

Facilities Costs

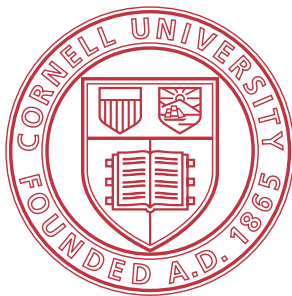
By Thomas E. Cole, Jr.

Division of Planning & Budget

Reprinted from

Cornell University
2005-06 Financial Plan

May 2005



Cornell University

FACILITIES COSTS

INTRODUCTION

In his book, *The Builder: A Biography of Ezra Cornell*, author Philip Dorf offered a prophetic story concerning Ezra Cornell, Andrew D. White, Alonzo Cornell (Ezra's son), and Francis M. Finch, and the siting of Cornell University on East Hill in Ithaca, New York.

At the March 14, 1866, meeting of the trustees White summarized the conclusions of the Building Committee: To build of stone; to draw up as complete a plan as possible, but to erect buildings only as required and as their resources permitted; to provide dormitories—a necessary evil in view of the distance from the village; to erect a large university library building as soon as possible; to use existing farm buildings at the start.

If White's report failed to mention the site of the campus, it was not through oversight, but because the exact location had not yet been chosen. In a general way the trustees knew that Cornell wanted the university to be built on East Hill overlooking the village. But how far up the hill? There were three possible sites: the one closest to the village, a plateau of about seven or eight acres; a second and slightly larger plateau about two hundred yards above the first; and finally, at the top of the steep slope, a large uneven shelf which stretched toward the east and contained most of the farm's tillable acreage.

From the upper plateau Cornell had first looked down upon Ithaca and then out upon the lake and distant hills. Innumerable times since that day in April, 1828, he had visited the spot, sometimes early in the morning to watch the rising sun light up the opposite bank, sometimes at the end of the day to see the sun sink behind the western range. The university would be a crown upon East Hill.

His mind was made up but he said nothing; he wished first to hear what the others would say. ...Early in May the regular building committee went over the ground; failing to reach a decision, they left the matter to another committee consisting of Cornell, Alonzo, Finch, and White. One day near the end of the month the four traveled by carriage up the winding road to the brow of East Hill, and then by foot to a point where they had a clear view of the two lower plateaus. Alonzo suggested the middle location, and Finch supported him. But White thought they should build as near to the village as possible and that the first plateau was an ideal site.

Cornell had listened quietly. "...gentlemen...you appear to be considering the location of half a dozen buildings, whereas some of you will live to see our campus occupied by fifty buildings and swarming with thousands of students."

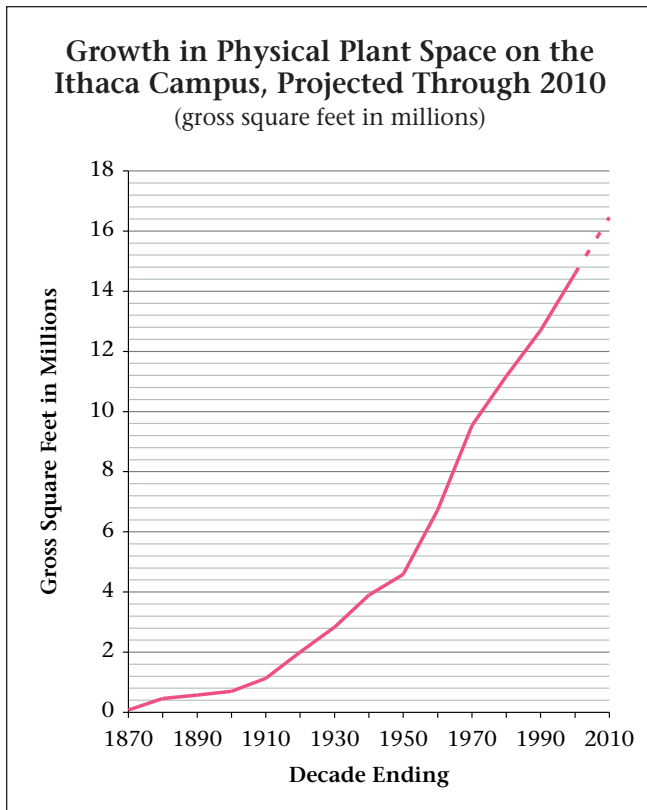
Many years later Alonzo revealed how dumfounded they were by these words; how they asked him where *he* thought the location should be; and how, turning toward the east and swinging his arms north and south, he said: "Here, on this line extending from Cascadilla to Fall Creek. ...We shall need every acre for the future necessary purposes of the University."[¶]

Ezra Cornell's vision was correct. The university he founded would need every acre on that site, and then some, as Cornell expanded to become one of the largest private research universities in the United States.

- From Ezra Cornell's initial donation of a 209½ acre farm on East Hill, the university now owns or has custody of over 21,000 acres of land that are used for its various educational programs.
- Beginning with two 40,000 gross square foot facilities perched on the edge of that upper plateau—South University (later Morrill Hall) and North University (later White Hall)—the university's programs swelled to fill 754 buildings in Ithaca and Tompkins County, occupying a total of 15.2 million gross square feet.[†]
- There are approximately 14 miles of roads, 100 acres of parking, and 12,700 parking spaces owned by Cornell in Tompkins County.
- The campus voice and data networks have approximately 17,000 phone jacks and 22,000 data ports. The voice network handles approximately 150,000 phone calls weekly and the data network handles approximately 3 terabytes of data daily and 680 million e-mail messages annually.
- The main Ithaca campus is served by 25 miles of underground steam and condensate piping and 120 miles of water piping.
- The campus consumes 2.7 trillion BTUs annually to provide heat and electricity. The total cost of supplying heating, cooling, electricity, and potable water for the campus averages \$110,000 per day.

[¶] Dorf, Philip, *The Builder: A Biography of Ezra Cornell*. Ithaca, NY: The Dewitt Historical Society of Tompkins County, Inc., 1952.

[†] Technically, the university's first building (excluding extant farm structures that were located on the original Cornell farm in 1868) was Cascadilla Place (Hall), the construction of which was begun in 1864. This facility—the brainchild of Samantha Nivison of Dryden, New York—was intended to serve as a combined water cure and training facility for women physicians and nurses. Ezra Cornell was one of the early investors, and when the project seemed doomed to failure (after only the first two floors had been built) Ezra and the other investors agreed to sell their interests in the facility to Cornell University for a dollar each. Cascadilla Place provided the fledgling university with dormitory, faculty residence, dining, instructional, physical education, recreational, and administrative space when it opened in October 1868—serving as Cornell's first learning and living center.



PATTERNS OF GROWTH

Cornell’s physical plant has grown steadily but at different rates since 1868. The capital plan included in this document indicates that the pattern of expansion shows no sign of abating over the coming five to ten years. (See graph above, which includes a projection of physical plant space additions through 2010 based on projects included in the approved capital activity shown in the university’s capital plan.)

- Physical plant space has been added annually to the Ithaca campus at an average rate of about 1.4 percent since 1970, which is about half the growth rate for the period 1900 through 1970. The current rate of expansion yields the addition of approximately two hundred thousand gross square feet of new building space per year.
- While some of the new facilities that are included in the university’s five-year capital plan for 2005-06 through 2009-10—such as the Life Sciences Technology Building, the East Campus Research Facility, and the Physical Sciences building—are substantial in size, the estimated addition of 1.2 million gross square feet reflected in the plan is

comparable to the kind of growth that the campus has experienced recently.

- In tandem with the expansion of physical space, the complexity of the campus’s facilities has increased dramatically. The heating, ventilation, air-conditioning, electrical, plumbing, data and voice communications (wired and wireless), fire alarm and suppression, security, lighting, and energy conservation-systems installed in even the simplest buildings are far more advanced and demanding in terms of operations and maintenance than those installed previously, even in buildings of relatively recent construction. For example, when it was opened in 1868, White Hall’s infrastructure was simple: it was heated by wood stove and ventilated with operable windows. Over the decades, hot water perimeter heating, some window air conditioners, electric power, and telephone and data systems had been added. The most recent renovation added systems for building-wide heating, ventilation, and air conditioning, including a complex air distribution system with digital controls and motor drives to maximize energy efficiency; modern phone and data wiring; fire alarm and sprinkler systems; and storm water handling. The complexity of these improvements was driven by regulation and code requirements, historic preservation concerns, and programmatic needs. Yet White Hall still serves essentially the same academic purpose as it did in 1868.

Cornell’s capital project planning and approval processes focus attention primarily on the costs of construction and renovation of campus facilities. Beyond the one-time costs of capital projects, however, investment in facilities includes significant ongoing costs of operating and maintaining those facilities, as well as the expense of various components of infrastructure required to support a modern research university. The network of utility lines (electric, steam, chilled water, potable water, sewer, gas, and communications), roads, bridges, parking lots and structures, service access, and sidewalks and foot paths represent an ongoing capital investment that grows in size and complexity along with the campus’s buildings.

Any analysis of the cost of the university’s facilities must recognize the unique nature of the physical plant in higher education and Cornell’s unusual position within higher education.

- In the case of an institution like Cornell, the location of the university is a fixed variable. Where a commercial enterprise might open and close plants or branches in a variety of locations to best suit its needs, the relocation of Cornell University's main campus to somewhere other than Ithaca, New York due to space or other facilities needs is not practical and would require legislative action.*
- The proximity requirements of a university campus—with the need for programs to be physically adjacent to support interdisciplinary interaction and allow faculty, staff, and students to easily get from one part of the campus to another, particularly by foot—constrain the location of facilities.
- Similarly, many campus facilities must be viewed as almost permanent fixtures. The historic nature of some buildings and the fact that most facilities are constructed based on an assumption of long-term use (even allowing for eventual adaptation for new purposes) has a significant impact on the type and cost of the campus's buildings.
- Finally, the construction, operation, and maintenance of campus's buildings is affected by Cornell's relationship with New York State and the State University of New York (SUNY). The laws enacted to create the four contract colleges at Cornell provided for the state to construct and operate facilities that would be used by Cornell to support the activities of these contract colleges. Thus, the state is connected directly (through the SUNY Construction Fund) in the design and construction of most contract college facilities. Today, there are 354 state-owned buildings at Cornell, occupying a total of 4.5 million gross square feet, and Cornell utilizes a portion of the annual funding provided by SUNY to pay for the maintenance, utilities, and custodial costs for these facilities.

Not only has the need for additional space to support the university's mission been growing, but also the changing nature of educational facilities has driven an increased investment in Cornell's buildings.

* Cornell's original charter specified the university's location and minimum size. The act of incorporation required that the university (a) "be located in the town of Ithaca, in the county of Tompkins, in this State" and (b) that "The farm and grounds to be occupied by said corporation, whereupon its buildings shall be erected...shall consist of not less than two hundred acres."

- Research in the sciences has become more space intensive, with lower net-to-gross square footage designs, more elaborate mechanical and infrastructure systems, and more complicated equipment requirements.
- Changes in requirements and expectations—regulatory or code requirements and the need for air conditioning, for example—have also forced facilities costs higher.
- Similarly, the nature of student residences and support facilities have become more extensive and expensive. The living/learning concept in the student residences—with decentralized dining, faculty advisor quarters, and other program spaces—requires building designs that are more elaborate than the double-loaded corridors of rooms found in the dormitories of the past.

All of these elements serve to act as multiplying factors, reinforcing each other and producing an increasing demand for additional, high-quality space.

ELEMENTS OF FACILITIES COSTS

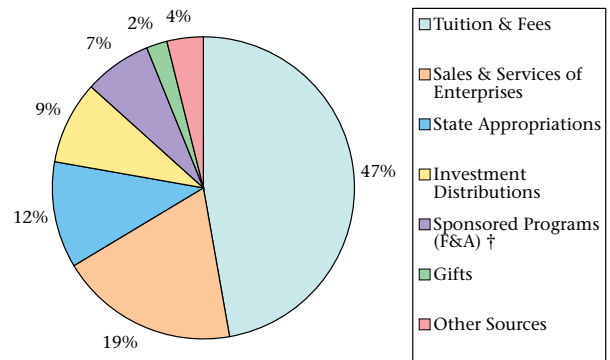
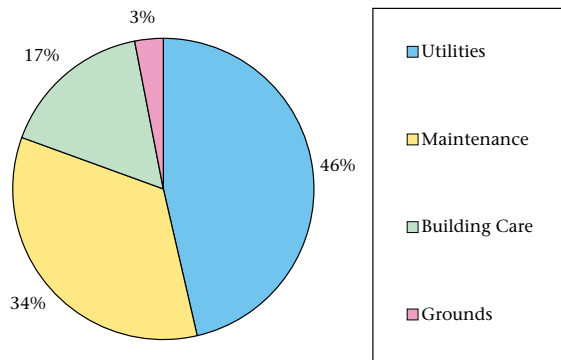
The universe of the direct and indirect facilities costs can be divided into three main categories: project costs, infrastructure costs, and ongoing costs.

- *Project costs* are the expenditures associated with new construction or the renovation of existing facilities, and are normally represented in a capital project. (At Cornell, the sum of such projects constitutes the capital plan.) Project costs include:
 - architectural and engineering design;
 - the activities of construction;
 - project management expenses;
 - project-specific support costs (such as contract preparation) and assessments (such as transportation displacement fees); and
 - furniture, fixtures, and equipment.

Factors that affect the overall cost of a university construction project include:

- the status of the local and regional economy and labor markets (including the availability of contractors and their workforces);
- materials costs, which are affected by national and international market demands;
- compliance with architectural standards; and
- the cost of the university's capital project

2003-04 Facilities Management and Operating Costs and Sources of Support – Ithaca Campus



† Sponsored programs (F&A) = indirect recovery of facilities and administrative costs from sponsored programs

approval and management process, which provides oversight and can entail iterative programming and design steps.

Cornell has in place a formal and comprehensive process to review and approve capital projects and their associated costs. The process includes involvement at the college or unit level, and entails multiple administration and trustee reviews to ensure that projects are of high priority, have the necessary funding and financing to be completed successfully, and constitute an architectural compliment to the existing campus. Recently, Cornell undertook an extensive analysis of capital construction costs in conjunction with the university's workforce planning efforts and a special task force created by the Buildings and Properties Committee of the Board of Trustees.

- *Infrastructure costs* can be affected by facilities projects in many ways. Utilities infrastructure and voice and data networks may require relocations and connections to new facilities, and new or changing buildings usually have a direct impact on the usage and capacity of utilities systems. Roads and parking are often affected by facilities additions and changes in faculty, staff, and student populations. Facilities projects often trigger both a change in the level of service that must be provided by an infrastructure system and the ongoing cost of maintaining those systems. The capital component of such infrastructure is significant, representing a projected \$233 million investment over the next five years (as embedded

in the university's five-year capital plan).

- *Ongoing costs* include:
 - facility maintenance;
 - custodial care;
 - utilities usage;
 - voice and data usage;
 - landscape and grounds maintenance;
 - security and environmental monitoring and compliance;
 - insurance; and
 - a host of support services (including mail, dining, and facility management).

The operating and maintenance cost of the Ithaca campus in 2003-04 was approximately \$114 million. The magnitude of the components of these costs and the sources of revenues that fund them are shown in the two graphs above.

PLANNING FOR FACILITIES COSTS

The cost elements of the university's facilities projects are planned for by individual project and collectively at the operating unit and university levels. Colleges and operating units provide some of the detailed analysis while much of the planning occurs at a university-wide level. The offices involved include facilities planning and space management operations located within academic and support units as well as university-level departments responsible for the overall provision of facilities management operations, utilities, and transportation services. The details of

these capital projects and their associated operating costs are evaluated as part of Cornell's operating and capital budget processes, leading to an eventual review and approval by the Board of Trustees.

A plan is prepared for each capital project that details:

- the project's full costs, including project-specific infrastructure requirements;
- all funding and financing sources (if debt financing is employed), including a cash inflow schedule;
- a project schedule, including workload and cash outflow requirements; and
- an estimate of and funding plan for the operating and maintenance costs created by the project.

The university's capital plan consolidates the individual project plans into a "big picture" view of facilities projects that includes their economic and operational impacts. Projects are evaluated in relation to the university's academic and other priorities. The capital funding needs are examined for fundraising feasibility and campaign planning, operating budget impacts, connection with the SUNY capital planning and funding process, and debt financing requirements. The planned schedule of projects describes cash flow and labor workforce requirements that must be anticipated. The extent to which the capital projects address the university's inventory of deferred maintenance and the estimated impact on annual operating and maintenance costs are factored into facilities maintenance and operating budget planning.

Other planning efforts that are related to the university's facilities plans include:

- campus master planning, which allows Cornell to consider the physical implications of expansion as well as densification on land and infrastructure and to establish guidelines for long-term growth;
- space utilization and allocation studies, which help Cornell better utilize its existing facilities;
- university debt planning, which enables the institution to make maximal beneficial use of taxable and nontaxable debt proceeds;
- planning designed to address and manage the university's deferred maintenance inventory; and
- infrastructure planning for utilities, transportation, and the voice and data networks.

These efforts are sometimes undertaken to evaluate a particular area or address a specific issue, and at other

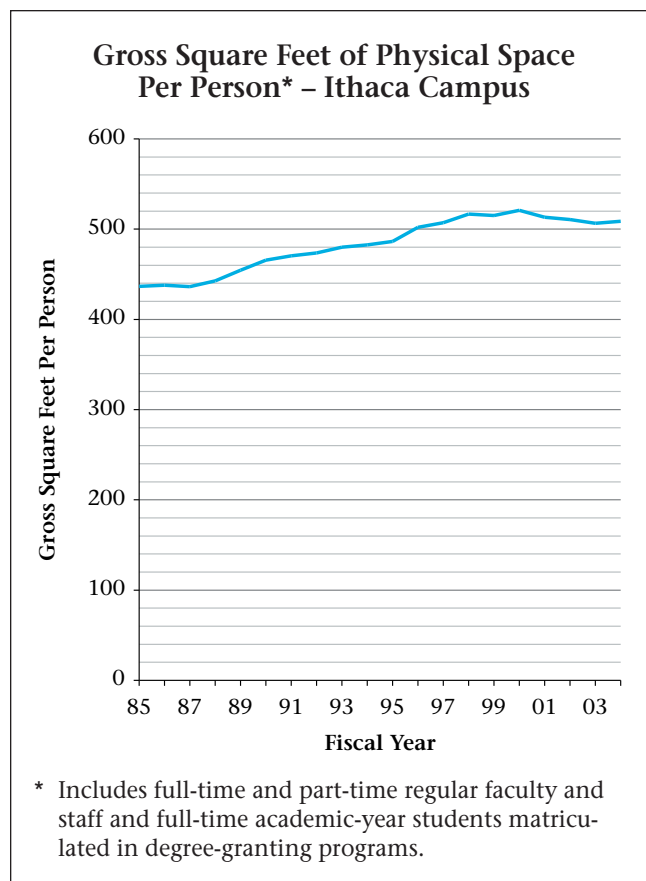
times with a more global campus view. Recent examples of the former include:

- a planning study focused on the "science sector" east of East Avenue and north of Tower Road,
- space utilization studies of the Colleges of Engineering and Agriculture and Life Sciences, and
- a utilities master planning effort that is currently underway.

Examples of the latter include an anticipated comprehensive plan for the Ithaca campus and a Generic Environmental Impact Study for campus transportation issues that is expected to begin in late 2005.

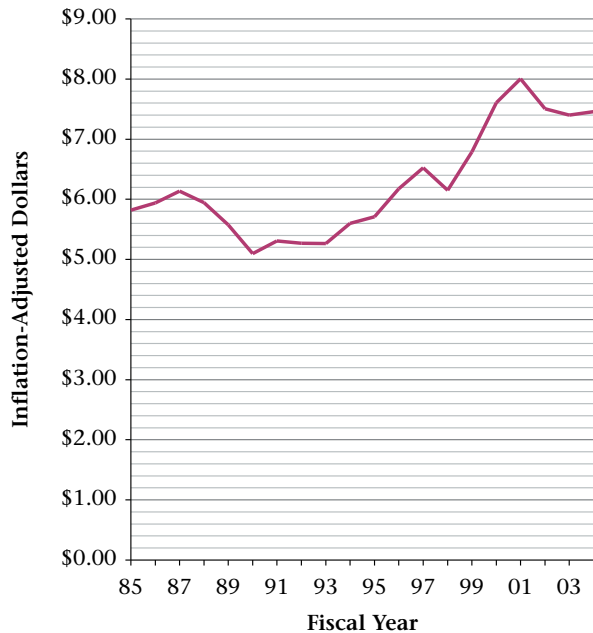
O&M COST ANALYSIS

As described earlier, the demand and need for physical space has been increasing steadily at Cornell. The graph below illustrates this phenomenon, showing a general increase in the amount of space devoted to the Ithaca campus population of faculty, staff, and students. While the amount of space has been growing



Cost per Gross Square Foot to Operate and Maintain Physical Space – Ithaca Campus

(inflation-adjusted, 2003-04 dollars)



at an annual rate of approximately 1.5% for the past twenty years, resulting in a campus physical plant that is nearly one-third bigger, the campus population grew only 13 percent over the same period. Since 1985, the primary growth has occurred in three areas.

- The amount of office space has increased by nearly 30 percent per faculty and staff member.
- The laboratory space has increased by 25 percent per faculty member.
- Student residence and health care space has increased 15 percent per student.

Other types of space—classroom, study, support, and special/general use—have remained more constant in relation to the size of the campus population. While the amount of Ithaca campus space is growing at a slower rate than that of the size of the university's budget, operating and maintenance costs have been growing at a much faster rate since the early 1990's. For the period from 1984-85 through 2003-04:

- the amount of campus space (measured in gross square feet) increased by 32 percent;
- the expenditures for the Ithaca campus, adjusted for inflation, increased by 56 percent;

- Ithaca campus revenues grew by an inflation-adjusted 62 percent; and
- the operating and maintenance expenditures, also adjusted for inflation, increased by 70 percent.

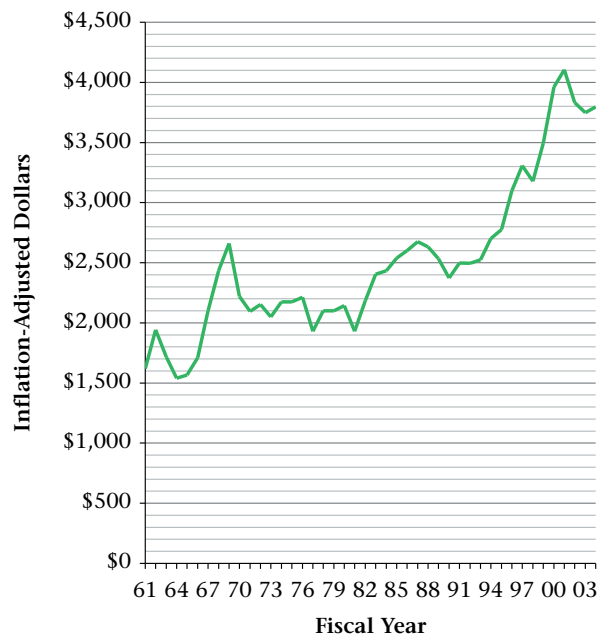
Changes in these factors and their interrelationships are illustrated in the graphs at left and below and on the lower left of page 8, which show:

- that the cost of operating and maintaining space has increased in inflation-adjusted terms on a square-foot and a per-person basis and
- that the university is spending a greater fraction of its operating budget to support that space.

The amount spent on operating and maintaining the campus facilities in recent years has been considerably different for Cornell-owned facilities compared to state-owned facilities. Maintenance expenditures in Cornell-owned buildings have grown much faster over the last twenty years, at a rate significantly higher than the rate of growth in square footage, compared to maintenance of state-owned buildings, which has not kept pace with the growth in space. Cornell has

Cost per Person[†] to Operate and Maintain Physical Space – Ithaca Campus

(inflation-adjusted, 2003-04 dollars)



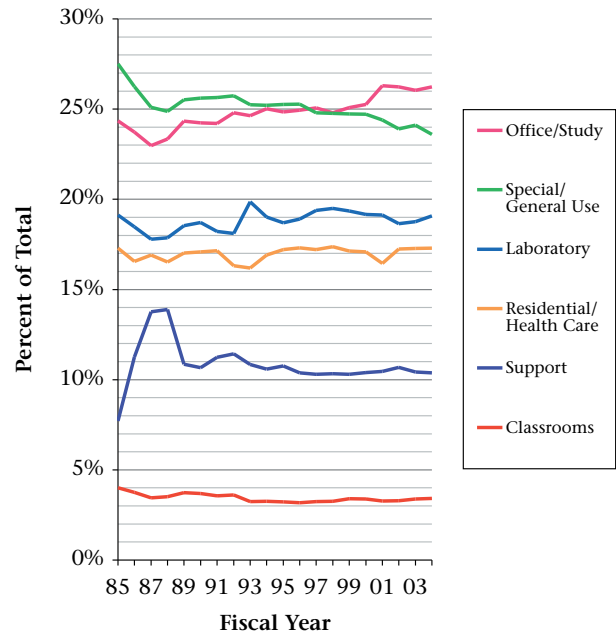
[†] Includes full-time and part-time regular faculty and staff and full-time academic-year students matriculated in degree-granting programs.

kept a focus on addressing deferred maintenance over the past 15 to 20 years, increasing the level of annual maintenance funding, taking on major maintenance projects utilizing debt financing, and engaging in a multi-year program to address maintenance needs in residential facilities. Although the differential in maintenance spending is somewhat offset by SUNY funding of facilities maintenance through its capital plan, in 2003-04, maintenance expenditures per square foot were approximately 70 percent higher in Cornell-owned versus state-owned facilities. Custodial costs follow a similar pattern, with inflation-adjusted costs rising faster than the growth in space, while custodial expenditures in state-owned buildings are flat or even decreasing over time in inflation-adjusted terms.

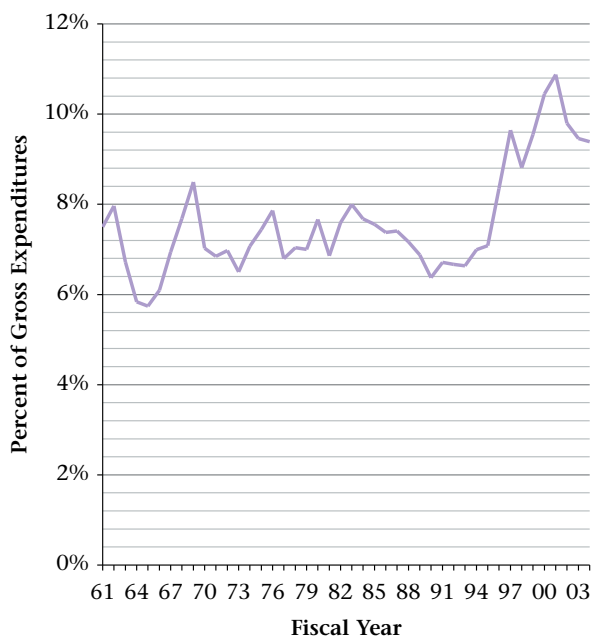
Utilities costs are less controllable, and can fluctuate significantly due to weather and commodity price variations. Utilities costs for both Cornell-owned and state-owned facilities have grown more slowly over time than would be expected based on space growth, due to energy conservation measures. While utilities costs for Cornell-owned versus state-owned facilities generally track together, on a square footage basis, the costs for state-owned facilities are significantly higher. The principal reason for the difference is the fact that

Change in the Type of Physical Space Ithaca Campus

(percent of net assignable square feet)



Operating and Maintenance Costs for Physical Space as a Percent of Total Expenditures – Ithaca Campus



Cornell-owned space includes a higher proportion of lower-usage facilities, such as residences, community centers, and non-laboratory academic spaces, compared to the higher-usage research spaces that are proportionately more present in the state-owned facilities. Also, Cornell-owned facilities have benefited more from energy conservation measures that have not been undertaken as actively in state-owned facilities.

With operating and maintenance costs growing in recent years at rates greater than that of Cornell's revenues in general or other expense categories, new funding sources and cost savings in other areas have been needed to maintain the university's overall financial equilibrium. Since the size of the student body and revenues from sponsored research, government support, and enterprise sources have been growing relatively more slowly than operating and maintenance costs, those rising costs have put pressure on revenue generation from tuition, fundraising, and investments. The recent growth in the proportionate costs of operations and maintenance is not due to a significant change in the mix of types of space. (See graph above.) Other than a moderate increase in the category of *office/study* space, offset by a corresponding decrease in space classified as *special/general use*, the

shares of various space types have stayed relatively the same over the last ten years.

Given the trends in space growth and the increased cost of operating and maintaining the university's buildings, the five-year capital plan shown in this document includes a number of new buildings and substantial renovations of existing space that will drive additional demands on the university's operating and maintenance budgets. Major projects include:

- the full operational impact of Duffield Hall;
- five new houses and a community/recreation center as part of the West Campus Residential Initiative;
- the new Life Sciences Technology Building;
- a physical sciences facility;
- the East Campus Research Facility;
- the new Milstein Hall;
- replacement of the north wing of Martha Van Rensselaer Hall;
- additions to the Library Storage Facility, the Johnson Museum, Schoellkopf Hall, and Lynah Rink;
- renovations to Mann Library and Bailey Hall; and
- the potential construction of parking garages at Milstein Hall and Martha Van Rensselaer Hall.

The capital plan includes an estimated additional 1.232 million gross square feet for the Ithaca campus with an operating and maintenance impact of \$14.3 million annually at the end of the five-year period.

CONCLUSION

The university's history of growth in the size of the physical plant and improvements in the quality of that space coupled with evidence that the cost of operating and maintaining campus facilities is likely to increase irrespective of that growth suggest that Cornell must continue its vigilant attention to the space planning process and controls that are already in place. Throughout much of the 1990's, cost savings were achieved via a modest reduction in the size of the faculty and staff workforces, which allowed for increased physical-plant expenditures. Looking to the future, the university will need to seek additional funding sources, including endowments for operating and maintenance costs, as well as controlling costs in order to sustain the planned growth in physical space.

In light of the projections of significant new facilities being created on campus in the next five to ten years, additional measures may be required in order to ensure balance and sustainability in Cornell's physical plant. To that end:

- space utilization studies are being used to ensure that existing facilities are being used most effectively, potentially reducing the need for the creation of new facilities;
- continued attention to the maintenance needs of facilities will allow them to function optimally and avoid the need for costly major rehabilitations or replacements;
- analyses of initial versus life-cycle costs have been an important part of the design of new buildings;
- coordination of the planning for construction and ongoing operating and maintenance costs for facilities with planning of revenues and other expenses remains a crucial step in the planning process; and
- the coming comprehensive master planning effort—examining the priorities, structure, constraints, interrelationships, and criteria for change of the university's campus—will provide a solid basis for addressing the university's facilities needs.

The first expenditure made by Cornell University (authorized at the third meeting of the Board of Trustees, held on March 14, 1866) was \$500 for building plans. President White, in his autobiography, counseled future generations of Cornellians on the need to plan carefully for the university's physical plant.

At the opening of Cornell, as I have already said, a general plan was determined upon, with an upper quadrangle of stone, plain but dignified, to be at some future time architecturally enriched, and with a freer treatment of buildings on other parts of the grounds; but there is always danger, and I trust that I may be allowed to remind my associates and successors in the board of trustees, of the necessity, in the future development of the university, for a satisfactory plan, suitable to the site, to be steadily kept in mind.[¶]

Cornell's trustees continue to provide direct and valuable advice and guidance as the institution refines its planning processes that are designed to result in a physical plant that is both beautiful and meets the institution's programmatic needs and yet remains affordable.

¶ White, Andrew D., *Autobiography of Andrew Dickson White*, New York, NY: The Century Co., 1905.