

**Office Building**  
Washington, Dc

**Project Overview**

- M Street Ramp Re-design: Steel vs. Concrete
- Linking a Matrix Schedule
- Implementing the Whole Building Design Guide
- Conclusions
- Questions

Katey Andaloro

**Project Overview**

Less than a mile North of Union Station


Direct Access to Numerous Public Transportation:

- ✓ MACRT Train Service
- ✓ Virginia Railway Express Trains
- ✓ Antrak
- ✓ 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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**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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**Project Overview**

**Structural:**

**Main Foundation**  
- 5,000 psi, 4'-6" thick  
Mat Slab Foundation

**Main Structure**  
- 2 Way CIP Post-Tension

**Ramp Foundation**  
- Uses the Ramp's Existing Foundation System

**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  
 □ FCAColumn

**Step 4: Re-size Duct Due to the Increase in Flenum Depth**  
 □ Ductulator

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### STAAD

**Flenum Depth Comparison**

Floor to Floor Height	(5th Level to 9th Level)	(10th Level)
Steel Structure	11'-0"	12'-0"
Maximum Member Depth	24"	24"
Maximum Concrete Slab Thickness	9" x 1.15'	9" x 1.15'
Space of Structure in Perichukam	30.5'	30.5'
CIP Concrete Structure	Maximum Member Depth	19"
Slab Thickness	3"	3"
Space of Structure in Perichukam	24'	24'
Increase Flenum Space	6.5'	

**CIP Concrete Structural System**


Columns	Strength	Depth	Width
Strength	4000 psi	24"	24"
Depth			
Width			
Rebar #			
Columns			
Clear Cover	1.5"		
Reinforcing (All Sides Equal)	(2) #10 (As = 1.24 SF)		

FCAColumn

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## M Street Ramp Re-design

**Budget & Schedule Comparison**

**Budget:**

- Steel **\$908,458**
- CIP Concrete **\$582,047**
- Saves **\$325,511 / \$8.42 per SF**

**Schedule:**

- Steel - **109 days**
- CIP Concrete - **81 days**
- Saves **28 days**

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### Detailed Cost Analysis of the Steel Structure

Description	Amount	Material Price	Material Cost	Labor Price	Labor Cost	Equipment Price	Equipment Cost	Total Cost
Concrete Rebar	182.00	\$100.00	\$18,200.00	\$20.00	\$3,640.00	\$10.00	\$1,820.00	\$23,660.00
Steel	181.00	\$1,000.00	\$181,000.00	\$100.00	\$18,100.00	\$50.00	\$9,050.00	\$208,150.00
<b>TOTAL STEEL ESTIMATE</b>	<b>363.00</b>		<b>\$199,200.00</b>		<b>\$21,740.00</b>		<b>\$10,870.00</b>	<b>\$231,810.00</b>
Total Material Cost			\$199,200.00		\$21,740.00		\$10,870.00	\$231,810.00
Total Labor Cost				\$21,740.00			\$10,870.00	\$32,610.00
Total Equipment Cost						\$10,870.00		\$10,870.00

**Square Foot Cost Comparison**

Description	Amount	Material Price	Material Cost	Labor Price	Labor Cost	Equipment Price	Equipment Cost	Total Cost
M Street Ramp Square Foot	38628							
CIP Concrete per SQ FT Cost	\$15.09							
Steel per SQ FT Cost	\$23.52							
<b>TOTAL CIP ESTIMATE</b>	<b>\$582,047</b>							<b>\$231,810</b>
Total Material Cost			\$582,047.00					\$582,047.00
Total Labor Cost				\$21,740.00			\$10,870.00	\$32,610.00
Total Equipment Cost						\$10,870.00		\$10,870.00

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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 19 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
<b>Total Cost</b>	<b>\$120,750</b>


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
<b>Total Cost</b>	<b>\$12,315</b>

**CIP Concrete \$204,700**

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## 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

**Goal:**

- Compare the Matrix Schedule to the Original Accelerated Schedule

**Why Use a Matrix Schedule?**

- Repetitive Floor Plans
- Create an 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**

Activity	Total Units	Daily Output	# of Crews	Total Daily Output	Duration Per Section
Forming	1000	20	50	1000	50
Reinforcing	400	100	4	400	4
Placing	200	100	2	200	2
Finishing	100	100	1	100	1



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## Conclusions

**Utilizing a Matrix Schedule**

Original Schedule - 32 weeks	Matrix Schedule - 22.5 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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## 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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### Office Building

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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 Buildings

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 Overlapping Various Different Techniques in Their Current & Future Projects to Exceed Their Current Criteria.

Pursuing a Specific Client

GSA General Services Administration (GSA)

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## The Whole Building Design Guide

Introduction to WBD

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 Objectives	
Design Objective	Description
Accessibility	Refers to building elements, heights and materials incorporated to address the specific needs of disabled people.
Aesthetics	Refers to the physical appearance and design of building elements and spaces as well as the integrated design process.
Cost Effective	Refers to selecting building elements on the basis of lifecycle costs as well as basic cost estimating and budget control.
Functional/Operational	Refers to building programming/initial needs and requirements, system performance as well as durability and efficient maintenance of building elements.
Healthy Preparation	Refers to specific actions related to systems design or offering a healthy building strategy, including material and strategies for control (like air flow for respiratory protection, ventilation, remediation, or reconstruction).
Productive	Refers to occupancy, making physical and psychological comfort, including building elements such as air circulation, lighting, workplaces, systems, and technology.
Secure Safe	Refers to the physical protection of occupants and assets from man-made and natural hazards.
Sustainable	Refers to environmental performance of building elements and designs.

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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



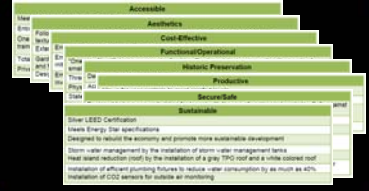
Integrated Team Process

Design Charrette

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### Integrated Design Approach



Accomplished

- Cost-Effective
- Functional/Operational
- Historic Preservation
- Production
- Secure/Safe
- Sustainable


Silver LEED Certification

- Meets Energy Star specifications
- Designed to reduce the economy and promote more sustainable development
- Storm water management by the installation of a grey TPO roof and a white coated roof
- Integration of efficient plumbing fixtures to reduce water consumption by as much as 40%
- Installation of CO2 sensors for outside air monitoring

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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
- Strengths the Building's Surroundings & Environment, Creating an Integrated Society for all the people within it

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Code	Item	Category
1100	1100	Cost-Effective
1101	1101	Productive
1102	1102	Secure/Safe
1103	1103	Sustainable
1104	1104	1104
1105	1105	1105
1106	1106	1106
1107	1107	1107
1108	1108	1108
1109	1109	1109
1110	1110	1110
1111	1111	1111
1112	1112	1112
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1119	1119	1119
1120	1120	1120
1121	1121	1121
1122	1122	1122
1123	1123	1123
1124	1124	1124
1125	1125	1125
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1194	1194	1194
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1199	1199	1199
1200	1200	1200