Food Science Building

University Park, PA

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Construction Management

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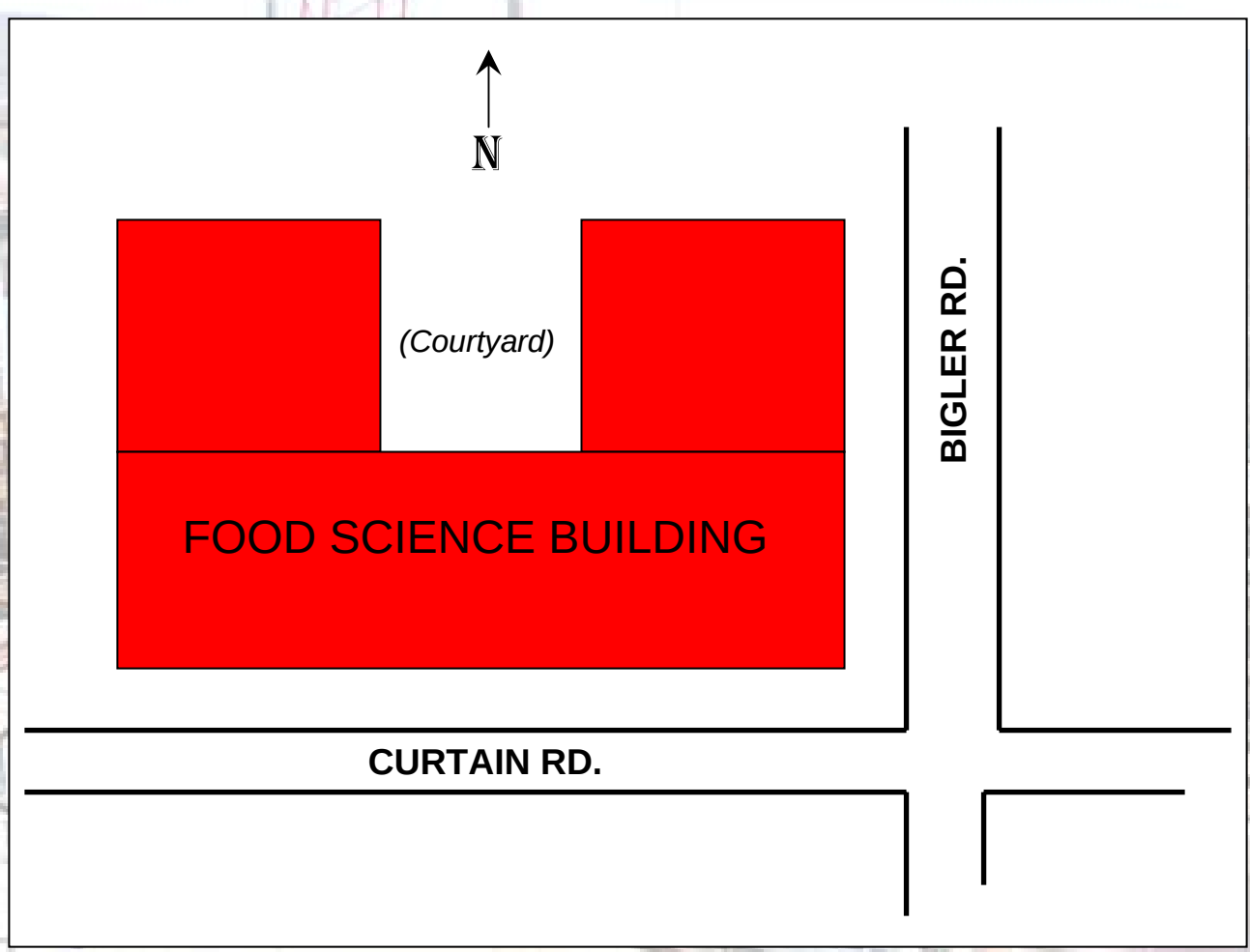
Building Layout



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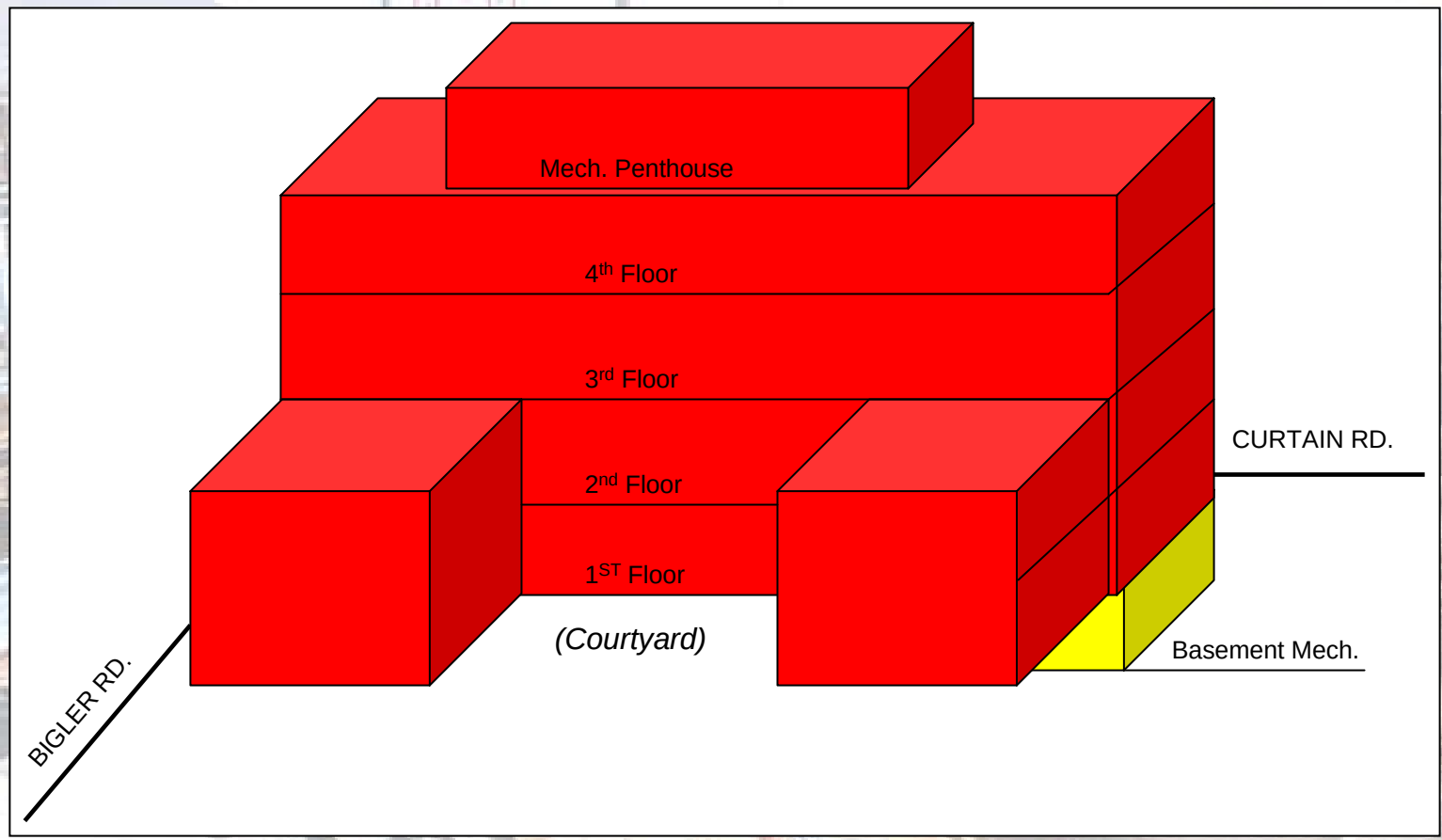
Building Layout



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Creamery

Old West Creamery: Established in 1865

- In the 'College Barns' behind Old Main
- Along with a blacksmith shop and hayloft

New Home of PSU Creamey: 2006

- Food Science Building

Penn State Tradition

- Who could leave Happy Valley without stopping at the Creamery?
- Every day people - to Presidents
- Undeniably a distinctive part of PSU

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Research

Research

Issue: Sustainability Design for Production Areas

Initial Investigation

- Milk Processing Facilities differ from normal Production Facilities
- Sanitation / Cleanliness requirements are significant
  - No exposed carbon steel allowed due to chemical wash down process
  - All food process piping and equipment must be stainless steel

Existing Creamery

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Structural Breadth

Current Design

Analysis 1: Basement Relocation and Structural Redesign

Background: Current Basement & Production Area

- Current Design
  - Basement Mech. Rm. Located on west side of bldg.
  - Production Area located on east side of bldg.
  - Production Area floor rests upon 6” slab on grade
  - Production Area Ceiling is the exposed 2nd Floor structure
    - Concrete encased steel beams and girders with a structural flat slab
- Problems
  - Constructability- Structure
    - No repetitive formwork
    - Not a typical construction for the area
  - Sequencing & Coordination for the Area
    - Extremely trade dependant progression
    - An extensive amount of work in one area.

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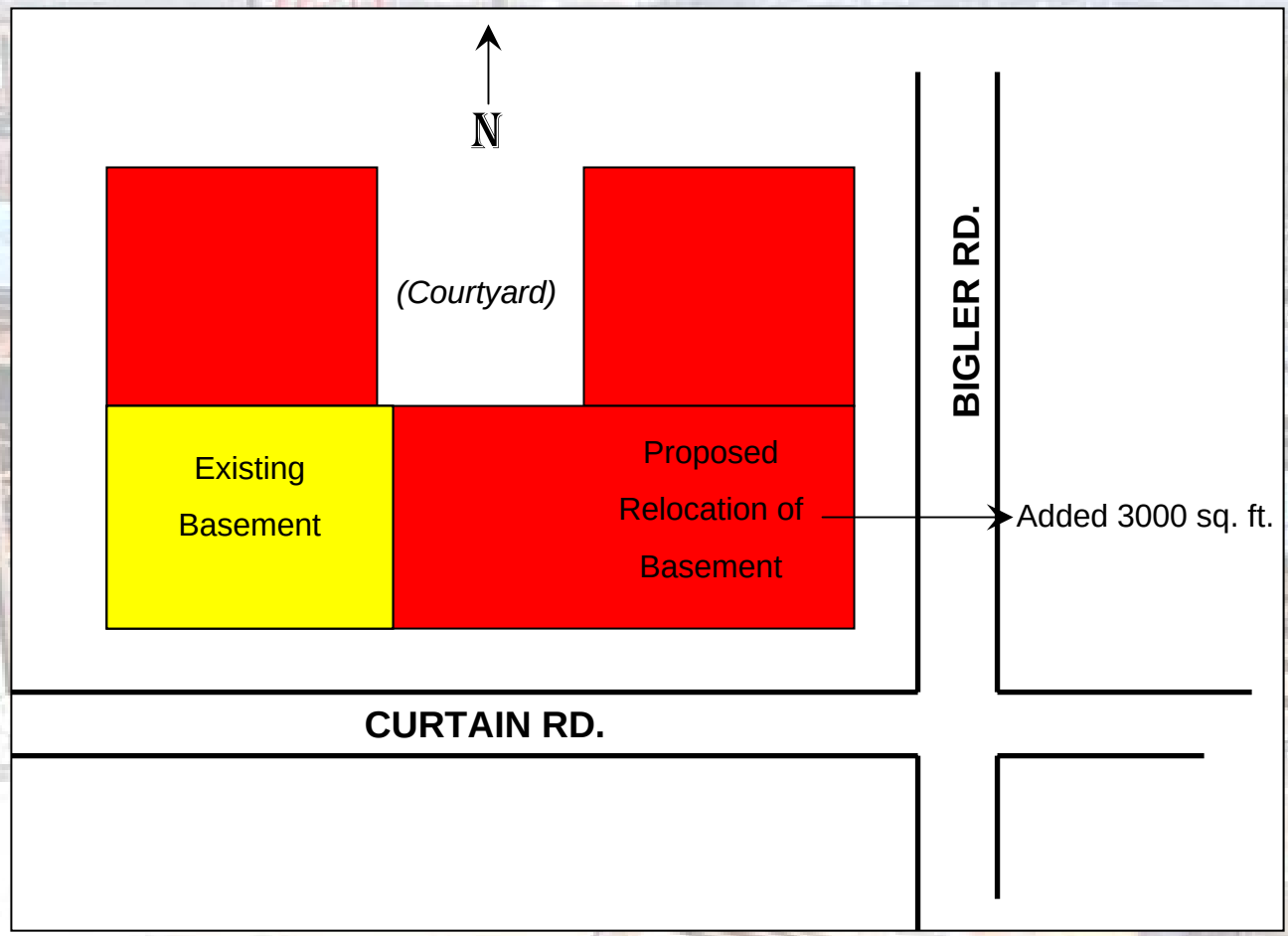
Structural Breadth

Proposed Basement Relocation

Analysis 1: Basement Relocation and Structural Redesign



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Structural Breadth

Proposed Structure

Analysis 1: Basement Relocation and Structural Redesign

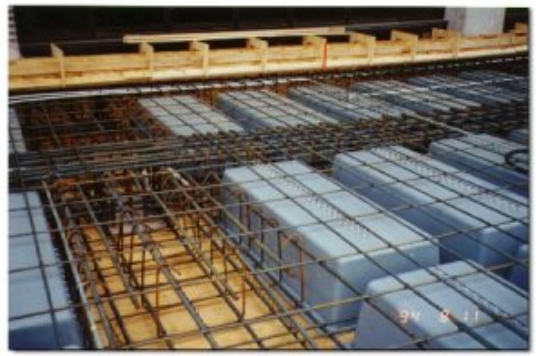
Proposed:

- Relocating Basement Mechanical Room- (to east side under Production Area)
- Complete Cast In Place Concrete Structure from Basement to 2nd Floor Level
  - Utilizing a CIP Wide Module Concrete Joist Floor System

- *$190,000 Savings*
- *More aesthetic exposed concrete ceiling*

Design:

- 1st Floor Level (Production Area Floor)
  - Total Factored Floor Load = 436 psf
  - Utilized CRSI Handbook:
    - Wide Module Concrete Floor System=
      40” Forms + 10” Ribs @ 50” c.-c.
      24.5” Deep Rib + 4.5” Slab = 28.5” Total Depth
    - Girder= 48” x 28.5
      w/ 20- #9 bars on Top
      w/ 17- #8 bars on Bottom



Example: Wide Module Concrete Joist Floor System

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Structural Breadth

Proposed Structure

Analysis 1: Basement Relocation and Structural Redesign

Design:

- 2nd Floor Level
  - Total Factored Floor Load = 276 psf
  - Utilized CRSI Handbook:
    - Wide Module Concrete Floor System=
      40” Forms + 10” Ribs @ 50” c.-c.
      18” Deep Rib + 4.5” Slab = 22.5” Total Depth
    - Girder= 44” x 22.5
      w/ 18- #9 bars on Top
      w/ 16- #8 bars on Bottom

•17” Ceiling Height Savings in Production Area

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Structural Breadth

Current Structure vs. Proposed Relocation

Analysis 1: Basement Relocation and Structural Redesign

Take-Off Summary

Current Design Deletion

Area	Deletion	Addition	Associated Cost
WEST SIDE (Basement Area)			
Basement Level			
Piles, Caps, Grade Beams, Foundation Walls, Slab on Grade	X		$276,845.00
First Floor Level			
W Shape, Composite Deck, Slab on Deck	X		$197,912.00
EAST SIDE			
First Floor Level			
Piles, Caps, Grade Beams, Walls, Slab on Grade, Concrete Encased Steel Columns	X		$161,346.00
Second Floor Level			
Composite Beams & Cast in Place Slab	X		$348,416.00
Total Savings			$984,519.00

Proposed Relocation Addition

Area	Deletion	Addition	Associated Cost
WEST SIDE			
First Floor Level			
Slab on Grade		X	$60,488.00
EAST SIDE (Basement / Production Area)			
Basement Level			
Sheet Piles, Caps, Grade Beams, Foundation Walls, Slab on Grade, CIP Concrete Columns		X	$315,680.00
First Floor Level			
CIP Concret Joist Slab & Columns		X	$241,290.00
Second Floor Level			
CIP Concrete Joist Slab		X	$173,418.00
Total Savings			$790,876.00
Total Cost Impact of Relocation	**Savings of:**		**$193,643.00**

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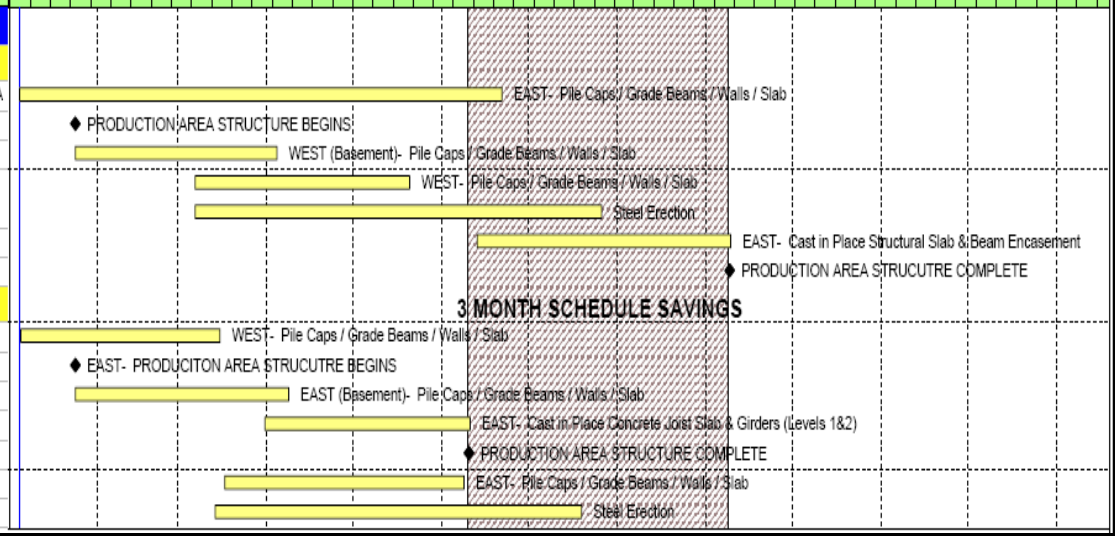
Food Science Building – Schedule Comparison

Current Schedule vs. Proposed Relocation Schedule

Food Science Building | Compared Relocation Schedule | Anthony Lucostic

Activity ID	Activity Name	Original Duration	Start	Finish
Food Science Building		315	05-Jan-05 A	09-Sep-05
Current Project Schedule		302	05-Jan-05 A	09-Sep-05
A1010	EAST- Pile Caps / Grade Beams / Walls / Slab	1	05-Jan-05 A	22-Jun-05 A
A1015	PRODUCTION AREA STRUCTURE BEGINS	0	24-Jan-05*	
A1050	WEST (Basement)- Pile Caps / Grade Beams / Walls / Slab	51	24-Jan-05*	04-Apr-05
A1070	WEST- Pile Caps / Grade Beams / Walls / Slab	55	07-Mar-05*	20-May-05
A1090	Steel Erection	100	07-Mar-05*	26-Jul-05
A1110	EAST- Cast in Place Structural Slab & Beam Encasement	63	13-Jun-05*	09-Sep-05
A1190	PRODUCTION AREA STRUCUTRE COMPLETE	0	09-Sep-05*	
Proposed Relocation Schedule		138	05-Jan-05	19-Jul-05
A1030	WEST- Pile Caps / Grade Beams / Walls / Slab	50	05-Jan-05*	15-Mar-05
A1120	EAST- PRODUCITON AREA STRUCUTRE BEGINS	0	24-Jan-05*	
A1130	EAST (Basement)- Pile Caps / Grade Beams / Walls / Slab	55	24-Jan-05*	08-Apr-05
A1140	EAST- Cast in Place Concrete Joist Slab & Girders (Levels 1&2)	51	31-Mar-05*	10-Jun-05
A1145	PRODUCTION AREA STRUCTURE COMPLETE	0	10-Jun-05*	
A1150	EAST- Pile Caps / Grade Beams / Walls / Slab	59	17-Mar-05*	08-Jun-05
A1160	Steel Erection	90	14-Mar-05*	19-Jul-05



3 month Schedule Savings

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Structural Breadth

Proposed Structure

Analysis 1: Basement Relocation and Structural Redesign

Benefits:

- Added 3000 sq. ft. to Basement Mech. Rm
- $190,000 dollar cost savings
- Cleaner, smoother more aesthetically pleasing ceiling in Production Area
- 17” Height savings in Production Area
- 3 month Schedule Savings

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Mechanical Breadth

Production Area Rough-In

Analysis 2: MEP & Utility Relocations with Regards to Basement Relocation

Production Area Rough-In

Benefits

- Relocated Basement under Production Area
  - Structure changed to C-I-P concrete
  - Layout for rough-in penetrations can now be done from the formwork vs. a stone base
    - Easier constructability for rough-in
    - More precise and exact layout for critical equipment penetrations
    - Rough-in accessible from below
  - Future maintenance issues and relocations
    - Now able to be done from below

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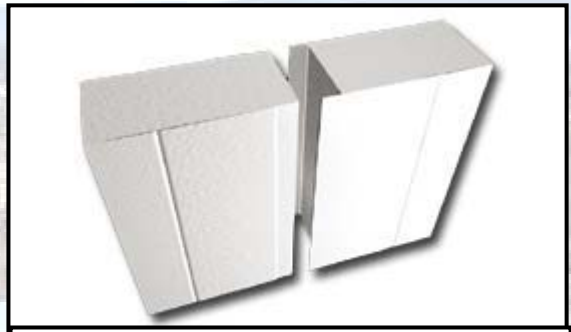
Research

Research

Issue: Sustainability Design for Production Areas

Guidelines for Sustainable Production Areas

- Use HCFC free composite metal panels *(Hydrochlorofluorocarbon)*
  - Reduces ozone depletion
- Use high speed quick rolling doors
  - Reduce thermal loss



Insulated Metal Panels

High Speed Quick Rolling Doors

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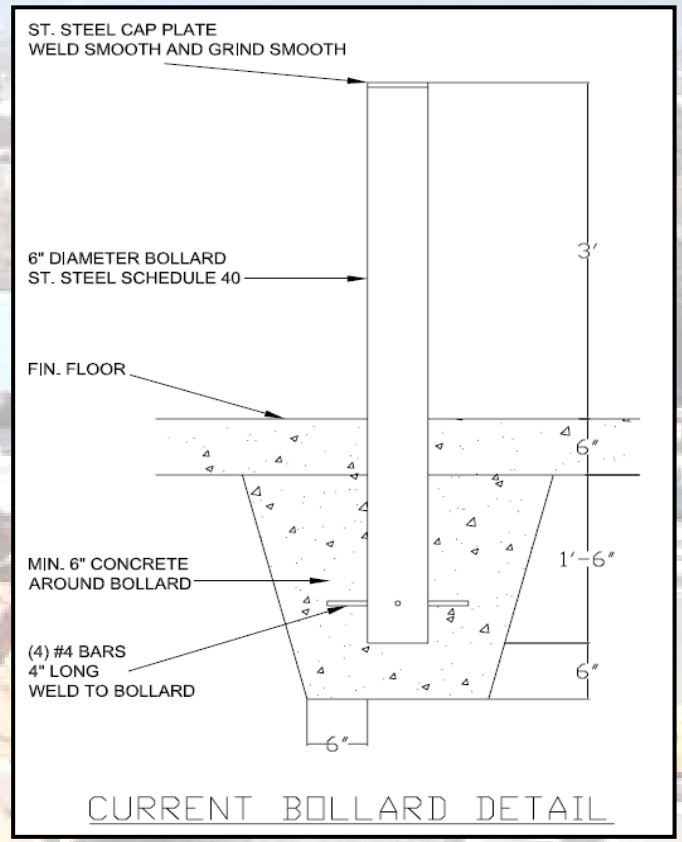
Existing Detail

Analysis 3: Stainless Steel Bollard Detail

Current Detail

- Complex coordination detail
- Requires precise placement with respect to objects not installed
- Difficult layout from stone base conditions



CURRENT BOLLARD DETAIL

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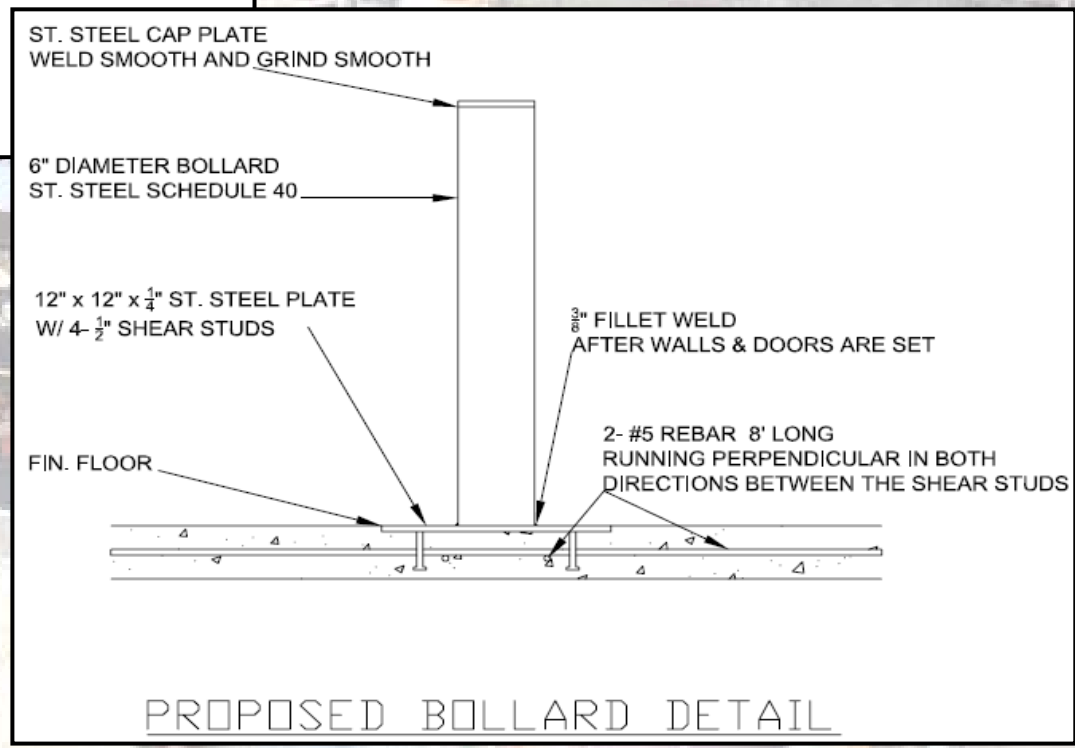
Proposed Detail

Analysis 3: Stainless Steel Bollard Detail

Proposed Detail

- Simplified installation detail
  - Easier initial layout from formwork surface
  - Allows for more exact placement later
  - Better-quality finish product



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Mechanical Breadth

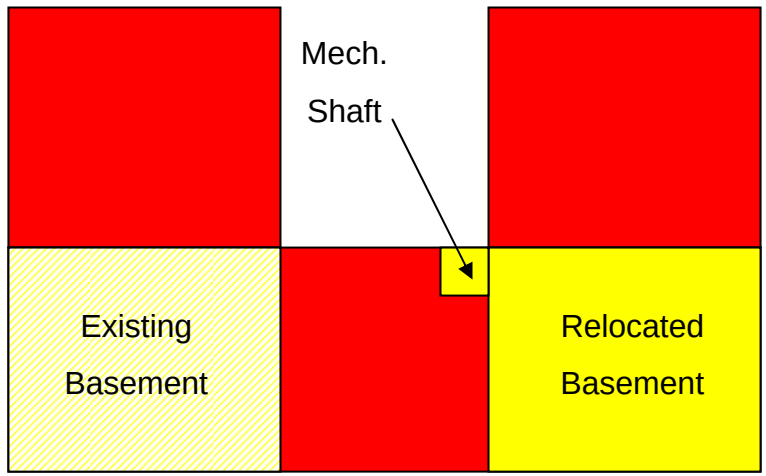
Interior Piping

Analysis 2: MEP & Utility Relocations with Regards to Basement Relocation

Interior Piping

Background:

- Relocating basement closer to mechanical shaft
- Thus eliminating the need for the horizontal runs across the building



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Mechanical Breadth

Interior Piping

Analysis 2: MEP & Utility Relocations with Regards to Basement Relocation

Design:

- Decreased the horizontal distance of the pipe runs
- LPS/R, CHWS/R, HWPS/R in shaft that supply AHU's @ Penthouse

- Utilized a pipe sizing and computational head loss chart from ASHRAE
  - Decreased head pressure on each line
    - Minimal head pressure loss when compared to entire pipe run.
      - Therefore not enough to decrease pump size
      - Will increase the efficiency of pump

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Mechanical Breadth

Interior Piping

Analysis 2: MEP & Utility Relocations with Regards to Basement Relocation

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Interior Piping Take-Off

Description	Savings	Addition	Quantity	Cost		Total Cost
				Piping	Insulation	
Low Pressure Steam / Return						
4" LPS	X		120'	$2,520.00	$2,106.00	$4,626.00
4" LPR	X		120'	$2,520.00	$2,106.00	$4,626.00
4" 90° Elbows	X		4	$1,024.00	$0.00	$1,024.00
Chilled Water Supply / Return						
8" CHWS	X		120'	$5,700.00	$3,900.00	$9,600.00
8" CHWR	X		120'	$5,700.00	$3,900.00	$9,600.00
8" 90° Elbow	X		8	$5,200.00	$0.00	$5,200.00
Hot Water Permieter Supply / Return						
6" HWPS	X		120'	$3,960.00	$3,120.00	$7,080.00
6" HWPR	X		120'	$3,960.00	$3,120.00	$7,080.00
6" 90° Elbows	X		8	$3,440.00	$0.00	$3,440.00
Total Cost Impact				Savings of:		$48,836.00

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Mechanical Breadth

Interior Piping

Analysis 2: MEP & Utility Relocations with Regards to Basement Relocation

Benefits:

- $48,000 dollar cost savings
- Decrease piping lengths
  - Increase current pump efficiencies
  - Decrease the chances for leaks and future maintenance concerns
    - Access to these areas is extremely difficult

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Mechanical Breadth

Utility Relocation

Analysis 2: MEP & Utility Relocations with Regards to Basement Relocation

Current Utility Plan

•Building Utilities currently run into the basement on the west side of the building

Proposed Relocated Utility Plan

•Building Utilities will be rerouted to the relocated basement on the east side of the building

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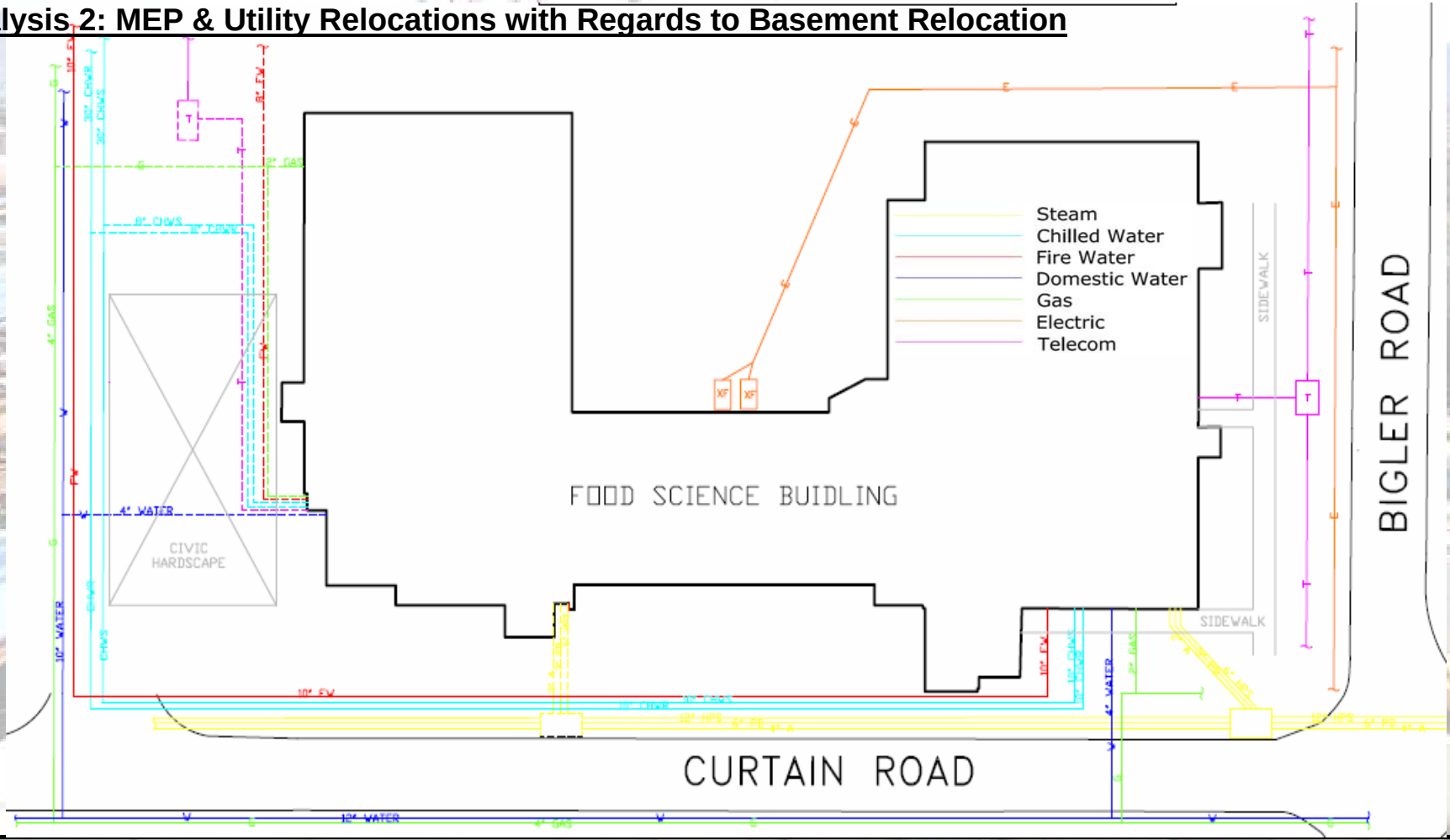
Mechanical Breadth

Utility Relocation

Analysis 2: MEP & Utility Relocations with Regards to Basement Relocation



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Mechanical Breadth

Utility Relocation

Analysis 2: MEP & Utility Relocations with Regards to Basement Relocation

Design:

- Increases the horizontal distance of some pipe runs
  - Fire Water horizontal distance increased 350 ft. + added 1 fitting
  - Chilled Water Supply / Return increased 200 ft. – minus 1 fitting
- Utilized a pipe sizing and computational head loss chart from ASHRAE
  - Compared old head loss to new head loss
    - Increased pipe sizes from 8” to 10”
    - Capable of maintaining current head loss with added length

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Utility Relocation Take-Off

Description	Savings	Addition	Quantity	Cost		Total Cost
				Piping	Excavation	
Steam						
6" HPS (High Pressure Steam)	No Cost Impact		0	$0.00	$0.00	$0.00
3" PD (Pump Discharge,Condensate)	No Cost Impact		0	$0.00	$0.00	$0.00
2" A (Compressed Air)	No Cost Impact		0	$0.00	$0.00	$0.00
Chilled Water						
10" CHWS (Chilled Water Supply)		X	200'	$426.00	$1,088.10	$1,514.10
10" CHWR (Chilled Water Return)		X	200'	$426.00	$1,088.10	$1,514.10
10" 90° Elbow	X		2	$930.00	$0.00	$930.00
Fire Protection						
10" FW (Fire Water)		X	350'	$710.00	$2,176.20	$2,886.20
10" 90° Elbow		X	1	$465.00	$0.00	$465.00
Natural Gas						
2" G (Gas)	X		200'	$2,140.00	$1,088.10	$3,228.10
8" 90° Elbow	X		1	$256.00	$0.00	$257.00
Domestic Water						
4" W (Water)	No Cost Impact		0	$0.00	$0.00	$0.00
Electric						
E (Electric Ductbank)	No Cost Impact		0	$0.00	$0.00	$0.00
Telecommunications						
T (Telecom. Ductbank)						
4- 5" PVC Conduit	X		80'	$1,680.00	$627.75	$2,307.75
5" 90° Elbow	X		4	$314.00	$0.00	$314.00
Reinforcing Rods	X		1 Ton	$1,575.00	$0.00	$1,575.00
Concrete In Place	X		7 CY	$1,211.00	$0.00	$1,211.00
Total Cost					Savings	$9,822.85
Total Cost					Addition	$6,379.40
Total Cost Impact				**Savings of:**		**$3,443.45**

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Mechanical Breadth

Utility Relocation

Analysis 2: MEP & Utility Relocations with Regards to Basement Relocation

Benefits:

- $3,000 dollar cost savings
- Removes all utilities from hardscape civic area
  - Future utility maintenance and concerns
    - No longer have to demo entire hardscape to repair utilities
    - Would only have to replace 8’ of sidewalk

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Recommendation

Relocate Basement to east side under Production Area

Structure change to complete CIP concrete from basement through 2nd Floor

Utilize wide module concrete joist flooring system
- 3 month schedule saving
- $190,000 cost savings
- More aesthetically pleasing exposed concrete ceiling in Production Area
- Increased ceiling height of 17” in Production Area

Interior Piping Deletion
- $48,000 cost savings
- Decrease risk of future maintenance risks

Utility Relocation
- $3,000 cost saving
- Removes all utilities from hardscape civic area

Bollard detail simplified
- Will allow for more precise placement
- Better-quality finished product

Sustainable Designs for Production Areas
- Utilize a compressed ammonia refrigeration system for cooling
- Use a steam system when heating water for cleaning and equipment purposes
- Facilitate GMP’s into design (Good Manufacturing Practices)
- Use high speed quick rolling doors at coolers and freezers
- Use HCFC free insulated composite metal panels

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Recomendation

Proposed Relocations & Design Changes

- 3 month schedule savings
- $241,000 cost savings
- Enhance the Production Facility
- Considering maintenance and possible future changes

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Questions ?

Acknowledgements

•PSU AE Faculty
•Fellow AE Colleagues
•PSU Office of Physical Plant
•Gilbane Building Company
•IKM Incorporated
•H.F. Lenz Inc.
•Food Engineering Inc.
•Sauer Inc.
•Wyatt Interiors Inc.
•Harris Masonry Inc.
•McClure Co.
•Robinson Concrete Co.

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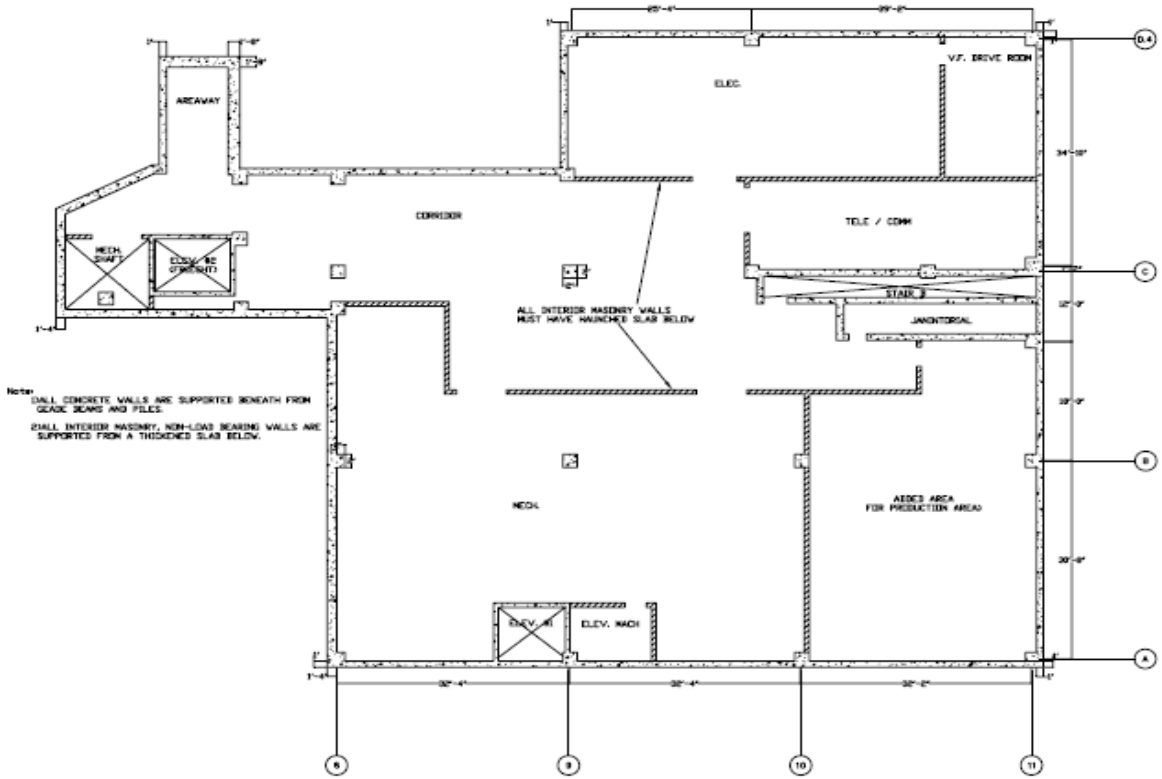

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Food Science Building
HOME OF THE NEW CREAMERY &
THE DEPARTMENT OF FOOD SCIENCES

NOTES:

RELOCATED BASEMENT PLAN
TO THE EAST SIDE OF BLDG. UNDER THE PRODUCTION AREA OF THE CREAMERY.

SCALE:
1/16" = 1'-0"

DRAWN BY:
ANTHONY J. LUCOSTIC
CONSTRUCTION MANAGEMENT
5TH YEAR SENIOR THESIS PROJECT

PENNSTATE 1855

Gilbane

IKM INCORPORATED ARCHITECTS, PLANNERS INTERIOR DESIGNERS One PPG Place Pittsburgh, Pennsylvania 15222	H.F. LENZ COMPANY Engineers • Planners • Surveyors • Energy Consultants	GILBANE BUILDING COMPANY CONSTUCTION MANAGER 7 Jackson Walkway Providence, RI 02903	The Pennsylvania State University Food Science Building FOUNDATION PLAN EAST	JOB NO. DATE 3/31/06	DWG. NO. S2.0B

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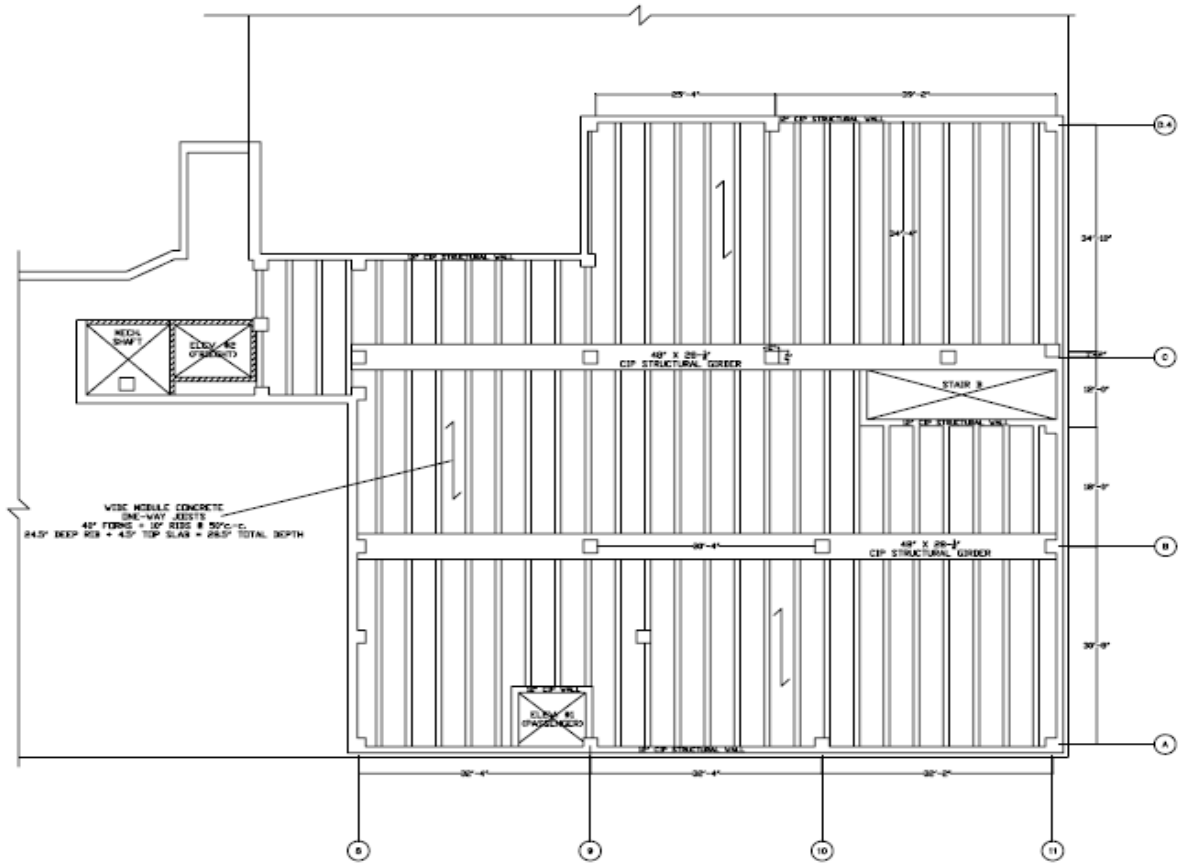

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NOTES:

FIRST FLOOR FRAMING PLAN
THE FIRST FLOOR FOR THE PRODUCTON AREA

SCALE:
1/16" = 1'-0"

DRAWN BY:
ANTHONY J. LUCOSTIC
CONSTRUCTION MANAGEMENT
5TH YEAR SENIOR THESIS PROJECT

PENNSTATE 1855

Gilbane

IKM INCORPORATED
ARCHITECTS, PLANNERS
INTERIOR DESIGNERS
One PPG Place
Pittsburgh, Pennsylvania 15222

H.F. LENZ COMPANY
Engineers • Planners • Surveyors • Energy Consultants

GILBANE BUILDING COMPANY
CONSTUCTION MANAGER
7 Jackson Walkway
Providence, RI 02903

The Pennsylvania State University
Food Science Building
FIRST FLOOR FRAMING EAST

JOB NO.
IKM 02-001
DGS90C-271
PSU-01778
DATE
3/31/06

DWG. NO.
S2.1B

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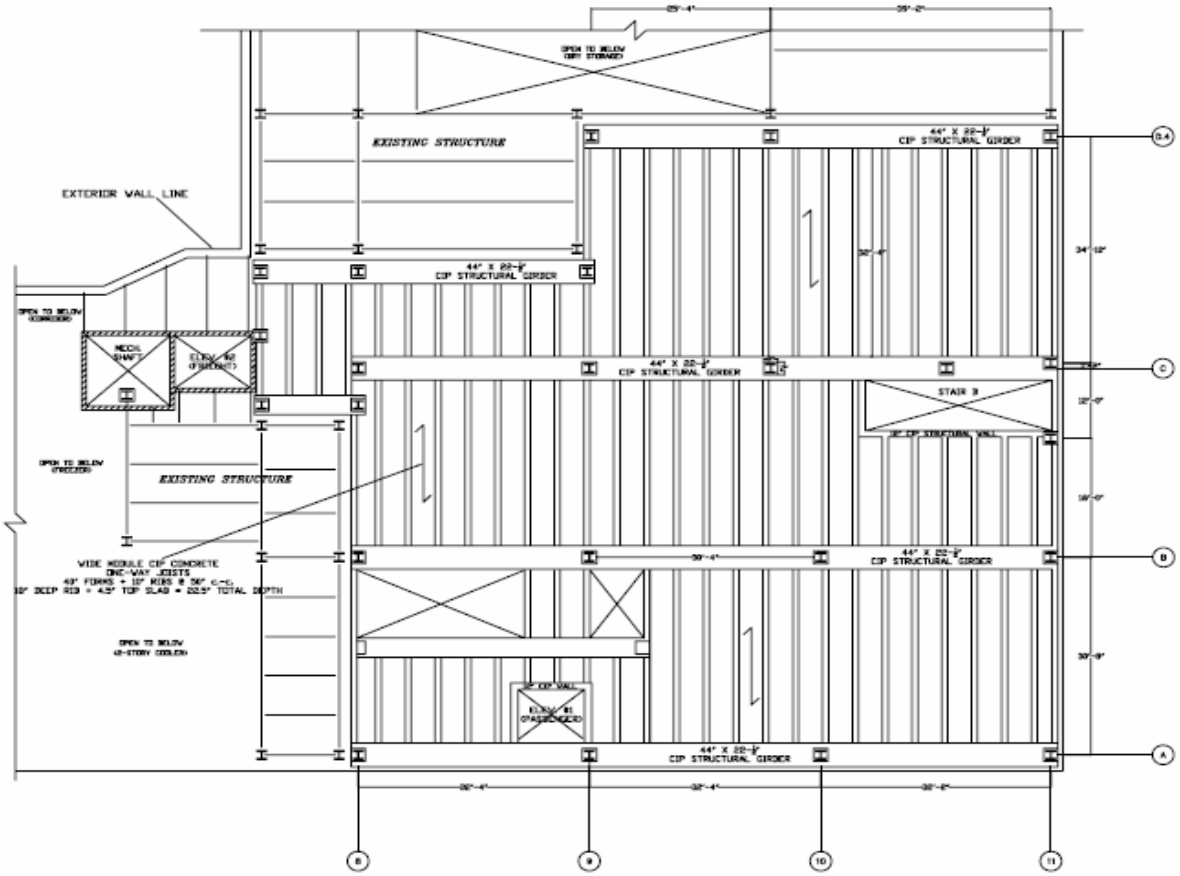

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HOME OF THE NEW CREAMERY & THE DEPARTMENT OF FOOD SCIENCES

NOTES:

SECOND FLOOR FRAMING PLAN

THE UNDERSIDE OF THE STRUCTURE WILL BE EXPOSED AND SERVE AS THE FINISHED CEILING IN THE PRODUCTION AREA

SCALE:

1/16" = 1'-0"

DRAWN BY:

ANTHONY J. LUCOSTIC

CONSTRUCTION MANAGEMENT

5TH YEAR SENIOR THESIS PROJECT

PENNSTATE 1855

Gilbane

IKM INCORPORATED
ARCHITECTS, PLANNERS
INTERIOR DESIGNERS
One PPG Place
Pittsburgh, Pennsylvania 15222

H.F. LENZ COMPANY
Engineers · Planners · Surveyors · Energy Consultants

GILBANE BUILDING COMPANY
CONSTUCTION MANAGER
7 Jackson Walkway
Providence, RI 02903

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JOB NO.
IKM 02-061
DGS#05-271
PSU-01778

DWG. NO.

SECOND FLOOR FRAMING EAST

DATE 3/31/06

S2.2B

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Expansion Joints