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Contents

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Editorial

The Journal of Building Surveying is a peer-reviewed journal published by the Building Surveying Division of Hong Kong Institute of Surveyors. It intends to promote practical and theoretical knowledge in building surveying. This will provide a forum for practitioners as well as researchers to present, develop and discuss innovative ideas in the field of building surveying and the related construction industry.

Papers describing advances in building surveying and other building or construction related areas are welcomed. The journal is a cross-disciplinary journal, and we encourage manuscripts addressing issues in building /construction technology, building maintenance, construction project management, facilities management, real estate development, building laws, and other areas related to the building industry. Publishing decisions on manuscripts are based on technical content, originality, validity, usefulness, and presentation. The Council of the Building Surveying Division of the Hong Kong Institute of Surveyors will overseeing this process upon the recommendation of eminent specialists and practitioners in relevant field.

We sincerely hope that this journal will continue to contain articles of interest and use to practising professionals as well as academics.

Finally we thank the reviewers and many contributors and authors for their support.

Council of the Building Surveying Division
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Journal Objectives

Unique Attributes

The Journal of Building Surveying aims to publish practical and academic materials for building surveyors, building professionals and all other professionals in the construction industry. All articles submitted for the journal are subject to a refereeing procedure.

Topicality

The Journal is expected to have influential and authoritative voice in the building surveying practice in Hong Kong. It looks at the major issues facing the profession today. Many buildings erected in the last forty years are already displaying various types of defects. The addition and alteration works in buildings presents quite different problems. The works require compliance with current regulations and codes of practices may cause fundamental difficulties in the design. An understanding of fire safety engineering may form part of the knowledge basis of building surveyors in Hong Kong. Materials and their suitability for construction work is another field requiring a degree of expertise. Real estate development will continue be an essential part of Hong Kong building surveyors' duties. Facilities/ property management should be area that needs understanding. These areas and others are expected to be presented in the journal.

Key Benefits

The practical nature of the journal's content means it is an resource for practitioners in the industry wishing to keep abreast of current and international practice, thinking and developments.

Key Journal Audiences

Building surveyors, architects, building services engineers, structural engineers and other professionals in the construction industry.

Coverage

- Building regulations and codes
- Building and construction technology
- Building Maintenance
- Materials, components and building defects
- Real estate development
- Construction management
- Facilities management
- Practice abroad
- Other areas related to the construction industry

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A PILOT STUDY OF THE EXTERNAL SMOKE SPREAD IN HIGH-RISE BUILDINGS

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ABSTRACT

Usually, a building fire causes not only hazard to the occupants in that compartment, but also a possible threat to the occupants in other compartments, in particular to those located at upper storeys. This paper presents a numerical study of external heat and smoke spread caused by compartment fires in multi-storey buildings. A computational fluid dynamics (CFD) code, CFX-4.2 based on the Navier-Stokes equations and the standard k-ε model is employed. This pilot study illustrates the capabilities and applicabilities of the CFD techniques in predicting the external smoke spread through an opening on the building facade. It can also provide necessary quantitative data for the understanding of the complex wind-buoyancy interactions. The computed results for a scenario with rectangular window configuration are presented. The effects of the window configurations and area as well as its location on the safety of the occupants at upper storeys are discussed. The CFD techniques can be further explored for the study of window design of multi-storey buildings, in terms of fire safety.

KEYWORDS: External smoke speed, windows, CFD.

INTRODUCTION

The hazard caused by fire within a compartment or a building is discussed in many literatures (Chow and Leung, 1990; Chow and Wong, 1993; Haegglund et al, 1998; He and Beck, 1997; Markatos et al, 1982; Rho and Ryou, 1999; Thomas, 1983). However, many researches focused only on the internal airflow and smoke movement. Little attention has been placed on the external smoke spread (Lu et al, 2001).

It is well known that a fire may cause safety problems to occupants located at levels higher than the fire compartment. Apart from the influence of high temperature, another hazard for occupants at upper storeys is that the smoke generated by the fire may spread to the external and re-enter into other compartments at upper levels through external openings.

In such cases, the airflow in the fire compartment that influences the heat and smoke spread, is induced by the fire and dominated in general by buoyancy. A typical flow of this kind is a cavity flow (natural convection flow), which has very simple geometry and boundary condition. The cavity flow has been studied by some researchers (Cheesewright and Bowles, 1989: Tian and karayiannis, 2000). The velocity and temperature gradients in the boundary layers are strongly affected by the buoyancy, the presence of the solid wall and the molecular viscosity (Henkes and Hoogendoorn, 1990). However, flows in building engineering are complex in which both internal and external wind flow behaviour should be considered. Yuen et al has investigated the smoke movement and smoked migration in a designated refuge floor numerically (Yuen et al, 1999). The ingress of smoke into the refuge floor is dependent not only on the wind inflow, but also on the conditions of the opening configuration. The existence of the wind velocity gradient "forces" smoke to spread into the refuge

floor and affects the evacuees at the refuge floor (Lo et al, 1999). A further study has indicated that the buoyancy effect is another important factor affecting the smoke migration to the refuge floor (Lo et al, 2000).

With the buoyancy-induced airflow, the released smoke and the heat may spread to upper storeys under the effect of wind and artificial ventilation (HVAC system). It is known that many physical factors may also affect this convection. For example, the location and configuration of the openings and the profile of the building facade. Other significant factors are the size and location of the fire as well as the configurations of the fire compartment. In the present study, we apply the computational fluid dynamics (CFD), also known as field modeling techniques to analyse the airflow and external smoke spread. In particular, the effects of window configurations on the heat and smoke flow patterns are explored.

THE MATHEMATICAL MODEL

The system of partial differential equations modeling the compressible flow of a Newtonian fluid in a three-dimensional spatial domain, using the Cartesian spatial co-ordinates x_k, are the Reynolds averaged Navier-Stockes (RANS) equations. To simulate the energy transfer, a transport equation with the total enthalpy H as unknown is included. The standard k-ε model with logarithmic wall law is adopted for the turbulence model of this study. A commercial software package called CFX-4.2, was employed for the current numerical study. This special software package is based on the finite volume approach and multi-block grids technique. It provides many options to solve wide varied problems in fluid as well as thermal dynamics (AEA, 1997)

THE NUMERCIAL MODEL

The building with a fire compartment considered in this study is shown in Figure 1. The actual geometrical sizes of the building are 145m high and both the width and depth are set to be 31m. The fire compartment is placed at the middle of the building. Its size is assumed to be 4.16(4.16(2.88m (length (width(height) and a window opening is arranged at the frontage of the compartment. Further details of the building and the location of the compartment in the building can be referred to Figure 1 and Table 1. To model the airflow and the smoke spread, the solution domain is selected as shown in Figure 2. The whole computational domain is divided into 91000 control cells.

Calculation with the scenario of a rectangular window configuration (Case I) has been performed. However, in order to explore the influence of the window configuration on the heat and smoke concentration spread, two other calculations (Case II and III) with different window configurations has also been carried out. And the corresponding results will be discussed later in a separate paper. The sizes of the window openings and their locations are listed in Table 1.

The fire is modeled with a cubic heat source and is represented in the enthalpy equation. The fire has a size of 0.96(0.96(0.96m3 (length(width (height) and amount to 1MW. The fire is taken place at x = 15. 68 m, y = 8.48 m, z = 68.73 m as shown in Figure 2. The windows in all cases are taken to be fully opened.

RESULTS AND DISCUSSION

The CFD model has been used to simulation the smoke spilling out of the fire compartment from the window opening and smoke spreading to the upper storeys of the high-rise building.

Figure 3 shows the velocity fields in Case I at the vertical plane (y = 10 m) and Figure 4 is its enlargement for the fire compartment. The velocity field at the horizontal plane through the centre of the opening is given in Figure 5. It is obvious that the fluid above the fire flows up (see the upward velocity at the bottom of the right side in Figure 5), and leaves the fire compartment from the opening (see the left side in Figure 5). In Case I, the airflow induced by the buoyancy is confined in a small region close to the facade as shown in Figure 3. While it can be seen that the flow in the compartment is very complex and vortices have been developed

as shown in Figure 4. From the same plot, we can see that the air is entered into the compartment from the low part of the opening and then reaches the bottom of the compartment. Finally, it left from the compartment through the high part of the opening.

The temperature contours for Case I at a plane, x = 11.9 m (10 cm away from the facade) is given in Figure 6. The white boundary shows the opening and the white line is the separation between the fire compartment and the upper storeys. From the figure, the influence of the temperature reaches some storeys. The maximal horizontal width affected by the temperature is near the fire compartment and it is a little bit smaller than the width of the opening. Figure 7 gives a side view of the temperature field at y = 10 m. The temperature at bottom is obviously lower than that at top of the fire compartment. Apart of the fire compartment, the maximal temperature is on the facade of the storey which is one storey higher than the fire compartment, and therefore the most hazardous condition happens in that storey. Further investigations (i.e. Cases II and III) will be carried out to study the effect of different window configurations on the temperature field. These results will be reported separately.

Figures 8 and 9 give the smoke concentration at x = 11.9 m and y = 10 m respectively for Case I. From the front view of the smoke concentration, it is obvious that the smoke affects a large region vertically as shown in Figure 8. The side view of the smoke concentration tells us that the the smoke is spreading near the facade and high smoke concentration region is at the upper part of the fire compartment. Further investigations (Cases II and III) will be needed to understand the effects of different window configurations on the distribution of smoke concentration.

CONCLUSION

A numerical investigation of the airflow and smoke spread for a multi-storey building in case of a fire has been presented in this paper. The model is developed on the basis of the governing equations for momentum, heat and mass transfer as well as the turbulence and smoke concentration. These equations have been solved numerically using a CFD code, CFX 4.2 code. Numerical analysis of the airflow outside and inside the fire compartment and external smoke spread from an opening over the building facade have been performed.

It shows that in Case I, the maximal temperature is on the facade of the storey which is one storey higher than the fire compartment and the smoke is spreading near the facade and high smoke concentration region is at the upper part of the fire compartment, and therefore the most hazardous condition happens in that storey.

The presented calculation gives analysis for only one of the many scenarios. Therefore, further work is necessary to study the effect of window configuration on the flow and smoke spread.

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Case	Shape	Width (m)	Height (m)	Area (m^2)	Position		
					x_c (m)	y_c (m)	z_c (m)
I	rectangle	2.24	0.96	2.1504	12.0	10.0	70.33
II	rectangle	0.96	2.24	2.1504	12.0	10.0	69.69
III	square	0.96	0.96	0.9216	12.0	10.0	70.33

Table 1: Configurations of openings

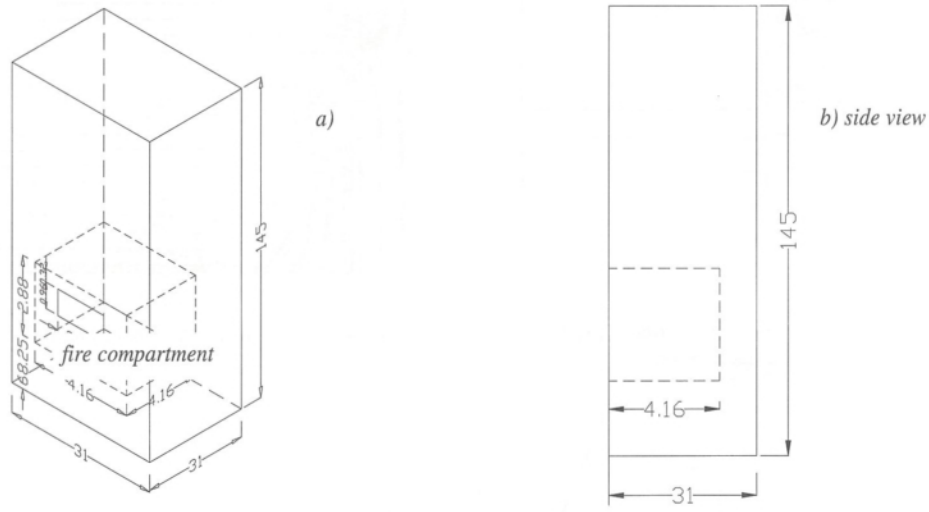

Figure 1: Outlines of model building (dimensions in meter)

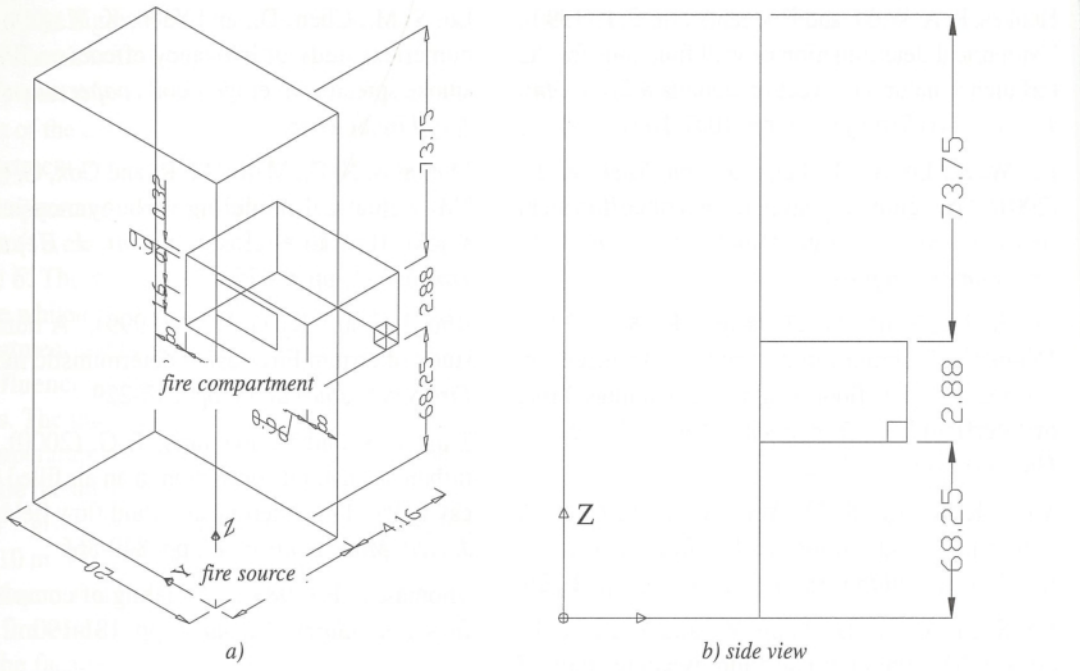

Figure 2: Solution domain and the coordinate system (dimensions in meter)

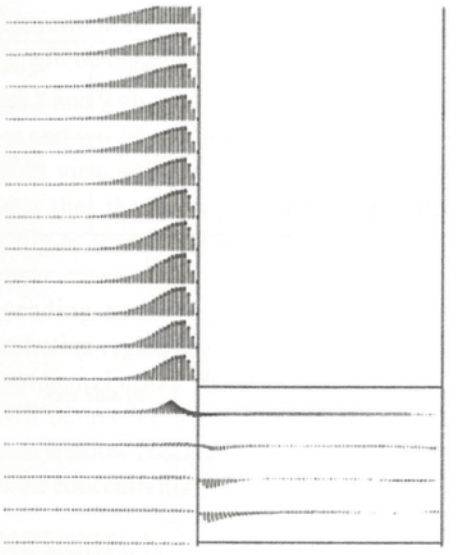

Figure 3: Velocity field at y = 10m (Case I)

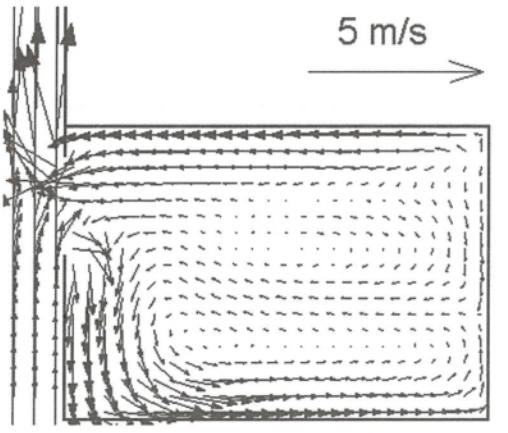

Figure 4: Velocity field in the fire compartment at y=10.0m (Case I)

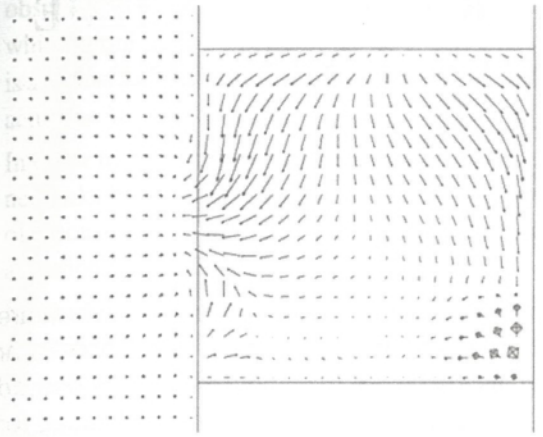

Figure 5: Velocity at the half height of the opening, z=70. 33m (Case I)

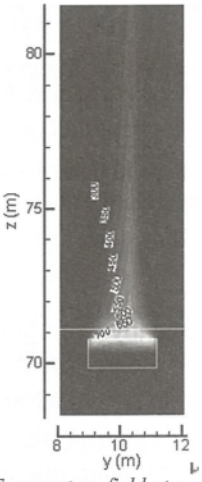

Figure 6: Temperature field at x=11.9m (Case I)

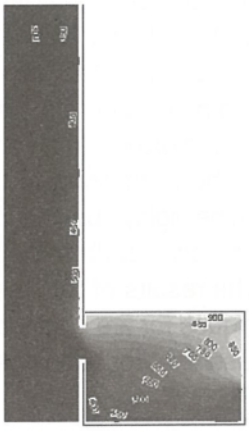

Figure 7: Temperature field at y=10m (Case I)

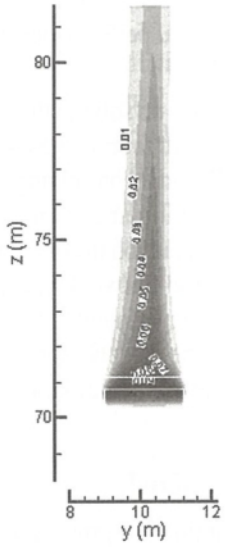

Figure 8: Smoke concentration at x=11.9m (Case I)

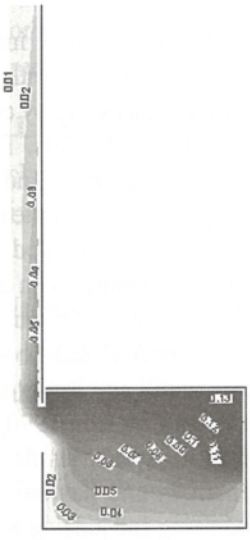

Figure 9: Smoke concentration at y=10m (Case I)

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PREDICTION OF SPRINKLER ACTUATION TIME USING THE ARTIFICIAL NEURAL NETWORKS

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ABSTRACT

Fire phenomena involve complicated, coupled chemical and physical processes which are affected by the environmental and fire parameters. These processes are coupled, non-linear and interactive in nature. Currently, computer simulation by use of numerical methods derived from mathematical models in the form of differential equations have been widely used for predicting results of fire phenomena. Such methods include the zone and field (computational fluid dynamics) modelling techniques. While the accuracy of the prediction is highly dependent on the sophistication of the mathematical models, the latter also involves extremely expensive computational resources. Recently, the Artificial Neural Network (ANN) has been proven to be effective and popular for handling complicated, non-linear and interactive systems. The ANN possesses abilities of learning from the data sets: historical (or experimental) or theoretical data. For a defined problem such as fire growth in an enclosure, an ANN model can provide predictions of the phenomenon without referring to the theoretical interactions and the corresponding parameters which can be highly non-linear. This research study will demonstrate the effectiveness and accuracy of a new, yet promising modelling technique - ANN on fire growth phenomena in buildings. The results of this research study will also lead to a new stream of models using ANN techniques for fire engineering predictions including flame and smoke spread and the fire risk assessment for buildings.

KEYWORDS: Sprinkler outuation, ANN.

INTRODUCTION

Fire phenomena are complicated, interacting and highly non-linear processes. Currently, some of fire problems are solved numerically by computational fluid dynamics and zone models. The former is highly computationally expensive and the latter can be preformed in personal computers. Instead of using traditional analytical method or numerical methods, this paper concentrates on using ANN to simulate the behaviour of the fire phenomena. The fundamental theories of ANN have been introduced in literatures (by Caudill and Butler 1992, Chester 1993, Aleksander and Morton 1990). ANN is an information processing system similar to the human judgment mechanism and has been considered effective in recognizing and judging a situation with "fluctuating" and "obscure" factors. In fact, it is a sophisticated mathematical tool for data regression by learning the historical performance of the system i.e. training data.

This paper concentrates on solving the fire problems with a total different techniques - ANN. The applicability of ANN model on solving the problems (by network construction and training) to predict the time to sprinkler actuation in compartmental fires are studied. Data for network training can be obtained either from experimental data or results of fire simulations by zone models, computational fluid dynamics models or other numerical simulation models.

NETWORK MODEL

A general pattern of time to sprinkler actuation with respect to fire size is shown in Fig. 1. It can be

observed that there is a minimum fire size below which sprinklers could not be actuated. Also, there is a critical fire size above which the time to sprinkler actuation becomes constant.

In order to perform ANN modelling, two separate networks have been constructed for the prediction of occurrence of sprinkler actuation and also actuation time. i.e.

Network 1 - Prediction of occurrence of sprinkler actuation

Network 2 - Prediction of sprinkler actuation time

Should there be no sprinkler actuation predicted by Network 1, the result predicted by Network 2 will be neglected.

Three layers feed-forward neural networks which have been proven to be applicable for most problems were to be designed for the problem. Number of hidden neurons in hidden layers of Network 1 and 2 were assigned to be 11 and 15 respectively. Two different networks as shown in Fig. 2 and 3 were constructed to determine the occurrence of sprinkler actuation and determination of sprinkler actuation time respectively.

NUMERICAL SIMULATION MODELS

For training the network models, data obtained from Cheng (1998) using FIRECALC were used. A room model was established as shown in Fig. 4 for the investigation. For simplificity, only fire size, height of sprinkler and horizontal distance from sprinkler to axis of fire were varied with other parameters being kept constant in the computations to obtain the sprinkler actuation time. Sprinkler response index and the fire profile were assumed to be 150m1/2s1/2 and fast-growth-t2 fire respectively.

RESULTS AND DISCUSSION

Upon the completion of network training, the weights of all links of the networks were determined. The "trained" ANN model is then ready for the prediction of sprinkler actuation time for various input parameters. It is necessary to compare the results predicted by the neural networks to the results simulated by FIRECALC. Fig.5 shows the comparison of the predicted results to the simulated results for the sprinkler actuation. It can be observed that the ANN prediction results are very close to the results simulated by FIRECALC. The coefficient of correlation (R) measuring the strength of the relationship between the results predicted by ANN and FIRECALC simulation is 0.989. This is very close to unity and implies that the prediction by using ANN is very accurate and successful.

CONCLUSION AND RECOMMENDATION

The method using ANN for sprinkler actuation time prediction has been reported. With adequate and suitably collected or generated data, the sprinkler actuation time can be accurately predicted by ANN. The accuracy of prediction is highly dependent on the accuracy of training data sets. The applicability of using ANN models for fire predictions are demonstrated, although they do not consist of the physical and chemical process modelling equations. Also, it can be concluded that it is feasible to use different network architectures for other fire problems. More sophisticated, complicated problems can be simulated with ANN models. Since some of the fire parameters (e.g. fire size) may not be well-defined, possibilistic or probabilistic techniques can be integrated into ANN models in the analysis for a more realistic application on fire phenomena prediction.

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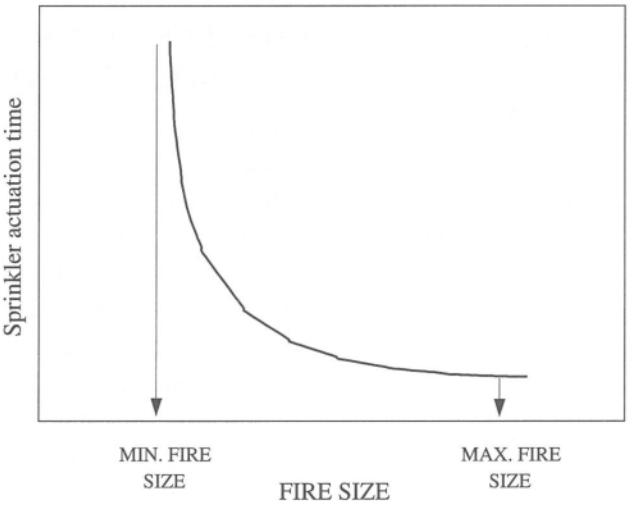

Figure 1: General pattern of sprinkler actuation time with respect to fire size

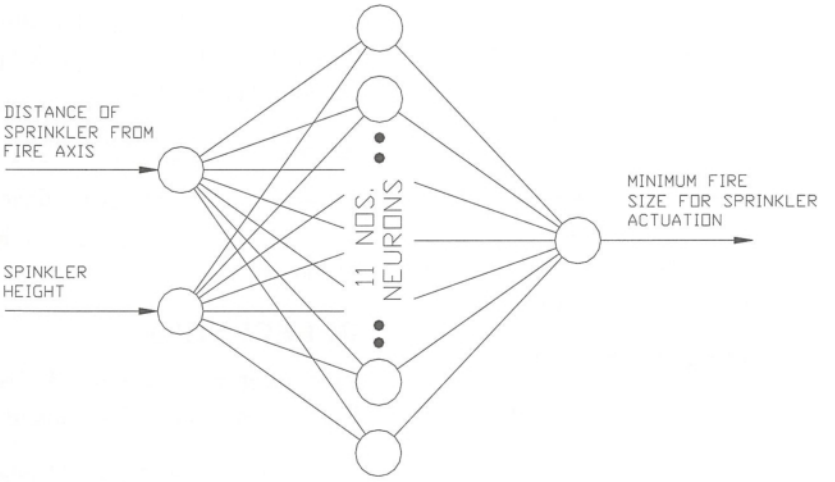

Figure 2: Network architecture for occurrence of sprinkler actuation

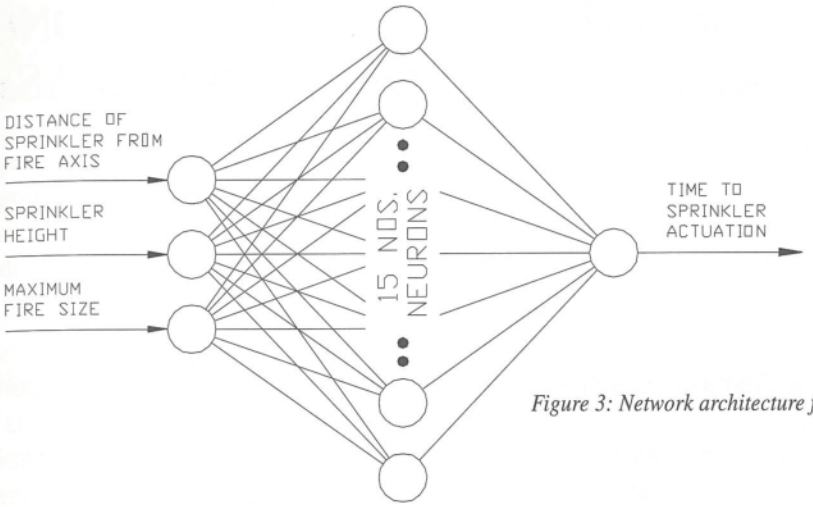

Figure 3: Network architecture for sprinkler actuation time

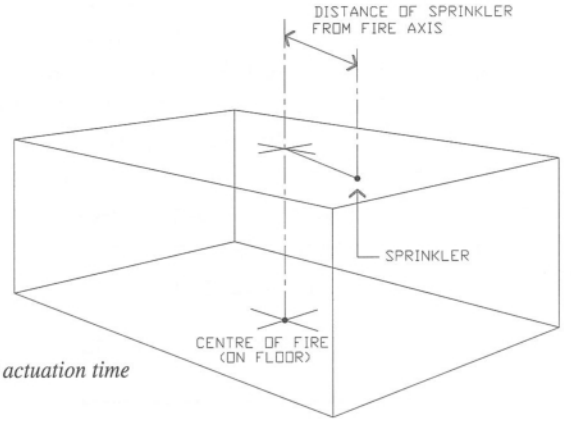

Figure 4: Room model for investigation of sprinkler actuation time

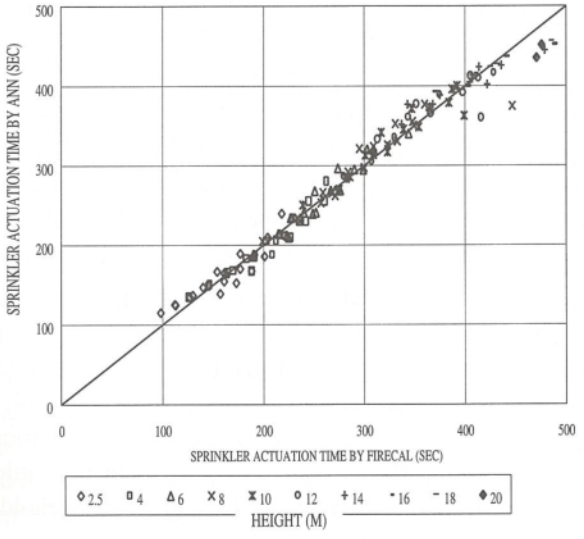

Figure 5: ANN Prediction vs. FIRECALC Simulation for Sprinkler Actuation Time

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A NON-STATUTORY INFLUENCE ON HONG KONG PROPERTY MARKET - GOVERNMENT LEASE CONDITIONS

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ABSTRACT

This study examines the effects of government lease conditions on private residential property sector in Hong Kong. Along with its other measures, the government uses land leases as a non-statutory instrument to assert its influence on the land and property markets. This paper first identifies the development conditions (controlling parameters) in government land leases and describes the ways in which they may have affected the private residential property market. We illustrate particularly how the non-statutory instrument may change real estate development with reference to supply quantity and price level. Several hypotheses are also set up to test the impacts of such non-statutory influence on the market. This study aims to provide an answer as to what has affected the supply in Hong Kong's residential property market and at the same time to alleviate the territory's long-term housing problems. The findings suggest that most of the development conditions identified as important have a statistically significant impact on the supply quantity of the private residential property market. Interestingly enough, however, none of them was found to be significant on price change.

KEYWORDS: lease conditions, Hong Kong, property market, development

INTRODUCTION

Hong Kong has been facing shortage of housing supply, due primarily too limited developable or redevelopable land relative to keen market demand. This has resulted in prolonged price volatility, especially in price appreciation in the last 15 years despite the recent fall in property prices. The Hong Kong government recognizes the long-term constraints on land supply and sees the need to increase supply by increasing development density and providing affordable housing for small sized households. The government even made a pledge in its 1997 Policy Address to increase annual housing production to 85,000 flats in the private residential property market. Moreover, Ford (1994) and Lo (1992) both commented that Hong Kong people prefer living as close to their work place as possible which means concentration in the built up areas. On the other hand, not only does the government control housing development from Town Planning and Building legislation, but also it uses "development conditions" in the government land leases to regulate the development, especially on flat size and development density. This has been, therefore, limiting market oriented development freedom and hence the supply. The local housing policies and regulations have obviously created a dilemma.

The leasehold system in Hong Kong compared with the freehold system in other countries is that the former imposes a civil contract between the government and an individual within a specification of a time dimension. Other than the specification for the duration of property rights, there is little real distinction between the leasehold and freehold land tenure systems.

All land disposed in Hong Kong is subject to lease

terms which are technically and commonly referred to as lease conditions. The local territory confronts both natural restrictions and contrived restrictions as defined by Rose (1989). In particular, the latter restrictions imposed by the government are not only zoning and Building Ordinance but also lease conditions, which are obstacles to market-oriented-desirable development.

The paramount question for the Hong Kong government is to resolve the dilemma between (1) the policy of providing adequate and affordable housing against shortage of housing supply and (2) the regulations for controls on property development. Redevelopment becomes more difficult because fewer underdeveloped areas are remaining; it is increasingly difficult to assemble developable sites due to multiple ownership, and it is extremely hard to identify financially viable opportunities for redevelopment. The government has also acknowledged that the smaller the gap between the supply and demand for housing, so the pressure on providing affordable housing can be eased. The obvious restriction on land site availability has led the government to conclude that an increase in development density to make use of existing housing sites is a possibility to alleviate the interim housing problem.

The government is well aware of the use of non-statutory and administrative practices to control the nature and intensity of property development in addition to statutory controls. It can simply include constraints and conditions in leases drawn up for developable sites. As each lease has contractually enforceable conditions, the government exerts almost absolute and monopolistic control directly over land supply and hence housing supply quantity. First and foremost, there is a need to take a more in-depth investigation into the extent of the development conditions in government land leases that affect the private residential property market in Hong Kong in terms of supply quantity and price. A requirement to discover which of the development conditions has the most impact becomes essential to improve future modification and formulation of regulations so as to ease the shortage of housing supply and provide affordable housing.

DEVELOPMENT CONTROL MEASURES

The Hong Kong government that disposes of land by way of long leases known as Government Leases owns all lands in Hong Kong. The contract between the lessee and the Government is known as 'Conditions of Sale'. It will contain all the terms General Conditions and Special Conditions upon which the lessee will hold and use the land. The General Conditions includes terms relating to disclosure of principal, rent, ratable value, effective date of the lease, maintenance, right to inspect, breach of lease condition, etc. The Special Conditions in the lease normally include the requirements of Master Layout Plan, layout of the buildings, use of the land, type of business allowed, maximum/minimum gross floor area, development period, design disposition & height of the building and a clause for compliance with all other ordinances. Only when all the positive obligations of the Conditions are complied then a Certificate of Compliance can be issued to the lessee. The property will not be alienated without the consent of the HKSAR Government.

Buildings Ordinance and Town Planning Ordinance as statutory laws prevail over lease provisions that are contract terms. If lease requirements are more restrictive than what the statutory laws allow, the property owner could apply to Lands Department for lease modification upon payment of a land premium. All recent leases consist of a clause for compliance with all other ordinances. Firstly, buildings erected or to be erected must comply with the Buildings Ordinance (Cap. 123), any regulations made under it, and any of its amending legislation. Secondly, the use of land lot for which buildings erected or to be erected must comply with the requirements of the Town Planning Ordinance (Cap. 131) and any of its amending legislation.

CONDITIONS OF GOVERNMENT LAND LEASES

In addition to the requirement for complying with the two ordinances, other development conditions mainly intend to control space development that can

increase or reduce housing supply quantity. These conditions emphasize the seven key areas of control in the housing development. They are (1) total gross floor area; (2) maximum site coverage; (3) height of building; (4) maximum number of storeys; (5) maximum number of units; (6) number of buildings on a lot; and (7) unit size.

Depending upon the location of a land lot, a lease may not include all seven conditions. The variance of this stipulation can either limit the availability of building space from a lot or make more space available for accommodations. Moreover, relying upon the Design, Disposition and Height clause, the government could dictate the design of buildings to be developed on the lot including external elevations and finishes of buildings. The discretion power under this cause is so subjective and with overriding effective that it seldom exercises.

The development conditions of the government land leases in Hong Kong can increase or decrease the number of housing units supplied into the local real estate market. These conditions can also constrain the sizes of units by varying their terms in the leases. Furthermore, the government can exercise control over the supply of land in the market by leasing within a leasehold land tenure system as discussed widely by Leung (1986) and Yeh (1993). Thus, the Hong Kong government can dictate not only the pace and direction of development through the leasing but more importantly the size and the number of units made available by relaxing or tightening the development conditions.

HYPOTHESES AND METHODOLOGY

After reviewing the development conditions, the compliance requirement of three of these conditions - Town Planning Ordinance, Buildings Ordinance, and design constraint have been uniformly applied in all recently issued leases. Consequently, their effects upon housing supply quantity and price are basically indifferent among the leases. The remaining development conditions on space development constraint are applied spasmodically in the leases and can be considered to have an impact on property supply quantity and price. The seven development conditions that follow are identified as the fundamental independent variables and are expected to affect both housing supply quantity and housing price in the private residential real estate market of Hong Kong. They are (1) minimum gross floor area, denoted by x_1; (2) site coverage, denoted by x_2 ; (3) height restriction, denoted by x_3 ; (4) maximum number of storeys, denoted by x_4 ; (5) number of units, denoted by x_5 ; (6) number of buildings, denoted by x_6 ; and (7) maximum size of each unit, denoted by x_7.

With the exception of the maximum size of each unit, x_7, an increase in one of other six variables ($x_1 ... x_7$) would increase the supply quantity of housing while the other five variables are assumed to be held constant. However, an increase in supply theoretically should decrease price. This inverse supply-price relationship implies that development conditions associated positively with supply would be negatively associated with price. The preliminary relationships between development conditions and housing supply and price are summarized in Table 1.

An independent variable that is expected to have a statistical impact upon housing supply quantity is a term varying in specifications among leases. As shown in Table 1, the seven variables are not necessarily and uniformly stated as development conditions in the leases. Some sites are more restrictive with the greater number of development conditions imposed. Others are found to have fewer development conditions in their leases. This divergence in specifying development conditions in each lease provides insight into setting the testing for the supply and price effects using regression analysis. The dummy variables of one and zero are used to represent the leases with and without the development conditions specifically stated therein. These variables are counted for the total number of the conditions specified in the leases for selected developable private residential property sites.

Variables (x_j)	Development Conditions	Relationships	
		Supply	Price
x_1	Maximum gross floor area	+	-
x_2	Maximum site coverage	+	-
x_3	Height in length	+	-
x_4	Maximum number of storeys	+	-
x_5	Maximum number of units	+	-
x_6	Number of building	+	-
x_7	Unit size in square meter	-	+

Table 1: Relationships between Development Conditions and Supply and Price

Assuming there is a linear relationship between the development conditions and housing supply quantity and housing price, two mathematical equations are set to determine the supply effect and price effect. While the two set of hypotheses appear to be quite general, their magnitude of the effects is clear. They focus on the effects of development conditions upon supply quantity and price.

Sources of Data

Three sets of data were gathered for this study from Hong Kong Property Review, a governmental publication. They are (1) the number of units completed for the five classes of private residential property between 1989 and 1998; (2) the average annual prices of those number of units as stated in (1); and (3) a weighted average price per square metre for each year from 1989 to 1999 computed by using the price data and the number of completed units for each respective class of properties.

A total of 110 leases of private residential users from 1985 to 1995 were gathered as the sample for this study. Since the completion year comes a few years after the issue year, the data analysis is based on the completion year of a lease rather than the issue year. The method of lease acquisition is by purchase through auction and tender offer. The property development has to be completed by the end of 1998.

Findings and Analysis

Among the seven development conditions that were tested, the number of units is the only one that directly specifies the number of potential housing units supplied from a particular developable site. The remaining six individual development conditions do not precisely determine the number of units a constructed building has to offer and directly affect the supply quantity and price of the residential property market. But, the common development conditions taken collectively would be able to indicate the relative magnitude of their impacts upon the supply quantity or price of the real estate market. Resulting from this interdependence, multicollinearity exists in the analysis of this study, but it is assumed to have no significant impact nor distort the findings of this study.

Table 2 presents the empirical results of the analysis of this paper. For testing the supply effect, the R^2 and adjusted R^2 indicate a fairly well fit. Over 90 percent of the variations in supply quantity can be explained by the seven development conditions identified in this study despite the fact there is some volatility in the explanatory power of the regression. However, a somewhat different indication has been found for the price effect, the R^2 indicates about 89 percent and adjusted R^2 shows about 51 percent of price variations can be explained by the seven variables.

Development Condition	Supply Effect		Price Effect	
	Coefficient	t-statistics	Coefficient	t-statistics
Intercept	3.480	19.966	7.114	4.065
Maximum gross floor area, x_1	1.025	6.109	2.495	1.481
Maximum site coverage, x_2	0.750	5.544	.785	.578
Height in length, x_3	-.399	-4.078	-.107	-.109
Maximum number of storeys, x_4	-1.459	-9.730	-.391	-.259
Number of units, x_5	-1.114	-6.295	1.528	.860
Number of buildings, x_6	-1.240	-2.913	-1.852	-.433
Unit size in square meter, x_7	-.116	-.539	1.566	.723
R^2	.995		.892	
Adjusted R^2	.978		.516	

Table 2: Regression Results

The empirical results from the regression analysis of this study indicate the following:

The development conditions that are found to have the relationships as expected with the supply quantity are maximum gross floor area, site coverage, and unit size in square meter. Additionally, the ones having relationships with the price as hypothesized are the height in length, maximum number of storeys, number of buildings, and unit size. Furthermore, only the unit size in square meters has demonstrated the result of an inverse supply-price relationship.

The maximum gross floor area and site coverage are positively related to the supply quantity. An increase in floor area as well as site coverage allows more accommodation space for a residential building. The number of units supplied into the market is likely to increase. On the other hand, the unit size in square meters is negatively related to supply quantity. As the units get bigger in sizes, fewer units can be built and made available to the market given the same developable areas provided from land supply.

The height in length, maximum number of storeys, number of buildings, and number of units are found to be negatively related to the supply quantity although they were originally hypothesized to be positively related with the supply quantity. The height in length and number of storeys are somewhat inter-related since the number of storeys has to be dependent upon the height of a building allowed to be built. Thus, the resulted relationship digresses from the original expectation of this study. Similarly, the number of buildings as well as the number of units may be inter-dependent. As the greater number of buildings permitted to be built for a developable site, it is more likely the number of units supplied into the market increases. The increasing number of leases that is excluding the number of buildings and units as development conditions in recent years can cause this.

At a 95 percent confidence level, only the maximum gross floor area and site coverage are statistically different from zero as indicated by the t-statistics as shown in Table 2. But, the unit size is not statistically different from zero at the same confidence level. Thus, only the maximum gross floor area and site coverage are found to be the determinants that can have an impact upon the supply quantity in the local real estate market.

The results from testing the price effect show that the development conditions including the maximum gross floor area, site coverage, and number of units are positively related to prices and differ from their expectation of the negative relationships with price. However, the unit size is in line with prediction by the positive sign as shown in Table 1. Likewise, the height in length, maximum number of storeys, and number of buildings have the negative signs as expected.

The finding of this study is in line with a similar study by Tse (1998), who found that there has been no causal relationship between housing price and land supply. The difference between land supply and development conditions is which of the two can dictate over the actual housing provision. The development conditions determine the actual size of a developable area that a building can be constructed on a given piece of land supplied, thus they can affect local housing supply quantity directly.

If the effects of development conditions upon supply quantity and price go into opposite directions, a theoretical supply-price inverse relationship can be formed in general. However, inconsistency has been found about this relationship in this study. Only the unit size is found to have the supply-price inverse relationship as expected. The number of units also indicates the supply-price inverse relationship, but it is oppositely formed against the original prediction. The number of units specified on a lease should bear a positive relationship with the supply quantity. As the number of housing units allowed for construction increase for a lease, so as the number of residential units available in the market should increase. This basic original premise has not been supported by the findings of this study despite that the inverse relationship between the supply and

price effects has been evidenced. This can be caused by the frequent practice of delaying the sale of completed housing units in anticipation of future property price increase.

The supply-price inverse relationship is not found among maximum gross floor area, maximum site coverage, height in length, number of storeys, and number of building. Each of these five variables is inter-dependent with each other and affects the actual supply quantity of housing indirectly. A modification in one development condition can be counteracted by a change of another one. For example, the site coverage specified in a lease is increased, but at the same time the height is reduced. Thus, the net result contributes no change to the supply quantity.

CONCLUSIONS

This study limits its scope to the examination of the local supply only. It attempts to identify the extent of development conditions as a special type of control measures has impacted upon the supply and price of the private residential property market in Hong Kong. Similar to the findings of other studies conducted in a freehold land tenure system investigating into the effect of regulatory, population, economic, social and other variables mixed results were found concerning the effects of development conditions upon the local real estate market. Mixed conclusions could be drawn between the two effects of this study.

The impacts of development conditions upon the supply quantity are much more explainable. The alternative hypothesis for quantity-effect can be accepted for six out of the seven development conditions. The floor area, site coverage, height, number of storeys, number of units, and number of buildings can be concluded to have impacts upon supply quantity. In particular, the maximum gross floor area and site coverage are positively related to the supply quantity and thus can be the conditions that the Hong Kong government should consider to relax in drawing up future leases.

It is well recognized that certain areas in the territory have been built up, for instance, Hong Kong Island. Relaxing the gross floor area and site coverage may at the same time require larger unit size to be built in order to maintain the same quality of living in these areas. To resolve the issue of affordable housing, a mixture of unit sizes should be stipulated in the development conditions of future leases so as to ensure different market segments of housing needs in certain local districts are satisfied.

The results are less supportive for the price-effect hypothesis. From the statistical analysis, these lease conditions therefore have no direct impact upon housing prices in the private residential real estate market of Hong Kong. Although Tse (1998) concluded that there is no causal relationship between land supply and housing prices, land supply cannot directly determine the provision of housing in Hong Kong. In essence, the development conditions are the most crucial factors affecting the actual quantity of residential land supplied, not just the size of a piece of land given. It seems that the government's policy in restricting land supply to regulate property price has hurt the construction and real estate industry for no apparent benefit. The timing of land supply and sentiment of purchaser have more effect on the private property market than simply the quantity of land supply. It would be worthwhile to investigate the relationship between the property market price and lease conditions with particular reference to the timing and pattern of land supply for private residential development.

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MODELLING THERMAL PERFORMANCE OF BUILDING ENVELOPE IN HONG KONG

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ABSTRACT

This paper reviews and comments the relevant legislative requirements for the control of thermal transfer value of building envelopes in Hong Kong. This paper is then to present a practical, user-friendly computer software which can instantly model the thermal performance of a building envelope design and can also check whether it can comply with the Building (Energy Efficiency) Regulation and the OTTV Code of Practice.

KEYWORDS: Building Regulations, Energy efficiency, Hong Kong, Overall Thermal Transfer Value.

INTRODUCTION

The question of energy conservation became an issue during the energy crisis brought about by increases in oil prices in the late 1970's. In recent years, energy conservation has again been brought to the forefront, this time in the context of addressing environmental problems such as air pollution, acid rain and of the threat of global warming caused by the burning of fossil fuels. A consultant commissioned by the Hong Kong Government in October 1990 found that the adoption of an overall thermal transfer value (OTTV) for the envelope of a building will improve its overall energy efficiency and if a building is constructed to a suitable OTTV standard, electricity demand for air-conditioning, and environmental pollution from the power stations generating the electricity, could both be reduced.

As a result, a new Building (Energy Efficiency) Regulation was introduced in Hong Kong on 21st July 1995. This regulation requires that the external walls and roofs of a commercial building and hotel should be designed and constructed to have "suitable" OTT values. A Code of Practice for Overall Thermal Transfer Value in Buildings (the OTTV Code) is published by the Buildings Department of HKSAR Government to set out the technical guidance on OTT values. Basically, they aim at reducing heat transfer from the outdoor environment into a building through the building envelope (i.e. external walls and roofs thus saving the cooling load of the air-conditioning system1.

OVERVIEW OF LEGISLATIVE REQUIREMENTS

Application of Building (Energy Efficiency) Regulation and its Control Procedures

As the OTTV requirement is aimed at reducing the amount of heat transfer through the building envelope, it mainly controls air-conditioned buildings. Therefore, the Building (Energy Efficiency) Regulation 3(1) states that this regulation applies to commercial buildings and hotels only, as buildings of this nature are normally expected to be air-conditioned. The term "commercial building" is defined to include offices, shops, department stores, places of public entertainment, places of public assembly, restaurants and any other buildings used for commercial purposes. Other buildings such as domestic buildings, industrial buildings, schools, car parking buildings, bulk storage buildings and utility buildings do not need to design in compliance with this regulation. However, it is suggested that as a matter of principle, this regulation should apply to all air-conditioned buildings irrespective of its types. For instance, a fully air-conditioned school should also comply with this regulation.

By virtue of Section 39(2) of the Buildings Ordinance, this regulation does not apply to building works which have been commenced on or before 21st July 1995. Thus, this regulation does not have any retrospective effect. Existing commercial buildings and hotels do not need to undertake any improvement work for its building envelopes in compliance with this regulation. In order to achieve energy conservation throughout the whole territories, it is suggested that this regulation should also be applicable to all existing air-conditioning buildings by allowing building owners to improve their buildings within a certain period of time (say, 3 to 5 years).

When new building plans are submitted to the Buildings Department for approval, they must be accompanied by all necessary information and calculations relating to the OTTV of the proposed building as required by the Building (Energy Efficiency) Regulation 5. It is possible that the design of the building envelope may not have been finalised when submitting the first building plans. As such, the Buildings Department would accept a simplified version of OTTV calculations, demonstrating compliance with the regulation to be included in the first submission. However, detailed calculations must be submitted before granting consent to commence building works.

Maximum OTTV Criteria

In Hong Kong, most commercial buildings and hotels are designed in such a way that there is a building tower above a relative large podium2. Thus, separate OTTV criteria are set for a building tower and a podium which are 35 W/m^2 and 80 W/m^2 respectively according to the OTTV Code. The maximum OTTV for a building tower is generally comparable with the OTTV criteria set by other South East Asian countries as shown in Table 1. However, the OTTV criterion of 80 W/m^2 for a podium is too low for effective control of the thermal performance of a building envelope and thus its energy consumption.

Countries	Maximum Criteria	OTTV (W/m^2)
	Wall	Roof
ASHRAE[3]	92	27
Thailand	45	45
Singapore	45	45
Malaysia	45	25

Table 1: Comparision of OTTV Values of Some Asian Countries

The OTTV in Hong Kong is set for the overall building envelope of a building tower and a podium "in average" only and there is no separate criteria for the wall and roof as other South East Asian countries. As it does not apply to the individual wall/ roof, an individual wall/roof can have an OTTV above or below the maximum control value as long as the overall OTTV of a building tower or podium, as the case may be, does not exceed the maximum value. As a result, architects tend to use better insulated materials for the podium and main roof so that the overall OTTV can still be acceptable, even through the OTTV of the wall is poor. Again, this makes the Building (Energy Efficiency) Regulation to become less effective in controlling the thermal performance of a building envelope. Perhaps, the major advantage of this formulation is that it allows architects greater flexibility of design to vary important envelope components such as wall and roof construction, wall and roof colour, type of glazing for window and rooflight, size of window and rooflight and external shading to windows to meet the maximum OTTV criteria.

Principles of OTTV Calculations

The principle of OTTV is based on the assumption that the envelope of a building is completely enclosed. On the basis of this principle, a building should not have unenclosed doorways and entrances. For building where heavy traffic of people is anticipated, self-closing doors, revolving doors or other similar means of minimising heat gain should be used. In addition, windows should be sealed against leakage.

Basically, all external walls and roofs of a commercial building or hotel should be included in

OTTV calculations, except the following non air-conditioning or less important components:

- an external wall of a refuge floor,
- an external wall or roof of a carparking floor,
- an external wall of a lightwell having an area not exceeding 21 m^2, and
- any wall on above roof.

According to the OTTV Code, however, an external party wall is also required to be included in OTTV calculations whether or not there exists an adjoining building. This is because an adjoining building may be demolished and thus changes the original OTTV of a building. For the same reason, shading to the party wall from adjoining buildings are not considered in OTTV calculations.

Thermal Performances of External Walls and Roofs

The thermal performance of the external walls of a building tower or a podium, $OTTV_w$, is calculated by the following formula:

$$OTTV_w = \frac{(A_w\, xUx\, \alpha xTD_{EQw}) + (Af_w\, xSCxESMxSF)}{Ao_w}$$

where

A_W = Area of opaque wall, m^2,

U = Thermal transmittance of opaque wall, $W/m^{20}C$

α = Absorptivity of the opaque wall

TD_{EQw} = Equivalent temperature difference for wall, ^0C

Af_w = Area of fenestration in wall, m^2

SC = Shading coefficient of fenestration in wall

ESM = External shading multiplier

SF = Solar factor for the vertical surface, W/m^2

Ao_w = Gross area of external walls, i.e. $A_w + Af_w$, m^2

The thermal performance of the roofs of a building tower or a podium, OTTVr, is calculated by following formula:

$$OTTV_w = \frac{(A_r\, xUx\, \alpha xTD_{EQw}) + (Afr\, xSCx\, SF)}{Ao_r}$$

where

A_r = Area of opaque roof, m^2,

U = Thermal transmittance of opaque roof, $W/m^{20}C$

α = Absorptivity of the opaque roof

TD_{EQr} = Equivalent temperature difference for roof, ^0C

Af_r = Area of fenestration in roof, m^2

SC = Shading coefficient of fenestration in roof

SF = Solar factor for the vertical surface, W/m^2

Ao_r = Gross area of roof, i.e. $A_r + Af_r$, m^2

Opaque walls and roofs usually involve a composite of materials. The thermal transmittance of an opaque wall or roof is calculated by the following formula:

$$U = \frac{1}{Ri + \frac{x1}{k1} = \frac{x2}{k2} + ... \frac{xn}{kn} + Ra + Ro}$$

where

x = Thickness of building material of the wall or roof or part thereof, m

k = Thermal conductivity of the building material, W/m^0C

Ri = Surface film resistance of internal surface of the wall or roof, $m^{20}C/W$

Ro = Surface film resistance of external surface of the wall or roof, $m^{20}C/W$

Ra = Air space resistance, $m^{20}C/W$

MODELLING THERMAL PERFORMANCE OF BUILDING ENVELOPE DESIGN

Problems Faced by Building Professionals

As shown in the above formulas, the building envelope design and its associated OTTV calculations can be handled by most building professionals under normal circumstances. However, most modern commercial buildings and hotels in Hong Kong are high-rise and complicated

in nature. Thus, its envelope design and OTTV calculations become a problem because it involves a large amount of different parameters. A review of a number of office projects indicates that its statutory OTTV calculations are about one inch thick - it is really a nightmare for many building professionals. In addition, the OTTV Code itself is not user-friendly. Many building professionals cannot be sure what building envelope design would be able to comply with the statutory requirements.

Given the aforesaid situations, many architects have experienced a great difficulty in designing the building envelope, while at the same time handling the statutory OTTV requirements, thus often resulting in substantial abortive design and calculations. In addition, most building control officers are also required to take considerable time to check the submitted designs and calculations to ensure its compliance with the Building (Energy Efficiency) Regulations should they do so. This non-productive time can be greatly reduced if there is computer software to model the anticipated building performance.

Main Features of Computer Software

In order to overcome the aforesaid problems, practical user-friendly computer software is thus developed for modelling the thermal performances of building envelope design and also handling all OTTV calculations. Its main features are outlined as follows:

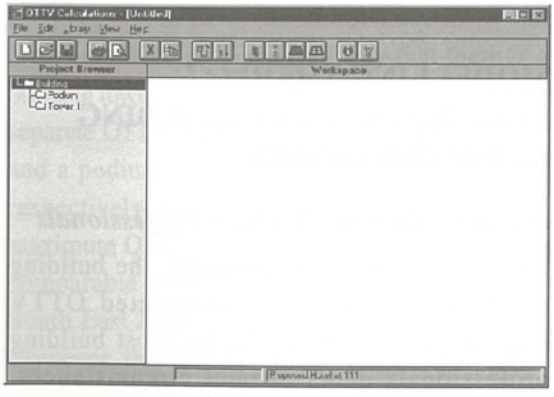

Figure 1: Overview of Overall Screen

Overview of Overall Screen

The programme is started by double-clicking the OTTV icon in the screen. It can then either create a new project or open an existing project. A project browser and blank workspace will appear on the screen as shown in Figure 1. The "project browser" functions as the content page of a book, showing the design of the opaque walls/roofs and fenestration under different orientations. The "workspace" is used for data entries and editing.

Adding and Editing Opaque Wall and Roof

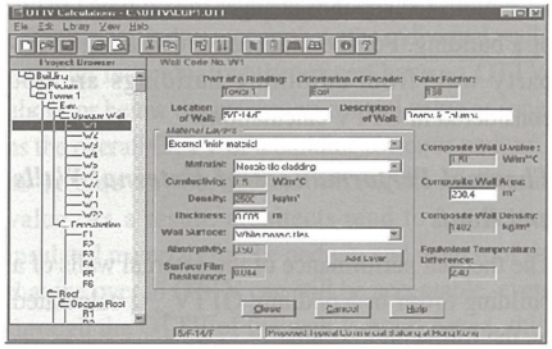

Figure 2: Editing Opaque Wall or Roof

When a new opaque wall/roof is added by choosing the "Add Opaque Wall" or "Add Opaque Roof" commend from the Edit menu, a workspace screen then appears as shown in Figure 2. Opaque walls and roofs usually involve a composite of materials. Thus, it is divided into external finish material layer, intermediate component layer(s) and internal finish layer. This software contains databases for the thermal conductivity of most common building materials, surface film resistance, air space resistance, surface absorptivity and equivalent temperature difference.

Once the appropriate data of each material layer (i. e. orientation of facade, location and description of wall or roof, material itself, its thickness, surface and area) are entered/selected in the workspace screen, this software will instantly generate the required results.

Since a wall/roof design in one orientation may be similar in other orientation(s), the "Copy" commend is useful to copy an individual wall/roof design from one orientation to another orientation(s). Any wall/roof design can subsequently be edited in the

workspace screen. All wall/roof designs can also be "Renamed" and "Re-numbered" in a proper order. A wall/roof design can also be deleted by using the "Delete" commend.

Adding and Editing Fenestration in Wall and Roof

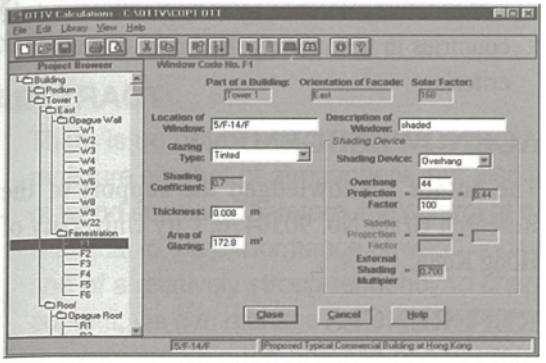

Figure 3: Editing Fenestration in Wall or Roof

Same as the opaque wall and roof, a new window/ rooflight can be added by choosing the "Add Fenestration in Wall" or "Add Fenestration in Roof" commend from the Edit menu. Again, this software contains databases for the shading coefficient of fenestration, external shading multiplier for overhang and sidefin projections and solar factor.

Once the appropriate data of the fenestration (i.e. orientation of facade, location and description of window or rooflight, type of glazing, area of glazing and shading device) are entered/selected in the workspace screen as shown in Figure 3, this software will instantly generate the required results.

Again, the "Copy", "Delete", "Rename" and "Re-number" commends are available to edit the appropriate fenestration.

User Libraries

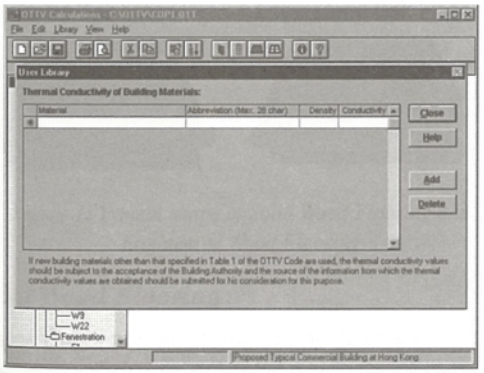

Figure 4: User Library for Thermal Conductivity of Building Materials

Although this software contains an extensive database for those traditional building materials accepted by the Buildings Department, there will be new building materials. Thus, this software contains three user libraries; (i) thermal conductivity of building materials, (ii) absortivity for wall/roof surfaces and (iii) shading coefficient of glass. User can have great flexibility to "Add" (or "Delete") the relevant data of new building materials in these libraries. Figure 4 shows an example of the user library for the thermal conductivity of building materials.

View Data, Print Preview and Printing

The OTTV Code specifies that the OTTV information and calculations should be submitted on the prescribed standard Form 1 (Calculation of 'U' Value of Composite Wall/Roof), Form 2 (Window/Rooflight), Form 3 (Calculation of OTTV of Individual Facade in Building Envelope) and Form 4 (Summary of OTTV of Building Envelope). This software automatically sorts all data into these prescribed standard forms which can be printed for direct submission to the Buildings Department for approval.

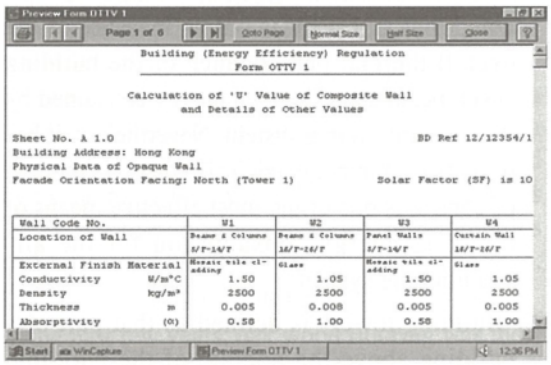

Figure 5: Print Preview of Form OTTV 1

All data can be quickly viewed by using the "View" commend to check any error in data entries, the individual thermal performance of a wall or roof or the overall thermal performance of a building tower or podium. Before printing, all standard forms can be previewed first as shown in Figure 5. It can print either all standard forms, a particular standard form or a selected range of sheet.

CONCLUSION

With this software, an architect may not need to rely on a building service engineer for the design of a building envelope and the preparation and checking of the statutory OTTV calculations. In fact, due to user-friendly nature of this software, even an architectural draftman is also able to handle the required calculations. This would substantially reduce the time of all professionals involved in its design and checking and also the possible amount of abortive designs and calculations.

More importantly, an architect can instantly model the thermal performances of building envelope designs. This allows great flexibility for an architect to select the most appropriate building materials in respect of its OTTV. In addition, an architect can also quickly compare the thermal performances of different facade designs, which may be further studied in respect of its effect on cooling load by a building service engineer, and its initial and life cycle costs by a quantity surveyor.

ENDNOTES

1. Although higher OTTV implies larger heat gain and thus more cooling requirement, it must be noted that an OTTV is only a measure of the overall thermal performance of the building envelope, and not the total energy consumed by the air-conditioning system. Nevertheless, it has been proved in many countries that this method of control is one of the most effective means of reducing energy consumption for the air-conditioning system.
2. "Building tower" is defined as that part of a building above the podium of the building, whereas "podium" is defined as that part of a building within 15m above ground level as permitted under Building (Planning) Regulation.
3. The concept of OTTV was first proposed in 1975 by the American Society of Heating, Refrigerating and Air-conditioning Engineers which set out the maximum OTTV for mechanically cooled buildings in their ASHRAE Standard 90-75 "Energy Conservation in New Building Design". This standard and its subsequent amendments have been implemented in most areas of the USA. Although different countries are subject to different climatic environments, these standards have been an authoritative reference by most South East Asia countries in formulating their maximum OTTV criteria.

ACKNOWLEDGEMENT

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STUDY ON INSTALLATION AND MAINTENANCE FOR USING BEECH OR OTHER WOOD FLOORING IN HONG KONG

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ABSTRACT

There is no doubt that all woods, not only beech, will change their dimension in different moisture content of atmosphere, but also depending on the dimensional change coefficient of wood species. Therefore, the control of moisture content before, being and after installation is critical to the performance of wood flooring. Even beech is used to dry climate environment and of a relatively strong tendency to change dimension resulted from changes of moisture content, we can manage the expected expansion and contraction by following the guidelines recommended in the process of site preparation, storage, handling, installation and future maintenance so as to work successfully with wood flooring. This provides some general guidelines for someone who would like to use beech or other wood flooring.

KEYWORDS: Wood flooring, Beech, Installation and maintenance guidelines

BRIEF OF HARDWOOD FLOORING ADOPTED IN HONG KONG

Hardwoods are premium materials with unique, natural character and quirks responding to the environment, which is subjected to many variations in colour, dimensional stability, grain and hardness. Because of its beauty and decorative quality, hardwood flooring, i.e. beech, oak, teak, etc, is being used more and more for interior floor finishes works in Hong Kong. There are two main types of wood flooring most commonly used in Hong Kong, namely solid wood flooring and engineered wood flooring (Figure 1).

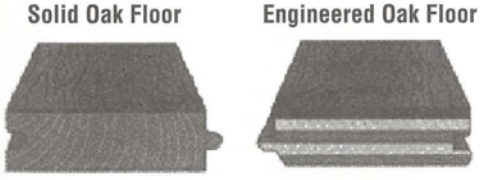

Figure 1: Typical shape of Solid Wood Flooring and Engineered Wood Flooring

Solid Wood Flooring

These floors are one complete piece of solid wood from top to bottom. All solid products react to the presents of moisture. Solid strip or plank floors can only be installed with the Nail Down and Staple Down procedure on a wooden subfloor, such as plywood, etc.

Engineered Wood Flooring

Some called as "Laminated" wood flooring. These floors refer to products that have 2, 3 or 5 layers of wood laminated together to become one board. Engineered floors have layers of wood that have a cross-graining lamination process resulting in a product that is dimensionally stable and not affected by moisture as greatly as solids. Engineered floors can be installed on any grade level of the premises and are suitable for the Nail Down, Staple Down, Glue Down or Floating installation procedures.

In the past few years, oak wood flooring was most commonly used in Hong Kong due to its high durability and good dimensional stability in humid climate. Nowadays, the trend of wood flooring adopted in Hong Kong had been shifted to another "competitor", i.e. Beech.

The report herewith would focus to discuss the suitability of 'Beech' wood as being used for floor finishes in Hong Kong and to present several general tips on the proper installation and maintenance procedures when finishing the floor in Beech wood and other similar materials.

DESCRIPTION OF BEECH WOOD FLOORING

Beech varies in colour from nearly white sapwood to reddish-brown heartwood in some trees. Sometimes there is no clear line of demarcation between heartwood and sapwood. Sapwood may be from 3 to 5 inches thick. The wood has little figure and is of close, uniform texture. It has no characteristic taste or odor.

The wood of beech (Figure 2) is classified as heavy (44lbs./cu.ft), hard, strong, high in resistance to shock, and highly suitable for steam bending. Beech shrinks substantially and therefore requires careful drying. It machines smoothly, is an excellent wood for turning, wears well, and is rather easily treated with preservatives. Easy to stain, paint or bleach.

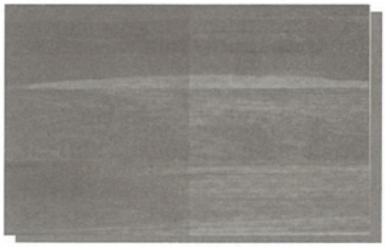

Figure 2: Beech Wood

In respect of hardness, beech has a Janka Hardness Rating of 1300%, which is 1% harder than northern red oak. The following hardness chart (Figure 3) showing the comparison between beech and other woods in terms of hardness.

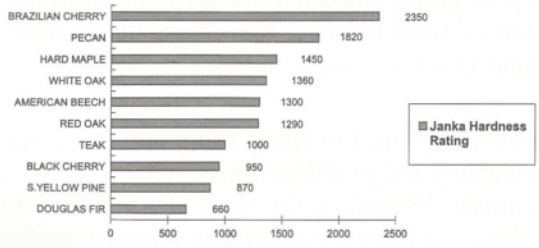

Figure 3: Relative Hardness of 10 Selected Wood Flooring Species

Distribution of beech is mainly come from some countries with dry climate, i.e. America and Europe. Grades of beech are categorized into 3 grades, which are "First", "Second" and "Third".

"First" Grade

Has the best appearance, natural colour variations and limited character marks

"Second" Grade

Variegated in appearance with varying sound wood characteristics of species

"Third" Grade

Rustic in appearance allowing all wood characteristics of the species

BEHAVIOUR OF WOOD FLOORING IN COMBINED WITH MOISTURE

Wood is hygroscopic, which means it readily absorbs moisture from the surrounding environment. This accounts for the direct relationship between moisture and wood. Solid-wood floors are most susceptible to moisture-related expansion and contraction, whereas the multi-ply construction of engineered wood floors makes them less inclined to expand and contract.

Wood fibers are dimensionally stable when the moisture content is above the fiber saturation point (usually about 30% moisture content). Below that, all wood, including oak, beech, maple and other wood species gains and loses moisture before and after installation, as surrounding conditions fluctuate. In this respect, wood changes dimension when it gains (swell) or loses moisture (shrink). The influence on the dimension change of wood due to moisture content changes is depended on different dimensional stability coefficient of varies wood species. The following tables (Figure 4) showing different dimensional stability coefficient of varies wood species:-

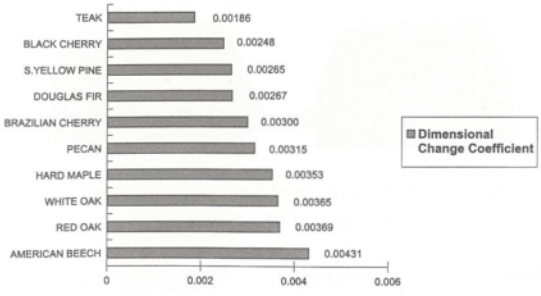

Figure 4: Relative Dimensional Stability of 10 Selected Wood Flooring Species

Remember, beech is of relatively high dimensional change coefficient (0.00431) than

that of red oak (0.00396), white oak (0.00369) and hard maple (0.00353). Therefore, considerable care should be taken in controlling the moisture content when using the wood of beech.

Followings are the three typical defects resulted from the dimension change of wood flooring in relation to moisture content: -

1.Cupping (Figure 5)

Flooring absorbing excessive moisture on the underside causes expansion and cupping with the edges raised.

2.Crowning (Figure 5)

Crowning describes when the surface of the wood floor boards become convex rather than concave. The expansion associated with crowning is usually the result of topical, rather than subsurface, exposure to water.

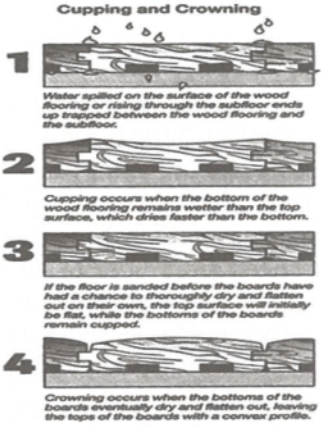

Figure 5: Cupping and Crowning

3.Buckling

Buckling of hardwood floors, when the flooring literary pulls away from the subfloor, lifting up to several inches in one or more places, is one of the most extreme reactions to moisture that can occur. Fortunately, it is not a common occurrence.

Buckling happens most often after a floor is flooded for a time, but there are numerous other causes. On nailed floors, insufficient nailing, incorrect nails or incorrect subfloor construction are possibilities. On glue doen floors, the causes range from the use of incorrect or insufficient mastics to an inadequate mastic transfer, a subfloor separation or a subfloor contamination.

The above revealed that all woods, no matter it is oak or beech or other species, absorb moisture when the air is humid, and lose moisture when it is dry. The difference of varies wood species in this respect is solely the degree of dimension change. Therefore, the pre-requisite of sustaining the best performance of wood flooring is to achieve the Equilibrium Moisture Content (EMC), at which the wood is neither gaining nor losing moisture. The following table (Table 1) showing the varies moisture content of wood in equilibrium with stated dry-bulb temperature and relative humidity:

Temp, Dry-bulb, °F	Relative Humidity (%)														
	30	35	40	45	50	55	60	65	70	75	80	85	90	95	98
30...	6.3	7.1	7.9	8.7	9.5	10.4	11.3	12.4	13.5	14.9	16.5	18.5	21.0	24.3	26.9
40...	6.3	7.1	7.9	8.7	9.5	10.4	11.3	12.3	13.5	14.9	16.5	18.5	21.0	24.3	26.9
50...	6.3	7.1	7.9	8.7	9.5	10.3	11.2	12.3	13.4	14.8	16.4	18.4	20.9	24.3	26.9
60...	6.2	7.0	7.8	8.6	9.4	10.2	11.1	12.1	13.3	14.6	16.2	18.2	20.7	24.1	26.8
70...	6.2	6.9	7.7	8.5	9.2	10.1	11.0	12.0	13.1	14.4	16.0	17.9	20.5	23.9	26.6
80...	6.1	6.8	7.6	8.3	9.1	9.9	10.8	11.7	12.9	14.2	15.7	17.7	20.2	23.6	26.3
90...	5.9	6.7	7.4	8.1	8.9	9.7	10.5	11.5	12.6	13.9	15.4	17.3	19.8	23.3	26.0
100...	5.8	6.5	7.2	7.9	8.7	9.5	10.3	11.2	12.3	13.6	15.1	17.0	19.5	22.9	25.6

General Weather Condition in Hong Kong

Table 1: Moisture content of wood in equilibrium with stated dry-bulb temperature and relative humidity

To achieve the equilibrium moisture content, knowledge of the following is necessary:

- Expected moisture content of wood flooring in a particular area after acclimation
- Moisture content of flooring at the time of installation, and
- Additional factors which contribute to the changing moisture content of wood flooring

The above showing how to manage the resulting expansion and contraction by understanding how the hardwoods behave. The following section will provide a few simple guidelines for site preparation, handling and installation so as to sustain the best performance of hardwood flooring.

GUIDELINES IN APPLICATION OF BEECH WOOD AND OTHER HARDWOOD

Flooring

As discussed in the previous section 3.0, the core criterion of sustaining the best performance of all wood flooring is whether the EMC is achieved. Even beech wood is mainly distributed from some "dry climate" countries, i.e. America & Europe and of relatively high dimensional change coefficient, i.e. 0.00431, we can manage the resulting expansion and contraction by achieving the EMC so as to work successfully with beech wood flooring and any other hardwood products. Proper site preparation in moisture content, proper storage and handling of wood products, appropriate installation method and future maintenance are the keys for working successfully with any hardwood product.

Proper Site Preparation in Moisture Content

To avoid the occurrence of shrinkage and swelling of hardwood flooring, it is favourite to bring the wood to a moisture content corresponding to the average atmospheric conditions to which it will be used.

Most hardwood flooring is dried to the national average moisture content expected in use so that shrinkage and swelling are minimized and buckling or large gaps between boards does not occur. For some "dry climate" countries, i.e. America, etc, most hardwood lumber is dried to an average of 6% to 9% moisture before milling is begun.

Therefore, when using the hardwood products come from the countries in dry climate, it is necessary to inform the wood manufacturer of eventual changes in moisture content for its end use and consult with him in deciding the suitable moisture content of hardwood products when using in Hong Kong.

Refer to the Summary of Meteorological Observations in Hong Kong, 1999, the mean relative humidity of Hong Kong for each month in 1999 is ranged from 60% to 84% and the mean air temperature is ranged from 16.8oC to 29.2oC. By incorporating the above data to the Table 1, the moisture content of wood flooring when using in Hong Kong shall be at a level between 12% to 15%.

一九九九年香港氣象觀測摘要
Summary of Meteroeological Observations in Hong Kong, 1999

月份 Month	平均氣壓 Mean Pressure	氣溫 Air Temperature 平均日最高 Mean Daily Maximum	平均 Mean	平均日最低 Mean Daily Minimum	平均露點 Mean Dew Point	平均相對濕度 Mean Relative Humidity	平均雲量 Mean Amount of Cloud	總雨量 Total Rainfall	總日照 Total Bright Sunshine	平均每日太陽總輻射 Mean Daily Global Solar Radiation	總蒸發量 Total Evaporation	盛行風向 Prevailing Wind Direction	平均風速 Mean Wind Speed
	百帕斯卡 hPa	℃	℃	℃	℃	%	%	毫米 mm	小時 hours	兆焦耳/米² MJ/m²	毫米 mm	度	公里/小時
一月 January	1018.3	19.6	17.3	15.5	11.6	70	60	4.5	133.3	10.14	73.4	060	24.9
二月 February	1020.2	21.2	18.7	16.5	12.0	67	40	Tr	182.6	13.33	94.9	070	24.9
三月 March	1011.5	22.7	20.4	18.4	17.5	84	76	23.6	99.4	9.35	64.5	070	25.1
四月 Apirl	1011.3	26.9	24.3	22.4	20.2	79	75	176.9	139.7	14.03	114.9	070	27.2
五月 May	1009.7	27.2	24.9	23.1	21.5	82	83	177.8	109.8	13.36	97.6	070	25.1
六月 June	1005.5	31.5	28.9	26.8	24.7	79	74	197.4	191.0	16.38	136.8	190	20.0
七月 July	1003.0	31.6	29.2	27.2	25.4	81	82	203.8	158.0	15.30	130.6	220	20.9
八月 August	1005.0	30.8	28.3	26.2	24.9	82	80	892.0	138.5	12.56	135.2	220	19.7
九月 September	1006.7	10.4	27.8	25.9	23.5	78	70	365.7	148.5	13.39	123.0	010	21.7
十月 October	1013.7	28.6	26.2	24.6	20.9	73	62	38.8	195.2	14.51	130.6	080	28.3
十一月 November	1017.1	24.5	22.2	20.3	16.2	70	53	15.7	191.2	13.03	105.5	070	29.1
十二月 December	1021.3	19.1	16.8	14.8	8.4	60	51	32.9	165.4	10.80	86.3	010	28.0
平均 / 總值 Mean/Total	1011.9	26.2	23.8	21.8	18.9	75	67	2129.1	1852.6	13.02	1293.3	070	24.6
正常 Normal	1012.9	25.7	23.0	20.9	18.6	77	65	2214.3	1948.1	14.46	1528.8	080	22.6
觀測站 Station	天文台 Hong Kong Observatory								京士柏 King's Park			橫瀾島 Waglan Island	

天文台於九月十六日08時09分錄得本年最低氣壓976.1百帕斯卡。
The minimun pressure at the Hong Kong Obeservatory was 976.1 hectopascals at 0809 HKT on 16 September.
天文台於八月二十一日14時50分錄得本年最高氣溫35.1℃。
The maximum air temperature at the Hong Kong Observatory was 35.1℃ at 1450 HKT on 21 August.
天文台於十二月二十三日05時51分錄得本年最低氣溫5.8℃。
The minimun air temperature at the Hong Kong Observatory was 58℃ at 0551 HKT on 23 December.
橫瀾島於九月十六日05時14分錄得本年最高陣風234公里/小時，風向020度。
The maximum gust peak speed recorded at Waglan Island was 234 kilometers per hour from 020 degrees at 0514 HKT on 16 September.
京士柏於九月十六日05時04分錄得本年最高瞬時降雨率180毫米/小時。
The maximun instantaneous rate of rainfall recorded at King's Park was 180 millimetres per hour at 0504 HKT on 16 September.

Tr-微量（降雨量少於 0.05 毫米） Tr-Trace of rainfall (amounr less than 0.05mm)

Table 2: Summary of Meteorological observations in Hong Kong, 1999

HANDLING AND STORAGE OF WOODING OF WOOD FLOORING

To ensure the wood flooring being stored in conditions of temperature and humidity similar to those which will prevail in the completed building, require the manufacturer to attach the moisture-meter reading (recorded before the flooring leaves the facilities) to invoice and packing lists for own checking.

When handling wood flooring, never truck, unload or store unprotected hardwood products in rain or other wet conditions. Besides, do not deliver wood flooring, skirting and components materials to site until immediately before required for fixing.

INSTALLATION OF WOOD FLOORING

For different types of wood flooring, i.e. solid wood and engineered wood, different installation methods shall be adopted:

Nail Down Procedure : Solid and Engineered
Staple Down Procedure : Solid and Engineered
Glue Down Procedure : Engineered
Floating Procedure : Engineered


Nail / Staple


Glue


Floating

Nail Down Procedure

Typically used with the 3/4 inches solid products, however there are adapters available for thinner products as well. 2 inches nailing cleats are used with a wood flooring nailer and mallet to attach the flooring to the subfloor. Solid strip floors or plank floors can only be installed on wooden subfloors on grade or above grade.

Staple Down Procedure

Staples are used versus nailing cleats to attach the wood flooring to the subfloor. A pneumatic gun is used to drive the staple into the wood flooring and subfloor. This procedure is easier than the nail down for do-it-yourself installations. Not all wood flooring manufacturers recommend the same staple gun. Read the manufacturers installation manual to assure you have the right staple gun and right size staples.

Glue Down Procedure

Mastic or adhesive is spread on with a trowel to adhere the wood flooring to the subfloor. Engineered wood floors and parquets can be glued down. Solid strip floors and plank floors can only be nailed or stapled. Even variety of adhesive with different properties is available in the market, manufacturers recommended adhesive shall be used when installing their flooring as not using their adhesive could void any warranties you may. Besides, read the manufacturers installation manual on coverage, drying time and ventilation when installing the flooring.

Floating Procedure

Floating refers that the flooring are not mechanically fastened to the subfloor. There is a thin pad that is placed between the wood flooring and the subfloor. A wood glue is applied in the tongue and groove of each plank to hold the planks together. The padding protects against moisture, reduces noise transmission and soften under foot. Some engineered floors and all longstrip floors can be floated. This is a very fast, easy and clean method of installation. Consult the manufacturer installation instruction to see if your flooring can be floated.

Remember, which type of installation method to be adopted is varied from different job site conditions. Consult with the wood manufacturer to decide which method is appropriate to particular site is a must to prevent the occurrence of any problem resulted from improper installation method. Notwithstanding to the above, followings are some quick points to be considered when installing wood flooring:-

PREPARATION OF FLOOR SLAB AND LEVELLING SCREEDING

The slab must be flat and level with a trowel finish, free of grease, oil, stains and dust. Since new concrete is heavy with moisture, the relative humidity of base slabs shall be ensured in a suitable level before beginning the subfloor.

Wood flooring should not be installed until after all concrete and plaster work are completed and dry. Therefore, schedule of the works well in advance of timing for wood flooring installation is essential to allow sufficient time for drying out and curing of the levelling screeding.

Where wood flooring is to be laid over newly dried-out wet-laid bases:-

- Turn off drying aids for not less than 4 days
- Test for moisture content using an accurately calibrated hydrometer in accordance with BS 8021 Appendix A; take readings in all corners, along edges and at various points over the areas being tested
- Do not lay wood flooring or components until all readings show 75% relative humidity or less.

Provision of vapour barrier

Before installation of levelling screeding, covering the slab with a vapour barrier as a liquid applied waterproofing system, and the waterproofing coating shall also be applied to a min. 75mm up the base wall surface from the base slab level.

Provision of vapour check membrane

Cover the entire levelling screeding with min. 0. 5mm polyethylene sheet, overlapping the edges with min. 100mm to provide a fully sealed barrier free from tears and punctures.

Fixing of plywood subfloor

Fixing the plywood subfloor to cement sand levelling screeding by using countersunk brass screws into plastic plugs. Do not use concrete nails as this may split and spall the levelling screeding.

Allow for Expansion

Design and provide expansion joints to all wood flooring for expansion movement of flooring materials. 3/4" gap is recommended to leave at the wall line for expansion.

Different Manufacturers Products

Do not randomly mix different manufacturers' products. Use transition areas such as doorways to separate the different products.

SURFACE FINISHES OF WOOD FLOORING

Wood in service usually is exposed to both long-term (seasonal) and short-term (such as daily) changes in the relative humidity and temperature of the surrounding air. Thus, wood flooring virtually always is undergoing at least slight changes in moisture content. These changes usually are gradual, and short-term fluctuations tend to influence only the wood surface. Moisture content changes may be retarded, but not prevented, by protective coatings, such as varnish, lacquer, or paint. Surface finishes are categorized into 2 main types, namely factory pre-finished and job-site finished.

FACTORY PRE-FINISHED

Followings are some typical factory pre-finished products available in market:-

(a) Polyurethane:
A clear, tough and durable finish that is applied as a wear layer

(b) Acrylic-urethane:
A slightly different chemical make up than Polyurethane with the same benefits

(c) Ceramic:
Advanced technology that allows the use of ceramics to increase the abrasion resistance of the wear layer

(d) Aluminum Oxide:
Added to the urethane finish for increased abrasion resistance of the wear layer

(e) Acrylic Impregnated:
Acrylic monomers are injected into the cell structure of the wood to give increased hardness and then finished with a wear layer over the wood

JOB-SITE FINISHED

In addition to pre-finish the hardwood in factory, the alternative of applying the finishes after flooring has been installed is also feasible to prevent quick deterioration of wood flooring. The varies finishes on the market today are all good finishes, however, the best finish is depended on varies life style and specific needs of end user. Following are some general comparisons between five selected types of finishes available in market:

Water Base Urethane

- Durability Very Good
- Mild Odor
- Clear to Amber Colour
- Fast Drying
- Non-Combustible
- Satin to Gloss Finish
- Easy to Apply

Oil Modified Urethanes (Solvent evaporates to cure)

- Durability Very Good
- Moderate Odor
- Amber in Colour
- Slow Drying
- Combustible
- Satin to Gloss Finish
- Easy to Apply

Moisture-Cured Urethane (Absorbs moisture to cure)

- Durability Excellent
- Strong Odor
- Clear to Dark Amber Colour
- Dries Quickly in High Humidity
- Combustible
- Satin to Gloss Finish
- Extremely Difficult to Apply

Wax or Oil Finish

- Durability Good
- Mild Odor
- Slight Amber in Colour
- Dry Time Varies with Product
- Combustible
- Wax Luster
- Water Spots

Conversion Varnish

- Durability Excellent
- Very Strong Odor
- Clear to Slight Amber in Colour
- Slow to Fast Drying
- Satin to Gloss Finish

When using any type of surface finishes, follow the manufacturer's recommendation for proper amount and consult wood flooring professional for recoat.

GUIDELINES FOR MAINTENANCE OF WOOD FLOORING

Type of finish on a wood floor dictates what proper maintenance steps should be followed. Therefore, maintenance procedures suggested by the finish manufacturer should always be followed. The followings are some general tips provided for maintaining the wood flooring in a satisfactory condition throughout its lifetime:

- Sweep your floors or use a dust mop daily, but do not use a household dust treatment, as this may cause your floors to become slick or dull the finish.
- Clean your floor's coated surface with a lightly dampened cloth using a recommended cleaning product, and according to the manufacturer's directions for use.
- Vacuum your floor regularly, as often as you would vacuum carpets.
- Never damp mop a wood floor. In all cases, use minimum water, because water causes deterioration of the wood itself, as well as the finish.
- Buy a "floor care kit" that your installer or flooring retailer recommends instead of counting on a home-made remedy of vinegar and water to clean your floors. Different finishes have different maintenance requirements, and it's best to follow professional advice in this area.
- Clean light stains by rubbing with a damp cloth.
- Avoid using mops or cloths that leave excessive water on the floor. Never let a spill of water dry on the floor.
- Control humidity levels by use of a dehumidifier or humidifier. You may need to add portable units in some rooms.
- Have your floors recoated periodically as the finish shows wear.
- Do not clean your wood floors with water or water-based products on a regular schedule. Clean only when necessary and clean only the soiled areas.

- Do not over-wax a wood floor. If the floor dulls, try buffing instead. Avoid wax buildup under furniture and other light traffic areas by applying wax in these spots every other waxing session.
- Put soft plastic or fabric-faced glides under the legs of furniture to prevent scuffing and scratching.
- For the cracks resulted under pressure from humidity, board replacement or injecting a special epoxy glue through the face of the plank will remedy the problem.

The above only are the general tips for maintenance of wood flooring, check the manufacturer's specific warranty guidelines and consult with manufacturer before any treatment on finished floors will help you to see how to make a great investment last much longer.

CONCLUSION AND RECOMMENDATION

With no doubt, all woods, not only beech, change their dimension in different moisture content of atmosphere, and also depending on the dimensional change coefficient of wood species. Therefore, the control of moisture content before, being and after installation, is critical to the performance of wood flooring.

Even beech is used to dry climate environment and of a relatively strong tendency to change dimension resulted from changes of moisture content, we can manage the expected expansion and contraction by following the guidelines recommended in the process of site preparation, storage, handling, installation and future maintenance so as to work successfully with wood flooring.

This report is only provided some general guidelines for someone who would like to use beech or other wood flooring. Consultation with wood manufacturer to cope with special job-site conditions, specific life style and individual needs is essential for obtaining the best performance of wood flooring.

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A NEW DIMENSION IN PLAN PROCESSING

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(This article has been presented in the Hong Kong Building Surveying' Conference 1998, in the then capacity of Chief Building Surveyor, PADS & Rail Section, Buildings Department)

ABSTRACT

Plan processing by building officials has traditionally been conducted in an authoritative approach, which would be acceptable when building codes were prescriptive. However with the increase in magnitude and complexity of building development projects, and the changes from prescriptive codes to performance codes, the traditional approach may not be effective. This paper looks at a new dimension of plan processing for want of more satisfactory results.

KEYWORDS: Building Officials, Plan processing, Professionalism

Plan processing is a necessary element of building surveying practice. It is obvious for those building surveyors in the building control practice as they spend most of their time processing plan submissions. It is also obvious for those building surveyors in the project management practice as they spend a lot of time checking proposals Corn authorized persons. It is also relevant for those building surveyors in the property management practice as they do spend time in checking proposed fitting-out or alteration works of their tenants. I hope this discussion will be of relevance to all building surveyors. To keep it simple, I will confine my discussion to plan processing by building control surveyors, or building officials, and I hope the concept could be extended to the other practices. It is a requirement under the Buildings Ordinance that all plan submissions must be responded within the prescribed statutory period, otherwise they will be deemed approved. The Ordinance sets out a long list of grounds on which approval may be refused, but there is no explicit requirement that submitted plans must be approved. It is therefore not surprising that the major activity of building officials has traditionally been the disapproval of plans. They would nonetheless approve some plans when they could not stretch their power anymore. For authorized persons (AP) who submit plans, it has always been an excitement and something to celebrate when they receive an approval.

In the last decade, development sites have generally increased in size and building projects have become more complex and sophisticated. There is often insufficient time for the building officials to fully consider the proposal within the prescribed statutory period for plan processing. It has therefore been the practice of many building officials to disapprove the plans on some issues while reserving the position on some other issues. This is one of the "tricks" they use to buy time. Sometimes this is understandable and many APs are sympathetic to the approach especially when they are fully aware that their submissions could never be approved without resolution of certain fundamental anomalies. However, in some other times this is not the case and I have received unofficial complaints that some building officials disapprove plans simply to demonstrate their authority, in other words, the "power play". Plans are disapproved just because the AP does not agree with the officer's interpretation of the regulations or the AP does not make the amendments on plan as dictated by the officer. I hope these are rare incidents that should not be too alarming. Nonetheless, all the traditional practices

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do reflect an "authoritative approach" in plan processing.

Hitherto the authoritative approach may be all that was required, to ensure total compliance with the prescriptive requirements of the regulations. It is however not necessarily the case now as the regulations are moving from prescriptive codes to performance-based codes.

Prescriptive standards do not apply equally in all cases and the performance-based approach requires assessment of compliance strategies. The authoritative approach is fault-finding and more fault-finding. Decisions are often inconclusive and inconsistent, sometimes even losing sight of the holistic objective of building control. While to disapprove unsatisfactory proposals is a legitimate exercise of authority, to approve acceptable proposals is the obligatory discharge of statutory duty. The authoritative approach in plan processing is certainly ineffective and unprofessional in the context of today's building control.

To be effective in plan processing, we should understand why we need to process plans at all. We process plans to ensure compliance with the regulations, but this is only part of the game. This is only the means, and just one of the means, but 'not the end of the building control process. Similarly the building control process is just one of the means in the overall building development process. In the building development process, developers plan, design and construct buildings and produce various types of accommodation to satisfy certain social need. It is imperative that they have their fingers on the pulse of social need so that they know exactly what to produce.

When developers submit plans, or provide the input into the system, they anticipate approval in the output. Building officials are duty-bound to process the plans. They are expected to be appreciative of the social need. They are expected not just to effect approvals of proposals but to deliver the approvals in a cost-effective manner. Cost-effectiveness works on both sides.

Building officials expect the submission plans to show full compliance in all respects and developers expect prompt and straightforward approvals. This is the utopia scenario that is not available in real life, but we can all work towards it and create a win-win situation. The concern here is what happens in the throughput inside the black box of plan processing.

In the black box of plan processing, building officials use their expertise to scrutinize the plans, identify anomalies if any, and demand their rectification before approval. What affects the output is not what they do but really how they do it. It is not how much expertise they possess but really with what attitude they approach the process. The motive is more important than the deed. The motive is the driving force and the deed is only its outcome. The attitudinal dimension is more important than the technical dimension. It is relatively easier to improve on the technical dimension, their expertise and specialized knowledge. Yet it would be much difficult to introduce an attitudinal change if an undesirable attitude has been deeply entrenched. It will need a metamorphosis, if not a miracle. So if a child will decide at 3 what he will become at 80 ( ), we must start young and instill the desirable elements of professionalism at the commencement of our professional career.

Building officials are professionals rather than bureaucrats, or technocrats. They should demonstrate their professionalism, and not bureaucracy.

Building officials are experts in the building codes and there should be no difficulty for them to identify any anomalies in building plans or non-conformity with building regulations. Building officials have the privilege of reading a lot more building plans than anybody else. They will develop and improve their expertise if they will adopt a problem-solving approach to plan processing, and demonstrate a positive attitude with the courage and the confidence to approve plans instead of disapproving them.

In plan processing, the objective is indeed to confirm that the proposed building works comply with the

provisions of the building regulations in achieving an acceptable standard of safety and health. Simply to identify anomalies is not enough. It is also necessary to overcome the anomalies to facilitate approval. In order to identify solutions, it is necessary to diagnose the problems first. The diagnostic approach should be no stranger to building surveyors, the so-called "building doctors". While we are involved in the pre-natal stage of building developments, we need to understand the project objective, the design concept and the planning constraints. We need to appreciate the attempts taken to overcome non-conformities with the building codes, the strategies adopted to achieve safety and health standards, the expectation of ultimate users, as well as the probable effects on the neighbourhood and on the environment.

In medical terms, you look, sniff and inquire before you diagnose. ( ). In plan processing, we do the same. We look at the plans. The plans will illustrate the design and constructional form of the new buildings but they do not necessarily tell you much of the design concept, the planning constraints and the rest of it. So we sniff around trying to find out more. Unfortunately, very often our sniffing is clouded with illusions, misunderstanding or misinterpretation, The more effective way is to inquire with direct communication. Yet many building officials are reluctant to act, or they act with bias and predetermination, rather than with an open mind.

Indeed, communication does not always produce agreement, but it can certainly clarify a lot of issues, obviate unnecessary guesswork and cultivate understanding Communication with an open mind will help identify and confirm fundamental issues and establish the principles and strategies to resolve anomalies. Communication by way of presentations and discussions can take place prior to submission of plans or even prior to finalization of detailed designs. With such "pm-processing", the building plans will no doubt be more fundamentally "approvable" when they are formally submitted. Further dialogue during the early stage of plan processing will also help iron out other technical anomalies to facilitate early approval. Where building codes are to be implemented on the principle of equivalency, multilogue with all interested parties will help all actors put the building proposal in conceptual perspective instead of tackling fragmented problems singularly and individually. This will eliminate unnecessary disapproval and resubmission thus creating savings in paperwork and handling. This will also reduce the overall time for plan processing and guarantee more satisfying building proposals.

This new dimension in plan processing is in fact nothing new. It boils down to the, old familiar word "professionalism". To understand not only what we do and how we do it, but also why we do it and why we do it in a particular way. I am not calling for any revolutionary approach in practice but just to advocate that we should return to the basic approach in plan processing, thoroughly understanding our role in the whole building control process and practising our specialization with a positive attitude of facilitating building development.

It is with this approach I lead the PADS & Rail Section in the Buildings Department to handle the new airport and railway projects. We have pledged to process and approve plans to meet development programme schedules. The Centralized Processing Co-ordinating Committee (CPCC), which was created to provide a forum for open and direct communication among all relevant interested parties, has been instrumental in resolving anomalies, overcoming problems, soliciting constructive input from interested departments, guiding positive responses from APs and their consultants, and ultimately expediting approval. The procedure for plan processing encompasses an element of preprocessing. Our statistics for January to September of this year (1997) indicate that the average time taken to approve or accept a submission was only 57.2 days, which is well within the prescribed statutory processing period of 60 days for first submission of building plans. Furthermore, building surveyors in my Section perform as project managers monitoring all categories of submissions (for approval, for consent, for certifications, for

permits, etc.) as required under the Buildings Ordinance, foreseeing probable problems, resolving them before they exacerbate, and assisting in keeping the projects on schedule. They are not supermen or superwomen but they don't play any tricks. They simply carry out their duties diligently and act professionally to render a level of service that is well received by our customers.

The Chief Executive Mr. C.H. Tung, through his policy address on 8 October 1997, has set a target of producing not less than 85,000 flats a year. He said, "'My Administration has responded vigorously to the challenge..... developed a realistic production programme and has revised the procedures for land and housing development to ensure that absolute priority is given to housing." The Financial Secretary Mr. Donald Tsang who chairs the Committee on Land Supply for Housing (HOUSCOM), which is responsible for ensuring and overseeing this level of production, has recently announced certain streamlining of approval processes, which include, inter alia, to decide in principle on building proposals within 45 days, and to improve the centralized processing system to reduce checking, encourage discussion with authorized persons and promote self-regulation.

In order to fulfil this commitment, building officials should adopt a more pragmatic approach to plan processing and, as suggested by the Financial Secretary, reduce checking to. The fundamental, and allow APs to attend to the non-fundamental and other conditional or advisory aspects as a matter of self-regulation. No matter what changes we introduce to plan processing, the basic dimension is unchanged. I urge you building control surveyors, and building surveyors in other practices as well, to return to the basic, and to approach plan processing with professionalism. It may take great pain to effect an attitudinal change but it will eventually lead to cultural change, that building officials and building professionals can truly collaborate in partnership for the betterment of the built environment. This is also the way to broaden our expertise and promote building surveyors as the chosen professionals for building control.

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開拓設施管理新路向

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概　論

設施管理(Facility Management)是一種新興的專業服務，而全球對設施管理服務的需求正急速增長。為了加強我們的競爭力，香港的設施管理業已經發展成熟，其間引進了不少嶄新的概念，成功地結合不同的電腦智能工具及軟件。數碼化的設施管理服務已被認定將會為從事建築及物業管理人士帶來新的機遇，促使這些專業人士成為公共和私人機構的資產和設施的監理者。他們的努力令樓宇和設施發揮最大的用途和價值，僱用他們的機構將更具實力去接受二十一世紀的新挑戰。

電子商貿與設施管理

電子商貿(e-Commerce)在今天已成為大家熟悉的熱門話題，它不斷地滲透到各大小私人公司及公共機構，最終很可能令每一個人都成為它的用戶。互聯網及內聯網技術被迅速接受發展，一日千里，同時又得到商界普遍認同和廣泛採用，這可以說是二十世紀末非常突出的創新發明之一。

不久的將來，大部份的私人或公共機構都會將自己改革成為以「電子商貿」為中心主導的組織。據全球市場調查公司AC尼爾信的一項報告指出，亞洲現時的上網人數為一千四百萬人。亞太區互聯網普及程度在未來數年將會繼續蓬勃發展，估計上網人數在二零零二年前，將增加三倍達至六千萬人。電子商貿的急速增長也催化了數碼設施管理的發展，本港的主要物業管理組織將體會到在設施管理服務中電子媒體的快捷、可靠及經濟的潛力。這些資訊科技的發展，對從事物業及設施管理的專業人員極具影響。

自動化設施管理的歷史

大約在一九七六年，一些最初期的自動化設施管理的應用軟件已經發展完成，但當時的軟件只限於在大型電腦及以財務管理為基礎的應用。以現今的電腦標準來看，當時的軟件只是簡單的試算表和資料庫而已，在軟件的專用性上，它們並不能應付複雜的商業用途。

在一九七零末至一九八零初期間，應用設施管理的開發者已成功把這些軟件用於大型主機及工作台電腦上，但應用這些軟件的成本普遍要用上數以千萬美元。

從一九八五年開始，「電腦輔助設施管理」(Computer Aided Facility Management)令數以千計的設施管理專業人士受惠，企業化科技優勢使「電腦整合設施管理」(Computer Integrated Facility Management)得到迅速的發展，在九十年代已成為非常成功的商業產品。

「電腦整合設施管理系統」使電腦輔助設施管理和廣泛的企業通過資訊科技系統得以連繫，國際性商業機構通過區域網絡(LANs)、遙控區域網絡(RANs)、廣泛區域網絡(WANs)及衛星區域網絡(SANs)與全球各地的分公司緊密連繫。而人力資源管理、財務管理、行政管理、銷售管理、市場管理及其他管理系統便成為自動化設施管理的主要範疇。世界上第一代的「電腦整合設施管理」企業方案始創於一九九零年初，現今美國已有超過二十萬家設施管理經理採用了自動化設施管理系統，其中「電腦整合設施管理系統」的運作成本也減低至每位用家三千美元左右。

在一九八九年，「設施管理數碼資訊網絡」(FM-Cyberspace)的新概念已引進到設施管理專業上。到了公元二千年，自動化設施管理的應用將會有急劇的轉變，設施管理數碼資訊網絡將會有驚人的增長。

設施管理數碼資訊空間帶領設施管理者進入二十一世紀

「設施管理數碼資訊空間(espace™)已普遍被設施管理者(FM-Cybrarian)認為是新的機會。位於美國波士頓市世界領先的自動化設施管理發展商，在一九九零年發展出第一代世界性設施管理數碼資訊網絡系統。在一九九九年一年內設施管理數碼資訊空間有超過二十五萬個新用戶；估計到二零零五年，「設施管理數碼資訊空間」的用家將會超過一億。

「設施管理數碼資訊空間」的引進將推動全球機構的設施運用、公司架構、產品分銷、數據處理、資訊分析的發展路向，而每用戶的設立費用是少於一百美元。

「設施管理數碼資訊網絡」給予策略性行政人員選擇的科技工具

「電腦輔助設施管理」和「電腦整合設施管理」工具在機構重組，資源調配及削減開支上一向都扮演非常重要的角色。新一代的「設施管理數碼資訊系統」提供行政人員使用視覺用戶界面(VUI™)來管理企業解決方案、數據和資料，用戶只需按下滑鼠便能很容易地使用其巨大的力量。

視覺用戶界面是一種令普通用家也能一學即會地使用「設施管理數碼資訊系統」的工具。它能迅速給予數千

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用戶同時存取數百企業的資料，擁有視覺用戶界面的「設施管理數碼資訊空間」將會成為在二千年成功電子商貿機構的重要支柱。

互聯網和內聯網促使新的商業運作進入二十一世紀，「設施管理數碼資訊空間」將會用來應付未來管理和成本上的問題，它的龐大專業系統及電子信息有助機構作出未來的商業決定，並在選擇合作夥伴、合併公司和評估日後變化情況均能作出具體的分析。

在明日的電子經濟裏，策略性行政人員將透過「設施管理數碼資訊空間」和視像用戶界面來管理企業的設施，使機構可善用資源、節省人力和提供最佳的產品和服務，以致機構變為更具生產力、賺取更高盈利和令顧客更滿意。

遙距監控及模擬真實科技和「設施管理數碼資訊空間」的配合

在「設施管理數碼資訊空間」上，不單能透過互聯網絡提供設施數據，還可以作真正即時的監察和控制，包括「出入管制系統」、「遙距保安監察系統」，「機電設施及能源監控系統」及提供「管理專訊頻道」等。當任何設施發生事故，「設施管理監控員」可第一時間從網絡得到警報訊息，並可經網絡即時知會有關的工程人員，更可由遙距攝像器觀察現場環境，即時採取適當的應變措施，全面發揮多元化先進智能管理技術。

此外，模擬真實科技可配合「設施管理數碼資訊空間」的應用，使設施管理更有效率。模擬真實科技(Virtual Reality)是一種用戶憑專業儀器裝置的幫助或靠在電腦螢幕中觀看虛擬模型，令你在模擬的建築物內隨意走動和觀摩當中的每一細節，從而體驗這個仿真的立體世界。由設計到建築階段中不斷集合所有的資料來製造虛擬的模型，設施管理者便可用模擬真實模型去管理樓宇的各方面設備，而樓宇的資料可在「設施管理數碼資訊空間」上無時間和地區限制下互動交流。業主或顧客可隨時得到樓宇的資料，資料內容和檔案大小更可無限擴展，當中資料例如業權、租用歷史、樓宇價格與趨勢走向等可幫助未來的物業交易在更佳的情況下成交。

使用這嶄新的管理概念，設施管理者將無需進入真正的樓宇內，而可以了解樓宇設施的情況，例如設施的位置、形狀和價值等。在日後進行樓宇評估的時候，設施管理者透過「設施管理數碼資訊空間」可即時得到樓宇的資料和作出報告。

另一方面，設施管理者可以更有系統地處理樓宇的老化或病態的出現。由於對建築物有足夠的紀錄及深入了解，老化部份的更換及安裝程序亦變得更有效率和更安全。

結　論

物業發展的過程中需要很多專業人士的參與，例如建築師、工程師、測量師、會計師和銀行家等等。對項目的整體控制是需要一些特別的控制技巧來聯繫各方，但這些技巧在個別的專業領域裡發展有一定的困難。在今天市場上，個別電腦軟件的協助，例如製作電腦畫象、流程分析、作業編排、成本控制、設施管理等，集合這些軟件成為一個統一而有效的設施管理程序是知難行更難的工作。

由於物業發展牽涉到不同的複雜相互關係，任何一個最簡單的變動，都可能會對其他專業人仕構成極大的虛耗工作和時間上的損失，故此，我們相信只有以「設施管理數碼資訊空間」為基礎，促使各單位的資料可以互相傳送，達到協力統籌才可成功地做到整體控制。這個系統大大加強了對物業發展過程的監管，亦可隨時為發展商、專業人士和用戶對產品提供一幅清晰的畫象。適當地分發第一手資料，使發展商和建築師在改良設計時，可直接傳送予其他專業成員，各方面可據此作仔細分析評估改動的影響以及計算最終成本等，期望盡量縮短落實商業及技術決定的時間。

我們深信要全面控制複雜的物業發展過程，採用模擬真實的「設施管理數碼資訊空間」會是踏進正確的一步。這是透過建立一個共用系統，讓各專業人士共同參照。此系統更可安排各類的資料檔案逐步建立，及引進不斷升級的電腦技術。這過程由初步設計階段至結合發展過程的不同層面，包括可行性研究設計理念、投資分析、發展編序、耗用成本研究、銷售與出租策略及設施管理等。

ISO 9000(品質系統)的要求也可完全結合於「設施管理數碼資訊系統」中。所以，設計與建築過程的每一部份都可以有系統地查核，任何錯誤或缺點都可即時矯正，實際的建築紀錄圖則差不多是同步得到。

「電子商貿」改革將成為二十一世紀的標誌，更多行政人士將會使用設施管理和「設施管理數碼資訊空間」來為機構去創造新的商業機會，而且聘請設施管理者將成為商業上的新需求，也是今日設施管理專業人士的新機會。設施管理專業人士必須尋找和應用所有技術來提升機構的管理能力，包括工程項目管理，租務管理、空間管理、有形資產管理、電訊網絡管理和物業運作管理等，並能在互聯網提供咨詢及協助服務，未來的公司將更全面運用「設施管理數碼資訊空間」來統籌財務、行政、推銷、市場推廣、人力資源、資訊、生產等活動。

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Instructions for Authors

1. Submission

Authors should submit four copies of their papers to facilitate refereeing with original artwork to Dr. S.M. Lo, journal co-ordinator, of Department of Building & Construction, City University of Hong Kong, Tat Chee Avenue, Kowloon Tong, Hong Kong. It will be assumed that the authors will keep a copy. Papers will be refereed by acknowledged experts in the subject area. Only those receiving favorable recommendations from the referees will be accepted for publication.

2. Effective communication

The paper should be written and arranged in a style that is succinct and easily followed. An informative but short title, a concise abstract with keywords, and a well-written introduction will help to achieve this. Simple language, short sentences and a good use of headings all help to communicate information more effectively. Figures should be used to aid the clarity of the paper.

3. Manuscript

(a) Length: although there is no length limitation, papers should fall within the range of 1,000-3,000 words. The manuscript is preferably in English, typed in double spacing on one side of A4 Paper only, with a 4-cm margin on the left-hand side. The pages should be numbered consecutively. There should be no loose addenda or notes or other explanatory material. The manuscript should be arranged under headings and subheadings.

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(e) Measurements: metric units should be used; if other units are used then metric equivalents should be given in parentheses.

(f) References: the Harvard system is used. References in the text should be quoted in the following manner:

Chan (1997) or Lo and Yuen (1997), or if there are more than two authors, Yuen et al. (1997). References should be collected at the end of the paper in alphabetical order by the first author's surname. If references to the same author have the same year, they should be differentiated by using 1980a and 1980b etc. The style should follow the examples below:

Chan, K. (1997) A comprehensive approach to building management, maintenance and safety inspection of private buildings in Hong Kong. Surveying, Hong Kong Institute of Surveyors, vol.6, Issue 8, pp1-3.

Feld, J. and Carper, K.L. (1977) Construction Failure, 2nd Ed., John Wiley & Sons, Inc, New York.

If no person is named as the author the body should be used - for example: Hong Kong Institute of Surveyors (1998) The Engagement of Building Surveyors, Hong Kong.

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