

HOW THE UNIVERSITY IS PREPARING STUDENTS TO INFLUENCE THE DEVELOPMENT AND MANAGEMENT OF THE HEALTHCARE BUILT ENVIRONMENT

2015 MIDWEST HEALTHCARE ENGINEERING CONFERENCE

NOVEMBER 11-13, 2015

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Theodore J. Weidner, Ph.D., PE, AIA, GGP, CEFM

Associate Professor, Division of Construction Engineering & Management

Bradley Benhart, MBA, LEED

Clinical Assistant Professor & Assistant Head, School of Construction Management Technology

Principal, Integrated Construction Resources

OVERVIEW

Brief History at Purdue

Research Examples

Healthcare Construction Management Education

Facilities Engineering and Management Education

Industry-Academe Cooperation and Collaboration

BRIEF HISTORY

BACKGROUND OF DEVELOPMENTS AT PURDUE

- Regenstrief Center for Healthcare Engineering (RCHE) established 2005
- Healthcare Construction Management (HCM) concentration within the Polytechnic Institute (formerly College of Technology)
- ASHE engaged regarding succession planning leading to first student chapter of ASHE (2007)

The screenshot shows the website for the Regenstrief Center for Healthcare Engineering (RCHE) at Purdue University. The page includes a navigation menu with links for Home, About Us, Research, Resources, Partners, Regenstrief Foundation, News, and Events. A central infographic titled 'National Impact' displays a map of the United States with various statistics: 1 Research and Analysis Hospital Partners, 21 (in a green circle), 5 (in a green circle), 1 (in a green circle), 40 (in a green circle), 1 (in a green circle), 2 (in a green circle), 50 (in a green circle), 123 Healthcare Providers, and 4 Healthcare Vendors. A 'Patient Safety Organization' and 'National Community of Practice' button is visible. A 'New Director Search' announcement for Summer 2015 is also present, along with a 'View All News' button. The footer contains contact information for Purdue University and social media links.



HEALTHCARE CONSTRUCTION MANAGEMENT (HCM) - SCHOOL OF CONSTRUCTION MANAGEMENT TECHNOLOGY

Bradley Benhart, MBA, LEED

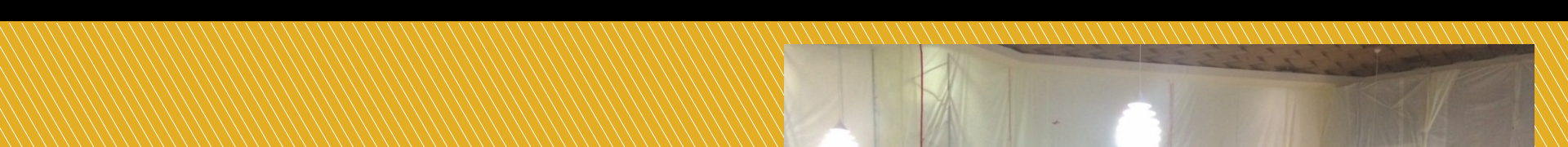
Clinical Assistant Professor & Assistant Head, School of Construction Management Technology



PROGRAM DETAILS

- ❖ Classroom
- ❖ Partnerships
- ❖ Case Studies
- ❖ Guest Lectures
- ❖ Project Tours
- ❖ Mock Ups
- ❖ Internships
- ❖ Applied Research











Indiana Society for Healthcare Engineering



PURDUE
UNIVERSITY

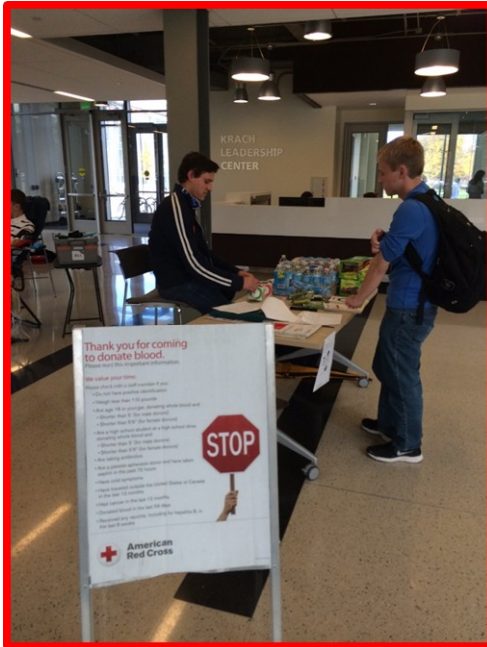


PURDUE ASHE CHAPTER 2014-2015

ASC CONSTRUCTION COMPETITION



ANNUAL ASHE BLOOD DRIVE



2015 PDC SUMMIT



P+D STUDENT DESIGN CHALLENGE



HEALTH ASSURANCE

Healthcare facilities are designed to ensure the safety and well-being of patients and staff. This project aims to enhance health assurance through various measures.

PROJECT GOALS

- COMMUNITY MAPPING
- DATA WAYS DAILY
- ENVIRONMENTAL PRESERVATION

1963

2015

The project involves a comprehensive health assurance plan, including community mapping, data analysis, and environmental preservation. The plan is divided into two main phases: 1963 and 2015, illustrating the evolution of the facility's health assurance measures over time.

SITE CIRCULATION

SITE PLAN

VEGETABLE

PEDESTRIAN

The site plan details the building layout, parking areas, and surrounding streets (Broadway St, 10th Avenue). It also includes detailed plans for vegetation and pedestrian circulation, ensuring a safe and accessible environment for all users.

PLANS + FEASIBILITY

GROUND FLOOR

MEZZANINE

\$260/sf

\$9.4 million

11 months

The plans and feasibility study provide a detailed overview of the building's ground floor and mezzanine levels. Key metrics include a cost of \$260/sf, a total project cost of \$9.4 million, and a completion timeline of 11 months. The 3D rendering shows the building's modern architectural style and glass facade.

MEP FEATURES

AHU service

Duct layout

daylighting
(through acute + waiting)

daylighting+airflow
(through FT + trauma)

mechanical schematic

Building Vitals

Human Essentials

The MEP features section details the building's mechanical, electrical, and plumbing systems. It includes schematics for AHU service, duct layout, and mechanical systems. It also highlights daylighting and airflow strategies, as well as building vitals and human essentials like air, water, and fire safety.

+ FLOAT

ADAPTIVE REUSE | REDESIGNING EMERGENCY CENTER

© 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100

CONCEPT: SAVE IT FLOAT!

- 01 existing building
- 02 float the building
- 03 LIFT UP
- 04 reposition post

01 existing post
02 reposition
03 LIFT program
04 system

+ FLOAT

ADAPTIVE REUSE | REDESIGNING EMERGENCY CENTER

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THANK YOU!

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FACILITIES ENGINEERING & MANAGEMENT

Theodore J. Weidner, Ph.D., PE, AIA, GGP, CEFP

Associate Professor, Division of Construction Engineering & Management

INCREASING STUDENT AWARENESS

FACILITY ENGINEERING & MANAGEMENT

- Technical/numerical approach to operating and maintaining hospital facilities
- Analysis of total staff requirements
- Determination of maintenance expenditures
- Workload balancing
- Capital renewal projections
- Energy consumption and management

FACILITY ENGINEERING & MANAGEMENT

Data Inputs

- Building size
- Building area breakdown
 - Clinical facilities
 - Laboratories
 - Offices
 - Other
- Building Components
 - Recognized standards for maintenance
 - Empirically developed standards

EXAMPLE SQUARE FOOT ANALYSIS

Description	Classification	Level	Area	Sf/person/ day	People
Telecom	Utility	2	1,305	6,000	0.2
Electrical	Utility	2	1,305	6,000	0.2
Janitorial supply	Utility	2	1,305	6,000	0.2
Floor mechanical rooms	Utility	2	1,305	6,000	0.2
Laundry / Housekeeping	Public (Circulation) with Hard Floor	2	17,500	24,400	0.7
Stairwell	Stairwell	2	6,750	18,600	0.4
Elevators	Vending	1	920	5,900	0.2
Mail/Receiving	Storeroom	2	2,500	240,200	0.0
Structural Components	No Cleanable Area	1	33,750	0	

CUSTODIAL EMPLOYEES REQUIRED

Sum of Required Employees	52.70
Adjusted FTE required	74.80
Round up	75

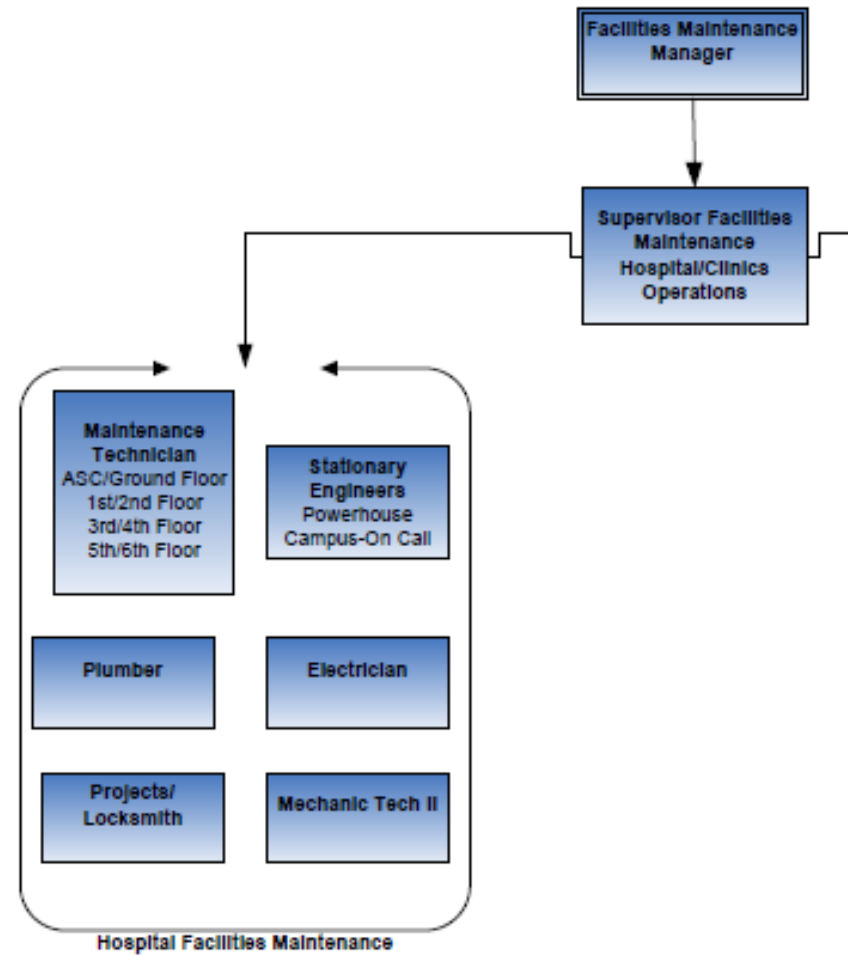
Direct Wage	\$9.50
Overhead (Assumed)	\$15.00
Per Hour Cost	\$24.50
Custodial Required Budget	\$3,836,700

EXAMPLE MAINTENANCE ANALYSIS

Current staffing

- Lead (1)
- Electrician (1)
- HVAC (1)
- Carpenter (2)
- Plumber (1)
- Mechanic Tech (4)
- Stationary Eng. (1)

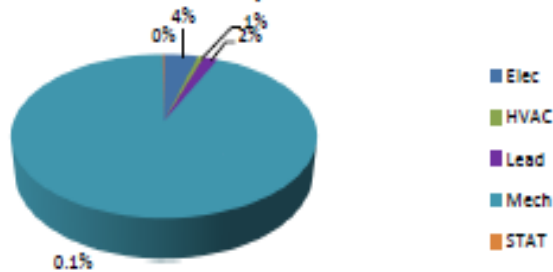
Trade hours?



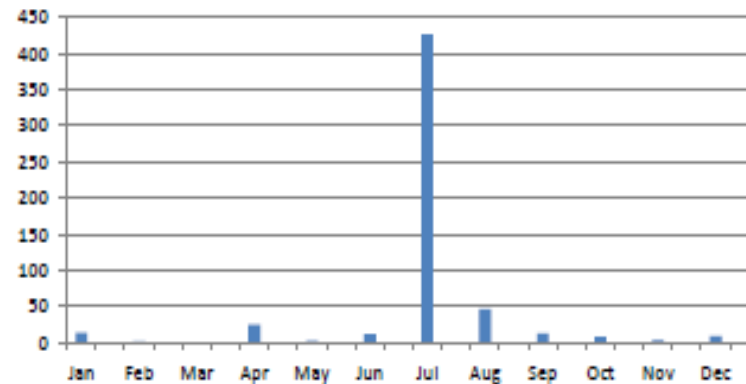
MONTHLY REVIEW OF STAFFING

Annual PMs		554		554															
Due Date:	Jan		Feb		Mar		Apr		May		Jun								
	1	31	1	28	1	31	1	30	1	31	1	30							
	13		1		0		24		2		11								
Quantity:	13		1				21		3		9		2						
%:	2.35	0.00	0.00	0.18	0.00	0.00	3.79	0.54	0.18	0.18	1.62	0.36							
Due Date:	Jul		Aug		Sep		Oct		Nov		Dec								
	1	31	1	31	1	30	1	31	1	30	1	31							
	427		46		12		7		3		8								
Quantity:	238	189	46		12		1	6	3		7	1							
%:	42.96	34.12	8.30	0.00	2.17	0.00	0.18	1.08	0.54	0.00	1.26	0.18							
Skill	Trade	# PMs	% PMs	Trade	# PMs	% PMs	Trade	# PMs	% PMs	Trade	# PMs	% PMs	Trade	# PMs	% PMs				
	Elec	24	4.33	HVAC	4	0.72	Lead	10	1.81	Mech	515	92.96	STAT	1	0.18				

Annual PM/Skill

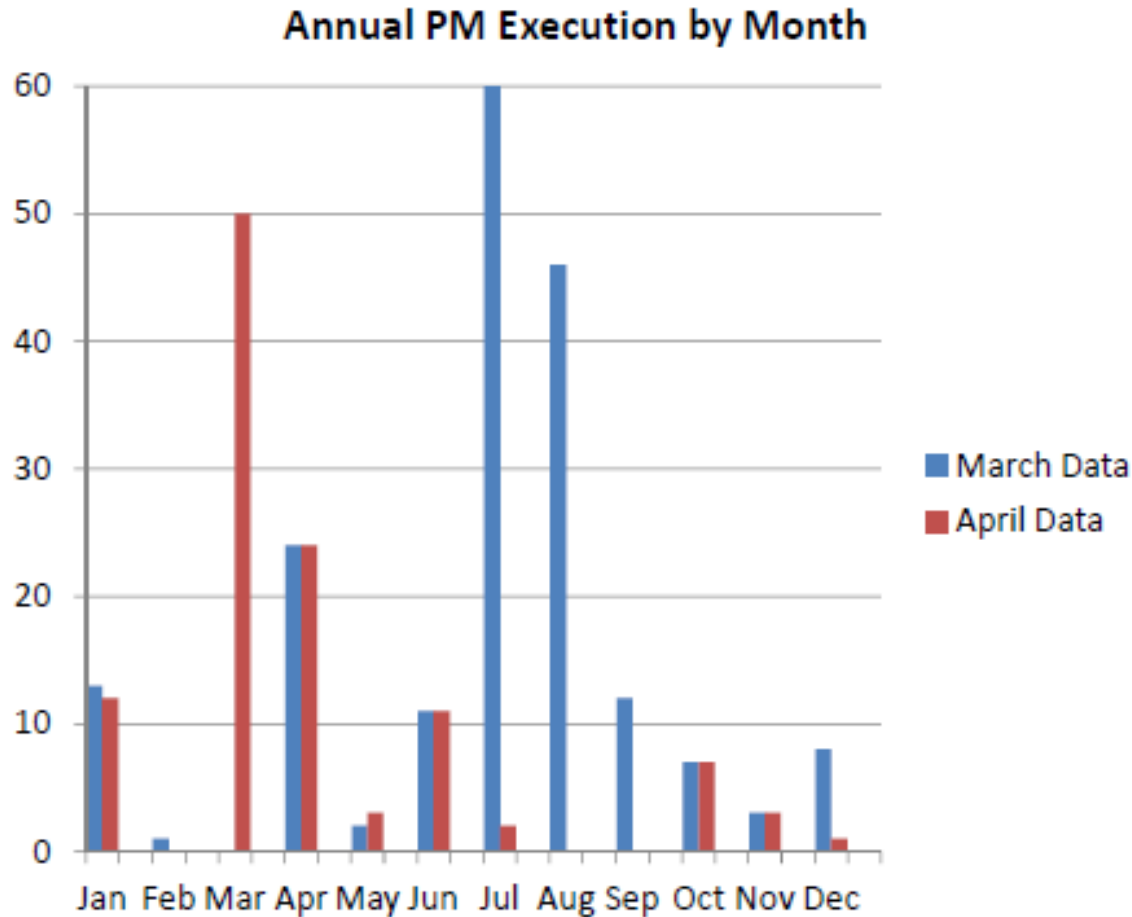


Annual PM Execution by Month



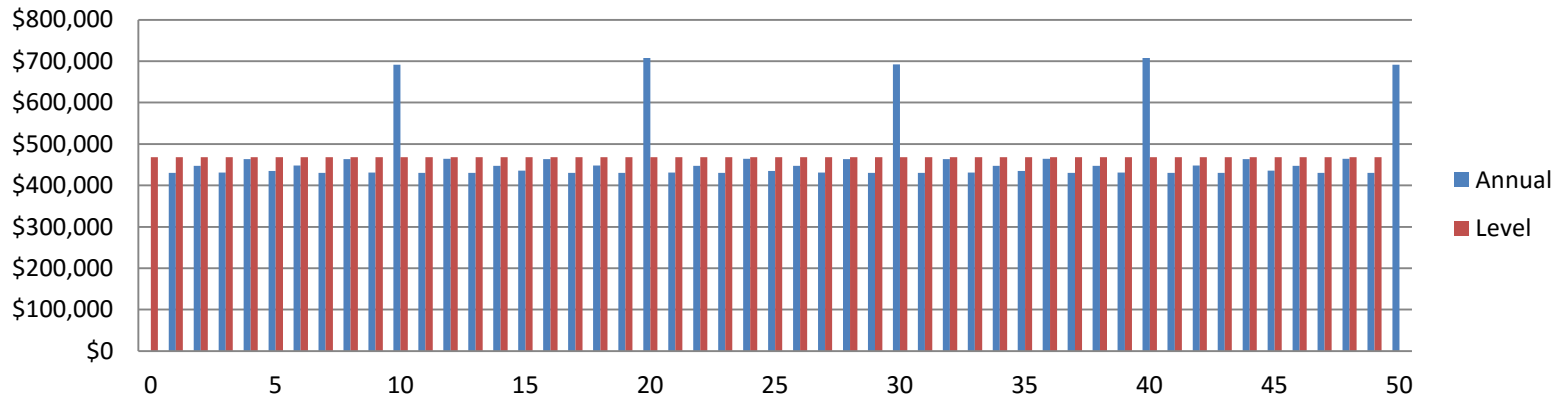
MONTHLY COMPARISONS

GOAL TO LEVEL MONTHLY WORKLOAD WHILE REMAINING COMPLIANT



MAINTENANCE – IN HOUSE \$

In House

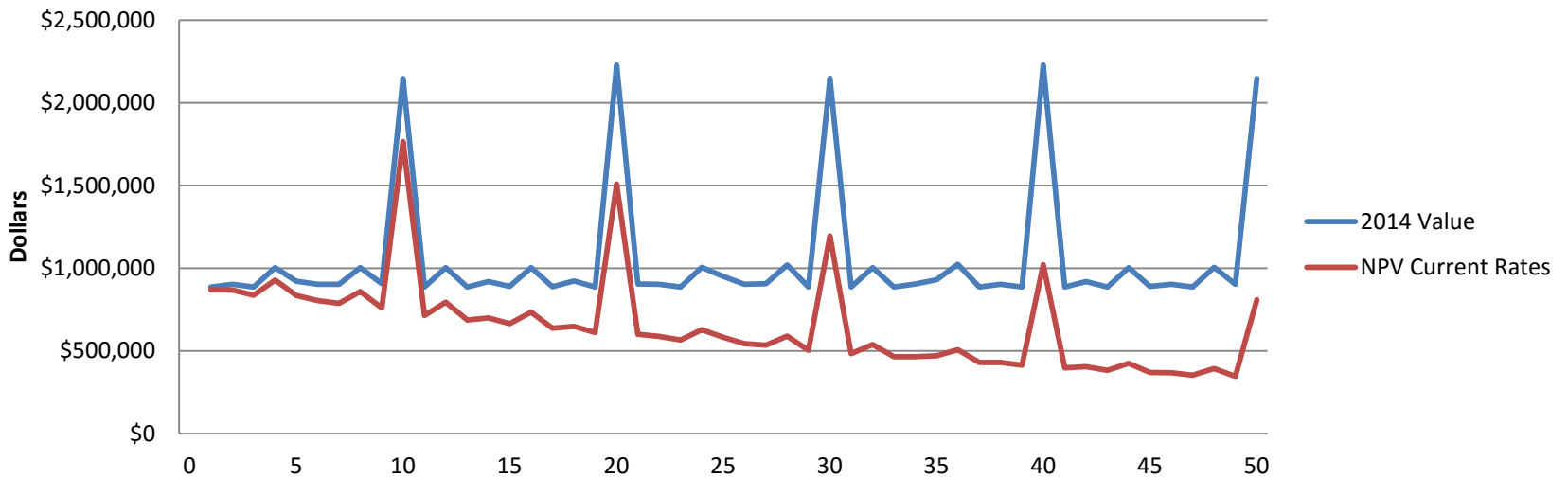


Maximum	\$707,736
Minimum	\$430,011
Average	\$467,831

LONG-TERM MAINTENANCE

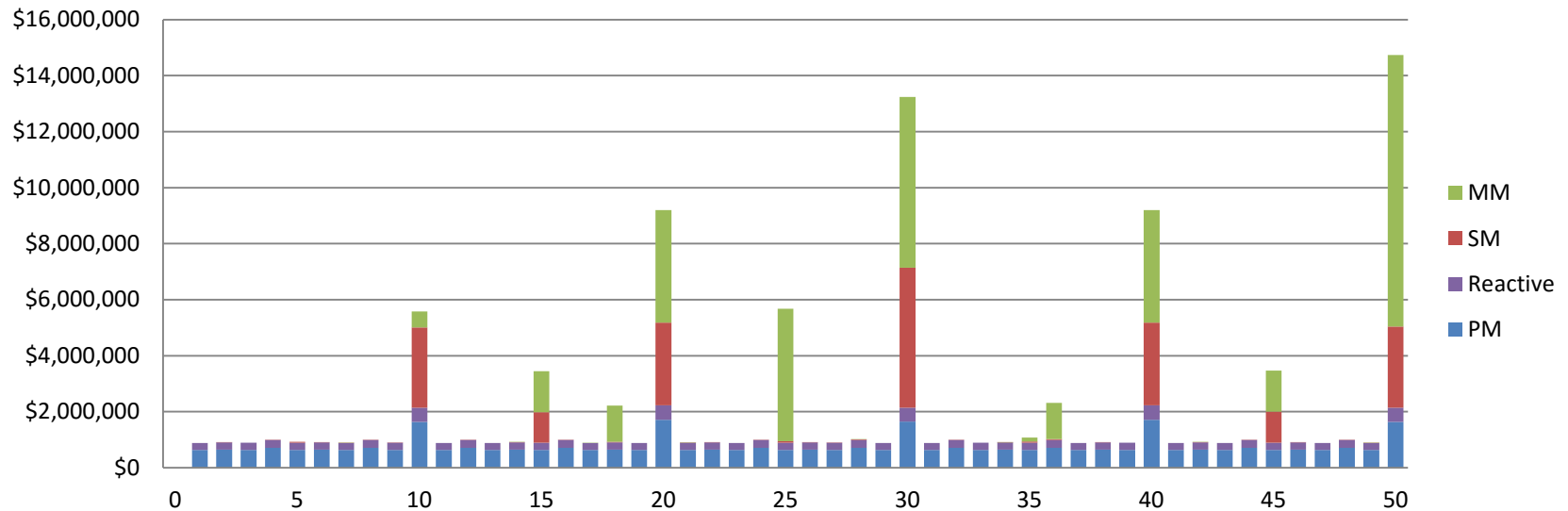
Planned Budget and Capital Expenditures

Projected Cost: 2014 Value & NPV (Current Interest)



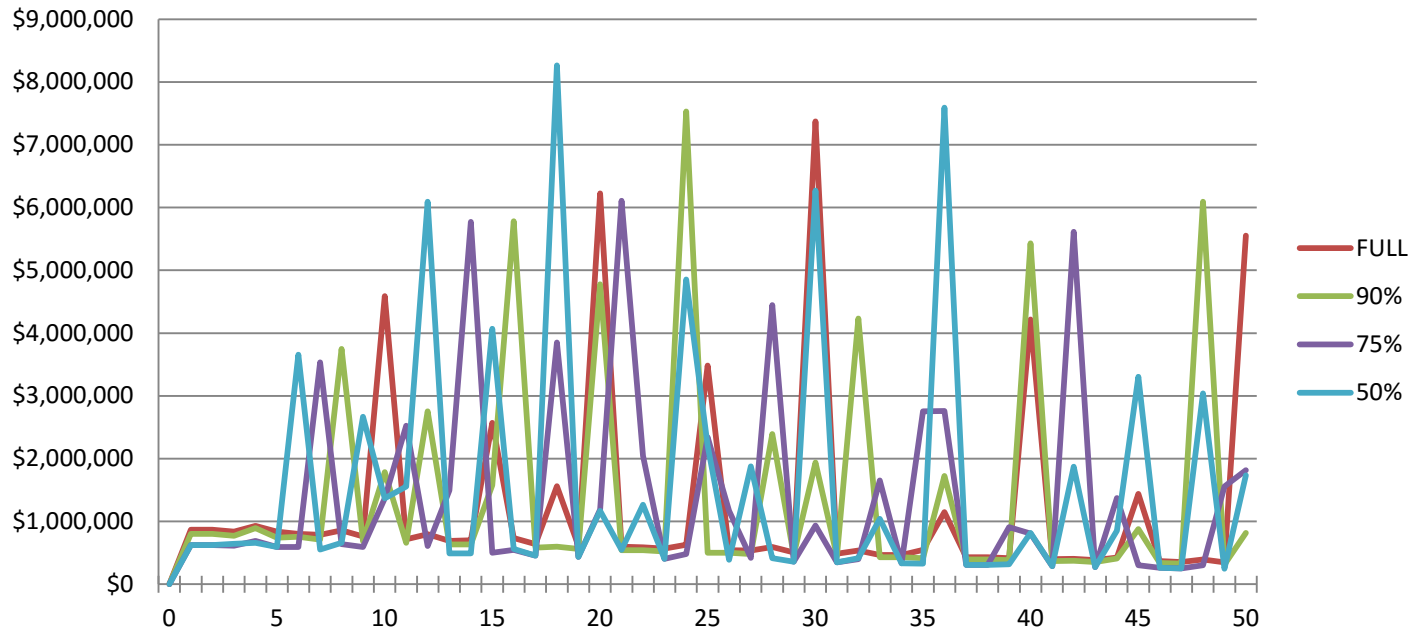
LONG TERM MAINTENANCE PLANNING

Complete

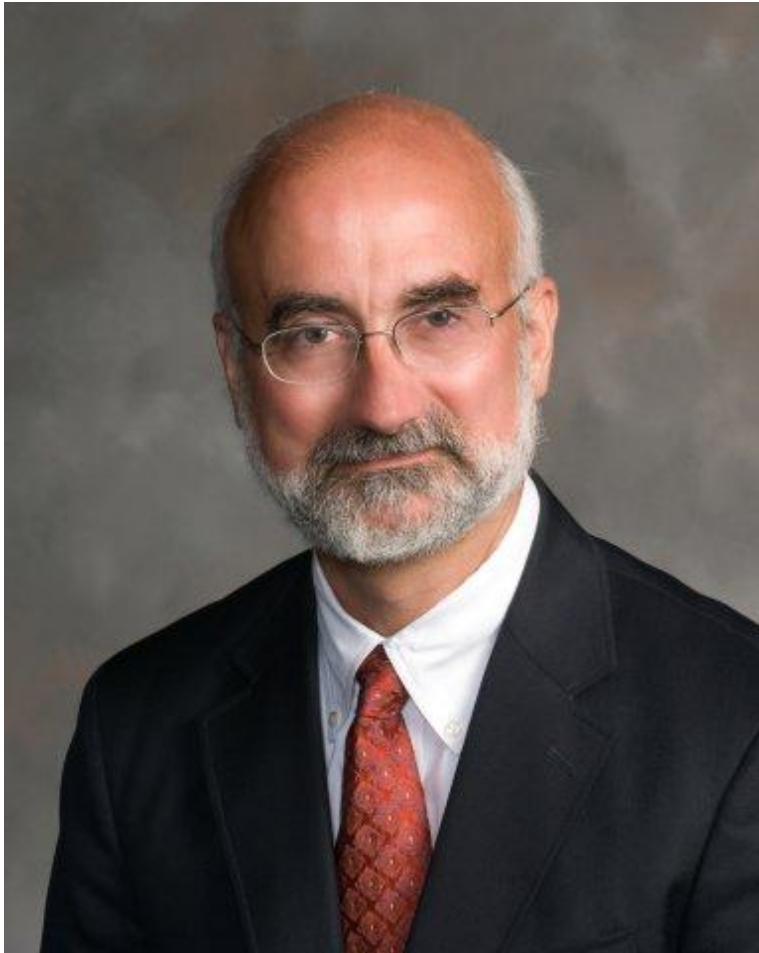


DEFERRED MAINTENANCE:

TVM Current Rates



NPV			
FULL	90%	75%	50%
\$61,992,559	\$70,209,823	\$69,113,727	\$78,153,448



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RESEARCH IN THE HEALTHCARE FACILITY DOMAIN

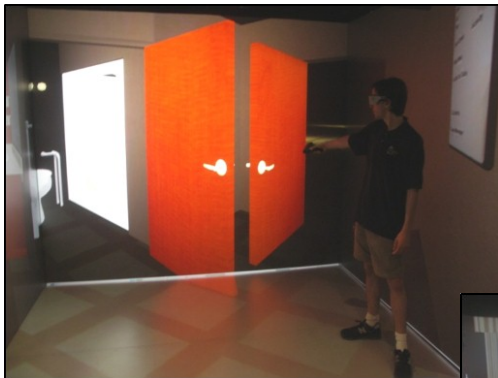
EXPLORATION OF VIRTUAL MOCK-UPS FOR HEALTHCARE FACILITY PROJECTS

Team:

Phillip Dunston (Civil Engrg/CEM)

James McGlothlin (Health Sciences)

Laura Arns (Envision Ctr)



RESEARCH IN THE HEALTHCARE FACILITY DOMAIN

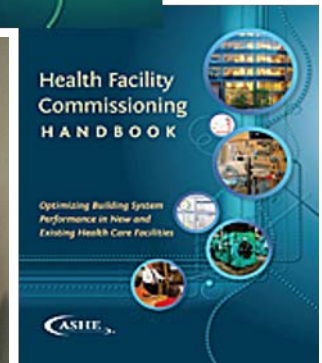
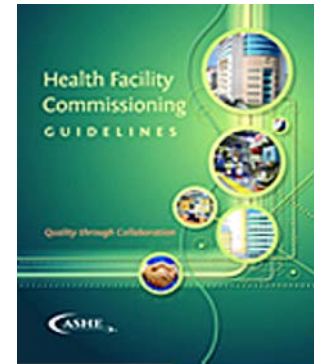
HFCX PROJECT CASE STUDY FOR UNIVERSITY OF ARKANSAS FOR MEDICAL SCIENCES

Team Leaders:

Gregory Lasker (BCM)

Phillip Dunston (Civil Engrg/CEM)

Focus: ASHE-funded engagement on health facility commissioning (~2010-2012). Involved unique deployment of student interns from Purdue and University of Arkansas at Little Rock



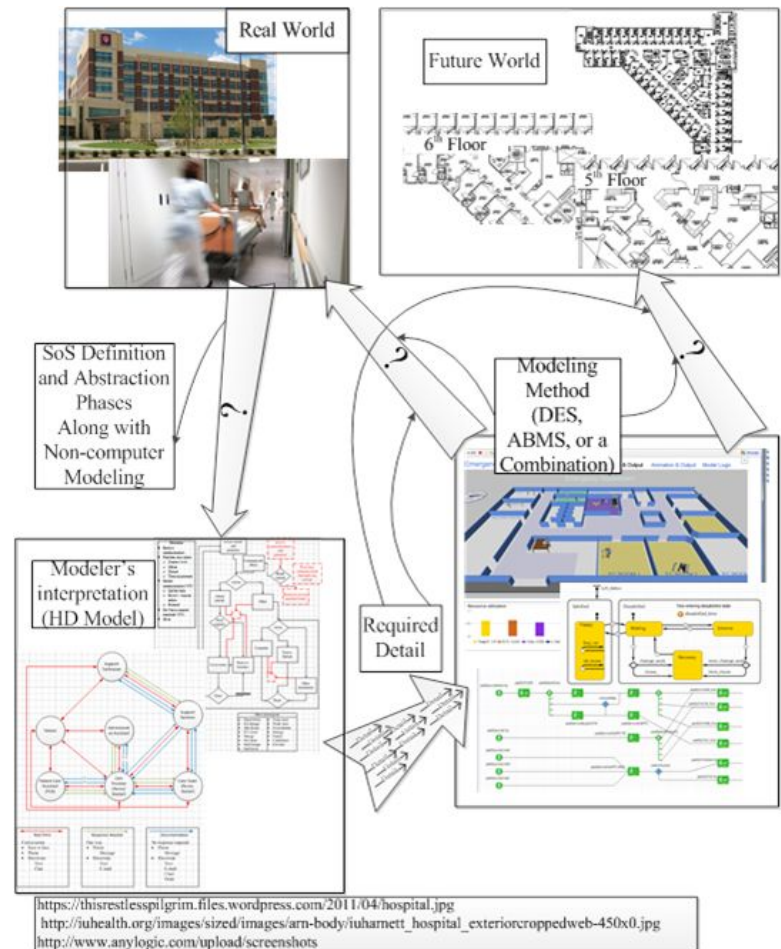
RESEARCH IN THE HEALTHCARE FACILITY DOMAIN

PROTOCOL AND COMPUTER MODELING TECHNIQUE FOR IDENTIFYING INEFFICIENCIES FROM MEDICAL BUILDING CONFIGURATION

Student: Timothy B. McClure

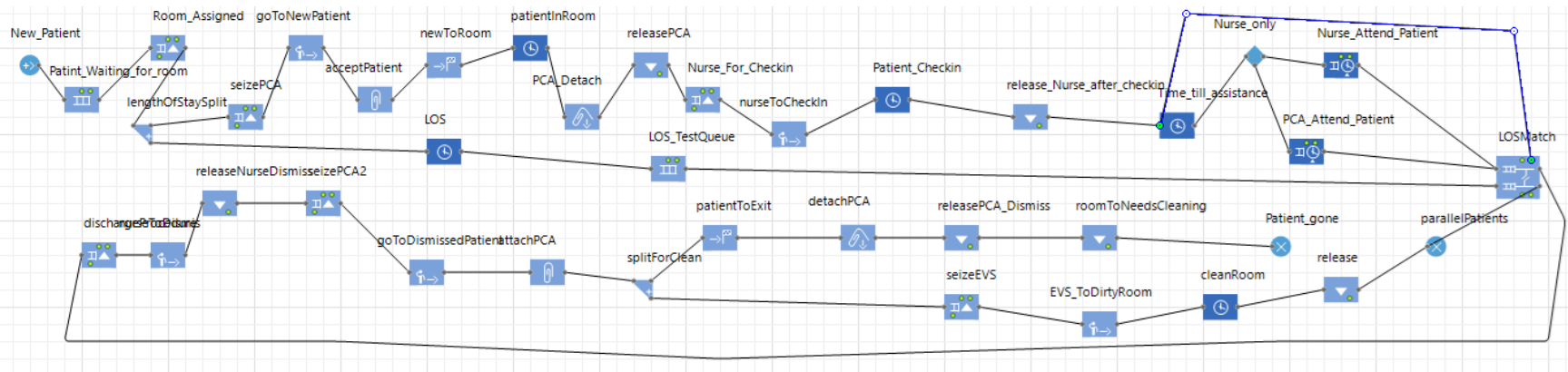
Advisor: Phillip S. Dunston

Focus: Validation of a procedure for modeling healthcare delivery operations and validating a corresponding simulation model that then can be used to evaluate proposed design layouts for future facilities.



RESEARCH IN THE HEALTHCARE FACILITY DOMAIN

TITLE: PROTOCOL AND COMPUTER MODELING TECHNIQUE FOR IDENTIFYING INEFFICIENCIES FROM MEDICAL BUILDING CONFIGURATION



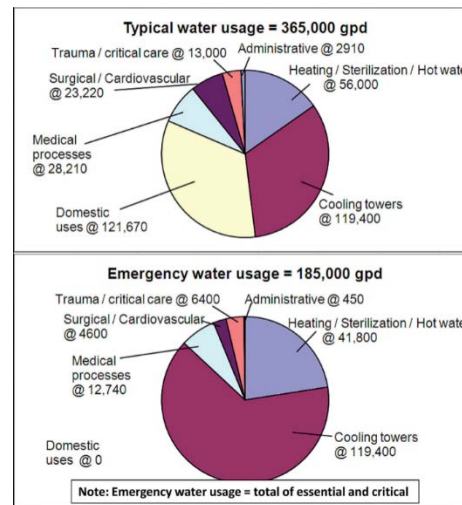
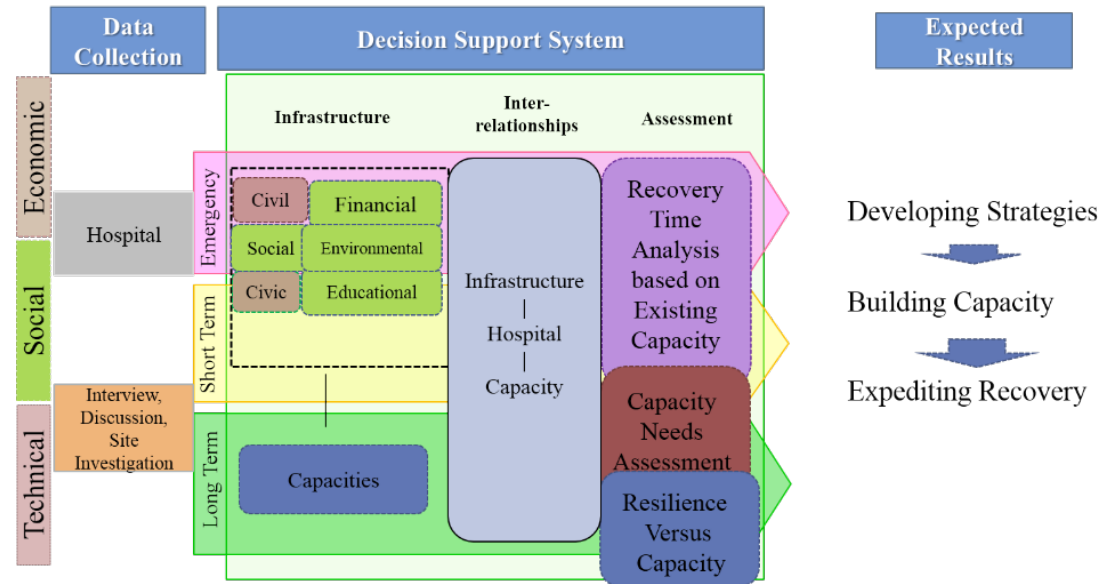
RESEARCH IN THE HEALTHCARE FACILITY DOMAIN

CAPACITY BUILDING OF HOSPITALS – EMERGENCY PLANNING

Student: Abhijeet Deshmukh

Advisor: Makarand Hastak

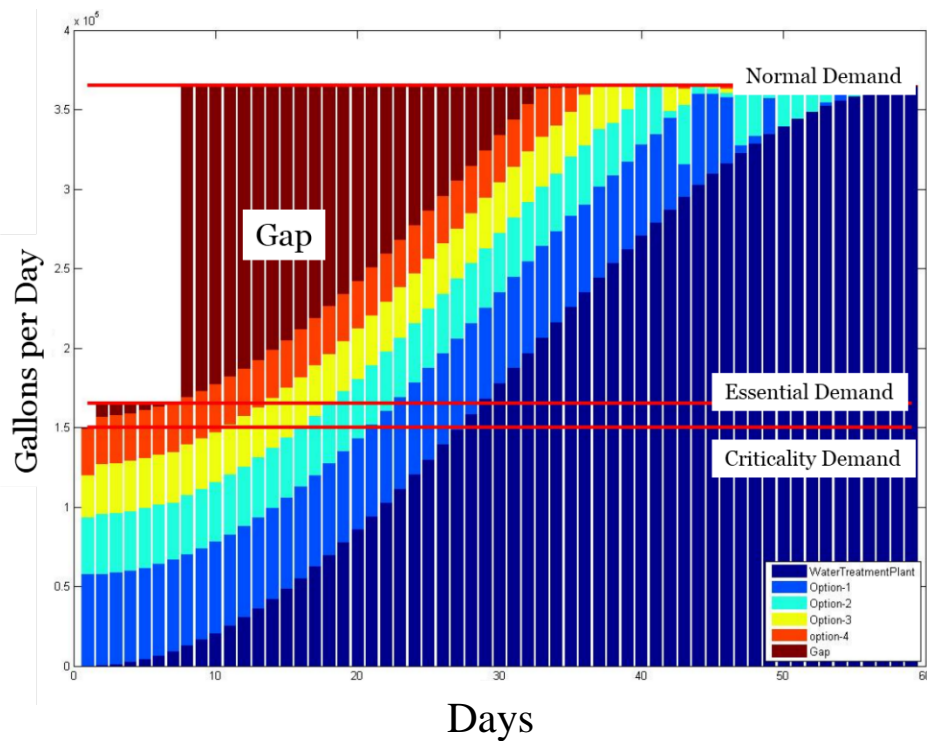
Focus: Decision support system for emergency planning procedure for water outages impacting essential facilities, focusing on domestic water supply outage exceeding 8 hours



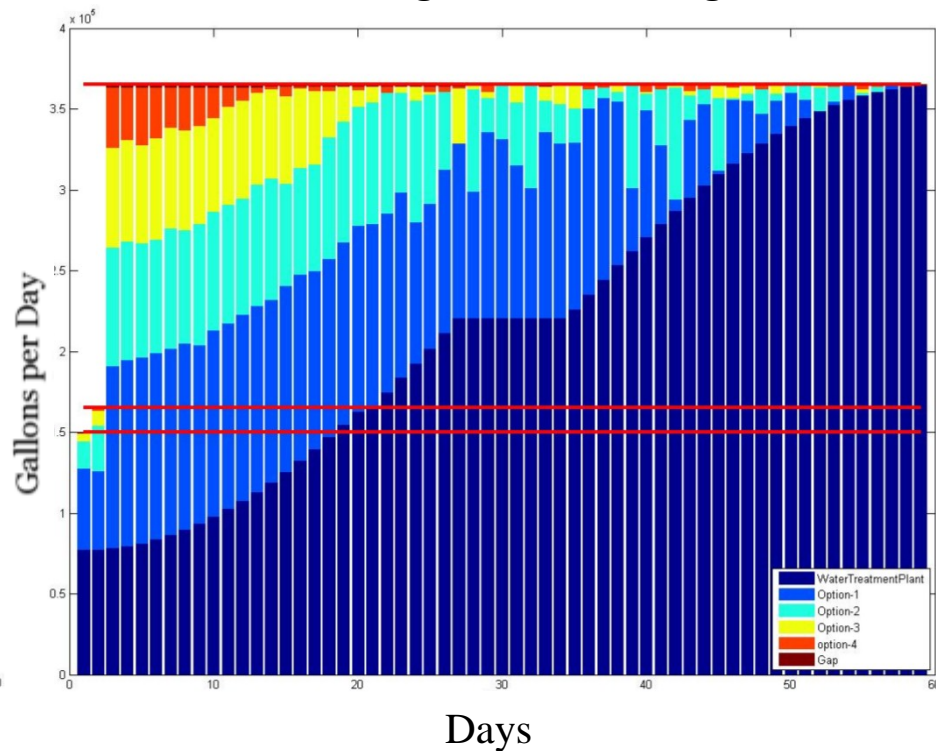
RESEARCH IN THE HEALTHCARE FACILITY DOMAIN

CAPACITY BUILDING OF HOSPITALS – EMERGENCY PLANNING

Capacity for Present Situation



Emergency Decisions Integrated with Long Term Planning



RESEARCH IN THE HEALTHCARE FACILITY DOMAIN

STRESS ASSESSMENT FOR THE POST-DISASTER MEDICAL FACILITY

Cause for excessive stress :

Reduced utility service

Limited road access to facilities

...

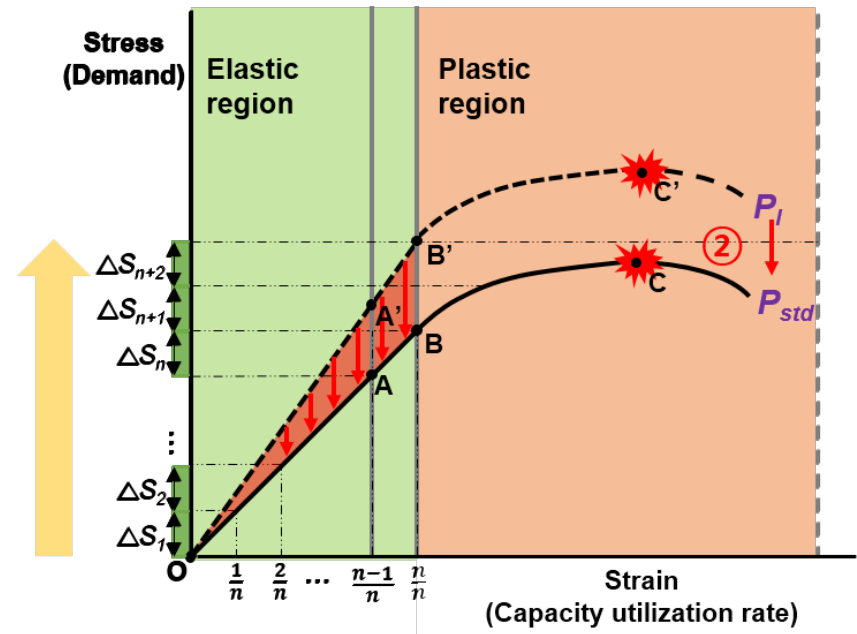
Increase in demands

Insufficient capacities of other facilities

Student: Juyeong Choi

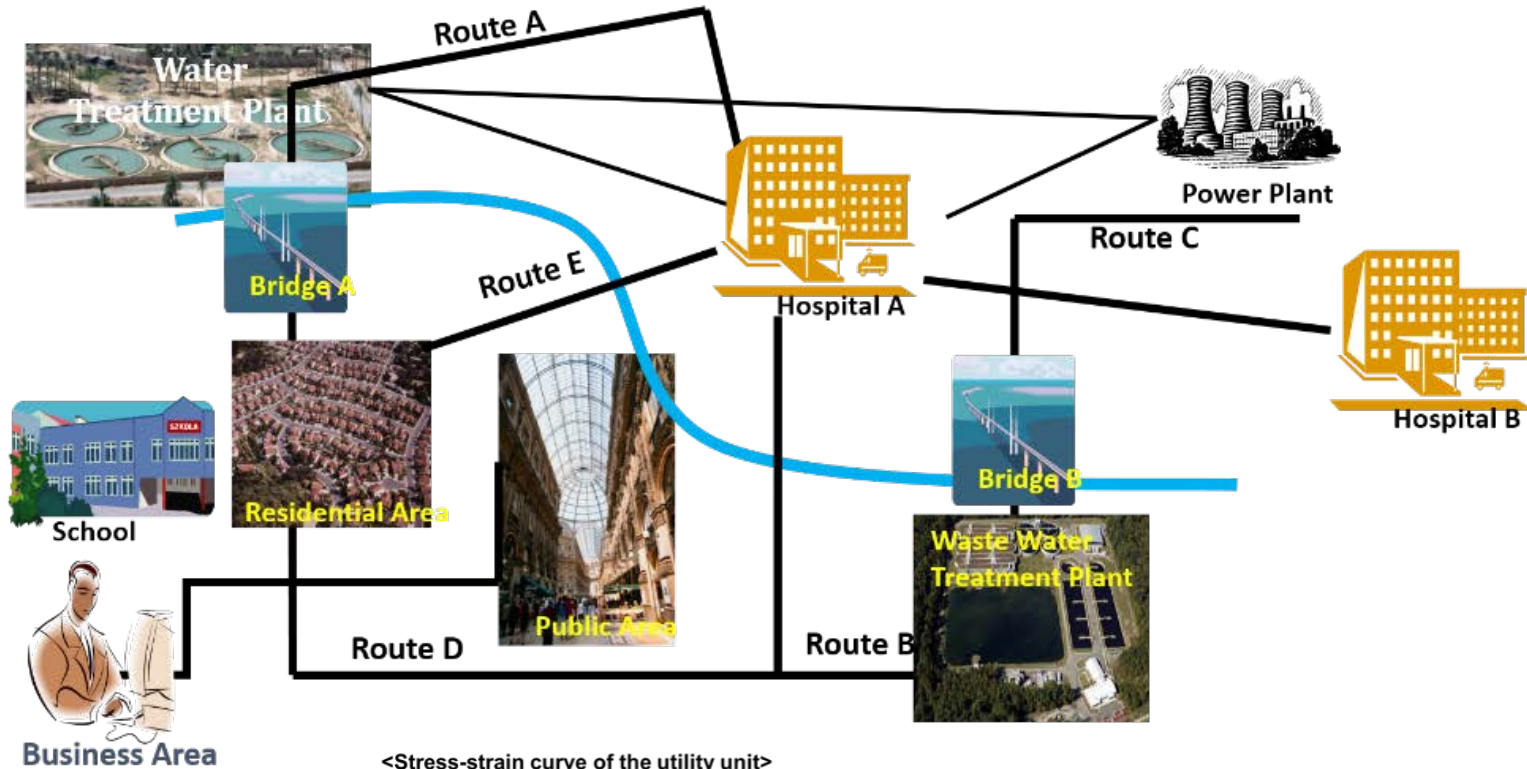
Advisor: Makarand Hastak

Focus: Understand **and evaluate the stress level** in infrastructure facilities under disaster conditions in terms of their quality of service in response to affected communities' demands, especially hospitals, and then develop effective strategies for relieving increased stress on infrastructure supporting essential facilities.

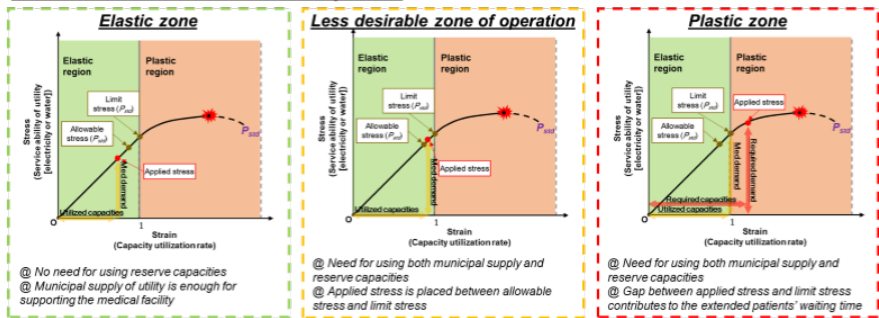


RESEARCH IN THE HEALTHCARE FACILITY DOMAIN

STRESS ASSESSMENT FOR THE POST-DISASTER MEDICAL FACILITY



<Stress-strain curve of the utility unit>



INDUSTRY-ACADEME COOPERATION AND COLLABORATION

Undergraduate curriculum materials

Graduate curriculum materials

Student interns

Faculty interns

Guest lectures by industry

Facility access for case studies/projects

Research collaborations



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