ADDITIONAL POSSIBLE ANALYSIS

UNITIZED GLAZING SYSTEM

Problem

The exterior skin system consists of masonry, metal panels, glass curtain wall, and glass storefront. Most of the masonry applications are with CMU back-up. There is a sunshade surrounding the building and the roof consists of three different types of material – EPDM, built-up and metal panel. The numerous materials cause multiple interfaces with difficult connection details. The building is stick built which can cause quality issues. Facades are vital for keeping water out of the building.

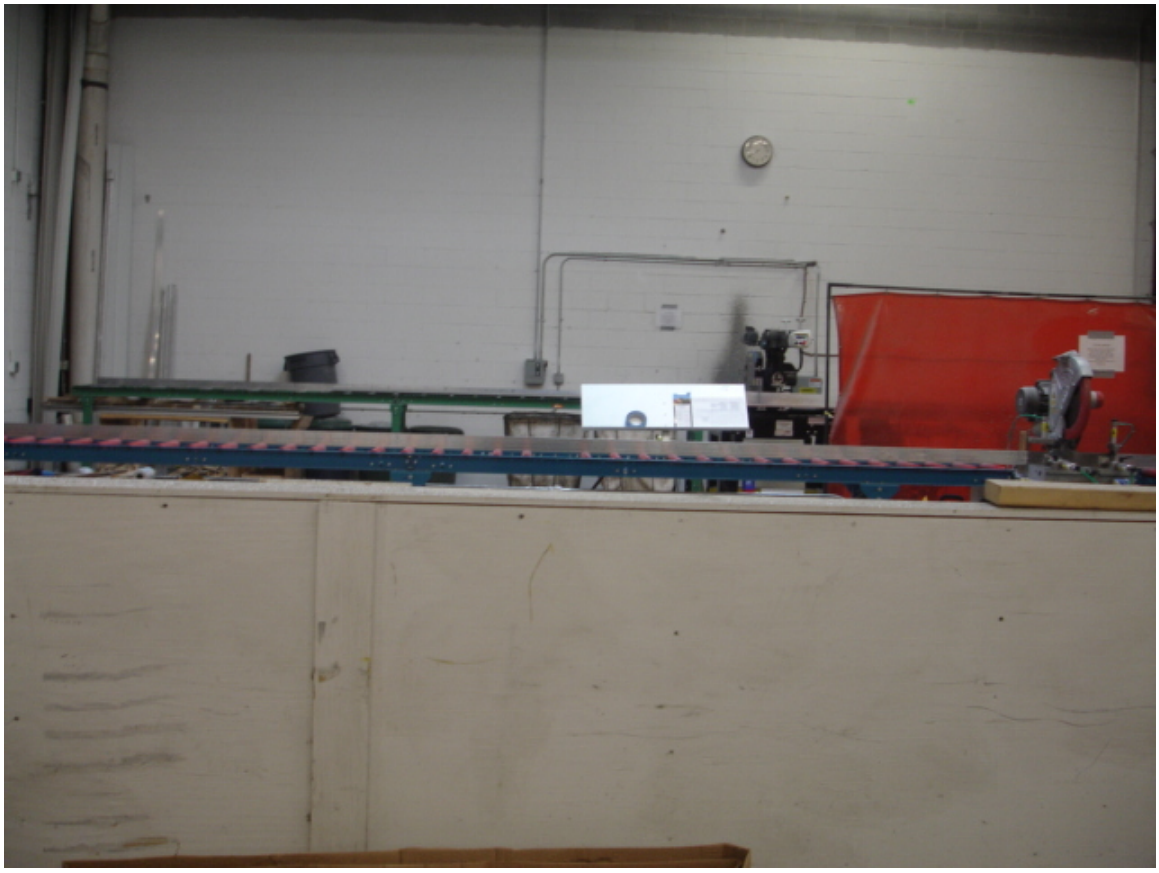
Goal

The goal is to redesign the building envelope to improve the constructability and quality of the glass curtain wall using a unitized system. The unitized glass system will provide a better quality because all conditions are controlled in a factory however it requires a longer lead time. Once the unitized panels are on site they can be installed very quickly. A mock up of the system would also be beneficial for identifying key areas where the design needs improvement.

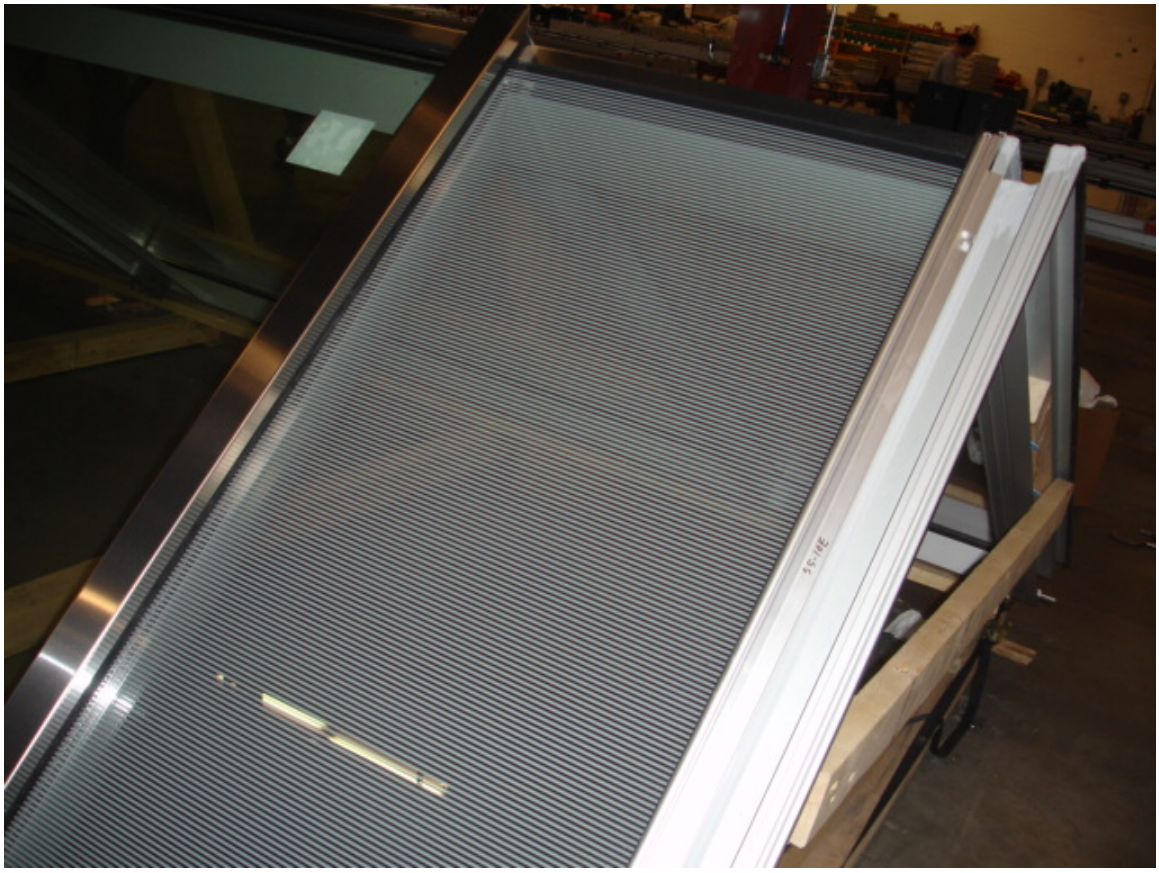
Research

A visit to Harmon, Inc was made to view the process of fabricating a unitized system. Implementation of the unitized glazing system will impact the schedule. The length of on site construction is dramatically decreased but the lead time is significantly increased. The quality of the window is increased because all conditions are controlled in the factory.

This analysis was not comprehensive enough for a structural breadth because the same materials in both the stick built system and the unitized system. The weight of the façade remains the same. Therefore, there is no change in loading to analyze. Pictures from the visit to Harmon, Inc are provided on pages 44-49.




HARMON



Summary and Conclusions

The critical industry issue affecting the Health and Human Services Building at Coppin State University is the volatility of escalating construction costs. The risk associated with the escalation of construction costs has been analyzed by interviewing contractors, construction managers, designers and owners regarding the current strategies of managing this risk. Through the interview process it was found that some risk is passed to each party starting with the owner and ending with the vendor. As the risk is passed costs are increased to compensate for the escalation of material and labor costs. In the end, the owner pays a premium for cost escalation that may never occur. The proposed solution is for the owner to control more of the risk and implement changes in the contractor's procurement and bid process.

The first technical analysis examines the affects of lowering and extending the 5th floor's existing sunshade. Lowering the sunshade to the head of the window and extending the sunshade beyond its current length of four feet increases the percentage of shaded glazing which in turn decreases the amount of solar heat gain. The structural connection of the sunshade to the building needs to be altered to accommodate the lower sunshade. It was found that a total of 30,008 pounds of steel needs to be added to the building in the form of 156 steel plates to support the lowered sunshade. The first year's mechanical savings from lowering the sunshade totals $20,498 and decreases to a yearly savings of $3,220 for every year succeeding the first. The one time initial cost of the addition of steel is $6,017. The extension of the sunshade beyond five feet requires a payback period of eight years due to the additional costs of material and labor. It is recommended that the sunshade be lowered to the head of the window and left at its current overhang length of four feet.

The second technical analysis alters the lighting scheme of the overhead pedestrian bridge that spans W. North Avenue and connects the college's current campus to its new campus. The bridge is a unique architectural feature that signifies the presence of Coppin State University in the community. The Health and Human Services Building contains outreach programs that will service the community which include a daycare center and a clinic. The redesigned lighting scheme highlights the prominent architectural and structural features of the bridge while shining a beacon of light into the community.

APPENDIX A

DETAILED PROJECT SCHEDULE

Activity ID	Activity Description	Orig Dur
1000	Schematic Design Development	83
0900	Ownership of All Homes	382
1005	Delay In Schematic Design	184
1006	A/E Remobilizes Team and	1
1007	Schematic Design Development -	50
1010	SD University/Coppin Review &	10
1020	Schematic Design Estimate	10
1025	SD Constructability Review	1
1030	SD Estimate	1
1045	Receive Authorization from	1
1050	Design Development Documents	77
0950	Closure of Whitmore Avenue	174
1060	DD University/ Coppin Review &	10
1070	Design Development Estimate	15
1075	DD Constructability Review	10
1080	DD Estimate Review/	5
1090	Receive Authorization from	0
1055	Sediment/Erosion Control &	1
1100	50% Construction Documents	54
1091	Receive 100% Civil Documents	0
1110	50% CD University/ Coppin	15
1120	50% CD Estimate	15
1125	50% CD Constructability Review	10
1105	A/E Bid Package 1-Demo, Site,	12
1150	CSU/UMB/BMC Review - A/E	10
1130	50% CD Estimate Review	2
1140	Receive Authorization from	0
1160	95% Construction Documents	47
1255	Receive Bid Pack #1 Documents	0
1256	Bid Pack#1/ GMP Preparation	25
1257	GMP #1 Review	10
1250	Submit For Franchise Agreement	135
1258	GMP #1 - Approval- "Letter of	1
1280	Constructoin Substructure	60
1170	95% CD University/ Coppin	15
1180	95% CD Estimate	15
1185	95% CD Constructability Review	10
1097	Recieve Sediment/Erosion	0
1190	95% CD Estimate Review	3

Start Date	09SEP03
Finish Date	06AUG08
Data Date	09SEP03
Run Date	30OCT06 20:08

Early Bar
Float Bar
Progress Bar
Critical Activity

CRI2

Sheet 1 of 5

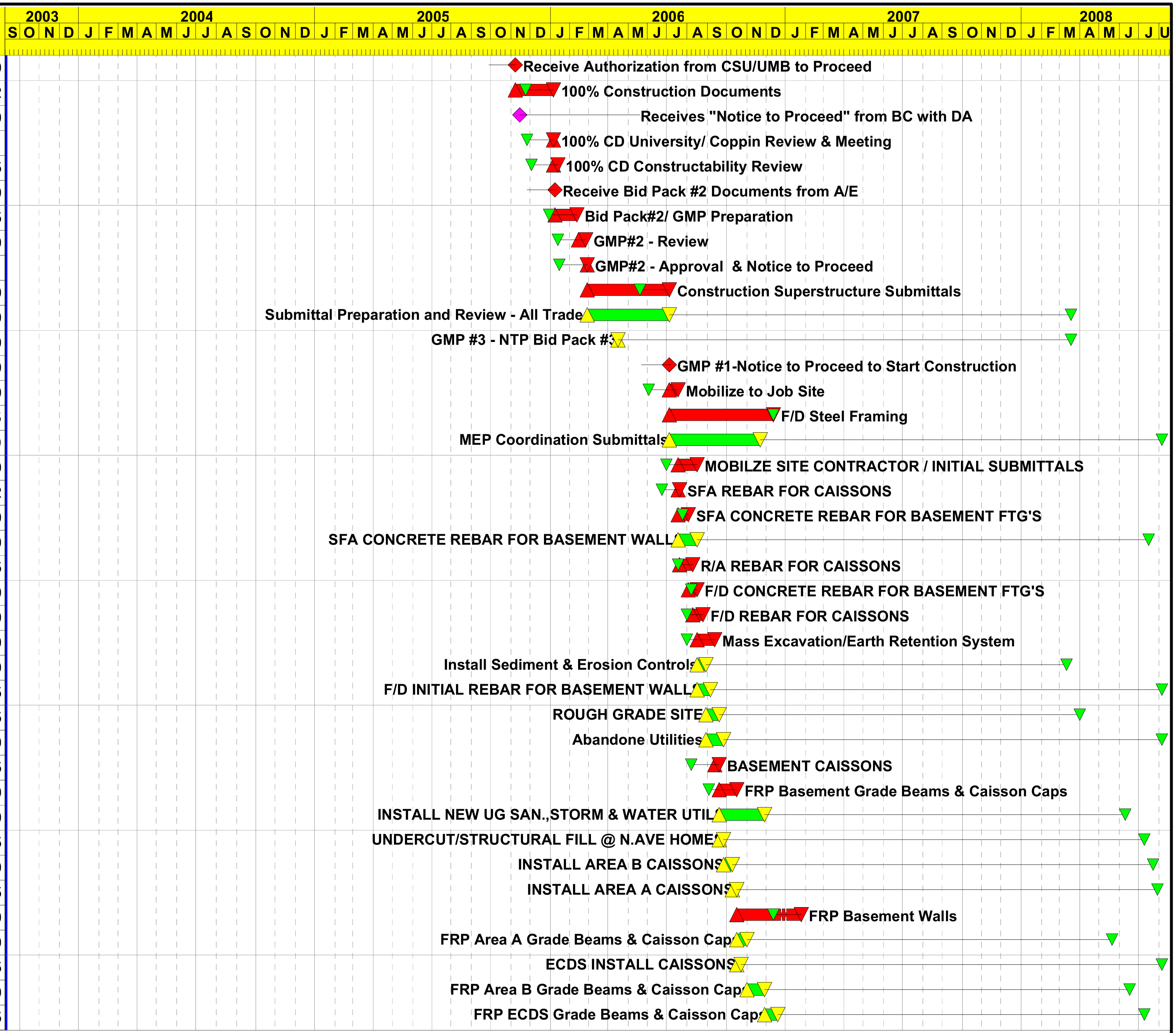
Barton Malow Company

CSC Health & Human Service Building

Classic Schedule Layout

Date	Revision	Checked	Approved

Activity ID	Activity Description	Orig Dur
1200	Receive Authorization from	0
1220	100% Construction Documents	42
1098	Receives "Notice to Proceed"	0
1230	100% CD University/ Coppin	1
1240	100% CD Constructability Review	5
1490	Receive Bid Pack #2 Documents	0
1491	Bid Pack#2/ GMP Preparation	25
1492	GMP#2 - Review	10
1493	GMP#2 - Approval & Notice to	1
1290	Construction Superstructure	90
1295	Submittal Preparation and	90
1300	GMP #3 - NTP Bid Pack #3	0
1269	GMP #1-Notice to Proceed to	0
1270	Mobilize to Job Site	10
1370	F/D Steel Framing	115
1296	MEP Coordination Submittals	100
2010	MOBILZE SITE CONTRACTOR /	20
100	SFA REBAR FOR CAISSONS	2
110	SFA CONCRETE REBAR FOR	10
120	SFA CONCRETE REBAR FOR	20
104	R/A REBAR FOR CAISSONS	15
118	F/D CONCRETE REBAR FOR	10
108	F/D REBAR FOR CAISSONS	10
2070	Mass Excavation/Earth Retention	20
2030	Install Sediment & Erosion	10
128	F/D INITIAL REBAR FOR	15
2080	ROUGH GRADE SITE	15
2040	Abandone Utilities	20
2500	BASEMENT CAISSONS	5
1310	FRP Basement Grade Beams &	20
2090	INSTALL NEW UG SAN.,STORM	50
2055	UNDERCUT/STRUCTURAL FILL	5
2520	INSTALL AREA B CAISSONS	10
2510	INSTALL AREA A CAISSONS	5
1320	FRP Basement Walls	70
1330	FRP Area A Grade Beams &	10
4500	ECDS INSTALL CAISSONS	5
1340	FRP Area B Grade Beams &	20
1350	FRP ECDS Grade Beams &	15



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CRI2

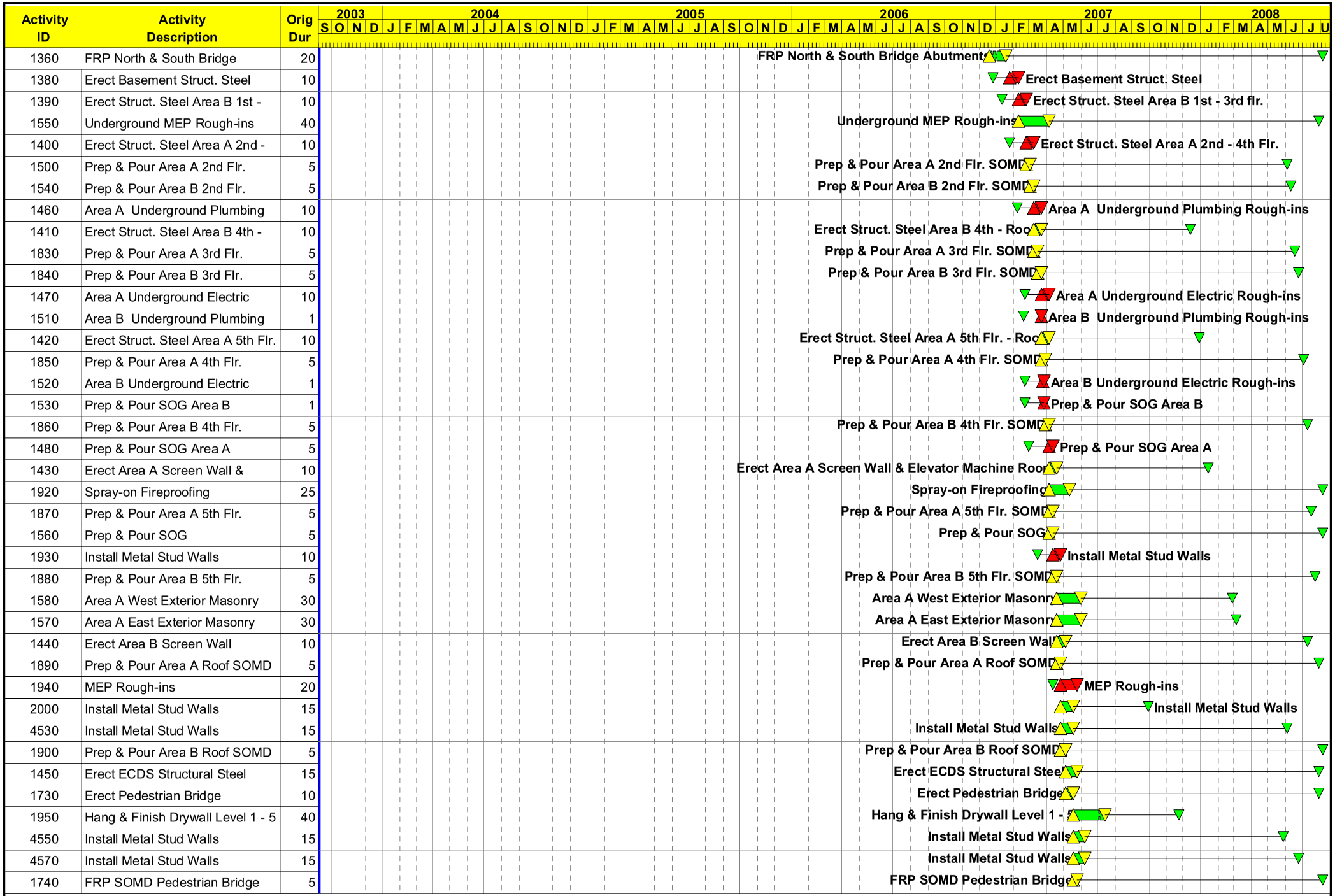
Sheet 2 of 5

Barton Malow Company

CSC Health & Human Service Building

Classic Schedule Layout

Date	Revision	Checked	Approved



Activity ID	Activity Description	Orig Dur
1360	FRP North & South Bridge	20
1380	Erect Basement Struct. Steel	10
1390	Erect Struct. Steel Area B 1st -	10
1550	Underground MEP Rough-ins	40
1400	Erect Struct. Steel Area A 2nd -	10
1500	Prep & Pour Area A 2nd Flr.	5
1540	Prep & Pour Area B 2nd Flr.	5
1460	Area A Underground Plumbing	10
1410	Erect Struct. Steel Area B 4th -	10
1830	Prep & Pour Area A 3rd Flr.	5
1840	Prep & Pour Area B 3rd Flr.	5
1470	Area A Underground Electric	10
1510	Area B Underground Plumbing	1
1420	Erect Struct. Steel Area A 5th Flr.	10
1850	Prep & Pour Area A 4th Flr.	5
1520	Area B Underground Electric	1
1530	Prep & Pour SOG Area B	1
1860	Prep & Pour Area B 4th Flr.	5
1480	Prep & Pour SOG Area A	5
1430	Erect Area A Screen Wall &	10
1920	Spray-on Fireproofing	25
1870	Prep & Pour Area A 5th Flr.	5
1560	Prep & Pour SOG	5
1930	Install Metal Stud Walls	10
1880	Prep & Pour Area B 5th Flr.	5
1580	Area A West Exterior Masonry	30
1570	Area A East Exterior Masonry	30
1440	Erect Area B Screen Wall	10
1890	Prep & Pour Area A Roof SOMD	5
1940	MEP Rough-ins	20
2000	Install Metal Stud Walls	15
4530	Install Metal Stud Walls	15
1900	Prep & Pour Area B Roof SOMD	5
1450	Erect ECDS Structural Steel	15
1730	Erect Pedestrian Bridge	10
1950	Hang & Finish Drywall Level 1 - 5	40
4550	Install Metal Stud Walls	15
4570	Install Metal Stud Walls	15
1740	FRP SOMD Pedestrian Bridge	5

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Sheet 3 of 5

Barton Malow Company

CSC Health & Human Service Building

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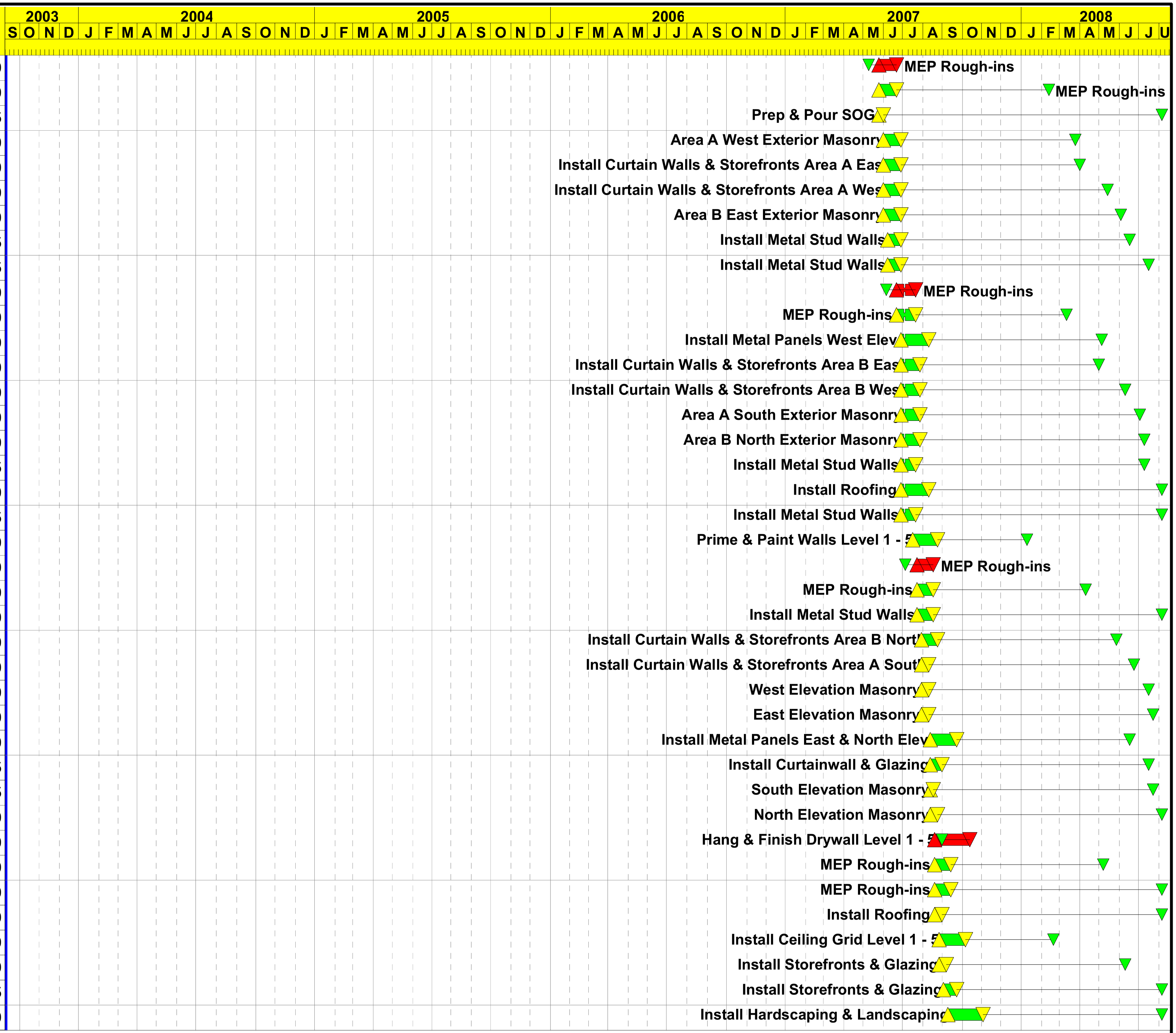
Date	Revision	Checked	Approved

Activity ID	Activity Description	Orig Dur
4540	MEP Rough-ins	20
2020	MEP Rough-ins	20
1910	Prep & Pour SOG	5
1600	Area A West Exterior Masonry	20
1630	Install Curtain Walls & Storefronts	20
1640	Install Curtain Walls & Storefronts	20
1590	Area B East Exterior Masonry	20
4590	Install Metal Stud Walls	15
4610	Install Metal Stud Walls	15
4580	MEP Rough-ins	20
4560	MEP Rough-ins	20
1700	Install Metal Panels West Elev.	30
1650	Install Curtain Walls & Storefronts	20
1660	Install Curtain Walls & Storefronts	20
1620	Area A South Exterior Masonry	20
1610	Area B North Exterior Masonry	20
4650	Install Metal Stud Walls	15
1690	Install Roofing	30
4630	Install Metal Stud Walls	15
1960	Prime & Paint Walls Level 1 - 5	30
4620	MEP Rough-ins	20
4600	MEP Rough-ins	20
4670	Install Metal Stud Walls	20
1670	Install Curtain Walls & Storefronts	20
1680	Install Curtain Walls & Storefronts	10
1750	West Elevation Masonry	10
1760	East Elevation Masonry	10
1710	Install Metal Panels East & North	30
4520	Install Curtainwall & Glazing	15
1780	South Elevation Masonry	5
1770	North Elevation Masonry	10
2050	Hang & Finish Drywall Level 1 - 5	40
4660	MEP Rough-ins	20
4640	MEP Rough-ins	20
1790	Install Roofing	10
1970	Install Ceiling Grid Level 1 - 5	30
4510	Install Storefronts & Glazing	10
1800	Install Storefronts & Glazing	15
2210	Install Hardscaping &	40



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Critical Activity

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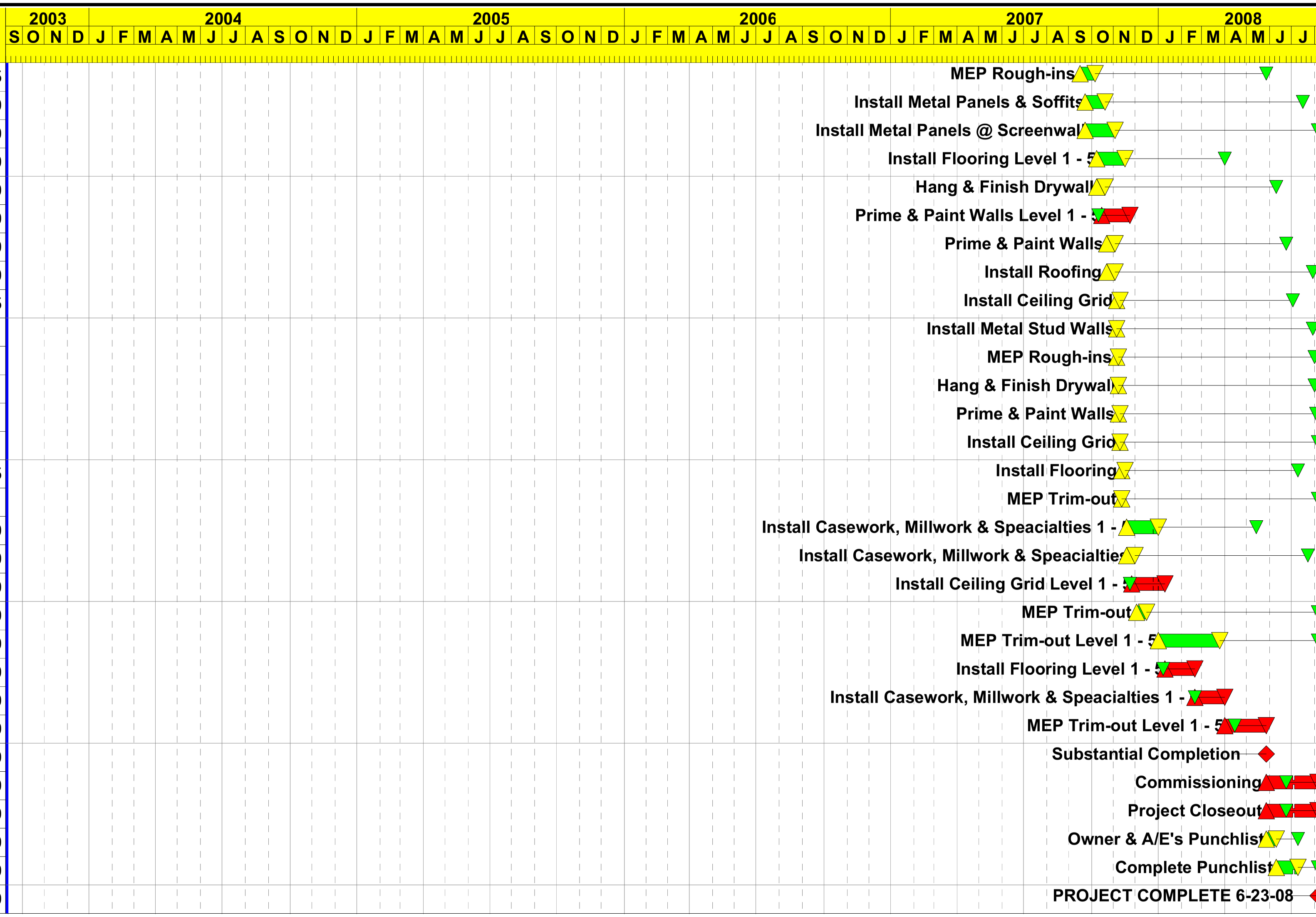
Barton Malow Company

CSC Health & Human Service Building

Classic Schedule Layout

Date	Revision	Checked	Approved

Activity ID	Activity Description	Orig Dur
4680	MEP Rough-ins	15
1810	Install Metal Panels & Soffits	20
1720	Install Metal Panels @	30
2140	Install Flooring Level 1 - 5	30
4690	Hang & Finish Drywall	10
2060	Prime & Paint Walls Level 1 - 5	30
4700	Prime & Paint Walls	10
1820	Install Roofing	10
4710	Install Ceiling Grid	5
2150	Install Metal Stud Walls	1
2160	MEP Rough-ins	1
2170	Hang & Finish Drywall	1
2190	Prime & Paint Walls	1
2180	Install Ceiling Grid	1
4720	Install Flooring	5
2200	MEP Trim-out	1
1980	Install Casework, Millwork &	30
4730	Install Casework, Millwork &	10
2100	Install Ceiling Grid Level 1 - 5	30
4740	MEP Trim-out	10
1990	MEP Trim-out Level 1 - 5	60
2130	Install Flooring Level 1 - 5	30
2110	Install Casework, Millwork &	30
2120	MEP Trim-out Level 1 - 5	40
40000	Substantial Completion	0
40050	Commissioning	50
50000	Project Closeout	50
40100	Owner & A/E's Punchlist	10
40500	Complete Punchlist	20
51000	PROJECT COMPLETE 6-23-08	0



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Barton Malow Company

CSC Health & Human Service Building

Classic Schedule Layout

Date	Revision	Checked	Approved

APPENDIX B

INTERVIEW MATERIAL

Cover letter
Survey Questions
Interview Notes

Management of the Risk Associated with Material Cost Escalation

My name is Corinne Ambler and I am currently a senior architectural engineering student at The Pennsylvania State University. I am pursing a bachelor degree in the construction management option; one of the requirements is to perform a senior capstone project that relates to a current construction project.

The construction project that my thesis focuses on is a five-story academic facility for Coppin State University located in Baltimore, Maryland. The project had some difficulties with material escalation especially because Hurricane Katrina hit during the bidding of the project. I am expanding my research to include the entire industry.

The goal of this research project is to address the following questions:

1. How can owners, designers, construction managers, and contractors manage the risk of volatile materials?
2. How will using alternate materials impact the construction process?

After analyzing the answers of the four different parties, I will propose a tool that will allow each party to evaluate the risk associated with the use of each volatile material in the project.

By responding, I would like to schedule a thirty-minute phone conversation to discuss this study. Please let me know your availability. Thank you in advance for taking the time to participate in this study. Your insight will allow for a better understanding of the issues associated with this topic. Please feel free to contact me with any questions.

Respectfully,

Corinne Ambler
The Pennsylvania State University
Bachelor of Architectural Engineering Candidate
Phone: 215.850.6755
Email: cra140@psu.edu
http://www.arche.psu.edu/thesis/eportfolio/2007/portfolios/CRA140/

Material Escalation Survey for Contractors

Name of Compay:

Please check your area(s) of construction expertise.

- ☐ Mechanical
- ☐ Electrical
- ☐ Steel
- ☐ Glass Systems
- ☐ Metal Panels
- ☐ Concrete
- ☐ Masonry
- ☐ Miscellaneous Metals
- ☐ Fire Protection
- ☐ Ceilings and Partitions

Which material(s) create the most risk when bidding/procuring a project?

- ☐ Copper
- ☐ Glass
- ☐ Aluminum
- ☐ Steel
- ☐ Drywall
- ☐ Concrete

How do you manage the risk involved with material cost escalation (check all that apply)?

- ☐ Pre-purchase of volatile materials in bulk
- ☐ Contract Clauses
- ☐ Increased bid

Do you incorporate a multiplier in your material estimate for the escalation of material prices?

- ☐ Yes
- ☐ No

If yes, how much of your total bid?

- ☐ 1-5%
- ☐ 5-10%
- ☐ 15-20%
- ☐ 20-30%

How many different suppliers do you typically have for one material?

- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4+

How long will a supplier hold their price?

- ☐ 1-14 Days
- ☐ 30-59 days
- ☐ 15-29 Days
- ☐ > 60 Days

Please list any other methods used to combat material escalation or any comments you have.

Material Escalation Survey for Designers

What is your area of design expertise?

- ☐ Architect
- ☐ Mechanical
- ☐ Structural
- ☐ Electrical
- ☐ Other _____

Please check your area(s) of expertise.

- ☐ Academic - University
- ☐ Acade University
- ☐ Health Care/Lab
- ☐ Hotel/Condo
- ☐ Industrial
- ☐ Office Building
- ☐ Specialty
- ☐ Sports Facility
- ☐ Other

Is volitatity of material prices a factor in the design process?

- ☐ Yes
- ☐ No

Please rank the materials as they affect the design. (1-Most 6-Least)

- ☐ Copper
- ☐ Steel
- ☐ Glass
- ☐ Drywall
- ☐ Aluminum
- ☐ Concrete

Material Escalation Survey for Construction Managers

Who is your typical owner?

☐ Public ☐ Private ☐ Both

What types of buildings do you build (check all that apply)?

☐ Academic
☐ Health Care/Lab
☐ Hotel/Condo
☐ Industrial
☐ Office Building
☐ Specialty
☐ Sports Facility
☐ Other

What material prices typically affect the budget the most?

☐ Copper
☐ Glass
☐ Aluminum
☐ Steel
☐ Drywall
☐ Concrete

How do you compensate for the cost of material escalation (check all that apply)?

☐ Value Engineering
☐ Pre-purchase of volatile materials
☐ Contingency for each material
☐ General Contingency
☐ Contract Clause

For hard bid projects (GMP) do you include a mark-up for material escalation?

☐ Yes ☐ No

If yes, how much of the project cost?

☐ 1-5%
☐ 5-10%
☐ 15-20%
☐ 20-30%

After project award, do you re-estimate the cost before bidding the project to sub-contractors?

☐ Yes ☐ No

Material Escalation for Owners

How are your projects typically funded?

☐ Public ☐ Private

What types of buildings do you own/build (check all that apply)?

☐ Academic
☐ Health Care/Lab
☐ Hotel/Condo
☐ Industrial
☐ Office Building
☐ Specialty
☐ Sports Facility
☐ Other

Do you take cost escalation into account when planning a project?

☐ Yes - Just General Inflation
☐ Yes - Inflation and Cost Escalation
☐ No

Do you put money aside for the increase in material prices when allocating your budget?

☐ Yes ☐ No

If yes, how much of your budget?

☐ 1-5%
☐ 5-10%
☐ 15-20%
☐ 20-30%

Which would you prefer?

☐ A higher and more accurate cost estimate
☐ A lower cost estimate that has the ability to change at any given time

If you would prefer a higher but more accurate cost estimate

What percent more of your total bidget are you willing to pay?

☐ 1-5%
☐ 5-10%
☐ 15-20%
☐ 20-30%

Would you prefer contractors to have a separate contingency for material escalation?

☐ Yes ☐ No

Material Escalation interview Notes

Construction Managers

Bob Grottenthaler

-Glass- long lead time for raw materials mean very long lead time for finished product
-Steel used for structure and reinforcing – has no good alternate
-Concrete – increased due to petroleum prices more expensive to manufacture & truck
-Copper – just for pipes and wire
-Masonry – Expensive due to lack of skilled masons – labor cost very high
-Global economy changed – 1-2 weeks started taking 6-8 weeks some suppliers only gave part of order (30 of 50 valves at first) can delay schedule
-Value Engineering – happens after bid – if budget is over 5% or less
-Pre-purchase of materials – contractor has better relationship with supplier to lock in. Risky and harder for CM to get a better price
-CM needs to make sure all scopes cover everything and don't double cover if pre-purchase mechanical equipment make sure contractor has start-up and training in scope
-General Contingency – established in GMP – Market Contingency – owner can store too much money and then not have enough for brick and mortar
-Have contractor do base bid and then deduct/add alternates according to material prices too may alternates are undesirable to contractor make base bid due first and alternate after vendors like to give price at last minute especially light fixtures and gear
-China has bought up a lot of materials which leaves shortages
-Create a reasonable escalation percentage during estimate phase
-Architects and Designers make it difficult with proprietary specifications which makes it difficult for the contractor to acquire materials
-Award to subcontractors as early as possible
-After project awarded to CM scope is written then each scope is estimated to compare to actual bid received from contractor
-Budget way over after bid – owner sometimes ask shell out area and will fit it out later
-Work with low bidder to let them know they are the lowest but they are still over budget – allows contractor to know they can get the work if they need it
-Re-bid to get in budget sometimes after 2-3 weeks can get new contractors – need to reject all from first bid and increase competition
-In a hard bid may not get a bid for each spec section
-Hard for contractor to hold bid price and keep bid bond

Lee Evey

-Escalation is a function of time – the longer it takes to produce the more expensive it becomes
-Design Build's duration is shorter than design-bid-build so the time is already decreased
-CIAA – Sanveto and Mark Conchar paper
  -6% less expensive then design-bid-build
  -12% saved in construction
  -33% saved in program
-Usually everyone pushes off the risk to someone else and the owner starts the push – it gets pushed all the way down to the contractor
-Design Build gives each party an appropriate portion of risk
-It is effective because it enables interaction between people which causes communications about software and materials
-when oriented as a TEAM more likely to solve problems together which reduces the total risk
-Example- Pentagon
  -Create and Award Fee and incentive features – causes more teamwork and reliance on other parties
  -Award fee is a profit opportunity
  -Owner/CM controls the fee and contractors bid on pure cost without inflation
  -Materials basket used for cost escalation
  -Design-bid-build there is no motivation for contractor to work with owner – the owner just wants the lowest cost and the project is more likely to have change orders because the contractor under-bid the project
  -each contractor is asked to propose the best product the contractor knows the budget and his fee and needs to respond to owners – goal, challenges, problems, constraints, and budget
-This method forces contractors to think outside of the box and come up with good solutions to earn their 10% fee (which is unheard of)
  -owner has already set aside 10% of budget for fees
  -contractors want to be part of the project because it is a great opportunity to make a big profit
-gets everyone away from price based competition and focuses on more solutions for a successful project
-Contractor is evaluated on quality, effective communication, and safety every three months – must pass evaluation to receive all of profit (live up to their end of the agreement)
-Forms a high quality project from good behaviors
-if the contractor can do what he said he can do and save money then the contractor and owner split the savings 50/50
-establishes a strong relationship between the owner and the contractors
-Escalation controlled by a source selection process
-Two parts of the bidding
-First part anyone can bid and the owner looks at past performance – includes team and experience – recently, relevancy, quality
-Three parties are selected to compete in next part of selection
-Phase two is when the 3 competitors respond to the goals, challenges, problems, constraints, and budget
-A performance requirement is agreed upon – quiet, clean and quality – all pre-defined
-Everyone has a fair proportion of risk otherwise game of roulette for contractors

-Price everything in today's prices and then take escalation into accountant each quarter
-Market Basket- steel, concrete, drywall, and copper – escalation covered by owner
-Current bids- "rip them and read them" award to the biggest liar
-BIM, VE, Sustainability, Commissioning operate poorly in design bid build
-BIM is a database and produces a report for design, material list, renderings, schedules
-Design Build decreases/eliminates schedule over-run litigation

Sarah Forrest - Estimator

-Calculation of material escalation depends on material of building and time frame
-if notice to proceed is soon may not include anything for material escalation
-if long negotiated job then use Beck's index (historical index) and have relationship with new-core steel mill to get flyer monthly with the change (up or down) in steel prices – new core works with structural shapes and rebar
-HP has graphed the monthly reports from new core as an extra tool
-3 months ago steel leveled off now it has started to increase again
-have a similar process for tracking cement
-rely heavily on subs for copper and drywall escalation
-ENR has index and can be good reference for copper and drywall
-Can become a problem in volatile market, pay too much of a premium for something that will never happen
-Past example: agreement with sub for rebar HP would get a quartly review of price increase and adjust payment to sub accordingly for the amount delivered to site that quarter
-If owner is willing can change materials – copper to aluminum or aluminum to copper
-In some contracts owners carry risk and create a similar situation with HP as the rebar sub
-For a GMP give most of the risk to the subs
-If early enough in design HP will take risk and manage it until they can sell it off to the subs
-Design Build is a very good way to manage material escalation
-work hard with architect and check budget daily to manage costs
-one project concrete and steel was designed and then picked according to price

Mike Miller

-Pre-purchase steel and copper that can be used on most jobs.
-Buy in bulk using a 30-day look ahead
-Hurricane Katrina impact on oil rigs increased price of PVC piping
-Supplier and Contractor have include escalation in price
-Commodity items can hold price for 90 days
-Buy from multiple vendors/mills based on supply and demand
-Carry contingency for escalation
-Can change materials for VE – Copper, Galvanized, and Stainless Steel
-Cast iron very high consider using plastic
-95% of projects are in-house design and construction
-In-house helps with over designs that waste material and creates more constructible solutions
-Keep the same amount of contingency for escalation

Economist

Ken Simonson

-Chief economist for Associated General Contractors of America
-Job is to keep people informed about material price inflation and trends
-Provide documentation for owners on behalf of contractor to justify dramatic increase in material prices
-Membership of organization is all contractors so that is who he mainly deals with
-Contractors have varied opinions on willingness to participate in design build
-Best way contractor manage risk
  -work with owner and designer at early phase to allow them to realize volatility
  -owner can consider providing separate pricing to reduce contractor risk
  -allow contractor to buy materials early to lock in price
  -contractor includes widest range in price
-CM risk depends on flexibility of the owner to get more money
-Very little to no designer interaction (unfortunately more true than should be)
-Owners need to increase their awareness in order to adapt to availability of materials
-Katrina and Rita cause PVC pipe and insulation harder to make due to increase
  -steel, diesel fuel, gypsum, copper
  -cement increase 10% each year in last 3 years lots of energy goes into processing and shipping

Owner

Jorge Scotti

-Develop cost of building then develop percentage for escalation.
-General inflation and market conditions taken into account
-Amount depends on size and length of project around 3-6%
-Take out a contingency for unforeseen conditions
-Bid out to contractors and assume that escalation is taken into their bid amount
-Contractor responsible for all of risk
-Award to lowest bidder
-If bid comes in high – ask state for more money or revise scope of project
-State of Maryland will not approve a higher price unless documentation is provided
-Contract is fixed number
-10-15% of projects are design build

Designer

Merton Harris – Mechanical

-Designs academic, and health care/lab facilities
-Steel is the #1 most volatile
-Takes the volatility of materials into consideration when designing but can't say how
-Will change the design if the budget is over as long as the building is still functional
-Some materials come into play when asked to VE but most are un-changeable

Matt Herbert - Architect

-DCI has own estimator who checked BMC's estimate after each submission
-Building material is picked to perform a certain way and the budget is a second consideration
-The right design is addressed first for the area/campus/owner
-Building envelope tends to affect the budget the most

Hope Furrer - Structural

-Two or three alternate studies (systems) are considered
-An estimate is performed by the construction manager for each system
-Then a system is selected

Contractor

David Allen Company – Ceramic, Terrazzo, marble

-Pre-purchase volatile materials in bulk
-Increases bid
-Multiplies bid by 5-10% for escalation of material prices
-3 different suppliers
-Supplier will hold price for ceramics for one year and 60 days for stone

Homewood General Contractors – Concrete, Lumber, Specialty (doors and hardware)

-Uses contract clauses for specialty items
-Increases bid for lumber and concrete
-Multiplies 5-10% for escalation of material prices
-Uses just one supplier
-Supplier will hold price for 30-59 days

Finishes Inc – Ceilings and Partitions

-Believes drywall and steel create most risk when bidding and procuring
-Uses contract clauses to manage risk
-Multiplies bid by 5-10% for escalation of material prices
-Uses one supplier
-Supplier will hold prices for sixty days or more
-After letter of intent is sent ask vendors for "vendor quote sheets" so prices can be compared. Tell vendor how long they need them to hold prices but most will not hold for more than one year

Zephyr Aluminum – Glass Systems

-Believe that glass and aluminum is the riskiest
-Uses contract clauses and increases bid to manage the risk
-Does not incorporate multiplier for material escalation
-Uses three different suppliers
-Supplier will hold price for 30-59 days

MBR Construction Services - Electrical

-Believes copper, aluminum, and steel have most risk
-Pre-purchases volatile materials in bulk
-Multiplies bid by 5-10% for material escalation
-Uses 3 different suppliers
-Supplier will hold price for 1-14 days

-Electrical is a two step process – run the raceway (being conduit or cable tray made of steel or aluminum) and install the process thru the first system being copper, aluminum, or fiber cable

Sody Concrete

-Concrete and rebar
-It is a back and forth whether cost of cement or steel (rebar) is the driver for increase in concrete bids (relative to the time of year)
-Rebar escalation $25/ton increase per quarter – projected escalation
-Cement Escalation – on average 3-5% increase
-Uses contract clauses a little mainly increases bid (padding 5-10%)
-Price of lumber for formwork has also escalated which in turn increases concrete bid
-4 different ready mix vendors
-Use 2 rebar subs mainly 1 due to a good relationship
-Ready Mix vender will hold prices for one year
-Rebar vendor will hold price for 2-3 months

APPENDIX C

MONTHLY SOLAR HEAT GAIN TABLES

The tables in this appendix are for a four foot overhang and a distance of zero between the sunshade and the head of the window.

January

Solar Time	Altitude (degrees)	Azimuth (degrees)	Shadow Length (ft)			Percent Shaded (SF)			Solar Heat Gain Factor (Btu/h-ft2)				Solar Heat Gain (Btu)				Solar Heat Gain Coefficient	Sunny Days per Month	Hourly Btu
			South	East	West	South	East	West	North	South	East	West	North	South	East	West			
8	8.1	55.3	1.00	0.69	0.00	0.15	0.09	0.00	5	75	111	5	3159	11210	139665	8427	0.4	12	779816
9	16.8	44	1.68	1.74	0.00	0.25	0.24	0.00	12	160	154	12	7583	21403	166418	20225	0.4	12	1035021
10	23.8	30.9	2.06	3.44	0.00	0.30	0.47	0.00	16	213	124	16	10110	26612	101517	26967	0.4	12	792987
11	28.4	16	2.25	7.85	0.00	0.33	1.00	0.00	19	244	61	19	12006	29414	26276	32023	0.4	12	478654
12	30	0	2.31	0.00	0.00	0.34	0.00	0.00	20	254	21	21	12638	30280	29042	35394	0.4	12	515299
1	28.4	16	2.25	0.00	7.85	0.33	0.00	1.00	19	244	19	61	12006	29414	26276	32023	0.4	12	478654
2	23.8	30.9	2.06	0.00	3.44	0.30	0.00	0.47	16	213	16	124	10110	26612	22127	123722	0.4	12	876341
3	16.8	44	1.68	0.00	1.74	0.25	0.00	0.24	12	160	12	154	7583	21403	16595	202820	0.4	12	1192325
4	8.1	55.3	1.00	0.00	0.69	0.15	0.00	0.09	5	75	5	111	3159	11210	6915	170215	0.4	12	919196
																		Total Btu:	**7068294**

February

Solar Time	Altitude (degrees)	Azimuth (degrees)	Shadow Length (ft)			Percent Shaded (SF)			Solar Heat Gain Factor (Btu/h-ft2)				Solar Heat Gain (Btu)				Solar Heat Gain Coefficient	Sunny Days per Month	Hourly Btu
			South	East	West	South	East	West	North	South	East	West	North	South	East	West			
7	4.8	72.7	1.13	0.35	0.00	0.17	0.05	0.00	2	14	1	51	1264	2080	1449	85958	0.4	11.5	417454
8	15.4	62.2	2.36	1.25	0.00	0.35	0.17	0.00	10	94	183	10	6319	11245	212443	16854	0.4	11.5	1135564
9	25	50.2	2.91	2.43	0.00	0.43	0.33	0.00	16	157	186	16	10110	16770	179395	26967	0.4	11.5	1072913
10	32.8	35.9	3.18	4.40	0.00	0.47	0.60	0.00	21	203	143	21	13270	20469	96616	35394	0.4	11.5	762447
11	38.1	18.9	3.32	9.68	0.00	0.49	1.00	0.00	23	231	71	23	14533	22520	31808	38765	0.4	11.5	495082
12	40	0	3.36	0.00	0.00	0.49	0.00	0.00	24	241	25	25	15165	23269	34574	42136	0.4	11.5	529661
1	38.1	18.9	3.32	0.00	9.68	0.49	0.00	1.00	23	231	23	71	14533	22520	31808	38765	0.4	11.5	495082
2	32.8	35.9	3.18	0.00	4.40	0.47	0.00	0.60	21	203	21	143	13270	20469	29042	117750	0.4	11.5	830439
3	25	50.2	2.91	0.00	2.43	0.43	0.00	0.33	16	157	16	186	10110	16770	22127	218635	0.4	11.5	1231154
4	15.4	62.2	2.36	0.00	1.25	0.35	0.00	0.17	10	94	10	183	6319	11245	13829	258912	0.4	11.5	1335406
5	4.8	72.7	1.13	0.00	0.35	0.17	0.00	0.05	2	14	51	2	1264	2080	2766	81996	0.4	11.5	405286
																		Total Btu:	**8293033**

March

Solar Time	Altitude (degrees)	Azimuth (degrees)	Shadow Length (ft)			Percent Shaded (SF)			Solar Heat Gain Factor (Btu/h-ft2)				Solar Heat Gain (Btu)				Solar Heat Gain Coefficient	Sunny Days per Month	Hourly Btu
			South	East	West	South	East	West	North	South	East	West	North	South	East	West			
7	11.4	80.2	4.74	0.82	0.00	0.69	0.11	0.00	9	22	8	163	5687	2248	11218	274727	0.4	12.5	1469401
8	22.5	69.6	4.75	1.77	0.00	0.70	0.24	0.00	16	74	218	16	10110	5826	234143	26967	0.4	12.5	1385230
9	32.8	57.3	4.77	3.06	0.00	0.70	0.42	0.00	21	128	203	21	13270	9224	175598	35394	0.4	12.5	1167428
10	41.6	41.9	4.77	5.32	0.00	0.70	0.73	0.00	25	171	153	25	15797	11954	83227	42136	0.4	12.5	765574
11	47.7	22.6	4.76	11.44	0.00	0.70	1.00	0.00	28	197	78	28	17693	13717	38722	47192	0.4	12.5	586624
12	50	0	4.77	0.00	0.00	0.70	0.00	0.00	29	206	31	31	18325	14286	42871	52249	0.4	12.5	638652
1	47.7	22.6	4.76	0.00	11.44	0.70	0.00	1.00	28	197	28	78	17693	13717	38722	47192	0.4	12.5	586624
2	41.6	41.9	4.77	0.00	5.32	0.70	0.00	0.73	25	171	25	153	15797	11954	34574	101432	0.4	12.5	818786
3	32.8	57.3	4.77	0.00	3.06	0.70	0.00	0.42	21	128	21	203	13270	9224	29042	214007	0.4	12.5	1327713
4	22.5	69.6	4.75	0.00	1.77	0.70	0.00	0.24	16	74	16	218	10110	5826	22127	285358	0.4	12.5	1617107
5	11.4	80.2	4.74	0.00	0.82	0.69	0.00	0.11	9	22	163	8	5687	2248	11064	245758	0.4	12.5	1323781
																		Total Btu:	**10217519**

April

Solar Time	Altitude (degrees)	Azimuth (degrees)	Shadow Length (ft)			Percent Shaded (SF)			Solar Heat Gain Factor (Btu/h-ft2)				Solar Heat Gain (Btu)				Solar Heat Gain Coefficient	Sunny Days per Month	Hourly Btu
			South	East	West	South	East	West	North	South	East	West	North	South	East	West			
6	7.4	98.9	-3.36	0.53	0.00	0.00	0.07	0.00	11	5	88	5	6951	866	114063	8427	0.4	12.5	651535
7	18.9	89.5	156.94	1.37	0.00	1.00	0.19	0.00	16	16	201	14	10110	2770	230191	23596	0.4	12.5	1333335
8	30.3	79.3	12.59	2.38	0.00	1.00	0.32	0.00	22	41	224	21	13902	3808	219163	35394	0.4	12.5	1361337
9	41.3	67.2	9.07	3.81	0.00	1.00	0.52	0.00	27	83	202	27	17061	4674	153553	45507	0.4	12.5	1103974
10	51.2	51.4	7.97	6.37	0.00	1.00	0.87	0.00	31	121	152	31	19589	5366	64949	52249	0.4	12.5	710765
11	58.7	29.2	7.54	13.49	0.00	1.00	1.00	0.00	33	146	81	33	20852	5713	45637	55620	0.4	12.5	639109
12	61.6	0	7.40	0.00	0.00	1.00	0.00	0.00	34	154	36	36	21484	5886	49786	60676	0.4	12.5	689160
1	58.7	29.2	7.54	13.49	13.49	1.00	1.00	1.00	33	146	33	81	20852	5713	45637	55620	0.4	12.5	639109
2	51.2	51.4	7.97	0.00	6.37	1.00	0.00	0.87	31	121	31	152	19589	5366	42871	79156	0.4	12.5	734911
3	41.3	67.2	9.07	0.00	3.81	1.00	0.00	0.52	27	83	27	202	17061	4674	37340	187140	0.4	12.5	1231075
4	30.3	79.3	12.59	0.00	2.38	1.00	0.00	0.32	22	41	21	224	13902	3808	29042	267102	0.4	12.5	1569269
5	18.9	89.5	156.94	0.00	1.37	1.00	0.00	0.19	16	16	14	201	10110	2770	19361	280542	0.4	12.5	1563915
6	7.4	98.9	-3.36	0.00	0.53	0.00	0.00	0.07	11	5	5	88	6951	866	121699	9152	0.4	12.5	693339
																		Total Btu:	**12269298**

May

Solar Time	Altitude (degrees)	Azimuth (degrees)	Shadow Length (ft)			Percent Shaded (SF)			Solar Heat Gain Factor (Btu/h-ft2)				Solar Heat Gain (Btu)				Solar Heat Gain Coefficient	Sunny Days per Month	Hourly Btu
			South	East	West	South	East	West	North	South	East	West	North	South	East	West			
5	1.9	114.7	-0.32	0.15	0.00	0.00	0.02	0.00	0	0	1	0	0	0	1355	0	0.4	13	7048
6	12.7	105.6	-3.35	0.94	0.00	0.00	0.13	0.00	36	10	141	10	22748	1731	176463	16854	0.4	13	1132541
7	24	96.6	-15.49	1.79	0.00	0.00	0.24	0.00	28	20	209	19	17693	3462	227841	32023	0.4	13	1461301
8	35.4	87.2	58.19	2.85	0.00	1.00	0.39	0.00	27	29	220	25	17061	4674	200661	42136	0.4	13	1375568
9	46.8	76	17.61	4.39	0.00	1.00	0.60	0.00	31	53	197	30	19589	5366	135013	50563	0.4	13	1094762
10	57.5	60.9	12.91	7.19	0.00	1.00	0.98	0.00	34	83	148	34	21484	5886	50192	57305	0.4	13	701310
11	66.2	37.1	11.37	15.03	0.00	1.00	1.00	0.00	36	105	81	36	22748	6232	49786	60676	0.4	13	725098
12	70	0	10.99	0.00	0.00	1.00	0.00	0.00	37	113	40	40	23380	6405	55318	67418	0.4	13	793107
1	66.2	37.1	11.37	0.00	15.03	1.00	0.00	1.00	36	105	36	81	22748	6232	49786	60676	0.4	13	725098
2	57.5	60.9	12.91	0.00	7.19	1.00	0.00	0.98	34	83	34	148	21484	5886	47020	61171	0.4	13	704917
3	46.8	76	17.61	0.00	4.39	1.00	0.00	0.60	31	53	30	197	19589	5366	41488	164545	0.4	13	1201139
4	35.4	87.2	58.19	0.00	2.85	1.00	0.00	0.39	27	29	25	220	17061	4674	34574	244553	0.4	13	1564481
5	24	96.6	-15.49	0.00	1.79	0.00	0.00	0.24	28	20	19	209	17693	3462	26276	277678	0.4	13	1690566
6	12.7	105.6	-3.35	0.00	0.94	0.00	0.00	0.13	36	10	10	141	22748	1731	13829	215062	0.4	13	1317525
7	1.9	114.7	-0.32	0.00	0.15	0.00	0.00	0.02	0	0	0	1	0	0	0	1652	0.4	13	8590
																		Total Btu:	**14496006**

June

Solar Time	Altitude (degrees)	Azimuth (degrees)	Shadow Length (ft)			Percent Shaded (SF)			Solar Heat Gain Factor (Btu/h-ft2)				Solar Heat Gain (Btu)				Solar Heat Gain Coefficient	Sunny Days per Month	Hourly Btu
			South	East	West	South	East	West	North	South	East	West	North	South	East	West			
5	4.2	117.3	-0.64	0.33	0.00	0.00	0.05	0.00	10	1	20	1	6319	173	27036	1685	0.4	13.5	190150
6	14.8	108.4	-3.35	1.11	0.00	0.00	0.15	0.00	48	13	151	13	30331	2250	187190	21911	0.4	13.5	1305084
7	26	99.7	-11.58	1.98	0.00	0.00	0.27	0.00	37	22	207	21	23380	3808	222817	35394	0.4	13.5	1541159
8	37.4	90.7	-250.33	3.06	0.00	0.00	0.42	0.00	30	29	216	27	18957	5020	191436	45507	0.4	13.5	1408967
9	48.8	80.2	26.84	4.64	0.00	1.00	0.63	0.00	33	45	192	32	20852	5713	126491	53934	0.4	13.5	1117749
10	59.8	65.8	16.77	7.53	0.00	1.00	1.00	0.00	35	69	145	35	22116	6059	48403	58991	0.4	13.5	732071
11	69.2	41.9	14.15	15.77	0.00	1.00	1.00	0.00	38	88	81	38	24012	6578	52552	64047	0.4	13.5	794819
12	73.5	0	13.50	0.00	0.00	1.00	0.00	0.00	38	95	41	41	24012	6578	56701	69103	0.4	13.5	844527
1	69.2	41.9	14.15	0.00	15.77	1.00	0.00	1.00	38	88	38	81	24012	6578	52552	64047	0.4	13.5	794819
2	59.8	65.8	16.77	0.00	7.53	1.00	0.00	1.00	35	69	35	145	22116	6059	48403	58991	0.4	13.5	732071
3	48.8	80.2	26.84	0.00	4.64	1.00	0.00	0.63	33	45	32	192	20852	5713	44254	154160	0.4	13.5	1214885
4	37.4	90.7	-250.33	0.00	3.06	0.00	0.00	0.42	30	29	27	216	18957	5020	37340	233310	0.4	13.5	1590982
5	26	99.7	-11.58	0.00	1.98	0.00	0.00	0.27	37	22	21	207	23380	3808	29042	271555	0.4	13.5	1770042
6	14.8	108.4	-3.35	0.00	1.11	0.00	0.00	0.15	48	13	13	151	30331	2250	17978	228136	0.4	13.5	1504953
7	4.2	117.3	-0.64	0.00	0.33	0.00	0.00	0.05	10	1	1	20	6319	173	1383	32949	0.4	13.5	220450
																		Total Btu:	**15572578**

July

Solar Time	Altitude (degrees)	Azimuth (degrees)	Shadow Length (ft)			Percent Shaded (SF)			Solar Heat Gain Factor (Btu/h-ft2)				Solar Heat Gain (Btu)				Solar Heat Gain Coefficient	Sunny Days per Month	Hourly Btu
			South	East	West	South	East	West	North	South	East	West	North	South	East	West			
5	2.3	115.2	-0.38	0.18	0.00	0.00	0.02	0.00	1	0	2	0	632	0	2732	0	0.4	15	20186
6	13.1	106.1	-3.36	0.97	0.00	0.00	0.13	0.00	37	11	137	11	23380	1904	171193	18540	0.4	15	1290102
7	24.3	97.2	-14.41	1.82	0.00	0.00	0.25	0.00	30	21	201	20	18957	3635	219267	33709	0.4	15	1653409
8	35.8	87.8	75.15	2.89	0.00	1.00	0.39	0.00	28	30	216	26	17693	4847	196361	43822	0.4	15	1576333
9	47.2	76.7	18.78	4.44	0.00	1.00	0.61	0.00	32	52	193	31	20220	5540	132142	52249	0.4	15	1260906
10	57.9	61.7	13.45	7.24	0.00	1.00	0.99	0.00	35	81	146	35	22116	6059	50312	58991	0.4	15	824864
11	66.7	37.9	11.77	15.12	0.00	1.00	1.00	0.00	37	102	81	37	23380	6405	51169	62361	0.4	15	859892
12	70.6	0	11.36	0.00	0.00	1.00	0.00	0.00	38	109	41	41	24012	6578	56701	69103	0.4	15	938364
1	66.7	37.9	11.77	0.00	15.12	1.00	0.00	1.00	37	102	37	81	23380	6405	51169	62361	0.4	15	859892
2	57.9	61.7	13.45	0.00	7.24	1.00	0.00	0.99	35	81	35	146	22116	6059	48403	61317	0.4	15	827369
3	47.2	76.7	18.78	0.00	4.44	1.00	0.00	0.61	32	52	31	193	20220	5540	42871	161046	0.4	15	1378066
4	35.8	87.8	75.15	0.00	2.89	1.00	0.00	0.39	28	30	26	216	17693	4847	35957	239312	0.4	15	1786850
5	24.3	97.2	-14.41	0.00	1.82	0.00	0.00	0.25	30	21	20	201	18957	3635	27659	267229	0.4	15	1904879
6	13.1	106.1	-3.36	0.00	0.97	0.00	0.00	0.13	37	11	11	137	23380	1904	15212	208639	0.4	15	1494813
7	2.3	115.2	-0.38	0.00	0.18	0.00	0.00	0.02	1	0	0	2	632	0	0	3330	0.4	15	23772
																		Total Btu:	**16679511**

August

Solar Time	Altitude (degrees)	Azimuth (degrees)	Shadow Length (ft)			Percent Shaded (SF)			Solar Heat Gain Factor (Btu/h-ft2)				Solar Heat Gain (Btu)				Solar Heat Gain Coefficient	Sunny Days per Month	Hourly Btu
			South	East	West	South	East	West	North	South	East	West	North	South	East	West			
6	7.9	99.5	-3.36	0.56	0.00	0.00	0.08	0.00	12	6	82	5	7583	1039	104858	8427	0.4	14.5	707060
7	19.3	90.1	-802.59	1.40	0.00	0.00	0.19	0.00	17	17	191	16	10742	2943	214249	26967	0.4	14.5	1478427
8	30.7	79.9	13.54	2.41	0.00	1.00	0.33	0.00	24	41	216	23	15165	4155	201816	38765	0.4	14.5	1507425
9	41.8	67.9	9.51	3.86	0.00	1.00	0.53	0.00	28	80	197	28	17693	4847	131588	47192	0.4	14.5	1167661
10	51.7	52.1	8.25	6.42	0.00	1.00	0.88	0.00	32	116	150	32	20220	5540	30722	53934	0.4	14.5	640413
11	59.3	29.7	7.76	13.60	0.00	1.00	1.00	0.00	35	141	81	35	22116	6059	6059	58991	0.4	14.5	540702
12	62.3	0	7.62	0.00	0.00	1.00	0.00	0.00	35	149	38	38	22116	6059	52552	64047	0.4	14.5	839688
1	59.3	29.7	7.76	0.00	13.60	1.00	0.00	1.00	35	141	35	81	22116	6059	48403	6059	0.4	14.5	479294
2	51.7	52.1	8.25	0.00	6.42	1.00	0.00	0.88	32	116	32	150	20220	5540	44254	36381	0.4	14.5	617094
3	41.8	67.9	9.51	0.00	3.86	1.00	0.00	0.53	28	80	28	197	17693	4847	38722	159813	0.4	14.5	1282240
4	30.7	79.9	13.54	0.00	2.41	1.00	0.00	0.33	24	41	23	216	15165	4155	31808	245661	0.4	14.5	1721375
5	19.3	90.1	-802.59	0.00	1.40	0.00	0.00	0.19	17	17	16	191	10742	2943	22127	260990	0.4	14.5	1721454
6	7.9	99.5	-3.36	0.00	0.56	0.00	0.00	0.08	12	6	5	82	7583	1039	6915	127760	0.4	14.5	831116
																		Total Btu:	**13533949**

September

Solar Time	Altitude (degrees)	Azimuth (degrees)	Shadow Length (ft)			Percent Shaded (SF)			Solar Heat Gain Factor (Btu/h-ft2)				Solar Heat Gain (Btu)				Solar Heat Gain Coefficient	Sunny Days per Month	Hourly Btu
			South	East	West	South	East	West	North	South	East	West	North	South	East	West			
7	11.4	80.2	4.74	0.82	0.00	0.69	0.11	0.00	9	21	146	9	5687	2195	180764	15169	0.4	15.5	1263649
8	22.5	69.6	4.75	1.77	0.00	0.70	0.24	0.00	17	71	205	17	10742	5788	220831	28653	0.4	15.5	1649290
9	32.8	57.3	4.77	3.06	0.00	0.70	0.42	0.00	22	124	194	22	13902	9136	168928	37080	0.4	15.5	1420081
10	41.6	41.9	4.77	5.32	0.00	0.70	0.73	0.00	27	165	148	27	17061	11883	83332	45507	0.4	15.5	978255
11	47.7	22.6	4.76	11.44	0.00	0.70	1.00	0.00	29	191	78	29	18325	13523	40105	48878	0.4	15.5	749151
12	50	0	4.77	0.00	0.00	0.70	0.00	0.00	30	200	32	32	18957	14092	44254	53934	0.4	15.5	813672
1	47.7	22.6	4.76	0.00	11.44	0.70	0.00	1.00	29	191	29	78	18325	13523	40105	48878	0.4	15.5	749151
2	41.6	41.9	4.77	0.00	5.32	0.70	0.00	0.73	27	165	27	148	17061	11883	37340	101560	0.4	15.5	1040628
3	32.8	57.3	4.77	0.00	3.06	0.70	0.00	0.42	22	124	22	194	13902	9136	30425	205879	0.4	15.5	1607914
4	22.5	69.6	4.75	0.00	1.77	0.70	0.00	0.24	17	71	17	205	10742	5788	23510	269135	0.4	15.5	1916890
5	11.4	80.2	4.74	0.00	0.82	0.69	0.00	0.11	9	21	9	146	5687	2195	12447	220303	0.4	15.5	1491915
																		Total Btu:	**13680595**

October

Solar Time	Altitude (degrees)	Azimuth (degrees)	Shadow Length (ft)			Percent Shaded (SF)			Solar Heat Gain Factor (Btu/h-ft2)				Solar Heat Gain (Btu)				Solar Heat Gain Coefficient	Sunny Days per Month	Hourly Btu
			South	East	West	South	East	West	North	South	East	West	North	South	East	West			
7	4.5	72.3	1.04	0.33	0.00	0.15	0.05	0.00	2	12	45	2	1264	1815	59553	3371	0.4	16	422416
8	15	61.9	2.28	1.22	0.00	0.33	0.17	0.00	11	89	173	11	6951	10910	202130	18540	0.4	16	1526600
9	24.5	49.8	2.82	2.39	0.00	0.41	0.33	0.00	17	151	180	17	10742	16553	175567	28653	0.4	16	1481690
10	32.4	35.6	3.12	4.36	0.00	0.46	0.59	0.00	21	196	139	21	13270	20089	95191	35394	0.4	16	1049241
11	37.6	18.7	3.25	9.61	0.00	0.48	1.00	0.00	24	224	71	24	15165	22300	33191	40451	0.4	16	711080
12	39.5	0	3.30	0.00	0.00	0.48	0.00	0.00	25	234	27	27	15797	23050	37340	45507	0.4	16	778838
1	37.6	18.7	3.25	0.00	9.61	0.48	0.00	1.00	24	224	24	71	15165	22300	33191	40451	0.4	16	711080
2	32.4	35.6	3.12	0.00	4.36	0.46	0.00	0.59	21	196	21	139	13270	20089	29042	116013	0.4	16	1141844
3	24.5	49.8	2.82	0.00	2.39	0.41	0.00	0.33	17	151	17	180	10742	16553	23510	213970	0.4	16	1694557
4	15	61.9	2.28	0.00	1.22	0.33	0.00	0.17	11	89	11	173	6951	10910	15212	246343	0.4	16	1788268
5	4.5	72.3	1.04	0.00	0.33	0.15	0.00	0.05	2	12	2	45	1264	1815	2766	72579	0.4	16	501913
																		Total Btu:	**11807527**

November

Solar Time	Altitude (degrees)	Azimuth (degrees)	Shadow Length (ft)			Percent Shaded (SF)			Solar Heat Gain Factor (Btu/h-ft2)				Solar Heat Gain (Btu)				Solar Heat Gain Coefficient	Sunny Days per Month	Hourly Btu
			South	East	West	South	East	West	North	South	East	West	North	South	East	West			
8	8.2	55.4	1.02	0.70	0.00	0.15	0.10	0.00	5	72	108	5	3159	10741	135756	8427	0.4	12	758802
9	17	44.1	1.70	1.76	0.00	0.25	0.24	0.00	12	156	181	12	7583	20793	194307	20225	0.4	12	1165958
10	24	31	2.08	3.46	0.00	0.30	0.47	0.00	16	209	122	16	10110	26022	99598	26967	0.4	12	780945
11	28.6	16.1	2.27	7.86	0.00	0.33	1.00	0.00	19	240	61	19	12006	28838	26276	32023	0.4	12	475889
12	30.2	0	2.33	0.00	0.00	0.34	0.00	0.00	20	250	21	21	12638	29713	29042	35394	0.4	12	512577
1	28.6	16.1	2.27	0.00	7.86	0.33	0.00	1.00	19	240	19	61	12006	28838	26276	32023	0.4	12	475889
2	24	31	2.08	0.00	3.46	0.30	0.00	0.47	16	209	16	122	10110	26022	22127	121383	0.4	12	862284
3	17	44.1	1.70	0.00	1.76	0.25	0.00	0.24	12	156	12	181	7583	20793	16595	236809	0.4	12	1352544
4	8.2	55.4	1.02	0.00	0.70	0.15	0.00	0.10	5	72	5	108	3159	10741	6915	165451	0.4	12	894077
																		Total Btu:	**7278966**

December

Solar Time	Altitude (degrees)	Azimuth (degrees)	Shadow Length (ft)			Percent Shaded (SF)			Solar Heat Gain Factor (Btu/h-ft2)				Solar Heat Gain (Btu)				Solar Heat Gain Coefficient	Sunny Days per Month	Hourly Btu
			South	East	West	South	East	West	North	South	East	West	North	South	East	West			
8	5.5	53	0.64	0.48	0.00	0.09	0.07	0.00	3	50	67	3	1896	7894	86837	5056	0.4	11.5	467738
9	14	41.9	1.34	1.49	0.00	0.20	0.20	0.00	10	151	135	10	6319	21354	151495	16854	0.4	11.5	901700
10	20.7	29.4	1.73	3.08	0.00	0.25	0.42	0.00	14	210	113	14	8846	27739	98789	23596	0.4	11.5	731266
11	25	15.2	1.93	7.11	0.00	0.28	0.97	0.00	17	242	56	17	10742	30876	25123	28653	0.4	11.5	438808
12	26.6	0	2.00	0.00	0.00	0.29	0.00	0.00	18	253	19	19	11374	31872	26276	32023	0.4	11.5	467110
1	25	15.2	1.93	0.00	7.11	0.28	0.00	0.97	17	242	17	56	10742	30876	23510	30618	0.4	11.5	440431
2	20.7	29.4	1.73	0.00	3.08	0.25	0.00	0.42	14	210	14	113	8846	27739	19361	120398	0.4	11.5	811185
3	14	41.9	1.34	0.00	1.49	0.20	0.00	0.20	10	151	10	135	6319	21354	13829	184632	0.4	11.5	1040217
4	5.5	53	0.64	0.00	0.48	0.09	0.00	0.07	3	50	3	67	1896	7894	4149	105831	0.4	11.5	550937
																		Total Btu:	**5849392**

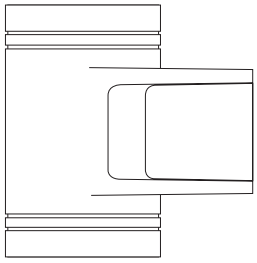
APPENDIX D

LUMINAIRE CUT SHEETS

Notes: Job:
Type:

CYLINDERS

301 LINE UP/DOWN



GENERAL DESCRIPTION: The Gardco 301 LINE is a series of high performance up/down wall mounted cylinders. Each luminaire utilizes a single high intensity discharge lamp and provides illumination above and below. Housings are diecast aluminum with twin architectural reveals at both the lower and upper apertures. Six (6) downlight and two (2) uplight optical systems are available. The unique optional "Spike" downlight and/or uplight distribution creates a dramatic narrow stripe of illumination on the wall or column. Luminaires are finished with a fade and abrasion resistant polyester powder coat offered in 5 standard colors.

ORDERING

PREFIX	MODEL	MOUNTING	TRIMS	WATTAGE	VOLTAGE	FINISH	OPTIONS

Enter the order code into the appropriate box above. Note: Gardco reserves the right to refuse a configuration. Not all combinations and configurations are valid. Refer to notes below for exclusions and limitations. For questions or concerns, please consult the factory.

PREFIX

301

MODEL

E Fully Enclosed

O Open Downlight

MOUNTING

W Wall Mount

TRIMS

Fully Enclosed "E" Units Only

L Obscuring lenses on uplight and downlight. Soft symmetrical distributions

LL Egg crate louvers on downlight. Obscuring lenses on uplight and downlight.

SD Spike downlight distribution. Obscuring lens on uplight

SU Spike uplight distribution. Obscuring lens on downlight

SB Spike uplight and downlight distributions.

FT Forward throw downlight distributions. Soft uplight glow. FT Trims utilize T6 lamps. Lamps are supplied with the luminaire

Open Downlight "O" Units Only

R Reflector produces medium downlight distribution with sharp cutoff to lamp and images. Obscuring lens on uplight.

B Black baffled downlight. Obscuring lens on uplight.

WATTAGE

Fully Enclosed "E" Units
(N/A with FT Trims)

50MH[1]
70MH
100MH
150MH
50HPS
70HPS
100HPS
150HPS[2]

FT Trims Only

T70MH
T150MH

Open Downlight "O" Units

50MH[1]
70MH
100MH
150MH
50HPS
70HPS
100HPS
150HPS

MH Metal Halide
HPS High Pressure Sodium

1. N/A with 347V
2. Contact factory for availabilty of 150HPS w/SD, SU or SB Trims

VOLTAGE

120
208
240
277
347

FINISH

BRP	Bronze Paint	**OC**	Optional Color Paint *Specify RAL designation ex: OC-RAL7024*
BLP	Black Paint		
WP	White Paint		
NP	Natural Aluminum Paint	**SC**	Special Color Paint *Specify Must supply color chip*
BGP	Beige Paint		
VP	Verde Green Paint		

OPTIONS

F	Fusing
RCA	Round Column Mounting Adapter
WS	Wall Mounted J-Box for Surface Conduit

A Genlyte Company

Gardco Lighting
2661 Alvarado Street
San Leandro, CA 94577

800/227-0758
510/357-6900 in California
Fax: 510/357-3088
www.sitelighting.com

GARDCO LIGHTING

79115-112/0604

CYLINDERS

301 LINE UP/DOWN

SPECIFICATIONS

HOUSINGS:
Housings are single-piece diecast aluminum cylindrical forms with integral side wall mounting canopy / ballast chambers. Provided mounting brackets are galvanized steel.

OPTICAL SYSTEMS:
Lens (L): The uplight and downlight components both utilize twin (four total per luminaire) spun specular Alzak reflectors which provide the symmetrical distributions. The uplight-obscuring lens is flush mounted and the downlight-obscuring lens is regressed. The lenses soften the distribution and conceal the optical system and internal hardware.

Louvers (LL): Diecast aluminum egg crate louvers are installed over the downlight-obscuring lens. All other optical elements are as described in the Lens (L) option.

Spike Downlight (SD): Inner and outer spun specular Alzak reflectors provide a very narrow spot beam at nadir. Uplight optical system is as described in the Lens (L) option.

Spike Uplight (SU): Inner and outer spun specular Alzak reflectors provide a very narrow spot at zenith. Downlight optical system is as described in the Lens (L) option.

Spike Both Uplight and Downlight (SB): Two sets of inner and outer spun specular Alzak reflectors provide very narrow spot beams at nadir and zenith.

Reflector (R): Spun specular Alzak reflector produces a medium symmetrical downlight distribution with sharp cutoff to lamp and lamp images. Uplight optical system is as described in the Lens (L) option.

Baffle (B): Upper spun specular Alzak reflector and lower black baffle produce a medium symmetrical downlight distribution with exceptional control of high angle brightness. Uplight optical system is as described in the Lens (L) option.

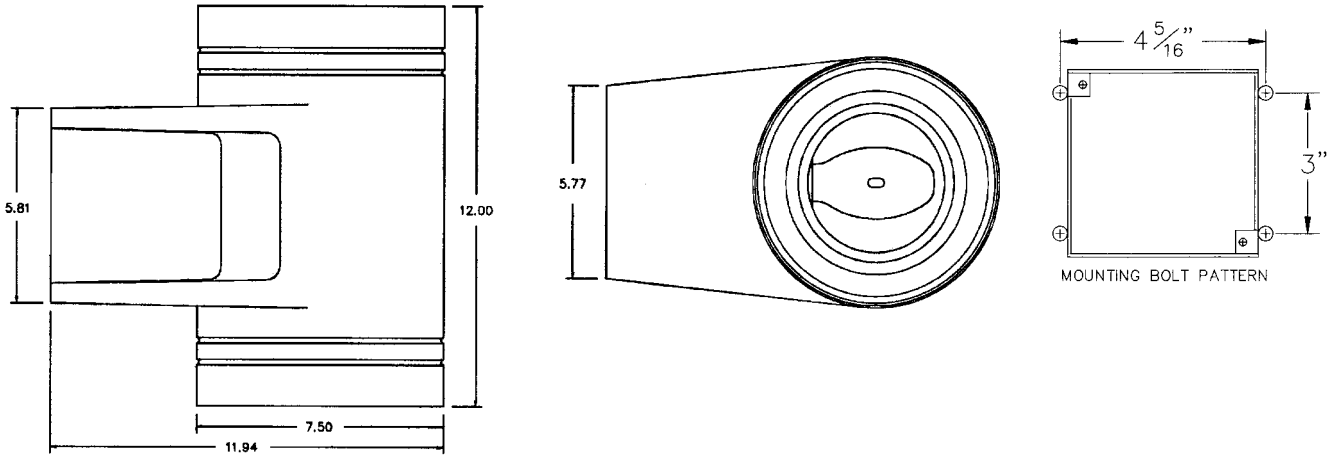
Forward Throw (FT) Faceted specular Alzak reflector system produces an asymmetric forward projecting distribution. Secondary optical system with obscuring lens produces a soft uplight glow.

ELECTRICAL:
All luminaires utilize magnetic HID ballasts that are high power factor and designed for reliable lamp starting to -20° F. Pulse rated sockets are glazed porcelain with nickel plated screw shells.

FINISH:
Each luminaire receives a fade and abrasion resistant electrostatically applied, thermally cured, (TGIC) polyester powder coat finish. Standard finishes are textured.

LABELS:
All fixtures bear UL or CUL (where applicable) Wet Location labels.

DIMENSIONS AND MOUNTING DETAIL



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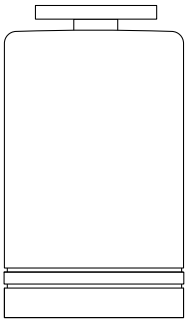
GARDCO LIGHTING

79115-112/0604

Notes: Job:
Type:

CYLINDERS

300 LINE OPEN DOWNLIGHT



GENERAL DESCRIPTION: The Gardco 300 LINE is a series of compact, high performance cylinder luminaires in a variety of styles and mounting configurations. The Open Downlight style uses high intensity discharge, incandescent or fluorescent lamps. Housings are diecast aluminum with twin architectural reveals located near the luminaire apertures. A choice of two (2) light control styles and three (3) mounting options is available. Luminaires are finished with a fade and abrasion resistant polyester powder coat offered in five standard colors.

ORDERING

300 Open Downlight Luminaires installed in the normal downlight position meet IESNA Full Cutoff criteria.

PREFIX	MODEL	MOUNTING	TRIMS	LAMP	VOLTAGE	FINISH	OPTIONS

Enter the order code into the appropriate box above. Note: Gardco reserves the right to refuse a configuration. Not all combinations and configurations are valid. Refer to notes below for exclusions and limitations. For questions or concerns, please consult the factory.

PREFIX

300

MODEL

O Open Downlight

MOUNTING

C Ceiling

P Pendant

Standard pendant length is 18". Stated length is the distance from the ceiling to the top of the luminaire and takes into account the mounting hardware. For other stem lengths, add desired length in inches after "P". ex. 300-D-P24-L-50HPS-120-BRP (for 24").

W Wall Mount

TRIMS

R Reflector

B Black Baffle
(n/a with Fluorescent)

Luminaires cannot be field modified to change optics or lamp types.

LAMP/VOLTAGE CHART

LAMP/VOLTAGE CHART

Voltage:	120	208	240	277	347	480
E17						
50MH[2]	●			●	●	
70MH[2]	●	●	●	●	●	
100MH[2]	●	●	●	●	●	●
50HPS	●			●	●	
70HPS	●	●	●	●	●	
100HPS	●	●	●	●		
PAR38						
P70MH[1]	●	●	●	●	●	
P100MH[1]	●	●	●	●	●	●
P70HPS[1]	●	●	●	●	●	
Fluorescent (Type "R" Trim only)						
26QF[3]	●	●	●	●	●	
32TRF[3]	●	●	●	●	●	
42TRF[3]	●	●	●	●	●	
Incandescent						
250PAR38[1]	●					
300R40[1]	●					

MH - Metal Halide HPS - High Pressure Sodium
QF - Quad Fluorescent TRF - Triple Tube Fluorescent

Luminaires cannot be field modified to change optics or lamp types.

1. *Not available with reflector (R) trim.*
2. *Must use open fixture rated E-17 Metal Halide lamps.*
3. *Fluorescent units feature an electronic fluorescent ballast that accepts 120V through 277V or 347V only. Starting temperature is 0°F.*

FINISH

BRP	Bronze Paint	**OC**	Optional Color Paint *Specify RAL designation ex: OC-RAL7024*
BLP	Black Paint		
WP	White Paint		
NP	Natural Aluminum Paint	**SC**	Special Color Paint *Specify. Must supply color chip*
BGP	Beige Paint		
VP	Verde Green Paint		

OPTIONS

F Fusing

PCB Button Type Photocontrol *(Contact factory for availability)*

WS Wall Mounted Box for Surface Conduit

Genlyte Thomas Group LLC

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GARDCO LIGHTING

79115-105/1104

CYLINDERS

300 LINE OPEN DOWNLIGHT

SPECIFICATIONS

HOUSING: Housings are diecast aluminum in a single-piece cylindrical form of corrosion resistant alloy, 1/8" min. wall thickness. Units are 7.5" in diameter and 12" in height, nominal measurements.

MOUNTING:

Ceiling (C): Provides for direct ceiling mount as shown.

Pendant Assembly (P): Swivel pendant assembly with locking set screws. Standard pendant length is 18". Stated length is the distance from the ceiling to the top of the luminaire and takes into account the mounting hardware. For other stem lengths, add desired length in inches after ``P". Can accommodate 35° sloped ceiling maximum.

Wall Bracket (W): Cast aluminum canopy with integrated aluminum arm secured to housing with (2) 5/16" bolts. Requires mounting to a structural member of the building.

LIGHT CONTROL (Trim):

Reflector (R): Reflectors are composed of spun Alzak® components, electro-polished, anodized and sealed. Reflectors for compact fluorescent lamps feature a dual stage construction.

Baffle (B): Step black baffles are die cast aluminum and finished with black TGIC powdercoat

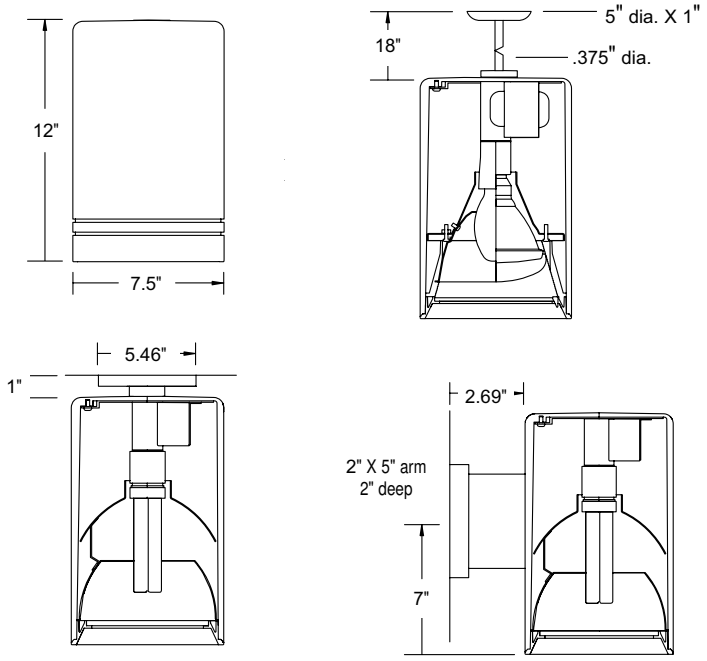
ELECTRICAL: Internal ballast will be provided based on the specified lamp configuration. Standard fluorescent ballasts are solid state. Standard and dimming fluorescent units have a starting temperature of 0°F (-18°C). Dimming range is 15% to 100% (42F/120v only).

LAMPHOLDER: Pulse rated medium base lampholders are glazed porcelain with nickel-plated screw shell. Fluorescent lampholders are high temperature thermoplastic (PBT) with brass alloy contacts.

FINISH: Each luminaire receives a fade and abrasion resistant, electrostatically applied, thermally cured, textured TGIC polyester powder coat finish.

LABELS: All fixtures bear UL or CUL (where applicable) Wet Location labels

DIMENSIONS AND MOUNTING DETAIL



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GARDCO LIGHTING

79115-105/1104

87516 – GEMH50-MSF-120

GE HID UltraMax™ Electronic Low Frequency Ballast

GENERAL CHARACTERISTICS

Application	1- 50W M110 M/C148 120V High Effeciency Low Frequency Electronic HID
Category	High Intensity Discharge
Ballast Type	Electronic - Low Frequency
Line Voltage Regulation (+/-)	10 %
Ambient Temperature (MAX)	55 °C (131 °F)
Case Temperature (MAX)	90 °C (194 °F)
Ballast Factor	Normal
Circuit Type	Electronic
Sound Rating	A (20-24 decibels)
Enclosure Type	Plastic
Distance to Lamp (MAX)	8 ft
Additional Info	End of Life Protection (EOL), Thermally protected

ELECTRICAL CHARACTERISTICS

Lamp Operating Frequency	130 Hz
Supply Current Frequency	60 Hz/50

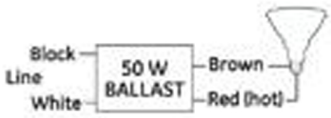
PRODUCT INFORMATION

Product Code	87516
Description	GEMH50-MSF-120
Standard Package	Case
Standard Package GTIN	10043168875162
Standard Package Quantity	10
Sales Unit	Case
No Of Items Per Sales Unit	1
No Of Items Per Standard Package	10
UPC	043168875165

View Larger

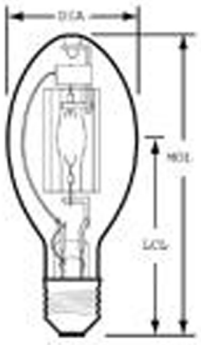
DIMENSIONS

Case dimensions			
Length (L)	3.7 in (94.99 mm)		
Width (W)	2.9 in (75.69 mm)		
Height (H)	1.2 in (30.73 mm)		
Mounting dimensions			
Mount Length (M)	3.3 in (86.10 mm)		
Mount Width (X or F)	2.5 in (63.75 mm)		
Mount Slots (MS)	0.1 in (4.31 mm)		
Weight	0.62 lbs		
Exit Type	Side		
Remote mounting distance to lamp	8 ft		
Remote Mounting Wire Gauge	18 AWG		
Lead lengths	Qty	Exit	Length (± 1 in.)
Brown	1	Right	10 in (254 mm)
Red	1	Right	10 in (254 mm)
Black	1	Left	10 in (254 mm)
White	1	Left	10 in (254 mm)



45670 – MXR50/U/MED/O

GE Protected Multi-Vapor® PulseArc® Quartz Metal Halide ED17



Bulb

Base

View Larger

GENERAL CHARACTERISTICS

Lamp type	High Intensity Discharge - Quartz Metal Halide
Bulb	ED17
Base	Medium Screw (E26)
Bulb Finish	Clear
Wattage	50
Voltage	85
Rated Life	10000 hrs
Bulb Material	Hard glass
Lamp Enclosure Type (LET)	Open or enclosed fixtures

PHOTOMETRIC CHARACTERISTICS

Initial Lumens	3400
Mean Lumens	1700
Nominal Initial Lumens per Watt	68
Color Temperature	3500 K
Color Rendering Index (CRI)	70
Effective Arc Length	0.300000 in (7.620000 mm)

ELECTRICAL CHARACTERISTICS

Burn Position	Universal burning position
Open Circuit Voltage (peak lead ballast) (MIN)	332 V
Open Circuit Voltage (RMS lag ballast) (MIN)	235 V
Warm Up Time to 90% (MIN)	2 min
Warm Up Time to 90% (MAX)	5 min
Hot Restart Time to 90% (MIN)	10 min
Hot Restart Time to 90% (MAX)	15 min

DIMENSIONS

Maximum Overall Length (MOL)	5.4300 in (137.9 mm)
Nominal Length	5.430 in (137.9 mm)
Bulb Diameter (DIA)	2.125 in (53.9 mm)
Light Center Length (LCL)	3.430 in (87.1 mm)

ADDITIONAL RESOURCES

Catalogs

Testimonials

Brochures

Application/Segment Brochures

- Contractor Lighting
- Retail Lighting

Product Brochures

- HID Lamps
- Industrial Lighting

MSDS (Material Safety Data Sheets)

Disposal Policies & Recycling Information

GRAPHS & CHARTS

Spectral Power Distribution