CODE RED
CONSULTANTS

Fire Department Access

Jeremy Souza, P.E.

BSA Codes Committee Meeting
November 17, 2021

Presentation Overview

- Scoping Language
- FD Access Roads
  - Dimensions
  - Capacities
  - Geometry & Configuration
- Building Access
  - 50-foot rule
  - 150/250-foot rule
- Local complications
- Case Studies
- Lessons Learned

"WHY" IS A BIG DEAL!

We will talk a lot about why the FD access requirements are what they are.

The "why" is Very Important to what the AHJ is looking at, and impacts what we can do to create solutions

Scoping Language

- 527 CMR 1.00 Massachusetts Comprehensive Fire Safety Code
  - NFPA 1, 2015 Edition with MA Amendments
  - Amendment updates – most recent being from October 2019 – *FDA requirements are in this amendment set*
- 527 CMR 1.00, Section 18.2 contains Fire Department Access Road requirements
- Mass General Laws Chapter 40A – Each municipality can modify fire department access via zoning bylaws or ordinances

Fire Department Access Roads

- Clearances
- Road surface
- Dead ends
- Grade
- Turning Radius
- Curb cuts

Fire Department Access Roads

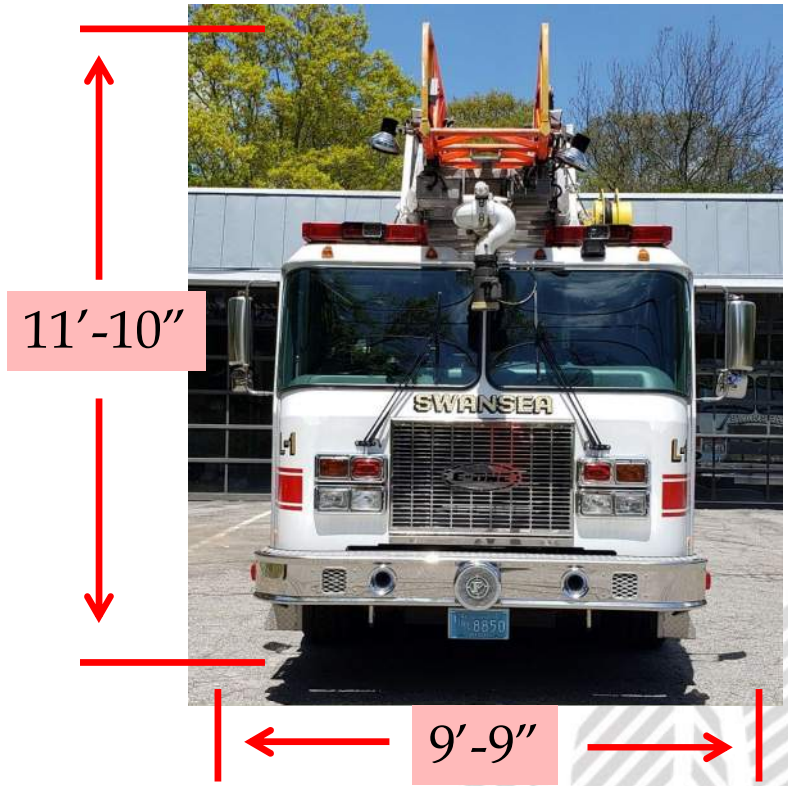
- What is an access road?
- *Code Compliance*: Roadways that guarantee a fire engine can get to where it needs to for that building
  - Unobstructed width of 20 feet and an unobstructed vertical clearance of 13’-6”
  - Boulevard roads are permitted where lanes are between 10’ and 20’ and they do not provide access
- *Reality*: if you can drive on it, it’s an access road to a building.

Width and Height – Why?

- Most fire engines are 8’-6” wide, plus mirrors
- Ladder trucks can be up to 13’ tall
- Equipment is on top of the trucks
- Trucks need to pass each other
- Trucks need to park next to each other
- Ladder trucks need to set jacks, outriggers, or stabilizers to use the aerial

Max Height and Width

- All New England states:
  - Max width 102 inches (8’-6”)
  - Max height 162 inches (13’6”)



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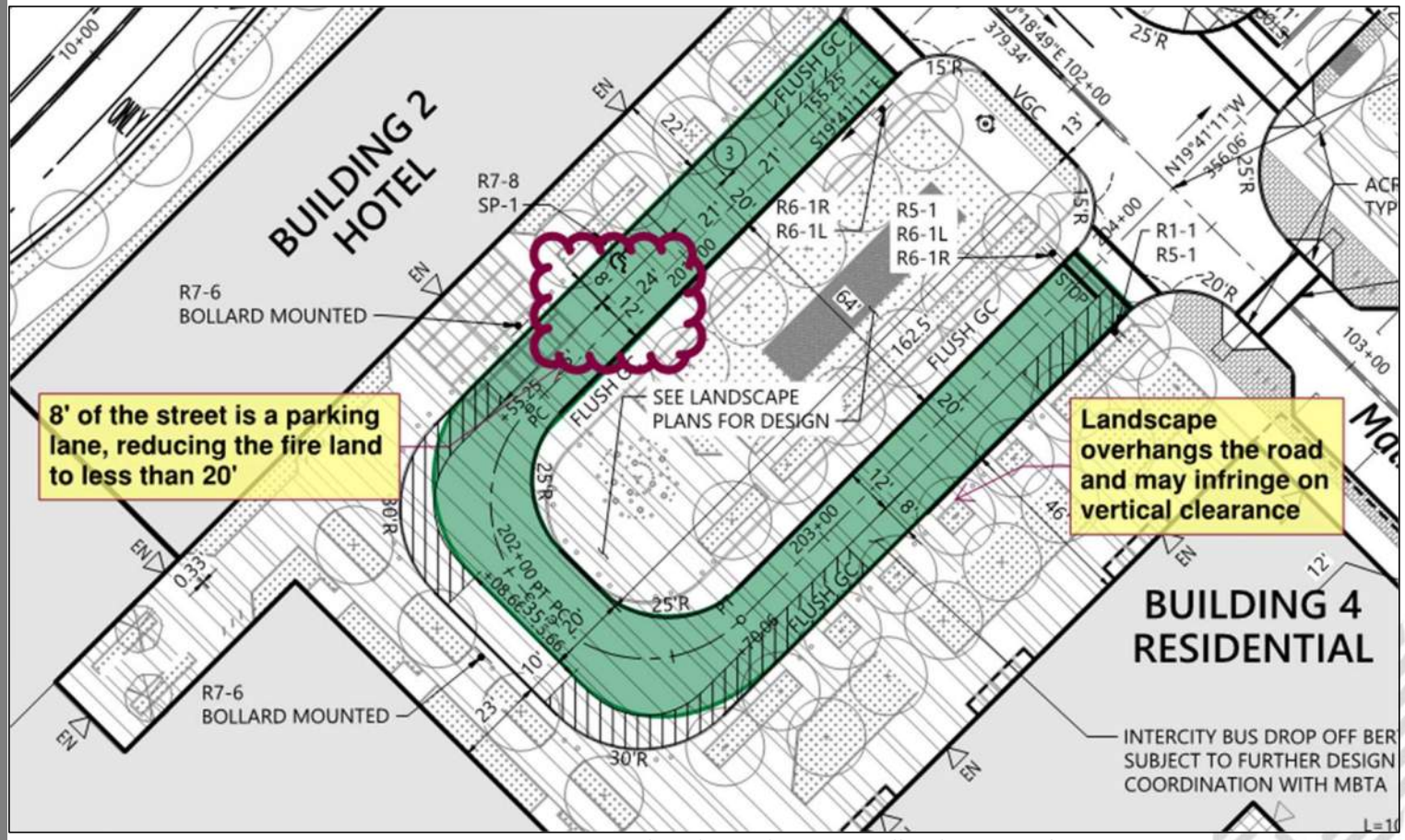

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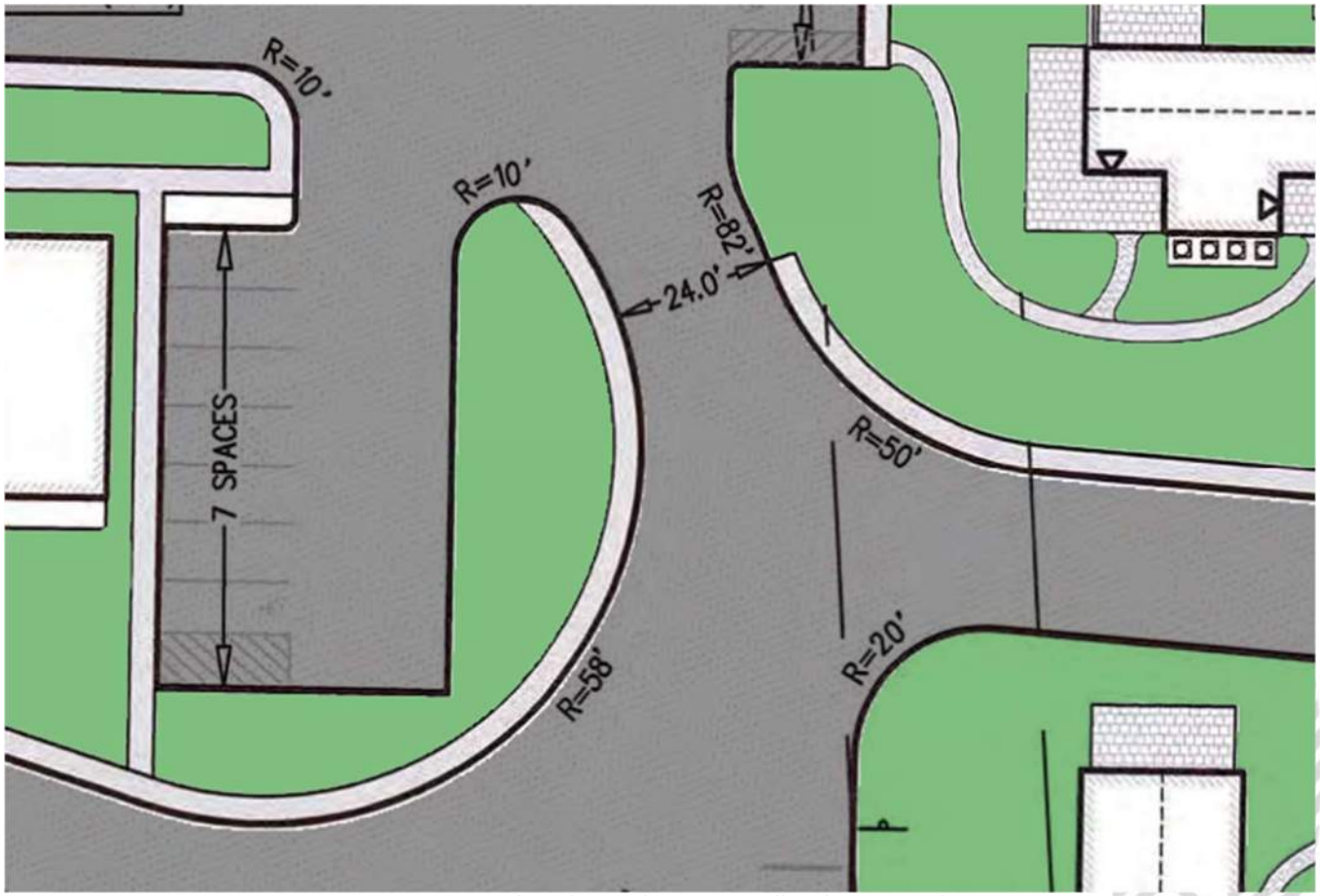

Width and Height - Boulevards

Gates - UL 325

- Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems
- Automatic Vehicle gates
  - Sliding gates
  - Swinging gates
  - Pedestrian gates (and those near vehicle gates)

Basic Requirements – Road Surfaces

- Road surface required to be designed and maintained to support the imposed loads of fire apparatus and provide all-weather capabilities – 527 CMR 18.2.3.4.2
- Imposed loads:
  - Engines and rescues weigh up to 54,000 pounds (27 tons) or more, spread across 6 (or 10) tires
  - Ladders weigh up to 80,000 pounds (40 tons), spread across 10 (or 6) tires
  - Ground pressure under ladder truck jacks – up to 75 psi
- "H-20" requirements often cited – this is a 32,000 lb axle – 8,000 lbs per wheel (4 wheels per axle)
- The Civil Engineer needs to be involved in the roadway design and understand the criteria
- If you see < 8 inches of gravel beneath the road, look deeper

Vehicle Weight - Maximums

Type	GVW	Steering Axle	Single Drive Axle	Tandem Drive Axle
Commercial Engine	50,000	18,000	31,000	
Custom Engine	56,000	24,000	31,000	
Tanker	84,000	24,000		62,000
Straight Aerial	80,000	22,800		54,000
Tractor-Drawn Aerial	80,000	22,800	31,000	31,000

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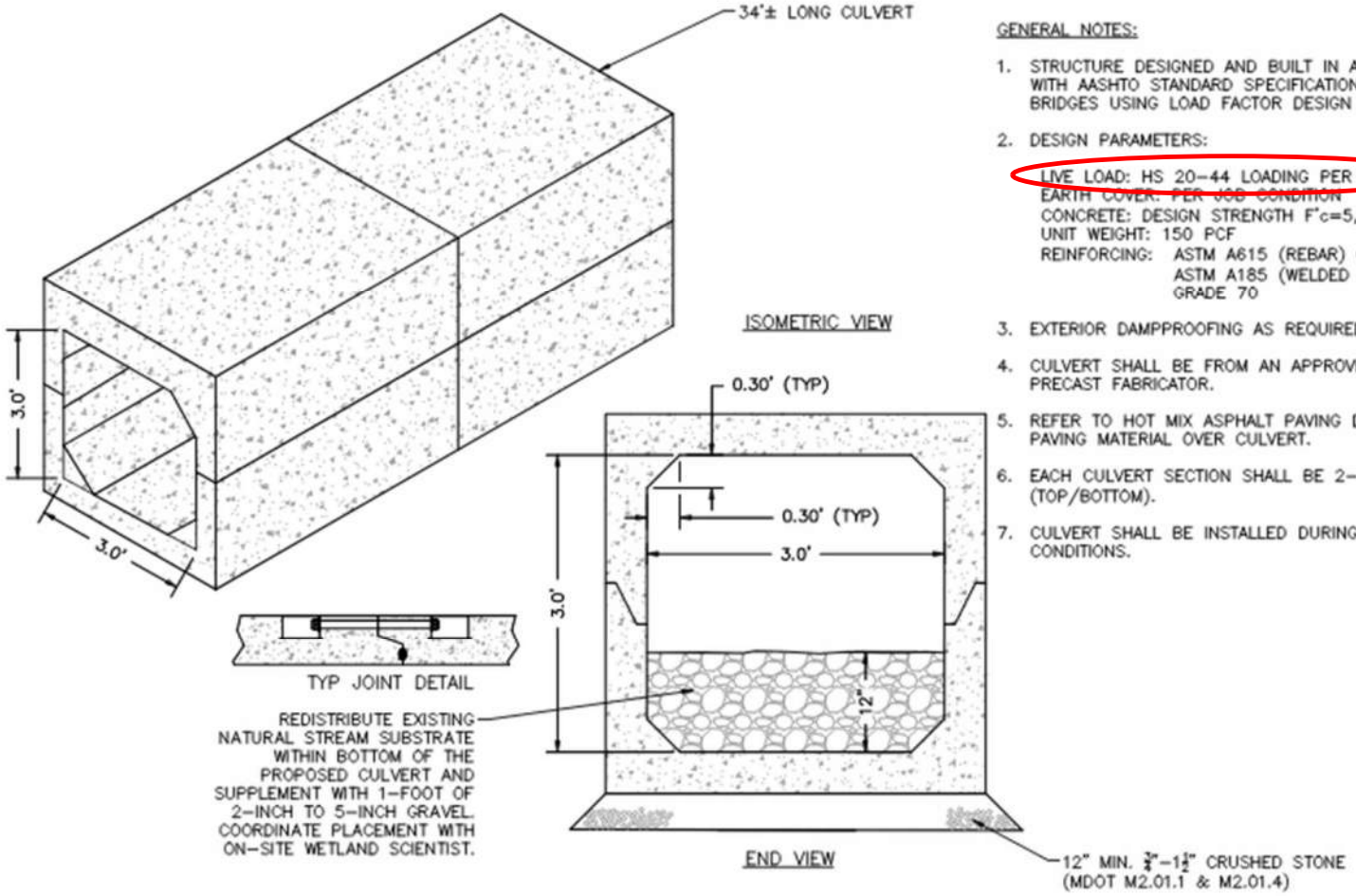
Exceeds 40-ton limit!

Exceeds 8,000 lbs per wheel per H-20 rating!



GENERAL NOTES:

1. STRUCTURE DESIGNED AND BUILT IN ACCORDANCE WITH AASHTO STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES USING LOAD FACTOR DESIGN METHODOLOGY.
2. DESIGN PARAMETERS:
   LIVE LOAD: HS 20-44 LOADING PER AASHTO
   EARTH COVER: PER JOB CONDITION
   CONCRETE: DESIGN STRENGTH F'c=5,000 PSI
   UNIT WEIGHT: 150 PCF
   REINFORCING: ASTM A615 (REBAR) GRADE 60
   ASTM A185 (WELDED WIRE FABRIC) GRADE 70
3. EXTERIOR DAMPPROOFING AS REQUIRED.
4. CULVERT SHALL BE FROM AN APPROVED MASSDOT PRECAST FABRICATOR.
5. REFER TO HOT MIX ASPHALT PAVING DETAIL FOR PAVING MATERIAL OVER CULVERT.
6. EACH CULVERT SECTION SHALL BE 2-PIECE (TOP/BOTTOM).
7. CULVERT SHALL BE INSTALLED DURING DRY CONDITIONS.

PRECAST CONCRETE BOX CULVERT DETAIL

NOT TO SCALE

Imposed Loads - Trucks

Imposed Loads - Aerials

- Jacks / outriggers / stabilizers will take the entire weight of the truck
- Up to 75 psi ground loading is permitted per NFPA 1901
- Realistic - up to 40,000 lbs on a 12” x 12” pad (278 psi!)

Imposed Loads - Aerials

Basic Requirements – Road Surfaces

- Usually bituminous asphalt or Portland concrete
- Gravel *might* be acceptable
- Geogrid (max 200 tons / m^2 – that's 284 psi)
- Permeable pavers
- Any permeable pavers require approval by the FD and need to be marked with approved marking

Road Surface - Gravel

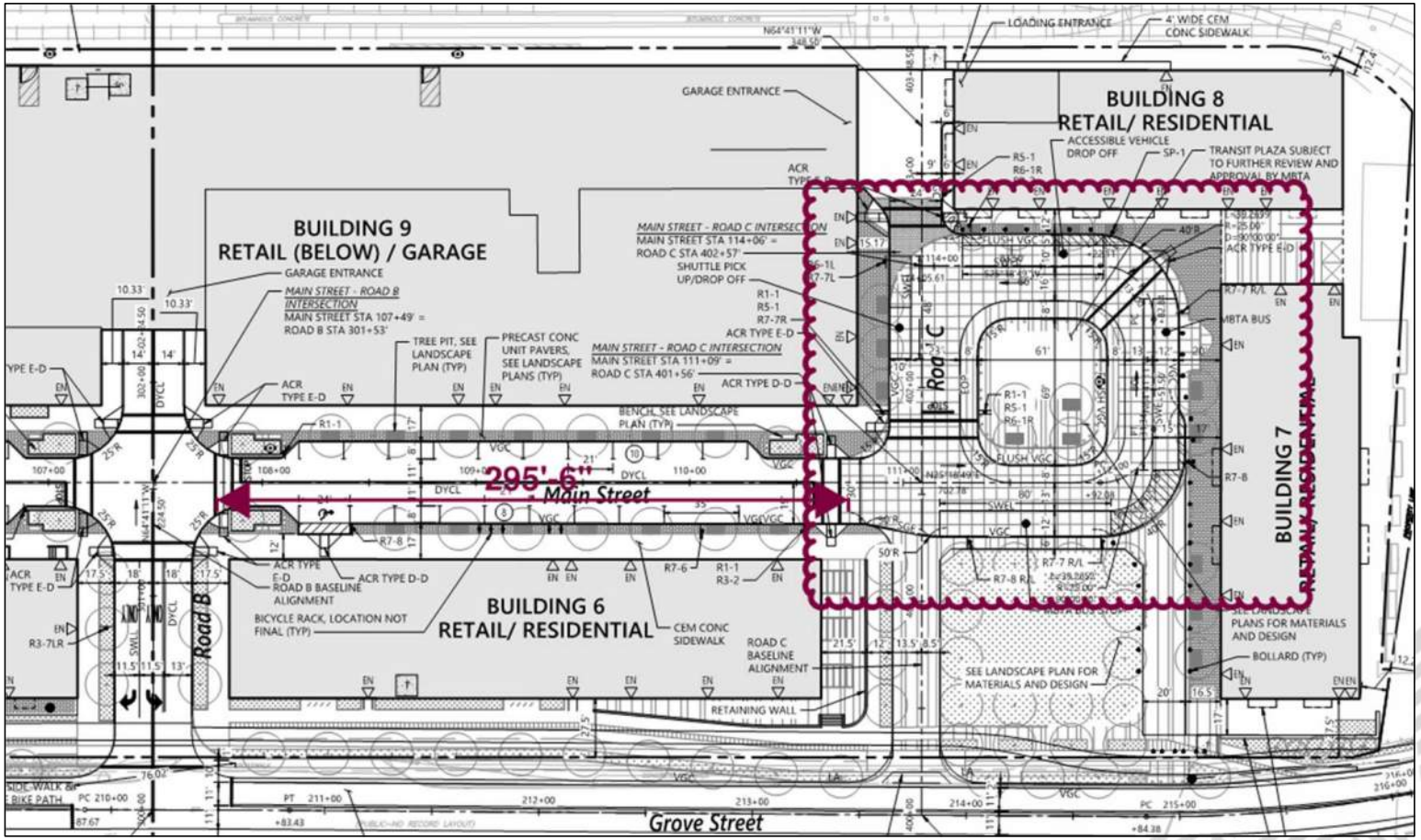
Road Surface - Dirt

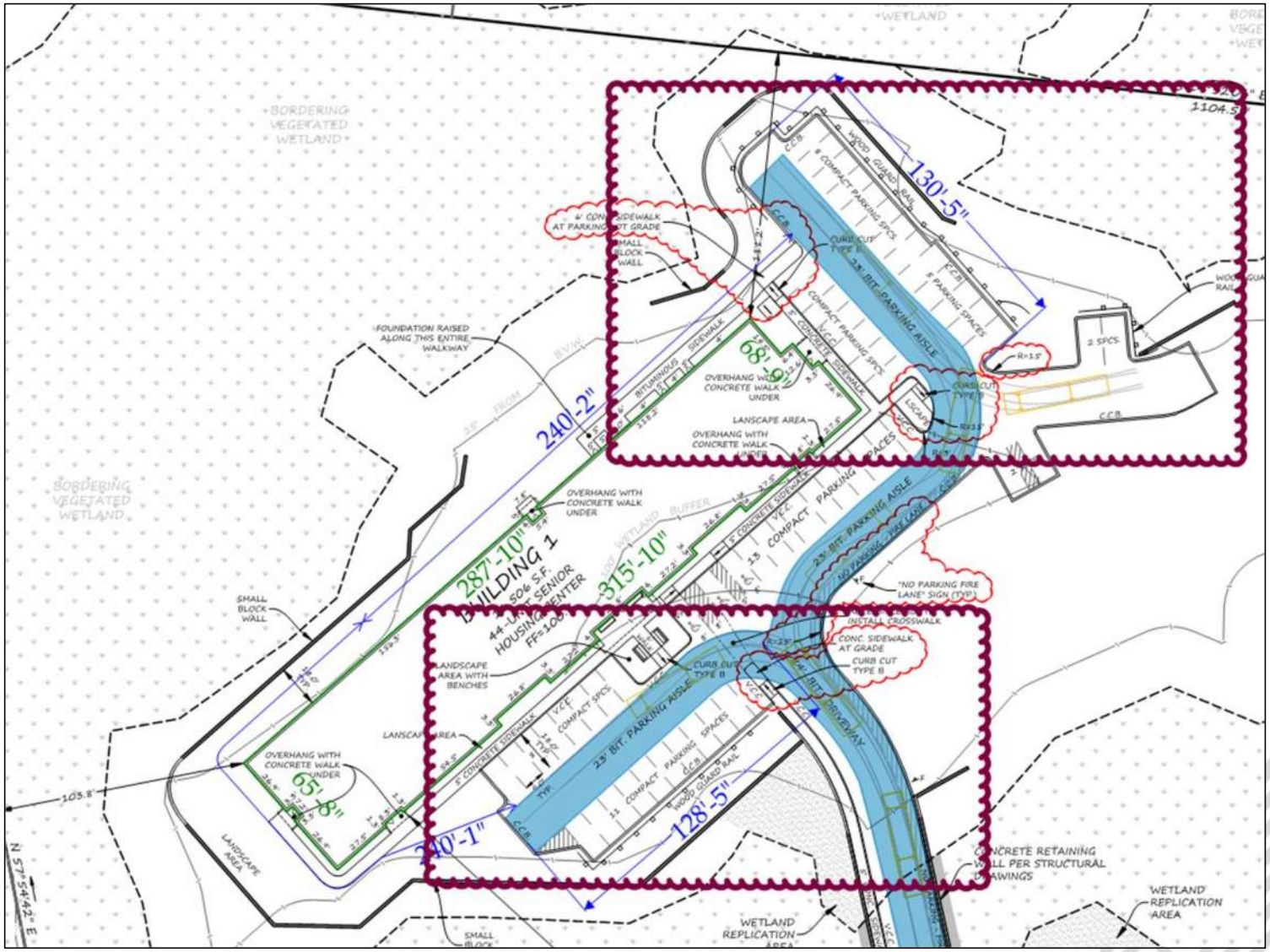
Photo: Monmouth, ME Fire Dept

Dead Ends

- Dead end access roads over 150’ in length require **approved** turn-around space for the apparatus – 527 CMR 18.2.3.4.4
- Turnarounds can be:
  - Looped roadway
  - Cul-de-sac
  - “T”, “L”,”K” or “hammerhead” for a truck to back into*
- Dead end distance gets reset at a turnaround
- Any turnaround that trucks need to back up to use require fire department approval

Basic Requirements – Dead Ends

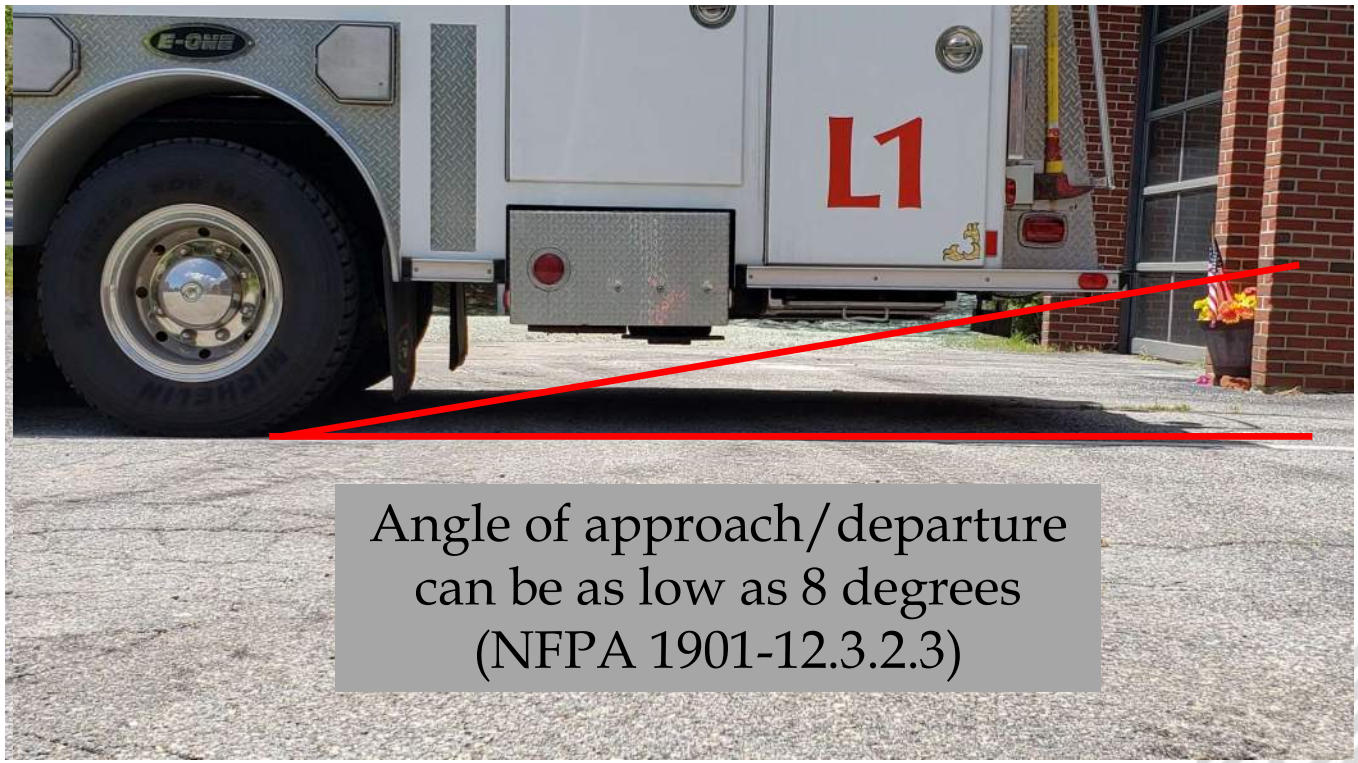




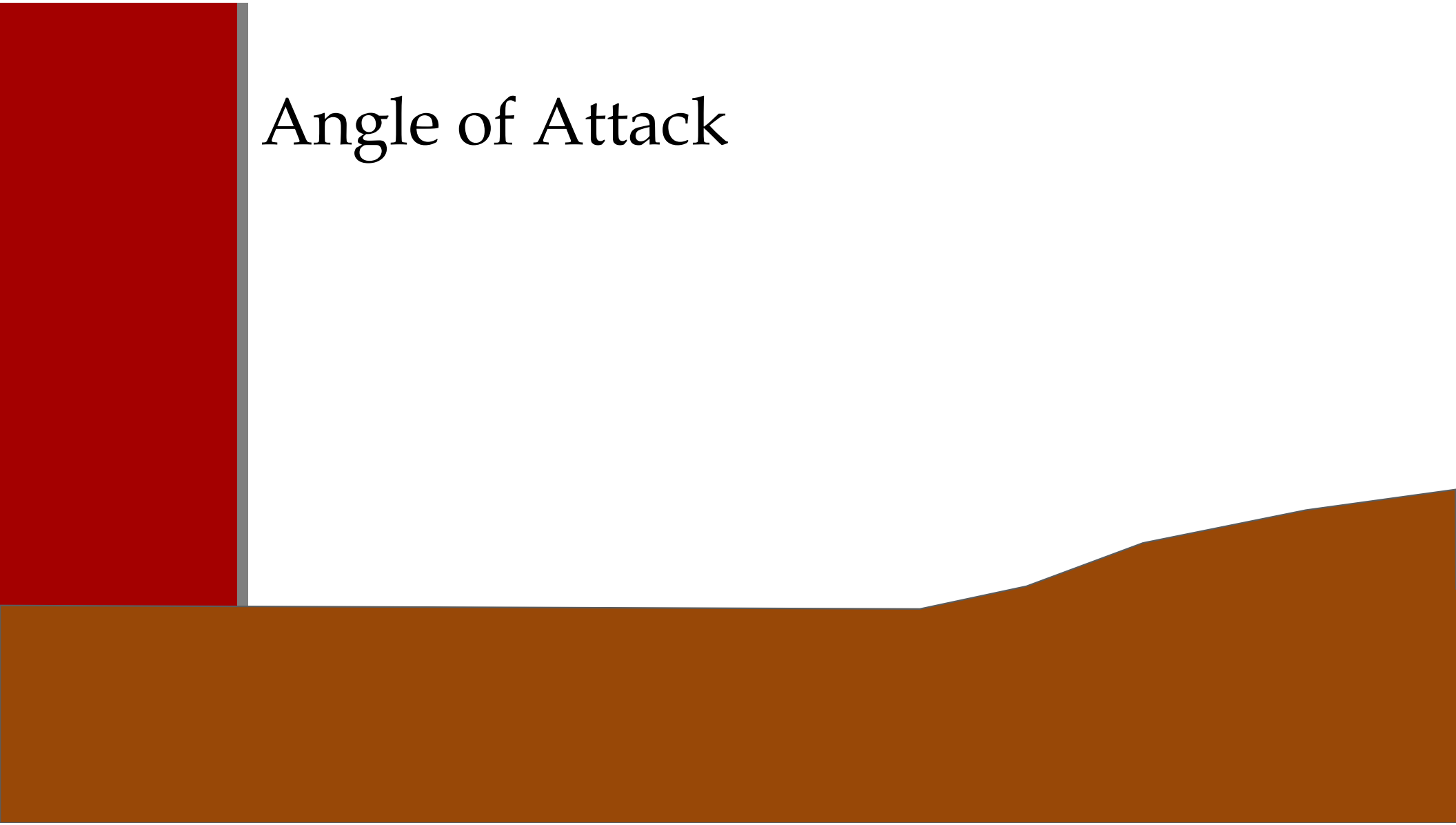
Grade

- Grade cannot exceed 10% unless approved in writing by AHJ – 527 CMR 18.2.3.4.6.1
- Angles of approach and departure for access roads – cannot exceed 1’ drop in 20’ or as established by the AHJ – 527 CMR 18.2.3.4.6.2
- Grade along the axis of the road
  - Driving up a hill
  - Driving down a hill
- Grade across the axis of the road
  - Steep banking or pitching of the road
  - Parking lots across slopes
- Grade of any paved areas near the building may be questioned
- Sudden or prominent grade changes are also a problem

Grade Changes



Angle of Attack



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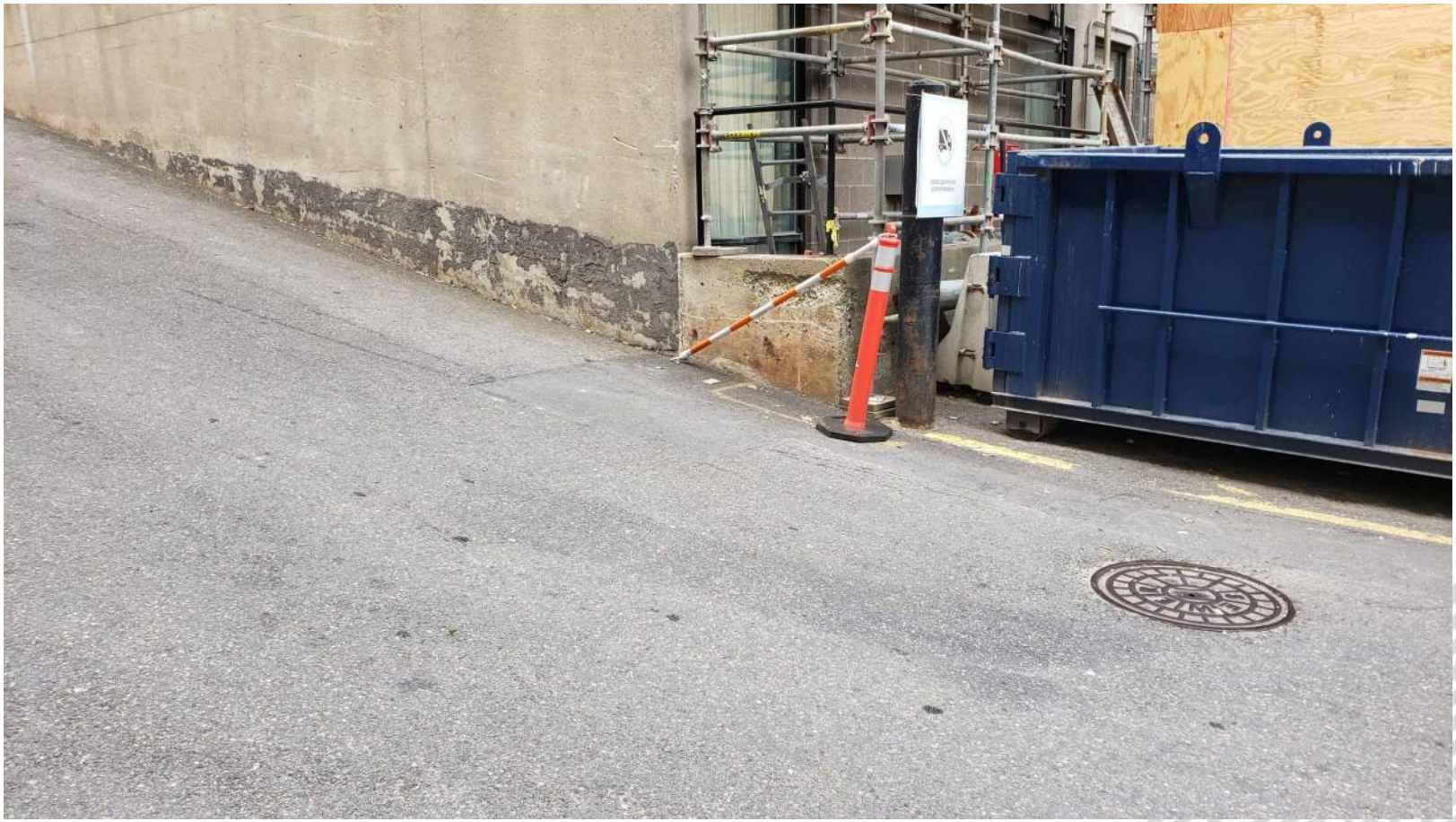
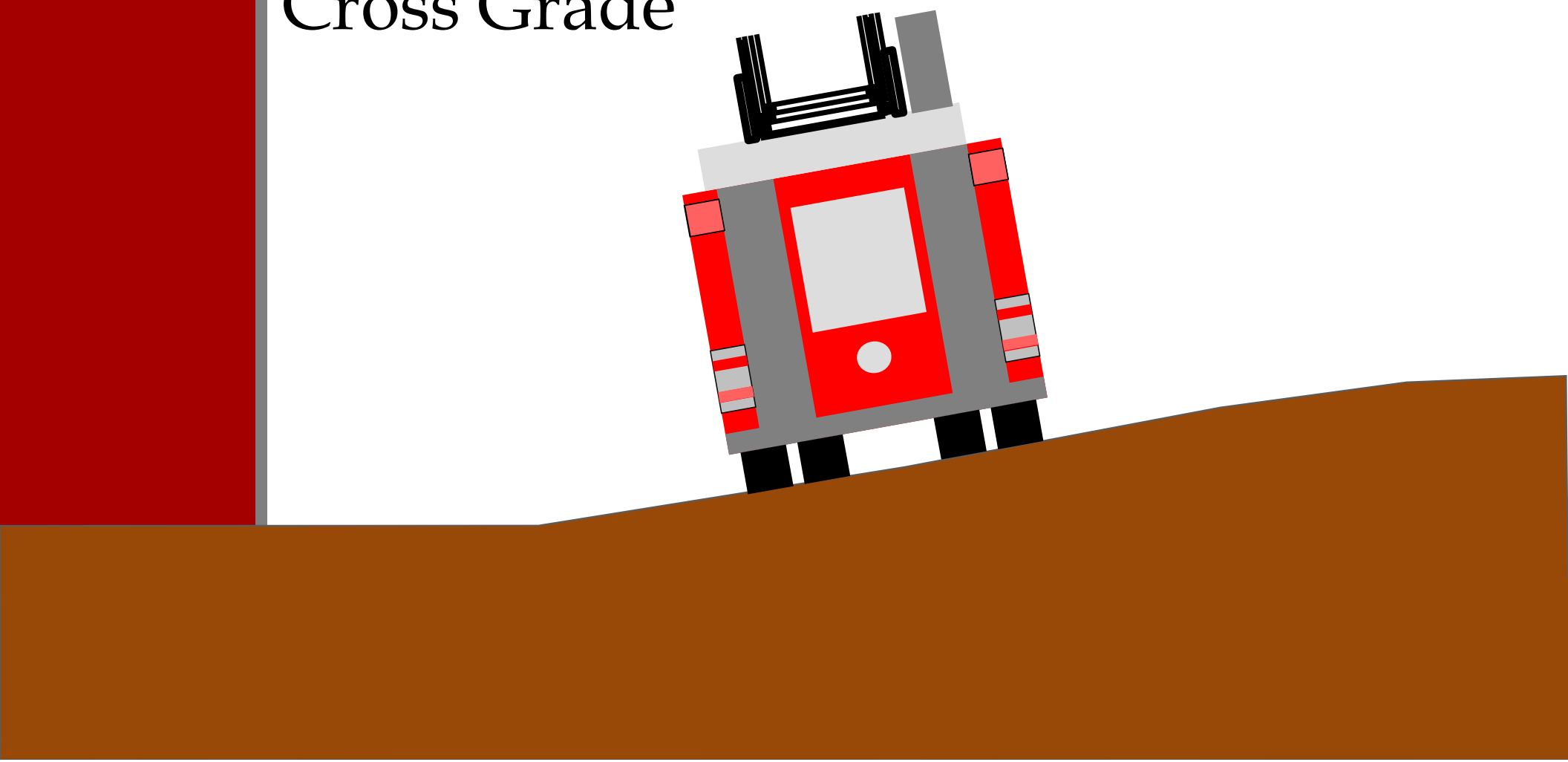
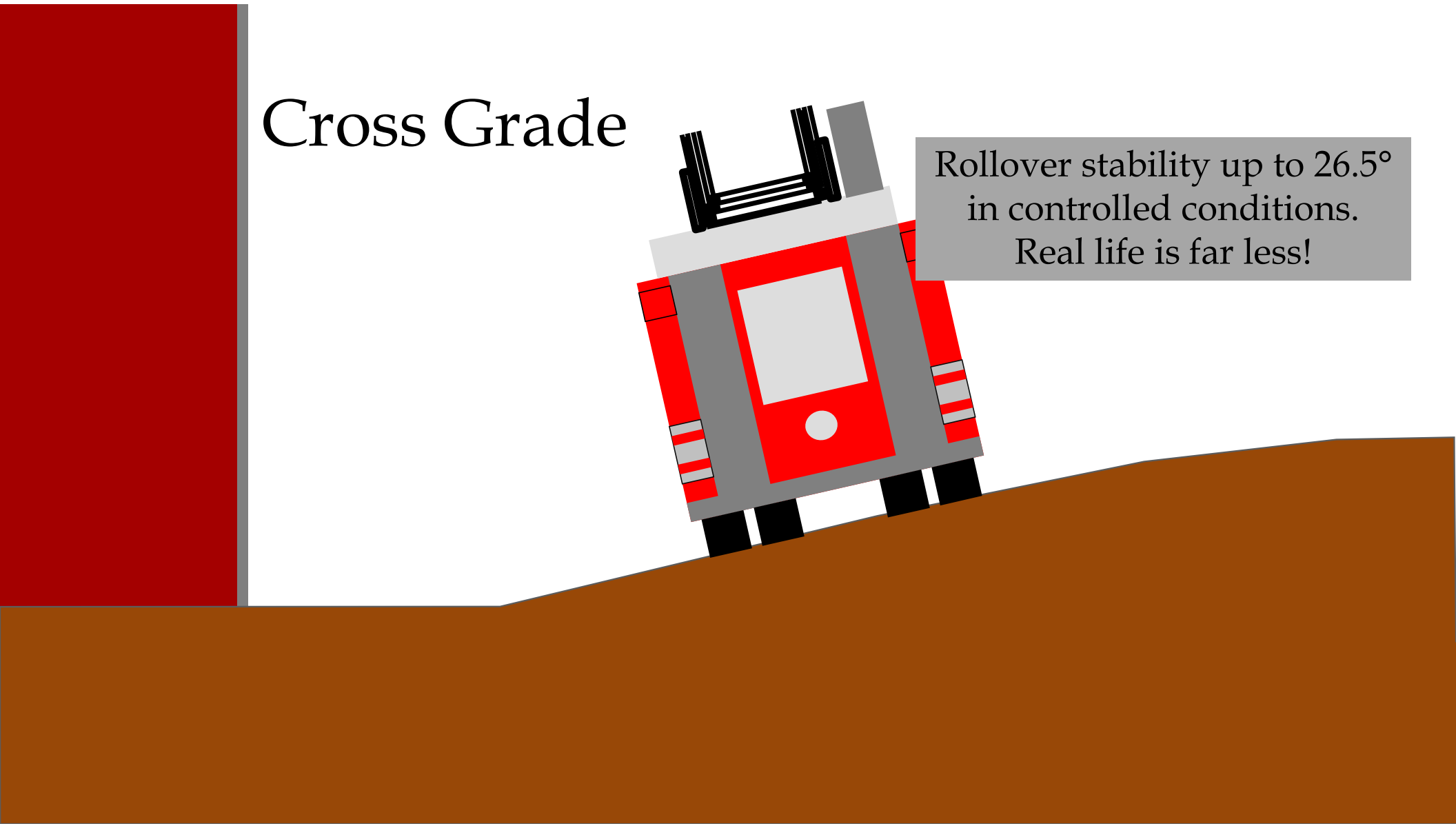


Cross Grade



Cross Grade



Rollover stability up to 26.5°
in controlled conditions.
Real life is far less!

Cross Grade

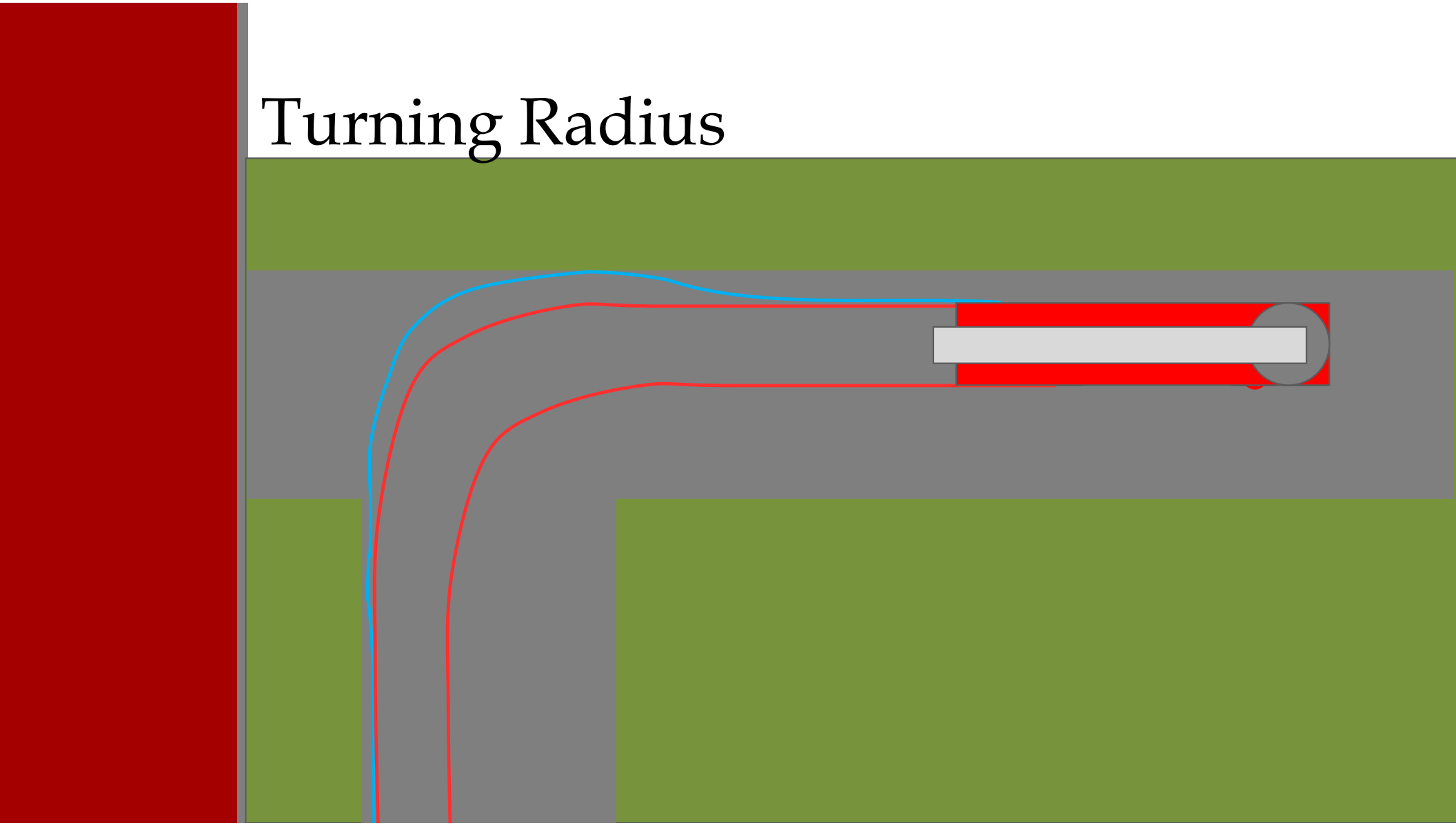
Turning Radius

- The minimum inner turning radius is required to be *at least* 25′ – 527 CMR 18.2.3.4.3.1.
  - This can be extended by the AHJ if their apparatus won't fit.
- The outer turning radius is required to be *at least* 45′ (20′ road + 25′ inner radius).
- A swept path analysis must be conducted – 527 CMR 18.1.1.4.
- Does the 25′ inner radius mean that a 10′ radius cannot be constructed?

Turning Radius

Turning Radius

Turning Radius



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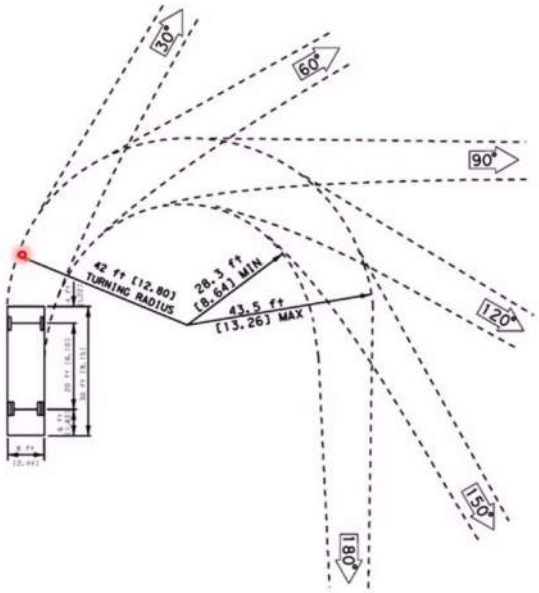
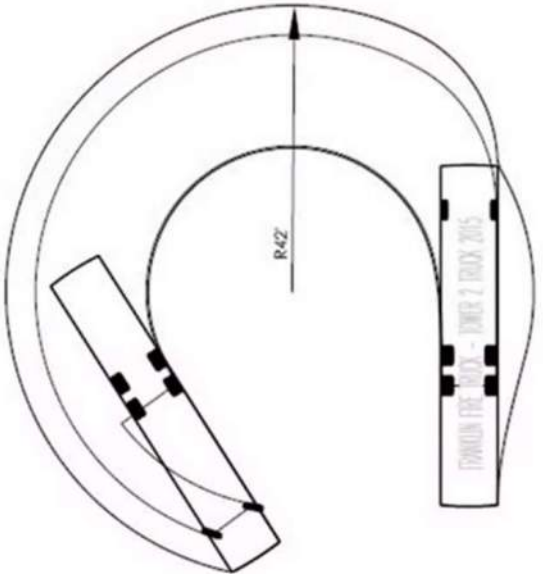
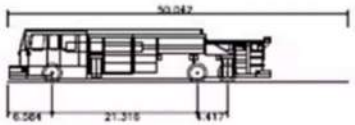


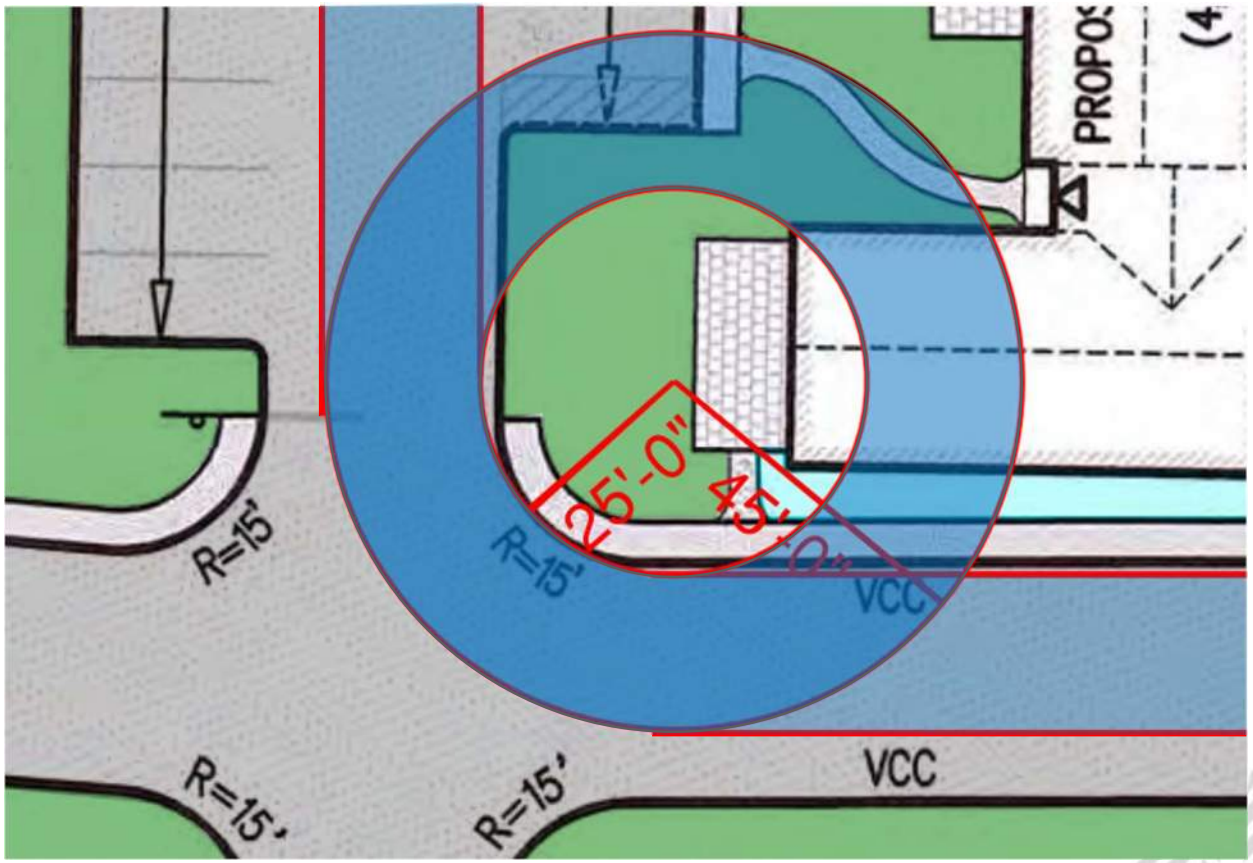


AUTOTURN INFORMATION - SUTPEHN CORPORATION HS-3661
NUMBER OF FRONT AXLES = 1
FRONT TRACK WIDTH = 8' [96"]
WHEELS ON EACH FRONT AXLE = 2
NUMBER OF REAR AXLES = 2
REAR TRACK WIDTH = 8' [96"]
WHEELS ON EACH REAR AXLE = 4
WHEELBASE = 21.3159'
REAR AXLE SPACING = 4.4167'
BODY LENGTH = 50.0417'
WIDTH = 8.3333' [100"]
REAR OVERHANG = 22.1424'
BODY STYLE = FIRE TRUCK
TURNING RADIUS WALL TO WALL = 42'

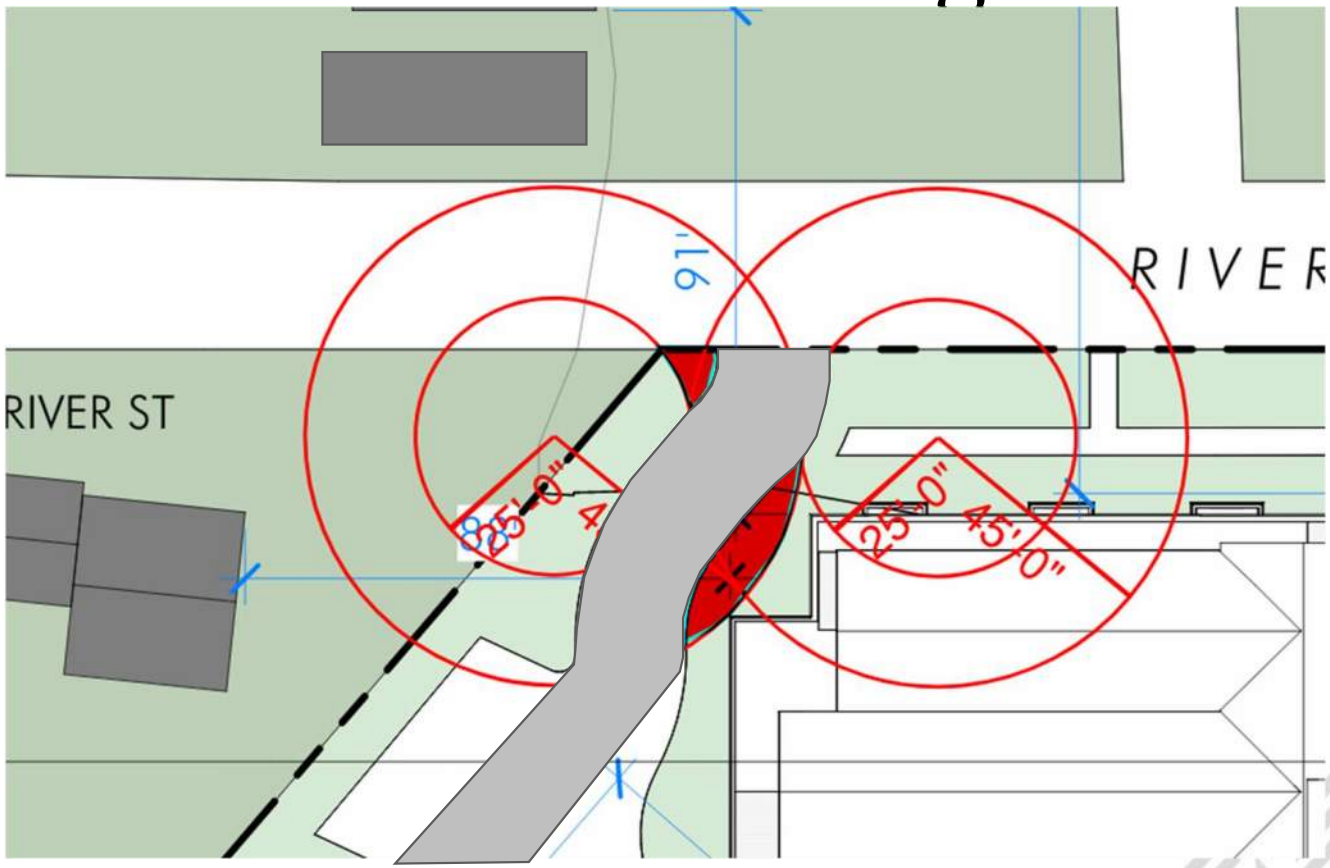


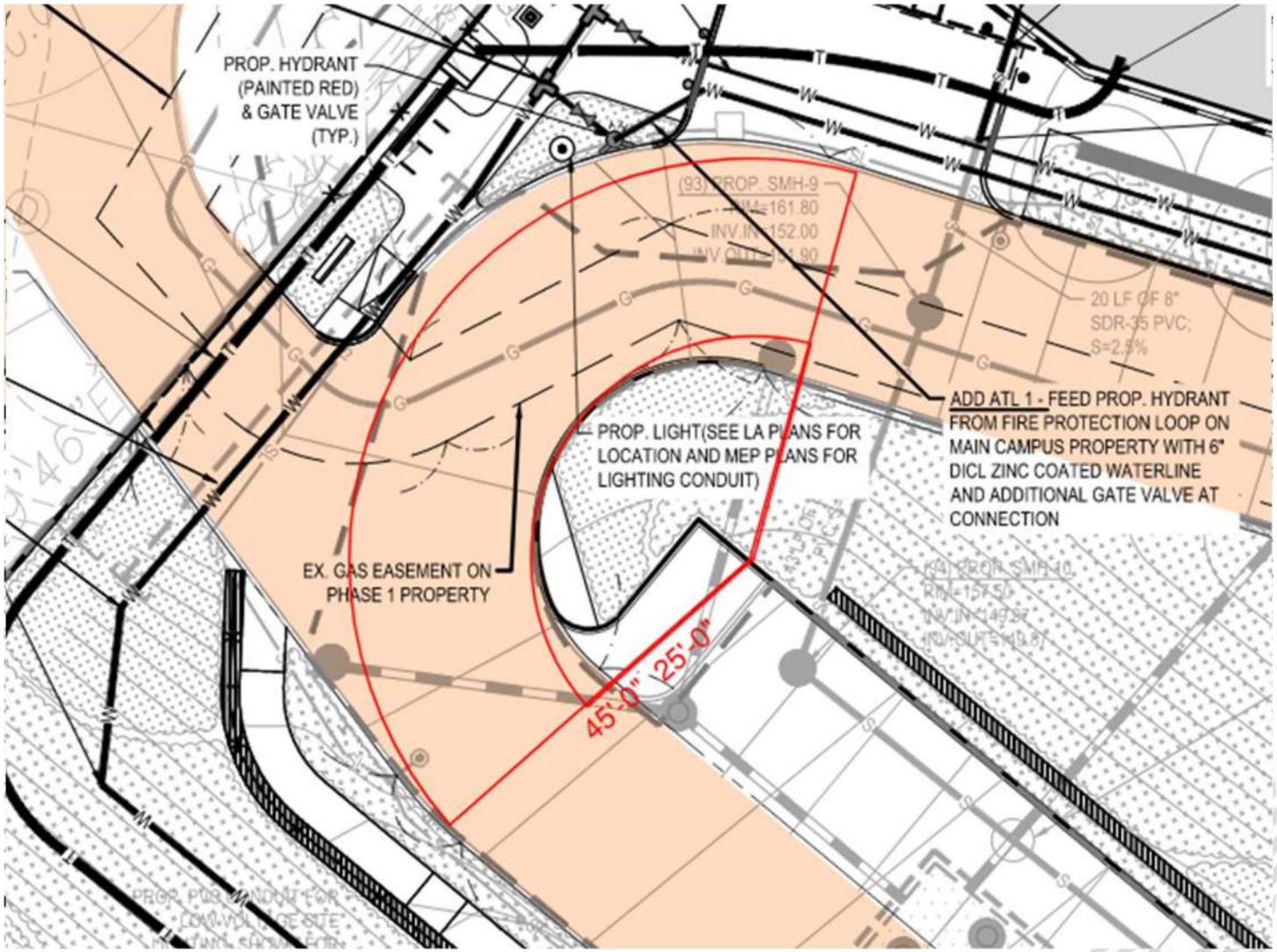
FRANKLIN FIRE TRUCK – TOWER 2 TRUCK 2015	
Overall Length	50.042ft
Overall Width	8.333ft
Overall Body Height	7.715ft
Min Body Ground Clearance	0.627ft
Track Width	8.000ft
Lock-to-lock time	6.00s
Wall to Wall Turning Radius	42.000ft

How to Measure Turning Radius



How to Measure Turning Radius





Traffic Calming Devices

- Speed bumps
- Speed humps
- Speed tables
- S-curves
- Roundabouts

- Make sure the fire department is on board with any traffic calming devices that are planned!

Traffic Calming Devices

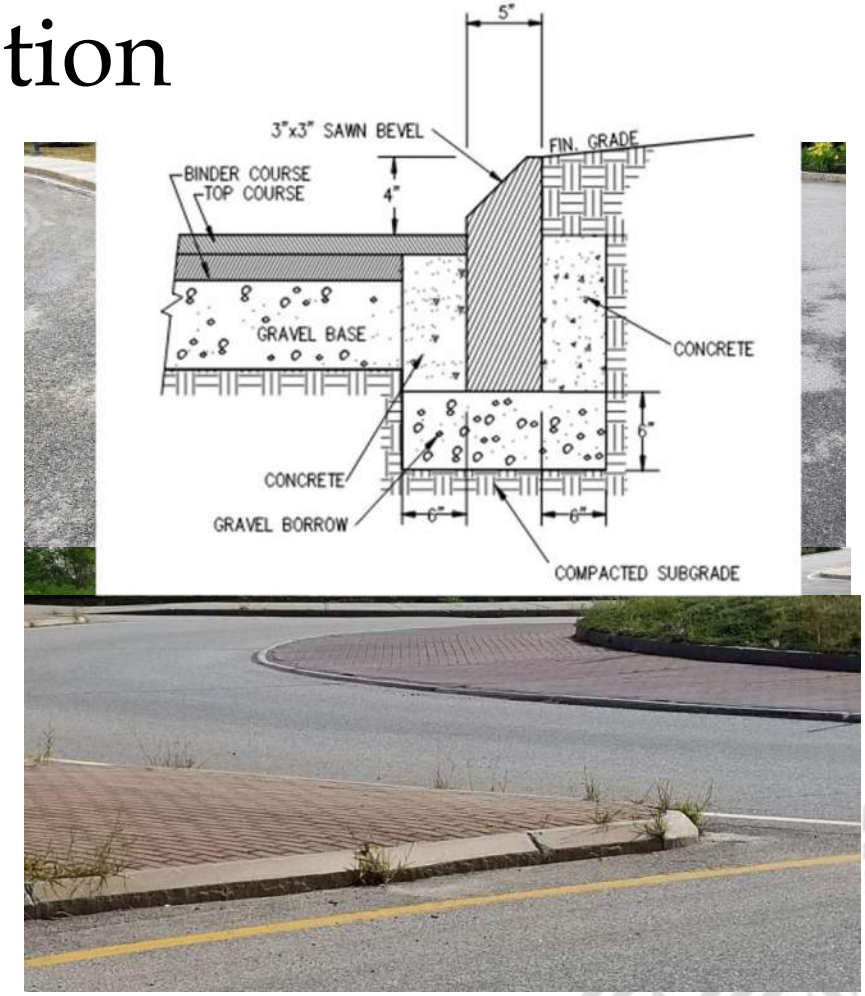
Curb Cuts

Access roads connecting to roadways are required to have curb cuts extending 2’ beyond each edge or more of the fire lane – 527 CMR 18.2.3.4.6.3

Curb Cut Mitigation

All subject to AHJ approval:

- "Cape Cod" style curbs
- No curb, but use brick/pavers to delineate road edge
- Mitered / chamfered granite curbing



Road Surfaces - Maintenance

Whatever the road material, it needs to be maintained in usable condition.

Basic Requirements

Approved Signs – NO PARKING – FIRE LANE where required by AHJ – 527 CMR 18.2.3.5

Proximity to the Building

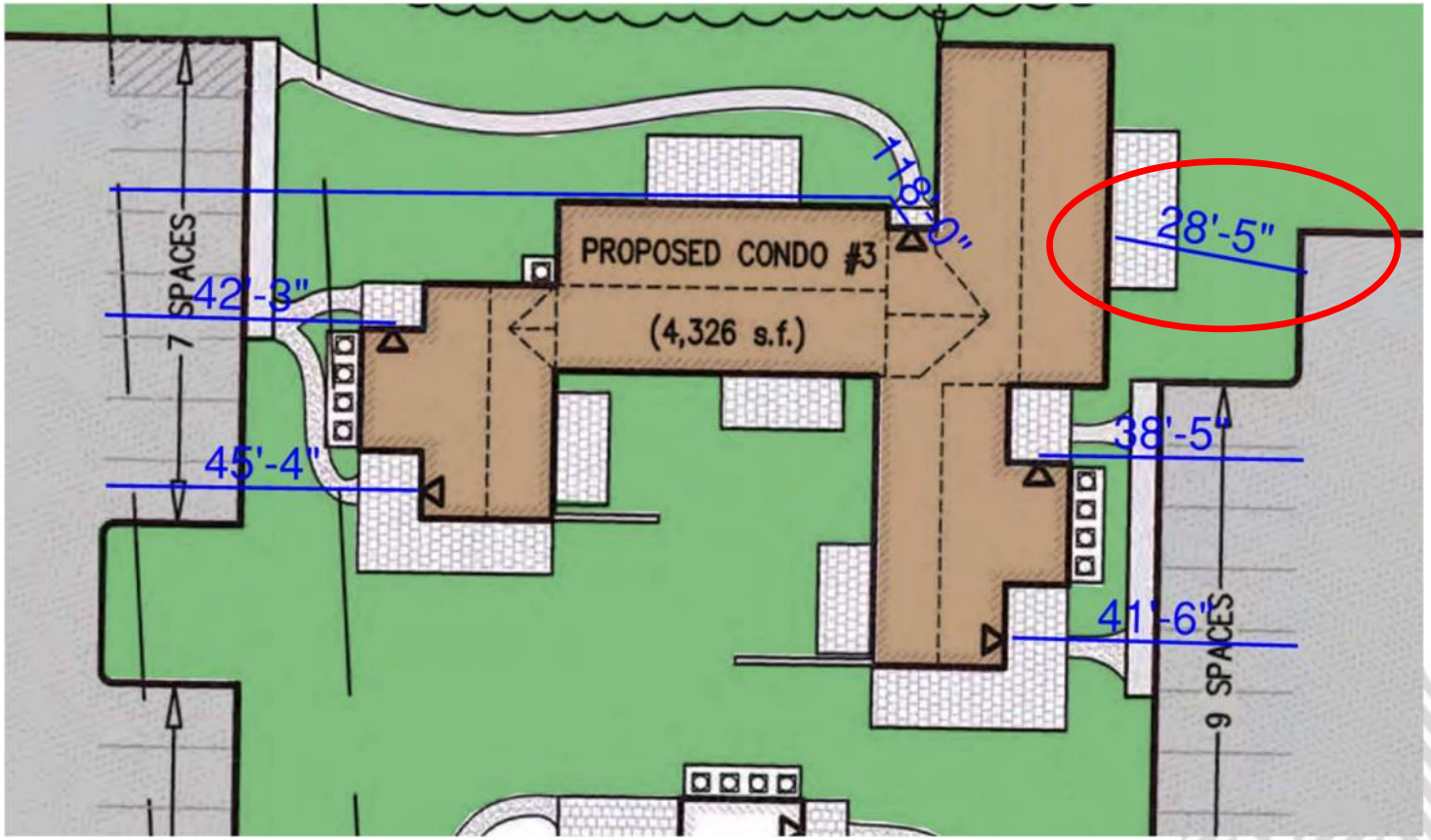
The 50′ Rule

The 150/250′ Rule

Access Road Proximity – 50′ Rule

- An access road is required to extend to within 50′ of one exterior door that can be opened from the outside and that provides access to the interior of the buildings – 527 CMR 18.2.3.2.1
- This is decreased to 25′ where a new building doesn't have adequate frontage and is located behind an existing building that does have frontage.

50′ Rule

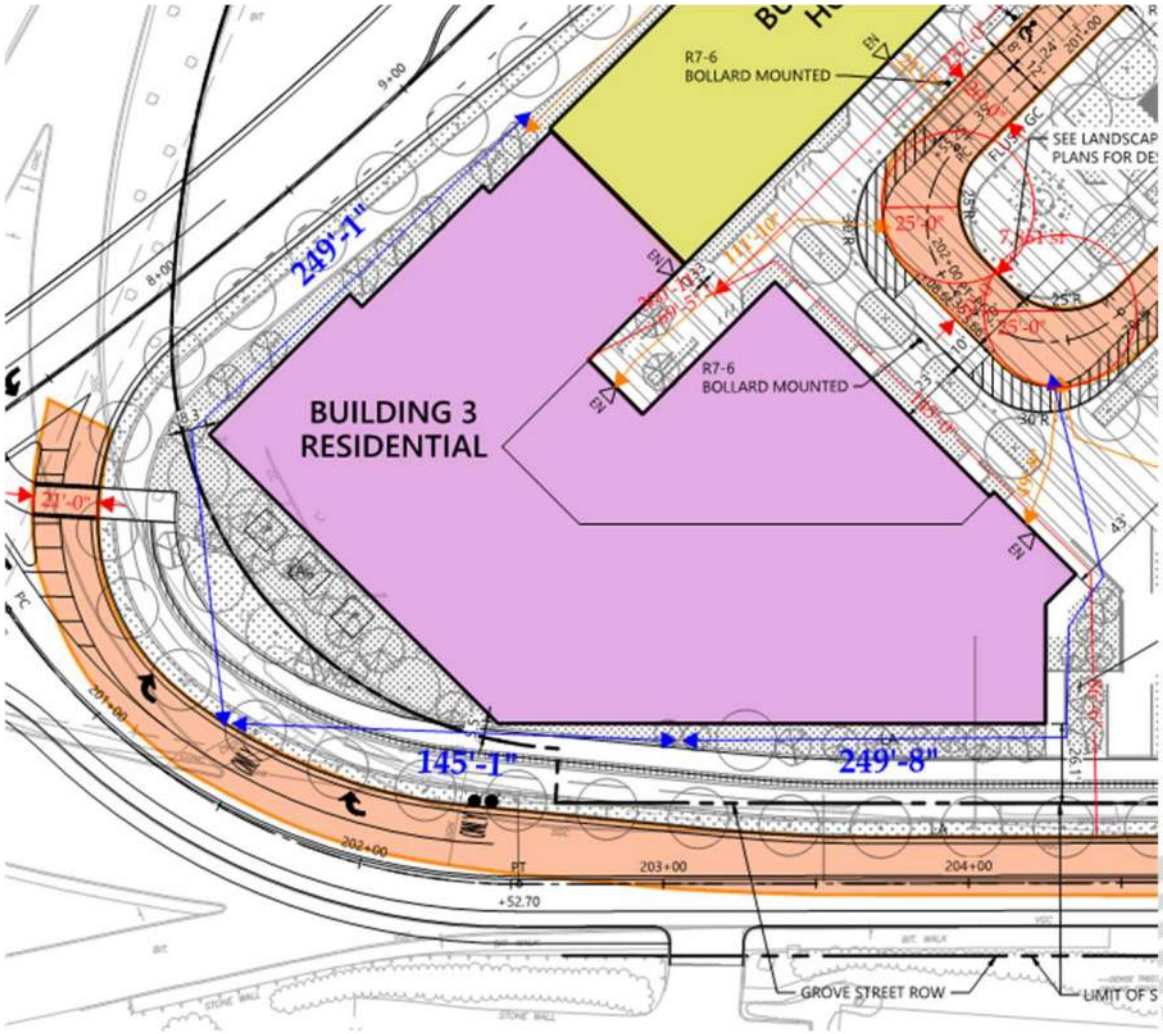


Basic Requirements – 150/250′ Rule

- Access roads must be provided so all portions of the exterior wall are within 150′ of the access road as measured by an approved route around the exterior of the building (527 CMR 18.2.3.2.2.1)
- This is to allow fire hoses to go around the building
- Extended to 250′ if the building has an NFPA 13 sprinkler system (Mass amendment – base code is 450′)
- NFPA 13D and NFPA 13R systems do not get the extended distance (Mass amendment)


9-111
STOP

FD Access required to all portions of the first floor exterior within 250’



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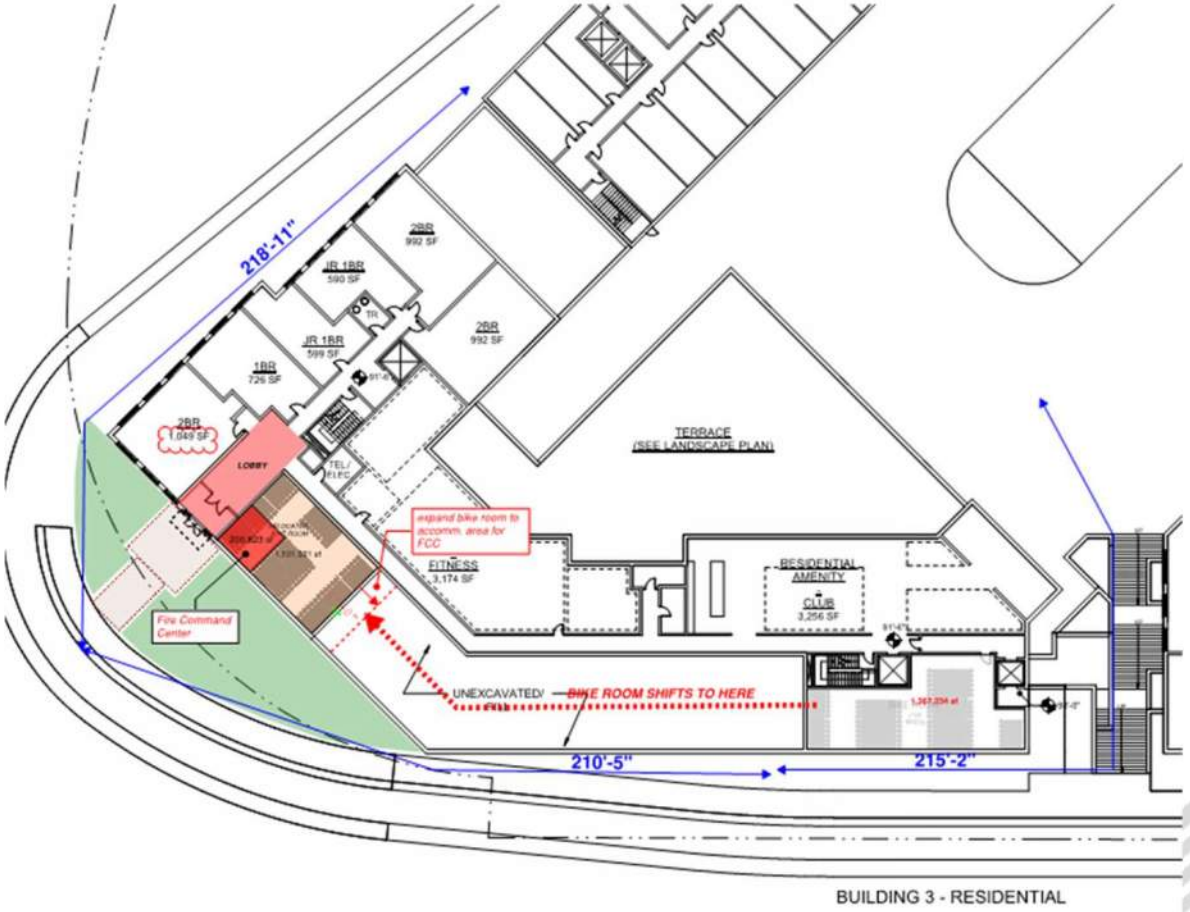
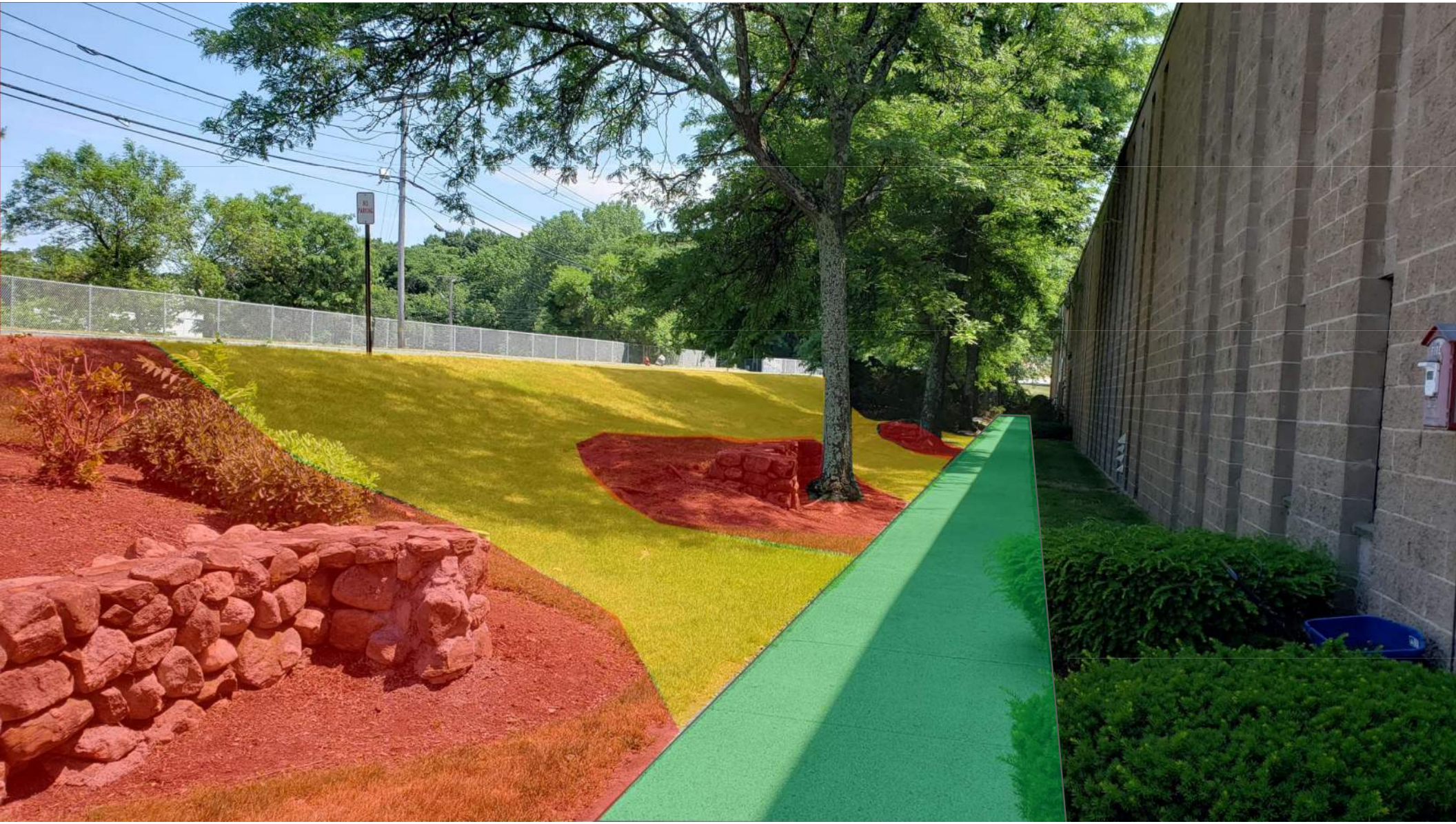
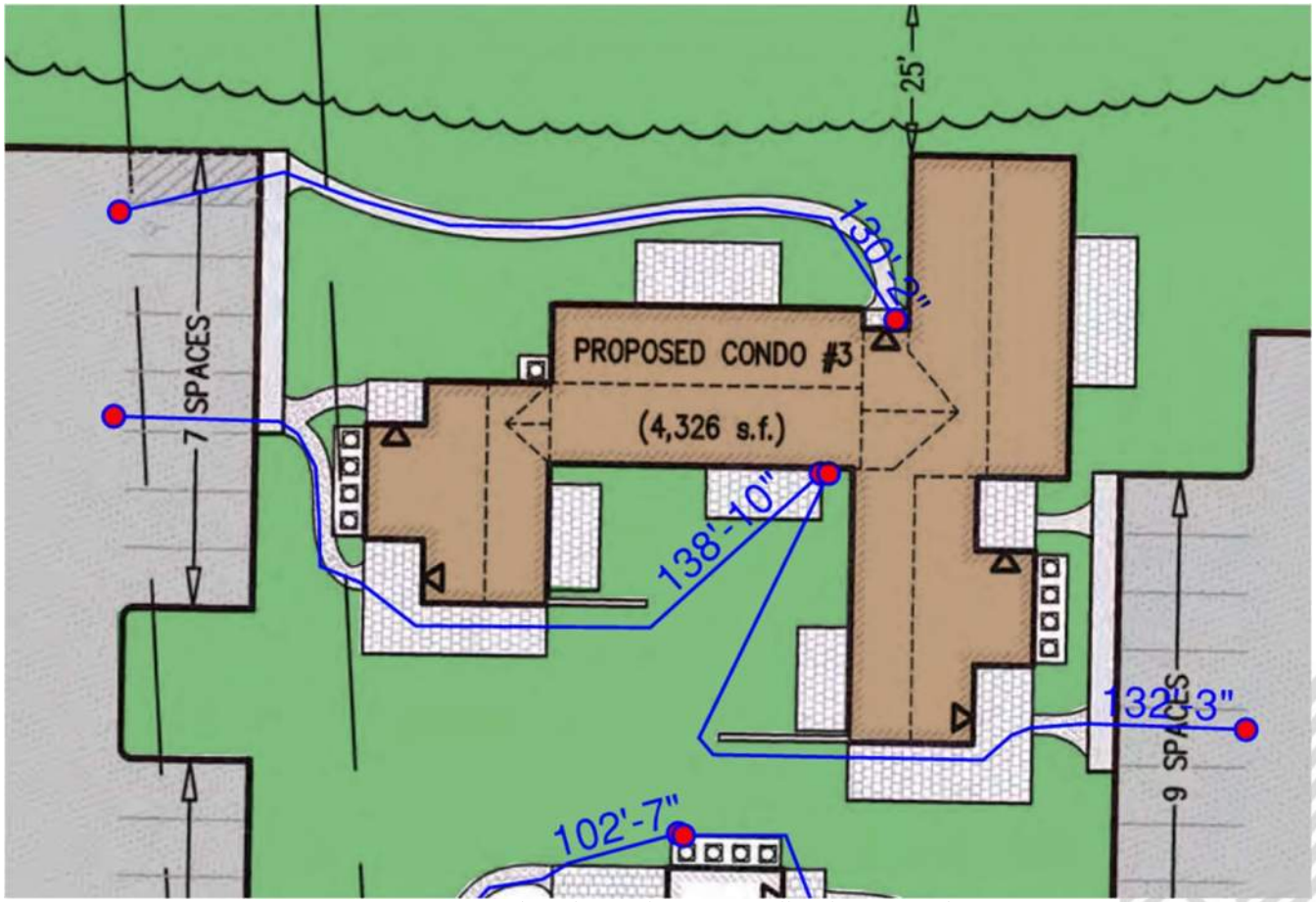


Measuring Exterior Access

- A straight line is rarely possible!
  - Do not cross fences or guardrails (gates or openings may be ok, though)
  - Do not cross retaining walls of any height
  - Avoid steep hills of any kind (what is steep?)
  - Do not cross through planters
  - Do not go over benches
  - Go around rocks, shrubs, or other obstructions
- Grass may be acceptable (snow, mud)
- Improved walking paths are usually good
- How wide does the path need to be?
  - What's the required exit width for the exit the path serves?
- What constitutes "improved"?



Measuring Exterior Access



Exterior Access Mitigation

- If you can't meet the 150' distance:
  - Install an NFPA 13 sprinkler system
- If you can't meet the 250' distance:
  - Confirm the building has an NFPA 13 sprinkler system
  - Provide Class I standpipe hose stations at all exterior entrances*
  - Provide an FDC at strategic locations where fire apparatus would likely park, as near as possible to the farthest FD access point*
- The 150/250 is to provide access for hoselines from a truck. Standpipes "move the truck" into the building

Other Considerations

- Bridges required to provide access
- Overhangs/cantilevered buildings
- Traffic / parking
- Terrain
- Elevation changes around building

Bridges

Bridges

Bridges

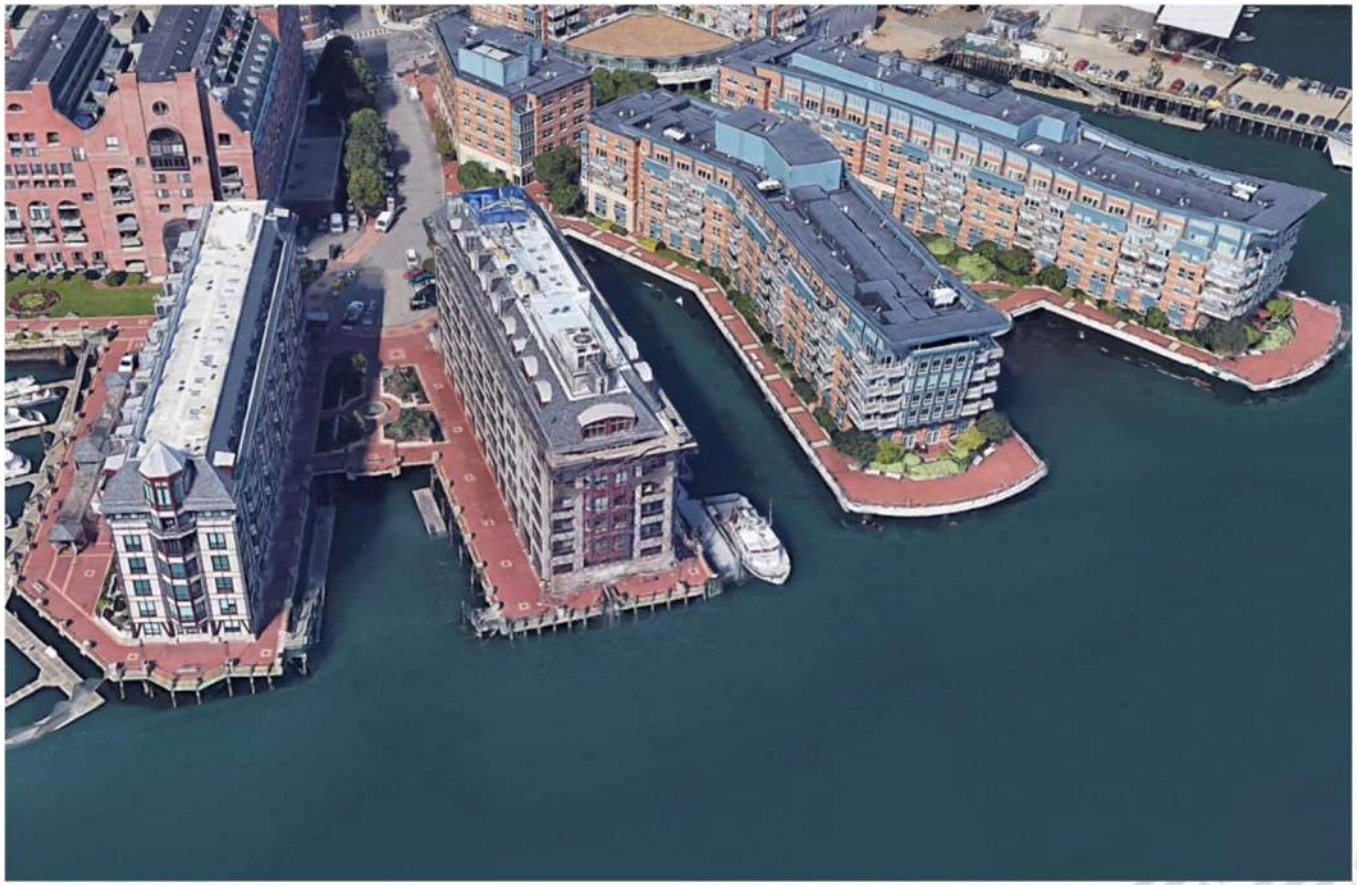
Cantilevers & Overhangs

Wiki Commons, © Tim Pierce

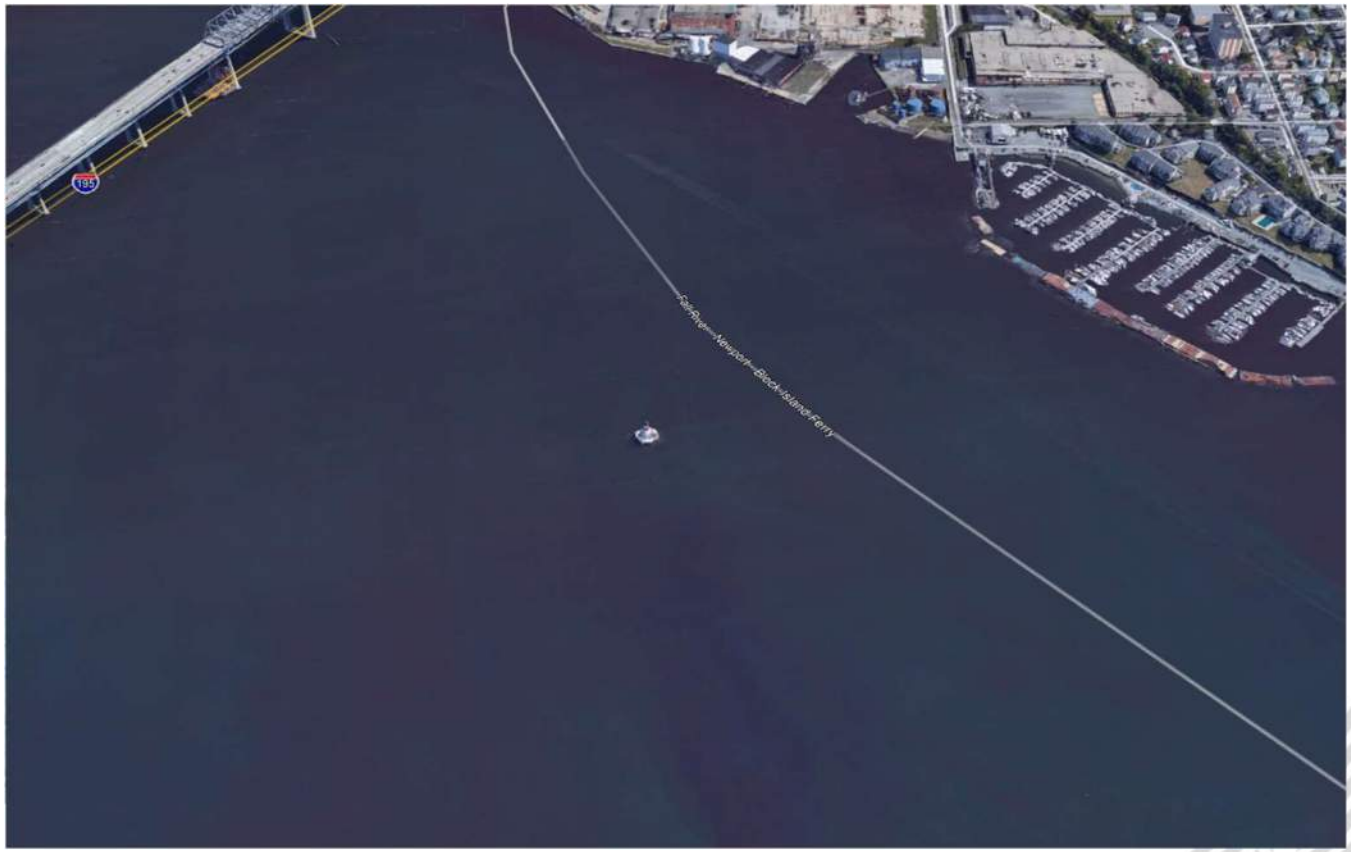
- Anything with building over it = bad
- Do not expect AHJ approval for vehicles under overhangs, cantilevers, porte cocheres, etc
- 50/50 chance for on-foot 150/250 access

Terrain – Elevation Changes

Terrain - Water



Terrain - Water

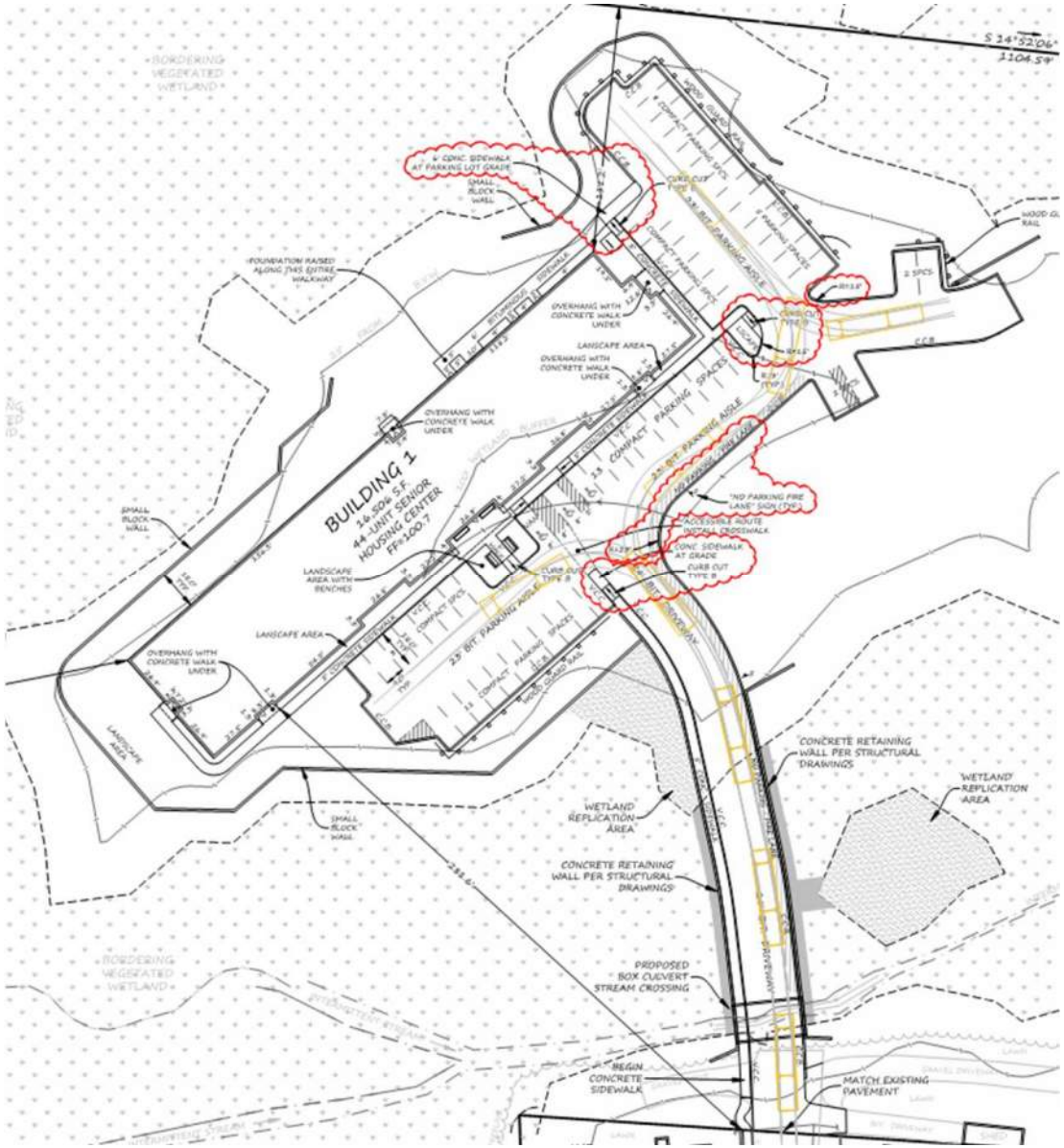


Local Complications

- Each community has its own tolerance for FD access
- Bigger cities (Boston, Cambridge, New Bedford, etc.)
  - Usually ok with narrow alleys, tall buildings
  - Not ok with long distances to hydrants or FDCs
- Smaller towns (< 30,000 pop)
  - Not ok with alleys
  - Wants separation between buildings
  - Wants wide roads
  - May demand items not in MGL/780/527
- Local opposition may be reflected in the fire department – the vague "approved" term in FDA requirements
  - Last minute changes to previously approved plans
  - Moving goalposts
  - Requests/demands for things not in MGL/780/527 (aerial access, collapse zones, roadway around building)

Case Study 1

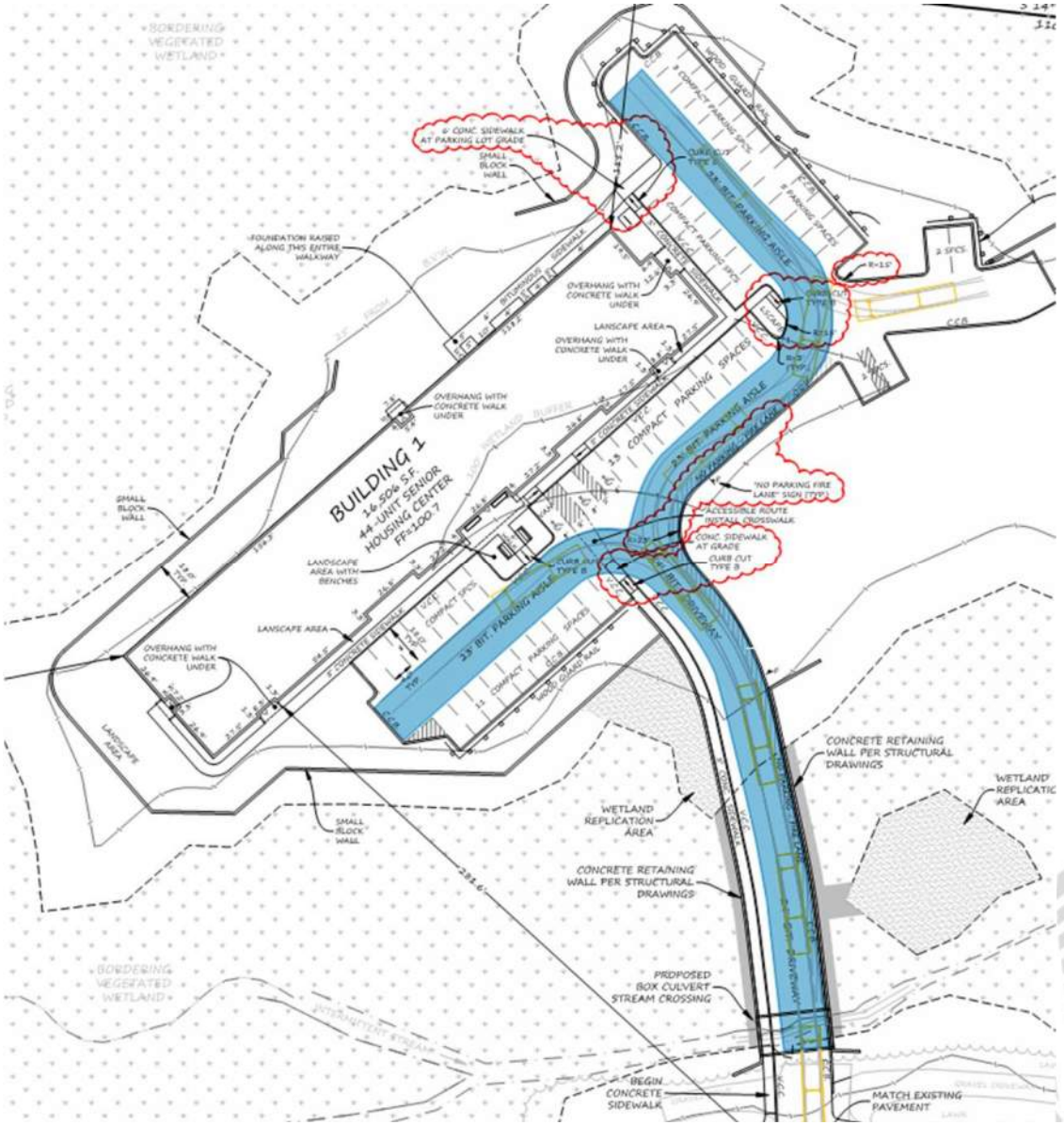
- Proposed new residential building
- Wetlands surrounding the proposed site
  - Multi-year negotiations with Conservation Commission for approval – the site plan is set in stone
- No turning radius for apparatus
- FDA Road will not/cannot go around all sides of building
- Entry roadway crosses bridge


BUILDING 1
16,504 S.F.
44-UNIT SENIOR
HOUSING CENTER
FF=100.7
FOUNDATION RAISED ALONG THIS ENTIRE WALKWAY
OVERHANG WITH CONCRETE WALK UNDER
LANDSCAPE AREA
LANDSCAPE AREA WITH BENCHES
SMALL BLOCK WALL
CONCRETE RETAINING WALL PER STRUCTURAL DRAWINGS
WETLAND REPLICATION AREA
PROPOSED BOX CULVERT STREAM CROSSING
BEGIN CONCRETE SIDEWALK
MATCH EXISTING PAVEMENT
"NO PARKING FIRE LANE" SIGN (TYP.)
ACCESSIBLE ROUTE ACROSS DRIVEWAY
CONC. SIDEWALK AT GRADE
CURB CUT TYPE B
23' BIT. PARKING AISLE
COMPACT PARKING SPACES
BORDERING VEGETATED WETLAND
S 24°32'06" E
1104.54'

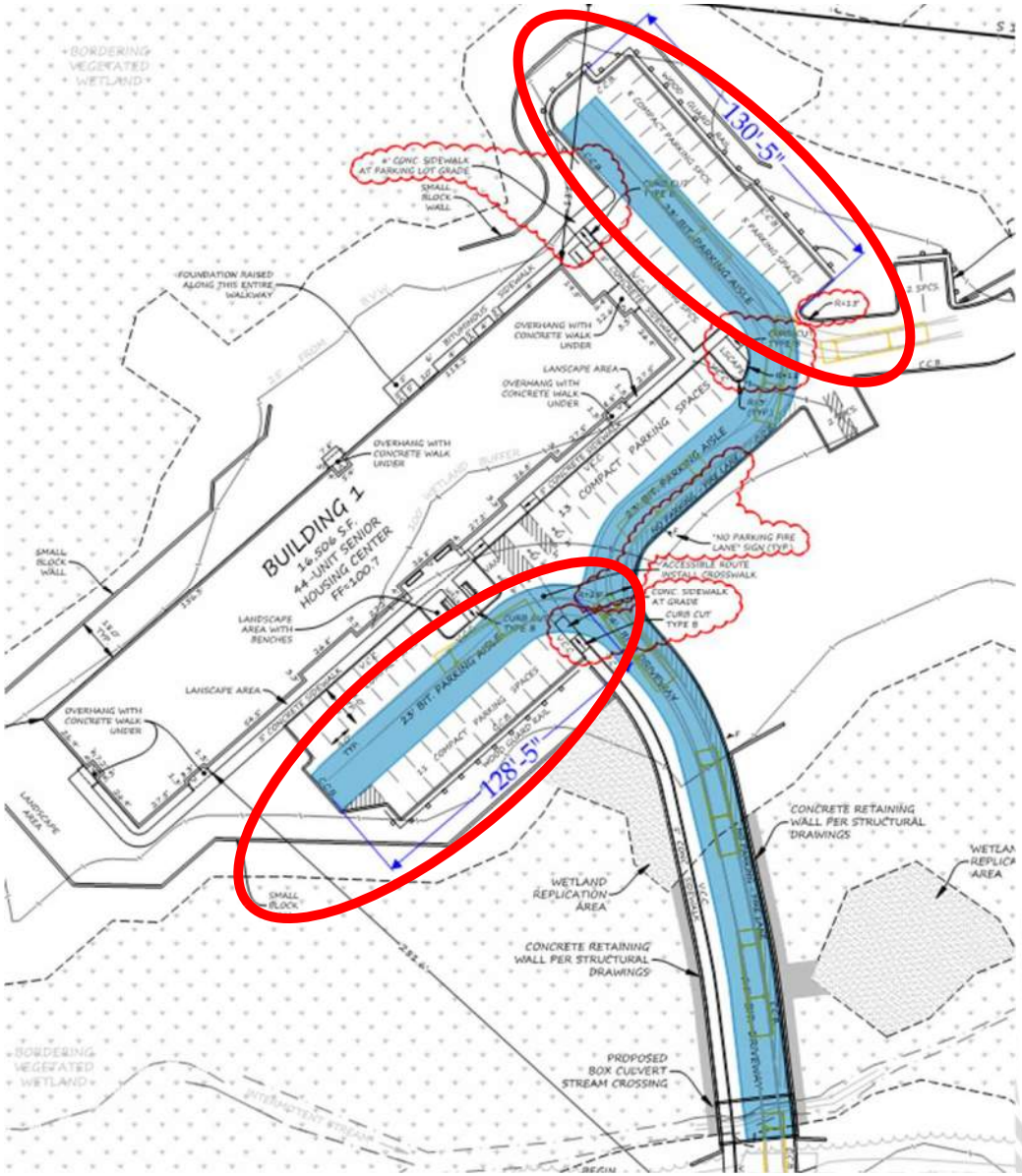
Case Study 1

- What kind of sprinklers?
  - Residential building, what kind would we normally see?
  - Make sure it's a full NFPA 13 system to gain the 250' allowance
- Site plan is fixed by Conservation
  - Can we move parking spaces?
  - Can we add pavement?
  - Can we use permeable pavers?
- Turning radius
  - Can we move roads?
  - Full-sized curbs on sidewalks at roadway edge?
  - Retaining wall at the edge of the road
- Use the full 250' to gain 500' of distance around the exterior of the building
- Make sure the bridge can support fire apparatus

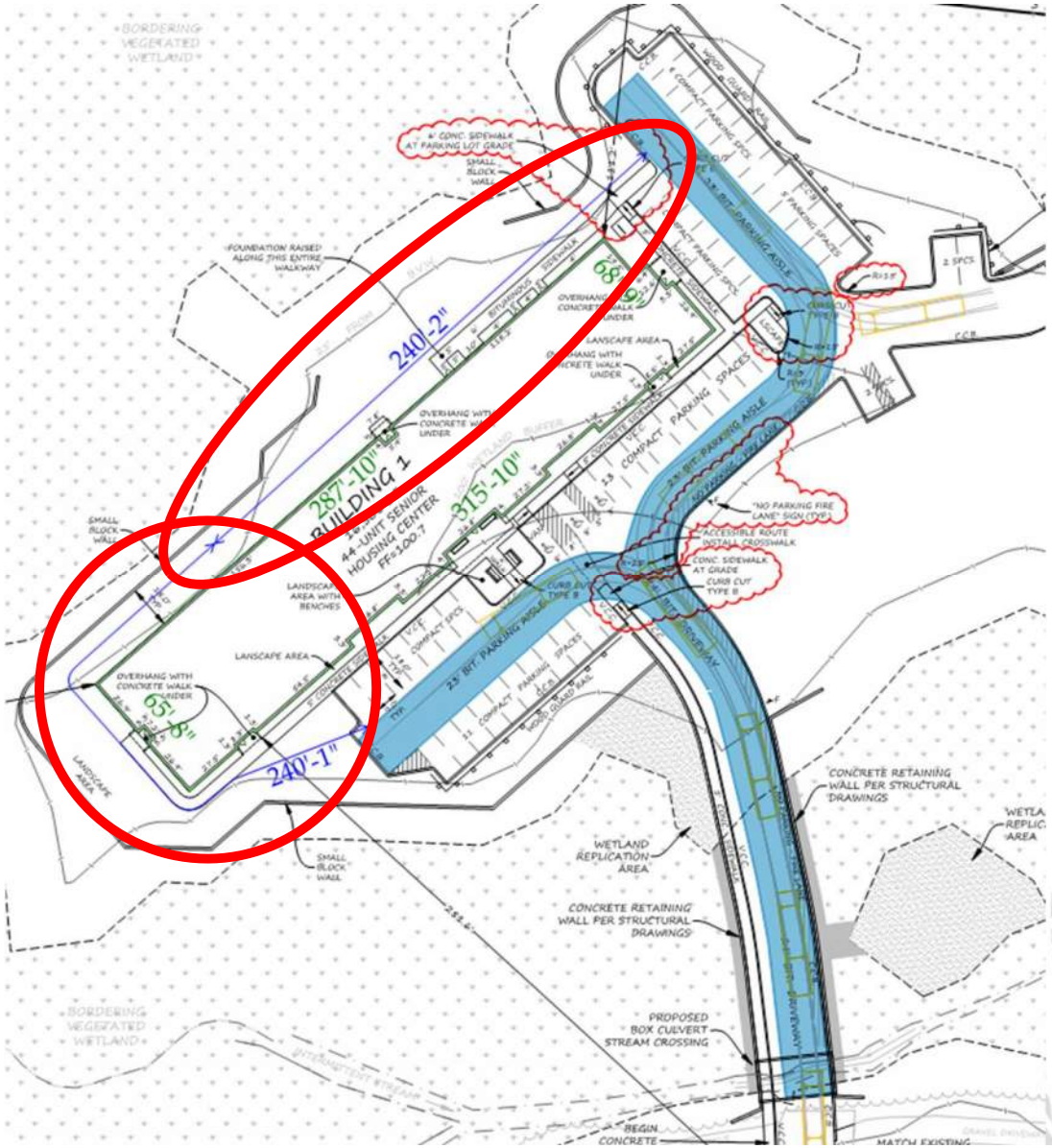
Proposed FD Access Lane



Keep dead ends under 150’

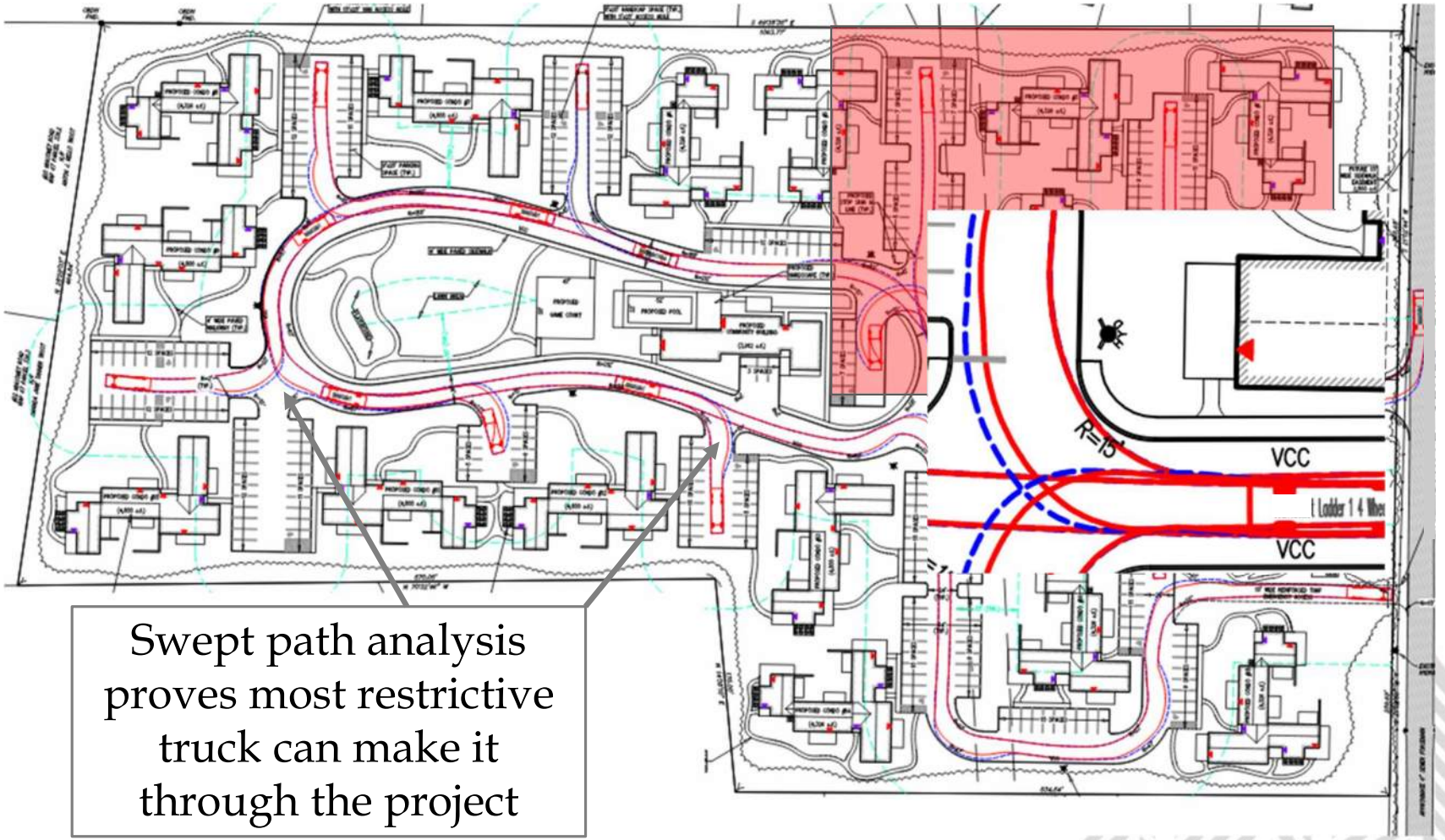


Every portion of building can be reached within 250′ of the fire department access road

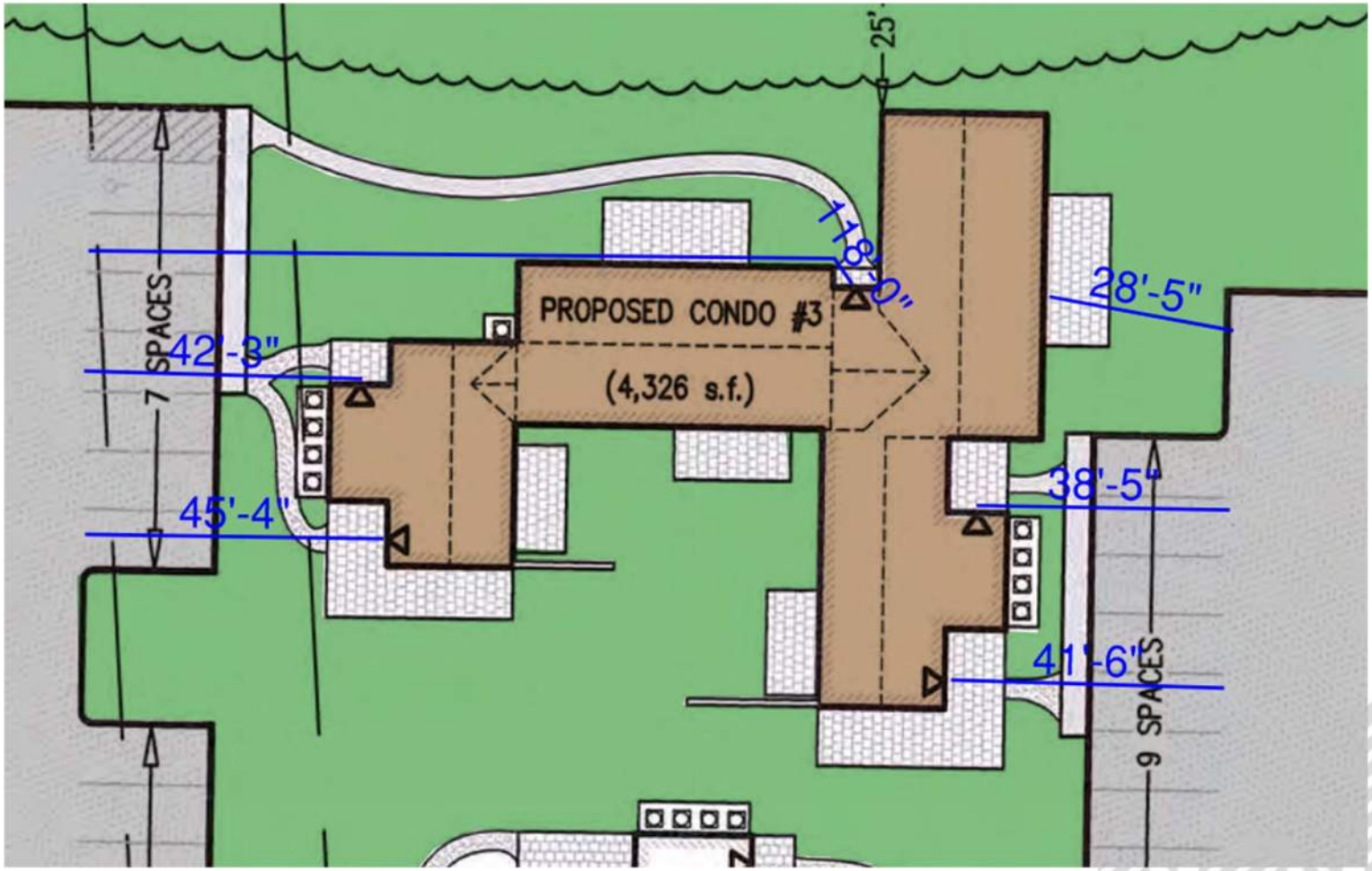


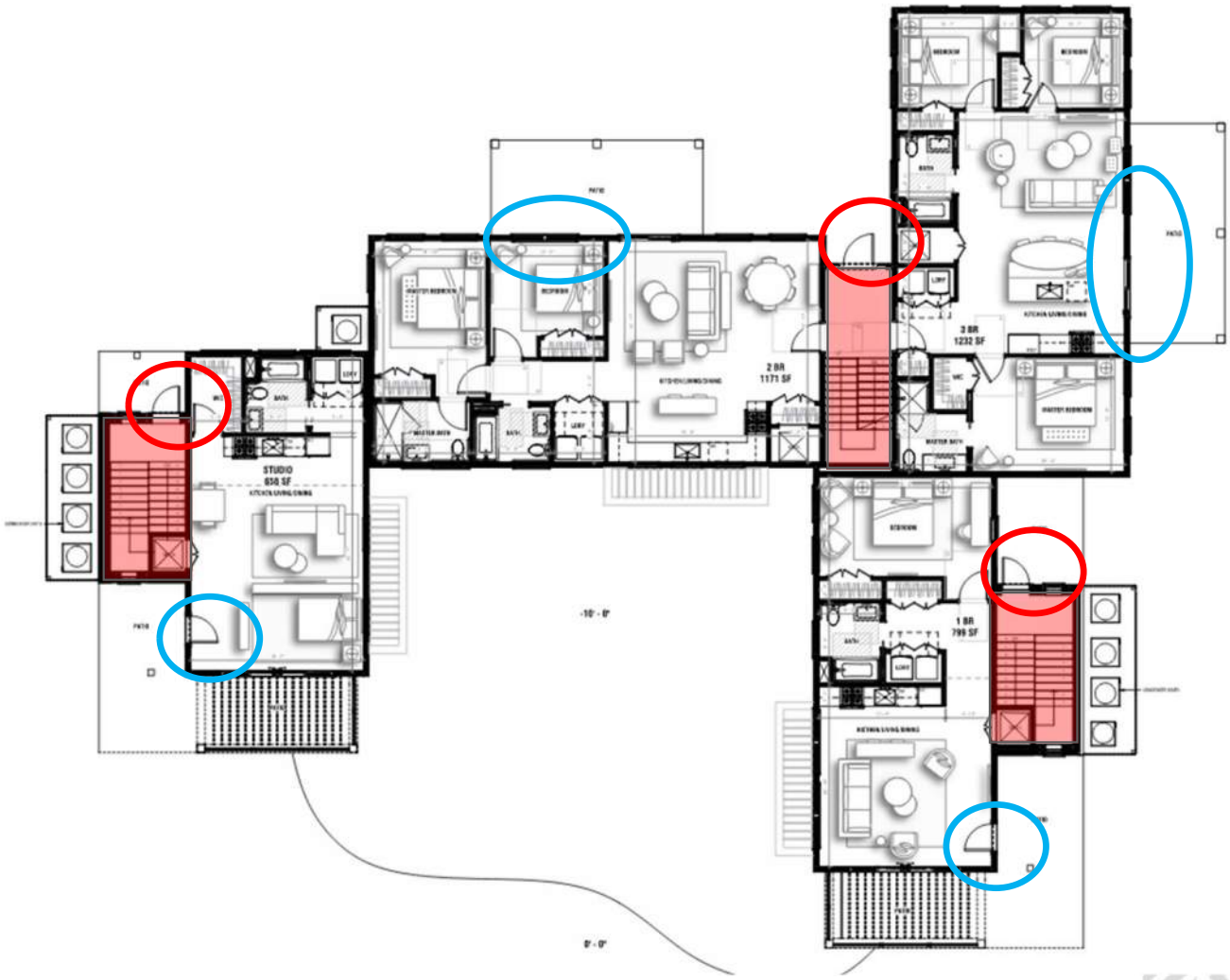
Case Study #2

- Proposed 40B housing development
- 18 residential buildings
  - 8 and 9-unit condos
  - 2 story w/ walk-out basements
- FD Roadways
  - Roadway loop through development, parking lots between buildings
  - Dead ends
  - Question of turning radii
- Distances
  - 50′ Rule - what constitutes an exterior entry?
  - 150′ vs 250′ rule
  - Other distances?



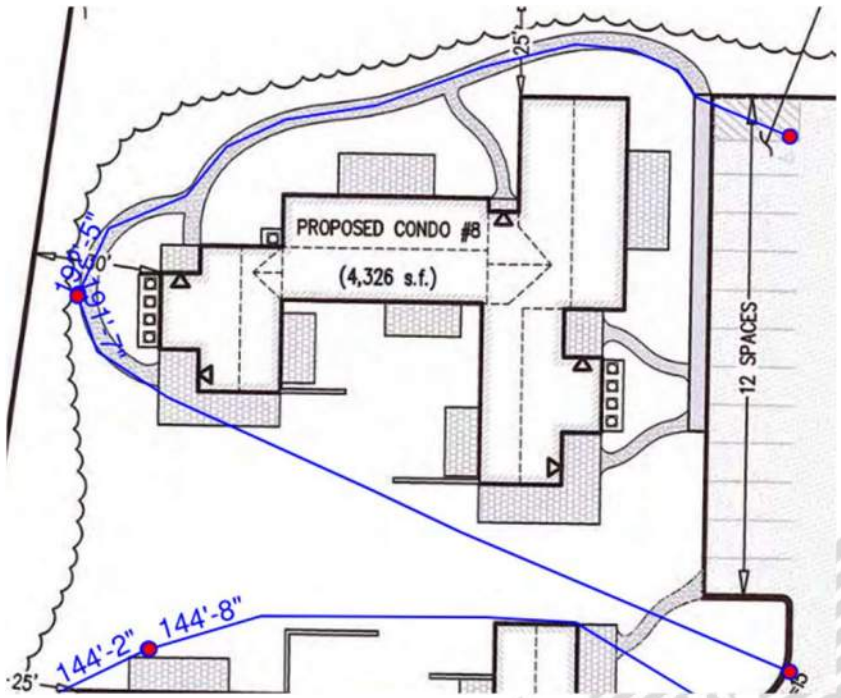
Swept path analysis proves most restrictive truck can make it through the project





150′ vs 250′ Exterior Access

- What kind of sprinkler system would you expect in an 8-9 unit condo?
  - 13R (780 CMR 903.3.1.2)
- Upgrade sprinkler system in buildings with > 150′ distance to a full NFPA 13 system to gain the full 250′ allowance
  - Impacted 4 out of 18 buildings



Conclusion

- Scoping
- Rationale for requirements
- Roadway and distance requirements
- Local considerations

Thank You For Your Time

Questions?

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