





BRIDGESIDE BUILDING II  
PITTSBURGH, PA








Erik Carlson  
Senior Thesis 2009  
Construction Management





 Monday, April 13<sup>th</sup> 2009 Presentation Date

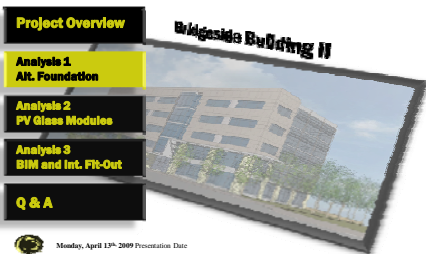
<b>Presentation Topics</b>	
	<ul style="list-style-type: none"><li>•Project Overview</li><li>•Alternative Foundation System</li><li>•Photovoltaic Glass Replacement</li><li>•Implementing BIM during Interior Fit-Out Phases</li><li>•Summary and Conclusions</li></ul>

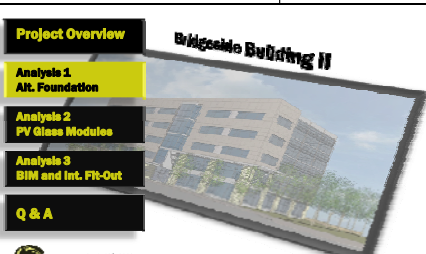
Presentation Agenda	Erik Carlson Construction Management	Project Overview	
<p><b>Project Overview</b></p> <p><b>Analysis 1</b> Alt. Foundation</p> <p><b>Analysis 2</b> PV Glass Modules</p> <p><b>Analysis 3</b> BIM and Int. Fit-Out</p> <p><b>Q &amp; A</b></p>  <p>Monday, April 13<sup>th</sup> 2009 Presentation Date</p>		<p><b>Location and Site:</b> Pittsburgh Technology Center, Pittsburgh, PA  <b>Building Type:</b> Core and Shell  <b>Future Use:</b> 80% Lab Space / 20% Office Space  <b>Size:</b> 160,000 SF  <b>Number of Stories:</b> 5 plus a small penthouse  <b>Dates of Construction:</b> November 2007 to January 2009  <b>Construction Costs:</b> \$18 Million - GMP Project  <b>Delivery Method:</b> Design-Bid-Build</p>	



Presentation Agenda	Erik Carlson Construction Management	Project Overview		
<p><b>Project Overview</b></p> <p><b>Analysis 1</b> Alt. Foundation</p> <p><b>Analysis 2</b> PV Glass Modules</p> <p><b>Analysis 3</b> BIM and Int. Fit-Out</p> <p><b>Q &amp; A</b></p>  <p>Monday, April 13<sup>th</sup> 2009 Presentation Date</p>		<p><b>Location and Site:</b> Pittsburgh Technology Center, Pittsburgh, PA  <b>Building Type:</b> Core and Shell  <b>Future Use:</b> 80% Lab Space / 20% Office Space  <b>Size:</b> 160,000 SF  <b>Number of Stories:</b> 5 plus a small penthouse  <b>Dates of Construction:</b> November 2007 to January 2009  <b>Construction Costs:</b> \$18 Million - GMP Project  <b>Delivery Method:</b> Design-Bid-Build</p>		


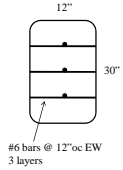
<p><b>Presentation Agenda</b></p>	<p>Erik Carlson Construction Management</p>	<p><b>Project Overview</b></p>		
<p><b>Project Overview</b></p> <p><b>Analysis 1</b> Alt. Foundation</p> <p><b>Analysis 2</b> PV Glass Modules</p> <p><b>Analysis 3</b> BIM and Int. Fit-Out</p> <p><b>Q &amp; A</b></p>  <p>Monday, April 13<sup>th</sup> 2009 Presentation Date</p>	<p><b>Project Team</b>  <b>Owner:</b> The Ferchill Group  <b>General Contractor:</b> Turner Construction Company  <b>Architect:</b> Strada Architecture  <b>MEP Engineer:</b> Allen and Shariff Corporation  <b>Structural Engineer:</b> Atlantic Engineering Services  <b>Geotechnical Engineer:</b> Professional Service Industries</p>   			


<p><b>Presentation Agenda</b></p>	<p>Erik Carlson Construction Management</p>	<p><b>Project Overview</b></p>		
<p><b>Project Overview</b></p> <p><b>Analysis 1</b> Alt. Foundation</p> <p><b>Analysis 2</b> PV Glass Modules</p> <p><b>Analysis 3</b> BIM and Int. Fit-Out</p> <p><b>Q &amp; A</b></p>  <p>Monday, April 13<sup>th</sup> 2009 Presentation Date</p>	<p><b>Architectural Features</b></p> <ul style="list-style-type: none"> <li>•Modern Industrial design</li> <li>•Exposed lateral bracing</li> <li>•Steel canopies and screen walls</li> <li>•Balconies with views of the skyline</li> </ul> <p><b>Structural System</b></p> <ul style="list-style-type: none"> <li>•Structural steel</li> <li>•Composite floor slabs</li> <li>•Driven H-Pile foundation</li> </ul>	 <p><b>Building Enclosure</b></p> <ul style="list-style-type: none"> <li>•Aluminum window walls</li> <li>•Storefront glass</li> <li>•Insulated metal panels</li> <li>•Cast stone</li> <li>•Built-up EPDM roof</li> </ul>		



<b>Presentation Agenda</b>		Erik Carlson Construction Management	<b>Analysis 1 – Alternative Foundation System</b>
 <p><b>Project Overview</b></p> <p><b>Analysis 1</b> Alt. Foundation</p> <p><b>Analysis 2</b> PV Glass Modules</p> <p><b>Analysis 3</b> BIM and Int. Fit-Out</p> <p><b>Q &amp; A</b></p> <p>Monday, April 13<sup>th</sup> 2009 Presentation Date</p>		<p><b>Problem</b></p> <ul style="list-style-type: none"> <li>• Bridgeside II sits on 25-40 feet of man-placed fill</li> <li>• Concrete and steel obstructed the driven piles</li> <li>• Pre-drilling created schedule delays and increased costs</li> </ul> <p><b>Objective</b></p> <ul style="list-style-type: none"> <li>• Compare other foundation systems that can be applied</li> <li>• Analyze the structural requirements</li> <li>• Recommend a system that can be installed more efficiently and in less time</li> </ul>	

<b>Presentation Agenda</b>		Erik Carlson Construction Management	<b>Analysis 1 – Alternative Foundation System</b>																																														
 <p><b>Project Overview</b></p> <p><b>Analysis 1</b> Alt. Foundation</p> <p><b>Analysis 2</b> PV Glass Modules</p> <p><b>Analysis 3</b> BIM and Int. Fit-Out</p> <p><b>Q &amp; A</b></p> <p>Monday, April 13<sup>th</sup> 2009 Presentation Date</p>		<p><b>Driven H-Piles - Cost and Schedule</b></p> <p>Total Costs: \$1,119,999 Total Duration: 123 Days (4 Months)</p> <table border="1"> <thead> <tr> <th colspan="2">Driven Pile Estimate</th> </tr> <tr> <th>Item</th> <th>Cost</th> </tr> </thead> <tbody> <tr> <td>Pre-Drilling</td> <td>\$285,000</td> </tr> <tr> <td>Steel H-Piles</td> <td>\$620,565</td> </tr> <tr> <td>F/R/P Pile Caps</td> <td>\$39,039.56</td> </tr> <tr> <td>F/R/P Grade Beams and Piers</td> <td>\$75,354.92</td> </tr> <tr> <td>F/R/P Foundation Walls</td> <td>\$18,583.76</td> </tr> <tr> <td>Concrete - 3000 psi</td> <td>\$81,455.11</td> </tr> <tr> <td><b>Total Cost</b></td> <td><b>\$1,119,999</b></td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th>Foundations</th> <th>123 days</th> <th>Wed 11/21/07</th> <th>Fri 5/8/08</th> </tr> </thead> <tbody> <tr> <td>Pre-Drill Piles</td> <td>47 days</td> <td>Wed 11/21/07</td> <td>Thu 1/24/08</td> </tr> <tr> <td>Install H-Piles</td> <td>36 days</td> <td>Tue 12/18/07</td> <td>Tue 2/5/08</td> </tr> <tr> <td>Concrete Pile Caps</td> <td>60 days</td> <td>Tue 1/8/08</td> <td>Mon 3/31/08</td> </tr> <tr> <td>Concrete Grade Beams and Piers</td> <td>54 days</td> <td>Tue 1/29/08</td> <td>Fri 4/11/08</td> </tr> <tr> <td>Concrete Foundation Walls</td> <td>30 days</td> <td>Wed 3/12/08</td> <td>Tue 4/22/08</td> </tr> <tr> <td>Grout Base Plates</td> <td>11 days</td> <td>Fri 4/25/08</td> <td>Fri 5/9/08</td> </tr> </tbody> </table>		Driven Pile Estimate		Item	Cost	Pre-Drilling	\$285,000	Steel H-Piles	\$620,565	F/R/P Pile Caps	\$39,039.56	F/R/P Grade Beams and Piers	\$75,354.92	F/R/P Foundation Walls	\$18,583.76	Concrete - 3000 psi	\$81,455.11	<b>Total Cost</b>	<b>\$1,119,999</b>	Foundations	123 days	Wed 11/21/07	Fri 5/8/08	Pre-Drill Piles	47 days	Wed 11/21/07	Thu 1/24/08	Install H-Piles	36 days	Tue 12/18/07	Tue 2/5/08	Concrete Pile Caps	60 days	Tue 1/8/08	Mon 3/31/08	Concrete Grade Beams and Piers	54 days	Tue 1/29/08	Fri 4/11/08	Concrete Foundation Walls	30 days	Wed 3/12/08	Tue 4/22/08	Grout Base Plates	11 days	Fri 4/25/08	Fri 5/9/08
Driven Pile Estimate																																																	
Item	Cost																																																
Pre-Drilling	\$285,000																																																
Steel H-Piles	\$620,565																																																
F/R/P Pile Caps	\$39,039.56																																																
F/R/P Grade Beams and Piers	\$75,354.92																																																
F/R/P Foundation Walls	\$18,583.76																																																
Concrete - 3000 psi	\$81,455.11																																																
<b>Total Cost</b>	<b>\$1,119,999</b>																																																
Foundations	123 days	Wed 11/21/07	Fri 5/8/08																																														
Pre-Drill Piles	47 days	Wed 11/21/07	Thu 1/24/08																																														
Install H-Piles	36 days	Tue 12/18/07	Tue 2/5/08																																														
Concrete Pile Caps	60 days	Tue 1/8/08	Mon 3/31/08																																														
Concrete Grade Beams and Piers	54 days	Tue 1/29/08	Fri 4/11/08																																														
Concrete Foundation Walls	30 days	Wed 3/12/08	Tue 4/22/08																																														
Grout Base Plates	11 days	Fri 4/25/08	Fri 5/9/08																																														

<p><b>Presentation Agenda</b></p>	<p>Erik Carlson Construction Management</p>	<p><b>Analysis 1 – Alternative Foundation System</b></p>	
<div style="display: flex;"> <div style="width: 20%; background-color: black; color: white; padding: 5px;"> <p><b>Project Overview</b></p> <p>Analysis 1 Alt. Foundation</p> <p>Analysis 2 PV Glass Modules</p> <p>Analysis 3 BIM and Int. Fit-Out</p> <p>Q &amp; A</p> </div> <div style="width: 80%; text-align: center;">  <p><b>BridgeSide Building II</b></p> <p>Monday, April 13<sup>th</sup> 2009 Presentation Date</p> </div> </div>	<p style="text-align: center;"><b>Advantages and Disadvantages of Mat Slabs</b></p> <p><b>Advantages:</b></p> <ul style="list-style-type: none"> <li>•Relatively inexpensive</li> <li>•Simple to construct</li> <li>•Distributes heavy loads over the entire slab</li> <li>•Very stable and durable if the soil conditions are sufficient</li> </ul> <p><b>Disadvantages:</b></p> <ul style="list-style-type: none"> <li>•Differential settlement can occur</li> <li>•Must be done correctly the first time</li> <li>•Substantial excavation is necessary</li> <li>•Tying the rebar is time consuming</li> <li>•Limits underground utility access</li> </ul> 		


<p><b>Presentation Agenda</b></p>	<p>Erik Carlson Construction Management</p>	<p><b>Analysis 1 – Alternative Foundation System</b></p>	
<div style="display: flex;"> <div style="width: 20%; background-color: black; color: white; padding: 5px;"> <p><b>Project Overview</b></p> <p>Analysis 1 Alt. Foundation</p> <p>Analysis 2 PV Glass Modules</p> <p>Analysis 3 BIM and Int. Fit-Out</p> <p>Q &amp; A</p> </div> <div style="width: 80%; text-align: center;">  <p><b>BridgeSide Building II</b></p> <p>Monday, April 13<sup>th</sup> 2009 Presentation Date</p> </div> </div>	<p style="text-align: center;"><b>Structural Analysis –</b></p> <p style="text-align: center;"><b>Width</b></p> <p>Slab Area: 32,038 sq ft          Live Loads: 24,956 kips          Dead Loads: 56,556 kips          Critical Column Load: 805 kips          Base Plate: 22'x22'</p> <p>Slab Thickness – Controlled by punching shear</p> <ul style="list-style-type: none"> <li>• 30" slab</li> </ul> <p>Reinforcing</p> <ul style="list-style-type: none"> <li>• Minimum steel area = 1.2 in<sup>2</sup>/ft</li> <li>• #6 bars @ 12" o.c. – 3 layers each way</li> <li>• As = 1.32 in<sup>2</sup>/ft</li> </ul> 		


<p><b>Presentation Agenda</b></p>	<p>Erik Carlson Construction Management</p>	<p><b>Analysis 1 – Alternative Foundation System</b></p>																																																																																									
<div><b>Project Overview</b></div> <div><b>Analysis 1 Alt. Foundation</b></div> <div><b>Analysis 2 PV Glass Modules</b></div> <div><b>Analysis 3 BIM and Int. Fit-Out</b></div> <div><b>Q &amp; A</b></div>  <p>Monday, April 13<sup>th</sup> 2009 Presentation Date</p>	<p><b>Mat Slab Cost and Schedule</b></p> <p>Total Cost: \$704,252 Total Duration: 112 days</p> <ul style="list-style-type: none"> <li>•Duration is 11 days shorter than the driven piles</li> <li>•Steel is delayed by 14 days due to curing time</li> </ul> <p>Cost Savings: \$415,747 Lost Rent Income: (\$274,000)</p> <p>Total Savings: \$141,747 Schedule Delay: 14 days</p> <table border="1"> <thead> <tr> <th colspan="5">Mat Slab Estimate</th> </tr> <tr> <th>Item</th> <th>Quantity</th> <th>Unit</th> <th>Cost/Unit</th> <th>Total Cost</th> </tr> </thead> <tbody> <tr> <td>Excavation</td> <td>5423</td> <td>CY</td> <td>\$1.59</td> <td>\$15,282.57</td> </tr> <tr> <td>Fill</td> <td>2373</td> <td>CY</td> <td>\$3.96</td> <td>\$9,397.08</td> </tr> <tr> <td>Hauling</td> <td>9483</td> <td>CY</td> <td>\$4.16</td> <td>\$39,450.88</td> </tr> <tr> <td>Reinforcing</td> <td>145</td> <td>Tons</td> <td>\$3,800</td> <td>\$551,200.00</td> </tr> <tr> <td>Concrete Paving</td> <td>3115</td> <td>CY</td> <td>\$8.90</td> <td>\$27,723.50</td> </tr> <tr> <td>Concrete 3000 psi</td> <td>3140</td> <td>CY</td> <td>\$155.00</td> <td>\$486,600.00</td> </tr> <tr> <td>F/P/P Concrete Piers</td> <td>-</td> <td>-</td> <td>-</td> <td>\$6,146.44</td> </tr> <tr> <td colspan="4"><b>Total</b></td> <td><b>\$704,252</b></td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th colspan="5">Mat Slab Foundation</th> </tr> <tr> <th>Item</th> <th>Quantity</th> <th>Unit</th> <th>Start</th> <th>End</th> </tr> </thead> <tbody> <tr> <td>Slab Excavation</td> <td>10 days</td> <td></td> <td>Wed 11/21/07</td> <td>Tue 12/04/07</td> </tr> <tr> <td>Underfill Fill</td> <td>3 days</td> <td></td> <td>Wed 12/05/07</td> <td>Fri 12/07/07</td> </tr> <tr> <td>Tie Reinforcing</td> <td>83 days</td> <td></td> <td>Mon 12/10/07</td> <td>Wed 03/06/08</td> </tr> <tr> <td>Pour Mat Slab</td> <td>8 days</td> <td></td> <td>Thu 3/06/08</td> <td>Mon 3/17/08</td> </tr> <tr> <td>F/P/P Piers</td> <td>2 days</td> <td></td> <td>Tue 3/18/08</td> <td>Wed 3/19/08</td> </tr> <tr> <td>Slab Curing</td> <td>28 days</td> <td></td> <td>Tue 3/19/08</td> <td>Thu 4/24/08</td> </tr> </tbody> </table>	Mat Slab Estimate					Item	Quantity	Unit	Cost/Unit	Total Cost	Excavation	5423	CY	\$1.59	\$15,282.57	Fill	2373	CY	\$3.96	\$9,397.08	Hauling	9483	CY	\$4.16	\$39,450.88	Reinforcing	145	Tons	\$3,800	\$551,200.00	Concrete Paving	3115	CY	\$8.90	\$27,723.50	Concrete 3000 psi	3140	CY	\$155.00	\$486,600.00	F/P/P Concrete Piers	-	-	-	\$6,146.44	<b>Total</b>				<b>\$704,252</b>	Mat Slab Foundation					Item	Quantity	Unit	Start	End	Slab Excavation	10 days		Wed 11/21/07	Tue 12/04/07	Underfill Fill	3 days		Wed 12/05/07	Fri 12/07/07	Tie Reinforcing	83 days		Mon 12/10/07	Wed 03/06/08	Pour Mat Slab	8 days		Thu 3/06/08	Mon 3/17/08	F/P/P Piers	2 days		Tue 3/18/08	Wed 3/19/08	Slab Curing	28 days		Tue 3/19/08	Thu 4/24/08
Mat Slab Estimate																																																																																											
Item	Quantity	Unit	Cost/Unit	Total Cost																																																																																							
Excavation	5423	CY	\$1.59	\$15,282.57																																																																																							
Fill	2373	CY	\$3.96	\$9,397.08																																																																																							
Hauling	9483	CY	\$4.16	\$39,450.88																																																																																							
Reinforcing	145	Tons	\$3,800	\$551,200.00																																																																																							
Concrete Paving	3115	CY	\$8.90	\$27,723.50																																																																																							
Concrete 3000 psi	3140	CY	\$155.00	\$486,600.00																																																																																							
F/P/P Concrete Piers	-	-	-	\$6,146.44																																																																																							
<b>Total</b>				<b>\$704,252</b>																																																																																							
Mat Slab Foundation																																																																																											
Item	Quantity	Unit	Start	End																																																																																							
Slab Excavation	10 days		Wed 11/21/07	Tue 12/04/07																																																																																							
Underfill Fill	3 days		Wed 12/05/07	Fri 12/07/07																																																																																							
Tie Reinforcing	83 days		Mon 12/10/07	Wed 03/06/08																																																																																							
Pour Mat Slab	8 days		Thu 3/06/08	Mon 3/17/08																																																																																							
F/P/P Piers	2 days		Tue 3/18/08	Wed 3/19/08																																																																																							
Slab Curing	28 days		Tue 3/19/08	Thu 4/24/08																																																																																							

<p><b>Presentation Agenda</b></p>	<p>Erik Carlson Construction Management</p>	<p><b>Analysis 1 – Alternative Foundation System</b></p>
<div><b>Project Overview</b></div> <div><b>Analysis 1 Alt. Foundation Sys.</b></div> <div><b>Analysis 2 PV Glass Modules</b></div> <div><b>Analysis 3 BIM and Int. Fit-Out</b></div> <div><b>Q &amp; A</b></div>  <p>Monday, April 13<sup>th</sup> 2009 Presentation Date</p>	<p><b>Advantages and Disadvantages of Micro Piles</b></p> <p><b>Advantages:</b></p> <ul style="list-style-type: none"> <li>•Appropriate for any type of ground condition</li> <li>•Can penetrate most obstacles</li> <li>•Low noise and vibration</li> <li>•Can be installed in low headroom situations</li> <li>•Design loads can range from 3 to 500 tons</li> </ul>  <p><b>Disadvantages:</b></p> <ul style="list-style-type: none"> <li>•If there are no obstacles they are more time consuming than a driven pile</li> <li>•Expensive</li> <li>•Ground water inflow can be an issue</li> </ul>	



<b>Presentation Agenda</b>		Erik Carlson Construction Management	<b>Analysis 1 – Alternative Foundation System</b>		
<b>Project Overview</b> <b>Analysis 1</b> <b>Alt. Foundation Sys.</b> <b>Analysis 2</b> <b>PV Glass Modules</b> <b>Analysis 3</b> <b>BIM and Int. Fit-Out</b> <b>Q &amp; A</b>		<b>Micro Piles</b> <ul style="list-style-type: none"> <li>• 10" diameter, 250 kip capacity</li> <li>• 45 to 55 foot lengths</li> <li>• Same number of piles and pile caps as driven piles</li> <li>• Total of 171 piles and 53 pile caps</li> <li>• Steel casing is drilled into the ground and filled with grout</li> <li>• Carbide teeth can break through debris</li> <li>• 6 piles per day</li> </ul>			

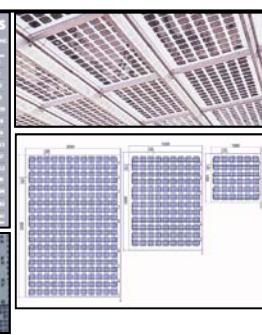

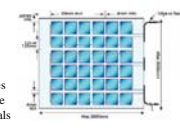
<b>Presentation Agenda</b>		Erik Carlson Construction Management	<b>Analysis 1 – Alternative Foundation System</b>																																									
<b>Project Overview</b> <b>Analysis 1</b> <b>Alt. Foundation Sys.</b> <b>Analysis 2</b> <b>PV Glass Modules</b> <b>Analysis 3</b> <b>BIM and Int. Fit-Out</b> <b>Q &amp; A</b>		<b>Micro Piles Cost and Schedule</b> Total Cost: \$1,240,434 Total Duration: 99 days Schedule Reduction: 24 days Cost Increase: \$120,435 Add. Rent Income: \$387,000 Total Savings: \$266,565		<table border="1"> <thead> <tr> <th colspan="2">Micro Pile Estimate</th> </tr> <tr> <th>Item</th> <th>Cost</th> </tr> </thead> <tbody> <tr> <td>Micro Piles</td> <td>\$1,026,000</td> </tr> <tr> <td>F/R/P Pile Caps</td> <td>\$39,039.56</td> </tr> <tr> <td>F/R/P Grade Beams and Piers</td> <td>\$75,354.92</td> </tr> <tr> <td>F/R/P Foundation Walls</td> <td>\$18,583.76</td> </tr> <tr> <td>Concrete - 3000 psi</td> <td>\$81,459.6</td> </tr> <tr> <td><b>Total cost</b></td> <td><b>\$1,240,434</b></td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th>Micro Pile Foundation</th> <th>39 days</th> <th>Wed 11/21/07</th> <th>Mon 4/17/08</th> </tr> </thead> <tbody> <tr> <td>Install Monopiles</td> <td>29 days</td> <td>Wed 11/21/07</td> <td>Mon 12/31/07</td> </tr> <tr> <td>Concrete Pile Caps</td> <td>40 days</td> <td>Wed 12/17/07</td> <td>Thu 2/22/08</td> </tr> <tr> <td>Concrete Grade Beams and Piers</td> <td>54 days</td> <td>Fri 12/28/07</td> <td>Wed 3/12/08</td> </tr> <tr> <td>Concrete Foundation Walls</td> <td>30 days</td> <td>Mon 2/11/08</td> <td>Fri 3/21/08</td> </tr> <tr> <td>Grout Base Plates</td> <td>11 days</td> <td>Mon 3/24/08</td> <td>Mon 4/1/08</td> </tr> </tbody> </table>		Micro Pile Estimate		Item	Cost	Micro Piles	\$1,026,000	F/R/P Pile Caps	\$39,039.56	F/R/P Grade Beams and Piers	\$75,354.92	F/R/P Foundation Walls	\$18,583.76	Concrete - 3000 psi	\$81,459.6	<b>Total cost</b>	<b>\$1,240,434</b>	Micro Pile Foundation	39 days	Wed 11/21/07	Mon 4/17/08	Install Monopiles	29 days	Wed 11/21/07	Mon 12/31/07	Concrete Pile Caps	40 days	Wed 12/17/07	Thu 2/22/08	Concrete Grade Beams and Piers	54 days	Fri 12/28/07	Wed 3/12/08	Concrete Foundation Walls	30 days	Mon 2/11/08	Fri 3/21/08	Grout Base Plates	11 days	Mon 3/24/08
Micro Pile Estimate																																												
Item	Cost																																											
Micro Piles	\$1,026,000																																											
F/R/P Pile Caps	\$39,039.56																																											
F/R/P Grade Beams and Piers	\$75,354.92																																											
F/R/P Foundation Walls	\$18,583.76																																											
Concrete - 3000 psi	\$81,459.6																																											
<b>Total cost</b>	<b>\$1,240,434</b>																																											
Micro Pile Foundation	39 days	Wed 11/21/07	Mon 4/17/08																																									
Install Monopiles	29 days	Wed 11/21/07	Mon 12/31/07																																									
Concrete Pile Caps	40 days	Wed 12/17/07	Thu 2/22/08																																									
Concrete Grade Beams and Piers	54 days	Fri 12/28/07	Wed 3/12/08																																									
Concrete Foundation Walls	30 days	Mon 2/11/08	Fri 3/21/08																																									
Grout Base Plates	11 days	Mon 3/24/08	Mon 4/1/08																																									

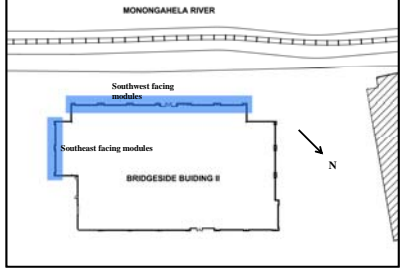

<p><b>Presentation Agenda</b></p>	<p>Erik Carlson Construction Management</p>	<p><b>Analysis 1 – Alternative Foundation System</b></p>																	
<div style="display: flex;"> <div style="width: 20%; background-color: black; color: white; padding: 5px;"> <p><b>Project Overview</b></p> <p>Analysis 1 Alt. Foundation Sys.</p> <p>Analysis 2 PV Glass Modules</p> <p>Analysis 3 BIM and Int. Fit-Out</p> <p>Q &amp; A</p> </div> <div style="width: 80%; text-align: center;">  <p><b>Bridgeside Building II</b></p> <p>Monday, April 13<sup>th</sup> 2009 Presentation Date</p> </div> </div>	<p style="text-align: center;"><b>Conclusion</b></p> <table border="0"> <tr> <td><u>Driven H-Piles</u></td> <td>Total Costs: \$1,119,999</td> <td></td> </tr> <tr> <td></td> <td>Total Duration: 123 Days</td> <td></td> </tr> <tr> <td><u>Mat Slab</u></td> <td>Total Cost: \$704,252</td> <td>Total Savings: \$141,747</td> </tr> <tr> <td></td> <td>Total Duration: 112 days</td> <td>Schedule Delay: 14 days</td> </tr> <tr style="border: 1px solid red;"> <td><u>Micro Piles</u></td> <td>Total Cost: \$1,240,434</td> <td>Total Savings: \$266,565</td> </tr> <tr style="border: 1px solid red;"> <td></td> <td>Total Duration: 99 days</td> <td>Schedule Reduction: 24 days</td> </tr> </table>	<u>Driven H-Piles</u>		Total Costs: \$1,119,999			Total Duration: 123 Days		<u>Mat Slab</u>	Total Cost: \$704,252	Total Savings: \$141,747		Total Duration: 112 days	Schedule Delay: 14 days	<u>Micro Piles</u>	Total Cost: \$1,240,434	Total Savings: \$266,565		Total Duration: 99 days
<u>Driven H-Piles</u>	Total Costs: \$1,119,999																		
	Total Duration: 123 Days																		
<u>Mat Slab</u>	Total Cost: \$704,252	Total Savings: \$141,747																	
	Total Duration: 112 days	Schedule Delay: 14 days																	
<u>Micro Piles</u>	Total Cost: \$1,240,434	Total Savings: \$266,565																	
	Total Duration: 99 days	Schedule Reduction: 24 days																	

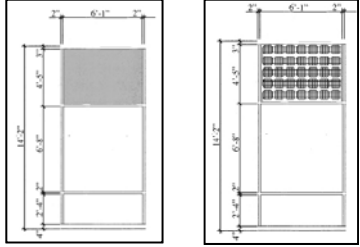

<p><b>Presentation Agenda</b></p>	<p>Erik Carlson Construction Management</p>	<p><b>Analysis 2 – Photovoltaic Glass Replacement</b></p>	
<div style="display: flex;"> <div style="width: 20%; background-color: black; color: white; padding: 5px;"> <p><b>Project Overview</b></p> <p>Analysis 1 Alt. Foundation</p> <p>Analysis 2 PV Glass Modules</p> <p>Analysis 3 BIM and Int. Fit-Out</p> <p>Q &amp; A</p> </div> <div style="width: 80%; text-align: center;">  <p><b>Bridgeside Building II</b></p> <p>Monday, April 13<sup>th</sup> 2009 Presentation Date</p> </div> </div>	<p><b>Problem</b></p> <ul style="list-style-type: none"> <li>• Electricity caps in Pennsylvania are expiring</li> <li>• Lab spaces demand higher energy loads than office space</li> <li>• Pittsburgh was selected to be a Solar America City</li> </ul> <p><b>Objective</b></p> <ul style="list-style-type: none"> <li>• Replace selected spandrel panels with PV modules</li> <li>• Develop an energy savings to reduce life cycle costs</li> <li>• Size the PV system and determine the effects on the electrical panels</li> <li>• Attract potential tenants</li> </ul>		

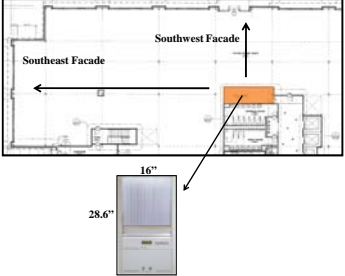


<b>Presentation Agenda</b>		Erik Carlson Construction Management	<b>Analysis 2 – Photovoltaic Glass Replacement</b>
<b>Project Overview</b> <b>Analysis 1</b> Alt. Foundation <b>Analysis 2</b> PV Glass Modules <b>Analysis 3</b> BIM and Int. Fit-Out <b>Q &amp; A</b> 		<p><b>Solar Energy Benefits</b></p> <ul style="list-style-type: none"> <li>•Reduced Energy Costs</li> <li>•Reduced CO<sub>2</sub> emissions</li> <li>•Can be used in remote locations</li> <li>•No pollution</li> <li>•Tax credits, federal grants, and rebates             <ul style="list-style-type: none"> <li>•Pittsburgh is 1 of 13 inaugural Solar America Cities</li> <li>•Pittsburgh was given a total of \$450,000 from DOE to assist in developing solar projects</li> <li>•Projects in Pennsylvania are eligible for a 30% tax credit</li> </ul> </li> </ul> 	



<b>Presentation Agenda</b>		Erik Carlson Construction Management	<b>Analysis 2 – Photovoltaic Glass Replacement</b>	<b>technical specifications</b>																																																																																																																																																																																
<b>Project Overview</b> <b>Analysis 1</b> Alt. Foundation <b>Analysis 2</b> PV Glass Modules <b>Analysis 3</b> BIM and Int. Fit-Out <b>Q &amp; A</b> 		<p><b>Suntech Photovoltaic Modules</b></p> <ul style="list-style-type: none"> <li>•Suntech Light-Thru modules</li> <li>•Custom sizes</li> <li>•10% light transmittance</li> <li>•10 Watts / SF</li> <li>•Plug and Play connectors</li> <li>•Building Integrated Photovoltaic modules             <ul style="list-style-type: none"> <li>•Component in the building enclosure</li> <li>•Eliminates unnecessary base materials</li> </ul> </li> <li>•Additional Benefits:             <ul style="list-style-type: none"> <li>•Higher building resale value</li> <li>•Reduction of interior UV damage</li> </ul> </li> </ul> 	<table border="1"> <tr> <td>Length (ft)</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>6</td> <td>7</td> <td>8</td> <td>9</td> <td>10</td> </tr> <tr> <td>Width (ft)</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>6</td> <td>7</td> <td>8</td> <td>9</td> <td>10</td> </tr> <tr> <td>Cell Area (sq ft)</td> <td>1</td> <td>4</td> <td>9</td> <td>16</td> <td>25</td> <td>36</td> <td>49</td> <td>64</td> <td>81</td> <td>100</td> </tr> <tr> <td>Transparency (%)</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> </tr> <tr> <td>Cost (\$/sq ft)</td> <td>100</td> <td>100</td> <td>100</td> <td>100</td> <td>100</td> <td>100</td> <td>100</td> <td>100</td> <td>100</td> <td>100</td> </tr> <tr> <td>Power (W)</td> <td>10</td> <td>20</td> <td>30</td> <td>40</td> <td>50</td> <td>60</td> <td>70</td> <td>80</td> <td>90</td> <td>100</td> </tr> <tr> <td>Area (sq ft)</td> <td>1</td> <td>4</td> <td>9</td> <td>16</td> <td>25</td> <td>36</td> <td>49</td> <td>64</td> <td>81</td> <td>100</td> </tr> <tr> <td>Weight (lb)</td> <td>10</td> <td>40</td> <td>90</td> <td>160</td> <td>250</td> <td>360</td> <td>490</td> <td>640</td> <td>810</td> <td>1000</td> </tr> <tr> <td>UV Protection</td> <td>100%</td> <td>100%</td> <td>100%</td> <td>100%</td> <td>100%</td> <td>100%</td> <td>100%</td> <td>100%</td> <td>100%</td> <td>100%</td> </tr> <tr> <td>Fire Rating</td> <td>Class 1</td> <td>Class 1</td> <td>Class 1</td> <td>Class 1</td> <td>Class 1</td> <td>Class 1</td> <td>Class 1</td> <td>Class 1</td> <td>Class 1</td> <td>Class 1</td> </tr> <tr> <td>Warranty</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> </tr> <tr> <td>Lead Time</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> </tr> <tr> <td>Installation</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> </tr> <tr> <td>Shipping</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> </tr> <tr> <td>Storage</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> </tr> <tr> <td>Recycling</td> <td>100%</td> <td>100%</td> <td>100%</td> <td>100%</td> <td>100%</td> <td>100%</td> <td>100%</td> <td>100%</td> <td>100%</td> <td>100%</td> </tr> </table>	Length (ft)	1	2	3	4	5	6	7	8	9	10	Width (ft)	1	2	3	4	5	6	7	8	9	10	Cell Area (sq ft)	1	4	9	16	25	36	49	64	81	100	Transparency (%)	10	10	10	10	10	10	10	10	10	10	Cost (\$/sq ft)	100	100	100	100	100	100	100	100	100	100	Power (W)	10	20	30	40	50	60	70	80	90	100	Area (sq ft)	1	4	9	16	25	36	49	64	81	100	Weight (lb)	10	40	90	160	250	360	490	640	810	1000	UV Protection	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	Fire Rating	Class 1	Class 1	Class 1	Class 1	Class 1	Class 1	Class 1	Class 1	Class 1	Class 1	Warranty	10	10	10	10	10	10	10	10	10	10	Lead Time	10	10	10	10	10	10	10	10	10	10	Installation	10	10	10	10	10	10	10	10	10	10	Shipping	10	10	10	10	10	10	10	10	10	10	Storage	10	10	10	10	10	10	10	10	10	10	Recycling	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	
Length (ft)	1	2	3	4	5	6	7	8	9	10																																																																																																																																																																										
Width (ft)	1	2	3	4	5	6	7	8	9	10																																																																																																																																																																										
Cell Area (sq ft)	1	4	9	16	25	36	49	64	81	100																																																																																																																																																																										
Transparency (%)	10	10	10	10	10	10	10	10	10	10																																																																																																																																																																										
Cost (\$/sq ft)	100	100	100	100	100	100	100	100	100	100																																																																																																																																																																										
Power (W)	10	20	30	40	50	60	70	80	90	100																																																																																																																																																																										
Area (sq ft)	1	4	9	16	25	36	49	64	81	100																																																																																																																																																																										
Weight (lb)	10	40	90	160	250	360	490	640	810	1000																																																																																																																																																																										
UV Protection	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%																																																																																																																																																																										
Fire Rating	Class 1	Class 1	Class 1	Class 1	Class 1	Class 1	Class 1	Class 1	Class 1	Class 1																																																																																																																																																																										
Warranty	10	10	10	10	10	10	10	10	10	10																																																																																																																																																																										
Lead Time	10	10	10	10	10	10	10	10	10	10																																																																																																																																																																										
Installation	10	10	10	10	10	10	10	10	10	10																																																																																																																																																																										
Shipping	10	10	10	10	10	10	10	10	10	10																																																																																																																																																																										
Storage	10	10	10	10	10	10	10	10	10	10																																																																																																																																																																										
Recycling	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%																																																																																																																																																																										


<p><b>Presentation Agenda</b></p>	<p>Erik Carlson Construction Management</p>	<p><b>Analysis 2 – Photovoltaic Glass Replacement</b></p>	
<p><b>Project Overview</b></p> <p><b>Analysis 1</b> Alt. Foundation</p> <p><b>Analysis 2</b> PV Glass Modules</p> <p><b>Analysis 3</b> BIM and Int. Fit-Out</p> <p><b>Q &amp; A</b></p>  <p>Monday, April 13<sup>th</sup> 2009 Presentation Date</p>	<p><b>Design and Constructability</b></p> <ul style="list-style-type: none"> <li>•Replace non-vision spandrel glass</li> <li>•Southwest and southeast facing facades</li> <li>•River allows for unobstructed solar views</li> </ul> <p><b>Original vs. Proposed</b></p> <ul style="list-style-type: none"> <li>•Same sized panels ( 6'1 x 4'5)</li> <li>•No reduction in light transmittance</li> <li>•No reduction in visible glass area</li> <li>•Modules still prevent views of the elevated slab edges</li> <li>•Modules can be same thickness as spandrel glass</li> </ul>		


<p><b>Presentation Agenda</b></p>	<p>Erik Carlson Construction Management</p>	<p><b>Analysis 2 – Photovoltaic Glass Replacement</b></p>	 <p>Original Window Design      Proposed Window Design</p>
<p><b>Project Overview</b></p> <p><b>Analysis 1</b> Alt. Foundation</p> <p><b>Analysis 2</b> PV Glass Modules</p> <p><b>Analysis 3</b> BIM and Int. Fit-Out</p> <p><b>Q &amp; A</b></p>  <p>Monday, April 13<sup>th</sup> 2009 Presentation Date</p>	<p><b>Design and Constructability</b></p> <ul style="list-style-type: none"> <li>•Replace non-vision spandrel glass</li> <li>•Southwest and southeast facing facades</li> <li>•River allows for unobstructed solar views</li> </ul> <p><b>Original vs. Proposed</b></p> <ul style="list-style-type: none"> <li>•Same sized panels ( 6'1 x 4'5)</li> <li>•No reduction in light transmittance</li> <li>•No reduction in visible glass area</li> <li>•Modules still prevent views of the elevated slab edges</li> <li>•Modules can be same thickness as spandrel glass</li> </ul>		


<p><b>Presentation Agenda</b></p>	<p>Erik Carlson Construction Management</p>	<p><b>Analysis 2 – Photovoltaic Glass Replacement</b></p>																																	
<p><b>Project Overview</b></p> <p><b>BridgeSide Building II</b></p> <p><b>Analysis 1</b> Alt. Foundation</p> <p><b>Analysis 2</b> PV Glass Modules</p> <p><b>Analysis 3</b> BIM and Int. Fit-Out</p> <p><b>Q &amp; A</b></p> <p>Monday, April 13<sup>th</sup> 2009 Presentation Date</p>		<p><b>System Sizing – Electrical Breadth</b></p> <ul style="list-style-type: none"> <li>•Number of modules: 168</li> <li>•Total Area: 3,697 SF</li> </ul> <p>Xantrex GT 5.0 Inverter</p> <ul style="list-style-type: none"> <li>•Number of modules per string: 4 •Based on inverter voltage range</li> <li>•Number of strings per inverter: 3 •Based on max inverter power</li> <li>•Number of inverters: 12</li> </ul> <table border="1"> <thead> <tr> <th colspan="2">Light Thru Modules</th> </tr> <tr> <th colspan="2">Technical Specifications</th> </tr> </thead> <tbody> <tr> <td>Maximum Power (Pmax)</td> <td>290 W</td> </tr> <tr> <td>Optimum Operating Voltage (Vmp)</td> <td>66.3 V</td> </tr> <tr> <td>Optimum Operating Current (Imp)</td> <td>4.37 A</td> </tr> <tr> <td>Open Circuit Voltage (Voc)</td> <td>80 V</td> </tr> <tr> <td>Short Circuit Current (Isc)</td> <td>4.8 A</td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th colspan="2">GT 5.0 Xantrex Inverter</th> </tr> <tr> <th colspan="2">Technical Specifications</th> </tr> </thead> <tbody> <tr> <td>AC Output Voltage(V)</td> <td>240 V</td> </tr> <tr> <td>Max AC Power Output (W)</td> <td>5000 W</td> </tr> <tr> <td>Max Array Open Circuit Voltage (Voc)</td> <td>600 Vdc</td> </tr> <tr> <td>MPPT Voltage Range (Vdc)</td> <td>240-550 Vdc</td> </tr> <tr> <td>Max Input Current (Aac)</td> <td>22 Aac</td> </tr> <tr> <td>Inverter Efficiency</td> <td>95.90%</td> </tr> <tr> <td>Dimensions</td> <td>38.0x16x5.75"</td> </tr> </tbody> </table>		Light Thru Modules		Technical Specifications		Maximum Power (Pmax)	290 W	Optimum Operating Voltage (Vmp)	66.3 V	Optimum Operating Current (Imp)	4.37 A	Open Circuit Voltage (Voc)	80 V	Short Circuit Current (Isc)	4.8 A	GT 5.0 Xantrex Inverter		Technical Specifications		AC Output Voltage(V)	240 V	Max AC Power Output (W)	5000 W	Max Array Open Circuit Voltage (Voc)	600 Vdc	MPPT Voltage Range (Vdc)	240-550 Vdc	Max Input Current (Aac)	22 Aac	Inverter Efficiency	95.90%	Dimensions	38.0x16x5.75"
Light Thru Modules																																			
Technical Specifications																																			
Maximum Power (Pmax)	290 W																																		
Optimum Operating Voltage (Vmp)	66.3 V																																		
Optimum Operating Current (Imp)	4.37 A																																		
Open Circuit Voltage (Voc)	80 V																																		
Short Circuit Current (Isc)	4.8 A																																		
GT 5.0 Xantrex Inverter																																			
Technical Specifications																																			
AC Output Voltage(V)	240 V																																		
Max AC Power Output (W)	5000 W																																		
Max Array Open Circuit Voltage (Voc)	600 Vdc																																		
MPPT Voltage Range (Vdc)	240-550 Vdc																																		
Max Input Current (Aac)	22 Aac																																		
Inverter Efficiency	95.90%																																		
Dimensions	38.0x16x5.75"																																		

<p><b>Presentation Agenda</b></p>	<p>Erik Carlson Construction Management</p>	<p><b>Analysis 2 – Photovoltaic Glass Replacement</b></p>																									
<p><b>Project Overview</b></p> <p><b>BridgeSide Building II</b></p> <p><b>Analysis 1</b> Alt. Foundation</p> <p><b>Analysis 2</b> PV Glass Modules</p> <p><b>Analysis 3</b> BIM and Int. Fit-Out</p> <p><b>Q &amp; A</b></p> <p>Monday, April 13<sup>th</sup> 2009 Presentation Date</p>		<p><b>Cost Comparison</b></p> <p>Total Costs: \$306,190 Cost Increase: \$228,553</p> <table border="1"> <thead> <tr> <th colspan="4">Photovoltaic System Costs</th> </tr> <tr> <th>Item</th> <th>Quantity</th> <th>Unit Cost</th> <th>Total Cost</th> </tr> </thead> <tbody> <tr> <td>Spandrel Glass</td> <td>3697 SF</td> <td>\$21/SF</td> <td>\$77,637</td> </tr> <tr> <td>Light Thru Modules</td> <td>3697 SF</td> <td>\$70/SF</td> <td>\$258,790</td> </tr> <tr> <td>Inverters</td> <td>12</td> <td>\$3,950</td> <td>\$47,400</td> </tr> <tr> <td></td> <td></td> <td><b>Total</b></td> <td><b>\$228,553</b></td> </tr> </tbody> </table>		Photovoltaic System Costs				Item	Quantity	Unit Cost	Total Cost	Spandrel Glass	3697 SF	\$21/SF	\$77,637	Light Thru Modules	3697 SF	\$70/SF	\$258,790	Inverters	12	\$3,950	\$47,400			<b>Total</b>	<b>\$228,553</b>
Photovoltaic System Costs																											
Item	Quantity	Unit Cost	Total Cost																								
Spandrel Glass	3697 SF	\$21/SF	\$77,637																								
Light Thru Modules	3697 SF	\$70/SF	\$258,790																								
Inverters	12	\$3,950	\$47,400																								
		<b>Total</b>	<b>\$228,553</b>																								

<p><b>Presentation Agenda</b></p>	<p>Erik Carlson Construction Management</p>	<p><b>Analysis 2 – Photovoltaic Glass Replacement</b></p>	
<div style="display: flex;"> <div style="flex: 1;"> <p><b>Project Overview</b></p> <p><b>Analysis 1</b> Alt. Foundation</p> <p><b>Analysis 2</b> PV Glass Modules</p> <p><b>Analysis 3</b> BIM and Int. Fit-Out</p> <p><b>Q &amp; A</b></p> </div> <div style="flex: 2;">  </div> </div> <p>Monday, April 13<sup>th</sup> 2009 Presentation Date</p>	<p style="text-align: center;"><b>Energy Analysis</b></p> <p>PV Watts version 2 National Renewable Energy Laboratory</p> <p><u>Inputs:</u> Southwest Façade: 2713 SF x 10 W/SF = 27.13 kW Southeast Façade: 984 SF x 10 W/SF = 9.83 kW</p> <p>Vertical orientation Southwest azimuth angle: 225 Southeast azimuth angle: 135</p> <p>Cost of Electricity: 8.2 cents/kWh</p> 		



<p><b>Presentation Agenda</b></p>	<p>Erik Carlson Construction Management</p>	<p><b>Analysis 2 – Photovoltaic Glass Replacement</b></p>																																																																																																																																											
<div style="display: flex;"> <div style="flex: 1;"> <p><b>Project Overview</b></p> <p><b>Analysis 1</b> Alt. Foundation</p> <p><b>Analysis 2</b> PV Glass Modules</p> <p><b>Analysis 3</b> BIM and Int. Fit-Out</p> <p><b>Q &amp; A</b></p> </div> <div style="flex: 2;">  </div> </div> <p>Monday, April 13<sup>th</sup> 2009 Presentation Date</p>	<p style="text-align: center;"><b>Energy Analysis</b></p> <p>Energy Production: 23.4 kWh of AC Power</p> <p>\$1917 savings per year 119 year payback period</p> <table border="1"> <thead> <tr> <th colspan="2">Station Identification</th> <th colspan="3">Results</th> </tr> <tr> <th>Cell ID</th> <th>Module</th> <th>Area (sqft)</th> <th>AC Energy (kWh)</th> <th>Energy Value (\$)</th> </tr> </thead> <tbody> <tr> <td>1027712</td> <td>1</td> <td>2.74</td> <td>498</td> <td>13.28</td> </tr> <tr> <td>1027712</td> <td>2</td> <td>2.20</td> <td>407</td> <td>10.25</td> </tr> <tr> <td colspan="2"><b>PV System Specifications</b></td> <td></td> <td></td> <td></td> </tr> <tr> <td>DC Rating</td> <td>11.84 kW</td> <td>8</td> <td>2.52</td> <td>666</td> </tr> <tr> <td>DC to AC Conversion Factor</td> <td>0.808</td> <td>8</td> <td>2.03</td> <td>548</td> </tr> <tr> <td>AC Rating</td> <td>7.87 kW</td> <td>8</td> <td>2.80</td> <td>741</td> </tr> <tr> <td>Area Type</td> <td>Fixed TB</td> <td>7</td> <td>2.80</td> <td>741</td> </tr> <tr> <td>Area TB</td> <td>40.87</td> <td>8</td> <td>2.82</td> <td>746</td> </tr> <tr> <td>Area Azimuth</td> <td>139.07</td> <td>9</td> <td>3.00</td> <td>810</td> </tr> <tr> <td colspan="2"><b>Energy Specifications</b></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Cost of Electricity</td> <td>78.2¢/kWh</td> <td>12</td> <td>3.62</td> <td>951</td> </tr> <tr> <td><b>Total</b></td> <td></td> <td></td> <td><b>8.00</b></td> <td><b>214.1</b></td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th colspan="2">Station Identification</th> <th colspan="3">Results</th> </tr> <tr> <th>Cell ID</th> <th>Module</th> <th>Area (sqft)</th> <th>AC Energy (kWh)</th> <th>Energy Value (\$)</th> </tr> </thead> <tbody> <tr> <td>1027712</td> <td>1</td> <td>2.74</td> <td>498</td> <td>13.28</td> </tr> <tr> <td>1027712</td> <td>2</td> <td>2.20</td> <td>407</td> <td>10.25</td> </tr> <tr> <td colspan="2"><b>PV System Specifications</b></td> <td></td> <td></td> <td></td> </tr> <tr> <td>DC Rating</td> <td>12.1 kW</td> <td>8</td> <td>2.58</td> <td>680</td> </tr> <tr> <td>DC to AC Conversion Factor</td> <td>0.808</td> <td>8</td> <td>2.09</td> <td>560</td> </tr> <tr> <td>AC Rating</td> <td>12.7 kW</td> <td>8</td> <td>2.80</td> <td>741</td> </tr> <tr> <td>Area Type</td> <td>Fixed TB</td> <td>7</td> <td>2.80</td> <td>741</td> </tr> <tr> <td>Area TB</td> <td>40.87</td> <td>8</td> <td>2.82</td> <td>746</td> </tr> <tr> <td>Area Azimuth</td> <td>139.07</td> <td>9</td> <td>3.00</td> <td>810</td> </tr> <tr> <td colspan="2"><b>Energy Specifications</b></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Cost of Electricity</td> <td>78.2¢/kWh</td> <td>12</td> <td>3.78</td> <td>969</td> </tr> <tr> <td><b>Total</b></td> <td></td> <td></td> <td><b>12.00</b></td> <td><b>319.7</b></td> </tr> </tbody> </table>	Station Identification		Results			Cell ID	Module	Area (sqft)	AC Energy (kWh)	Energy Value (\$)	1027712	1	2.74	498	13.28	1027712	2	2.20	407	10.25	<b>PV System Specifications</b>					DC Rating	11.84 kW	8	2.52	666	DC to AC Conversion Factor	0.808	8	2.03	548	AC Rating	7.87 kW	8	2.80	741	Area Type	Fixed TB	7	2.80	741	Area TB	40.87	8	2.82	746	Area Azimuth	139.07	9	3.00	810	<b>Energy Specifications</b>					Cost of Electricity	78.2¢/kWh	12	3.62	951	<b>Total</b>			<b>8.00</b>	<b>214.1</b>	Station Identification		Results			Cell ID	Module	Area (sqft)	AC Energy (kWh)	Energy Value (\$)	1027712	1	2.74	498	13.28	1027712	2	2.20	407	10.25	<b>PV System Specifications</b>					DC Rating	12.1 kW	8	2.58	680	DC to AC Conversion Factor	0.808	8	2.09	560	AC Rating	12.7 kW	8	2.80	741	Area Type	Fixed TB	7	2.80	741	Area TB	40.87	8	2.82	746	Area Azimuth	139.07	9	3.00	810	<b>Energy Specifications</b>					Cost of Electricity	78.2¢/kWh	12	3.78	969	<b>Total</b>			<b>12.00</b>	<b>319.7</b>
Station Identification		Results																																																																																																																																											
Cell ID	Module	Area (sqft)	AC Energy (kWh)	Energy Value (\$)																																																																																																																																									
1027712	1	2.74	498	13.28																																																																																																																																									
1027712	2	2.20	407	10.25																																																																																																																																									
<b>PV System Specifications</b>																																																																																																																																													
DC Rating	11.84 kW	8	2.52	666																																																																																																																																									
DC to AC Conversion Factor	0.808	8	2.03	548																																																																																																																																									
AC Rating	7.87 kW	8	2.80	741																																																																																																																																									
Area Type	Fixed TB	7	2.80	741																																																																																																																																									
Area TB	40.87	8	2.82	746																																																																																																																																									
Area Azimuth	139.07	9	3.00	810																																																																																																																																									
<b>Energy Specifications</b>																																																																																																																																													
Cost of Electricity	78.2¢/kWh	12	3.62	951																																																																																																																																									
<b>Total</b>			<b>8.00</b>	<b>214.1</b>																																																																																																																																									
Station Identification		Results																																																																																																																																											
Cell ID	Module	Area (sqft)	AC Energy (kWh)	Energy Value (\$)																																																																																																																																									
1027712	1	2.74	498	13.28																																																																																																																																									
1027712	2	2.20	407	10.25																																																																																																																																									
<b>PV System Specifications</b>																																																																																																																																													
DC Rating	12.1 kW	8	2.58	680																																																																																																																																									
DC to AC Conversion Factor	0.808	8	2.09	560																																																																																																																																									
AC Rating	12.7 kW	8	2.80	741																																																																																																																																									
Area Type	Fixed TB	7	2.80	741																																																																																																																																									
Area TB	40.87	8	2.82	746																																																																																																																																									
Area Azimuth	139.07	9	3.00	810																																																																																																																																									
<b>Energy Specifications</b>																																																																																																																																													
Cost of Electricity	78.2¢/kWh	12	3.78	969																																																																																																																																									
<b>Total</b>			<b>12.00</b>	<b>319.7</b>																																																																																																																																									


<p><b>Presentation Agenda</b></p>	<p>Erik Carlson Construction Management</p>	<p><b>Analysis 2 – Photovoltaic Glass Replacement</b></p>	
<div style="display: flex; align-items: center;"> <div style="width: 20%; background-color: black; color: white; padding: 5px;"> <p><b>Project Overview</b></p> <p>Analysis 1 Alt. Foundation</p> <p>Analysis 2 PV Glass Modules</p> <p>Analysis 3 BIM and Int. Fit-Out</p> <p>Q &amp; A</p> </div> <div style="width: 80%; text-align: center;">  <p><b>BridgeSide Building II</b></p> <p>Monday, April 13<sup>th</sup> 2009 Presentation Date</p> </div> </div>	<div style="text-align: center;"> <p><b>Conclusion</b></p> <table border="0" style="width: 100%;"> <tr> <td style="width: 50%; vertical-align: top;"> <p><u>PV System</u></p> <p>Cost Increase: \$228,553 Schedule Effect: 0 days</p> </td> <td style="width: 50%; vertical-align: top;"> <p><u>Micro Piles</u></p> <p>Cost Savings: \$266,565 Schedule Reduction: 24 days</p> </td> </tr> </table> <p style="font-size: 2em; color: blue; margin: 10px 0;">↓</p> <p>Cost Savings: \$38,012 Schedule Reduction: 24 days</p> <p>Additional Savings: \$48,000 Over 25 years</p> </div>	<p><u>PV System</u></p> <p>Cost Increase: \$228,553 Schedule Effect: 0 days</p>	
<p><u>PV System</u></p> <p>Cost Increase: \$228,553 Schedule Effect: 0 days</p>	<p><u>Micro Piles</u></p> <p>Cost Savings: \$266,565 Schedule Reduction: 24 days</p>		


<p><b>Presentation Agenda</b></p>	<p>Erik Carlson Construction Management</p>	<p><b>Analysis 3 – Int. Fit-Out BIM Implementation</b></p>	
<div style="display: flex; align-items: center;"> <div style="width: 20%; background-color: black; color: white; padding: 5px;"> <p><b>Project Overview</b></p> <p>Analysis 1 Alt. Foundation</p> <p>Analysis 2 PV Glass Modules</p> <p>Analysis 3 BIM and Int. Fit-Out</p> <p>Q &amp; A</p> </div> <div style="width: 80%; text-align: center;">  <p><b>BridgeSide Building II</b></p> <p>Monday, April 13<sup>th</sup> 2009 Presentation Date</p> </div> </div>	<p><b>Problem</b></p> <ul style="list-style-type: none"> <li>• Owners like the idea of BIM but don't know how to implement it</li> <li>• Tenants like to be able to visualize their future space</li> <li>• It is difficult to get project teams to agree on model responsibilities</li> </ul> <p><b>Objective</b></p> <ul style="list-style-type: none"> <li>• Determine BIM benefits for interior phases</li> <li>• Determine model responsibilities</li> <li>• Determine a level of detail for interior models</li> <li>• Attract future tenants earlier in the project</li> </ul>		


<p><b>Presentation Agenda</b></p>	<p>Erik Carlson Construction Management</p>	<p><b>Analysis 3 – Int. Fit-Out BIM Implementation</b></p>	
<div> <p><b>Project Overview</b></p> <p><b>Analysis 1</b> Alt. Foundation</p> <p><b>Analysis 2</b> PV Glass Modules</p> <p><b>Analysis 3</b> BIM and Int. Fit-Out</p> <p><b>Q &amp; A</b></p> </div> <div> <p style="text-align: center;"><b>BridgeSide Building II</b></p> </div> <div> <p>Monday, April 13<sup>th</sup> 2009 Presentation Date</p> </div>	<p style="text-align: center;"><b>Analysis Questions</b></p> <ol style="list-style-type: none"> <li>1. In what ways is BIM beneficial for interior fit-outs?</li> <li>2. How will potential tenants utilize a BIM model when designing their space?</li> <li>3. What are the cost and schedule implications of implementing BIM?</li> <li>4. What deters owners from implementing BIM on their projects?</li> <li>5. What are the model requirements for interior design?</li> </ol>		

<p><b>Presentation Agenda</b></p>	<p>Erik Carlson Construction Management</p>	<p><b>Analysis 3 – Int. Fit-Out BIM Implementation</b></p>	
<div> <p><b>Project Overview</b></p> <p><b>Analysis 1</b> Alt. Foundation</p> <p><b>Analysis 2</b> PV Glass Modules</p> <p><b>Analysis 3</b> BIM and Int. Fit-Out</p> <p><b>Q &amp; A</b></p> </div> <div> <p style="text-align: center;"><b>BridgeSide Building II</b></p> </div> <div> <p>Monday, April 13<sup>th</sup> 2009 Presentation Date</p> </div>	<p style="text-align: center;"><b>Interior Uses and Benefits</b></p> <ul style="list-style-type: none"> <li>•The speed and ease of creating an interior model.</li> <li>•The ability to visualize the design.</li> <li>•The ability to create multiple interior designs on one building model, which will accommodate multiple tenants or multiple ideas.</li> <li>•Organizing material information, cost data, schedules, and material quantities.</li> </ul>		


<p><b>Presentation Agenda</b></p>	<p>Erik Carlson Construction Management</p>	<p><b>Analysis 3 – Int. Fit-Out BIM Implementation</b></p>	
<div style="display: flex; align-items: center;"> <div style="width: 150px;"> <p><b>Project Overview</b></p> <p><b>Analysis 1</b> Alt. Foundation</p> <p><b>Analysis 2</b> PV Glass Modules</p> <p><b>Analysis 3</b> BIM and Int. Fit-Out</p> <p><b>Q &amp; A</b></p> </div> <div style="margin-left: 20px;">  </div> </div> <p style="font-size: small; margin-top: 10px;">Monday, April 13<sup>th</sup> 2009 Presentation Date</p>	<p style="text-align: center;"><b>Interior Uses and Benefits</b></p> <ul style="list-style-type: none"> <li>•The speed and ease of creating an interior model.</li> <li>•The ability to visualize the design.</li> <li>•The ability to create a model which will accommodate...</li> <li>•Organizing material quantities.</li> </ul> <div style="text-align: center; margin: 10px 0;">  </div>		








<p><b>Presentation Agenda</b></p>	<p>Erik Carlson Construction Management</p>	<p><b>Analysis 3 – Int. Fit-Out BIM Implementation</b></p>	
<div style="display: flex; align-items: center;"> <div style="width: 150px;"> <p><b>Project Overview</b></p> <p><b>Analysis 1</b> Alt. Foundation</p> <p><b>Analysis 2</b> PV Glass Modules</p> <p><b>Analysis 3</b> BIM and Int. Fit-Out</p> <p><b>Q &amp; A</b></p> </div> <div style="margin-left: 20px;">  </div> </div> <p style="font-size: small; margin-top: 10px;">Monday, April 13<sup>th</sup> 2009 Presentation Date</p>	<p style="text-align: center;"><b>Implementation Challenges</b></p> <ul style="list-style-type: none"> <li>•Determining model responsibilities</li> <li>•Changing the way project teams work together</li> <li>•Communication</li> <li>•Defining how the model will be used</li> </ul>		



<p><b>Presentation Agenda</b></p>	<p>Erik Carlson Construction Management</p>	<p><b>Analysis 3 – Int. Fit-Out BIM Implementation</b></p>	
<div style="display: flex;"> <div style="flex: 1;"> <p><b>Project Overview</b></p> <p><b>Analysis 1</b> Alt. Foundation</p> <p><b>Analysis 2</b> PV Glass Modules</p> <p><b>Analysis 3</b> BIM and Int. Fit-Out</p> <p><b>Q &amp; A</b></p> </div> <div style="flex: 2;">  </div> </div> <p>Monday, April 13<sup>th</sup> 2009 Presentation Date</p>	<p><b>BIM Documents</b></p> <ul style="list-style-type: none"> <li>•Model Progression Specification</li> <li>•AIA E202 BIM Protocol Exhibit</li> </ul>		


<p><b>Presentation Agenda</b></p>	<p>Erik Carlson Construction Management</p>	<p><b>Analysis 3 – Int. Fit-Out BIM Implementation</b></p>	<table border="1"> <thead> <tr> <th>Model Content</th> <th>100</th> <th>200</th> <th>300</th> <th>400</th> <th>500</th> </tr> </thead> <tbody> <tr> <td><b>Design &amp; Coordination</b>—(functional form / behavior)</td> <td>Non-geometric data of the model, when relevant (e.g., volume, mass, etc.)</td> <td>Generic attributes (dimensions, elevations, etc.)</td> <td>Specific attributes (dimensions, elevations, etc.)</td> <td>Shop drawings (fabrication)</td> <td>As-built</td> </tr> <tr> <td><b>Estimated Uses</b></td> <td>100</td> <td>200</td> <td>300</td> <td>400</td> <td>500</td> </tr> <tr> <td><b>4D Scheduling</b></td> <td>Not project dependent (calendar planning of major elements)</td> <td>Time-related (project dependent) (sequence of major activities)</td> <td>Time-related (project dependent) (sequence of included activities)</td> <td>Simulation and analysis (including construction means and methods (cranes, man lifts, etc.))</td> <td></td> </tr> <tr> <td><b>Cost Estimating</b></td> <td>Unrelated cost structure. Example: bid of floor area, Sheetrock bid, painting bid, etc. Assumptions on basic content</td> <td>Estimated cost based on measurement of generic elements. (e.g., generic interior wall)</td> <td>Estimated cost based on measurement of specific assemblies (e.g., specific wall type)</td> <td>Committed purchase price of specific assembly as Banned</td> <td>Record Uses</td> </tr> <tr> <td><b>Program Compliance</b></td> <td>Generic requirements</td> <td>Generic requirements</td> <td>IFC: Materials, FF&amp;E connections</td> <td>Specific manufacturer purchase selections</td> <td>As-built documentation</td> </tr> <tr> <td><b>Sustainable Materials</b></td> <td>LEED strategies</td> <td>Generic quantities of materials by LEED categories</td> <td>Material quantities by manufacturer or recycled content</td> <td>Specific manufacturer purchase selections</td> <td>As-built documentation</td> </tr> <tr> <td><b>ENVIRONMENTAL LIGHTING</b></td> <td>Energy code, air flow, daylight, etc.</td> <td>Conceptual design based on generic and assumed system</td> <td>Quantitative analysis based on specific building materials and installed system components</td> <td>Product simulation based on specific manufacturer and installed system components</td> <td>Commissioning and recording of measured performance</td> </tr> </tbody> </table>	Model Content	100	200	300	400	500	<b>Design &amp; Coordination</b> —(functional form / behavior)	Non-geometric data of the model, when relevant (e.g., volume, mass, etc.)	Generic attributes (dimensions, elevations, etc.)	Specific attributes (dimensions, elevations, etc.)	Shop drawings (fabrication)	As-built	<b>Estimated Uses</b>	100	200	300	400	500	<b>4D Scheduling</b>	Not project dependent (calendar planning of major elements)	Time-related (project dependent) (sequence of major activities)	Time-related (project dependent) (sequence of included activities)	Simulation and analysis (including construction means and methods (cranes, man lifts, etc.))		<b>Cost Estimating</b>	Unrelated cost structure. Example: bid of floor area, Sheetrock bid, painting bid, etc. Assumptions on basic content	Estimated cost based on measurement of generic elements. (e.g., generic interior wall)	Estimated cost based on measurement of specific assemblies (e.g., specific wall type)	Committed purchase price of specific assembly as Banned	Record Uses	<b>Program Compliance</b>	Generic requirements	Generic requirements	IFC: Materials, FF&E connections	Specific manufacturer purchase selections	As-built documentation	<b>Sustainable Materials</b>	LEED strategies	Generic quantities of materials by LEED categories	Material quantities by manufacturer or recycled content	Specific manufacturer purchase selections	As-built documentation	<b>ENVIRONMENTAL LIGHTING</b>	Energy code, air flow, daylight, etc.	Conceptual design based on generic and assumed system	Quantitative analysis based on specific building materials and installed system components	Product simulation based on specific manufacturer and installed system components	Commissioning and recording of measured performance
Model Content	100	200	300	400	500																																														
<b>Design &amp; Coordination</b> —(functional form / behavior)	Non-geometric data of the model, when relevant (e.g., volume, mass, etc.)	Generic attributes (dimensions, elevations, etc.)	Specific attributes (dimensions, elevations, etc.)	Shop drawings (fabrication)	As-built																																														
<b>Estimated Uses</b>	100	200	300	400	500																																														
<b>4D Scheduling</b>	Not project dependent (calendar planning of major elements)	Time-related (project dependent) (sequence of major activities)	Time-related (project dependent) (sequence of included activities)	Simulation and analysis (including construction means and methods (cranes, man lifts, etc.))																																															
<b>Cost Estimating</b>	Unrelated cost structure. Example: bid of floor area, Sheetrock bid, painting bid, etc. Assumptions on basic content	Estimated cost based on measurement of generic elements. (e.g., generic interior wall)	Estimated cost based on measurement of specific assemblies (e.g., specific wall type)	Committed purchase price of specific assembly as Banned	Record Uses																																														
<b>Program Compliance</b>	Generic requirements	Generic requirements	IFC: Materials, FF&E connections	Specific manufacturer purchase selections	As-built documentation																																														
<b>Sustainable Materials</b>	LEED strategies	Generic quantities of materials by LEED categories	Material quantities by manufacturer or recycled content	Specific manufacturer purchase selections	As-built documentation																																														
<b>ENVIRONMENTAL LIGHTING</b>	Energy code, air flow, daylight, etc.	Conceptual design based on generic and assumed system	Quantitative analysis based on specific building materials and installed system components	Product simulation based on specific manufacturer and installed system components	Commissioning and recording of measured performance																																														
<div style="display: flex;"> <div style="flex: 1;"> <p><b>Project Overview</b></p> <p><b>Analysis 1</b> Alt. Foundation</p> <p><b>Analysis 2</b> PV Glass Modules</p> <p><b>Analysis 3</b> BIM and Int. Fit-Out</p> <p><b>Q &amp; A</b></p> </div> <div style="flex: 2;">  </div> </div> <p>Monday, April 13<sup>th</sup> 2009 Presentation Date</p>	<p><b>BIM Documents</b></p> <ul style="list-style-type: none"> <li>•Model Progression Specification</li> <li>•AIA E202 BIM Protocol Exhibit</li> </ul> <ul style="list-style-type: none"> <li>•Levels of detail 100 through 500</li> <li>•Determines the model's level of detail and potential uses</li> <li>•Prevents misinterpretations of the model</li> <li>•Allows owners to specify a level of detail based on what they want to use the model for</li> </ul>																																																		





<p><b>Presentation Agenda</b></p>	<p>Erik Carlson Construction Management</p>	<p><b>Analysis 3 – Int. Fit-Out BIM Implementation</b></p>	<table border="1"> <thead> <tr> <th rowspan="2">Element (ASTM Uniformat II Classification)</th> <th colspan="8">Level of Detail (LOD) and Model Component Author (MCA)</th> </tr> <tr> <th colspan="2">Original</th> <th colspan="2">Design</th> <th colspan="2">Contract</th> <th colspan="2">As-Built</th> </tr> <tr> <th></th> <th>LOD 100</th> <th>LOD 200</th> <th>LOD 300</th> <th>LOD 400</th> <th>LOD 100</th> <th>LOD 200</th> <th>LOD 300</th> <th>LOD 400</th> </tr> </thead> <tbody> <tr> <td>C - INTERIORS</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>C100 Interior Construction</td> <td>C1010 Partitions</td> <td>100</td> <td>PD</td> <td>200</td> <td>PD</td> <td>300</td> <td>PD</td> <td>400</td> </tr> <tr> <td></td> <td>C1020 Interior Doors</td> <td>100</td> <td>PD</td> <td>200</td> <td>PD</td> <td>300</td> <td>PD</td> <td>400</td> </tr> <tr> <td></td> <td>C1030 Partings</td> <td>100</td> <td>PD</td> <td>150</td> <td>PD</td> <td>200</td> <td>PD</td> <td>400</td> </tr> <tr> <td>C20 Stairs</td> <td>C2010 Stair Construction</td> <td>100</td> <td>PD</td> <td>200</td> <td>PD</td> <td>300</td> <td>TC</td> <td>400</td> </tr> <tr> <td></td> <td>C2020 Stair Finishes</td> <td>100</td> <td>PD</td> <td>150</td> <td>PD</td> <td>100</td> <td>TC</td> <td>100</td> </tr> <tr> <td>C30 Interior Finishes</td> <td>C3010 Wall Finishes</td> <td>100</td> <td>PD</td> <td>100</td> <td>PD</td> <td>100</td> <td>TC</td> <td>100</td> </tr> <tr> <td></td> <td>C3020 Floor Finishes</td> <td>100</td> <td>PD</td> <td>150</td> <td>PD</td> <td>100</td> <td>TC</td> <td>100</td> </tr> <tr> <td></td> <td>C3030 Ceiling Finishes</td> <td>100</td> <td>PD</td> <td>100</td> <td>PD</td> <td>100</td> <td>TC</td> <td>100</td> </tr> </tbody> </table> <p>Model Component Authors:                  PD – Prime Designer                  DC – Design Consultants                  PC – Prime Contractor                  TC – Trade Contractors                  S – Suppliers</p>	Element (ASTM Uniformat II Classification)	Level of Detail (LOD) and Model Component Author (MCA)								Original		Design		Contract		As-Built			LOD 100	LOD 200	LOD 300	LOD 400	LOD 100	LOD 200	LOD 300	LOD 400	C - INTERIORS									C100 Interior Construction	C1010 Partitions	100	PD	200	PD	300	PD	400		C1020 Interior Doors	100	PD	200	PD	300	PD	400		C1030 Partings	100	PD	150	PD	200	PD	400	C20 Stairs	C2010 Stair Construction	100	PD	200	PD	300	TC	400		C2020 Stair Finishes	100	PD	150	PD	100	TC	100	C30 Interior Finishes	C3010 Wall Finishes	100	PD	100	PD	100	TC	100		C3020 Floor Finishes	100	PD	150	PD	100	TC	100		C3030 Ceiling Finishes	100	PD	100	PD	100	TC	100
Element (ASTM Uniformat II Classification)	Level of Detail (LOD) and Model Component Author (MCA)																																																																																																													
	Original		Design		Contract		As-Built																																																																																																							
	LOD 100	LOD 200	LOD 300	LOD 400	LOD 100	LOD 200	LOD 300	LOD 400																																																																																																						
C - INTERIORS																																																																																																														
C100 Interior Construction	C1010 Partitions	100	PD	200	PD	300	PD	400																																																																																																						
	C1020 Interior Doors	100	PD	200	PD	300	PD	400																																																																																																						
	C1030 Partings	100	PD	150	PD	200	PD	400																																																																																																						
C20 Stairs	C2010 Stair Construction	100	PD	200	PD	300	TC	400																																																																																																						
	C2020 Stair Finishes	100	PD	150	PD	100	TC	100																																																																																																						
C30 Interior Finishes	C3010 Wall Finishes	100	PD	100	PD	100	TC	100																																																																																																						
	C3020 Floor Finishes	100	PD	150	PD	100	TC	100																																																																																																						
	C3030 Ceiling Finishes	100	PD	100	PD	100	TC	100																																																																																																						
<p><b>Project Overview</b></p> <p><b>Analysis 1</b> Alt. Foundation</p> <p><b>Analysis 2</b> PV Glass Modules</p> <p><b>Analysis 3</b> BIM and Int. Fit-Out</p> <p><b>Q &amp; A</b></p>  <p>Monday, April 13<sup>th</sup> 2009 Presentation Date</p>	<p><b>BIM Documents</b></p> <ul style="list-style-type: none"> <li>•Model Progression Specification</li> <li>•AIA E202 BIM Protocol Exhibit</li> </ul> <ul style="list-style-type: none"> <li>•Defines who is responsible for the model detail at each phase</li> <li>•Can be adjusted to meet the needs of the project</li> <li>•Defining responsibilities at the beginning of the project prevents future conflicts</li> </ul>																																																																																																													

<p><b>Presentation Agenda</b></p>	<p>Erik Carlson Construction Management</p>	<p><b>Analysis 3 – Int. Fit-Out BIM Implementation</b></p>	<table border="1"> <tr> <td> <p><b>[1.4] Initial Responsibilities.</b> The party responsible for managing the Model shall facilitate the establishment, protocols for the following:</p> <ol style="list-style-type: none"> <li>1. Model origin, ownership system, and tools</li> <li>2. File storage location(s)</li> <li>3. Protocols for transferring and accessing Model files</li> <li>4. Clash detection</li> <li>5. Access rights</li> <li>6. Other protocols</li> </ol> <p>(Insert additional protocols below.)</p> </td> <td>  </td> </tr> <tr> <td> <p><b>[1.4] Ongoing Responsibilities.</b> The party responsible for managing the Model shall have the following ongoing responsibilities:</p> <ol style="list-style-type: none"> <li>1. Collect incoming Models</li> <li>1. Coordinate information and exchange of Models</li> <li>2. Log incoming Models</li> <li>4. Maintain record copy of each file received</li> <li>2. Aggregate Model files and make available for viewing</li> <li>3. Perform clash detection in accordance with established protocols and issue periodic clash detection reports</li> <li>4. Maintain Model archives and backups</li> <li>3. Manage access rights</li> <li>6. Follow protocols established in Section 2.4.2</li> </ol> </td> <td>  </td> </tr> </table>	<p><b>[1.4] Initial Responsibilities.</b> The party responsible for managing the Model shall facilitate the establishment, protocols for the following:</p> <ol style="list-style-type: none"> <li>1. Model origin, ownership system, and tools</li> <li>2. File storage location(s)</li> <li>3. Protocols for transferring and accessing Model files</li> <li>4. Clash detection</li> <li>5. Access rights</li> <li>6. Other protocols</li> </ol> <p>(Insert additional protocols below.)</p>		<p><b>[1.4] Ongoing Responsibilities.</b> The party responsible for managing the Model shall have the following ongoing responsibilities:</p> <ol style="list-style-type: none"> <li>1. Collect incoming Models</li> <li>1. Coordinate information and exchange of Models</li> <li>2. Log incoming Models</li> <li>4. Maintain record copy of each file received</li> <li>2. Aggregate Model files and make available for viewing</li> <li>3. Perform clash detection in accordance with established protocols and issue periodic clash detection reports</li> <li>4. Maintain Model archives and backups</li> <li>3. Manage access rights</li> <li>6. Follow protocols established in Section 2.4.2</li> </ol>	
<p><b>[1.4] Initial Responsibilities.</b> The party responsible for managing the Model shall facilitate the establishment, protocols for the following:</p> <ol style="list-style-type: none"> <li>1. Model origin, ownership system, and tools</li> <li>2. File storage location(s)</li> <li>3. Protocols for transferring and accessing Model files</li> <li>4. Clash detection</li> <li>5. Access rights</li> <li>6. Other protocols</li> </ol> <p>(Insert additional protocols below.)</p>							
<p><b>[1.4] Ongoing Responsibilities.</b> The party responsible for managing the Model shall have the following ongoing responsibilities:</p> <ol style="list-style-type: none"> <li>1. Collect incoming Models</li> <li>1. Coordinate information and exchange of Models</li> <li>2. Log incoming Models</li> <li>4. Maintain record copy of each file received</li> <li>2. Aggregate Model files and make available for viewing</li> <li>3. Perform clash detection in accordance with established protocols and issue periodic clash detection reports</li> <li>4. Maintain Model archives and backups</li> <li>3. Manage access rights</li> <li>6. Follow protocols established in Section 2.4.2</li> </ol>							
<p><b>Project Overview</b></p> <p><b>Analysis 1</b> Alt. Foundation</p> <p><b>Analysis 2</b> PV Glass Modules</p> <p><b>Analysis 3</b> BIM and Int. Fit-Out</p> <p><b>Q &amp; A</b></p>  <p>Monday, April 13<sup>th</sup> 2009 Presentation Date</p>	<p><b>BIM Documents</b></p> <ul style="list-style-type: none"> <li>•Model Progression Specification</li> <li>•AIA E202 BIM Protocol Exhibit</li> </ul> <ul style="list-style-type: none"> <li>•Applies the MPS information into a contractual form</li> <li>•Assigns model manager responsibilities</li> <li>•Can be understood and customized by inexperienced owners</li> </ul> <ul style="list-style-type: none"> <li>•Model standards</li> <li>•File formats for model uses</li> <li>•Responsible parties for model management</li> <li>•Model archive requirements</li> <li>•Model uses per level of detail</li> <li>•Model Element Authors</li> </ul>						

<p><b>Presentation Agenda</b></p>	<p>Erik Carlson Construction Management</p>	<p><b>Analysis 3 – Int. Fit-Out BIM Implementation</b></p>	<table border="1"> <thead> <tr> <th>Model Content</th> <th>100</th> <th>200</th> <th>300</th> <th>400</th> <th>500</th> </tr> </thead> <tbody> <tr> <td>Design &amp; Coordination—(function) or form / behavior)</td> <td>Non-geometric (non-physical) or line work, elev., volume curves, etc.</td> <td>Generic elements placed in three dimensions</td> <td>Specific elements defined in 2D objects</td> <td>End-Building structure</td> <td>Actual</td> </tr> <tr> <td>Authorial uses</td> <td>Dimensions position rotation</td> <td>Dimensions position rotation color</td> <td>Dimensions position rotation color material</td> <td>Dimensions position rotation color material texture</td> <td>Actual</td> </tr> <tr> <td>3D Scheduling</td> <td>and project construction duration</td> <td>Time-based, ordered appearance of major activities</td> <td>Time-based, ordered appearance of major activities</td> <td>Time-based, ordered appearance of major activities</td> <td>Actual</td> </tr> <tr> <td>Cost Estimating</td> <td>parametric cost reference. Example: Bill of Materials (BOM) based, quantity take-off, etc. assumptions on value content</td> <td>parametric cost reference. Example: Bill of Materials (BOM) based, generic interior wall type</td> <td>parametric cost reference. Example: Bill of Materials (BOM) based, specific wall type</td> <td>parametric cost reference. Example: Bill of Materials (BOM) based, specific wall type</td> <td>Actual cost</td> </tr> <tr> <td>Program Compliance</td> <td>Class department code</td> <td>Specific room requirements</td> <td>IFC, constraints</td> <td>IFC, constraints</td> <td>Actual</td> </tr> <tr> <td>Sustainable Materials</td> <td>LEED strategies</td> <td>Approximate quantities of materials by LEED categories</td> <td>Specific quantities of materials by LEED categories</td> <td>Specific quantities of materials by LEED categories</td> <td>Actual</td> </tr> <tr> <td>Environmental, Lighting, Energy, etc. (if provided)</td> <td>Strategy and performance analysis based on volumes and areas</td> <td>Conceptual design based on generic, end assumed system types</td> <td>Simulation based on specific building assemblies and program systems</td> <td>Simulation based on specific building assemblies and program systems</td> <td>Actual performance</td> </tr> </tbody> </table>	Model Content	100	200	300	400	500	Design & Coordination—(function) or form / behavior)	Non-geometric (non-physical) or line work, elev., volume curves, etc.	Generic elements placed in three dimensions	Specific elements defined in 2D objects	End-Building structure	Actual	Authorial uses	Dimensions position rotation	Dimensions position rotation color	Dimensions position rotation color material	Dimensions position rotation color material texture	Actual	3D Scheduling	and project construction duration	Time-based, ordered appearance of major activities	Time-based, ordered appearance of major activities	Time-based, ordered appearance of major activities	Actual	Cost Estimating	parametric cost reference. Example: Bill of Materials (BOM) based, quantity take-off, etc. assumptions on value content	parametric cost reference. Example: Bill of Materials (BOM) based, generic interior wall type	parametric cost reference. Example: Bill of Materials (BOM) based, specific wall type	parametric cost reference. Example: Bill of Materials (BOM) based, specific wall type	Actual cost	Program Compliance	Class department code	Specific room requirements	IFC, constraints	IFC, constraints	Actual	Sustainable Materials	LEED strategies	Approximate quantities of materials by LEED categories	Specific quantities of materials by LEED categories	Specific quantities of materials by LEED categories	Actual	Environmental, Lighting, Energy, etc. (if provided)	Strategy and performance analysis based on volumes and areas	Conceptual design based on generic, end assumed system types	Simulation based on specific building assemblies and program systems	Simulation based on specific building assemblies and program systems	Actual performance
Model Content	100	200	300	400	500																																														
Design & Coordination—(function) or form / behavior)	Non-geometric (non-physical) or line work, elev., volume curves, etc.	Generic elements placed in three dimensions	Specific elements defined in 2D objects	End-Building structure	Actual																																														
Authorial uses	Dimensions position rotation	Dimensions position rotation color	Dimensions position rotation color material	Dimensions position rotation color material texture	Actual																																														
3D Scheduling	and project construction duration	Time-based, ordered appearance of major activities	Time-based, ordered appearance of major activities	Time-based, ordered appearance of major activities	Actual																																														
Cost Estimating	parametric cost reference. Example: Bill of Materials (BOM) based, quantity take-off, etc. assumptions on value content	parametric cost reference. Example: Bill of Materials (BOM) based, generic interior wall type	parametric cost reference. Example: Bill of Materials (BOM) based, specific wall type	parametric cost reference. Example: Bill of Materials (BOM) based, specific wall type	Actual cost																																														
Program Compliance	Class department code	Specific room requirements	IFC, constraints	IFC, constraints	Actual																																														
Sustainable Materials	LEED strategies	Approximate quantities of materials by LEED categories	Specific quantities of materials by LEED categories	Specific quantities of materials by LEED categories	Actual																																														
Environmental, Lighting, Energy, etc. (if provided)	Strategy and performance analysis based on volumes and areas	Conceptual design based on generic, end assumed system types	Simulation based on specific building assemblies and program systems	Simulation based on specific building assemblies and program systems	Actual performance																																														
<p><b>Project Overview</b></p> <p><b>Analysis 1</b> Alt. Foundation</p> <p><b>Analysis 2</b> PV Glass Modules</p> <p><b>Analysis 3</b> BIM and Int. Fit-Out</p> <p><b>Q &amp; A</b></p>  <p>Monday, April 13<sup>th</sup> 2009 Presentation Date</p>		<p><b>Interior Model</b></p>  <ul style="list-style-type: none"> <li>•Visualization             <ul style="list-style-type: none"> <li>•Material selection</li> <li>•Floor layouts</li> <li>•Design comparison</li> </ul> </li> <li>•Level of Detail: 300             <ul style="list-style-type: none"> <li>•Accurate assembly details – correct size, shape, location</li> <li>•Accommodate non-geometrical information</li> <li>•Accurate scheduling and cost estimating based on the model</li> <li>•Shop Drawings</li> </ul> </li> </ul>																																																	

<p><b>Presentation Agenda</b></p>	<p>Erik Carlson Construction Management</p>	<p><b>Thesis Conclusions</b></p>	<div style="background-color: black; width: 100%; height: 100%;"></div>
<p><b>Project Overview</b></p> <p><b>Analysis 1</b> Alt. Foundation</p> <p><b>Analysis 2</b> PV Glass Modules</p> <p><b>Analysis 3</b> BIM and Int. Fit-Out</p> <p><b>Q &amp; A</b></p>  <p>Monday, April 13<sup>th</sup> 2009 Presentation Date</p>		<p><b>Micro Piles</b></p> <ul style="list-style-type: none"> <li>•Can be installed faster and more efficiently</li> <li>•Cost savings and schedule reduction</li> </ul> <p><b>PV Modules</b></p> <ul style="list-style-type: none"> <li>•Façade design is not sacrificed</li> <li>•Energy and environmental benefits</li> <li>•Payback period of 119 years is not acceptable</li> <li>•Initial costs can be offset by the micro pile cost savings</li> </ul> <p><b>Interior BIM Implementation</b></p> <ul style="list-style-type: none"> <li>•Visualization aspect is very beneficial to potential tenants</li> <li>•MPS and AIA E202 help inexperienced owners use BIM</li> <li>•A LOD of 300 would be sufficient for the interior models that potential tenants would use</li> </ul>	

<p><b>Presentation Agenda</b></p>	<p>Erik Carlson Construction Management</p>	<p><b>Acknowledgements</b></p>	
<div style="display: flex; align-items: center;"> <div style="width: 150px;"> <p><b>Project Overview</b></p> <p><b>Analysis 1</b> Alt. Foundation</p> <p><b>Analysis 2</b> PV Glass Modules</p> <p><b>Analysis 3</b> BIM and Int. Fit-Out</p> <p><b>Q &amp; A</b></p> </div> <div style="margin-left: 20px;">  </div> </div> <p style="font-size: small;">Monday, April 13<sup>th</sup> 2009 Presentation Date</p>	<p>Turner Construction Company Will Masters John Demarco I would also like to thank Turner Construction for sponsoring my thesis project</p> <p>Granley Construction Ty Orner Michael Tardif</p> <p>Idea Design Facilities David Manno</p> <p>Penn State AE Faculty Dr. John Mesner Dr. Walt Schneider Dr. David Riley Prof. Kevin Purifit Prof. Robert Holland</p> <p>My friends and family for their support.</p>		

<p><b>Presentation Agenda</b></p>	<p>Erik Carlson Construction Management</p>	<p><b>Questions?</b></p>	
<div style="display: flex; align-items: center;"> <div style="width: 150px;"> <p><b>Project Overview</b></p> <p><b>Analysis 1</b> Alt. Foundation</p> <p><b>Analysis 2</b> PV Glass Modules</p> <p><b>Analysis 3</b> BIM and Int. Fit-Out</p> <p><b>Q &amp; A</b></p> </div> <div style="margin-left: 20px;">  </div> </div> <p style="font-size: small;">Monday, April 13<sup>th</sup> 2009 Presentation Date</p>	