

## PROPOSED CODE CHANGES

As the result of a thorough review of current City of Dallas codes and ordinances, 56 code and ordinance changes are proposed. The changes developed subsequent to this review are aimed at providing an improved level of safety through the increased use of automatic sprinklers, while minimizing the financial impact of such a requirement upon the community by eliminating or minimizing overly redundant requirements.

Of the 56 code changes, 48 are proposed to the Dallas Building Code, 6 are proposed to the Dallas Fire Code and 2 are proposed to the Waterworks Ordinances. The actual changes -- including existing code wording, proposed new wording and deleted wording -- are presented in Appendix A in succession by numerical code section.

Each of the proposed code changes can be classified into one of two basic types. The first type of code change concerns those changes which mandate automatic sprinkler installations. These changes are few in number but wide in scope. The second type of change is that which eliminates, reduces or modifies other fire protection or life safety requirements in lieu of mandatory automatic sprinklers. These eliminations, reductions and modifications will help off-set the cost of mandatory sprinkler protection.

The identification and development of the proposed code changes was dependent upon several concerns and considerations. Understanding the development of codes was important in order to realize how current requirements came to exist and how they interface with other code requirements. A knowledge of fire department operations was important in evaluating the impact that code requirements have on effective and safe fire fighting. Understanding the performance and application of automatic sprinklers is essential since sprinklers become the premise for the reduction, elimination and modification of some current code requirements. An understanding of the interrelation of building fire safety features is most important to assure that code requirements provide fire safety redundancy. Coupling the above considerations with supportive technical information, requirements of other recognized codes and standards, fire experience data, along with experience and engineering judgment provides the basis for the proposed code changes.

The supporting rationale for the proposed code changes is discussed below with accompanying explanations of the code changes. The following text does not necessarily represent an exhaustive critical analysis of any particular code section or topic, but is intended to provide the supportive reasoning and technical basis behind the proposed changes. Certain issues involved in the proposed code changes have themselves been the subject of intensive studies and analyses.

## BUILDING CODE CHANGES

### Subchapter 5

Subchapter 5 of the Dallas Building Code addresses general requirements for the various occupancies -- hospitals, offices, dwellings, factories, schools, restaurants, etc. -- which are categorized in the code. Among the general requirements are limitations on the allowable height and floor size (area) of a building, the degree of fire resistance required for structural members of a building, and requirements for buildings that house more than one occupancy.

The first code change, B-1, allows a doubling of the area for a minor accessory use in a building. Code Section 503 allows occupancies which do not occupy a large floor area to be considered accessory to the major occupancy of the building without subjecting the building to a more stringent area limitation requirement or requiring a fire-resistive separation between the occupancies. Currently, the code permits occupancies to be considered accessory use for up to 10 percent of the area of the floor. With the provision of automatic sprinkler protection, the proposed change will permit accessory uses up to 20 percent of a floor area. Regardless of the provision of automatic sprinklers, the basic area permitted for accessory use will still be limited to the basic areas found in Table 5-C of the Dallas Building Code. The additional risk introduced by allowing greater area for accessory use will be compensated for by the provision of automatic sprinkler systems. The current provision allowing 10 percent is essentially founded on a subjective basis. Since most codes allow increases in the total allowable building area of up to three times the basic area, a 100 percent increase in the allowed accessory use is consistent with currently accepted fire protection practice.

Proposed code changes B-4, B-5, B-6, B-7 and B-8 address the topic of maximum allowable building heights and areas. The Dallas Building Code, as other building codes,

prescribes basic height and area limitations for buildings of a particular occupancy and type of construction. These limitations, which were primarily developed out of a concern for property protection and manual fire fighting capabilities, have been based upon experience, judgment and applied assumptions.

Height and area limitations help to reduce or eliminate the possibility of large, disastrous fires and limit the number of persons exposed to a single fire. The potential for total building involvement and possible conflagration depends upon the amount and arrangement of a building's combustible contents, the ability of a building structure to resist the effects of a fire involving the contents, and the success of suppression efforts. This threat of unrestricted fire spread and the experience of unsuccessful, hazardous manual fire fighting are primary reasons for height and area limitations. The greater the area and height of a building, the greater will be the amount of combustible materials which can contribute to the development and spread of a fire. As a fire spreads and involves larger portions of a building, there will be an increasing demand upon fire department suppression efforts, decreased possibility of successful manual extinguishment or containment, and an increased risk of fire spread to adjacent properties. Larger buildings also increase the hazard to fire fighters due to the greater distances of travel required to reach the fire.

Although limiting the number of persons exposed to fire is not a primary reason for area limits, it is a consideration for height limits. The National Fire Protection Association's "Guide on Building Areas and Heights (NFPA 206M)," does not identify the prevention of loss of life and personal injury as a reason for the limitation of building areas and heights. Such provisions for the prevention of life loss and personal injury are generally addressed by other code regulations. A primary example of such life safety regulations can be found in the Dallas Building Code in the form of exit requirements. Since the number and location of exits are required to adequately accommodate any building, regardless of size, the necessity to limit the area of a building becomes less important from a life safety standpoint. The height of a building, however, does increase the required time and travel distance necessary for evacuation. The concept of not limiting the area, but only the height of buildings for life safety purposes, is exemplified by the National Fire Protection Association's Life Safety Code (NFPA 101) which restricts the allowable height of various construction types for some occupancies, but does not restrict the area of the buildings.

Although limiting the height and area of buildings is a fundamental principle of building codes to the problems of conflagration, fire fighting and evacuation of buildings, there is another solution which is widely recognized by building codes for effective fire control. This solution considers the use of automatic fire extinguishing systems. Typically, building codes will allow a 100 to 300 percent increase in the allowable building area and/or an increase in the allowable height when a building is protected by an automatic fire extinguishing system. Proposed changes to Sections 506(b), 506(c) and 507 of the Dallas Building Code are an expansion of this principle.

The provision of automatic sprinkler protection essentially minimizes the problems of conflagration, manual fire fighting and evacuation. Automatic sprinkler systems are designed to limit fires to the area of fire origin and have proven to accomplish this function as demonstrated by sprinkler performance statistics. The ability of a sprinkler system to control a building fire is not dependent upon the floor area protected. The significance of this method of fire control is simply stated by NFPA's "Guide on Building Areas and Heights:"

The total fire area of a building is irrelevant when a fire is controlled or extinguished at the point of origin.

Automatic sprinkler systems have proven to be a much more effective method of suppression than manual methods and will prevent excessive demands on the fire department and water supplies. Automatic sprinklers will also greatly reduce or eliminate potential risks to fire fighters.

The current Dallas Building Code allows a 200 percent increase in area for one-story buildings and either a 100 percent increase in area or a one-story height increase in multi-story buildings protected by automatic sprinklers. The Dallas Building Code does not permit simultaneous increases for both height and area. However, proposed modifications to sections 506(c) and 507 of the Dallas Building Code will allow height increases and area increases to be taken together. Simultaneous increases are permissible since the area of a building is not a significant life safety consideration. Also, the area is an irrelevant consideration for buildings with dependable automatic suppression capability. This change is consistent with the Basic Building Code which permits simultaneous height and area increases. The prohibition of height and area increases for Group H, Division 1 and 2 occupancies remains applicable.

"Unlimited area" buildings are currently permitted by the Dallas Building Code for one- and two-story buildings of Group B and Group H, Division 5 occupancies that are provided with automatic sprinklers and/or surrounded by a 60 foot clear space, and Type I fire-resistive structures. These unlimited area provisions will remain applicable. Additional unlimited area provisions are proposed for occupancies housed in Type II or Type IV construction. Current exclusion of Group H, Division 1 and 2 occupancies (occupancies used for the storage and handling of flammable or explosive materials) from the unlimited area provisions will remain in the code.

Unlimited area will be permitted for Type II fire-resistive buildings protected by automatic sprinkler systems. This construction type will also be permitted to be unlimited in height as proposed in Code Change B-8. The basic minimum fire resistance required for Type II fire-resistive structures is two hours and is considered to provide sufficient fire limiting redundancy between floors. The 1981 edition of the NFPA Life Safety Code recognizes buildings having two hours of fire resistance as providing adequate structural fire integrity without the supplemental use of sprinklers and does not limit the height of such buildings.

Type II construction having one-hour fire-resistive structural elements (Type II-1 hour) and protected by automatic sprinkler systems will also be allowed unlimited area. The fire-resistance capability of one-hour structures also provides fire-limiting redundancy but is not comparable to that provided for structures having two hours of fire resistance. Therefore, the heights for one-hour structures are restricted to the currently specified tabular quantities with a permissible one-story increase for automatic sprinklers.

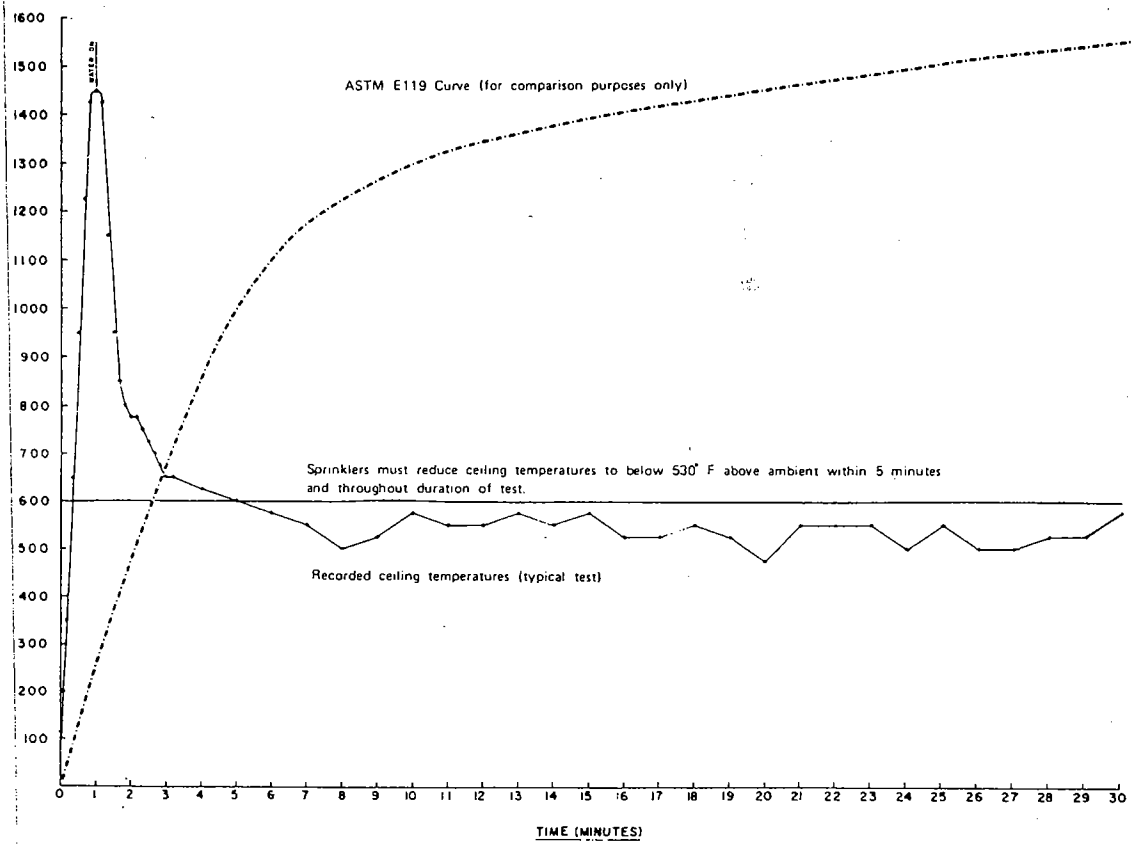
Both Type IV (commonly known as heavy timber construction which consists of large solid wood members) and Type II noncombustible (Type II-N) construction (commonly known as unprotected noncombustible construction) are proposed to be allowed unlimited area for buildings permitted up to three stories in height. Although both Type IV and Type II-noncombustible construction technically have no test-qualified fire resistance, they both exhibit inherent fire-resistive characteristics that is attributed to the size and mass of the structural members involved in their construction. The sprinkler system protection required for unlimited area buildings will supplement the

inherent structural fire resistance of these construction types. The ability of automatic sprinklers to provide structural protection and substitute for other methods of fire resistance such as tested fire assemblies, sprayed-on fireproofing, and plaster, gypsum or concrete coverings is well substantiated.

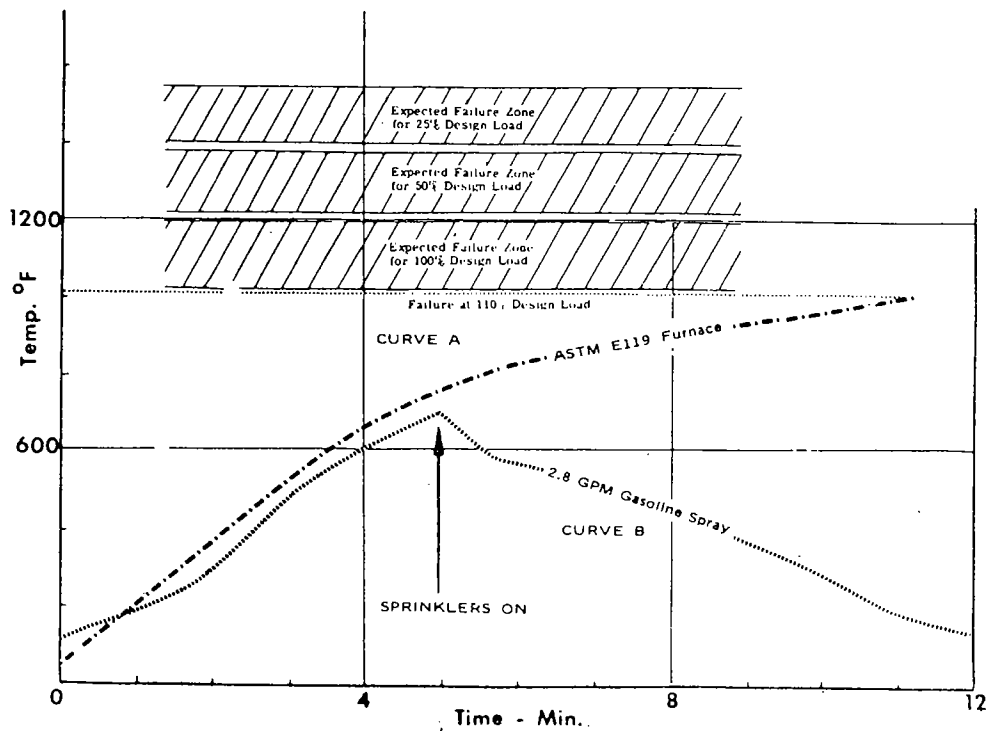
The basic criteria used for determining the relative fire resistance of structural elements is the American Society for Testing Materials (ASTM) E119 standard time temperature furnace test. A fire-resistance rating is the time period a building element (e.g., column, beam) can withstand a fire exposure of the standard time temperature furnace test without failure. The use of the ASTM E119 fire exposure is based upon a representative fire exposure a building can be expected to endure which has been correlated to full-scale burnout tests. The premise of the application of the test, however, is that the structure only provides passive resistance to the fire. No suppression, manual or automatic, is considered.

The temperature-limiting capability of automatic sprinklers is graphically compared to the ASTM E119 temperature curve in Figure 13. The sprinkler test represented in the graph is one of a multitude of tests used by Underwriters Laboratories, Inc. and Factory Mutual Research for sprinkler listing and approval. The test uses a 300-pound wood crib centered under four open sprinklers. The wood crib is allowed to burn above a combustible liquid spray of n-heptane. After approximately one minute or after ceiling temperatures reach 1,400°F, water is supplied to the four open sprinklers. Within five minutes and throughout the duration of the test, the sprinklers must bring ceiling temperatures back below 600°F. Steel without fireproofing is considered to be threatened if it is exposed to temperatures over 1,000°F for over 10 minutes. Obviously, the test criteria are below this threatening limit.

Another example of the ability of sprinklers to limit temperature and provide structural protection is illustrated in Figure 14. Developed in 1965 by Factory Mutual Research, the curves shown in Figure 14 indicate that a bare steel H-column, subjected to a fire exposure similar to that encountered by the ASTM E119 test, could be expected to maintain its strength indefinitely with the use of automatic sprinkler protection. The steel column would otherwise be expected to fail in less than 15 minutes.



**FIGURE 13**  
**TYPICAL SPRINKLER FIRE TEST PERFORMANCE**



**FIGURE 14**  
**COLUMN TEMPERATURES DURING EXPOSURE TO ASTM E-119**  
**STANDARD FURNACE AND SIMULATED EXPOSURE WITH SPRINKLER PROTECTION**  
 Source: Fire Sprinkler Laws, NAS & FCA.

Further substantiation of the ability of sprinklers to provide primary structural protection, particularly for light steel members, is based on large scale fire tests conducted at the Factory Mutual Research Center in Rhode Island. The tests that were conducted used a heavy fire loading consisting of combustibles in a rack storage arrangement. The sprinkler densities which were used are those from NFPA 231C, "Rack Storage of Materials." None of the tests conducted produced critical temperatures in bar joists 12 feet, 6 inches away from the ignition source and roof steel never exceeded critical temperatures, even with sprinkler densities less than the quantities specified by NFPA 231C. Likewise, tests with polyurethane buns conducted by Factory Mutual confirmed the ability of sprinklers to control column temperatures under very severe fire conditions.

The above cited substantiation provides a strong basis for allowing active protection systems to substitute for traditional passive fire resistance in certain limited height structures, such as proposed for three-story Type II-noncombustible structures. Tests also confirm the ability of sprinklers to provide structural protection for wood construction and, therefore, unlimited area, is similarly proposed for Type IV construction (heavy timber) up to 3 stories in height. Development work for the modern-day sprinkler by Factory Mutual Research in the 1940's and 50's showed that sprinklers were able to eliminate active flaming combustion of wood ceilings by preventing the adjacent air temperature from rising substantially above 1,000<sup>o</sup>F.

A dramatic illustration of sprinkler protection to supplement the fire resistance of wood materials occurred in full-scale fire experiments conducted by the Illinois Institute of Technology Research Institute in 1972. These experiments demonstrated that a hollow-core wood door protected by a simplified sprinkler system, with a water delivery rate much less than required by design standards, could indefinitely withstand the room fire exposure of a heavily fire-loaded residential occupancy.

The previously discussed code changes for unlimited area allowances are instituted only for noncombustible and heavy timber construction types. The existing code allowances for increased area of other combustible construction types remains unchanged. Again, however, simultaneous height increases are proposed to be permitted.

In addition to the across-the-board height and area changes proposed to the Dallas Building Code, there is a specific change proposed for Tables 5-C and 5-D of the



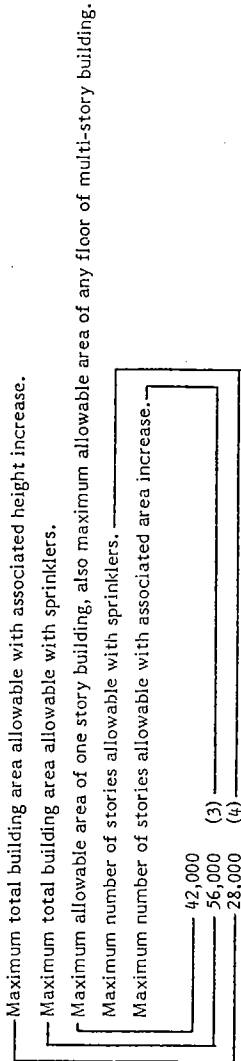
building code. These tables, which provide the basic areas and heights from which increases are derived, are proposed to remain unchanged with the following exception. Currently, Group I, Division 1 and 2 occupancies (nursing homes, nurseries and hospitals) are not permitted to be built of Type II-N (unprotected noncombustible) construction. A note added to both these tables (Proposed Changes B-4 and B-5) permits an exception by allowing Type II-N construction to a maximum height of one story with unlimited area if the building is protected by automatic sprinklers. All other "Not Permitted" categories will remain as found in the code. Permissible use of sprinklered, one-story, unprotected noncombustible construction for hospitals and nursing homes is consistent with the Basic Building Code, the Standard Building Code and the NFPA Life Safety Code.

All the ramifications and interrelations of the height and area limit changes are not directly apparent from reading the actual proposed code change wording in Appendix A. In order to clarify the intent of these changes and to assist the reader in understanding the extent of the changes, Table 10 has been prepared. This table allows the comparison of existing maximum height and areas allowed for sprinklered buildings and the maximum height and areas that are possible as a result of the code changes. The maximum areas shown are based on the increases permitted only for automatic sprinklers and do not consider increases permitted for clear space separation around buildings. The cumulative corresponding maximum allowable area with sprinkler increases and clear space separation increases, however, can be determined by multiplying the area figures shown in the chart by a factor of two.

The final change proposed to Subchapter 5, Change B-9, involves the deletion and rewrite of Section 508. The existing Section 508 allows the substitution of an approved automatic fire extinguishing system for construction required to have one hour of fire resistance, when the extinguishing system is not otherwise required. This permitted reduction in fire resistance is strongly supported by tests and other technical data which was previously discussed. However, by means of an existing exception to Section 508, application of this substitution principle is disallowed for occupancy separations, exterior wall protection, area separation walls, shaft enclosures, corridor wall construction, exit enclosures and construction separations.

**TABLE 10**  
**COMPARISON OF MAXIMUM ALLOWABLE HEIGHTS AND AREAS OF SPRINKLERED ONE-STORY AND MULTIPLE STORY BUILDINGS**  
**EXISTING REQUIREMENTS VS. PROPOSED REQUIREMENTS**

Explanation of Table: Each grouping of numbers provides the following information:



Existing

Proposed

Proposed maximum total area and number of stories simultaneously allowable with sprinklers.  
 Proposed maximum allowable area of one story building, also maximum allowable area of any floor of multi-story building.

Occupancy	Type I		Type II		Type III		Type IV		Type V	
	Fire Resistive	Fire Resistive	I-Hour	N	I-Hour	N	I-Hour	N	I-Hour	N
A-1 Existing	UL	89,700								
	UL (UL)	119,600 (4)	NP	NP	NP	NP	NP	NP	NP	NP
Proposed	NC	UL	NC	NC	NC	NC	NC	NC	NC	NC
	NC (NC)	UL (UL)								
A) 2-2.1 Existing	UL	89,700	40,500	NP x	40,500	NP x	40,500	NP x	31,500	NP x
	UL (UL)	119,600 (4)	54,000 (2)	NP x	54,000 (2)	NP x	54,000 (2)	NP x	42,000 (2)	NP x
Proposed	NC	UL	UL	NC x	NC	NC x	UL	NC	NC	NC
	NC (NC)	UL (UL)	UL (3)	NC (3)	54,000 (3)	NC (3)	UL (3)	UL (3)	42,000 (3)	NC x
A) 3-4 Existing	UL	89,700	40,500	27,300	40,500	27,300	40,500	40,500	31,500	18,000
	UL (UL)	119,600 (12)	54,000 (2)	18,200 (2)	54,000 (2)	18,200 (2)	54,000 (2)	54,000 (2)	42,000 (2)	12,000 (2)
Proposed	NC	UL	UL	UL	NC	NC	NC	NC	NC	NC
	NC (NC)	UL (UL)	UL (3)	UL (2)	54,000 (3)	36,400 (2)	UL	UL	42,000 (3)	24,000 (2)
B) 1-2-3 Existing	UL	119,700	54,000	36,000	54,000	36,000	54,000	54,000	42,000	24,000
	UL (UL)	159,600 (12)*	72,000 (4)*	48,000 (2)*	72,000 (4)*	48,000 (2)*	72,000 (4)*	72,000 (4)*	56,000 (3)*	32,000 (2)*
Proposed	NC	UL	UL	UL	NC	NC	UL	UL	NC	NC
	NC (NC)	UL (UL)	UL (5)	UL (3)	72,000 (5)*	48,000 (3)*	72,000 (5)	72,000 (5)	56,000 (4)*	32,000 (3)*

TABLE 10  
 COMPARISON OF MAXIMUM ALLOWABLE HEIGHTS AND AREAS OF SPRINKLERED ONE-STORY AND MULTIPLE STORY BUILDINGS  
 EXISTING REQUIREMENTS VS. PROPOSED REQUIREMENTS  
 (CONTINUED)

Occupancy	Type I		Type II		Type III		Type IV		Type V	
	Fire Resistive	Fire Resistive	I-Hour	N	I-Hour	N	I-Hour	N	I-Hour	N
B-4 Existing	UL (UL)	179,700 **	81,000 **	54,000 **	81,000 **	54,000 **	81,000 **	54,000 **	63,000	36,000
	UL (UL)	239,600 (12)*	108,000 (4)*	72,000 (2)*	108,000 (4)*	72,000 (2)*	108,000 (4)*	72,000 (2)*	84,000 (3)*	48,000 (2)*
Proposed	NC (NC)	UL **	UL **	UL **	NC **	NC **	UL (3)	NC (3)*	NC	NC
	NC (NC)	UL (UL)	UL (5)	UL (3)	108,000 (5)*	74,000 (3)*	UL (3)	UL (5)	84,000 (4)	48,000 (3)
E Existing***	UL (UL)	135,600	60,600	40,500	60,600	40,500	60,600	40,500	47,100	27,300
	UL (UL)	180,800 (4)	80,800 (2)*	27,000 (2)	80,800 (2)*	27,000 (2)	80,800 (2)*	27,000 (2)	62,800 (2)*	18,200 (2)
Proposed***	NC (NC)	UL (UL)	UL (3)*	UL (2)*	NC	NC	UL (3)*	NC (3)*	NC	NC
	NC (NC)	UL (UL)	UL (3)*	UL (2)*	80,800 (3)*	54,000 (3)*	UL (3)*	UL (3)*	62,800 (3)*	36,400 (2)*
H) 1 Existing	15,000	12,400	5,600	3,700	5,600	3,700	5,600	3,700	4,400	2,500
	30,000 (UL)	24,800 (2)	1,500 (2)	1,500 (2)	1,500 (2)	1,500 (2)	1,500 (2)	1,500 (2)	1,500 (2)	1,500 (2)
Proposed	NC (NC)	NC (NC)	NC (NC)	NC (NC)	NC (NC)	NC (NC)	NC (NC)	NC (NC)	NC (NC)	NC (NC)
	NC (NC)	NC (NC)	NC (NC)	NC (NC)	NC (NC)	NC (NC)	NC (NC)	NC (NC)	NC (NC)	NC (NC)
H) 2 Existing	15,000	12,400	5,600	3,700	5,600	3,700	5,600	3,700	4,400	2,500
	30,000 (UL)	24,800 (5)	11,200 (2)	1,500 (2)	11,200 (2)	1,500 (2)	11,200 (2)	1,500 (2)	8,800 (2)	1,500 (2)
Proposed	NC (NC)	NC (NC)	NC (NC)	NC (NC)	NC (NC)	NC (NC)	NC (NC)	NC (NC)	NC (NC)	NC (NC)
	NC (NC)	NC (NC)	NC (NC)	NC (NC)	NC (NC)	NC (NC)	NC (NC)	NC (NC)	NC (NC)	NC (NC)
H) 3-4-5 Existing	UL (UL)	74,400	33,600	22,500	33,600	22,500	33,600	22,500	26,400	15,300
	UL (UL)	99,200 (5)*	44,800 (2)*	15,000 (2)*	44,800 (2)*	15,000 (2)*	44,800 (2)	15,000 (2)*	35,200 (2)	10,200 (2)*
Proposed	NC (NC)	UL (5)	UL (2)	UL (2)	NC	NC	NC (3)*	NC (3)*	NC	NC
	NC (NC)	UL (UL)	UL (2)	UL (1)	44,800 (2)*	30,000 (2)*	UL (3)*	UL (3)*	35,200 (2)*	20,400 (2)*
I-1 Existing	UL (UL)	45,300	20,400	NP	20,400	NP	20,400	NP	15,600	NP
	UL (UL)	60,400 (3)	13,600 (2)	NP	13,600 (2)	NP	13,600 (2)	NP	10,400 (2)	NP
Proposed	NC (NC)	UL (UL)	UL (2)	UL (1)	NC	NC	NC (2)	NC (2)	NC	NC
	NC (NC)	UL (UL)	UL (2)	UL (1)	27,200 (2)	UL (1)	UL (2)	UL (2)	20,800 (2)	NC
I-2 Existing	UL (UL)	45,300	20,400	NP	20,400	NP	20,400	NP	15,600	NP
	UL (UL)	60,400 (3)	27,200 (2)	NP	27,200 (2)	NP	27,200 (2)	NP	20,800 (2)	NP
Proposed	NC (NC)	UL (UL)	UL (3)	UL (1)	NC	NC	NC (3)	NC (3)	NC	NC
	NC (NC)	UL (UL)	UL (3)	UL (1)	27,200 (3)	UL (1)	UL (3)	UL (3)	20,800 (3)	NC

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 COMPARISON OF MAXIMUM ALLOWABLE HEIGHTS AND AREAS OF SPRINKLERED ONE-STORY AND MULTIPLE STORY BUILDINGS  
 EXISTING REQUIREMENTS VS. PROPOSED REQUIREMENTS  
 (CONTINUED)

Occupancy	Type I		Type II		Type III		Type IV		Type V	
	Fire Resistive	Fire Resistive	I-Hour	N	I-Hour	N	I-Hour	N	I-Hour	N
I-3	Existing	UL (UL) 45,300 60,400 (2) 30,200 (3)	NP	NP	NP	NP	NP	NP	NP	NP
	Proposed	NC (NC) UL (3)	NC	NC	NC	NC	NC	NC	NC	NC
M	Existing		Special Provisions of Chapter 11 are Applicable							
	Proposed		No Change							
R-1	Existing	UL (UL) 89,700 119,600 (12) 59,800 (13)	40,500 54,000 (4) 27,000 (5)	27,300 36,400 (2)** NA	40,500 54,000 (4) 27,000 (5)	27,300 36,400 (2)** NA	40,500 54,000 (4) 27,000 (5)	31,500 42,000 (3) 21,000 (4)	18,000 24,000 (2)** NA	
	Proposed	NC (NC) UL (UL)	UL (5) UL (5)	UL (2)** UL (2)**	NC 54,000 (5)	NC NC(NC)**	NC UL (3) 54,000 (5)	NC NC NC	NC NC(NC)** NC(NC)**	
R-3	Existing	UL (UL) UL (UL)	UL (3) UL (3)	UL (3) UL (3)	UL (3) UL (3)	UL (3) UL (3)	UL (3) UL (3)	UL (3) UL (3)	UL (3) UL (3)	UL (3) UL (3)
	Proposed	NC (NC) NC (NC)	NC (4) NC (4)	NC (4) NC (4)	NC (4) NC (4)	NC (4) NC (4)	NC (4) NC (4)	NC (4) NC (4)	NC (4) NC (4)	NC (4) NC (4)

Notes:

- NA - Not Applicable
- NP - Not Permitted
- NC - No Change
- UL - Unlimited

- x Permitted by Section 508, which allows one-hour construction to be reduced to unprotected construction. Height and area may not exceed maximum unsprinklered height and area for one-hour protected construction.
- \* The area of a sprinklered one- or two-story Group B or Group H, Division 5 occupancy of this construction type is not limited if the building is entirely surrounded by clear space of 60 feet in width.
- \*\* The existing code provisions allow unlimited area for a sprinklered or unsprinklered building of this construction type if the building is entirely surrounded by clear space of 60 feet in width. Proposed provisions will also permit unlimited area; however, such buildings are required to be sprinklered by the proposed provisions.
- \*\*\* Section 802(a) allows areas to be increased by 50 percent when the maximum travel distance specified in Section 3302(d) is reduced by 50 percent.
- + Rooms in Divisions 1 and 2 occupancies used for day care purposes, kindergarten, first or second grade pupils and Division 3 occupancies are not permitted above the first story.
- \*\* Group R, Division 1 occupancies more than two stories in height or having more than 3,000 square feet of floor area above the first story, are required to be not less than one-hour fire-resistive construction.

The proposed rewritten version of Section 508 will allow the substitution of automatic sprinklers for several of these fire safety features. Crediting automatic extinguishing systems, such as sprinkler systems, for otherwise necessary fire safety features is a basic consideration of the NFPA Systems Concept. This consideration of the Systems Concept is currently being applied nationally via the "Fire Safety Evaluation System" (FSES) for health care facilities. The FSES which was developed by the National Bureau of Standards and is formally recognized by the NFPA Life Safety Code, allows the use of one or more fire safety features to compensate for the lack of other features. The FSES recognizes automatic sprinklers as the only fire safety feature which can compensate for any of the other required fire safety features, such as fire resistance, compartmentation, smoke control, exits, etc.

The fire-resistance requirements for occupancy separations is the first item of the rewritten Section 508 for which sprinklers may be substituted. This change will effectively eliminate one-hour occupancy separations required by Table 5-B of the Dallas Building Code and will allow a one hour reduction in the fire resistance for occupancy separations required to have two or more hours of fire resistance. It should be noted that the fire-resistive reductions will not be permitted for Group B, Division 1 occupancies (gas stations and vehicle storage garages) or Group H occupancies (occupancies used for storage and handling of flammable or explosive materials). These occupancies have characteristics where materials having an explosive nature are frequently encountered. Since these hazards may represent non-traditional fire growth scenarios upon which sprinklers can reasonably be expected to perform, an additional degree of redundancy is considered necessary.

The fire resistance and opening protection requirements for exterior walls is the second item for which sprinkler protection is allowed to substitute. This allowed substitution is applicable only to the wall requirements governed by Section 504(b) and Table 5-A of the Dallas Code, but does not apply to the wall requirements governed by Table 17-A for types of construction.

The prevention of the spread of fire between buildings and potential damage from fire in an exposing building are the main fire protection functions of rated exterior building walls. The exterior wall requirements of the Dallas Building Code are dependent upon the the fire load of the occupancy and distance of walls from the property line (or an assumed property line for buildings located on the same property). The risk of fire

spread from exposing buildings is increased as buildings are located closer together. Depending upon the occupancy and separation distance between adjoining properties, the requirement for exterior walls can vary from a required four-hour fire-resistive wall with no allowed openings, to one-hour walls with unprotected openings or openings protected by fire doors and fire windows. These current exterior wall protection requirements of the Dallas Building Code which reduce the risk of fire spread can be reduced for the provision of automatic sprinklers, which will greatly diminish or eliminate the risk of building-to-building fire spread. The 1980 edition of NFPA 80A, "Recommended Practice for Protection of Buildings from Exterior Fire Exposures," recognizes automatic sprinkler protection as a solution to the problem of fire exposure, as follows:

Where the exposing building or structure is protected throughout by an approved properly maintained system of automatic sprinklers of adequate design for the hazard involved, no exposure hazard is considered to exist.

Also,

Where the exposed building or structure is protected throughout by an approved properly maintained system of automatic sprinklers of adequate design for the hazard involved, the exposure hazard to the total exposed building and its contents is materially reduced.

If all buildings of any particular community were protected by automatic sprinkler systems, no exposure hazard would be present and fire-resistive requirements for exterior walls could be eliminated, except as would be necessary to comply with construction type requirements. However, new buildings protected by automatic sprinkler systems are considered to have the exposure risk and potential for fire spread significantly reduced. Therefore, Section 508, although not permitting an elimination of the fire resistance of exterior walls, does permit a reduction in the required fire protection rating of the walls. Four-hour required exterior walls will be allowed to be reduced to two-hour walls and two-hour walls will similarly be allowed a reduction to one hour of fire resistance. Where one-hour walls and opening protectives are required, the opening protectives may be eliminated with the provision of automatic sprinklers, however, the required fire resistance of the walls shall not be reduced.

The fire-resistive reduction allowed for four-hour exterior walls by the proposed Section 508 will also be permitted for walls used to separate buildings of the same or

different construction type. This change will allow separation walls constructed in accordance with the code provisions for two-hour area separation walls to define the boundaries of a building for all occupancies, except Group H.

Current Sections 3304(g) and 3304(h) of the Dallas Building Code require corridors serving greater than thirty occupants to be constructed with walls and ceilings having a fire resistance of one hour. Penetrations of this corridor envelope created by door openings or duct penetrations are required to be protected by self-closing, 20 minute rated fire doors and fire dampers, respectively. The provision of automatic sprinkler protection will be allowed to substitute for this corridor separation requirement for all occupancy groups except Group H, Division 1, Group I, Division 3 (institutional buildings where inmates are restrained) and Group R (hotels, apartments).

Both the Life Safety Code and the 1981 Basic Building Code allow such reduction for automatic sprinklers. The Life Safety Code allows health care occupancies protected by automatic sprinkler systems to have corridors constructed of nonrated fire partitions that terminate at a ceiling. The Basic Building Code allows buildings with automatic sprinkler systems supervised at a constantly attended location to utilize nonrated fire corridor construction for business, industrial, mercantile, storage and various assembly occupancies. The Basic Building Code also allows a reduction in the fire-resistance rating of corridor walls to one-half hour for hotel and apartment occupancies. The primary reasoning behind such allowances is the ability of automatic sprinklers to control a fire at the area of origin while reducing the "stress" on rated construction components, thereby preventing the spread of fire into or out of a corridor and allowing additional time that may be needed for evacuation by means of a building's corridor system.

Several tests substantiate this rationale. In 1959, the Los Angeles Fire Department undertook a series of fire tests known as "Operation School Burning." The tests, which were conducted in a three-story school facility, concluded that a complete system of automatic sprinklers will maintain low temperatures throughout a building and will reduce build-up of smoke and irritating gases, allowing more time for evacuating occupants. In 1966, tests conducted by the City of Denver at the Parklane Hotel indicated that sprinklers located only in corridors were able to permit egress past an opening of a room involved in fire. This was further confirmed by the National Bureau of Standards in 1977. Testing and research performed by the National Bureau of

Standards and sponsored by the Departments of Housing and Urban Development and Health, Education and Welfare showed that the application of sprinkler spray in the corridor is effective in reducing exit corridor gas temperatures outside of the spray zone to a level low enough for passage. The American Health Care Association sponsored a series of 14 full-scale tests in 1974 which concluded that corridor wall construction having one-hour fire-resistance rating provides no significant fire safety function in buildings provided with automatic sprinkler protection.<sup>21</sup>

The fifth and last item in the proposed Section 508 is very specific in nature and is provided in order to maintain consistency with the existing Section 508. The deletion of the existing provision would disallow unprotected construction types housing Group A, Division 2 and 2.1 occupancies. Table 5-C of the Dallas Building Code does not permit unprotected construction types for these assembly occupancies. However, it permits structures having one hour of fire resistance to be built as structures having no fire-resistance rating when the structures are provided with an automatic sprinkler system. Therefore, the intent of this change to revised Section 508 is made to assure that the allowances previously permitted by this section are not inadvertently deleted.

Also consistent with the existing Section 508 is the continuation of the exception which prevents the fire-resistive construction requirements for shaft enclosures, stair enclosures and exit passageways from being reduced because of the provision of automatic sprinkler systems. Structural members supporting shaft enclosures or exit passageways are additionally listed as an exception. Redundancy for the exit facilities in a building is considered a necessary feature.

The last exception listed in the revised Section 508 will prevent one-hour corridor separations for unsprinklered hospital rooms from being deleted. In effect, any room in a hospital which is exempt from protection by automatic sprinklers must still comply with the corridor separation requirements stipulated by the Dallas Building Code.

## **Subchapter 6**

Subchapter 6 of the Dallas Building Code contains specific requirements for Group A (assembly) occupancies.



Proposed Code Change B-10, which is the only change proposed to Subchapter 6 of the Dallas Building Code, is a corollary change to Proposed Code Change B-38, which deletes the requirements for smokeproof enclosures. It should be noted that Proposed Code Change B-10 is applicable to five other code sections in addition to Section 604 of Subchapter 6. Commentary regarding Proposed Code Changes B-10 and B-38 can be found in the discussion related to the proposed changes of Subchapter 33.

### **Subchapter 7**

Subchapter 7 of the Dallas Building Code addresses requirements for Group B occupancies. This classification includes gasoline service stations, retail stores, office buildings, factories, aircraft storage hangars, open parking garages, power plants and storage buildings. This occupancy classification within the UBC is unique to that of most other codes in that a broad range of commercial buildings is included. Many other building codes provide distinct occupancy classifications for business buildings, factory buildings, mercantile buildings and storage buildings. The activity within the Board for the Coordination of Model Codes is presently working toward a common occupancy classification system for all model building codes which may ultimately result in more discrete occupancy classifications for the UBC.

The first change (B-11) in Subchapter 7 modifies Section 702(a)2 of the Dallas Building Code. This section currently allows a designer to build a structure housing a Group B, Division 2 occupancy (e.g., office) or a Group R, Division 1 occupancy (e.g., hotel) above a Group B, Division 1 occupancy (e.g., garage) and allow the garage and office or hotel to be considered as separate buildings when four conditions are met. With the four conditions met, a designer can benefit by building the office/hotel portion of the structure of a lesser construction with greater height and area than would otherwise be permitted. One of the four conditions requires a three-hour occupancy separation between the garage and office/hotel. The proposed code change will permit a two-hour fire-resistive separation to be utilized when the entire structure is protected by automatic sprinklers. This reduction is permitted with regard for the ability of automatic sprinklers to offset passive fire-resistance criteria, and the relative low hazard of Group B, Division 1 occupancies. Even with this fire-resistance reduction, an ample degree of fire-resistance redundancy is assured by the requirement for two hours of fire resistance.

Proposed Change B-12 deletes the reference in Section 702(b) to Section 3206. As discussed in a later section of this report, the requirement for smoke and heat venting in fully sprinklered buildings is proposed to be deleted.

Section 709 of the Dallas Building Code addresses special requirements applicable to open-air parking garages, including allowable types of construction as specified in Table 7-A. While the inclusion of an automatic fire extinguishing system is presently considered in Table 7-A, the present requirements are considered more restrictive than that allowed by a national consensus standard specifically dealing with open-air parking garages. NFPA Standard No. 88A-1979, "Standard for Parking Structures," allows a substantial increase both in area and height for open-air parking structures over that presently allowed in the Dallas Building Code. In fact, both larger areas and greater heights are allowed in the NFPA standard for unsprinklered parking garages, as well. Being conservative, however, Proposed Code Change B-13 only allows increased area and height limits for sprinklered open-air parking garages. The resulting code language proposed for the Dallas Building Code remains slightly more conservative than that contained in the NFPA standard.

Additional rationale for the reduction in fire-resistance ratings for sprinklered open-air parking garages beyond that presently allowed by the Dallas Building Code is based upon studies conducted in Europe, Japan and the United States, including full scale tests in open-air parking structures.<sup>22</sup> Fire tests have demonstrated that a fire in an automobile in an open-air parking structure will be limited to the vehicle of origin with a high degree of probability. In addition, even in a parking structure of unprotected noncombustible (Type II-N) construction, the maximum temperature of structural steel remained far below critical levels during the test fire.

Surveys of fire experience in automobile parking structures have also demonstrated that the structures have a low-fire frequency as well as a low fire load (less than two pounds per square foot).<sup>23</sup> Parking structures also have a relatively low occupant load when compared to most other occupancies.

These data, in conjunction with a building configuration that facilitates fire department access and the dissipation of combustion products, form the basis for a liberalization of present code requirements.

As can be seen in Table 7-A of the current Dallas Building Code, unlimited area and height is currently allowed for open-air parking garages of Type I construction, whether or not the garage is sprinklered. The previously referenced studies indicate that the fire-resistance rating afforded by a Type I structure is more than sufficient for the occupancy, as currently reflected in the table. Proposed Change B-13 also allows unlimited area and unlimited height for open-air parking garages of Type II fire-resistive construction if they are fully sprinklered. Again, the fire-resistance rating of the structure would be more than sufficient to accommodate the occupancy, even if the building is not sprinklered. This particular modification, therefore, is considered to be an acceptable liberalization, yet provides the necessary factor of safety for structural integrity. Similarly, the proposed modification for sprinklered Type II one-hour open-air parking structures would provide the redundancy of inherent fire resistance for the structure in conjunction with an automatic fire extinguishing system.

The proposed changes for Type II-N construction are based upon the current requirements of NFPA 88A, in conjunction with engineering judgment and fire experience. Again, the configuration and nature of the occupancy are considered sufficient bases to allow an increase in the square footage and height of open-air parking structures of Type II unprotected noncombustible construction. The present differential in allowable height between sprinklered ramp access garages and sprinklered mechanical access garages will be eliminated. The difference in risk to the general public between these structures, if fully sprinklered, is considered negligible.

An editorial change is included in the heading of Table 7-A, specifically referencing the provision of an automatic sprinkler system as opposed to another type of automatic fire extinguishing system. Fire experience indicates that water-based extinguishing systems are superior to gaseous or chemical-type extinguishing systems in an open-air parking environment. This editorial change is not intended to preclude the use of foam water sprinkler systems, or other extinguishing systems for special hazards which may exist in conjunction with the building.

Proposed Section 710 (Change B-14) would be a new section to the Dallas Building Code applicable to the covered man buildings. The proposal is based largely upon the requirements contained in Chapter 7 of the Appendix of the 1982 edition of the Uniform Building Code. The amendments to the material contained in the 1982 Uniform Building Code are based upon the requirements of other model codes, fire experience and

