BREADTH ANALYSIS 2: CONSTRUCTION MANAGEMENT COMPARISON

Basis of Comparison

To most effectively compare the cost and constructability of both the steel and concrete systems, only the structures will be considered. For the concrete system, this includes concrete slabs, columns, and beams, while for the composite steel system, this includes steel columns and beams, composite decks, shear studs, concrete on the decks, and fireproofing. Since footings increased dramatically while floor section depths reduced under the concrete system, their impact will be analyzed, though separately.

Cost and Schedule Comparison

Using R.S. Means 2006, takeoffs and schedules are summarized in Table 9 and Figure 20. Cost estimates from the construction manager, R.W. Murray Company, suggest that the scope of structural steel encompassed 8 weeks erection time and $550,000, so it can be assumed that the steel estimate is conservative if not accurate.

Material	Cost	Construction Duration
Concrete System		
Columns, Slabs, Beams	$1,120,566	14 weeks
Footings	$230,887	2 weeks
Steel System		
Columns and Beams	$668,928	8 weeks
Deck and Shear Studs	$170,345	
Poured Conc. On Deck	$162,010	
Fireproofing	$73,044	
Total	$1,074,327	12 weeks, 4 days
Footings	$73,044	3 days

Table 9. Summary of Cost and Duration for Both Structural Systems

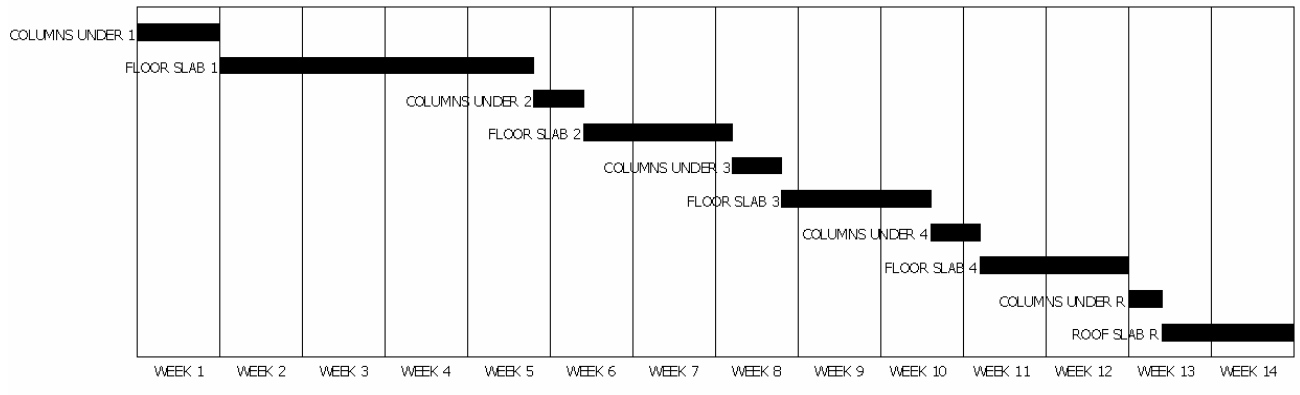

Figure 20A. Schedule for Concrete System, using Critical Path Method

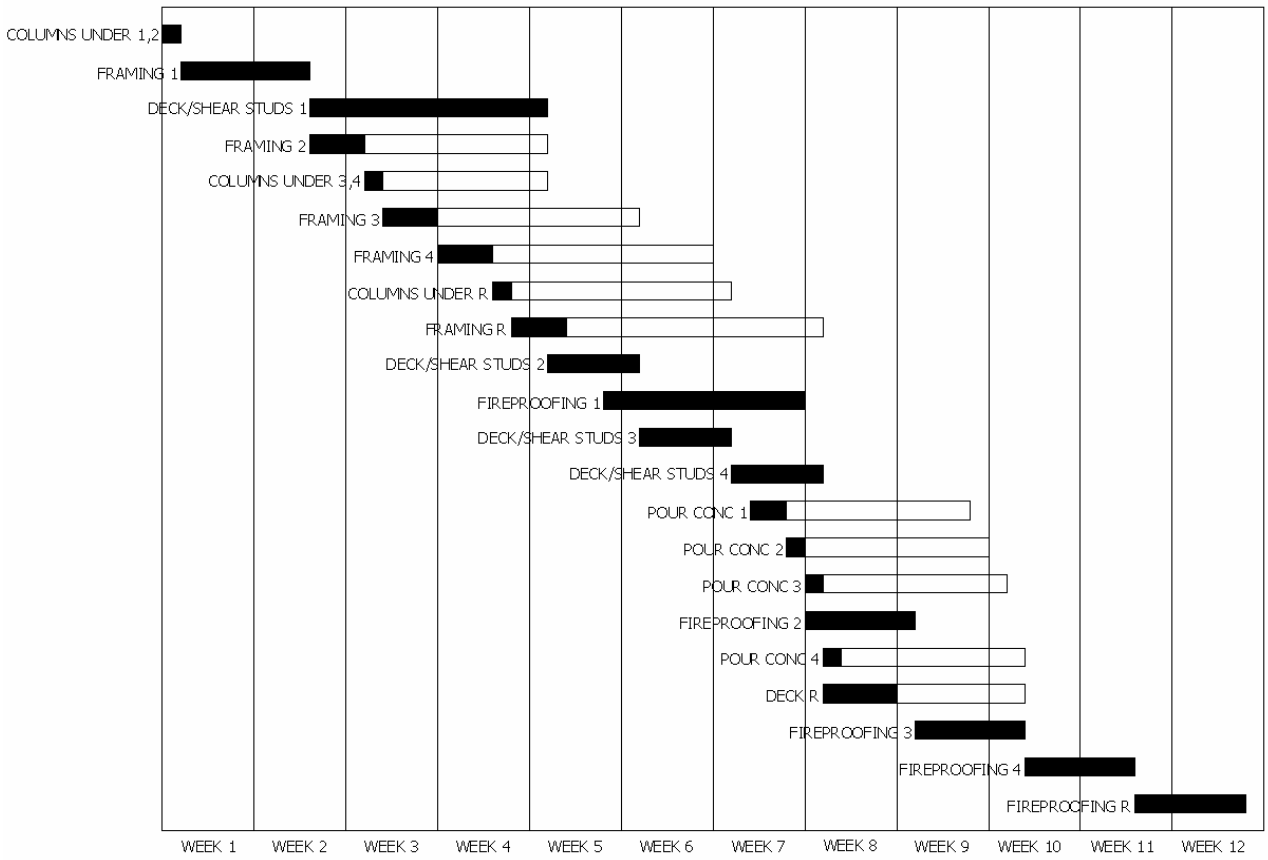

Figure 20B. Schedule for Steel System using Critical Path Method (Clear areas are float times)

It appears that the steel system is cheaper and requires a shorter erection time. When the increased footing size under the concrete system is additionally considered, the steel system becomes slightly more than $200,000 cheaper, requiring almost 3 less weeks of construction. Even when considering that the overall depth of the underground parking area will reduce by almost 13" in the concrete system due to a significantly narrower floor section depth, this equates to only about 400 less bank cubic yards of excavation, which would reduce construction costs by only $3,575 to $8,495.

Additional Construction Considerations for the Washington DC Area

Though the reduced floor section depth in the concrete system does not play a large role in this particular building, reduced floor section depths are equated with more floors and therefore more profit in many buildings subject to strict height restrictions throughout the Washington area. However, it seems that the steel system for this given building is significantly and consistently cheaper than the concrete system. Perhaps the local construction trades and economy come to influence building construction, making R.S. Means less indicative of an accurate cost analysis.

Cost Adjustments in Northern Virginia. Data supplied by representatives at the American Institute of Steel Construction regarding steel and concrete costs relative to the national average are summarized in Table 10. In the Washington area, concrete construction is indeed less expensive on average than steel.

Location	Concrete Costs	Steel Costs
Washington, DC	0.992	1.062
Fairfax, VA	0.921	0.921
Arlington, VA	0.902	0.898
Alexandria, VA	0.915	0.952
Winchester, VA	0.795	0.891

Table 10. Summary of Material Costs relative to the National Average

Assuming that the Manassas area would be grouped with nearby Fairfax, the values given by R.S. Means are directly proportional to the national average. If the construction costs were compared neglecting footing placement, concrete would be cheaper in Washington, Alexandria, and Winchester, though steel is still cheaper at all locations when footings are considered.

Lead Times. Though the actual erection time for the steel system is shorter, the overall length of construction time increases with longer procurement lag times. On average, after design completion, procurement, submittals, and approvals, it takes 12 weeks to produce structural steel while it only takes 3 weeks to produce rebar for concrete construction. Therefore, even with the longer erection time, concrete may take 6 less weeks from design completion to complete structural construction.

Supply and Demand. In any area, it is possible that any given contractor can undercut a bid to promote either concrete or steel construction. However, short term influences can affect this ability; two years ago, steel costs increased dramatically due to relative shortages of scrap materials, while in 2005, the Portland Cement Association placed Washington DC on the “tight cement supply” list, with similar market conditions predicted for 2006.

Weather Conditions and Schedule. As suggested by R.W. Murray Company, wintry conditions onsite during construction would increase the time and cost to pour and place a concrete system. According to ACI 318-05, all concrete forms must be free from frost and all concrete materials must be protected from freezing conditions. Therefore, it is locally accepted that concrete will only be placed if conditions can be maintained above 40 degrees Fahrenheit. Given that winter temperatures in Northern Virginia are often below freezing, protective tarps, covers, and heaters may be required throughout structural construction, raising cost and extending construction duration.