FORT PICKETT REGIONAL TRAINING INSTITUTE – PHASE II

MILITARY BARRACKS

BLACKSTONE, VA

PENN STATE AE SENIOR CAPSTONE PROJECT

KENDALL MAHAN | CONSTRUCTION MANAGEMENT OPTION

ADVISOR: PROFESSOR FAUST

INTRODUCTION

SCHEDULE ACCELERATION & MANAGEMENT

PROJECT BACKGROUND

PROJECT LOCATION:

- BLACKSTONE, VIRGINIA

BUILDING PARAMETERS:

- **# OF BULDINGS:** 3
- **AREA:** 116,400 SF (~40,000 SF / BUILDING
- **# OF FLOORS:** 2 STORIES

PROJECT PARAMETERS:

- **COST:** $28 M
- **CONTRACT TYPE:** GMP
- **DELIVERY METHOD:** DESIGN-BUILD
- **TIMELINE:** 10/25/10 – 12/31/11

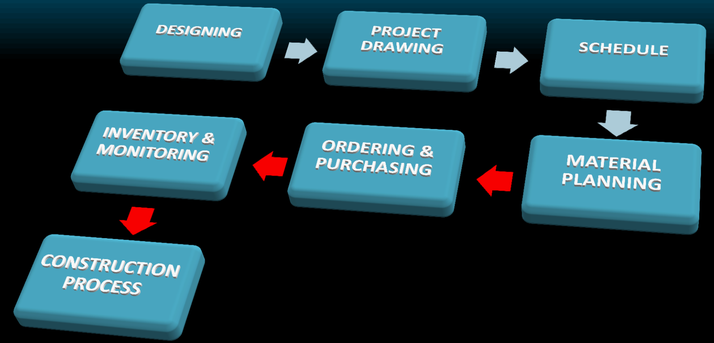
MATERIAL TRACKING TECHNOLOGY

PROBLEM:

- PRECAST HOLLOW-CORE PLANKS ARE MOST CRITICAL ACTIVITY
- MATERIAL MANAGEMENT PROCESS
- EXTENSIVE COORDINATION

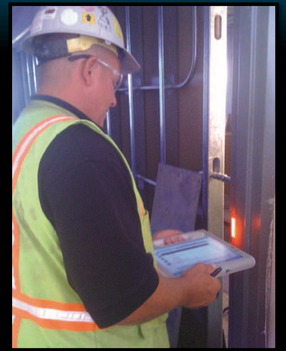
BACKGROUND:

- SECOND FLOOR STRUCTURAL SYSTEM
- 774 HOLLOW-CORE PLANKS
- 20 DIFFERENT MEMBERS



FLAWS IN MATERIAL MANAGEMENT PROCESS

MATERIAL TRACKING TECHNOLOGY

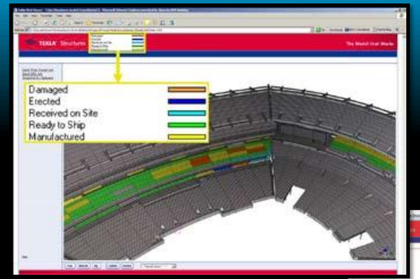


MEADOWLANDS STADIUM:

- $998M PROJECT
- STRICT SCHEDULE WITH UPCOMING FOOTBALL SEASON
- 3,200 PRECAST CONCRETE MEMBERS
- SAVED $1M & 10 DAYS OFF THE SCHEDULE

UCSC PORTER B COLLEGE:

- DOORS, FRAMES, & HARDWARE
- 50-80% TIME SAVINGS FOR DFH TASKS
- ELIMINATED TYPICAL 2% JOB COST RELATED TO QA/QC AND REORDERS



MEADOWLANDS STADIUM

UCSC PORTER B COLLEGE

MATERIAL TRACKING TECHNOLOGY

MATERIAL TAGS:

- PROJECT CONSIDERATIONS
  - ADEQUATE SPACE
  - ACCESSIBILITY
- BARCODE LABELS
  - CHEAPEST
  - LOW RANGE

HARDWARE:

- iPAD
- OTTERBOX DEFENDER CASE
- OPTICON BLUETOOTH
- PRINTER

Active RFID Tags	Passive RFID Tags	Barcode Tags	Barcode Labels
100 Meter read range; can be read under snow & ice	10 – 20' read range; cannot be read under snow & ice	Less than 1' read range; cannot be read under snow and ice	Less than 1' read range; cannot be read under snow and ice
Does not require line of site to scan; can be used with inventory sweeps to update GPS location	Does not require line of site to scan	Does require line of site to scan	Does require line of site to scan
$$$	$$	$	--

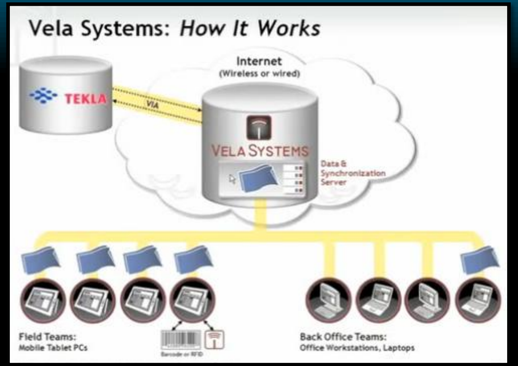
MATERIAL TAGGING SYSTEMS

MATERIAL TRACKING TECHNOLOGY

VELA SYSTEMS

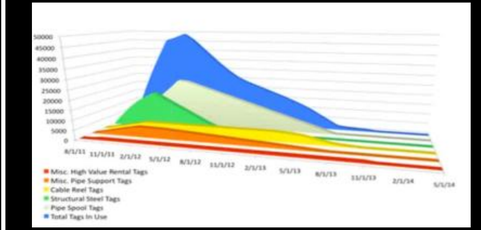
SOFTWARE:

- VELA SYSTEMS – *FIELD SOFTWARE*
  - USED ON FORT PICKETT PROJECT FOR PUNCHLIST & SAFETY
  - VELA MOBILE
  - FIELD BIM
  - UNLIMITED USER LICENSE
- TEKLA STRUCTURES – *BIM TECHNOLOGY*
  - 4D MODEL
  - MATERIAL STATUS INDICATOR
- BARTENDER – *BARCODING*
  - PRINT BARCODES ON-SITE
- ITUNES – *IPAD MANAGEMENT*
  - BLUETOOTH & BARTENDER APPLICATIONS



MATERIAL TRACKING PROCESS MAP

MATERIAL TRACKING TECHNOLOGY



TAGS IN USE

IMPLEMENTATION:

- DEFINE SCOPE OF WORK
- DEVELOP WORK FLOW DIAGRAMS
- MANAGED BY QC MANAGER
- 4 PHASE TRACKING PROCESS
- ASSOCIATE TAGS AT MANUFACTURING FACILITY
- MANAGE NUMBER OF TAGS IN USE

MATERIAL TRACKING PHASES

MATERIAL TRACKING TECHNOLOGY

RESULTS:

- COST SAVINGS
  - COST TO IMPLEMENT - $9,300
  - 2% SAVINGS IN QA/QC ISSUES - $440,463
  - LIQUIDATED DAMAGES - $2,281/DAY
- ONE-TIME COST & CAN BE APPLIED TO OTHER BUILDING COMPONENTS
- 2-4 HOURS/DAY SAVED IN PAPERWORK
- TRACK TOOLS & EQUIPMENT
- REDUCED THEFT AND VANDALISM RISKS

RECOMMENDATION:

- PROCEED FORWARD WITH MATERIAL TRACKING SYSTEM DUE TO THE ELEVATED RISK ASSOCIATED WITH THE HOLLOW-CORE PLANKS

Cost to Implement Material Tracking

Item	Existing System	Proposed System	Additional Cost
Vela			
System	$4,800	$7,600	$2,800
Base Services	$1,500	$1,500	$0
Training	$1,800	$1,800	$0
Field BIM	-	$4,200	$4,200
Field BIM Services	-	$1,500	$1,500
iPad	$600	$600	$0
OtterBox Case	$75	$75	$0
NavisWorks	-	-	$0
Opticon Scanner	-	$250	$250
Bartender	-	$250	$250
Barcodes	-	$300	$300
Totals	**$8,775**	**$18,075**	**$9,300**

SHORT INTERVAL PRODUCTION SCHEDULE

PROBLEM:

- PRECAST HOLLOW-CORE PLANKS ARE MOST CRITICAL ACTIVITY
- CREW MANAGEMENT
- 3 BUILDINGS IN ERECTION SEQUENCE

BACKGROUND:

- 774 PRECAST FLOOR PLANKS
- SET PLANKS – PLACE REBAR - GROUT

Hollow-core Plank Erection Dates (Not Including Grout, Rebar, etc.)

	Side	Duration	Start	Finish
Building 700	North	3	11/18/10	11/24/10
	South	3	11/29/10	12/1/10
Building 500	North	3	12/6/10	12/8/10
	South	3	12/10/10	12/14/10
Building 600	West	3	12/13/10	12/16/10
	East	3	12/17/10	12/22/10

SHORT INTERVAL PRODUCTION SCHEDULE

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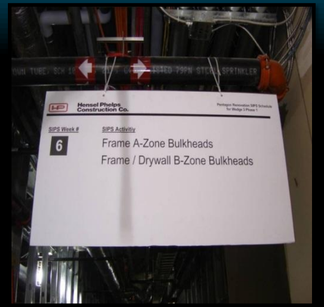
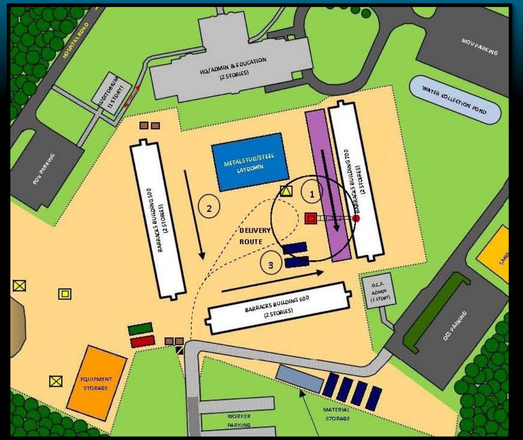


SIGNS DESIGNATE WORK AREA & ACTIVITIES

IMPLEMENTATION:

- TRADITIONAL SIPS
- SEQUENCING BETWEEN BUILDINGS
- DISTINCT WORK AREAS
- 6 CRANE LOCATIONS
- ESTABLISH CRITICAL DATES
- THANKSGIVING HOLIDAY
- (4) 10-HOUR WORK WEEK
- WORK BUFFER
- END OF WEEK INSPECTIONS & CLEAN-UP



HOLLOW-CORE PLANK ERECTION SITE PLAN

SHORT INTERVAL PRODUCTION SCHEDULE

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Cost Savings		
	Unadjusted Cost	Adjusted Cost (Time=1.085) (Location=0.849)
Mobile Truck Crane	$3,575.00	$39,325
Project Overhead	$72,929.88	$78,199
	Total Cost Savings	$117,524

RESULTS:

- RESEQUENCED WORK
- ACCELERATED DEPENDENT ACTIVITIES
- **SAVED 11 WORK DAYS**
- SAVINGS IN THE FORM OF CRANE RENTAL AND GENERAL CONDITIONS
- **SAVED $117,524**

RECOMMENDATION:

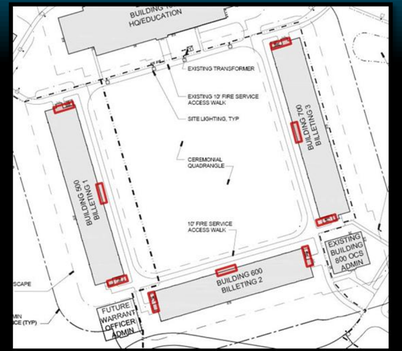
- IN THE BEST INTEREST OF THE FORT PICKETT PROJECT TO UTILIZE A SIPS FOR THE ERECTION OF THE HOLLOW-CORE PLANKS

Short Interval Production Schedule
Week of 11/22 - 11/26
Subcontractor: Gate Precast
Activities: Hollow Core Planks

Activity	Monday		Tuesday		Wednesday		Thursday		Friday		Total Man Hours
	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	
Install Rebar - 700 North	2	2	2	2			Thanksgiving Holiday				32
Grout - 700 North	2	2	2	2							32
Mobilize Crane - 700 South	1										4
Set Planks - 700 South	5	6	6	5							88
Demobilize Crane - 700 South				1							4
Layout - 500 North			2								8
Layout - 500 South				2							8
Install Rebar - 700 South					2	1					12
Grout - 700 South					2	1					12
Mobilize Crane - 500 North					1						4
Set Planks - 500 North					5	6					44
Cleanup						2					8
Manpower Totals	10	10	12	12	10	10	0	0	0	0	256
Equipment Totals (Crane Hrs)	4	4	4	4	4	4	0	0	0	0	24

SIPS PRODUCED FOR HOLLOW-CORE PLANKS

PRECAST FAÇADE PANELS



BUILDING ENTRANCES

PROBLEM:

- COMPLEX CMU VENEER
- QUALITY WITH MORTAR JOINTS
- BUILDING ACCESSIBILITY

BACKGROUND:

- 58,700 SF OF BLOCK
- MULITPLE TEXTURES: PRECAST CONCRETE LINTELS, SMOOTH FACE CMU, SPLIT FACE CMU
- MULTIPLE COLORS: WINE, BLACK, GREY

PRECAST FAÇADE PANELS

BUILDING 500 (80 PANELS)

BUILDING 600 (70 PANELS)

BUILDING 700 (80 PANELS)

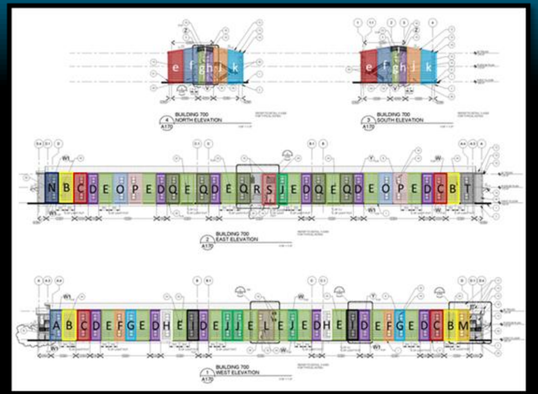
PRECAST MANUFACTURERS:

- GATE PRECAST
- SHOCKEY PRECAST
- **NITTERHOUSE CONCRETE PRODUCTS**

DESIGN:

- PANELS SPAN TWO FLOORS
- 230 PANELS
- 34 DIFFERENT PANELS
- 7 PANEL WIDTHS

Panel Systems (59,700 SF)				
	Cost/SF	Thickness	Weight	Cost of Panel System
Concrete Panel	**$20**	**7"**	**88 PSF**	**$1,194,000**
Sandwich Panel	$30	9"	88 PSF	$1,791,000
Concrete Panel w/ CMU Embeds	$25	7"	88 PSF	$1,492,500
Sandwich Panel w/ CMU Embeds	$35	9"	88 PSF	$2,089,500



PANEL DESIGNATIONS & TAKEOFF

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BILLETING BUILDINGS

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PRECAST FAÇADE PANELS

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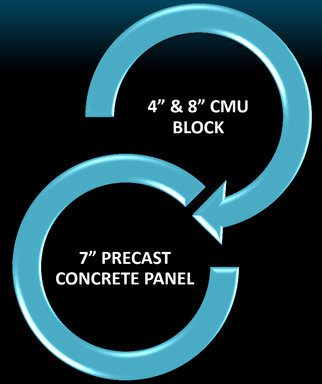
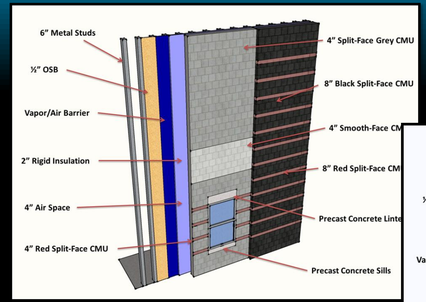
PANEL FINISHES

DESIGN:

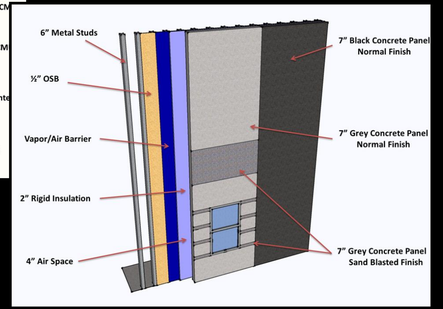
- BUMP-OUTS REMOVED
- LINEAR STRIPS
- GREY AND BLACK FINISH
- NORMAL AND SAND BLASTED FINISH



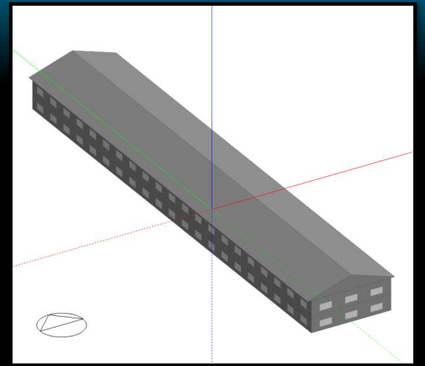
CURRENT DESIGN



PROPOSED DESIGN



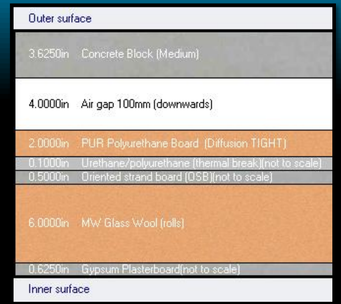
PRECAST FAÇADE PANELS



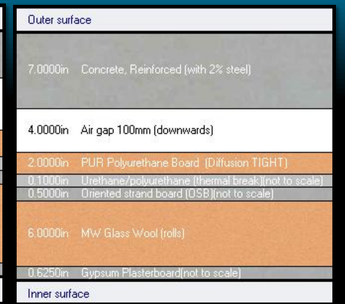
ENERGY ANALYSIS MODEL

ENERGY ANALYSIS:

- DESIGN BUILDER ENERGY PLUS
- MODEL DESIGNED USING BUILDING SPECIFICS FROM BARRACKS
- CMU VENEER
  - U-VALUE: 0.028 BTU/HR-SF-F
  - R-VALUE: 36.976 SF-F-H/BTU
  - SURFACE RESISTANCE: 0.227 SF-F-HR/BTU
- PRECAST CONCRETE PANELS
  - U-VALUE: 0.028 BTU/HR-SF-F
  - R-VALUE: 36.354
  - SURFACE RESISTANCE: 0.227 SF-F-HR/BTU
- **NEARLY IDENTICAL THERMAL PROPERTIES**



CMU VENEER



PRECAST PANELS

PRECAST FAÇADE PANELS

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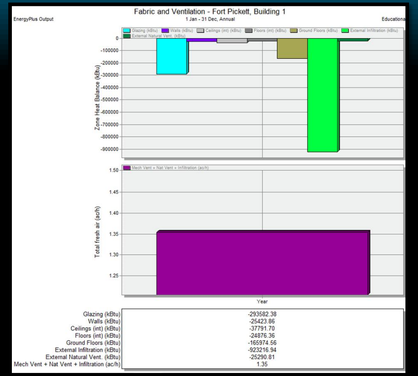
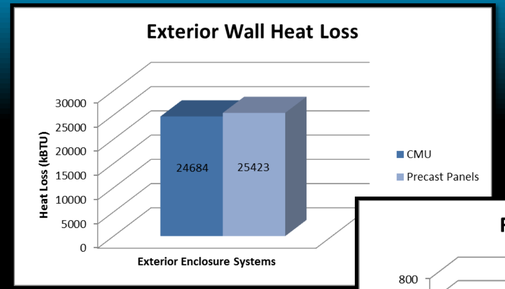


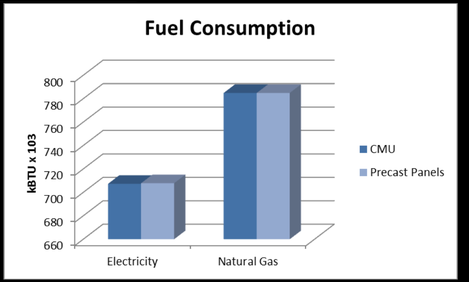
HEAT TRANSFER FOR ENCLOSURE

ENERGY ANALYSIS:

- CMU VENEER
  - HEAT LOSS: 24,684 kBTU
  - ELECTRICITY CONSUMPTION: 707,301 kBTU
  - GAS CONSUMPTION: 784,870 kBTU
- PRECAST PANELS
  - HEAT LOSS: 25,423 kBTU
  - ELECTRICITY CONSUMPTION: 707,801 kBTU
  - GAS CONSUMPTION: 784,890 kBTU

- CMU ENCLOSURE PEFORMED BETTER, BUT THE ADVANTAGE IS SO MINIMAL THAT SIGNIFICANT WEIGHT SHOULD NOT BE PLACED ON ENERGY ANALYSIS FOR FINAL DECISION





PRECAST FAÇADE PANELS

MANUFACTURING:

- CONTROLLED WORK ENVIRONMENT
- REDUCED SAFETY INCIDENTS
- FAVORABLE WORKING HEIGHTS

QUALITY CONTROL:

- HIGHER QUALITY OF WORK
- PCI CERTIFIED
- MUST PASS TWO UNANNOUNCED INSPECTION S TO MAINTAIN CERTIFICATION
- RESULTS IN CONSISTENT WORK PRACTICES

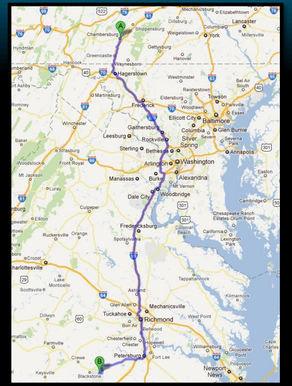
PRECAST FAÇADE PANELS

DELIVERY:

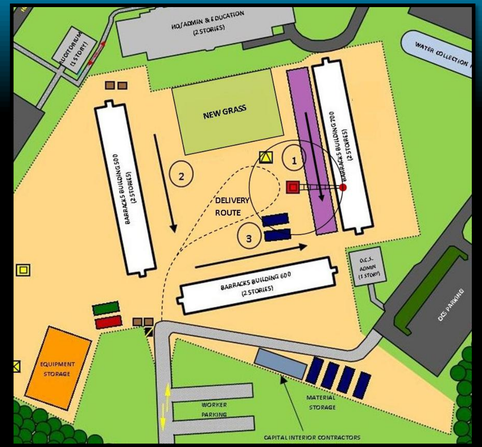
- 12’ X 50’ TRUCK BED MOST ECONOMICAL
- USE NON-STAINING, SHOCK ABSORBING MATERIAL
- SHIPPED FROM CHAMBERSBURG, PA
- 250 MILES, 5 HOURS

ERECTION:

- 40 TON CRAWLER CRANE
- PICKED FROM POINTS SPECIFIED IN SHOP DRAWINGS
- 6 CRANE LOCATIONS
- 15-20 PANELS ERECTED/DAY



DELIVERY ROUTE



PRECAST PANEL ERECTION SITE PLAN

PRECAST FAÇADE PANELS

Building Enclosure Activity Accelerations		
Activity	Duration/Building	Duration/Project
CMU Wall		
Erect CMU Walls	50	150
Clean CMU Walls	20	60
Total	70	210
Precast Panels		
Erect Panels	5	15
Seal Joints/Clean Panels	20	60
Total	25	75
Days Saved on Enclosure	45	135

SCHEDULE IMPACT:

- REDUCED FAÇADE ERECTION FROM 50 TO 5 DAYS
- 1 WEEK ADDED TO STRUCTURAL SCHEDULE FOR CONNECTIONS
- REPLACED CLEANING DURATION WITH CLEANING AND SEALING
- FAÇADE ACTIVITIES RESEQUENCED
- **REDUCED ENCLOSURE DURATION BY 14.5 WEEKS**
- **POTENTIAL TO ACCELERATE SCHEDULE BY 10 WEEKS**
- **NOT ALONG THE CRITICAL PATH – ROOF**

Schedule Impacts Building 700							
	Previous			Proposed			
Activity	Start Date	Finish Date	Duration	Start Date	Finish Date	Duration	Days Saved
Exterior Sheathing	12/23/10	3/7/11	53	1/24/11	3/18/11	40	13
Vapor Barrier/Insulation	1/13/11	3/31/11	56	1/31/11	4/1/11	45	11
Erect Masonry/Panels	1/7/11	5/20/11	96	3/28/11	4/8/11	10	86
Seal Joints/Clean	1/27/11	6/3/11	92	4/11/11	5/6/11	20	72
Punch Windows	2/4/11	6/10/11	91	4/18/11	5/13/11	20	71
Aluminum Storefronts	5/13/11	5/17/11	3	4/20/11	4/22/11	3	0
Caulk Exterior of Windows	6/16/11	7/11/11	18	4/20/11	5/13/11	18	0
Caulk Exterior of Doors	6/6/11	6/10/11	5	4/25/11	4/29/11	5	0
Leak Test Windows & Storefronts	7/25/11	7/28/11	4	5/16/11	5/19/11	4	0
Overall	12/23/10	7/28/11	156	1/24/11	5/19/11	84	72

PRECAST FAÇADE PANELS

COST IMPACT:

- ELIMINATED BUDGET FOR FAÇADE WASHES AND CHEMICAL TREATMENT
- ELIMINATED LULL & SCAFFOLDING
- ELIMINATED COSTLY CHANGE ORDER FOR SOFFIT/MASONRY JOINT
- SAVED ON GENERAL CONDITONS
- ORIGINAL ENCLOSURE COST: $2,490,660
- PRECAST PANEL SYSTEM COST: $1,701,897
- **SAVED $1,094,129**

Cost of Precast Panel System			
	Cost/Quantity	Quantity	Cost
½"OSB Sheathing	$1.09	59,700 SF	$65,073
Air/Vapor Barrier	$0.33	59,700 SF	$19,701
2" Rigid Insulation	$1.84	59,700 SF	$109,848
7" Precast Panels (Material/Delivery/Installation)	$20/SF	59,700 SF	$1,194,000
Black Finish on Panels	$0.50/SF	13,294 SF	$6,647
Sandblasting Finish on Panels	$3.50/LF	1,924 LF	$6,734
Joints	$0.25 LF	5,574 LF	$1,394
Connections	$5.00 SF	59,700 LF	$298,500
		Total Cost	**$1,701,897**

PRECAST FAÇADE PANELS

Time Savings from Use of Precast Panels	
	Duration
Prior to Constructing Building Enclosure	4.5 Weeks
Post Construction of Building Enclosure	10 Weeks
Total Time Saved	14.5 Weeks

RESULTS:

- REDUCED ENCLOSURE ACTIVITIES BY 14.5 WEEKS
- POTENTIAL TO ACCELERATE SCHEDULE BY 10 WEEKS
- SAVED $1,094,129
- HIGHER LEVEL OF QUALITY
- REDUCED SITE CONGESTION
- ALTERED ARCHITECTURAL APPEARANCE

RECOMMENDATION:

- DUE TO THE SAVINGS ASSOCIATED WITH THE SCHEDULE AND COST, I WOULD IMPLEMENT THE PRECAST PANEL SYSTEM WITH OWNER APPROVAL OF THE ARCHITECTURAL CHANGE

Cost Savings	
CMU Wall Enclosure	
CMU Walls	$2,490,660
Total	$2,490,660
Precast Panel Enclosure	
Precast Walls	$1,701,897
General Conditions (10 Weeks)	$305,366
Total	$1,396,531
Total Cost Savings	$1,094,129

FORT PICKETT REGIONAL TRAINING INSTITUTE – PHASE II

Billeting Buildings
Blackstone, VA

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MODULARIZED BATHROOM UNITS

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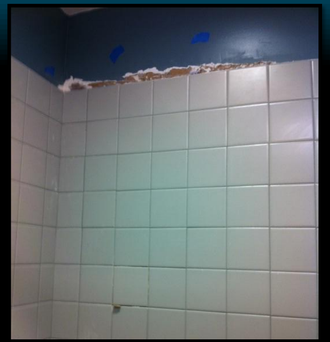


CERAMIC TILE/GWB JOINT

PROBLEM:

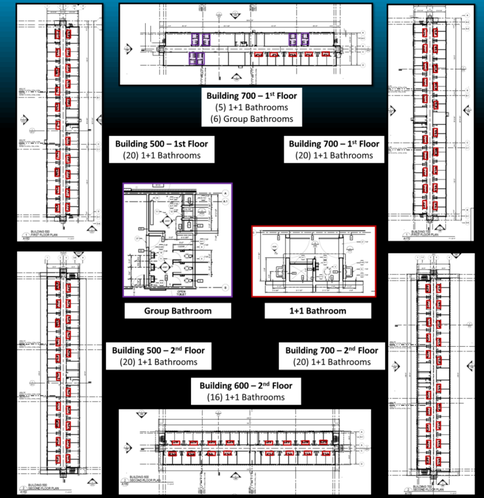
- AMOUNT OF WORK IN BATHROOMS COMPARED TO ROOMS
- MULTIPLE TRADES WORKING IN CONCENTRATED AREA
- QUALITY OF WORK
  - CERAMIC TILE/GWB JOINTS
  - DOOR HEIGHTS

BACKGROUND:

- 101 SHARED BATHROOMS
- BUILDING 600 CONTAINS 5 GROUP BATHROOMS

POTENTIAL SOLUTIONS:

- UTILIZE OFF-SITE MANUFACTURING FACILITY
- MODULARIZE ENTIRE BUILDING
- **MODULARIZE BATHROOM UNITS – *KULLMAN BUILDINGS***



BATHROOM PLANS

FORT PICKETT REGIONAL TRAINING INSTITUTE – PHASE II

BILLETING BUILDINGS

BLACKSTONE, VA

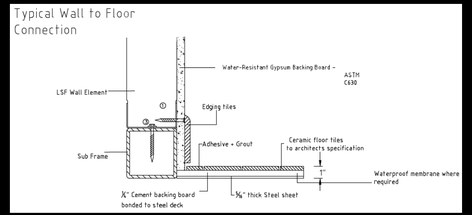
KENDALL MAHAN | CONSTRUCTION MANAGEMENT OPTION

MODULARIZED BATHROOM UNITS

BARTON MALOW

U.S. ARMY CORPS OF ENGINEERS

VIRGINIA ARMY NATIONAL GUARD

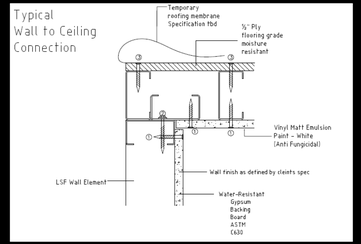


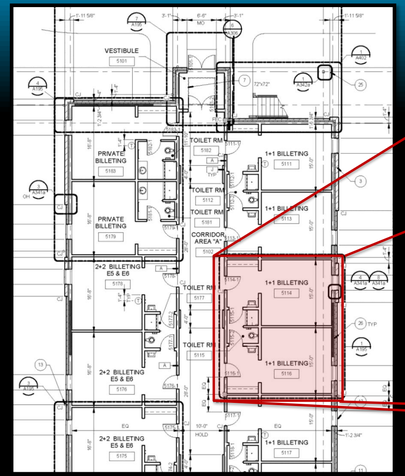
DESIGN:

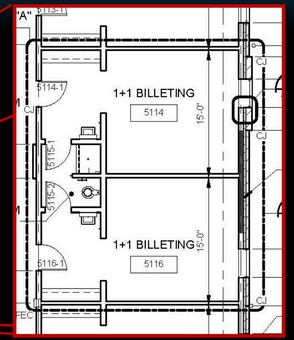
- EARLY PLANNING & PROCUREMENT
- MULTIITUDE OF RESPONSIBLE PARTIES
- EXTENSIVE COORDINATION
- DESIGN-BUILD

CONSIDERATIONS:

- CONSTRUCTION SCHEDULE
- SHIPPING SIZES
- POD TO STRUCTURE CONNECTIONS
- SLAB DEPRESSIONS
- FLOOR TO FLOOR HEIGHT
- FIRE PENETRATIONS
- CORRIDOR WALL FINISHES



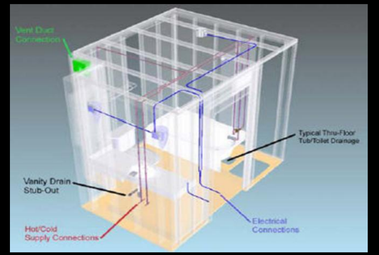


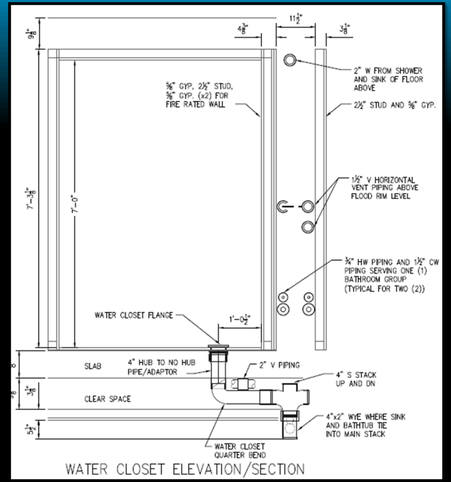


MODULARIZED BATHROOM UNITS

MEP:

- SINKS LOCATED OUTSIDE OF ROOMS
- 4 DRAIN CONNECTIONS
- HOT AND COLD CONNECTIONS
- LIMITED HVAC WORK
- COORDINATE CONNECTIONS AND RISERS
- FACILITATE USING 3D MODELING





WATER CLOSET ELEVATION/SECTION

MEP CONNECTIONS

MODULARIZED BATHROOM UNITS

BARTON MALOW
U.S. ARMY CORPS OF ENGINEERS
VIRGINIA ARMY NATIONAL GUARD

MANUFACTURING:

- SHIFTS WORK FROM FIELD TO CONTROLLED ENVIRONMENT
- HIGHER PRODUCTIVITY
- LESS SAFETY AND WEATHER PROBLEMS
- REDUCES WASTE BY 10X
- 25% CHEAPER LABOR COSTS COMPARED TO FIELD

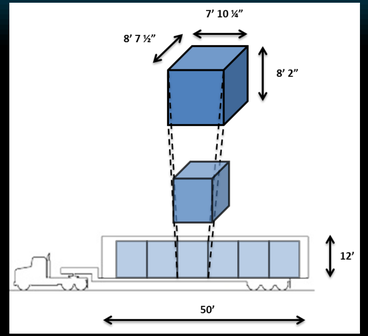
QUALITY CONTROL:

- LEVEL OF QUALITY UNACHIEAVABLE IN THE FIELD
- BETTER ACCESSBILITY TO WORK
- PEFORM RIGOROUS TESTS BEFORE BEING SHIPPED

Type of Test	Description
Leak Testing of Mains Cold Water System (Set and Test Pressure Regulators)	A pressure test required to identify any potential leaks within the mains cold water supply system, period held and pressure.
Leak Testing of Domestic Hot Water Supply System (Set and Test Pressure Regulators)	A pressure test required identifying any potential leaks within the domestic hot water supply system, period held and pressure.
Leak and Functional Testing of the Waste Pipes, Traps, etc.	A functional water test to ensure actual drainage and detect for leaks. Period air test 50mm or 75 mm complete system.
Setting of Toilet Level Flushing	A functional test to ensure that the manufacturers' recommendation for cistern flush volumes and performance are met.
WHB overflows	A functional and visual test in accordance with requirements to ensure all overflows functional correctly.
Shower Flow Rate Setting	A functional and visual test in accordance with requirements to ensure that the flow rate of the shower head is set correctly.
Shower Temperature Setting	A functional test to ensure that the thermostatic temperature of the shower is set in accordance with requirement. Max temperature if required.
Functional Electrical Appliance Testing	A functional test to ensure that all fitted electrical appliances work correctly.
Electrical System Conformity and Safety Testing	A prescribed test in accordance with IEE Regulations (or code equivalent) to ensure safety performance. Insulation, continuity, polarity checks, visual and dimensional check that all service outlets are to drg's, labeled and capped.

QUALITY CONTROL TESTS PERFORMED PRIOR TO SHIPMENT

MODULARIZED BATHROOM UNITS



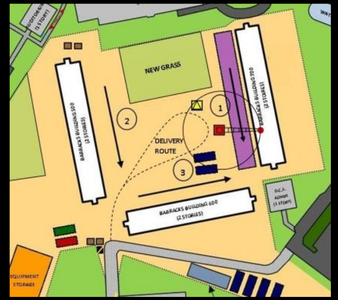
SHIPPING DIAGRAM

DELIVERY:

- WRAPPED AND WEATHERPROOFED
- COVERED TRUCK
- 370 MILES FROM KULLMAN’S FACILITY IN LEBANON, NJ
- PLANNED TO SHIP WITHOUT SPECIAL PERMITTING
- 17 TRUCKS

PLACEMENT:

- 25 TON MOBILE TRUCK CRANE
- 2 MAN CREW TO PLACE IN BUILDING
- SET 12 PODS/DAY
- SPECIAL EQUIPMENT TO MOVE PODS



FORT PICKETT REGIONAL TRAINING INSTITUTE – PHASE II

Billeting Buildings

Blackstone, VA

Kendall Mahan | Construction Management Option

MODULARIZED BATHROOM UNITS

Barton Malow

U.S. Army Corps of Engineers

Virginia Army National Guard

INSTALLATION:

- MEP TEMPLATE
- PARTITION WALLS AND ROUGH IN
- MOVE POD INTO PLACE
- MEP CONNECTIONS – TOP DOWN STRATEGY
- CONNECTION TO STRUCTURE
- FRAME INTO BULDING AND FINISH

MODULARIZED BATHROOM UNITS

SCHEDULE IMPACT:

- LITTLE IMPACT TO HVAC WORK
- PODS PLACED IN BUILDINGS PRIOR TO PLANK AND TRUSS ERECTIONS
- POD INSTALLATIONS DO NOT INTERFERE WITH INTERIOR WORK
- ALONG THE CRITICAL PATH
- **SHORTENED FIT-OUT BY 8 WEEKS**

Fit-Out Schedule Acceleration

	Fit-Out Start Date	Fit-Out Finish Date	Duration (Days)
Bathrooms Built in Field	2/8/11	10/17/11	180
Bathroom Pods	2/8/11	8/19/11	139
		Total	41

Estimated Schedule Reduction

	Percentage Reduced	Old Duration	New Duration	Days Saved
Cement Board	90%	21	3	18
Ceramic Tile	90%	15	3	12
Plumbing Fixtures	50%	22	11	11
Door Frames	50%	25	13	12
Doors/Hardware	50%	15	8	7
Plumbing Rough-in	50%	25	13	12
Plumbing Piping Installation	50%	25	13	12
Metal Stud Wall Framing	30%	25	18	7
Insulate Walls	30%	11	8	3
Hang Drywall	30%	18	12	6
Finish Drywall	30%	59	42	17
Paint	30%	53	37	16
Electrical Rough-in	30%	52	37	15
Light Fixtures	20%	7	6	1
Power and Lighting Wiring	20%	30	24	6
HVAC Ductwork	5%	43	41	2

MODULARIZED BATHROOM UNITS

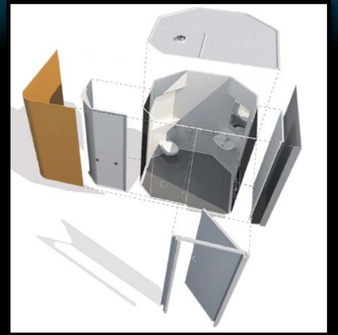
Cost Impact to Bathrooms		
	Cost/Bathroom	Total Cost
Bathrooms Built in Field		
Labor	$4,866	$491,466
Material	$8,286	$836,886
Total	$13,152	$1,328,352
Bathroom Pods		
Labor (25% Savings)	$3,650	$368,650
Material	$8,286	$836,886
Additional Material	$1,548	$156,348
Total	$12,628	$1,361,884
Total Additional Cost	$1,216	$33,532

COST IMPACT:

- ADDITONAL MATERIALS: PARTITION WALL, ¼" STEEL FLOOR PLATE, ¼" CEMENT BOARD
- CONCRETE DEPRESSIONS
- SAVED 8 WEEKS IN GC COSTS
- 25% SAVINGS IN LABOR COSTS
- 5% SAVINGS FROM DELIVERIES
- COST OF BATHROOMS BUILT IN FIELD: $1,276,329
- COST OF BATHROOMS PODS: $1,062,426
- **SAVED $213,903**

Cost Impact of Using Pods		
	Unadjusted Cost	Adjusted Cost (Time=1.085) (Location=0.849)
Bathrooms Built in Field		
Cost of Construction	$1,328,352	$1,223,631
Lull	$42,800	$39,426
Deliveries	$13,272	$13,272
Total		$1,276,329
Bathroom Pods		
Cost of Construction	$1,361,884	$1,254,520
Concrete Depressions	$16,877	$15,547
Crane	$17,875	$16,466
Pod Install Crew	$9,306	$8,572
Deliveries	$12,608	$11,614
General Condition Savings	$265,200	$244,293
Total		$1,062,426
Total Cost Savings		$213,903

MODULARIZED BATHROOM UNITS



RESULTS:

- SAVED $213,903
- ACCELERATED FIT-OUT SCHEDULE BY 8 WEEKS
- HIGHER LEVEL OF QUALITY
- LESS WORKERS ON SITE

RECOMMENDATIONS:

- UTILIZE BATHROOM PODS ON THE REGIONAL TRAINING INSTITUTE DUE TO QUALITY, COST, AND SCHEDULE BENEFITS

CONCLUSION

ANALYSIS #1: MATERIAL TRACKING TECHNOLOGY

- COST $9,300 TO IMPLEMENT SYSTEM
- ONE TIME COST
- CAN BE APPLIED TO VARIOUS OTHER BUIILDING COMPONENTS:
  - BATHROOM PODS
  - PRECAST PANELS
  - SIPS
- ALLEVIATES POTENTIAL RISKS

ANALYSIS #2: SIPS

- ACCELERATED SCHEDULE BY 11 DAYS
- SAVED $117,524
- SAVINGS PRIMARILY ATTRIBUTED TO RESEQUENCING OF WORK
- MINIMIZES RISKS ASSOCIATED WITH CRITICAL PATH

ANALYSIS #3: PRECAST FAÇADE PANELS

- ACCELERATED ENCLOSURE SCHEDULE BY 10 WEEKS
- SAVED $1,094,129
- REDUCED SITE CONGESTION
- POTENTIAL TO SAVE BY REDUCING FLOOR TO FLOOR HEIGHTS
- ALTERED THE ARCHITECTURAL APPEARANCE
- SHOULD BE INVESTIGATED FOR STRUCTURAL IMPLICATIONS
  - LATERAL LOADS

ANALYSIS #4: MODULARIZED BATHROOM UNITS

- ACCELERATED FIT-OUT SCHEDULE BY 8 WEEKS
- SAVED $213,903
- DELIVERS A HIGHER QUALITY PRODUCT
- SHOULD BE INVESTIGATED FOR STRUCTURAL IMPLICATIONS
  - SLABS, LOAD BEARING WALLS

CONCLUSION

- IMPROVED QUALITY
- MINIMIZED RISK
- TOTAL COST SAVINGS - $1,416,256
- TOTAL SCHEDULE SAVINGS – 2 WEEKS

ACKNOWLEDGEMENTS

ACADEMIC ACKNOWLEDGMENTS:

- PENN STATE AE FACULTY
- DR. DUBLER – THESIS ADVISOR
- PROFESSOR FAUST – THESIS ADVISOR
- DR. LEICHT

INDSUSTRY ACKNOWLEGEMENTS:

- BARTON MALOW
- US ARMY CORPS OF ENGINEERS
- VIRGINIA ARMY NATIONAL GUARD
- DAVIS CONSTRUCTION
- NITTERHOUSE CONCRETE PRODUCTS
- VELA SYSTEMS
- HENSEL PHELPS
- KULLMAN

SPECIAL THANKS:

- BRIAN BASS
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- ANDY LAWLESS
- JIM MILLER
- BILL MOYER
- DAVE MENSH
- MIKE PITTSMAN
- MARK TAYLOR
- ADAM OMANSKY
- BRIAN CLARKE
- FRIENDS AND FAMILY

QUESTIONS?

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APPENDICES – GENERAL INFO

Barton Malow

Barton Malow
U.S. Army Corps of Engineers
Virginia Army National Guard

DETAILED GC ESTIMATE

General Conditions Estimate

Code	Item	Crew	Daily Output	Labor Hours	Unit	Material	Labor	Equipment	Total	Total Incl O&P	Quantity	Project Total	Project Total Incl O&P
Division 01 - General Requirements													
01 31 13.30 0020	Insurance - Builders Risk, Standard, Minimum				Job					0.24%	28177099.86	$ -	$ 67,625.04
01 31 13.30 0250	Insurance - General Liability, Maximum				Job					0.42%	28177099.86	$ -	$ 274,995.02
01 31 13.90 0020	Performance Bond - Per Buildings, Minimum				Job					0.60%	28177099.86	$ -	$ 169,062.60
01 32 13.50 0850	Scheduling - Rule of Thumb, CPM Scheduling, Large Job ($50M)				Job					0.05%	28177099.86	$ -	$ 14,088.55
01 32 33.50 0500	Photographs - Aerial Photo, Initial Fly-over, 6 Shots, 1 Print Ea., 8" x 10"				Set	845			845	925	11	$ 9,295.00	$ 10,175.00
01 41 26.50 0020	Permits - Most Cities, Minimum				Job					0.05%	28177099.86	$ -	$ 14,088.55
01 45 23.50 0050	Testing and Inspecting Services - For Steel Building Maximum				Job				4725	5200	1	$ 4,725.00	$ 5,200.00
01 31 13.20 0100	Field Personnel - Field Engineer				Week		975		975	1500	90	$ 87,750.00	$ 135,000.00
01 31 13.20 0120	Field Personnel - Project Engineer				Week		1265		1265	1950	90	$ 113,850.00	$ 175,500.00
01 31 13.20 0140	Field Personnel - Project Manager				Week		2075		2075	3175	90	$ 186,750.00	$ 285,750.00
01 31 13.20 0220	Field Personnel - Project Administrator				Week		1375		2375	3650	90	$ 213,750.00	$ 328,500.00
01 31 13.20 0100	Field Personnel - Quality Control Manager				Week		975		975	1500	90	$ 87,750.00	$ 135,000.00
01 31 13.20 0240	Field Personnel - Assistant Superintendent				Week		1750		1750	2675	90	$ 157,500.00	$ 240,750.00
01 31 13.20 0280	Field Personnel - Senior Superintendent				Week		2200		2200	3375	90	$ 198,000.00	$ 303,750.00
01 31 13.20 0100	Field Personnel - Intern				Week		975		975	1500	12	$ 11,700.00	$ 18,000.00
01 51 13.80 0650	Temporary Utilities - Power for Job Duration Incl. Elevator, Etc., Minimum				CSF Flr				47	51.5	164	$ 7,708.00	$ 8,446.00
01 51 13.80 0700	Temporary Utilities - Temporary Construction Water Bill per Month				Month	62			62	68	11	$ 682.00	$ 748.00
01 51 33.40 6410	Temporary Utilities - Rent Toilet Portable Chemical				Ea.	0.31	18.85	.56	168	180.1	360	$ 60,480.00	$ 64,836.00
01 52 13.20 0550	Office and Storage Space - Trailer, Furnished, No Hookups, 50' x 12' Rent per Month				Ea.	360			360	395	10.5	$ 3,780.00	$ 4,147.50
01 52 33.20 0700	Office and Storage Space - Add Air Conditioning, Rent per Month, Add				Ea.	41.5			41.5	45.5	10.5	$ 435.75	$ 477.75
01 52 13.20 0800	Office and Storage Space - Add Delivery, Add per Mile				Mile	4.6			4.6	5.05	75	$ 345.00	$ 378.75
01 52 13.20 1350	Office and Storage Space - Storage Boxes, 20' x 8', Rent per Month				Ea.	71.5			71.5	78.5	10.5	$ 750.75	$ 824.25
01 52 13.40 0120	Field Office Equipment Rental Average				Month	200			200	220	10.5	$ 2,100.00	$ 2,310.00
01 52 13.40 0120	Field Office Expense - Office Supplies, Average				Month	68			68	84.5	10.5	$ 903.00	$ 982.25
01 52 13.40 0140	Field Office Expense - Telephone Bill, Incl. Long Distance				Month	81			81	89	10.5	$ 850.50	$ 934.50
01 52 13.40 0160	Field Office Expense - Lights & HVAC				Month	152			152	167	10.5	$ 1,596.00	$ 1,753.50
01 54 09.60 6220	Protective Equipment - Safety Supplies and First Aid Kits				Month	24.5			24.5	27	90	$ 2,205.00	$ 2,430.00
01 56 13.90 0250	Winter Protection - Tarpaulin Polyester Reinf. w/ Integral Fastening System 11 Mils Thick	2 Clab	1600	0.01	SF		0.0	0.34	1.14	1.41	25000	$ 28,500.00	$ 35,250.00
01 55 23.50 0050	Roads and Sidewalks - Roads, Gravel Fill, No Surfacing, 4" Gravel Depth	B-14	715	0.067	SY	4	2.43	0.45	6.88	8.6	1700	$ 11,696.00	$ 14,620.00
01 56 23.10 0300	Barricades - Steel Units, 6' High, 8' Wide, Plain, Buy				Ea.	435			435	480	10	$ 4,350.00	$ 4,800.00
01 56 23.10 1300	Barricades - Barricade Tape, Polyethylene, 7 mil, 3" Wide x 500' Long Roll				Ea.	25			25	27.5	20	$ 500.00	$ 550.00
01 56 26.50 0250	Temporary Fencing - Rented Chain Link, 6' High, Over 1000' (Up to 12 mo.)	2 Clab	300	0.053	LF	3.29	1.83		5.12	6.45	2440	$ 12,492.80	$ 15,738.00
01 56 13.50 0020	Signs - High Intensity Reflectorized, No Posts, Buy				SF	26.5			26.5	29.5	200	$ 5,300.00	$ 5,900.00
01 71 23.13 1400	Construction Layout - Crew for Roadway Layout, 4 Person Crew	A-6	1	32	Day		1475	70	1545	1920	20	$ 30,900.00	$ 48,000.00
01 74 13.20 0200	Cleaning Up - After Job Completion, Allow, Minimum				Job					0.30%	28177099.86	$ -	$ 84,531.30
01 74 13.20 0050	Cleaning Up - Cleanup of Floor Area, Continuous, Per Day, During Construction	A-5	24	0.75	MSF	1.7	25.5	1.87	26.07	30.93	11640	$ 303,454.80	$ 453,145.20
01 91 13.50 0020	Building Commissioning - Basic Building Commissioning, Minimum				%					0.25%	28177099.86	$ -	$ 70,442.75
											Total	**$ 1,550,099.60**	**$ 2,896,443.51**
Division 02- Existing Conditions													
02 21 13.09 0020	Topographical Surveying - Convential, Minimum	A-7	3.3	7.273	Acre		18.2	360	21	379.2	565.00	10	$ 3,792.00	$ 5,650.00
02 21 13.50 5320	Boundary and Survey Markers - Lot Location and Lines, Large Quantities, Average	A-7	1.25	19.2	Acre		51.5	900	55.5	1007	1560.00	10	$ 10,070.00	$ 15,600.00
02 21 13.13 0800	Boundary and Survey Markers - Monuments	A-7	10	2.4	Ea.		30.5	113	6.95	150.45	212.00	3	$ 451.35	$ 636.00
02 21 13.13 0000	Boundary and Survey Markers - Property Lines, Perimeter, Cleared Land	A-7	1000	0.024	LF		0.03	1.13	0.07	1.23	1.82	2440	$ 3,001.20	$ 4,440.80
02 32 13.10 0020	Borings and Exploratory Drilling - Borings, Initial Field Stake Out & Determination of Elevations	A-6	1	16	Day			690	88.5	799.5	1125.00	1	$ 799.50	$ 1,125.00
02 32 13.10 0100	Borings and Exploratory Drilling - Drawings Showing Boring Details				Total			300		300	375.00	2	$ 600.00	$ 750.00
02 32 13.10 0200	Borings and Exploratory Drilling - Reports and Recommendations for P.E.				Total			700		700	875.00	2	$ 1,400.00	$ 1,750.00
02 32 13.10 0300	Borings and Exploratory Drilling - Mobilization and Demobilization, Minimum	B-55	4	6	Total			204	231	435	565.00	2	$ 870.00	$ 1,130.00
02 32 33.00 1400	Borings and Exploratory Drilling - Borings, Earth, Drill Rig and Crew with Truck Mounted Auger	B-55	1	24	Day			815	925	1740	2275.00	2	$ 3,480.00	$ 4,550.00
02 41 19.23 0700	Rubbish Handling - Dumpster, Weekly Rental, 1 Dump/Week, 40 C.Y. Capacity (13 Tons)				Week		525			525	578.00	90	$ 47,250.00	$ 52,020.00
											Total	**$ 71,574.05**	**$ 87,913.80**
											Project Total	**$ 1,621,773.65**	**$ 2,983,495.31**

REBAR TAKEOFFS

Rebar (03 21 10.60 0400) Elevated Slabs #5				
	Bar Length (LF)	Quantity (Ea.)	Total (LF)	Weight (Ton)
Building 500/700	20	108	2160.00	1.13
	18.17	1	18.17	0.01
	12.08	4	48.32	0.03
	11.66	1	11.66	0.01
	11.33	4	45.32	0.02
	7.33	4	29.32	0.02
	6.00	171	1026.00	0.54
	0.66	184	121.44	0.06
			Total	1.80
Building 600	20.00	96	1920.00	1.00
	14.42	2	28.84	0.02
	14.00	1	14.00	0.01
	11.33	4	45.32	0.02
	7.33	4	29.32	0.02
	6.33	2	12.66	0.01
	6.00	151	906.00	0.47
	0.66	162	106.92	0.06
			Total	1.60

DURATIONS

Hollow-Core Plank Activity Durations			
	Quantity	Daily Output	Days
Crane Mobilization	1.11 Ea.	7.20 Ea.	0.14
Crane Demobilization	1.11 Ea.	7.20 Ea.	0.14
Set Planks & Grout (500/700)	20,455 SF	3,200 SF	6.39
Set Planks & Grout (600)	17,977	3,200 SF	5.62
Install Rebar (500/700)	1.80 Ton	1.45 Ton	1.24
Install Rebar (600)	1.60 Ton	1.45 Ton	1.10

Typical Work Sequence				
	Activity	Days Needed	Days Given	Buffer
Building 700 (N/S)	Mobilize Crane	0.14*	0	0.86*
	Set Planks	2.13	2	-0.13
	Demobilize Crane	0.14*	0	0.86*
	Install Rebar	1.24	2	0.76
	Grout	1.07	2	0.93
		4.44	6	0.56
Building 500 (N/S)	Mobilize Crane	0.14*	0	0.86*
	Set Planks	2.13	2	-0.13
	Demobilize Crane	0.14*	0	0.86*
	Install Rebar	1.24	2	0.76
	Grout	1.07	2	0.93
		4.44	6	0.56
Building 600 (W/E)	Mobilize Crane	0.14*	0	0.86*
	Set Planks	1.87	2	-0.13
	Demobilize Crane	0.14*	0	0.86*
	Install Rebar	1.10	2	0.76
	Grout	0.94	2	0.93
		3.91	6	2.09

*Denotes Activity That Does Not Impact Buffer — Phase 01: Typical Work Sequence

SIPS – WEEK 1

Short Interval Production Schedule Week of 11/15 - 11/19 Subcontractor: Gate Precast Activities: Hollow Core Planks											
Activity	Monday		Tuesday		Wednesday		Thursday		Friday		Total Man Hours
	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	
Coordination Meeting					2	2					16
Layout - 700 North					2						8
Layout - 700 South						2					4
Set Up Batch Plant					2	2					16
Mobilize Crane - 700 North							1				4
Set Planks - 700 North							5	6	6	4	84
Demobilize Crane - 700 North										1	4
Cleanup										1	4
Manpower Totals	0	0	0	0	6	6	6	6	6	6	140
Equipment Totals (Crane Hrs)	0	0	0	0	0	0	4	4	4	4	16

SIPS – WEEK 2

Short Interval Production Schedule
Week of 11/22 - 11/26
Subcontractor: Gate Precast
Activities: Hollow Core Planks

Activity	Monday		Tuesday		Wednesday		Thursday		Friday		Total Man Hours
	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	
Install Rebar - 700 North	2	2	2	2			Thanksgiving Holiday				32
Grout - 700 North	2	2	2	2							32
Mobilize Crane - 700 South	1										4
Set Planks - 700 South	5	6	6	5							88
Demobilize Crane - 700 South				1							4
Layout - 500 North			2								8
Layout - 500 South				2							8
Install Rebar - 700 South					2	1					12
Grout - 700 South					2	1					12
Mobilize Crane - 500 North					1						4
Set Planks - 500 North					5	6					44
Cleanup						2					8
Manpower Totals	10	10	12	12	10	10	0	0	0	0	256
Equipment Totals (Crane Hrs)	4	4	4	4	4	4	0	0	0	0	24

SIPS - WEEK 3

Short Interval Production Schedule
Week of 11/29 - 12/3
Subcontractor: Gate Precast
Activities: Hollow Core Planks

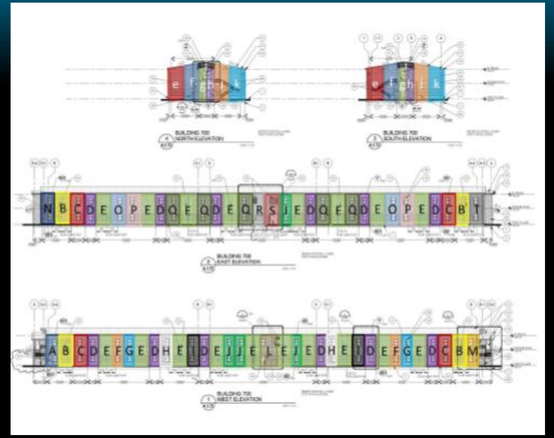
Activity	Monday		Tuesday		Wednesday		Thursday		Friday		Total Man Hours
	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	
Install Rebar - 700 South	2	2									16
Grout - 700 South	2	2									16
Set Planks - 500 North	6	5									44
Demobilize Crane - 500 North		1									4
Grout - 500 North			2	2	2	2					32
Install Rebar - 500 North			2	2	2	2					32
Mobilize Crane - 500 South			1								4
Set Planks - 500 South			5	6	6	5					88
Demobilize Crane - 500 South						1					4
Layout - 600 East					2						8
Layout - 600 West						2					8
Install Rebar - 500 South							2	2	2	1	28
Grout - 500 South							2	2	2	1	28
Mobilize Crane - 600 West							1				4
Set Planks - 600 West							5	6	6	5	88
Demobilize Crane - 600 West										1	4
Cleanup										2	8
Manpower Totals	10	10	10	10	12	12	10	10	10	10	416
Equipment Totals (Crane Hrs)	4	4	4	4	4	4	4	4	4	4	40

SIPS – WEEK 4

Short Interval Production Schedule
Week of 12/6 - 12/10
Subcontractor: Gate Precast
Activities: Hollow Core Planks

Activity	Monday		Tuesday		Wednesday		Thursday		Friday		Total Man Hours
	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	
Install Rebar - 600 West	2	2	2	2							32
Grout - 600 West	2	2	2	2							32
Mobilize Crane - 600 East	1										4
Set Planks - 600 East	5	6	6	5							88
Demobilize Crane - 600 East				1							4
Install Rebar - 600 East					2	2	2	2			32
Grout - 600 East					2	2	2	2			32
Cleanup									4	3	28
Inspection by USACE										1	4
Manpower Totals	10	10	10	10	4	4	4	4	4	4	256
Equipment Totals (Crane Hrs)	4	4	4	4	0	0	0	0	0	0	16

PANEL DESIGNATIONS BUILDING 500



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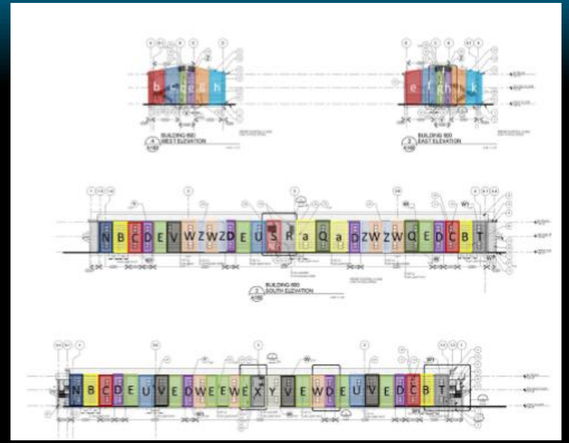
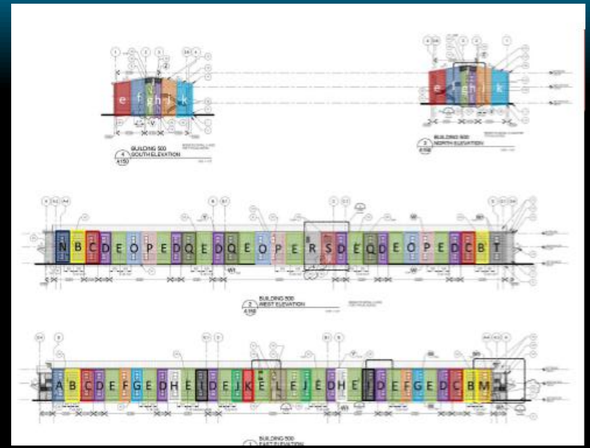


PANEL DESIGNATIONS BUILDING 700



APPENDICES – PRECAST PANELS

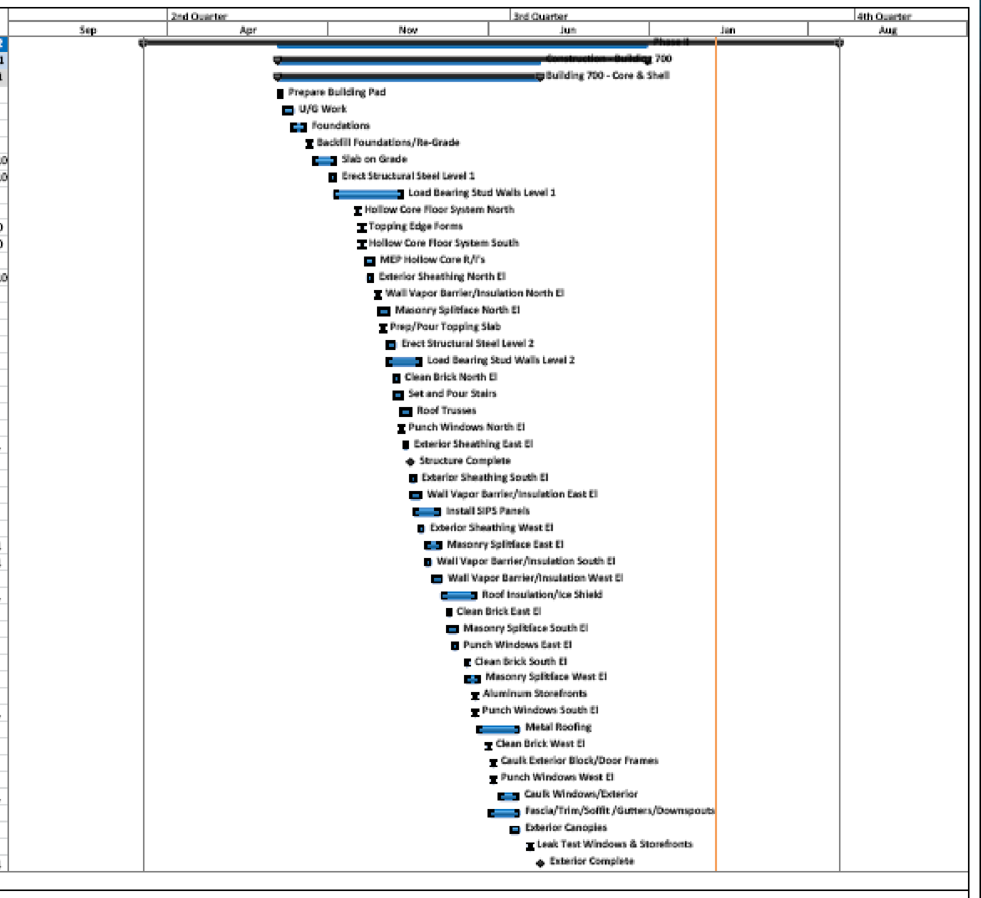
PANEL TAKEOFFS

Precast Panel Takeoffs

Panel Type	Description	Width (FT)	Height (FT)	Area (SF)	Weight/Panel (LBS)	Quantity	Total Width (FT)	Total Height (FT)	Total Area (SF)	Total Weight (LBS)
A	Bump Out, Window (1,2), Black	8.66	24.33	210.70	18541.41	2	17.32	48.66	421.40	37082.81
B	Bump Out, Window (1,2), Black	12.00	24.33	291.96	25692.48	12	144.00	291.96	3503.52	308309.76
C	Window (1,2)	11.66	24.33	283.69	24964.53	12	139.92	291.96	3404.25	299574.32
D	Bump Out, Window (1,2), Black	8.66	24.33	210.70	18541.41	32	277.12	778.56	6742.33	593325.00
E	None	12.00	24.33	291.96	25692.48	47	564.00	1143.51	13722.12	1207546.56
F	Window (1,2)	8.66	24.33	210.70	18541.41	4	34.64	97.32	842.79	74165.63
G	Window (1,2)	8.66	24.33	210.70	18541.41	4	34.64	97.32	842.79	74165.63
H	Window (1,2)	9.66	24.33	235.03	20682.45	4	38.64	97.32	940.11	82729.79
I	Window (1,2)	9.66	24.33	235.03	20682.45	4	38.64	97.32	940.11	82729.79
J	Windows (1,2)	7.33	24.33	178.34	15693.82	6	43.98	145.98	1070.03	94162.94
K	None	8.66	24.33	210.70	18541.41	1	8.66	24.33	210.70	18541.41
L	Door, Window (2)	12.00	24.33	291.96	25692.48	2	24.00	48.66	583.92	51384.96
M	Bump Out, Windows (1,2), Black	8.66	24.33	210.70	18541.41	2	17.32	48.66	421.40	37082.81
N	Bump Out, Window (1,2), Black	11.33	24.33	275.66	24257.98	4	45.32	97.32	1102.64	97031.93
O	Window (1,2)	12.00	24.33	291.96	25692.48	5	60.00	121.65	1459.80	128462.40
P	Windows (1,2)	12.00	24.33	291.96	25692.48	5	60.00	121.65	1459.80	128462.40
Q	Window (1,2)	12.00	24.33	291.96	25692.48	10	120.00	243.30	2919.60	256924.80
R	Louver	12.00	24.33	291.96	25692.48	3	36.00	72.99	875.88	77077.44
S	Door, Louver	12.00	24.33	291.96	25692.48	3	36.00	72.99	875.88	77077.44
T	Window (1,2), Black	11.33	24.33	275.66	24257.98	4	45.32	97.32	1102.64	97031.93
U	Window (2)	12.00	24.33	291.96	25692.48	3	36.00	72.99	875.88	77077.44
V	Window (2)	12.00	24.33	291.96	25692.48	4	48.00	97.32	1167.84	102769.92
W	Window (2)	12.00	24.33	291.96	25692.48	7	84.00	170.31	2043.72	179847.36
X	Door, Window (2)	12.00	24.33	291.96	25692.48	1	12.00	24.33	291.96	25692.48
Y	Window (2)	12.00	24.33	291.96	25692.48	1	12.00	24.33	291.96	25692.48
Z	None	7.33	24.33	178.34	15693.82	4	29.32	97.32	713.36	62775.29
a	Windows (1)	12.00	24.33	291.96	25692.48	2	24.00	48.66	583.92	51384.96
b	None	12.00	26.33	315.96	27804.48	6	72.00	157.98	1895.76	166826.88
c	None	12.00	28.33	339.96	29916.48	6	72.00	169.98	2039.76	179498.88
d	Door, Window (2)	6.33	25.33	160.34	14109.82	6	37.98	151.98	962.03	84658.94
e	Door, Window (2)	6.33	25.33	160.34	14109.82	6	37.98	151.98	962.03	84658.94
f	None	12.66	4.66	59.00	5191.61	6	75.96	27.96	353.97	31149.68
g	None	12.00	28.33	339.96	29916.48	6	72.00	169.98	2039.76	179498.88
h	None	12.00	28.33	339.96	29916.48	6	72.00	169.98	2039.76	179498.88
					Totals	230	2470.76	5573.88	59703.42	5,253,900.75

CURRENT ENCLOSURE SCHEDULE

ID	Task Name	Duration	Start	Finish
1	Phase II	662 days	Sat 2/27/10	Mon 9/10/12
2	Construction - Building 700	352 days	Wed 8/25/10	Thu 12/29/11
3	Building 700 - Core & Shell	250 days	Wed 8/25/10	Wed 8/10/11
4	Prepare Building Pad	5 days	Wed 8/25/10	Tue 8/31/10
5	U/G Work	10 days	Wed 9/1/10	Tue 9/14/10
6	Foundations	15 days	Mon 9/13/10	Fri 10/1/10
7	Backfill Foundations/Re-Grade	5 days	Mon 10/4/10	Fri 10/8/10
8	Slab on Grade	23 days	Mon 10/11/10	Wed 11/10/10
9	Erect Structural Steel Level 1	6 days	Wed 11/3/10	Wed 11/10/10
10	Load Bearing Stud Walls Level 1	66 days	Mon 11/8/10	Mon 2/7/11
11	Hollow Core Floor System North	3 days	Wed 12/8/10	Fri 12/10/10
12	Topping Edge Forms	3 days	Tue 12/14/10	Thu 12/16/10
13	Hollow Core Floor System South	3 days	Tue 12/14/10	Thu 12/16/10
14	MEP Hollow Core R/I's	10 days	Mon 12/20/10	Fri 12/31/10
15	Exterior Sheathing North El	5 days	Thu 12/23/10	Wed 12/29/10
16	Wall Vapor Barrier/Insulation North El	5 days	Mon 1/3/11	Fri 1/7/11
17	Masonry Splitface North El	10 days	Fri 1/7/11	Thu 1/20/11
18	Prep/Pour Topping Slab	4 days	Mon 1/10/11	Thu 1/13/11
19	Erect Structural Steel Level 2	10 days	Mon 1/17/11	Fri 1/28/11
20	Load Bearing Stud Walls Level 2	35 days	Mon 1/17/11	Fri 3/4/11
21	Clean Brick North El	5 days	Thu 1/27/11	Wed 2/2/11
22	Set and Pour Stairs	8 days	Thu 1/27/11	Mon 2/7/11
23	Roof Trusses	11 days	Fri 2/4/11	Fri 2/18/11
24	Punch Windows North El	2 days	Fri 2/4/11	Mon 2/7/11
25	Exterior Sheathing East El	5 days	Tue 2/8/11	Mon 2/14/11
26	Structure Complete	0 days	Fri 2/18/11	Fri 2/18/11
27	Exterior Sheathing South El	5 days	Fri 2/18/11	Thu 2/24/11
28	Wall Vapor Barrier/Insulation East El	10 days	Fri 2/18/11	Thu 3/3/11
29	Install SIPS Panels	26 days	Tue 2/22/11	Tue 3/29/11
30	Exterior Sheathing West El	5 days	Tue 3/1/11	Mon 3/7/11
31	Masonry Splitface East El	15 days	Thu 3/10/11	Wed 3/30/11
32	Wall Vapor Barrier/Insulation South El	5 days	Thu 3/10/11	Wed 3/16/11
33	Wall Vapor Barrier/Insulation West El	10 days	Fri 3/18/11	Thu 3/31/11
34	Roof Insulation/Ice Shield	33 days	Thu 3/31/11	Mon 5/16/11
35	Clean Brick East El	3 days	Fri 4/8/11	Tue 4/12/11
36	Masonry Splitface South El	10 days	Fri 4/8/11	Thu 4/21/11
37	Punch Windows East El	5 days	Fri 4/15/11	Thu 4/21/11
38	Clean Brick South El	5 days	Mon 5/2/11	Fri 5/6/11
39	Masonry Splitface West El	15 days	Mon 5/2/11	Fri 5/20/11
40	Aluminum Storefronts	3 days	Fri 5/13/11	Tue 5/17/11
41	Punch Windows South El	2 days	Fri 5/13/11	Mon 5/16/11
42	Metal Roofing	40 days	Wed 5/18/11	Tue 7/12/11
43	Clean Brick West El	3 days	Wed 6/1/11	Fri 6/3/11
44	Caulk Exterior Block/Door Frames	5 days	Mon 6/6/11	Fri 6/10/11
45	Punch Windows West El	5 days	Mon 6/6/11	Fri 6/10/11
46	Caulk Windows/Exterior	18 days	Thu 6/16/11	Mon 7/11/11
47	Fascia/Trim/Soffit /Gutters/Downspouts	28 days	Fri 6/3/11	Tue 7/12/11
48	Exterior Canopies	8 days	Fri 7/1/11	Tue 7/12/11
49	Leak Test Windows & Storefronts	4 days	Mon 7/25/11	Thu 7/28/11
50	Exterior Complete	0 days	Wed 8/10/11	Wed 8/10/11



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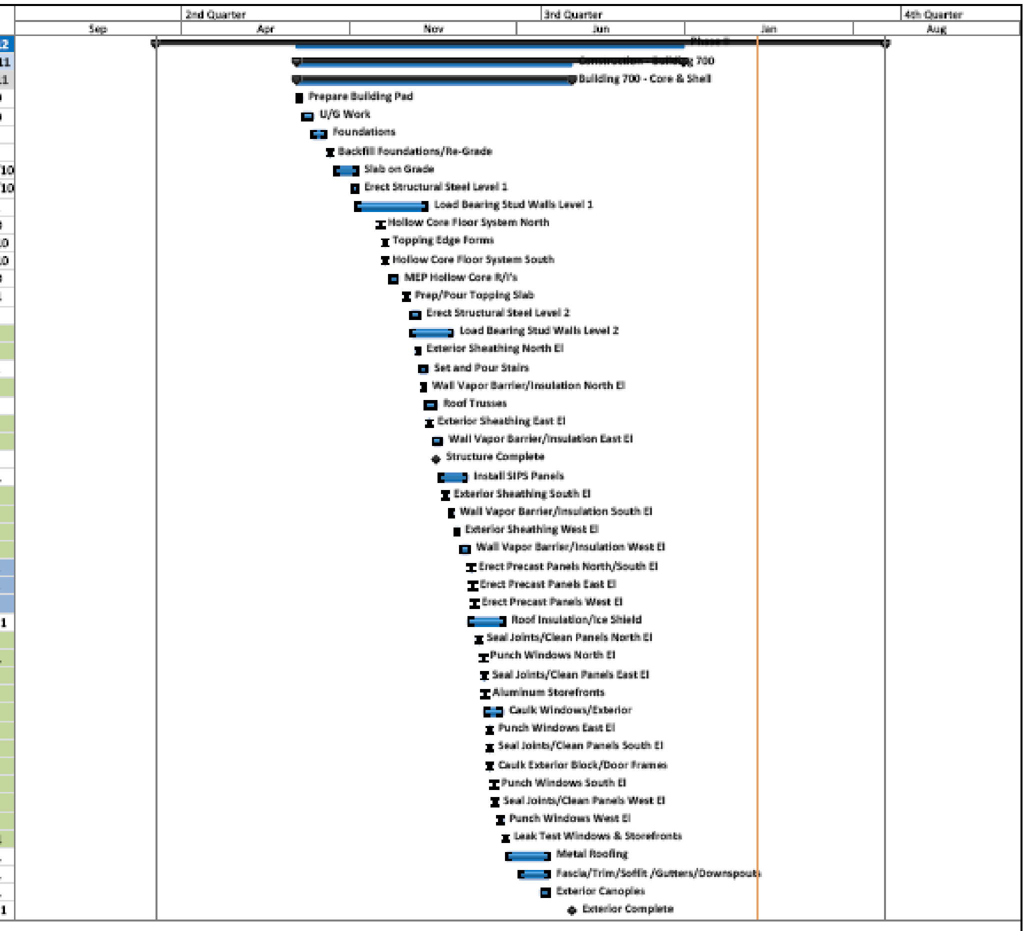
Kendall Mahan
CM Option

PROPOSED ENCLOSURE SCHEDULE

ID	Task Name	Duration	Start	Finish
1	Phase II	662 days	Sat 2/27/10	Mon 9/10/12
2	Construction - Building 700	352 days	Wed 8/25/10	Thu 12/29/11
3	Building 700 - Core & Shell	250 days	Wed 8/25/10	Wed 8/10/11
4	Prepare Building Pad	5 days	Wed 8/25/10	Tue 8/31/10
5	U/G Work	10 days	Wed 9/1/10	Tue 9/14/10
6	Foundations	15 days	Mon 9/13/10	Fri 10/1/10
7	Backfill Foundations/Re-Grade	5 days	Mon 10/4/10	Fri 10/8/10
8	Slab on Grade	23 days	Mon 10/11/10	Wed 11/10/10
9	Erect Structural Steel Level 1	6 days	Wed 11/3/10	Wed 11/10/10
10	Load Bearing Stud Walls Level 1	66 days	Mon 11/8/10	Mon 2/7/11
11	Hollow Core Floor System North	3 days	Wed 12/8/10	Fri 12/10/10
12	Topping Edge Forms	3 days	Tue 12/14/10	Thu 12/16/10
13	Hollow Core Floor System South	3 days	Tue 12/14/10	Thu 12/16/10
14	MEP Hollow Core R/I's	10 days	Mon 12/20/10	Fri 12/31/10
15	Prep/Pour Topping Slab	4 days	Mon 1/10/11	Thu 1/13/11
16	Erect Structural Steel Level 2	10 days	Mon 1/17/11	Fri 1/28/11
17	Load Bearing Stud Walls Level 2	40 days	Mon 1/17/11	Fri 3/11/11
18	Exterior Sheathing North El	5 days	Mon 1/24/11	Fri 1/28/11
19	Set and Pour Stairs	8 days	Thu 1/27/11	Mon 2/7/11
20	Wall Vapor Barrier/Insulation North El	5 days	Mon 1/31/11	Fri 2/4/11
21	Roof Trusses	11 days	Fri 2/4/11	Fri 2/18/11
22	Exterior Sheathing East El	5 days	Mon 2/7/11	Fri 2/11/11
23	Wall Vapor Barrier/Insulation East El	10 days	Mon 2/14/11	Fri 2/25/11
24	Structure Complete	0 days	Fri 2/18/11	Fri 2/18/11
25	Install SIPS Panels	26 days	Tue 2/22/11	Tue 3/29/11
26	Exterior Sheathing South El	5 days	Mon 2/28/11	Fri 3/4/11
27	Wall Vapor Barrier/Insulation South El	5 days	Mon 3/7/11	Fri 3/11/11
28	Exterior Sheathing West El	5 days	Mon 3/14/11	Fri 3/18/11
29	Wall Vapor Barrier/Insulation West El	10 days	Mon 3/21/11	Fri 4/1/11
30	Erect Precast Panels North/South El	1 day	Mon 4/4/11	Mon 4/4/11
31	Erect Precast Panels East El	2 days	Tue 4/5/11	Wed 4/6/11
32	Erect Precast Panels West El	2 days	Thu 4/7/11	Fri 4/8/11
33	Roof Insulation/Ice Shield	33 days	Thu 3/31/11	Mon 5/16/11
34	Seal Joints/Clean Panels North El	5 days	Mon 4/11/11	Fri 4/15/11
35	Punch Windows North El	2 days	Mon 4/18/11	Tue 4/19/11
36	Seal Joints/Clean Panels East El	5 days	Mon 4/18/11	Fri 4/22/11
37	Aluminum Storefronts	3 days	Wed 4/20/11	Fri 4/22/11
38	Caulk Windows/Exterior	18 days	Wed 4/20/11	Fri 5/13/11
39	Punch Windows East El	5 days	Mon 4/25/11	Fri 4/29/11
40	Seal Joints/Clean Panels South El	5 days	Mon 4/25/11	Fri 4/29/11
41	Caulk Exterior Block/Door Frames	5 days	Mon 4/25/11	Fri 4/29/11
42	Punch Windows South El	2 days	Mon 5/2/11	Tue 5/3/11
43	Seal Joints/Clean Panels West El	5 days	Mon 5/2/11	Fri 5/6/11
44	Punch Windows West El	5 days	Mon 5/9/11	Fri 5/13/11
45	Leak Test Windows & Storefronts	4 days	Mon 5/16/11	Thu 5/19/11
46	Metal Roofing	40 days	Wed 5/18/11	Tue 7/12/11
47	Fascia/Trim/Soffit /Gutters/Downspouts	28 days	Fri 6/3/11	Tue 7/12/11
48	Exterior Canopies	8 days	Fri 7/1/11	Tue 7/12/11
49	Exterior Complete	0 days	Wed 8/10/11	Wed 8/10/11



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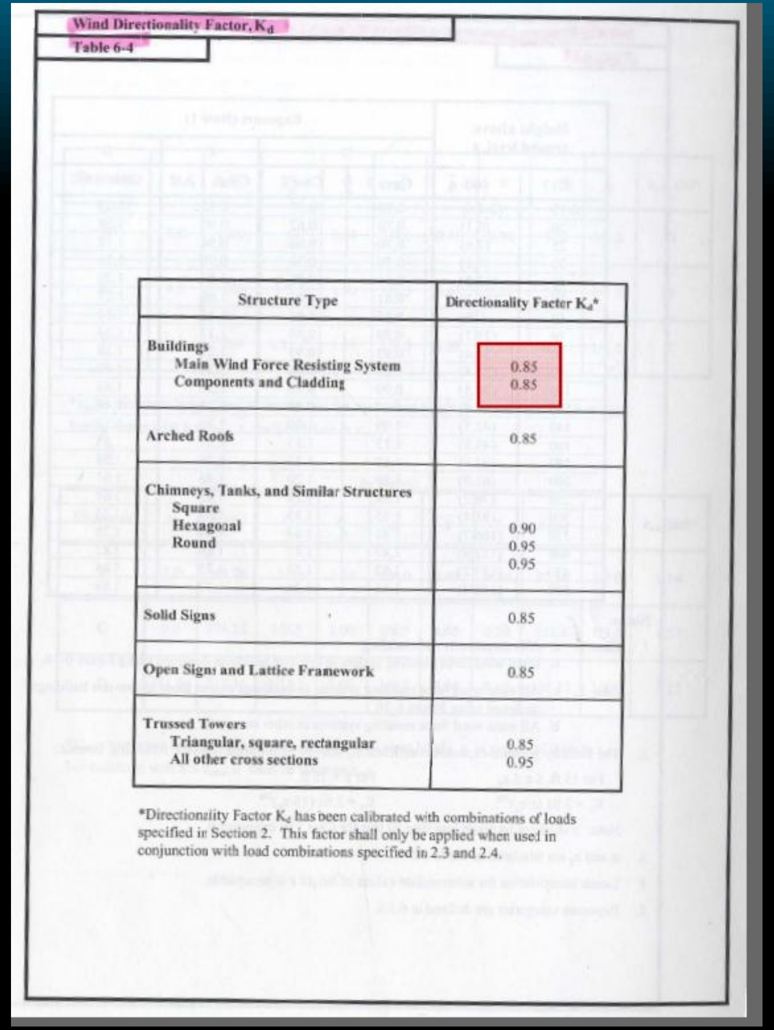
Kendall Mahan

WIND LOADS

Wind Loads		
Basic Wind Speed (3 sec Gust)	V = 90 mph	ASCE Fig. 6-1
Importance Factor	I = 1.0	ASCE Table 6-1
Exposure Category	C	ASCE Sec. 6.5.6.3
Internal Pressure Coefficient	+/- 0.18 (Enclosed)	ASCE Fig. 6-5

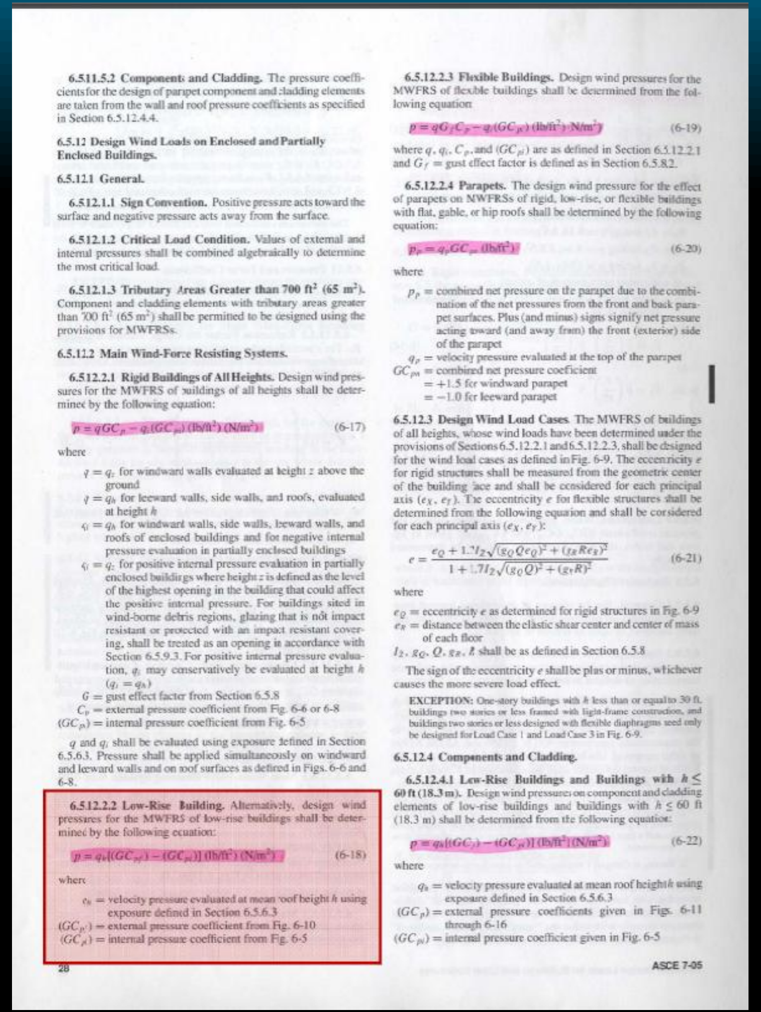
Lateral Wind Pressures		
Windward	16.58 psf	Controls
Leeward	13.87 psf	

ASCE REFERENCES

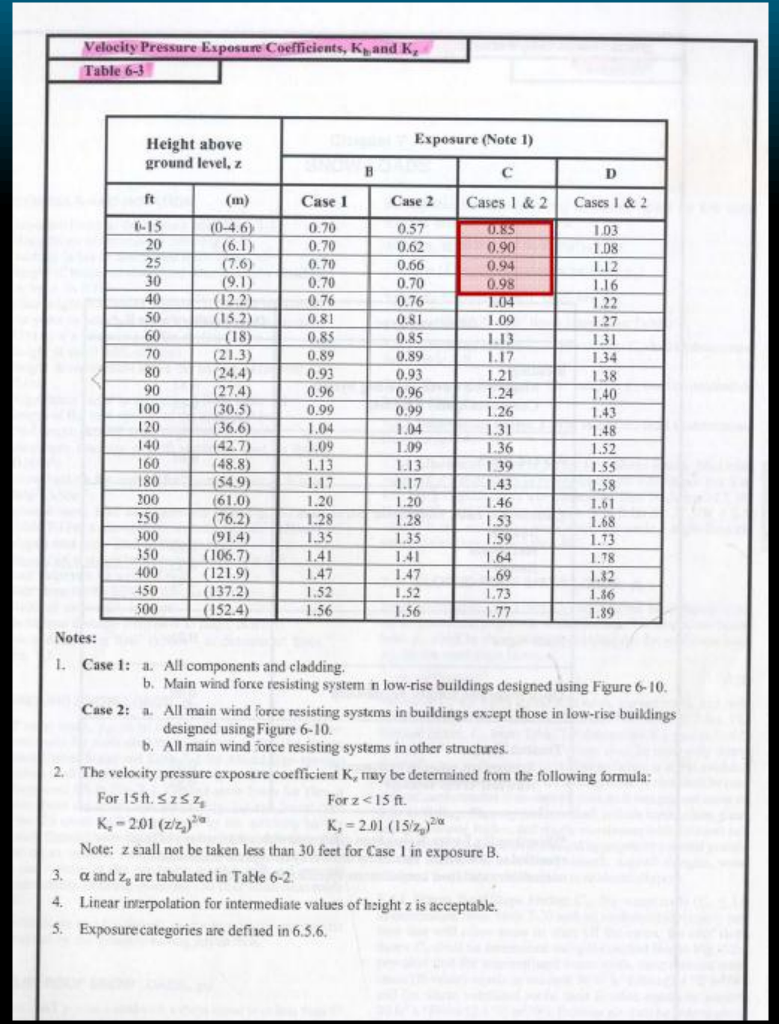

Wind Directionality Factor, K_d
Table 6-4

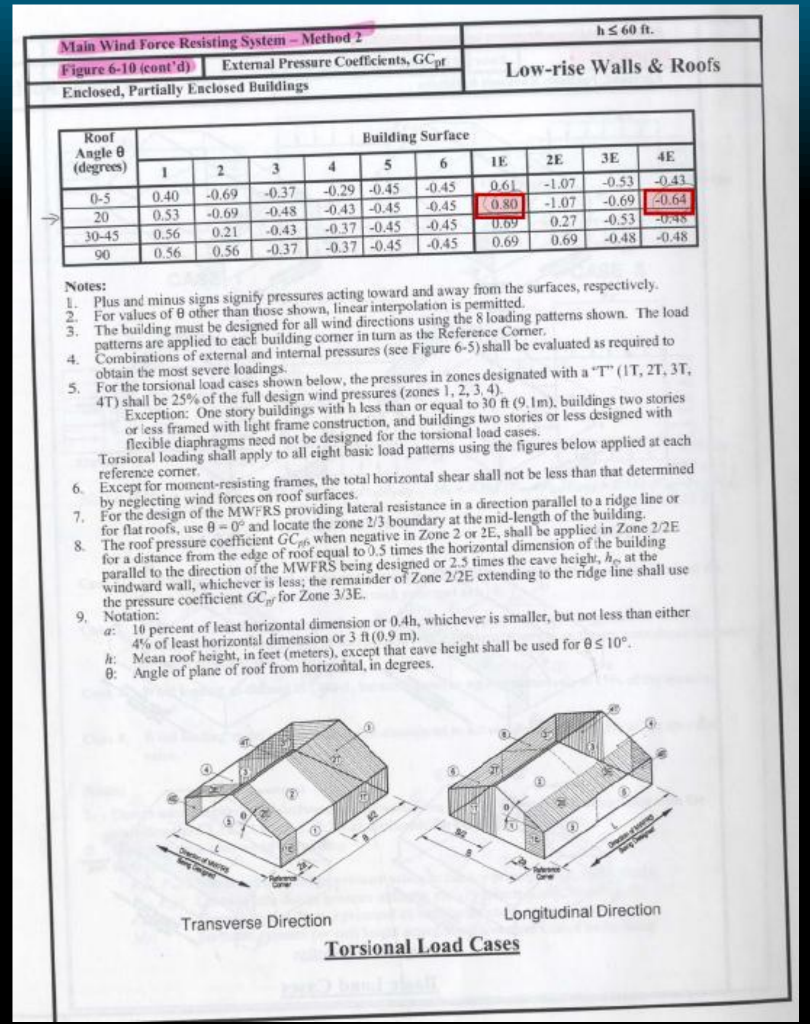
Structure Type	Directionality Factor K_d*
Buildings Main Wind Force Resisting System Components and Cladding	0.85 0.85
Arched Roofs	0.85
Chimneys, Tanks, and Similar Structures Square Hexagonal Round	 0.90 0.95 0.95
Solid Signs	0.85
Open Signs and Lattice Framework	0.85
Trussed Towers Triangular, square, rectangular All other cross sections	 0.85 0.95

*Directionality Factor K_d has been calibrated with combinations of loads specified in Section 2. This factor shall only be applied when used in conjunction with load combinations specified in 2.3 and 2.4.

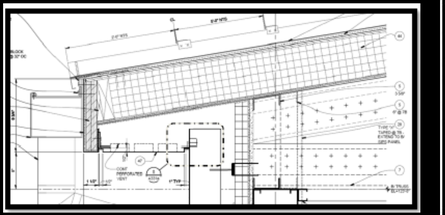


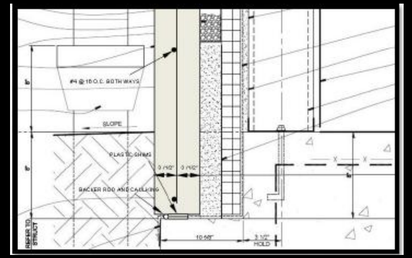
ASCE REFERENCES


Velocity Pressure Exposure Coefficients, K_h and K_z
Table 6-3


Main Wind Force Resisting System – Method 2
Figure 6-10 (cont'd)
External Pressure Coefficients, GC_{pf}
Enclosed, Partially Enclosed Buildings
Low-rise Walls & Roofs
Transverse Direction
Longitudinal Direction
Torsional Load Cases

TOP AND BOTTOM CONNECTIONS





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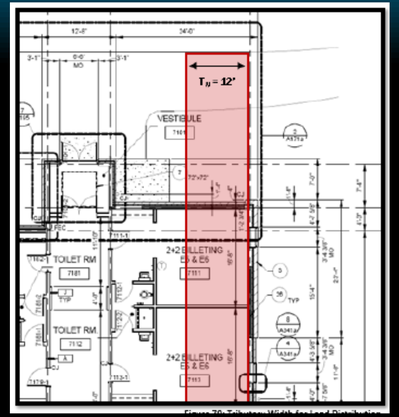
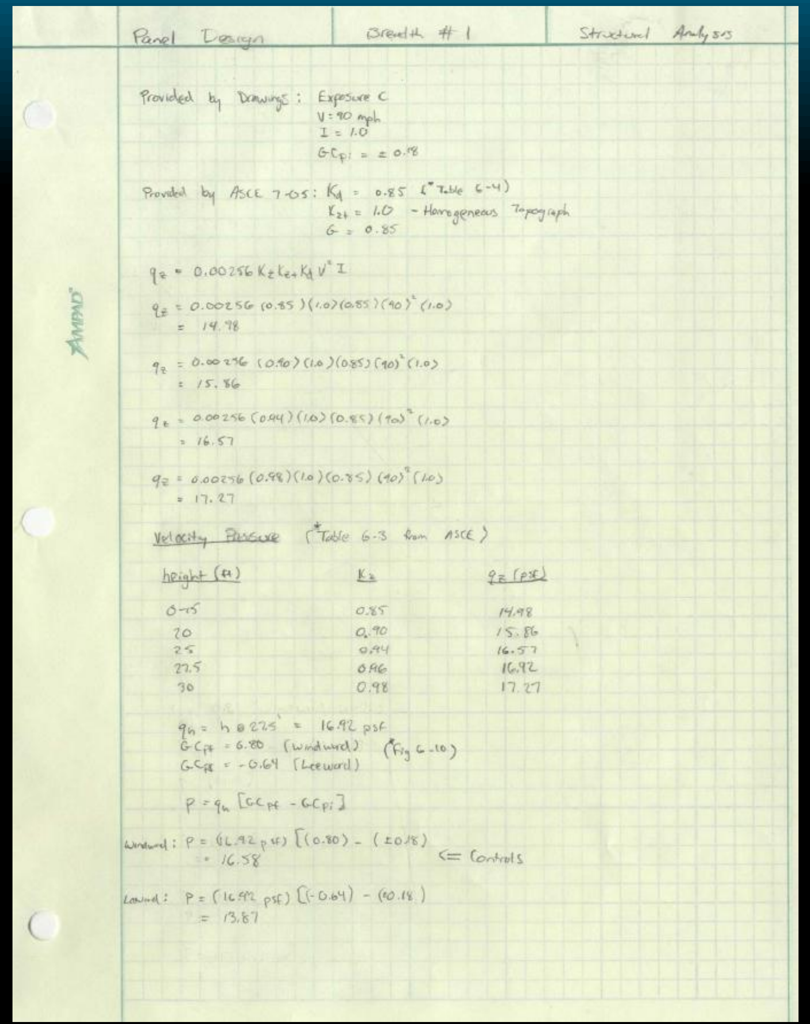


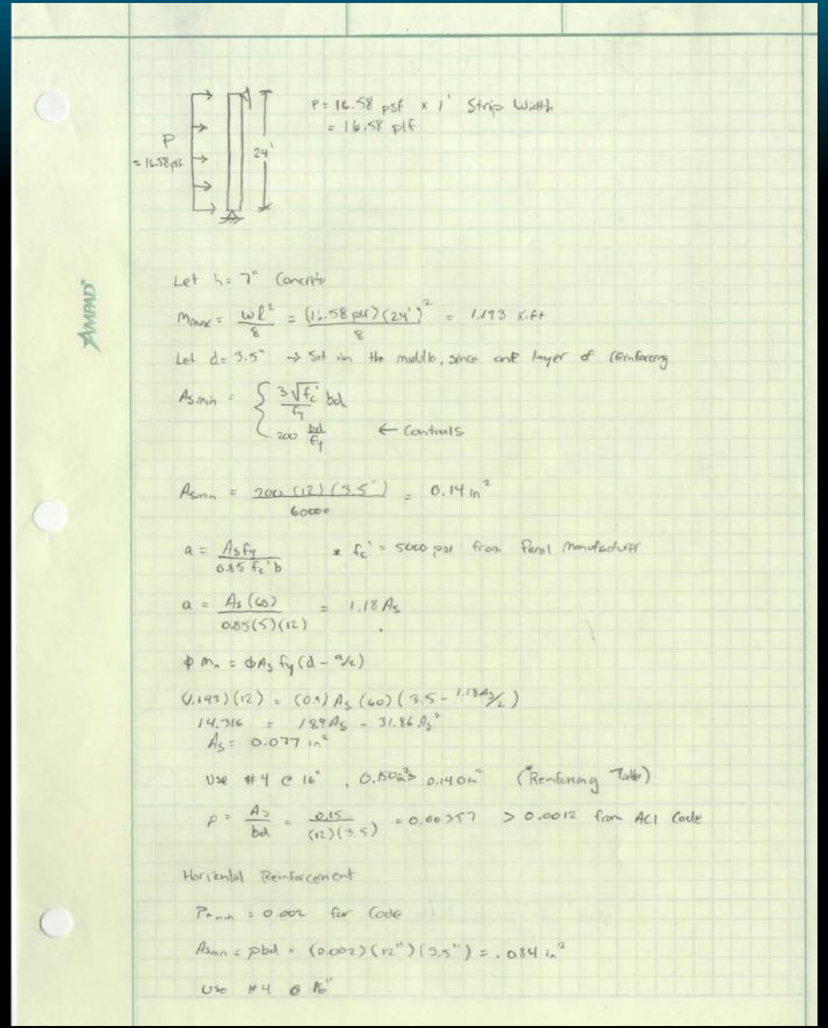
DESIGN LOADS

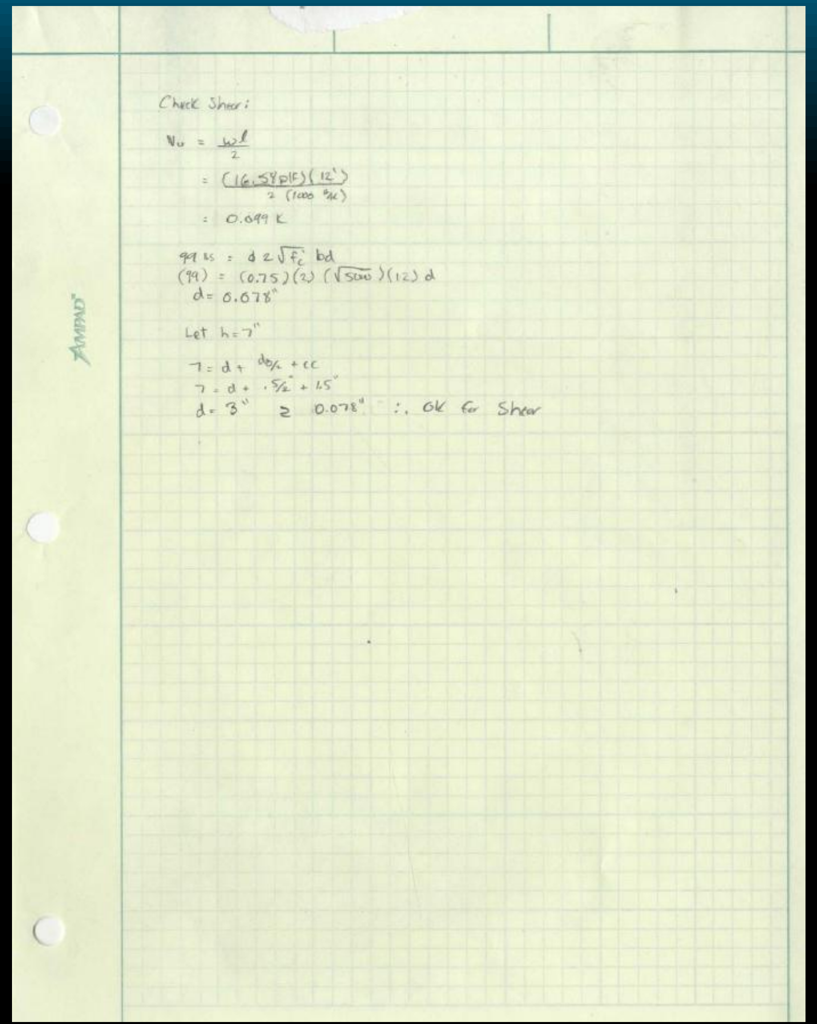
Design Loads	
Roof Dead Loads	
Roofing	5.0 PSF
Sheathing/Insulation	3.5 PSF
Cold Formed Metal Trusses	3.5 PSF
Ceiling	5.0 PSF
Mech. & Misc.	5.0 PSF
Dry Pipe Sprinkler	3.0 PSF
Total	**25 PSF**
Roof Live Loads	
Total	**20 PSF**
Floor Dead Loads	
8" Hollow-Core Precast Plank	62 PSF
2" Concrete Topping Slab	25 PSF
Mech./Electrical	3 PSF
Ceiling	5 PSF
Sprinklers	2.5 PSF
Misc.	2.5 PSF
Total	**100 PSF**
Floor Live Loads	
Total	**125 PSF**

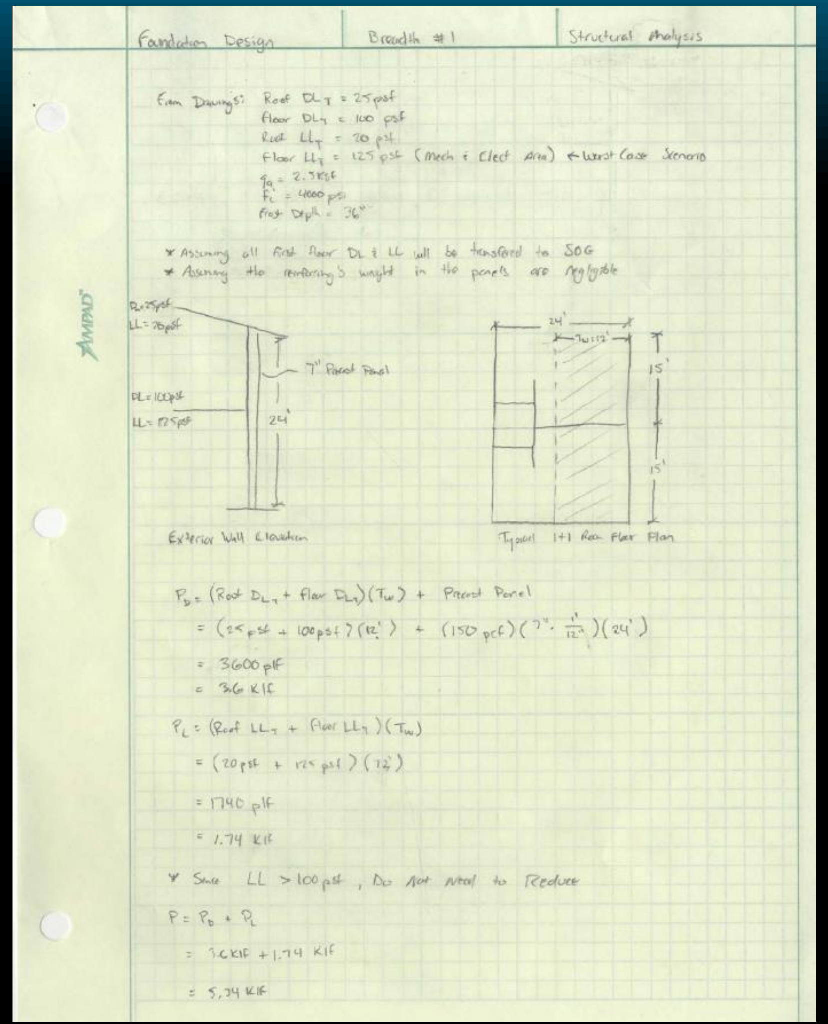
APPENDICES – PRECAST PANELS

PANEL DESIGN

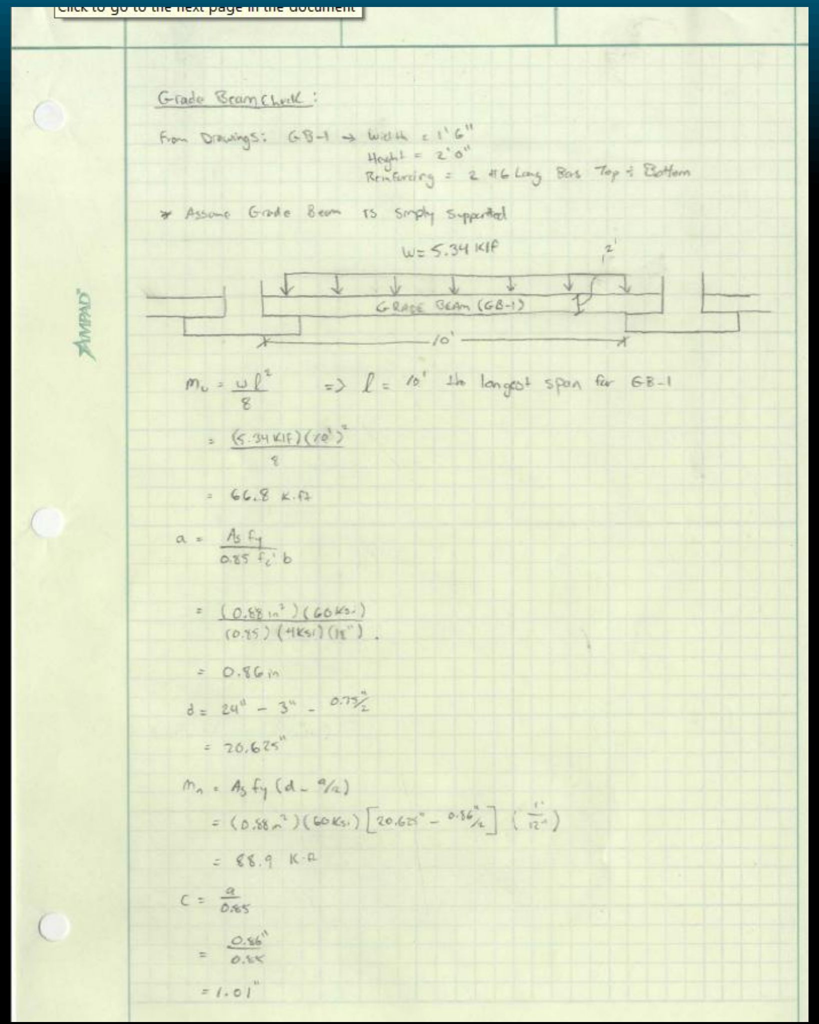


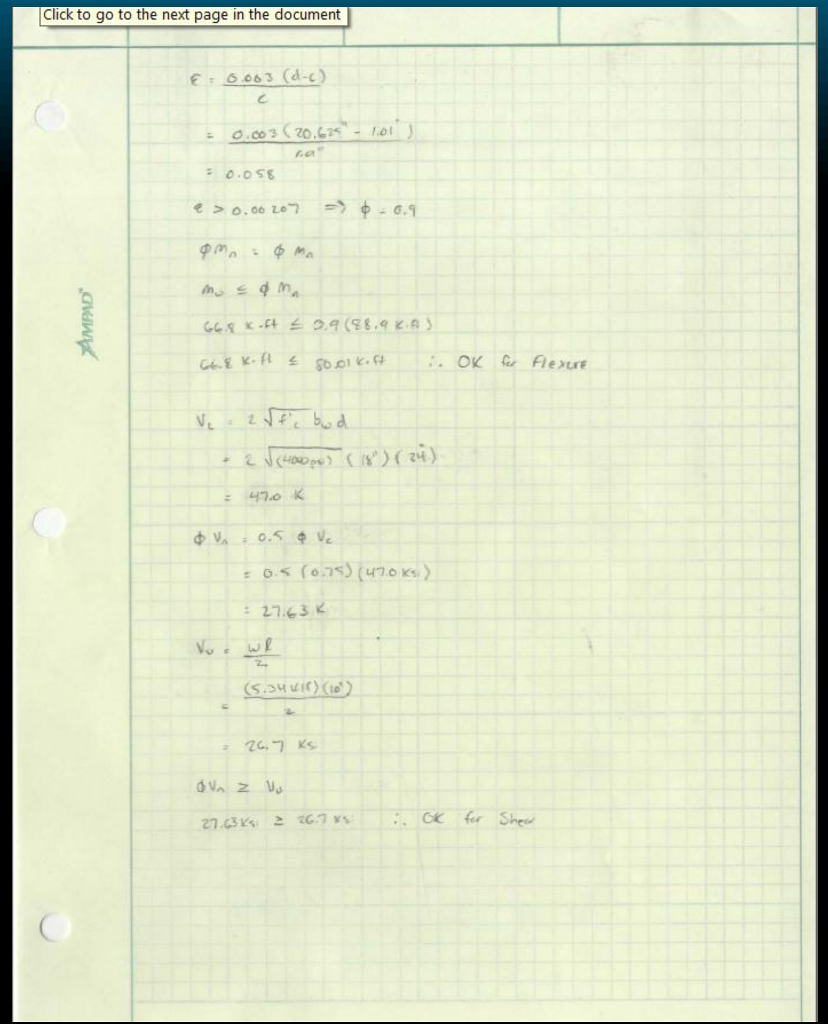






GRADE BEAM DESIGN





FORT PICKETT REGIONAL TRAINING INSTITUTE – PHASE II

Billeting Buildings
Blackstone, VA

KENDALL MAHAN | CONSTRUCTION MANAGEMENT OPTION

APPENDICES - PODS

BARTON MALOW
U.S. ARMY CORPS OF ENGINEERS
VIRGINIA ARMY NATIONAL GUARD

BATHROOM TAKEOFFS

Stud Walls (6")	Length (FT)	Height (FT)	Area (SF)
Shower/Sink Wall	7	8	56
Water Closet/Sink Wall	7	8	56
Room Wall	8.66	8	69.28
Total			**181.28**

Stud Walls (3-5/8")	Length (FT)	Height (FT)	Area (SF)
Switch Wall	8.66	8	69.28
Divider Wall	3.33	8	26.64
Total			**95.92**

Acoustic Insulation	Length (FT)	Height (FT)	Area (SF)
Shower/Sink Wall	8	8	56
Water Closet/Sink Wall	7	8	56
Room Wall	8.66	8	69.28
Total			**181.28**

GWB/Paint	Length (FT)	Height (FT)	Area (SF)
Switch Wall	7	4	28
Shower/Sink Wall	7	8	56
Door	3	-7	-21
Shower Tile	3.5	-7	-24.5
Water Closet/Sink Wall	7	8	56
Door	3	-7	-21
Water Closet Tile	3.5	-4	14
Divider Wall	7.33	8	58.64
Divider Wall Non Shower Side	3.5	-7	-24.5
Shower Wall	3.5	1	3.5
Water Closet Wall	3.5	4	14
Total			**111.14**

Cementitious Board Wall Board (5/8")	Length (FT)	Height (FT)	Area (SF)
Switch Wall	7	4	28
Shower/Sink Wall	4	7	28
Water Closet/Sink Wall	7	7	49
Door	1	4	4
Divider Wall	7.33	7	51.31
Divider Wall Non Shower Side	3.83	-3	-11.49
Shower Wall	3.5	7	24.5
Water Closet Wall	3.5	4	14
Total			**187.32**

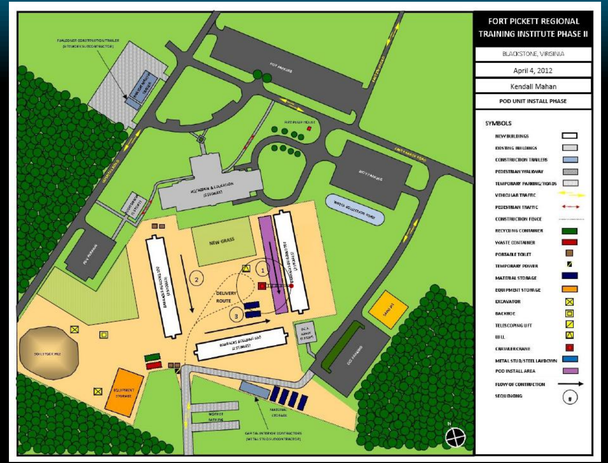
Ceramic Tile	Length (FT)	Height (FT)	Area (SF)
Floor			103
Switch Wall	7	4	28
Shower/Sink Wall	4	7	28
Water Closet/Sink Wall	7	7	49
Door	1	4	4
Divider Wall	7.33	7	51.31
Divider Wall Non Shower Side	3.83	-3	-11.49
Shower Wall	3.5	7	24.5
Water Closet Wall	3.5	4	14
Total			**290.32**

DETAILED ESTIMATE

Detailed 1+1 Bathroom Estimate

Code	Crew	Daily Output	Labor Hours	Units	Material	Labor	Equipment	Total	Total Incl O&P	Quantity	Project Total	Project Total Incl O&P
06 12 13.33 0100	Standard Hollow Metal Frames, 16 ga. Up to 5-3/4" Jamb Depth, 7'-0" High, 3'-0" W, Single	1 Carp	16	1.000 Ea.	148.00	48.00		196	223	1	$ 372.00	$ 446.00
08 13 13.13 0640	Hollow Metal Doors, Hollow Core, 1-3/4" Thick, Full Panel, 20 ga., 3'-0" x 7'-0"	1 Carp	17	0.941 Ea.	420.00	45.50		465.5	530	2	$ 931.00	$ 1,060.00
09 22 16.13 1740	Non-Structural Metal Stud Framing, Non-Load Bearing, Galv, 8" High, 20 Ga. Studs, 3-5/8" Wide, 16" O.C.	1 Carp	481	0.017 SF	0.45	0.72		1.17	1.6	96	$ 112.32	$ 153.60
09 22 16.13 1780	Non-Structure Metal Stud Framing, Non-Load Bearing, Galv, 8" High, 20 Ga. Studs, 8" Wide, 16" O.C.	1 Carp	489	0.017 SF	0.83	0.73		1.56	1.82	182	$ 247.52	$ 331.24
09 22 26.13 8320	Ceiling Suspension Systems For Gypsum Board or Plaster, 1-1/2" Carriers, 24" O.C. with 7/8" Channels, 24" O.C.	1 Lath	910	0.026 SF	0.34	1.00		1.34	1.83	103	$ 138.02	$ 188.49
09 29 10.30 0200	Gypsum Board, Fiber Reinforced, On Wall, 5'-6" x 5'-9" Sheets	2 Carp	350	0.046 SF	0.82	1.97		2.79	3.93	188	$ 524.52	$ 738.84
09 29 10.50 0590	High Abuse Gypsum Board, Fiber Reinforced, Screwed to Studs, 5/8" Thick On Walls, Taped, Finished, Compound Skim Coat Level 5 Finish	2 Carp	700	0.023 SF	0.88	0.99		1.86	2.48	113	$ 209.32	$ 277.76
09 29 10.50 0770	High Abuse Gypsum Board, Fiber Reinforced, Screwed to Studs, 5/8" Thick On Ceiling, Taped, Finished, Compound Skim Coat Level 5 Finish	2 Carp	550	0.029 SF	0.88	1.25		2.13	2.89	103	$ 218.39	$ 297.67
09 30 13.10 3310	Ceramic Tile, Porcelain Type, 1 Color, 2" x 2", Thin Set	D-7	190	0.084 SF	4.26	3.04		7.3	9.15	291	$ 2,124.30	$ 2,662.65
09 30 13.10 4600	Ceramic Tile, Add For Epoxy Grout, 1/16" Joint, 2" x 2" Tile	D-7	820	0.020 SF	0.59	0.74		1.3	1.68	291	$ 378.30	$ 488.88
09 81 16.10 1500	Acoustic Insulation, Blanket, 3" Thick	1 Clg	910	0.009 SF	0.50	0.33		0.83	1.13	182	$ 160.16	$ 205.66
09 91 23.35 0140	Doors & Windows, Interior Latex, Doors, Flush, Both Sides, Incl. Frame & Trim, Roll & Brush, Primer & 2 Coats Latex	1 Pord	9	1.600 Ea.	11.75	60.00		71.75	102	2	$ 143.50	$ 204.00
09 91 23.72 0100	Walls & Ceilings Interior, Latex, Primer, Paint 3 Coats, Smooth Finish, Spray	1 Pord	1625	0.005 SF	0.15	0.18		0.33	0.44	113	$ 36.96	$ 49.28
10 28 13.13 0310	Curtain Rod, Stainless Steel, 1" Diameter	1 Carp	13	0.615 Ea.	34.50	26.50		61	78.5	1	$ 61.00	$ 78.50
10 28 13.13 4300	Robe Hook, Single, Regular	1 Carp	36	0.222 Ea.	11.50	9.55		21.05	27	1	$ 20.85	$ 27.00
10 28 13.13 6200	Toilet Tissue Dispenser, Surface Mounted, SS, Double Roll	1 Carp	24	0.333 Ea.	22.50	14.35		36.85	47	1	$ 36.85	$ 47.00
10 28 13.13 7400	Tumbler Holder, Tumbler Only	1 Carp	30	0.267 Ea.	41.50	11.50		53	69	1	$ 53.00	$ 69.00
22 41 13.40 1100	Water Closet, Tank Type, Vitreous China, Incl. Seat, Supply Pipe w/Stop, 1.6 gpf, Floor Mounted	Q-1	5.3	3.019 Ea.	240.00	144.00		384	480	1	$ 384.00	$ 480.00
22 41 16.10 6980	Lavatories, Roughing-In, Supply, Waste and Vent	Q-1	1.66	9.639 Ea.	420.00	465.00		885	1150	2	$ 1,770.00	$ 2,300.00
22 41 23.20 4200	Shower, Rough-In, Supply, Waste and Vent	Q-1	2.05	7.805 Ea.	483.00	375.00		860	1100	1	$ 860.00	$ 1,100.00
22 42 13.40 3400	Water Closet, Rough-In, Supply, Waste and Vent	Q-1	3.64	4.396 Ea.	365.00	272.00		637	810	1	$ 637.00	$ 810.00
22 42 39.10 0972	Automatic Flush Sensor and Operator For Water Closets, Standard	1 Plum	8	1.000 Ea.	415.00	51.50		466.5	540	1	$ 466.50	$ 540.00
23 37 13.30 1000	Aluminum Air Return, 6" x 6"	1 Shee	24	0.308 Ea.	17.55	15.90		33.45	43.5	1	$ 33.45	$ 43.50
23 33 46.10 1600	Flexible Air Ducts, Coated Fiberglass Fabric, Non-Insulated, 8"	1 Sprk	200	0.080 L.F.	2.10	3.72		5.82	7.9	3	$ 17.46	$ 23.70
26 05 90.10 2770	Residential Wiring: 20' Avg. Runs, Switch Devices, Decorator Style, S.P. Touch Dimmer, Type MC Cable	1 Elec	14.3	0.559 Ea.	48.50	26.00		74.5	92.5	1	$ 74.50	$ 92.50
26 05 90.10 2790	Residential Wiring: 20' Avg. Runs, Lighting Outlets, Type MC Cable	1 Elec	24	0.333 Ea.	17.25	16.75		34	44	2	$ 68.00	$ 88.00
26 27 26.10 4800	Low Voltage Switching, Switchplates, 1 Gang, 1, 2, or 3 Switch, Plastic	1 Elec	80	0.100 Ea.	4.67	5.05		9.72	12.6	1	$ 9.70	$ 12.60
26 51 13.50 3250	Interior Lighting Fixtures, Lamps, Mounting, Hardware & Connections, Fluor: Recess Mounted, Troffer, 1'W x 4'L, Two 32 W T8	1 Elec	5.3	1.509 Ea.	154.00	76.00		210	259	1	$ 210.00	$ 259.00
26 51 13.50 3470	Interior Lighting Fixture, Inc: Lamps, Mounting, Hardware & Connections, Fluor: Recess Mounted, Troffer, 6" Diameter	1 Elec	20	0.400 Ea.	67.50	20.00		87.5	104	1	$ 87.50	$ 104.00
											$ 10,380.12	$ 13,152.87
Concrete Work												
03 11 13.35 7500	Cast-in-Place Forming Concrete, Elevated Slabs, Depressed Area Forms to 12" High, 4 Use	C-1	300	0.107 L.F.	0.78	4.96		5.74	7.55	31.33	$ 181.04	$ 236.54
03 11 13.65 5500	Cast-in-Place Forming Concrete, Slab-On-Grade, Depressed Area Forms to 12" High, 4 Use	C-1	300	0.107 SF	0.6	4.96		5.56	7.35	31.33	$ 175.40	$ 230.28
03 31 05.0300	Normal Weight Structural Concrete - 4000 psi Concrete			CY	109			109	113	0.16	$ 16.48	$ 18.08
03 31 05.35 0300	Normal Weight Structural Concrete - Structural Lightweight			CY	128.8			128.8	141.25	0.16	$ 20.61	$ 22.60
03 31 05.70 1400	Placing Concrete - Elevated Slabs, Less than 6", Pumped	C-20	140	0.457 CY		16.8	5.6	22.4	31.5	0.16	$ 3.58	$ 5.04
03 31 05.70 4150	Placing Concrete - Slab on Grade, Up to 6", Pumped	C-20	130	0.492 CY		18.1	6.05	24.15	34	0.16	$ 3.86	$ 5.44
03 35 29.30 0350	Finishing: Power Screed, Bull Float, Machine Float & Trowel (Ride-On)	C-10E	4000	0.006 SF		0.23	0.06	0.29	0.4	103	$ 29.87	$ 41.20
Additional Materials												
05 12 23.62 0350	Structural Steel, Plates, 1/4" Thick (10.2 lb/SF)			SF	11.55			11.5	12.6	103	$ 1,184.50	$ 1,297.80
09 22 16.13 1740	Non-Structural Metal Stud Framing, Non-Load Bearing, Galv, 8" High, 20 Ga. Studs, 3-5/8" Wide, 16" O.C.	1 Carp	481	0.017 SF	0.45	0.72		1.17	1.6	8.7	$ 10.18	$ 13.92
09 29 10.30 0260	Cementitious Backerboard, On Floor, 3'x 5' x 1/4" Sheets	2 Carp	525	0.03 SF	0.54	1.31		1.85	2.59	103	$ 169.95	$ 235.87
											$ 1,364.63	$ 1,547.59

PIOD ERECTION SITE PLAN



FORT PICKETT REGIONAL TRAINING INSTITUTE – PHASE II

Billeting Buildings
Blackstone, VA

KENDALL MAHAN | CONSTRUCTION MANAGEMENT OPTION

APPENDICES - PODS

BARTON MALOW
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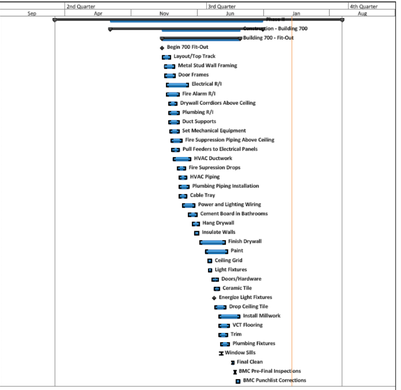
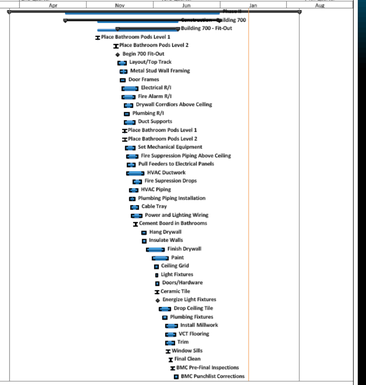
CURRENT FIT-OUT SCHEDULE

ID	Task Name	Duration	Start	Finish
1	**Phase II**	**662 days**	**Sat 2/27/10**	**Mon 9/10/12**
2	**Construction - Building 700**	**352 days**	**Wed 8/25/10**	**Thu 12/29/11**
3	**Building 700 - Fit-Out**	**180 days**	**Tue 2/8/11**	**Mon 10/17/11**
4	Begin 700 Fit-Out	0 days	Tue 2/8/11	Tue 2/8/11
5	Layout/Top Track	20 days	Tue 2/8/11	Mon 3/7/11
6	Metal Stud Wall Framing	25 days	Tue 2/15/11	Mon 3/21/11
7	Door Frames	25 days	Wed 2/16/11	Tue 3/22/11
8	Electrical R/I	52 days	Tue 2/22/11	Wed 5/4/11
9	Fire Alarm R/I	30 days	Tue 2/22/11	Mon 4/4/11
10	Drywall Corridors Above Ceiling	20 days	Tue 3/1/11	Mon 3/28/11
11	Plumbing R/I	25 days	Tue 3/1/11	Mon 4/4/11
12	Duct Supports	25 days	Tue 3/1/11	Mon 4/4/11
13	Set Mechanical Equipment	22 days	Fri 3/4/11	Mon 4/4/11
14	Fire Suppression Piping Above Ceiling	27 days	Tue 3/8/11	Wed 4/13/11
15	Pull Feeders to Electrical Panels	18 days	Fri 3/11/11	Tue 4/5/11
16	HVAC Ductwork	43 days	Tue 3/15/11	Thu 5/12/11
17	Fire Supression Drops	20 days	Tue 3/29/11	Mon 4/25/11
18	HVAC Piping	20 days	Mon 4/4/11	Fri 4/29/11
19	Plumbing Piping Installation	25 days	Mon 4/4/11	Fri 5/6/11
20	Cable Tray	20 days	Mon 4/4/11	Fri 4/29/11
21	Power and Lighting Wiring	30 days	Thu 4/14/11	Wed 5/25/11
22	Cement Board in Bathrooms	21 days	Wed 5/4/11	Wed 6/1/11
23	Hang Drywall	18 days	Mon 5/16/11	Wed 6/8/11
24	Insulate Walls	11 days	Mon 5/23/11	Mon 6/6/11
25	Finish Drywall	59 days	Thu 6/9/11	Tue 8/30/11
26	Paint	53 days	Mon 6/27/11	Wed 9/7/11
27	Ceiling Grid	10 days	Tue 7/5/11	Mon 7/18/11
28	Light Fixtures	7 days	Wed 7/13/11	Thu 7/21/11
29	Doors/Hardware	15 days	Tue 7/19/11	Mon 8/8/11
30	Ceramic Tile	15 days	Mon 7/25/11	Fri 8/12/11
31	Energize Light Fixtures	0 days	Tue 7/26/11	Tue 7/26/11
32	Drop Ceiling Tile	28 days	Wed 7/27/11	Fri 9/2/11
33	Install Millwork	49 days	Wed 8/10/11	Mon 10/17/11
34	VCT Flooring	25 days	Wed 8/10/11	Tue 9/13/11
35	Trim	21 days	Wed 8/10/11	Wed 9/7/11
36	Plumbing Fixtures	22 days	Mon 8/15/11	Tue 9/13/11
37	Window Sills	3 days	Wed 8/17/11	Fri 8/19/11
38	Final Clean	5 days	Wed 9/21/11	Tue 9/27/11
39	BMC Pre-Final Inspections	4 days	Wed 9/28/11	Mon 10/3/11
40	BMC Punchlist Corrections	10 days	Tue 10/4/11	Mon 10/17/11



PROPOSED FIT-OUT SCHEDULE

ID	Task Name	Duration	Start	Finish
1	**Phase II**	**662 days**	**Sat 2/27/10**	**Mon 9/10/12**
2	**Construction - Building 700**	**352 days**	**Wed 8/25/10**	**Thu 12/29/11**
3	**Building 700 - Fit-Out**	**139 days**	**Tue 2/8/11**	**Fri 8/26/11**
4	Place Bathroom Pods Level 1	2 days	Mon 12/6/10	Tue 12/7/10
5	Place Bathroom Pods Level 2	2 days	Wed 2/2/11	Thu 2/3/11
6	Begin 700 Fit-Out	0 days	Tue 2/8/11	Tue 2/8/11
7	Layout/Top Track	20 days	Tue 2/8/11	Mon 3/7/11
8	Metal Stud Wall Framing	18 days	Tue 2/15/11	Thu 3/10/11
9	Door Frames	13 days	Wed 2/16/11	Fri 3/4/11
10	Electrical R/I	37 days	Tue 2/22/11	Wed 4/13/11
11	Fire Alarm R/I	30 days	Tue 2/22/11	Mon 4/4/11
12	Drywall Corridors Above Ceiling	20 days	Tue 3/1/11	Mon 3/28/11
13	Plumbing R/I	13 days	Tue 3/1/11	Thu 3/17/11
14	Duct Supports	25 days	Tue 3/1/11	Mon 4/4/11
15	Place Bathroom Pods Level 1	1 day	Wed 3/2/11	Wed 3/2/11
16	Place Bathroom Pods Level 2	1 day	Thu 3/3/11	Thu 3/3/11
17	Set Mechanical Equipment	22 days	Fri 3/4/11	Mon 4/4/11
18	Fire Suppression Piping Above Ceiling	27 days	Tue 3/8/11	Wed 4/13/11
19	Pull Feeders to Electrical Panels	18 days	Fri 3/11/11	Tue 4/5/11
20	HVAC Ductwork	41 days	Tue 3/8/11	Tue 5/3/11
21	Fire Supression Drops	20 days	Tue 3/29/11	Mon 4/25/11
22	HVAC Piping	20 days	Thu 3/17/11	Wed 4/13/11
23	Plumbing Piping Installation	13 days	Thu 3/17/11	Mon 4/4/11
24	Cable Tray	20 days	Mon 3/21/11	Fri 4/15/11
25	Power and Lighting Wiring	24 days	Thu 3/24/11	Tue 4/26/11
26	Cement Board in Bathrooms	3 days	Tue 4/5/11	Thu 4/7/11
27	Hang Drywall	12 days	Mon 4/25/11	Tue 5/10/11
28	Insulate Walls	8 days	Thu 4/28/11	Mon 5/9/11
29	Finish Drywall	42 days	Wed 5/11/11	Thu 7/7/11
30	Paint	37 days	Mon 5/30/11	Tue 7/19/11
31	Ceiling Grid	10 days	Mon 6/6/11	Fri 6/17/11
32	Light Fixtures	6 days	Thu 6/9/11	Thu 6/16/11
33	Doors/Hardware	8 days	Thu 6/9/11	Mon 6/20/11
34	Ceramic Tile	3 days	Mon 6/13/11	Wed 6/15/11
35	Energize Light Fixtures	0 days	Thu 6/16/11	Thu 6/16/11
36	Drop Ceiling Tile	28 days	Mon 6/20/11	Wed 7/27/11
37	Plumbing Fixtures	11 days	Fri 7/1/11	Fri 7/15/11
38	Install Millwork	28 days	Mon 7/11/11	Wed 8/17/11
39	VCT Flooring	25 days	Mon 7/11/11	Fri 8/12/11
40	Trim	21 days	Mon 7/11/11	Mon 8/8/11
41	Window Sills	3 days	Mon 7/18/11	Wed 7/20/11
42	Final Clean	5 days	Mon 7/25/11	Fri 7/29/11
43	BMC Pre-Final Inspections	4 days	Mon 8/1/11	Thu 8/4/11
44	BMC Punchlist Corrections	10 days	Mon 8/8/11	Fri 8/19/11



PIOD ERECTION SITE PLAN