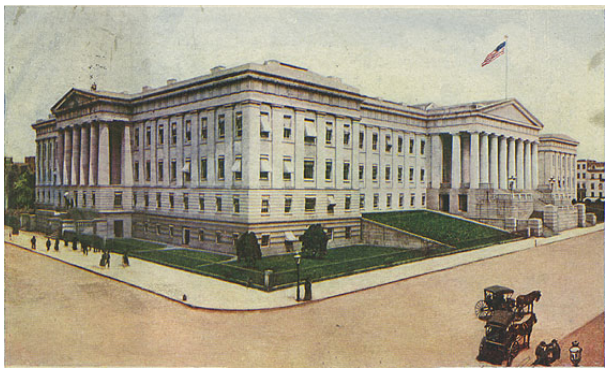


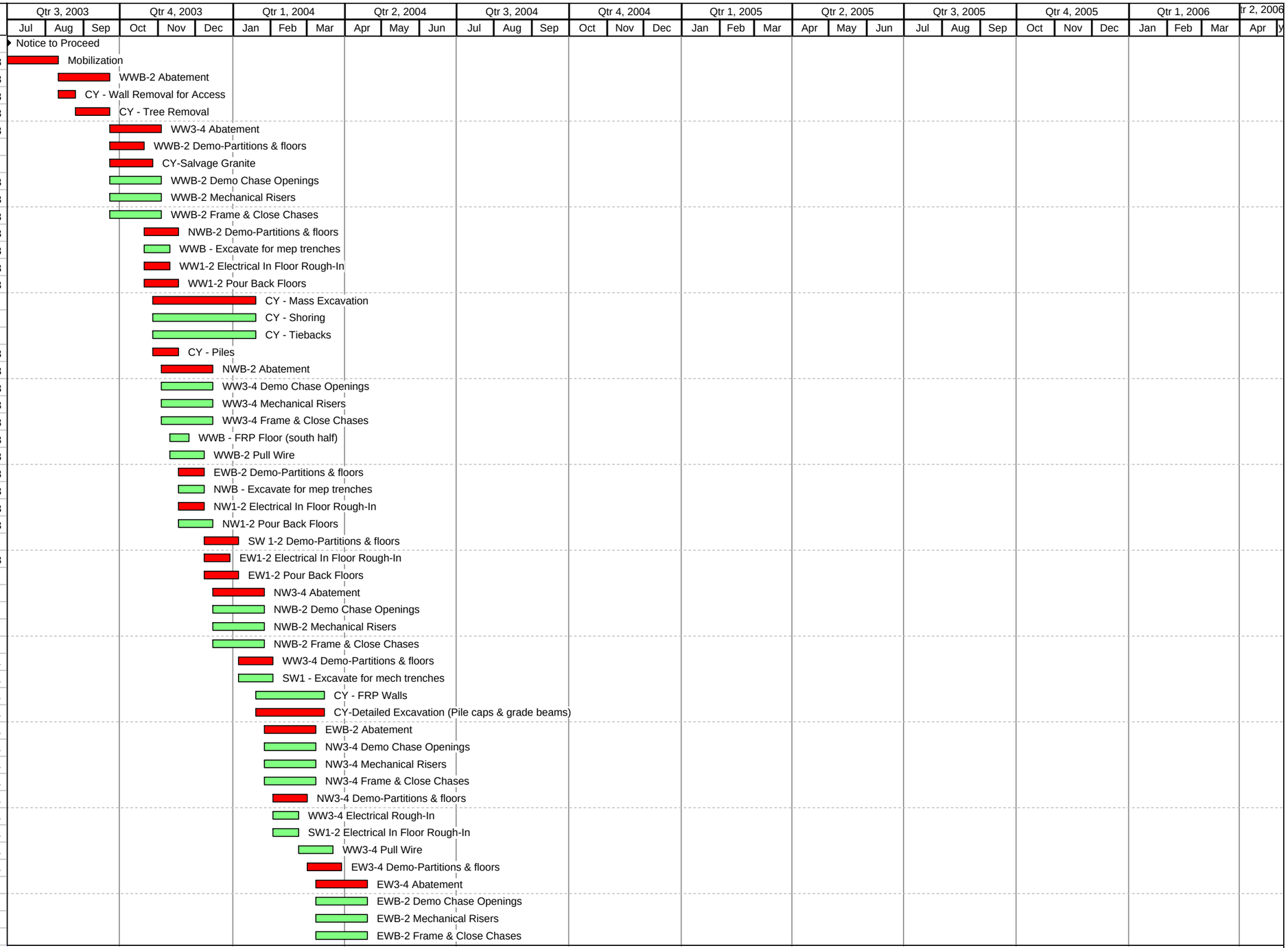
Robert M. Leicht
Construction Management Option
Advisor: Dr. John Messner
Bldg: Smithsonian Institution
Patent Office building
Washington, DC
27 October 2004
Technical Assignment 2

Executive Summary:

Included in this submission are a detailed project schedule, an assemblies estimate of the buildings courtyard structural systems, an overview and evaluation of the contracts used on the project, the staffing plan for the general contractor, an overview of the plan for the MEP coordination, a write-up of the PACE roundtable event and an overview of the existing soils conditions on site. The highlights of the submission are the dual systems employed in the courtyard structural system and the differing costs. The contracts employed on the project are rather straight forward with lump sum contracts being used in all instances. The highlight of the contracts was the use of a best value selection process for the general contractor. The staffing plan is of a typical nature for how Hensel Phelps usually staffs a job, though due to the size of the job there is a large staff on site. The age and historic nature of the building introduce a number of interesting aspects into the design coordination for the MEP systems. The key area of trouble in the field tends to come from the conversion of the old chimneys into mechanical chases. The critical industry issues write up covers the Performance Contracting, Green and High Performance Buildings, and the Leadership Jump Start sessions. The direction the roundtable has pushed my research interests has been towards LEED rating and green building systems.

Submission Contents:	**Page(s)**

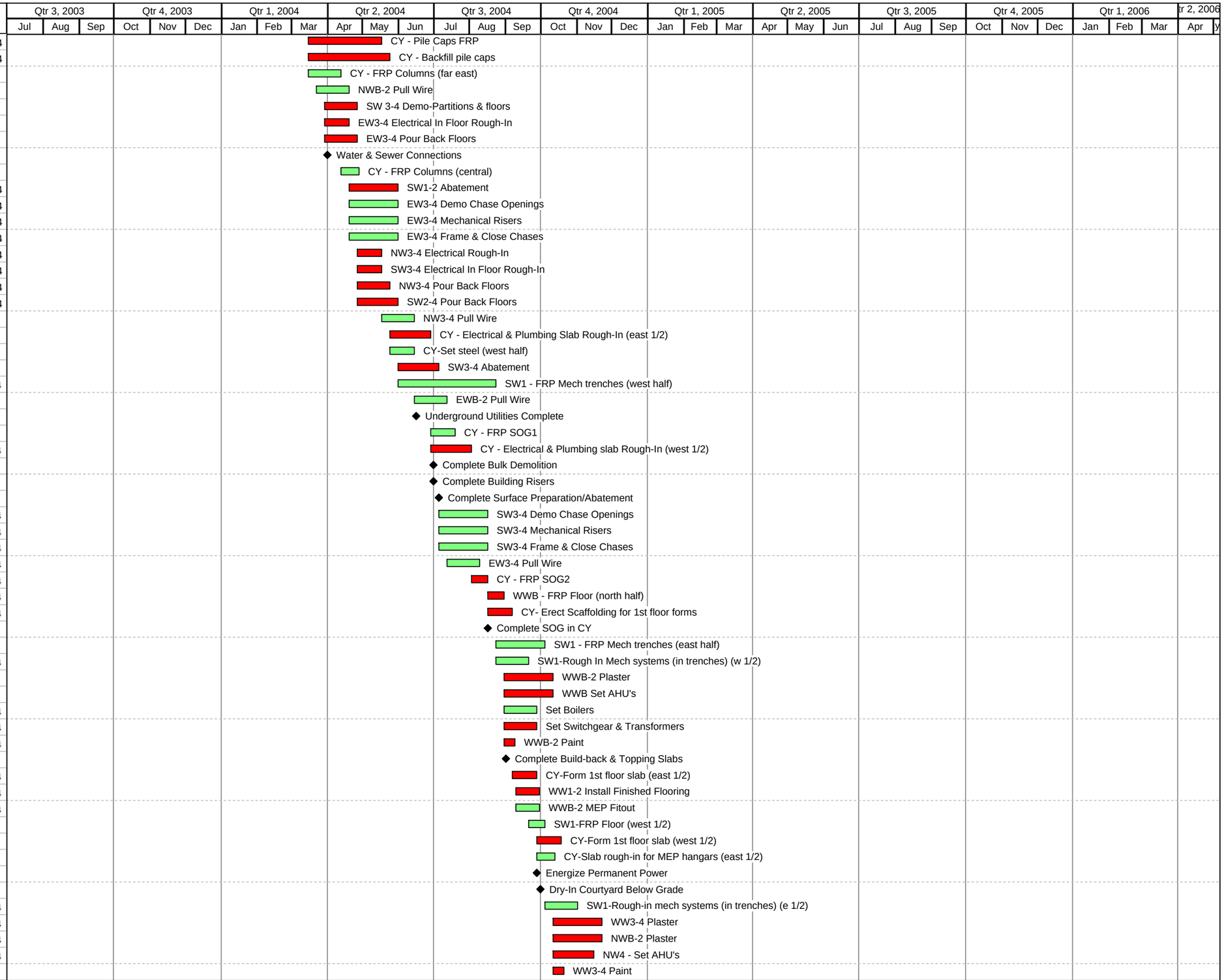
Activity ID	Activity Name	Start	Finish
A1000	Notice to Proceed	01-Jul-03	
A1350	Mobilization	01-Jul-03	11-Aug-03
A1010	WWB-2 Abatement	12-Aug-03	22-Sep-03
A1180	CY - Wall Removal for Access	12-Aug-03	25-Aug-03
A1170	CY - Tree Removal	26-Aug-03	22-Sep-03
A1040	WW3-4 Abatement	23-Sep-03	03-Nov-03
A1360	WWB-2 Demo-Partitions & floors	23-Sep-03	20-Oct-03
A1510	CY-Salvage Granite	23-Sep-03	27-Oct-03
A2190	WWB-2 Demo Chase Openings	23-Sep-03	03-Nov-03
A2130	WWB-2 Mechanical Risers	23-Sep-03	03-Nov-03
A2340	WWB-2 Frame & Close Chases	23-Sep-03	03-Nov-03
A1420	NWB-2 Demo-Partitions & floors	21-Oct-03	17-Nov-03
A1450	WWB - Excavate for mep trenches	21-Oct-03	10-Nov-03
A2040	WW1-2 Electrical In Floor Rough-In	21-Oct-03	10-Nov-03
A2120	WW1-2 Pour Back Floors	21-Oct-03	17-Nov-03
A1160	CY - Mass Excavation	28-Oct-03	19-Jan-04
A1190	CY - Shoring	28-Oct-03	19-Jan-04
A1200	CY - Tiebacks	28-Oct-03	19-Jan-04
A1520	CY - Piles	28-Oct-03	17-Nov-03
A1130	NWB-2 Abatement	04-Nov-03	15-Dec-03
A2200	WW3-4 Demo Chase Openings	04-Nov-03	15-Dec-03
A2270	WW3-4 Mechanical Risers	04-Nov-03	15-Dec-03
A2350	WW3-4 Frame & Close Chases	04-Nov-03	15-Dec-03
A1470	WWB - FRP Floor (south half)	11-Nov-03	26-Nov-03
A2570	WWB-2 Pull Wire	11-Nov-03	08-Dec-03
A1400	EWB-2 Demo-Partitions & floors	18-Nov-03	08-Dec-03
A1460	NWB - Excavate for mep trenches	18-Nov-03	08-Dec-03
A2060	NW1-2 Electrical In Floor Rough-In	18-Nov-03	08-Dec-03
A2140	NW1-2 Pour Back Floors	18-Nov-03	15-Dec-03
A1380	SW 1-2 Demo-Partitions & floors	09-Dec-03	05-Jan-04
A2080	EW1-2 Electrical In Floor Rough-In	09-Dec-03	29-Dec-03
A2160	EW1-2 Pour Back Floors	09-Dec-03	05-Jan-04
A1140	NW3-4 Abatement	16-Dec-03	26-Jan-04
A2210	NWB-2 Demo Chase Openings	16-Dec-03	26-Jan-04
A2280	NWB-2 Mechanical Risers	16-Dec-03	26-Jan-04
A2360	NWB-2 Frame & Close Chases	16-Dec-03	26-Jan-04
A1370	WW3-4 Demo-Partitions & floors	06-Jan-04	02-Feb-04
A1440	SW1 - Excavate for mech trenches	06-Jan-04	02-Feb-04
A1250	CY - FRP Walls	20-Jan-04	15-Mar-04
A1530	CY-Detailed Excavation (Pile caps & grade b...	20-Jan-04	15-Mar-04
A1100	EWB-2 Abatement	27-Jan-04	08-Mar-04
A2220	NW3-4 Demo Chase Openings	27-Jan-04	08-Mar-04
A2290	NW3-4 Mechanical Risers	27-Jan-04	08-Mar-04
A2380	NW3-4 Frame & Close Chases	27-Jan-04	08-Mar-04
A1430	NW3-4 Demo-Partitions & floors	03-Feb-04	01-Mar-04
A2050	WW3-4 Electrical Rough-In	03-Feb-04	23-Feb-04
A2100	SW1-2 Electrical In Floor Rough-In	03-Feb-04	23-Feb-04
A2580	WW3-4 Pull Wire	24-Feb-04	22-Mar-04
A1410	EW3-4 Demo-Partitions & floors	02-Mar-04	29-Mar-04
A1120	EW3-4 Abatement	09-Mar-04	19-Apr-04
A2230	EWB-2 Demo Chase Openings	09-Mar-04	19-Apr-04
A2300	EWB-2 Mechanical Risers	09-Mar-04	19-Apr-04
A2370	EWB-2 Frame & Close Chases	09-Mar-04	19-Apr-04



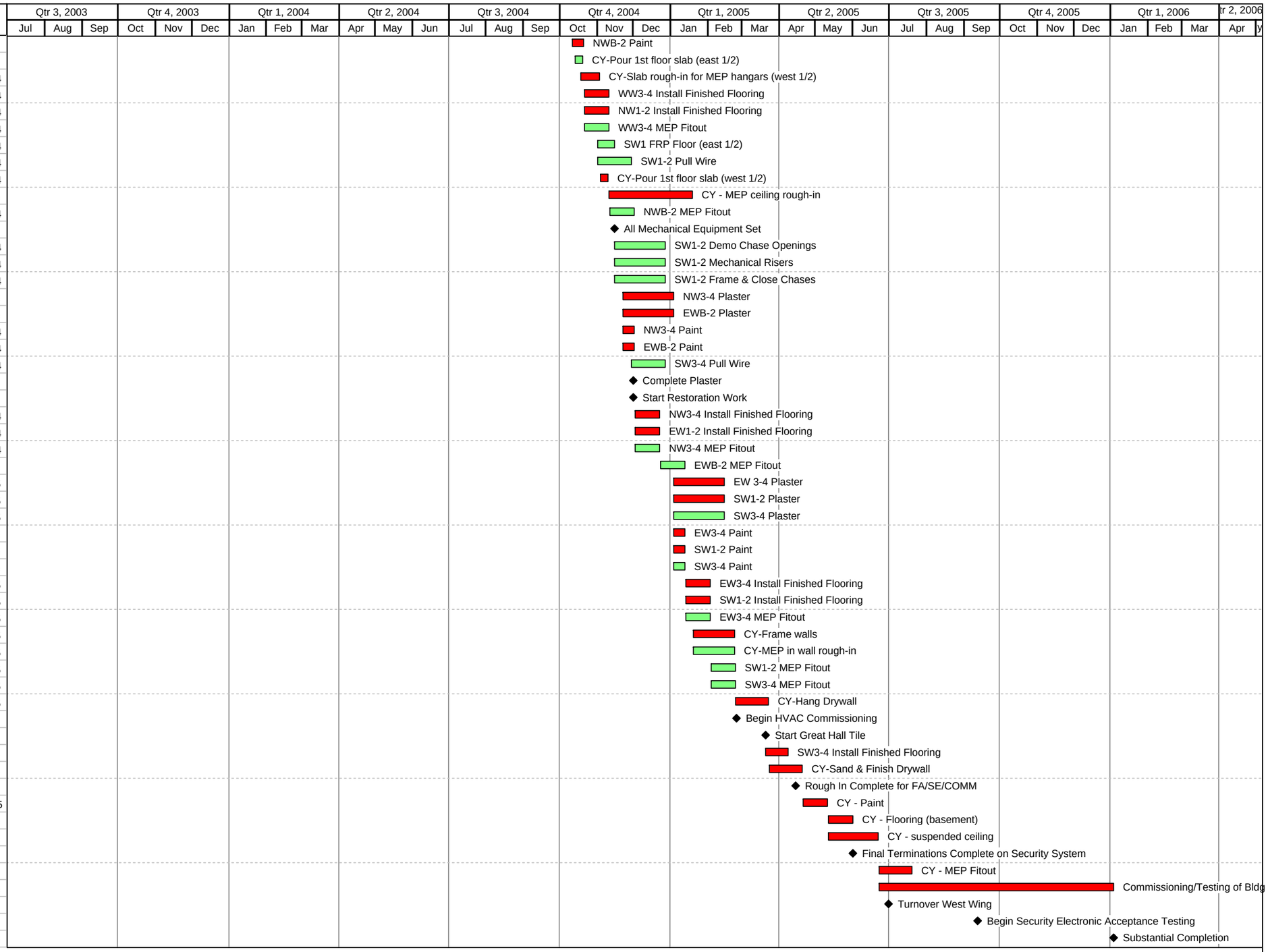
Actual Work
Remaining Work
Critical Remaining Work
Milestone
Summary

TASK filter: All Activities

Activity ID	Activity Name	Start	Finish
A1210	CY - Pile Caps FRP	16-Mar-04	17-May-04
A1220	CY - Backfill pile caps	16-Mar-04	24-May-04
A1260	CY - FRP Columns (far east)	16-Mar-04	12-Apr-04
A2590	NWB-2 Pull Wire	23-Mar-04	19-Apr-04
A1390	SW 3-4 Demo-Partitions & floors	30-Mar-04	26-Apr-04
A2090	EW3-4 Electrical In Floor Rough-In	30-Mar-04	19-Apr-04
A2170	EW3-4 Pour Back Floors	30-Mar-04	26-Apr-04
A1720	Water & Sewer Connections	01-Apr-04*	
A1270	CY - FRP Columns (central)	13-Apr-04	28-Apr-04
A1060	SW1-2 Abatement	20-Apr-04	31-May-04
A2240	EW3-4 Demo Chase Openings	20-Apr-04	31-May-04
A2310	EW3-4 Mechanical Risers	20-Apr-04	31-May-04
A2390	EW3-4 Frame & Close Chases	20-Apr-04	31-May-04
A2070	NW3-4 Electrical Rough-In	27-Apr-04	17-May-04
A2110	SW3-4 Electrical In Floor Rough-In	27-Apr-04	17-May-04
A2150	NW3-4 Pour Back Floors	27-Apr-04	24-May-04
A2180	SW2-4 Pour Back Floors	27-Apr-04	31-May-04
A2600	NW3-4 Pull Wire	18-May-04	14-Jun-04
A1280	CY - Electrical & Plumbing Slab Rough-In (ea...	25-May-04	28-Jun-04
A1550	CY-Set steel (west half)	25-May-04	14-Jun-04
A1080	SW3-4 Abatement	01-Jun-04	05-Jul-04
A1490	SW1 - FRP Mech trenches (west half)	01-Jun-04	23-Aug-04
A2610	EWB-2 Pull Wire	15-Jun-04	12-Jul-04
A1740	Underground Utilities Complete	16-Jun-04*	
A1230	CY - FRP SOG1	29-Jun-04	19-Jul-04
A1290	CY - Electrical & Plumbing slab Rough-In (we...	29-Jun-04	02-Aug-04
A1750	Complete Bulk Demolition	01-Jul-04*	
A1760	Complete Building Risers	01-Jul-04*	
A1730	Complete Surface Preparation/Abatement	06-Jul-04*	
A2260	SW3-4 Demo Chase Openings	06-Jul-04	16-Aug-04
A2330	SW3-4 Mechanical Risers	06-Jul-04	16-Aug-04
A2410	SW3-4 Frame & Close Chases	06-Jul-04	16-Aug-04
A2620	EW3-4 Pull Wire	13-Jul-04	09-Aug-04
A1240	CY - FRP SOG2	03-Aug-04	16-Aug-04
A1480	WWB - FRP Floor (north half)	17-Aug-04	30-Aug-04
A1540	CY- Erect Scaffolding for 1st floor forms	17-Aug-04	06-Sep-04
A1780	Complete SOG in CY	17-Aug-04*	
A1500	SW1 - FRP Mech trenches (east half)	24-Aug-04	04-Oct-04
A1670	SW1-Rough In Mech systems (in trenches) (...	24-Aug-04	20-Sep-04
A1710	WWB-2 Plaster	31-Aug-04	11-Oct-04
A1990	WWB Set AHU's	31-Aug-04	11-Oct-04
A2010	Set Boilers	31-Aug-04	27-Sep-04
A2020	Set Switchgear & Transformers	31-Aug-04	27-Sep-04
A2030	WWB-2 Paint	31-Aug-04	09-Sep-04
A1790	Complete Build-back & Topping Slabs	01-Sep-04*	
A1560	CY-Form 1st floor slab (east 1/2)	07-Sep-04	27-Sep-04
A1020	WW1-2 Install Finished Flooring	10-Sep-04	30-Sep-04
A2490	WWB-2 MEP Fitout	10-Sep-04	30-Sep-04
A1690	SW1-FRP Floor (west 1/2)	21-Sep-04	04-Oct-04
A1570	CY-Form 1st floor slab (west 1/2)	28-Sep-04	18-Oct-04
A1580	CY-Slab rough-in for MEP hangars (east 1/2)	28-Sep-04	13-Oct-04
A1770	Energize Permanent Power	28-Sep-04*	
A1820	Dry-In Courtyard Below Grade	01-Oct-04*	
A1680	SW1-Rough-in mech systems (in trenches) (...	05-Oct-04	01-Nov-04
A1920	WW3-4 Plaster	12-Oct-04	22-Nov-04
A1930	NWB-2 Plaster	12-Oct-04	22-Nov-04
A2000	NW4 - Set AHU's	12-Oct-04	15-Nov-04
A2420	WW3-4 Paint	12-Oct-04	21-Oct-04



Activity ID	Activity Name	Start	Finish
A2430	NWB-2 Paint	12-Oct-04	21-Oct-04
A1600	CY-Pour 1st floor slab (east 1/2)	14-Oct-04	20-Oct-04
A1590	CY-Slab rough-in for MEP hangars (west 1/2)	19-Oct-04	03-Nov-04
A1030	WW3-4 Install Finished Flooring	22-Oct-04	11-Nov-04
A1050	NW1-2 Install Finished Flooring	22-Oct-04	11-Nov-04
A2500	WW3-4 MEP Fitout	22-Oct-04	11-Nov-04
A1700	SW1 FRP Floor (east 1/2)	02-Nov-04	15-Nov-04
A2630	SW1-2 Pull Wire	02-Nov-04	29-Nov-04
A1610	CY-Pour 1st floor slab (west 1/2)	04-Nov-04	10-Nov-04
A1300	CY - MEP ceiling rough-in	11-Nov-04	19-Jan-05
A2510	NWB-2 MEP Fitout	12-Nov-04	02-Dec-04
A1800	All Mechanical Equipment Set	16-Nov-04*	
A2250	SW1-2 Demo Chase Openings	16-Nov-04	27-Dec-04
A2320	SW1-2 Mechanical Risers	16-Nov-04	27-Dec-04
A2400	SW1-2 Frame & Close Chases	16-Nov-04	27-Dec-04
A1940	NW3-4 Plaster	23-Nov-04	03-Jan-05
A1950	EWB-2 Plaster	23-Nov-04	03-Jan-05
A2440	NW3-4 Paint	23-Nov-04	02-Dec-04
A2450	EWB-2 Paint	23-Nov-04	02-Dec-04
A2640	SW3-4 Pull Wire	30-Nov-04	27-Dec-04
A1830	Complete Plaster	01-Dec-04*	
A1840	Start Restoration Work	01-Dec-04*	
A1070	NW3-4 Install Finished Flooring	03-Dec-04	23-Dec-04
A1090	EW1-2 Install Finished Flooring	03-Dec-04	23-Dec-04
A2520	NW3-4 MEP Fitout	03-Dec-04	23-Dec-04
A2530	EWB-2 MEP Fitout	24-Dec-04	13-Jan-05
A1960	EW 3-4 Plaster	04-Jan-05	14-Feb-05
A1970	SW1-2 Plaster	04-Jan-05	14-Feb-05
A1980	SW3-4 Plaster	04-Jan-05	14-Feb-05
A2460	EW3-4 Paint	04-Jan-05	13-Jan-05
A2470	SW1-2 Paint	04-Jan-05	13-Jan-05
A2480	SW3-4 Paint	04-Jan-05	13-Jan-05
A1110	EW3-4 Install Finished Flooring	14-Jan-05	03-Feb-05
A1150	SW1-2 Install Finished Flooring	14-Jan-05	03-Feb-05
A2540	EW3-4 MEP Fitout	14-Jan-05	03-Feb-05
A1620	CY-Frame walls	20-Jan-05	23-Feb-05
A1630	CY-MEP in wall rough-in	20-Jan-05	23-Feb-05
A2550	SW1-2 MEP Fitout	04-Feb-05	24-Feb-05
A2560	SW3-4 MEP Fitout	04-Feb-05	24-Feb-05
A1640	CY-Hang Drywall	24-Feb-05	23-Mar-05
A1810	Begin HVAC Commissioning	25-Feb-05*	
A1850	Start Great Hall Tile	21-Mar-05*	
A1900	SW3-4 Install Finished Flooring	21-Mar-05	08-Apr-05
A1650	CY-Sand & Finish Drywall	24-Mar-05	20-Apr-05
A1860	Rough In Complete for FA/SE/COMM	15-Apr-05*	
A1320	CY - Paint	21-Apr-05	11-May-05
A1310	CY - Flooring (basement)	12-May-05	01-Jun-05
A1340	CY - suspended ceiling	12-May-05	22-Jun-05
A1870	Final Terminations Complete on Security Sys...	01-Jun-05*	
A1330	CY - MEP Fitout	23-Jun-05	20-Jul-05
A1660	Commissioning/Testing of Bldg MEP systems	23-Jun-05	03-Jan-06
A1880	Turnover West Wing	01-Jul-05*	
A1890	Begin Security Electronic Acceptance Testing	13-Sep-05*	
A1910	Substantial Completion		03-Jan-06



Assemblies Estimate

The assemblies estimate looks at the structural systems in the Courtyard of the Patent Office building. The courtyard's structural elements were chosen because the courtyard has two different structural systems being used. The west half of the courtyard is structural steel with a one way slab. The east half is a structural two way slab with concrete cast in place columns. Around the perimeter of the courtyard is a structural concrete wall with varying height (the auditorium section in the west half slopes downward and has higher floor to ceiling height. The courtyard will also be looked at in detail in the third technical assignment with a detailed estimate.

Material Takeoff Data

Item	Dimension	Quantity
CIP Columns	14' Tall, 15" square	35
Steel Columns	18' Tall, 48 plf	24
Steel Columns	18' Tall, 58 plf	5
One Way Slab	30' x 6'	1
	200' x 7'	1
	20' x 40'	1
	53' x 16	1
Totall		3250 SF
Two Way Slab	80' x 43'	1
	53' x 3'	1
	33' x 6'	1
Totall		3800 SF
Slab on Grade		7050 SF
W shape Beams & Girders	3250 SF	1
CIP Walls	18' x 53'	2
	18' x 16'	1
	14' x 75'	2
	14' x 53'	1
Total		5000 SF

Source	Line Number	Description	Quantity	Unit	Ext. Material Incl O&P	Ext. Installation Incl O&P	Ext. Total Incl O&P	Zip Code Prefix	Type	Release
Assembly	A10301202280*	Slab on grade, 4" thick, light industrial, reinforced	7,050.00	S.F.	$13,481.43	$16,020.35	$29,501.78	20004	Union	2003
Assembly	B10102030900*	CIP col, sq tied,200 K,14' sty ht,14" col,196 PLF wt,4000 PSI conc	35.00	V.L.F.	$407.73	$1,679.63	$2,087.36	20004	Union	2003
Assembly	B10102083800*	Steel columns,125 KIPS,20' unsupported height,48 PLF weight,8" wf	24.00	V.L.F.	$851.76	$149.93	$1,001.69	20004	Union	2003
Assembly	B10102085000*	Steel col,200 KIPS,20' unsupported height,58 PLF weight,12" wf	5.00	V.L.F.	$215.08	$31.23	$246.31	20004	Union	2003
Assembly	B10102173800*	CIP slbs, 1 way,sgl 15' span,200 PSF supimp,8.5" thk,306 PSF tot	3,250.00	S.F.	$13,394.06	$23,719.41	$37,113.47	20004	Union	2003
Assembly	B10102206600*	CIP bm&slb,2 way,25x30',200PSF su-pimp,20"col min,8.5" slb,341PSF tot	3,800.00	S.F.	$22,801.90	$40,275.82	$63,077.72	20004	Union	2003
Assembly	B10102418980*	Wf b&g,35x30' (BXg),200 PSF supimp,36" d,.874 SF/SF fprf,281 PSF tot	3,250.00	S.F.	$39,502.13	$16,420.98	$55,923.11	20004	Union	2003
Assembly	B20101017400*	Conc wall reinforced, 8' high, 12" thick, plain finish, 3000 PSI	5,000.00	S.F.	$25,254.00	$71,765.85	$97,019.85	20004	Union	2003
					$115,908.09	**$170,063.20**	**$285,971.29**			

*Note: The table above was put together using RS Means Costwork 2004 Program which allows the inupt of the zip code of the project for location cost calculations as well as the year of the project start to convert for time value of money.

When reviewing the data it is interesting to not the steel system employed on the west half and the concrete system on the east half show a significant difference in price. The column systems are comparable, but when looking at the slabs employed on both, the one way slab used on the west half cost about half again as mush as the two way slab on the east half when the cost of the steel beams and girders are taken into account. There seems to be a prime opportunity here to find an alternative system that would make the courtyard one consistent structural system (making construction simpler) and at the same time making the system itself less expensive from a materials standpoint.

Contracts

Hensel Phelps - GC

- The main contract for the construction of the building was a lump sum contract given to the GC on a best value decision process
- Hensel Phelps bid was, in fact, the highest of the bids put in
- The reasoning behind the Best Value selection was mainly due to the historic nature of the project and the emphasis on preservation of the building and its unique materials
- The owner felt that using a lowest bidder selection process would result in a lower quality final product from the desired results
- The project has no OCIP or CCIP requirements, there are insurance requirements, but they are of a standard nature for construction projects and in line with Hensel Phelp's normal insurance requirements, (eg. General Liability, Workers Compensation, etc.)
- The bonding on the project is a little unusual, the GC has a performance bond for 100% of the contract value, however the payment bond is only for 50% of the value of the base contract
- The contract contains no incentives, rewards, shared savings clauses, nor liquidated damages clause

Subcontractors

- The contracts between Hensel Phelps and its subcontractors is a standard lump sum contract used for all of its subs
- The insurance and bonding requirements from the owner are passed on in the same format to all of the subcontractors
- The contracts follow the same lump sum format as the main contract between Hensel Phelps and Smithsonian for simplicity of management, changing to a different style of contract could lead to a variety of complications

Hartman-Cox Associates

- The contract with the architect was originally on an hourly basis, with the architect submitting a log of the hours spent by themselves as well as the consulting engineering firms
- The contract was amended later to change to a lump sum contract due to the excessive tracking work needed by both the architect and the owner in order to maintain proper billing procedures

Bovis Lend-Lease

- The contract with the Construction Management Agency is assumed to be a Lump Sum contract, which would fall in line with the rest of the contract types
- The CM is focused on managing the construction process so the insurance requirements would match those of the contractors and subcontractors, with the exception of liability relating to the work in place
- It is possible that the CM may have Errors and Omissions Insurance due to their involvement in constructability reviews and the potential for liability in that area

Appropriateness of Contracts

Hensel Phelps

- The lump sum contract, chosen with the Best Value selection method, seems quite appropriate due to the focus of the owner's interests on the quality of the final product
- Using the Best Value process allows the owner to weight other aspects of the bidding organizations including the experience of the project team and the thoroughness of the construction plan, budget, schedule, etc.
- Smithsonian Institution has worked with Hensel Phelps on other projects in the past, namely the new National Air and Space Museum at Dulles Airport, which may have influenced Smithsonian's decision to use Hensel Phelps

Subcontractors

- Due to the size of the project and the complexity, the use of a boilerplate contract simplifies the process to simple modifications from a universal base contract
- There are obviously some modifications based on scope of work and preferences of subcontractors on certain terms and clauses, however the contracts are very consistent
- Using a boilerplate contract for all of the subcontractors seems very appropriate considering the number of subs employed on the project and the long duration
- The contract type also is appropriate because of its alignment with the main contract between Smithsonian and Hensel Phelps

Hartmann-Cox Associates

- The use of an hourly contract for the design firms seemed very inappropriate
- The fact that the contract did not match the project was born out when the contract changed to a lump sum partway through
- The use of the lump sum seems appropriate, again, because of its alignment with the contracts for the rest of the project and the amount of work it saves for both the designer and the owner

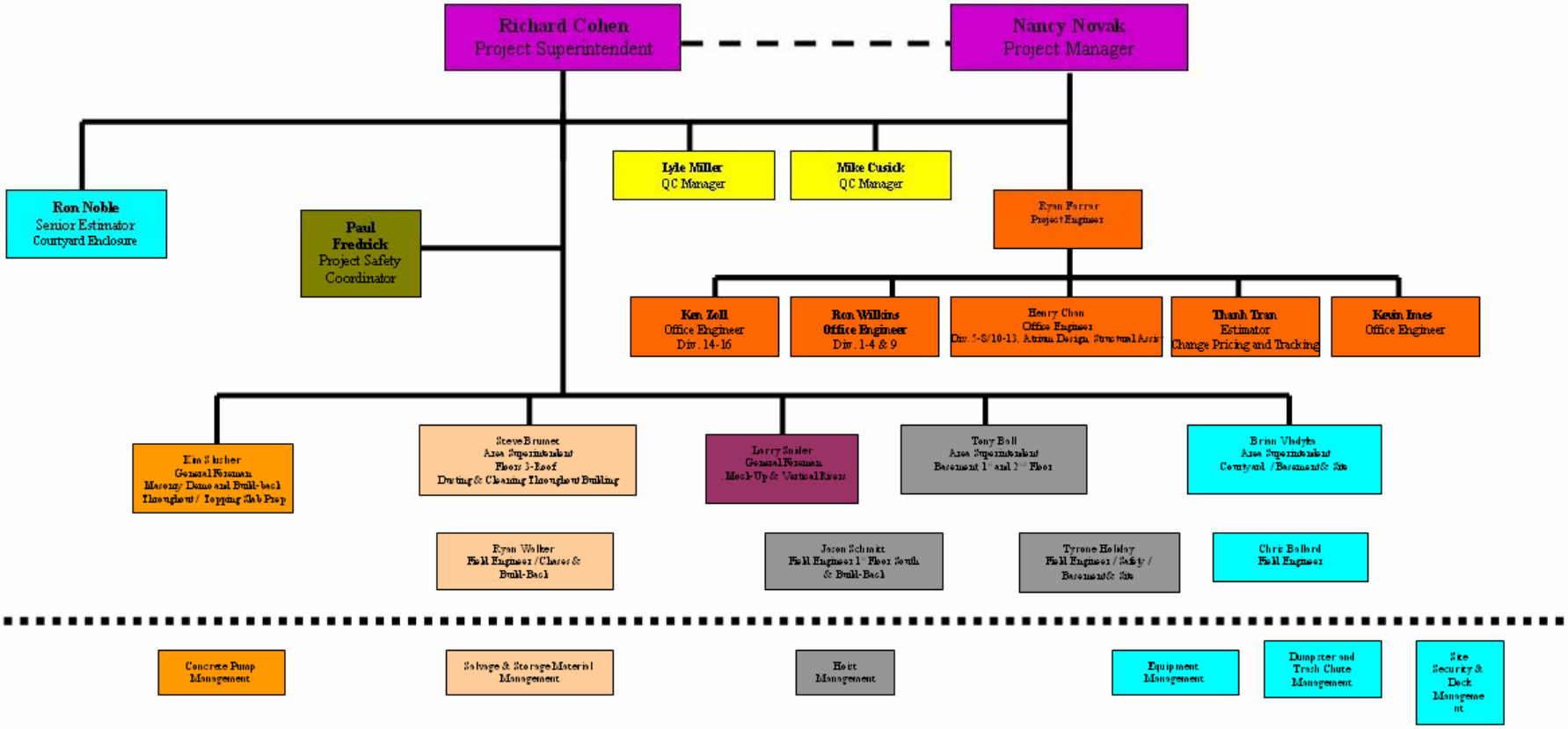
Bovis Lend-Lease

- Using a lump sum contract is the right choice for the construction management firm for much the same reason as for the general contractor, the level of quality requires a knowledgeable and experienced builder

The alignment of all of the contract types saves the owner a considerable amount of work because the system they use to track all of the companies in their employ is all the same format and they are getting billed in the same manner by all parties. The owner is experienced in construction and was pretty wise in their decision for the proper delivery method for the project and the selection process they used in choosing a contractor.

SI - Old Patent Office Building
Organization and Responsibilities

Hensel Phelps Construction Co.



Staffing Plan

Staffing Plan

- The staffing plan for Hensel Phelps is fairly standard following the set up they typically use on a project
- The main division is between the field staff and the office staff
- The Project Manager heads the office team
    - The Project Manager is in charge of all of the project documentation and overseeing of the contractual relationships on the job
- The Project Engineer is directly under the project manager
    - The Project Engineer performs the accounting and key documentation for the project
    - The Project Engineer also serves as the main conduit of information flow between the owner, architect, Construction Manager, and the Office Engineers
- The Office Engineers function under the Project Engineer and are divided up among specification sections and their respective subcontractors
    - The Office Engineers are responsible for the submittals, RFI's and necessary procedures related to their spec sections and the respective documentation
    - There is also an Office Engineer assigned to tracking the change orders and potential change orders due to the vast number of changes on a project of this size
- The Project Superintendent is the respective head of the team that runs and performs the actual construction of the building
    - The Project Super focuses on getting the project built and maintaining the quality, schedule, and safety aspects of the job
    - The Project Super also runs the construction of the mock-up to work with subcontractors performing their work for the first time and to ensure the result meets the expectations of the designers and the owner
- Directly under the Project Superintendent are several Area Superintendents and General Foreman who are responsible for specific sections or aspects of the building
    - The Area Supers are divided up with one taking the sitework and courtyard construction, one taking the lower half of the existing building, and one taking the upper half of the building
    - The General Foreman are split into the Masonry Foreman due to the extensive masonry work throughout the building, and a Foreman in charge of the chases/vertical risers for the mechanical work
    - The Area Supers and the General Foremen are all designated certain managerial aspects for the project, such as equipment management, material storage, etc.

Staffing Plan continued

- Under the Area superintendents are the Field Engineers
    - The Field Engineers are responsible for the layout of work for the respective areas of the Supers
- The connection between the field and the office teams lies in the Quality Control department with a manager in the office to focus on documentation and a field inspector to review work and ensure proper installation

Overall

The staffing set up for the project works well. Hensel Phelps is a large firm and has been using the same general staffing plan for a number of projects over many years. The main complication for this project lies in the size of the project and the coordination of the large staff it requires. There are communication problems, though daily meetings between the field staff and the office staff clear up most difficulties and help focus the work for that day.

The project is manned at approximately the right number of personnel. Most staff members work approximately a 50 hour week. Adding one or two people to the project would lighten the individual load of a few people, but would add to the coordination needed for the whole project and in the end most of the staff's load would not change significantly.

The integration between the field and the office is fairly strong. Hensel Phelps has a fairly regimented program for personnel coming up through the ranks and upper level personnel are familiar with the duties of the other staff and know who's responsible for which tasks. They are also there to assist in making sure the newer staff can do the work expected of them. There is a strong atmosphere of guidance without overbearing control.

The staffing plan is also distributed to the subcontractors, Construction Manager, the Design team, and the owner. Sharing the staffing plan with the project team allows for the communication to go more smoothly between the different entities on site. The owner and all of the subcontractors still have a main point of contact, but they are also aware of the duties of the entire team and it is easier for them to know whom to consult in various situations and conflicts.

Design Coordination

Scope / Contract Requirements

Coordination of MEP work is required by contract for the Mechanical/Plumbing, Electrical, and Fire Protection Contractors. The contracts call for the overlaying of respective shop drawings to identify areas of conflict and the resolution of those conflicts. The first step required is for a schedule of the order of coordination drawings listing the areas of main concern and the dates when the coordinated drawings will be submitted to the designers. The mechanical contractor, Pierce Associates, will take the lead in coordinating the drawings.

Intensity

Since the building is an art museum, the mechanical coordination does not appear at first glance to be an intensive one. The age of the building and the unique structure make the building rare by nature, the systems used in it have to function accordingly and therefore tend to be somewhat complex so they do not impact the nature or use of the building. The mechanical areas will require a fair amount of coordination due to the amount of equipment needed to supply a building with such immense size.

The use of an all air system increases the amount of space the mechanical system will take up. Duct work is one of the most space consuming systems in a building. The building's layout by wing causes the systems to have long runs of duct, pipe, and conduit in order to feed the various spaces in the building. On top of the layout, the system is split into two parts, one feeding up from the basement and the other feeding down from the fourth floor. Having two mechanical rooms means having to coordinate two separate mechanical rooms.

One of the details of the building that simplifies the coordination process is the lack of ceilings in the various spaces. There are very few spaces in the building that have a ceiling besides the structure of the floor above. The mechanical rooms and the basement spaces have exposed MEP work running openly. The electrical conduit is run in the floor slabs. Most of the duct that feeds the spaces is run in vertical chases that do not have horizontal runs on the floor but feed the space from the sides.

One of the unique areas that requires coordination is the cooling tower. The cooling tower requires a new steel structure to be erected on top of the roof. The cooling tower will require coordination between the steel and the mechanical lines that feed the cooling tower.

Deadlines

The shop drawings, after the plans have been coordinated, must be submitted to the respective engineers for approval of any changes that needed to be made. The schedule of submissions for the drawings was drawn up in advance based on the construction schedule of when those areas would be built.

Design Coordination continued

Problems, C/O's & Field Conflicts

The key problems associated with the MEP systems focus on the use of the former chimneys as the riser space for the mechanical chases. The chases are typically 1 ft by 1 ft when they are first opened up. The chases need to hold the ductwork, as well as some other plumbing and mechanical risers. In almost every case the chases need to be widened in order to fit the MEP work in place. Widening the chases creates a number of structural issues due to the age of the building and the fact it's structural masonry. There are questions about the structural stability of all of the extra holes and openings being made. Also, the reinforcement to support the structure is typically steel channel which expands and contracts differently from masonry and could lead to cracking and other structural issues.

The age of the building also means that there are not a good set of As-Built drawings to work from when the systems were designed. Many problems arise when opening the chimneys to see the existing size. Often the structural engineer has to come to site because a chases do not conform to the typical structural details for reinforcing shown in the drawings.

Once installation of the MEP rough in and equipment began, weekly coordination meetings started. The meetings look at the 4-week look ahead schedule to find areas the subcontractors will be working that may have conflicts. The conflicts are worked out in advance to minimize schedule impacts

One of the solutions for coordination in the West Basement, the main mechanical and electrical space, was the use of metal racks to support some of the MEP runs**.** The racks hold up the lowest layer of ductwork and piping. The system enables the contractors to have two tiers of MEP systems running down the corridor in the basement. The system also detracts from the amount of structural support needed from the arched masonry ceiling above.

One of the major changes that occurred with relation to MEP coordination was in the East Basement. Originally the MEP systems were to run exposed from the ceiling as in the West Basement. The space is going to be used for certain offices and the occupants did not want exposed systems running through the corridor (the ceiling height was low to start). The systems were changed so the mechanical and electrical systems run in the slab, requiring the excavation of trenches due to the amount of conduit and ductwork going down the corridor. The change required an extensive amount of coordination to locate where the crossover of systems was underground and also to work around the foundation as much as possible rather than coring through the footings.

Design Coordination continued

In the area where there is a ceiling (North West of the 3rd floor) there is a conflict of the mechanical equipment due to limited space above the ceiling, resulting in the lowering of the ceiling. In the Luce Center, one of the "Great Spaces," there are display cases which require electric hook ups, the conduit needs to be run under the floor for appearances sake and the floor is existing slate and not easily fixed in case of a mistake or change.

In the courtyard the MEP systems have been re-coordinated several times because of multiple changes from the owner, there are extensive Mechanical and Electrical systems running above the ceiling in order to support the auditorium. The re-coordination effort is a strain on the personnel because they have already performed the work and are in the process of planning the construction only to have the whole area changed and they have to start again almost from scratch.

Critical Industry Issues

Session 1: Performance Contracting I: Rewards & Incentives

During the first session, it was interesting to learn the contractors' views on the idea of rewards and incentives in contracts. All of the contractors tended to be agree that some sort of reward or incentive was usually a good thing in a contract. There was unanimous approval for shared savings clauses.

There was general agreement that performance based fees worked, though they felt there should be some more objective criteria for assessing the performance. They referred to the more subjective areas as "working for tips." The other issue raised about performance based fees was the potential for personality clashes between the contractor and the owner that could lead to unfair assessments for the contractor.

When the idea of incentives came up there developed some interesting conversation about the manner in which owners went about dispensing the incentive. One example where an employer wanted to hand checks directly to the GC's employees was considered a serious issue. The manager felt the payment could lead to a "mutiny" from other employees on other jobs who were not being compensated in an equivalent manner when they were working to the same level. Also, the potential for new employees could come to expect the incentives as money they were entitled to on every job. Also, because the employees were new they might not perform in the owner's best interests but try to get the most money out of the owner, in effect working in their own best interest.

Other incentives that were discussed were early completion incentives, safety awards and the potential for more work from the owner. One of the questions raised during the discussion was whether or not early completion bonuses led to an overall lower cost for the project for the owner due to the shorter period on site, or if the contractors were building in extra money into their bid to cover the cost of earlier completion.

After the discussion of fees the discussion moved to try to define what high performance contracting actually meant. The industry members present tended to agree that it went beyond being on time and on budget for the project. They felt serving the customer's needs, beyond the requirements of the contract, was where the step above came from.

The key to being a high performance contractor, from the point of view of the companies present, was in the people working for the company. The personnel needed to be able to adapt to changing conditions, have continuity in education, and that success for the project needed to be defined up front. When the project was of significant length, the success might need to be redefined multiple times. *The question was raised by the students about the relationship between contract incentives and repeat clientele. The industry members said that most of their work where they had incentives was with customers who were repeat clients*.

The last topic discussed was the idea of a performance specification. The industry members said that if the spec was a "true" performance specification then it would work, however most performance specs were "hybrid" specs where some items were specified by name and took away the performance potential for some of the systems. Also, there tended to be problems where there were too many customers to please, such as at the Pentagon, where so many people had a preconceived notion of what they were getting. Also, the key seemed to lie in the submittal process to ensure the products submitted met the intent of the specification, and the owner needed to be involved to see exactly what they were getting.

Another question raised by industry members was why do incentives not always work in contracts, certain contractors seem to not work toward getting the incentives.

Critical Industry Issues continued

Session 2: Emerging Markets II: Green and High Performance Buildings

In the second session the topic started with why do people pursue green buildings. The main responses seemed to be driven by the bottom line, whether that was governmental incentives, higher turnover of merchandise, improved marketing, or possible fundraising opportunities. The questions that were raised were what are the legal aspects of a contractor pursuing the LEED certification for a building, and one of the subs drops the ball, taking the certification down a level. Who is now the responsible party if the building does not reach the level specified? Is it the responsibility of the GC when a sub came up short? What are the damages to the owner?

The conversation then turned to a delineation of what exactly we were talking about. The comment was raised that we were of course talking about LEED, since it's possible to be green without getting a LEED certification. Another comment was thrown out that LEED is basically equivalent to Energy Star on electrical appliances, etc. If someone wants a TV that uses low energy then they buy one with an energy star symbol, if they want a building like that, they expect a LEED certificate.

The perspective then moved to that of the companies. What are the actual costs of gaining points at each certificate level. How do the costs change by region. Also, the business case needs to be proven for companies to really be on board. Someone brought up the point that when people built houses, etc., a long time ago they were designed to be comfortable. When air conditioning was developed we stopped designing that way and just loaded up on the AC. Now we're just reverting back to what made sense in the first place.

The suggestion was made to come up with a checklist of reasons to obtain each point with the incremental cost changes associated with each point. For example, if someone were looking at the point for the bike rack. The checklist would show the value/intent of the point, a few reasons why someone might choose it, state the up front cost of buying the appropriate number of bicycle racks and showers if necessary, and the life cycle cost increase or decrease for the point. There would need to be a significant amount of study to show the cost per SF to get each point since they are somewhat interdependent. It might be possible to generalize it to what is the minimum cost per SF to step from the bare minimum of one certification to the next. There would be less adjustment and the dependence of the points would balance themselves out.

Another area that could be researched would be which points are most and which are least often obtained on a project. Then also correlate them to what level of certification the building received. One area of suggestion, when comparing the US to Europe, was cradle to the grave analysis of energy input into various items involved in construction, as well as LEED point items. One question raised was how many owners get a LEED certification, then decide not to pursue the certification on another project. What reasons do they have for this, is it the cost of documentation, or are the projects no longer green, etc.

When recycling moved into the forefront of the discussion, the issue was raised of how could the logistics of recycling be handled. The area of concern seemed to lie in the enforcement of the recycling plan. It was suggested that recycling could be improved significantly through education of the workers, in the same manner that safety has. Also, planning to minimize waste on site can save a significant amount of non-recycled garbage.

Critical Industry Issues continued

Guest Speaker: Chris Hewitt of AISC: "Managing steel prices and a volatile market."

Chris gave a brief overview of the myriad of issues that were causing the price of steel to rise. He started by showing how originally the price of steel was actually artificially low in the US due to an oversupply, a strong dollar, and cost pricing of the milling and fabrication. Recently, China has been beginning to build up its infrastructure, and with the size of China the affects of their purchasing has had a significant financial impact worldwide. On top of that the American dollar value has dropped, shipping prices are rising, and global demand has increased. All in all the price of steel has just been moved much closer to the global price of steel. The effect of China's influence is not limited to the steel market, the effect will also be felt in wood and cement as well.

He then reviewed the five V's that have an influence on the steel prices. Volume of work is actually less than what the American steel fabricators can handle currently. The businesses can handle about half again as much work as they are currently performing (throughout the country, that does not mean that individual companies can handle that much more work). Velocity, the standard mill and fabrication cycle has not changed recently by any significant amount. Value, mill prices have risen by approximately 50%, raising project costs directly by 1.5-2%. Variety, many contractors are stockpiling rebar in stock sizes to keep their prices artificially low for the time being. With steel, stockpiling is not easy due to the large variety of sizes specified in drawings. Volatility, the price of steel has been unpredictable for the last 9 months, which has led to higher prices mainly to protect those giving prices. All of the issues together are leading to an increase of 10-12% for projects overall, regardless of the materials used.

Some of the ways contractors can manage the process is to bring the specialty contractors in early to get their perspective and influence in minimizing the cost to the project. Some of the other ways to manage the costs are through the management of expectations, through realistic risk identification and acceptance, consistency completeness & coordination of structural drawings.

Critical Industry Issues continued

Session 3: Leadership Jump-Start for Entry Level/Undergraduates

The last session of the day focused on Leadership, the characteristics needed for leaders, and the ways new hires can learn to become good leaders. The discussion started out in simple terms, set expectations, learn to be a good follower as a starting point to being a good leader. One of the keys was in observing traits of good leaders and people that others want to work for. Too often students rely on their technical skills, they need to learn to delegate and give proper guidance when delegating. Also, the delegation of responsibility and authority need to go along with the onus of the task.

The students felt that they could benefit from more feedback from companies. The industry members replied that the students needed to learn to read the feedback they were already getting. Possibly a class on reading body language would be beneficial. The idea that motivation and initiative were the most commonly sought traits arose. Also, the idea that the company's goals, mission, values, vision, etc., should be thoroughly driven into the new company members. Also, new hires should be given an understanding of the potential growth path that is available to them and that through their understanding they can define their own path through the company.

The value of appropriate mentors was touted as a strong method for weaving new staff into a company. The comment that if you don't make a mistake then you're not trying hard enough. The new hires should make mistakes, but also should own up to them immediately so they have an opportunity to learn and grow. Also, the reasons for making the mistakes should be worked through so the errors are legitimate and educational, not through laziness or ignorance. A potential research question is what first and second year hires in a company find to be their most valuable resources and what resources they wish they had available, as well as what they wished they new about companies before they went to work for them.

The areas that industry members said they were expecting from new staff was commitment and flexibility, the challenge and reward aspects of the construction industry as an incentive, people have to be ready to respond and make decisions because those are what's needed in construction. Also, new members of the staff should be ready to challenge the company to make them work, learn to be good at face to face conversation. The issue of reading body language was reiterated. Lastly, the effective use of email since the "now" generation has a tendency to avoid confrontation.

Soil Conditions

- The soils found on site were consistent with the prevailing soils in the area, mainly Silty Sand, Clayey Sand, and Lean clay
- Some construction debris and brick fragments were found in the samples
- The water table was not encountered in any of the boring samples, nor evident in the holes within 24 hours after the samples were taken

Based on the location of some of the clays found, there is potential for water appearing and de-watering will most likely be needed

General Site Preparation Suggestions

- The existing clay and clayey soils should be removed from the site

The remaining sand should be stockpiled for reuse as backfill

Foundation Recommendations

- The soil is quite capable of supporting a standard spread footing, but some of the underlying clay layers will most likely lead to some differential settlement
- A deep foundation system is suggested to remove the effects of the underlying clay soils
- Pressure injected concrete piles are suggested

Driven piles are not suggested due to the impact it may have on the existing structure

Excavation

- The suggested shoring method for excavation support is sheeting and shoring
- The depth of excavation ranges from 20 to 25 feet

The max effective stress value of 25 degrees and max cohesion of 150 psf is recommended for preliminary design of the sheeting and shoring system

Chemical Analysis

- A geoprobe of the soils on site were taken to assess the presence of hazardous compounds within the soil
- The test found the presence of arsenic, chromium, copper, lead, nickel, and zinc
- The levels of contaminants found were low enough that the soil was classified as non-hazardous for disposal purposes