Office Building

Washington, Dc

Katey Andaloro
Construction Management
Senior Thesis Presentation 2009
The Pennsylvania State University

Office Building
Washington, Dc

Presentation Outline

Project Overview
Analysis #1: M Street Ramp Re-design - Steel vs. Concrete
Analysis #2: Utilizing a Matrix Schedule
Analysis #3: Implementing the Whole Building Design Guide
Conclusions
Questions

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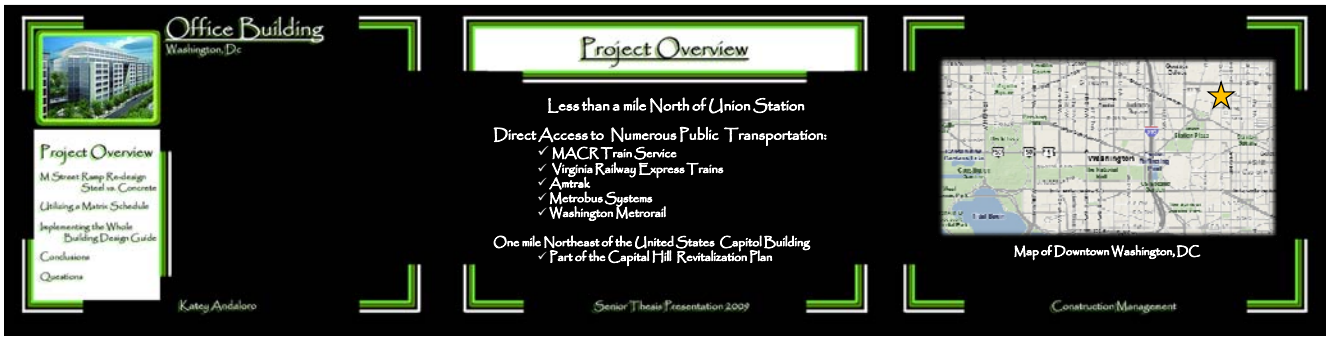
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Project Overview
Less than a mile North of Union Station
Direct Access to Numerous Public Transportation:
✓ MACR Train Service
✓ Virginia Railway Express Trains
✓ Amtrak
✓ Metrobus Systems
✓ Washington Metrorail
One mile Northeast of the United States Capitol Building
✓ Part of the Capital Hill Revitalization Plan
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Map of Downtown Washington, DC
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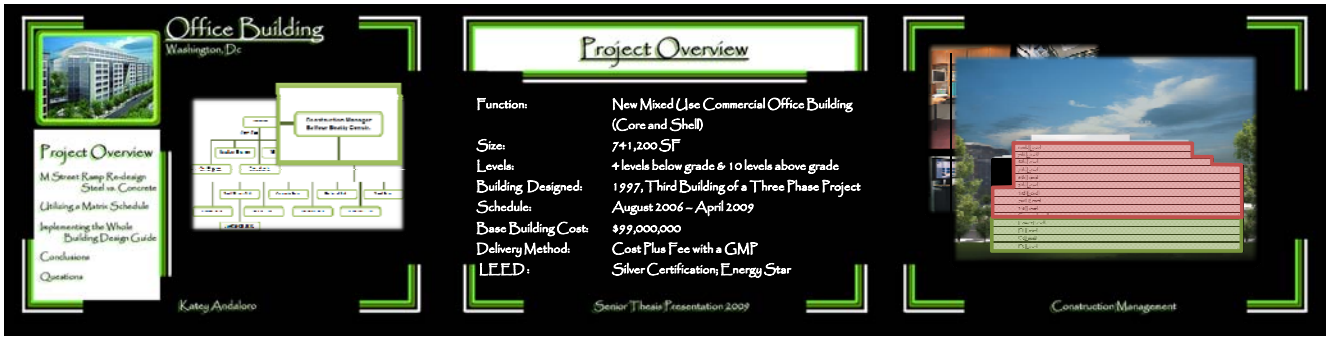
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Project Overview
Function: New Mixed Use Commercial Office Building (Core and Shell)
Size: 741,200 SF
Levels: 4 levels below grade & 10 levels above grade
Building Designed: 1997, Third Building of a Three Phase Project
Schedule: August 2006 – April 2009
Base Building Cost: $99,000,000
Delivery Method: Cost Plus Fee with a GMP
LEED: Silver Certification; Energy Star
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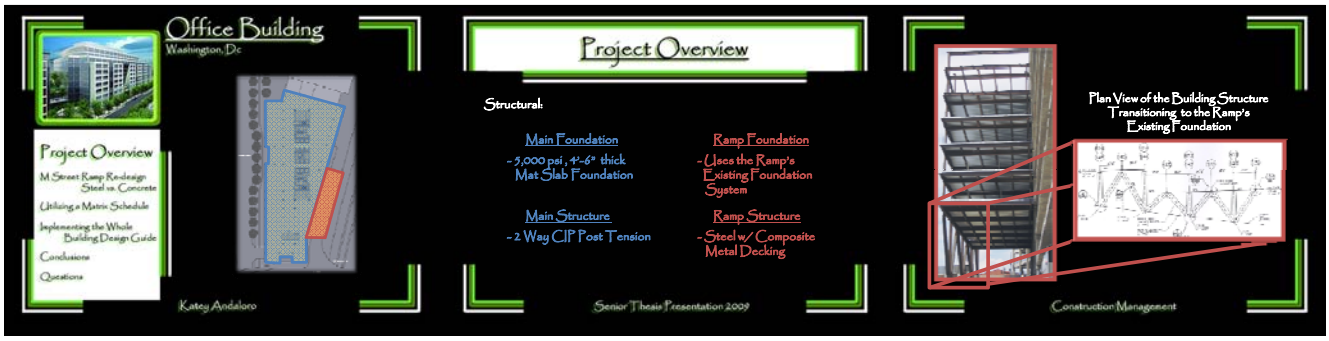
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Project Overview
Structural:
Main Foundation
- 5,000 psi, 4'-6" thick Mat Slab Foundation
Ramp Foundation
- Uses the Ramp's Existing Foundation System
Main Structure
- 2 Way CIP Post Tension
Ramp Structure
- Steel w/ Composite Metal Decking
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Plan View of the Building Structure Transitioning to the Ramp's Existing Foundation
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M Street Ramp Re-design
Problem:
- Majority of Building is CIP Concrete
- Construction on the Steel Structure begins after the CIP Concrete Structure finishes
- Separate Pours Due to Decking
Proposal:
- Re-design the M Street Ramp using CIP Concrete
Goal:
- Determine if the CIP Concrete Structure is a Viable Option
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M Street Ramp Re-design
Re-designing the M Street Ramp in CIP Concrete
Step 1: General Design Information
Step 2: Design Slab Thickness, Beams, & Girders
One-Way Slab - ACI 318-08 Table 9.5
Step 3: Design the Ramp's & Building's Columns
STAAD Pro 2006
PCAColumn
Step 4: Re-size Duct Due to the Increase in Plenum Depth
Ductulator
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STAAD
Plenum Depth Comparison
Floor to Floor Height
(5th Level to 9th Level) 11'-9"
(10th Level) 12'-9"
Steel Structure
Maximum Member Depth 24"
Maximum Composite Slab Thickness 5" + 1.5"
Space of Structure in Pendulum 30.5"
CIP Concrete Structure
Maximum Girder Beam Depth 19"
Slab Thickness 5"
Space of Structure in Pendulum 24"
Increase Plenum Space 6.5"
CIP Concrete Structural System
Columns
Strength 4000 psi
Depth 24"
Width 24"
Reinforcing
Columns
Clear Cover 1.5"
Reinforcing (All Sides Equal) (12) #10 (As = 1.24 in²)
PCAColumn
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Steel
CIP Concrete
2
3
4
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M Street Ramp Re-design
Budget & Schedule Comparison
Budget:
- Steel $908,458
- CIP Concrete $582,947
- Saves $325,511 / $8.43 per SF
Schedule:
- Steel -109 days
- CIP Concrete - 81 days
- Saves 28 days
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Detailed Cost Analysis of the Steel Structure
TOTAL STEEL ESTIMATE : $908,458
Square Foot Cost Comparison
M Street Ramp Square Foot 38628
CIP Concrete per SQ FT Cost $15.09
Steel per SQ FT Cost $23.52
TOTAL CIP ESTIMATE : $582,947
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Parking
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M Street Ramp Re-design
Constructability Comparison
CIP Concrete:
- Closing Ramp for Formwork Construction
❑ No Parking for Individuals in Buildings 1 & 2
- Closed for 15 days = 3 weeks
Solution?
- Alternative Parking Areas Or Metro Compensation
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Cost of Parking Due to Ramp Closure
Avg. Cost of Parking in DC per day $23.00
Duration (days) 15
Number of Parking Passes 350
Total Cost $120,750
Cost of Metro Due to Ramp Closure
Cost of One Day Pass per day $7.80
Cost of Parking at Metro Station $4.25
Duration (days) 15
Number of Metro Passes 350
Total Cost $22,313
CIP Concrete $204,700
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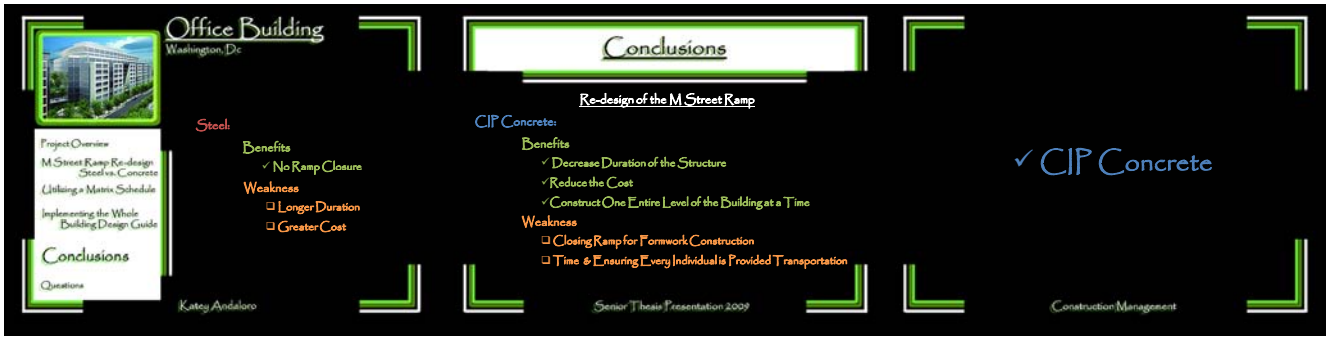
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Steel:
Benefits
✓ No Ramp Closure
Weakness
❑ Longer Duration
❑ Greater Cost
Conclusions
Re-design of the M Street Ramp
CIP Concrete:
Benefits
✓ Decrease Duration of the Structure
✓ Reduce the Cost
✓ Construct One Entire Level of the Building at a Time
Weakness
❑ Closing Ramp for Formwork Construction
❑ Time & Ensuring Every Individual is Provided Transportation
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✓ CIP Concrete
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Utilizing a Matrix Schedule
Problem:
- Time Lost During the Excavation Phase Due to Unforeseen Conditions
- Quickly Accelerated Original Structural Schedule
Lacking a Solid Schedule
Proposal:
- Create a Detailed Matrix Schedule for the CIP Concrete Structure
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Goal:
- Compare the Matrix Schedule to the Original Accelerated Schedule
Why Use a Matrix Schedule?
- Repetitive Floor Plans
- Creates Organized Pattern of Activities
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Utilizing a Matrix Schedule
Creating a Matrix Schedule
Step #1: Group Same Levels Together & Break Down into Manageable Sections
Step #2: Activities & Schedule Sequencing
Step #3: Calculate the Number of Crews and Each Activity Durations
Step #4: Create Matrix Schedule
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Conclusions
Utilizing a Matrix Schedule
Original Schedule
- 34 weeks
Matrix Schedule
- 32.5 weeks
Reduced Duration by 1.5 weeks
Matrix Schedule:
Benefits
✓ Decrease Duration by 1.5 weeks
✓ Developed a Detailed & Organized Day-to-Day Production Schedule
✓ Improve Trade Flow
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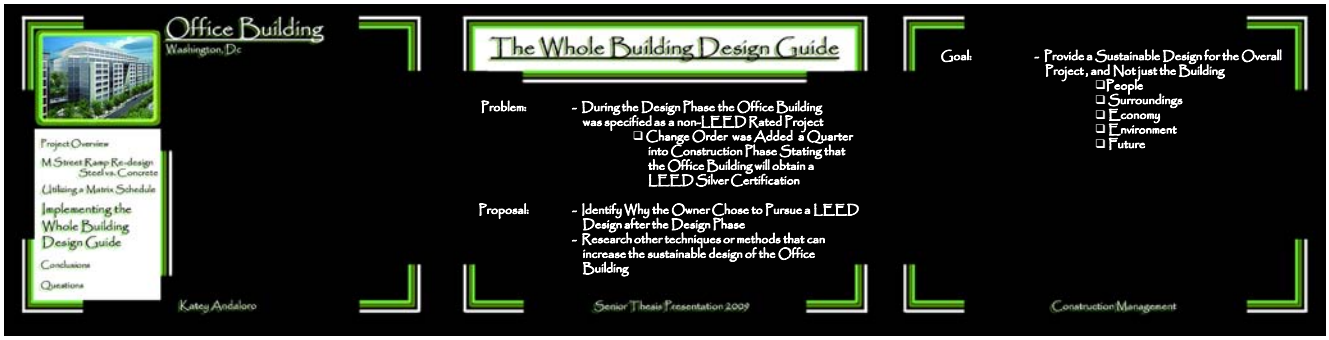
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The Whole Building Design Guide
Problem:
- During the Design Phase the Office Building was specified as a non-LEED Rated Project
❑ Change Order was Added a Quarter into Construction Phase Stating that the Office Building will obtain a LEED Silver Certification
Proposal:
- Identify Why the Owner Chose to Pursue a LEED Design after the Design Phase
- Research other techniques or methods that can increase the sustainable design of the Office Building
Goal:
- Provide a Sustainable Design for the Overall Project, and Not just the Building
❑ People
❑ Surroundings
❑ Economy
❑ Environment
❑ Future
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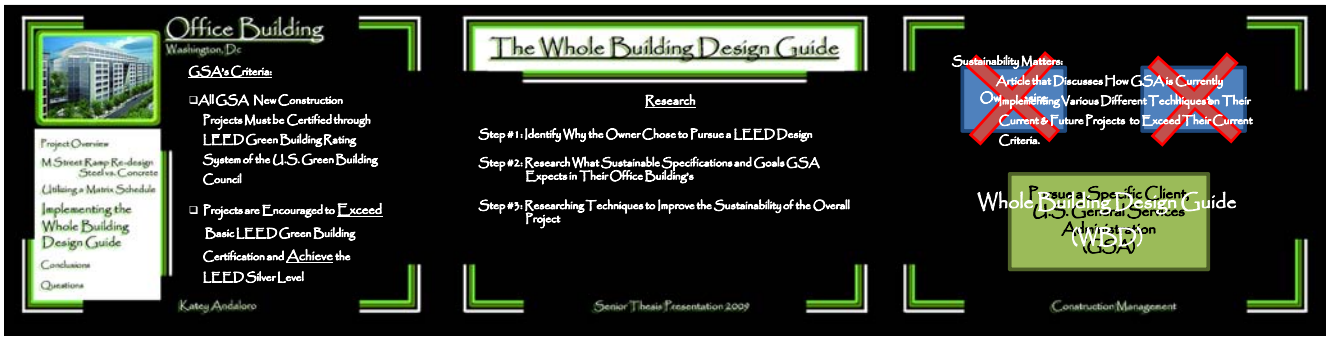
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GSA's Criteria:
All GSA New Construction Projects Must be Certified through LEED Green Building Rating System of the U.S. Green Building Council
Projects are Encouraged to Exceed Basic LEED Green Building Certification and Achieve the LEED Silver Level
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The Whole Building Design Guide
Research
Step #1: Identify Why the Owner Chose to Pursue a LEED Design
Step #2: Research What Sustainable Specifications and Goals GSA Expects in Their Office Building's
Step #3: Researching Techniques to Improve the Sustainability of the Overall Project
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Sustainability Matters:
Article that Discusses How GSA is Currently Implementing Various Different Techniques on Their Current & Future Projects to Exceed Their Current Criteria.
Pursue a Specific Client
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U.S. General Services Administration
(GSA)
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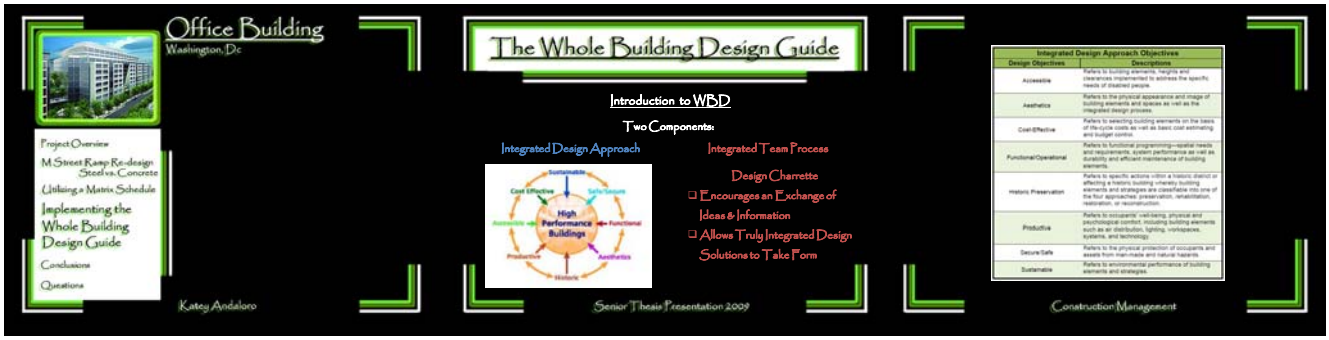
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The Whole Building Design Guide
Introduction to WBD
Two Components:
Integrated Design Approach
Sustainable
Safe/Secure
Functional
Aesthetics
Historic
Productive
Accessible
Cost Effective
High Performance Buildings
Integrated Team Process
Design Charrette
Encourages an Exchange of Ideas & Information
Allows Truly Integrated Design Solutions to Take Form
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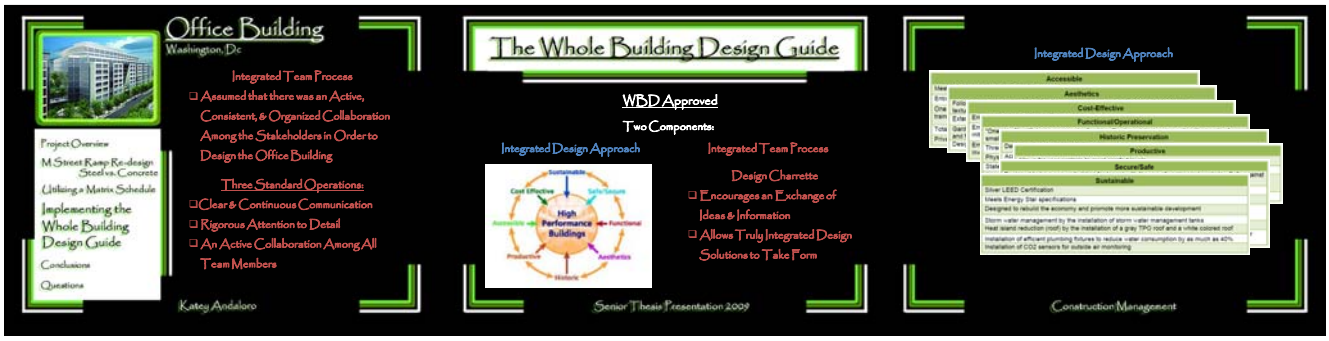
Integrated Design Approach Objectives
Design Objectives
Descriptions
Accessible
Aesthetics
Cost-Effective
Functional/Operational
Historic Preservation
Productive
Secure/Safe
Sustainable
Construction Management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Integrated Team Process
❑ Assumed that there was an Active, Consistent, & Organized Collaboration Among the Stakeholders in Order to Design the Office Building
Three Standard Operations:
❑ Clear & Continuous Communication
❑ Rigorous Attention to Detail
❑ An Active Collaboration Among All Team Members
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The Whole Building Design Guide
WBD Approved
Two Components:
Integrated Design Approach
Integrated Team Process
Design Charrette
❑ Encourages an Exchange of Ideas & Information
❑ Allows Truly Integrated Design Solutions to Take Form
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Integrated Design Approach
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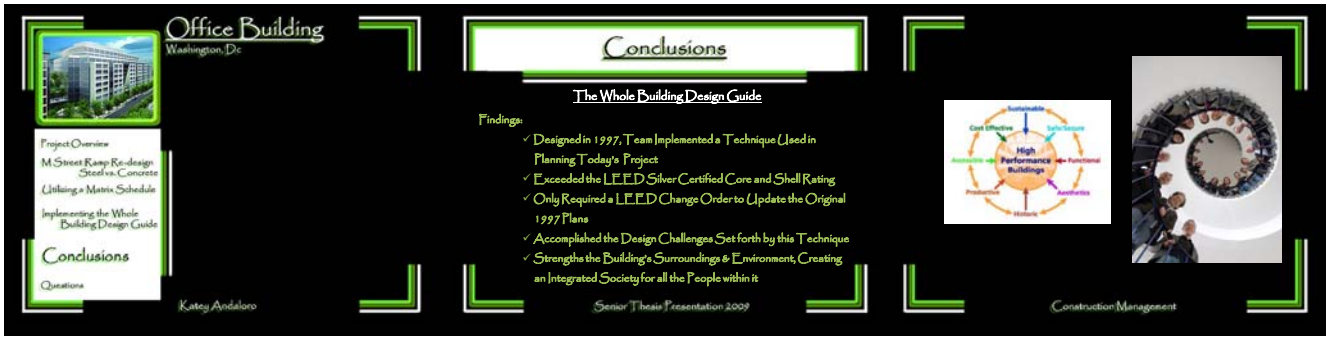
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Conclusions
The Whole Building Design Guide
Findings:
✓ Designed in 1997, Team Implemented a Technique Used in Planning Today's Project
✓ Exceeded the LEED Silver Certified Core and Shell Rating
✓ Only Required a LEED Change Order to Update the Original 1997 Plans
✓ Accomplished the Design Challenges Set forth by this Technique
✓ Strengthe the Building's Surroundings & Environment, Creating an Integrated Society for all the People within it
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Questions
Cost-Effective
Productive
Secure/Safe
Sustainable
Utilize LEED for Commercial Interiors
Purchase cleaning products and supplies that are resource-efficient and non-toxic
Minimize travel by supporting telecommuting programs and enabling telecontferencing
Train building occupants, facilities managers, and maintenance staff in sustainable design principles and methods
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