



## 7 | Project Logistics Details

### 7.1 Project Schedule Summary

#### General Schedule Overview

While this project is classified as design-build, the project schedule does not reflect the fast track process that usually coincides with a design-build project. After referencing the detailed project schedule in Appendix B, it is apparent that the design phase was completed before building construction began. It should be noted that small design changes are occasionally made, however the main design was to be finalized before construction began so it could be approved by the Washington Christian Academy Organization. Upon further review of the schedules, a large gap in time exists between October 30, 2006 and January 25, 2007. The reason for the almost 3 month delay was obtaining the necessary permits for construction. During this lapse, the project essentially shut down and valuable time was wasted. To compensate for this delay, many item durations have been shortened and tasks condensed. So in a sense, the project will be moving at a fast track pace even though that was not the initial intention.

The driving force of this project is the schedule. The Flagship School and Gymnasium must be open for the commencement of the 2008-2009 school year. As it is scheduled now, WCA moves in at the end of July 2008, and punchlist items continue through August. While this meets the crucial school year deadline, this leaves no room for delays or complications from now until project completion. The initial delay of permits took away any float or “buffer time” from the contractor. There are key elements in the building process that must happen sequentially. Ensuring that these tasks are completed on time is essential in finishing successfully, as one delay will cause a domino effect. It is the designed structure of the building that dictates this sequential order.

#### Foundation and Structural Schedule Impacts

The structural foundations are mainly made up of shallow concrete continuous wall footings. The rest of the base structure is a simple slab on grade, bearing on compacted soil. The foundations must be excavated, formed, and placed before the superstructure can begin being constructed. The superstructure of both buildings is CMU load bearing walls with steel joists. These must also be built sequentially, due to the obvious necessity that the CMU walls must bear on the foundation, and the steel must bear on the CMU. Some overlapping occurs in the schedule for the structural construction of the multiple floors. Once the steel trusses are up, and the decking and concrete is placed, the next floor’s load bearing walls may begin. Simultaneously, the lower floors rough-in may begin. Once the roof is complete, the exterior façade and interior finish work may begin.

Proper foresight by the construction manager resulted in building the Gymnasium at the same time as the Flagship Building. This is to keep production and efficiency rates high. Since some items of the Flagship Building will take longer to construct (because it is larger and more complex), the Gymnasium can use trades that are not busy on the Flagship Building. For instance, both foundations will go in at the same time because it is logical to excavate, form, and place concrete at the same time. Naturally,



the Gymnasium foundation will be completed first. While the foundation is still being worked on for the Flagship Building, CMU block can be placed at the Gym. Once finished at the Gym, the mason can move directly over to the Flagship. This creates a parade of trades from the Gymnasium to the Flagship.

## Finishing Constraints

The finish work in the Gymnasium is slightly different than an average building. In order to lay the gym flooring, there must be a conditioning period for not less than 7 days prior to the placement of the floor, during the placement of the floor, and 3 days after placement. From this point forward, the ambient temperature must be maintained between 65 and 75 degrees Fahrenheit and have no more than 50 percent relative humidity. All overhead work including mechanical and lighting systems and athletic equipment must be installed prior to the floor placement. Although the gym flooring is atypical of building finishes and has strict guidelines, it should not cause problems for the overall schedule because the Gymnasium finishes early and it is the Flagship Building that determines when the project is finished.

## **7.2 Detailed Project Schedule**

*Please see the Detailed Project Schedule in **Appendix B**.*

### Overview

The Washington Christian Academy (WCA) Flagship Building and Gymnasium site was undeveloped prior to breaking ground for the school. Therefore, neither demolition nor school release dates constrained the schedule. In other words, construction was not limited to only the summer months as it most likely would have been on the current WCA site in Silver Spring, MD. The Washington Christian Academy is able to function normally in their current facility while the construction of the new facility is underway. The largest constraint on the project is that the school must be completed and open for the 2008-2009 school year.

This opening date constraint should have been no problem according to the contract schedule. Upon review of the schedule in Appendix B, a large gap in time can be noticed between October 30, 2006 (Building Permit) and January 25, 2007 (NTP, mobilization). The reason for the almost 3 month delay was obtaining the necessary permits for construction. During this lapse, valuable time was wasted. To compensate for this delay, many activity durations have been shortened. The more rigorous schedule will allow the project to still meet the necessary completion date. As it is scheduled now, the tenant will be able to move-in in mid July, 2008. There is very little tolerance for any more substantial project delays.

### Sequencing

In general terms, the sequencing of the project is by floor, not by phases or sections. The structural system of the building requires the building to be built from the bottom up, floor by floor. The foundations of both buildings will begin construction at the same time. Tradesmen will work between



the two buildings sequentially, creating less down time and increasing efficiency. An example of the sequence after foundation completion is as follows:

**Table 7.1** Sequencing of activities after the foundation.

Time	Activity			
T1	Floor 1 Superstructure	Gym Superstructure		
T2	Floor 2 Superstructure	Floor 1 MEP Rough-In	Gym MEP Rough-In	
T3	Floor 3 Superstructure	Floor 2 MEP Rough-In	Floor 1 Interior	Gym Interior
T4	Roof Superstructure	Floor 3 MEP Rough-In	Floor 2 Interior	Floor 1 Finishes

This sequencing continues until both buildings are complete. This sequence should maximize the productivity of the subcontractors, as well as the use of the crane and concrete pump. Once the crane is on site, it should be used to its maximum capabilities every day in order to avoid losing money on the lack of productivity.

Schedule Assumptions

The following assumptions were made in the creation of the project schedule.

- Activity Durations: Great effort was made to make the activity durations accurate. With limited experience on creating schedules, some of these durations were knowledgeable guesses.
- Floor Sequencing: Activities on each floor occur in the same order as the previous floor.
- Overall Project: The Flagship Building and Gymnasium can be under construction at the same time.
- Inspections: Inspections that need to occur during construction are not listed as activity items. For instance, if the sprinkler system needs to be checked before the ceiling is hung, that inspection time is not included.
- Delays: No weather or any other delay “buffers” were accounted for.
- Move-In: The tenant may move in while punch list items are still being remedied.



### 7.3 Project Cost Evaluation

#### Actual Cost

- Total Size: 78,271 SF
  - Flagship: 67,616 SF
  - Gymnasium: 10,655 SF

**Table 7.2** Actual Building Construction Costs (CC) and Construction Costs per SF (CC/SF).

Building	Cost per SF (CC/SF)	Size (SF)	Total Cost (CC)
Flagship	\$164.03	67,616	\$11,091,050
Gymnasium	\$148.23	10,655	\$1,579,390
			<b>\$12,670,440</b>

This results in a cost of approximately \$161.88/SF for the entire project (both buildings).

#### Project Cost

**Table 7.3** Total Project Costs (TC) and Project Costs per SF (TC/SF).

Included	Cost per SF (TC/SF)	Size (SF)	Total Cost (TC)
A	\$220.72	78,271	\$17,275,640
B	\$264.99	78,271	<b>\$20,741,480</b>

**A:** Includes Actual Building Construction Costs, Permits, and Site work

**B:** Includes all of A, plus Design Costs, Unsuitable Soils Contingency Allowance, Owner’s Change Contingency, Testing, and Owner’s Rep. Salary

**Table 7.4** Major Building Systems Costs.

System	Building	Cost/SF	Size (SF)	Total Cost
Electrical <sup>1</sup>	F	\$31.24	67,616	\$2,112,322
	G	\$9.00	10,655	\$95,900
	B	\$28.21	78,271	\$2,208,222
Fire Protection	F	\$2.58	67,616	\$174,360
	G	\$2.31	10,655	\$24,640
	B	\$2.54	78,271	\$199,000
Mechanical <sup>2</sup>	F	\$24.73	67,616	\$1,672,188
	G	\$18.19	10,655	\$193,790
	B	\$23.84	78,271	\$1,865,978
Structural <sup>3</sup>	F	\$37.88	67,616	\$2,561,300
	G	\$62.39	10,655	\$664,765
	B	\$41.22	78,271	\$3,226,065
TOTAL	B	\$95.81	78,271	<b>\$7,499,265</b>

F: Flagship Building    G: Gymnasium    B: Both Buildings (total for project)

<sup>1</sup> Includes Electrical System and Communication System

<sup>2</sup> Includes Plumbing, HVAC Systems, and Mechanical Equipment

<sup>3</sup> Includes Concrete, Masonry, and Structural Steel Only



Square Foot Estimate using R.S. Means 2007

The 2007 R.S. Means Square Foot estimate guide contained entry M.520: Religious Education. Upon review, the largest SF area for this building type was 13,000 SF, 1 story. Even multiplied by 3 to account for the extra stories in the Flagship Building results in 39,000 SF, which is significantly less than the buildings' actual 78,271 SF.

It was decided to use M.580: School, Jr. High, 2-3 story. The reasons for this decision were the following:

- The Flagship Building is a school teaching K-12, Jr. High is in the middle of that range.
- The costs for Elementary schools and High schools were less than the Jr. High, so using the Jr. High for the cost estimate would yield the highest school cost and therefore be the most conservative solution.
- The gymnasium is included in the Jr. High estimate.

Below is the cost breakdown using R.S Means:

<b>Cost per square foot of floor area:</b>	\$121.19
<b>Perimeter Adjustment:</b>	\$2.51
<b>Story Height Adjustment:</b>	<u>\$1.22</u>
	\$124.92/SF

**\$124.92/SF at 78,271 SF yields a building construction cost of:**

\$9,777,613

**Common Additives account for an approximate additional cost of:**

\$1,500,000

**Location Factor:**

Olney, Maryland was not on the list and the WCA is not actually in Washington, D.C. Therefore, the most fair and accurate method available was to use an average.

Average for all listings in Maryland	.865
Washington, D.C.	.98
Location Factor Average:	.92

**Time Factor:**

Not used because data from 2007

**Final Result**

R.S. Means M.580: School, Jr. High, 2-3 Story Building Construction Cost:

**\$132.56/SF x 78,271SF:                      \$10,375,404**



Parametric Estimate

The following parametric estimate was performed in the *D4 Cost 2002* estimating software. The table represents four similar projects that were chosen to produce SF and Building Construction Cost estimates. The location, time, size, and construction methods were changed from the projects listed below to better match those of the WCA project. After the adjustments, the following cost estimates were reported.

**Table 7.5** Parametric Estimate Summary.

Building Name	Description	Cost per SF	Total Building Construction Cost
St. Anne’s Episcopal School	Rural, traditional architecture, gym included	\$178.48	\$13,969,976
Christ the Teacher Catholic School	Rural, gym included, K-8	\$108.72	\$8,509,695
Pope John XXIII HS	High School Building	\$83.41	\$5,639,553
	High School Gymnasium	\$82.84	\$882,608
			\$6,522,161
Northwood School District	Rural, K-12, gym included	\$53.61	\$4,196,163
AVERAGE		\$106.03	\$8,299,499

Estimate Comparison

**Table 7.6** Estimate Comparison Summary.

Estimating Tool	Cost/SF	Cost
Actual Building Construction Cost	\$161.88	\$12,670,440
Total Project Cost	\$264.99	\$20,741,480
<i>R.S. Means 2007</i>	\$132.56	\$10,375,404
<i>D4 2002</i>	\$106.03	\$8,299,499

For comparisons sake, the total project cost should not be considered because no other estimating tool accounted for sitework, contingencies, design fees, etc. Therefore, the true comparison lies between the Actual Building Construction Cost vs. *R.S Means 2007* and *D4 2002*. The *R.S. Means 2007* comparison is relatively close to the actual cost. This is predictable because practically every part of the WCA buildings was included (correct size, height, school & gymnasium, kitchen, bleachers, etc.). The fact that the guide is from 2007 also helps because SF values are current and more accurate to today’s estimates. The *D4 2002* cost estimate is significantly lower. This could be attributed to outdated information, not finding suitable school matches (most were only K-8), and the high quality construction that the WCA owner is seeking.



## 7.4 General Conditions Estimate

Please see the General Conditions Estimate in **Appendix C**.

### Assumptions

To complete the General Conditions Estimate, the following information was assumed. Most of the information came from the detailed project schedule and basic general conditions estimates from class notes.

- Construction Start: 2/1/07 based off of the 1/25/07 NTP/Mobilization from the project schedule.
- Construction Completion: 7/1/07 based off the substantial completion for the Flagship Building from the project schedule. The reason for the slight change in dates was to create an even number of months on the project. It can be assumed that the project completion date will change as the project continues, however this estimate does not account for that.
- Duration (months): 17 months derived from the dates above.
- Duration (weeks):  $(52 \text{ weeks} / 12 \text{ months}) \times 17 \text{ month duration} = 73.7 \text{ weeks}$   
This is a rough estimate. The leap year is not accounted for, but neither are holidays and other non-working days. Overall, it is a reasonable amount of time for the general conditions estimate.
- Temporary heat will only be needed on the project for 6 months.
- The warranty quantity comes from 10% of the total project cost.
- The Superintendent does not completely finish the project. Once the project is within the final weeks and activities are winding down (finishes, landscaping, punchlist), the Assistant Superintendent takes over and the Superintendent moves on to another project.
- The project time for the Project Executive, Senior Project Manager, Administrative Assistant, and IT Technician were obtained from information from Forrester Construction Company. They are merely estimates and could vary week to week. If problems were to arise on the project, these times would increase.
- Progress photographs, schedules, reports, and meetings are included by the General Contractor with no specific charge.

### Analysis

- The General Conditions cost is approximately 9% of the total project cost. This is a reasonable estimate for this size project. The owner and general contractor have a good working relationship. All parties involved are striving to solve problems collectively and efficiently to avoid change orders and delays. Avoiding change orders will save the owner money, and finishing early will save everyone money.