AE Senior Thesis 2010

700 SIX

700 Sixth Street

APRIL 12TH 2010

- Shane Flynn
- Hometown
  - Lakewood, PA
- Have a family stone business
  - Flynnstone
  - Arlington National Cemetery

Arlington National Cemetery Niche Wall

Visit website for more info

www.flynnstonerocks.com

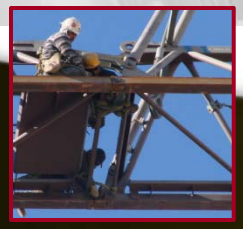
700 Sixth Street

ABOUT MYSELF

General Data

- **Size:**
  - 300,000 S.F. 12 Story Office Space w/ 3 1/2 Level Underground Parking Garage
- **Location:**
  - Downtown DC (Next to Verizon Center)
- **Contract Value:**
  - $46.5 million
- **Project Schedule:**
  - May 2007 thru May 2009
- **Building Features:**
  - Innovative Green Roof Design
  - Glass Bridge Located in the Lobby
  - Curtain Wall/Pre-Cast/Stone Façade
  - Contracted at LEED ‘Silver’ (Rated LEED ‘Platinum’)

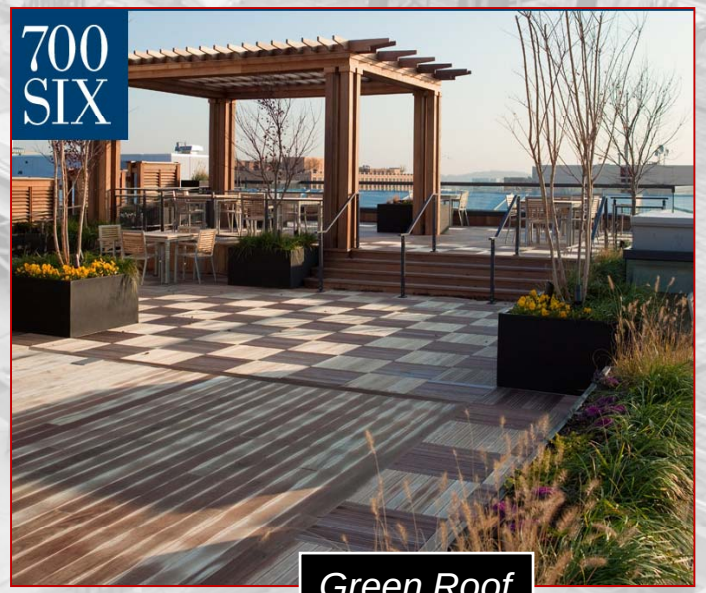
700 6th Street Rendering



700 Sixth Street

PROJECT OVERVIEW

- **Size:**
  - 300,000 S.F. 12 Story Office Space w/ 3 1/2 Level Underground Parking Garage
- **Location:**
  - Downtown DC (Next to Verizon Center)
- **Contract Value:**
  - $51.3 million
- **Project Schedule:**
  - May 2007 thru March 2009
- **Building Features:**
  - **Innovative Green Roof Design**
  - Glass Bridge Located in the Lobby
  - Curtain Wall/Pre-Cast/Stone Façade
  - Contracted at LEED ‘Silver’ (Rated LEED ‘Platinum’)



Green Roof




700 Sixth Street

PROJECT OVERVIEW

- **Size:**
  - 294,000+ S.F. 12 Story Office Space w/ 3 1/2 Level Underground Parking Garage
- **Location:**
  - Downtown DC (Next to Verizon Center)
- **Contract Value:**
  - $51.3 million
- **Project Schedule:**
  - May 2007 thru March 2009
- **Building Features:**
  - Innovative Green Roof Design
  - **Glass Bridge located in the Lobby**
  - Curtain Wall/Pre-Cast/Stone Façade
  - Contracted at LEED ‘Silver’ (Rated LEED ‘Platinum’)

Glass Bridge

700 Sixth Street

PROJECT OVERVIEW

- **Size:**
  - 300,000 S.F. 12 Story Office Space w/ 3 1/2 Level Underground Parking Garage
- **Location:**
  - Downtown DC (Next to Verizon Center)
- **Contract Value:**
  - $46.5 million
- **Project Schedule:**
  - May 2007 thru May 2009
- **Building Features:**
  - Innovative Green Roof Design
  - Lobby Glass Bridge
  - **Curtain Wall/Pre-Cast/Stone Façade**
  - Contracted at LEED ‘Silver’ (Rated LEED ‘Platinum’)

Building Façade




700 Sixth Street

PROJECT OVERVIEW

- **Mechanical:**
  - VAV System
  - Main components located on the Penthouse floor
    - 3 cooling towers
    - Emergency generator
  - Each individual floor has a mechanical room
  - 25 air handling units located throughout the building




- **Structural System:**
  - Cast In Place Concrete
    - Footings
    - Foundation Walls
    - Grade Beams
    - Slab on Grade
    - Suspended Slabs
    - Columns
  - Column Spacing 30’ x 30’
  - Columns typically 24” x 24”
  - Finished Ceiling Height 8’-6”
  - Typical Slab Thickness is 9”

Cast in Place

700 Sixth Street

PROJECT OVERVIEW

- **Major Players in Construction:**
  - **Owner:** Akridge Real Estate Services
  - **General Contractor/Construction Manager:** Balfour Beatty Construction
  - **Architect:** HOK
  - **Engineer:** Cagley & Associates
  - **MEP Engineer:** Girard Engineering
  - **LEED Consultant:** Sustainable Design Consulting
  - **Commissioning Consultant:** Advanced Building Performance




700 Sixth Street

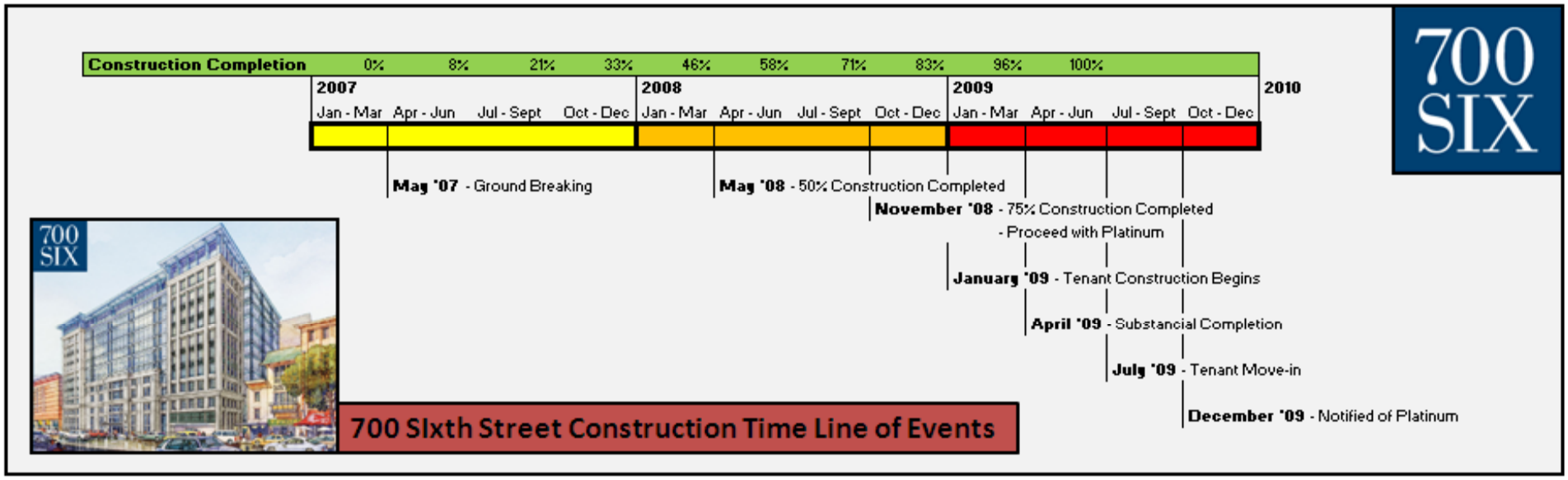
PROJECT OVERVIEW

Topics to be Presented:

- Construction Industry Issue
  - It's Never to Late to Go Green
- Alternative Stone For Lobby
- Precast vs. Handset Stone (Architectural Breadth)

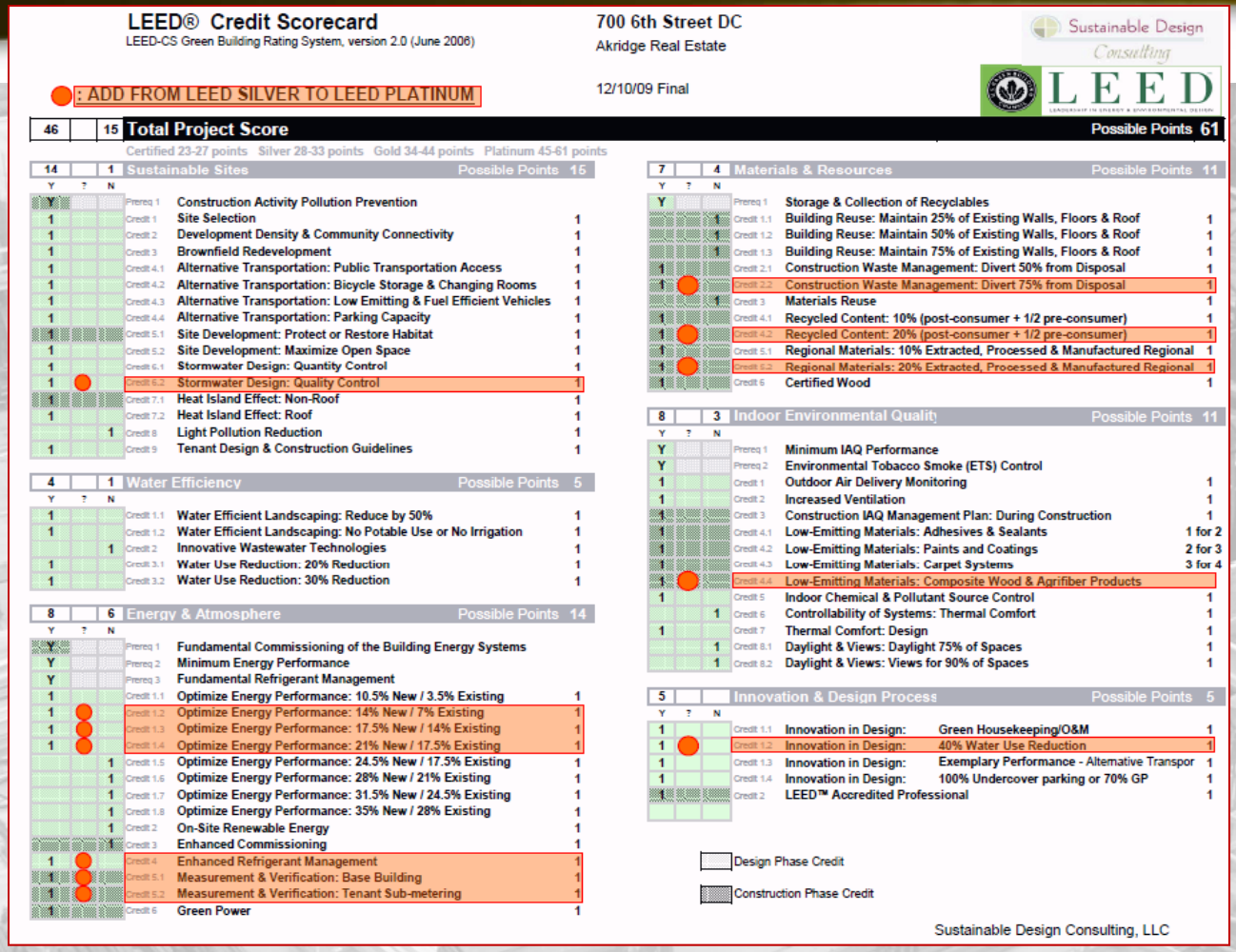
Not Presenting:

- Glass Bridge Improvements (Structural Breadth)



- **Nov. 08 75% of Construction Completed (Owner decides to go for 'Platinum')**
- **December 09-Notified of 'Platinum'**

IT'S NEVER TO LATE TO GO GREEN



LEED® Credit Scorecard

LEED-CS Green Building Rating System, version 2.0 (June 2006)

700 6th Street DC

Akridge Real Estate

12/10/09 Final

Sustainable Design Consulting

LEED

: ADD FROM LEED SILVER TO LEED PLATINUM

46 | 15 Total Project Score — Possible Points 61

Certified 23-27 points Silver 28-33 points Gold 34-44 points Platinum 45-61 points

14 | 1 Sustainable Sites — Possible Points 15

Y	?	N			
Y			Prereq 1	Construction Activity Pollution Prevention	
1			Credit 1	Site Selection	1
1			Credit 2	Development Density & Community Connectivity	1
1			Credit 3	Brownfield Redevelopment	1
1			Credit 4.1	Alternative Transportation: Public Transportation Access	1
1			Credit 4.2	Alternative Transportation: Bicycle Storage & Changing Rooms	1
1			Credit 4.3	Alternative Transportation: Low Emitting & Fuel Efficient Vehicles	1
1			Credit 4.4	Alternative Transportation: Parking Capacity	1
1			Credit 5.1	Site Development: Protect or Restore Habitat	1
1			Credit 5.2	Site Development: Maximize Open Space	1
1			Credit 6.1	Stormwater Design: Quantity Control	1
1	●		Credit 6.2	Stormwater Design: Quality Control	1
1			Credit 7.1	Heat Island Effect: Non-Roof	1
1			Credit 7.2	Heat Island Effect: Roof	1
		1	Credit 8	Light Pollution Reduction	1
1			Credit 9	Tenant Design & Construction Guidelines	1

4 | 1 Water Efficiency — Possible Points 5

Y	?	N			
1			Credit 1.1	Water Efficient Landscaping: Reduce by 50%	1
1			Credit 1.2	Water Efficient Landscaping: No Potable Use or No Irrigation	1
		1	Credit 2	Innovative Wastewater Technologies	1
1			Credit 3.1	Water Use Reduction: 20% Reduction	1
1			Credit 3.2	Water Use Reduction: 30% Reduction	1

8 | 6 Energy & Atmosphere — Possible Points 14

Y	?	N			
Y			Prereq 1	Fundamental Commissioning of the Building Energy Systems	
Y			Prereq 2	Minimum Energy Performance	
Y			Prereq 3	Fundamental Refrigerant Management	
1			Credit 1.1	Optimize Energy Performance: 10.5% New / 3.5% Existing	1
1	●		Credit 1.2	Optimize Energy Performance: 14% New / 7% Existing	1
1	●		Credit 1.3	Optimize Energy Performance: 17.5% New / 14% Existing	1
1	●		Credit 1.4	Optimize Energy Performance: 21% New / 17.5% Existing	1
		1	Credit 1.5	Optimize Energy Performance: 24.5% New / 17.5% Existing	1
		1	Credit 1.6	Optimize Energy Performance: 28% New / 21% Existing	1
		1	Credit 1.7	Optimize Energy Performance: 31.5% New / 24.5% Existing	1
		1	Credit 1.8	Optimize Energy Performance: 35% New / 28% Existing	1
		1	Credit 2	On-Site Renewable Energy	1
		1	Credit 3	Enhanced Commissioning	1
1	●		Credit 4	Enhanced Refrigerant Management	1
1	●		Credit 5.1	Measurement & Verification: Base Building	1
1	●		Credit 5.2	Measurement & Verification: Tenant Sub-metering	1
1			Credit 6	Green Power	1

7 | 4 Materials & Resources — Possible Points 11

Y	?	N			
Y			Prereq 1	Storage & Collection of Recyclables	
		1	Credit 1.1	Building Reuse: Maintain 25% of Existing Walls, Floors & Roof	1
		1	Credit 1.2	Building Reuse: Maintain 50% of Existing Walls, Floors & Roof	1
		1	Credit 1.3	Building Reuse: Maintain 75% of Existing Walls, Floors & Roof	1
1			Credit 2.1	Construction Waste Management: Divert 50% from Disposal	1
1	●		Credit 2.2	Construction Waste Management: Divert 75% from Disposal	1
		1	Credit 3	Materials Reuse	1
1			Credit 4.1	Recycled Content: 10% (post-consumer + 1/2 pre-consumer)	1
1	●		Credit 4.2	Recycled Content: 20% (post-consumer + 1/2 pre-consumer)	1
1			Credit 5.1	Regional Materials: 10% Extracted, Processed & Manufactured Regional	1
1	●		Credit 5.2	Regional Materials: 20% Extracted, Processed & Manufactured Regional	1
1			Credit 6	Certified Wood	1

8 | 3 Indoor Environmental Quality — Possible Points 11

Y	?	N			
Y			Prereq 1	Minimum IAQ Performance	
Y			Prereq 2	Environmental Tobacco Smoke (ETS) Control	
1			Credit 1	Outdoor Air Delivery Monitoring	1
1			Credit 2	Increased Ventilation	1
1			Credit 3	Construction IAQ Management Plan: During Construction	1
1			Credit 4.1	Low-Emitting Materials: Adhesives & Sealants	1 for 2
1			Credit 4.2	Low-Emitting Materials: Paints and Coatings	2 for 3
1			Credit 4.3	Low-Emitting Materials: Carpet Systems	3 for 4
1	●		Credit 4.4	Low-Emitting Materials: Composite Wood & Agrifiber Products	
1			Credit 5	Indoor Chemical & Pollutant Source Control	1
		1	Credit 6	Controllability of Systems: Thermal Comfort	1
1			Credit 7	Thermal Comfort: Design	1
		1	Credit 8.1	Daylight & Views: Daylight 75% of Spaces	1
		1	Credit 8.2	Daylight & Views: Views for 90% of Spaces	1

5 Innovation & Design Process — Possible Points 5

Y	?	N				
1			Credit 1.1	Innovation in Design:	Green Housekeeping/O&M	1
1	●		Credit 1.2	Innovation in Design:	40% Water Use Reduction	1
1			Credit 1.3	Innovation in Design:	Exemplary Performance - Alternative Transpor	1
1			Credit 1.4	Innovation in Design:	100% Undercover parking or 70% GP	1
1			Credit 2	LEED™ Accredited Professional		1

Design Phase Credit

Construction Phase Credit

Sustainable Design Consulting, LLC

Final LEED Scorecard (Added 12 points from original design)

IT'S NEVER TO LATE TO GO GREEN

700 Sixth Street

Relevant Overview of LEED Items:

- **Item #1:** Improve Energy Design Performance (Most Important)
- **Item #2:** Increase Recycled Content to 20%
- **Item #3:** Increase Construction Waste Management to 75%
- **Item #4:** 20% of Materials needed to be Within a 500 Mile Radius
- **Item #5:** Low Emitting Materials
- **Item #6:** 40% Water Use Reduction

- **Item #1:** Energy Design Performance

- **"Baseline" Projections**
  - $2.41/SF annual energy cost

- **Initial Design Performance**
  - 16.3% savings over baseline = 2 points
  - $2.02/SF annual energy cost

2	1	11	Energy & Atmosphere	Possible Points 14	
Y	?	N			
Y			Prereq 1	Fundamental Commissioning of the Building Energy Systems	
Y			Prereq 2	Minimum Energy Performance	
Y			Prereq 3	Fundamental Refrigerant Management	
			Credit 1.1	Optimize Energy Performance: 10.5% New / 3.5% Existing	1
		1	Credit 1.2	Optimize Energy Performance: 14% New / 7% Existing	1
		1	Credit 1.3	Optimize Energy Performance: 17.5% New / 14% Existing	1
		1	Credit 1.4	Optimize Energy Performance: 21% New / 17.5% Existing	1
		1	Credit 1.5	Optimize Energy Performance: 24.5% New / 17.5% Existing	1
		1	Credit 1.6	Optimize Energy Performance: 28% New / 21% Existing	1

- **Item #1:** Energy Design Performance

- **Energy Design Strategies (Need to get energy performance over 21%)**
  - Upgrading core lighting (Changed restroom lighting to LED)
  - Reducing garage lighting power density (Lowered Foot Candle Levels and redesigned layout)
  - Adding garage lighting occupancy sensors (Provides 15 minutes of illumination when tripped)
  - Adding tenant day lighting controls (lease requires use of dimmable perimeter zone fixtures)

- **Item #1:** Energy Design Performance

- **Platinum Strategy Energy Savings**

  - Cumulative Savings = 21.4% compared to baseline projections; 4 points achieved total
  - $151,770/yr utility cost savings
  - $0.52/SF annual utility cost savings

2	1	11	Energy & Atmosphere	Possible Points 14
Y	?	N		
Y			Prereq 1 **Fundamental Commissioning of the Building Energy Systems**	
Y			Prereq 2 **Minimum Energy Performance**	
			Prereq 3 **Fundamental Refrigerant Management**	
			Credit 1.1 **Optimize Energy Performance: 10.5% New / 3.5% Existing**	1
		1	Credit 1.2 **Optimize Energy Performance: 14% New / 7% Existing**	1
		1	Credit 1.3 **Optimize Energy Performance: 17.5% New / 14% Existing**	1
		1	Credit 1.4 **Optimize Energy Performance: 21% New / 17.5% Existing**	1
		1	Credit 1.5 **Optimize Energy Performance: 24.5% New / 17.5% Existing**	1
		1	Credit 1.6 **Optimize Energy Performance: 28% New / 21% Existing**	1

- **Item #2:** Increase Recycled Content to 20%
  - Originally contracted for 10%
  - All steel and aluminum used on project was recycled
  - Toilet partitions
  - CMU
  - Construction team achieved 20.5% (barely enough)
  - Achieved another LEED point

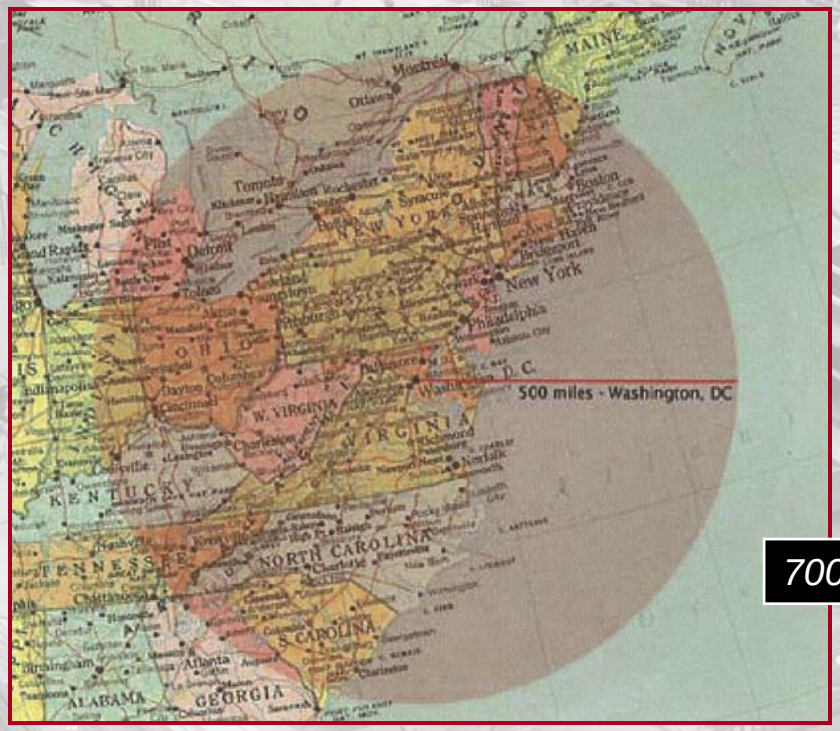
Item #3: Increased *Construction Waste Management*

- ***Divert debris from disposal in landfills.***
  - LEED provides 1 point for 50% diversion which is what they were contracted to do
  - LEED provides 1 additional point if 75% diversion is obtained
- **How did Balfour Beatty achieve this?**
  - Developed construction waste management plans with subcontractors
  - Subcontractor reported the percentages of waste diverted from land fills
  - Reported recycling percentages monthly
  - During excavation a demo'd structure was found (some schedule implications but helped with this LEED point)
    - Concrete and rebar from existing was used
- **2 Points Awarded**

Item #4: 20% of Materials needed to be Within a 500 Mile Radius

- ***What:***
  - 10% of building material cost must be manufactured/harvested/extracted within 500 miles of project to achieve first point
  - If 20% is achieved, a second LEED Point is granted
- ***Materials:***
  - Limestone
  - Precast
  - Concrete
  - All the furniture in the building is within the radius as well.
- Achieved second LEED point for the category

Item #4: 20% of Materials Needed to be Within a 500 Mile Radius



700 Sixth Street 500 Mile Radius

Item #5: Low Emitting Materials

- Had to redesign elevator cabs to reduce VOC content
- Locker room benches, telephone room backer boards, walnut window sills, rest room purse shelves, all got changed
- New materials contained no formaldehyde resins
- Construction team verified that the proper VOC compliant material that was specified was used on the project

Item #6: 40% Water Reduce Reduction

- Waterless Urinals
- Aerated Faucets and Shower Heads
- Dual Flush Valve Toilets (full or half flush option for the user)

Conclusion:

- Construction Team achieved LEED ‘Platinum’ 75% of the way through construction
  - Achieved this with a holistic approach
  - Was able to add 12 points
  - Changes did not affect schedule
    - Besides elevator cab construction

Main Lobby

ALTERNATIVE STONE FOR LOBBY

700 Sixth Street

- **Marble vs. Granite:**
  - Italian Marble
    - Porous Material
    - Needs to be resealed every 9 months
    - Expensive
    - Long lead time
  - Vermont Limestone
    - More durable and harder
    - Needs to be resealed less
    - Within 500 mile radius for LEED
    - Readily available

ALTERNATIVE STONE FOR LOBBY

Marble vs. Granite Architectural Comparison:

Italian Marble

Vermont Limestone

ALTERNATIVE STONE FOR LOBBY

Marble vs. Granite Aesthetic Comparison:

Italian Marble

Vermont Limestone

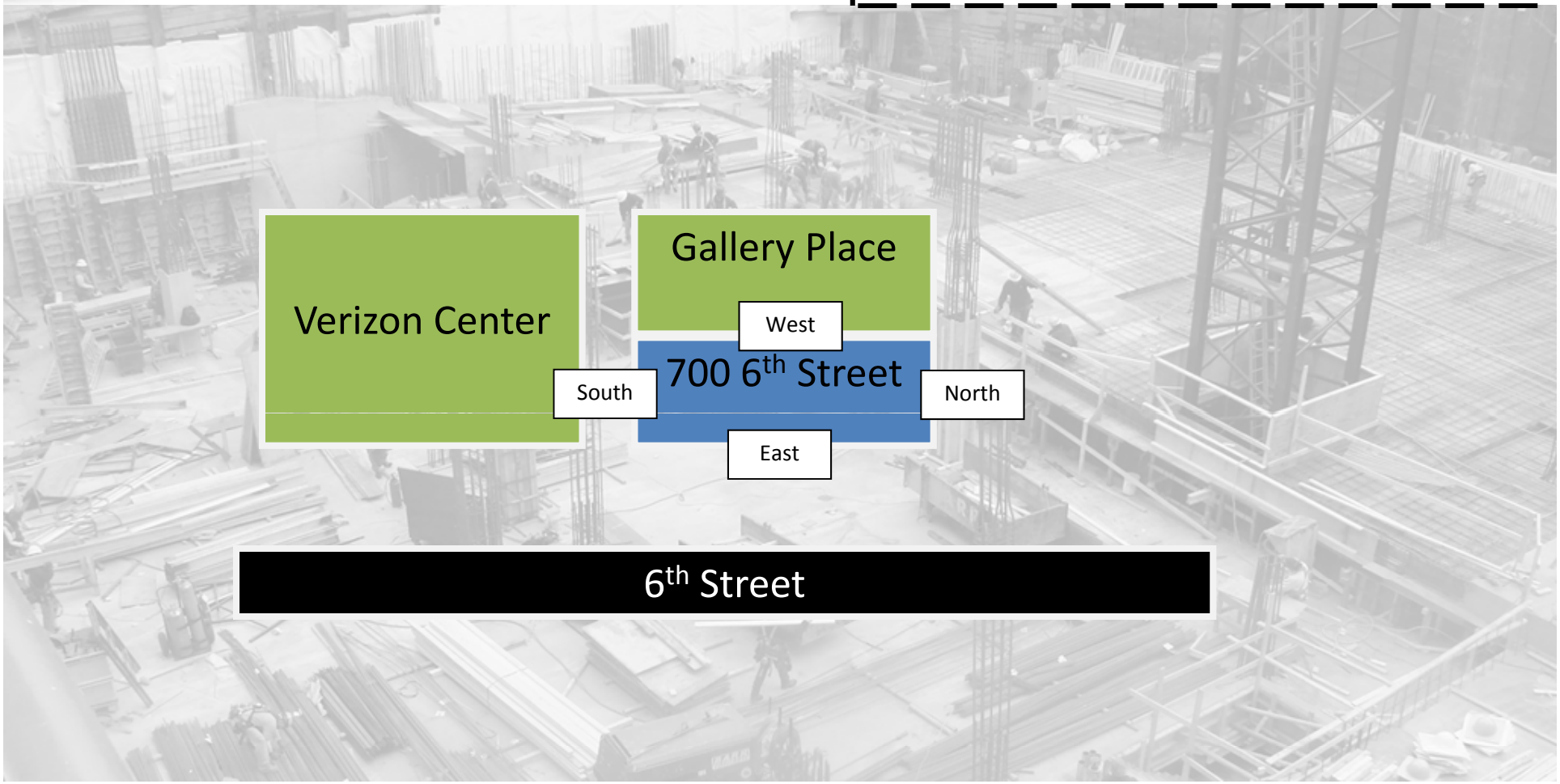
ALTERNATIVE STONE FOR LOBBY

- **Marble vs. Granite Cost Comparison:**
  - Italian Marble
    - $70 per SF to install and furnish
    - Total cost: $243,740
  - Vermont Limestone
    - $50 per SF to install and furnish
    - Total Cost: $174,100
  - Total Savings: Approx. $70,000

- **Recommendation:**
  - Granite!
  - More durable
  - Cheaper
  - American Made
  - Looks Similar
  - Would also recommend PA Blue Stone Supplied by Flynnstone for half the Price

ALTERNATIVE STONE FOR LOBBY

ARCH. BREADTH ANALYSIS



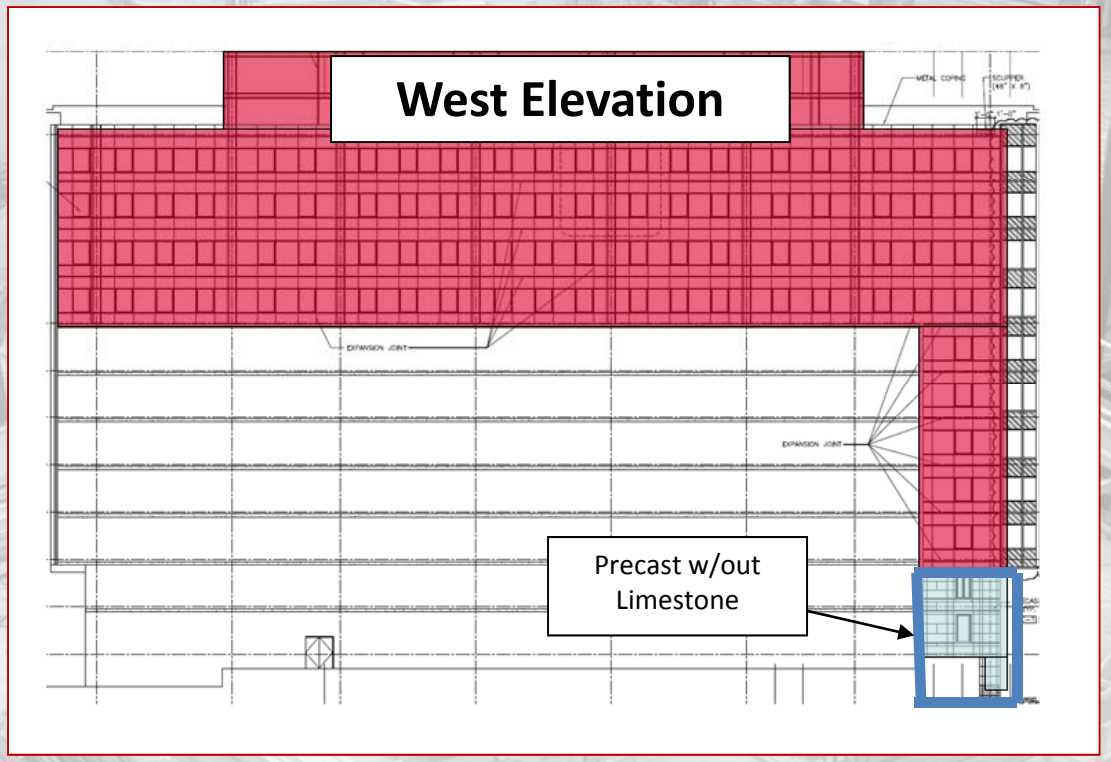
700 Sixth Street

PRECAST VS. HANDSET STONE

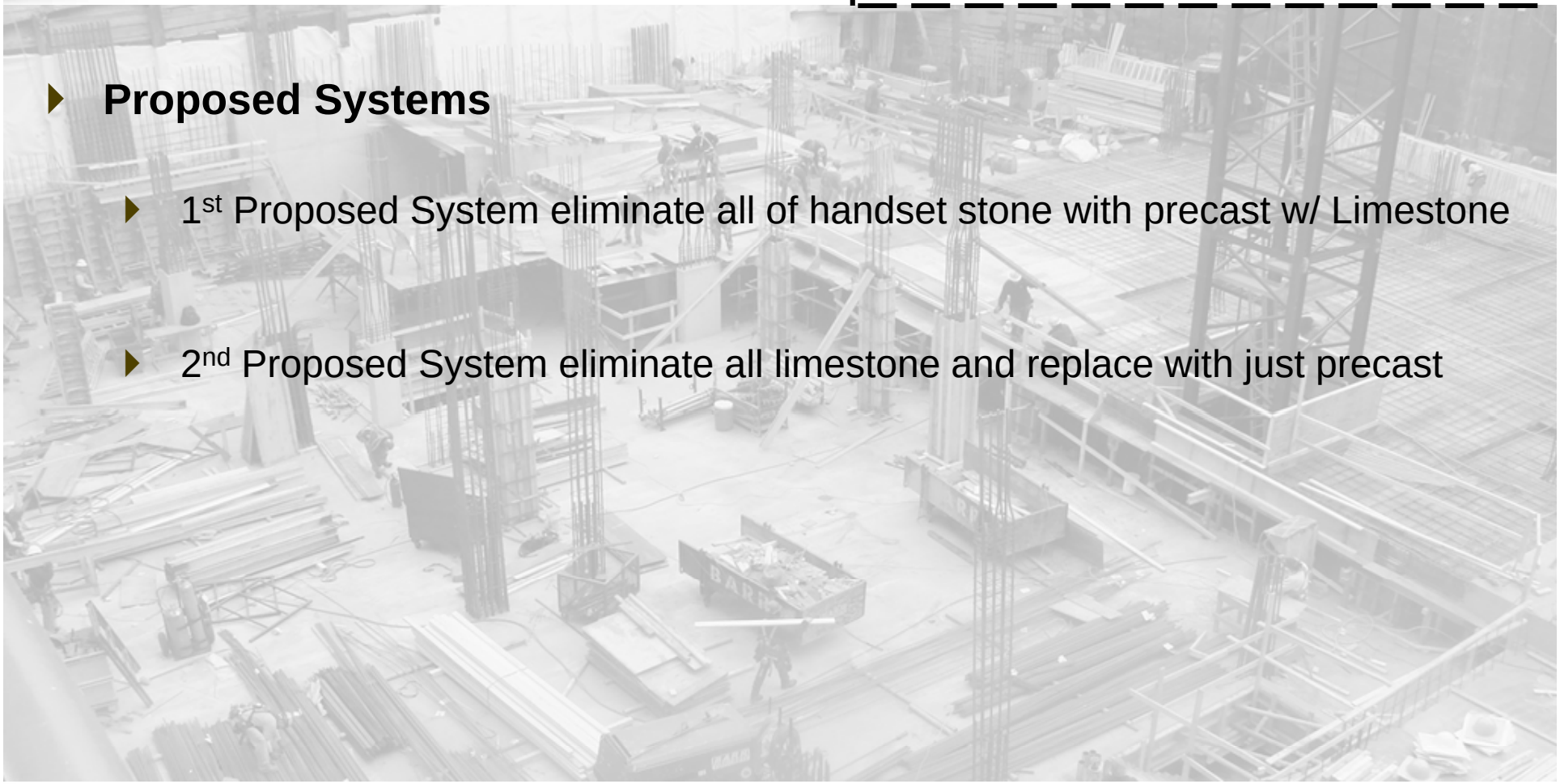
- **Existing Facade**

- South, East, and North Elevations all have handset on floors 1-3 and precast with Limestone floors 4-12

- Existing Facade



- **Precast vs. Handset Stone**
  - Handset more expensive
  - Longer installation time than precast
  - Handset is very labor intensive
  - Handset stone causes site congestion on an already congested site
    - Precast is craned off of the truck and into position
  - One con of precast is some of the precast pieces were very large and were hard to install



- **Proposed Systems**
  - 1st Proposed System eliminate all of handset stone with precast w/ Limestone
  - 2nd Proposed System eliminate all limestone and replace with just precast

- **Schedule Analysis**
  - Precast for floors 3-12 took 60 days
  - Handset for floors 1-3 took 60 days
  - **Precast is 3 times faster than handset**
  - 25 days of construction could have been saved

- **Cost Analysis**
  - Cost of Existing System
    - $2,027,970
      - Precast w/ Limestone $85/SF to Install and Furnish
        - Total Cost $1,056,720
      - Handset Limestone $105/SF to Install and Furnish
        - Total Cost $971,250

- **Cost Analysis**
  - Cost of Proposed System 1 (Eliminate Handset Stone)
    - $1,842,970
      - Total Savings of $185,000
      - 25 days saved on schedule
        - $77,000 of general conditions is saved
    - Total Savings **$262,000**

- **Cost Analysis**
  - Cost of Proposed System 2 (Eliminate All Limestone)
    - $1,311,761
      - Total Savings of $716,209
      - 25 days saved on schedule
        - $77,000 of general conditions is saved
    - Total Savings **$793,209**

- **Architectural Analysis**

Handset Limestone

Precast w/out Limestone

- **Architectural Analysis**

Precast (left) and Limestone (right) Side by Side

PRECAST VS. HANDSET STONE

- **Recommendation/Summary**
  - Precast is cheaper
  - Quicker to install
  - Looks Similar to Limestone
  - Proposed System 2 (removal of all limestone) is my recommendation
    - Biggest Cost Savings

- **In Conclusion**
  - It Is Never to Late to Go Green
    - 700 6th Street did it with minimal schedulee impact
    - Recommend
  - Alternative Stone for Lobby
    - Granite is the obvious choice because of cost and durability
    - Recommend
  - Precast is cheaper and looks similar to Limestone
    - Recommend

Acknowledgements

- The AE Department
- Balfour Beatty Construction
  - Sean Flynn
- My Family and Friends
- Lorton Stone
  - Manuel Seara
- 700 6th Street
  - John E. Akridge
  - Matthew J. Klein

Questions or Comments?

QUESTIONS