Geisinger Gray's Woods
Ambulatory Care Campus Phase I

Erica L. Craig
Construction Management - Dr. Riley

The Pennsylvania State University

Geisinger Gray's Woods
Ambulatory Care Campus Phase I

Enhance Quality for the Owner Through a Balance of Constructability, Budgeting, and Development

The Pennsylvania State University

Erica L. Craig

Construction Management

Building Size:
64,350 SF

Construction Costs:
$15 Million

Construction Dates:
April 07' – June 08'

Building Functions

70 Exam Rooms, 16 Procedure Rooms, Imaging Center, Laboratory Services, On-Site Pharmacy

Multi-Specialty Out Patient Services:
OBGYN Practice, Pediatrics, Family Medicine

Specialty Services:
ENT, Cardiology, Urology, Ophthalmology

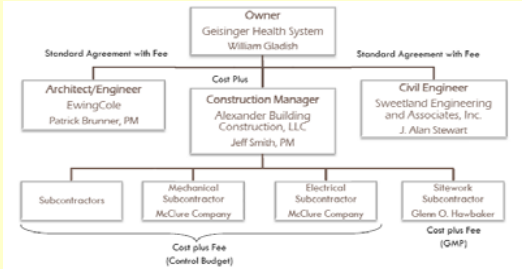
GEISINGER

EwingCole

ALEXANDER
ALEXANDER BUILDING CONSTRUCTION, LLC

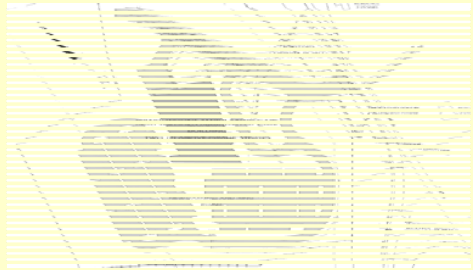
Sweetland Engineering & Associates, Inc.

Project Team



52 Acre Lot
Off I-99 Interchange

Project Site Plan



Structural System

CIP Concrete Pier Foundations

ASTM Structural Steel Framing

Concrete Slab on Composite Metal Decking

Electrical System

2500A, 480/277 Volt Service

250 kW, Diesel-Driven Emergency Generator

T8 Lamps, Compact Fluorescent, Occupancy Sensors

Mechanical System

400-Ton Cooling Tower

Water-Cooled 250-Ton Electric Chiller

Three 19,000 CFM Modular Rooftop Air-Handling Units

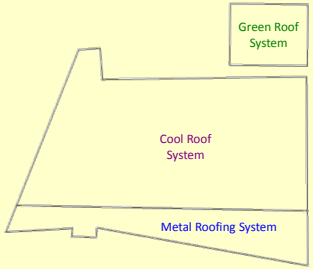
Gas Hot Water Boiler

Building Envelope

Aluminum Curtain Wall System on Metal Studs

Brick Masonry and EIFS on CMU and CIP Concrete Walls

Metal Roofing System and Skylights on Metal Studs



Roofing Systems

Aluminum Metal Roof System with Skylights on Front Sloped Roof

Cool Roof on Main Flat Roof

Green Roof on Separate Chiller/Boiler Room

Systems used primarily to obtain LEED Credits for heat island effect as well as aesthetics and to reduce the buildings heat gain.

Green Roof

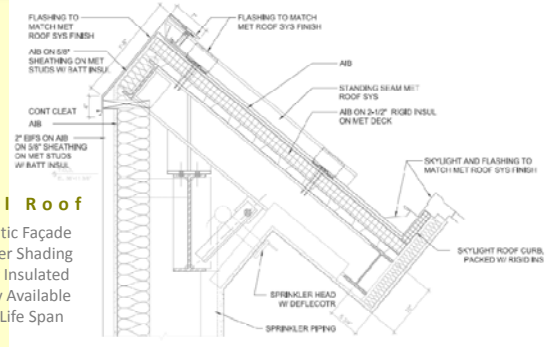
Storm Water Management
Views from Future Parking Garage
Highly Insulated
Extensive System
Reduce Heat Island Effect
Long Life Span

Cool Roof

Reduce Heat Island Effect
Highly Insulated
Long Life Span
Easy Installation

Metal Roof

Dramatic Façade
Summer Shading
Highly Insulated
Locally Available
Long Life Span



Design Critique

Green Roof Hidden Behind Building

Thermal Benefits of Green Roof Lost

Proposal

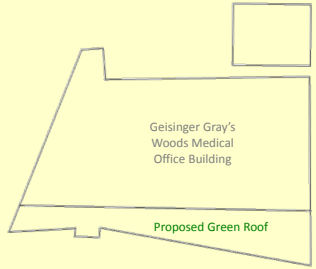
Relocate Green Roof to Sloped Roof:

Various Green Roof Systems

Rendering

Building Section

Thermal Heat Gain Calculations



Proposed Green Roof Rendering

Xero Flor Green Roof System

Lightweight Extensive System

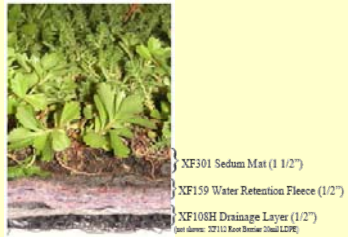
Drought Resistant & Low Profile Plants

Textile Carrier Design

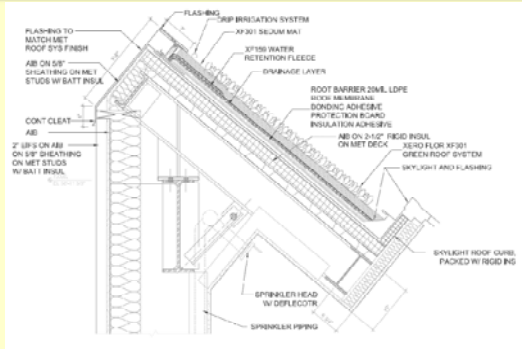
Pre-Vegetate Mat Design

Low Maintenance

Proposed Green Roof



Xero Flor Green Roof System



American Hydrotech Green Roof System

Lightweight and Low Profile Extensive System

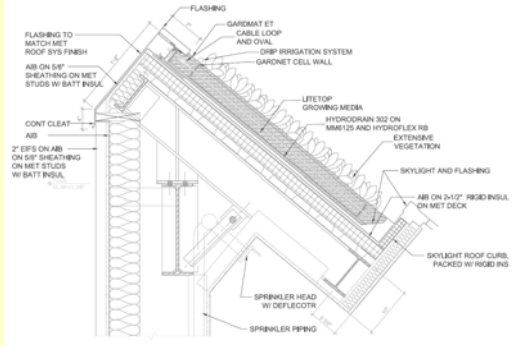
Low Maintenance

Gardnet Soil Stabilization

Plants Include Sedum, Herbs, & Grasses

Proposed Green Roof

American Hydrotech Green Roof System



Portion of Cooling Load on Equipment

Roof Area Only :
5015 SF

Design Temperature Change :
20° F

Thermal Resistance

R-Value of Varying Roofing Systems

	Metal Roof Current Design	Xero Flor Roof	Hydrotech Roof
R-Value	21.83	23.48	23.34
Difference from Current Design		-1.65	-1.51

Heat Flow Rate Calculations

$$\text{Heat Flow Rate} = \frac{\text{Area of Roof x Design Temperature Change}}{\text{R-value of Roof System}}$$

Higher R-Value = Reduced Heat Gain

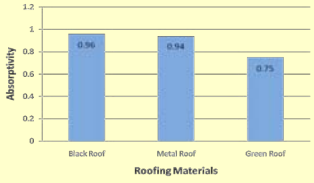
Green Roof Systems Provide About a 7% Heat Gain Reduction

Thermal Resistance

Cooling Load on Equipment

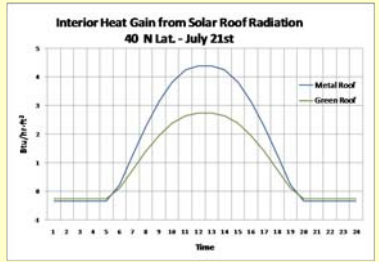
	Metal Roof Current Design	Xero Flor Roof	Hydrotech Roof
Btu/Year	543,191,351	505,019,898	508,049,152
Difference from Current Design		38,171,454	35,142,200

Absorptivity of Roof Materials

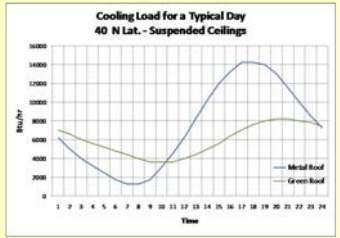


Solar Radiation

Interior Heat Gain



Cooling Load for Typical Sunny Day



Solar Radiation

Solar and Interior Heat Gain

$$\text{Cooling Load from Heat Gain} = \frac{\text{Area of Roof x Cooling Load Temperature Difference (CLTD)}}{\text{R-value of Roof System}}$$

Cooling Load on Equipment

	Total Btu/Day	# of Sunny Days Per Year	Total Btu/Year
Metal Roof	177,250	215	38,108,750
Green Roof	142,000	215	30,530,000

Thermal Resistance

	Metal Roof Current Design	Xero Flor Roof	Hydrotech Roof
Btu/Year	581,300,101	535,549,898	538,579,152

Solar Radiation

	Total Btu/Day	# of Sunny Days Per Year	Total Btu/Year
Metal Roof	177,250	215	38,108,750
Green Roof	142,000	215	30,530,000

Thermal Resistance and Solar Radiation

Total Cooling Load on Equipment

	Metal Roof Current Design	Xero Flor Roof	Hydrotech Roof
Btu/Year	581,300,101	535,549,898	538,579,152
Difference from Current Design		45,750,204	42,720,950

Initial Building Costs

Includes Standard Components

Other Components Added for Green Roof Systems

Includes Labor and Installation Costs

Current Roofing Systems					
	Amount		Cost		Total
Green Roof - Boiler Room	3290	SF	25	$/SF	82,250
+ Plants for Green Roof	3290	SF	5	$/SF	16,450
Cool Roof - Flat Main Roof	24200	SF	10	$/SF	242,000
Metal System	5105	SF	16	$/SF	81,680
				PRICE	$422,380

Relocation of Green Roof - XeroFlor					
	Amount		Cost		Total
Cool Roof - Boiler Room	3290	SF	10	$/SF	32,900
Cool Roof - Flat Main Roof	24200	SF	10	$/SF	242,000
Green Roof - Sloped	5105	SF	13	$/SF	66,365
+ Shipping Costs	5105	SF	0.25	$/SF	1,500
+ Roofing Membrane & Insulation	5105	SF	8	$/SF	40,840
+ Tacking and Accessories	5105	SF	2	$/SF	10,210
+ Irrigation					2,500
				PRICE	$396,315

Relocation of Green Roof - Hydrotech					
	Amount		Cost		Total
Cool Roof - Boiler Room	3290	SF	10	$/SF	32,900
Cool Roof - Flat Main Roof	24200	SF	10	$/SF	242,000
Green Roof - Sloped	5105	SF	32	$/SF	163,360
+ Irrigation					2,500
+ Plants for Green Roof	5105	SF	5	$/SF	25,525
				PRICE	$466,285

Current Roofing Systems	Amount		Cost		Total
Green Roof - Boiler Room	3290	SF	25	$/SF	82,250
+ Plants for Green Roof	3290	SF	5	$/SF	16,450
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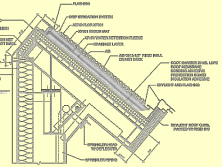
				PRICE	$466,285

Initial Building Costs

	Current Roofing System	Relocation with Xero Flor	Relocation with Hydrotech
Initial Cost	$422,400	$396,300	$466,300
Difference		-$26,100	$43,900

Yearly Operating Costs

	Current Roofing	Relocation with Xero Flor	Relocation with Hydrotech
Yearly Operating Costs	$15,680.00	$14,530	$14,480
Difference		-$1,150	-$1,200



	Current Roofing System	Relocation with Xero Flor	Relocation with Hydrotech
Initial Cost	$422,400	$396,300	$466,300
Difference		-$26,100	$43,900

	Current Roofing	Relocation with Xero Flor	Relocation with Hydrotech
Yearly Operating Costs	$15,680.00	$14,530	$14,480
Difference		-$1,150	-$1,200

Aesthetics Play a Huge Part in Decision

Green Roofs Reduce Heat-Gain but Research Not Inclusive

Initial Cost Savings of Xero Flor

Yearly Utility Savings of Either Green Roof

Green Roof Training Time vs. Metal Roof Installation Time

Structural Implications

Design Critique

Premium Cost of Lightweight Concrete

Proposal

Current System
Lightweight Concrete on Composite Metal Decking

Normal Weight Concrete on Composite Metal Decking

Normal Weight Concrete on Form Decking and Joists

Existing Conditions

Lightweight Concrete on Composite Metal Decking

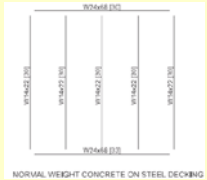
(26) 30' x 30' bays

CURRENT TYPICAL BAY DESIGN

LW to NW Concrete

Normal Weight Concrete on Composite Metal Decking

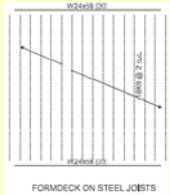
(26) 30' x 30' bays



Composite to Form Decking

Normal Weight Concrete on Form Decking and Joists

(26) 30' x 30' bays



System	Cost	Difference
2"Decking with LW Concrete - *Current Design*	$347,942	-
2" Decking with NW Concrete	$382,481	$34,538
9/16" Form Decking with NW Concrete	$331,339	-$16,604

NW and Form Deck ONLY for Typical Bays

Negligible Schedule Changes for Structural System

Overhead MEP Installation and Coordination

Geisinger Gray's Woods Conditions

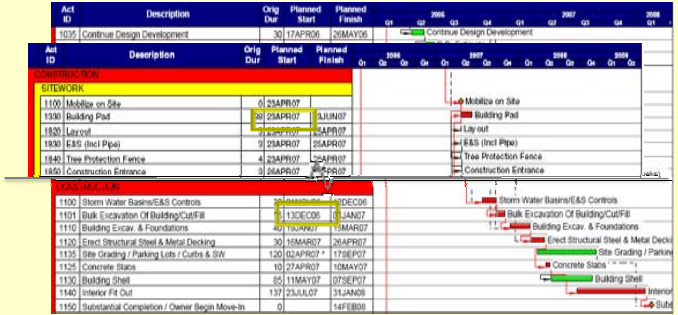
Delayed the Start of Construction Project

Involved with About Six Agencies

Entire Process Took Over a Year – 13 Months

Schedule to Start December '06

Actual Start April '07



Critique

Time Delays

Owner Occupancy and Revenue Delayed

Causes Frustration and Aggravation for All

Proposal

Continuing Education for Codes

Increase Number of Code Review Officials

Research of Other Permitting Processes

Services of ICC

- Education and Certification Programs
- Plan Reviews
- Magazines and Newsletters
- Training and Informational Videos
- Code Change Publications

International Code Council

Founded in 1994

Develops Codes for Commercial and Residential Buildings

Combitnation of BOCA, ICBO, and SBCCI

Non-Profit Organization

Name	Position	Municipality, Company
Michael Rupert	Senior Building Inspector	Centre Region Code Administration
Donald Fure	Code Enforcement Officer	Swatara Township
Ned Liggett	Commercial Plan Examiner	Centre Region Code Administration
Rod Seney	Manager	Bureau Veritas
Albert Wrightstone	Building Inspector	Susquehanna Township
Dan Slatt	Building Inspector	Lower Paxton Township

Permitting in Central Pennsylvania

Handled by the Municipality in which the Project is Located

Two Approaches:

In Office Reviews

Third Party Reviews

In-Office Reviews

Used by Regions: 1 Plan Reviewer/554 SM

On All Projects: Of Any Size

Used in Rural Areas

30 Day Time Limit for Approvals

Easily Navigated Website with Documentation

On-Site Meetings and Inspections

Third Party Reviews

Used by Small Municipalities: 1 Plan Reviewer /9 SM

On Large Projects: (> 5,500 SF)

Smaller Projects Reviewed In-Office

30 Day Time Limit for Approvals

Basic Website Design with Limited Information

On-Site Meetings and Inspections

Best Ways For Contractors and Design Professionals to Improve the Permitting Process

- Schedule a Preliminary Meeting with Region Office
- Communication Between All Parties Involved with Plans and Plan Review
- Properly Prepare Permitting Packages Prior to Submittal

Green Roof Design

Aesthetics Play a Huge Part in Decision

Initial Cost Savings of Xero Flor of $26,000

Yearly Utility Savings of Either Green Roof of $1,000

Floor Sub System

NW and Form Deck ONLY for Typical Bays to Save $16,000

Overhead MEP Installation and Coordination

Approvals & Permitting

Preliminary Meeting Scheduled Early in Design Phase

Communication Key Between All Parties Involved

Prepare Complete Permitting Packages

Continuing Education on Codes

Special Thank You To:

Alexander Building Construction, LLC

EwingCole

Geisinger Health System

PSU AE Facutly

Family and Friends

Industry Members

Questions & Comments

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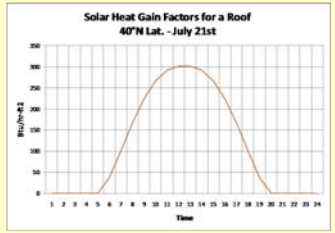
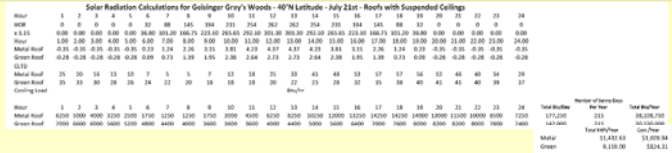
Solar Radiation





Structural Impacts

CURRENT DESIGN	Size	
LW Concrete	3.5"	
Concrete Placing	< 6" thick	
Steel Decking	2" LOK	
Steel Beams	W 16x26	3
Steel Girders	W24x55	1
Steel Columns	W10x68	2
Fireproofing		

NW CONCRETE	Size	
NW Concrete	4.5"	
Concrete Placing	< 6" thick	
Steel Decking	2" LOK	
Steel Beams	W14x22	4
Steel Girders	W24x68	1
Steel Columns	W10x88	2
Fireproofing		

FORMDECK	Size	
NW Concrete	3"	
Concrete Placing	< 6" thick	
Steel Decking	9/6" FD	
Steel Joists	18K9	10
Steel Girders	W24x76	1
Steel Columns	W10x88	2
Steel Dunnage		
Fireproofing		

Design Review Program

Case Study: Department of Planning and Development (DPD)

Located in Seattle, Washington

35 Members, 5 for each of the Seven Districts

Meet Two Times a Month

Perform On-Site Inspections and Approves Land and Construction Related Permits

No Financial Compensation for Members

Easy to Navigate Website with Documentation Available

Design Review Process Designed to Open Lines of Communication, be Flexible, and Encourage Great Design