

SURVEY ON THE FIRE SAFETY REQUIREMENTS IN KARAOKE ESTABLISHMENTS

W.K. Chow and Gigi C.H. Lui

Department of Building Services Engineering, The Hong Kong Polytechnic University, Hong Kong, China

ABSTRACT

A preliminary study on the fire safety aspects for karaoke establishments is reported. Two field surveys on the building nature, fire safety parameters and awareness of fire safety management in 45 karaokes with total floor areas from 502 m² to 2,900 m² were carried out in May 1998 and December 1999.

For building nature, the size, shape, use of the building where the karaoke is located, period of construction, number of levels, and number of exits to the outside were surveyed. The two key parameters, fire load density and occupant load factor, in the fire safety requirements in local codes were studied with the movable fire load density and transient occupancy characteristics surveyed. Also, fire protection systems installed were inspected and the number of staff having fire safety training was surveyed to assess the awareness of fire safety management.

The 20-point fire safety ranking system proposed earlier was used to assess the karaokes surveyed. However, the scores are not so high though slight improvement is found in the second survey. Conducting high-level research on karaoke fires should be a long-term plan. An immediate action is to enhance the fire safety management, at least by appointing a Fire Safety Officer.

1. INTRODUCTION

Many people, especially those aged 15 to 45, in the Hong Kong Special Administrative Region (HKSAR, formerly Hong Kong) enjoy going to karaokes for entertainment. Karaokes are always crowded with people during weekends and public holidays. Not until recent years, fire safety aspects in karaokes were not so concerned as in other service industries. The potential fire hazards in karaokes were not being aware of. In fact, very few fires were reported in karaokes, apart from an arson fire in a karaoke located in a shopping mall in Tuen Mun years ago. There, fire spreading mechanism to the atrium and the performance of high headroom sprinkler heads were studied [e.g. 1]. However, fire in the karaoke itself was not investigated in that study [1].

Consequent to several big fires in the HKSAR during the past two years [e.g. 2,3], people are starting to become more aware of the potential fire hazards in buildings. One of those big fires was an arson fire in a karaoke [4]. It was then discovered that no license was specially designated for karaokes. Most of them were issued with licenses for restaurants or bars. Recently, suggestions are made on defining "Karaoke Establishments" and licenses are to be issued to those satisfying various requirements including fire safety. A consultation paper [5] was distributed for comments. Upon smooth reunification to the China Mainland, the HKSAR government is very open and keen on

seeking advice from professionals and academics for working out good regulations through such consultation papers.

The term "karaoke establishments" is defined as the premises that allow business of karaoke activity, in which a person or a group, chant, intone, sing or vocalise in association with or in company with any music or other sound, or any visual image or other information, to be carried on. This activity can be on its own account or in connection with other business activities, to which the general public may be admitted with or without payment [5]. Karaoke establishments are usually located in the basement or on levels above ground of shopping malls, hotels and highrise commercial buildings. The special features of karaokes are that they are partitioned into many boxes and with long corridors, and they are usually crowded with people during weekends and holidays.

In that consultation paper [5], a very long list of fire safety requirements with due reference to those required by the Fire Services Department (FSD) [6] and Buildings Department (BD) [e.g. 7-9] were described. However, there is neither indication that the requirements can really enhance safety in case of a fire, nor evidence that the proposals are supported by research and development works [10]. The objectives for protection against "accidental fire" or "arson fire" are not too clearly spelled out. If the proposed rules are implemented, very few existing karaokes can pass. Karaoke establishment

is a very big sector of the service industry in the HKSAR and safety must be provided to the public. There are now over 160 karaokes with some kind of licenses, each with an investment of at least HK\$7 Million, giving a total of over HK\$1,000 Million (10^9)!

A Karaoke Requirement Concern Group was established to oversee how these are implemented. A general response is that fire safety should be enhanced so that the public would have more confidence to have entertainment in a safe karaoke. However, there is concern about the targets being over-set because there were no big accidental karaoke fires occurred in the past. Most of the recommendations on fire protection systems [6] are acceptable and in fact, have been implemented once the consultation paper was released. However, there are reservations on three points:

- Increasing the corridor width to 1.2 m;
- Imposing fire resistance requirements on the partitions; and
- Eliminating “dead-ends” of corridor.

It has not been demonstrated that including only all the above three points would ensure fire safety. Perhaps, other better approaches giving the same safety level can be worked out. Therefore, research works on karaoke fires must be carried out before making a decision to set up such regulations. Further, implementing all three items would lead to spending very high cost on the refurbishment works. Whether it is worthwhile or not remains an open question.

The Hong Kong Polytechnic University (PolyU) is very keen on carrying out “Applied Research” to provide “Quality Teaching”. A long-term research project on karaoke fire was established. The first step of study was to review the current situation. A questionnaire was designed to study the fire safety aspects in existing karaokes. Three important areas on the building nature, fire aspects and awareness of fire safety management were surveyed. The two key factors on fire risk analysis appeared in the local fire codes [6-9] were studied, i.e. the fire load density and the occupant load factor. With those data, probable fire scenarios and consequences can be estimated by fire models [e.g. 1-3]. The results are useful for providing directions for future works on fire safety desired and management aspects required for developing workable regulations [11].

2. BACKGROUND

With the democratic policy of the SAR government, a consultation paper on licensing control of karaoke establishments was distributed in February 1998. Since it is only a consultation paper, the

parts related to fire safety have not yet been demonstrated to be supported by research and development works. An in-depth investigation on karaoke fires should be carried out by third parties such as academics, before implementing such controls in order to ensure public safety, which is a key area of the service industry.

There are two important points on fire safety requirements in the local codes [6-9]: fire load density and occupant load factor.

- Fire load density

Fire load [e.g. 12-14] is the total amount of heat released to the compartment environment by burning up all the combustible items. It is regarded [e.g. 14] as one of the most important parameters in determining the potential severity of compartment fires. The fire load FL (in MJ) is given by:

$$FL = \sum_i M_i C_i \quad (1)$$

where M_i is the mass of the i th combustible material in the building (in kg) and C_i is the calorific value of the item (in MJkg^{-1}).

The fire load density FLD (in MJm^{-2}) can be determined by dividing FL by the floor area of the building A_f (in m^2):

$$FLD = FL / A_f \quad (2)$$

FLD can also be expressed in terms of equivalent mass of wood (in kg-wood m^{-2}), i.e. dividing value in MJm^{-2} by the calorific value of wood.

- Occupant load factor

As stated in the Life Safety Code Handbook [15], the occupant load factor OLF is a density factor which assumes the presence of at least one person for each specified unit of area. The occupant load is the total number of persons that might occupy a building or portion thereof at any one time, i.e. it is determined as the maximum number of people anticipated to occupy the building rooms or spaces at any given time, under all probable situations. OLF was used widely elsewhere [e.g. 16].

Studies on restaurant fires indicated that the FLD at certain areas is quite high [e.g. 17]. As there are kitchens with cooking facilities such as gas stoves for big “woks”, the risk of having an accidental fire is high. Consequently, it can give rise to a thick smoke layer with high temperature. Fire will then spread rapidly and it is likely to have a flashover fire. Most Chinese restaurants are observed to be extremely crowded during lunch hours and weekends. This will pose problems in evacuation,

particularly for those located in highrise buildings with normal access through lifts. Further, those restaurants with Korean barbecue and fire pots may possess high fire risks.

On the other hand, there are very few karaokes with kitchens and gas stoves (though some are issued with restaurant licenses), meaning that the FLD should not be high normally. As the land prices, rents and interior decorations are so expensive, it is unlikely that the owners would use the karaoke as a store. Therefore, the chance of igniting combustibles accidentally in a karaoke should be lower than in a Chinese restaurant. Also, there are many small "partitioned rooms" in a karaoke. This feature might not be too bad since the fire can be confined within that room for some time, even if the room is constructed of materials which are easy to ignite. The disadvantage is that people singing in the other rooms would not be aware of the fire. It is possible that a karaoke under an accidental fire can be as safe as an ordinary restaurant.

Other compartmented public places such as mahjong parlours, sauna and hot spring bath houses, studios, small-scale shopping malls selling video compact discs and computer games with similar features may also require great attention. High population densities with storage of goods blocking the escape routes may hinder the rescue and egress of occupants. Besides, people concentrated on loud music and computer games may be less attentive to the fire alarm (FA) signals. Moreover, high pile of goods blocking the sprinklers may obstruct them from extinguishing fires. All these should be considered carefully in order to ensure public safety.

Fire safety management in a karaoke is very important. In a karaoke, each room is well-communicated with the central control room for arranging songs and music. Closed circuit television systems are installed for security. If an intelligent fire detection (FD) system is designed (i.e. a system which can detect fire, instruct the occupants where to evacuate and report to the FSD); a Fire Safety Officer with good training in fire control (more than just using extinguishers) is appointed; and a good fire safety management scheme is worked out beforehand; then a karaoke should be at least of the same safety level as an ordinary restaurant. This applies to those karaokes with the so called "dead-end" corridors.

3. QUESTIONNAIRE SURVEY

With strong support from the industry, a survey on reviewing the fire safety aspects in karaokes was

conducted in May 1998. Over 100 questionnaires were distributed to those likely to be classified as "karaoke establishments" with very good responses. The questionnaire is shown in Appendix A. After careful processing, 40 questionnaires were accepted. However, as there were some inconsistencies in the returned data, a second survey was conducted in December 1999. Two of the karaokes surveyed in 1998 were closed down but five new karaokes were established in this year. Therefore, a total of 45 karaoke establishments were studied (though only 43 are still open), in which, some improvements were found in fire safety management. The compiled data for the two surveys are shown in Table 1.

Three main aspects were surveyed:

- Building nature

The use of the building where the karaoke is located, time of construction, geometry, total floor area, shape, number of levels and location of the karaoke in the building were surveyed. The objective is to get a general idea of the building nature so that further studies can be carried out.

The time of construction is important and three periods are of interest: before 1972, between 1972 to 1987, and after 1987. For those old buildings constructed before 1972, apart from fire hydrants and hose reel systems (FH/HR), very limited fire protection systems are provided. It is expected that buildings constructed after 1987 should have very good provisions of fire safety systems [e.g. 6]. A long list of items such as sprinkler and FD systems are required for non-residential buildings since then. The transition period was from 1972 to 1987. Key fire services installations such as sprinkler systems might or might not be provided, depending on the interest of the building owners. For example, most of the expensive commercial buildings are protected by sprinkler.

- Fire safety parameters

The OLF, number of exits, number of karaoke boxes, furnishing provision such as wallpaper and carpet, number of furniture items and the fire services provisions including FH/HR, FA, FD, sprinkler, fire extinguishers (FE) and smoke control (SC) systems were surveyed.

Collecting data on the number of different furniture items is important. From the results, the possible heat release rate curves upon burning those items can be estimated and used as input data for fire simulation. Further, decorations with wallpapers and carpets were surveyed as those materials, if not selected carefully, would aid in fire spreading.

Table 1: Results of questionnaire survey on fire safety in karaoke establishments

Number	Building nature									
	Use of building	Period of construction	Geometry			Total floor area /m ²	Shape	Location in building	Number of levels	No. of exits per floor to outside
			Length/m	Width/m	Height/m					
1	Others	1972-1987	76.25	10.67	2.74	814		Basement & G/F (B/F & G/F)	2	3
2	Shopping mall	After 1987	61.00	12.20	3.66	744		Basement (B/F)	1	3
3	Others	1972-1987	76.25	10.67	2.74	814	Square	G/F & levels above ground (G/F & 1/F)	2	3
4	Highrise commercial	After 1987	28.55	23.41	3.40	668	Square	Levels above ground (13/F)	1	2 (+ 6 lifts)
5	Highrise commercial	After 1987	21.35	18.30	2.74	781	Rectangle	Levels above ground	2	3
6	Highrise commercial	After 1987	30.50	21.35	2.90	651	Rectangle	Levels above ground	1	3
7	Highrise commercial	After 1987	27.45	21.35	4.27	1172	Irregular	Basement	2	4/5
8	Highrise commercial	After 1987	27.45	21.35	3.96	586	Rectangle	Levels above ground	1	4
9	Highrise commercial	1972-1987	27.45	18.30	2.28	502	Rectangle	Levels above ground	1	3
10	Highrise commercial	1972-1987	24.40	18.30	2.28	893		Levels above ground	2	4
11	Highrise commercial	After 1987	45.75	24.40	2.59	1116	Rectangle	Levels above ground	1	5
12	Highrise commercial	1972-1987	18.30	15.25	2.44	837	Rectangle	Levels above ground	3	2
13	Highrise commercial	1972-1987				689		Basement	1	3
14	Shopping mall	1972-1987				805		Levels above ground (3/F)	1	4
15	Highrise commercial	1972-1987				525		Levels above ground (3/F & 4/F)	2	3
16	Shopping mall	1972-1987				1497		Levels above ground (3/F)	1	5
17	Highrise commercial	1972-1987				971		Levels above ground (5/F)	1	4
18	Highrise commercial	After 1987				990		Levels above ground (8/F & 9/F)	2	4
19	Others	1972-1987				677		Levels above ground (1/F)	1	3
20	Shopping mall	1972-1987				2900		Levels above ground (5/F)	1	3
21	Others	Before 1972				793		Levels above ground (1/F)	1	3
22	Highrise commercial	1972-1987				998		Levels above ground (6/F & 7/F)	2	3
23	Hotel	After 1987	44.00	33.17	3.80	1459	Rectangle	Basement (2nd level)	1	4
24	Residential & commercial	1972-1987	34.00	21.00	2.20	714	Square	Basement	1	3
25	Highrise commercial	After 1987	45.50	9.90	2.80	901	Rectangle	Levels above ground (12/F & 13/F)	2	2
26	Highrise commercial	After 1987	44.30	28.00	2.50	1240	Rectangle	Basement	1	4
27	Highrise commercial	1972-1987	59.20	14.00	3.00	829	Irregular	Levels above ground (9/F)	1	6
28	Shopping mall & hotel	Before 1972	41.00	20.00	2.40	820	Irregular	Levels above ground (1/F)	1	4
29	Shopping mall	After 1987	23.50	23.00	2.60	1081	Square	Levels above ground (4/F & 5/F)	2	3
30	Highrise commercial	After 1987	25.60	11.80	3.10	1208	Rectangle	Levels above ground (13/F to 16/F)	4	2
31	Shopping mall	1972-1987			2.28	743	Irregular	Basement	1	3
32	Shopping mall	After 1987			2.28	650	Rectangle	Levels above ground (1/F)	1	2
33	Highrise commercial	After 1987			2.28	1394	Rectangle	Levels above ground (10/F & 11/F)	2	2
34	Highrise commercial	After 1987			2.28	1486	Rectangle	Levels above ground (13/F to 15/F)	2	2
35	Shopping mall	Before 1972			2.28	743	Rectangle	Levels above ground (3/F)	1	2
36	Shopping mall	After 1987	30.48	27.43 / 12.80	2.74	1226	Rectangle	Levels above ground (2/F & 3/F)	2	3
37	Shopping mall	1972-1987	56.73	39.65	2.74	2249	Rectangle	Levels above ground	1	4
38	Highrise commercial	Before 1972	42.67	24.38 / 24.38	2.74	2081	Rectangle	Levels above ground (1/F & 2/F)	2	4
39	Highrise commercial	1972-1987	46.05	23.18	2.74	1067	Rectangle	Levels above ground	1	3
40	Hotel	After 1987	42.68	24.39	3.05	1041	Irregular	Basement	1	3
41	Shopping mall	1972-1987	76.95	14.10	3.20	1085	Rectangle	Levels above ground	1	6
42	Hotel	After 1987	38.20	23.50	3.20	898	Irregular	Basement	1	5
43	Highrise commercial	After 1987			2.13	1115	Rectangle	Levels above ground	2	2
44	Shopping mall	Before 1972			2.29	929		Levels above ground (1/F & 2/F)	2	2
45	Shopping mall	After 1987	36.58	27.43	2.74	1003	Rectangle	Levels above ground	1	3

Number	Fire safety parameters														Fire safety management		
	Maximum number of customers	Number of boxes	Furnishing provisions of boxes		Number of furniture items in each box				Fire services provisions						Total number of staff	Number of staff with training in fire safety management	
			Wall paper	Carpet	Sofa	Coffee table	Chair	Cushion	FH/HR	FA	FD	SPR	FE	SC		May 1998	Dec 1999
1	200	26	Yes	Yes	3-6	1-3	0		Yes	Yes	Yes	Yes	Yes		60	0	2
2	200	30	Yes	Yes	3-6	1-3	0		Yes	Yes	Yes	Yes	Yes		50	0	1
3	200	30	Yes	Yes	3-6	1-3	0		Yes	Yes		Yes	Yes		60	0	0
4	140	12	Yes	Yes	2	1-2	0	3-6	Yes	Yes	Yes	Yes	Yes		34	3	3
5	489	58	Yes	Yes	1	1	0	2	Yes	Yes		Yes	Yes		56	0	2
6	368	48	Yes	Yes	1	1	0	2	Yes	Yes		Yes	Yes		50	0	2
7	622	74	Yes	Yes	1	1	0	2	Yes	Yes		Yes	Yes		64	0	2
8	548	48	Yes	Yes	1	1	0	2	Yes	Yes		Yes	Yes		50	0	2
9	257	34	Yes	Yes	1	1	0	2	Yes	Yes		Yes	Yes		29	0	1
10	461	58	Yes	Yes	1	1	0	2	Yes	Yes		Yes	Yes		58	0	2
11	616	64	Yes	Yes	1	1	0	2	Yes	Yes		Yes	Yes		53	0	2
12	418	66	Yes	Yes	1	1	0	2	Yes	Yes		Yes	Yes		61	0	2
13	269	25	Yes	Yes	1	1	0		Yes	Yes		Yes	Yes	Yes	43	0	2
14	374	27	Yes	Yes	1	1	0		Yes	Yes		Yes	Yes	Yes	45	0	2
15	277	12	Yes	Yes	1	1	0		Yes	Yes		Yes	Yes	Yes	40	0	2
16	743	68	Yes	Yes	1	1	0		Yes	Yes		Yes	Yes	Yes	67	0	2
17	464	36	Yes	Yes	1	1	0		Yes	Yes		Yes	Yes	Yes	57	0	2
18	477	36	Yes	Yes	1	1	0		Yes	Yes		Yes	Yes	Yes	59	0	0
19	282	24	Yes	Yes	1	1	0		Yes	Yes		Yes	Yes		49	0	0
20	400	106	Yes	Yes	1	1	0		Yes	Yes		Yes	Yes	Yes	60	0	0
21	410	32	Yes	Yes	1	1	0		Yes	Yes		Yes	Yes		54	0	0
22	496	35	Yes	Yes	1	1	0		Yes	Yes		Yes	Yes	Yes	51	0	0
23	460	60	Yes	Yes	2	3	3		Yes	Yes	Yes	Yes	Yes	Yes	50	5	14
24	268	42	Yes	Yes	Small 1 Medium 1 Large 2	Small 1 Medium 2 Large 3-4	Small 0 Medium 1 Large 2-3		Yes	Yes		Yes	Yes	Yes	25	5	Closed
25	490	64	Yes	Yes	2	3	3		Yes	Yes		Yes	Yes	Yes	50	5	15
26	436	58	Yes	Yes	2	3	3		Yes	Yes		Yes	Yes		50	5	13
27	480	65	Yes	Yes	2	3	3		Yes	Yes		Yes	Yes	Yes	50	5	13
28	440	57	Yes	Yes	Small 1 Medium 1 Large 2	Small 1 Medium 2 Large 3-4	Small 0 Medium 1 Large 2-3		Yes	Yes		Yes	Yes	Yes	25	5	Closed
29	446	60	Yes	Yes	2	3	3		Yes	Yes		Yes	Yes	Yes	50	5	14
30	460	58	Yes	Yes	2	3	3		Yes	Yes		Yes	Yes		50	5	17
31	240	34	Yes	Yes	136 total	80 total	0		Yes	Yes		Yes	Yes		28	0	0
32	180	31	Yes	Yes/PVC tiles in corridors	110 total	60 total	0		Yes	Yes		Yes	Yes		28	0	1
33	400	61	Yes	Yes	230 total	132 total	0		Yes	Yes		Yes	Yes		40	0	0
34	380	54	Yes	Yes	220 total	130 total	0		Yes	Yes		Yes	Yes		40	0	0
35	240	32	Yes	Yes	130 total	75 total	0		Yes	Yes		Yes	Yes		28	0	0
36	450	56	Yes	Yes	70 total	65 total	30		Yes	Yes	Yes	Yes	Yes		36	4	4
37	700	74	Yes	Yes	105 total	120 total	40		Yes	Yes	Yes	Yes	Yes		50	5	5
38	700	70	Yes	Yes	98 total	105 total	30		Yes	Yes	Yes	Yes	Yes		53	3	3
39	550	56	Yes	Yes	70 total	65 total	18		Yes	Yes	Yes	Yes	Yes		42	4	4
40	500	57	Yes	Yes	70 total	68 total	20		Yes	Yes	Yes	Yes	Yes	Yes	45	5	5
41	530	57	Yes	Yes	2	3	3		Yes	Yes		Yes	Yes		50	No info	13
42	400	46	Yes	Yes	2	3	3		Yes	Yes	Yes	Yes	Yes	Yes	50	No info	15
43	270	45	Yes	Yes	140 total	100 total	0		Yes	Yes		Yes	Yes		35	No info	1
44	280	47	Yes	Yes	190 total	95 total	0		Yes	Yes		Yes	Yes		30	No info	0
45	420	56	No (Boards treated with fire protection)	Yes	70 total	65 total	30 total		Yes	Yes	Yes	Yes	Yes	Yes	38	No info	2

- Awareness of fire safety management

The total number of management staff and the number of staff with fire safety training were surveyed. This information is very important for evaluating the awareness of fire safety management. In fact, there are always sufficient number of security staff to ensure that the karaokes are working in good order.

“Hardware” and “software” items of fire protection can be identified. “Hardware” includes the building design, passive protection and active systems. “Software” is the fire safety management imposed by the karaokes. Good “hardware” with bad “software” would not give a safe enough karaoke. Therefore, fire safety management is of paramount importance.

4. SURVEY RESULTS

- Building nature

It is found that 13 out of 43 karaokes surveyed are located in shopping malls; 23 in highrise commercial buildings; three in hotels; and four in buildings of other uses. One karaoke located in a combined shopping mall and hotel, and another one in a combined residential and commercial building were already closed down. The smallest one has a total floor area of 502 m² and the biggest one occupies an area of 2,900 m². Most of the karaokes are of rectangular shape.

Among the 43 karaokes surveyed, 33 are located on levels above ground, and eight are in basement; 25 of them have only one level and 16 have two levels. One of the karaokes no longer in business is located on a level above ground and the other one in basement, both occupying one level.

Further, four karaokes are in buildings constructed before 1972; 18 in buildings constructed between 1972 to 1987; and 21 in buildings constructed after 1987. The two karaokes already closed down were in buildings built before 1972 and between 1972 to 1987 respectively. It is likely that sufficient fire protection systems are installed in those 21 karaokes located in buildings constructed after 1987, as such systems are required by the FSD [6]. However, decoration and refurbishment works might change the situation.

- Fire safety parameters

Concerning the estimation of FLD by counting the number of combustible items, 42 karaokes have wallpapers and one has boards treated with fire protection. Besides, 43 have carpets with one also has polyvinyl chloride (PVC) tiles as the flooring

materials for the corridors. A more detailed description on FLD is presented in the next section. The OLF of the karaokes range from 0.98 m² to 6.3 m² per person, with an average of 2.36 m² per occupant. The surveyed OLF did not correlate with the use of building, period of construction and location in building. Surprisingly, the biggest karaoke has the largest OLF of 6.3 m² per person, and the third smallest karaoke has the smallest OLF of 0.98 m² per person.

The minimum and maximum values of OLF being 0.98 m² per occupant and 6.3 m² per occupant respectively, were both found in karaoke establishments occupying levels above ground.

Moreover, the maximum number of exits per floor to the outside is six and the minimum number is two. It is observed that the number of exits provided does not correlate with the floor area of the karaokes. The smallest karaoke with a floor area of 502 m² has three exits from the establishment to the outside, whereas the largest karaoke of floor area 2,900 m² also has three exits.

On fire services provisions, it is observed that FD systems are absent in most karaokes. Even for those located in shopping malls, the provisions of FD and SC systems are not common. Not many karaokes in highrise buildings have FD and SC systems, but all of them have FH/HR installations inside, together with FA and FE systems. All except one have sprinkler systems. For the four karaokes in buildings of other uses, none of them have full provision of services systems and all of them do not have SC systems.

For the karaokes in buildings constructed before 1972, one has a FD system and one has a SC system. The worst one does not possess FD, sprinkler and SC systems. However, all four have FH/HR, FA and FE installations. For the 18 karaokes in buildings built between 1972 and 1987, only three have FD systems while seven of them have got only FH/HR, FA, sprinkler and FE systems. For the 21 karaokes built in buildings after 1987, 11 have only FH/HR, FA, sprinkler and FE systems, and only seven are installed with FD systems.

In addition, three out of eight karaokes in basements have installed FH/HR, FA, FD, sprinkler, FE and SC systems; but three do not have FD and SC systems. All of the 34 karaokes on levels above ground possess FH/HR, FA and FE systems. Only one of them does not have sprinkler systems, and six have FD systems.

Only four out of 43 karaokes surveyed possess all the fire services provisions required in the new regulations imposed since 1987 [6]: three are in

hotels and one in a shopping mall. Besides, all of those four karaokes are located in buildings built after 1987. It is observed that three of them are in basement and one is on levels above ground.

- Awareness of fire safety management

From the first survey conducted in May 1998, it is observed that 26 out of 40 karaokes do not have staff with training in fire safety management. Only 64 in a total number of 1,890 staff (i.e. 3.4%) have had such training before. It seems that fire safety should be more emphasized by staff operating the karaoke. The number of trained staff should be increased through clear instructions from senior staff with proper fire protection knowledge.

From the second survey conducted in December 1999, only 11 out of 43 karaokes do not have staff with fire safety management training. There are 84 out of 2,043 staff (i.e. 4.1%) have training on how to deal with accidental fire. It is obvious that improvements have been made as the karaoke industry is also very concerned about public safety. However, fire safety management should be further enhanced.

5. ESTIMATION ON FIRE LOAD DENSITY

Fire load can be divided into fixed and movable fire load. Fixed fire load is due to combustible items which are unlikely to be changed. Examples are the backings of walls, ceilings, timber floors, full height partitions, and their finishing materials that enclose the space. Movable fire load is due to the combustible materials that are put into the room after the construction of the establishment is completed, which includes furniture items, carpets, curtains, televisions, speakers and microphones.

Part of the questionnaire (as shown in Appendix A) is on surveying the movable fire load. Basically, combustible items like furniture in the small karaoke boxes were surveyed, bearing in mind that alcohol and beer might be stored though it is not allowed without permission. The results are used to estimate the FLD. This is a rough estimation and is different from the inventory technique used in the past 20 years [e.g. 12,18]. However, no disturbance to the normal operation of each karaoke was made. Furniture in local karaokes would normally be assembled in the karaoke itself during decoration. Therefore, furniture in a certain karaoke (or even a chain of karaokes) would be very similar and usually made of common materials such as polyurethane PU foam, wood, cotton fibre and plywood with calorific values shown in Table 2.

Table 2: Calorific values of common materials in karaokes

Material	Calorific value (MJkg ⁻¹)
PU foam	26.7
Wood (average)	18.6
Cotton fibre	16.7
Aluminum	31.0
Leather	18.6
Plywood	18.6
PVC	22.8

In the questionnaire, the dimensions of furniture items commonly available such as sofa, coffee table and chair, were not measured. Instead, only the number of items in each room was counted. Those not listed such as cushions were recorded separately in the form.

A summary of the movable FLD is shown in Table 3. The movable FLD varies from 110 MJm⁻² to 275 MJm⁻², with a mean value of 183.2 MJm⁻², or equivalent weight of wood 9.8 kgm⁻².

The cumulative frequency of the FLD of the 43 karaokes under survey is calculated and shown in Fig. 1. The limits for the cumulative frequencies of 50 %, 80 % and 90 % are 181 MJm⁻², 215 MJm⁻² and 228 MJm⁻² respectively.

6. GENERAL OBSERVATIONS

Observations on the relationship of the movable FLD and OLF with the floor area, use of building, period of construction of building and location in building are outlined:

- Floor area

There are no specific correlations between the floor area and the FLD of the karaoke establishments. However, the OLF generally increases with increasing floor area.

- Use of building

Four types of building uses in which karaokes being located are considered. It was found in Table 1 that the smallest karaoke is built in a highrise commercial building and the largest one of 2900 m² is in a shopping mall. About 53.5% of the karaokes are in highrise commercial buildings, 30.2% of them are located in shopping malls and another 7% in hotels.

Table 3: Occupant load factor and movable fire load density

Karaoke number	Maximum number of occupants	OLF (m ² /occupant)	Movable FLD	
			(MJm ⁻²)	Wood equivalent (kgm ⁻²)
1	260	3.13	146	7.9
2	250	2.98	166	8.9
3	260	3.13	158	8.5
4	174	3.84	110	5.9
5	545	1.43	226	12.2
6	418	1.56	225	12.1
7	686	1.71	207	11.1
8	598	0.98	238	12.8
9	286	1.76	215	11.6
10	519	1.72	210	11.3
11	669	1.67	197	10.6
12	479	1.75	234	12.6
13	312	2.21	151	8.1
14	419	1.92	145	7.8
15	317	1.66	119	6.4
16	810	1.85	170	9.1
17	521	1.86	153	8.2
18	536	1.85	151	8.1
19	331	2.05	149	8.0
20	460	6.30	152	8.2
21	464	1.71	160	8.6
22	547	1.82	148	8.0
23	510	2.86	187	10.1
24	293	2.44	200	10.8
25	540	1.67	259	13.9
26	468	2.55	202	10.9
27	530	1.56	275	14.8
28	465	1.76	219	11.8
29	496	2.18	223	12.0
30	510	2.37	205	11.0
31	268	2.77	180	9.7
32	208	3.13	181	9.7
33	440	3.17	174	9.4
34	420	3.54	159	8.5
35	268	2.77	174	9.3
36	486	2.52	174	9.4
37	750	3.00	149	8.0
38	753	2.76	149	8.0
39	592	1.80	186	10.0
40	545	1.91	191	10.3
41	580	1.87	216	11.6
42	450	2.00	213	11.5
43	305	3.66	167	9.0
44	310	3.00	187	10.1
45	458	2.19	194	10.4

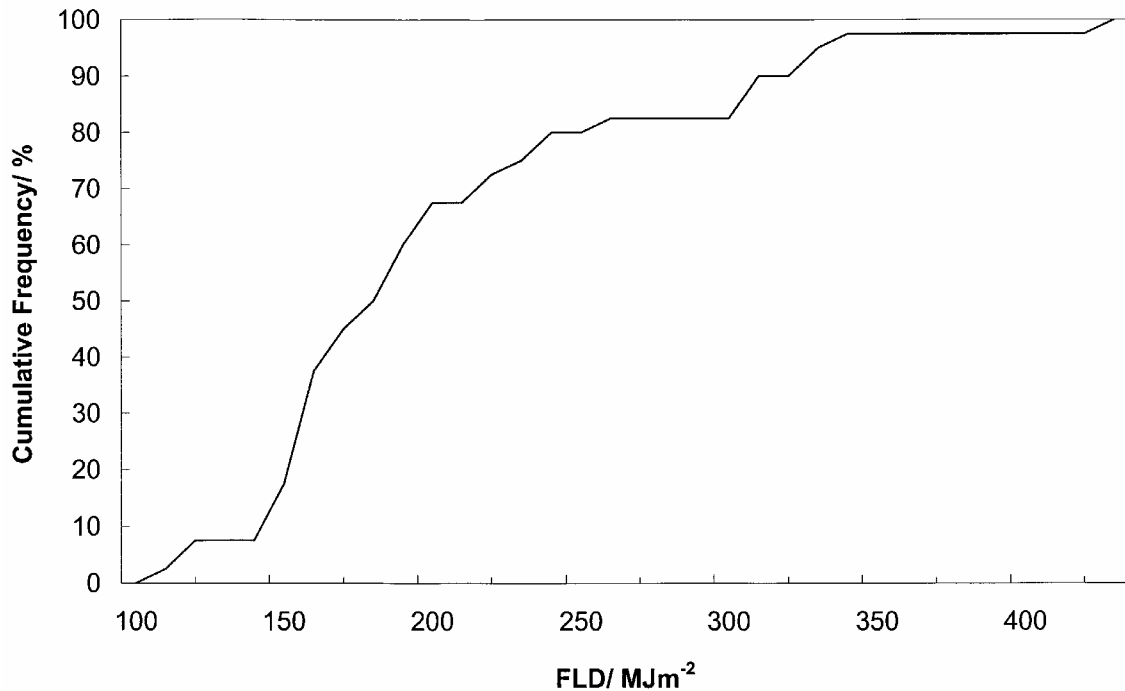


Fig. 1: Cumulative frequency of the fire load densities of 43 karaoke establishments

The maximum FLD of wood equivalent of 14.8 kgm^{-2} was found in a karaoke located in a highrise commercial building. In fact, karaokes in highrise commercial buildings have the highest values of FLD.

The minimum and maximum OLF were obtained as 0.98 m^2 per occupant in a highrise commercial building and 6.3 m^2 per occupant in a shopping mall respectively. The largest karaoke has the highest value of OLF.

- Period of construction of building

Three periods of construction of buildings are identified. The smallest and the largest karaokes are both built in buildings constructed between 1972 to 1987. Being the largest proportion, 48.8% of the karaokes are built in buildings constructed after 1987, while those in buildings built before 1972 constitute only 9.3%.

It was observed that karaokes located in buildings built between 1972 to 1987 have the maximum FLD of wood equivalent of 14.8 kgm^{-2} .

The minimum and maximum OLF of 0.98 m^2 per occupant and 6.3 m^2 per occupant respectively were found in buildings built after 1987 and between 1972 to 1987 respectively.

- Location in building

Karaokes can be located in basement, basement and levels above ground, and on levels above

ground in a building. About 76.7% of karaokes surveyed are built on levels above ground and 18.6% are situated in the basement. The smallest and the largest areas were both found in karaokes located on levels above ground. Karaokes built on levels above ground have the lowest and the highest FLD of wood equivalent of 5.9 kgm^{-2} and 14.8 kgm^{-2} respectively.

7. FIRE SAFETY RANKING

A fire safety ranking system similar to a “ranking” method [19] on fire risk analysis was proposed [20] to describe the safety level of each karaoke. This is a 20-point system with attributes selected based on professional judgement with reference to the local requirements on fire safety [e.g. 6-9]. It is divided into four parts:

- Key parameters on local fire codes (5 points):

This is based on the FLD and OLF, the two key parameters appeared in local fire codes.

- Passive design (5 points):

This is based on the building where the karaoke is located. The fire resisting construction, means of escape and “dead-ends” inside the karaokes are also evaluated by referring to the building regulations specified by the BD [7-9].

- Active systems (5 points):

This is based on the provision of fire services installation satisfying the FSD requirements [6].
 - Fire safety management (5 points):

This is an assessment on management of the karaoke establishments.
- Detailed description of the fire safety ranking system is presented in another article [20] and would not be repeated in here. A “fire-safe” karaoke is expected to score higher points. However, points might be deducted if the local fire safety requirements are not satisfied, for example, failing to maintain the FH/HR systems properly.
- Following this fire safety ranking system, scores of the karaokes surveyed are shown in Table 4. The total points scored ranged from 5 to 10 in the first survey; and ranged from 6 to 11 in the second survey.

Table 4: Results on fire safety ranking

Karaoke number	Fire parameters (5)	Passive design (5)	Active system (5)	Fire safety survey (5)		TOTAL (20)	
				1 st survey	2 nd survey	1 st survey	2 nd survey
1	5	1	2	0	1	8	9
2	5	1	2	0	1	8	9
3	5	2	1	0	0	8	8
4	5	1	2	1	1	9	9
5	4	1	1	0	1	6	7
6	4	2	1	0	1	7	8
7	4	1	1	0	1	6	7
8	2	2	1	0	1	5	6
9	4	2	1	0	1	7	8
10	4	2	1	0	1	7	8
11	4	2	1	0	1	7	8
12	4	1	1	0	1	6	7
13	5	1	2	0	1	8	9
14	4	2	2	0	1	8	9
15	4	2	2	0	1	8	9
16	4	2	2	0	1	8	9
17	4	2	2	0	1	8	9
18	4	2	2	0	0	8	8
19	5	2	1	0	0	8	8
20	5	2	2	0	0	9	9
21	4	2	0	0	0	6	6
22	4	1	2	0	0	7	7
23	5	1	3	1	1	10	10
24	5	1	2	1	X	9	X
25	4	0	2	1	1	7	7
26	5	1	1	1	1	8	8
27	4	2	2	1	1	9	9
28	4	2	2	1	X	9	X
29	5	2	2	1	1	10	10
30	5	-1	1	1	1	6	6
31	5	1	1	0	0	7	7
32	5	1	1	0	1	7	8
33	5	1	1	0	0	7	7
34	5	0	1	0	0	6	6
35	5	1	1	0	0	7	7
36	5	2	2	1	1	10	10
37	5	2	2	1	1	10	10
38	5	1	2	1	1	9	9
39	4	1	2	1	1	8	8
40	4	0	3	1	1	8	8
41	4	2	1	X	1	X	8
42	4	1	3	X	1	X	9
43	5	1	1	X	1	X	8
44	5	1	1	X	0	X	7
45	5	2	3	X	1	X	11

A general observation is that fire safety has not yet been considered carefully by both the government departments and the local industry. The reason is simple:

No in-depth research works for local karaoke fires have ever been carried out!

Therefore, even following all the new fire regulations appeared in the consultation paper [5] does not guarantee high score for a karaoke. Note that it is very expensive to carry out the building works and the business has to be suspended while refurbishing the building. Therefore, research on karaoke fires must be carried out systematically, though applying for funding twice were not supported.

An immediate action is to enhance the fire safety management by appointing a Fire Safety Officer. This staff should work out a good fire safety management scheme. All the essential items such as FH/HR system have to be kept properly and FE must be provided. In this way, at least 5 points will be added to fire safety management, and giving a total of 5 points to those karaokes scoring low.

8. CONCLUSION

Fire safety requirements in karaokes are briefly discussed. Two surveys on the building nature, fire safety parameters, and awareness of fire safety management were carried out in May 1998 and December 1999. Results are analyzed by a proposed 20-point fire safety ranking system. Preliminary results indicated that the fire safety aspects are not so carefully considered, with karaokes scoring only 5 to 10 points in the first survey and 6 to 11 in the second survey.

An immediate action is to enhance fire safety management by appointing a Fire Safety Officer. Many karaokes are in fact starting to do so for improvements. If those staff are doing their jobs properly, that will push the score up by 5 points for some karaokes. Taking this into account, karaokes with upgraded fire safety management would have scores from 10 to 15 points.

A long-term plan is to carry out research on karaoke fires. Both fire simulations and full-scale burning tests on selected designs of karaokes should be performed so that key issues on fire safety can be identified. It is difficult to work out regulations to control fire safety aspects, or to recommend good fire safety management without in-depth studies:

- To carry out surveys on the required input data for studying the fire scenarios using fire models, but with care [e.g. 21,22].
- To identify the fire hazard scenarios and study their consequences.
- To study the evacuation pattern in a large sample size of karaokes.
- To study the fire spread of partition materials and put into the building codes.
- To study the feasibility of installing active systems.
- To recommend fire safety design and fire safety management schemes.

The SAR government is very open and welcome any new and workable ideas [5]. Karaoke industries are ready to improve their fire safety. Academics like those at PolyU are in the positions to help the industry as part of their "quality teaching". The three parties should work together to provide a safe environment to the karaoke establishments.

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APPENDIX A

**Questionnaire Survey
on
Fire Safety in Karaoke Establishment**

Prof. W.K. Chow

Your Karaoke is located
in a building for

- Shopping mall
- Highrise commercial
- Hotel
- Others _____

The building was constructed

- Before 1972
- 1972 – 1987
- After 1987

Geometry of Karaoke is

Length _____ Shape: Square / Rectangle / Irregular
Width _____
Height _____ Number of levels _____

The Karaoke is at

- Basement
- Ground floor
- Levels above ground

Number of 'exits' to outside

Number of rooms

Furnishing of rooms

Wallpaper _____
Carpet _____

Furniture in each room

Number of sofa _____
Number of coffee tables _____
Number of chairs _____

Fire services provisions

- Fire Hydrant/Hose Reel
- Fire Alarm
- Fire Detection System
- Sprinkler System
- Fire Extinguishers
- Smoke Control System

Targeted number of customers

Total number of staff

Number of staff with training
on fire safety management
