

# Existing Construction Conditions & Technical Assignment 2

By Anthony Lucostic

# **Contents**

Executive Summary Detailed Project Schedule Site Layout Planning Assemblies Estimate Detailed Superstructure Estimate General Conditions Estimate

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### Executive Summary

The contents of this report capture a more in depth look at the Food Science Building's schedule, site plan, estimates and general conditions. The detailed project schedule looks closely at the procedure of constructing the building including durations and linking activities. It begins with excavation, sitework, piles and concrete then continues to procede with the structural steel, building envelope, and interiors. A crucial part of the building in the schedule is the Production Area of the building and Creamery Sales Area which are definitely the driving forces behind completing the project on schedule. The following site layout plans depict the project from all views showing the overall layout of the site with the surrounding features. The site plans then become more detailed on the Food Science Project itself looking at utilities, site logistics, and the structural steel erection sequence of the project. Next, there is an assemblies estimate of the fire protection system of the building. The Food Science Building is mostly all a wet sprinkler system but there is a small portion of the system in the Production Area that is dry; these costs are separated and shown on the summary and take-offs. The estimate I created is approximately \$18,000 dollars shy of the actual cost of the fire protection package on the project. The main conflict here is that there was a \$10,000 dollar add for misc. metal support to the contract at bid time. Following this is a detailed estimate of the entire Food Science Building's superstructure including piles, concrete, and structural steel. Finally, is a general conditions estimate that was put together from Cost Works 2005. The estimate I created for this ended up being approximately \$1.1 million dollars shy of the typical 10% cost of the project for general conditions. I feel the main reason for this is because a lot of the temporary facilities and equipment costs were written into the subcontractors scope of work and was not part of the construction managers general conditions. The entire report gives a more in depth look at the Food Science Building than the previous technical assignment 1.

Food Science Builidng															October 31, 2005								
Activity Name	Start	Finish	J	F	M	A	M	J	J	A	S	0	N	D	J	F	M	A	M	J	J	A	
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Steel Deck Seq. 5	15-Aug-05	02-Sep-05	1								j Steel	Deck	eq. 5										
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SOD Rough-in 2nd floor	06-Sep-05	16-Sep-05	1								🗖 si	DD Roi	igh-in 2	hd floor									
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F/R/P 4th floor	22-Aug-05	25-Aug-05	1	1			-			0	F/R/P 4	th floo								[			
F/R/P 3rd floor	06-Sep-05	08-Sep-05	1								∎ F/R	P 3rd 1	oor										
F/R/P 2nd floor	19-Sep-05	21-Sep-05	1								0	F/R/P 2	nd flooi										
F/R/P Structural Slab	05-Jul-05	05-Aug-05	1	1				-		F/R/	P Struc	ural SI	ab										
F/R/P Slab-on-grade	27-Jun-05	05-Aug-05							:	F/R/	P Slab-	on-grad	e										
raming/Sheathing court	26-Sep-05	21-Oct-05	1	1	1		1						Framing	¢Sheath	ling cou	irtyard	l'area/n	orth sid	e				
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Finish     -05*   23-Nov-05     -05*   24-Nov-05     -05*   21-Nov-05     -05*   02-Dec-05     -05*   09-Dec-05     -05*   30-Nov-05     -05*   30-Nov-05     -05*   09-Dec-05     -05*   30-Nov-05     -05*   16-Dec-05     -05*   16-Sep-05     -05*   30-Sep-05     -05*   14-Oct-05		F 301 22	M 3122	A 01112	M 3 3 1 2	3 <u>)   </u> 3		A 3 0 1 2	S 2 J   1 2	0 1)1)12	🛛 Brio	Framir & court Brick v	ig/She yard a	irea/nor ide	ast side		M 3 0 1 2 2	ן וונ 2 וונ	J <u>) )   2</u>	A 3 )
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Area Da   -06* 24-Feb-06 Page 2 of 3	-05 28-Oct-05   -05 04-Nov-05   -05* 16-Dec-05   -05* 20-Jan-06   -06* 17-Feb-06   -06* 17-Mar-06   -05* 23-Sep-05   -05* 13-Jan-06   -06* 17-Feb-06   -06* 17-Feb-06   -06* 17-Mar-06   -05* 13-Jan-06   -06* 17-Mar-06   -06* 17-Feb-06   -06* 17-Feb-06   -06* 17-Mar-06   -05 18-Nov-05   -05 18-Nov-05   -06* 13-Jan-06   -06* 24-Feb-06	-05 28-Oct-05 MEP rough-in 2nd floor   -05 04-Nov-05 MEP rough-in 1st floor   -05* 16-Dec-05 Drywall/finishes 4th floor   -06* 17-Feb-06 Drywall/finishes   -06* 17-Mar-06 Drywall/finishes   -05 07-Oct-05 Roof High   -05* 13-Jan-06 Lab Casework 4   -06* 17-Feb-06 Lab Casework 4   -06* 17-Feb-06 Lab Casework 4   -06* 17-Feb-06 Lab Casework 4   -06* 17-Mar-06 Lab Casework 4   -06* 17-Mar-06 Production Area polished block walls   -06* 16-Sep-05 Prod. Area MEP rough-in   -05 13-Jan-06 Prod. Area Dairy Brick/Flooring   -06* 24-Feb-06 Prod. Area MEP rough-in	05 28-Oct-05 MEP rough-in 2nd floor   05 04-Nov-05 MEP:rough-in 1st floor   -05* 16-Dec-05 Drywall/finishes 4th floor   06* 17-Feb-06 Drywall/finishes 3rd floor   -06* 17-Mar-06 Proof Low   -05 31-Oct-05 Roof Low   -05* 13-Jan-06 Building Roof DRY   -06* 17-Feb-06 Eab Casework 4th floor   -06* 17-Mar-06 Eab Casework 4th floor   -06* 19-Un-06 Production Area polished block walls   -05 18-Nov-05 Prod. Area MEP rough-in   -05* 13-Jan-06 Page 2 of 3	05 28-Oct-05 MEP reugh-in 2nd floor   05 04-Nov-05 MEP reugh-in 1st floor   -05* 16-Dec-05 Drywall/finishes 3td floor   -06* 17-Feb-06 Drywall/finishes 3nd floor   -06* 17-Mar-06 Proveall/finishes 2nd floor   -05* 23-Sep-05 Roof High   -05 31-Oct-05 Roof Low   05* 13-Jan-06 Eab Case work 3rd floor   -06* 17-Feb-06 Eab Case work 3rd floor   -06* 17-Feb-06 Eab Case work 3rd floor   -05* 13-Jan-06 Eab Case work 3rd floor   -06* 17-Feb-06 Eab Case work 3rd floor   -06* 17-Mar-06 Eab Case work 3rd floor   -05 16-Sep-05 Frod. Area Deliny Brick/Flooring   -05 18-Nov-05 Frod. Area Deliny Brick/Flooring   -05* 13-Jan-06 Frod. Area Deliny Brick/Flooring   -06* 24-Feb-06 Pipe production	05 28-Oct-05   05 04-Nov-05   0-05 16-Dec-05   0-05* 16-Dec-05   0-05* 20-Jan-06   0-06* 17-Feb-06   0-06* 17-Keb-06   0-05 23-Sep-05   0-05 31-Oct-05   0-05 31-Oct-05   0-06* 17-Feb-06   0-06* 17-Feb-06   0-05 31-Oct-05   0-06* 17-Feb-06   0-05 13-Jan-06   0-06* 17-Keb-06   0-06* 17-Keb-06   0-06* 17-Keb-06   0-06* 17-Keb-06   0-05 18-Nov-05   0-05 18-Nov-05   0-05 18-Nov-05   0-05 13-Jan-06   0-06* 17-Keb-06   0-06* 17-Mar-06   0-05 18-Nov-05   0-05 18-Nov-05   0-05 18-Nov-05   0-05 13-Jan-06   0-05 18-Nov-05   0-05 18-Nov-05   0-05 18	05 28-Oct-05 MEP reugh-in 2nd floor   05 04-Nov-05 MEP:reugh-in 2nd floor   05' 16-Dec-05 Drywall/finishes 4th floor   06' 17-Feb-06 Drywall/finishes 3nd floor   06' 17-Mar-06 Drywall/finishes 1st floor   06' 17-Mar-06 Drywall/finishes 1st floor   05' 23-Sep-05 Roof Figh   06' 17-Feb-06 Roof Low   05' 31-Oct-05 Lab Casework 4th floor   06' 17-Feb-06 Lab Casework 3nd floor   06' 17-Feb-06 Creamery   05' 31-Oct-05 Lab Casework 3nd floor   06' 17-Kar-06 Creamery   06' 17-Kar-06 Creamery   05' 18-Nov-05 Production Area polished block walls   05' 18-Nov-05 Prod. Area MEP rough-in   06' 13-Jan-06 Prod. Area Dairy Brick/Flooring   05' 18-Nov-05 Prod. Area Dairy Brick/Flooring   05' 13-Jan-06 Set Production equipment   06' 24-Feb-06 Pipe production equipment

					Food Science Builidng													Oc	tober 3	31,200	05	
Activity Name	Start	Finish	J	F	M	A	M	J	J	A	S	0	N	D	J	F	M	A	M	J	J	A
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Finishes in Production Ar	01-May-06*	31-May-06																		Finish	es in P	roductio
Finishes in Creamery Sales	22-May-06*	16-Jun-06		1						-					1		1			Fi	nishes	in Crea
Testing and Comissioning	01-Mar-06*	30-Jun-06					1	1	1									,	,		Testir	ng and (
Punchlist	01-May-06*	30-Jun-06																			Puncl	hlist
Certificate of Occupancy	01-Aug-06*	01-Aug-06		1		1									1							Certit
Actual Work	Cr	ritical Remainin	ng Work	-	- s	ummar	у		Page 3	of 3		Α	nthony	Luco	etie	см. 4	5th Va	or So	nior Th	ncie D	oiact	
Remaining Work	♦ Mi	ilestone										1 ^	mony	LUCO	and -	0101 - 3	501.16	ai Sei	nor m	5010 171	ojeci	

### Site Layout Planning

The Food Science Building proves to be a challenging project when looking at the confined site conditions during construction. The Food Science Building is the last of four building that Gilbane Building Co. is building on the East Sub Campus Site of The Pennsylvania State University. First there was the Smeal Building along with the Parking Deck, next and still in progress is the Forestry Building and lastly the Food Science Building. Due to this sequence and the logistics of these projects with site hardscape, etc. all of the work ends up finishing and gets pushed towards the Food Science Building. Therefore, the already congested Food Science Site becomes even more congested daily by sharing their space with the Forestry Building.

I've developed a series of eight site plans trying to show these issues along with a detailed look at the structural steel erection sequence of the Food Science Building. Below I will talk about each site plan individually pointing out the key features of each.

#### SK-1: East Sub Campus Site Plan

This sketch shows the locations of all of the projects and their current state in relation to the Food Science Building. It illustrates the overall East Sub Campus Site in relation to roads and other buildings, along with the site fence and lay down locations.

#### SK-2: Food Science Building Utilities Plan

This sketch shows the locations of all utilities on or near the Food Science Building. Additionally, it shows new utility work to be installed along with the existing utilities and the utilities that need to be removed.

#### SK-3: Food Science Building Site Logistics Plan

This sketch shows the location of the Gilbane Site Office along with the OCIP nurses trailer. Additionally, you can see the overall flow through the job with the site fence and gates and the laydown and trailer area around the site. Also, all temporary facilities are shown.

#### SK-4: Structural Steel Sequence 1

This sketch shows the first phase of the structural steel erection on the Food Science Building. The structural steel sequence was split into five sequences beginning on the east side of the building and working around to the west. The crane used for erection was a Manitowoc lattice-boom crawler crane model 12000. It had a 120 ton lifting capacity with a 230' heavy boom lift. The approximate working radius for the crane when erecting typical steel sizes, as on the Food Science Building, was 175'.

The bays of sequence 1 contained floors 2 and 3. In this location the third floor level is as high as the building goes and it becomes a low roof.

This sketch also shows the flow of the steel delivery trucks, shake out areas, and crane placement. During the first sequence of erection piles where finishing up along with the concrete pile caps, grade beams, and piers. Shoring was needed for the excavation and work of the basement on the west side of the building along curtain road, the placement is shown on the plan. A soilder beam and lagging system was used as the shoring system in this area. It will be left in and backfilled against when the work is complete.

#### SK-5: Structural Steel Sequence 2

This sketch shows the erection of sequence 2. Sequence 2 worked from the existing corner of the previously erected steel out as designated by the arrows in the sketch. Sequence 2 erection went from the second floor level to the high roof of the building five stories up. Additionally, during this sequence a small ramp was built against the buildings grade beam inside the courtyard. This was to provide access into this area of the building for the multiple trades that were beginning work. The ramp merely acted as a ramp to be able to drive over top the grade beam.

#### SK-6: Structural Steel Sequence 3

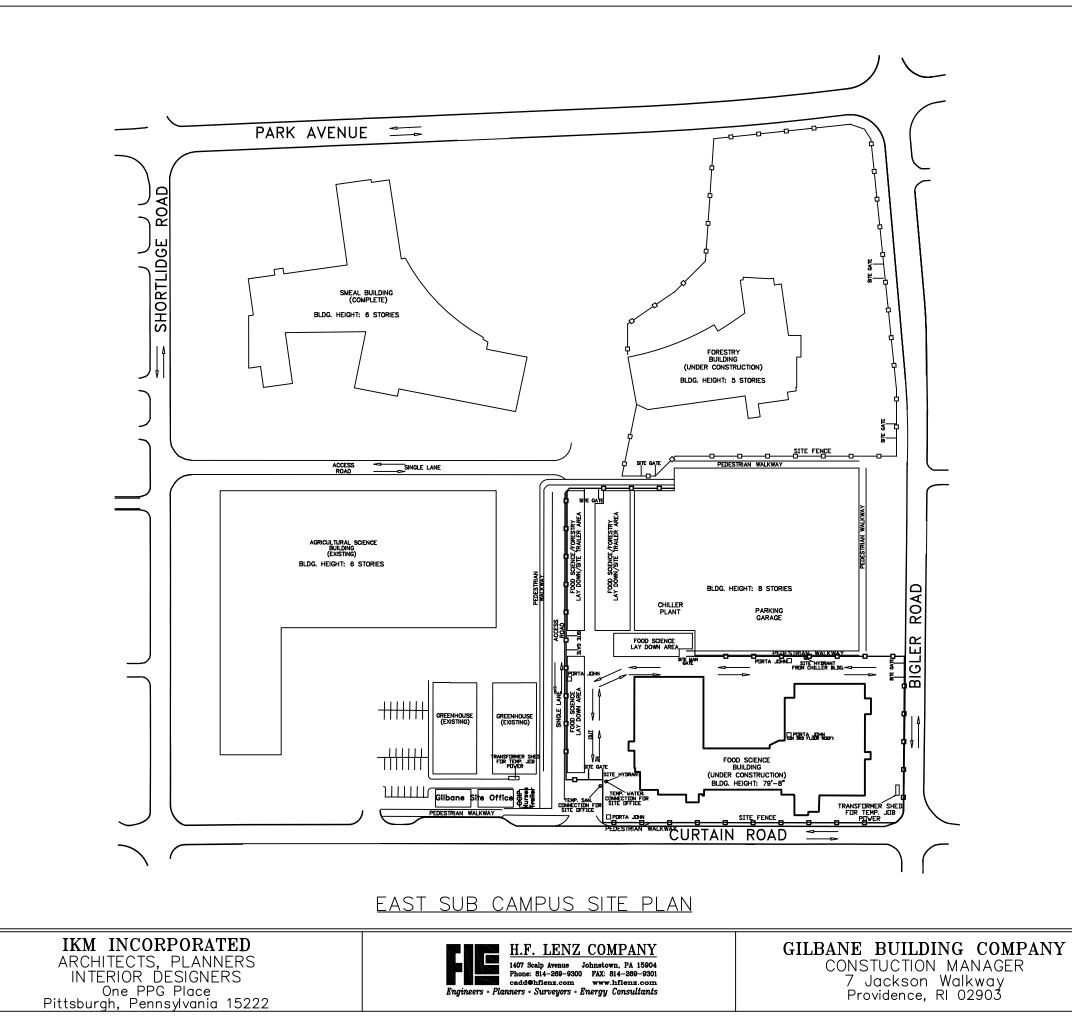
This sketch shows the erection of sequence 3. Sequence 3 is the linking section between the east and west of the building. The steel in this area went form the  $2^{nd}$  floor to the penthouse level 6 stories up.

#### SK-7: Structural Steel Sequence 4

This sketch shows the erection of sequence 4. At this sequence it was necessary for the crane to move out of the courtyard area due to congestion. This was a critical area that was needed for many other trades to begin their work. Therefore the crane moved to the far west side of the building for the remaining erection of the building. At this point it was also becoming too congested for the steel trucks to drive around the entire site as they have been. Therefore, for the few remaining deliveries of steel they chose to back the trucks off Curtain Rd. into the site. This section went from the first floor level, above the basement, to the high roof level five stories up.

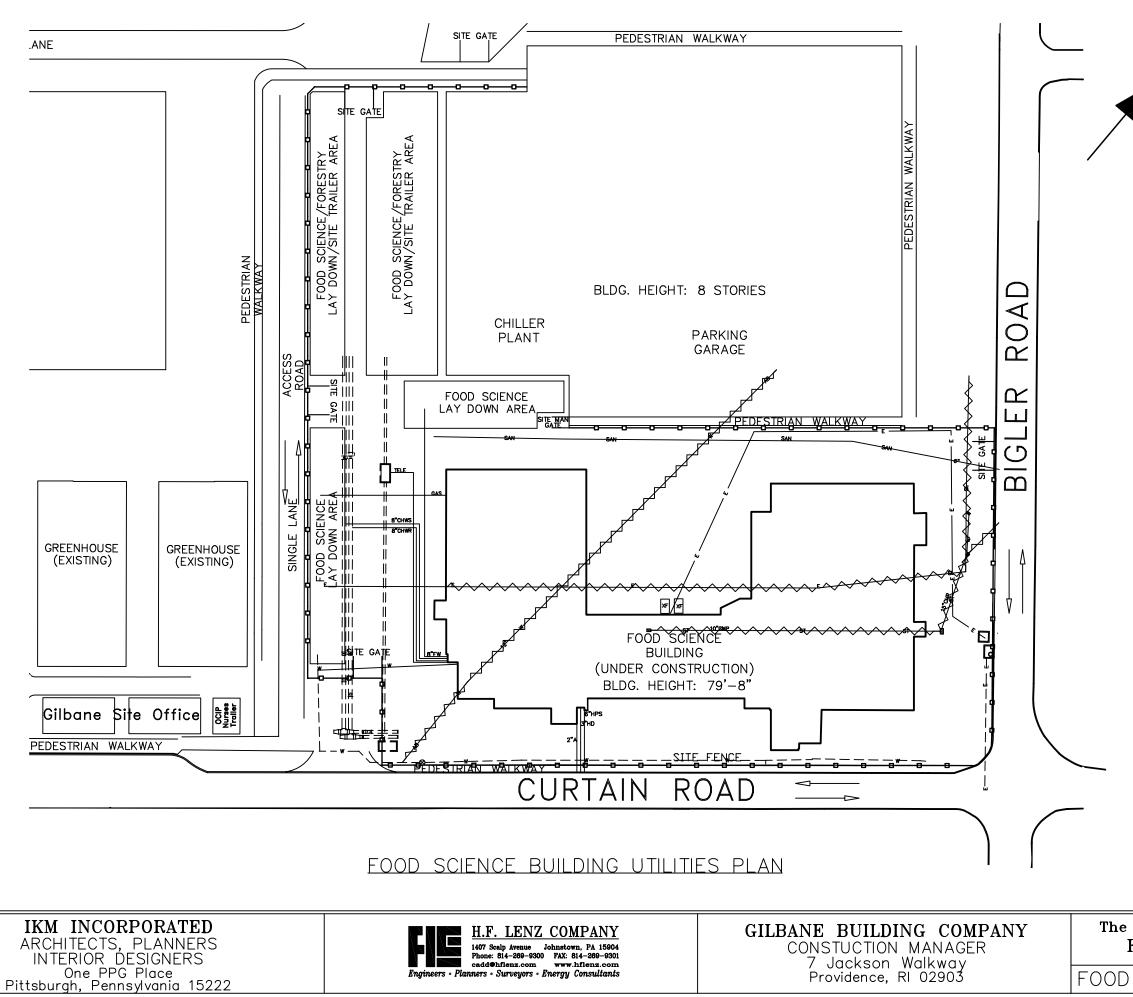
#### SK-8: Structural Steel Sequence 5

This sketch shows the erection of the last sequence of steel, sequence five. Sequence five was performed similarly to sequence four. The bays of sequence 5 contained floors 2 and 3. In this location the third floor level is as high as the building goes and it becomes a low roof. Additionally, by this time the building is starting to be detailed and decked out and slabs were being poured. Therefore, the typical location of the concrete pump set-up and path of the concrete trucks is also shown on the plan.

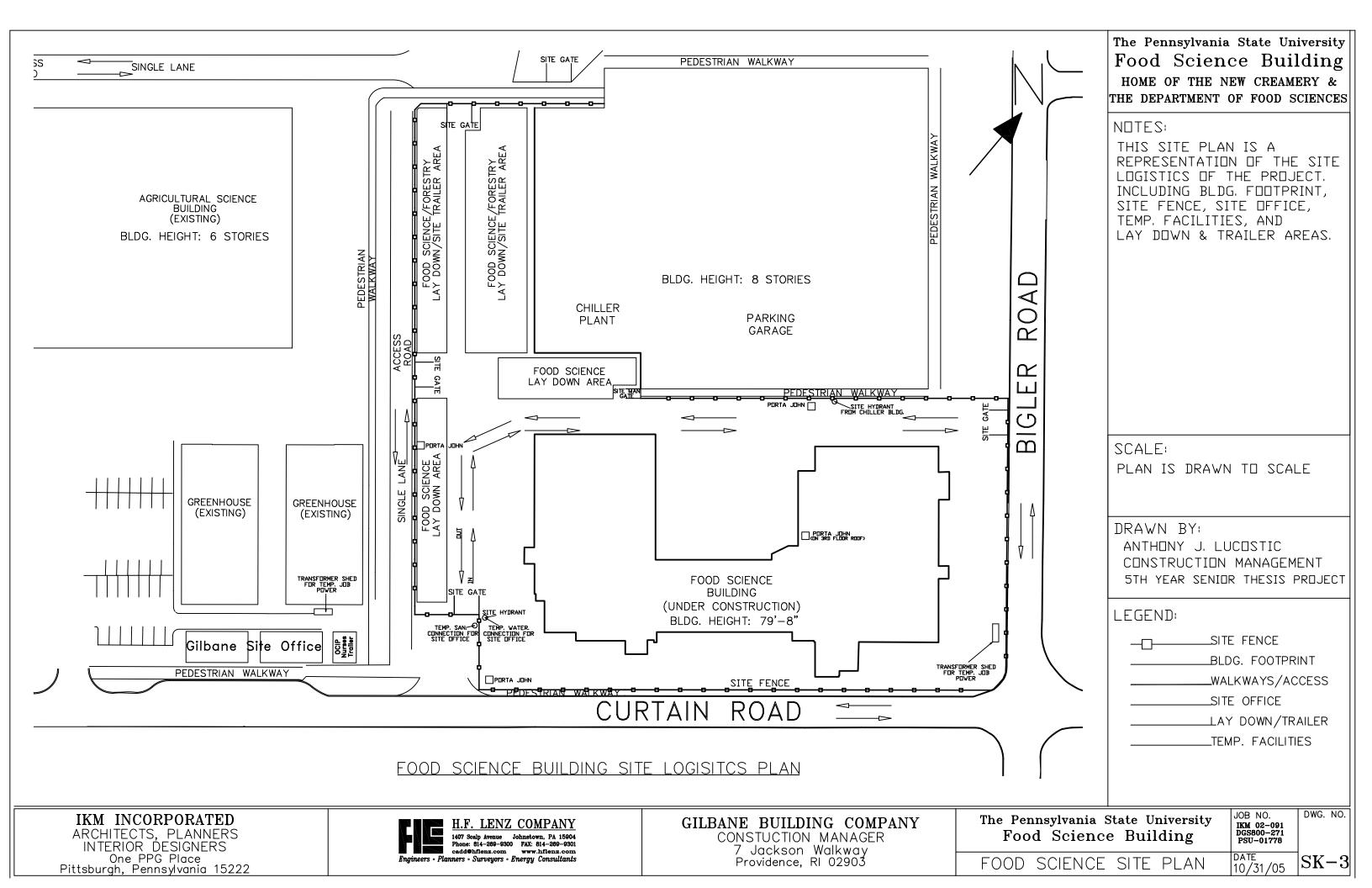


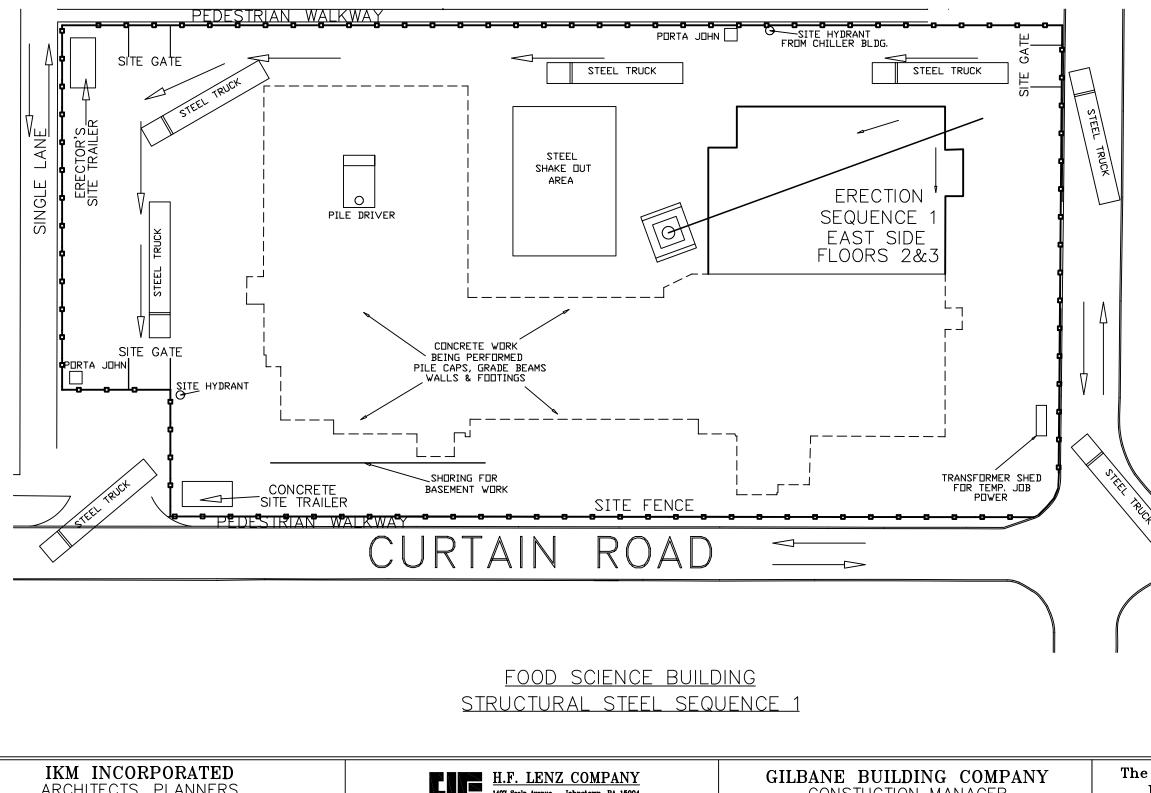
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	The Pennsylvania Food Scien HOME OF THE N THE DEPARTMENT (	ce Buil ew creami	ding ERY &
	NUTES: THIS SITE PLAN THE CURRENT V FUDD SCIENCE F RELATION TO TH EAST SUBCAMPU THAT GILBANE IS WORKING ON THIS SITE PLAN THE MAJOR CHA HAPPENED TO S DURING THE COM FUDD SCIENCE THESE CHANGES MUSTLY SITE OF RELOCATION, SI PEDESTRIAN ACC ON-SITE LAY DI TRAILER AREA.	VIEW OF PROJECT HE OTHER S BUILDI BUILDING N REPRES NGES THA ITE LOGI NSTRUCIT BUILDING. AFFECTE FFICE TE FENCE CESS, ANI OWN &	THE IN NGS CD. ENTS AT STICS DN DF ED E & D
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ood Science	6	JOB NO. IKM 02-091 DGS800-271 PSU-01778	DWG. NO.
SOR CAMPI	JS SITE PLAN	10/31/05	SK-1



The Pennsylvania State University Food Science Building HOME OF THE NEW CREAMERY & THE DEPARTMENT OF FOOD SCIENCES NDTES: THIS SITE PLAN CONTAINS THE UTILITIES (NEW & DEMO) ALONG WITH THE JOB LAY-DOWN AND TRAILER AREAS WHICH ARE SHARED WITH THE FORESTRY BUILDING AS SEEN ON SK-1. SCALE: PLAN IS DRAWN TO SCALE. DRAWN BY: ANTHONY J. LUCOSTIC CONSTRUCTION MANAGEMENT 5TH YEAR SENIOR THESIS PROJECT LEGEND: \_SITE FENCE \_BLDG. FOOTPRINT \_WALKWAYS/ACCESS \_SITE OFFICE LAY DOWN/TRAILER ~~~~DEMO UTILITIES NEW UTILITIES \_\_\_\_EX. UTILITIES DWG. NO. JOB NO. The Pennsylvania State University IKM 02-091 DGS800-271 PSU-01778 Food Science Building FOOD SCIENCE UTILITIES PLAN 10/31/05 |SK-2|





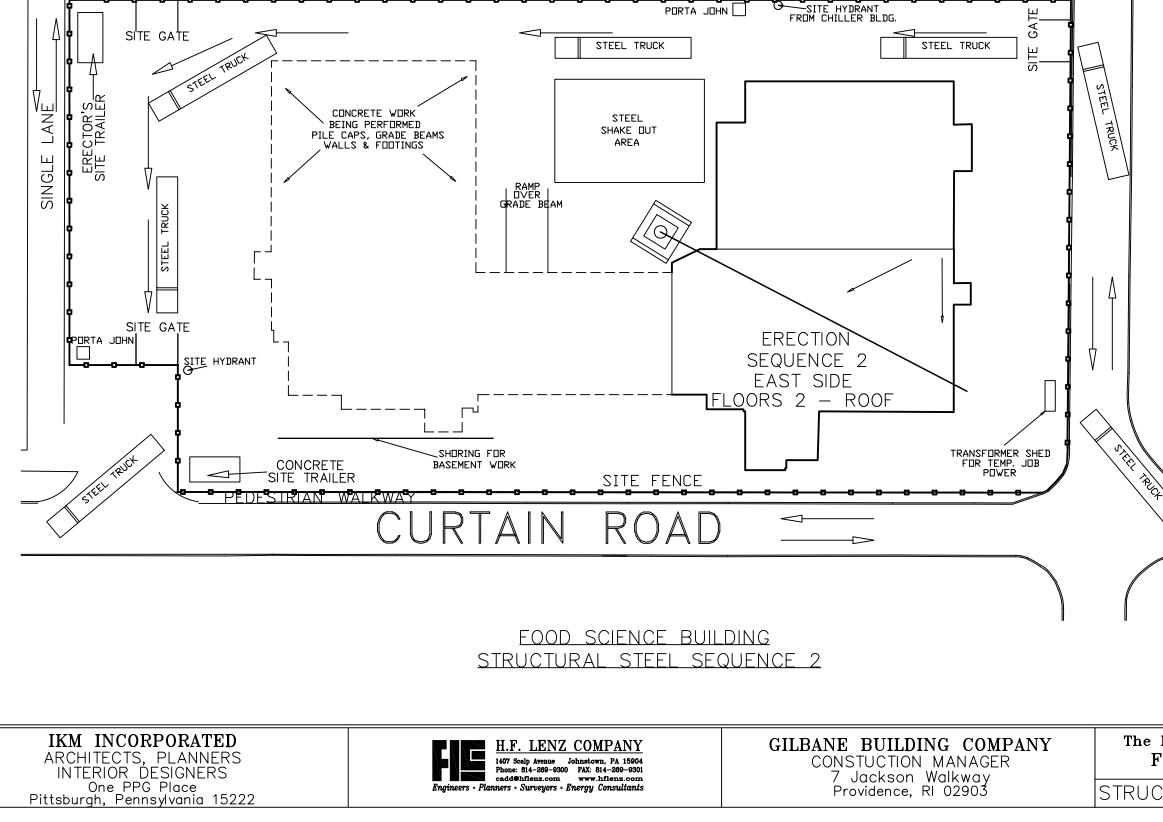
ARCHITECTS, PLANNERS INTERIOR DESIGNERS One PPG Place Pittsburgh, Pennsylvania 15222



CONSTUCTION MANAGER 7 Jackson Walkway Providence, RI 02903

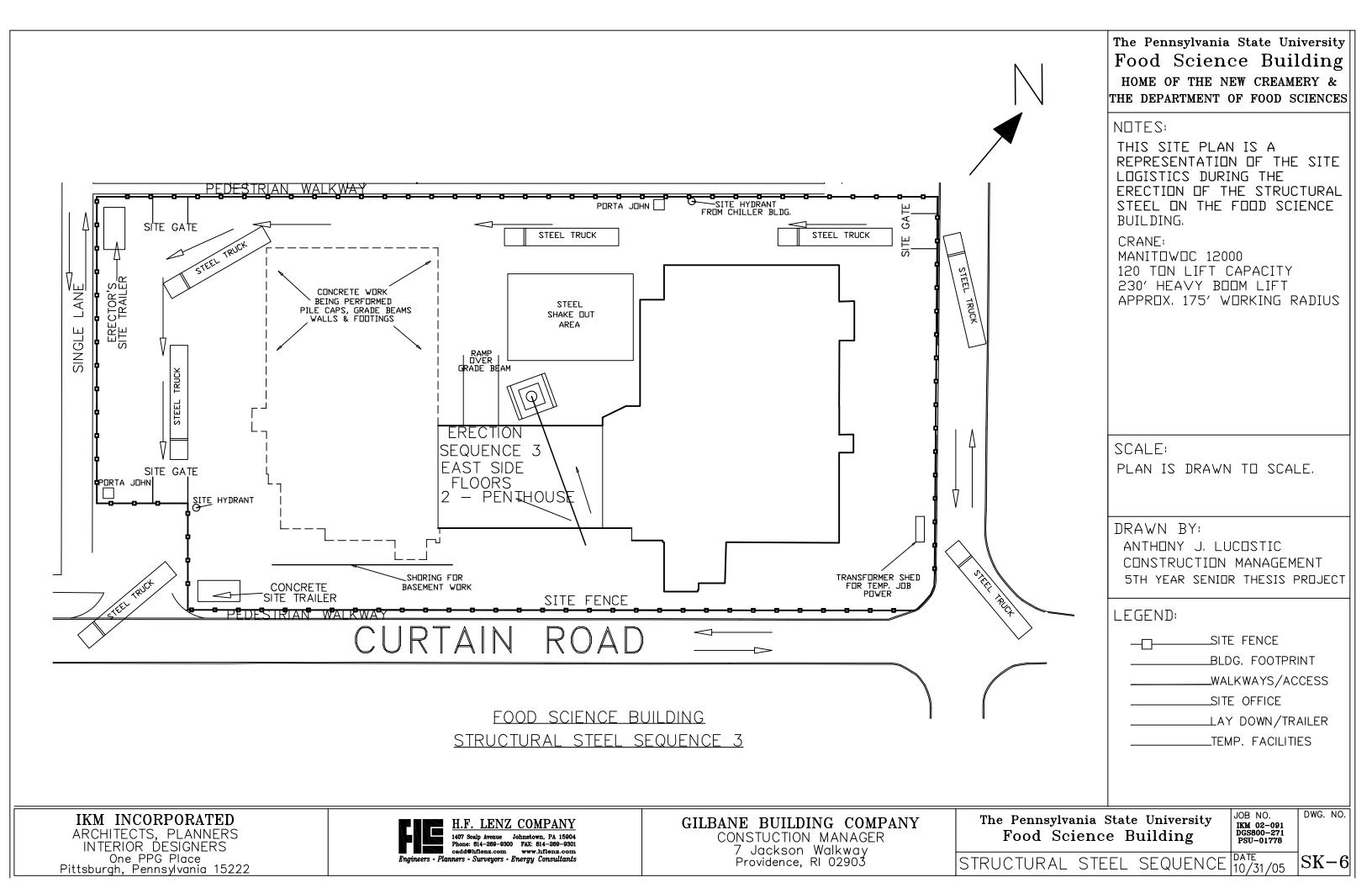


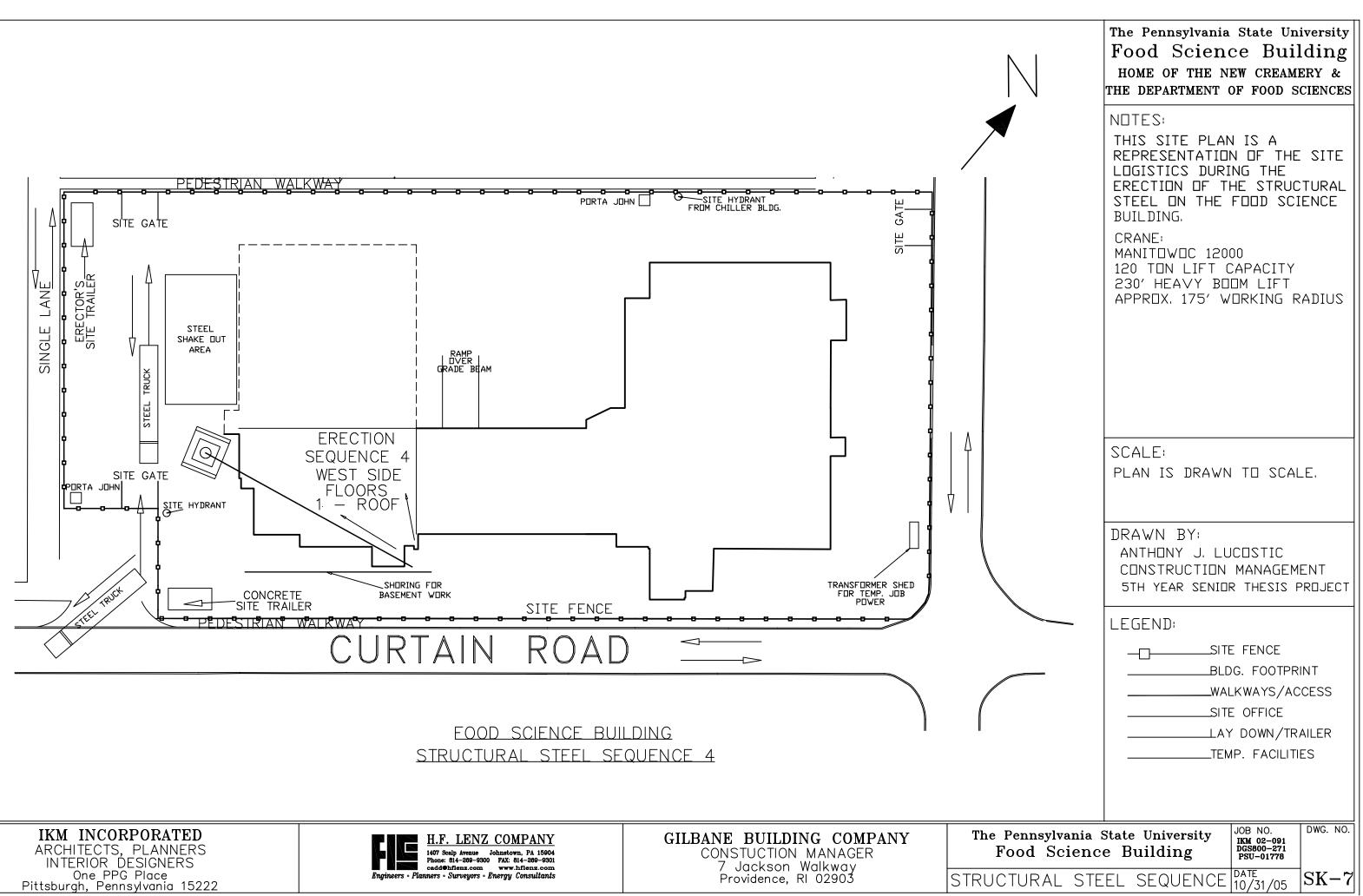
The Pennsylvania State University Food Science Building HOME OF THE NEW CREAMERY & THE DEPARTMENT OF FOOD SCIENCES NDTES: THIS SITE PLAN IS A REPRESENTATION OF THE SITE LOGISTICS DURING THE ERECTION OF THE STRUCTURAL STEEL ON THE FOOD SCIENCE BUILDING. CRANE: MANITOWOC 12000 120 TON LIFT CAPACITY 230' HEAVY BOOM LIFT APPROX. 175' WORKING RADIUS SCALE: PLAN IS DRAWN TO SCALE. DRAWN BY: ANTHONY J. LUCOSTIC CONSTRUCTION MANAGEMENT 5TH YEAR SENIOR THESIS PROJECT LEGEND: \_SITE FENCE  $-\Box$ \_BLDG. FOOTPRINT \_WALKWAYS/ACCESS \_SITE OFFICE LAY DOWN/TRAILER TEMP. FACILITIES DWG. NO. JOB NO. The Pennsylvania State University IKM 02-091 DGS800-271 Food Science Building PSU-01778 date 10/31/05 |SK-4|STRUCTURAL STEEL SEQUENCE

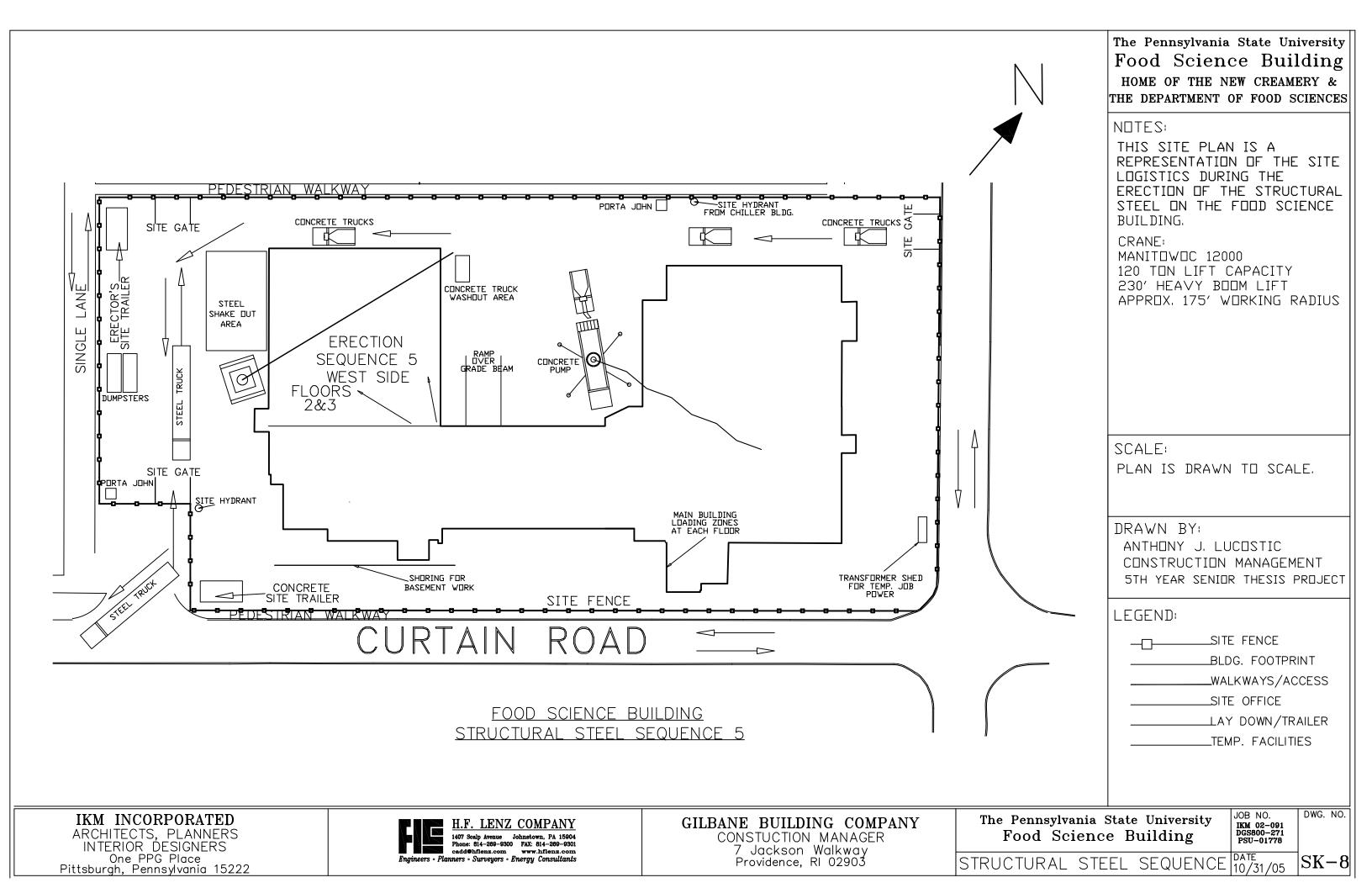


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The Pennsylvania State University Food Science Building HOME OF THE NEW CREAMERY & THE DEPARTMENT OF FOOD SCIENCES NDTES: THIS SITE PLAN IS A REPRESENTATION OF THE SITE LOGISTICS DURING THE ERECTION OF THE STRUCTURAL STEEL ON THE FOOD SCIENCE BUILDING. CRANE: MANITOWOC 12000 120 TON LIFT CAPACITY 230' HEAVY BOOM LIFT APPROX. 175' WORKING RADIUS SCALE: PLAN IS DRAWN TO SCALE. DRAWN BY: ANTHONY J. LUCOSTIC CONSTRUCTION MANAGEMENT 5TH YEAR SENIOR THESIS PROJECT LEGEND \_SITE FENCE  $\neg \neg$ \_BLDG. FOOTPRINT \_WALKWAYS/ACCESS \_SITE OFFICE LAY DOWN/TRAILER TEMP. FACILITIES DWG. NO. JOB NO. The Pennsylvania State University IKM 02-091 DGS800-271 Food Science Building PSU-01778 date 10/31/05 |SK-5|STRUCTURAL STEEL SEQUENCE







## Assemblies Estimate of the Fire Protection System for Food Science Building

The following is an assemblies estimate of the Food Science Builidng's Fire Protection System. The take-off quantities were taken form the contract documents while the per unit costs were taken from Cost Works 2005. All numbers include installation, material handling and delivery, and all equipment necessary to complete the work. Below is a summary of the results found:

Summary:

#### Assemblies Estimate for Fire Protection System CSI Specification Section 14000

Total Cost for Fire Protection	
System	313,859
Total Cost for Entire System Per Square Foot	2.57
Total Cost for Dry System Per Square Foot	3.28
Total Cost for Wet System Per Square Foot	2.68

The estimate calculated with cost works turned out to be \$18,107 dollars shy of the realistic \$331,966 estimate which was used on the job. One reason for this error would be the misc. metals that were added for the support of the system. This add occurred in the early phases of bidding through an addendum to the Fire Protection Contract.

On the following page you will find the take-off checklist used to find these numbers categorized by CSI Uniformat II.

## Assemblies Estimate of the Fire Protection System for Food Science Building

Take Off:

Section   Area   Unit   Unit   Cos     14310   Dry Pipe Sprinkler System: Cooler/Freezer/Loading Dock   Ordinary Hazard, one floor   -   -   -   -   -   -   -   -   -   -   16,4     14320   Wet Pipe Sprinkler System: Second Floor   Stand Pipes   -   -   -   -   -   -   -   -   -   16,4   14,2   16,1   16,1   2,300,00   2,2,7   17,7   17,7   17,7   17,7   17,7   17,7   17,7   17,7   17,7   17,7   17,7   17,7   17,7   17,7<		Assemblies Estimate for r		Oy Sic		
14310   Dry Pipe Sprinkler System: Cooler/Freezer/Loading Dock   floor   -   -   -   -   -   -   -   16,7     14320   Wet Pipe Sprinkler System: First Floor   Stand Pipes   -   16,7   17,7 <t< td=""><td></td><td>Area</td><td>Unit</td><td></td><td></td><td>Total Cost</td></t<>		Area	Unit			Total Cost
14310   Dry Pipe Sprinkler System: Cooler/Freezer/Loading Dock   floor   -   -   -   -   -   -   -   16,7     14320   Wet Pipe Sprinkler System: First Floor   Stand Pipes   -   16,4   16,4   16,4     14320   Wet Pipe Sprinkler System: Second Floor   1   flr   8,550.00   8,5     14320   Wet Pipe Sprinkler System: Fourth Floor   1   flr   2,300.00   2,3     14410   Wet Pipe Sprinkler System: Basement   1   flr   2,300.00   2,3     14410   Wet Pipe Sprinkler System: First Floor   0rdinary Hazard, one floor   1   flr   2,300.00   2,5     14410   Wet Pipe Sprinkler System: First Floor   0rdinary Hazard, one floor   1   flr   2,300.00   2,5     14410   Wet Pipe Sprinkler System: First Floor   23,750   sf   2.42   7,5     14420   Wet Pipe Sprinkler System: 2-1/2" Hose Station w/Cabinet   1   1   2   65,5     14420   Wet Pipe Sprinkler System: 2-1/2" Hose Station w/Cabinet   1   1			Ordinary Hazard,	one		
Cooler/Freezer/Loading Dock   5,000 sf   3.28   16,4     14320   Wet Pipe Sprinkler System:   Stand Pipes   16,4     14320   Wet Pipe Sprinkler System:   Stand Pipes   -     First Floor   1   flr   8,550.00   8,5     Second Floor   1   flr   2,300.00   2,3     Third Floor   1   flr   2,300.00   2,3     Fourth Floor   1   flr   2,300.00   2,3     Penthouse   1   flr   2,300.00   2,3     Penthouse   1   flr   2,300.00   2,3     14410   Wet Pipe Sprinkler System:   Ifor   2,300.00   2,5     Met Pipe Sprinkler System:   Ordinary Hazard, one   1   1     14410   Wet Pipe Sprinkler System:   0rdinary Hazard, one   5   2.422   7,5     Second Floor   23,750   sf   2.276   65,5   5   5   5,5   5,5   5,5,5   5,5,5   5,5,5   5,5,5   5,5,5   5,5,5	14310	Dry Pipe Sprinkler System:				
14320   Wet Pipe Sprinkler System: First Floor   Stand Pipes				sf	3.28	16,400
First Floor   1   flr   8,550.00   8,9     Second Floor   1   flr   2,300.00   2,3     Third Floor   1   flr   2,300.00   2,3     Fourth Floor   1   flr   2,300.00   2,3     Penthouse   1   flr   2,300.00   2,3     Total   Penthouse   1   flr   2,300.00   2,3     14410   Wet Pipe Sprinkler System:   Ordinary Hazard, one   17,7     Basement   3,000   sf   2.42   7,3     Second Floor   23,750   sf   2.76   65,3     Second Floor   28,750   sf   2.27   65,3     Third Floor   28,750   sf   2.27   65,3     Fourth Floor   28,750   sf   2.27   65,3     Penthouse   4,000   sf   2.37   9,4     Total   Total   278,0   278,0   278,0     14420   Wet Pipe Sprinkler System:   Fire House Equipment   <		Total				16,400
First Floor   1   fir   8,550.00   8,5     Second Floor   1   flr   2,300.00   2,3     Third Floor   1   flr   2,300.00   2,3     Fourth Floor   1   flr   2,300.00   2,3     Penthouse   1   flr   2,300.00   2,3     Total   1   flr   2,300.00   2,3     Ordinary Hazard, one   1   flr   2,300.00   2,3     Total   Ordinary Hazard, one   17,7   17,7     Basement   3,000   sf   2.42   7,3     First Floor   23,750   sf   2.27   65,3     Second Floor   28,750   sf   2.27   65,3     Fourth Floor   28,750   sf   2.27   65,3     Penthouse   4,000   sf   2.37   9,4     Total   Total   278,0   278,0   278,0     14420   Wet Pipe Sprinkler System:   Fire House Equipment   303.00   278,0	14320	Wet Pipe Sprinkler System:	Stand Pipes			
Third Floor   1   flr   2,300.00   2,3     Fourth Floor   1   flr   2,300.00   2,3     Penthouse   1   flr   2,300.00   2,3     Total   Total   1   flr   2,300.00   2,3     14410   Wet Pipe Sprinkler System:   0rdinary Hazard, one   17,7     Basement   3,000   sf   2.42   7,3     First Floor   23,750   sf   2.76   65,3     Second Floor   28,750   sf   2.27   65,3     Third Floor   28,750   sf   2.27   65,3     Fourth Floor   28,750   sf   2.27   65,3     Fourth Floor   28,750   sf   2.27   65,3     Fourth Floor   28,750   sf   2.37   9,4     Total   Ket Pipe Sprinkler System:   Fire House Equipment   278,0     14420   Wet Pipe Sprinkler System:   Fire House Equipment   303.00   4			1	flr	8,550.00	8,550
Fourth Floor   1   flr   2,300.00   2,3		Second Floor	1	flr	2,300.00	2,300
Penthouse   1 flr   2,300.00   <		Third Floor	1	flr	2,300.00	2,300
Total   Ordinary Hazard, one floor   17,7     14410   Wet Pipe Sprinkler System: Basement   0rdinary Hazard, one floor   17,7     Basement   3,000 sf   2.42   7,3     First Floor   23,750 sf   2.76   65,3     Second Floor   28,750 sf   2.27   65,3     Third Floor   28,750 sf   2.27   65,3     Fourth Floor   28,750 sf   2.27   65,3     Penthouse   4,000 sf   2.37   9,4     Total   Total   278,0   278,0     14420   Wet Pipe Sprinkler System: 2-1/2" Hose Station w/Cabinet   Fire House Equipment   303.00		Fourth Floor	1	flr	2,300.00	2,300
14410   Wet Pipe Sprinkler System:   Ordinary Hazard, one floor   -		Penthouse	1	flr	2,300.00	2,300
14410   Wet Pipe Sprinkler System:   Ordinary Hazard, one floor		Total				17,750
Basement   3,000 sf   2.42   7,7     First Floor   23,750 sf   2.76   65,7     Second Floor   28,750 sf   2.27   65,7     Third Floor   28,750 sf   2.27   65,7     Fourth Floor   28,750 sf   2.27   65,7     Penthouse   4,000 sf   2.37   9,7     Total   Total   278,0   278,0     14420   Wet Pipe Sprinkler System:   Fire House Equipment   303.00   6			Ordinary Hazard,	one		
First Floor   23,750 sf   2.76   65,7     Second Floor   28,750 sf   2.27   65,7     Third Floor   28,750 sf   2.27   65,7     Fourth Floor   28,750 sf   2.27   65,7     Fourth Floor   28,750 sf   2.27   65,7     Penthouse   4,000 sf   2.37   9,4     Total   Total   278,0   278,0     14420   Wet Pipe Sprinkler System:   Fire House Equipment   303.00   6	14410	Wet Pipe Sprinkler System:	floor		_	
Second Floor   28,750 sf   2.27   65,2     Third Floor   28,750 sf   2.27   65,2     Fourth Floor   28,750 sf   2.27   65,2     Fourth Floor   28,750 sf   2.27   65,2     Penthouse   4,000 sf   2.37   9,4     Total		Basement	3,000	sf	2.42	7,260
Third Floor   28,750 sf   2.27   65,2     Fourth Floor   28,750 sf   2.27   65,2     Penthouse   4,000 sf   2.37   9,4     Total   278,0   278,0   278,0     14420   Wet Pipe Sprinkler System:   Fire House Equipment   303.00   6		First Floor	23,750	sf	2.76	65,550
Fourth Floor   28,750 sf   2.27   65,7     Penthouse   4,000 sf   2.37   9,7     Total   278,0   278,0     14420   Wet Pipe Sprinkler System:   Fire House Equipment   303.00		Second Floor	28,750	sf	2.27	65,263
Penthouse4,000 sf2.379,4TotalTotal278,014420Wet Pipe Sprinkler System: 2-1/2" Hose Station w/CabinetFire House Equipment 2 ea303.00		Third Floor	28,750	sf	2.27	65,263
TotalTotal278,014420Wet Pipe Sprinkler System: 2-1/2" Hose Station w/CabinetFire House Equipment 2 ea303.00		Fourth Floor	28,750	sf	2.27	65,263
14420Wet Pipe Sprinkler System: 2-1/2" Hose Station w/CabinetFire House Equipment 2 ea303.00		Penthouse	4,000	sf	2.37	9,480
2-1/2" Hose Station w/Cabinet 2 ea 303.00		Total				278,078
2-1/2" Hose Station w/Cabinet 2 ea 303.00	14420	Wet Pipe Sprinkler System:	Fire House Equipr	ment		
Siamese polished brass 1 ea 1,025.00 1,0		2-1/2" Hose Station w/Cabinet			303.00	606
		Siamese polished brass	1	ea	1,025.00	1,025
		-				1,631
						, -
Total Cost for Fire Protection System 313,8		Total Cost for Fire Protection	n Svstem		I	313,859

### Assemblies Estimate for Fire Protection System

Assumptions:

\*Numbers are all inclusive, containing material handling, installation, and all necessary equipment fees. \*Cost Works' per unit cost numbers are current and apply to the University Park Area.

Details:

Dry Pipe Sprinkler System: Steel, Black, SCH 40 Pipe Wet Pipe Sprinkler System: Steel, Black, SCH 40 Pipe Wet Pipe Sprinkler Stand Pipes: Class I, Steel, Black, SCH 40, 6" Dia. Pipe, 10' height

### **Detailed Structural System Estimate**

The estimate below is the detailed structural systems estimate for the entire Food Science Building superstructure. This included bid packages 02 Piles, 03 Concrete, and 05 Structural Steel. The cost per unit numbers that I used to figure out my systems cost were obtained from Gilbane Building Co.'s Estimating Department and are the actual competitive numbers from the market when the project went out to bid. By using these numbers I was able to create an accurate estimate that would coincide with the numbers used in my previous estimate analysis from tech assignment 1. Additionally, it will put an accurate perspective of cost ratios for the job and the area.

The total unit costs presented in this estimate include all appropriate labor (at local rates), material and equipment costs necessary for a complete installation along with fringe benefits, trade subcontractor overhead, profit and bonds. Below you will find a summary of the results found. Additionally, on the following page a detailed cost breakdown is shown.

Bid Package	Description	Takeoff Quantity		Total Amount
02	Piles	330	piles	1,199,214.00
03	Concrete	22,365.00	су	2,034,938.00
05	Structural Steel	1,888.00	ton	2,629,773.00
	Total Superstructure Cost	5,863,925.00		
	Total Superstructure Cost per Squ	48.06 / sf		
	Total Superstructure Cost per cy of		262.19 / cy	
	Total Superstructure Cost per ton	of Steel		3105.89 / ton

#### Cost Breakdown of Entire Building Superstructure

# **Detailed Cost Breakdown of Entire Building Superstructure**

Bid	Description	Takeoff		Total	Total
Package		Quantity		Cost/Unit	Amount
02	Piles				
	Steel Piles Round 7" Tip	17,050.00	vf	61.50	1,048,575
	Tension Piles	125.00	vf	50.98	6,373
	Steel Piles Round - Break Factor 7" Tip	1,249.00	vf	41.74	52,133
	Steel Piles Round - Obstruction Factor 7"				=0.400
	Тір	1,249.00	vf	41.74	52,133
	Piles - Spoils Removal	1.00	ls	15,000.00	15,000
	Piles - Compression Testing	1.00	ls	25,000.00	25,000
02	Piles				1,199,214
03	Concrete				
	Building Excavation - Gravel Base under				
	Slab	950.00	су	25.00	23,750
	Slab on Grade - 4"	73.00	су	265.00	19,345
	Slab on Grade - 5"	217.00	су	265.00	57,505
	Slab on Grade - 6"	111.00	су	265.00	29,415
	Slab Haunch	21.60	су	265.00	5,724
	Slab on Deck	1,889.00	су	325.00	613,925
	Concrete Pan Stair Fill	2,278.00	sf	29.45	67,087
	Grade Beam	542.25	су	425.00	230,456
	Pile Cap	211.00	су	550.00	116,050
	Foundation Wall	502.00	су	600.00	301,200
	8" Structural Slab	532.36	су	575.00	306,107
	Encase Steel Beams	135.00	су	750.00	101,250
	Precast Double Tees Install	8,590.00	су	9.54	81,949
	Precast Double Tees Supply	8,590.00	су	9.45	81,176
03	Concrete	22,364.21	су		2,034,938
05	Structural Steel				
	Structural Steel Misc. Framing	55.00	ton	2,000.00	110,000
	Structural Steel Plates	106.00	ea.	350.00	37,100
	Bearing Plates	9.00	ea.	370.75	3,337
	Structural Steel - Columns	6.00	ton	1,779.15	10,675
	Structural Steel	770.15	ton	1,779.15	1,370,212
	Structural Steel HSS 4x2x1/8	1.20	ton	1,779.20	2,135
	Structural Steel HSS 6x6x1/4	4.50	ton	1,779.20	8,006
	Structural Steel - Market Conditions	1,010.00	ton	700.00	707,000
	Moment Connections	237.00	ea.	370.75	87,868
	Shear Studs	5,390.00	ea.	2.35	12,667
	Pour Stop	40.79	ton	2,038.54	83,152
	Metal Roof Deck 3"x20 Ga.	12,300.00	sf	1.62	19,926
	Metal Roof Deck 3"x18 Ga.	98,174.00	sf	1.81	177,695
05	Structural Steel	1,887.64	ton		2,629,773
	Total Superstructure Estimate				5,863,925

- \* Unit costs provided by Gilbane Building Co. Estimating Department at current market conditions during bid time.\* All numbers include total overall cost for material, installation, shipping, storage, etc.

## <u>General Conditions Estimate</u> <u>for Food Science Project</u>

The General Conditions Estimate provided below is my representation of the general conditions owned by the construction manager on the Food Science Project. The total costs per unit are an all inclusive costs for set-up and tear-down and any additional costs that are necessary for that particular task. The Costs/Unit came from Cost Works 2005 and are assumed to be the current market conditions costs for the center Pennsylvania area. The estimate includes all project staffing, fees, office supplies, and temporary services which can be broken down into monthly job costs. Below find the take-off breakdown of the general conditions estimate:

#### **General Conditions Estimate**

Spec Section	Task	Description	Quantity		Total Cost/Unit	Total Amount
		Crew for layout of building, trenching and				
1170	Surveying	piping	30	day	900.00	27,000
1310	Bond	Performance	2.50%	ea.	37,500,000.00	937,500
1310	Clerk		80	wk	500.00	40,000
1310	Field Engineer		80	wk	1,550.00	124,000
1310	Project Executive		100	wk	2,875.00	287,500
1310	Project Manager		90	wk	2,525.00	227,250
1310	Ass. Project Manager		80	wk	2,225.00	178,000
	General					
1310	Superintendent		85	wk	2,675.00	227,375
1310	Ass. Superintendent		80	wk	2,150.00	172,000
1310	MEP Superintendent		85	wk	2,325.00	197,625
1310	Ass. MEP Super.		80	wk	2,150.00	172,000
1310	Laborer		150	wk	1,625.00	243,750
1320	Scheduler	Update the Job Schedule	8	ea.	450.00	3,600
1321	Photographer Temp. Site Office	Areial Job Photos	3	ea.	760.00	2,280
1510	Power	400amp Underground Feed	1	ea.	1,950.00	1,950
1520	Site Office Trailers	32x8	33	mo.	180.00	5,940
1520	Field Office Expense	Office Equipment Rental Average	20	mo.	175.00	3,500
1520	Office Supplies	Average	20	mo.	93.50	1,870
1520	Telephone Bill	Average bill includes long distance	20	mo.	224.00	4,480
1520	Field Office Utilities	Lights and HVAC	60	mo.	108.00	6,480
1540	Walk Through Frame	Scaffold Buck to make walkway for sidewalk along Curtain Rd.	50	ea.	2.20	110
1540	Scaffold Plank	2"x10"x16'	100	ea.	5.50	550
1560	Site Fence	8' high	1100	lf	24.00	26,400
1590	Site Office Toilet	Running Water Restroom Facilities	3	ea.	71.50	215
	·	Total			•	2,891,375
		General Conditions Costs per Month				83,756
		*Based upon an 11 month schedule (January 2005	- August 200	)6)		

\*Assumptions: on following page.

### General Conditions Estimate for Food Science Project

Assumptions:

\*AE fees are by owner.

\*No labor shortage problems in area.

\*Job site transformer / temporary power / lighting is in electrical subcontractors package.

\*All cranes and lifts needed are to be supplied by trade subcontractor as necessary.

\*No winter protection included.

\*Road sweeping by general trades subcontractor.

\*Assume site fence includes all necessary gates.

\*OCIP, therefore no insurance program required.

\*Project schedule January 2005 to August 2006. 20 months

The general condition estimate total is approximately \$1.1 million below the average 10% of the contract value. The main source for this error would be in the way the contracts are written and the bid packages awarded. A lot of the tasks that are normally in the GC's general conditions were made the responsibility of the subcontractors. For example, the crane was owned by the structural steel erection contractor. The temporary transformer, building power, and lighting was owned by the electrical subcontractor. The road sweeping for the job was owned by the general trades subcontractor, etc. Additionally, the salary costs per week for the project staffing are assumed to be a bit lower than actual; this could make a significant difference because your on-site staffing is normally the largest general conditions item you will have on a project. When the above is taken into account it is my belief that the above general conditions estimate would be directly comparable to the actual.