

ARIC HEFFELFINGER
FORDHAM PLACE
BRONX, NY
STRUCTURAL OPTION
ADVISOR - DR. HANAGAN



Final Conclusions

All concrete vs. Composite steel

When you compare two structural systems, there is a lot more to compare than just how long will the job take and how much will it cost. Other such factors are perceptibility to floor vibrations, constructability, floor depths, area of the country, resistance to lateral motion, and many others. These factors will be examined in this section and in turn I will rate each of the two structural systems. Cost and duration analysis can be examined in the construction management breadth work.

The constructability of each of the structures is similar; however the edge would have to go to the composite steel. Although there are many hours put towards placing formwork, it is not very difficult to do so. Moment connections are a very difficult and time consuming connection, but the engineers were able to limit the building to only a few. Shear connections are very easy and quick to erect. In a concrete building, there is a lag time on the erection of the building due to the need to let the concrete cure. With a steel building, as fast as the steel erectors can put up the steel is how quick the project will move along.

When comparing floor depths between a concrete structure and a steel structure, an obvious advantage goes to the concrete building. Maximum floor depth needs to be looked at when

ARIC HEFFELFINGER FORDHAM PLACE BRONX, NY STRUCTURAL OPTION ADVISOR - DR. HANAGAN



comparing floor depths. The following is a table showing maximum floor depths for each of the two buildings.

	Slab	Beam	MEP	Total (in)
Composite steel	6.25	30	18	54.25
All Concrete	9	5.5	18	32.5

The higher floor depth essentially means a taller building.

In the area where this building is being built, New York, building height is not an issue. However if you were to proposed this design to a developer in the DC area, they would laugh at you. In Washington, DC all buildings need to be shorter than the capital building. Essentially the difference between a steel building and a concrete building in DC is an extra floor. With and extra floor, as an owner you can lease it out and make about 15% more profit than you would in a steel building.

The lateral stability of the steel and concrete structures is completely dependent on the type of lateral resisting system used within the building. For a steel building, moment frames or braced frames can be used. In a concrete building, moment frames or shear walls are used. Braced frames and shear walls have a much larger stiffness, therefore limiting the lateral drift of the building. Braced frames resist loads through axial deformation while shear walls resist loads through shear

ARIC HEFFELFINGER
FORDHAM PLACE
BRONX, NY
STRUCTURAL OPTION
ADVISOR - DR. HANAGAN



deformation. Both of which are exponentially better than resisting loads through moment rotation. With this said, both the shear walls and braced frames are very comparable and great lateral resisting systems.

Typically, you will not experience noticeable floor vibrations in a normal weight concrete structure nor a composite steel structure. Floor vibrations are sometimes a serious issue with open web steel joist as a floor system. Other floor systems that will sometimes cause vibrations are lightweight concrete floors, non composite steel systems with a small concrete slab. The two major factors that affect floor vibrations are rigidity and weight of the floor system. The following is a table rating each of the two systems on the basis of 0 being the worst and 5 being the best.

	Composite steel	All Concrete
Cost	5	4
Duration	5	2
Vibration Issues	5	5
Constructibility	4	3
Floor depth	2	5
Area of country	4	1
Lateral Drift	5	5
OVERALL	4.29	3.57

ARIC HEFFELFINGER
FORDHAM PLACE
BRONX, NY
STRUCTURAL OPTION
ADVISOR - DR. HANAGAN



Cost and Duration

When looking and cost and duration of the two systems in detail, it is easy to see the composite steel structure has a distinct advantage. The cost of the concrete superstructure was nearly 40% more than the cost of the steel. The duration of the concrete structure was nearly 2 times the duration of the steel structure. This can be seen in the following table.

	Composite steel	All Concrete	Concrete / Steel	
Labor Cost	701,761	1,355,553	1.93	%
Material / Equipment Cost	1,036,060	1,064,579	102.75	%
Total Cost	1,737,821	2,420,132	139.26	%
Duration (weeks)	40	78	195.00	%

Cost and durations were pulled off the construction assemblies in ICE 2000 Estimating. Then the software was used to analyze and compare differences in material cost, labor cost, and durations.