1038 Fulton – A New Type of Timber Building For Chicago

Presented by: John Mitchell

Hartshorne Plunkard Architecture

Disclaimer: This presentation was developed by a third party and is not funded by WoodWorks or the Softwood Lumber Board.

LEARNING OBJECTIVES

1. Provide an example of how an Alternative Code Approval was achieved in the City of Chicago.
2. Show how mass timber technology and codes are evolving.
3. Communicate some of the technical resources that are available for designers working with mass timber.
4. Show some of the design considerations, advantages, and constraints working with mass timber.

PROJECT TEAM:

OWNER/ GC -	Summit Design + Build
ARCHITECT -	Hartshorne Plunkard Architecture
STRUCTURAL ENGINEER -	IMEG Corp.
MEP ENGINEER -	WT Engineering
CIVIL ENGINEER -	Weaver Consultants Group

PROGRAM:

-New construction office building

-Client is a general contractor with whom the architect has a long-standing relationship

-Program:

- Ground Floor retail
- Basement parking
- Upper floors - office
- Maximum area and # stories allowed by Zoning and the Landmark District

-Include some feature in the design to help distinguish it from its market peers (timber)

THE NEIGHBORHOOD - FULTON MARKET

SOURCE: GOOGLE MAPS

THE NEIGHBORHOOD - FULTON MARKET

SOURCE: VSTUDIOS

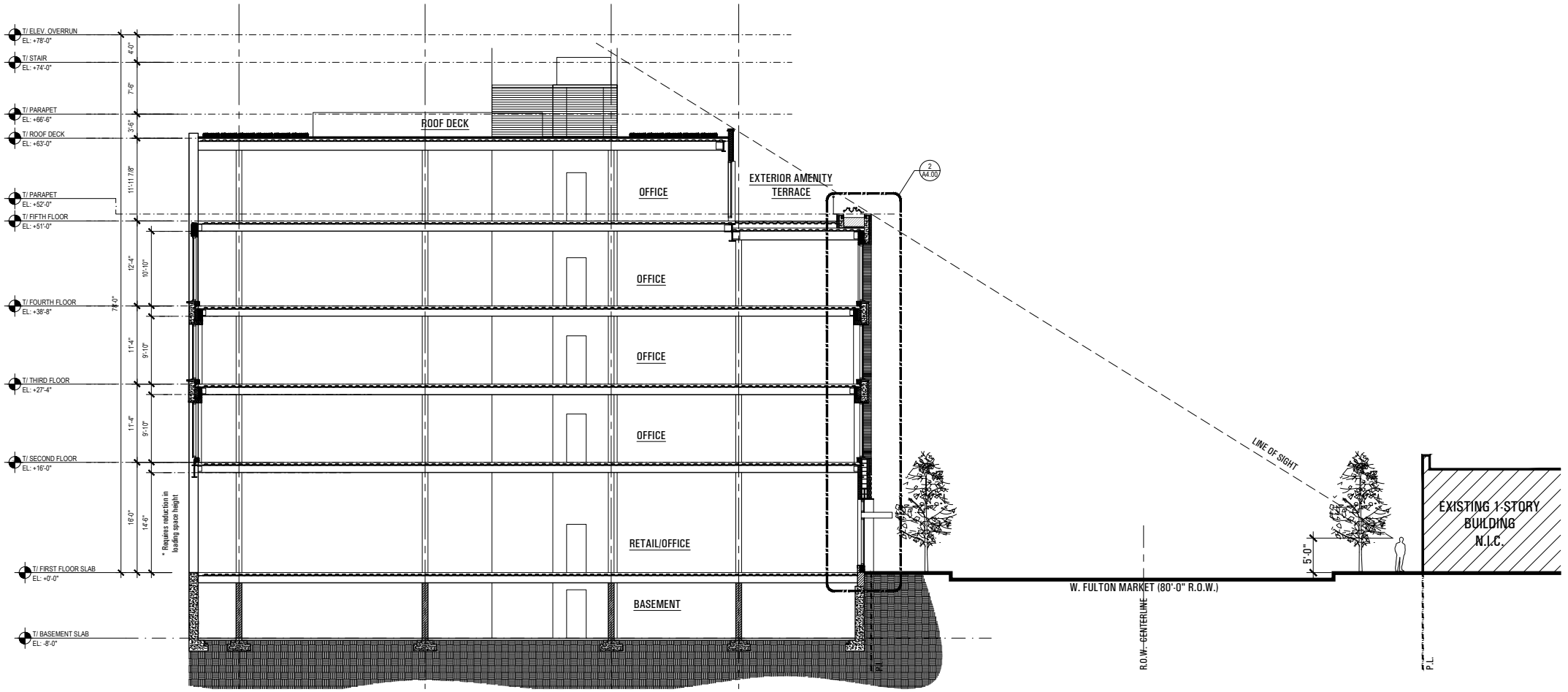
THE NEIGHBORHOOD - FULTON MARKET

SOURCE: VSTUDIOS

PART I - CODE REQUIREMENTS

ZONING/ LANDMARKS REQUIREMENTS - FULTON MARKET HISTORIC DISTRICT

-5 stories maximum; top floor must be set back from the street

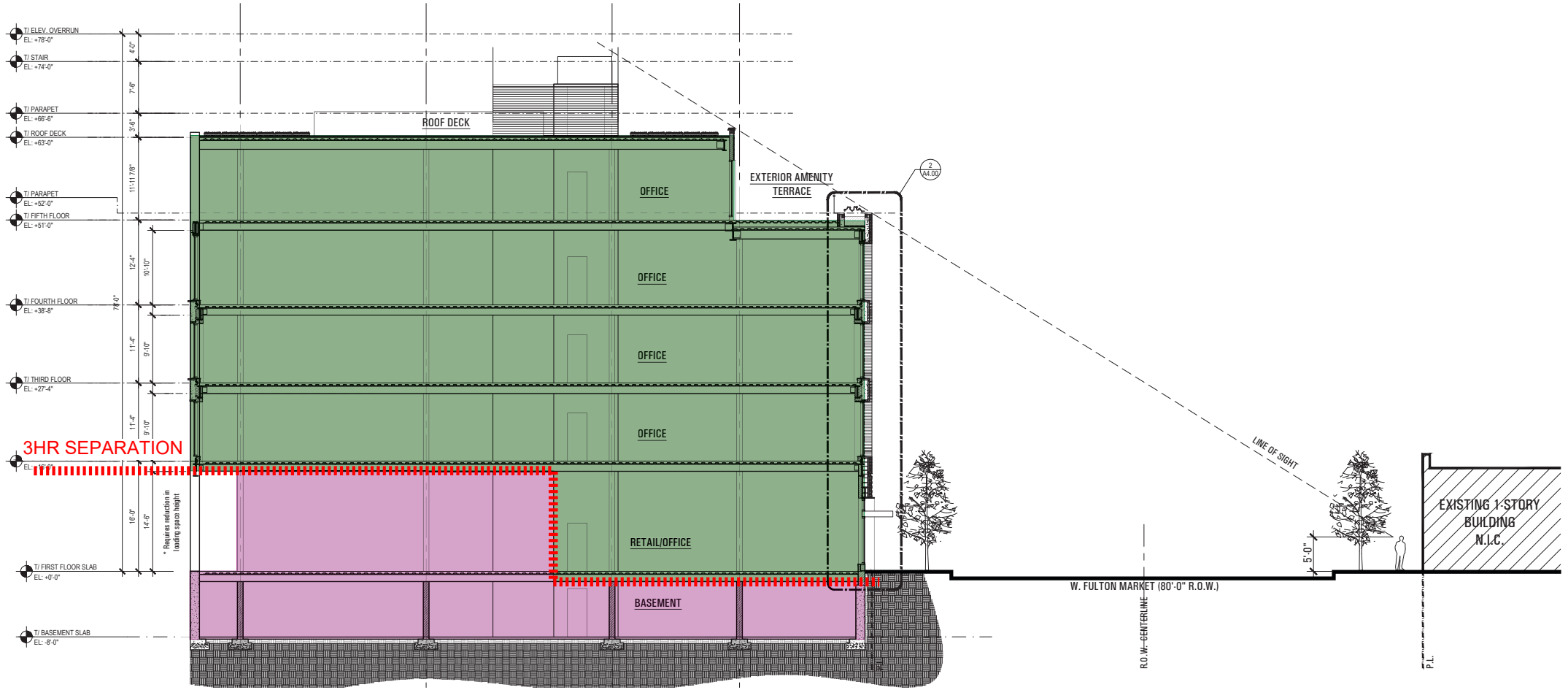


ZONING/ LANDMARKS REQUIREMENTS - FULTON MARKET HISTORIC DISTRICT

-Design requirements for building facade materials, fenestration

BUILDING CODE REQUIREMENTS - OCCUPANCY SEPARATIONS

Per CBC, a 3-HR separation is required between Parking and Office uses

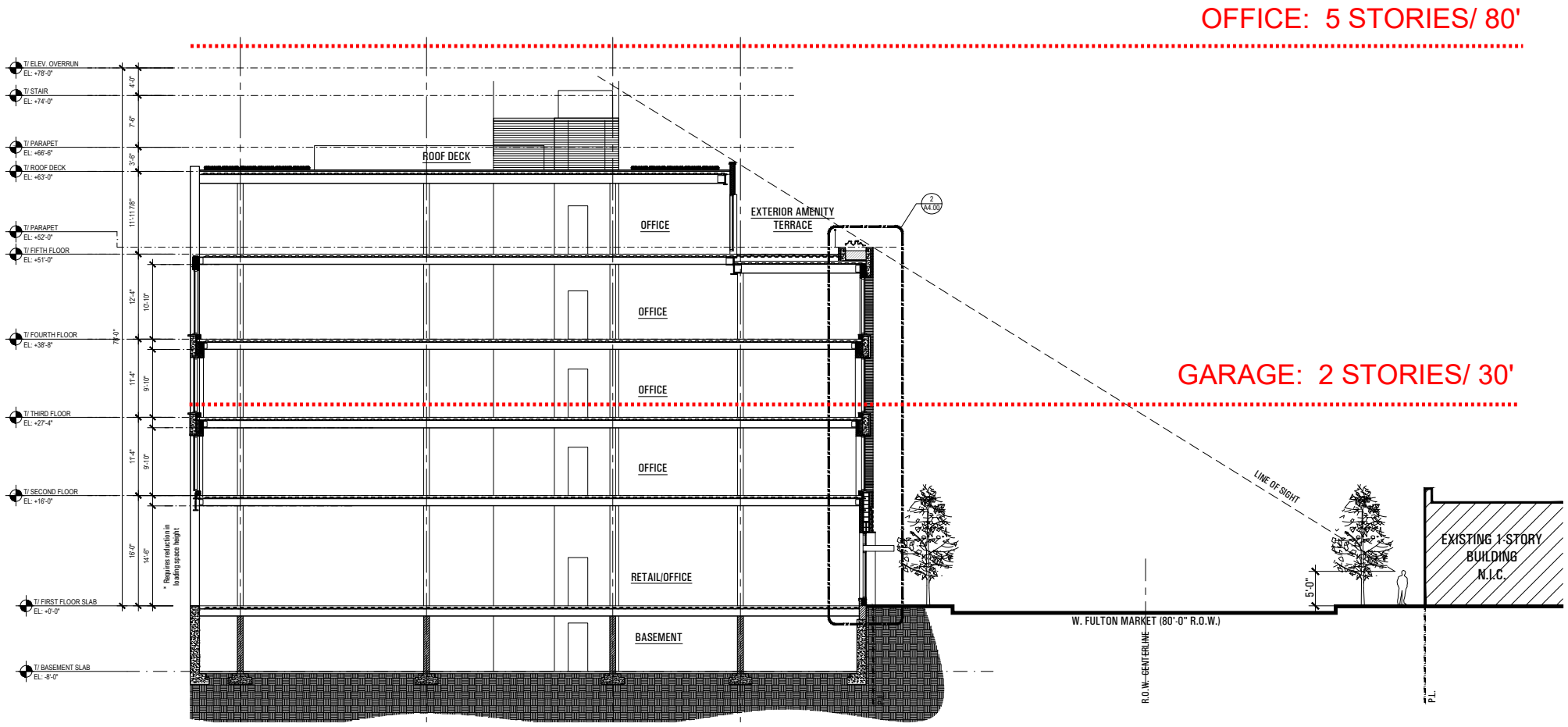


BUILDING CODE REQUIREMENTS - HEIGHT, AREA, MASSING

Per Chicago Building Code, 2016 Edition:

-Business or Mercantile Occupancy = 5 Stories/ 65’ (height increases 15’ with sprinklers)

-Parking = 2 Stories/ 30’



MASS TIMBER ANALYSIS

PROS:

-5 stories allowed for Office use

-Warmth of material consistent with other buildings in the neighborhood

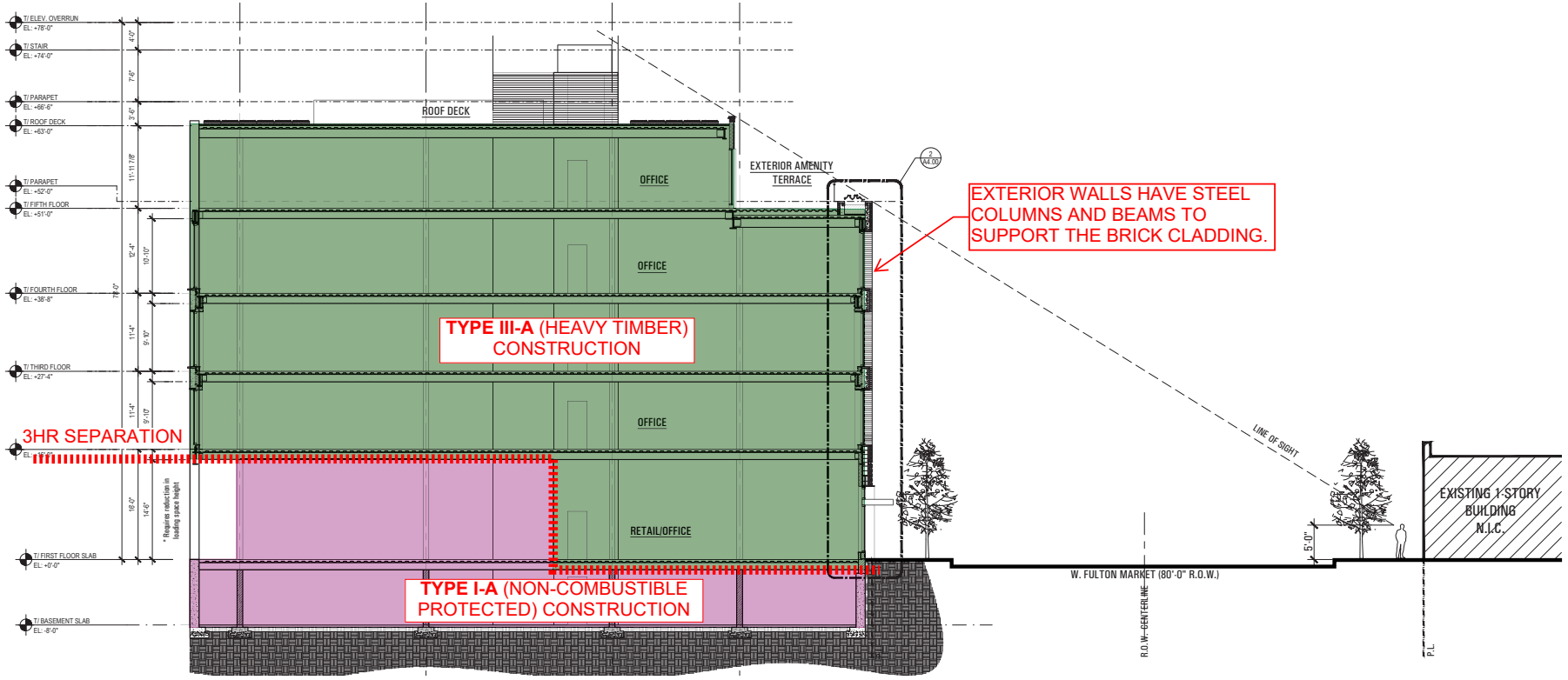
-Building geometry and framing plan is conducive to timber

CONS:

-Brick cladding - shelf angle details are more complex than with concrete or steel framing

-2 story maximum for parking

PROPOSED SOLUTION - HYBRID CONSTRUCTION



13-60-050 Type III-A, heavy timber construction.

Type III-A, heavy timber construction, shall have interior structural elements of heavy timber material as required in this section.

(a) Wood members of heavy timber construction shall be arranged so that there will be no concealed spaces within the construction.

(b) Columns shall have a minimum dimension of eight inches.

(c) Floor framing members shall have minimum nominal dimensions of six by ten inches.

(d) Roof framing members, except trusses, shall have a minimum nominal dimension of six inches.

(e) The members of roof trusses shall have minimum nominal dimensions of four inches by six inches with the following exceptions:

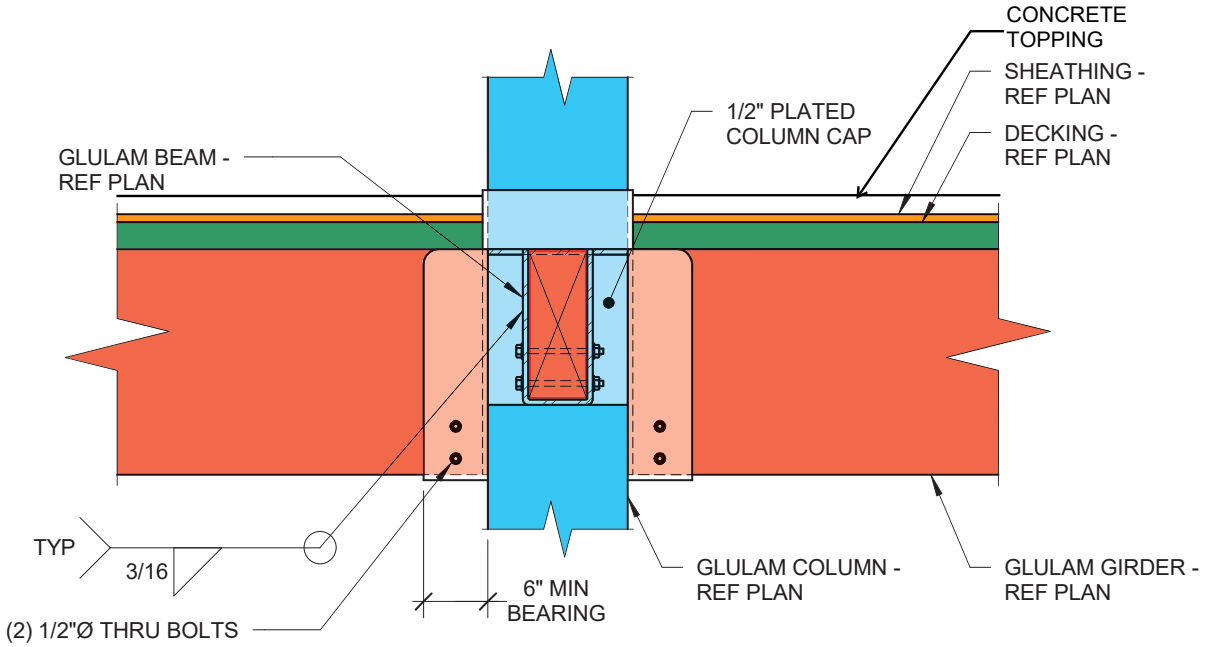
(1) Members may consist of two or more pieces of three-inch nominal thickness with intervening spaces blocked solidly or tightly closed by a continuous wood cover plate of not less than two-inch nominal thickness.

(2) Any member may be reduced to three- inch nominal thickness when protected by an approved automatic sprinkler system under the roof deck.

(f) Wood floors shall be splined or tongue and grooved planks of not less than three-inch nominal thickness or of laminated planking laid on edge of not less than four-inch nominal thickness. A top flooring of not less than one inch nominal thickness shall be added to the structural floor.

(g) Roof construction shall be of construction not less fire resistive than splined or tongue and grooved planks of not less than two-inch nominal thickness or laminated planking laid on edge of not less than three- inch nominal thickness.

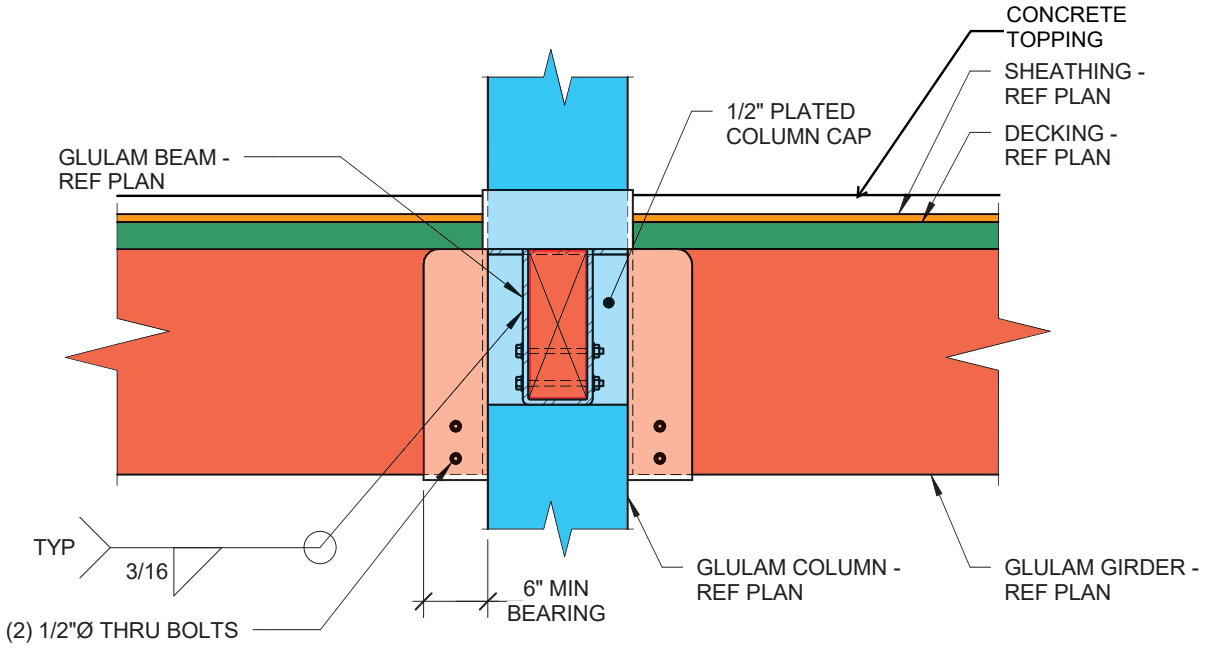
(h) Construction conforming to the requirements of Type I construction may be used.



13-144-030 Heavy timber.

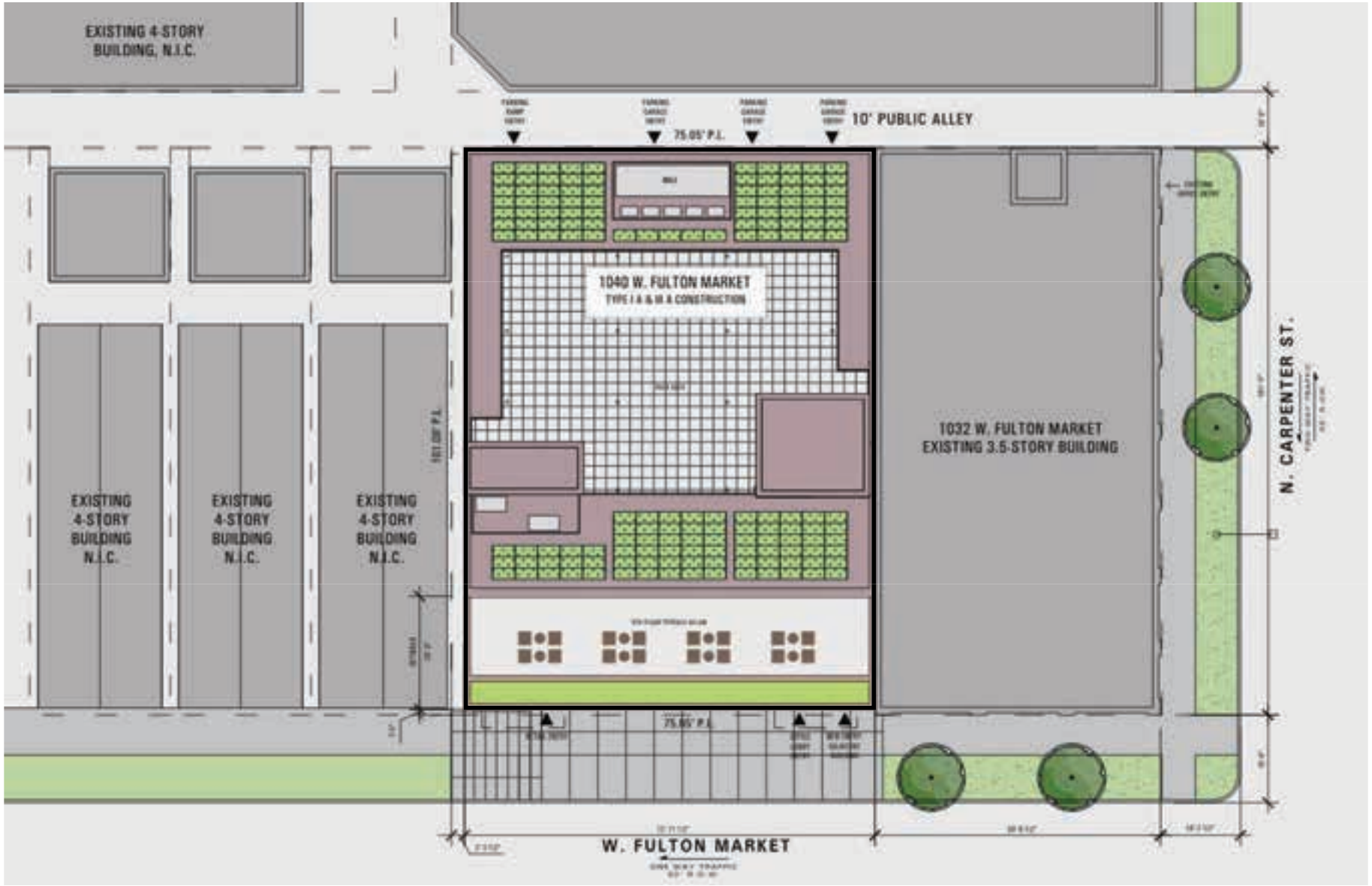
Heavy timber members, **sawn or glue-laminated**, used in Type III-A construction shall be stress-grade timbers identified as to grade and strength by approved manufacturing, testing, or inspection agencies or bureaus. All structural members shall have the minimum dimensions specified in Section 13-60-050 for Type III-A construction and shall be designed, fabricated and installed in accordance with ANSI/NFoPA NDS-91 and American Institute of Timber Construction standard ANSI/AITC A190.1-92.

CODE SPEAKS TO 'SAWN OR GLUE-LAMINATED' TIMBER ONLY; NO MENTION OF CLT, NLT, ETC.

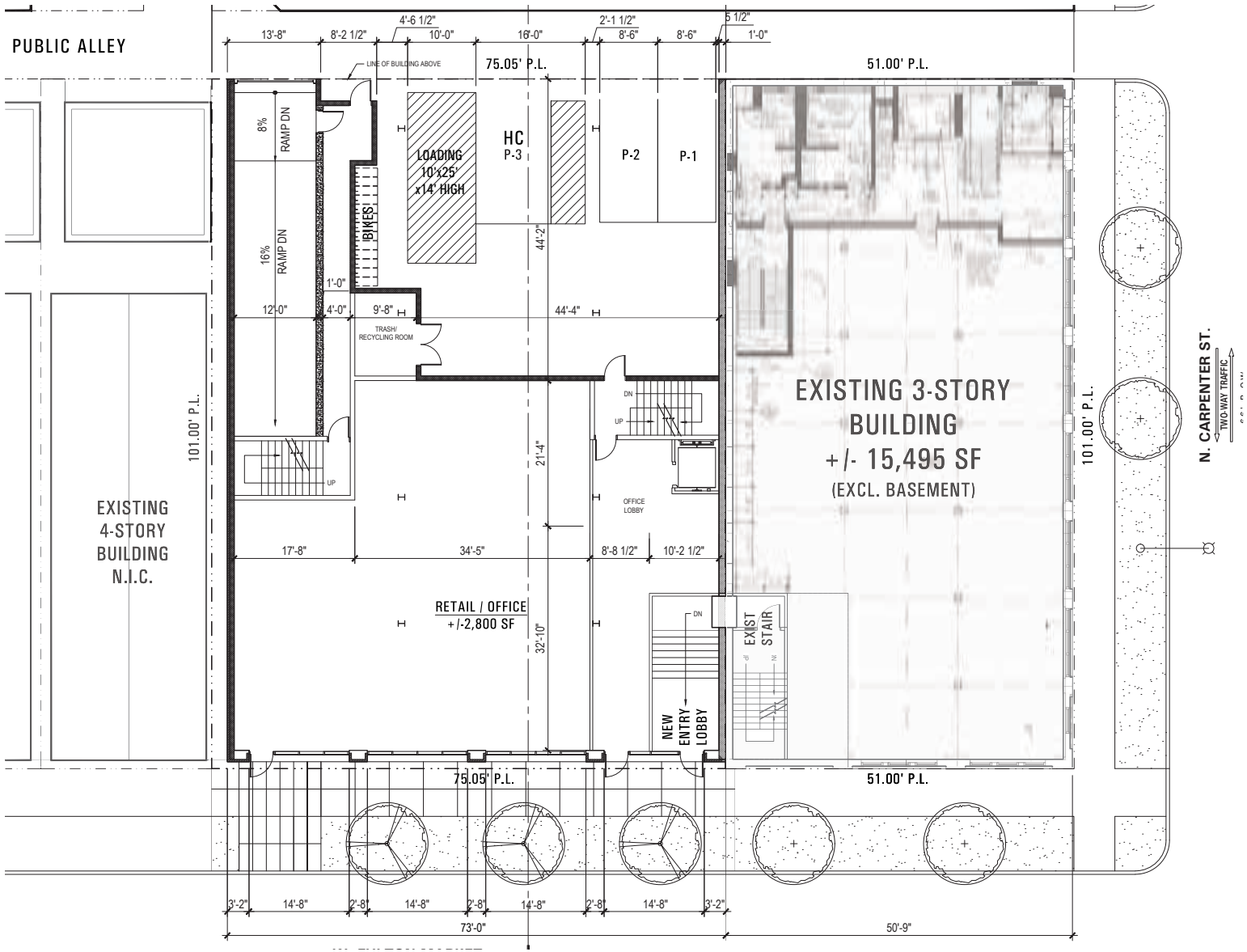


PART II - THE DESIGN

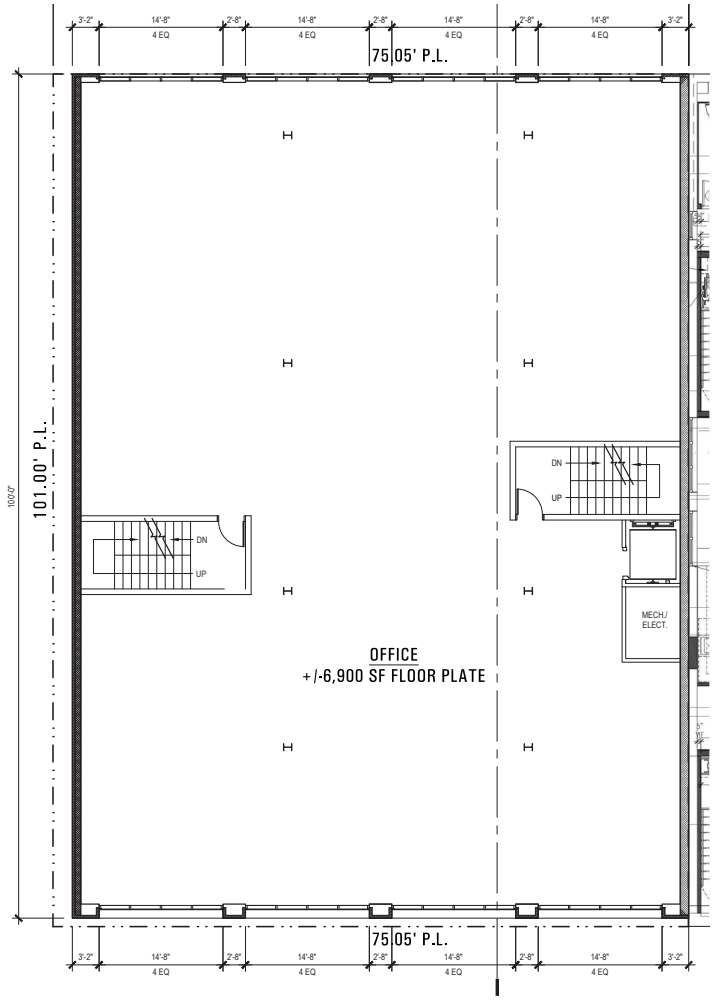
SITE PLAN


EXISTING 4-STORY
BUILDING, N.I.C.
10' PUBLIC ALLEY
75.05' P.L.
1040 W. FULTON MARKET
TYPE I A & III A CONSTRUCTION
1032 W. FULTON MARKET
EXISTING 3.5-STORY BUILDING
EXISTING
4-STORY
BUILDING
N.I.C.
EXISTING
4-STORY
BUILDING
N.I.C.
EXISTING
4-STORY
BUILDING
N.I.C.
161.08' P.L.
75.05' P.L.
N. CARPENTER ST.
W. FULTON MARKET

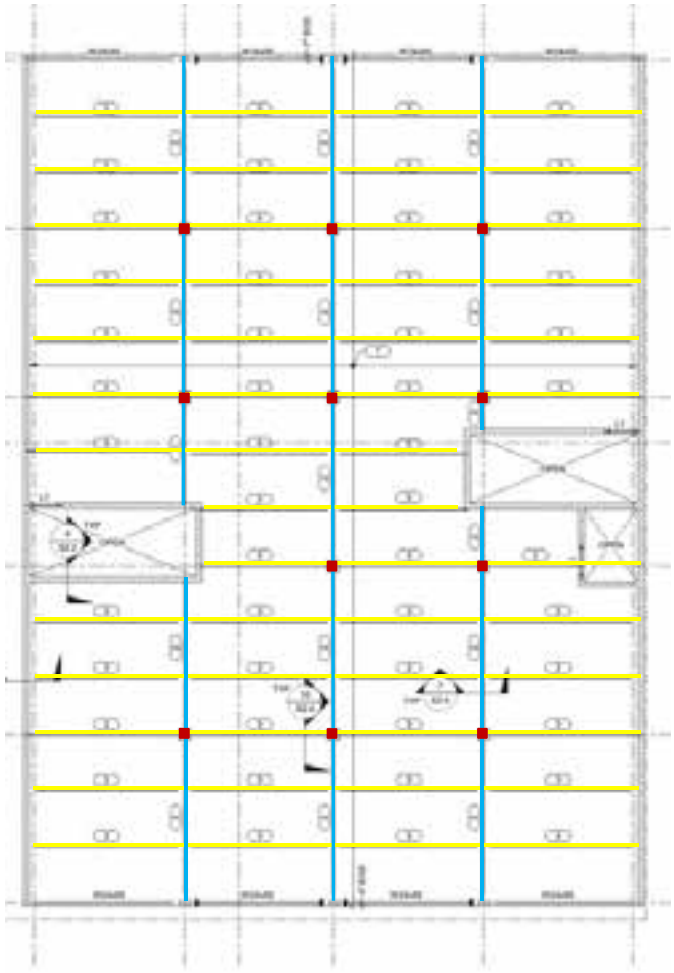
1ST FLOOR PLAN



TYPICAL OFFICE FLOOR



ARCHITECTURAL



SOURCE: IMEG

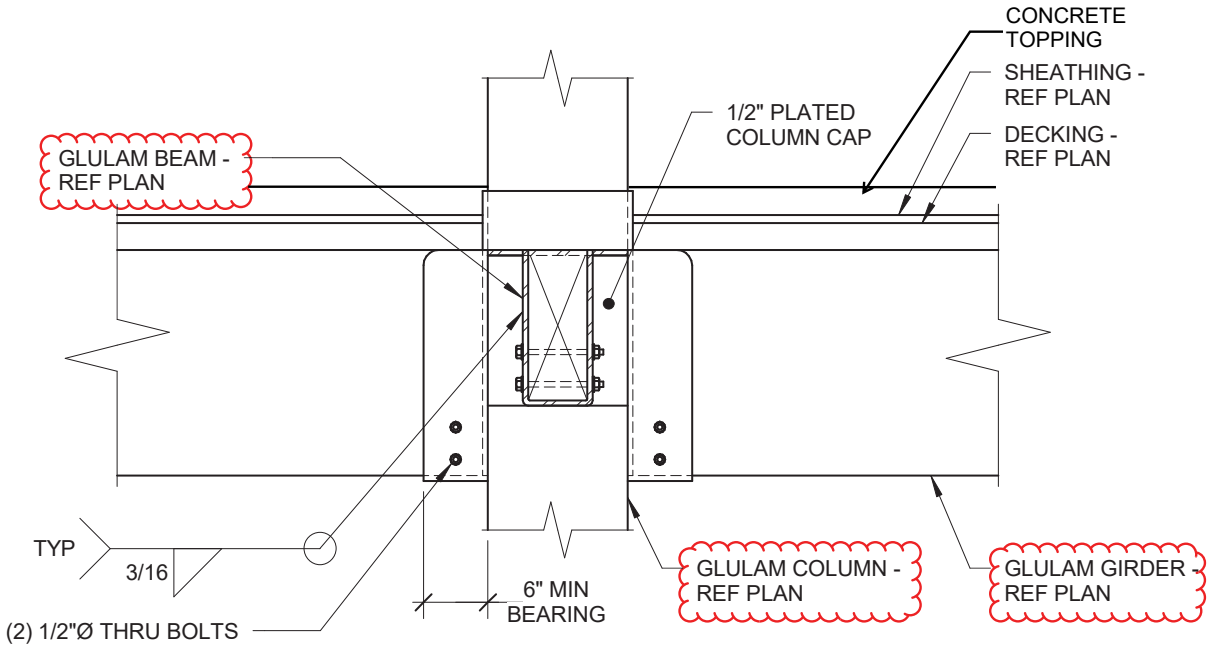
STRUCTURAL

VIEW FROM FULTON MARKET

SOURCE: VSTUDIOS

PART III - ALTERNATIVE CODE APPROVAL
(CITY OF CHICAGO COMMITTEE ON STANDARDS AND TESTS)

1. Proposed glulam columns, girders, and beams are larger than the solid wood dimensions prescribed in the code.
2. Building is fully sprinklered.
3. A Class 1 Fire Alarm System is included for the entire building.
4. The floor assembly includes a 2” concrete topping slab.



STANDARDS AND TESTS - MEMBER SIZES

TABLE 602.4
WOOD MEMBER SIZE EQUIVALENCIES

MINIMUM NOMINAL SOLID SAWN SIZE		MINIMUM GLUED-LAMINATED NET SIZE		MINIMUM STRUCTURAL COMPOSITE LUMBER NET SIZE	
Width, inch	Depth, inch	Width, inch	Depth, inch	Width, inch	Depth, inch
8	8	6¾	8¼	7	7½
6	10	5	10½	5¼	9½
6	8	5	8¼	5¼	7½
6	6	5	6	5¼	5½
4	6	3	6⅞	3½	5½

For SI: 1 inch = 25.4 mm.

SOURCE: INTERNATIONAL BUILDING CODE, 2015 EDITION

Sawn heavy timber - code				Glulam - proposed	
Actual dimensions*	Calculated fire rating	Member type		Calculated fire rating	Actual dimensions
8″ x 8″	45 min.	Column	+ 30 min	75 min.	12 ¼″ x 12 ¼″
5 ½″ x 9 ¼″	45 min.	Floor Framing (Girder)	+ 25 min	70 min.	6 ¾″ x 21″
5 ½″ x 9 ¼″	45 min.	Floor Framing (Beam)	+ 15 min	60 min.	5 ½″ x 14″
5 ½″ x 5 ½″	35 min.	Roof Framing (Girder)	+ 35 min	70 min.	6 ¾″ x 22 ½″
5 ½″ x 5 ½″	35 min.	Roof Framing (Beam)	+ 15 min	50 min.	5 ½″ x 14″

**Dimensions taken from CBC Section 13-60-040 Type IIIA, heavy timber construction.*

Calculated fire ratings are per equations from NDS 2015 and are approximate.

16.2.1 Char Rate

16.2.1.1 The effective char rate to be used in this procedure can be estimated from published nominal 1-hour char rate data using the following equation:

$$\beta_{eff} = \frac{1.2\beta_n}{t^{0.187}} \qquad (16.2\text{-}1)$$

where:

β_{eff} = effective char rate (in./hr.), adjusted for exposure time, t

β_n = nominal char rate (in./hr.), linear char rate based on 1-hour exposure

t = exposure time (hr.)

NDS FOR WOOD CONSTRUCTION - 2015

PART IV - CONSTRUCTION

CONSTRUCTION PHOTOS

1ST FLOOR WALLS AND INITIAL TIMBER BEAMS BEING INSTALLED

CONSTRUCTION PHOTOS

EXTERIOR WALL SUPPORT STEEL INSTALLATION

CONSTRUCTION PHOTOS

FRAMING IN PROGRESS

CONSTRUCTION PHOTOS

EXTERIOR FRAMING AND AWB INSTALLATION IN PROGRESS

CONSTRUCTION PHOTOS

TIMBER FRAMING AT 2ND AND 3RD FLOOR

CONSTRUCTION PHOTOS

1ST FLOOR TIMBER COLUMN

FRONT FACADE PRIOR TO EXTERIOR WALL FRAMING

CONSTRUCTION PHOTOS

BEAM AND PURLIN CONNECTIONS

CONSTRUCTION PHOTOS

VIEW FROM THE 5TH FLOOR ROOF DECK

CONSTRUCTION PHOTOS

CURRENT EXTERIOR FACADE

QUESTIONS?

This concludes The American Institute of Architects Continuing Education Systems Course

John Mitchell

Hartshorne Plunkard Architecture

jmitchell@hparchitecture.com