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	 	<h3 style="text-decoration: underline;">Presentation Outline</h3> <ul style="list-style-type: none"> <li>• Project Overview</li> <li>• Analysis #1 - BIM Analysis</li> <li>• Analysis #2 - PTAC Analysis</li> <li>• Analysis #3 - Parking Structure Analysis</li> <li>• Summary &amp; Conclusions</li> <li>• Acknowledgements</li> <li>• Questions</li> </ul>	 	
<a href="#">Overview</a>   <a href="#">BIM Analysis</a>   <a href="#">PTAC Analysis</a>   <a href="#">Parking Structure Analysis</a>   <a href="#">Summary</a>   <a href="#">Acknowledgements</a>   <a href="#">Questions</a>				

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	 	<h3 style="text-align: center;">Project Background</h3> <hr/> <p><b><u>Aloft Hotel</u></b></p> <ul style="list-style-type: none"> <li>• 7 Stories – 142 Guestrooms – 76,883 SF</li> </ul> <p><b><u>Element Hotel (Extended Stay)</u></b></p> <ul style="list-style-type: none"> <li>• 7 Stories - 149 Guestrooms – 97,923 SF</li> </ul> <p><b><u>Parking Structure</u></b></p> <ul style="list-style-type: none"> <li>• 2 Stories – 118 Spaces – 34,700 SF</li> </ul>	 	
<p><small>Overview   BIM Analysis   PTAC Analysis   Parking Structure Analysis   Summary   Acknowledgements   Questions</small></p>				

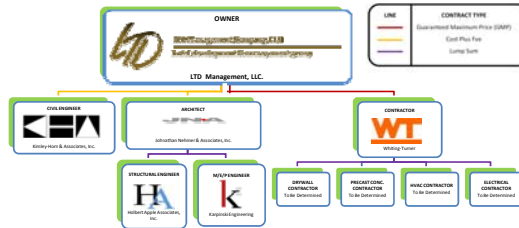
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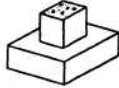



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### Project Team & Organization



Overview | BIM Analysis | PTAC Analysis | Parking Structure Analysis | Summary | Acknowledgements | Questions

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	 	<h3 style="text-decoration: underline;">Structure - Hotels</h3> <ul style="list-style-type: none"> <li>•Cast In Place Spread Footings </li> <li>•Load Bearing Steel Studs </li> <li>•8" Hollow Core Planks</li> </ul>	 	
		<p><small>Overview   BIM Analysis   PTAC Analysis   Parking Structure Analysis   Summary   Acknowledgements   Questions</small></p>		

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	 	<h3>Structure – Parking Structure</h3> <ul style="list-style-type: none"><li>•Cast-in-Place Concrete</li></ul> 	 	
<p><b>Overview</b>   BIM Analysis   PTAC Analysis   Parking Structure Analysis   Summary   Acknowledgements   Questions</p>				

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### Location



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	 	<h3>Site</h3> 	 	
<p><b>Overview</b>   BIM Analysis   PTAC Analysis   Parking Structure Analysis   Summary   Acknowledgements   Questions</p>				



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### Project Costs





CSI DIVISION	ALOFT		ELEMENT		PARKING STRUCTURE		SITE
	Amount	Cost/SF	Amount	Cost/SF	Amount	Cost/SF	Amount
00 Building Requirements	NA	NA	NA	NA	NA	NA	NA
01 General Requirements	\$ 900,000	\$ 11.71	\$ 1,040,000	\$ 30.21	\$ 50,000	\$ 1.40	\$ 201,000
02 Site Work	NA	NA	NA	NA	NA	NA	\$ 2,400,000
03 Concrete	\$ 1,100,000	\$ 14.31	\$ 1,300,000	\$ 13.20	\$ 800,000	\$ 23.05	NA
04 Masonry	NA	NA	NA	NA	NA	NA	\$ 20,000
05 Metals	\$ 600,000	\$ 7.80	\$ 600,000	\$ 6.13	\$ 30,000	\$ 0.86	\$ 20,000
06 Wood & Plastics	\$ 400,000	\$ 5.30	\$ 1,200,000	\$ 12.25	NA	NA	NA
07 Thermal & Moisture Protection	\$ 1,000,000	\$ 13.01	\$ 1,200,000	\$ 12.25	\$ 20,000	\$ 0.58	NA
08 Doors & Windows	\$ 1,200,000	\$ 16.31	\$ 1,100,000	\$ 11.23	NA	NA	NA
09 Finishes	\$ 2,800,000	\$ 36.42	\$ 3,800,000	\$ 38.81	\$ 10,000	\$ 0.29	NA
10 Specialties	\$ 100,000	\$ 1.30	\$ 100,000	\$ 1.00	\$ 1,000	\$ 0.03	\$ 10,000
11 Equipment	NA	NA	NA	NA	NA	NA	NA
12 Miscellaneous	NA	NA	NA	NA	NA	NA	NA
13 Special Contracts	\$ 14,520,000	\$ 189.00	\$ 15,820,000	\$ 161.04	\$ 961,000	\$ 27.60	\$ 2,960,000
14 Emerging System	\$ 0	\$ 0.00	\$ 0	\$ 0.00	\$ 0	\$ 0.00	\$ 0
15 Mechanical (Plum)	\$ 0	\$ 0.00	\$ 0	\$ 0.00	\$ 0	\$ 0.00	\$ 0
16 Electrical	\$ 0	\$ 0.00	\$ 0	\$ 0.00	\$ 0	\$ 0.00	\$ 0
TOTAL	\$ 14,520,000	\$ 189.00	\$ 15,820,000	\$ 161.04	\$ 961,000	\$ 27.60	\$ 2,960,000





Total: \$36 Million











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	 	<h3>Challenges Faced</h3> <hr/> <ul style="list-style-type: none"><li>•Over Budget</li><li>•Poor Quality Construction Documents</li></ul>	 	
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<p><small>Overview   BIM Analysis   PTAC Analysis   Parking Structure Analysis   Summary   Acknowledgements   Questions</small></p>				

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	 	<p><b>Analysis #1 – BIM Analysis</b></p> <hr/> <p><b>Development of Methodology to Evaluate the Effectiveness of BIM</b></p>	 	
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 		<h3 style="text-align: center;">Current Method used by One Contractor</h3> <ul style="list-style-type: none"> <li>•Categorize Clashes into Types</li> <li>•Assign material cost/hour and labor cost/hour to Types</li> <li>•Multiply by estimated time to “solve” clash</li> <li>•Total costs of clashes</li> <li>•Total costs reduced by 50% to account for overestimating to achieve final cost of clashes</li> <li>•Reduce final cost by 75% to account for clashes that may have been detected through other coordination processes</li> <li>•Achieve “<i>Estimated Cost of Avoidance</i>”</li> </ul>	 	
<p style="font-size: small; text-align: center;">Overview   <b>BIM Analysis</b>   PTAC Analysis   Parking Structure Analysis   Summary   Acknowledgements   Questions</p>				

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	 	<p><b>“Comparison of Construction Metrics”</b></p> <hr/> <p>BIM Project vs. Non-BIM project</p> <p>“BIM” – Virtual coordination and clash detection</p> <p>Same:</p> <ul style="list-style-type: none"> <li>•Contractor/Construction Manager</li> <li>•Project Manager</li> </ul>	 	
		<p><small>Overview   <b>BIM Analysis</b>   PTAC Analysis   Parking Structure Analysis   Summary   Acknowledgements   Questions</small></p>		

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	 	<h3 style="text-align: center;">"Comparison of Construction Metrics"</h3> <hr/> <ul style="list-style-type: none"> <li>• <b>Number of RFI's per a square footage</b> <ul style="list-style-type: none"> <li>•Ex. 1.79 RFI's / 1,000 SF</li> </ul> </li>   <li>• <b>Number of RFI's per a dollar amount</b> <ul style="list-style-type: none"> <li>•Ex. 2.95 RFI's / \$1 million</li> </ul> </li>   <li>• <b>Number of change orders per a square footage</b> <ul style="list-style-type: none"> <li>•Do NOT include owner changes</li> <li>•Do NOT include CO's that encompass entire contract amount</li> <li>•Ex. 0.95 CO's / 1,000 SF</li> </ul> </li> </ul>	 	
<p style="font-size: small; text-align: center;">Overview   <b>BIM Analysis</b>   PTAC Analysis   Parking Structure Analysis   Summary   Acknowledgements   Questions</p>				

	PHILIP CORRIE	AE SENIOR THESIS	CONSTRUCTION MANAGEMENT	
	 	<h3 style="text-align: center;">"Comparison of Construction Metrics"</h3> <ul style="list-style-type: none"> <li>• <b>Number of change orders per a dollar amount</b> <ul style="list-style-type: none"> <li>• Do NOT include owner changes</li> <li>• Do NOT include CO's that encompass entire contract amount</li> <li>• Ex. 1.24 CO's / \$1 million</li> </ul> </li>   <li>• <b>Ratio of total construction contingency used relative to the total cost of change orders</b> <ul style="list-style-type: none"> <li>• Do NOT include contingency spent at owners request</li> <li>• Ex. \$346 : \$1 (Lower ratio the better)</li> </ul> </li>   <li>• <b>Ratio of the amount of contingency used relative to the total project cost compared to the total amount of contingency on the project relative to the total project cost</b> <ul style="list-style-type: none"> <li>• Do NOT include contingency spent at owners request</li> <li>• Ex. 0.8% / 5%</li> </ul> </li> </ul>	 	
<p style="font-size: small; text-align: center;">Overview   <b>BIM Analysis</b>   PTAC Analysis   Parking Structure Analysis   Summary   Acknowledgements   Questions</p>				

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### Case Study

	Ohio Data Center (RM Project)	South Dakota Data Center
Total Project Costs	\$164.3 million	\$71.2 million
Total Square Footage	304,000 SF	185,000 SF
Cost per Square Foot	\$540.48	\$385.48
Total Project Contingency	\$4,947,753	\$2,366,930
Number of RFIs	211	310
Number of CO's*	251	43
Total cost of CO's**	\$1,473,000	\$65,991
Total Contingency Used**	\$1,371,139	\$79,182





\* Owner change orders and change orders meant to encompass work that was found in the initial construction documents were not included.  
 \*\* Contingency used at the owners request to improve the overall value of the building, was not included.

	Data Center (Ohio)	Data Center (South Dakota)
# of RFIs / 1000 SF	1.71	1.68
# of RFIs / \$1 million	3.17	4.23
# of CO's / 1000 SF	0.83	0.34
# of CO's / \$1 million	1.53	0.85
Total costs / CO costs	\$115 / \$1	\$1109 / \$1
Conting. Used/ Tot. Conting.	0.8%/3.0%	0.1%/3.2%



Overview | BIM Analysis | PTAC Analysis | Parking Structure Analysis | Summary | Acknowledgements | Questions



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	 	<h3 style="text-decoration: underline;">Findings</h3> <ul style="list-style-type: none"> <li>• <b>Many variables</b> <ul style="list-style-type: none"> <li>• Different owners have different mentalities</li> <li>• Different designers produce varying quality levels in drawings</li> </ul> </li> <li>• <b>Better comparison would be between two a BIM and non-BIM project with same:</b> <ul style="list-style-type: none"> <li>• Construction manager / general contractor</li> <li>• Project Manager</li> <li>• Owner</li> <li>• Design Firm</li> </ul> </li> <li>• <b>BIM software is not 100% perfect</b> <ul style="list-style-type: none"> <li>• Warn owners</li> </ul> </li> </ul>	 	
<p style="font-size: small; text-align: center;">Overview   <b>BIM Analysis</b>   PTAC Analysis   Parking Structure Analysis   Summary   Acknowledgements   Questions</p>				

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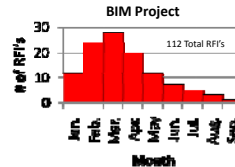
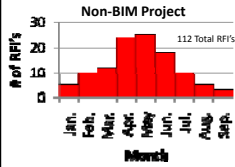
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### Findings





- RFI's comparisons
- Frequency can increase, decrease, or remain same
- Depends on RFI process
- RFI's should be weight more towards preconstruction and coordination







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	 	<p><b>Analysis #2 – PTAC Analysis</b></p> <hr/> <p><b>PTAC Units in Lieu of a Forced Air System</b></p>	 	
<p><small>Overview   BIM Analysis   <b>PTAC Analysis</b>   Parking Structure Analysis   Summary   Acknowledgements   Questions</small></p>				

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	 	<h3>Problem</h3> <hr/> <ul style="list-style-type: none"><li>• \$5.4 million</li><li>• 15% of total project cost</li></ul>	 	
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	 	<h3 style="text-decoration: underline;">Current System</h3> <ul style="list-style-type: none"> <li>• DX System</li> <li>• 3 Root-top Air Handling Units (RTU's) per hotel (6 total)</li> <li>• 12 variable refrigerant volume, air cooled condensing units per hotel (24 total)</li> <li>• 1 FCU per guestroom (289 total)</li> </ul>	 	
<p style="font-size: small; text-align: center;">Overview   BIM Analysis   <b>PTAC Analysis</b>   Parking Structure Analysis   Summary   Acknowledgements   Questions</p>				

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	 	<h3>Potential Solution</h3> <ul style="list-style-type: none"><li>•Package Terminal Air Conditioning Units (PTAC)</li></ul> 	 	
<p>Overview   BIM Analysis   <b>PTAC Analysis</b>   Parking Structure Analysis   Summary   Acknowledgements   Questions</p>				

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	 	<h3 style="text-align: center;">PTAC's</h3> <hr/> <p><b>Positives</b></p> <ul style="list-style-type: none"> <li>• Cheap</li> <li>• Easy and quick to install</li> </ul> <p><b>Negatives</b></p> <ul style="list-style-type: none"> <li>• Inefficient, excess energy consumption</li> <li>• Noise</li> <li>• Humidity</li> <li>• Moisture</li> <li>• Aesthetics</li> </ul>	 	
<p style="font-size: small; text-align: center;">Overview   BIM Analysis   <b>PTAC Analysis</b>   Parking Structure Analysis   Summary   Acknowledgements   Questions</p>				

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	 	<h3>Select PTAC Type</h3> <hr/> <p><b>Carrier® 52M Performance Series</b></p>  <ul style="list-style-type: none"> <li>• Quiet &amp; efficient</li> <li>• 65 CFM of outdoor air</li> <li>• Re-circulates 265 CFM of indoor air (Min)</li> </ul>	 	
<p><small>Overview   BIM Analysis   <b>PTAC Analysis</b>   Parking Structure Analysis   Summary   Acknowledgements   Questions</small></p>				



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## Mechanical Breadth - Size PTAC's

### Ventilation Air Equation





$$(SF \text{ of Room} \times 0.06) + \left( \frac{\# \text{ of People}}{\text{Room}} \right) \times (CFM / \text{Person}) = \text{Ventilation CFM}$$





### Typical Guestroom (Conference Room)

$$(562 SF \times 0.06) + \left( \frac{3 \text{ People}}{\text{Room}} \right) \times \left( 5 CFM / \text{Person} \right) = 48.72 CFM \quad \text{Okay}$$



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	 	<h3>Size PTAC's</h3> <hr/> <p><b>Required CFM of Air</b></p> $280 \text{ cfm}_{\text{Circulated Air}} - 65 \text{ cfm}_{\text{Outdoor Air}} = 215 \text{ cfm}_{\text{Indoor Air}}$ <p style="margin-left: 40px;">└──────────┘ From FCU's</p>	 	
<p style="font-size: small; text-align: center;">Overview   BIM Analysis   <b>PTAC Analysis</b>   Parking Structure Analysis   Summary   Acknowledgements   Questions</p>				

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	 	<h3 style="text-align: center;">Size PTAC's</h3> <hr/> <p><b>Baltimore Outdoor Design Temperatures</b>            Summer → 91°F            Winter → 13°F</p> <p><b>Hotel Indoor Design Temperatures</b>            Summer → 75°F            Winter → 70°F</p> <p><b>Design CFM</b></p> $CFM_{Total} = CFM_{Outdoor\ Air} + CFM_{Indoor\ Air}$ $CFM_{Total} = 65\ cfm + 265\ cfm$ $CFM_{Total} = 330\ cfm$	 	
<p style="font-size: small; text-align: center;">Overview   BIM Analysis   <b>PTAC Analysis</b>   Parking Structure Analysis   Summary   Acknowledgements   Questions</p>				

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### Sizing PTAC's

#### Cooling Load Determined

$$\begin{aligned}
 \text{Total Load} &= \frac{(\text{CFM}_{\text{Mechanical}} \times \Delta T_{\text{Mechanical}}) + (\text{CFM}_{\text{Mechanical}} \times \Delta T_{\text{Fan}})}{\text{CFM}_{\text{Total}}} \\
 \text{Total Load} &= \frac{(250 \text{ CFM} \times 15 \text{ }^\circ\text{F}) + (200 \text{ CFM} \times 7 \text{ }^\circ\text{F})}{350 \text{ CFM}} \\
 \text{Total Load} &= 76.2 \text{ TON} \\
 Q &= 1.08 \times \text{CFM}_{\text{Total}} \times (\text{Total Load} - \text{Fan Load}) \\
 Q &= 1.08 \times 350 \text{ CFM} \times (76.2 \text{ TON} - 7 \text{ }^\circ\text{F}) \\
 Q &= 1,140,000 \text{ BTU/h}
 \end{aligned}$$

#### Heating Load Determined

$$\begin{aligned}
 \text{Total Load} &= \frac{(\text{CFM}_{\text{Mechanical}} \times \Delta T_{\text{Mechanical}}) + (\text{CFM}_{\text{Mechanical}} \times \Delta T_{\text{Fan}})}{\text{CFM}_{\text{Total}}} \\
 \text{Total Load} &= \frac{(600 \text{ CFM} \times 12 \text{ }^\circ\text{F}) + (200 \text{ CFM} \times 7 \text{ }^\circ\text{F})}{800 \text{ CFM}} \\
 \text{Total Load} &= 56.25 \text{ TON} \\
 Q &= 1.08 \times \text{CFM}_{\text{Total}} \times (\text{Total Load} - \text{Fan Load}) \\
 Q &= 1.08 \times 800 \text{ CFM} \times (56.25 \text{ TON} - 7 \text{ }^\circ\text{F}) \\
 Q &= 4,000,000 \text{ BTU/h}
 \end{aligned}$$



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### PTAC's

#### Selection of PTAC

MODEL NUMBER	POWER RATING (KW)	SIR	RATED RUNNING H.P.	POWER FACTOR (%)	SHP	SHP RANGE	WATER LPM			COST/LIN	APPROX. NO. PEOPLE IN
							LOW	MID	HIGH		
52ME-U09-3	1500	1.0	1000	90	1000	1000-1500	100	100	100	100	100
52ME-U09-3	1500	1.0	1000	90	1000	1000-1500	100	100	100	100	100
52ME-U09-3	1500	1.0	1000	90	1000	1000-1500	100	100	100	100	100
52ME-U09-3	1500	1.0	1000	90	1000	1000-1500	100	100	100	100	100
52ME-U09-3	1500	1.0	1000	90	1000	1000-1500	100	100	100	100	100

#### Selection of Power Chord

Model No.	Power Rating (KW)	Running Amps (A)	Service Amps (A)	Service Voltage (V)	Service Phase	Service Grounding (V)	Service Frequency (Hz)	Service Type	Service Notes
52ME-U09-3	1500	1000	1500	480	3	480	60	3	3
52ME-U09-3	1500	1000	1500	480	3	480	60	3	3
52ME-U09-3	1500	1000	1500	480	3	480	60	3	3
52ME-U09-3	1500	1000	1500	480	3	480	60	3	3
52ME-U09-3	1500	1000	1500	480	3	480	60	3	3

52ME-U09-3 with PWRCORD-265V-15A



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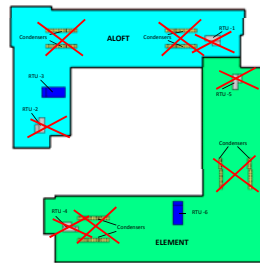
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### Implications

**Eliminate:**

- Rooftop HVAC Equipment
- Ductwork (Floors 2-Rooftop)
- FCU's (Floors 2-7)
- Grilles (Floors 2-7)
- Thermostats (Floors 2-7)
- Refrigerant piping
- Branch Selectors



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## Implications

### Cost

	ORIGINAL HVAC COST	ELIMINATED HVAC COST	PTAC COST	TOTAL SAVINGS	FINAL HVAC COST
ALLOFT	\$1,294,000	\$962,214	\$136,500	\$895,286	\$1,194,984
ELMERRY	\$1,048,300	\$1,388,984	\$141,100	\$889,786	\$1,508,704





Total HVAC Savings: \$1.7 million

### Scheduling





Activity	Aloft		Element	
	Orig. Duration	Final Duration	Orig. Duration	Final Duration
Set Rooftop Equip. & Hookup	24	* 12	22	* 9
Duct & FCUs	93	72	94	87
Refrigerant Piping	89	0	94	0
Developing & Trim	43	* 8	48	* 11
PTAC Units	0	* 29	0	* 13








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	 	<h3 style="text-align: center;">Other Considerations</h3> <hr/> <ul style="list-style-type: none"> <li>•Electrical System</li> <li>•Energy Consumption</li> <li>•Smaller Plenum Space</li> <li>•Roof-top Walkways</li> <li>•Fewer Roofing Penetrations</li> </ul>	 	
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	 	<p><b>Analysis #3 – Parking Structure</b></p> <hr/> <p><b>Parking Structure Value Engineering</b></p>	 	
<p><small>Overview   BIM Analysis   PTAC Analysis   <b>Parking Structure Analysis</b>   Summary   Acknowledgements   Questions</small></p>				

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	 	<h3 style="text-align: center;">Current Issues</h3> <hr/>  <ul style="list-style-type: none"> <li>• \$961,000 – 3% of Total Project Costs</li> <li>• Construction             <ul style="list-style-type: none"> <li>• December 5, 2007 – February 8, 2007</li> <li>• 48 working days</li> </ul> </li> <li>• Site of construction parking upon completion</li> </ul>	 	
<p style="font-size: small; text-align: center;">Overview   BIM Analysis   PTAC Analysis   <b>Parking Structure Analysis</b>   Summary   Acknowledgements   Questions</p>				

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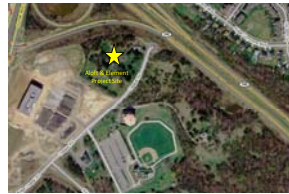
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## Construction Parking

Harmons Park (500 ft away)



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 	<h3 style="text-align: center;">Original Schedule</h3> <hr/> <table border="1"> <thead> <tr> <th>Task Name</th> <th>Duration</th> <th>Start</th> <th>Finish</th> </tr> </thead> <tbody> <tr> <td>PARKING STRUCTURE</td> <td>180 Days</td> <td>Week 1 (2008)</td> <td>Week 12 (2009)</td> </tr> <tr> <td>CONCRETE FOUNDATION</td> <td>24 Days</td> <td>Week 1 (2008)</td> <td>Week 1 (2008)</td> </tr> <tr> <td>CONCRETE SUPERSTRUCTURE</td> <td>100 Days</td> <td>Week 1 (2008)</td> <td>Week 12 (2008)</td> </tr> <tr style="border: 2px solid red;"> <td>ELEVATED CONCRETE DECK</td> <td>18 Days</td> <td>Week 1 (2008)</td> <td>Week 1 (2008)</td> </tr> <tr> <td>STEEL</td> <td>18 Days</td> <td>Week 1 (2008)</td> <td>Week 1 (2008)</td> </tr> <tr> <td>MECHANICAL</td> <td>8 Days</td> <td>Week 1 (2008)</td> <td>Week 1 (2008)</td> </tr> <tr> <td>ELECTRICAL &amp; PIPING</td> <td>7 Days</td> <td>Week 1 (2008)</td> <td>Week 1 (2008)</td> </tr> </tbody> </table> <ul style="list-style-type: none"> <li>• 111 Days of Float Time</li> <li>• Elevated Concrete Deck - 18 Days</li> </ul>	Task Name	Duration	Start	Finish	PARKING STRUCTURE	180 Days	Week 1 (2008)	Week 12 (2009)	CONCRETE FOUNDATION	24 Days	Week 1 (2008)	Week 1 (2008)	CONCRETE SUPERSTRUCTURE	100 Days	Week 1 (2008)	Week 12 (2008)	ELEVATED CONCRETE DECK	18 Days	Week 1 (2008)	Week 1 (2008)	STEEL	18 Days	Week 1 (2008)	Week 1 (2008)	MECHANICAL	8 Days	Week 1 (2008)	Week 1 (2008)	ELECTRICAL & PIPING	7 Days	Week 1 (2008)	Week 1 (2008)	 
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## Formwork Sequencing

### Minimize Formwork Material Costs



Elevated deck  
 33 days compared to 18 days  
 Early strip mix (3 days)  
 •\$300 - \$350 added



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### Structural Breadth - Formwork Design

- Plywood Decking
- Aluminum Joists & Stringers
- Doka® Props



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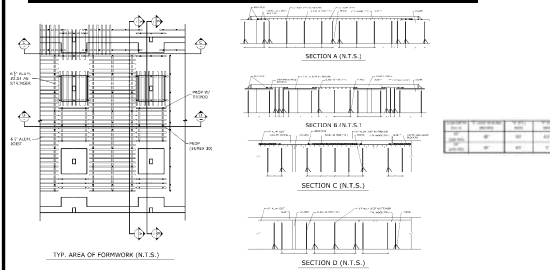
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## Formwork Design



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	 	<p style="text-align: center;"><b>Problems with Formwork Design and Sequencing</b></p> <hr/> <ul style="list-style-type: none"> <li>•Original 48 day construction schedule is feasible, ideal</li> <li>•Sufficient manpower and formwork material                             <ul style="list-style-type: none"> <li>•Minimizing formwork material does not necessarily mean reduced cost</li> </ul> </li> <li>•Lack of flow in work</li> </ul>	 	
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	 	<h3 style="text-decoration: underline;">Cold Weather Concrete Construction</h3> <ul style="list-style-type: none"> <li>•Winter construction ( Dec. 5, 2007 – Feb. 8, 2007)</li> <li>•Added costs from winter protection</li> </ul>	 	
<p style="font-size: small; text-align: center;"> <a href="#">Overview</a>   <a href="#">BIM Analysis</a>   <a href="#">PTAC Analysis</a>   <a href="#">Parking Structure Analysis</a>   <a href="#">Summary</a>   <a href="#">Acknowledgements</a>   <a href="#">Questions</a> </p>				

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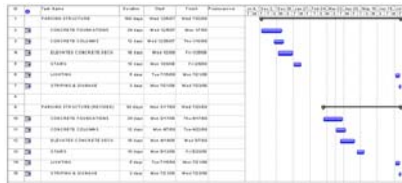
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### Cold Weather Concrete Construction

- Move start of parking structure to mid-March



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### Cost

#### Winter Protection

ITEM	QUANTITY	UNIT PRICE	CONTRACTOR	ESTIMATED COST	ESTIMATED SALES TAX	TOTAL
WINTER PROTECTION	1,000 SF	\$1.00		\$1,000.00	\$0.00	\$1,000.00
WINTER PROTECTION	1,000 SF	\$1.00		\$1,000.00	\$0.00	\$1,000.00
WINTER PROTECTION	1,000 SF	\$1.00		\$1,000.00	\$0.00	\$1,000.00
WINTER PROTECTION	1,000 SF	\$1.00		\$1,000.00	\$0.00	\$1,000.00
WINTER PROTECTION	1,000 SF	\$1.00		\$1,000.00	\$0.00	\$1,000.00
<b>TOTAL</b>				<b>\$5,000.00</b>	<b>\$0.00</b>	<b>\$5,000.00</b>

#### Accelerator Admixture

ITEM	QUANTITY OF CONCRETE	PER 100 CY CONCRETE	COST OF ADMIXTURE	ESTIMATED COST	ESTIMATED SALES TAX	TOTAL
ACCELERATOR ADMIXTURE	10,000 CY	\$0.05		\$500.00	\$0.00	\$500.00
ACCELERATOR ADMIXTURE	10,000 CY	\$0.05		\$500.00	\$0.00	\$500.00
ACCELERATOR ADMIXTURE	10,000 CY	\$0.05		\$500.00	\$0.00	\$500.00
ACCELERATOR ADMIXTURE	10,000 CY	\$0.05		\$500.00	\$0.00	\$500.00
ACCELERATOR ADMIXTURE	10,000 CY	\$0.05		\$500.00	\$0.00	\$500.00
<b>TOTAL</b>				<b>\$2,500.00</b>	<b>\$0.00</b>	<b>\$2,500.00</b>

#### Prerequisites:

- Formwork in possession
- Rebar previously purchased
- Concrete price “locked in”

Total Savings: \$38,200



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### Summary

- BIM Analysis**
  - Evaluate BIM with "Comparison of Construction Metrics"
  - Same GC/CM, PM, owner, designer
  - May yield unwanted results
  - Warn against imperfect software
  - RFI trends
- PTAC Analysis**
  - Huge Cost savings
  - Schedule savings
  - Weigh against negatives
- Parking Structure Analysis**
  - Original durations are ideal
  - Formwork design and sequencing will have little impact on cost
  - Eliminating winter concrete construction may result in savings



Overview | BIM Analysis | PTAC Analysis | Parking Structure Analysis | **Summary** | Acknowledgements | Questions

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<hr/>				
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