

Canada Mortgage and Housing Corporation

**EXPANDING THE KOREAN MARKET
FOR RESIDENTIAL WOOD-FRAME CONSTRUCTION**

FINAL REPORT

January 1998



LARDEN MUNIAK CONSULTING INC.

In Association with:
SANG-MAN YOUN ARCHITECT

EXPANDING THE KOREAN MARKET FOR RESIDENTIAL WOOD-FRAME CONSTRUCTION

TABLE OF CONTENTS

EXECUTIVE SUMMARY	i
PURPOSE AND SCOPE OF STUDY	1
THE MARKET FOR RESIDENTIAL CONSTRUCTION	2
<i>MARKET SIZE</i>	2
<i>DWELLING TYPES</i>	2
<i>COST OF HOUSING</i>	2
<i>WOOD-FRAME MARKET</i>	2
IMPEDIMENTS TO INCREASING THE USE OF WOOD-FRAME CONSTRUCTION	3
<i>SOUTH KOREAN BUILDING LAW</i>	3
<i>NON-REGULATORY IMPEDIMENTS</i>	6
POSITIVE FACTORS	8
STRATEGIZING AN EXPANSION OF THE SOUTH KOREAN MARKET FOR WOOD-FRAME CONSTRUCTION	10
<i>THE AUDIENCE</i>	10
<i>THE MESSAGE</i>	13
Scope of the Initiative	13
Acceptance in Other Jurisdictions	15
Advantages to Korea	15
Industry and Infrastructure Shortfalls	16
<i>DELIVERING THE MESSAGE</i>	17
APPENDIX A	
KOREAN CONSTRUCTION LAW: TRANSLATED EXCERPTS	
APPENDIX B	
ADVANTAGES OF WOOD-FRAME CONSTRUCTION TO KOREA	
Advantages of Wood-Frame Construction to South Korea	
Precautions	
APPENDIX C	
PROMOTING CANADIAN MULTI-UNIT WOOD-FRAME CONSTRUCTION	
Generic vs. Pro-Canadian	
National Building Code of Canada	
APPENDIX D	
BIBLIOGRAPHY	

EXECUTIVE SUMMARY

The residential construction market in South Korea is large by Canadian standards; in recent years over 500,000 units have been constructed annually. A strong demand is expected to continue for a number of years.

In the 1990's, most residential development has consisted of reinforced concrete apartment structures. Less than 10% of recently constructed dwellings have been of the single family-type; most of these have been constructed of masonry or concrete.

Very high land costs in urban areas (particularly in greater Seoul, which accounts for some 40% of the South Korean population) have encouraged high-rise development. This construction is dominated by the construction arms of major industrial conglomerates.

However, there has been a recent upsurge in North American-style single family wood-frame house construction in suburban areas. The U.S.A. and Canada are the leading suppliers of wood materials for this construction. American interests have been promoting wood-frame house construction and have sponsored carpenter training seminars.

Given the size of the South Korean market, there is potential to expand the scope of residential construction to include wood-framed multi-unit residential buildings. There is both academic and small builder interest in such potential, based on CMHC contacts to date.

The Korean building code and urban fire districts severely limit the use of wood-frame construction. In multi-unit residential buildings, all demising walls must be of noncombustible construction. If second floor residential use exceeds 400 m² in a building, noncombustible construction is required. Where a building is 3 or more storeys in height, all structural elements must be noncombustible.

High density urban areas may be designated as special fire zones in which almost all structures must be of noncombustible construction.

South Korean test standards for evaluating fire-resistivity of construction materials differ from comparable North American standards.

Arguments in favour of extending the scope of combustible construction extend beyond project-specific technical and cost advantages. South Korea realizes that the small firm business sector (which in North America includes a large portion of the wood-frame construction industry) needs to be enhanced to stimulate overall national economic health.

It is apparent that the major impetus for change must come from within the South Korean construction industry. To this end, the potential benefit of wood-frame construction must be communicated to builders, architects, trades, potential institutional purchasers and regulators.

Canadian interests have been involved in Japan's incremental acceptance of multi-unit wood-frame construction. This experience may be constructive in promoting multi-unit wood-frame construction in South Korea.

Canada can mount an independent campaign to persuade South Korea to expand the permitted scope of wood-frame construction; alternately, it may be possible to work together with American interests.

Expansion du marché coréen de la construction résidentielle à ossature de bois : rapport final

Préparé par la firme Larden Muniak Consulting Inc. en collaboration avec l'architecte Sang-Man Youn. Agent de projet de la SCHL : Jay Thakar. Ottawa : Société canadienne d'hypothèques et de logement, 1998.

Ce rapport résume les résultats d'une étude menée sur les obstacles réglementaires et sur d'autres entraves à l'expansion éventuelle du marché sud-coréen de la construction de collectifs d'habitation à ossature de bois de type canadien. L'objectif global de l'étude était de trouver des moyens d'accroître les perspectives de vente de matériaux, d'équipement et de services professionnels reliés à ce type de construction en Corée du Sud.

Les auteurs fournissent un aperçu du marché du logement et résument les exigences du code du bâtiment sud-coréen qui régissent la construction de collectifs d'habitation et limitent la production d'immeubles à ossature de bois. Ils commentent aussi les activités du secteur de l'habitation sud-coréen dans l'optique de la construction à ossature de bois, ainsi que des perceptions de divers intervenants sud-coréens concernant l'expansion éventuelle du marché de la construction à ossature de bois. Ils abordent en outre les considérations stratégiques relatives au développement possible de ce marché.

Expanding the Korean Market for Residential Wood-Frame Construction

Résumé

Le marché de la construction résidentielle de la Corée du Sud est étendu, selon les normes canadiennes; ces dernières années, il s'est construit plus de 500 000 logements par an. On s'attend à ce que la demande reste forte pendant encore quelques années.

Dans les années 1990, la plupart des constructions résidentielles étaient constituées d'immeubles d'appartements en béton armé. Par contre, moins de 10 % des logements récents appartenaient à la catégorie des maisons individuelles, la plupart étant construits de maçonnerie ou de béton.

Le coût très élevé des terrains en milieu urbain (en particulier dans la région métropolitaine de Séoul, qui compte pour quelque 40 % de la population de la Corée du Sud) a favorisé la construction de tours d'habitation. Ce genre de construction est dominé par la division de la construction des importants conglomérats industriels.

Par contre, la construction de maisons individuelles à ossature de bois de type nord-américain a récemment connu un regain de popularité en milieu suburbain. Les États-Unis et le Canada constituent les principaux fournisseurs de matériaux en bois pour ce genre de construction. Les intérêts américains ont fait la promotion de la construction de maisons à ossature de bois et ont parrainé des séminaires de formation des charpentiers.

Vu la taille du marché de la Corée du Sud, la possibilité existe d'étendre la construction résidentielle aux immeubles collectifs à ossature de bois. D'après les contacts de la SCHL établis jusqu'à présent, aussi bien les établissements d'enseignement que les petits constructeurs ont manifesté de l'intérêt à exploiter ces possibilités.

Le code du bâtiment de la Corée et les services urbains de lutte contre l'incendie limitent sérieusement le recours à la construction à ossature de bois. En effet, tous les murs mitoyens des immeubles résidentiels collectifs doivent être de construction incombustible. Le bâtiment dont plus de 400 m² de la surface du deuxième étage sont affectés à des fins résidentielles doit être de construction incombustible. De même, tous les éléments structuraux d'un bâtiment d'une hauteur de 3 étages ou plus doivent être de construction incombustible.

Les zones urbaines à forte densité peuvent être désignées comme zones spéciales de lutte contre l'incendie où tous les bâtiments doivent être de construction incombustible.

Les normes sud-coréennes d'évaluation de la résistance au feu des matériaux de construction diffèrent des normes semblables en vigueur en Amérique du Nord.

Les arguments prônant l'élargissement de la portée de la construction combustible vont au-delà des avantages techniques et financiers propres aux bâtiments. La Corée du Sud se rend compte que le secteur des petites entreprises (qui comprend en Amérique du Nord une forte proportion

du secteur de la construction de maisons à ossature de bois) a besoin d'être relevé de façon à stimuler la vigueur économique de l'ensemble de la nation.

Il est évident que le profond désir de changement devra venir du secteur de la construction de la Corée du Sud. À cette fin, les avantages possibles de la construction à ossature de bois doivent être communiqués aux constructeurs, aux architectes, aux corps de métier, aux acheteurs institutionnels éventuels et aux organismes de réglementation.

Des intérêts canadiens ont moussé l'acceptation progressive de la construction de bâtiments collectifs à ossature de bois en Corée du Sud.

Le Canada peut organiser une campagne indépendante en vue de persuader la Corée du Sud d'étendre la portée autorisée de la construction à ossature de bois; sinon, il pourra peut-être envisager d'unir ses forces aux intérêts américains.

CMHC SCHL

Helping to
house Canadians

Question habitation,
comptez sur nous

National Office

Bureau national

700 Montreal Road
Ottawa, Ontario
K1A 0P7

700 chemin de Montréal
Ottawa (Ontario)
K1A 0P7

Puisqu'on prévoit une demande restreinte pour ce document de recherche, seul le sommaire a été traduit.

La SCHL fera traduire le document si la demande le justifie.

Pour nous aider à déterminer si la demande justifie que ce rapport soit traduit en français, veuillez remplir la partie ci-dessous et la retourner à l'adresse suivante :

Le Centre canadien de documentation sur l'habitation
La Société canadienne d'hypothèques et de logement
700, chemin de Montréal, bureau C1-200
Ottawa (Ontario)
K1A 0P7

TITRE DU RAPPORT : _____

Je préférerais que ce rapport soit disponible en français.

NOM _____

ADRESSE _____
rue app.

_____ ville province code postal

No de téléphone () _____

TEL: (613) 748-2000

Canada Mortgage and Housing Corporation

Société canadienne d'hypothèques et de logement

Canada



Expanding the Korean Market For Residential Wood-Frame Construction

This report summarizes a study of regulatory and other impediments to the potential expansion of the South Korean market for Canadian-style wood-frame construction for multiple unit residential buildings.

We first introduce the purpose and scope of the study and provide an overview of the housing market. We then summarize South Korean building code requirements which affect multiple unit residential construction and limit the use of wood structures. We also discuss the activities of the South Korean housing industry in respect of wood-frame construction, as well as perceptions of a variety of South Korean sources regarding the possible expansion of the wood-frame construction market. Strategic considerations respecting this potential expansion of market are also identified.

Canada Mortgage and Housing Corporation commissioned the study and holds copyright in respect of this report.

PURPOSE AND SCOPE OF STUDY

The overall goal of the study was to identify means of eventually increasing sales of Canadian wood-frame residential construction materials, equipment and professional services in South Korea. Terms of reference indicated that such an increase could be stimulated by an expansion of wood-frame construction to low-rise, multi-unit residential buildings.

The immediate objective of the study was to ascertain current impediments to the use of wood-frame construction for low-rise multi-dwelling unit buildings and to provide a strategy for the removal of such impediments. It was recognized that in addition to the obvious regulatory impediments, there may also be societal, historical or economic impediments.

The study included the following activities:

- Translation and review of South Korean Building Code restrictions on wood-frame construction.
- Meetings and interviews with groups and individuals in South Korea in order to more fully identify issues, including:
 - South Korean governmental officials
 - South Korean construction industry association representatives
 - South Korean housing research representatives
 - Canadian Embassy officials in South Korea
 - House builders active in South Korea's wood-frame construction industry
 - South Korean academics with an interest in wood-frame construction.
- Preliminary presentation of observations and discussion of strategic issues at a 16 September 1997 meeting with representatives of CMHC, the Department of Foreign Affairs and International Trade, Natural Resources Canada, the National Research Council of Canada, the Council of Forest Industries (COFI) and the Canadian Home Builders Association.
- Telephone interviews with representatives of Underwriters' Laboratories of Canada (ULC), Canadian Wood Council and Forintek Canada Corp.

Expanding the Korean Market for Residential Wood-Frame Construction

THE MARKET FOR RESIDENTIAL CONSTRUCTION

MARKET SIZE

The population of South Korea is approximately 46 million persons. Of this number, approximately 18 million live in Seoul and the surrounding area.

The South Korean housing market is significant. Although in recent years in excess of 500,000 dwelling units have been constructed annually, there is still a need for additional housing. Approximately 1 in 5 households shares a dwelling unit with another household. In the Seoul area the ratio is closer to 2 in 5.

The rate of population growth in South Korea is expected to slow over the next 20 years. However, due to the existing significant shortage, desire for newer and bigger housing and increasing prosperity, a large housing market is expected to be maintained for the next 20 years.

Many South Koreans expect that North Korea will open up to outside investment and, perhaps, full reunification. If this were to occur, it would likely create a much larger housing demand.

DWELLING TYPES

In the early 1980's, single family dwelling construction represented about 36% of new construction while apartments represented approximately 50% of new residential construction. By the early 1990's, the portion of single family dwelling construction declined dramatically to about 9% while the portion of apartment construction rose to about 80%. The recent sharp increase in the ratio of apartment construction may be partly explained by superiority of new construction and communal facilities; however, government planning policy and land costs in urban areas figure significantly in this change.

It has been suggested that the current relative amounts of construction between high-rise apartments and other forms of housing could change significantly. Recently there has been a significant increase in the construction of suburban houses attributed in part to dissatisfaction with apartment life style.

COST OF HOUSING

Housing is expensive in South Korea. On average, an apartment costs 8 to 10 times the yearly income of the household. Less than half of the households own their dwellings. However, a relatively small portion (about 10%) of construction of dwellings is for the rental market. On this basis, there appears to be a large market for rental dwelling units. This situation appears to represent an opportunity for expansion of wood-frame construction into multiple-unit residential buildings.

WOOD-FRAME MARKET

Up until the late 1960's almost one-half of South Korean dwellings were of indigenous wood-frame construction. Subsequently, concrete construction took over most of the construction market.

Recently there has been an increased popularity of North American-style wood-frame houses, particularly in suburban areas. Purchasers are characterized as having above average income and their new houses are often second homes or retirement homes that are usually custom built. This appears to be a niche market, given the relative cost of such buildings. Nonetheless, the surge in wood-frame construction activity in this area strongly suggests there is a base to build upon in terms of expanding the scope of wood-frame construction in South Korea.

Expanding the Korean Market for Residential Wood-Frame Construction

Given South Korea's need for large numbers of dwellings, there appears to be a significant potential market for wood-frame multiple-unit residential construction.

Demographic data support additional opportunities for wood-frame construction. The population of South Korea has a large number of people approaching retirement age and it is felt that senior citizen retirement facilities and similar developments outside of the most congested urban areas are a viable opportunity for wood-frame construction.

Within urban areas – particularly Seoul – there may be opportunities for development of wood-frame apartment buildings in greenbelt areas and on hillside sites. The hills in and around Seoul have not been extensively developed but the pressures of expanding populations suggest that this may change to some extent.

Other opportunities have been identified in terms of fishing and farming communities. For example, the National Corporation for Development of Fishing and Agriculture has responsibility for the provision of low-cost housing in such communities. Evidently, prototype precast concrete housing has been developed for this market. It appears likely that wood-frame construction could provide a flexible low-cost alternative for such housing.

IMPEDIMENTS TO INCREASING THE USE OF WOOD-FRAME CONSTRUCTION

SOUTH KOREAN BUILDING LAW

Construction regulations in South Korea severely restrict construction of wood-framed multi-unit residential buildings. It appears that this situation is based on a number of factors.

High density development in Korean cities suggests that noncombustible construction is appropriate in order to limit fire spread between buildings.

It has been suggested that the memories of the devastation of war have promoted the notion that regulations should mandate strong, durable and fire-resistant construction.

The Korean War had a very negative impact on forests and has contributed to limiting timber production in South Korea. On the other hand, materials used in concrete are produced in quantity in Korea, although the rapid increase in construction in the 1990's saw an increase in the importing of cement and reinforcing steel.

Significant regulatory restrictions that prevent or impede the construction of Canadian-style wood-frame residential buildings are summarized as follows:

- Buildings incorporating major structural components of wood are limited in height to 13 m (9 m to an eave) and in gross floor area to 1,000 m² (p.7, Appendix A).
- Demising walls between dwelling units must always be of noncombustible construction and acoustically insulated. Concrete or masonry construction is specifically identified for these purposes. (p.10, Appendix A).
- Noncombustible construction is required where the second floor of a building is used for a "multi-family house" or apartments, and the gross floor area exceeds 400 m² (p. 12, Appendix A).

Expanding the Korean Market for Residential Wood-Frame Construction

- Noncombustible construction is required for a multi-unit residential building 3 or more storeys in height (p. 12, Appendix A).
- Where the gross floor area of a wood structure building exceeds 1,000 m²:
 - the building must be divided by firewalls so that each portion does not exceed 1,000 m² in gross floor area,
 - exterior walls and eaves may require fire-resistive construction, depending on setbacks and the nature of opposing properties, and
 - roofs are required to be of nonflammable material.

Due to restrictions on use of wood in multi-storey construction, the requirement would usually apply to a single storey structure. However, such a large, single storey residential building is not likely to be constructed (at least in an urban area) as it would be a very inefficient use of expensive land.

- In specially designated fire safety districts, all buildings are required to be of noncombustible construction, except 1-storey accessory buildings not exceeding 50 m² in area and having fire-resistant or noncombustible exterior wall and eave surfaces. These fire safety districts are typically located in the older, more densely built-up portions of large cities.

The Korean construction regulations define *noncombustible, nonflammable material* and *fire preventive construction* by giving a number of specific examples of assemblies of noncombustible material. Materials are specified (e.g. concrete, steel, brick, stone, glass block, clay roof tile) and in many examples, the minimum thicknesses of materials are also described.

Table 1 illustrates major impacts that South Korean regulations would have on combustible multi-unit residential buildings that would be permitted by the 1995 National Building Code of Canada (NBCC).

If a designer wishes to use a material or assembly not specifically described in the regulations but which is required to be fire-resistive or rated, there is an allowance whereby alternate materials may be used if they have been successfully tested by the National Construction Research Institute (NCRI) which is part of the Ministry of Construction and Transportation.

There is no specific allowance in the regulation for accepting test results from other agencies. In addition, Korean fire testing imposes somewhat more severe time/temperature criteria than do North American tests. These factors could affect the viability of using off-the-shelf Canadian wood-frame fire separation designs.

Appendix A contains translated relevant extracts from South Korean construction regulations and supplementary explanatory material.

TABLE 1: COMPARISON OF CONSTRUCTION REQUIREMENTS FOR MULTI-UNIT RESIDENTIAL BUILDINGS⁽¹⁾

National Building Code of Canada - 1995	South Korea Building Regulations					
	Permitted Combustible (comb.)/Required Noncombustible (noncomb.) Construction	Demising Walls	Demising Floors	Main Structure	Floors Within Dwellings	Firewalls
Combustible Construction						
Semi-detached (2 units)						
1-storey	noncomb.	n.a.	comb.	comb.	n.a.	
2-storey	noncomb.	n.a.	comb.	comb.	n.a.	
3-storey	noncomb.	n.a.	comb.	noncomb.	n.a.	
Row-/Town-houses						
1-storey	noncomb.	n.a.	comb.	comb.	(2)	
2-storey	noncomb.	n.a.	comb./noncomb. ⁽³⁾	comb./noncomb.	n.a.	
3-storey	noncomb.	n.a.	noncomb.	noncomb.	n.a.	
Duplex	n.a.	comb.	comb.	comb.	n.a.	
Apartment Building						
2-storey	noncomb.	comb./noncomb. ⁽³⁾	comb./noncomb. ⁽³⁾	comb./noncomb. ⁽³⁾	n.a.	
3-storey	noncomb.	noncomb.	noncomb.	noncomb.	n.a.	
4-storey (sprinklered)	noncomb.	noncomb.	noncomb.	noncomb.	n.a.	

Notes: ⁽¹⁾ Building areas are assumed to be in the ranges permitted under NBCC for combustible construction.

⁽²⁾ S. Korean regulations require a firewall to subdivide combustible construction where GFA exceeds 1000 m².

⁽³⁾ Noncombustible construction required where residential occupancy is on 2nd floor and area of occupancy exceeds 400 m².

Expanding the Korean Market for Residential Wood-Frame Construction

NON-REGULATORY IMPEDIMENTS

There are a number of other impediments to increasing the scope of wood-frame construction in South Korea to include multiple unit housing.

- **Land Costs.** Land costs in those parts of the country where housing demand is greatest – particularly in the vicinity of Seoul – are evidently extremely high. This encourages the notion that low-rise construction is not feasible.
- **Structure of Industry.** Most Korean housing is constructed by medium- or large-size firms who tend to build repetitive, mass-produced product. They are oriented towards large-scale construction and concrete technology. These firms have built a large number of high-rise apartment buildings in recent years. However, these organizations are aware of interest in other forms of housing and could become involved in wood-frame construction if it was deemed viable.
- **Lack of Infrastructure.** It has been suggested that more low-rise, medium-density residential development could occur in suburban or country areas. However, the road system may present difficulties in terms of commuting (a marketing consideration) or in terms of access for construction purposes. It has also been suggested that many smaller centres or rural areas would not have adequate water supply for firefighting and that the fire services may be limited in their ability to fight fires in wood-frame buildings.
- **Personnel.** There are relatively few construction workers who are knowledgeable about Canadian-style wood-frame construction. Wood-frame housing construction to date has often involved the utilization of Canadian or American personnel.

Expansion of this currently small portion of the residential construction industry into multi-unit buildings will require more workers (particularly supervisors) and additional training of workers – especially in consideration of the need for fire-resistive combustible construction.

- **Housing Technology.** In order to achieve the full economic benefit of wood-frame construction, the most appropriate technologies for the non-structural building systems must also be utilized. North American-style plumbing and electrical installations are most prominent examples of such systems. Korean plumbing and wiring practices should be investigated to determine if they have been optimized for wood-frame construction. It has been reported that some wood-frame construction projects have incorporated electrical installations using materials and techniques appropriate for concrete construction.
- **Enforcement Culture.** Although the Korean building regulations are administered nationally by the Ministry of Construction and Transportation, they are enforced at the local municipal level. Plans for most structures must be prepared by an architect and/or engineer. Municipal officials do not appear to play as prominent an inspection role during construction, compared to their Canadian counterparts. More emphasis is placed on the role of the architect and engineers as inspectors, with officials monitoring their reports.

By comparison, in Canada, there is a degree of reliance on municipal inspectors and warranty programs as a means of ensuring safe and reasonable quality housing construction. In Korea, municipal officials have little knowledge of wood-frame construction techniques and there appears to be no warranty program for privately constructed wood-frame residential buildings.

Expanding the Korean Market for Residential Wood-Frame Construction

Adherence to appropriate construction standards has been a problem in some instances; there have, in recent years, been a few notable failures of large structures. Implicitly, this suggests the need for caution in introducing new construction technology where public safety is dependent on correct procedure.

- **Negative Impressions Re Cost and Quality.** To the extent they exist, there appear to be varying or even contradictory attitudes with respect to wood-frame construction in housing on the part of the general populace in South Korea.

New wood-frame construction has a reputation for being expensive. This notion may derive from the reported high cost of new wood-frame houses which have been erected recently and the perception that they are often built for well-off persons as country or vacation homes. This image appears to be encouraged by articles and advertisements in consumer-oriented housing magazines.

To some extent wood-frame construction may be associated with older forms of Korean housing which, by comparison with modern structures, are relatively uncomfortable and inefficient. However, there are concerns and some complaints respecting quality in new wood-frame houses. There is concern about fire in combustible construction, compared to concrete and masonry. There have been complaints about noise between different rooms and spaces within wood-frame buildings and about squeaks in flooring and stairs. It is pointed out that framed drywall is more susceptible to impact damage than plastered masonry or concrete.

- **Importing Materials.** Korean sources indicate that individual home builders have experienced difficulty with customs officials delaying shipments of housing components. It is also reported that occasionally there are also problems with quality of shipped materials where the building is dependent on a North American supplier.

Expanding the Korean Market for Residential Wood-Frame Construction

POSITIVE FACTORS

The impediments to an expansion of wood-frame construction in South Korea are balanced to an extent by a number of positive factors based on the success of a relatively small but established house-building industry, a degree of academic and general construction industry interest, and positive aspects to the general public image of North American-style wood-frame houses.

- **Established Active House Builders.** Although it represents a small portion of South Korea's residential construction, the wood-frame house-building industry is established and growing. The firms involved in this activity have developed a familiarity with the relevant construction techniques and materials and will favour an expansion of scope of wood-frame construction to multi-unit projects.

The rapid increase in the number of wood-frame houses constructed since 1993 is reflected in a corresponding increase in the value of imported wood products. Table 2¹ illustrates this trend.

TABLE 2

Exporting Country	\$ U.S. Value of Imported Wood-Frame Housing Material				
	1992	1993	1994	1995	1996*
U.S.A.	2,180,738	1,227,048	2,282,278	7,665,000	11,555,000
Canada	130,764	170,771	433,458	1,138,000	4,158,000
Finland	284,038	453,332	1,058,081	724,000	713,000
Sweden	–	–	320,338	45,000	44,000
New Zealand	–	–	–	304,000	121,000
Russia	–	–	–	10,000	171,000
Other	3,103	6,930	72,065	1,156,982	2,835,000
Total	2,598,643	1,858,081	4,166,220	11,042,982	19,587,000

* 1996 is from January to October

- **Interest of Larger Players.** There are two major associations representing private sector residential apartment builders. The Korea Housing Association represents large builders and the Korea House Builders Association represents medium- and small-sized builders.

The Korea National Housing Corporation, an agency of the national government, has its own housing development program and is directly responsible for construction of a large portion of South Korea's new housing.

¹Adapted from "Wood-Framed Housing in Korea: An Overview", Korea Housing Institute, 1996

Expanding the Korean Market for Residential Wood-Frame Construction

Despite their preponderant involvement in the construction of concrete apartment buildings – and the assumption on the part of many builder members that wood is not a suitable structural material – these organizations are aware of a growing interest in wood-frame construction and would likely endorse a loosening of regulatory restrictions on multi-unit combustible construction if they perceive a sufficiently large and profitable market developing for such construction.

The Korean Housing Institute (HRI) is a housing research-oriented organization affiliated with the Korea House Builders Association. Recent papers and presentations of HRI officials demonstrate a marked interest in the potential to expand wood-frame construction in South Korea.

- **American Activity.** Export-oriented American forest product firms and builders also view South Korea as a significant, growing market. To date, the majority of wood-frame projects in South Korea have been constructed with American materials, or by American builders.

The American Forest and Paper Association (AFPA), with the assistance of the U.S. federal government, have been actively promoting wood-frame house construction utilizing American resource material. Technical guides for wood-frame construction have been translated into Korean and distributed to South Korean architects and builders. The Korea Wood Construction Association, a group of South Korean wood-frame house builders, appears to have a strong relationship with the AFPA. Recently the AFPA has sponsored one- or two-week training courses for Korean workers. The AFPA maintains an office in Seoul.

These American efforts may be viewed as beneficial for Canadian exporters of wood-frame construction materials and technology, as they promote a broad interest in wood-frame construction and help to establish demand for products on a generic basis.

- **Favourable Public Perceptions.** There are positive aspects to the general public image of North American-style wood-frame housing, although to some extent these may be characterized as vague or romantic.

Part of the attractiveness of North American-style houses appears to be their association with less crowded development and the closer relationship of occupants to a more natural and healthy environment. By extension, wood – as a "natural" material – may be appreciated as being "healthy".

Expanding the Korean Market for Residential Wood-Frame Construction

STRATEGIZING AN EXPANSION OF THE SOUTH KOREAN MARKET FOR WOOD-FRAME CONSTRUCTION

Beyond identifying impediments to an increased scope for wood-frame construction in South Korea, the second major task of this study is to identify measures which may be taken to remove such impediments.

South Korean sources suggest that it would be inappropriate for foreign interests to make an immediate, direct approach to the government of South Korea requesting regulatory change to broaden the scope of wood-frame construction. It would be preferable to encourage the creation of demand for such an expanded scope of wood-frame construction on the part of South Korean builders and consumers – with particular emphasis on the builders. A larger Korean "fan club" will be more effective in influencing regulatory policy.

On this basis, formulation of specific regulatory change proposals for consideration by South Korea would be premature at this time. The more immediate task is to persuade builders and potential purchasers of multi-unit residential buildings that the ability to utilize combustible construction would be advantageous.

A comprehensive and detailed description of such a task is beyond the scope of this paper. There are many variables and many potential choices as to strategies to be employed, co-ordination with allied interests, timing and other matters.

However, the general strategic parameters for this task of persuasion intended to stimulate an eventual regulatory change can be identified on the basis of consideration of the following four questions:

- Who is the audience?
- What will be the content of the message?
- How will the message be developed and delivered?
- What is the time frame?

These questions are elaborated upon as follows:

THE AUDIENCE

The early stages of an information campaign may be directed to the following groups:

- **Builders.** Builders are presumed to include constructors and developers of residential buildings.

Perhaps the first group to focus upon would be small- or medium-size builders such as are represented by the membership of the Korea Housing Builders Association (KHBA). The affiliation of the KHBA with the Korea Housing Institute (KHI), which has demonstrated a marked interest in wood-frame construction, suggests that small- or medium-size firms would be most interested in achieving greater flexibility in construction procedure and in reducing costs.

The small- and medium-size business sector has in general have been identified by Korean economic planners as a potential source of increased vitality and competitiveness for the Korean economy as a whole.

Existing house builders may also be targeted for an information campaign aimed at increasing the scope of wood-frame construction. It is logical to assume that they could progress from single family to multi-unit wood-frame construction.

Expanding the Korean Market for Residential Wood-Frame Construction

The very large builders who are responsible for much of the high-rise residential construction (as well as major civil engineering projects) may be supportive of multi-unit wood-frame construction being permitted, if there is potential for large scale development such as would be entailed in the construction of entire subdivisions, or satellite towns. It is likely that the interest of this group would be tied to changes in land costs, the opening up of new sites for construction and any broad trend toward public or governmental interest in wood-frame technology.

- **Architects.** An architect must be engaged for the design of almost any building in Korea, including a house. On this basis, architects are expected to have significant influence in the choice of building material and structural systems and should logically be targeted as recipients of information and eventually, as allies in respect of increasing the scope of wood-frame construction.

There are two architectural associations which may be approached. One is the legal body responsible for enforcing professional activities under legislation. The other is a voluntary organization which promotes broader interests of practice and artistic and design excellence, which may be compared to the Royal Architectural Institute of Canada (RAIC) or the American Institute of Architects (AIA).

An expansion of scope for wood-frame design, including the more recent "engineered wood products" such as I-joists, laminated veneer lumber and composite trusses, would significantly enhance design freedom and may offer significant stimulation to an ideas-oriented profession.

Technical training and liability issues may be of interest to the licensing body, while the enhancement of design and construction flexibility may be of interest to the voluntary association.

Architects have already been the recipients of literature on wood-frame housing prepared by American interests. Additional information on multi-unit, wood-frame construction from Canadian sources may be of interest – especially if it demonstrates more design freedom and more flexibility in meeting client needs, and can emphasize a leading role for the architectural profession in take-up of the technology.

- **Trades.** Organizations representing trades persons, particularly carpenters, may be interested in encouraging greater use of wood-frame construction.
- **Purchasers.** Interested potential purchasers of multi-unit wood-frame buildings should be addressed as well as that of builders/developers.

Purchasers could include governmental or institutional groups such as the National Corporation for Development of Fishing and Agriculture, which was mentioned earlier, or public housing authorities.

It may also be possible to interest individual investors in constructing wood-frame apartments for purposes of rental income.

- **General Public.** An already significant consumer interest in North American-style single family wood-frame houses. This audience could be further cultivated. Positive attributes of the single family house could be attributed to townhouse or low-rise apartment designs.

In addition, positive environmental factors associated with the use of wood and natural products can also be emphasized.

Expanding the Korean Market for Residential Wood-Frame Construction

A campaign to remove regulatory impediments would very obviously have to include the Government.

The government component of the "audience" may be considered in three groups. Two of these groups reside in the bureaucracy and are characterized as being responsible either for economic development and national infrastructure or for the preservation of public safety through building regulations. The third governmental group are the elected officials who may eventually have to approve regulatory change.

- **Financial/Infrastructure Bureaucracy.** As noted previously, it is known that the Government believes that the small- and medium-sized business sector should be enhanced to stimulate overall national economic health. The flexibility of wood-frame construction and the ability of very small firms – even individuals – to use this technology is a strong argument in favour of its being an eventual contributor to Korean economic diversification and small business sector vitality.

It is anticipated that the builders, designers and other private sector components of the "audience" would eventually be able to assist in influencing the bureaucracy with these economic arguments.

- **Construction Regulators.** The eventual persuasion of this governmental group of the technical benefits of allowing multi-unit wood-frame construction is of critical importance. It is expected that the assistance of other components of industry in Korea would be beneficial in helping to persuade this group of the need for a change.

Concerns this group may have about fire safety and means of assuring the integrity of the built product would have to be addressed.

Official responsibility for fire testing of structural assemblies may be particularly important. As noted previously, Korean standards for evaluation of fire-resistance are somewhat more stringent or vary in certain requirements relative to North American (including Canadian) standards. Re-testing could be a significant problem if Korean codes eventually permit wood-framed fire separations but do not accept North American test results.

- **Elected Officials.** If elected officials perceive that their constituents want an expanded scope for wood-frame construction, and if they are assured that the change would offer economic benefit and maintain public safety, it is anticipated they will be amenable to the change.

Expanding the Korean Market for Residential Wood-Frame Construction

THE MESSAGE

There several components to the message or information package which may be presented to Korea. These include a general description of regulatory changes being proposed, reasons for the initiative, and suggestions as to how the proposed changes could be strategized and accomplished in Korea.

Scope of the Initiative

The proposed scope of multi-storey and multi-unit combustible construction must be identified. The existing restrictions and required changes to such restrictions must also be identified and discussed.

- **Proposed Scope of Combustible Construction.** Choice of height and area limits is somewhat arbitrary but can be based on precedent in North American codes. A general height limit of 3 storeys may be suggested with 4 storeys being permitted in sprinklered buildings, as in the NBCC.

The allowable area of a building, measured either in terms of gross floor area or building footprints (*building area*, as defined in the NBCC), must be large enough to encourage a viable project size for development. The maximum building areas in the NBCC may be proposed (including variations based on direct accessibility of the building perimeter from firefighting access routes, building height and sprinklers) as a starting point for evaluation.

- **Identification and Modification of Existing Restrictions**

- **Height.** The current restriction on height (13 m or 9 m to an eave) and gross floor area (1000 m²) for buildings using wood as a major structural component would require modifications. In particular, the 9 m eave height limit would prevent construction of 4- storey (sprinklered) construction and the 1000 m² gross floor area (GFA). GFA limit would cap the floor area of industrial storeys to about 330 m² in a 3-storey building or 250 m² in a (sprinklered) 4-storey building.

It may be proposed that the eave height limit be modified to accommodate 4-storey (sprinklered) construction and the GFA limit be increased to accommodate significantly larger projects.

- **Demising Walls.** The requirement that demising walls be noncombustible would have to be modified to permit combustible walls, appropriately rated for fire and sound transmission, in buildings permitted to be of combustible construction.
- **Noncombustible Construction.** The requirement that noncombustible construction be used where the second floor of a building exceeds 400 m² in area and is used for apartments may be deleted in favour of more comprehensive allowances for wood construction based on height and area restrictions.

Similarly, the requirement that an apartment building 3 or more storeys in height be of noncombustible construction would have to be deleted in favour of changes proposed above, relative to 3- and 4-storey structures.

Expanding the Korean Market for Residential Wood-Frame Construction

- **Firewalls.** The requirements that a wood structure building be divided by firewalls into components having a GFA not exceeding 1000 m² would be onerous, if left unchanged and changes are made to accommodate 3- or 4-storey apartment buildings. It would be desirable to subdivide a project of combustible construction into components which could be up to the size permitted for an individual building of combustible construction, similar to NBCC allowances.
- **Fire Safety Districts.** In special fire safety districts in urban areas, all buildings (except small 1-storey accessory structures) are required to be of noncombustible construction. If left unchanged, this restriction will have the effect of denying the use of wood-frame construction in potential urban infill or renewal projects.

A reasonable case can be made for removing or modifying the noncombustibility restriction on the basis of at least two technical approaches:

1. "Wrapping" of combustible structure with rated noncombustible exterior walls (with limitations on openings) and fire-resistant roof surfaces. This approach is used in the NBCC for buildings of combustible construction in close proximity to property lines.
2. Sprinklering. Full and proper sprinkler protection would largely obviate the potential for both a well-developed fire in the building of fire origin and the consequential spread of the fire to neighbouring structures.

Limited access to the building in some areas due to narrow and congested laneways will likely figure prominently in reviewing any proposal to enable combustible construction in fire safety districts.

- **Test Standards.** The difference between Korean and North American fire test standards as they would apply to rated wood-frame assemblies would also have to be reviewed. If South Korea were to decide to allow fire-rated combustible construction but maintained requirements for testing to Korean standards, a whole range of Canadian and American listed assemblies would conceivably have to be re-tested for use in Korea. Some assemblies may have to be modified to pass such tests. There would be an obvious benefit to Canadian suppliers if existing assemblies could be accepted without modifications.

On this basis, it would be desirable to persuade South Korea of the acceptability of Canadian assemblies and test standards based on satisfactory experience in Canada.

Expanding the Korean Market for Residential Wood-Frame Construction

Acceptance in Other Jurisdictions

The progress that has been made in promoting Canadian-style wood-frame construction in jurisdictions outside of North America should be reviewed with South Korea. Japan and Germany, in particular, should be considered.

- **Japan.** Post-war Japanese building regulations also severely limited the use of wood-frame construction. However, Canadian and American forest products industries have put significant effort into promoting wood construction in Japan.

In 1991, a "shake and bake" test was conducted in Japan to assess the ability of wood-frame construction to withstand the effect of both earthquake and fire. The test provided sufficient confidence for the Japanese to permit 3-storey wood-frame apartment buildings in low density districts.

In March 1996, another test was undertaken to assess the potential for fire spread if similarly configured buildings were to be permitted in more densely populated urban areas. It is anticipated that analysis of this test will lead to permitting 3-storey wood-frame apartment buildings in urban "fire protection zones" in large Japanese cities.

Canadian scientists under contract with the Canadian Forest Service participated in both the 1991 and 1996 tests. Currently, there are Canadian representatives on (Japanese) Ministry of Construction committees that are considering revisions to fire test standards and the creation of performance-based approaches to fire safety in Japanese regulations.

- **Germany.** Canada Mortgage and Housing Corporation has spearheaded an initiative to have Germany accept Canadian wood-frame construction as an allowable housing technology on the basis of proven performance in Canada. It is understood that this recognition is close to being formalized.

A review of the negotiation and approval process respecting German acceptance of Canadian wood-frame housing technology may be instructive for South Korea and could provide additional leverage in persuading Korea to change regulations.

Advantages to Korea

The potential benefits of the proposal for Korea can be enumerated under several categories. These include:

- **Technical Advantage.** Description of advantages re flexibility, costs, comfort, etc. on a site-specific, building design-oriented basis can be extensively developed.

Care should be taken to identify possible negative implications of more wood-frame construction and to have answers for questions regarding such implications while presenting the positive aspects.

There must be a demonstrated capability to adapt to specific Korean needs in housing design. The almost universal inclusion of the *ondol* (in-floor heating) system in residential construction is perhaps the most obvious example of specifically Korean design requirements.

Appendix D provides additional discussion of technical advantages and precautions to be considered.

Expanding the Korean Market for Residential Wood-Frame Construction

- **Economic Advantages.** The overall advantages to the Korean economy of a diversification of construction method through adoption of multi-unit wood-frame construction could also be clearly identified.

Builders' organizations, in particular, would be expected to be keenly aware of economic planning issues.

- **Future Advantages.** Beyond advantages to South Korea's internal economy, it may be pointed out that the capability of participating in wood-frame construction technology offers more flexibility for future evolution of Korea's housing needs internally and the country's ability to adapt wood-frame technology.

In addition, it is likely that other sources of wood-based construction materials will come on stream, to the general advantage of importing nations. Of particular interest in this respect are the vast forest reserves of eastern Russia which are only beginning to be tapped.

Industry and Infrastructure Shortfalls

The content of the message should acknowledge non-regulatory difficulties which must be overcome to achieve efficient and widespread use of wood-frame technology. In particular, the limited availability of skilled trades and the need for more training must be addressed.

Expanding the Korean Market for Residential Wood-Frame Construction

DELIVERING THE MESSAGE

Any serious effort to promote an expansion of wood-frame construction to multi-unit residential buildings in South Korea will necessitate careful consideration of how the message is to be delivered.

Consideration should be given to involving South Korean marketing or government relations experts in this effort. Ongoing communication with the prominent interest groups should also be established.

Strategizing and implementing such a campaign will involve many variables and choices. Parameters to be considered include:

- **Potential Allies.** CMHC may wish to approach other groups and agencies to provide assistance in devising and executing a strategy.

These potential helpers in this activity can be considered in two groupings: those outside of Korea who wish to sell goods and services and those inside Korea who wish to purchase such goods and services or who wish to see the modifications to regulation to further public policy.

In Canada, those who wish to promote an expanded scope for wood-frame construction in Korea include government agencies and private industry.

Government agencies potentially interested in this area may include, in addition to CMHC, the following:

- External Affairs and International Trade Canada.
- Natural Resources Canada.
- The Institute for Research in Construction of the National Research Council of Canada.

Governments of Canadian provinces with significant forest industries may also be considered.

Examples of private sector organizations who may be able to assist in the project include:

- Canadian Wood Council.
- Canadian lumber manufacturing and producing associations.
- Canadian Home Builders Association (CHBA).
- Council of Forest Industries.
- Standard writing and product testing agencies.

The Canadian Building Officials Association (CBOA) may also be interested in helping to promote Canadian wood-frame construction technology in Korea from the point of view of inspector training and enforcement procedure.

American interests represent the other major category of potential strategic allies outside of Korea. Fundamentally, Americans are interested in selling the same wood-related products and services as Canadians. An expansion of the wood-frame construction market into multi-unit buildings will provide a bigger market for both Canada and the United States.

Expanding the Korean Market for Residential Wood-Frame Construction

In Korea, it would appear that the primary potential allies in promoting multi-unit wood-frame construction are the small- and medium-size builders who would have the most to gain from an expansion in this area. If subdivision construction is considered feasible, the larger builders may also be considered. Other potential allies include designers and architects, construction trades, importers and local manufacturers of materials which may be incorporated into wood-frame construction.

Eventually it may be possible to seek allies for increasing the scope of wood-frame construction in government departments which have an interest in and a responsibility for promoting the overall health of the Korean economy.

- **Communication Tools.** Media and communication tools for carrying Canada's message regarding the benefits of wood-frame construction to Korea must be considered. A variety of options are available:
 - Translated written/graphic material. A variety of existing CMHC and NBCC technical documents could be translated. It may be necessary to produce additional material with specific information respecting multi-unit construction.
 - Videos.
 - Seminars/presentations in Korea.
 - Meetings in Korea with key industry associations, government representatives.
 - Demonstration construction projects in Korea.
 - Media clips and news releases.

Demonstration projects would likely be effective in capturing the attention of both the general public and the construction industry. It is suggested that either a small apartment building or a representative group of town houses be constructed on a site which would be readily accessible to a large number of people. This would most appropriately be in the Seoul area.

The demonstration project could show a finished unit, a unit where the finishes are cut away to expose framing, insulation, vapour barrier, and building systems installations (heating, plumbing and wiring) as well as a portion which showed the unfinished framing system.

- **Delegations to Canada.** Additional delegations of Koreans could be brought to Canada to expose their members to multi-unit wood-frame construction in particular. These delegations could include builders, trades people, government officials, educators, media representatives and students. Every attempt should be made to expose such delegations to actual construction in urban, suburban and rural settings and to the total Canadian process of code writing, supportive research, education and certification of builders and enforcement officials, enforcement procedure, and housing warranty programs.

In preparing literature, it may be appropriate to suggest an incremental approach to increasing the permitted scope of wood-frame construction. For example, smaller scale and simpler construction represented by semi-detached, duplex or town house-like developments could be encouraged first with an expectation that regulations for larger apartment structures or even non-residential structures could be developed after industry familiarity with simpler structures is established. This approval would be similar to that which has been adopted in Japan.

APPENDIX A
KOREAN CONSTRUCTION LAW:
TRANSLATED EXCERPTS



LARDEN MUNIAK CONSULTING INC.

In Association with:
SANG-MAN YOUN ARCHITECT

CHAPTER 1. KOREAN CONSTRUCTION LAWS - GENERAL INFORMATION

1. Structure of the Korean Construction Laws

The highest law defining the organization and the operation of the country is the Constitution. Under the Constitution, there are laws, regulation and etc. in the following hierarchy.

(1) Law:

Established by the Parliament and announced by the President in accordance with the procedure set out in the constitution. Generally, limitation or imposition of rights and duties of the people of the nation are done through the laws.

(e.g.) Construction Law - in this report called "Law"

(2) Ordinance:

An order instituted by the President regarding the matters necessary to carry out the law or about the matters mandated to the President to clarify the scope of the law. An enforcement ordinance.

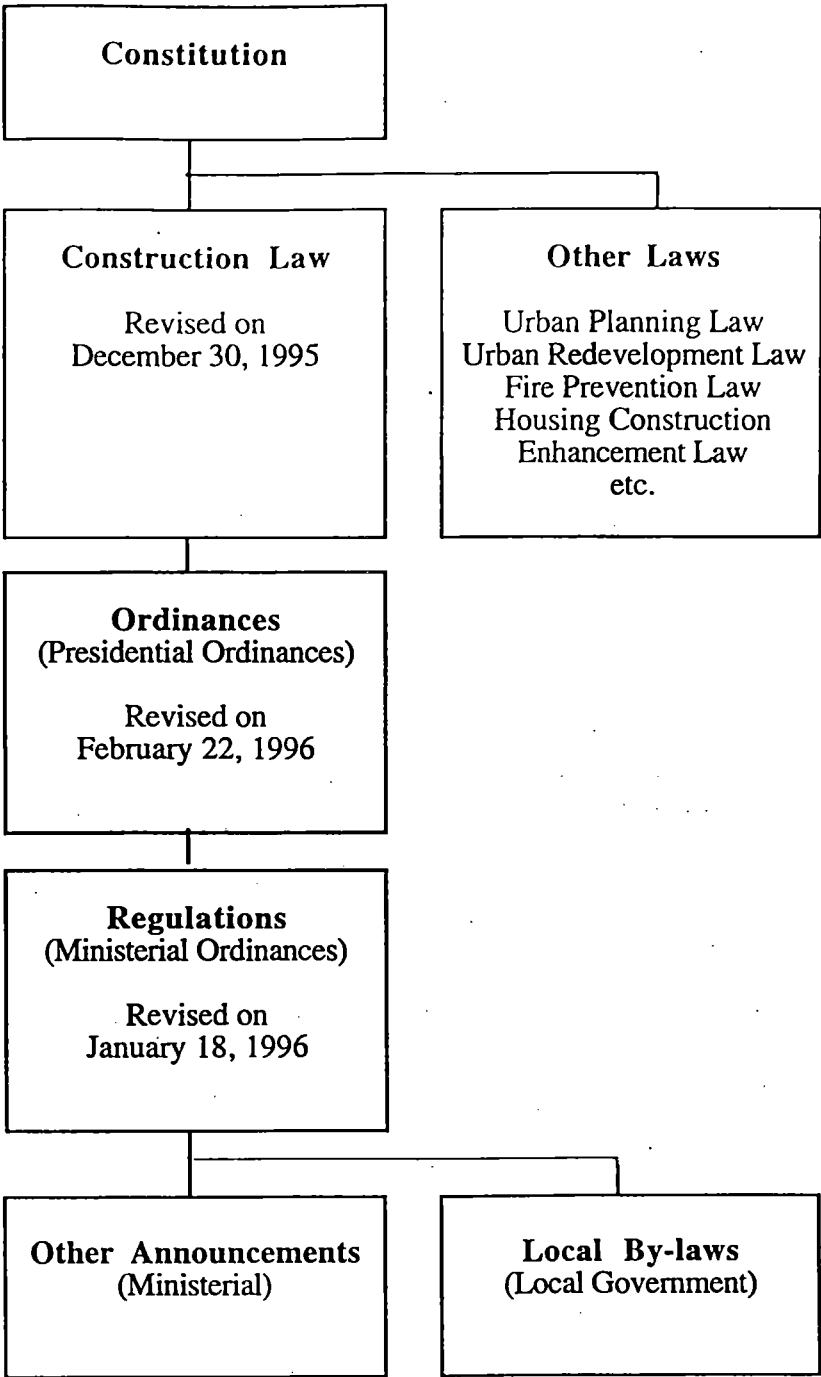
(e.g.) Construction Enforcement Ordinance - in this report called "Ordinance"

(3) Regulation:

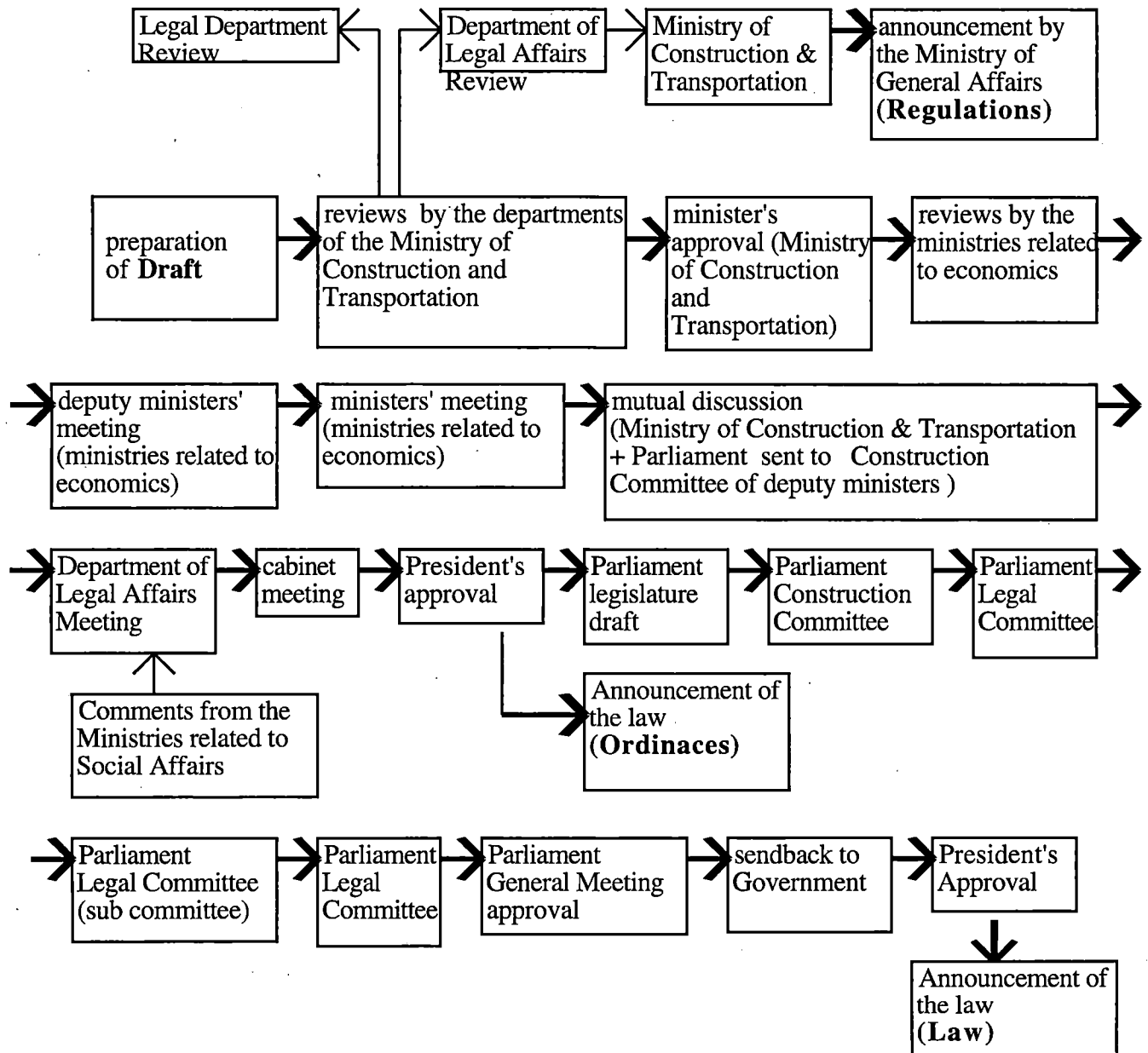
An order instituted by a Minister or a Prime Minister regarding the matters under his jurisdiction mandated by a law or by a presidential ordinance. An enforcement regulation.

(e.g.) Construction Enforcement Regulation - in this report called "Regulation"

(4) Local by-law: A law instituted by a Local Government regarding the matters mandated for a local government to institute by the Construction Law, a Construction Enforcement Ordinance or a Construction Enforcement Regulation. A detailed modification of the law, an ordinance or a regulation to suit the local conditions. However, this is the lowest among the laws and can not infringe the intention of the law, an ordinance or a regulation in any case. In this report called "By-law".



2. Procedure of making and revising Construction Laws



• If a law is initiated by the Parliament, the process of draft and review by the Government is eliminated. In such a case, the Parliament consults only with the Department of Legislature of the Government.

• **Ordinances** are instituted by the government with no involvement of the Parliament. Initially drafted and reviewed by the government officials, they are submitted to the cabinet Meeting and to the President. With the final approval of the President, Ordinances are officially announced for their execution.

• **Regulations** are drafted and reviewed within the Ministry of Construction & Transportation. With the approval of the Minister, Regulations are officially announced for their execution.

CHAPTER 2. CONSTRUCTION AND MATERIALS OF BUILDING (Items related to wood framed housing industry.)

1. Definitions of The Terms

Major Structural Components :

Law Article 2 Item 6:

Major Structural Components means walls, columns, floors, beams, roofs and main stairs. It does not include partitions, mid span columns, lowest floor, small beam, canopy and exterior stair and other similar structural components that are not structurally important.

Noncombustible construction :

Law Article 2 Item 7:

Noncombustible construction means reinforced concrete construction, masonry construction or other similar construction which is noncombustible as defined by the Presidential Ordinance.

Ordinance, Article 3

1. Wall:

- a. Reinforced concrete construction or steel construction with minimum 10 centimetre thick reinforced concrete cover.
- b. Steel construction protected on both sides with minimum 4 centimetre thick steel mesh reinforced cement mortar or minimum 5 centimetre thick concrete block or brick.
- c. Concrete block, brick or stone construction reinforced with steel reinforcing material, of which the thickness of the concrete block protecting reinforcing material is minimum 5 centimetre.
- d. Minimum 19 centimetre thick brick construction.
- e. Minimum 10 centimetre thick, high temperature, high pressurized steam cured light weight concrete panel construction or light weight concrete block construction.

2. Non bearing exterior wall (in lieu of item 1):

- a. Reinforced concrete construction or steel construction with minimum 7 centimetre thick reinforced concrete cover.
- b. Steel construction protected on both sides with minimum 3 centimetre thick steel mesh reinforced cement mortar or minimum 4 centimetre thick concrete block or brick.
- c. Concrete block, brick or stone construction reinforced with steel reinforcing material, of which the thickness of the concrete block protecting reinforcing material is minimum 4 centimetre.
- d. Minimum 7 centimetre thick, concrete construction with no reinforcing or concrete block construction or brick construction.

3. Column with minimum 25 centimetre diameter:

- a. Reinforced concrete construction or concrete protected steel construction.
- b. Steel construction protected with minimum 6 centimetre thick steel mesh reinforced cement mortar (5 centimetre if light weight aggregate is used) or minimum 7 centimetre thick concrete block or brick.
- c. Steel construction protected with minimum 5 centimetre thick concrete.

4. Floor:

- a. Minimum 10 centimetre thick reinforced concrete construction or concrete protected steel construction.
- b. Concrete block, brick or stone construction reinforced with steel reinforcing material, of which the thickness of the concrete block protecting reinforcing material is minimum 5 centimetre.
- c. Steel construction protected on both sides with minimum 5 centimetre thick steel mesh reinforced cement mortar or minimum 4 centimetre thick concrete block or brick.

5. Beam:

- a. Reinforced concrete construction or concrete protected steel construction.
- b. Steel construction protected with minimum 6 centimetre thick steel mesh reinforced cement mortar (5 centimetre if light weight aggregate is used) or minimum 5 centimetre thick concrete.
- c. Steel roof beam construction (of which the height from the floor to the underside of the roof is 4 M or more) with no ceiling or with non flammable ceiling.

6. Roof:

- a. Reinforced concrete construction or concrete protected steel construction.
- b. Concrete block, brick or stone construction reinforced with steel reinforcing material.
- c. Glass block or wire meshed glass construction reinforced with steel reinforcing material.

7. Stair:

- a. Reinforced concrete construction or concrete protected steel construction.
- b. Concrete construction with no reinforcing, concrete block construction, brick construction or stone construction.
- c. Concrete block, brick or stone construction reinforced with steel reinforcing material.
- d. Steel construction.

8. Other material designated by the Ministry of Construction and Transportation whereby the quality of the material is tested and accepted by the National Construction Research Institute in accordance with the standards set by the Ministry of Construction and Transportation, and also passed the quality test executed by an agent designated by the Ministry of Construction and Transportation.

Fire Rating of Noncombustible Construction - Ministry of Construction and Transportation,
Announcement 1992-560, October 17, 1992
(Endurance time for Ordinary fire)

	1st - 5th floor from the highest storey	6th - 14th floor from the highest storey	15th floor and up from the highest storey
Non bearing exterior wall where exposed to fire hazard	1 hr.	1 hr.	1 hr.
Non bearing exterior wall where not exposed to fire hazard	1/2 hr.	1/2 hr.	1/2 hr.
Bearing Wall Demising Wall Floor	1 hr.	2 hr.	2 hr.
Column Beam	1 hr.	2 hr.	3 hr.
Roof	1/2 hr.		

Nonflammable Material:

Law, Article 2, Item 8:

Nonflammable material includes concrete, stone, brick, clay roof tile, asbestos panel, steel, aluminum, glass, mortar, gypsum and other similar noncombustible material which complies to the standard set by the Ministry of Construction and Transportation.

Ordinance Article 2, Item 1:

Nonflammable material means construction material which complies with one of the following requirements.

- a. Tested and approved as 1st class nonflammable by the Korean Industrial Standard as defined in the Industrial Standard Law.
- b. Confirmed its conformity with the standards established by the Ministry of Construction and Transportation through a test performed by the National Construction Research Institute and passed a test by an agent designated by the Ministry of Construction and Transportation.

Fire Preventative Construction:

Ordinance, Article 2, Item 1.8

- a. Minimum 2 centimetre thick cement mortar with wire mesh.
- b. Cement mortar or gypsum plaster finished asbestos cement board or gypsum board, of

which the aggregate thickness is minimum 2.5 centimetres.

c. Ceramic tile finished cement board of which the aggregate thickness is minimum 2.5 centimetres.

d. Asbestos cement board finish on minimum 1.2 centimetre thick gypsum board.

e. Asbestos cement board finish on minimum 2.5 centimetre thick rockwool board.

f. Clay.

g. Other material designated by the Ministry of Construction and Transportation whereby the quality of the material is tested and accepted by the National Construction Research Institute in accordance with the standards set by the Ministry of Construction and Transportation, and also passed the quality test executed by an agent designated by the Ministry of Construction and Transportation.

2. Use of Building

Ordinance Article 2, Item 13

2.1 Detached Dwelling

- a. A single family detached house (including home daycare)
- b. A detached house for multi-family (rental) - GFA 660 M² or less, 3 storey or under
- c. A government official residence

2.2 Multi Family Dwelling

- a. Apartment - 5 storey or more
- b. Townhouse - (individual ownership) - GFA 660 M² or more, 4 storey or under
- c. A detached house for multi-family (individual ownership) - GFA 660 M² or less, 4 storey or under

3. Requirements of Structural Engineering

Law, Article 38

Ordinance, Article 32

As per Article 38, Item 2 of the Construction Law, any building where the number of storeys is 3 or more, (even when the number of stories is less than 3, if the building height is 13 M or more, or the height to the eave is 9 M or more from ground), total gross floor area is 1,000 M² or more or the distance between columns is 10 M or more, the safety of the structure must be calculated and confirmed by a professional engineer. When the building is more than 6 story high or total gross floor area of the building is more than 10,000 M², or if the building is designated by the Ministerial Ordinance, the structural calculation shall include the confirmation of the safety against earthquakes as well.

3.1 Confirmation of Structural Safety

Confirmation is required for the following buildings.

- 3 storey high or more
- total gross floor area, 1,000 M² or more

- less than 3 storey but the height of the building is 13 M or more, or the eave height is 9 M or more

3.2 Earthquake Design

- design standard: ATC 3-06 of U.S.A. (Richter Magnitude 7),
- structural design against earthquake is required as follows.

Entire Area	<ul style="list-style-type: none"> • 6 storey or more, or total gross floor area 10,000 M² or more • museum or memorial hall which is 5,000 M² or more • building required for the national security
Seismic Zone 2	<ul style="list-style-type: none"> • high hazard storage or treating plant, hospital, clinic, broadcasting station, telephone or other communication station, power plant, public building and facility for old people or children, of which the total gross floor area is 1,000 M² or more. • theatre, assembly hall, sports facility, transportation facility, exhibition hall, of which the total gross floor area is 5,000 M² or more • mercantile facility of which the total gross floor area is 5,000 M² or more • hotel, officetel or dormitory, which is 6 storey and up • apartment building

3.3. Structural Strength Standard (Ministerial Announcement 1996-43)

Article 6:

When the major structural component of a building is made of a wood construction, maximum building height of the building shall be 13 M(height to the eave shall be maximum 9 M), and the total gross floor area shall be 3,000 M² or less.

Article 7:

Chart 1
(Unit: Kg / Cm²)

		Allowable Strength of Material Against Long Term applied Load			Allowable Strength of material Short Term applied Load
		Compression	Tension, Bending	Shear	

Needle Leaf Trees	Pine, Acacia	50	60	4
	Fir, Spruce	60	70	5
	Japanese White Pine	70	80	6
	Larch,	80	90	7
Broad Leaf Trees	Chestnut Tree, Japanese Oak	70	95	10
	Zelcova Tree	80	110	12
	Overcup Oak	90	125	14
	Lauan	70	90	6

4. Fire Safety measures in buildings and limitations of usage

4.1 Prohibition of uses that can be obstacles to fire fighting :

Law, Article 39

Ordinance Article 45

Regulation, Article 28

When the following group of uses - multi-family housing, medical facility, facility for children, facility for elderly, multi-family house, dormitory; or officetel - are planned to be in the same building together with another group of uses - place of entertainment, place of performance, storage for dangerous material or treatment facility of dangerous material, lodging facility, youth hostel, factory or automobile repair shop -, the building must meet following standards.

- 1) Entrance to a multiple family housing and entrance to a place of amusement shall be minimum 30 M apart from each other.
- 2) The two groups of uses mentioned above shall be separated from each other with noncombustible floors and walls.
- 3) These 2 groups shall not be located adjacent to each other.
- 4) Major structural component of such building shall be of noncombustible construction.
- 5) Finish material of the walls and ceilings of the rooms shall be non flammable or semi-non flammable and finish material of the walls and ceilings of the corridor, stair and other exit routes shall be non flammable or semi-non flammable.

4.2 Fire Prevention Zone :

Ordinance, Article 46

1) Except as provided in paragraph 2, a building of which the total gross floor area is 1,000 M² or more and major structural component of the building is non combustible construction shall be divided into fire prevention zones as defined below, by fire separations made of fire rated floors, walls and Class A fire rated doors.

(1) Every 1,000 M² in the 10th storey or below. (Every 3,000 M² when the building is sprinklered.)

(2) At every floor level in a building which is 3 storey high or more and in underground storeys.

(3) From the 11th floor and up, every 200 M² (if the building is sprinklered, 600 M²), except when the finish material used for walls and ceilings is non flammable material, every 500 M². (If the building is sprinklered, 1,500 M².)

2) Exceptions:

(5) intermediate floor of a multi-level residential unit in a multi-family residential building.

(7) single family detached house,

3) when a portion of a building belongs to the category as defined by the Building Code 40.1, that portion and the rest of the building must be separated from each other by fire separations.

4.3 Demising Walls and Partitions :

Law, Article 53

1) Demising walls and partitions as defined below shall be of noncombustible construction and shall be extended to the underside of the floor or roof deck above.

1) Demising wall between dwelling units in a multi-family residential building. (except balcony)

2) Partition between classrooms, hospital bedrooms, hotel bedrooms and dormitory bedrooms.

2) The demising walls and partitions in item 1) shall be acoustically insulated without interruption.

Regulation, Article 31

Demising walls and partitions in Article 53 of the Construction Law shall be constructed as follows, except that the demising walls and partitions in a multi family dwelling units shall be constructed as per The Regulation on the Residential Construction Standards.

1) Minimum 10 centimetre thick, reinforced concrete structure or steel structure with reinforced concrete protection.

2) Minimum 10 centimetre thick (including the thickness of cement mortar or plaster finish) , concrete, concrete block, brick or stone construction.

3) Other material approved for its acoustical control ability by the National Construction Research Institute.

Acoustical Insulation Value of Walls

Construction of wall	Partition	Demising wall between dwelling units in multi family residential building
(1) Reinforced concrete, steel frame with reinforced concrete protection	10 cm thick or more	15 cm thick or more (including the thickness of plaster finish)
(2) Concrete block, brick, concrete, stone	10 cm thick or more (including the thickness of plaster finish)	20 cm or more (including the thickness of plaster finish)
(3) Precast concrete panel (pre-fab house material)	-	12 cm thick or more
other	Acoustical insulation value equivalent to (1) and (2)	Acoustical insulation value equivalent to (1), (2) and (3)
Note	Regulation, Article 31	The Regulation on the Residential Construction Standards

Sound Transmission Classes of Walls

Hz	dB
125	30
500	45
2,000	55

5. Noncombustible Construction and Firewall

Law, Article 40

1. Major structural components of a building with the occupancy of theatre, hospital, multi family dwelling and other occupancies and sizes defined by the presidential ordinances shall be non combustible construction.
2. A building with certain occupancies and sizes as defined by the presidential ordinances shall be divided by firewall.

5.1 Noncombustible Construction

Ordinance, Article 56

1) As per Article 40 of the Construction Law, item 1, any building to which any one of the following items applies (when item 6 applies to a 2 storey or less building, only for the basement floor), major structural component of the building shall be non-combustible construction. However, a one storey accessory building whose total gross floor area is 50 M² or less and whose exterior wall and eave construction is fire preventative structure, this requirement is waived.

.....

2) When the 2nd floor of a building is used for hotel, youth hostel, medical facility, facility for children, neighbourhood facility (medical use only), multi-family house, apartment, dormitory or hostel, and the floor area is 400 M² or more,

3) 3 storey or higher building, or a building with basement floor, except a single family detached house, government employee's official residence, animal house, botanical facility, correctional facility, martial facility and grave (except mausoleum) .

.....

		1st - 5th storey from the highest storey	6th - 14th storey from the highest storey	15th or more storey from the highest storey
Exterior non-bearing wall	Highly vulnerable to fire	1	1	1
	No danger for fire	1/2	1/2	1/2
Exterior bearing wall, demising wall, floor		1	2	2
Column, Beam		1	2	3
Roof		1/2		

5.2 Firewall for Large Buildings

Ordinance, Article 57

1) As per Article 40 of the Construction Law, Item 2, when the total gross floor area of a building is 1,000 M² or more, the building must be divided by a firewall so that the total gross floor area of each block becomes less than 1,000 M². This requirement does not apply to the buildings where the major structural components of a building are noncombustible or non-flammable or the buildings defined in the building code, article 56; 1.6 or storage buildings that can not be divided.

2) When the total gross floor area of a wood-structured building is 1,000 M² or more, the exterior walls and the area under eave which is vulnerable to fire shall be of fire preventive construction, and the roof shall be made of non flammable material.

3) "The area under eave which is vulnerable to fire" in 2) means all the parts of a building of which the distance from the property line, centre of the road or the imaginary centre line of the distance between 2 or more buildings in the same property (if the total gross floor area of these buildings is less than 500 M², they are considered as one building) is less than 3 M at 1st floor, and less than 5 M at 2nd floor level or higher. However, if the same area is facing park, plaza, empty space along stream or water front, walls of noncombustible construction or other similar situations, this requirement does not apply.

6. Special Requirements in Fire Safety District

Law, Article 41

1. In a district specially designated for special fire safety by a zoning by-law, major structural components of all buildings, except the ones exempted by the presidential ordinance, shall be of noncombustible construction.
2. Roofs, fire doors and exterior walls facing property line shall be constructed of structure and materials designated by the Presidential Ordinances.

Ordinance, Article 58

The exemption mentioned in Construction Law, article 41 (1) is as follows.

A 1 storey accessory building of which the total gross floor area is less than 50 M² and the exterior walls and the eave surface is either non combustible construction or non flammable material.

7. Quality of Construction Material

Law, Article 42

Ordinance, Article 60

Regulation, Article 32

Quality of construction material:

3 storey and up, 500 M² and up: • Confirmation of using KS material for the items listed in chart 10 (not shown).

CHAPTER 3. MECHANICAL & ELECTRICAL ENGINEERING

1. Construction of Ondol system

Law, Article 56

Regulation, Article 4

1.1 Construction and material of Hot Water Ondol system

- a. Base: Minimum 30 mm thick concrete, if the base is built directly on the ground, provide

water proofing layer.

b. Thermal insulation layer: Insulation material described in Article 21.

c. Heat reservoir layer: 40 mm - 70 mm aggregate, mortar, concrete, etc.

d. Hot Water Pipe: Minimum 15 mm dia., non corrosive, heat resistant pipe @ 150 mm - 300 mm o.c. Except that in forced circulation system, the pipe size can be reduced to 12 mm dia.

e. Maximum length of 1 section of pipe shall be 50 M (in case of 9 hole coal briquette fuelled hot water boiler system, the maximum length shall be 30 M).

f. Other standards defined in Ministerial Ordinance to be met.

1.2 Construction and material of Traditional Ondol system

Not applicable.

2. Thermal Insulation

Law, Article 59

Regulation, Article 21

2.1 Heat loss control in a building:

Heat Transmission Class Chart by the Region

(Unit: Kilo Calorie / M² * hour * OC)

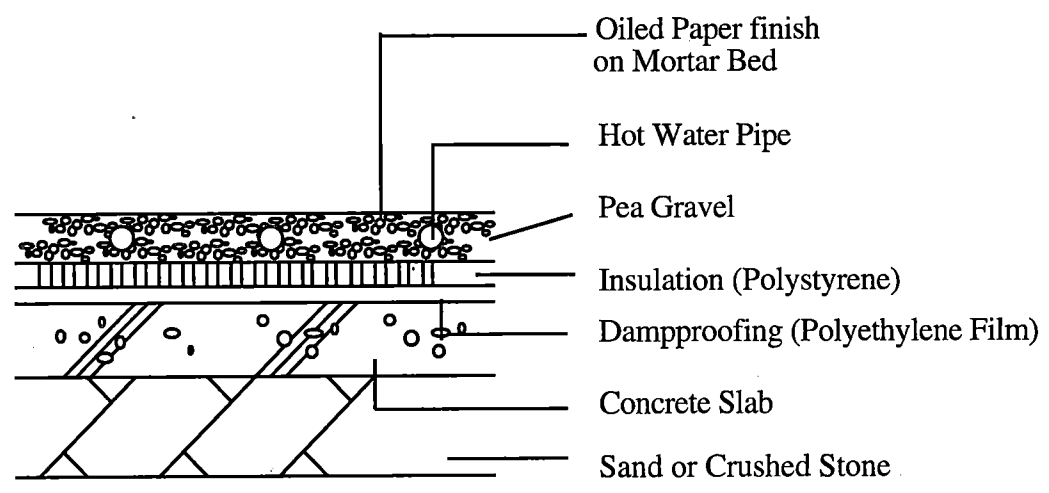
	Central Region (Seoul, Kyung-gi Do, Inchon, Choong-chung Book Do, Kang-won Do)	Southern Region (Choon-chun Nam Do, Tae-jun, Jul-la Book Do, Kwang-ju, Jul-la Nam Do, Kyung-sang Book Do, Kyung-sang Nam Do, Tae-gu, Pu-san)	Je-joo Island
Exterior walls of habitable rooms, Underside of habitable rooms which is exposed to outside	0.5 and under	0.65 and under	1.0 and under
Ceiling or roof of habitable rooms at the highest floor	0.35 and under	0.45 and under	0.65 and under
Side walls of multi-family dwelling building	0.4 and under	0.6 and under	0.7 and under

Exterior windows of habitable rooms (double glazed windows are not included)	2.9 and under	3.1 and under	5.0 and under
--	---------------	---------------	---------------

		rockwool, glassfibre, polystyrene, polyurethane (Unit : mm)	other material: thickness to achieve the following heat transmission resistance value (Unit: M ² * Hr. * OC / Kilo Calorie)
Exterior walls of rooms, Underside of the lowest floor exposed to outside	Central	50 or more	1.6 or more
	Southern	40 or more	1.25 or more
	Je-Joo	30 or more	1.0 or more
Ceiling or roof of the highest floor	Central	80 or more	2.5 or more
	Southern	60 or more	1.9 or more
	Je-Joo	40 or more	1.25 or more
Side walls of multi family dwelling building	Central	70 or more	2.2 or more
	Southern	50 or more	1.6 or more
	Je-Joo	40 or more	1.25 or more

2.2 Thermal Insulation of Floors

Hot Water Ondol System



CHAPTER 4. TESTING AND APPROVAL STANDARD OF NONCOMBUSTIBLE CONSTRUCTION

1. Performance Standard and Testing Method of Non combustible construction.

1.1 Performance Standard:

Chart 1 Performance Standard Chart

		1st - 5th floor from the highest floor	6th - 14th floor from the highest floor	15th floor and up from the highest floor
Exterior non-bearing wall	Area vulnerable to fire	1	1	1
	Area not vulnerable to fire	1/2	1/2	1/2
Exterior bearing wall, Demising wall, Floor		1	2	2
Column, Beam		1	2	3
Roof		1/2		

1.2 Designation of non combustible construction

- 1) National Construction Research Institute designates and announces non combustible construction when the system is tested and confirmed in accordance with this regulation.
- 2) Testing to designate non combustible construction shall be done by the National Construction Research Institute or other testing agency appointed by the Institute.

1.3 Testing Method:

- 1) Sampling or fabrication of samples for the testing shall be done following the instructions and supervision of the Institute. The sampling method is KSA 3151 (random sampling method).
- 2) Testing method and other related issues will be selected by the Institute.
- 3) Designation Procedure of Non combustible Construction

(1) Application:

The person who wants to have his system to be designated as non combustible construction

as defined in the chart 1 above, shall submit an application with the documents listed in the Chart 2 below.

Chart 2 Documents required for an application for a designation

Documents	Content
1. Design drawing of the con-combustible construction assembly	<ul style="list-style-type: none"> • explanation of the construction (the shape, size, structure and material etc.)
2. Business Description of the Applicant	<p>a. If the applicant is a manufacturer</p> <ul style="list-style-type: none"> • business history and achievement • capital size • number of employees • production facility <p>b. If the applicant is a user</p> <ul style="list-style-type: none"> • owner, contractor • information on the construction project (location, total gross floor area, structure, uses, construction time etc.) • quantity of the assembly and material
3. Description of the quality control	<p>a. Quality control of the assembly and material</p> <ul style="list-style-type: none"> • testing method for the physical and chemical performance • testing facility of the applicant • quality control staff and organization • inspection standards of the factory (manufacturer only) • inspection standards at the construction site <p>b. Manufacturer's production standards etc.</p>
4. Fire test results	<ul style="list-style-type: none"> • temperature of fire side • temperature of non fire side • condition of the tested material at the end of the testing • other items required for the test
5. Description of the construction project (user applicant only)	<ul style="list-style-type: none"> • address of the project • use • number of stories and gross floor area • structure • quantity of the non-combustible construction to be used in the project

(2) Examination:

A. The National Construction Research Institute will examine the following items. If the applicant is a user, item 2 and 3 can be exempted.

- a. Non combustibility of the applied assembly and its fabrication.
- b. Condition of the applicant's capital and production facility.
- c. Manufacturing and quality control methods.

B. The National Construction Research Institute can have a consulting committee of fire prevention specialists to examine the application.

C. National Construction Research Institute can establish its own standards to test the application with the consultation of the committee mentioned in (2).

D. Cost of the testing will be charged to the applicant.

(3) Announcement of the designation

When the National Construction Research Institute decides to designate an application to a non-combustible construction, it will issue an official designation certificate to the applicant and the design will be published by government literature.

(4) Labelling of the designation

Designated non-combustible construction (assembly) or the wrapping shall carry a label showing the designation, as per the Chart 3 below.

Chart 3 Labelling of the designation of non-combustible construction

National Construction Research Institute Designation
(Designation Number)
(Location of usage) *1
(Non-combustible Performance Rating) *2
(Name of the manufacturer)

*1: Location of usage means the locations where this tested assembly can be used in a building and what substrate is required to use this assembly.

*2: Non-combustible performance rating means designated fire endurance time in Hr.

(5) Term of validity of the designation:

When the applicant is a user, the designation will be valid only for the particular construction project which he has applied for and the requirement of labelling can be

waived.

4) Managing the designated non-combustible construction

(1) Report:

Manufacturer will test the assembly every 3 years and report to the Institute.

2. Standard for acoustical treatment of walls

Performance Standard and Testing Method of Acoustical Construction:
Chart 1 Performance Level of Acoustical Construction

Main Frequency (HZ)	Sound Transmission Class (dB)
125	30
500	45
2,000	55

Application and testing and designation , similar to the ones for the designation of the non-combustible construction.

...

APPENDIX B

ADVANTAGES OF WOOD-FRAME CONSTRUCTION TO KOREA



LARDEN MUNIAK CONSULTING INC.

**In Association with:
SANG-MAN YOUN ARCHITECT**

Appendix B – Advantages of Wood-Frame Construction to Korea

Advantages of Wood-Frame Construction to South Korea

- **Cost.** Wood-frame construction can represent a cost saving compared to other forms of construction, especially depending on site and volume of work. The current Korean perception that wood-frame construction is expensive may derive largely from the fact that most wood-frame construction is for custom-built single-family homes where the purchasers are relatively well off.

A good deal of the construction expenditure appears to be related to finishes. With more wood-frame construction volume, expansion into multi-family buildings and orientation towards lower income purchasers or renters, significant economies should be achievable.

- **Flexibility.** For certain site conditions, wood-frame construction may offer a significant advantage. In rural areas or in situations where road access may be difficult for transportation of heavy construction materials (particularly concrete), wood-frame construction offers the advantage of being able to transport lighter components.

Design freedom is enhanced with wood-framed construction. Longer spans and features such as larger windows or sloped ceilings can be incorporated more cost-effectively than with poured concrete.

Engineered wood products could also be used.

Wood-frame construction is more forgiving in terms of changing designs, both before and during construction. It also may be mixed with other forms of construction, e.g. use of masonry or concrete foundation or demising walls with wood-frame flooring and roofing systems.

Wood-frame construction is more flexible in terms of installation of building systems. While piping or wiring can be run through voids in spaces between wood framing members, concrete or masonry construction requires the use of sleeving and conduit and more costly and time-consuming procedures for the installation of such services.

Sprinklers may be utilized on a selective basis to compensate for deficiencies in firefighting capabilities or to allay concerns about fire spread in high density areas.

- **Impact on National Economy.** The current domination of the South Korean residential construction industry by large-sized firms oriented to mass-produced concrete apartment structures is reflective of policy favouring large conglomerates in general and a central planning process for new housing. It appears this policy has contributed to the high cost for product and limited growth in the small business sector. The Government now realizes that small- and medium-sized firms are vital to economic advancement and overall competitiveness.

The North American wood-frame construction industry is characterized by the presence of many small- and medium-sized firms, is highly competitive and benefits from a vast and innovative system of product supply and development. The introduction of a larger scope of activity for wood-frame construction in Korea would have the effect of stimulating comparable infrastructure to the general benefit of the Korean economy.

Wood-frame construction is inherently adaptable and facilitates the introduction of a wide variety of new products and construction techniques. The opportunity to participate in these secondary benefits is enhanced if the industry is larger.

Appendix B – Advantages of Wood-Frame Construction to Korea

The creation of a well-established wood-frame construction industry in Korea will offer competitive advantages in the construction export market. South Korea is currently a world leader in the provision of offshore construction services; development of additional capabilities and expertise in wood-frame construction may be considered as enhancing the available scope of services that may be offered to overseas customers.

- **Training and Education.** The creation of a larger wood-frame construction market in South Korea presents an opportunity to educational institutions to develop and offer training in wood-frame design and construction techniques.
- **Labour.** The creation of a larger wood-frame construction market will provide an opportunity for South Korean workers to acquire new skills and interests and flexibility of opportunity. The availability of skilled workers in wood-frame construction enhances the vitality of the smaller-size business sector.

Precautions

An expansion of wood-frame construction must also be considered in terms of possible untoward events (such as significant fires), poor quality construction and other negative experiences that could have a detrimental effect in the process of trying to enhance the South Korean market. Issues to be considered include the following:

- **Safety.** Fire safety in multiple-unit buildings is of critical importance. The knowledge must be in place to properly construct fire separations and provide for all details associated with fire and structural safety. These matters would include not only the details of building construction but matters relating to siting of buildings (relative to other construction and properties), access for firefighting and the capabilities of fire services in different parts of the country. Construction to Canadian standards implicitly suggests that firefighting and building services infrastructure should also be to Canadian standards.
- **Quality and Durability of Construction.** The perception that wood-frame construction is prone to greater noise transmission, squeaky floors and stairs and presents less substantial construction than traditional plaster and masonry must be addressed.

These matters are also issues in the North American context and there are approaches to minimizing problems. For example, there may be fewer squeaky floors with the use of panel products and glued application of sub-flooring to joists and structural members; newer technology structural members such as wood I-joists may also be beneficial. Drywall can be backed up with plywood to provide a base for nailing and more substantial impact resistance. Alternately, products such as cement board may be used in high traffic areas.

Knowledgeable and skilled trades are also a prime line of defence against poor construction.

Even with the widespread use of concrete in construction in Korea there are concerns about leaks and general quality of construction. This suggests that attention must be paid to the integrity of the entire building and not just wood-framing construction techniques.

Canadian builders active in Korea may wish to establish a voluntary quality control program.

Appendix B – Advantages of Wood-Frame Construction to Korea

- **Quality of Import Materials.** There have been reports of dissatisfaction with the quality of wood-frame construction material – particularly lumber – on the part of some Korean builders, although Canada appears to have a superior reputation as a source of quality materials. An effective self-governing quality control program by Canadian exporters could, again, be an effective solution to this problem.
- **Construction Skills and Knowledge.** There is very limited availability of skilled trades for wood-frame construction in South Korea. Training will be necessary for both builders and officials.

APPENDIX C
PROMOTING CANADIAN MULTI-UNIT
WOOD-FRAME CONSTRUCTION



LARDEN MUNIAK CONSULTING INC.

In Association with:
SANG-MAN YOUN ARCHITECT

Appendix C – Promoting Canadian Multi-Unit Wood-Frame Construction

The major downturn in the residential construction market in Canada in the first half of the 1990's may have stimulated more interest in overseas markets on the part of the housing industry. However, with the rebounding Canadian construction economy in the late 1990's, the interest of the Canadian housing industry in overseas markets may decline. If interest is lagging or insufficient, it may not be worth expending time and money on an overseas marketing effort. On the other hand, achieving an overall goal of regulatory change and increased market demand for multi-unit wood-frame construction in South Korea may be a long-term effort and commitment to such effort may have to proceed despite the variations in Canadian construction activity.

Before embarking on a major initiative to increase the scope of wood-frame construction in Korea, CMHC may also wish to consider the extent to which Canadian industry can "coat-tail" on a clearly developing trend towards more wood construction in Korea. It is likely that export opportunities for Canada will continue to grow in respect of Korean house construction alone, aided by Korean consumer interest and the promoting activities of other suppliers of wood-frame construction materials and services – particularly American sources.

Generic vs. Pro-Canadian

There is a choice of promoting multi-unit combustible wood-frame construction in Korea on either a generic or specifically pro-Canadian basis.

Promoting such change on a generic basis would facilitate the exporting of wood-frame construction products and services from other parts of the world, including the U.S.A., Northern Europe and eventually Russia.

However, if the pro-Canadian approach is taken, there are a number of factors which may be advantageous to such promotion. If a campaign to expand the scope for wood-frame construction by changing Korean regulations is successful as a result of such promotion, there may also be more benefit to Canadian interests than would otherwise have been the case.

National Building Code of Canada

A pro-Canadian approach to lobbying for changes in Korean construction regulations would emphasize the "fit" of the current scope of combustible construction allowance of the National Building Code of Canada (NBCC) with the scope of regulatory change proposed for South Korea.

In Canada, residential buildings up to 3-storeys in building height (i.e. 3-storeys plus basement) and with an area per floor of up to 600 m² may be erected by conforming to the prescriptive requirements of Part 9 of the NBCC. Even larger projects can be developed with 3-storey buildings where firewalls are used to subdivide the areas so the individual components between firewalls do not exceed the size limitations for Part 9 buildings.

American codes, by contrast, do not organize their codes in the same manner for purposes of differentiating between small building and large building construction. Typically, American model code organizations have a code for one- and two-family dwellings and a code for all other building types.

Appendix C – Promoting Canadian Multi-Unit Wood-Frame Construction

There may be other advantages to promoting Part 9 of the NBCC as a model for Korean regulations:

- **Canadian Government Affiliation.** The NBCC is written by an organization which is directly sponsored and funded by the Government of Canada, i.e., the Institute for Research and Construction of the National Research Council. American codes, on the other hand, are written and administered by private building official organizations and are not yet consolidated into a single national document.¹ The Canadian government affiliation may appeal to Korean government officials as well as Korean builders who are used to a prominent government role in industrial and economic planning.
- **Canadian Construction Materials Centre.** The Canadian Construction Materials Centre (CCMC) is a strong example of the support that exists in Canada for innovation in building and housing technology. The NBCC system and Part 9 is not static; a wide variety of new and innovative products evaluated by CCMC have been readily accepted for inclusion in wood-frame construction.
- **Canadian Research.** NBCC Part 9 has had the benefit of a long history of research in wood-frame construction and building science related to housing. Most of this research was undertaken by NRC or other federal government departments and Canada continues to service the evolution of technology associated with housing.
- **Metric Measurement.** The NBCC uses metric measurement. Korea's regulations use metric as well as traditional Korean measurement. American codes, on the other hand, still use traditional English-based measurement with supplementary hard conversions to metric quantities.
- **Training and Certification for Enforcers.** Canada also has a national organization of building officials – the Canadian Building Officials Association (CBOA) – and affiliated provincial associations. All of them focus on the NBCC or its various similar provisional derivatives. Training and certification courses which have been developed to qualify building officials in Canada may be a significant resource in persuading Korea to broaden the regulatory base for wood-frame construction along the lines of NBCC Part 9.
- **Precedent Acceptance by Other Jurisdictions.** Reference can also be made to CMHC's recent success in persuading Germany to adopt the Canadian wood-frame construction system based on long and successful Canadian experience with the requirements of Part 9 of the NBCC.

In short, if CMHC wishes to pursue a pro-Canadian approach in promoting wood-frame construction in Korea, there are significant advantages in offering a "package deal" encompassing Part 9 of the NBC and affiliated research, materials evaluation and enforcement resources. South Korea would be provided with a shortcut to a fully-implemented wood-frame construction system and Canada could realize a greater benefit in terms of trade and international prestige.

¹ American model code groups are currently working on the creation of a single model building code and a single model fire code. These documents are apparently intended to be utilized throughout the U.S.A., however, they are being termed "international" codes.

APPENDIX D
BIBLIOGRAPHY



LARDEN MUNIAK CONSULTING INC.

In Association with:
SANG-MAN YOUN ARCHITECT

Appendix D – Bibliography

1. Government of Korea, Ministry of Construction and Transportation, "Korean Construction Law", 1996.*
2. Korea Trade Promotion Corporation, "How to Trade with Korea – A Guide to Trade and Investment", Seoul, Korea, 1991.
3. External Affairs and International Trade Canada, "Briefing Notes: Canadian Participants Expo '93 Theme Weeks".
4. External Affairs and International Trade Canada, "Korea's Construction Industry and Market", 1993.
5. External Affairs and International Trade Canada, "A Guide for Canadian Business in Korea", 1993.
6. External Affairs and International Trade Canada, "Doing Business in Korea", 1996.
7. Lee, C.S., Canadian Embassy, Seoul, Korea, "Korea's Housing Market", Presentation to Canada Export Housing '97, Winnipeg, Manitoba, June 1997.
8. Pacific Consultants Corporation, "Market Study on Housing and Building Materials to the Republic of Korea", Report for Canadian Embassy, Seoul, Korea, 1991.
9. Canada Mortgage and Housing Corporation, "Housing Export Opportunities Series, South Korea", 1997.
10. Chung, Hee-Soo; Korea Housing Institute, "Potentials of the Korean Housing Market", 1997.
11. Korea Housing Institute, "Wood-Framed Housing in Korea: An Overview", 1996.*
12. Korea Housing Association, "Introduction to the Korea Housing Association".
13. Korea Housing Builders Association "Korea Housing Builders Association", Booklet providing descriptions of the Associations.
14. Korea National Housing Corporation, "Korea National Housing Corporation", Booklet describing activities of the Corporation, 1996.
15. Housing Research Institute, Korea National Housing Corporation, "Annual Research Reports, Vol. 3", 1997.
16. The Korea Herald, "Land No Longer Attractive for Investment", Newspaper article, Seoul, Korea, 25 June 1997.

*Korean language document.