Mercantile Bank Buildings

302 West Main Street, Ionia Michigan

Study of the Load Bearing Capacity of the First Floor

Prepared For:
Ionia Community Library
Ionia, Michigan

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Project No. 201317

fishbeck
Engineers | Architects | Scientists | Constructors

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Project Information

Building Location

The Mercantile Bank facility is located at 302 West Main Street, Ionia, Michigan.

Project Participants

Ionia Community Library

Dale Parus, Library Director

Paula Wood, Library Business Manager

Gale Yeomans, Library Board President

Fishbeck

Gregg Yeomans, Architect & Project Manager

Carl Otte, Senior Structural Engineer

Scope of Project

Ionia Community Library has directed Fishbeck to address the question of whether library book stacks could be located on the first floor of the Bank facility. The Code prescribed minimum live load capacity for library stack areas is 150 pounds per square foot. The generally agreed upon assumption is that the existing floor structures aren't strong enough to support that loading criteria. Through site observation of exposed conditions, Fishbeck will determine the composition of the existing structural systems. Calculations will then be done to determine the general magnitude of the current load bearing capacity. Conceptual design strategies will then be developed to provide the strength required to support stack loading.

This Study is intended as a proof of concept of whether the goal can be reached throughout the entire facility, not a design exercise that provides the details of how to reach it.

The Bank occupies three adjacent buildings that have been combined by interior connections into one business use. For purposes of this Study the buildings will be described as the East Building, the Center Building, and the West Building. These buildings would be locally known (east to west) as the National Bank, JC Penney, and the Lawyers office. There is a large addition to the north that wraps behind the East and Center Buildings. This will be referred to as the North Addition.

Note that the North Addition first floor is a concrete slab on grade, so there is no basement to be concerned with for that area. Book stacks can be located at any location on the first floor of that Addition.

Findings of Study

Executive Summary

As might be expected, there are different floor support systems in different areas of all of the different buildings. Consequently, there isn't a one size fits all answer to this floor loading question. It can be said that it appears workable solutions exist for all of the areas and all of the conditions encountered.
Qualifying statements for this general assertion are:

1. The field observations had to be done in the midst of existing ceilings and other obstructions that limited a full view of all conditions. There are sure to be unique details, old repairs, and damaged structural members that were missed. A complete condition assessment is required to observe all areas of the basements.
2. The structural member size and spacing used for any calculations are based on field dimensions of a limited number of members that were able to be reached.
3. The weight for the existing floor construction, along with piping, ductwork, and other equipment hung from the structure is estimated to be 10 pounds per square foot.
4. The weight of the existing floor construction is estimated, as it would require selective demolition to determine the actual composition of the floors. Any unusually heavy floor systems added for a planned renovation would affect calculations done for this Study.

Conditions Within Individual Buildings

General Conditions

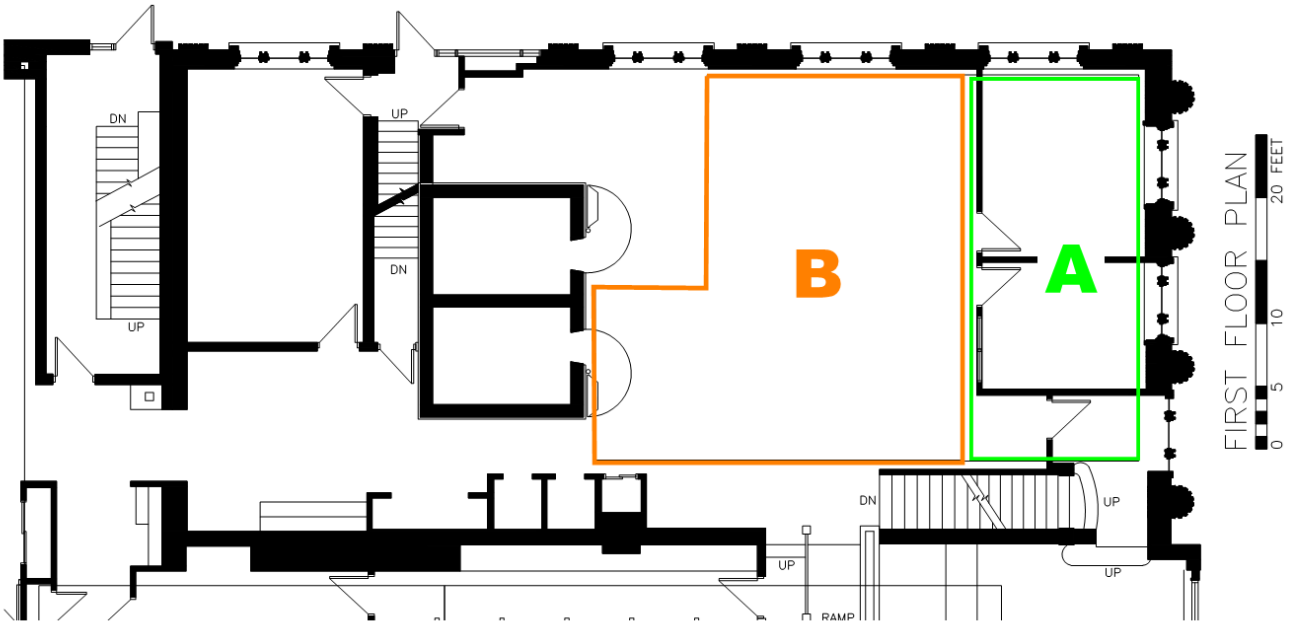
A new concrete footing will be required wherever a new column is called for. The existing floor slab will be cut out to the required dimensions; soil will be excavated to footing depth (or to suitable soil bearing conditions, whichever is deeper); and new concrete poured up to the existing floor height.

Existing ceilings will have to be removed throughout the basements to facilitate placement of new beams. This will also allow for the full investigation of existing conditions. Some split joists were discovered and some members aren't properly seated in their supports. All of these conditions must be repaired or stabilized.

Conditions of the existing load bearing walls will have to be closely examined. Floor joists bear on these walls and deteriorated bearing conditions must be fixed.

The graphics that are included with each building's narrative are First Floor plans with the areas being described in the basement below given a reference letter. This is done to help show where stacks could be placed on the First Floor, relative to the work required below. The graphics are also shown on the full Basement and First Floor Plans on page 6.

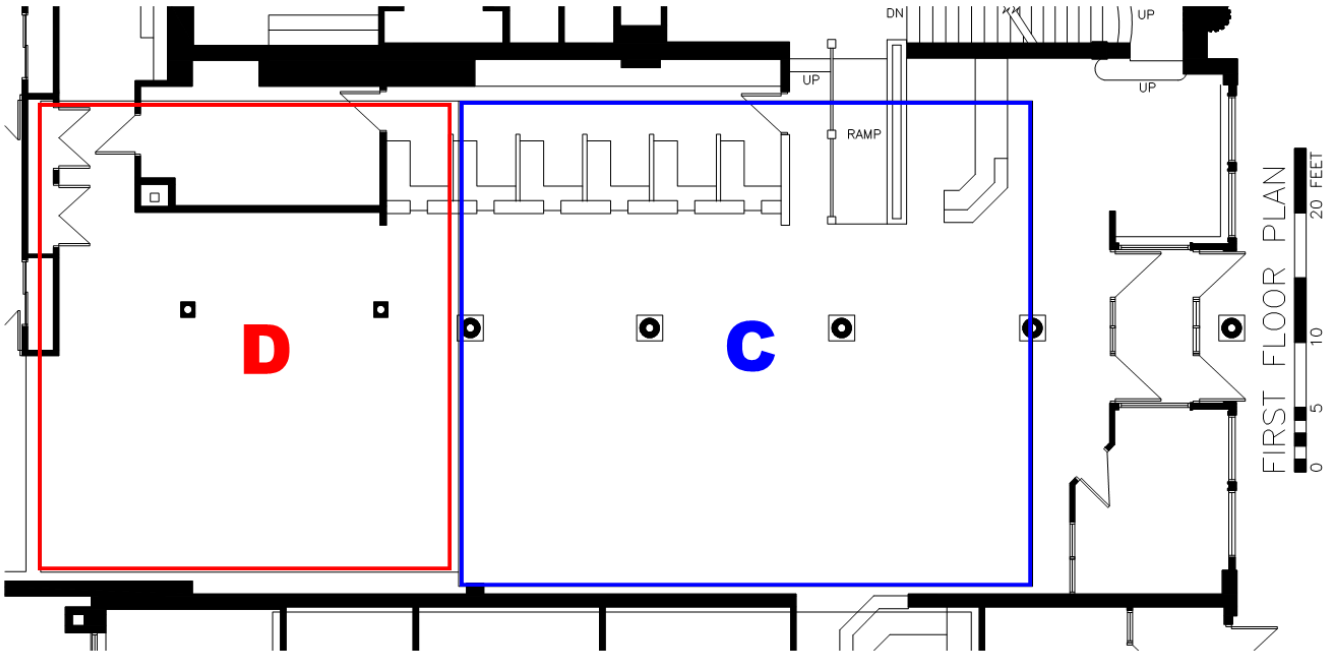
East Building



The areas investigated in the East Building can be generally described as the portion of the building between the Vault and the front of the building. There are a series of rooms across the front (existing restrooms) that have plaster ceilings so the sizes of floor joist couldn't be determined, see Area A.
With some selective demolition the size of the members above the ceilings could be determined. At the Women's Restroom and Lounge it's possible that beams could be slid across to bear on new columns tight to the sidewalls of the rooms. In that way the configuration of the rooms could be maintained with minimal architectural changes. At the Men's Restroom it's possible that the shorter span may be adequate without reinforcement, or a new intermediate beam could be added at the side wall of the room.
The rooms between the Restrooms and the Vault are unfinished spaces so the structure could be observed, see Area B. The floor joists are of adequate size and spacing. The existing support beams can stay in place. The new work would consist of providing new columns under the existing beams, centered between the existing columns. This cuts the beam spans in half.
There is also support missing above a doorway through a bearing wall. A new lintel would be installed there.

There is a notch out of Area B where the ceilings didn't allow observation of the structural system. Some selective demolition would be required to calculate what was required to reinforce that floor area.

Center Building

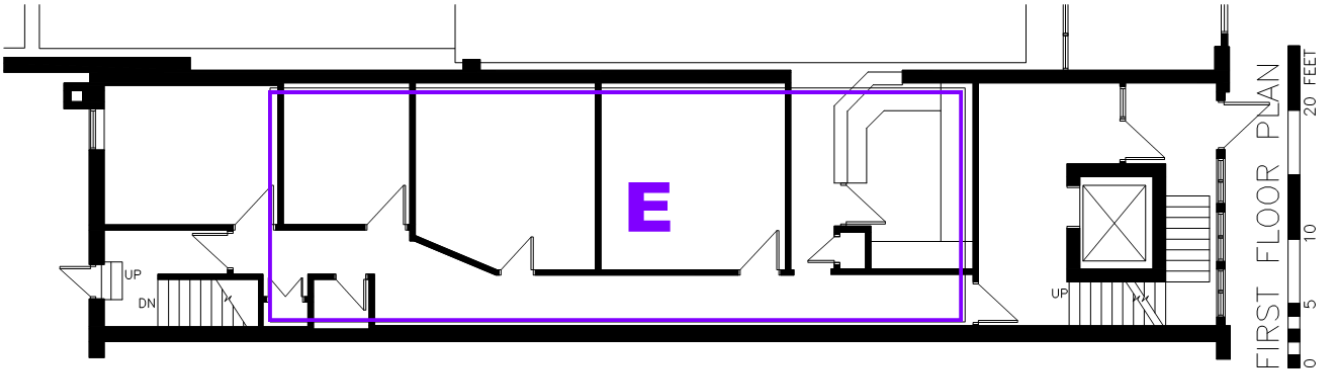


A large area running towards the south end of the Center Building has a single type of structural system with members that are fairly regularly sized and spaced, see Area C. The floor joists will be adequate if their span length is cut in half. This means running new beam lines and columns parallel with the existing center beam. A couple of new columns will also be required splitting the existing beam spans in half at specific locations under the existing center beam. And finally, multiple columns will be required wherever the regularity of the existing joist layout is interrupted.

The area between Area C and the south end of the building isn't being considered for reinforcement because it doesn't appear stacks would be located on this portion of the First Floor. Investigation of this area could be undertaken if the need arose, and there's no reason to believe the floor area couldn't be adequately reinforced.

Area D, at the north end of the Center Building has the most complicated first floor framing. It consists of floor joists of different sizes in different rooms, running in different directions and with varying bearing conditions. Nothing was discovered that would preclude reinforcement being able to be done. All of the specifics required to do so would be custom solutions calculated room to room, which is beyond the scope of this study.

West Building

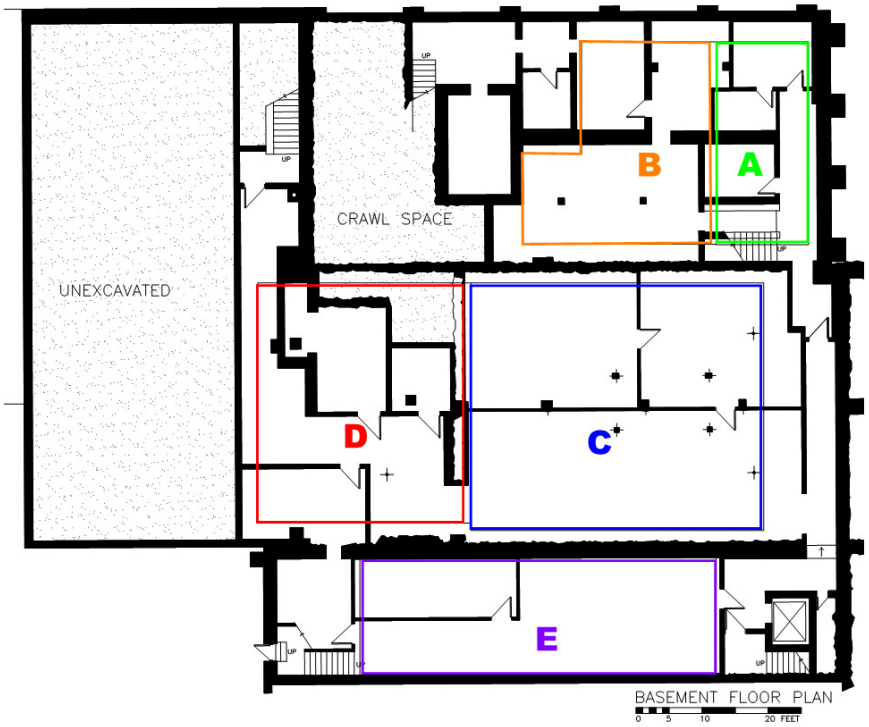


The West Building, area E, has a plaster ceiling over its entire area, so learning about its structural system was a challenge. There was one hole that showed repetitive wood joists and it's clear they span the full width of the basement (about 18'). Based on that, there's a high degree of certainty that adding a beam with a line of columns down the center of the basement will provide the needed structural upgrade.

End of Report

Appendix One

Basement Floor Plan



First Floor Plan