The mid-rise elevator case study described here is a steel and concrete structure with a concrete foundation. This structural type is heavy and in very close proximity to the neighboring structure therefore not suitable for elevation.

The retrofit strategy that will result in full NFIP reduction in flood insurance premiums requires filling the basement to the lowest adjacent grade; changing the first floor use from residential to community facility to allow for dry floodproofing the areas below the DFE, and wet floodproofing the residential lobby. Elevator equipment must be relocated above the DFE and the pit must be wet floodproofed. These mitigation strategies require significant structural reinforcement and lead to the loss of six units and the gain of additional community facility space, a reconfiguration that has implications for the property’s financial viability. Additionally, because of the limited need for new community facility space, this strategy may not be applicable at a neighborhood scale. Further restricting options for this typology. Critical systems can also be elevated within the building, on the roof, or in the rear yard if clearance is provided. Alternative adaptation strategies, currently not recognized by NFIP, include leaving existing residential uses in the cellar and first floor, critical systems in the basement within a floodproof enclosure, and wet floodproofing below the DFE. All floodproofing solutions require assessment of the building’s structural integrity and a consideration of the impacts and implications for neighboring buildings.

**SITE & BUILDING CONDITIONS**

**SITE CONDITIONS**
Sites with wide lot size and shallow rear yard depth. Rear yards typically range from 0 to 6 feet below the sidewalk grade. No side yards are provided, and streets and sidewalks are typically of standard width.

**BUILDING TYPOLOGY**
Buildings are five to six-story steel encased in concrete structure and masonry or concrete foundation. Vertical circulation is provided by an elevator and stairs, and egress is provided by fire escapes and pathway through the fire-separated cellar. Critical systems are located in the basement/cellar. Entrances located at or above the sidewalk grade.

**FLOOD RISK**
- Flood Zone/BFE: AE +11'
- Grade Elevation: +6' at sidewalk and property
- Design Flood Elevation (DFE): +12’ (6’ above sidewalk grade)
- Cellar Elevation: -1’ (7’ below sidewalk grade)

**TYPOLGY**
- Lot Size: 100’ x 100’
- Building Size: 100’ x 84’
- Yards: 3’ front, 14’ rear
- Construction Type: Steel frame/concrete slab
- Foundation Type: Concrete
- Year Built: 1930
- Stories: 6 + cellar
- Residential Floor Area: 50,400 s.f.
- Residential Units: 36
- Elevator: Yes

**SITE CONDITIONS**
- Sidewalk Width: 15’
- Roadbed Width: 34’
- Zoning District: R7-1, Residential
**EXISTING CONDITIONS**

**ILLUSTRATIVE RETROFIT STRATEGY**

**FLOOD ELEVATION**

12’ DFE = BFE + freeboard = 2’ above lowest occupiable floor = 6’ above lowest property grade

15’ front setback
10’ rear setback
30’ rear yard

**ACCESS**

Building access is provided at three front entrances; one residential lobby entrance at 1’ above the sidewalk grade; two egress doors are located 5’ below the sidewalk grade. The building access at the rear yard is provided 5’ below the rear yard grade and serves as the required egress path.

**STRUCTURAL SYSTEMS**

Six-story non-combustible steel frame structure on a concrete foundation. All steel is encased in concrete.

**CRITICAL SYSTEMS**

All systems are located in the mechanical room in the basement.

**STREETSCAPE**

Converting to community facility use activates the ground floor and increases transparency.

**USE**

Convert lowest level residential units to community facility with separate entrances from residential lobby. Residential lobby to remain. Partial loss of floor area at the cellar storage and laundry facility where it has been filled to grade. One new residential egress route is provided to replace existing exit discharge to the street.

**WET & DRY FLOODPROOF**

Fill partial cellar to lowest adjacent grade. Convert lowest occupiable floor from residential to community facility use to enable dry floodproofing of the ground floor. Contain mechanical systems and utilities within dry floodproofed double-height enclosure within existing mechanical room footprint. Wet floodproof area below the DFE by installing flood vents located at all exterior and interior walls, and replacing all windows, doors and finishes with flood damage-resistant materials.

Fill partial cellar to lowest adjacent grade. Convert lowest occupiable floor from residential to community facility use to enable dry floodproofing of the ground floor. Contain mechanical systems and utilities within dry floodproofed double-height enclosure within existing mechanical room footprint. Wet floodproof area below the DFE by installing flood vents located at all exterior and interior walls, and replacing all windows, doors and finishes with flood damage-resistant materials.

**ZONING ENVELOPE**

The allowable building height is measured from the DFE. The building has a non-compliant rear yard. The building is built to the maximum allowable floor area. To comply with zoning standards, the floor area below the DFE can be relocated within the adjusted bulk envelope.

**FLOOD ELEVATION**

12’ DFE

10’ lowest occupiable floor

6’ sidewalk grade

1’ cellar

**CRITICAL SYSTEMS**

Convert lowest level residential units to community facility with separate entrances from residential lobby. Residential lobby to remain. Partial loss of floor area at the cellar storage and laundry facility where it has been filled to grade. One new residential egress route is provided to replace existing exit discharge to the street.

**USE**

Convert lowest level residential units to community facility with separate entrances from residential lobby. Residential lobby to remain. Partial loss of floor area at the cellar storage and laundry facility where it has been filled to grade. One new residential egress route is provided to replace existing exit discharge to the street.

**STRUCTURAL SYSTEMS**

Six-story non-combustible steel frame structure on a concrete foundation. All steel is encased in concrete.

**CRITICAL SYSTEMS**

Convert lowest level residential units to community facility with separate entrances from residential lobby. Residential lobby to remain. Partial loss of floor area at the cellar storage and laundry facility where it has been filled to grade. One new residential egress route is provided to replace existing exit discharge to the street.

**ZONING ENVELOPE**

The allowable building height is measured from the DFE.
Non-substantially improved buildings within the floodplain are not required to comply with Appendix G of the NYC Building Code. This allows for greater flexibility in adapting buildings for flood resiliency. The alternatives illustrated below lower the risk for buildings and provide practical pathways for adaptation. Under current NFIP regulations, these measures may not lower insurance premiums.

The blue icons below illustrate adaptive measures that receive full reduction of NFIP premiums. Icons in gray indicate strategies that improve building resilience, but receive no or partial reduction of NFIP premiums.

If the lowest occupiable floor is left below the DFE, life safety must be considered. Residents should always follow evacuation procedures.

- Elevate critical systems above the DFE.
- Wet floodproof below the DFE. Install flood vents and replace all windows, doors and finishes with flood damage-resistant materials.
- All existing uses to remain.
- Add reinforcement at roof to support relocated critical systems.
- Relocate critical systems to the roof within a fire-rated and vented enclosure. Raise electrical utilities above the DFE.

No or partial reduction in NFIP premiums. Residential use and partial critical systems remain located below the DFE and the structure is not filled to the lowest adjacent grade. Dry floodproofing is not permitted at residential use. Lowest occupiable floor is below the DFE.

- Systems to remain in place below the DFE in dry floodproofed enclosure. Install outdoor natural gas emergency generator in rear yard to backup essential electrical infrastructure.
- All existing building uses below the DFE remain.

No or partial reduction in NFIP premiums. Residential use remains located below the DFE and the structure is not filled to the lowest adjacent grade. Wet floodproofing is not permitted at residential use. Lowest occupiable floor is below the DFE.

- Occupied Space
- Critical Systems
- Dry Floodproof
- Wet Floodproof
- Open Structure
- NFIP Premium Reduction