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Supplemental Report

A STUDY EVALUATING THE CITY OF DALLAS CODES TO IDENTIFY CODE MODIFICATIONS COROLLARY TO THE PROPOSED EXPANSION OF AUTOMATIC SPRINKLER REQUIREMENTS

FOR THE

CITY OF DALLAS

By C. F. Baldassarra and D. J. O'Connor

OCTOBER, 1983

REVISION NOTICE

This report has been revised as a result of a review by the City of Dallas Staff after it was originally submitted to the City on October 17, 1983. Revised sections and/or pages of the report are identified as such in this report.

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INTRODUCTION

In 1981, changes proposed to the building code by the City of Dallas included a proposal to require that all buildings having an area greater than 7,500 square feet be sprinklered. The building size limit of 7,500 square feet was based upon the physical ability of the Dallas Fire Department to manually extinguish fires in typical occupancies of that size. Without such an ordinance, it could be expected that the manpower, operating expenditures and capital expenditures for the fire department would be greatly increased in the future. This proposed change represented a significant expansion of sprinkler requirements in the code at that time. Given such a requirement, the City of Dallas codes and ordinances were analyzed by Schirmer Engineering Corporation to identify traditional provisions which could be amended, recognizing the benefits of automatic sprinkler protection.

In February, 1983, Schirmer Engineering Corporation submitted a series of proposed changes and accompanying rationale for the 1980 edition of the Dallas Building Code (DBC), Dallas Fire Code and Dallas Water Works ordinances. The proposed changes identified amendments which could be made to the city codes and ordinances in order to provide an improved level of fire safety for the citizens of Dallas, and their property, without imposing an economic hardship.

The proposed modifications consisted of 48 changes to the building code, 6 changes to the fire code and 2 changes to the water works ordinances. The proposed changes, aimed at providing an improved level of safety while minimizing overly redundant requirements, were based upon a study of local and national fire experience, selected building and fire department records, other codes and standards, technical articles, test data and application of the "systems concepts" along with professional engineering judgment.

In addition to code language to accomplish the city's intent to require sprinkler systems in buildings greater than 7,500 square feet, proposed modifications included:

- An overall reduction in the required class of building construction for most occupancy groups.

- Greater allowable building height and areas than presently permitted for sprinklered buildings.

- Reduced requirements for high-rise buildings, atrium buildings, covered mall shopping centers and open parking garages.

- Revised method of calculating the required number of exits and exit width.

- Increased exit travel distance in selected occupancies.

- Reduced requirements for corridor construction.

- Additional requirements for electrical supervision of sprinkler system components for increased reliability.

- Reduced public fire (water) flow requirements.

- Elimination of water meters for closed sprinkler systems.

- Elimination of monthly charges for water connections serving fire protection systems.

Following submission of the proposed changes, the Dallas Building Code Advisory and Appeals Board (BCAAB), the Dallas Fire Code Advisory Board (FCAB) and the staffs of the Dallas Building Inspection Division and Fire Department (Staff) conducted an extensive review of each proposed modification. The FCAB and fire department have recommended approval for each of the proposed changes to the Dallas Fire Code. Proposed changes to the water works ordinances are presently under consideration.

The Dallas BCAAB conducted several public meetings in recent months to consider each of the proposed changes to the building code. As a result, the BCAAB has recommended

either approval, modification or disapproval for each of the changes. Certain concerns have been expressed by the BCAAB related to some of the proposed changes. Concern has been expressed on behalf of the Staff for some of the proposed changes which have been modified by the BCAAB. The Building Inspection Division has established a position for each proposal.

Prior to completion of the February, 1983 report, the City of Dallas adopted the 1983 edition of the Dallas Building Code, based upon the 1982 Uniform Building Code (UBC). The adoption of the 1983 edition rendered several of the proposed changes editorially obsolete because of changes between the 1980 and 1983 editions.

During the BCAAB study period, considerable discussion centered upon the original recommendation of the city for the provision of automatic sprinkler protection for buildings greater than 7,500 square feet. The Dallas Fire Department demonstrated to the BCAAB that this area represented the size of a typical building beyond which the fire department did not have capabilities in terms of manpower or equipment.

The BCAAB felt that application of a 7,500 square foot provision in the building code was "arbitrary" and did not take into account other pertinent factors such as building construction type and the relative combustibility of the occupancy.

To alleviate this concern, the fire department prepared an alternate method for determining the maximum size of an unsprinklered building by presenting the Insurance Services Office (ISO) method of calculating fire flow. The ISO fire flow formula takes into consideration building construction type, building area, occupancy and exposures. The fire department stated that the original 7,500 square foot area was derived from a fire flow of 3,000 gpm, which was the maximum amount of water that could be delivered by the fire department onto a fire, given the physical limitations of manpower and equipment. The fire department had previously averaged this data to produce the 7,500 square foot building size.

Working from the 3,000 gpm figure and taking the construction and occupancy into consideration for each building type could, therefore, generate a table of maximum allowable unsprinklered areas for each occupancy and construction type as defined in the

building code. Such a table was produced by the Staff and reviewed by the BCAAB. Because the fire flow formulas favor noncombustible construction, the table produced by the fire department demonstrated a rather substantial discrimination against combustible construction types.

The BCAAB, therefore, in conjunction with the Building Inspection Division, requested Schirmer Engineering Corporation to perform the following tasks:

- Evaluate the modifications proposed by the BCAAB and Staff to the code changes proposed by Schirmer Engineering Corporation in its February, 1983, report to assure that the overall integrity of the code would be maintained in the interest of public safety. Recommendations for acceptance, modification or rejection of each modification proposed by the Board and Staff, along with supporting rationale, is to be provided for each recommendation.

- Evaluate additional possible modifications of the code with respect to residential occupancies, as furnished by the city, along with supporting rationale for each recommendation.

- Evaluate all proposed code changes with respect to their applicability to 1983 edition of the code. Insure that all changes are preserved and that other affected sections of the code will be consistent with the context of the changes. Modify code language as necessary to accomplish the transition and to provide ordinance-ready language.

- Recommend criteria for the application of automatic sprinkler protection, depending upon building construction and occupancy, and evaluate the criteria developed by the city for maximum allowable unsprinklered building areas, along with rationale.

This report represents an evaluation of each of the proposed code changes which have been modified by the BCAAB as well as further discussion for proposed changes which have been questioned or recommended for rejection by the BCAAB or Staff. This report also includes modifications for each change proposed in the February, 1983 report to

correlate with 1983 code language. Additional proposed modifications for residential occupancies are also included. An evaluation of the criteria for the application of automatic sprinkler requirements was performed and is included in this report, along with supporting rationale. The following section of this report includes a discussion of the code changes and supporting rationale for those changes which were were either modified or rejected by the BCAAB or Staff. In addition, a discussion of the newly proposed code changes for residential occupancies is presented.

It should be noted that the February report contained a more lengthy discussion of rationale, including references and bibliography, for all code changes that were initially proposed. That rationale is not included in this report for those changes which have only been editorially revised.

Table 1 is a summary of the current code change status indicating each code change, section number, topic, BCAAB recommendation, Staff recommendation, Schirmer Engineering Corporation (SEC) recommendation and a summary of its disposition.

Complete code change language is included in Appendix A of this report. For the convenience of the reader, a summary of occupancy classifications is included in Appendix B.

TABLE 1 -- CODE CHANGE STATUS SUMMARY

Change Number	Code Section	Topic	Recommended Action/Modifications by Building Code Advisory & Appeals Board (BCAAB)	Recommended Action/Modifications by Staff	SEC Recommendation of BCAAB and Staff Modifications	Disposition of Code Change
B-1	503(a)	Minor Accessory Uses	Accept[1]	Accept	N/A	Text revised to correspond with '83 code language.
B-2	503(d)	Occupancy Separation	Accept	Accept	N/A	No revisions. Proposal compatible with '83 code.
B-3	Table No. 5-B	Occupancy Separation	Accept	Accept	N/A	No revisions. Proposal compatible with '83 code.
B-4	Table No. 5-C	Allowable Area for Group I, Division 1 & 2 Occupancies.	Accept	Accept	N/A	Text revised to correspond with '83 code.
B-5	Table No. 5-D	Allowable Height for Group I, Division 1 & 2 Occupancies.	Accept[2]	Accept	N/A	No revisions. Proposal compatible with '83 code.
B-6	506(b)	Unlimited Area	Substitute unlimited area all slots in 5C present permitted - See Table 5F.	Accept - staff cannot agree to unlimited areas for combustible construction types.	Reject BCAAB recommendation. Accept change as originally proposed.	No revisions. Proposal compatible with '83 code.
B-7	506(c)	Area Increases for Automatic Sprinklers	Delete - in lieu of permitting unlimited area for all construction types in 506(b).	Accept	Reject BCAAB recommendation. Accept change as originally proposed.	Text revised to correspond with '83 code with deletion of exclusion of atrium buildings from area increase.
B-8	507	Building Height	Accept with elimination of I Occupancies from height increase.	Accept with elimination of I Occupancies from height increase.	Accept as originally proposed. Do not eliminate I Occupancies from height increase.	Text revised to correspond with '83 code with deletion of exclusion of atrium buildings from height increase.
B-9	508	Fire Resistive Substitution	Accept with addition of Type IV Buildings to Item 5 under the "new" Section 508.	Accept with addition of Type IV Buildings to Item 5 under the "new" Section 508.	Accept as originally proposed. Do not add Type IV Buildings to Item 5.	Text revised to correspond with '83 code.
B-10	604, 704, 804, 904, 1004, & 1204	Smokeproof Enclosures	Accept	Accept, but retain '79 DBC 1807 - smokeproof enclosure.	Reject Staff recommendation. Accept as originally proposed.	Text revised to correspond with '83 code.
B-11	702(a)2	B1 Occupancy Separation in B2 and R1 Buildings	Accept	Accept	N/A	No revisions. Proposal compatible with '83 code.
B-12	702(b)	Smoke and Heat Venting	Accept	Accept	N/A	No revisions. Proposal compatible with '83 code.

TABLE 1 -- CODE CHANGE STATUS SUMMARY
(CONTINUED)

Change Number	Code Section	Topic	Recommended Action/Modifications by Building Code Advisory & Appeals Board (BCAAB)	Recommended Action/Modifications by Staff	SEC Recommendation of BCAAB and Staff Modifications	Disposition of Code Change
B-13	709, Table No. 7-A	Open Parking Garages	Modify to allow unlimited height & unlimited area without sprinklers.	Accept - BCAAB suggested modification is not a tradeoff for sprinklers.	Accept BCAAB recommendation. Modify proposal with criteria similar to NFPA 88A. Add criteria for occupancies located above garage.	Text revised to correspond with '83 code, with technical modification.
B-14	711	Covered Mall Buildings	Accept	Delete - Use '83 DBC.	Reject Staff recommendation. Accept as originally proposed with minor modifications.	Text revised to correspond with '83 code, with technical modification.
B-15	802(c)	Construction of Closets in Group E Occupancies	Accept	Accept	N/A	Text revised to correspond with '83 code.
B-17	901(b)	Vocation Shops, Laboratories, etc., in Educational Buildings	Accept	Accept	N/A	No revisions. Proposal compatible with '83 code.
B-18	902(b)	Smoke & Heat Venting	Accept	Accept	N/A	No revisions. Proposal compatible with '83 code.
B-19	1204	Emergency Egress for Group R Occupancies	Accept	Accept	N/A	Text revised to correspond with '83 code.
B-20	1705(b)5	Nonrated Partitions Within a Single Tenant Space	Accept	Accept	N/A	Text deleted to correspond with '83 code.
B-21	1706(b)	Fire Dampers	Accept	Delete	Reject Staff recommendation. Accept with modifications.	Text revised with technical modifications.
B-22	1706(d)	Elevator Shaft Venting	Accept	Accept	N/A	No revisions. Proposal compatible with '83 code.
B-23	1715	Atriums	Accept	Delete - use '83 DBC.	Reject Staff recommendation. Accept with modifications.	Text revised with technical modifications.
B-24	1717 (New)	Materials in Plenum Spaces	Delete	Delete	Original proposal considered acceptable but will delete as recommended in lieu of '83 code, Section 4305(e). (Revised: 10/28)	Deleted in lieu of '83 code, Section 4305(e). (Revised: 10/28)

TABLE 1 -- CODE CHANGE STATUS SUMMARY
(CONTINUED)

Change Number	Code Section	Topic	Recommended Action/Modifications by Building Code Advisory & Appeals Board (BCAAB)	Recommended Action/Modifications by Staff	SEC Recommendation of BCAAB and Staff Modifications	Disposition of Code Change
B-25	1806	Roof Construction of Type I Buildings	Accept - add Type IV HT as permissible for roof construction.	Accept - add Type IV HT as permissible for roof construction.	Accept as modified per BCAAB and Staff comments.	Text modified to allow use of heavy timber construction for roof members.
B-26	1807	High Rise Buildings	Accept	Accept - make requirements applicable to all "high-rise" occupancies except B-3 (open deck parking).	Accept Staff recommendation.	Text revised to correspond with '83 code. Provisions expanded to include other building occupancies.
B-27	1907	Roof Construction in Type II-F.R. Buildings	Accept - add Type IV HT as permissible for roof construction.	Accept - add Type IV HT as permissible for roof construction.	Accept as modified per BCAAB and Staff comments.	Modification suggested by BCAAB and Staff will be effective with implementation of B-25.
B-28	2516(f)4	Subdivision of Combustible Concealed Spaces	Accept - if all concealed spaces are sprinklered - relocate to Sec. 2516(f).	Accept - if all concealed spaces are sprinklered - relocate to Sec. 2516(f).	Code change relocated to 2516(f) as recommended.	Text revised to correspond with '83 code. Change relocated from Section 3205(b) to Section 2516(f) in '83 code.
B-29	3206	Smoke and Heat Venting	Accept	Accept	N/A	No revisions. Proposal compatible with '83 code.
B-30	3303(a)	Number of Exits Calculation Procedure	Accept	Accept	N/A	Text revised to correspond with '83 code.
B-31	3303(b)	Exit Width Calculation Procedure	Accept	Accept	N/A	Text revised to correspond with '83 code.
B-32	3303(c)	Arrangement of Exits	Accept ⅛ diagonal with 30-foot minimum.	Accept ⅛ diagonal with 30-foot minimum.	Accept as modified per BCAAB and Staff recommendation.	Text revised to correspond with '83 code using a ⅛ diagonal rule.
B-33	3303(d)	Exit Travel Distance	Accept	Accept with 200 feet in H-2 and H-3.	Accept Staff recommendation. Modify change to eliminate H-2 and H-3 from 300-foot travel distance.	Text revised to correspond with '83 code. The 300-foot travel distance for H-2 and H-2 as originally proposed is eliminated.
B-34	3303(e)	Exiting Through Storerooms	Delete - use '83 DBC - comparison requested.	Delete - use '83 DBC - comparison requested.	Reject BCAAB/Staff recommendations. Incorporate change in '83 code.	Text revised to correspond with '83 code.
B-35	3305(e)	Maximum Dead End Corridor Distance	Accept - allow all occupancies except I-1 & R-1 (motel/hotel) to be 50 feet; I-1 & R-1 (motel/hotel) [illegible] e 30	Accept - allow occupancies except I-1 & R-1 (motel/hotel) to be 50 feet; I-1 & R-1 (motel/hotel) to [illegible] feet.	Reject recommendations for 50-foot dead end, but modify proposal to allow 35 feet in R-1.	Text revised to corr-spond with '83 code. Dead end of 35 feet for R-1 occupancies added.

TABLE 1 -- CODE CHANGE STATUS SUMMARY
(CONTINUED)

Change Number	Code Section	Topic	Recommended Action/Modifications by Building Code Advisory & Appeals Board (BCAAB)	Recommended Action/Modifications by Staff	SEC Recommendation of BCAAB and Staff Modifications	Disposition of Code Change
B-36	3305(g)	Corridor Wall Construction	Accept - allow all buildings other than R-1 (motel/hotel).	Accept - allow all buildings other than R-1 (motel/hotel).	Reject recommendations in part. Allow for all but R-1 and I-3. Allow reduction to ½ hour without dampers in R-1.	Text revised to correspond with '83 code. Change modified to allow reduction of corridor construction in R-1.
B-37	3305(h)	Corridor Door Gaskets	Accept	Accept	N/A	Text revised to correspond with '83 code.
B-38	3310	Smokeproof Enclosure	Accept but retain '79 DBC 1807 - smokeproof enclosure.	Accept but retain '79 DBC 1807 - smokeproof enclosure.	Reject BCAAB/Staff recommendations.	Text revised to corrspond with '83 code.
B-39	3319(e)	Educational Occupancies Corridor Wall Construction	Accept	Accept	N/A	The curent code ('83) permits the exception originally proposed for corridor walls, in educacational occupancies. Therefore, B-39 is not needed and text is deleted.
B-40	3802, Table 38-B	Automatic Sprinkler System Requirements	Delete	Delete - Substitute Table 5-E.	Accept recommendations in part. Use Table 5E (38-B) with modifications.	Text revised to correspond with '83 code. Technical modification made for mandatory sprinkler provisions both in maximum allowable unsprinklered areas and exceptions thereto.
B-41	3803	Supervision of Automatic Sprinkler System	Accept	Accept	N/A	Text revised to correspond with '83 code.
B-42	3805(g) (New)	Standpipe Water Supply Requirements	Delete - use '83 DBC.	Delete - use '83 DBC.	Accept recommendations to delete and use '83 code.	The current code ('83) addresses filling standpipes with water and UBC Standard 38-2 addresses water supplies. Therefore, B-42 is not needed and the text is deleted.
B-43	3803, Table 38-A	Standpipe Requirements	Accept	Accept	N/A	Text revised to correspond with '83 code.
B-44	3805(c)	Standpipe Outlets	Accept	Accept	N/A	Text revised to correspond with '83 code.

TABLE 1 -- CODE CHANGE STATUS SUMMARY
(CONTINUED)

Change Number	Code Section	Topic	Recommended Action/Modifications by Building Code Advisory & Appeals Board (BCAAB)	Recommended Action/Modifications by Staff	SEC Recommendation of BCAAB and Staff Modifications	Disposition of Code Change
B-45	3806(b)	Standpipes in Buildings Under Construction	Delete - use '83 DBC.	Delete - use '83 DBC.	Accept recommendations to delete and use '83 code with editorial revision.	The current code ('83) permits an exception similar to that proposed for buildings under construction. B-45 is not needed, however, an editorial revision is included.
B-46	5103(d)	Elevator Door Operation	Delete - use '83 DBC.	Delete - use '83 DBC.	Accept recommendation in part. Allow exception when automatic recall is provided.	Text revised with technical modification.
B-47	5206	Roof Panels	Accept - ask if can be unlimited.	Accept - ask if can be unlimited.	Reject unlimited proposal.	Text revised to correspond with '83 code.
B-48	5207(a)	Skylights	Accept - ask if can be unlimited.	Accept - ask if can be unlimited.	Reject unlimited proposal.	Text revised to correspond with '83 code.
B-49	Table No. 5-A	Exterior Wall Requirements at Property Line for R-1 Occupancies	N/A	N/A	Accept	New Change.
B-50	503(d), Exception 3	Separation of Parking Garages in R-1 Occupancies	N/A	N/A	Accept	New Change.
B-51	503(d), Exception 4	Separation of Parking Garages in Dwellings	N/A	N/A	Accept	New Change.
B-52	Table No. 5-B	Separation of Parking Garages in R-1 Occupancies	N/A	N/A	Accept	New Change.
B-53	1202(c) (New)	Material Substitution	N/A	N/A	Accept	New Change.
B-54	Section 4205 and Table No. 42-B	Flame Spread of Exterior Exitways	N/A	N/A	Accept	New Change.

TABLE 1 -- CODE CHANGE STATUS SUMMARY
(CONTINUED)

Change Number	Code Section	Topic	Recommended Action/Modifications Fire Code Advisory Board (FCAB)	Recommended Action/Modifications byStaff	SEC Recommendation of BCAAB and Staff Modifications	Disposition of Code Change
FIRE CODE						
F-1	16-13.101(12)	Water Main Size	Accept	Accept	N/A	Editorial change. Technical content remains unaffected.
F-2	16-13.104(3)	Fire Hydrant Location	Accept	Accept	N/A	Text revised to correspond wtih '83 code.
F-3	16-13.401A	Alarm System - When Required	Accept	Accept	N/A	No revisions. Proposal compatible with '83 code.
F-4	16-13.502	Fire Dept. Connections for Standpipes	Accept	Accept	N/A	No revisions. Proposal compatible with '83 code.
F-5	16-13.503	Standpipe Outlets	Accept	Accept	N/A	No revisions. Proposal compatible with '83 code.
F-6	16-35.103	Access Doors	Accept	Accept	N/A	No revisions. Proposal compatible with '83 code.
WATER WORKS ORDINANCE						
W-1	49-26	Sprinkler or Fire Service Requirements	No Board action required.	Accept	N/A	No revisions. Proposal compatible with current ordinance.
W-2	49-26A	Charges for Fire Service Systems	No Board action required.	Accept	N/A	No revisions. Proposal compatible with current ordinance.

Notes to Table:

1. "Accept" means acceptance of proposals in February report.
2. Not officially stated in Meeting Minutes (8/16), but believed to have been intent of the BCAAB since this change is companion change to B-4.

PROPOSED CODE CHANGES

A discussion of each proposed code change, including supporting rationale, was presented for the 56 original code changes in the February report. This report includes a discussion of each proposed building code change which:

- Has been technically modified since the February report.
- Required clarification or additional rationale, as expressed by the BCAAB or Staff.
- Has been added since the February report.

Modifications to proposed changes to the Dallas Fire Code and Water Works ordinances beyond the February report are editorial in nature and do not require further discussion.

B-6 — Unlimited Area; and B-7 — Area Increases for Automatic Sprinklers

Building Code Change B-6, as presented in the February, 1983 report, was intended to allow buildings of noncombustible construction (Types I and II) and heavy timber construction (Type IV) to be built without any limitation of the area when the building is protected by automatic sprinklers. The BCAAB considered the proposal to be unfair to combustible types of construction, since an "equivalence" in the allowable areas between noncombustible construction types and the combustible construction types of equal fire resistance would be reduced or eliminated. For example, the allowable area table of the building code, Table 5-C, currently permits Group A-3 sprinklered occupancies of either Type II-N (noncombustible construction) or Type III-N (combustible construction) to be built to the same maximum area of either 27,300 square feet for one-story buildings or 18,200 square feet for two-story structures. The February, 1983, proposal would change the allowable area requirement such that the area of a noncombustible structure of this

example would not be limited at a one- or two-story height, while the combustible structure would be limited to 36,400 square feet in area.

This example illustrates that while a combustible structure would receive a benefit resulting from Code Change B-5, the benefit would not be equal in magnitude to that permitted for the noncombustible construction type. Thus, the parity that currently exists in the 1983 DBC would be eliminated with the implementation of Code Change B-6.

In recognition of the potential elimination of this parity of allowable areas between combustible and noncombustible construction types, the BCAAB recommended that Code Change B-6 be modified to extend the unlimited area allowances to the combustible construction categories. Pursuant to this recommendation, the BCAAB recommended deletion of Code Change B-7, which would be unnecessary if unlimited area were permitted per the modification of B-6. The Staff is opposed to the extension of the unlimited area provisions for the combustible construction categories of the code and has recommended acceptance of Change B-6 as originally proposed.

It is recommended that Code Changes B-6 and B-7 be accepted without the modification to allow unlimited area for combustible construction types. The basis for this action is related to the nature of sprinkler installations in combustible construction-type buildings, particularly Type III construction (commonly referred to as ordinary construction) and Type V construction (commonly referred to as wood frame construction). Both Type III and Type V buildings are constructed primarily of wooden members which result in numerous concealed combustible areas or pockets in walls, floors and roof areas.

The installation standards for automatic sprinklers recognize the practical problems associated with maintenance and installation of sprinklers in such concealed spaces and, therefore, allow the omission of sprinklers in properly firestopped areas and spaces less than six inches in depth. Such spaces, primarily unsprinklered six-inch spaces, pose a potential for failure of the sprinkler system to control a fire originating or spreading to these spaces. For this reason, unlimited area of Type III or Type V construction is not considered an acceptable risk.

The lack of sprinkler protection in combustible concealed spaces has been cited as a leading cause of unsatisfactory sprinkler performance by the Australian studies. More than twenty-eight percent of the unsatisfactory performances reported have been attributed to concealed space fires. The National Fire Protection Association's automatic sprinkler performance tables (1970 edition) attribute 161 of over 3,000 reported failures to the lack of sprinkler protection in concealed horizontal or vertical spaces within a structure. These statistics demonstrate that a potential does exist for a fire in a concealed space to gain impetus before sprinklers in the nearest protected area have the opportunity to affect control of the fire. By limiting the area of the building, and consequently the extent of combustible concealed spaces in a structure, the potential for a large loss fire or a fire that may be difficult for fire department personnel to access is minimized. It is noted that the construction types, Types I, II and IV, which will be permitted unlimited area, inherently will not contain unsprinklered combustible concealed spaces and, therefore, are distinguished from the combustible construction types, Type III and V.

B-8 — Building Height

Change B-8 would permit unlimited height for sprinklered Type II-Fire Resistive structures which are currently limited to various heights or respective occupancy classifications in the code. Both the BCAAB and the Staff, however, have expressed a concern regarding the use of Type II-Fire Resistive building types for Group I occupancies (e.g., hospitals, nursing homes, jails, etc.) and have suggested that height limitations remain for Group I occupancies.

This modification to B-8 is not considered necessary. The basic level of fire resistance of Type II-Fire Resistive buildings, two hours, provides sufficient redundancy for Group I occupancies which exhibit fuel loads equating to a fire severity of one hour. Also, as previously noted in the February report, 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. For these reasons, Change B-8 has not been modified and the intent of this change remains as originally proposed.

Presented, again, in this "Supplemental Report" is Table 2 which summarizes the intent of all the height and area code change modifications. This Table 2 is an updated version, including editorial corrections, of Table 10 of the February report.

B-9 — Fire Resistive Substitution

Section 508 of the building code is modified by Code Change B-9 to allow the provision of automatic sprinkler systems to substitute for or reduce the magnitude of various fire-resistive features of a building. Both the BCAAB and Staff have accepted this proposal, but have recommended that Type IV (heavy timber) construction be added to Item 5 of the proposed Section 508. This modification would allow a one hour reduction in the fire resistance of Type IV structures housing assembly occupancies.

This recommendation is rejected since the elimination of one-hour fire resistance for Type IV structures is not plausible. Type IV or heavy timber construction consists primarily of noncombustible walls (typically masonry) with columns, beams, floors and roofs of large dimensional bare wood members. The wooden members must meet the minimum size requirements of the building code to qualify as heavy timber. Due to the nature of the size and mass of this type of wood construction, there is inherent resistance to the effects of fire. However, since the bare wooden components have no specified fire-resistance rating, a specific one-hour reduction in fire resistance cannot be easily quantified nor can it be accomplished without down-sizing the wood members. Simply, the fire resistance of heavy timber structures cannot be reduced without downgrading the structure to the classification of a lesser construction type. Since the less substantial wood construction types are already permitted for A-2 and A-2.1 occupancies via Item 5 of Section 508, there would be no purpose served by the implementation of this modification. Code Change B-9 remains as originally proposed.

TABLE 2
COMPARISON OF MAXIMUM ALLOWABLE HEIGHTS AND AREAS OF SPRINKLERED ONE-STORY AND MULTIPLE STORY BUILDINGS
EXISTING REQUIREMENTS VS. PROPOSED REQUIRMENTS

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

- Maximum total building area allowable with associated height increase.
- Maximum total building area allowable with sprinklers.
- Maximum allowable area of one story building, also maximum allowable area of any floor of multi-story building.
- Maximum number of stories allowable with sprinklers.
- Maximum number of stories allowable with associated area increase.

Existing:
42,000
56,000 (3)
28,000 (4)

Proposed:
NC
56,000 (4)

- 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 Fire Resistive	Type II Fire Resistive	Type II 1-Hour	Type II N	Type III 1-Hour	Type III N	Type IV	Type V 1-Hour	Type V N
A-1	Existing	UL UL (UL)	89,700 119,600 (4) 59,800 (5)	NP	NP	NP	NP	NP	NP	NP
	Proposed	NC NC (NC)	UL UL (UL)	NC	NC	NC	NC	NC	NC	NC
A) 2-2.1	Existing	UL UL (UL)	89,700 119,600 (4) 59,800 (5)	40,500 54,000 (2) 27,000 (3)	NP x	40,500 54,000 (2) 27,000 (3)	NP x	40,500 54,000 (2) 27,000 (3)	31,500 42,000 (2) 21,000 (3)	NP x
	Proposed	NC NC (NC)	UL UL (UL)	UL UL (3)	NC x	NC 54,000 (3)	NC x	UL UL (3)	NC 42,000 (3)	NC x
A) 3-4	Existing	UL UL (UL)	89,700 119,600 (12) 59,800 (13)	40,500 54,000 (2) 27,000 (3)	27,300 18,200 (2) NA	40,500 54,000 (2) 27,000 (3)	27,300 18,200 (2) NA	40,500 54,000 (2) 27,000 (3)	31,500 42,000 (2) 21,000 (3)	18,000 12,000 (2) NA
	Proposed	NC NC (NC)	UL UL (UL)	UL UL (3)	UL UL (2)	NC 54,000 (3)	NC 36,400 (2)	NC UL (3)	NC 42,000 (3)	NC 24,000 (2)
B) 1-2-3	Existing	UL UL (UL)	119,700 159,600 (12)* 79,800 (13)	54,000 72,000 (4)* 36,000 (5)	36,000 48,000 (2)* 24,000 (3)	54,000 72,000 (4)* 36,000 (5)	36,000 48,000 (2)* 24,000 (3)	54,000 72,000 (4)* 36,000 (5)	42,000 56,000 (3)* 28,000 (4)	24,000 32,000 (2)* 16,000 (3)
	Proposed	NC NC (NC)	UL UL (UL)	UL UL (5)	UL UL (3)	NC 72,000 (5)*	NC 48,000 (3)*	UL UL (3) 72,000 (5)	NC 56,000 (4)*	NC 32,000 (3)*

TABLE 2

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

Occupancy		Type I	Type II			Type III		Type IV	Type V	
		Fire Resistive	Fire Resistive	1-Hour	N	1-Hour	N		1-Hour	N
B-4	Existing	UL UL (UL)	179,700 ** 239,600 (12)* 119,800 (13)	81,000 ** 108,000 (4)* 54,000 (5)	54,000 ** 72,000 (2)* 36,000 (3)	81,000 ** 108,000 (4)* 54,000 (5)	54,000 72,000 (2)* 36,000 (3)	81,000 ** 108,000 (4)* 54,000 (5)	63,000 84,000 (3)* 42,000 (4)	36,000 48,000 (2)* 24,000 (3)
	Proposed	NC NC (NC)	UL ** UL (UL)	UL ** UL (5)	UL ** UL (3)	NC ** 108,000 (5)*	NC 74,000 (3)*	UL UL (3) 108,000 (5)	NC 84,000 (4)	NC 48,000 (3)
E	Existing***	UL UL (UL)	135,600 180,800 (4) 90,400 (5)	60,600 80,800 (2)+ 40,400 (3)	40,500 27,000 (2) NA	60,600 80,800 (2)+ 40,400 (3)	40,500 27,000 (2) NA	60,600 80,800 (2)+ 40,400 (3)	47,100 62,800 (2)+ 31,400 (3)	27,300 18,200 (2) NA
	Proposed***	NC NC (NC)	UL UL (UL)	UL UL (3)+	UL UL (2)+	NC 80,800 (3)+	NC 54,000 (3)+	UL UL (3)+	NC 62,800 (3)+	NC 36,400 (2)+
H) 1	Existing	15,000 30,000 (UL) NA	12,400 24,800 (2) 1,500 (3)	5,600 1,500 (2) NA	3,700 1,500 (2) NA	5,600 1,500 (2) NA	3,700 1,500 (2) NA	5,600 1,500 (2) NA	4,400 1,500 (2) NA	2,500 1,500 (2) NA
	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)
H) 2	Existing	15,000 30,000 (UL) NA	12,400 24,800 (5) 1,500 (6)	5,600 11,200 (2) 1,500 (3)	3,700 1,500 (2) NA	5,600 11,200 (2) 1,500 (3)	3,700 1,500 (2) NA	5,600 11,200 (2) 1,500 (3)	4,400 8,800 (2) 1,500 (3)	2,500 1,500 (2) NA
	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)
H) 3-4-5	Existing	UL UL (UL)	74,400 99,200 (5)* 49,600 (6)	33,600 44,800 (2)* 22,400 (3)	22,500 15,000 (2)* NA	33,600 44,800 (2)* 22,400 (3)	22,500 15,000 (2)* NA	33,600 44,800 (2) 22,400 (3)	26,400 35,200 (2) 17,600 (3)	15,300 10,200 (2)* NA
	Proposed	NC NC (NC)	UL UL (5)	UL UL (2)	UL UL (2)	NC 44,800 (2)*	NC 30,000 (2)*	NC UL (3)*	NC 35,200 (2)*	NC 20,400 (2)*
I-1	Existing	UL UL (UL)	45,300 60,400 (3) 30,200 (4)	20,400 13,600 (2) NA	NP	20,400 13,600 (2) NA	NP	20,400 13,600 (2) NA	15,600 10,400 (2) NA	NP
	Proposed	NC NC (NC)	UL UL (UL)	UL UL (2)	UL (1)	NC 27,200 (2)	NC	NC UL (2)	NC 20,800 (2)	NC
I-2	Existing	UL UL (UL)	45,300 60,400 (3) 30,200 (4)	20,400 27,200 (2) 13,600 (3)	NP	20,400 27,200 (2) 13,600 (3)	NP	20,400 27,200 (2) 13,600 (3)	15,600 20,800 (2) 10,400 (3)	NP
	Proposed	NC NC (NC)	UL UL (UL)	UL UL (3)	UL (1)	NC 27,200 (3)	NC	NC UL (3)	NC 20,800 (3)	NC

TABLE 2

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

Occupancy		Type I	Type II			Type III		Type IV	Type V	
		Fire Resistive	Fire Resistive	1-Hour	N	1-Hour	N		1-Hour	N
I-3	Existing	UL UL (UL)	45,300 60,400 (2) 30,200 (3)	NP	NP	NP	NP	NP	NP	NP
	Proposed	NC NC (NC)	UL UL (3)	NC	NC	NC	NC	NC	NC	NC
M	Existing	Special Provisions of Chapter 11 are Applicable								
	Proposed	No Change								
R-1	Existing	UL 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 (NC)	UL UL (UL)	UL UL (5)	UL UL (2)++	NC 54,000 (5)	NC NC (NC)++	NC UL (3) 54,000 (5)	NC 42,000 (4)	NC NC (NC)++
R-3	Existing	UL UL (UL)	UL UL (3)	UL UL (3)	UL UL (3)	UL UL (3)	UL UL (3)	UL UL (3)	UL UL (3)	UL UL (3)
	Proposed	NC NC (NC)	NC NC (4)	NC NC (4)	NC NC (4)	NC NC (4)	NC NC (4)	NC NC (4)	NC NC (4)	NC 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.

B-10 — Smokeproof Enclosures; and B-38 -- Smokeproof Enclosure Requirements

The requirements and references relating to smokeproof enclosures and pressurized stairs in the DBC were proposed in the February report to be deleted per Code Changes B-10, B-38 and additionally with Code Change B-26 from the high-rise requirements of Section 1807.

The 1979 DBC required one smokeproof enclosure for high-rise office and residential buildings and also for other buildings with floors located 75 feet above grade. Also, high-rise office and residential structures were permitted by the 1979 code to substitute all pressurized stairwells in lieu of providing a single smokeproof enclosure when the building is sprinklered. The most recent edition of the code, 1983 DBC, which incorporates recent changes of the Uniform Building Code, requires all stairs in buildings with floors 75 feet above grade to be either smokeproof enclosures or be pressurized when the building is sprinklered.

The Staff and the BCAAB have accepted Code Changes B-10 and B-38 as they relate to the elimination of the references to smokeproof enclosures. However, the Staff has additionally recommended retention of the smokeproof requirements as found in the 1979 DBC for high-rise buildings.

The use of smokeproof enclosures in a sprinklered building or pressurized stairways in a sprinklered high-rise building is an unnecessarily redundant exit feature which also requires the incorporation of emergency power facilities. The "Decision Tree" (Figure 1, February report) demonstrates the unnecessary redundancy by indicating that automatic suppression is the single and only fire protection feature needed to protect building occupants and that concern for an exiting system is not necessary. However, since the code changes do not intend to remove all safety redundancies related to exiting, requirements for protected fire-resistive stair enclosures remain in the code and only the unnecessarily redundant requirements for smokeproof enclosures, stair pressurization and associated emergency power equipment are suggested to be eliminated.

The requirements for pressurized stairways and smokeproof enclosures have been promulgated only within the last 10 years into various codes and have evolved out of the original

concern to provide a protected access for fire fighters in unsprinklered high-rise buildings. With regard to fully sprinklered high-rise buildings, there has been no justification or substantiating history to indicate that smokeproof enclosures and pressurized stairs are necessary. Therefore, Code Changes B-10 and B-38 are proposed as originally intended and without modifications suggested by the Staff.

B-13 — Open Parking Garages

In the February report, Table 7-A of the 1980 edition of the Dallas Building Code (DBC) was modified to allow greater heights and areas for sprinklered open parking garages, in accordance with the intent of this project. However, in the conclusion of the report, we recommended that the subject of the open parking garages be studied for possible further modification as the provision of automatic sprinkler protection in garages has recently been recognized to be of limited value. The 1982 edition of the Uniform Building Code (UBC), upon which the 1983 DBC is based, was revised to allow larger areas for unsprinklered parking garages, subject to certain limitations.

Given the modification of the 1982 UBC and the desire of the BCAAB to allow greater areas for the unsprinklered condition, the February proposal was modified. Change B-13, as presented in this report, is consistent with the construction requirements of the nationally recognized NFPA Standard 88A-1979, "Standard for Parking Structures," which allows unlimited areas for unsprinklered Type I or Type II open parking garages up to 75 feet in height and unlimited area and height when construction is at least Type II-One hour. The major difference between the current DBC and NFPA 88A is that the DBC requires that such garages be open on all sides, while NFPA 88A requires only two sides of the garage to be open. The requirement that the horizontal distance on each tier be within 200 feet of an exterior wall opening in both the DBC and NFPA 88A is maintained in the proposed change. The provisions in NFPA Standard 88A represent some of the few building construction provisions included in nationally recognized codes and standards that are technically based, the result of a series of full-scale tests in open parking garages.

The revised Table 7-A has been simplified and does not distinguish between sprinklered and unsprinklered garages as the provisions for each condition are identical. The recently adopted text from the 1982 UBC is essentially redundant to Table 7-A and has been

stricken (at the top of page A-19 of this report). The basic construction requirements proposed in B-13 are consistent with those contained in the nationally recognized consensus standard, NFPA 88A.

Additional language has been added to Section 709(c) to address the subject of buildings which may be built with other occupancies over an open parking garage, as a result of an expressed concern by the Dallas Fire Department. The revision includes a requirement that construction of the parking garage supporting an occupancy above shall not be of less fire resistance than that required for the upper occupancy. Because of the relatively low fire loading, lack of continuity of combustibles and good fire experience of open parking structures, the provision of sprinklers in the garage for such a condition is not considered necessary, provided that the required occupancy separation is maintained.

B-14 — Covered Mall Buildings

At the initiation of this project, the 1980 DBC did not contain specific requirements for covered mall shopping centers. New requirements for covered malls were proposed in Code Change B-14 in the February report. During the BCAAB study period, Dallas Ordinance 17791 was adopted which included requirements for covered malls essentially as published in Appendix Chapter 7 of the 1982 UBC. The language originally proposed in B-14 was also based upon UBC Appendix Chapter 7, with certain technical modification. The BCAAB and Staff did not critically review Proposed Code Change B-14 because it was felt that the newly adopted code language was adequate. However, after discussion, the BCAAB has recently endorsed the concepts contained in the proposed change.

The proposal in this report has been editorially revised to correspond with the 1983 DBC and contains several major technical revisions aimed at minimizing overly redundant provisions in this section.

The amendments to the material contained in the 1982 Uniform Building Code are based upon the requirements of other model codes, fire experience and engineering judgment. Section 710 begins with definitions specifically applicable to covered mall buildings. As a matter of clarification, the term "covered mall building" is intended to include the covered common pedestrian area, associated "tenant" spaces and attached anchor stores.

The allowable types of construction for covered mall buildings have been limited to Type I, Type II or Type IV construction. This is a departure from the requirements contained in the 1982 UBC. The construction of an unlimited area building used as a covered mall shopping center of Type III or Type V construction, two stories in height (as allowed by the 1982 UBC), is not considered good fire protection practice. As previously stated, sections of UBC Standard 38-1 allow the omission of sprinklers in certain concealed spaces which may be of combustible construction. Fire loss statistics for sprinklered buildings indicate this as a contributing factor leading to unsatisfactory sprinkler performance. (While Type IV construction is combustible, concealed spaces within the structure are not contemplated.)

For buildings of noncombustible construction (Types I and II) and Type IV construction, the allowable height of a covered mall building, including anchor stores, is three stories. The use of Type II-N construction for a covered mall building up to three stories in height is consistent with Code Change B-6 and represents a liberalization of the requirements contained in UBC Appendix Chapter 7. This liberalization, as with some of the other less stringent provisions in this proposal when compared to the UBC, are largely based upon the exceptionally good fire experience of fully sprinklered covered mall shopping centers constructed in this manner throughout the United States over the last 20 years.

Because covered mall shopping center buildings may have other attached structures of combustible construction, the provision requiring a public space, street or yard not less than 60 feet in width around the covered mall building is appropriate. This is also consistent with Code Change B-6 dealing with Section 506(b).

The portion of this code change dealing with smoke control is much less detailed than the requirements contained in the UBC. First, the dependence upon a smoke control system for life safety in a three-story, fully sprinklered retail building is minimal. The configuration of the covered mall building, i.e., a large open space where visual communication is provided to facilitate retailing, enhances the occupants' awareness of any fire threat. Also, the control of the fire size by automatic sprinkler protection will minimize the quantity of smoke. This, in conjunction with exit facilities conforming to the requirements of the DBC, will provide a high degree of safety.

There has not been a demonstrated need for such sophisticated smoke control systems on the basis of actual fire experience. As explained in another section of this report, current code provisions in many of the model building codes dealing with smoke control are more specific than necessary and, in many cases, are not technically based upon any engineering data. Such is the case with the requirements contained in the 1982 UBC for covered malls. The specification for supply air in the vicinity of the fire may inadvertantly produce conditions which can negatively affect the ability of the automatic sprinklers to control the fire.

The requirement for standby power for the public address system, exit signs, emergency lighting and smoke control system, specified in the 1982 UBC, is not included in the proposal for the Dallas Building Code. The provision of emergency power for the public address and smoke control systems is not justified on the basis of fire experience, expected fire severity or life safety threat in this occupancy. Furthermore, emergency power is not economically warranted as a minimum requirement of the building code. The provisions for exit illumination and illumination of exit signs are adequately addressed in Chapter 33.

The exit provisions dealing specifically with covered mall buildings are identical to those specified in the DBC.

Section 715 includes an additional paragraph beyond that included in the DBC. The intent of the paragraph is to allow other buildings to be attached to a covered mall building, provided they are fully sprinklered and separated from the covered mall building by an occupancy separation as specified in Section 503. The intent of this section is for the code to allow the construction of multi-occupancy "mega-structures" which are becoming more popular in metropolitan areas. These structures may contain a combination of retail, hotel, and business occupancies in one complex. Numerous examples of such complexes exist accross the United States. The provisions of Section 711 govern the specific requirements applicable to the covered mall portion of such a structure. It is the intent of this section that all contiguous portions of such a facility be fully sprinklered.

B-16 -- Exempt Amounts of Hazardous Materials

Code Change B-16 has been accepted by Staff and the BCAAB, however, per their request, the following explanation and an example of the intended application of the change to Table 9-A is presented.

Table 9-A specifies maximum quantities of flammable liquids, combustible liquids, flammable gases, fibers, solids, unstable materials, corrosive liquids, oxidizing materials, highly toxic materials and poisonous gases which may be allowed in a building. Quantities exceeding these amounts will cause the building to be classified as "Group H," and subject it to more stringent code requirements. The quantities of materials specified in Table 9-A do not have a unit basis. The allowed quantities of materials apply regardless of building size. For example, the presence of 30 gallons of a Class I-A flammable liquid in a 5,000 square foot building will have the same impact upon building occupancy classification as 30 gallons of Class I-A flammable liquid in a 100,000 square foot building.

Code Change B-16 represents an amendment to allow the quantities of materials specified in Table 9-A to be utilized on the basis of multiples of a building area of 24,000 square feet. It is not the intention of this code change that allowable quantities of materials referenced in Table 9-A be distributed in a building on a per square foot basis. The quantities of materials stored in a building may be stored in a single room in a building or may be stored in various places within the same building. It is also intended that buildings less than 24,000 square feet may utilize the permitted increase without prorating the area of the building against the 24,000 square foot criteria. The amount of hazardous materials permitted for buildings over 24,000 square feet is intended to be calculated on a prorata basis.

Example 1:

Given a 20,000 square foot building, what is the maximum quantity of Class I-A flammable liquids that may be stored in a sprinklered building without classifying the structure as Group H Occupancy?

The base quantity in Table No. 9-A for Class I-A liquids is 30 gallons. This value may be increased 100 percent to 60 gallons for a sprinklered building.

Since the building is less than 24,000 square feet, a prorata basis should not be used and the entire 60 gallons of Class I-A liquids may be used in the 24,000 square foot building.

Example 2:

Given a 60,000 square foot building, what is the maximum quantity of Class I-A flammable liquids that may be stored in a sprinklered building without classifying the structure as Group H Occupancy?

Again, the base quantity from Table No. 9-A is 30 gallons, which is increased to 60 gallons for the provision of automatic sprinklers. However, in this case the proposed building is 36,000 square feet greater than the base area of 24,000 square feet. In this case, the quantity of Class I-A liquids may be increased by the percent of area in excess of the 24,000 square feet.

$$60 \times \frac{60,000}{24,000} = 60 \times 2.5 = 150 \text{ gallons}$$

As demonstrated by the calculation above, 150 gallons of Class I-A liquid can be used in a 60,000 square foot building without classifying the building as a Class H Occupancy.

B-21 — Fire Dampers

Proposal B-21 allows the omission of fire dampers from air duct penetrations of shaft enclosures in sprinklered buildings. The BCAAB has accepted this proposal while the Staff has recommended deletion of this proposal. This recommended action by the Staff is rejected and the proposal is resubmitted in the report with two modifications.

The originally Proposed Code Change B-21 was based upon current high-rise requirements of the model building codes which allow the omission of fire dampers (other than those needed to protect floor/ceiling assemblies) in fully sprinklered high-rise business and high-rise residential buildings.

As discussed in the February report, this concept of omitting dampers from air shaft openings had its origination with the Reconvened International Conference of Fire Safety in High-Rise Buildings, which was sponsored by the General Services Administration in 1971. The concern for of fire propagation in a completely sprinklered building was considered insignificant. Also, the physical arrangement of shafts is such that shaft openings on one floor are separated by several feet from openings on the next floor. The possibility of flame propagation -- even with the remote chance of sprinkler failure -- through such a mechanism is highly improbable. It is also recognized that the use of fire dampers, the operation of which will impede air flow, can also be detrimental to the operation of smoke control systems.

If Change B-21 was deleted, one of the incentives to utilize sprinklers in "high-rise" buildings would no longer be applicable (unless the provision was reinstituted to Change B-26) and, therefore, a primary reason to retain this code change is to allow the exclusion of referenced dampers as currently permitted. Also, since this concept is considered acceptable practice in high-rise structures, its application can also be extended to sprinklered low-rise structures, which do not pose the more significant risks associated with high-rise buildings.

As previously mentioned, although B-21 is resubmitted, two modifications have been made. Previously B-6 excluded R-1 occupancies from the requirement. However, this negates the benefit of omitting dampers as currently permitted by the DBC and, after further consideration, it is considered acceptable to allow the omission of dampers in R-1 Occupancies. However, due to Staff concerns over the lack of a specified distance between shaft openings, an additional modification is made to B-21. A three-foot minimum distance separation between adjacent openings is specified. This will assure that the mechanism upon which the principal of omission of shaft dampers is based cannot be abused by the use of slab-to-slab openings. The three-foot dimension is based upon the heights of spandrels required to serve as flame barriers in high-rise buildings designed under the "compartmentation" option.

B-23 — Atrium Buildings

The 1980 Dallas Building Code did not contain specific requirements for atrium buildings. Provisions for atrium buildings were proposed in the February report, based upon the provisions in the 1982 UBC. Prior to the completion of the February report, however, the City of Dallas adopted the atrium provisions of the 1982 UBC into the 1983 DBC, effective January 1, 1983. Similar to Code Change B-14, the BCAAB and Staff did not critically review Code Change B-23 in the February report as it was felt that the newly adopted code language for atriums was adequate. However, after discussion, the BCAAB has recently endorsed the concepts contained in the proposal.

The proposal in this report has been editorially revised to correspond with the 1983 DBC and contains several major technical revisions intended to minimize several overly redundant provisions in this section, especially when such provisions are applied to a "low-rise" atrium building.

Similar to the requirements of the Uniform Building Code, all atrium buildings are required to be sprinklered in the proposed code change to Section 1715. The proposal specifies a minimum size of floor opening for the atrium building. The proposed provisions are a simplified version of those presently included in the DBC. This minimum size is intended to provide a degree of visual communication between floor levels for occupants of the building as well as to minimize the flue effect of products of combustion which may be transmitted to the upper stories. The larger the floor opening is, the slower the velocity of products of combustion will be through the floor opening. However, an exception was proposed to this requirement which would have allowed the use of smaller floor openings which can be treated in a more traditional manner. (Revised: 10/28)

Small floor openings such as escalator openings have been utilized for many years in fully sprinklered buildings when protected by a draft stop installed around the perimeter of the floor opening at each story in conjunction with close-spaced sprinklers. The draft stop is intended to prevent the rapid movement of products of combustion to the stories above and to facilitate the operation of sprinklers installed around the draft stop, thereby further precluding the transmission of smoke and heat to the story above. This approach is consistent with Section 1706(a) of the 1982 UBC which allows escalator openings for an unlimited number of stories in Group B occupancies to be so protected.

This concept for allowing smaller floor openings is accepted in principal by the Staff. However, due to concerns regarding possible misinterpretation and/or misuse of this concept for "small" vertical openings, the originally proposed requirement has been deleted as it is desired to handle such vertical openings on a case-by-case basis with the BCAAB. (Revised: 10/28)

A much less prescriptive requirement concerning smoke control is included in the proposal. The code change proposal included in this report specifies the need for a smoke control or smoke removal system designed to control the migration of products of combustion. Since the utility of smoke detectors in a very large volume is minimal, smoke detectors are not required by this section to activate the smoke control function and, therefore, they are not required to be provided. In the majority of fires, sprinkler waterflow will provide a more rapid means of activating the smoke control function. The requirement to provide a smoke control system in "enclosed tenant spaces" within the atrium has been deleted. Such a requirement is not consistent with the intent of providing smoke control for the atrium. The smoke control system, in conjunction with the sprinkler system, is intended to minimize the effects of the floor opening. Providing smoke control in spaces not contiguous with the atrium is not necessary and, in fact, may be counter-productive.

The proposal contained in this report does not limit the number of stories which may be open to the atrium space. The requirement contained in the Uniform Building Code, as in some of the other model codes, is historically rooted, allowing a maximum number of three stories of communicating floor levels. There is no engineering basis to require the limitation of the number of stories of a building which may open onto the atrium space. This architectural feature has been utilized for many years without adverse experience. The atrium sections of at least two major city codes (Chicago, Illinois and Kansas City, Missouri) have not limited the number of communicating floors in an atrium building.

Section 1715(i) has been modified to more specifically describe the nature of the required acceptance test for the smoke control system. The intent of this section is that a complete functional test of mechanical and electrical operation of the equipment be conducted. Some jurisdictions have interpreted this section to require the release of "smoke" in the atrium and the observation of smoke movement patterns. Besides such a

"test" being highly subjective due to a lack of measurable pass-fail criteria, smoke tests under quiescent test conditions do not represent smoke behavior in an actual fire.

The proposal does not include other specifications contained in Section 1715 of the 1982 Uniform Building Code as they are adequately addressed in the remainder of the code.

B-24 — Materials in Plenum Spaces

A new section was proposed for the Dallas Building Code in the February report, now identified as Section 1717. This proposed change would allow limited amounts of low voltage wire to be installed in concealed spaces such as air handling plenums in buildings which are protected throughout with an automatic sprinkler system. Both the BCAAB and the Staff have rejected this proposed change on the basis that an economical alternate to conduit systems, e.g., "Teflon" wire, is available.

Since 1975, the National Electrical Code has prohibited the installation of low voltage wiring in concealed spaces used for environmental air handling. This requirement was incorporated into many municipal codes because of their reference to the National Electrical Code. The National Electrical Code (NEC) requires that such wiring be installed in conduit or be of a low smoke producing material. This provision has resulted in a substantially increased cost of installation for these systems. Typically, low voltage wiring in a commercial building would include telephone, data, temperature control, closed circuit television, and fire and security alarm system wiring. An examination of the history of this change to the NEC will show that the change lacked technical substantiation; no adverse fire experience attributable to such installations can be found. Nevertheless, the code required a more expensive installation method for these wiring systems.

Several municipalities have adopted local code amendments or practices which allow limited quantities of low voltage wiring in air handling plenum spaces to reduce the cost of these installations. The 1980 City of Dallas Building Code previously allowed limited quantities of low voltage wiring, but this amendment has been lost with the City of Dallas' recent adoption of the 1982 UBC. The provision of the National Electrical Code presents an unnecessary financial burden on the building community. No significant benefit in the

area of improved safety is apparent. Several unpublished fire test reports and studies addressing this subject have demonstrated that the "hazard" created by such installations is negligible.

The increased cost associated with the special installation methods or materials is not negligible, however. A trade journal shows that ordinary wire in plenums can be installed for $0.03 per foot, $0.25 per foot for the low smoke producing wire, and $1.03 per foot for ordinary wire in conduit. Thus it is apparent that while the cost of the new type of wiring is less than wire in conduit, it is still more than eight times more expensive than ordinary wire.

As a result, we feel an amendment to this section to allow limited quantities of low voltage wiring in plenum spaces would be in order. However, because recent changes to the Dallas Building, Mechanical and Electrical Codes are considered less restrictive from the stanpoint that codes allow similar materials (which meet specific test criteria) in unsprinklered buildings, there is no urgent desire by the staff to retain this modification. In consideration of this position by the Staff, Code Change B-24 is deleted and existing code Section 4305(e) will sustain ample requirements for wiring in plenums. (Revised: 10/28)

B-25 — Roof Construction of Type I Buildings; and B-27 — Roof Construction of Type II-F.R. Buildings

Code Changes B-25 and B-27 are currently acceptable to both the BCAAB and Staff. They have, however, recommended a modification which would permit the use of heavy timber construction for the roof of a Type I or Type II building.

Changes B-25 and B-27, as proposed in the February report, would allow roof construction and its supporting frame in Type I and Type II buildings, which are fully sprinklered, to be of unprotected (no specified fire resistance) noncombustible materials.

This was based upon the ability of sprinklers to prevent unprotected steel from reaching critical temperatures. Also, since the roof construction does not support an occupied floor above, the need for fire resistance is greatly reduced. Comparatively, heavy timber

members can have greater inherent fire resistance than unprotected steel and, although combustible, would not pose any significantly greater risks than noncombustible roof construction in a sprinklered building. Therefore, B-25 and B-27 have been modified as recommended by the BCAAB and Staff to allow the use of heavy timber construction for the roof of a Type I or Type II-F.R. building.

B-26 — High-Rise Buildings

Although the proposed change to the high-rise building section of the code was accepted by the BCAAB, at the request of the Staff, additional modification was made to this section, making it applicable to other occupancy groups in addition to Group B-2 office buildings and Group R-1 residential buildings. Exemption from the high-rise requirements were given to Groups B-3, B-4 and M Occupancies because of either a low occupancy load, a low hazard of contents or both.

This change is significant in that it recognizes that the high-rise building fire problem is not unique to Group B-2 or R-1 Occupancies. The physical limitation of fire fighting in a high-rise building as well as the potential need for defending building occupants in place, i.e., not relying upon occupants to evacuate the building, is common to other occupancies. Nationally, there is a trend toward the expansion of high-rise requirements to occupancies other than B-2 office and R-1. Such an expansion has been resisted by some groups because it is felt that the present high-rise requirements are overly redundant and not cost-effective. The modifications included in the proposal which minimize the overly redundant and costly provisions of Section 1807 of the DBC make the expansion of these requirements to other occupancy groups reasonable.

Because of the expansion of the requirements, it was necessary to review the necessity of the provisions for a given occupancy. Accordingly, Section 1807(e) was further modified to selectively require the provision of fire alarm and voice communication systems. Occupant density and the nature of each occupancy were considered in this evaluation. For example, a voice communication system is not necessary in a high-rise hospital building because of occupancy factors such as the presence of hospital staff. The requirement for pressurized stairways has again been deleted although the Staff has requested that this provision be maintained in Section 1807. The rationale for eliminating

pressurized stairways in a fully sprinklered high-rise building has been given in the discussion of this report pertaining to Code Changes B-10 and B-38.

This proposed change was also editorially revised to be consistent with the 1983 DBC.

B-28 -- Subdivision of Combustible Attic Spaces

Code Change B-28 of the February report addressed Section 3205(b) of the DBC and would allow combustible attic space to be undivided, when the entire building including the attic spaces are equipped with automatic sprinklers. With the City of Dallas' adoption of the 1982 Uniform Building Code as the 1983 DBC, the requirements for firestopping and combustibles in concealed spaces were relocated to Section 2516(f)4 of the DBC.

Along with the relocation of the requirements from 3205(b) of the 1979 code to 2516(f)4 of the 1983 code, there also occurred a substantial revision of the subdivision requirements for concealed areas in wood frame construction. This revision consisted primarily of more requirements which discriminate between residential occupancies and other occupancies.

Although the BCAAB and Staff have found the original B-28 acceptable, it was not clear as to how the February proposal intended to apply to the new 1983 code section. The BCAAB and Staff, however, did recommend that the proposed modification be incorporated into the concealed space provisions of the 1983 DBC. From review of the original proposal and the 1983 DBC, it is concluded that this recommendation is in keeping with the intent of the originally proposed code change. Thus, Code Change B-28 has been revised to correspond with the 1983 code.

B-32 -- Arrangement of Exits

The Uniform Building Code is the only major model code which currently provides definitive requirements for separation of exits. The exit separation provisions of the 1979 DBC required a minimum distance between exits not less than one-fifth of the perimeter of the building or area served. In the early 1970's, the one-fifth perimeter basis was changed in the Uniform Building Code to require the distance between exits to be not less

than one-half of the length of the maximum overall diagonal dimension of the building or area to be served. Up until the adoption of the 1982 edition of the Uniform Building Code, the City of Dallas maintained and enforced the one-fifth perimeter rule, upon which the original Code Change B-32 was based. The one-fifth perimeter requirement, as related to the 1979 Dallas Building Code in the February report, was proposed to be applicable to unsprinklered buildings only and a one-tenth perimeter concept would be applicable to buildings protected by automatic sprinklers. This effectively is a 50 percent reduction in the required separation distance for sprinklered buildings.

It is the desire of the BCAAB and Staff to accept the 50 percent reduction concept, but incorporate it with the "one-half diagonal rule" in the 1983 DBC. Such a modification is consistent with the original intent of B-32 and, therefore, B-32 has been revised to reflect a "one-fourth diagonal rule" for sprinklered buildings.

The BCAAB and Staff have also recommended that an Exception found in 3303(c) be retained and applied to sprinklered buildings. This exception would limit the diagonal separation between exits to be no less than 30 feet. The exception is considered to have merit for unsprinklered situations, but is unnecessarily stringent for sprinklered buildings. The exception will remain in the code and will be applicable to unsprinklered buildings and in sprinklered buildings where the required separation (one-fourth of the diagonal) cannot be met. However, the 30-foot limitation is not otherwise necessary and this provision is not incorporated for sprinklered buildings.

B-33 -- Exit Travel Distance

In the February report, the proposal allowed an exit travel distance of 300 feet for Group B-2 Occupancies (other than wholesale and retail stores), and Group H-2 and H-3 Occupancies. Although these proposed changes are consistent with other nationally recognized codes, the Staff has recommended that the maximum allowalbe exit travel distance not be extended to 300 feet in Group H-2 and H-3 Occupancies. Therefore, the proposal has been modified in this report.

The proposal also includes a modification which only allows the provision granting 100 additional feet of travel distance in those buildings having an allowable travel distance of

150 or 200 feet. The intent is that this provision not be cumulative with the proposed greater exit travel distance (300 feet) allowed for selected B-2 Occupancies. In addition, a modification has been added to clarify that the additional 100 feet can only be utilized in a one-hour rated corridor. Merely referring to Section 3305 can be construed to include the exceptions to one-hour construction which is not the intent of this provision.

B-34 — Exiting Through Storerooms

The proposal presented in the February report was intended to allow the use of a kitchen or storeroom to constitute a secondary means of exiting from an adjoining space in a fully sprinklered building. Both the BCAAB and Staff have suggested that the provisions in the 1982 UBC (1983 DBC) are now adequate and, therefore, no further modification is needed.

While the 1982 UBC was revised, particularly with respect to dwelling units, the revisions do not address the subject of the original proposal.

Code Change B-34 is intended to allow a secondary exit to pass through kitchens or store rooms in buildings having an approved automatic sprinkler system. Allowing exiting through kitchens or store rooms as a secondary exit route is not considered to pose any more unusual risk to occupants than would be posed through other available egress routes. In the event of fire, it is expected that occupants will normally proceed in a direction away from the fire occurrance. This arrangement is often used in covered mall shopping centers where a secondary means of egress is routed through the stock room of tenant spaces, providing the necessary redundancy in the exiting system without negatively affecting the level of safety. Without such a change, the exiting arrangement of small retail facilities will be extremely limited and subject to costly alternatives.

The provision of automatic sprinklers will compensate for the elimination of an exit route that may result from a fire in a kitchen or store room. Automatic sprinklers provided to suppress and limit a fire will afford the additional necessary time for occupants to utilize alternate exit routes. The prohibition of exiting through rest rooms, closets and similar spaces will remain applicable for other than dwelling units. The use of such small rooms for exit routes, some of which are subject to locking, is not consistent with recognized fire protection practice.

B-35 — Maximum Dead End Corridor Distance

The BCAAB and Staff have recommended that the maximum allowable dead-end corridor distance be extended to 50 feet, except for I-1 and R-1 (hotel/motels) which should be limited to 30 feet. At the present time, the DBC limits the maximum dead-end corridor distance to 20 feet in all occupancies.

In order to be consistent with other nationally recognized codes and standards, however, it is recommended that the change remain as originally proposed with the additional provision allowing a dead-end corridor length of 35 feet in R-1 Occupancies. This distance is consistent with the requirements of the NFPA Life Safety Code for residential occupancies. No distinction is made in the Life Safety Code in the dead-end distance for hotel/motel and other residential occupancies, and no distinction is included in this proposal. Even though the occupants of a multi-family residential building may be more familiar with the building arrangement than persons in a hotel/motel, the frequency and severity of fires in multi-family reidential buildings is greater because of the inherent cooking operations.

While it can be stated that the current requirements in the Life Safety Code do not distinguish between sprinklered and unsprinklered buildings, the exit system is considered a primary fire safety element in the building and is complimented by the sprinkler system. Given the proposed reduction in inherent fire-resistance rating of the structure and the corridor system and the nature of the occupancy not contemplated by the Life Safety Code, a degree of prudence is suggested until additional experience is gained in sprinklered residential occupancies.

B-36 — Corridor Wall Construction

The exemption of sprinklered buildings from the fire-resistive corridor wall requirements has been accepted by the BCAAB and Staff, with the recommendation that the change be modified to allow all occupancies except hotels and motels to use nonrated corridor wall construction. Change B-36, as proposed in February, did not exempt apartment buildings nor Group I, Division 3 Occupancies (jails, prisons) from the corridor requirements since rated corridors were considered necessary redundancies in occupancies where people are sleeping or are restrained.

Further consideration has been given to the recommended modification suggested by the BCAAB and Staff resulting in the parital modification of B-36. The modification made to B-36 allows a degree of corridor construction intermediate between that originally proposed for all residential occupancies and that which is suggested for apartments and Group I-3 Occupancies. More specifically, B-36 has been modified to permit all residential buildings, including apartments, hotels and motels, to utilize one-half hour fire-resistive corridor construction when fully sprinklered. More specifically, one-half inch gypsum wallboard may be substituted for 5/8-inch Type X gypsum wallboard which is typically used to obtain one-hour of fire resistance. The new proposal will also allow the omission of fire dampers where ducts penetrate the corridor walls in sprinklered buildings and also permit the use of approved self-closing 1-3/4 inch solid core wood door installations in lieu of rated door assemblies. (Solid core wood doors with standard commercial frames and hardware have historically exhibited performance comparable to that of 20-minute rated door assemblies and will provide ample redundancy in a residential building's compartmentation.) Although reliance for safety on corridor walls is greatly diminished in a fully sprinklered building, some degree of redundancy in corridor integrity is needed in situation for residential occupancies. This modification is basically consistent with the corridor wall provisions of the 1981 Basic Building Code and the 1981 Life Safety Code for residential occupancies. This modification allowing reduced corridor construction does not apply to Group I, Division 3 Occupancies, however, an exception for open-barred cells in jails, prisons, etc., which is currently in the 1983 DBC, will remain applicable. (Revised: 10/28)

B-40 -- Automatic Sprinkler System Requirements

The city's proposal to require automatic sprinkler protection in buildings greater than 7,500 square feet formed the basis of the February report which identified modifications that could be made to the Dallas codes and ordinances, reducing overly redundant requirements and minimizing the economic impact of the sprinkler ordinance without negatively affecting safety.

In the original study, the 7,500 square foot figure was a given criteria, based upon an evaluation of the capabilities of the Dallas Fire Department which concluded that 3,000 gpm is the practical limit of water delivery and related services that could be provided by

traditional manual efforts. For fires greater than this size, internal (automatic) suppression systems would be necessary as the additional manpower and equipment required for manual fire suppression expand exponentially and quickly reach impractical and extremely costly levels.

The 3,000 gpm fire (water) flow rate was equated to a fire in a 7,500 square foot size building of typical construction and occupancy by the fire department using the principles contained in the Insurance Services Office (ISO), "Guide for Determination of Required Fire Flow."

After the February report was presented, considerable discussion at the BCAAB hearings was related to the basis for the specified "triggering limit" for automatic sprinkler protection. The BCAAB felt that the 7,500 square foot size was too arbitrary, especially for buildings which were of noncombustible construction and having a noncombustible occupancy. It was felt that any mandatory sprinkler provision should consider building construction and occupancy conditions.

The staffs of the fire department and Building Inspection Division prepared a revised proposal for requiring automatic sprinkler protection which took construction type and the combustiblity of the occupancy into consideration. This evaluation is known as the proposed Table 5-E of the Dallas Building Code (Table 3). Because the fire flow formula favors noncombustible construction, Table 5-E demonstrated a rather substantial discrimination against combustible construction types.

The scope of work for the February report prepared by Schirmer Engineering Corporation only included a requirement to identify proposed code modifications, given the 7,500 square foot area developed by the city. No evaluation of this criteria was made by Schirmer Engineering Corporation. The BCAAB, therefore, in conjunction with the Building Inspection Division, requested Schirmer Engineering Corporation to perform an analysis of the table generated by the Staff and to recommend criteria for the application of automatic sprinkler protection, based upon the application of professional engineering judgment.

In reviewing the table which was calculated by the Staff, it is apparent that certain judgments were included which produced building areas different from what the literal definitions in the ISO Commercial Fire Rating Schedule, 1980 edition, would produce.

TABLE 3 -- PROPOSED TABLE 5-E BY DALLAS STAFF

		TYPES OF CONSTRUCTION								
		I .6	.6	II .8	0.8 1.0	1.0 III .8	1.0	1.0 IV .8	V 1.5	1.5
	OCCUPANCY	F.R.	F.R.	ONE-HOUR	N	ONE-HOUR	N	H.T.	ONE-HOUR	N
1.0	A-1,2,2.1	25,195	25,195	A-1 N.P. 14,172	Not Permitted	A-1 N.P. 14,172	Not Permitted	A-1 N.P. 14,172	A-1 N.P. 4,031	Not Permitted
.85	A-3,4	34,872	34,872	19,616	12,554	19,616	12,554	19,616	5,580	5,580
1.15	B-1,2,3	19,051	19,051	10,716	6,858	10,716	6,858	10,716	3,048	3,048
1.0	B-2 office Bldgs	25,195	25,195	14,172	9,070	14,172	9,070	14,172	4,031	4,031
1.15	B-4	19,051	19,051	10,716	6,858	10,716	6,858	10,716	3,048	3,048
1.0	E	25,195	25,195	14,172	9,070	14,172	9,070	14,172	4,031	4,031
1.25	H-1,2	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500
1.25	H-3,4,5	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000
1.0	I-1,2	25,195	25,195	14,172	Not Permitted	14,172	Not Permitted	14,172	4,031	Not Permitted
.85	I-3	34,872	34,872	Not Permitted						
1.0	R-1	25,195	25,195	14,172	9,070	14,172	9,070	14,172	4,031	4,031
1.0	R-3	25,195	25,195	14,172	9,070	14,172	9,070	14,172	4.031	4.031
	M									

1. All others

2. Office Bldgs., Drinking & Dining, Retail, Police & Fire Stations, Education less than 50, Service Stations, Garages

   For Open Parking Gargaes see Sec. 709

For example, a building construction factor of 1.0 was used for Type II-N noncombustible construction as opposed to the proper factor of 0.8. Similarly, a construction factor of 0.8 was used for Type III-One hour (masonry joisted) construction and Type IV (heavy timber) construction. Values of 0.8 are normally used for noncombustible construction types and values of 1.0 are normally used for combustible contruction other than frame. The use of these values by the Staff resulted in lower than normally calculated areas for Type II-N construction and greater than normally calculated areas for Type III-One hour and Type IV construction.

The use of the different construction types is appropriate in this case as an attempt to preserve the relative order of "desirabilty" in construction types as expressed by the traditionally allowed area table presently included in the DBC (Table 5-C). In reviewing the table, it can be noted that the basic areas for a given occupancy are the same for Type II-One hour, Type III-One hour and Type IV construction. Similarly, the basic areas are the same for Type II-N and Type III-N construction. The use of other than the specified construction factors by the Staff was intended to maintain this relationship. Such an approach is acceptable given the fact that, in most cases, the early growth of a fire is more related to the contents of a building rather than its construction type. The use of the construction type factor by the Staff recognizes that the inherent fire resistance of a structure is, initially, not related to the construction type. Also, only in severe fires does the construction of the building become a factor. Such is considered to be the case for frame buildings which continue to be the most restricted in terms of allowable unsprinklered area.

The Staff calculations were also noted to be conservative in the application of a maximum exposure factor of 1.75 and in the designation of occupancy factors. For example, the occupancy factor used by the Staff in computing the allowable areas for educational and residential occupancies was 1.00. The values specified for these occupancies in the ISO Commercial Fire Rating Schedule (CFRS) is 0.85, resulting in a larger allowable unsprinklered area for these uses. All occupancy factors were verified against the values contained in the ISO CFRS. As a result, the maximum allowable unsprinklered areas were recomputed, as shown in Table 4. As can be seen, Table 4 also contains three more occupancy designations than Table 5-E submitted by the Staff owing to a more discrete definition of occupancies as a result of the verification with the CFRS.

TABLE 4 -- CALCULATED ALLOWABLE UNSPRINKLERED AREAS

Occupancy	ISO Occy. Factor	Type of Construction								
		I	II-F.R.	II-1 hr.	II-N	III-1 hr.	III-N	IV	V-1 hr.	V-N
		(C[1] = 0.6)	(C = 0.6)	(C = 0.8)	(C = 1.0)	(C = 0.8)	(C = 1.0)	(C = 0.8)	(C = 1.5)	(C = 1.5)
A-1	1.00	25,200	25,200	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.
A)2-2.1	1.00	25,200	25,200	14,200	N.P.[2]	14,200	N.P.[2]	14,200	4,000	N.P.[2]
A-3	1.00	25,200	25,200	14,200	9,100	14,200	9,100	14,200	4,000	4,000
A-4	0.85	34,900	34,900	19,700	12,600	19,700	12,600	19,700	5,600	5,600
B)1-2[3]	0.85	34,900	34,900	19,700	12,600	19,700	12,600	19,700	5,600	5,600
B)1-2-3[4]	1.00	25,200	25,200	14,200	9,100	14,200	9,100	14,200	4,000	4,000
B-4	1.00	25,200	25,200	14,200	9,100	14,200	9,100	14,200	4,000	4,000
E	0.85	34,900	34,900	19,700	12,600	19,700	12,600	19,700	5,600	5,600
H)1-2	1.25	16,100	16,100	9,100	5,800	9,100	5,800	9,100	2,600	2,600
H-3	1.15	19,100	19,100	10,700	6,900	10,700	6,900	10,700	3,000	3,000
H)4-5	1.00	25,200	25,200	14,200	9,100	14,200	9,100	14,200	4,000	4,000
I)1-2	0.85	34,900	34,900	19,700	N.P.[5]	19,700	N.P.	19,700	5,600	N.P.
I-3	0.85	34,900	34,900	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.
R-1	0.85	34,900	34,900	19,700	12,600	19,700	12,600	19,700	5,600	5,600
R-3	0.85	34,900	34,900	19,700	12,600	19,700	12,600	19,700	5,600	5,600

Notes to Table:

1. ISO construction factor.
2. Not permitted except when fully sprinklered. See Section 508.
3. Office buildings, police and fire stations, educational with occupant load less than 50.
4. All other B-2 occupancies.
5. Not permitted except when fully sprinklered. See Table 5-C.

The calculated values (for other than Group H) vary between 4,000 square feet and 34,900 square feet. These values were utilized in the development of Table 38-B associated with Proposed Change B-40 which designates maximum allowable unsprinklered building areas. In comparing Table 4 and Table 38-B, it can be seen that Table 38-B reflects the requirements of Section 3802 which presently require sprinklers in various occupancies, such as Group I. For other than Group H, the minimum area included in Table 38-B is 7,500 square feet. This value was selected as a practical minimum building area for defining a requirement for automatic sprinkler protection at this time. Other values in the table have been rounded to the nearest multiple of 5,000 square feet, with the exception of those values for Group R Occupancies.

At the first public hearing related to the February report, several comments were expressed relating to the fact that commercial and residential occupancies were being treated equally (with respect to the application of the original 7,500 square foot criteria) even though residential occupancies have a disproportionately high fire loss experience (Tables 5 and 6), as stated in the February report. The designation of 7,500 square feet as the maximum allowable unsprinklered area for a residential building, irrespective of its construction type, is an attempt to deal with this fact and is intended to be a positive step toward minimizing residential fire losses in the City of Dallas.

While it is true that the use of the ISO fire flow relationship was not intended for this application -- determining maximum allowable areas for unsprinklered buildings -- the calculations were made with experienced judgment for the task. A vigorous statistical analysis of fire losses by occupancy and building construction type, if adequate data were available, could be performed. Recent attempts to do this have not been successful, primarily due to a lack of data and other variables not being held constant. In any event, it is expected that such an analysis would show residential occupancies of all construction types as needing the greatest attention.

It must be recognized that any such sprinkler ordinance is more a reflection of a community's fire safety objectives than a technically-based matter. The basic height and area limits were included in the building codes more than 50 years ago. At that time, those limits were considered reasonable safegaurds against devastation of large city areas caused by conflagrations earlier in the century. While the basic height and area limitations, in conjunction with other provisions, have proven to be adequate in preventing building-to-building fire spread, they have recently been judged to be inadequate in curtailing the growth of fire losses due to a variety of reasons.

TABLE 5

DALLAS FIRE EXPERIENCE BY OCCUPANCY GROUP

FOR 5 YEAR PERIOD, 1974-78

Occupancy	Number of Fires (%)	Property Loss (%)
Residential	12,016 (78.8)	$63,602,000 (68.1)
Miscellaneous[1]	796 (5.2)	1,263,000 (1.4)
Mercantile	748 (4.9)	10,777,000 (11.5)
Storage	538 (3.5)	5,358,000 (5.7)
Public Assembly	521 (3.4)	5,901,000 (6.3)
Industrial	233 (1.5)	2,947,000 (3.2)
Business	179 (1.2)	2,980,000 (3.2)
Educational	133 (0.9)	330,000 (0.4)
Institutional	82 (0.6)	192,000 (0.2)
Total	15,246(100.0)	$93,350,000 (100.0)

1. Garages, barns, sheds and all other property.

Source: Dallas Fire Department.

TABLE 6
WHERE FIRE FATALITIES OCCUR IN DALLAS[1]

Occupancy		Number (%)
Residential		312 (87.4)
1 and 2 Family Dwellings	163	
Apartments	108	
Hotels/Motels	8	
Mobile Homes	4	
Not Identified	29	
Automobile		17 (4.8)
Industrial		11 (3.1)
Automotive Garage		6 (1.7)
Yard		4 (1.1)
Nursing Home		2 (0.5)
Shed		2 (0.5)
Community Center		1 (0.3)
Dance Hall		1 (0.3)
Office		1 (0.3)
Total		357(100.0)

1. This data reflects the identification of building occupancy involving fire fatalities in the years 1970, 1972-1977, FY 1979-80, FY 1980-81 and FY 1981-82.

Source: Dallas Fire Department.

As a result, an ever-increasing number of communties across the United States have enacted or are considering sprinkler ordinances (mostly based upon a specified building area and/or height, irrespective of construction or occupancy) to supplement the requirements of their building codes. However, unlike Dallas -- the largest city considering such an ordinance -- these ordinances have been enacted in addition to existing code requirements. The evaluation of possible reductions in existing, traditional code requirements to minimize the economic impact of such a provision has not been performed on a large scale until the February report and this Supplemental Report for the City of Dallas.

As opposed to the use of the traditional methods of dealing with a community's fire protection, the city is considering taking a positive role in effecting a reduction in its fire losses and stabilization of fire department expenditures by the enactment of an ordinance similar to that contained in Change B-40. It is also important to note that methods such as the ISO fire flow relationship are primarily concerned with achieving manual fire control and the prevention of building-to-building fire spread rather than the achievement of a specified life safety goal. The designation of a maximum allowable unsprinklered area for residential occupancies, regardless of construction, is intended to achieve a consistent level of fire protection in the occupancy group which deserves the most attention. Yet, it is recognized that a significant number of new residential buildings will not be affected by such a provision, particularly one- and two-family dwellings. This proposed change should be viewed as the first step toward improving the level of fire safety in this occupancy group until such time as the community's fire protection goals demand an additional degree of protection in this area.

Change B-40 also incorporates other provisions resulting from the public hearings. For example, exemptions are provided from the sprinkler provision for noncombustible buildings having noncombustible operations or contents.

The proposal was also editorially revised to be consistent with the 1983 Dallas Building Code.

B-42 -- Standpipe Water Supply Requirements

The proposed change in the February report has essentially been incorporated into the 1983 Dallas Building Code since the Dallas revision to Section 3805(c) requires all standpipes to be either filled with water or air (for supervisory purposes) and the new U.B.C. Standard 38-2 addresses water supplies. Therefore, Proposed Code Change B-42 is no longer necessary and the text is deleted.

B-45 -- Standpipes in Buildings Under Construction

At the request of the fire department, Code Change B-45 was proposed in the February report in order to allow reduced cost for temporary fire protection during construction by requiring an on-site water supply for the standpipe system only when construction exceeds the capabilities of fire department pumpers. Such a change was incorporated as a City of Dallas revision in the 1983 building code. Therefore, the proposed code change is not needed.

However, the 1983 Dallas Building Code apparently contains an editorial error which renders the language inconsistent with the intent of the section. Code Change B-45 is presented in this report for the purpose of correcting the current code language of this section.

B-46 — Elevator Door Operation

The proposal presented in the February report has been modified to reflect the concerns of the BCAAB and Staff. Originally, the proposed change would have exempted the provision of a smoke detector in elevator lobbies in sprinklered buildings. The purpose of these detectors is to prevent the opening of elevator doors on a fire floor. Because the Dallas Building Code references ANSI Standard A17.1 for elevator design and operation requiring the automatic recall of elevators in tall buildings during a fire emergency, it was not considered necessary to provide the smoke detector in a sprinklered low-rise building. The ANSI standard did not even require elevator recall in sprinklered buildings of any height until very recently, apparently a reaction to the several high-rise fire tragedies, even though none of these occurred in a sprinklered building.

Nevertheless, the proposal was modified to allow the deletion of the smoke detector door-closing function in a fully sprinklered building when the elevator is automatically recalled either by sprinkler waterflow or by smoke detectors. This arrangement will automatically return the affected elevators to the ground floor, by-passing the fire floor and not jeopardizing occupants that may be in the elevator. This accomplishes the same intent as the present Section 5103(d). Low-rise buildings which do not have an automatic recall feature would remain subject to the current provision. In all cases, the electrical interlocks of the elevator are intended to be arranged to allow the fire department to manually by-pass the automatic return feature or smoke detector on the fire floor.

B-47 — Roof Panels; and B-48 — Skylights

The BCAAB and Staff have accepted the original proposals and have requested consideration for further liberalization of these two proposed code requirements. Both B-47 and B-48 have been editorially revised to be consistent with the 1983 DBC and resubmitted without technical modification. The suggested changes submitted in February, 1983 allowed a doubling of the previous plastic roof panel sizes, plastic roof panel aggregate area and plastic skylight aggregate area.

As proposed, the provisions will allow plastic roof panels to constitute up to 50 percent of the floor area and plastic skylights to constitute up to two-thirds of the floor area in sprinklered buildings. Both the BCAAB and Staff have requested the consideration of allowing 100 percent of a building's roof area to be of plastic roof panels or skylights.

The increases proposed in the February report were based upon recommended revisions to all the model building codes by the Board for the Coordination of Model Codes (BCMC), an organization consisting of representatives of each of the three model building codes and the NFPA, the purpose of which is to provide uniformity in the major subject areas of the model codes used in the United States.

The subject of plastics in building construction has generally been viewed with skepticism in recent years, especially materials which may constitute an interior finish application. While there is no technical reason or adverse experience to limit the use of approved plastic roof panels or skylights in sprinklered buildings, the building community has

approached the subject cautiously until more experience can be gained. The proposed revisions are considered to provide increased design freedom, yet, they incorporate a degree of prudence. It is recommended that the City of Dallas be consistent with the requirements recommended by BCMC at this time.

B-49 — Exterior Wall Requirements

Schirmer Engineering Corporation was asked to review a list of other suggested modifications for residential occcupancies in order to provide a greater opportunity to help off-set the cost of sprinkler protection in these occupancies. As demonstrated in the February report, small residential buildings acrue the least benefits from the 48 changes that were originally proposed. In the conclusions section of the February report, it was recommended that zoning ordinances be evaluated to allow a greater density of residential units if they are fully sprinklered. While fire protection considerations are only one factor affecting land density, sprinkler protection can overcome the fire safety issue.

Provisions to allow a reduction in the fire-resistance rating of exterior walls and opening protectives for all sprinklered buildings are included in Change B-9.

A proposal to allow a reduction in the maximum distance at which fire resistance is necessary for exterior walls is consistent with the rationale given for Change B-9. The prevention of the spread of fire among buildings and the potential damage to a building from an exposing fire is intended by the current provisions in Table 5-A. As discussed in the February report under B-9, the exposure hazard associated with sprinklered buildings is materially reduced.

The proposal to allow sprinklered R-1 buildings to utilize the same criteria for determining the need for a rated exterior wall as R-3 buildings was considered and found to be technically acceptable and an additional measure which can contribute to reducing the construction cost for Group R-1 Occupancies.

B-50 -- Separation of Parking Garages in R-1 Occupancies; B-51 -- Separation of Parking Garages in Dwellings; B-52 -- Separation of Parking Garages in R-1 Occupancies

In consideration of the effort to achieve greater cost benefits for the installation of automatic sprinklers in residential occupancies, three additional code changes related to parking garage separations are proposed to the 1983 DBC as follows.

Code Change B-50 allows the one-hour fire separtion required between parking garages less than 3,000 square feet and residential buildings such as apartments or motels to be constucted of standard ½ inch gypsum wallboard in lieu of Type X gypsum wallboard. Doors in the wall may be 1-3/4 inch self-closing solid core wood doors in lieu of rated door assemblies.

Code Change B-51 allows the omission of weatherstripping on the door(s) between garages and attached one- or two-family dwellings and also permits the use of glass in such doors.

The newly proposed B-52 will allow the separation between parking garages (over 3,000 square feet) used for passenger vehicles and residential occupancies to be of one-hour fire-resistive construction rather than a two-hour separation as currently required by the 1983 DBC.

All of the above allowances are permitted only when the entire building is protected throughout by automatic sprinklers.

The rationale for allowing such fire-resistive or construction tradeoffs is similar to that discussed in the February report for the reduction of fire resistance of various building components. Again, it relates to the ability of sprinklers to control a fire at the point of origin, thereby supplanting the need for greater magnitudes of passive fire control.

B-53 — Material Substitution

This change proposes a new section to Subchapter 12 of the 1983 DBC. Subchapter 12 contains provisions applicable to residential occupancies -- apartments, hotels, dwellings. The addition of this new section is, again, an attempt to incur some cost benefits for residential buildings that have automatic sprinkler protection.

Change B-53 addresses specific construction materials typically used in multi-family residential buildings. Gypsum wallboard, which is a common material for sheathing and protection of a building's structural components such as walls, floors and roofs is typically used in one-hour fire-resistive type structures to provide passive fire resistance. The specific type of wallboard generally used in such circumstances is known as Type X gypsum wallboard (typically 5/8-inch thickness).

Without completely eliminating structural redundancy, Code Change B-53 will allow the substitution of standard gypsum wallboard, which is slightly less expensive than Type X (appropriately $55 per 1,000 square feet), where Type X gypsum wallboard would be required to provide one-hour of fire resistance. This substitution is limited to buildings three stories in height and is not permitted for exit enclosures or the parking garage separation addressed previously in Code Change B-52. The substitution of a less substantial grade of gypsum wallboard is considered an acceptable reduction of structural redundancy for sprinklered buildings limited to three stories in height.

Again, complete sprinkler protection and its ability to supplement passive structural features is the basis for the material substitutions.

B-54 -- Flame Spread of Exterior Exitways

A suggested change to Table 42-B was considered for residential occupancies. A recent change to Table 42-B of the UBC was enacted by Ordinance 17791 which changed the allowable finish materials of exit balconies and external stairways of a Group R-1 Occupancy from a Class II material to a Class I material. Thus, this provision of the DBC is more stringent than that contained in the UBC.

The provision of automatic sprinkler protection in a building will minimize the risk associated with involving combustible materials on its exterior. Therefore, a modification is proposed to allow a Class II material to be utilized, as currently allowed by the UBC, providing additional design freedom for such structures.

CONCLUSION

This study and associated proposed changes to the codes of the City of Dallas represent a unique approach to improving the level of fire protection while minimizing the economic impact associated with a sprinkler ordinance.

Proposed changes to the Dallas Building Code included in the February, 1983 report by Schirmer Engineering Corporation were evaluated with respect to their applicability to the current edition of the code and modified, if necessary. Suggested modifications of the proposed changes by the BCAAB and Staff were considered along with several new proposals for residential occupancies.

Criteria for the application of automatic sprinkler protection, with supporting rationale, have also been provided in this report. The criteria represent the recommendation of Schirmer Engineering Corporation based upon the available level of public fire protection fire loss experience in Dallas and comments received from the public. The designation of a maximum allowable unsprinklered area for residentail occupancies, regardless of construction, is intended to achieve a consistent level of fire protection in the occupancy group which deserves the most attention.

If adopted, the proposed ordinance will affect a significant proportion of new buildings to be built in Dallas in the near future. Yet, it must be recognized that a significant number of buildings will not be affected: one- and two-family dwellings, small multi-family buildings and, of course, existing buildings in the city. The modification proposed to the sprinkler requirements contained in this report represent a first, but significant, step toward minimizing fire losses in the city, and its accompanying benefits until such time as the community's fire protection goals dictate an additional degree of protection. Any enhancement the city's codes can only be viewed as a reflection of that community's desired level of fire protection.