GOVERNING CODES:

ICC, International Building Code, 2015 edition (IBC)
NFPA 101, *Life Safety Code*, 2015 edition (LSC)
NFPA 10, Standard for Portable Fire Extinguishers, 2013 edition.
NFPA 13, Standard for the Installation of Sprinkler Systems, 2013 edition.
NFPA 14, Standard for the Installation of Standpipe and Hose System, 2013 edition.
NFPA 24, Standard for the Installation of Private Fire Service Mains and their Appurtenance, 2013 edition.
NFPA 72, *National Fire Alarm Code*, 2013 edition.
NFPA 70, *National Electric Code*, 2014 edition.
NFPA 80, Standard for Fire Doors and Other Opening Protectives, 2013 edition.
NFPA 88A, Standard for Parking Structures, 2015 edition.
NFPA 90A, Standard for the Installation of Air-Conditioning and Ventilating Systems, 2015 edition.
NFPA 220, Standard Types of Building Construction, 2015 edition.
NFPA 291, Recommended Practice for Fire Flow Testing and Marking of Hydrants, 2013 edition.
ASTM E2072-04, Specification for Photoluminescent (Phosphorescent) Safety Markings, 2004 edition.

International Plumbing Code
ASHRAE 90.1-2012
ASHRAE 62.1 – 2012
ANSI A117.1-2009 Standard on Accessible & Usable Buildings and Facilities
2010 ADA Standards for Accessible Design
ASCE-07-10
ACI 318-14
ACI 530-13
AISC 341-10
AISC 360-10
PCI MNL 120-10, Design Handbook

VA DESIGN MANUALS:

VA Parking Design Manual & Demand Model, April 2013
VA Barrier Free Design Guide
Architectural
Electrical
HVAC
Plumbing
Site and Landscape
Auto Transport
Interior Design
Structural
Sanitary
Fire Protection, Sixth Edition Revised September 2011
Facilities
Physical Security Design Manual: Life-Safety Protected
Sustainablity Guidelines
Wayfinding and Signage
05 Parking Structure Signs
09 Interior Signs

CODE ANALYSIS

A. OCCUPANCY CLASSIFICATION
1. The parking garage is classified as low-hazard storage facilities, a Group S-2 Occupancy, and as an ordinary hazard by NFPA 101 42.8.15
2. The parking garage is considered an OPEN PARKING STRUCTURE openings shall comply with the following:
   a. Open Parking Structure: A parking structure that meets the requirements of NFPA 88A Section 5.5
      i. Each parking level shall have wall openings to the atmosphere for an area of not less than 1.4 square feet for each linear foot of the exterior perimeter.
      ii. Opening shall be distributed over a minimum of 40% of the building perimeter or uniformly over two opposing sides.
      iii. Interior wall lines and columns shall be at least 20% open, with openings distributed to provide ventilation.
3. This parking garage is classified as a Ramp Type Parking Structure: A parking Structure that utilizes sloped ramps for vertical vehicle circulation per NFPA 88A 4.1.3

B. CONSTRUCTION CLASSIFICATION
1. The parking garage is to be constructed in accordance with the provisions of NFPA 88A as defined in NFPA 220. Construction type for a building exceeding 25 feet in height shall be Type I, Type II(222) or Type II(111). An open parking garage of these construction types may be unlimited in height and area. In addition, per NFPA 88 5.1.4, Type II(000) is permitted to be of unlimited area where both the height does not exceed 75 feet and the horizontal distance from any point on any parking level to an exterior wall opening on a street, an alley, a courtyard or other similar permanent open space does not exceed 200 feet.
2. The Parking Garage has four levels above grade and is classified as an open parking structure. The construction classification is Type II(000) based upon the occupancy and area of the building.
3. Primary structural elements of Type II(000) buildings are not required to be rated. Primary structural elements supporting a roof are not required to be rated, and all floor construction are not required to be rated. NFPA 220 Table 4.1.1
4. Primary structural members are considered to be bearing walls, columns, and the girders, beams, trusses and spandrels having direct connections to columns and bracing members designed to carry gravity loads. The members of floor or roof panels which have no connection to the columns and do not carry a gravity load are considered secondary members and are not part of the structural frame of a building

C. FIRE RESISTANCE RATED SEPARATIONS
The Garages will be designed as nonseparated mixed uses. Incidental uses are not anticipated, so no fire rated separation is required between occupancies. Interior building elements that require fire resistance ratings are listed below:

BUILDING ELEMENT	FIRE RESISTANCE RATING	CODE REFERENCE
Non-enclosed Exit Stairs (Provided)	0	NFPA 88A, 4.1.5
Enclosed Exit Stairs (NOT PROVIDED)	1,2	NFPA 101 7.1.3.2.1
Ramps	0	NFPA 101 42.8.3.1.2
Other shafts which connect 2 or more stories	2	NFPA 101 42.8.3.1.2
Elevator machine rooms	2	NFPA 101 7.14.7.1
Emergency generator (if provided)	2	NFPA 70

(1) Supporting structural members (located within one structural bay) must have the same fire resistance rating. The fire resistance rating must be carried through all structural members; extending to the foundation. In addition, the shaft construction must maintain the same fire rating as the floor construction (1 Hr rated).

(2) Where nonrated walls or unprotected openings enclose the exterior of the stairway and the walls or openings are exposed by other parts of the building at an angle of less than 180 degrees, the building exterior walls within 3.048 m (10 ft) horizontally of a nonrated wall or unprotected opening must have a fire resistance rating of not less than 1-hour. Openings within such exterior walls must be protected by opening protectives having a fire protection rating of not less than ¾-hour. This construction must extend vertically from the ground to a point 3.048 m (10 ft) above the top most landing of the stairway or to the roof line, whichever is lower.

1. Mechanical equipment rooms incidental to the use of the building are not required to be separated by an occupancy separation. Special hazard rooms such as general storage and furnace/boiler rooms and electrical switchgear rooms shall be separated per NFPA 70 and potentially IBC Table 508.2.
2. Cashier and attendant booths are not required to be separated. NFPA 88A 5.2.4.
3. The electrical, security and IT rooms do not have a total area exceedign 3,000 SF therefore shall be separated by partitions built to resist the passage of smoke. NFPA 88A 5.2.4.
4. Fire barriers will extend from the top of the floor below to the underside of the floor or roof deck above. The openings and penetrations in required exit enclosures will be protected with self-closing or automatic-closing opening protectives. Openings in fire resistance rated walls will be protected in accordance with the following:

COMPONENT	WALLS AND PARTITIONS (HR) NFPA 101 8.3.4.2	FIRE DOOR ASSEMBLIES (HR/MIN) NFPA 101 8.3.4.2
Elevator Hoistways	0 (NFPA 101 42.8.3.1.2)	0
Elevator Machine Rooms	2 (NFPA 7.14.7.1)	1.5(90)
Vertical Shafts (including enclosed exit stairways)	0 (NFPA 101 42.8.3.1.2)	0
Fire Barriers	1	.75(45)
	2	1.5(90)
	3	3(180)

Piping, conduit, and wire penetrations of fire rated construction will be protected by materials or systems of the same hourly rating listed by Underwriters Laboratories (UL), Factory Mutual (FM), or a National Recognized Testing Laboratory (NRTL). Duct, air transfer openings, and other penetrations through floors, shaft enclosures and other fire rated construction will be protected in accordance with the LSC and the IBC.

D. BUILDING PLACEMENT
The code requires the exterior walls of buildings to be protected from one another based on the fire separation distance between buildings, or to a lot line. Fire separation distance is defined as the distance measured from the face of a building to one of the following three points:
1. The closest interior lot line;
2. To the centerline of a street, an alley or public way, or;
3. To an imaginary line between two buildings on the property.
No fire rated separation is required where the parking structure is separated by 10 feet. NFPA 88A 5.2.2

E. INTERIOR FINISH
Interior wall and ceiling finish to be designed in accordance with the NFPA 101, 42.8.3.3.3.
1. Class A, B and C finish is permitted for interior walls and ceilings in rooms, and corridors. Class A or B finish is permitted for exits.
2. Per the IBC Section 406.2.6 all floor surfaces shall be of concrete or other similar non-combustible and non-absorbent materials. Floor Finish shall not be less than Class II.

F. EGRESS LIGHTING AND EXIT SIGNAGE
Emergency egress lighting will be provided throughout the common portions of the means of egress in accordance with The Life Safety Code Code section 42.8.2.8, 42.8.2.9 and 42.8.2.10.
1. These areas include drive lanes, corridors, exit access spaces within areas requiring two (2) or more means of egress, the lobby/entrance areas, exit stairs, and the exit discharge areas (including exterior locations to the public way).
2. Each required exit will be identified with an exit sign, including exit access, and within areas requiring multiple exits. Directional exit signs will also be provided to direct occupants toward the closest exit so that no occupant is more than 100 feet from an exit sign.
3. The egress lighting and exit signs will be provided with a secondary source of power in the event that the primary power source is disrupted. The secondary power source will consist of either internal batteries or a connection to an emergency power system.

G. MEANS OF EGRESS
Means of egress shall be in compliance with NFPA 101 and as modified by NFPA 88A. Egress requirements are based upon a non-sprinklered building. Exits must be so located on each story such that the maximum length of exit access travel, measured from the most remote point within a story along the natural and unobstructed path of egress travel to an exterior exit door at the level of exit discharge, an entrance to a vertical exit enclosure, an exit passageway, a horizontal exit, an exterior exit stairway or an exterior exit ramp, may not exceed the distances allowed by the Code. Egress requirements are outlined below.
1. Maximum travel distance: open parking garage – 300 feet (NFPA 101 Table 42.8.2.6.1)
2. Common path of travel: 50 feet (NFPA 101 Table 42.8.2.5.1)
3. Dead ends: 50 feet (NFPA 101 Table 42.8.2.5.2)
4. Number of exits: At least two exits shall be provided from every floor [illegible] conditions ramps may be substituted for an egress stair. (NFPA 101 Table 42.8.2.4)
5. Egress Width Factor: NFPA 101 Table 7.3.3.1 requires a minimum egress width of 0.2 in per occupant for doors, ramps, and corridors and a minimum egress width of 0.3 in per occupant for stairs.
6. Occupant Load factor: NFPA 101 Table 7.3.1.2 requires an Occupant load factor of 500 sf per person be applied to storage use type facilities other than storage [illegible] mercantile occupancies. Parking garages are classified by chapter [illegible] the NFPA 101 as storage type occupancies. IBC Table [illegible] 1.2 requires an occupant load factor of 200 for parking garages
7. Remoteness of exits: Where [illegible] are exits or exit access doorways [illegible] from any portion of the exit access, at least two of the exit doors or exit access doorways must be placed a distance apart equal to not less than one-half of the length of the maximum overall diagonal dimension of the building or area to be served measured in a straight line between exit doors or exit access doorways.
8. Stairs Design (per NFPA 101 7.2.2):
9. Maximum Riser Height: 7 inches (NFPA 101 Table 7.2.2.2.1.1(a))
   Minimum Tread Length: 11 inches (NFPA 101 Table 7.2.2.2.1.1(a))
   Minimum Stair Width: 44 inches (NFPA 101 Table 7.2.2.2.1.2(B))
   Guard: 42 inches(Required where elevation change exceeds 30 inches. Design shall prevent the passage of a 4 inch Sphere.) (NFPA 101 7.2.2.4.6.2)
   Handrail: 34-38 inches (NFPA 101 7.2.2.4.5.1)
   Minimum Clearance: 6 feet 8 inches (Measured vertically from nose of tread.)
   Signage: Required at each floor level (NFPA 101 7.2.2.5.4)
10. Ramp Design: per the NFPA 101 7.2.5):
   Maximum Slope: 1/12 (NFPA 101 Table 7.2.5.3(a))
   Guard: 42 inches(Required where elevation change exceeds 30 inches. Design shall prevent the passage of a 4 inch Sphere.) (NFPA 101 7.2.2.4.6.2) 4 inch curbs required for drop off edge of ramp
   Handrail: 34-38 inches (required for ramps with more than a 6 inch rise) (NFPA 101 7.2.2.4.5.1)
11. Areas Of Refuge: Not required in open parking garages (NFPA 101 42.8.2.2.9.2)

H. EMERGENCY ELEVATOR OPERATION
Elevator will have a Smoke detector, located in its respective lobby, on each floor level where the lobby is enclosed. A heat detector is permitted where the lobby is open to the environment. Upon activation of a lobby heat detector or machine room smoke detector, the elevators served by that lobby or machine room will be recalled to the main level of the building, one at a time. In the event that the alarm is on this designated level, the elevators will be recalled one at a time to an alternate level. It is proposed to recall only the elevator or group of elevators served by the affected lobby or elevator machine room.
After returning to the appropriate level, the elevators will stop, the doors will open, and the elevators will be rendered inoperable without the use of the fireman's key or until such time that they are manually reset to the normal operating mode. This mode of operation is provided for fire department use to allow for access to all levels served by the elevators.

I. Automatic Sprinkler System
Not required in open parking garages (NFPA 101 42.8.3.5 and NFPA 88A 6.4.4)

J. Standpipes
Class I Standpipes are not required in open parking garages not exceeding 50 feet in height PER NFPA 88A 6.5.1

K. PORTABLE FIRE EXTINGUISHERS
1.Portable fire extinguishers will be provided throughout the garages as required by IFC section 906.1 and spaced in accordance with NFPA 10, 2013 edition. 75' Spacing

L. Fire alarm system
Not required per NFPA 101 42.8.3.4.1.2. and IBC 907.2

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BID SET

Drawing Title: CODE ANALYSIS
Approved for Design Concept: FACILITY MANAGEMENT DIVISION MANAGER
Project Title: CONSTRUCT PARKING GARAGE ON WEST LOT
Location: MEMPHIS, TN
Date: 11/14/2016
Checked By: UJ
Drawn By: KH
Project Number: 15.1067
Building Number:
Drawing Number: GI101
OFFICE OF FACILITIES MANAGEMENT
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