

# Loyola/Notre Dame Library

## Baltimore, MD

Technical Report 2 : Cost and Methods Analysis

**Sandra M. DiRupo**

Construction Management

Dr. Michael J. Horman

Friday, November 2, 2007



# Loyola/Notre Dame Library, Baltimore, MD

## Technical Report 2: Cost and Methods Analysis



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### **Executive Summary**

In Technical Report 2, the cost and methods analysis have lead me to find out about key features of the Loyola/Notre Dame Library Expansion and Renovation that affect the project's final execution. Important schedule attributes and costs of key building systems were analyzed using MS project for scheduling and RS Means for cost data. I then compared my findings to actual schedule and cost data provided by the Whiting-Turner Contracting Company. Some of the important findings in this report include:

- Detailed project schedule arranged by phase
- Description & photographs of phase activities to better understand schedule
- Site layout planning and staging for mechanical equipment and materials
- Curtain wall assembly estimate compared to actual values
- Detailed Structural Estimate for concrete compared to actual values
- General Conditions Estimate: Percent make-up of each GC cost

As this report unfolds, the following items will be discussed in great detail to give a better understanding of how the scheduling and cost estimates were put together for a number of systems and General Conditions:

- A. Detailed Project Schedule
- B. Site Layout Plan & Discussion
- C. Assemblies Estimate for Curtain Wall System
- D. Detailed Structural Systems Estimate: 25,000 SF Expansion Only
- E. General Conditions Estimate

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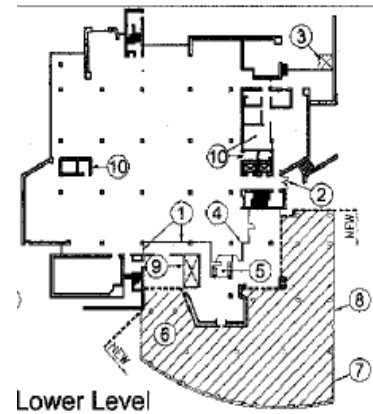
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### A. Detailed Project Schedule

The project schedule was designed to be completed in five phases. As stated in Technical Report 1, the completion of each phase is very important to the Notre/Dame Library because the Library will remain open during construction, and the project may not be delayed for any exceptions. Although the building is an expansion and renovation project, the building is to be completed by floor after the addition shell is assembled in phase 1. Phases 2, 3, 4, and 5 are designated to each of the four stories of the new 100,000 SF library building. Listed below is a detailed summary for each phase of construction. Phase 1 began in October 2006 and Phase 5 is to be completed by August 2008 at the latest.

#### Phase I:

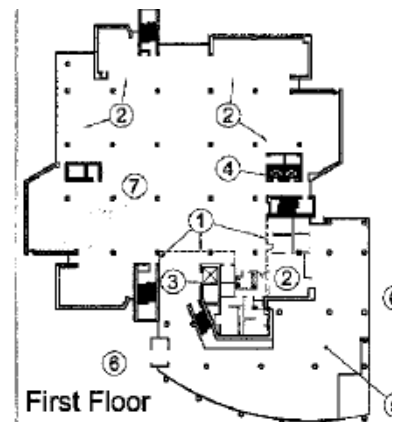
- 1.) Install dust partitions to separate existing library space from area of new addition. Provide and maintain access from existing library space to existing women's restroom. Restrooms shall be designated as men's on lower level and second floor
- 2.) Disassemble existing curtain wall and provide temporary entrance at lower level elevator lobby
- 3.) Utilize dock lift for temporary entrance during phase 1 & 2
- 4.) Existing partitions to remain as temporary dust partitions
- 5.) Maintain use of women's restroom. Designate as men's restroom on lower level & second floor
- 6.) Demolish steps, site wall, & paving as required for construction addition
- 7.) Construct deep foundations and new site utilities
- 8.) Construct four story addition shell and primary MEP systems (NO finishes or fit-out)
- 9.) Erect new shaft walls and cut new floor openings per structural drawings. Install new main plumbing riser
- 10.) Demo maintenance area and construct new server room. Preserve existing data and electrical risers



#### Phase II:

- 1.) Remove dust partition & complete demolition work
- 2.) Perform all first floor demolition and renovation to existing building as indicated on drawings to complete fit-out
- 3.) Complete new elevator with operable service to all floors
- 4.) Replace existing elevator machinery
- 5.) Fit-out first floor addition
- 6.) Construct site walls, steps, ramp, and paving
- 7.) Install existing bookshelves with new end panels

*(See Appendix A I & A II for progress photos in Phase I&II)*



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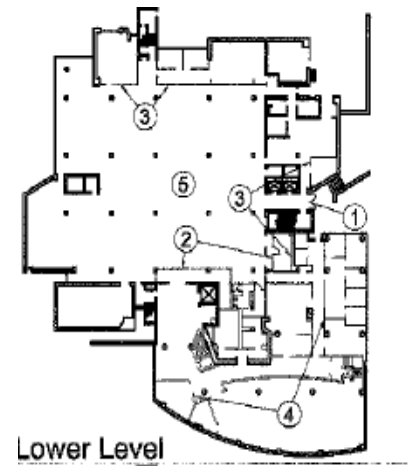
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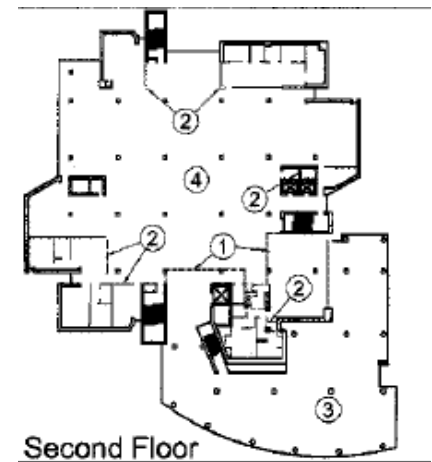
### Phase III: Lower Level Floor Fit-out & Finishing

- 1.) Temporary Entrance becomes construction entrance
- 2.) Remove dust partition & complete demolition work
- 3.) Perform all lower level renovation to existing building as indicated on drawings to complete fit-out
- 4.) Fit-out lower level addition
- 5.) Install existing bookshelves with new end panels



### Phase IV: Second Floor Fit-out & Finishing

- 1.) Remove dust partition & complete demolition work
- 2.) Perform all second floor renovation to existing building as indicated on drawings to complete fit-out
- 3.) Fit-out second floor addition
- 4.) Install existing bookshelves with new end panels



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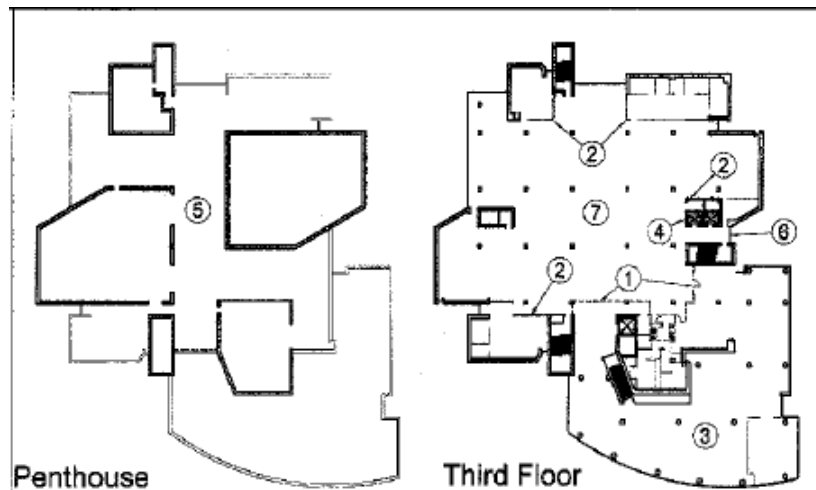
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## Phase V: Third Floor Fit-out & Finishing

- 1.) Remove dust partition & complete demolition work
- 2.) Perform all third floor renovation to existing building as indicated on drawings to complete fit-out
- 3.) Fit-out third floor addition
- 4.) Replace existing controls and finishes in existing elevator cabs
- 5.) Replace existing roof
- 6.) Remove temp entrance at lower level & reassemble curtain wall
- 7.) Install Existing bookshelves with new end panels



*(See Appendix A for a Detailed Project Schedule)*

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## **B. Site Layout Planning**

The site layout for this project varies in different phases of the project. I have chosen to represent the site layout plan for the mechanical equipment placement in any typical phase 2 through 5, after the new building shell has been constructed in phase 1.

The flow of traffic patterns will remain the same as phase 1. No contractors will be permitted to use Winston Avenue. All deliveries shall be made using Notre Dame Lane, and all contractors should park at the Cathedral on Charles Street, as stated in Technical Report 1.

A few dumpsters are located throughout the perimeter of the building for each phase of construction and will be moved accordingly. A window opening will be left in the north wall during each floor renovation as a trash chute pathway for debris and material scraps that cannot be recycled.

The Whiting-Turner superintendent trailer is placed on the east side of the building near the library parking lot for the first two phases of work. Once site work begins, the trailer will be relocated according to the amount of space that paving, concrete, and landscape contractors take up.

On the site plan in Appendix B, there is a flat bed truck located at the south end of the site. There is an access road here for deliveries to unload and turn around here, so this would be a probable place for the crane provided by the mechanical contractor, M. Nelson Barnes, to pick AHU and other heavy equipment with their 150 ton crane. A hoist is used to lift other materials through openings left throughout the curtain wall.

*(A more detailed understanding of the site layout plan may be seen in Appendix B)*

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### C. Assemblies Estimate

Assemblies Estimate - Loyola/Notre Dame Library						
B20 Exterior Enclosure (Excluding CIP Retaining Wall)						
Reference	Description	Qty	Unit	Mat	Inst	Total
System Components						
B2020 210 1750	Joints for tube frame, 90° clip type	2000	Ea.	\$2.10		\$4,200.00
B2020 220 1250	Caulking/sealants, polysulfide	8250	L.F.	\$0.17	\$1.72	\$15,592.50
B2020 210 1750	Alum framing for insulating glass, One Intermediate horizontal	10500	S.F.	\$16.30	\$13.25	\$310,275.00
Curtain Wall Panels & Doors						
B2020 210 1750	Aluminum sunshades (use same data from alum framing)	8250	L.F.	\$16.30	\$13.25	\$243,787.50
B2020 220 2600	Glazing panel, insulating, 3/4" thick, clear	5325	S.F.	\$28.00	\$25.00	\$282,225.00
B2020 220 2650	Tempered (Fritted glass)	2380	S.F.	\$32.50	\$25.00	\$136,850.00
B2020 220 3000	Spandrel Glass, panels, 1/4" plate glass, insulated, 1" thick	2745	S.F.	\$13.20	\$7.30	\$56,272.50
B2030 110 7650	Alum. & glass, automatic	4	Opg	\$32,300.00	\$3,725.00	\$132,925.00
B2030 220 3350	Hollow Metal, 3'-0"x7'-0"	2	Opg	\$1,200.00	\$258.00	\$2,916.00
Misc Costs						
	Delivery Fees (approx 4 trips)	250	Miles	\$0.40		\$400.00

**TOTAL    \$1,185,443.50**

An assembly estimate was conducted for the curtain wall system for the new library expansion. RS Means was utilized to determine all of the materials necessary in the hanging of the curtain wall. Most of the figures were taken from manually measuring the SF of each type of window opening, and the total length of aluminum mullions. The estimate was only off by a few thousand dollars.

- The number of joints was determined by the approximate number of right angles for all of the mullions.
- Caulking and sealants was found by measuring the total lengths of areas needing caulked.
- Glass was estimated by the number SF amount of opening for the three different types of glass.

(See Appendix C for figures displaying curtain wall assembly)



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The estimate came out to be rather close to the actual estimate. Some of the items in the assembly were not measured exact, due to a lack of options in RS Means. For example, sunshades were not listed as a typical assembly item, so I priced it similar to the aluminum framing. The expensive decorative glass varieties made up for most of the curtain wall as expected.

Below is a breakdown by percent of the total cost for the curtain wall system:

- Joints - 0.35%
- Caulking - 1.3%
- Framing - 26%
- Sunshades - 21%
- Glazing panel, insulating - 24%
- Fritted Glass - 12%
- Spandrel Glass - 4.7%
- Aluminum & Glass Doors, Auto - 11.2%
- Hollow Metal Doors - 0.2%
- Delivery Fees - 0.03%

Some of these numbers may be off more than others, but the assemblies estimate must have balanced everything out for the most part, since the totals were so close. There is another automatic, glass wall and door on the first floor of the new addition. That is one reason that the cost may have come out to be less. Also, there are glass lights and transoms in many of the new doors. These items may also contribute to the total cost of glass.

**Assemblies Estimate: \$1,185,443.5**

**Actual Estimate: \$1,447,060**

**Difference: \$261,616.50**

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### D. Detailed Structural Estimate

03 31 Structural Concrete								
03 31 05 - Normal Weight Structural Concrete								
Reference	Description	Qty	Unit	Mat	Labor	Equip	Total	Cost
03 30 53 Concrete in Place - Foundations								
1200	Mini Piles: Deep foundation, augured (16" dia)	197	CY	\$465.00	\$400.00	\$39.50	\$904.50	\$178,186.50
5900	Spread Footings: Pile caps, under 5 CY, pumped	207	CY	\$160.00	\$76.00	\$0.46	\$236.46	\$48,947.22
1950	Perimeter Footings, Incl. Grade Beams: Continuous, shallow, pumped	155	CY	\$133.00	\$85.50	\$0.51	\$219.01	\$33,946.55
4200	Foundation Wall: 8" thick, 8' tall	248	CY	\$177.00	\$166.00	\$16.45	\$359.45	\$89,143.60
3940	Interior Footings, Incl. Grade Beams: Continuous, shallow (24"x12")	30	CY	\$133.00	\$85.50	\$0.51	\$219.01	\$6,570.30
6200	Retaining Wall: 10' high	68	CY	\$133.00	\$61.00	\$6.05	\$200.05	\$13,603.40
4050	Mat Slab: Over 20 CY	62	CY	\$173.00	\$72.50	\$0.44	\$245.94	\$15,248.28
<b>GRADE BEAMS, RETAINING WALLS, CONTINUOUS FOOTINGS, AND A 1'-6" MAT SLAB IN THE AUDITORIUM</b>								
03 30 53 Concrete In Place - Columns & Slabs								
1440	Columns: 24" thick, pumped, Max Reinforced	219	CY	\$685.00	\$420.00	\$41.00	\$1,146.00	\$250,974.00
2750	Two Way Slabs: 25' span	1020	CY	\$216.00	\$222.00	\$21.00	\$459.00	\$468,180.00
* SLABS ARE TYP. FOR 1ST, 2ND, 3RD FLOORS, AND ROOF SLAB								
*SF/FLR DETERMINED FROM 25,000 SF EXPANSION DIV. BY FOUR FLOORS=6250 SF/FLR								
*SINCE BAYS AND BUILDING GEOMETRY ARE NOT TYPICAL, I HAVE UTILIZED THE AREA TOOL ON CAD TO FIND SF/FLR								

03 30 Cast-In-Place Concrete								
Reference	Description	Qty	Unit	Mat	Labor	Equip	Total	Cost
03 31 05.70 Concrete in Place - Slab on Grade								
4650	Slab on Grade: 4" thick, not incl. finish, pumped	72	CY	\$122.00	\$55.00	\$0.41	\$177.41	\$12,773.52
* SLAB ON GRADE DOES NOT INCLUDE STAIRWELLS OR CONCRETE STEPS IN AUDITORIUM ON LOWER LEVEL								

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## Detailed Structural Estimate Continued

**Total: \$1,102,325.09**

<b>Foundations:</b>	<b>\$370,397.57</b>
<b>Columns:</b>	<b>\$250,974.00</b>
<b>Slabs:</b>	<b>\$480,953.52</b>

After performing a detailed estimate for the structural system on the 25,000 SF expansion portion of the building, an estimate of approximately \$1.1 Million was determined. In comparison to the original estimate of \$1.5 Million, this figure is a little low. However, aside from building costs, there is also some site work that requires new concrete sidewalks, so \$400,000 of the total may go toward site work. A number of assumptions have convinced me that this estimate is correct. Here is a list of some on my assumptions:

- 1.) I performed extensive take-offs for all of the concrete involved in the foundations and superstructure systems. I have double checked these calculations. They seem to make sense.
- 2.) Rebar and formwork were included in most of the concrete estimates. To double check my answer, I took an overall estimate of all of the CY of concrete. RS Means offers an estimate which includes formwork, rebar, and finishing. I took all 2278 CY of concrete, and then multiplied by the unit overall price \$853.00.
- 3.) If \$400,000 covers more than enough of the concrete which makes up the sidewalks, then some of the remaining funds may also go toward rebar and/or formwork that were not accounted for by RS Means. Most of the estimates include both formwork and rebar, but a few did not.

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As a result, \$1.9 Million was the RS Means estimate including rebar, formwork, and finishing. I think that this is a bit high since it does not leave funds for the additional concrete sidewalks, but I did include a 10% waste factor for all of my concrete takeoffs, and I took maximum heights on all of the foundation walls. I may have been a little too generous according to this estimate.

03 30 03 Concrete in Place – Concrete With Reinforcement& Formwork									
0010	Concrete in Place: Including forms, reinforcing steel, concrete, placement, and finishing unless otherwise indicated beams, 5 k/L.F., 10' span								
0020									
0050									
0300		2278	CY	\$315.00	\$490.00	\$48.50	\$853.50	\$1,944,273.00	
* APPROXIMATE TOTAL COST OF CONCRETE WITH REBAR AND FORMWORK COMPARED TO ACTUAL ESTIMATE of \$1.5 Million									

**Detailed Structural (Concrete) Estimate: \$1,102,324.09**

**Actual Concrete Estimate: \$1,515,000**

*(See Appendix D for Quantity Take-off information)*

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### E. General Conditions Estimate

General Conditions Estimate							
		PH I	PH II	PH III	PH IV	PH V	TOTALS
<b>1</b>	<b>Mobilization</b>						
	Move in/out Equip	\$10,000.00	\$0.00	\$0.00	\$0.00	\$0.00	\$10,000.00
	Move in/out Trailers	\$0.00	\$0.00	\$0.00	\$5,000.00	\$0.00	\$5,000.00
<b>2</b>	<b>Tools and Equipment</b>						
	Small Hand Tools	\$1,500.00	\$1,500.00	\$1,500.00	\$0.00	\$0.00	\$4,500.00
	Misc. Supplies	\$3,200.00	\$2,400.00	\$2,400.00	\$0.00	\$0.00	\$8,000.00
	WT Yard Rental	\$2,500.00	\$2,500.00	\$2,500.00	\$0.00	\$0.00	\$7,500.00
<b>3</b>	<b>Plans &amp; Permits</b>						
	Drawings & Specifications	\$7,500.00	\$7,500.00	\$7,500.00	\$0.00	\$0.00	\$22,500.00
<b>4</b>	<b>Supervision</b>						
	Senior Project Manager (50%)	\$55,000.00	\$55,000.00	\$55,000.00	\$0.00	\$0.00	\$165,000.00
	Project Manager (100%)	\$95,000.00	\$68,000.00	\$68,000.00	\$0.00	\$0.00	\$231,000.00
	Asst. Project Manger (100%)	\$0.00	\$0.00	\$66,000.00	\$62,000.00	\$62,000.00	\$190,000.00
	Project Engineer 1 (100%)	\$48,000.00	\$48,000.00	\$48,000.00	\$0.00	\$0.00	\$96,000.00
	Superintendent (100%)	\$95,000.00	\$76,000.00	\$76,000.00	\$0.00	\$0.00	\$247,000.00
<b>4</b>	<b>Incidental Construction</b>						
	Restore Construction Area	\$5,000.00	\$5,000.00	\$5,000.00	\$0.00	\$0.00	\$15,000.00
	Barricades	\$2,500.00	\$2,500.00	\$2,500.00	\$0.00	\$0.00	\$7,500.00
	Dust/Weather Protection	\$3,500.00	\$3,500.00	\$3,500.00	\$0.00	\$0.00	\$10,500.00
	First Aid	\$1,000.00	\$1,000.00	\$1,000.00	\$0.00	\$0.00	\$3,000.00
	Pedestrian Barricades	\$20,000.00	\$0.00	\$0.00	\$0.00	\$0.00	\$20,000.00
	Fall Protection	\$7,500.00	\$0.00	\$0.00	\$0.00	\$0.00	\$7,500.00
<b>5</b>	<b>Temporary Facilities</b>						
	Telephones	\$7,500.00	\$3,000.00	\$3,000.00	\$0.00	\$0.00	\$13,500.00
	Temp Water	\$800.00	\$600.00	\$600.00	\$0.00	\$0.00	\$2,000.00
	Contractor Restrooms	\$2000	\$2000	\$2000	\$2000	\$2000	\$10,000.00
	Trailer Furniture	\$500.00	\$0.00	\$0.00	\$0.00	\$0.00	\$500.00
	Office Equipment	\$3,300.00	\$3,000.00	\$2,250.00	\$0.00	\$0.00	\$8,550.00

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### General Conditions Continued

<b>6</b>	<b>Clean Up</b>						
	Daily Clean Up	\$18,600.00	\$32,550.00	\$32,550.00	\$0.00	\$0.00	\$83,700.00
	Final Clean Up	\$5,000.00	\$5,000.00	\$5,000.00	\$0.00	\$0.00	\$15,000.00
	Dumpsters	\$22,500.00	\$37,500.00	\$37,500.00	\$0.00	\$0.00	\$97,500.00
<b>7</b>	<b>Procedures</b>						
	Professional Photos	\$0.00	\$2,500.00	\$0.00	\$0.00	\$0.00	\$2,500.00
<b>8</b>	<b>Closeout</b>						
	Paperwork	\$0.00	\$0.00	\$5,000.00	\$0.00	\$0.00	\$5,000.00
	O & M Manuals	\$0.00	\$0.00	\$2,500.00	\$0.00	\$0.00	\$2,500.00
	Punchlist	\$0.00	\$0.00	\$15,000.00	\$0.00	\$0.00	\$7,500.00
<b>9</b>	<b>Totals</b>						
	Without CM at Risk Fee	\$415,400.00	\$357,050.00	\$442,300.00	\$67,000.00	\$62,000.00	\$1,288,250.00
	With 2% Fee	\$8,308.00	\$7,141.00	\$8,846.00	\$1,340.00	\$1,240.00	\$392,084.58

<b>Fee</b>	<b>\$392,084.58</b>
<b>Subtotal</b>	<b>\$1,288,250.00</b>
<b>Budgeted GC's and Fee</b>	<b>\$1,778,355.73</b>

The estimated general conditions data was based on items that Whiting-Turner considers when putting together a GC estimate. Some of the costs have been monitored a bit, but for the most part are directly related to the actual GC cost of the original estimate. I have estimated the GC costs to be about \$100,000 higher than the contract GC amount of \$1.58 Million. One main reason behind this is the additional staffing that was added during construction, after the contract amount was already determined. As phases of the project become complete, the staffing may decrease, and GC costs will probably drop back to the original contract amount, or somewhere a little closer to the amount. On the other hand, additional staffing may be necessary to complete the job on schedule. Phases 3, 4, and 5 will determine the final GC costs, as far as staffing is concerned.

All other costs are rather accurate, and they will probably remain stationary throughout the duration of the project. Safety/Protection and clean-up accounted for much of the GC costs, which I had not expected. Of the subtotal GC costs, 20% of the costs were from incidental construction and clean-up.

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The remainder of the General Conditions costs were broken down as follows:

- Mobilization 1%
- Tools and Equipment 1.5%
- Plans & Permits 1.7%
- Supervision 72%
- Incidental Construction 15%
- Temporary Facilities 1.9%
- Clean Up 5%
- Procedures 0.1%
- Closeout 1.2%

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## **Appendices A-D**

### **Appendix A, A I, & A II: Detailed Project Schedule**

- Microsoft Project Schedule Summary
- Project Photos of Phases I & II

### **Appendix B: Site Layout Planning**

- Site plan showing mechanical equipment and material sequencing

### **Appendix C: Assemblies Estimate**

- Curtain wall assembly photos

### **Appendix D: Detailed Structural Estimate**

- Quantity Take-offs for concrete



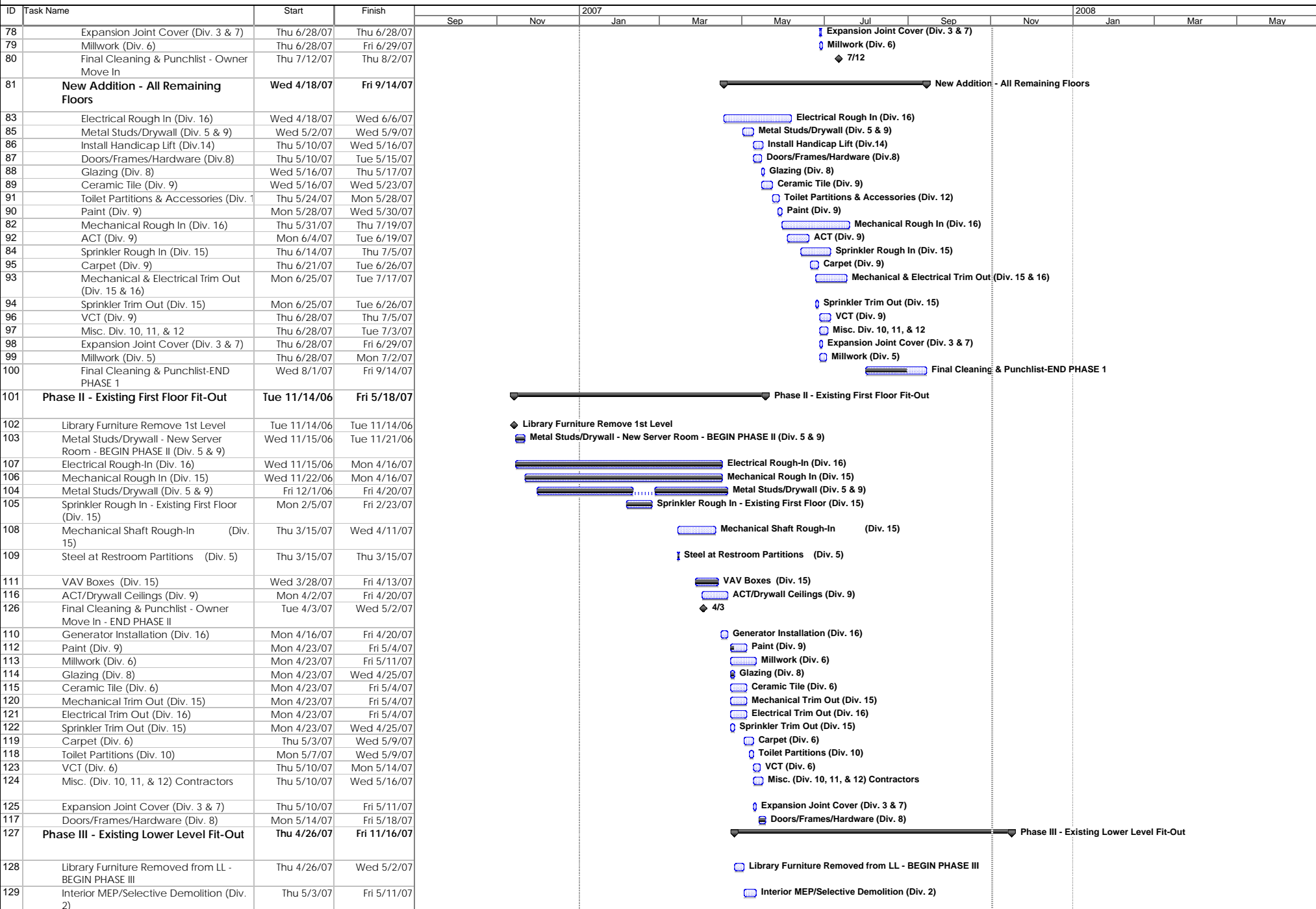
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ID	Task Name	Start	Finish	2007					2008					
				Sep	Nov	Jan	Mar	May	Jul	Sep	Nov	Jan	Mar	May
1	<b>Construction Schedule</b>	Mon 10/9/06	Mon 6/23/08											
2	<b>Phase I</b>	Mon 10/9/06	Fri 9/14/07											
3	<b>Sitework (Div. 2)</b>	Mon 10/9/06	Tue 12/5/06											
4	Stakeout - BEGIN PHASE I	Mon 10/9/06	Fri 10/13/06											
5	Temporary Stairs @ Bridge at West Side of Building	Fri 10/13/06	Tue 10/24/06											
6	Temporary Handicap Ramp at East Side of Building	Fri 10/13/06	Tue 10/17/06											
7	Install Temporary Road at North Side of Building	Mon 10/16/06	Tue 10/17/06											
8	Sediment Control	Mon 10/16/06	Fri 10/20/06											
9	Clean Exterior Building Façade	Mon 10/16/06	Tue 10/17/06											
10	Close First Floor Main Entrance - Open West and East Side Entrances	Tue 10/24/06	Tue 10/24/06											
11	Site Demolition	Wed 10/25/06	Tue 11/7/06											
13	Relocate Sanitary Line	Wed 11/1/06	Tue 11/7/06											
14	Remaining Site Utilities	Wed 11/8/06	Tue 12/5/06											
15	Prep Building Pad	Wed 11/8/06	Tue 11/21/06											
16	Shoring	Wed 11/8/06	Mon 11/20/06											
12	Gas Line Relocation	Thu 11/16/06	Thu 11/30/06											
49	<b>Addition Fit-Out</b>	Mon 10/9/06	Wed 3/14/07											
50	Temporary Partitions (Div. 2)	Mon 10/9/06	Fri 10/20/06											
51	Lower Level - Mech/Elevator Shaft: Selective Demolition & Interior MEP (Div. 2)	Wed 10/25/06	Fri 10/27/06											
52	First Floor: Selective Demolition & Interior MEP (Div. 2)	Mon 10/30/06	Tue 11/14/06											
53	Metal Studs - Existing First Floor - New Restroom (Div. 5)	Mon 11/6/06	Fri 11/10/06											
55	Core Drilling for Mini Piles (Div. 2)	Wed 1/17/07	Fri 1/19/07											
54	Metal Studs - Existing Lower Level - New Restroom (Div. 2)	Wed 1/24/07	Fri 1/26/07											
56	Load Test for Mini Piles (Div. 2)	Thu 1/25/07	Fri 2/2/07											
57	Mini Piles (Div. 2 & 3)	Tue 1/30/07	Tue 2/6/07											
58	Concrete at Shaft Foundations (Div. 3)	Wed 2/7/07	Tue 2/13/07											
59	Demolition of Floor Slab at Mechanical & Elevator Shafts (Div. 2)	Thu 2/8/07	Tue 2/27/07											
60	Block at Mechanical & Elevator Shafts (Div. 4)	Wed 2/14/07	Fri 3/9/07											
61	Waterproofing at Mechanical & Elevator Shafts (Div. 7)	Tue 2/20/07	Wed 2/21/07											
62	Concrete at Mechanical & Elevator Shaft Roof (Div. 3)	Mon 3/12/07	Wed 3/14/07											
17	<b>Building Shell</b>	Thu 10/19/06	Fri 8/10/07											
19	Removal of Existing Storefront and Brick (Div. 2 & 4)	Thu 10/19/06	Tue 10/24/06											
20	Load Test & Piles (Div. 2)	Wed 12/13/06	Thu 1/25/07											
22	Surveying (Div. 2)	Mon 1/29/07	Tue 1/30/07											
23	Concrete Footings/Walls (+ 5 Saturdays) (Div. 3)	Wed 1/31/07	Tue 3/6/07											
24	Excavate Building to Subgrade for Auditorium (Div. 2)	Wed 1/31/07	Fri 2/9/07											
25	Underground Drainage (Div. 2)	Wed 2/14/07	Tue 2/20/07											
18	Structural Steel at First Floor (Div. 5)	Thu 2/15/07	Fri 2/16/07											
28	Waterproofing at Walls (Div. 7)	Tue 2/20/07	Wed 3/7/07											









# Loyola/Notre Dame Library, Baltimore, MD

Technical Report 2: Cost and Methods Analysis

Sandra DiRupo

Construction Management

Dr. Horman

Nov. 2, 2007

## Appendix A: Project Photos, Phase I & II

Fig. 1: Removal of wall and steps



Fig. 2: Temporary steps for public access to library at west entrance



Fig. 3: Auger cast mini piles



Fig. 4: Pouring footings along curved foundation wall



Fig. 5: Pouring columns in lower level addition



Fig. 6: Pouring slabs with truck and pump



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## Appendix A: Project Photos, Phase I & II

Fig. 7: Insulating duct work & painting existing waffle slab on first floor



Fig. 8: Installing light fixtures



Fig. 9: Millwork Installation



Fig. 10: Hanging of Floating Ceiling



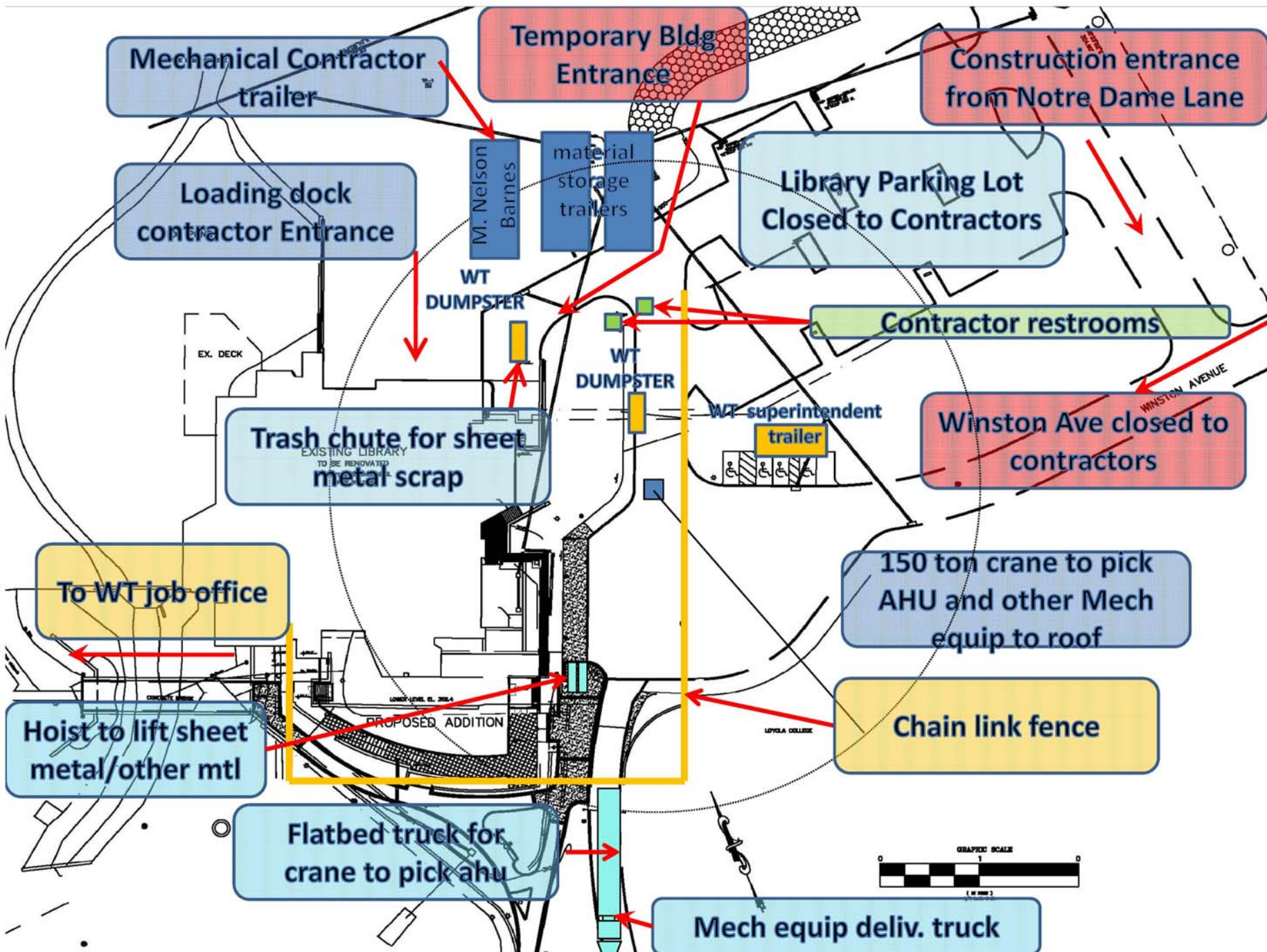
Fig. 5: Finished existing library space



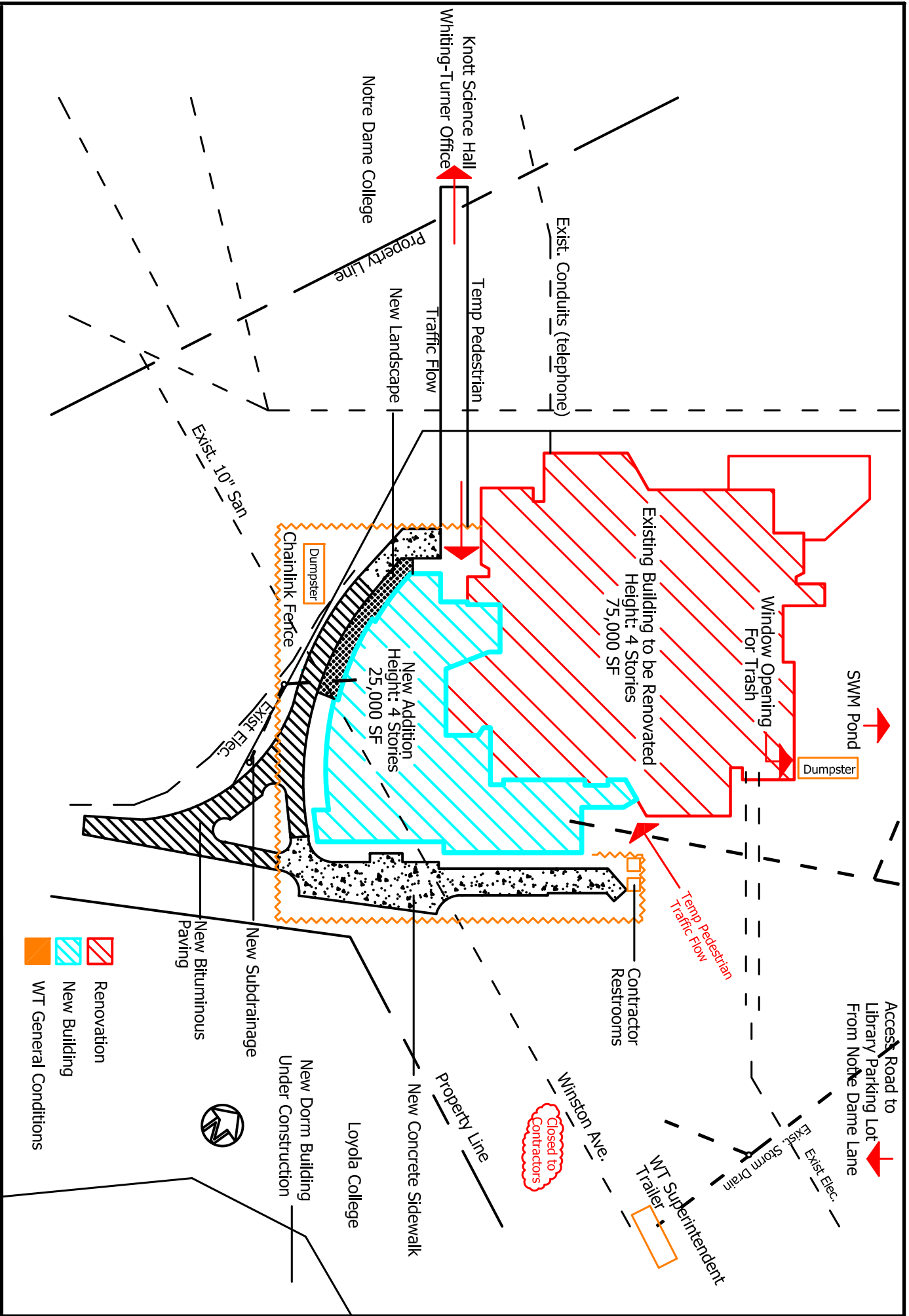
Fig. 10: New automatic sliding doors from gallery to newly renovated space



Appendix B: Site Layout Planning for Mechanical Sequencing







# Loyola/Notre Dame Library

Sandra DiRupo  
Construction Management  
Friday, November 2, 2007

Appendix B  
Technical Report 2  
Dr. Hornan

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### Appendix C: Curtain Wall Assembly

Fig. 1: Applying aluminum grid around addition perimeter



Fig. 2: Two genies erecting glass



Fig. 3: Applying insulation at top of third floor



Fig. 4: More glass and insulation installation



Fig. 5: Close Up after installation of clear and spandrel glass



Fig. 6: New addition curtain wall 85% complete

