

Executive Summary

The Christina Landing Apartment Tower is a 22 story apartment building located just outside center city Wilmington, DE. The tower provides 250,000 square feet of floor space. The structure is a predominately cast-in-place concrete building. Its floors are supported by a two way flat slab system. The typical floor system also incorporates small areas of reinforced concrete and post-tensioned beams to aid the lateral force resisting system. The floors are supported by square and round concrete columns. Lateral forces induced on the building are resisted by a box of four shear walls. All columns and shear walls rest on a foundation system of H-piles and pile caps. Typical floor loads are 130psf dead load and 40psf live load.

For this report four alternate floor system designs were analyzed in addition to the existing design. The existing design is an 8" flat slab with top and bottom reinforcing. This system was found to be sufficient for the applied loads. The first alternate designed was a 7.5" flat plate with 3.5" drop panel. This system saves concrete, however it has less constructability than the existing slab. Second, a steel frame with a 4" composite deck was analyzed over 4 bays using RAM structural system and hand calculations. Typical beam sizes were W14x22s and typical girders were W18x35s. This system is not practical for the existing column grid because of span lengths and constructability issues. The third system analyzed was steel joists with a 3.5" metal deck. This system was also analyzed using RAM and checked with the New Columbia Joist manual. Similarly to the steel alternate this system is unlikely due to the floor layout. Lastly a 7" post-tensioned slab was designed for the floor system. This system was found to be sufficient with 82k of pre-stressing force per foot for a typical bay.

After evaluation of each system it seems that both the steel with composite deck system and the joist with metal deck system are unlikely candidates for a redesign because of the unusual column layout and spans. For these systems fabrication and erection of steel would be difficult. Both flat plate with drop panels and the post-tensioned slab are more likely to be favorable systems for a redesign. Both systems provide potential significant material savings but also require a higher constructability cost.