



# DOUGHNUT CONSTRUCTION



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## OBJECTIVES

- Define “Doughnut” construction
- List challenges associated with their construction
- Identify common building construction features
- Discuss firefighter safety concerns
- Discuss tactical concerns
- Discuss Command considerations

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## THE FEATURES OF DOUGHNUT CONSTRUCTION

- The "Doughnut", Texas Wrap or Transit Oriented Development (TOD) construction describes a residential building wrapped around a parking garage
- This style maximizes the number of building units within a smaller foot print

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## THE FEATURES OF DOUGHNUT CONSTRUCTION

The garage is accessible by many units within the building typically by vestibule



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# THE FEATURES OF DOUGHNUT CONSTRUCTION

There are a number of these structures either being built or currently existing within all five MCFRS Battalions:

8001 13<sup>th</sup>  
Street  
Battalion 1



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# THE FEATURES OF DOUGHNUT CONSTRUCTION

64 Rock Forest  
Drive  
Battalion 2



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# THE FEATURES OF DOUGHNUT CONSTRUCTION

100 First Street  
Battalion 3



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# THE FEATURES OF DOUGHNUT CONSTRUCTION



1175 Georgia Ave  
Battalion 4

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## THE FEATURES OF DOUGHNUT CONSTRUCTION



550 South Frederick Ave  
Battalion 5

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## CHALLENGES

- Doughnut construction represents increased residential density above “garden style” apartments
- Zoning and redevelopment plans around mass transit hubs (Metro) make these buildings more attractive to developers and residents

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## CHALLENGES

- 20%-30% higher residential density
- More units and lower parking cost (5%-36% lower cost)
- Diminished need to expand roads
- Transit authorities realizing increased ridership

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## CHALLENGES

- Increase “location efficiency” so people have the option to walk, bike and take transit rather than using an auto
- Provide a rich mix of housing, shopping and transportation choices
- Generate revenue for the public and private sectors and provide value for both new and existing residents
- Create a sense of place

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## Building Construction

- The 2009 International Building code allows an R2 apartment building of Type V A construction to be up to three (3) stories in height.
- A one (1) story increase, typically masonry construction on the first level, is permitted with the use of automatic sprinkler protection in accordance with NFPA 13

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## Building Construction

### NFPA 13R Versus NFPA 13

- NFPA 13R Sprinkler Protection Designed Essentially for Life Safety
- NFPA 13 Sprinkler Protection Designed for Both Life Safety and Property Conservation

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## Building Construction

### NFPA 13 Versus NFPA 13R

- NFPA 13R allows a maximum four head sprinkler design in the largest compartment with a delivery rate of .05 gpm per square foot
- NFPA 13 allows a four sprinkler design in residential areas to have a delivery rate of .10 gpm per square foot
- **50% reduction in flow rate from NFPA 13 to NFPA 13R**

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## Building Construction

### NFPA 13 Versus NFPA 13R

- NFPA 13R specifies that sprinklers are not required in combustible concealed spaces which are not used for living, storage, or fuel fired equipment (**most importantly, attics**)
- NFPA 13 requires combustible concealed spaces including attics, floor/ceiling assemblies, exterior balconies, and bathrooms to be sprinklered

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## Building Construction

**Larry Iseminger, Chief Fire Protection Engineer for the Office of the State Fire Marshall writes:**

*“It appears to be pretty clear that the design professional community have stretched the provisions of the applicable codes as far possible with these new designs. I suspect that the committees who wrote the code provisions never imagined combustible buildings this tall and this large when the code provisions were being written.”*

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## Building Construction

The International Building Code (IBC 2000) and the Building Construction and Safety Code, NFPA 5000TM-2002, define high-rise buildings as buildings 75 feet or greater in height measured from the lowest level of fire department vehicle access to the floor of the highest occupiable story.



So what is this?

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# Building Construction

These structures are typically four story Type V Construction (“stick built”) incorporating light weight structural assemblies including: open chord wooden joist, oriented strand board (OSB), and engineered roof truss systems



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# Building Construction



Open chord floor joist



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## Building Construction



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## Building Construction

- Buildings are divided into several separate buildings from a building code perspective based on maximum height and area restrictions in the International Building Code
- Fire Barriers used as Horizontal Exits are 2 Hour Rated Assemblies with rated doors
- Consist of 2 sheets of 5/8" Type X Drywall on each side of the stud

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## Building Construction

- Egress paths are protected by at least 1 hour rated assemblies; 1 sheet of 5/8" Type X Drywall on each side of the stud
- Exit stair towers four (4) stories and above are required to have two hour rated assemblies; below four (4) stories only one hour rated assemblies are required
- Utility areas typically have 1 hour fire separations
- Vertical chases have fire stops

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## Building Construction

Framed hallway



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## Building Construction

- Parking Garages are typically of Tilt Up/Pre cast construction
- Rated assemblies (3-4 hour) separates each structure from the garage
- 50% Open Perimeter
- Dry standpipe systems; some are combination sprinkler/standpipe systems

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## Building Construction



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## Building Construction

How many connections are there?

Where are they?

Are they interconnected?

Do they meet NFPA 13R or NFPA 13 Requirements?



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## Building Construction

- Attic Space; Large cubic footage (can be more than 20 feet above finished ceiling)
- Draft stopping for every 3000 square feet in addition to 2 hour fire separation walls
- Rated Ceiling above the top floor (2 sheets of 5/8" Type X Drywall)
- Unsprinklered (NFPA 13R)



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## Building Construction

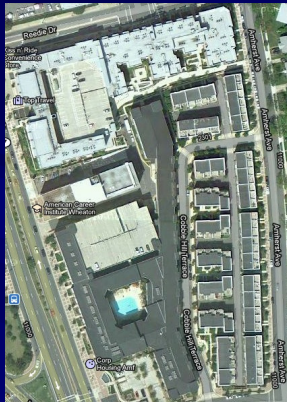
- Vertical 2 hour assemblies extend to underside of roof deck.
- Can act as a 5th floor or 4<sup>th</sup> floor unit with loft



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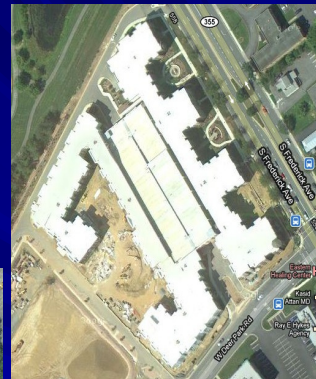
## Tactical Concerns



There is often little or no access to interior courtyards

Buildings often carry multiple addresses

Fire from burning autos can extend to the main structure



Extremely long hallways make hose stretches challenging



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## Tactical Concerns

- Early detection is possible in the entire structure because of the fire alarm and suppression systems.
- Fires within habitable spaces will likely be controlled or contained by the NFPA 13R suppression systems

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## Tactical Concerns

- Exterior fire spread must be immediately addressed
- Rapid fire extension across the exterior surfaces into structural voids
- Exterior finish may be vinyl or non-combustible “Redi-Board”
- Significant structural involvement – large potential for failure

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## Tactical Concerns



Exterior finishes can aid in fire extension from brush or balcony fires



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## Tactical Concerns

- Fire extension into and across roof/attic spaces
- NFPA 13R requires no effective suppression or detection systems in these spaces.
- Interior units must ensure exterior fire spread is controlled

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## Tactical Concerns

- Limited apparatus access
- None for aerial devices in some areas
- Ground ladders for rescue and egress
- Consider protecting in place

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## Tactical Concerns

View from a courtyard within the complex.....no apparatus access



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## Tactical Concerns

- 4th Floor access difficult - 45 Foot ladders no longer required in NFPA ground ladder compliment (MCFRS carries them on tractor-drawn aerial units)
- Fire Lanes with parallel parking outside the garage
- 20 foot fire lanes
- First company may eliminate access for subsequent arrivals
- Gates and fences for security
- Must ensure access to Knox Box Systems

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## Tactical Concerns

Gated access to the courtyard



Gated access to the parking garage

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## Tactical Concerns

- Limited access to Parking Garage (auto fire scenario)
- Parking Garage access is essential to most egress pathways; will likely get congested with occupants
- Rated assemblies (3-4 hour) separates each structure from the garage
- May still have exposure and smoke travel issues into the structure

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## Tactical Concerns

Parking garage is in close proximity to the dwelling structure.



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## Tactical Concerns

- Multiple Siamese Connections around the buildings. Are they Interconnected?
- How many must you supply?



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## Tactical Concerns

- Maximum distance from dwelling unit to protected egress - 250 feet
- Are 200 foot Standpipe Packs sufficient?
- Depending on the stairwell that is chosen, the stretch may be very long
- **Tactical crews must select the correct stairwell and riser for deployment**

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## Tactical Concerns

“Where the most remote portion of a sprinklered floor or story is located in excess of 200 feet of travel distance from a required exit containing or adjacent to a hose connection, additional hose connections shall be provided, in approved locations, where required by the local fire department or the AHJ.”

International Building Code

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## Tactical Concerns

- Long hallways requiring multiple standpipe packs
- May have unprotected standpipe connections in the hallways
- Some hallways may not contain smoke barriers



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## Tactical Concerns

- Triple studs throughout 1st floor bearing walls carry the weight of the structure.
- Firefighter safety and survival training guides you to breach this wall with hand tools. The stud spacing is very tight; they are still spaced on center.
- There are two additional studs in that space. Breaching this wall and removing vertical members could lead to possible structural compromise.

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## Tactical Concerns



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## Tactical Concerns

**Confusing interior layouts.** A firefighter walking down the continuous hallway of this building – without going up or down any stairs – passes apartments addressed to three different floors and four different buildings.



Apartment numbers change without changing elevations

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## Command Considerations

### CALL FOR ADDITIONAL RESOURCES EARLY!

- Call for an additional truck with the initial alarm
- These buildings are not considered high rise structures but pose the same challenges encountered in such
- Additional aerial coverage may be needed in remote areas
- Additional ground ladders (28-35) will be needed in inaccessible areas
- Call for a greater alarm early

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## Command Considerations

### INCIDENT COMMAND SYSTEM

- Recon Group – consider a recon group using **the first two arriving engines and the first special service** to find and locate the source before committing units inside the structure; stage personnel with tools and equipment in the lobby
- Ventilation Group – a ventilation group will be needed to manage smoke movement throughout the build [*and adjoining structures*]

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## Command Considerations

### INCIDENT COMMAND SYSTEM

- Divisions Alpha, Bravo, Charlie, or Delta to address exterior fire spread. Consider using the fourth due engine company to address rapid exterior fire spread. ***Exterior vertical fire spread into void spaces through vents or eaves may lead to catastrophic structural failure***

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## Command Considerations

### INCIDENT COMMAND SYSTEM

- **Rescue Group** - the buildings residential density may require the use of several units engaged in a rescue effort within the structure. Protecting in place may be the most prudent option
- **Court Yard Division** - Additional personnel may be needed to effect rescues from ground level courtyards within the center of the building configuration. Crews may have to *carry ladders through corridors* to access courtyard units

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## Summary

- Doughnut construction represents increased residential density above “garden style” apartments.....**CONSIDER THEM AS LIGHTWEIGHT HIGHRISES!**
- Their architectural design stretches the limits of NFPA 13 and 13R
- These structures are typically four story Type V Construction (“stick built”) incorporating light weight structural assemblies
- Depending upon the building code; they can extend five stories (type V four stories above a masonry first story)
- They pose a number of tactical concerns for fire department response including ground ladder access, confusing layouts, close stud spacing, multiple addresses, and long interior hose stretches

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**THE MOST EFFECTIVE WAY TO  
PREPARE COMPANIES FOR  
EMERGENCIES WITHIN THESE  
STRUCTURES IS TO  
PREPLAN!  
PREPLAN!  
PREPLAN!**

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## **Credits**

This presentation was developed with the assistance of the following contributors:

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