NEW YORK POLICE ACADEMY

COLLEGE POINT, NEW YORK

PENN STATE AE SENIOR CAPSTONE PROJECT

SHAWN SIDELINGER – CONSTRUCTION MANAGEMENT
DR. ROBERT LEICHT – CM ADVISOR

PRESENTATION OUTLINE

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COLLEGE POINT, NEW YORK
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PRESENTATION OUTLINE

PROJECT BACKGROUND

OWNER
- NYC DEPARTMENT OF DESIGN AND CONSTRUCTION
- NYC POLICE DEPARTMENT

CONSTRUCTION MANAGER
- TURNER CONSTUCTION CO.
- SVT CONSTRUCTION

ARCHITECT
- PERKINS+WILL

LOCATION
- 28-11 28TH AVENUE, COLLEGE POINT, NEW YORK
- FORMER NYPD COLLEGE POINT TOW POUND

BUILDING PARAMETERS
- TWO SEPARATE FACILITIES
  - CENTRAL UTILITY PLANT / PHYSICAL TRAINING
  - ACADEMICS / ADMINISTRATIONS BUILDING
- MAIN CONCEPT: ONE CENTRALIZED FACILITY

PROJECT PARAMETERS
- NEGOTIATED GMP: $656 MILLION
- DELIVERY METHOD: MODIFIED FAST TRACK
- DATES OF CONSTRUCTION: 10/2011 – 01/2014
- 720,000 SQUARE FEET OF NEW CONSTRUCTION

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CELLULAR BEAM SYSTEM REDESIGN

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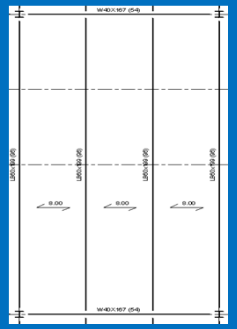
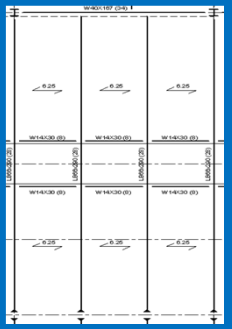
PRESENTATION OUTLINE

ORIGINAL DESIGN

FLOOR SYSTEM
- SINGLE CELLULAR BEAM SPANNING 60’ TO SUPPORT IN-DOOR TRACK SYSTEM
- APPROXIMATELY 6’ IN DEPTH

ROOF SYSTEM
- THREE CELLULAR BEAMS SPANNING 180’ TO SUPPORT ROOF SYSTEM ABOVE IN-DOOR TRACK
- APPROXIMATELY 6’ IN DEPTH
- 8” STEEL PIPE FILLED WITH CONCRETE ADDED TO HELP STIFFEN BEAMS





CELLULAR BEAM SYSTEM REDESIGN

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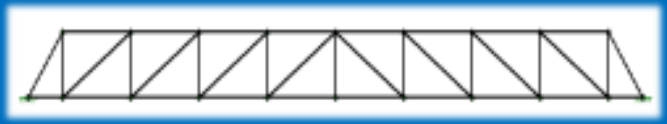
PRESENTATION OUTLINE

PROPOSED DESIGN

FLOOR SYSTEM
- SINGLE WIDE FLANGE BEAM TO SUPPORT THE 60’ SPAN

ROOF SYSTEM
- STRUCTURAL STEEL TRUSS SYSTEM TO SUPPORT 180’ SPAN
- WILL ALLOW FOR THE ELIMINATION OF 8” CONCRETE FILLED STEEL PIPES
- TRADE COORDINATION GOVERNED ROOF SYSTEM DESIGN
- WILL CAUSE AN INCREASE IN CURTAIN WALL AREA



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CELLULAR BEAM SYSTEM REDESIGN

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PRESENTATION OUTLINE

EQUATIONS USED

$$L = L_0\left(.25 + \frac{15}{\sqrt{A_T K_{TT}}}\right)$$

$$w_u = 1.2D_L + 1.6L_L$$

STRUCTURAL IMPACT ON FLOOR SYSTEM

TOTAL LIVE LOAD: 150 PSF
TOTAL DEAD LOAD: 62 PSF

MOMENT ACTING ON LB66x199: 1072 ft-kips
REPLACEMENT BEAM: W24x104, 1080 ft-kips

SUPPORTING BEAMS CAN BE RESIZED DUE TO REDUCE WEIGHT

MOMENT ACTING ON W40x167: 1210 ft-kips
REPLACEMENT BEAM: W24x117, 1230 ft-kips

STRUCTURAL IMPACT ON ROOF SYSTEM

TOTAL LIVE LOAD: 40 PSF
TOTAL DEAD LOAD: 82 PSF

SINGLE COMPOSOITE CELLULAR BEAM WEIGHT: 351 lbs/ft
SINGLE STRUCTURAL TRUSS WEIGHT: 216 lbs/ft

SUPPORTING BEAMS CAN BE RESIZED DUE TO REDUCE WEIGHT

MOMENT ACTING ON W40x167: 1480 ft-kips
REPLACEMENT BEAM: W18x175, 1490 ft-kips

PRESENTATION OUTLINE

CELLULAR BEAM SYSTEM REDESIGN

COST IMPACT

FLOOR SYSTEM
ORIGINAL CELLULAR BEAM SYSTEM COST: $3 MILLION
WIDE FLANGE BEAM SYSTEM COST: $1 MILLION
SAVINGS: $2 MILLION

ROOF SYSTEM
ORIGINAL CELLULAR BEAM SYSTEM COST: $6 MILLION
STRUCTURAL STEEL TRUSS SYSTEM COST: $4 MILLION
SAVINGS: $2 MILLION

TOTAL SAVINGS $4 MILLION

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SCHEDULE IMPACT

- NO IMPACT WITH FLOOR SYSTEM
- NO IMPACT WITH STRUCTURAL TRUSS SYSTEM
- ADDITION OF 45 DAYS DUE TO FAÇADE INCREASE

CELLULAR BEAM SYSTEM REDESIGN

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PRESENTATION OUTLINE

CAN IT MAKE IT TO THE JOB SITE?

TRUSS SYSYEMS WILL ARRIVE ON-SITE SEMI-PREFABRICATED TO ALLOW FOR STRUCTURAL STEEL SCHEDULE TO REMAIN ON TIME

ASSUME PREFABRICATION SHOP IN PITTSBURGH, PA EACH TRUSS WILL BE CONSTRUCTED IN FOUR PIECES APPROXIMATELY 45’ IN LENGTH AND PLACED ON FLATBED TRAILERS

LOCATION OF JOB SITE NEXT TO OFF-RAMP OF FREEWAY ALLOWS FOR EASY TRANSPORTATION

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CELLULAR BEAM SYSTEM REDESIGN

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PRESENTATION OUTLINE

CONCLUSIONS

REDESIGNS OF BOTH THE FLOOR AND ROOF SYSTEMS INVOLVING CELLULAR BEAMS WILL RESULT IN SAVINGS OF APPROXIMATELY $4 MILLION BUT AN INCREASE TO PROCJECT SCHEULE BY 45 DAYS

RECOMMENDATIONS

TO CONSIDER THE OPTION OF SWITICHING OUT THE ROOF CELLULAR BEAMS WITH THE STRUCTURAL STEEL TRUSS

ALLOWS FOR TRADE INTEGRATION TO BE PERFORMED EASILY AND PRODUCES ADDITIONAL FUNDS TO BE DISTRIBUTED TO PROGRAM ITEMS THAT HAD TO BE CUT DUE TO FUNDING PROBLEMS

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PRESENTATION OUTLINE

FUEL ROOM RESEQUENCING

ORIGINAL SEQUENCING

- CONCRETE SUBCONTRACTOR WILL PLACE 2ND STRUCTURAL MATT SLAB TO SUPPORT ADDITIONAL WEIGHT FROM FULL FUEL OIL TANKS WHILE STEEL SYSTEM IS ERECTED OVERHEAD
- ALLOWS FOR CONCRETE, A MAJOR ACTIVITY, TO REMAIN ON CRITICAL PATH WITHOUT DELAYING OVERALL PROJECT

OSHA REQUIREMENTS

- ONLY ALLOWED UNDER CERTAIN CRITERIA
- MUST ENSURE RIGGING EQUIPMENT IS CHECK PRIOR TO AND AFTER EACH LIFT
- PERSON OF COMPETENCE MUST BE PRESENT AT ALL TIMES

CURRENT SEQUENCING CAN BECOME COSTLY AND DELAY SCHEDULE

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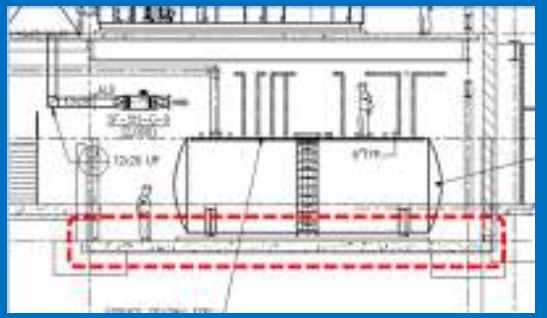

FUEL ROOM RESEQUENCING

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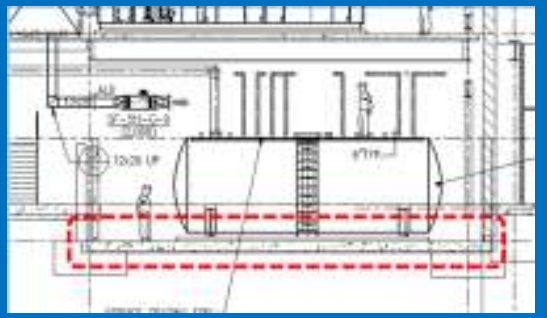
PROPOSED SEQUENCING

- HAVE CONCRETE SUBCONTRACTOR BE CONTRACTED TO PERFORM WORK DURING SECOND SHIFT OR AT A LATER TIME WHEN STRUCTURAL STEEL SYSTEM IS NOT BEING ERECTED

OSHA REQUIREMENTS

- SIMILAR TO PREVIOUS SEQUENCING BUT NOT AS STRICT
- WILL ALLOW "CHRISTMAS TREE" RIGGING TO BE PERFORMED, ALLOWING FOR AN INCREASED PRODUCTIVITY OF STRUCTURAL STEEL ERECTION

WILL REMOVE THE UNKNOWN COSTS ASSOCIATED WITH ORIGINAL SEQEUNCING



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PRESENTATION OUTLINE

FUEL ROOM RESEQUENCING

COST IMPACT

CONTRACTING WORK TO HAPPEN AT LATER DATE:
$38,357.87

CONTRACTING WORK TO HAPPEN ON SECOND SHIFT:
$46,578.05

COST DIFFERENCE OF APPROXIMATELY $8,000

SCHEDULE IMPACT

NO IMPACT DUE TO CONCRETE WORK FOR FUEL ROOMS NOT BEING ALONG CRITICAL PATH OF PROJECT SCHEDULE

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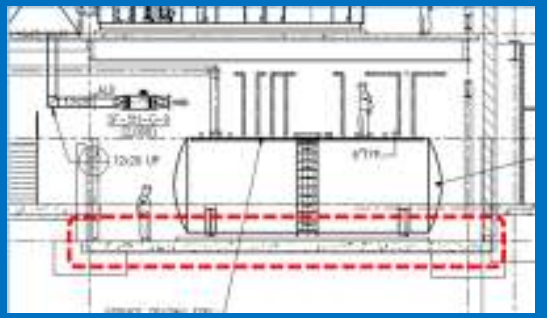

FUEL ROOM RESEQUENCING

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PRESENTATION OUTLINE

CONCLUSIONS

CONTRACTING THE CONCRETE SUBCONTRACTOR TO PERFORM DURING THE SECOND SHIFT WILL INCREASE THE COST BY $8,000 BUT IMPROVE THE OVERALL SAFETY OF THE ACTIVITY

RECOMMENDATIONS

TO CONTRACT THE CONCRETE SUBCONTRACTOR TO COME BACK AT A LATER TIME TO FINSIH THE PLACEMENT OF THE SECOND MATT SLAB; THIS WILL ALLOW THE PROJECT'S SAFETY TO INCREASE AND PRODUCE NO INCREASE TO OVERALL PROJECT COST

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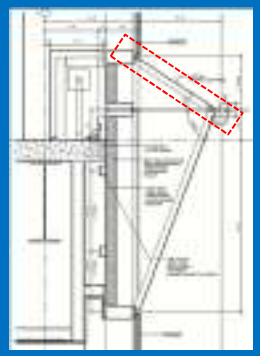
PRESENTATION OUTLINE



PHOTOVOLTAIC SYSTEM INTEGRATION

DESIGN COMPONENTS

ATTACHED TO ANGULAR PANELS OF SOUTHERN FAÇADE
33° NATURAL SLOPE
USE UNI-SOLAR PVL-144 PANELS RATED AT 144W
EASY TO INSTALL, NO BRACKETS NEEDED
USE SATCON POWERGATE PLUS INVERTER RATED AT 75kW
ALLOWS FOR FUTURE EXPANSION

PANELS ATTACHED IN STRINGS OF EIGHT PANELS
162 PANELS TOTAL
1 INVERTER

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PHOTOVOLTAIC SYSTEM INTEGRATION

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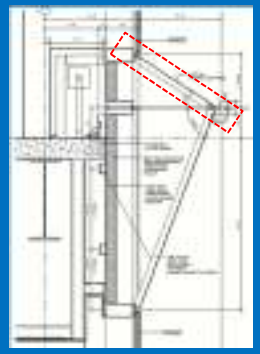
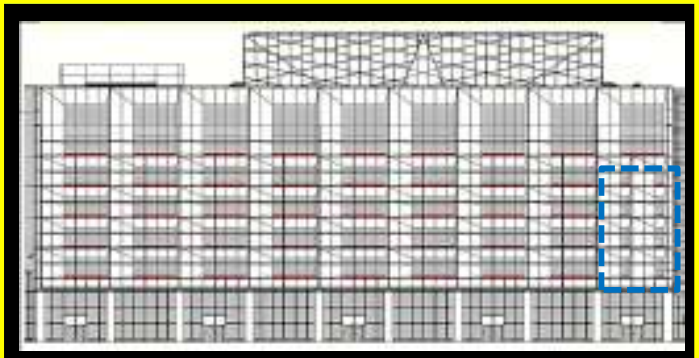
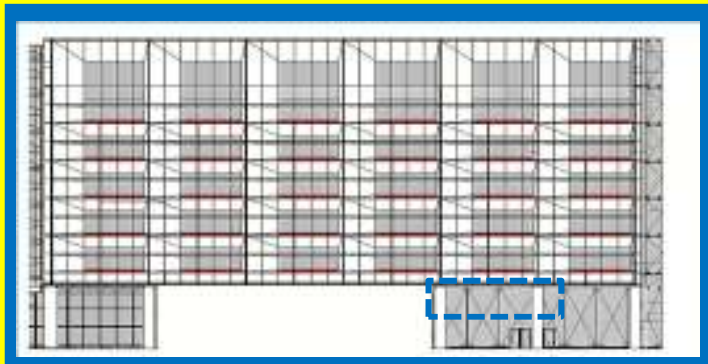
PRESENTATION OUTLINE







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PHOTOVOLTAIC SYSTEM INTEGRATION

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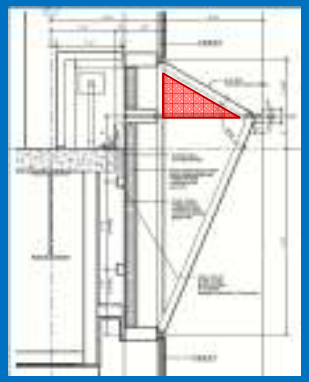
PRESENTATION OUTLINE



ENERGY VALUES AND SAVINGS

APPROXIMATELY 30,000 kWh COLLECTED EACH YEAR

PRODUCES APPROXIMATELY $4,300 IN ENERGY SAVINGS EACH YEAR

ELECTRICAL BREADTH CALCULATIONS

RATED AMPACITY OF 66.25 A, RESULTING IN A WIRE SIZE OF #1 AWG DUE TO NEC FACTORS

POWER DROP OF FARTHEST STRING 2.72 W
FAR LOWER THAN THE 3% OF THE 1152 W STRING

EQUATIONS USED

$$A = I_S n * 1.25 * 1.25$$

$$P_D = C_R \frac{L}{1000} I_{OP}$$

NEC FACTORS

CONDUIT W/ 10-20 CURRENT CARRYING WIRES = 0.50

RESISTANCE OF #1 AWG WIRE = 0.160

PANEL VALUES

SHORT CIRCUIT CURRENT = 5.3 A
OPERATING CURRENT = 4.36 A

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PHOTOVOLTAIC SYSTEM INTEGRATION

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PRESENTATION OUTLINE

COST IMPACT

PANEL COST = $162,000
INVERTER COST = $31,000
CONDUIT AND WIRE COST = $500,000
TOTAL SYSETM APPROXIMATELY $700,000

INCENTIVES

30% OF INSTALLATION COST FOR SYSTEMS UNDER 30kW

FEASIBILITY

108 YEAR PAYBACK PERIOD, NOT FEASIBLE

SCHEDULE IMPACT

TWO POSSIBLE SCENARIOS

NO INCREASE IN PROJECT SCHEDULE DUE TO THE EASY INSTALLATION OF THE PANELS ONTO THE INSULATED METAL PANELS VIA HIGH STRENGTH ADHESIVE

SLIGHT SCHEDULE DELAY, APROXIMATELY 1-2 WEEKS IN CURTAIN WALL ACTIVITY OF THE PROJECT DUE TO INSTALLATION OF CONDUIT AND WIRE DURING CONSTURCTION

PHOTOVOLTAIC SYSTEM INTEGRATION

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PRESENTATION OUTLINE

CONCLUSIONS

REDUCTION OF 30,000 kWh FROM THE CITY'S POWER GRID RESULTING IN AN ENERGY SAVINGS OF $4,500 ANNUALLY

INITIAL COST OF $700,000 LOWERED TO $500,000 WITH INCENTIVES; THIS LEADS TO A PAY BACK PERIOD OF 108 YEARS

RECOMMENDATIONS

NOT TO INSTALL THE PHOTOVOLTAIC SYSTEM AS DESIGNED FOR THIS PROPOSAL; OTHER SCENARIOS MAY PROVE MORE EFFICIENT AND ALLOW A MORE SUSTAINABLE DESIGN FOR THE OWNER

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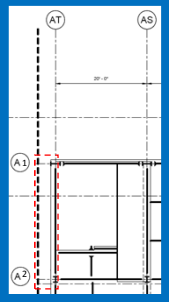
PRESENTATION OUTLINE



FAÇADE REDESIGN

ORIGINAL DESIGN

PRECAST CONCRETE PANELS COLORED GRAY TO MATCH REMAING FAÇADE
15’ x 5’ PANEL SIZE
APPROXIMATELY 102 PSF

PROPOSED DESIGN

INSULATED METAL PANELS TO PRODUCE A REPETITIVE NATURE TO ALLOW SHORTER DURATIONS
5’ x 2.5’ PANEL SIZE
APPROXIMATELY 5 PSF

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FAÇADE REDESIGN

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PRESENTATION OUTLINE

EQUATIONS USED

$$L = L_0\left(.25 + \frac{15}{\sqrt{A_T K_{TT}}}\right)$$

$$w_u = 1.2D_L + 1.6L_L$$

TOTAL LIVE LOAD = 100 PSF
TOTAL DEAD LOAD = 57 PSF

STRUCTURAL IMPACT USING INSULATED METAL PANELS

WEIGHT ACTING ON BEAM
FLOOR: 2184.5 PLF
SELF WEIGHT: 90 PLF
TOTAL: 2274.5 PLF

MOMENT ACTING ON BEAM: 177 ft-kips
BEAM SIZE: W16x31; 203 ft-kips

STRUCTURAL IMPACT USING PRECAST CONCRETE PANELS

WEIGHT ACTING ON BEAM
FLOOR: 2184.5 PLF
SELF WEIGHT: 1836 PLF
TOTAL: 4020.5 PLF

MOMENT ACTING ON BEAM: 314 ft-kips
BEAM SIZE: W21x44; 358 ft-kips

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PRESENTATION OUTLINE

ORIGINAL COST CALCULATIONS WERE CALCULATED WITH USE OF R.S. MEANS, BUT PROVED TO BE INACCURATE AFTER INTERVIEWS WITH DESIGN TEAM

FAÇADE REDESIGN

COST IMPACTS

PRECAST CONCRETE PANEL: $85.00 / SF
BRICK ON CMU: $110.00 / SF
INSULATED METAL PANEL: $150.00 / SF

Item	Unit	Quantity	Cost / SF	Total
Metal Panel (Traditional Curtain Wall System)	SF	31000	$150.00	$4,650,000.00
Precast Concrete Panel (Current Curtain Wall System)	SF	31000	$85.00	$2,635,000.00
Brick on CMU	SF	31000	$110.00	$3,410,000.00
Most Ideal System for Installation			Precast Concrete Panel System	

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SCHEDULE IMPACT

INSULATED METAL PANELS: 136 DAYS
PRECAST CONCRETE PANELS: 77 DAYS

FAÇADE REDESIGN

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PRESENTATION OUTLINE

CONCLUSIONS

INSULATED METAL PANELS PROVED TO COUNTERACT ORGINIAL IDEALS BY INCREASING LABOR COSTS FOR THE ACTIVITY.

INCREASED IN $2 MILLION AND 59 DAYS FOR THE PROJECT

RECOMMENDATIONS

IT IS IDEAL TO KEEP THE EXISTING PRECAST CONCRETE PANEL DESIGN DUE TO LOWER COST, FASTER INSTALLATION RATES, AND IMPROVED PROTECTION FOR THE OCCUPANTS OF THE FACILITY

PRESENTATION OUTLINE

CONCLUSIONS

ANALYSIS 1: REDESIGN OF CELLULAR BEAMS

COST SAVINGS OF $4 MILLION
SCHEDULE INCREASE OF 45 DAYS
WILL ALLOW FOR EASY TRADE COORDINATION VIA ROOF SYSTEM

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ANALYSIS 2: FUEL ROOM RE-SEQUENCING

$8,000 COST DIFFERENCE BETWEEN CONTRACTING CONCRETE SUB-CONTRACTOR AT A LATER TIME AND DURING THE SECOND SHIFT

NO IMPACTS TO OVERALL SCHEDULE

IMPROVED JOB SITE SAFETY

PRESENTATION OUTLINE

CONCLUSIONS

ANALYSIS 3: SUSTAINABLE DESIGN OF PHOTOVOLATIC SYSTEM

COST SAVINGS: $4,500 PER YEAR

COST IMPACT: $470,000 INSTALLATION COST

PAYBACK PERIOD: 108 YEARS

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ANALYSIS 4: FAÇADE REDESIGN

COST / SCHEDULE IMPACE:

INSULATED METAL PANELS:
$4,650,000, 136 DAYS

PRECAST CONCRETE PANELS:
$2,635,000, 77 DAYS

DIFFERENCE OF $2 MILLION AND 59 DAYS

ACKNOWLEDGMENTS

DR. ROBERT LEICHT
DENSON GROENENDAAL
AE FACULTY

TURNER CONSTRUCTION COMPANY:
PAT MURRAY
JOSE CLASS

PERKINS+WILL:
MING YEUNG

ROBERT SILMAN ASSOCIATES:
YEGAL SHAMASH

SVT PROJECT TEAM

NEW YORK CITY DEPARTMENT OF DESIGN AND CONSTRUCTION

NEW YORK POLICE DEPARTMENT

MY FAMILY AND FRIENDS

MY FIANCÉE CRYSTAL DAVIES

MY AE COMRADES

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PRESENTATION OUTLINE

QUESTIONS?

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APPENDIX SLIDES

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Replacement Cellular Beam Design (Truss Implementation)					
Item	Crew Size	Unit	Daily Output	Total Material Amount	Days Required
Truss Assembly (On-Site)	10	EA	2	26	13.00
Truss Installation	10	EA	2	26	13.00
Metal Framing, Aluminum	4	SF	340	8640	25.41
Vapor Barrier	2	SF	500	8640	17.28
Metal Panels, Aluminum Insulated	2	SF	375	8640	23.04
Actual Duration				52	Days

Insulated Metal Panel Façade Schedule Durations					
Item	Crew Size	Unit	Daily Output	Total Material Amount	Days Required
Metal Framing, Aluminum	4	SF	340	31000	91.18
Vapor Barrier	2	SF	500	31000	62.00
Metal Panels, Aluminum Insulated	2	SF	375	31000	82.67
Actual Duration				136	Days

Precast Concrete Panel Façade Durations					
Item	Crew Size	Unit	Daily Output	Total Material Amount	Days Required
Precast Concrete Panel	8	SF	1400	31000	22.14
Vapor Barrier	3	SF	750	31000	41.33
Insulation, Rigid 2"	1	SF	890	31000	34.83
Actual Duration				77	Days

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Item	Unit	Quantity	Material / Labor Cost per Unit	Total Cost
Uni-Solar 144w PV Module	EA	162.00	$1,000.00	$162,000.00
Satcon PowerGate Plus 75 kW Solar PV Inverter	EA	1.00	$31,000.00	$31,000.00
Conductor, #1 AWG	CLF	510.00	$961.00	$490,110.00
4" Diameter EMT	CLF	65.00	$410.00	$26,650.00
Total Cost of Photovoltaic Panel System			$709,760.00	

APPENDIX SLIDES

Energy Output and Energy Cost Savings for Photovoltaic System Integration								
Month	Days in Month	Insolation Value	Energy Rates	Panel Output (kW)	Adj. for Inverter Efficiency	Number of Panels	Energy Output (kWh)	Energy Cost Savings
January	31	1.79	$0.15	0.14	0.96	162	1242.69	$180.19
February	28	2.66	$0.15	0.14	0.96	162	1667.97	$241.86
March	31	3.66	$0.15	0.14	0.96	162	2540.92	$368.43
April	30	4.44	$0.15	0.14	0.96	162	2983.00	$432.53
May	31	5.21	$0.15	0.14	0.96	162	3617.00	$524.46
June	30	5.70	$0.15	0.14	0.96	162	3829.52	$555.28
July	31	5.65	$0.15	0.14	0.96	162	3922.46	$568.76
August	31	5.00	$0.15	0.14	0.96	162	3471.21	$503.32
September	30	3.98	$0.15	0.14	0.96	162	2673.95	$387.72
October	31	2.89	$0.15	0.14	0.96	162	2006.36	$290.92
November	30	1.89	$0.15	0.14	0.96	162	1269.79	$184.12
December	31	1.57	$0.15	0.14	0.96	162	1089.96	$158.04
TOTALS:							30314.83	$4,395.65

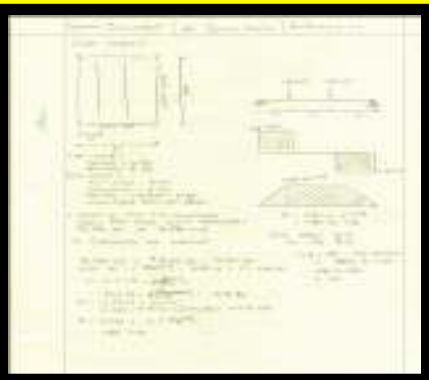
Solar Radiation Received for College Point, New York												
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Insolation, kWh/m²/day	1.7	2.6	3.6	4.4	5.2	5.7	5.6	5.0	3.9	2.8	1.8	1.5

NEW YORK POLICE ACADEMY
COLLEGE POINT, NEW YORK
SHAWN SIDELIGNER – CONSTRUCTION MANAGEMENT

Station Identification	
City	College Point, New York City
State	New York
Latitude	40.78° N
Longitude	73.97° W
Elevation	57 M
PV System Specifications	
DC Rating	23.3
DC to AC Derate Factor	0.85
AC Rating	19.8
Array Type	Fixed Tilt
Array Tilt	33.2°
Array Azimuth	180.0°

Month	Solar Radiation (kWh/m²/day)	AC Energy (Wh)	Energy Value ($)
1	3.00	1807645.00	$276.66
2	4.03	2169404.00	$332.78
3	4.55	2609996.00	$401.94
4	5.35	2881435.00	$445.15
5	5.51	2990295.00	$463.56
6	6.05	3091197.00	$479.66
7	5.88	3051956.00	$473.57
8	5.66	2964426.00	$458.78
9	5.08	2627448.00	$405.13
10	4.37	2426461.00	$372.80
11	2.79	1539283.00	$236.21
12	2.70	1584089.00	$242.44
Year	4.58	29743636.00	$4,588.68

NEW YORK POLICE ACADEMY
COLLEGE POINT, NEW YORK
SHAWN SIDELIGNER – CONSTRUCTION MANAGEMENT



APPENDIX SLIDES

NEW YORK POLICE ACADEMY
COLLEGE POINT, NEW YORK
SHAWN SIDELIGNER – CONSTRUCTION MANAGEMENT

Member	Area (SF)	Length (ft)	Volume (CF)	Weight (lb)	Cost per Pound	Total Cost
2L8 x 6 x 7/8	0.16042	448	71.86816	35215.3984	$3.10	$109,167.74
2L5 x 3 1/2 x 3/8	0.04236	217.8314	9.227338104	4521.39567	$3.10	$14,016.33
Individual Truss Cost				$123,184.06		
Total Truss System Cost				$3,202,785.60		

Item	Unit	Quantity	Bare Material Cost	Material Cost	Bare Labor Cost	Labor Cost	Bare Equipment Cost	Equipment Cost	Total
Framework, Aluminum	SF	8640	$41.65	$359,856.00	$5.49	$47,416.32	$0.00	$0.00	$407,272.32
Metal Panels, Aluminum Insulated	SF	8640	$11.36	$98,189.28	$3.52	$30,412.80	$0.00	$0.00	$128,602.08
Vapor Barrier	SF	8640	$0.63	$5,469.81	$1.79	$15,444.17	$0.57	$4,964.20	$25,878.18
W18 x 175, Structural Beam	LF	540	$79.14	$42,732.90	$4.90	$2,643.84	$4.85	$2,617.92	$47,994.66
Total Increase in Façade Cost						$609,747.24			

APPENDIX SLIDES

Item	Unit	Quantity	Bare Material Cost	Material Cost	Bare Labor Cost	Labor Cost	Bare Equipment Cost	Equipment Cost	Total
LB66 x 290, Cellular Beam	LF	4160	$715.00	$2,974,400.00	$14.56	$60,569.60	$8.45	$35,143.68	$3,070,113.28
Steel Pipe, 8" Diameter Hollow	EA	338	$751.78	$254,102.49	$73.42	$24,814.61	$43.62	$14,744.91	$293,662.01
Concrete, 4000 psi	CY	8712.68	$209.44	$1,824,783.70	$87.20	$759,745.70	$0.53	$4,600.30	$2,589,129.69
W14 x 30, Structural Beam	LF	690	$43.44	$29,970.15	$4.16	$2,870.40	$2.78	$1,920.96	$34,761.51
W40 x 167, Structural Beam	LF	540	$245.14	$132,375.60	$4.72	$2,548.80	$2.37	$1,278.72	$136,203.12
Original Cost of Cellular Beam System							$6,123,869.61		

Item	Unit	Quantity	Material / Labor Cost per Unit	Total Cost
Uni-Solar 144w PV Module	EA	162.00	$1,000.00	$162,000.00
Satcon PowerGate Plus 75 kW Solar PV Inverter	EA	1.00	$31,000.00	$31,000.00
Conductor, #1 AWG	CLF	510.00	$961.00	$490,110.00
4" Diameter EMT	CLF	510.00	$410.00	$209,100.00
Total Cost of Photovoltaic Panel System			$892,210.00	

NEW YORK POLICE ACADEMY
COLLEGE POINT, NEW YORK
SHAWN SIDELIGNER – CONSTRUCTION MANAGEMENT

Cost of Concrete Work Performed in Fuel Tank Rooms (Normal Wages)

Item	Unit	Quantity	Bare Material Cost	Total Material Cost	Bare Labor Cost	Total Labor Cost	Bare Equipment Cost	Total Equipment Cost	Total
Forms in Place, Mat Foundation	SFCA	226.67	$2.14	$484.58	$9.46	$2,145.17	$0.00	$0.00	$2,629.75
#6 Reinforcing Steel	TON	9.01	$670.45	$6,042.10	$915.20	$8,247.78	$0.00	$0.00	$14,289.88
Concrete, 4000 psi	CY	148.15	$81.59	$12,087.78	$0.00	$0.00	$0.00	$0.00	$12,087.78
Concrete Pump Truck	CY	148.15	$0.00	$0.00	$7.97	$1,180.21	$2.31	$342.96	$1,523.16
Machine Trowel	SF	6000.00	$0.00	$0.00	$0.81	$4,867.20	$0.49	$2,960.10	$7,827.30
Total Cost of Concrete Work								$38,357.87	

Cost of Concrete Work Performed in Fuel Tank Rooms (Overtime Wages)

Item	Unit	Quantity	Bare Material Cost	Total Material Cost	Bare Labor Cost	Total Labor Cost	Bare Equipment Cost	Total Equipment Cost	Total
Forms in Place, Mat Foundation	SFCA	226.67	$2.14	$484.58	$14.20	$3,217.76	$0.00	$0.00	$3,702.34
#6 Reinforcing Steel	TON	9.01	$670.45	$6,042.10	$1,372.80	$12,371.67	$0.00	$0.00	$18,413.77
Concrete, 4000 psi	CY	148.15	$81.59	$12,087.78	$0.00	$0.00	$0.00	$0.00	$12,087.78
Concrete Pump Truck	CY	148.15	$0.00	$0.00	$11.95	$1,770.31	$2.31	$342.96	$2,113.27
Machine Trowel	SF	6000.00	$0.00	$0.00	$1.22	$7,300.80	$0.49	$2,960.10	$10,260.90
Total Cost of Concrete Work								$46,578.05	

Item	Unit	Quantity	Bare Material Cost	Material Cost	Bare Labor Cost	Labor Cost	Bare Equipment Cost	Equipment Cost	Total
Metal Framing, Aluminum	SF	375	$41.65	$15,618.75	$5.49	$2,058.00	$0.00	$0.00	$17,676.75
Metal Panel, Aluminum Insulated	SF	375	$11.36	$4,261.69	$3.52	$1,320.00	$0.00	$0.00	$5,581.69
Vapor Barrier	SF	375	$0.63	$237.41	$1.79	$670.32	$0.57	$215.46	$1,123.19
W16 x 31, Structural Beam	LF	25	$57.72	$1,442.88	$4.69	$117.20	$3.14	$78.40	$1,638.48
Total Cost of Select Metal Panel Façade						$26,020.10		Cost per SF	$69.39

Item	Unit	Quantity	Bare Material Cost	Material Cost	Bare Labor Cost	Labor Cost	Bare Equipment Cost	Equipment Cost	Total
Structural Connections	EA	36	$100.00	$3,600.00	$100.00	$3,600.00	$50.00	$1,800.00	$9,000.00
Precast Concrete Panel	SF	375	$42.25	$15,841.88	$3.92	$1,470.00	$2.18	$816.00	$18,127.88
Vapor Barrier	SF	375	$0.63	$237.41	$1.79	$670.32	$0.57	$215.46	$1,123.19
Insulation, Rigid 2"	SF	375	$1.47	$549.78	$0.53	$199.50	$2.17	$813.96	$1,563.24
W21 x 44, Structural Beam	LF	25	$63.07	$1,576.75	$5.10	$127.60	$2.56	$64.00	$1,768.35
Total Cost of Select Precast Concrete Panel Façade						$31,582.65		Cost per SF	$84.22

APPENDIX SLIDES

NEW YORK POLICE ACADEMY
COLLEGE POINT, NEW YORK
SHAWN SIDELIGNER – CONSTRUCTION MANAGEMENT

Item	Unit	Quantity	Bare Material Cost	Material Cost	Bare Labor Cost	Labor Cost	Bare Equipment Cost	Equipment Cost	Total
Metal Framing, Aluminum	SF	31000	$41.65	$1,291,150.00	$5.49	$170,128.00	$0.00	$0.00	$1,461,278.00
Metal Panel, Aluminum Insulated	SF	31000	$11.36	$352,299.50	$3.52	$109,120.00	$0.00	$0.00	$461,419.50
Vapor Barrier	SF	31000	$0.63	$19,625.48	$1.79	$55,413.12	$0.57	$17,811.36	$92,849.96
Total Cost of Metal Panel Façade						$2,015,547.46		Cost per SF	$65.02

Item	Unit	Quantity	Bare Material Cost	Material Cost	Bare Labor Cost	Labor Cost	Bare Equipment Cost	Equipment Cost	Total
Structural Connections	EA	1350	$100.00	$135,000.00	$100.00	$135,000.00	$50.00	$67,500.00	$337,500.00
Precast Concrete Panel	SF	31000	$42.25	$1,309,595.00	$3.92	$121,520.00	$2.18	$67,456.00	$1,498,571.00
Vapor Barrier	SF	31000	$0.63	$19,625.48	$1.79	$55,413.12	$0.57	$17,811.36	$92,849.96
Insulation, Rigid 2"	SF	31000	$1.47	$45,448.48	$0.53	$16,492.00	$2.17	$67,287.36	$129,227.84
Total Cost of Precast Concrete Panel Façade						$2,058,148.80		Cost per SF	$66.39