# *Facilities & Infrastructure Report 2007*

**Vice President for Finance & Operations**
**January 19, 2007**

MICHIGAN STATE UNIVERSITY

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## Executive Summary

Michigan State University is a public institution located in East Lansing, Michigan. The main campus is 5,200 acres which includes 566 buildings (85 with instructional space) and 18 miles of roads. The University supports over 45,000 students and 10,500 employees.

The Office of the Vice President for Finance and Operations and its units are charged with constructing, maintaining and securing facilities and infrastructure to support the teaching, research, and outreach missions of the University. The succeeding report details the current status of the facilities and infrastructure, as well as some of the challenges facing MSU in the future.

This report on MSU facilities and infrastructure is the first in a series of annual reports to the Board of Trustees. In the preparation of the report, administrative units were asked to be self critical in analyzing problems, performance, and emerging issues in their respective areas. No attempt was made to prioritize issues across the reports. This task is left to the University administration.

Over the last 10 years, MSU has made substantial progress toward improving the operations and infrastructure of the University. New approaches to planning have helped improve the coordination of construction and maintenance projects. The Just-in-Time approach where industry life cycles, practical MSU experience and access to bonded debt are used to address maintenance needs have helped the University eliminate over $250 million dollars of maintenance backlog and better predict future needs. Additionally, in the MSU tradition of partnership and collaboration, engineers, planners, faculty and graduate students have changed MSU construction standards and practices to be more efficient and minimize costly planning, scheduling and implementation changes.

Furthermore, the University has focused on incorporating environmental sustainability in its everyday practice. Construction standards have been changed to be consistent with Leadership in Energy and Environmental Design (LEED) standards. In addition, alternative energy sources are being tested to address the growing demand for energy as new buildings are constructed and technology needs increase.

MSU is not without its challenges in these areas. On-time construction completion is still an issue. Steps are being taken to improve construction planning and communication so that MSU architects and engineers, suppliers and MSU units can work together more efficiently. The implementation of FAMIS (Facilities Asset Management Information System) software has also helped the University target potential areas for improvement.

With over 55,000 students and employees on campus, transportation and safety are always important considerations. For the scope of this report, transportation includes the Capital Area Transportation Authority (CATA) bus system that services Michigan State University, parking, and general roadway safety. Additional campus safety considerations include building security and facility safety devices.

Since Michigan State University changed from servicing its own bus routes to outsourcing campus routes to CATA in 1999, ridership has increased from 829,420 to 3,196,161. Students and employees have benefited from the connection of on and off campus routes.

Parking at MSU as with most university campuses has been a challenge. Although certain campus districts have ample parking, others have a parking deficit. Additional parking structures, improvements to existing structures and the improvement of transportation from perimeter parking areas to campus have helped alleviate parking issues north of Red Cedar River. Parking within the Central Academic district is still insufficient to meet the demand.

Over the last 20 years traffic and pedestrian congestion increased dramatically. As a consequence the number of major and minor accidents also increased significantly. The University implemented a number of changes pedestrian and traffic safety, including the redesign of problematic intersections, increased law enforcement, and a public relations campaign targeted at pedestrian safety. As a result, campus accidents have been reduced by 62% and injuries have been reduced by 83% since 1995.

Safety issues have also been addressed within buildings to protect people and research. The University shifted from a key-based security system to a card access system. At present the exterior doors on 58 buildings have been fitted with security card access. Interior security for sensitive areas has also been improved by fitting doors with card access. The University has also increased the number of full sprinkler systems buildings to 26 and full smoke detection to 37. In addition all of the electronic fire alarm systems in buildings across campus now report to a single location.

MSU has also been aggressive in attaining regulatory compliance on many health and human safety issues. The University has maintained detailed asbestos surveys and has been quick to address air quality complaints. Of the 58 air quality complaints in 2006 only 3 required immediate action.

Over the last 10 years the acreage available for the disposal (spreading) of animal waste has decreased significantly. This has created a nutrient management problem on the remaining acreage which must be addressed. If left unattended environmental problems with soil nutrients will develop or livestock-based research must be limited. Several options are being evaluated to address the issue such as increased export of nutrients, nutrient separation technologies, the development of an integrated manure treatment system (anaerobic digester), acquiring additional land, reducing animal numbers, and transferring plant research acreage to general production to increase acreage for manure disposal.

Undoubtedly one can identify any number of specific programmatic shortcomings regarding MSU facilities and infrastructure. Because of the size and complexity of the university this will probably always be the case. MSU, has, however, invested significant time, intellect, and resources in updating and adapting its infrastructure to meet the changing needs of its teaching, research, and outreach programs. Substantial thought has been given to the security of its faculty, staff, and students resulting in significant improvements health and human safety.

F.L. Poston
Vice President
Finance and Operations

# Chapter 1
# Just-in-Time

## Summary

Prior to 2002, the Physical Plant addressed infrastructure maintenance in the way most common for universities. A list of needed projects was prepared for maintenance or replacement of infrastructure components based on industry standard life cycles. Available funding was applied to the most urgent items, and whatever was not funded was placed on a list of "deferred maintenance" projects. Because funding was never adequate to address all projects, this led to an ever-growing list. Although the list of deferred projects was precise, one drawback of using industry life cycles rather than actual field conditions to determine repair schedules was that it was not possible to accurately predict, over a decade, what portions of the infrastructure would truly fail.

Recognizing that the very large number of buildings built during the 1950's and 1960's were approaching 40 to 50 years of age, it was obvious MSU would have serious difficulty keeping up with the repair and replacement of major infrastructure components such as roofs, elevators, heating, ventilating and air conditioning (HVAC) systems, roads, etc. across the campus if it did not modify its approach. In response to this concern, an assessment of the actual campus infrastructure condition was made. It was determined that there was a backlog of approximately $260 million in necessary maintenance projects. A new approach was needed to address the problem or the figure would continue to rise and eventually building system failures would occur. A plan was developed and initiated in fiscal year 2002.

The new approach, an evaluation process known as Just-In-Time (JIT), requires a comprehensive review of all building components to determine their condition and estimated failure date. The industry-predicted life cycle of building components is used as the early determination point for potential replacement. Then MSU's actual experiences with component life cycles, plus field observations, are used to adjust the industry life cycle. For example, if the system life expectancy is 25 years, but MSU has normally been able to extract 30 years, the life cycle is adjusted accordingly. Field observations during preventive maintenance and testing of component condition are also used to make life-cycle predictions more precise. The information is collected in a database and used to predict annual maintenance and replacement costs for the forthcoming decade. MSU has a history of obtaining longer life from building components than almost any other institution.

The accuracy of our data and the ability to predict when critical infrastructure needs must be addressed enabled us to plan for the annual revenue necessary to cover the cost of the identified projects. An additional benefit of the accuracy of our predictive capabilities is that we have been able to coordinate repair and maintenance projects so that the campus is not disrupted at the same location for multiple successive years. We have also been able to better coordinate our access to bonded debt.

As a result of the new approach, Michigan State University is a leader among other large universities in addressing and maintaining its infrastructure. The $260 million backlog of maintenance projects has been reduced to $6 million in 5 years and maintenance issues are being addressed in a systematic and timely manner.

## Analysis

*Progress Analysis*

As a result of the JIT initiative, significant progress has occurred since fiscal year 2002. Substantially more infrastructure maintenance projects are able to be addressed today than when the process started. Five years ago, funding was received to address only 43 projects in the JIT category. In fiscal year 2007, 170 projects have been funded and are underway. In addition, nearly every building on MSU's campus has been impacted by Just-In-Time, resulting in a more reliable infrastructure system to support the operation of the university.

Figure 1 shows the amount of funding spent on JIT over the past five fiscal years (FY02-FY06) separated into two sections: General Fund supported buildings and Housing and Food Services (HFS) facilities.

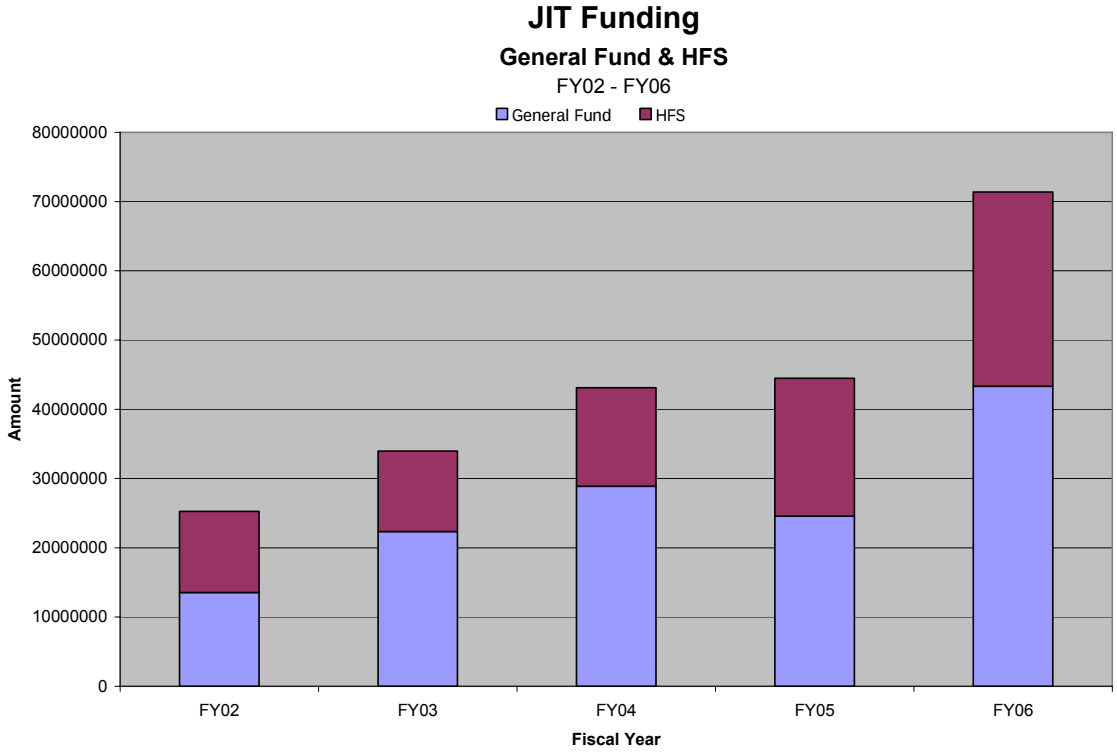



**Figure 1.** *JIT Funding for General Fund and Housing and Food Service*

*General Fund*

There are four categories that comprise the JIT needs for the general fund. They include buildings, utility distribution, power and water, and roads. Each category contains its own set of sub-components. An explanation of these components can be found in Table 1.

**Table 1.** *JIT General Fund Categories*

| JIT GENERAL FUNDING CATEGORIES | |
|---|---|
| **Buildings** | |
| E | Envelope (roofing, exterior masonry, doors) |
| I | Interior Finishes (ceilings, walls, floors) |
| S | Systems (mechanical, electrical, elevators) |
| **Utility Distribution** | |
| ST | Steam |
| ED | Electrical |
| C | Communication |
| WA | Water |
| SEW | Sanitary & Storm Sewers |
| **Roads** | |
| R | Reconstruction |
| M | Mill & Cap |
| **Power & Water** | |
| P | Power Plant |
| W | Wells |

Since fiscal year 2002, a total of $182,042,481 has been funded for general fund JIT projects. The breakdown of funding by category and funding by category as a percentage of the total amount funded can be found in Table 2 and Table 3.

**Table 2**. *General Fund Just-in-Time Funding Analysis by Category*

## General Fund Just-in-Time Funding Analysis by Category

**Funded JIT for FY02 to FY07**

| JIT Category | FY02 | FY03 | FY04 | FY05 | FY06 | FY07 | Total |
|---|---|---|---|---|---|---|---|
| Buildings | | | | | | | |
| Envelope | $937,000 | $2,450,260 | $4,298,000 | $4,086,474 | $2,935,160 | $11,398,300 | **$26,105,194** |
| Interior Finishes | $0 | $237,000 | $197,000 | $20,000 | $10,000 | $1,326,000 | **$1,790,000** |
| Systems | $2,109,000 | $2,199,000 | $12,739,860 | $2,559,000 | $21,283,306 | $9,887,000 | **$50,777,166** |
| | ***$3,046,000*** | ***$4,886,260*** | ***$17,234,860*** | ***$6,665,474*** | ***$24,228,466*** | ***$22,611,300*** | ***$78,672,360*** |
| Utility Distribution | | | | | | | |
| Steam | $3,209,000 | $1,150,000 | $7,855,102 | $10,080,000 | $9,105,000 | $6,445,000 | **$37,844,102** |
| Electrical | $270,000 | $13,275,000 | $785,822 | $3,902,000 | $571,276 | $290,000 | **$19,094,098** |
| Communication | $0 | $0 | $0 | $0 | $0 | $2,405,000 | **$2,405,000** |
| Water | $0 | $0 | $0 | $755,000 | $665,000 | $1,861,000 | **$3,281,000** |
| San & Storm Sewers | $0 | $0 | $0 | $0 | $0 | $219,789 | **$219,789** |
| | ***$3,479,000*** | ***$14,425,000*** | ***$8,640,924*** | ***$14,737,000*** | ***$10,341,276*** | ***$11,220,789*** | ***$62,843,989*** |
| Roads | | | | | | | |
| Reconstruction | $0 | $0 | $0 | $0 | $4,789,544 | $13,107,000 | **$17,896,544** |
| Mill & Cap | $0 | $0 | $0 | $0 | $33,686 | $0 | **$33,686** |
| | ***$0*** | ***$0*** | ***$0*** | ***$0*** | ***$4,823,230*** | ***$13,107,000*** | ***$17,930,230*** |
| Power & Water | | | | | | | |
| Turbines, Boilers, Baghouses | $6,856,146 | $2,875,000 | $2,904,000 | $2,510,000 | $3,747,960 | $2,282,000 | **$21,175,106** |
| Wells | $150,000 | $150,000 | $100,000 | $650,000 | $170,796 | $200,000 | **$1,420,796** |
| | ***$7,006,146*** | ***$3,025,000*** | ***$3,004,000*** | ***$3,160,000*** | ***$3,918,756*** | ***$2,482,000*** | ***$22,595,902*** |
| Totals | $13,531,146 | $22,336,260 | $28,879,784 | $24,562,474 | $43,311,728 | $49,421,089 | $182,042,481 |

**Table 3**. *General Fund JIT Funding Categories by Percentage*

## General Fund Just-in-Time Funding Categories by Percentages

**Funded JIT for FY02 to FY07**

| JIT Category | Total | Percentage of the total | Object Class total | Percentage of Category Total |
|---|---|---|---|---|
| | | | | Of the total for each category, the following % was spent on the object class: |
| **Buildings** | | | | |
| Envelope | | | $26,105,194 | 33% |
| Interior Finishes | | | $1,790,000 | 2% |
| Systems | | | $50,777,166 | 65% |
| **Total** | **$78,672,360** | 43% | | |
| **Utility Distribution** | | | | |
| Steam | | | $37,844,102 | 60% |
| Electrical | | | $19,094,098 | 30% |
| Communication | | | $2,405,000 | 4% |
| Water | | | $3,281,000 | 5% |
| San & Storm Sewers | | | $219,789 | 0% |
| **Total** | $62,843,989 | 35% | | |
| **Roads** | | | | |
| Reconstruction | | | $17,896,544 | 100% |
| Mill & Cap | | | $33,686 | 0% |
| **Total** | $17,930,230 | 10% | | |
| **Power & Water** | | | | |
| Baghouses | | | $21,175,106 | 94% |
| Wells | | | $1,420,796 | 6% |
| **Total** | $22,595,902 | 12% | | |
| General Fund Totals | $182,042,481 | | | |

As with buildings and utilities, the condition of the campus road system has been evaluated and maintenance needs have been prioritized. A pavement rating system developed by Pavement Management Systems, Inc. (PMSI) was used to develop the JIT priorities for roads. Examples of roads with PMSI ratings are available in Appendix A. Figure 2 shows road segments that have had JIT work done to date and which road segments still have JIT needs.

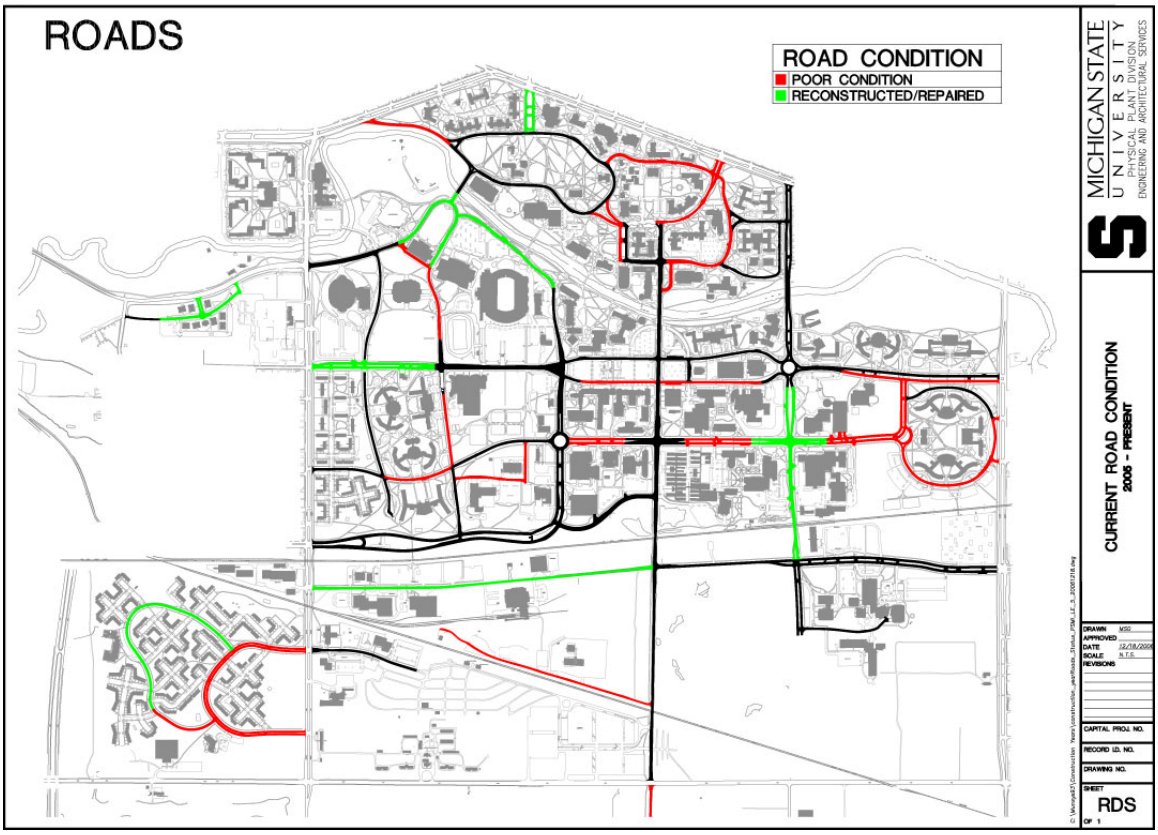



**Figure 2**. *Road Conditions Map* Based on PMSI ratings.

The original campus roads were constructed inexpensively for light duty traffic. As the campus grew, and traffic volumes significantly increased, the pavement design was no longer adequate for the demands being placed upon it. This has led to deterioration and, in some cases, failure of the roads. Where road improvements are being implemented, the new design provides for an appropriate granular base supporting the road pavement. By properly designing the base for the traffic loads, future maintenance costs (see Table 4) will be greatly reduced because only the surface asphalt layer will need to be milled off and replaced in order to recondition the road. The more expensive base should remain in place without deterioration.

**Table 4.** *Projected Road Reconstruction and Mill and Cap Cost for the Next 10 Years*

| JIT Roads Components | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Fiscal Year ---> | FY07 | FY08 | FY09 | FY10 | FY11 | FY12 | FY13 | FY14 | FY15 | FY16 | Category Totals |
| Reconstruction | $12,975,930 | $3,821,400 | $5,643,000 | $7,474,500 | $9,504,000 | $2,227,500 | $1,336,500 | $766,978 | $317,007 | $2,260,107 | $46,326,921 |
| Mill & Cap | $131,070 | $38,600 | $57,000 | $75,500 | $96,000 | $22,500 | $3,500 | $7,747 | $3,202 | $22,829 | $457,948 |
| Total | $13,107,000 | $3,860,000 | $5,700,000 | $7,550,000 | $9,600,000 | $2,250,000 | $1,340,000 | $774,725 | $320,209 | $2,282,936 | $46,794,870 |

Over the next ten fiscal years, a total of $289 million in JIT needs has been projected for General Fund facilities. Figure 3 shows how much funding is needed for each of the four categories.

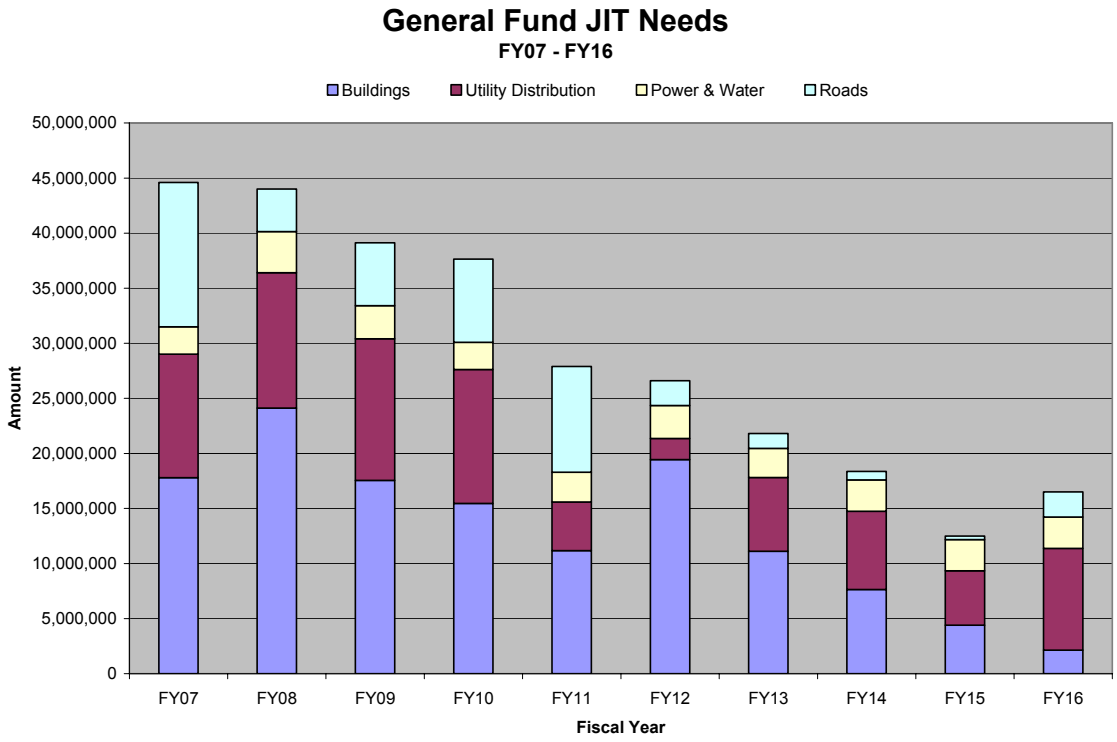



**Figure 3.** *General Fund JIT Needs from Fiscal Year 2007 through Fiscal Year 2016* Includes JIT needs for Buildings, Utility Distribution, Power & Water and Roads

## *JIT Parking*

The next step is using the JIT approach to analyze the maintenance needs of campus parking lots and ramps. Parking lots and parking ramps maintenance is funded through the fees collected through the parking system. Table 5 shows the initial examination of JIT for parking lots and ramps for the next ten fiscal years. A detailed parking lot analysis is being developed.

**Table 5**. *Just-in-Time Funding Needs for Parking Lots and Ramps*

| Just-in-Time Funding Needs for Parking Lots and Parking Ramps - 10 Year Projections | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Fiscal Year ---> | FY07 | FY08 | FY09 | FY10 | FY11 | FY12 | FY13 | FY14 | FY15 | FY16 | Category Totals |
| Parking Lots | $650,000 | $5,030,000 | $5,130,000 | $4,890,000 | $4,830,000 | $4,930,000 | $4,920,000 | $4,980,000 | $4,880,000 | $4,660,000 | $44,900,000 |
| Parking Ramps | $725,000 | $370,000 | $615,000 | $195,000 | $505,000 | $595,000 | $505,000 | $400,000 | $195,000 | $620,000 | $4,725,000 |
| *Parking Totals* | *$1,375,000* | *$5,400,000* | *$5,745,000* | *$5,085,000* | *$5,335,000* | *$5,525,000* | *$5,425,000* | *$5,380,000* | *$5,075,000* | *$5,280,000* | *$49,625,000* |

*Housing and Food Services (HFS)*

Most of the university's housing facilities were constructed in 1950's and 60's. The buildings are now near the 50 year old mark, which is when major building systems need replacement and renovation is required. HFS recently completed a Ten Year Strategic Plan which delineates the scope and sequencing of infrastructure improvements for housing facilities and food service operations. Projected renovations and expenditures are based on this plan.

Table 6 shows the seven categories that make up the JIT needs for HFS. Figure 4 shows a map of all HFS funded buildings on campus.

**Table 6.** *JIT HFS Funding Categories*

| JIT HFS FUNDING CATEGORIES | |
|---|---|
| **Architectural** | Overall structure of the building; walls, floors, and roof, both inside and out, and all the finishes attached to them |
| **Mechanical** | All components that combine to provide comfortable living temperatures, water supply and drainage, and elevator maintenance |
| **Electrical** | All components that combine to provide electrical power to spaces, mechanical equipment, and lighting |
| **Site Work** | Work related to the buildings exterior grounds |
| **Renovation** | A substantial project involving closing the building for the academic year |
| **New** | New construction |
| **FF & E** | Furniture, fixtures, & equipment |

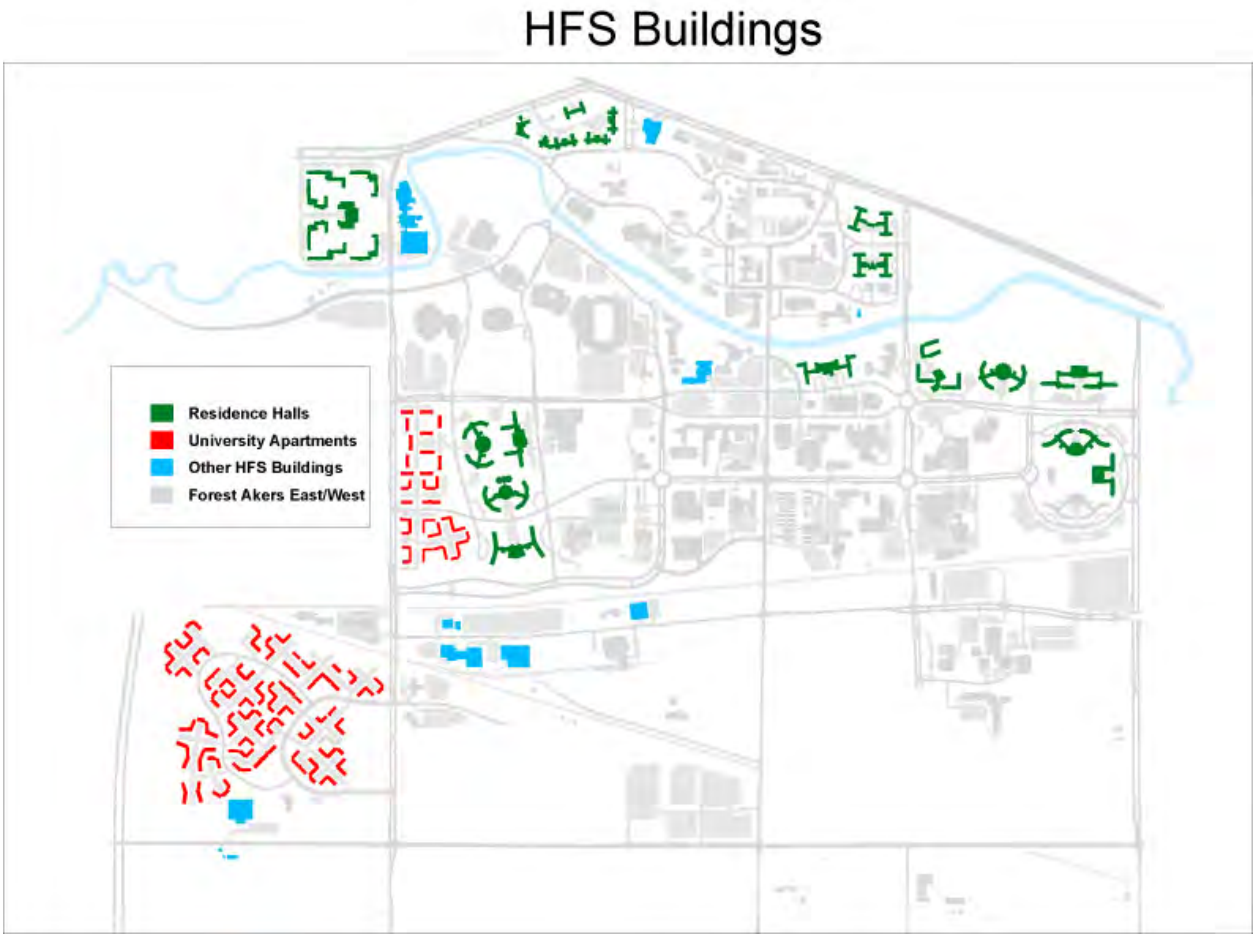



**Figure 4.** *HFS funded JIT buildings on MSU Campus*

Since fiscal year 2002, HFS has spent over $85 million in repairs and renovation, including over $10,000,000 in furniture replacement. Another $17,500,000 has been targeted for future furniture replacement over the next ten years. The breakdown of funding by category and funding as a percentage of the overall HFS JIT total can be found on Table 7. Table 8 and Table 9 show the HFS renovation schedule and refurnishing schedule, respectively.

**Table 7.** *HFS JIT Funding Analysis by Category*

## **HFS Just-in-Time** Funding Analysis by Category

**Funded JIT for FY02 to FY06**

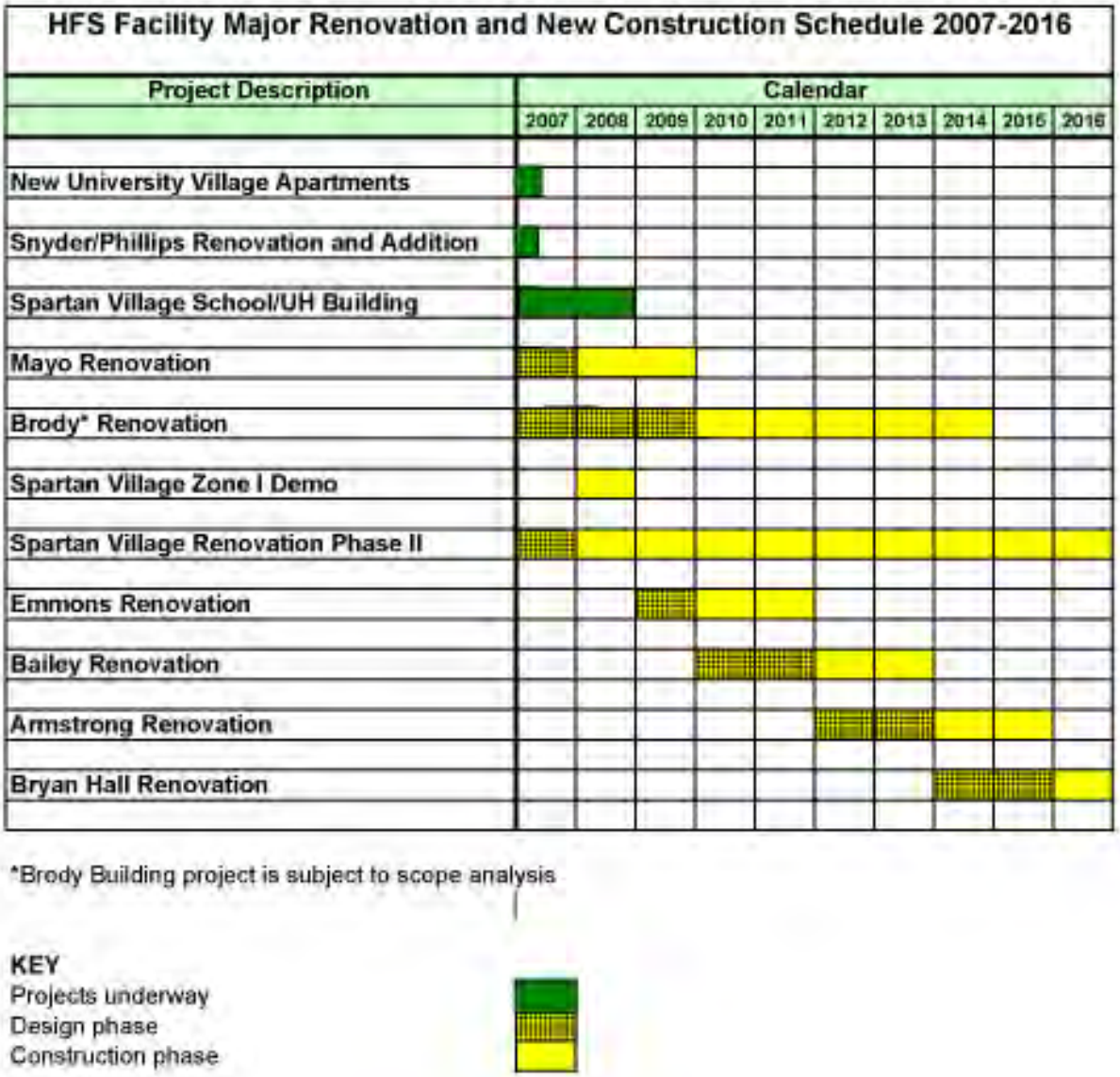
| JIT Category | FY02 | FY03 | FY04 | FY05 | FY06 | Total |
|---|---|---|---|---|---|---|
| **Buildings** | | | | | | |
| Architectural | $3,418,000 | $4,379,000 | $4,278,000 | $3,731,166 | $1,071,300 | **$16,877,466** |
| Electrical | $1,145,000 | $2,299,000 | $1,564,000 | $212,636 | $385,000 | **$5,605,636** |
| FF&E | $2,820,000 | $645,000 | $1,220,000 | $2,788,450 | $6,301,000 | **$13,774,450** |
| Mechanical | $1,061,000 | $2,713,000 | $2,564,000 | $2,549,898 | $654,000 | **$9,541,898** |
| Renovation | $3,000,000 | $1,500,000 | $4,450,000 | $10,500,000 | $19,500,000 | **$38,950,000** |
| Site | $290,000 | $100,000 | $150,000 | $120,850 | $150,000 | **$810,850** |
| **Totals** | **$11,734,000** | **$11,636,000** | **$14,226,000** | **$19,903,000** | **$28,061,300** | **$85,560,300** |

| JIT Category | Category | Percentage of Category Total |
|---|---|---|
| **Housing & Food Services** | | Of the total for each category, the following % was spent on the specific category: |
| Architectural | $16,877,466 | **19%** |
| Electrical | $5,605,636 | **7%** |
| FF&E | $13,774,450 | **16%** |
| Mechanical | $9,541,898 | **11%** |
| Renovation | $38,950,000 | **46%** |
| Site | $810,850 | **1%** |
| **H&FS Total** | **$85,560,300** | |

**Table 8**. *Residence Hall Refurnishing Schedule 2007-2016*

| Residence Halls Refurnishing Schedule 2007-2016 | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Project Description | Last refurnished | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
| Snyder Phillips | 1988 | | | | | | | | | | |
| Wilson | 1992 | | | | | | | | | | |
| Mayo | 1989 | | | | | | | | | | |
| Akers | 1988 | | | | | | | | | | |
| Mason Abbot | 1989 | | | | | | | | | | |
| Emmons | 1994 | | | | | | | | | | |
| Wonders | 1993 | | | | | | | | | | |
| Bailey | 1992 | | | | | | | | | | |
| Campbell | 1995 | | | | | | | | | | |
| McDonel | 1994 | | | | | | | | | | |
| Holden | 1996 | | | | | | | | | | |
| Williams | 1988 | | | | | | | | | | |
| Armstrong | 1987 | | | | | | | | | | |
| Owen | 1990 | | | | | | | | | | |
| Bryan | 1993 | | | | | | | | | | |

**Table 9**. HFS Facility Major Renovation and New Construction Schedule 2007-2016



Over the next ten fiscal years, there is an estimated $281.8 million in JIT needs for HFS. Figure 5 provides a chart that shows the funding need for each of the seven categories.

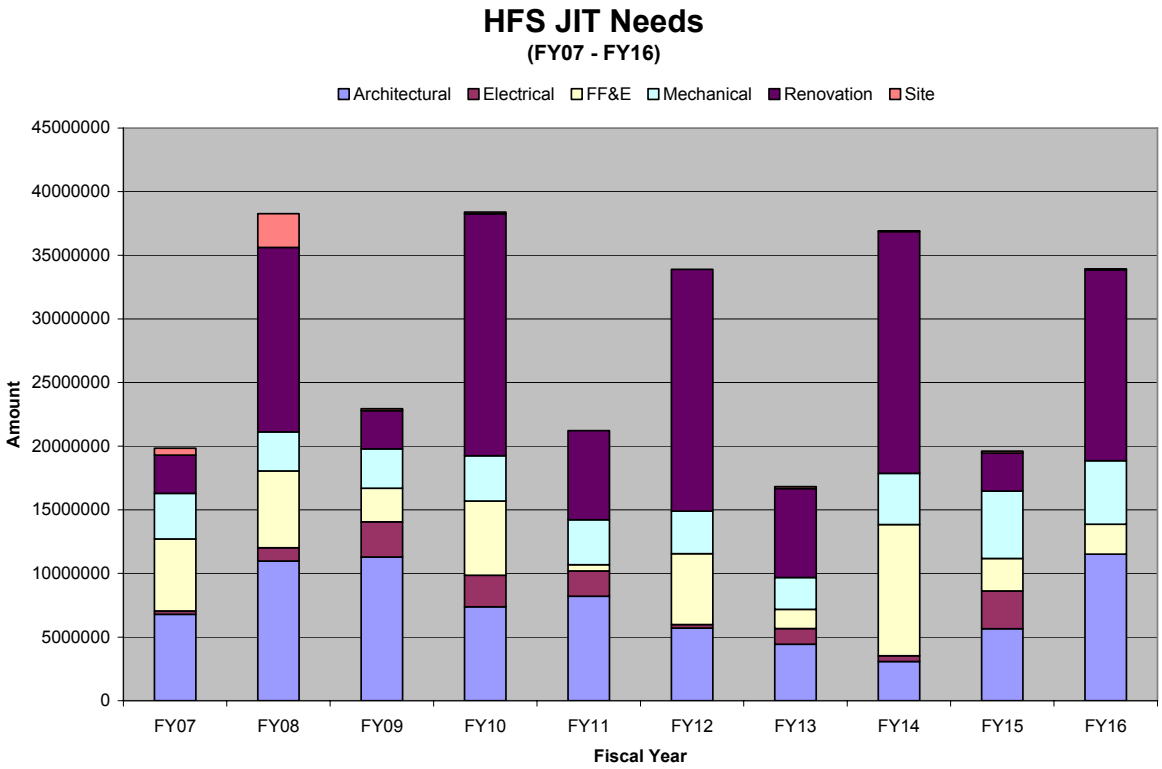



**Figure 5.** *HFS JIT Needs By Category* Includes Architectural, Electrical, FF&E, Mechanical, Renovation and Site needs

## Future Directions

Figure 6 shows the projected JIT needs for general fund buildings and roads, HFS and parking for the next twenty years. Needs for the first five years are determined by a refined analysis from field inspections; the need for the following 5 years are determined by experience-adjusted industry life cycles for infrastructure systems and equipment; and the remaining ten year forecast is determined by the industry life-cycle alone. As a consequence, the prediction for the first 10 year period is more accurate than for the second 10 years. This pattern of examining the actual life of an infrastructure component will continue to become more precise as each fiscal year passes and the quality of the database and field inspections increases.

The chart illustrates that the amount of needed annual expenditures is trending downward. Some of this can be attributed to less precise data for the outlying life cycle years. A more significant factor, however, is that much of the backlogged work is now being addressed. Over the next 5 years, many of the deferred major infrastructure system repair and replacement projects will be completed. For example, most of the campus roads will have been reconstructed, the replacement of direct buried steam lines will have been accomplished, and the campus electrical delivery system conversion from 4,160 volts to 13,200 volts will be complete. These items should not need major attention again for 40 to 50 years.

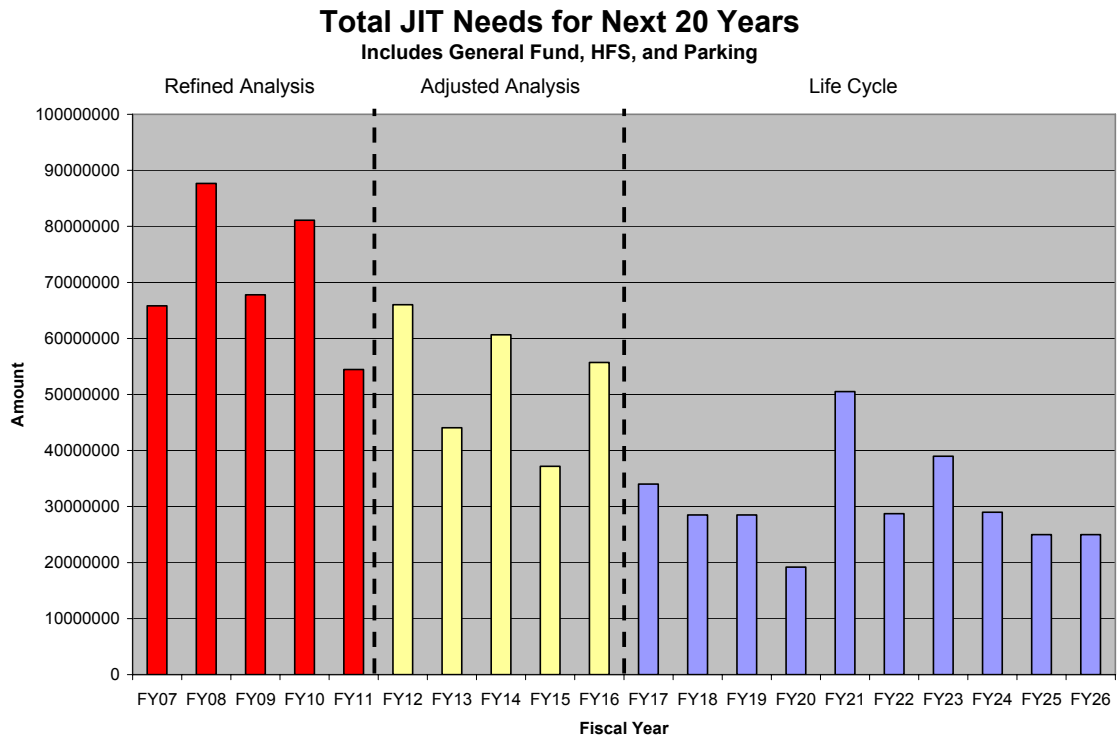



**Figure 6.** *Total JIT Needs for the Next 20 Years* Data includes general fund buildings and roads, HFS buildings and Parking

A more detailed look at the JIT needs for the next ten years is provided in Table 10. General fund costs total $289 million and are trending downward for the reasons stated above. The annual HFS expenditures will vary based on the implementation schedule of the strategic plan and the total for the 10 year period is approximately $282 million.

Parking ramps and parking lots are now included, as this area will utilize the JIT assessment process in determining future maintenance needs and the estimated cost is nearly $50 million.

**Table 10.** *Just-in-Time Projections for the Next 10 Years*

**Total Just-in-Time** 10 year Projections

**Funding Needs**

| Fiscal Year ---> | FY07 | FY08 | FY09 | FY10 | FY11 | FY12 | FY13 | FY14 | FY15 | FY16 | Category Totals |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Buildings | $17,794,000 | $24,117,000 | $17,553,000 | $15,456,000 | $11,173,506 | $19,442,236 | $11,123,933 | $7,636,466 | $4,395,000 | $2,132,410 | **$130,823,551** |
| Utility Distribution | $11,221,000 | $12,298,000 | $12,853,000 | $12,153,000 | $4,414,700 | $1,915,250 | $6,684,525 | $7,103,701 | $4,936,875 | $9,235,001 | **$82,815,052** |
| Power & Water | $2,482,000 | $3,734,000 | $3,010,000 | $2,481,000 | $2,700,000 | $2,988,640 | $2,650,000 | $2,850,000 | $2,850,000 | $2,850,000 | **$28,595,640** |
| Roads | $13,107,000 | $3,860,000 | $5,700,000 | $7,550,000 | $9,600,000 | $2,250,000 | $1,350,000 | $774,725 | $320,209 | $2,282,936 | **$46,794,870** |
| *General Fund Sub-totals* | ***$44,604,000*** | ***$44,009,000*** | ***$39,116,000*** | ***$37,640,000*** | ***$27,888,206*** | ***$26,596,126*** | ***$21,808,458*** | ***$18,364,892*** | ***$12,502,084*** | ***$16,500,347*** | ***$289,029,113*** |
| HFS | **$19,836,910** | **$38,268,706** | **$22,937,740** | **$38,391,131** | **$21,221,948** | **$33,891,799** | **$16,826,996** | **$36,914,142** | **$19,615,529** | **$33,927,063** | $281,831,964 |
| *HFS Sub-totals* | ***$19,836,910*** | ***$38,268,706*** | ***$22,937,740*** | ***$38,391,131*** | ***$21,221,948*** | ***$33,891,799*** | ***$16,826,996*** | ***$36,914,142*** | ***$19,615,529*** | ***$33,927,063*** | $281,831,964 |
| Parking Lots | $650,000 | $5,030,000 | $5,130,000 | $4,890,000 | $4,830,000 | $4,930,000 | $4,920,000 | $4,980,000 | $4,880,000 | $4,660,000 | **$44,900,000** |
| Parking Ramps | $725,000 | $370,000 | $615,000 | $195,000 | $505,000 | $595,000 | $505,000 | $400,000 | $195,000 | $620,000 | **$4,725,000** |
| *Parking Sub-totals* | ***$1,375,000*** | ***$5,400,000*** | ***$5,745,000*** | ***$5,085,000*** | ***$5,335,000*** | ***$5,525,000*** | ***$5,425,000*** | ***$5,380,000*** | ***$5,075,000*** | ***$5,280,000*** | ***$49,625,000*** |
| Overall JIT Totals by FY | **$65,815,910** | **$87,677,706** | **$67,798,740** | **$81,116,131** | **$54,445,154** | **$66,012,925** | **$44,060,454** | **$60,659,034** | **$37,192,613** | **$55,707,410** | ***$620,486,077*** |

Much of HFS JIT needs are based on marketability as well as infrastructure needs. HFS will continue an aggressive renovation schedule. Renovation includes major upgrades to building systems, life safety improvements and accessibility. Scheduled renovation projects include Mayo, Brody, Emmons, Bailey, Armstrong and Bryan Halls. The HFS projected JIT need also includes funding to renovate sixty apartment buildings in Spartan Village. The plans are flexible so that revisions will be easily assimilated as situations dictate.

The HFS renovation projects form the core of the comprehensive facilities plan as outlined in the *2006 HFS Strategic Plan* and will keep the facilities at the level that the customer base expects and demands. Achieving this vision will require targeted emphasis in several primary areas. Revenue increases, along with expenditure control within the various sources of funds, and redirection of existing resources will be used to leverage opportunities and accomplish identified goals.

# Chapter 2
# Construction

## Summary

The University has had a significant increase in design and construction in the past three years. The University uses the Facilities Asset Management Information System (FAMIS) software to track design, construction projects, and improve performance. We continue to try to improve the performance on change orders, particularly those related to design and timely completion of projects. We have responded with several actions, including dedicating staff to design review, establishing new scheduling requirements, performance feedback to designers and contractors, and continued collaboration and evaluation with the School of Planning Design and Construction.

Michigan State University has also been improving construction standards to move toward more environmentally-friendly approaches for construction and renovation projects. Engineering and Architectural Services (EAS) partnered with the Construction Management program to evaluate the existing MSU Construction Standards with regard to Leadership in Energy and Environmental Design (LEED) and the United States Green Building Council (USBC) rating system. The team evaluated the new construction and major renovation credits as to their applicability to Michigan State University and made recommendations for changes to the MSU Construction Standards to reach LEED Silver Level Although many other universities are integrating LEED into their standards, MSU's inclusive and comprehensive approach involving students, faculty, and operations staff is unique and demonstrates our commitment to environmental stewardship and a collaborative approach.

## Analysis

*FAMIS*

Since September 2003, the University has used the Facilities Asset Management Information System (FAMIS) to track design and construction projects. The FAMIS Capital Projects module was implemented to provide timely and accurate project information, report on our project performance in the aggregate, analyze our strengths and weaknesses, and improve processes. Since implementation, MSU has steadily improved the timeliness of projects, providing the ability to make more informed and better decisions. Project managers and customers can now access real time budget information updated daily. It is also considerably easier to compile project information at completion.

The FAMIS annual report to the Board of Trustees on completed projects is published annually in January (See Appendix B for 2007 Annual Report). Quarterly reports for active projects will be reported to the Board of Trustees in January, April, July and September.

Figure 1 provides a budget summary of the closed projects for fiscal year 2006.

## Budget Summary of Closed Projects for FY 2006

| Budget | | | |
|---|---|---|---|
| Authorized Budget: | $9,536,000 | | |
| Final Cost: | $8,696,811 | | |
| Returned: | $839,189 | Budgeted Contingency: | $1,443,238 |

| Change Orders | | % of Contract | % Contingency |
|---|---|---|---|
| Contract: | $6,972,678 | | |
| Scope: | $7,857 | 0.1% | 0.5% |
| Document: | $102,891 | 1.5% | 7.1% |
| Field: | $287,745 | 4.1% | 19.9% |
| **Total:** | $398,493 | 5.7% | 27.6% |

**Figure 1.** *Budget Summary of Board Approved Closed Capital Projects for FY 2006.* The above figure shows the value of 26 projects closed in fiscal year 2006. Since FAMIS Capital Projects module was recently implemented for MSU, projects closed in the fiscal year ending June 30, 2006 are smaller in size and complexity.

### *Construction and Design Volume*

In the past four years, payments for design and construction have increased significantly (See Figure 2 and Figure 3). Design increases lead construction by approximately one year. This increase is driven by both programmatic requirements and investment in the Just-In-Time infrastructure requirements.

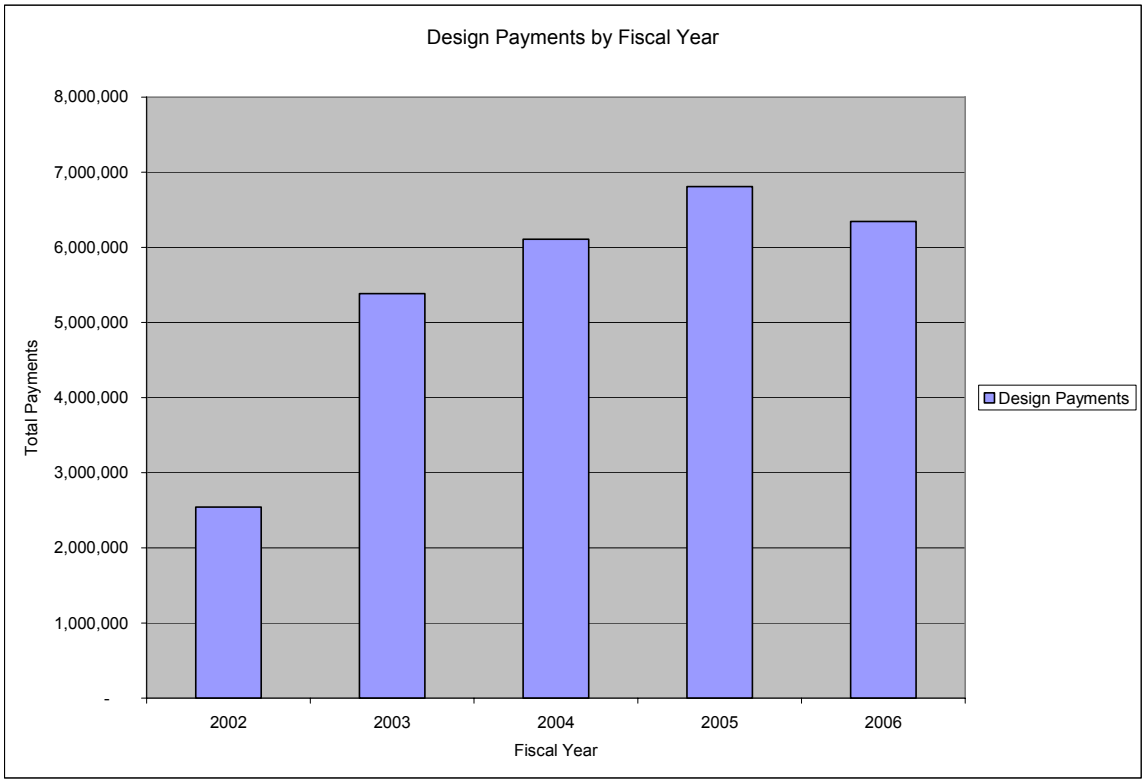



**Figure 2.** *Design Payments by Fiscal Year.* The above figure shows the payments made to professional consultants for design work by fiscal year. 2005 includes $500,000 in fees for cancelled Brody project. 2006 does not include $400,000 in design fees for University Village, which is a Design-Build project.

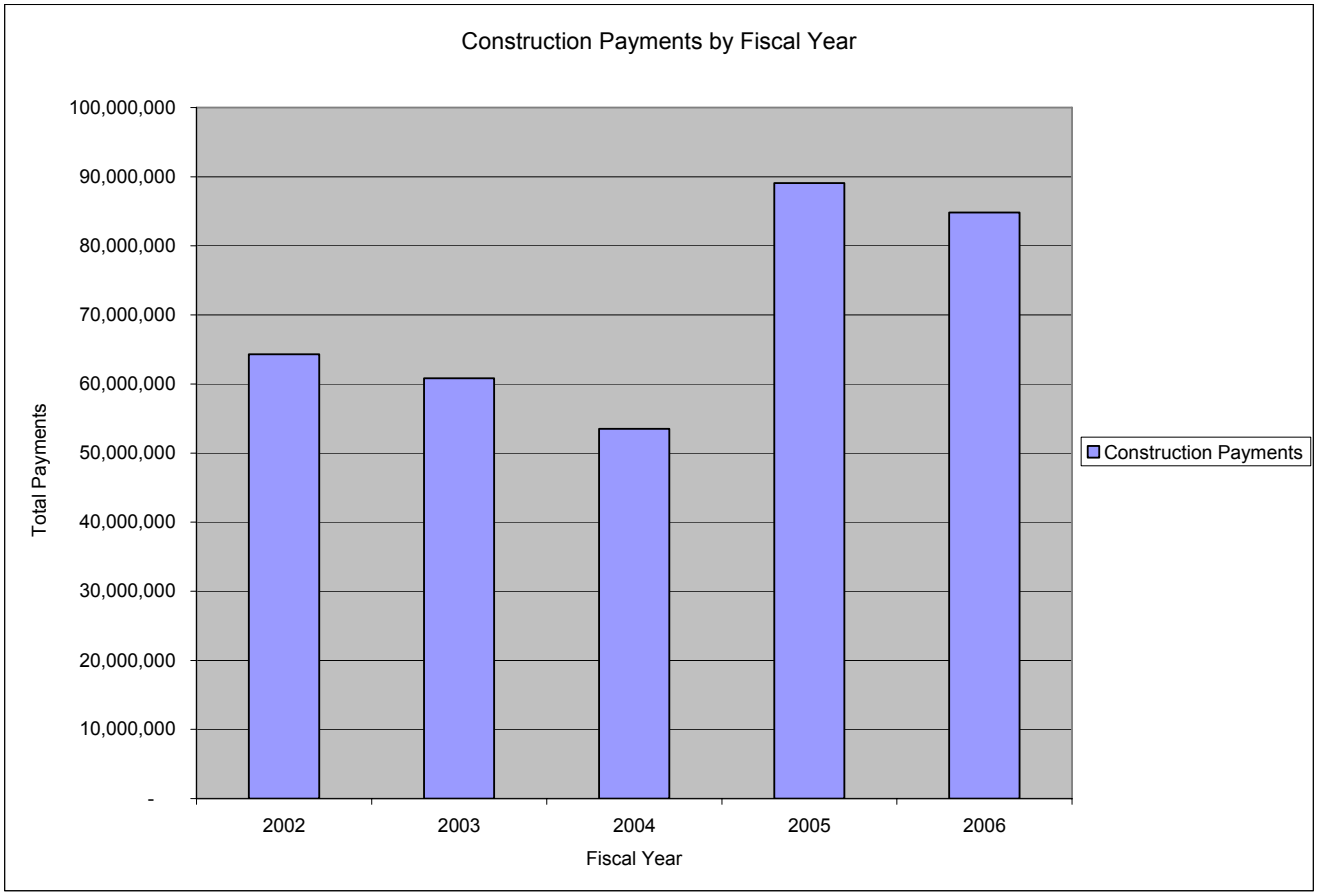



**Figure 3.** *Construction Payments by Fiscal Year.* The above figure shows the payments made for construction work by fiscal year.

### *Construction Change Orders*

Campus Planning & Administration (CPA) and Engineering & Architectural Services (EAS) use aggregate data to review processes and make improvements. One of the earliest focus areas was construction change orders. Change orders are a reality in the construction process for a number of reasons including differing field conditions (e.g. bad soils, concealed asbestos); document discrepancies where the work specified either can not be built or does not meet the intent of the project; and scope changes for additional work which was originally planned.

Though sometimes necessary, changes can lead to delays in construction and disputes with contractors. Often these disputes are not from a single change, but numerous small changes. This can lead to a contractor claiming that the volume of minor changes delayed the project or impacted their productivity, in turn leading to a demand for substantial additional compensation. These concerns prompted MSU to track change order rates measured by change orders divided by construction payments. See Figure 4.

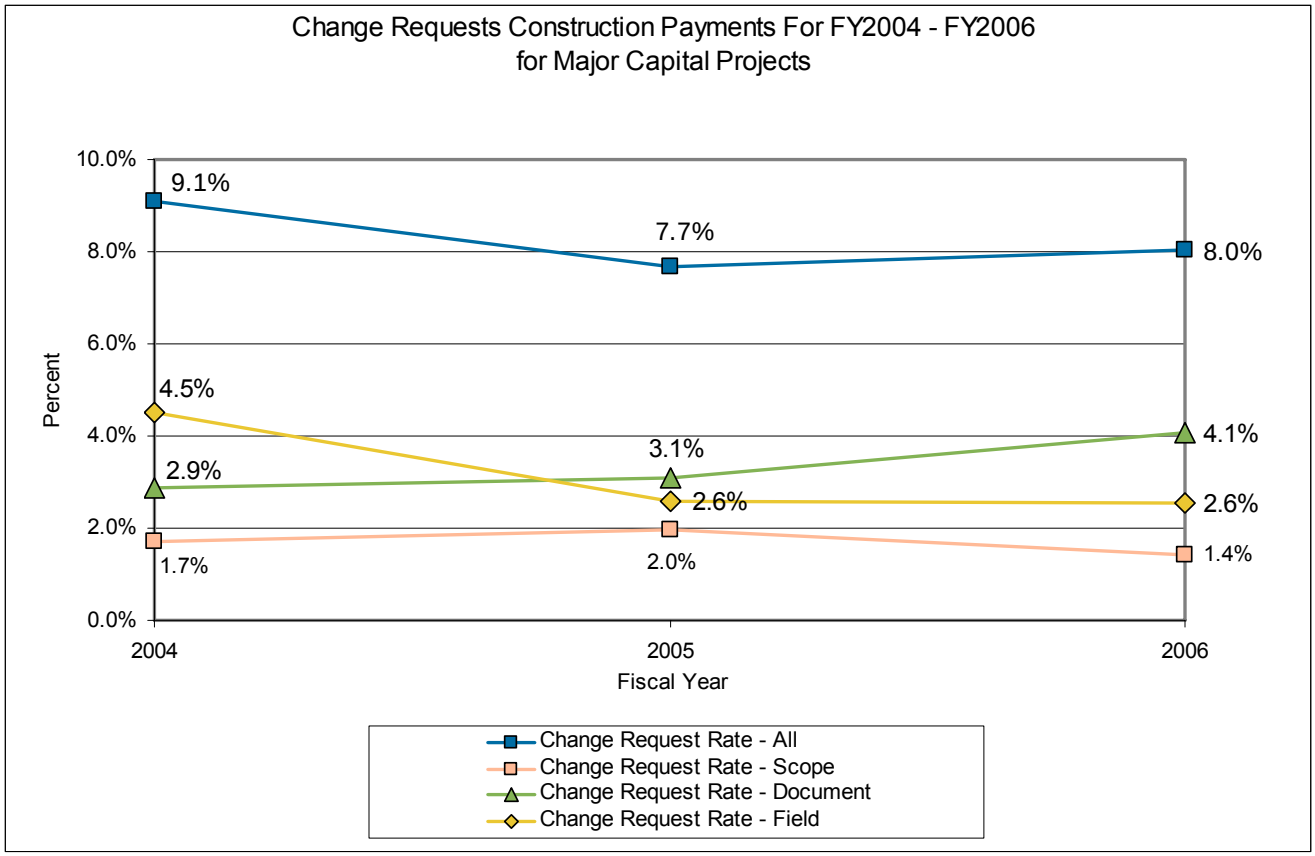



**Figure 4**. *Change Requests as a Percentage of Construction Payments.* The change request rate is calculated by the value of change requests created in a year divided by the amount of construction payments made in that year.

Scope change, which is the most easily controlled source, is discouraged. Initial efforts to work with units on project planning has led to overall changes dropping significantly in 2005, and scope changes decreasing in 2006. The document change rate has steadily climbed over the last two years to 4.1%; however they remain within a reasonable level based on an analysis of change order practice by the School of Planning, Design and Construction. It may be the result of squeezing the balloon, substituting document errors for scope changes. However, it may also be a result of increased project work and limited resources. The increase in design changes trails the increase in design payments. Physical Plant Engineering and Architectural Services staff did not increase the number of design professionals or construction representatives as the number of projects increased. Thus, EAS professionals had to manage more projects with fewer resources. This may have led to an increase in document changes.

In response to these and other challenges, EAS has added three designers. They have also added two additional construction representatives. While Physical Plant Building Services had provided design review in the past, this was in addition to their primary operations and maintenance responsibilities and with the number of projects increasing could no longer keep up with the reviews. Perhaps most importantly, Physical Plant has reassigned five skilled tradespeople to EAS, with responsibility for technical inspection in the field and design review before projects are bid. The early results are promising. The initial design reviews have lead to requests for more than 40 changes to MSU construction standards. See Figure 5.

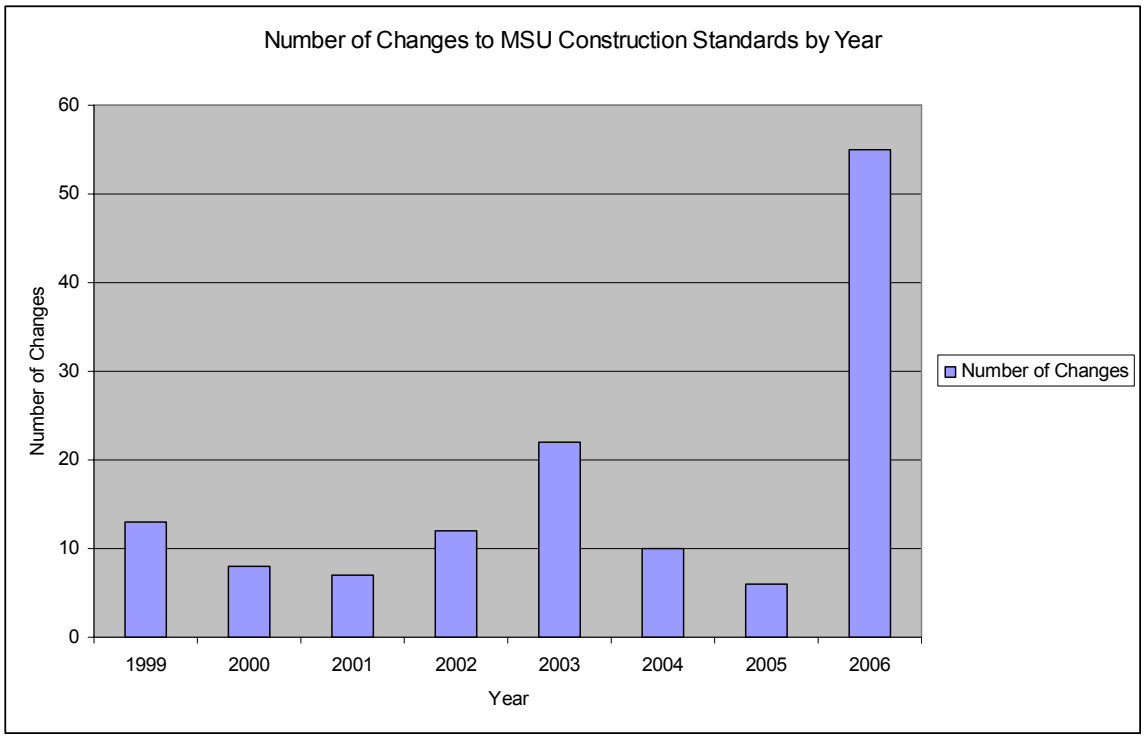



**Figure 5**. *Number of Changes to MSU Construction Standards by Year.* The above figure shows the changes to MSU construction standards requested by skilled trades and planned reviewers since assignment to EAS. This figure does not include recommended changes from the analysis of LEED standards

*Timely Project Completion*

There is also evidence to suggest MSU can improve performance on meeting substantial completion and closing projects. A project is substantially complete when usable for its intended purpose (e.g., an intersection is open, classes or research can be conducted in a laboratory, or an elevator is permitted to carry passengers). Of the projects closed in Fiscal Year 2005-06, approximately 50% of projects met substantial completion deadlines. See Figure 6.

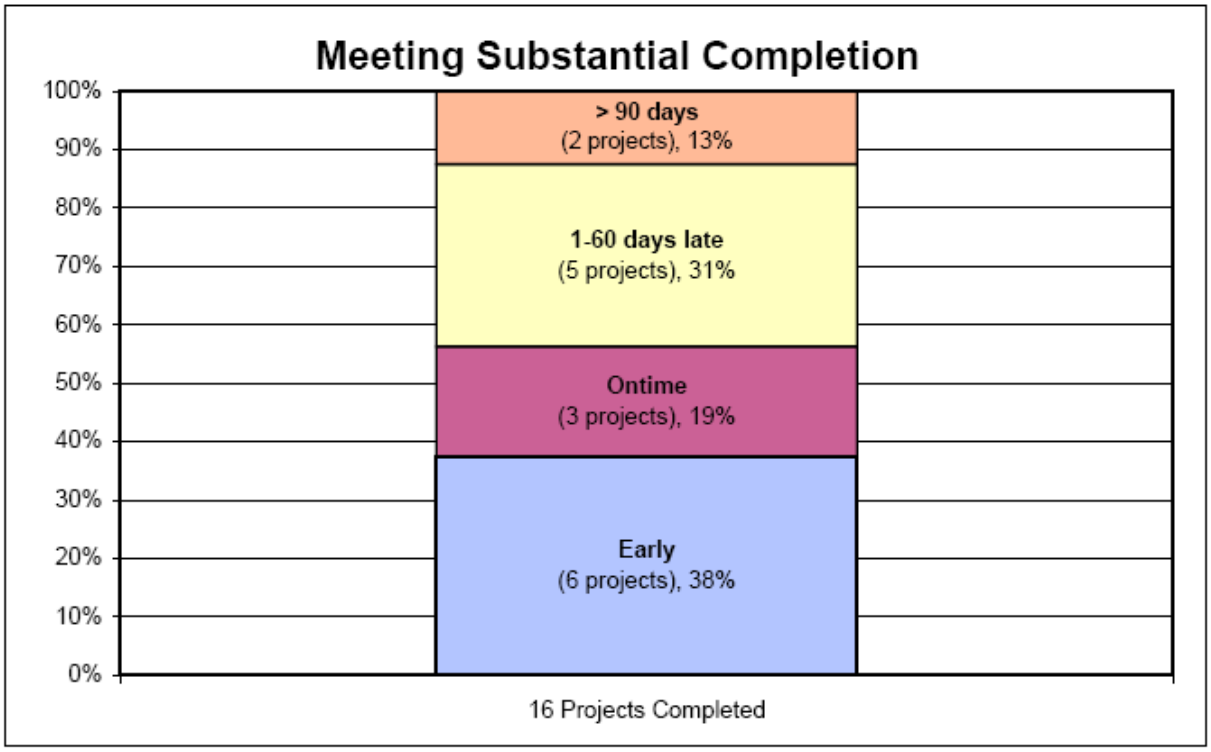



**Figure 6**. *MSU Projects Meeting Substantial Completion*. The number and value of projects meeting substantial completion

Final Completion requires all activities for a project be finished, including the contractor's list of corrective items, work by MSU for tasks such as landscaping, and all expenses completed, including returning unused funds. See Figure 7. Only 19% of the projects in FY2005-06 met final completion on schedule.

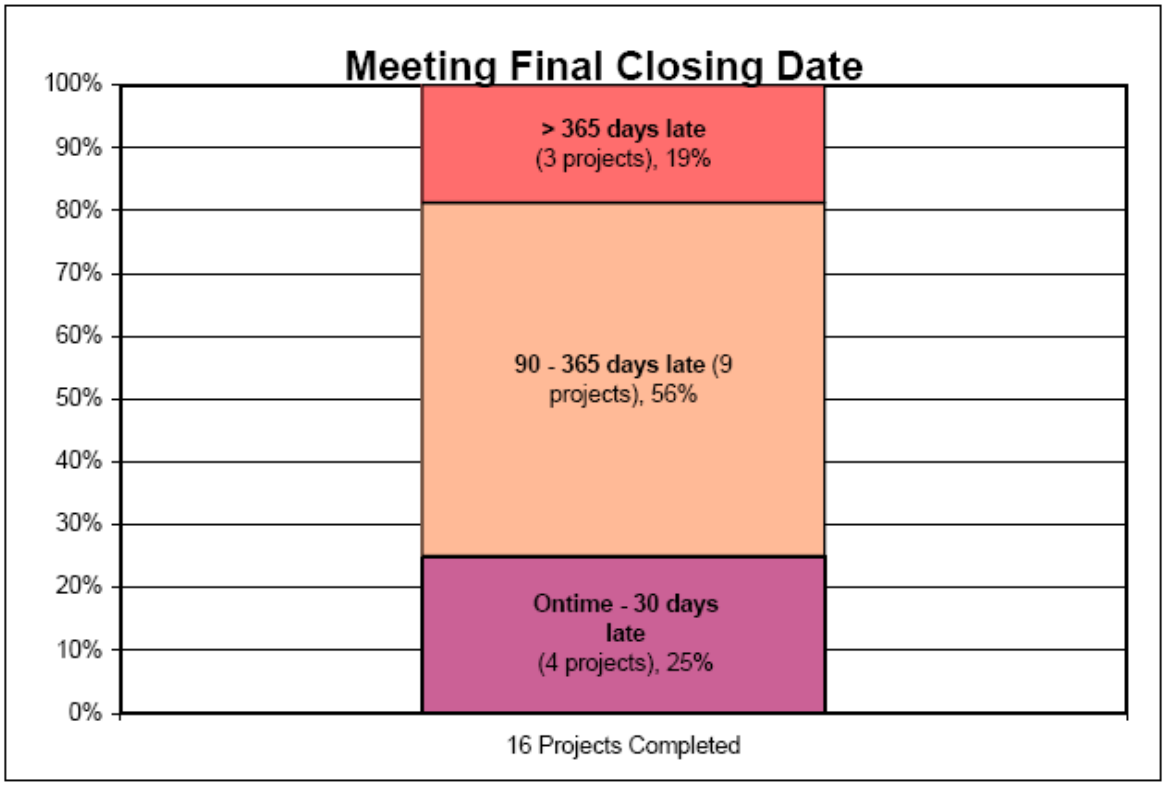



**Figure 7.** *MSU Projects Meeting Final Close Out*. The number and value of projects meeting final close out.

It should be noted that none of these late completions impacted MSU's programmatic functions (e.g., roads were open before student fall semester move-in, some elevators were functioning throughout the project, and other laboratories were available for instruction or research).

There are a number of factors that contributed to less than 1/5 of the projects meeting final completion dates. Some University-caused delays, such as late delivery of equipment, were not factored into the schedules. These delays should have increased the contractor's time to complete the project. Also, MSU performs a number of project functions, and some schedules did not have realistic timelines for these activities.

In response to this issue, the University is putting more effort into setting and maintaining schedule information. EAS is implementing new scheduling specifications that will allow their project managers to better monitor contractor progress, and give more enforcement options when a project starts to slip. Schedules are built with MSU activities in mind. CPA & EAS have partnered with the School of Planning, Design and Construction to evaluate the project closeout process. This will include an analysis of the work MSU Physical Plant continues to perform and the type of activities that are included in the contractor's scope of work. Faster project close out frees university resources for other needs, returns continuity to units, allows resources to move to the next project, and lets MSU programs to conduct normal operations. The project will benchmark MSU's performance against industry standards, and identify process improvements.

*LEED*

Engineering and Architectural Services (EAS) partnered with the School of Planning, Design and Construction to evaluate MSU construction standards regarding their consistency with LEED and USBC requirements.

Through the use of focus groups, researchers, and EAS designers determined which LEED credits were appropriate for incorporation into the construction standards with minimal cost impact to construction projects. Recommendations were made and the changes were incorporated into the construction standards. EAS also provided informational sessions for in-house construction teams on the changes to the construction standards with regard to LEED.

Forty-two construction standards have been changed and LEED principles are being incorporated in to the 2020 Campus Master Plan Update Planning Principles. As an example, 95% of the construction demolition for the Chemistry Building addition was recycled. The project achieved LEED Silver Level status and is registered with the USGBC.

**Future Directions**

*Quality Control*

The School of Planning, Design and Construction will assist in developing a Supplier Feedback assessment tool. The tool is intended to evaluate contractor and designer project performance.

During the current evaluation period, Campus Planning and Administration has joined with Engineering and Architecture Services to create a performance document for evaluating general contractors and designers. The evaluation for general contractors focuses on five areas: quality, schedule, cost, project management, and project close out. The data is collected on each score card by the construction representative for each project, stored in a database, and analyzed at the project and supplier level. Examples of contractor evaluation tools are available in Appendix C.

Although the results of the performance reviews require further evaluation to determine if the correct items are being measured and weighted properly, this feedback provides an excellent opportunity to identify superior that can be used as part of the vendor selection process.

*LEED*

EAS is committed to looking forward to improve the sustainability of construction and renovation practices and will continue to explore new technology and materials for construction and update Construction Standards as they become available.

# Chapter 3
# Power & Water

## Summary

Over the last several years, Michigan State University's campus utility systems have proven to be reliable, efficient and secure. Distribution upgrades and plant additions have increased reliability and efficiency of the overall electrical system while improving the plant environmental profile. Well additions and well house upgrades have improved capacity and security of the campus domestic water supply. Collaboration with other units including the Office of Environmental and Occupational Safety (OEOS) to develop an Environmental Management System[1] (EMS) for the Power Plant will provide opportunities to continue to improve the overall campus environmental footprint. MSU has consistently used the least amount of electricity per square foot of building space within the Big Ten (Figure 1), demonstrating our commitment to environmental stewardship. MSU continues to be a leader in this area of global concern with the recent membership in the Chicago Climate Exchange (CCX) to monitor and regulate CO2 emissions.

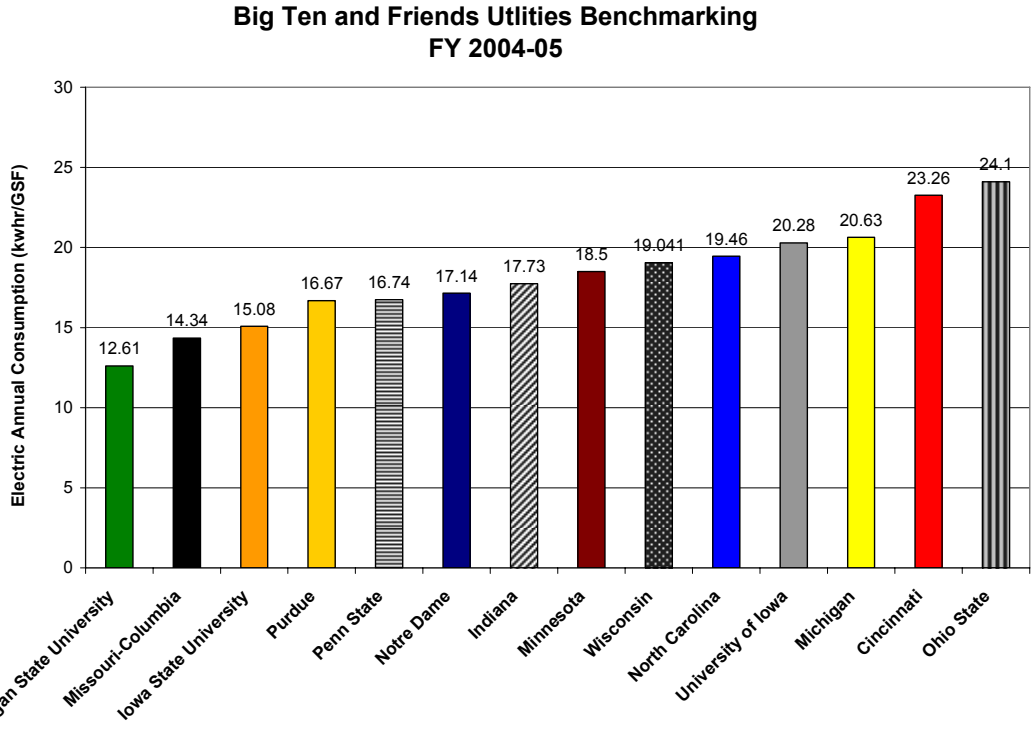



**Figure 1.** *Big Ten and Friends Utilities Benchmarking* Comparison of electrical consumption per square foot among Big Ten and similar size universities

[1]The T.B. Simon Power Plant is currently in the initial stages of developing an Environmental Management System (EMS) which supports Michigan State University's initiative toward integrated environmental stewardship. The EMS will be integrated into current operations and become an integral part in planning, setting goals, cost analysis, and environmental compliance. The EMS will also allow the power plant to petition for the MDEQ and EPA voluntary environmental certification programs.

## Analysis

*Electric and Steam*

For over 100 years, MSU's power plant has been a co-generating facility, generating electricity from the steam as it flows out to heat the campus. Fortunately, this concept has been continued in all phases of the T. B. Simon Power Plant whose first two phases were built in 1965. The cogeneration system operates at approximately 60% efficiency, as compared to a conventional electric plant operating at 30% efficiency. The decision for the University to own and operate its own power plant has proven to be a driving force of efficient operation of all utilities on campus as it continues to grow. The "Hannah Years", from 1941 to 1969, was a period of great growth on campus, not only in enrollment but also in the construction of new facilities. Energy consumption rose dramatically and a power plant addition was required in 1973. Figure 2 illustrates the rise in annual utility consumption from the mid 1950s to present.

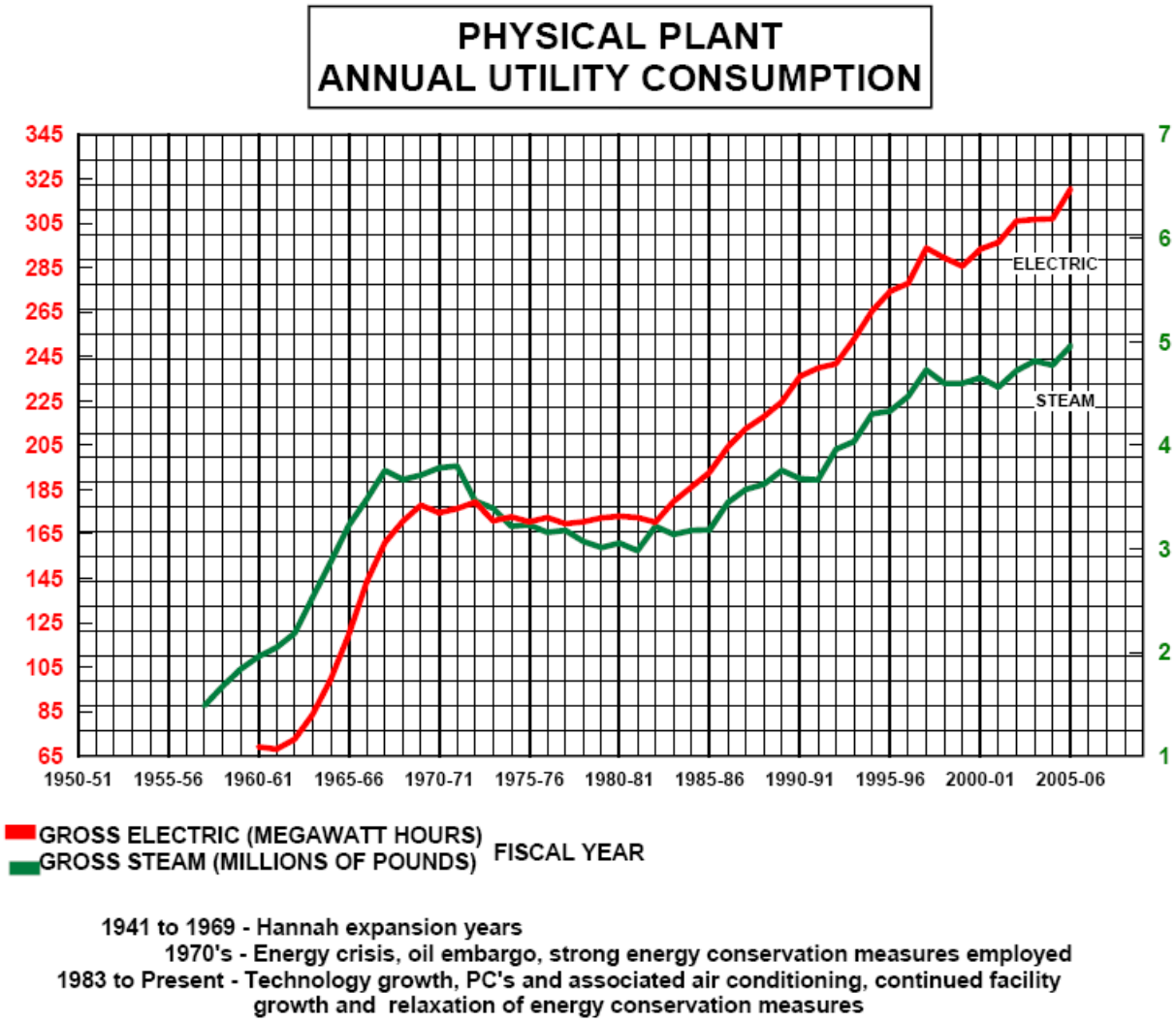



**Figure 2.** *Annual Utility Consumption*.

After the 1970's "energy crisis" when there was a push to conserve energy, there was a period of relatively flat growth in energy consumption. During these years centralized computer control was installed in buildings for the main heating and cooling equipment

and vigorous control of energy use was mandated, i.e., locking thermostats at a maximum of 68° F for winter. The steady increase in electrical consumption in the 1980's was due in large part to the growth of technology and the associated air conditioning requirements to cool this equipment. The campus community also pressed for easing of the mandated energy conservation measures. The increased demand required an addition to the power plant in 1993 and another in 2006. Figure 3 shows the historical steam and electric demands as well as the anticipated demand for campus.

The increase in electrical consumption has exceeded the increase in steam consumption for the past 25 years, which has converted the plant from being driven by steam heating needs to being driven by electrical needs. This increase in annual consumption impacts annual fuel and operating costs. Without a change in campus operations and behaviors, the next plant expansion will be required in 2023. Current plant firm electrical capacity is 90 Mega-watts; firm steam capacity is 950,000 pounds per hour. Firm capacity is defined as the largest unit out of service.

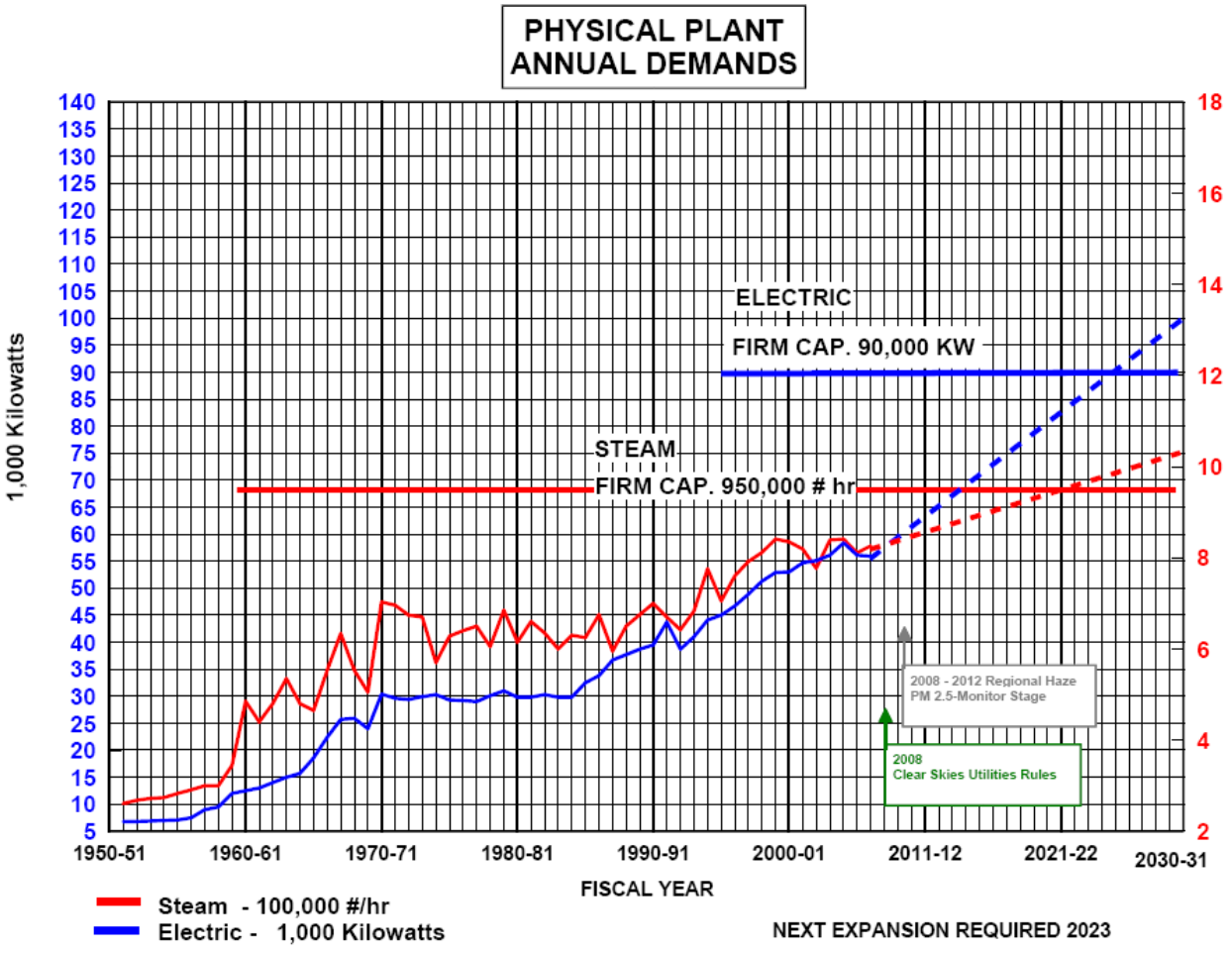



**Figure 3**. *Annual Steam and Electric Demand*

The most recent Power Plant addition added reliability and increased capacity. The Northeast Blackout of 2003 affected 50 million people across Canada and the United States. Michigan State University's main campus was not impacted by this event because of owning and operating our own plant. However, it did bring forth the need to have "black start" capability at the Power Plant in the event the entire plant was taken down and grid power was not available to restart the plant. This "black start" capability

was included in the design and construction of the recent addition with a highly efficient natural gas combined cycle generator which greatly enhances reliability by allowing the Plant to recover from catastrophic failure (all generation off) to generating power within 20 minutes.

*Electric Distribution*

The 1995 (Figure 4) and current 2006 (Figure 5) electrical distribution system maps are shown below. The electrical distribution system has been modified over the past 11 years to upgrade from 4,160 to 13,200 volts. As the new power plant (now known as T. B. Simon Power Plant) was being planned in 1963 for the expanding campus, it was realized that the longer cable distances justified a higher voltage (13,200 V) and campus reliability would be enhanced with parallel feeds to each building with automatic transfer. As the old 4,160 V system was being replaced, the buildings received the enhanced feature of parallel feeds with automatic transfer. There is only small percentage of campus highlighted in blue that remains to be upgraded. (Figure 5)

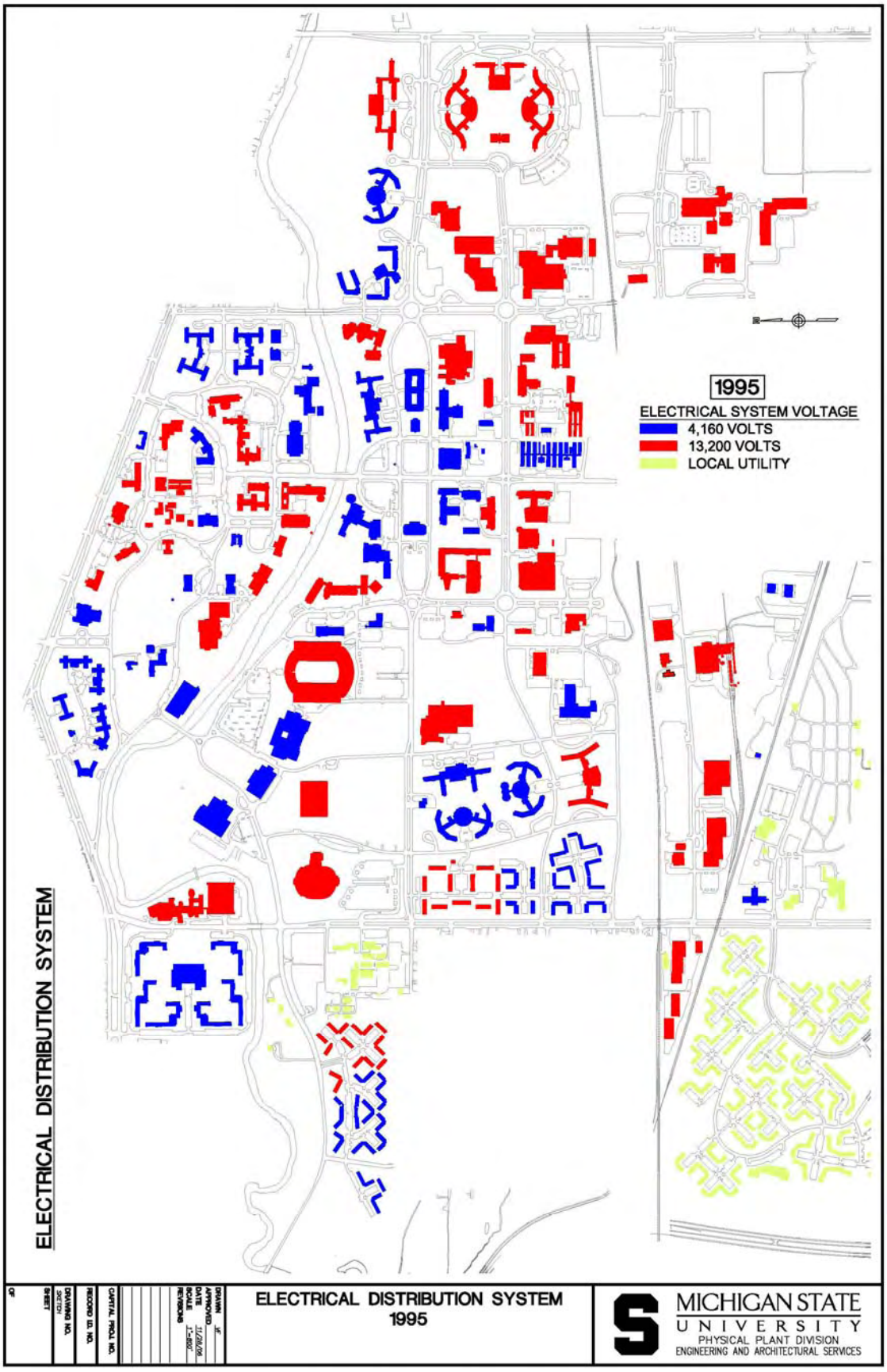



**Figure 4.** *Electrical Distribution System Map 1995*

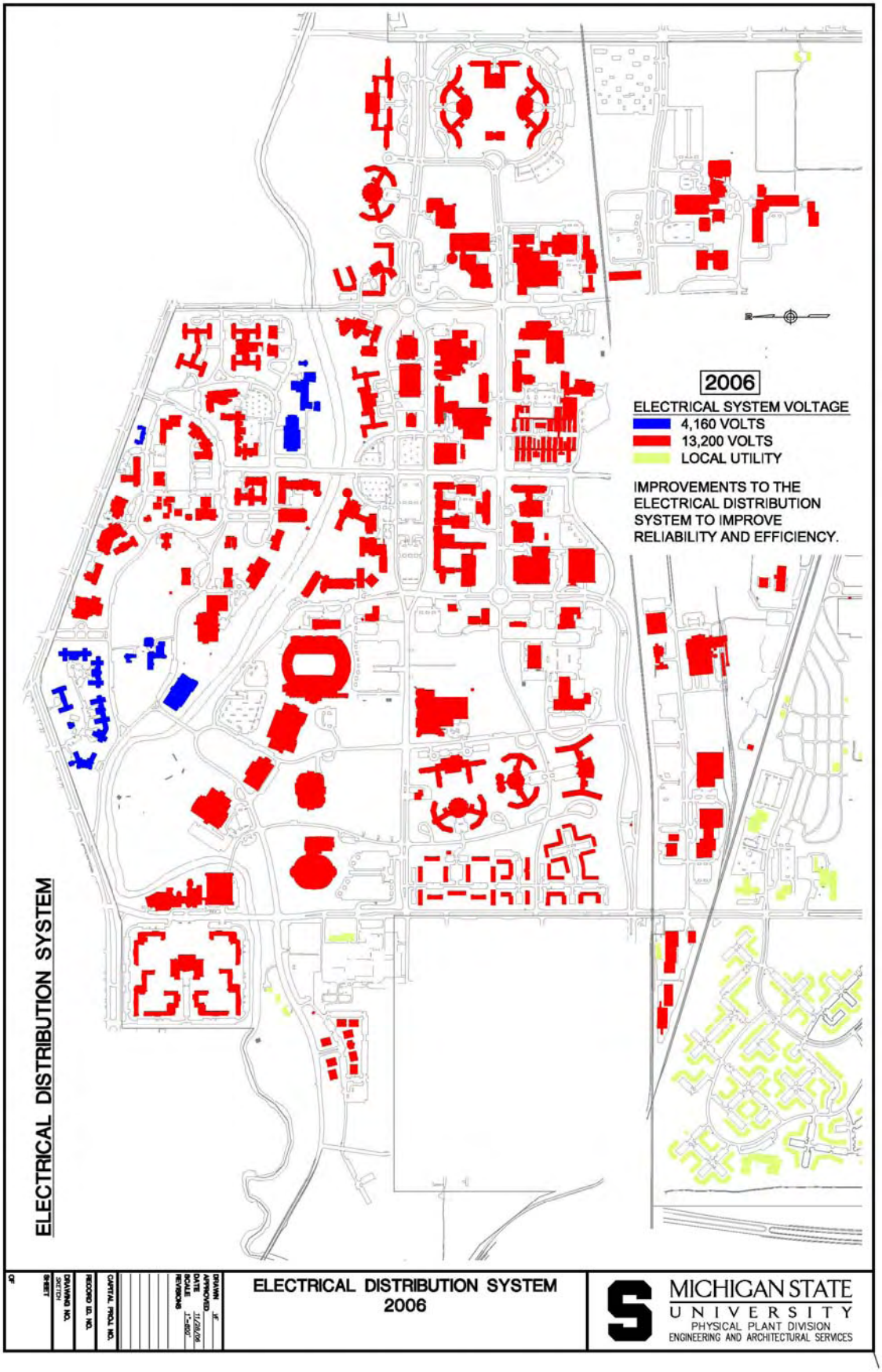



**Figure 5.** *Electrical Distribution System Map 2006*

*Water*

Reliable water supply to the campus requires the reserve of three major wells to accommodate unexpected outages and scheduled overhauls. One new well will be installed in 2007. With this added well there will be a total of 15. The next well will be required in 2010 at current projections. The water distribution chart shown in Figure 5, indicates the maximum water demand for campus and the farm area.

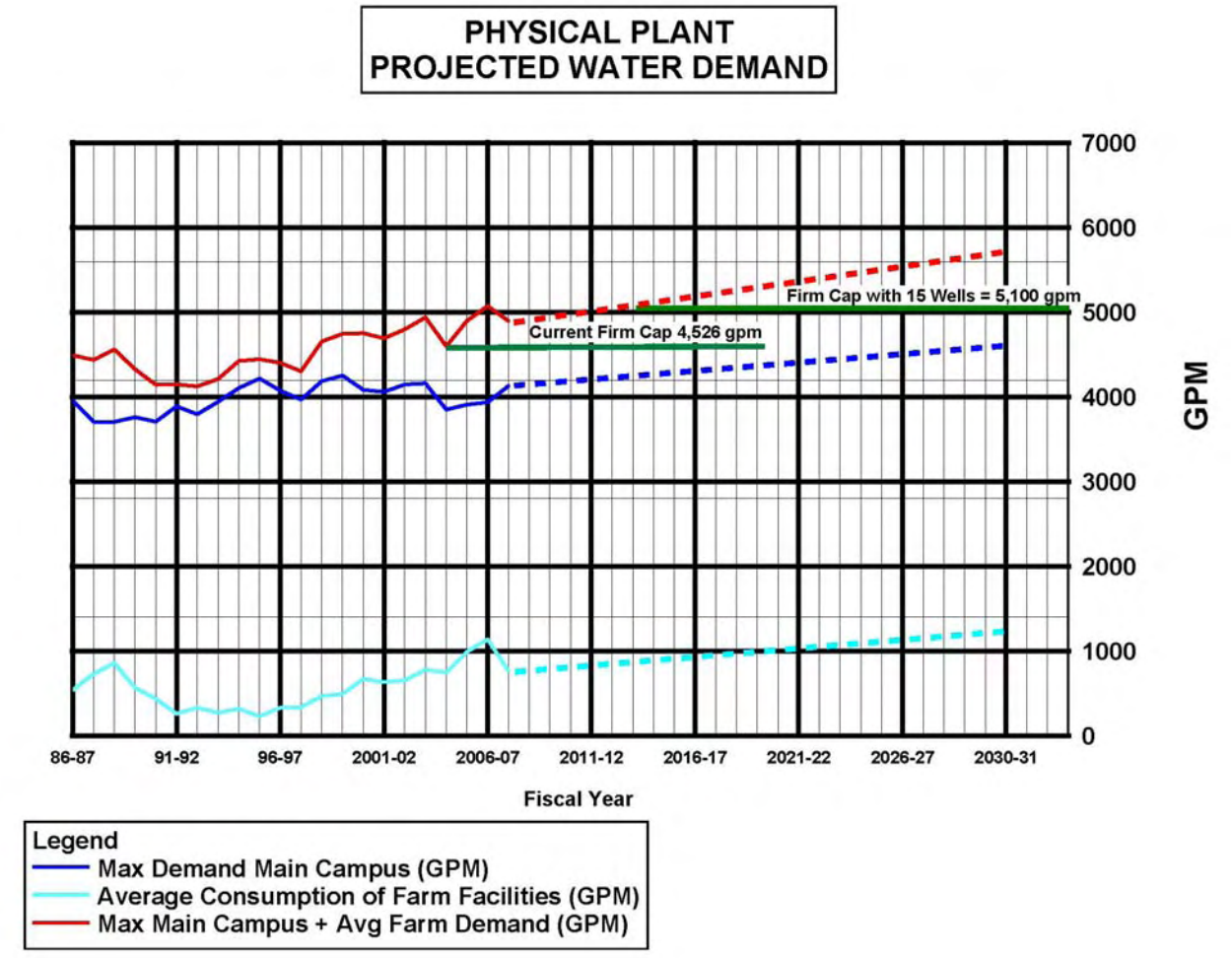



**Figure 6.** *Projected Water Demand.* Well 15 will be installed during 2007. The next projected additional well will be required in 2010 to meet increasing demand.

During the Northeast Blackout of 2003, campus wells, powered by Consumers Energy, were non-functional and led to a near crisis for water. As a result, six large portable generators were purchased as an emergency backup should the grid fail again.

*Regulatory Compliance*

The T. B. Simon Power Plant is in compliance with all State and Federal environmental rules and regulations. In order to monitor and develop compliance plans for changing environmental regulations, the Power and Water Department has participated in State and Federal rule making work groups. In 2004 MSU completed the installation of new environmental controls to reduce nitrous oxides (NOx), a contributor of atmospheric ozone. In 2006 MSU submitted a compliance plan for the Industrial Boiler Maximum

Achievable Control Technology (MACT), a new regulation which takes effect in 2007 to control mercury, chlorine and particulates in coal fired boilers. The baghouse filters installed by MSU for particulate control are also effective in capturing mercury. The Clean Air Interstate Rule (CAIR) for Michigan was submitted for administrative approval in November 2006. This rule will place additional sulphur oxides (SOx) and NOx controls on Utility and Industrial Boilers to reduce small condensable gas particles to improve public health. MSU complies with this rule due to the 2004 installation of NOx controls at the plant. Continued compliance will involve participation in the Federal NOx cap and trade program. MSU has achieved total revenue from NOx credit sales in this program for 2004-2006 of $680,000. Currently the Power Plant is working with the Office of Environmental and Occupational Safety (OEOS) to develop an EMS for the T.B. Simon Plant. Following Cyclotron's lead this will be the second campus EMS. Participation in the Chicago Climate Exchange will assure monitoring of campus CO2 emissions. These activities will promote MSU's environmental stewardship and compliance.

**Future Directions**

*Compliance*

Future pending compliance regulations such as Clear Skies and Regional Haze are being developed to improve visibility in national parks and wilderness areas by implementing additional control of fine particulates created by condensable gases. The State modeling for the rule is currently underway. The T. B. Simon Power Plant may very well become a Best Available Retrofit Technology (BART) site and if so, additional SOx controls will be needed by 2010.

*Coal Handling*

Conventional rail coal delivery has become unreliable for the Power Plant. Railroads are reluctant to deliver less than a unit train of 75 cars. In winter 2005, on site inventories were less than 30 days whereas our target fuel inventory is 60 days to assure reliability. A possible solution to this dilemma is to install a fast coal unloading system (coal car tipper) as well as coal silos. Coal silos will solve the continuing nagging problem of wet coal and fugitive dust. A business plan is being developed regarding these system modifications**.**

*Supplemental Alternative Fuels*

The T.B. Simon Plant is experimenting with the use of supplemental alternative fuels by performing test burns. During October 2006, a quantity of foam cell waste from bio-degradable corn starch was fed into one of our boilers thereby reducing the quantity of coal burned without negatively impacting emissions. See Figure 7. A review is underway to determine the annual available quantity of this material and what necessary modifications to the fuel system are needed. In January a test burn will be performed with a pelletized mixture of coal ash, dried animal waste and sewage sludge in conjunction with coal. Operational impacts will be studied at the conclusion of that burn. This is expected to reduce emissions.


**Figure 7.** *Alternative Fuel Testing* Power Plant Alternative Fuel Testing – Loading Corn Starch Waste Byproduct

*Future Energy Issues*

Planning new buildings to address research needs; renovation of existing space with high technology equipment; and the trend to air condition previously unconditioned space on campus all point to increased energy use in the future. There are large areas of existing space that are not air conditioned and the campus push for small, electrically driven cooling systems due to low capital costs versus large central, steam absorption cooling plants causes higher electrical demand and an imbalance at the power plant. This trend requires a study of various campus sites for regional steam absorption cooling plants to meet the campus demand for energy at the lowest possible life cycle cost.

Meeting campus energy demand while at the same time responding to the immense concern of global warming will be another challenge. MSU has responded to this challenge by joining the Chicago Climate Exchange (CCX) to reduce green house gas emissions. MSU's commitment through the CCX is to reduce our emissions by 6% below our baseline over the next three years. This is equal to "turning off" around 2 ½ million square feet of space to reduce energy consumption. Literally turning off that amount of space is not an option for the campus and will consequently lead to innovative ways to reduce consumption while still meeting the challenge.

Change is in the wind. During the next 5 to 20 years, the challenge for the campus community will be to continue to support the growth of programs including new

buildings, additions and renovation while minimizing the growth of energy consumption. The opportunities that come with this challenge include:

- encouraging behavioral changes with regard to energy use
- continuing to explore burning alternative fuels at the Power Plant
- developing a campus plan to install regional cooling plants
- reviewing current purchasing policies including energy star compliant equipment
- reviewing building scheduling and classroom scheduling policies
- exploring alternative fuel vehicles for the MSU fleet
- evaluating new energy saving technologies
- keeping up-to-date with green energy options

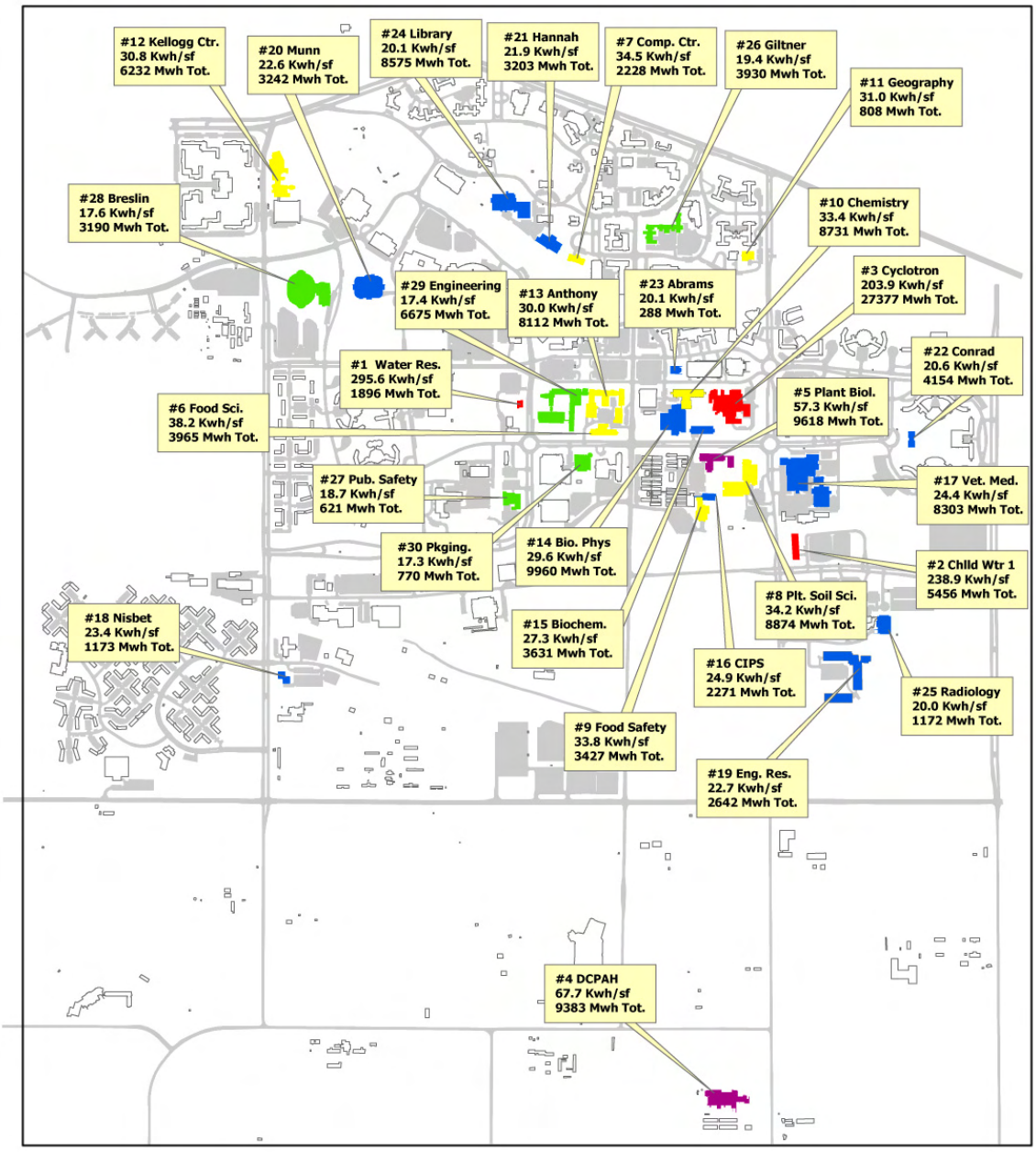
*On-going Analysis*

Energy analysis is currently underway to determine what areas to target for reduction on campus.

Figure 8 shows the top 30 electrical consumers for fiscal year 2005-2006 on a building per square foot basis. Figure 9 indicates the top 15 electrical consumers for fiscal year 2005-2006 for residence halls. While this data is interesting, the anomalies require further investigation to determine the cause. Other options to help reduce consumption while maintaining current growth may be energy performance contracting and or energy audits of selected buildings. A detailed list of current and future energy initiatives is available in Appendix D.

The challenges and opportunities will be ever-changing as we maintain MSU's commitment to environmental stewardship, while continuing to grow as a world class University.

# Top 30 Electrical Consumers FY 05-06




**KiloWatt Hours Per Square Foot**
**Fiscal Year 2005-2006**

- 15 < 20
- 20 < 30
- 30 < 50
- 50 < 100
- 100+

The top 30 electrical consuming facilities for Fiscal Year 2005-2006 based on consumption per square foot. The list is dominated by science facilties. Certain facilities, such as wellhouses, were excluded from the list because their function would bias the results.

**Figure 8.** *Top 30 Electrical Consumers FY05-06*

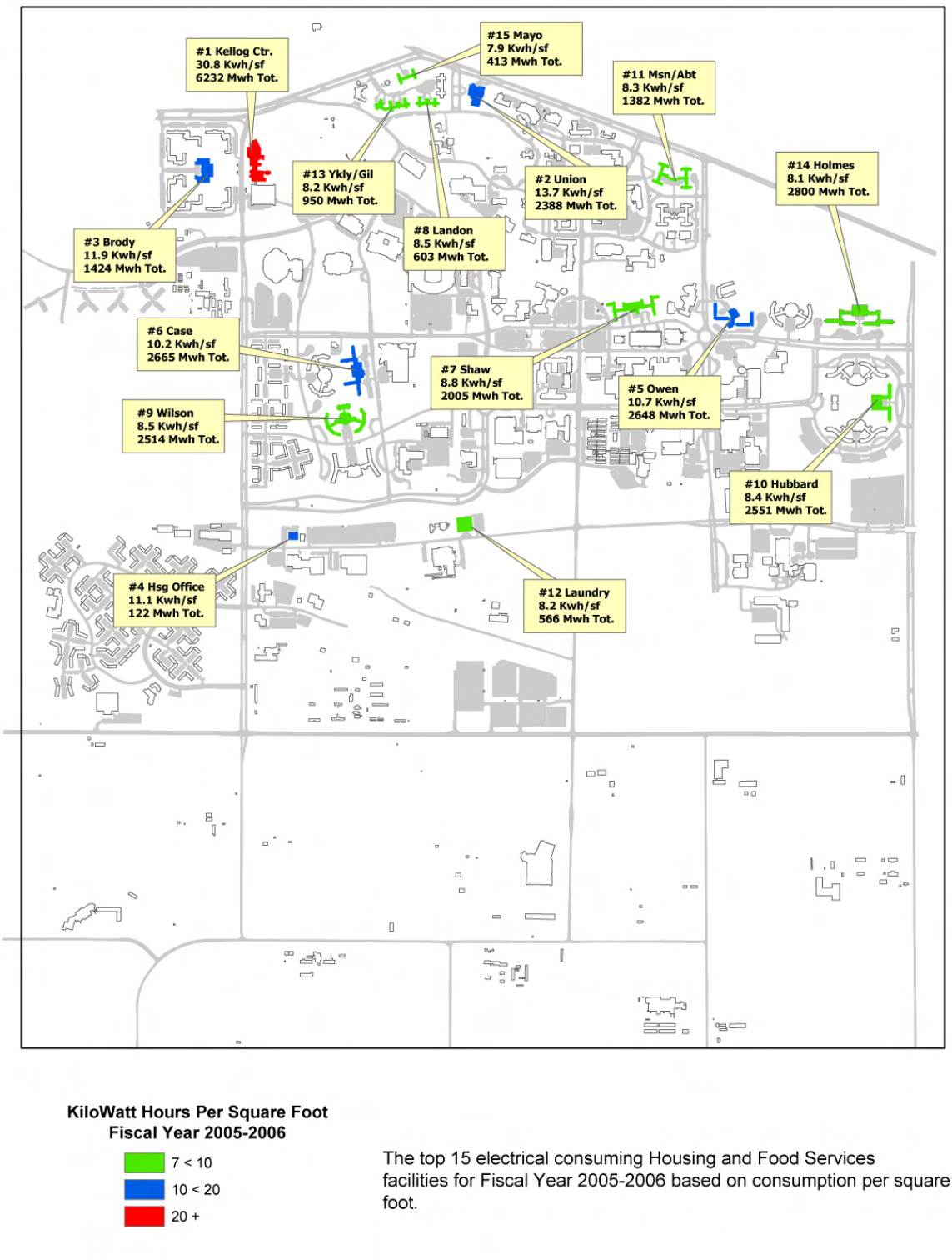



**Figure 9**. *Top 15 Housing & Food Service Electrical Consumers for FY05-06*

# Chapter 4
# Instructional Space

## Summary

A primary component of the teaching and learning environment is the University's instructional space. The University maintains over 800 instructional spaces, which represents over 900,000 net square feet of space. These spaces range from the traditional classroom that can be utilized by any discipline and are categorized as "university classrooms" to the more specialized spaces that are assigned to a specific department and categorized as "teaching laboratories". This report focuses on the utilization and quality of university classrooms and teaching laboratories. Understanding the utilization informs our planning for the appropriate number of rooms and seats, course scheduling, and best use of a limited physical resource. The quality of the rooms is essential to the teaching and learning process and requires proper lighting, seating, acoustical treatment, sound and video support, proper and functioning laboratory benches, fume hoods and other related utilities as well as computing technologies, dependent on room function.

## Analysis

*Utilization*

For utilization purposes, university classrooms and teaching laboratories are typically grouped by capacity range (e.g. 30-39 seats). Fall semester data is used for the purpose of utilization reviews as this is typically the highest use semester. Hours of utilization are calculated based on a 50 hour week, which represents 10 course start times per day beginning at 8:00 a.m. with the last start time at 7:00 p.m., Monday-Friday. The seat utilization is based on the room capacity compared with actual course enrollment.

*University Classrooms*

The University maintains approximately 330 centrally scheduled classrooms and lecture halls. As part of the University's main campus facilities, the centrally scheduled classrooms account for approximately 394,000 net square feet of space.

Dependent upon capacity and configuration of the room, utilization of these classrooms by scheduled instructional periods (not including a significant number of one-time events such as special seminars, help sessions, department and student organization meetings, etc.) ranges as high as 75 percent of the available hours and averages 61 percent across all rooms. One-time events typically account for an additional 8% in utilization. The seat utilization (percent capacity) ranges as high as 69 percent of the available capacity and averages 59 percent across all rooms. By comparison peer institution utilization ranges from 62-83% of the total hours available. Seat utilization ranges from 30– 69% of the total seats available. (Table 1)

**Table 1.** *University Classrooms Utilization by Capacity Group – Fall 2006*

| Capacity Group | Total Rooms | Hours based on 50 hour week | Hours | Percent Utilization | Percent Occupied |
|---|---|---|---|---|---|
| 0 - 29 | 40 | 2000 | 891 | 45% | 69% |
| 30 -39 | 57 | 2850 | 1649 | 58% | 69% |
| 40 - 49 | 81 | 4050 | 2706 | 67% | 56% |
| 50 - 59 | 29 | 1450 | 979 | 68% | 53% |
| 60 - 69 | 34 | 1700 | 960 | 56% | 51% |
| 70 - 79 | 20 | 1000 | 613 | 61% | 48% |
| 80 - 89 | 15 | 750 | 404 | 54% | 51% |
| 90 - 99 | 2 | 100 | 67 | 67% | 62% |
| 100 - 149 | 13 | 650 | 424 | 65% | 54% |
| 150 - 199 | 11 | 550 | 350 | 64% | 59% |
| 200 - 249 | 11 | 550 | 346 | 63% | 62% |
| 250 - 299 | 6 | 300 | 217 | 72% | 61% |
| 300 - 399 | 6 | 300 | 203 | 68% | 59% |
| 400 - 499 | 3 | 150 | 113 | 75% | 68% |
| 500 + | 5 | 250 | 152 | 61% | 66% |
| | 333 | 16650 | 10074 | 61% | 59% |

Hour utilization is based on a 50 hour scheduled week. Seat utilization is based on a 50 hour scheduled week. This table does not include the scheduled "events" activity which typically represents an additional 8% in room utilization, for a total utilization of 69%.

*Teaching Laboratories*

The University maintains approximately 500 departmentally assigned instructional spaces. These space types of specialized instructional facilities serve various disciplines ranging from Biology to Landscape Architecture and Zoology, as examples. The rooms account for approximately 510,000 net square feet of space. The room types range from traditional scheduled class laboratories to open class laboratories (available for class project work on an unscheduled basis) and tutorial rooms. For those rooms that are regularly scheduled for courses, the level of utilization is indicative of the highly specialized nature of these room types. The utilization ranges as high as 57 percent of the available hours and averages 32 percent across all rooms. The seat utilization ranges as high as 77 percent of the available capacity and averages 33 percent across all rooms. (Table 2)

**Table 2.** *Teaching Laboratories Utilization by Capacity Group – Fall 2006*

| Capacity Group | Total Rooms | Hours based on 50 hour week | Hours | Percent Utilization | Percent Occupied |
|---|---|---|---|---|---|
| 0 - 29 | 133 | 6650 | 2057 | 31% | 77% |
| 30 -39 | 53 | 2650 | 996 | 38% | 71% |
| 40 - 49 | 35 | 1750 | 513 | 29% | 51% |
| 50 - 59 | 11 | 550 | 115 | 21% | 50% |
| 60 - 69 | 3 | 150 | 44 | 29% | 29% |
| 70 - 79 | 4 | 200 | 63 | 32% | 36% |
| 80 - 89 | 2 | 100 | 46 | 46% | 37% |
| 90 - 99 | 2 | 100 | 26 | 26% | 47% |
| 100 - 149 | 7 | 350 | 74 | 21% | 42% |
| 150 - 199 | 1 | 50 | 15 | 30% | 47% |
| 200 - 249 | 0 | 0 | 0 | 0% | 0% |
| 250 - 299 | 2 | 100 | 57 | 57% | 10% |
| 300 - 399 | 0 | 0 | 0 | 0% | 0% |
| 400 - 499 | 0 | 0 | 0 | 0% | 0% |
| 500 + | 0 | 0 | 0 | 0% | 0% |
| | 253 | 12650 | 4006 | 32% | 33% |

The table shows scheduled course utilization and seat occupancy by room capacity group. Hour utilization is based on a 50 hour scheduled week. Seat utilization is based on a 50 hour scheduled week.

*Quality*

The quality of these rooms is essential to the teaching and learning process and requires proper lighting, seating, acoustical treatment, sound and video support, proper and functioning laboratory benches, fume hoods and other related utilities as well as computing technologies that facilitate specialized teaching methods and instruction in specific disciplines.

A multi year improvement plan, informed by onsite assessment of the room condition utilization levels, last improvement date, as well as input from departmental faculty and staff, and an advisory group consisting of faculty and university staff guides the maintenance improvements, equipment replacement and program enhancement of these spaces. The onsite assessment ranks a number of factors within each room to arrive at an overall room condition rank. See Table 3. During the period FY95-FY06 approximately $29.3M has been invested to upgrade instructional facilities. This included alterations and improvements, technology equipment installations, and a technology equipment replacement program that began in FY03. Of the $29.3M in total upgrades this represents approximately $21.0M in alterations and improvements and $8.3M in technology installations and upgrades. Funding for these improvements is from general and auxiliary fund sources, and in limited cases from private fundraising.

**Table 3**. *Room Condition Assessment Tool*

| Room Attributes | Condition Rank 1 | 2 | 3 |
|---|---|---|---|
| Air Conditioning | | | |
| Accessibility | | | |
| Clock | | | |
| Lectern - Tabletop, Floor | | | |
| Seating - fixed or movable | | | |
| Seating - Tablet Arm, Strip Table, Seatdesk, Table and Chair | | | |
| Seating - Upholstered or Not Upholstered | | | |
| Seating - area or seating for students with disabilities | | | |
| Seating with Power & Data Connections | | | |
| Ceiling - Plaster, Tiles, Other | | | |
| Chalkboard - Fixed or Movable | | | |
| Floors - Level, Risers, Sloped | | | |
| Floor Covering - Carpeted, Vinyl, Wood | | | |
| Lighting - Fluorescent, Parabolic, Multi level switching, Combination of Florescent and Dim. | | | |
| Movable Walls (Accordion Folding) | | | |
| Window Coverings - Shades, Drapes, Blinds, Blackout | | | |
| Ceiling Fans | | | |
| Last Renovation Date | | | |

A condition rank of 1 - No Attention Required; 2 - Requires Attention; 3 - Requires Immediate Response is assigned each field as applicable to the room. The rankings for each room are then evaluated and the rooms are then placed on the Multi-Year Improvement Plan as a 1 - Good to Excellent Requiring Minimal to No Alterations and Improvements; 2 - Moderate to Selected Improvements Needed; 3 - Comprehensive Upgrades Needed

Of the approximately 330 university classrooms approximately 65 percent of the rooms are in good to excellent condition requiring minimal to no alterations or improvements. Another 28 percent of the classrooms require moderate and selected improvements such as new seating, lighting, or painting. The remaining 7 percent of these rooms will require a comprehensive upgrade. New technology installations for the university classrooms are planned at a minimum of 20 rooms per year. Of the 330 rooms 213 or 65% are currently technology equipped and include video, audio, and a networked computer connected to a permanently installed, high-quality projection system via a technology cart or laptop podium. These installations are located throughout campus. (Figure 1)

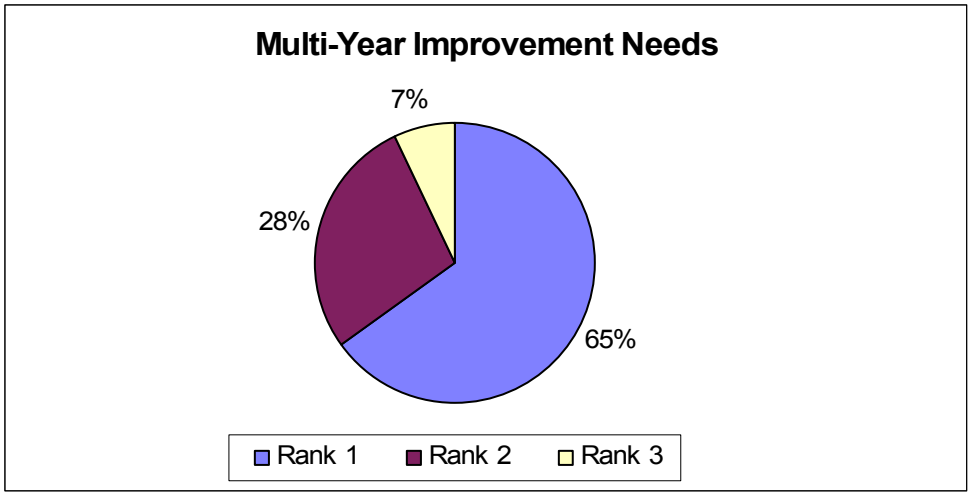



**Figure 1.** *Classroom Multi-Year Improvement Needs by Rank* The chart shows the status of the multi-year improvement plan for university classrooms. Rank 1 = good to excellent, Rank 2 = Moderate to Selected Improvements, Rank 3 = Comprehensive Upgrade.

Of the approximately 500 teaching laboratories approximately 44 percent of the rooms are in good to excellent condition requiring minimal to no alterations or improvements. Another 46 percent of the departmental rooms require moderate and selected improvements such as new lighting, bench replacement or painting. The remaining 10 percent of these rooms will require a comprehensive upgrade. (Figure 2)

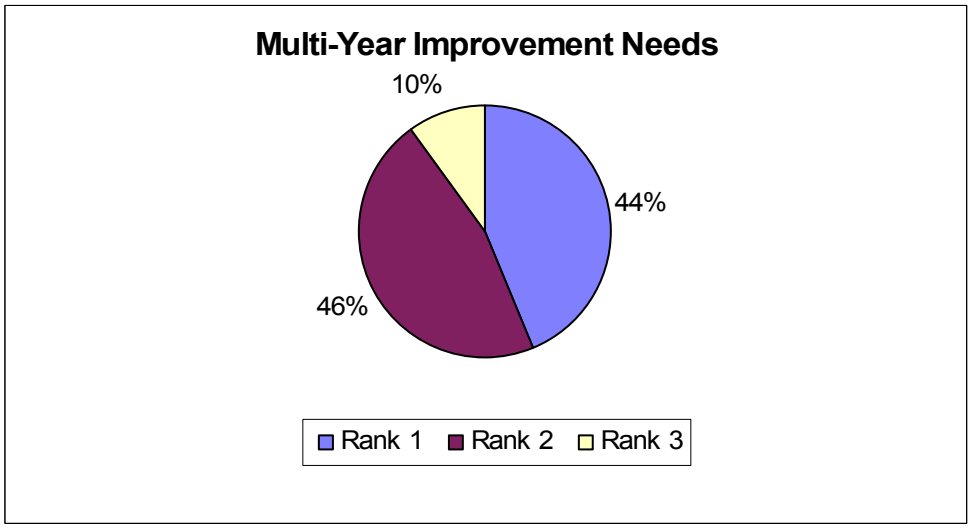



**Figure 2.** *Teaching Laboratory Multi-Year Improvement Needs by Rank.* Rank 1 = good to excellent, Rank 2 = Moderate to Selected Improvements, Rank 3 = Comprehensive Upgrade.

Technology equipment installations, which may range from computers and video projectors - growth chambers – microscopes, are typically planned on a room-by-room basis for these specialized facilities. Recently completed or in process upgrades include 37 teaching laboratories that support instruction for Chemistry (as part of the Addition project), Integrative Studies General Science, Lyman Briggs, Plant Biology, Science and Math Education, and Zoology.

## Future Directions

Space is a limited and highly valued resource. Because instructional spaces are utilized on a regular basis by students and faculty for the purpose of teaching and learning it is important that the University continue to monitor, evaluate, and invest in this campus resource.

Annual reviews of the utilization, both hours and seat capacity, of instructional space will continue along with ad hoc analysis based on requests for changes in capacity or room use, as examples. The intent is to ensure that the University has the right number and kind of instructional spaces to meet the demands of scheduled courses, help sessions, student group meetings, individual project and study needs, and pedagogy.

A developing area is the creation of informal learning spaces in areas near or adjacent to classrooms or paths of travel to foster interactions among students and between faculty and students outside of the classrooms. Opportunities for development of these types of spaces are a part of the overall classroom planning effort.

The quality of these spaces is critical to the teaching and learning. On-site inspection of these facilities will continue in order to focus efforts on those rooms of the highest need relative to maintenance and upgrade of the built infrastructure. One area that continues to evolve is the type of seating. The movement is toward movable tables and chairs for greatest flexibility. Use of this type of seating often presents challenges relative to the room capacity and requires analysis of seating options and seat utilization. Technology plans continue to target a minimum of 20 newly equipped rooms per year. The selection of new technology rooms is informed by department requests, Instructional Media Center requests for delivery of portable technology equipment, classroom scheduling requests for equipment and coordination opportunities as it relates to other maintenance and upgrades planned for the room(s).

# Chapter 5
# Accessibility

## Summary

Michigan State University is committed to providing equal opportunity for full participation in all programs, services and activities. As part of this commitment, MSU has included the evolving set of state, national and local accessibility/barrier free standards throughout the past 30 plus years to provide an increasingly accessible learning and work environment.

Beyond integration of the evolving accessibility codes in each new construction project, MSU has served as a lead innovator in technologies that often extend beyond state and national guidelines for accessible design. During the 1980s MSU was a pioneer of new concepts in automatic snow melt systems at building entrances, adoption of accessible elevator control panels, and innovations in slip resistant entrance ramps. And while program accessibility is the primary driver behind building accessibility, MSU has chosen to make a majority of its facilities accessible that existed prior to the passage of the 1973 Federal Rehabilitation Act, Section 504 and subsequently the 1990 Americans with Disabilities Act. Today, all but four of the university's academic facilities are accessible and all of the athletic facilities can be accessed by persons with disabilities. Most residence halls are accessible at grade and selected buildings include specially designed barrier free rooms. All of the instructional classroom spaces within the residence halls are accessible.

MSU strives to employ concepts of universal design to more fully integrate accessibility features in new and existing structures. Each year the university sets aside funds for new projects that further the goal of maximizing access to all campus facilities. The Office of Planning and Budgets/Facility Planning and Space Management, Athletic Facility planners, Campus Planning and Administration, the Council for Students With Disabilities, the Department of Housing and Food Services, the Physical Plant Division, and the Resource Center for Persons with Disabilities routinely solicit and incorporate feedback from the MSU community and in particular, people with disabilities, toward enhanced campus accessibility.

## Analysis

Michigan State University's efforts to remove physical barriers to program accessibility date from the late 1960's. Among the earliest projects was the installation of curb cuts for persons with mobility impairments to facilitate their ability to move around the campus. One of the earliest written documents that affirmed the University's commitment to including individuals with disabilities was an affirmative action plan for persons with disabilities adopted on November 15, 1974. The Michigan State University Affirmative Action Plan for Handicappers (as it was titled at that time) was designed to provide equal opportunity for persons with disabilities among the University's academic and non-academic personnel as well as to make the University's programs more attractive and accessible to students with disabilities. Since that time, the university has made significant progress in removing barriers to building access. Today, very few buildings are completely inaccessible although, all of the university's programs are accessible as determined through a self study conducted in 1995 in response to the passage of the Americans with Disabilities Act of 1990. A small set of academic

buildings, some residence halls and apartments, and a limited number of support buildings are not yet accessible as shown in Figure 1.

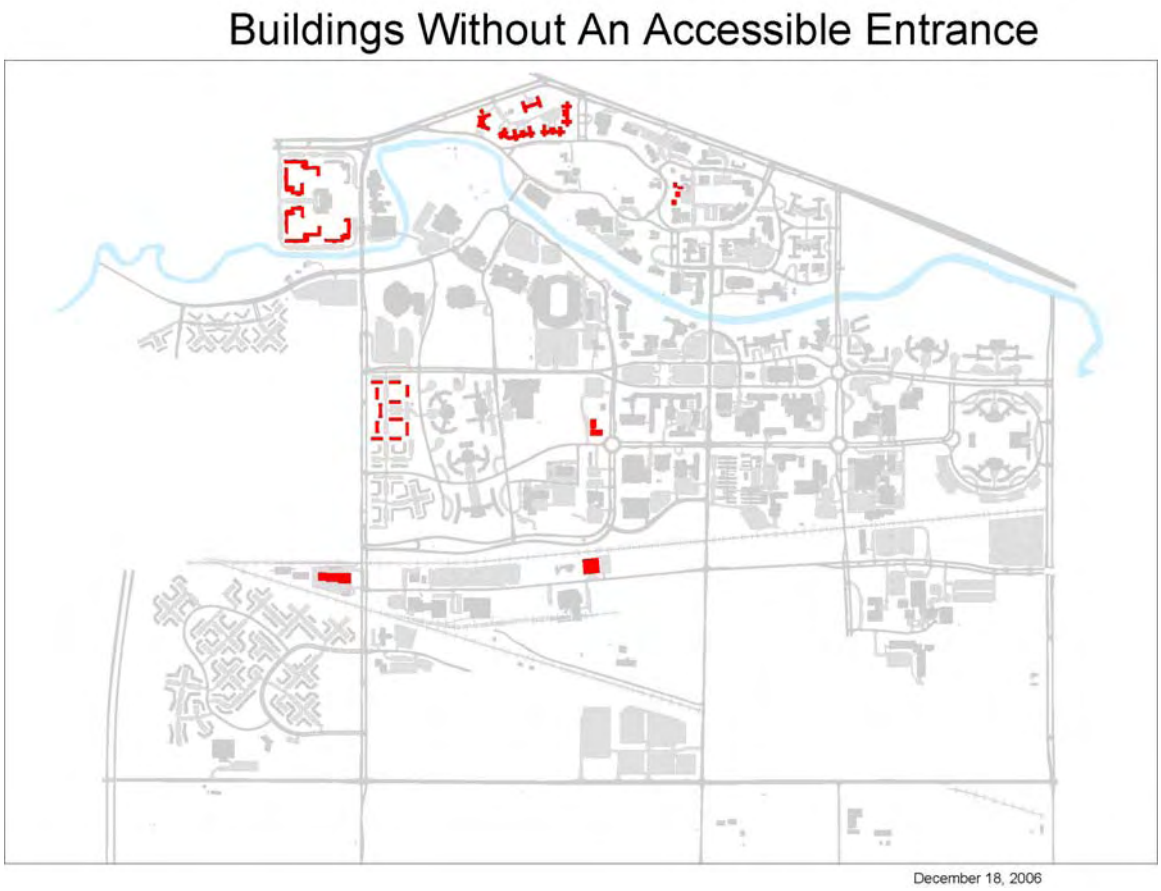



**Figure 1**. *Buildings Without an Accessible Entrance*

The university continues to work towards making all of its facilities accessible and moreover, to enhance the access and usability of its facilities. In addition to funds that are separately budgeted each year to improve accessibility on the campus, other sources include the Housing and Food Services Division, the Athletics Department, and private donor support especially for those projects that are renovations and additions.

A three year summary (see Appendix E) shows ten projects have been completed that improved accessibility of campus facilities. These projects represent expenditures that are in excess of $3.5 million with funding sources representing a combination of internal university funds and external sources. The scope of these projects ranged from:

- A minor improvement such as the installation of magnetic hold open devices on the hallway doors of a classroom building to,
- Improving interior building access as part of a program renovations and additions project such as the IM West Fitness Center to,
- Creating accessibility through a comprehensive renovation program such as in Marshall-Adams Hall and the Geography Buildings as well as,
- Enhancing current barrier free parking and adding additional spaces to meet current needs and code requirements.

Three additional projects are funded currently and in process. Two of the projects are major renovation and additions with an important part of the work scope involving

accessibility: the Renovation/Addition project at Snyder-Philips Hall and the Erickson Hall Addition. As a part of the addition to Erickson Hall, the main east front entrance to the building will be enhanced with a snowmelt system and new power assisted doors. The third project is solely focused on accessibility and involves the installation of automated door opening-closing devices at the Computer Center. The automated doors will partner with the newly graded entrances which included tactile strips for persons with visual impairments and will facilitate access particularly at the East and South entrances.

**Future Directions and Developing Issues**

To assist with identifying future barrier-removal needs and developing the scope of projects, a university team reviews barrier-removal issues on an annual basis. However, this does not limit the ability to respond to a more immediate need that may be identified throughout the course of a year and would be handled as a reasonable accommodation. The annual planning team is convened by the Facilities Planning Office. The team includes Athletic Facility planners, Campus Planning and Administration, the Council for Students with Disabilities, the Department of Housing and Food Services, the Physical Plant Division, and the Resource Center for Persons with Disabilities. As a result of their efforts eight projects have been identified and are currently under review. Descriptions of the projects are available in Appendix E.

The scope of the projects ranges from improving exterior access such as the ramp project at the Demonstration Hall building to enhancing interior building circulation such as the Auditorium elevator project to creating exterior access for a facility that is currently inaccessible such as Old Botany, Chittenden Hall, Cook Hall, and the UPLA buildings. With regard to the older buildings (Old Botany, Chittenden, and Cook Hall), accessibility will be achieved as part of a comprehensive building renovation plan and will occur following the identification of donor funding. One of the more significant issues then, for all of the noted projects, is the identification of sufficient funding such that the projects can be accomplished in a reasonable timeframe.

Discussion has also occurred in the planning group on other issues that are less costly but would enhance accessibility on the campus. One of these items is to increase the number of facilities with power assisted doors. While many buildings across the campus have had at least one entrance modified with a power assisted door, there are others that will be examined and considered for this feature. See Figure 2.

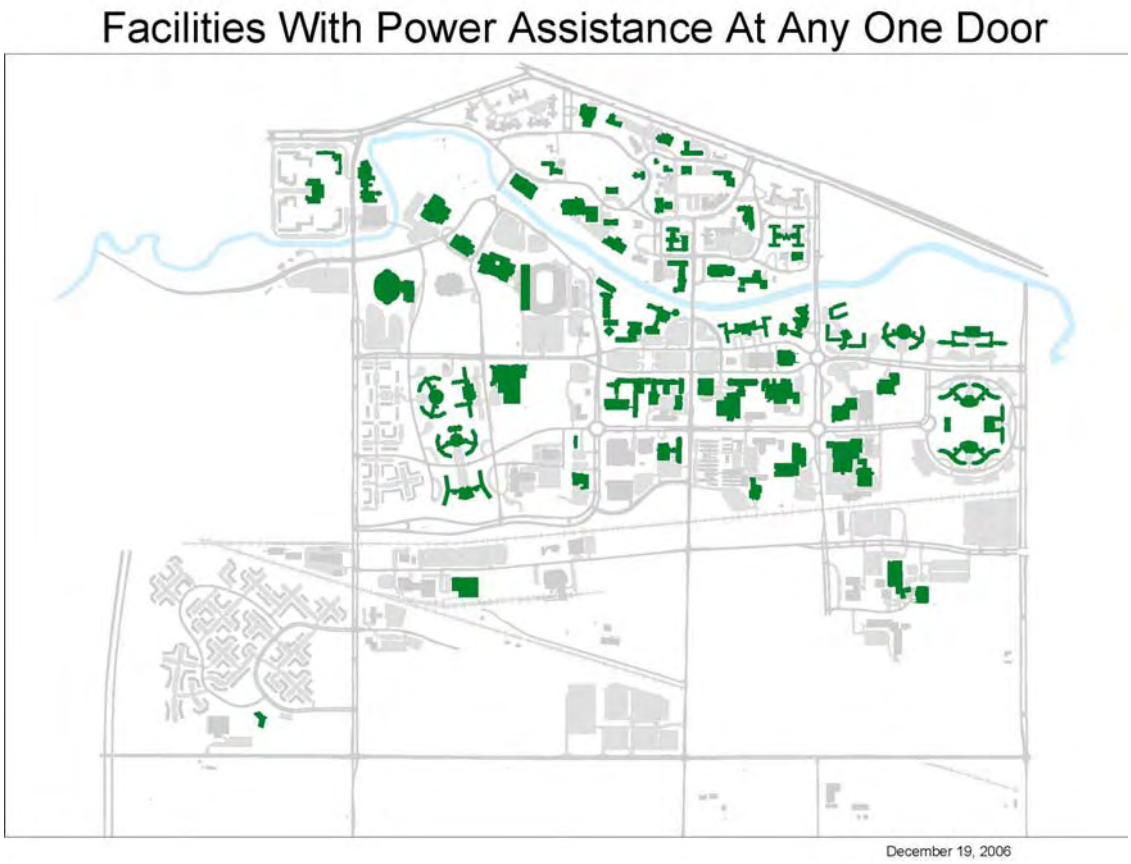



**Figure 2**. *Facilities with Power Assistance at Any One Door*

In summary, plans for dealing with the inherent characteristics of the built environment and the diverse needs of persons with disabilities present a constant challenge in balancing priorities between a totally accommodating and user-friendly environment, and a plan which may be more modest, but acceptable under the requirements. At any given point in time, the University's approach is to deal first with barriers that limit or hinder program access; then with modifications that more fully accommodate the population of persons with disabilities; and last with the many possible refinements of design and state-of-the-art technology that can render a facility more user-friendly. It is noteworthy that in most cases, the University typically goes beyond code requirements, to the extent possible, in the scope and design of individual barrier-removal projects.

More information about the Michigan State University's commitment to barrier free access can be found at: http://opbweb.msu.edu/Accessibility/index.htm

## Chapter 6
## CATA Ridership Information

### Summary

The Capital Area Transportation Authority (CATA) has been providing transit services to Michigan State University since the fall of 1999. Transit ridership has grown significantly since then, due to improvements to routes, increased frequency of service and enhanced user-friendliness.

### Analysis

When CATA took over the campus transit service in 1999, approximately 829,000 rides per year were being provided by the MSU-operated system. During the first year of the contract, the existing campus routes were kept in place while a Comprehensive Operational Analysis (COA) was performed in order to evaluate the quality and efficiency of existing service and to identify possible improvements to both routing and frequency. The existing routes were judged based on industry standards. Several campus focus groups were assembled so that a clear understanding of transit rider needs and desires could be obtained. The information was used to create a plan for a major redesign of all of the on-campus bus routes. When the plan was implemented in FY 2001, ridership nearly doubled, jumping from 912,000 to 1.76 million. Refinements to the routes and student recognition of transit as a viable alternative for campus circulation have produced continuous growth in ridership numbers. Nearly 3.2 million rides were provided on campus in FY 2006. See Figure 1.

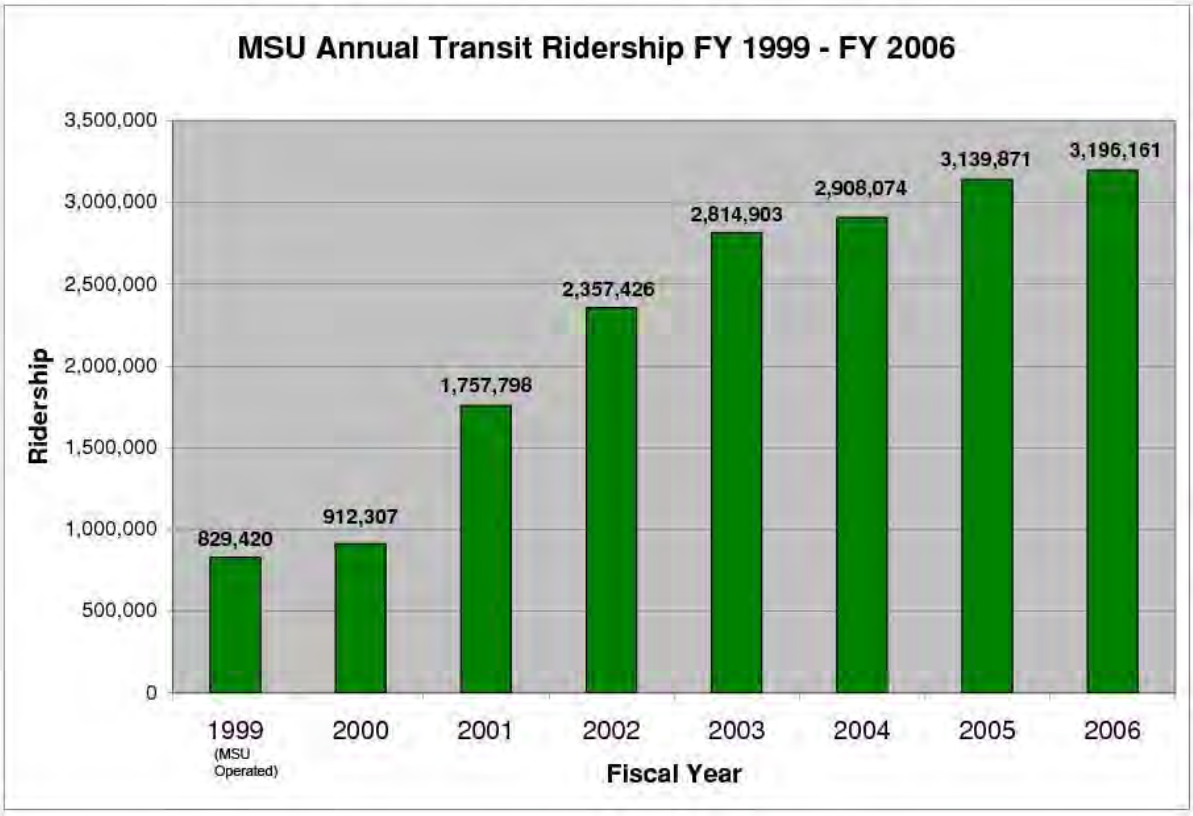



**Figure 1.** *MSU Annual Transit Ridership from FY 1999 – FY 2006*

Off-campus student apartment opportunities have increased greatly with the development of several new complexes in the area. There has been a particular concentration of these developments in the Chandler Road corridor of the northern part of the City of East Lansing. CATA has implemented new routes to accommodate student travel to campus from the new developments. They have also continued to refine the other routes connecting to campus so that optimum service could be provided within budget limitations. As result, continued steady growth has taken place in the number of riders. There were 450,000 riders in FY 2000. That number increased to more than one million in FY 2006. See Figure 2.

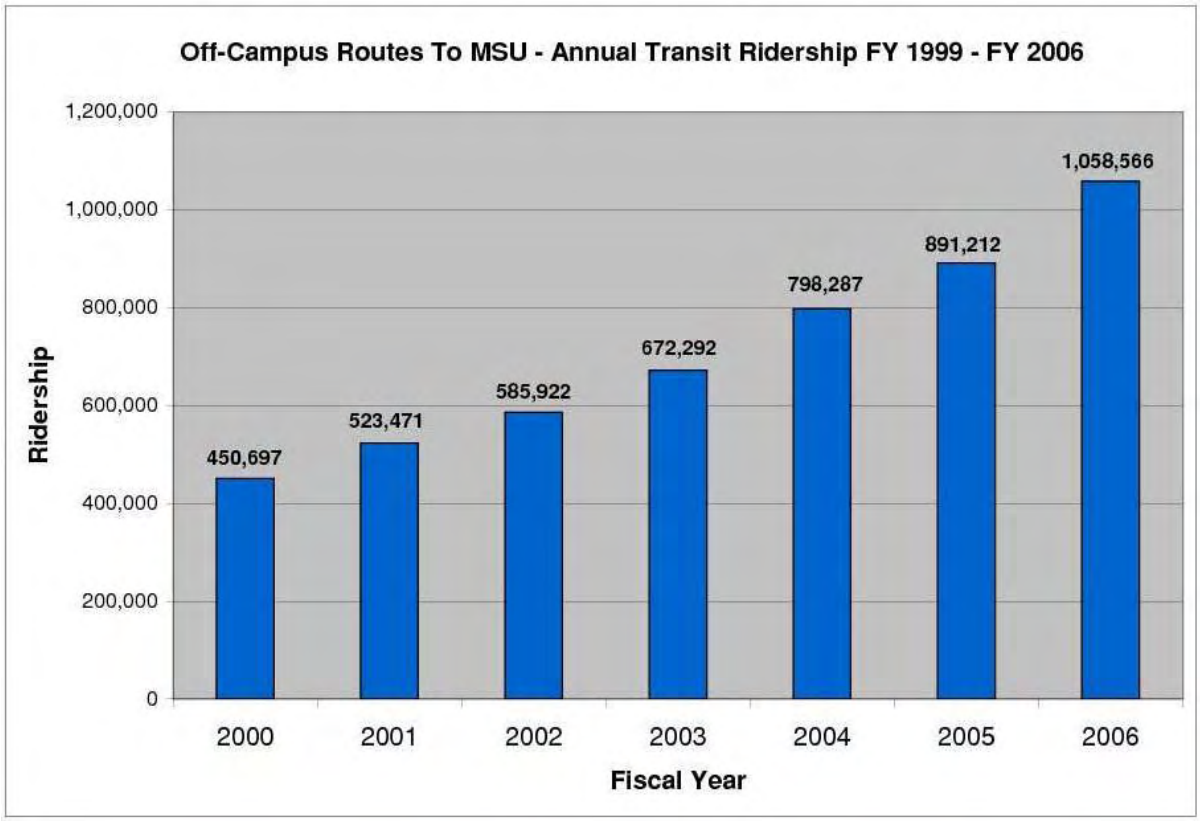



**Figure 2**. *Off-Campus Routes to MSU – Annual Transit Ridership FY 1999 – FY 2006*

While ridership on campus and connecting to campus grew over the last seven years, CATA's non-MSU routes have remained fairly steady in number in the 5 million rides per year range. In total, CATA has had steady growth in system-wide ridership, moving from 6.2 million rides in FY2000 to more than 10 million in FY2006. See Figure 3.

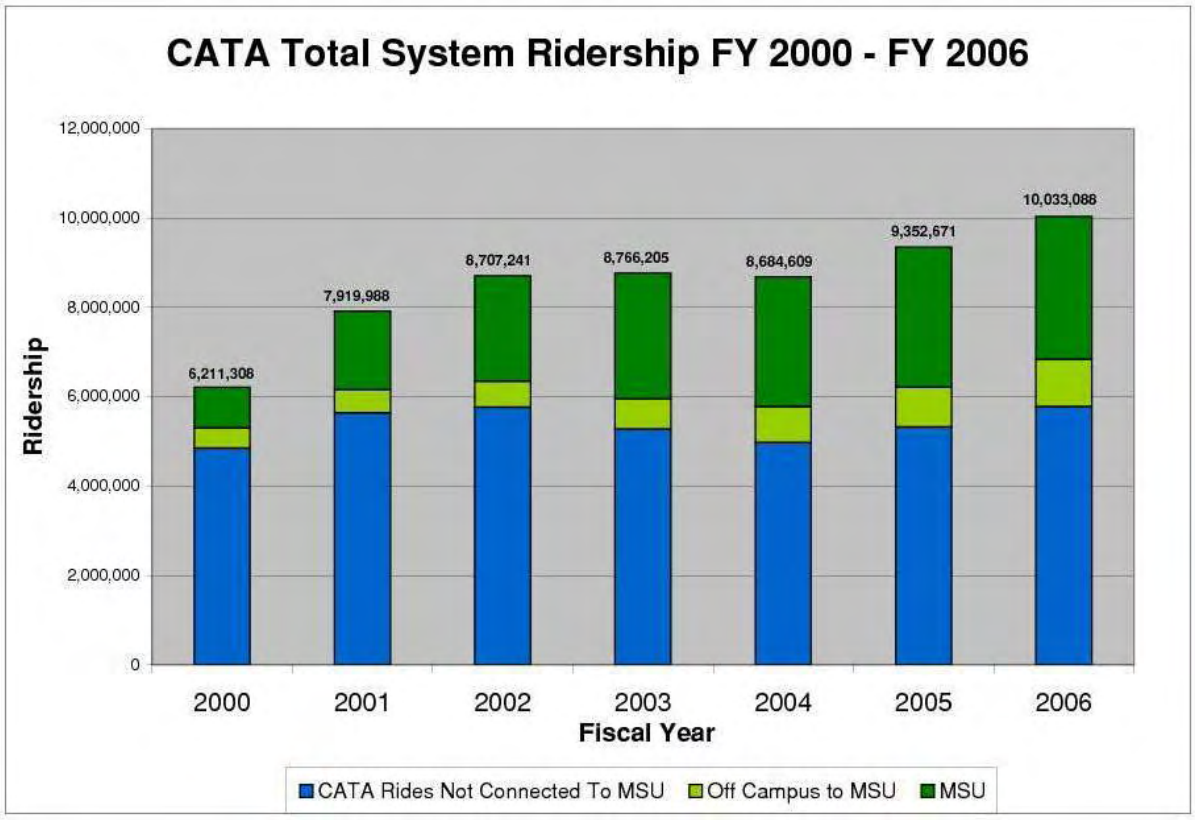



**Figure 3**. *CATA Total System Ridership from FY 2000 – FY 2006*

As expected from the increased ridership numbers, student bus pass sales have also grown significantly, moving from 2,728 in 2000 to 17,279 in 2006. See Figure 4.

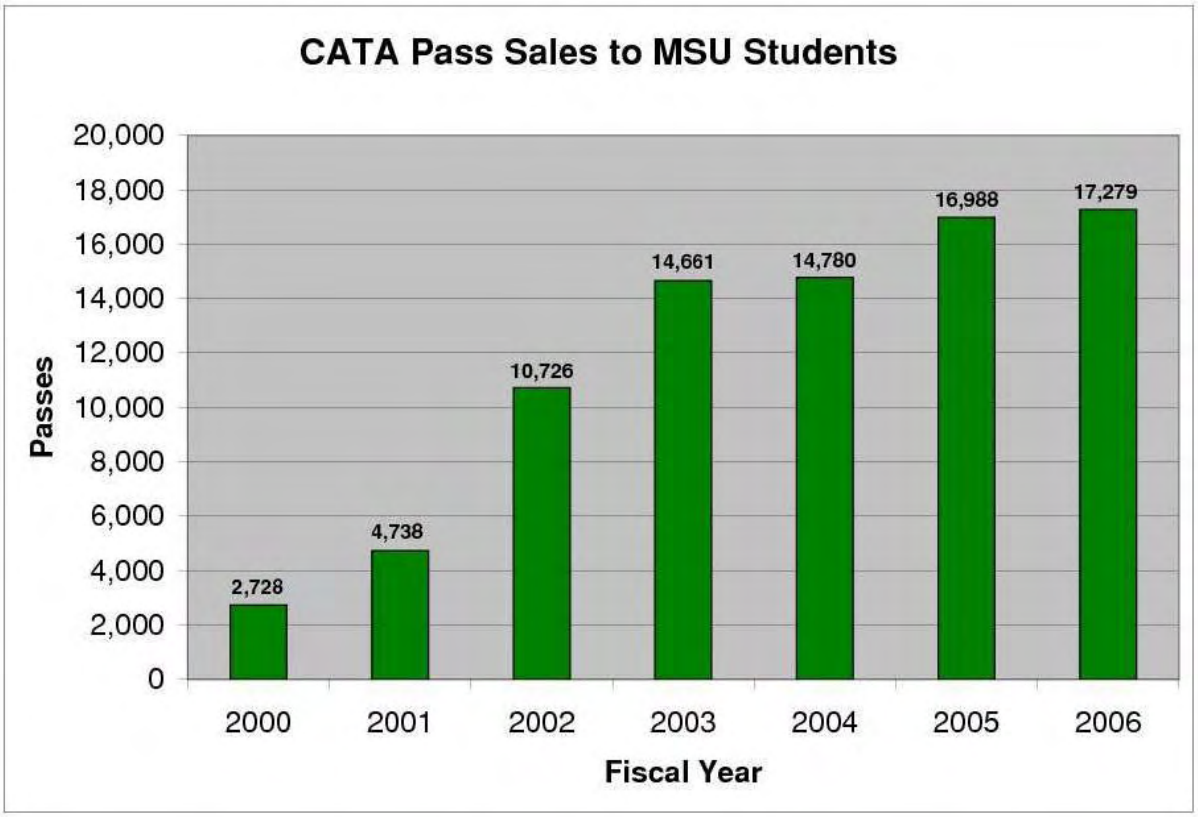



**Figure 4.** *CATA Pass Sales to MSU Students*

**Future Directions**

This past summer, MSU renewed its contract to retain CATA as the university transit service provider. The new agreement extends through FY 2011.

CATA will be conducting a new COA during FY 2007 and it is anticipated that new opportunities for service improvement will be recommended as result and will also incorporate recommendations for route changes once the Farm Lane Underpass project is complete. Cost containment is a key issue for the university, and these opportunities will be evaluated based on their impact not only to service, but also to overall university expense for the future.

# Chapter 7
# Traffic Safety 1996 - 2006

## Summary

Michigan State University's 5200 acre main campus includes 566 buildings, over 25,000 parking spaces and approximately 18 miles of streets. The MSU community consists of 45,000 students, 4,500 faculty and professional staff and 6,000 staff employees. The MSU community and its visitors generate within the limits of the campus approximately 110,000 vehicle trips per day. Unlike most communities with two peak hours of traffic per day, MSU has a "peak hour" of traffic for every 20 minute class change from 8 am until 10 pm.

In the early 1990's, three separate fatal accidents involving trains within the environs of the campus, precipitated an examination of traffic safety issues and in 1995 the MSU Department of Police & Public Safety reactivated the Office of the Traffic Engineer with the specific goal of reducing traffic accidents. Emphasis was placed on reducing personal injuries. Traffic safety was subsequently made a core part of the University's 2020 Master Plan, and thus institutionalized at the executive level.

In 1995, there were 507 crashes and 139 injuries, equating to approximately 28 crashes and 7.7 injuries per mile of campus road per year. The State of Michigan experienced 3.5 crashes and 1.2 injuries per mile of public road per year during the same period. After addressing traffic safety on a number of fronts, campus accidents have been reduced by 62% and injuries have been reduced by 83%.

## Analysis

MSU's streets are not part of the Michigan Accident Location Index (MALI) system and there was no convenient means for locating and analyzing traffic accident reports. It took three years to develop a referencing system and a computer file for locating all traffic crashes. Every crash was also processed into an automated collision diagram.

There are hundreds of traffic control signs on campus. Field reviews of all traffic control devices were conducted. Numerous signs were no longer in compliance with the current Michigan Manual of Uniform Traffic Control Devices (MMUTCD) and were replaced; many others were relocated to improve their visibility. Most of the yield signs were replaced with stop signs. More than 1,000 work orders have been issued in the upgrading of traffic control devices.

Traffic volume counts and vehicular speed studies were taken on all of the streets and added to the data base. Engineering analyses of the traffic volume counts revealed that many of the intersections met the criteria for stop-and-go traffic signals. Many of these intersections were experiencing a profound pattern of right-angle crashes. Over a period of several years many traffic safety improvements have been made:

- Farm Lane and East Circle Drive - existing traffic signal was removed and the intersection eliminated
- Farm Lane at Auditorium Road - traffic signals and geometric reconfigurations were provided

- Farm Lane at Wilson Road - traffic signals and geometric reconfigurations were provided
- Farm Lane at Trowbridge - traffic signals and geometric reconfigurations were provided
- Shaw Lane at Red Cedar Road - traffic signals and geometric reconfigurations were provided
- Shaw Lane at Chestnut Road - traffic signals and geometric reconfigurations were provided
- Wilson Road and Bogue Street - traffic circle reconstructed into a traditional intersection with traffic signals
- Shaw and Bogue - geometry of the existing traffic circle reconfigured, converting the circle to a functioning roundabout
- Trowbridge Road extended eastward into the campus from its intersection with Harrison Road in order to reduce the traffic volumes on North campus.

Figure 1 reflects the intersections that were reconfigured and the change in the number of accidents.

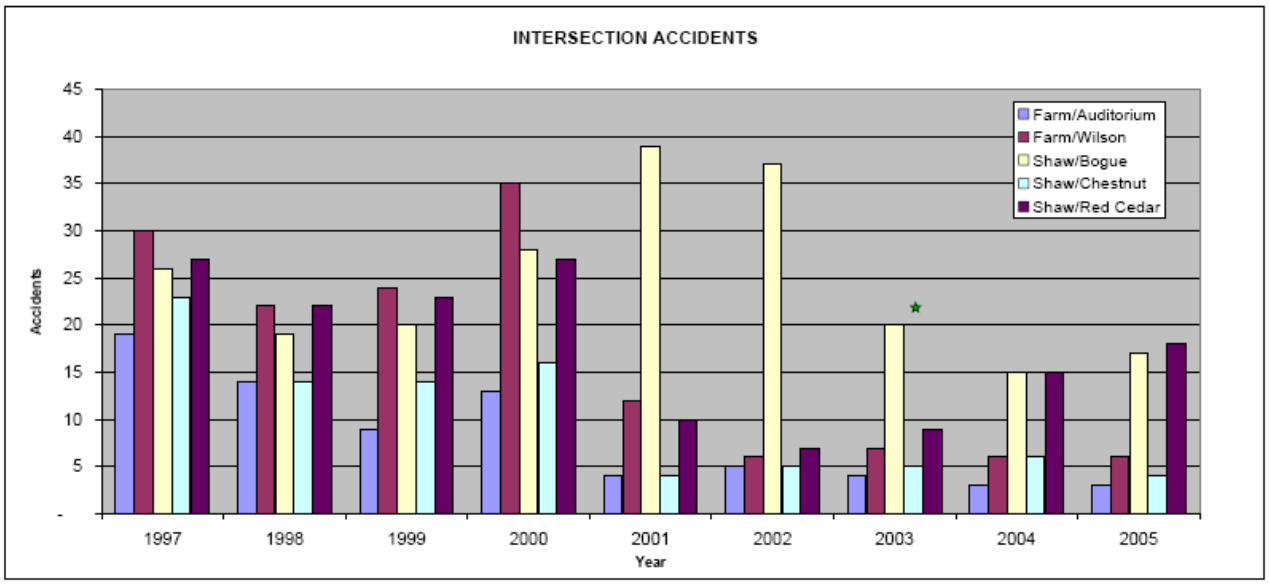



**Figure 1.** *Intersection Accidents on MSU's campus* Demonstrates the successful reduction of roadway accidents (property damage and personal injury) at reconstructed intersections. The statistics prove the value of the capital investment in reconstructing high-accident areas on campus and should be continued. Star indicates lane and pavement marking changes in August 2003

The enforcement of traffic laws has increased to much higher levels, from a low of 770 citations in 1999 to 4,184 citations in 2005, an increase of 440%. Traffic enforcement efforts were targeted at high accident locations, locations with high vehicular-pedestrian conflicts, and locations where speed was an accident factor. Additional radar and laser equipment were put into service. A motorcycle unit became operational, facilitating enforcement in congested areas. Please refer to Table 1 and Figure 2.

**Table 1**. *Traffic Citations By Category from 1996-2006*

**TRAFFIC CITATIONS 1996-2006**

| TRAFFIC TICKETS WRITTEN | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 (to date) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| RECKLESS DRIVING | 24 | 7 | 2 | 5 | 2 | 1 | 0 | 0 | 0 | 4 | 0 |
| SPEED VIOLATIONS | 641 | 493 | 629 | 736 | 727 | 900 | 903 | 1,021 | 1,336 | 1,626 | 1,326 |
| TRAFFIC CONTROL DEVICES | 327 | 279 | 292 | 304 | 212 | 101 | 106 | 250 | 213 | 148 | 91 |
| RIGHT OF WAY | 44 | 46 | 39 | 34 | 106 | 143 | 165 | 280 | 190 | 265 | 160 |
| TURNING MOVEMENTS | 91 | 88 | 72 | 61 | 39 | 35 | 43 | 59 | 74 | 60 | 67 |
| PASSING & LANE USAGE | 10 | 18 | 12 | 17 | 8 | 19 | 17 | 29 | 28 | 36 | 25 |
| ONE WAY VIOLATIONS | 18 | 18 | 14 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| OTHER MOVING VIOLATIONS | 45 | 72 | 36 | 49 | 48 | 95 | 112 | 180 | 132 | 33 | 17 |
| LICENSE & REGISTRATION VIOLATIONS | 697 | 737 | 839 | 793 | 478 | 669 | 846 | 1,068 | 958 | 1,154 | 812 |
| DEFECTIVE EQUIPMENT | 164 | 112 | 92 | 84 | 61 | 96 | 72 | 92 | 87 | 169 | 133 |
| LEAVING THE SCENE - FATAL ACCIDENT | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| LEAVING THE SCENE - PERSONAL INJURY | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| LEAVING SCENE/FAIL TO REPORT - PROPERTY DAMAGE | 9 | 12 | 16 | 12 | 11 | 6 | 6 | 14 | 8 | 6 | 1 |
| PEDESTRIAN VIOLATION | 3 | 0 | 0 | 0 | 3 | 0 | 1 | 2 | 5 | 1 | 0 |
| BICYCLE VIOLATION | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SEATBELT VIOLATION | 0 | 0 | 0 | 94 | 242 | 149 | 533 | 852 | 630 | 661 | 608 |
| OTHER NON-MOVING VIOLATIONS | 373 | 517 | 853 | 504 | 88 | 4 | 21 | 18 | 31 | 20 | 12 |
| **TICKET TOTALS** | 2,446 | 2,399 | 2,897 | 2,703 | 2,025 | 2,218 | 2,825 | 3,865 | 3,692 | 4,184 | 3,254 |

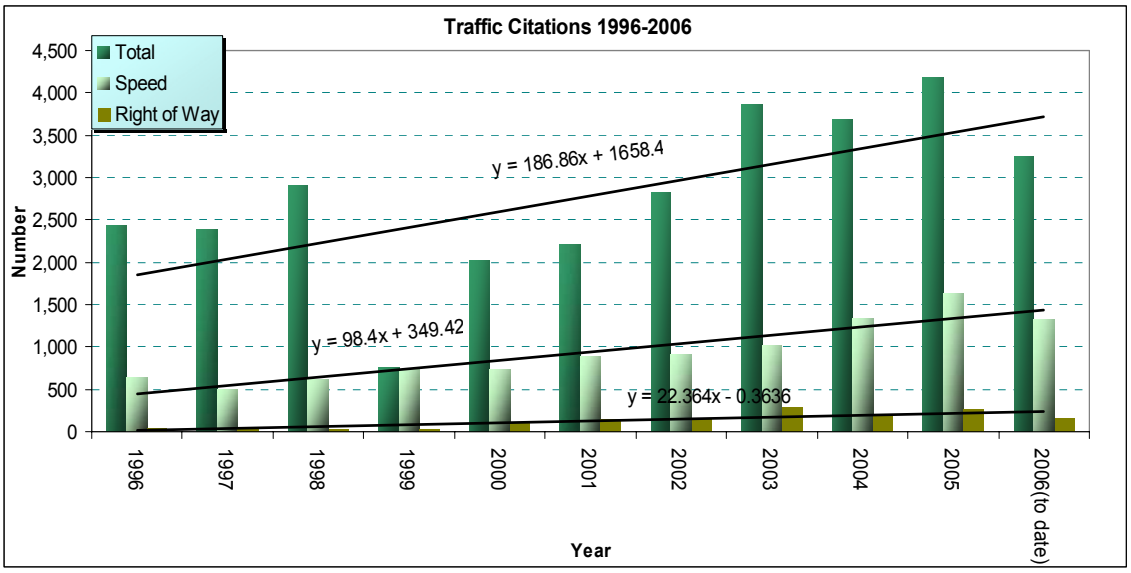



**Figure 2.** *Increase in Traffic Citations from 1996-2006*

In the face of a major shortage in parking spaces, considerable on-street parking was removed at locations with an adverse crash history. Additional parking was provided at the periphery of the academic core, resulting in a significant reduction in traffic volumes by generating shorter trips. When a large parking lot was reconstructed its geometric design was changed to improve safety (early results are very encouraging). CATA bus services were expanded to enhance the use of perimeter parking and reduce the number of vehicle trips. The cumulative effect of managing the parking on campus has greatly reduced and redistributed traffic volumes.

The intersection of Kalamazoo Street, Chestnut Road and Red Cedar Road, had the "Sparty" statue located in the center of traffic and the resulting geometry was so confusing that no satisfactory traffic control was found. The intersection was

reconstructed to have only three legs and an all-way stop sign control. Pedestrian and bicycle traffic circulation was accommodated successfully in the new design.
A standard design for bus stops was developed with help from CATA. The primary goal was to eliminate sight restrictions for pedestrians created by a stopped bus. Every bus stop was field reviewed and many were changed and/or relocated.

A standard was developed for pedestrian crosswalks. Over 150 crosswalks were field reviewed. Most of the crosswalks were modified to fit the standard. Others were eliminated. Often chaining or landscaping was installed along the street margin to reduce the frequency of pedestrians crossing outside of a marked crosswalk.

Cameras and communication hardware were provided for the traffic signals, and a signal coordination plan was developed and installed. Traffic exiting campus is presently progressed at the expense of traffic entering campus, thus reducing vehicular backups in the presence of pedestrians.

Of major concern was the paucity in the number of motorists yielding to pedestrians in crosswalks. A special “yield to peds” sign was developed for MSU. These signs are placed daily in the middle of the road in proximity to the crosswalks. The sign folds up if struck by a vehicle. There has been a noticeable improvement in motorists yielding to pedestrians and a very similar sign has since been added to the Michigan Manual on Uniform Traffic Control Devices.

The cumulative impact of all of the traffic safety initiatives has been significant. Table 2 shows the reductions in the number of accidents over the life of this program.

Figure 3 illustrates the impacts with the regression lines indicating that there has been a decrease of 20 accidents and a decrease of 8 injuries per each year of the program. The projected 2006 crash data indicates a 62% reduction in the number of accidents and an 83% reduction in the number of injuries since 1995. This degree of accident reduction in a community or university setting is unprecedented, as far as can be determined. Using data provided by the National Safety Council on the societal costs of traffic crashes, approximately $10 million in savings will be realized in 2006 (compared to 1995) alone.

**Table 2**. *Number of Accidents per Year Analysis*

| Year | Number of accidents | Number of Injuries |
|---|---|---|
| 1995 | 507 | 139 |
| 1996 | 458 | 89 |
| 1997 | 494 | 97 |
| 1998 | 403 | 82 |
| 1999 | 397 | 83 |
| 2000 | 438 | 63 |
| 2001 | 356 | 75 |
| 2002 | 430 | 42 |
| 2003 | 360 | 48 |
| 2004 | 358 | 47 |
| 2005 | 337 | 46 |
| 2006 (Jan-Sept) | 147 | 18 |
| Projected 2006 | 195 | 24 |

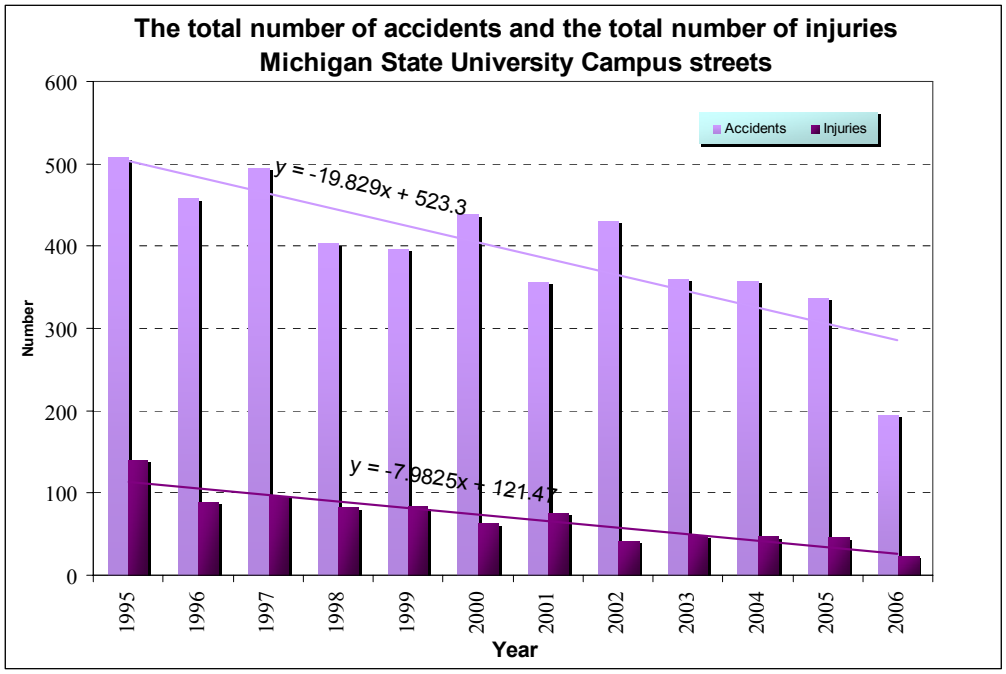



**Figure 3.** *Total Number of Accidents and Injuries on MSU Campus Streets*

Changes to the vehicular transportation system have also had positive effects on traffic volumes in high pedestrian areas. Figures 4 & 5 illustrate the changes in average daily vehicular trips (ADT) from 1997 to 2005. In most academic areas, the number of vehicle trips has gone down. This is a positive benefit to pedestrians because conflicts with vehicular traffic have been reduced. The reduction of vehicle trips in the academic core was one of the planning goals of the 2020 Campus Master Plan and the data indicate that good progress has been made.

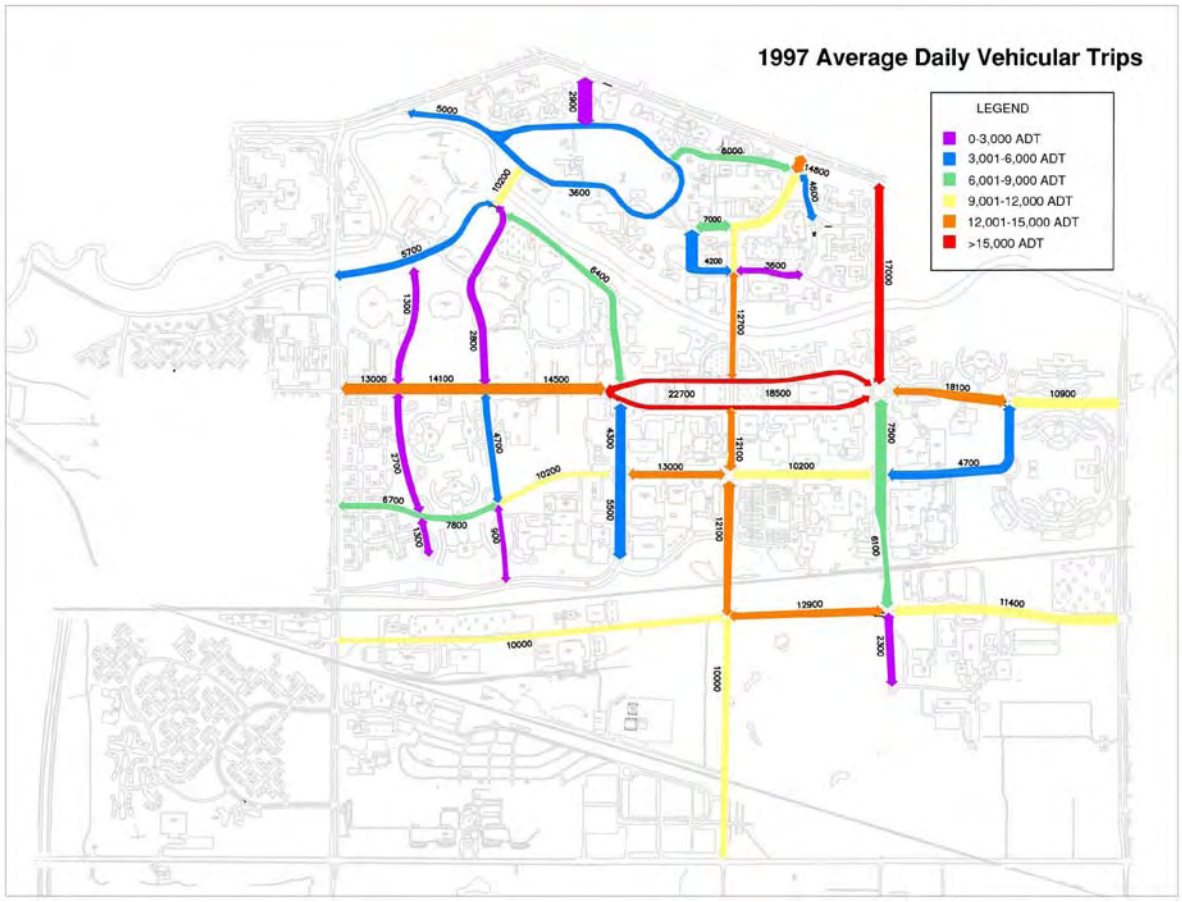



**Figure 4**. *1997 Average Daily Vehicular Trips on MSU Campus*

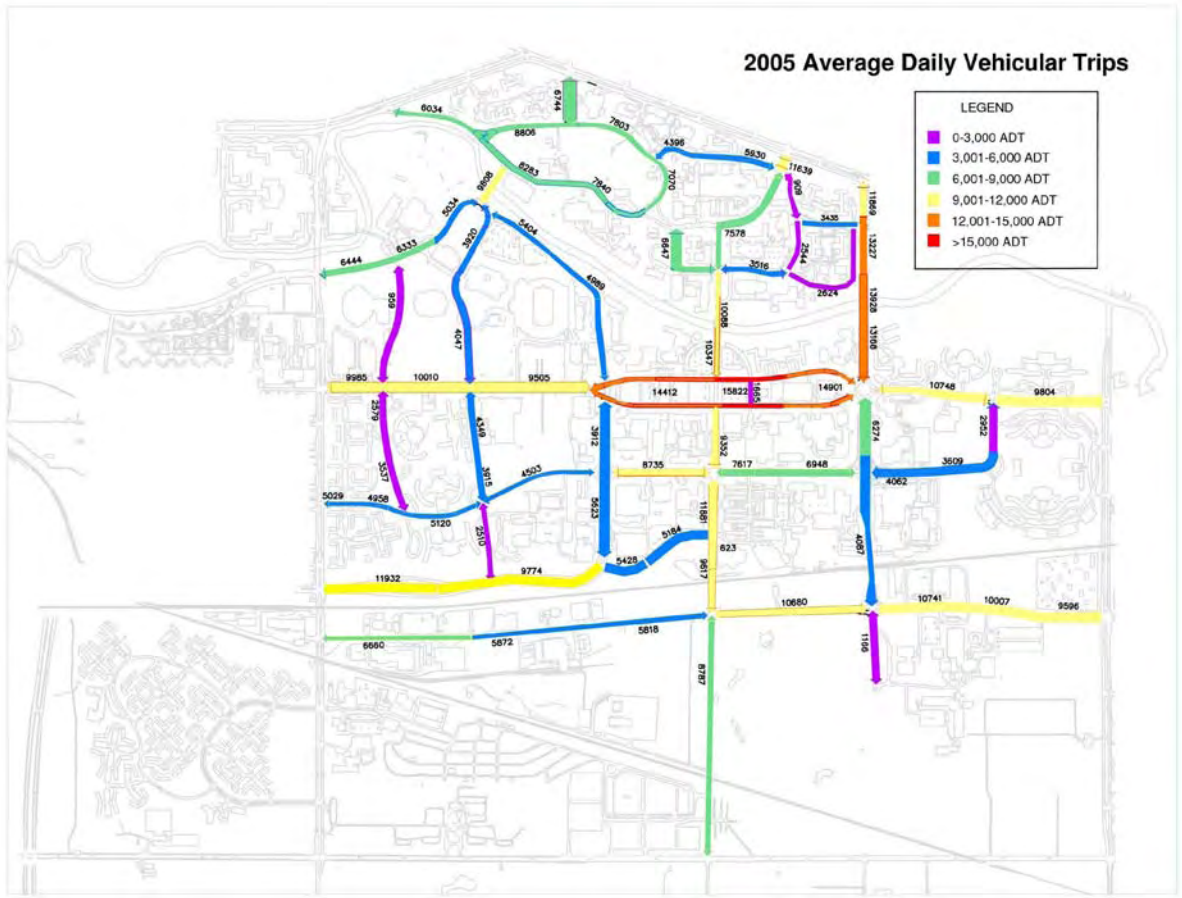



**Figure 5.** *2005 Average Daily Vehicular Trips on MSU Campus*

**Future Directions**

Federal funding was obtained to provide grade separations for Farm Lane with its two railroad crossings. MDOT has agreed to oversee this complex project and construction plans are being prepared. The grade separations will provide enhanced safety and operational benefits for the university and the region. Project completion is anticipated in 2009.

Traffic count and accident data will continue to be collected in order to document the effects of past safety improvements and to guide solutions to remaining safety problems. Lessons learned will be applied to future campus development.

Parking lot safety improvement will be a major area of focus in the future, with emphasis on reduction of accidents and injuries. With virtually nothing published on this topic, some experimentation will be required to determine the most effective design standards for both safety and operational efficiency.

# Chapter 8
# Parking

## Summary

With the recent opening of the Grand River Parking Ramp, campus-wide parking ratios meet the identified target established in the 2020 Campus Master Plan (0.90 parking spaces for every faculty, staff, and graduate assistant); however, some districts have a surplus while others have a deficit.

Refer to Figure 1. University Zoning District Map for a depiction of specific planning areas.


**Figure 1**. *University Zoning District Map*

Initiatives to expand research activities are anticipated to increase the population of researchers and graduate students on campus. This population increase will necessitate additional parking resources to meet projected demand. Greatest new demands are anticipated within the Central and South Academic Districts.

## Analysis

*Parking Assessment Parameters*

The 2020 Campus Master Plan identified an ideal goal of providing 0.90 parking spaces per every faculty, staff, and graduate assistant. This ratio was based on current

vehicular mobility patterns that include unrestricted access to any properly designated employee permit lot and ample supply to meet daily demand with some flexibility to accommodate vehicular movement between districts throughout the work day. It should be noted that while the 0.90 ratio offers an ideal goal, the campus can and does operate effectively at a slightly lower ratio. Table 1 reflects the historic, current, and estimated parking supply/demand ratios.

**Table 1.** *District Summary for Estimated Parking Supply and Demand*

| District Summary | | | |
|---|---|---|---|
| **District** | **2020 Vision** | **December 2006** | **2012 Estimate** |
| North Academic District | 0.74 | 0.87 | 0.85 |
| Central Academic | 0.77 | 0.78 | 0.71 |
| South Academic | 0.85 | 0.84 | 0.90 |
| Athletic | 5.85 | 2.09 | 1.91 |
| East Residential | 1.33 | 1.20 | 1.20 |
| Support | 1.75 | 1.78 | 1.68 |
| West Residential | 1.26 | 1.05 | 1.05 |

*This data compares the parking ratios identified in the 2020 Vision Campus Master Plan to current and projected conditions through the year 2012.*

New population data was provided by Human Resources through the campus Geographic Information System (GIS) based on a zip code plus four digit accounting with fractional values (e.g., an employee with an address in two districts is counted in both at ½ value). New parking supply numbers were provided by the Department of Police and Public Safety (DPPS) with a field count of the North Academic District conducted in early 2006.

*District Comparisons*

The greatest parking supply deficit identified in the 2020 Vision Campus Master Plan, within the North Academic District, has been positively addressed. The parking ratio has increased over the last five years from 0.74 to 0.85 along with an increase in the visitor parking supply (approximately 160 spaces in the Grand River Ramp). The North Academic District had a small growth in population but a notable growth in parking supply due to the new Grand River Ramp opening in December 2006. With the removal

of numerous on-street parking spaces over the next five to six years (200 total spaces removed, 150 faculty/staff and 50 visitor), the parking ratio will adjust downward but remain adequate. Full realization of the Campus Master Plan will further reduce the parking ratio to 0.70; however, if the proposed School of Music building is located in the Central Academic District and Parking Lot #9 (located east of Giltner Hall, between Giltner Hall and the Auditorium) remains open, the ratio is estimated at 0.79.

Table 2 shows the anticipated gain and loss of parking spaces through 2012. The summary of the table is as follows

- West Circle Drive: removal of 47 on-street employee parking spaces plus an additional 16 on-street visitor parking spaces across from the Union to improve safety
- Snyder Phillips: loss of 43 spaces due to new building footprint and service access off the Baker Hall vehicular drive
- Grand River Ramp: addition of 553 faculty/staff spaces
- East Circle Drive: removal of 102 employee spaces (40 north of Kedzie Hall for creation of open space and 62 on-street spaces) plus an additional 11 on-street visitor spaces adjacent to Student Services
- An additional 42 employee spaces are projected for removal along the northern segment of East Circle Drive (from Berkey Hall to Student Services) plus 6 visitor spaces
- Bessey Hall Ramp: displacement of existing parking for ramp rebuild and expansion

**Table 2.** *North Academic District Parking Summary*

| Construction Impact to Faculty & Staff Parking Supply | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | |
| West Circle Drive Modifications | | (-35) | (-12) | | | | | | |
| Snyder / Phillips Construction | | (-43) | | | | | | | |
| Grand River Garage | | (+553) | | | | | | | |
| East Circle Drive Modifications | | | (-102) | | | | (-42) | | |
| Bessey Garage Reconstruction | | | | | | (-610) | | (+730) | |
| | | | | | | | | | |
| Parking Surplus / Deficit @0.9 Spaces per Employee | -500 | -179 | -281 | -284 | -308 | -846 | -886 | -246 | |
| Effective Ratio | 0.75 | 0.85 | 0.81 | 0.81 | 0.81 | 0.64 | 0.63 | 0.82 | |

Based on current inventory and projected construction project timing, this figure illustrates when major construction projects will impact parking for faculty and staff within the North Academic District. Red indicates a reduction in supply and blue indicates an increase in supply. The surplus/deficit number indicates the difference from the ideal goal established in the 2020 Vision Campus Master Plan, which identifies a parking supply of 0.90 spaces for every faculty and staff residing in the district.

Parking ratios are expected to drop within the Central Academic District with anticipated future population increases to support expanding research endeavors. With a projected population increase of approximately 800 people, construction of two parking ramps (at the stadium and southwest corner of Shaw and Red Cedar Road), and elimination of the central surface parking lots over the next 20 years, the effective ratio will drop to approximately 0.64. This will require a reassessment of who has privileges to park within this district. If the visitor/commuter lot #79 south of Spartan Stadium is reassigned for faculty and staff and reallocated from the Athletic District to the Central Academic District where a majority of its users are destined then the long-term effective ratio will approach 0.76.

The South Academic District has flexibility to balance future facilities and population growth with future parking resources. Given its remoteness from the other campus districts, it is not assumed that any surplus here will offset deficits elsewhere.

The Athletic District witnessed a slight growth in population primarily from the stadium mixed-use project; however it maintains a parking surplus. The visitor/commuter lot south of the stadium (Lot #79) is not factored into the supply today (616 spaces), but could be reassigned to meet projected demand increases within the adjacent Central Academic District. Additional perimeter commuter parking will be required to offset the

reassignment of this parking to faculty and staff to meet future projected parking deficits within the adjacent Central Academic District.

The East Residential District parking ratio dropped from 1.33 to 1.20 primarily based on the new population estimates. Visual observations of the parking lot utilization rates indicate a higher demand than what was calculated, warranting a future verification of the population data and utilization patterns.

The ratio within the West Residential District remained just over 1 parking space for every faculty, staff and graduate assistant with no measurable projected change in the future.

The Support District's parking ratio is projected to remain relatively constant with a surplus of parking supply within the twenty-year campus planning horizon.

*Parking Violations*

According to the DPPS, anecdotal evidence from customers in the University Police Department Parking Office suggests that the current fine cap to parking violations on college and university campuses in Michigan is too low to act as a deterrent for illegal parking. Many motorists accumulate hundreds of dollars in fines while at the same time negatively impacting the parking supply for valid permit holders. Refer to Figure 2. *Parking Violation Trends* for a 25-year review of collected data.

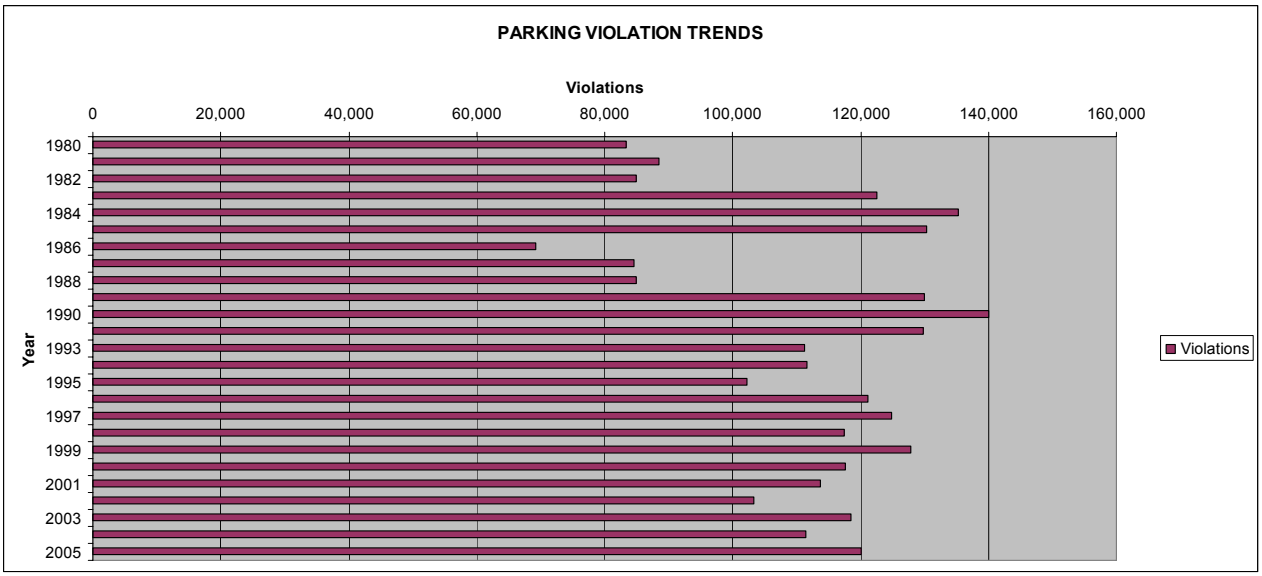



**Figure 2.** *Parking Violation Trends* Chart depicts the number of parking tickets issues on an annualized basis. A violation is a parking citation issued by a department employee for violation of university ordinances or state law. Year to year variations in citations issued may result from such events as the introduction of new technology, reconstruction of major parking lots, and the gating of increasing numbers of parking facilities.

*Gated Parking*

Numerous parking facilities are gated, restricting access during the work day to valid permit holders or paying visitors. Refer to Figure 3 *Gated Parking Facilities Map* for the location of gated parking facilities on campus. Access to gated parking facilities is governed by a card-swipe access control system or staffed by an attendant.

Approximately 7,560 parking spaces are located within gated facilities, which accounts for approximately 30% of the overall campus supply.

**Figure 3.** *Gated Parking Facilities Map*

## Future Directions

Future parking challenges will be greatest within the Central Academic District, due to anticipated population growth and displacement of existing parking supply per the Campus Master Plan. Additional parking ramps and reassigning commuter parking to faculty/staff/visitor parking may be required along with additional perimeter parking in other districts that is well serviced by mass transit. Additional perimeter parking locations include the northeast corner of Mount Hope Road and Farm Lane, repurposing of the State Police facility should this become available, and repurposing of the Agriculture Exposition site.

Graduated parking rates are required to promote utilization of perimeter parking facilities by faculty and staff along with enhanced year-round transit service. The Farm Lane railroad underpasses will enhance efficient connectivity of the campus' academic core with the perimeter parking facilities.

Parking fines should be increased to reduce the number of violations and increase the available parking supply for those with valid permits but are State regulated as to the amount.

A campus-wide parking utilization study should be completed to improve our understanding of parking patterns and to prioritize future investments.

University-sponsored initiatives that promote alternative modes of transportation should be investigated.

No assessment was prepared for resident and commuter student parking; however, visual observations indicate the existing parking supply is heavily used.

# Chapter 9
# Safety & Security

## Summary

In the last three years, significant steps have been made to enhance the security of people and infrastructure at Michigan State University. Two committees, the Safety and Inspection Committee for Property and Casualty (SICPAC) and the Card Access team have been the primary drivers for significant safety and security enhancements since 2003. As a result of their efforts, the University has been able to systematically approach four key safety and security issues: Fire alarms, smoke detectors, building sprinklers and card access/security alarms (interior and exterior).

## Analysis

*SICPAC*

SICPAC was established in 1988 to review inspection reports from the University's external insurance consultants and determine priorities for funding or otherwise establish follow-up issues. In the past few years, the mission was expanded to serve as a repository for tracking facility-related safety issues, provide collective consultation and advice on safety matters, and review and prioritize projects based on potential risk factors.

In 2003, SICPAC funded adding sprinklers and smoke detectors to several buildings to increase the protection to facilities during a fire. Additionally, funds were allotted to begin implementation of exterior door card access of high priority buildings. To determine building priority, several risk categories were considered to come up with a "risk ranking" for each building.

Today, the number of buildings with full smoke detection has increased from 16 (in 2004) to 37. The number of buildings with exterior door card access has increased from 47 (in 2003) to 58 (Figure 1). Interior card readers have increased from 28 to 480 (Figure 2), and there are over 7,500 users. The card access system has also increased in size and capacity and an access control unit was developed with the Department of Police and Public Safety.

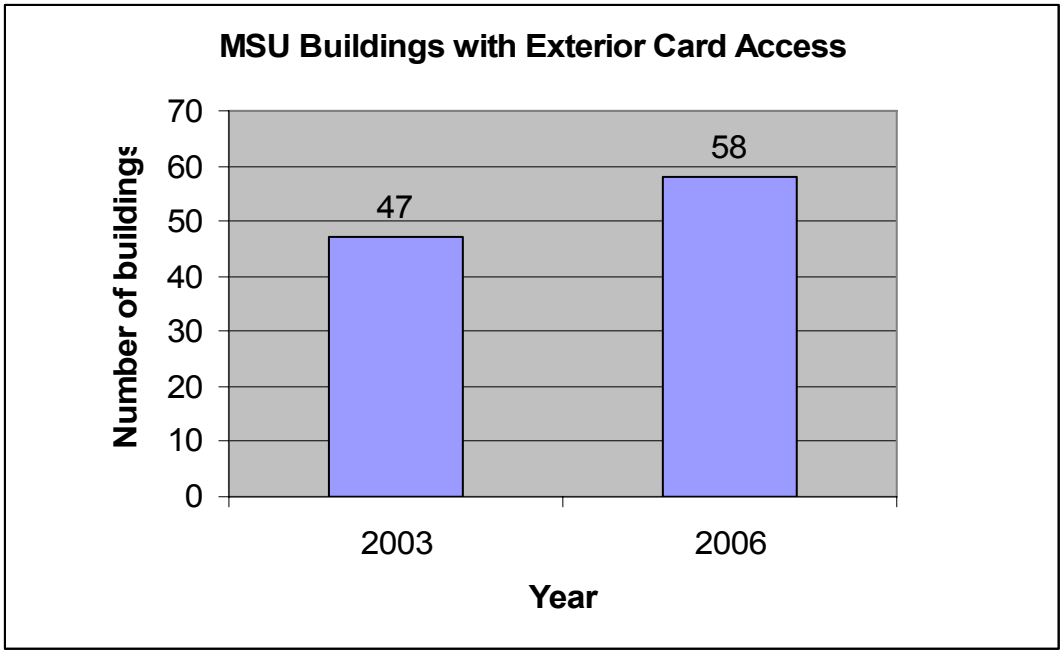



**Figure 1.** *MSU Buildings with Exterior Card Access*

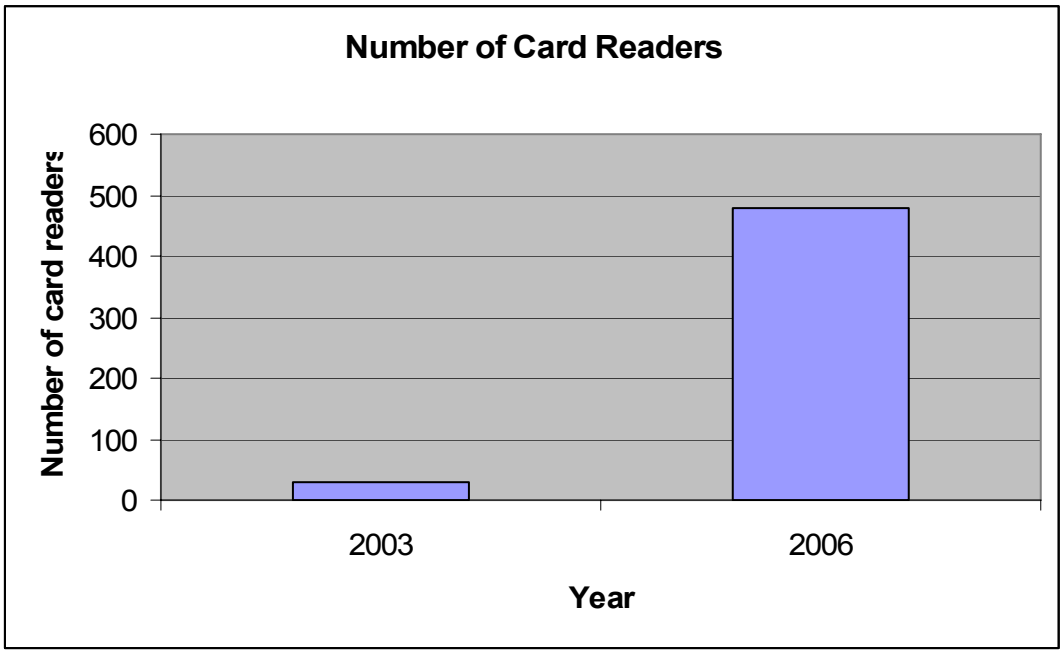



**Figure 2.** *Number of Card Readers for Interior and Exterior Card Access*

Also in 2003, most of the campus fire alarm systems were stand alone and did not report to a central location. As a result of the access control project, now all of the building evacuation alarms are centrally monitored through the Department of Police and Public Safety. Also, a new access/alarm system was added and today the new system has many addition features and is able to meet the needs of the University for several years.

The access/alarm system in 2003 was at that time more than seven years old, unable to expand and operated by two police department staff members, on a part time basis. Today the new system has many additional features, is able to meet the needs of the University for several years.

*Enhanced Security Work Group*

The Enhanced Security working group was formed in June 2006 with the goal of creating enhanced security criteria and an implementation plan for interior spaces, server rooms, and farm areas. In December 2006, the group completed its charge by establishing card access and enhanced security criteria checklists and a developed a plan to implement the new security measures.

The building construction standards were also updated to reflect the need to equip the exterior doors of all new buildings and major renovations with card access. The standard also requires a review of all interior rooms, using the developed checklist criteria, to determine if access control or enhanced security is required.

*Moving from Keys to Cards*

Moving from keys to access cards offers several advantages and cost saving opportunities:

- Lost cards may be instantly deleted from the system and made inoperable, lost keys cannot
- Cards allow for the restricting of access by area, time, day, etc.
- Access control can be used to remotely lock and unlock facilities, eliminating the current practice of opening buildings by key starting in the early morning hours and increasing exposure to theft and vandalism
- Cards may be used for multiple functions such as identification, building access, and meal plans

To ensure a simplified and cost effective card access system, the University is developing a plan to move to a universal card stock, so that one card can provide access to academic buildings, residence halls, library and technology services, parking lots, and other campus areas. In the interim, new key policies have been instituted to enhance security.

**Future Directions**

Although there have been significant strides to enhance the security on campus, there are still ways for Michigan State University to improve safety and security.

Instead of operating separate working groups (i.e., SICPAC, Enhanced Security), the decision was made to create a University Safety and Security committee to address safety issues related to facilities and infrastructure. The team has a wide range of membership to capture many different areas of expertise on campus related to safety, security, and risk.

# Chapter 10
# South Campus Farms Nutrient Management

## Summary

South Campus Farms are faced with a significant challenge related to manure phosphorus production and sustainable nutrient management on the South Campus Farms land base. Shrinking research support acres and increasing soil phosphorus levels are having a severe impact on the sustainable operation of the livestock facilities, Pavilion, and Veterinary Medicine. With increasing regulatory requirements over the years, we have been unable to handle in a sustainable manner, all of the manure and nutrients being generated without incorporating composting and raw manure export into the comprehensive nutrient management plan (CNMP). Recent surface water related regulations have added substantial requirements to the way South Campus Farms are managed. The collective size of the animal populations on the South Campus Farms classifies MSU as a Concentrated Animal Feeding Operation (CAFO) and requires the livestock facilities, Pavilion, and Veterinary Medicine to operate under a National Pollution Discharge Elimination System (NPDES) CAFO permit. A number of initiatives have already been implemented to promote future sustainability and to meet regulatory compliance requirements, with additional projects under consideration.

The South Campus Farms are diligently working to:

1. Balance nutrients being produced from the livestock facilities, Pavilion, and Veterinary Medicine with soil nutrient levels and a shrinking land base;

2. Secure additional funding to complete regulatory required facility enhancements;

3. Provide facilities and land base to maximize researchable and educational opportunities.

## Analysis

*Land Base and Soil Nutrient Loading*

Over the years, South Campus Farms land base acreage losses have been attributed to departmental research projects, buildings and facilities, and environmental requirements and setbacks (Figure 1). Research support acres are plots of land that support research conducted in departmental projects, buildings and facilities. They include areas for growing animal feed and land used for manure disposal. Because research land has increased, the amount of land available for research support has decreased. Research support acreage totaled 1,325 acres in the early 1970's and has been reduced to 978 acres in 2006. Of these 978 acres, 388 acres are currently available for manure nutrient application (spreadable acres) while the remaining acreage is utilized as pasture or is marginal land not suitable for manure application. Spreadable acres generally fluctuate with the cropping plan for corn and wheat as these are the fields that can and will receive manure applications annually (Figure 2). Significant acreage losses in 1991 were related to removing fields with high phosphorus soil tests from the manure spreading plan. Significant acreage losses in 1998 were related to eliminating

the majority of pastures and all marginal land from the manure spreading plan. Significant acreage losses in 2004 were related to eliminating the remaining pastures (30 Acres used on a limited basis) out of the manure spreading plan.

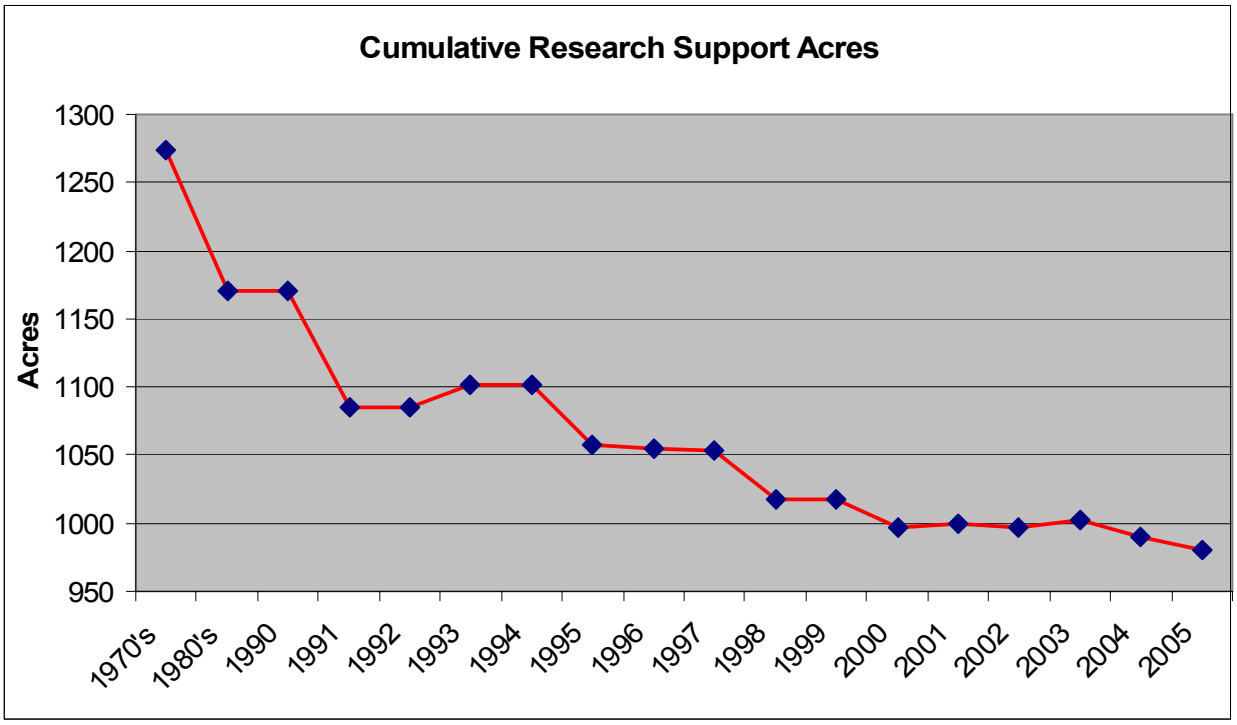



**Figure 1.** *Cumulative Research Support Acres* Impacts to the amount of research support acreage available (1,325 Acres in early 1970's to 978 Acres in 2006). Acreage losses are attributed to departmental research projects, buildings and facilities, and environmental regulations and setbacks

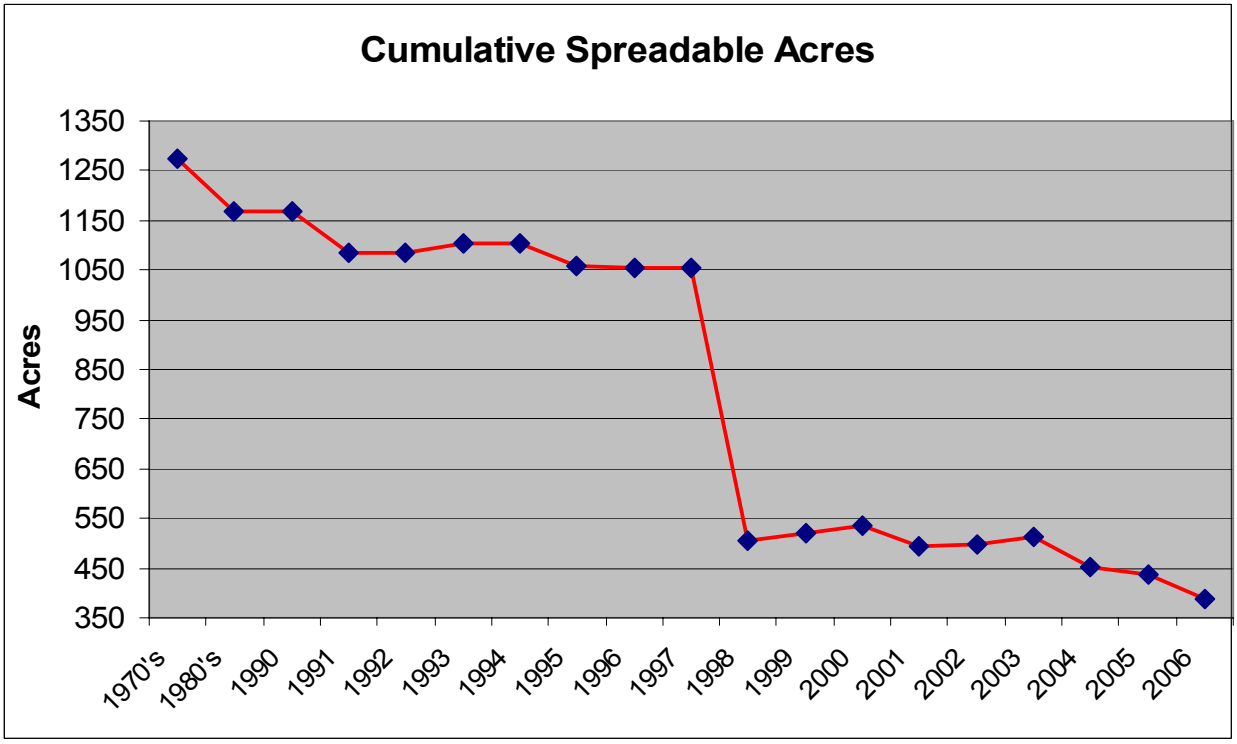



**Figure 2.** *Cumulative Spreadable Acres* Impacts to the amount of research support acreage available for manure application (spreadable acres) (1,325 Acres in early 1970's to 388 Acres in 2006)

While available manure application acreage has continued to decline, phosphorus loading has been steadily increasing (Figure 3) to a point where the average soil phosphorus loading across all research support acres is 160+ lbs/Ac. At 150 lbs of soil test phosphorus, additional application of phosphorus is limited to agronomic rates, based upon one year of crop removal (52 lbs/Ac). At 300 pounds of soil test phosphorus, additional application of phosphorus is not considered a Generally Accepted Agriculture and Management Practice (GAAMP) under Right to Farm. Since 1990, over 100 acres have become unavailable for manure application due to high phosphorus soil test levels.

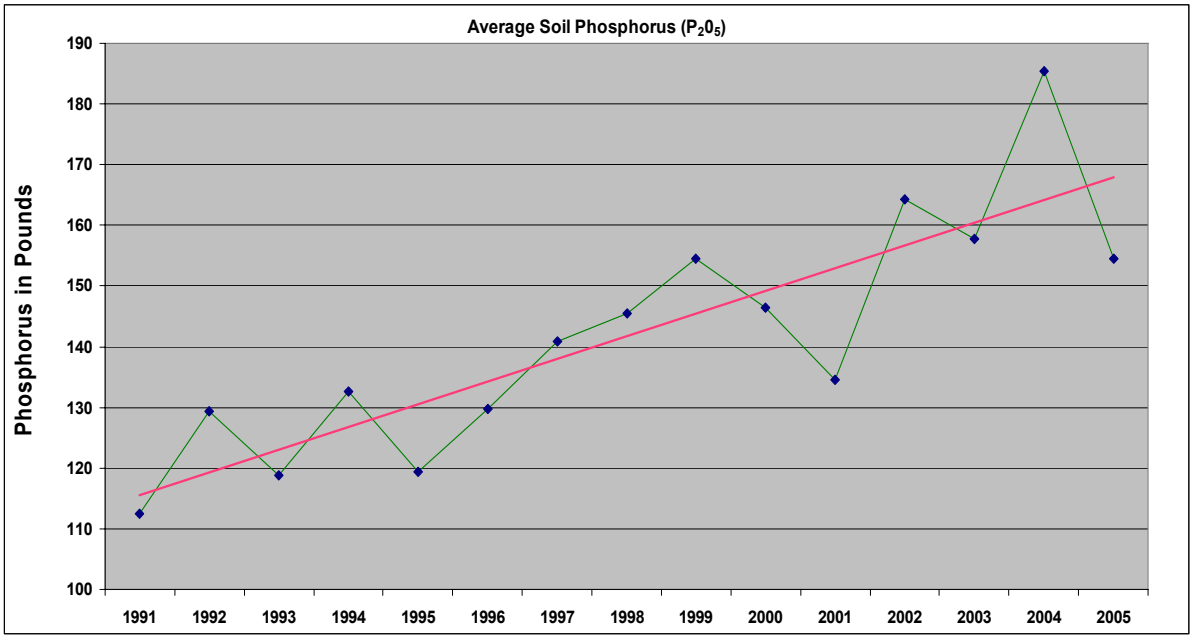



**Figure 3.** *Research Support Acreage – Soil P2O5 Loading* Average annual soil phosphorus levels as calculated across research support acreage that receives manure. Individual year soil test variations are due to not testing every field, every year, as well as soil sampling location variability within a field. Manure phosphorus applications have limitations once the soil phosphorus levels exceed 150 lbs/Ac.

*Nutrient Management*

Over the years there has been an imbalance in the amount of manure phosphorus produced and the amount of phosphorus that could be removed through crop production (Figure 4). Total manure phosphorus production from the livestock facilities, Pavilion, and Veterinary Medicine has averaged nearly 78,000 lbs annually over the last six years. Phosphorus removed through crop production has averaged nearly 50,000 lbs annually over the last six years. Composting, which began in mid-2003, has averaged nearly 20,000 lbs of phosphorus removal annually as the final product is sold to consumers and does not go back on the South Campus Farms land base. This leaves an annual imbalance of 8,000-10,000 lbs of phosphorus in the nutrient management system. In Fall 2005, the export of raw manure to non-university land was initiated. In that first year, approximately 12,000 lbs of phosphorus was exported off campus, essentially re-establishing the nutrient balance.

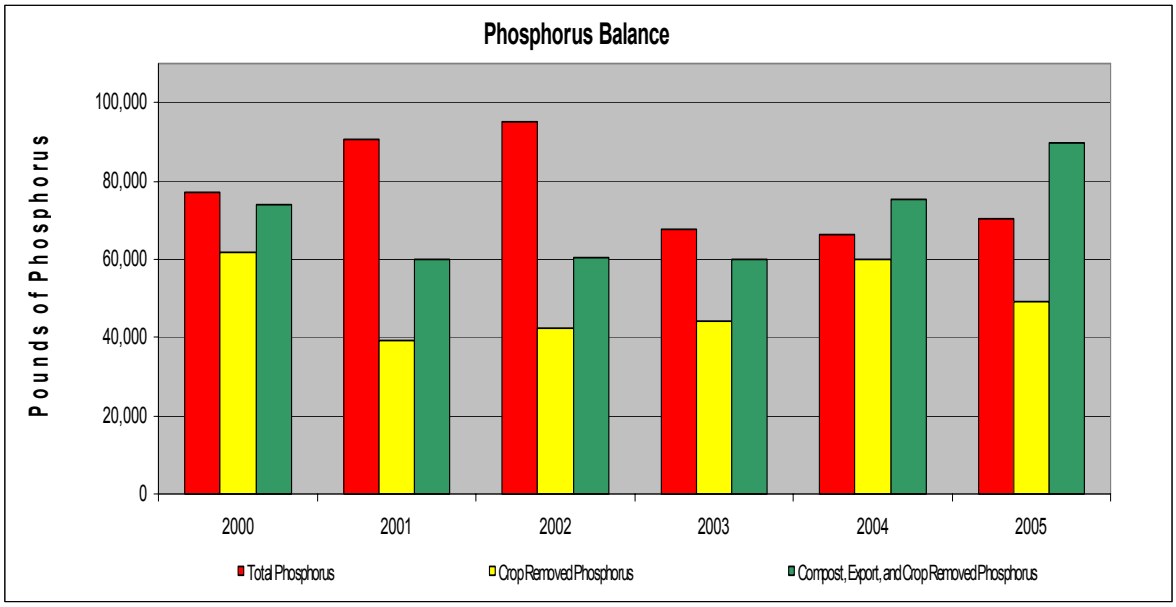



**Figure 4.** *Research Support Acreage – Phosphorus Balance* Phosphorus balance for research support acreage on the South Campus Farms. Total phosphorus represents manure phosphorus produced at South Campus Farms livestock facilities, the Pavilion, and Vet Med. Phosphorus removed represents the amount of phosphorus removed through crop production across all acreage, removed by processing manure through the manure composting facility which then leaves the South Campus Farms land base, and removed through the export of raw manure to non-university land. High crop yields in 2000 & 2004 were a result of plentiful precipitation. Composting began in mid-July 2003. Manure export began in 2005.

Many factors impact the nutrient management plan and changes occur on a regular basis. These include animal research projects and fluctuations in animal numbers that impact manure production, plant-type research projects impacting land base utilization, feed management changes that impact crop production, weather conditions that impact crop yields and manure application opportunities, and material handling issues that impact composting rates and raw manure export. Therefore, the nutrient management plan is a very fluid document requiring extensive coordination between researchers, managers, facilities, departments, and colleges.

Figure 5 depicts the seven year average for the source and amount of manure phosphorus being generated by each of the South Campus Farms livestock facilities, the Pavilion, and Veterinary Medicine. Totaling nearly 80,000 lbs of manure phosphorus annually, this is the manure requiring hauling and spreading and does not include that deposited directly to the land in the pasture setting. In general, Dairy, Swine, BCRC, Pavilion, and Waste Feed make up the majority of manure phosphorus production.

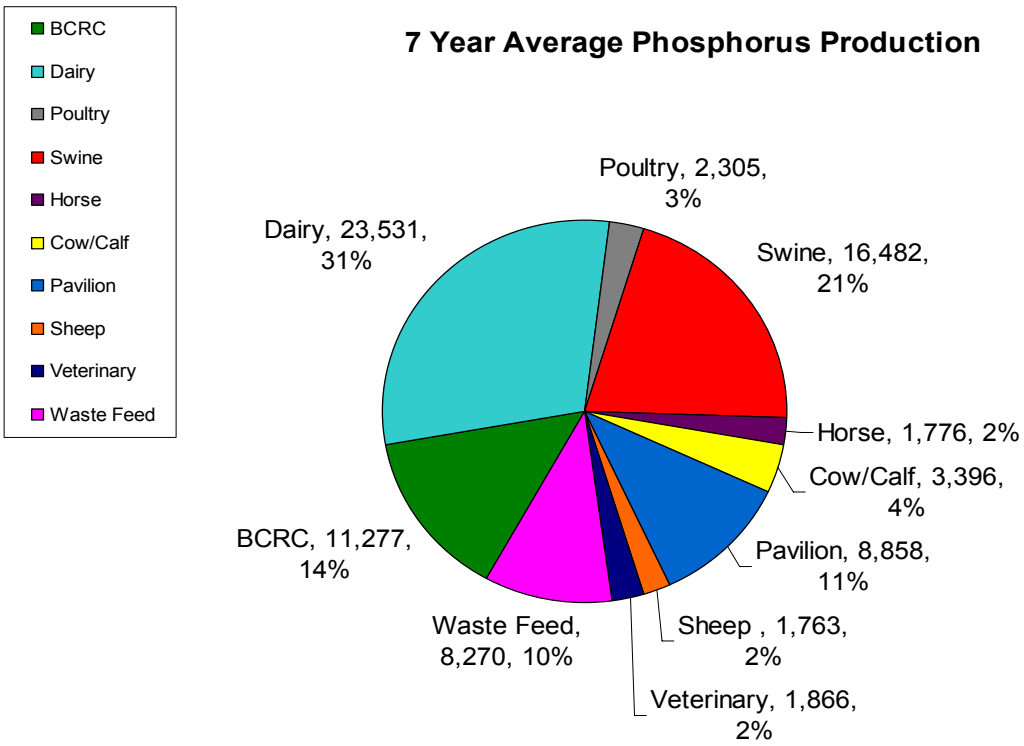



**Figure 5.** *Seven Year Average – Manure Phosphorus Production* The seven year average for the source and amount of manure phosphorus being generated by each of the South Campus Farms livestock facilities, Pavilion and Vet Med. The manure being generated is a by product of research and educational activities and requires hauling and spreading. This manure does not include that deposited directly to the land in the pasture setting.

A manure management system plan (MMSP) has been utilized since 1990 to manage the application of manure nutrients in conformance with Right to Farm GAAMPs. A CNMP is currently under development to further manage all nutrient sources on the South Campus Farms, balancing across the entire land base to meet environmental requirements.

## Future Directions

There are many options being considered for current and future management of the nutrients being generated on the South Campus Farms to ensure long term sustainability. Notable options include:

1. Manure export: This entails moving, treating, or handling manure/nutrients to promote utilization in areas other than on the South Campus Farms land base. This could include additional composting, increasing raw manure export, and

utilizing bedding/manure as a fuel source at the Power Plant. All of these require additional operational and input costs to undertake and sustain. Environmental benefits can be realized both through sustainability and "Green" initiatives (Carbon Credit Exchange).

2. Manure nutrient separation technologies could segregate nutrients from the bio-mass providing opportunities to apply the manure "organics" separately from the nutrients (N, P2O5, K2O). The technology for nutrient separation is improving, becoming more economical and efficient. Annual operational costs will still be significant.

3. Anaerobic Digestion could treat the manure and other bio-mass/food wastes producing methane that could be used for generating electricity and heat, producing nutrient separated solids for site specific land application, and producing nutrient separated liquids for crop irrigation. Additional new and beneficial nutrient management opportunities would be expected as this is a highly researchable area. Significant infrastructure costs are required.

4. Acquisition of an additional 500 acres in land base, in the immediate area and contiguous to South Campus Farms, could potentially provide enough land for sustainable operation of the livestock facilities, the Pavilion, and Veterinary Medicine at the current level of manure nutrient production. A significantly high price tag would be associated with an acquisition of this size, if contiguous land in proximity to the South Campus Farms could be identified.

5. A reduction in the current level of operation at the livestock facilities, the Pavilion, and Veterinary Medicine could result in a reduction in manure nutrient production. This may then allow for sustainable operation on the current South Campus Farms land base. Major impacts on the ability to conduct research and education would be expected.

6. Transferring plant-type research land base into general crop production, which would allow manure nutrient application, could potentially provide enough land for sustainable operation of the livestock facilities, the Pavilion, and Veterinary Medicine at the current level of manure nutrient production. However, plant-type research would then have to be relocated, not necessarily within close proximity or to high quality land. Major impacts on the ability to conduct research and education would be expected.

## Chapter 11
## Environmental Compliance – South Campus Farms

### Summary

Environmental compliance continues to be a major area of focus on the South Campus Farms. Figure 1 highlights a number of environmental initiatives that have either been recently implemented on the South Campus Farms or are in advanced stages of planning. All are critical to enhancing sustainability and ensuring that the University meets ever stringent regulatory requirements.

The major environmental initiatives include:

- Conservation Practices
- Environmental Setbacks
- Well Head Protection
- Environmental Management System Development
- Intensive Feed Storage and Pasture Management,
- Storm water Management
- Department of Environmental Quality Wastewater Discharge Permit

In particular, surface water quality management has become an acutely important issue to the South Campus Farms over the last 18 months. Following is a discussion of recent University efforts to maintain compliance with federal, state and local surface water requirements and standards at the South Campus Farms.

### *Analysis*

In February 2005, MDEQ determined that historic storm water and process water runoff from the Beef Cattle Research Center (BCRC) contained nutrients and contaminants that likely contributed to exceeding state surface water quality standards. The Office of the Ingham County Drain Commissioner concurrently found that the BCRC runoff constituted a prohibited discharge to its system. Following negotiations with MDEQ and the Ingham County Drain Commissioner, the University agreed to close and retire open pen facilities at BCRC, extend roofing of existing pens, and obtain NPDES permit coverage for the entire South Campus Farms Complex.

Closure of the BCRC pens and construction of the new roofs was completed by October, 2005, per agreement with MDEQ (See Figure 1 photograph depicts the new enclosed pens at BCRC).


**Figure 1**. *Environmental Initiatives on South Campus Farms* NPDES is the National Pollutant Discharge Elimination System and CNMP stands for Comprehensive Nutrient Management Plan

In July 2005, the University hosted United States Environmental Protection Agency (USEPA) enforcement and compliance inspectors. Although no violations were identified, EPA provided the University with a number of suggestions and waste management guidance.

As agreed, the University originally submitted an application for coverage under the MDEQ General Concentrated Animal Feed Operation (CAFO) permit in late 2005. However, it was determined that this permit would not allow the University flexibility to pursue much needed research and demonstration projects in the areas of manure and nutrient management, and animal waste treatment on the South Campus Farms. These projects should aid in the development of farm management innovations. The University therefore sought and obtained an individual National Pollutant Discharge Elimination System (NPDES) permit with provisions that will allow it conduct research and demonstration projects on the South Campus Farms, provided that the University provides MDEQ with advance notice of such projects.

In November, 2006 Michigan State received its individual National Pollutant Discharge Elimination System (NPDES) permit from the Michigan Department of Environmental Quality (DEQ). This permit essentially prohibits all surface water discharges from contaminated sources at the South Campus Farms, including water relating to the land application of animal wastes, except under very limited circumstance, such as in the event of a catastrophic flood. This permit requires the South Campus Farms to implement certain Best Management Practices, conduct periodic monitoring, and develop additional onsite waste storage capacity. The permit also requires the South

Campus Farms to develop and implement a Comprehensive Nutrient Management Plan (CNMP), which must be submitted to MDEQ for approval by October, 2007. Additional capital improvements required by the NPDES permit, including enhances waste treatment, storage and containment, must be in place by November 2009. The NPDES permit term expires in October 2010.

*Permit Terms*

To remain in compliance with its NPDES Permit, the University must, by October 2007 develop and submit its CNMP to MDEQ. The University, with assistance for MSU Extension and key faculty members, is nearing completion of its CNMP. CNMP development began in early 2005 and should be ready for MDEQ submittal by the October deadline.

In addition, the University is required, by 2009 to develop and maintain appropriate levels of waste and wastewater storage, segregate clean water sources from contaminated sources (i.e., roofs and parking lots) and construct and maintain appropriate containment structures.

Note that in lieu of conventional containment and treatment, the University is currently preparing to partner MDEQ and the USDA to design, construct, operate and monitor a series of vegetative filter strips to serve BCRC and the University Dairy. If successful, these strips will be engineered to effectively treat low levels of contaminated process water and should provide an economically efficient and sustainable alternative to other wastewater treatment methods. Advance notification to MDEQ of University plans to install these filter strips (in accordance with its permit condition), is expected to be submitted by February, 2007.

*Projected Expenses*

It is anticipated that the University will be required to expend more than $2 million dollars by 2009 in order to construct necessary water quality infrastructure to maintain compliance with the terms and conditions of the NPDES permit and to accommodate current and projected South Campus animal populations and research functions.

**Future Directions**

As discussed above, compliance with the NPDES permit will necessitate the implementation of a number of infrastructural and operational improvements on South Campus farms over the course of the next three years. Over the next few years, the University also intends to maintain and enhance its current relationships with regulators and the local environmental community by striving to continue to improve communication and coordination with these interested parties.

The University has recently conducted as series of meetings with the Ingham County Drain Commissioner to discuss its water quality obligations and commitments. The University has scheduled additional meetings with the Commissioner's office to keep it apprised of current and future South Campus improvements.

In addition, the University has met with members of the Michigan Farm Bureau and members of the Michigan Chapter of the Sierra Club to discuss its concerns regarding

South Campus Farms management. The University has agreed to maintain a dialogue with the officers of the Michigan Chapter of the Sierra Club with respect to University activities on South Campus farms. Also, in early 2007, the University has agreed to host an MDEQ training workshop for MDEQ Water Quality inspectors and managers.

Finally, in addition to stepped up monitoring and inspections, Animal Science and Land Management have recently created a new General Manager position to serve all of the South Campus Farms. Going forward, this position should improve overall environmental performance on the South Campus Farms by providing additional onsite environmental leadership and oversight to each individual farm.

# Chapter 12
# Environmental Compliance – Health & Safety

## Summary

Older University buildings and structures typically present a number of environmental health and safety challenges. For example, asbestos containing materials (ACM) are common in most buildings and structures constructed prior to 1980. However, when properly managed and maintained, they do not present a health hazard to building workers or occupants. In accordance with US Environmental Protection Agency (USEPA), federal Occupational Safety and Health Administration (OSHA) and Michigan Department of Environmental Quality (MDEQ) standards, the University manages asbestos "in-place" and only removes (abates) ACM when undertaking significant renovations or when materials begin to display signs of deterioration. To that end, MSU is required to create and maintain very detailed asbestos surveys for all buildings and structures build prior to 1980. Such surveys allow University personnel to make all custodial and maintenance workers aware of potential hazards, as well as alerting contractors and repair personnel to the location and extent of ACM within the building. The University, in accordance with federal and state regulations, also requires rigorous asbestos awareness and asbestos management training for all custodial, maintenance, trades, and other employees that may work with ACM.

Similarly, the potential hazards presented by water floods/leaks and mold, and other indoor air quality factors, while not exclusive to older buildings, do in fact manifest more frequently in older structures. This is largely due to aging infrastructure including, but not limited to, leak prone roofs, old and damaged pipes and sumps, deteriorating basements and sub-basements etc. Regardless of the source of water and/or mold, the University has chosen to deal quickly and aggressively with all indoor building water leaks, spills and floods in order to minimize the direct damage caused to building structures by the water sources, as well as to eliminate the potential for coincidental mold growth and contamination. The University also has been aggressive in responding to all indoor-air complaints. Using sophisticated monitoring equipment, the Occupational Safety Group, created in January 2006 within Environmental Health and Safety (EHS), has begun responding to all non-mold and water-related indoor air quality complaints.

## Analysis

*Asbestos*

Historically, the University had conducted and maintained limited asbestos inspections and surveys for its campus buildings constructed prior to 1980. However, new regulations were adopted by USEPA, OSHA and MIOSHA in the mid 1990's, requiring a more comprehensive approach to asbestos documentation and management. These regulations also required extensive training (and re-training) of custodians and maintenance personnel working in buildings known or assumed to have ACM.

Following two notable asbestos-related incidents resulting in citations from MIOSHA in late 2002 and early 2003, the University adopted a new and aggressive asbestos management plan and transferred asbestos management responsibilities to the Office of Environmental Health and Safety.

Since 2003, the University has conducted new asbestos surveys and asbestos management inspections in over 100 campus buildings and structures. For example, asbestos inspections and surveys have been completed for all Housing and Food Service buildings (as of January 1, 2007). New surveys and inspections have also been completed in many of the larger and more heavily utilized facilities. Figure 1 shows the current asbestos inventory status of all of the main campus buildings and structures through December 2006. Asbestos inventory updated should be completed for all major campus buildings and structures by the end of calendar year 2008.

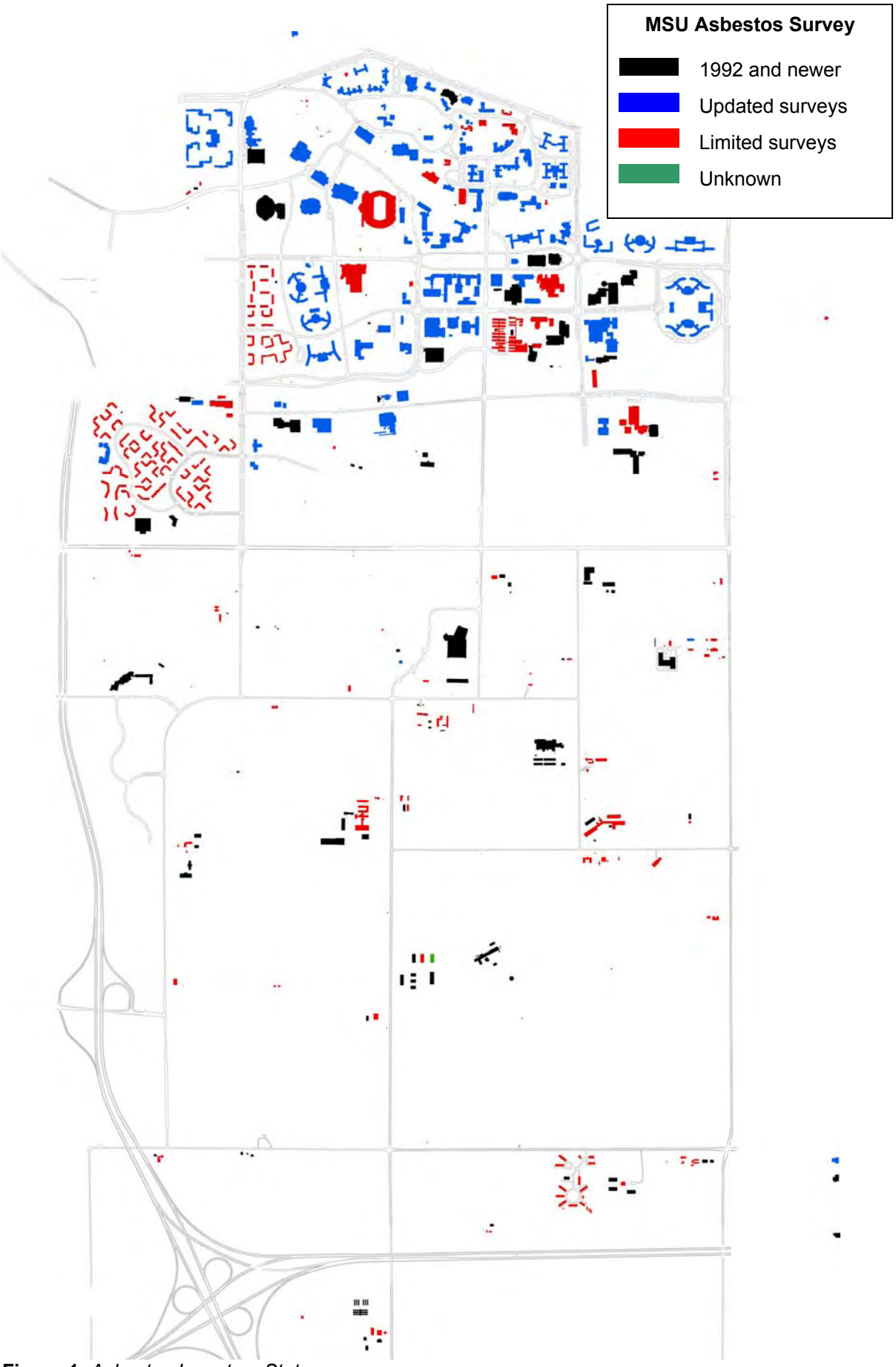



**Figure 1**. *Asbestos Inventory Status*

In addition to developing new comprehensive asbestos inventories, the University, as part of its new asbestos management plan, developed and administered several asbestos awareness training courses and on-line refresher training modules for University employees. In 2006, over 3,000 full and part time University employees have taken asbestos awareness training.

*Mold & Water Infiltration*

Most University building and facility water related damage occurs from heavy rains or excessive snowfall and melt, or human error including malicious safety shower activation or employee failure to turn off water sources which leads to flooding. Most mold damage is directly related to improperly managed or undetected fugitive water sources; however, mold may also be result from high seasonal humidity levels and a lack of proper airflow in vacant, unused rooms.

Regardless of the source of water and/or mold, the University has chosen to deal aggressively with all building water leaks, spills and floods in order to minimize the direct damage caused to building structures by the water sources, as well as to eliminate the potential for coincidental mold growth and contamination.

Figure 2 depicts reported water damage and mold incidents from 2004 to 2006. Note that the University did not commence the formal tracking of mold and water incidents until 2004; therefore, it is difficult to project any trends associated with these types of events given the only three years of data. The only notable anomaly suggested by the graph is 2005, where both water and mold events (22 and 18, respectively) were much higher than the prior and successive years. This is attributed to the extremely heavy rains that occurred over the July 4th weekend of that year, which caused several floods in a number of buildings across campus ultimately leading to subsequent incidents of mold related to initially undetected water damage.

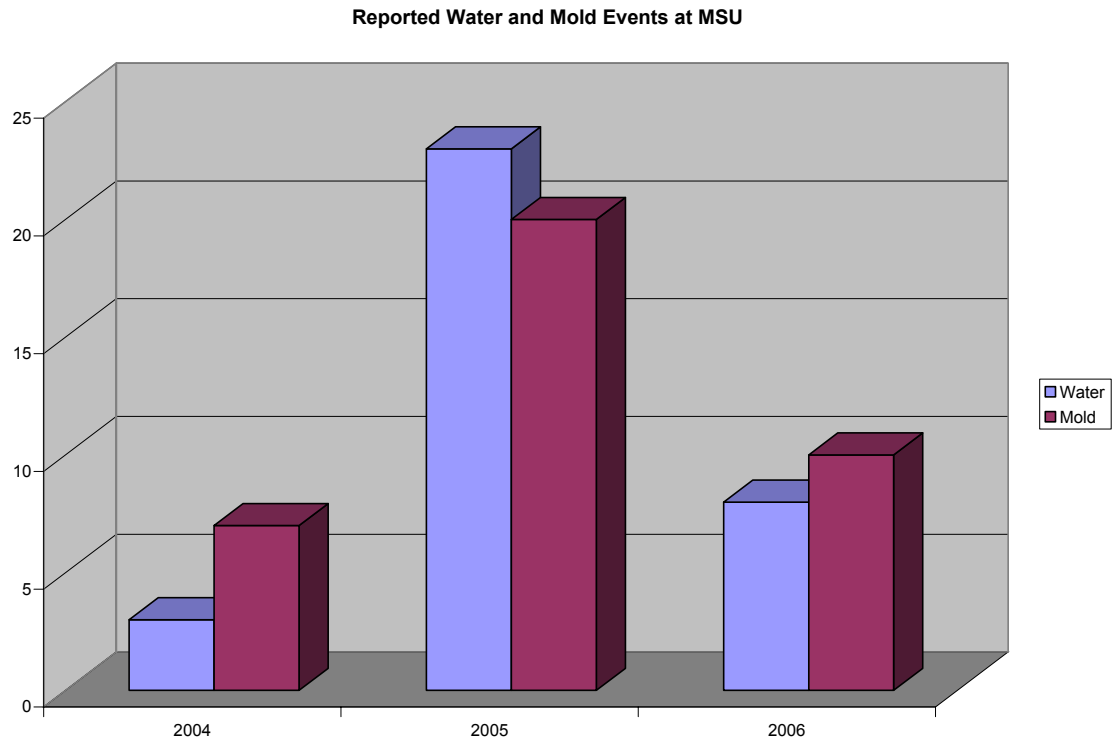



**Figure 2**. *Reported Water and Mold Events at MSU*

In early 2001 the University formed a water/mold committee to address issues associated with water and mold damage in aging buildings, from events of nature, fire suppression etc. The committee adapted and adopted the New York Guidelines for mold assessment and remediation as it was the most stringent in the country as a result of clean up events stemming from the September 11, 2001 World Trade Center attack. For water damage, the committee also adapted and adopted the standards from the Institute of Inspection, Cleaning and Restoration Certification (IICRC), Standard and Reference Guide for Professional Water Remediation. To date, these standards and guidelines remain in use on campus. An interdepartmental inspection team was recently formed including members from Physical Plant and Environmental Health and Safety (EHS) to address and assess the actual water and mold incidents on campus. Once the assessment has been completed, remediation is either conducted by MSU Physical Plant custodians or a pre-selected contractor (depending on the severity of the water or mold damage and depending on what the guidelines suggest). A certified industrial hygiene contractor also provides the protocols for cleanup and restoration on larger projects and provides final clearance sampling when these larger projects are completed.

*Other Indoor Air Quality Issues*

The University strives to maintain for its employees a healthy, safe and productive workplace. Beginning in January 2006, EHS created the Occupational Safety Group staffed by three certified industrial hygienists. This group is charged with investigating indoor air quality complaints, in addition to managing University compliance with hundreds of MIOSHA occupational safety standards. In its first year, the Occupational Safety Group staff conducted 58 indoor air related investigations. Of these investigations, only three presented a recognizable occupational safety or health hazard. Over two thirds of the complaints investigated involved strange odors or odors

or dust associated with construction and over one fourth of the complaints could not be substantiated. Figure 3 reflects the types of indoor air incidents.

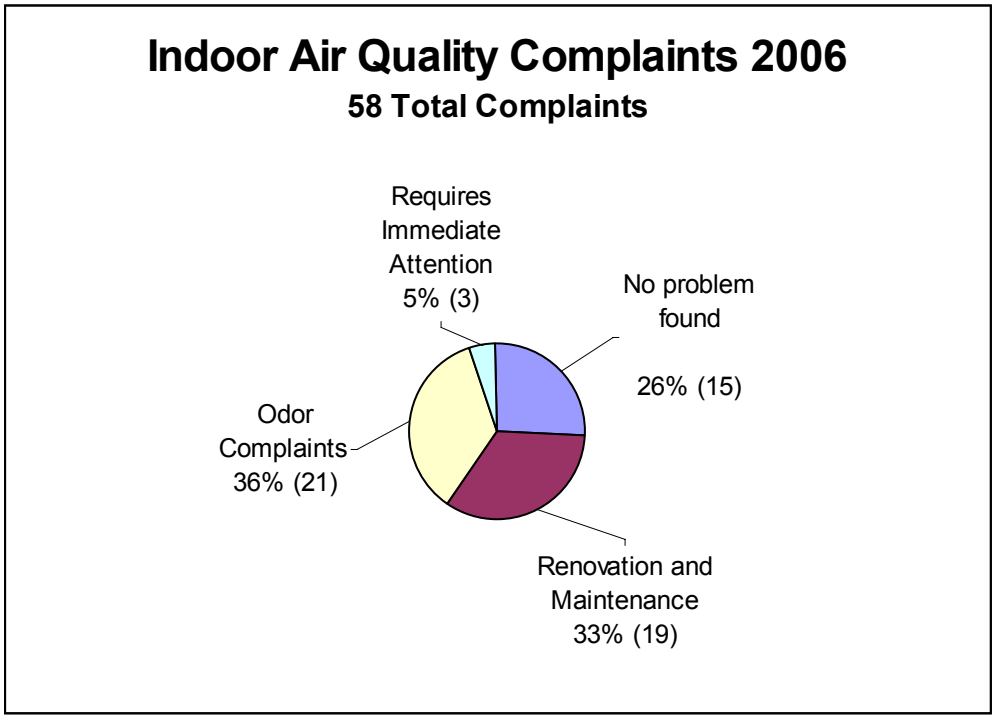



**Figure 3.** *Indoor Quality Complaints in 2006*

Of the 58 total complaints above, the following actions were taken to address the reported incidents:

15 (26%) No problem found/not air quality issues
- Non-specific complaints or concerns which are currently discussed in the media.
- Resolved by education, confirming ventilation is working within established limits

19 (33%) Renovation and maintenance
- Problems with dust or odors from construction, overheating equipment, broken fan belts, etc.
- Change construction activities to off hours, repair equipment

21 (36%) Odor complaints
- Dry drain traps, odors from garbage, etc.
- Educate occupants in drain maintenance, proper garbage disposal

3 (5%) Require immediate attention
- Kitchen exhaust in stadium tower, low frequency fan vibration, carbon monoxide from a heater
- Usually require unbudgeted funds to repair

## Future Directions

*Asbestos*

As mentioned above, the University plans to complete its comprehensive update of asbestos surveys for all campus buildings and structures by the end of 2008. The projected cost for this remaining work is estimated to require approximately $350,000. The University is also in the process of rewriting those asbestos specifications applicable to consultants and contractors. This effort is intended to ensure that asbestos contractors and consultants remain in compliance with all applicable regulations and that their respective employees are provided with appropriate safety training.

*Mold & Water Infiltration*

At this time, the water and mold events tracked by EHS are from reported incidents and findings; however, it is assumed that undetected problems will continue to arise as the normal course of managing aging buildings and structure. MSU Physical Plant and EHS personnel are currently developing enhanced awareness training, brochures and information to personnel on campus (especially to building managers, safety officers, etc.) in an attempt to quickly identify sources (water) and symptoms and alleviate the damage and hazards caused by water and mold. Recently, Physical Plant, in conjunction with EHS, created a new joint-reporting construction management position. This position's primary responsibility will be to oversee and manage major water infiltration and mold related remediation projects. The creation of this position should facilitate and expedite water damage and mold hazard remediation on campus.

Finally, the University has begun to create cross-discipline design teams to share lessons learned on campus, including those learned in managing water and mold related problems. New buildings and major renovations are incorporating advanced designs mold resistant materials, and new ventilation schemes where possible, to proactively mitigate against future water and mold damage.

*Indoor Air Quality*

The University will continue to support indoor air monitoring and investigations and is investigating the purchase of new and advanced air monitoring technologies that will assist in assessing air quality and improve response performance.

## APPENDICES

Appendix A: Just in Time

Appendix B: 2007 Construction Management Report

Appendix C: Construction

Appendix D: Power & Water

Appendix E: Accessibility

**Appendix A: Just-in-Time**

## *Pavement Management Services, Inc. (PMSI)*

| Rating | Definition | |
|---|---|---|
| 0 – 2 | Entire area cracked with structural Failure and poor drainage |  |
| 3 – 5 | Entire area cracked with signs of structural failure. Maintenance repairs will have minimal impact |  |
| 6 – 8 | Large area of cracking. Maintenance repairs will have minimal impact |  |
| 9 – 10 | Large area of unsealed cracks with structural failure. May be able to repair with a patch and undercut |  |
| 11 – 12 | Cracks with secondary cracks and soon structural failure. Can seal cracks or patch to repair. |  |
| 13 – 15 | Cracking with major secondary cracks. these must be sealed as soon as possible. This is also the limit on sealing for cracks. |  |
| 16 – 17 | Minor cracking with secondary cracks |  |
| 18 – 20 | Minor cracking with NO secondary cracks |  |

# Construction Management Report

Prepared for the Michigan State University Board of Trustees
January 2007

*The annual construction report as requested by the Board of Trustees includes construction projects which have been completed and project accounts have been "closed." Major capital projects are those that are $1 million or greater and require Board approval. Also included in this report are projects which were initiated under the previous construction threshold of $250,000, but closed under the new construction policy.*

*Minor capital projects are projects greater than $250,000 and less than $1 million. The Board requested a listing of these projects on an annual basis. In addition to this annual report, the Board will receive quarterly construction reports reflecting current and on-going construction projects.*

# Closed Major Capital Projects
# 2005-06

## Summary of Data

This report highlights three areas for major capital projects that were closed during the fiscal year 2005-06. These areas include the authorized budget, final cost of the project, contingency use, data relative to performance to the construction schedule, and change order management. The reports are utilized to provide timely and accurate project information, and report on our project performance in the aggregate, analyzing our strengths and weaknesses, and improving our processes.

## Analysis

Sixteen major projects were closed during the 2005-06 fiscal year. The approved budgets for these projects totaled $9,536,000. The final cost of these projects was $8,696,811, (ca 8%), a difference of $839,189 that was returned to the appropriate unit.

Of the 16 projects, two were utility projects (steam tunnels), nine were elevator and roofing projects, two were alteration projects and one was a Housing and Food Service data project.

Approximately 50% of the projects met substantial completion dates. Substantial completion is the date the facility is safe for occupancy. Of the remaining projects 31% were 1-90 days late and 13% were over 90 days late. It should be noted that none of these late completions impacted MSU's programmatic functions (e.g., roads were open before student fall semester move-in, at least some elevators were functioning throughout the project, and other laboratories were available for instruction or research). Only 19% met the final completion date. There are a number of factors that contributed to the majority of projects not meeting final completion. Some University delays were not factored into schedules and some schedules did not have realistic timelines for MSU project functions.

For the sixteen closed projects, change orders totaled approximately $390,000 or about 4.1% of the authorized budget. Change orders were further examined by category type, scope, document and field changes, in the report. Field changes resulted in $300,000 or 77% of the total change order requests and 3.1% of the authorized budget. Field changes that were not discoverable during the planning process, i.e. conditions found behind walls, underground, etc. Document changes equaled $82,000, or 21% of the total change order requests, and less than 1% of the authorized budget. Scope changes resulted in $7,800, or 2% of the total change requests, and less than 1% of the authorized budget. These figures fall within an acceptable range based on analysis of and comparison to other large universities and major contractors.

## Future Focus

Improvement in the construction process is dependent on continuous evaluation and incremental adjustment. During the coming year, the University will concentrate on reducing the upward trend in document changes and improving results related to both substantial and final completion dates.

### *CP03227 - CAMPUS - CONVERT LIGHTING FROM T12 TO T8 - PHASE II*

| | | | | | |
|---|---|---|---|---|---|
| **Authorized Budget:** | 1,030,000 | **Final Cost:** | 925,213 | **Classification:** | BUILDING |
| **Construction** | 785,917 | **Returned:** | 104,787 | **Contractor:** | URG, INC. |
| **Professional Services** | 84,120 | | | **A/E:** | EAS |
| **Owner Work and Material** | | | | | |
| **Contingency** | 159,963 | | | **Funds returned to:** | 51-4343 2005 Bonds - Project Proceeds |

| Change Orders | | % of Contract | % of Contingency |
|---|---|---|---|
| **Scope:** | 0 | 0.0% | 0.0% |
| **Document:** | 0 | 0.0% | 0.0% |
| **Field:** | 44,835 | 5.7% | 28.0% |
| **Total** | 44,835 | 5.7% | 28.0% |

| Schedule | Planned | Actual | Days (Under) / Over |
|---|---|---|---|
| **Substantial Completion:** | 9/30/2004 | 7/28/2004 | (64) |
| **Close Out:** | 5/30/2005 | 5/31/2006 | 366 |

### *CP03361 - WONDERS HALL - ELEVATOR REPLACEMENT*

| | | | | | |
|---|---|---|---|---|---|
| **Authorized Budget:** | 1,000,000 | **Final Cost:** | 902,295 | **Classification:** | BUILDING |
| **Construction** | 816,800 | **Returned:** | 97,705 | **Contractor:** | MOORE TROSPER CONSTRUCTION |
| **Professional Services** | 71,000 | | | **A/E:** | IDS CONSULTANTS |
| **Owner Work and Material** | 3,000 | | | | |
| **Contingency** | 109,200 | | | **Funds returned to:** | 41-4337 Coord, Construct & Maint/Spec/Housing Elev Repair |

| Change Order | | % of Contract | % of Contingency |
|---|---|---|---|
| **Scope:** | 0 | 0.0% | 0.0% |
| **Document:** | 0 | 0.0% | 0.0% |
| **Field:** | 29,892 | 3.7% | 27.4% |
| **Total** | 29,892 | 3.7% | 27.4% |

| Schedule | Planned | Actual | Days (Under) / Over |
|---|---|---|---|
| **Substantial Completion:** | 12/30/2004 | 4/12/2005 | 103 |
| **Close Out:** | 6/30/2005 | 4/4/2006 | 278 |

## *CP03384 - KEDZIE HALL SOUTH - ELEVATOR REPLACEMENT*

| | | | | | |
|---|---|---|---|---|---|
| **Authorized Budget:** | 595,000 | **Final Cost:** | 523,880 | **Classification:** | BUILDING |
| **Construction** | 474,400 | **Returned:** | 71,120 | **Contractor:** | KARES CONSTRUCTION COMPANY |
| **Professional Services** | 38,375 | | | **A/E:** | IDS CONSULTANTS |
| **Owner Work and Material** | | | | | |
| **Contingency** | 82,225 | | | **Funds returned to:** | 51-4325 FPSM/Reserve-Facilities |

| Change Orders | | % of Contract | % of Contingency |
|---|---|---|---|
| **Scope:** | 0 | 0.0% | 0.0% |
| **Document:** | 4,778 | 1.0% | 5.8% |
| **Field:** | 1,509 | 0.3% | 1.8% |
| **Total** | 6,287 | 1.0% | 7.6% |

| Schedule | Planned | Actual | Days (Under)/Over |
|---|---|---|---|
| **Substantial Completion:** | 6/30/2005 | 6/30/2005 | 0 |
| **Close Out:** | 8/31/2005 | 5/31/2006 | 273 |

## *CP03418 - NATURAL RESOURCES BUILDING - ROOF REPLACEMENT**

| | | | | | |
|---|---|---|---|---|---|
| **Authorized Budget:** | 590,000 | **Final Cost:** | 526,617 | **Classification:** | BUILDING |
| **Construction** | 468,900 | **Returned:** | 63,383 | **Contractor:** | BORNOR RESTORATION, INC. |
| **Professional Services** | 48,500 | | | **A/E:** | EAS |
| **Owner Work and Material** | 0 | | | | |
| **Contingency** | 72,600 | | | **Funds returned to:** | 51-4325 FPSM/Reserve-Facilities |

| Change Order | | % of Contract | % of Contingency |
|---|---|---|---|
| **Scope:** | 0 | 0.0% | 0.0% |
| **Document:** | 0 | 0.0% | 0.0% |
| **Field:** | 6,608 | 1.4% | 6.1% |
| **Total** | 6,608 | 1.4% | 6.1% |

| Schedule | Planned | Actual | Days (Under)/Over |
|---|---|---|---|
| **Substantial Completion:** | 12/31/2004 | 12/1/2004 | (30) |
| **Close Out:** | 5/1/2005 | 11/1/2005 | 184 |

## *CP03238 - WELLS HALL - ROOF REPLACEMENT*

| | | | | | |
|---|---|---|---|---|---|
| **Authorized Budget:** | 570,000 | **Final Cost:** | 538,605 | **Classification:** | BUILDING |
| **Construction** | 477,500 | **Returned:** | 31,395 | **Contractor:** | BORNOR RESTORATION, INC. |
| **Professional Services** | 41,400 | | | **A/E:** | ROOFING TECHNOLOGIES ASSOCIATE |
| **Owner Work and Material** | | | | | |
| **Contingency** | 51,100 | | | **Funds returned to:** | 41-4933 Phys Plt Maj Rep/Repl 03 - Maint. Sch. |

| Change Orders | | % of Contract | % of Contingency |
|---|---|---|---|
| **Scope:** | 0 | 0.0% | 0.0% |
| **Document:** | 0 | 0.0% | 0.0% |
| **Field:** | 15,618 | 3.3% | 30.6% |
| **Total** | 15,618 | 3.3% | 30.6% |

| Schedule | Planned | Actual | Days (Under)/Over |
|---|---|---|---|
| **Substantial Completion:** | 9/14/2004 | 9/14/2004 | 0 |
| **Close Out:** | 7/30/2005 | 8/3/2005 | 4 |

## *CP03239 - I.M. SPORTS CIRCLE - ROOF REPLACEMENT**

| | | | | | |
|---|---|---|---|---|---|
| **Authorized Budget:** | 538,000 | **Final Cost:** | 489,769 | **Classification:** | BUILDING |
| **Construction** | 428,386 | **Returned:** | 48,231 | **Contractor:** | MID MICHIGAN ROOFING |
| **Professional Services** | 49,759 | | | **A/E:** | ROOFING TECHNOLOGIES ASSOCIATE |
| **Owner Work and Material** | | | | | |
| **Contingency** | 59,855 | | | **Funds returned to:** | 41-4933 Maint/Phys Plant Mojor Rep/Repl '03 |

| Change Order | | % of Contract | % of Contingency |
|---|---|---|---|
| **Scope:** | 0 | 0.0% | 0.0% |
| **Document:** | 0 | 0.0% | 0.0% |
| **Field:** | 7,897 | 1.8% | 7.2% |
| **Total** | 7,897 | 1.8% | 7.2% |

| Schedule | Planned | Actual | Days (Under)/Over |
|---|---|---|---|
| **Substantial Completion:** | 8/13/2004 | 9/21/2004 | 39 |
| **Close Out:** | 4/30/2006 | 4/30/2006 | 0 |

## *CP03310 - CHEMISTRY BUILDING - ALTERATIONS TO ROOMS 208, 208A, AND 209*

| | | | | | |
|---|---|---|---|---|---|
| **Authorized Budget:** | 500,000 | **Final Cost:** | 483,089 | **Classification:** | BUILDING |
| **Construction** | 406,400 | **Returned:** | 16,911 | **Contractor:** | MOORE TROSPER CONSTRUCTION |
| **Professional Services** | 56,900 | | | **A/E:** | FTC&H |
| **Owner Work and Material** | 5,000 | | | | |
| **Contingency** | 31,700 | | | **Funds returned to:** | 51-4325 FPSM/Reserve-Facilities |

| Change Orders | | % of Contract | % of Contingency |
|---|---|---|---|
| **Scope:** | 0 | 0.0% | 0.0% |
| **Document:** | 594 | 0.1% | 1.9% |
| **Field:** | 15,058 | 3.7% | 47.5% |
| **Total** | 15,652 | 3.9% | 49.4% |

| Schedule | Planned | Actual | Days (Under) / Over |
|---|---|---|---|
| **Substantial Completion:** | 9/30/2004 | 10/15/2004 | 15 |
| **Close Out:** | 7/30/2005 | 11/11/2005 | 104 |

## *CP03249 - CHERRY LANE APARTMENTS - DATA ACCESS SERVICE*

| | | | | | |
|---|---|---|---|---|---|
| **Authorized Budget:** | 480,000 | **Final Cost:** | 435,733 | **Classification:** | BUILDING |
| **Construction** | 338,232 | **Returned:** | 44,267 | **Contractor:** | TOWN & COUNTRY TEL-COM |
| **Professional Services** | 42,900 | | | **A/E:** | EAS |
| **Owner Work and Material** | 9,000 | | | | |
| **Contingency** | 89,868 | | | **Funds returned to:** | 41-4355 Coord, Constr, & Maint/Spec/Univ Apt Data Access |

| Change Order | | % of Contract | % of Contingency |
|---|---|---|---|
| **Scope:** | 0 | 0.0% | 0.0% |
| **Document:** | 0 | 0.0% | 0.0% |
| **Field:** | 1,096 | 0.3% | 1.0% |
| **Total** | 1,096 | 0.3% | 1.0% |

| Schedule | Planned | Actual | Days (Under) / Over |
|---|---|---|---|
| **Substantial Completion:** | 11/1/2004 | 11/19/2004 | 18 |
| **Close Out:** | 4/1/2005 | 4/30/2006 | 394 |

## *CP03380 - CHEMISTRY BUILDING - ELEVATOR UPGRADE**

| | | | | | |
|---|---|---|---|---|---|
| **Authorized Budget:** | 480,000 | **Final Cost:** | 436,779 | **Classification:** | BUILDING |
| **Construction** | 381,900 | **Returned:** | 43,221 | **Contractor:** | KARES CONSTRUCTION COMPANY |
| **Professional Services** | 40,800 | | | **A/E:** | EAS |
| **Owner Work and Material** | | | | | |
| **Contingency** | 57,300 | | | **Funds returned to:** | 51-4325 FPSM/Reserve-Facilities |

| Change Orders | | % of Contract | % of Contingency |
|---|---|---|---|
| **Scope:** | 0 | 0.0% | 0.0% |
| **Document:** | 0 | 0.0% | 0.0% |
| **Field:** | 997 | 0.3% | 1.7% |
| **Total** | 997 | 0.3% | 1.7% |

| Schedule | Planned | Actual | Days (Under)/Over |
|---|---|---|---|
| **Substantial Completion:** | 12/15/2004 | 12/1/2004 | (14) |
| **Close Out:** | 10/31/2005 | 11/1/2005 | 1 |

## *CP03381 - LIBRARY - ELEVATOR REPLACEMENT*

| | | | | | |
|---|---|---|---|---|---|
| **Authorized Budget:** | 465,000 | **Final Cost:** | 420,135 | **Classification:** | BUILDING |
| **Construction** | 369,800 | **Returned:** | 44,865 | **Contractor:** | IRISH CONSTRUCTION COMPANY |
| **Professional Services** | 37,800 | | | **A/E:** | EAS |
| **Owner Work and Material** | | | | | |
| **Contingency** | 57,400 | | | **Funds returned to:** | 51-4325 FPSM/Reserve-Facilities |

| Change Order | | % of Contract | % of Contingency |
|---|---|---|---|
| **Scope:** | 0 | 0.0% | 0.0% |
| **Document:** | 2,206 | 0.6% | 2.0% |
| **Field:** | 4,159 | 1.1% | 3.8% |
| **Total** | 6,364 | 1.7% | 5.8% |

| Schedule | Planned | Actual | Days (Under)/Over |
|---|---|---|---|
| **Substantial Completion:** | 2/15/2005 | 6/30/2005 | 135 |
| **Close Out:** | 8/5/2005 | 5/31/2006 | 299 |

## *CP03383 - BAKER HALL - ELEVATOR REPLACEMENT**

| | | | | | |
|---|---|---|---|---|---|
| **Authorized Budget:** | 460,000 | **Final Cost:** | 435,383 | **Classification:** | BUILDING |
| **Construction** | 367,400 | **Returned:** | 24,617 | **Contractor:** | MOORE TROSPER CONSTRUCTION |
| **Professional Services** | 63,980 | | | **A/E:** | DOSHI ASSOCIATES |
| **Owner Work and Material** | 2,000 | | | | |
| **Contingency** | 26,620 | | | **Funds returned to:** | 51-4325 FPSM/Reserve-Facilities |

| Change Orders | | % of Contract | % of Contingency |
|---|---|---|---|
| **Scope:** | 0 | 0.0% | 0.0% |
| **Document:** | 0 | 0.0% | 0.0% |
| **Field:** | 573 | 0.2% | 2.2% |
| **Total** | 573 | 0.2% | 2.2% |

| Schedule | Planned | Actual | Days (Under)/Over |
|---|---|---|---|
| **Substantial Completion:** | 3/25/2005 | 3/25/2005 | 0 |
| **Close Out:** | 8/31/2005 | 5/31/2006 | 273 |

## *CP03204 - CENTER FOR INTEGRATED PLANT SYSTEMS - POLY GREENHOUSE 2004*

| | | | | | |
|---|---|---|---|---|---|
| **Authorized Budget:** | 443,000 | **Final Cost:** | 443,000 | **Classification:** | BUILDING |
| **Construction** | 185,013 | **Returned:** | 0 | **Contractor:** | H&C EARTHWORKS & CONSTRUCTION |
| **Professional Services** | 8,794 | | | **A/E:** | EAS |
| **Owner Work and Material** | 158,000 | | | | |
| **Contingency** | 91,193 | | | **Funds returned to:** | 0 |

| Change Order | | % of Contract | % of Contingency |
|---|---|---|---|
| **Scope:** | 0 | 0.0% | 0.0% |
| **Document:** | 15,620 | 22.5% | 14.3% |
| **Field:** | 12,464 | 17.9% | 11.4% |
| **Total** | 28,085 | 40.4% | 25.7% |

| Schedule | Planned | Actual | Days (Under)/Over |
|---|---|---|---|
| **Substantial Completion:** | 8/21/2004 | 8/17/2004 | (4) |
| **Close Out:** | 6/28/2005 | 4/30/2006 | 306 |

## *CP03121 - ENGINEERING BUILDING - CONVERT ROOM 2150 FROM CLASSROOM TO LABS*

| | | | | | |
|---|---|---|---|---|---|
| **Authorized Budget:** | 400,000 | **Final Cost:** | 399,372 | **Classification:** | BUILDING |
| **Construction** | 269,800 | **Returned:** | 628 | **Contractor:** | J. PEREZ CONSTRUCTION, INC. |
| **Professional Services** | 52,600 | | | **A/E:** | DICLEMENTE SIEGEL DESIGN |
| **Owner Work and Material** | 23,240 | | | | |
| **Contingency** | 54,360 | | | **Funds returned to:** | 51-4325 FPSM/Reserve-Facilities |

| Change Orders | | % of Contract | % of Contingency |
|---|---|---|---|
| **Scope:** | 8,100 | 3.0% | 14.9% |
| **Document:** | 29,321 | 10.9% | 53.9% |
| **Field:** | 0 | 0.0% | 0.0% |
| **Total** | 37,420 | 13.9% | 68.8% |

| Schedule | Planned | Actual | Days (Under) / Over |
|---|---|---|---|
| **Substantial Completion:** | 6/30/2004 | 7/30/2004 | 30 |
| **Close Out:** | 5/31/2006 | 5/31/2006 | 0 |

## *CP03234 - PRINTING SERVICES BUILDING - ROOF REPLACEMENT*

| | | | | | |
|---|---|---|---|---|---|
| **Authorized Budget:** | 360,000 | **Final Cost:** | 318,796 | **Classification:** | BUILDING |
| **Construction** | 267,700 | **Returned:** | 41,204 | **Contractor:** | LUTZ ROOFING, INC. |
| **Professional Services** | 44,200 | | | **A/E:** | ROOFING TECHNOLOGIES ASSOCIATE |
| **Owner Work and Material** | 0 | | | | |
| **Contingency** | 48,100 | | | **Funds returned to:** | 41-1448 EAS PPD '04 |

| Change Order | | % of Contract | % of Contingency |
|---|---|---|---|
| **Scope:** | 0 | 0.0% | 0.0% |
| **Document:** | 0 | 0.0% | 0.0% |
| **Field:** | 720 | 0.3% | 0.7% |
| **Total** | 720 | 0.3% | 0.7% |

| Schedule | Planned | Actual | Days (Under) / Over |
|---|---|---|---|
| **Substantial Completion:** | 6/4/2004 | 6/1/2004 | (3) |
| **Close Out:** | 1/30/2005 | 1/30/2005 | 0 |

## *CP02044 - CAMPUS - STEAM TUNNEL - VAULT 188 TO FARRALL HALL*

| | | | | | |
|---|---|---|---|---|---|
| **Authorized Budget:** | 1,150,000 | **Final Cost:** | 1,088,525 | **Classification:** | UTILITIES |
| **Construction** | 767,000 | **Returned:** | 61,475 | **Contractor:** | IRISH CONSTRUCTION COMPANY |
| **Professional Services** | 36,096 | | | **A/E:** | FTC&H |
| **Owner Work and Material** | | | | | |
| **Contingency** | 346,904 | | | **Funds returned to:** | 41-1888 Farrall Hall Steam Vault 188 |

| Change Orders | | % of Contract | % of Contingency |
|---|---|---|---|
| **Scope:** | -243 | 0.0% | -0.1% |
| **Document:** | 55,150 | 7.2% | 15.9% |
| **Field:** | 155,010 | 20.2% | 44.7% |
| **Total** | 209,917 | 27.4% | 60.5% |

| Schedule | Planned | Actual | Days (Under) / Over |
|---|---|---|---|
| **Substantial Completion:** | 8/30/2003 | 9/10/2003 | 11 |
| **Close Out:** | 2/21/2005 | 6/8/2006 | 472 |

## *CP04015 - CAMPUS - STEAM DIST. - VAULT 15 TO BUS. COLLEGE COMPLEX (EPPLEY WING) REPAIR VAULTS 61 & 78**

| | | | | | |
|---|---|---|---|---|---|
| **Authorized Budget:** | 475,000 | **Final Cost:** | 329,619 | **Classification:** | UTILITIES |
| **Construction** | 283,000 | **Returned:** | 145,381 | **Contractor:** | SANDBORN CONSTRUCTION, INC. |
| **Professional Services** | 77,150 | | | **A/E:** | EAS |
| **Owner Work and Material** | 10,000 | | | | |
| **Contingency** | 104,850 | | | **Funds returned to:** | 41-4844 Eng. Services/Condensate Lines & Steam Vault |

| Change Order | | % of Contract | % of Contingency |
|---|---|---|---|
| **Scope:** | 0 | 0.0% | 0.0% |
| **Document:** | -25,490 | -9.0% | -23.3% |
| **Field:** | 3,529 | 1.2% | 3.2% |
| **Total** | -21,961 | -7.8% | -20.1% |

| Schedule | Planned | Actual | Days (Under) / Over |
|---|---|---|---|
| **Substantial Completion:** | 9/17/2004 | 8/28/2004 | (20) |
| **Close Out:** | 6/30/2005 | 11/1/2005 | 124 |

# Closed Minor Capital Projects
# 2005-06

*Minor capital projects are projects greater than $250,000 and less than $1 million. The Board requested a listing of these projects on an annual basis. In addition to this annual report the Board will receive quarterly construction reports reflecting current and on-going construction projects.*

## Summary of Data

This report highlights the final cost for minor capital projects that were closed during the fiscal year. A minor capital projects is any project with an authorized budget less than $1 Million and $250,000 or greater. Since projects are closed, these are final costs.

## Analysis

Ten minor projects were closed during the fiscal year 2005-06. Fifteen of these projects were Just in Time projects. The total authorized budget for these projects was $4.3 million. The final project budget costs for these projects was $3.4 million dollars allowing a return of over $919,000, or 21% of the authorized budget.

## Future Focus

The funds returned were most closely associated with projects that have a higher contingency due to potential unknown or field conditions. Review and assessment of refining the contingency amount for these projects is underway.

## Appendix B: 2007 Annual Construction Management Report

| CP | Description | Budget | Final Cost | Returned |
|---|---|---|---|---|
| CP03377 | BERKEY HALL - REPLACE STEAM BOOSTER COILS IN BASEMENT | 780,000 | 657,769 | 122,231 |
| CP02073 | I.M. SPORTS WEST - REPLACE ELECTRICAL SUBSTATION | 740,000 | 560,304 | 179,696 |
| CP03129 | CASE HALL - REPLACE ELECTRICAL SUBSTATION | 650,000 | 361,979 | 288,021 |
| CP03308 | NATURAL SCIENCE - UPGRADE FIRE ALARM SYSTEM | 379,000 | 258,143 | 120,857 |
| CP02046 | REGIONAL CHILLED WATER PLANT NO. 1 - NORTH LOOP PUMP ADDITION | 330,000 | 295,928 | 34,072 |
| CP03408 | BERKEY HALL - FOURTH FLOOR UPGRADES | 320,000 | 272,505 | 47,495 |
| CP03132 | SHAW LANE POWER PLANT - REPLACE SUBSTATION | 300,000 | 278,295 | 21,705 |
| CP03252 | STEAM DISTRIBUTION - CAMPUS STEAM TUNNEL - FLOOD BULKHEADS | 285,000 | 212,451 | 72,549 |
| CP04444 | WONDERS HALL - REROOF AREAS 13, 18, 19, 21, 22, 23 | 270,000 | 256,649 | 13,351 |
| CP03394 | NATURAL RESOURCES - ELEVATOR REPLACEMENT | 250,000 | 230,548 | 19,452 |
| | **Projects: 10** | **4,304,000** | **3,384,571** | **919,429** |

## Appendix C: Construction

**Supplier Score Card for General Contractors**

| Standard | Score | Comments |
|---|---|---|
| **Quality - 30%** | 1 2 3 4 | |
| Timely Closure of Rework Items | | |
| Interruptions to Operations | | |
| Responsiveness to MSU comments/feedback | | |
| Qualitative Quality Rating Assessment | | |
| **Schedule - 20%** | 1 2 3 4 | |
| Performance Against Milestones | | |
| Uses Sound Logic for Schedule | | |
| **Timeliness of Schedule Reports to MSU** | | |
| Qualitative Schedule Rating | | |
| **Cost - 20%** | 1 2 3 4 | |
| Reasonableness In Dealing With Changes | | |
| Timely Processing of Changes | | |
| Change Order Rate | | |
| Qualitative Cost Rating | | |
| **Management Systems - 20%** | 1 2 3 4 | |
| Effectiveness of Coordination | | |
| Effectiveness of RFI/Change Order Process | | |
| Supplier Responsiveness | | |
| Management Commitment to MSU | | |
| Qualitative Management Rating | | |
| **Close Out - 10%** | 1 2 3 4 | |
| Punch List | | |
| Records Drawing and Documentation | | |
| Warranty Performance | | |
| **Total Score** (Based on Weighted Values) | 0.00 | |

**Figure 1.** *Supplier Score Card for General Contractors* Data is collected on each score card by the construction representative for each projects, stored in a database, and analyzed at the project and supplier level

## Appendix C: Construction

**AE Supplier Report Card**

| | |
|---|---|
| Supplier: | |
| Quarter for Review: | |
| Project: | |
| Prepared by: | |

| | Points | Data | Score | Comments |
|---|---|---|---|---|
| **Safety** | 10.0 | | | |
| | | | | |
| | | | | |
| | | | | |
| **Quality** | 30.00 | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| **Cost** | 15.00 | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| **Schedule** | 30.00 | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| **Management Systems** | 15.00 | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| **Total Score** | **100.00** | | **0.00** | |

**Figure 2.** *Supplier Report Card for Architects and Engineers* Data is collected on each score card by the construction representative for each projects, stored in a database, and analyzed at the project and supplier level

## Appendix C: Construction

*Capital Project General Contractor Performance*
*By Project Ranking*

| CP Project Name | Status | Overall Ranking (100) | Quality Ranking (30) | Schedule Ranking (20) | Cost Ranking (20) | Project Management Ranking (20) | Close Out Ranking (10) |
|---|---|---|---|---|---|---|---|
| CP04360 - - Contractor 1 | | 1 | 1 | 2 | 1 | 1 | 1 |
| | | 93.875 | 30.000 | 18.875 | 17.500 | 19.000 | 8.500 |
| CP04385 - - Contractor 2 | | 2 | 3 | 1 | 3 | 2 | 2 |
| | | 85.125 | 25.125 | 20.000 | 14.500 | 18.000 | 7.500 |
| CP04248 - - Contractor 1 | | 3 | 2 | 5 | 2 | 4 | 4 |
| | | 75.250 | 26.250 | 12.750 | 15.000 | 14.000 | 7.250 |
| CP03381 - - Contractor 2 | | 4 | 3 | 4 | 4 | 4 | 2 |
| | | 74.625 | 25.125 | 14.000 | 14.000 | 14.000 | 7.500 |
| CP06146 - - Contractor 2 | | 5 | 6 | 3 | 6 | 3 | 6 |
| | | 72.500 | 22.875 | 14.625 | 12.000 | 17.000 | 6.000 |
| CP03358 - - Contractor 2 | | 6 | 5 | 6 | 5 | 6 | 5 |
| | | 64.625 | 23.625 | 10.625 | 13.000 | 11.000 | 6.375 |
| Projects: 6 | | | | | | | |
| Average Score | | 77.667 | 25.500 | 15.146 | 14.333 | 15.500 | 7.188 |

100% to 80%
79% to 70%
69% & Below

**Figure 3.** *General Contractor Performance by Project Report – Sample*

## Appendix C: Construction

*Capital Project General Contractor Performance*
*By Contractor Ranking*

| General Contractor | Status | Overall Ranking (100) | Quality Ranking (30) | Schedule Ranking (20) | Cost Ranking (20) | Project Management Ranking (20) | Close Out Ranking (10) | Number of Projects Scored |
|---|---|---|---|---|---|---|---|---|
| Contractor 1 | | 1 | 1 | 1 | 1 | 1 | 1 | 2 |
| | | 83.188 | 26.438 | 16.750 | 14.750 | 18.000 | 7.250 | |
| Contractor 2 | | 2 | 2 | 2 | 2 | 2 | 2 | 4 |
| | | 74.906 | 25.031 | 14.344 | 14.125 | 14.250 | 7.156 | |
| **Number of Contractors: 2** | | | | | | | | |
| **Average** | | **79.047** | **25.734** | **15.547** | **14.438** | **16.125** | **7.203** | |

**Figure 4.** *General Contractor Performance Ranking Report - Sample*

**Appendix D: Power & Water**

## CURRENT AND FUTURE ENERGY INITIATIVES LIST

### Current Pilot Projects

- **Retro-Commissioning** – Employ an "Energy Team" to perform retro-commissioning of existing buildings with a focus on energy savings. Pilot project in Veterinary Oncology Addition is proving to be of value, with 50 deficiencies identified to date. Commissioning includes balancing of air and water systems along with the evaluation of existing equipment/building performance by a group of air/water balance technicians and controls technicians to assure the building equipment is operating as designed and at peak efficiency.

- **Continuous Commissioning** – Central Control collects and trends data continuously on building operation to identify areas of potential energy savings. Pilot project in 4 buildings has identified $176,700 annual savings to date.

- **Bio-Mass Fuel** – Continue to investigate burning alternative fuels at the Power Plant.

### Future Energy Projects

**Owner Commissioning of New Facilities** – Provide an in house commissioning group for new facilities to ensure we meet energy achievements of Leadership in Energy and Environmental Design (LEED) criteria.

- **Building Utilization** – Review equipment schedules, building hours and class schedules to optimize and consolidate building and equipment use where possible.

- **Construction Standards** – Continue to explore new technologies with a focus on attaining LEED certification and 20% energy reduction below ASHRAE 90.1.

- **Air Conditioning Study** – Provide a forecast for air conditioning on campus, including residence halls. Feasibility study to convert select buildings on North Campus to distribution system in lieu of individual electric driven cooling (window ac units).

- **Computer Lab and Server Rooms** – Evaluate current practices with regard to computer lab and server room operation, including air conditioning of those spaces and conduct a utilization study.

- **Central Control** –Connect Manly Miles and Nisbet Building to Central Control.

- **Lighting Controls** – Continue to evaluate and identify areas that occupancy sensors or photo cell control would apply in existing facilities. Retrofit those areas that would lend themselves to control.

- **New Technology or Equipment** – Evaluate and identify opportunities to install new technology or equipment that have proven energy savings.

**Appendix D: Power & Water**

- **Metering** – Upgrade existing meters in buildings to include real time data accessible to campus users to encourage energy conservation and **behavioral changes**

- **Anaerobic Digester –** Install digester on south campus to provide alternative energy use, offset Methane project for CCX and decrease the need for more land to apply existing manure and stay within phosphorus concentration levels allowed.

- **Transportation** - Offer links from MSU Travel page to Terra Pass to allow concerned employees to offset travel miles. Continue to evaluate alternative fuel vehicles for campus fleet.

- **Compact Fluorescent Lamp (CFL) Replacement** - Join EPA's Change A Light Campaign – Swap out incandescent lamps on campus with CFL's website for individual lamps that customers on campus may have in their offices.

- **CCX** – Chicago Climate Exchange - Manage the program and perform the necessary reporting to comply.

**Appendix E: Accessibility**

# Michigan State University
# Barrier Free/Accessibility – Project Status Summary
# January 2007

## *Projects Completed – FY05, FY06, FY07 (projects arranged alphabetically)*[1]

### Bessey Hall

- Install magnetic hold open devices on the hallway doors to the classroom and faculty office wing on the 2nd floor. Status: Completed: Fall 2006. Cost ~$4,400.

### Campus Parking

- Phase II and III of a three year project to modify existing barrier free parking spaces to meet updated code requirements and install additional accessible spaces increasing the overall capacity of the parking system. The number of spaces updated across both years was approximately 390 and new spaces equated to approximately 380. Completed: Summer 2005 and Summer 2006. Cost ~$1.8 mil.

### Computer Center

- Raise the sidewalk grade at the south and east main entrances to match granite slab. Install tactile strip between walkway and bike loops at east door. Completed: Summer 2005. Cost: ~$14,000.

### Fee Hall - West

- Install automatic door opening devices on the exterior and interior door set at the barrier free main entrance of West Fee Hall. Completed: Fall 2006. Cost: ~$18,000.

### **Geography Building** (formerly Psychology Research Building)

- As part of a plan for alterations to house the department of Geography; modify site to provide ramped/grade level entry to the building (west entrance), automate entry doors, include snow melt system, rework barrier free parking, provide toilet room modifications, ADA signage and fire alarm modifications. Completed Fall 2005, Barrier free improvements Cost ~$515,000.

### Human Ecology Building – North Entrance

- Re-pave walkway and adjacent barrier-free parking spaces; reduce pound pressure on entry door and install magnetic hold open on interior entry door. Completed: Fall 2005, Cost: ~$3,000.

### IM West (Fitness Center)

- As part of the renovations to provide for a new Fitness Center at the IM West, the addition was constructed to meet barrier free accessibility codes, including elevator access to the second level, so that persons with disabilities could use the facility. Completed: Summer 2005. ~$80,000

[1] Project funding sources include the Athletic Department, the Housing and Food Services Division, the Parking System, Private Donor support as well as the centrally budgeted Alterations and Barrier Free Accounts.

## Appendix E: Accessibility

### Marshall-Adams Hall Renovation

- As part of the comprehensive renovation plan for the Department of Economics, exterior building access and interior building circulation was designed to meet ADA codes including: modification to toilet room facilities, corridor and door width alterations, signage, elevator installation and fire alarm upgrades. The accessible entrance also includes a snowmelt system. Completed: Summer 2005, Cost: within the total building renovation cost of $6.0 million.

### Owen Graduate Center

- Renovate 4 bathrooms on the main floor and basement areas to provide for and enhance accessibility. Completed: Summer 2006, Cost: ~$175,000.

### Psychology Building

- Install hold open devices on corridor entry doors to the center classroom wing to improve access for persons with mobility impairments. Completed: Fall 2005, Cost: ~$2,000.

## *Projects Funded & In Process FY07*

### Computer Center

- Install power assisted doors at the East and West main entrances. Status: In Process. Anticipated completion: Spring 2007. Cost ~$35,000

### Erickson Hall – Addition Project

- The project constructed a single story 6,700 gsf addition on the east side of the building. While conforming to all ADA construction codes, the project will also rework the main entrance and entrance to the addition. One set of the main entrance doors will continue to be automated and one set of doors at the SE entry (adjacent to the new addition) will be automated; a snowmelt system will be installed at the main entrance connecting to the barrier free parking areas. Anticipated Completion: Addition - December 2006, Main Entry – Summer 2007 Cost: ~$75,000 (estimated cost within total project of $2.45mil)

### Snyder-Phillips Hall – New Residential College

- As part of the planned renovation to the residence section of the building, work will include renovating bathrooms to ensure ADA compliance and upgrading signage to meet barrier free codes. The center section will be completely rebuilt with a new dining commons on the first floor; the ground level and two upper floors will house space for the New Residential College. The addition will be barrier free consistent with ADA construction codes, passenger elevators will be installed and barrier free parking is planned at the new north main entrance. Status: Completing design, expected construction start is May 2006.

# Accessibility Projects In Planning / Under Review

### Auditorium Building

- Provide elevator access to the second and third floor west office wing as well as the balcony seating of the Auditorium. Construct an elevator tower at the SW corner of the building including necessary walk-way improvements and power assisted entry doors. Interior modifications to include upgraded toilet rooms on the first floor, power assisted corridor doors, and ADA signage. Estimated cost: ~$1.5 mil. Status: Awaiting identification of funding.

### Chittenden Hall Building

- Modify site to provide ramped/grade level entry to the building, automate entry doors as necessary, evaluate need for snow melt system, check availability of barrier free parking, install elevator for access to all levels, provide toilet room modifications, ADA signage and fire alarm modifications as required. Program: Graduate School. Status: Will be completed as part of a comprehensive building renovation. Awaiting identification of funding.

### Cook Hall Building

- Modify site to provide ramped/grade level entry to the building, automate entry doors as necessary, evaluate need for snow melt system, check availability of barrier free parking, install elevator for access to all levels, provide toilet room modifications, ADA signage and fire alarm modifications as required. Program: Agricultural Economics. Status: Will be completed as part of a comprehensive building renovation. Awaiting identification of funding.

### Demonstration Hall

- Reevaluate design of barrier free access to the building. Replace the temporary ramp with a more permanent design that accomplishes access while integrating the system with the architecture of the building and the landscape of the surrounding area. Status: Design and cost study in progress.

### John Hannah Administration Building

- Alter first floor restrooms for barrier free access. Note: Restrooms on the third floor are barrier free however, due to the amount of public traffic on the first floor, these restrooms are under review. Estimated Cost: ~$70,000. Status: Under review.

### MSU Union

- Automate doors in various interior locations on the first and fourth floors. Replace wheelchair lifts on the third floor. Estimated Cost: ~$130,000. Status: Awaiting identification of funding.

### Old Botany Building

- Modify site to provide ramped/grade level entry to the building, automate entry doors as necessary, evaluate need for snow melt system, check availability of barrier free parking, install elevator for access to all levels, provide toilet room modifications, ADA signage and fire alarm modifications as required. Program: Economics Department. Status: Will be completed as part of a comprehensive building renovation. Awaiting identification of funding.

### Urban Planning and Landscape Architecture Building

- Modify site to provide ramped/grade level entry to the building, automate entry doors as necessary, evaluate need for snow melt system, check availability of barrier free parking, provide toilet room modifications, ADA signage and fire alarm modifications as required. Program: Urban and Regional Planning and Landscape Architecture. Estimated Cost: ~$985,000 - $1.3 mil. Status: Under review.