



# North Shore at Canton

Baltimore, MD

## Final Report

Introduction

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### **Introduction:**

#### *Project Overview:*

This is the final report presented for the analysis of North Shore at Canton. The objective of this report is to gain knowledge and experience in practical engineering practices. The current building systems of the North Shore at Canton are described in a series of technical reports; there is also a building proposal, which describes some possible issue that might arise with the current structural system as well as some possible solutions to those problems. This report analyzes those solutions and presents the most efficient options.



### Architectural Information:

North Shore at Canton is just one in a series of townhouses located on the 2300 block of Boston Street in Baltimore Harbor, however its specific location and unique setting place it apart from the rest. North Shore sit on top of a 50'x 266' pier in the center of the harbor. It offers private parking and a wooden pedestrian promenade. It contains three levels of living space above the parking level sitting on top of the pier. The third floor offers and exterior terrace offering great views of both the inner harbor and downtown Baltimore. The building is approximately 15,000 sq ft. per floor, with a total building area of 60,000 sq ft.

### Current Structural System:

The framing for the garage level consists of structural steel columns and beams, with full moment connections at column interface. The columns are comprised of W12x96, and are all 9' in height. The columns are to be considered pinned at the foundation, and are connected to the pier through base plates, which range from 14"x14"x3/4" to 18"x18"x1-1/4". The beams range from W 14x22 to W 24x68, and have spans ranging from, 18' to 25'. The garage floor, floor system, is the top of the pier. A framing plan and typical weld section are located in Appendix A.



The first floor, floor system, is made up of 8" hollow core precast concrete planks, with 3" of rigid insulation topped with 2.5" of concrete. The hollow core precast planks have embedded steel plates that are welded to the steel beams.

The first, second, and third floors were framed out using light gauge metal stud shear walls, with gypsum used as the diaphragm. The interior walls use 4" studs while the exterior walls use 6" studs. There are also 3 inch hollow steel tubes used to support steel beams or wood PSL, which ever specified by the plan, that support joist spanning in the transverse direction. General shear wall data is given in appendix A.

The floor systems of the remaining levels use open web pre-engineered wood joists, which bear on the shear walls, exterior joist have top chord bearing while interior joists are bottom chord bearing. Typical joist layout is located in Appendix A.



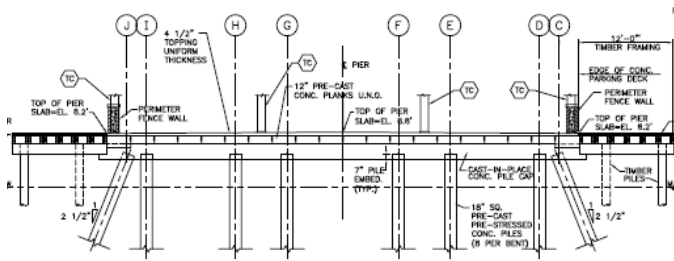
Picture A: Floor plank assembly



Picture B: Parking/Pier level

Foundation:

The foundations of the structure are the pier bents, which are directly supported by pier piles. The pier bents/pile caps are 18” deep with steel rebar reinforcement. The pier bents are topped with 12” hollow core pre-cast planks, which have an additional 4.5” concrete topping. There are 6 vertical piles and 2 battered piles, one on each side, to support the parking level and town homes. Each pile is made up of 7000 psi concrete and 60 ksi reinforcing steel.



An examination of the loads of the structure, dead, live and lateral, was also done. The original design loads used were from BOCA 1996, while the loads in this analysis came from the ASCE 7-02. The dead loads were mainly comprised of the weight of the structure and the snow loads. The live loads that were used were based on a residential structure. The lateral loads are made up from the wind and seismic loads.

### Mechanical System:

The North Shore Pier units have two zone HVAC systems. The top floor is served by a 40,000 btu 90% natural gas furnace, and the bottom two floors are served by a 40,000 btu natural gas furnace. The attic system has a 1.5 ton thru wall condenser on the interior units and a 2 ton thru wall condenser on the exterior units. While the bottom two floors are served with a 2.5 ton thru wall condenser throughout the building. The thru wall condensers had to be installed on the garage level in closets that were constructed out of brick.

### Lighting and Electrical Systems:

The electrical system consists of a low voltage 3 phase system, with the primary and secondary voltages being 220/210 from the panel. Since it is low voltage each unit uses only halogen lights approximately 90 watts each. The building also has security features hard wired into it, the fire detectors and alarms, and also a burglar alarm.

### Fire Protection:

The units are protected by the gypsum sheathed walls that separate them. Since the walls are covered with 1/2" of gypsum board on each side, they provide more than adequate protection from unit to unit. Level to level protection is provided by the floor sheathing, and the ceiling elements, 1/2" gypsum ceiling panels, to provide a 2 hour fire rating.

### Construction Process:

The previous wooden pier structure was demolished to make way for the new structure. Concrete piles were then driven, and the structural concrete was set in place as the base. Wooden piers and decking were then placed on top of the concrete piers. The steel frame for the parking level was erected, and the precast concrete planks were placed on top of the steel. Prefabricated wood and steel panels were delivered by barge and were erected by a barge mounted crane. The building was topped out and the MEP was installed as a design-build on site. Finishes were added later.