

## APPENDIX

### GOVERNING CODES AND REFERENCES

#### APPLICABLE CODES AND REGULATIONS

Michigan Building Code (2012 MBC)

State of Michigan Fire Safety Rules for Schools, Colleges and Universities (filed July 14, 1989 incorporating by reference NFPA 101 - 1997). Note that this standard applies only to fire compartments of buildings, which contain instructional space (classrooms and/or instructional laboratories)

2010 ADA Standards for Accessible Design (adopted March 9, 2011)

State of Michigan Elevator Rules (2010) incorporating by reference ANSI A17.1 (2010)

Michigan Uniform Energy Code (2009) incorporating the 2007 ASHRAE Standard 90.1

State of Michigan Mechanical Code (2012)

State of Michigan Plumbing Code (2012)

State of Michigan Electrical Code incorporating "NFPA 70-National Electrical Code" (2014)

NFPA 13 - Sprinkler Systems

NFPA 72 – National Fire Alarm Code

State of Michigan Occupational Safety and Health Standards (MIOSHA)

United States Occupational Safety and Health Standards (OSHA)

2010 ASCE Minimum Design Loads for Buildings and Other Structures (ASCE 7-10)

#### BUILDING DATA

Use Group – Mixed Use: Assembly Group A-3 and Business Group B

Construction Type – Type IB (MBC), Type II 222 (NFPA)

#### STRUCTURAL MATERIAL DESIGN CODES

American Concrete Institute, Building Code Requirements for Structural Concrete (ACI 318-11)

American Concrete Institute, Details and Detailing of Concrete Reinforcement (ACI 315-99)

Specifications for Structural Concrete, (ACI 301-10)

American Institute of Steel Construction, Steel Construction Manual, LRFD 14<sup>th</sup> Edition (AISC LRFD)

RCSC, Specification for Structural Joints Using ASTM A325 or A490 Bolts

Structural Welding Code (AWS D1.1)

2011 Masonry Standards Joint Committee Code, Specification and Commentaries, (ACI 530-11/ASCE 5-11/TMS 402-11)

2011 Specification for Masonry Structures (ACI 530.1-11/ASCE 6-11/TMS 602-11)

Steel Deck Institute, Code of Standard Practice, (SDI)

North American Specification and for the Design of Cold Formed Steel Structural Members, 2012 Edition (AISI S100-12)

AISI Commentary on the Specification for the Design of Cold Formed Steel Structural Members, 2012 Edition (AISI S100-12-C)

MECHANICAL DESIGN CODES

State of Michigan Mechanical Code 2012.  
State of Michigan Plumbing Code 2012.  
NFPA 13, "Sprinkler Systems".  
NFPA 14, "Standpipe and Hose Systems".  
NFPA 45, "Fire Protection for Laboratories Using Chemicals".  
NFPA 72, "National Fire Alarm Code with Appendix E".  
NFPA 90A, "Installation of Air Conditioning and Ventilation Systems".  
NFPA 101 1997, "Safety to Life from Fire in Buildings and Structures".  
SMACNA HVAC Duct Construction Standards – Metal and Flexible.  
ASHRAE 55 Thermal Environmental Conditions for Human Occupancy  
ASHRAE 62.1 Ventilation for Acceptable Indoor Air Quality.  
ANSI/ASHRAE/IES 90.1 Energy Standard.  
ASHRAE Handbooks – Fundamentals, Equipment, HVAC Systems and Applications, Refrigeration.  
SMACNA – HVAC Testing, Adjusting and Balancing.  
AABC or NEBB – Procedural Standard for Testing, Adjusting and Balancing of Environmental Systems.  
AMCA – Standards, Definitions, Terms and Test Codes for Louvers, Dampers and Shutters.

ELECTRICAL DESIGN CODES AND STANDARDS

American National Standards Institute (ANSI)  
American Society for Testing and Materials (ASTM)  
ASHRAE 90.1-2007 Energy Standard for Buildings Except Low-rise Residential  
City of Detroit adopted Ordinances and Codes  
Illuminating Engineering Society of North America – Lighting Handbook, 10<sup>th</sup> Edition  
Institute of Electrical and Electronics Engineers (IEEE)  
Michigan Electrical Code  
National Electrical Contractors Association (NECA)  
National Electrical Manufacturers Association (NEMA)  
National Fire Protection Association (NFPA) 70 – National Electrical Code  
National Fire Protection Association (NFPA) 72 – National Fire Alarm Code  
National Fire Protection Association (NFPA) 110 – Emergency and Standby Power Systems  
Underwriters Laboratories Inc. (UL)

Wayne State University Construction Design Standards – September 2012

Wayne State University Standards for Communications Infrastructure – March 13, 2015

## CODE REVIEW

### I. INTRODUCTION

This report contains a code analysis of fire protection and life safety features for the newly proposed Wayne State University Mike Ilitch School of Business based on the applicable codes and standards for the local jurisdiction. The building will house traditional instructional classrooms, departmental offices, a large auditorium and multi-level student gathering spaces.

The project will be located off the Wayne State University campus in the Olympia Entertainment District in Detroit, Michigan. Detroit falls within the limits of Wayne County. All jurisdictions within the state of Michigan adopt the 2012 *Michigan Building Code* (MBC) as the standard building code. Wayne State University has been granted by the State of Michigan the authority having jurisdiction for projects at their University. The project will additionally be reviewed by the State Bureau of Fire Services, per the terms of the Michigan Rules for Schools, Colleges and Universities for facilities with instructional spaces.

### II. APPLICABLE CODES AND STANDARDS

- A. The following codes and standards will be utilized in the development of this assessment:
  - 1. The 2012 *Michigan Building Code* (MBC), which amends the *International Building Code*, 2012 Ed.
  - 2. The 2014 *Michigan Electrical Code Rules, Part 8* (MEC), which incorporates the *National Electrical Code*, 2014 Ed.
  - 3. The 2012 *Michigan Mechanical Code* (MMC), which amends the *International Mechanical Code*, 2009 Ed.
  - 4. The 2012 *Michigan Plumbing Code* (MPC), which amends the *International Plumbing Code*, 2009 Ed.
  - 5. The *Michigan Fire Prevention Code* (MFPC), which adopts and amends NFPA 1 *Fire Code*, as published by the National Fire Protection Association
  - 6. The 2009 *Uniform Michigan Energy Code* (UMEC), which incorporates the *International Energy Conservation Code*, 2009 Ed.
- B. The National Fire Codes (NFC) published by National Fire Protection Association (NFPA) to include, but not limited to:
  - a. NFPA 1 – *Fire Code*
  - b. NFPA 10 – *Portable Fire Extinguishers*
  - c. NFPA 13 – *Installation of Sprinkler Systems*
  - d. NFPA 14 – *Installation of Standpipe, Private Hydrant, and Hose System*
  - e. NFPA 20 – *Standard for the Installation of Stationary Pumps for Fire Protection*
  - f. NFPA 24 – *Installation of Private Fire Service Mains and Their Appurtenances*
  - g. NFPA 70 – *National Electric Code*
  - h. NFPA 72 – *National Fire Alarm Code*
  - i. NFPA 80 – *Fire Doors and Fire Window*
  - j. NFPA 101 – *The Life Safety Code*
- C. ICC/ANSI A117.1, 2003 ed. – Accessible and Usable Buildings and Facilities as referenced by Chapter 11 of the MBC.
- D. The 2010 ADA Standards for Accessible Design
- E. The Michigan Rules for Schools, Colleges and Universities as enforced by the State Bureau of Fire Services for Instructional Spaces. The Rules adopt and amend the provisions of NFPA 101 *The Life Safety Code*, 1997 Edition

### III. GENERAL BUILDING DESCRIPTIONS

The proposed Wayne State University, Mike Ilitch School of Business will be a new four story building including classrooms, an auditorium, two story atrium, administrative offices, and a roof terrace. The highest occupied floor level will be less than 55 feet above the lowest level of fire department vehicle access so the building will not be considered a high rise. The building will be provided with full, automatic sprinkler protection and fire alarm notification throughout.

**IV. OCCUPANCY CLASSIFICATION**

The following use groups and occupancy classification is anticipated as part of the proposed design:

- A. University classroom building consisting of the following use groups:
  - 1. Business "B" Occupancy
  - 2. Assembly "A-3" Occupancy

**V. BUILDING CONSTRUCTION AND LIMITATIONS**

The building will be designated as a non-separated mixed use facility housing a combination of Business "B" and Assembly "A-3" functions. Business functions will include classrooms smaller than 980 square feet, enclosed and open office areas and general circulation spaces. Assembly functions will include classrooms exceeding 980 square feet, the auditorium, and atrium gathering spaces. Assembly "A-3" will be considered the most stringent occupancy for the purposes of defining construction type and maximum allowable height and area in accordance with MBC Table 503. The proposed construction type for the building is non-combustible Type IB per the MBC, which is equivalent to NFPA Construction Type II (222). The allowable footprint for a Type IB building housing an A-3 Occupancy is unlimited in area. The base allowable height is 11 stories per the MBC with a one story increase allowed by providing full automatic sprinkler protection throughout. The Bureau of Fire Services rules would allow 34,200 square feet per floor (68,400 square feet in a 100% sprinklered facility) and will allow 7 stories in height with an increase to 8 stories in a fully sprinklered building. The largest proposed floor area on a level is approximately 33,500 square feet. The building will be 4 stories in height

**VI. STRUCTURAL FIRE RESISTANCE**

In accordance with Type IB construction (Table 601 of the MBC), the fire resistance ratings in hours for the various building elements for the new building are as follows:

STRUCTURAL ELEMENT	FIRE RESISTANCE (HOURS)
Primary Structural Frame	2
Bracing Members	2
Bearing Walls Exterior and Interior	2
Shafts and Elevator Hoistways	2
Floor Construction and Secondary Members	2
Roof/Ceiling Assemblies	1
Nonbearing Walls and partitions (interior)	0

**VII. MEANS OF EGRESS**

The following means of egress requirements are applicable to Buildings A and B.

- A. Occupant Loads:  
The number of occupants for whom exit facilities shall be provided is based on the following occupant load factors as required by NFPA 101:

OCCUPANCY	OCCUPANT LOAD FACTOR

	PERSONS/SQUARE FOOT
Business Occupancy	100 gross
Classrooms	20 net
Assembly	
Fixed Seating	Number of Seats Provided
Unconcentrated	15 net
Concentrated	7 net
Electrical and Mechanical Rooms	300 gross
Storage	300 gross

- B. **Exit Capacity:**  
The capacity of means of egress components for the area served shall be sufficient for the occupant load served by the exits. The following exit component's capacities and notes are applicable, assuming the building is to be provided with automatic sprinkler protection:
1. Stairways: 0.30 inches of clear width per person.
  2. Doorways corridors and ramps: 0.2 inches of clear width per person.
  3. Where means of egress from floors above and below converge at an intermediate floor, the capacity of the means of egress from the point of convergence shall not be less than the sum of the two.
  4. Street floor exits shall be sufficient for the occupant load of the street floor plus the required capacity of stairs and ramps discharging through the street floor.
- C. **Number and Remoteness of Exits**
1. Not less than two exits are to be accessible from every floor, including floors below the level of exit discharge. Spaces with occupant loads greater than 500 and 1000 people will require three and four exits, respectively.
  2. The distance between two exits or exit access doors in sprinklered buildings shall be not less than 1/3 of the length of the maximum overall diagonal of the area served.
- D. **Arrangement of Means of Egress**
1. Exit Access passageways and corridors which serve more than one exit shall provide direct connection to exits in opposite directions from any point in the passageway. No dead-end corridor or passageway is to exceed 50 feet in the overall Business Occupancy, or 20 feet when serving an Assembly function.
  2. Common path of travel is the portion of exit access that is traveled before two separate and distinct paths of travel are available. A common path of travel of up to 100 feet is allowed in the overall Business Occupancy, but is limited to 75 feet when serving Assembly "A-3" areas.
- E. **Measurement of Travel Distance to Exits**
1. The length of exit access travel is measured from the most remote point to an approved exit along the natural and unobstructed line of travel. The maximum permitted exit travel distance in the overall Business Occupancy is 300 feet. The maximum exit travel distance from Assembly functions is limited to 200 feet when serving an Assembly Occupancy.
- F. **Doors**
1. Minimum clear width in means of egress - 32 inches.
  2. Doors shall swing in the direction of exit travel when serving an occupant load greater than 50 people or serving as an exit enclosure.

3. Listed hardware will be required on hardware for all rated.
  4. All of the exit doors shall remain accessible for use whenever the building is occupied.
- G. Corridors
1. Corridors shall be provided with smoke-tight construction to meet the requirements of the Bureau of Fire Services for buildings containing instructional spaces
- H. Marking of Means of Egress
1. Exit and exit access paths are required to be provided with approved exit signs. Exterior exit doors that are obvious and clearly are identifiable as exits do not require exit signage.
  2. Sign placement in exit access shall be such that any point is not more than 100 feet from the nearest visible sign.
  3. Directional indicators shall be provided on exit signs showing the direction of travel where the direction of travel to reach the nearest exit is not apparent.
  4. Required exit signs are to be located and of such size and design to be readily visible and provide contrast with decorations, interior finish or other signs.
  5. Required exit signs are to have letters at least 6-inches high with a minimum stroke of 3/4 inches. The "EXIT" shall have letters having a width not less than 2 inches except the "I", and the minimum spacing between letters shall be not less than 3/8 inch.
  6. Signs may be either internally or externally illuminated. Exit signs shall be illuminated by a source providing not less than 5 foot-candles (54 lux) and shall employ a contrast ratio of not less than 0.5.
- I. Illumination of Means of Egress
1. All means of egress are to be equipped with artificial lighting that provides the required level of illumination continuously for the duration of time that occupancy of the building requires exits to be available. Lighting shall also be provided to illuminate the exit discharge.
  2. Illumination of the means of egress is to provide a minimum of one foot-candle at the floor. Exit illumination is to be arranged such that the failure of any one single lighting unit, such as the burning out of a bulb, will not leave the area or space in total darkness.
  3. Lighting for all spaces required to have more than one exit or exit access must be connected to an approved emergency power source capable of providing minimum illumination for a period of 1-1/2 hours.

## VIII. PROTECTION OF VERTICAL OPENINGS

- A. Shaft Enclosure
1. Every stairway, elevator shaft and other vertical opening is to be enclosed with 2-hour fire resistance rated assemblies as required by the MBC to match the required fire resistance rating of the floor. Doors serving 2-hour shafts are to be 90-minute fire doors per the requirements of the *IBC*.
  2. Openings other than those necessary for the function of egress stair shafts shall not be permitted. All permitted openings into a new stair shall be protected with an approved opening protective. No storage shall be permitted within the shaft.
- B. Two-story Openings
1. A two-story "communicating space" is planned. The two-story opening will connect the First and Second Floors
  2. The two-story area will be protected in accordance with NFPA 101 Section 6-2.4.5 for "Communicating Spaces". The Communicating Spaces section is also commonly known as the "Mini-Atrium Section." In accordance with Section 6-2.4.5, the communicating space will not connect more than three contiguous stories and the lowest level within the communicating space is at street floor level. Additionally, the entire area of the communicating space is open and unobstructed. A smoke management system is not required for two-story communicating spaces that comply with NFPA 101 Section 6-2.4.5.

## IX. INTERIOR FINISH

Interior finish requirements for the fully sprinklered Buildings A and B are as follows:

- A. Exit enclosures: Class A or B
- B. Corridors and lobbies: Class A, B or C
- C. All other spaces: Class A, B or C
- D. Interior floor finish: Class I or II (NFPA 253)

## X. FIRE DETECTION, ALARM AND COMMUNICATION

- A. Functional System Description

The fire detection and alarm system will be designed in accordance with the applicable portions of the referenced codes and standards. The fire alarm system required for this facility must include the following major functional components:

1. Manual alarms:
  - a. To be provided within five feet of each exit within the path of egress. The maximum travel distance to a manual station shall not exceed 200 feet.
2. Monitoring of automatic fire suppression systems:
  - a. Full supervision required for all sprinkler system components, including water flow and valve supervisory switches
3. Automatic smoke detection:
  - a. Automatic smoke detection will be used in limited instances in the new Facility to initiate functions such as elevator recall. Beam detection will be provided in the atrium for initiation of the atrium smoke removal system.
4. Initiating Zones:
  - a. Each floor will be zoned separately and individual zones will not exceed 22,500 square feet. The length of each zone will not exceed 300 feet.
5. Building Evacuation System:
  - a. The fire alarm evacuation system will be a general evacuation notification system meeting the requirements of NFPA 72. Visible strobe alarm appliances will be utilized throughout the facility and atrium courtyard in accordance with NFPA 72.
  - b. The audio alarm system will be designed to output a minimum 15dB above the ambient noise level.
  - c. ADA compliance concerning visible alarm strobe appliances will be designed per ADA Section 2.2 provisions for "equivalent facilitation." Therefore, the visible strobe signal appliances will be designed in accordance with the tabular data contained in NFPA 72. This will provide the 0.030 lumens/square foot referenced in ADA guidelines. These tables are contained in the ADA Advisory Report referenced in the applicable criteria.
  - d. The visible alarm strobe indicating appliances will generally be 15, 30, 75 and 110 candela synchronized devices.
6. Fire Alarm Controls
  - a. Fire alarm control equipment will be provided at the main entrance vestibule based on requirements of local AHJ.
7. Supervision
  - a. The entire fire alarm wiring system will be supervised in accordance with NFPA 72. Addressable signaling line initiating circuits and notification circuits will be supervised in accordance with Class B with alarm receipt for a single ground. Conventional notification circuits will also be Class B. These Class B supervised circuits will report trouble conditions for a single open and a single ground condition.

8. Secondary Power
  - a. The fire detection and alarm system is to be provided with standby battery secondary power which will be designed to provide a minimum of 24 hour standby service under normal conditions followed by not less than 5 minutes in alarm.
  - b. Additionally, the entire fire alarm system will be connected to the emergency power distribution system.

## **XI. FIRE SUPPRESSION SYSTEMS**

### **A. Automatic Sprinklers**

1. The building will be provided with automatic wet pipe sprinkler system throughout. The design of the new sprinkler systems will be in accordance with the requirements of NFPA 13.
2. Offices, administrative spaces, and similar light hazard spaces will be designed in accordance with the requirements for Light Hazard Occupancies as defined by NFPA 13.
3. Mechanical rooms, storage spaces and select laboratories will be designed for Ordinary Hazard Group 1 occupancy requirements.
4. All new automatic sprinkler systems will be hydraulically calculated and designed to meet the requirements of NFPA 13. Quick response sprinklers will be used where practicable as the building standard.

### **B. Standpipe**

1. Standpipes will be required since the highest occupied floor is greater than 30 feet above lowest level of fire department access.
2. Since the highest occupied floor does not classify the building as a high rise, automatic standpipes are not required. A manual standpipe system will be provided
3. The manual standpipes will be located in each egress stair and have Class I fire hose connections at each primary floor landing. A fire department connection will be provided on the outside of the building at a location reviewed with and approved by the Fire Department.

### **C. Water Supply for Fire Suppression Systems**

1. A new incoming fire service into the building will provide the water supply for automatic fire suppression system. The size for the new fire pump will be based on only the needs of the sprinkler system (not the standpipe system) and based on hydrant water flow test results. The fire pump will be installed in a dedicated, 1-HR fire rated room.
2. The new incoming fire service shall be provided with a double check type backflow preventer assembly.