Fire Rating - Modelling Overview

Contents

1 Version History

Date	Version	Description	Author
15 November 2016	1.0	Initial draft	Johnathan McCabe

2 Executive Summary

3 Location Data

4 Calculation

The following defintions are used. Where a symbol has j superscript, this signifies that there is a separate value for each of buildings (B), contents (C) and BI.

Symbol	Defintion
T_i^j	TIV for buildings, contents or BI
r^j	Base rate
u	uplift factor
s^j_i	state factor

Symbol	Defintion
o^j_i	occupancy factor
b_i^j	construction factor
p_i^j	protection class factor
k_i	sprinkler factor

4.1 Base Loss Cost

The base loss cost L_i for location i is calculated as a product of the base rate and the various adjustment factors

$$L_i = \sum_{j \in \{B,C,BI\}} T_i^j \; r^j \; u \; s_i^j \; o_i^j \; b_i^j \; p_i \; k_i$$

5 Base Rates

Base rates are specified for each of buildings, contents and business interruption.

6 Adjustments

6.1 Occupancy

The occupancy adjustment is based on the ATC class for the location.

The same adjustment is applied to buildings, contents and BI.

6.2 Construction

There are five ISO classes for the construction type. The adjustment factor for a location is determined from the ISO construction class of that location.

The same adjustment is applied to buildings, contents and BI.

6.3 Protection Class

The adjustment for protection class is dependent upon two factors:

- construction group

Either unknown, non-fire resistant or fire resistant.

- protection class code

There are a range of value ranging from high protection to unprotected.

6.4 Sprinklers

Three options are used to encode the presence of sprinklers at a location:

- not present
- present
- unknown

'Not present' and 'unknown' will be treated in the same manner with no adjustment to the calculated loss cost. If sprinklers are present then a discount will be applied to the loss cost. This discount is dependent on the occupancy class of the building.

See Appendix A for more details.

7 SIR Adjustment

SIRs are allowed for by calculating an adjustment to the base loss cost. This adjustment is calculated in two parts:

- adjustment for the portion of the SIR less than $75k
- adjustment for the portion of the SIR above $75k

7.1 SIR adjustment to $75k

The SIR adjustment is calculated by applying a bilinear interpolation function to a table of adjustment factors driven by SIR and total TIV for the location. This is equivalent to a linear interpolation on TIV followed by a subsequent linear interpolation on the SIR.

If the SIR or TIV value falls outside the range of values in the table then the closest adjustment factor is used.

If the SIR and TIV both fall between points in the table, then the adjustment factor is calculated as

$$k = \frac{1}{(x_2 - x_1)(y_2 - y_1))} \begin{bmatrix} x_2 - x \\ x - x_1 \end{bmatrix}^t \begin{bmatrix} v_{11} & v_{12} \\ v_{21} & v_{22} \end{bmatrix} \begin{bmatrix} y_2 - y \\ y - y_1 \end{bmatrix}$$

The adjustment values are shown in Appendix B

Appendix A - Sprinkler Discount Rates

ATC Code	Description	Adjustment Factor
49	Acute Care Services Hospitals	85%
20	Agriculture	100%
28	Air	100%
48	Casinos	75%
15	Chemicals Processing	85%
35	Communication (Radio and TV)	85%
18	Construction	70%
40	Dwelling	85%
25	Education	80%
30	Electrical	85%
24	Emergency Response Services	85%
10	Entertainment and Recreation	85%
36	Flood Control	85%
14	Food and Drugs Processing	75%
44	Gasoline Service Station	100%
37	General Commercial	85%
38	General Industrial	85%
23	General Services	85%
4	Group Institutional Housing	85%
9	Health Care Service	85%
12	Heavy Fabrication and Assembly	85%
17	High Technology	85%
26	Highway	100%
41	Homeowner	85%
51	Hotels - Large	75%
52	Hotels - Small and Medium	75%
13	Light Fabrication and Assembly	85%
16	Metal and Minerals Processing	85%
21	Mining	100%
39	Miscellaneous	100%
43	Multi-Family Dwelling - Condominium Unit Owner	85%
42	Multi-Family Dwelling - Homeowners Association	85%
33	Natural Gas	100%
50	OSHPD Acute Care Services Hospitals (California ONLY)	85%
11	Parking	100%
2	Permanent Dwelling (multi family housing)	85%
1	Permanent Dwelling (single family housing)	85%
7	Personal and Repair Services	80%
19	Petroleum	100%
8	Professional, Technical and Business Services	85%
27	Railroad	100%
22	Religion and Nonprofit	75%
53	Rental - General Commercial	85%
47	Restaurants	85%
5	Retail Trade	75%
32	Sanitary Sewer	85%
29	Sea/Water	100%
34	Telephone & Telegraph	100%
3	Temporary Lodging	75%
54	Universities and Colleges	80%

ATC Code	Description	Adjustment Factor
31	Water	85%
6	Wholesale Trade	75%

8 Appendix B - SIR Adjustment Factors

TIV	SIR	Adjustment Factor
500	50,000	100.0%
500	100,000	100.0%
500	250,000	100.0%
500	999,999,999,999	100.0%
1,000	50,000	94.0%
1,000	100,000	96.0%
1,000	250,000	97.0%
1,000	999,999,999,999	99.0%
2,500	100,000	84.0%
2,500	250,000	90.0%
2,500	500,000	93.0%
2,500	999,999,999,999	96.0%
5,000	250,000	79.0%
5,000	500,000	87.0%
5,000	1,000,000	90.0%
5,000	999,999,999,999	95.0%
10,000	250,000	67.0%
10,000	500,000	78.0%
10,000	1,000,000	83.0%
10,000	5,000,000	89.0%
10,000	999,999,999,999	94.0%
25,000	500,000	60.0%
25,000	1,000,000	71.0%
25,000	5,000,000	81.0%
25,000	10,000,000	87.0%
25,000	999,999,999,999	93.0%
50,000	1,000,000	53.0%
50,000	3,500,000	72.0%
50,000	5,500,000	77.0%
50,000	10,000,000	81.0%
50,000	999,999,999,999	90.0%
75,000	1,000,000	50.0%
75,000	3,500,000	66.0%
75,000	5,500,000	73.0%
75,000	10,000,000	77.0%
75,000	999,999,999,999	87.0%