North Shore at Canton

Baltimore, MD

Thesis Proposal

Beau Menard
Structural
Parfitt
1/24/06

Executive Summary:

North Shore at Canton is a four story residential structure built over top of a pier in Baltimore harbor. The pier provides the base for the parking level, and the remaining three floors are the living units. The building can be thought of as threes separate structural systems. First the foundation is the pier, which is made up of concrete bents. There is a rigid steel frame that sits on top of the pier, which supports the three stories above. Finally a bearing/shear wall system supports the living units, the sheathing used for the shear walls is made up 1/2" gypsum board.

Since the structure is built over water, moisture issues are definitely a concern, especially when a major component of the structural system is greatly affected by moisture damage. It is recommended to replace gypsum board when ever there is possible damage from moisture, this becomes a problem since most moisture damage is not visible to the naked eye.

To resolve this problem, two alternative structural systems have been proposed. The first is comprised of a rigid steel frame for the entire height of the structure, the second is made up from precast concrete panels. Altering the structural system has the capabilities of affecting other aspects of the building process.

An examination of two breadth topics, for the proposal, will be looked into. First the construction management aspects of this building will be reviewed. The cost and schedule of the existing structural system will be compared to the two alternative systems. Second Since there was no formal design for the lighting of the parking level, an examination of safe lighting systems will be looked into to make sure that they stay with in building limitations.

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Breadth Work Summary:

Breadth Topic I: Construction Management

A cost analysis as well as a schedule overview of the current framing system of North Shore at Canton will be done, and compared to the proposed systems. The estimates will involve the costs of the structural framing system and any impact that these systems have on the foundation. The schedule analysis will compare the current system to the proposed systems, trying to determine the critical path activities for each system.

Breadth Topic II: Parking Level lighting system

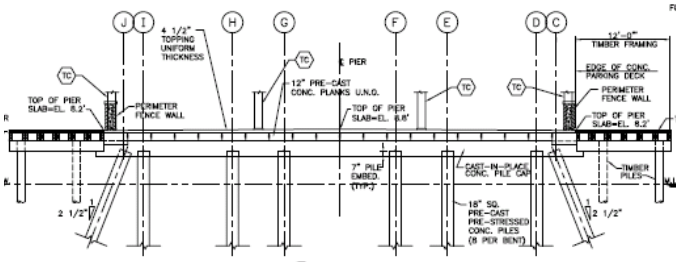
The second breadth topic will deal with the visual safety of the parking level. A safe lighting system for the parking level is ideal for the safety of the occupants, though this building is not a security problem, it is necessary for the tenants to feel safe and comfortable in a space that is designated for the general public.

B**ackground Information:**

Building Description:

North Shore at Canton is a 4 story town home and parking garage structure built on top of a pier in Baltimore harbor. The building is unique in the fact that it is built over the water. Each of the four levels are approximately 15,000 sq. ft., and the entire structure is approximately 60,000 sq. ft. The building is comprised of three different structural systems; the foundation of the building is the pier structure itself, the garage level is comprised of a rigid steel frame that is pinned to the pier, and the three occupied floors above are made up of a bearing/shear wall structure.

The pier is comprised of a one way concrete slab, that spans approximately 24' into reinforced precast concrete bents. Each bent is 60' wide and is built up from 6 vertical precast reinforced concrete piles, and 2 diagonal precast reinforced concrete piles.



The rigid steel frame is made up of three spans with the two exterior spans being 19', and the interior span being 22'. The steel frame is made up of w12x96 column, approximately 9' in height, which are pinned to the pier bents. The girders consist of w24x68 for the exterior spans and a w24x76 for the interior span, all beams and girders are fully supported at the column interfaces. The steel beams are topped with 8" hollow core precast concrete planks, with an additional 3" of rigid insulation and 2.5" concrete.

The remaining three floors are supported by bearing walls which are comprised of cold rolled steel studs spaced 16" on center. The floor systems are made up of 16" deep pre-engineered floor trusses spaced 16" on center. The floor trusses are sheathed with 3/4" OSB. The floor trusses span 25' between the bearing walls, which line up over the steel frame.

The lateral force resisting elements of the building can be divided into two structures. The bearing walls also act as shear walls to displace the story shears. The base shear and moment that result from the three stories of shear walls transfer through to the steel frame. The steel frame is pinned to the pier bents, so no moment transfers through to the piles.

Problem Statement:

"In general, gypsum board should not be exposed to elevated levels of moisture for extended periods. Examples of elevated levels of moisture include, but are not limited to, exposure to rain, condensation, water leakage, and standing water. Some board exposed to these conditions may not need to be replaced, depending upon the source of the moisture and the condition of the gypsum board being considered for replacement. However, IF THERE IS EVER A DOUBT ABOUT WHETHER TO KEEP OR REPLACE GYPSUM BOARD THAT HAS BEEN EXPOSED TO MOISTURE – REPLACE IT."

This quote was taken directly from an article written by the Gypsum Association, in regards to moisture related problems with gypsum board. Since the structure of the top three floors is dependent of the stability of the gypsum sheathing, the effects of water damage should be of great consideration. There are also issues that arise from the buildings constant exposure to moisture, since the building is built over Baltimore harbor.

Proposed Solution:

To help reduce the effect that moisture damage has on the existing structure, two alternative designs of the building superstructure will be proposed. The first structure will be comprised of a rigid steel frame; the second system will consist primarily of pre-cast concrete. Both systems will affect the cost and the schedule, of the building, as well as the heating and cooling systems.

The rigid steel frame will consist of four stories of steel columns and girders, affixed to the pier bents. The floor system will be comprised of open web steel joists, spanning 25', topped with steel decking and light weight concrete. The frame will contain braced members along shared interior walls. The effects on the foundation will

also be addressed, since the lateral loads will transfer differently than the original system. The design of the steel frame shall be in accordance with the AISC (LRFD) 3rd edition. Members will be analyzed by hand and checked against a computer model.

The pre-cast system will consist of raising the pier bents to the first level of the town homes, an additional concrete slab will be poured on the first floor so the pier structure would utilize a double diaphragm system. The remaining three floors will consist of pre-cast concrete shear walls, the floor system will also consist of pre-cast concrete planks. The design of the concrete system shall be in accordance with the ACI 318-05. Members will be analyzed by hand and checked against a computer model.

Loads and load cases will be determined from ASCE 7-02. The IBC 2003 will also be referenced through out the design process.

Breadth Topics:

The first breadth topic covered will deal with construction management. Altering the structure can have impacts on the cost and schedule of the building, and a comparative analysis will be done for the original, as well as the two alternative systems.

The second breadth topic will deal with the visual safety of the parking level. A safe lighting system for the parking level is ideal for the safety of the occupants, though this building is not a security problem, it is necessary for the tenants to feel safe and comfortable in a space that is designated for the general public.

Time Table:

Structural Analysis:

Analysis of new gravity loads	1/20/06
Preliminary Structural framing plans	1/22/06
Lateral Load Analysis	1/24/06
Steel connection analysis	1/27/06
Foundation Analysis	2/10/06

Breadth Topics:

Construction Management	
Cost comparison	2/24/06
Schedule comparison	3/03/06
Lighting System	
Luminary analysis	3/15/06
Design and layout	3/17/06
FLOAT time	3/20 – 3/31

Final Presentation:

Final Report due	4/05/06
Presentation review	4/07/06