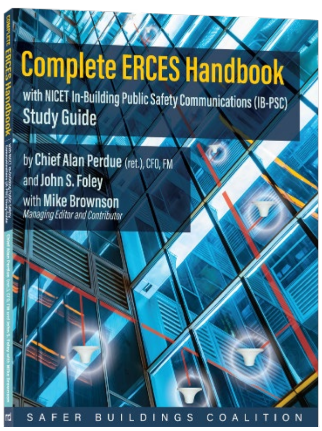
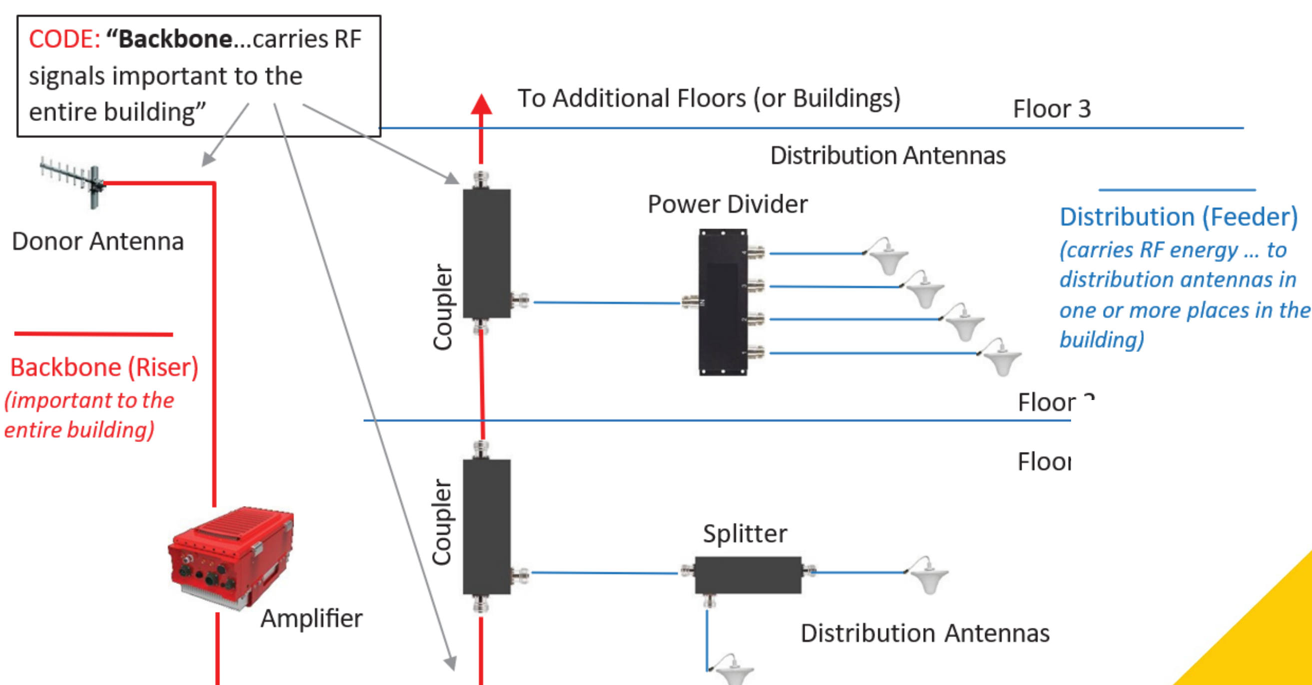
SAFER BUILDINGS COALITION™
Feel Safe Inside®

Best Practice:
Understanding ERCES Backbone, Distribution, and Pathway Survivability

An Excerpt from the Complete ERCES Handbook



By Chief Alan Perdue (ret.), CFO, FM
John S. Foley
with Mike Brownson
Managing Editor and Contributing Writer



Complete ERCES Handbook

with NICET In-Building Public Safety Communications (IB-PSC)
Study Guide

by Chief Alan Perdue (ret.), CFO, FM
and John S. Foley

with Mike Brownson
Managing Editor and Contributing Writer

EXCERPT: Backbone, Riser, and Pathway Survivability

SAFER BUILDING COALITION

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Complete ERCES Handbook with NICET In-Building Public Safety (IB-PSC) Study Guide
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The following are examples of the statements added to each chapter containing excerpts:

About the Authors

Chief Alan Perdue (ret.), CFO, FM
Executive Director, Safer Buildings Coalition

Chief Perdue began his fire service journey as a volunteer firefighter, and in 1979, the Guilford County Department of Emergency Services offered him full time employment. He progressed through the ranks and was appointed Emergency Services Director in 2003 and retired in 2013. The Center for Public Safety Excellence credentialed Perdue as a Chief Fire Office and Fire Marshal.

Perdue has a distinguished service record. He was the International Director representing Fire & Life Safety on the International Association of Fire Chiefs Board of Directors; he acted as the Governor's fire service appointee to the North Carolina State Building Code Council; he served as a Commissioner on the Center for Public Safety Excellence's Commission for Professional Credentialing; he was a member of the International Accreditation Services Technical Advisory Committee for Fire & Life Safety Departments; and he also served on the International Code Council's Codes and Standards Council.

Chief Perdue currently serves on the National Association of Counties Telecommunications and Technology Policy Steering Committee, on the Underwriters Laboratories Standard #2525 Standards Technical Panel and on the NFPA 1225 Technical Committee. He is also an elected County Commissioner in Guilford County, NC. and serves as a certified ERCES instructor for the Florida State Fire College.

John Foley
Managing Director, Safer Buildings Coalition (SBC)

In his role, John not only provides day to day Coalition management, but also develops and deploys SBC's mission-driven thought leadership, public policy, and lobbying efforts. John currently serves on the TIA Smart Buildings Working Group and Public Safety Subgroup, the CTIA Smart Cities Steering Committee, IWCE Advisory Board, and the NATE DAS and Small Cell Working Group. John has extensive experience in analyzing and developing positions for telecommunications regulatory and legislative issues involving federal and state agencies and legislative bodies. John is also a certified ERCES instructor for the Florida State Fire College.

John has held key business development, operations, engineering, and executive roles at telecom service companies such as Level 3 Communications, MFS, and MCI. John was a co-founder of Nextlink (later named XO Communications) where he served as VP of Operations and Engineering and VP of International Network Development. John led dark fiber provider City Signal Communications in the position of President and CEO. John also served for five years in the role of Capture Director and engineering team lead for a leading DAS Integrator.

Mike Brownson
Founder, Brownson Consulting

Mike Brownson started in the wireless industry over 50 years ago. During this time, he has been involved with a variety of wireless technologies and applications including two-way radio, 911 dispatch centers, cellular, microwave, and unlicensed broadband wireless. For the past 20 years Mike has focused his efforts on in-building enhancement solutions for public safety and cellular. His career includes installing and maintaining two-way radio systems, an independent manufacturer's rep, owning and operating a wholesale distributor of wireless solutions, and directing business development and product development for an ERCES equipment manufacturer. He also served as vendor chair for the Colorado APCO chapter, served on the Elbert County E911 Authority Board and was an advisor to the Aurora Public Schools electronics program.

Currently retired from full time employment, Mike contributes his time and energy to growing the ERCES industry, transferring his wealth of knowledge to installers and AHJs. With a time tested and mature curriculum, Mike has been delivering ERCES installation training for over 10 years. He participates in SBC's Codes and Standards workgroup, serves on the Standards Technical Panel for UL-2524 and holds numerous industry certifications.

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From the Chief's Corner: Why did we choose this content to share?

Chief Alan Perdue (ret.) CFO, FM

At the Safer Buildings Coalition, we are very often asked questions about ERCES technology, code interpretation, best practices, and every manner of topic you might imagine might come up in discussion on this admittedly complex, and at times confusing, subject.

But by far we receive more questions about pathway survivability of backbone and distribution infrastructure than any other subject. (The subject of testing requirements and best practices comes in second.)

The actual codes and standards requirements for pathway survivability have changed quite a bit since first defined in the IFC in 2009.

Early code language pertaining to ERCES came from subject matter experts, many of whom had a background in fire alarm and national electrical code development.

As a result, many concepts that made good common sense from a fire alarm perspective were embedded in early ERCES code language. This was a great head start, but it had some unintended consequences. There was more focus on physical infrastructure and fire marshals and inspectors, but limited focus on RF requirements and Frequency License Holders.

One of the core physical infrastructure concepts that came over from fire alarm code is pathway survivability.

Pathway survivability is defined in the Fire Alarm and Signaling Code (NFPA 72) as "the ability of any conductor, optic fiber, radio carrier, or other means for transmitting system information to remain operational during fire conditions."

ERCES are clearly fire and life safety systems. However, the value of survivability versus cost when considering how these systems are used suggests that we should define ERCES survivability with a good understanding of how ERCES are used in practical application.

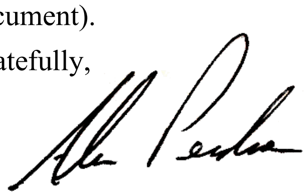
We must determine the difference between prudent safeguards and overbuilding, or what some might call the "belts and suspenders approach," or "ten-foot tall and bulletproof." The codes and standards help us distinguish the two. When local requirements exceed what is called for in the code, we are likely trending toward overbuilding.

As an example: ERCES antennas are made of plastic that would melt at relatively low heat levels. Does it make sense to require all the cables and connectors attached to the antenna to be fire rated if the antenna melted?

As a result, we have decided to share this important excerpt from our industry-leading reference: **Complete ERCES Handbook**, along with some useful bonus content. We hope you find it useful in arriving at the best decisions about pathway survivability for the ERCES projects in which you engage.

We also hope you will consider getting your own copy of the full reference (information about that in the back of this document).

Gratefully,



Chief Alan Perdue, (ret.) CFO, FM

CHAPTER
1

THE PURPOSE: WHY WE CREATED THIS BOOK

> If you think it's expensive to hire a professional to do the job, wait until you hire an amateur.
>
> *Source Unknown*

If you are holding this first-of-its-kind book, you are at the forefront of a movement and mission. What began as a reactive solution to a recurring problem has become a codes and standards driven industry comprising professionals spanning the public-safety, construction, and telecommunications technology industries. The growing number of Emergency Responder Communication Enhancement Systems (ERCES) being deployed across the US and abroad demands new training tools and professional credentialing to establish a level of competency that our important mission requires.

This book, and the creation of the NICET certification for In-Building Public Safety Communications (IB-PSC), represent important steps in moving our mission into the mainstream. Thank you for joining this cause. Now, to the problems we solve.

1.0 The Problem We Solve

When wireless macro (outdoor) networks are deployed, often signals cannot penetrate into buildings and other structures, creating "wireless dead zones" or areas where radio frequency (RF) coverage is inadequate. Often labeled, "the in-building coverage problem," it occurs in both public safety and commercial cellular networks.

The Safer Buildings Coalition (SBC) created this book to provide the data, information, and knowledge required to train the workforce and align stakeholders to ensure public safety communication services are available when and where needed. It discusses how solutions can be appropriately deployed to provide reliable operation where and when an indoor incident, accident, urgent, or emergent need for help arises.

Figure 1 **The three pillars of communication requirements that are necessary for a "Safer Building."**

5.1.1 Backbone (Formerly Riser) and Distribution (Formerly Feeder)

The terms Riser and Feed Main (Feeder) were borrowed from Sprinkler System terminology.

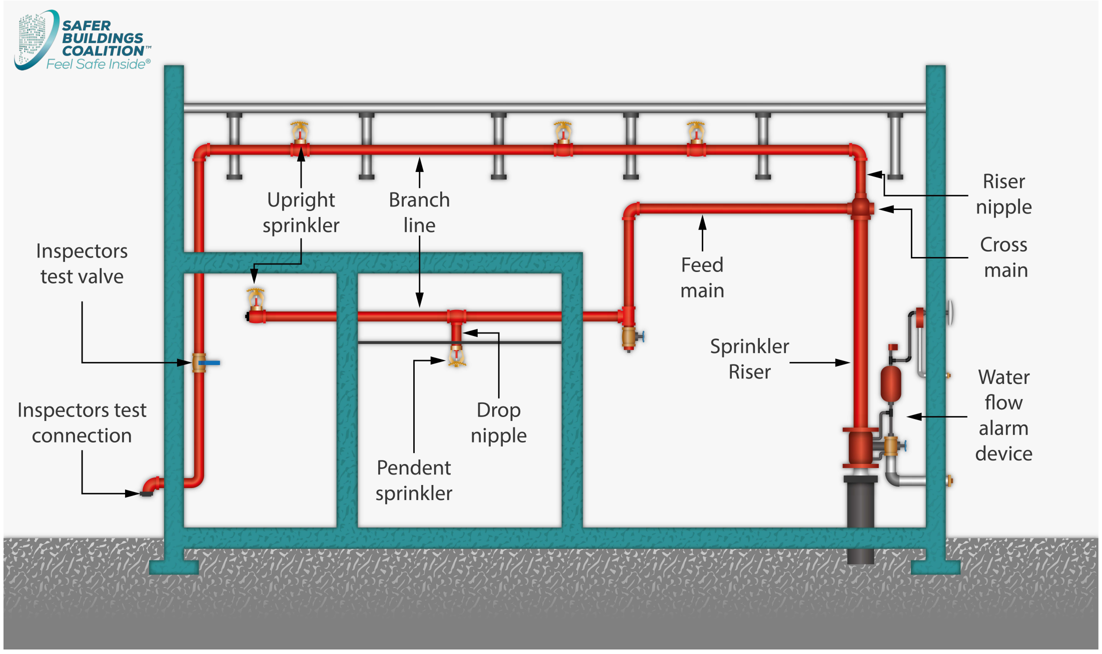


Figure 5.8.8 **Fire Sprinkler piping hierarchy**

Merriam Webster's Collegiate Dictionary defines RISER as "a vertical pipe (as for water or gas) or a vertical portion of an electric wiring system."

NFPA 13 The Standard for the Installation of Sprinkler Systems, defines Risers as:

NFPA 13, 2019 Edition
3.3.181 Risers.

The vertical supply pipes in a sprinkler system.

CODES STANDARDS

NFPA 13 does not exactly define "Feeders," but it defines Feed Mains, Cross Mains, and Branch Lines:

NFPA 13, 2019 Edition
3.3.72 Feed Mains.
The pipes supplying cross mains, either directly or through risers.

3.3.53 Cross Mains.
The pipes supplying the branch lines, either directly or through riser nipples.

3.3.19 Branch Lines.
The pipes supplying sprinklers, either directly or through sprigs, drops, return bends, or arm-overs.

CODES STANDARDS

As you can see, the terminology suggests a hierarchy of the systems.

Sprinkler System Hierarchy:

- Water Supply (Source from Street into a building)
  - Riser
    - Cross Main
      - Branch Line
        - Sprinkler Head

Prior to *NFPA* 1221 – 2019, ERCES Backbone Cables were called RISERS, and Distribution Cables were called FEEDERS.

The Backbone (formerly Riser) and Distributions (formerly Feeder) sections are discussed together in the next section as they must be compared and contrasted.

5.1.1.1 Backbone / Riser Cable Defined

IFC 2015	IFC 2018	IFC 2021	IFC 2024 DRAFT
Not Defined	Not Defined	Refers to NFPA 1221	Refers to NFPA 1225
NFPA 72-2013	**NFPA 1221-2016**	**NFPA 1221 - 2019**	**NFPA 1225 - 2022**
Not Defined	Not Defined	3.3.10	3.3.10

5.1.1.2 Distribution / Feeder Cable Defined

IFC 2015	IFC 2018	IFC 2021	IFC 2024 DRAFT
Not Defined	Not Defined	Refers to NFPA 1221	Refers to NFPA 1225
NFPA 72-2013	**NFPA 1221-2016**	**NFPA 1221 - 2019**	**NFPA 1225 - 2022**
Not Defined	Not Defined	3.3.46	3.3.49

To properly understand pathway survivability requirements for ERCES, one must first understand the difference between the Backbone and Distribution cabling components of the ERCES.

A Backbone Cable is a "communications cable in an in-building emergency responder communications enhancement system that carries radio frequency (RF) signals that are required to make the overall system operational from the donor antenna signal source, through the amplifiers, and up to the connection point of the distribution antenna cables."

Backbone cables can run vertically or horizontally. Failure of that cable would result in a system-wide loss of radio coverage.

CODES STANDARDS

NFPA 1221, 2019 Edition[32]
3.3.10* Backbone. A communications cable in an in-building radio enhancement system that carries wideband signals important to the entire building, from the donor antenna, through the amplifiers, and to distribution antenna lines.

[32] *NFPA 1221, 2019 edition.*

Note the subtle change between 1221 2019 and 1225 2022:

NFPA 1225, 2022 Edition[33]
3.3.10 * Backbone.
A communications cable in an in-building emergency responder communications enhancement system that carries radio frequency (RF) signals that are required to make the overall system operational from the donor antenna signal source, through the amplifiers, and up to the connection point of the distribution antenna cables.

3.3.11 Backbone Cable.
Coaxial cable, optical fiber cable and other cables utilized within the backbone to acquire and distribute RF signals to the in-building emergency responder communications enhancement systems.

3.3.12 Backbone Cable Components.
Splitters, couplers, and connectors utilized within the backbone to acquire and distribute RF signals to the in-building emergency responder communications enhancement systems

A.3.3.10 Backbone. Damage to a backbone cable or backbone cable components will disable the in-building emergency responder communications enhancement system through much or all of the building and, as a result, it should be identified and protected when installed in a building in accordance with 18.12.3. The backbone could be fiber-optic, copper, or coaxial cable, but it does not radiate RF energy along its path.

CODES STANDARDS

The **Distribution Antenna Cable** (formerly referred to as "feeder" cable), as defined in *NFPA* 1221 or 1225, carries RF energy to the distribution antennas in one or more places in the building outside of the heat and fire protection provided by any firewalls or other means as noted in *NFPA* 1225 A.3.3.49.

The Distribution Antenna Cable is connected to the distribution antennas throughout the service area designed for a specific coverage area. It is important to remember that these interior distribution antennas contain electronic components made of plastic-type materials and therefore are not fire-rated. In this case, there is no value-added benefit in requiring protection of the Distribution Antenna Cable itself, as the antenna would fail long before the cable as noted in *NFPA* 1225 A.3.3.48.

[There were no significant changes between 1221 and 1225 for Distribution]

NFPA 1225, 2022 Edition[34]
3.3.48* Distribution Antenna.
A radio antenna that is specifically designed to radiate RF energy into a specific and limited building area, usually from a ceiling- or wall-mounted antenna.

A.3.3.48 Distribution Antenna.
(See more in the Annex)

3.3.49* Distribution Antenna Cable.
A communications cable that carries RF energy in both directions along its length to distribution antennas in one or more places in a building.

A.3.3.49 Distribution Antenna Cable.
(See more in the Annex).

CODES STANDARDS

[33] *NFPA 1225, 2022 edition.*
[34] *NFPA 1225, 2022 edition.*

5.1.1.3 Backbone and Distribution Illustrations

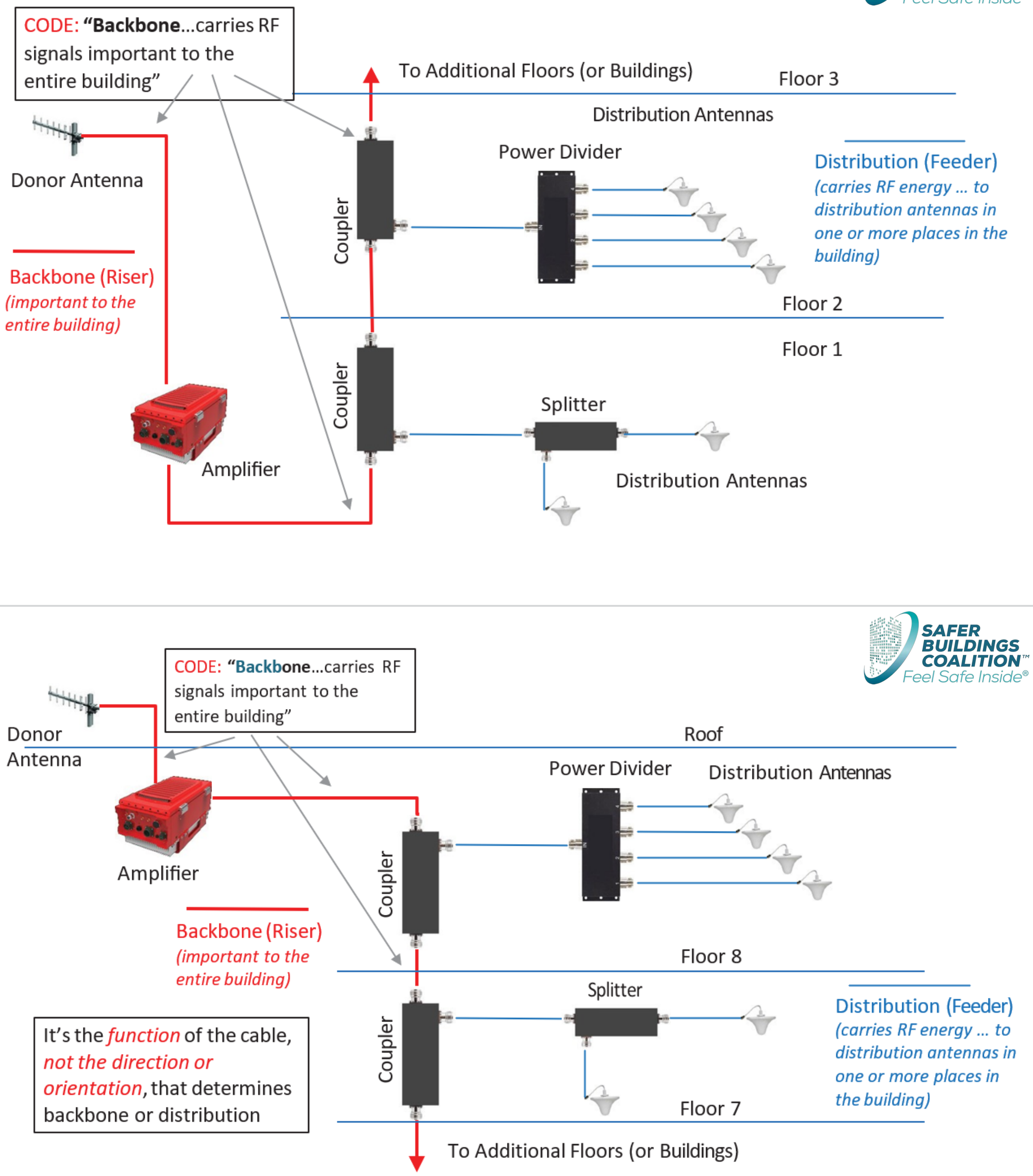


Figure 5.8.8.3 **Backbone and Distribution Illustrations**

5.1.2 Pathway Survivability: Fire Rating and Mechanical Protection

Early code language pertaining to ERCES came from subject matter experts, many of whom had a background in fire alarm and national electrical code development.

As a result, many concepts that made good common sense from a fire alarm perspective were embedded in early ERCES code language. This was a great head start, but it had some unintended consequences. There was more focus on physical infrastructure and fire marshals and inspectors, but limited focus on RF requirements and Frequency License Holders.

One of the core physical infrastructure concepts that came over from fire alarm code is ***pathway survivability***.

Figure 5.8.9 **Protecting Pathway: Prudent safeguards vs. "Belts and Suspenders"**

Pathway survivability is defined in the Fire Alarm and Signaling Code (*NFPA* 72) as "the ability of any conductor, optic fiber, radio carrier, or other means for transmitting system information to remain operational during fire conditions."

ERCES are clearly fire and life safety systems. *However*, the value of survivability versus cost when considering *how* these systems are used suggests that we should define ERCES survivability with a good understanding of how ERCES are used in practical application.

We must determine the difference between prudent safeguards and overbuilding, or what some might call the "belts and suspenders approach," or "ten-foot tall and bulletproof." The codes and standards help us distinguish the two. When local requirements exceed what is called for in the code, we are likely trending toward overbuilding.

As an example: ERCES antennas are made of plastic that would melt at relatively low heat levels. Does it make sense to require all the cables and connectors attached to the antenna to be fire rated if the antenna melted?

Historically, an important life-safety tool for public safety communications was In-Building Wired Emergency Services Communications Systems, commonly known as "fire phones," which are primarily required in high-rise buildings. These carry a requirement for pathway survivability in accordance with *NFPA* 72 Chapter 12.

When the requirements for ERCES transitioned from *NFPA* 72 (2013 Edition) to *NFPA* 1221 (2016 Edition), there was a specific reference to use cases where an ERCES is used *in lieu of* a Two-Way, In-Building Wired Emergency Services Communications Systems ("fire phones").

NFPA 1221, 2016 Edition[35]
9.6.2.1.1 * Where a two-way radio communications enhancement system is used in lieu of a two-way in-building wired emergency communications system, it shall have a pathway survivability of Level 1, Level 2, or Level 3. [72:24.3.13.8.1]

CODES
STANDARDS

Why is that significant? Since "fire phones" are really intended to be installed in high-rise buildings, then *pathway survivability requirements of the kind seen in NFPA 72 were only meant to apply to ERCES when ERCES solutions are used in lieu of "fire phones" in high-rise building applications.*

"Fire phones" were an important feature for high-rise buildings built before ERCES requirements came into place. But wireless ERCES solutions have significant advantages over wired systems.

[35] *NFPA 1221, 2016 edition.*

The Annex of NFPA 1221 talks about some of the ways that an ERCES is superior to "fire phones."

CODES STANDARDS

NFPA 1221, 2019 Edition[36]
A.9.6.7 The use of radio communication enhancement systems has become prevalent throughout the United States. Safety features and flexibilities of radio systems include the following:

(1) Full building coverage is allowed to facilitate communications from any point within the building in case access to the wired two-way communications system is compromised.
(2) Communications can be conducted between emergency responders in the field to allow quicker dissemination of safety and emergency information.
(3) Emergency responders typically carry individual radios, allowing the responders to provide information or request assistance individually, which can be important if crew members become separated during an incident.
(4) Radio systems permit "fire fighter or public safety officer down" emergency calls in case of injury — by the push of a single button, a call is placed to a central location to initiate a roll call to determine which emergency responder has been injured and requires assistance. Radio systems can employ an emergency call where, by the push of a single button, an emergency responder call can be given prioritized system access to allow wide-range communication.
(5) The AHJ can determine whether the in-building coverage is for tactical on-site communications, for communications to an off-site dispatch center, or both.

BEST PRACTICE

Key Point: *The pathway survivability requirements often associated with ERCES are the result of the code reference where ERCES are used in lieu of wired "fire phone" systems. In other words, in high-rise buildings. No such requirement or expectation exists for non-high-rise buildings!*

In fact, recent changes written int*o NFPA* 1225 (2022) clarify this concept. For example,

CODES STANDARDS

NFPA 1225, 2022 Edition[37]
18.12.3.3 Backbone cables and backbone cable components installed in buildings that are fully protected by an automatic sprinkler system in accordance with NFPA 13 shall not be required to have a fire resistance rating.

18.12.3.4* Backbone cables and backbone cable components installed in nonsprinklered buildings, in buildings that are partially protected by a sprinkler system, or in high-rise buildings shall be protected from attack by fire in accordance with one of the following: 18.12.3.4(1) or 18.12.3.4(2)

Determining Pathway Survivability Requirements

The SBC probably receives more questions and participates in more discussion about pathway survivability than just about any other ERCES topic. It is our observation that no other section has been the subject of more confusion, debate, or inconsistent interpretation.

The consequences of this are often wide variations in scope and cost for bid projects, and a difficulty in arriving at quotations that are "apples to apples." This places a strain on building owners, AHJs, and system integrators. It can lead to over-designed systems that add unnecessary cost, or to missed scope resulting in change orders.

[36] *NFPA 1221, 2019 edition.*
[37] *NFPA 1225, 2022 edition.*

The key elements of determining Pathway Survivability requirements for an ERCES project are:

- Code version?
- Backbone or Distribution?
- Occupancy Type?
- Fire Rating requirements?
- Mechanical Protection requirements?
- AHJ's flexibility regarding alternate methods and materials?

5.1.3 Pathway Survivability: Fire Rating

IFC 2015	IFC 2018	IFC 2021	IFC 2024 DRAFT
Not Specifically Addressed in Section 510. Referenced in 2013 NFPA 72 Section 24.3.6.8	Section 510.4.2 Reference to NFPA 1221 Note: Also See NFPA 1221 TIA 16-2	Sec. 510.4.2 Reference to NFPA 1221	Sec. 510.4.2 Reference to NFPA 1225
NFPA 72-2013	**NFPA 1221-2016**	**NFPA 1221 - 2019**	**NFPA 1225 - 2022**
2 Hour for Riser Coaxial Cable - Sec. 24.3.6.8	2 Hour for Riser Coaxial Cable - Sec. 9.6.2.1.3	Backbone Cable Routed Through Enclosure Matching Bldgs. Fire Rating - Sec. 9.6.2.3	Sections 18.12.3.1, 18.12.3.3, 18.12.3.4, 18.12.3.5, & 18.12.3.6

In *NFPA* 1225 2022 edition, the protection of cable /pathway survivability was modified extensively. Section 18.12.3.2 provides that if the building is fully protected by an automatic sprinkler system in accordance with *NFPA* 13 the ERCES shall not be required to have a fire resistance rating of the backbone cables or backbone cable components.

Backbone cables and backbone cable components installed in non-sprinklered buildings, in buildings that are partially protected by a sprinkler system, or in high-rise buildings shall be protected in accordance with the provisions of *NFPA* 1225 Section 18.12.3.4 (1) fire rated cable or (2) a protected enclosure or area. These sections identify the protection criteria based on the fire resistance rating of the primary structural frame of a building.

For several cycles of the ERCES standard, the determination of pathway survivability was based upon the building's fire rating. However, the building itself does not have a fire rating, certain components of the building do. The changes contained within *NFPA* 1225 2022 edition follow the concept that ERCES are in-building life safety systems and that the primary structural frame of the building serves to maintain structural stability of the structure therefore the rating of pathway survivability is based off that structural element.

NFPA 1221, 2019 Edition[38]

9.6.2.3 Backbone cables shall be routed through an enclosure that matches the building's fire rating.

9.6.2.4 The connection between the backbone cable and the antenna cables shall be made within an enclosure that matches the building's fire rating, and passage of the antenna distribution cable in and out of the enclosure shall be fire-stopped.

CODES STANDARDS

[35]*NFPA 1221, 2016 edition.*

To understand the elements of a building pertaining to fire rating, one must turn to the International Building Code and *NFPA* 5000 to find out:

- Primary Structural Frame Elements
- Standard Types of Construction

By knowing these two things, one can determine the fire rating requirements based on the code version being enforced by cross-referencing this information to the tables provided in IBC Chapter 6, Types of Construction.

5.1.3.1 Definition of Primary Structural Frame

CODES STANDARDS

IBC 2021
SECTION 202 - DEFINITIONS

PRIMARY STRUCTURAL FRAME. The primary structural frame shall include all of the following structural members:

1. The columns.
2. Structural members having direct connections to the columns, including girders, beams, trusses and spandrels.
3. Members of the floor construction and roof construction having direct connections to the columns.
4. Members that are essential to the vertical stability of the primary structural frame under gravity loading.

5.1.3.2 Types of Construction

There are five types of building construction within the IBC & *NFPA* 220 – Standard on Types of Construction:

- Type I (A, B) – Fire Resistive
- Type II (A, B) – Noncombustible
- Type III (A, B) – Ordinary,
- Type IV (A, B, C, HT) – Heavy Timber
- Type V (A, B) – Wood Frame

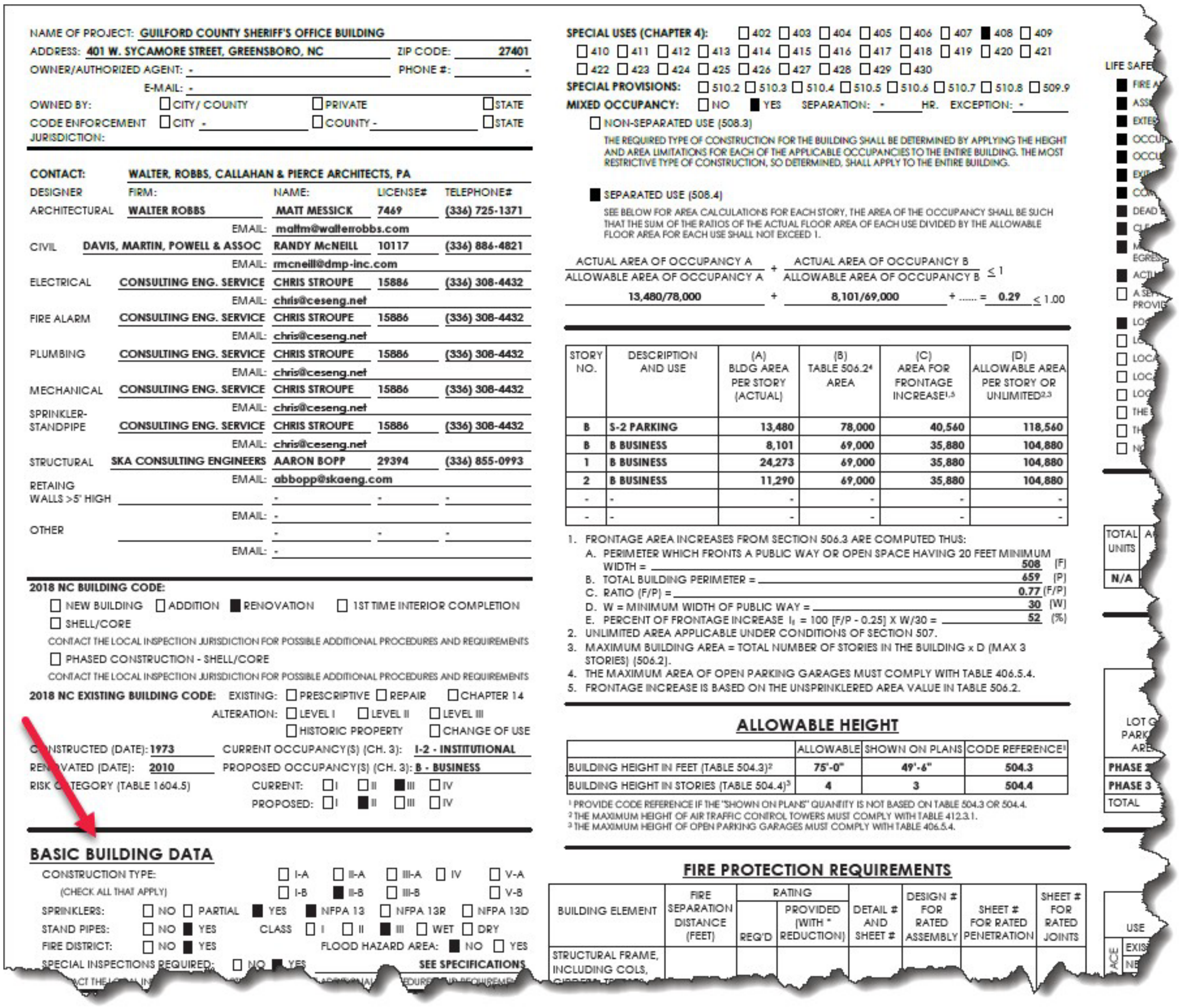
After each construction type (roman numeral), there is a subtype breakdown code. The code specifies max allowable building height and fire resistance requirements based on construction and occupancy type.

Since the maximum allowable fire rating is based upon the exact Construction Type, it is important to gather this information where fire rating of backbone cable and for enclosures protecting interconnections between backbone and distribution.

When reading and interpretating codes and standards to pay close attention to footnotes that are often associated with tables such as in IBC Table 601.

BEST PRACTICE

Construction Type (I – V) information is often contained in the building code summary document that is often located on the initial pages of the construction documents. If this information is not provided on the construction drawings, it should be available in building permit filings, and should be obtained from the GC, building owner, or building code official for the property.


NAME OF PROJECT: GUILFORD COUNTY SHERIFF'S OFFICE BUILDING
ADDRESS: 401 W. SYCAMORE STREET, GREENSBORO, NC ZIP CODE: 27401
OWNER/AUTHORIZED AGENT: - PHONE #: -
E-MAIL: -
OWNED BY: ☐ CITY/ COUNTY ☐ PRIVATE ☐ STATE
CODE ENFORCEMENT JURISDICTION: ☐ CITY - ☐ COUNTY - ☐ STATE

CONTACT: WALTER, ROBBS, CALLAHAN & PIERCE ARCHITECTS, PA

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	EMAIL:	abbopp@skaeng.com		
RETAINING WALLS >5' HIGH		-	-	-
	EMAIL:	-		
OTHER		-	-	-
	EMAIL:	-		

2018 NC BUILDING CODE:
☐ NEW BUILDING ☐ ADDITION ■ RENOVATION ☐ 1ST TIME INTERIOR COMPLETION
☐ SHELL/CORE
CONTACT THE LOCAL INSPECTION JURISDICTION FOR POSSIBLE ADDITIONAL PROCEDURES AND REQUIREMENTS
☐ PHASED CONSTRUCTION - SHELL/CORE
CONTACT THE LOCAL INSPECTION JURISDICTION FOR POSSIBLE ADDITIONAL PROCEDURES AND REQUIREMENTS
2018 NC EXISTING BUILDING CODE: EXISTING: ☐ PRESCRIPTIVE ☐ REPAIR ☐ CHAPTER 14
ALTERATION: ☐ LEVEL I ☐ LEVEL II ☐ LEVEL III
☐ HISTORIC PROPERTY ☐ CHANGE OF USE
CONSTRUCTED (DATE): 1973 CURRENT OCCUPANCY(S) (CH. 3): I-2 - INSTITUTIONAL
RENOVATED (DATE): 2010 PROPOSED OCCUPANCY(S) (CH. 3): B - BUSINESS
RISK CATEGORY (TABLE 1604.5) CURRENT: ☐ I ☐ II ■ III ☐ IV
PROPOSED: ☐ I ■ II ☐ III ☐ IV

BASIC BUILDING DATA
CONSTRUCTION TYPE: ☐ I-A ☐ II-A ☐ III-A ☐ IV ☐ V-A
(CHECK ALL THAT APPLY) ☐ I-B ■ II-B ☐ III-B ☐ V-B
SPRINKLERS: ☐ NO ☐ PARTIAL ■ YES ■ NFPA 13 ☐ NFPA 13R ☐ NFPA 13D
STAND PIPES: ☐ NO ■ YES CLASS ☐ I ☐ II ■ III ☐ WET ☐ DRY
FIRE DISTRICT: ☐ NO ■ YES FLOOD HAZARD AREA: ■ NO ☐ YES
SPECIAL INSPECTIONS REQUIRED: ☐ NO ■ YES SEE SPECIFICATIONS

SPECIAL USES (CHAPTER 4): ☐ 402 ☐ 403 ☐ 404 ☐ 405 ☐ 406 ☐ 407 ■ 408 ☐ 409 ☐ 410 ☐ 411 ☐ 412 ☐ 413 ☐ 414 ☐ 415 ☐ 416 ☐ 417 ☐ 418 ☐ 419 ☐ 420 ☐ 421 ☐ 422 ☐ 423 ☐ 424 ☐ 425 ☐ 426 ☐ 427 ☐ 428 ☐ 429 ☐ 430
SPECIAL PROVISIONS: ☐ 510.2 ☐ 510.3 ☐ 510.4 ☐ 510.5 ☐ 510.6 ☐ 510.7 ☐ 510.8 ☐ 509.9
MIXED OCCUPANCY: ☐ NO ■ YES SEPARATION: - HR. EXCEPTION: -
☐ NON-SEPARATED USE (508.3)
THE REQUIRED TYPE OF CONSTRUCTION FOR THE BUILDING SHALL BE DETERMINED BY APPLYING THE HEIGHT AND AREA LIMITATIONS FOR EACH OF THE APPLICABLE OCCUPANCIES TO THE ENTIRE BUILDING. THE MOST RESTRICTIVE TYPE OF CONSTRUCTION, SO DETERMINED, SHALL APPLY TO THE ENTIRE BUILDING.
■ SEPARATED USE (508.4)
SEE BELOW FOR AREA CALCULATIONS FOR EACH STORY, THE AREA OF THE OCCUPANCY SHALL BE SUCH THAT THE SUM OF THE RATIOS OF THE ACTUAL FLOOR AREA OF EACH USE DIVIDED BY THE ALLOWABLE FLOOR AREA FOR EACH USE SHALL NOT EXCEED 1.
ACTUAL AREA OF OCCUPANCY A / ALLOWABLE AREA OF OCCUPANCY A + ACTUAL AREA OF OCCUPANCY B / ALLOWABLE AREA OF OCCUPANCY B ≤ 1
13,480/78,000 + 8,101/69,000 + ... = 0.29 ≤ 1.00

STORY NO.	DESCRIPTION AND USE	(A) BLDG AREA PER STORY (ACTUAL)	(B) TABLE 506.2 AREA	(C) AREA FOR FRONTAGE INCREASE	(D) ALLOWABLE AREA PER STORY OR UNLIMITED
B	S-2 PARKING	13,480	78,000	40,560	118,560
B	B BUSINESS	8,101	69,000	35,880	104,880
1	B BUSINESS	24,273	69,000	35,880	104,880
2	B BUSINESS	11,290	69,000	35,880	104,880
-	-	-	-	-	-
-	-	-	-	-	-

1. FRONTAGE AREA INCREASES FROM SECTION 506.3 ARE COMPUTED THUS:
A. PERIMETER WHICH FRONTS A PUBLIC WAY OR OPEN SPACE HAVING 20 FEET MINIMUM WIDTH = 508 (F)
B. TOTAL BUILDING PERIMETER = 659 (P)
C. RATIO (F/P) = 0.77 (F/P)
D. W = MINIMUM WIDTH OF PUBLIC WAY = 30 (W)
E. PERCENT OF FRONTAGE INCREASE I_f = 100 [F/P - 0.25] X W/30 = 52 (%)
2. UNLIMITED AREA APPLICABLE UNDER CONDITIONS OF SECTION 507.
3. MAXIMUM BUILDING AREA = TOTAL NUMBER OF STORIES IN THE BUILDING x D (MAX 3 STORIES) (506.2).
4. THE MAXIMUM AREA OF OPEN PARKING GARAGES MUST COMPLY WITH TABLE 406.5.4.
5. FRONTAGE INCREASE IS BASED ON THE UNSPRINKLERED AREA VALUE IN TABLE 506.2.

ALLOWABLE HEIGHT

	ALLOWABLE	SHOWN ON PLANS	CODE REFERENCE
BUILDING HEIGHT IN FEET (TABLE 504.3)	75'-0"	49'-6"	504.3
BUILDING HEIGHT IN STORIES (TABLE 504.4)	4	3	504.4

1 PROVIDE CODE REFERENCE IF THE "SHOWN ON PLANS" QUANTITY IS NOT BASED ON TABLE 504.3 OR 504.4.
2 THE MAXIMUM HEIGHT OF AIR TRAFFIC CONTROL TOWERS MUST COMPLY WITH TABLE 412.3.1.
3 THE MAXIMUM HEIGHT OF OPEN PARKING GARAGES MUST COMPLY WITH TABLE 406.5.4.

FIRE PROTECTION REQUIREMENTS

BUILDING ELEMENT	FIRE SEPARATION DISTANCE (FEET)	RATING REQ'D	RATING PROVIDED (WITH * REDUCTION)	DETAIL # AND SHEET #	DESIGN # FOR RATED ASSEMBLY	SHEET # FOR RATED PENETRATION	SHEET # FOR RATED JOINTS
STRUCTURAL FRAME, INCLUDING COLS,							

Figure 5.8.10.2 **Example of Plan Sheet Showing Types of Construction**

NFPA 220 & 5000 have a slightly different way of naming these types. Table 5.8.10.2 provides a comparison of similar types of construction for various model building codes.

NFPA 220, 2021 Edition[39]

A.4.1.1 The system of designating types of construction also includes a specific breakdown of the types of construction through the use of Arabic numbers. These Arabic numbers follow the roman numeral notation where identifying a type of construction [e.g., Type I(442), Type II(111), Type III(200)] and indicate the fire resistance rating requirements for certain structural elements as follows:

(1) First Arabic number — exterior bearing walls
(2) Second Arabic number — columns, beams, girders, trusses and arches, supporting bearing walls, columns, or loads from more than one floor
(3) Third Arabic number — floor construction

CODES STANDARDS

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NFPA 220 / 5000 - IBC Cross-Reference										
NFPA 5000 ->	I(442)	I(332)	II(222)	II(111)	II(000)	III(211)	III(200)	IV(2HH)	V(111)	V(000)
IBC ->	—	IA	IB	IIA	IIB	IIIA	IIIB	IV	VA	VB

Table 5.8.10.2 **NFPA – IBC Construction Types cross-reference**

BUILDING ELEMENT	TYPE I		TYPE II		TYPE III		TYPE IV				TYPE V	
	A	B	A	B	A	B	A	B	C	HT	A	B
Primary structural frame (see sec. 202)	$3^{a,b}$	$2^{a,b,c}$	$1^{b,c}$	0^{c}	$1^{b,c}$	0	3^{a}	2^{a}	2^{a}	HT	$1^{b,c}$	0
Bearing Walls												
Exterior^{e,f}	3	2	1	0	2	2	3	2	2	2	1	0
Interior	3^{a}	2^{a}	1	0	1	0	3	2	2	1/HT^{g}	1	0
Nonbearing walls and partitions, Exterior	See Table 705.5											
Nonbearing walls and partitions, Interior^{d}	0	0	0	0	0	0	0	0	0	See Sec. 2304.11.2	0	0
Floor construction and associated secondary structural members	2	2	1	0	1	0	2	2	2	HT	1	0
Roof construction and associated secondary structural members	1 ½^{b}	$1^{b,c}$	$1^{b,c}$	0^{c}	$1^{b,c}$	0	1 ½	1	1	HT	$1^{b,c}$	0

TABLE 601 Footnotes

FIRE-RESISTANCE RATING REQUIREMENTS FOR BUILDING ELEMENTS (HOURS)

For SI: 1 foot = 304.8 mm.

a. Roof supports: Fire-resistance ratings of primary structural frame and bearing walls are permitted to be reduced by 1 hour where supporting a roof only.

b. Except in Group F-1, H, M and S-1 occupancies, fire protection of structural members in roof construction shall not be required, including protection of primary structural frame members, roof framing and decking where every part of the roof construction is 20 feet or more above any floor immediately below. Fire-retardant-treated wood members shall be allowed to be used for such unprotected members.

c. In all occupancies, heavy timber complying with Section 2304.11 shall be allowed for roof construction, including primary structural frame members, where a 1-hour or less fire-resistance rating is required.

d. Not less than the fire-resistance rating required by other sections of this code.

e. Not less than the fire-resistance rating based on fire separation distance (see Table 705.5).

f. Not less than the fire-resistance rating as referenced in Section 704.10.

g. Heavy timber bearing walls supporting more than two floors or more than a floor and a roof shall have a fire resistance rating of not less than 1 hour.

Table 5.8.10.2 **IBC Table 601,[40] Fire-Resistance Rating Requirements for Building Elements (Hours)**

TAKE NOTE

Examples:

1. Type V(B) construction, Primary structural frame fire rating = 0 hours.
   Therefore, max backbone cable fire rating = 0 hours.
2. Type IV(B) construction, Primary structural frame fire rating = 2 hours.
   Therefore, max backbone cable fire rating = 2 hours.
3. Type I(A) construction, Primary structural frame fire rating = 3 hours.
   Therefore, max backbone cable fire rating = 2 hours. (Do not have to exceed 2 hours)

[40] *2021 International Building Code.*

5.1.4 Pathway Survivability: Mechanical Protection

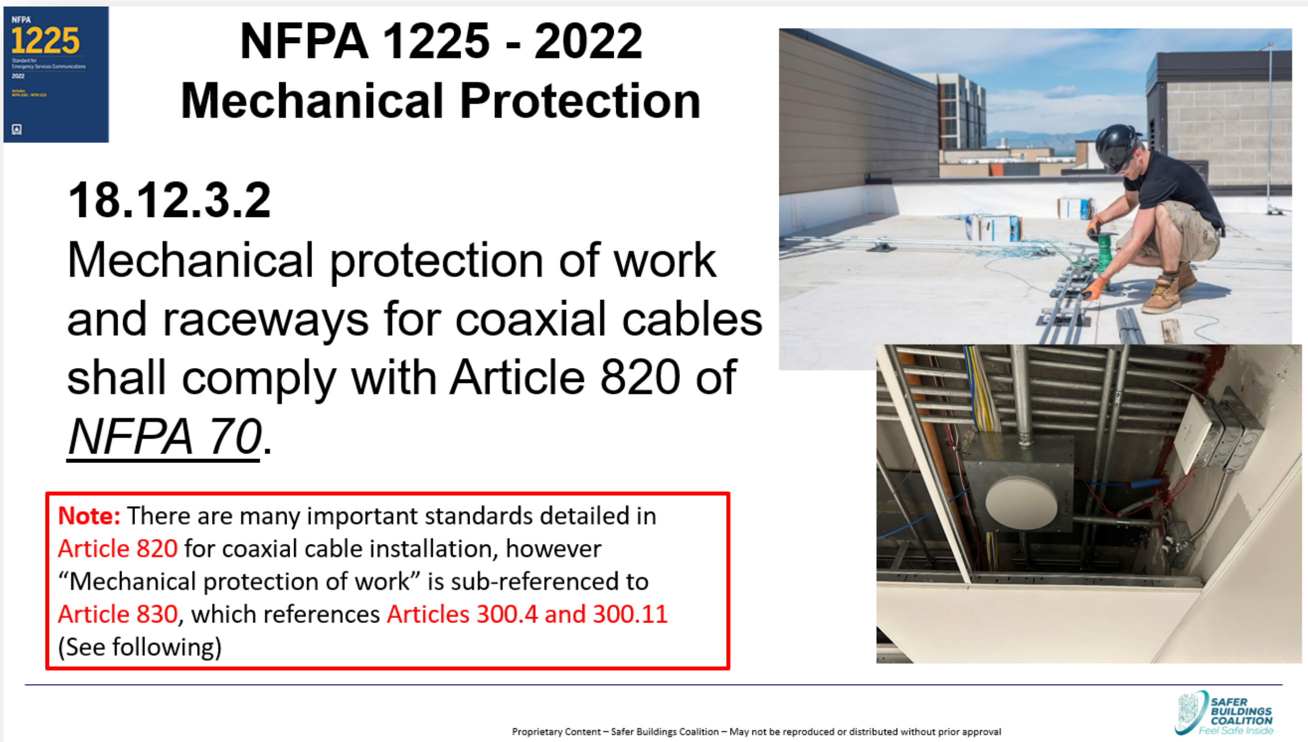
IFC 2015	IFC 2018	IFC 2021	IFC 2024 DRAFT
Not Specifically Addressed in Section 510. Referenced in 2013 NFPA 72 Section 24.3.6.8	Sec. 510.4.2 Reference to NFPA 1221	Sec. 510.4.2 Reference to NFPA 1221	Sec. 510.4.2 Reference to NFPA 1225
NFPA 72-2013	**NFPA 1221-2016**	**NFPA 1221 - 2019**	**NFPA 1225 - 2022**
Section 24.3.6.8	Levels DEFINED in Section 5.10 But REQUIREMENTS should be based upon NEC®[41] (NFPA 70)	Levels DEFINED in Section 5.10 But REQUIREMENTS should be based upon NEC (NFPA 70)	18.12.3.2 Refers to NEC

Mechanical protection of work and raceways for coaxial cables is required to comply with Article 820 of *NFPA* 70. For many this is thought of as conduit or metallic raceways. The concept behind mechanical protection of ERCES cables is to protect them where they are subject to physical damage. This can include but is not limited to stairways, electrical equipment rooms, loading docks and other areas where someone or some type of equipment might damage the cables.

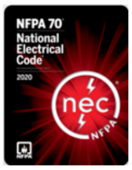
Cables installed within enclosed spaces or above finished ceilings are typically not subject to physical damage. The decision on what is and is not needed rests with the AHJ. This topic should be discussed early in the ERCES project plan.

Mechanical protection can be achieved in many ways, including conduit, raceways, and armored or flexible metal conduit. Check with the AHJ for acceptable materials and methods.

BONUS CONTENT: More on Mechanical Protection



BONUS CONTENT: More on Mechanical Protection



NFPA 70 - 2020
Article 820

> 830.24 Mechanical Execution of Work.
> The installation shall also conform to **300.4** and **300.11**.

820.3 Other Articles.

Circuits and equipment shall comply with **820.3(A)** and (B).

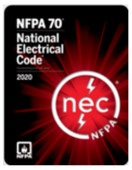
(A) General Requirements.

The general requirements of Article **800** shall apply.

(B) Alternate Wiring Methods.

The wiring methods of Article **830** shall be permitted to substitute for the wiring methods of Article **820**.

Informational Note: Use of Article 830 wiring methods will facilitate the upgrading of Article 820 installations to network-powered broadband applications.



NFPA 70 - 2020
Mechanical Protection

> 830.24 Mechanical Execution of Work.
> The installation shall also conform to **300.4** and **300.11**.

300.4 Protection Against Physical Damage.

Where subject to physical damage, conductors, raceways, and cables shall be protected.

(A) Cables and Raceways Through Wood Members.
- (1) Bored Holes.
- (2) Notches in Wood.

(B) Nonmetallic-Sheathed Cables and Electrical Nonmetallic Tubing Through Metal Framing Members.
- (1) Nonmetallic-Sheathed Cable.
- (2) Nonmetallic-Sheathed Cable and Electrical Nonmetallic Tubing.

(C) Cables Through Spaces Behind Panels Designed to Allow Access.

(D) Cables and Raceways Parallel to Framing Members and Furring Strips.

(E) Cables, Raceways, or Boxes Installed in or Under Roof Decking.

(F) Cables and Raceways Installed in Shallow Grooves.

(G) Fittings.

(H) Structural Joints.

300.11 Securing and Supporting.

(A) Secured in Place.

(B) Wiring Systems Installed Above Suspended Ceilings.
- (1) Fire-Rated Assemblies.

(2) Non–Fire-Rated Assemblies.

(C) Raceways Used as Means of Support.
- (1)Where the raceway or means of support is identified as a means of support
- (2)Where the raceway contains power supply conductors for electrically controlled equipment and is used to support Class 2 circuit conductors or cables that are solely for the purpose of connection to the equipment control circuits
- (3)Where the raceway is used to support boxes or conduit bodies in accordance with 314.23 or to support luminaires in accordance with 410.36(E)

(D) Cables Not Used as Means of Support.

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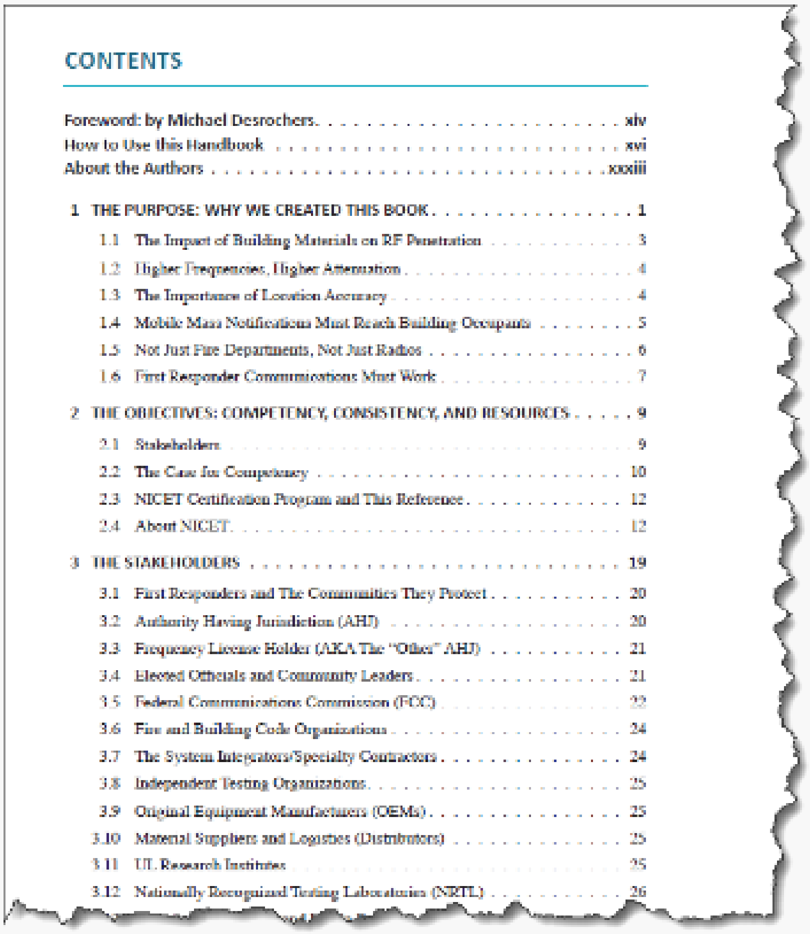
CONTENTS

- Table of Contents
- Index
- Foreword by **Michael Desrochers**, Vermont State Fire Marshal, President - National Association of State Fire Marshals (NASFM)

SCAN ME

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The Safer Buildings Coalition (SBC) is an independent, not for profit organization providing thought leadership and education focused on advancing policies, ideas, and technologies that ensure effective in-building wireless communication capabilities for public safety personnel and the communities they serve.

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