BURLINGTON
HIGH SCHOOL

TAPPÉ
ARCHITECTS

STRUCTURAL
EXISTING CONDITIONS REPORT
MAY 20, 2024

Burlington High School

Burlington, Massachusetts

Structural Assessment

May 20, 2024

PURPOSE

The purpose of this report is to describe, in broad terms, the structure of the existing building; to comment on the condition of the existing building; and on the feasibility of renovation and expansion of the school.

SCOPE

1. Description of existing structure
2. Comments on the existing condition
3. Comments on the feasibility of renovation and expansion

BASIS OF THE REPORT

This report is based on our visual observations during our site visit on April 10, 2024, review of the available Architectural drawings of the construction of the original school prepared by Earl R. Flansburgh & Associates dated February 9, 1971, and Master Plan update report prepared by Knight, Bagge & Anderson, Inc., dated March 27, 2017.

During our site visit, we did not remove any finishes or take measurements, so our understanding of the structure is limited to the available drawings and observations of the exposed structure and the exterior facade.

BUILDING DESCRIPTION

The school is located on Cambridge Street in Burlington, Massachusetts. The existing school was constructed in 1971 and there have been no substantial renovations or additions to the school since the original construction.

EXISTING BUILDING

The existing structure is essentially a two story reinforced concrete structure with a partial Ground level floor and partial second level floor, several mechanical penthouse structure project above the main roof level. The exterior grade around the building slopes around the building from the first floor down to ground floor level. The foundations supporting the structure are reinforced concrete walls and footings. The lowest level floors are a concrete slab on grade. The typical supported floors and the floors are precast concrete double tees supported on cast-in-place reinforced concrete beams, columns and walls. The roof of the Gymnasium is framed with wood fiber panels spanning between steel bulb tees supported on long span open web steel joists. The joists are supported on cast-in-place reinforced concrete walls. The roof above the stage in the Auditorium is metal deck supported on

open web steel joists. The entire school is contiguous but structurally divided in to structurally independent structures separated by way of expansion joints.

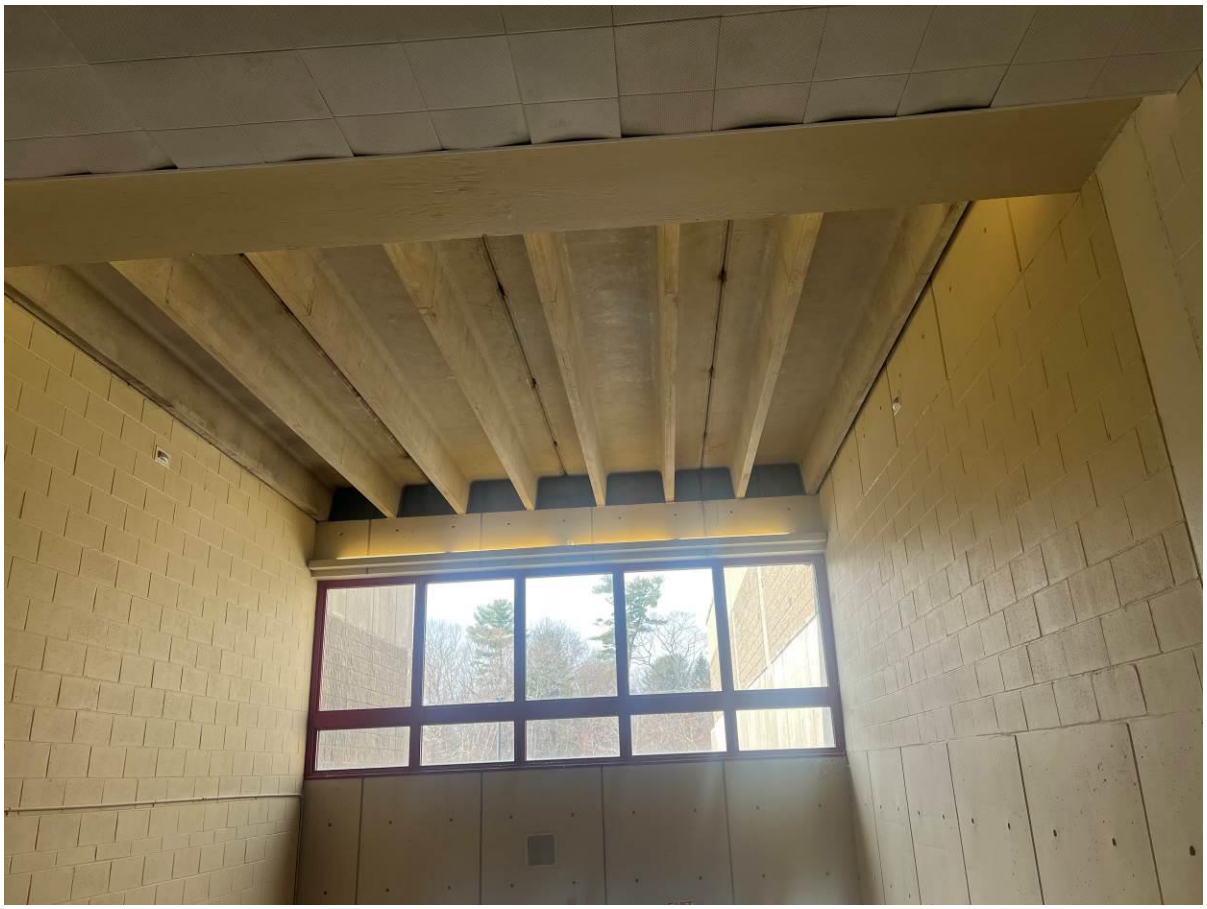
EXISTING CONDITIONS

We observed some signs of leaks in the ceilings. We observed cracks in the stems and flanges of the exposed precast concrete double tees that have been repaired in the past. We did not see any connections between the top of the interior masonry walls and the structure.

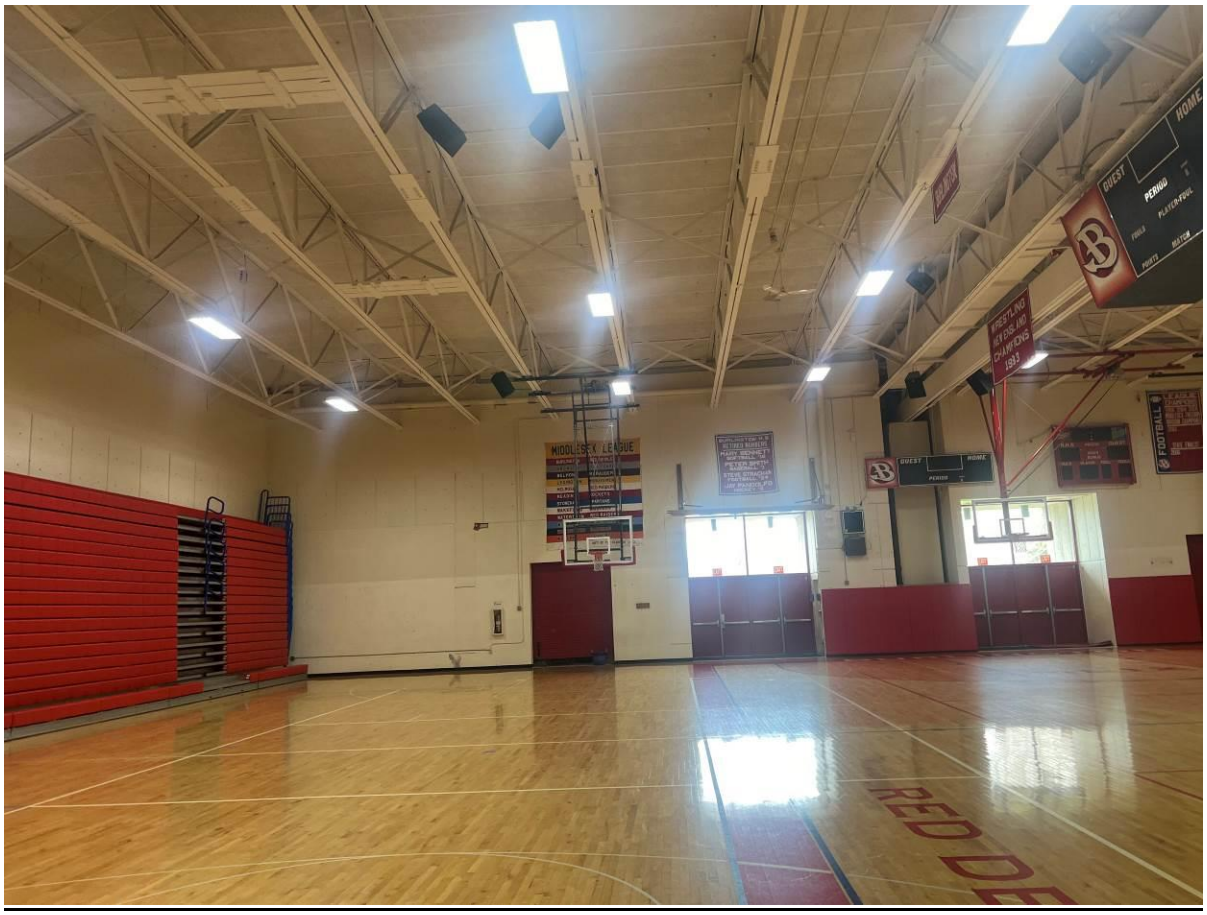
The exterior façade is cast-in-place concrete for the most part, we observed some damage to the walls at the corners and observed past repairs to the surface of a portion of a wall where the original concrete has spalled.

We did not perceive any perceptible vibrations due to footfall on the supported floor. We did not observe any signs of foundation settlement.

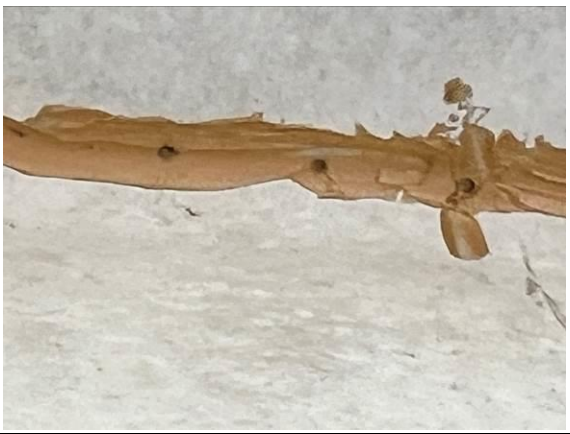
Based on our observations, majority of the school structure is in good condition and there are no major structural concerns at this time.

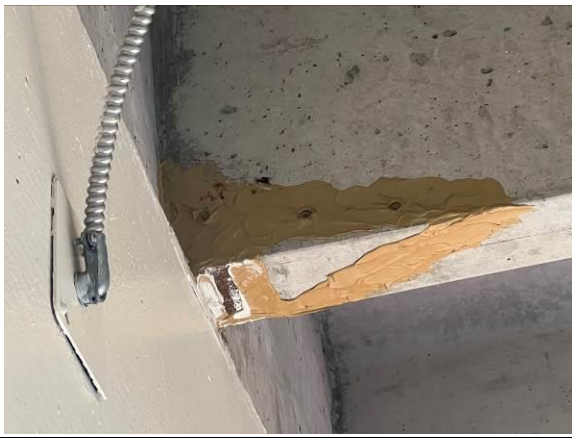


Typical Floor Framing and Roof Construction

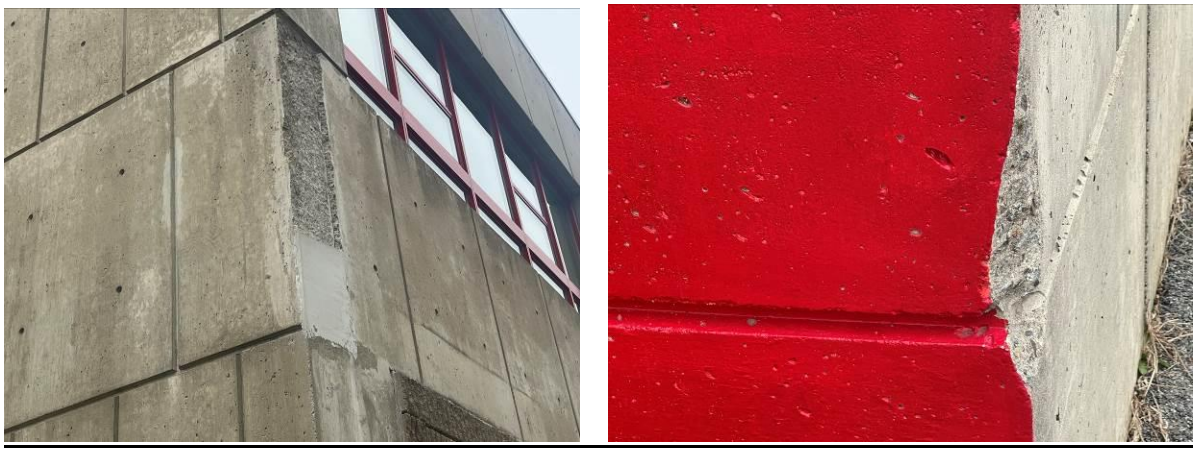


Typical Gymnasium Roof Construction





Example of past repairs to the flanges and stems of the precast concrete double tees



Damage to the exterior concrete gacade

FEASIBILITY OF RENOVATION AND EXPANSION OF THE STRUCTURE

Depending on the scope of the renovations to the school, it may be feasible to make modifications to the existing structure without requiring full compliance with the code requirements for new construction. We would recommend that any additions be separated from the existing structure by way of expansion joints.

GENERAL CODE CONSIDERATIONS

If any repairs, renovations, additions or change of occupancy or use are made to the existing structure, an evaluation of the structure is required to demonstrate compliance with 780 CMR, Chapter 34 "Existing Building Code" (Massachusetts Amendments to The International Existing Building Code 2015). The intent of the IEBC and the related Massachusetts Amendments to IEBC is to provide alternative approaches to alterations, repairs, additions and/or a change of occupancy or use without requiring full compliance with the code requirements for new construction.

The IEBC provides three compliance methods for the repair, alteration, change of use, or additions to an existing structure. The three compliance methods are as follows:

1. Prescription Compliance Method.
2. Work Area Compliance Method.
3. Performance Compliance Method.

A summary of the structural implications of the various compliance methods follows.

Prescriptive Compliance Method

In this method, compliance with Chapter 4 of the IEBC is required. As part of the scope of this report, the extent of the compliance requirements identified are limited to the structural requirements of this chapter.

Alterations

- If the proposed alterations of the structures increase the demand-capacity ratio of any lateral load resisting element by more than 10 percent, the structure of the altered building or structure shall meet the requirements for the code for new construction.
- Where alterations increase the design gravity loads by more than 5 percent on any structural members, those members would have to be strengthened, supplemented, or replaced.

Additions

Additions can be designed to be structurally separate or structurally connected to the existing building. Based on the project scope, the following structural issues must be addressed: The requirements applicable to the existing structure for connected additions are similar to those for altered structures.

- All construction of all addition areas must comply with the code requirements for new construction in the IBC.
- For additions that are not structurally independent of an existing structure, the following rules apply to the existing building:
    - The existing structure and its addition - acting as a single structure - must meet the requirements of the code for new construction for resisting lateral loads. Exceptions allow that structural elements that only resist lateral forces whose demand-capacity ratio is not increased by more than 10 percent may remain unaltered.
    - Any load-bearing structural element for which the addition or its related alterations causes an increase in the design gravity load of more than 5 percent shall be strengthened, supplemented or replaced. This may invoke or cause additional renovation work to access the structure.

In order to avoid invoking required structural modifications to the existing building, any planned additions should be designed as structurally separate buildings.

Work Area Compliance Method

In this method, compliance with Chapter 5 through 13 of the IEBC is required. The extent of alterations has to be classified into LEVELS OF WORK based on the scope and extent of the alterations to the existing building. Refer to the Regulatory Overview section of this report for an explanation of the Levels of Work.

This report addresses the scenario that planned renovation schemes would affect more than 50 percent of the floor area and invoke Level 3 Alteration requirements, and the following analysis is based on that assumption. In addition, there are requirements that have to be satisfied for additions to the existing structure.

Level 3 Alterations

- Any existing load-bearing structural element for which an alteration causes an increase in the design gravity load of more than 5 percent shall be strengthened, supplemented or replaced.
- If the proposed structural alterations of an existing structure exceed 30 percent of the total floor and roof areas of an existing structure, we have to demonstrate that the altered structure complies with the IBC for wind loading and with reduced IBC level seismic forces.
- Existing anchorage of all unreinforced masonry walls to the structure have to be evaluated. If the existing anchorage of the walls to the structure is deficient, the tops of the masonry walls will require new connections to the structure.
- If the proposed structural alterations of an existing structure are less than 30 percent of the total floor and roof areas of the existing structure, the project must demonstrate that the altered structure complies with the loads applicable at the time of the original construction (or the most recent major renovation) and that the seismic demand-capacity ratio is not increased by more than 10 percent on any existing structural element. Those structural elements whose seismic demand-capacity ratio is increased by more than 10 percent must be strengthened, supplemented, or replaced in order to comply with reduced IBC level seismic forces.

Additions

- All additions shall comply with the requirements for the code for new construction in the IBC.
- Any existing gravity, load-carrying structural element for which an addition or its related alterations cause an increase in design gravity load of more than 5 percent shall be strengthened, supplemented or replaced.
- For additions that are not structurally independent of any existing structures, the existing structure and its additions, acting as a single structure, shall meet the requirements of the code for new construction in the IBC for resisting wind loads and IBC Level Seismic Forces (may be lower than loads from the Code for New Construction in the IBC), except for small additions that would not increase the lateral force story shear in any story by more than 10 percent cumulative. In this case, the existing lateral load resisting system can remain unaltered.

Performance Compliance Method

Following the requirements of this method for the alterations and additions may be onerous on the project because this method requires that the altered existing structure and the additions meet the requirements for the code for new construction in the IBC.

Summary

The existing school structure appears to be in fair condition. All of the structural components that are visible appear to be in sound condition except the items noted above.

The compliance requirements of the two Prescriptive and Work Area Compliance methods are very similar in most respects for a major renovation. The Prescriptive Compliance Method would be more restrictive, as it would likely require that the existing lateral load resisting systems of the existing building meet the requirements of the code for new construction of the IBC, even for small increases of design lateral loads. Based on this, we would recommend the Work Area Compliance Method for the project.

Any major proposed renovations requiring modifications to the existing structure and additions would likely require that the structure be updated to meet the requirements for the Code for New Construction.