capital construction projects have eliminated several major parking lots and, as a result, parking needs for the campus have become strained. To address the growing need for more parking, the *Campus Master Plan*, which is currently being developed, will examine the possibility of parking garages and peripheral parking lots with shuttle services, balancing parking and transportation needs with improved pedestrian safety and convenience.

Focus On: A Green Campus

Focus on a green campus is propelling UMass Amherst as a leader in environmental conservation. UMass Amherst models best practices in environmental sustainability with conservation projects across its 1,400-acre campus – a natural extension for a public university that's gaining attention with leading-edge research in renewable energy. The new \$133-million Central Heating Plant exemplifies these efforts. The state-of-the-art facility, dedicated in 2009, is one of the cleanest-burning plants in the nation. It generates both electricity and steam, relies on natural gas and oil for fuel, and could be expanded with new equipment to burn biofuels. The Central Heating Plant is part of an effort that has helped UMass Amherst reduce greenhouse gas emissions by about 30 percent, significantly shrinking the campus's carbon footprint. By using treated wastewater from the town of Amherst, it also will conserve 65 million gallons of clean drinking water annually. More than four dozen green initiatives are sprouting elsewhere on campus, rooted in a conservation ethic promoted by the Environmental Performance Advisory Committee. For instance, the campus has replaced incandescent lights with compact florescent light bulbs and recycles nearly 60 percent of its solid waste. Dining Services supports sustainability by buying about 20 percent of its produce from local growers. The campus achieved the state's first green certification of its kind for cleaning operations that, among other benefits, reduce hazardous chemicals. And new campus building projects are designed to meet the silver level of Leadership in Energy and Environmental Design (LEED) standards. With such projects, UMass Amherst is getting greener all the time.

The Management and Oversight of Physical Resources

- **Management of Physical Resources**

Most of the administrative units responsible for campus physical resources and health and safety report to the Vice Chancellor for Administration and Finance. These units include:

- **Facilities and Campus Services:** Three divisions in this unit – Facilities Planning, Campus Planning, and Physical Plant – are responsible for the planning, design, construction and maintenance of the campus’s built environment, including buildings, grounds, infrastructure and utilities. Transportation and Parking are also in this unit.
- **Environmental Health & Safety:** This unit is responsible for the health, welfare and environmental protection of people on campus. It advises on fire protection and code-compliance issues, and serves as liaison with local and state regulatory agencies that deal with environmental and safety issues.
- **The Department of Public Safety (the University of Massachusetts Police Department):** This unit is responsible for the security of people on campus and for security of campus buildings (See Standard Six).
- **Controllers Office:** This office includes the Procurement Department, which manages the public bidding process for all construction-related contracts and ensures that the campus is in compliance with all applicable state procurement laws. The Procurement Office, through its Property Office, keeps track of all equipment items with a value of greater than \$1,000.

Management of general campus classrooms, seminar rooms and auditoria is the responsibility of the Undergraduate Registrar’s Office, which reports to the Provost and Senior Vice Chancellor for Academic Affairs.

- **Oversight of Physical Resources**

Campus administrators use space-needs assessment tools that provide a standardized basis for determining the future needs of campus units, based on staffing, teaching, research and administrative activities. To assure appropriate assessments and forecasts, deans, directors and vice chancellors review assumptions that the assessments make about future activities. These assessments determine overall space needs and are reviewed as part of the planning process for new construction, acquisition, major renovation and reallocation of space.

To prepare for forecasting, the campus has developed standardized forms for space requests and standardized methods for reviewing the allocation process. Executive summaries of current space assignments and needs for five-year intervals are prepared and shared with units and vice chancellors. In 2005, a Space Utilization Study was prepared by Comprehensive Facilities Planning Inc. of Columbus, Ohio. The study described space needs for each school or college and department. This analysis provides useful data for the comprehensive science/engineering and academic facilities plans currently under way.

Other [Campus Oversight Groups](#) provide reviews and recommendations concerning physical resources.

Appraisal

Facilities

The [Framework for Excellence](#) cites the condition of the campus’s physical facilities as “perhaps its greatest challenge”:

“Before the recent building program that invested \$760M in renovations and new construction, the campus had gone several decades without any significant investment in its facilities. As a result, many of the buildings on campus were not adequate for the purposes of contemporary science and modern education. The capital construction projects that will be

completed by the end of next year have helped considerably. ... But there are still many serious problems remaining.”

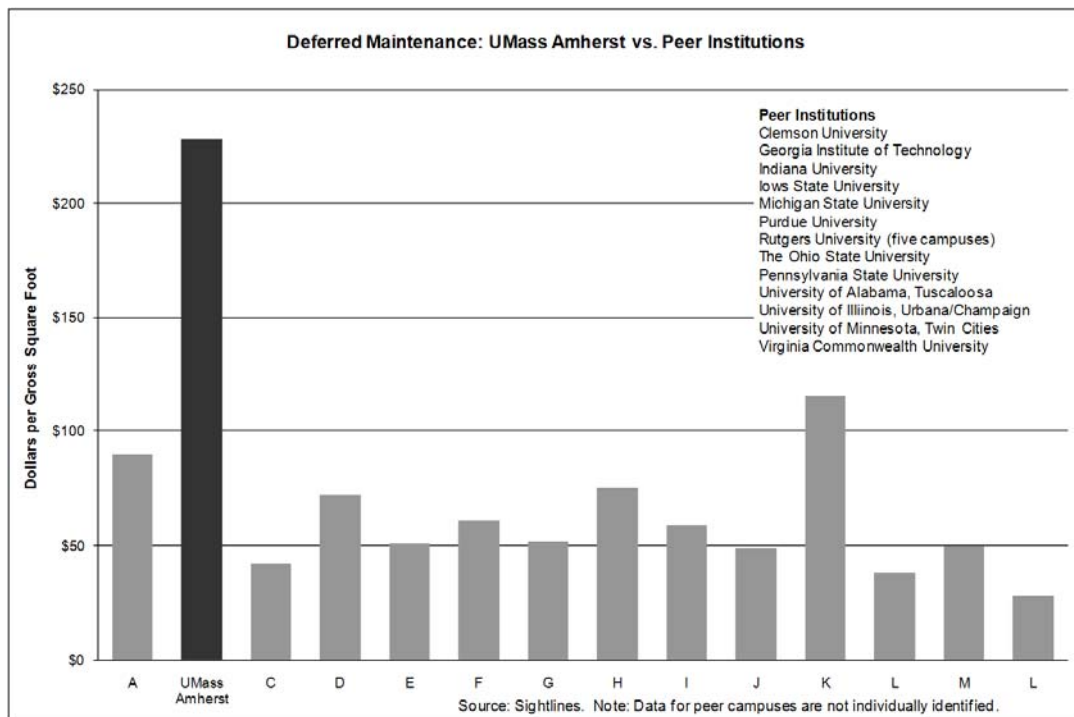
Ongoing planning for campus facility assets has included development of a comprehensive database of facilities condition and space utilization information. The campus also has initiated comprehensive studies of needs for new science and engineering facilities – and for traditional classroom and other academic space (See Standard Two). These facilities data provide important, detailed information that guide physical resources planning. This planning supports a commitment to meet the demands of an increasingly competitive market in higher education. It also recognizes the campus’s backlog of deferred maintenance and growing inventory of obsolete space that must be addressed to remain competitive as the leading public research university in the region.

UMass Amherst grew to its current form as a result of significant state capital investment over a period of many decades. That capital investment, however, was not accompanied by provision for adequate ongoing maintenance, nor for modernization and renewal as buildings reached the end of their useful lives. The heavy emphasis on new construction created an impressive campus, but the failure to provide for continued maintenance and renewal has led to the heavy backlog that the campus now confronts.

As the buildings of the expansion era aged, and could be neither replaced nor renewed, the campus began rapidly to accumulate deferred maintenance. At the same time, the evolving demands of modern science and instruction, changes in building codes, and rising expectations on the part of students and families were “raising the bar” in terms of the cost of acquiring and maintaining an adequate physical plant. As a result, the campus is sometimes unable to keep pace with the demands placed upon it by students, faculty and the commonwealth.

UMass Amherst is not alone in its struggle with aging physical facilities. But the magnitude of the problem underscores its significance as a key challenge for the campus. As reflected in Figure 8.2, a recent comprehensive facilities assessment by Sightlines Inc. demonstrates that the UMass Amherst deferred-maintenance backlog far surpasses that of comparable institutions.

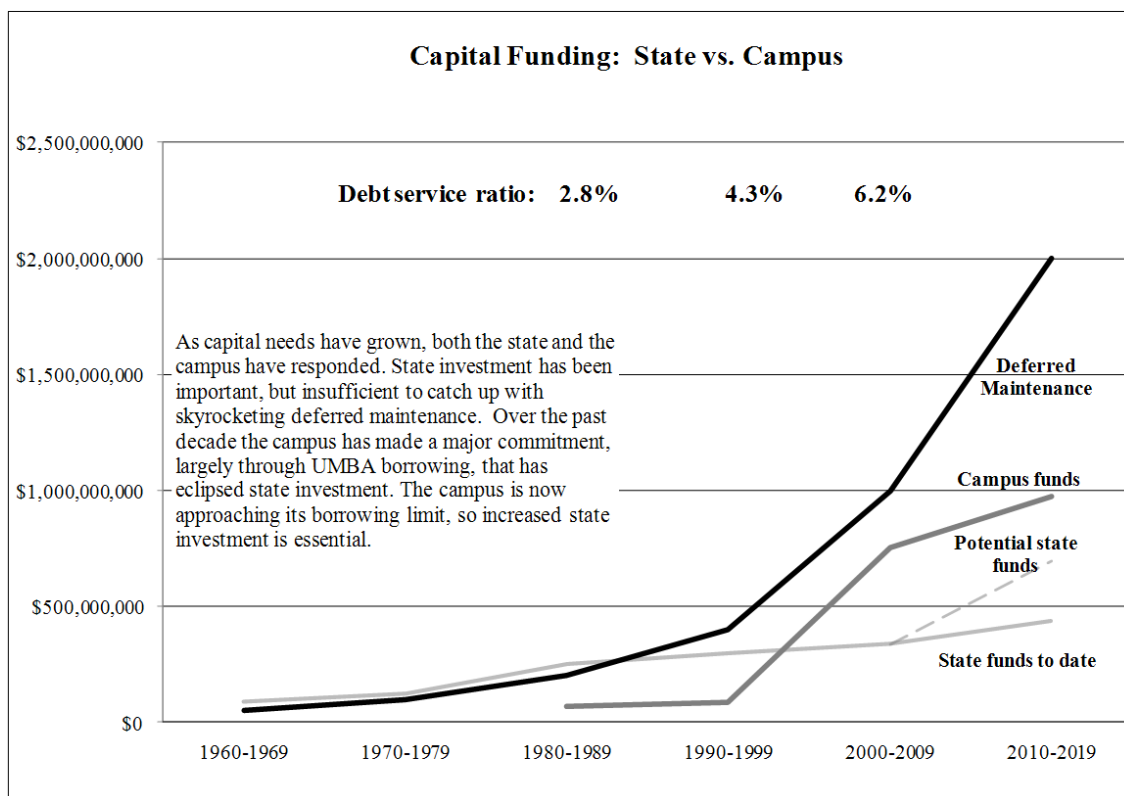
Figure 8.2



Both the state and the campus have attempted to respond. The state provided reasonably steady increases in funding, totaling more than \$400 million over five decades. In the 1980s and 1990s, however, as the magnitude of the deferred maintenance problem became increasingly apparent, the campus began to dedicate more of its own operating funds to the problem in the form of both direct expenditures and debt service for University of Massachusetts Building Authority (UMBA) borrowing. This effort required diverting funds from teaching and other regular operations, but there was no ready alternative.

Figure 8.3 shows the long-term trends that have led to the current facilities crisis. Over the past two years, the Commonwealth of Massachusetts has taken two major steps with the potential to greatly increase capital investment at UMass Amherst. The first was passage of a higher-education bond bill (HEBB) authorizing as much as \$700 million over the next 10 years for the Amherst campus. To date, \$100 million of that total has been committed for the construction of a new science building now under design. The second was passage of a life sciences bond bill (LSBB) that included \$95 million for a facility on the Amherst campus. Figure 8.3 shows both the actual state funds released to date, including the \$100 million for the science building, and also the potential state funding if the remaining authorizations in the two bond bills are released to the campus. It is clear that securing the remainder of the potential state funding is essential to keeping up with facilities needs, even as it is equally clear that doing so will not by itself solve the longstanding problem.

Figure 8.3



Note: The “Potential state funds” line represents monies generated with the higher-education bond bill (HEBB) and the life-sciences bond bill (LSBB).

The campus has now invested twice as much as the state. For a time, the dramatic increase in campus spending kept pace with the growth of deferred maintenance, as depicted in Figure 8.3. But as campus-funded borrowing increased, so did the proportion of the campus budget devoted to debt service. It is now approaching the limit established by the bonding agencies: current obligations into the next decade preclude significant additional borrowing, even if operating funds could be made available to pay the debt service. But the need continues to grow, even with the huge investments made by both the state and the campus.

The problem of deteriorating facilities has been long in coming but only relatively recently has it been fully understood and documented. The University has developed various ways of managing and measuring the condition of its physical resources: a space inventory together with a space-needs assessment modeling tool; a reorganized design and construction service; a comprehensive facilities audit; a comprehensive work-management system; and an equipment-inventory system. In addition, UMass Amherst has invested considerable resources in recent years in a detailed Geographic Information System (GIS) as a tool for assessment and planning documentation.

During the past six years, the campus has worked with expert external consultants. This includes Sightlines, a facilities advisory company based in Connecticut with the largest higher-education facilities database in the country. Sightlines reviews facilities conditions and benchmarks this information with peer institutions. Sightlines also provides recommendations for maintaining current facilities and for investments to improve facilities conditions. This portfolio of information is organized in an online database, which allows facilities personnel to prioritize maintenance and repair requirements. This effort was coupled with a campus effort, the *Building Disposition Plan*, a document that lists every campus building, details the deficiencies in each, and recommends the future for each. This effort enables staff to download information and identify how changes will affect the value of the facilities portfolio. Information is always current, and the collaboration with Sightlines has resulted in an *Integrated Facilities Plan*. The *Plan* supplements the space-needs assessment modeling described earlier, by adding a physical condition component, thus providing essential information for decision-making about space assignments.

The *Plan* assesses what space can be maintained and repaired, what can be repurposed, and what should be demolished. It provides one perspective on assessing the scale of the campus's facilities needs by calculating the dollar value of deferred maintenance – the cost of making existing campus structures fully functional in terms of their originally designed purposes. That figure now exceeds \$2 billion. Many of these structures, even if restored to original condition, would not be capable of supporting modern science and instructional programs. In many cases, funds would be better spent on new construction or major renovation and repurposing. The *Comprehensive Science and Engineering Plan* and the *Comprehensive Academic and Classroom Facilities Plan*, now nearing completion, indicate the scale of campus facilities needs in more practical terms: what it would take to construct and renovate the facilities necessary to support modern science and instruction, and to allow the campus to remain competitive? Early indications are that, from this perspective as well, funding needs exceed \$2 billion. In sum, all analyses converge on the need for the campus to attempt to secure capital investment exceeding \$2 billion over the next 10 to 15 years. Of that, much is needed in the near term to address immediate facilities deficiencies.

Staffing

Because of budget cuts, the Physical Plant staffing level has decreased more than 25 percent between 2000 and 2009, from 586 full-time employees to 436. This impact of this staffing decrease has been exacerbated by the construction of new facilities. Between fiscal 2000 and 2009, total campus facilities increased by 403,000 square feet. While Physical Plant personnel are competent, the ability of a reduced staff to keep up with larger workloads presents serious challenges.

The Physical Plant staff is also being challenged by increasingly complex technical systems and equipment being installed in new buildings. The University of Massachusetts Board of Trustees has recognized the problem of under-funding maintenance and has developed a policy that requires new construction to have an annual maintenance support equal to 3 percent of the construction cost, exclusive of utilities; it requires a fund to be set up with annual contributions equal to 1.5 percent of the construction cost for each new building. This will be used to cover future capital replacement costs associated with these buildings as they age.

Projection

Facilities

The completion of the *Comprehensive Science and Engineering Plan* and the *Comprehensive Academic and Classroom Facilities Plan* represents the next step in mapping a long-term facilities strategy for the campus. These plans will prioritize space needs; will establish a sequence for new construction, renovation and demolition; and will identify how most effectively to use available funding as it emerges over time. This planning sequence will culminate in a campus *Master Plan*, now being initiated. The *Master Plan* will tie together the science and academic plans and add comparable analysis for remaining categories of facilities, including student life and athletics. Taken together, these planning efforts will for the first time give the campus a comprehensive view of its facilities needs and capacities, the sequence and timing of necessary construction and renovation, and the funding necessary to achieve those improvements. It will guide campus decisions, and also will form the basis for seeking investment from private donors and state and federal governments.

Based on these new insights and ongoing financial planning, the campus has developed a capital funding framework for the next decade (Table 8.2). It shows funding needs apportioned over the first five years and the second five years of the period. It also shows known funding potential for the same periods. Nearly \$900 million is needed in the first five years, and over the entire decade funding needs total \$2.08 billion. Of this, the campus plans to provide nearly \$300 million through direct expenditure and University of Massachusetts Building Authority (UMBA) borrowing. The state has authorized \$694 million through the higher education bond bill and the life sciences bond bill, with the great majority of those funds scheduled to come in the second five-year period. Most of the funds have not yet been allocated to the campus, and securing them in a timely manner is critical. But Table 8.2 shows that even if all currently authorized state funding is fully allocated to the campus, the funding plan will still fall short by more than \$1 billion in meeting the needs identified in the various capital plans.

Table 8.2

Campus Planned Resources for Capital Funding, 2009 – 2018
(In Million \$)

Sources of Funds	Capital Plan II		Total of Plan II
	FY09 to FY13	FY14 to FY18	FY09 to FY18
Projected State	199	495	694
Committed Campus (excludes auxiliary)	199	91	290
Gifts/ Fed/ Other	3		3
	401	586	987
Uses of Funds	Capital Plan II, Projected Needs.		Total of Plan II
	FY09 to FY13	FY14 to FY18	FY09 to FY18
Science	304	725	1,029
Other Academic	243	240	483
Other: Deferred Maint. Student Life	335	230	565
Infrastructure, Admin			
	882	1,195	2,077
Surplus/ Deficit	(481)	(609)	(1,090)

The campus must continue to explore all possible funding sources to address its facilities needs in the coming decade. As part of this effort, the campus will enlist allies whenever possible to maintain and accelerate state investment in the campus. Targeted fundraising can ease the problem, as can assistance from the federal government and public-private partnerships. But the scale of the challenge makes clear that state capital

appropriations will have to be a major source of funding to maintain UMass Amherst's physical capacity to deliver instruction and to conduct research.

Money is not the only remedy needed. The campus will continue to pursue relief from the unduly bureaucratic processes required by the state that put major constraints on, and add substantial cost to, the process of planning, designing and building facilities. UMass Amherst has highly qualified professional design and construction project managers, so allowing the campus to manage its own projects should be considered as a major cost-saving measure.

Institutional Effectiveness

Over the past decade, the campus has transformed its understanding of and approach to facilities planning. Where once it was in the position of reacting to immediate problems, it now has a comprehensive and detailed analysis of its physical capacities and challenges. The shift has been particularly dramatic in terms of science, classroom, and other facilities critical to the UMass Amherst mission. The campus now has in place or is in the final stages of developing comprehensive plans for science and engineering and academic and classroom facilities. These evaluations reveal major challenges that will require years to address fully, but they have resulted in sharply focused resource and facilities plans in the short and medium term, allowing the campus to derive the maximum possible value from its investments. These assessments will also be used to inform conversations with the University system and the commonwealth in developing a long-term facilities strategy.