Facility Management at MIT

1.040 & 1.401J Project Management

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Agenda

- Context
  - MIT's Department of Facilities
  - Dimensions and challenges
  - Organization
  - Roles and responsibilities
- Recent Projects
- Integrated Design Process
- New Projects

MIT's Department of Facilities

- Enables the educational, research, and business activities of MIT
- 600+ employees, 12 million sq. ft. floor area, 125 buildings, 153 acres
- Stakeholders - 20,000 member community including faculty, students, researchers, administrative staff, and support personnel. Plus employees' and students' families, alumni, guests, benefactors, research grantors, abutters, the cities of Cambridge and Boston, insurers, and local, state, and federal regulators
- Manage and serve several billion dollar campus buildings and systems
- Annual operating budget - $90 million, excluding capital construction and parking and transportation
- $1.4 billion capital construction program recently completed – more on the way
- 20 megawatt cogeneration facility
- Responsibilities include the production and distribution of electricity, steam, and chilled water; distribution of fire protection and domestic water; cleaning, repair, and maintenance of buildings, parking areas, campus roads and walkways, and landscape; snow removal; mail collection and delivery; on campus moving, shipping and receiving; parking and transportation; campus planning; project management; architectural, interior, and engineering design; systems engineering; purchasing, finance, and accounting; and space accounting for government overhead recovery

Dimensions

- National
  - All levels
    - 4,168 institutions
    - 15,927,978 students
  - Public and private 4-year institutions
    - 2,466 institutions
    - 9,677,408 students
- MIT
  - 10,253 students

Challenges

- Physical condition
  - Impact on student's decision to apply for and accept admission
  - Impact on faculty recruitment and retention
  - Deferred maintenance
  - Stewardship
- Demanding clients
- Regulations - compliance
- Adequacy of internal and external infrastructures to enable near future technologies, e.g. HPC
- Hazards, natural and person related (intentional and unintentional)
- Upgrading skill sets for the future (without losing sight of the past)
- University as resource to community

Deferred Maintenance

Campus growth responds to increasing enrollment

- The GI Bill
- Society and new technologies

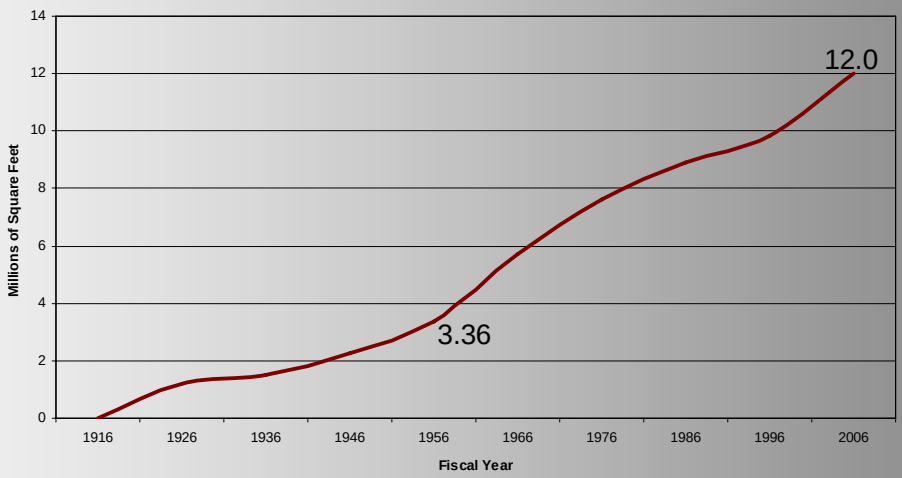
Funding for maintenance has not kept pace with growth, therefore, a deferred maintenance backlog and deteriorating infrastructures

Nationally 80% of campus buildings constructed < 1980

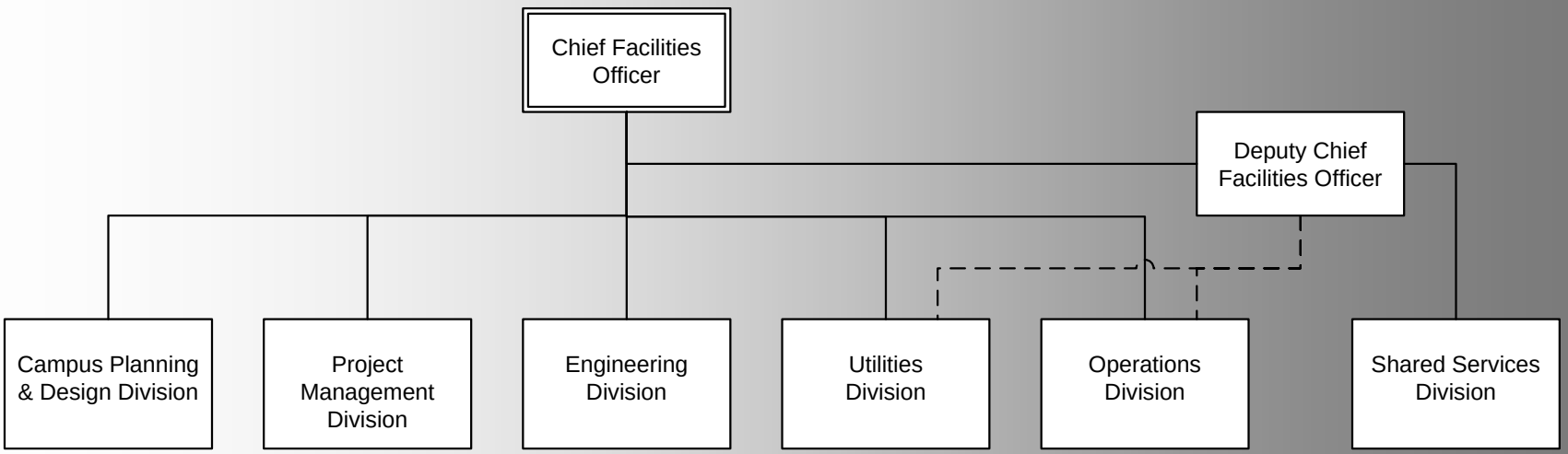
Funds focused on academic and research programs and capital construction does little to reduce the backlog

Deferred Maintenance at MIT

Since 1957, building floor area on MIT campus has increased and deferred maintenance funding has not kept pace, therefore a deferred maintenance backlog



Department of Facilities Organization



Roles and Responsibilities of Campus Facility Management Professionals

Engage & manage stakeholders

Repairs

Alarm monitoring

Dispatching

Codes and regulations

Employee performance

Quality control

Consultant

Salaries and wages

Strategic direction

Risk management

Application of resources

Preventative maintenance

Landscape & hardscape planning & design

Energy conservation

Utilities and building systems

Project management

Cross division projects

Stewardship

Emergency response

Security

Work scheduling

Staffing

Human resources

Training

Financing and accounting

Leadership

Bargaining unit

Planning and forecasting

Infrastructure renewal

Decision making

Cleaning

Grounds maintenance

Recycling and trash disposal

Engineering and architecture

Capital construction and renovations

Cross department projects

Campus Planning and Design Division

- Planning and analysis
- CRSP and Building Committee support
- Capital and space planning
- Capital project definition and development
- Designer selection
- Design review
- Drawing information services

Project Management Division

- Client advocate
- Design
- Estimating
- Project management
  - Capital
  - Space change
- Space planning
- Interior design
- Furniture selection

Engineering Division

- Sustainable building systems
- Waste water treatment
- Energy and utility conservation
- Building systems
  - HVAC
  - Energy conservation
  - Electrical
  - Plumbing and piping
  - Utilities
  - Fire alarm and suppression
  - Civil
  - Structural
- Consultant to project managers

Utilities Division

- Maintains electricity, heating & cooling resources
- Implements conservation efforts
- Plans for MIT's future energy needs
- Operates cogeneration facility
  - Electricity
  - Steam
  - Chilled water
- Operates east campus chiller plant
- Underground utility distribution systems
- Electric substations

Operations Division

- Custodial services
- Grounds
- Recycling
- Mail
- Operations center
- Repair and maintenance

Shared Services Division

- Administrative functions
- Human resources
- Labor relations
- Training
- Communications
- Recruitment
- Personnel information
- Finance and accounting services
- Information technology

Select Completed Projects: 1998-2005

Ray and Maria Stata Center	716,000 gsf
Brain and Cognitive Sciences	430,000 gsf
Building 18 Renovation	165,000 gsf
Zesiger Sports and Fitness Center	162,000 gsf
Simmons Hall Undergraduate Dorm	197,000 gsf
Sidney Pacific Grad Dorm	400,000 gsf
224 Albany Grad Dorm	90,000 gsf
Baker House Renovation	135,000 gsf
Vassar Streetscape East	
Utility Expansion	
Lobby 7 Cleaning and Skylights	
Infrastructure Renewal Projects	

Integrated Design Process

Until ~ 200 years ago

The Master Builder

Architect/Engineer, Builder, Materials supplier, Labor supplier

- Saw the project as a whole
- Understood constructability
- Controlled materials & labor
- Delivered a good result

Building Team

- Facility planner
- Program manager
- Programmer
- Real estate management
- Facility manager
- Architect
- Roofing consultant
- Day lighting consultant
- Plumbing engineer
- Fire protection engineer
- Code consultant
- Landscape designer
- Structural engineer
- Civil engineer
- Electrical engineer
- Lighting consultant
- HVAC engineer
- Window consultant
- Hardware consultant
- Commissioning agent
- Fire alarm testing agent
- CQM manager
- Sustainability consultant
- Energy modeler
- Cost consultant
- Construction manager
- Air quality consultant

An Iterative Process

- Benefits
  - Revisit earlier decisions
  - Examination of proposals in context of others
  - Works in real time
  - Better design
- Requirements
  - Needs a Facilitator
  - Design team – rules of thumb
  - Needs a commitment from all
- Risks
  - May take longer
  - May cost more in fees

Current Projects (select list)

Vassar Streetscape West	
Sloan School	215,000 gsf Plus 425 car garage 190,00 gsf
Media Arts and Sciences	197,000
NW35 Graduate Residence	275,000
PDSI	80,000 gsf Plus 50,000 gsf infill
E25 HST and EAPS Renovation	50,000 gsf
Cancer Research Facility	340,000 gsf
Main Group Window Replacement	
Kresge Exterior Renovation	

NW35 Graduate Student Dorm

Image of architectural mock-up removed due to copyright restrictions.

- 211 efficiencies, 50 two-bedroom apartments, 32 three-bedroom apartments, and 50 three-bedroom “lite” units (without kitchens or living rooms).
- Exercise facilities, performance/lounge space, large multi-purpose community room, space for the potential of a dining option, floor lounge/kitchens, and the relocation of the Thirsty Ear Pub.
- 550 beds, organized into efficiency, two, and three bedroom apartments.
- Three to five stories tall.
- Use of recycled materials and resources; low usage shower heads, toilets and appliances; energy efficient roofing materials and lamping; water reuse system for landscape irrigation.

Project Manager/MIT	Gary Tondorff-Dick, AIA, LEED
Design Architect	William Rawn Associates, Architects, Inc.
M/E/P Engineers	Vanderweil Engineers
Structural Engineers	LeMessurier Consultants
Landscape Architect	Richard Burck Associates, Inc.
Sustainable Design	The Green Engineer
Construction Manager	Bovis Lend Lease

Sloan School

Architect's sketch removed due to copyright restrictions.

- 205 offices, 6 classrooms, over 30 group study rooms, dining, Executive Education suite, lounge areas, and outdoor spaces including a rebuild of Sloan Plaza
- Connects Buildings E52 and E60, improving access to all MIT facilities on the block
- 425 car garage below the building
- Expected to qualify for a "LEED Silver" or higher
- Expected to achieve lighting at an average energy use below 1 watt per square foot (sq.ft.), cooling at over 700 sq.ft. per ton, heating at about 10 BTUH/sq.ft
- Heat gain controlled by high performance glazing supplemented by motor-operated window shading in critical applications, broad use of occupancy sensing and demand-based ventilation, and careful sizing of pumps and fans to reduce parasitic loads
- Offices will have operable windows and individual space temperature control
- Where feasible, water-based terminal units like chilled beams and radiant panels will be used for space heating and cooling

Sloan School – Project Team

Project Managers/MIT	Michael Hand, Senior Project Manager, Facilities Richard Quade, Construction Project Manager, Facilities Lakhan Verma, Senior Engineer, Facilities Cindy Hill, Director of Sloan Capital Projects
Design Architects	Moore Ruble Yudell Architects & Planners, Santa Monica, CA Executive Architects Bruner / CottArchitects, Cambridge, MA
M/E/P Engineers	vanZelm, Heywood & Shadford, Farmington, CT
Structural Engineers	LeMessurier Consultants, Cambridge, MA
Landscape Architect	Halvorson Design Partners, Boston, MA
Sustainable Design Consultant	Energysmiths, Meriden, NH
Civil Engineer	Nitsch Engineering
Geotechnical Engineer	Haley + Aldrich, Boston, MA
Acoustics/A-V/ IT/ Telephony Consulting	Acentech, Cambridge, MA
Lighting Design	Benya Lighting, West Linn, OR
Materials Handling Consulting	SEA Consultants, Cambridge, MA
Code Consulting	Shirmer Engineering Corporation, Farmington, MA
Elevator Consulting	Syska Hennessey Group, Inc., Cambridge, MA
Food Service Consulting	Ricca Newmark Design-Boston, Norwell, MA
Parking Consulting	MeM Parking, LLC, Cambridge, MA
Traffic Consulting	Tetra Tech Rizzo, Farmington, MA
Curtainwall Consulting	CDC Curtainwall Design & Consulting, Inc., Canton, CT
Permitting/Historic Consulting	Epsilon Associates, Inc., Maynard, MA
Specs	Kalin Associates, Inc., Newton, MA
Cost Consulting	Vermeulens Cost Consultants, Richmond Hill, ON, Canada
Construction Manager (Including Preconstruction Services)	Walsh Brothers, Inc., Boston, MA

Vassar Streetscape West

Plan-view diagram of street and buildings removed due to copyright restrictions.

Project Manager/MIT	Richard Quade
Construction Management	Camp Dresser & McKee, Inc.
Landscape Architect	Carol R. Johnson & Associates, Inc.
Civil Engineers	Judith Nitsch Engeering, Inc.
Utility Engineers	SEA Consultants, Inc.
Transportation Engineers	Rizzo Associates, Inc.
Lighting Design	Peter Coxe Associates
General Contractor	McCourt Contracting Company, Inc.

Media Arts and Sciences

Fumihko Maki + Maki & Associates

Leers Weinzapfel Associates, Architects, Inc

Image of architectural mock-up removed due to copyright restrictions.

Designed and bid: 2002

Re-designed & bid proposal: 2003

Design updated (code & product changes): September 2006

Bid: December 2006

February 2007 bids received (incomplete - w/o curtain wall)

- 25 entities in U.S. capable, 1 interested

March 2004 to February 2007

- Cost increased by 35% exclusive of curtain wall
- Curtain wall cost doubled

Main Group Window Replacement

Photograph of MIT main campus from Killian Court; removed due to copyright restrictions.

Project Manager:	John Hawes
Architect:	Payette
Engineer:	Simpson Gumpertz & Heger, Inc

- Primary facades: 560 units 67,000 sf
- Secondary facades: 900 units 70,000 sf
- Double hung counterweighted windows ingenious approach to occupant comfort
- Issues to consider: thermal performance, cost, comfort, durability, historical context, operability …

Kresge Exterior Renovation

Photograph of Kresge Auditorium on the MIT campus; removed due to copyright restrictions.

Designed by Eero Saarinen and built 1953 – 1955

Study underway:

Project Manager – John Hawes

Architect - Kevin Roche John Dinkeloo Architects, LLC

Engineer - Simpson Gumpertz & Heger, Inc

Cancer Research Facility

Architect	Ellenzweig Associates, Inc
HVAC Engineer	BR+A
Structural Engineer	LeMessurier Consultants
Civil Engineer	Nitsch Engineering
Sustainability	The Green Engineer (Chris Schaffner)

Elements under consideration:

- Heat recovery: entropy heat wheel, glycol coils, & heat-pipe recovery units
- Low flow fume hoods (70 feet per minute not 100 fpm)
- Lab HVAC: conventional vs. hydronic cooling hybrid
- Airflow monitoring & control: 6 air changes / hour occupied to 3 – 4 air changes / hour unoccupied
- Modify heat and cooling standard, i.e. warmer in summer & cooler in winter
- LEED Silver

Questions?