Construction Management Breadth – System Cost Study

Changing the structural system from the current design of concrete to the proposed design of steel resulted in a significant change in the overall construction cost: the total estimated cost of the proposed system was found to be 7.5% less than the original cost. Total costs are compared in Figure 25 below.

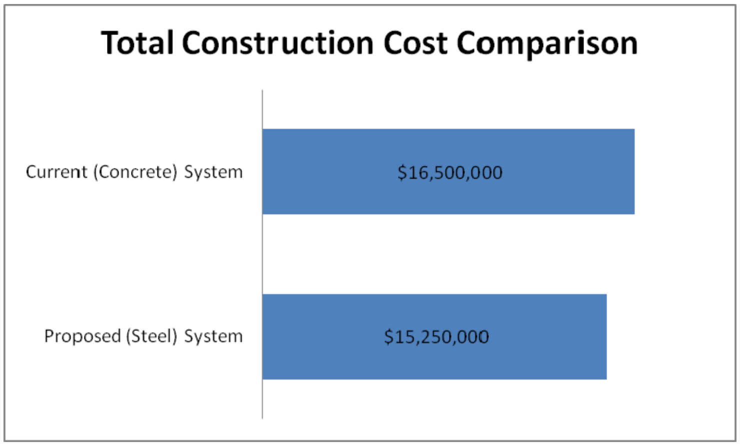

Figure 25: Comparison of total cost between current and proposed system

Current (Concrete) System		Proposed (Steel) System		Savings	
Foundation Cost		Foundation Cost		In Foundations	
$	202,133	$	140,687	$	61,446
Superstructure Cost		Superstructure Cost		In Superstructure	
$	2,423,497	$	1,235,295	$	1,188,202
Total Cost		Total Cost		In Total Cost	
$	16,500,000	$	15,250,352	$	1,249,648

Figure 26: Estimated savings in cost due to structural system optimization

As seen above in Figure 26, savings were found in both the foundation and the superstructure systems. Foundations accounted for approximately 5% of the total savings, while the superstructure accounted for the remaining 95%. These are due largely in part to reductions in the required quantity of concrete and in the equipment rental period. Even though the required labor may be seen to increase due to the welding required for the proposed steel system, the anticipated, accelerated pace of the steel construction offsets these expenses. Detailed estimate sheets may be found in Appendix D. Notice that for these calculations, only the construction costs that varied between the two structural types were taken into account; all other costs were assumed to remain the same and therefore not contribute to an overall change in cost.

Conclusion

Simply put, the current concrete-based design does not achieve structural optimization due to the extensive weight of the system. The following design possibilities are attainable with the use of a lighter steel system, and have thus been focused on in this report: the utilization of historic members in the lateral system, the reduction in transfer beam reinforcement size, and the reduction in foundation size.

As the lateral system analysis proved, the historic columns and beams can be utilized in the lateral force resisting system while meeting and exceeding design expectations. Not only were the code requirements met, but the stringent limitations on deflection and drift set by the neighboring building were attained as well. As this was the controlling factor, strength requirements were also easily attained.

The structural analysis also showed that the foundation system can be significantly reduced in size due to the decreased building weight. This has material, cost, and labor savings overall.

The mechanical breadth study focused on system coordination. The new floor system depth was something that could not be ignored, and so this potential problem was maneuvered around. The mechanical system coordination was found to be more than feasible.

The construction management study focused on relative system cost. The change in structural systems resulted in multiple changes in material and labor types as well, but the end result was one of savings. 7.5% of the total construction cost was reduced due to the structural system change.

The proposed design, which focuses on material consistency and the integration of the new steel framing system with the historic framing system, proves to be efficient from both a structural standpoint and a cost standpoint. After a few minor modifications, the system has proven to be adequate for mechanical space requirements as well. In summary, all of the checkpoints were met, thereby achieving the ultimate goal of structural system optimization.