

Urban Fire Defense Planning A Step Beyond The Code Revolution

Part IV The Pieces Come Together

- Building Codes
- "Fire Limits"
- The Municipal Grading Schedule

by Edward J. Reilly, President
Ed Reilly Associates

The American City of the eighties bears little resemblance to its ancestor. Social, political, economic, technological, demographic focus have transformed densely populated, vertically structured high value commercial and industrial communities into sprawling asphalt prairies. Today's centers of commerce accompanied by high value fire loadings are everywhere; their boundaries and borders, no where.

A whole new vocabulary of buzz words has been generated by this urban metamorphosis "megalopolis," "mall," "urban sprawl," "white flight," "urban blight," "inner city," "ghetto."

Cities came down. High value commercial and business districts fell under the crushing weight of wrecker's balls. Parking lots replaced older high rise office buildings. High value mercantile and industrial complexes were redeployed out along the new concrete rivers of commerce.

Whole new cities with hundreds of shops and stores clustered under single roof malls where millions of square feet of high value commodities were stored and sold.

Central cities decayed. Hundreds of square miles of apartment houses mysteriously perished in flames as owners denied complicity that rent control ordinance had made absentee land lordship as profitable as the buggy whip business. By the sixties New York City's Bronx County resembled Berlin in 1945.

The ghettos in Detroit, Newark, Los Angeles, Chicago, and Philadelphia were put to the torch by their own inhabitants as transplanted migratory workers from post war mechanized farms expressed frustration and anger that they had not shared in the prosperity of those who had gone to a suburbia that had no boundaries.

Racial strife and "White flight" followed, drying up the municipal tax base needed to fight fire and crime, disease and poverty. By the mid eighties signs began to appear suggesting that a moderating trend in self-inflicted municipal destruction was visible. Some notable signs of a reversal of both population and the flow of smart investment capital appeared. Pittsburgh, St. Louis, Chicago, Baltimore, and even staid old Boston came up with significant urban renewal programs.

Fresno

But no city went so far, or made such sweeping reversals as Fresno. Fresno had not been as severely damaged by the post war urban demolition that northeastern or midwestern urban centers had.

It was not a major population center like Los Angeles, 200 miles south or San Francisco equidistant northward. It was centered in a wealthy state during a time when agriculture prospered. With only 114,000 population in 1955 where its urban Fire Defense Plan was conceived it was nevertheless the agribusiness capital of America.

Its tax base was rich enough to support a Class I Fire Department in 1955. Less than eight fire departments in any city of any population class in America could boast of a National Board of Fire Underwriters Class I rating. Class I Fire Departments were just too expensive in terms of manpower, training expertise, land, building and equipment costs.

But Fresno's leadership saw the handwriting on the wall. The city could not hope to escape the plight of other American cities unless it controlled its expenses in the face of certain runaway inflation that lay ahead.

It had its pockets of poverty and urban blight especially in the "flophouse" district where migrating farm workers seasonally lived.

It also had a high value central business district with a dense population. It was well protected by nine fire stations, 22 rolling pumpers and ladders averaging 70 men on duty 24 hours a day.

These two areas were chosen by city planners as areas to be totally protected by automatic sprinkler systems which would eventually protect 95% of the total floor area of every building in the 44 square block of both project areas.

NBFU Fire Limits

The central business district was the area designated by Fresno's Building Code as Fire Zones 1 and 2. Fresno had adopted the Uniform Building Code early on. Fire Zones 1 and 2 were known to the National Board of Fire Underwriters as "Fire Limits."

"Fire Limits" is insurance industry terminology for high value central business district. "Fire Limits" had been established by NBFU as a requirement of the National Building Code shortly after the turn of the century when the NBFU promulgated America's first Building Code in 1905. Restrictive construction and/or protection requirements were mandated in the National Building Code for property located within "Fire Limits" where stricter rules affecting fire walls, parapets, fire proofing of structural members, exposure distance and sprinkler mandates applied.

UBC (Fresno's Building Code) had incorporated most of NBC's requirements into its code. It was then standard practice among the model code conferences to adopt NBFU fire limits into all model codes.

(Continued on page 8)

(Continued from page 6)

Municipal Grading Schedule

If Fresno's Building Code was the main link or lynch pin in its UFD, then the NBFU Municipal Grading Schedule was the engine that gave it power. The Grading Schedule was NBFU's Companion to the National Building Code. As early as 1904 both the Building Code and the Grading Schedules were planned as a two pronged attack by the insurance industry against conflagration and large loss fires. While the *code* and the *schedule* grew out of the same response to the need for less control, the grading schedule was not completed in comprehensive printed form until 1916, eleven years after the promulgation of the NBC.

Code/Schedule Purposes

While both the Building Code and the Grading Schedule were intended as loss control instruments, they had different specific purposes. The Code was the insurance industry's first attempt at limiting the spread of fire and avoiding conflagration. It was basically aimed at fire containment; not on extinguishment or control. Life safety was only corollary to a main thrust. The municipal grading schedule was designed to evaluate the entire community's capacity to defend itself against fire, earthquake and other natural disasters. It concentrated on evaluation of municipal water supply, hydrant spacing and location, the size, condition, training of fire departments; the number, kind and condition of fire apparatus, the location and number of fire stations, the kind and quality of building codes, the evaluation of enforcement, training of inspectors; alarm and notification systems and a vast array of anti-disaster mechanisms employed by local government against fire and other hazards.

From the fire insurance industry's viewpoint its bottom line was the establishment of "KEY RATES." It envisioned ten levels of protection from 1 to 10, with one as a perfect city and 10 being the worst case.

"Key rates" were suggested rates or "book rates." NBFU member companies (or anyone else) were not obligated to write premiums based on "key rates" which were only guides to carriers.

High NBFU municipal classification ratings were coveted by city managers. Fire chiefs were especially sensitive to NBFU grading results because city

mayors or managers sometimes used the grading of fire departments by NBFU to evaluate fire officer performance. There was latent and perennial contention between NBFU engineers and fire officers. NBFU was viewed as a kind of inspector general's office involuntarily drawing the NBFU into unwanted political entanglements. As objective as the standards in the grading schedule were, there was always room for individual judgements that could open the door to an accusation of subjectivity, bias or partiality.

As elaborate, well conceived, objective, balanced and fair as the grading schedule may have been, fairness of its impact upon an urban community rested, in the final analysis, upon "engineering judgement." The possibility of some subjectivity could never be dismissed despite all the checks and balances built into the system.

ISO Established

In 1965, NBFU disappeared after over a century of service to both the insurance industry and the American Municipality. It was merged into the American Insurance Association (AIA) as multi-peril insurance coverage became almost universal in the industry. The AIA continued grading cities until 1971 when the Insurance Services Office (ISO) was established in a further restructuring of the insurance industry.

Just as the American city had undergone a revolutionary transformation during the post World War II years of urban chaos, turbulence, economic and social deterioration, so the insurance industry experienced a metamorphosis of equal magnitude.

The fire insurance industry suffered an identity crisis in the wake of the merger of the NBFU with the AIA in 1965. Continued restructuring of the insurance industry as the industry sought to consolidate its services and implement cost cutting measures on every level in every state followed.

Fire Suppression Rating System

The municipal grading schedule was one of ISO's most costly services. Its critics were vocal and numerous. It was alleged to be cost ineffective, relying too heavily on "over design," capital and labor intensive prescriptions to loss control. Its emphasis on fire department manpower development, costly rolling apparatus and the land and buildings needed to support armies of fire fighters occurred at a time

when the municipal tax base was at its nadir. Its most severe critics alleged that the correlation between grading results and actual losses had not been demonstrated.

So the municipal grading schedule was abandoned and replaced by ISO's **FIRE SUPPRESSION RATING SYSTEM** in 1980. Its end purpose was the same as the grading schedule: namely, to develop a "Key" rate for commercial and industrial properties. It was vastly more economical to implement. ISO attempted to achieve the same purpose as the municipal grading schedule by building a mathematical model of an urban community factoring in the same weighted values that the older labor intensive system employed. Its heart and core assumption rested on the central concept the industry had built its loss control programs from its beginnings. That concept was (and is) known as "**FIRE FLOW.**" In its simplest terms "fire flow" is ratio of the amount and duration of water application to defined and quantified hazard, fire loadings, exposure distances, fire separations, fire walls, parapets and mathematical assumptions of both active and passive fire protectors in the "built up" community. They are the same assumptions upon which building codes theoretically rest.

At a risk of over simplification, ISO's 1980 **FIRE SUPPRESSION AND RATING SCHEDULE** can be described as computer adoptable mathematical model of selected elements of the old municipal grading schedule coupled with its more recently developed 1972 and 1974 **ISO GUIDES TO FIRE FLOW REQUIREMENTS.**

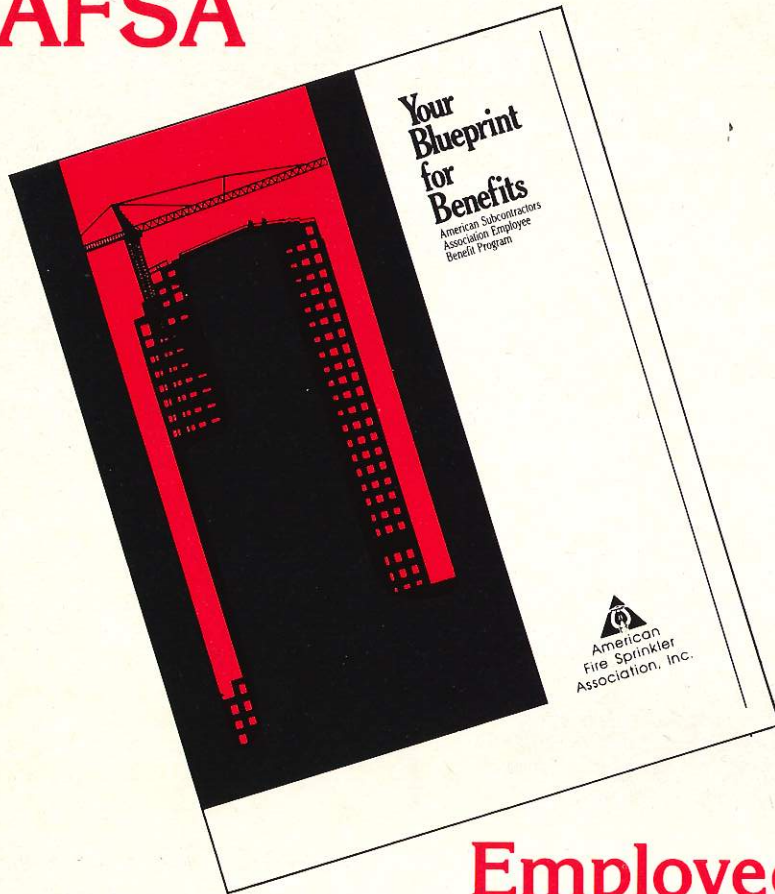
The whole system assumes that "key rates" should be based upon predictable losses and that the ratio of predictable losses to real losses is a function of timely delivery of water upon a predatory fire.

Automatic sprinkler systems key to successful UFD

ISO determined that fire flow requirements could be *cut in half* when "closely built up areas" were *completely* sprinklered and that required fire flow could be further reduced by another 25% when constructions meeting the equivalent standards of the National Building Code requirements for "fire limits" were provided. All model codes at the time were in

(Continued on page 24)

AFSA



Employee Benefits Program

Your Blueprint for Benefits

Affordable rates
Flexible options
Fully insured

Choose from 6 separate plans tailored to meet individual company needs.

- **Health Care** — Choice of 4 medical plans
- **Dental Care** — up to \$1000 eligible expenses annually
- **Vision Care** — \$10 annual deductible
- **Long Term Disability** — Customer designed protection
- **Weekly Income** — Choice of 4 plans
- **Life & AD&D** — Coverage — Choice of 6 plans

To find out how your company can take advantage of these special AFSA member benefits write or call AFSA, 11325 Pegasus, Suite E-109, Dallas, Texas 75238. (214) 349-5965.

(Continued from page 8)

“SYNC” with the NBC on fire limit requirements at the time.

The NBFU had delineated a definition of “closely built up” area in its “Guide to the NBFU’s ‘RECOMMENDED METHODS FOR LAYOUT OF FIRE LIMITS’ ” published in the fifties. The root assumptions upon which “Fire Limits” rested and therefore full credit for sprinkler protection was credited in ISO’s 1974 GUIDE TO FIRE FLOW REQUIREMENTS. The NBFU “Guide on Fire Limit Layout” is summarized in this criteria:

- a) 50% or more of the land area must be built up.
- b) The average height of construction must be 2½ stories.
- c) 40% of the land area must be commercial property.
- d) A buffer of 200 feet must be provided along the periphery of fire limits.

With ISO’s focus shifting from engineering assessments of manpower, equipment and buildings to fire flow, much of the possibility for controversy with municipalities was diminished, the prospect of mathematical objectivity was enhanced and the cost of developing a reliable rate making system was vastly reduced.

Urban Fire Defense Planning centered upon “Fresno-like” saturation sprinkler protection for central business districts and, by the eighties decentralized shopping malls, jump out as the most significant development in the history of the sprinkler industry.

As we move into the second half of the decade of the eighties; the central business district is no longer the principal object of a loss control project. The new high value urban center is the gigantic mall, the beneficiary of urban sprawl. But the time is near when a reversal will be obvious to everyone. The central city will be rebuilt. A mechanism for condemning unsafe, unhealthy and blighted urban areas was developed by Fresno.

How the Dangerous Building Ordinance fits into the whole UFDI we will see in coming installments.

(Continued from page 24)

The Fresno Experience

Of the 666 cities responding to an ISO survey in 1965 only seven had Class I fire departments as assessed by ISO. Fresno was one of them. It had a Class 3 water supply rating.

After its AIA's evaluation in 1966 its fire department was reduced to Class 3 (manpower and equipment shortfall) and its water supply rating to Class I with 30% of the weighted values assigned to fire departments and 34% assigned to water supply, the city's overall evaluation moved up from Class 3 to Class 2. No city has ever received a Class I overall rating.

Automatic sprinklers installed throughout built up high value districts, added a remarkable 50% credit to its water supply evaluation. Superior construction resulting from enforcement of both its **DANGEROUS BUILDING ORDINANCE** and its vision of the construction standards of the **UNIFORM BUILDING CODE** added another 25% credit.

These factors have been cranked into ISO's 1980 "**FIRE SUPPRESSION RATING SCHEDULE.**"

Required Strength of Fire Companies

| Fire Companies | Required Strength |
|---|-------------------|
| High-value companies (first-alarm response to high-value districts) | |
| Pumper company | 7 |
| Hose company | 6 |
| Aerial ladder company | 7 |
| Service ladder company | 8 |
| Pumper-ladder company | 10 |
| Other companies (in other districts) | |
| Pumper company | 5 |
| Hose company | 4 |
| Aerial ladder company | 6 |
| Service ladder company | 6 |
| Pumper-ladder company | 8 |
| Pumper company with extra ladder equipment | 7 |

Source: AIA Grading Schedule (Appendix A).

The Municipal Grading Schedule (NBFU, AIA and ISO) established the optimum required number of fire fighters prescribed for duty 24 hours a day.

Over 30% of possible deficiency points could be imposed on a municipality which failed to meet ISO's fire

department manpower strength.

An approximately equal weight was given to ISO's evaluation of its water supply (fire flow).

Under ISO's 1980 Fire Suppression Rating Schedule all of the elements in the support system to timely delivery of water onto a predatory fire. These values are factored into a mathemati-

cal model of a built up area. Hence, "closely built up" sprinklered areas envision automatic delivery of water in a timely basin as a substitute for manual delivery systems. So reduced manpower can be offset by sprinkler protections under the new rating schedule just as it was in Fresno under the older grading schedule.

IMPORTANT NOTICE

**TO INSTALLERS OF
MODEL C DELUGE & PRE-ACTION VALVES,
BOTH PNEUMATICALLY AND
ELECTRICALLY OPERATED, AND OTHER
EQUIPMENT USING MERCURY
CHECK DEVICES MANUFACTURED BY
"AUTOMATIC" SPRINKLER CORPORATION
OF AMERICA.**

PLEASE CONTACT US PROMPTLY!

Ongoing research and development work on our Deluge and Pre-Action Valves manufactured since 1956 has revealed a condition that we must call to your attention. Under fire situations, the valve may **NOT** operate. This condition can be corrected. But first, we need your help locating the valves.

The Model C Valves may bear one of several tradenames: **MULTITROL** by Grinnell, **DUALGUARD** by Rockwood, or **SUPROTEX** by "Automatic" Sprinkler.

The condition can also exist with other "Automatic" equipment having Mercury Checks: Electric Controls, Booster Units, Mechanical Control Releases, and Pneumatic-Released Pilot Valves. It can also exist with equipment of other companies where Mercury Checks made by "Automatic" were used in the actuation setup, this may include CO₂ systems, Dry Chemical systems, and other special applications equipment manufactured by Ansul, Chemetron (Cardox and Safety First), Norris, American LaFrance, and Rockwood.

This equipment may be found protecting a variety of hazards — both ordinary and extra hazards. It is essential that you contact us if you know of any such an installation.

"Automatic" has a total commitment to the customer's safety. We need to hear from you promptly. So please call us at:

1-800-ASCOA-US

(In Ohio: 1-800-228-0595)

or write to:

"Automatic" Sprinkler Corporation of America
1000 East Edgerton Road
Cleveland, OH 44147
Attn: Quality Assurance



Copyright © 1986 Figgie International Inc. All rights reserved.

(continued from page 25)

Automatic sprinkler systems installed throughout "closely built up" areas of high value central business districts or large "under one roof" shopping malls were the key to high NBFU, AIA and ISO gradings under older municipal grading schedule.

Fresno's sprinkler program caused it to jump from a Class 3 to a Class I city as measured under the **WATER SUPPLY** section of the grading schedule. Its fire department rating was precisely reversed moving from Class I to Class III.

Only a little more than one percent of all U.S. cities of every population class had a fire department rating of Class III or better.

The same (or improved) credit applies under ISO's successor 1980 "**FIRE SUPPRESSION RATING SCHEDULE.**"

When sprinkler protection blankets a "closely built up" area fire flow in gallons per minute or in "millions of gallons per day" can be reduced by 50%. An additional 25% reduction is allowed when construction standards meet specific measurement standards. Combined with recent editions of any of the model codes (or equivalent) are adequate evidence of compliance with structural requirements.

Apart from reduction in insurance rates, sprinkler protection can lead to reduced capital outlay for storage and/or pumping capacity of public utilities.

Population centers without adequate water storage capacity (gravity tanks, reservoirs, etc.) or delivery capability can benefit in terms of both capital outlays and/or insurance rate reductions.

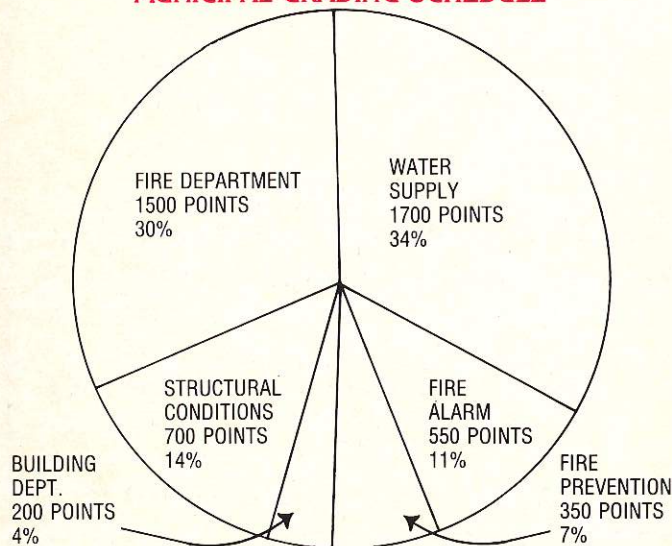
Under ISO's new rating system the city itself is not graded. Rather individual properties are evaluated in relation to the comprehensive fire suppression climate in which they reside. The ability to deliver water promptly and in the amount required in a fire of known passive construction constraints is the key to ISO's fire flow concept. The inherent ability of automatic sprinkler systems to deliver water at the soonest possible time after a fire starts, is recognized in ISO's **FIRE SUPPRESSION RATING SCHEDULE.**

Fresno's 93.8% reduction in fire losses between 1954 and 1985 is the best evidence that ISO schedule and its predecessor municipal grading schedule are based on the fact that automatic sprinkler protection has lived up to ISO's confidence in automatic suppression.¹

Points of Deficiency Which Determine Class for Major Items in Grading Schedule

| Class | Water Supply | Fire Department | Fire Alarm | Fire Prevention | Building Department | Structural Conditions |
|-------|--------------|-----------------|------------|-----------------|---------------------|-----------------------|
| 1 | 0-170 | 0-150 | 0-55 | 0-35 | 0-20 | 0-70 |
| 2 | 171-340 | 151-300 | 56-110 | 36-70 | 21-40 | 71-140 |
| 3 | 341-510 | 301-450 | 111-165 | 71-105 | 41-60 | 141-210 |
| 4 | 511-680 | 451-600 | 166-220 | 106-140 | 61-80 | 211-280 |
| 5 | 681-850 | 601-750 | 221-275 | 141-175 | 81-100 | 281-350 |
| 6 | 851-1020 | 751-900 | 276-330 | 176-210 | 101-120 | 351-420 |
| 7 | 1021-1190 | 901-1050 | 331-385 | 211-245 | 121-140 | 421-490 |
| 8 | 1191-1360 | 1051-1200 | 386-440 | 246-280 | 141-160 | 491-560 |
| 9 | 1361-1530 | 1201-1350 | 441-495 | 281-315 | 161-180 | 561-630 |
| 10 | 1531-1700 | 1351-1500 | 496-550 | 316-350 | 181-200 | 631-700 |

RELATIVE VALUE OF ITEMS IN MUNICIPAL GRADING SCHEDULE



Under the NBFU (AIA, ISO) municipal grading system the city itself was evaluated in terms of its total capability to defend itself against fire, earthquakes, hurricanes and other natural disasters.

In 1980, the **GRADING SCHEDULE** was replaced by the "**FIRE SUPPRESSION RATING SCHEDULE.**"

A mathematical model of a "closely built up" urban community which borrowed many elements from the grading system was constructed for computerized evaluation.

The principal elements that lent themselves to the suppression of fire and/or its containment were cranked into complex formulae that produce a "key rate" for classes of property within a "closely built up area."

Installation of automatic sprinklers creates up to a 50% overall rating schedule credit under ISO's "fire flow" formula. Good "passive" fire protection creates an additional 25% possible credit.

This new system is far less costly to administer, is less subject to subjective interpretation and it removes the insurance industry from involvement in the internal affairs of local government. It also enables the insurance industry to rate classes of property where no municipal government has jurisdiction.

Knowledgeable application of the schedule along with other recommendations gleaned from Fresno's success could result in totally automated fire protection for urban America.

¹"Effective Local Amendments" - Joseph L. Randall, P.E. - Building Standards Monthly, International Conference of Building Officials. August, 1985.